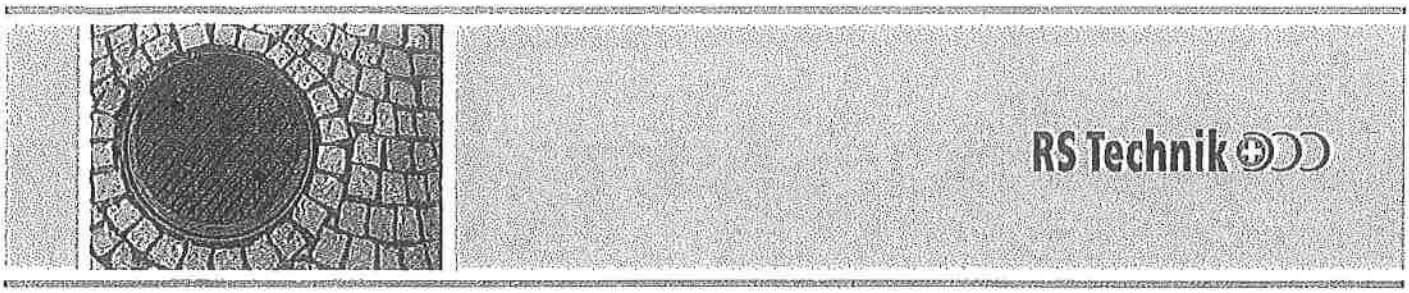
Lateral Resin



Pipeline Sectional Repair System

RS MaxPatch®

Introduction

RS MaxPatch is used to repair short lengths of damaged sewer pipelines. The RS MaxPatch system is a composite made of two basic materials - a fiberglass liner impregnated with an ambient curing two-part silicate resin system.

Technical Data

Liner: RS MaxPatch Fiberglass Matting

Resin: Three (3) silicate resin systems are available for the RS MaxPatch system:

Part A - RS MaxPatch Summer, RS MaxPatch Winter, RS MaxPatch SCW
Part B – RS MaxPatch

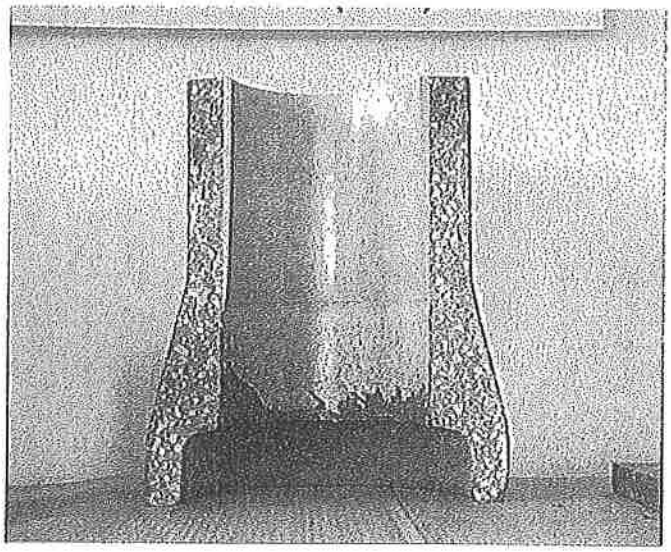
All Part A components use the same RS MaxPatch Part B and are mixed in a 1:2 volumetric ratio (Part A to Part B). The resin is selected for each installation based on the desired curing time and the ambient temperature. All three resin systems, when used with RS MaxPatch Fiberglass Matting and properly cured, will meet or exceed the minimum physical properties listed below.

Physical Properties:

	Test Method	Minimum Value
Flexural Modulus	ASTM D 790	1,200,000 psi
Flexural Strength	ASTM D 790	30,000 psi

RS MaxPatch exceeds the structural requirements of ASTM F 1216.

COMPARISON OF INITIAL MINIMUM STRUCTURAL PROPERTIES ASTM F 1216 vs RS MaxPatch		
Structural Property	**ASTM F 1216**	**RS MaxPatch**
Flexural Strength ASTM D790 (psi)	4,500	30,000
Flexural Modulus ASTM D 790 (psi)	250,000	1,200,000



RS MaxPatch provides a structural repair with a "frictional/interference" fit in sewer pipes, and are suitable for repairs in pipes of circular or egg-shaped cross section composed of concrete, reinforced concrete, vitrified clay, PVC or asbestos cement, where the structural stability of the patch is not dependent upon its bond to the host pipe. Structural stability of the patch is achieved by pressing the liner tightly against the walls of the host pipe and thereby forcing excess resin into irregularities and defects in the old pipe. When the excess resin is cured, it forms a tight interference fit with the host pipe, even without the formation of a chemical bond.

* Part A - RS MaxPatch Summer, Winter, and SCW (Severe Cold Weather) - are all comprised of the same base components, however, each contains additives to either retard or accelerate the pot life and curing time within a specific temperature range. Pot life and curing times may also be adjusted by mixing of two of the "Part A" components as shown in the RS installation procedures.

RS Technik

RS MaxPatch® Winter — Pipe Rehabilitation Resin System

Description

The RS MaxPatch™ Winter resin system is a non-foaming, elasticized, two-component, odor free resin for the application of partial liners in localized sewer repairs. As a part of the RS MaxPatch™ Sectional Repair System, this resin system has excellent chemical resistance and adhesion properties, is very low shrink and cured under ambient conditions, even in the presence of water. It is used in conjunction with RS Fiberglass Liners to produce a structural solution for short sections of sewer pipelines without excavation.

Technical Data

Mixed resin pot life varies with temperature and total mass of material mixed. The laboratory data provided below is for reference only. For more detailed product information, contact RS Technik prior to use.

Reaction Data

Mixing Ratio A:B	1:2 by volume
Components	Rs MaxPatch Winter (Part A) RS MaxPatch (Part B)

Temperature

	41°F(5°C)	50°F(10°C)	59°F(15° C)	68°F(20°C)	77°F(25°C)	86°F(30°C)
Pot life (spreading)*	30 min	25 min	20 min	15 min	12 min	8 min
Time for placing*	40 min	35 min	30 min	25 min	20 min	15 min
Curing time*	180 min	150 min	120 min	90 min	60 min	50 min

*Laboratory values may vary from field results

Material Data

		Part A	Part B
Density	at 77°F (25°C), lb/ga	12.43 ± 0.42 (1490 ± 50)	9.43 ± 0.33 (1130 ± 40)
Color		Honey color	Black/brown
Flash Point	°F (°C)	none	> 392 (> 200)
Viscosity	At 77°F, cps	300 ± 140	150 ± 50

Components and Properties

Components:

RS MaxPatch Winter (Part A) is a special waterglass (aqueous sodium silicate) with additives. RS MaxPatch (Part B) is a modified polyisocyanate. RS fiberglass liners are specifically designed for RS MaxPatch applications. Contact RS Technik for additional information on this product.

System:

Measured volumes of Part A and B are mixed and applied to the required size of RS Fiberglass Liner, wrapped tightly around and secured to an inflatable rubber packer, pulled into position, expanded against the host pipe using air pressure and cured under ambient conditions. The packer is then deflated and removed, completing the sectional repair.

Final Product:

The combined resin and liner system is cured after insertion into the host pipe to form a tough, strong renovated pipe. It is resistant to municipal sewage, acids and alkalis commonly found in drains, sewers and commercial wastewater.

