# Owner's Manual
# Residential Geothermal Products

**032-5080-05**

# Congratulations on your Geothermal purchase!

Thank you for purchasing a geothermal heating and cooling system. You have joined hundreds of thousands of smart homeowners all over the world who have discovered that geothermal systems are the ultimate heating and cooling technology, providing the best combination of comfort, efficiency, and reliability, with safe, clean, quiet operation. We're confident that your investment in the system will bring you many years of exceptional performance, comfort and savings.

For a quick reference, write your Geothermal Dealer's name, telephone number and other important information below:

Company Name: _____

Telephone Number: _____ Emergency: _____

_____

Date of Installation: _____ Warranty: _____

Unit Model Number:_____ Serial Number: _____

Type of Loop System (Refer to the loop section of this manual for assistance.)
Check one:

- ☐ Horizontal Closed Loop: Type_____, # Trenches/Bores_____ , Trench Length_____, Depth_____
- ☐ Vertical Closed Loop: # Boreholes_____, Depth of Boreholes_____
- ☐ Pond Loop: # Coils_____, Ft. of Pipe_____, Pond Depth_____
- ☐ Open Loop/Well Water: Gallons per minute_____, Discharged to _____
- ☐ Loop Antifreeze (type):_____

**Major Options Installed (check all that apply):**

- ☐ Auxiliary Heat: Internal_____, External_____, kW _____
- ☐ Hot Water Assist:
- ☐ Electronic Air Cleaner (brand): _____
- ☐ Humidifier (brand): _____
- ☐ Other:

***Note: Warranty for Geothermal Products is owned and administered by WFI Geothermal products.***
***Ingersoll Rand does not register nor fulfill warranty claims through Falcon Warranty Administration.***

# Warranty Registration

In order to receive full warranty benefits, it is necessary to register your unit.

There are two easy ways to register—

1. Register on-line at: www.wfionline.info

   or

2. Complete the Warranty Registration Card to the right, and fax to 800-934-9934.

Note: We respect your privacy. Please be assured that we will not provide your personal information to any outside company.

For your records —

I registered my warranty:

□ Online (date _____ )

□ By fax (date _____ )

Thank you!

What warranty do I have?

| | |
|---|---|
| Overall term of warranty: | _____ Years |
| Term of Parts warranty: | _____ Years |
| Term of Compressor warranty: | _____ Years |
| Term of Labor Allowance on warranted parts: | _____ Years |
| Term of Labor Allowance on compressor : | _____ Years |
| Term of Workmanship and dealer supplied materials: | _____ Months |

## Warranty for Accessories:

| Item | Years |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

# Warranty Registration

Owner's Name: _____

Installation Address

Street: _____

City: _____

State/Province: _____

Zip Code/Postal Code: _____

List current Mailing Address if different from above,

Street: _____

City: _____

State/Province: _____

Zip Code/Postal Code: _____

Other Required Information

E-mail: _____

Day Phone: _____

Date of Installation: _____

Dealer Name: _____

Model Number: _____

Serial Number: _____

Loop Type: □ Open Loop/Well □ Closed Loop
Installation: □ New Construction □ Replacement

We request the following information to help us achieve bet ter communication to existing and potential customers. Your response is confidential.

Size of Home:
□ Under 1500 square ft. □ 2500 to 4000 square ft.
□ 1500 to 2499 square ft. □ Over 4000 square ft.

Location of Home: □ Rural □ Suburban □ Urban

Value of Home:
□ Under $100,000 □ $100,000 to $200,000
□ $200,001 to $500,000 □ Over $500,000

How did you hear about our products?
(Check all that apply.)
□ Print Advertisement □ Website □ Radio □ TV
□ Billboard □ Open House/Field Day □ Home Show
□ Builder □ Utility Company □ Friend/Relative
□ HVAC Contractor □ Other: _____

What are the three most important reasons you decided to purchase a system?
□ Energy savings □ Comfort □ Safety □ Quiet
□ Reliability/Low Maintenance □ Long Equipment Life
□ Innovation □ Rebate/Incentive
□ Recommendation □ Environmentally Friendly
□ Other: _____

# Table of Contents

# Geothermal System Technology & Benefits

Geothermal heating and cooling technology is ideal because it provides exceptional performance while being environmentally friendly. Your investment in a Geothermal system will provide you with many years of benefits including:

## Energy Savings

Geothermal units deliver 3 to 4 units of energy for every 1 unit of energy consumed. Many homeowners experience energy savings from 30% to 60% over other ordinary heating and cooling systems.

## Cost Effective

Because of the extraordinary efficiency of a Geothermal system, any added investment related to installing a geothermal unit is usually more than offset by your energy savings.

## Comfort

You'll experience consistent, precise temperature control without the hot blasts of air associated with gas furnaces or the cold blow of an air source heat pump.

## Reliable

The geothermal reputation for reliability has been earned by using only the highest quality components, design, and workmanship. Like your refrigerator, your geothermal unit will provide many years of worry-free operation.

## Quiet

Unlike ordinary air conditioners or heat pumps, there are no noisy outdoor units. Our units are designed and constructed for quiet operation.

## Safe & Clean

Geothermal units don't burn fossil fuels, so there's no flame, fumes, combustion or concerns about carbon monoxide poisoning.

## Environmentally Friendly

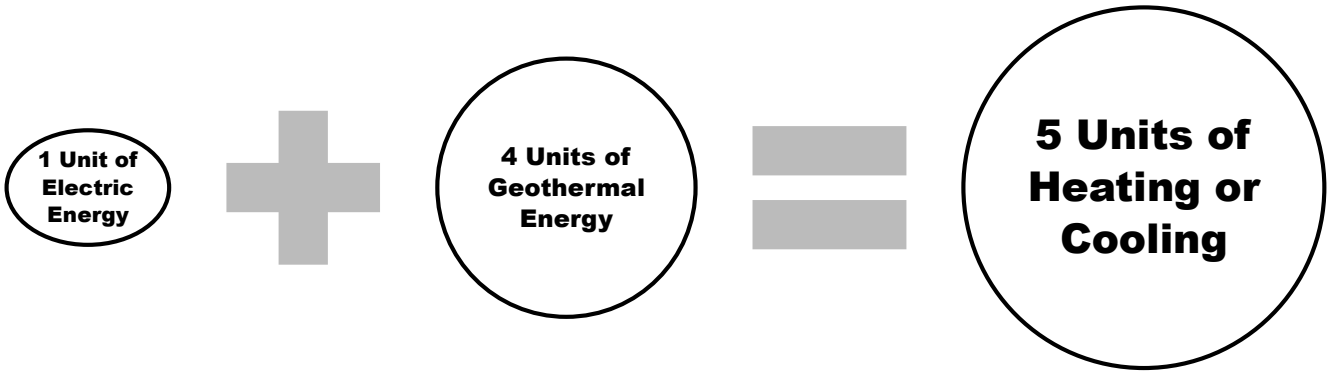
Your geothermal system doesn't release harmful greenhouse gasses into the air, unlike a fossil fuel burning furnace. The reduced energy consumption of a geothermal system further reduces the need for more coal-fired or nuclear power generating plants and places less demand on our current capability to produce electricity. Geothermal units use far less refrigerant than ordinary heat pumps or air conditioners and are factory sealed to prevent leakage.

We're confident that your investment in a Geothermal system will provide you with many years of savings, comfort, and safe, clean, reliable, quiet operation.

# About Your Geothermal System

This section includes some detailed information about how geothermal technology works and how the different components used in the system work together to provide you with the finest comfort system available. You'll find useful information about the refrigeration process, loop systems, safety, and warranties.

Although the mechanics behind this technology may seem complicated, it's based on the same technology that's used in your refrigerator —it's simply a device that moves heat energy from one place to another. Because of the infinite heat storage ability of the earth, you have a free, unlimited supply of energy in your own yard. In fact, for every one unit of electric energy the system consumes, four units of geothermal energy are provided free from the earth and delivered into your home. This energy flow can be easily represented by the diagram below.

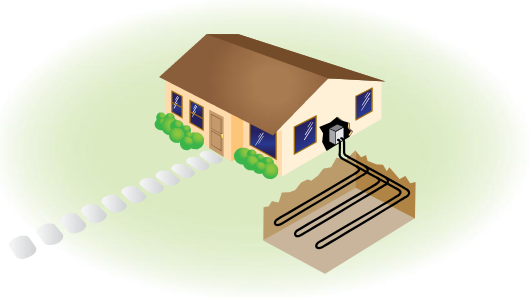



## Interesting Facts

- According to the Environmental Protection Agency (EPA), GeoExchange technology is the most energy-efficient, environmentally clean and cost-effective space conditioning system available.
- The EPA found that the systems can reduce energy consumption and corresponding emissions by over 40% compared to air source heat pumps and by over 70% compared to electric resistance heating with standard air conditioning equipment.
- If one in twelve California homes installed a GeoExchange system, the energy savings would equal nine new power plants.
- Installing a GeoExchange system in a typical home is equal, in greenhouse gas reduction, to planting an acre of trees or taking two cars off the road.
- Current GeoExchange installations equal 14 million barrels of crude oil saved per year.
- The ground absorbs 47% of the sun’s energy that reaches the earth. This amount of energy represents 500 times more than mankind needs every year.

# How Geothermal Systems Work

## The Basics…



Geothermal heat pumps utilize some of the same technology found in your home's refrigerator. They are both devices that move heat energy. Your refrigerator removes heat from the food and transfers it to the air in your home. Your geothermal heat pump removes heat energy from the earth to heat your home and removes heat energy from inside your home to cool it.

A Ground Source Heat Pump System consists of a water-to-air or water-to-water heat pump, connected to a series of long plastic pipes buried below the earth's surface or placed in a pond. These systems can also utilize well water instead of the earth loop. As fluid from the earth loop or well water is moved through the unit, the heat pump transfers thermal energy that heats or cools the home or building.

