Deutsches Institut für Bautechnik

Zulassungsstelle für Bauprodukte und Bauarten
Bautechnisches Prüfamt
Eine vom Bund und den Ländern gemeinsam getragene Anstalt des öffentlichen Rechts
Mitglied der EOTA, der UEAtc und der WFTAO

Allgemeine bauaufsichtliche Zulassung/ Allgemeine Bauartgenehmigung

Datum: June 29, 2021

Geschäftszeichen: III 54-1.42.3-47/20

Nummer:
Z-42.3-391

Geltungsdauer
vom: **June 29, 2021**
bis: **June 29, 2026**

Antragsteller:
MC-Bauchemie Müller GmbH & Co. KG Am Kruppwald 1-8
46238 Bottrop

Gegenstand dieses Bescheides:
Construction products and their use for the execution of short liners called "Konudur LM-Liner" for the renovation of damaged underground sewer pipes in the nominal diameter range from DN 100 to DN 500

The above-mentioned subject matter of the regulation is hereby generally approved/approved by the building authorities.
This notice comprises 16 pages and 17 appendices.

I GENERAL PROVISIONS

1 This notice proves the usability or applicability of the subject matter of the regulation within the meaning of the state building regulations.

2 This notice does not replace the permits, consents and certificates required by law for the implementation of construction projects.

3 This decision is issued without prejudice to the rights of third parties, in particular private property rights.

4 Copies of this notice must be made available to the user or user of the subject matter of the regulation, without prejudice to further regulations in the "Special Provisions". In addition, the user or user of the subject of the regulation must be informed that this notice must be available at the place of use or application. Copies must also be made available to the authorities involved upon request.

5 This notice may only be reproduced in full. Publication of excerpts requires the consent of the German Institute for Structural Engineering. Texts and drawings of advertising literature must not contradict this decision; translations must contain the note "Translation of the original German version not checked by the German Institute for Building Technology".

6 This decision is issued revocably. The provisions can be subsequently supplemented and changed, especially if new technical findings require this.

7 This decision refers to the information provided and documents submitted by the applicant. A change to these principles is not covered by this notice and must be disclosed to the German Institute for Structural Engineering immediately.

8th The general design approval included in this notice also applies as general building approval for the design.

II SPECIAL PROVISIONS

1 Subject of regulation and area of use or application

This notice applies to the production and use of short liners called "Konudur LM-Liner" with the two-component organo-mineral resin system called "Konudur 250 OM-PL Winterharz" for the repair or renovation of damaged, buried sewage pipes with circular cross-sections in nominal widths DN 100 to DN 500.

This notice applies to the repair or renovation of sewer pipes that are intended to drain wastewater in accordance with DIN 1986-3[1] derive.

The short liners can be used to repair or renovate wastewater pipes made of concrete, reinforced concrete, stoneware, asbestos-free fiber cement, cast iron and GRP, provided that the cross-section of the wastewater pipe to be renovated meets the process-related requirements and the static requirements.

The short liners can be used to repair or rehabilitate crack formations (e.g. radial cracks and longitudinal cracks as well as combinations of longitudinal and radial cracks) and leaky pipe connections under the condition that the old pipe-floor system alone is still load-bearing (e.g. longitudinal cracks with little pipe deformation with verified functional lateral bedding, if necessary this must be checked, for example, through long-term observations and/or ramming soundings).

Damaged sewer pipes are renovated with short liners by moving a resin-soaked glass fiber fabric or scrim mat, consisting of random fiber fabric layers, to the damaged area of the sewer pipe using an inflatable packer and pressing it against the pipe wall by inflating the packer. The packer is left in this position until curing is largely complete.

2 Regulations for construction products

2.1 Properties and composition Materials

2.1.1 of the components

2.1.1.1 Fiberglass material

Only E-CR glass fiber fabric or scrim mats and E-CR random glass fiber mats in accordance with DIN 1259-1 may be used as carrier material for the resin system[2], DIN 61853-1[3] and DIN 61853-2[4] and DIN 61854-1[5] are used that must correspond to the recipe information stored at the German Institute for Building Technology.

The glass fiber fabric or scrim mats each consist of a glass fiber fabric layer ("Konudur LM fabric 1050"; Appendix 1) or glass fiber fabric layer ("Konudur LM fabric 1080"; Appendix 2 and "Konudur LM fabric 1400"; Appendix 3) and a layer of random fibers that are sewn together.

1	DIN 1986-3	Drainage systems for buildings and properties - Part 3: Rules for operation and maintenance; Edition:2004-11
2	DIN 1259-1	Glass - Part 1: Terms for types of glass and glass groups; Edition:2001-09
3	DIN 61853-1	textile glass; Textile glass mats for plastic reinforcement; Technical delivery conditions; Edition:1987-04
4	DIN 61853-2	textile glass; Textile glass mats for plastic reinforcement; classification, application; Edition:1987-04
5	DIN 61854-1	textile glass; Textile glass fabric for plastic reinforcement; filament fabrics and roving fabrics; Technical delivery conditions; Edition:1987-04

Before processing, the glass fiber fabric or scrim mats have the following properties, among others:

1.) Glass fiber fabric mat: "Konudur LM fabric 1050" for a three-layer or four-layer short liner

- Weight per unit area 1,050 g/m²±10%
- Thickness: 1.5mm ± 10%
- Width: 1.25m ± 5%

2.) Glass fiber mat: "Konudur LM fabric 1080" for a three-layer or four-layer short liner

- Weight per unit area 1,080 g/m²±10%
- Thickness: 1.5mm ± 10%
- Width: 1.27m ± 5%

3.) Glass fiber mat: "Konudur LM fabric 1400" for a two-layer short liner

- Weight per unit area 1,400 g/m²±10%
- Thickness: 1.9mm ± 10%
- Width: 1.27m ± 5%

2.1.1.2 Resin components

The two-component resin system "Konudur 250 OM-PL winter resin" consists of components A (resin) and B (hardener). The composition of these components must correspond to the recipe information stored at the German Institute for Building Technology.

- Component A (resin)

  Before processing, the resin has the following properties, among others:

  - Density based on DIN EN ISO 1183-1[6] at +23 °C: 1.47g/cm³±0.2g/cm³
  - Viscosity based on DIN EN ISO 3219[7] at +25 °C: 260 mPa xs ± 60 mPa xs[A)]
  - PH value: ≈ 13
  - Color: colorless, clear

- Component B (hardener)

  Before processing, the hardener has the following properties, among others:

  - Density based on DIN EN ISO 1183-1[6] at +23 °C: 1.12g/cm³±0.2g/cm³
  - Viscosity based on DIN EN ISO 3219[7] at +25 °C: 420 mPa xs ± 80 mPa xs[A)]
  - PH value: ≈ 6
  - Color: dark brown

[6] DIN EN ISO 1183-1 Plastics - Methods for determining the density of non-foamed plastics - Part 1: Immersion methods, liquid pycnometer methods and titration methods (ISO 1183-1:2012); German version EN ISO 1183-1:2012, edition: 2013-04

[7] DIN EN ISO 3219 Plastics - Polymers/resins in liquid, emulsified or dispersed state - Determination of viscosity with a rotational viscometer at a defined velocity gradient (ISO 3219:1993); German version EN ISO 3219:1994; Edition:1994-10

[A)] Measurement cylinder / concentric, shear speed 10 rpm

The resin system must correspond to the recipes and IR spectra stored at the German Institute for Building Technology. The IR spectra must also be deposited with the third-party monitoring body by the applicant for this notice.

2.1.2 Environmental sustainability

The construction products meet the requirements of the “Principles for assessing the effects of construction products on soil and groundwater” (version: 2011; publications of the German Institute for Construction Technology). This statement only applies if the special provisions of this notice are adhered to.

The reservation of permission, particularly in water protection zones, by the responsible water authority remains unaffected.

2.1.3 Physical characteristics of the resin mixture

The cured resin mixture of components A and B has the following characteristics:

- Density at +23 °C based on DIN EN ISO 1183-1[6]: ≈ 1.2 g/cm³±0.2g/cm³
- Tensile strength based on DIN EN ISO 527-2[8th]: ≥ 9 N/mm²
- Tensile e-module based on DIN EN ISO 527-2[8th]: ≥ 150 N/mm²
- Compressive strength based on DIN EN ISO 604[9]: ≥ 25 N/mm²
- Compressive e-modulus based on DIN EN ISO 604[9]: ≥ 490 N/mm²
- Shrinkage dimension based on ISO 2577[10]: ≤0.2%

2.2 Manufacturing, packaging, transport, storage and labeling

2.2.1 Production of the individual components of the short liner

The glass fiber fabric or non-crimp mats must be manufactured in the supplier's factory with the dimensions specified in Section 2.1.1.1. The applicant must ensure that the pre-supplier adheres to the specified weight per unit area. He has obtained the values through an inspection certificate 3.1 based on DIN EN 10204[11] to be confirmed.

2.2.2 Packaging, transport, storage

The applicant must ensure that the fiberglass fabric or non-crimp mats delivered by the upstream supplier are stored in his premises or those of the contractors in such a way that the mats are not damaged.

The applicant must ensure that the components of the "Konudur 250 OM-PL winter resin" system for resin impregnation on the respective construction site are stored in suitable, separate, airtight containers in the applicant's or the contractor's premises until further use . The temperature range from +5 °C to + 25 °C must be maintained. The storage time is approximately twelve months after production and should not be exceeded. The containers must be protected from direct sunlight. The containers must be designed in such a way that the resin components A and B of the two-component organo-mineral resin system are stored in separate individual containers.

The storage containers must be transported to the respective place of use. The quantities of components required for the renovation measures can be found in the storage containers. At the point of use, the storage containers must be protected from the effects of the weather. The fiberglass fabric or scrim mats are in suitable transport containers

8th	DIN EN ISO 527-2	Plastics - Determination of tensile properties - Part 2: Test conditions for molding and extrusion compounds (ISO 527-2:1993 including Cor.1:1994); German version EN ISO 527-2:1996; Edition:1996-07
9	DIN EN ISO 604	Plastics - Determination of printing properties (ISO 604:2002); German version EN ISO 604:2003; Edition:2003-12
10	ISO 2577	Plastics - Thermosetting molded plastics - Determination of shrinkage; Edition:2007-12
11	DIN EN 10204	Metallic products - Types of test certificates; German version EN 10204:2004; Edition:2005-01

transport so that they are not damaged.

If the resin components are filled by the contractor, the applicant must ensure that this is only done in suitable transport containers (e.g. plastic canisters). Only the applicant's transport containers may be used.

During storage and transport, the relevant accident prevention regulations and the information in the applicant's procedure manual must be observed.

2.2.3 Labelling

The glass fiber fabric or laid mats and the respective transport containers of the resin components A and B must be marked with the conformity mark (Ü mark) in accordance with the conformity mark regulations of the federal states, including the notification number Z-42.3-391. Labeling may only take place if the requirements according to Section 2.3 Confirmation of Conformity are met.

The manufacturer has the danger symbols and H and P phrases in accordance with the Hazardous Substances Regulation and EU Regulation No. 1907/2006 (REACH) as well as the current version of the CLP Regulation on the containers, on the packaging, on the package insert or in the delivery note (EC) 1272/2008[12]to specify. The packaging must comply with the rules of ADR[13]be marked in the applicable versions.

In addition, the following must be stated on the transport containers of the glass fiber fabric or non-crimp mats:

- Weight per unit area and width
- Batch number

In addition, the transport containers for the resins and hardeners must be marked at least as follows:

- Component name
- Temperature range for processing +5 °C to +20 °C
- Container contents (volume or weight)
- Batch number

2.3 Compliance confirmation

2.3.1 General

Confirmation of the conformity of the construction products with the provisions of the general building approval covered by the notice must be provided for each manufacturing plant with a declaration of conformity on the basis of a factory production control and a certificate of conformity from a recognized certification body as well as regular third-party monitoring by a recognized monitoring body, including an initial test of the construction products in accordance with the following provisions.

For the issuance of the certificate of conformity and the external monitoring, including the product tests to be carried out, the manufacturer of the construction products must involve a recognized certification body and a recognized monitoring body.

The manufacturer must submit the declaration of conformity by labeling the construction products with the conformity mark (Ü mark) and indicating the intended use.

