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## General Building Inspectorate Approval

Approval no.:

Z-42.3-385

Applicant:

Epros Umweltschutztechnik GmbH  
Dr.-Alfred-Herrhausen-Allee 36  
47228 Duisburg

Object of approval:

“epros DrainPacker method” for the rehabilitation of buried damaged sewer lines with nominal diameters from DN 100 to DN 800 using point and part liners (collectively also referred to as “patch liners”)

Valid until:

31 January 2011

The above mentioned object is hereby granted general approval by the Building Inspectorate.

This General Building Inspectorate Approval covers 17 pages and eleven appendices.

**[DIBt  
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## I. GENERAL PROVISIONS

- 1 The General Building Inspectorate Approval is proof of the usability or applicability of the object of approval for the purpose of the German Lands' building regulations.
- 2 The General Building Inspectorate Approval is no substitute for permits, consents and certificates statutorily prescribed for the implementation of building projects.
- 3 The General Building Inspectorate Approval is granted without prejudice to any third-party rights including but not limited to private proprietary rights.
- 4 Manufacturers and distributors of the object of approval shall, notwithstanding any additional regulations laid down in the "Special Provisions", provide the user of said object with copies of the General Building Inspectorate Approval and shall instruct the user to the effect that the General Building Inspectorate Approval must be kept at the point of use or application. Upon request, copies of the General Building Inspectorate Approval shall be provided to the authorities interested.
- 5 The General Building Inspectorate Approval may not be reproduced unless in total. Any publication of part of this Approval requires the consent of the German Institute for Construction Engineering. Texts and drawings of advertising materials shall not be contradictory to the General Building Inspectorate Approval. Translations of the General Building Inspectorate Approval must contain the information that the "translation of the German original version has not been verified by the German Institute for Construction Engineering".
- 6 The General Building Inspectorate Approval is granted subject to revocation. The provisions of the General Building Inspectorate Approval may be altered by subsequent modifications and additions, especially when this is required by new technical findings.

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## II. SPECIAL PROVISIONS

### 1 Object of approval and scope of application

This General Building Inspectorate Approval applies to the cast-in-place point and part pipelining (CIPP) method called "epros DrainPacker repair system" (Appendices 1 to 3) using the two-component silicate resin system called "epros resin type-W", "type-W01" ("winter resins") and "type-S" ("summer resin") for the rehabilitation of damaged sewer lines with circular cross sections in the nominal diameters from DN 100 to DN 800. This Approval applies to the rehabilitation of sewer lines intended for the discharge of sewage as laid down in the standard DIN 1986-3<sup>1</sup>.

The point and part lining method can be used for the rehabilitation of sewer lines made of concrete, reinforced concrete, vitrified clay, asbestos cement, cast iron, GRP and PVC-U if the cross section of the sewer to be repaired meets the method-related requirements as well as the needs of structural stability.

The point and part lining method can be used, independently of said pipe material of the host line, for the repair of cracks (e.g. radial cracks, longitudinal cracks, and combinations of both), mechanical wear, corrosion, as well as for the sealing of lateral connections and leaking pipe joints on the condition that the host pipe-soil system in itself is still self-supporting (e.g. longitudinal cracks with low pipe deformation and verified functional side bedding, if necessary, this condition needs to be checked e.g. by long-term observations and/or driving rod tests).

For the repair of damaged sewer pipes according to the point and part lining method, a resin-wetted glass fibre matting composed of resin-wetted random/woven fibre layers is moved through the sewer pipe to the spot of repair by means of an inflatable packer ("DrainPacker"), which is then inflated to pressurise the glass fibre mat to the host pipe wall. The packer remains in that position until curing is complete.

### 2.1 Properties and composition

#### 2.1.1 Materials of the method components

##### 2.1.1.1 Glass fibre material (Appendix 1, Picture 1)

The resin system shall use no carrier material other than glass fibre mats designated "CRF(+)" matting" composed of woven and random-laid fibre glass mats under DIN 1259-1<sup>2</sup> and DIN 61853-1<sup>3</sup> and DIN 61853-2<sup>4</sup> as well as DIN 61854-1<sup>5</sup> in accordance with the recipe information lodged with the German Institute for Construction Engineering. The same recipe shall also be kept with the third-party inspection body.

Each continuous roving fibreglass mat consists of a woven glass layer and a random-fibre layer sewn to one another.

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1	DIN 1986-3	Drainage facilities for buildings and properties – Part 3: Rules for operation and maintenance; issue:2004-11
2	DIN 1259-1	Glass – Part 1: Terminology for glass types and groups; issue:2001-09
3	DIN 61853-1	Textile glass; textile glass mats for plastics reinforcement; technical delivery conditions; issue:1987-04
4	DIN 61853-2	Textile glass; textile glass mats for plastics reinforcement; classification, application; issue:1987-04
5	DIN 61854-1	Textile glass; woven glass fabrics for plastics reinforcement; woven glass filament fabric and woven roving; technical delivery conditions; issue:1987-04

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The glass fibre mats have the following properties prior to application:

- Mass per unit area: 1050 g/m<sup>2</sup> ± 10% according to ISO 3374<sup>6</sup>
- Thickness: 1.6 mm ± 15%
- Width: 400 mm to 2500 mm according to ISO 5025<sup>7</sup>

#### 2.1.1.2 Resin components

The silicate resin system to be used, which is “epros resin type-W”, “type-W01” and “type-S”, consists of the components **A** (hardener) and **B** (resin). The combination of the two components must correspond to the recipe information kept with the German Institute for Construction Engineering. A so-called “winter quality” type-W and type-W01 as well as a so-called “summer quality” type-S are used for component **B**. To avoid property changes, the equipment coming in contact with component **B**, e.g. barrels, other containers, lines, must contain no water.

##### • Component A (hardener):

The hardener shows the following properties prior to application.

- Density @ 20°C: 1.55 g/cm<sup>3</sup> ± 0.01 g/cm<sup>3</sup>
- Viscosity @ 20°C: 600 mPa x s ± 100 mPa x s
- pH: 13.0 ± 0.2
- Colour: white

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##### • Component B (resin):

a) The silicate resin **type-W01** shows the following properties prior to application.

- Density @ 25°C: 1.190 g/cm<sup>3</sup> ± 0.015 g/cm<sup>3</sup>
- Viscosity @ 25°C: 215 mPa x s ± 15 mPa x s
- Pot time @ 20°C: 6 min ± 1 min
- Bending force: 1800 N ± 200 N
- Colour: brown

b) The silicate resin **type-W** shows the following properties prior to application.

- Density @ 25°C: 1.240 g/cm<sup>3</sup> ± 0.015 g/cm<sup>3</sup>
- Viscosity @ 25°C: 175 mPa x s ± 15 mPa x s
- Pot time @ 20°C: 14.5 min ± 1 min
- Bending force: 1600 N ± 150 N
- Colour: brown

c) The silicate resin **type-S** shows the following properties prior to application:

- Density @ 25°C: 1.240 g/cm<sup>3</sup> ± 0.015 g/cm<sup>3</sup>
- Viscosity @ 25°C: 210 mPa x s ± 15 mPa x s
- Pot time @ 20°C: 31 min ± 2 min
- Bending force: 1700 N ± 150 N
- Colour: brown

The silicate resin systems are in compliance with the IR spectrums kept with the German Institute for Construction Engineering. The IR spectrums shall also be lodged with the third-party inspection body.

6	ISO 3374	Reinforcement products - Mats and fabrics - Determination of mass per unit area; issue:2000-06
7	ISO 5025	Reinforcement products - Woven fabrics - Determination of width and length; issue:1997-12

### 2.1.2 Environmental compatibility

As to potential impacts on soil hygiene, there are no concerns or objections to the application and use of the resin components **A** and **B** and glass fibre mats of the point and part liner method according to the recipe data kept with the German Institute for Construction Engineering. This environmental compatibility statement shall be valid only if and where the Special Provisions of this General Building Inspectorate Approval are complied with. The approval authority reserved to local water agencies or building inspectorates, especially in protected catchment areas, shall not be affected thereby.

### 2.1.3 Wall thickness and wall structure

A repair job according to this system uses resin-wetted point or part liners having a minimum wall thickness of 4 mm after installation and complete cure, regardless of the nominal diameter. The point or part liner installed in the host pipe must be at least three-layered. The liner's wall structure must be made up of an outer random-fibre layer and an inner random-fibre layer with a woven glass fibre layer in between (Appendix 2, Picture 11).

