

Trenchless Innovations from Germany 

TRENCHLESS Romania
18th Mai 2016
Bukarest







Prof. Jens Hoelterhoff
President

German Society of Trenchless
Technology e.V. (GSTT)



Trenchless Innovations from Germany 

- PRT – Pipe Replacement Technology
- Inspection Technology
- CIPP - Cured-in-place pipe rehabilitation
- Jacking Pipes - vitrified clay pipes
- Pipe jacking and HDD Systems
- High speed pipe and cable plowing technology for open terrain
- Keyhole – Technology



Trenchless Innovations from Germany



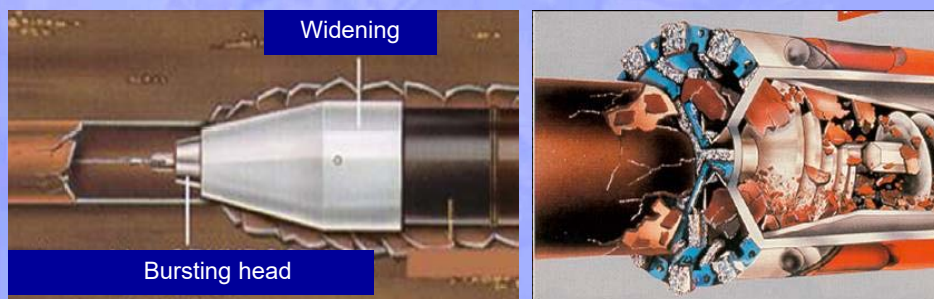
- PRT – Pipe Replacement Technology
- Inspection Technology
- CIPP - Cured-in-place pipe rehabilitation
- Jacking Pipes - vitrified clay pipes
- Pipe jacking and HDD Systems
- High speed pipe and cable plowing technology for open terrain
- Keyhole - Technology



PRT – Pipe Replacement Technology



So far only pipe bursting and modified micro tunneling systems (pipe-eating method) are available for a pipeline corridor, trenchless replacement of old pipelines.



**made
in
Germany**

A prerequisite to utilize this method is that the surrounding ground can be displaced; major increases of dimensions are often problematic or impossible.



**made
in
Germany**

technical perfected systems
...but too long construction time



Pipe Eating systems

The new inventive technology will especially be utilized when regular pipe - bursting can no longer be applied, because the soil cannot be displaced or because a necessary dimension enlargement is not sufficient displaced, or respectively if there is a guideline that the old pipe must be removed completely.

With this new technology it is possible to lower the construction time by 60 - 80%.

An Example: Advance length 60 meters, d = days

Pipe-eating method with slurry system:

set up 3.5 d, pipe eating 6.0 d, dismantling 2.0 d Σ 11.5 d

Pipe-eating method with guided auger system:

set up 2.5 d, pipe eating 6.0 d, dismantling 1.5 d Σ 10 d

The new Invention method with short pipes*:

set up 1.0 d, pulling process 2.5 d, dismantling 0.5 d Σ 4 d

*for example polymer concrete jacking pipe

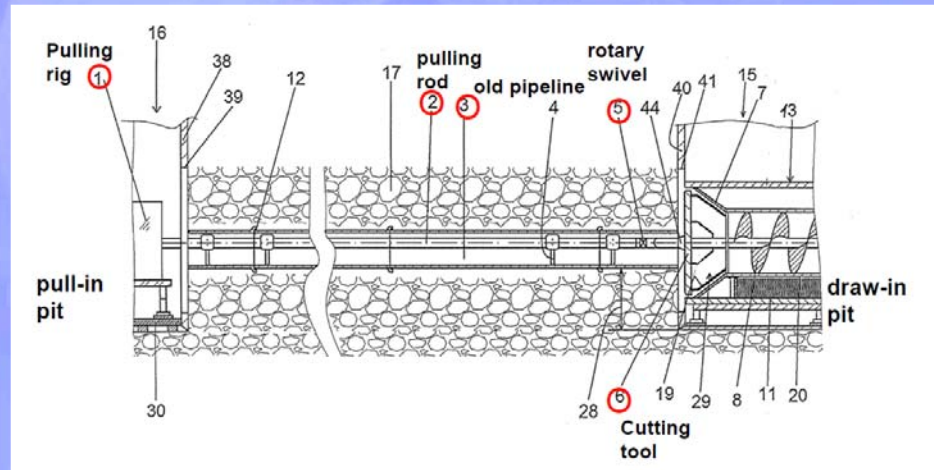
The new Invention method with PE Long pipes:

set up 1.0 d, pulling process 1.0 d, dismantling 0.5 d Σ 2.5 d

60 % - 80 % lower construction time!

PRT – Pipe Replacement Technology

made
in
Germany

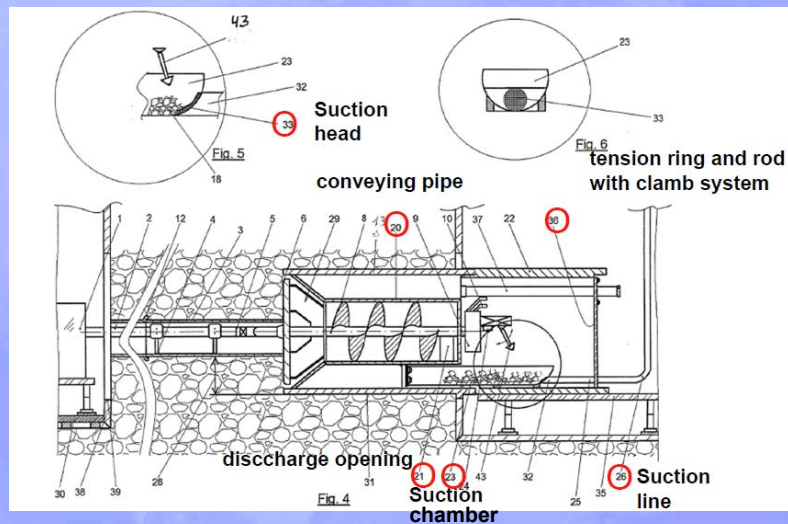


PROF. HÖLTERHOFF
INGENIEUR CONSULTING

GSTT

PRT – Pipe Replacement Technology

made
in
Germany



removal of drilled material is done with a suction excavator

PROF. HÖLTERHOFF
INGENIEUR CONSULTING

GSTT

PRT – Pipe Replacement Technology made in Germany

Computer-optimized sound-absorbing unit

efficient micromesh filter

patented separation system

standard radio remote control

high performance fan


resistant tilting container


integrated compressor

hydraulik driven Articulated hose carrier

Suction Excavator - patented suction principle


PROF. HÖLTERHOFF
INGENIEUR CONSULTING








Suction Excavators – a wealth of applications made in Germany

BUILDING SECTOR














EMERGENCY SERVICE













TREE RENOVATION





made in Germany

Suction Excavators – a wealth of applications

| | | | |
|-------------------|----------|------------------------|--|
| CIVIL ENGINEERING | | | |
| | DISPOSAL | | |
| | | CLEANING OF FLAT ROOFS | |

