



HORIZONTAL DIRECTIONAL DRILLING

POWERFUL TECHNOLOGY FOR TRENCHLESS PIPELINE INSTALLATION

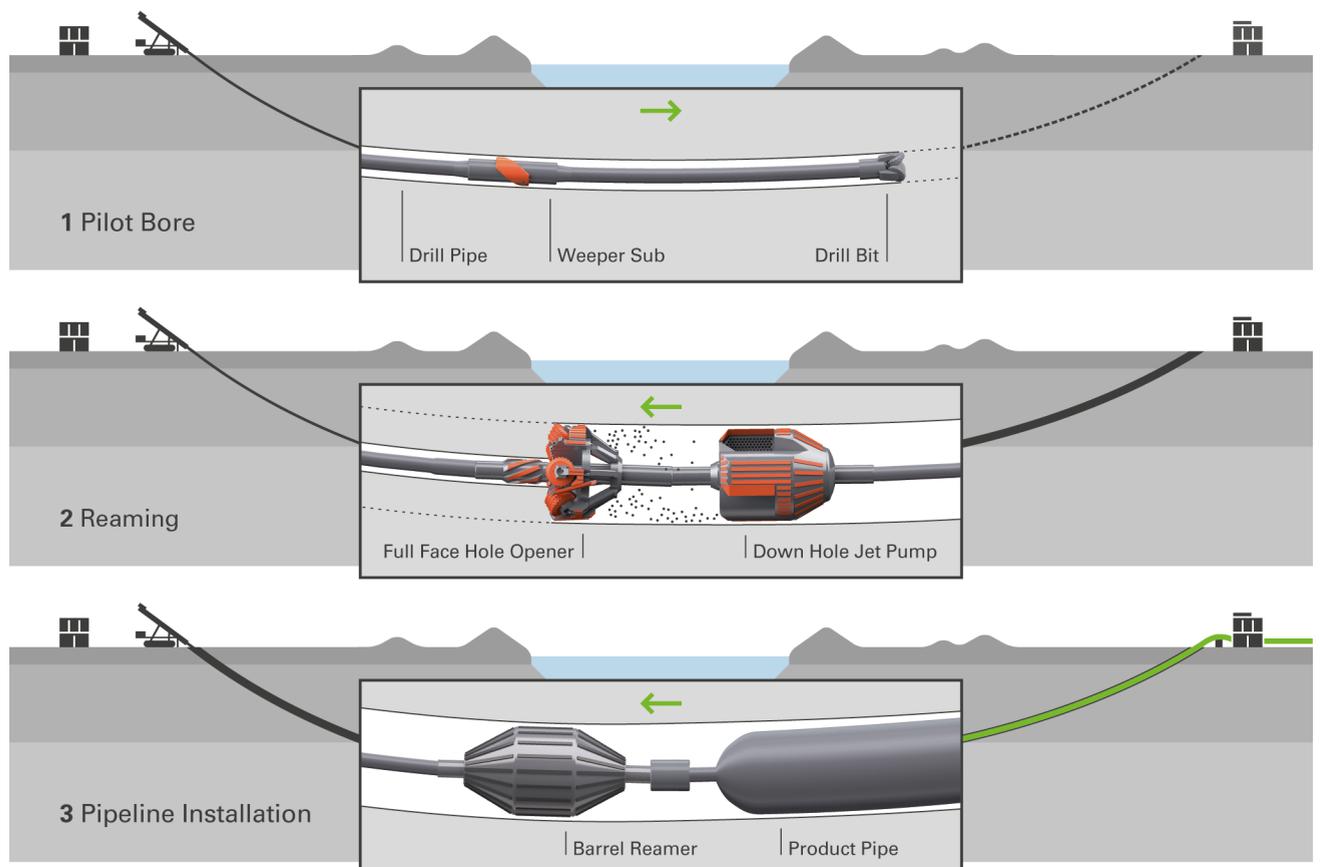
**PIONEERING
UNDERGROUND
TECHNOLOGIES**



Economic method for installing pipelines.