Packing

Part A:	Part B:
Pails or Canisters, 62 lb	Pails or Canisters, 47 lb
Drums, 617 lb	Drums, 463 lb

Other packing options available upon request

Shelf Life and Storage

At least 12 months from date of delivery when stored in a dry place between 50-86°F (10-30°C). Frost may damage part A. If flocculation occurs or if the material's shelf life has been exceeded consult RS Technik prior to use.

Safety

Refer to the Material Safety Data Sheets for these products for safety and health information prior to use. Follow all notices on the MSDS. If you do not understand or cannot adhere to the guidelines and procedures for handling and use of these products in strict accordance with the MSDS, do not use these products. Contact RS Technik at 919-481-1977 for a copy of the Material Safety Data Sheets.

Disposal

Follow local, state and federal regulations for disposal. Refer to product MSDS for additional information.

SuperLite
Max Calibration Hose™

DESCRIPTION:

- A light weight polyester fabric with PVC coating with an overlapped and taped joint.

TECHNICAL DATA:

- Coating: PVC
- Carrying Material: Polyester Fabric
- Installation: Inversion or "pull-in" method
- Hot water curing up to max: 122°F
- Use: with resin and hardener from the MaxPox™ System
- Highly recommended to use only once.

DIAMETER RANGE:

- 3" TO 6"

AVAILABLE MANUFACTURER LENGTHS:

- 164 and 328 ft lengths in stock (+/-)

INSTALLATION:

- Installation Air Pressure: 5 to 7 psi (may need additional pressure to invert around bends)
- Call our technical advisor with additional questions at 877.426.5948

This product information sheet gives general information. Exact coating type and thickness depend on the specific types of resin being used. Please contact our technical team for specific advice.

Revision #1
Effective Date: 5/24/12
Next Revision Date: 4/1/13

MAXLINER®

450 College Drive · Martinsville, VA 24112
P: 276.656.1225
F: 276.656.0419
www.maxlinerusa.com

Max LinerTube Reinforced™

DESCRIPTION:

- Cured In Place Pipe (CIPP) Scrim Reinforced Flexible Felt Tube. Polymer coated through an extrusion and laminating process non woven needle punched polyester. Fiber a weft inserted wrap knit 100 percent continuous filament polyester scrim. Tube forming and seam bonding achieved through specially designed thermal welding process that incorporates a reinforced seaming operation creating a superior enhanced performance liner.

TECHNICAL DATA:

- Coating: PU
- Carrying Material: Polyester Felt
- Installation: Inversion
- Resin Compatibility: Suitable for use with resin and hardener from the MaxLiner™ System

DIAMETER RANGE:

- 3" TO 8"

THICKNESS RANGE:

- 3 mm and 4.5 mm

AVAILABLE MANUFACTURER LENGTHS:

- 165 and 330 ft lengths in stock (+/-)

INSTALLATION:

- Installation Air Pressure: 7 to 10 psi (may need additional pressure to invert around bends)
- Curing Pressure: 7 to 8 psi
- Call our technical advisor with additional questions at 877.426.5948

This product information sheet gives general information. Exact coating type and thickness depend on the specific types of resin being used. Please contact our technical team for specific advice.

Revision #1
Effective Date: 5/24/12
Next Revision Date: 4/1/13

MAXLINER®

450 College Drive · Martinsville, VA 24112
P: 276.656.1225
F: 276.656.0419
www.maxlinerusa.com

Leaks
T/S

siebert+knipschild GmbH
Ingenieurbüro für Kunststofftechnik
Application technology
Materials testing
Quality assurance

Bergstücken 25
22113 Oststeinbek
phone: +49 (0)40-668 714 - 0
fax: +49 (0)40-668 714 - 99
e-mail: info@ibsiebert.de
internet: www.ibsiebert.de

managing directors:
Kay Siebert
Andreas Haacker

company seat: Oststeinbek
Lübeck Municipal Court
Comm. Register HR B 3262 RE

tax no.: 30 293 30162
VAT ID no. DE216346565

Test report

Report no. 1243594-2

Material examination in accordance with ASTM F1216-09, X2
CHEMICAL RESISTANCE TEST

sample no.:	1243594
Pipe geometry:	DN 150
sample designation:	Sample liner
samples received on:	July 06, 2012
order date:	July 06, 2012
client:	AMerik Engineering LLC 2600 Ainsley Ct. Marietta, GA 30066 USA

1 Determination of material properties according to ASTM F1216-09, X2 2
1.1 Test of the resistance of the cured CIPP to chemical attack acc. to ASTM F1216, Table X2.1 2
1.1.1 Determination of the change of flexural properties 2

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1 Determination of material properties according to ASTM F1216-09, X2

1.1 Test of the resistance of the cured CIPP to chemical attack acc. to ASTM F1216, Table X2.1

For the test the resistance of the cured CIPP to chemical attack acc. to ASTM F1216, Table X2.1, the test specimens were stored in the test media for 28 days at 23°C. The test media included:

- 100% Tap water
- 5% Nitric acid
- 10% Phosphoric acid
- 10% Sulfuric acid
- 100% Gasoline
- 100% Vegetable oil
- 0.1% Detergent
- 0.1% Soap

After the storage time the flexural properties were determined acc. to ASTM D790 – 10.

1.1.1 Determination of the change of flexural properties

5 test specimens were used to determine the change of the flexural properties, i. e. flexural strength and flexural modulus, after 28 days of storage at 23°C in the test media listed in chapter 1.3.

The change of flexural strength and flexural modulus in per cent was determined after removal from the test media and conditioning (24 hours in standard climate conditions).

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Table: Summary of test results (mean values):

test specimen designation	medium	test duration t [d]	change of flexural modulus E_f [%]	change of flexural strength σ_{fb} [%]
1243594	100% Tap water	28	-7.3	-10.0
	5% Nitric acid	28	12.6	10.7
	10% Phosphoric acid	28	10.5	-17.5
	10% Sulfuric acid	28	11.6	-6.6
	100% Gasoline	28	11.4	-5.6
	100% Vegetable oil	28	12.5	-6.6
	0.1% Detergent	28	8.8	-9.0
	0.1% Soap	28	6.8	-18.7

The measurement and test logs are enclosed as Annexes.

Oststeinbek, September 11, 2012

Technical Director
Dipl.-Ing. A. Haacker

Tester in charge
F. Meyer

Annex:
Individual test logs

siebert+knipschild Ingenieurbüro für Kunststofftechnik	Chemical Resistance according to ASTM F1216, X2 change of the mechanical properties	date: 05.09.2012 tester: M. Lutzke/A.

sample no.: 1243594 sample name: Test liner

Determination of flexural properties
acc. to ASTM D790 - 10

The specimens were taken in the longitudinally direction.

