egeplast

SLM® DCS

Processing Guidelines

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Foreword

Details given in this brochure reflect the state of the art. No claim is made with regard to their completeness, they are intended for instruction and guidance; no obligation may be derived from it. Mistake and subject to change reserved.

Our customer service will be pleased to answer any further questions regarding the installation or use of our products, or any other questions. In addition, our customer and applications engineering services are pleased to be at your disposal to provide any technical guidance that you may want.

Publisher:
egeplast international GmbH

Issue:
September 2023

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Please note that the guarantee does not apply if and insofar the instructions contained in this technical brochure for the correct installation, joining and use of our products are not followed precisely. Relevant safety regulations, current standards and codes of practice must be complied with.

The sale and delivery of our products are subject exclusively to our respectively applicable current general terms and conditions, which you can call up on our website (www.egeplast.de/www.egeplast.eu).

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Content

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SLM® DCS

Processing Guidelines

Supplement to the installation instructions for PE pressure pipes A 135 and A 435 from the Kunststoffrohrverband e.V. in Bonn

1 | General Information

The egeplast SLM® DCS is used as a buried pipe meeting heightened safety requirements. It provides permanent monitoring of the pipe system for leakages. Any damages on the pipe will be displayed and can thus be localised with great precision within a onemeter radius.

The following conditions must be fulfilled to allow for pipe monitoring according to the egeplast SLM® DCS principle:

- At least one factory-made connecting piece must be attached.
- There must be electrical continuity across all pipe joints and also throughout all installed fittings.
- Electrical insulation of the conductive strips to the ground/soil must be ensured. The joints must be directly insulated after welding. The joints must be dry and clean; any moisture must be removed. It is also essential to insulate the pipe ends.
- The egeplast SLM® DCS must be installed such that an electrical return through the ground is guaranteed. egeplast must be consulted in case of any planned.

Scope of application

The processing guidelines apply to buried egeplast SLM® DCS pipes with inner pipes made of PE 100-RC. The joints and pipeline components must comply with the respective operating pressure. The serviceability of the system is guaranteed only if the joints are carried out in accordance with the egeplast processing guidelines.

Installation, open trench method

egeplast SLM® DCS pipes are suited for installation without a sand bed because they are made of PE 100-RC, which is highly resistant to stress-induced cracking.
The excavated soil is suitable for backfilling as long as it can be compacted. For the assessment of the filling soil, the DIN 18196, inter alia, is relevant. The pipe trench is to be designed according to the DIN 4124 (Excavation pits and trenches) and DIN 1998 (Layout of pipelines in public areas). The working area must be sufficient to enable professional installation of the piping components and insulation of the pipe joints without any impairment. Dry excavation pits during the entire installation process are a must.
Longitudinal force-locked joining procedures must be carried out according to the current standards of DVS.
Butt welding is recommended. Sand must be filled in the area of the joints; the fittings must also be covered and surrounded with sand. If a blacktop or paving is to be fabricated, work should be postponed until the lines have undergone their final inspection.

If there are joints insulated with shrinking sleeves lying in the region of necessary pipe bends, egeplast must be consulted in detail regarding the permissible bending radius.

Installation, trenchless method

Multilayer pipes such as egeplast SLM® DCS is a practical solution in the case of trenchless installation and rehabilitation, the outer surface of the pipes is securely protected against wear. DVGW Worksheets GW 321 (Horizontal Directional Drilling) and GW 323 (pipe bursting) recommend the use of pipes with protective layers.

- The DVGW rules define the maximum permissible tensile forces. Exceeding the permissible tensile forces will cause permanent damage to the new pipeline and shall be prevented by taking the appropriate measures. The tensile forces are to be measured and recorded.
- In the case of protective layer pipes, special pulling heads with an outer sleeve, that surrounds the protective layer, are recommended. Alternatively, the joint edge is to be constructively protected (refer to Figures 1-1 and 1-2).
- Longitudinal force-locked joining procedures must be carried out according to the current regulatory codes of the DVGW and DVS. For trenchless installation, only butt welding is acceptable for this pipe system.
- The trenchless installation of the egeplast SLM® DCS system requires the use of special shrinking sleeves. The design of the required shrinking sleeves must be coordinated with egeplast.
- The minimum permissible bending radius must be observed. If there are welds insulated with shrinking sleeves lying in the region of any pipe bends required, egeplast must be consulted in detail regarding the bending radius.


