egeplast



egeplast

Protective Pipe Systems for Energy Cables

Your partner for tomorrow's power grid.

For many decades, we have been developing and producing innovative solutions providing a reliable supply of basic human needs such as clean drinking water, heat and electricity as well as access to a fast internet. Our added-value pipe systems are being used in more than 40 countries.

The egeplast Power Protect protection pipe systems are operating daily to ensure reliably functioning power grids in the medium-, high- and extra-high voltage ranges with a useful life being 100 years and more. The certified and tested system solutions are manufactured in our headquarters in Greven and have been specifically designed to meet the high requirements associated with underground installation.

Perfectly organised logistics as well as worldwide presence via international partners and production sites in Europe, along with an efficient manufacturing technology, create the prerequisite for high delivery performance.

With respect to service, we guarantee short routes and competent personal support. For us, customer satisfaction is our top priority.









Permanent
quality controls
during and after production

FACTORY OF THE YEAR
in the category "Outstanding Serial Production" in 2022

> 60 years
of experience in pipe extrusion

50.000
tons of plastic per year in Greven

> 60
patents

Competent support from ideas to delivery

High flexibility
in manufacturing and logistics

3
Production sites in Europe

Power pipe systems made in
Germany









Perfect one-stop service for your construction project







1 Planning service

Our customers are able to benefit from customised solutions helping them to safely implement their plans and construction projects. They can rely on a wealth of experience and technical expertise when approaching us for advice. Our staff will be happy to provide personal assistance to you.

2 egeplast Training Center

At the training facilities provided by our headquarters in Greven, you can participate in product training and also learn new handling techniques. Feel free to approach our staff for more information.

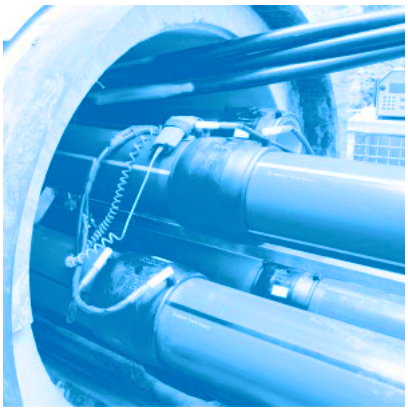
3 On-site instructions

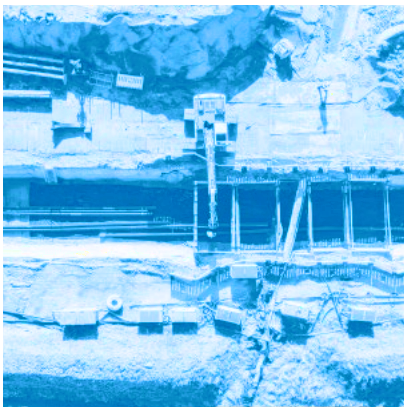
Do you have any questions about handling and installing our egeplast products? Please feel free to contact us. If you wish, we will provide personal assistance right at the construction site.

+49 2575 9710-0
www.egeplast.de/en/service-contact

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Schematic representation of Germany's major power lines



Peak performance for the energy transition. Safety included.

To implement the energy transition, expanding the electricity grids is a must. To ensure an environmentally friendly energy transport, high voltage and extra high voltage lines will be buried in the future.

This places high demands on the pipe systems and materials with regard to robustness and durability. In addition to mechanical and thermal stress, the type of installation used for the protection pipe system is a major criterion for the choice made.

egeplast Power Protect protection pipe systems feature temperature stable materials specifically developed for this purpose which can be used even under extreme conditions. The practice-proven protection and empty conduit programme, complemented by custom-fit system components, provides convincing innovative functionality features as well as efficient joining technology to ensure an economically viable installation of power cables.

egeplast Power Protect protection pipe systems are the ideal choice for a safe and sustainable energy supply – both for open-trench and trenchless installation.

High-quality polymer materials – flexible, durable and versatile

egeplast **Cable Protection Systems** are made of modified high-quality polymer materials. The PE-RT- and PP-HM versions feature permanent thermal resistance, thus enabling them to withstand even maximum stress over a long period of time.

PE-RT

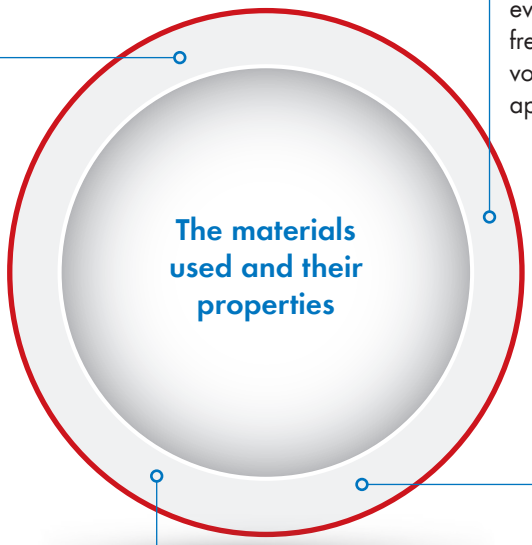
-40 °C 70 °C (95 °C)

Meets the requirements for PE 100 while also featuring thermal stability, thus achieving permanent thermal resistance for 50 years minimum even for temperatures way below freezing. Designed for high voltage and extra high voltage applications up to **525** kV.

PE-RT-RC

-40 °C 70 °C (95 °C)

Meets the requirements for PE 100 plus enhanced stress crack resistance and thermal stability. Designed for high voltage and extra high voltage applications up to **525** kV.



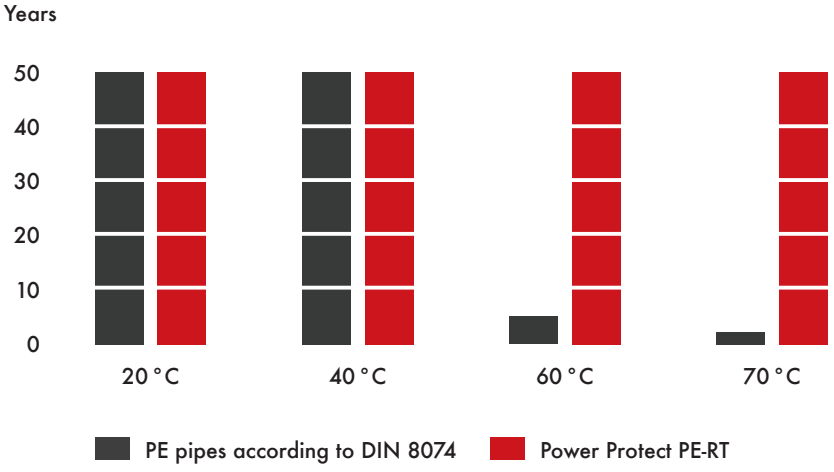
PP-HM

-10 °C 70 °C (95 °C)

Modified PP (high-modulus polypropylene) providing additional excellent heat stability allows for applications involving high temperatures. Designed for high voltage and extra high voltage applications up to **525** kV.

PE 100 / PE 100-RC

Meets the requirements for PE 100 and can be provided with enhanced stress crack resistance, resulting in improved mechanical stability for installation and operation.



Thanks to their specific long-term temperature resistant PE materials, egeplast **Power Protect pipe systems** provide a significantly longer service life than conventional PE pipes.

-40 °C 70 °C (95 °C)





> The utilisation of pipe systems plays a crucial role for a rapid and sustainable expansion of the energy transition. egeplast has identified the market requirements and translated its insights into innovative system solutions for all installation methods.

Dipl.-Ing. Erwin Behrends, Managing Director
at B+ INGENIEUR Gesellschaft mbH

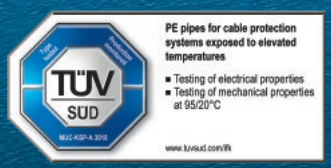


Safety and economic viability: Ensuring long-term operational safety and maintenance of value for power lines

Safety

egeplast offers a perfectly matched protection pipe system and range of accessories. Without any exception, the components are made of high-quality materials. They have been quality-tested and designed for a long service life:

- High-quality new materials
- Certified by TÜV-Süd
- Temperature-resistant
- Long service life
- Capacity / security of supply



Economic viability

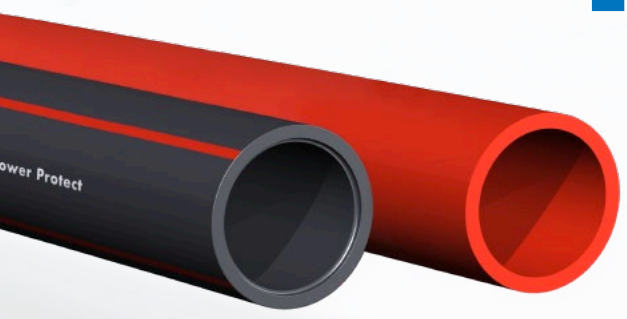
The large range of innovative products related to the egeplast Power Protect-Systems, together with efficient joining technolgies, ensure a rapid and economic installation of underground cables:

- Easy handling thanks to compatible components
- Innovative 3-layer technology with special functional layers
- Fast joining technologies ensuring high installation performance and easy assembly


egeplast Power Protect
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egeplast Power Protect
egeplast Power Protect Smart Connect

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1 Products



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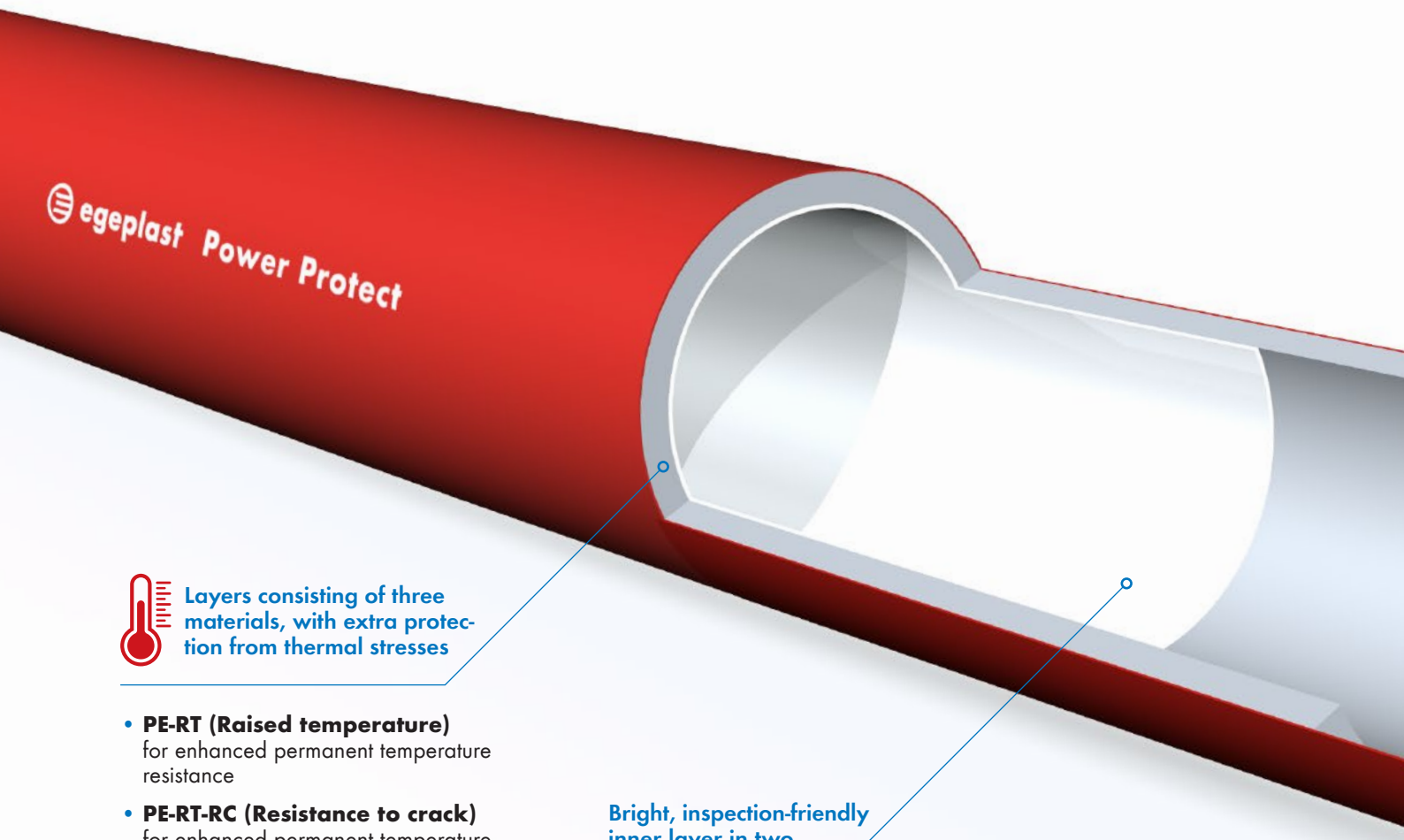
Power Protect

INNOVATIVE 3-LAYER TECHNOLOGY

Innovative 3-layer technology specifically designed to protect high and extra high voltage networks up to 525 kV

The **egeplast Power Protect protection pipe systems** have been developed specifically to meet the increased requirements associated with extra-high voltage power lines. They contribute to fast and economical installation particular across long distances.

Their functional, co-extruded pipe layers ensure perfect protection geared towards controlling heat dissipation and offer a long service life even under extreme conditions.