conditioning: 24h / standard climate test medium 100% tap water
intercalation: 28d / 23°C

date of test	comment	flexural modulus E [N/mm²]	flexural strength σ_f [N/mm²]
10.07.2012	reference sample	2427	41,1
30.08.3012	after removal from the test media and conditioning	2251	37,0

	change of flexural modulus E [%]	change of flexural strength σ_f [%]
change in per cent after removal and conditioning	-7,3	-10,0

conditioning: 24h / standard climate test medium 5% nitric acid
intercalation: 28d / 23°C

date of test	comment	flexural modulus E [N/mm²]	flexural strength σ_f [N/mm²]
10.07.2012	reference sample	2427	41,1
31.08.2012	after removal from the test media and conditioning	2733	36,7

	change of flexural modulus E [%]	change of flexural strength σ_f [%]
change in per cent after removal and conditioning	12,6	-10,7

conditioning: 24h / standard climate test medium 10% phosphoric acid
intercalation: 28d / 23°C

date of test	comment	flexural modulus E [N/mm²]	flexural strength σ_f [N/mm²]
10.07.2012	reference sample	2427	41,1
31.08.2012	after removal from the test media and conditioning	2681	33,9

	change of flexural modulus E [%]	change of flexural strength σ_f [%]
change in per cent after removal and conditioning	10,5	-17,6

conditioning: 24h / standard climate test medium 10% sulfuric acid
intercalation: 28d / 23°C

date of test	comment	flexural modulus E [N/mm²]	flexural strength σ_f [N/mm²]
10.07.2012	reference sample	2427	41,1
03.09.2012	after removal from the test media and conditioning	2709	38,4

	change of flexural modulus E [%]	change of flexural strength σ_f [%]
change in per cent after removal and conditioning	11,8	-6,6

siebert+knipschild Ingenieurbüro für Kunststofftechnik	Chemical Resistance according to ASTM F 1216, X2 change of the mechanical properties	date: 05.09.2012 tester: M. Lutzke / A.

sample no.: 1243594 sample name: Test liner

Determination of flexural properties
acc. to ASTM D790 - 10

The specimens were taken in the longitudinally direction.

conditioning: 24h / standard climate test medium 100% gasoline
Intercalation: 28d / 23°C

date of test	comment	flexural modulus E [N/mm²]	flexural strength σ_f [N/mm²]
10.07.2012	reference sample	2427	41,1
04.09.2012	after removal from the test media and conditioning	2704	39,9

	change of flexural modulus E [%]	change of flexural strength σ_f [%]
change in per cent after removal and conditioning	11,4	-5,6

conditioning: 24h / standard climate test medium 100% vegatable oil
Intercalation: 28d / 23°C

date of test	comment	flexural modulus E [N/mm²]	flexural strength σ_f [N/mm²]
10.07.2012	reference sample	2427	41,1
04.09.2012	after removal from the test media and conditioning	2731	38,4

	change of flexural modulus E [%]	change of flexural strength σ_f [%]
change in per cent after removal and conditioning	12,5	-6,6

conditioning: 24h / standard climate test medium 0,1% dentergent
Intercalation: 28d / 23°C

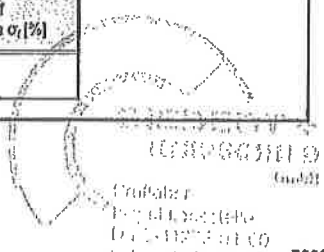
date of test	comment	flexural modulus E [N/mm²]	flexural strength σ_f [N/mm²]
10.07.2012	reference sample	2427	41,1
04.09.2012	after removal from the test media and conditioning	2640	37,4

	change of flexural modulus E [%]	change of flexural strength σ_f [%]
change in per cent after removal and conditioning	8,8	-9,0

conditioning: 24h / standard climate test medium 0,1% soap
Intercalation: 28d / 23°C

date of test	comment	flexural modulus E [N/mm²]	flexural strength σ_f [N/mm²]
10.07.2012	reference sample	2427	41,1
04.09.2012	after removal from the test media and conditioning	2593	33,4

	change of flexural modulus E [%]	change of flexural strength σ_f [%]
change in per cent after removal and conditioning	6,8	-18,7



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test certificate

11. September 2012

Siebert + Knipschild GmbH Bergstücken 25 D-22113 Oststeinbek Telefon: +49 (0)40 688 714 0 Telefax: +49 (0)40 688 714 99

test data :

construction project: Material examination in acc. to ASTM- Standards
client: AMerik Engineering LLC
contractor company: MultiLining Products AsP
date of order: 06.07.2012

pipe geometry: DN 150
line name: Test pipe
sample name: Test liner

test parameters :

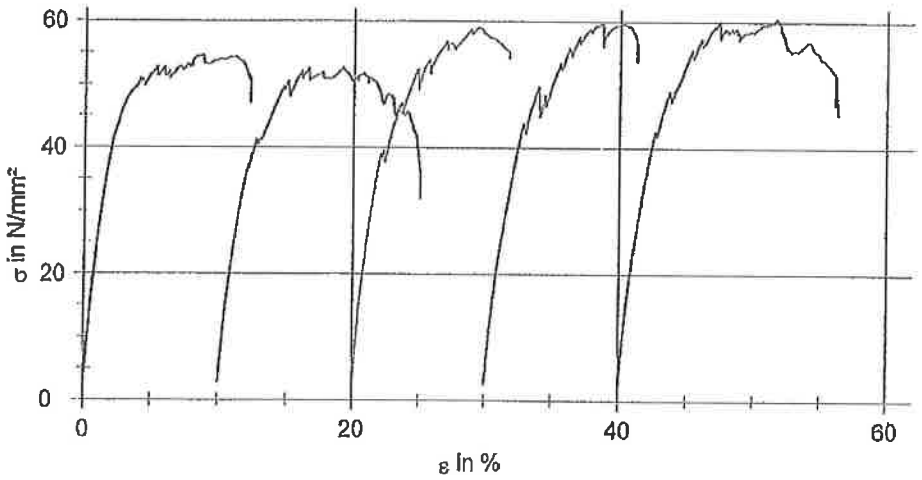
test date : 10.07.2012
direction of testing : logitudinal direction
machine data : 10TN2S WN:143453
Traversenwegaufnehmer WN:143453
Kraftsensor ID:0 WN:143454 10 kN

rate of crosshead motion : 1,8 mm/min
tester : M. Lutzke/A.

test results :

Nr	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
1	4,04	12,31	2307	42,5	2,22	54,6	8,98	10	15	68
2	4,14	12,19	2398	37,3	2,21	52,7	9,31	5	10	68
3	4,42	11,76	2549	39,2	2,11	59,0	9,49	5	10	68
4	4,33	12,88	2469	44,0	2,84	59,8	10,42	5	10	68
5	4,48	11,92	2412	42,7	2,61	60,5	11,81	5	10	68

diagram :

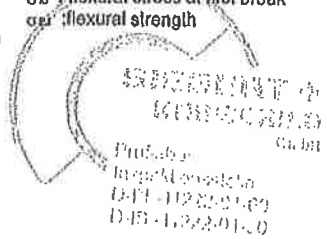


statistic :

Serie n = 5	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
x̄	4,28	12,21	2427	41,1	2,40	57,3	10,00	6	11	68
min	4,04	11,76	2307	37,3	2,11	52,7	8,98	5	10	68
max	4,48	12,88	2549	44,0	2,84	60,5	11,81	10	15	68
R	0,44	1,12	242	6,6	0,73	7,9	2,83	5	5	0

symbols persuant to ASTM D790

d : depth of beam
L : support span
σ_{f1} : initial stress of modulus identification
b : sample width
ε_{fb} : flexural strain at first break
ε_{fM} : flexural strain
σ_{f2} : end stress of modulus identification
E_f : flexural modulus
σ_{fb} : flexural stress at first break
σ_{fM} : flexural strength