Fig 1-1


Fig 1-2

2 | Permissible Bending Radii

The bending radius must not fall below any of the following bending radii. Pipe elbows or fittings are to be used in the case of smaller radii.

Pipe wall temperatures [°C]	Minimum permissible bending radius R_{min} [in mm]				
	SDR 33	SDR 26	SDR 17/17.6	SDR 11	SDR 7,4
0	150.0 x OD	112.5 x OD	75.0 x OD	75.0 x OD	75.0 x OD
10	100.0 x OD	75.0 x OD	52.5 x OD	52.5 x OD	52.5 x OD
20	60.0 x OD	45.0 x OD	30.0 x OD	30.0 x OD	30.0 x OD

Tab1-1: Following KRV Installation Instructions A 135/99-15 and A 435/96-10, DVGW Worksheet GW 320, GW 321, GW 324, GW 325 and DVGW Code of practice GW 323

OD = Outer diameter core pipe [in mm]

$$R_{interpolated} = R_{20°C} + \left[\frac{R_{0°C} - R_{20°C}}{20°C}\right] \cdot (20°C - \vartheta_{pipe\ wall})$$

with:

$R_{interpolated}$ = Required bending radius [mm]
$R_{0°C}$ = Bending radius of the pipe at 0 °C [mm]
$R_{20°C}$ = Bending radius of the pipe at 20 °C [mm]
$\vartheta_{pipewall}$ = Temperature of the pipe wall during installation [°C]

In the case of pipe wall temperatures between 0 °C and 20 °C, the respective permissible bending radius can be determined by linear interpolation.

Temporary Permissible Bending Radii for e.g. trenchless installation methods

Pipe wall temperatures [°C]	Temporary permissible, construction-related bending radii R_{min} [in mm] for e.g. trenchless installation methods	
	SDR 17	SDR 11
0	56.0 x OD	37.0 x OD
20	22.0 x OD	15.0 x OD

Tab1-2: Following DVGW Worksheet GW 320-1

OD = Outer diameter core pipe [in mm]

ⓘ In the case of a temporary, process-related reduction of the permissible bending radii, damage caused by buckling when bending or overexpanding must be constructively ruled out.

ⓘ The above-mentioned bending radii do not apply to pipes whose joints were post-factory coated with a mechanical protective coating, as e.g. two-component polyurethane coatings.

3 | Permissible Tensile Forces

The values apply to pipes made of PE 100, PE 100-RC as well as to egeplast protective layer pipes such as the SLM® DCS (since only the medium-carrying pressure pipe will be burdened during pipe installation). They are to be measured and recorded. Exceeding the permissible tensile forces will lead to permanent damage to the pipeline, appropriate measures shall be taken to avoid this.
Special pulling heads are to be used. In order to prevent protruding edges and to ensure that the protective layer is no additional obstacle when installing, pulling heads with an outer sleeve that surrounds the protective layer are commonly used. As an alternative, the protruding edge is to be constructively protected.

Tensile force: Permissible tensile force in kN for pipes of PE100 and PE 100-RC at 20 °C pipe wall temperature

Note: Values are to be reduced by 10% for pulling periods of > 30 min. and 25% for a pulling period of > 20 h.> 20 h.

Outer diameter	Permissible tensile force SLM® DCS			
OD [mm]	SDR 17.6 [kN]	SDR 17 [kN]	SDR 11 [kN]	SDR 7,4 [kN]
90	13.60	14.34	21.06	30.01
110	20.51	21.43	31.40	45.00
125	26.28	27.33	40.66	57.94
140	33.16	34.32	50.76	72.83
160	43.12	44.89	66.66	94.97
180	54.38	56.88	84.25	120.04
200	67.51	70.29	103.90	148.50
225	85.29	89.03	131.64	187.81
250	105.14	109.30	162.01	231.74
280	131.85	137.29	203.06	290.67
315	166.99	173.98	257.20	367.97
355	211.37	221.22	326.38	466.77
400	268.93	280.03	414.55	593.08
450	339.90	354.89	525.39	750.23
500	420.55	438.59	648.06	925.83
560	525.86	549.18	812.24	
630	666.20	695.93	1028.79	