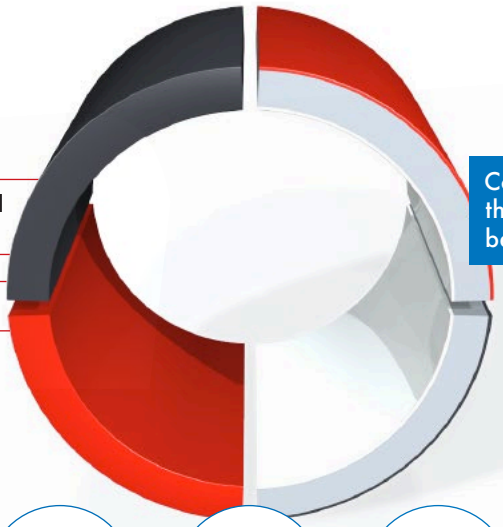
Layers consisting of three materials, with extra protection from thermal stresses

- **PE-RT (Raised temperature)** for enhanced permanent temperature resistance
- **PE-RT-RC (Resistance to crack)** for enhanced permanent temperature and crack resistance
- **PP-HM (High modular)** for increased mechanical stability and long-lasting temperature resistance

Bright, inspection-friendly inner layer in two variants

- Special sliding layer for smooth cable insertion with optimal insertion lengths
- Special layer with enhanced abrasion-resistance for additional protection from grooves and scores e. g. for traction cables

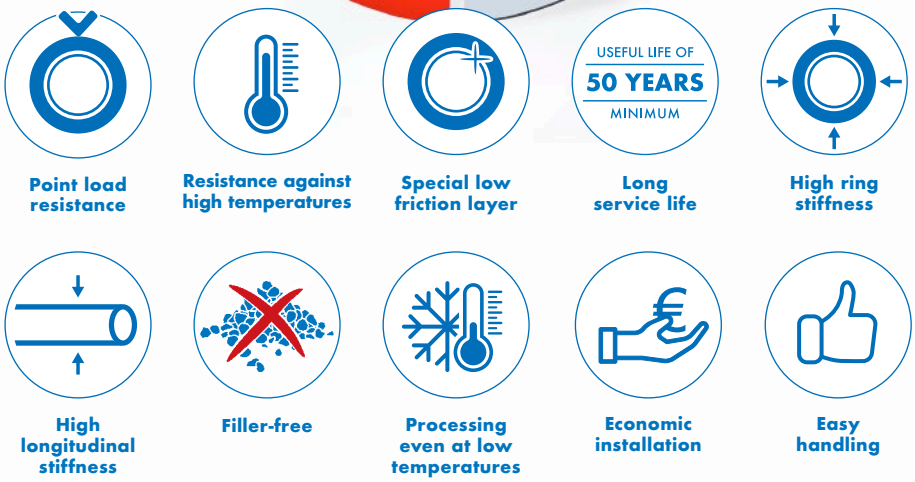
Individually configurable:



Suitable for any and all installation methods

100 % system-tested

Coextrusion ensures that the individual layers cannot be separated mechanically



Point load resistance

Resistance against high temperatures

Special low friction layer

Long service life

High ring stiffness

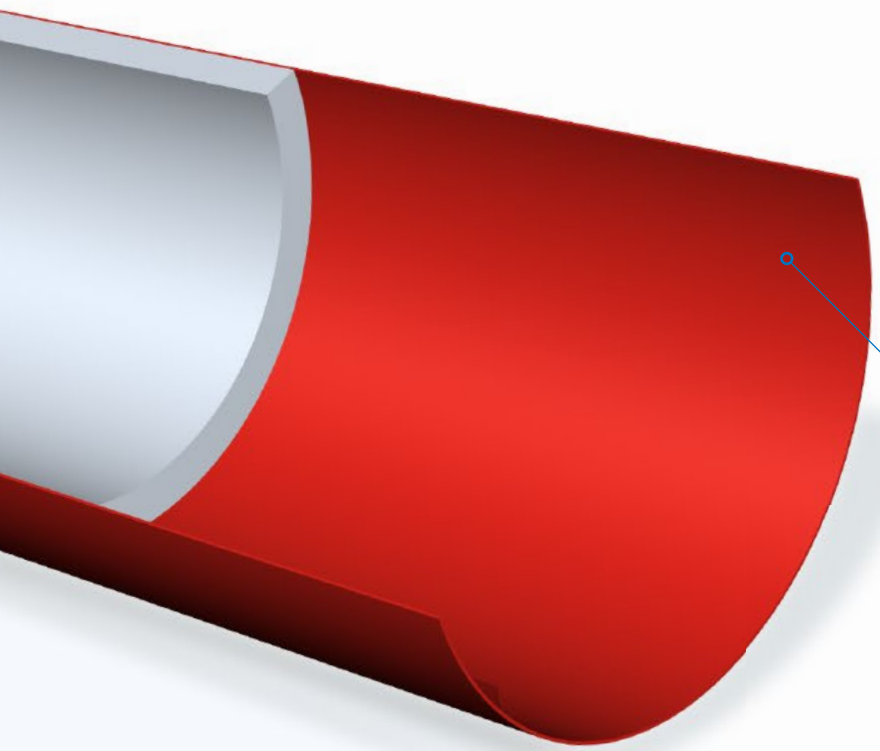
High longitudinal stiffness

Filler-free

Processing even at low temperatures

Economic installation

Easy handling



UV-resistant signal colour layer

Optionally available in the signal colours red, black or black with red stripes. Other colours are also available upon request.

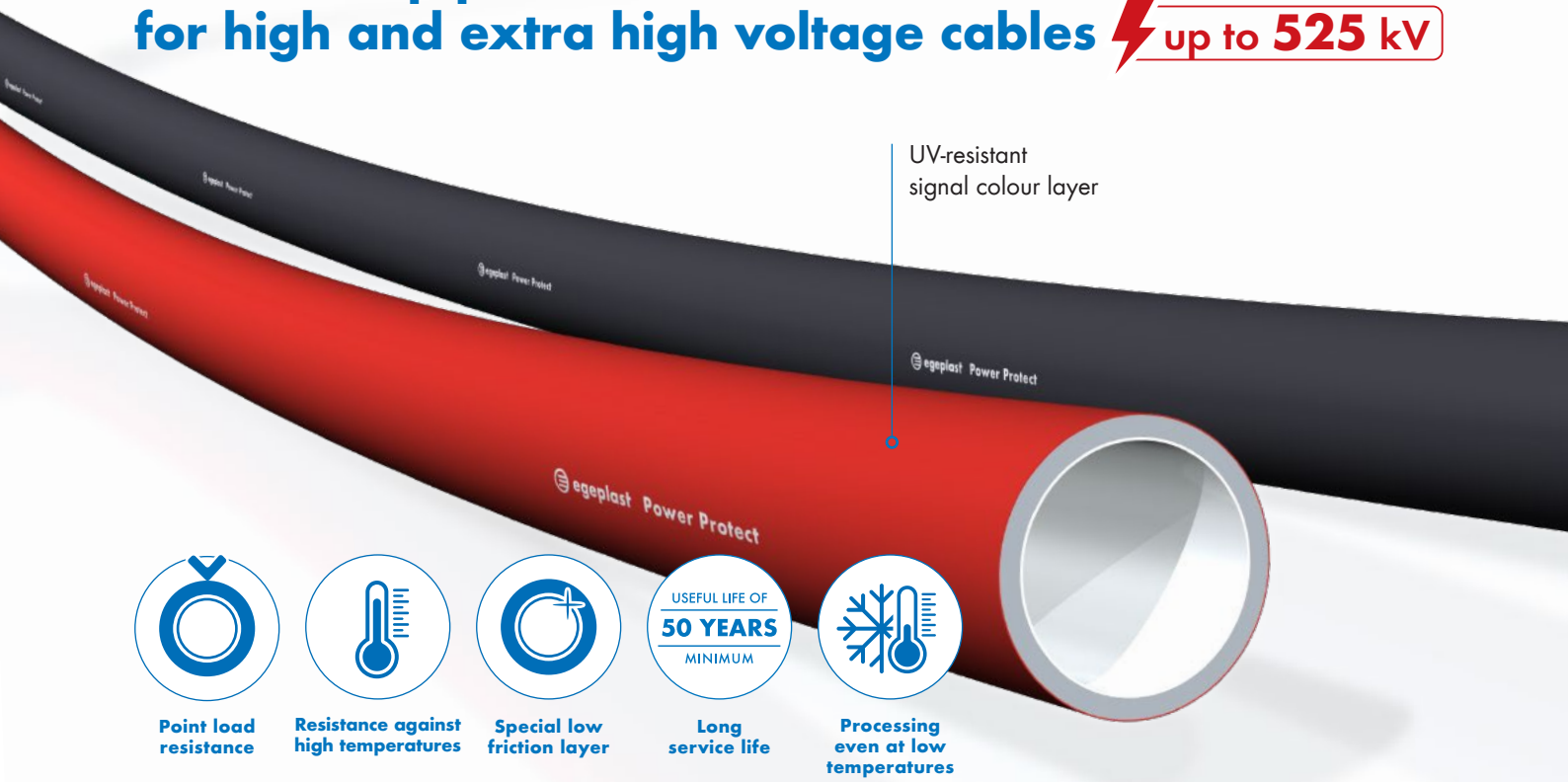


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Power Protect PE

Protection pipe made of PE-RT for high and extra high voltage cables

up to 525 kV



Point load resistance

Resistance against high temperatures

Special low friction layer

Long service life

Processing even at low temperatures

Dimensions

egeplast Power Protect PE						
Outer diameter [mm]	Wall thickness [mm]	Inner diameter [mm]	SDR class	Weight [kg/m]	Ring stiffness SN [kN/m²]	Tensile force [kN]
160	7.7	144.6	21	3.75	10	37
	9.5	141.0	17	4.57	16	45
	14.6	130.8	11	6.74	64	67
180	8.6	162.8	21	4.71	10	46
	10.7	158.6	17	5.77	16	57
	16.4	147.2	11	8.51	64	84
200	9.6	180.8	21	5.84	10	57
	11.9	176.2	17	7.12	16	70
	18.2	163.6	11	10.5	64	104
225	10.8	203.4	21	7.37	10	73
	13.4	198.2	17	9.03	16	89
	20.5	184.0	11	13.3	64	132
250	11.9	226.2	21	9.02	10	89
	14.8	220.4	17	11.1	16	109
	22.7	204.6	11	16.3	64	162

-40 °C 70 °C (95 °C)

High-performance pipe system to protect underground cables

Solid-wall protection pipe or co-extruded protection pipe made of modified PE-RT material able to withstand high thermal loads. In addition, the PE-RT-RC version can be used to increase stress crack resistance.

Solid wall or co-extruded pipes, optionally with stripes

Inspection-friendly inner layer: optionally high-slide or abrasion-resistant



PE pipes for cable protection systems exposed to elevated temperatures
- Testing of electrical properties
- Testing of mechanical properties at 95/20°C

TÜV SÜD

www.tuvsud.com/ifk

The material and pipe design meet all customer specifications

Dimension: **75 – 1,600 mm**

SDR: **7.4 – 26**

Delivery forms: **Bars, coiled bundles, drums**

According to DIN 8074/8075, ISO 24033, PAS 1075, DIN EN 1555, DIN 16833

egeplast Power Protect PE

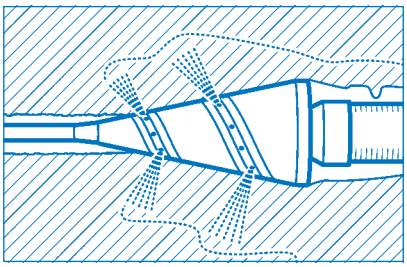
Outer diameter [mm]	Wall thickness [mm]	Inner diameter [mm]	SDR class	Weight [kg/m]	Ring stiffness SN [kN/m²]	Tensile force [kN]
280	13.4	253.2	21	11.4	10	112
	16.6	246.8	17	13.9	16	137
	25.4	229.2	11	20.5	64	203
315	15.0	285.0	21	14.3	10	141
	18.7	277.6	17	17.6	16	174
	28.6	257.8	11	25.9	64	257
355	16.9	321.2	21	18.2	10	180
	21.1	312.6	17	22.4	16	221
	32.2	290.6	11	32.9	64	327
400	19.1	362.0	21	23.1	10	227
	23.7	352.6	17	28.3	16	280
	36.3	327.4	11	41.7	64	415
450	21.5	407.0	21	29.3	10	289
	26.7	396.6	17	35.8	16	355
	40.9	368.2	11	52.8	64	526

More dimensions upon request

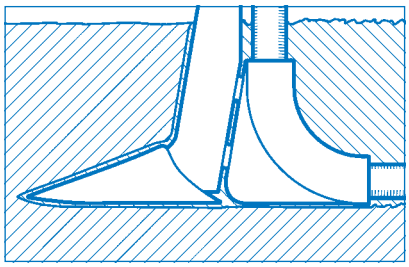
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Power Protect PE

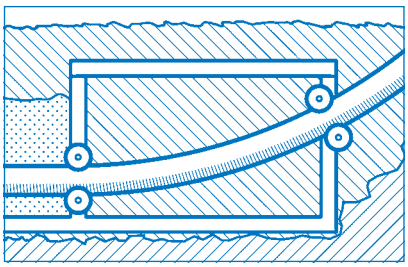
Suitable for the installation methods indicated below



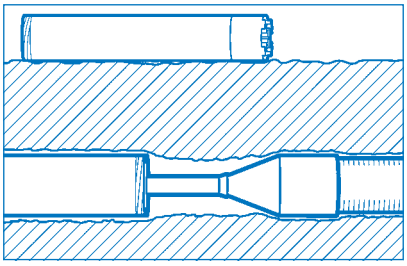
Horizontal directional drilling (HDD)



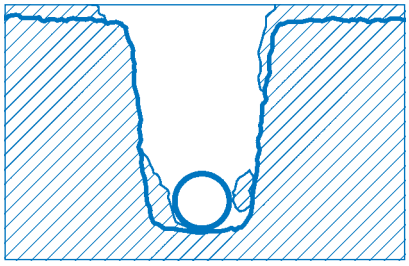
Ploughing



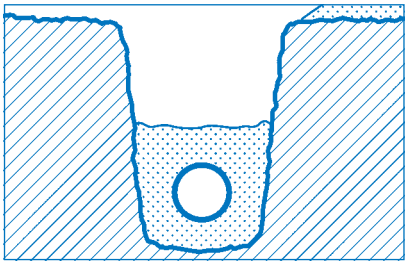
Pipe installation sledge



E-power pipe



Open-trench installation
without sand bed



Open-trench installation
in a sand bed

Low friction inner layer – ideal for long cable insertion distances

Fast and economic:
The special low friction layer supports a smooth insertion of power cables, ensuring an optimal cable insertion length und reducing the number of cable sleeve connections.





Additional use of RC materials helps to achieve increased stress crack resistance.

Connection types

Strong connections – efficient and tight.

All connection types can be used for double-sided cable insertion.

Laying of underground cables involves multiple requirements related to the pipe connections. Only with the matching connection part, a permanent pipe connection can be created which also withstands extreme conditions. The egeplast Power Protect product range provides a large selection of coordinated system connections which are fast and easy to apply.



