

Pipe Rehabilitation with stainless steel sleeves
Mark André Haebler, Uhrig Kanaltechnik GmbH, Germany

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DIN 1. Pipe repair according to DIN EN 15885

Agenda **DWA** 2. Pipe repair according to DWA-M 143-5

3. Presentation of partial repair by using the Quick-Lock system

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PIPE REHABILITATION WITH STAINLESS STEEL SLEEVE

14. December 2021
Mark André Haebler
Uhrig Kanaltechnik GmbH

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DIN

1. Chapter
DIN EN 15885

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	Non man entry	Man entry
Material	- Overlap compression ring and hinged clips of stainless steel	
	- Elastomeric ring seals typically EPDM	
Application	- Resin typically EP or PUR, with or without carrier material	
	- Gravity pipes only	- Gravity pipes, pressure pipes sealing of joints only
	- Main pipe	
Geometric capabilities	- Can be used to repair lined pipe	
	- Circular cross section	
	- Minimum size: 150 mm	- Minimum size: 800 mm
	- Maximum size: 800 mm	- Maximum size: 3.000 mm

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	Non man entry	Man entry
Installation characteristics	- Requires preparation of pipe surface	- Requires preparation of pipe surface, manual application only
	- Anchoring within host pipe is achieved by mechanical compression with or without additional resin adhesion	
	- Sealing achieved by compression of elastomeric rings or by resin material	
	- Steel compression ring locked in place by mechanical or hydraulic devices or tools	- Bends: not relevant (only applied at joints)
	- Surface working space is minimal	
	- Access through manhole is possible	
	- Some techniques allow through-flow others generally require consideration of flow management	
	Typical limit on working distance from access point: 100 m	Typical limit on working distance from access point: 200 m depending on conditions

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	Non man entry	Man entry
Performance	- Leak sealing	
	- re-rounding where techniques designed for that purpose	
	- Repair resists external water pressure where seal is provided	
	- Devices create local invert step	
	- Reduction in hydraulic capacity generally low due to localised nature	
		- Joint repairs in pressure pipes designed to resist internal pressure

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2. Chapter

DWA

KLARE KONZEPTE. SAUBERE UMWELT.

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- DWA-M 143-5 „Repair of drains and sewers outside from buildings“
- According to DWA „Repair with inner sleeves“ is the repair or stabilisation and seal of local damages. The aim of these repair is to obtain a pipe which meets the requirements in terms of use and safety.

DWA specified in three categories:

- Stainless steel sleeve based on compression with elastomeric seal for man entry and non man entry pipes
- Elastomeric sleeve based on compression with stainless steel bands for man entry and non man entry pipes
- Glued stainless steel sleeves for man entry and non man entry pipes

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Elastomeric seal with stainless steel bands

- Usually in man entry pipes with hydraulik or special tools
- The number of stainless steel bands depends on the outside pressure and the length of the damage

Application limits

Non man entry AND man entry
Manhole opening \geq 600 mm
Diameter: 800 – 3000 mm
Type of pipe: circular, egg profile
Cross sectional deformation: max. 6 %
Radial offset: max. 40 mm

Bild 2: System Fließrohr-Einleitung mit Kollabstabilität durch optionalen Stahl-Umringelband

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Stainless steel sleeve with elastomeric seal

- Usually in use for repair of man entry and non man entry pipes with circular cross section
- Installation with an offset packer in non man entry pipes
- More part systems can be used by man entry pipes

Application limits

Non man entry	Man entry
Manhole opening \geq 600 mm	
Diameter: 150 - 800 mm	Diameter: 800 - 1600 mm
Type of pipe: circular	
Cross sectional deformation: max. 3 %	
Radial offset: max. 10 mm	Radial offset: max. 5 mm

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Glued stainless steel sleeves

- Usually consisting of stainless steel sleeve, fiberglass mat and resin
- Usually installed with offset packer in man entry and non man entry pipes

Application limits

Non man entry AND man entry
Manhole opening \geq 600 mm
Diameter: 100 – 1200 mm
Type of pipe: circular, egg profile
Cross sectional deformation: max. 3 %
Radial offset: max. 5 mm

Bild 3: Beispiel einer verklebten Edelstahlmanschette mit Verstärkung durch korrosionsbeständige Glasfasermatte

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Requirement Stainless Steel



- Rust resistant stainless steel sleeve with material quality 1.4404 oder 1.4571
- Rust resistant stainless steel bands with material quality 1.4404 oder 1.4571
- Resistant against corrosion in municipal sewage
- Higher quality for more aggressive water
- Thickness of the stainless steel sleeve or the number of stainless steel bands depends on the static requirements and the diameter
- Aim: stainless steel sleeve or bands form-fitting with the host pipe

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Requirement resin



- Requirements settled in DIN 16945 und DIN 16946
- connection between sleeve and pipe material
 - Quality in general
 - Quality in sealing
 - Lifetime

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Requirements compression seal



- Compression Seal made out of elastomer (DIN EN 681-1)
- Very good resistance against high temperatures, acid or alkalis
- Usually EPDM is made for municipal sewage
- Compression seal must be made from one piece and not glued together

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Planning - Basics



- Basics regulated in DWA-A 143-1 and DIN EN 1465-2
- Professional assessment of the actual condition
- Including the following aspects:
 - Aim of the repair
 - Optical inspection
 - If necessary calibration
 - Building ground (soil, groundwater)
 - Economical aspects
 - Public conditions like accessibility
 - Stability of the host pipe
 - Amount of infiltration