Tab 1-3: See also DVGW Worksheets GW 320, GW 321, GW 324, GW 325 and DVGW Code of practice GW 323


Fig 1-3


Fig 1-4

4 | Joining Techniques

4.1 | Electrofusion Welding

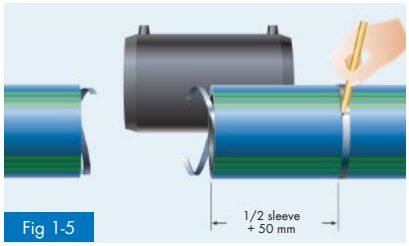

Fig 1-5

Marking the area from which the protective layer is to be peeled

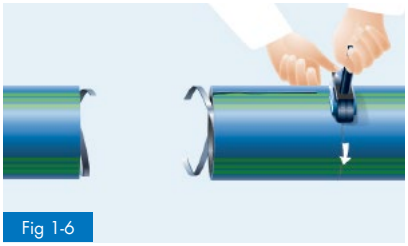

Fig 1-6

Removal of the protective layer with the egeplast M10 / M10 maxi peeling tool

Fig 1-7

Cutting back of the conductive strips;
20 mm minimum must remain on the pipe for subsequent processing

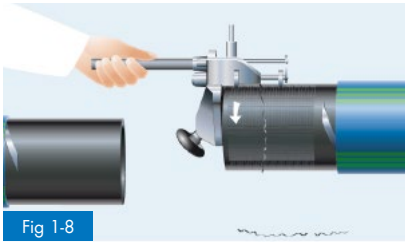

Fig 1-8

Removal of the oxide layer using a rotary scraper

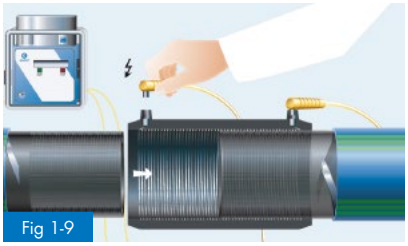

Fig 1-9

Welding procedure acc. to DVS 2207, Part 1

Removal of the outer layer at the jobsite (Figure 1-5 to 1-6)

If not already delivered with the outer layer being removed, the layer must be removed in the welding area without leaving any residue. For removal of the protective layer, we recommend the peeling tool M10 or M10 maxi. Any damage to the conductive strips must be avoided.

- The length of the pipe to be peeled corresponds to half the length of the fitting plus at least

Welding of the pipeline (Figure 1-7 to 1-9)

- The conductive strips must be cut away from the welding area, leaving a distance of approx. 20 mm from protective layer to the end of the conductive strips. It is not necessary to loosen the conductive strips from the core pipe.
- Machining of the pipe surface according to the specifications of DVS 2207-1 and processing directives of the fittings manufacturer. Any damage to the conductive strips through the rotary scraper has to be avoided.
- Welding acc. to directive DVS 2207-1.

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Continuation Electrofusion Welding