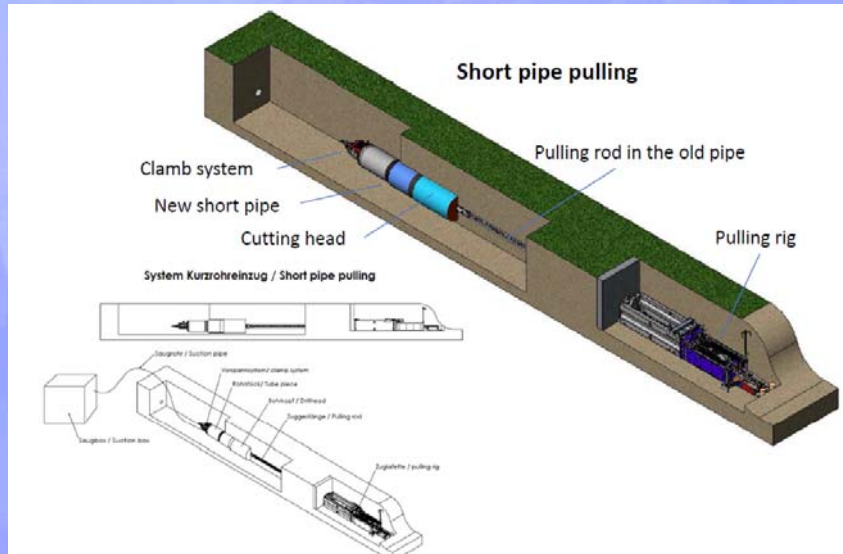
made in Germany

Suction Excavators – a wealth of applications

| | | | |
|-----------------|--|---------------------|------------------|
| | | BUILDING RENOVATION | |
| | | | OPEN CAST MINING |
| CHEMICAL PLANTS | | | |
| | | TRACK LAYING | |

PRT – Pipe Replacement Technology

made
in
Germany

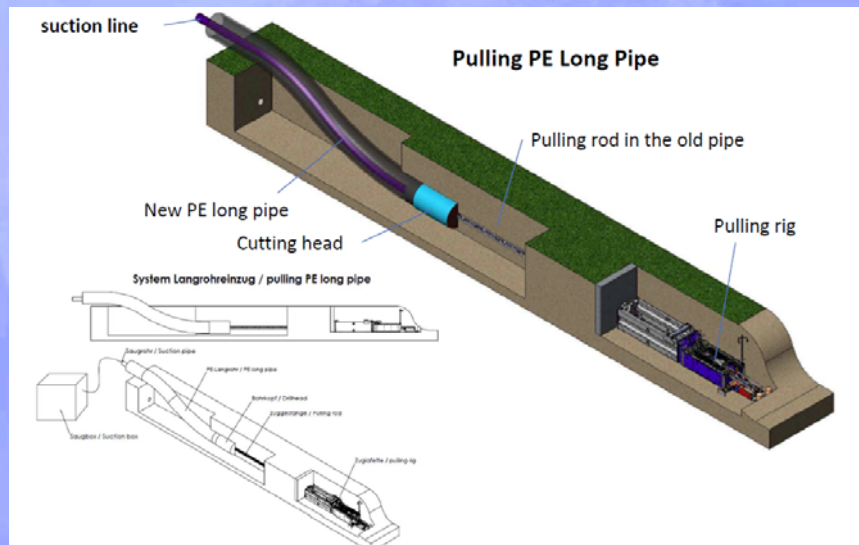


PROF. HÖLTERHOFF
INGENIEUR CONSULTING

GSTT

PRT – Pipe Replacement Technology

made
in
Germany




PROF. HÖLTERHOFF
INGENIEUR CONSULTING


GSTT

PRT – Pipe Replacement Technology


made
in
Germany




Pulling rig



Clamb system




Pulling rod




Hydraulic aggregate

A lot of the components can be used for other applicabilities (pipe bursting etc.)

PROF. HÖLTERHOFF
INGENIEUR CONSULTING

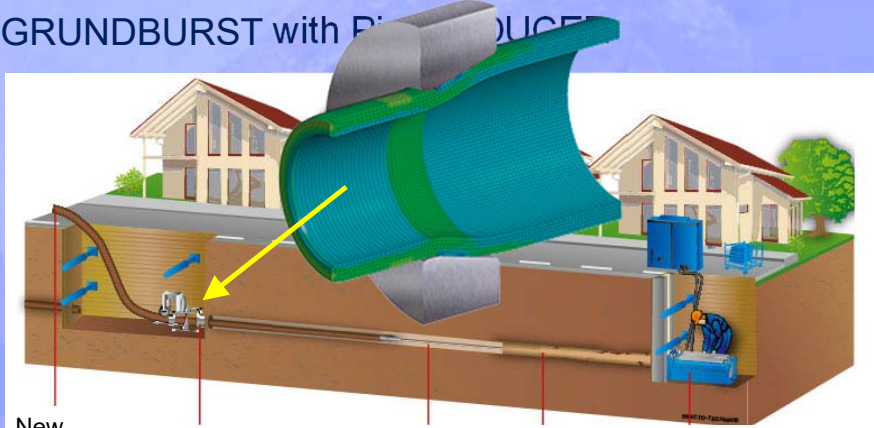




PE close-fit pipe lining

made
in
Germany

GRUNDBURST with PipeREDUCER



New
PE-pipe


PipeREDUCER


QuickLock rods

old pipe

GRUNDOBURST rig

In the process of pulling in, the PE pipe string is reduced by 5 - 12 %, due to cold deformation. When the pulling-in operation is completed, the pipe string can relax against the wall of the old pipe in a close fit (memory effect).





