

DEBUNKING FIVE COMMON GEOTHERMAL COMPLAINTS



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A QUICK GLANCE AT THE GEOTHERMAL INDUSTRY



The Beginnings of a Bad Reputation: Untrained & Inexperienced Geothermal Contractors

In 2005, the Energy Policy Act was signed into a law. This Act lets the IRS provide different types of tax credit incentives to promote the use of geothermal energy and was extended in 2009, bringing the largest tax credit ever given. Homeowners would receive a 30% Federal Tax Credit when installing a geothermal system. This tax credit was introduced with no limits, allowing homeowners to save thousands of dollars on installing geothermal! Because of this, geothermal was soon in high demand. With this new increase in demand, **the number of heating and cooling contractors that offered geothermal doubled overnight**, bringing the beginning of a whole new era of contractors and geothermal owners. With so many untrained and inexperienced contractors offering geothermal, the number of complaints and unsatisfied geothermal owners began to dramatically increase. There were still lots of homeowners that loved their new geothermal system and the tremendous savings, while many others weren't able to share the same experience.



Geothermal Technology began getting a bad reputation when new heating and cooling contractors began cutting corners during the geothermal design and installation phases by placing more emphasis on lowering the upfront cost. Unfortunately, many uneducated buyers who paid a lot less upfront ended up paying a lot more in the long run. As a result, many of these new geothermal owners were less than satisfied and started to experience higher operating cost, excessive repairs, shorter life of the system, lack of comfort, and an increase in the number of warranty claims. This doesn't have to be the case with your geothermal: by **doing your research**, you will learn the importance of choosing a reputable contractor and knowing exactly what questions need to be asked.

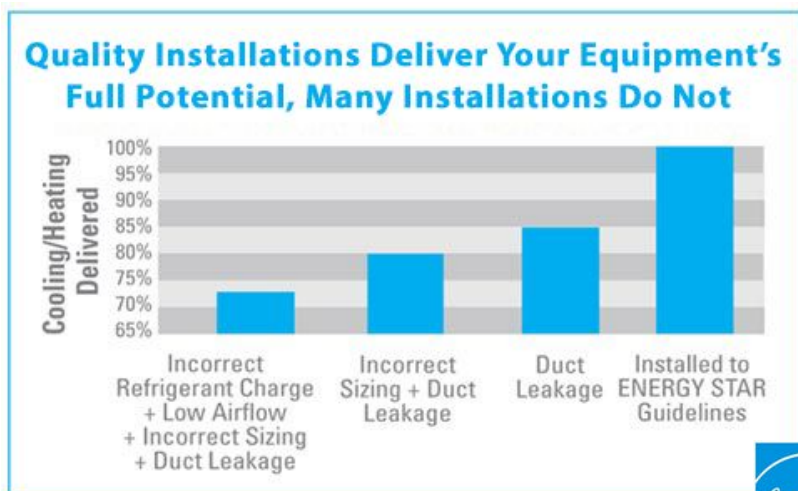
NEARLY HALF OF ALL HVAC SYSTEMS ARE INCORRECTLY INSTALLED



Choose an Experienced contractor with a Reputation of Quality to be sure your new system is installed correctly.

Energy Star has reported “that nearly half of all HVAC (Heating, Ventilation & Air Conditioning) systems are incorrectly installed and that improper installation can reduce system efficiency by up to 30%; costing you more on your utility bills and possibly shortening the equipment’s life.” The “Sensitivity Analysis of Installation Faults on Heat Pump Performance” Report done by the National Institute of Standards and Technology (NIST) has also looked into this further to assess the impacts that heating & cooling system installation errors had on the system’s electricity consumption (efficiency). According to that study, NIST found that..

...Typically-installed HVAC equipment operate inefficiently and waste considerable energy due to different installation errors (faults) such as duct leakage, refrigerant undercharge/overcharge, oversized/undersized heat pump with nominal ductwork, and low indoor airflow due to improperly sized ductwork have the most potential for causing significant performance degradation and increase annual energy consumption.



As you can see, with any HVAC system including a Geothermal system it's essential that the system be installed and designed properly in order to ensure your happiness. In the coming pages we provide you with the top complaints customers have with their geothermal system installation and design. We then show you how these complaints are easily resolved and how to find a reputable contractor that will ensure your system reaches **its highest efficiency**.

