

## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

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#### **epros patch liner repair system**

The **epros patch liner system** is a **repair method** for defective pipe sections in sewage lines. It serves the short to medium-term structural renovation of sewers.

The warranty period is 5 years. The indicated service life is up to 10 years.

The **epros patch liner repair system** is used in sewers under disrupted service conditions.

The defective spots and pipe sections to be repaired are different in type and extent and may need some preparatory work like cleaning with jetters prior to **epros patch lining**.

This manual for the **epros patch liner repair system** was prepared according to the criteria of **quality protection in sewer construction**.

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# Procedures Manual

## epros Patch Liner System for Sewer Spot Repairs

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### TABLE OF CONTENTS

- 1. Method Statement**
- 2. Material Characteristics**
  - 2.1 Material properties of the **epros patch liner**
  - 2.2 CRF glass fibre mat with data sheet according to 91/155/EEC
  - 2.3 Hardener with data sheet (Part A)
  - 2.4 Resin with data sheet (Part B)
- 3. Applications**
  - 3.1 Typical damages and defects for **epros patch liner repairs**
  - 3.2 Suitability
  - 3.3 Sewer operating conditions
  - 3.4 Quality assurance
  - 3.5 Occupational Health & Accident Prevention Regulations (UVV)
- 4. Work performance**
  - 4.1 Preparatory operations
  - 4.2 **epros patch liner repair** operations
  - 4.3 Final operations
- 5. Self-monitoring**
  - 5.1 Job site preparation (report)
  - 5.2 Reaction temperatures & times of the **epros resin system**
  - 5.3 Costing / example / CRF glass / resin usage for the standard repair length of 0.50 m
  - 5.4 Material checklist / job site
- 6. Staff guidance**

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<b>Procedures Manual</b>		

## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

---

#### 1. Method Statement

The **epros patch lining system** is a so-called “no-dig” or trenchless method of sewer repair.

In this process, an CRF glass fibre laminate is impregnated with epros resin and fixed against slippage on the **epros patch-lining packer**, then moved to the defective spot by means of push rods while being monitored with a camera, positioned there and pressed against the host pipe.

As a first step, take care to survey and measure exactly the section to be repaired and to monitor the positioning of the **epros patch lining packer** with a video camera.

Then inflate the **epros patch lining packer** with air to force the wetted CRF glass mat against the inner walling of the host pipe. Excessive resin will penetrate into the defective spots like gaps, offset joints, cracks and debris and thereby create a permanent link.

Remove the **epros patch packer** after a curing time of up to 2.5 hours of the resin-wetted CRF glass mat (at an ambient temperature of 20°C).

The cooler the sewer atmosphere is, the longer the curing process will be.

This is also true for host pipes with groundwater contact.

The warmer the sewer atmosphere is, the faster the reaction and curing times are.

The cured **epros patch liner** covers the entire surface of the repaired pipe section without any hydraulic changes, i.e. without obstructing the sewage flow.

The pipe-in-pipe system so obtained and the host pipe form a unit.

Finally, a CCTV camera will view, record and document the repaired pipe section.

A final leakage test and report can be made to prove that the **epros patch liner system** is tight.

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## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

---

#### 2. Material Characteristics

##### 2.1 Material properties of the epros patch liner

The tightness of the **epros patch liner** complies with the requirements of DIN EN 1610.  
(Proof will be furnished).

The **epros patch liner** is resistant to a pH range of 3 to 12.  
(Proof will be furnished).

The temperature of the sewage in contact with the cured **epros patch liner** shall not exceed 85°C.

The abrasion resistance is very high due to the 3-layered construction and fulfils the requirements of DIN 19565-1 (proof will be furnished).

Sewer cleaning operations after the complete curing of the patch liner should be carried out with a maximum pressure of 120 bars and a maximum flow rate of 420 l/min at the jetter nozzle, and at a feed rate of approximately 10 m/min.