12	1272/2008	Regulation (EC) No. 1272/2008 on the classification, labeling and packaging of substances and mixtures
13	ADDR	European Agreement concerning the International Carriage of Dangerous Goods by Road (*Accord European relative to international transport of dangerous goods by route)*

The certification body must provide the German Institute for Construction Technology with a copy of the certificate of conformity it issued.

A copy of the initial test report must also be provided to the German Institute for Structural Engineering.

2.3.2 Factory production control

A factory production control must be set up and carried out in every manufacturing plant. Factory production control means the continuous monitoring of production to be carried out by the manufacturer in order to ensure that the construction products it produces comply with the provisions of the general building authority approval covered by this notice.

The factory production control should include at least the measures listed below.

- Description and review of the source material

  The applicant has made use of fiberglass fabric or
  - fabric mats, raw materials for resin and hardener to ensure that the required properties according to Section 2.1.1 are met.

  For this purpose, the applicant has obtained corresponding factory certificates 2.2 from the respective preliminary supplier of the raw materials of the resin components and an acceptance test certificate 3.1 from the manufacturing plant of the respective preliminary supplier of the glass fiber fabric or scrim mats based on DIN EN 10204[11] to be presented.

  As part of the factory production control, the properties listed in Section 2.1.1.1 and the properties listed in Section 2.1.1.2 must also be randomly checked for each batch in accordance with the recipe information stored at the German Institute for Building Technology.

  Furthermore, the modulus of elasticity according to Section 2.1.3 of the ready-to-use resin mixture on at least three test specimens corresponds to the specifications of DIN 16946-1[14] Table 1 under No. 6 according to the test conditions of section 5.2.1 and according to DIN EN ISO 527-2[8th] to be checked in a tensile test.

  The shrinkage dimension according to Section 2.1.3 is based on ISO 2577[10] on at least three test specimens per batch or in accordance with DIN 16946-1[14] to check the determination of the mass loss. The test based on ISO 2577[10] is on test specimens after conditioning for 24 hours at +23 °C±2 °C. The use of a demountable metal mold is recommended for producing the test specimens.

- Controls and tests to be carried out during production: The requirements according to Section 2.2.1 must be checked.
  - Checking the containers:

    The labeling requirements in accordance with Section 2.2.3 must be checked for each resin batch.

The results of the factory production control must be recorded and evaluated. The records must contain at least the following information:

- Name of the construction products or the starting materials and the components,
- type of control or test,
- Date of manufacture and testing of the construction products or the raw materials or the components,

14 DIN 16946-1 reaction resin molding materials; casting resin molding materials; test procedures; Edition:1989-03

- Result of the controls and tests and, where applicable, comparison with the requirements,
- Signature of the person responsible for factory production control.

The records must be kept for at least five years and presented to the monitoring agency responsible for external monitoring. They must be presented to the German Institute for Construction Technology and the responsible highest building supervisory authority upon request.
If the test result is unsatisfactory, the manufacturer must immediately take the necessary measures to remedy the defect. Construction products that do not meet the requirements must be handled in such a way that confusion with matching ones is prevented. After the defect has been remedied - if technically possible and necessary to prove that the defect has been eliminated - the test in question must be repeated immediately.

2.3.3 External monitoring

In every manufacturing plant, the factory and the factory production control must be checked regularly by external monitoring, but at least once every six months.

As part of external monitoring, an initial test of the construction products must be carried out. The factory production control must be carried out through random checks as part of external monitoring. The requirements of sections 2.1.1 and 2.2.3 must be checked.

In addition, the manufacturing requirements in accordance with Section 2.2.1 must be checked on a random basis. This also includes checking the hardening behavior, the density of components A and B in Section 2.1.1.2 the storage stability and the basis weight of the glass fiber fabric or non-crimp mats as well as IR spectroscopy.

Sampling and testing is the responsibility of the recognized monitoring body. Third-party monitoring also includes factory certificates 2.1 and factory certificates 2.2 based on DIN EN 10204[11]to check. For the raw materials of the resin system, the factory certificates 2.2 must be checked for a raw material of component A and a raw material of component B.

The results of certification and third-party monitoring must be retained for at least five years. They must be presented by the certification body or the monitoring body to the German Institute for Construction Technology and the responsible highest building supervisory authority upon request.

3 Provisions for the application of the subject matter of the regulation

3.1 Planning and dimensioning

3.1.1 planning

The details of the necessary line data must be checked, e.g. E.g. lines, depth, location of side inlets, shaft depths, groundwater, pipe connections, hydraulic conditions, inspection openings, cleaning intervals. Existing video recordings must be evaluated according to the application. The accuracy of the information must be checked on site. The condition of the existing sewer pipe for the property drainage must be assessed with regard to the applicability of the renovation process.

The hydraulic effectiveness of the wastewater pipes must not be impaired by the installation of a short liner. Corresponding proof must be provided if necessary.

3.1.2 Rating

3.1.2.1 Wall thickness and wall structure

Due to the system, resin-soaked short liners are used for renovation measures, which after installation and hardening have a minimum wall thickness of 3 mm, regardless of the nominal width. The wall structure of the short liner must consist of at least an outer and inner random fiber layer with a woven or laid glass fiber layer in between (Appendix 7).

3.1.2.2 Physical characteristics of the cured short liner

After the fiberglass fabric or fiberglass mats (laminate) soaked in the resin system have hardened, they must have the following characteristics:

1.) "Konudur LM fabric 1050" and "Konudur LM fabric 1080"

- Density based on DIN EN ISO 1183-1[6]: ≈ 1.5 g/cm³±0.2g/cm³
- Ignition residue based on DIN EN ISO 1172[15]: ≥ 57%
- Short-term circumferential modulus of elasticity based on DIN EN 1228[16]: ≥ 7,000 N/mm²
- Bending stress σ_{fB} based on DIN EN ISO 11296-4[17] or DIN EN ISO 178[18]: ≥ 149 N/mm²

2.) "Konudur LM fabric 1400"

- Density based on DIN EN ISO 1183-1[6]: ≈ 1.4 g/cm³±0.2g/cm³
- Ignition residue based on DIN EN ISO 1172[15]: ≥ 52%
- Short-term circumferential modulus of elasticity based on DIN EN 1228[16]: ≥ 3,600 N/mm²
- Bending stress σ_{fB} based on DIN EN ISO 11296-4[17] or DIN EN ISO 178[18]: ≥ 110 N/mm²

3.2 execution

3.2.1 General

Damaged sewer pipes are renovated with short liners by moving a resin-soaked glass fiber fabric or scrim mat, consisting of random fiber fabric layers, to the damaged area of the sewer pipe using an inflatable packer and pressing it against the pipe wall by inflating the packer. The packer is left in this position until curing is largely complete.

In the following structural conditions, execution with the "Konudur LM-Liner" short liners is possible:

a) From the start point to the finish point

b) Starting from the starting point in a channel position with a defined length, without the need for another shaft opening

c) Side inlets, starting from the starting point to the connection point in the main sewer

The starting point or destination point can be a shaft, an inspection or cleaning opening or an open section of pipe.

15	DIN EN ISO 1172	Textile glass-reinforced plastics - prepregs, molding compounds and laminates - determination of textile glass and mineral filler content; Calcination process (ISO 1172: 1996); German version EN ISO 1172:1998; Edition:1998-12
16	DIN EN 1228	Plastic piping systems - Pipes made of glass fiber reinforced thermoset plastics (GRP) - Determination of the specific initial ring stiffness; German version EN 1228:1996; Edition:1996-08
17	DIN EN ISO 11296-4	Plastic piping systems for the renovation of underground non-pressure drainage networks (gravity pipes) - Part 4: Cure-in-place pipe lining (ISO 11296-4:2009, corrected version 2010-06-01); German version EN ISO 11296-4:2011; Edition:2011-07
18	DIN EN ISO 178	Plastics - Determination of bending properties (ISO 178:2019); German version EN ISO 178:2019; Edition:2019-08

An arch of up to 45° can be renovated with an arch renovation packer.
If wrinkling occurs, this must not be larger than in DIN EN ISO 11296-4[17] is fixed.

The applicant must create a manual with a description of the individual steps related to the execution of the renovation process.
The sufficient specialist knowledge of the executing company can, e.g. B. through a corresponding quality mark from the Guteschutz Kanalbau e. v.[19], be documented.

3.2.2 Equipment and facilities

Minimum components, devices and facilities required to carry out the renovation process:

- Sewer cleaning devices
- Devices for dewatering
- Devices for sewer inspection (DWA-M 149-2[20])
- Renovation facilities:
  - Equipment for subsurface preparation
  - Glass fiber fabric or laid mats for the nominal widths to be renovated
  - Container with resin (component A) and hardener (component B)
  - Dosing device for filling the resin components
  - Mixing container with mixing tool (agitator)
  - Weather-protected impregnation point
  - Work/construction films
  - Hand tools e.g. E.g. scissors, spatulas, distribution rollers etc.
  - Pipe rehabilitation device for the appropriate nominal pipe diameters (packer) and accessories
  - Release agents or PE films (stretch films) for the packer
  - Camera, control unit with screen
  - Locking air push rods for positioning the packer
  - Safety and pull-in ropes
  - Compressed air hoses for connection to the packer with pressure monitoring device
  - Compressor, pressure regulator
  - Shut-off bladders or shut-off disks suitable for the respective nominal diameter
  - Water supply
  - Power supply
  - Container for waste materials
  - Temperature sensor
  - Temperature monitoring and recording device
  - Small devices such as B. Compressed air cutting tool
  - If necessary, social and sanitary rooms

19 Quality protection canal construction e. v.; Linzer Str. 21, Bad Honnef, telephone: (02224) 9384-0, fax: (02224) 9384-84

20 DWA-M 149-2 German Union for water management, sewage and Waste e. v. (DWA) - Information sheet 149: Condition recording and assessment of drainage systems outside of buildings - Part 2: Coding system for visual inspection; output:2013-12

If electrical devices, e.g. B. video cameras (or so-called sewer remote eyes) are installed in the line to be renovated, then these must be designed in accordance with VDE regulations.

3.2.3 Implementation of the renovation measure

3.2.3.1 Preparatory measures

Before carrying out repairs or renovation work, it must be ensured that the line in question is not in operation; If necessary, appropriate shut-off bubbles must be installed and the wastewater diverted.

In preparation for the repair or renovation work, the pipe, including the associated side inlets, must be taken out of operation. The enclosure must then be cleaned using high-pressure flushing. In the case of smooth-walled inner surfaces of the damaged pipeline and those where deposits (the so-called "seal skin") cannot be removed by high-pressure flushing to the extent necessary for the process, surface removal (removal of the "seal skin") should be carried out depending on the damage pattern. Drainage obstructions must be removed.

The inner pipe surfaces in the area of the line shut-off devices must be even.

The location of the existing damage and that of the side inlets must be measured in the cleaned pipe section.

Before starting work, the ambient temperature must be measured. It must be assessed whether the temperature limits required for the process can be maintained.

The accident prevention regulations applicable to the application of the repair or renovation process must be adhered to.

Devices for the repair or renovation process that are to be installed in the pipe section to be renovated may only be used if testing has previously ensured that there are no flammable gases in the pipe section.

The relevant sections of the following regulations must be observed:

- GUV-R 126[21](previously GUV 17.6)
- DWA-M 149-2[18]
- DWA-A 199-1 and DWA-A 199-2[22]

The accuracy of the information mentioned in Section 3.1.1 must be checked on site. To do this, the pipe section to be renovated must be cleaned using standard high-pressure flushing devices so that the damage is visible on the monitor during the visual inspection in accordance with the information sheet DWA-M 149-2[18]can be recognized perfectly.

When people climb into shafts of the sewer pipes to be renovated and during all steps of the renovation process, the relevant accident prevention regulations must also be observed.

The formatting of the glass fiber fabric or scrim mats according to Section 3.2.3.3, the resin mixture according to Section 3.2.3.4 and the resin impregnation according to Section 3.2.3.5 are carried out in a weather-protected enclosure (e.g. in the renovation vehicle) on flat surfaces that are free of contamination of all kinds must be carried out.

21	GUV-R 126	Safety rules: Working in enclosed spaces of wastewater systems (previously GUV 17.6); Edition:2008-09
22	DWA-A 199-1	German Association for Water Management, Sewage and Waste e. V. (DWA) - Worksheet 199: Service and operating instructions for the staff of wastewater plants, - Part 1: Service instructions for the staff of wastewater plants; Edition:2011-11
	DWA-A 199-2	German Association for Water Management, Sewage and Waste e. V. (DWA) - Worksheet 199: Service and operating instructions for the staff of wastewater plants, - Part 2: Operating instructions for the staff of sewer networks and stormwater treatment plants; Edition:2020-04

The pot life according to Appendix 16 must be adhered to for the respective renovation measure using a resin mixture according to Section 3.2.3.4, so that the short liner lies in a form-fitting manner on the surface of the area of the sewer pipe to be renovated within this time, ie without incipient hardening.

