

Trenchless Innovations from Germany

made  
in  
Germany

**TRENCHLESS ASIA 2016**  
9<sup>th</sup> Mai 2016  
Kuala Lumpur



2016  
**TRENCHLESS  
ASIA**

Prof. Jens Hoelterhoff  
President

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

**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**

## Trenchless Innovations from Germany



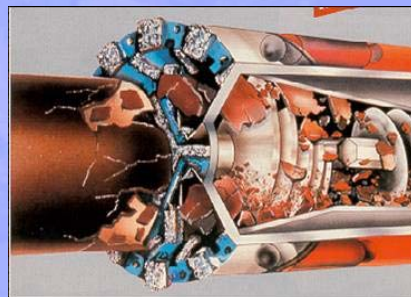
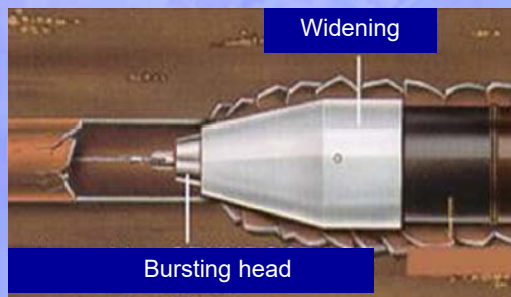
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## PRT – Pipe Replacement Technology



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

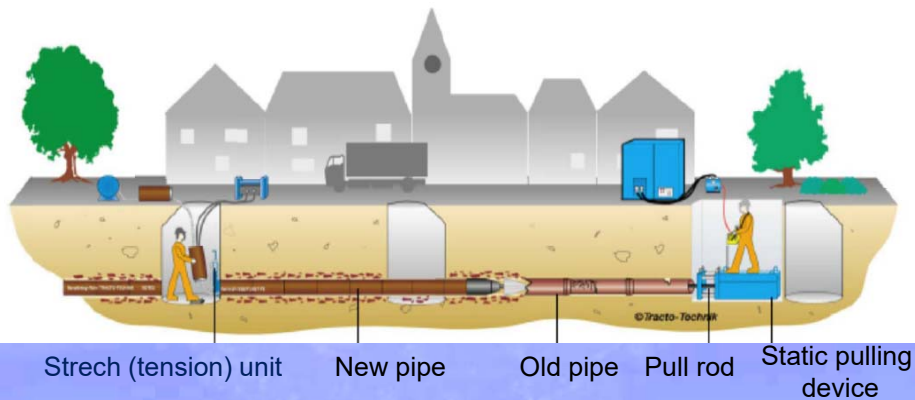


## PRT – Pipe Replacement Technology

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### Pipe bursting method

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



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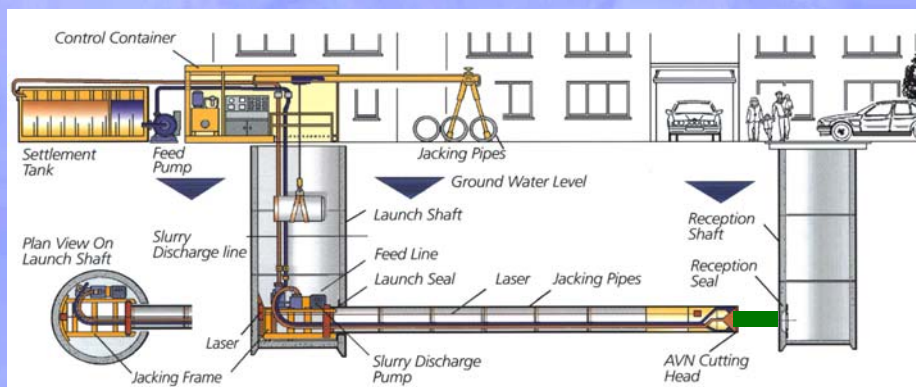
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## PRT – Pipe Replacement Technology

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### Pipe Eating systems

technical perfected systems  
...but too long construction time



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## 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       $\Sigma$  11.5 d

