

**GEOHERMAL
DOS &
DON'TS**

Geothermal Dos & Don'ts

For the Home Owner

Not many people have multiple experiences installing a geothermal heating and cooling system in their own homes. It isn't because its a bad experience, it is because the majority of people install geothermal in a home they plan on living in for a long time. Plus, geothermal loopfields, when installed properly, have an expected lifespan of 50+ years.

In other words, it can be hard to find someone that can really give solid advice about what to do and not do when purchasing a geo system and how to maintain the system properly once its installed. As a company we have had a lot of experience with geothermal installations for residences so we thought we would pass on what we have learned so far.

Before Purchasing or Installing Geo

Do

- ✓ Prioritize the reasons for considering a GSHP system, including costs, energy use, comfort levels and environmental impact (CO2 emissions). Cost considerations should include capital costs, operating costs, maintenance costs, and life-cycle costs.

- ✓ Ask about the installing contractor's credentials including IGSHPA Installer Accreditation status, years of experience, and customer testimonials.

- ✓ Enlist the services of a reputable design engineer and/or installation contractor.

- ✓ Ask about the method that was used to determine the peak heating and cooling loads. This will give some insight as to whether rules of thumb were used or if calculations were performed using an approved method. For residential/light commercial applications, ACCA Manual J load calculation procedures are recommended.

- ✓ Ask that a complete system warranty period or performance guarantee be provided by the installing contractor.

- ✓ Investigate methods to minimize space heating and cooling demand by incorporating energy efficiency measures in the home such as upgrading the insulation levels or by using heat absorbing, low-e windows. Check out the green home guide from the USGBC for ideas.

Don't

- ⊘ Expect initial capital cost to be lower than that for a conventional heating & cooling system.

- ⊘ Assume that the most expensive system will be the best option. Conversely, don't assume that the least expensive system will be the worst. If help is needed, find a company that will provide an independent, in-depth quote/design review to assist in choosing the option that will provide the best performance for the least cost.

Geothermal Dos & Don'ts

For the Home Owner

After Purchasing A GSHP System

Like any mechanical system there are some basic tips for maintaining and efficiently operating a geothermal heat pump system.

Do

- ✓ Check the air filter on a regular basis and change or clean it when necessary.

- ✓ Consider setting the fan to the "ON" position on the thermostat rather than the "AUTO" position. Doing so will allow the GSHP system to constantly circulate and mix the air in the home, keeping the entire space at a more uniform temperature.

- ✓ Request that the contractor provide an "As-Built" drawing for permanent record of what was actually installed. Ask that as much detail be provided as possible including pipe size, dimensions, exact loop locations, grout thermal conductivity value (if a vertically-bored or horizontally-bored system is used), and loop installation depth and configuration.

- ✓ Contact your contractor if you think a problem exists with your system. GSHP systems are the most reliable, environmentally-friendly, and efficient heating and cooling systems available so long as they are designed, installed, and controlled properly.

Don't

- ⊘ Don't use excessive thermostat setback controls during unoccupied periods in the home. It is best to keep the thermostat at a single temperature set point throughout the entire day.

Geothermal Dos & Don'ts

For the Designer

GeoConnections is in the geothermal business for the long haul. Which means that the quality of geothermal systems installed throughout the world matters to us because, one bad system can ruin an entire market. We have dedicated our lives to the creation of educational materials, software tools and training for geothermal design and installation professionals. Our goal with the following dos and don'ts is to bring into focus some of the key things that even experienced system designers sometimes forget to consider.

Do

- ✓ Recognize that proper design of a ground heat exchanger (GHEX) piping system is critical, including considerations for long-term energy build-up or draw-down in the loopfield caused by unbalanced system loads. If this concept is unfamiliar, attend an appropriate industry training event or enlist the help of a trained professional GSHP system designer.

- ✓ Perform peak heating and cooling load and energy usage calculations for the HVAC system. Accuracy is critical as system design and performance will be directly related to these calculations.

- ✓ Consider providing domestic hot water (DHW) with the GSHP system. Determine the quantity of water to be used, the hot water generation (HWG) loads, and then select the appropriate HWG system type.

- ✓ Perform economic analysis calculations for the selected HWG system to determine feasibility along with HWG system payback.

- ✓ Check the suitability of the local soil and geology for the type of GHEX being considered.

- ✓ Consider running a formation thermal conductivity (FTC, in-situ) test if the project size is greater than 25 tons or if the local geological conditions are relatively unknown.

- ✓ Design a vertically-bored or horizontally-bored GHEX piping system using a high thermal conductivity, low permeability grouting material. The grout thermal conductivity value should be selected based on an honest and comprehensive comparative economic analysis.