The steps required to carry out the procedure must be recorded for each impregnation and renovation using protocol sheets (e.g. Appendix 17).

3.2.3.2 Incoming inspection of the process components on the construction site

The transport containers of the process components must be checked to see whether the markings mentioned in Section 2.2.3 are present. The dimensions of the glass fiber fabric or mats related to the respective renovation object must be measured before impregnation or impregnation with the resin. Compliance with the resin and hardener storage temperature of +5 °C to +25 °C must be checked before impregnation.

3.2.3.3 Formatting the fiberglass fabric or scrim mats

The rolled up fiberglass fabric or scrim mat is on site on a work table in a weather-protected or air-conditioned room or in the renovation vehicle with a length of approx. 0.4 m to 3.0 m (depending on the planned individual renovation length) multiplied by 3. 5 times the diameter and taking into account the overlap lengths. The fiberglass fabric or scrim mats should be at least 1.25 m wide. It is important to ensure that the fiberglass fabric or scrim mats are cut to size so that the beginning and end areas of the later short liner lie at least 20 cm outside the damaged area on the pipe to be renovated. Sleeves must be covered by at least 20 cm of the short liner on both sides.

3.2.3.4 Resin mixture

The resin system consists of the resin component A and the hardener component B. One volume of component A must be mixed with two volumes of component B. The mixing temperature of + 5 °C to + 20 °C must be maintained. The amounts of resin required for each application must be determined taking into account the information in Appendix 16.

Components A and B must be mixed in a mixing container using an electrically operated stirring device in such a way that a bubble-free resin mixture with a homogeneous color is achieved.

The mixing of the resin system and the temperature conditions must be recorded in a protocol in accordance with Section 3.2.3.1. In addition, a reference sample must be taken from each resin mixture on the construction site and the hardening behavior of this must be checked.

3.2.3.5 Resin impregnation (Appendices 5 to 13)

After mixing the resin, it must be applied evenly to the glass fabric side on top (first layer) using a suitable spatula on the spread out glass fiber fabric or scrim mat (Appendix 4) in crisscross and transverse movements (Appendix 5). After that is for onetwo-layer Short liner, about a quarter of the fiberglass fabric or scrim mat should be folded over once and the now folded-in top random scrim side should be impregnated (Appendix 5). The second quarter must then be folded over, taking into account an overlap of approx. 5 cm, and the now folded over random layer side must be resinified (Appendix 6). The folded two-layer glass fiber fabric or scrim mat must now be turned over and the random scrim side must be impregnated with the resin system (Appendix 7).

Taking into account the cured minimum wall thickness of 3 mm according to Section 3.1.2.1, the two-layer structure is only recommended when using the "Konudur LM fabric 1400".

For a three-layer short liner (Appendix 8), after resinating the spread glass fiber fabric or scrim mat, it must be folded over by the first third. The folded first third must be resinated and then the second third must be folded over the resined first third (Appendix 9). The second third must be impregnated. The three-layer glass

The fiber fabric or scrim mat must be turned over and the random scrim side must be completely impregnated with the resin (Appendix 10).

For onefour-layer Short liner (Appendix 11), after the spread out fiberglass fabric or scrim mat has been resinified, it must be folded by a quarter on the right and left to form a two-layer fiberglass fabric or scrim mat. The two folded pages must be resinated (Appendix 12). The now two-layer glass fiber fabric or scrim mat must then be folded in half. The now four-layer glass fiber fabric or scrim mat must be impregnated on top of the twisted scrim side, then turned over and resin added to the random scrim side that is now on top (Appendix 13).

The minimum wall thickness of the short liners must be adhered to in accordance with Section 3.1.2.1.

To avoid air pockets, the resin should then be pressed into the fabric with a roller.

Due to the previously described folding into a two-, three- or four-layer short liner, one random side of the fiberglass fabric or fabric mat forms the side facing the wastewater and the other the side facing the old pipe. The glass fabric side or the glass fabric side of the glass fiber fabric or fabric mat is therefore between the random fabric layers (Appendix 7).

The curing time and the temperature profile must be recorded in the protocol according to Section 3.2.3.1.

3.2.3.6 Insertion of the short liner into the sewage pipe to be renovated

The impregnated short liner is introduced using a packer.

The rubber body of the packer suitable for the sewage pipe to be renovated must be covered with a PE protective film and then rubbed with a release agent (Appendix 14). The release agent serves as a separating layer for later removal of the packer from the sewer line. When selecting the packer, it is important to ensure that the outer diameter of the packer is approx. 50 mm to 80 mm smaller than the inner diameter of the pipe to be renovated.

The resin-soaked glass fiber fabric or scrim mat must be applied to the packer and secured against slipping and slipping (Appendixes 14 and 15). Only packers that are equipped with rollers may be used for renovation. The rollers must be arranged in such a way that when the packer is inserted and moved into the sewage pipe to be renovated, the resin-soaked glass fiber fabric or mat does not touch the inner pipe wall.

Before the packer is moved into the wastewater pipe to be renovated, a compressed air hose from the compressor must be connected to the packer (Appendix 15). The packer must be pulled in and positioned at the measured damage point in the sewer pipe using previously attached ropes and air push rods. By applying compressed air at a maximum of 2.0 bar (the maximum pressure application of the respective packer type must be taken into account), the rubber body of the packer expands and thus causes the resin-soaked glass fiber fabric or scrim mat to be pressed against the inner wall of the pipe to be renovated. The pressure must be maintained until the resin system has hardened (Appendix 16). At an ambient temperature of +20 °C, the set-up pressure can be released after approx. 1.5 hours and the packer can be removed. It is important to ensure that no excess resin escapes. The pressure must then be released from the rubber body and the packer pulled back to the starting point.

3.2.3.7 Labeling in the shaft

The following labeling should be permanently and easily readable in the start or end shaft of the repair or renovation measure:

- Type of renovation
- Designation of the line section
- Nominal diameter
- Wall thickness of the short liner
- Year of renovation

3.2.3.8 Final inspection and leak test

After completion of the work, the renovated pipe section must be visually inspected and documented. It must be determined whether any remaining material has been removed and whether there are no hydraulically disadvantageous folds.

After the short liner has hardened, the tightness is in accordance with DIN EN 1610[23] to consider. The renovated canal can then be put back into operation.

3.2.4 Testing on samples taken

3.2.4.1 Curing

At least four times a year, the contractor must produce a short liner in the most recently renovated nominal width using a support pipe (e.g. a PVC-U pipe) on the respective construction site. Short-term E-modulus values (1-hour value, 24-hour value) must be determined on the annulus obtained in this way at least twice a year. Using the 1-hour value and the 24-hour value, it can be determined whether the creep tendency is based on DIN EN ISO 899-2[24] by $K_n \leq 10\%$ is maintained in accordance with the following relationship:

$$K_n = \frac{E_{1h} - E_{24\,hours}}{E_{1h}} \times 100$$

3.2.4.2 Watertightness of the samples

The watertightness of the hardened short liner can be carried out either on a short liner section (circular ring) or on test pieces that were removed from the hardened short liner. For the test, any remaining film that was used to protect the packer must be removed from the short liner section.

Testing of test pieces can be carried out either with overpressure or underpressure of 0.5 bar.

During the negative pressure test, the sample must be exposed to water on one side. At a negative pressure of 0.5 bar, no water leakage may be visible on the uncontaminated side of the sample during a test period of 30 minutes.

When testing using overpressure, a water pressure of 0.5 bar must be applied for 30 minutes. Even with this method, no water leakage should be visible on the unexposed side of the sample.

23	DIN EN 1610	Installation and testing of sewer pipes and sewers; German version EN 1610:2015; Edition:2015-12
24	DIN EN ISO 899-2	Plastics - Determination of creep behavior - Part 2: Creep bending test under three-point loading (ISO 899-2:2003); German version EN ISO 899-2:2003; Edition:2003-10

3.2.5 Declaration of conformity regarding the renovation measure carried out

Confirmation of the compliance of the repair or renovation measure carried out with the provisions of the general type approval covered by this notice must be provided by the executing company with a declaration of conformity based on the specifications in Tables 1 and 2. The declaration of conformity must be accompanied by documents on the properties of the process components according to Section 2.1.1 and the results of the tests according to Tables 1 and 2.

The manager of the renovation measure or an expert representative of the manager must be present on the construction site while the renovation is being carried out. He must ensure that the work is carried out properly in accordance with the provisions of Section 3.2 and in particular carry out or arrange for the tests according to Table 1 and to arrange the tests according to Table 2. The number and scope of the specifications made are minimum requirements.

The tests on test pieces according to Table 2 must be carried out by a monitoring body recognized by the building authorities (see list of testing, monitoring and certification bodies according to the state building regulations, Part V, No. 9).

Once every six months, samples must be taken from a short liner of a renovation measure carried out by the aforementioned monitoring body. This must also check the documentation of the statements in Table 1 of the renovation measure.

Table 1 : "Procedural examinations"

Subject of the examination	**Type of request**	**frequency**
visual inspection of the line	according to Section 3.2.3.1 and DWA-M 149-2[20]	before any renovation
visual inspection of the line	according to Section 3.2.3.8 and DWA-M 149-2[20]	after every renovation
Device equipment	according to Section 3.2.2	every construction site
final inspection	according to Section 3.2.3.8	
Labeling of the containers for the renovation components	according to Section 2.2.3	
Resin mixture, amount of resin and hardening behavior per short liner	Mixing protocol according to Section 3.2.3.4	
Curing time and Pressure in the packer	according to Section 3.2.3.6	

The inspections listed in Table 2 must be carried out by the head of the renovation measure or his expert representative. Samples must be taken from the short liners for the tests listed in Table 2.

Table 2 : "Testing on test pieces"

Subject of the examination	Type of request	frequency
Short-term modulus of elasticity (1-hour and 24-hour value) and tendency to creep	according to Section 3.2.4.1	every 6th month of production per performer
Physical parameters	according to Section 3.1.2.2	
Waterproofness the sample	without mounting foil according to Section 3.2.4.2	
Wall thickness and wall structure	according to Section 3.1.2.1	

The test results must be recorded and evaluated; they must be presented to the German Institute for Structural Engineering upon request. The number and scope of the specifications listed in the tables are minimum requirements.

