Report

Project:	**Jetting restistance test according to draft DIN-standard 19523, August 2007**

Product: Quick-Lock-System

Client: Uhrig Kanaltechnik GmbH
Am Roten Kreuz 2
78187 Geisingen

Contractor: IRO GmbH Oldenburg
Ofener Straße 18
26121 Oldenburg

date: 18.04.2008

mangager: Prof. Dipl.-Ing. Th. Wegener

competent official: Dipl.-Ing. M. Böge

Jetting resistance test

according to

Draft DIN-standard 19523, August 2007

Report

Contents

1 Theme

The „Quick-Lock“– system of the company Uhrig Kanaltechnik GmbH, as one of the mounting system for internal pipe rehabilitations, has been tested against high pressure clean water jetting by iro GmbH Oldenburg.

The draft of the DIN-standard 19523 specifies a test method for the resistance to high pressure clean water jetting of pipes systems. The test method was applied to the „Quick-Lock“– system.

In principle the mechanical load resulting from the high pressure water jet can negatively influence the function of a rehabilitation product. Therefore the focus was laid on the displace security and water tightness of the system during the tests.

In addition the test assemblies should be placed for usual damages which can occur on sewer or other pipe system made of vitrified clay or concrete. For that the conditions of the defected pipe system should be as realistic as possible.

The water tightness of the rehabilitated system was proofed by a watertight - test method described in DIN EN-standard 1610.

2 Test specimen

The test specimen is a stainless steel gasket with an integral mechanical lock system – the so called „Quick-Lock”-gasket from type „standard“.

The water tightness and place security is achieved by an EPDM- compression sealing, which fits closely to the inner pipe after expanding the gasket.

Dates of test assembles:

Producer	UHRIG Kanaltechnik
Name of product	„Quick-Lock“-System“ - type standard
Diameter	DN 300
Wall thickness	1.2 mm
Length	400 mm

The „Quick-Lock“-gaskets are usually qualified for partial rehabilitating of damaged pipe systems. The damages are confined to “condition I and II”. Both are defined in dwa-sheet M 127-2. Mainly of the described damages on pipes are leaks caused by cracks, occurrence of fragments and lost pieces.

The test range was committed as following shown:

A 1.00 m section of vitrified clay pipe was used for the material test. Here a „Quick-Lock“- gasket was placed on a cross-cracked part of the pipe.

Fig. 1: section of vitrified clay pipe with cross-crack (outer face)

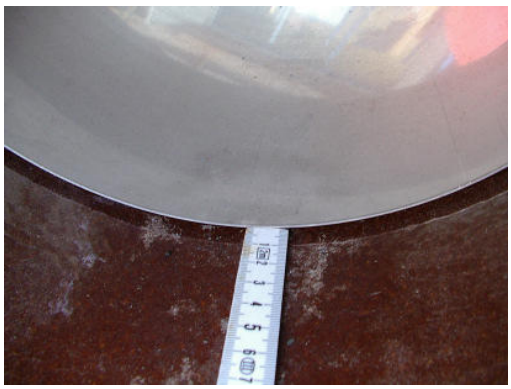


Fig. 2: section of vitrified clay pipe with placed gasket (inner face)

For carrying out the practical test two 10 m long test courses of vitrified clay and concrete pipe sections (DN 300) were built over ground. The simulated damages were created by iro as shown by the following:

	Damage description	Vitrified clay pipe	Concrete pipe
1	Fragments		
2	Cross-crack	Not taken in consideration	
3	Longitudinal crack		Not taken in consideration
4	Broken sealing in joint section		
5	Lost piece / failed connection		

For creating the cracks the definitions of condition II according to dwa sheet M 127 – 2 were observed. Therefore the crack-width resulted from the defined pipe deformation.

Beyond it the length of the fragments has to be longer than a gasket is (40 cm). Such damages usually are rehabilitated by the use of successively placed gaskets.

3 Test conditions

As described below the tests were carried out under consideration of specifically test parameters and test conditions.

3.1 Material test method

A high pressure water jet is directed at a specified angle to and distance from the test surface. It is moved relative and parallel to the inner surface of the test specimen. The resulting mechanical load (expressed as jet power density) is kept within specified limits for the duration of the test by controlling the parameters water pressure, flow rate, distance and jet spread angle.

nominal test parameters for the material method:

Water quality	Freshwater
Temperature of water and air	15 °C ±10 °C
Jet power density D_j	450 W/mm^2
Jet spread angle ω	≤ 3.3 °
Nozzle angle α	30 ° ± 1 °
Vertical distance between the test surface and the centre of the nozzle orifice	(10 + 0.00 – 2.00) mm
Orifice diameter of the nozzle insert	(2.50 ± 0.02) mm
Amount of test courses	3 with a distance t.a. of 10 cm
Length of test courses	usually 1.00 m + 2 x 150 mm accelerating length (here: length of gasket + 100 mm for testing the edge of the gasket)
Velocity of travel	(0.2 ± 0.02) m/min.
Test procedure per test course	3 test cycles (forwards/backwards)

All dimensions of the nozzle shall conform to figure 3.