Prior to cleaning, take care to properly instruct the cleaning staff on the patch liner repairs performed in the sewer lines to be cleaned.

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<b>Procedures Manual</b>		

**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

---

2.2 Safety data sheet of the CRF glass fibre mat according to 91 / 155 / EEC

**Product / trade name:** **CRF glass fabric mat system**

**1. Product/Preparation and Company Identification**

- 1.1 Trade name: CRF glass fabric mat system
- 1.2 Manufacturer / supplier information: epros GmbH  
 Dr. Alfred-Herrhausen-Allee 20d  
 D-47228 Duisburg  
 Tel. : +49 (0) 2065 – 999 0  
 Fax: +49 (0) 2065 – 999 111

**2. Composition/information on ingredients**

- Chemical identification: Substance
- Manufacture: CRF glass filament roving, continuous, mechanically drawn and provided with a size finish
- Ingredients: CRF glass  
 According to DIN 1259 PART 1, an aluminoborosilicate glass with an alkali weight percentage of  $\geq 1$  % for general manufacture of glass-reinforced plastics and electrical applications.  
 Glass percentage 99 %  
 Size percentage  $< 1$  % (silane finish)

**3. Potential hazards**

Small broken filaments may cause short-term irritations to the eyes, skin or respiratory tracts.

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## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

---

#### **4. First aid measures**

We recommend in case of the following complaints:

Trouble in breathing:

Leave the location.

Skin irritation:

Wash your skin with lukewarm water and soap; no rubbing.

Eye irritation:

Flush the eyes with clear water for several minutes.

Other allergies:

Leave the location.

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#### **5. Fire fighting measures**

Textile glass filaments are not flammable, only the package is flammable. Suitable fire fighting agents are water, foam or powder.

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#### **6. Accidental release measures**

Personal precautions:

none

Environmental precautions:

The product causes no environmental risks. For waste disposal, respect the local waste management regulations. The residual waste dCRFees shall apply.

Waste code: 31408 and 31416.

Cleaning method:

No special regulations or rules need to be respected.

#### **7. Handling & storage**

7.1 Handling:

Persons with increased sensibilisation for skin irritations are recommended to avoid skin contact. No rubbing!

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**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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7.2 Storage: The material should be stored in its original packing in a dry place and kept from direct sunlight. The recommended storage temperatures are between 10°C and 35°C, and the recommended relative humidity of air is between 40 % and 70 %.

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**8. Exposure controls & personal protective equipment**

8.1 Additional information on the design of technical plants:

No special recommendations under normal conditions of use.  
In case of high loads, exhaust plants can be installed.

8.2 Ingredients requiring occupational exposure limits to be controlled:

not applicable

8.3 Personal protective equipment:

Clothing: No special measures required, but avoid worn-off spots.

Respiratory protection: No special measures required, but a paper mask could be used (protection degree 1).

Eye protection: No special measures required, but in special cases, we recommend protective glasses.

Other measures: No special measures required, but in special cases we recommend a skin ointment.

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**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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**10. Stability & reactivity**

Hazardous reactions:

Glass filament yarns are products that cannot cause any hazardous reactions.

Hazardous decomposition products:

not applicable

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**11. Toxicological information**

The product contains no toxic or hazardous substances or preparations under the German hazmat regulations or under § 3 of the German Chemicals Act.

It has no carcinogenic effect and is not harmful to human health.

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**12. Ecological Information**

The product causes no ecological risks, but it is not biodegradable.

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**13. Disposal considerations**

In compliance with the waste management regulations, waste codes 31408 and 31416.

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**14. Transport information**

14.1 Land transport:

Warning sign:  
not applicable

Class / section / letter:  
not applicable

14.2 Waterway transport:

Warning sign:  
not applicable

Class / section / letter:  
not applicable

14.3 Sea transport:

Warning sign:  
not applicable

Class / section / letter:  
not applicable

14.4 Air transport:

Warning sign:  
not applicable

Class / section / letter:  
not applicable

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**epros Patch Liner System for Sewer Spot Repairs**

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14.5 Further information:

Textile filament yarns are no hazardous product under the German HazMat regulation GGVS. Transport, handle and store the product in a dry place and in its original packaging.

