Deutsches Institut für Bautechnik

DIBt

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

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Z-42.3-565

Geltungsdauer
vom: **13 August 2018**
bis: **13 August 2023**

Antragsteller:
Relining Group International Oy
Artturinkatu 2
20200 TURKU
FINLAND

Gegenstand dieses Bescheides:
Renovation of defective sewage pipes inside buildings in the nominal width range from DN 50 to DN 200 with the coating system called "ElastoFlake".

The above-mentioned subject of regulation is hereby generally approved/approved by the building authorities.
This decision comprises 15 pages and seven annexes.

I GENERAL PROVISIONS

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

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

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

4 Notwithstanding further provisions in the "Special Provisions", copies of this notice shall be made available to the user of the subject matter of the regulation. In addition, the user of the subject matter of the regulation must be informed that this notification 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 Deutsches Institut für Bautechnik. Texts and drawings of advertising material must not contradict this notice, translations must contain the note "Translation of the original German version not checked by Deutsches Institut für Bautechnik".

6 This notice is issued revocably. The provisions may be subsequently supplemented and amended, in particular if new technical findings so require.

7 This notice refers to the information and documents provided by the applicant. Any change in these basic principles is not covered by this notification and must be disclosed to Deutsches Institut für Bautechnik without delay.

8 The general type approval encompassed by this notification shall also be deemed to be the general technical approval for the type.

II SPECIAL PROVISIONS

1 Subject of approval and field of application

This general building authority approval applies to the manufacture and use of the two-component polyurethane resin system with the designation "ElastoFlake" for the rehabilitation of defective wastewater pipes such as wastewater, rainwater downpipes and collection pipes within the building structure according to DIN 1986-100[1] (Annex 1) by means of coating. This notice does not apply to the rehabilitation of ground pipes.

The two-component coating can be used to rehabilitate wastewater pipes with circular cross-sections in nominal widths from DN 50 to DN 200 made of concrete, reinforced concrete, stone, cast iron (SML pipes), asbestos-free fibre cement, GRP, PP, PE and PVC. The two-component coating is suitable for the rehabilitation of damage with dimensions of up to 10 mm such as flaws, radial and longitudinal cracks, corrosion, mechanical wear and leaks as well as their combinations.

Damaged wastewater pipes are rehabilitated with the "ElastoFlake" system by applying at least four to eight layers of the polyurethane resin system to the inside of the pipe using an endoscopic procedure, depending on the pipe cross-section, with a spray/spinner nozzle and/or brush. The polyurethane resin system cures after application under ambient temperatures and forms a self-supporting pipe system with wall thicknesses of at least 2 mm to 4 mm after curing.

As a rule, the vertical downpipes from the roof are renovated via the ventilation pipe and the connection pipes via the connections of the sanitary objects.

The polyurethane resin system meets the requirements for normally flammable building materials of European class E according to DIN EN 13501-1[2] or building material class B2 according to DIN 4102-1[3] .

Wastewater pipes with pipe bulkheads that foam up in the event of a fire (e.g. pipe sleeves) must not be renovated. These must be left out of the renovation and checked afterwards.

This approval applies to the renovation of wastewater pipes intended to discharge wastewater in accordance with DIN 1986-3 .[4]

2 Provisions for the construction products

2.1 Properties and composition

2.1.1 Components of the resin system

The two-component polyurethane resin system must comply with the formulation details deposited with Deutsches Institut für Bautechnik. The resin system must comply with the IR spectra deposited with Deutsches Institut für Bautechnik. The IR spectra shall also be deposited with the third party inspection body.

[1] DIN 1986-100Drainage systems for buildings and sites - Part 100: Provisions in In conjunction with DIN EN 752 and DIN EN 12056; Issue:2016-12

[2] DIN EN 13501-1Classification of construction products and types of construction with respect to their reaction to fire - Part 1: Classification using the results of reaction to fire tests for construction products; German version EN 13501-1:2007+A1:2009; Publication:2010-01

[3] DIN 4102-1Brandverhalten von Baustoffen und Bauteilen - Part 1: Baustoffe; Begriffe, Anforder- and testing; Issue: 1998-05 in conjunction with Corrigendum 1; Issue:1998-08

[4] DIN 1986-3Drainage systems for buildings and sites - Part 3: Rules for operation and maintenance; Edition:2004-11

The polyurethane resin has the following properties:

1) Component A (resin)
   - Density at +23 °C following DIN EN ISO 1183-1[5] : ≈ 1.40 g/cm³ ±10%.
   - Viscosity according to DIN EN ISO 3219[6] with shear rate-time 10 s/-1 at +20 °C :≈ 6,100 mPa x s ±10%.
   - colour: white
2) Component B (isocyanate)
   - Density at +23 °C following DIN EN ISO 1183-1[5] : ≈ 1.25 g/cm³ ±10%.
   - Viscosity according to DIN EN ISO 3219[6] with shear rate-time 10 s/-1 at +20 °C :≈ 1,150 mPa x s ±10%.
   - colour: brown
3) Pot life and mixing ratio A:B
   - Pot life according to DIN EN 14022[7] at a starting temperature of +25 °C and a final temperature of +50 °C 200 g resin mixture in a 300 ml beaker (gel time): ≈ 67 seconds
   - Mixing ratio component A:B: 100:29

2.1.2 Environmental compatibility

There are no objections to the use of the building product "ElastoFlake" within the building structure, in accordance with the formulation data deposited with the Deutsches Institut für Bautechnik. The renovation of underground pipes is not permitted.

2.2 Production, packaging, transport, storage and labelling

2.2.1 Production

The supplier of the polyurethane resin (component A) and the isocyanate (component B) must confirm the properties listed in section 2.1.1 under items 1), 2) and 3) for each delivery by submitting factory certificates 2.2 in accordance with DIN EN 10204 .[8]

The following properties of the individual components A and B must be checked during the incoming goods inspection:

- Density
- Viscosity

In addition, a reserve sample of the resin to be mixed from components A and B must be prepared for each batch as part of the incoming inspection. Compliance with the properties according to section 3.1.2.3 under point 1) density shall be checked on this sample.