Pipe-eating method with guided auger system:

set up 2.5 d, pipe eating 6.0 d, dismantling 1.5 d       $\Sigma$  10 d

The new Invention method with short pipes\*:

set up 1.0 d, pulling process 2.5 d, dismantling 0.5 d       $\Sigma$  4 d

\*for example polymer concrete jacking pipe

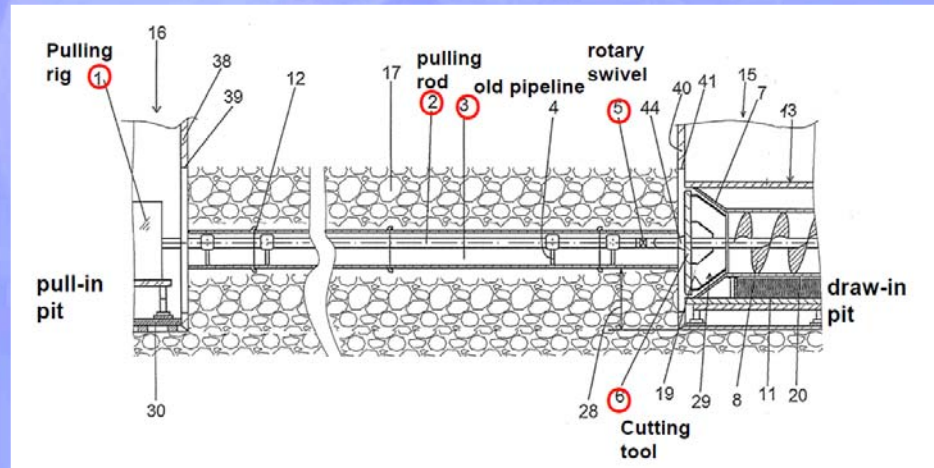
The new Invention method with PE Long pipes:

set up 1.0 d, pulling process 1.0 d, dismantling 0.5 d       $\Sigma$  2.5 d

60 % - 80 % lower construction time!

## PRT – Pipe Replacement Technology

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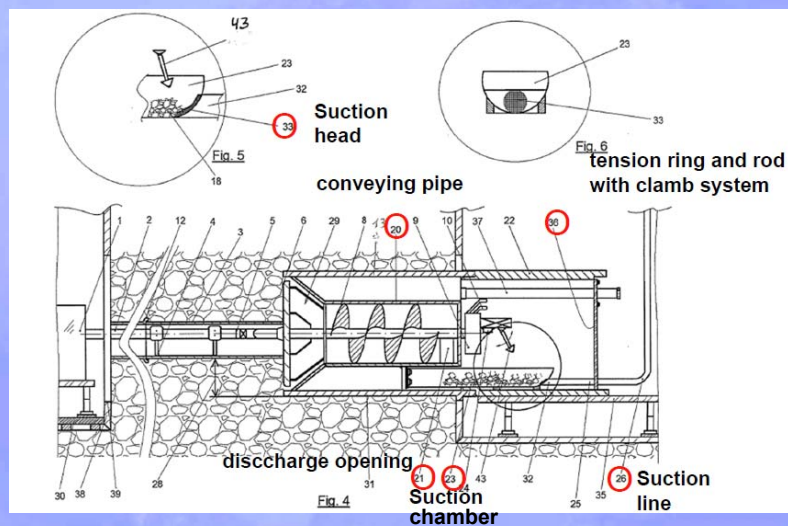


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## PRT – Pipe Replacement Technology

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removal of drilled material is done with a suction excavator

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**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

hydraulic driven Articulated hose carrier

Suction Excavator - patented suction principle

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**Suction Excavators – a wealth of applications** made in Germany