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**15. Regulatory information**

15.1 Identification of the product according to European directives

No labelling duty for the product under the German hazmat regulations.

The product contains:	R-phrases:	not applicable
	S-phrases:	not applicable

Further information:	none
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15.2 National Regulations (Germany)

Information on limited occupational exposure:	none
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Regulation on Disruption of Operations:	not applicable
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Vbf regulation on flammable liquids:	not applicable
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<u>Water Hazard Class:</u>	not applicable
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<u>Other regulations, restrictions, limitations:</u>	none
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**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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**2.3 Hardener with data sheet (Part A)**

**1. Product/Preparation and Company Identification**

**Product information**

Trade name: epros patch liner resin (A) (hardener)  
 Manufacturer/supplier: epros GmbH  
 Dr.-Alfred-Herrhausen-Allee 20 d  
 D-47228 Duisburg  
 Tel. : +49 (0) 2065-999-0 +49 (0) 171-2766636  
 Fax: +49 (0) 2065-999-111

**Information**

**Department:** +49 621 5402-239, -261  
**Emergency hotline:** Poisoning hotline: +49 30 19240

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**2. Composition/information on ingredients**

**Chemical identification:**

**Description:**

Mix of the following substances, difference to 100 %:  
 Components not to be classified as hazardous under the German hazmat regulations.

**Hazardous ingredients:**

1344-09-8 Aqueous solution of sodium silicate 25-50%  
 Xi; R 38-41

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**3. Potential hazards**

**Hazards identification:** (Xi) Irritant

**Special danger instructions for the human and natural environment:**

R 38 Irritating to skin  
 R 41 Risk to serious damage to eyes

**Classification system:**

Classification is in compliance with the current lists of the European Community, but includes additional statements taken from technical literature and company information.

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---	--	--

## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

---

#### 4. First aid measures

**General instructions:**

Take off immediately all contaminated clothing.

**After contact with skin:** Wash immediately with water

**After contact with eyes:** Flush eyes with running water for several minutes while holding lids apart.

**If swallowed:** Rinse mouth with water and then drink much water.

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#### 5. Fire fighting measures

**Suitable agents:**

The product itself will not burn; adjust the fire fighting measures to the ambient fire.

**Special protective equipment:** No special measures required.

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#### 6. Accidental release measures

**Personal precautions:**

Product leakage or spilled product causes high danger of slipping.

**Environmental precautions:**

Prevent the product from penetrating into sewers / water bodies / ground water.

**Cleaning/take-up:**

Take up with an absorbent (sand, diatom earth, acid binder, universal binder, sawmill dust).

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#### 7. Handling & storage

**Handling:****Safe handling:**

In case of proper use, no special measures required.

**Fire & explosion protection instructions:**

No special measures required.

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<b>Procedures Manual</b>		

**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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Storage:

**Requirements of storing rooms & containers:**

- Make sure the floor is resistant to caustic solutions.
- Never use light-metal containers.
- Use containers made of polyolefins.
- Suitable material for containers, tanks and pipes: steel or stainless steel.
- Unsuitable container material: aluminium
- Unsuitable container material: glass or ceramics
- Unsuitable container material: zinc.

Storage with other materials: Never store together with acids.

**Further information on storage conditions:** Protect the product from frost – if required, the transport vehicle must be heated.

**Storage class:**

**VbF Class:** not applicable

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**8. Exposure controls & personal protective equipment**

**Additional information on the design of technical plants:**

no further statements, refer to item 7

**Ingredients requiring occupational exposure limits to be controlled:**

The product contains no significant amounts of substances requiring occupational exposure limits to be controlled.

**Additional information:**

The foregoing statements are based on the lists applicable on the date of issue.