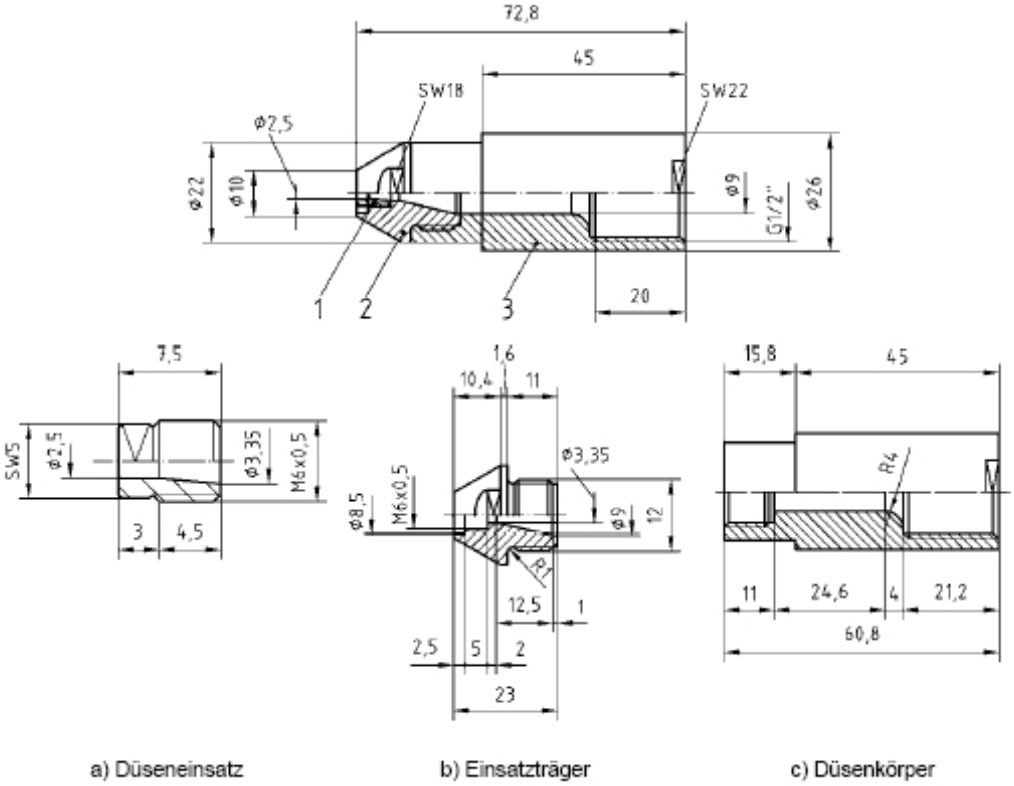


fig 3: nozzle Ø 2,5 mm for material test method according to draft DIN-standard 19523

The nozzle shall have a wear-resistant ceramic insert.

3.2 Practical test method

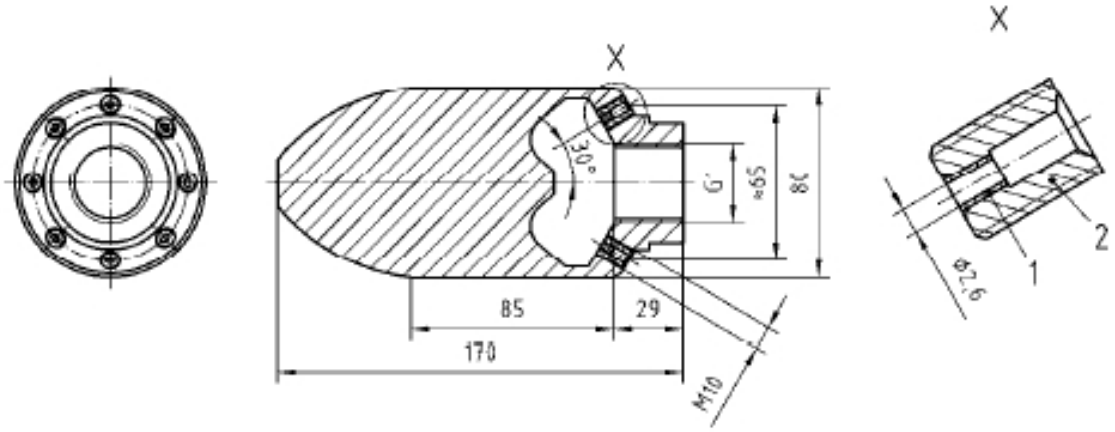
This test method considers the mechanical loads during the high pressure clean water jetting resulted from the high water jet itself and additionally the weight of the nozzle and hose.

