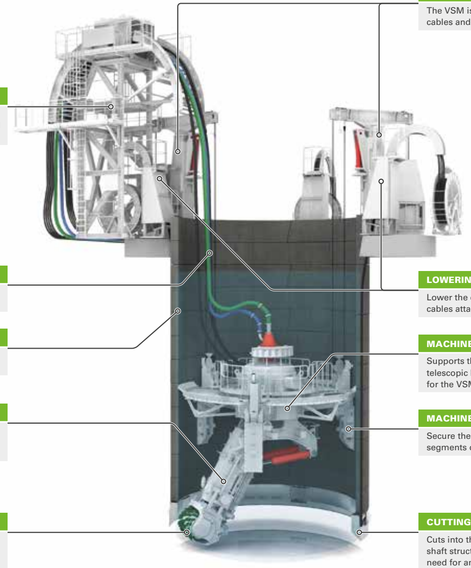
Herrenknecht shaft sinking solution
VSM advantages

- **Reliable:** planning reliability thanks to continuous performance even in difficult ground conditions
- **Accurate:** high accuracy of shaft dimensions and verticality due to constant monitoring of the excavation and sinking process
- **Efficient:** low wall thickness means less soil excavation and less concrete consumption, no groundwater lowering or ground treatment necessary
- **Quick:** simultaneous excavation and installation of final lining on the surface
- **Safe:** no personnel in the shaft and less working activities on site during sinking of the shaft
- **Flexible:** flexible arrangement due to modular equipment enables use even under tight inner-city space conditions

SAFETY FIRST
HIGH LEVEL OF SAFETY
no personnel in shaft during construction, less personnel in risk zones.

50% FASTER
CONSTRUCTION TIME
compared to conventional methods.

Functional principle



RECOVERY WINCHES
The VSM is recovered using steel cables and recovery winches

ENERGY CABLE TOWER
Guides the cables and hoses of the energy chain into the shaft – synchronized with lowering of the shaft structure

ENERGY CHAIN
Consists of all the supply lines between the VSM and the surface

SHAFT
Overall shaft lining made of reinforced concrete segments or in-situ concrete

TELESCOPIC BOOM
Due to hydraulic movability and telescopic adjustment, the entire cross-section of the shaft can be reached

CUTTING DRUM
Excavates the soil at the shaft bottom using chisel tools at high rotational speeds (max. 80 rpm)

LOWERING UNITS
Lower the entire shaft structure on steel cables attached to the shaft edge

MACHINE FRAME
Supports the rotary drive of the telescopic boom and the supply units for the VSM

MACHINE ARMS
Secure the VSM to the bottom segments of the shaft wall

CUTTING EDGE
Cuts into the soil when lowering the shaft structure – thus, eliminating the need for an overcut

Herrenknecht
A world leader in groundbreaking tunnelling technology

Herrenknecht is a professionally positioned and internationally oriented family enterprise. 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. Herrenknecht also manufactures state-of-the-art equipment for vertical and inclined drilling.
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 6,200 project references, we are a technology leader all around the globe.

HERRENKNECHT
Tunnelling Systems

HERRENKNECHT AG
77963 Schwanau
Germany
Phone +49 7824 302-0
pr@herrenknecht.com
www.herrenknecht.com

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PIONEERING UNDERGROUND TECHNOLOGIES