Fig 1-10

Roughen the protective layer in the area of the shrinking sleeves

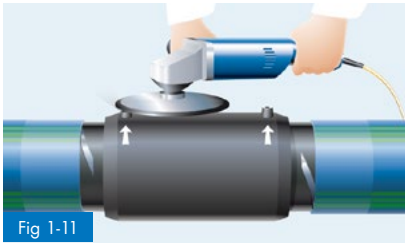

Fig 1-11

Removing the contact plugs

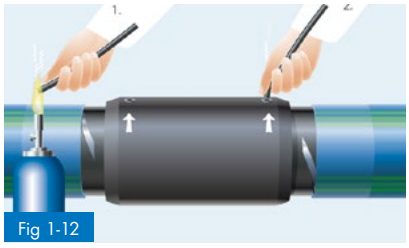

Fig 1-12

Insulating the contact plugs

Fig 1-13

Sealing of the ring gap between pipe and the electrofusion fitting

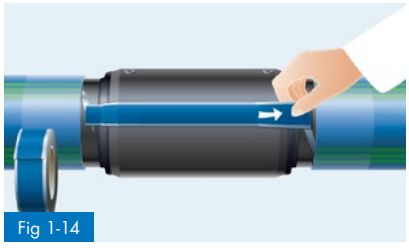

Fig 1-14

Restoring and fixing of electrical connection

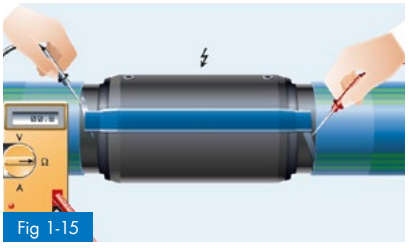

Fig 1-15

Measuring and recording the electrical resistance, max. 0.5 Ohm

Following this, the protective layer in the area of the shrinking sleeve to be positioned later must be roughened using sandpaper (P60) in order to achieve better adhesion for the shrinking sleeve (Fig 1-10).

In the next step, the contact plugs of the fitting are removed (Figure 1-11). After this, the area of the removed contact plugs must be insulated (Figure 1-12). For this purpose, a hot melt stick (LCRP stick) is warmed up and pressed onto the surface to be insulated. It must be ensured that the entire surface of the area is completely insulated.

In the following step, the ring gap between the pipe and the electrofusion coupler is to be sealed with egeplast filling adhesive on the entire surface (Figure 1-13).

In order to restore the electrical connection at the welded joints, a specially conductive aluminium adhesive tape is used. On the exposed and cleaned aluminium strips, two strips of conductive aluminium adhesive tape are applied onto the fitting lengthwise (see Figure 1-14). The contact surfaces of the adhesive tape must be pressed firmly on the aluminium surface.

The electrical resistance is then measured using an ohmmeter (see Fig 1-15). The measurement is made between each of the conductive strips just in front of the outer layer (on the area of aluminium belonging to the pipe). The measured resistance value is not permitted to be more than 0,5 Ohms. If this value is exceeded, the joint must be reapplied. The measured value is to be recorded for every joint (see Section 4.3).

Continuation on the next page →

Continuation Electrofusion Welding

Subsequently, an aluminium adhesive tape is to be wrapped around ensuring a minimum of 50% overlap. The aluminium adhesive tape serves to protect the conductor strips which for this purpose must be fully covered by it. The aluminium adhesive tape which will be used for wrapping needs to be procured from egeplast. The film must be glued firmly onto the pipe while avoiding shrink holes or air pockets. If needed, the film should be processed using a pressure roller (e. g. silicone roller) during and after wrapping. Afterwards, the joint is to be protected by wrapping heat shrink products (SLM® DCS insulation kit) around it, thus ensuring its electric insulation from the environment. The type of shrink product to be selected will depend on the installation method and is to be selected following consultation with egeplast. The respective processing guidelines of the insulation kits must be observed. The shrinking sleeve (SLM® DCS insulation kit) must be placed in the center above the electrofusion coupler. It is not permitted to shorten the heat-shrink product. Before the shrinking procedure begins, the protective layer must itself be protected by using a suitable heat shield at the border area of the shrink product (Fig 1-19). The application of a shrinking sleeve always proceeds from the middle outwards, working with a low gas flame. Air pockets are to be avoided as far as possible in the process.

Backfilling:
Backfilling with sand is required in the area of the welded joint and the fittings. As an additional protection against external damage, the area can be safeguarded with a pipe half shell laid over the position of the joint.

If a black top or paving has to be fabricated, that work should be postponed until final inspection of the pipeline.