### 2.1.4 Physical characteristics of the cured point or part liner

The glass fibre mats (laminates) wetted with the resin system must show the following characteristic values after complete cure:

1. Density after DIN EN ISO 1183-1<sup>8</sup>:
  - Type-W01:  $\approx 1.451 \text{ g/cm}^3$
  - Type-W:  $\approx 1.518 \text{ g/cm}^3$
  - Type-S:  $\approx 1.508 \text{ g/cm}^3$
  - Mixture of type-W and type-S:  $\approx 1.538 \text{ g/cm}^2$
2. Calcination after DIN EN ISO 1172<sup>9</sup>:
  - Type-W01:  $\geq 57\%$
  - Type-W:  $\geq 52\%$  [DIBt seal]
  - Type-S:  $\geq 58\%$
  - Mixture of type-W and type-S:  $\geq 58\%$
3. Initial E-modulus after DIN EN 16869-2<sup>10</sup>:
  - Type-W01:  $\geq 5546 \text{ N/mm}^2$
  - Type-W:  $\geq 7850 \text{ N/mm}^2$
  - Type-S:  $\geq 6678 \text{ N/mm}^2$
  - Mixture of type-W and type-S:  $\geq 6439 \text{ N/mm}^2$
4. Bending strength after DIN EN ISO 178<sup>11</sup>:
  - Bending strength with type-W01:  $\geq 161 \text{ N/mm}^2$
  - Bending strength with type-W:  $\geq 152 \text{ N/mm}^2$
  - Bending strength with type-S:  $\geq 143 \text{ N/mm}^2$
  - Bending strength with mixture of type-W and type-S:  $\geq 124 \text{ N/mm}^2$

8	DIN EN ISO 1183-1	Plastics - Methods for determining the density of non-cellular plastics Part 1: Immersion method, liquid pycnometer method and titration method (ISO 1183-1:2004); German version EN ISO 1183-1:2004; issue:2004-05
9	DIN EN ISO 1172	Textile-glass-reinforced plastics - Prepregs, moulding compounds and laminates - Determination of the textile-glass and mineral-filler content; calcination methods (ISO 1172:1996); German version EN ISO 1172:1998; issue:1998-12
10	DIN EN 61869-2	Pipes of glass fibre reinforced polyester resin, wound, filled – Part 2: General quality requirements; testing; issue: 1995-12
11	DIN EN ISO 178	Plastics - Determination of flexural properties (ISO 178:2001); German version EN ISO 178:2003; issue:2003-06 in conjunction with (draft standard) DIN EN ISO 178/A1, issue:2004-10 Plastics - Determination of flexural properties - Amendment 1: Precision statement (ISO 178:2001/Amd 1:2004); German version EN ISO 178:2001/prA1:2004

## 2.1.5 Physical characteristics of the cured silicate resin mixture

The cured resin mixture of the components **A** and **B** shows the following characteristic values:

1. Density after DIN EN ISO 1183-1<sup>8</sup>:
  - Type-W01:  $\approx 1.295 \text{ g/cm}^3$
  - Type-W:  $\approx 1.286 \text{ g/cm}^3$
  - Type-S:  $\approx 1.343 \text{ g/cm}^3$
  - Mixture of type-W and type-S:  $\approx 1.341 \text{ g/cm}^3$
2. Tensile strength after DIN EN ISO 527<sup>12</sup>:
  - Type-W01:  $\geq 14.9 \text{ N/mm}^2$
  - Type-W:  $\geq 15.0 \text{ N/mm}^2$
  - Type-S:  $\geq 15.0 \text{ N/mm}^2$
  - Mixture of type-W and type-S:  $\geq 14.5 \text{ N/mm}^2$
3. E-modulus (tensile) after DIN EN ISO 527<sup>12</sup>:
  - Type-W01:  $\geq 210 \text{ N/mm}^2$
  - Type-W:  $\geq 201 \text{ N/mm}^2$
  - Type-S:  $\geq 211 \text{ N/mm}^2$
  - Mixture of type-W and type-S:  $\geq 195 \text{ N/mm}^2$
4. Compressive strength after DIN EN ISO 604<sup>13</sup>:
  - Type-W01:  $\geq 44.8 \text{ N/mm}^2$
  - Type-W:  $\geq 45.3 \text{ N/mm}^2$
  - Type-S:  $\geq 48.3 \text{ N/mm}^2$
  - Mixture of type-W and type-S:  $\geq 38.4 \text{ N/mm}^2$
5. E-modulus (compression) after DIN EN ISO 604<sup>13</sup>:
  - Type-W01:  $\geq 739 \text{ N/mm}^2$
  - Type-W:  $\geq 766 \text{ N/mm}^2$
  - Type-S:  $\geq 698 \text{ N/mm}^2$
  - Mixture of type-W and type-S:  $\geq 607 \text{ N/mm}^2$
6. Shrinkage coefficient:
  - Type-W01: **[DIBt]**  $0.44\% \pm 0.04\%$
  - Type-W: **[seal]**  $0.22\% \pm 0.02\%$
  - Type-S:  $0.19\% \pm 0.01\%$
  - Mixture of type-W and type-S:  $0.21\% \pm 0.02\%$

## 2.2 Manufacture, packaging, transport, storage and identification

### 2.2.1 Manufacture of point and part liners

The glass fibre mats shall be manufactured in the sub-supplier's factory with the minimum thicknesses stated in Section 2.1.1.1. The Applicant shall check and make sure the specified lengths and wall thicknesses are observed by the sub-supplier.

12	DIN EN ISO 527	Plastics - Determination of tensile properties - Part 1: General principles (ISO 527-1:1993 including Amendment 1:1994); German version EN ISO 527-1:1996; issue: 1996-04 - Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:1993 including Amendment 1:1994); German version EN ISO 527-2:1996; issue: 1996-07
13	DIN EN ISO 604	Plastics - Determination of compressive properties (ISO 604:2002); German version EN ISO 604:2003; issue:2003-12

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The Applicant shall obtain proof to make sure the resins and the hardener are in compliance with the recipe data. For this purpose, the Applicant will cause the sub-supplier to produce test reports 2.2 after DIN EN 10204<sup>14</sup> upon each delivery.

The scope of inspection for the incoming goods shall include the verification of the following properties of the resin components **A** (hardener) and **B** (resins: type-W01, type-W and type S).

Properties of resins and hardener:

- Density
- Viscosity

#### 2.2.2 Packaging, transport, storage

The glass fibre mats delivered by the sub-supplier shall be stored prior to use in the premises of the Applicant in a way to ensure the mats will not be damaged.

The components (resins and hardener) delivered by the sub-supplier for resin impregnation on the given job site shall be stored until further use in suitable and separate hermetically closed containers in the premises of the Applicant. The storage temperature of +5°C to +25°C and the relative air humidity of 40% to 70% shall be observed. The shelf time is approximately six months following the day of the delivery and shall not be exceeded. The storage containers shall be protected from direct sunlight. They shall be designed such that the silicate resin (component **B**) and the hardener (component **A**) are kept in separate receptacles/containers.

The usage amounts of each component as required for the repair jobs shall be withdrawn from the storage containers and then transported in suitable, separate and hermetically closed receptacles to the given place of application. There, the receptacles must be protected from weather. The glass fibre mats shall be transported in suitable transport containers to ensure they are not damaged.

When and where the resin components are packed at the Applicant's site, they shall be filled in suitable transport containers only (e.g. plastic canisters). Care shall be taken to ensure the component **B** is not filled in moist containers.

The relevant rules and regulations of accident prevention as well as the instructions given in the Applicant's procedures manual shall be observed during storage, handling and transport.

#### 2.2.3 Identification

The glass fibre mats and the transport containers of the resin components **A** and **B** shall be identified with the compliance mark in accordance with the applicable national compliance and conformity regulations, inclusive of the Approval number Z-42.3-385. Said identification is subject to the condition that the requirements set forth in Section 2.3 Proof of Compliance have been met.

Additionally, the transport containers of the glass fibre mats shall be labelled with the following information:

- Roll width
- Total weight
- Mass per unit area
- Batch number

In addition, the transport containers for the resins and the hardener shall be labelled with at least the following information:

- Component designation
- Winter or summer quality of component **B**
- Temperature range for application: +0°C to +25°C
- Holding capacity of storage container (volume or weight)

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- Where appropriate, the hazmat identification (in accordance with the relevant hazardous material regulation)
- Batch number

## 2.3 Proof of Compliance

### 2.3.1 General

The confirmation that the method components are in compliance with the provisions of this General Building Inspectorate Approval must be provided for each manufacturing plant by means of a certificate of compliance based on in-house production control and regular third-party inspection systems including initial testing of the method components in accordance with the following conditions.

For issuing the certificate of compliance and for third-party inspection including associated product testing, the manufacturer shall call in a generally accepted certification body as well as an inspection body having general acceptance to this effect.

The certification body shall, for information purposes, give the German Institute for Construction Engineering a copy of the Compliance Certificate issued by said body.