According to the draft DIN-Standard 19523 the test course shall have a length of at least 15 m with a gradient of 0 ‰ – 3 ‰. In contrast to this requirement the „Quick-Lock"- gaskets were built in the two test courses described in chapter 2.

Nominal test parameters for the material method:

Water quality	Freshwater
Temperature of water and air	15 °C ±10 °C
Jet power density D_j	330 W/mm^2
Test nozzle	Standard-nozzle (fig. 4)
Nozzle angle α	30° ± 1°
Amount of nozzle insert	8
Orifice diameter of the nozzle insert	(2.60 ± 0.02) mm
Length of test courses	usually 15 m (here description in chapter 2)
Velocity of travel – feed	(1.0 ± 0.1) m/s
Velocity of travel – retreat	(0.1± 0.02) m/s
Test procedure	60 test cycles (forwards/backwards)

All dimensions of the nozzle and inserts shall conform to figure 4.



Parameter	Value
Length of nozzle	(17 +- 0.5) cm
Weight of nozzle	(4.5 +- 0.1) kg
Diameter of nozzle	(8+- 0.5) cm

fig 4: standard-nozzle for practical test method according to draft DIN-standard 19523

The nozzle shall have wear-resistant ceramic inserts.

4 Test

The material test on the test specimen was carried out on February, 5th 2008 at the testing ground of iro GmbH Oldenburg.

After placing the gasket the test specimen had no visual damages and could now be tested.

Fig. 5: test specimen with placed gasket installed in test-stand

During the material test the water jet forced through the sealing and came out of the pre-damaged pipe-wall (fig. 5).

After the test there were no visual damages on the gasket. Beyond it the water tightness of the system was proved according to the air test method described in DIN EN –standard 1610 [2].

The practical test on the two test course was carried out on January, 17th and 21st 2008 at the testing ground of iro GmbH Oldenburg.

(fig. 6 + 7).

The test courses described in chapter 2 had no visual damages and could now be tested.

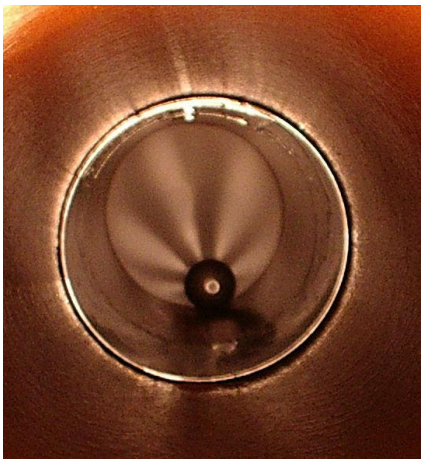


Fig. 6: practical testing of the Quick-Lock-System in vitrified clay pipe (inside)

fig 7: practical testing of the Quick-Lock-System in concrete pipe (outside)

During the material test the area around the cross-crack at the concrete pipe was conspicuous. In the development of the test an increasing amount of water established which came out of the pre-damaged pipe-wall.

After the test there were visual deformations on two of the gasket-edges placed in the vitrified clay pipes. The cause of these deformations is obviously a mechanical hitch of the nozzle during the retreat-process. During the water tightness-test with 0,5 bar according DIN EN –standard 1610 [2] one of the gaskets which was placed at the cross-cracked concrete-pipe failed.

After replacing the gasket which failed the jetting test was repeated in this section of the test-course with the following proofs of failures.

The repeated investigations on the gasket system had shown no further failures.

5 Material test method on beaded gasket

In addition to the described tests the material test method was applied on a further developed gasket of the company Uhrig Kanaltechnik GmbH.

The difference to the „standard“-gasket described in chapter 2 is a beaded edge placed in flow and cleaning direction.

Analogous the material test was carried out like the test described in Chapter 3.1 (fig.8).

