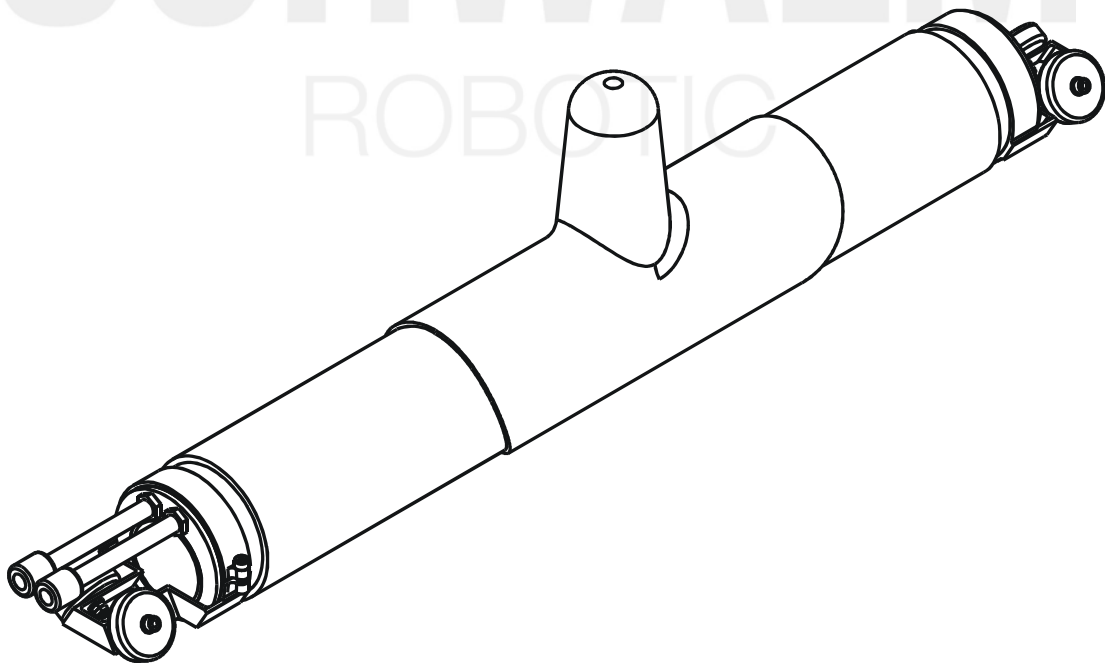


System manual

Preparing a HutlinerPacker® / lateral connection and setting a cap profile or a cap liner



System manual for the
S 15.2 HutlinerPacker® / lateral connection rehabilitation process,
RAL Institute GZ 961, Güteschutz Kanalbau (quality assurance in sewer
construction)

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Important!

Before use, please read the system manual as well as the operating instructions for the system components used and keep them in a safe place. Make sure that the system manual and the operating instructions are available at all times. **SCHWALM-ROBOTIC GmbH** shall not be liable for the readability of a supplied CD during the required retention period. Therefore, please file an additional hardcopy version of this system manual. If the system manual should be lost, you may request this document at www.schwalm-robotic.de



About this system manual

This system manual forms part of the HutlinerPacker® / lateral connections and describes the safe and appropriate use and handling of the system components for sewer rehabilitation in all process stages. The system manual must always be available at the site of application of the HutlinerPacker® / lateral connection.

This system manual contains notes which are important for a safe and appropriate use of the HutlinerPacker® / lateral connections. Following these instructions helps to prevent dangers, minimise repair costs and avoid downtime. Any person in charge of working on the HutlinerPacker® / lateral connections must read and apply this system manual.

For clarity purposes and due to the great number of possible situations, this system manual does not contain all detailed information and in particular cannot cover every possible case of operation or maintenance.

Service

If you desire more information or if specific issues occur which are not covered sufficiently in these operating instructions, you can request the required information. For any queries, please do not hesitate to contact:

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Target group

This system manual is intended for inspectors who have successfully completed the DWA (Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V. – German Association for Water, Wastewater and Waste) sewer inspection course or a comparable training and were additionally instructed in handling HutlinerPacker® / lateral connections by **SCHWALM-ROBOTIC GmbH**.

HutlinerPacker® / lateral connections may only be commissioned and maintained by people who have been instructed in the appropriate use and have read and understood the content of the system manual.

Relevance

This system manual is only relevant for the HutlinerPacker® / lateral connections distributed by **SCHWALM-ROBOTIC GmbH**, including the required system components. This system manual does not replace practical training, which is imperative for handling the HutlinerPacker® / lateral connections. Aiming at continuous improvement, amendments are implemented at certain intervals which may not yet have been considered at the time of printing this system manual. In the case of amendments, the system manual is entirely replaced. We reserve the right to implement changes in order to develop our products.

Copyright

Copyright for this system manual remains with **SCHWALM-ROBOTIC GmbH**.

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Safety notes

The following signs and symbols are used in this system manual:



Danger Specific information or requirements and prohibitions to prevent injuries and significant property damage are indicated by the displayed pictogram and the word “Danger” in **bold** print.



Caution Specific information or requirements and prohibitions to prevent damage are indicated by the displayed pictogram and the word “Caution” in **bold** print.



Information Specific information concerning the commercial use of the device are indicated by the by the displayed pictogram and the word “Information” in **bold** print.

If the hazard can be defined more specifically, the following pictograms are used:



Fall hazard This sign indicates tasks entailing a risk of falling.



Biohazard This sign indicates tasks entailing a danger due to biogenic substances.



Risk of hand injuries This sign indicates tasks entailing danger to the hands.



Overhead load warning This sign indicates tasks entailing a danger due to overhead loads.



Hazard due to harmful or irritating substances This sign indicates tasks entailing a danger due to handling harmful or irritating substances.



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Precautions when handling the HutlinerPacker® / lateral connection



There is a **falling hazard** when handling the HutlinerPacker® / lateral connection at an open sewer.



There is a **biohazard** when working in the sewage area and with equipment that is contaminated with biogenic substances after use.