Christina Pritzkow
i. V. Head of department

Notarized

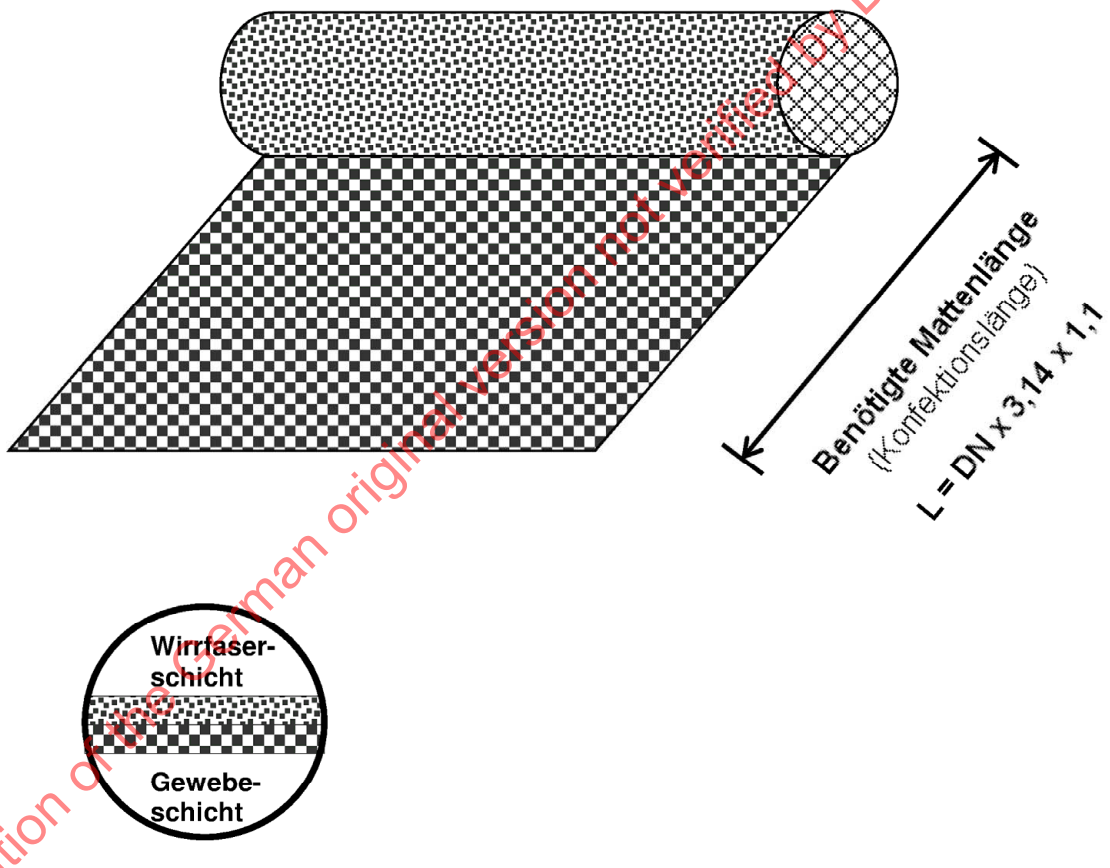
Deutsches Institut für Bautechnik DIBt

Konudur LM-Gewebe 1050

Glasfasergewebematte – Gewebe auf Wirrfasergelege vernäht

Rollenbreite:	ca. 125 cm
Nominales Flächengewicht:	ca. 1.050 g/m²
Gewebedicke (Stärke):	ca. 1,50 mm

Konfektionslänge in mm = Rohrdurchmesser (DN) x 3,14 x 1,1



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 1
Glasfasergewebematte „Konudur LM-Gewebe 1050“	

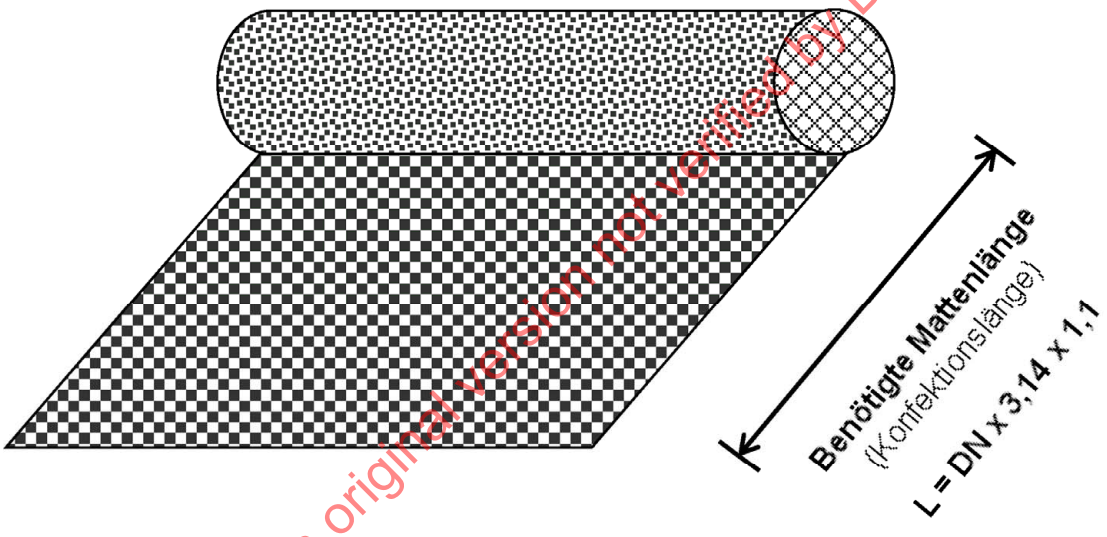
Deutsches Institut für Bautechnik DIBt

Konudur LM-Gewebe 1080

Glasfasergelegematte – Gelege auf Wirrfaser vernäht

Rollenbreite:	ca. 127 cm
Nominales Flächengewicht:	ca. 1.080 g/m²
Gewebedicke (Stärke):	ca. 1,50 mm

Konfektionslänge in mm = Rohrdurchmesser (DN) x 3,14 x 1,1



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 2
Glasfasergelegematte „Konudur LM-Gewebe 1080“	

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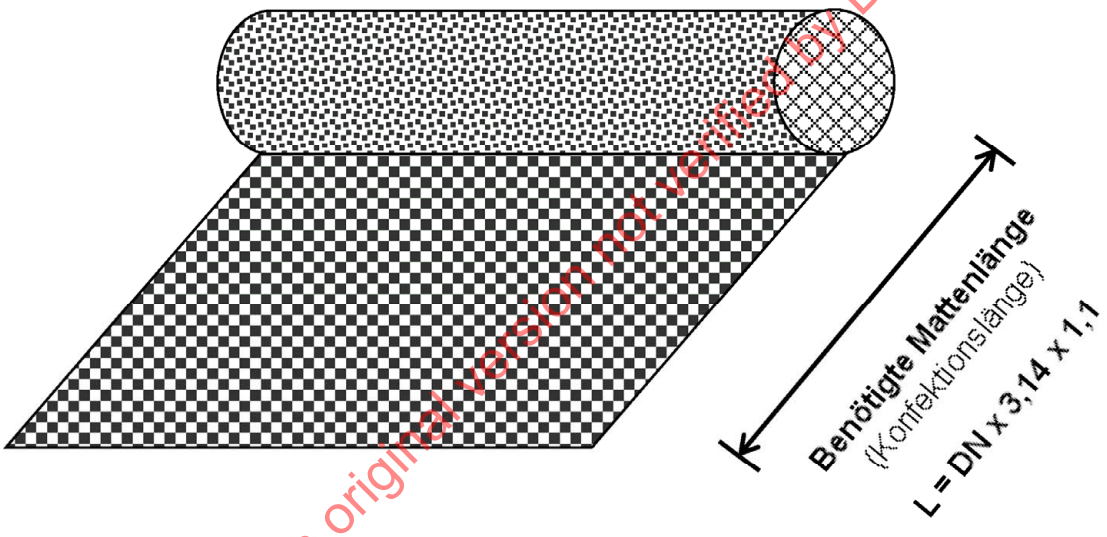
Konudur LM-Gewebe 1400

Glasfasergelegematte – Gelege auf Wirrfaser vernäht

Rollenbreite:	ca. 127 cm
Nominales Flächengewicht:	ca. 1.400 g/m²
Gewebedicke (Stärke):	ca. 1,90 mm

Konfektionslänge in mm = Rohrdurchmesser (DN) x 3,14 x 1,1



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 3
Glasfasergelegematte „Konudur LM-Gewebe 1400“	

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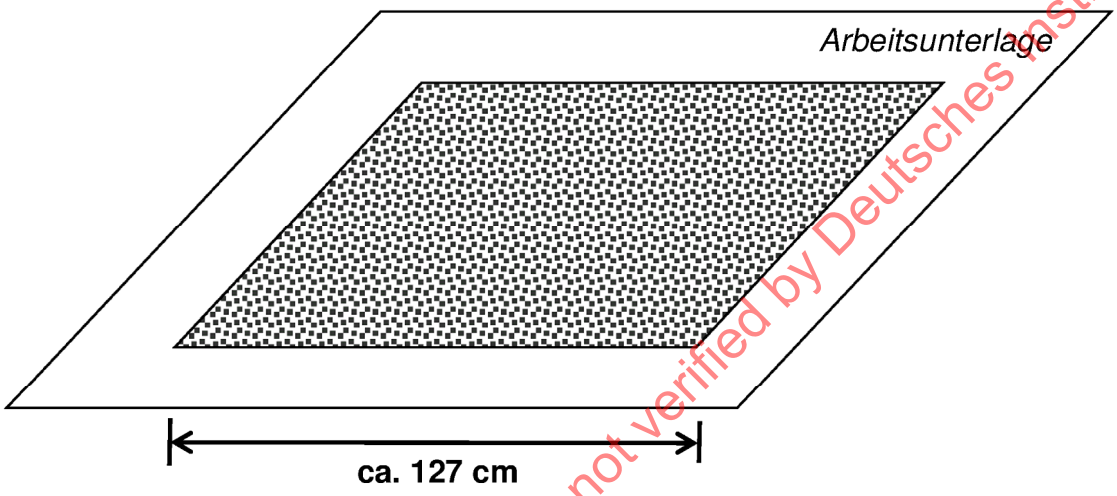
Konudur LM-Gewebe

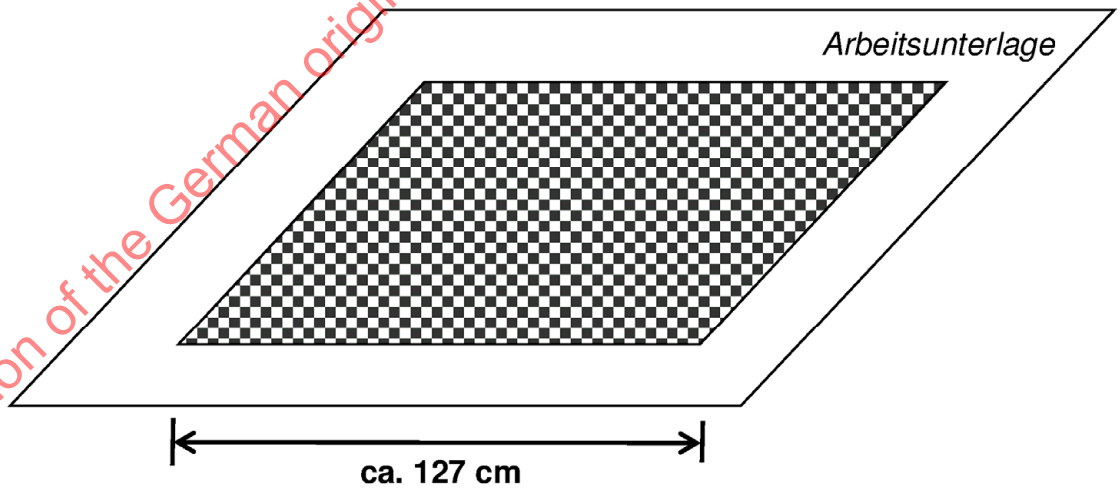
Auf Arbeitsunterlage ausgebreitete Glasfasergelegematte

Zunächst die Glasfasergelegematte auf dem mit Folie bedeckten Untergrund der Länge nach auslegen. Dabei die Glasfasergelegeseite nach oben legen.

Wirrfaserlage – oben



Gelegelage – oben



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 4
Tränken und Falten der Glasfasergelegematten	

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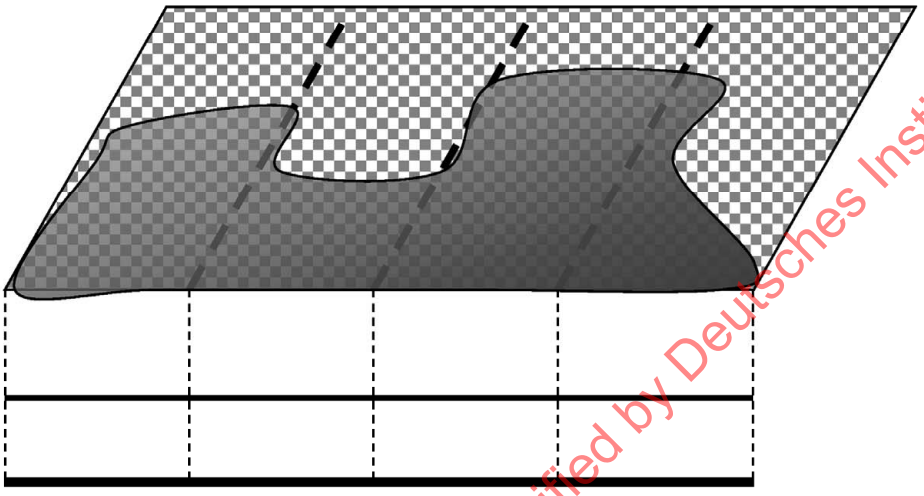
Konudur LM-Gewebe (2-lagig)

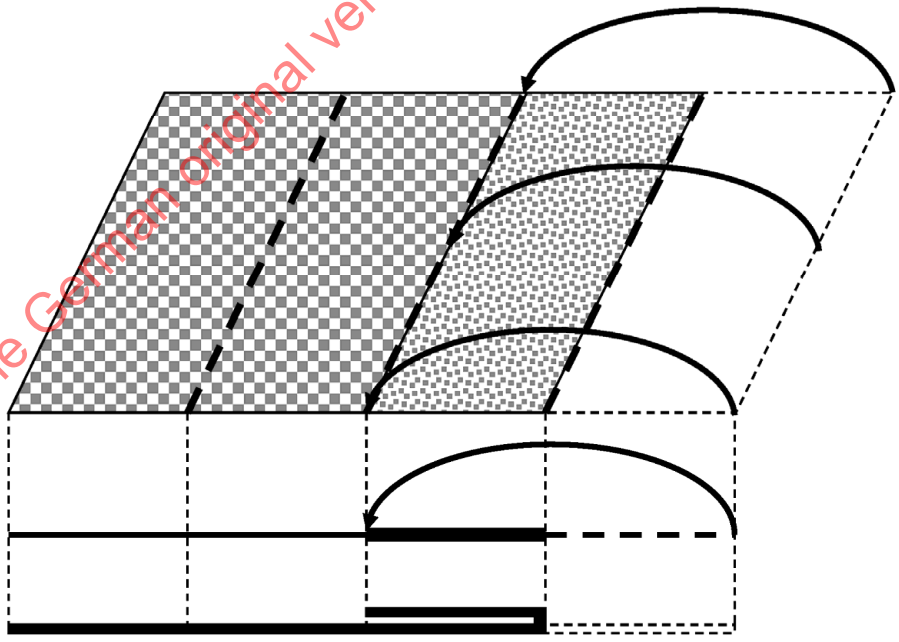
Erste Tränkung der Glasfasergelegematte mit Laminierharz

Die ausgebreitete Glasfasergelegeseite mit Laminierharz tränken.