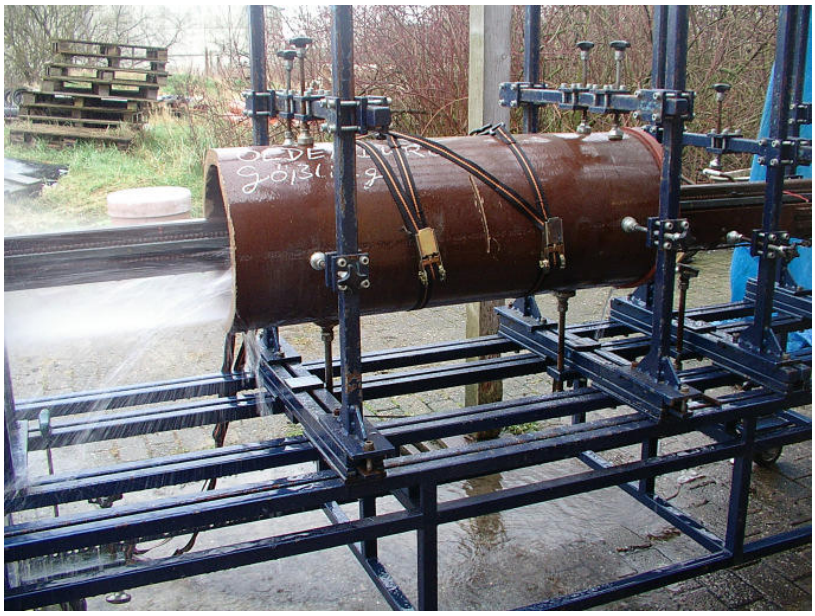


Fig. 8: test assembly with beaded gasket installed in test-stand

Compared to the test-results of the „standard“-gasket the beaded gasket prevented the forcing of the water jet through the sealing. During the test the gasket obviously stayed tight.

After the test there were no visual damages on the gasket. Beyond it the water tightness of the system was proved according to the air test method described in DIN EN –standard 1610 [2].

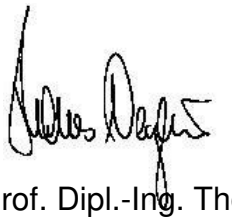
6 Results

The résumé of the tests shows that the tested rehabilitation method „Quick-Lock“-gasket of the company Uhrig Kanaltechnik GmbH has withstood the test conditions according the draft of DIN-standard 19523, August 2007. The draft of the standard defines the requirements on test conditions to test the behaviour of sewer or parts of it during the high pressure clean water jetting.

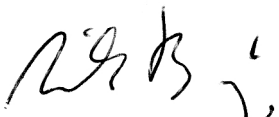
An additional material test on a further developed gasket had shown a positive effect. During the jetting cleaning the beaded edge of the gasket prevented the water jet from forcing through the sealing. Besides the risk of a possible nozzle hick during the retreat could be minimised.

Oldenburg,

April, 8th 2008



Prof. Dipl.-Ing. Thomas Wegener
Geschäftsführer



Dipl.-Ing. Mike Böge
Sachbearbeiter

7 Literature

[1] DIN 19523 – Norm-Entwurf, Anforderungen und Prüfverfahren zur Ermittlung der Hochdruckstrahlbeständigkeit und -spülfestigkeit von Rohrleitungsteilen für Abwasserleitungen und -kanäle, August 2007

[2] DIN EN 1610, Verlegung und Prüfung von Abwasserleitungen und –kanälen, Oktober 1997

8 Annex

1. Prüfprotokoll mit Fotodokumentation der Werkstoffprüfung nach Norm-Entwurf DIN 19523, August 2007
   - 1-1 Quick-Lock-Standard
   - 1-2 Quick-Lock Aufbördelung
2. Prüfprotokoll mit Fotodokumentation der Praxisprüfung nach Norm-Entwurf DIN 19523, August 2007
3. Kanalfernsehprotokoll, Fa. Kleen GmbH, Norden

Anhang 1-1

Protokoll

Werkstoffprüfung gemäß DIN-Entwurf 19523, August 2007

Projekt:	G 35.560
Prüfdatum:	21.01.08
Prüfer:	MBö
Hersteller:	Uhrig Kanaltechnik GmbH
Bezeichnung:	Quick-Lock-System
Kennzeichnung des Prüfstücks:	QL-Standard/STZ

Abbildung 1: Prüfstück während der Werkstoffprüfung

Prüfparameter:

Vertikaler Abstand zwischen der Prüfoberfläche und der Mitte des Düseneinsatzes	10 mm -2mm
Strahlwinkel α:	30° +/- 1°
Düseneinsatz- Ø d vor und nach Prüfung:	2,50 +/-0,02 mm
Prüfgeschwindigkeit:	0,2 +/- 0,02 m /min
Anzahl der Prüfzyklen:	3 x 3 Zyklen
Umgebungstemperatur	7 °C
Wassertemperatur	15 °C
Ausbreitungswinkel des Spülstrahls ω:	< 3,3°
cd – Wert vor der Prüfung	0,899
cd – Wert nach der Prüfung	0,900
Durchschnittliche Spülstrahl-Leistungsdichte D_J für	
Prüfstrecke 1	451 W/mm^2
Prüfstrecke 2	446 W/mm^2
Prüfstrecke 3	451 W/mm^2

Ergebnisse

Schadensdokumentation:

Oberflächenbeschaffenheit des Prüfstücks vor der Prüfung

- Glatt, keine Auffälligkeiten

Oberflächenbeschaffenheit des Prüfstücks nach der Prüfung

- Die Manschette weist nach der Prüfung keine Schäden infolge des HD-Spülstrahls auf.