[5] DIN EN ISO 1183-1Plastics - Method for the determination of the density of non-foamed plastics Plastics- Part 1: Immersion method, liquid pycnometer method and titration method (ISO 1183-1:2012); German version EN ISO 1183-1:2012, Publication:2013-04

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

[7] DIN EN 14022Structural adhesives - Determination of the pot life (working time) of multi-purpose adhesives component adhesives; German version EN 14022:2010; Ausgabe:2010-06

[8] DIN EN 10204Metallic products - Types of inspection certificates; German version EN 10204:2004; Issue:2005-01

2.2.2 Packaging, transport, storage

The components for the resin coating delivered by the pre-supplier on the respective construction site shall be stored in suitable, separate, airtight containers on the applicant's premises until further use. The applicant shall ensure that the containers of components A and B are stored on his premises in such a way that they are not damaged. The resin components A and B shall be stored at the applicant's premises in suitable containers at a storage temperature of between ±10 °C and +28 °C. The storage time of the components is approx. 6 months after manufacture. The container for component A must be turned over every 2 weeks so that the additives or fillers do not precipitate or settle on the bottom of the container.

If the resin components are filled at the applicant's plant, this may only be done in transport containers suitable for this purpose (e.g. in plastic canisters). Care must be taken that component B (isocyanate) is not filled into moist containers. Filling may only take place in dry, clean and grease-free containers. If these containers are stored by the users of the process, the storage temperature must also be maintained. Transport and storage must be carried out in such a way that the usability of the components is not impaired.

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

2.2.3 Labelling

The transport containers of resin components A and B must be marked with the mark of conformity (Ü mark) according to the conformity mark regulations of the federal states, including the approval number Z-42.3-565. The marking may only be carried out if the requirements according to section 2.3 Confirmation of conformity are fulfilled.

The manufacturer shall indicate the hazard symbols and H and P phrases on the containers, on the packaging, on the instruction leaflet or in the delivery note in accordance with the Ordinance on Hazardous Substances and the EU Regulation No. 1907/2006 (REACH) as well as the respective current version of the CLP Regulation (EC) 1272/2008[9] . The packagings must be labelled in accordance with the rules of the ADR[10] in the respective applicable versions.

In addition, the transport containers for the resin components must be marked with at least the following:

- Component designation A (polyurethane resin) and B (isocyanate)
- Temperature range for processing ±15 °C to +40 °C
- Storage temperature range ±10 °C to +28 °C
- Container content (volume or weight)
- Batch number

2.3 Confirmation of conformity

2.3.1 General

The confirmation of conformity of the pipe liner and the connecting sleeve (construction products) with the provisions of this general building approval shall be provided for each manufacturing plant with a manufacturer's declaration of conformity on the basis of a factory production control and a certificate of conformity of a certification body recognised for this purpose as well as regular external surveillance.

[9] 1272/2008Regulation (EC) No 1272/2008 on Classification, Labelling and Prescribi Packaging of substances and mixtures

[10] ADREuropean Agreement concerning the International Carriage of Dangerous Goods by Road (*Accord européen relatif au transport international des marchandises Dangereuses par Route)*

by a recognised inspection body including an initial inspection of the construction products in accordance with the following provisions.

For the issuing of the certificate of conformity and the external surveillance including the product tests to be carried out, the manufacturer of the construction products shall involve a certification body recognised for this purpose as well as a surveillance body recognised for this purpose.

The manufacturer shall submit the declaration of conformity by marking the construction products with the mark of conformity (Ü mark) with reference to the intended use.

The certification body shall provide the Deutsches Institut für Bautechnik with a copy of the certificate of conformity issued by it.

The Deutsches Institut für Bautechnik shall also be provided with a copy of the initial inspection report.

2.3.2 In-house production control

In each manufacturing plant (plants of the applicant) a factory production control shall be established and implemented. Factory production control means the continuous surveillance of production to be carried out by the manufacturer to ensure that the construction products manufactured by him conform to the provisions of this general technical approval.

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

- Description and verification of the source material

  For each delivery of components A resin and B isocyanate, the applicant shall satisfy himself that the required properties according to section 2.1.1 are met.

  For this purpose, the applicant shall have the respective supplier of the raw materials of the resin components submit the corresponding factory certificates 2.2 in accordance with DIN EN 10204 .[8]

  Within the scope of the incoming goods inspection, the properties mentioned in section 2.1.1 (resin system) must also be randomly checked.

  Furthermore, the pot life according to section 2.1.1 point 3) as well as the density and bending stress in section 3.1.2.3 of the ready-to-use resin mixture shall be checked on at least three test specimens.

  The shrinkage according to section 3.1.2.3 shall be tested in accordance with ISO 2577[11] on at least three test specimens per batch or according to DIN 16946-1[12] by determining the mass loss. The test in accordance with ISO 2577[11] shall be carried out on test specimens after conditioning for 24 hours at +23 °C. The use of a demountable metal mould is recommended for the production of the test specimens.

- Checks and tests to be carried out during manufacture: The requirements according to section 2.2.1 shall be checked.

- Checking the containers:

  For each batch of resin, the requirements for labelling according to section 2.2.3 shall be checked.

