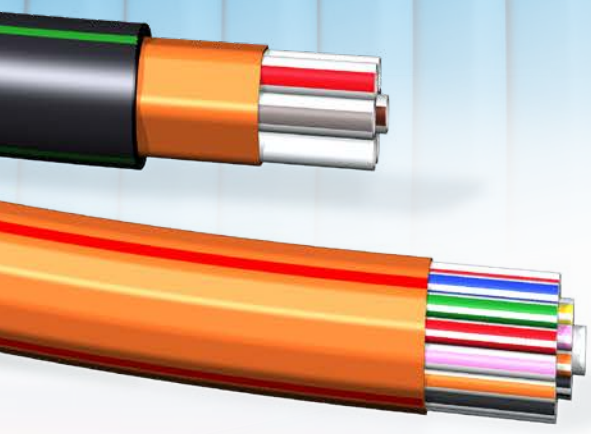
egeplast

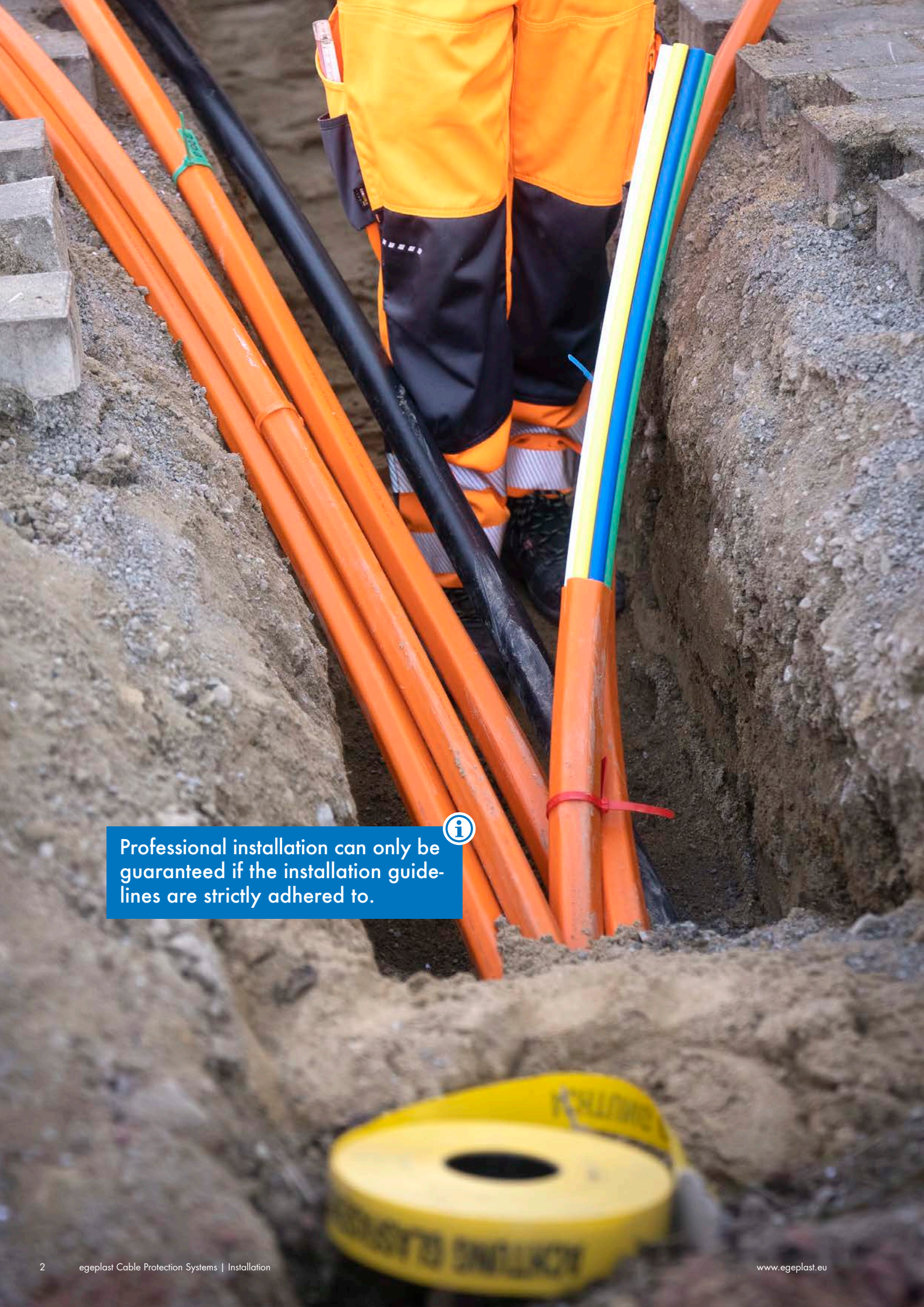
Cable Protection Systems



egeplast

Instructions for the installation, transportation and storage of pipes and drums

Installation guidelines 3
Drum brake 4
Transportation 6
Storage 7
Temperatures, bending radii and tensile load 8
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Professional installation can only be guaranteed if the installation guidelines are strictly adhered to.

Instructions for the installation, transportation and storage of pipes and drums

In addition to using proper and intact products, skillful installation of the micro tubes including the appropriate accessories is required for establishing a high-quality FTTX network. The installation guidelines as well as the instructions on transportation and storage below provide a detailed description of the recommended handling of the egeplast products, thus enabling you to safely expand your fibre optic network.

egeplast will gladly offer you an installation training in our headquarters in Greven or directly on site. We will be available to answer your technical questions basically anytime.

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www.egeplast.eu

Installation guidelines

The pipes must always be handled with care. Do not pull them over sharp edges or rocks, since this might lead to damages. Check the pipes for external intactness before any installation.

The inside of the pipes is to be protected from contaminations and water at all times by taking appropriate measures.

The permissible deflection radii must not be exceeded when laying out the pipes.

Particular care should be taken to ensure that the drum has to be unwound from underneath and the ducts are inserted into the trench in compliance with the permissible bending radii. In doing so, you must ensure to rule out any damage to the pipes.

For drums and coils, you must absolutely bear in mind that the pipe end might spring away as soon as the fastening is removed. Improper handling might result in a risk of injury.

Drum brake

For optimal blow-in results, use a proper installation pattern. Winding the duct bundles onto a wooden drum leads to a wound orientation. To install the ducts into a trench, pull them off linearly from underneath the duct and with increased tension. To do so, **using a drum brake is a must**, because only then the pipe bundle will be under tension during the entire installation operation. This is the only way to ensure that the required traction force is transmitted to the pipe bundle to enable you to undo the winding tensions in a controlled way. In doing so, the maximum traction forces must not be exceeded. Unwinding the ducts from above or via the side flange is not permitted.

Since the tendency of spiraling increases along with a higher number of inner pipes, it should be counteracted by a proportionately higher pull-off force. In addition, stiffness of the pipe increases with low temperatures, meaning that in this case, too, higher braking force needs to be applied. To prevent potential spiraling, the pipe which has been laid in the trench can also be stabilised additionally by weighting it with sand.

We do not recommend forming coils from the drum since coils are difficult to straighten.

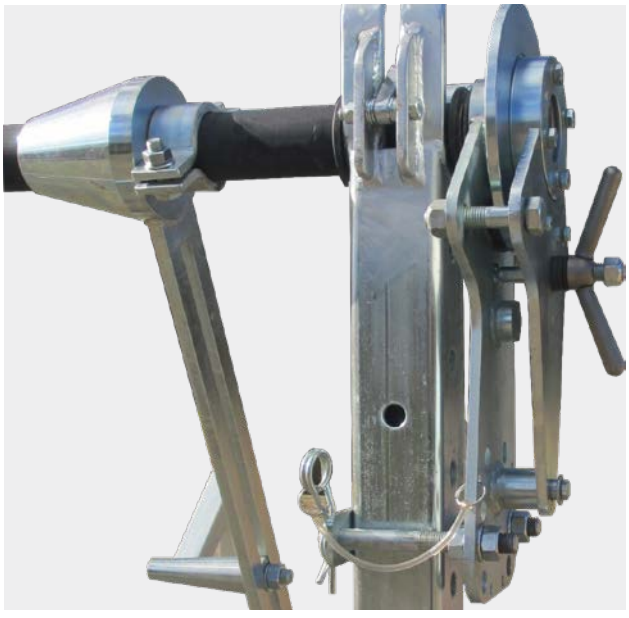
Failure to comply with the instructions listed here may result in a strong run-out of the pipe bundles, which would make installation significantly more difficult and drastically reduce subsequent blow-in performance.