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11. September 2012

Siebert + Knipschild GmbH Bergstücken 25 D-22113 Oststeinbek Telefon: +49 (0)40 688 714 0 Telefax: +49 (0)40 688 714 99

test data :

construction project: Material examination in acc. to ASTM- Standards
client: AMerik Engineering LLC
contractor company: MultiLining Products AsP
date of order: 06.07.2012

pipe geometry: DN 150
line name: Test pipe
sample name: Test liner 100% tap water

test parameters :

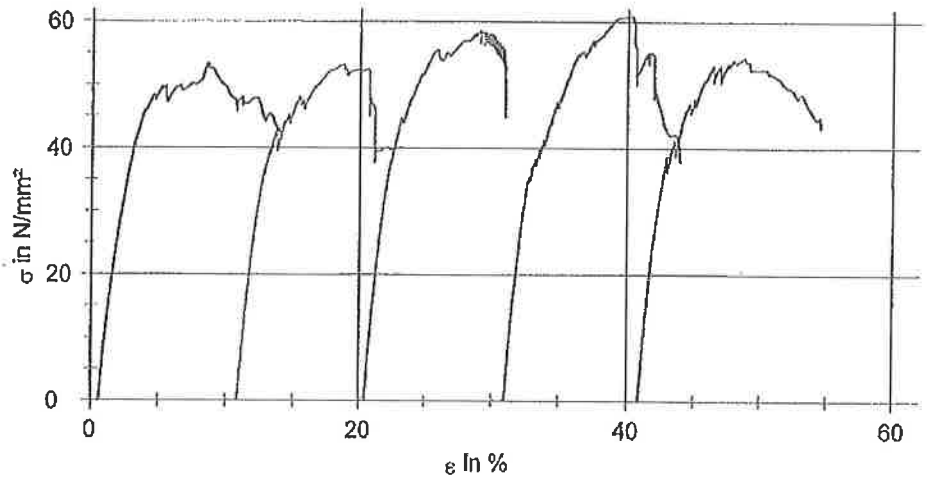
test date : 30.08.2012
direction of testing : logitudinal direction
machine data : 10TN2S WN:143453
Traversenwegaufnehmer WN:143453
Kraftsensor ID:0 WN:143454 10 kN

rate of crosshead motion : 2 mm/min
tester : T.Ruch/A.

test results :

Nr	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
1	4,13	12,98	1995	46,4	4,09	53,3	8,10	10	15	74
3	4,55	12,87	2210	31,5	2,45	53,1	7,87	10	15	74
4	4,76	12,26	2365	37,9	2,37	58,5	8,67	10	15	74
5	5,04	12,12	2314	30,2	2,33	60,9	9,35	10	15	74
7	4,43	12,52	2371	38,8	2,94	54,3	7,95	10	15	74

diagram :



statistic :

Serie n = 5	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
$\bar{x}$	4,58	12,55	2251	37,0	2,84	56,0	8,39	10	15	74
min	4,13	12,12	1995	30,2	2,33	53,1	7,87	10	15	74
max	5,04	12,98	2371	46,4	4,09	60,9	9,35	10	15	74
R	0,91	0,86	376	16,2	1,75	7,8	1,48	0	0	0

symbols persuant to ASTM D790

d : depth of beam
L : support span
σ_{f1} : initial stress of modulus identification

b : sample width
ε_{fb} : flexural strain at first break
ε_{f1} : flexural strain
σ_{f2} : end stress of modulus identification

E_f : flexural modulus
σ_{fb} : flexural stress at first break
σ_{fM} :flexural strength

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test certificate

11. September 2012

Siebert + Knipschild GmbH Bergstücken 25 D-22113 Oststeinbek Telefon: +49 (0)40 688 714 0 Telefax: +49 (0)40 688 714 99

test data :

construction project: Material examination in acc. to ASTM- Standards
client: AMerik Engineering LLC
contractor company: MultiLining Products AsP
date of order: 06.07.2012

pipe geometry: DN 150
line name: Test pipe
sample name: Test liner 5% nitric acid

test parameters :

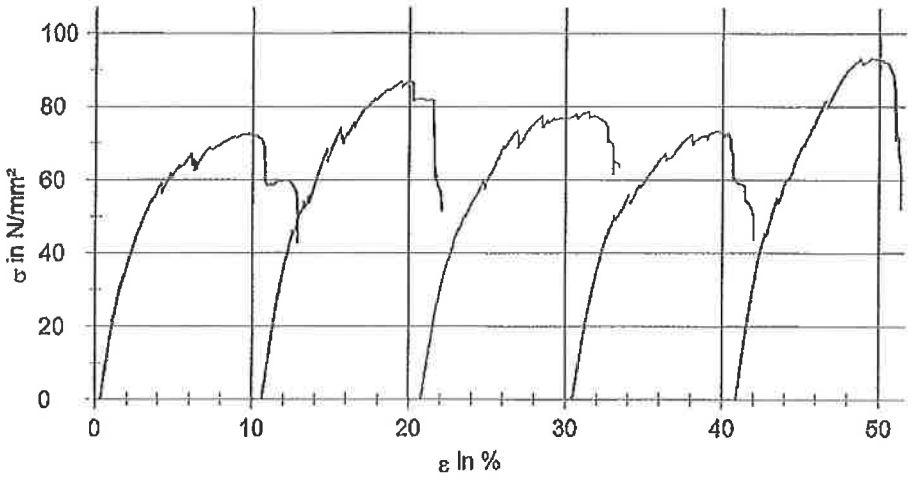
test date : 31.08.2012
direction of testing : logitudinal direction
machine data : 10TN2S WN:143453
Traversenwegaufnehmer WN:143453
Kraftsensor ID:0 WN:143454 10 kN

rate of crosshead motion : 1,7 mm/min
tester : T.Ruch/A.

test results :

Nr	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
1	4,62	12,67	2702	31,4	1,60	72,5	9,50	10	20	70
2	5,05	12,66	2883	38,0	2,13	86,9	9,42	10	20	70
3	4,83	12,50	2676	38,3	2,48	78,5	10,65	10	20	70
4	5,31	12,28	2567	37,5	2,09	73,3	9,36	10	20	70
7	4,94	12,69	2938	38,6	2,28	93,3	8,83	10	20	70

diagram :

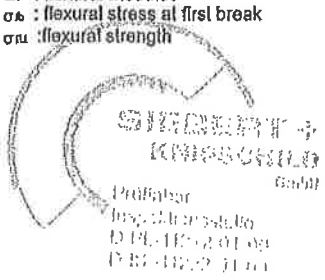


statistic :

Serie n = 5	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
$\bar{x}$	4,93	12,56	2733	36,7	2,11	80,9	9,55	10	20	70
min	4,62	12,28	2567	31,4	1,60	72,5	8,83	10	20	70
max	5,31	12,69	2938	38,6	2,48	93,3	10,65	10	20	70
R	0,79	0,41	371	7,2	0,88	20,8	1,82	0	0	0

symbols persuant to ASTM D790

d : depth of beam
L : support span
σ_{f1} : initial stress of modulus identification
b : sample width
ε_{fb} : flexural strain at first break
ε_{fM} : flexural strain
σ_{f2} : end stress of modulus identification
E_f : flexural modulus
σ_{fb} : flexural stress at first break
σ_{fM} :flexural strength



