Energy Transfer Systems
Residential, Commercial, Industrial

**EXTEDED RANGE GEOTHERMAL HEAT PUMPS,
DEHUMIDIFICATION & CHILLER SYSTEMS**

Water to Air Heat Pumps

Water to Water Heat Pumps

Quad-function Heat Pumps
Dehumidification Heat Pumps

Multiflex Water to Water,
Modularized Heat Pumps

WELCOME TO GEOFLEX

Thank you

Thank you for purchasing the **Geoflex** "Revolutionary" Liquid (Ground/Water) Source Heating and/or Cooling, "Liquid Cooled A/C" or Dehumidification System.

By choosing to install a **Geoflex** system in your home or business you can greatly reduce the impact you and your family or business have on global warming and climate change.

Registering Your System

For a number of reasons, it is important to register your Geoflex System with the manufacturer. It helps us help you if you are have questions about the operation of your system, having problems with your system or having difficulty contacting the dealer/installer who installed your system. By registering your system with Geoflex, it helps us communicate with you if there are recommendations that can help enhance the performance of your system. Most importantly, it helps us estimate the greenhouse gas emissions you and all of our clients are preventing from entering the atmosphere.

You can register your system online at www.geoflexsystems.com, via email or via mail.

Purpose of this Manual

This manual offers a general overview and understanding of the equipment that you have purchased. Geoflex manufactures many styles of systems, including many specialized applications. If any information herein does not match your system, please do not hesitate to contact the factory or your local installer.

Appropriate installation, record keeping and servicing of your equipment will lead to a longer life and can lead to much higher efficiencies. Inappropriate record keeping and/or non-registration can affect your system warranty. Some repair and diagnosis work, as outlined herein, must be carried out by qualified and, in many cases, licensed contractors.

Your **Geoflex System** will offer years of reliable and efficient service, provided adequate maintenance is supplied (i.e. filter changes, cleanings, etc).Keep this guide with your unit at all times and record your Dealer/Installer's name and contact information in the space provided.

NOTES TO READER: *The Geoflex product line and this manual will be continually upgraded. If you are unable to find information that you're looking for or your system is not covered in this manual, please contact your installer or Geoflex for further information at any time.*

As Geoflex manufactures a very broad product line which includes standard and specialty products, the unit that you have may not be configured exactly as shown herein. If this case should arise, please do not hesitate to contact the factory.

Geoflex reserves the right to change, alter or modify products at anytime without notice.

Geoflex General Registration Form:

Product Information	
Model Number:	Serial Number:
Purchase Date:	Installation Date:

Project Owner Mailing Information Customer (Installation Address)

Title:	First Name:	Last Name:
Address1:		Address2:
City:		State/Prov.:
Zip/Postal Code::		Country:
Phone:		Email Address:

Installer Information (if different than above)

Title:	First Name:	Last Name:
Address1:		Address2:
City:		State/Prov.:
Zip/Postal Code:		Country:
Phone:		Email Address:

General Comments/Questions:

Geoflex General Nomenclature (If your systems differs, call for details)

Geoflex Nomenclature

Air Handlers Only

GF A WA - V L A B B X

GF 1 A 040 WA 1 R L M X 1 X V L A B B X

Model	
GF	Geoflex

Number of Compressors	
X	Not Applicable
1	Single Compressor
2	Two Compressors
3	Three Compressors
4	Four Compressors

Unit Voltage and Phase	
A	208 - 230 / 1 / 60
B	265 / 3 / 60
C	208 - 230 / 3 / 60
D	460 / 3/ 60
E	575 / 3/ 60
F	380 / 3 / 60

Nominal Capacity	
028	120
040	180
054	300
068	450
076	

Refrigerant Type	
X	Not Applicable
1	R22
2	R404
3	R407

Unit Type (Compressor-specific)	
WA	Water to Air
WW	Water to Water
DH	Dehumidification
AH	Air Handler

Reversing/Non-Reversing	
X	Not Applicable (Air Handler)
R	Reversing Valve
N	No Reversing Valve

Loop or Well	
X	Not Applicable
L	Loop
W	Well
B	Loop/Well (Both)

Load Heat Exchanger (With/Without Internal Circ. Pump)			
X	Not Applicable	I	Copper Tube/Shell with Pump
A	Copper Tube/Shell	J	CN Tube/Shell with Pump
B	CN Tube/Shell	K	SS Brazed with Pump
C	SS Brazed	L	DW SS Brazed with Pump
D	DW SS Brazed	M	Copper Coax with Pump
E	Copper Coax	N	CN Coax with Pump
F	CN Coax	O	Double Wall Copper Coax with Pump
G	Double Wall Copper Coax	P	Double Wall CN Coax with Pump
H	Double Wall CN Coax		

Cabinet Configuration	
X	Not Applicable
V	Vertical Upflow
D	Vertical Downflow
H	Horizontal

Demand Hot Water Heat Exchanger	
X	No Demand
A	Copper (No Pump)
B	Cupro-nickel (No Pump)
C	Double Wall (No Pump)
D	Copper (With Pump)
E	Cupro-nickel (With Pump)
F	Double Wall (With Pump)

Desuperheater (With/Without Internal Circ Pump)	
X	No Desuperheater
1	1/3 HP Desuperheater with Pump
2	1/3 HP Desuperheater without Pump
3	1/2 HP Desuperheater with Pump
4	1/2 HP Desuperheater without Pump
5	Special Desuperheater c/w Head Pres Cont

Earth Loop Heat Exchanger (With/Without Internal Circ. Pump)			
X	Not Applicable (Dehumid)	I	Copper Tube/Shell with Pump
A	Copper Tube/Shell	J	CN Tube/Shell with Pump
B	CN Tube/Shell	K	SS Brazed with Pump
C	SS Brazed	L	DW SS Brazed with Pump
D	DW SS Brazed	M	Copper Coax with Pump
E	Copper Coax	N	CN Coax with Pump
F	CN Coax	O	Double Wall Copper Coax with Pump
G	Double Wall Copper Coax	P	Double Wall CN Coax with Pump
H	Double Wall CN Coax		

Electric Aux. Backup/Emergency	
X	Not Applicable
A	10 KW Elec Aux
B	15 KW Elec Aux
C	20 KW Elec Aux

Hydronic Coil	
X	Not Applicable
A	60 MBH Hydronic
B	30 MBH Hydronic (With Pump)
C	60 MBH Hydronic (With Pump)

Blower Motor Type	
X	Not Applicable
P	PSC Blower Motor
A	Adaptive Climate Control Motor

Cabinet Configuration	
X	Not Applicable
L	Left Return
R	Right Return
S	Straight Thru

Air Handlers	
X	Not Applicable
A	30 MBH 2 pipe Hydronic AH
B	60 MBH 2 pipe Hydronic AH
C	90 MBH 2 pipe Hydronic AH
D	30 MBH 2 pipe Hydronic AH (With Pump)
E	60 MBH 2 pipe Hydronic AH (With Pump)
F	90 MBH 2 pipe Hydronic AH (With Pump)

geoflex
Geothermal heating, cooling & hot water systems for home or business

GF-TD-11-22-06-1
Geoflex Nomenclature

www.geoflexsystems.com

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1069 Clarke Rd., Unit B, London, Ontario N5V 3B3
Phone: 519.488.1653 or 519.451.7783 Fax: 519.913.1259
Email: plant@geoflexsystems.com

Administration Office:
301 Pakwa, Unit #1, Saskatoon, Sk, S71 6A3
Phone: 306.668.7611 Fax: 306.668.0049
Email: admin@geoflexsystems.com

1. RECEIVING AND STORAGE

1.1. Receiving Equipment:

- The shipment matches the bill of lading and all units and accessories have been received
- That you inspect for damage(s)
- That the freight carrier notes damage(s) and non-receipts on every freight bill and records a "Carrier inspection report" (A "carrier inspection report" should always be available from the freight carrier).
- Any damage not discovered during unloading must be reported to the carrier within 15 days

Note: *The equipment is shipped FOB (Free On Board), from the factory in London, Ontario. It is the responsibility of the purchaser to file all necessary claims with the carrier. Notify Geoflex Systems immediately, not later than 48 hours after shipment arrives. If equipment is shipped FOB job site from any other location, it is the responsibility of the purchaser to notify Geoflex of any damage, before acceptance, otherwise the damage becomes the responsibility of the receiver.*

1.2. Transporting Equipment:

- **Keep the unit upright at all times.** The compressor must NOT be placed in a horizontal position because oil will drain into the compressor. If the unit cannot be transported in any other manner, it is very important that the compressor remain upright for a minimum of 24 hours before it is started.
- Heat pumps are relatively heavy appliances, especially larger units and Quad units. Basement stairs, especially temporary basement stairs, should be supported when moving the unit downstairs.
- Larger multi-stacked water to water heat pump systems are easily disassembled to move into place and then reassembled.

1.3. Storing Equipment:

- Unit retains its packaging (or protective covering) and is kept upright, in a clean and dry area
- Stackable units are stored no higher than two per stack, some units cannot be stacked
- Open ends of pipes are in good shape and free from damage
- All pipes, fittings, and valves are examined before installing any system components

To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to system water. Condenser coils never fully drain by themselves and will freeze unless winterized with antifreeze.

STOP

2. TYPES AND CONFIGURATIONS OF HEAT PUMPS

Geoflex Systems manufactures a number of different types of heat pumps. These include:

- Water to air heat pumps are designed to be used with forced air distribution systems, and typically supply warm or cool air to the home or building. They are available in various configurations, including:
  - Vertical cabinet with return air on the left or right side of the cabinet, and the supply air on top of the cabinet. This configuration is typically located in a basement, with the ductwork suspended from the ceiling above the unit.

  - Vertical cabinet with return air on left or right side of the cabinet, and supply air on the bottom of the cabinet. These units are typically located on the main floor of a building with ductwork located in a crawlspace below the unit
  - Horizontal cabinet, with return air on left or right side of the unit, with supply air on the opposite side of the unit or the end of the unit. These units are typically located in the crawlspace of a building, or above a suspended ceiling.
- Water to water heat pumps are designed to produce heated or chilled water, and are typically used to provide warm water for a radiant floor heating system, or supply hot and/or chilled water to a fan coil unit. Water to water heat pumps are used for a variety of other applications as well, including:
  - Swimming pool heating (with double wall vented heat exchanger)
  - Snow melt applications
  - Heating domestic hot water (with double wall vented heat exchanger)
  - Industrial process cooling applications with heat recovery
  - Cooling and heat recovery applications
- Quad-function heat pumps are designed as combination water to air / water to water heat pumps. They are typically used in applications where forced air heating and cooling is required as well as warm water for radiant floor heating, domestic hot water, pool heating etc.
- Dehumidification heat pumps are designed to dehumidify air in swimming pool or other applications requiring specific humidity control. The air coils and air flow rates of these heat pumps are designed for moisture removal from the air.

2.1. Geoflex Options

Geoflex manufacturing process is designed to accommodate the specific needs of your application. Some of the options Geoflex can provide include:

- Dual compressor, dual or three capacity operation. All types of heat pumps listed above, including water to air units, water to water units, quad-function units or dehumidification units, can be manufactured with either one compressor, two equal size compressors, or two different capacity compressors. This provides a great deal of flexibility to suit your application and requirements.
- Modularization allows Geoflex water to water systems to be ganged in virtually unlimited numbers and staged according to the demand of the building. This feature allows for the benefit of infinite sizing and operational flexibility.
- Internally mounted electric auxiliary can be provided with any of the water to air heat pump systems listed above, including the quad-function and dehumidification heat pumps.
- Internally mounted hydronic auxiliary can be provided with many of the water to air heat pump systems listed above, including the quad-function and dehumidification units. This option is often used in applications where the electrical service to the building is not adequate to operate electric resistance auxiliary, or where the electric utility discourages the use of electric auxiliary. Natural gas or other fossil fuel water heaters can be used to supply hot water for the hydronic heating coil.
- An internal desuperheater, with or without an internally mounted water circulation pump, can be included in all of the heat pump types listed above, including the quad-function and dehumidification heat pumps. A desuperheater is designed to be connected to an electric water heater, and produces hot water whenever the heat pump is operating either in heating or cooling mode. The desuperheater option can provide much of the domestic hot water for a typical residential application.

- Cupro-nickel coils are available on request, and dual wall vented water coils for domestic hot water or swimming pool applications are available for many heat pump models.

The flexibility of the Geoflex manufacturing process allows us to design and manufacture a heat pump specifically for your application. Please contact the factory for specific requirements for your application.

3. INITIAL SETUP

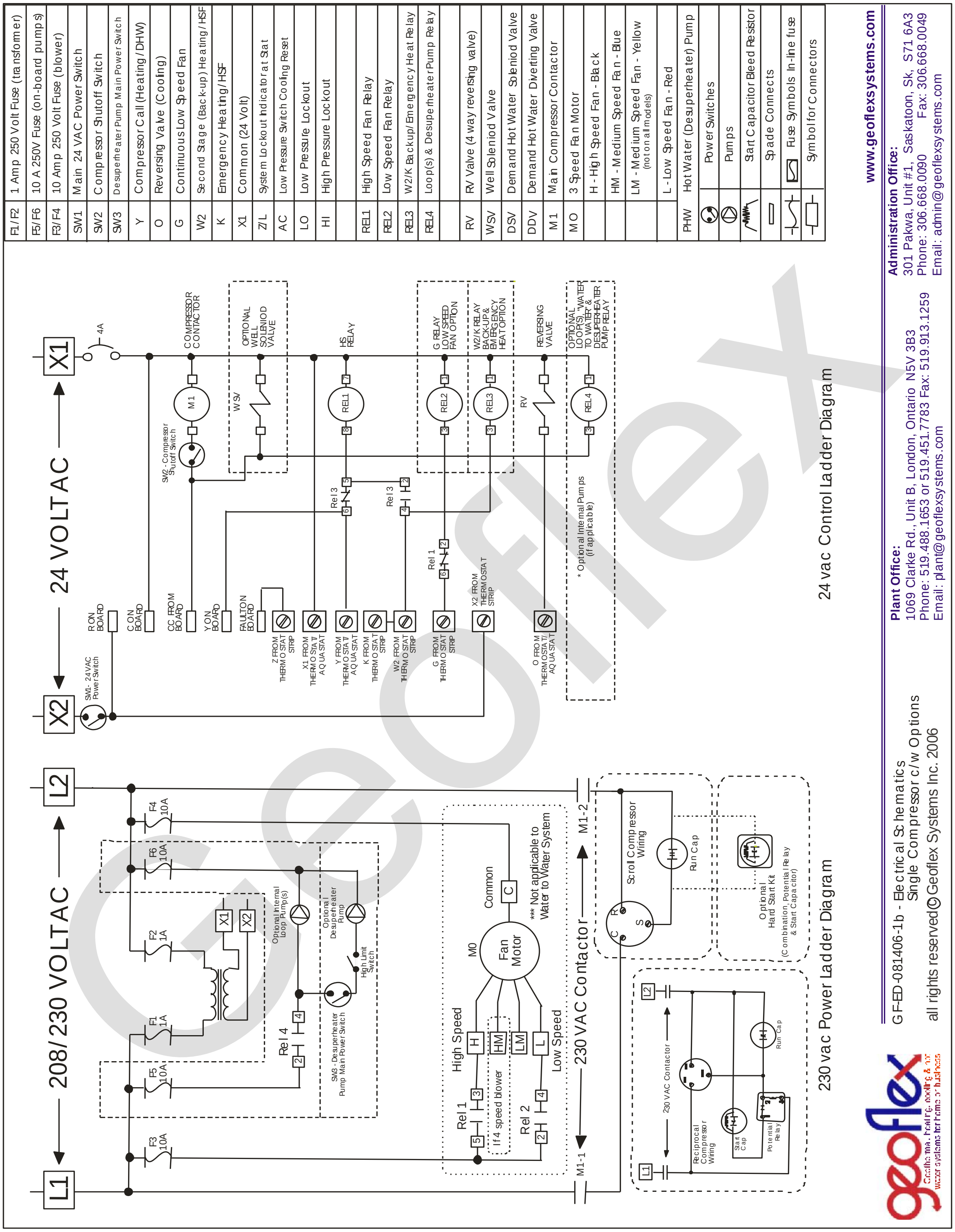
- Remove any shipping restraints, including any screws that may be in place to hold the system to the wooden pallet
- The airflow configuration of the supply and return air for some units is field convertible.
- Locate and verify any thermostats, hangers, or other accessory kits in the compressor and/or blower section
- Unit must be set on a minimum 1" thick sound absorption pad to reduce potential noise
- An access space of 24" (for servicing) should be maintained around the perimeter of the unit. If the unit must be installed against a wall, be sure maintenance and service issues are considered.
- Copper or hard pipes must **never** be attached to floor joists, as doing so causes vibration transfer. This will cause noise to transmit through the building structure.
- Once the unit is set into position, the installer must loosen compressor bolts to avoid noise transfer through the cabinet. Loosen compressor bolts on units equipped with compressor spring vibration isolation until the compressor rides freely on the springs.
- If refrigerant is needed, it should be added by a licensed refrigeration technician. The licensed refrigeration technician must **never charge to a full sight glass.** Charging must be performed by measuring superheat in the heating mode with all "optional" hot water pumps turned off. When the system is designed for cooling only or heating only, superheat will be set in that mode.
- The compressor must never be started until the system is completely installed and the general electronic and electrical logic is properly assessed and tested.
- The system must never be started prior to a complete water hookup to avoid pump burnouts and any other damage. **ALWAYS check and tighten any hose clamps, as they can be loosened during shipping.**
- For a system general setup illustration, please refer to drawings on pages 12 to 15.

4. ELECTRICAL CONNECTIONS AND POWER SUPPLY

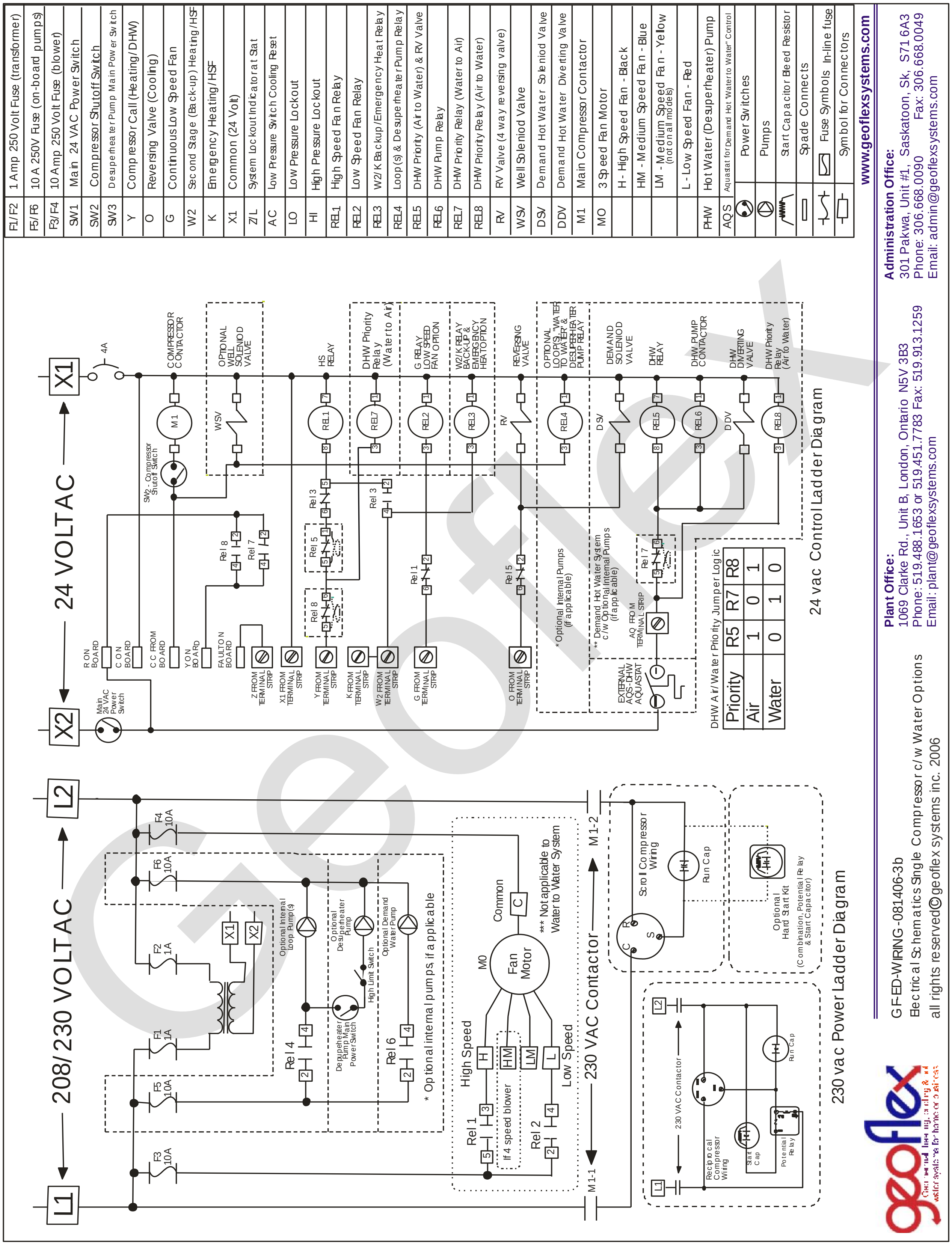
All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit wiring diagrams for fuse sizes and a schematic of the field connections which must be made by the installing (or electrical) contractor. Consult the unit wiring diagram located on the inside of the compressor access panel to ensure proper electrical hookup. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