**Personal protective equipment:**

**General protection & hygienic measures:**

- Keep away from food, drink and animal fodder.
- Take off immediately all contaminated clothing.

Wash hands before breaks and at the end of work.

Avoid contact with eyes and skin.

**Respiratory protection:** Not required.

**Hand protection:** Safety gloves

**Eye protection:** Tightly closing safety goggles

**Body protection:** caustic-resistant protective clothing

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**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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**9. Physical & chemical properties**

Appearance: liquid  
 Colour: colourless  
 Odour: odourless

	Value/range	Unit	Method
<b>Change of state:</b>			
<b>Boiling point/range:</b>	> 100 °C		
<b>Flash point:</b>	Not applicable		
<b>Self-inflammability:</b>	The product is not self-inflammable		
<b>Explosion hazard:</b>	The product implies no explosion hazard.		
<b>Specific gravity at 20°C</b>	approx. 1.55	g/cm <sup>3</sup>	
<b>Solubility in / miscibility with water:</b>	completely miscible		
<b>pH: at 20°C</b>	approx. 12.5		
<b>Viscosity:</b>			
<b>Organic solvents:</b>	0.0%		

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**10. Stability & reactivity**

**Thermal decomposition (conditions to be avoided):**  
 No decomposition in case of proper use.

**Hazardous reactions:**  
 Vigorous exothermic reaction with acids.  
 Reacts with light metals to form hydrogen.

**Hazardous decomposition products:**  
 No hazardous decomposition products are known.

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**11. Toxicological information**

**Acute toxicity:**  
**Primary irritation:**  
**Skin contact:** Irritating to skin and mucous membranes.  
**Eye contact:** Strong irritation with risk of serious damage to eyes  
**Sensitisation:** No sensitising effect is known

**Additional toxicological information:**  
 On the basis of the calculation method in the European General Classification Directive for preparations in the latest revised version, the product involves the following hazards: irritating

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**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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**12. Ecological information**

**Elimination considerations (persistence and degradability)**

**Other remarks:**

Physicochemical eliminability: well eliminable from water. Inorganic substance, biodegradability not applicable

**Ecotoxicity:**

**Remark:** No toxicity needs to be considered after neutralisation.

**Behaviour in sewage treatment:**

The product is a caustic solution. Generally, the product needs to be neutralised before getting into sewage treatment plants.

**General instructions:**

Prevent the undiluted product or larger amounts of the product from penetrating into groundwater, waters, or sewers.

Water Hazard Class 1: low water hazard

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**13. Disposal considerations**

**Product:**

**Recommendation:**

Can be stored together with construction waste after neutralisation and compaction in compliance with the applicable regulations after consultation of the waste owner and the competent authority.

**Waste code:**

060299 Used caustic solutions, n.o.s.  
52402

Description: Caustic solutions, caustic mixtures and mordants (alkaline)

**Disposal instructions:**

chemo-physical treatment

**Unclean packagings/containers:**

**Recommendation:** Dispose of unclean packagings/containers in compliance with local regulations.

**Recommended cleaning agent:**

Use water; add cleaning agents, if necessary.

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**14. Transport information**

Land transport ADR/RID and GGVS/GGVE (transnational/domestic):

ADR/RID-GGVSee Class:

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---	--	--

**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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Sea transport IMDG/GGVSee:  
 IMDG/GGVSee Class: -  
 Marine pollutant: No  
 Air transport ICAO-TI and IATA-DGR:  
 ICAO/IATA Class:

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**15. Regulatory information**

**Unclean packagings/containers:**

The product is classified and marked in accordance with EU directives / German hazmat regulations (GefStoffV).

Letter and description of product hazards: Xi Irritant

R-phrases:

- 38 Irritating to skin
- 41 Risk of serious damage to eyes

S-phrases:

- 24/25 Avoid contact with eyes and skin.
- 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
- 27 Take off immediately all contaminated clothing.
- 28 After contact with skin, wash immediately with plenty of water
- 37/39 Wear suitable gloves and suitable eye/face protection.