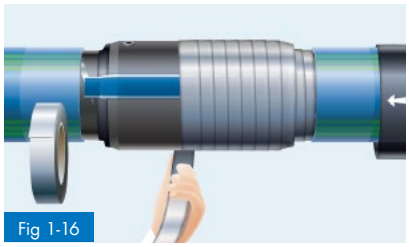

Fig 1-16

Wrapping of the fitting with aluminium adhesive tape

Fig 1-17

Attaching the heat shield and applying the heat shrink product

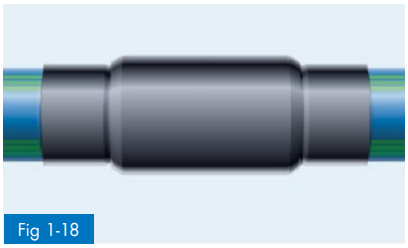

Fig 1-18

Welded joint, protected by the heat shrink product

4.2 | Butt Welding

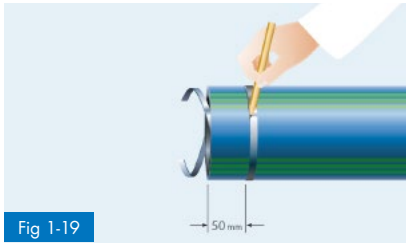

Fig 1-19

Marking the area from which the layer is to be peeled

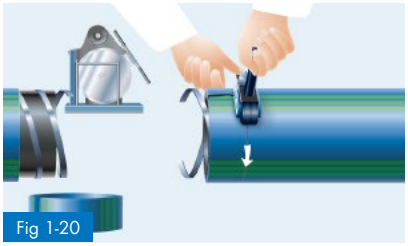

Fig 1-20

Removal of the protective layer with the egeplast M10 / M10 maxi peeling tool

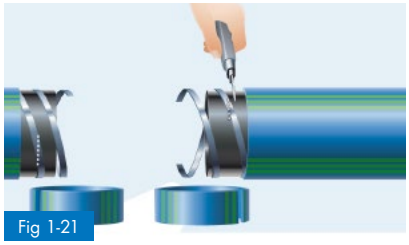

Fig 1-21

Trimming the conductive strips

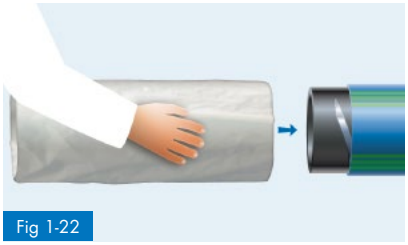

Fig 1-22

Mount shrinking sleeve prior to manufacture of the pipe joint, do not remove the protective foil

Removal of the outer layer at the jobsite (Figure 1-19 to 1-22)

If not already delivered with the outer layer being removed, the layer must be removed in the welding area without leaving any residue. For removal of the protective layer, we recommend the peeling tool M10 or M10 maxi. Damage to the conductive strips must be avoided.

- Marking of the area to be peeled, at least 50 mm; it is recommended to adjust the peeling length to the outside debeader (see also Table 1-4, Page 18)
- The conductive strips must be cut away from the welding area; there must be a distance of approx. 20 mm from protective layer to the end of the conductive strips. It is not necessary to loosen the conductive strips from the core pipe.

For mechanical protection of the joint, egeplast recommends the use of egeplast egeFit® shrinking sleeves. The sleeve is packed in a plastic foil for delivery. This foil protects it from humidity and contamination. The sleeve must be pushed onto the pipe to be welded while it is still in its packed condition, prior to establishing the pipe connection.

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Continuation Butt Welding

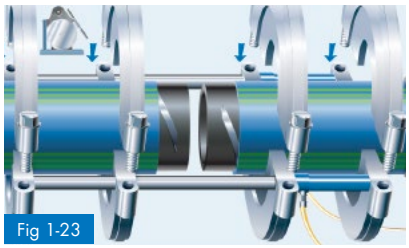

Fig 1-23

Mounting of the special clamping jaws available at egeplast (see Table 1-5)

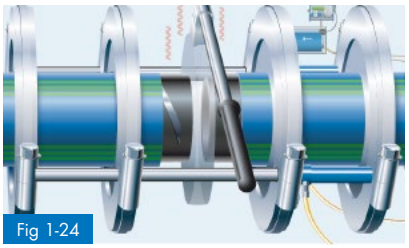

Fig 1-24

Welding according to DVS 2207, Part 1

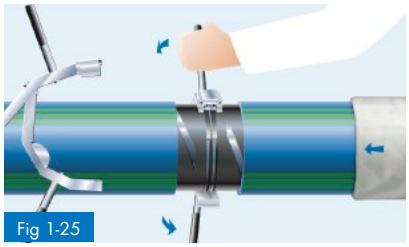

Fig 1-25

Removal of weld bead with an outer debeader

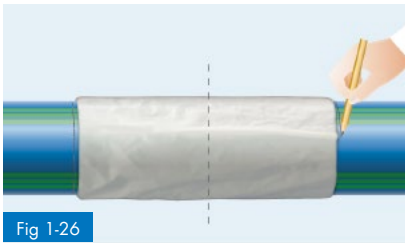

Fig 1-26

Positioning of the shrinking sleeve

Fig 1-27

Roughen the shrink area of the sleeve radially with the emery cloth

Welding of the pipeline (Figure 1-23/1-35)