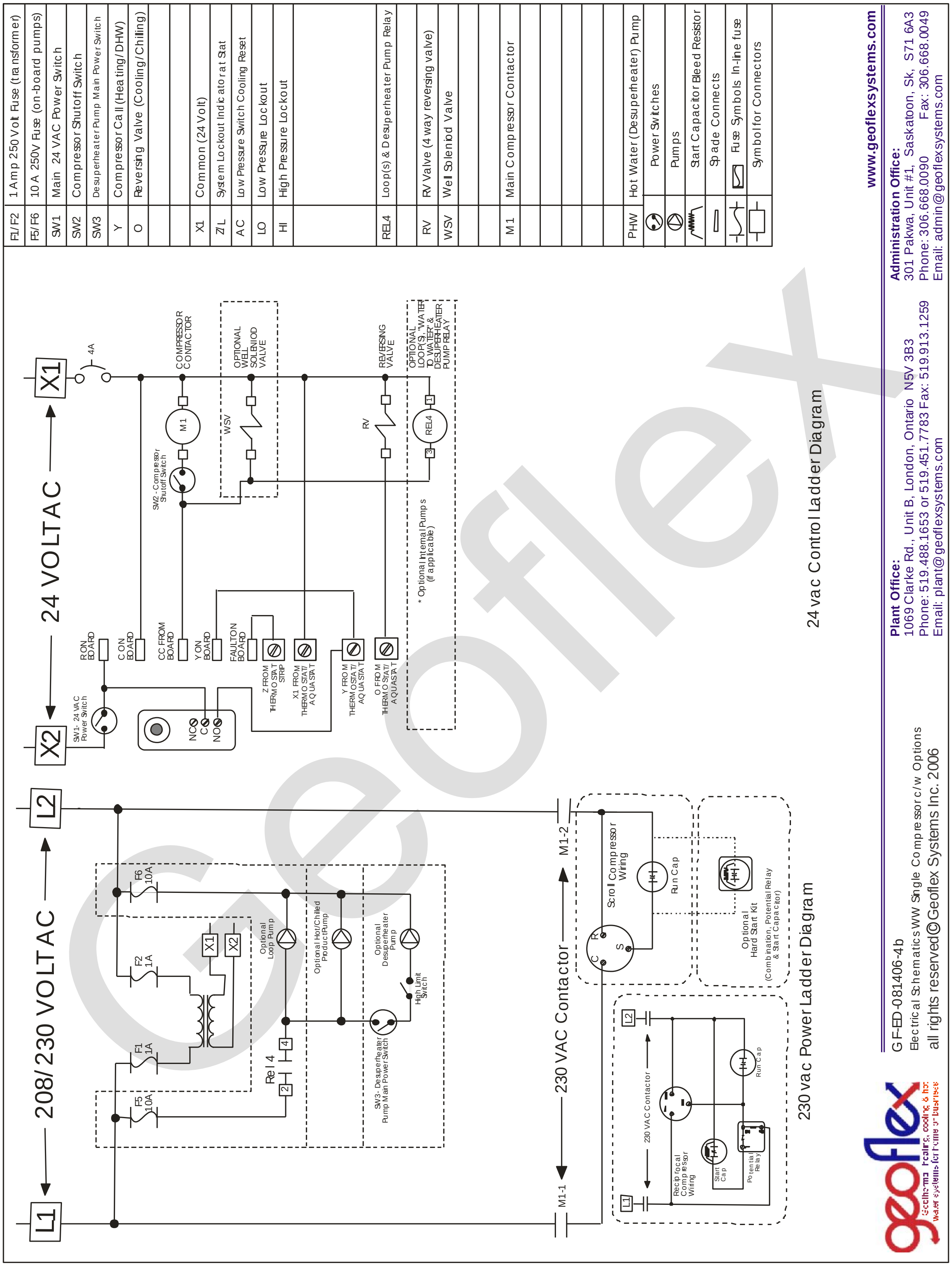
- **Important Power Supply Note:** Make sure that you have an appropriate service, not just your panel, to handle the in-rush load of your equipment which is reflected as LRA (Locked Rotor Amps) in the product specifications and on the electrical nameplate of your system. If the LRA runs higher than 100 LRA, power providers, under their "conditions of service", commonly require notification to ensure that the service can handle the abrupt load. If the LRA on your system is too high there are soft start style (Secure Start) systems which can be purchased or ordered on the equipment, to dramatically reduce the LRA on your system. This is a very important detail, as power supply issues are generally not covered by any warranty and can dramatically reducer the life of your compressor.
- Supply properly sized wire, determined by the Full Load Amps (FLA) on the nameplate of your unit and an adequate circuit breaker, adhering to all local and national electrical codes.
- Connect thermostat wiring (number of leads vary with unit size and model) to the low voltage terminal strip, located inside the electrical box. **Do not connect to "R"** on the Geoflex terminal strip, until you are prepared to start the system in order to avoid blowing fuses and burning out thermostats.
- For power supply connections refer to wiring drawings within this manual or call factory for further details.
- **Thermostat wiring:** *(used with forced air heat pumps)* A Geoflex **Standard "Liquid to Air" System** can utilize various "heat pump" style thermostats. However, many other alternate heat/cool thermostats will operate effectively with a Geoflex System (if not listed in this manual, call technical service for details). When adjusting or seasonally changing your thermostat, ensure that you wait a few minutes between adjustments to allow the unit time to respond. If your space or water temperature is unsuitable, simply perform the adjustment. Frequently changing your room temperature will cause the system to operate inefficiently…this is not recommended.
- **Aquastat wiring:** *(used with "water to water" heat pumps and units with a "Demand Water option").* Geoflex standard "Water to Water" Systems or "Demand Water" Options would use an **Aquastat** for water temperature control. Although not common, an Aquastat can also be used for an adjustable control of a desuperheater. A desuperheater will most commonly arrive with a factory installed, non-adjustable control, set for 130F/54.4C. For further information, refer to Aquastat Water to Water and Demand Water sections within this manual.



4.1. Electrical Schematic, "Single Compressor, Water to Air" System



4.2. Electrical Schematic, "Quad, Single Compressor, Water to Air" System



4.3. Electrical Schematic, "Single Compressor, Water to Water" System

5. AIR DISTRIBUTION SYSTEMS

Geoflex heat pumps are available with high efficiency PSC 3 or 4 speed blower motors. Dual compressor models 054 & 068 are available with belt drive or PSC direct drive blower motors. Dual systems can use ACC blower motors or belt drive fans with single motors. Your system can be equipped with a variable speed blower system. Please refer to your model number or call for details. If your system does employ a variable speed blower system it will adjust the fan speed based on air temperature leaving the unit. The fan motor is field adjustable for low air flow threshold.

Fan speed: All single compressor models with PSC motors have 3 or 4 speed taps. To change the speed of the motor to a higher or lower speed, remove the electric box cover that is mounted on the blower. Locate the label on the motor to identify the wire color for each speed. Remove wire nut of existing speed and replace with wire of selected speed.

Most forced air heat pumps are designed to provide approximately 400 cfm (189 L/s) of air per nominal ton to the distribution system. A dehumidification system requires approximately 360 cfm (170 L/s) per nominal ton, across the evaporator coil. The following chart provides blower motor electrical specifications and air delivery information.

Model	PSC Motor hp	Approx. Heat Pump Design CFM	Approx. Dehumidification Design CFM
028	¼ DD	800	720
040	1/3 DD	1200	1080
054	½ DD	1600	1440
068	¾ DD	2000	1800
076	1.0 DD	2250	2050
2X040	1.0 DD	2400	1440
2X054	1.5 BD	3600	2900
2X068	2.0 BD	4000	3600
2X076	2.5 BD	4500	4100

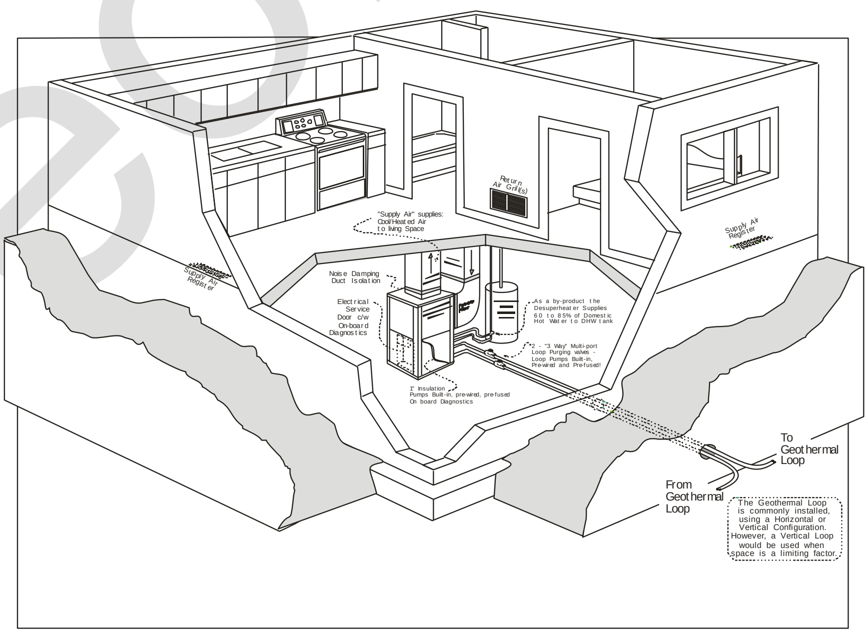
Note: For design purposes, all systems are designed for to accommodate a .05 inches of water column, including filter, as external static pressure.

Operating	**Ramping & Temp**
Hi	80(50%) to 105(110%)
Low	55(50%) to 40(110%)
Non-operating	*(If equipped with TSFO)*
Hi	50% to 10%
Low	50% to 10%

An ACC option offers a full range of variability to 110% of original. See attached chart

It has two ranges to choose from when your system is equipped with a two speed fan option (TSFO).

The low speed threshold can be changed by adjusting the low line speed control.

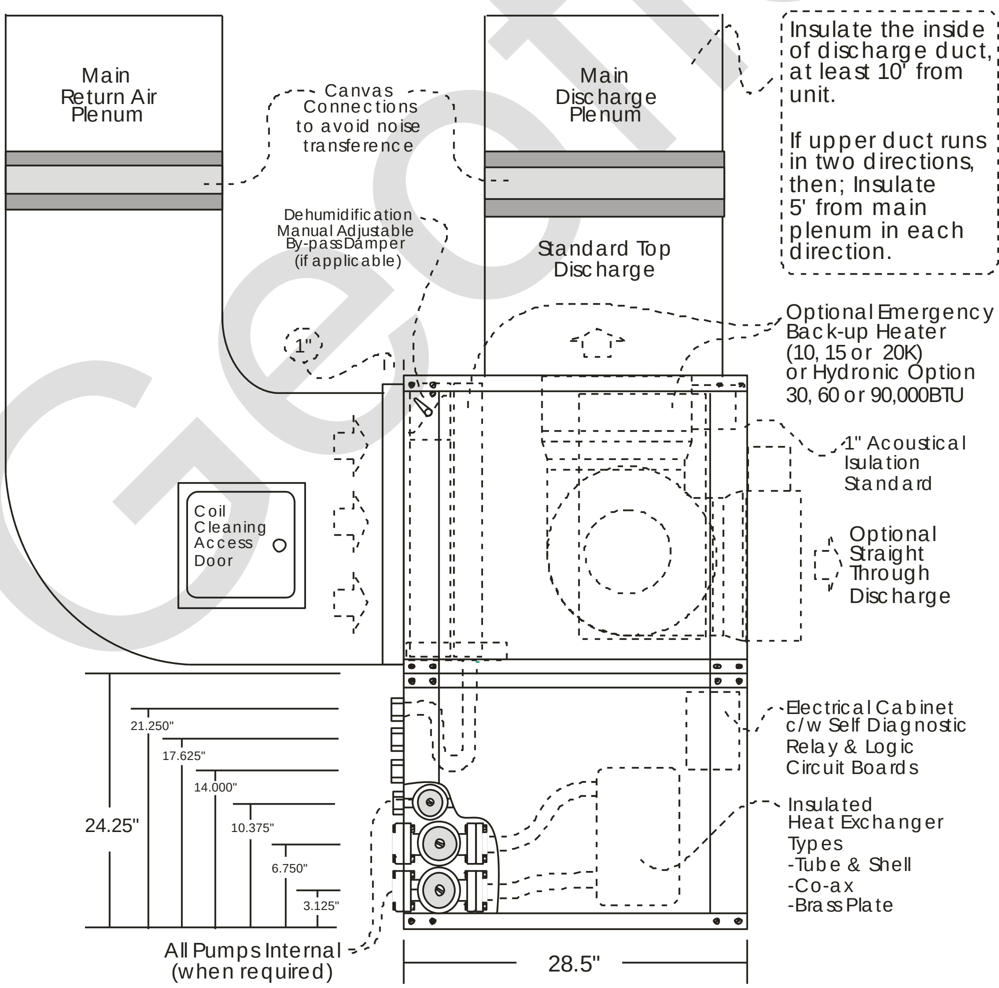


Typical Ducting and Closed Loop

5.1. Air Plenums

- Connect the discharge air plenum, supplying appropriate duct size and runs, to allow adequate airflow as recorded on the system specification sheet **(inadequate airflow can void your warranty).**
- Flexible canvas or rubber duct connections must be used on both the supply and return ducts to isolate the system from the structure and reduce the risk of any potential noise problems.
- The return air plenum **must** have a coil cleaning access door on the return air duct to allow for routine air coil cleaning (refer to illustration below).
- If an electronic air cleaner (plate style) is used, a furnace filter must also be installed to reduce dust passing and adhering to the air coil (dramatically reduces time spent on maintenance)
- A dehumidification system could incorporate an “optional by-pass damper” (as illustrated below) designed to allow for appropriate amount of air across the evaporator, which is crucial to adequate dehumidification, see start-up for dehumidification systems (page 19) for further dehumidification systems duct layout information. A manual by-pass damper is a common option, which is used with a small pool in large room to accommodate “specific” air flows.

5.2. Geothermal/Dehumidification Typical Ducting Installation



6. OPTIONAL AUXILIARY HEAT

Water to air heat pump systems can be designed to provide all the heat required for a home or business regardless of the heat loss. It can be more cost-effective in many cases, however, to design a system that provides 70-90% of the heat on the coldest day of the year and use auxiliary heat to provide the remainder.

Geoflex can supply heat pumps with either internally mounted electric auxiliary heat, or with a hydronic (hot water) heating coil. Hydronic heating coils can be supplied with hot water from anyone of a number of different sources, including a gas water heater or boiler, or other type of fossil fuel appliance.

A hydronic heating coil is suitable in homes or buildings that have a power supply that is not large enough to operate an electric resistance element.

6.1. Internal Electric Auxiliary Heat

- Install an external electric plenum heater or hydronic coil (if required) in the discharge plenum to ensure proper airflow across the elements or hydronic coil without restricting airflow to the spaces (call for information before installing an external hydronic air coil for backup)
- Supply a separate power supply to the electric plenum heater through your system (the plenum heater manufacturer supplies all electrical power hookup diagrams)
- You can wire the 24-volt control circuit for the plenum heater through your system (the plenum heater manufacturer supplies all electrical control hookup diagrams)
- If your system was supplied from Geoflex complete with an internal electrical 10 kW, 15 kW or 20 kW plenum heater or 30,000 BTU/hr, 60,000 BTU/hr or 90,000 BTU/hr hydronic coil, the airflows and wiring are already integrated into the system (no adjustment is required)

6.2. Internal Hydronic Auxiliary Heat

If an internal hydronic heating coil is required for the heat pump it must be installed when the heat pump is being manufactured.

7. HYDRONIC DISTRIBUTION SYSTEM

Geoflex manufactures water to water heat pumps used in hydronic heating and cooling system, as well as Quad-function heat pumps designed to provide hot and cool air for a forced air system as well as hot water for hydronic heating.

7.1. Mass Storage Tanks

Mass storage tanks are strongly recommended for use with water to water heat pump systems and the water to water section of the Quad-function heat pumps. There are two reasons storage tanks must be used:

- The use of a storage tank prevents the heat pump compressor from short-cycling. Compressor manufacturers strongly recommend that a compressor not be cycled more than 6 times per hour. The tank must be sized to accommodate the heating or cooling capacity of the heat pump to operate for at least 6 minutes. The temperature set points that activate and deactivate the heat pump. The minimum storage tank capacity in US gallons can be calculated with the following formula:

- HC / 12 / 8.33 / ΔT = US gallons
  - HC = heating capacity
  - ΔT = heating shutoff set point – heating activation set point
- CC / 12 / 8.33 / ΔT = US gallons
  - CC = cooling capacity
  - ΔT = cooling activation set point – cooling shutoff set point

- If a hydronic distribution system includes is designed with more than one heating or cooling zone, the flow rate to the distribution system varies as various zones open and close. The flow rate to the heat pump, however, must be maintained for it to operate properly. The simplest method to ensure this is to pump water from the heat pump to the storage tank and back, and provide a separate pump for the distribution system.

7.2. Maximum Water Temperature Setpoint

Systems that use warm or chilled water for heat distribution to the spaces should be designed to operate at as low (heating) or high (cooling) a temperature as possible for maximum efficiency. Properly designed radiant floor heating systems work very well with water to water heat pumps since they can in most cases be designed to operate effectively with temperatures as low as 80 to 90ºF (27 to 32ºC)

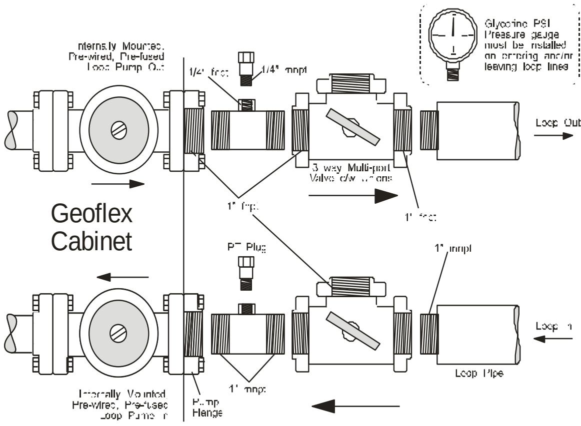
Fan coils and air handlers should be selected to provide the appropriate heating capacity for the space based on the water temperature the heat pump is capable of producing efficiently. With current refrigerants the **leaving** water temperature should be no greater than 120ºF (50ºC). That means entering water temperature to the heat pump should be no greater than 110 to 115ºF (43-46ºC)

Radiant floor heating systems should be designed to operate as at low a temperature as possible to maximize the efficiency and capacity of a water to water heat pump system. Outdoor reset controllers should be considered if possible, to reduce the hot water supply temperature or raise the chilled water temperature set point.

The drawing on the following page illustrates a typical water to water heat pump installation with pumps, hot and chilled water storage tanks and piping.

8. WATER PIPING FOR GROUND LOOP INSTALLATION

- A ground loop supply and discharge line diameter of 1.25" to 2.00" (depending on number of circuits and loop pipe) should be provided to reduce loop pipe friction loss.
- The typical system will have a 1" FNPT fitting for supply and return connections.
- If an external loop kit is included, isolation valves (gate or ball valves) should be installed on both sides of the pump package, isolating this area for servicing or pump replacement (if required)
- If the pumps are factory-installed within the cabinet, the diagram below can be referenced as an installation guide.
- As the complete purging of air is a primary concern and crucial to the appropriate operation of the complete system on any closed loop system, whether Earth coupled or on the product side on a “water to water” or an optional “Demand Water” system, please read on for more information regarding air purging.



Typical hookup when Loop Pumps are installed within the Geoflex cabinet

A 3-way "T-Valve" is provided by Geoflex. These valves should be installed near the water inlet and outlet of the heat pump.

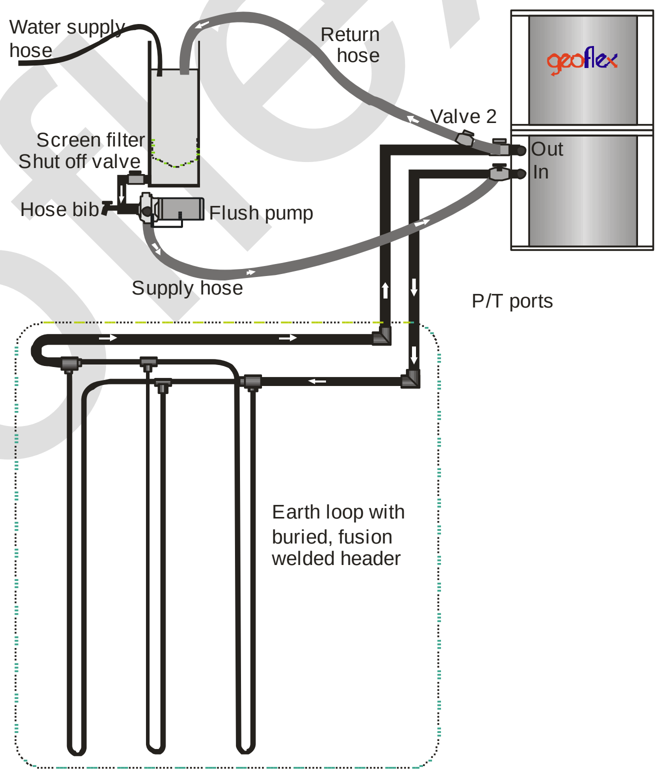
IMPORTANT NOTES:

The closed loop must be filled with water and air must be eliminated before operating any circulator pumps, including loop and optional hot water circulator pumps, as excessive air will cause pump burnout Closed loops should not run in heating without appropriate anti-freeze protection, as this will damage coil and void warranty..

Air Purging:

An air purging tank system will typically facilitate the commissioning process. Although not illustrated in this manual, a "stand pipe" can be installed on specific loops (before sealing) for re-pressurization. Call or email the installer or factory for more information regarding stand pipe type installation. The loop should maintain a minimum standing pressure of 20 to 40 PSI to accommodate appropriate circulation (slightly higher standing pressure commonly increases flow rate).