National Regulations (Germany)  
 VbF Classification: not applicable  
 Water Hazard Class: WGK 1: low water hazard

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**16. Other information**

The product is exclusively intended for commercial/industrial applications. The foregoing information reflects the current state of our technical knowledge and experience, but does not imply any legally binding warranty of defined characteristics or suitability for any particular purpose or application. The user is not released from performing own tests.

Issuing department: Technical laboratory  
 Contact: Dr. Kissel (Mrs.) Tel. : +49 (0) 6215402-261 or -0  
 Mister Gettwert Tel. : +49 (0) 6215402-239

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## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

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#### 2.4 Resin with data sheet (Part B)

##### 1. Product/Preparation and Company Identification

###### **Product information**

Trade name: epros patch liner resin (B), type W and type S  
Manufacturer/supplier: epros GmbH  
Dr.-Alfred-Herrhausen-Allee 20 d  
D-47228 Duisburg  
Tel. : +49 (0) 2065-999-0 +49 (0) 171-2766636  
Fax: +49 (0) 2065-999-111  
**Emergency hotline:** +36-29-346386

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##### 2. Composition/information on ingredients

Chemical identification:  
diphenyl methane 4,4'-diisocyanate, isomers, homologues: (MDI, polymeric MDI)  
CAS No. 9016-87-9  
EINECS No.: 615-005-01-6

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##### 3. Potential hazards

###### **Hazards identification:**

Xn harmful

Harmful to health if inhaled.  
Irritating to eyes, to respiratory organs, and to skin.  
May cause sensitisation by inhalation.

###### **Special danger instructions for the human and natural environment:**

Contains isocyanates. Observe the manufacturer's instructions.

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##### 4. First aid measures

###### **General instructions:**

###### **After inhalation:**

Inhalation of aerosols or vapours at high concentrations:  
Remove casualty to fresh air, keep warm, keep at rest; in case of breathing complaints, seek medical advice.

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<b>Procedures Manual</b>		

## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

---

**After contact with skin:**

Remove the product mechanically, wash with plenty of soap and water, carefully cream the cleaned skin zones.

**After contact with eyes:**

Flush eyes for a sufficiently long time while keeping lids apart.  
Then seek immediately medical advice (eye specialist).

**If swallowed:**

Do NOT induce vomiting, seek medical advice.

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#### 5. Fire fighting measures

**Suitable agents:**

Water, spray jet  
Water mist  
Powder  
Foam

**Unsuitable agents:**

Water, full jet

**Special hazard caused by the substance, its combustion products or gases produced:**

Do not inhale explosion and smoke gases.

**In case of fire, the following hazardous smoke gases may be formed:** hydrogen cyanide, isocyanate, carbon monoxide, nitrogen oxides

**Special protective equipment:**

In case of fire, wear self-contained respirator and chemical protective suit.

**Further information:**

Fire residues must be eliminated properly. Prevent fire water from penetrating into sewers, subsoil or waters.

Provide for sufficient fire water retention means.

Contaminated fire water must be eliminated in compliance with the official local regulations. In case of fire, separate threatened tanks or containers and take them to a safe place, if possible without danger.

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<b>Procedures Manual</b>		

## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

---

#### 6. Accidental release measures

**Personal precautions:**

Keep away unprotected persons.  
Wear personal protective equipment, refer to Section 8.

**Environmental precautions:**

**For small quantities:** Isolate and seal defective containers immediately.  
Observe water protection issues (collect, dam, cover).  
Avoid penetration into sewage, subsoil, waters.  
Protect the product from water, due to the hazardous reaction potential.

**Cleaning/take-up:**

Take up with an absorbent (e.g. inert absorbent, sawmill dust, sand).  
Take up with an appropriate mechanical means and collect in a suitable container.  
Keep moist the contents of the container.  
Keep the container open, never close it hermetically.  
In case of contact with water, carbon dioxide will form.