There is a **hand injury hazard** when manipulating HutlinerPacker® / lateral connections into the sewer and when assembling the connection.



There is an **overhead load hazard** when handling HutlinerPacker® / lateral connections with a hoist.



Hazards due to harmful or irritating substances must be considered when handling the required resins and components and for the final cleaning of the equipment.



There is a **danger due to damage resulting from air chamber rupture** when damaged air chambers are used and when the maximum pressures in the air chambers are exceeded.



Danger

The information on maximum pressure for the HutlinerPacker® / lateral connections only relates to the working state on site in the sewer.

Outside the pipelines, the HutlinerPacker® / lateral connections may only be filled up to 0.2 bar for visual inspection.



Danger

The HutlinerPacker® / lateral connections and their components may only be operated consistent with their intended use, in a safety- and risk conscious manner, in accordance with the operating instructions in the HutlinerPacker® / lateral connection system when they are in a technically sound state, undamaged and working without malfunction. Even during intended use of the HutlinerPacker® / lateral connections, faulty operation by the machinists, misconduct of building site personnel, a fault or a control breakdown **may lead to hazardous situations.**


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Product safety

The HutlinerPacker® / lateral connections have been constructed according to the state of the art technology and recognised safety-related rules.
However, use of the HutlinerPacker® / lateral connections may lead to dangers to life for users or third parties and / or to damage to the HutlinerPacker® / lateral connections and other property.

Legal disclaimer

	<p>Information</p> <p><i>We expressly note that SCHWALM-ROBOTIC GmbH shall not be liable for damage resulting from faulty or negligent operation, maintenance or repair or due to unintended use. This also applies for changes, extensions and conversions of the HutlinerPacker® / lateral connections which can affect safety. In such cases, the factory guarantee is no longer valid.</i></p>
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System description

Range of application

The HutlinerPacker® / lateral connections allows fitting cap profiles or Hutliner® / lateral connections in a nominal width area of DN 100 to DN 800 in the main pipe and a nominal width area of DN 100 to DN 250 at an angle of 30° to 90° in the connection pipe.

The method is suitable for rehabilitation of pipelines and concrete shaped parts, stoneware, fibre cement, cast iron, and reinforced and non-reinforced plastics.

Limits of application: The application of the HutlinerPacker® / lateral connection is limited by certain failure modes in the non-rehabilitated main sewer as well as by unusual outlet angles.

Intended use

The HutlinerPacker® / lateral connections are devices for installing cap profiles and Hutliner® / cap liners for form-fit integration of sewage hook-ups into other sewage channels.

The major case of application is the tethering of a connecting pipeline to a sewer rehabilitated via relining. The cap profile or Hutliner® / cap liner process is also suitable for repairing junctions using the original pipeline construction.

With the HutlinerPacker® / lateral connection, a cap profile is inserted into the prepared branch or junction of the confluent sewer. For this purpose, a resin-impregnated cap profile made of synthetic fibre felt is placed onto the HutlinerPacker® / lateral connection's rubber hat and placed and fastened on the application spot by a robot, monitored by TV. The HutlinerPacker® / lateral connection is expanded using compressed air and the cap profile is pressed against the tube wall of the main line where it hardens at ambient temperature.

After application, the cap profile collar should be connected form-fit with the inner wall of the main sewer, and the hose should be connected form-fit with the connecting line.

Intended use also includes complying with all information in this system manual.

System components

The HutlinerPacker® / lateral connections are provided with the following system components:

- Packers with 2 separate pressure chambers
- Connection hoses for compressed air
- Customary pressure reducer / regulator
- 2 resin system components
- Cap profile and fibreglass mat, if necessary
- Robot-specific support plate
- Talpa milling robot

The conditions required for an operation as defined by the system target include:

- System components in a combination of hardware system components geared towards target attainment
- Availability of adjustable compressed air, max. 2.5 bar
- Availability of other media for supplying the milling and rehabilitation robot
- Manpower qualified for handling the system



Possible combinations of components

There are **HutlinerPacker® (HLP) / lateral connections** available for four major diameters:

Table 1

HutlinerPacker® (Nominal width)	Design
HutlinerFlexpacker® DN 100	without flow passage
HutlinerFlexpacker® DN 125	without flow passage
HutlinerFlexpacker® DN 150	without flow passage
HutlinerFlexpacker® DN 180	without flow passage
HutlinerFlexpacker® DN 200 without flow passage	without flow passage
HutlinerFlexpacker® DN 200 with flow passage	with flow passage
HutlinerPacker® DN 250-300	with flow passage
HutlinerPacker® DN 300-400	with flow passage
HutlinerPacker® DN 400-500	with flow passage
HutlinerPacker® DN 400-600	with flow passage
HutlinerPacker® DN 500-700	with flow passage
HutlinerPacker® DN 600-800	with flow passage

Multipurpose packers are adapted to the several nominal widths by an implemented chassis adjusting system on the HutlinerPacker® / lateral connection.

There are **rubber hats** for the HutlinerPacker® / lateral connections available in the following sizes:

Table 2

Rubber hat	Connection diameter
Size 1	90 – 125 mm
Size 2	>125 – 160 mm
Size 2, long	>125 – 160 mm
Size 3	>160 – 250 mm
Size 4	90 – 150 mm (HLP 150)
Size 5	90 - 125 mm (HLP 100 and 125)

Cap profiles are available for the following diameters and angles:

- DN 100, DN 125, DN 150, DN 200, DN 250
- Angles 45° and 90°, respectively

Resin system for impregnation of the cap profiles and, if applicable, the fibreglass, consisting of 2 units in a standard bottle system:

- Resin and catalyser: Unit 1 (components A + C)
- Curing agent: Unit 2 (component B)

Separating agent for separating the reusable hardware components of the HutlinerPacker® / lateral connection system of the rehabilitation components remaining in situ:

- Separating agent (non-stick agent)
- PE film (rolls, bags)

Fixing agent for temporary mechanical fixing of the rubber hat and the impregnated cap profiles and / or on the Hutliner® / cap liners on the HutlinerPacker® / lateral connections:



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- Rubber bands DN50, DN 80, DN 100, DN 200, DN 260
- Crepe tape

Robots for positioning the standard HutlinerPacker® / lateral connections at the place of application:

- Robots with engaging adapter for retaining plate
- Retaining plate for form- and force-fit engaging of the HutlinerPacker® / lateral connections



Caution The individual hardware components may be systemically combined with each other within the given limits, according to the target of application.