The instructions for flushing and purging a system with an internal loop pump in the heat pump are identical to flushing a loop with a pressurized pump module shown later in this manual.



9. PUMPING SYSTEMS FOR SINGLE HEAT PUMP SYSTEMS

For a geothermal system to operate properly there must be good heat transfer between the earth and the fluid circulating through the earth loop pipe. The fluid circulating through the loop must be clean and any debris, (such as plastic cuttings, pebbles, dirt etc.) that may have inadvertently entered the loop must be removed to prevent damage to the pump and to avoid clogging the heat exchanger in the heat pump. All the air trapped in the earth loop must also be removed (purged) from the loop. Oxygen in the fluid can oxidize metals in the system and/or constrict circulation of fluid through part of the loop (basically "air locking" some of the loop circuits) and essentially eliminate the use of part of the earth loop.

Several types of "pump modules" are used in residential and small commercial geothermal systems manufactured by Geoflex Systems Inc. They include:

- External pump modules designed for a "pressurized system", complete with three-way flush ports to facilitate flushing and purging the system
- External pump module designed for a "non-pressurized system". With this system the pump module itself is used to flush the debris and air from the earth loop.
- Internally mounted circulation pumps

External Pump Module for "Pressurized System":

This is an illustration of a commonly used pump module system for residential and small commercial systems. The pump modules are available with either one or two Grundfos model 26-116 circulators, and with either brass or composite plastic full port ball valves. The supply and return lines from the earth loop are connected to one end of the pump module while connections on the opposite end are connected to the heat pump. If the pump module is built with two pumps, they are designed to pump in series. The pump module should be installed with valves between the earth loop connections and the pumps to allow the loop to be isolated from the system if the pumps need to be replaced.

Non-pressurized Pump Modules:

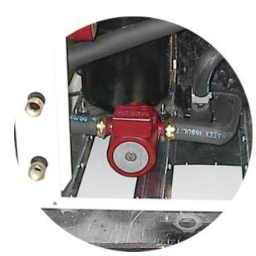
These pump modules are designed ONLY for installation in small heat pump systems, and only for heat pumps that require a flow rate of less than 16 USgpm. The advantage of this pump module is that it can be used to flush the air and debris from the earth loop without the need for a large flush cart.

There are limitations to using this pump module to flush air from the earth loop. These include:

- Only one heat pump or two heat pumps with a total flow rate requirement of less than 16 USgpm can be flushed.
- Buried, fusion welded headers MUST NOT be used with this pump module. Individual loop circuits must be accessible and there MUST be a shut-off valve on each individual circuit. The flow rate available from this module is inadequate to provide enough flow to flush several parallel loop circuits simultaneously.
- Pipes larger than 1.25" MUST NOT be used in a system with this type of pump module.

Internal Pump(s) for Pressurized System

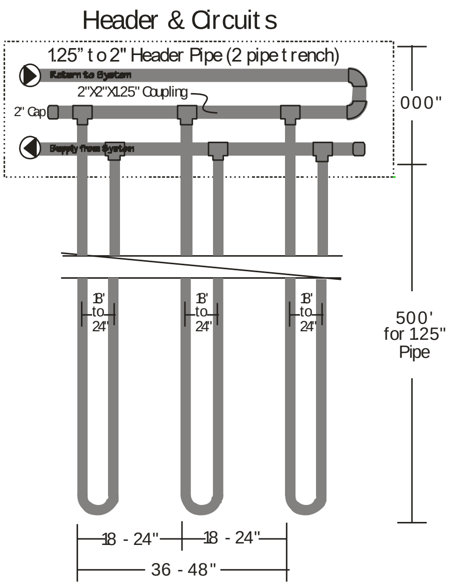
Geoflex builds heat pumps with an internal loop pump option on some models typically units with a heating capacity less than 60,000 Btu/hr (18 kW). Three-way "T-Valves" must be installed near the heat pump water connections to facilitate flushing and purging the earth loop.

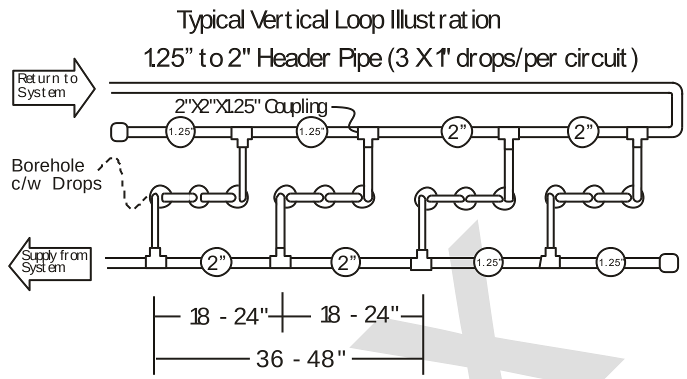


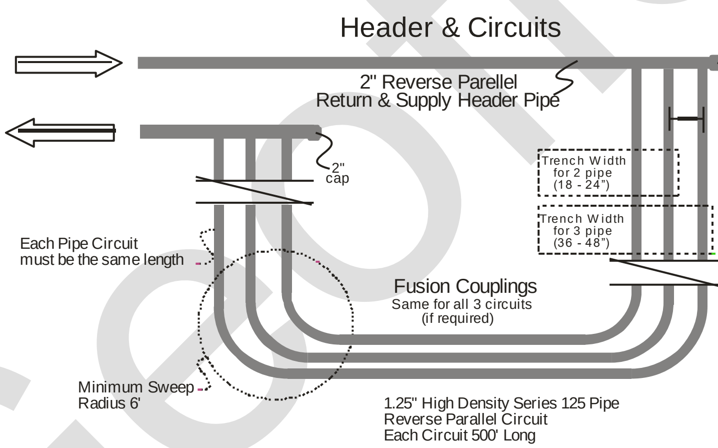
Geoflex, Pre-designed Internal Manifold Systems

Geoflex manufactures a Manifold System, designed to eliminate the need for underground fusing. When a manifold system is employed all of the loop circuits would come into the building where all loop connections are made. Although a manifold system cannot be used on all installations, it can be used on most an it offers many benefits, including but not limited to, reduced purging horse power, as each circuit can be purged individually, no need for specialty fusing equipment, less possibility of underground design flaws, if one circuit is punctured, that circuit can be shut down individually allowing for continued use, serviceability of the loop, the manifold commonly comes with diagnostics tools built on, allowing for simpler monitoring of the system. Manifold Systems are commonly used on commercial projects but Geoflex has developed a cost effective system which is now commonly used for residential applications.

10. TRADITIONAL, THERMALLY FUSED UNDERGROUND CLOSED LOOP ARRANGEMENT (Sample for single heat pump systems)





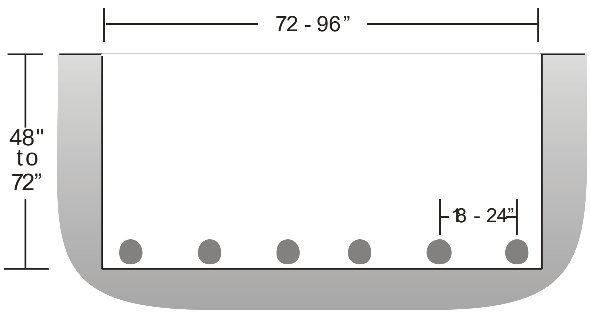


Rules of Thumb for Closed Loops:

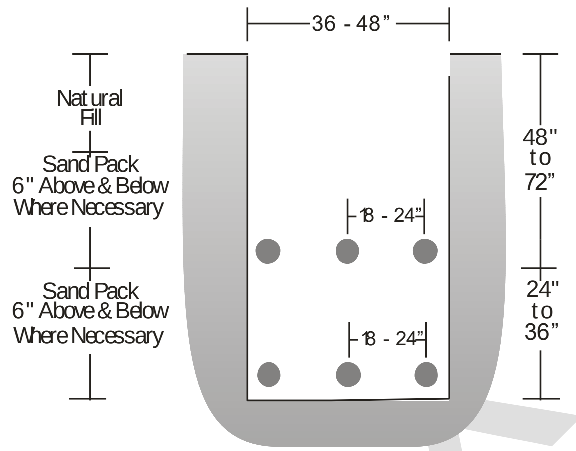
* Sanding pressure on a closed should run at approximately 30 PSI
* All closed Loop should be installed in a parallel reverse fashion
* All loop circuits must be the same length

Pipe Size	Minimum Spacing in Trench	Feet per Circuit
0.75"	18 - 24"	550 - 650
1.00"	22 - 28"	750-850
1.25"	24 - 30"	950-1050

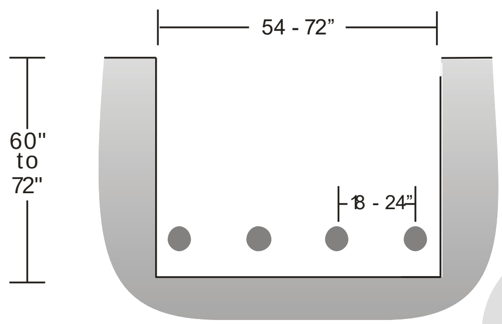
11. Closed Loop Sample Trench Types



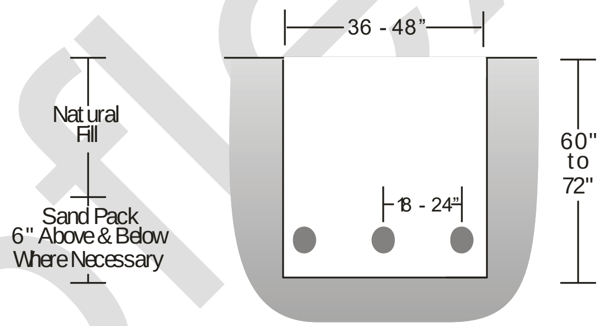
Typical 6 pipe Configuration



Typical 6 pipe (2X3) Configuration



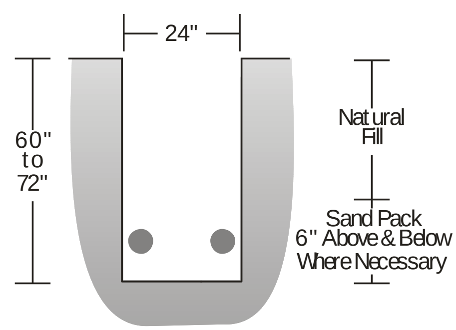
Typical 4 Pipe Trench



Typical 3 Pipe Trench

Notes:

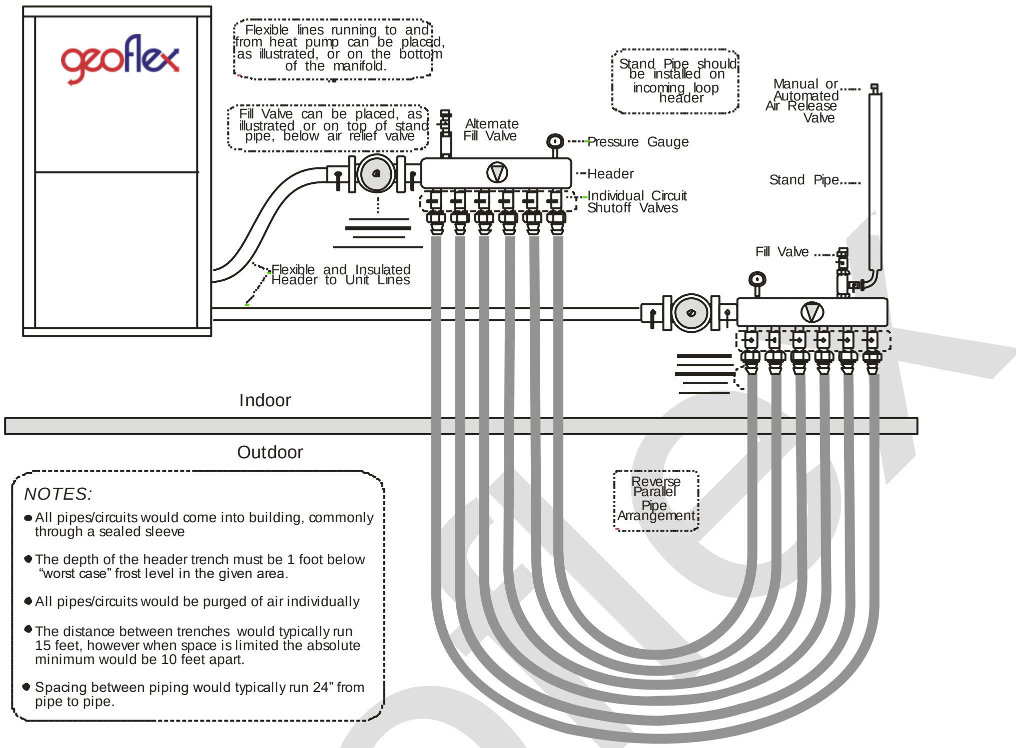
- The depth measurement will be completely dependant on the frost level in the given location. The general rule of thumb is to keep the loop pipe at least 1 foot below the frost line in the area.
- When using a two pipe layout, you would simply take one pipe out of the illustration of 3 pipe.
- When locating area on property to run your loop, you should note when considering ground, usually the wetter the better for better thermal transmission.
- We have illustrated 1.25” loop pipe with 2” headers herein, however loop pipe will come commonly in three sizes .75”, 1.00” and 1.25”, headers will adjust accordingly.
- The further you can space the pipe apart, and the wetter the ground, the better.
- Be sure no rocks, sharp or otherwise, are lying to close to the loop pipe, prior to backfilling, as they can move and damage the pipe.



Typical 2 Pipe Trench

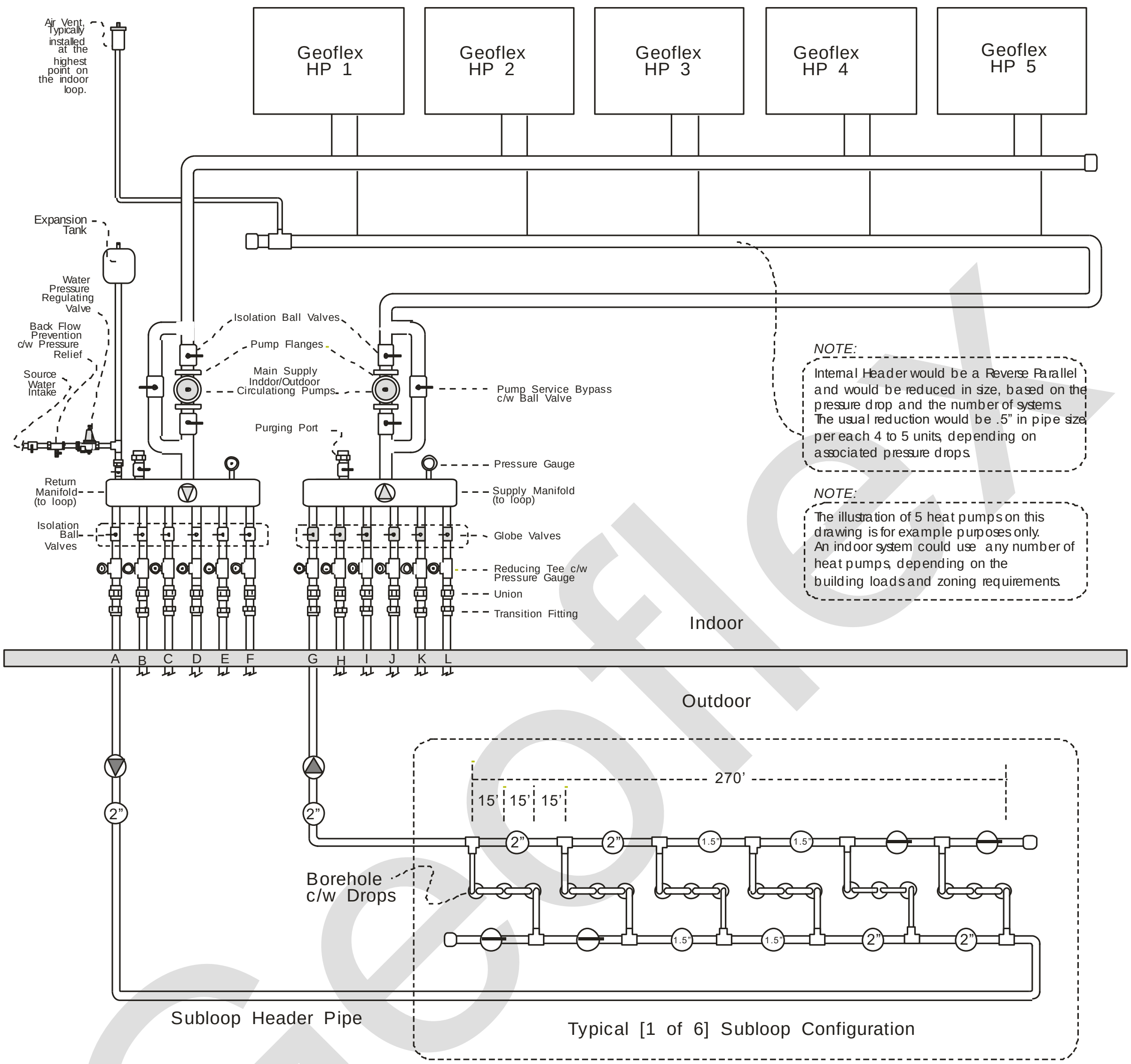
12. CLOSED LOOP ARRANGEMENT – INTERNAL HEADERS – NO FUSING

[SAMPLE FOR (HEADERS INSIDE) SINGLE HEAT PUMP SYSTEMS]



SLIM JIMS HEAT TYPE STAINLESS STEEL EXCANGERS – Placeholder Insert Here

13. CLOSED LOOP ARRANGEMENT - SAMPLE FOR MULITPLE HEAT PUMP SYSTEMS



NOTES:

- The main header trench would typically be 4 to 5 feet wide, at minumum.
- The depth of the header trench must be 1 foot below "worst case" frost level in the given area.
- This illustration shows a typical subloop, however there would be another 5 subloops with this particular loop layout.
- The distance between the boreholes and subloops would typically run 15 feet, however when space is limited the absolute minimum would be 10 feet apart.
- The borehole depth would be dependant on the ground characteristics and test hole results.

14. PUMPING SYSTEMS FOR LARGER SYSTEMS

There are many different methods of installing circulation pumps for larger commercial systems. The use of the building, the number and type of heat pumps, the location of the heat pumps in the building, the concentration and type of antifreeze used in the system and many other factors may have an influence on the type and size of pump selected. Please contact the factory or work with a qualified engineering firm or installation company to design an appropriate pumping system for your application.

15. OPEN WELL WATER SOURCE SYSTEM

General

Geoflex Systems may be successfully applied in a wide range of residential, commercial, and industrial applications. It is the responsibility of the system designer and installing contractor to ensure that acceptable water quality is present and that all applicable codes have been met in these installations.

Water Treatment

Do not use untreated or improperly treated water. Equipment damage may occur. The use of improperly treated or untreated water in this equipment may result in scaling, erosion, corrosion, algae or slime. The services of a qualified water treatment specialist should be engaged to determine what treatment, if any, is required. The product warranty specifically excludes liability for corrosion, erosion or deterioration of equipment. The heat exchangers in the units are either copper or optional cupro-nickel, copper or cupro-nickel double wall vented heat exchangers are used. Brazed plate heat exchangers are commonly used with larger industrial water to water systems. The water piping in the heat exchanger is commonly copper, unless otherwise specified. There may be other materials in the building's piping system that the designer may need to take into consideration when deciding the parameters of the water quality. If an antifreeze or water treatment solution is to be used, the designer should confirm it does not have a detrimental effect on the materials in the system.

Contaminated Water

In applications where the water quality cannot be held to prescribed limits, the use of a secondary or intermediate heat exchanger is highly recommended to separate the unit from the contaminated water.

Water Quality

The following table outlines the water quality guidelines for unit heat exchangers. If these conditions are exceeded, a secondary heat exchanger is required. Failure to supply a secondary heat exchanger where needed will result in a warranty exclusion for primary heat exchanger corrosion or failure.

Water Quality Guidelines

Material		Copper	90/10 Cupro-Nickel	316 Stainless Steel
pH	Acidity/Alkalinity	7 - 9	7 - 9	7 - 9
Scaling	Calcium and Magnesium Carbonate	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm
Corrosion	Hydrogen Sulfide	Less than .5 ppm (rotten egg smell appears at 0.5 PPM)	10 - 50 ppm	Less than 1 ppm
	Sulfates	Less than 125 ppm	Less than 125 ppm	Less than 200 ppm
	Chlorine	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Chlorides	Less than 20 ppm	Less than125 ppm	Less than 300 ppm
	Carbon Dioxide	Less than 50 ppm	10 - 50 ppm	10- 50 ppm
	Ammonia	Less than 2 ppm	Less than 2 ppm	Less than 20 ppm
	Ammonia Chloride	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Ammonia Nitrate	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Ammonia Hydroxide	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Ammonia Sulfate	Less than .5 ppm	Less than .5 ppm	Less than .5 ppm
	Total Dissolved Solids (TDS)	Less than 1000 ppm	1000-1500 ppm	1000-1500 ppm
	LSI Index	+0.5 to -.05	+0.5 to -.05	+0.5 to -.05
Iron Fouling (Biological Fouling)	Iron, Fe2+ (Ferrous) Bacterial Iron Potential	< .2 ppm	< .2 ppm	< .2 ppm
	Iron Oxide	Less than 1 ppm. Above this level deposition will occur.	Less than 1 ppm. Above this level deposition will occur.	Less than 1 ppm. Above this level deposition will occur.
Erosion	Suspended Solids	Less than 10 ppm and filtered for max of 600 micron size	Less than 10 ppm and filtered for max of 600 micron size	Less than 10 ppm and filtered for max of 600 micron size
	Threshold Velocity (Fresh Water)	< 6 ft/sec	< 6 ft/sec	< 6 ft/sec

NOTE: Strainers/Filters

When a brazed plate heat exchanger(s) is used with an industrial water to water system, these units must have properly sized strainers/filters upstream of any brazed plate heat exchangers to protect them against particles in the fluid. In a standard residential application, a strainer or filter can be used to avoid potential fouling and would be up stream of the heat exchanger. Failure to install proper strainers/filters and perform regular service can result in serious damage to the unit, and cause degraded performance, reduced operating life and failed compressors. Improper installation of the unit (which includes not having proper strainers/filters to protect the heat exchangers) can also result in voiding the warranty. Field supplied strainers/filters with 20-40 mesh (530-1060 microns) are recommended, with 30 mesh (800 microns) being the optimum choice. The strainers selected should have a mesh open area of at least 6 square inches (39 square centimeters) for each unit being serviced by the strainer/filter. Using strainers/filters with a smaller amount of open area will result in the need for more frequent cleaning. Strainers/filters should be selected on the basis of acceptable pressure drop, and not on pipe diameter. The strainers/filters selected should have a pressure drop at the nominal flow rate of the units low enough to be within the pumping capacity of the pump being used.

