

PANTA RHEI

ALLES FLIESST – EVERYTHING FLOWS – LES EAUX VIVES – TUTTO SCORRE – VŠETKO PLYN LES EAUX VIVES – TUTTO SCORRE – VŠETKO PLYNIE – VŠE PLYNE – TODO FLUYE – WSZYST



A REVOLUTION IN PIPELINE CONSTRUCTION A STURDY AND CORROSION-RESISTANT PIPE SYSTEM FOR THE USE IN OPEN TRENCH - MICROTUNNELING -AND JACKING APPLICATIONS

With PERFECT PIPE begins a new era for sanitary sewerage systems. By combining all the advantages of the robust concrete pipe – it is a structure - with the corrosion resistance of high-density polyethylene (HDPE) liner we have created the technically ideal pipe. The concrete-HDPE composite pipe meets all the essential requirements of a modern, durable sewerage system.

- Resistant against chemical attacks lasting acid-resistant HDPE lining.
- Static load capacity even with high traffic loads - pipe with or without reinforcement for high load capacities.
- **Secure pipe connection –** flexible plastic connectors for tight pipe connections and easy, quick installation.



THE PERFECT SYNERGY A CONCRETE PIPE WITH A CORROSION-RESISTANT **HDPF LINER**

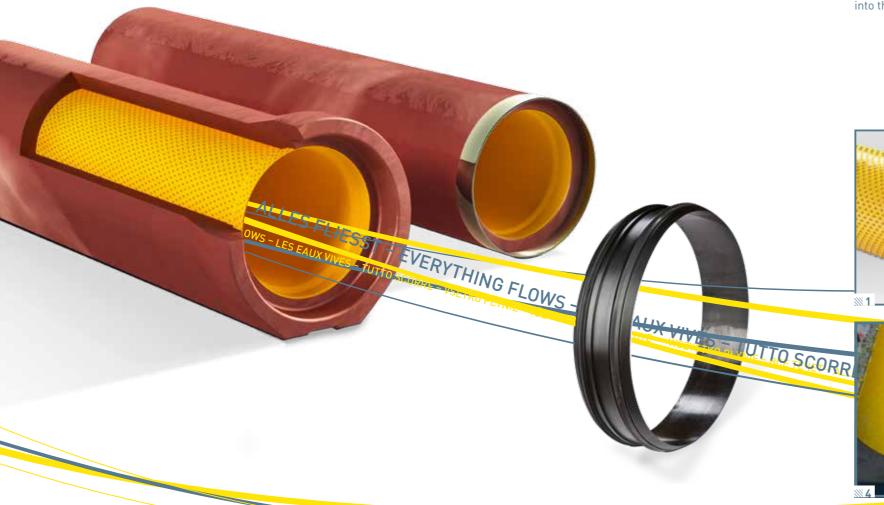
The PERFECT HDPE liner is resistant against hydrogen sulfite gas – and liquid chemical attack.

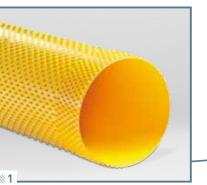
Other key – and proven features of the liner are its weldability and increased resistance to abrasion, high pressure flushing and anchor withdrawal. During the "Darmstädter Kipprinne" abrasion testing phase, a moderate abrasion of only 0.22 mm (0.009 inches) was detected after 200,000 load cycles.

The solid bond of the PERFECT liner to the surrounding concrete is achieved by numerous anchorage points. The density of anchor connections to the various pipe sections and the optimum shape of the anchors, designed especially for PERFECT PIPE, facilitates a reliable connection up into the joints.

The tested anchor pullout strength is with over than 250 N per anchor impressive. These anchors securely hold the entire liner, as demonstrated in a 1,000-hour outdoor water pressure test with a permanent ground water pressure of 1.5 bar (22 psi).