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System requirements for a safe application of the Hutliner® / cap liner method

In general, the following system components are applied in situ:

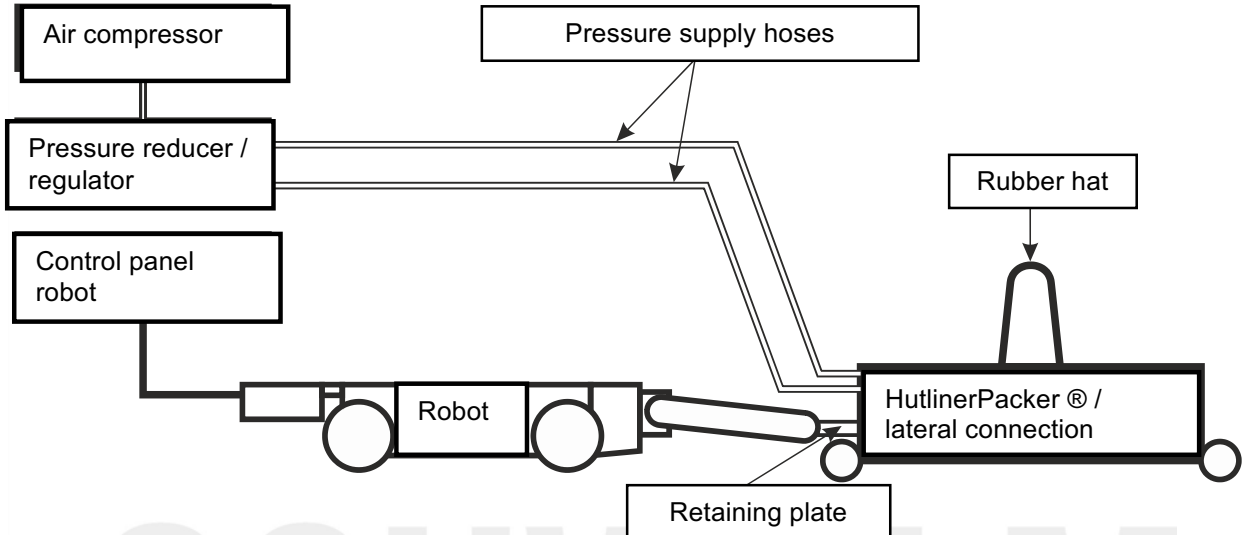
- HutlinerPacker® / lateral connections of the appropriate size
- Cap profile of the appropriate size
- E-CR fibreglass mat of the appropriate size
- Felt hat (polyester fibre felt)
- 2-unit resin system of the appropriate quantity
- Robot-specific retaining plate
- Milling robot with an appropriate control system
- Air compressor
- Standard pressure reducer / regulator
- Connecting hoses for air
- Various auxiliary materials and safety equipment

General course of the Hutliner® / cap liner method

Fitting the cap profiles and or Hutliner® / cap liners is geared to the following general requirements:

- First of all, the connection area is prepared mechanically for the fitting of the cap profile or Hutliner® / cap liner. When tethering the connection lines to a main sewer, the area the cap profile or Hutliner® / cap liner should abut to is mechanically cleaned. The milling residues are removed by high-pressure cleaning.
- The HutlinerPacker® / lateral connection is selected and prepared for application according to the nominal width of the main line. The rubber hat is selected and prepared for application according to the connection line to be tethered.
- The cap profile or Hutliner® / cap liner is selected according to the failure mode and to the nominal width of the connection sewer and the main sewer and is impregnated with the resin. The impregnation is applied manually. The pot lives only allow a limited application period.
- A robot carries the HutlinerPacker® / lateral connection with the cap profile or Hutliner® / cap liner to the faulty spot where it inserts the cap profile into the connection line. Due to the controlled filling of the pressure chambers with compressed air, the hose of the cap profile is pressed against the connection line wall, and the collar – and, if applicable, the fibreglass laminate – is pressed against the main line wall.
- The process is controlled remotely by the technician inside the vehicle. The process is monitored by the robot camera in the main tube.
- The cap profile or Hutliner® / cap liner cures at ambient temperature and under compressive load of the HutlinerPacker® / lateral connection.
- Once the cap profile has cured, the HutlinerPacker® / lateral connection pressure chambers are depressurized and the HutlinerPacker® / lateral connections are manually removed from the operating site. The next steps are the quality control and, if applicable, post-treatments.

Block diagram



Assembly / Commissioning

The HutlinerPacker® / lateral connection is supplied by **SCHWALM-ROBOTIC GmbH** in an assembled state.

The **range of application of the HutlinerPacker® / lateral connection** as well as the **pressure maximum** for the HutlinerPacker® / lateral connection are indicated on the nameplate.



Figure 01



Caution Before each start-up, the state of the HutlinerPacker® / lateral connection must be checked. In particular, the pressure chambers must be assessed. Damaged parts, especially damaged or flawed rubber components, must absolutely be replaced before using the system again.

Connections

Pneumatic connection

Each HutlinerPacker® / lateral connection is provided with two compressed air connections at the rear part, coupling type KLI 7 MS. The coupling marked in red is the compressed air connection for pressurizing the rubber hat.

The unmarked coupling is the compressed air connection for pressurizing the packer top surface.

Before every start-up, the couplings must be checked and, if necessary, replaced.



Figure 02



Figure 03

Compressed air connections using the example of a HutlinerPacker® / lateral connection 200

Safety devices

The HutlinerPacker® / lateral connection may only be connected following an upstream connection of a standard pressure reducer / regulator which ensures that the pressurizing of the individual HutlinerPacker® / lateral connection pressure chambers with compressed air stays within the permitted limits.