Protokoll

Werkstoffprüfung gemäß DIN-Entwurf 19523, August 2007

Fotodokumentation

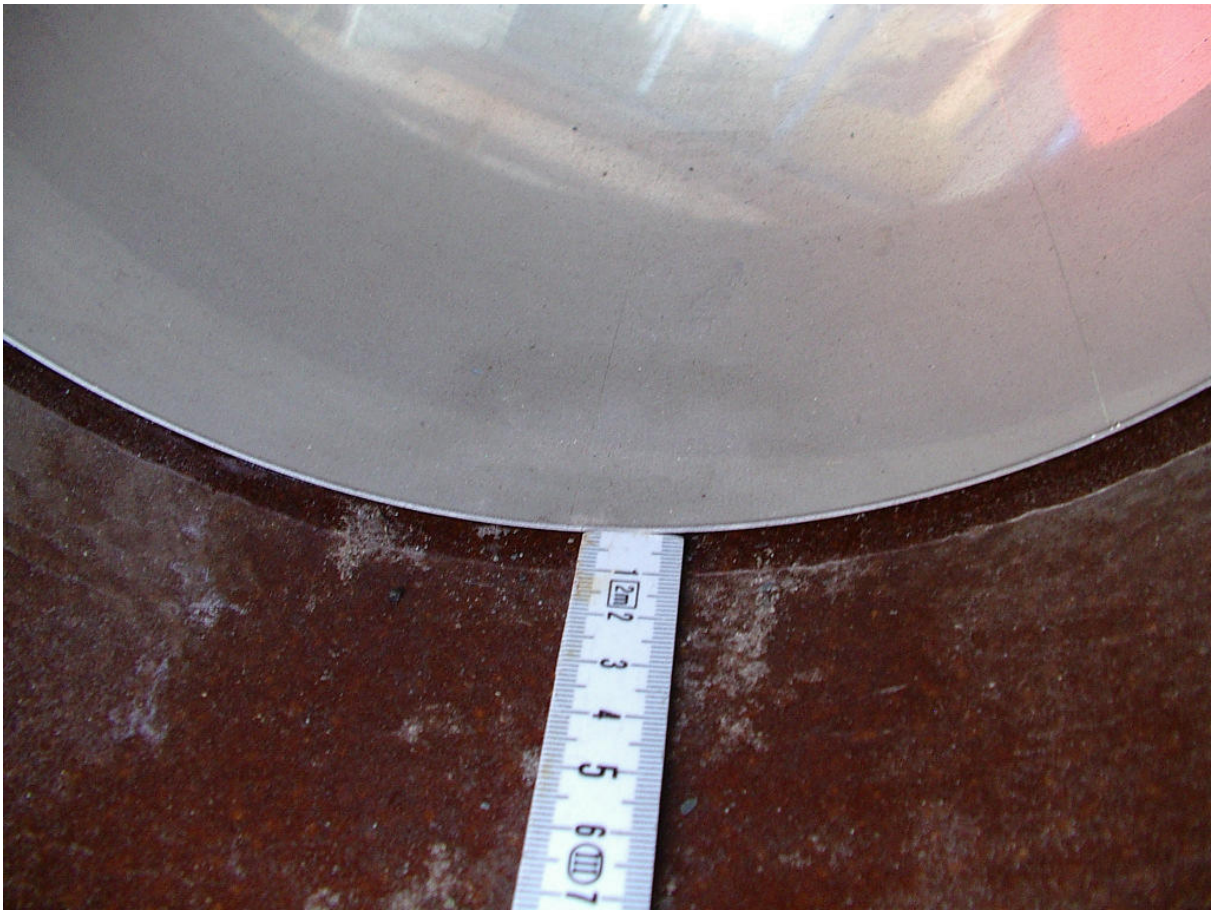


Abbildung 2: Prüfstück nach der Prüfung

Anhang 1-2

Protokoll

Werkstoffprüfung gemäß DIN-Entwurf 19523, August 2007

Projekt:	G 35.560
Prüfdatum:	21.01.08
Prüfer:	MBö
Hersteller:	Uhrig Kanaltechnik GmbH
Bezeichnung:	Quick-Lock-System
Kennzeichnung des Prüfstücks:	QL-Aufbördelung/STZ