In addition, the German Institute for Construction Engineering shall be given for information a copy of the initial test report.

### 2.3.2 In-house production control

In-house production control shall be implemented and carried out in every manufacturing plant. In-house production control shall mean the continuous inspection or monitoring of production by the manufacturer to ensure that the construction products made by the manufacturer comply with the provisions of this General Building Inspectorate Approval.

In-house production control shall include the following minimum requirements:

- Description and inspection of the base material

For each delivery of the incoming components, which are glass fibre mats, resin and hardener, the operator of the manufacturing plant shall check and make sure the properties required at Section 2.1.1 are met.

For this purpose, the operator of the manufacturing plant must cause each of the sub-suppliers of the resin components to submit corresponding test reports 2.2 and the manufacturing plant of the sub-suppliers of the glass fibre mats to submit certificates of compliance with the order 2.1 after DIN EN 10204<sup>14</sup>.

In addition, the incoming goods inspection shall include a random check verifying the properties specified in Section 2.1.1.1 and Section 2.1.1.2 hereof in accordance with the recipe statements kept with the German Institute for Construction Engineering.

Furthermore, the modulus of elasticity of the ready-for-use resin mixture as given in Section 2.1.5 hereof shall be tested on at least three specimens in compliance with the specifications of Table 1 of DIN 16946-1<sup>15</sup>, item 6, according to the test conditions laid down in Section 5.2.1 hereof and according to DIN EN ISO 527<sup>12</sup> using the tensile test procedure.

Shrinkage according to Section 2.1.5 hereof shall be tested for each resin delivery on at least three specimens with the dimensions 150 mm x 10 mm x 5 mm.

- Checks and inspections to be performed during manufacture

It shall be checked that the requirements laid down in Section 2.2.1 are fulfilled.

- Checks and inspections of containers

Each resin batch shall be checked for meeting the identification requirements set forth in Section 2.2.3.

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The results of in-house production controls shall be recorded. The records shall contain at least the following information:

- Designation of the construction product or of the base product and its components
- Type of control, test or inspection
- Date when the construction product or base material was manufactured and inspected
- Result of control checks and inspections and, where appropriate, comparison with the specifications
- Signature of the person responsible for in-house production control

The records shall be kept for at least five years and submitted to the external inspection body called in for third-party inspection. On request, they shall be submitted to the German Institute for Construction Engineering and to the competent supreme building inspection authority.

If the inspection result is not satisfactory, the manufacturer shall immediately take the actions required for correcting the defect. Non-conforming construction products shall be handled in a way to ensure there is no confusion possible with conforming products. Once the defect has been corrected, the failed test or inspection shall be repeated immediately – where technically feasible and required for proving the success of the corrective action.

### 2.3.3 Third-party inspection

In every manufacturing factory, the in-house production control shall be inspected and verified by an external body at regular intervals, but at least twice a year.

The scope of third-party inspection includes an original inspection (initial testing) of the method components. In-house production control shall be verified by means of random checks within the scope of third-party inspection. Compliance with the requirements under the Sections 2.1.1 and 2.2.3 shall be verified.

Furthermore, random checks shall be performed as to compliance with the manufacturing requirements laid down in Section 2.2.1. These include the verification of the curing behaviour, the densities of the components **A** and **B** according to Section 2.1.1.2, the storage stability and mass per unit area of the “CRF(+) matting”, as well as the IR spectroscopies.

The generally accepted inspection body is responsible for sampling and testing. During third-party inspection, the certificates of compliance with the order 2.1 and the test reports 2.2 after DIN EN 10204<sup>4</sup> shall be verified, too.

The results of the certification and third-party inspection processes shall be kept for no less than five years. When requested, the certification body or the inspection body shall submit them to the German Institute for Construction Engineering and to the competent supreme building inspection authority.

## 3 Provisions for the design of the renovation job

The necessary pipeline data shall be verified, e.g. routing, depth, position of laterals, manhole depths, groundwater, pipe joints, hydraulic conditions, inspection holes, cleaning intervals. Existing video takes must be analyzed for application-specific evaluation. The correctness of the data must be verified on the job site. The condition of the existing sewer line of the property drainage system must be assessed in terms of the applicability of the pipelining method.

The hydraulic capacity of the sewer lines shall not be affected by the installation of a pipeliner. If necessary, appropriate proof shall be furnished.

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## 4 Provisions for job performance

### 4.1 General

The point and part cast-in-place pipelining method can be used for the following structural conditions:

- a) From the start to the end point
  - b) From the start point down into a pipe run for a defined length with no further manhole or access pit being required
  - c) Lateral connections, from the start point down to the main line/lateral interface
- The start or end points can be a manhole, an inspection or cleaning hole, or an open pipe socket.

A line bend of up to 90 degrees in nominal diameters from DN 100 to DN 150 can be relined by means of appropriate packers able to negotiate bends. Wrinkles in straight pipeline sections are allowed if not exceeding 2% of the nominal diameter according to DIN EN 13566-4<sup>16</sup>. No wrinkles at all are allowed in the invert. Wrinkles in line bends may not exceed 5% of the nominal diameter according to DIN EN 13566-4<sup>16</sup>.

The Applicant shall prepare a procedures manual describing each of the steps to be performed with reference to the way how the pipelining method is to be executed.

The Applicant shall also ensure the installers are sufficiently familiarised with the method. The sufficient technical knowledge can be documented for the installer company by means of an appropriate quality mark of the German Association for Sewer Construction Quality Protection *Güteschutz Kanalbau e.V.*<sup>17</sup>.

### 4.2 Equipment and installations

Includes but is not limited to the equipment and installations required for implementing the CIPP lining method:

- Equipment for sewer cleaning operations
- Equipment for containment
- Equipment for sewer inspection (refer to ATV-M 143-2<sup>18</sup>)
- Installations for pipelining operations:
  - Glass fibre matting for the nominal diameters to be relined,
  - Containers with resin (component **B**) and hardener (component **A**)
  - Unit for dosing and filling the resin components
  - Mixing container with mixing tool (stirrer)
  - Weatherproof impregnation point
  - Base sheeting
  - “DrainPacker” device for the given pipe diameters and accessories
  - Separating agent and PE film (stretch film) for the packer
  - Camera, control unit with screen

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16	DIN EN 13566-4	Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks (gravity sewers) – Part 4: Lining with cured-in-place pipes; German version EN 13566-4:2002; issue: 2003-04
17	Güteschutz Kanalbau e.V.; Linzer Str. 21, Bad Honnef, phone: (02224) 9384-0; fax: (02224) 9384-84	
18	ATV-M 143-2	Information Sheet of the Wastewater Association – Part 2: Optical inspection – inspection, repair, renovation and renewal of sewers and drains; issue: 1999-04

- Air push rods for positioning the packer
- Safety and pull-in ropes
- Pressure hoses for connection with the packer including pressure monitoring device
- Compressor, air hoses, air regulators
- Inflatable pipe plugs, or stop discs for the given nominal diameters
- Water supply
- Power supply
- Containers for residual waste
- Temperature sensor
- Small equipment
- Pneumatic drill
- Hand tools, e.g. scissors, spatulas, rollers etc.
- Social and sanitary rooms where necessary

Any electrical equipment to be introduced into the pipe such as CCTV cameras (or so-called crawlers) must be in compliance with the VDE regulations.

### 4.3 Performance of pipelining work

#### 4.3.1 Preparatory work

Before starting the pipelining job, it is imperative to ensure the sewer to be renovated is out of service; if necessary, the service flow is to be stopped by pipe plugs and bypassed.

In preparation for the pipelining job, the pipe run to be relined, inclusive of its lateral connections, shall be put out of service. Then the pipe run shall be cleaned with a high-pressure water equipment (so-called "jetting"). In case the inner surfaces of the defective line are smooth-walled and in case jetter operation is not able to remove existing deposits (the so-called "sewer slime") to the extent required for the pipelining method, the installer should strip the surface (remove the "sewer slime") as required by the damage pattern. Obstacles to service flows shall be eliminated.

The inner pipe wall surfaces in the region of stop discs or plugs must be even.

The exact positions of the damages and those of the laterals shall be measured over the cleaned pipe length.

Before starting the actual pipelining operation, it is necessary to measure the ambient temperature to assess whether or not the required temperature limits of the method can be observed.

The rules and regulations of accident prevention applicable to the use of the pipelining method shall be complied with.

No pipelining method equipment to be introduced into the defective sewer section shall be used unless and until it has been ensured by appropriate inspection that there are no inflammable gases in the line section to be repaired. More specifically, the relevant sections of the following codes and regulations shall be complied with:

- GUV-R 126 (formerly GUV 17.6)<sup>19</sup>
- ATV Information Sheet M 143-2<sup>18</sup>
- ATV Worksheet A 140<sup>20</sup>

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19	GUV-R 126	Safety rules for work in confined spaces of wastewater facilities, Federal German Association of Accident Insurers (GUV), issue: 1996-03
20	ATV-A 140	Worksheet of the Wastewater Association – Rules for sewer operation Part 1: Sewer system, – Sections 2 and 4.2 – issue: 1990-03

The data stated in Section 3 shall be checked on the job site to make sure they are correct. The pipe run to be relined shall be cleaned with usual high-pressure cleaning equipment (jetters) to the same extent as is necessary to be able to perfectly recognise the pipe defects on the monitor during the optical inspection according to the Information Sheet ATV-M 143-2<sup>18</sup>.

Also, for any persons descending into manholes of sewer lines to be renovated as well as in all steps of the pipelining method, the relevant regulations of accident prevention shall be complied with.

The operations of formatting the glass fibre mats according to Section 4.3.3.1, mixing the resin according to Section 4.3.3.2 and resin impregnation according to Section 4.3.3.3 shall be performed in a waterproof closed room or shelter (e.g. in the installation vehicle) on even supports free of dirt or contaminations of any type.

The pot time given in Table 1 shall be adjusted to the given pipelining job by mixing the resin according to Section 4.3.3.2 in a way to ensure that the point liner or part liner remains in perfect contact with the surface of the defective sewer wall over the full length of repair during said time, i.e. without cure starting.

The steps required for the performance of the method shall be recorded for each impregnation and pipelining job on specific report forms (e.g. Appendices 9 and 10).

#### 4.3.2 Inspection of incoming method components on the job site

The transport containers of the method components shall be checked for proper identification as specified in Section 2.2.3. The circumference dimension of the glass fibre mats as referred to the given pipelining job shall be checked before the mat is wetted with resin. It must also be checked that the prescribed pre-impregnation storage temperature is maintained between +15°C and +20°C.

#### 4.3.3 Formatting and impregnation of the glass fibre mats

##### 4.3.3.1 How to cut the glass fibre matting

The unrolled glass fibre matting is to be cut to size on the job site (Appendix 1, picture 2), on a work table located in a weatherproof or air-conditioned room or in the installation vehicle, with the cut length being approximately 0.5 m to 5.0 m (projected single-run length, Appendix 6) multiplied with 3.5 times the diameter for a three-layered point or part liner inclusive of the overlapping lengths (Appendix 3, picture 13). The glass fibre mats should have a width of at least 1.27 m to allow for the minimum single-run length of 0.5 m of a three-layered point liner. It is important to ensure that the glass fibre mats are cut such that the front and end regions of the later point or part liner closely fit the host pipe with an extending portion of at least 5 cm beyond the defect.

##### 4.3.3.2 How to mix the resin

The silicate system is composed of the catalyst component **A** (hardener) and the resin component **B** (silicate resin type-W, type-W01, and type-S). One volume part of component **A** shall be mixed with two volume parts of component **B** (see tables 1 and 2). The container of component **B** (hardener) must be hermetically closed again immediately after the removal of the required amount. The resin usage amounts shall be determined for each specific application in accordance with the statements given in Table 3 and Table 4 (Appendix 1, picture 4). The components **A** and **B** shall be mixed in a mixing container using a stirring device (e.g. electrically operated) in a way to achieve a bubble-free resin mixture with a uniform colour (Appendix 1, picture 5).

The resin mixture as well as the temperature conditions shall be recorded in a report according to Section 4.3.1. Also, a retention sample shall be taken from each resin batch on the job site and then checked and reported for its curing behaviour.

**[DIBt  
seal]**

**Table 1:** "Mixing ratio of the components **A** and **B** (type-W and type-S)"

Nr.	Mixing ratio by volume			Pot time at 20°C min	Cure time at 15°C min
	Comp. A: hardener	Comp. B: resin type-W	Comp. B: resin type-S		
1	3	6	–	15	115
2	3	5	1	18	120
3	3	4	2	21	140
4	3	3	3	25	165
5	3	2	4	28	180
6	3	1	5	31	200
7	3	–	6	32	260

**Table 2:** "Mixing ratio of the components **A** and **B** (type-W01)"

Nr.	Mixing ratio by volume		Pot time at 10°C min	Pot time at 22°C min	Cure time at 12°C min	Cure time at 20°C min
	Comp. A: hardener	Comp. B: resin type-W01				
1	1	2	13-15	4.5-7.5	35	20

**Table 3:** "Determination of usage amounts for components **A** and **B**"

[DIBt seal]

Nom. diam.	Glass fibre matting designated "CRF(+)"				Resin system				
	DN	Length	Width	Area	Mat layers folded	Resin factor <sup>2)</sup>	Resin batch total	Comp. A hardener	Comp. B resin
mm	m	m	m <sup>2</sup>	units	Ltr/m <sup>2</sup>	Litres	Litres	Litres	Litres
100	0.35	1.27	0.44	3	1.6	0.75	0.25	0.50	
125	0.45	1.27	0.57	3	1.6	0.90	0.30	0.60	
150	0.55	1.27	0.70	3	1.6	1.20	0.40	0.80	
200	0.70	1.27	0.89	3	1.6	1.50	0.50	1.00	
250	0.90	1.27	1.14	3	1.6	1.80	0.60	1.20	
300	1.10	1.27	1.40	3	1.6	2.40	0.80	1.60	
400	1.40	1.27	1.78	3	1.6	2.85	0.95	1.90	
500	1.75	1.27	2.22	3	1.6	3.60	1.20	2.40	
600	2.10	1.27	2.67	3	1.6	4.20	1.40	2.80	
700	2.50	1.27	3.18	3	1.6	5.10	1.70	3.40	
800	2.85	1.27	3.62	3	1.6	6.00	2.00	4.00	

1) for a lining length of 0.50 m

2) specific usage amount for a fibreglass weight of 1050 g/m<sup>2</sup>

#### 4.3.3.3 Wetting with resin

After mixing, the resin batch shall be applied with an appropriate spatula homogeneously onto the spread glass fibre mat (first layer) and into the woven glass top layer by means of crossing movements all over the fabric (Appendix 1, picture 6, and Appendix 2, picture 7). Then, the glass fibre mat is to be folded once to the left (second layer; Appendix 2, picture 8) and the random-fibre side shall be impregnated with the resin system in the same way as in the previous steps. Then, the glass fibre mat shall be folded to the right over the second layer and the resin system shall once more be applied with a spatula onto the mat, now with the random-fibre layer up (third layer; Appendix 2, picture 9). The then three-layered glass fibre mat is to be turned over and the resin system to be applied onto the random-fibre backside of the laminate (Appendix 2, picture 10).

For point or part liners having more than three layers, it is necessary to place additional glass fibre mats onto the first mat and wet them with resin as additional operation (Appendix 5) in between the steps described in picture 7 and picture 8 of Appendix 2, prior to folding. Then the steps are the same as those described for a three-layered point or patch liner.

The minimum wall thickness of the point or part liners shall be observed as laid down in Section 2.1.3.

For the avoidance of entrapped air, a roller should be used to press the resin into the fabric.

Due to the previously described step of folding the fabric into an at least three-layered point or part liner, one random-fibre layer of the glass fibre mat faces the service flow and the other random-fibre side is in contact with the host pipe. So the woven glass layer of the glass fibre matting is sandwiched between the layers with random fibre orientation (Appendix 2, picture 11).

The cure time and the ambient temperature as well as the temperature in the sewer line shall be recorded in the report set forth in Section 4.3.1.

#### 4.3.4 Point or part liner installation in the host pipe

The impregnated point liner or part liner is installed by means of a packer.

The rubber sleeve of the host pipe-specific packer shall be wrapped with a protective PE film (Appendix 1, picture 3), which forms a separating layer for the later removal of the packer from the sewer. For the selection of the appropriate packer, care shall be taken to ensure the outer diameter of the packer is some 50 mm to 80 mm smaller than the inner diameter (bore) of the host pipe (Appendices 7 and 8).

The resin-wetted glass fibre mat shall be placed onto the packer and protected from slipping or falling (Appendix 2, picture 12 and Appendix 3, pictures 13 and 14). The repair job shall be performed only with packers equipped with rollers. Said rollers must be arranged such that the resin-wetted glass fibre mat will not contact the inner pipe wall when the packer is introduced into and moved inside the host pipe.

Before the packer is introduced into the sewer to be repaired, an air hose from the compressor is to be connected to the packer. Then, the packer is pulled or pushed into the host pipe until and positioned at the point of repair as previously measured (Appendix 3, pictures 15 to 17). The application of compressed air according to Appendices 7 and 8 will cause the rubber sleeve of the packer to expand and thus press the resin-wetted glass fibre mat against the inner wall of the host pipe. The pressure shall be maintained until complete cure of the resin system (tables 1 and 2 as well as Appendix 5). Excessive resin is forced out at both ends of the point or patch liner to form hydraulically favourable conical transition zones with the host pipe. Eventually, the pressure will be released from the sleeve and the packer withdrawn from the pipe back to its start position (Appendix 3, picture 18).

