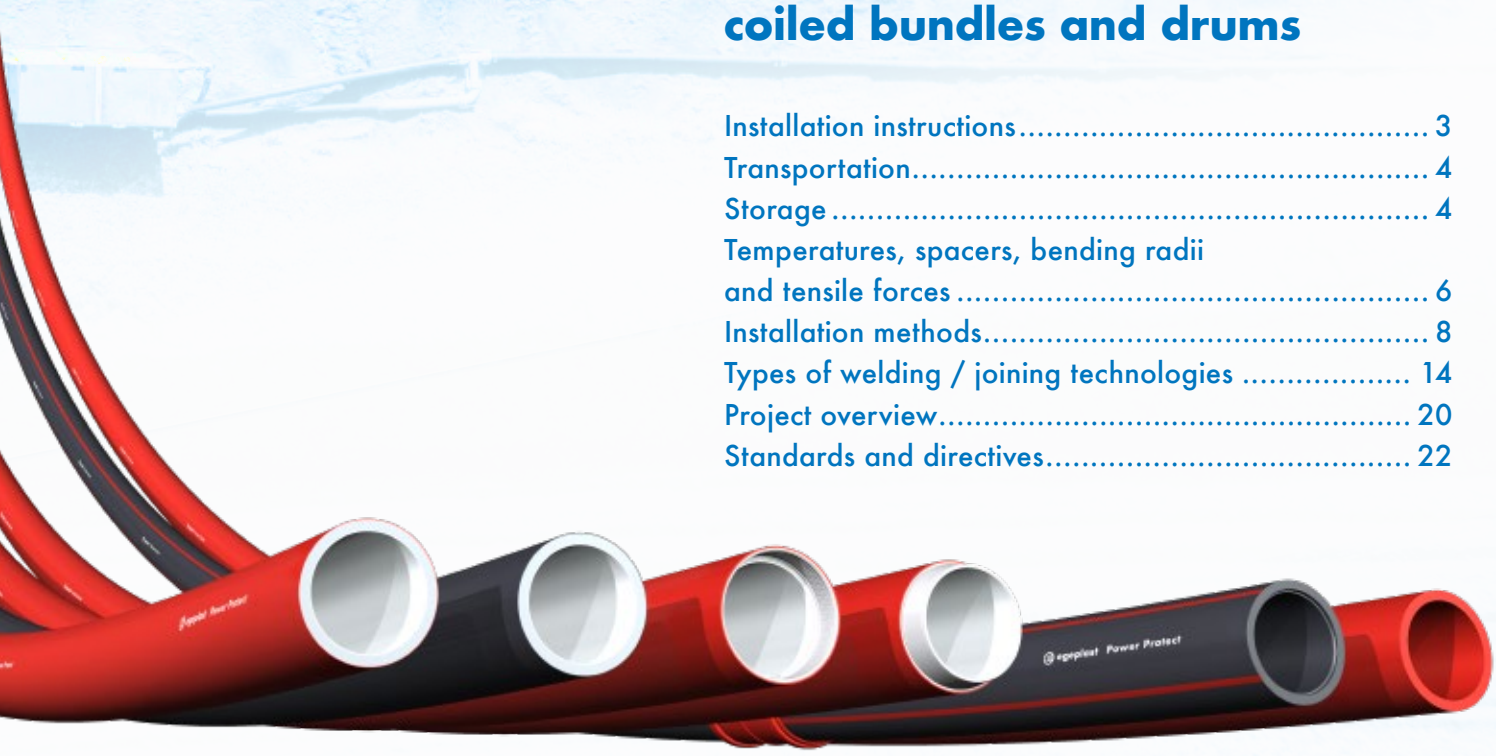
egeplast

Protective Pipe Systems for Energy Cables

egeplast

Instructions for the installation, transportation and storage of Power Protect systems as well as coiled bundles and drums

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Professional installation can only be ensured by strict adherance to the Installation Instructions.

Instructions for the installation, transportation and storage of Power Protect systems as well as coiled bundles and drums

In addition to using faultless products, expert installation of the selected Power Protect protective pipes and the respective accessories is a must to create the prerequisites for a smoothly operating power supply grid. Please refer to the installation instructions below as well as the instructions related to transportation and storage for a detailed description of our recommendations around handling the egeplast products to ensure a safe on-site installation.

In our egeplast headquarters in Greven, we offer comprehensive installation and product trainings, which we will also be happy to provide on site, if you wish. For any technical questions, please feel free to call us any time.

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Installation instructions

Please note the specific details of the KRV Installation Instructions and the technical specifications of the transmission grid operators.

- The pipes must be handled with care at all times. They must not be pulled across any sharp edges or rocks, since this might result in damages. Check the pipes for external damage prior to every installation.
- The interior of the pipes must be protected from contamination and water via through suitable measures.
- The permissible deflection radii must not be exceeded during the laying process. If you are dealing with any changes of direction with regard to the pipe route (beyond the natural bending radius), prefabricated bends can be used.
- For drums and coiled bundles, make sure that the pipe end can spring away when opening the fastener. Mishandling entails a risk of injury.
- For heated element butt welding, the interior weld bead must be removed professionally. The bead material must be collected, documented and presented separately for the respective weld processes.
- Cable insertion should be possible regardless of the orientation.
- Transitions between different wall thicknesses, diameters, or materials should be carried out using adaptors without any offset. The cone is designed to facilitate adaptation to pipes with various inside diameters and a gradient of approximately 2 °.
- The minimum diameter required for cable protection pipes depend on the outer diameter of the cable. $Di_{Inside\ diameter\ pipe,min} \sim 1{,}5 \times Da_{outside\ diameter\ cable,max}$

Transportation

The pipeline components should be transported on suitable vehicles and require skilled loading and unloading.

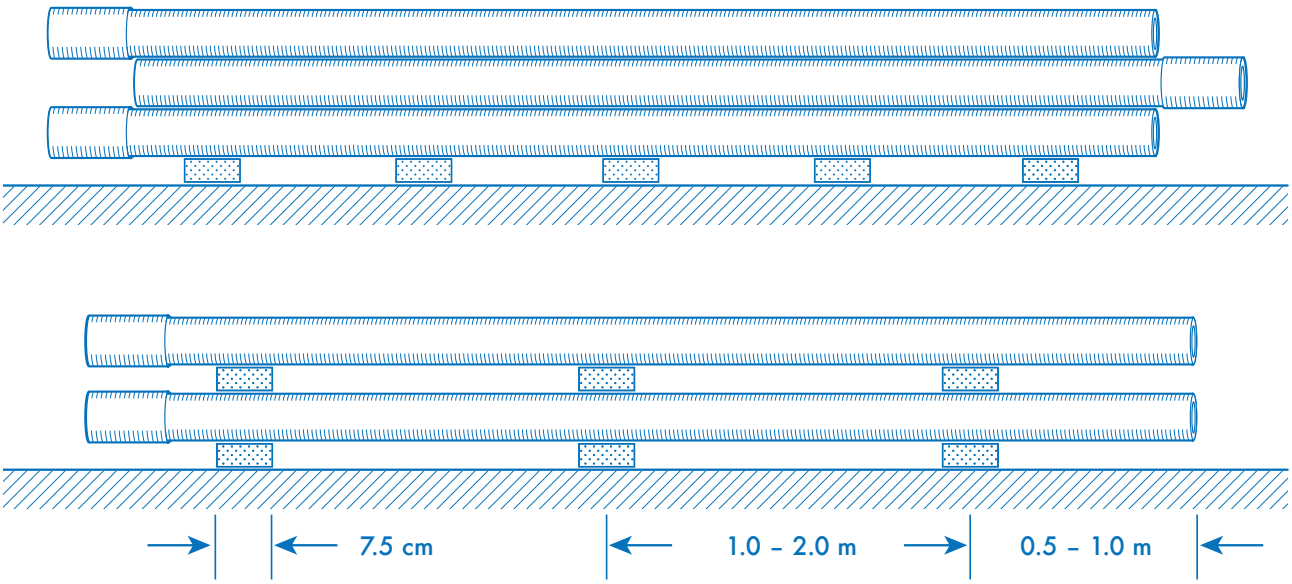
Unloading must be performed using suitable equipment. We recommend broad lifting straps and, for bigger pipe lengths, traverses; coiled bundles should be unloaded individually using a sling. Dropping or rolling the pipes off from the lorry bed.

When transporting the pipes on the construction site, pulling them along the ground is not permissible. On site, the pipes and pipe components need to be stored and transported in a way which does not result in lasting deformations and/or damages.

Storage

Palletised pipe bundles can be stacked on top of each other, provided that the timbers are placed on top of each other. For deliveries of non-palletised pipes, the stacking height of loose pipe must not exceed 1.0 m. Any deformation of the pipes resulting from loose stacking must be avoided.