Therefore, please observe the following instructions:

1. **Use a drum brake.**
2. **Unwind from below and insert into the trench from below in a shallow, curved arc.**
3. **Adjust the force used to the number of inner pipes and to the temperature.**
4. **Preferably stabilise with the help of piles of sand.**



Drum emergency brake made by Vetter



Drum brake made by Bagela


egeplast
www.egeplast.de

Transportation

All egeplast products are to be stored, transported and processed in a way which ensures that no damages or deformations can occur.

Both when receiving the pipes as well as when laying them it is always advisable to visually inspect the pipes for damages in transit.

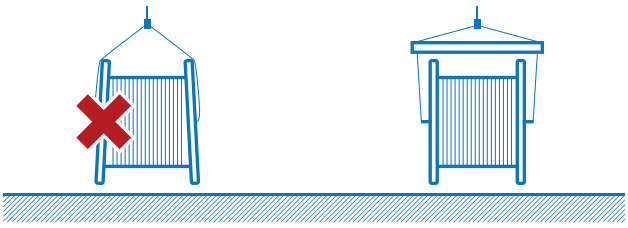
Loading must be carried out using a lifting beam.

Knocking the drums over is not permissible. The drums should always be stored standing upright.

We recommend using a drum cone to ensure optimum support on the shaft of the drum carrier.

The drums should exclusively be loaded or moved around using appropriate equipment and always perpendicular to the winding direction.

Lift the drums with a lifting beam.



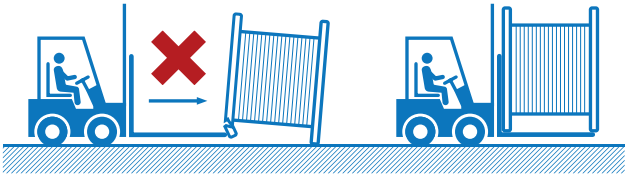
Lifting the drums only via the wooden wheels.



Do not knock over the drums!



Do not push the drum, only lift it.





Storage

The pipes come blocked with shrink caps on both sides ex works. In the event of residual lengths on the wooden drum the end pieces of the individual pipes are to be sealed using egeFit end stops. This measure provides protection from contamination and water and is the only way to ensure that the blow-in range will not be impaired.

The drums are to be stored on firm and level ground free from rocks and sharp objects. They should be secured against unintended rolling by means of wedges or with the help of other suitable fixtures.

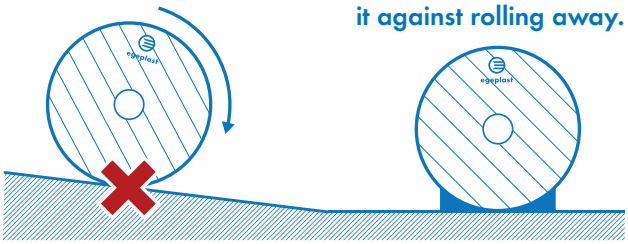
The pipes are wrapped with a UV-resistant protective foil in our factory, extending the time period for open storage by another year.

Remaining lengths on the drum are always to be fastened tightly to prevent the outer layer from becoming loose which will cause spiraling during subsequent installation.

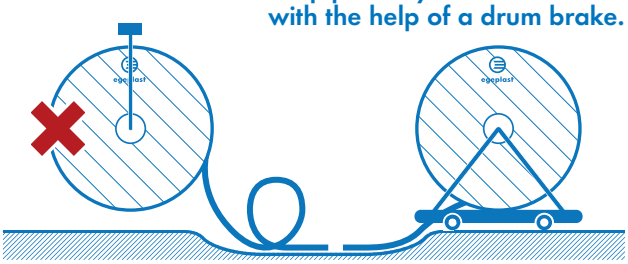
**Store drums in a dry place.
Always close the ends of the tubes.**

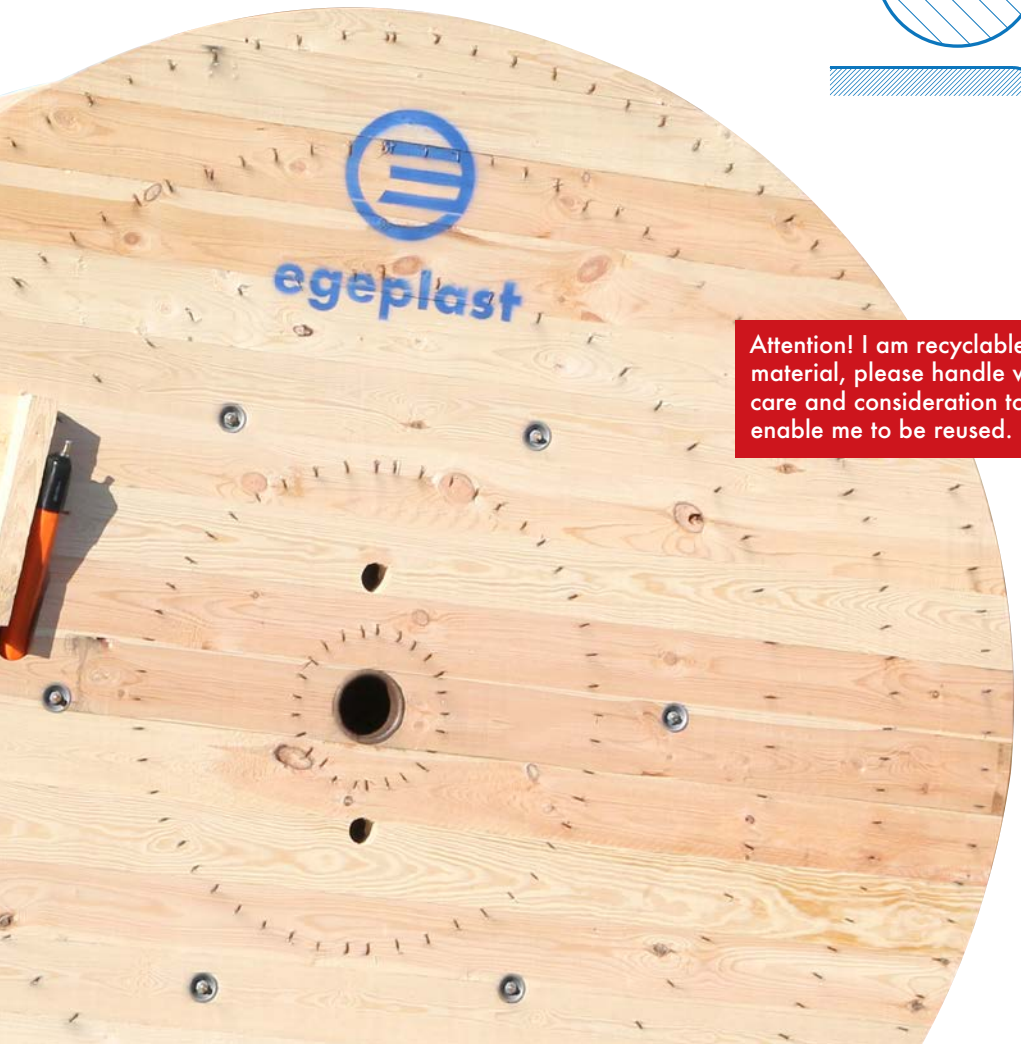


Store the drum level and secure it against rolling away.



Pull off the pipes only from below and with the help of a drum brake.





Attention! I am recyclable material, please handle with care and consideration to enable me to be reused.

Temperatures, bending radii and tensile load

Temperature-related limits of use

At high temperatures (> 50° C), mechanical stress can result in deformation of the pipes quicker. At low temperatures (< -10° C), however, impact sensitivity will increase. At temperatures below freezing, the pipes should be stored in a heated environment before installation for 12 to 24 hours. Heating with open flames is not permissible.

At temperatures below freezing, the drums should be stored in a hall, since they are much easier to handle once they have been warmed up.