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Siebert + Knipschild GmbH Bergstücken 25 D-22113 Oststeinbek Telefon: +49 (0)40 686 714 0 Telefax: +49 (0)40 686 714 99

test certificate

11. September 2012

test data :

construction project: Material examination in acc. to ASTM- Standards
client: AMerik Engineering LLC
contractor company: MultiLining Products AsP
date of order: 06.07.2012

pipe geometry: DN 150
line name: Test pipe
sample name: Test liner 10% phosphoric acid

test parameters :

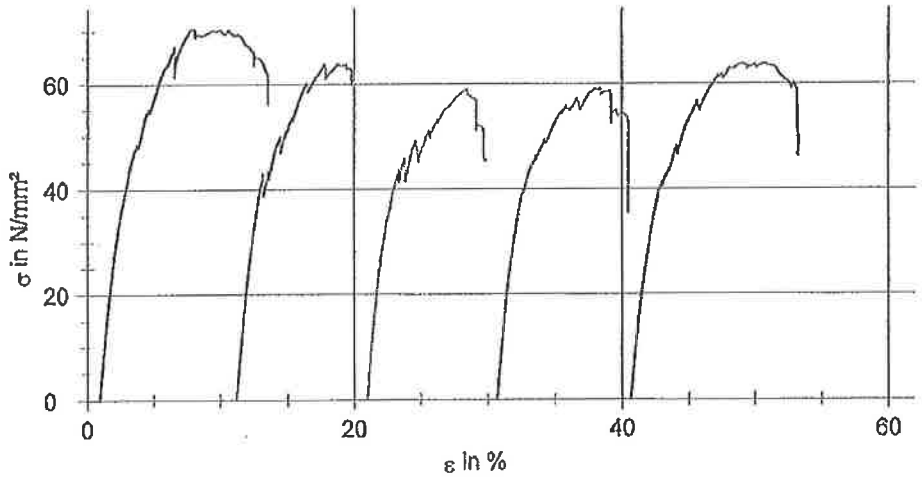
test date : 31.08.2012
direction of testing : logitudinal direction
machine data : 10TN2S WN:143453
Traversenwegaufnehmer WN:143453
Kraftsensor ID:0 WN:143454 10 kN

rate of crosshead motion : 1,7 mm/min
tester : T.Ruch/A.

test results :

Nr	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
1	4,39	12,56	2704	30,6	2,17	70,5	7,14	10	15	74
2	4,75	12,60	2713	32,2	2,48	63,9	7,60	10	15	74
3	4,83	12,19	2810	34,2	2,41	58,9	7,52	10	15	74
5	4,36	12,61	2748	39,5	2,55	59,1	7,77	10	15	74
6	4,88	12,68	2432	33,0	2,17	63,7	10,09	10	15	74

diagram :

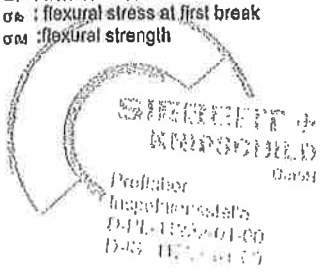


statistic :

Serie n = 5	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
$\bar{x}$	4,64	12,53	2681	33,9	2,36	63,2	8,03	10	15	74
min	4,36	12,19	2432	30,6	2,17	58,9	7,14	10	15	74
max	4,88	12,68	2810	39,5	2,55	70,5	10,09	10	15	74
R	0,52	0,49	378	8,9	0,38	11,5	2,96	0	0	0

symbols persuant to ASTM D790

d : depth of beam
L : support span
σ_{f1} : initial stress of modulus identification
b : sample width
ε_{fb} : flexural strain at first break
ε_{fM} : flexural strain
σ_{f2} : end stress of modulus identification
E_f : flexural modulus
σ_{fb} : flexural stress at first break
σ_{fM} :flexural strength



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Siebert + Knipschild GmbH Bergstücken 25 D-22113 Oststeinbek Telefon: +49 (0)40 688 714 0 Telefax: +49 (0)40 688 714 99

test data :

construction project: Material examination in acc. to ASTM- Standards
client: AMerik Engineering LLC
contractor company: MultiLining Products AsP
date of order: 06.07.2012

pipe geometry: DN 150
line name: Test pipe
sample name: Test liner 10% sulfuric acid

test parameters :

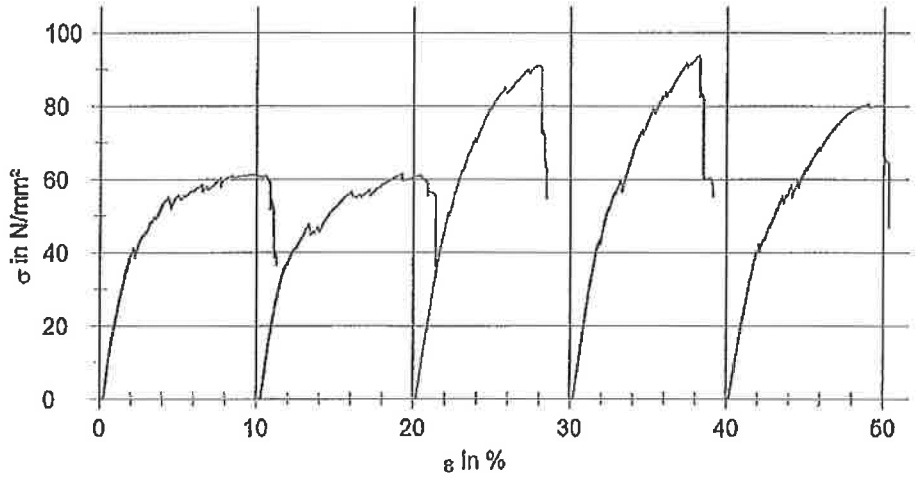
test date : 03.09.2012
direction of testing : logitudinal direction
machine data : 10TN2S WN:143453
Traversenwegaufnehmer WN:143453
Kraftsensor ID:0 WN:143454 10 kN

rate of crosshead motion : 1,6 mm/min
tester : T.Ruch/A.

test results :

Nr	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
1	4,51	12,33	2540	35,4	1,75	61,4	9,76	10	20	70
2	4,71	12,69	2752	35,6	1,76	61,5	8,97	10	20	70
3	5,24	11,88	2845	44,3	1,89	91,2	7,86	10	20	70
4	5,23	11,94	2903	43,0	1,80	93,9	8,02	10	20	70
5	5,04	12,42	2504	33,8	1,52	80,5	8,92	10	20	70

diagram :



statistic :

Serie n = 5	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
$\bar{x}$	4,95	12,25	2709	38,4	1,74	77,7	8,71	10	20	70
min	4,51	11,88	2504	33,8	1,52	61,4	7,86	10	20	70
max	5,24	12,69	2903	44,3	1,89	93,9	9,76	10	20	70
R	0,73	0,81	399	10,4	0,37	32,5	1,90	0	0	0

symbols persuant to ASTM D790

d : depth of beam
L : support span
σ_{f1} : initial stress of modulus identification
b : sample width
ε_{fb} : flexural strain at first break
ε_{fM} : flexural strain
σ_{f2} : end stress of modulus identification
E_f : flexural modulus
σ_{fb} : flexural stress at first break
σ_{fM} : flexural strength

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Siebert + Knipschild GmbH Bergstücken 25 D-22113 Oststeinbek Telefon: +49 (0)40 668 714 0 Telefax: +49 (0)40 668 714 99

test data :

construction project: Material examination in acc. to ASTM- Standards
client: AMerik Engineering LLC
contractor company: MultiLining Products AsP
date of order: 06.07.2012

pipe geometry: DN 150
line name: Test pipe
sample name: Test liner 100% gasoline

test parameters :