Don't

- ⊘ Don't guess or use rules-of-thumb for heat loss calculations, GHEX design, or pipe sizing and associated pump selection. There are software tools available for use including LoopLink to help you in this area.

- ⊘ Do not add a large safety factor to equipment capacities. Doing so will increase project cost and more importantly decrease system performance.

- ⊘ Don't assume there will be sufficient space for a GHEX without calculating the actual amount space required.

- ⊘ Don't assume that even though there is sufficient space for GHEX installation, a system can be installed without considering buried utility locations, property setback and easement restrictions, and ensuring that heavy equipment access is not an issue.

- ⊘ Don't allow the center to center spacing between vertical or horizontal-bores to be less than 15 ft. The bores will interact long term and decrease the loopfield's capacity.

- ⊘ Don't leave it to the drilling contractor to provide a loopfield design for the system. A qualified engineer should perform the analysis necessary to provide such a design. You can contact us directly or take advantage of our certified designer programmer to find people in your area trained to properly complete this crucial step.

Geothermal Dos & Don'ts

For the Designer continued...

Do

- ✓ For a retrofit application with baseboard heat served by an existing boiler (150-180°F hot water supply temperatures), a GSHP system will not provide water temperatures that are high enough for the existing distribution system to be effective. Additional measures must be taken to properly heat the home.
- ✓ Create a thorough, detailed set of specifications so that all parties understand what is expected through all phases of the GSHP system design and installation process.
- ✓ Refer to state and local codes to ensure that all aspects of the GSHP system design are in compliance including antifreeze type, interior piping material selection, grout material selection and placement method and ground connection method.
- ✓ ASK FOR HELP if GHEX design is unfamiliar territory. Paying for consulting fees up front is much less expensive than having to fix a poorly designed system after the fact.
- ✓ Optimize the design of the interior piping and GHEX piping systems along with the selection of the associated circulating pumps. Advertised operating cost savings provided by a GSHP system can be quickly negated by a poor piping/pumping system design.
- ✓ Select the antifreeze type and concentration based on the minimum expected circulating fluid temperatures (if necessary). Freeze protection to 10°F below the average circulating fluid temperature under design conditions is required if fluid temperatures fall below 40°F at any point in the system at any time.
- ✓ Check the site for access points for the GHEX installation equipment. A site visit is mandatory.
- ✓ Correctly size the equipment.
- ✓ For retrofit applications, ensure that a GSHP system retrofit is possible with the existing distribution system.
 - Water-to-Air GSHP units typically provide 400 cubic feet per minute (cfm) airflow rates per ton of nominal capacity. Ductwork should be properly sized to handle the required amount of airflow without excessive restriction.
 - Water-to-Water GSHP units can efficiently provide hot water at temperatures up to about 120°F (100°F hot water supply temperatures are optimum, the lower the better). Beyond that, equipment capacities and efficiencies suffer greatly.

Geothermal Dos & Don'ts

For the Installer

Geothermal system installation is a big job and often a lot gets passed onto the guy installing the system that should be taken care of in the planning stages. The following is a list of some things to pay attention to during installation to help guarantee the long term success of the system.

Do

- ✓ Coordinate with other contractors on-site for minimal work disruption. Discuss the implications of the GSHP system installation with the general contractor so it can be included in site operations planning.
- ✓ Ensure that water and electricity are available on-site. Both will be necessary during installation.
- ✓ Check the site for access points for the GHEX installation equipment. A site visit is mandatory.
- ✓ Consider space for the spoils when planning trenches in a given area.
- ✓ Ensure that the GHEX piping is pressure tested according to industry standards before and after it is inserted in the ground and before the header trenches are completely buried.
- ✓ Closely review all documentation including project specifications, design reports, and layout and detail drawings. Ensure that the project scope is completely understood and that the design is reasonable according to past experience and best practice principles.
- ✓ Protect the GHEX piping from damage and clearly mark its location after installation via warning tape and tracer wire in the header trench.
- ✓ Insulate all interior GHEX pipe and fittings with closed-cell pipe insulation to limit the risk of damage caused by condensation.
- ✓ Provide the general contractor and homeowner with a complete set of project documentation, including As-Built drawings, antifreeze type and concentration details, pressure test results, warranty/performance guarantee information, grout thermal conductivity test reports, etc.
- ✓ Follow GSHP start-up instructions supplied by the manufacturer.
- ✓ Adhere to industry standards regarding pipe material and fitting selection for the buried portion of the GHEX piping system.
 - Use high density polyethylene (HDPE) with the approved material designation for the entire buried portion of the GHEX piping system.
 - Heat fuse all buried joints and connections using an approved method (butt, socket, sidewall, or electro-fusion).

Don't

- ⊘ Use mechanical fittings (ball valves, circuit setter valves, etc) on any buried portion of the GHEX piping system.