Erste Faltung der Glasfasergelegematte

Ca. 1/4 der Glasfasergelegematte nach innen falten.



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 5
Tränken und Falten der Glasfasergelegematten: 2-lagiger Aufbau	

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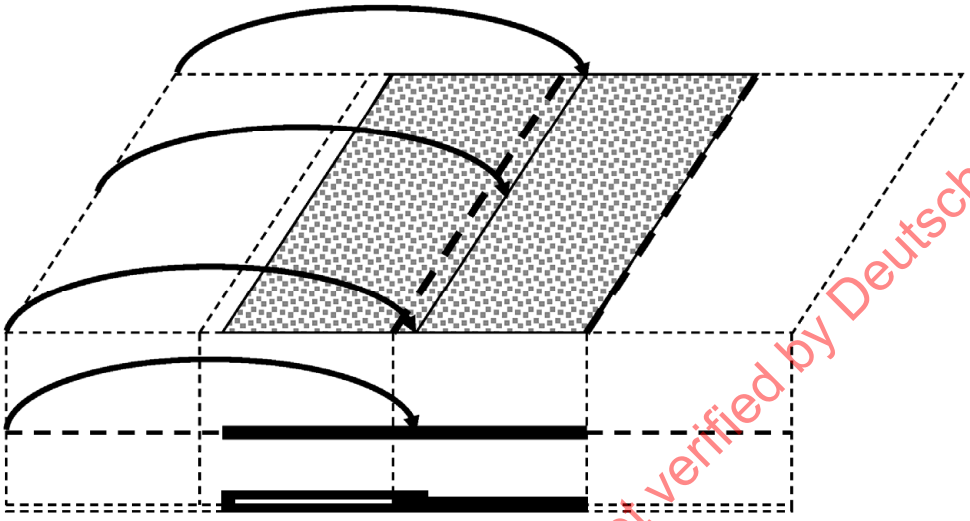
Konudur LM-Gewebe (2-lagig)

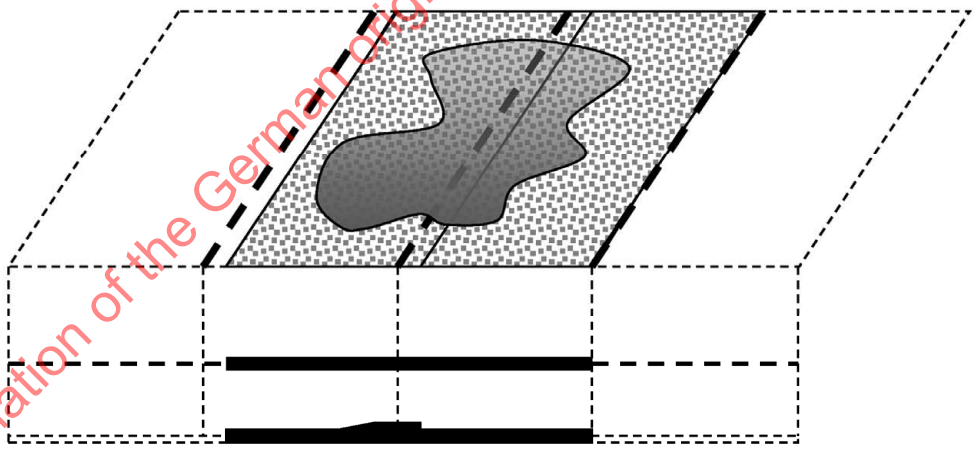
Zweite Faltung der Glasfasergelegematte

Auch die andere Seite um ca. 1/4 nach Innen falten und dabei die Glasfaser-gelegematte ca. 3 cm bis 5 cm überlappen lassen.



Zweite Tränkung der Glasfasergelegematte mit Laminierharz

Die obenliegende Seite vollständig mit Harz tränken.



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 6
Tränken und Falten der Glasfasergelegematten: 2-lagiger Aufbau	

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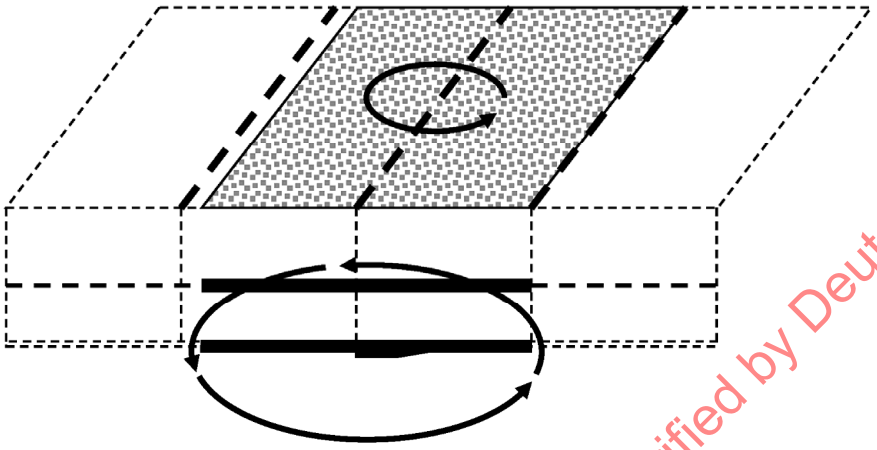
Konudur LM-Gewebe (2-lagig)

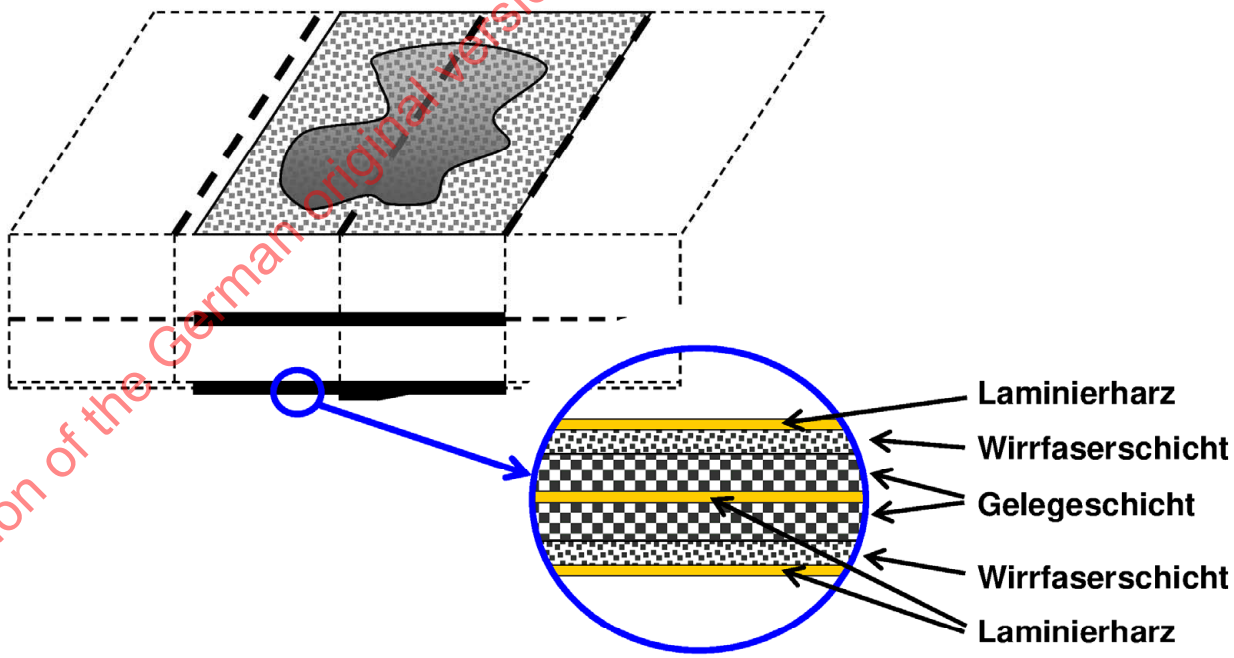
Wenden der gefalteten Glasfasergelegematte

Die gefaltete und mit Laminierharz getränkte Glasfasergelegematte anschließend wenden.



Tränkung der Rückseite der Glasfasergelegematte mit Laminierharz

Die Rückseite auch vollständig mit Laminierharz tränken.



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 7
Tränken und Falten der Glasfaserlegematten: 2-lagiger Aufbau	

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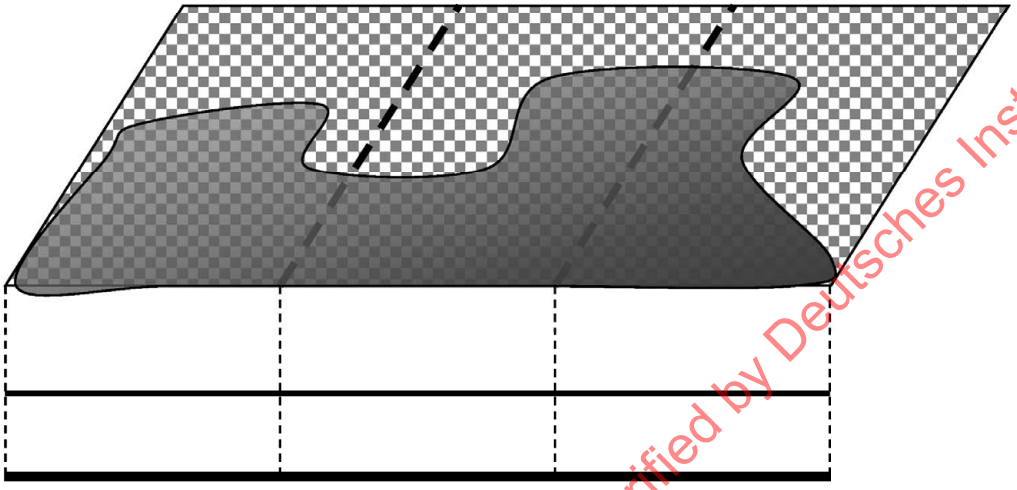
Konudur LM-Gewebe (3-lagig)

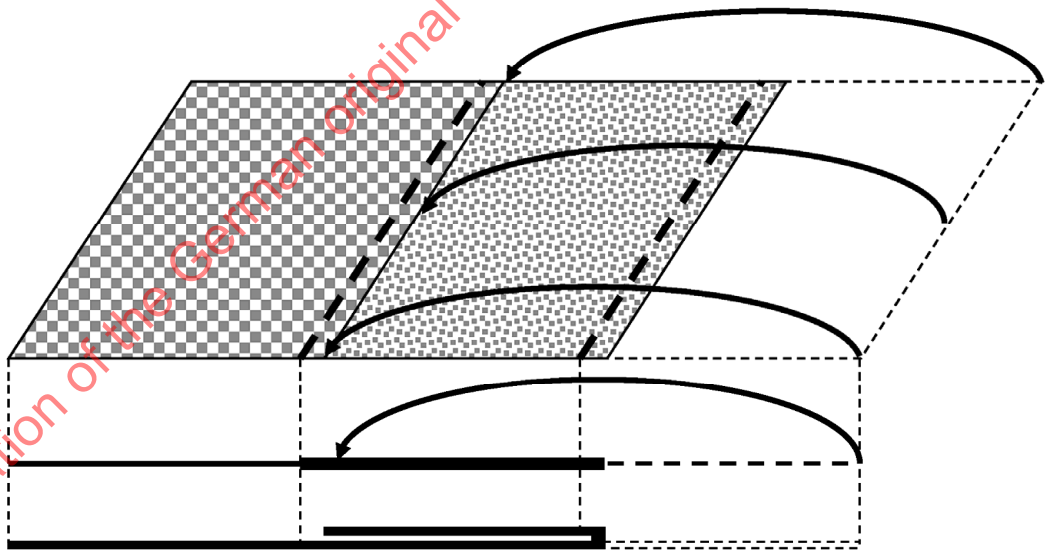
Erste Tränkung der Glasfasergelegematte mit Laminierharz

Die ausgebreitete Glasfasergelegeseite mit Laminierharz tränken.