**[DIBt  
seal]**



## 5 Job data in the manhole

The following job data should be indicated by means of a permanent and readily legible inscription in the start or finish manhole of the pipelining job:

- Type of pipelining operation
- Designation of the pipe run
- Nominal diameter
- Wall thickness of the liner
- Year the relining work was performed

## 6 Final inspection and tightness test

Once the pipelining job is complete, the relined pipe section shall undergo optical inspection with appropriate proof and documentation (Appendix 11) for verification that any residual waste material has been removed and that there are no wrinkles impairing the hydraulic capacity.

After complete cure of the point or part liner, the sewer line shall be subjected to a tightness test according to DIN EN 1610<sup>21</sup>. Then, the service can be reinstated in the repaired sewer.

## 7 Testing of samples

### 7.1 Curing

At least four times a year, the installer shall make a point or part liner in the nominal diameter of the last pipelining job using a test pipe (e.g. a PVC U-pipe) on the given job site. The circular ring sample thus obtained shall be tested at least twice a year for its short-term E-modulus (1-hour value, 24-hour value). The 1-hour value and the 24-hour value shall be used for checking whether creep is  $K_n \leq 11$  % according to the following formula:

$$K_n = \frac{E_{1h} - E_{24h}}{E_{1h}} \times 100 \quad \text{[DIBt seal]}$$

### 7.3 Water tightness of the samples

The water tightness of the cured point or part liner can be tested either on a circular liner segment (ring) or on specimens taken from the cured point or part liner. Before testing, it may be necessary to clear the point or part liner from residual separating foil that had been used to protect the packer.

The test on specimens may use either a positive pressure or a negative pressure of 0.5 bar.

In the negative pressure test, water is supplied to one end of the specimen. A negative pressure of 0.5 bar is applied for a load period of 30 minutes to check whether or not there is visible leakage of water at the other end of the specimen.

In the positive pressure test, a water pressure of 0.5 bar is applied. Again, it is to be checked whether or not the other end of the specimen shows any leakage.

21 DIN EN 1610 Construction and testing of drains and sewers;  
German version EN 1610:1997; issue: 1997-10



**8 Declaration of Compliance for the performed pipelining job**

The contractor must provide a confirmation that the relining job as performed complies with the provisions laid down in this General Building Inspectorate Approval by issuing a Declaration of Compliance based on the specifications given in Table 4 and Table 5. The Declaration of Compliance shall be accompanied by documents regarding the properties of the method components according to Section 2.1.1 and the inspection and test results according to Table 4 and Table 5.

The pipelining job manager or a technically competent representative of the job manager shall be present on the job site during the performance of the pipelining operation. He shall see to proper execution of the work according to the provisions laid down in Article 4 and in doing so, more specifically, he shall perform or arrange for the inspections and tests according to Table 4 and Table 5. The number and scope as specified shall be minimum requirements.

**Table 4:** "Inspections and tests accompanying the pipelining method"

Test object	Type of requirement	Frequency
Optical inspection of the line	according to 4.3.1 and ATV-M 143-2 <sup>18</sup>	before each pipelining job
Optical inspection of the line	according to 6 and ATV-M 143-2 <sup>18</sup>	after each pipelining job
Equipment	according to 4.2	each job site
Final inspection	according to 6	
Identification of containers of pipelining components	according to 2.2.3	
Resin mixture, resin amount and cure behaviour of each point liner	Mixing report according to 4.3.3.2	
Cure time and pressure in the packer	according to 4.3.4	

The pipelining job manager or his technically competent representative shall arrange for the tests mentioned in Table 5. The samples for the tests mentioned in Table 5 shall be taken from the above described sample pipes.

**Table 5:** "Tests to be carried out on specimens"

Test object	Type of requirement	Frequency
Short-term E-modulus (1-hour value and 24-hour value) and creep	according to 7.1	every 6 <sup>th</sup> month of prod. each installer
Physical characteristics	according to 2.1.4	
Water tightness of sample	without sheeting according to 7.2	
Wall thickness and wall structure	according to 2.1.3	

[DIBt seal]

The test results shall be recorded and evaluated; they shall be submitted to the German Institute for Construction Engineering on request. The number and scope as specified in the tables shall be minimum requirements.

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**8 Provisions for maintenance**

During the validity period of this Approval, the Applicant shall always carry out optical inspections of six repaired sewer lines. The results thereof, including the associated description of the repaired defects, shall be submitted to the German Institute for Construction Engineering without special request during the validity of this Approval.

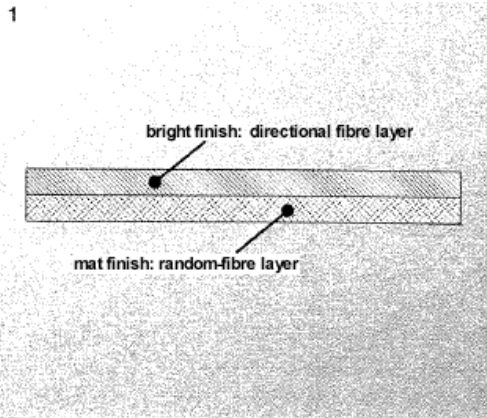
Prior to the expiry date of this Approval, three of the aforementioned pipelining jobs shall be subjected to a tightness test to be carried out at the expense of the Applicant under the direction of an expert, in addition to the tightness test performed immediately after the pipelining job.

Prof. Hoppe

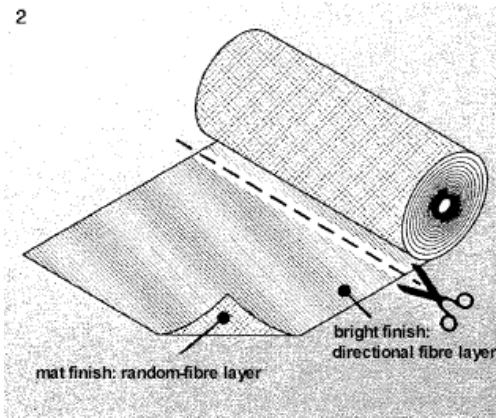
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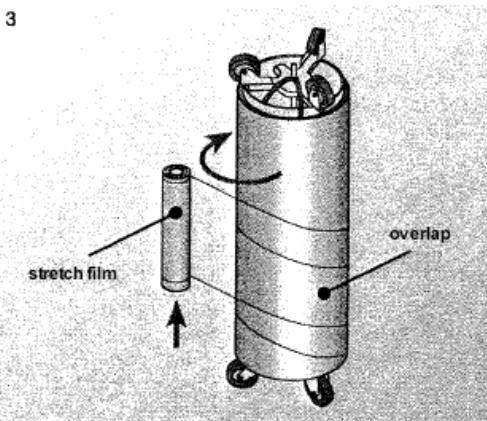
*[DIBt  
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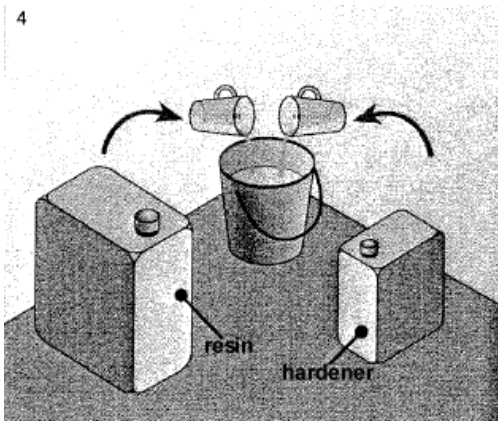
Sectional view of the glass fibre matting



Preparation of the glass fibre matting

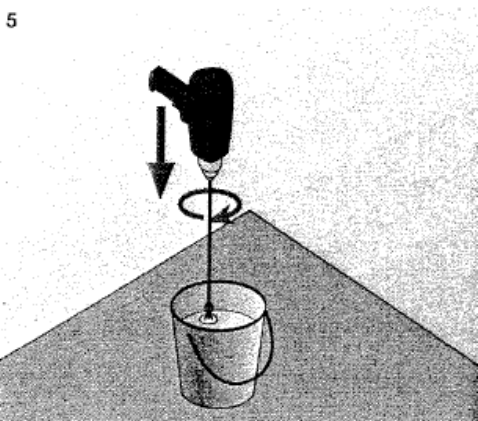


Wrap overlapping stretch film around the packer and tape the ends to fix them in place on the packer.