Power Protect for butt welding

Smooth pipe ends make them ideally suited for butt welding.

Product benefits:

- Optimised tensile strength
- Smooth pipe ends
- High flexibility for installation in a bend environment

Power Protect with a "Golden Joint"

The "Golden Joint" is generated by means of a specifically developed recess integrated in the pipe which reliably receives the inner beading during the welding procedure.

Product benefits:

- High-tensile strength connection associated with minor reduction of the permissible tensile force
- No subsequent removal of the inner bead
- High flexibility for installation in arches
- Serves to reduce the documentation effort involved
- Also available as an adapter (cf. p. 37)

Power Protect with double plug-in socket

Based on the high installation performance it results in, the extra long version of the plug-in system is particularly economic.

Product benefits:

- System- and water tight
- Increased longitudinal stiffness
- With insertion depth marking on the pipes
- Impenetrable to roots



- Horizontal directional drilling (HDD)
- Ploughing
- Open installation in a sand bed
- Pipe installation sledge
- E-power pipe

Power Protect with electrofusion couplers

High tensile strength pipe connection by means of an electrofusion socket. The integrated heating coils ensure a gentle energy input.

Product benefits:

- Reduced welding and cooling times (DVS-compliant)
- High tensile strength connection
- High flexibility for laying in a bend area
- High laying performance

Power Protect Smart Connect (socket ends)

Power Protect pipe with an integrated joining technology for plug-in and welding. The spigot and weldable socket end are connected via a one-click connection (cf. p. 22).

Product benefits:

- Flush joint connection
- No machining of the weld zone required
- High flexibility for laying in a bend area
- Shorter welding- and cooling times

Power Protect Smart Connect (spigot)

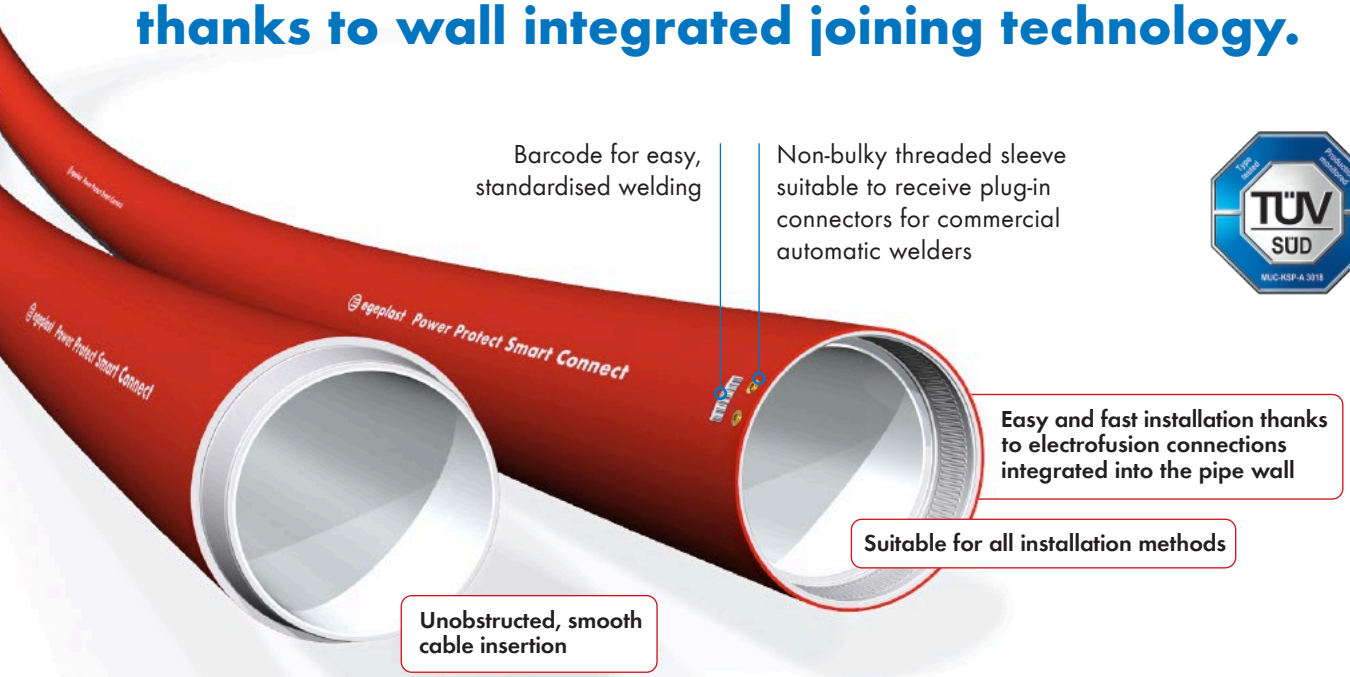
For laying in arches, material-to-material joining technologies (electrofusion or heating element butt welding) are mandatory!

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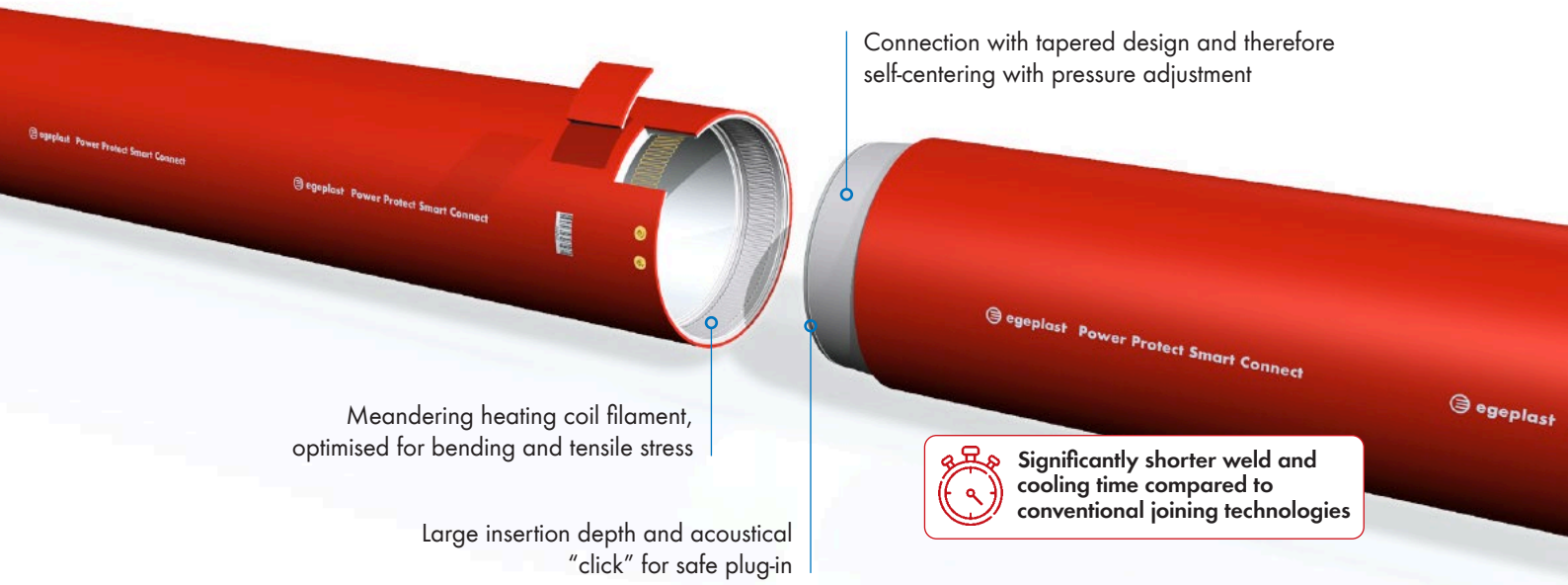
INNOVATION!

Power Protect Smart Connect

Plug in – weld – tight: Faster installation thanks to wall integrated joining technology.



With **egeplast Smart Connect**, you have Power Protect pipes and joining technology combined in a single component. The spigot and the weldable socket end have been integrated directly into the pipe, thus generating a permanent connection of the pipe system. The flush connection at each joint enables you to skip the time-consuming subsequent machining and re-work of the weld zone. This ensures a lasting strong connection while just minimally reducing the permissible tensile strength.





Watch our video “The Energy Transition Requires Sustainable and Future-proof Power Grids.”

egeplast

Power Protect PP

INNOVATIVE 3-LAYER TECHNOLOGY

Protection pipe made of PP-HM for high and extra-high cables

up to 525 kV



- Resistance against high temperatures
- Special low friction layer
- Long service life (USEFUL LIFE OF 50 YEARS MINIMUM)
- High ring stiffness
- High longitudinal stiffness
- Processing even at low temperatures
- Filler-free

Dimensions

egeplast Power Protect PP-HM					
Outer diameter [mm]	Wall thickness [mm]	Inner diameter [mm]	SDR class	Weight [kg/m]	Ring stiffness SN [kN/m²]
160	6.2	147.6	26	2.92	10
	7.3	145.4	22	3.41	16
	9.5	141.0	17	4.33	32
180	6.9	166.2	26	3.63	10
	8.2	163.6	22	4.31	16
	10.7	158.6	17	5.47	32
200	7.7	184.6	26	4.50	10
	9.1	181.8	22	5.31	16
	11.9	176.2	17	6.75	32

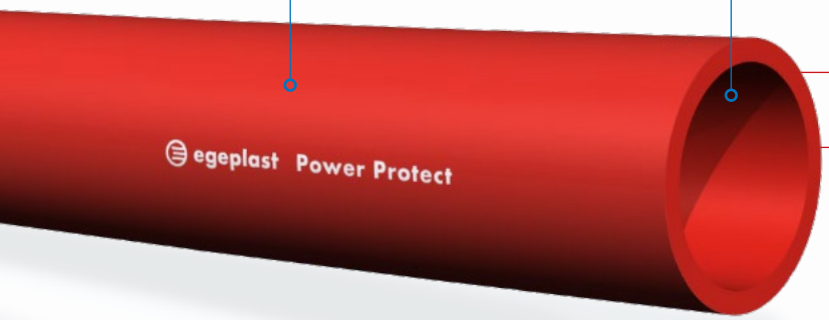
-10 °C 70 °C (95 °C)

Power Protect protection pipes made of high-modular polypropylene (PP-HM) are mechanically particularly robust and offer the best protection for the installation of underground cables. The functional co-extruded pipe layers are made to withstand high temperatures in the long run and are suitable for applications requiring long-lasting durability.

100 % QUALITY TESTED
FROM THE MATERIAL TO THE FINAL PRODUCT

UV-resistant signal colour layer

Connection types: Suitable for double plug-in sockets, electrofusion sockets and butt welding



The material and pipe design meet all customer specifications

Dimension: **160 – 280 mm**

Ringsteifigkeit: **SN 10 – SN 32**

SDR: **17 – 26**

Delivery form: **6- or 12-m-bar**

According to DIN EN 1852-1, DIN 8077, DIN 16878

egeplast Power Protect PP-HM

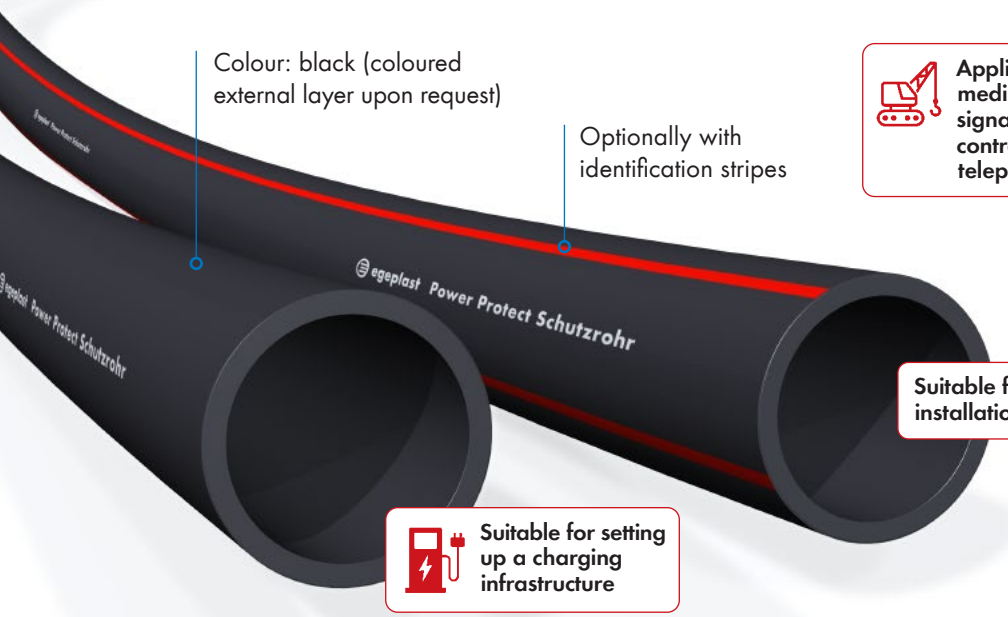
Outer diameter [mm]	Wall thickness [mm]	Inner diameter [mm]	SDR class	Weight [kg/m]	Ring stiffness SN [kN/m²]
225	8.6	207.8	26	5.65	10
	10.2	204.6	22	6.68	16
	13.4	198.2	17	8.56	32
250	9.6	230.8	26	6.99	10
	11.4	227.2	22	8.27	16
	14.8	220.4	17	10.5	32
280	10.7	258.6	26	8.72	10
	12.8	254.4	22	10.38	16
	16.6	246.8	17	13.2	32

More dimensions upon request

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Power Protect protection pipe

The right protection for control cables



Application area: control lines in the low, medium and high voltage range, railway signal cables, cables for measurement, control and regulation technology as well as telephone and telecommunication cables.

Suitable for all installation methods

100 % QUALITY TESTED
FROM THE MATERIAL TO THE FINAL PRODUCT

Suitable for setting up a charging infrastructure

Outer diameter OD: **75 – 1,600 mm**

SDR: **7.4 – 21**

The **egeplast Power Protect-protection pipe** for control lines offers specific mechanical protection for a large range of cables and lines. It is also ideally suited as an empty conduit to insert additional cables later on.

