RADIANTMAX®
Radiant Heating Systems

Volume
3

CLOSED LOOP GEOTHERMAL SYSTEMS

Vertical Loop Field Installation Guide

Vertical Installation Guide

CLOSED LOOP GEOTHERMAL SYSTEMS

Installation Guide

4353 Bristol Valley Road, Canandaigua NY 14424
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com

Table of Contents

Chapter 1

Installing a Vertical Loop Field

To ensure a successful installation of vertical loop fields we recommend you read this document carefully.

This document will give you a brief overview of how to complete the following: Job site analysis, site excavation, pressure testing, pipe placement, header design and backfilling.

At no time should this document be understood as modifying any local or state codes or safety regulations.

Job Site Analysis

Drilling methods vary a great deal depending on the area in which you are located and the specific site soil conditions. Two most common methods are (1) mud and air rotary drilling; and (2) standard auger or hollowstem auger drilling.

Drilling for water wells and boring holes for earth loop insertion. Boring for the geo system is much simpler. In the geo system the goal is to install a specified length of heat exchanger, in most cases 170' of well.

Soil conditions play an important part in your project. Soil and rock conditions will determine drill rates and thus cost. Ground temperatures change closer to the surface, thus the reason we require 170' wells. If you do not know your exact soil conditions, a soil survey from the U.S. Soil Conservation Service office for the proposed site will describe the soil by layers. This will help to determine the equipment you will need for successful drilling by indicating the types of ground layers, presence of rocks, and unstable soils.

In the case where your buried geothermal pipes contain antifreeze material passing within 5 feet of any wall, structure or water pipe, the tubing should be insulated with

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com

R2 minimum closed cell insulation. Also avoid site plans, which could require sharp bends in tubing.

Special consideration needs to be taken prior to design for sites with

- Large rock formations
- High water tables
- Large amounts of fill
- Steep grades
- Heavily wooded areas
- Or other concerns with regard to installation

Warnings

- Prior to design and excavating be sure to have all utilities flagged to avoid costly and potentially dangerous damage. **You can call for a stake out (800) 962-7962**
- Prior to and during excavation all OSHA regulations and local government codes must be followed.

General Notes

- Try to keep tubing free from debris at all times. Taping the ends of the tubing when not in use can do preventing problems. You should also follow this procedure after you have made a cut in the field.
- Pressure testing will be key to the success of your project.
- Wells should be a minimum of 4" in diameter
- Wells should be drilled to a depth of 170'