BUILDING SECTOR

EMERGENCY SERVICE

TREE RENOVATION

Suction Excavators – a wealth of applications

made in Germany

CIVIL ENGINEERING

DISPOSAL

CLEANING OF FLAT ROOFS

Suction Excavators – a wealth of applications


made in Germany

BUILDING RENOVATION

OPEN CAST MINING

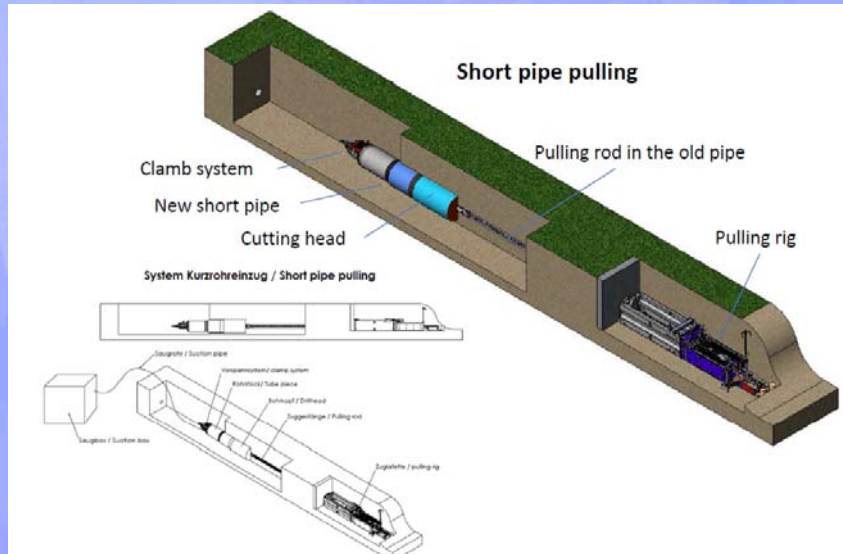
CHEMICAL PLANTS

TRACK LAYING

## PRT – Pipe Replacement Technology

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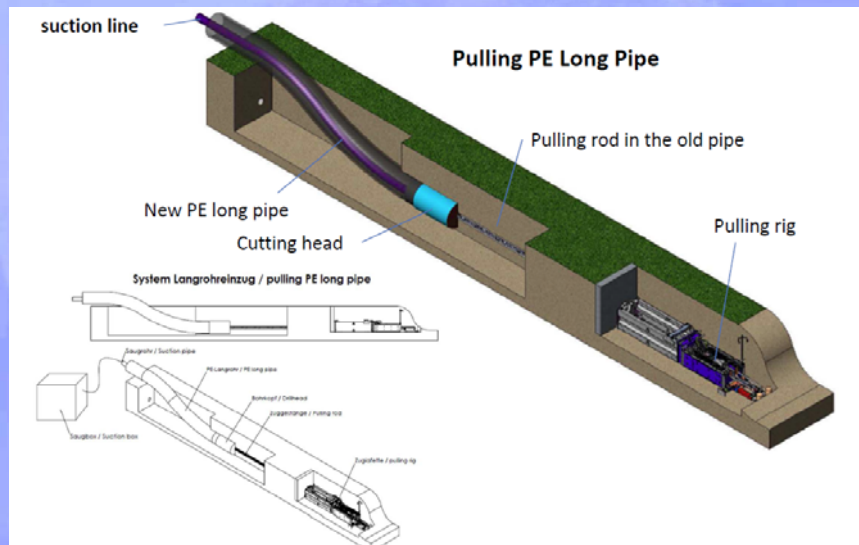


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## PRT – Pipe Replacement Technology

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## PRT – Pipe Replacement Technology


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Pulling rig



Clamb system




Pulling rod




Hydraulic aggregate

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

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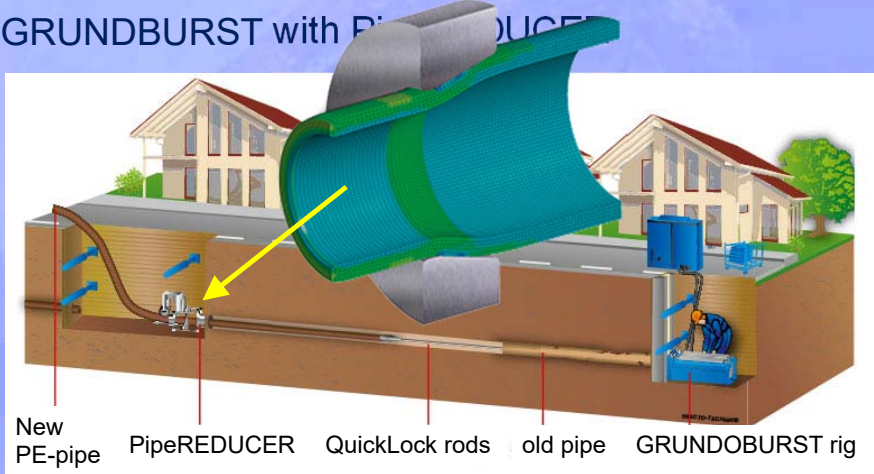




## PE close-fit pipe lining


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### GRUNDBURST with PipeREDUCER



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).