Erste Faltung der Glasfasergelegematte

Ca. 1/3 der Glasfasergelegematte nach Innen falten und ca. 3 cm bis 5 cm neben dem Drittelpunkt anlegen.



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 8
Tränken und Falten der Glasfasergelegematten: 3-lagiger Aufbau	

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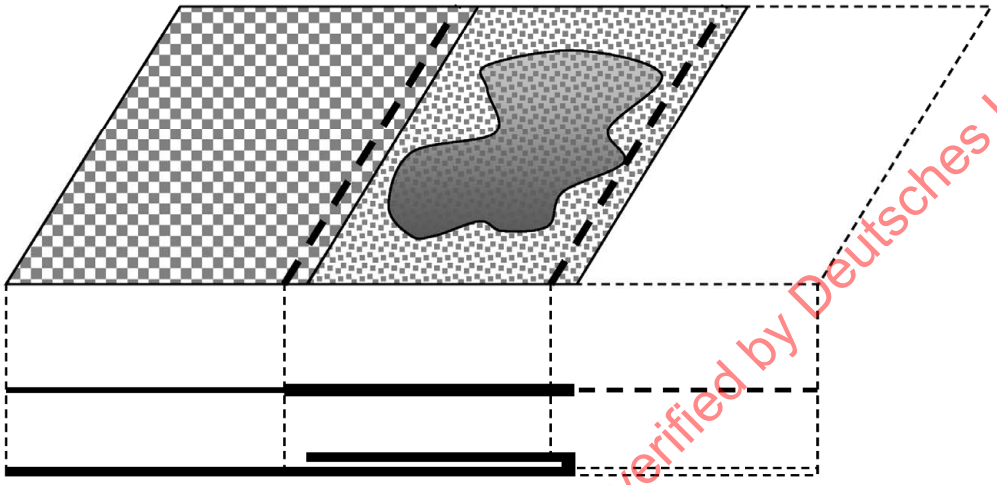
Konudur LM-Gewebe (3-lagig)

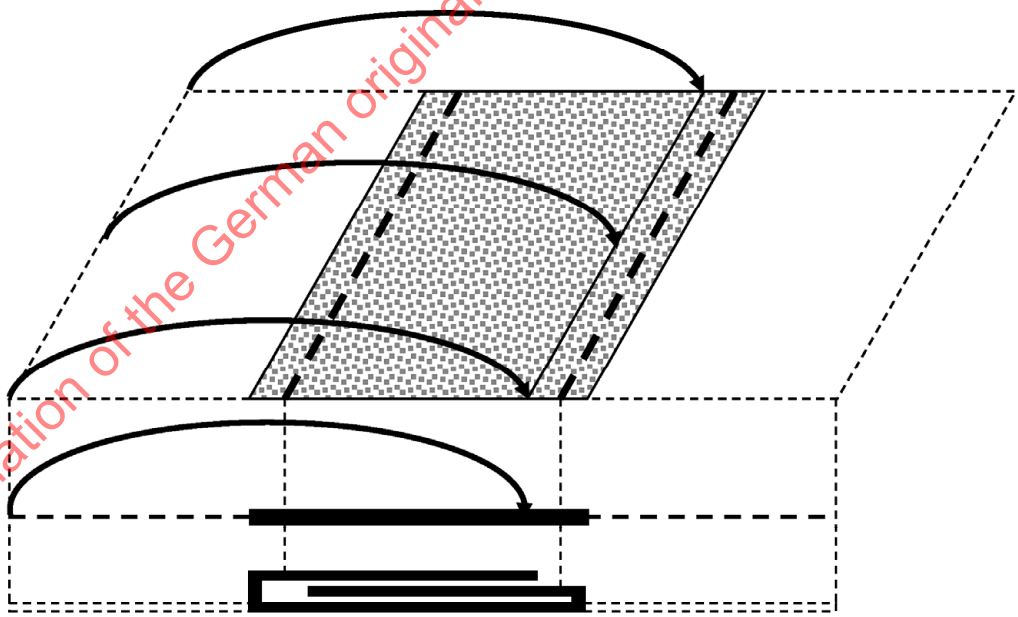
Zweite Tränkung der Glasfasergelegematte mit Laminierharz

Anschließend die gefaltete und nach obenliegende Seite vollständig mit Laminierharz tränken.



Zweite Faltung der Glasfasergelegematte

Auch die zweite Seite um ca. 1/3 nach Innen falten und beim Überlappen einen Randbereich von ca. 3 cm bis 5 cm frei lassen.



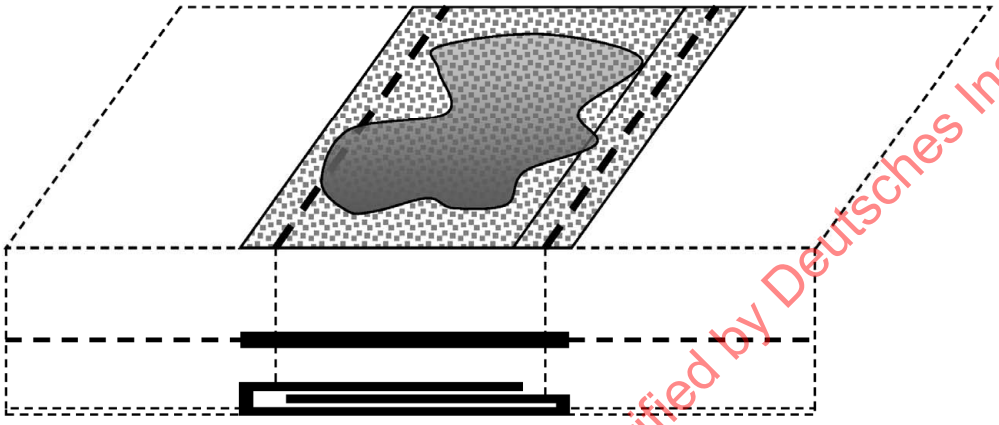
Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 9
Tränken und Falten der Glasfasergelegematten: 3-lagiger Aufbau	

Deutsches Institut für Bautechnik DIBt

Konudur LM-Gewebe (3-lagig)

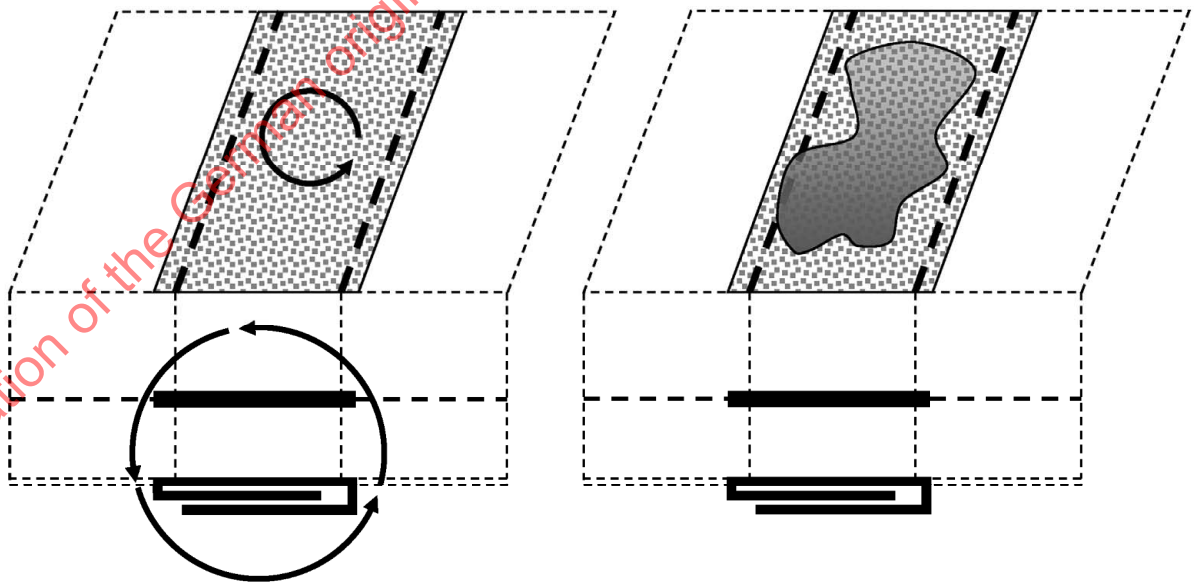
Dritte Tränkung der Glasfasergelegematte mit Laminierharz

Anschließend die gefaltete und nach obenliegende Seite vollständig mit Laminierharz tränken.



Wenden und Tränken der Rückseite der gefalteten Glasfasergelegematte mit Laminierharz

Die gefaltete und mit Laminierharz getränkte Glasfasergelegematte anschließend wenden. Die Rückseite auch vollständig mit Laminierharz tränken.



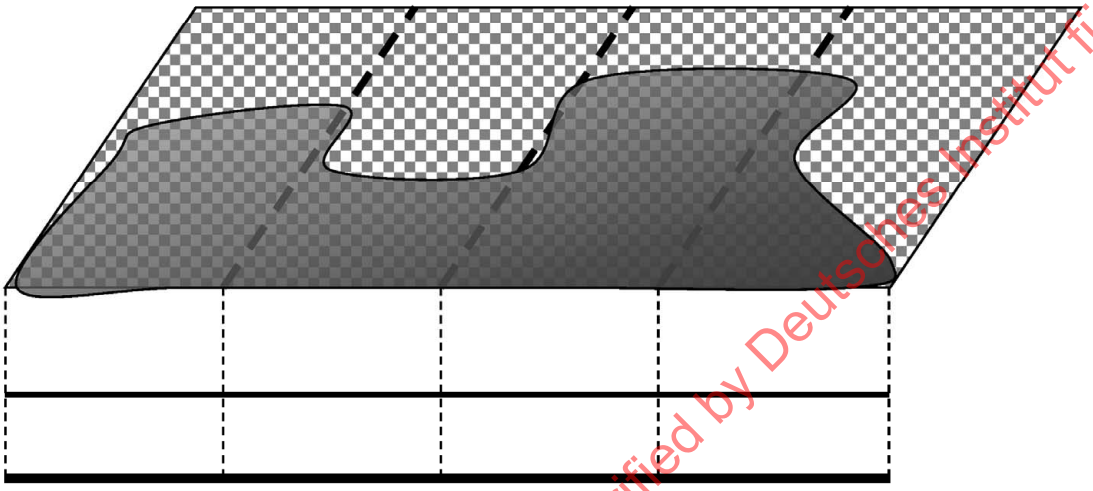
Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 10
Tränken und Falten der Glasfasergelegematten: 3-lagiger Aufbau	

Deutsches Institut für Bautechnik DIBt

Konudur LM-Gewebe (4-lagig)