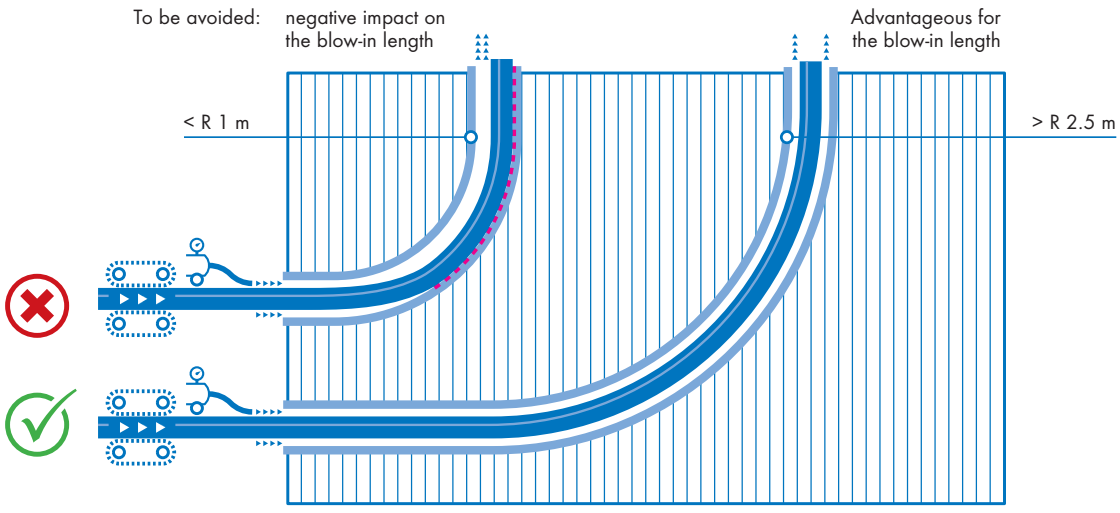
Area	Permissible temperature range
Transportation & storage	-10°C – 50°C
Installation	-10°C – 50°C
Blow-in	-5°C – 35°C
Operation	-20°C – 60°C
Ideal temperature Tensile load	5°C – 20°C

Smallest permissible bending radius

Dropping below the smallest permissible bending radii should be avoided. This value will depend on the pipe temperature.

To allow for optimum blow-in performance, the bending radius always needs to be the largest one possible.

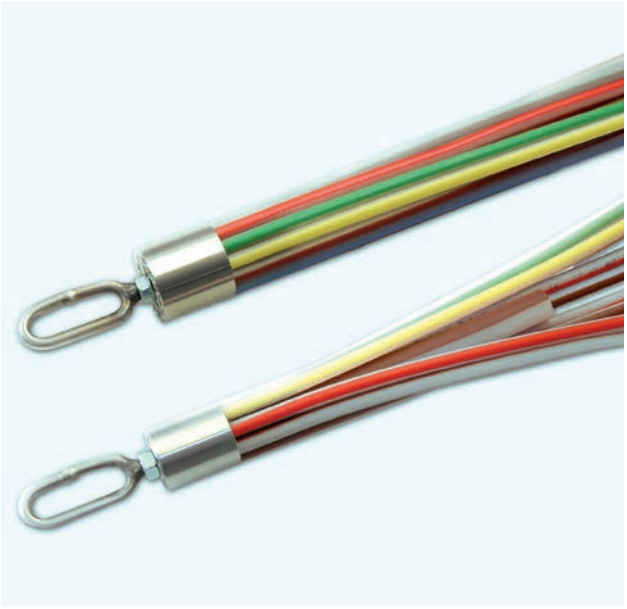
Pipe temperature	Smallest permissible bending radius R
20° C	20 x OD
10° C	35 x OD
0° C	50 x OD



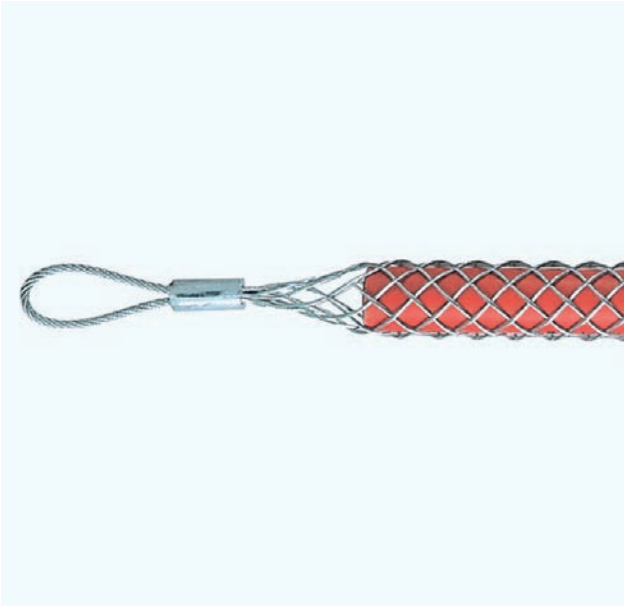
Maximal permissible tensile loads

The permissible tensile loads listed in the table are applicable for pipes made of PE-HD at an ambient temperature of 20 °C. We recommend to monitor and document the tensile loads occurring at the time of installation. Exceeding the maximum permissible tensile loads will result in permanent pipe damage and needs to be prevented by taking appropriate measures. Microduct Multi pipes are pulled in by means of a suitable pulling head or pulling grip. Please ensure an even distribution of loads affecting the pipe bundle.

Maximum permissible tensile loads for egeplast Microduct Mono pipes				
OD [mm]	di		db	
	s [mm]	F_{zul} [N]	s [mm]	F_{zul} [N]
7	0.75	150	1.50	260
10	1.00	250	2.00	490
12	1.10	350	2.00	620
14	–	–	2.00	750
16	–	–	2.00	850
20	–	–	2.50	1,300



Pulling head made by Vetter



Pulling grip made by Vetter

Cutting, connecting and removing

Cutting

Any cutting work on egeplast Microducts or Microduct Multi bundles should be performed using the appropriate tools. The blades should be sharp to avoid squeezing of the pipe. Moreover, any chip formation is to be avoided. It is therefore not allowed to use saws, carpet knives or an angle grinder for cutting. The pipes must be cut straight and perpendicular to the axis. After cutting, chips, if any, should be removed and any ovalisations should be rerounded using the 5/20 tool (calibration mandrel).





Connecting and removing Microducts

After cutting, Microduct Mono pipes can be coupled with the help of egeFit® connectors.
Slide the connector onto the pipe as far as possible. Check the seat of the connector by pulling slightly.
You can undo the connection following removal of the safety clip by pushing in the clamp sleeve while simultaneously pulling the pipe out.

Microduct Multi pipes require a staggered mounting of the connectors. The detached sheathing can be reattached afterwards to provide additional protection and sealed with adhesive tape. To seal the pipe bundles at the interfaces, divisible multi-fit seals (p. 32).