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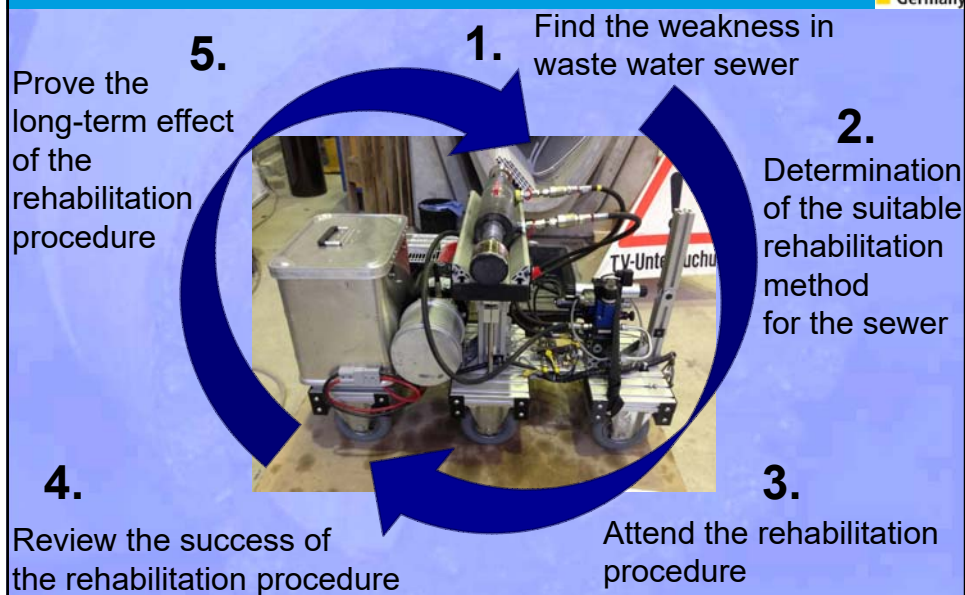
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## The MAC method (Mecanique d'Auscultation des Conduits)



## The MAC method (Mecanique d'Auscultation des Conduits)

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Specification of the MAC system:

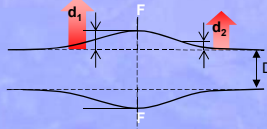
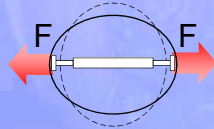
- To gauge the deformation force and the deformation trajectory

global stiffness:

$$K_G = F/d_1$$

Transfer factor:

$$\Omega = d_2/d_1$$



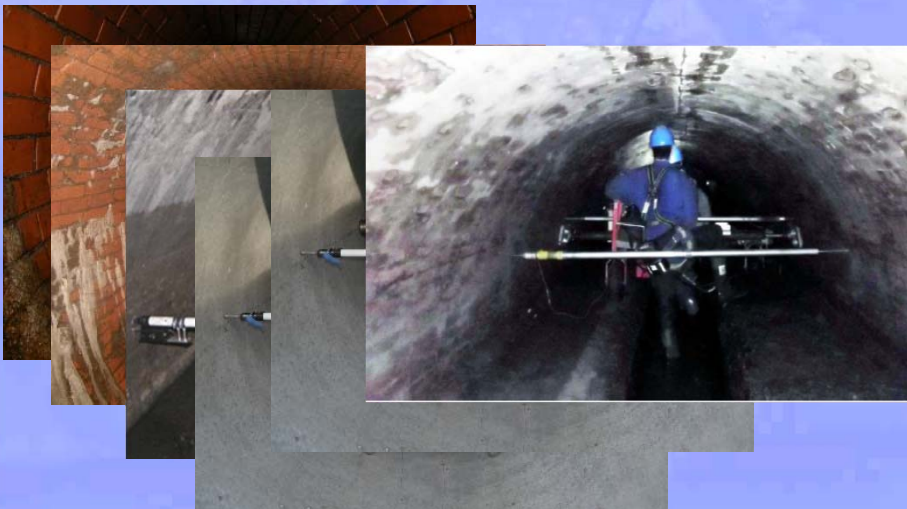
- Measuring **different types** of sewers
- Size of sewers: useable by **DN 800** to **DN 1500**
- Various **materials**: concrete, brick or synthetic
- **Non-destructive** method of measurement



## The MAC method (Mecanique d'Auscultation des Conduits)

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Target: Inspection and testing the stability of large pipes:





## TV-Inspection - Electronical sewer mirror FastPicture

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


made  
 in  
 Germany






## TV-Inspection - Electronical sewer mirror FastPicture

made  
 in  
 Germany



54980156  
 157  
 54980156  
 155  
 3'



## 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

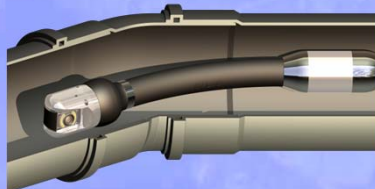
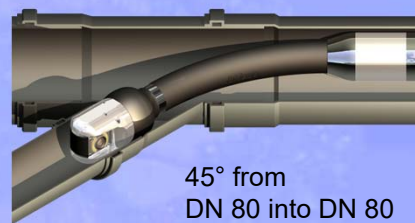
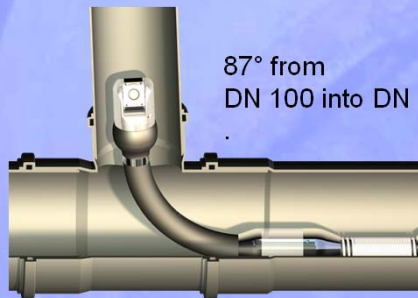