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.RadiantMax.com

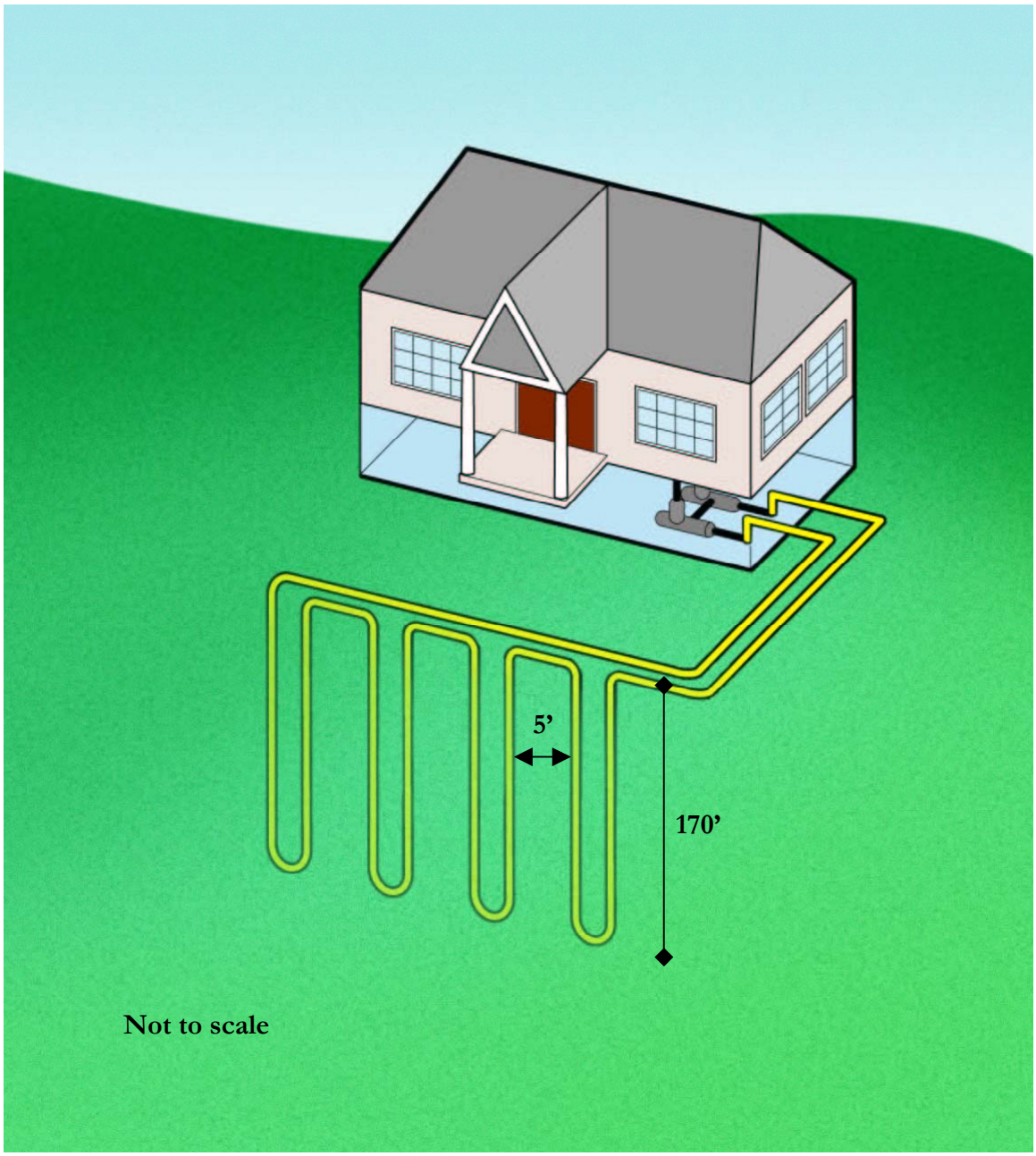
- If you hit a rock layer that becomes difficult to drill, it may be more economical to move to a slightly different location to drill
- Wells should be a minimum of 5 feet away from structures or other wells
- The need for casing will be determined by your well driller and the soil conditions