[11] ISO 2577Plastics - Thermosetting moulding plastics - Determination of shrinkage; Edition:2007-12

[12] DIN 16946-1 Reactive resin moulding materials; casting resin moulding materials; test methods; Ausgabe:1989-03

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

- Designation of the construction products or the basic product and the components,
- Type of control or audit,
- Date of manufacture and testing of the construction products or of the basic materials or of the constituents,
- Result of the checks 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 submitted to the inspection body responsible for third-party inspection. They shall be submitted to Deutsches Institut für Bautechnik and the competent supreme building supervisory authority upon request.
If the test result is unsatisfactory, the manufacturer shall immediately take the necessary measures to remedy the defect. Construction products that do not comply with the requirements shall be handled in such a way that confusion with matching products is excluded. After the defect has been remedied, the test in question must be repeated without delay, insofar as this is technically possible and necessary to prove that the defect has been remedied.

2.3.3 External monitoring

In each manufacturing plant (plants of the applicant), the factory production control shall be inspected regularly by an external inspection, however, at least once every six months. Retention samples shall be taken from the materials at least once every six months and shall be kept until the next external inspection.

An initial test of the construction products must be carried out as part of the external surveillance. The factory production control shall be checked by means of random tests within the scope of the external surveillance. The requirements of sections 2.1.1, 3.1.2.3, 3.1.2.4 and 2.2.3 shall be checked.

In addition, the requirements for manufacture according to section 2.2.1 shall be randomly checked. This also includes checking the curing behaviour, bending properties according to section 3.1.2.3, DMA analysis according to section 3.1.2.4 as well as the density of components A and B and the pot life according to section 2.1.1 as well as the IR spectroscopies.

Sampling and testing are the responsibility of the recognised inspection body. During the external inspection, the factory certificates 2.1 and the factory tools 2.2 must also be checked in accordance with DIN EN 10204 .[14]

The results of certification and external surveillance shall be kept for at least five years. They shall be submitted by the certification body or the inspection body to Deutsches Institut für Bautechnik and the competent supreme building supervisory authority upon request.

3 Provisions for the application of the subject of the authorisation

3.1 Planning and dimensioning

3.1.1 Planning

To determine whether the damage to the wastewater system can be remediated with the "ElastoFlake coating", an inspection must be carried out in accordance with DIN EN 1986-3[4] . The details of the necessary pipe data must be checked and documented, e.g. pipe material, routing and length, deflections and nominal widths, location of the ventilation pipes above the roof as well as the cleaning openings, hydraulic conditions, already

repair measures carried out and the identification of connections that are no longer required.

Existing video recordings must be evaluated in relation to the application. The accuracy of the information must be checked on site. An evaluation of the condition of the existing wastewater pipe with regard to the applicability of the "ElastoFlake" coating for renovation must be carried out.

In particular, the pipe sections to be renovated must be evaluated in each individual case with regard to the fire protection requirements.

Fire protection devices (pipe bulkheads) that are installed for bulkheading must be left out before coating during renovation. The provisions of the guideline on fire protection requirements for piping systems of the respective federal states must be taken into account.

The hydraulic efficiency of the wastewater pipes must not be impaired. Proof of this must be provided if necessary.

Ground pipes and damage larger than 10 mm must not be renovated with this coating.

3.1.2 Dimensioning

3.1.2.1 Wall thicknesses

The wall thicknesses for this renovation measure are 2 mm to 4 mm due to the system.

3.1.2.2 Fire behaviour

The two-component polyurethane resin system meets the requirements for normally flammable building materials and is assigned to European class E according to DIN EN 13501-1[2] or building material class B2 according to DIN 4102-1 .[3]

3.1.2.3 Properties of the cured resin system

The cured two-component polyurethane resin system has the following properties after curing:

Properties of the cured polyurethane resin

- Density according to DIN EN ISO 1183-1[5] : ≈ 1.36 g/cm³
- Short-time bending modulus of elasticity based on DIN EN ISO 178[13] : ≥ 840 N/mm²
- Bending stress σ_{fB} following DIN EN ISO 178[13] : ≥ 19.5 N/mm²
- Short-time flexural modulus of elasticity following DIN EN ISO 178[13] at +95 °C: ≈ 197 N/mm²
- Bending stress σ_{fB} following DIN EN ISO 178[13] at +95 °C: ≈ 7.7 N/mm²
- Tensile modulus of elasticity according to DIN EN ISO 527-2[14] : ≈ 875 N/mm²
- Tensile strength following DIN EN ISO 527-2[14] : ≈ 17.6 N/mm²
- Elongation at break following DIN EN ISO 527-2[14] : ≈ 14,5 %
- Shrinkage measurement based on ISO 2577[11] : < 0,12 %
- Compressive stress following DIN EN ISO 604[15] : ≈ 37.8 N/mm²
- Compressive stress following DIN EN ISO 604[15] at +95 °C: ≈ 19.6 N/mm²

[13] DIN EN ISO 178Plastics - Determination of flexural properties (ISO 178:2001 + Amd.1:2004); German version EN ISO 178:2003 + A1:2005; Publication:2006-04

[14] DIN EN ISO 527-2Plastics - Determination of tensile properties - Part 2: Test conditions for Moulding and extrusion compounds (ISO 527-2:1993 including Cor.1:1994); German version EN ISO 527-2:1996; Ausgabe:1996-07

[15] DIN EN ISO 604Plastics - Determination of compressive properties (ISO 604:2002); German Version EN ISO 604:2003; Issue:2003-12

- Heat distortion temperature according to DIN EN ISO 75-2[16] :≈ 48 °C
- Curing time: approx. 2.5 minutes

3.1.2.4 Properties of the cured resin composite based on dynamic mechanical analysis (DMA analysis)

DMA analysis according to ISO 6721-5[17] according to section 3.2.10.1 (alternative) for the determination of the flexural modulus.

3.2 Version

3.2.1 General

Damaged sewage pipes are rehabilitated with the "ElastoFlake method" by applying four to eight layers of the two-component polyurethane resin system to the inside of the pipe in a combined spraying and spinning process, depending on the pipe cross-section. The two-component polyurethane resin system cures after application at ambient temperatures and forms a self-supporting pipe system with wall thicknesses of approx. 2 mm to 4 mm after curing.