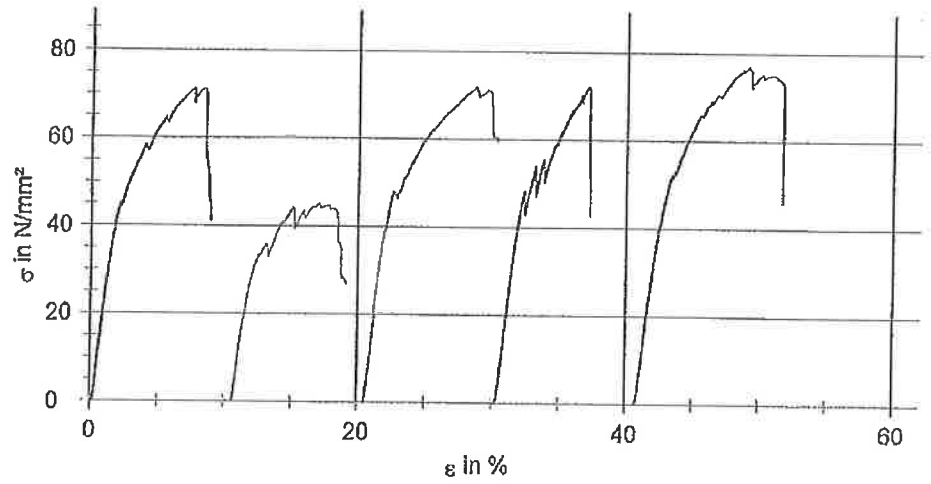
test date : 03.09.2012
direction of testing : logitudinal direction
machine data : 10TN2S WN:143453
Traversenwegaufnehmer WN:143453
Kraftsensor ID:0 WN:143454 10 kN

rate of crosshead motion : 1,7 mm/min
tester : T.Ruch/A.

test results :

Nr	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
1	4,74	12,14	2709	38,2	1,69	71,3	7,47	10	20	74
3	4,51	12,63	2448	33,5	2,60	44,9	6,43	5	10	74
4	4,61	12,63	2894	48,2	2,58	72,0	8,15	10	20	74
6	6,68	12,26	2850	33,0	1,50	72,1	6,72	10	20	74
7	6,09	12,37	2618	41,0	2,52	77,1	8,30	10	20	74

diagram :



statistic :

Serie n = 6	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
$\bar{x}$	5,33	12,41	2704	38,8	2,18	67,5	7,41	9	18	74
min	4,51	12,14	2448	33,0	1,50	44,9	6,43	5	10	74
max	6,68	12,63	2894	48,2	2,60	77,1	8,30	10	20	74
R	2,17	0,49	446	15,2	1,10	32,1	1,88	5	10	0

symbols persuant to ASTM D790

d : depth of beam
L : support span
σ_{f1} : initial stress of modulus identification
b : sample width
ε_{fb} : flexural strain at first break
ε_{fM} : flexural strain
σ_{f2} : end stress of modulus identification
E_f : flexural modulus
σ_{fb} : flexural stress at first break
σ_{fM} :flexural strength

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Siebert + Knipschild GmbH Bergstücken 25 D-22113 Oststeinbek Telefon: +49 (0)40 688 714 0 Telefax: +49 (0)40 688 714 99

test data :

construction project: Material examination in acc. to ASTM- Standards
client: AMerik Engineering LLC
contractor company: MultiLining Products AsP
date of order: 06.07.2012

pipe geometry: DN 160
line name: Test pipe
sample name: Test liner
100% vegetable oil

test parameters :

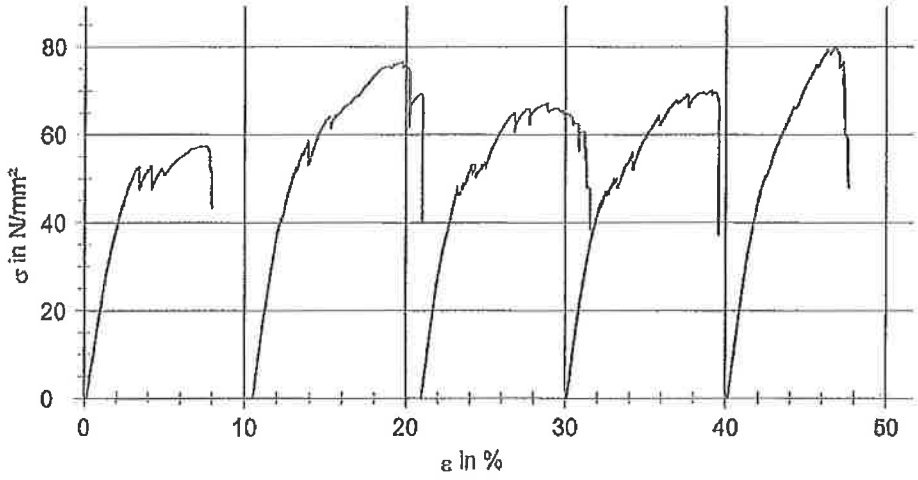
test date : 07.09.2012
direction of testing : logitudinal direction
machine data : 10TN2S WN:143453
Traversenwegaufnehmer WN:143453
Kraftsensor ID:0 WN:143454 10 kN

rate of crosshead motion : 1,8 mm/min
tester : T.Ruch/A.

test results :

Nr	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
2	4,95	12,65	2606	44,0	2,38	57,5	7,37	10	15	74
4	5,42	12,64	2749	30,3	1,66	76,5	9,25	10	15	74
5	4,56	12,34	2835	37,9	2,56	67,1	7,88	10	15	74
6	4,98	11,77	2789	44,9	2,18	70,0	9,02	10	15	74
7	5,65	12,16	2775	34,8	1,42	79,9	6,79	10	15	74

diagram :



statistic :

Serie n = 6	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
x	5,11	12,31	2731	38,4	2,04	70,2	8,06	10	15	74
min	4,56	11,77	2606	30,3	1,42	57,5	6,79	10	15	74
max	5,65	12,65	2835	44,9	2,56	79,9	9,25	10	15	74
R	1,09	0,88	330	14,6	1,15	22,5	2,46	0	0	0

symbols persuant to ASTM D790

d : depth of beam
L : support span
σ_{f1} : initial stress of modulus identification
b : sample width
ε_{fb} : flexural strain at first break
ε_{fM} : flexural strain
σ_{f2} : end stress of modulus identification
E_f : flexural modulus
σ_{fb} : flexural stress at first break
σ_{fM} :flexural strength

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11. September 2012

Siebert + Knipschild GmbH Bergstücken 25 D-22113 Oststeinbek Telefon: +49 (0)40 668 714 0 Telefax: +49 (0)40 668 714 99

test data :

construction project: Material examination in acc. to ASTM- Standards
client: AMerik Engineering LLC
contractor company: MultiLining Products AsP
date of order: 06.07.2012

pipe geometry: DN 150
line name: Test pipe
sample name: Test liner 0,1% dentergent

test parameters :