1. Using the 5/20 tool



2. Mounting a connector



3. Pulling the safety clip, dismantling



4. Fully through-connected Microduct




VISCO
Kubota

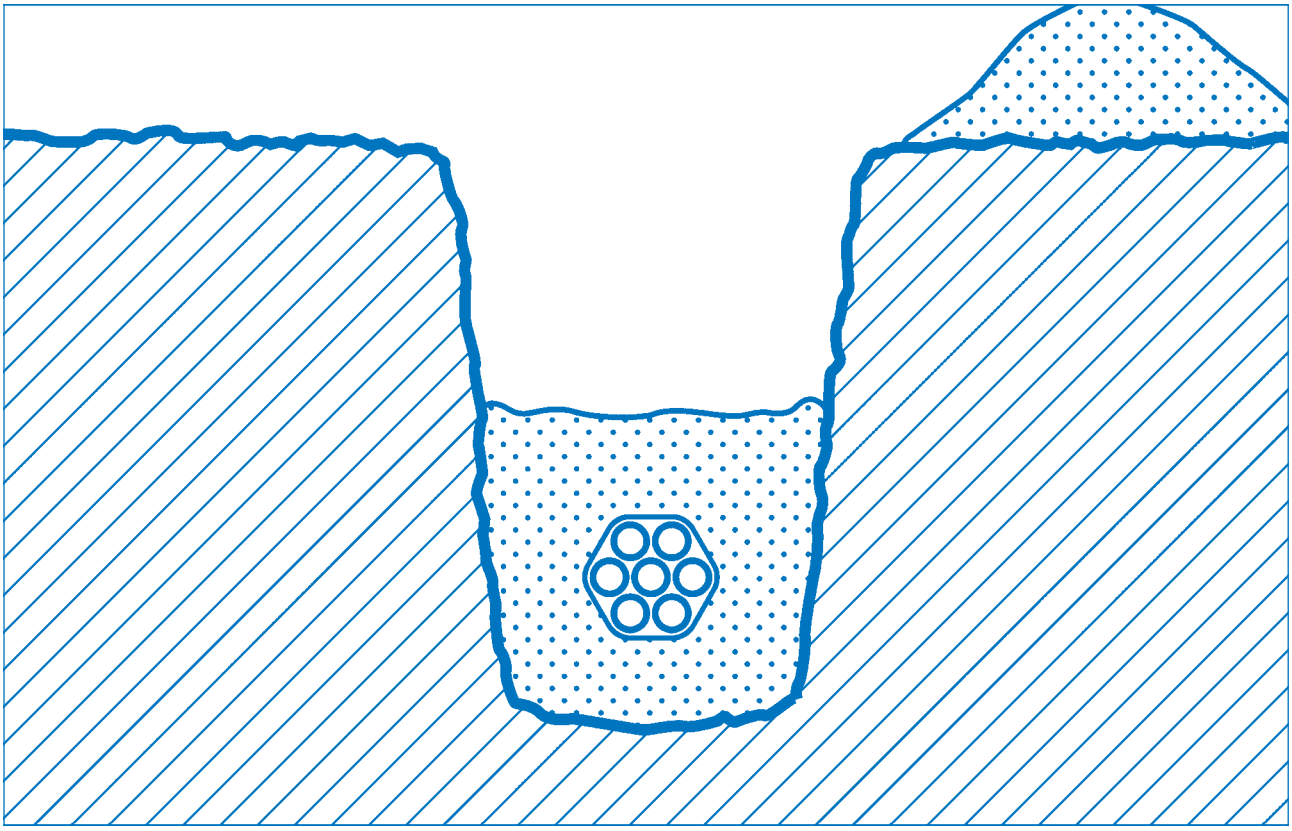
Installation methods

Open-trench installation

When inserting the pipes into the trench, mechanical damages must be prevented: Pulling the pipes across sharp edges as well as kinking of pipes or impact stress are inadmissible. The pipe should be inserted into the trench as flat as possible and respecting the admissible bending radii and traction forces (p. 48/49). Also, the pipes have to be as straight as possible during laying. Any lateral unwinding from drums and coils is to be avoided at all cost, since it will result in spiraling torsions which can no longer be straightened and drastically reduce blow-in lengths. For direct-buried installation, sealing the pipes is of great significance, since any penetration of water and contamination needs to be avoided.

If multiple pipe bundles are installed parallel to each other, the distance between them should equal no less than the width of one pipe bundle.

Owing to the material properties of PE-HD, cold deformation will only have been completed after approx. 1000 hours. During these 1000 hours, the individual Microducts in the pipe bundle might get damaged as a result of incorrect compaction.



Pipe trench installation

The trench bottom should be level and flat and be free from roots and rocks. If the underground is very uneven, the trench bottom should be compacted with light-weight equipment. If uneven surfaces fail to be removed, there is the risk of them being transferred to the pipe bundles, which would result in impairment of the blow-in performance.

The pipes should be surrounded by a uniform layer of sand (rock-free, which is at least 10 cm thick (rock-free, compactible sand, grain size ≤ 6 mm, no crushed sand). For a rocky and stony substrate (grain size ≥ 63 mm), the minimum thickness of the sand layer should be 15 cm.

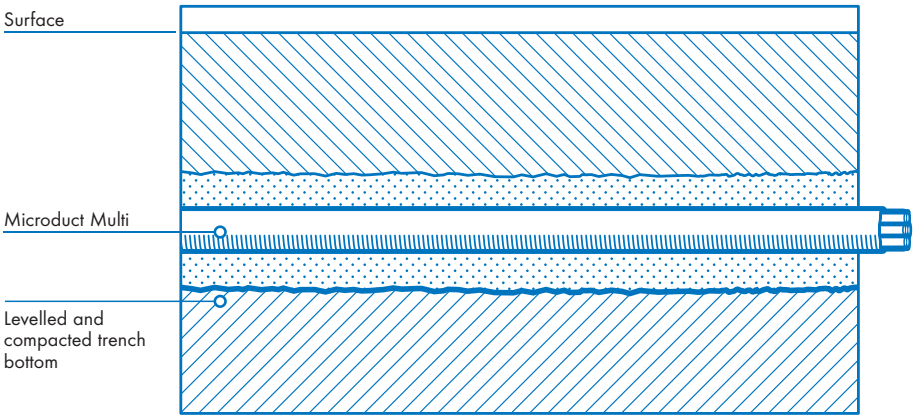
The trench is refilled with 30 cm minimum of compactible, rock-free material.

To prevent future damages to the pipe bundles, installing a trench warning tape approx. 30 cm above the pipe crown is imperative. Above this height, mechanical compaction can be applied.

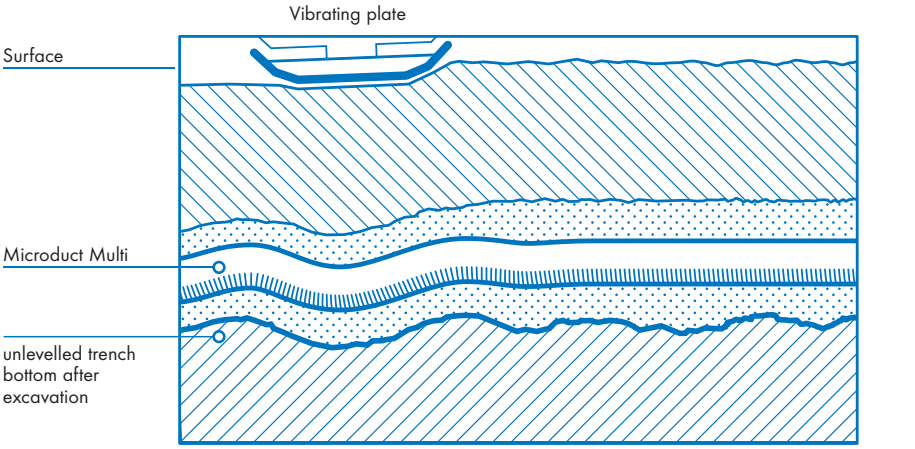
Important: One common cause of blow-in problems consists in damaged Microducts as a result of insufficient sand bedding. Bedding on a sufficient quantity of sand is a must!

Prior to installation, the following prerequisites must be fulfilled:

1. **The minimum width and depth of the trench must be ensured.**
2. **The trench must be sufficiently secured.**
3. **The trench bottom needs to be inspected for freeness from rocks, bearing capacity and evenness.**
4. **The bedding material must fulfil the requirements.**
5. **Intersections with other pipelines are to be marked and secured.**



A levelled and compacted trench bottom will prevent occurrance of Multi bundle waviness during subsequent compaction.



In this, case, the undulating trench bottom failed to be compensated and thus is transfered to the pipe bundle. This is likely to result in a significant reduction of the blow-in length!