Sewage pipes with pipe bulkheads that foam up in the event of a fire (e.g. pipe sleeves) must not be renovated. These must be left out of the renovation and checked afterwards.

The applicant shall prepare a procedure manual with a description of the individual instructions and steps related to the type of remediation procedure. The applicant shall also ensure that the persons carrying out the remediation are adequately familiarised with the procedure.

The remediation measures may only be carried out by employees/users who have been thoroughly familiarised with the remediation procedure. This includes training measures by the applicant. It must also be ensured that the user has familiarised himself with the procedure manual, the operating instructions, the safety and technical data sheets of the resin system and has acquired the a s s o c i a t e d knowledge.

Before starting the rehabilitation measure, all affected pipe sections must be taken out of service. Before processing the components, make sure that the components, the sewage pipe system and its surroundings are at the processing temperatures of ±15 °C to +40 °C specified by the manufacturer.

The method can be used to rehabilitate pipes with nominal diameters of DN 50 to DN 200 as well as floor drainage systems.

In the following structural conditions, among others, the execution of the "ElastoFlake" method is possible:

a) Rehabilitation of the vertical downpipe,
b) Rehabilitation of the manifolds and
c) Rehabilitation of the connection pipes.

Access openings can be ventilation ducts, inspection and cleaning openings, floor drainage and sanitary objects. The prerequisite is that the size of the access openings is sufficient to insert the spray or centring head.

Dimensional changes, deflections and distortions up to 90 degrees can be rehabilitated.

[16] DIN EN ISO 75-2Plastics - Determination of heat deflection temperature - Part 2: Plastics - Part 2: Plastics - Part 2: Plastics - Part 2: Plastics - Part 2: Plastics - Part 3: Plastics materials and hard rubber (ISO 75-2:2013); German version EN ISO 75-2:2013; Publication:2013-08

[17] ISO 6721-5Plastics - Determination of dynamic mechanical properties - Part 5: Flexural properties Vibration - Forced vibration; Ausgabe:1996-05 mit Änderung 1; Aus- gabe:2007-02

The steps required to carry out the procedure shall be recorded using record sheets (e.g. Appendix 7) for each remediation.

The relevant accident prevention regulations must be observed during the preparation and execution of the remediation procedure.

3.2.2 Equipment and facilities

The following equipment, components and facilities are required for the "ElastoFlake" process.

- Devices for visual inspection
- Cleaning devices for small to medium nominal diameters (abrasive-sensitive pipe materials are to be cleaned using appropriately soft attachments such as brushes and sponges or a high-pressure rinse (Annex 4).
- Cleaning agents, cleaning brushes, cleaning chains Water hose (Annex 4)
- Shaft drive and centrifugal nozzle (annex 6)
- Spray head and accessories, flushing nozzles
- Delivery hoses, centring rings, rotary motor for driving the spray head and brush attachments for smoothing the surface
- Pneumatic bladders for shutting off
- Weather-protected workplace, devices and equipment for mixing the resin system
- Resin component A and B "ElastoFlake
- ElastoTec" machine Model L (Appendix 2) or Model M (Appendix 3) incl. two-component pump
- Power supply
- Blower (fan), fan heater and water vacuum cleaner (Annex 5)
- Packer, air hose and pump
- Mixer
- Winches for larger nominal diameters
- personal safety equipment
- Hose camera
- Hand tools
- Drilling machine
- Small parts such as screws, wires
- Social and sanitary rooms, if applicable

If electrical devices, e.g. video cameras (or so-called remote sewer eyes) are inserted into the pipe to be rehabilitated, then these must be designed in accordance with the VDE regulations.

3.2.3 Capture the necessary line data

Before starting the work, the necessary pipe data must be recorded using an inspection camera in accordance with section 3.1.1.

3.2.4 Preparation and cleaning of the pipeline system

Since the traps or entire sanitary objects are dismantled during the renovation and no odours or germs are allowed to enter the living space, the extraction system (blower/fan) is to be installed and put into operation at the corresponding ventilation openings above the roof according to Annex 1. The working area must be covered with the appropriate cover.

material must be protected from contamination. It must be ensured that no waste water can enter the waste water system to be rehabilitated during the rehabilitation work.

Afterwards, the pipes and floor drainage systems to be rehabilitated are to be flushed with warm water. Whether this cleaning is sufficient for the application of the rehabilitation procedure is to be checked and evaluated by inspection with the camera. Depending on the existing wastewater pipes (material, degree of contamination or corrosion), the tool selection for further cleaning with a chain spinner head (not for plastic pipes), if necessary, is to be made in accordance with Appendix 4. For the cleaning of plastic pipes, abrasive pads or wire brushes shall be used. The cleaning results shall be checked with the aid of the camera. The cleaning shall be repeated until the inner surface of the waste water pipes is free from loose and separating parts (surface solid), oils, greases and faecal residues.

Subsequently, the wastewater pipes to be rehabilitated are to be dried, if necessary, by setting up a heating air blower in accordance with Annex 5. The duration of drying depends on various parameters (nominal diameters, material, horizontal or vertical position, humidity) and usually takes about 30 minutes. The drying phase can be shortened by installing additional fan heaters in the accommodation units (Annex 5).

The actual condition is to be recorded for documentation following cleaning and drying using a camera with video recording. Holes and cracks that were not visible before cleaning due to deposits and incrustations m u s t be documented and recorded on video.

3.2.5 Closing holes

The "ElastoFlake" system is not intended for closing large-area holes from approx. 10 mm.

For the sealing of holes larger than 10 mm, other repair or renovation methods can be used for which general building inspectorate approvals are valid.

3.2.6 Application of the "ElastoFlake" procedures

Before applying the resin, the expiry dates and batch numbers of the consumables must be checked; these must be recorded by the person responsible for the remediation. After the remediation, a reserve sample must be taken at a suitable location. If it is not possible to take a sample in accordance with section 3.2.7, it should be possible to take a reserve sample by making an excess length. The amount of resin, the resin mixture, the resin temperature and the curing behaviour must be recorded.