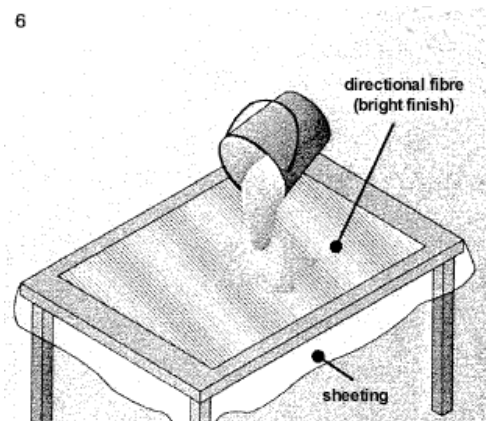


Determine the usage amount of resin, pour resin and hardener into the mixing container.

[DIBt seal]



Mix the resin and the hardener.

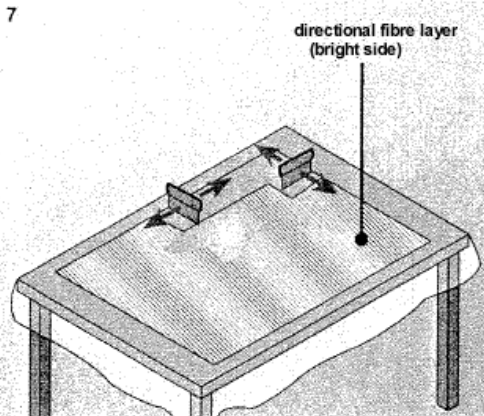


Pour a portion of the epros resin system onto the side with directional fibre orientation of the matting.

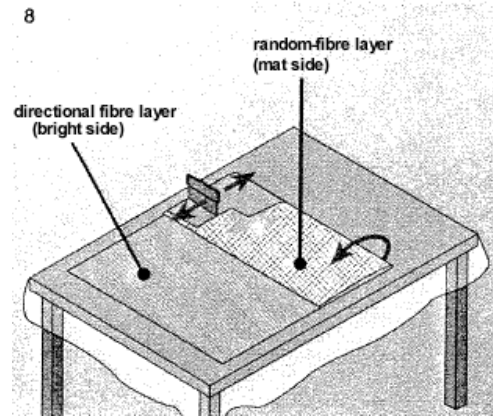
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Appendix: **I**  
to the General Building Inspectorate  
Approval No. **Z-42.3-385**  
dated **03/02/2006**

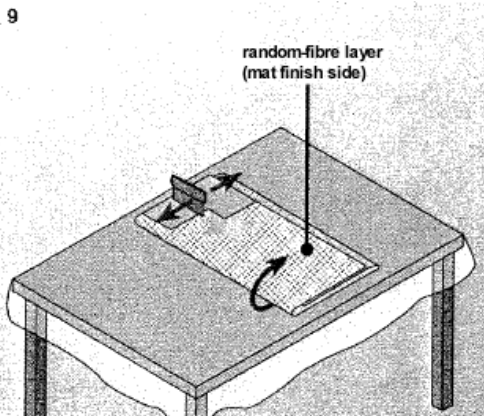




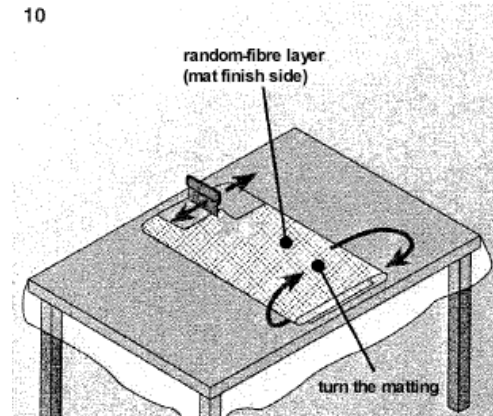
Spread the epros resin system for impregnation evenly with the hand spatula.



Fold the impregnated glass fibre mat for appr. 1/3<sup>rd</sup>. Apply the epros resin system onto the random-fibre layer on top and spread the resin evenly with the hand spatula for homogenous impregnation

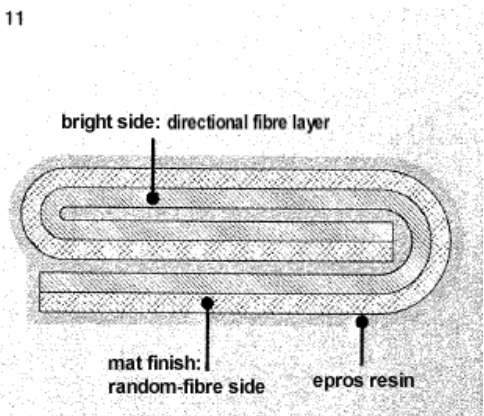


Fold the glass fibre mat again. Apply the epros resin system evenly onto the random-fibre layer on top and spread the resin evenly with the hand spatula for homogenous impregnation.

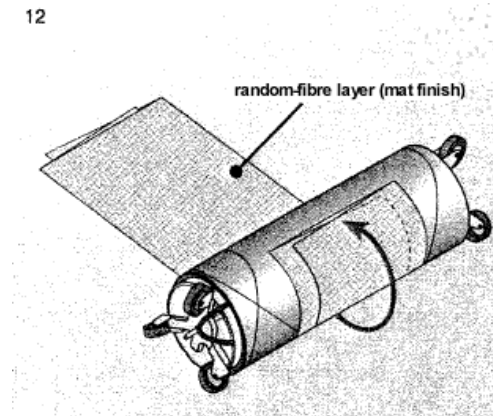


Turn over the glass fibre mat. Apply the epros resin system evenly onto the random-fibre layer on top and spread the resin evenly with the hand spatula for homogenous impregnation.

[DIBt seal]



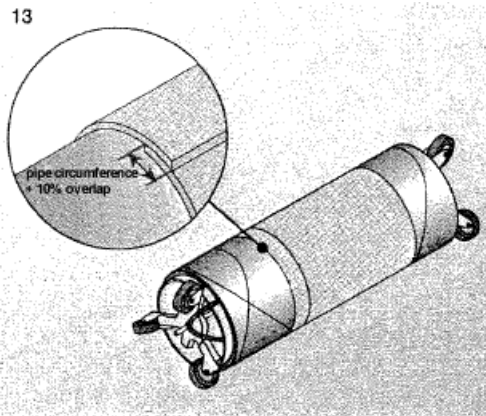
Sectional view of the glass fibre mat impregnated with the epros resin system.



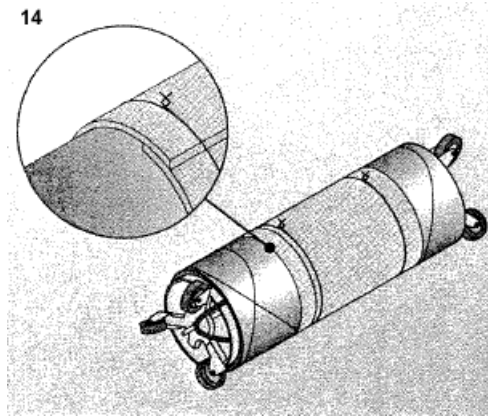
Place the impregnated glass fibre mat onto the packer.

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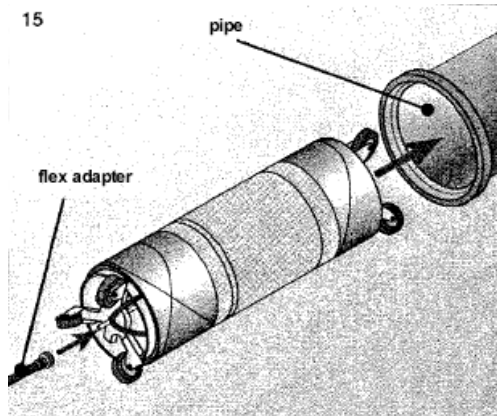
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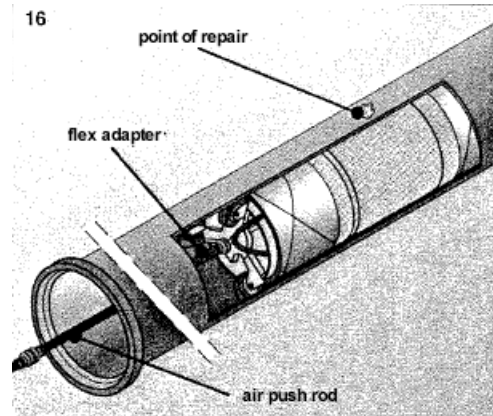
The glass fibre mat must be precut to overlapping size.