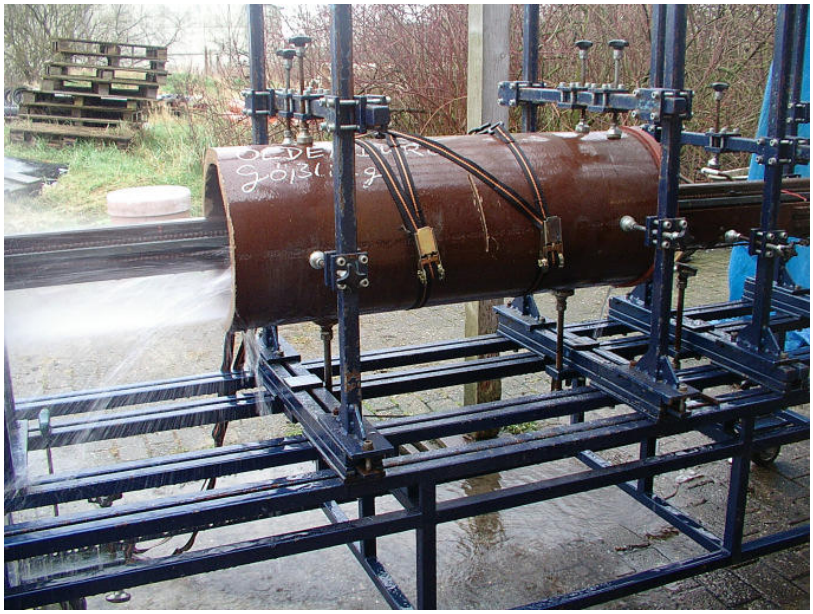


Abbildung 1: Prüfstück während der Werkstoffprüfung

Prüfparameter:

Vertikaler Abstand zwischen der Prüfoberfläche und der Mitte des Düseneinsatzes	10 mm -2mm
Strahlwinkel α:	30° +/- 1°
Düseneinsatz- Ø d vor und nach Prüfung:	2,50 +/-0,02 mm
Prüfgeschwindigkeit:	0,2 +/- 0,02 m /min
Anzahl der Prüfzyklen:	3 x 3 Zyklen
Umgebungstemperatur	7 °C
Wassertemperatur	15 °C
Ausbreitungswinkel des Spülstrahls ω:	< 3,3°
cd – Wert vor der Prüfung	0,889
cd – Wert nach der Prüfung	0,895
Durchschnittliche Spülstrahl-Leistungsdichte D_J für	
Prüfstrecke 1	450 W/mm^2
Prüfstrecke 2	451 W/mm^2
Prüfstrecke 3	451 W/mm^2

Ergebnisse

Schadensdokumentation:

Oberflächenbeschaffenheit des Prüfstücks vor der Prüfung

- Glatt, keine Auffälligkeiten

Oberflächenbeschaffenheit des Prüfstücks nach der Prüfung

- Die Manschette weist nach der Prüfung keine Schäden infolge des HD-Spülstrahls auf.

Protokoll

Werkstoffprüfung gemäß DIN-Entwurf 19523, August 2007

Fotodokumentation

Abbildung 2: Prüfstück nach der Prüfung

Anhang 2

Protokoll

Praxisprüfung gemäß Entwurf DIN 19523, August 2007

Projekt:	G 35.560
Prüfdatum:	17. + 21.01.2008
Prüfer:	MBö
Hersteller:	Uhrig Kanaltechnik GmbH
Bezeichnung:	Quick-Lock-System
Kennzeichnung der Prüfstrecke:	QL Steinzeug / Beton

Aufbau der Versuchsstrecken:

Siehe „Kanalfernsehprotokolle“ der Fa. Kleen GmbH, Norden

Düsenkörper:

Düsenlänge:	17 +/- 0,5 cm
Düsengewicht:	4,5 +/- 0,1 kg
Düsenkörperdurchmesser:	8 +/- 0,5 cm

Prüfparameter:

Durchfluss *Q*:	280 – 285 l/min
Strahlwinkel *α*:	30° +/- 1°
Düseneinsatz- *Ø d* vor und nach Prüfung:	2,60 +/-0,02 mm
Vorschubgeschwindigkeit:	1,0 +/- 0,1 m/s
Rückzuggeschwindigkeit:	0,1 +/- 0,02 m/s
Anzahl der Prüfzyklen:	60
Umgebungstemperatur	9 °C
Wassertemperatur	12° C
Druck vor der Prüfung bei 282,5 l/min	104,2 bar
Druck nach der Prüfung bei 282,5 l/min	105,9 bar
cd – Wert vor der Prüfung	0,761
cd – Wert nach der Prüfung	0,757
Durchschnittliche Spülstrahl-Leistungsdichte D_J	332 W/mm^2

Protokoll

Praxisprüfung gemäß Entwurf DIN 19523, August 2007

Ergebnisse

Schadensdokumentation:

Oberflächenbeschaffenheit der Manschetten vor der Prüfung

- Glatt, keine Auffälligkeiten

Oberflächenbeschaffenheit der Manschetten nach der Prüfung

- Die Innenoberfläche der Manschetten weist nach der Prüfung im Sohlbereich Schlauchabriebspuren auf.
- Zwei Manschetten im Steinzeugrohr weisen nach der Prüfung am Rand leichte Verformungen infolge mechanischen Düsenwiderstandes auf.