- Clamping jaws are to be used that are adjusted to the outer diameter of the protective layer of the pipe. Appropriate clamping jaws for Widos welding machines are available at egeplast (see also Table 1-5, Page 19).
- Welding according to directive DVS 2207-1.
- Removal of the weld bead with an appropriate outer debeader. Damages to the conductive strips are to be avoided. Position the shrinking sleeve in the center above the weld seam and mark the shrink area. Subsequently slide back the sleeve and remove it from the shrink area. The protective layer is to be roughened in the area of the shrinking sleeve which is to be positioned later using an emery cloth (P60) for better adhesion (Figure 1-27).

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Continuation Butt Welding

In order to restore the electrical connection at the welded joints, a specially conductive aluminium adhesive tape is used. On the exposed and cleaned aluminium strips, two strips of conductive aluminium adhesive tape are applied onto the joint lengthwise (see Figure 1-28). The contact surfaces of the adhesive tape must be pressed firmly on the aluminium surface.

The electrical resistance is then measured using an ohmmeter (see Fig 1-29). The measurement is made between each of the conductive strips just in front of the outer layer (on the area of aluminium belonging to the pipe). The measured resistance value is not permitted to be more than 0.5 Ohms. If this value is exceeded, the joint must be reapplied. The measured value is to be recorded for every joint (see Section 4.3).

Subsequently, an aluminium adhesive tape is to be wrapped around ensuring a minimum of 50% overlap. The aluminium adhesive tape serves to protect the conductor strips which for this purpose must be fully covered by it. The aluminium adhesive tape which will be used for wrapping needs to be procured from egeplast. The film must be glued firmly onto the pipe while avoiding shrink holes or air pockets. If needed, the film should be processed using a pressure roller (e. g. silicone roller) during and after wrapping.

Waterproof insulation of the electrical joint by means of egeplast wrapping green (Fig. 1-31)
- full wrapping with 50 % overlap minimum
- Beginning and end points of wrapping no less than 10 cm on the protective layer

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Fig 1-28

Restoring the electrical connection

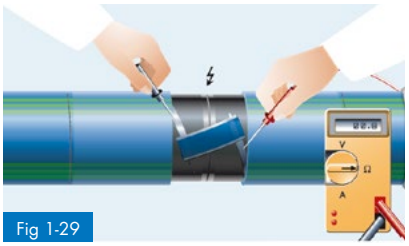


Fig 1-29

Measuring the ohmic Resistance, max. 0,5 Ohms

Fig 1-30

Wrapping the weld area with aluminium adhesive tape

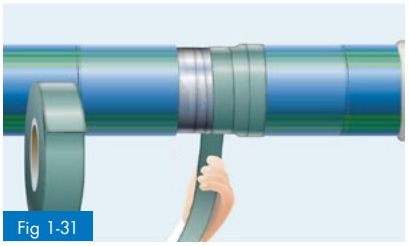


Fig 1-31

Water-tight insulation of the electrical joints, with 50 % overlap minimum

Continuation Butt Welding

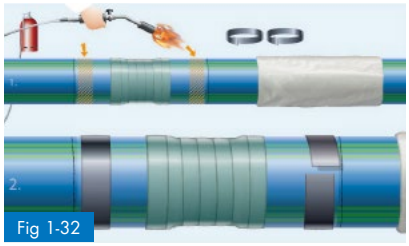


Fig 1-32

Preheating the pipe surface and applying the hot-melt adhesive

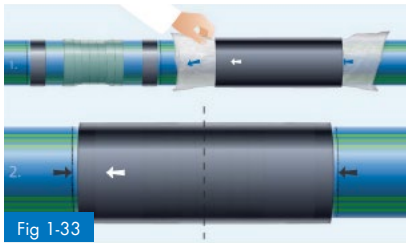


Fig 1-33

Removal of the protective foil and alignment of the shrinking sleeve

Fig 1-34

Shrinking by using a soft gas flame

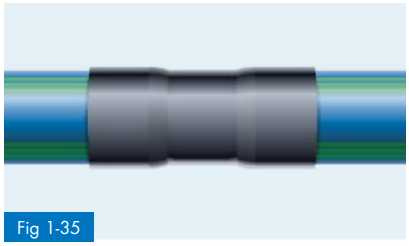


Fig 1-35

Welded joint protected by means of a shrinking sleeve

Mechanical protection of the insulation layer using egeplast egeFit® shrinking sleeves (Figs. 1-32 up to 1-34)