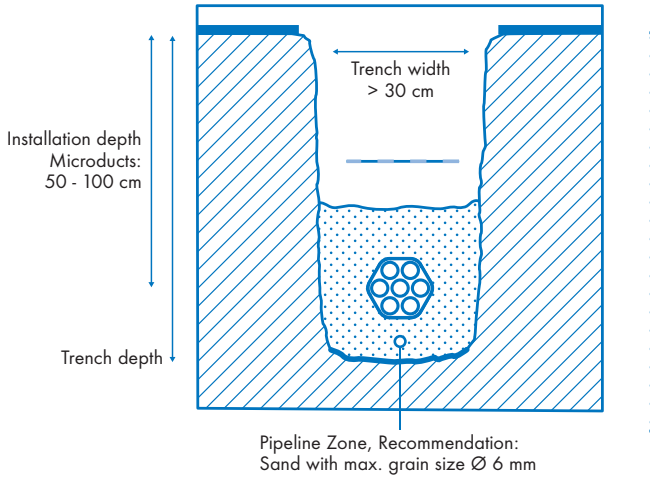
No-traffic zones and traffic zones up to SLW 60	
Dimensions (OD/ID) [mm]	Microduct Mono db and Microduct Multi
Installation depth [cm]	50 – 100

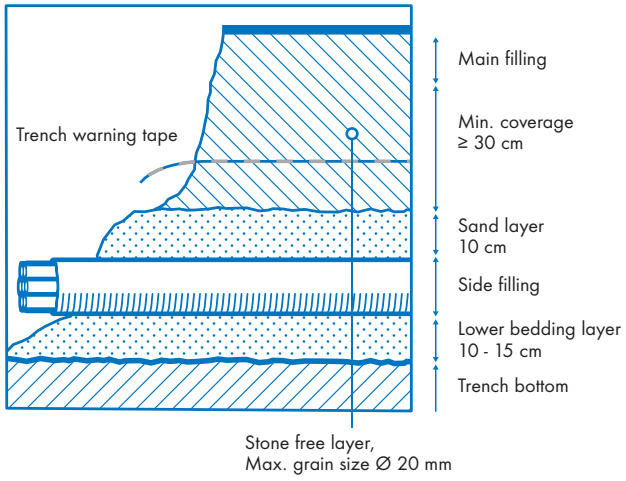
Furthermore, the appropriate installation depth may vary according to the conditions on site, and therefore local regulations and the ground structure need to be taken into account.

Pipe trench installation is subject to the specifications of the DIN 4124 standard.

Ø outer diameter of the installed pipe/pipe bundle [cm]	**Trench width per installation depth [cm]**		
	≤ 70	**71 – 90**	**91 – 100**
20	30	40	50
25	35	40	50
30	40	40	50
For every additional 5 cm	Plus 5 cm		

Recommended standard-pipe trench installation following ZTV-TK Network 10 and KRV A 535b. In special cases, such as for field and wood paths, water bodies, roads or on private property, local regulations must be heeded and adaptations made, if required.

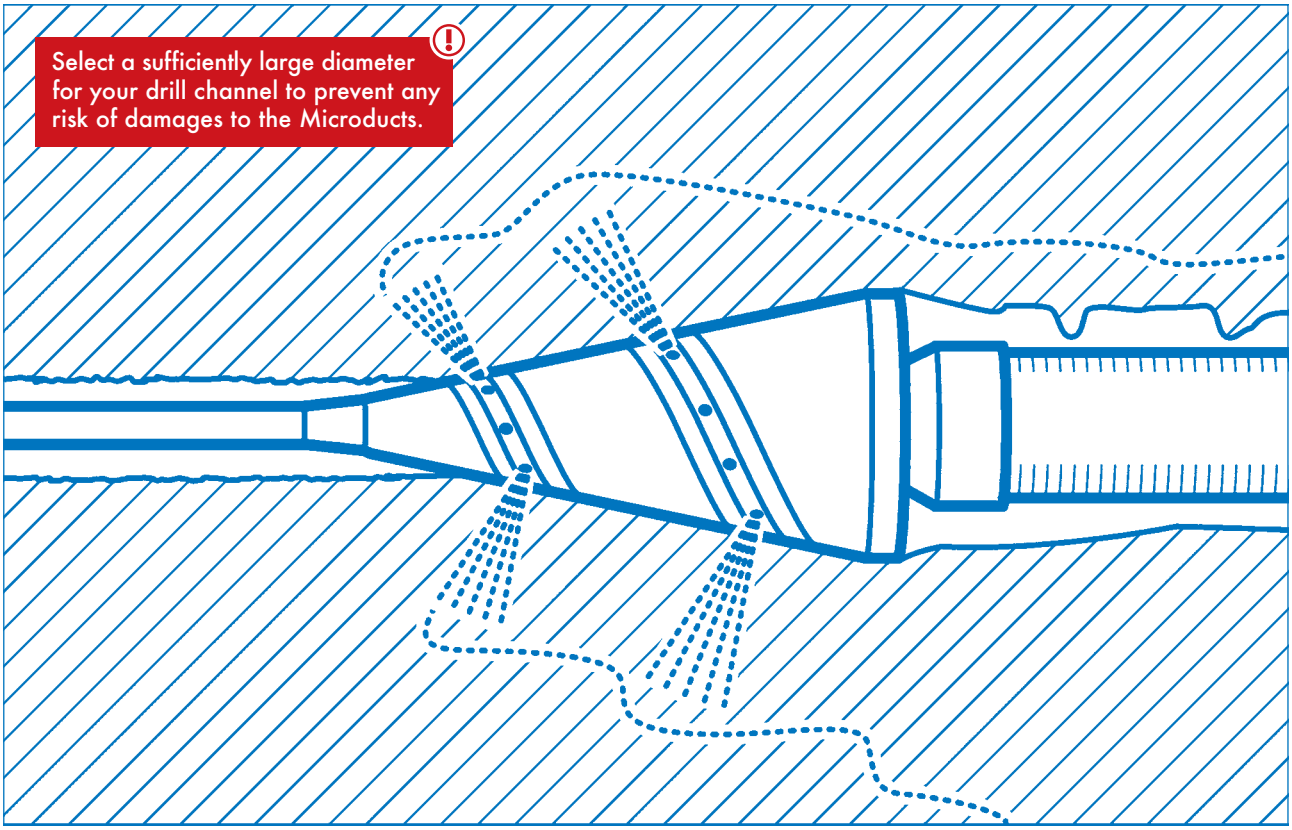




Horizontal Directional Drilling

Flush-drilling initially involves drilling an underground canal with a lance. During the pulling back process, one or multipe Micro pipe bundles are connected at the drilling head and subsequently pulled back. This method is appropriate whenever the ground surface is required to remain untouched or at locations where construction sites may or can only take up little room. This includes places such as protected areas or difficult-to-access terrain with significant differences in height. Compared to other methods, the HDD method significantly reduces interference with nature and the local landscape to ensure that impairment of bio diversity remains as low as possible. With a view to protecting nature in particular, this method offers a particular/big advantage.

Flush drilling is associated with enormously strict requirements regarding the pipe bundles. Ideally, the pipe bundles of choice should be as round as possible and feature a robust and dimensionally stable outer sheathing. The egeplast Microduct Multi protec has been optimised for these increased demands as well as the high traction forces involved.