This is particularly important at pipe temperatures > 35 °C and can be achieved by reducing the height of the stack or by covering the stack with white foil. The pipe stacks must be secured laterally.



Recommended storage of pipes with lugged pipe ends on intermediate wooden blocks or staggered sockets.

1. For deliveries with pre-assembled sockets, it is important to ensure that the sockets are supported freely, which is achieved via alternating mounting of the socket and spigot ends or by means of intermediate timbers.

2. Double plug-in sleeves — whether supplied separately or along with the pipe — must always be protected from direct sunlight and contamination, e. g. by providing a suitable cover.

3. Pallets must be placed on a sufficiently solid and plane surface. Unstable undergrounds (e. g. wet soil) are to be avoided or prepared accordingly.

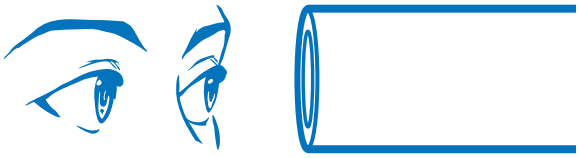
4. egeplast Power Protect-pipes with a black outer layer can be stored outdoors without any limitations.

5. For coloured outer layer, a maximum storage time of two years must not be exceeded.

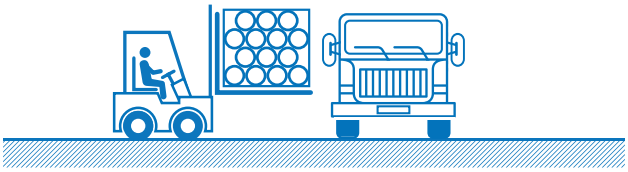
6. On the construction site, the pipes should be stored with a white cover—a customary white filter fleece (e. g. class II; 120 g/m²) or white foil.

7. The pipes should only be extracted from the covered pallet right before installation. In case the installation turns out to be delayed, we recommend to protect the pipe stored next to the pipe trench with the covering material.

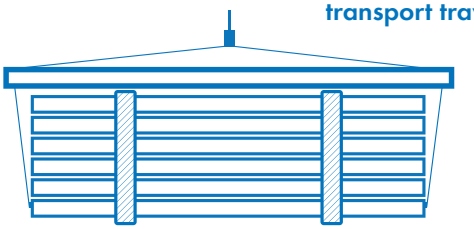
Visual examination of pipes or fittings



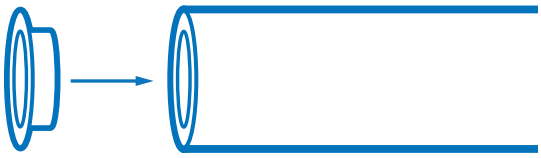
Careful loading and unloading of a truck (using a forklift)



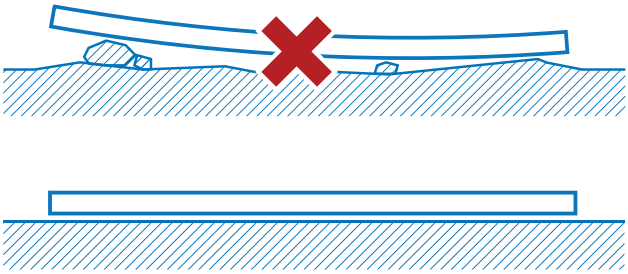
Transportation of a pipe palet via a transport traverse



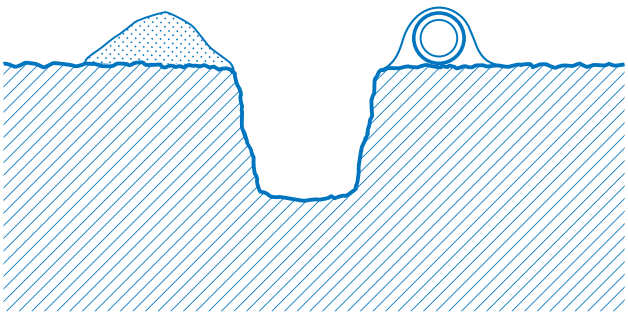
Secure storage: With sealed pipes



Secure storage: Level surface free from rocks and other obstacles



Protect individual pipes pulled out from solar radiation if stored for longer storage (tarpaulin)



Temperatures, spacers, bending radii and tensile forces

Temperatures

- At high temperatures (> 50 °C), mechanical loads can lead to faster pipe deformation.
- In a temperature range from -20 °C to +50 °C, PE pipes can be transported easily in their original packaging. For PP, this holds true for temperatures between -10 °C and +35 °C. At low temperatures, impact stress in particular is to be avoided.

Temperatures below zero involve a risk of condensation. Hence, make sure to dry the welding area with hot air or a lint-free cloth.

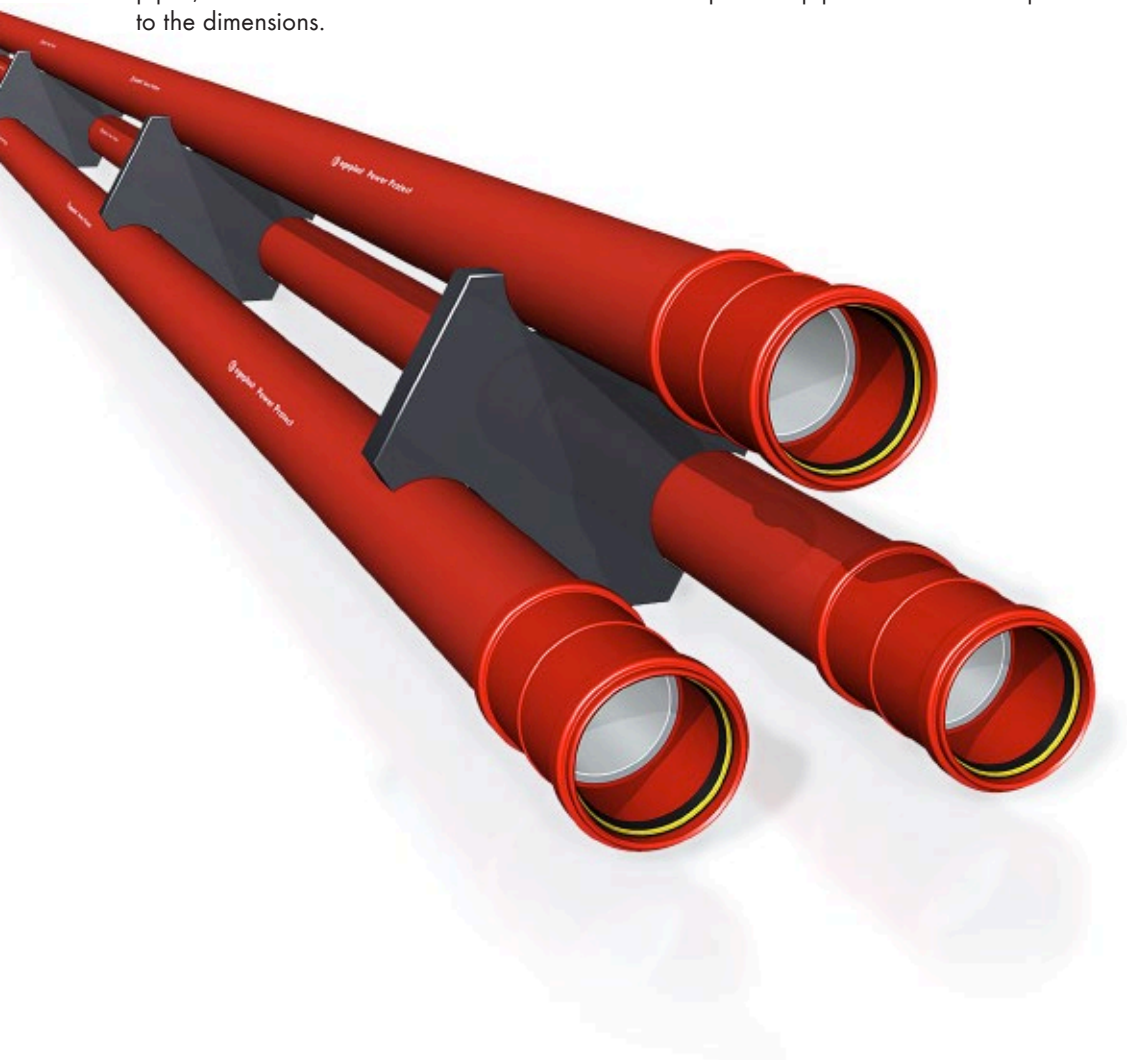
- egeplast Power Protect pipes can be handled at temperatures from -10 °C to +45 °C.
- Coloured outer layers provide protection from additional heating when the pipes are in the sun.
- Unfavourable weather conditions such as moisture and draughts are to be avoided, e.g. by means of pitching a tent.
- The pipes and fittings should have approx. the same temperature upon installation.