Nominal pressures – rubber hats

The **maximum nominal pressure** to be set for the rubber hats is:

Table 3

Rubber hat	Nominal pressure
Size 1	1.4 bar (max.)
Size 2	1.4 bar (max.)
Size 2, long	1.6 bar (max.)
Size 3	1.2 bar (max.)
Size 4 (HLP 150)	1.4 bar (max.)
Size 5 (HLP 100 and 125)	1.4 bar (max.)

Nominal pressures - HutlinerPacker® / lateral connections

The **maximum nominal pressure** to be set for the HutlinerPacker® / lateral connection is:

Table 4

HutlinerPacker®	Nominal pressure
HutlinerFlexpacker® DN 100 without flow passage	2.5 bar (max.)
HutlinerFlexpacker® DN 125 without flow passage	2.5 bar (max.)
HutlinerFlexpacker® DN 150 without flow passage	2.5 bar (max.)
HutlinerFlexpacker® DN 180 without flow passage	2.0 bar (max.)
HutlinerFlexpacker® DN 200 without flow passage	2.0 bar (max.)
HutlinerFlexpacker® DN 200 with flow passage	2.0 bar (max.)
HutlinerPacker® DN 250-300 with flow passage	2.0 bar (max.)
HutlinerPacker® DN 300-400 with flow passage	2.0 bar (max.)
HutlinerPacker® DN 400-500 with flow passage	2.0 bar (max.)
HutlinerPacker® DN 400-600 with flow passage	2.0 bar (max.)
HutlinerPacker® DN 500-700 with flow passage	2.0 bar (max.)
HutlinerPacker® DN 600-800 with flow passage	2.0 bar (max.)



Danger due to damage resulting from air chamber rupture when damaged air chambers are used and when the maximum pressures in the air chambers are exceeded.

Do not exceed nominal pressures

Deviating pressures may destroy the HutlinerPacker® / lateral connections and rubber cap pressure chambers and may lead to resulting damage in their environment.

Processing components for forming the Hutliner® / cap liners

Support components

The following support components are applied for the resin system

- **Fibreglass mats**

The fibreglass tissue mats (E-CR fibreglass tissue mats, E-CR non-woven fibreglass mats) consist of three layers, two tissue layers are offset by 90° and a non-woven fibre layer, which are sewn together. The specific weight is 1,387 g/m².

- **Felt hats**

The felt hats for manufacturing of the connecting pieces consist of polyester needle felt. These cap profiles are available in 10 different designs.

Table 5

Cap Size	Angle in °
DN 100	90 or 45
DN125	90 or 45
DN150	90 or 45
DN200	90 or 45
DN250	90 or 45

The type designation of the felt hats consists of three digits:
e.g. 150/45/5

Table 6

Digit 1	Digit 2	Digit 3
Connection diameter in mm	Connection angle 90 / 45	Material thickness in mm

Reaction components – 2-unit resin system

In general, the reaction components of the silicate isocyanate resin system consist of:

- Unit 1 (honey-coloured) – consisting of: Component A (resin) and component C (catalyser).
A distinction should be made between summer and winter units, which have different ratios of component C (catalyst).
- Unit 2 (dark brown) – consists of component B (hardening agent) (irrespective of the season).

Mixing ratio

The resin is the main component for determining the quantities to be applied. The other component must be added to the resin in the indicated ratio. Units **1 (resin)** and **2 (hardening agent)** are mixed in the ratio of **1 (resin) : 2 (hardening agent)**. The preconditioned fillings are available for winter and summer application (see page 18).

Quantities

The resin system is supplied in the units 1 and 2 in bottles in the mixing ration indicated above. By filling unit 1 (resin) into unit 2 (hardening agent) and subsequent mixing of the units, the resin system to be processed is formed (detailed information on page 26: *Tables 15 + 16*).



Required resin system quantities and mat lengths for HutlinerPacker® / lateral connections:

Table 7

Diameter	Length for 127 cm mat width	Total resin quantity	Unit 1 (resin)	Unit 2 (hardening agent)
DN 100	36 cm	0.75 l	0.25 l	0.5 l
DN 125	45 cm	1.0 l	0.335 l	0.665 l
DN 150	56 cm	1.0 l	0.335 l	0.665 l
DN 200	70 cm	1.0 l	0.335 l	0.665 l
DN 250	85 cm	1.5 l	0.5 l	1.0 l
DN 300	100 cm	2.0 l	0.67 l	1.33 l
DN 350	115 cm	2.0 l	0.67 l	1.33 l
DN 400	135 cm	2.5 l	0.835 l	1.665 l
DN 500	170 cm	3.0 l	1.005 l	1.995 l
DN 600	200 cm	4.5 l	1.505 l	2.995 l
DN 700	250 cm	5.0 l	1.675 l	3.325 l
DN 800	310 cm	6.0 l	2.01 l	3.99 l

Table 8

Uniform bottles pre-assembled for the cap profiles and Hutliner® / cap liners	Pre-assembled uniform bottle unit 2	0.5 l
	Pre-assembled uniform bottle unit 2	0.665 l
	Pre-assembled uniform bottle unit 1 summer	0.250 l
	Pre-assembled uniform bottle unit 1 winter	0.250 l
	Pre-assembled uniform bottle unit 1 summer	0.335 l
	Pre-assembled uniform bottle unit 1 winter	0.335 l

Required resin system quantities for felt hats:

Table 9

Felt hat	Total resin quantity	Unit 1 (resin)	Unit 2 (hardening agent)
DN 100	0.75 l	0.25 l	0.5 l
DN 125	1.0 l	0.335 l	0.665 l
DN 150	1.0 l	0.335 l	0.665 l
DN 150, long	1.5 l	0.5 l	1.0 l
DN 200	1.5 l	0.5 l	1.0 l
DN 250	1.5 l	0.5 l	1.0 l



The quantity indications are benchmarks. The quantity can differ according to size and failure mode type!