The protection pipe is available in three grades by default:

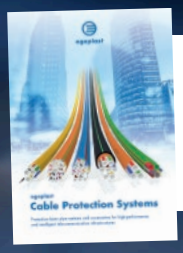
① **Pressure pipe quality based on DIN 8074 (PE 100)**

② **Pipes according to DIN 16874**

③ **Pipes according to DIN 16876**

Power Protect protection pipe

Requirement	Pressure quality PE 100 according to DIN 8074/75	Telecommunication pipe DIN 16874	Cable protection pipe DIN 16876
Raw material	Virgin material, circulation material	Virgin material, circulation material, defined granules	Virgin material, circulation material, granules, regenerates
Internal pressure creep	5.4 MPa, 80 °C – 170 h	4.0 MPa, 80 °C – 170 h	Not applicable
Durability / temperature resistance	40 °C – 50 a	Not applicable	Not applicable
Weldability	Yes	Yes	Not applicable
Mechanical testing	Not stipulated	Not stipulated	Folding test Drop test
Air injection pressure testing	Not applicable	Not applicable	12 bar 35 °C – 2 h
Monitoring	Not monitored	SKZ	Not monitored



For information on OD 32 – 63 mm pipes, please refer to the “egeplast Cable Protection Systems: Protection Pipe Systems and Accessories for Efficient and Intelligent Telecommunication Infrastructures“ catalogue.


egeplast Power Protect
egeplast Power Protect Smart Connect
egeplast Power Protect
egeplast Power

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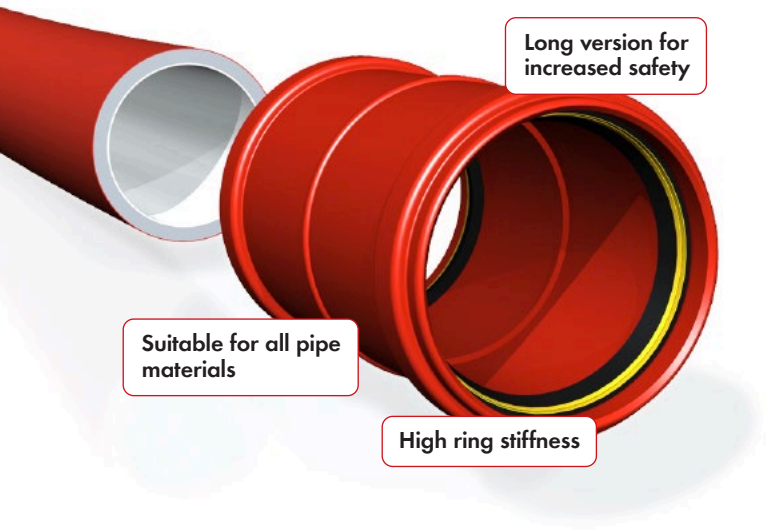
2 Power Protect System accessories

Double socket/sleeve socket, electrofusion couplers ... 30
pipe bends, end caps, flanges, spacers, buoyancy controls, cable protection foils and cable cover plates, trench warning tape ... 31
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Double socket (PP-HM)
Sleeve socket (PP-HM)

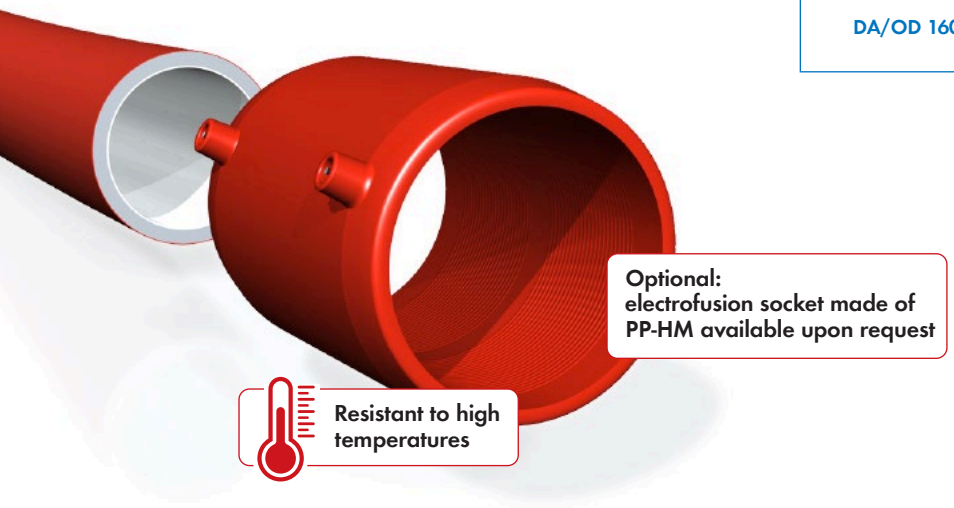
Double sockets in an extra long version made of PP-HM with sealing rings made of EPDM, resistant to pressures of 2.5 bar minimum.



egeplast Double socket / Sleeve socket	
Dimensions	Length
OD pipe [mm]	L [mm]
160	279
200	326
225	364
250	400
280	430
315	472

Electrofusion couplers (PE-RT)

Electrofusion couplers made of PE-RT (Raised Temperature), DVS-tested for reduced welding and cooling time.



egeplast Electrofusion couplers	
DA/OD 160 – 800 mm	SDR 11 – 26

Pipe bends

Flexible **pipe bends** made of PE-RT.



End caps

End caps made of PE-RT or PE 100, weldable design or as plug-in sleeves to seal off protection pipes.



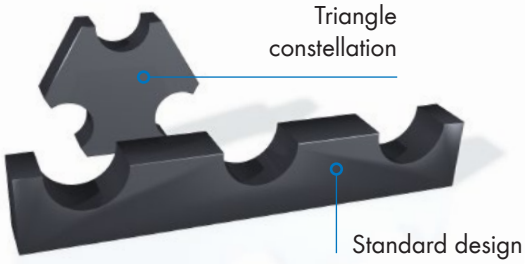
Flanges

Flanges available in different versions upon request.



Spacers

Spacers for precise fixation in an open trench. Customised solutions based on customer's specifications possible.



Buoyancy control

Concrete component to prevent pipe buoyancy with simultaneous positioning.



Cable protection foils

Cable protection foil to provide secure protection from external impact.



Cable cover plates

Cable cover plates to provide secure protection from external impact.

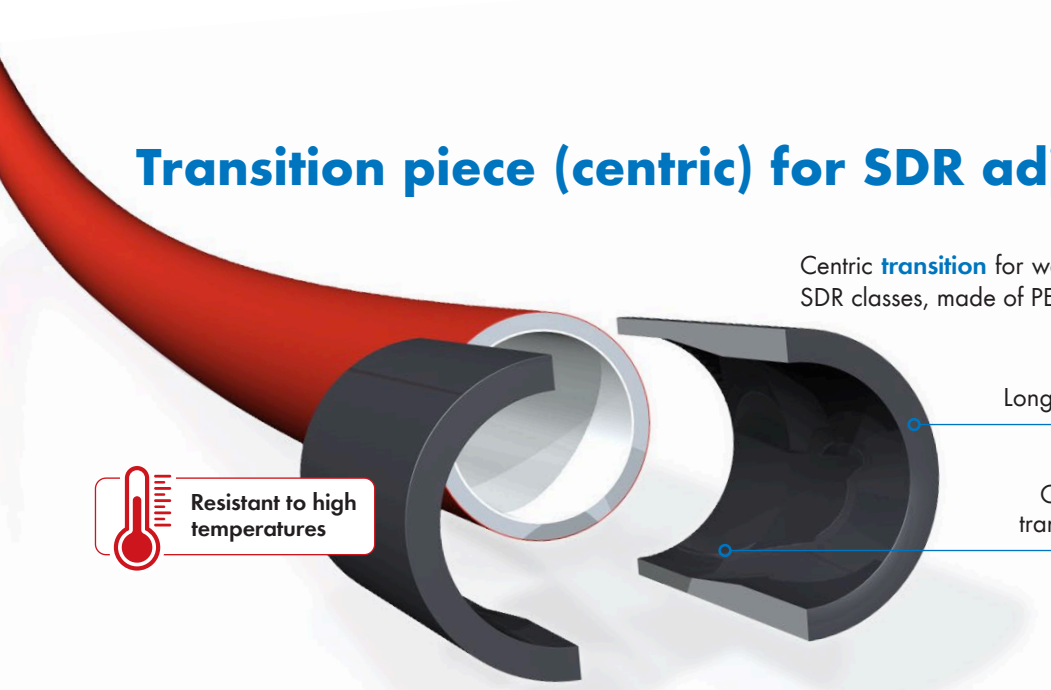


Trench warning tape

E-composite film according to FTZ 548464 TV1, ageing- and cold resistant, colourfast, permanently legible, with transparent foil coating over the printed area.



Transition piece (centric) for SDR adjustment



Centric **transition** for wall thickness adjustment for different SDR classes, made of PE-RT (Raised Temperature).

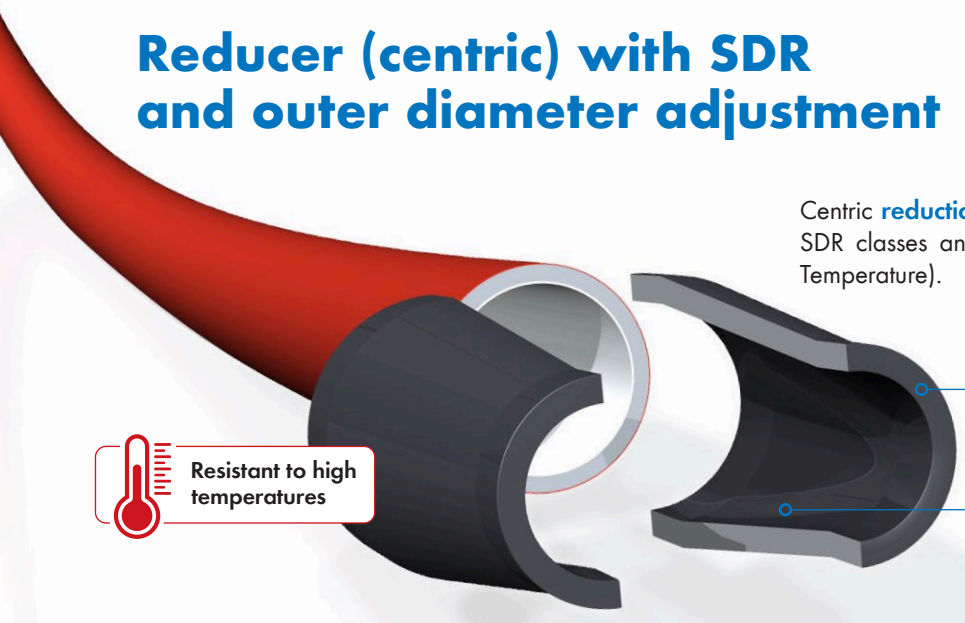
Long ends for electrofusion socket

Gradient inside in the transition area max. 2°

egeplast Transition piece (centric) for SDR adjustment

Outer diameter [mm]	SDR class	Wall thickness [mm]	Inner diameter [mm]	Outer diameter [mm]	SDR class	Wall thickness [mm]	Inner diameter [mm]
200	11	18.2	163.6	200	17	11.9	176.2
225		20.5	184.0	225		13.4	198.2
250		22.7	204.6	250		14.8	220.4
280		25.4	229.2	280		16.6	246.8
315		28.6	257.8	315		18.7	277.6

Reducer (centric) with SDR and outer diameter adjustment



Centric **reduction** for wall thickness adjustment for different SDR classes and outer diameters, made of PE-RT (Raised Temperature).

Long ends for electrofusion socket

Gradient inside in the transition area max. 2°

egeplast Reducer (centric) with SDR and outer diameter adjustment

Outer diameter [mm]	SDR class	Wall thickness [mm]	Inner diameter [mm]	Outer diameter [mm]	SDR class	Wall thickness [mm]	Inner diameter [mm]
225	11	20.5	184.0	200	17	11.9	176.2
250		22.7	204.6	225		13.4	198.2
280		25.4	229.2	250		14.8	220.4
315		28.6	257.8	280		16.6	246.8

“Golden Joint” joining technology

The “Golden Joint” is generated via a specifically designed integrated deepening which automatically receives the inner bead. Subsequent removal of the weld bead is thus no longer required. Available as an adapter or as a solution which has already been integrated into the pipe string.