Protokoll

Praxisprüfung gemäß Entwurf DIN 19523, August 2007

Fotodokumentation

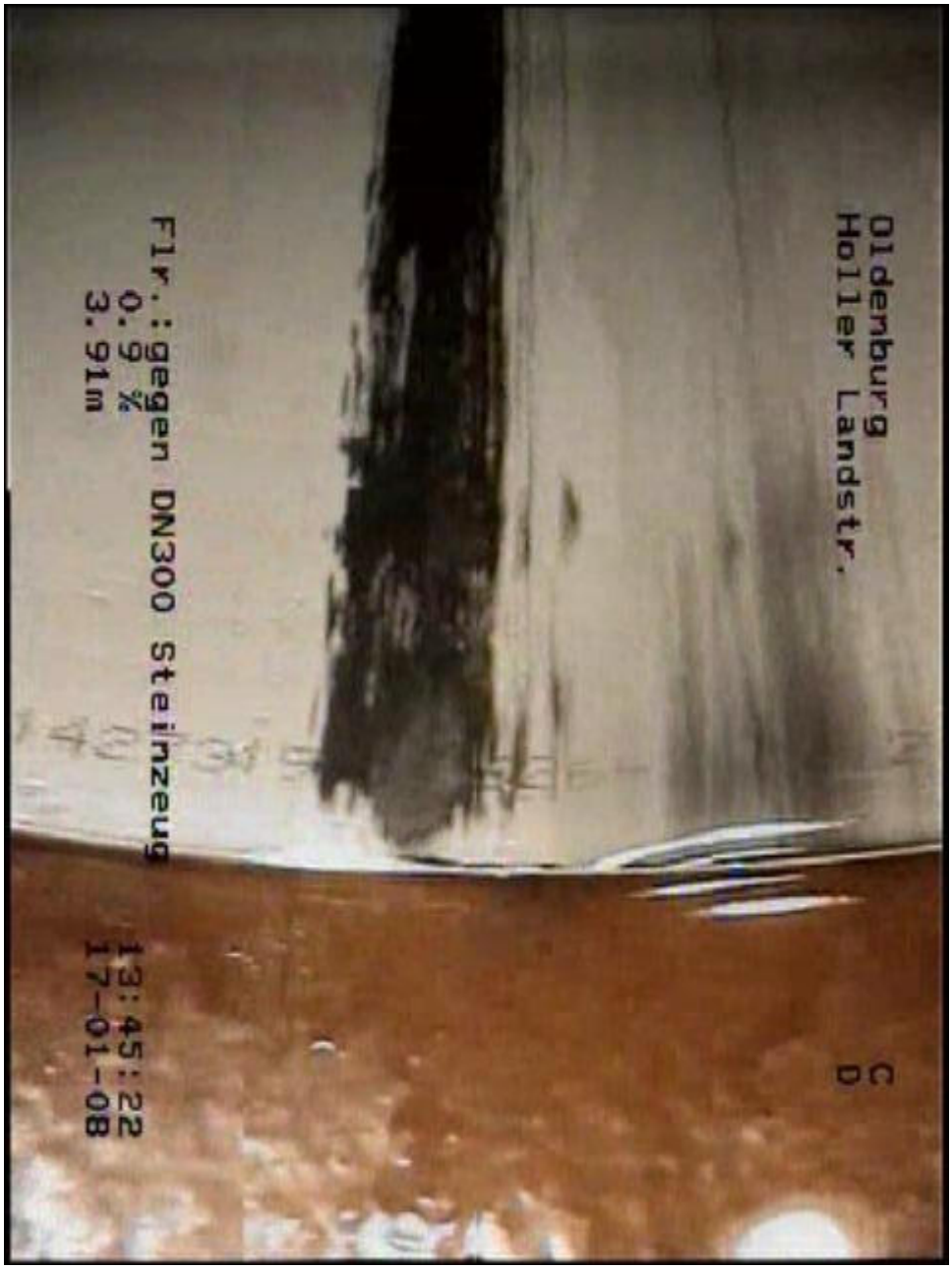


Abbildung 1: Schlauchabrieb im Sohlbereich nach der Prüfung

Protokoll

Praxisprüfung gemäß Entwurf DIN 19523, August 2007

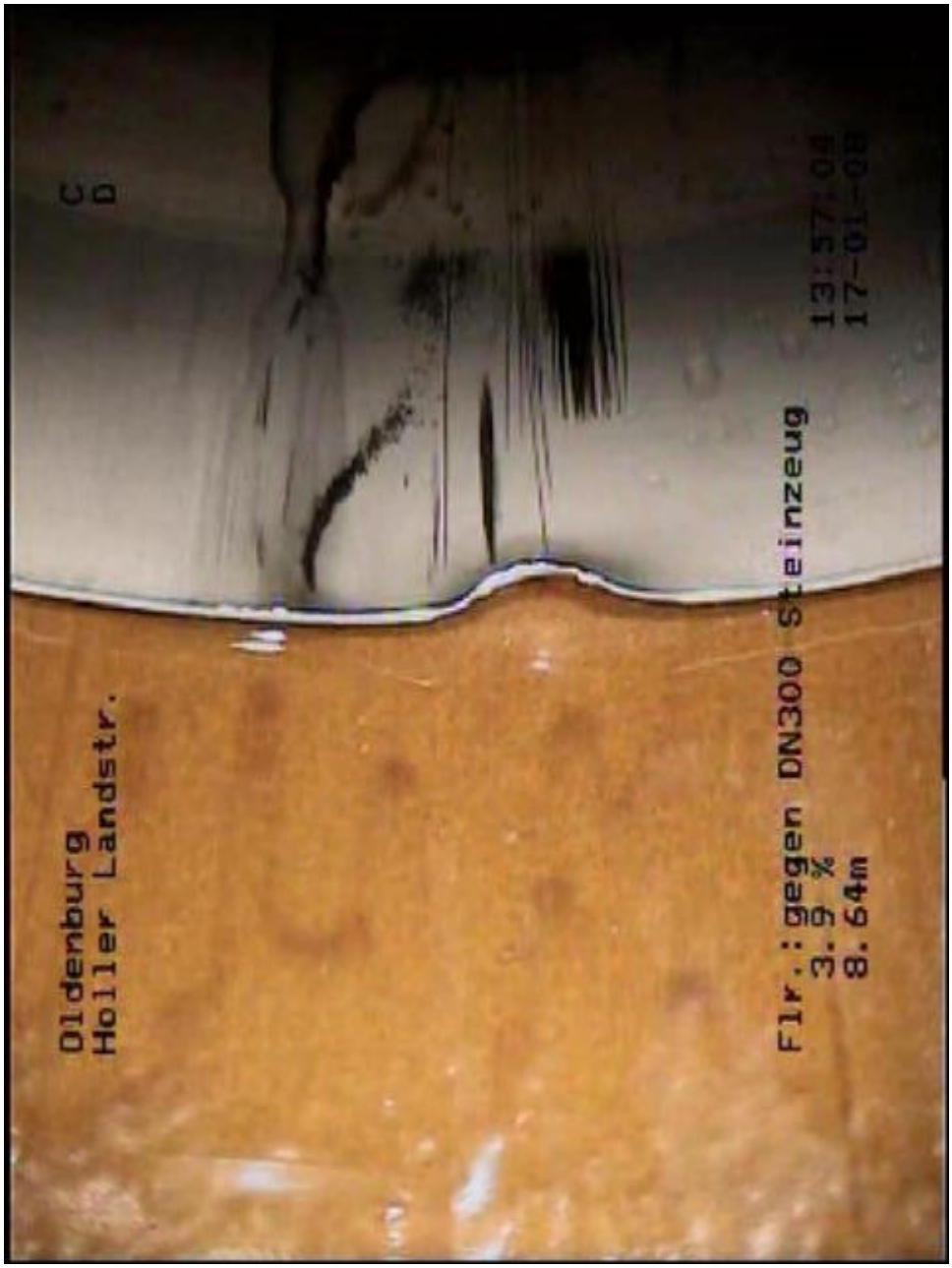


Abbildung 2: Deformation des Manschettenrandes nach der Prüfung