Information The conversion of the required resin system quantities in a standardized amount of the units 1 and 2 in bottles can be found on page 26: tables 15 + 16 in the resin preparation section.



Technological dwell times

The dwell times which depend on the temperature and technological conditions must absolutely be adhered to. The dwell times required for the curing of the mixed resin system are distinguished into:

Pot life:	Processability time (during which the resin system can be spread)
Placing time:	Time for manipulating the liners to and at the place of application
Deshelling time:	Time for dwelling of the HutlinerPacker® / lateral connection at the place of application under pressure

Cold hardening

The resin is cured in a cold-hardening manner, i.e. without heat input from the outside, at ambient temperature. The ambient temperature must be at least 8°C.

Heat

The reaction time of the resin system depends on the temperature and determines the time periods available for processing. Depending on the resin quantity applied, the resin reaction leads to process heat which also affects the reaction process; the reaction time is reduced.

Storage

Reactive resins should be stored in a dry place at a temperature of at least 10°C.

Reaction times dependent on temperature and used unit 1:

Table 10

Temperature	Times	Unit 1	
		Summer	Winter
10° C	Pot life	-	12 min.
	Placing time	-	25 min.
	Deshelling time	-	90 min.
15° C	Pot life	-	10 min.
	Placing time	-	20 min.
	Deshelling time	-	60 min.
20° C	Pot life	15 min.	8 min.
	Placing time	25 min.	15 min.
	Deshelling time	90 min.	50 min.
25° C	Pot life	15 min.	-
	Placing time	20 min.	-
	Deshelling time	60 min.	-
30° C	Pot life	8 min.	-
	Placing time	15 min.	-
	Deshelling time	50 min.	-

This table is for orientation purposes; real values can differ.

Safety information for handling reaction resins



The resin system is subject to the hazard designation:
Xn (harmful), Xi (irritating).

The specific danger information, information about first aid measures and disposal can be found in the current safety data sheets for this product which are to be requested from the supplier.



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System specifications and standard requirements

HutlinerPacker® / lateral connection type dependent on the nominal width

Table 11

HutlinerPacker® (nominal width)
HutlinerFlexpacker® DN 100 without flow passage
HutlinerFlexpacker® DN 125 without flow passage
HutlinerFlexpacker® DN 150 without flow passage
HutlinerFlexpacker® DN 180 without flow passage
HutlinerFlexpacker® DN 200 without and with flow passage
HutlinerPacker® DN 250-300 with flow passage
HutlinerPacker® DN 300-400 with flow passage
HutlinerPacker® DN 400-500 with flow passage
HutlinerPacker® DN 400-600 with flow passage
HutlinerPacker® DN 500-700 with flow passage
HutlinerPacker® DN 600-800 with flow passage

Ambient conditions



Caution Differing sewage conditions may destroy the HutlinerPacker® / lateral connection. The HutlinerPacker® / lateral connections are designed for the application in the municipal wastewater sector with a pH value of 3 – 9. When applied in the industrial sewage sector, the chemical composition of the wastewater must be analysed beforehand.

Temperature, humidity

Application of the HutlinerPacker® / lateral connection is restricted to frost-free space in the sewage area. The HutlinerPacker® / lateral connections are designed to be applied in a wet environment.

Compressed air requirements

The compressed air to be applied should either be supplied from bottles or from air compressors. The air should be largely dry and free of oil.



There is a **danger due to damage resulting from air chamber rupture** when damaged air chambers are used and when the maximum pressures in the air chambers are exceeded.

Water retention in the rehab sewer

Before starting the rehabilitation, the water ratios within the sewer must be verified for the time of work in the sewer. It must be ensured that

- the lines concerned do not conduct wastewater or
- a HutlinerPacker® / lateral connection permitting flow has been selected.

Otherwise, the respective blocking measures in the sewer must be selected; e.g. setting blocking bladders or installing bypasses.



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Implementation of the Hutliner® / cap liner rehab

Devices, equipment (minimum equipment)

For setting the Hutliner® / cap liner or cap profiles, the following equipment is necessary:

- Devices for exploring and preparing the operation site
 - Devices for cleaning the application area (sewer cleaning)
 - Water retention facilities
 - Devices for channel inspection

- Devices for setting the Hutliner® / cap liners or cap profiles
 - Personal protective equipment (PPE)
 - Gas detector
 - Tripod (personal security device)
 - Safety and rescue harness
 - HutlinerPacker® / lateral connections and accessories depending on the nominal width
 - Bottles with resin components
 - Weather protected impregnation workplace
 - Construction sheeting
 - E-CR fibreglass mat and felt hats for the nominal width to be rehabilitated
 - Separating agents (non-stick agent, PE film)
 - Rehabilitation robot with control unit and monitoring screen
 - Compressed air hoses
 - Blocking bladders
 - Compressed air supply with pressure regulating device
 - Water supply
 - Power supply
 - Container for residues
 - Temperature meter
 - Tools for handling the process components

Preparatory measures

If the rehabilitation site is located within the public traffic space, appropriate measures for traffic security and management must be taken.

When preparing the actions in situ, the conditions for wastewater must be suitably provided for the rehab. The main connections should be put out of operation, if possible. In the sewer to be integrated, appropriate measures for water retention should be taken.

The affected line section and the service line locations must be calibrated and reported.

It must be verified that the sewers are gas-free. The ambient temperature of the rehabilitation site must be measured and a corresponding estimation of the temperature limits and processing times must be made.

The required PPE and the corresponding securing and rescuing technique for the staff must be provided in situ.

Checking and donning the PPE (personal protective equipment)

The work is done in areas with biogenic substance hazards and handling the resin system requires protection from irritating substances. The PPE includes:

- Protective clothing (disposable coverall)
- Gloves made of nitrile rubber or butyl rubber
- Protective goggles / face protections

The PPE must be supplemented by further components, if these are required following inspection of the real operating conditions.

Please also observe the notes in the safety data sheets of the component manufacturers.



Figure 04



Preparing the gluing spot

The point of contact for the Hutliner® or the cap profile with the sewer and / or inliner must be mechanically cleaned of dirt and adhesions.