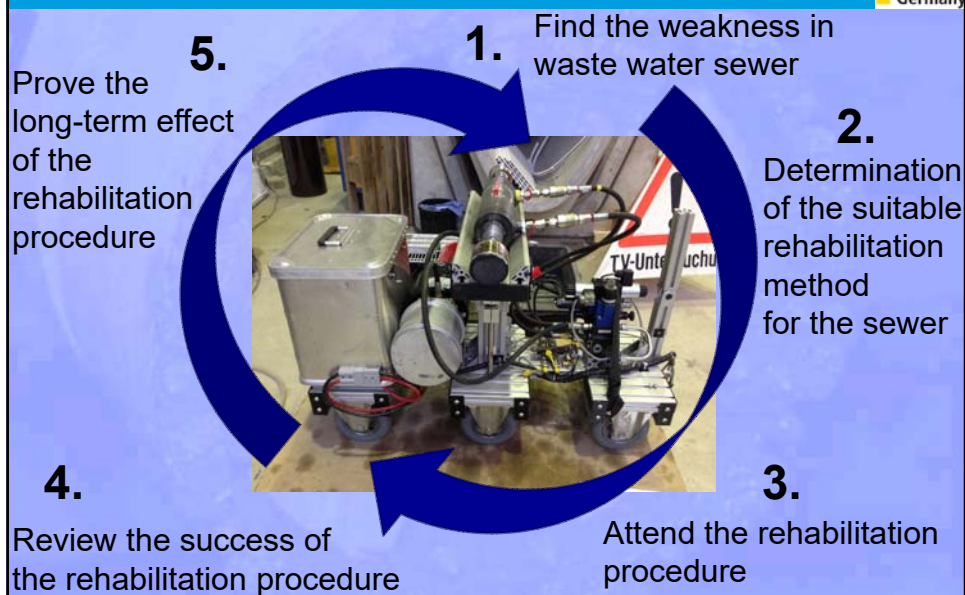
Trenchless Innovations from Germany



- PRT – Pipe Replacement Technology
- **Inspection Technology**
- CIPP - Cured-in-place pipe rehabilitation
- Jacking Pipes - vitrified clay pipes
- Pipe jacking and HDD Systems
- High speed pipe and cable plowing technology for open terrain
- Keyhole - Technology



The MAC method (**M**ecanique d'**A**uscultation des **C**onduits)



The MAC method (Mecanique d'Auscultation des Conduits)

made
in
Germany

Specification of the MAC system:

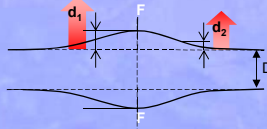
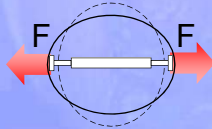
- To gauge the deformation force and the deformation trajectory

global stiffness:

$$K_G = F/d_1$$

Transfer factor:

$$\Omega = d_2/d_1$$



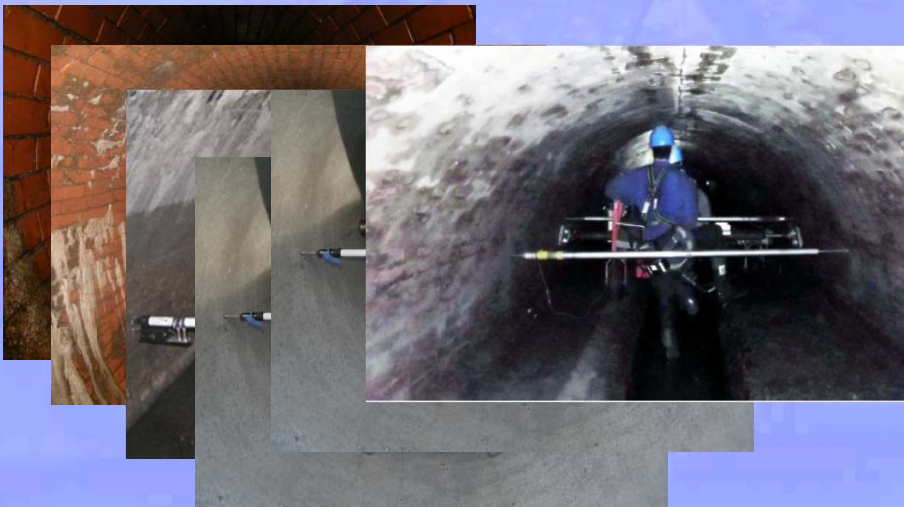
- Measuring **different types** of sewers
- Size of sewers: useable by **DN 800** to **DN 1500**
- Various **materials**: concrete, brick or synthetic
- **Non-destructive** method of measurement



The MAC method (Mecanique d'Auscultation des Conduits)

made
in
Germany

Target: Inspection and testing the stability of large pipes:



TV-Inspection - Electronical sewer mirror FastPicture

made in Germany




The new **FastPicture** camera was developed to quickly monitor the condition of the sewer.



Technical Properties:

- -camera (1920x1080)
- **FULL HD** 60 x (30 x optical / 12 x digital)
- Battery and mains operation power supply
- Recording with digital recorder (H.264) by USB

Some new options :


- Tilt angle -45°/+90°
- Gas-sensor
- Additional HDMI output
- Changable battery
- Tripod und harness
- Holder for drop manhole
- Sun shade





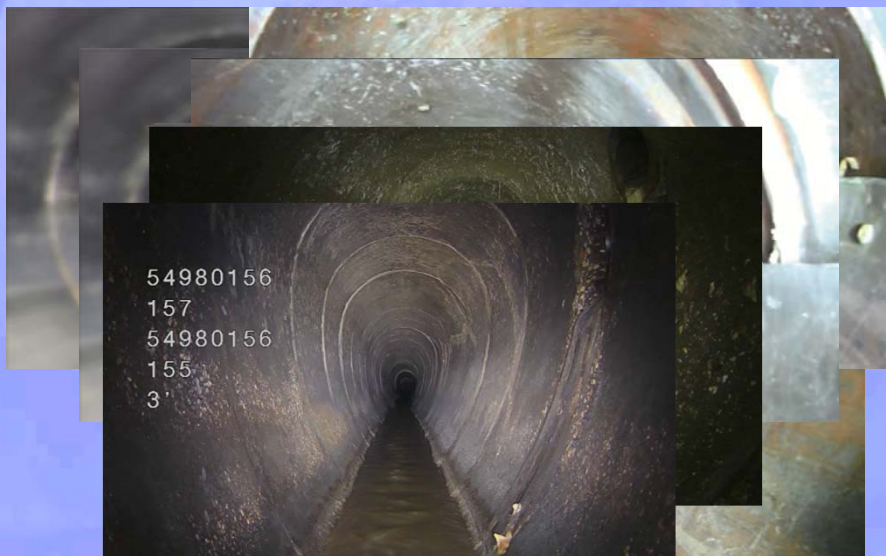
TV-Inspection - Electronical sewer mirror FastPicture