ritec

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## TV-Inspection for small diameter HD pushing with water

made  
in  
Germany



Pan & tilt camera  
head and unimpeded  
view

ritec

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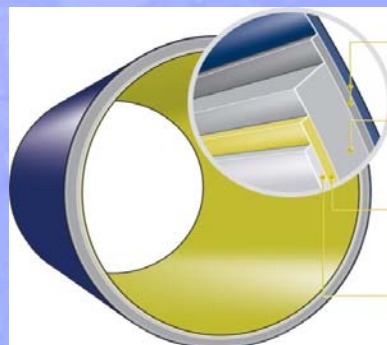
## CIPP - Cured-in-place pipe rehabilitation with double wall



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

SL 11.1 m HR 3:00- HP -0\*†

## 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 <sup>2</sup>     |
| ▪ Long-term circumferential E-Modul (ring stiffness)  | <b>16,000 N/mm<sup>2</sup></b> |
| ▪ Short-term bending E-Modul (three-point bending)    | ≥ 16,800 N/mm <sup>2</sup>     |
| ▪ Short-term bending strength (three-point bending)   | ≥ 270 N/mm <sup>2</sup>        |
| ▪ Long-term bending strength (three-point bending)    | 210 N/mm <sup>2</sup>          |
| ▪ 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® H<sub>2</sub>O

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

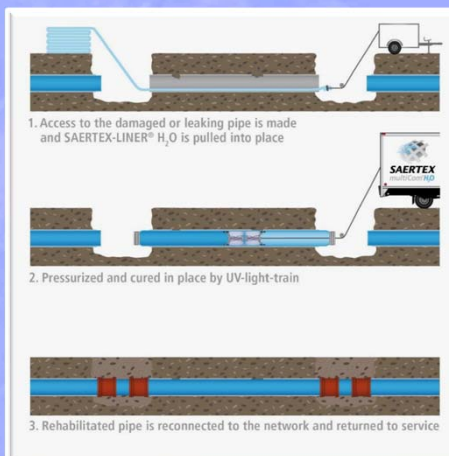
Due to high mechanical properties

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

Diameter range

- 8 - 48 in (200 - 1200 mm)

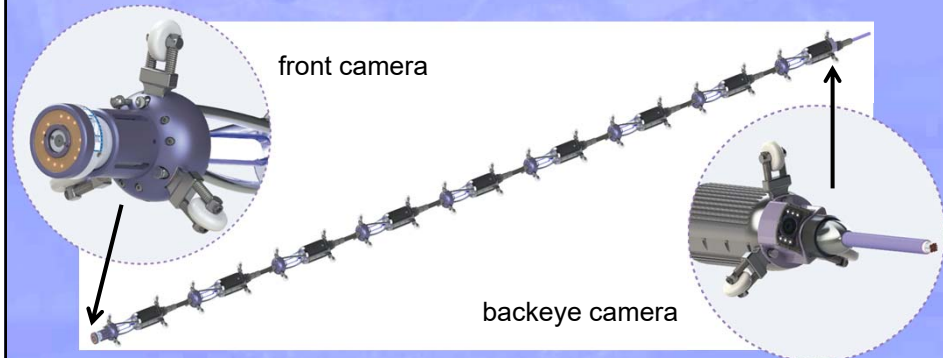
The Liner can withstand external and internal pressure, including a vacuum



## 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

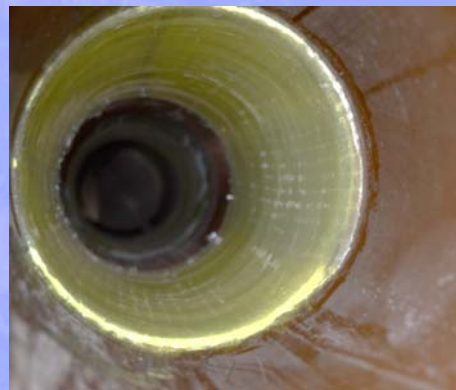
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## UV-Patch System for short liners

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



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Lining Systems

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## 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)



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Lining Systems

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## STREET TO HOME

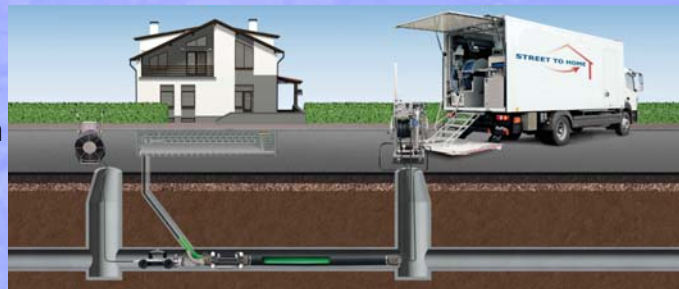
made  
in  
Germany

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.