The ground serves as a giant solar collector, storing heat energy. At depths greater than 30 feet, the temperature is about the same as the annual average outdoor air temperature for that climate. Air temperatures may fluctuate as much as 50° F above and below the annual average temperature. However, only a few feet below the surface the changes in earth temperatures are much less severe. Earth temperature variations decrease with increasing depth. During heating, the earth serves as a heat source. During cooling, the earth serves as a heat sink.

The earth loop is placed in the ground either horizontally or vertically, or it can be placed in a pond. Water (or water and anti-freeze) is circulated through the pipe, transporting heat to the heat pump during the heating mode and away from the heat pump during the cooling mode. The heat transfer takes place inside the heat pump in a water-to-refrigerant heat exchanger.

## The Details…

HEAT PUMP OPERATION - Geothermal heat pump systems consist of four circuits:

1. Air circuit — The duct system that distributes the air throughout the home or building and returns it to the unit.
2. Refrigerant circuit — A sealed and pressurized circuit of refrigerant including compressor, expansion valve, water-to-refrigerant heat exchanger, air coil and reversing valve. The refrigerant is R-410A.
3. Earth loop circuit — The piping system buried in the ground or in the pond (or well water) with fluid that is circulated by pumps to and from the geothermal unit.
4. Hot water circuit — Domestic water can be heated in a geothermal unit with a device called a hot water generator. A piping connection is made from the geothermal unit to the water heater.

Each of these circuits is closed and sealed from the others — there is no direct mixing. However, heat energy does mix from the refrigeration circuit to the other three circuits.

The air circuit, the earth loop circuit, and the domestic hot water circuit always travel in the same direction. However, the refrigeration circuit will change direction depending on what mode (heating or cooling) the unit is in. (The exception to the change in direction of refrigerant flow is the flow through the compressor. This change of direction is controlled by the reversing valve.)

# Cooling Mode

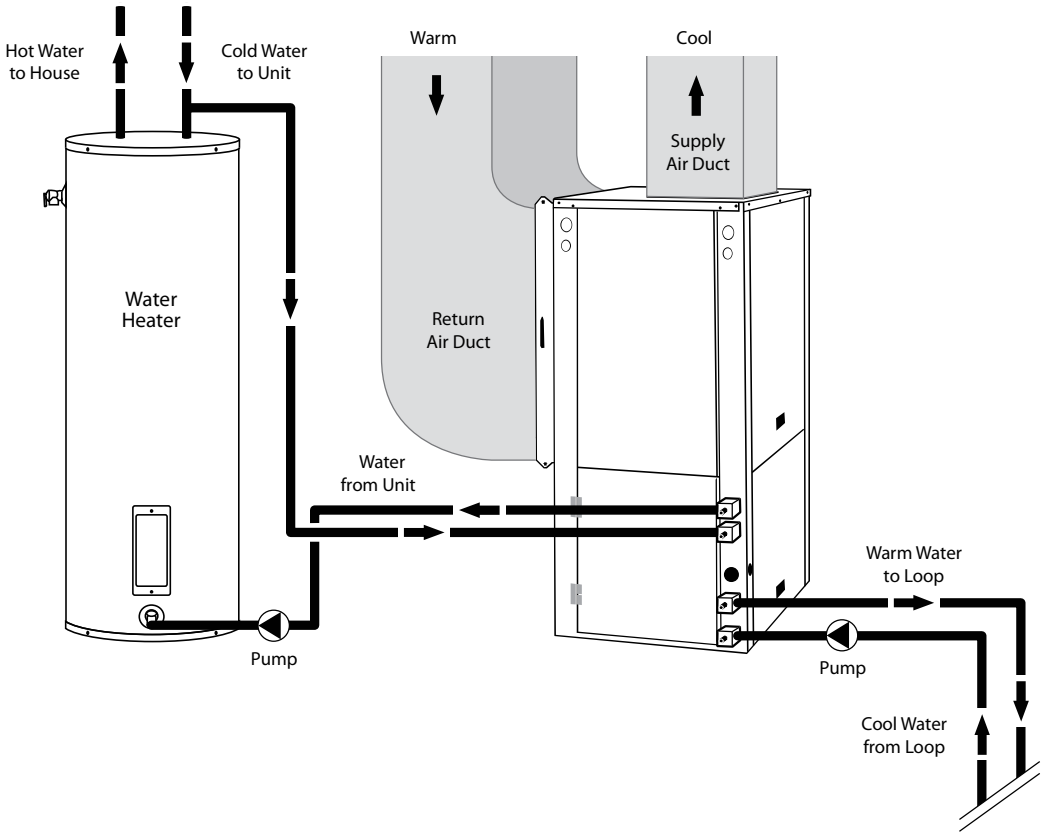
During cooling, a geothermal system rejects the heat from the indoor air into the earth loop. The cooling cycle starts as cold, liquid refrigerant passes through the air coil (the evaporator during cooling).

As the refrigerant flows through the air coil, the heat energy transfers from the warm return air to the refrigerant. This heat transfer causes the cold liquid refrigerant to turn into a gas. The compressor draws the refrigerant gas, compresses it, and discharges it through the reversing valve. During cooling, the reversing valve is energized, which changes the openings from one port to another causing the refrigerant flow to go in the opposite direction as in heating mode. (However, the flow to the compressor does not change direction.)

After compression, the hot refrigerant passes through the coax (the condenser during cooling). In the coax, the hot refrigerant releases its heat energy to the cool loop fluid through the copper walls. Now cooled and liquified, the refrigerant passes through the expansion valve back to the air coil. Warm air passing over the cool air coil causes the air to be cooled and dehumidified.

This process is continuous during the cooling mode, until the thermostat set point is achieved.

Cooling Operation



# Heating Mode

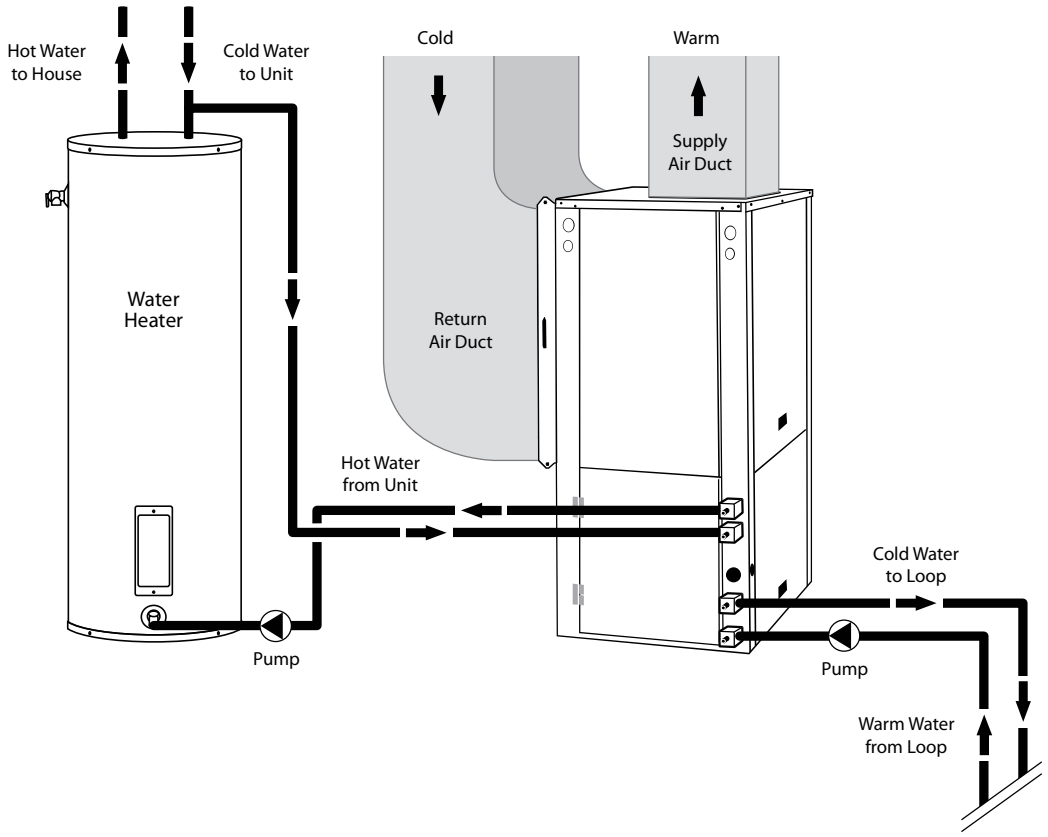
During heating, a geothermal system absorbs the heat from the ground via the earth loop. The heating cycle starts as cold, liquid refrigerant passes through the water-to-refrigerant heat exchanger (coax, and also the evaporator during heating). The coax is made of copper (or copper and nickel) and consists of a tube within a tube - water from the loop travels through one tube (the inside tube), refrigerant pases through the other (outer) tube.

As the loop fluid flows through the coax, the heat energy transfers from the loop fluid to the refrigerant through the copper wall separating the two. This heat transfer causes the cold liquid refrigerant to turn into a gas. (Unlike water, refrigerant changes from a liquid into a gas at a very low temperature.) The now gaseous refrigerant flows into the compressor where it is compressed. After compression the refrigerant will be very hot (approximately 165° F) and discharged through the reversing valve and into the air coil.

The air coil is a radiator-like device that has thin aluminum "fins" attached to either copper or aluminum refrigerant tubing. The refrigerant passes through the air coil (the condenser during heating). As air from the return air duct system passes over the air coil, heat is released from the refrigerant and absorbed by the cooler air. The result is warm air (typically 95° to 105° F) which is delivered through the duct system by the blower.

The refrigerant, now cooled again, passes through the expansion valve (which acts as a flow control), returning to the coax where it can accept more heat from the warmer loop fluid.