Drying and cleaning of the shrink area. Preheat the pipe surface and apply the enclosed hot-melt adhesive, approx. 5 cm from the end of the shrinking sleeve on either side (Fig. 1-32). Subsequently remove the protective foil into a single direction. Align shrinking sleeve to the center and position above the weld seam (Fig. 1-33).

Before initiating the shrinking process, make sure to protect the protective layer with suitable heat protection mats around the edges of the shrinking sleeve. Use a soft, yellow gas flame for shrinking on the sleeve. Always work from the middle outwards and constantly keep the propane torch rotating (Fig. 1-34).

The installation is complete once the shrinking sleeve fits closely.

Note:
Following the shrink-on process, the joint should be allowed to cool down to ambient temperature to enable the material to obtain adequate strength.

Attachment of the measuring cable by means of the egeplast SLM® DCS connecting piece

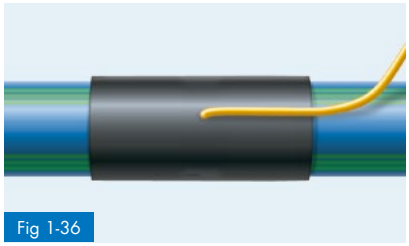


Fig 1-36
egeplast SLM® DCS Connecting Piece

The egeplast SLM® DCS connecting piece provides the electrical connection from the monitoring unit to the conductive strips of the pipe to be monitored.

The connecting piece is supplied as a fully assembled egeplast SLM® DCS pipe section. Dimensioning of the connecting piece in carried out as for the pipeline to be monitored. The connecting piece is to be integrated close to where the monitoring unit is to be installed.

4.3 | egeplast SLM® DCS Report

To be filled out for each joint. To be shown on the concluding verification of the SLM® DCS requirements.

Project:

_____

_____

Constructing company:

_____

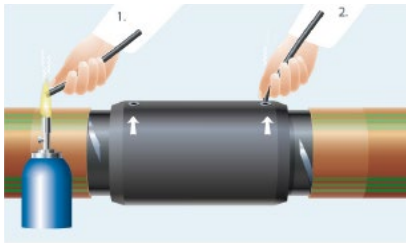
_____

Control parameters

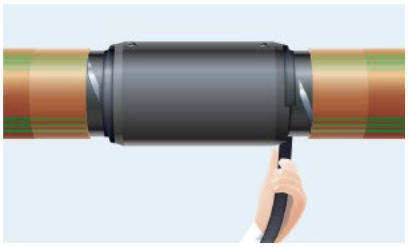
Serial number for SLM® DCS report: _____

Identification of the SLM® DCS joint: _____

Joining technique: O Electrofusion O Butt welding



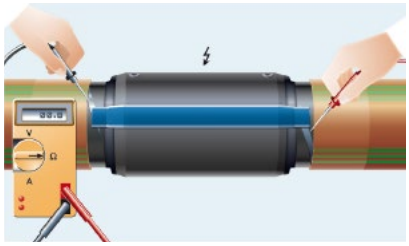
① Insulation of the contact plugs with Raychem melt sticks



② Sealing of the ring gap between the electrofusion coupler and the pipe with filling adhesive

Performed: O Yes O No

Performed: O Yes O No



In the case of measured values of the contact resistance > 0.5 Ω the electrical connection must be tested. If necessary, the electrical connection must be renewed!

③ Measurements after manufacturing the electrical connection

Contact resistance from the already installed to the new pipe section:

_____ Ω

Authentication

Executor: _____

Date: _____

Signature: _____

4.4 | System Components

Fittings

In the case of fittings, e.g. pipe branches and bends in the SLM® DCS main lines, only SLM® DCS fittings of egeplast must be used. The fittings are to be laid in a sandbed. Welding of the pipes with the fittings and insulation has to take place in line with the processing directives for butt welding and/or electrofusion.