**Additional information:**

Eliminate any contaminated material as waste in compliance with Section 13.

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#### 7. Handling & storage

**Handling:**

Provide appropriate suction/ventilation when emptying or cleaning processing equipment.  
Good aeration and ventilation of storage rooms and workplaces. Provide appropriate exhaust/ventilation equipment on the processing machines. Avoid inhaling vapours/aerosols. In case of inhalative aerosol/dust occurrences, spraying operations, dust formation, handling the molten product, higher temperatures: respiratory protection required.  
Fire and explosion protection: Keep away from ignition sources – No smoking.

**Storage:**

Keep the product in tightly closed containers in a dry and cool place with good ventilation. Humidity penetrations will cause CO<sub>2</sub> overpressure to build up in isocyanate containers. Never store the product together with: acids, amines or amine-containing products, substances containing active hydrogen. Stew/store/load the product separately from food, animal fodder and luxury foodstuffs.

**Storage temperature: min. 15°C, max. 25°C, at a relative air humidity between 40% and 70%.**

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**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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**8. Exposure controls & personal protective equipment**

Additional information on the design of technical plants: (see 7)

Ingredients requiring occupational exposure limits to be controlled:

diphenyl methane 4-4'-diisocyanate

I

n case of inhalative aerosols:

Max. working-site concentration: 0.005 ml/m<sup>3</sup> = 0.05 mg/m<sup>3</sup> [Hungary, Germany]

**Personal protective equipment**

**General protection & hygienic measures:**

Take normal precautions as usual for the handling of chemical products. Do not eat, drink, smoke, take snuff during work. Wash your hands and/or face before breaks and at end of work

**Respiratory protection:** Wear self-contained respiratory protection.

**Hand protection:** Wear safety gloves made of PVC or rubber.

**Eye protection:** Wear safety goggles.

**Body protection:** Wear suitable protective clothing during work.  
Change immediately used and contaminated clothing.

**9. Physical & chemical properties**

Appearance: liquid  
 Colour: dark brown  
 Odour: nutlike

	Value/range	Unit	Method
Flash point:	> 150°C		
Method:	DIN 51 758		
Ignition temperature:	> 230°C		
Method:	DIN 51 794		
Vapour pressure:			
Density:	1.20 to 1.27 g/cm <sup>3</sup>	(at 20°C)	
Viscosity:	150-600 mPas	(at 20°C)	
Solubility in water:	Slow interface reaction with water to form insoluble high-melting polyurea while releasing CO <sub>2</sub> .		
pH:	not applicable		
Distribution coefficient n-octanol/water (log pow):	not applicable		

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**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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**10. Stability & reactivity**

**Conditions to be avoided:**

No decomposition in case of proper use.  
 Decomposes when heated up.  
 Starting decomposition temperature: approx. 260°C

**Substances to be avoided:**

Risk of decomposition in contact with alcohols, amines, diluted acids, alkalis, water.

**Hazardous decomposition products:**

carbon dioxide

**Additional information:**

Be careful when opening the container, because internal pressure may have built up.

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**11. Toxicological information**

**Classification-related LD/LC<sub>50</sub> values:**

Acute oral toxicity: LD50>15000 mg/kg, rat, literature.  
 Acute inhalative toxicity: approx. 370 aerosol mg/1/4h, rat, literature.  
 4,4' MDI saturated vapour concentration at 25°C: 0.09 mg/m<sup>3</sup>

**Primary irritation:**

Primary irritation to skin: irritating.  
 Primary irritation to eye: irritating.

**Sensitisation:**

May cause sensitisation by inhalation.

**Subacute to chronic toxicity:**

No effect level (NOEL): rat (male and female): 0.2 mg/m<sup>3</sup> inhalative (aerosols).  
 Lowest effect level (LOEL): rat (male and female): 1 mg/m<sup>3</sup> inhalative (aerosols).