egeplast “Golden Joint” connection piece	
DA/OD 160 – 800 mm	SDR 7.4 – 17



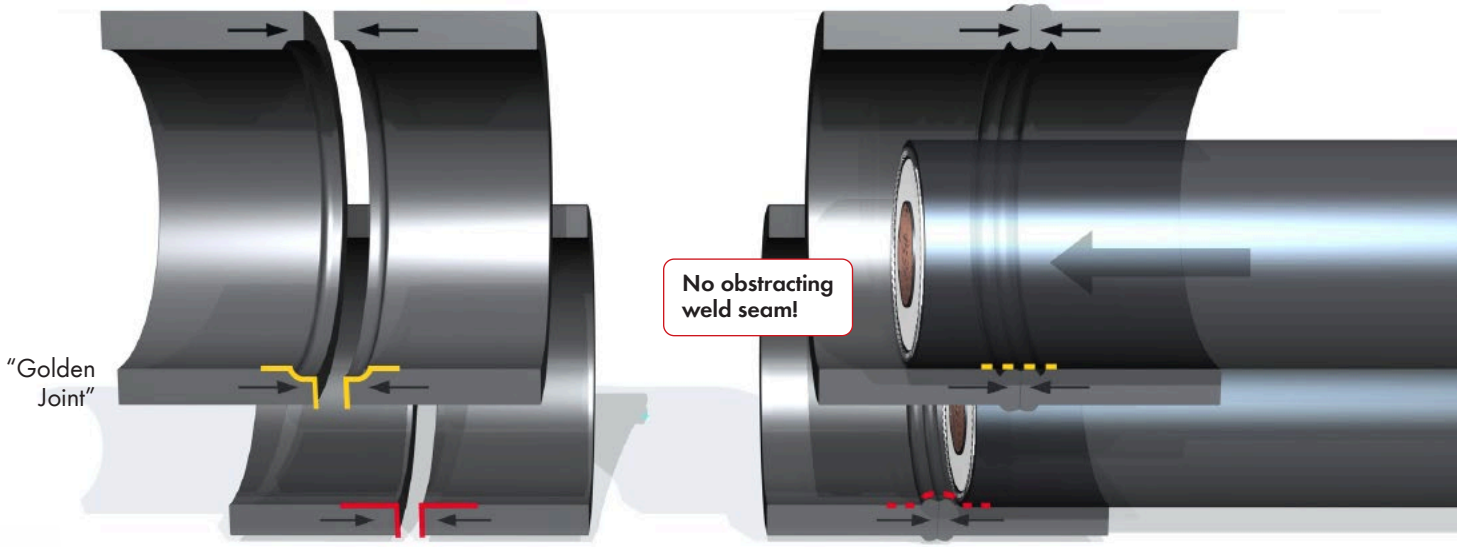
Integrated into the pipe string

As a weld-on adapter

Resistant to high temperatures

Proven and tested connection integrity with a smooth cable insertion

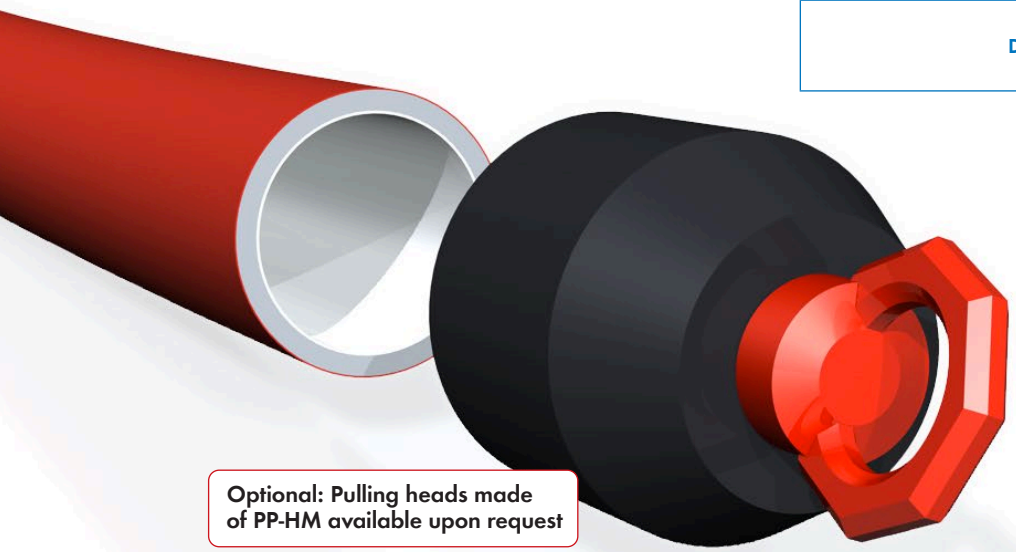
This type of connection is particularly suitable for confined spaces at the construction site since it allows for connecting relatively long pipe strings. The “Golden Joint” is available as a ready-to-use integrated solution for the Power Protect-pipe strings. As an adapter, the connector can be welded flexibly to any pipe end.



Pulling heads

Weldable **pulling head** made of PE 100 in various SDR classes with a traction eye.

egeplast Pulling heads
DA/OD 180 – 355 mm



Optional: Pulling heads made of PP-HM available upon request

Filler neck for filling with bentonite

Allows for filling of the installed protection pipe systems following cable insertion.

egeplast Filler neck
DA/OD 50 mm / 63 mm





Tools

The robust system tools provided by egeplast ensure easy, comforable and fast installation of the Power Protect connection technologies. The comprehensive egeplast product range offers the right tools for every application.

Internal debeader

To remove internal weld beads on PE and PP pipes



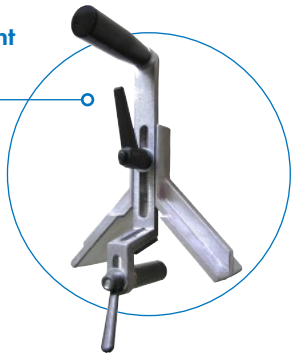
External debeader

To remove external weld beads on PE and PP pipes



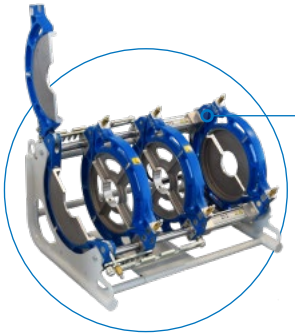
Pipe chamfering equipment (chamfering device)

Used to chamfer the pipe ends, to be used with pipes with double plug-in sockets



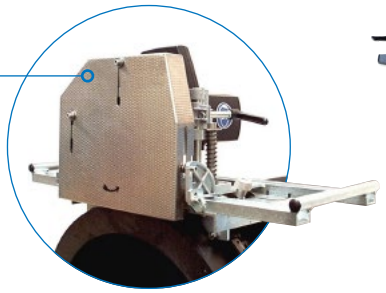
Assembly device (Smart Connect)

Mounting aid for connecting two pipe strings



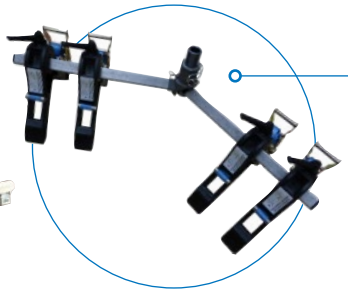
Pipe cutting machine / Tube saw

To separate pipe strings at the construction site



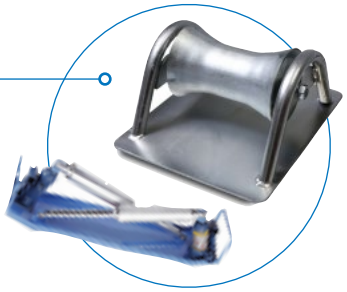
Holding clamps

Used to fasten Smart Connect connections during the welding procedure for stress-relieved welding



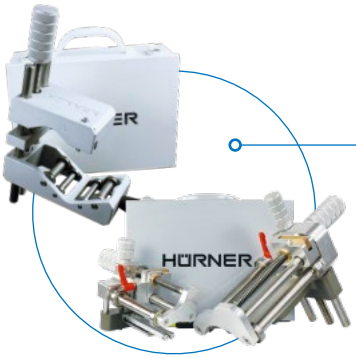
Roller blocks

For optimum alignment of the pipe strings and to reduce the kinetic forces

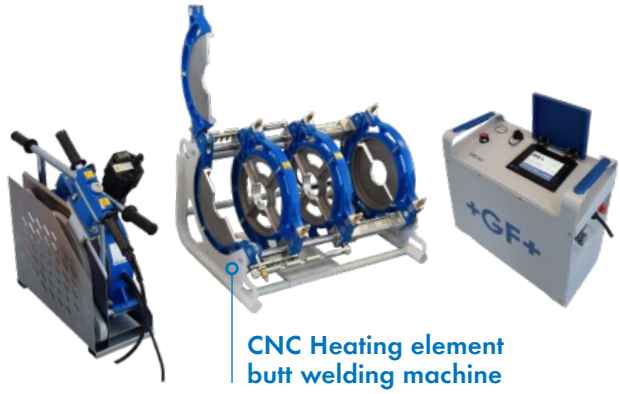


Peeling tools

Pipe peeler for mechanical processing of the pipe surface



Installation equipment for rental and sale



CNC Heating element butt welding machine



CNC Heating element butt welding machine



Universal electrofusion welding machines

Consumables



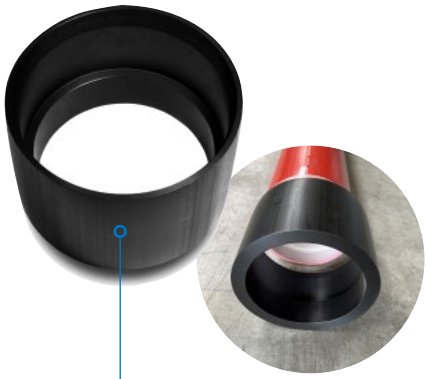
Lubricant

Lubricant to reduce friction during cable insertion



PE/PP cleaner and wipes (white)

To clean the welding zones in order to create a secure welded joint



Push-up adapter (Dummy)

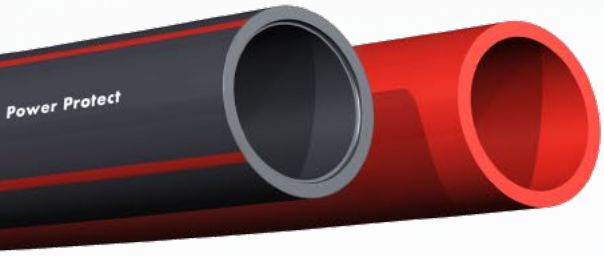
Tool used to mount and protect egeplast Smart Connect joints


egeplast Power Protect
egeplast

Find our Installation Instructions online as a PDF for download.

egeplast

3 Installation



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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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www.egeplast.eu

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.

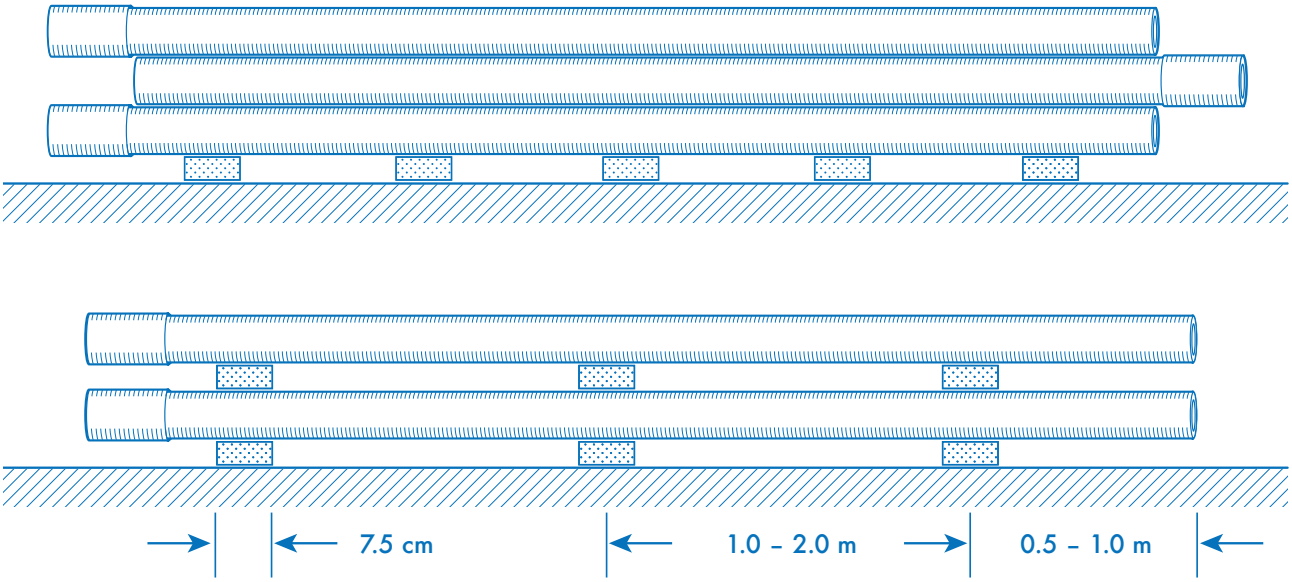
Unloading must be performed using suitable equipment. We recommend broad lifting straps and, for bigger pipe lengths, traverses; coiled bundles should be unloaded individually using a sling. Dropping or rolling the pipes off from the lorry bed.

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.

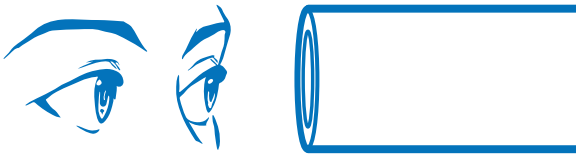
4. egeplast Power Protect-pipes with a black outer layer can be stored outdoors without any limitations.

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

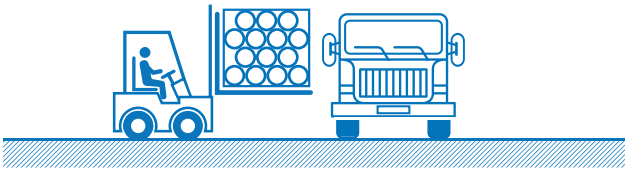
6. On the construction site, the pipes should be stored with a white cover—a customary white filter fleece (e. g. class II; 120 g/m²) or white foil.

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.

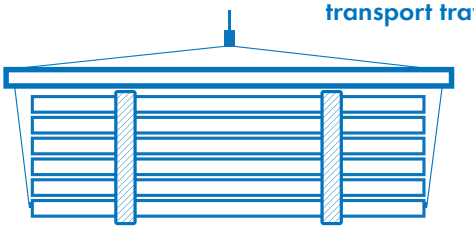
Visual examination of pipes or fittings



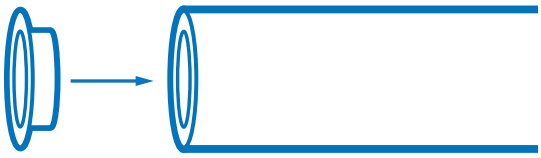
Careful loading and unloading of a truck (using a forklift)



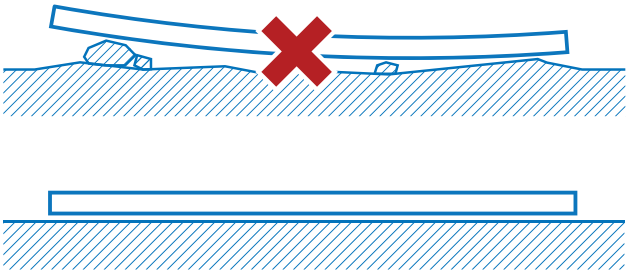
Transportation of a pipe palet via a transport traverse



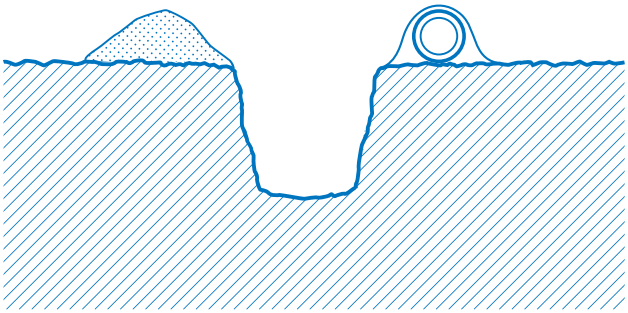
Secure storage: With sealed pipes



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.