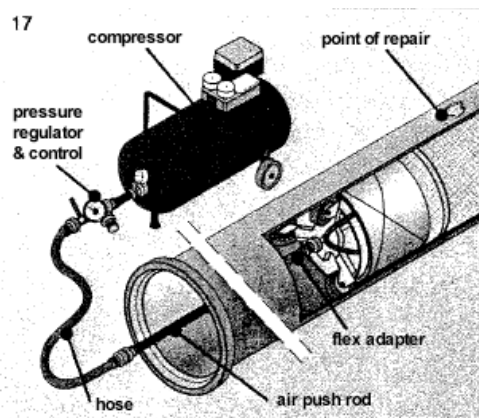
Fix the glass fibre mat in place with binding wire.



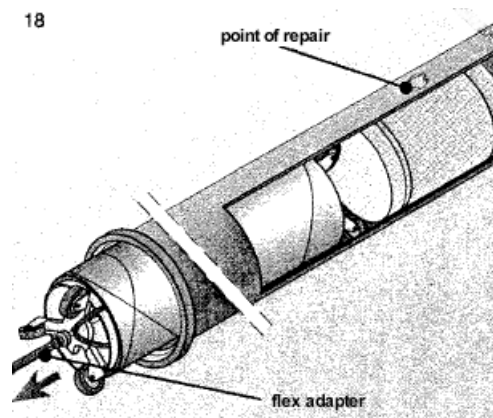
Introduce the packer into the pipe.



Push the packer to the point of repair and position it properly.



Inflate the packer with the authorised pressure. The wetted glass fibre mat will be pressed against the inner wall of the pipe.



After final cure of the liner, remove the air from the packer and remove the packer from the line.

[DIBt seal]

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Appendix: 3  
 to the General Building Inspectorate  
 Approval No. **Z-42.3-385**  
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**Resin Usage Amounts for DrainPacker**

**[DIBt seal]**

Fibreglass density: 1050 g/m<sup>2</sup>  
 Resin system: W, S,  
 DrainPacker length: 0.5 m – 0.60 m

Colour of components  
 White      Brown  
 ↓                      ↓

Pipe bore mm	Circumference mm	Fibreglass roll width m	Fibreglass matting 1050 g/m <sup>2</sup>		Resin system factor Litres/m <sup>2</sup>	Calculation	Resin system (Comp. A+B) Litres*2	Waterglass		Resin		Fibreglass layers Single wrap
			Area m <sup>2</sup>	Area m <sup>2</sup>				Comp. A Litres	Comp. B Litres			
100	350	1.27	0.44	1.6	0.70	0.70	1.40	0.25	0.50	0.50	3	
125	450	"	0.57	1.6	0.91	0.91	1.82	0.30	0.60	0.60	3	
150	550	"	0.70	1.6	1.12	1.12	2.24	0.40	0.80	0.80	3	
200	700	"	0.89	1.6	1.42	1.42	2.84	0.50	1.00	1.00	3	
225	800	"	1.02	1.6	1.63	1.63	3.26	0.55	1.10	1.10	3	
250	900	"	1.14	1.6	1.82	1.82	3.64	0.60	1.20	1.20	3	
300	1100	"	1.40	1.6	2.24	2.24	4.48	0.80	1.60	1.60	3	
350	1250	"	1.59	1.6	2.54	2.54	5.08	0.90	1.80	1.80	3	
375	1320	"	1.68	1.6	2.69	2.69	5.38	0.95	1.90	1.90	3	
400	1400	"	1.78	1.6	2.85	2.85	5.70	0.95	1.90	1.90	3	
450	1580	"	2.01	1.6	3.22	3.22	6.44	1.10	2.20	2.20	3	
500	1750	"	2.22	0.875	4.95	4.95	9.90	1.70	3.40	3.40	4	
525	1840	"	2.34	0.92	5.22	5.22	10.44	1.80	3.60	3.60	4	
600	2100	"	2.67	1.05	5.95	5.95	11.90	2.00	4.00	4.00	4	
675	2400	"	3.05	2.40	8.72	8.72	17.44	3.00	6.00	6.00	5	
700	2500	"	3.18	2.50	9.09	9.09	18.18	3.10	6.20	6.20	5	
750	2650	"	3.37	2.65	9.63	9.63	19.26	3.20	6.40	6.40	5	
800	2850	"	3.62	4.28	12.63	12.63	25.26	4.20	8.40	8.40	6	

Area \*1 = Additional fibreglass matting      Liter \*2 = Values have been rounded off for facilitating the dosing operation

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**Appendix: 4**  
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Application temperatures versus reaction times

Resin type Temperature °C	W	
	Pot time min	Cure time min
18	16 – 19	75 – 100
23	15 – 17	60 – 70
28	10 – 12	45 – 55
33	7 – 9	40 – 45

W = epros point liner resin type W

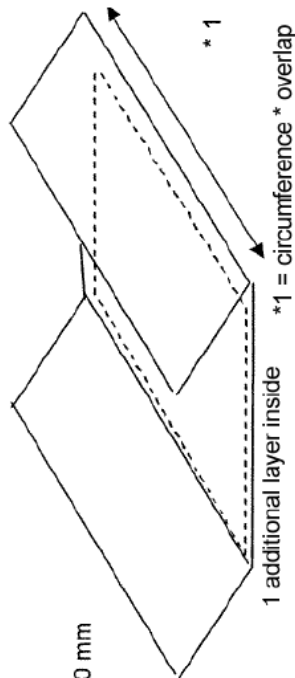
Resin type Temperature °C	S	
	Pot time min	Cure time min
18	32 – 35	120 – 135
23	30 – 32	90 – 100
28	20 – 23	70 – 85
33	14 – 16	65 – 75

S = epros part liner resin type S

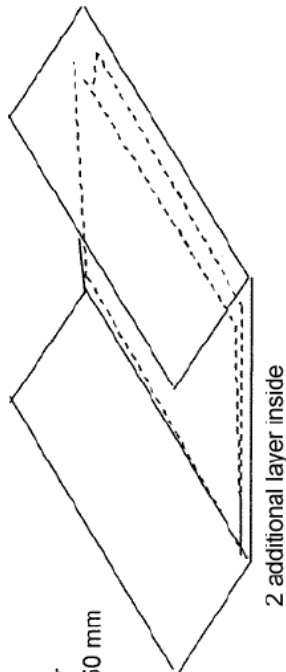
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Additional fibreglass layers

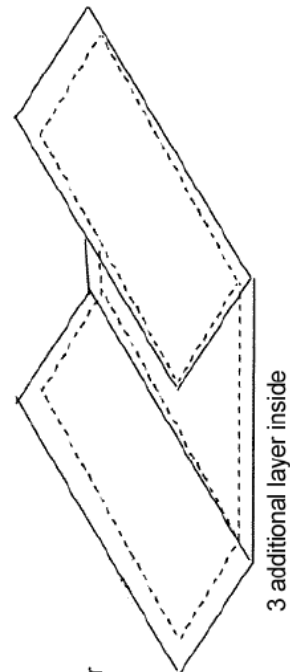
For diameter  
500, 525, 600 mm



For diameter  
675, 700, 750 mm



For diameter  
800 mm



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Appendix: 5  
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Long packer : Maximum repair lengths in mm (=built-in length of wetted epros fibreglass matting)												
Statements for long packers with and without flow-through:												
Long packer	Lengths	100 mm	150 mm	200 mm	250 mm	300 mm	350 mm	400 mm	450 mm	500 mm	550 mm	600 mm
100-150	1.50	1200	1000									
100-150	2.00	1700	1620									
100-150	2.50	2300	2220									
100-150	3.00	2800	2720									
100-150	4.00	3800	3720									
100-150	5.00	4700	4620									
150-200	1.50		1250	1170								
150-200	2.00		1750	1670								
150-200	2.50		2250	2170								
150-200	3.00		2750	2670								
150-200	4.00		3750	3670								
150-200	5.00		4750	4670								
200-300	1.50			1210	1130	1050						
200-300	2.00			1710	1630	1550						
200-300	2.50			2210	2130	2050						
200-300	3.00			2710	2630	2550						
200-300	4.00			3710	3630	3550						
200-300	5.00			4710	4630	4550						
300-400	1.50				1130	1210	1130	1050				
300-400	2.00				1630	1710	1630	1550				
300-400	3.00				2130	2210	2050	2550				
300-400	4.00				2630	2710	2630	3550				
300-400	5.00				3630	3710	3630	4550				
400-500	1.50					4710	4630	4550	1190	1110	1030	
400-500	2.00					1690	1690	1690	1610	1530		
400-500	3.00					2690	2690	2690	2610	2530		
400-500	4.00					3690	3690	3690	3610	3530		
400-500	5.00					4690	4690	4690	4610	4530		
500-600	1.50								1140	1060	990	
500-600	2.00								1640	1560	1490	
500-600	3.00								2640	2560	2490	
500-600	4.00								3640	3560	3490	