Manhole structures

- egeplast SLM® DCS manholes

The egeplast SLM® DCS manholes are made from polyethylene. Their wall construction matches that of the SLM® DCS fittings. The manholes are fabricated according to the customers specifications. Welding and insulation of the SLM® DCS pipes with the manhole is carried out as per the installation guidelines for butt welding or electrofusion, as the case may be.

- Other manhole systems

For manhole structures (made e.g. of concrete, PE, PP or GRP), special SLM® DCS connection pieces for manhole structures are to be attached at the entrances and exits of the manholes. The connection pieces are factory-assembled after consultation. The pipe is to be sealed using standard techniques (e.g. wall collar, Link-Seal modular seals, or equivalent) in the area of the manhole entrances and exits. At the connection pieces, joints on the inside of the manhole to other fittings, components, cleaning ports, etc. are to be made using flanged or welded joints. The manhole diameter should be chosen such that the installations described above can be carried out inside the manhole.

4.5 | Verification of the SLM® DCS System Requirements

Continuity and isolation

Verification of both the continuity and the isolation of the conductive strips from the ground is performed after installation of the egeplast SLM® DCS pipe.
The verification is performed by egeplast or an authorized service provider. The installation of the monitoring unit for the SLM® DCS pipe is done, after successful verification, by the client or the constructing company.

The verification of the continuity of the conductive strips requires that the pipe string is accessible at the pipe ends. Access can be achieved using the SLM® DCS connection pieces.This procedure allows the pipe trench to be filled in before verification is carried out. Furthermore, the continuity can also be checked at any time while the pipe is in operation. An alternative approach is to isolate the pipe ends only after verification of continuity. The trench must then be kept open at these positions on the pipe. In the places where the conductive strips are exposed, the pipe may not have any contact with the ground or with any groundwater that may be present.

The verification of isolation from the ground should take place, at the earliest, 1 week after filling in the pipe trench. This ensures that the soil is sufficiently damp. The drier the bedding material is during installation, the longer the waiting time to choose before verifying the isolation.

5 | Tables

Layer backcut recommended (Minimum values)

Before electrofusion welding or butt welding of egeplast SLM® DCS pipes can take place, the protective layer must be removed with egeplast peeling tools. Peeling of the pipe ends can be carried out by egeplast on request. For this we need an indication of the welding procedure to be used.

Layer Backcut for the SLM® DCS		
Medium-Bearing Pipe DIN 8074 OD [mm]	Butt welding [mm]	Electrofusion welding* [mm]
90	40	130
110	40	140
125	40	145
140	50	150
160	50	155
180	50	160
200	50	165
225	50	175
250	50	185
280	60	190
315	60	200
355	60	205
400	60	215
450	60	225
500	70	235
560	70	240
630	70	255

Tab 1-4 * Dimensions specified for the product ranges of the Georg Fischer, Friatec, and Plasson companies, Long sleeve fittings are not considered

Overview of outer and core pipe diameter of egeplast SLM® DCS pipes / butt welding machines / clamps

Special clamps which are adapted to the outer diameter of the SLM® DCS pipe are required using butt fusion welding so that the ends of pipes can be securely positioned. Appropriate clamps and adapters for WIDOS welding machines can be obtained from egeplast.

The following list contains the outer diameter of the pipes as well as the types of WIDOS machines that may be used, depending on the pipe dimensions.

Medium-Bearing Pipe DIN 8074 OD [mm]	Outer diameter egeplast SLM® DCS [mm]	WIDOS Welding Machines – Area of Application				
		WIDOS 4600	WIDOS 4800	WIDOS 4900	WIDOS 5100	WIDOS 6100
90	95.6	●	●*	●*		
110	116.4	●	●*	●*		
125	132.0	●	●*	●*		
140	147.3	●	●*	●*		
160	168.4	●	●*	●*		
180	189.0	●	●*	●*		
200	209.0	●	●*	●*		
225	234.1	●	●*	●*		
250	259.1		●	●	●*	
280	289.2				●*	
315	325.0				●*	
355	366.0				●	
400	411.0				●	
450	461.1					●
500	511.3					●
560	571.5					●
Manufacturing tolerances possible		* Appropriate adapter required				

Tab 1-5

egeplast

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