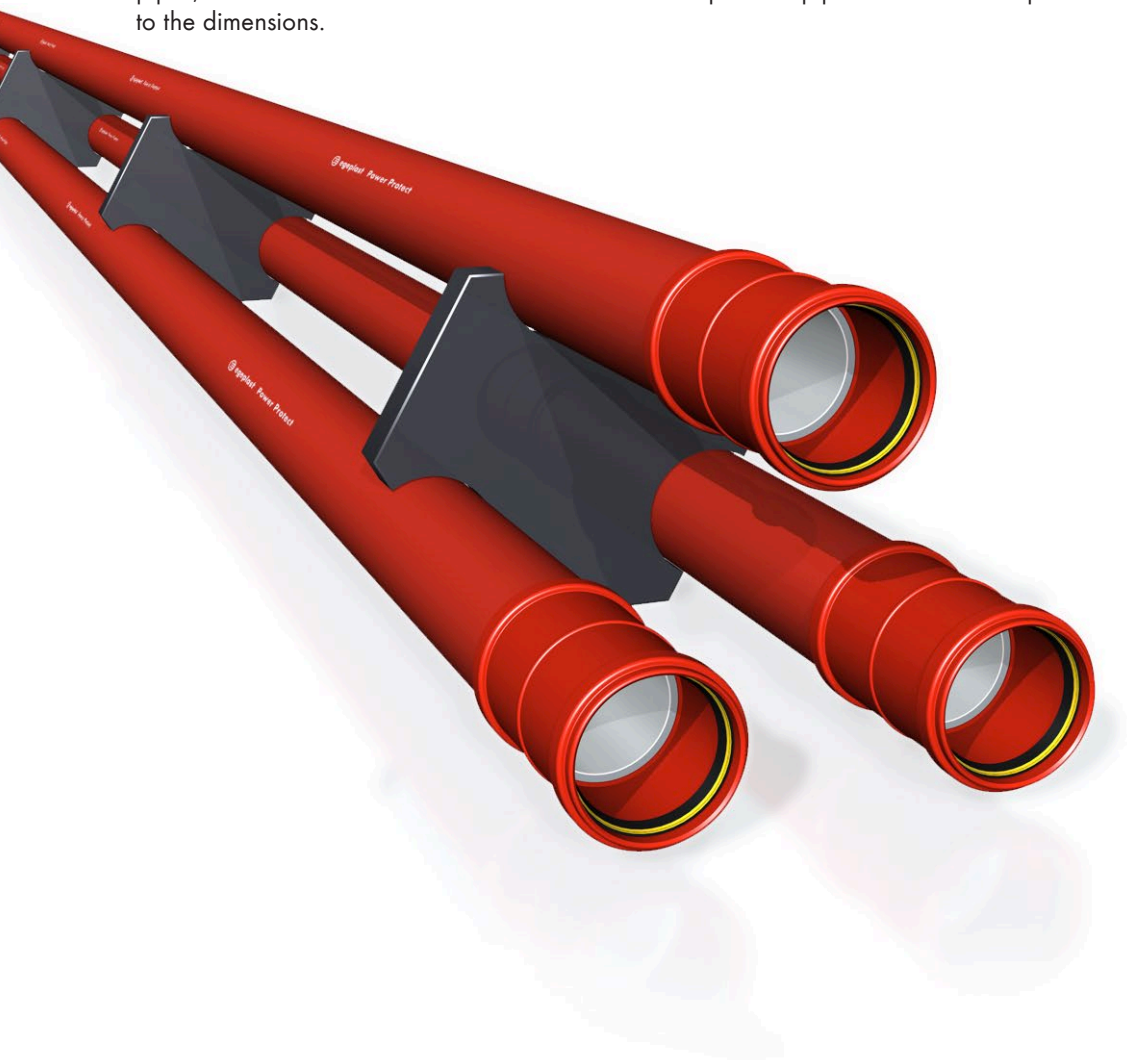
- egeplast Power Protect pipes can be handled at temperatures from -10 °C to +45 °C.
- Coloured outer layers provide protection from additional heating when the pipes are in the sun.
- Unfavourable weather conditions such as moisture and draughts are to be avoided, e.g. by means of pitching a tent.
-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

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

Spacers

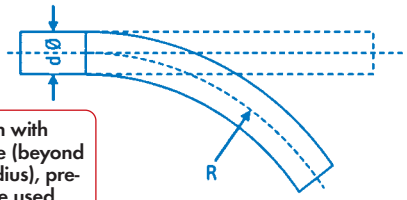
For a multi-layer arrangement of cable protection pipes in the pipe trench, we recommend fixing the pipes by means of spacers. To prevent the occurrence of point loads on the pipes, the width of the contact surface should be adapted to the dimensions.

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), prefabricated 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.

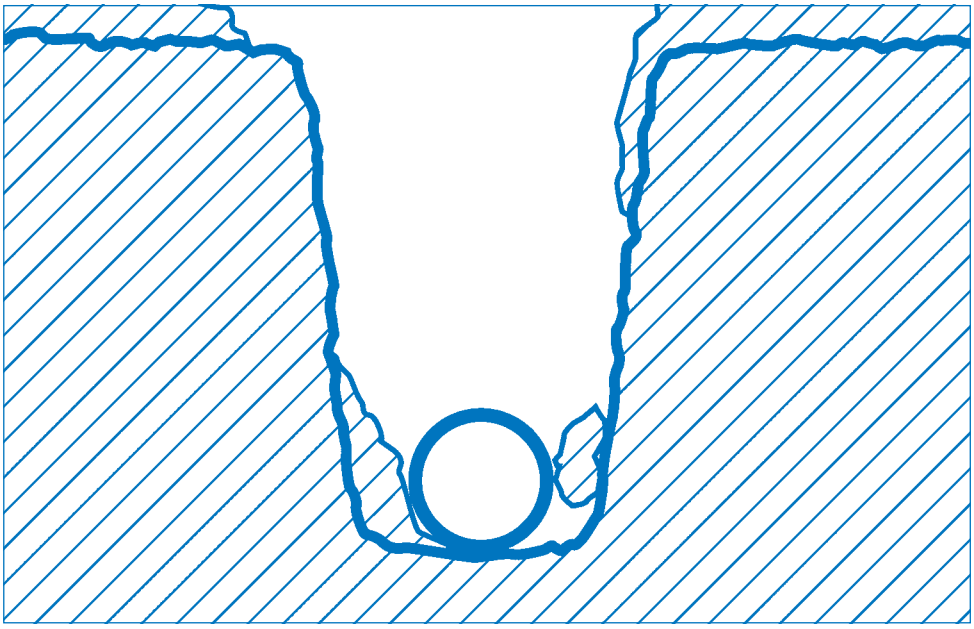
> 30 minutes: reduction by 10 %
> 20 hours: reduction by 25 %

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

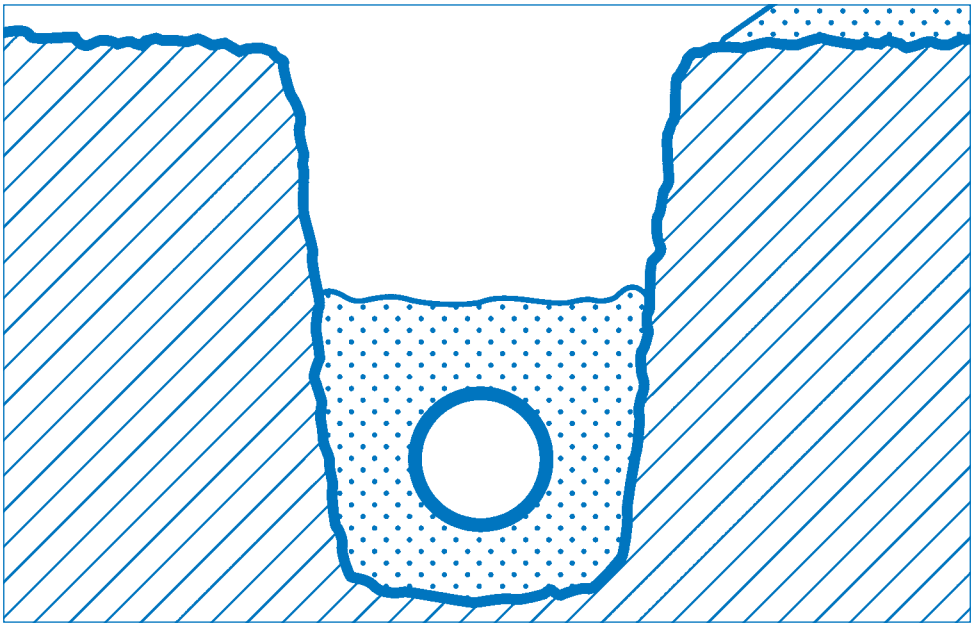
Installation methods

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

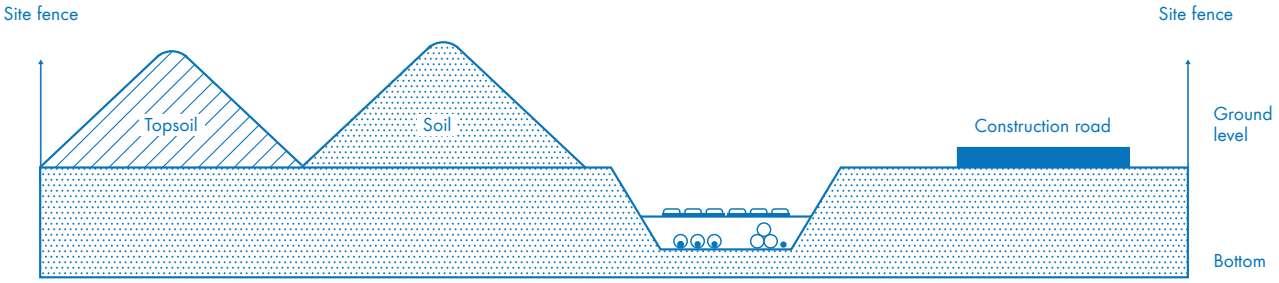
The execution of the trench bottom should be plane and shallow as well as free from roots and rocks. For very uneven substrates, the trench bottom should be compacted using light-weight equipment. The trench bottom has to be prepared in a way which enables the pipeline to be supported evenly. The pipes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

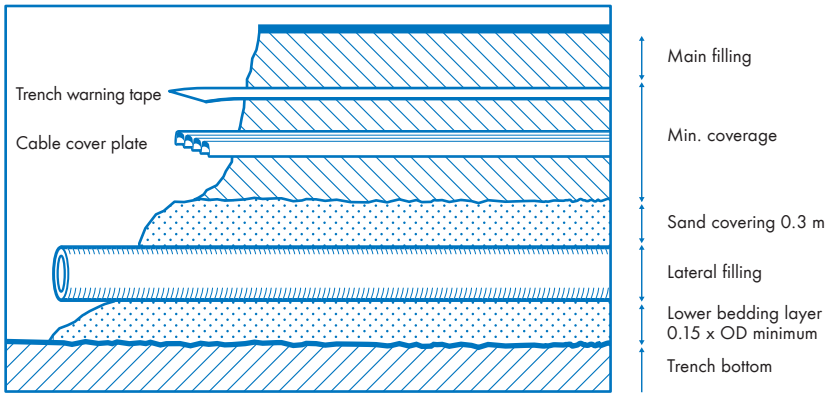
Upon backfilling the pipeline zone with self-compacting backfill materials and highly thermally conductive special types of concrete, buoyancy control and securing the position of the pipes are to be monitored with particular care (see p. 31)!