In order to ensure secure adhesion, the gluing spot must be roughened both on the main line and in the connection area. We recommend doing this with a milling attachment with diamond segments and an air motor with a high rotational speed.



Figure 05



Cleaning the gluing spot

Clean the entire gluing spot area with high water pressure using the pipe socket syringing device. All contamination, such as milling dust, fat, and sediment, must be removed from the gluing spot. It is very important that the cleaning also be performed towards the interior of the connection.

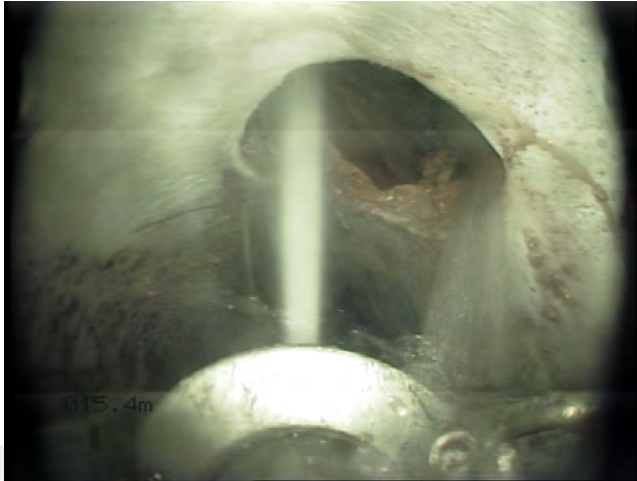


Figure 06

Selecting the rubber hat

Select a rubber hat that matches with the connection diameter.

Table 12

Rubber hat	Connection diameter
Size 1	90 – 125 mm
Size 2	>125 – 160 mm
Size 2, long	>125 – 160 mm
Size 3	>160 – 250 mm
Size 4	90 – 150 mm (HLP 150)
Size 5	90 - 125 mm (HLP 100 und 125)

Rubber hat sealing



Caution Verify the presence and the sound state of the seal on the connecting thread on the rubber hat bottom.



Figure 07

Fixing the rubber hat



Caution Tighten the rubber hat hand-tight on the connection of the HutlinerPacker® / lateral connection.



Figure 08

Attaching the PE bag

Pull a PE bag (accessory from **SCHWALM-ROBOTIC GmbH**) over the rubber hat. Make sure that there remains enough space for the expanding rubber hat (about 12 – 17 cm, yellow arrow).



Figure 09



Caution Attach the rubber hat brim together with the PE bag with one rubber band at the front and at the back, respectively (red arrows).

Wrapping into PE wrapping film

Wrap the HutlinerPacker® / lateral connection and the rubber hat into PE film. Start at one end of the HutlinerPacker® / lateral connection and wrap it into two layers of PE film in a uniform manner, i.e. you start at one end, wrap the packer to the other end and wrap back again to the starting side.

HutlinerPacker® / lateral connection DN 400-600: 3 layers

HutlinerPacker® / lateral connection DN 500-700: 3 layers

HutlinerPacker® / lateral connection DN 600-800: 4 layers



Figure 10



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PE wrapping foil around rubber hat

In order to wrap the rubber hat in, fold the redundant film of the PE bag at the peak and attach it with one layer of PE film.



Figure 11

Trimming the rubber hats

Trim your rubber hat to the recommended maximum length (see tables).

For main line diameters of DN 200 and more:

Table 13

Ø Rubber hat	Length (max.)
100 mm	130 mm
125 mm	230 mm
150 mm	200 (*300) mm
200 mm	160 mm
250 mm	120 mm

(*300) only with rubber hat size 2, long!

For main line diameter DN 100 to DN 150

Table 14

Ø Rubber hat	Length
100 mm	130 mm
125 mm	150 mm
150 mm	150 mm



Figure 12



Preparing the fibreglass mat

The fibreglass mat is cut to size according to *table 7* (page 17) for the main line diameter to be processed.



Figure 13

Fold both sides of the fibreglass mat with the cross-laid side (alongside the coloured markings) towards the inside so that the subsequent installation length of max. 60 cm is achieved.

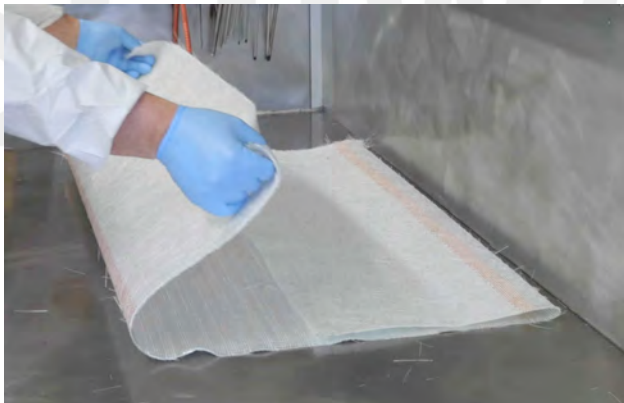


Figure 14

Now, the fibreglass mat is folded so that the cutting edges are arranged flush one over the other.

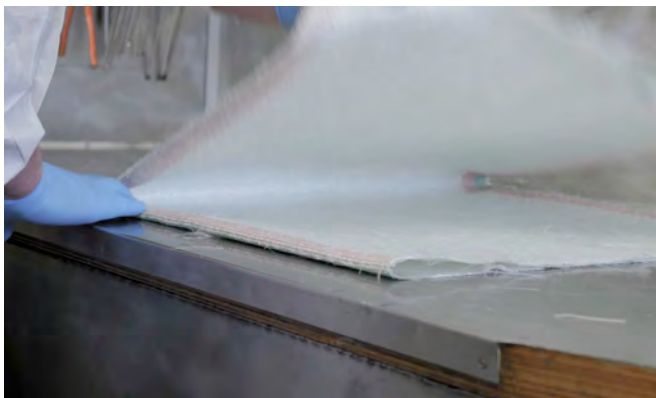


Figure 15

In the centre of the last fold of the fibreglass mat, one section corresponding to the size and geometry of the connection line is cut out.