*Energy Star- A Guide to Energy-Efficient Heating and Cooling



COMPLAINT 1

HIGH OPERATING COSTS

“The backup heat is expensive to operate, and the savings aren’t as much as what I expected.”



While new geothermal contractors tried to save on upfront costs, they began installing poorly designed systems that relied on the backup heat. Since homeowners would have to rely on their backup heat, the geothermal system became more costly to operate. Although backup heat is a nice convenience; in case of an emergency, it can end costing a lot more to operate.

SOLUTION SUMMARY TO HIGH OPERATING COSTS

The design techniques used for any heating and cooling system can impact the system's overall performance, but that doesn't mean that you have to give up the tremendous savings a geothermal system can offer. Savings as much as 60-70% on your utility bills are very practical with today's geothermal technology. The maximum efficiency of a geothermal can be achieved by customizing each home to its own geothermal design while taking into consideration many factors which include:

1. Size of the Home
2. Window and Home Insulation
3. Ground Loop Design
4. Geographic Location

By having a customized plan, it allows the geothermal system to be engineered with higher efficiencies and lower annual energy cost.





1

Size of the Home: Large or Small, size doesn't matter; installing a geothermal in your home can save you lots of money on your energy bills each year! Even with a small home, you can make a good investment that will have a quick payback. For those with larger homes, you may also wonder, "Will a geothermal system provide enough heat for my home without using backup heat?" The answer is: Yes! It is possible when it's been properly designed! **The right sized geothermal system can heat any home on its own when it's been customized to the home's construction.**

2

Window & Home Insulation: How well your home is insulated can determine how much heat may escape your home. **If your home is losing large amounts of heat, your system will have to work much harder and run much longer during periods of cold temperatures.**

- **Window Efficiency:** Choosing a more efficient window can be done by comparing the rated U Value. The lower the U-Value the better the efficiency. Installing a more efficient window can pay dividends for years to come.
- **Type of Insulation:** Many times contractors will choose the lowest cost insulation vs. the best performing insulation. There are many different types of insulation you can install in your home. When deciding which insulation material you should use, be aware of which material is most suitable for your situation. Each type of insulation serves a very different purposes and has different applications. To find out more information about insulation visit US Department of Energy's website: <https://www.energy.gov/energysaver/types-insulation>
- **Fully Insulated Home:** A poorly insulated home is like running your heat with your window open. The heat in your home is being wasted as fast as it's being produced. The better your home is insulated the shorter run times your system will have since the heat is not being lost as quickly. Properly insulating every part of your home including the attic, crawlspace, and basement will allow the home to retain a higher amount of heat. Improving the insulation in your home will reduce operating cost and be like closing that window!