Heating Operation



# Hot Water Assist

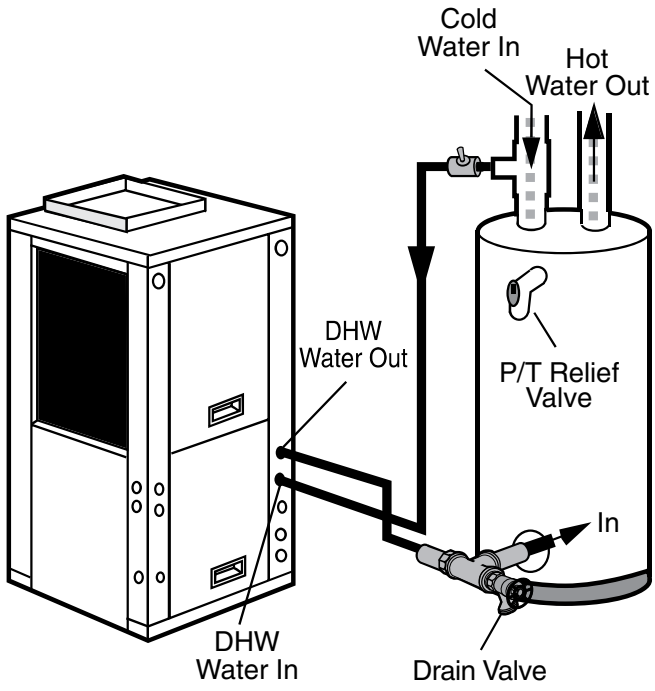
Many geothermal units installed in homes have an optional feature called a hot water generator. This component removes excess heat from the refrigerant circuit and adds it to a hot water circuit in the unit. For more information refer to page 38.

It is important to note that the Hot Water Assist function simply assists in preheating water. The temperature rise through the unit is as much as 2-10º F.

The amount of hot water generated is a function of the model and run time of the unit. On very hot days and cold days, the hot water generator could produce more hot water than is required for the home due to the long run times of the unit. On milder days when the unit has short duty cycles, the electric elements in the water heater will maintain the desired temperature so there will always be enough hot water for the homeowner.

Some installations use a single tank for storage of hot water. Other installations use two tanks to provide extra hot water capacity with added efficiency.

Typical Hot Water Generator



# Typical Installation and Components

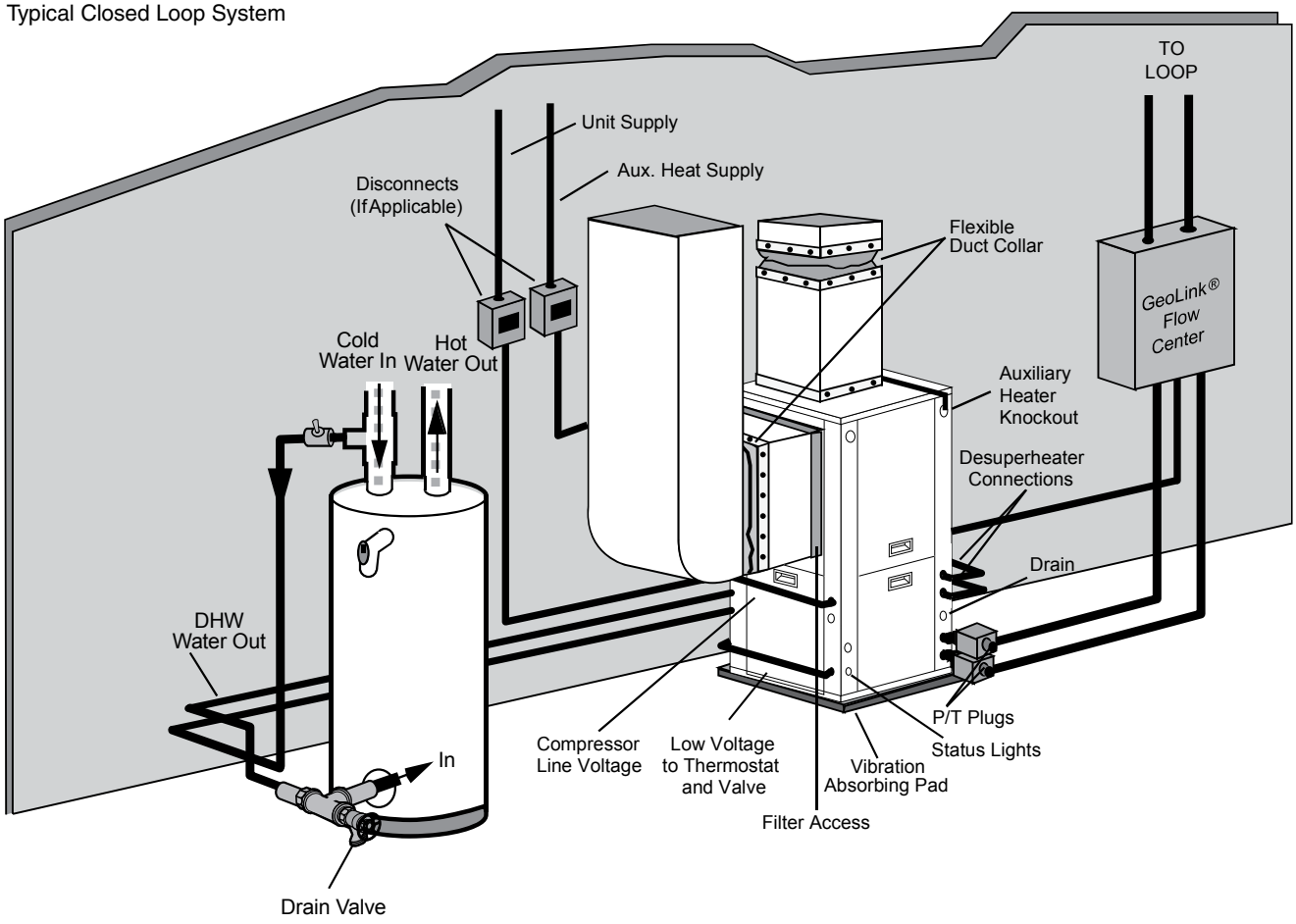
Your geothermal system is actually a collection of components working together to perform the heating, cooling and water heating functions. The basic system includes the unit, power supply, a control component, the water circuit and a distribution method. Many additional optional accessories are available, but listed below are the basic components used in most every installation.

## Closed Loop Components

Major components in a closed loop earth coupled system include:

- Geothermal unit placed on mounting pad
- Thermostat
- Earth loop piping
- Earth loop circulators (pumps)
- Electrical supply
- Duct system (except for radiant floor heating systems)
- Hot water piping (if hot water generator used)
- Auxiliary heater (if used)

Typical Closed Loop System

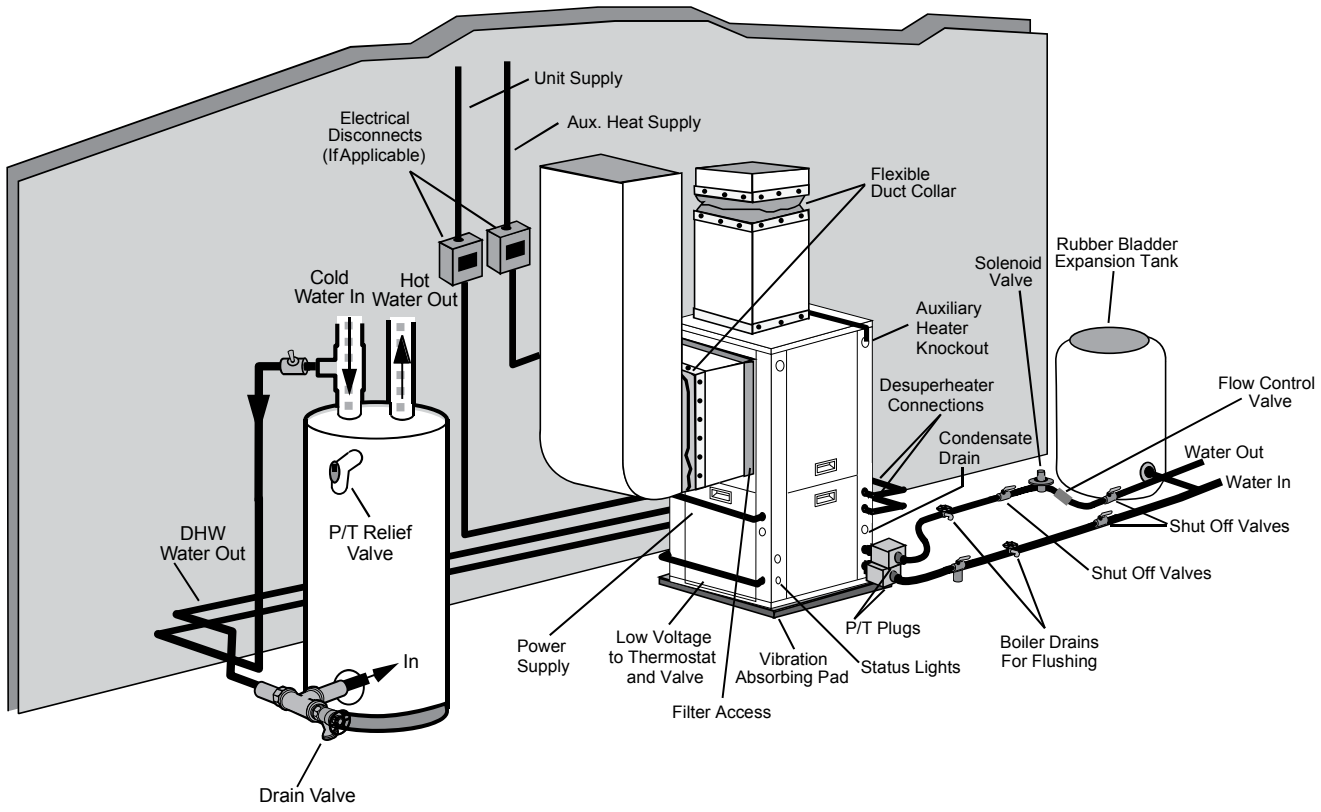


## Open Loop Components

Major components in an open loop/well system include:

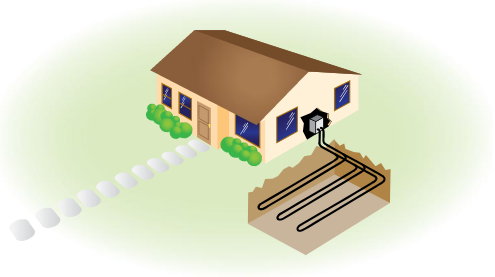
- Geothermal unit placed on mounting pad
- Thermostat
- Well & pump
- Pressure tank
- Supply water piping
- Discharge water piping with solenoid valves and flow regulators
- Shut-off/isolation valves and drain valves
- Electrical supply
- Duct system (except for radiant floor heating systems)
- Hot water piping (if hot water generator used)
- Auxiliary heater (if used)

Typical Open Loop System



# Closed Loop Systems

## Horizontal Loops

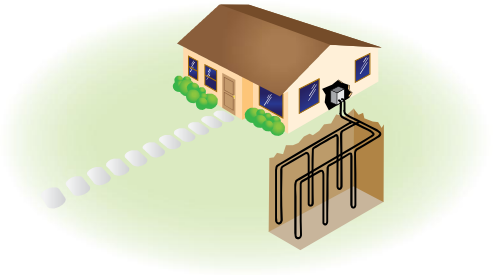


Horizontal earth loops are used where the space allowed for the loop is not extremely limited. There are various designs of horizontal loops. There is not one type of horizontal loop that is best for every application. The selection of which type to use should be based on system size, space available, soil conditions and the type of excavating equipment used. Regardless of the type selected, operating costs will not vary substantially.

*If you have this loop type, record information here:*

Number of trenches or horizontal bores: _____
Length of each trench: _____
Number of pipes in trench: _____ Pipe size: _____

## Vertical Loops

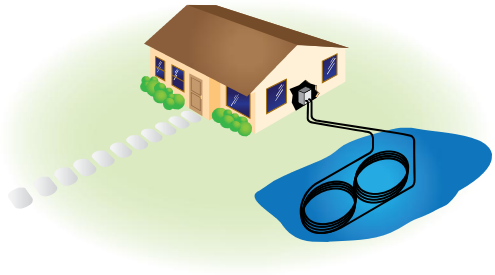


Vertical loops are used where space is limited or where soil conditions are not conducive to horizontal loops. Installing vertical loops requires the use of a drilling rig. Multiple holes are bored. A double pipe connected with a U-bend is inserted into each hole. The hole is then filled with grout to provide good contact around the pipe and to seal the hole. The vertical pipes are then connected to a header system horizontally a few feet below the surface.

*If you have this loop type, record information here:*

Number of bore holes: _____
Depth of each bore hole: _____ Pipe size: _____

## Pond Loops



Pond loops are a cost-effective way to install a geothermal system because trenching is limited to only the supply and return piping from the pond to the house.

Pond loops consist of a series of coils connected together, and placed at the bottom of the pond. In order for a pond to be suitable for a geothermal application in a typical home, the pond should be at least ½ acre in surface area and at least 8 ft. deep, even during a dry spell. Ideally, the pond should be close to the home (less than 200 ft.). If the pond is farther from the home, the benefit of using a pond loop is reduced due to added trenching, materials and pumping costs.

*If you have this loop type, record information here:*

Number of coils: _____ Pipe size: _____
Depth of pond where coils are located: _____

## Water Supply for all Closed Loops

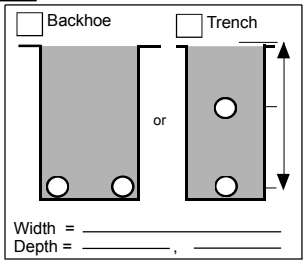
Closed loops require no regular maintenance. However, if you notice air noise within the piping or if your loop is ever damaged by excavation, contact your dealer.

## Your Loop Location

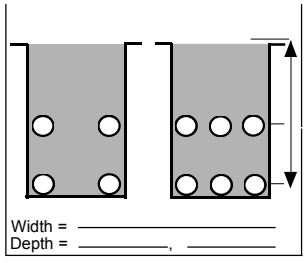
It is strongly recommended that you have a record of the location of your earth loop. Using the grid below, draw a bird's eye view of the property where the loop is located. Include the house and measurements from various points so that there is no question about the location of the piping system. You may also want to include the location of any underground utilities.

Scale: 1 square equals ___ ft.

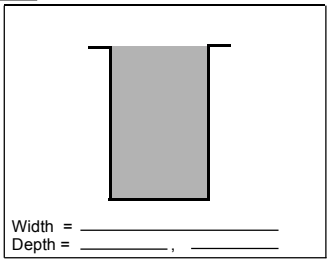
☐ 2 Pipe



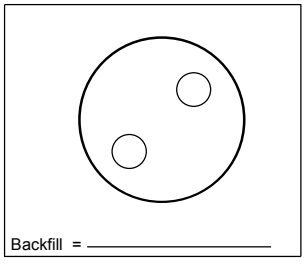

☐ 4 Pipe ☐ 6 Pipe



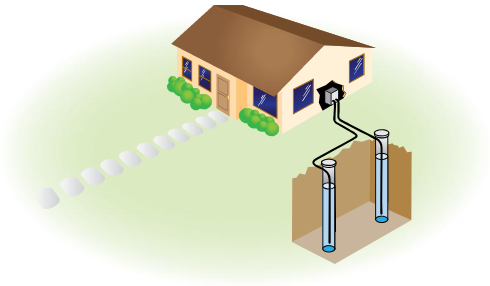

☐ Other




☐ 1 Pair Vertical



# Open Loop Systems



## Open Loop or Well Water Systems

An alternative to closed loops are open loop systems, also known as well-water systems. If your system is an open loop, it uses water that comes into your home from your well. Water from the well is circulated through the unit whenever the unit is heating or cooling. When the unit is not running, it is not using any water.

Once the water has run through the unit, it is discharged into a location like a pond, drainage ditch, field tile, etc. Water used in the unit is not re-used for other domestic purposes.

*If you have an open loop, record information here:*

Total Domestic System designed for _____ gpm.
Geothermal System designed for _____ gpm.
Well depth: _____ ft. Pump depth: _____ ft.
Water table depth: _____ ft. Pump HP: _____
Well yield: _____ gpm

## Unit Maintenance with Open Loop Systems

Depending on the water quality, some maintenance is usually required with a well water system. Because of minerals and other particles in the water, without a routine of preventative maintenance, this material may eventually begin to clog the heat exchanger in the unit. When this happens, the efficiency and capacity of the unit is decreased, eventually to the point where failure may occur.

To minimize the potential of this happening, a heat exchanger cleaning schedule should be established with your dealer. The frequency will depend on the specific quality of your well water. Some homeowners find that they can go a few years between cleaning while others may need to have the heat exchanger cleaned yearly. In order to achieve optimum performance, energy savings and long system life, it is necessary to have your dealer perform this service as needed. Remember — preventative maintenance is less expensive than replacing major components.

The cleaning procedure requires special equipment and chemicals. Therefore, do not attempt to clean the heat exchanger yourself.

## Water Supply

An adequate water supply to the unit is very important. Do not let anyone disrupt the water supply by rerouting the supply line or tapping into it without first checking with your dealer. If the well pumping system requires service or is inoperable, your unit should be turned off or placed into emergency heat until an adequate water supply is restored.

# Safety Warnings

WARNING: Equipment used for heating, air conditioning and water heating can cause injury if safety precautions are not observed. These systems generally use a 230 volt power supply which is double the voltage used by other household appliances. Electrical shock from these systems could cause personal injury or death. Before performing any service or maintenance operations on a system, turn off main power switches to the unit, and turn off the auxiliary heater power also if used.

Although your geothermal unit has been designed and manufactured with your safety in mind, and is certified to the safety standards of ETL, failure to observe safety precautions can result in injury. Only trained and qualified service personnel should install, repair, service or adjust heating and air conditioning equipment. Untrained personnel can perform the basic maintenance functions listed below. All other operations should be performed by trained service personnel. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and any other safety precautions that may apply.

Do not allow children or pets to play around the unit.

## Safety Precautions

Adhere to these safety precautions when performing the following:

- Replacing a disposable filter — Turn off the unit and fan at the thermostat.
- Cleaning an electronic air cleaner — Turn off all power supplies to the unit and the air cleaner. Wait 5 minutes to allow static to discharge.
- Checking/cleaning the internal condensate drain pan — Turn off all power supplies to the unit, and be careful around the sharp fin edges of the air coil. Wear safety glasses and work gloves. Do not allow water to drip onto electrical components in the unit.
- Cleaning/replacing media for unit-mounted or duct-mounted humidifiers — Turn off all power supplies to the unit and humidifier.
- Cleaning thermostats — Do not spray cleaning solution directly onto the thermostat. Wipe down with a damp cloth.
- Cleaning units — Turn off all power supplies to the unit. Do not spray water or cleaning solutions directly onto the unit. Wipe down with a damp cloth.

## Safety Tips

We want you and your family to be safe in your home. Here are some additional useful safety tips:

- Have working smoke detectors (replace batteries two times each year).
- Have working carbon monoxide detectors (even in all-electric homes).
- Have fire extinguishers available in kitchen, utility room, garage, etc.
- Have a well-stocked first aid kit available.
- Have an emergency/evacuation plan in place for all members of the family.