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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.

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.

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

IBAK robotics GSTT

## 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.

- 1<sup>st</sup> step: it can be marked with a marking device that is adapted on the cutter robot
- 2<sup>nd</sup> 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  
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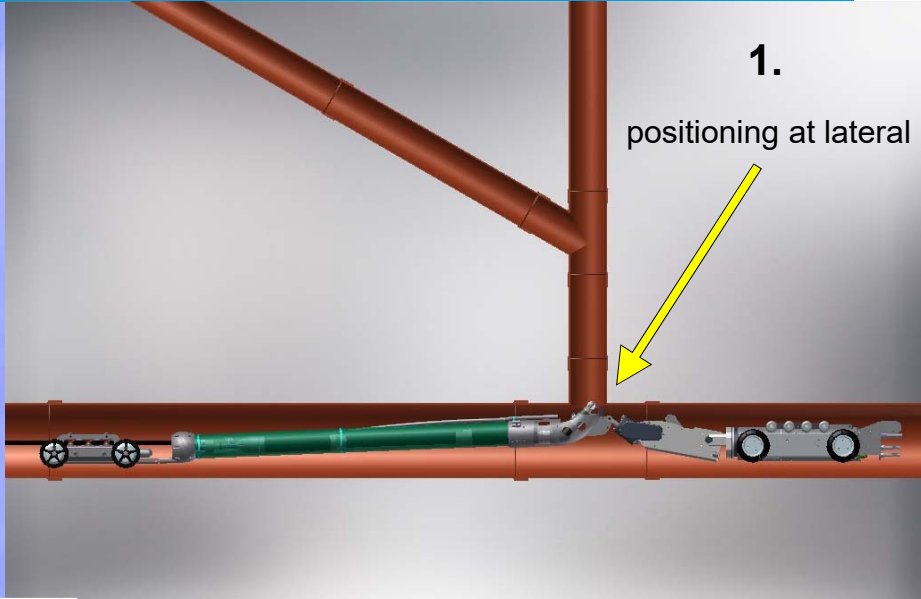