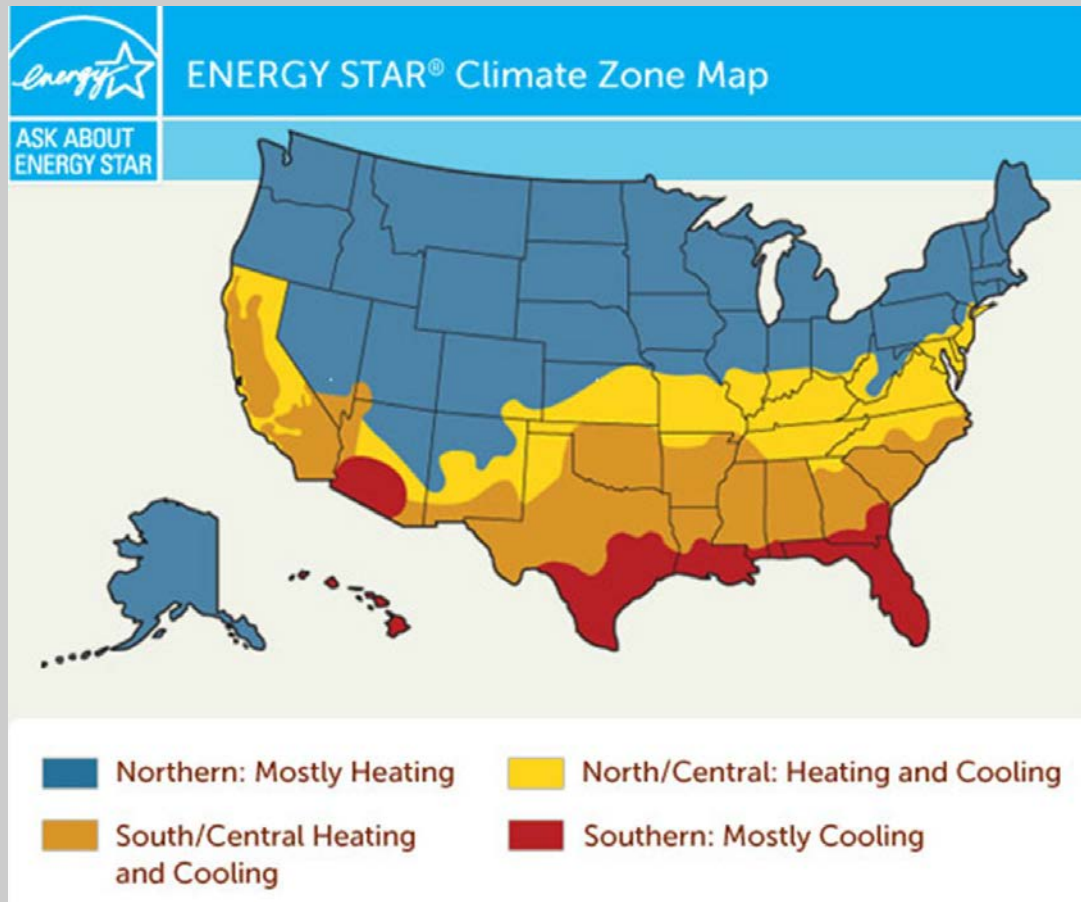
3

Ground Loop Design: Designing an efficient ground loop system requires three critical aspects: **Loop layout, Ground loop material, and the Loop fluid**. Although each one of these is important, it all begins with deciding which loop layout makes the most sense for you. The loop layout can be either a horizontal ground loop or a vertical ground loop. The ground loop material, and the loop fluid will be addressed later in Section 3.

- **Horizontal:** A horizontal ground loop is 4-5 feet below the surface. The shallower depths associated with a horizontal ground loop is subject to more temperature fluctuations due to the outside temperature changes. **These fluctuations can cause the backup heat to kick on earlier and more often during periods of cold temperatures throughout the heating season.**
- **Vertical:** A vertical ground loop can typically reach anywhere from 70-300 feet deep! The depth of the vertical ground loop reaches ground temperatures that remain more consistent and are warmer than the temperatures of the horizontal shallow ground loop. As a result, **a vertical ground loop will produce more heat, reducing the use of the backup heat system.** Not only will a vertical loop design produce more heat, but it will also take up a much smaller space in your yard. If yard space is an issue, a vertical ground loop design would be right for you.

4

Geographic Location: Your operating cost for a geothermal system throughout the winter months will depend on your geographic location and how often temperatures reach below freezing (32°F). Most advertised efficiencies better known as “peak efficiencies” are achieved under laboratory conditions simulated at a moderate climate condition. **However, if the geothermal system is installed in a cold “northern” climate region or a hot “southern region, these efficiencies will change dramatically.** There are several other factors that need to be reviewed before determine the true operating efficiency. **Other factors like the geographic location that are often overlooked and can reduce the overall efficiency and performance of your system are: the cost of running backup heat, thermostat set temperatures, system design, and sizing parameters.**



Find which region you are in, if you are in the Northern Region (Heating Dominate) or Southern Region (Cooling Dominate), you can expect the actual efficiency of a Geothermal System (and even a traditional HVAC system) to differ from the advertised efficiencies. Make sure your heating and cooling contractor factors the temperatures for your climate zone when estimating your annual cost of operation.

COMPLAINT 2

EXCESSIVE REPAIRS

"I feel like my Geothermal gets serviced several times a year."



SOLUTION SUMMARY TO EXCESSIVE REPAIRS

Homeowners that owned heat pumps (including geothermal) and air conditioning systems experienced additional repairs because of thinner, lighter, and cheaper materials that came from manufacturers in countries like China and Mexico. However, a geothermal system that is properly designed and installed requires infrequent repairs. Geothermal systems are made to be durable and operate very differently than the traditional HVAC systems. Excessive repairs can be avoided by:

1. Domestic Parts
2. Preventive Maintenance
3. Less Parts

1

Domestic Parts: Years ago, in an effort to cut cost, many domestic heating and cooling equipment manufacturers began to import parts from their suppliers with the intent to pass down these savings to the American people. After years of poor quality control, manufacturers eventually decided to bring a majority of their suppliers back to the US. As a result, the parts are now of a higher quality with more reliability. This is why it's so important to verify that your products are American made.