Please be aware of the temperature-related variations in length!

Spacers

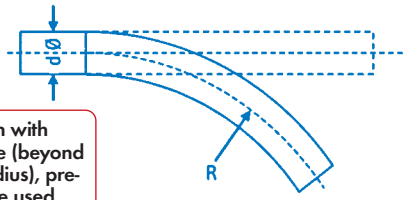
For a multi-layer arrangement of cable protection pipes in the pipe trench, we recommend fixing the pipes by means of spacers. To prevent the occurrence of point loads on the pipes, the width of the contact surface should be adapted to the dimensions.

The distance between the spacers which is required to avoid sagging depends, among other things, on the SDR series of the protective pipes and the backfilling material used. The pipe manufacturer's specifications must be heeded.



Bending radii

Undercutting of the lowest permissible bending radii should be avoided. This value depends on the pipe temperature.



For changes of direction with regard to the pipe route (beyond the natural bending radius), pre-fabricated bends can be used.

Bending and fixating the pipes up to the smallest permissible bending radii indicated in the two tables requires application of significant forces.

In the context of installing protection pipes in a pipe bundle in particular, these smallest permissible bending radii can often not be implemented in practice.

Pipe temperature	Smallest permissible bending radius R			
	SDR 11	SDR 17.6	SDR 26	SDR 33
0 °C	50 x d		60 x d	
10 °C	35 x d		45 x d	
20 °C	20 x d		30 x d	

Smallest permissible bending radius for pipes made of PE100, PE100-RC, PE-RT, PE100-RT and PE100-RT/RC

Pipe temperature	Smallest permissible bending radius R			
	SDR 11	SDR 17.6	SDR 26	SDR 33
0 °C	85 x d		95 x d	
10 °C	55 x d		65 x d	
20 °C	30 x d		40 x d	

Smallest permissible bending radius for pipes made of PP-HM

Tensile forces

Exceeding the maximum permissible tensile force will result in permanent damage of the pipes and must be prevented by appropriate actions. The tensile forces occurring during installation must be monitored and documented. To check out the permissible tensile forces of the pipes, please refer to the data sheets.

The permissible tensile force for trenchless installation depends on the tensile strength of the pipe material as well as the cross section of the pipe, that is, the SDR series, the temperature as well as the duration of the insertion process.

The values apply for the maximum duration of the insertion process which lasts 30 minutes and a pipe temperature of 20 °C. For longer insertion times, these values must be lowered.

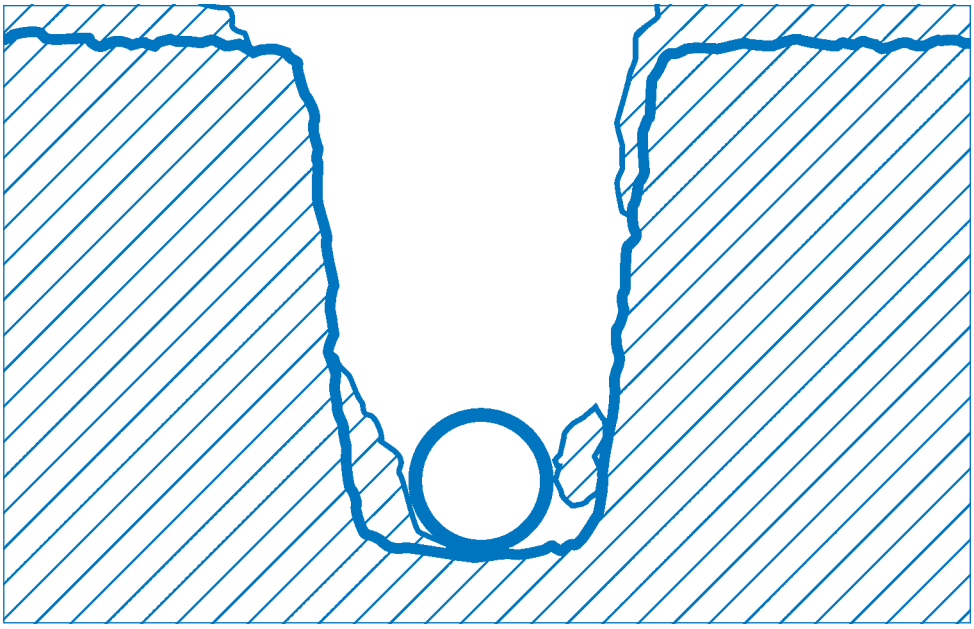
> 30 minutes: reduction by 10 %
> 20 hours: reduction by 25 %

From a pipe temperature of 40 °C, the values must be reduced by a factor of 0.7. Interpolation between the values is possible.

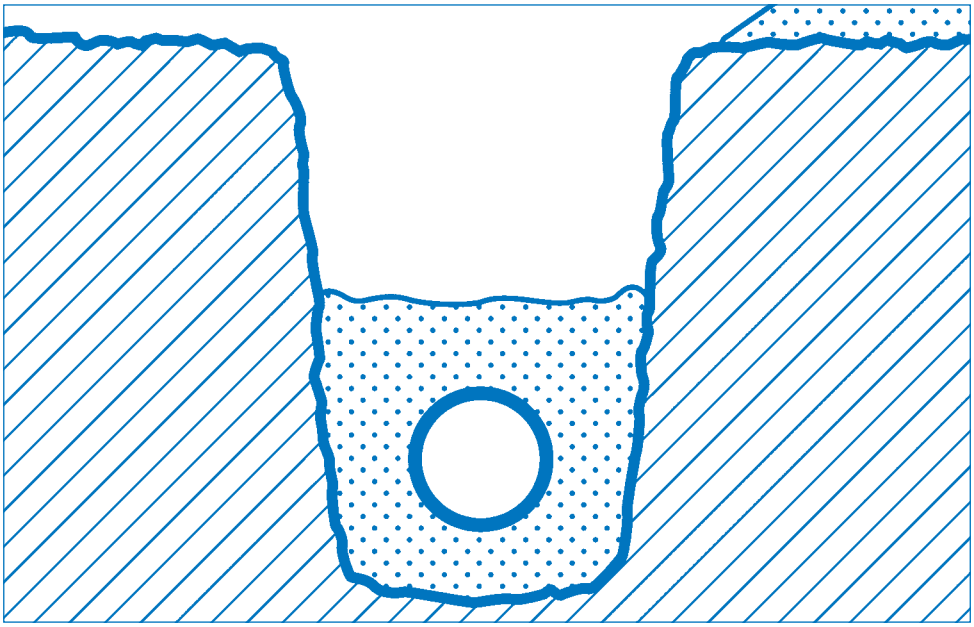
Installation methods

Open-trench installation

The execution of the pipe trench is subject to the DIN 4124 standard, "Construction pits and trenches – slopes, working space widths, sheeting". In view of the mechanical stress affecting the pipes, e. g. during insertion of the high- and extra-high voltage cables, only pipes ≤ SDR 26 should be used, with deviations from this being conceivable depending on the project. When using egeplast Power Protect PP pipes, open-trench installation in a sandbed is recommended.



Open-trench installation without a sand bed



Open-trench installation in a sand bed

Execution of the pipe trench

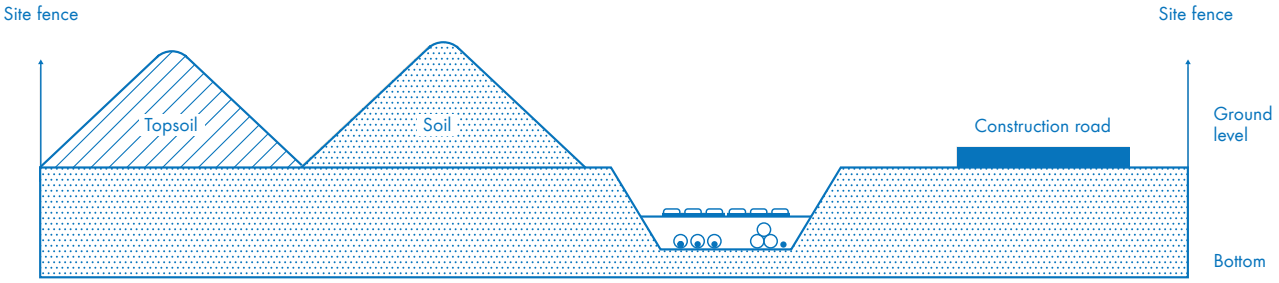
The execution of the trench bottom should be plane and shallow as well as free from roots and rocks. For very uneven substrates, the trench bottom should be compacted using light-weight equipment. The trench bottom has to be prepared in a way which enables the pipeline to be supported evenly. The pipes and fittings must be supported and embedded in accordance with the DIN EN 1610 standard.

Compaction contributes directly to the stability of the buried pipe and thus must be carried out diligently. On both sides of the pipeline, a compactable soil free of rocks (max. grain size Ø 20 mm) should be backfilled in layers of up to 0.3 m and compacted either manually or using light-weight machinery. The pipes must not be shifted sidewards during this process.