The PERFECT liner is offered in thicknesses ranging from 1.65 to 3 mm (0.065 to 0.12 inches), depending on regional standards or projectspecific requirements.











- 1 The corrosion resistant PERFECT PIPE HDPE liner
- 2 Permanent connection:

there is no separation of the liner from the surrounding concrete even with temperature fluctuations during storage, transport and installation.

- 3 The exceptional pull-out strength of the PERFECT liner has been proven in extensive test settings.
- 4 The "Darmstädter Kipprinne" abrasion test

WITHSTANDING HIGH STATIC LOADS THE STRENGTH OF CONCRETE IN ALL TYPES OF PIPE

Over the centuries, concrete has been tried and tested. It is today worldwide known as a proven building material. Due to the technological advances of concrete itself (SCC) it is now possible to combine the advantages of concrete pipe with those of HDPE. PERFECT PIPE warrants the long term and leak-proof discharge of waste water for a broad range of applications.

In comparison to other building materials, concrete is impressive what concerns its static properties, especially due to the fact that almost no age-related decrease in strength occurs.

PIPE FOR OPEN TRENCH

- Round, circular PERFECT PIPE with the HDPE liner can be made up to and incl. DN 1200 mm (48 inches).
- **M** Prebed PERFECT PIPE with round inner cross-sections, comes with improved structural properties and is quick and easy to install.
- **Especially with smaller sizes, PERFECT PIPE** enables you to run prebed pipe without bell, which allows cost savings from using less material. You also gain efficiencies in terms of storage, transportation and installation.



PERFECT JACKING PIPE STARTING AT DN 300 MM (12 INCHES) **EFFECTIVE MICRO-TUNNELING**

The PERFECT PIPE system is ideal for pipe jacking. A big advantage of this wet cast pipe is the extremely low tolerance of both the inner and outer diameter and its tight and precise joint connections.

PERFECT PIPE jacking pipe has a decisive design advantage: preinstalled pipe connectors enable tight connections and rapid installation.

Connectors are preinstalled in the joints before pipe jacking starts. Upon reaching the target shaft, PERFECT PIPE's combination of liner and connector, ranging from DN 300mm (12 inches) to DN1200mm (48 inches), achieves a tight pipe line system without additional steps right away. No field welding at the joints is required. In other words – now also lined small bore concrete pipe which are not accessible are available. Thus, the efficiency of pipe jacking is significantly improved over traditional methods.

THE PERFECT CONNECTOR

- **The application**, installation of the corrosion resistant small bore concrete jacking pipe is now possible due to the preinstalled plastic connectors. The welding of liner joints in the field of small bore pipe would not be possible. The PERFECT PIPE connector does away with that.
- **Migh rate of penetration –** the pipe jacking route can be further advanced by using concrete lubrication and intermediate jacking stations.
- **Safe operation and installation –** plastic connectors with tilting lip gaskets (Kipplippen-Dichtungen) for the permanently watertight concrete-HDPE composite pipe system.

DIN V 1201-TYPE2-SB-VT-VM LENGTH 3000 MM (118") Wall Thickness Pipe Jacking Force DN800-DA1106 150 mm / 6" approx. 2,400 kN 240 mm /10" DN800-DA1286 approx. 4,600kN

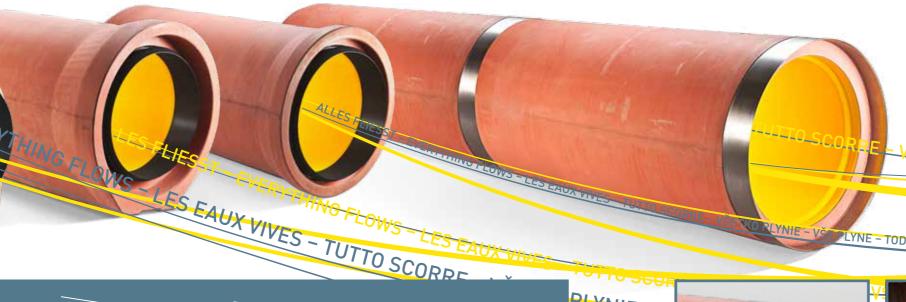
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- 1 Efficient Micro-tunneling with plastic connectors
- 2 An already tight fitting pipe connection ready to be jacked