2

Preventative Maintenance: Like an automobile, any heating and cooling system (including geothermal) has many mechanical components which require preventative maintenance. Maintaining your system will end up paying for itself because it will help prevent unwanted costs and future repairs.

- **Optional Maintenance (HVAC Contractor):** Having your contractor do an annual or biannual pre-season check-up on your equipment will help keep any heating and air conditioning system performing efficiently. If there is going to be an issue with the system, it's better to find a problem early on, before it starts to affect other areas of the system which can save you from larger, more expensive repairs.
- **Necessary Maintenance (Homeowner):** Some preventative measures that you are able to do on your own is inspect, clean, and/or change the system air filters. You can also inspect for a clogged air conditioner drain line. These checkups to your system should be done on a monthly basis. Although you will be inspecting the system monthly, it's not necessary to change your filter until it becomes dirty.



Less Parts: When comparing the number of parts in a geothermal system to a standard gas furnace and central air conditioning system, or an air source heat pump system, you'll find that they can be very similar. If you would list the different system designs in the order beginning with the system that contains the least amount of parts, it would go as such: Waterless Direct Exchange (DX) Geothermal, Gas Furnace & Air Conditioner, Gas Furnace & Air Source Heat Pump, Open Loop Water Geothermal, and finally Closed Loop Water Geothermal. (see graphic below).

Waterless DX (Closed Loop) Geothermal: A Waterless DX Geothermal operates with the least number of components than any other system. By removing these components from the system there is a lot less parts which can result in less problems.

Open Loop Geothermal: One of the original geothermal designs was an open loop system that uses your well water. This type of system doesn't require you to bury a ground loop. An open loop system has fewer parts than a closed loop system but the efficiency can be affected by the quality of water in your well. It's a good idea to check your iron and water hardness levels to ensure peak operating efficiency for the life of your system.

Closed Loop Water Geothermal: The most commonly known geothermal design is a Closed Loop Water Geothermal System. The number of parts in the system is determined by the type of loop system installed. This water source design utilizes a water/antifreeze solution along with a plastics ground loop (outdoor heat exchanger)

Gas Furnace & Heat Pump or A/C System: Although a Water Geothermal System contains more parts than a traditional Gas Furnace and Heat Pump or A/C, it's important to consider the significant efficiency advantage of a Geothermal system over that of a traditional gas furnace, air conditioner or an air source heat pump system.

Enjoy **MORE** PEACE OF MIND with **LESS** PARTS

MAJOR COMPONENTS	GEOTHERMAL			TRADITIONAL HVAC	
	WATERLESS GEOTHERMAL	WELL WATER OPEN LOOP GEOTHERMAL	WATER CLOSED LOOP GEOTHERMAL	GAS FURNACE & A/C	GAS FURNACE & HEAT PUMP
INDOOR FAN MOTOR	×	×	×	×	×
INDOOR AIR COIL	×	×	×	×	×
REFRIGERANT (REFRIG.)	×	×	×	×	×
BLOWER	×	×	×	×	×
COMPRESSOR	×	×	×	×	×
OUTDOOR HEAT EXCHG.	×		×	×	×
REFRIG. REVERSING VALVE	×	×	×		×
DEFROST CYCLE				×	×
OUTDOOR FAN MOTOR				×	×
WATER (WTR.)		×	×		
ANTIFREEZE SOLUTION		×	×		
WTR. CIRCUIT ELECTRONICS		×	×		
WTR. REGULATOR VALVES		×	×		
WTR. CIRCULATION PUMP		×	×		
WTR./REFRIG. HEAT EXCHG.		×	×		
TOTAL PARTS	7	12	13	8	9
EFFICIENCY RANKING	MAXIMUM	HIGH	HIGH	LOW	MEDIUM

COMPLAINT 3

SHORTER SYSTEM LIFE

"I can't believe my geothermal only lasted 15 years."



If a geothermal system is not designed or installed properly, it can cause longer or even excessive run times. By working the system harder and longer the system is more likely to fail sooner.