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

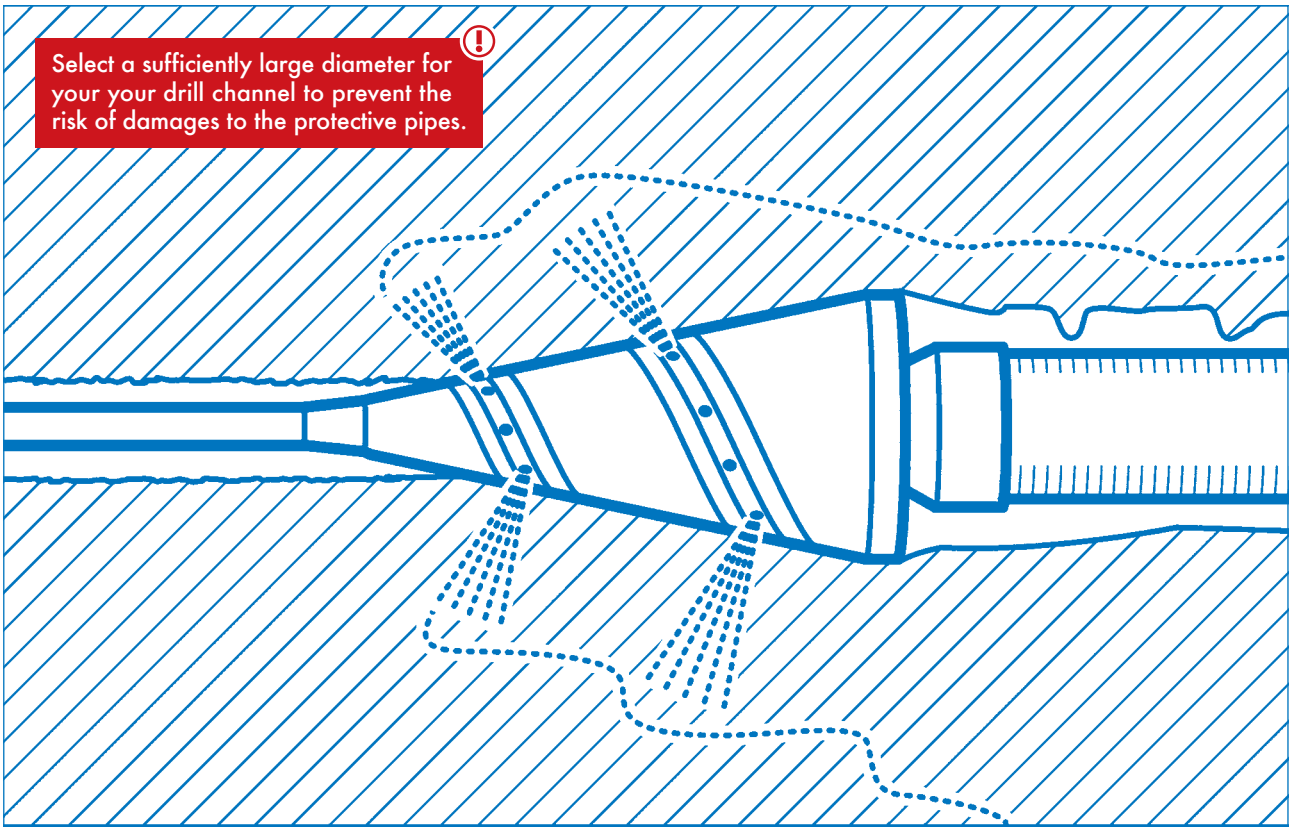


Example for empty conduit systems based on open-trench installation

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

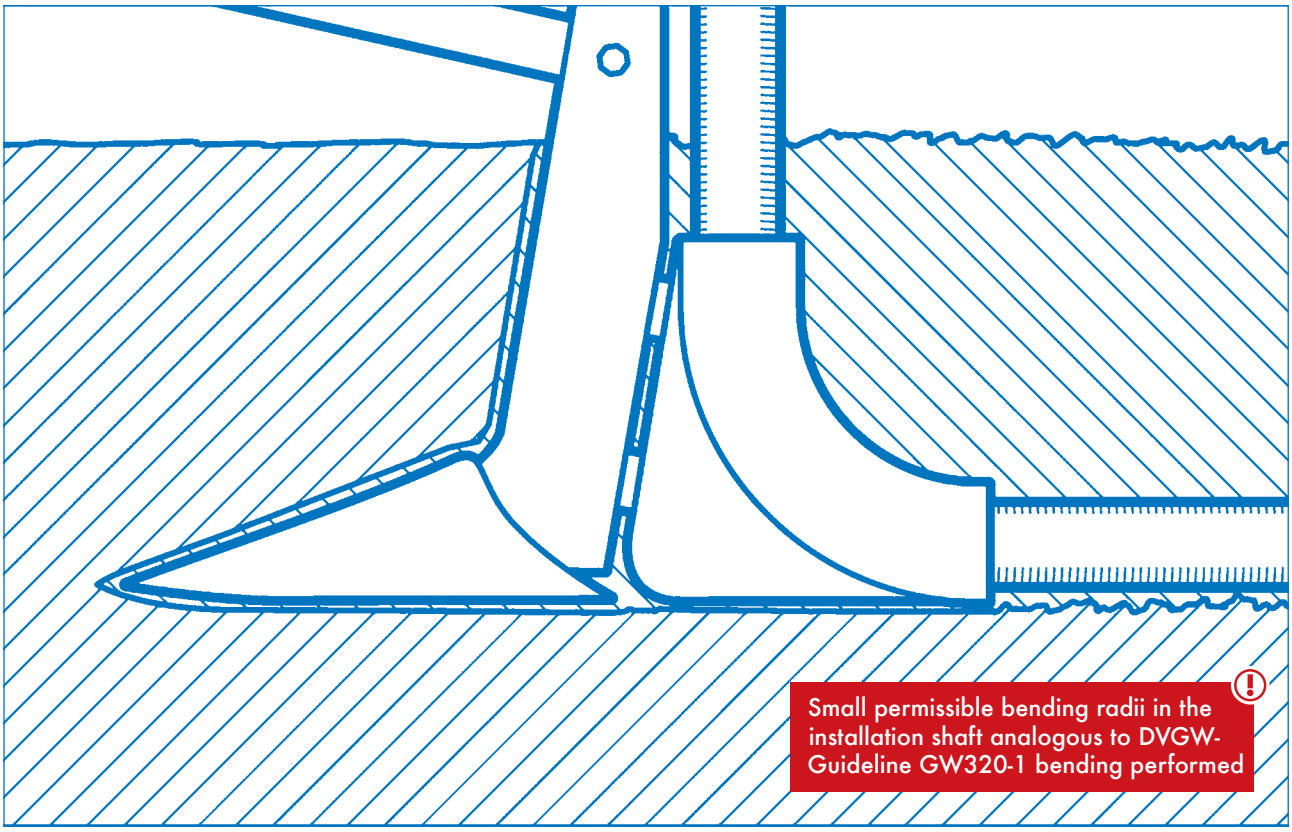
Ploughing method

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

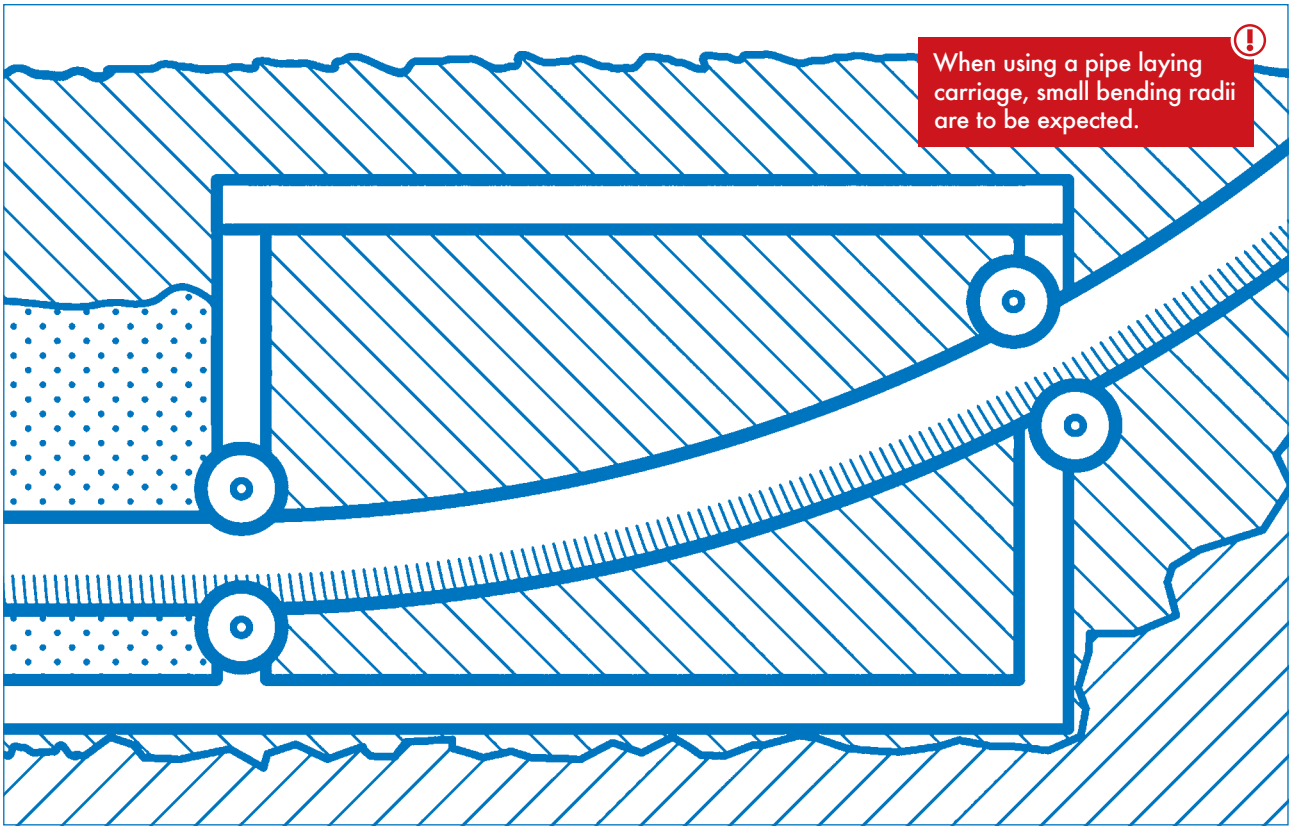
Type of connection:

- 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

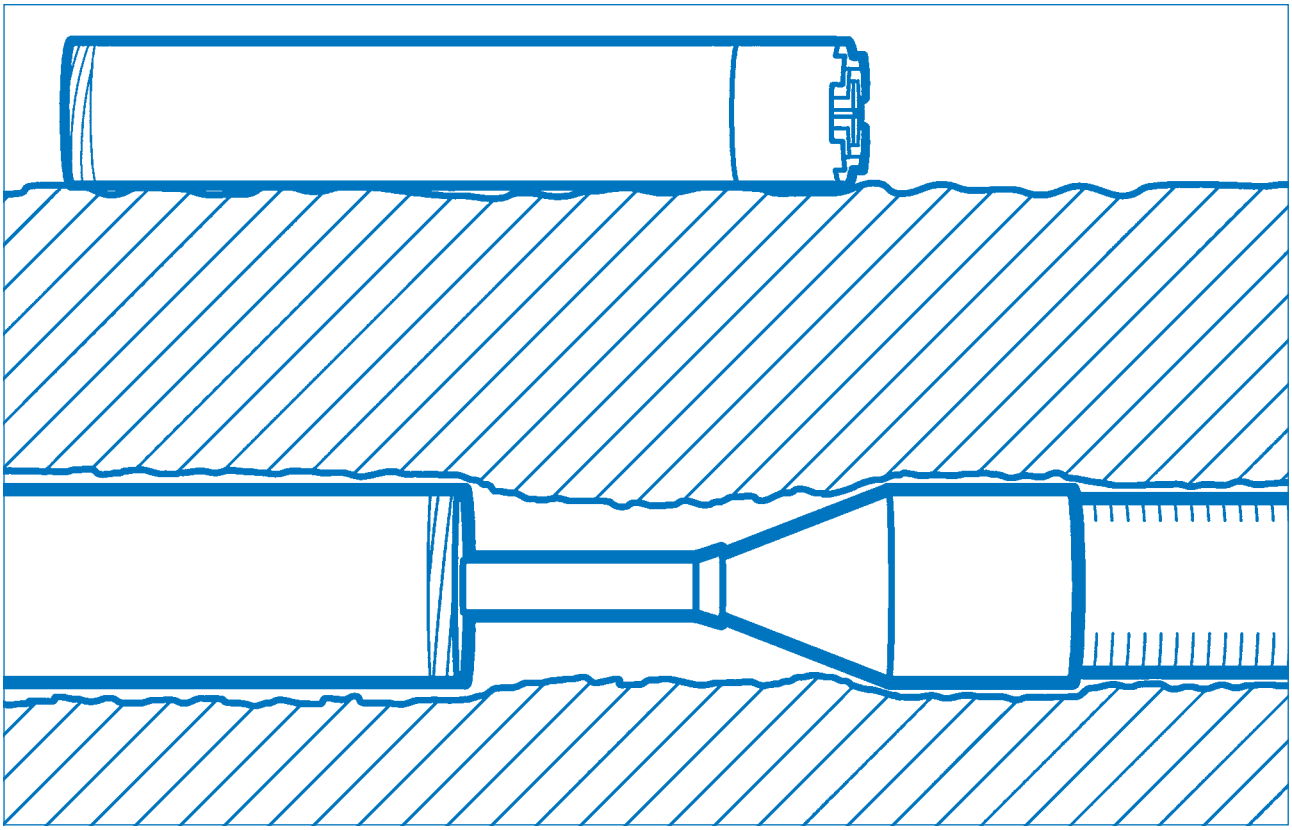
Type of connection:

- 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

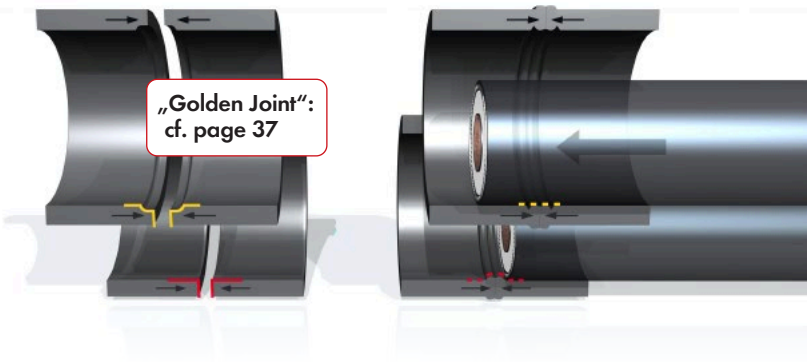
Welding of the egeplast Power Protect pipes requires removal of the inner weld bead to prevent abutting edges and increased frictional resistance which would impair the insertion of the energy cables.

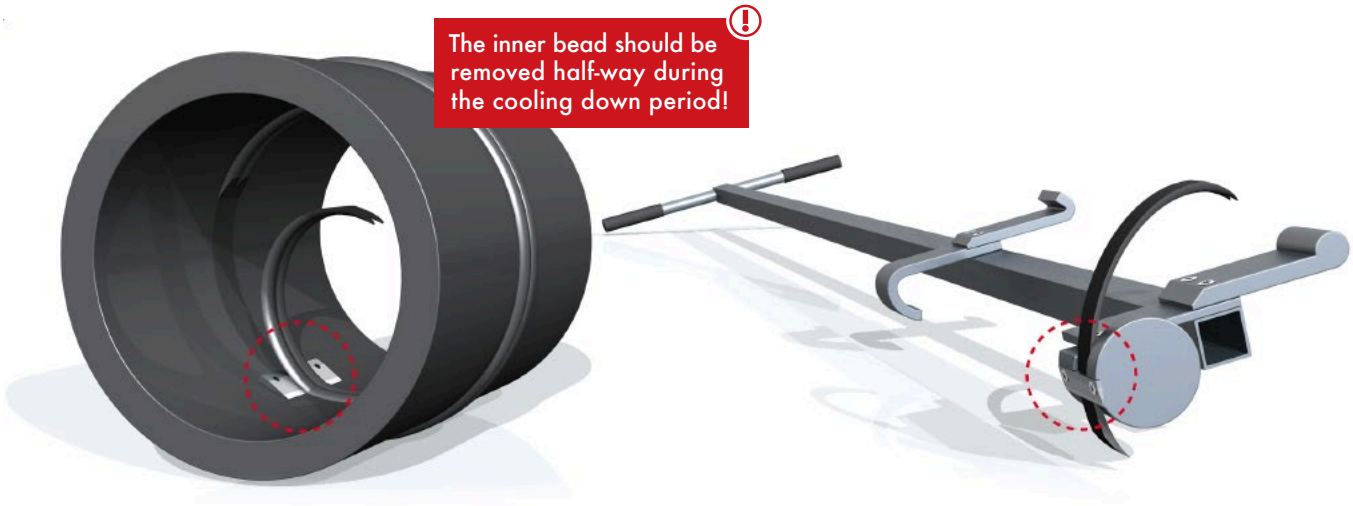
Attention should be paid to not damaging the pipe during debeading (e. g. by causing notches) and to not fall below the nominal wall thickness of the pipe in the area of the weld seam.

