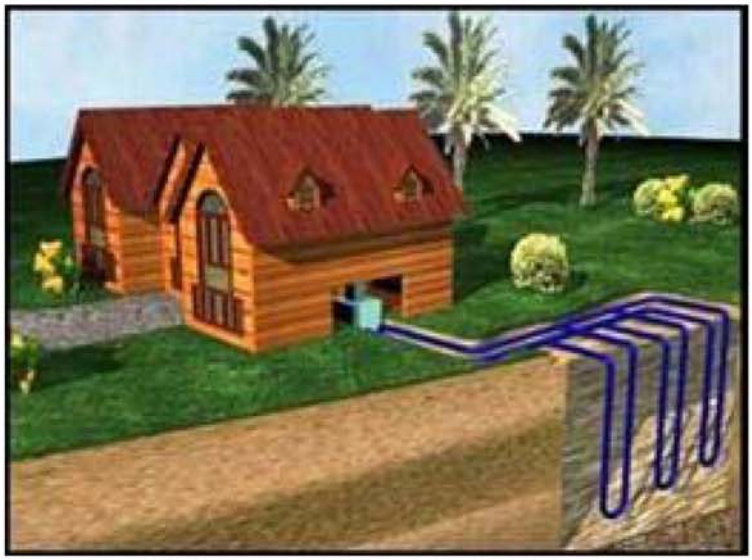
New application of the S5 EV/TM: Ground source heat pump

Ground source heat pumps are pipe bundles that are placed into the ground by a special drilling method. With their help the geothermal energy from the lower ground can be gained for heating or cooling.

Pairs of pipes which are connected at the bottom with a U-shaped part are placed into the borehole. Therefore, they are called U-sensors. The remaining hollow space within the borehole will be filled with a good heat conductance like bentonite or grouting mortar. Thereby, a good thermal transfer from the ground to the pipes of the sensors can be achieved. At the same time the borehole will be sealed by this technique avoiding the leakage of ground water and the infiltration of harmful substances into the ground water.



This new application is used at the construction of a new IKEA store. The Building site of the Swedish furniture manufacturer is located in Bei Cai Town, Shanghai, China and extends over a total building area of 126524 m². The underground area, where the ground source heat pumps will be assembled, covers 43550 m². Whereas the total construction time takes 1,5 years, the assembling of the ground source heat pumps will be finished in 2 months time.

The next picture gives an overview of the jobsite:

Within the underground area 810 holes with a depth of 92 meters each will be made to place the ground source heat pumps inside of them. The diameter of the U-pipes is 130 mm.
On the whole jobsite 19 machines are used to make holes into the ground. Only 2 units of the S5 EV/TM fill the holes with grouting mortar. The principal ordered 3 machines although 2 units would be sufficient.
It takes about 3 to 4 hours to dig a hole. The filling process with the S5 EV/TM takes another 30 minutes. According to experience of the IKEA jobsite, 35 holes can be finished per day. Thus, it will take about 24 days to complete all holes.

Using the S5 EV/TM is very efficient as it saves time and money. It takes the operator only 30 minutes one time to fill the holes with the material. On the contrary, the same process takes 30 minutes 3 to 5 times if it is done by hand. At such a big jobsite like the construction of the new IKEA store working without the S5 EV/TM would delay the whole time schedule. Furthermore, more labor would be needed for the filling process as only 5 people are working at each of the two machines.
Other advantages of using the S5 EV/TM are the prevention of heat exchange and the guarantee that the material is spread consistently and does not seep away too much. As the holes are very deep, it is nearly impossible to ensure that the material is transported to the bottom evenly when working by hand. If the material is not distributed correctly between the pipes it runs the risk of heat exchange, making the ground source heat pumps inoperable.

With the S5 EV/TM the application of the ground source heat pumps is more efficient as it reduces time, labor and money expenses. Furthermore, it is more qualitative as it prevents heat exchange and material seeping.

The following pictures illustrate the different operation steps:

1. Hole-making process:

   With these special machines the holes are made into the underground area. Each bore hole reaches a depth of 92 meters.

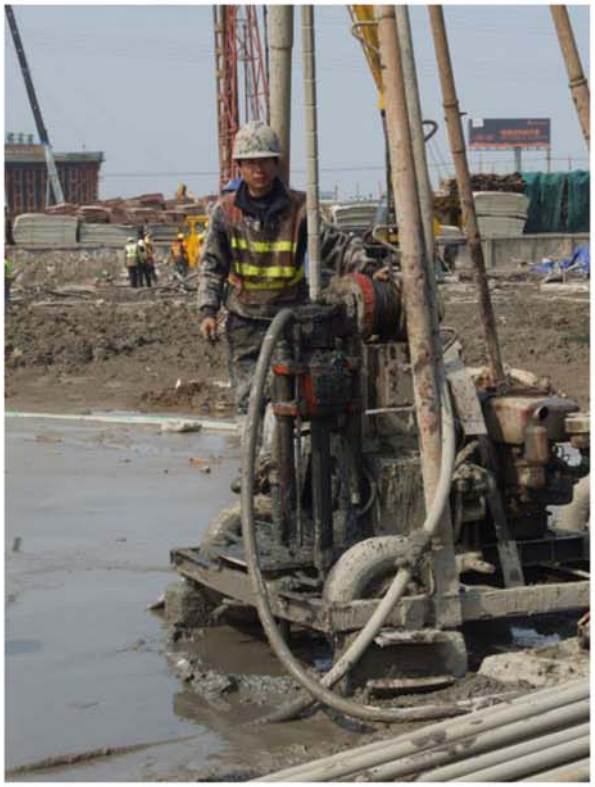
2. Intubation:

   With the aid of a special Y-pipe the U-pipes are inserted into the holes. While the U-pipes are soft the Y-pipe consists of 31 hard pipes, 3 meters length each, which are connected to reach the hole depth of 92 meters. At the end of the hard pipe a top piece, looking like a Y, is added giving the pipe its name. On the one hand this top piece is used to insert the soft U-pipes deep into the ground. On the other hand it pumps the mortar into the holes.

3. Filling process:

Before filling the material into the holes it has to be guaranteed that the U-pipes have no leak. Otherwise the pumped material will get into the pipes and make the ground source heat pumps ineffective. To avoid this some water will be flushed with low pressure through the pipes. If there is no leak the filling process will begin. Afterwards all 31 pieces of the Y-pipe have to be removed as they will also be used for the following holes. The U-pipes stay in the underground.

The material that is pumped into the holes is a grouting mortar consisting of sand : cement : additive which is mixed in the relation of 5 : 1 : 1.



U-pipes:

Y-pipes: