



Pioneering Underground Technologies

HDD DOWNHOLE TOOLS

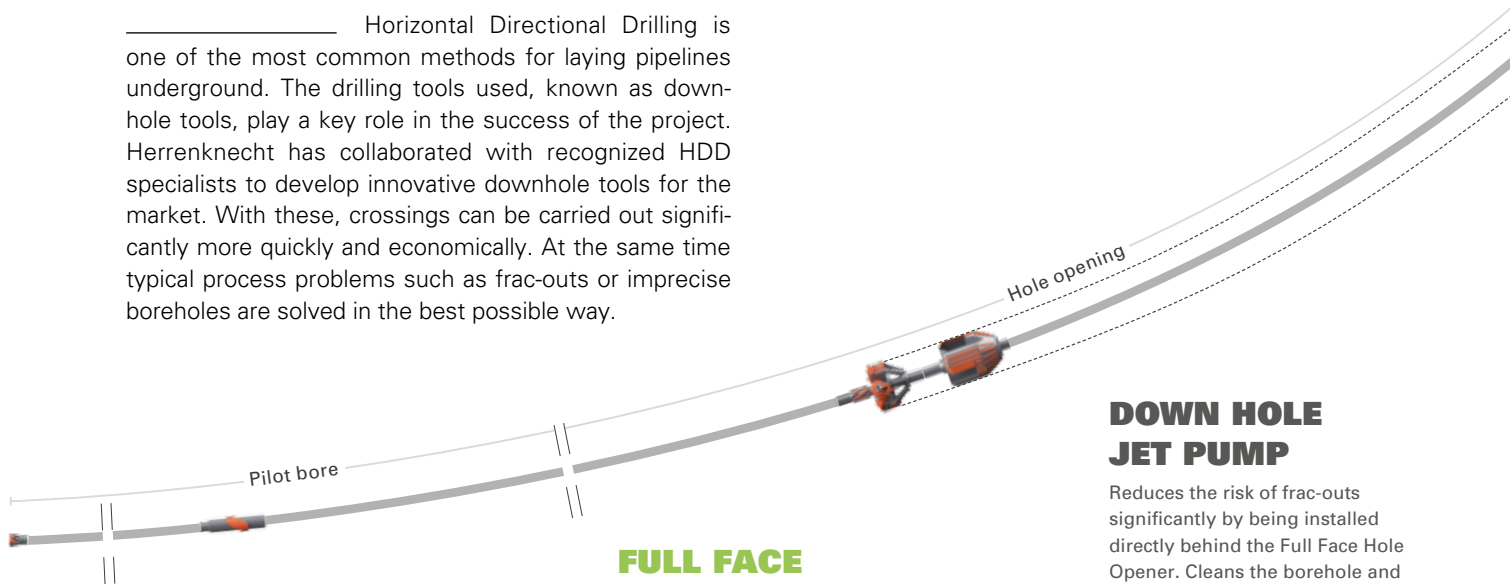
Increasing efficiency and safety in
Horizontal Directional Drilling



HDD Downhole Tools

Game changer in HDD drilling.

Horizontal Directional Drilling is one of the most common methods for laying pipelines underground. The drilling tools used, known as downhole tools, play a key role in the success of the project. Herrenknecht has collaborated with recognized HDD specialists to develop innovative downhole tools for the market. With these, crossings can be carried out significantly more quickly and economically. At the same time typical process problems such as frac-outs or imprecise boreholes are solved in the best possible way.



WEEPER SUB

Reduces the risk of frac-outs significantly by gradually increasing the volume flow in the borehole. Less drilling fluid required at the drill bit.

FULL FACE HOLE OPENER

Enables the contractor to drill from pilot bore to final diameter in a single step.

DOWN HOLE JET PUMP

Reduces the risk of frac-outs significantly by being installed directly behind the Full Face Hole Opener. Cleans the borehole and removes the cuttings directly inside the drill string.

Weeper Sub

For safe and efficient production of pilot holes

In every HDD project a pilot hole is first created. Here, in particular with longer drilling distances, the typical process problem of frac-outs frequently occurs. Drilling fluid unintentionally escapes from the mud circulation into the formation or to the surface. With the Weeper Subs developed by Herrenknecht this risk is significantly reduced.

During the drilling process, part of the drilling fluid from the drill string is actively directed into the mud return flow in the annulus via an extraction nozzle system. This improves the material flow in the annulus and the removal of settled cuttings. The eccentric screw shape of the Weeper Sub supports the process. A clean pilot borehole without major deposits is the result.

Multiple subs are installed at intervals along the drill string. Depending on the soil conditions and the drilling distance, the typical spacing between two units is 200 to 300 meters.

Especially designed for HDD pilot boreholes, the Herrenknecht Weeper Subs reduce the risk of frac-outs significantly by gradually increasing the volume flow and therefore reduce the required amount of drilling fluid at the drill bit.



Unique HDD Tools by Herrenknecht

Advantages at a glance



Weeper Sub

TECHNICAL DATA

Pilot borehole diameter: 8 1/2" - 9 7/8" - 12 1/4"

Adjustable jet volume: 20-105gpm (75-400l/min)

PRODUCT HIGHLIGHTS

Selective increase of volume flow along the bore path causes reduction of annulus pressure level and therefore minimizes risk of frac-outs.

Axial annulus nozzles spray along the borehole instead of cutting into the borehole wall.

Extraction nozzle system with helix-shaped agitation wing improves the material flow in the annulus and the removal of settled cuttings.

Several nozzle configurations for adjusting the extraction flow and special tools in order to maintain and adjust the sub included.

Full Face Hole Opener

TECHNICAL DATA

Excavation diameter: 30"-72"

Min. pilot borehole diameter: 12 1/4"

Application range: soft rock to hard rock up to 350MPa

PRODUCT HIGHLIGHTS

Enlargement from pilot borehole to the final target diameter in a single step.

Self-centering tool face for low torque and smooth rotation.

Non-stick coated inner area to avoid bit balling in sticky formations.

Field replaceable front centralizer and hardfacing plates.

Tool face cleaning system for larger cuttings, higher ROP and less wear.

Scraper for optimum cleaning and optimized cutting transport.

3 different cutter types enable application in various ground conditions – from soft rock to hard rock.

Modular design allows replacing cutters quickly and cost-efficiently as required.

Wear-protected and pressure-compensated roller cutters with long bearing lifetime allow loads of up to 250 kN per cutter.

Already successfully tested in several reference deployments.

Several nozzle configurations for different types of rock.

Down Hole Jet Pump

TECHNICAL DATA

Operation diameter: 20"-72"

Operation flow rate:
475gpm (1800l/min) at 65bar

PRODUCT HIGHLIGHTS

Cleans the borehole up to 98% and removes the cuttings directly inside the drill string.

Bentonite and other additives can be reduced significantly.

Reduces the frac-out risk to a minimum.

Simple and robust pump without rotating parts.

Possibility to transport large-sized cuttings which increases the ROP (rate of penetration) of the HDD process.

Can be used as a stand-alone cleaning system or in combination with the Hole Opener.

In stable formations the Down Hole Jet Pump is also able to work in dry, non-filled boreholes.



Full Face Hole Opener

One step to the final diameter

After completion of the pilot hole, this is usually enlarged to the target diameter in multiple passes before the pipeline is inserted. With the new Full Face Hole Opener from Herrenknecht the reaming process can be carried out in a single step. The innovative tool is modular in design. Thanks to replaceable cutters it can be used in various ground conditions and quickly and economically refurbished or modified.