WARNING: Must order with specialized heat exchanger or have intermediate heat exchanger when used in pool /hot tub applications.

Open Well Set-up

- All "well" valves and controls should be installed outside of the system, allowing for easy service.
- All components and controls should be installed with plumbing unions and isolation ball or gate valves to accommodate quick removal for replacement or maintenance (cleaning screens, etc.)
- The supply line must be a minimum diameter of 3/4" to the unit with a pressure regulating valve connected to the incoming water lines
- A motorized shut-off valve must be connected to the outgoing water line. The motorized valve is installed close to the unit on the outgoing water line and connected to the 24-volt leads coming out of the unit. These leads are connected to a water solenoid relay, which will operate in heating and cooling or in heating only. To operate in heating and cooling, modes must be switched by using Dip Switch #1.
- An A/C head pressure control valve reduces water flow in A/C mode (not always installed).
- The discharge line from the unit should be a minimum of 3/4" and ensure proper drainage. The discharge line must be buried below the frost level to avoid water freezing (insulating this line will prevent excessive condensation in the heating mode).
- Channel condensation from the unit (created in cooling mode) to a free-flowing drain.
- A pressure-regulating water valve c/w a filter screen and with a pressure gauge should be installed on the incoming water line to garantee consistent water flow rates, without fluctuations commonly caused from the well pumping system. This valve ensures constant water flow by providing a constant pressure to the unit. Fluctuations in water flow will reduce the equipment's lifespan. The screen located on the bottom of the pressure-regulating valve must be cleaned periodically (required cleaning frequency varies due to water system-specific contaminants).
- Although water filtration should always be a point of consideration, with specified heat exchangers (eg. brazed plate) and/or with below pare water conditions a filter/Strainer must be used upstream of heat exchangers, if required

NOTE: Always use two wrenches when attaching any well water lines to the system (twisting off the fitting can cause leakage and necessitate subsequent repair)

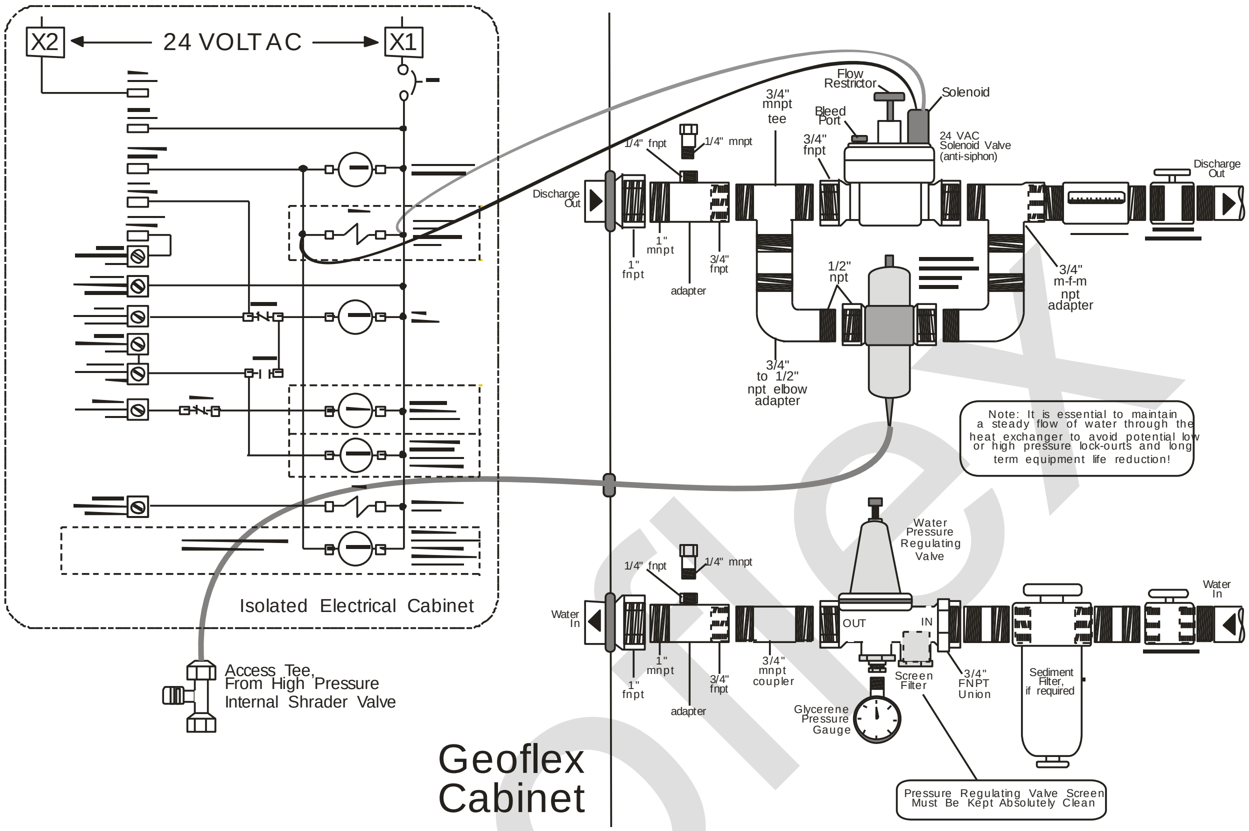
Please note that the safety features of your Geoflex Geothermal System is in a sense monitoring your well system flow to ensure it is within the parameters of its internal operational safety range. Your system will require a predetermined water flow rate and temperature. If your entering water temperature (EWT) fluctuates, adjust the flow rate to accommodate this fluctuation. For example, if the system calls for 9 USgpm at 50 °F, EWT, and the EWT temperature drops to read, 45 °F, the new flow rate will increase to 10 GPM to maintain rated output. Never allow the leaving water temperature (LWT) to drop below 35 °F. If this occurs, increase the flow rate to bring the LWT up to an appropriate level (low temperature operation can void your warranty, as the heat exchanger could potentially be ruptured due to freezing). In heating mode, if there is a water flow reduction or dramatic drop in water temperature, the Geoflex System could activate the internal low pressure safety lockout. Before calling for service, please ensure that water flow is adequate.

Chart of Water Rates
(rounded to nearest whole number):

Nominal Capacity	Heating @32 F EWT (GPM)	Heating @50 F EWT (GPM)
026	8	4
038	9	6
049	12	8
064	16	10
022	18	11
030	8	5
036	9	6
042	10	7
048	12	7
060	15	9
070	18	10

Expected Delta T @ 32 in Heating 4-6 F
Expected Delta T @ 50 in Heating 9-11 F

15.1. Water Well Hook-up Illustration



15.2. "Open Water Pump and Dump" type Systems

A "Pump and Dump" System is a system that uses various open water sources. Lake, Pond, River, underground stream, to name just a few. It would be considered an open loop, as it would not be sealed in a closed loop arrangement and no anti-freeze can be used. However, in some cases the loop can be closed with the utilization of a heat exchanger. The system will circulate the water from one place to another, commonly within the same body of water. For example, you could use a system that will pull water from one side of a pond or loop, filter that water and reject it to another side of the same pond. The pond or water body must have the appropriate amount of water volume to sustain the load for winter and summer operation. Care must be taken to be sure that the yield, quality of water and temperatures are appropriate fro winter and summer operation. If you have this type of system, call the factory for further information.

15.3. Water Quality for Open Well Systems

Water quantity should be plentiful and of good quality. Consult Table 3 for water quality guidelines. The unit can be ordered with either a copper or cupro-nickel water heat exchanger. Consult the following table for recommendations. Copper is recommended for closed loop systems and open loop ground water systems that are not high in mineral content or corrosiveness. In conditions anticipating heavy scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, a closed loop system is recommended. Heat exchanger coils may over time lose heat exchange capabilities due to a build up of mineral deposits inside. These can be cleaned only by a qualified service mechanic as acid and special pumping equipment are required. Desuperheater coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional acid flushing.

15.4. Water Quality Chart for Open Loop

Water Quality Parameter	HX Material	Water Quality Standard		
Scaling Potential – Primary Measurement – above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below				
pH/calcium hardness method	All	pH < 7.5 and Ca Hardness < 100		
Index Limits for Probable Scaling Situations – (operation outside these limits not recommended) Scaling indexes should be calculated at 150°F for direct used and HWG applications, and at 90°F for indirect HX use. A monitoring plan should be implemented				
Ryznar Stability Index	All	6.0-7.5 (if > 7.5 minimize steel pipe use		
Langelier Saturation Index	All	-0.5 to +0.5 If <-0.5 minimize steel pipe use. Based on 150°F HWG and direct well, 85°F indirect well HX		
Iron Fouling				
Iron Fe^{2+} (Ferrous) Bacterial Iron Potential	All	<0.2 ppm (Ferrous) If Fe^{2+} (ferrous)>0.2 ppm with pH 6-8, O_2<5 ppm check for iron bacteria		
Iron fouling	All	<0.5 ppm of Oxygen (above this limit deposition will occur		
Corrosion Prevention				
pH	All	6-8.5 Minimize steel pipe use below 7 and no open tanks with pH<8		
Hydrogen Sulfide (H_2S)	All	At H2S>0.2 ppm, avoid use of copper and copper nickel piping or HX's. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronzes or brass) cast components ar OK to <0.5 ppm		
Ammonia ion as hydroxide, chloride, nitrate and sulfate compounds	All	<0.5 ppm		
Maximum Chloride Levels		Maximum Allowable at Maximum Water Temps		
		50°F (10°C)	75°F (24°C)	100°F (38°C)
	Copper	<20 ppm	NR	NR
	CuNi	<150 ppm	NR	NR
	304 SS	<400 ppm	<250 ppm	< 150 ppm
	316 SS	<1000 ppm	<550 ppm	<375 ppm
	Titanium	>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging				
Particulate Size & Erosion	All	<10 ppm (<1 ppm "sandfree" for reinjection) of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size. Any particulate that is not removed can potentially clog components		

16. HEAT PUMP START-UP COMMISSIONING PROCEDURES

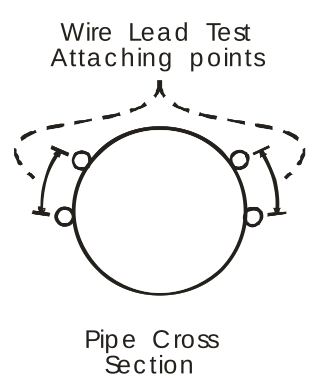
16.1. Legend of testing points (Install the temperature probes on…)

Type	Acrynom	Equipment	Sensing… Sensor Probe attachment point
T1	ELEWT	WA,WW	"Earth Coupled" Loop Entering Water/Liquid Temperature (Loop In)
T2	ELLWT	WA,WW	"Earth Coupled" Loop Leaving Water/Liquid Temperature (Loop out)
T3	EAT	WA,DH	Entering (Return from space) Air Temperature
T4	LAT	WA,DH	Leaving (Discharge to space) Air Temperature
T5	DSWEWT	OP-ALL	"Desuperheater Water option" Entering Water Temperature
T6	DSWLWT	OP-ALL	"Desuperheater Water option" Leaving Water Temperature
T7	ODWEWT	OP-WA-DH	Demand Entering Water Line Temperature & On-Demand Liquid Cooled Option on dehumidification systems
T8	ODWLWT	OP-WA-DH	On-Demand Leaving Water Line Temperature & On-Demand Liquid Cooled Option on dehumidification systems
T9	HBTEWT	OP-ALL	"Hydronic Buffer Tank" Entering Water Temperature (Demand Water or Water to Water buffering tank product side)
T10	HBTLWT	OP-ALL	"Hydronic Buffer Tank" Leaving Water Temperature (Demand Water or Water to Water buffering tank product side)
T11	PWEWT	WW	Product (Hot/Chilled) Entering Water Temperature (Hot/Chilled "Water to Water")
T12	PWLWT	WW	Product (Hot/Chilled) Leaving Water Temperature (Hot/Chilled "Water to Water")
T13	PRWEWT	OP-DH	"Proportional Reheat Water Coil" Entering Water Temperature, (most commonly used on Dehumidification Systems)
T14	PRWLWT	OP-DH	"Proportional Reheat Water Coil" Leaving Water Temperature, (most commonly used on Dehumidification Systems)
* T15	SLT	WA-WW-DH	Suction/Liquid Line Temperature - if gauges are installed (see illustrations for refrigeration circuitry, in this manual)
* T16	LLT/FLT	WA-WW-DH	Liquid/Flash (for reversing mode units) Line Temperature(s) - if gauges are installed, (see illustrations for refrigeration circuitry, in this manual)
* T17	FLT/LLT	WA-WW-DH	Flash/Liquid (for reversing mode units) Line Temperature(s) - if gauges are installed, (see illustrations for refrigeration circuitry, in this manual)
* T18	DLT	WA-WW-DH	Discharge Line Temperature - if gauges are installed (see illustrations for refrigeration circuitry, in this manual)
* T19	ECLI	WA/DH	Discharge Line Freon Temperature Out to External Remote, Condenser
* T20	ECLO	WA/DH	Liquid Line Freon Temperature In from External Remote, Condenser
* PT17	SGT	WA-WW-DH	Suction Gauge Temperature - Pressure/Temperature read directly from pressure gauges only if, needed, must be qualified refrigeration technician
* PT18	DGT	WA-WW-DH	Discharge Gauge Temperature - Pressure/Temperature read directly from pressure gauges only if, needed, must be qualified refrigeration technician
* RP19	SGP	WA-WW-DH	Suction Gauge Pressure (PSI), Pressure directly from pressure gauges only if, needed, must be qualified refrigeration technician
* RP20	DPT	WA-WW-DH	Discharge Gauge Pressure (PSI) - Pressure directly from pressure gauges only if, needed, must be qualified refrigeration technician

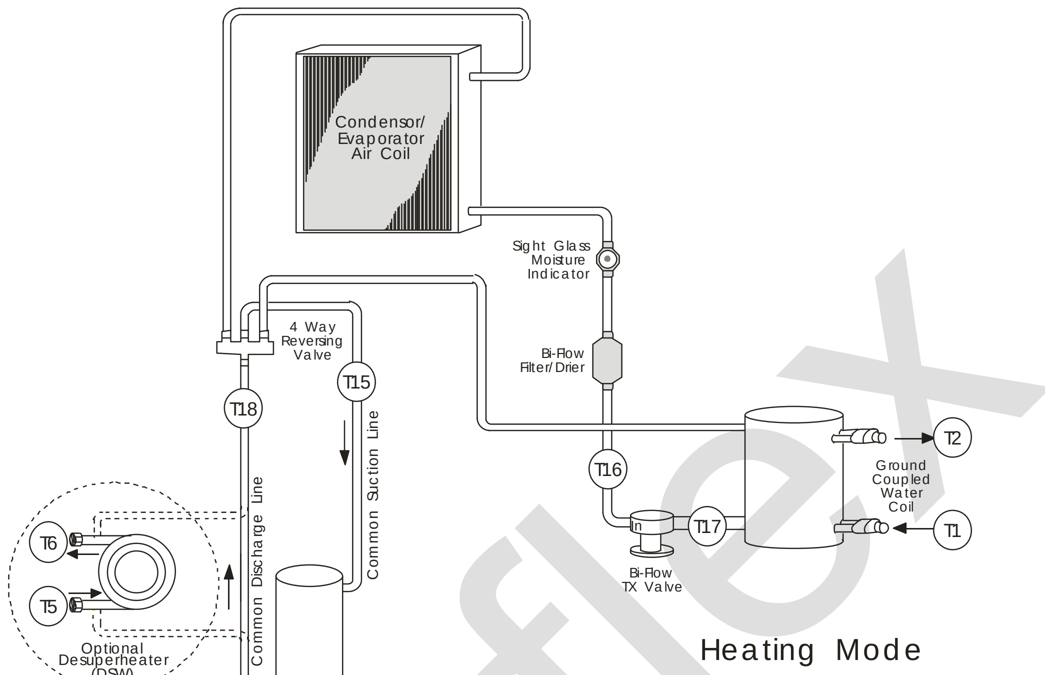
* Must be qualified refrigeration technician for this testing and analysis.

NOTE: As Geoflex manufacturers an extremely broad range of standard and specialized equipment, please note that locations of water lines and return and discharge air locations can vary, depending on system, please refer to labeling on equipment for appropriate locations.

The terms Delta T, which equals "Difference in Temperature" and Delta P, which equals, "Difference in pressure", between incoming and outgoing water and airflows, will be used throughout this manual.

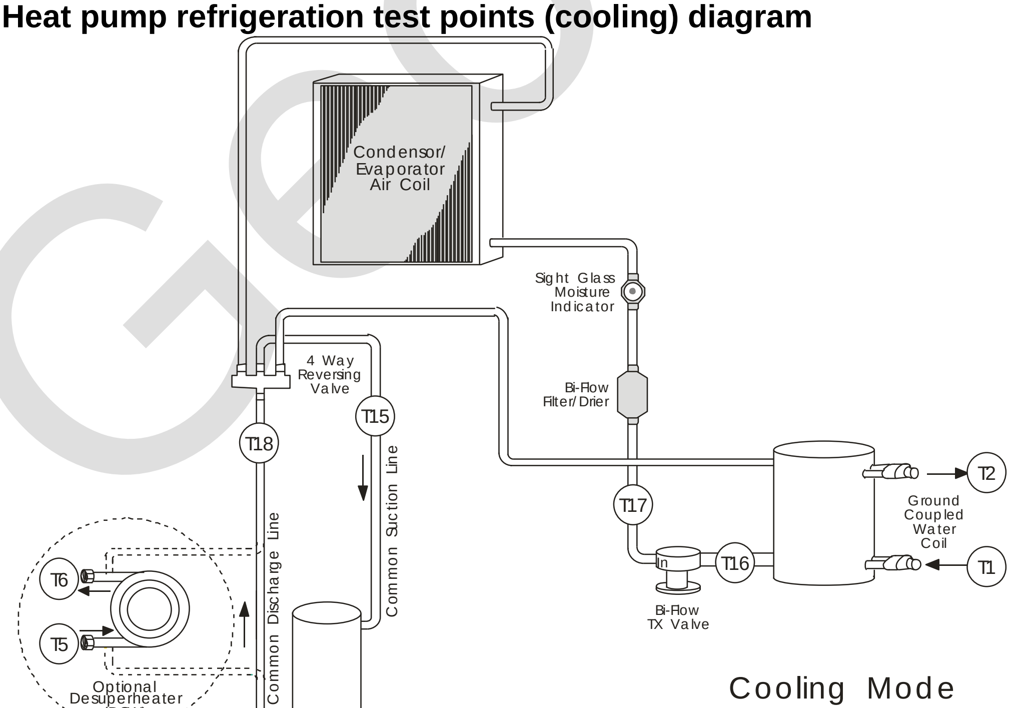


16.2. Heat pump refrigeration test points (heating) diagrams



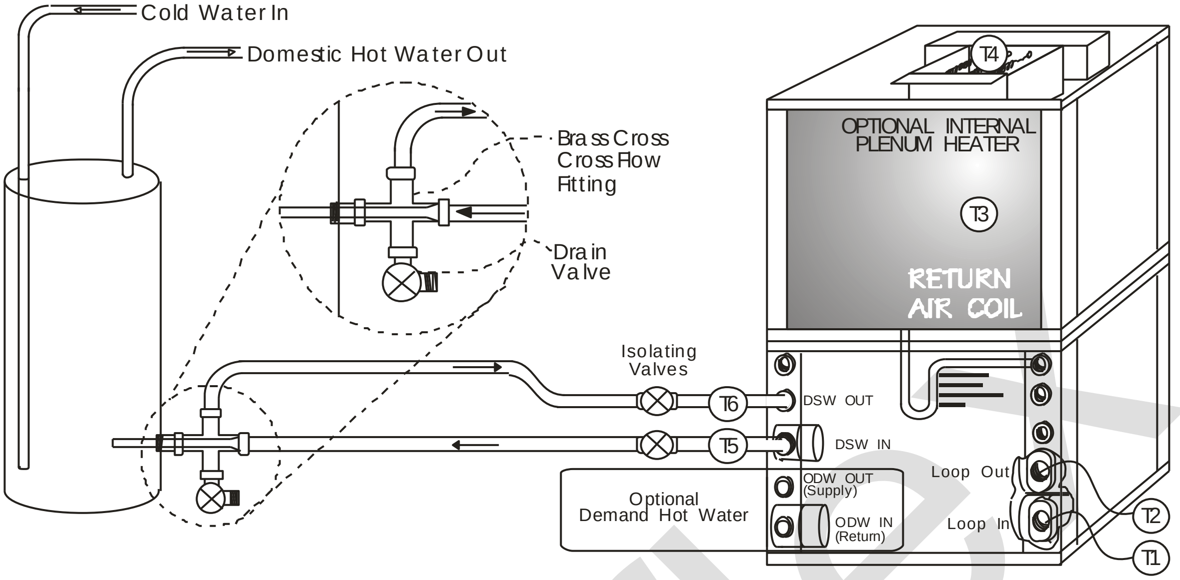
24V Electrical Pattern	Heating	Cooling
4 Way RV Valve	Off	24V

16.3. Heat pump refrigeration test points (cooling) diagram

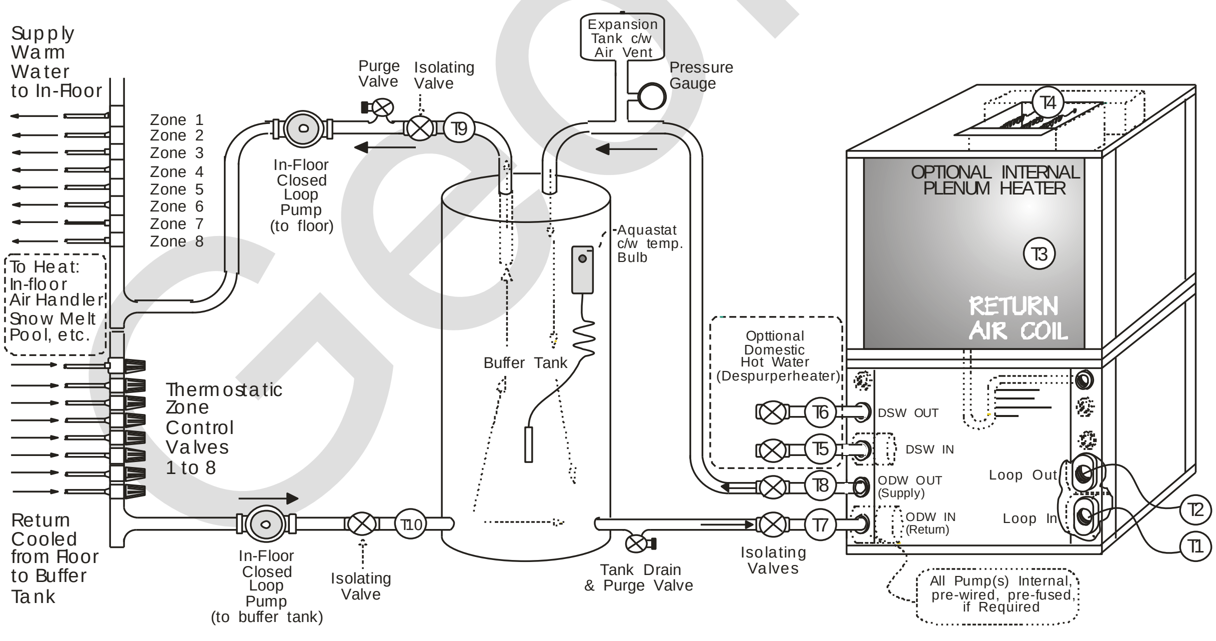


24V Electrical Pattern	Heating	Cooling
4 Way RV Valve	Off	24V

16.4. Heat pump with optional desuperheater showing piping connections



16.5. Heat pump showing piping connections with Demand Water option



16.6. Commissioning and Test Record/Log Sheet

Product Model Number:________________ Product Serial Number:__________________________

Type	Acronym-Equipment	Sensing… Sensor Probe attachment point	Heat/Cool	Heat/Cool	Heat/Cool	Heat/Cool
		Date Time				
		Voltage Amperage Watts (Voltage X Amps)				
T1	ELEWT-WA,WW	"Earth Coupled" Loop Entering Water/Liquid Temperature (Loop In)				
T2	ELLWT WA,WW	"Earth Coupled" Loop Leaving Water/Liquid Temperature (Loop out)				
T3	EAT-WA,DH	Entering (Return from space) Air Temperature				
T4	LAT-WA,DH	Leaving (Discharge to space) Air Temperature				
T5	DSWEWT-OP-ALL	"Desuperheater Water option" or "Pool Reheat" Entering Water Temperature				
T6	DSWLWT-OP-ALL	"Desuperheater Water option" or "Pool Reheat" Leaving Water Temperature				
T7	ODWEWT-OP-WA-DH	Demand Entering Water Line Temperature & On-Demand Liquid Cooled Option on dehumidification systems				
T8	ODWLWT-OP-WA-DH	On-Demand Leaving Water Line Temperature & On-Demand Liquid Cooled Option on dehumidification systems				
T9	HBTEWT-OP-ALL	"Hydronic Buffer Tank" Entering Water Temperature (Demand Water or Water to Water buffering tank product side)				
T10	HBTLWT-OP-ALL	"Hydronic Buffer Tank" Leaving Water Temperature (Demand Water or Water to Water buffering tank product side)				
T11	PWEWT-WW	Product (Hot/Chilled) Entering Water Temperature (Hot/Chilled "Water to Water")				
T12	PWLWT-WW	Product (Hot/Chilled) Leaving Water Temperature (Hot/Chilled "Water to Water")				
T13	PRWEWT OP-DH -	"Proportional Reheat Water Coil" Entering Water Temperature, (most commonly used on Dehumidification Systems)				
T14	PRWLWT-OP-DH	"Proportional Reheat Water Coil" Leaving Water Temperature, (most commonly used on Dehumidification Systems)				
T29	BAC-DH	If Requested/Included… Between "Air Condensor" and "Air Evaporator" Air Temperature, (only on Dehumidification Systems)				
* T15	SLT- WA-WW-DH	Suction/Liquid Line Temperature - if gauges are installed (see illustrations for refrigeration circuitry, in this manual)				
* T16	LLT/FLT-WA-WW-DH	Liquid/Flash (for reversing mode units) Line Temperature(s) - if gauges are installed, (see illustrations for refrigeration circuitry, in this manual)				
* T17	FLT/LLT-WA-WW-DH	Flash/Liquid (for reversing mode units) Line Temperature(s) - if gauges are installed, (see illustrations for refrigeration circuitry, in this manual)				
* T18	DLT- WA-WW-DH	Discharge Line Temperature - if gauges are installed (see illustrations for refrigeration circuitry, in this manual)				
* PT17	SGT- WA-WW-DH	Suction Gauge Temperature - Pressure/Temperature read directly from pressure gauges only if, needed, must be qualified refrigeration technician				
* PT18	DGT- WA-WW-DH	Discharge Gauge Temperature - Pressure/Temperature read directly from pressure gauges only if, needed, must be qualified refrigeration technician				
* RP19	SGP- WA-WW-DH	Suction Gauge Pressure (PSI), Pressure directly from pressure gauges only if, needed, must be qualified refrigeration technician				
* RP20	DPT- WA-WW-DH	Discharge Gauge Pressure (PSI) - Pressure directly from pressure gauges only if, needed, must be qualified refrigeration technician				

16.7. Water to Air c/w Desuperheater and/or Demand Water Option

STEP ONE: As the refrigeration is similar to a refrigerator and is a closed system, refrigeration gauges should not be installed. However, if and only when the complete system performance does not fall within prescribed parameters and is approved and supervised by Geoflex, gauge installation and charge adjustments are allowed. If a qualified refrigeration person deems it necessary to asses and in some cases reset the charge superheat, please contact Geoflex for the appropriate superheat setting for your specific installation. Before starting the system, ensure that all plumbing hookups and water lines are installed and have been ***"double checked" for leaks*** *(inside and outside of the equipment),* the air ducting is in place, drywall sanding has been completed and all dust has been completely eliminated from the space, all electrical wiring is complete and ALL elements adhere to manufacture's specifications and local codes. **On all closed loop system, be absolutely sure that anti-freeze is in system at the appropriate levels PRIOR, to start-up, other wise you can damage your system, with a water coil rupture and this is not covered by any warranty.** ***All testing and diagnosis must be carried out by qualified technicians.*** **NOTE:** If your system incorporates an integrated "Desuperheater Option" see Step nine below and ensure to turn off SW#3 (Desuperheater Control Switch) until startup is complete. If your system is built with a Demand Water option, ensure that the Aquastat is turned off for initial commissioning. For more information on the Desuperheater and/or Demand Water (ODW) Options, see Step Eight below and drawing on page 20. If your system incorporates an electrical or hydronic back-up/emergency heater, be sure that it is turned off for all initial testing, or until you are specifically testing it, which would be done last. Note for the testing in this section, see the range of delta T's. as listed herein.

STEP TWO: Install the temperature sensors in the appropriate places, at a "2 to 3" or "9 to 10:00" o'clock (see diagram on legend of testing points in section 11.1) position on the pipe. For a water-to-air system, attach temperature sensors on points T1, T2, T3 and T4. If a Desuperheater Option is installed, also attach temperature sensors on points T5 and T6. If Demand Water Option is installed, also attach sensors on points T7 and T8. See attached legend and drawings to find locations to install the temperature sensors

STEP THREE: Install clamp-on type amperage meter onto the L1 main power line into system and be sure to have a multi-meter available to check and record voltages. When checking operating amperages, it is important to check both L1 and L2 independently, then add and divide by two to get proper amperages. This will also serve to be sure that your power is being drawn evenly across both power legs. The differential should not exceed, 2 amps.

STEP FOUR: With the **main breaker/fuse power disconnect "turned off"**, be sure switch SW1, SW2 (compressor switch) and SW3 (Desuperheater switch, if installed), are turned off. Set the air thermostat to heat and the "fan switch" to "auto" and then set the temperature selector to "call for heat" (set the selector higher than the current room temperature). If Demand Water option is incorporated, leave the Aquastat to the off position at this stage since the air system should **always** be tested first. As a note, heating mode should always be tested first.

STEP FIVE: With SW1, SW2 and SW3 turned off, then turn on the main disconnect. The main voltage should be tested across L1 and L2, with a multi-meter, to be sure that you have appropriate power, which should be between, 208 and 250 VAC, depending on service. The clamp on amperage meter should have no reading and provided voltage falls within appropriate parameters, turn on SW1. The fan will start immediately and loop pumps will start after a 3 minute time delay, but the compressor will not start (this is normal)**.** Ensure that the system's blower is on and delivering airflow, through the ducts. Once the blower starts, the amperage meter will start to register an amperage draw, record that draw while waiting for loop pumps to start. Once loop pumps start, the amperage draw will increase accordingly (1 to 2 amps). This will help to ensure that the loop pumps are powered. The service jumper on the circuit board should be factory set to "no" which means that you'll have a 3 minute time delay, for the loop pumps to start. However, if the test jumper is set to "yes", there will only be a very short time delay. Once all testing is complete, be sure the jumper is set to no (normal operation), as the time delay is important to the operation of the system.

STEP SIX: Check and record all pressure drops across all operating water coils. PT (pressure/temperature) plugs would normally be provided with the system for this purpose. They allow a temperature or pressure probe to be inserted into the pipe without letting air in or fluid out. The desuperheater pressure drop is commonly not tested as it is easily tested (covered in instructions below). Refer to the diagram on page 20 for the location of PT plug pressure and temperature testing points.

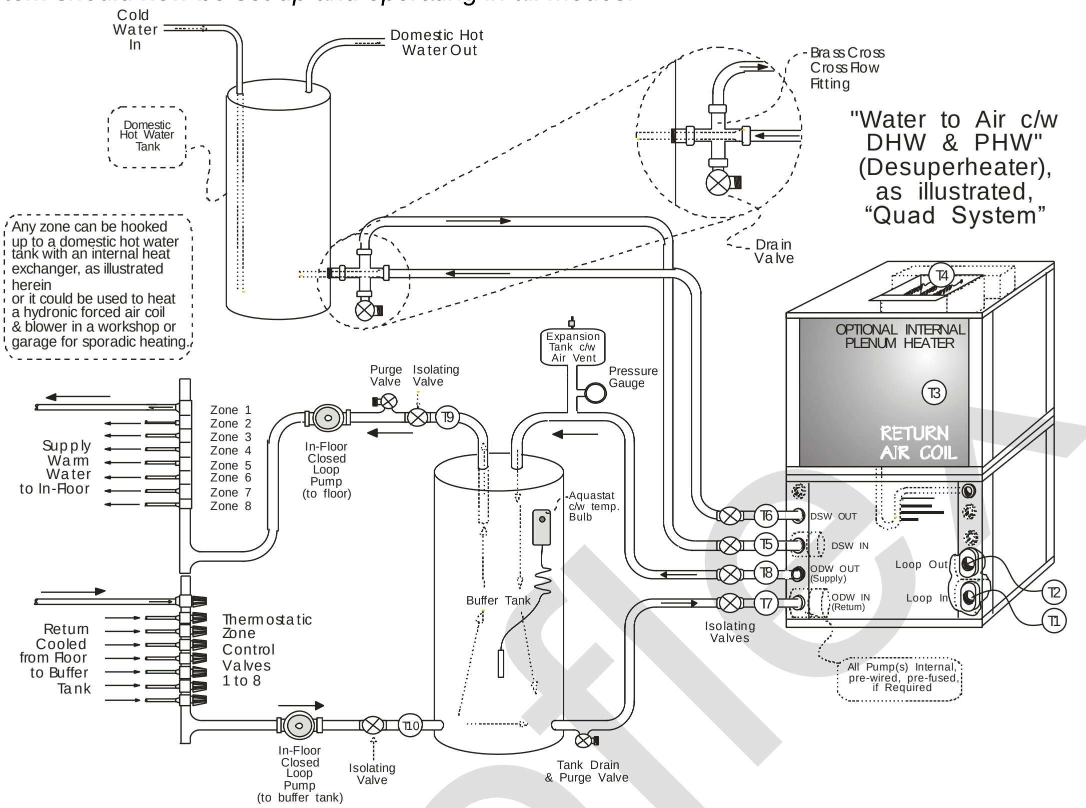
STEP SEVEN: Upon establishing water flow based on amperage draws and pressure drop and airflow with the air filters in place, turn on SW2. The compressor will now start, immediately, as time delay has already elapsed. If all seem to be running correctly, allow the system to operate for 10 to 15 minutes before recording numbers or performing any system balancing. Be sure that airflow is in accordance with the manufacturer's specifications based on Delta T (difference in temperature) in heating mode. Now systems will be running in forced air heating mode. Check and record all associated temperatures/pressures/electrical points at sensor/gauge/probe locations, after the required time has elapsed.

STEP EIGHT: To check system operation in cooling mode, set the thermostat to "cool" and the fan switch to "auto" and then repeat Steps Four through Seven. When operating in cooling mode, care should be given to note the humidity level of the space, as the latent energy (latent - the amount of energy that is take to change the state, eg. taking moisture out of air) will occur before you will notice a sensible change (sensible – the temperature that see change on your thermostat). (difference in temperature) in heating mode. Now systems will be running in forced air heating mode. Check and record all associated temperatures/pressures/electrical points at sensor/gauge/probe locations, after the required time has elapsed.

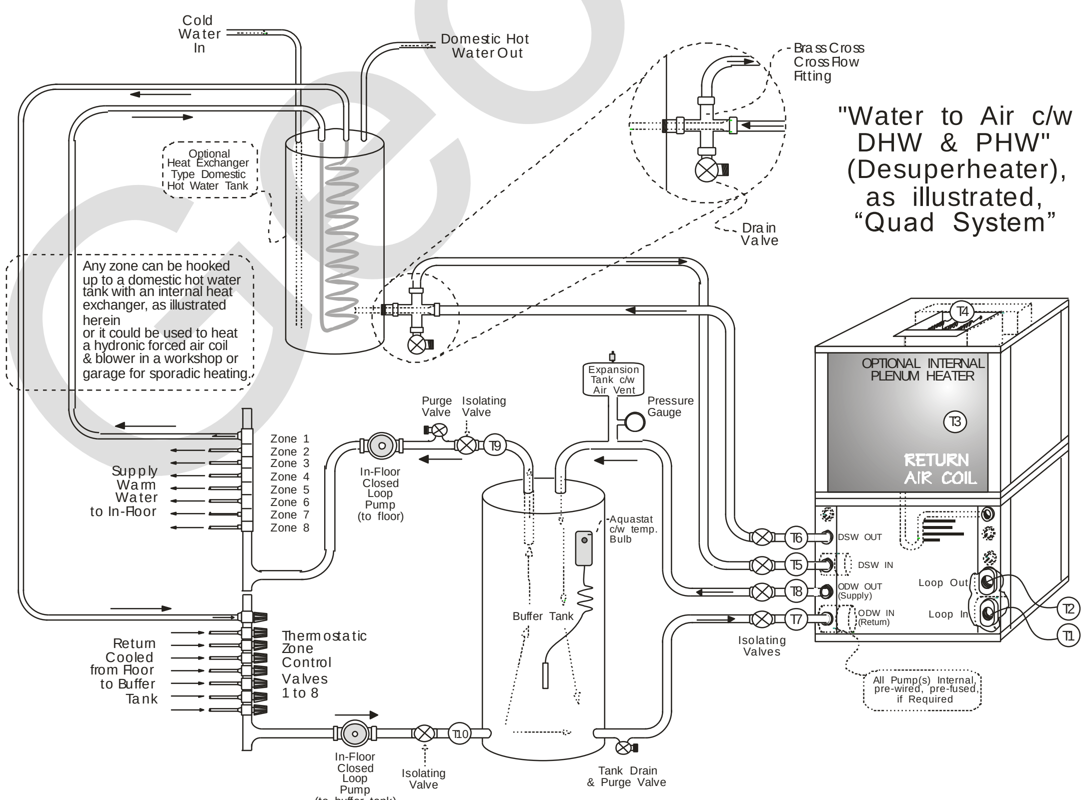
STEP NINE: (Only applicable to systems with the desuperheater hot water option). A desuperheater will offer a "portion of total" hot water when any other refrigeration mode (Forced air heating, cooling or, if equipped, ODW) is operating. Upon completion of the original Heating and Cooling tests, with or without ODW, the desuperheater can be tested. After the system is started in heating, cooling or ODW, if applicable, turn on SW3, if hot water is required, the desuperheater pump will activate. Now, check again for water line leaks. Refer to Figure ?: Desuperheater Setup Diagram. **NOTE:** The internal hot water pump (if present) will incorporate a high limit switch (130°F cutout) to regulate the Desuperheater operation. Before testing, ensure that the desuperheater is calling. If not, run hot water out of the hot water tank to bring the temperature down, in order to cause the desuperheater pump to turn on. Check and record all associated temperatures/pressures at sensor/gauge/probe locations, after the required time has elapsed.

STEP TEN: (Only applicable to systems with the ODW option). The ODW option provides 100% of the condenser heat to the hot water heating system when operating. The ODW system will switch back and forth between ODW mode and forced air (Heating/Cooling), based on the priority setting. To check the Demand Water option, turn the thermostat down on the air system to turn off the forced air, (in heating, turn thermostat up if the thermostat is set to cooling) so ODW can start, as the systems are factory set to prioritize to heating or cooling air. If your system is equipped with a desuperheater be sure that SW3 if off during ODW testing. To start the ODW, simply set the water temperature control (Aquastat) higher than the current water tank temperature (do not exceed 120 ºF to avoid stressing the system). Once you have run the ODW for a reasonable period of time (say 5 minutes) and you are comfortable that the system is operating correctly, set the thermostat up to call for forced air heating, to be sure it switches to air without a problem. The air should override the ODW. Check and record all associated temperatures/pressures/electrical points at sensor/probe locations, after the required time has elapsed, switch the thermostat off to turn off the air portion of the system and the ODW will start again. Let it run for at least 5 minutes in the ODW mode, then turn the thermostat over to cooling and set the thermostat down to call for cooling (A/C), this should again override the ODW and run the system in forced air cooling. Once the A/C has run for a period of time, without problems (after a minimum of 5 minutes), satisfy the thermostat and let the ODW start again. To set the ODW as the priority over the air side of the system, there are jumpers to change. If you want to re-set the priority to ODW rather than forced air, see schematic for ODW on page…..

The system should now be set up and operating in all modes.



Quad Heat pump c/w standard domestic hot water tank and desuperheater and Demand Water test point



Quad Heat pump c/w optional heat exchanger domestic hot water tank and desuperheater and Demand Water test point

16.8. Commissioning and Test Sheet (Refrigeration, thorough testing)

During or after you have tested/serviced or are commissioning a system and the unit is operating outside of parameters, based on specifications, a thorough check may needed. In this case, refrigeration gauges will/may be needed. Refrigeration gauges can **only** be installed by a qualified, licensee refrigeration mechanic/technician.

Only when/if necessary, install the manifold gauges to the suction and discharge service valves (located in the compressor cabinet). Refrigeration gauges need to be installed for a "thorough check", ONLY IF the temperatures or amperages are operating outside specified parameters for the system after a suitable run time (minimum 10 minutes?). Refer to reasonable operational parameters in section 12.2, page 28 (Water Flow and Overall System Fluid Flow Balancing), *as well as gauge suction and discharge pressures, if installed. Use these readings to calculate the superheat and balance the system using the procedures in* Section 12.1 (SETTING SUPERHEAT) and Section 12.2 AIR, WATER FLOW & OVERALL SYSTEM FLUID BALANCING.