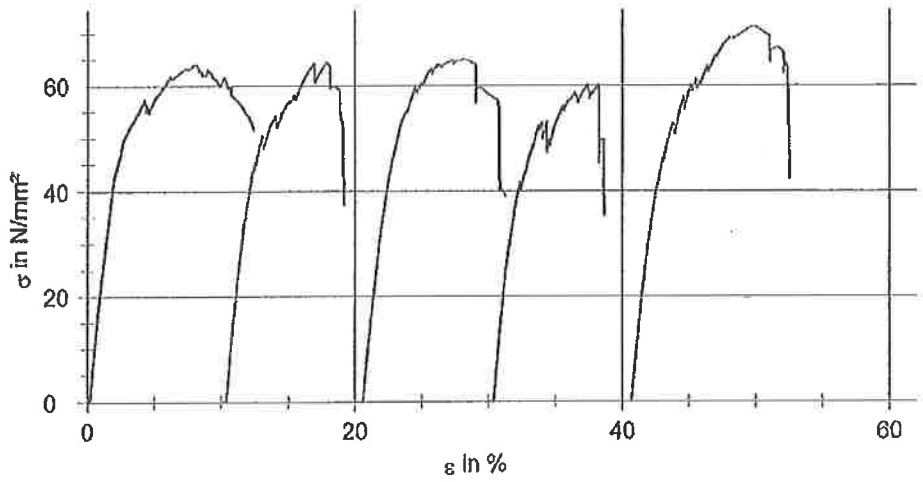
test date : 07.09.2012
direction of testing : logitudinal direction
machine data : 10TN2S WN:143453
Traversenwegaufnehmer WN:143453
Kraftsensor ID:0 WN:143454 10 kN

rate of crosshead motion : 1,8 mm/min
tester : T.Ruch/A.

test results :

Nr	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
1	4,48	12,58	2518	44,9	2,16	64,1	7,94	10	15	74
2	5,23	11,96	2719	34,7	1,75	64,4	6,59	10	15	74
5	4,40	12,37	2512	43,4	2,59	65,0	7,61	10	15	74
6	5,04	12,60	2839	29,3	1,51	60,3	7,09	10	15	74
7	5,36	11,88	2613	34,7	2,16	71,2	9,22	10	15	74

diagram :



statistic :

Serie n = 5	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
$\bar{x}$	4,90	12,28	2640	37,4	2,03	65,0	7,69	10	15	74
min	4,40	11,88	2512	29,3	1,51	60,3	6,59	10	15	74
max	5,36	12,60	2839	44,9	2,59	71,2	9,22	10	15	74
R	0,96	0,72	326	15,6	1,08	11,0	2,62	0	0	0

symbols persuant to ASTM D790

d : depth of beam
L : support span
σ_{f1} : initial stress of modulus identification

b : sample width
ε_{fb} : flexural strain at first break
ε_{fM} : flexural strain
σ_{f2} : end stress of modulus identification

E_f : flexural modulus
σ_{fb} : flexural stress at first break
σ_{fM} :flexural strength

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11. September 2012

Siebert + Knipschild GmbH Bergstücken 26 D-22113 Oststeinbek Telefon: +49 (0)40 668 714 0 Telefax: +49 (0)40 668 714 99

test data :

construction project: Material examination in acc. to ASTM- Standards
client: AMerik Engineering LLC
contractor company: MultiLining Products AsP
date of order: 06.07.2012

pipe geometry: DN 150
line name: Test pipe
sample name: Test liner 0,1% soap

test parameters :

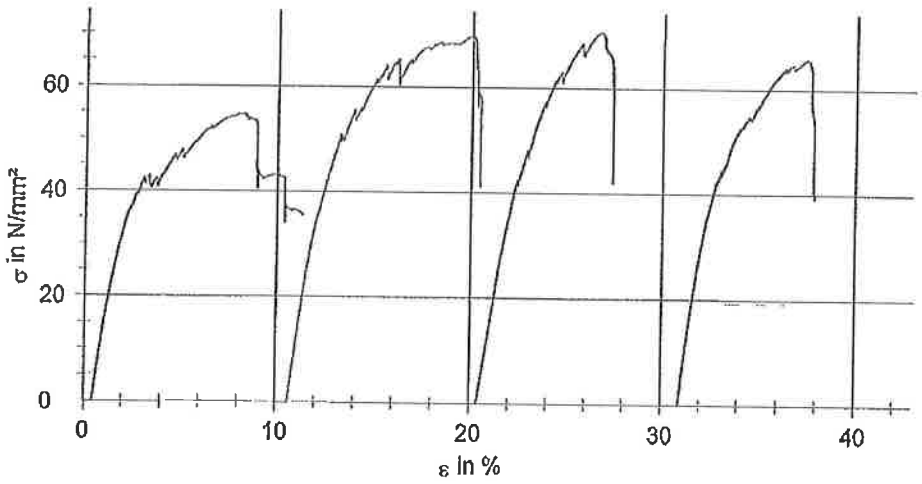
test date : 04.09.2012
direction of testing : logitudinal direction
machine data : 10TN2S WN:143453
Traversenwegaufnehmer WN:143453
Kraftsensor ID:0 WN:143454 10 kN

rate of crosshead motion : 1,9 mm/min
tester : T.Ruch/A.

test results :

Nr	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
2	4,68	12,29	2387	37,1	2,36	54,7	7,80	10	15	74
3	4,86	12,52	2769	32,6	1,90	69,6	9,29	10	15	74
4	4,57	12,45	2411	28,3	1,56	70,7	6,39	10	15	74
5	4,40	11,55	2806	35,8	2,32	65,7	6,55	10	15	74

diagram :

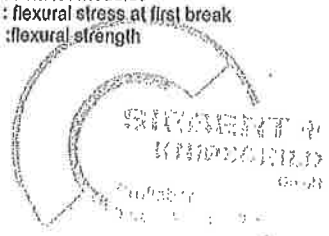


statistic :

Serie n = 4	d mm	b mm	E_f N/mm²	σ_{fb} N/mm²	ε_{fb} %	σ_{fM} N/mm²	ε_{fM} %	σ_{f1} N/mm²	σ_{f2} N/mm²	L mm
$\bar{x}$	4,63	12,20	2593	33,4	2,04	65,2	7,51	10	15	74
min	4,40	11,55	2387	28,3	1,56	64,7	6,39	10	15	74
max	4,86	12,52	2806	37,1	2,36	70,7	9,29	10	15	74
R	0,46	0,97	419	8,8	0,80	15,9	2,90	0	0	0

symbols persuant to ASTM D790

d : depth of beam
L : support span
σ_{f1} : initial stress of modulus identification
b : sample width
ε_{fb} : flexural strain at first break
ε_{fM} : flexural strain
σ_{f2} : end stress of modulus identification
E_f : flexural modulus
σ_{fb} : flexural stress at first break
σ_{fM} : flexural strength



Specification for Top Hat Lateral Connection Sealing and Repair Product in Relined or Unlined Sewer Main (010505)
(As Provided by Amerik Supplies, Inc.)