Figure 16

After folding back the last fold, the fibreglass mat is ready for the resin treatment.



Figure 17

Figure 17

Preparing the resin system

Select the appropriate resin system based on the following table.



Figure 18

Table 15

Required resin system quantity, depending on the mat size				
Dia- meter	Length for a mat width of 127 cm	Total resin quantity	Number of bottles unit 1 (resin)	Number of bottles unit 2 (hardening agent)
DN 100	36 cm	0.75 l	1 x 0.25 l	1 x 0.5 l
DN 125	45 cm	1.0 l	1 x 0.335 l	1 x 0.665 l
DN 150	56 cm	1.0 l	1 x 0.335 l	1 x 0.665 l
DN 200	70 cm	1.0 l	1 x 0.335 l	1 x 0.665 l
DN 250	85 cm	1.5 l	2 x 0.250 l	2 x 0.500 l
DN 300	100 cm	2.0 l	2 x 0.335 l	2 x 0.665 l
DN 350	115 cm	2.0 l	2 x 0.335 l	2 x 0.665 l
DN 400	135 cm	2.5 l	2 x 0.335 l + 1 x 0.25 l	2 x 0.665 l + 1 x 0.5 l
DN 500	170 cm	3.0 l	3 x 0.335 l	3 x 0.665 l
DN 600	200 cm	4.5 l	1 x 0.25 l + 4 x 0.335 l	1 x 0.5 l + 4 x 0.665 l
DN 700	250 cm	5.0 l	5 x 0.335 l	5 x 0.665 l
DN 800	310 cm	6.0 l	6 x 0.335 l	6 x 0.665 l

Table 16

Required resin quantities, depending on the cap size			
Felt hats	Total resin quantity	Number of bottles unit 1 (resin)	Number of bottles unit 2 (hardening agent)
DN 100	0.75 l	1 x 0.25 l	1 x 0.5 l
DN 125	1.0 l	1 x 0.335 l	1 x 0.665 l
DN 150	1.0 l	1 x 0.335 l	1 x 0.665 l
DN 150, long	1.5 l	2 x 0.25 l	2 x 0.5 l
DN 200	1.5 l	2 x 0.25 l	2 x 0.5 l
DN 250	1.5 l	2 x 0.25 l	2 x 0.5 l



Caution Always pour the complete contents of the bottle of unit 1 into the bottle of unit 2! Mix the combined unit inside the bottle of unit 2 by shaking this bottle for **at least 2 minutes**. The total resin quantity to be processed is composed of the indicated number of pre-assembled units (table 16 above).



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Resin treatment of the E-CR fibreglass mat

The fibreglass mat should be entirely unfolded prior to soaking. This facilitates a uniform and complete soaking of the fibreglass mat.



Figure 19

Soak the fibreglass mat from all sides and uniformly with the mixed resin system by vigorously rubbing in the resin system with a putty knife. Make sure that there are no more "white spots" visible on the fibreglass mat.

Now, restore the same folds that were in place before the resin treatment.

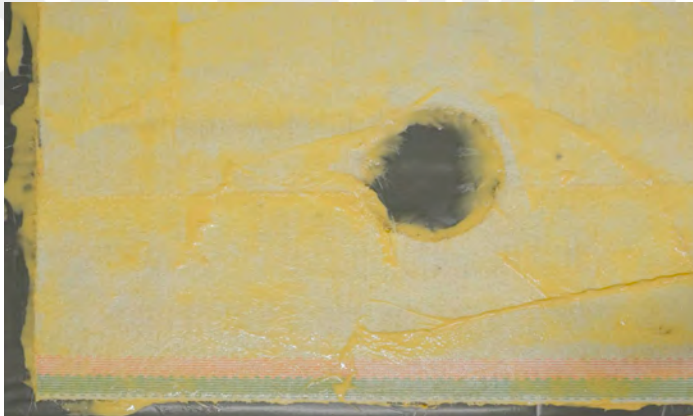


Figure 20



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Resin treatment of the felt hat

First, soak the outer surface of the exterior of the felt hat with the mixed resin system. After vigorously rubbing in the resin system with a putty knife, place the felt hat over it and repeat the process from the other side. Make sure that there are no more “white spots” visible on the felt hat.



Figure 21



This procedure also applies for the connecting hose and for the felt hat brim.



Figure 22

Figure 22



Attaching the felt hat

Place the resin-soaked felt hat on the rubber hat of the HutlinerPacker® / lateral connection.
Fold it up in the connecting hose area.



Figure 23

Attach the fold with a layer of crepe tape about 6 cm away from the upper edge.



Figure 24

Applying the fibreglass mat

Drape the resin-soaked fibreglass mat with the circular cutout centrally to the rubber hat on the HutlinerPacker® / lateral connection.

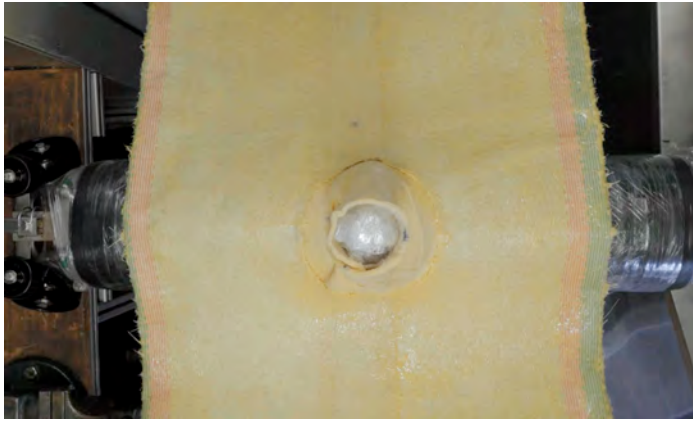


Figure 25

Attach the resin-soaked fibreglass mat with the layer of crepe tape about 10 cm away from each end of the fibreglass mat, respectively.



