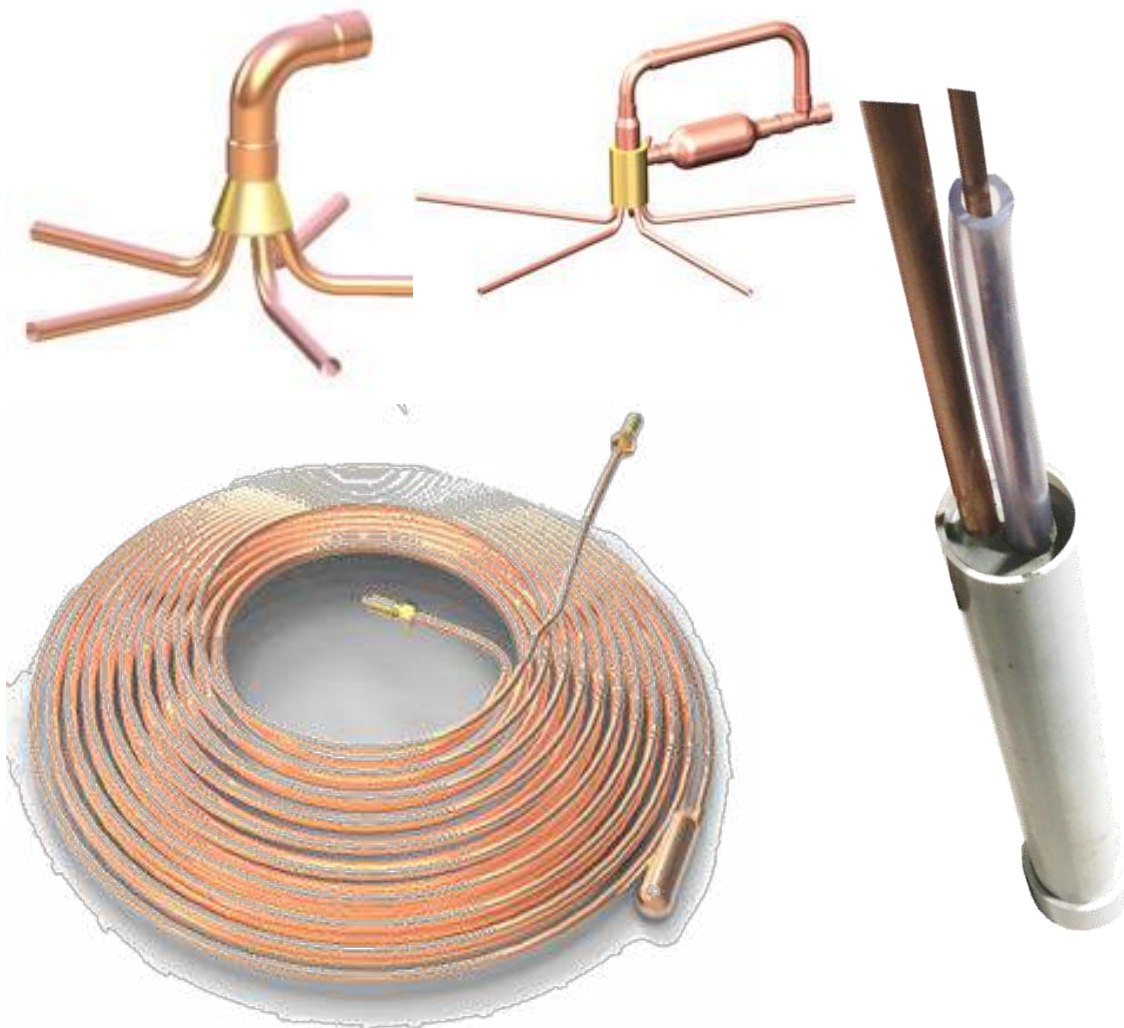


Encasing Earth Loop Instructions

Protection for Aggressive Soil Conditions



Installation Instructions

Disclaimer

Proper installation of the Total Green Mfg. Earth Loop is essential to its reliable performance. All Total Green Mfg. systems must be installed and serviced by a qualified HVAC contractor. Equipment sizing, selection and installation are the sole responsibility of the installing contractor. Installation must be done in accordance with local well drilling codes and the instructions set forth in this manual. Failure to provide installation by a qualified HVAC contractor in a manner consistent with this manual will void and nullify the limited warranty coverage for the system.