EASY AND RAPID INSTALLATION THE CONNECTOR SYSTEM ENABLES INCREASED EFFICENCY WHEN LAYING PIPE

The use of preinstalled plastic connectors with the various types of PERFECT PIPE helps construction companies to rapidly install the pipe inline with the technical requirements.

Depending on the pipe diameter, depth and soil conditions, the use of prebed PERFECT PIPE can reduce the size of the trench as well as the volume of soil and backfill material needed.

A simple and compact ground level is sufficient support for prebed PERFECT PIPE. There is no need for extra excavation due to protuding bells. The prebed pipe remains stable in its bedding. Uneven pressure loads on the pipe are avoided thanks to the pipe's flat base.

Depending on soil conditions, the already excavated soil can be reused to refill the pipe zone, thanks to the structural strength of the pipe.

The laying of round, circular pipe in an open trench is consistent with the already well established practice in concrete and reinforced concrete pipe installation.



WATER TIGHT CONNECTIONS/JOINTS - ZERO LEAKS THE PERFECT LINER RECESS AND CONNECTOR

In order to protect the entire sanitary sewer line against aggressive chemical attack, also the pipe joints are well protected by corrosion-resistant plastic connectors.

Gaskets at both ends are fitted with connectors that withstand a constant internal pressure of 2.5 bar (36 psi). The entire internal surface of the pipeline, liner and connector, is permanently sealed against infiltration/inflow and exfiltration. Being able to guarantee zero leak was clearly our goal when developing PERFECT PIPE.

In addition to meet standard specifications for concrete pipe, the connector allows reliable sealing when PERFECT PIPE is being deflected within certain limits. Connectors are made in various sizes in hard metric dimensions for the various pipe diameters from DN 300 mm (12 inches) – DN 1200 mm (48 inches).

The proven and certified long-term water tightness of PERFECT PIPE, tested under 2.5 bar (36 psi) of internal pressure, enables PERFECT PIPE to be used even in sensitive areas where drinking water is being recovered/procured. Certification of this standard was tested and confirmed by the German PÜZ BAU GmbH, a recognized organization for the testing, monitoring and certification of construction products and processes. Optionally, pipe liner connections can be welded.



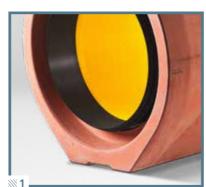








- 1 Project specific manufactured pipe lengths
- 2 Simple compact bedding supports the pipe
- 3 Homing pipe with connectors
- 4 Rapid backfilling of the trench
- **5 Additional lateral pipe connections** can be added at any time by using commercially
- available fittings









- **1 The pipe joint**
- is protected against chemical attack by the connector.
- **2 PERFECT PIPE** to manhole connections
- are made in the same way as conventional pipe to manhole connections, using plastic connectors.
- 🚿 3 PÜZ BAU approves PERFECT PIPE.
- **4 The German Institute for Building Technology DIBt** approves the PERFECT PIPE liner.



SAFETY IN DESIGN AND OPERATION INSPECTION AND MAINTENANCE-FRIENDLY

The easy inspection and maintenance of PERFECT PIPE, in addition to its corrosion resistance and high static load characteristics, contribute to its long life cycle of more than 100 years.

PERFECT PIPE's robust rigid concrete shell prohibits internal changes in the pipe cross-section, which enables easy inspection of the pipe using standard inspection equipment.

The bright coloured liner facilitates the inspection process by providing a robotic camera with sufficient luminosity for imaging. Possible contaminants are easily recognized.

