Translation of the article:
"Sicheres Bohren nach Erdwärme"
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Safe Drilling for Geothermal Energy

The condition of the soil determines the kind of drilling technique to be used.

A new Hütte drill rig offers all techniques.

Free heating with geothermal energy: this attractive motto was the beginning of a geothermal boom which was meanwhile stopped as the technology also caused some unpleasant experiences. An example is **a village in the Black Forest** which is still facing swelling of the soil lifting up the houses. During drilling of the holes, anhydrite lenses were pierced, letting water flow in. Thereby, plaster is produced which creates heat and an increase by 60% in the volume of the calcium sulfate. Another spectacular event was an unstoppable water fountain next to the Wiesbaden tax office. This was caused by piercing an artesian.

As for this and many other incidents, sloppiness was the reason. Those incidents could have been avoided by engaging highly skilled and more experienced companies **using drilling rigs especially designed for geothermal applications**. The rigs used on above mentioned jobsites were simple drill rigs for dwell drilling, but not for geothermal drilling. When using rigs for dwell drilling, no second outer rod is used which keeps the soil from collapsing. Another problem with the simple drilling rigs is that the water flowing in the hole cannot be stopped.

All the mentioned problems can be avoided using **the drilling rig HBR 207 GT** which was recently presented at the Geothermiezentrum Bochum (GZB). According to the explanations of GZB director, Mr. Rolf Bracke, this 20 to heavy drilling rig moving on crawlers **is the most innovative drilling rig ever designed for geothermal applications** (up to 1.000 m depth). The drill rig designed by Hütte Bohrtechnik in Olpe controls all common drilling methods. Furthermore, it can enter the soil with an inclination of max. 30°. This way it is possible to drill the soil star-like, which reduces both noise and disturbances. It is planned to first drill the geothermal holes for the heat pump system of the new GZB and then ship it to a jobsite in Bottrop.

The HBR 207 GT shall assist to open up a new residential area as regards heating (Innovation City). Step by step it shall drill all the necessary holes from a specially

designed drill site. The researching drill rig will be equipped with a double head. A double head consists of two drill gears in a row which work in opposite directions. The front is used for the outer rods, the protective piping, while the back one is used for the inner rods. This way you can drill exactly in the aimed direction and the detached rock can be moved upwards in a controlled way. Another advantage of the double head is that the water flow can be stopped in case an artesian was pierced. This is done by a non-return-valve installed in the protective rod.

The particular characteristic of the new drilling rig is its **diversity.** For all types of geology a suitable method can be used. Thanks to the Witten company Kamat, a powerful piston pump was installed offering flexible pressures up to 1500 bar. This way, both (water) hydraulic or pneumatic drill hammers are operated. Furthermore, the multi-functional drill enables the traditional rotary drilling. Thereby, the casings are moved from a turntable at the top of the drilling rig and the flush transporting the drill leftovers flows through the inner of the rods.

The equipment can offer even more: this way, the **GeoJetting method, developed by Mr. Bracke and his colleagues at the Geothermiezentrum Bochum**, can be used. Thereby, **the soil is cut with a sharp, powerful water jet**: the water is sprayed with a pressure of more than 1000 bar against rock out of protective tubes flanged at the drill head in vertical bottom direction. To ensure that the soil is "atomized", the abrasive material corundum is added. This way, even very hard rock can be dissected. Anyway, the dissected rock has to be removed from the hole whereas the material dissected from light soil mostly vanishes through the pores of the borehole.

According to Mr. Bracke, **the drill times (of light soils) are reduced considerably** by implementing the GeoJetting method. Moreover, **the costs of this method are also lower than of the traditional one** resulting from the fact that less material needs to be transported on the jobsite. The method for lifting the drill head is patented. This is not an easy job as it needs to be lifted upwards through the protective piping.

The geothermal drilling rig HBR 207 GT shall enable the perfect production of soil sensors. Above all, when you expect to drill stable soils, it was drilled (and is still drilled) in an unprotected way. This penny pinching is inappropriate. Because lateral soil or rock collapsing of the borehole make both installing the sensors and the heat transfer tubes and filling the hole perfectly with the most appropriate material (Bentonite) after lifting of the drill impossible. Air locks are created and the desired heat transfer of the soil to circulating sensors in the sensors is worsened. Consequently, the heat pump cannot achieve the desired performance. This is very annoying as the power of a heat pump depends on amount of heat which can be withdrawn from its surroundings. To conclude: as more than half of the investment costs of installing such a geothermal heating system are associated to drilling the holes, wrongly filled holes are a simple waste of money. An alternative is an air-water-heat pump system.