Figure 26

Cap profile and fibreglass mat are hence adequately secured against slipping during placement and positioning in the connection area.

Connect air supplies

Connect both air hoses to the HutlinerPacker® / lateral connection. Make sure that the hose with the red marking is connected with the coupling marked in red. The coupling marked in red is intended for filling and emptying the rubber hat.



Ventilate the rubber hat before inserting the HutlinerPacker® / lateral connection into the tube.



Figure 27

Parking the milling tool

In order to ensure a quick coupling of the milling tool, park the milling tool in the opposing orientation, if possible. Make sure not to bend the cable.



Figure 28



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Lowering the HutlinerPacker® / lateral connections

Lower the HutlinerPacker® / lateral connection into the shaft. Make sure that the retaining block points towards the robot. Guide the HutlinerPacker® into the position to be rehabilitated manually or by using a rod.



Figure 29



Caution:

If installing the HutlinerPacker® / lateral connection requires entering the sewer system, the necessary safety measures must be taken in advance. This includes in particular:

Donning the PPE, donning the safety and rescue harness, mounting the tripod, testing for gas in the sections to be entered, a second person for safety reasons.

Coupling the milling tool

Guide the milling tool placed inside the tube towards the HutlinerPacker® / lateral connection and couple the retaining plate of the milling tool to the retaining block of the HutlinerPacker® / lateral connection.



Figure 30



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Transporting the packer



In order to comply with the pot life of the resin system, slide the HutlinerPacker® / lateral connection to the damaged area immediately. In order to pivot the HutlinerPacker® / lateral connection to a certain orientation, turn it during the sliding movement. If you have already arrived at the damaged area, perform short back and forth sliding movements and simultaneously pivot the HutlinerPacker® / lateral connection.



Figure 31

Threading the felt hat

Once the position with respect to length and orientation of the damaged area is achieved, the rubber cap engages with the felt hat. Perform short back and forth sliding movements of the milling tool and the coupled HutlinerPacker® / lateral connection in order to optically determine the connection's centre point.



Figure 32

Inflating the HutlinerPacker® / lateral connection

Inflating the HutlinerPacker® / lateral connection is performed in seven steps:

1. A short air blast into the rubber hat (red air connection) so that the rubber hat, including the laminate, is set up.
2. Centre the cap profile in the connection.
3. Inflate the top cover until it is 1 – 2 cm away from the tube wall.
4. Uncouple the milling tool from the HutlinerPacker® / lateral connection.
5. Inflate the rubber hat (red air connection) to a pressure of 0.3 to 0.5 bar.
6. Inflate the upper cover to the nominal pressure (see table).
7. Inflate the rubber hat to a pressure of 1.4 bar. Maintain this pressure for a maximum of 10 seconds. Then reduce or increase to the nominal pressure (see table).



*There is a **danger due to damage resulting from air chamber rupture** when damaged air chambers are used and when the nominal pressures in the air chambers are exceeded. (Please consider the indications in the nominal pressure tables)*

For connections underneath the abutment, approx. between the angles of 110° and 190°C, the HutlinerPacker® / lateral connection should be held by the milling tool until the HutlinerPacker® / lateral connection is inflated to the nominal pressure.



Figure 33

After setting the cap profile or Hutliner® / cap liner, the milling tool can be removed and used for other tasks.

Lowering the HutlinerPacker® / lateral connection

Once the determined **deshelling time** has completely expired, the air can be released from the pressure chambers of the HutlinerPacker® / lateral connection. In order to prevent damage to the rubber hat, it is mandatory to comply with the sequence for emptying the air chambers:



- 1. Release all pressure from the rubber hat (red air connection)**
- 2. Release all pressure from the packer.**

The HutlinerPacker® / lateral connection can now be pulled out at both air tubes. It is not necessary to pick up the HutlinerPacker® / lateral connection with the milling robot.

Acceptance

The next step is the acceptance inspection, which is performed using a camera. The rehabilitation operation is registered and reported.

Control and maintenance



Hazard of rupture!

A function test of the air chambers of the HutlinerPacker® / lateral connection may only be performed inside the pipelines.



Hazard of rupture!

Indications about maximum pressure for the HutlinerPacker® / lateral connection and the rubber hats only refer to the working state in situ inside the sewer.

Outside the pipelines, the HutlinerPacker® / lateral connections may only be pressurized up to a maximum of 0.2 bar for visual inspection.

Table 17

Device		Control / maintenance interval	
HutlinerPacker® / lateral connection	Air chambers	Before and after every application	Visual inspection
		At least every three months	Function test
	Connections	Before and after every application	Visual inspection
		At least once a year	Visual inspection
	Mechanical pieces	At least every three months	Inspection of all hose connections
		At least every three months	Inspection of all hose binders
Pressure regulator	Before and after every application	Visual inspection	
	At least every three months	Function test	
Air hoses	Before and after every application	Visual inspection	
	At least every three months	Function test	



Caution During the visual inspections of the air chambers, special attention should be paid to cracks, abrasions and surface changes.



Caution After every application, the HutlinerPacker® / lateral connections, rubber hats and the all equipment used must be cleaned with a neutral cleaner and dried for storage. For storing the HutlinerPacker® / lateral connections, the upper cover should be slightly pressurized.

Accessory list

Table 18

<i>Designation</i>	<i>Order number</i>
Coverall white	2500-010-1017-001
Nitrile-covered gloves	0000002881, 0000005925, 0000005924
Safety goggles	2500-010-1019-001
Rubber hat seal (packet of 10)	0000001714
PE bag	0000001149
Rubber bands DN 50 (packet of 10)	0000003403
Rubber bands DN 80 (packet of 10)	0000001758
Rubber bands DN 100 (packet of 10)	0000001978
Rubber bands DN 160 (packet of 10)	0000004198
Rubber bands DN 200 (packet of 10)	0000003143
Rubber bands DN 260 (packet of 10)	0000003404
Putty knife 195 mm VA	2500-020-1021-001
PE wrapping film	0000001098
Separating and care agent for rubber	0000001177

Subject to technical modifications.

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