

Herrenknecht Vertical

Automated Rig Technology

The exploration of new energy deposits is one of the global challenges for future energy supply. Whether the development of onshore and offshore oil and gas or deep geothermal energy is economically reasonable also depends on the drilling equipment used. Herrenknecht Vertical, a subsidiary of Herrenknecht AG, the market leader in mechanized tunnelling systems, designs and manufactures customized high-quality rigs for drilling, workover and decommissioning, meeting the needs of our customers and their projects. The hydraulic rig concepts for drilling to 8,000 meters incorporate comprehensive, safety-based automation, setting new standards of safety, efficiency and environmental protection. **Automated Rig Technology. Engineered and built for your performance.**



Headquarters in Germany, active worldwide. With more than 40 years of engineering and manufacturing experience, around 5,000 employees and 76 locations within the Herrenknecht Group, we support our customers globally.

TI-350 BOX-ON-BOX

GEOHERMAL ENERGY PROJECTS IN GERMANY



Containerized rig TI-350 Box-on-box for efficient and environmentally-friendly geothermal drilling in urban areas in Germany



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**AUTOMATED
RIG TECHNOLOGY**



**HERRENKNECHT
VERTICAL**

TI-350 Box-on-box for urban geothermal drilling

Geothermal energy provides enormous potential for a reliable future energy concept, for both power generation and heating. It is capable to supply the base load as it is constantly available, independent of the season, weather or time of the day – unlike other renewable energies such as wind or solar power.

Wherever two tectonic plates meet, high temperatures are to be found just a few hundred meters beneath the earth's crust. In Germany, underground temperature increases by approx. 30°C at each kilometer of depth. This means, temperatures exceeding 100°C are found at depths from around 3,500 meters (11,480 feet), which is hot enough for power generation. To date, mostly hydrothermal doublet systems are used, with one well for production and one for injection of the geothermal water. To ensure efficient use, especially of district heating, both drilling locations and power plants are situated close to built-up areas. This poses special demands on the drilling rig, in particular with regard to space requirements and emissions.



Lift tests after drilling show the productivity of the geothermal wells

In this context, Herrenknecht Vertical developed a dedicated geothermal drilling rig, which has proven its benefits in several geothermal projects across Europe. The innovative, hydraulic box-on-box rigs contribute to safe and economic development of geothermal reservoirs:

Reliable operations under diverse conditions

- › Constant and reliable performance through powerful, sensitive hoisting system and automation
- › Flexible hydraulic hoisting and rotary system adaptable to different drilling methods in all geologies
- › Rig site layout adjustable to local site

Work safety and efficiency through automation

- › Hands-off concept for pipe and casing handling with automated pipe handler and horizontal box-type pipe rack system with gantry crane for doubles
- › Remote control from the driller's cabin for precise and reliable operations
- › Sophisticated anti-collision system

Cost efficiency due to hydraulic drive concept and minimized staff requirements

- › Central energy-sharing hydraulic drive with high redundancy
- › Energy management system for flexibility of working with gensets or from the public grid saving fuel and reducing emissions
- › Smaller crews thanks to high automation reducing personnel costs

Drilling close to urban areas thanks to minimized environmental impact

- › Containerized box-on-box substructure for compact footprint and easy handling and transport
- › Time-saving skidding system for drilling of injection and production well on one location without rig moves between wells
- › Comprehensive integrated noise protection concept using silent hydraulic components and noise capsulation making it the quietest rig on the market

TI-350 BOX-ON-BOX

› Max. hook load:	350 mt (375 sht)
› Max. push load:	160 mt (175 sht)
› Hoisting power:	1,600 kW (2,200 hp)
› Top drive power:	800 kW (1,000 hp)
› Max. tripping speed:	600 m/h (1,970 ft/h) ¹
› Max. drilling depth:	6,000 m (19,700 ft) ²
› Mud pumps:	3 units per 1,000 kW (1,340 hp)
› Power source:	10/20 KV power from the grid via the medium voltage switchgear unit

¹ depends on training level and experience of the crew

² depends on inclination and string weight as well as formation and casing design

Efficient deep geothermal project development

In Germany, there are three major deep geothermal regions with natural hydrothermal reservoirs:

Three box-on-box rigs made by Herrenknecht Vertical operated in the Bavarian molasse basin between the Alps and the Danube. To date, nine directional wells were drilled successfully down to depths of about 5,500 meters (18,050 feet). The hydrothermal projects are based on doublet wells, where the skidding system ensures a quick moving of the rig from one well to the other. Another project, with only one well drilled, is used for research on petrothermal systems.

Also for the Genesys project in Hanover a Herrenknecht Vertical rig was employed. The sediment formations of this city are typical for the North German basin. The research project examines geothermal utilization of a single borehole: the hot water is transported to the surface in an installed pipe and fed back via the annular space after heat extraction.

The Upper Rhine valley is the region with the best conditions for hydrothermal utilization in Germany, thanks to above-average temperatures. However, the geological conditions make drilling more challenging compared to the Bavarian molasse basin. Once again, the hydraulic rig concept of Herrenknecht Vertical worked with high precision and efficiency to enable constant and reliable drilling operations.

Close to urban areas, the rigs distinguished themselves with smooth and quiet operations. Customers profited from high availability rates coupled with maximum safety standards without any accidents.



Silent box-on-box rig drilling in close proximity to built-up areas

DEEP GEOTHERMAL DRILLING IN GERMANY

› Locations:	Bavarian molasse basin: Mauerstetten, Dürnrhaar, Kirchstockach, Kirchweidach, Traunreut, Munich-Freiham North German basin: Hanover Upper Rhine valley: Brühl/Heidelberg
› Applications:	Power generation, district heating and research projects
› Well depths:	3,100 m - 5,500 m (10,170 ft - 18,050 ft)
› Well diameters:	711.2 mm - 215.9 mm (28" - 8½")
› Total no. of wells:	11
› Total drilling depth (MD):	approx. 56,000 m (183,700 ft)
› Geology:	Bavarian molasse basin: tertiary, malm North German basin: chalkstone, jurassic, tertiary Upper Rhine valley: clay, sandstone

Projects drilled with Herrenknecht Vertical's box-on-box rigs in the Bavarian molasse basin