made in Germany







TV-Inspection for small diameter HD pushing with water

made
in
Germany

Pan & tilt camera, turn off able

Operating range DN 80 – 200

Able to negotiate bends
45° from DN 80

Able to negotiate bends
87° from DN 100

Camera diameter
56 mm

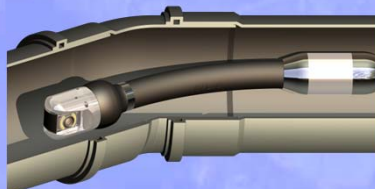
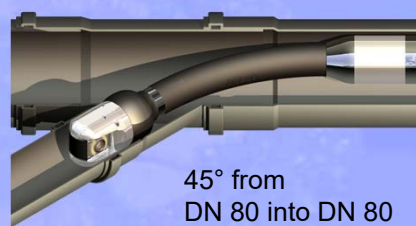
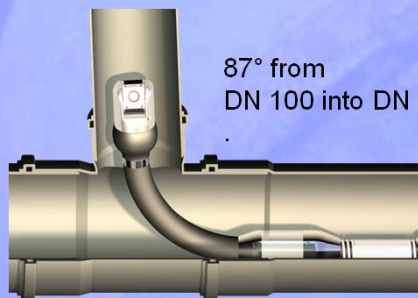


ritec

GSTT

TV-Inspection for small diameter HD pushing with water

made
in
Germany



Pan & tilt camera
head and unimpeded
view

ritec

GSTT

Trenchless Innovations from Germany



- PRT – Pipe Replacement Technology
- Inspection Technology
- CIPP - Cured-in-place pipe rehabilitation
- Jacking Pipes - vitrified clay pipes
- Pipe jacking and HDD Systems
- High speed pipe and cable plowing technology for open terrain
- Keyhole - Technology



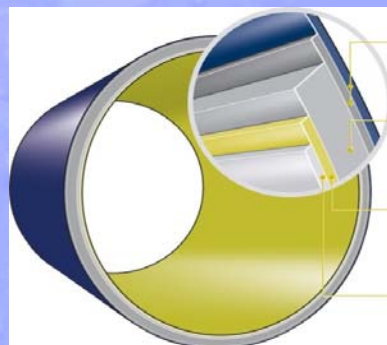
CIPP - Cured-in-place pipe rehabilitation with double wall



Alphaliner500G with double wall construction:

- A special, patented double wall construction
- Extremely tight, resin rich back wall with closed foil shell
- Covering of the structural load-bearing core of the Alphaliner
- Protection against environmental influences
- Perfect long-term safety
- Extension of the service life
- DIBt approval Z-42.3-447

Double wall and outer film
Structural thickness –
Statically relevant element
Defined wear protection layer
Removable inner film



RELINEEUROPE®



CIPP - Cured-in-place pipe rehabilitation up to 1800 mm

made
in
Germany

Alphaliner1800 for diameters up to DN 1800:

- Unique glass fibre material based on the innovative “Ultrapipe” ECR glass fibre
- Higher transparency, better and quicker curing
- Different layout of the random and transverse fibre orientation to create technical properties

| Alphaliner1800 | Technical data |
|---|----------------|
| Elastic modulus short-term value acc. DIN EN 1228 | 20380 MPa |
| Elastic modulus short-term value 5% quantile acc. DIN EN 1228 | 16304 MPa |
| Elastic modulus long-term value acc. DIN EN 1228 | 12445 MPa |
| Elastic modulus short-term value 5%- quantile acc. DIN EN ISO 178 | 13857 MPa |
| Bending strength short-term value 5% quantile acc. DIN EN ISO 178 | 280 MPa |
| Bending strength long-term value | 213 MPa |
| Reduction factor 50 years | 1,31 [-] |
| Wearout value as per CEN/TR 15729 | 0,23mm |
| Wear layer | 0,5mm |
| Grouping DWA-M 144-3 | MKG 24 |
| DIBt approval | Z-42.3-447 |

CIPP - Cured-in-place pipe rehabilitation - expandability

made
in
Germany

Job site - Berolina-Liner ID 800 [32 inch] 11,0 mm wall thickness

Before installation
of the Berolina-Liner

After installation
of the Berolina-Liner

Facts about BKP Berolina Polyester

- BKP Berolina provides individual solutions for trenchless gravity pipe rehabilitation.
- Available diameters 150 mm [6 inch] up to 1500 mm [60 inch] and wall thickness 3,5 mm up to 15,0 mm (Wall thickness over 15,0 mm on request and without peroxide).
- Range of expandability: manufactured with up to 5% undersize and expandable up to 5% oversize (in special cases even more).
- Liner length up to 400m (longest Berolina-Liner in 2014 ID 300 with 354 m) and cured by UV-light.



Benefit of the undersize

- No wrinkles in deformed pipes and offsets.
- Lateral connections easily detected.
- Reduction and prevention of annular gaps between host pipe and the liner (corrosion in concrete pipes can increase its diameter).
- Static design formulas allow only very limited gaps. Annular gaps dramatically influence the loading capability of a CIPP.



CIPP - UV curing technology

The innovative GRP-Liner for the trenchless rehabilitation of sewer pipes with the world's **highest** mechanical properties up to **DN 1600**

- Extremely high mechanical properties
- Better handling through lower weight
- Shorter curing time
- Even more economical
- Approved by DIBt Z-42.3-350

| | |
|---|--------------------------------|
| ▪ Short-term circumferential E-Modul (ring stiffness) | ≥ 20,500 N/mm ² |
| ▪ Long-term circumferential E-Modul (ring stiffness) | 16,000 N/mm² |
| ▪ Short-term bending E-Modul (three-point bending) | ≥ 16,800 N/mm ² |
| ▪ Short-term bending strength (three-point bending) | ≥ 270 N/mm ² |
| ▪ Long-term bending strength (three-point bending) | 210 N/mm ² |
| ▪ Reduction factor A after 10 000 h | 1.28 |
| ▪ Dimension range | DN 150 - 1,600 mm |
| ▪ Wall thickness in cured condition | 3 - 15 mm |

Also available with internal coating as solid ingredient:
SAERTEX-LINER® Premium Type S*



CIPP - UV curing technology for Drinking Water

SAERTEX-LINER® H₂O

The world's first curable GRP-Liner for the trenchless rehabilitation of potable water pipes: **Third party approved, environmentally friendly & sustainable!**

Structural classification of the Liner

- according to DIN EN ISO 11295 / AWWA M28

Certifications:

- NSF / ANSI Standard 61
- DVGW – W 270 and KTW Guideline,
- Ordinance 2914:2011

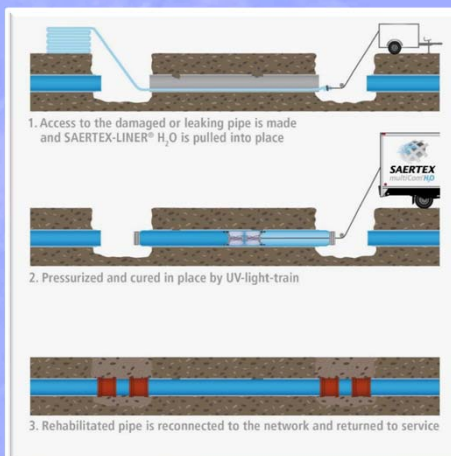
Due to high mechanical properties

- Very thin walls are used
- High pressure applications are possible

Diameter range

- 8 - 48 in (200 - 1200 mm)