LATERAL PREPARATION SYSTEM


made  
in  
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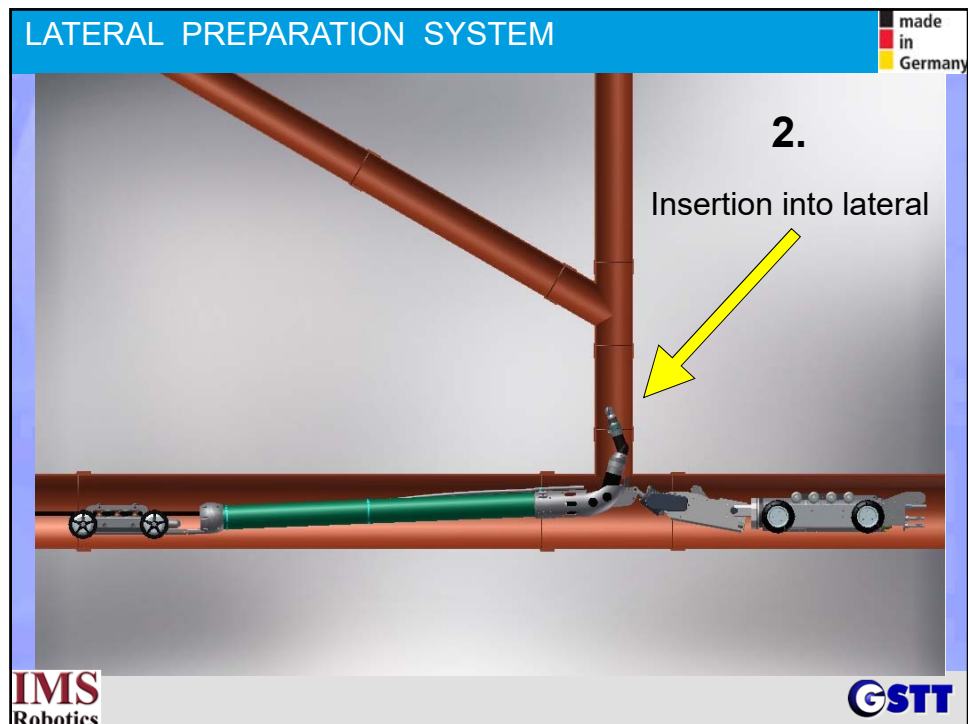
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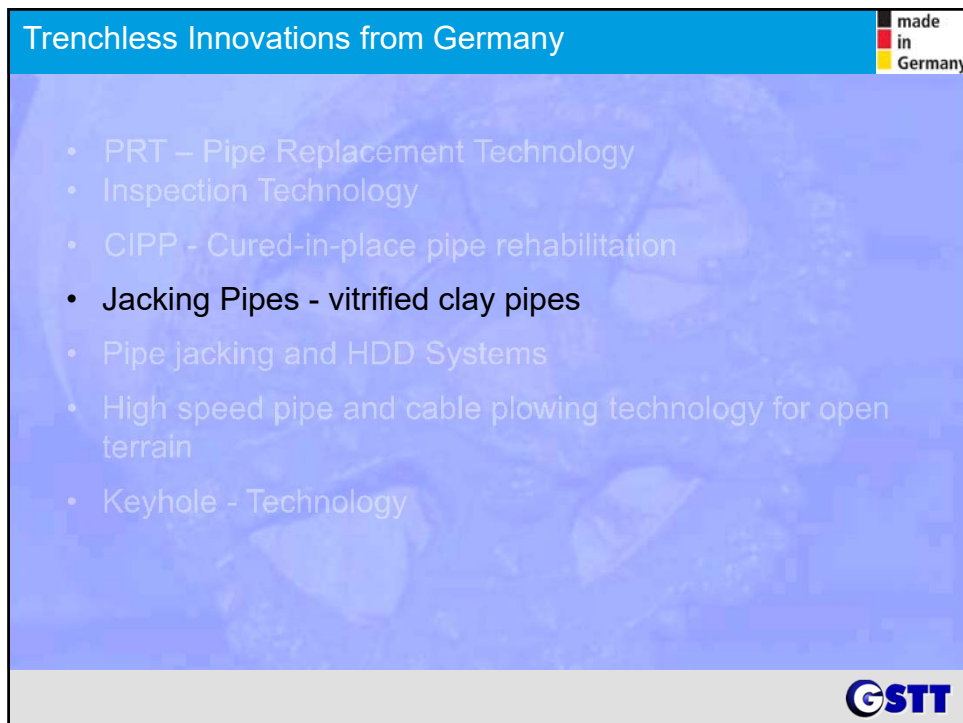












## Jacking Pipes - vitrified clay pipes



### 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



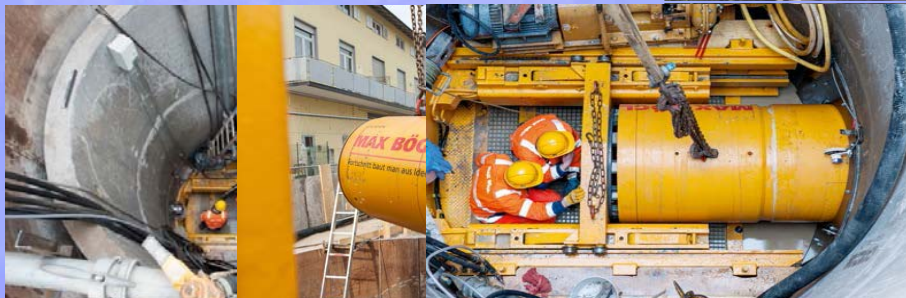
**STEINZEUG  
KERAMO**

**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**

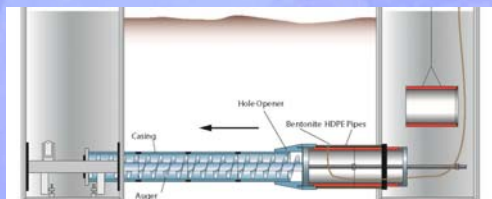
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- High speed pipe and cable plowing technology for open terrain
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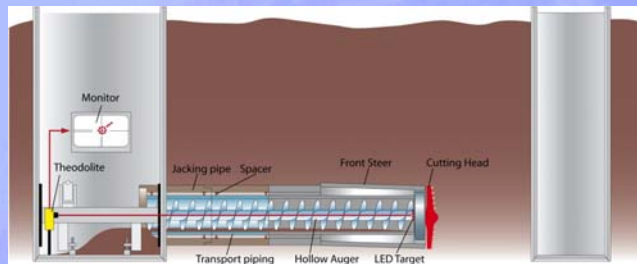
## Hole Opener for Pulling Plastic Pipes on Line and Grade