Total Green Mfg. shall not be liable for any defect, unsatisfactory performance, damage or loss, whether direct or consequential, relative to the design, manufacture, construction, application or installation of any field specified components.

All commissioning and registration paper work must be filled out at start up and returned to Total Green Mfg. for full warranty coverage.

Index:

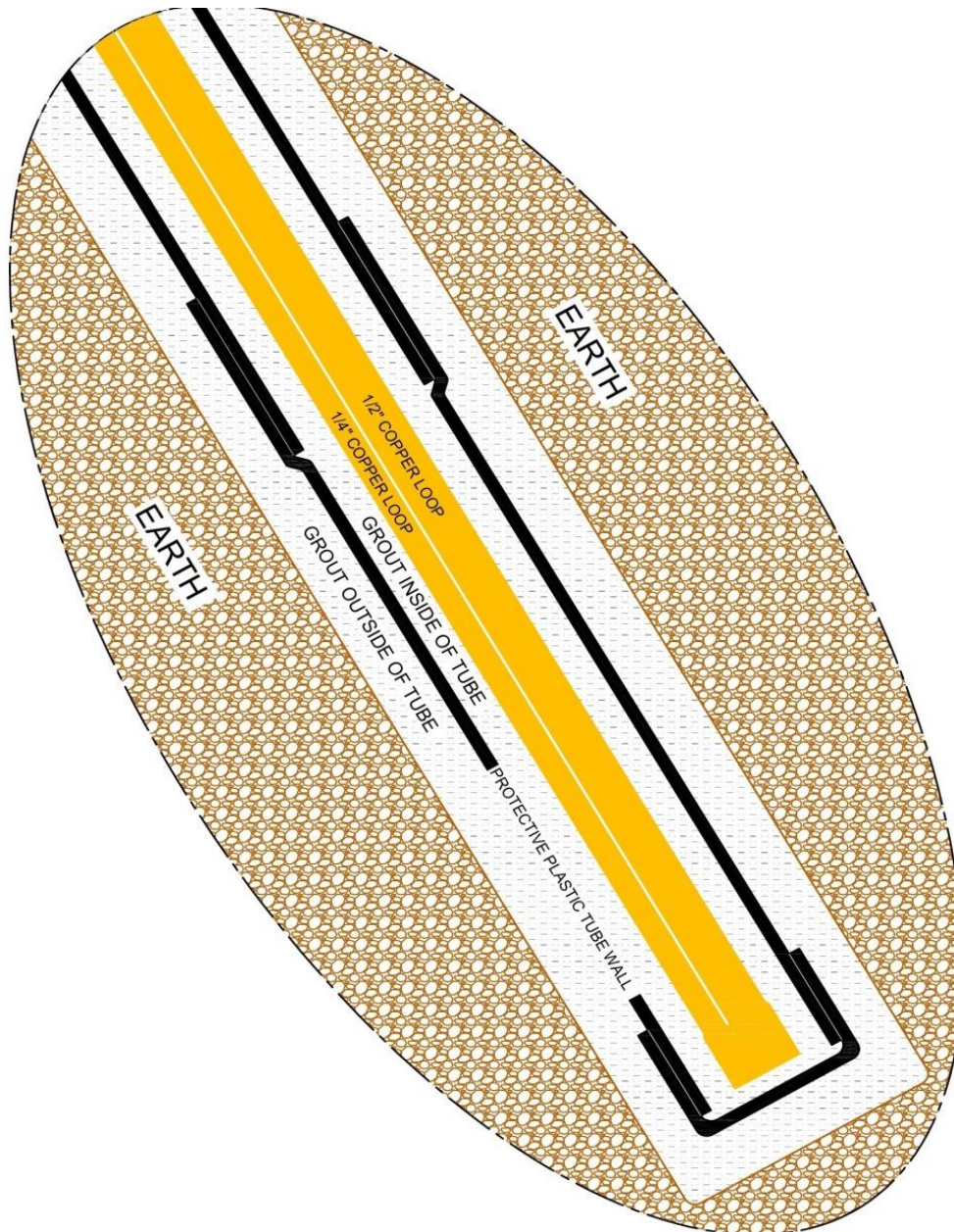
Introduction.....	Page 3
Required Materials.....	Page 4
Installation Steps.....	Pages 5 and 6
Grouting.....	Pages 6
Anode Placement.....	Pages 7
Backfilling Manifold Pit.....	Page 8