The resin mixture must be applied by persons who are sufficiently familiar with the coating process. The work safety equipment in accordance with the processing instructions must be worn.

The fan and, if applicable, the fan heater of the cleaning must be switched off.

The process components, consisting of the resin component A and the isocyanate component B, must comply with the processing temperatures specified by the manufacturer of
±15 °C to +40 °C; this must also be recorded. The two components of polyurethane resin A and B shall be mixed automatically in the "ElastoTec" machine Model L (appendix 2) or Model M (appendix 3).

To apply the first internal coating, the polyurethane resin must be fed through the two-component pump and the hoses connected to it to the spray/spin nozzle or the brush. The resin can be applied by the spray/spin method and/or by the brush method (Appendix 6). The mixing ratio must correspond to the ratio mentioned in section 2.1.1 under point 3). The spray/spin nozzle or brush shall be inserted to the end of the pipe to be rehabilitated. Then the shaft drive must be switched on, which will

Rotate the spray/spray nozzle or brush. Then switch on the two-component pump. Then pull out the hose evenly according to Annex 6; the respective nominal width to be rehabilitated and the pulling speed determine the layer thickness; this should be approx. 1.0 mm.

The pull speed of the spray/spray nozzle or brush is approx.1 m per minute.

The spray/spray nozzle or brush must be guided centrally in the pipe by a spacer (centring ring depending on nominal width). The application is to be checked by means of a camera carried along. The switched-on spray/spray nozzle or brush must always be pulled through the pipe, it must not be pushed!

After the 1st coating process after 1 minute drying time, another coating process can be started. Before this, clean the spray/spray nozzle or the brush used with a suitable cleaning agent. The spray
/spinner nozzle, in contrast to the brush, has its own cleaning line. During cleaning, care must be taken to ensure good ventilation of the premises and responsible handling of the cleaning agent in accordance with the occupational health and safety instructions and safety data sheets.

The 2nd coating process is carried out in the same way as the 1st coating, but with a changed direction of rotation of the spray/spin nozzle or the brush. The second coating thickness should be approx. 1 mm. Clean the tools as described in the 1st coating process.

Further coating processes are to be carried out according to the 2nd coating process, but with alternating rotation direction.

Table 1: "Minimum wall thicknesses of the coating".

Diameter [mm]	Minimum wall thickness	Number of min. Coating processes
DN 50	2.0 mm	4
DN 75	3.0 mm	6
DN 100	3.0 mm	6
DN 150 to 200	4.0 mm	8

As a rule, the collector and downpipes are rehabilitated first, followed by the connection and interconnecting pipes.

The remediation must be documented and, if necessary, recorded on video.

3.2.7 Floor drains and cleaning openings

Floor drains and cleaning fittings can be renovated at the same time. The floor drains and cleaning fittings must be cleaned, rinsed and dried.

In the case of floor drains, the openings closed by plugs must be drilled out to clean the traps in the event of severe corrosion. Then coat the drains with a spray/spray nozzle as described in section 3.2.6 and rework any defects with a brush. The inspection is to be carried out with the aid of an angle mirror. After the renovation, the plug opening must be closed with an elastic plastic plug.

The lids of the cleaning moulds must be protected from the coating by wrapping them in foil or paper on the inside of the lid. After cleaning, open the lids and remove the coating inside the opening with a saw. The inside of the lids should also be coated with a brush. After drying, seal the openings tightly with the lids and new elastomeric seals. The cut-out is to be kept as a retention sample.

3.2.8 Commissioning

The cleaning of the rehabilitated wastewater pipes by means of high-pressure flushing (max. 100 bar) may take place at the earliest 7 days after the rehabilitation.

The commissioning times of the rehabilitated wastewater pipes can be found in Table 2.

Table 2: "Commissioning times after the refurbishment

Water load capacity with temperatures of approx. 20 °C (e.g. toilet flushing)	20 minutes
Water resistance with temperatures of approx. 40 °C (e.g. shower / bath water)	30 minutes
Water resistance with temperatures of approx. 90 °C (e.g. kitchen sink cooking water)	1 hour

3.2.8 Final inspection and leak test

After completion of the work, the rehabilitated pipe section must be visually inspected. It must be determined whether any material residues have been removed and no hydraulically detrimental residues are present.

After the coating system has cured, the tightness must be checked. This can also be done in sections. The watertightness can be tested by filling the renovated pipes completely.

3.2.10 Tests on samples taken

3.2.10.1 General

For the investigation of the characteristic material properties or strength properties, test specimens are to be taken on site or reserve samples are to be prepared in accordance with Sections 3.2.6 and 3.2.7.

3.2.10.2 Determination of the strength properties Bending properties

The bending properties of the samples taken at the construction site shall be determined in accordance with DIN EN ISO 178[13] as per section 3.1.2.3.

DMA analysis

Alternatively, a DMA analysis (following ISO 6721-5[17] , section 3.1.2.4) can be carried out on the samples taken at the construction site. For this purpose, the following test procedure must be followed:

1. Measurement of the wall thickness of the coating at three points
2. Qualitative assessment of the coating in the area of the saw cut according to DIN 18820-3[18], section 5.2
3. Removal of the test specimen for DMA analysis from the coating or from the retention sample according to section 3.2.6 and 3.2.7.
4. DMA analysis according to ISO 6721-5[14]
5. Evaluation of the results

[18] DIN 18820-3Laminates of textile glass reinforced unsaturated polyester and phenacrylate resins for load-bearing components (GF-UP, GF-PHA); protective measures for the load-bearing laminate; Ausgabe:1991-03

3.2.11 Declaration of conformity on the executed repair measure

The confirmation of conformity of the executed remediation measure with the provisions of this type approval shall be made by the manager of the remediation measure with a declaration of conformity based on the specifications in Table 3. The declaration of conformity shall be accompanied by documents on the properties of the process components according to sections 2.1.1, 3.1.2.3 and 3.1.2.4 and the results of the tests according to Table 3.