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.RadiantMax.com

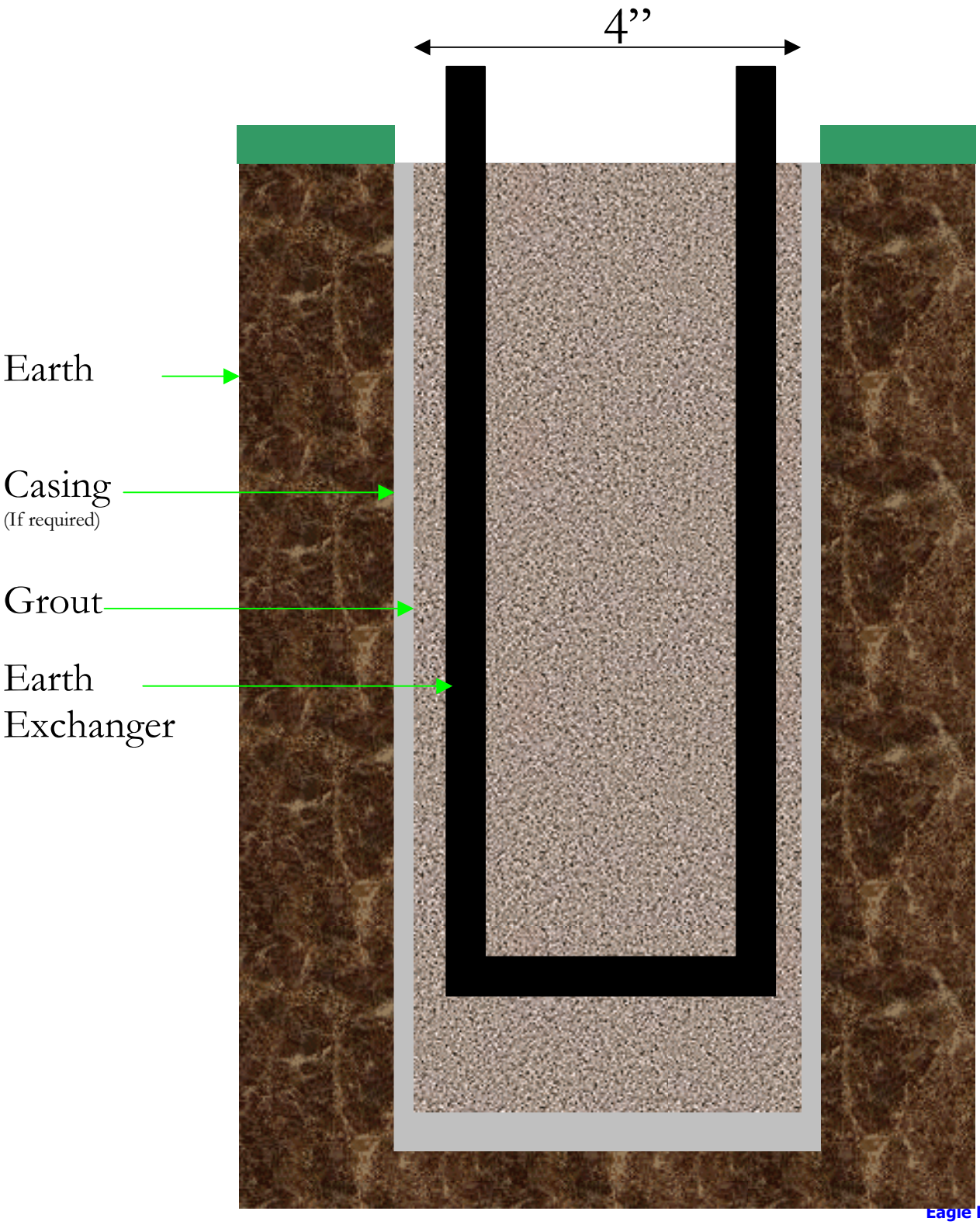
Site Excavation & Drilling

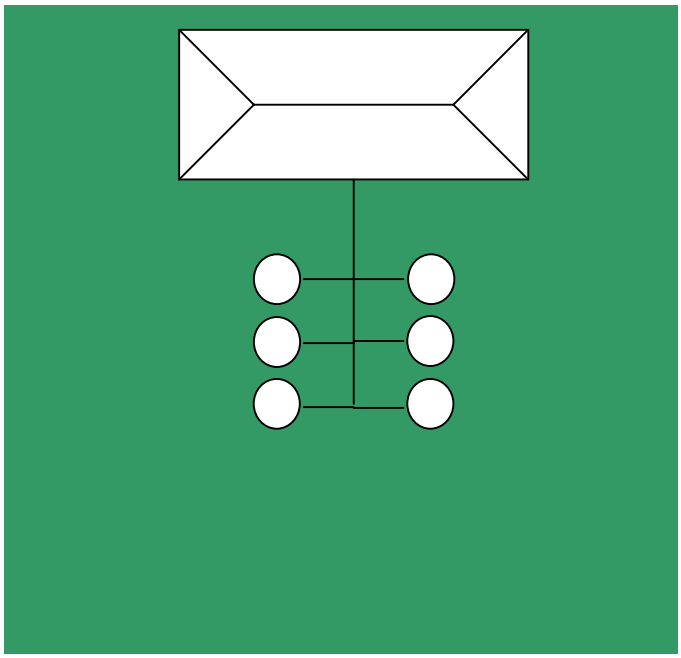
Excavation methods will vary depending on local conditions. Most situations will allow you to work with a 4" drilled hole and a back hoe or trencher.