SOLUTION SUMMARY TO SHORTER LIFE OF SYSTEM



The typical lifespan of a geothermal is 25-50 years. Three factors that can affect the life of a geothermal system are;

1. The proper design and installation of your system
2. The conductivity of the tubing used for the ground loop
3. The heat transfer properties of the ground loop fluid

By having a higher heat producing/ thermally conductive ground loop system you can increase the lifetime of the equipment. As this warmer heat enters your home, the system doesn't have to run as long because you are satisfying the set temperature much quicker. This ultimately results in a more efficient system, higher energy savings, and a longer life.

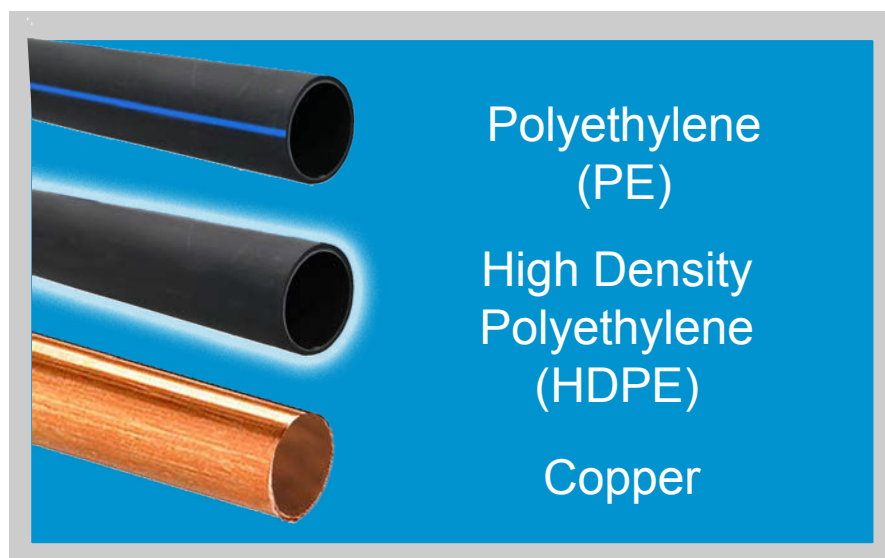
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Properly Designed and Installed System: You may have already read or heard this several times, going to show how important it truly is. The performance and lifetime of your equipment is directly related to the design process. When your contractor invests a little extra time during the design phase, it will increase the accuracy of your systems performance and comfort. Once the the installation is complete, performing a complete start-up analysis of your system is another way to validate the system's efficiency and is performing to the manufacturer's specifications. More details on how to properly design and install a geothermal system is reviewed in Section 4.

Conductivity of tubing used for the Ground Loop: All geothermal loops are NOT the same. Although they look similar the tubings used have very different pressure rating and conductivity properties. The two most popular types of ground loop tubing used are Plastic and Copper. Plastic tubing can be used for a Water Geothermal Design while Copper tubing is used for the Waterless™ DX Geothermal Design. Each material is able to transfer heat, however some material will transfer more heat than others. **As stated before, the more heat that the loops are able to transfer to the home the longer the life of the system will be.**

Ground Loop Material:

- **Polyethylene (PE) Plastic Loop:** Polyethylene Plastic is the least costly and can be used in most geothermal systems. PE Pipe is typically used in horizontal loops but is not recommended for vertical loop applications due to its inability to withstand the higher pressures required for a vertical loop design. This is the entry level geothermal ground loop material with the lowest cost and the lowest conductivity.
- **High Density Polyethylene (HDPE) Plastic Loop:** HDPE Plastic tubing is the standard ground loop material used in most geothermal systems today. HDPE Plastic tubing is an upgrade from the standard PE plastic tubing and is able to withstand higher pressures for both horizontal and vertical loop installations, reducing the odds of a ground loop leak. This type of plastic is charged with a more conductive material and expands and contracts less than the conventional Polyethylene(PE) plastic resulting in a stronger more efficient ground loop.
- **Copper Loop:** Copper tubing is the most conductive ground loop material, and creates the largest amount of heat transfer. The thermal conductivity of copper is over 600% more conductive than that of the conventional HDPE Plastic Ground Loop! A copper loop can withstand the most pressure of these 3 loop designs and is used in both horizontal and vertical loop designs as well. The odds of copper leaking due to expansion and contraction is virtually zero, ensuring a longer lasting ground loop.