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Appendix: **6**  
 to the General Building Inspectorate  
 Approval No. **Z-42.3-385**  
 dated **03/02/2006**

Technical Information on the Short Packer with wheels and flow-through									
Art. No.	Nominal size	Range of application		Prescribed filling pressure bar	Weight kg	Non inflated packer		Sleeve length mm	
		Min. diam. mm	Max. diam. mm			Length mm	Diameter mm		
0201001	15-20	150	200	2.0	6.2	960	115	800	
0201002	25-30	250	300	2.0	12.6	1010	205	800	
0201003	30-35	300	350	1.5	6.9	1010	250	800	
0201004	35-40	350	400	1.5	19.2	1010	305	800	
0201005	45-50	450	500	1.5	29.8	1010	380	800	
0201006	60-70	600	700	1.0	50.2	1180	465	970	

**[DIBt  
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Appendix: 7  
to the General Building Inspectorate  
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Technical Information on the Flexible Packer with wheels and flow-through (from DN 150/250)										
Art. No.	Nominal size		Range of application		Prescribed filling pressure bar	Weight kg	Non inflated packer			Sleeve length mm
	m		Min. diameter mm	Max. diameter mm			Length mm	Diameter mm		
0202001	10-15	1.0	100	150	2.5	2.1	1080	65	1000	
0202002	10-15	2.0	100	150	2.5	3.5	1980	65	1900	
0202028	10-15	2.5	100	150	2.5	3.6	2580	65	2500	
0202029	10-15	3.0	100	150	2.5	4.2	3080	65	3000	
0202030	10-15	4.0	100	150	2.5	5.0	4080	65	4000	
0202031	10-15	5.0	100	150	2.5	6.0	4980	65	4900	
0202003	15-25	1.0	150	250	2.0	8.3	1210	112	1000	
0202004	15-25	2.0	150	250	2.0	11.0	2110	112	1900	
0202032	15-25	2.5	150	250	2.0	12.7	2710	112	2500	
0202033	15-25	3.0	150	250	2.0	13.9	3210	112	3000	
0202034	15-25	4.0	150	250	2.0	17.4	4210	112	4000	
0202035	15-25	5.0	150	250	2.0	20.5	5110	112	4900	
0202005	30-40	1.0	300	400	1.5	19.6	1240	112	1120	
0202006	30-40	2.0	300	400	1.5	24.3	2140	210	2120	
0202036	30-40	2.5	300	400	1.5	25.0	2740	210	2620	
0202037	30-40	3.0	300	400	1.5	26.5	3240	210	3120	
0202038	30-40	4.0	300	400	1.5	31.1	4240	210	4120	
0202039	30-40	5.0	300	400	1.5	35.8	5140	210	4880	
0202007	45-60	1.0	450	600	1.2	33.0	1240	340	1120	
0202008	45-60	2.0	450	600	1.2	41.2	2140	340	2020	
0202040	45-60	2.5	450	600	1.2	45.8	2740	340	2620	
0202041	45-60	3.0	450	600	1.2	49.0	3140	340	2880	
0202009	60-80	1.5	600	800	1.0	36.0	1740	400	1620	
0202010	60-80	2.0	600	800	1.0	40.5	2140	400	2020	
0202042	60-80	2.5	600	800	1.0	45.8	2740	400	2620	
0202043	60-80	3.0	600	800	1.0	49.0	3140	400	2880	

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Appendix: 8  
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dated **03/02/2006**

Sewer Patch Repair Site Visit											
<b>Individual report per patch repair:</b>				Sewage <input type="checkbox"/>		Initial CCTV survey		Survey dated:			
Job site:				Storm w. <input type="checkbox"/>		existing		Name:			
Street address:				Mixed w. <input type="checkbox"/>		non existing		Name:			
From MH (1) number	To MH (2) number	Depth of MH (1)	Depth of MH (2)	DN mm checked?	DN acc.to site plan	Length in metres	Section shape	Comments			
							Egg-shaped pipe circumf.	MH centre-to-centre survey measurement			
<b>Distance from start MH</b>				Comments:							
Pillar hydrant								Sketch, if r'd			
Undergr. hydr.											
Heater											
Additional pump	No										
Hose racks	Yes										
Road width	No										
Access with large heater	Yes										
Given traffic load	No										
Suitable traffic control plan	Yes										
Containment	No										
Heater removal	Good										
Inspection manholes available	Bad										
	High										
	Medium										
	Low										
	Plan B1/5							urban areas: 2-lane road with one lane closed (B 1/6 with traffic lights)			
	Plan B1/7							urban areas: 2-lane road with works in the middle of the road			
	Other										
	Retention										
	Pumping										
	yes							no			

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Appendix: **9**  
 to the General Building Inspectorate  
 Approval No. **Z-42.3-385**  
 dated **03/02/2006**

**Installation & Manufacture Report**

Project No.: \_\_\_\_\_

Client: _____	Contractor: _____
Town/city: _____	Town/city: _____
Street address: _____	Street address: _____
Contact: _____	Contact: _____
Telephone: _____	Telephone: _____

Job site: _____	
Town/city: _____	
From manhole: _____	To manhole: _____
Line section no. _____	Material: _____
Nominal diameter: _____	Point liner positioned at: _____
Video cassette: _____	Photo no.: _____

Service maintained: <input type="checkbox"/> yes <input type="checkbox"/> no	Permit required: <input type="checkbox"/> yes <input type="checkbox"/> no
Containment required: <input type="checkbox"/> yes <input type="checkbox"/> no	Site safety measures requ'd: <input type="checkbox"/> yes <input type="checkbox"/> no
Line section prewashed: <input type="checkbox"/> yes <input type="checkbox"/> no	Damage area free of faeces: <input type="checkbox"/> yes <input type="checkbox"/> no
Damage area prepared by: <input type="checkbox"/> HP water jetting	Weather: <input type="checkbox"/> dry <input type="checkbox"/> humid
<input type="checkbox"/> mech. cleaning	Outdoor temperature: _____ °C
<input type="checkbox"/> cutter	Sewer temperature: _____ °C

Dates of delivery:	
For component A: _____	For component B: _____
Batch No.: _____	Batch No.: _____
For CRF(+): _____	For component B: _____
Batch No.: _____	Batch No. _____

Material tested by customer: yes <input type="checkbox"/> no <input type="checkbox"/>	Specific handling problems: yes <input type="checkbox"/> no <input type="checkbox"/>
---	--

Remark: \_\_\_\_\_

Size of glass fibre matting: \_\_\_\_\_ m X \_\_\_\_\_ m gives \_\_\_\_\_ m<sup>2</sup>  
 Required total amount for mixing: \_\_\_\_\_ Litres

Mixing ratio: A: \_\_\_\_\_ Litres; Bw01: \_\_\_\_\_ Litres; Bw: \_\_\_\_\_ Litres; Bs: \_\_\_\_\_ Litres

Contact pressure: \_\_\_\_\_ bar Curing pressure: \_\_\_\_\_ bar

Pot time: specified maximum \_\_\_\_\_ min actual pot time: \_\_\_\_\_ min

Cure time: specified minimum \_\_\_\_\_ min actual cure time: \_\_\_\_\_ min

**[DIBT  
seal]**\_\_\_\_\_  
Date/signature

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 D-47228 Duisburg

Appendix: **10**  
 to the General Building Inspectorate  
 Approval No. **Z-42.3-385**  
 dated **03/02/2006**

## Tightness test

according to EN 1610, Section 13.3, Method "W"

Pipe run from MH no. \_\_\_\_\_ to MH no. \_\_\_\_\_

Interior diameter  $D_i$ : \_\_\_\_\_ m

Length to be relined: \_\_\_\_\_ m

Inner area of pipe run  $A=3.14 \times L \times D_i$ : \_\_\_\_\_  $m^2$

Admissible water inflow : 0.15 l/m<sup>2</sup> in 30 +/- 1 min

Adm. water inflow in host pipe run: \_\_\_\_\_ l  
(inner area x admissible water inflow)

Prefill time: \_\_\_\_\_ hours (1 h will normally do) <sup>1)</sup>

Start of test: \_\_\_\_\_ End of test: \_\_\_\_\_ (duration 30 +/- 1 min)

Test pressure \_\_\_\_\_ (maximum 50 kPa / minimum 10 kPa at pipe crown)

Water inflow in pipe run \_\_\_\_\_ litres

Admissible water inflow in pipe run \_\_\_\_\_ litres

Pressure test passed  yes  no

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

This is to certify that the leakage test was properly performed according to standard.

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Date: \_\_\_\_\_ Name: \_\_\_\_\_

1) concrete pipes may require more time due to dry ambient conditions.

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Appendix: **II**  
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