**Further information:**

Irritating to skin and to the mucous membranes of eyes and respiratory tract.

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**12. Ecological information**

The product contains diphenyl methane 4,4'-diisocyanate, to which the following statements apply:  
 Elimination data:

**Evaluation:**

Slow interface reaction with water to form insoluble high-melting polyurea while releasing CO<sub>2</sub>.  
 According to previous experience, this product is inert and not degradable.

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## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

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**Ecotoxicity:**

Daphnia toxicity (acute): EC/LC50: > 1,000 mg/l

**Bacteria toxicity:** EC/LC0: > 10,000 mg/l

Fish toxicity: EC/LC0 (96h): 10,000 mg/l.

**Further ecological information:**

The product may not penetrate into water bodies without previous treatment (biological treatment).  
Avoid penetration into subsoil and water bodies.

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### 13. Disposal considerations

**Product:**

**Recommendation:**

Must be disposed of after previous treatment as special waste in compliance with the relevant local regulations by transfer to accredited special waste landfills or incinerators.

Waste classification (Germany, TA Abfall):

572 02: Production waste from the manufacture and processing of plastic materials (SAV 1)

European Waste Catalogue (EWC):

070299 Wastes n.o.s.

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### 14. Transport instructions

**Hazardous material within the scope of the transport instructions:**

GGVS/GGVE/RID/ADR/IMDG-Code/ICAO-TI

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### 15. Regulatory information

Substance to be labelled in compliance with 67/548/EEC.

**Letter and description of product hazards:**

Xn: Harmful

Component(s) determining for the hazard:

diphenyl methane diisocyanate, isomers, and homologues

**R-phrases:**

R20 Harmful to health if inhaled.

R36/37/38 Irritating to eyes, to respiratory organs, and to skin.

R42 May cause sensitisation by inhalation.

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---	--	--

## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

---

**S-phrases:**

- S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
- S28 After contact with skin, wash immediately with plenty of water and soap.
- S38 In case of insufficient ventilation, wear respiratory equipment.
- S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible (see the picture below)).

Contains isocyanates. Observe the manufacturer's instructions.

**VbF flammability classification (Germany):** none

**Water Hazard Class:** WGK 1 (self-assessment) – low water hazard.

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**16. Other information**

The foregoing information, which reflects the current state of our knowledge and experience, is intended to describe our product in terms of any safety requirements.

This information implies no warranted qualities or quality descriptions.

This data sheet is issued by: National Institute for Hygiene, Budapest

Contact: Dr. Gyula DURA, Tel: +36 (0) 1 218 3158

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## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

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#### **3. Applications**

##### **3.1 Typical damages and defects for epros patch liner repairs**

The **epros patch liner system** is used to repair defective points with exfiltration or infiltration at pipe joints, pipe walls, connections and transitions, as well as offsets, cracks, debris, breaks, and to close laterals.

Patch lined sections after prior root elimination will permanently prevent any new root intrusions.

So the **epros patch repair system** provides long-term tightness and structural stability (see 4.2.7).

For bends, extreme pipe offsets, collapsed breaks, longitudinal joint-to-joint cracks with diverse bedding problems, the **epros patch liner method cannot** be used (due to unforeseeable follow-up costs).

##### **3.2 Suitability**

The **epros patch liner system** is suitable for repairs in gravity sewers and pressurised pipes.

The liner provides a structural repair with a frictional fit in sewer pipes of the public and private sewage system. Repairs can be made only in pipes of circular or egg-shaped section made of concrete, reinforced concrete, vitrified clay, PVC or asbestos cement, where the liner is not or just partially cemented with the pipe wall surface. Tightness is achieved by pressing the liner against the walls of the host pipe and thereby forcing excess resin into the defective spots. The adhesive frictional force provides direct adherence and a tight fit even in case of pipe materials that have no adherence or cannot be surface-sealed by gluing.

The nominal widths of repairable pipelines range between DN 100 and DN 700 and, for egg-shaped sections, between 250/375 and 500/750.