The head of the remediation measure or a representative of the head who is competent in the remediation must be present on the construction site during the execution of the remediation. He shall ensure the proper execution of the work in accordance with the provisions of Section 3.2 and, in particular, carry out the inspections in accordance with Table 3 or arrange for them to be carried out. The number and extent of the inspections carried out are minimum requirements.

Table 3: "In-process audits

Subject of the examination	Type of requirement	Frequency
Visual inspection of the pipe	according to section 3.2.3	Before any renovation
Visual inspection of the pipe	according to section 3.2.9	After each renovation
Equipment	according to section 3.2.2	every construction site
Labelling of the containers of the remediation components	according to section 2.2.3	
Waterproofness	according to section 3.2.9	
Resin mixture, resin quantity and curing behaviour	according to sections 3.2.6 and 3.2.7	
Curing temperature and curing time	according to sections 3.2.6 and 3.2.7	
Wall construction, wall thickness	according to sections 3.1.2.1, 3.2.6 and 3.2.7 and Table 2	
Bending properties according to DIN EN ISO 178[13] or DMA-Analysis according to ISO 6721-5[17]	according to sections 3.1.2.3, 3.1.2.4 and 3.2.10.2	
Cured polyurethane resin (retention sample) Bending E-modulus	according to section 3.1.2.3	At every 10th reset sample

The results of the inspections shall be recorded, e.g. by means of an execution r e c o r d (Annex 7). The records must contain at least the following information:

- Designation of the repair method and the designation of the resin system used.
- Quantity and batch number of the resin or resin components used.
- Ambient and duct temperatures
- Signature of the person responsible for carrying out the repair work.

The recordings and the labelled video recordings must be kept in the building files. They shall be handed over to the operator of the waste water pipes and presented to Deutsches Institut für Bautechnik, the responsible building supervisory authority and the third party supervising body on request.

4 Provisions for use, maintenance and servicing

In the cellar or in the service connection room of the building in which the repair work was carried out, the following inscription should be affixed permanently and easily legible:

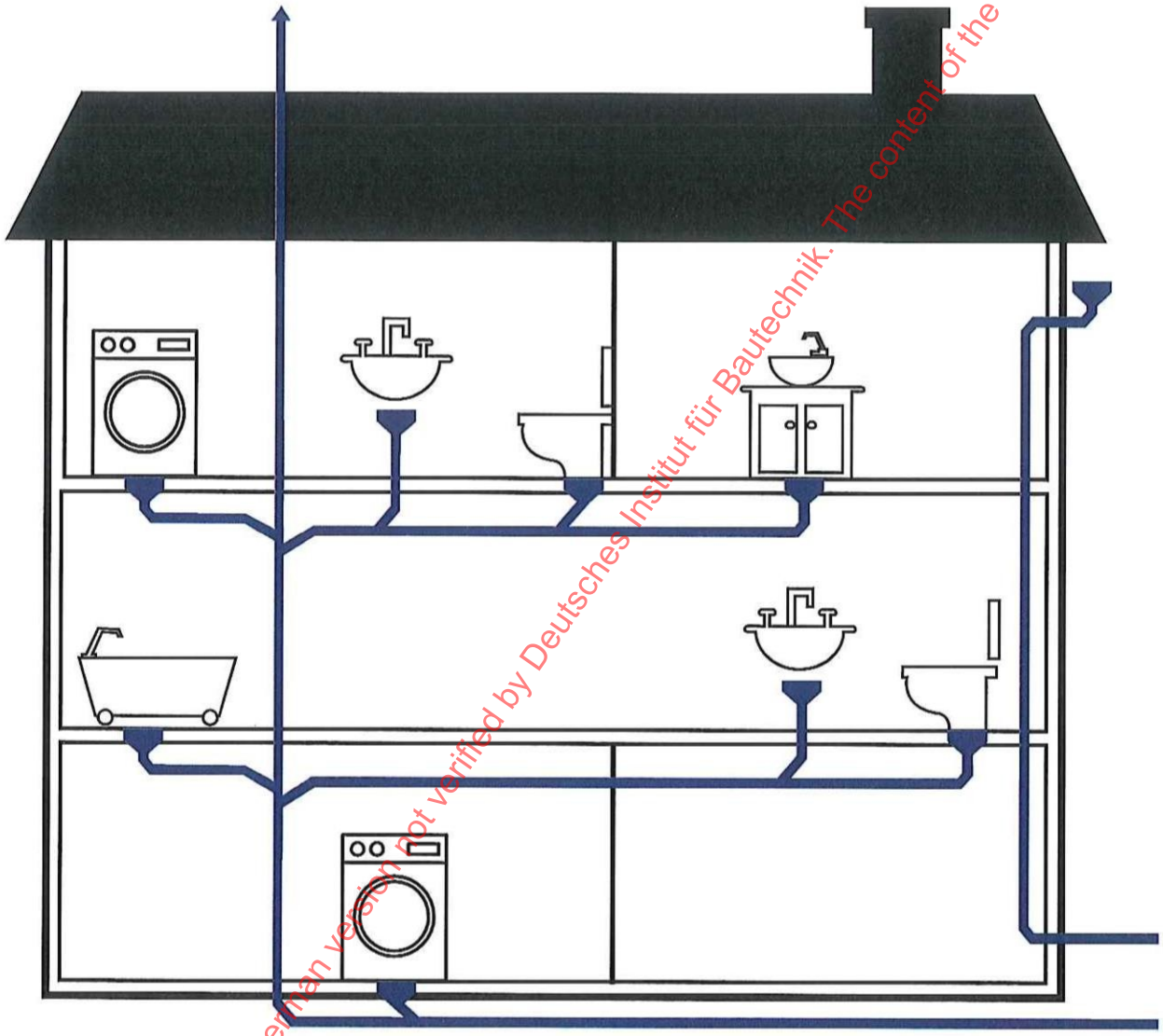
- Type of repair
- Designation of the line section
- Year of repair
- executing firm

During the period of validity of this approval, the applicant shall visually inspect six rehabilitated waste water pipes. The results with an accompanying description of the rehabilitated damage shall be submitted to Deutsches Institut für Bautechnik without request during the period of validity of this approval.