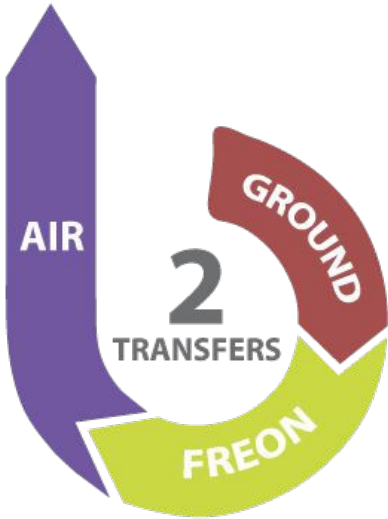


Heat Transfer Properties of the Ground Loop Fluid

→ Refrigerant Only System

Refrigerant is the foundation of many appliances used in our lives today, it’s used both commercially and in many residential applications. Everyday appliances that contain refrigerant are things like your household refrigerator, freezers, air conditioners, ice machines, supermarket coolers, geothermal units and much more. The reason for the popularity of refrigerant is due to its ability to absorb large amounts of heat very efficiently. A Waterless™ Direct Exchange (DX) Geothermal is a complete refrigerant based system, which circulates refrigerant through both the inside unit and the outside ground loop.

By transferring the heat directly from the refrigerant to the air that circulates throughout your home you are able to eliminate longer run times, and ensure a longer life of your system.



→ Refrigerant & Water System

A water source geothermal circulates a water/antifreeze based mixture through the plastic ground loop outside, while at the same time circulating refrigerant through the inside unit. The heat begins in the ground where it then moves to the water. This type of system has one more step where the mixture moves the heat to the refrigerant in the inside unit. The heat is then transferred from the refrigerant to the air that circulates throughout your home. The additional heat transfer step, can result in less heat output and may lead to longer run times.



GEOTHERMAL FLUID COMPARISON CHART

 Geothermal Designs	Refrigerant	Water	Antifreeze
Water Closed Loop	✓	✓	✓
Water Open Loop	✓	✓	
Waterless Closed Loop	✓		

COMPLAINT 4

LACK OF COMFORT

"The system is loud and we feel hot & cold spots, and there is poor airflow in our home."



SOLUTION SUMMARY TO LACK OF COMFORT

The air duct systems should be customized to the specifications of each home to ensure the appropriate amount of warm and cool airflow is delivered to each area. To maximize your comfort and ensure a smooth and quiet operation, the following should be calculated according to industry standards:

1. Duct & System design
2. Duct Installation

The level of comfort for a heating and cooling system, especially geothermal, can be different from one home to the next. If designed properly Geothermal should deliver the proper amount of air to each room in order to maintain the same comfort level of a gas furnace.

1

Duct Design: To create a proper duct design, industry standards require heating and cooling contractors to perform a Manual D duct design calculation and a Manual J heat load calculation on each project. By doing these calculations the contractor takes into consideration the supply air requirements for each room which includes the amount of air volume, air velocity, air leakage, and heat loss (through the duct) that occurs. Accounting for all of these factors in the duct design allows for the appropriate amount of warm or cool air to be delivered to each area of your home. Discussing these design aspects with your heating and cooling contractor will reveal how much experience they have designing ductwork systems. This can also help prevent you from sacrificing your comfort, and making a costly mistake.

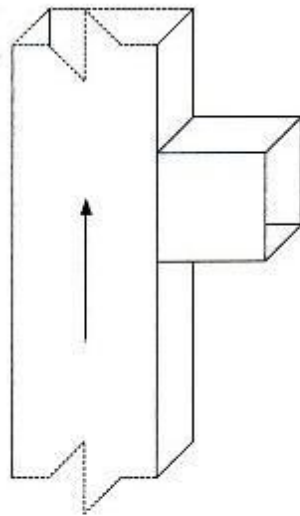


Duct Installation: When the ductwork is being installed in your home there are many details that need to be considered to ensure your comfort. The duct size, degree of each bend, and how the duct transitions from one size to another can seriously impact the entire performance of the system. The branch duct lines coming from the main trunk should be limited in length. When there are excessive lengths to branch duct lines installed, it can cause poor airflow to your home.

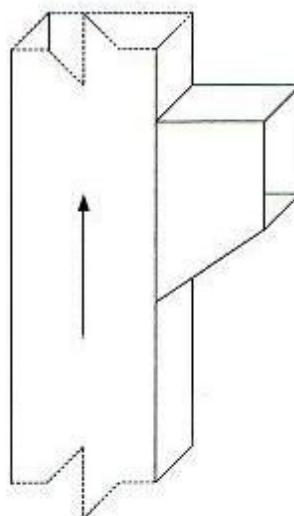
You may also want to consider a zone system if your home has multiple levels. In this case, a thermostat is installed in each area (zone) of your home to ensure your comfort is consistent from room to room, even in two story homes.