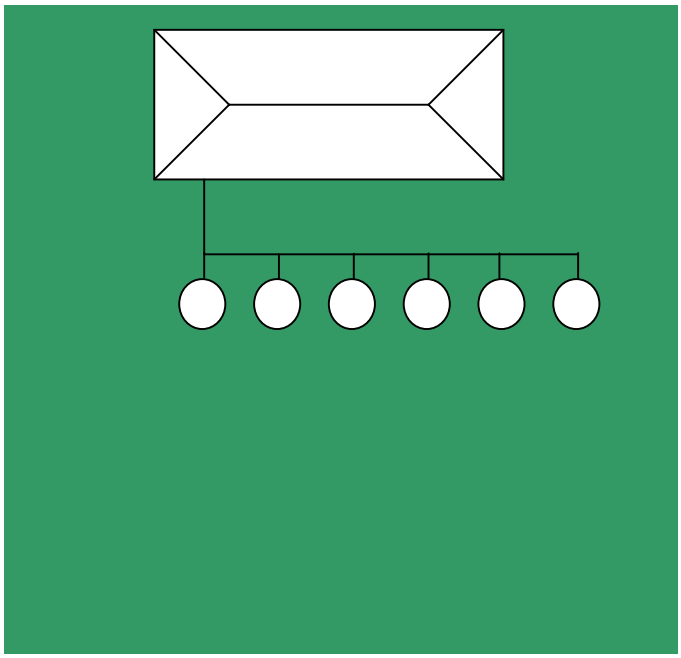
In general, your loop field installation should look as follows:



Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.RadiantMax.com


4”
Earth
Casing
(If required)
Grout
Earth
Exchanger





Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com

Drilling:

All codes and compliance must be met for this process. See your state and local codes.

In general the well diameter does not need to be more than 4" and the depth will not exceed 170'.

The well does not need to be cased for the performance of the geothermal system. The well only needs to be open long enough to install the earth loop exchanger and grout the well. A hollow tipped auger can also be used for this application in place of casing where appropriate. Your driller will be able to determine the drilling method and casing requirement by the type of soil conditions present.

Earth Loop Installation:

- Each loop should be assembled and laid out straight.
- Carefully test for leaks. This can be done with air and a pressure test kit.
- The earth loop should be 5' to 10' shorter than the well to allow for expansion.
- Fill the loop with water prior to insertion into the well, this will also need to be pressurized to prevent collapse during grouting.
- Insert the loop into the well in a U shape with both ends sticking out of the well.
- Attach a stake to the end of the tube vertically to prevent crimping and damage during installation.
- Test the loops with water that is under a pressure of at least 40 psi.
- With low water tables, a high solids bentonite grout should be used for backfilling so good geothermal contact is maintained.
- Insert Grouting Procedures for Ground Source Heat Pump Systems, 1991, IGSHPA
- Grouting can be done with a small plastic discharge pipe inserted with the earth loop.

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com

Connecting to the Header trench

- A typical design can be seen in the next figures:
- The header trench should be 6" wide and 6' deep
- When connecting the earth loop to the header use a 90-degree elbow to prevent undue stress on the pipe.
- Pressure test everything before closing the trench and keep under pressure.
- Hand fill all trenches to prevent damage.

Header Trench: In general the header trench should be a minimum of 6 inches wide x 6 feet deep. The header trench should also lead back to the building and to the exposed foundation wall to allow for your supply and return pipes. To penetrate the foundation wall we recommend (2) 3" PVC pipes with Fernco rubber couplings over the ends to adapt 3" PVC to 1 ¼" supply and return GEO tube. This allows for the supply and return piping to remain independent. This will also help prevent shearing of the GEO pipe as it passes across the fresh backfill from the new construction in the event of settling.