Rudolf Kersten
Head of Unit

Certified

Deutsches Institut für Bautechnik DIBt



Sanierung von schadhaften Abwasserleitungen innerhalb von Gebäuden im Nennweitenbereich von DN 50 bis DN 200 mit dem Beschichtungssystem der Bezeichnung "ElastoFlake"	Anlage 1
Schnittzeichnung	

Deutsches Institut für Bautechnik DIBt

1 Material-Tank A
2 Material-Tank B
3 Störungslicht
4 Bildschirm
5 Update-Adapter
6 USB-Adapter
7 Fernsteuerungsempfänger
8 Fernsteuerung
9 Materialschläuche
10 Hauptschalter
11 Zirkulator-Stromkabelstecker
12 Stromkabel

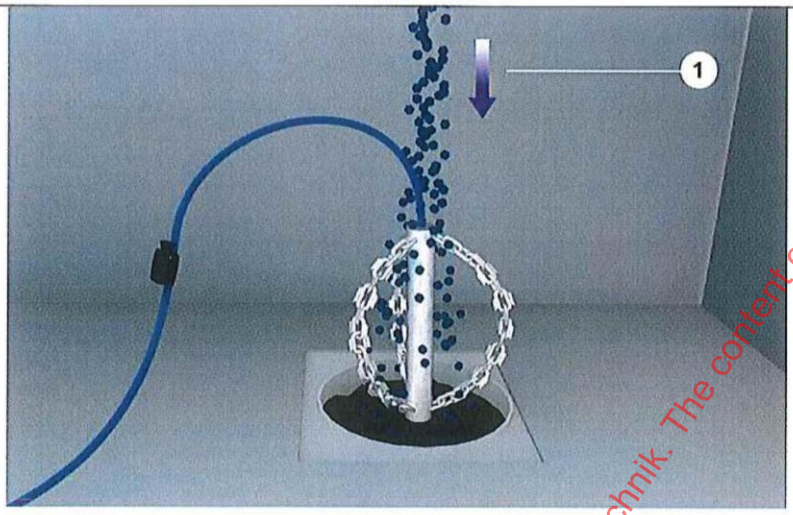
Sanierung von schadhaften Abwasserleitungen innerhalb von Gebäuden im Nennweitenbereich von DN 50 bis DN 200 mit dem Beschichtungssystem der Bezeichnung "ElastoFlake"	Anlage 2
ElastoTec Model L	

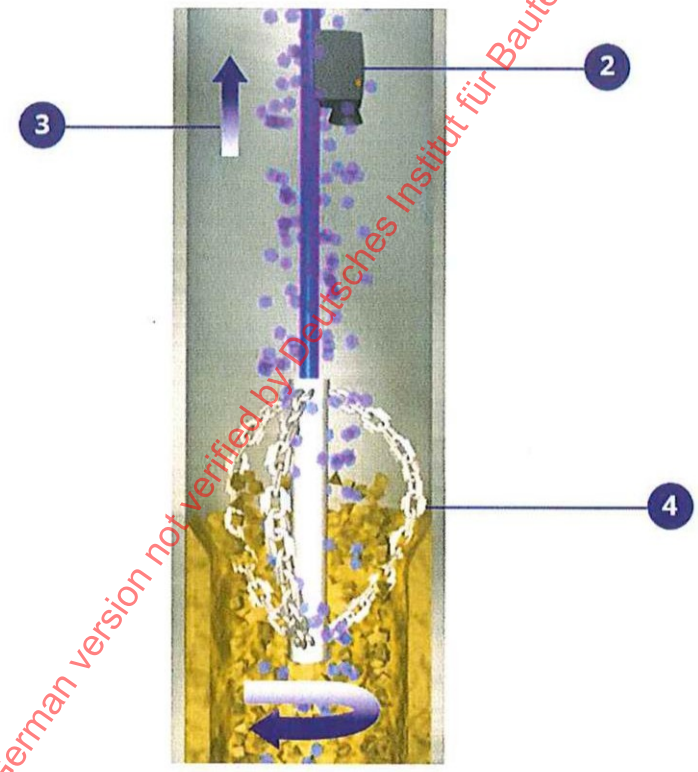
Deutsches Institut für Bautechnik DIBt

1 Material-Tank A
2 Material-Tank B
3 Bildschirm
4 Update-Adapter
5 USB-Adapter
6 Reinigungsbehälter
7 Hauptschalter
8 Störungslicht
9 Zirkulator-Stromkabelstecker
10 Stromkabel
11 Fernsteuerungsempfänger
12 Fernsteuerung

Sanierung von schadhaften Abwasserleitungen innerhalb von Gebäuden im Nennweitenbereich von DN 50 bis DN 200 mit dem Beschichtungssystem der Bezeichnung "ElastoFlake"	Anlage 3
ElastoTec Model M	

Deutsches Institut für Bautechnik





1 Warmwasser
2 Kamera
3 Zugrichtung
4 Kettenschleuder/ Schleifpad/ säureresistente Bürste

Sanierung von schadhaften Abwasserleitungen innerhalb von Gebäuden im Nennweitenbereich von DN 50 bis DN 200 mit dem Beschichtungssystem der Bezeichnung "ElastoFlake"	Anlage 4
Rohr- / Kanalreinigung	