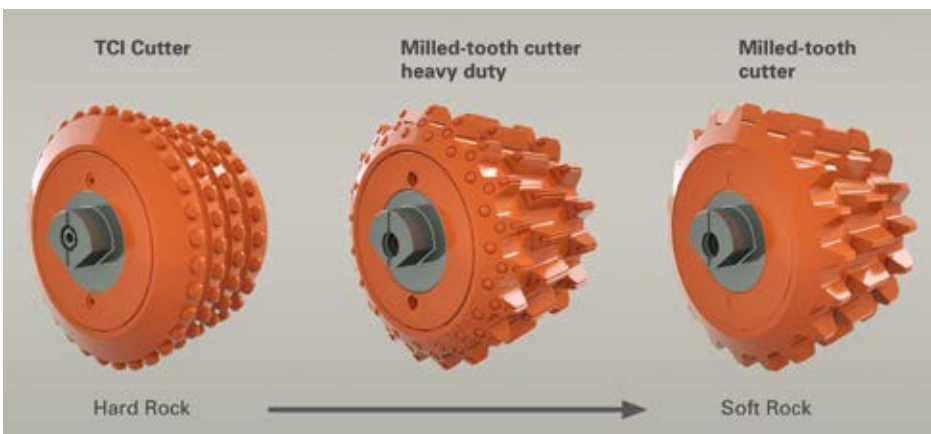
To make rotation smoother the Full Face Hole Opener has several centering mechanisms. As a result, both the tools and the complete drilling system including

the HDD Rig are protected against major vibrations and impacts. This reduces wear and simultaneously ensures an exactly round borehole cut.

During the drilling process, sedimented material at the tool face and from the borehole invert is taken up and actively directed into the mud flow via the scrapers. The reaming process to the final diameter is carried out in a single step. Conventional multi-stage reaming is not required.

The Full Face Hole Opener thus increases productivity, reduces the duration of the project and saves total costs.

Available Cutter Types



TECHNICAL DATA

Robust and modular cutter types for various ground conditions.

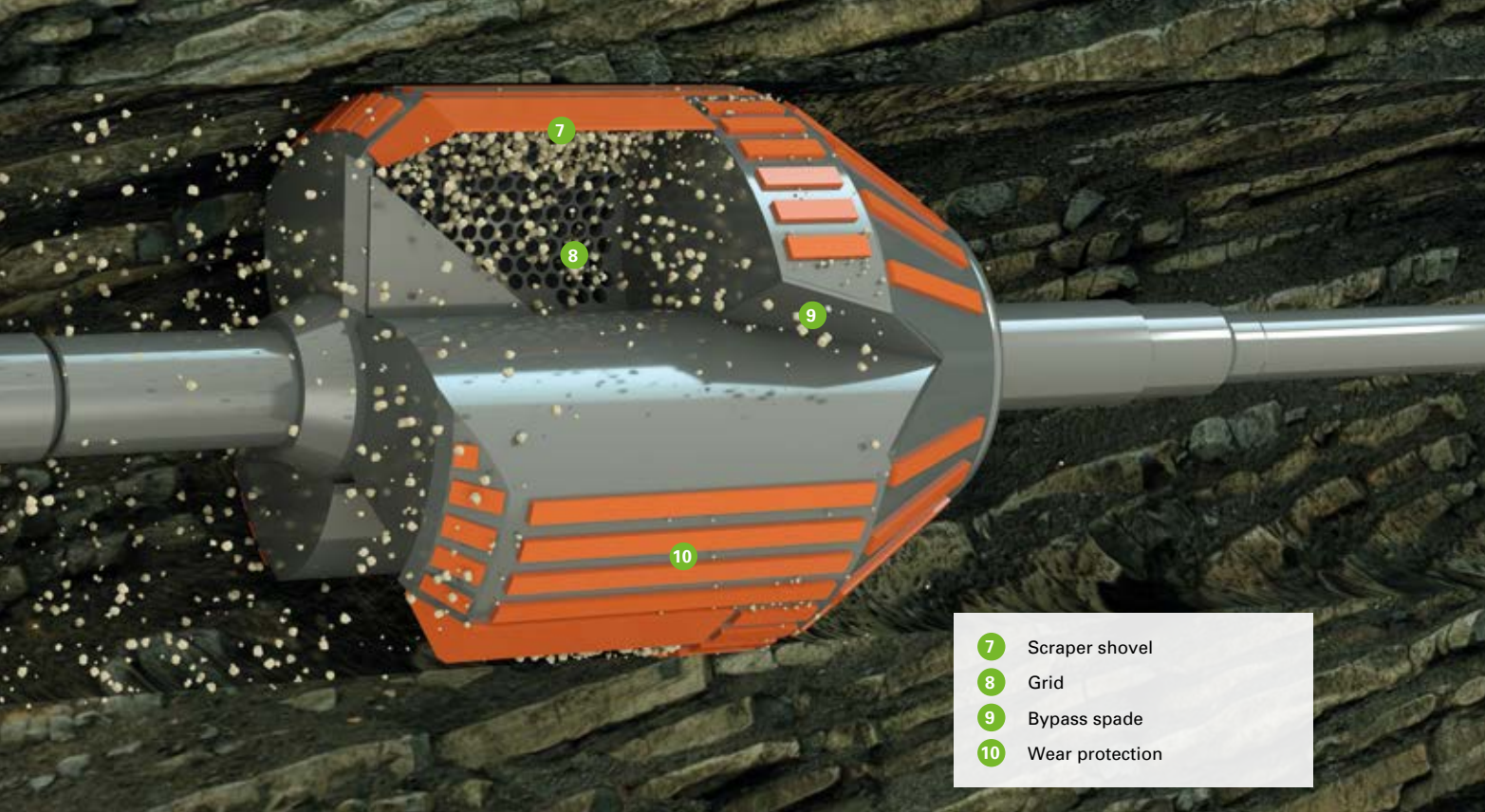
Modular design enables application in various ground conditions.