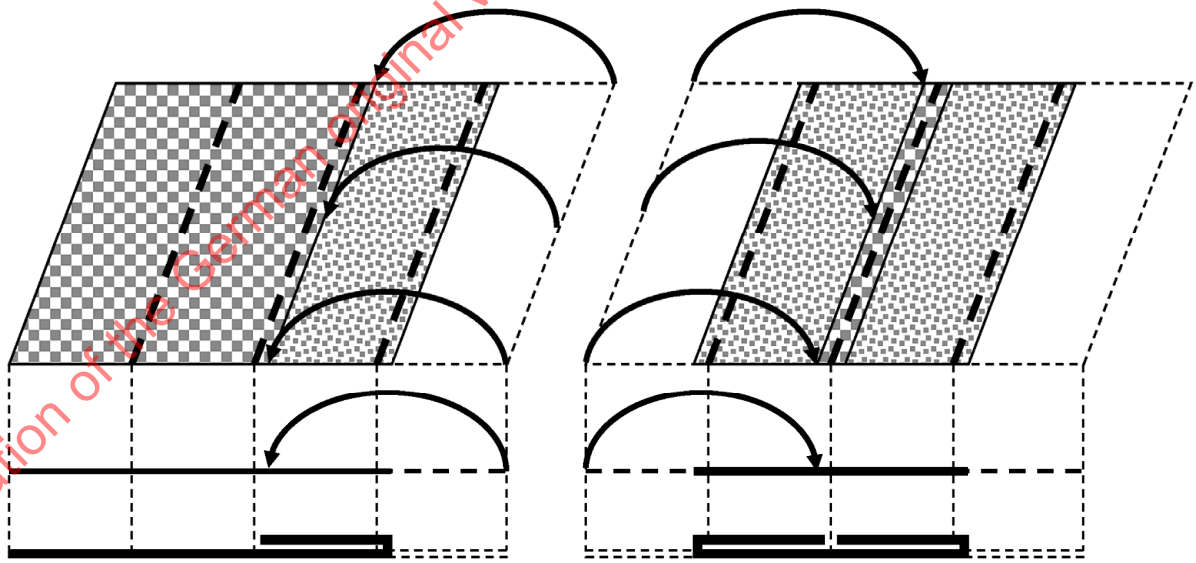
Erste Tränkung der Glasfasergelegematte mit Laminierharz

Die ausgebreitete Glasfasergelegeseite mit Laminierharz tränken.



Erste Faltung der Glasfasergelegematte

Ca. 1/4 der Glasfasergelegematte nach Innen falten und ca. 3 cm bis 5 cm neben dem Mittelpunkt anlegen. Das Gleiche für das andere Viertel der Glasfasergelegematte durchführen.



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 11
Tränken und Falten der Glasfasergelegematten: 4-lagiger Aufbau	

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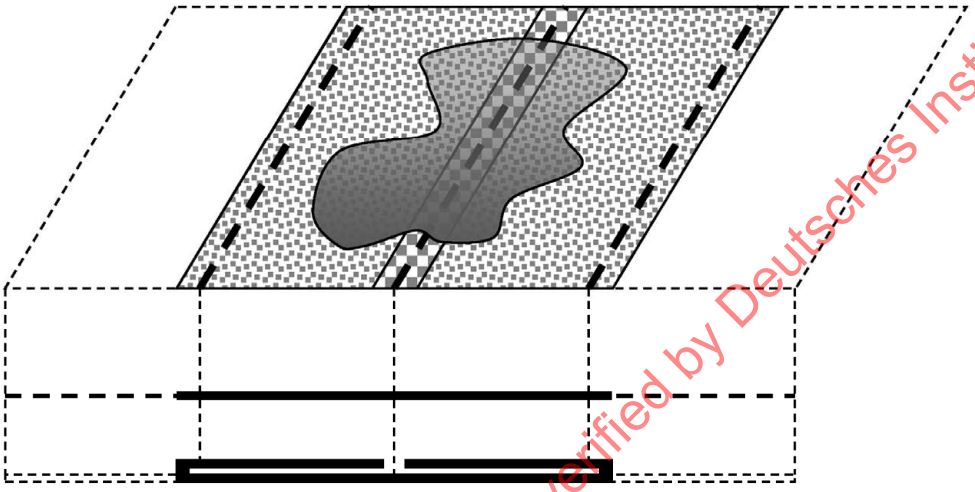
Konudur LM-Gewebe (4-lagig)

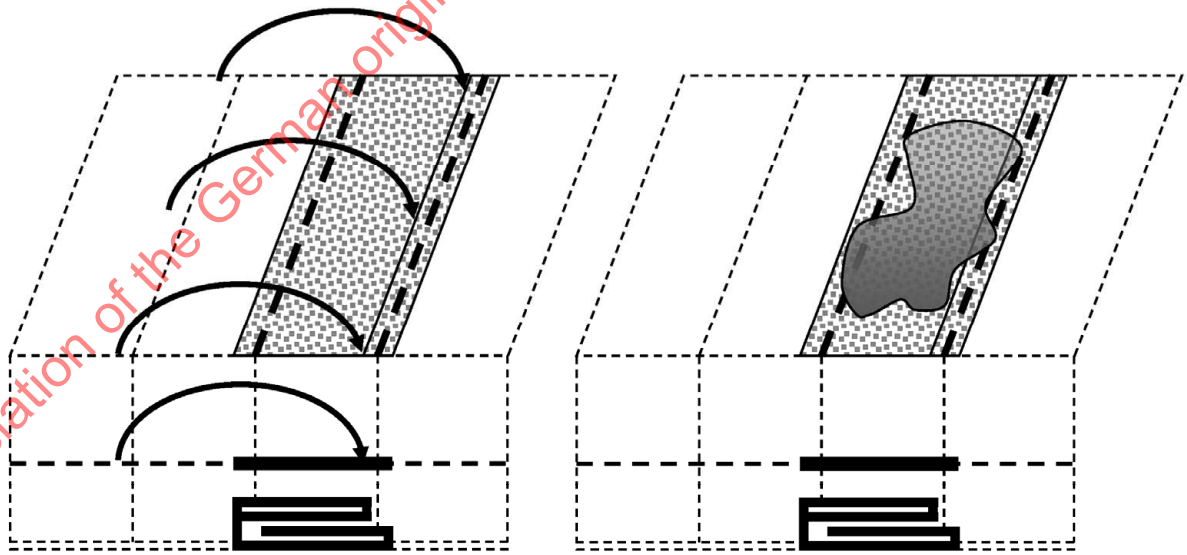
Zweite Tränkung der Glasfasergelegematte mit Laminierharz

Anschließend die gefaltete und nach obenliegende Seite vollständig mit Laminierharz tränken.



Zweite Faltung der Glasfasergelegematte

Die Glasfasergelegematte an einem der Enden der ersten Faltung (ca. 3 cm bis 5 cm neben dem Mittelpunkt) zur Seite umfalten und die obenliegende Fläche mit Laminierharz tränken.



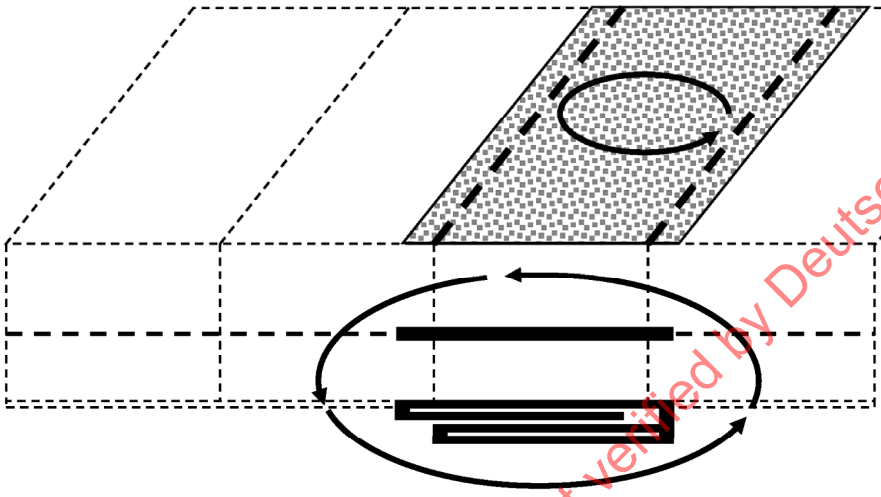
Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 12
Tränken und Falten der Glasfasergelegematten: 4-lagiger Aufbau	

Deutsches Institut für Bautechnik DIBt

Konudur LM-Gewebe (4-lagig)

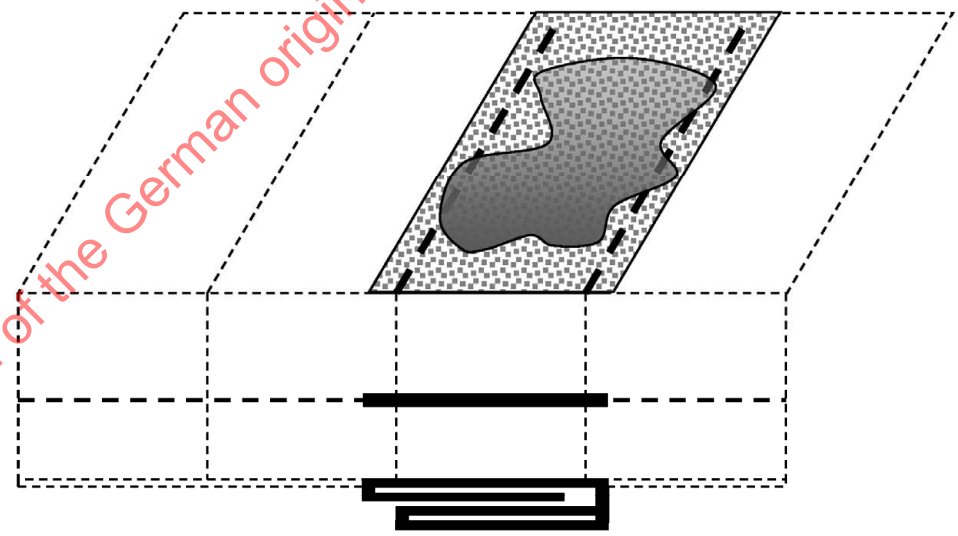
Wenden der gefalteten Glasfasergelegematte

Die gefaltete und mit Laminierharz getränkte Glasfasergelegematte anschließend wenden.



Tränkung der Rückseite der Glasfasergelegematte mit Laminierharz

Die Rückseite auch vollständig mit Laminierharz tränken.



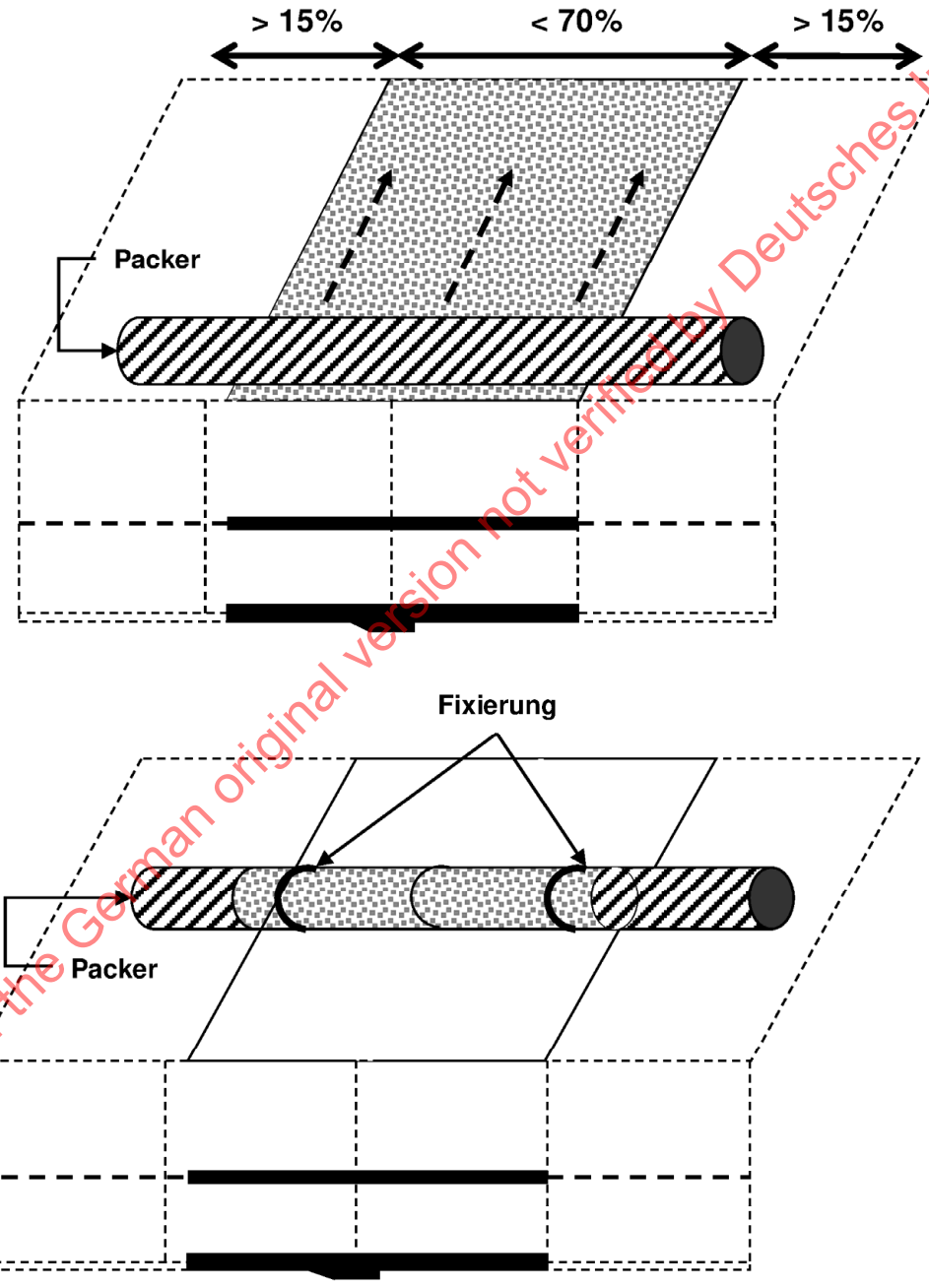
Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 13
Tränken und Falten der Glasfasergelegematten: 4-lagiger Aufbau	