Delta T's Range

Mode	Type	Entering Water Temp (EWT)F/C	Probes	Expected Delta T's F
Closed loop Heating	Earth Loop	@32 F/0 C	**T1-T2**	**4 - 6**
Closed Loop Cooling	Earth Loop	**@77 F**	**T1-T2**	**7 - 10**
Open Loop (Well) Heating	Well Side	@ **50 F**	**T1-T2**	**9 - 11**
Open Loop (Well) Cooling	Well Side	**@50 F**	**T1-T2**	**12 - 15**
Forced Air Heating	Air Side	**70 F**	**T1**	**23 - 30**
Forced Air Cooling	Air Side	**75 F**	**T1**	**14 - 20**
ODW	Water Coil	**90 – 100**	**T1**	**10 17**
Desuperheater		@ **100 F**	**T1**	
Dehumidification	Dehumidification	@ **82**	**T1**	**10 - 17**
Option	Proportional Hot Water – Reheat	@ **85**	**T1**	**10 - 12**
Option	Desuperheater	@ **85**	**T1**	**4 - 7**
Option	LCAC/ODW	@ **80**	**T1**	**12 - 20**

16.9 Water to Water Heat Pump c/w Desuperheater and/or Demand Water Option

STEP ONE: As the refrigeration is similar to a refrigerator and is a closed system, refrigeration gauges should not be installed. However, if and only when the complete system performance does not fall within prescribed parameters and is approved and supervised by Geoflex, gauge installation and adjustments are allowed. If a qualified refrigeration person deems it necessary to asses and in some cases reset the charge superheat, please contact Geoflex for the appropriate superheat setting for your specific installation. Before starting the system, ensure that the buffer tank (see attached drawing) is installed if required and all plumbing hookups and water lines are installed and have been ***"double checked" for leaks*** *(inside and outside of the equipment),* the air ducting is in place, all electrical wiring is complete and ALL elements adhere to manufacture's specifications and local codes. **On all closed loop system, be absolutely sure that anti-freeze is in system at the appropriate levels PRIOR, to start-up, other wise you can damage your system, with a water coil rupture and this is not covered by any warranty. *All testing and diagnosis must be carried out by qualified technicians.* NOTE:** If your system incorporates an integrated "Desuperheater Option" see Step nine below and ensure to turn off SW#3 (Desuperheater Control Switch) until startup is complete. If your system is built with a Demand Water option, ensure that the Aquastat is turned off for initial commissioning. For more information on the Desuperheater and/or Demand Water (ODW) Options, see Step Eight below and drawing on page 20. Note for the commissioning/testing in this section, see the range of delta T's. as listed 11.8 herein.

STEP TWO: Install the temperature sensors in the appropriate places, at a "2 to 3" or "9 to 10:00" o'clock (see diagram on legend of testing points in section 11.1) position on the pipe. For a water-to-water system, attach temperature sensors on points T1, T2, T3 and T4. If a Desuperheater Option is installed, also attach temperature sensors on points T5 and T6. If Demand Water Option is installed, also attach sensors on points T7 and T8. See attached legend and drawings to find locations to install the temperature sensors.

STEP THREE: Install clamp-on type amperage meter onto the L1 main power line into system and be sure to have a multi-meter available to check and record voltages. When checking operating amperages, it is important to check both L1 and L2 independently, then add and divide by two to get proper amperages. This will also serve to be sure that your power is being drawn evenly across both power legs. The differential should not exceed, 2 amps.

STEP FOUR: With the **main breaker/fuse power disconnect "turned off"**, be sure switch SW1, SW2 (compressor switch) and SW3 (Desuperheater switch, if installed), are turned off. Set the main water to water aquastat to heat the buffer tank and then set the temperature selector to "call for heat" (set the aquastat selector higher than the current buffer tank temperature). If Demand Water option is incorporated, leave the Aquastat to the off position at this stage since the main water to water system should **always** be tested first. As a note, heating mode should always be tested first.

STEP FIVE: With SW1, SW2 and SW3 turned off, then turn on the main disconnect. The main voltage should be tested across L1 and L2, with a multi-meter, to be sure that you have appropriate power, which should be between, 208 and 250 VAC, depending on service. The clamp on amperage meter should have no reading and provided voltage falls within appropriate parameters, turn on SW1. The pumps that circulates water from the water to water heat pump to the buffer tank and loop pumps will start after a 3 minute time delay, but the compressor will not start (this is normal). After an appropriate time delay has elapsed, check to ensure that the system's circulating pumps are on and delivering water flow. Once the pumps start, the amperage meter will start to register an amperage draw, record that draw while waiting for loop pumps to start. Once loop pumps start, the amperage draw will increase accordingly (1 to 2 amps). This will help to ensure that the loop pumps are powered. The service jumper on the circuit board should be factory set to "no" which means that you'll have a 3 minute time delay, for the loop pumps to start. However, if the test jumper is set to "yes", there will only be a very short time delay. Once all testing is complete, be sure the jumper is set to no (normal operation), as the time delay is important to the operation of the system.

STEP SIX: Check and record all pressure drops across all operating water coils. PT (pressure/temperature) plugs would normally be provided with the system for this purpose. They allow a temperature or pressure probe to be inserted into the pipe without letting air in or fluid out. The desuperheater pressure drop is commonly not tested, as it is easily tested. Refer to the diagram on page 20 for the location of PT plug pressure and temperature testing points.

STEP SEVEN: Upon establishing water flow based on amperage draws and pressure drop and any applicable water filters in place, turn on SW2. The compressor will now start, immediately, as time delay has already elapsed. If all seem to be running correctly, allow the system to operate for 10 to 15 minutes before recording numbers or performing any system balancing. Be sure that airflow is in accordance with the manufacturer's specifications based on Delta T (difference in temperature) in heating mode. Now systems will be running in forced air heating mode. Check and record all associated temperatures/pressures/electrical points at sensor/gauge/probe locations, after the required time has elapsed.

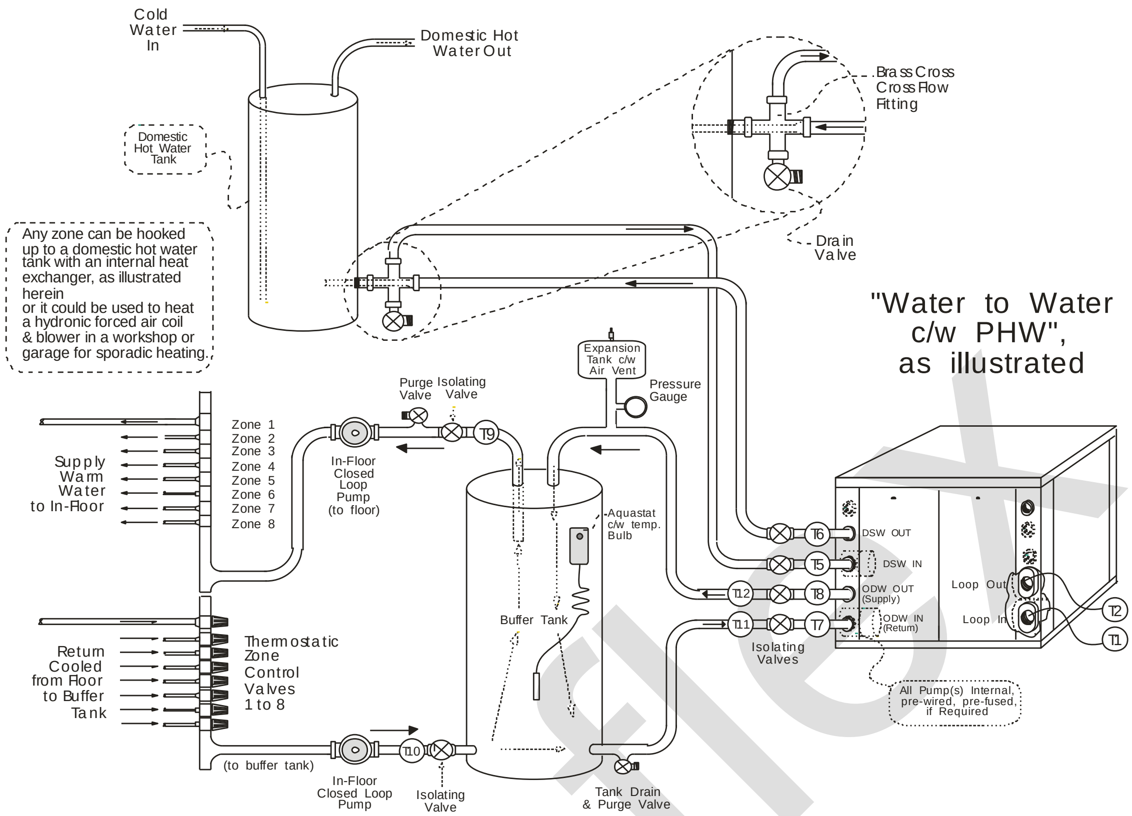
STEP EIGHT: To check system operation in chilling mode, set the aquastat to "cooling" and then repeat Steps Four through Seven. When operating in chilling mode, care should be given to note the anti-freeze level in the system, if your unit utilizes a closed loop. If a closed loop is used, you MUST be sure that the water on the product side as well as the closed loop has the appropriate amount of anti-freeze solution/concentration, as the safety "will" allow the water to fall below freezing and you risk a rupture of your water coil, which is not covered by any warranty. Check and record all associated temperatures/pressures/electrical points at sensor/gauge/probe locations, after the required time has elapsed.

STEP NINE: (Only applicable to systems with the desuperheater hot water option). A desuperheater will offer a "portion of total" hot water when any other refrigeration mode (heating, chilling or, if equipped, ODW) is operating. Upon completion of the original Heating and Cooling tests, with or without ODW, the desuperheater can be tested. After the system is started in heating, cooling or ODW, if applicable, turn on SW3, if hot water is required, the desuperheater pump will activate. Now, check again for water line leaks. Refer to Figure ?: Desuperheater Setup Diagram. **NOTE:** The internal hot water pump (if present) will incorporate a high limit switch (130°F cutout) to regulate the Desuperheater high limit operation. Before testing, ensure that the desuperheater is calling. If not, run hot water out of the hot water tank to bring the temperature down, in order to cause the desuperheater pump to turn on. Check and record all associated temperatures/pressures at sensor/gauge/probe locations, after the required time has elapsed.

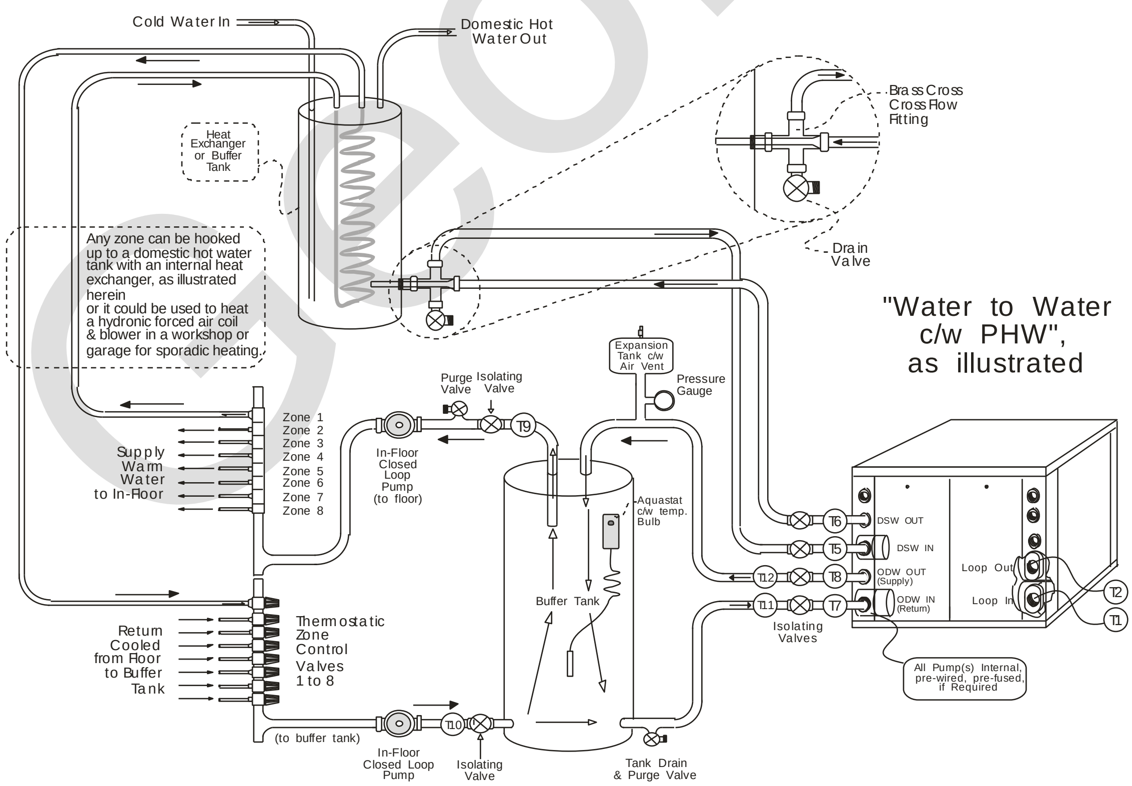
STEP TEN: It is not common to use an ODW option with a "water to water" system, however, there are circumstances where it is used, so be sure that your system is or isn't equipped with the option, before going through this section.

(Only applicable to systems with the ODW option). The ODW option provides 100% of the condenser heat to a hot water heating system when operating. The ODW system will switch back and forth between ODW mode and "water to water" (Heating/Chilling), based on the priority setting. To check the Demand Water option, turn the aquastat down on the buffer tank system to turn off the "water to water", (in heating, turn aquastat down to turn off, if the aquastat is set to chilling, turn the aquastat up to turn off) so ODW can start, as the systems are factory set to prioritize to heating/chilling the "water to water" over the ODW. If your system is equipped with a desuperheater be sure that SW3 if off during ODW testing. To start the ODW, simply set the water temperature control (Aquastat) higher than the current water buffer tank temperature (do not exceed 120 ºF to avoid stressing the system). Once you have run the ODW for a reasonable period of time (5 – 15 minutes) and you are comfortable that the system is operating correctly, set the aquastat up to call for "water to water" heating, to be sure it switches without a problem. The "water to water" system should override the ODW. Check and record all associated temperatures/pressures/electrical points at sensor/probe locations, after the required time has elapsed, switch the thermostat off to turn off the "water to water" portion of the system and the ODW will start again. Let it run for at least 5 minutes in the ODW mode, then turn the thermostat over to cooling and set the thermostat down to call for chilling, this should again override the ODW and run the system in "water to water" chilling. Once the "water to water" chilling has run for a period of time, without problems (after a minimum of 5 minutes), satisfy the thermostat and let the ODW start again. To set the ODW as the priority over the air side of the system, there are jumpers to change. If you want to re-set the priority to ODW rather than forced air, see schematic for ODW on page…..

The system should now be set up and operating in all modes.



Typical piping layout for water to water heat pump



Typical piping layout for water to water c/w optional heat exchanger domestic water tank

16.10 Dehumidification System (General and Commissioning)

Notes: As the dehumidification process commonly rejects heat, the following water (Rejection) reheat cooling & back-up heating options are available on Geoflex dehumidification systems….

- Desuperheater (a double wall vented coil is used to a heat hot water from a portion of the process heat, commonly used to heat a spa or domestic hot water)
- The ODW/LCAC option can be used for cooling mode and the feed any other demand hot water application/opportunity, including but not limited to:
    - In-floor Heating
    - Buffer tank to heat exchanger for indoor or outdoor pool heating
    - Buffer tank to heat exchanger for domestic hot water heating
    - Air Handler
    - Many other heating opportunities

Other Options Include:

- By-pass damper (used to allow the exact amount of air to flow through the air coil, without sacrificing air flow to the room)
- Back-up electrical/hydronic heater (used to offer any extra heat that is required to the space)

STEP ONE: As the refrigeration is similar to a refrigerator and is a closed system, refrigeration gauges should not be installed. However, if and only when the complete system performance does not fall within prescribed parameters and is approved and supervised by Geoflex, gauge installation and adjustments are allowed. If a qualified refrigeration person deems it necessary to asses and in some cases reset the charge superheat, please contact Geoflex for the appropriate superheat setting for your specific installation. Before starting the system, ensure that the buffer tank (see attached drawing) is installed if required and all plumbing hookups and water lines are installed and have been ***"double checked" for leaks*** *(inside and outside of the equipment),* the air ducting is in place, drywall sanding has been completed and all dust has been completely eliminated from the space, all electrical wiring is complete and ALL elements adhere to manufacture's specifications and local codes. **On all closed loop system, be absolutely sure that anti-freeze is in system at the appropriate levels PRIOR, to start-up, other wise you can damage your system, with a water coil rupture and this is not covered by any warranty.** ***All testing and diagnosis must be carried out by qualified technicians.*** **NOTES:** DO NOT start your system or any forced air system before all drywall sanding has been completed, as this can void your warranty, drywall dust can damage air coils beyond repair. If your system incorporates an integrated "Desuperheater", see Step nine below and ensure to turn off SW#3 (Desuperheater Control Switch) until startup is complete. If your system is built with a Proportional Reheat Water Coil, be sure you have it turned off prior to startup. If your system has a built-in LCAC coil option, ensure that it is not operating during initial commissioning. For more information on the Desuperheater and/or Demand Water (ODW/LCAC) Options, see sections below, as they pertain to your system.

STOP

Before starting a dehumidification system, ensure that the minimum temperature (75°F) and relative humidity (above 60%) conditions are met. If the humidity and/or temperature are below this threshold, **do not start the system** (improper operation will result). After ensuring that the humidity levels are above the appropriate threshold, system startup can proceed after ensuring that all electrical hookups are complete and adhere to the local codes.

STEP TWO: Install the temperature sensors in the appropriate places, at a "2 to 3" or "9 to 10:00" o'clock (see diagram on legend of testing points in section 11.1) position on the pipe. For a water-to-water system, attach temperature sensors on points T1, T2, T3 and T4. If a Desuperheater Option is installed, also attach temperature sensors on points T5 and T6. If Demand Water (LCAC) Option is installed, also attach sensors on points T7 and T8. If a proportional hot water coil is installed within your system, also attach sensors on points T13 and T14. See attached legend and drawings to find locations to install the temperature sensors.

STEP THREE:
Shut off SW1 (fan switch) and SW2 (compressor switch). Set the humidistat to 70% and turn on the main electrical disconnect (supplied by dealer)

Install clamp-on type amperage meter onto the L1 main power line into system and be sure to have a multi-meter available to check and record voltages. When checking operating amperages, it is important to check both L1 and L2 independently, then add and divide by two to get proper amperages. This will also serve to be sure that your power is being drawn evenly across both power legs. The differential should not exceed, 2 amps.

STEP FOUR: With the **main breaker/fuse power disconnect "turned off"**, be sure switch SW1, SW2 (compressor switch) and SW3 (Desuperheater switch, if installed), are turned off. Set the air thermostat to heat and the "fan switch" to "auto" and then set the temperature selector to "call for heat" (set the selector higher than the current room temperature). If Demand Water option is incorporated, leave the Aquastat to the off position at this stage since the air system should **always** be tested first. As a note, heating mode should always be tested first.

STEP FIVE: With SW1, SW2 and SW3 turned off, then turn on the main disconnect. The main voltage should be tested across L1 and L2, with a multi-meter, to be sure that you have appropriate power, which should be between, 208 and 250 VAC, depending on service. The clamp on amperage meter should have no reading and provided voltage falls within appropriate parameters, turn on SW1. The fan will start immediately and loop pumps will start after a 3 minute time delay, but the compressor will not start (this is normal)**.** Ensure that the system's blower is on and delivering airflow, through the ducts. Once the blower starts, the amperage meter will start to register an amperage draw, record that draw while waiting for loop pumps to start. Once loop pumps start, the amperage draw will increase accordingly (1 to 2 amps). This will help to ensure that the loop pumps are powered. The service jumper on the circuit board should be factory set to "no" which means that you'll have a 3 minute time delay, for the loop pumps to start. However, if the test jumper is set to "yes", there will only be a very short time delay. Once all testing is complete, be sure the jumper is set to no (normal operation), as the time delay is important to the operation of the system.

STEP SIX: Check and record all pressure drops across all operating water coils. PT (pressure/temperature) plugs would normally be provided with the system for this purpose. They allow a temperature or pressure probe to be inserted into the pipe without letting air in or fluid out. The desuperheater pressure drop is commonly not tested as it is easily tested (covered in instructions below). Refer to the diagram on page 20 for the location of PT plug pressure and temperature testing points.

STEP SEVEN: Upon establishing water flow based on amperage draws and pressure drop and airflow with the air filters in place, turn on SW2. The compressor will now start, immediately, as time delay has already elapsed. If all seem to be running correctly, allow the system to operate for 10 to 15 minutes before recording numbers or performing any system balancing. Be sure that airflow is in accordance with the manufacturer's specifications based on Delta T (difference in temperature) in heating mode. Now systems will be running in forced air heating mode. Check and record all associated temperatures/pressures/electrical points at sensor/gauge/probe locations, after the required time has elapsed.