3 different cutter types:

- › TCI Cutter
- › Milled-tooth cutter
- › Milled-tooth cutter heavy duty

Wear-protected and pressure-compensated for a longer bearing lifetime.

Big bearing assembly and two point mounting allowing loads of up to 250kN per cutter.



- 7 Scraper shovel
- 8 Grid
- 9 Bypass spade
- 10 Wear protection

Down Hole Jet Pump New borehole cleaning tool

The recently developed Down Hole Jet Pump cleans the borehole and removes the cuttings directly inside the drill string.

To take up the material from the borehole, the Down Hole Jet Pump has three laterally placed vanes with an integrated grid. Rotation causes the cuttings to fall inside the pump. With the help of a jet pump system, they are pumped into the drill string and transported away inside it. Drilling companies can thus use simpler drilling fluid even with larger cuttings. Its only function remains the support and sealing of the borehole.

The Down Hole Jet Pump works with low suction at the grid. Thus, there is no risk of a negative pressure inside the borehole. Positive pressure is also not generated in comparison to conventional conveyance. The risk of frac-outs during reaming is thus also reduced. This tool can be used as a stand-alone cleaning tool in

existing boreholes and is available in all standard diameter ranges.

After the cleaning operation the borehole is almost completely clean.



Combining unique tools for quicker pipeline installations

In HDD projects, different combinations of the newly developed downhole tools from Herrenknecht can be used.

If required by the customer, all possible variations are conceivable with a parallel insertion of the prefabricated pipeline.

The advantages of the Full Face Hole Opener and Down Hole Jet Pump are especially apparent when they are used together. An existing pilot hole can be

reamed to the required final diameter in only one step. At the same time, an almost residue-free borehole is created and the risk of frac-outs is significantly reduced.

The new downhole tools from Herrenknecht thus offer drilling companies decisive advantages to improve the efficiency of their HDD projects.

Herrenknecht

A world leader in groundbreaking tunnelling technology.

Herrenknecht is a technology and market leader in the area of mechanized tunnelling systems. 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 3,100 project references, we are a market leader all around the globe.



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