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

made  
in  
Germany

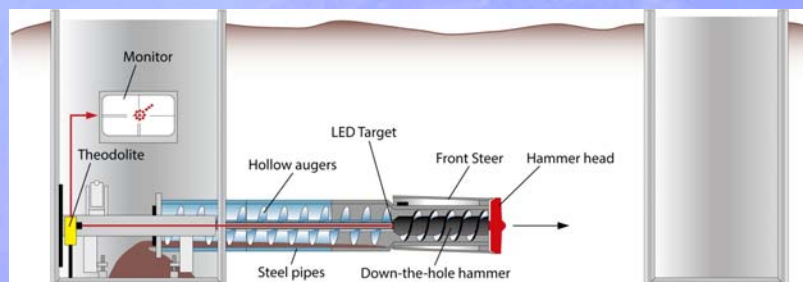


**Bohrtec**

**GSTT**

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

made  
in  
Germany



**Bohrtec**

**GSTT**



### 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

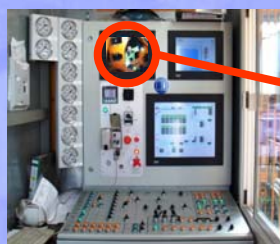


### CAMERA SYSTEM in excavation chamber

- 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

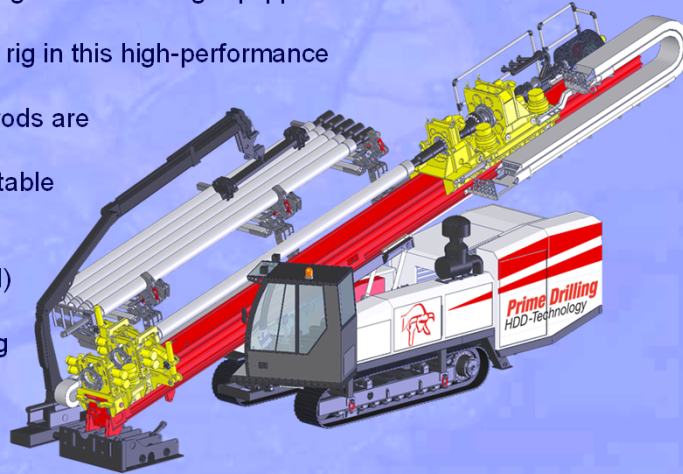


## HDD - Rock Drilling Rig

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**

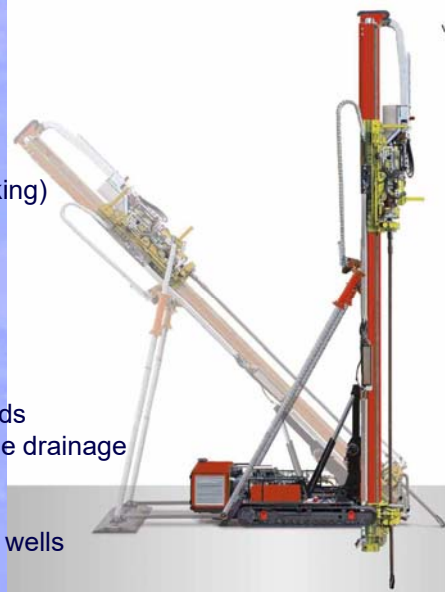
## MDD – Rigs 0° - 90° (Multi Directional Drilling)

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**  
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## 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

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in  
Germany

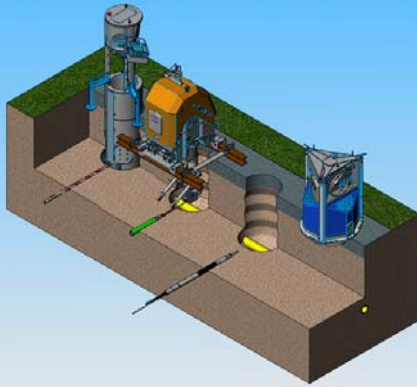
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**GSTT**

## 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

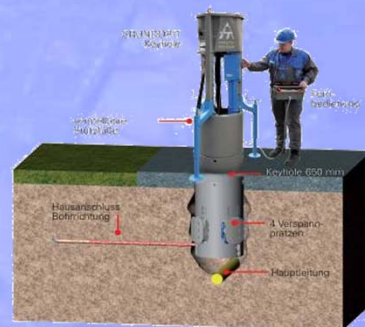
Where the keyhole technique is applied, surface damage and consequential costs only too well known from open trench installation methods are insignificant. The performance of soil and surface works is safer, more productive and less elaborate. Inspection of the construction pit is not required.



## Keyhole-Technology + Trenchless Technique

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### 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](http://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](mailto:info@gstt.de)  
Internet: [www.gstt.de](http://www.gstt.de)