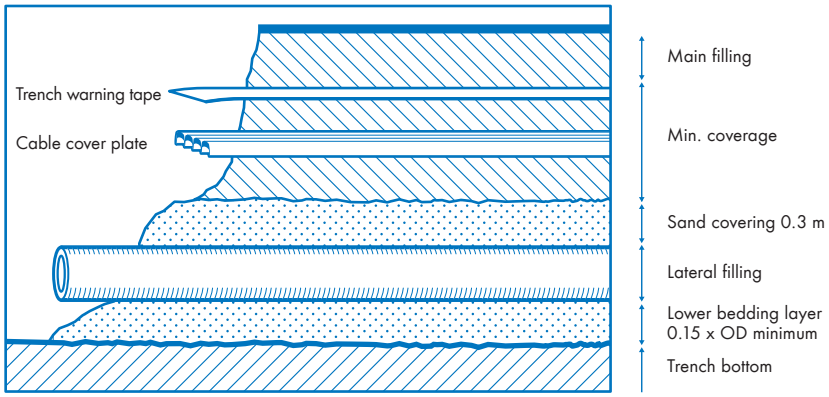
Upon backfilling the pipeline zone with self-compacting backfill materials and highly thermally conductive special types of concrete, buoyancy control and securing the position of the pipes are to be monitored with particular care (see p. 31)!

Prior to installation, the following prerequisites should be borne in mind:

1. **Ensure that the minimum width and depth of the trench is respected.**
2. **Ensure sufficient trench safety.**
3. **Check the trench bottom for freedom from rocks, and examine it for load capacity and evenness.**
4. **Make sure that the bedding material meets the specifications indicated above.**
5. **Junctions with other pipelines must be marked and secured.**



Example for empty conduit systems based on open-trench installation: two empty conduit systems based on open-trench installation, one system with cable

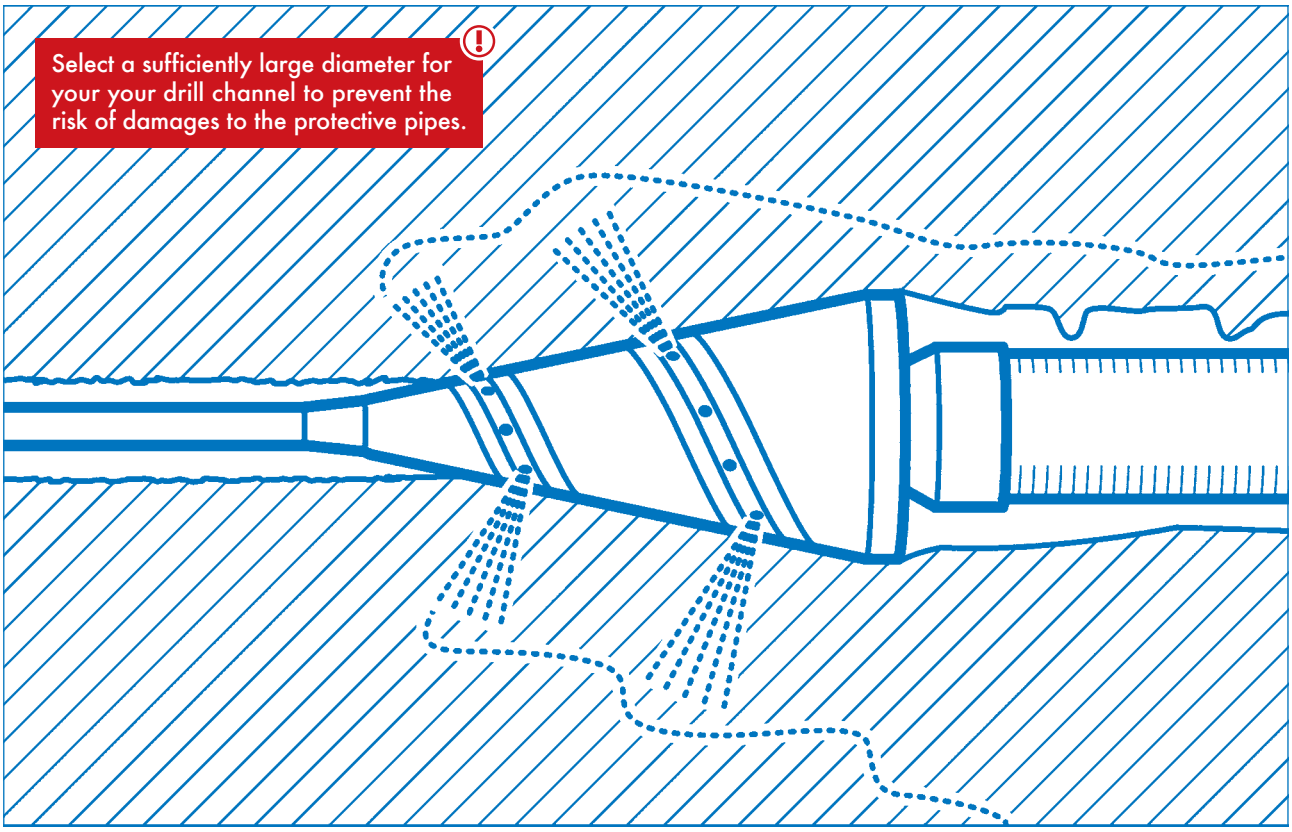


Example for empty conduit systems based on open-trench installation

Horizontal directional drilling method (HDD)

Applying the horizontal directional drilling method initially involves drilling a culvert with a lance. In the course of retracting it, one or multiple pipes are connected to the drill head and then pulled back. This approach is suitable for any sites where the soil surface is supposed to remain untouched or at locations where construction sites may or can only take up little space, such as protected areas or difficult-to-access terrain with significant differences in height. Compared to other approaches, horizontal directional drilling helps to significantly reduce interference with nature and the landscape, thus affecting biodiversity on as small a scale as possible. With regard to nature protection in particular, this approach thus offers a particular advantage.

In applying the horizontal directional drilling method, Power Protect protection pipes are subject to enormous requirements; buckling pressures occurring at larger installation and tensile forces form the basis of dimensioning.



- ✓ Suitable for many kinds of soil
- ✓ Less material input
- ✓ Shorter construction period
- ✓ Less impact on circulation areas
- ✓ Less damage to the surfaces
- ✓ Less demanding restoration of the surfaces
- ✓ For more information, please refer to the DVGW, spreadsheet GW321

Type of connection:

- Heating element butt welding
- Golden Joint
- Smart Connect

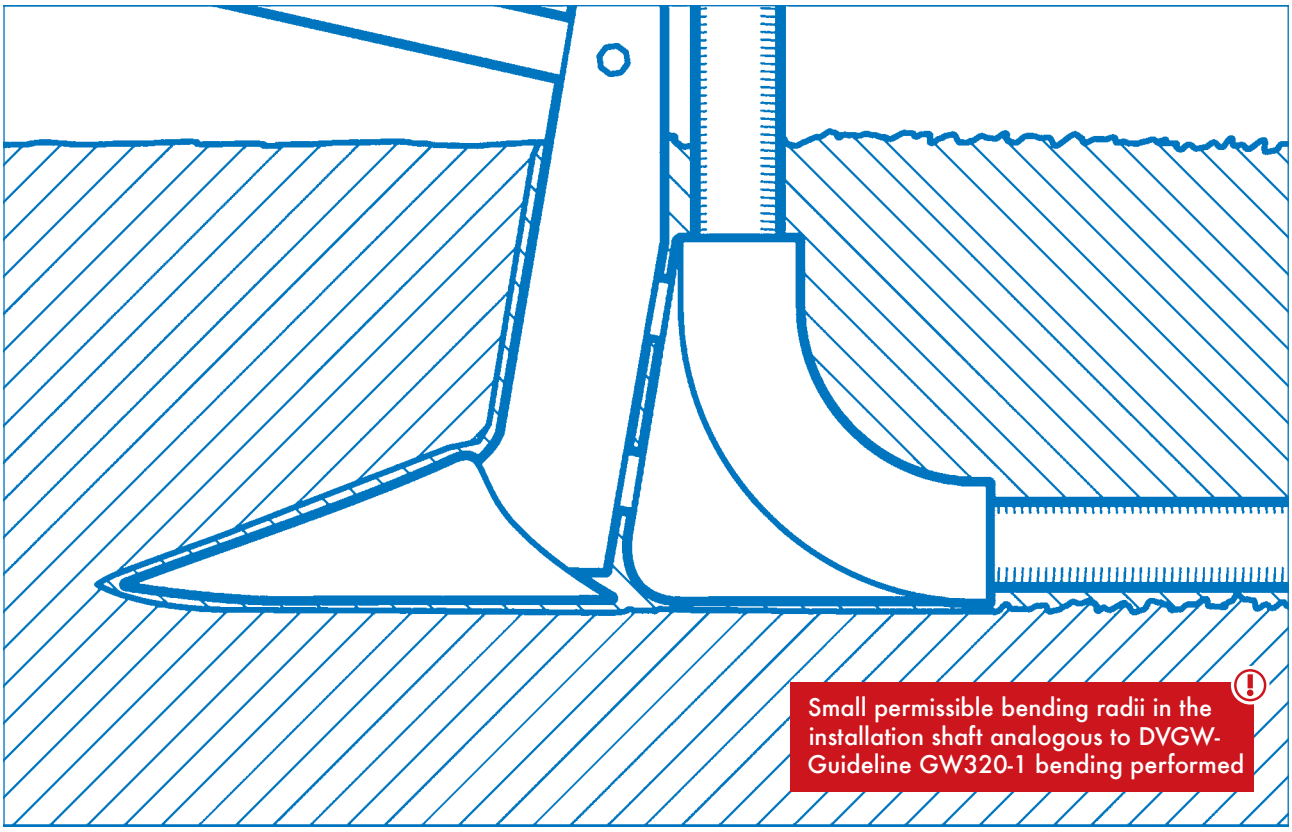
Ploughing method

The ploughing method is an innovative installation method for the purpose of laying empty conduits for buried three-phase AC-current (AC alternating current) as well as buried direct current (DC) cables. Both single-plough as well as multiple-plough systems are used.

In most cases, a cable plough is pulled through the soil by a suitable tractor unit, thus generating a furrow, the installation height of which can be customized via the setting of the ploughshare. The pipeline is inserted into the hollow space created this way.

At the same time, the hollow space is backfilled with the displaced earth. Optionally, it is also possible to use a sand cart to backfill the pipeline with sand, which is why h egeplast protection pipes can be installed quickly and economically. This way, the ploughing method can be used to quickly achieve significant installation rates over long pipe-laying paths.

Among the factors influencing the installation capacity are aspects such as ground conditions, steep gradients, obstacles on the surface or difficult-to-drive-across some sections of the terrain.



- ✓ Suitable for a large range of terrains
- ✓ High installation capacity
- ✓ Cost-efficient installation method
- ✓ Instant restoration of the route
- ✓ Optional multiple installation of empty conduits

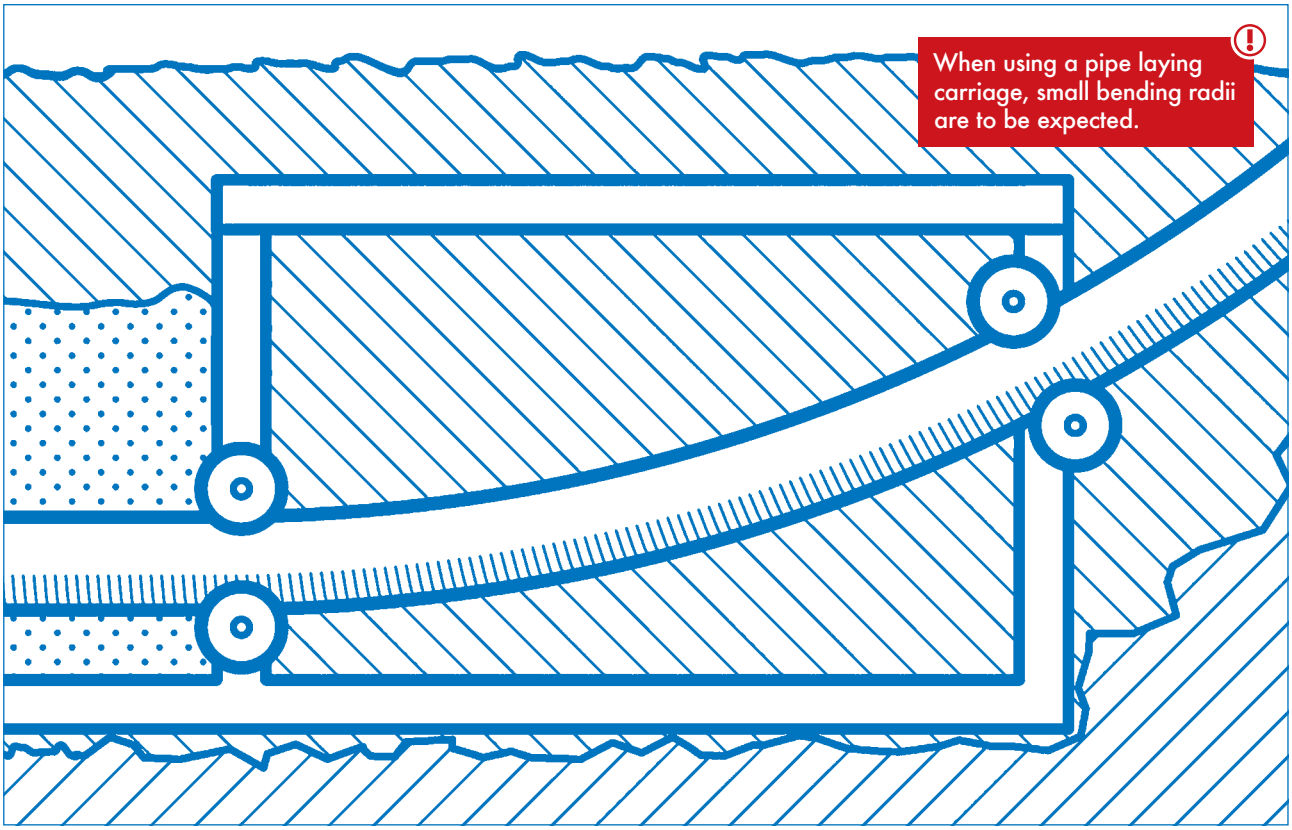
Type of connection:

- Heating element butt welding
- Golden Joint
- Smart Connect

Method using a pipe laying carriage

Applying the pipe laying carriage requires an open trench. This open trench is prepared in exactly the same way as for the "open trench" method. The difference between these two methods consists in using the pipe laying carriage to install the pipes.

With the help of the installation unit, prefabricated pipe strands are brought into a precise position via pulleys. Subsequent embedding in sand completes the bedding process, thus allowing for immediate installation in the soil.



- ✓ High installation capacity
- ✓ Suitable for a wide range of terrains
- ✓ Shorter construction period
- ✓ Instant restoration of the route
- ✓ Optional multiple installation of empty conduits

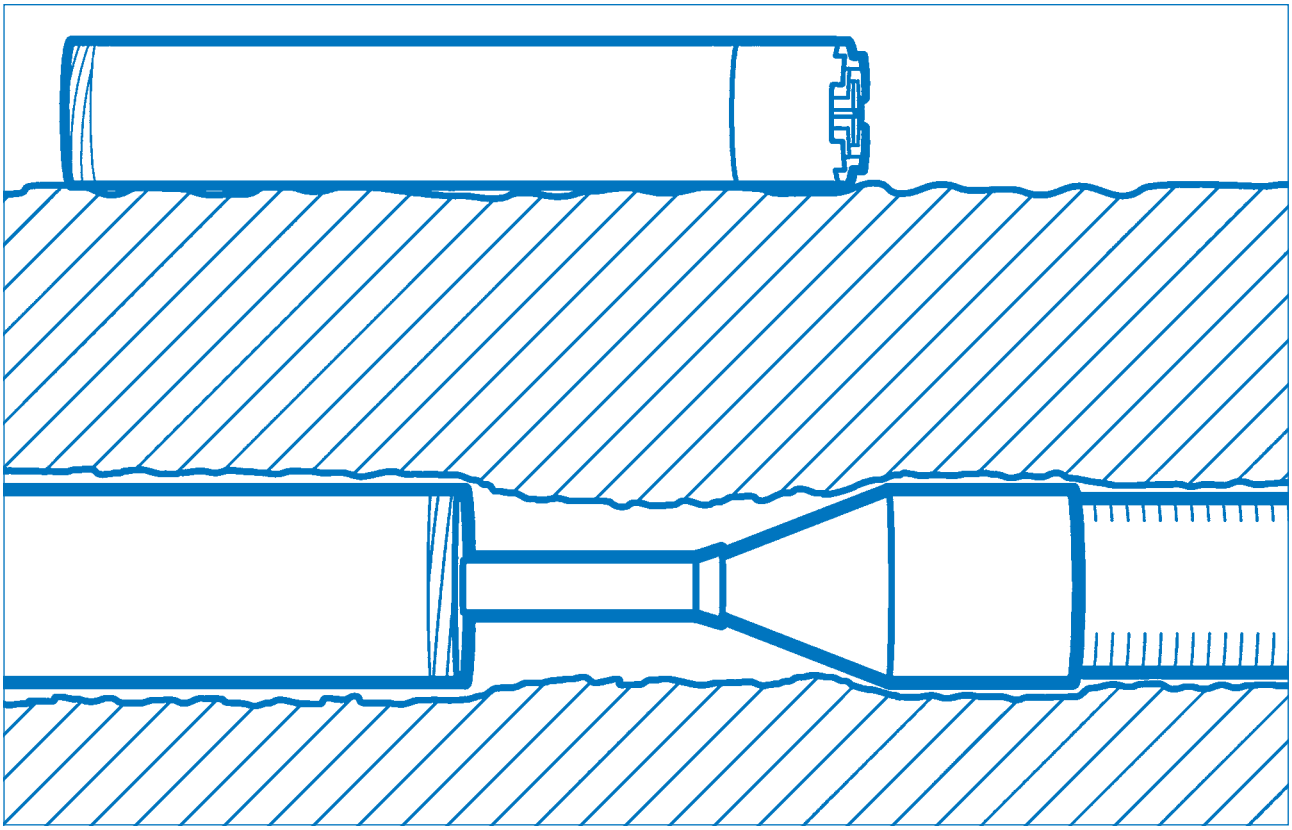
Type of connection:

- Heating element butt welding
- Golden Joint
- Pilot: Smart Connect

E-Power pipe method

The E-Power Pipe method makes use of principles known from the popular HDD-installation method and from microtunneling. It was developed for laying protective pipes at a low installation depth and long and straight distances. It requires a starting and an end shaft. A press frame is installed in the starting shaft. This press frame serves to push the pipe-jacking machine through the soil along a previously specified with a jacking pipe. Once the jacking pipe has arrived at the target shaft, the pipe-jacking machine is separated from the jacking pipes.

Subsequently, a traction head is mounted to the jacking pipe once it has been pushed through to which the pipe string to be inserted is attached. The retraction action oft he jacking pipe by means oft he press frame, the pipe string to be installed is inserted. Adding the backfilling material then will result in a mechanical and thermal coupling to the underground. For this approach, egeplast Power Protect protection pipes must be dimensioned sufficiently to absorb the occurring tensile forces.



- ✓ **Trenchless installation**
- ✓ **Low installation depth**
- ✓ **Installation distances of up to two kilometres**
- ✓ **Little earth movement**
- ✓ **Combination of two widely known methods: Horizontal Directional Drilling (HDD) and pipe jacking (microtunneling)**
- ✓ **Continued use of agricultural areas during the execution of the construction project**

Type of connection:

- Heating element butt welding
- Golden Joint

Types of welding / joining technologies

Joining technology – electrofusion socket / butt welding

In conformity with DVS 2207

Pipes and pipeline components made of polyethylene lend themselves to either thermal or mechanical connections. The major thermal approaches are heating element butt welding and electrofusion welding.

Heating element butt welding involves bringing the joining surfaces to welding temperature and connecting the plastified pipe ends under pressure with a heating unit following the required processing (cleaning and levelling the pipe ends). Welding takes place in accordance with specified process operations which are documented in DVS 2207.

Electrofusion welding, performed with the help of an electrofusion socket, involves sliding a fitting onto the joining surface. This fitting houses resistance wires (heating coil) which are heated to welding temperature using electrical energy. This principle is used to weld the pipes and the fitting together. The additional process steps are also documented in DVS 2207.

Removal of the inner bead

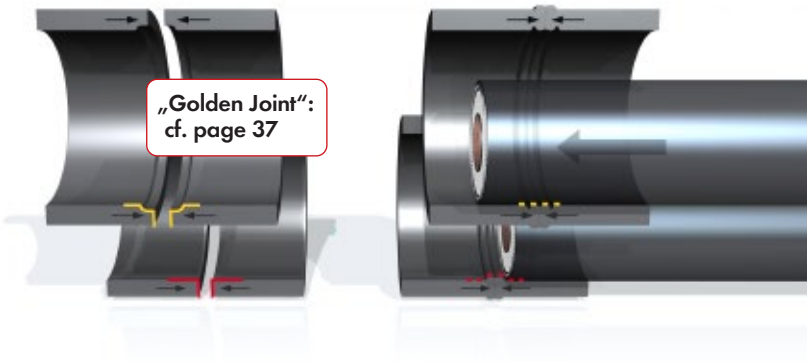
Welding of the egeplast Power Protect pipes requires removal of the inner weld bead to prevent abutting edges and increased frictional resistance which would impair the insertion of the energy cables.

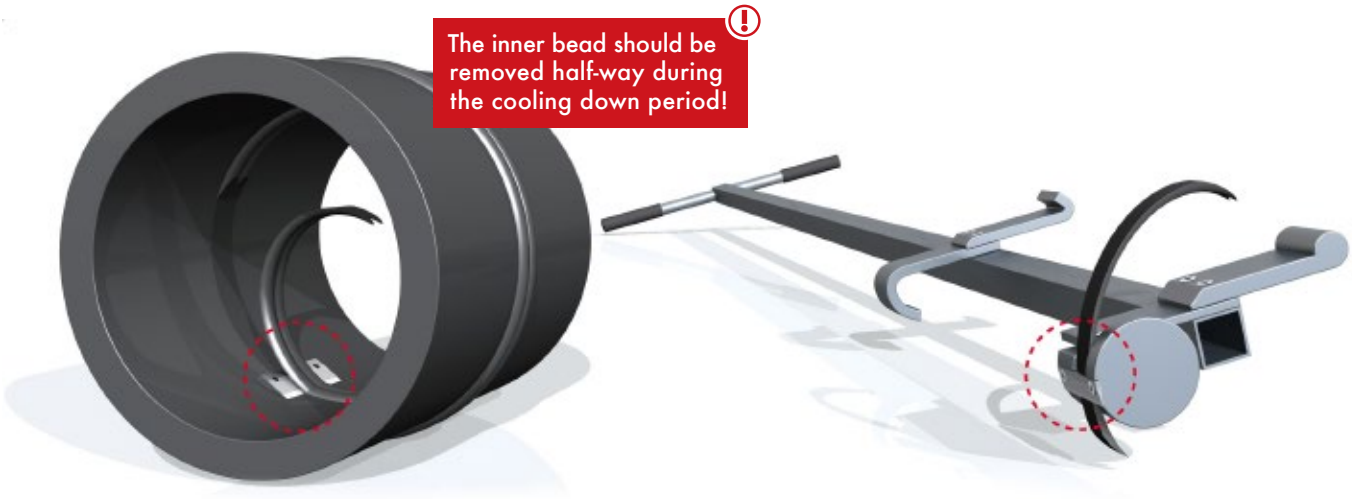
Attention should be paid to not damaging the pipe during debeading (e. g. by causing notches) and to not fall below the nominal wall thickness of the pipe in the area of the weld seam.

This can only be ensured with suitable equipment and tools, e. g. by using debeaders which are able to remove the bead neatly and in one continuous stripe without damaging the pipe surface.

The required equipment can be rented from egeplast. Ideally, the inner bead can be removed half-way through the cooling time. Once cooling off has been completed, the rigid pipe material becomes very difficult to remove. The application specifications of the respective equipment manufacturers must be respected.

Removing the inner bead is not required for the egeplast Power Protect products Smart Connect and Golden Joint. For Smart Connect, joining takes place via conical electrofusion welding filaments integrated into the pipe wall, which prevent the formation of a weld seam on the inside or outside of the pipes. For the "Golden Joint" connection, a specially designed integrated "recess" ensures that the inner bead forming during the welding process is reliably received.