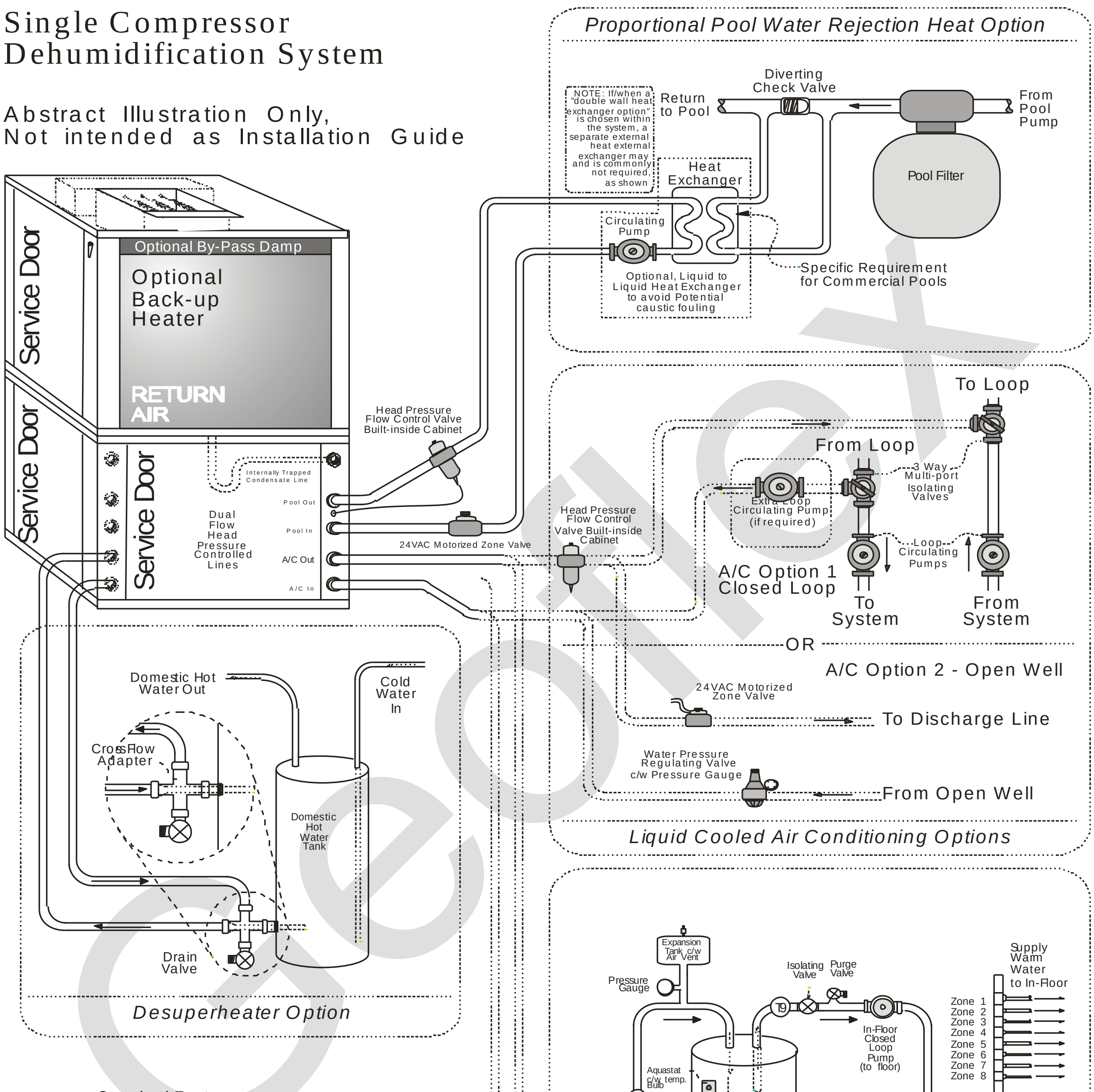
STEP EIGHT: To check system operation in cooling mode, set the thermostat to "cool" and the fan switch to "auto" and then repeat Steps Four through Seven. When operating in cooling mode, care should be given to note the humidity level of the space, as the latent energy (latent - the amount of energy that is take to change the state, eg. taking moisture out of air) will occur before you will notice a sensible change (sensible – the temperature that see change on your thermostat). (difference in temperature) in heating mode. Now systems will be running in forced air heating mode. Check and record all associated temperatures/pressures/electrical points at sensor/gauge/probe locations, after the required time has elapsed.

STEP NINE: (Only applicable to systems with the desuperheater hot water option). A desuperheater will offer a "portion of total" hot water when any other refrigeration mode (Forced air heating, cooling or, if equipped, ODW) is operating. Upon completion of the original Heating and Cooling tests, with or without ODW, the desuperheater can be tested. After the system is started in heating, cooling or ODW, if applicable, turn on SW3, if hot water is required, the desuperheater pump will activate. Now, check again for water line leaks. Refer to Figure ?: Desuperheater Setup Diagram. **NOTE:** The internal hot water pump (if present) will incorporate a high limit switch (130°F cutout) to regulate the Desuperheater operation. Before testing, ensure that the desuperheater is calling. If not, run hot water out of the hot water tank to bring the temperature down, in order to cause the desuperheater pump to turn on. Check and record all associated temperatures/pressures at sensor/gauge/probe locations, after the required time has elapsed.

STEP TEN: (Only applicable to systems with the ODW option for cooling mode). The ODW option provides 100% of the condenser heat to a fluid cooler or closed loop when system is operating. The ODW system will switch back and forth between ODW mode and forced air (Dehumidification/Heating/Cooling), based on the priority setting. To check the Demand Water option, turn the thermostat down on the air system to turn off the forced air, (in heating, turn thermostat up if the thermostat is set to cooling) so ODW can start, as the systems are factory set to prioritize to heating or cooling air. If your system is equipped with a desuperheater be sure that SW3 if off during ODW testing. To start the ODW, simply set the water temperature control (Aquastat) higher than the current water tank temperature (do not exceed 120 ºF to avoid stressing the system). Once you have run the ODW for a reasonable period of time (say 5 minutes) and you are comfortable that the system is operating correctly, set the thermostat up to call for forced air heating, to be sure it switches to air without a problem. The air should override the ODW. Check and record all associated temperatures/pressures/electrical points at sensor/probe locations, after the required time has elapsed, switch the thermostat off to turn off the air portion of the system and the ODW will start again. Let it run for at least 5 minutes in the ODW mode, then turn the thermostat over to cooling and set the thermostat down to call for cooling (A/C), this should again override the ODW and run the system in forced air cooling. Once the A/C has run for a period of time, without problems (after a minimum of 5 minutes), satisfy the thermostat and let the ODW start again. To set the ODW as the priority over the air side of the system, there are jumpers to change. If you want to re-set the priority to ODW rather than forced air, see schematic for ODW within this manual.

STEP ELEVEN: (Only applicable to systems with the Proportional Reheat Coil" (PRC), option for pool/spa water heating). The Proportional Reheat coil option provides approximately 50% of the condenser heat to the pool or spa or in some rare cases hot water heating system when the dehumidification mode is operating. The PWC option can switch back and forth between pool/spa heating mode and forced air reheat, based on the priority control method and settings. This coil is commonly applied in such a way as to allow for self regulating flow by setting the system up with a head pressure control which is usually installed within the system, as and option. The head pressure control will be factory set, however, it can be re-set in the fied to allow for higher levels of heat to go to the pool water, if required.

To check the Demand Water option, turn the thermostat down on the air system to turn off the forced air, (in heating, turn thermostat up if the thermostat is set to cooling) so ODW can start, as the systems are factory set to prioritize to heating or cooling air. If your system is equipped with a desuperheater be sure that SW3 if off during ODW testing. To start the ODW, simply set the water temperature control (Aquastat) higher than the current water tank temperature (do not exceed 120 ºF to avoid stressing the system). Once you have run the ODW for a reasonable period of time (say 5 minutes) and you are comfortable that the system is operating correctly, set the thermostat up to call for forced air heating, to be sure it switches to air without a problem. The air should override the ODW. Check and record all associated temperatures/pressures/electrical points at sensor/probe locations, after the required time has elapsed, switch the thermostat off to turn off the air portion of the system and the ODW will start again. Let it run for at least 5 minutes in the ODW mode, then turn the thermostat over to cooling and set the thermostat down to call for cooling (A/C), this should again override the ODW and run the system in forced air cooling. Once the A/C has run for a period of time, without problems (after a minimum of 5 minutes), satisfy the thermostat and let the ODW start again. To set the ODW as the priority over the air side of the system, there are jumpers to change. If you want to re-set the priority to ODW rather than forced air, see schematic for ODW on page…..



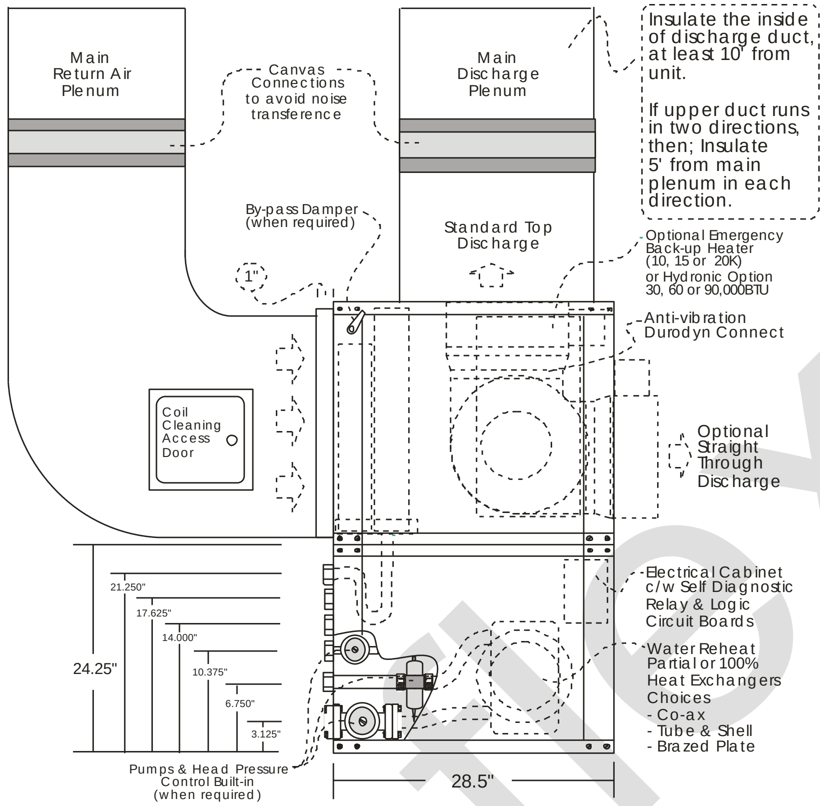
Standard Features

- Service Doors Surround System
- On-Board Diagnostic Circuit Boards
- Internally Mounted Head Pressure Flow Controls
- 1" Acoustical Insulation throughout system
- Moisture Indicating Sight Glass & Filter/Drier
- Internally Trapped Condensate Drain Line
- Top or Straight through Air Discharge available

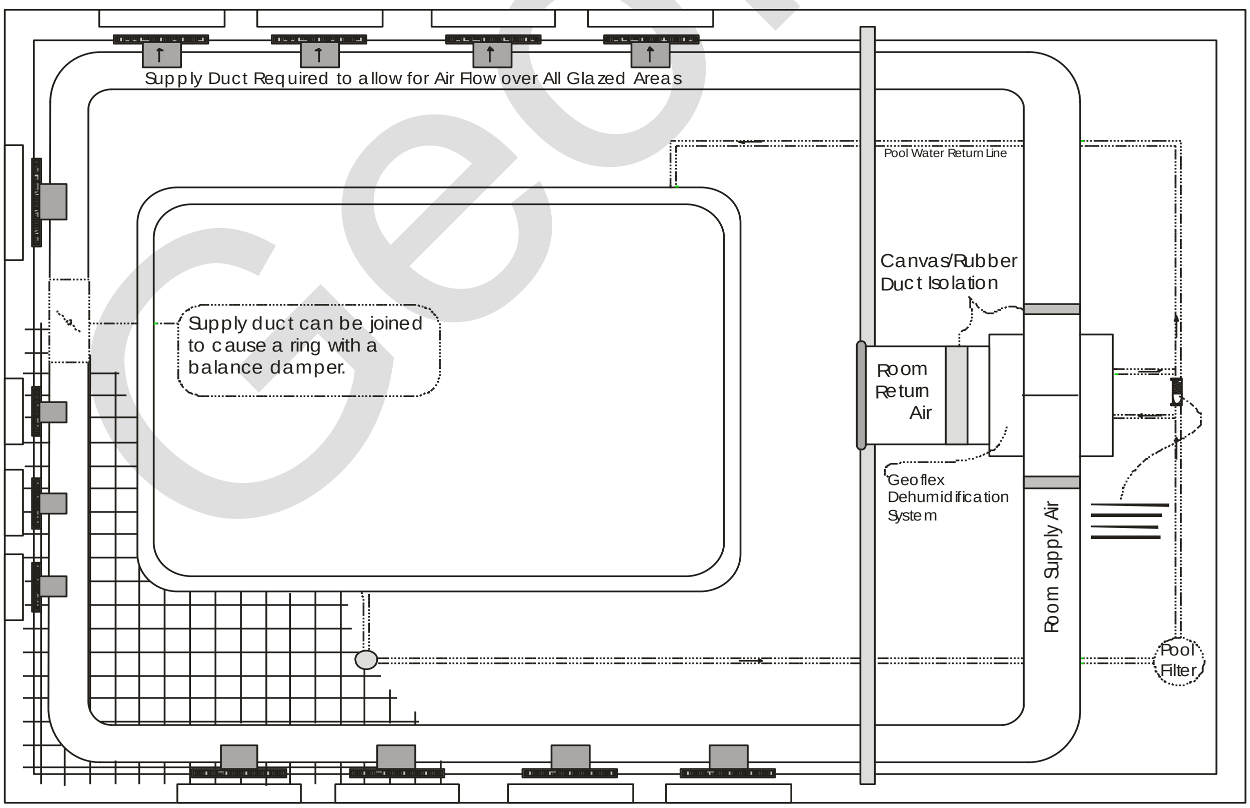
Notes

- Dehumidification Process Heat is Recovered and Sent to the Pool Water/Pool Room Air
- Process Heat can be sent to open well, closed loop or any other Heat Recovery Opportunity.
- When system is installed in a commercial application, Secondary Heat Exchanger must be used to avoid corrossion opportunites

Geoflex Dehumidification System c/w Optional Pool Water Rejection Heat System



Geoflex Dehumidification System Typical Ducting Installation



Typical ductwork layout for dehumidification system in pool area

17. TECHNICAL PROCEDURES

17.1. Setting Superheat

A Geoflex Ground & Water Source Heating/Cooling/Dehumidification System will arrive to the dealer/site with a factory-set superheat (refrigeration charge). Superheat adjustment should not be adjusted unless the system is operating outside of normal operating parameters. Adjusting superheat should only be done by a qualified, licensed refrigeration person, with the supervision of Geoflex. Low superheat generally means that the system is over charged, high superheat generally means that the system is low on refrigerant. **Refrigeration parameters must only be addressed, assessed and adjusted by a qualified refrigeration technician. Gauges should only be used on the equipment if necessary, under the supervision and approval of Geoflex**. The TX valve may be adjustable but this should be adjusted, as it is factory preset.

STEP ONE: Remove the refrigerant service access door, allowing access to the High and Low Pressure service valves located on the suction (Low Pressure) and discharge (High Pressure) lines of the compressor. Attach your refrigerant pressure gauges to the appropriate access valves (Low Pressure gauge to the suction service valve; High Pressure gauge to the discharge service valve). Do not forget to purge your gauges prior to exposing the system to contamination. A curl will be incorporated into the High Pressure 1/4" service line where the service valve is attached.

STEP TWO: Deactivate Service Switch to M1 (Main Compressor Contactor). Turn on SW1 to supply control with 24 volts. Set the thermostat to “heat”, the fan switch to “auto” and then set the thermostat to call for heat. The fan will start, but the compressor will not start **(this is normal)**.

STEP THREE: Start the water pump. Ensure that the water flow rate meets the manufacturer’s recommended system flow rate as outlined in specifications. Attach a temperature probe to the water line in and out and all other test points as listed herein.

STEP FOUR: With water pumps turned on and water flowing through the water coil, check the airflow across the air coil. Ensure that clean filters are in place and that airflow adheres to the manufacturer’s specifications how?. **You are now ready to set the superheat.**

STEP FIVE: Attach a temperature probe to the suction line **(probe location is very important)**. Locate the probe on the top of the suction line. Attach the refrigerant tank to the gauge manifold and purge the air from the line to avoid contamination. With the compressor off, open the suction manifold and allow refrigerant gas to enter the unit. When the tank pressure and the Geoflex System pressure are equalized, ensure that the air and water flows are satisfactory. The unit is ready to be started.

STEP SIX: Turn on M1 Main Contactor Switch and wait for the compressor to start (systems with a time delay must timeout before the compressor will start). With the suction manifold open, R22 gas will now enter the unit. Charge the unit to 50 to 60 PSIG on the suction gauge until the High Pressure gauge reaches 200 to 235 PSIG. Close the suction pressure line and allow the unit to run for approximately 5 to 10 minutes. During this process, the unit may shut down (lockout on Low Pressure). Simply allow pressure to climb and then reset the lockout by toggling M1 off and then on again. It may be necessary to repeat this process until the suction pressure is adequate (50 - 60 PSIG) to operate the unit **(this is normal)**.

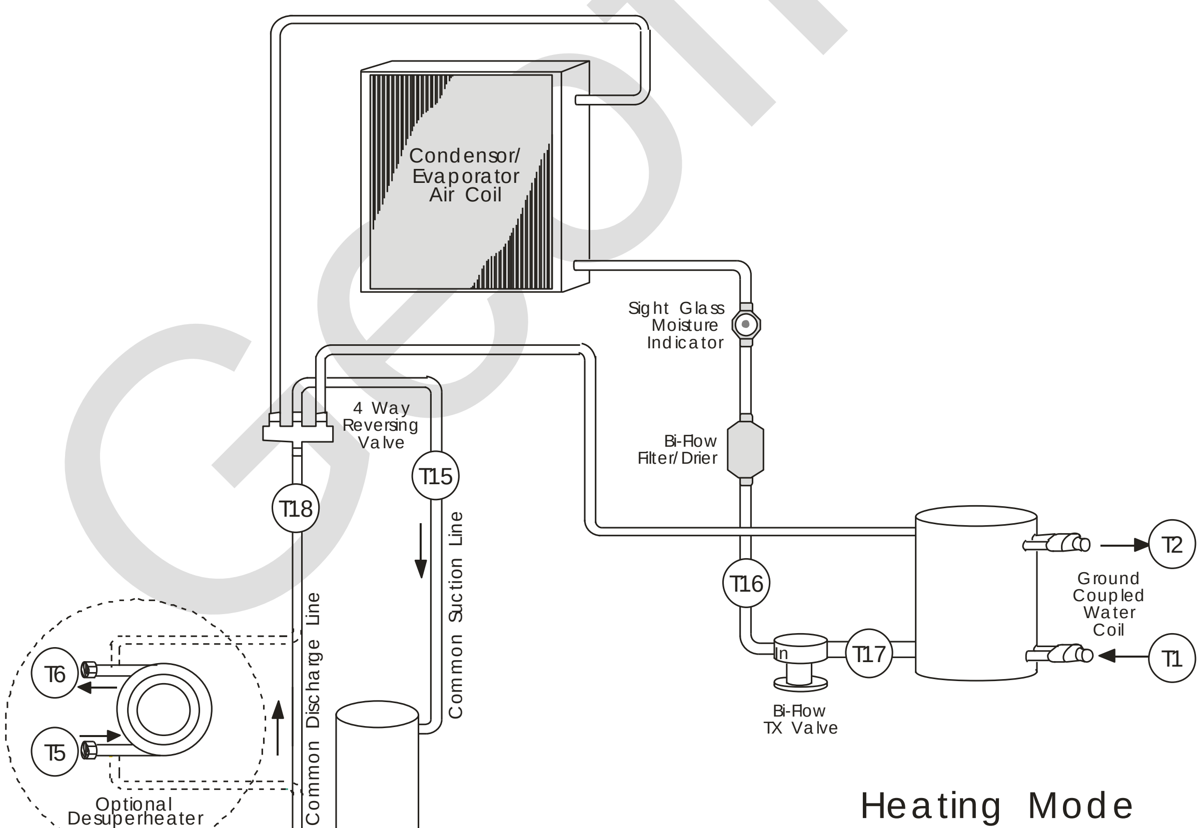
STEP SEVEN: Record the suction line temperature from the pressure gauge or with a temperature-pressure chart for R22. Subtract the pressure gauge temperature from the suction line temperature.

EXAMPLE:
Temperature Probe Temp. 47 °F
Pressure gauge Temp - 30 °F
SUPERHEAT 17 °F

Recommended superheat setting is 15 °F on a reciprocal compressor and 17 °F on a scroll compressor. If the superheat is **higher**, slowly add more refrigerant (Vapour) to the suction side. If the superheat is **lower**, slowly remove refrigerant from the suction line **(allow 10 to 20 minutes to elapse for the unit to balance between adjustments)**.

After setting the superheat, the air and water flow rate can be balanced. If the superheat is correct, but the discharge pressure is too high, adjust airflow higher (if possible) and/or adjust the water flow rate. If the superheat is correct, but the discharge pressure is too low, increase/decrease water flow and/or airflow. If the suction pressure is too high, decrease the water flow rate.

Typical Refrigeration System in Heating Mode



24V Electrical Pattern	Heating	Cooling
4 Way RV Valve	Off	24V

17.2. Water flow and Overall System Fluid Flow Balancing

After ensuring that the factory-preset superheat is correct (15 °F for reciprocal compressor and 17 °F for scroll compressor), the system can balanced according to the operating parameters below:

"Water to Air" System: When testing, the system must be in heating mode and any hot water "options" must be deactivated. The incoming return air temperature should be approximately 70 °F and the incoming water temperature between 48 to 52 °F. If air and water flows are correct with the superheat stabilized at 15 to 17 °F, the system's Suction Pressures should be 57 to 62 PSIG and the Discharge Pressures between 215 to 245 PSIG (a closed loop system can run at lower entering water temperatures and associated suction pressures once anti-freeze is added to the system).

If the discharge pressures are too high (above 250 PSIG) at the appropriate incoming air and water temperatures (see above), increasing the airflow will reduce the discharge pressure. If the airflow is low, ensure that the air filter and air coil are clean and that the ducting has been installed with the appropriate allowable external static pressure (0.5 in/wc).

The air coil temperature difference (Delta T) should be 25 to 30 °F when measured close to the unit (upstream of the return air and downstream of supply air collars). The Delta T across the water coil should be 9 to 11 °F for an open loop (i.e., well system) and 4 to 6 °F for a closed loop (i.e., earth loop system).