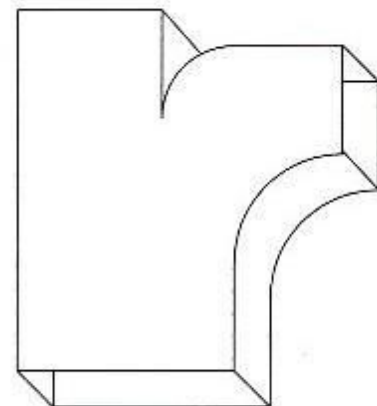
If you're installing a geothermal in an existing home it's possible to reuse your existing duct work, however, it may require a few modifications to allow for the suitable amount of airflow to each room. You won't regret making these modifications because it will create a quieter more efficient system, and a more enjoyable environment. Testing your duct system for any air leakage is a great idea and can help boost your comfort level even more, once properly sealed for air leaks. Energy Star has found that by having your home sealed and insulated accurately you can save up to 20% on your heating and cooling costs ultimately leading to a more comfortable home, and a more efficient system.



POOR



BETTER



BEST

POOR WARRANTY

“That’s all the longer the warranty is...”

“Knowledge and Support from the Dealer and Factory stink after the sale.”



SOLUTION SUMMARY TO A POOR WARRANTY



Warranties and support are very different depending on which contractor you go with and the brand of system that is installed. With any warranty, it’s important to know what is covered and what is not. In every industry, you have to be aware that although a warranty says “Lifetime”, it may not cover the whole life of the product. This is where the customer service reputation of the company you choose is so important to investigate, so you can truly sit back and enjoy the system. Verify you have:

1. A Comprehensive Warranty
2. A Contractor with a Good Reputation

1

A Comprehensive Warranty: No one system is ever perfect, no matter how hard a contractor or manufacturer works to achieve perfection. Every product in any industry has its own glitches. The more comprehensive the warranty, (provided by the manufacturer and the contractor), the better the warranty will end up being for you. You will be spending the next few decades with your geothermal system, and it’s crucial that you are covered in every aspect of your warranty. Most warranties entail two separate components for each area of your system, the parts and labor inside and the parts and labor outside. When reviewing geothermal warranties be sure to ask what is covered under each part of the system. If things like excavating, or refrigerant are missing from the parts warranty it may become very costly if a problem occurs. The more complete a warranty is the more satisfied you will be.



“It’s unwise to pay too much, but it’s worse to pay to little. You pay for what you get. When you pay to little you sometimes lose everything, because the thing you bought was incapable of doing the thing it was bought to do in the first place.”

- John Ruskin



2

Contractor Reputation: With nearly half of all HVAC systems incorrectly installed, it’s imperative to validate the reputation of your contractor. You can do this by evaluating their method of design and gauging their appreciation for quality workmanship during the installation phase. The reputation of your contractor can also be defined by how many clients they have that are satisfied with the savings and cost of operation from their new geothermal system. You will also want to choose a contractor you will be able to trust after the sale. To know what kind of service you will receive after the sale, you should look at the quality of service the heating and cooling contractor provides before the sale. Seek out people who have had a geothermal system installed and ask them when they had trouble with their geothermal system, then ask them “How well did the contractor take care of them after the sale?” A few other great questions to ask are: “How much do you pay to heat and cool your home each year using your geothermal?” and “Is there any type of cost of operation guarantee after the system is installed?” Knowledge is crucial throughout the whole process and if your heating and cooling contractor is experienced it will show! Ask Questions, and Find out the Answers!

Ultimately when you're choosing which geothermal contractor to go with it comes down to their knowledge, experience, and reputation.

That’s why it is so important to do your research ahead of time to find a qualified installer that is credible and has installed many geothermal systems in the past. You can also contact, the International Ground Source Heat Pump Association, or the Geothermal Heat Pump Consortium for a listing of qualified installers in your area. It’s also wise to check to see if your contractor is certified by the following:



LET'S WRAP IT UP!



Waterless™ Geothermal is a highly efficient technology that can create large amounts of energy savings for homeowners when it's properly designed, engineered, and installed. Doing your research allows you to enjoy the many rewards of your investment.



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Learn More Today!

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