Joining technology – joint installation

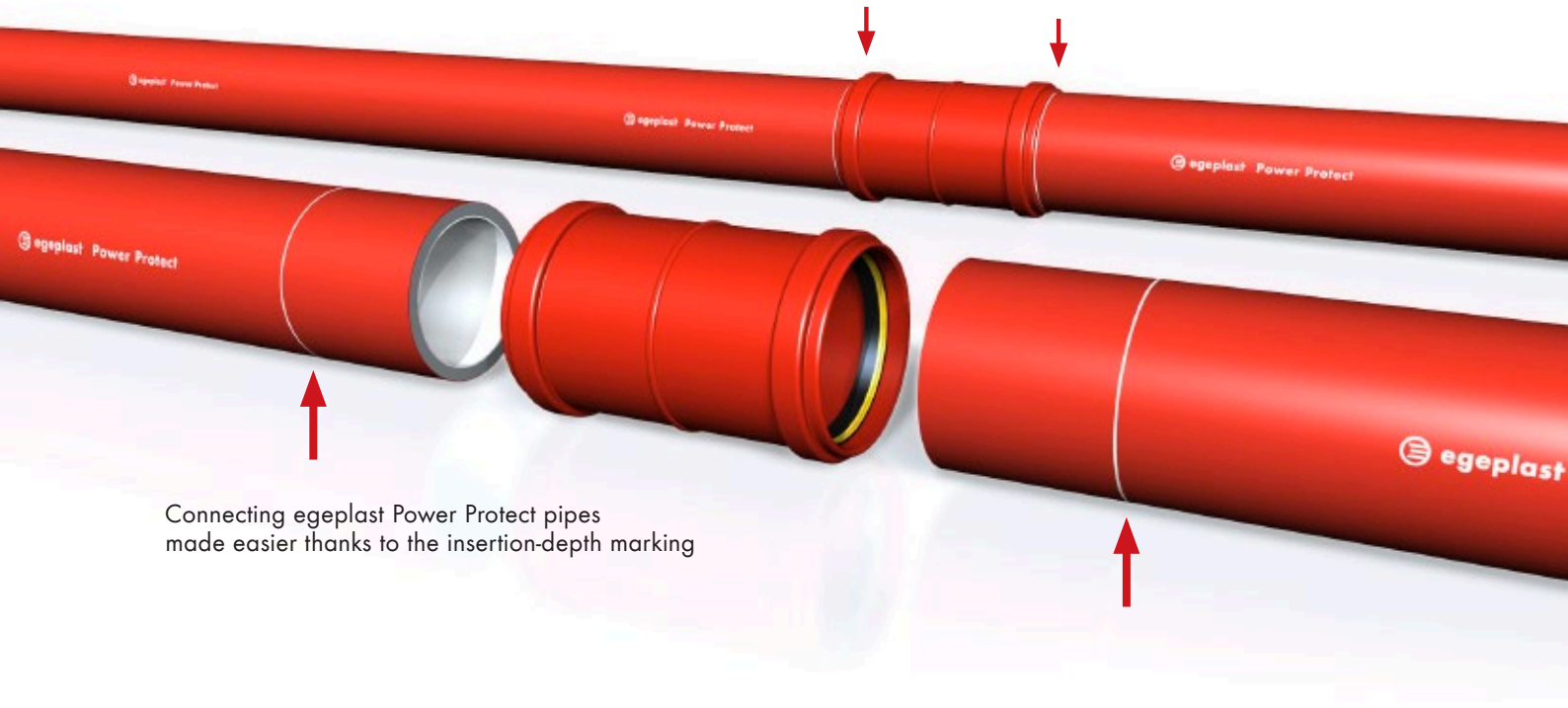
To allow for absorption of temperature-related changes in length for pipe segments, the long version of sockets (L ≥ 400 mm) must be used for pipes DN ≥ 250 mm.

The bedding must be prepared in a way which provides the required recesses for the sockets which will allow for proper execution of the connections.

Prior to insertion (of the pipe or fitting) into the socket connection, the chamfered spigot end should be cleaned from any potential contamination or the like with a cloth. Attention must be given to the sealing ring being positioned in the corrugation correctly and being free from damage or contamination.

Any damaged sealing rings must not be used and need to be replaced. The insertion depth is to be marked on the spigot end with a suitable marker ahead of time unless already provided ex works. Make sure to apply a sufficient quantity of egeplast lubricant on the seal and the spigot end before sliding the pipe in up to the previously marked socket insertion depth (up to the end stop).

The lubricant used must not negatively impact the lpipe material and the elastomeric sealing ring. Attention should be paid to not bringing any contaminations or the like into the socket connection during the insertion operations.



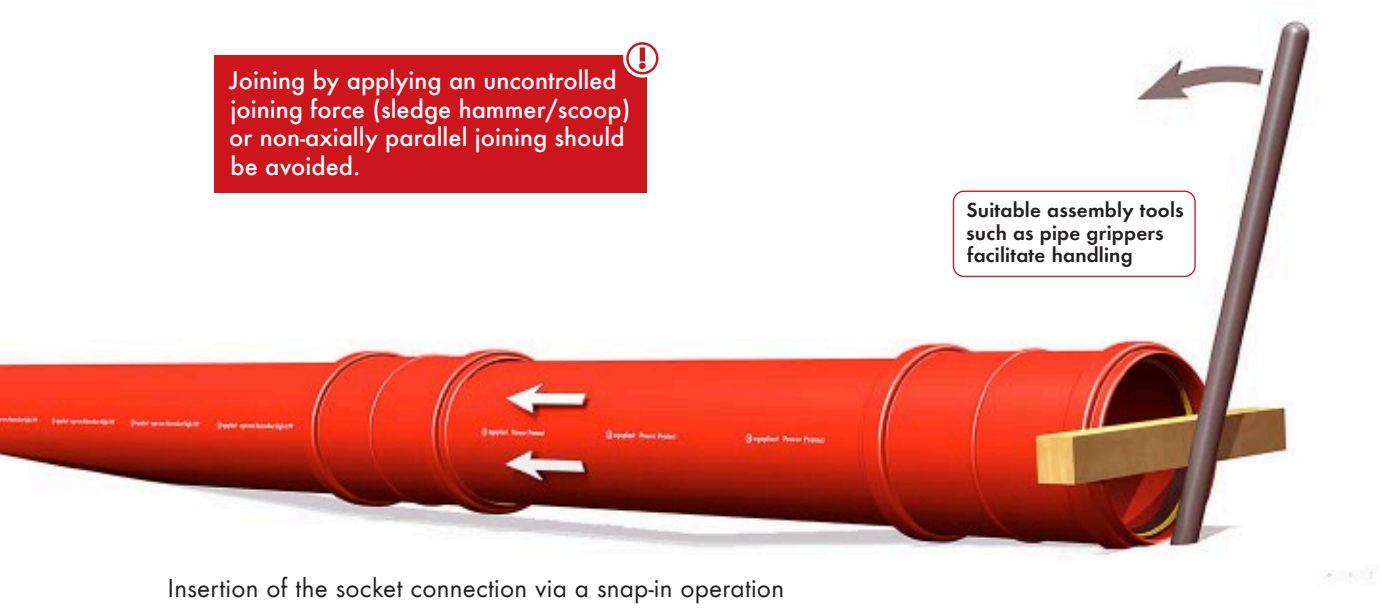
Connecting egeplast Power Protect pipes
made easier thanks to the insertion-depth marking



Snapping in of the socket pipe connection

The pipe can only be inserted manually in an axially centric direction (axially parallel) or using a suitable lever tool with the help of a square timber positioned crossways to the pipe axis. As for the pipe support, a recess reflecting the length of the socket should be provided for in the area of the socket to ensure a complete bedding area across the entire length of the pipe.

For unsupported pipelines, the length variation (from the temperature at the time of assembly, difference between the lowest and the highest expected wall temperature) must be taken into account and the pipe must be inserted axially parallel up to the marking (use an insertion device for larger pipes).



Insertion of the socket connection via a snap-in operation

Trimming of pipes

To trim pipes at the construction site, suitable tools such as fine-toothed saws or pipe end cutters can be used. The trimmed pipe end must then be bevelled with a ≥ 15° (max. 30°) chamfer (1/3 of the pipe wall strength minimum must remain).

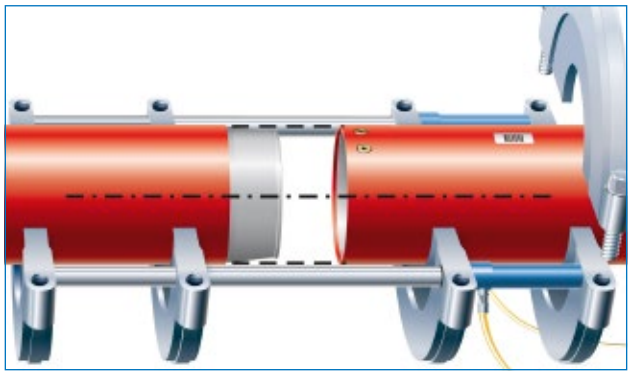
To do so, we recommend commercially available chamfering units. Alternatively, other suitable tools such as files or angle grinders can be used. The cutting edges must categorically be deburred.

Joining technology – Smart Connect

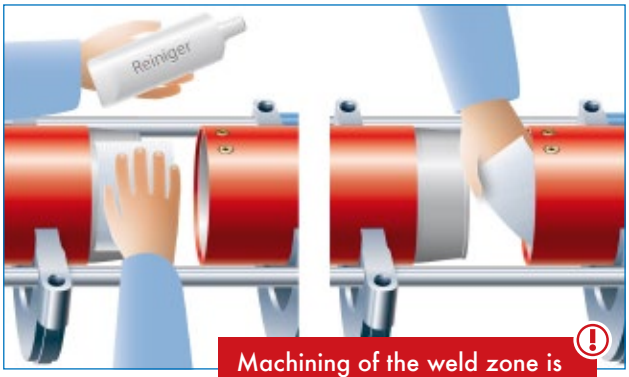
The egeplast Smart Connect combines egeplast Power Protect PE pipes and connection technology in a single component. The spigot end and the weldable socket end have been integrated into the pipe, thus allowing for a permanent connection of the pipe system.