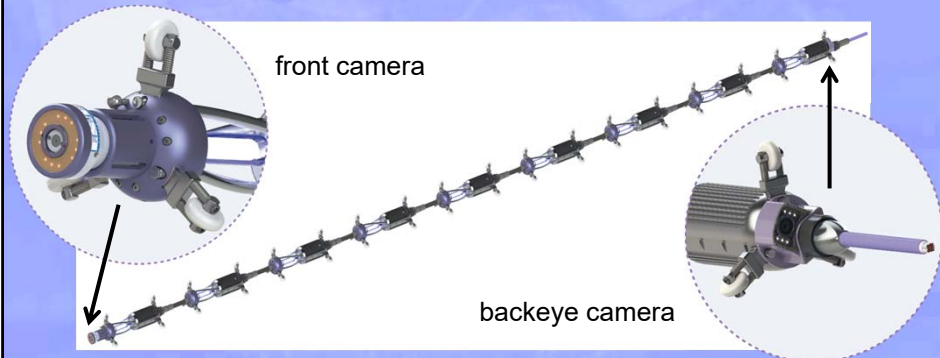
The Liner can withstand external and internal pressure, including a vacuum



New UV System for Renovating Drinking-water Pipelines



With the revolutionary **nVision** concept for light curing of drinking-water pipelines, I.S.T. is putting a patent-protected technology on the market that allows for cables up to 1,000 meters in length.



New UV System for Renovating Drinking-water Pipelines



nVision

- All of the benefits at a glance:

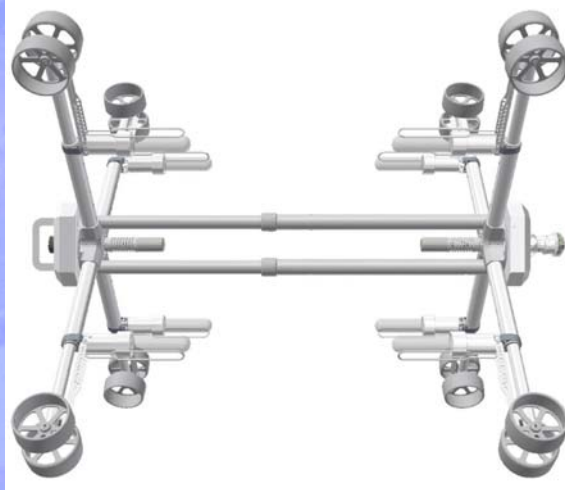
- Revolutionary ignition technology
- Cables can be extended up to 1,000 meters
- Cuts the control cabinet size by more than half
- No temperature problems for the cable or cable drum
- Infinitely variable output of up to 2,000 watts per beam
- Simultaneous video recording of front and backeye camera images
- Optimal quality control for the curing process at every liner position
- The individual modules of the light chain can be plugged in anywhere
- BUS system for constant data transmission of all curing parameters



UV-Core DN 1100 -1600

made
in
Germany

- Light core with 8 UV-bulbs
(opt. 16 UV-bulbs,
750 watts each)
- 1200 / 1500 watts
per bulb
- (12 KW total output)
- electric driven set-up
of the single core
- manual extension
for optimum
illumination



IBG HydroTech®
Cleaning • Robotic • WPT
Lining Systems

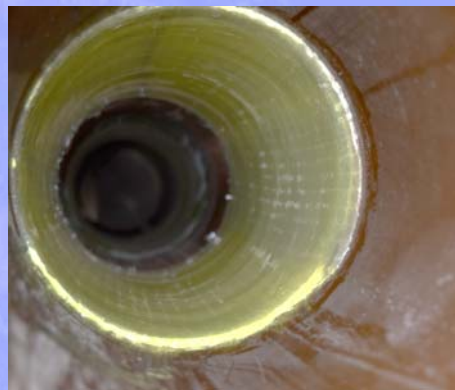
CSTT

UV-Patch System for short liners

made
in
Germany

allows the rehabilitation of
damaged pipe sections
From DN 150-600 (6" – 24")

- max. occupancy with short
liners up to 100 cm (40")
- 3 UV-bulbs (250 watts each)
- articulated joint for better
inserting through manhole
into the channel
- curing time of only 8 minutes



IBG HydroTech®
Cleaning • Robotic • WPT
Lining Systems

CSTT

Multi Tophat cap placement-system

made
in
Germany

for lateral rehabilitation in in main pipes from
DN 250-600 (10" – 24")

Flexible system to use for:

1. cold-curing
top-hat profiles
with silicate resins
2. top-hat profiles
with epoxy resins
(incl. heating shield)
3. UV-curing
with UP-resin
(polyester)



IBG HydroTech®
Cleaning • Robotic • WPT
Lining Systems

CSTT

STREET TO HOME

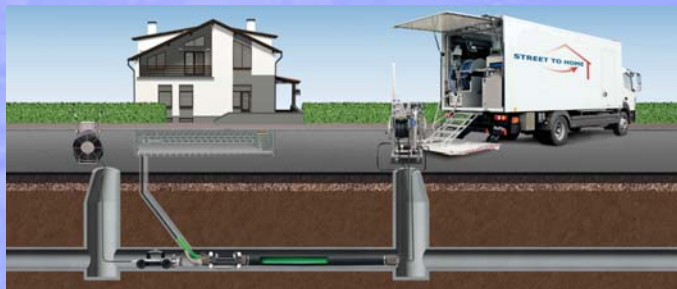
made
in
Germany

for lateral relining from of the main pipe

The system allows inverting GRP-Liner against flow direction
with open-end-method :

Positioning unit and inversion unit are placed into the main
pipe (> DN 250 relined)
from two opposing manholes.

From there,
after coupling
of the units,
the rehabilitation
of the lateral
(> DN100) is
carried out.



IBG HydroTech®
Cleaning • Robotic • WPT
Lining Systems

CSTT

CIPP – Lateral detector made in Germany

IBAK – Lateral Detector Sensor system for locating branches in rehabilitated sewer pipes

Proceeding: An antenna is routed along the liner wall.
The output signal of the sensor changes depending on the structure detected behind the wall.

The diagram illustrates the IBAK Lateral Detector system. It shows a cross-section of a main pipe with a branch and an embedding. A lateral detector is shown inside the main pipe, with an antenna extending towards the branch. A graph below shows the U/V signal profile along the route, with a peak corresponding to the branch location.