Deutsches Institut für Bautechnik DIBt

Konudur LM-Gewebe

Montage der vorbereiteten Glasfasergelegematte auf den Packer

Das Glasfasergelege auf den mit Schutzfolie versehenen Packer aufwickeln und fixieren.

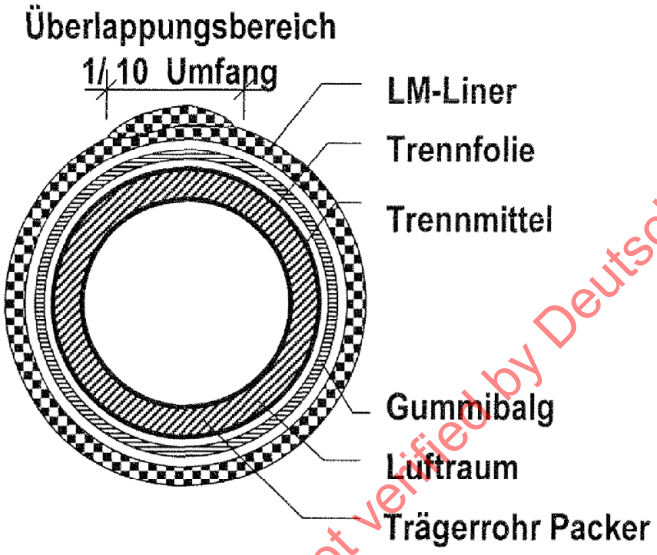


Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 14
Montage der vorbereiteten Glasfasergelegematte auf Packer	

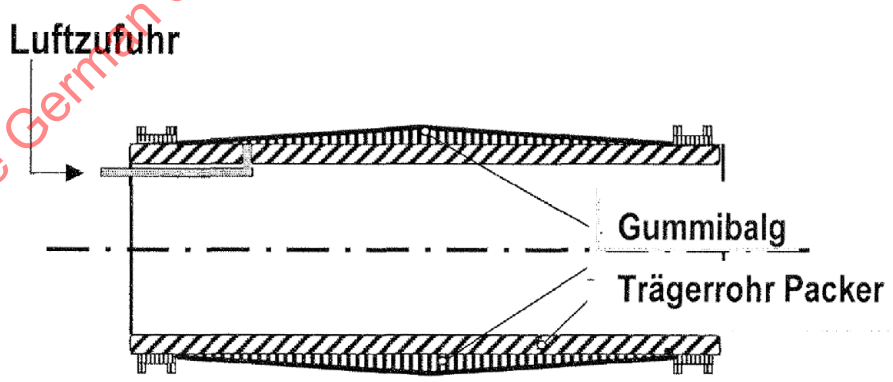
Deutsches Institut für Bautechnik DIBt

Konudur LM-Gewebe

Querschnitt: Packer umwickelt mit vorbereiteter Glasfasergelegematte



Längsschnitt: Packer umwickelt mit vorbereiteter Glasfasergelegematte



Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 15
Mit vorbereiteter Glasfasergelegematte umwickelter Packer	

Mischungsverhältnis, Harz- und Gelegebedarf

	Mischungsverhältnis Volumenteile			
Harz- und Umgebungs temperatur	Komponente A	Komponente B	Topfzeit ca. Minuten	Aushärtezeit ca. Minuten
10°C	1	2	16	120

Tabelle 1: allgemeine Angaben zu Konudur 250 OM-PL Winterharz

Nennweite	Konudur LM-Gewebe 1.080 (Verbrauch ca. 1,6 l / m²)											
	2-lagig				3-lagig				4-lagig			
	Verbrauch Gewebe	Verbrauch Harz			Verbrauch Gewebe	Verbrauch Harz			Verbrauch Gewebe	Verbrauch Harz		
		Mischung	Komp. A	Komp. B		Mischung	Komp. A	Komp. B		Mischung	Komp. A	Komp. B
DN 100	0,69 m²	1,11 l	0,37 l	0,74 l	1,04 m²	1,66 l	0,55 l	1,11 l	1,38 m²	2,21 l	0,74 l	1,47 l
DN 150	1,04 m²	1,66 l	0,55 l	1,11 l	1,56 m²	2,49 l	0,83 l	1,66 l	2,07 m²	3,32 l	1,11 l	2,21 l
DN 200	1,38 m²	2,21 l	0,74 l	1,47 l	2,07 m²	3,32 l	1,11 l	2,21 l	2,76 m²	4,42 l	1,47 l	2,95 l
DN 250	1,73 m²	2,76 l	0,92 l	1,84 l	2,59 m²	4,15 l	1,38 l	2,76 l	3,46 m²	5,53 l	1,84 l	3,69 l
DN 300	2,07 m²	3,32 l	1,11 l	2,21 l	3,11 m²	4,98 l	1,66 l	3,32 l	4,15 m²	6,64 l	2,21 l	4,42 l
DN 350	2,42 m²	3,87 l	1,29 l	2,58 l	3,63 m²	5,81 l	1,94 l	3,87 l	4,84 m²	7,74 l	2,58 l	5,16 l
DN 400	2,76 m²	4,42 l	1,47 l	2,95 l	4,15 m²	6,64 l	2,21 l	4,42 l	5,53 m²	8,85 l	2,95 l	5,90 l
DN 450	3,11 m²	4,98 l	1,66 l	3,32 l	4,67 m²	7,46 l	2,49 l	4,98 l	6,22 m²	9,95 l	3,32 l	6,64 l
DN 500	3,46 m²	5,53 l	1,84 l	3,69 l	5,18 m²	8,29 l	2,76 l	5,53 l	6,91 m²	11,06 l	3,69 l	7,37 l

Tabelle 2: Harz- und Gelegebedarf (Konudur LM-Gewebe 1080) bei einer Sanierungslänge von 1,00 m

Nennweite	Konudur LM-Gewebe 1.400 (Verbrauch ca. 1,9 l / m²)											
	2-lagig				3-lagig				4-lagig			
	Verbrauch Gewebe	Verbrauch Harz			Verbrauch Gewebe	Verbrauch Harz			Verbrauch Gewebe	Verbrauch Harz		
		Mischung	Komp. A	Komp. B		Mischung	Komp. A	Komp. B		Mischung	Komp. A	Komp. B
DN 100	0,69 m²	1,31 l	0,44 l	0,88 l	1,04 m²	1,97 l	0,66 l	1,31 l	1,38 m²	2,63 l	0,88 l	1,75 l
DN 150	1,04 m²	1,97 l	0,66 l	1,31 l	1,56 m²	2,95 l	0,98 l	1,97 l	2,07 m²	3,94 l	1,31 l	2,63 l
DN 200	1,38 m²	2,63 l	0,88 l	1,75 l	2,07 m²	3,94 l	1,31 l	2,63 l	2,76 m²	5,25 l	1,75 l	3,50 l
DN 250	1,73 m²	3,28 l	1,09 l	2,19 l	2,59 m²	4,92 l	1,64 l	3,28 l	3,46 m²	6,57 l	2,19 l	4,38 l
DN 300	2,07 m²	3,94 l	1,31 l	2,63 l	3,11 m²	5,91 l	1,97 l	3,94 l	4,15 m²	7,88 l	2,63 l	5,25 l
DN 350	2,42 m²	4,60 l	1,53 l	3,06 l	3,63 m²	6,89 l	2,30 l	4,60 l	4,84 m²	9,19 l	3,06 l	6,13 l
DN 400	2,76 m²	5,25 l	1,75 l	3,50 l	4,15 m²	7,88 l	2,63 l	5,25 l	5,53 m²	10,51 l	3,50 l	7,00 l
DN 450	3,11 m²	5,91 l	1,97 l	3,94 l	4,67 m²	8,86 l	2,95 l	5,91 l	6,22 m²	11,82 l	3,94 l	7,88 l
DN 500	3,46 m²	6,57 l	2,19 l	4,38 l	5,18 m²	9,85 l	3,28 l	6,57 l	6,91 m²	13,13 l	4,38 l	8,75 l

Tabelle 3: Harz- und Gelegebedarf (Konudur LM-Gewebe 1400) bei einer Sanierungslänge von 1,00 m

Harzverbrauch [Liter] = ***pi*** x (***DN*** / 1000) x ***1,1*** x ***l*** x ***n*** x ***V***

l = Sanierlänge [m] / ***n*** = Anzahl der Lagen [-] / ***V*** = spez. Harzverbrauch des Gewebes [l/m²]
1,1 = 10%ige Sicherheit bzw Überlappung / ***DN*** = Rohrinnendurchmesser [mm]

Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 16
Mischungsverhältnis, Harz- und Gelegebedarf	

Ausführungsprotokoll Konudur LM-Liner je Kurzliner Nr._____

Auftraggeber:	_____	Auftragnehmer:	_____
Ort:	_____	Ort:	_____
Straße:	_____	Straße:	_____
Ansprechpartner:	_____	Ansprechpartner:	_____
Telefon:	_____	Telefon:	_____

Baustelle:

Ort:	_____	Straße:	_____
von Schacht:	_____	nach Schacht:	_____
Haltungs-Nr.:	_____	Material:	_____
Nennweite:	_____	Kurzliner positioniert bei:	_____ m
Videokassette:	_____	Bild-Nr.	_____

Rohrleitung in Betrieb:	☐ ja	☐ nein	Genehmigung erforderlich:	☐ ja	☐ nein
Wasserhaltung erforderlich:	☐ ja	☐ nein	Baustellensicherung erforderlich:	☐ ja	☐ nein
Haltung vorgespült:	☐ ja	☐ nein	Schadstelle fäkalienfrei:	☐ ja	☐ nein
Schadstelle vorbehandelt:	HD-Reinigung ☐		Wettersituation:	☐ trocken	☐ feucht
	mech. Reinigung ☐		Außentemperatur (°C):	_____	
	Fräse ☐		Kanaltemperatur (°C):	_____	

Material geliefert:

Komponente A am:	_____	Komponente B am:	_____
Chargennummer:	_____	Chargennummer:	_____
ECR-Glasfaser am:	_____		

Material vom Anwender geprüft: ☐ ja ☐ nein Auffälligkeiten: ☐ ja ☐ nein

Ausführung:

Erforderliche Gesamtmischmenge: _____ l

Mischungsverhältnis ist: Komp. A: _____ l Komp. B: _____ l

Anfangsdruck Packer: _____ bar

Packerdruck abgesenkt: _____ bar für _____ Stunden

_____
Datum / Unterschrift

Bauprodukte und deren Verwendung zur Ausführung von Kurzlinern mit der Bezeichnung „Konudur LM-Liner“ zur Sanierung schadhafter erdverlegter Abwasserleitungen im Nennweitenbereich von DN 100 bis DN 500	Anlage 17
Ausführungsprotokoll für Konudur LM-Liner	