With HDD (Horizontal Directional Drilling), pipelines are installed in three steps. The depth and alignment of the pre-defined path for the bore is chosen by considering

all different layers of soil and potential obstacles like boulders, foundations and more. The only on-surface equipment is located at the launch and reception point.



The HDD Rig drills a pilot bore from the launch point toward the reception point. The rotating drill rods are guided by a surveying system located directly behind the drill bit. During drilling, mud pumps supply a bentonite suspension directly through the drill rods to the jets in the drill bit. The bentonite is mixed with the excavated material and flows back through the annulus to the starting point.

The pilot bore is followed by a second step: the reaming. After exiting at the reception point, the pilot drill bit is replaced by a reamer. The borehole is enlarged when the drill rods are pulled back with the reamer toward the launch point. The water-bentonite

mixture in the borehole supports the expanded borehole. Reaming is usually performed in several passes until the final borehole diameter is achieved – which is about 30–50% larger than the actual pipeline diameter. The Herrenknecht Full Face Hole Opener shown enables reaming in one step from the pilot to a final diameter.

In a third stage, the prefabricated pipeline is connected to the drill rods. The pipeline is attached behind a smaller reamer to ensure a clean borehole and a swivel joint. The pipeline is then pulled back to the entry point by the HDD Rig until it reaches its final position.

Herrenknecht HDD Rigs

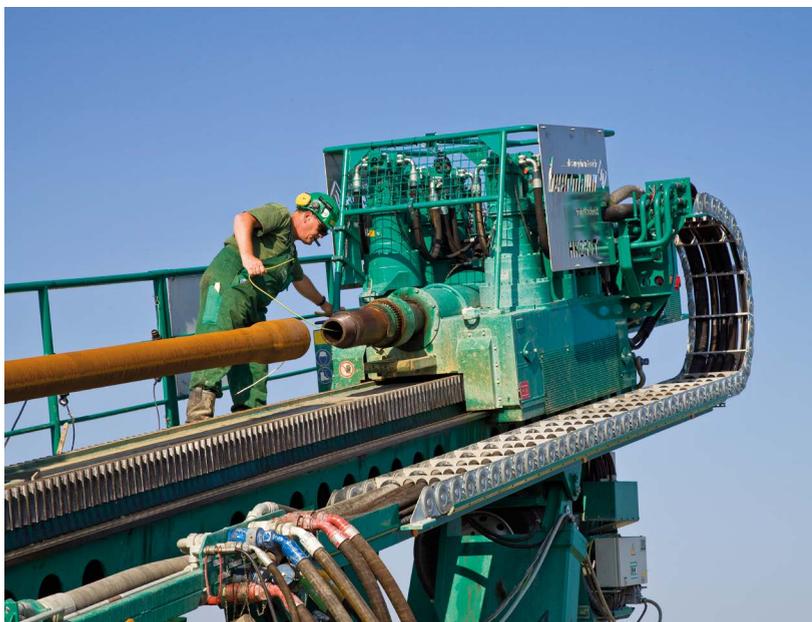
Proven and reliable.

With horizontal directional drilling technology from Herrenknecht, pipelines can be installed rapidly, economically and with minimized impact on environment and existing infrastructure. Later application of the pipelines include the transportation of oil & gas,

sewage water, district heating, high-voltage power lines, cable bundles for telecommunication and more. HDD Rigs are highly adaptable in diameter and lengths of the borehole and used mainly in stable, loose soils and rock.



On Jobsite:
Connecting the next drill pipe.



PRODUCT HIGHLIGHTS

Complete portfolio from rigs to high pressure mud pumps, separation and mixing systems, Pipe Thruster, tooling and training programs.

Broad geological range of application: stable loose soils and rock.

Five basic rig types for different ranges of implementation available.

Economic and environmentally friendly method for installing pipelines.



Additional power for long crossings.

Herrenknecht rigs are defined by their pulling forces, which are between 80 and 600 tons (180,000 and 1,349,000lbs). Depending on the application, the attached power packs have an output ranging from

328 to more than 940 kilowatts (from 440 to more than 1,261 hp) and are engineered to the customer's requirements.

HDD RIG Range

| Model | Thrust / Pullback [lbs / kN] | Torque [ft.lbs / Nm] | Engine [hp / kW] | Weight [lbs / kg] |
|-------|---------------------------------|------------------------------|---------------------|-----------------------------|
| HK80 | 180,000/800 | 44,250/60,000 | 440/328 | 66,140/30,000 ¹ |
| HK100 | 225,000/1,000 | 44,250/60,000 | 440/328 | 68,340/31,000 ¹ |
| HK150 | 337,000/1,500 | 51,650/70,000 | 440/328 | 55,115/25,000 ² |
| HK250 | 562,000/2,500 | 66,400/90,000 ³ | 630/470 | 63,930/29,000 ² |
| HK300 | 674,000/3,000 | 66,400/90,000 ³ | 630/470 | 67,240/30,500 ² |
| HK400 | 899,000/4,000 | 88,500/120,000 ³ | 1,261/940 | 99,200/45,000 ² |
| HK500 | 1,125,000/5,000 | 103,300/140,000 ³ | 1,261/940 | 100,310/45,500 ² |
| HK600 | 1,349,000/6,000 | 147,500/200,000 | 1,261/940 | 110,230/50,000 |

¹ Crawler type

² Trailer type

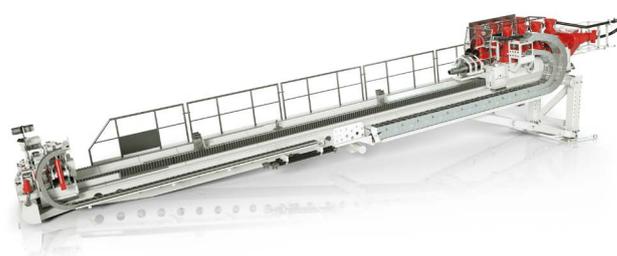
³ High-torque option available: HK250/300 (88,500 ft. lbs / 120,000 Nm), HK400 (103,300 ft. lbs / 140,000 Nm), HK500 (132,800 ft. lbs / 180,000 Nm)

The right rig for the job.

HDD Rigs developed by Herrenknecht can be delivered in five different standard configurations. All models have a control cabin, as well as their own power supply pack powered by a diesel or electrical engine in a sound-insulated container or onboard.

Combinations of all types are possible and one of Herrenknechts' strengths. Fusions of Trailer and Modular Rigs or Compact and Crawler Rig merged with an electrical power unit are often made and jobsite approved.

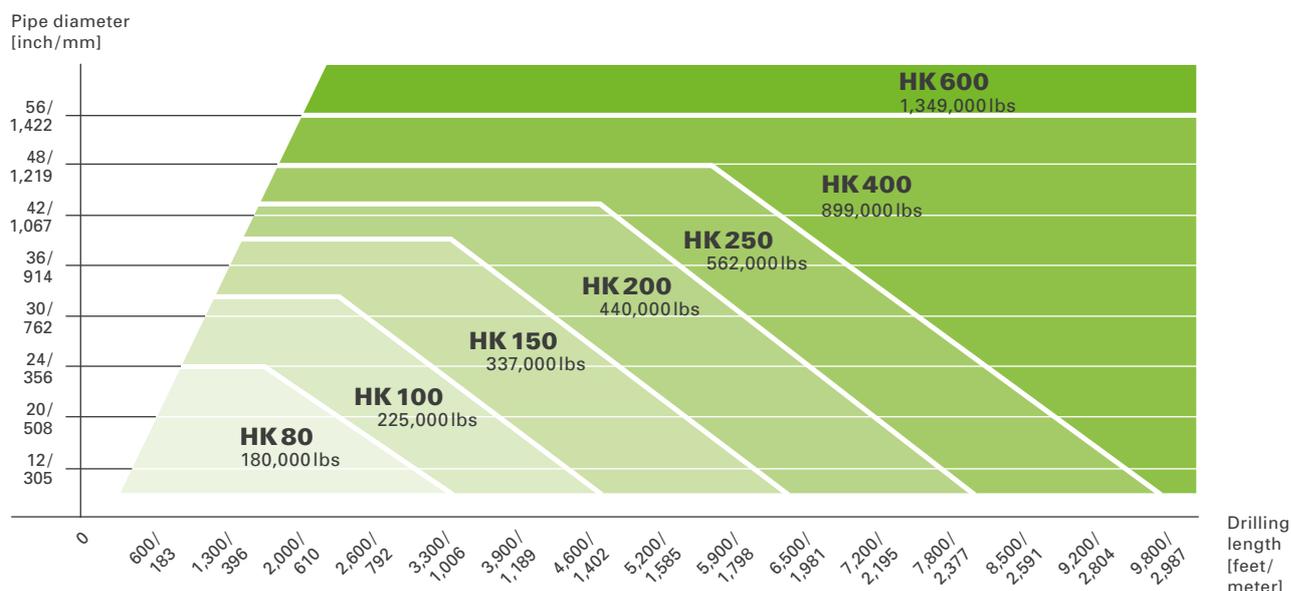
Frame Rig: The low weight of Frame Rigs ensures easy transport, reaching the destination on a regular truck trailer. Loading or unloading and aligning of the rig on the jobsite only needs a standard crane. All these factors make this unit a reliable and economical solution.



Trailer Rig: Being flexible is the great advantage of Trailer Rigs. The low-weight design allows the transportation with standard semi-trailer trucks. Setup, positioning, demobilization are all done without a crane. Projects with long distances to the jobsite or between crossings can benefit from this type of Rig.



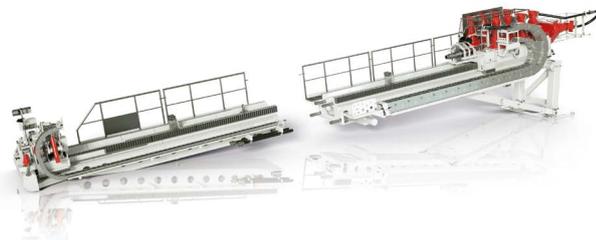
Typical rig working ranges



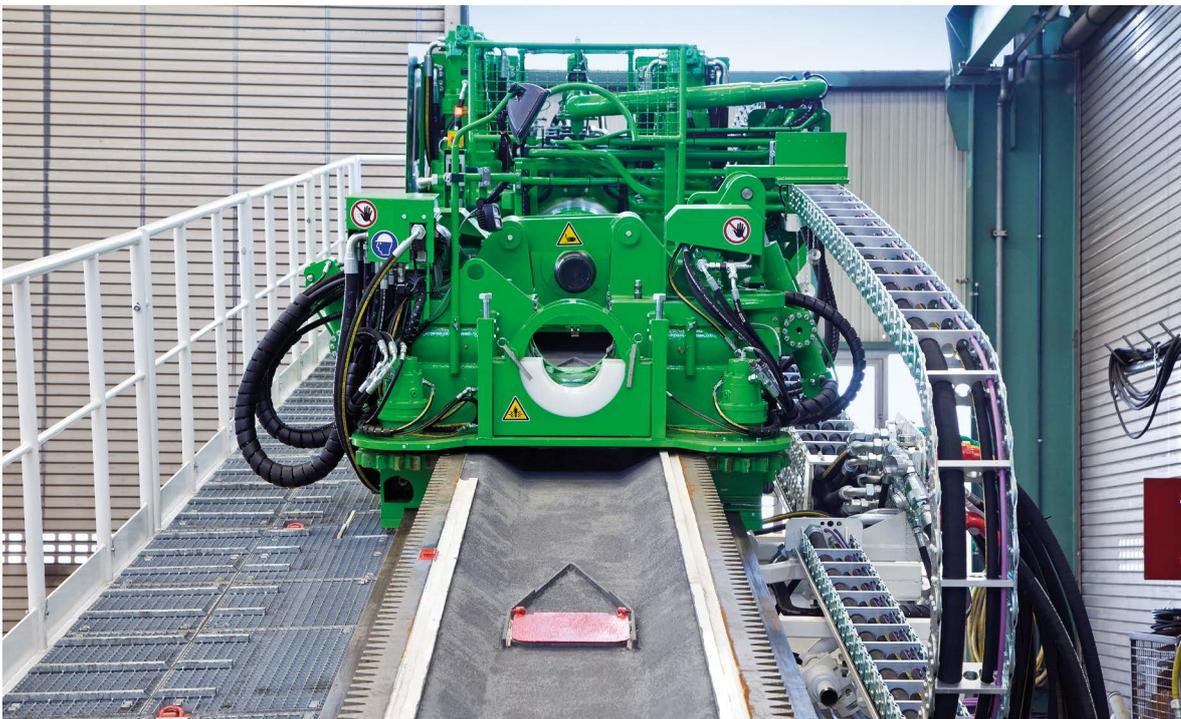
Crawler Rig: The Crawler Rig can be fully autonomously unloaded from the trailer and positioned on site thanks to the fitted crawler system. On rough "off-road" terrain not accessible to trucks or cranes, Crawler Rigs enable mobility and maneuverability.



Modular Rig: Modular Rigs can be disassembled into two or three modules and transported in standard freight containers. Quick re-assembling on site guaranteed and an optional, remote-controlled crawler adds further mobility on the jobsite.



Compact Rig: Short and compact designed rig optimized for smaller projects or inner city applications. Using range 1 (6m/20ft) drill pipes and optionally equipped with onboard control cabin and high pressure Mud Pump, the rig serves all customers needs.



Carriage: completed carriage during assembly in workshop.

Herrenknecht

HDD Full range equipment.

SEPARATION AND MIXING



- › Separation Units from 100 to 300m³ capacity
- › Fine Stage System additionally available
- › Mud Mixing Units
- › Transfer Tanks
- › Bentonite Pumps and Filters

PIPE THRUSTER



- › Pushing Forces up to 750 tons
- › Diameters up to 60"
- › Field proven and reliable design
- › Completely independent of HDD Rig with its own Power Pack and Control Cabin

HIGH-PRESSURE MUD PUMP



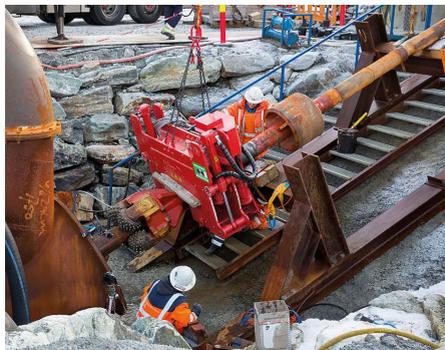
- › Triplex High Pressure Pumps in 20ft Container
- › Diesel or electric driven power unit available
- › Adjustable capacity from 0 to 100%
- › Capacity up to 3500l/min possible
- › Soundproof Container

TOOLS



- › Full Face Hole Openers from 30" to 72" available
- › Reaming from pilot to final diameter in one step
- › Different interchangeable Cutters to suit ground conditions
- › Down Hole Jet Pump ensures a 98% clean borehole
- › Weeper Subs greatly reduce frack-out risks

BREAKOUT UNIT



- › Mobile Breakout Unit for safe handling of drill pipe connections on pipe site
- › Moved by crane or on adjustable support frame
- › Driven independently by small diesel and electric power pack
- › Available as complete bucking unit including spinner

TRAINING AND SUPPORT



- › Individual training packages available
- › Content and length adjusted to customer needs
- › Support of all equipment worldwide
- › Highly trained experts guarantee fast and professional support on site

Herrenknecht

A world leader in groundbreaking tunnelling technology.

Herrenknecht is a professionally positioned and internationally oriented family enterprise. As the only company worldwide, Herrenknecht delivers cutting-edge tunnel boring machines for all ground conditions and in all diameters – ranging from 0.10 to 19 meters. Under the umbrella of the Herrenknecht Group, a team of innovative specialists has formed to provide integrated solutions around mechanized tunnel construction with project-specific additional equipment and services. Pioneering technology by Herrenknecht is always involved when paving the way for the future underground – whether for tunnelling, mining or exploration. Herrenknecht ensures safe and fast progress when constructing modern infrastructures in all areas of application. Exactly where they are needed.



Headquarters in Germany, active worldwide. With more than 4,100 project references, we are a market leader all around the globe.



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