The **epros patch liner system** constitutes a solid and structurally stable construction with a covering of approximately 0.5 metres. If longer sections need to be covered, it is possible to install several **epros patch liner systems** by overlapping, for which purpose it is important always to use the same 3-layered CRF glass mat construction while considering the hydraulic capacity of the host pipe. **(Refer to items 3.1 and 4.2.4 to 4.2.7.)**

Repairs of longer pipe segments need to be executed **from pipe joint to pipe joint**. In such case, it is necessary to use the **epros long liner repair system**.

The standard repair length of the **epros patch liner system** is approximately 0.5 m.

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## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

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#### **3.3 Sewer operating conditions**

The **epros patch liner system** can be used regardless of the sewage temperature and the sewer atmosphere. Before starting the lining operation, remove or flatten in-pipe obstacles that might prevent the epros short packer from being pulled in with a winch or pushed in with air rods, or from being expanded.

#### **3.4 Quality assurance**

For a high-quality **epros patch repair**, it is necessary that the pipe is in a clean condition with no sewage flow. To achieve this condition, clean the pipe by means of jetters or mechanically by cutting or grinding; cleaning by jetters should be done after service disruption immediately before pulling or pushing in the **epros patch liner**.

#### **3.5 Occupational Health & Accident Prevention Regulations (UVV)**

To guarantee the absence of any risks for people entering the access points and for the equipment to be used, make sure there are no dangerous gas concentrations in the manhole and the pipe. If necessary, provide appropriate and sufficient ventilation.

Use an appropriate and tested gas detection device.

Observe the relevant VDE, UVV and ATV-DVWK regulations and specifications.

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<b>Procedures Manual</b>		

**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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**4. Work performance**

**4.1 Preparatory operations**

Block the job site in compliance with the relevant traffic and safety regulations. Observe the applicable rules and regulations. That means that the entire pipe length (manhole to manhole section) is to be cleaned with jetters the day before the installation job, and the defective spot directly before the **epros patch repair** operation is started, with a water pressure adapted to the pipe diameter. (Preparation & installation report).

To do so, disrupt all service flows in and into the entire manhole-to-manhole section inclusive of any lateral connections. The damaged point must be clean and free from faeces. Measure the defective spot to be repaired, photograph or CCTV the defective section. Check the nominal widths. (Preparation & installation report).

**4.2 epros patch liner repair operations**

Adjust the wheel sets of the **epros short packer** to the nominal width of the host pipe. Check the **epros short packer** for proper operation and protect the rubber jacket by lubricating the entire surface with epros separating agent. In addition, wrap separating PE stretch foil around the packer, overlap and fix it.



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**Procedures Manual**

**epros Patch Liner System for Sewer Spot Repairs**

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**4.2.1 Preparation of the CRF glass mat**

For lengths and widths, **refer to 5.3**.  
Place the CRF glass mat onto the base sheeting with the fibre woven layer up.  
Use 3 layers.



**4.2.2 Preparation of the epros resin system**

Wear suitable safety goggles and safety equipment. Observe the safety instructions. The resin usage data for the two components are given in **5.3**. Observe the mixing ratio. For pipe diameters above 400 mm, mix the resin system in two steps. So less heat will be built up and the pot and reaction times specified in **5.2** of the data sheet can be maintained. Mix the epros resin system until a homogenously coloured mix is formed. Avoid entrapped air bubbles.



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## Procedures Manual

### epros Patch Liner System for Sewer Spot Repairs

---

#### 4.2.3 Wet out the CRF glass mat with epros resin system

Wet out the entire surface of the CRF glass mat using an appropriate tool. Make sure the corners and edges of the CRF glass mat are well covered with the epros resin system and that no fibre lift occurs. Move the tool all over the mat to fill the CRF glass fabric and then scrape off air bubbles. Use a spatula to press the epros resin system firmly into the CRF glass mat.



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