IBAK robotics **GSTT**

CIPP – Lateral detector made in Germany

IBAK – Lateral Detector Sensor system for locating branches in rehabilitated sewer pipes

With this innovative technology it is possible to locate and cut open branches (size DN 80 or larger) to be opened after liner insertion.

The image shows the IBAK Lateral Detector robot, a small, white, cylindrical device with a red antenna and a black base. It is designed to be inserted into a pipe to detect and cut open branches.

IBAK robotics **GSTT**

Gefördert durch:
Bundesministerium für Wirtschaft und Energie
aufgrund eines Beschlusses des Deutschen Bundestages

CIPP – Lateral detector



IBAK – Lateral Detector

Sensor system for locating branches in rehabilitated sewer pipes

The sections graphic from the camera inspection serves as basis

- it is not necessary to scan the entire pipe again.

It is possible to find dry branches as well as those with water behind the liner.

The operator receives a visual reference of where the optimal opening point is.

- 1st step: it can be marked with a marking device that is adapted on the cutter robot
- 2nd step: the cutter automatically moves to the optimal opening point, and thus it can be reliably opened



LATERAL PREPARATION SYSTEM



SEWER to LATERAL (STL)

WORLDWIDE UNIQUE SATELLITE SYSTEM

for cutting, inspection and cleaning

from main sewer (DN 200-600) to lateral (DN 100-150)

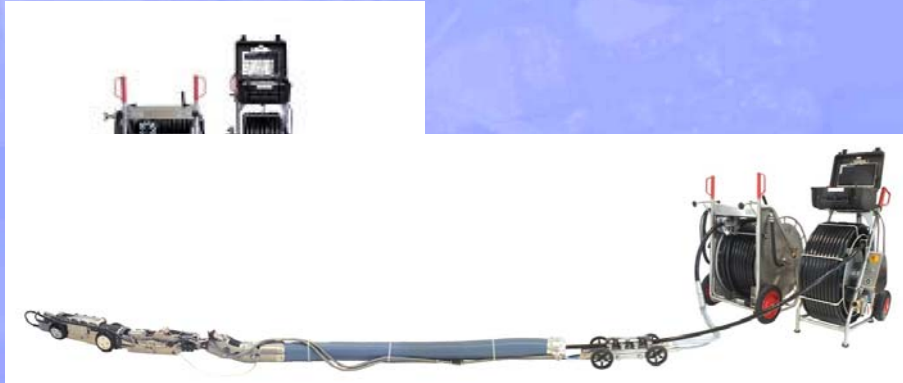


LATERAL PREPARATION SYSTEM

made
in
Germany

SEWER to LATERAL (STL)

WORLDWIDE UNIQUE SATELLITE SYSTEM
for cutting, inspection and cleaning
from main sewer (DN 200-600) to lateral (DN 100-150)

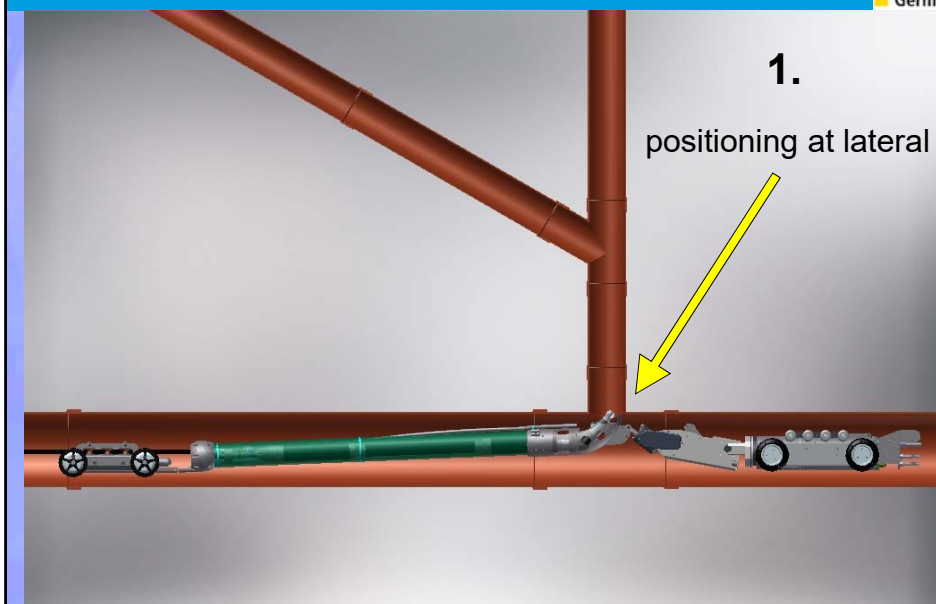


IMS
Robotics

GSTT

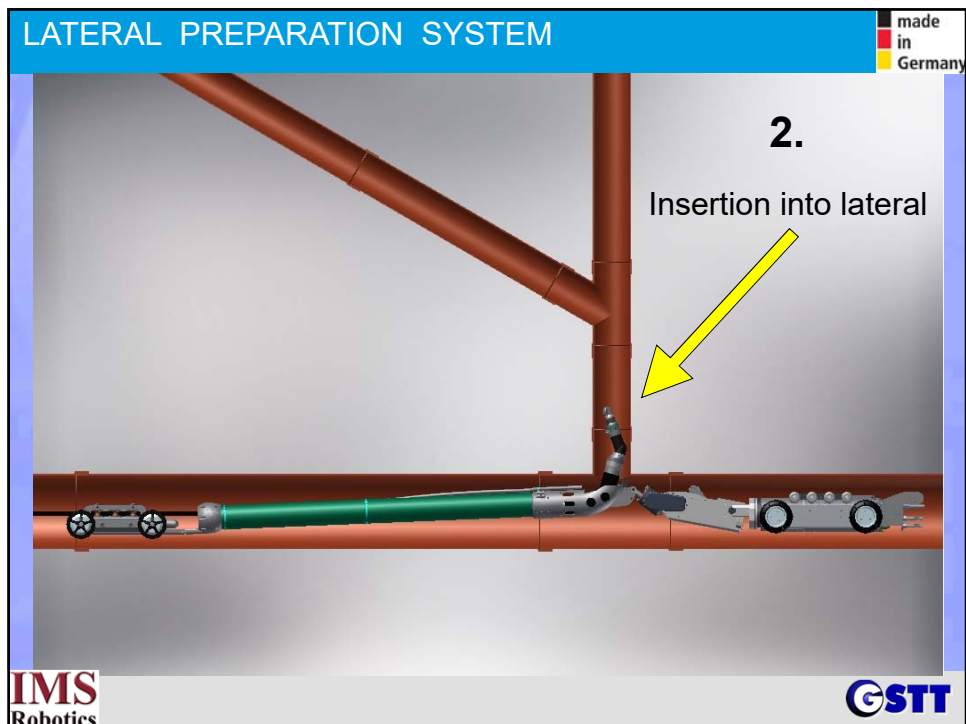
LATERAL PREPARATION SYSTEM

made
in
Germany



IMS
Robotics

GSTT





Trenchless Innovations from Germany

made in Germany

- PRT – Pipe Replacement Technology
- Inspection Technology
- CIPP - Cured-in-place pipe rehabilitation
- **Jacking Pipes - vitrified clay pipes**
- Pipe jacking and HDD Systems
- High speed pipe and cable plowing technology for open terrain
- Keyhole - Technology