1.0 General

It is the intent of this portion of the specification to provide for the rehabilitation and reconnection of service lateral connections (SLC) to rehabilitated sewer lines, without excavation, by installation and ultraviolet (UV) light curing of a resin-impregnated, flexible fiberglass insert with sealing epoxy element in the form of a tube or top hat that will be installed into the existing service lateral utilizing a pressure apparatus and ultraviolet light curing devise positioned in the mainline pipe. Service lateral connections may be a combination of tee's, wye's or break-in taps of varying sized and angle from 30 to 90 degrees and may include over-cut lateral openings, pilot holes or defects in relined sewer pipe. The resin shall be rapidly cured to transform the flexible insert into a hard, impermeable top hat seal around and in the lateral connection. The SLC product shall extend from the mainline into the lateral connection in a continuous tight fitting, watertight pipe-within-a-pipe to eliminate any visible ground water leakage and future root growth at the lateral to mainline connection. SLC product system shall be compatible with the mainline and/or lateral pipe or liner. If, within the warranty period, the SLC product installed in the sewer system is not acceptable due to leakage or any other defects, although originally accepted, the contractor shall repair or replace the affected portion at no cost to the customer. It is understood that if the contractor fails to do such work as required, the contractor shall be responsible for said costs of repair or replacement.

2.0 Material Requirements

1. The finished SLC product shall be an ECR (E-glass corrosion resistant) fiberglass laminate impregnated with an UV-light reactive Polyester resin which when cured is chemically resistant to domestic sewage over the expected life time of the rehabilitated pipe.
2. The SLC product shall be compatible with the lining system utilized for the main and/or lateral sewer lines.
3. This specification references the American Society for Testing and Materials (ASTM) standards that are made part hereof by reference and shall be the latest edition and revision.
   D543 Testing Method of Plastics to Chemical Reagents
   D578 Standard Specifications for Glass Fiber Strands
   D1600 Abbreviations of Terms Relating to Plastics
4. Reference is further made to NASSCO Standard: Recommended Specification for Sewer Collection Systems Rehabilitation.

3.0 SLC Product

1. The flexible fiberglass top hat tube insert shall be fabricated to a size that when installed will key into the internal surface irregularities of the lateral joint and neatly fit tight to the internal circumference of the lateral. The top hat tube shall be a laminate made of non-woven fiberglass materials that allow for circumferential stretching and angular alignment with the lateral pipe connection geometry during insertion.
2. The insert laminate shall seal to the inside wall of the sewer main 3 inches around the lateral opening and to the lateral wall 6 inches up into the lateral pipe from the main.
3. Unless otherwise specified, the installer shall furnish a specially formulated polyester resin and catalyst system compatible with the SLC process that provides cured physical strength at least to the same level as required for the lateral liner if specified.
4. A secondary epoxy-sealing component shall be used to form a sealing bond between the SLC product and the host lateral and main pipe walls.

4.0 Physical Properties

1. The cured SLC shall conform to the minimum standard listed below:

Flexural Modulus ASTM 0790 Of Elasticity	800,000 psi minimum

5.0 Line Preparation

1. Prior to installing the SLC product the area around the lateral sealing surface in both the main and lateral shall be inspected. Waste product build-up, hard scale, roots, lateral cutting debris or resin slugs must be removed using high pressure water jetting or in-line cutters.
2. Break-in connection and /or lateral pipe protruding into the mains shall be ground back to no more than a 1/8-inch protrusion into the mainline.
3. Built-up deposits on the main and lateral pipe walls shall be removed. The removal shall reach at least one foot beyond the SLC product to allow the bladder to inflate tightly against the pipe walls ensuring a smooth transition from SLC product to the existing pipe wall.
4. In relined pipes the lateral must be opened 95 percent or more and edges finished without "teeth". Over-cuts shall not exceed one inch beyond the internal diameter of the lateral.
5. The contractor shall be responsible, if needed, for bypassing of sewage during the installation of the SLC product. In cases where the temporary backup of sewage is accepted as a replacement for bypassing, the contractor is responsible for all damage caused by the backup.
6. The lateral seal installation contractor is not responsible for the overall cleaning of the main or lateral lines prior to seal installation unless specified in the contract.

6.0 SLC Product Installation

1. The resin impregnated SLC product shall be loaded on the applicator apparatus, attached to a robotic manipulator devise and positioned in the mainline pipe at the service connection that is to be rehabilitated. The robotic devise together with a television camera will be used to align the SLC repair product with the service connection opening. Air pressure, supplied to the applicator through an air hose, shall be used to insert the resin impregnated connection repair product into the lateral pipe. The inserted product will then be inspected using a TV camera to confirm the SLC product is correctly positioned and/or centered in the lateral opening prior to curing. (This TV inspection step is necessary to minimize the reworking or dig-up of incorrectly deployed SLC product) The insertion pressure will be adjusted to fully deploy the SLC product into the lateral connection and hold the SLC product tight to the main and lateral pipe walls.

2. The pressure apparatus shall include a bladder of sufficient length in both the main and lateral lines such that the inflated bladder extends beyond the ends of both the lateral tube and main line brim segments of the SLC product pressing the end edges flat against the internal pipe wall thus forming a smooth transition from SLC product to pipe diameters without a step, ridge or gap between the SLC product and the inner diameters of the lateral and mainline pipes.

3. After insertion is completed, recommended pressure must be maintained on the impregnated SLC product for the duration of the UV light curing process.

4. The packer is then deflated, removed from connection and returned to the manhole to repeat the cycle.

5. The finished SLC product shall be free of dry spots, lifts and delamination. The installed SLC product should not inhibit the post installation video inspection, using a closed circuit television camera, of the mainline and service lateral pipes or future pipe cleaning operations.

6. After the work is completed the contractor will provide the customer with an electronic picture and recorded data identifying the location and showing the completed work and restored condition of all the rehabilitated SLCs.

7. During the warranty period any defects with the SLC that affect the performance or cleaning of the lateral connection shall be repaired at the contractor's expense in a manner acceptable to the customer.

7.0 Deviations

1. Contracts, that include both the relining of the main line and the installation of SLC seal product, require the main line relining contractor identify (size and location), video document and notify the customer per para.7.2 which lateral connections are deemed unfit for the SLC product. Where the contract is only for installing the SLC product, the installation contractor shall inform the customer of service laterals which cannot be installed per para. 7.2.
2. Service laterals in which a SLC product cannot be installed will be identified, documented, video recorded, and the owner's representative will be informed of the conditions encountered. The contractor will not attempt to install a SLC product in these connections unless directed by the customer's representative.

8.0 Payment Items

The following are work item prices for the job;

1. Removal of roots and soft deposits inside the lateral pipe for a distance of 2 feet up the lateral from the mainline connection. $_____per lateral
2. Lateral connection preparation including rounding or removing sharp or pointed cutout edges in a relined or break-in lateral opening. $ ___per lateral
3. Removal of protruding lateral pipe tap materials down to within 1/8 inch of mainline sewer wall. Clay and plastic lateral material $ _____ per tap
   Concrete lateral material $ _____ per tap
   Steel and cast iron material $_____ per tap
4. Installation of Top Hat lateral insert per Top Hat installed and accepted, for 8, 10, 12,15,18 and 21 inch mains with 4 or 6 inch lateral connection $ per Top Hat. Larger mains and special laterals will be quoted as separate priced line items.
5. Mobilization charge. $ _____
6. Waiting days outside control of Top Hat installer $_____per day
7. Short liners installed using Top Hat fiberglass and UV light cured resin system. $ _____per short liner installed.

9.0 Job Site Conditions

The contractor acknowledges that he has reviewed the job site conditions and the videotapes or pictures of the laterals to be rehabilitated using Top Hat inserts. Any exceptions, qualifications or clarifications the contractor has should be included in a bid submittal cover letter. If at a later date during the rehabilitation of the connections it becomes questionable if a SLC can be rehabilitated, then the contractor will inform the customer's representative and a decision as to install or not install a SCL product will be made by the customers representative.