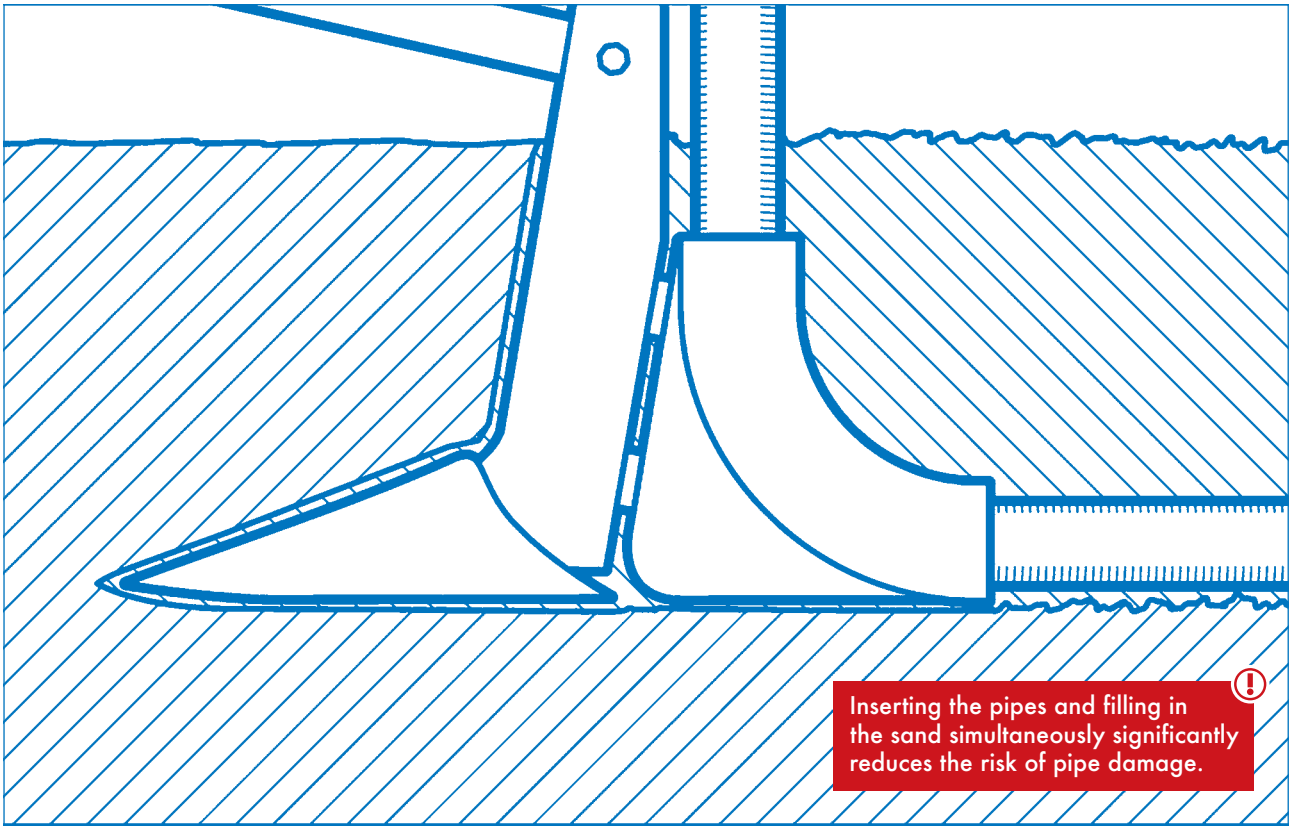


- ✓ can be used in many types of soil
- ✓ lower material input
- ✓ shorter construction time
- ✓ traffic areas subject to less mechanical stress
- ✓ less damage to surfaces
- ✓ lower cost and less work associated with the restoration of the surfaces
- ✓ high practicability related to the connection of FTTB/ FTTH house connection

Ploughing method

The ploughing method involves pulling a pipe-laying mole plow through the soil with the help of a suitable tractor unit, thus generating a furrow in the soil and providing a laying depth which can be determined individually by adjusting the plough attachment accordingly. The pipe is inserted into the resulting hollow space. At the same time, the hollow space is backfilled with the previously displaced soil.

Accordingly, the ploughing method allows for long installation distances. Under the optimum conditions, this method allows for a laying performance of up to 5 km per day. On the other hand, however, the laying performance depends on the soil condition: steep declivity, obstacles on the surface or difficult-to-access terrain result in a significant reduction of the laying performance – or even make it impossible to use this method. Also, the ploughing method can only be used for unsealed surfaces.



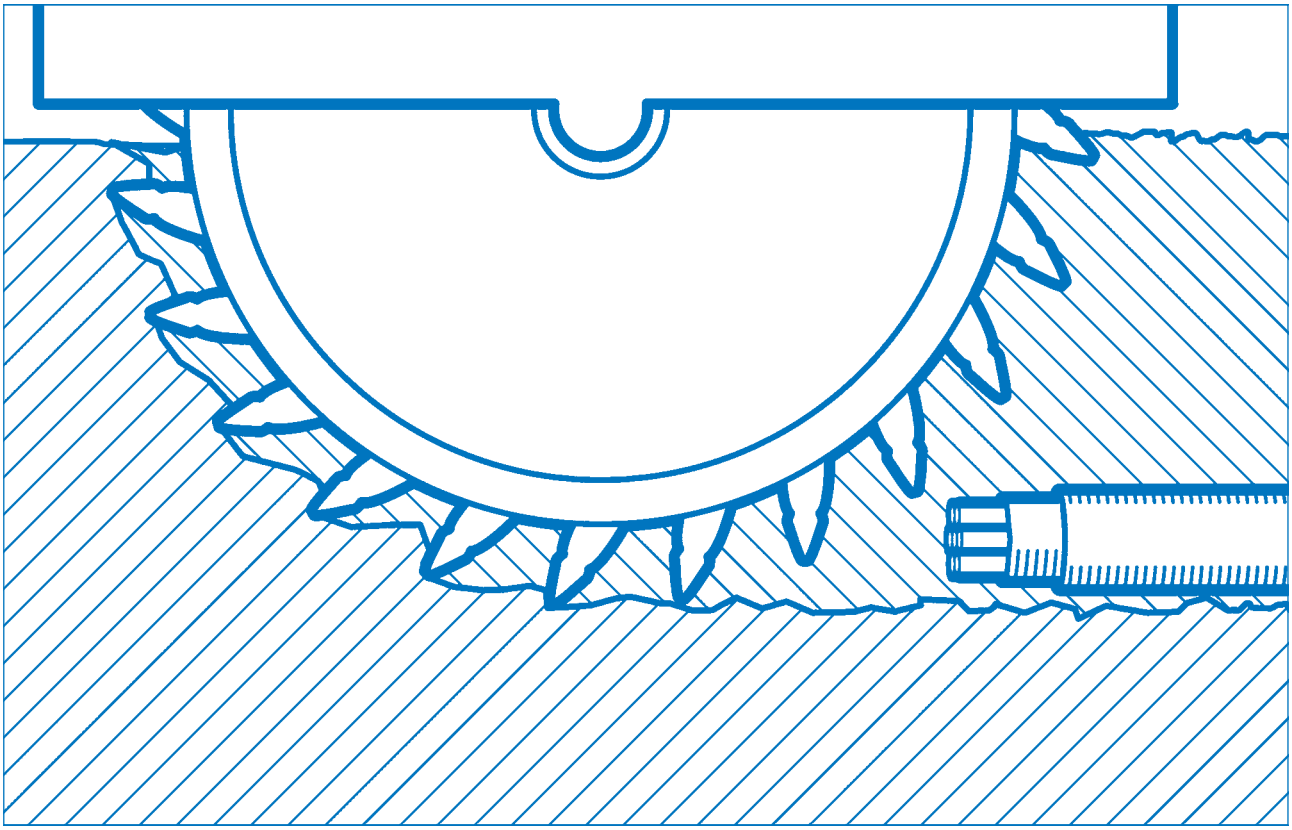
- ✓ applicable in a wide array of terrains
- ✓ high laying performance (up to 5 km per day)
- ✓ cost-efficient installation method
- ✓ immediate restoration of the route
- ✓ little traffic obstruction
- ✓ multiple installation of empty conduits possible

Trenching

Trenching has many advantages for network operators and installers alike. Among other things, it is characterized by low construction costs, rapid installation and little traffic obstruction.

They mainly differ from each other with regard to the width and depth of the completed installation joint as well as the cutting or milling technique applied. The application of trenching requires the presence of an asphalt surface.

Trenching is recommended on sidewalks or bicycle paths because of road damages.