Removal of the dummy

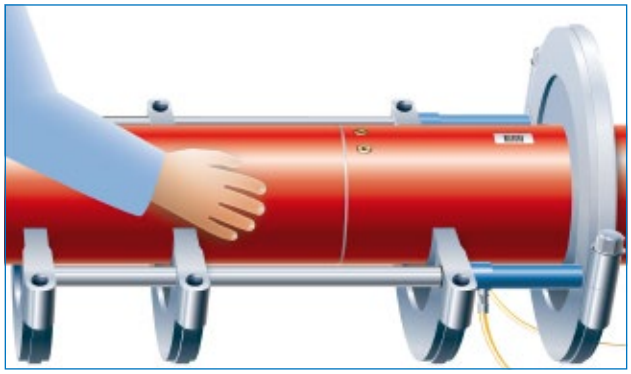


Positioning of the egeplast Smart Connect pipes

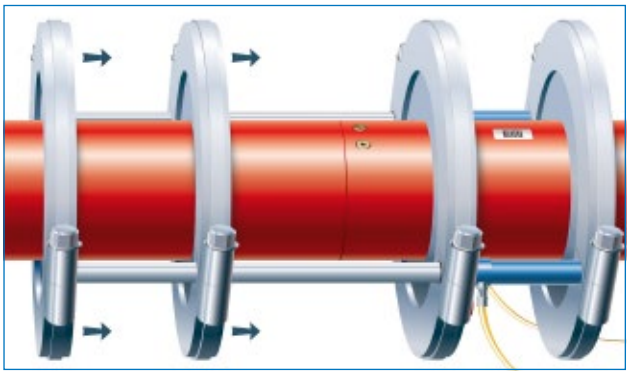


Cleaning of the weld surfaces

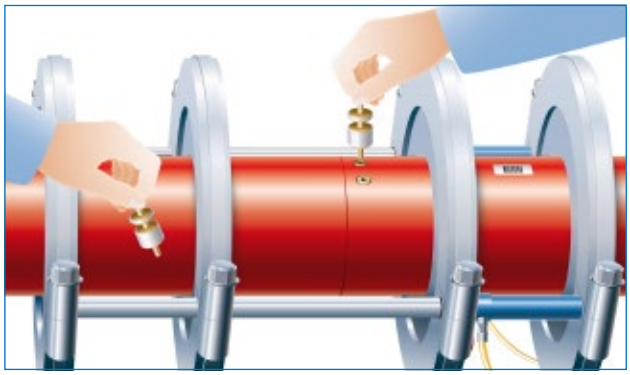
Machining of the weld zone is not required; craters and striae around the weld zone are not acceptable. Paper: lint-free and non-dyed



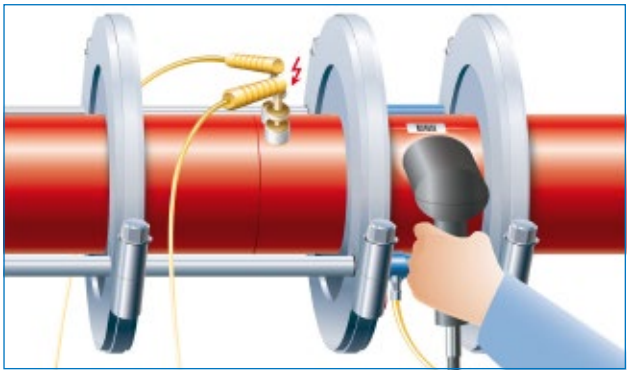
Insertion of the spigot ends into the socket has to be a priority



Fixation of the pipes during the welding procedure is essential. Suitable fixture (assembly device, welding slide); maximum gap width ≤ 2.0 mm



Screwing in of the welding connectors



Preferably, the weld parameters should be scanned using the barcode scanner. Welding cards are also available if needed.

For more instructions and a detailed installation instruction, please scan this QR-code.

We are happy to offer you trainings and on-site instructions/product support for our products!

Final leak test

Make sure to perform a leak test on the pipeline. The acceptability standards are usually specified by the client. In the absence of clear requirements with regard to tightness, the pipeline is to be subjected to a pressure test with air segment by segment (at an over-pressure of 200 mbar) prior to backfilling the trench. In doing so, the requirements stipulated under DIN EN 1610 must be respected.

Calibration

Calibration is to be carried out following completion of the leak test. Which calibre will be used depends on the cables supposed to be assigned to the cable protection pipe subject to agreement with the client. In making this decision, the differences in ovalities for coiled bundles and rods as well as pulled bends must be taken into account. In addition, the permissible pipe tolerances and the allowed deformation due to the installation procedure as well as caused by soil and live loads. For the reasons outlined above, the calibration standard should not exceed 90 % of the nominal inner pipe diameter.



Project overview

Wahle Mecklar (WMC)



Installation	Open-trench installation; HDD
Dimension	250 x 14.8 mm / 280 x 25.4 mm
Volume	45,600 m / 12,840 m
Client	TenneT TSO GmbH

Norderney: BorWin 5 Grid Connection



Installation	HDD
Dimension	450 x 61.5 mm / 250 x 34.2 mm
Volume	6,640 m / 852 m
Client	TenneT Offshore GmbH

ALEGrO



Installation	Open-trench installation; HDD; thrust-boring method
Dimension	250 x 11.4 mm / 280 x 25.4 mm
Volume	65,000 m / 9,500 m
Client	Amprion GmbH

Emden – Conneforde (EmCo)



Installation	Open-trench installation; HDD
Dimension	250 x 14.8 / 280 x 25.4 / 315 x 28.6 / 200 x 18.2
Volume	29,000 m / 4,700 m / 28,000 m / 4,800 m
Client	TenneT TSO GmbH

Hanekenfähr



Installation	Open-trench installation; HDD; thrust-boring method
Dimension	250 x 14.8 mm / 200 x 11.9 mm
Volume	13,320 m / 9,860 m
Client	Amprion GmbH

NVP South Schönewalde



Installation	Open-trench installation; HDD
Dimension	200 x 9.1 mm / 225 x 13.4 mm / 225 x 20.5 mm
Volume	151,348 m / 9,756 m / 1,860 m
Client	e.dis Netz GmbH

Grid Connection of Offshore Wind Power Plants in Clusters “West ofAdlergrund” and “Lake Arkona”



Installation	HDD
Dimension	800 x 58.8 mm / 250 x 22.7 mm
Volume	3,960 m / 44,300 m
Client	50hertz Transmission GmbH

Smart Connect Pilot Project with Föckersperger



Installation	Ploughing method (simple-& double plough)
Dimension	280 x 16.6 mm
Volume	648 m
Client	Amprion GmbH / TenneT TSO GmbH

Smart Connect Pilot Project with Bohlen & Doyen Wahle Mecklar



Installation	Cable laying carriage (KaRoSch)
Dimension	250 x 14.8 mm
Volume	9,900 m
Client	TenneT GmbH

Standards and directives

DIN 16784
High-density pipes made of polyethylene (PE-HD) for buried telecommunication cable ducting – Dimensions and technical delivery conditions

DIN 16876
Pipes and fittings of high-density polyethylene (PE-HD) for buried cable ducting – Dimensions and technical delivery conditions

DIN 8074
Pipes made of polyethylene (PE) – PE 80, PE 100 – Dimensions

DIN 8075
Pipes made of polyethylene (PE) – PE 80, PE 100 – General quality requirements, testing

DIN 16833
Pipes of raised-temperature-resistance polyethylene (PE-RT) – PE-RT Type I and PE-RT Type II – General quality requirements, testing

DIN EN 1852
Plastics piping systems for non-pressure underground drainage and sewerage – Polypropylene (PP)

DIN EN 12201-2
Plastics piping systems for water supply, and for drainage and sewerage under pressure – Polyethylene (PE) – Part 2: Pipes

DIN IEC 167 (VDE 0303, Part 31)
Methods of test for the determination of the insulation resistance of solid insulating materials.

DVS 2201-1
Testing semi-finished thermoplastic products – Basic principles – Notes – Materials and abbreviation

DVS 2207
Welding of thermoplastics – Heated element welding of pipes, piping parts and panels made of polyethylene

PAS 1075
Polyethylene pipes for alternative installation techniques – Dimensions, technical requirements and testing



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Information and instructions

The information provided in this document reflects the state of the art at the time of its compilattion. It serves to instruct and provide advice, without any ensuing obligations. The information does not claim to be exhaustive and shall be subject to change.

For any further inquiries related to installing, using, maintaining or repairing our products or any other questions, please feel free to contact our customer service. Our staff will also be at your disposal for technical instructions.

Published by:
egeplast international GmbH

Issue:
June 2023

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Information, sources and background details regarding our sustainability management can be found on our website at www.egeplast.de/en/sustainability

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