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

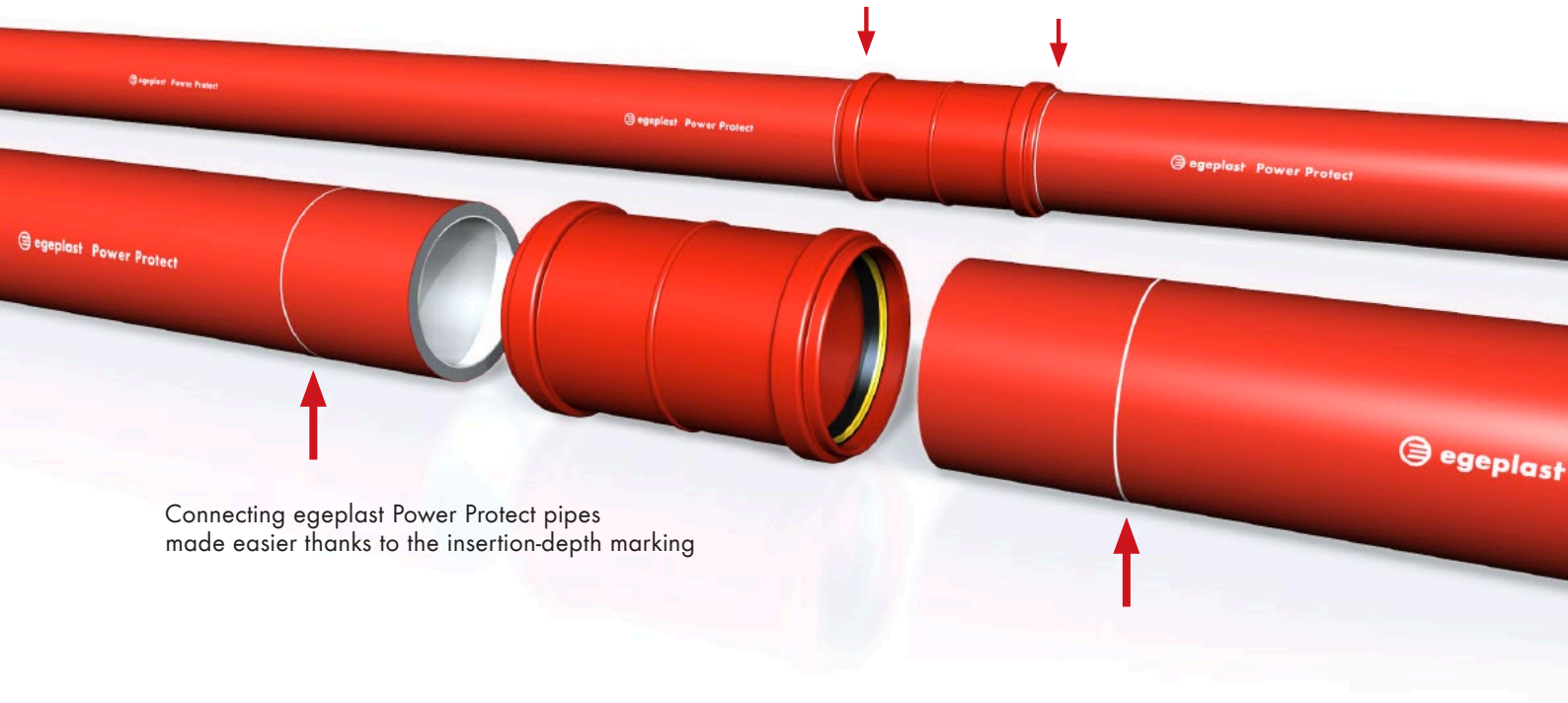
To allow for absorption of temperature-related changes in length for pipe segments, the long version of sockets (L ≥ 400 mm) must be used for pipes DN ≥ 250 mm.

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.



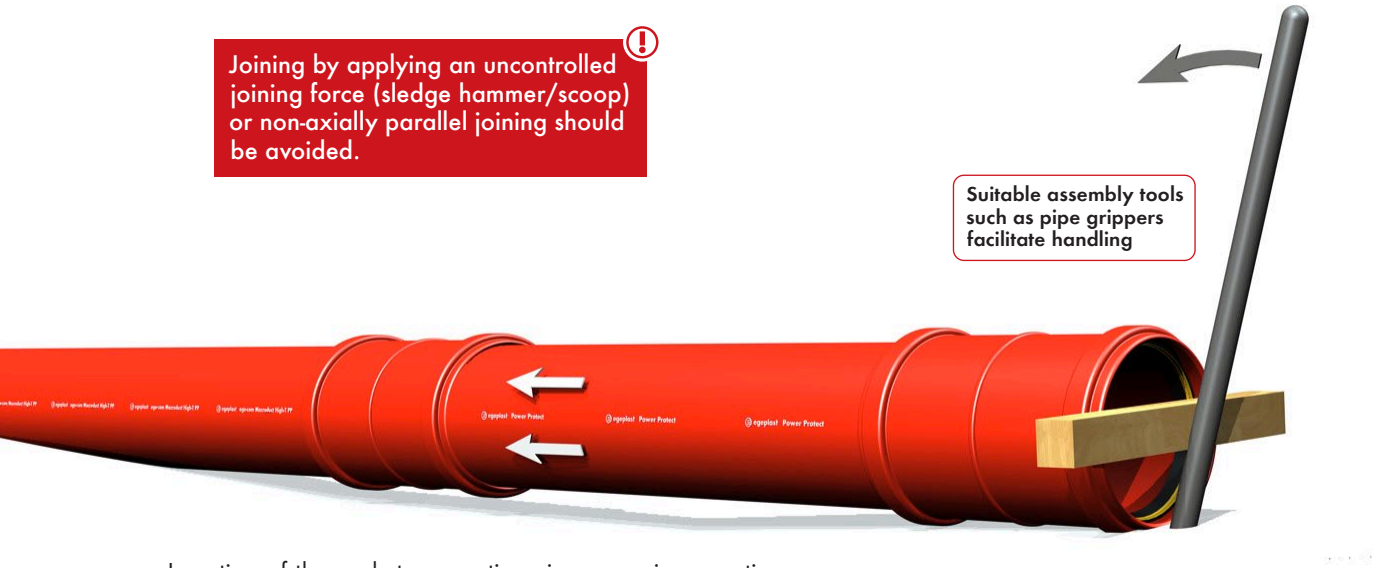
Connecting egeplast Power Protect pipes
made easier thanks to the insertion-depth marking



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

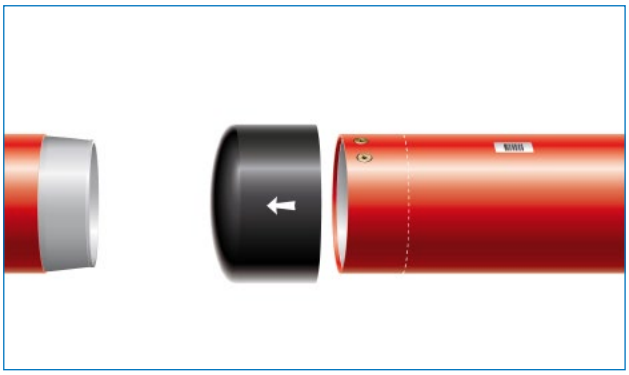
Trimming of pipes

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).

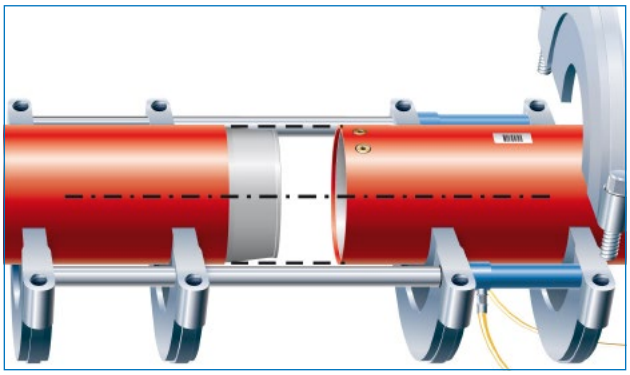
To do so, we recommend commercially available chamfering units. Alternatively, other suitable tools such as files or angle grinders can be used. The cutting edges must categorically be deburred.

Joining technology – Smart Connect

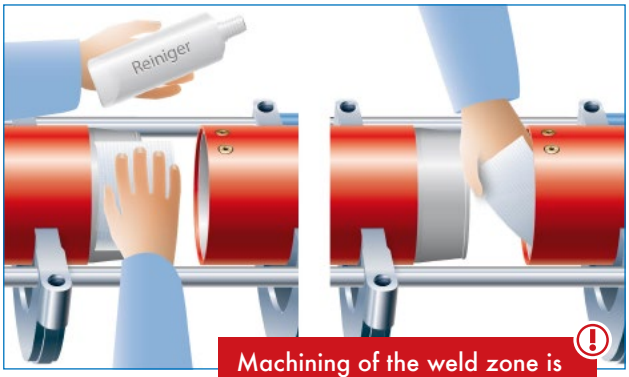
The egeplast Smart Connect combines egeplast Power Protect PE pipes and connection technology in a single component. The spigot end and the weldable socket end have been integrated into the pipe, thus allowing for a permanent connection of the pipe system.



Removal of the dummy

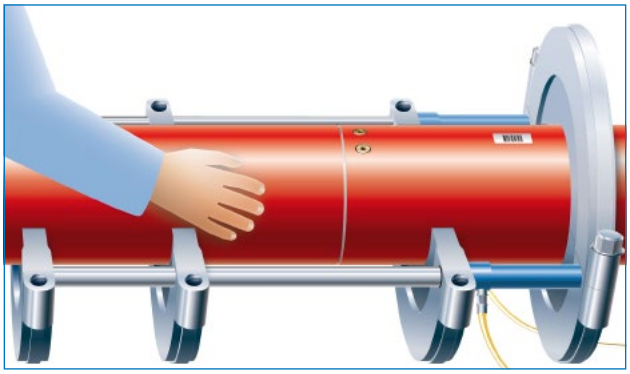


Positioning of the egeplast Smart Connect pipes

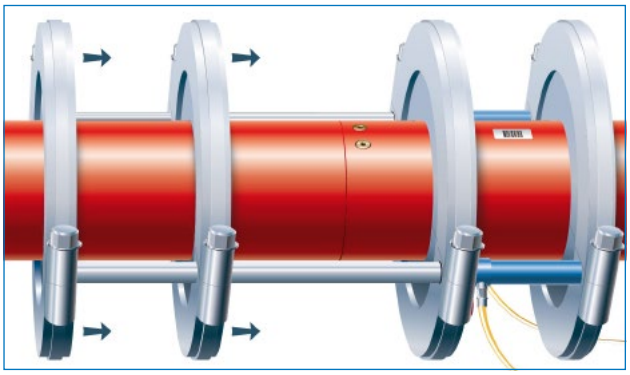


Cleaning of the weld surfaces

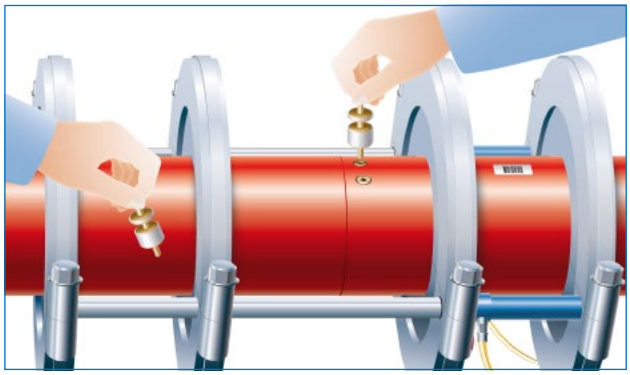
Machining of the weld zone is not required; craters and striae around the weld zone are not acceptable. Paper: lint-free and non-dyed



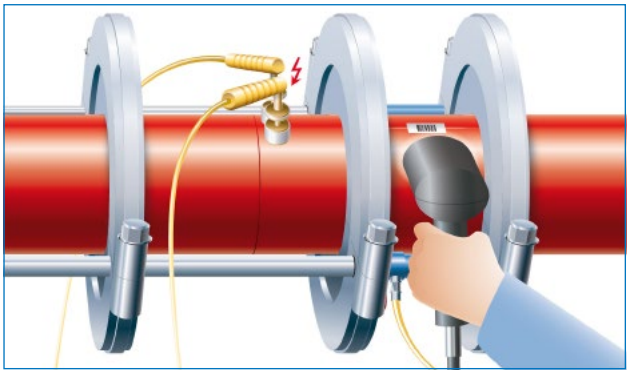
Insertion of the spigot ends into the socket has to be a priority



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.

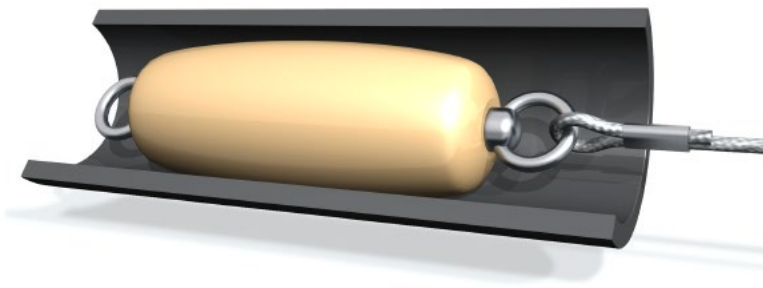
We are happy to offer you trainings and on-site instructions/product support for our products!

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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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.

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