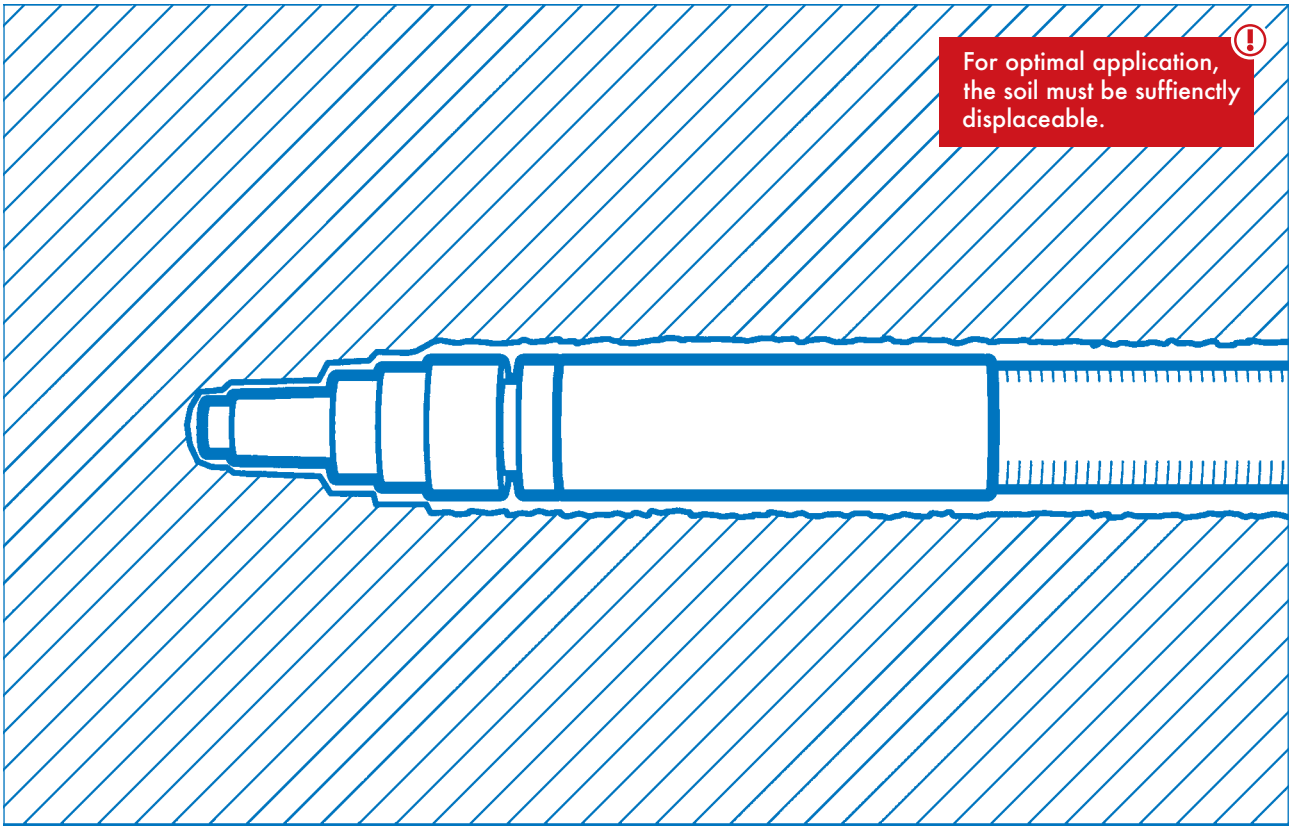
- ✓ low place requirement
- ✓ less traffic obstruction
- ✓ high performance over long distances for good asphalt surface (up tp 600 m/day)
- ✓ small quantity of demolition material
- ✓ minimum surface damages
- ✓ hardly any hazard to existing pipelines thanks to low milling depth

Moling (impact mole)

Moling using an impact mole is an installation method usually used in connection with house connections. Fibre optic house connections are established using a fast, safe und economic trenchless installation method and can be laid up to the building or guided out of it.

A pneumatically operated hammer creates a hollow space into which the new pipeline can be bedded. To do so, the soil must be sufficiently displaceable.

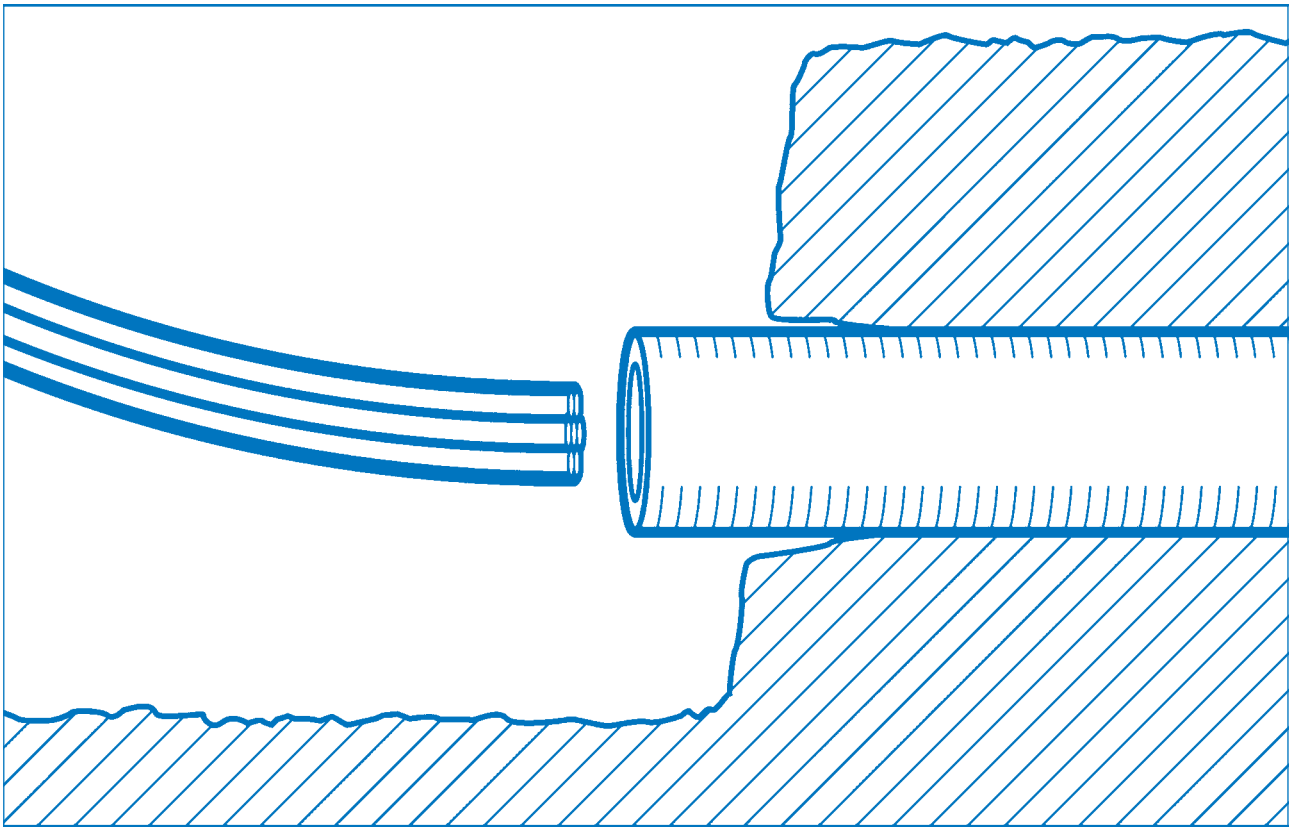
In loose and soft soils, the impact mole requires some static support since otherwise it will not be possible to build up sufficient friction with the soil to enable independent advance. Accordingly, the propulsion channel must be designed more precisely in stony soils owing to lateral displacement of the rocks. Under these soil conditions, the impact mole will only escape sidewards to a lesser extent. Bearing of the target is taken in the starting pit and is vitally important since the impact mole cannot be controlled.



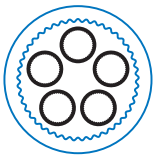
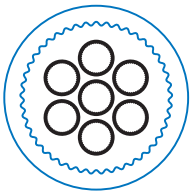
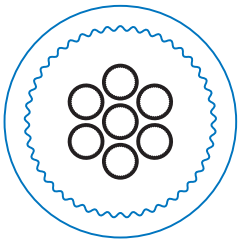
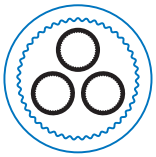
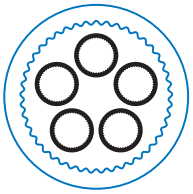
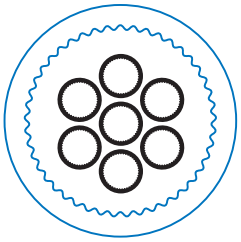
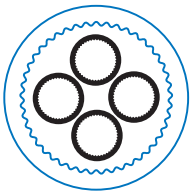
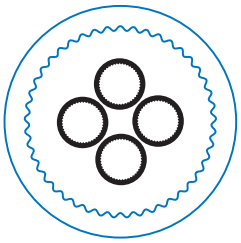
- ✓ installation of the empty conduit in a single pass
- ✓ little traffic obstruction
- ✓ small constructions sites and small equipment
- ✓ crossing of obstacles
- ✓ minimal surface damages
- ✓ flexible installation depths
- ✓ relatively short installation distances

Blow-in into an empty conduit

The di version of the egeplast Microduct Mono pipes is particularly suitable for subsequent assignment in larger egeplast Macroducts. Prior to the blow-in operation, we recommend to calibrate and clean the empty conduit and to lubricate it. Prior to initiating the measure, a crash test should be carried out in order to determine the maximum feed force. Mono pipes are to be filled at a pressure between approx. 8 and 10 bar, which will make then stiffer and reduce sidestroke, thus enabling increased blow-in lengths. Make sure that the Mono pipes run as straight as possible and that the drums can rotate freely. All Mono pipes are to be blown in in a single pass, since subsequent blowing in is not possible.