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Installation of the product - general

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- Installation is subject to the manufacturers instruction
- Often necessary to get a training from the manufacturer
- Traffic / Road securtiy „Guideline for the rehabilitation of workplaces near roads“
- All planning documents must handed out to the installation company

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Installation – Stainless steel sleeve with elastomeric seal non man entry

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Link bar

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Preparation before usage

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- Individual depending on the damage
- Free from deposits and incrustions
- Offsets and positional deviations may have to be prepared
- High-pressure cleaning

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Serial installation – Stainless steel sleeve

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Aufbündelung

3. G.L. Manschette mit Aufbündelung 2. G.L. Manschette ohne Aufbündelung 1. G.L. Manschette ohne Aufbündelung

Fließrichtung

Blechüberlappung

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Installation – Stainless steel sleeve with elastomeric seal man entry



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Installation – Elastomeric seal with stainless steel bands



- Place the elastomer seal with sealing lips above the damaged area
- Place the stainless steel bands in the provided strips of the elastomeric seal and expand them
- There are mainly three different kinds of locking mechanism:
 - Expansion by hydraulic-press
 - Expansion by „wedge locks“
 - Expansion by snap locks and hinges



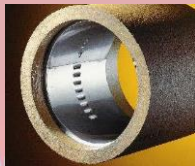
Quelle: Bilder: https://de.wikipedia.org/wiki/Datei:Hydraulic_press.jpg
https://de.wikipedia.org/wiki/Datei:Wedge_locks.jpg
https://de.wikipedia.org/wiki/Datei:Snap_locks_and_hinges.jpg

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Installation – glued Stainless steel sleeve



- Put the Material f. e. ERC-Glass fiber with Epoxy-, Silicate or PUR-Resin on top of the steel sleeve
- Thickness depends on the diameter: min. >= 3 mm
- Installation with a packer by pressurizing
- Wait until the Resin is cured



Quelle: Bilder: https://de.wikipedia.org/wiki/Datei:ERC-Glass_fiber.jpg
<https://de.wikipedia.org/wiki/Datei:Epoxy-resin.jpg>
<https://de.wikipedia.org/wiki/Datei:Silicate.jpg>
<https://de.wikipedia.org/wiki/Datei:PUR-Resin.jpg>

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How to guarantee a good quality?



- Qualification of the user → Training course by the manufacturer!
- Installation process of the user
- Suitability check of the material
- Documentation
- Optical inspection and leak test

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Costs glued Stainless steel sleeve

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<p>Main costs:</p> <ul style="list-style-type: none"> • Preparation • Bringing the Sleeve to the damaged area • Expansion and curing of the glued sleeve • Material costs 	<p>Additional costs:</p> <ul style="list-style-type: none"> • Equipment for the construction side • Traffic / road security • Water-flow management • Cleaning • Cutting • If necessary presealing • Additional cleaning after finishing preparation • Inspection
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Conclusion costs

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- Especially for the glued stainless steel sleeve the additional costs are very high in relation the main costs
- For smaller diameter the additional costs can be higher than the main costs

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Costs stainless steel sleeve

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<p>Main costs:</p> <ul style="list-style-type: none"> • Preparation • Bringing the Sleeve to the damaged area • Expansion of the sleeve • Material costs 	<p>Additional costs:</p> <ul style="list-style-type: none"> • Equipment for the construction side • Traffic / road security • Water-flow management • Cleaning • Cutting • Inspection
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Economical view compared to other possibilities?

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- Strategical: use of a repair techniques and the delayed renovation or replacement work makes sense
- Individual components have a long life cycle



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Environmental impact


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- Basically, attention must be paid to an environmentally freindly and compatible
- Do not release any soil or substances hazardous to groundwater
- Resin applications = anchored in DiBt approvals
- Glued stainless steel sleeves = more information on technical data sheets regarding, transport, strage and installation
- Waste (like packaging) must be deposit properly

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3. Chapter

Presentation of partial repair by using the Quick-Lock system



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Approvals



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Product overview

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	Quick-Lock Standard DN 150 – DN 800		BIG Liner end sleeve DN 800 – DN 1600
	Liner end sleeve DN 150 – DN 800		QL Mini / Mini LEM DN 100 – DN 150
	Quick-Lock BIG DN 800 – 2000		Quick-Lock Flex DN 200 – DN 600

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Type of applications

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QL FLEX

- Radial offsets: max. 2.5 cm

QL MINI

- House connetions and gravity pipes DN 100 – DN 150
- Bending packer can be used up to 45° degree

QL BIG

- Length: 20 cm, so perfect for leaking joints
- Up to DN 2.000

Pipe Material: Stoneware, Concrete, Reinforced concrete, Plastic, GPR-Pipe, cast iron, steel pipe

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Examples construction site – single installation

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When talking about Quick-Lock it means...

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V4A Stainless steel sleeve

Rubber seal

Offset packer

- EPDM → municipal sewer
- NBR → industrial sewer
- Silicone → potable water

Offset packer DN 100 – DN 800

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Examples construction site – single installation

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Contact information if you have any further questions...

- Mr. Christopher Rings - von der Kall
- Sales / Support Europe
- E-Mail: rings@uhrig-bau.de
- Phone: +49 151 52524124
- Mr. Mark André Haebler
- Head of International Sales and Development
- E-Mail: haebler@uhrig-bau.de
- Phone: +49 151 64 61 84 31

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