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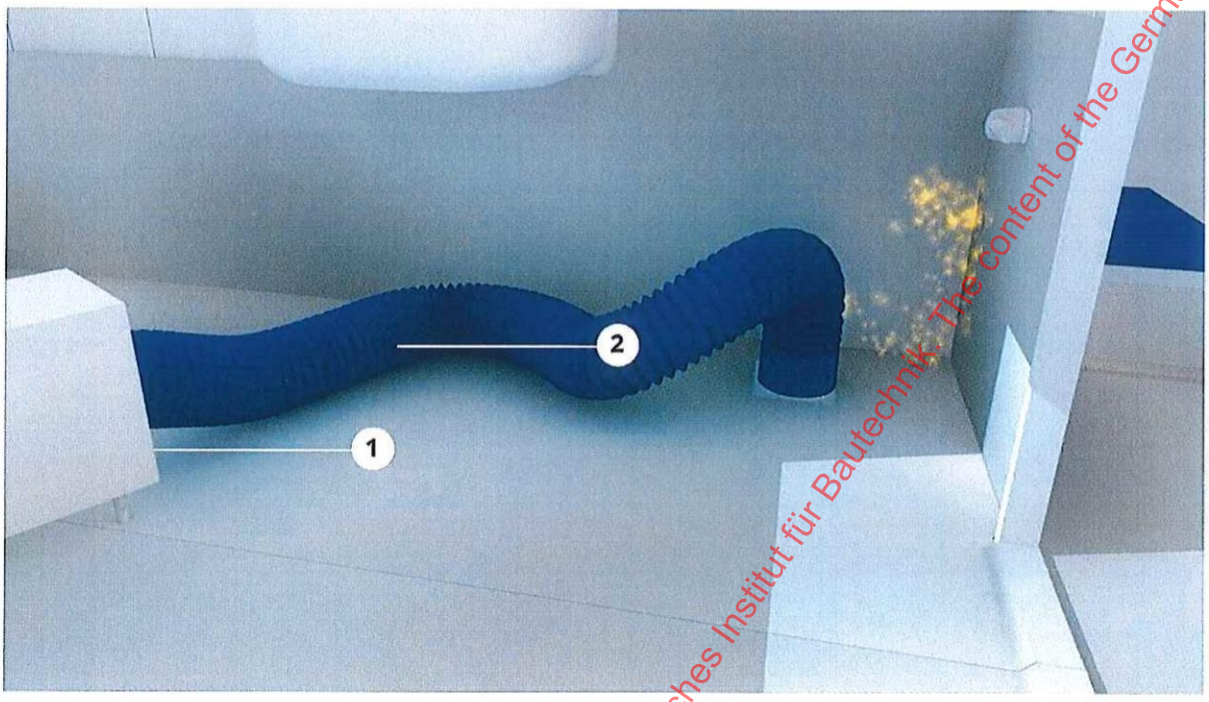

1 FanTec Heißluft Gebläse

2 FanTec Belüftungsschlauch

Sanierung von schadhaften Abwasserleitungen innerhalb von Gebäuden im Nennweitenbereich von DN 50 bis DN 200 mit dem Beschichtungssystem der Bezeichnung "ElastoFlake"	Anlage 5
Trocknen der Rohrleitungen	

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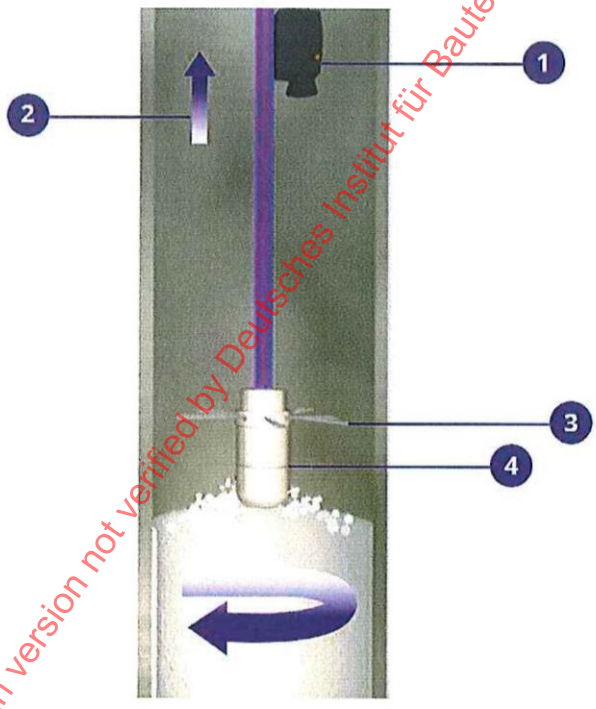

1 Kamera
2 Zugrichtung
3 Zentrierstern
4 Sprühkopf

Sanierung von schadhaften Abwasserleitungen innerhalb von Gebäuden im Nennweitenbereich von DN 50 bis DN 200 mit dem Beschichtungssystem der Bezeichnung "ElastoFlake"	Anlage 6
Beschichtung	

Auftragnehmer:					ElastoTec L			
Projekt:					ElastoTec M			
Projektnummer:					Pumpennummer:			
Kunde:								
Kundenummer:								
Reinigungsgeräte:	Reinigungskette:				Schleifpapier	Reinigungsbürste		
Kamera Inspektion nach der					Videonummer:			
Kamera Inspektion vorwärts					Video nummer:			
Kamera Inspektion rückwärts					Video nummer:			
	1	2	3	4	5	6	7	8
Datum								
Temperatur								
Leitung								
ElastoFlake A								
ElastoFlake B								
Materialverhältnis								
Startpunkt								
Endpunkt								
Materialverbrauch								
Gebürstet oder Gesprüht								
Anfangszeit								
Endzeit								
Leitungslänge								
Information:								
Mechaniker:								
Ort	Datum	Unterschrift						