Breaker Box

Disconnect Box

# Warranty Explanation and Coverage

## Industry Leading Warranty

Our standard warranty provides coverage for all unit parts for a period of 5 or 10 years depending on your location and warranty plan. In addition to replacement parts coverage, your servicing dealer receives a repair or replacement labor allowance on warranted components in the unit.

Your independent Geothermal dealer should have previously discussed with you the terms of these options, and together you have selected the one that best fits your needs.

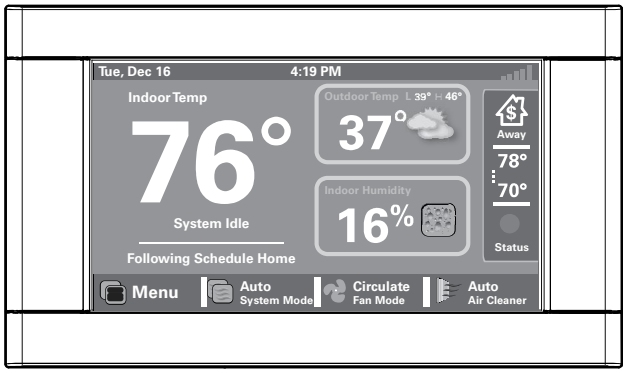
## The Warranty Includes

Our standard warranty covers parts and most accessories. “Parts” are considered to be any factory-installed component inside the unit including, but not limited to, the compressor, reversing valve, expansion valve, electrical components, air coil, heat exchanger, etc. Upon failure of a part, the company provides a replacement part to the servicing contractor at no charge. “Accessories” are generally external to the unit and include items like thermostats, pumps, humidifiers, etc. In most cases, accessories carry a 5 year warranty. Some warranties do not cover accessories. Contact your dealer to determine the specific terms and extent of your coverage.

## Labor Warranty Coverage

Some warranty options include a Labor Allowance, which is an amount credited to your servicing company based on the type of repair made. The labor allowance is designed to reduce the cost of repairs. However, it may not cover the entire labor fee charged by your dealer. Not all warranty options include a labor allowance.

# Thermostats




The main control (or interface) between you and your Geothermal unit is the thermostat. Electronic thermostats are widely used in today's heating and cooling systems, replacing old electro-mechanical models containing mercury. In addition to providing more precise temperature control, electronic thermostats can also include many more features and options, along with a more aesthetically-pleasing look. Although these thermostats are significantly more high tech, you'll find that they are easy to operate.

Note: Most thermostats have an automatic minimum temperature separation (in degrees) from the heating setpoint to the cooling setpoint. This is necessary so the unit cannot continuously switch back and forth between heating and cooling when the thermostat is set in the automatic changeover mode. This separation is called the "dead band" and is usually 2 degrees F. For example, if you place your cooling setpoint at 72, your heating setpoint cannot be higher than 70. If you would then increase your heating setpoint from 70 to 72, your cooling setpoint would automatically increase by that same 2 degrees to 74.

Your electronic thermostat is designed to provide precise comfort. To get the best comfort from your system it is recommended that you resist the temptation to frequently adjust the thermostat. Simply find a comfortable setting for heating and cooling and let the system do the rest. It will provide you with many years of energy savings without sacrificing comfort. Most homeowners prefer setpoints in heating from 70 to 72, and from 73 to 75 during cooling.

## Thermostat Owners Manuals

Because several different thermostat options are available for your Geothermal unit, please contact your Geothermal dealer for Owner's Manual.

# Homeowner Maintenance

Your investment in a geothermal system was a significant expenditure. While these systems are among the most reliable HVAC systems available, your Geothermal system (and any other HVAC system) must be properly maintained in order to achieve maximum performance and long system life (like your automobile). It is recommended that you have your system thoroughly checked by your dealer twice per year (usually Spring and Fall) to maintain optimum performance. If your dealer offers a maintenance agreement program, we suggest you take advantage of it. Regular checks will ensure that your system performs safely and efficiently with less likelihood of major problems and premature failure.

## Things You Can Do

1. Keep your filter clean
   - Standard Disposable Filters (Replace every 2-4 months) — If you use disposable filters, change them regularly before they accumulate too much dirt. Do not attempt to clean a disposable filter. Simply throw it away and reinstall a new one. Do not turn a dirty filter over to the clean side and reinstall it — this results in blowing the accumulated dirt right back into the home. Disposable filters can be purchased at most hardware stores or through your local Geothermal dealer.
   - Pleated Disposable Filters (Replace 1" filters every 2-4 months; Replace 2" & 4" filters every 4-6 months) — If you use pleated filters, change them regularly before they accumulate too much dirt. Do not attempt to clean a pleated filter. Simply throw it away and reinstall a new one. Pleated filters can be purchased from your Geothermal dealer.
   - Electronic Air Cleaners (check every 2-4 months)
2. Check Drain Pan (Once per year during heavy cooling periods)
   The drain pan accumulates water that has condensed on the air coil during cooling to provide dehumidification. Occasionally, the drain hole in the pan (or the drain hose) can become clogged. This will most likely occur during the cooling season. See page 24 for cleaning instructions.
3. Check Ductwork (Once per year)
   A recent study found that many homes had a least one section of duct disconnected resulting in the blowing of conditioned air into attics or crawl spaces. Check any visible ductwork, especially in attics or crawl spaces, for disconnected sections or large leaks. Check registers in every room for air flow and to ensure they are open.
4. Check Thermostat (Once per month)
   Check your thermostat to ensure that there are no fault signals displayed or that Emergency Heat is not engaged. If you have selected Constant Fan on your thermostat, your operating cost will be affected more (they will be higher) if your unit is equipped with a single speed PSC blower instead of a variable speed ECM blower.
5. Check the Unit (Twice per year).
   Check for LEDs that are ON (see page 23).
   Check for moisture around the base of the unit or the flow center.
   Check for anything appearing or sounding unusual.
6. Check Accessories (Twice per year).
   Check for proper operation and for anything appearing or sounding unusual.

# Maintenance Schedule

| | Monthly | 1-2 Months | 2-4 Months | 4-6 Months | Yearly |
|---|---|---|---|---|---|
| Replace disposable filter (1") | | | ● | | |
| Replace disposable filter (2" & 4") | | | | ● | |
| Clean electronic air cleaner (if used) | | | ● | | |
| - Clean electronic pre-filter (30 day fan run time) | ● | | | | |
| - Clean electronic collection cells (60 day run time) | | ● | | | |
| - Clean electronic field charger | | | | | ● |
| Check condensate drain pan | | | | | ● |
| Check duct system | | | | | ● |
| Check thermostat operation and signals | ● | | | | |
| Visual check of unit & LEDs | | | | ● | |
| Visual check of accessories | | | | ● | |

# Troubleshooting

In the event that your unit is not functioning properly, check the fault lights and troubleshooting information below. After determining that a service call is required, call your dealer for an appointment. When calling the dealer, it is beneficial to provide your model number and indicate any fault lights that are "on" either at the unit or on the thermostat.

Troubleshooting Reference

| Symptom/Problem | What You Can Do |
|---|---|
| Unit not operating. | Check status/fault lights. |
| Unit not heating or cooling adequately. | Check filter and status/fault lights. |
| Unit just “hums” and doesn’t heat or cool. | Disconnect power. Call for service. |
| Electric bills too high. | Is unit always in Emergency Heat?<br>Is thermostat set to Continuous Fan when using PSC blower? |
| One room is too cold/hot. | Check for closed registers and<br>disconnected duct. |
| Too much air flow. | Check for closed registers in other areas. |
| Whistling noise coming from fan. | Check filter. |
| Loop has been damaged. | Turn off unit at breaker. Call for service. |
| Thermostat settings “mysteriously” change. | Check setpoints for both heating and cooling. |
| Red LED on at thermostat. | Check status/fault lights on unit.<br>See thermostat instructions. |
| Red LED on or flashing at unit. | Determine fault condition by noting which light is on. |
| Drain light is flashing. | Check condensate pan and drain. |

# Frequently Asked Questions and Energy Saving Tips

The following section includes the most frequently asked questions (FAQs). It also includes operating tips, other information and how to get the best results in comfort, savings, and reliability.

If this is your first ownership experience with a geothermal system, you'll find this information valuable. Geothermal systems do function differently than ordinary systems. However, by using this section as a reference, you'll be able to find answers to the most common questions.

## What about my thermostat operation?

Your unit is controlled by one or more thermostats. Thermostats sense the temperature in the room in which they are located, and determine the mode of the unit (heating or cooling) and control the duration of the cycle. There are a variety of thermostats available, and while each one operates on the same principle their settings, buttons and commands are different.

## What do I do in case of a power failure?

Don't worry. Today's electronic thermostats employ the latest developments in solid-state technology. Most electronic thermostats do not require a battery in order to maintain your selected set points in the event of a power loss. The thermostat memory is unaffected by power failures of any duration. When power is restored, the thermostat will continue operating as if the power had never been interrupted. However, there will be no heating or cooling during the outage.

## What if my unit stops working?

Your unit has been equipped with a variety of self-protection devices and controls. Should you suspect that heating or cooling operation has ceased, look at the thermostat to see if the unit lockout indicator light is illuminated. If the lockout indicator light is illuminated, see the section on resetting the unit.

## What about regular service?

Your system requires little regular maintenance. However, once a year or so, have the unit inspected by your dealer. They will check the unit's performance and make sure that your unit is heating and cooling at its peak performance level. If your system is using a well as its water supply, your unit may need periodic cleaning to remove mineral deposits.

## What kind of safety controls does my unit have?

Your Geothermal unit is equipped with safety controls that are designed to protect the unit in case of improper airflow, water flow or refrigerant charge. These safety controls should not be bypassed. Doing so may void the warranty.