To check out the common occupancy rates of empty pipes, please refer to the table below:

	40x3.7 mm	50x4.6 mm	63x5.8 mm
10x1.0 mm	Max. 5x 	Max. 7x 	Max. 7x 
12x1.1 mm	Max. 3x 	Max. 5x 	Max. 7x 
14x1.3 mm	nicht empfohlen	Max. 4x 	Max. 4x 

Important tips for the blow-in process (cable)

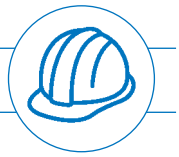
Successful blow-in of fibre optic cables depends on many factors. All egeplast Microducts feature dimensionally optimised grooves to minimise friction for the cable. Every pipe dimension has a cable diameter which is optimal for the blow-in process.

Dimension	ID	Cable-Ø	Optimal cable-Ø
7 x 1.5 mm	4.0 mm	1.0 – 2.9 mm	2.3 mm
10 x 2.0 mm	6.0 mm	2.0 – 4.5 mm	4.0 mm
10 x 1.0 mm	8.0 mm	4.0 – 6.5 mm	6.2 mm
12 x 2.0 mm	8.0 mm	4.0 – 6.5 mm	6.2 mm
12 x 1.1 mm	9.8 mm	5.0 – 8.3 mm	8.0 mm
14 x 2.0 mm	10.0 mm	5.0 – 8.5 mm	8.0 mm
14 x 1.3 mm	11.4 mm	6.4 – 9.8 mm	9.0 mm
16 x 2.0 mm	12.0 mm	7.0 – 10.0 mm	9.8 mm
20 x 2.5 mm	15.0 mm	8.0 – 12.0 mm	10.5 mm

Factors influencing the blow-in process

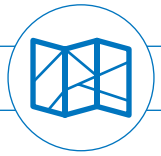
In addition to the cable diameter there are other factors which may impact the successful completion of the process:

Blow-in team



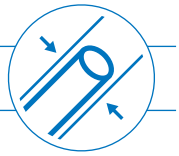
- execution by skilled expert staff
- inspection of the pipeline route

Planning of pipe routes



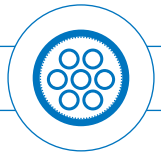
- scareful consideration of differences in height
- reduction of bend diversity

Cable



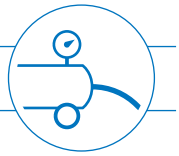
- optimised, smooth surface
- low tolerance variations
- cable diameter adapted pipe dimension
- neat appearance of winding – no sidestroke

Microducts



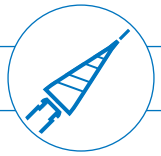
- low-friction inner layer with optimized sliding corrugation
- low tolerance variations
- reduced ovalities
- always protect the inside of the pipe from contamination and water

Blow-in equipment



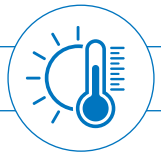
- use of a reasonable quantity of lubricant
- use of a cable guiding head is urgently recommended
- use of an intelligent blow-in unit with automated logging
- compressor with an adequate volume flow rate and optional blow-in pressure of up to 15 bar
- use of an external air cooler
- use of a “lubricator” for optimum cable lubrication

Installation



- adherence to the largest bending radii possible
- straight installation
- no twisting of the pipe bundles
- trench bottom must be flat

Weather



- Optimum blow-in temperature between **5 °C** and **20 °C**

Insertion into empty conduits

The precondition for pulling in pipe bundles is that the empty conduit is clean and dry. Its inner diameter should exceed the outer diameter of the pipe bundle to be inserted by 25 % minimum. The drum or coil should be positioned in a way which ensures smooth insertion of the pipe. The pipe bundles are pulled in by means of a pulling head or pulling grip which suit this purpose. We urgently recommend using a lubricant. The maximum tensile forces must not be exceeded in this process (p. 49).

Important!: The ends of the inner pipes should always be closed off during pulling in.

Since the pipe might reset owing to tensile stress and temperature differences, an extra length of 1 m minimum should be maintained at both ends of the empty conduit. Before connecting the pipes, the egeplast Microduct Multi bundle should rest for 12 to 24 hours.

Against this background, the factors impacting the reset time for the expansion following pulling are as follows:

the tensile forces which occurred

the inserted length

the local temperature conditions

Final inspection

After completion of the installation work, it is recommended to check the pipes for leaks and to document this.

Recommendation based on ZTV-TKNetz 40:

- Filling phase during which all pipes are filled with air pressure – Checking via pressure gauges at the beginning and end of the pipe
- Simultaneous preliminary testing of several pipes (5 min testing time at 5 bar, maximum pressure drop 0.5 bar)
- Settling phase: 20% of the main test time
- The duration of the main test is given by the following formula:

$t = t_{min1} + n * t_{min2} * L_F$

t = Duration of main test
t_{min} = Minimum test time
t_{min1} = 5 min.
t_{min2} = 3 min.
n = Number of tubes
L_F = Pipe length [m] / 1,250 (length factor)

tested with 5 +/- 0.3 bar
maximum pressure drop 0.5 bar

Calibration

We recommend to check the installation of the Microduct Mono and/or Microduct Multi pipes by means of calibres, primarily using calibration sets together with a micro transmitter for subsequent localisation.

Setting up a house connection: Stripping of Microduct Multi pipes

To connect two Microduct Multi pipes or to integrate a branch for a house connection, you will need to remove the sheathing of the Microduct Multi pipe. Utilisation of improper tools mmay result in damage to the inner pipes, which can cause the pipe to burst during blow-in. Accordingly, only blades with a slide shoe should be used. For a step-by-step description of the stripping of a pipe end, please check out the illustrations below:



1. Notch the sheathing with the circular pliers at two spots at a distance of 60-100 cm from each other.



For your own safety, please always ensure that your cutting movement leads away from your body when stripping the pipes.

2. Use the sheathing knife to prick the sheathing at the notch and push it as far as to the 2nd notch.



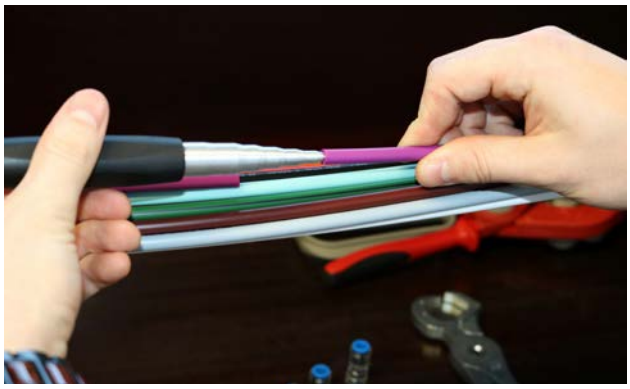
3. Open the sheathing.



4. Perform a perpendicular cut on the pipe to be cut using the pipe cutter.



5. Cut off another 3 to 4 cm to create enough space for the connector and end stop.



6. Reround the interfaces using the 5/20 tool.



7. Slide the connector and end stopper on up to the stop. Connect the house connection pipe.



8. Fasten the connection and end stopper with cable tie or the like.



To connect two Microduct Multi pipe bundles, both ends should overlap by approx. 50 cm and the pipe sheathing should be stripped. In doing so, it is important to ensure that the connectors are positioned with some offset to prevent generation of bending radii.

Perfect one-stop service for your construction project







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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 trainings 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.

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Information and instructions

The information in this document reflects the state of the art at the time of its compilation. It serves to provide instructions and advice, but no liability can be derived from it. It does not purport to be exhaustive and is subject to modifications.

For any inquiries related to the installation, use, maintenance or repair of our products or other questions, please feel free to approach our customer service. In addition, our staff will be happy to provide you with a technical briefing.

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