Wells: Each of the wells should be 4" in diameter x 170' deep. It is important that you allow for a minimum of 5' of earth between each of the wells. This dimension can be reduced slightly at the header trench. An illustration of a general trench system can be seen below:

Pipe Joining Methods (Fusion)

The only acceptable method for joining buried pipe systems is by a heat fusion process. Polyethylene pipe shall be socket fused in accordance with the manufacturer's procedures. Polybutylene pipe shall be socket fused in accordance with the manufacturer's procedures. Fused transition fittings with reinforced threads must be used to adapt copper or high strength hose connections to the circulating pump and heat pump inside your utility room. Barbed fittings are not permitted in the soil.

Heat Fusion: Heat fusion is the process by which the plastic pipe material is cut, cleaned, heated to their melting point, aligned and brought together to form a homogeneous material. The illustrations below will allow you to see this process:

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com

Step 1: Release air from pressure testing (release the air in the slinky after backfilling)

Step 2: Cut the pipe

Step 3: Clean the pipe & fitting (using emery cloth or fitting brush)

Step 4: Set gauge clamp on pipe using gauge cap to preset the depth of the pipe in the fitting.

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com

Step 5: Heat to melting point. Check manufacturers spec for timing and temperature. Use melt sticks to verify temperature settings and temperature gauge.

Warning, due to high temperatures do not allow these surfaces to touch your skin or flammable surfaces.

Close up of fusion tool

Step 6: Quickly align and bring together (hold for 30 seconds, full cure in 30 minutes)

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com

Step 7: Pressure test: When all fusion is complete and fully cured, pressure test. Also check all fusion joints for leaks using a suitable leak detector solution.

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com

Pressure Testing

Once the earth loops have been built, they need to be pressure tested at the job site and keep them under pressure during the install process. This ensures there is no damage to the loop and that the system remains free of leaks.

All fusion joints must also be pressure tested prior to installation, but after allowing 30 minutes for all fusion joints to cure. This process should be done for a minimum of 30 minutes to ensure no leaks.

Testing pressures should be at a minimum constant pressure of 50 psi using air. This should begin prior to placing the slinky in the trench.

Earth Loop Placement

- **It is safest to make all connections outside the trench, above grade. When working in the trench or below grade it is critical that you follow all safe excavating guides and OSHA standards.**

The installation process begins by laying the earth loop on the ground surface the entire length of the trench. One end of the loop is picked up and dropped in from the ground surface while a second individual further down the trench holds the loop over the trench. The two people can alternate moving down the trench while dropping the loop into the trench until the entire slinky is in the trench. A positioning tool should be used to shift the slinky in the trench to avoid working in the trench as much as possible. The ends of the slinkies should remain long enough to allow for the fusion to the header.

Header Pipe Placement

After the header pipe has been fused to the individual slinky loops, it should be gently placed into the header trench and the backfilled as described in the next section. Always monitor the pressure to ensure you are free of leaks.

Backfilling

Prior to backfilling your trench, be sure you have not had a loss in pressure which could indicate damaged material or a leak in the system.

Backfilling should begin by placing approximately one foot of clean soil, free from rocks, large clumps and other obstacles, which could damage your piping once, covered. Have someone monitor the fill as it is dumped form the excavator bucket

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com

and **stop filling should a rock or other objectionable material fall on the tube**. If this happens, safely remove the obstruction and continue. If the previously excavated soil is not clean enough and free from rocks and clumps you should use clean topsoil, limestone dust or other acceptable material to cover the tubing. This prevents damage and ensures there is good contact between the earth and the tubing allowing the best heat transfer. When possible water soak the first foot of backfill material. Once this has been done, finish the rest of the backfill operation.

Final Connections

Please read the manufacturers specifications for your geothermal heat exchanger to instructions on your final connections.

Technical Support

For technical support, contact Radiantmax at 800-572-7831.

Eagle Mountain Inc.
(800) 572-7831 (585) 229-2265 FAX: (585) 229-4585
www.Radiantmax.com