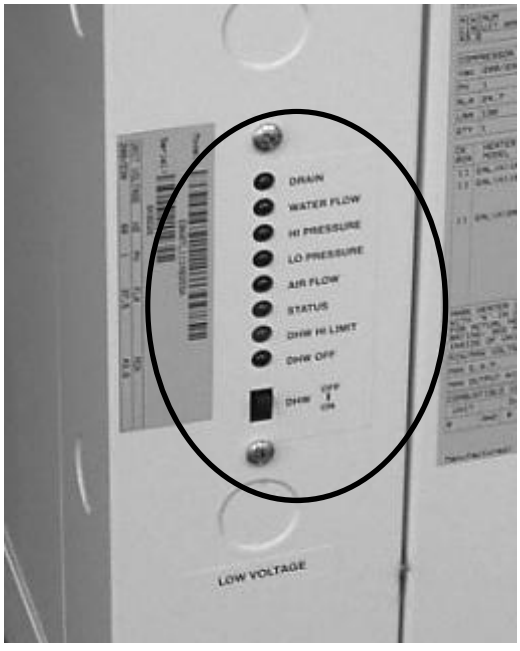
## What are the lights for?

Some models are equipped with STATUS lights. These lights are mounted in plain view on the front of your unit. They will help you properly identify any problems and determine what might be required to correct the situation.

These lights will:

- Help determine whether your system is operating correctly.
- Help identify any problems.
- Help determine if you can fix the problem yourself and avoid a service call.
- Save you time and expense when you need to call an independent Geothermal dealer by helping them identify the problem before they come out.

### Status Lights



## What do the status lights indicate?

In general, red LEDs continuously illuminated indicate the unit is attempting to self-correct a fault. Flashing red LEDs indicate the unit has locked out in a fault mode. In this case, Emergency Heat will be activated to provide heat if necessary. Call your dealer for service after reviewing the specific fault information below.


## Drain

When this light comes on, it indicates that the condensate drain pan within the unit has reached the overflow level. This may be caused by foreign matter blocking the drain pan opening or a clog in the drain line. See page 24 for cleaning procedure.

## Water Flow

A sensor protects your unit against internal freeze-up caused by a water flow loss in the heating mode. When the WATER FLOW light is on, this signals that internal freezing conditions have occurred. This may be caused by a pump failure, low antifreeze level or air pockets in the loop piping (see the section on resetting the unit below).

## High Pressure

When this light is on, it indicates high refrigerant pressure. This may be caused by a loss of water flow in the cooling mode or low airflow in the heating mode caused by a dirty filter.

## Low Pressure

When this light is on, it indicates a loss in refrigerant pressure in the system. This may be caused by a refrigerant leak (see the section on resetting the unit below) or a dirty filter in the cooling mode.

## Airflow

When this light is on, it indicates either a dirty filter or an airflow problem. Clean/replace air filter. Contact your Geothermal dealer if problem persists.

## Status

A blinking green STATUS light indicates that the microprocessor control, which is the “brain” of the unit, is operating properly. If the light doesn’t flash but remains continuously on or off, the control is inoperative. Turn off all power to the unit, including auxiliary heat, and then turn it back on. If the light remains continuously on or off, call your Geothermal dealer.

## DHW Limit

A sensor monitors the temperature of the water leaving the unit. The light will come on if the temperature is above 130°F (54°C). At this time your unit’s hot water pump will be de-energized to prevent excessive temperatures. Don’t worry; hot water operation will resume when the tank cools off. This is not a fault condition, and the unit does not require resetting.

## DHW Pump Switch

When this switch is off, your unit’s hot water pump is manually disabled, and DHW OFF status light will be lit. This switch may be used when the water heater is being serviced or replaced. This switch must be turned off when water flow from the water heater to the unit is turned off or disconnected. Damage to the pump may otherwise occur.

## If my unit shuts off, how do I reset it?

- To reset the unit, repeatedly push the SYSTEM button on the thermostat until the display reads OFF.
- The unit lockout indicator light will remain on for up to 15 seconds after turning the system off.
- After the unit lockout indicator light goes out, turn the system back on to the desired MODE.
- Unit operation should resume within five minutes if heating or cooling is required.
- The appropriate status light on the unit will continue indicating the fault until power is interrupted to the unit. This serves as a diagnostic aid for your dealer.
- If the unit shuts down again, call your Geothermal dealer as soon as possible. Do not repeatedly reset your unit.

## What if my unit does not operate properly?

Before you call your Geothermal dealer for service, check these service hints:

- Check air filters. Depending upon filter type, clean or replace if necessary. (See below.)
- Make sure the thermostat is set properly.
- Check to make sure the electrical disconnect switches are in the ON position. Both the unit and auxiliary heat (if present) must be powered for proper operation.
- Check for a tripped circuit breaker or a blown fuse in your home or building's main power box. Reset breaker or replace fuse.
- If either the disconnect switch or the circuit breaker continues to trip after you reset it, call your Geothermal dealer immediately to prevent damage to your unit.
- Check the thermostat indicator lights to ensure proper operation of the system.
- Check the unit status lights on the front of the unit to ensure the unit is operating properly.
- If you can't determine the problem, call your Geothermal dealer promptly.

## What is a "lockout"?

A lockout occurs when the unit has faulted and cannot correct itself. This mode protects the unit from further damage. During lockout mode, Emergency Heat will be activated to provide heating if necessary.

## What about air filters?

One of the most important things you can do to ensure long system life, high performance and clean indoor air is to keep the air filter clean. For filters with disposable media, discard the filter when it is dirty and replace it with a new clean filter. Never attempt to re-use a disposable filter by cleaning it or placing it in backwards. Never run the unit without a filter.

The frequency with which you should clean or replace your filter is dependent upon several variables including the type of filter media, your outdoor environment and your indoor environment. Families with lots of activities, pets or people sensitive to allergies should clean/replace filters more often. Contact your dealer with a recommended schedule for filter maintenance.

If you have an electronic air cleaner installed, check with your dealer or refer to the air cleaner's owner's manual for cleaning instructions.

Filter Access

## How do I unclog the drain pan?

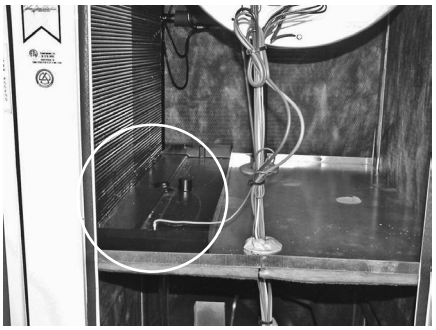
In the cooling mode, moisture removed from the air forms as condensation on the air coil, and the resulting water runs down to the condensate drain pan. The drain can pick up lint and dirt, especially with dirty air filters. If overflow occurs, the DRAIN light will come on (in units equipped with status lights) and the system will shut down. If the water does not run freely, clean the drain pipe. Dilute a capful of chlorine bleach in a quart of water and pour the solution in the drain pan once a year. This helps prevent algae.

To gain access to the drain pan for inspection or cleaning:

1. Turn off all power to unit and auxiliary heat.
2. Remove the screws holding the fan compartment door closed.
3. Lift the door up and pull out at the bottom.

Note: The drain pan is the black plastic or metal rectangular pan with the drain hole in the middle under the air coil.

Drain Pain



## If my system includes an Auxiliary Heater, what does it do and why was it used?

Your system may include an Auxiliary Heater (mounted either internally or externally depending on the model) which is used for two purposes:

- To supply back-up heat during cold outdoor temperatures.
- To provide emergency heat if the unit's compressor fails.

Generally, dealers will size the geothermal unit to provide the majority of the heating requirements down to a certain outdoor air temperature. When conditions exist that require more capacity than the geothermal unit is sized to deliver, the auxiliary heater engages to assist the geothermal unit, (which continues to work). If the unit were to be sized to provide 100% of the heat on the coldest day, the unit would be "oversized" every day that isn't the coldest day of the year. Plus, the initial cost of installation could have been significantly higher for a larger unit and additional loop. Your dealer has determined the right combination/size of equipment that makes economic sense in terms of installation cost and operation.

The other reason for the Auxiliary Heater is to provide heating in the event of a compressor failure. Switching to Emergency Heat mode on your thermostat will provide the home with a source of heat until the compressor is replaced.

## Does my unit heat water?

Some units are equipped with a "hot water assist" component. Depending on conditions, this component can preheat water by raising the temperature by as much as 2°-10° F and then deliver it to your water heater using a small pump. The "hot water assist" is not designed to heat water like your water heater. However, a unit equipped with a "hot water assist" heats water much more efficiently than your water heater and can provide energy savings whenever the hot water assist is operating. The amount of hot water generated by the "hot water assist" is a function of how long the unit is running and what mode it is in.

## What if I run out of hot water?

Units equipped with hot water generators provide only supplemental water heating. Your water heater will operate if the unit is not heating the water adequately. If you run out of hot water, it is most likely a problem with the water heater and not the geothermal unit.

## How do I know where my earth loop is located?

Earth loops can be installed in several configurations depending on the space available. The company who installed your loop should provide you with a layout of the loop field with measurements & locations of each circuit length based on fixed locations (e.g. the corners of the house). Some loop contractors install metallic tape or tracer wire in the trench to assist in future locating. Keep this document and refer to it before doing any digging or excavating in the area of the loop. It is also recommended that you sketch out the loop location.

## Is maintenance required for the earth loop?

No regular maintenance is required. However, if you notice air noise within the piping or if your loop is ever damaged by excavation, contact your Geothermal dealer.

## Should I use the Continuous Fan mode?

In Continuous Fan mode, your blower operates constantly, even when the unit is not heating or cooling. The Continuous Fan mode (selected on your thermostat) can reduce hot spots or cold spots throughout the home by constantly mixing the air. Indoor air quality is also improved due to continuous filtration. Using Continuous Fan mode will increase operating costs.

IMPORTANT: If the indoor air exceeds 60% relative humidity or simply feels uncomfortably humid, it is recommended that the indoor fan only be used in the AUTO mode.