CSTT

Jacking Pipes - vitrified clay pipes



INTERMEDIATE JACKING STATION FOR VITRIFIED CLAY JACKING PIPE DN 1200

- second Job site: Peine (Germany), Dungenbeck
- Length 260 m, DN 1200
- ground condition: gravel, sand and ground water level 0,5m under earth surfaces
- construction company: STRABAG Germany



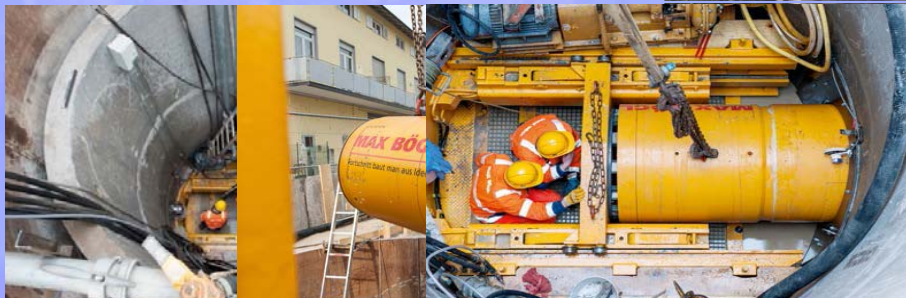
**STEINZEUG
KERAMO**

GSTT

Jacking Pipes - vitrified clay pipes

Mikrotunnelling with slurry systems

- Bolzano Italy
- 1200 m DN 800
- Difficult soil conditions, gravel and big stones
- Reinforced concrete caisson shafts
- construction company: MAX BÖGL (branch Schwabach) Germany



GSTT

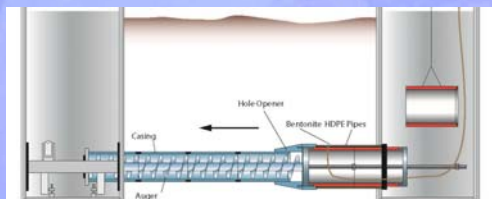
Trenchless Innovations from Germany



- PRT – Pipe Replacement Technology
- Inspection Technology
- CIPP - Cured-in-place pipe rehabilitation
- Jacking Pipes - vitrified clay pipes
- **Pipe jacking and HDD Systems**
- High speed pipe and cable plowing technology for open terrain
- Keyhole - Technology

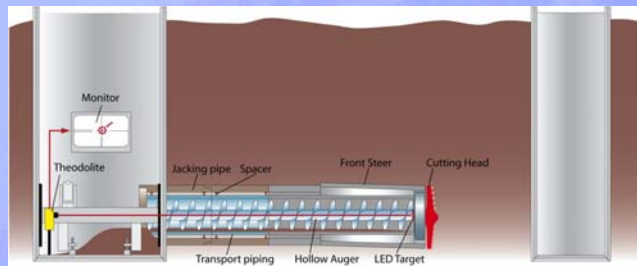


Hole Opener for Pulling Plastic Pipes on Line and Grade



Guided Auger Boring with Front Steer and Inner Pipe Transport inside of Hobas OD860

made
in
Germany

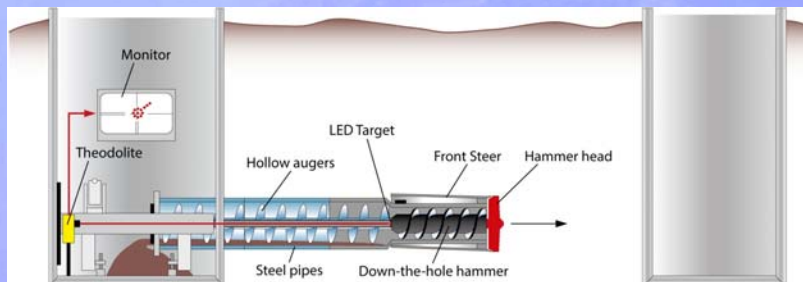


Bohrtec

GSTT

Guided Auger Boring with Front Steer and Optical Path in Extremest Ground Conditions

made
in
Germany



Bohrtec

GSTT

Trenchless Innovations from Germany

made
in
Germany

Bentonite lubrication with VOLUME CONTROL

Advantages of volume control in lubrication:

- Optimizes lubrication volume on specific tunnel sections according to geology
- Controls distribution of bentonite along the tunnel
- reduces jacking forces
- minimizes the use of intermediate jacking stations
- saves time and money
- Visualization on control panel and reporting of bentonite volume, pressure and friction forces



Trenchless Innovations from Germany

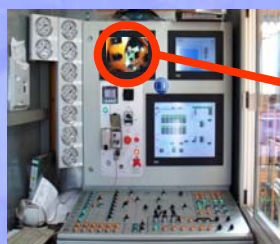
made
in
Germany

CAMERA SYSTEM in excavation chamber

- Suitable for Utility Tunnelling machines ID 1600-3000
- Camera with cleaning system and lighting installed in the upper part of excavation chamber
- Visualization on monitor in control container
- Visual check of cutting tools and conditions in excavation chamber
- Better planning of tool exchange and man entry

Work safety:

- Evaluation of the tunnel face stability before man entry
- Monitoring of working personnel in the excavation chamber