"Water to Water" System: The discharge pressures will vary (in heating mode) between a "Water to Water" System and a "Water to Air" System. The "Water to Water" System discharge pressures will depend on the incoming indoor water temperature (indoor buffer tank water temperature and discharge pressure will increase simultaneously). The "Water to Water" System pressure should not exceed 290 PSIG. The outgoing water temperature to the buffer tank should not exceed 125 °F. In heating mode, the indoor water coil Delta T should be approximately 15 °F.

If temperature differences and amperages are correct (according to the Geoflex specifications), refrigeration gauges are unnecessary (as the superheat and air flows are factory-preset, the first system adjustments should concern water flow with proper temperature differences only).

Dehumidification System: With the water reheat coil turned off (if applicable), the air side Delta T on a dehumidification system will be approximately 12 to 17 °F (depending on airflow: higher airflow equals lower Delta T). Entering air temperature affects the discharge pressure.

CONSIDER: The system fluid dynamics and results of all balance adjustments are delayed; therefore, **wait adequately after each individual adjustment** (contact the factory for any system-related inquiries).

18. TROUBLE SHOOTING GUIDE

To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

18.1. Heating Mode

Please Note: Your system could be equipped with a blinking light to indicate fault code on the circuit board or the front of the cabinet. Your system could also come equipped with a fault code light only as well as a blinking light on the circuit board, which can be directly connected to your thermostat or an LED light within the electrical cabinet (Internal Z). Whether you have independent fault code lights beyond the blinking light, will depend on the installation methods.

Blinking light on circuit board or on front of cabinet. If your system comes equipped with a blinking light to show fault, please note the legend, as listed in the area of the light to determine the blink code for lock-out type. The blink code will indicate which specific lock-out switch is being activated.

Internal Z, thermostat Lock-out Light or Fault “blinking” light on circuit board - activated by High Pressure Switch
Check the following:

- direct drive blower assembly or fan belt and pulley for tightness, if applicable
- fan motor fuses
- fan motor for short or open circuit
- air filter for dirt or obstructions
- ensure that the pressure switch does not cut out [on lower pressure than setting? With gauges?] (predetermined pressure setting excluded)
- proper CFM air flow as per heat pump specifications sheet
- excessive water flow and/or high water temperature in the water coil
- for excessive return air temperature resulting from other heat sources (i.e. a woodstove or furnace connected to the ductwork): **do not install supplemental heating systems in the return air stream, upstream of the Geoflex System**

NOTE: High discharge pressure may also be caused by a defective thermal expansion (TX) valve, a faulty reversing valve or an overcharge of refrigerant.

Internal Z, thermostat Lock-out Light or Fault “blinking” light on circuit board - activated by Low Pressure Switch
Check for the following:

- insufficient flow of liquid through evaporator water coil
- defective well pump or loop circulator pump
- possible loss of refrigerant
- premature activation of malfunctioning low pressure switch, which can be determined by measuring the suction pressure as the unit trips out and comparing it to the setting of the switch (XX PSIG).

18.2. Cooling Mode

Internal Z, thermostat Lock-out Light or Fault "blinking" light on circuit board - activated by High Pressure Switch

Check for the following:

- insufficient flow of liquid through WATER coil (could be air-locked or clogged)
- defective well pump or loop circulator pump
- overcharge of refrigerant
- premature activation of high pressure switch, which can be determined by measuring the suction pressure as the unit trips out and comparing it to the setting of the switch (see switch for PSIG rating).

NOTE:

- Refrigerant should never be added in the cooling mode
- Refrigerant charge is checked only in the heating mode, based on superheat

Internal Z, thermostat Lock-out Light or Fault "blinking" light on circuit board - activated by Low Pressure Switch

Check the following :

- direct drive blower assembly
- proper CFM air flow as per heat pump specification sheet [how for network client?]
- loss of refrigerant charge (see Technical Bulletin #120491 for details)
- fan motor fuses
- fan motor for short or open circuit
- for ice formation on air coil caused by low setting of room thermostat
- for excessive water coil liquid causing low head and suction pressure (ice build-up on the air coil)
- for dirty air filters or obstructions on the air coil
- for premature activation of low pressure switch

NOTE: To check pressure switch conditions, test the Low Pressure on terminals X1 & LO and the High Pressure switch on terminals X1 & HI. High voltage across terminals (24 VDC) indicates ? and no voltage indicates?

18.3. Heat Pump Unresponsive in Heating and/or Cooling Mode

Thermostat :

- Set on heating and highest temperature setting
- Set on cooling and lowest temperature setting
- Turn on fan
- If system does not operate in any position, disconnect heat pump terminal block wires and jump R, G, Y
- If system operates, replace thermostat with correct thermostat only.

Thermostat Wiring:

- Tighten or replace thermostat wiring

Fuse:

- Check size, replace or reset circuit breaker

- Check low voltage circuit breaker

Low Voltage Circuit:
- Ensure green light (outside corner) is active (if inactive, check circuit breaker or main breaker)
- Ensure 24-volt transformer is operating at full capacity (or replace)

18.4. System shuts down in heating/cooling mode after 30 seconds

- Low (less than 1 GPM) water flow will shut system down
- Ensure Hydronic Pump Module or solenoid valve is connected to the Hydronic Pump Module relay (see wiring diagram).
- Ensure the heat exchanger displays appropriately directed water flow (see labels at water fitting connections) or compressor will stop operating
- Flow switch is stuck (use an ohmmeter to ensure conductance at the flow switch: if conductance is present and flow is normal, remove flow switch and check for blockage or malfunction)

18.5. If blower operates, but compressor is unresponsive, check:

- Time delay is working properly

Thermostat:
- Set on heating and highest temperature setting
- Set on cooling and lowest temperature setting
- If system does not operate, disconnect heat pump terminal block wires and jump R, to Y
    - If unit operates, tighten or replace thermostat wiring
- Check time delay

18.6. If blower operates but compressor short-cycles, check:

- Wiring – tighten or replace if necessary

Fuse:
- For correct fuse sizing (from unit nameplate)
- Replace fuse or reset low voltage circuit breaker
- Ensure green light is active (outside corner of system)

Flow switch:
- Bypass flow switch (replace switch if compressor is unresponsive)
- If switch is operative, check for and purge any air in loop system

Water flow:
- Low (less than 1 GPM) water flow will shut system down
- Ensure Hydronic Pump Module or solenoid valve is connected to the Hydronic Pump Module relay (see wiring diagram).
- Ensure the heat exchanger displays appropriately directed water flow (see labels at water fitting connections) or compressor will stop operating

- Flow switch is stuck (use an ohmmeter to ensure conductance at the flow switch: if conductance is present and flow is normal, remove flow switch and check for blockage or malfunction)

High or low pressure switches (if unit locks out on either switch):
- Check for faulty switches by jumping the High and Low Pressure switches separately (replace if defective)
- Check airflow, filters, water flow, refrigerant loss and ambient temperature

Time delay relay:
- Jump or bypass relay (replace if defective)

Capacitor):
- Replace if defective

"Frozen" compressor:
- Use a hermetic check kit to loosen compressor (replace if inoperative)

Low refrigerant charge:
- Refrigerant leaks MUST be repaired…repair leak and recharge refrigerant.

18.7. If compressor attempts to start, but blower fails, check:

- Blower capacitor (replace if defective)
- Blower motor (replace if defective)
- Blower motor relay (replace if defective)

18.8. If blower is noisy, check:

- If blower wheel if wheel is in contact with housing and adjust if necessary
- For foreign material in housing and remove
- For loose ductwork and tighten if necessary
- For broken fan belt (in dual compressor unit with belt drive blower)
- For defective pulley or frozen bearing and replace if necessary

18.9. If air flow is inadequate, check:

- Correct fan speed setting (compare with nameplate or manual)
- Dirty air filter (clean or replace)
- Interior or ductwork obstructions
- Open and clear balancing dampers and air registers
- Leaks in ductwork (seal if necessary)
- Ductwork sizing (replace if necessary)

18.10. If water flow is shut off or inadequate, check:

In closed loop systems:
- Ensure wiring to pump module from heat pump power supply terminals is connected and wiring is sound.
- Ensure Grundfos pump is lubricated by removing end screw of pump and is filled with water.

- If necessary, close isolation valves to pump and replace pump if defective.

In open loop systems:

- Ensure solenoid valve that controls water flow to heat pump is connected to heat pump power supply terminals and operating. Solenoid is often supplied by a third party…240 volt AC valve is recommended.

18.11. If heating or cooling capacity is inadequate, check:

- Entering water / antifreeze temperature is above 25ºF (-4ºC)
- Blower motor is connected to recommended speed taps for your unit
- Air filter is clean (clean or replace if necessary) DO NOT OPERATE UNIT WITHOUT AIR FILTER)
- For low refrigerant charge after checking air and water flows (a licensed refrigeration mechanic must check refrigerant charge)
- Reversing valve…can bypass refrigerant to compressor suction if defective. Switch unit rapidly between heating and cooling. If defective it must be replaced by licensed refrigeration mechanic.
- Coaxial heat exchanger to ensure pressure drop and temperature difference (ΔT) are within specifications for the model of heat pump. Heat exchanger may require descaling if ΔT is lower than specifications.

18.12. If heat pump will only cool or only heat, check:

- Wiring to reversing valve to ensure wiring is tight and not broken
- For defective reversing valve and replace if required (a licensed refrigeration mechanic must check refrigerant charge)

18.13. If water heat exchanger freezes while in heating mode, check:

- Water flow through heat exchanger by measuring pressure drop through heat ground source heat exchanger, calculating pressure drop and comparing to unit pressure drop charts. If pressure drop is lower than pressure drop chart for the heat pump model, check:
  - For obstructions in ground loop piping or closed valves
  - Loop or well pump selection and operation and repair or replace pump if necessary
  - Solenoid or motorized valve operation. Repair or replace valve if necessary.

18.14. If refrigerant pressure is high during cooling mode, check:

- Water flow through ground source heat exchanger (see section 14.13.)

18.15. If refrigerant pressure is high during heating mode, check:

- Air flow through air coil of water – air heat pump (see section 14.9), or water flow through water coil of water – water heat pump.

18.16. If air coil freezes during cooling mode, check:

- Air flow through air coil (see section 14.9)

- To ensure heat pump cabinet doors are in place and tightly sealed
- Refrigerant charge. Have licensed refrigeration technician check for refrigerant leak and repair, and add refrigerant if required

18.17. If water is leaking from heat pump, check:

- If vertical configuration of heat pump, ensure heat pump is level
- If horizontal configuration of heat pump, ensure unit is mounted to slope slightly downwards to the condensate drain pan under the air coil.
- Condensate line is unobstructed
- Blower motor fan speed is at the proper setting for the specific heat pump model

18.18. If unit is running normally, but area temperatures are unstable, check:

- Thermostat location and ensure the thermostat temperature sensor is not influenced by direct sunlight, cold or warm drafts from nearby doors or windows, air circulating through wall behind thermostat etc.

19. BEFORE CALLING SERVICE TECHNICIAN, DID YOU CHECK?

- [ ] Are the thermostat settings at the desired temperature?
- [ ] Is the air filter clean and in good condition?
- [ ] Is the air coil clean and free of dirt?
- [ ] Are the air supply ducts unobstructed?
- [ ] Are the return air ducts unobstructed?
- [ ] Are the loop pumps and solenoid valves operating properly?
- [ ] If you have an open loop, is the well operating properly?
- [ ] Is the fan blower motor operating properly?
- [ ] Are the fuses / circuit breakers for the heat pump working properly?
- [ ] Are the fuses / circuit breakers for the circulating / well pumps working properly?
- [ ] Are the fuses / circuit breakers for the internal electric auxiliary working properly?
- [ ] Are other changes (home renovations, power failures, changes in heating and cooling requirements, etc.) possibly affecting the cooling requirements?

20.0 Progressive Quality Control Geoflex Warranty

20.1 Terms of Warranty:

All Geoflex products manufactured by Geoflex Systems Inc. (Geoflex) are warranted to be free from defects in material and workmanship under normal use and maintenance for a period of 12 from date of manufacture. Geoflex will furnish, from factory, excluding shipping costs, to a recognized/authorized dealer/contractor/customer or service organization, a new or rebuilt part in exchange for the part, which has failed because of a defect in material or workmanship.

All systems must be registered by mail or online to allow warranty to take effect. Registration must be accompanied by an original commissioning report, which must be compiled in accordance with testing procedures by a qualified/authorized Geoflex dealer. Yearly service and appropriate maintenance must be strictly adhered to for all warranties to take effect. All warranty claims must be approved by the factory prior to any warranty work commencing.

Labour allowance is based on factored rates complete with a pre-determined or negotiated number of hours and rate.

20.2 Extended Limited Warranty:

If the original compressor supplied by Geoflex fails because of defect in factory workmanship or material within 60 months from date of manufacture and adequate start-up/commissioning data sheet MUST have been completed and service records are available, Geoflex will furnish a new or rebuilt compressor. Shipping costs would be the responsibility of the dealer/contractor/owner.

20.3 The following is NOT supplied by Geoflex Systems Inc.

Geoflex is not responsible for unapproved labor, refrigerant or material cost involved in diagnosis, removal of the defective part or in obtaining and replacing of the new or rebuilt part supplied by Geoflex.

This warranty does not apply to products….

- which have had unauthorized opening of the refrigerant circuit
- which have been operated at below average temperatures, pressures and/or flow rates
- which have damage or defects caused by contaminated or corrosive liquid supply or circuit
- which have damage caused by under voltage/power, lightning or fluctuating voltages
- which have been damaged due to misuse or abuse such as improper
- installation, wiring, fire, or misapplication of product, be it accidental or otherwise
- of which appropriate payment has not been made to Geoflex
- with defaced or removed name plates
- which have been relocated after initial installation
- which have not been supplied by Geoflex
- this warranty does not apply to any refrigerant, fuses or air filters under any circumstances
- collateral water/fluid damage, have all hoses checked and inspected
- shipping costs associated with replaced parts

Geoflex is not responsible for any default or delay in performance caused by Government restrictions, strikes, material shortage or any other mishap beyond the control of Geoflex, including Acts Of God.

Any implied warranties are limited to the duration of this warranty and Geoflex expressly excludes any liability for any damage for breach of any expressed or implied warranty.

GEOFLEX SYSTEMS INC

21 LEGEND for HEAT PUMP START-UP COMMISSIONING

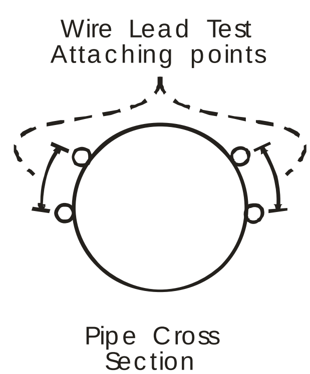
21.1 Legend of testing points (Install the temperature probes on…)

Type	Acronym	Equipment	Sensing… Sensor Probe attachment point
T1	ELEWT	WA,WW	"Earth Coupled" Loop Entering Water/Liquid Temperature (Loop In)
T2	ELLWT	WA,WW	"Earth Coupled" Loop Leaving Water/Liquid Temperature (Loop out)
T3	EAT	WA,DH	Entering (Return from space) Air Temperature
T4	LAT	WA,DH	Leaving (Discharge to space) Air Temperature
T5	DSWEWT	OP-ALL	"Desuperheater Water option" Entering Water Temperature
T6	DSWLWT	OP-ALL	"Desuperheater Water option" Leaving Water Temperature
T7	ODWEWT	OP-WA-DH	Demand Entering Water Line Temperature & On-Demand Liquid Cooled Option on dehumidification systems
T8	ODWLWT	OP-WA-DH	On-Demand Leaving Water Line Temperature & On-Demand Liquid Cooled Option on dehumidification systems
T9	HBTEWT	OP-ALL	"Hydronic Buffer Tank" Entering Water Temperature (Demand Water or Water to Water buffering tank product side)
T10	HBTLWT	OP-ALL	"Hydronic Buffer Tank" Leaving Water Temperature (Demand Water or Water to Water buffering tank product side)
T11	PWEWT	WW	Product (Hot/Chilled) Entering Water Temperature (Hot/Chilled "Water to Water")
T12	PWLWT	WW	Product (Hot/Chilled) Leaving Water Temperature (Hot/Chilled "Water to Water")
T13	PRWEWT	OP-DH	"Proportional Reheat Water Coil" Entering Water Temperature, (most commonly used on Dehumidification Systems)
T14	PRWLWT	OP-DH	"Proportional Reheat Water Coil" Leaving Water Temperature, (most commonly used on Dehumidification Systems)
* T15	SLT	WA-WW-DH	Suction/Liquid Line Temperature - if gauges are installed (see illustrations for refrigeration circuitry, in this manual)
* T16	LLT/FLT	WA-WW-DH	Liquid/Flash (for reversing mode units) Line Temperature(s) - if gauges are installed, (see illustrations for refrigeration circuitry, in this manual)
* T17	FLT/LLT	WA-WW-DH	Flash/Liquid (for reversing mode units) Line Temperature(s) - if gauges are installed, (see illustrations for refrigeration circuitry, in this manual)
* T18	DLT	WA-WW-DH	Discharge Line Temperature - if gauges are installed (see illustrations for refrigeration circuitry, in this manual)
* PT17	SGT	WA-WW-DH	Suction Gauge Temperature - Pressure/Temperature read directly from pressure gauges only if, needed, must be qualified refrigeration technician
* PT18	DGT	WA-WW-DH	Discharge Gauge Temperature - Pressure/Temperature read directly from pressure gauges only if, needed, must be qualified refrigeration technician
* RP19	SGP	WA-WW-DH	Suction Gauge Pressure (PSI), Pressure directly from pressure gauges only if, needed, must be qualified refrigeration technician
* RP20	DPT	WA-WW-DH	Discharge Gauge Pressure (PSI) - Pressure directly from pressure gauges only if, needed, must be qualified refrigeration technician

* Must be qualified refrigeration technician for this testing and analysis.

NOTE: As Geoflex manufacturers an extremely broad range of standard and specialized equipment, please note that locations of water lines and return and discharge air locations can vary, depending on system, please refer to labeling on equipment for appropriate locations.

The terms Delta T, which equals "Difference in Temperature" and Delta P, which equals, "Difference in pressure", between incoming and outgoing water and airflows, will be used throughout this manual.



22 Commissioning and Test Record/Log Sheet

Product Model Number:_________________ Product Serial Number:____________________________

Type	Acrynom-Equipment	Sensing… Sensor Probe attachment point	Heat/Cool	Heat/Cool	Heat/Cool	Heat/Cool
		Date Time				
		Voltage Amerage Watts (Voltage X Amps)				
T1	ELEWT-WA,WW	"Earth Coupled" Loop Entering Water/Liquid Temperature (Loop In)				
T2	ELLWT WA,WW	"Earth Coupled" Loop Leaving Water/Liquid Temperature (Loop out)				
T3	EAT-WA,DH	Entering (Return from space) Air Temperature				
T4	LAT-WA,DH	Leaving (Discharge to space) Air Temperature				
T5	DSWEWT-OP-ALL	"Desuperheater Water option" Entering Water Temperature				
T6	DSWLWT-OP-ALL	"Desuperheater Water option" Leaving Water Temperature				
T7	ODWEWT-OP-WA-DH	Demand Entering Water Line Temperature & On-Demand Liquid Cooled Option on dehumidification .systems				
T8	ODWLWT-OP-WA-DH	On-Demand Leaving Water Line Temperature & On-Demand Liquid Cooled Option on dehumidification systems				
T9	HBTEWT-OP-ALL	"Hydronic Buffer Tank" Entering Water Temperature (Demand Water or Water to Water buffering tank product side)				
T10	HBTLWT-OP-ALL	"Hydronic Buffer Tank" Leaving Water Temperature (Demand Water or Water to Water buffering tank product side)				
T11	PWEWT-WW	Product (Hot/Chilled) Entering Water Temperature (Hot/Chilled "Water to Water")				
T12	PWLWT-WW	Product (Hot/Chilled) Leaving Water Temperature (Hot/Chilled "Water to Water")				
T13	PRWEWT OP-DH -	"Proportional Reheat Water Coil" Entering Water Temperature, (most commonly used on Dehumidification Systems)				
T14	PRWLWT-OP-DH	"Proportional Reheat Water Coil" Leaving Water Temperature, (most commonly used on Dehumidification Systems)				
* T15	SLT- WA-WW-DH	Suction/Liquid Line Temperature - if gauges are installed (see illustrations for refrigeration circuitry, in this manual)				
* T16	LLT/FLT-WA-WW-DH	Liquid/Flash (for reversing mode units) Line Temperature(s) - if gauges are installed, (see illustrations for refrigeration circuitry, in this manual)				
* T17	FLT/LLT-WA-WW-DH	Flash/Liquid (for reversing mode units) Line Temperature(s) - if gauges are installed, (see illustrations for refrigeration circuitry, in this manual)				
* T18	DLT- WA-WW-DH	Discharge Line Temperature - if gauges are installed (see illustrations for refrigeration circuitry, in this manual)				
* PT17	SGT- WA-WW-DH	Suction Gauge Temperature - Pressure/Temperature read directly from pressure gauges only if, needed, must be qualified refrigeration technician				
* PT18	DGT- WA-WW-DH	Discharge Gauge Temperature - Pressure/Temperature read directly from pressure gauges only if, needed, must be qualified refrigeration technician				
* RP19	SGP- WA-WW-DH	Suction Gauge Pressure (PSI), Pressure directly from pressure gauges only if, needed, must be qualified refrigeration technician				
* RP20	DPT- WA-WW-DH	Discharge Gauge Pressure (PSI) - Pressure directly from pressure gauges only if, needed, must be qualified refrigeration technician				