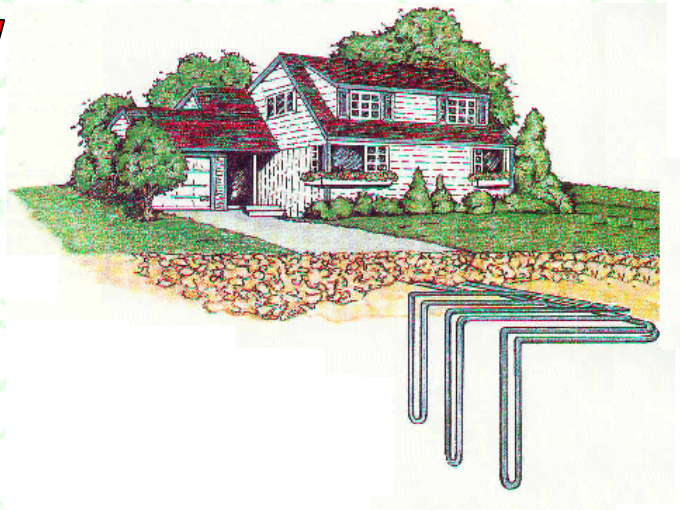
Case Study

Vertical Closed Loop Geothermal Installation



Derek Burgess Residence
Canaan, NB

In 1981 Derek Burgess decided to build a new home on the south shore of the Canaan River in New Brunswick, Canada. After careful consideration of all options, he selected a NORDIC® 3 ton well based geothermal heat pump to provide energy efficient heating and hot water for the new structure.

Derek wanted an automatic system which provided the cost savings of wood heat without the mess, smoke and fuss of gathering and handling the fuel. The heat pump also had the distinct advantage of being able to supply a source of water to a fish pond located on the property.

Due to poor quality water at deeper depths, water wells in the area were less than 20 ft deep on average and although the well performed admirably during most years, a dry winter could often leave the Burgesses on back-up heat.

To solve the problem and add air conditioning to the home, a new "R" series NORDIC® HP and a closed vertical loop system was installed in 1997.

Positioning drill for 1st borehole

The new system installed was a 5 ton unit with 5 five 150 ft. vertical boreholes.

Outside drilling and trenching work was contracted to Armlin Geothermal Drilling. The drill unit required to drill the 3.5" boreholes is small enough to be towed by a 4x4 half ton truck and thus maneuvering into place in the average back yard is easily accomplished.

Drilling a 3.5" hole rather than a 6" borehole allows plenty of room for the "U" tube made up of 2 x 3/4" and the 1" grout pipe used to refill the hole with bentonite clay grout. Bentonite or a mix of bentonite and silica sand is pumped down the borehole under pressure with a diaphragm or screw style pump to insure the best possible heat transfer

Vertical Drilling & Pipe Installation

with the surrounding strata and to prevent surface water contamination

Inserting pipes in boreholes

of any nearby aquifers.

The picture above shows the plastic pipe being inserted while the "temporary" plastic casing is still in the hole. Steel casing is generally not used in the construction of the boreholes however caving conditions sometimes require the temporary insertion and subsequent removal after grouting and piping have been installed.

To keep the bottom few feet of the "U" tube straight so that it will not gouge into the side of the borehole a 15 ft length of 3/4" steel rebar is attached with plastic tape to the bottom of the "U" tube and the piping is filled with water for added weight.

All holes are drilled, filled with pipe and grouted before the horizontal trenching is begun.

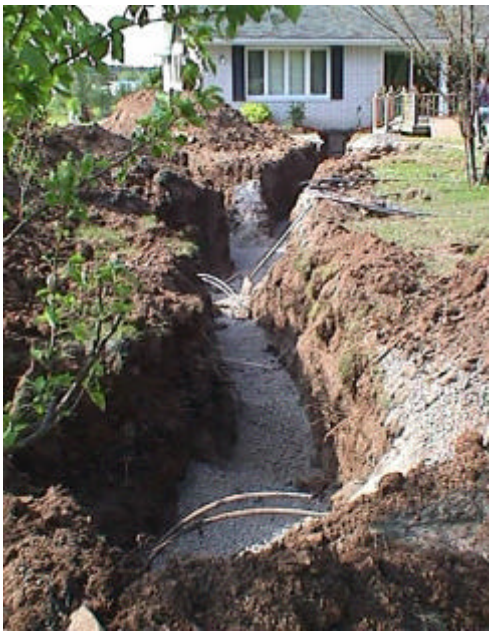
A horizontal trench is dug beside each borehole so that the 3/4" pipe can be fused into a 1-1/4" header with 2 x 1-1/4" pipes extending into the home. A relief at least 30 tomes the diameter of the pipe is dug from the trench to each borehole so that pipe lays in a wide radius from the boreholes to trench. The wide radius eliminates the use of 90° elbows at the well head and prevents kinking of the plastic pipe. If the base of the trench is rocky, fine crushed rock or limestone tailings can be spread out in the trench to prevent possible damage to the piping. Once all piping joints have been made and tested for leaks at 100 psig air pressure for 8 hours, the trench can be back filled.

Digging radius in earth

Preparing to grouting

Pipes inserted & sealed

Final outdoor work consists of penetrating the concrete wall and inserting the (2) x 1-1/4" pipes into the basement of the home. The pipe entrance is then grouted with "quick grout" (hydraulic cement grout) and allowed to set for 2 hours before manipulating the piping inside the home.



Inside Installation

Inside piping and plumbing consists of picking up the 1-1/4" piping where it comes through the wall and routing it to the heat pump via a

Dual Loop Pumps

loop pump kit or (2) circulator pumps selected and sized for 15 USgpm at the required head loss of the system. All internal piping and the piping from the basement wall to ten ft out from the building should be insulated with waterproof insulation such as armaflex.

Final fluid connections to the heat pump from the pump pack can be plumbed in copper or PVC. Water shut-off valves and unions are shown in the diagram below and

Final plumbing connections to HP

should be considered a requirement for all installations.

Final installation considerations should encompass provisions to ensure the longevity of the HP as well as the most silent operation possible form the unit.

The HP should be mounted on a base of 2" Styrofoam to insure a flat base for the unit and to keep the base of the unit dry.

All plenums and ductwork for the first 8 ft of the supply and return should be insulated as in the case of

Electrical & thermostat wiring

the photo at the left. Insulated ductwork both silences the unit and ensures that delivered air to the home is uniformly constant in temperature at all points in the home.

Insulated ductwork

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