## What about units using well water?

An adequate water supply to the unit is very important. Do not let anyone disrupt the water supply by rerouting the supply line or tapping into it without first checking with your Geothermal dealer. If the well pumping system requires service or is inoperable, your unit should be turned off or placed into emergency heat until an adequate water supply is restored.

Depending on the water quality, some maintenance is usually required with a well water system. Without scheduled checkups, minerals and other particles in the water may eventually begin to clog the heat exchanger in the unit. When this happens, the efficiency and capacity of the unit is decreased, eventually to the point where failure may occur.

To minimize the potential of this happening, a heat exchanger cleaning schedule should be established with your dealer. The frequency will depend on the specific quality of your well water. Some homeowners find that they can go a few years between cleanings while others may need to have the heat exchanger cleaned yearly. In order to achieve optimum performance, energy savings and long system life, it is necessary to have your dealer perform this service as needed. Remember — preventative maintenance is less expensive than replacing major components.

The cleaning procedure requires special equipment and chemicals. Therefore, do not attempt to clean the heat exchanger yourself.

## Why does the unit run more/longer than a gas furnace?

The amount or percentage of time that your unit is actually heating or cooling is called Run Time. To achieve maximum comfort during heating, geothermal systems will typically have a longer run time than a natural gas or propane furnace. That's because geothermal systems will deliver a more moderate air temperature instead of the hot blast of air from a gas furnace.

Fossil fuel forced air heating systems will typically have short run times — a lot of high temperature air for a few minutes followed by a cooling off period, then another blast of hot air... and on and on. This type of operation results in ever-changing indoor temperatures and hot/cold spots within the home. This frequent cycling causes wear and tear on a gas furnace.

Your geothermal system will most likely run for longer periods of time than a gas furnace. It's designed to do just that. You'll get improved comfort and minimize hot/cold spots. These longer run hours actually help to increase efficiency and reduce wear and tear associated with frequent starting and stopping. It's like driving your car in the city vs. the highway. The frequent starting and stopping of city driving causes more wear and tear than highway driving. Also, you achieve more miles per gallon (better efficiency) on the highway with fewer stops and starts. The same principle holds true with your geothermal system.

## How is the unit sized for my home?

Your system has been designed to meet the heating and cooling requirements of your home based on your local weather. Each home is different, so calculations are performed to ensure that the unit size is the optimum selection. These calculations are based on square footage, insulation, windows, doors, infiltration, outdoor weather extremes, and many other factors. If the unit were undersized and unable to meet the heating requirements on a very cold day, you would notice a drop in indoor temperature. In addition, the unit would consume more energy than is necessary. If the unit were undersized and unable to meet the cooling requirements on a very hot day, you would notice that the indoor temperature may not ever reach the setpoint on the thermostat. Conversely, units that are oversized with too much capacity may result in short cycle times which may adversely affect comfort in both heating and cooling. Oversized units would also result in poor dehumidification during cooling.

Heating systems are measured by BTU capacity per hour. Cooling systems are measured by "tons" (which is also BTU capacity). One BTU is the amount of energy required to raise 1 lb. of water 1 degree F — it's roughly equivalent to the amount of heat given off by a wooden kitchen match burned end to end. In air conditioning terms, a "ton" is 12,000 BTUs/hr.

## Should I close off a register in an unused room?

Some homeowners have unused rooms that may not require heating or cooling like the rest of the home. While there is often a tendency to close registers in an unused room, the effects may actually reduce comfort without saving any money in operating costs. The home's duct system has been designed to deliver the right amount of air into the various spaces. Closing off one or more registers disrupts the air flow pattern, creates an unbalanced system, and may in fact be detrimental to the comfort levels experienced in the other rooms. In addition, the desired energy savings may not be achieved.

If you have larger areas or multiple rooms that do not require continuous heating and cooling, you may want to consider a zone control system. These systems use several thermostats throughout the home and has motorized dampers that are electronically controlled. The dampers deliver properly balanced air flow and desired temperatures throughout the various zones. For more information on zone control systems, contact your Geothermal dealer.

## What about remodeling & room additions?

Because your system has been selected, designed and installed based on the existing heating and cooling requirements of your home, a significant change or addition to the home may result in the system being inadequately sized. If you are planning any remodeling that might affect the heating/cooling requirements including adding more rooms, windows, or exterior doors, consult with your dealer to determine if the existing system is adequate. Depending on the extent of your changes, your existing unit may be adequate, or you may have to install a larger or additional unit. Installing a larger or additional unit will require more ductwork and may also result in the need to add more loop in the ground.

## What about adjusting the thermostat when entertaining many people?

The temperature in your home can be affected significantly by the number of people inside. Our bodies generate heat through metabolism — in fact, your body gives off about 300 – 400 BTUs per hour. This number can double or even triple at high activity levels (dancing, sports, etc.) Many homeowners find that when entertaining large numbers of people in the home, the temperature may rise noticeably due to the number of people "generating" heat and the heat given off by using many lights and other appliances (TVs, stereos, cooking devices, etc.)

As a result, you may find a need to air condition even though it may be cold outside. If your thermostat has an automatic changeover feature, ensure that the cooling setpoint will be a comfortable setting for your guests. If you have a manual changeover thermostat or if your thermostat is set for heating only, you should be prepared to change it over to cooling when you have many people inside the home. Another suggestion is to set the fan for continuous "on" so that the air is fully circulated throughout the various rooms to minimize hot spots or cold spots. When the guests leave and occupancy levels return to "normal," be sure to switch back to heating mode if it's cold outside. In the summer, you could benefit by setting the cooling setpoint a little lower than normal prior to many guests arriving so that the system can adequately maintain the temperature inside with the additional people and high outdoor temperatures.

Depending on a combination of factors (unit capacity, number of people, activity levels, and outdoor temperature) you may experience some fluctuation in indoor temperature. This is normal and only temporary.

Don't worry about energy costs when doing some "extra" cooling. If your unit is equipped with a hot water generator, the heat removed from the house during cooling is going into your water heater.

## What about humidity control?

Geothermal units do an excellent job of removing humidity during cooling. This results in better comfort. However, during heating (depending on your home and outdoor air temperatures) you may experience the effects of having too little humidity indoors. This is not the fault of the unit — it does not remove any humidity during heating. In the event that your home does not maintain optimum indoor humidity levels during the heating season, you may benefit from using a whole house humidifier integrated into your system. Contact your dealer for more information.

## Should the ductwork be cleaned?

Ducted HVAC systems can be a collection point for a variety of contaminants (mold, fungi, bacteria and dust) that have the potential to adversely affect your health. In addition to improved indoor air quality and the possible health benefits of duct cleaning, the EPA has demonstrated that HVAC systems run more efficiently when these contaminants are removed from the system. Older homes or homes with smokers, pets, and people sensitive to allergies could benefit from duct cleaning. Many HVAC contractors can perform an inspection and duct cleaning using specialized equipment. Contact your dealer for more information.

## What is ENERGY STAR®?

ENERGY STAR® is a program supported by the U.S. Dept. of Energy and the EPA designed it to help homeowners and businesses protect the environment using superior energy efficient technologies. Nationwide, the annual savings using ENERGY STAR® products is equal to the amount of energy required to power 20 million homes and avoid greenhouse gas emissions equivalent to 18 million cars. This represents billions of dollars in savings.

Energy efficient choices for the home can save you up to one third of your energy bill without sacrificing features, style or comfort. When considering new household appliances, consider ones that have earned the ENERGY STAR® rating. They meet strict efficiency guidelines established by the government. In addition to appliances, whole homes can be constructed with ENERGY STAR® standards built right in. For more information on ENERGY STAR®, go to www.energystar.gov.

## Is my unit ENERGY STAR® rated?

Our highest efficiency units meet ENERGY STAR® standards. Check with your installing contractor or at www.EnergyStar.gov to confirm your system meets the current requirements for Energy Star.

# Energy Saving Tips

Now that you've invested in the most energy efficient heating and cooling system available, here are some additional tips to help you save money on your energy costs throughout your entire home.

## Fluorescent Lights

Fluorescent lights use a fraction of the amount of energy as incandescent bulbs. Consider replacing your highest usage incandescent bulbs with fluorescent ones.

## Consider ENERGY STAR® Appliances

In addition to your highly efficient geothermal system, you may want to consider other household appliances that meet the ENERGY STAR® standards. ENERGY STAR® options are available for refrigerators, clothes washers, ceiling fans, dishwashers, home audio systems, TVs, computer equipment, etc. A listing of ENERGY STAR® appliances can be found at www.energystar.gov.

## Duct Sealing and Insulation

A recent study revealed that a large percentage of homes had at least one section of duct disconnected somewhere in the system (without the homeowner knowing about it). Regardless of the heating & cooling system type installed, having properly connected and sealed ductwork is critical to proper performance. Despite its name, duct tape is generally insufficient to seal leaks in a duct system. Over time, the adhesive used on duct tape will dry out resulting in tape failure. Other tape types and sealants used by professional HVAC contractors are better suited for sealing duct systems. It is also recommended that the ductwork be insulated (either internally or externally) when it is located in an unheated or uncooled area (attic, crawl space, etc.)

## Insulation, Weather Stripping and Sealing

Ensure that your home has the suggested levels of insulation. The amount of insulation required depends on the type of insulation and your climate. Adequate weather stripping and sealing around windows, doors, and electrical outlets can have a dramatic effect on air moving from outside to inside (infiltration) and on air moving from inside to outside (exfiltration).

## Water Heater Blankets

Most water heaters can benefit from adding a special insulating blanket around the tank. These are inexpensive and available at most hardware stores and are easy to install. Water heaters placed directly on concrete floors dissipate heat into the concrete adding operating cost.

## Replacement Windows

If you have old leaky windows, consider replacing them with high efficiency models. Today's premium windows are very energy efficient, and some contain coatings or gasses that reduce harmful ultraviolet rays and reduce your cooling requirements. Consider ENERGY STAR® models.