¿ **Important:** For soil conditions where the pH is 6 or lower, encasing the loop is required. Only D2 and V/D1P loops systems qualify for encapsulation. A high quality soil pH tester sold at gardening and farm supply stores can be used as reference.

¿ **Please Note:** This manual is a supplement to the standard Earth Loop Installation manual. Other than the anode location and specific instructions to the insertion of the loops in the PVC casing, all other earth loop installation procedures apply. Please refer to the Earth Loop manual in addition to this supplement.

Introduction:

In the past, installation of an earth loop system in soils with high concentrations of acids, chlorides, sulfides, sulfates, carbon, coal, cinders or ammonia; or organic soils with anaerobic bacteria, or in coastal areas with brackish water marshes, salt water intrusion or acidic peat bogs were not allowed. However, Total Green Mfg. has engineered a solution when these conditions can't be avoided. The following pages will detail how to protect the loop field with a combination of a cathodic protection system, encapsulating the earth loops using 1 ½ inch SCH (Schedule) 21 PVC pipe as viewed in picture 1A and, using pulverized limestone as packing material around manifolds and line sets to help raise soil ph.



Picture 1

Encapsulating the earth loops using 1 ½ inch SCH 21 PVC pipe requires no special drilling process. It is simply a manner of inserting the SCH 21 PVC pipe in the borehole prior to inserting the loop which will be placed inside the PVC pipe. Follow the steps below.

Required Materials:

1. When installing 70 ft. loops; 70 feet of SCH 21 pipe will also be needed for each loop and when installing 100 ft. loops; 100 feet of SCH 21 PVC will be needed for each loop.
2. Use SDR21 PVC pipe with bell ends (no inner gasket) to encase the copper earth loop as viewed in picture1B. **DO NOT** use PVC pipe with a greater wall thickness than SCH 21 as the heat transfer will be disrupted.
3. Use a standard 1½ inch PVC caps to seal off the bottom of the pipe. You will need twice as many caps as boreholes for example you will need 10 caps for 5 boreholes. One cap get's glued on the bottom of each loop casing and the other cap gets temporarily placed on the top of each loop casing to prevent contaminants from entering the interior of each loop casing.
4. All pipe joints and end caps must be assembled using PVC Primer and PVC Glue.
5. You will also need two (½" or ¾") tremie tubes for each borehole. The size of the temmie tube is determined by the diameter of the borehole. Boreholes smaller than **3 1/2"** in diameter will require a ½" tremie tube to grout the void between the borehole and the exterior of the PVC casing.



Picture 1B

Installation Steps:

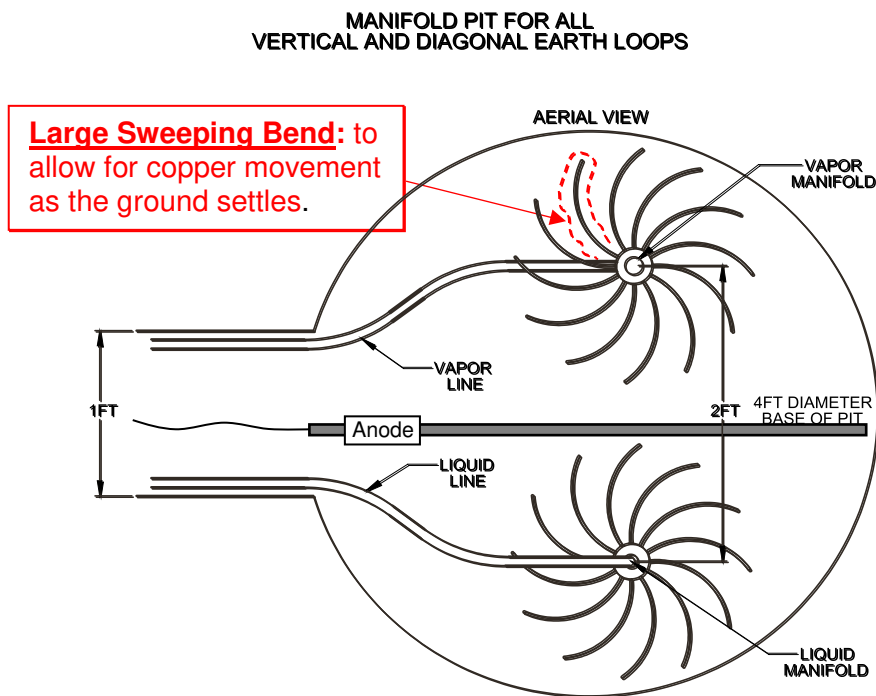
1. Dig the manifold pit prior to drilling the loop boreholes around the outer edge inside the pit. Pit should be 4 ft. deep or 18" below the frost line, which ever is greater. (If you prefer to dig up the manifold pit up after the boreholes are drilled, steps 2 – 6 remain the same for installing the PVC casing inside the borehole but, keep in mind that step 1 now becomes step 7.)
2. After drilling the borehole, begin by cleaning the end of the first piece of the sch 21 PVC pipe, then glue a 1½" PVC cap onto the straight end of the PVC pipe.
3. Insert the first piece of PVC pipe along with a ½" or ¾" tremie tube (on the exterior side of the PVC) into the borehole, leading with the cap end of the PVC.
4. Clean and glue the next piece of PVC pipe to the first piece then continue to push the PVC pipe and the tremie tube down the borehole, adding another piece of PVC as needed until the PVC pipe reaches the bottom of the borehole. Leave at least a minimum of 12 inches of PVC sticking out of the borehole to prevent internal contamination while drilling the remaining boreholes.
5. If the water table is higher than the deepest depth drilled, you will most likely need to fill each piece of PVC pipe with water to prevent ground water from pushing the PVC back out of the borehole (after the PVC casing is in the borehole, but prior to inserting the loop inside the casing. This water will be pushed out when grouting inside the pipe.

NOTICE

Please note that the water used to fill the PVC pipe must be brought in from a known noncorrosive, clean water supply. Using water from the job site may introduce contaminates inside the PVC casing that can cause a corrosive enviroment!

6. Place a PVC cap on the top of the pipe but, **DO NOT glue the cap on**. This cap is only in place so that drill shavings and other contaminates do not enter the pipe while drilling the remaining boreholes.
7. Once all the boreholes are drilled and PVC pipe casing is inserted, dig up the manifold pit if it has not already been dug up, along with trenches from boreholes to the manifold pit (for vertical loop designs). Pit should be 4 ft. deep or 1.5 ft. below the frost line, which ever is greater. Disregard if manifold pit was dug at step 1.
8. Cut off the PVC pipes just below (or level with) the ground at the bottom of the pit. Do not leave the PVC casing stick out more than 1 inch above the dirt, to prevent from kinking of the copper loop. Please refer to Picture 1E on page 8.

9. Insert a copper earth loop along with a ½" or ¾" tremie tube down the inside of each PVC pipe. Allow the copper loop to extend above the PVC pipe to make a large sweeping bend before connecting to the manifolds. This allows for future movement of the copper loop as the ground settles around the manifold as well as for the normal expansion and contraction of the tubing as it heats and cools. **Failure to do so will result in leaks.** Please refer to picture 1C.



Picture 1C

Grouting:

NOTICE

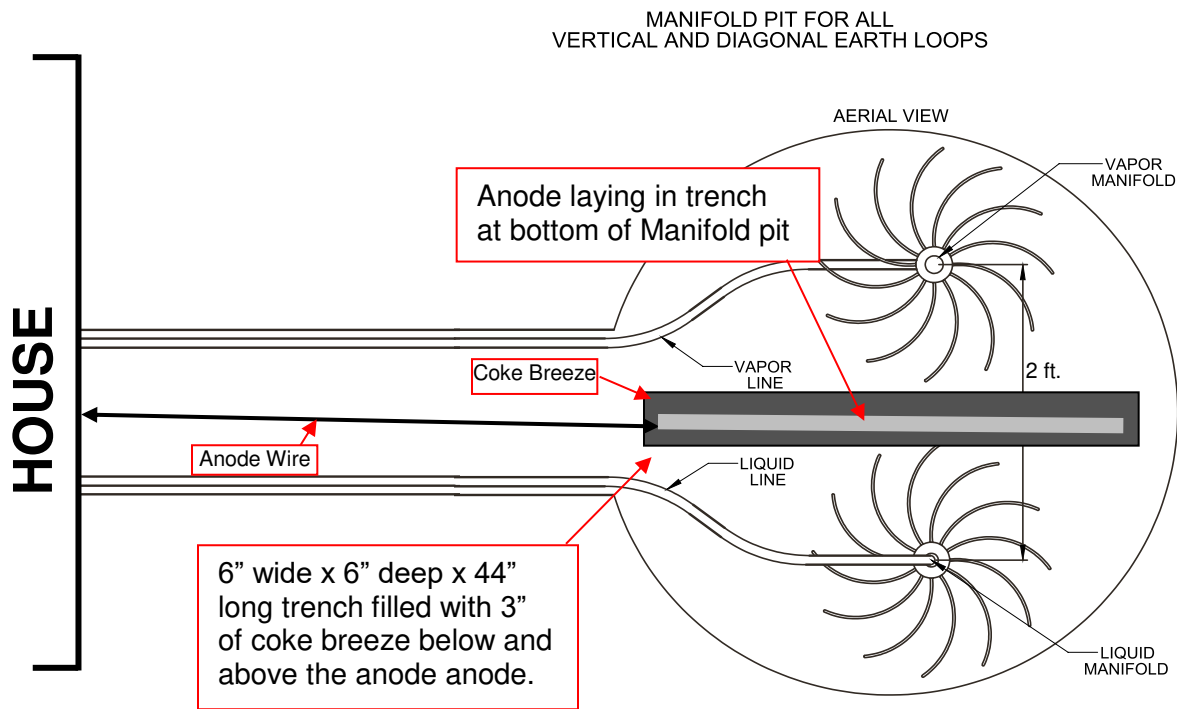
Please note that the water used to mix your grout must be brought in from a known noncorrosive, clean water supply. Using water from the job site may introduce contaminants inside the PVC casing that can cause a corrosive environment!

1. Once the loops and tremie tubes are inserted into the PVC casing, the interior casing must be grouted (before grouting the exterior of the casing). Pump the PVC full of grout from the bottom up. Grouting must be done to bridge the thermal transfer of heat from the copper loop to the PVC pipe.
2. Once the inside of the PVC pipe is grouted, you must then grout the outside of the PVC pipe against the earth, from the bottom up as well using the tremie pipe insert on the outside of the PVC pipe. This is done to bridge the thermal transfer of heat between the PVC pipe and the earth.

Anode Placement:

Since the earth loops themselves are protected by encapsulation, anode placement for the cathodic protection system will differ from a standard field install. That difference being that the cathodic protection only needs to protect the manifolds and shallow lines. Once the earth loops are installed and prior to manifold installation:

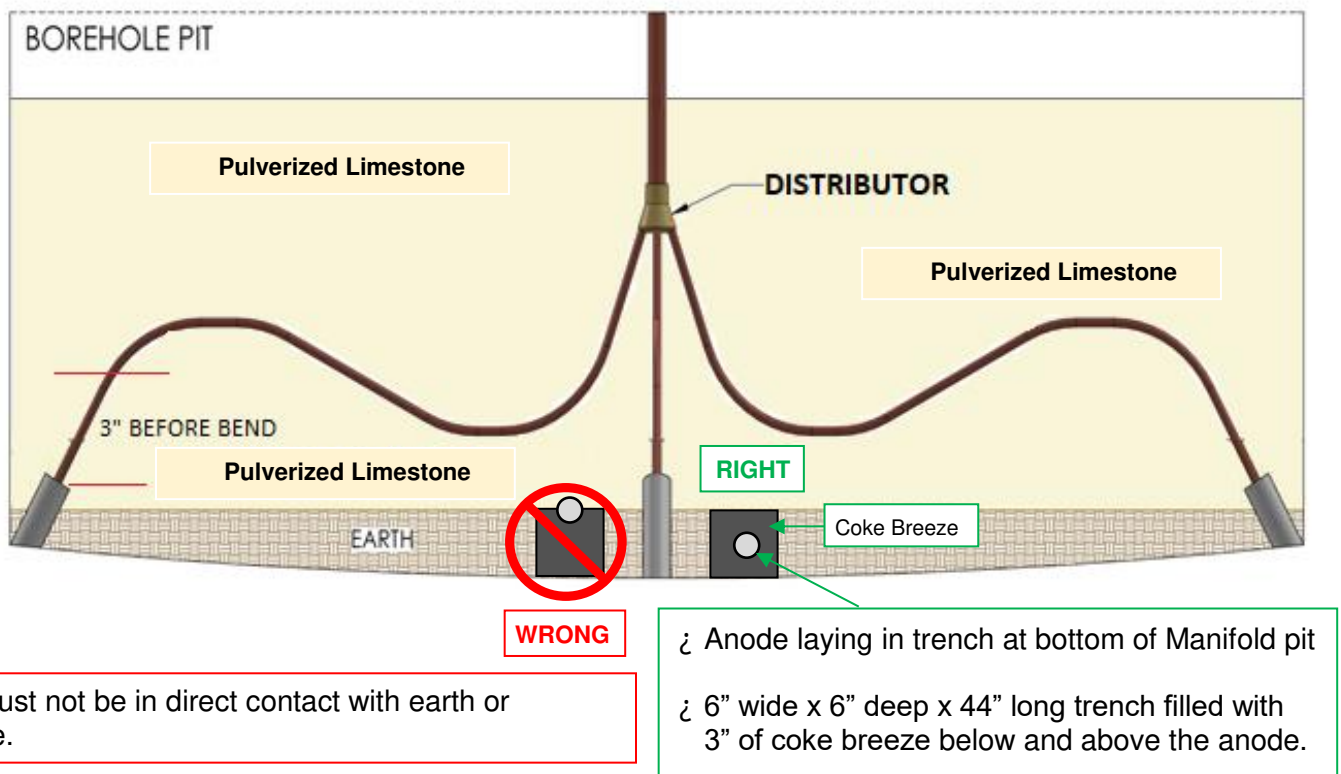
1. Dig one 6" wide x 6" deep x 44" long trench at the base of the manifold pit to install the anode. See picture 1D on this page and picture 1E on the page 8.
2. Pour a 3" layer of coke breeze at the bottom of anode trench.
3. Lay a 40" long tubular anode in the center of the bed of coke breeze. (anode is typically shipped with the copper earth loops)
4. Pour another 3" layer of coke breeze on top of the anode. Anode **MUST** be fully encapsulated with coke breeze prior to back filling. Refer to picture 1E on page 8.
5. Backfill the anode and copper manifolds with a minimum of 2 ft. of pulverized limestone.



Picture 1D

Backfilling Manifold Pit

3. Fill the manifold pit with 2 ft. of pulverized limestone on top of the coke breeze. Refer to your drilling manual and, refer to picture 1E.
4. Add a layer of pulverized limestone on the bottom of the manifold pit to a level approximately 2 inches above the ends of the PVC pipe. Allow the copper loops to rise a short distance (approximately 3 inches) above the PVC pipes before beginning to gradually bend the copper towards the manifold. This will prevent too tight of a copper bend from occurring, and preventing the PVC from kinking the copper as the ground will slightly settle. Please refer to picture 1E. **Please Note:** The line set should be packed in pulverized limestone 2 to 3 inches above and below the line set as well.



Picture 1E

Please note that this methodology is only to be used in adverse soil conditions beyond the scope of what cathodic protection can cover. This methodology must be followed exactly for success of the project. Using PVC pipe heavier than SCH21 or failure to fully grout from bottom to top of both the PVC pipe and the borehole will result in a poorly performing earth loop field. Failure to bring in noncorrosive clean water from an outside source can also negate the protection of encapsulating the loop.

For any question pertaining these procedures, please contact Total Green Mfg. Technical support at 419-678-2032.