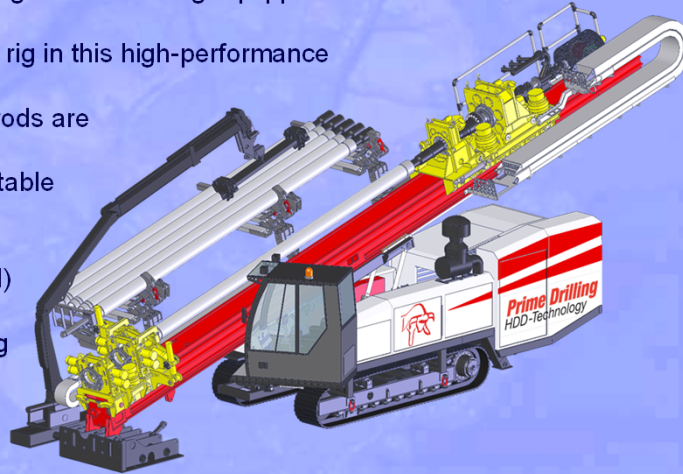


HDD - Rock Drilling Rig

made
in
Germany

with Prime Double Rod System and „on board“ pump

- HDD-Compact Rig for rock drilling equipped with double rod magazine
- First rock drilling rig in this high-performance category (> 50 t)
- Inner and outer rods are independently
- driven by two flatable rotary heads
- high torque (up to 90,000 kN)
- Use of any common locating system possible
- Application with standard drill pipes



 Prime Drilling
HDD-Technology

 GSTT

HDD - Rock Drilling Rig

made
in
Germany



 Prime Drilling
HDD-Technology

 GSTT

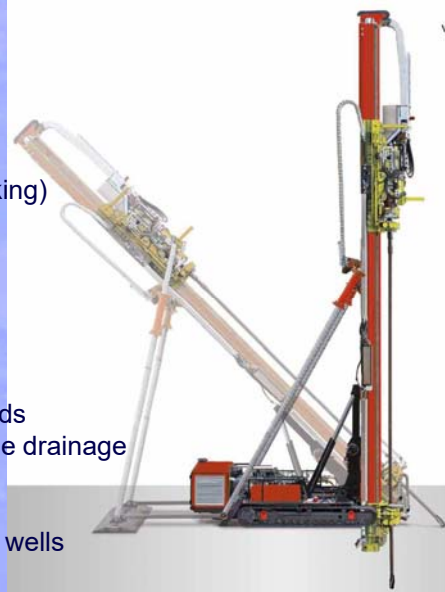
MDD – Rigs 0° - 90° (Multi Directional Drilling)

made
in
Germany

up to 5,000 kN pull force (500 t)
up to 120 kNm torque

Typical applications:

- recovery of inactive oil and gas wells
- recovery of operational wells (sidetracking)
- hydro-geological purposes
- production of other natural resources
- geological prospecting purposes
- exploration of crude hydrocarbons
- installation of pipelines
- mine rescue operations
- preliminary decontamination of coal beds
- preliminary decontamination of methane drainage
- arrangement of sea gates
- arrangement of discharge lines
- capital repairs of producing oil and gas wells



Prime Drilling
HDD-Technology

GSTT

Trenchless Innovations from Germany

made
in
Germany

- PRT – Pipe Replacement Technology
- Inspection Technology
- CIPP - Cured-in-place pipe rehabilitation
- Jacking Pipes - vitrified clay pipes
- Pipe jacking and HDD Systems
- High speed pipe and cable plowing technology for open terrain
- Keyhole - Technology

GSTT

High speed pipe and cable plowing technology for open terrain



Hydraulic spider plow unit

pulling winch,
pulling force up to 160 t

For power and broadband cables over long distances as well as water and gas pipes up to 355 mm OD (in soft soils up to 450 mm OD) Daily performance (meters installed) with a plowing unit can exceed 5,000 m with only a small start and construction pit



High speed pipe and cable plowing technology for open terrain



Applicable also in difficult terrain



High speed pipe and cable plowing technology for open terrain

made
in
Germany



Applicable also in difficult terrain

FRANK
FÖCKERSPERGER

GSTT

Trenchless Innovations from Germany

made
in
Germany

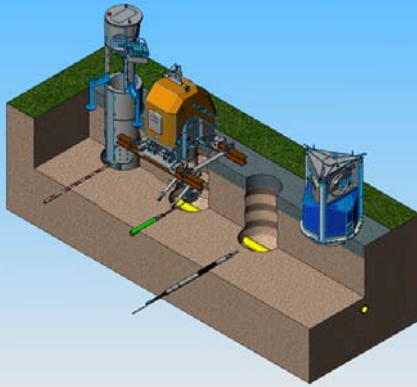
- PRT – Pipe Replacement Technology
- Inspection Technology
- CIPP - Cured-in-place pipe rehabilitation
- Jacking Pipes - vitrified clay pipes
- Pipe jacking and HDD Systems
- High speed pipe and cable plowing technology for open terrain
- Keyhole - Technology

GSTT

Keyhole-Technology + Trenchless Technique

made
in
Germany

A Tiny Circle - the Construction Pit of the Future



Application range:

- installation of new property service connections with non-directional **GRUNDOMAT impact moles**
- installation of new property service connections with the directional drill rig **GRUNDOPIT-K**
- replacement of new property service connections with the cable winch **GRUNDOTUGGER**
- sleeve sealing of cast iron and steel lines
- repair of high pressure PE pipe lines
- insertion of survey slots
- pipe line inspection
- corrosion protection sacrificial anodes

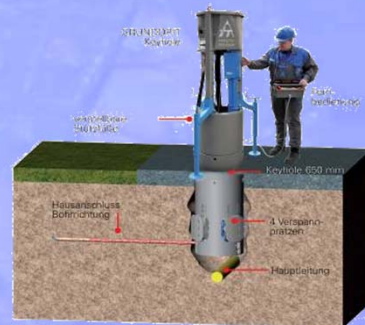
Where the keyhole technique is applied, surface damage and consequential costs only too well known from open trench installation methods are insignificant. The performance of soil and surface works is safer, more productive and less elaborate. Inspection of the construction pit is not required.



Keyhole-Technology + Trenchless Technique

made
in
Germany

Establishing a keyhole using a core drill



- the core drill CD 650 bores a hole of 650 mm in diameter in the road surface.
- after all other jobs are done, the bore core yielded in this working step is reinserted into the road surface, fitting perfectly.
- a suction excavator takes up the soil covering the main line
- installation of the Pit K rig and performance of the bore with wall duct into the basement
- connection with the main line is carried out above the surface.



Trenchless Innovations from Germany



We invite you, to visit the NO DIG BERLIN 2017 in conjunction with WATER BERLIN INTERNATIONAL.
Here you can see life the newest Trenchless Innovations from Germany



Symposium and Exhibition
28 – 31 March 2017
www.NODIGBERLIN.com
Berlin Exhibition Grounds

More than 500 Visitors will
transported with 20 busses to
more than 15 sitesites



Trenchless Innovations from Germany



Thank you for your attention

Prof. Jens Hoelterhoff
President

German Society of Trenchless
Technology E.V. (GSTT)

Messedamm 22
D – 14055 Berlin
Tel.: +49 30 3038-2143
FAX: +49 30 3038-2079
E-Mail: info@gstt.de
Internet: www.gstt.de