# Optional Hot Water Assist

Many geothermal units installed in homes have an optional factory installed feature called a hot water generator. Your dealer should have informed you if your unit has this option installed. This component consists of a refrigerant-to-water heat exchanger installed at the discharge of the compressor. The hot gas at this point is in a “superheated” condition. In the hot water generator, the refrigerant releases some of the heat into the cooler water through the copper wall of the hot water generator heat exchanger. A small circulator moves the water from the water heater to the heat pump and back to the water heater.

This excess hot gas is available in both the heating and cooling modes. However, there is a greater hot water benefit during cooling because some of the heat that is extracted from the air ends up in the superheat and is transferred to the water. When operating in second stage heating, some units disable the circulator so that all the heat energy is devoted to the air.

It is important to note that the Hot Water Assist function simply assists in preheating water. Depending on conditions, the hot water generator can raise the water temperature by as much as 2°-10° F with each pass through the hot water generator.

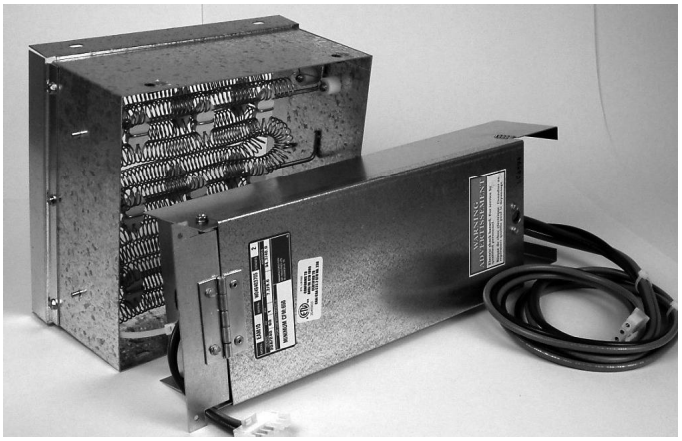
The amount of hot water generated is a function of the model and run time of the unit. On very hot and cold days, the hot water generator could generate more hot water required for the home due to the long run times of the unit. On milder days when the unit has short duty cycles, the electric elements in the water heater will maintain the desired temperature so there will always be enough hot water for the homeowner.

Some installations use a single tank for storage of hot water. The recommended installation uses two tanks to provide extra hot water capacity with added efficiency.

A safety device (sensor) shuts off the circulator for the hot water generator in the event that the water temperature reaches 130° F (54° C). The yellow status light will be illuminated. At this time your unit’s hot water pump will be de-energized to prevent excessive temperatures. Don’t worry, hot water operation will automatically resume when the tank cools off. This is not a fault condition, and the unit does not require resetting.

Some models have a switch located below the status lights which enables you to manually turn off the internal hot water generator pump. When this switch is off, your unit’s hot water pump is manually disabled and DHW OFF status light will be lit. This switch may be used when the water heater is being serviced or replaced. This switch must be turned off when water flow from the water heater to the unit is turned off or disconnected. Damage to the pump may otherwise occur. Reference the specification catalog for the hot water generator performance at specific conditions.

# Auxiliary Heater



Most installations in northern climates include an Auxiliary Heater (mounted either internally or externally depending on the model). Auxiliary heaters are used for two purposes:

- To supply back-up heat during cold outdoor temperatures.
- To provide emergency heat if the unit's compressor fails.

## Back-up Heat

Your geothermal unit will provide the largest majority of your heating. The amount of heat provided by the auxiliary heater will vary from house to house depending on factors like climate, unit sizing, heating load, and economics.

Economically, there is a point based on (outdoor air temperature) where it makes sense for the geothermal unit to work in conjunction with the auxiliary heat. When considering both the cost of installation and the cost of operation, it often makes sense to size the geothermal unit to provide something less than 100% of the total heating requirement. Generally, sizing the unit in a northern climate to provide 100% of the heating does not make sense economically because the added initial cost of the larger unit and earth loop may not be recovered in energy savings over a reasonable period of time.

For example:
Installation Option A: The geothermal unit is sized to provide 95% of your heating requirement with the other 5% using the auxiliary electric.
Installation Option B: The geothermal unit is sized to provide 100% of the heating load.

Assume the cost to operate the auxiliary heat (in Option A) is $50 per year. The additional cost of the larger system (Option B) is $2,000.

So, dividing $50 (savings) into $2,000 (additional investment) yields a 40-year return on investment. You can easily see why it makes sense to size the system to allow auxiliary electric to provide some of the heating requirement.

Oversizing the unit may not be cost-effective, and it can also lead to decreased comfort and additional wear and tear on your unit. Units that run for very short periods of time actually incur more stress on the compressor than units that run for longer periods.

Geothermal dealers are trained and have the design tools to determine the most effective size system for your home considering performance, comfort, installation cost and operating cost.

## Emergency Heat

The other reason for the Auxiliary Heater is to provide heating in the event of a compressor failure. Switching to Emergency Heat mode on your thermostat will provide the home with a source of heat until the compressor is replaced.

# Flow Center


A module called the Flow Center circulates the fluid in the closed loop system and through the geothermal unit. This device typically contains one or two small pumps (1/6 hp circulators) that are engaged when the unit is heating or cooling. Generally, one pump is used for units up through 3 tons and two pumps are used for units from 3.5 to 6 tons. However, some 4 to 6 ton applications may require only one pump depending on the loop's pressure drop as these units have been designed with heat exchangers to operate with single pump flow centers. Systems larger than 6 tons may require a third pump, the use of a single larger pump, or possibly separate loops and pumps for each unit.

Units using well water do not use a flow center. They use the well pump.

Flow centers and pumps require no regular maintenance.

If you experience any of the following, contact your dealer:

- Excessive frost buildup around pump or flow center cabinet.
- Leaking around the fittings.
- Air noise in the water piping.
- A pump that is too hot to touch.
- Operation will be halted when the heat pump is locked out.

DO NOT ATTEMPT TO SERVICE THE FLOW CENTER. IMPROPER SERVICE COULD RESULT IN ELECTRICAL SHOCK, FLOODING, AIR ENTRAPMENT IN THE LOOP OR EQUIPMENT/SYSTEM FAILURE. CONTACT YOUR DEALER FOR PROPER SERVICE AND REPAIR.

# Glossary

Learn to speak like your favorite HVAC contractor using these key terms.

AFUE (Annual Fuel Utilization Efficiency): The percent (efficiency) of fossil fuel furnaces. Includes cycling and flue losses and other factors.

BTU (British Thermal Unit): The amount of heat needed to raise the temperature of one pound of water one degree Fahrenheit.

BTUH: The number of BTUs produced in one hour. Used to signify the heating and cooling capacity of a system and the heat losses and gains of buildings and homes.

CFM (Cubic Feet per Minute): Volume of air movement. Used in duct design calculations.

Compressor: The central part of a heat pump system. The compressor increases the pressure and temperature of the refrigerant and simultaneously reduces its volume while causing the refrigerant to move through the system.

Condenser: A heat exchanger in which hot, pressurized (gaseous) refrigerant is condensed by transferring heat to cooler surrounding air, water or earth.

COP (Coefficient of Performance): Heating efficiency rating for a geothermal system. BTU output divided by BTU input.

Degree Days (Heating & Cooling): Calculated by adding the high and low temperatures of the day, dividing by 2, then subtracting from 65. (Example: High 42, Low 20 = 34 heating degree days.)

Delta T (or $\Delta$T): The change in temperature (degrees). Usually associated with water or air temperatures.

Hot water generator: A device that recovers superheat from the compressor discharge gas for heating water.

EER (Energy Efficiency Ratio): Cooling efficiency rating for geothermal systems. BTU output divided by watt input.

Fossil fuel: Any of several types of combustible fuels formed from the decomposition of organic matter. Examples are natural gas, propane, fuel oil, oil and coal.

GPM (Gallons per Minute): A reference to the flow rate of water through the geothermal unit.

Heat Exchanger: A device designed to transfer heat between two physically separated fluids or mediums (air, water, or refrigerant) of different temperatures.

Heat Loss: The amount of energy (BTUs/hr) lost from the home during cold weather that needs to be overcome/supplied by the heating system. The amount varies based on outdoor air temperatures.

Heat Gain: The amount of heat (BTUs/hr) that is absorbed by the home during hot weather, requiring removal by the air conditioner in order to cool the home. Varies based on outdoor air temperatures.

Heat Sink: The medium (air, water or earth) which receives heat rejected from a heat pump.

Heat Source: The medium (air, water or earth) from which heat is extracted by a heat pump.

HSPF (Heating Season Performance Factor): Heating efficiency rating for heat pumps over the course of the entire heating season.

Infiltration / Exfiltration:  Air movement into the home through “leaks” (infiltration), or movement of air from inside the home to the outside (exfiltration).

Relative Humidity: The ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.

R-Value: The resistance of heat movement through an insulating material. Varies with thickness and type.

SEER (Seasonal Energy Efficiency Ratio): Cooling efficiency rating for heat pumps and air conditioners. Calculated over the entire cooling season.

Solar Gains: Heat gain generated through the heating of walls and windows by the sun.

Ton: In HVAC terms, 12,000 BTUs per hour.

Wind Chill: A still-air temperature that would have the same cooling effect on exposed skin as a given combination of temperature and wind speed. Does not affect heating requirements for your home.

# Preventative Maintenance Service Record

In order to keep your system operating at peak performance levels, it is recommended that you take advantage of your dealer's planned maintenance program. This will normally include semi-annual preventative maintenance checks.

| YEAR | DATE OF 1st SERVICE CHECK | DATE OF 2nd SERVICE CHECK | NOTES |
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Publication Number: 032-5080-05
Supercedes: 032-5080-04
Publication Date: 06/15

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