VERTICAL SHAFT SINKING MACHINES

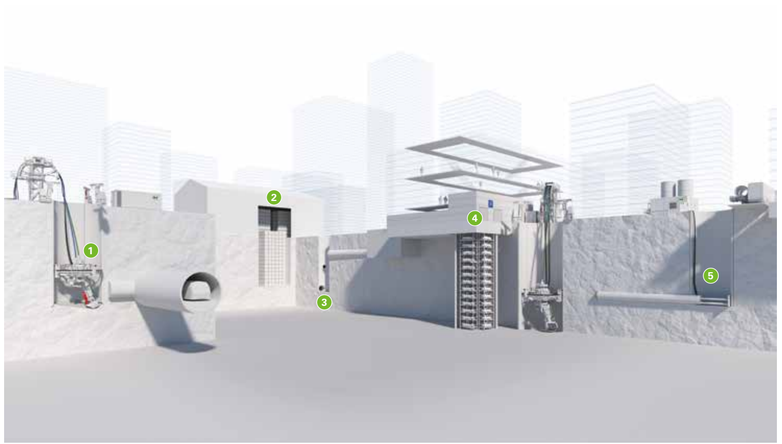
Shaft sinking for all ground conditions

HERRENKNECHT
Tunnelling Systems

Herrenknecht VSM

Mechanized shaft sinking in inner-city conditions

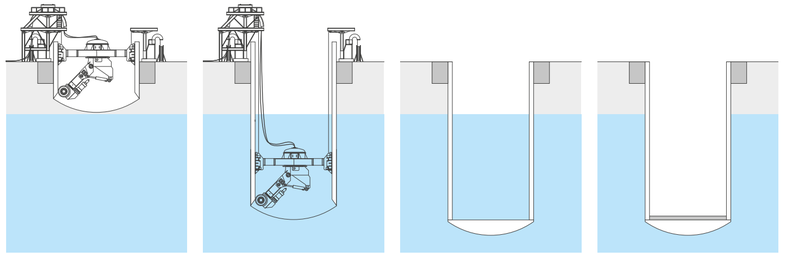
Herrenknecht's Vertical Shaft Sinking Machine (VSM) has been designed with a flexible and compact jobsite set-up for the reliable construction of vertical shafts in confined space conditions. The VSM technology shows its strengths particularly below groundwater and can be used in all ground conditions, with compressive strengths of up to 140 megapascal.
Shaft sinking with VSM has a wide range of applications. With diameters ranging from 4.5 to 18 meters, these shafts can serve as launch and reception shafts for tunnelling operations, as access and ventilation shafts for traffic tunnels, or as service and access points for all kinds of underground structures. Furthermore, deep shafts can be used for underground storage facilities and automated parking solutions, in so-called U-Park systems.
The VSM technology has been in operation in countless projects worldwide, covering the overall range of inner-city applications. Another focus of VSM is the mining industry, which is increasingly considering the VSM technology for the mechanized construction of deep shafts and pre-shafts for the exploration of deposits.



Application fields

1. Metro ventilation and emergency shafts
2. Storage shafts
3. Sewage collector shafts
4. U-Park® systems
5. Tunnelling shafts

The entire vertical shaft sinking process



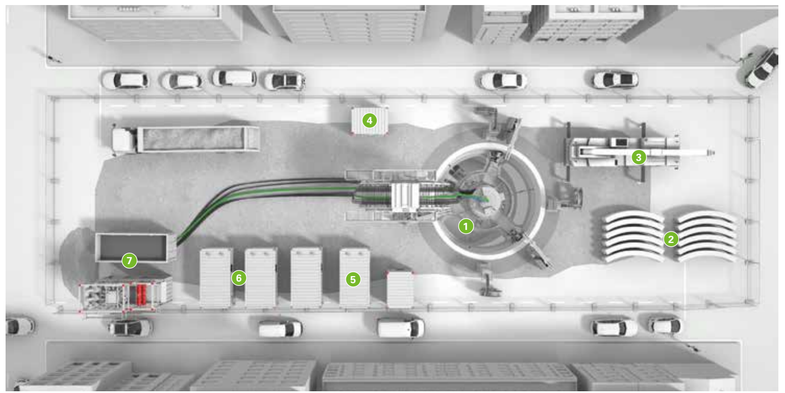
1. Jobsite setup; VSM installation in launch section.

2. Excavation and shaft sinking in parallel; VSM is working under groundwater level.

3. VSM recovery; installation of bottom plug; grouting of annulus.

4. Dewatering of shaft; construction of bottom plate.

Flexible jobsite setup of VSM equipment



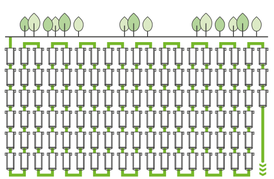
1. VSM machinery
2. Segment stock
3. Mobile crane
4. Control container
5. VSM power supply
6. Jobsite container
7. Separation plant

Technical specifications

	VSM9000	VSM12000	VSM15000	VSM18000
Diameter range (shaft ID in mm)	4,500–9,000	7,000–12,000	10,000–15,000	13,000–18,000
Max. cutting diameter	∅ 10.3 m	∅ 13.3 m	∅ 16.3 m	∅ 20.3 m
Excavation	partial-face or full-face excavation	partial-face or full-face excavation	partial-face excavation	partial-face excavation
Ground conditions	all kinds of ground conditions/mixed soil			
Rock strengths	≤ 140 MPa	≤ 140 MPa	≤ 140 MPa	≤ 140 MPa
Groundwater	with groundwater or without groundwater			
Shaft depth	≤ 450 m/50 bar	≤ 450 m/50 bar	≤ 450 m/50 bar	≤ 450 m/50 bar
Shaft lining	segments (concete, steel) or in-situ			
Removal of excavated material				
› hydraulic (slurry)	x	x	x	x
› pneumatic	–	x	x	x
› without	–	x	x	x
Min. required jobsite area	≥ 600 m²	≥ 800 m²	≥ 1,200 m²	≥ 3,000 m²
Installed power	891 kW	891 kW	968 kW	1,638 kW
Cutting drum				
› torque	80 kNm	80 kNm	80 kNm	300 kNm
› speed	0 U/min–60 U/min	0 U/min–60 U/min	0 U/min–60 U/min	0 U/min–60 U/min
› tools	96	96	96	193
Slurry circuit	400 m³/h	400 m³/h	400 m³/h	800 m³/h
Machine weight	68 t	75 t	85 t	195 t

VSM project references overview

MORE THAN
111 SHAFTS
were built with VSM by 2024.



OUTER DIAMETERS
≤ 12.8 m
were realized by 2024.
(Up to 20 m OD are possible.)

DEPTHS
≤ 115 m
were realized by 2024.
(Up to 450 m depth are possible.)