Especially in traditional pipelines with low overall gradients, sediment generally occurs. Prebed PERFECT PIPE, however, is ideal in supporting low but constant gradients and ensures that deposits do not occur.

For cleaning purposes, PERFECT PIPE is fully suitable for all common high pressure flushing.



INSTALLATION / OPERATION

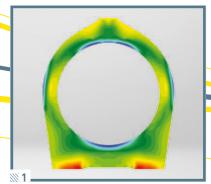
- **Economical** due to rapid installation
- **Economical** due to longevity, easy inspection and maintenance, resulting in low life cycle costs.

DECOMMISSIONING / RECYCLING

Recycling of safe raw materials – concrete and environmentally friendly thermoplastics, even after a hundred years of use.

PERFECT PIPE has a very favorable overall CO₂ footprint, from its manufacturing and installation stages, all the way through to its ongoing operation and decommissioning stages.











- 1 The ideal tube shape is determined using a finite element analysis ("Finite-Elemente-Berechnung").
- **2 Permanently sealed piping system,** tested with up to 36 psi of internal pressure.
- **3 Proven durability** for normal and high-pressure flushing
- **4 The inspection and maintenance-friendly** plastic lining



Production and operation with a low CO₂ footprint

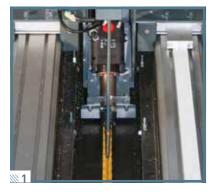
INDUSTRIAL PRODUCTION CONCRETE-HPDE LINER COMPOSITE PIPE

The production process is fully automated with integrated step by step quality control, finally each pipe is being vacuum tested. After completing the test, each pipe is labelled with clear identification and product parameters.

The PERFECT liner is brought into its final shape by automated welding - and a subsequent thermoplastic forming process of the bells at both ends of each pipe which will later on accommodate the connectors.

During casting the entire liner is held perfectly in place and shape by a collapsible steel core and two bell formers.

The final external shape of PERFECT PIPE is created by the moulds/jackets applied in this industrial wet cast process. The PERFECT liner is embedded in the concrete. Different grades of concrete can be used. For the dimensional integrity of PERFECT PIPE, curing takes place in the mould.















◎ 1-6 PERFECT PIPE PRODUCTION SYSTEM

In addition to PERFECT PIPE in standard length, PERFECT PIPE is being produced as 1000 mm (40 inches) long spigot – spigot link element and in any other length between 1000 mm (40 inches) – 2000 mm (78 inches) as project specific bell and spigot fitting pipe, either as reinforced or non-reinforced pipe.

7 FBS quality mark - security of certified quality for designers and operators



VERSATILE, AVAILABLE FOR DIFFERENT APPLICATIONSRELIABLE FOR GENERATIONS

CONCRETE-HDPE LINED COMPOSITE PIPE

PERFECT PIPE provides a consistent and proven corrosion protection against chemical attack ranging from PH 1 to PH 14.

- The HDPE liner permanently protects the concrete against chemical attack and improves the pipeline flow rate.
- The plastic pipe connectors allow deflection of the pipeline and simple connections to the manhole. Lateral connections can be installed either at the production plant or on the construction site.

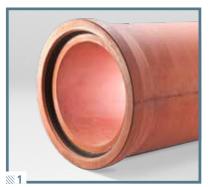
CONCRETE PIPE

Not all sewer pipelines require increased corrosion protection. In many cases, the use of high quality concrete pipe for a long life cycle is sufficient.

Because of the need for various pipe types, PERFECT PIPE is ideal for installation in a wide variety of applications. Whether for municipal wastewater pipelines, industrial park developments, industrial pipelines or infrastructure projects such as railway, road or airfield drainage, PERFECT PIPE provides the appropriate pipeline for every application.











1 High quality concrete pipe with or without reinforcement can be manufactured by using the same production technology.



A REVOLUTION IN PIPELINE CONSTRUCTION

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