No-dig renovation of pressure pipelines, re-connection techniques and case studies

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RELIE APTEC
Introduction.
Pressure Liner Built-up.

1. Seamless, thermoplastic nonwoven fabric coating

2. Resin rich layer with PET fabric

3. Structural complex of glass fibre, corrosion resistant ECR glass fibre

4. Compression foil; abutment and compressions fabric

5. Glass fabric pulling tape; at top and invert of liner

6. Thermoplastic outer foil; UV-light barrier, leak tight and gliding protective foil

Layer 2./3./4./5. are impregnated with UV-light curing resin
Remark: The items in pictures of classes C and D report to gluing connection
Product management
Sewerage water.

AlphalinerPN
• Diameter from DN150 (6“) up to DN1200 (48“)
• Pressure range PN 2,5 (36 psi) up to PN 16 (232 psi)
• Abrasion resistance of the seamless coating inner foil
• Dynamic internal stress test passed (certificate pressure cycles 10,000,000 x -0.8 bar to 9 bar)
Product management
Gas – low pressure.

GasLiner®
- Diameter from DN 150 (6“) up to DN 1200 (48“)
- Low and medium pressure range
- Diffusion-tightness of seamless interior coating
- WRc Approval for 2 bar
- Pilot project in GB / Wales: Renovation of a gas pipeline DN290
- Since September 2014 for a long-term survey
Product management
Potable water.

AQUA.UV® CIPP

- Diameter from DN 150 (6”) up to DN 800 (48”)
- Pressure range up to PN 16 (232 psi)
- Hygienic safety and food safety
- Approvals
  - HyG – UBA-KTW Guidelines
  - DVGW W 270
  - NSF International ANSI 61
  - ACS (running)
RELINEAPTEC pressure liner
The advantages at a glance.

- Fully structural system (Class A acc. ISO 11295)
- Stand-Alone System – NO bonding to existing pipe needed
- Seamless thermoplastic lining foil made of polyethylene (PE)
- Resistant to internal pressure up to 16 bar (operating pressure)
- Factory production - ready-to-install delivery
- NO impregnation on site
- NO steam or water curing
- Very fast installation due to UV light curing
- Small space requirement, short preparation, short cut or diversion times (bypass)
- At least 50 years lifespan
- Total Quality Management System – TQM
AlphalinerPN
Coated, seamless inner foil.

- Testing of the abrasion behavior with subsequent HP flushing test

<table>
<thead>
<tr>
<th>Surface abrasion on average after 100,000 load cycles;</th>
<th>DIN EN 295-3</th>
<th>mm</th>
<th>0,06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tipping frequency 20 load cycles / min</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High pressure rinse strength; 3 x 3 purge lines;</th>
<th>DIN 19523-1</th>
<th>W/mm²</th>
<th>450 ± 15</th>
<th>passed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Testing the adhesion of the seamless inner coating.

- **Vacuum test**
  - after previous weight drop test at 0 degrees C and 24 h internal pressure 3 bar

<table>
<thead>
<tr>
<th>Vacuum test</th>
<th>DIN EN 1119:2009</th>
<th>100 h (-0.7 ± 0.1) bar</th>
<th>NO De-Lamination</th>
</tr>
</thead>
</table>

International No-Dig Florence
AlphalinerPN
Dynamic stress test.

- 10,000,000 pressure change cycles (based on DIN 50100)
- Testing parameter

<table>
<thead>
<tr>
<th>Pressure</th>
<th>-0.8 ± 0.1 bar up to 9+1 -0.5 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>2 Hz</td>
</tr>
<tr>
<td>Test medium</td>
<td>Tap water</td>
</tr>
</tbody>
</table>

- Passed without material damage and without leaks!
GasLiner®
Long-term diffusion test.

- Pressure test under special conditions

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Specification</th>
<th>Temperature</th>
<th>Duration</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term pressure test</td>
<td>DIN EN ISO 1167-1</td>
<td>70°C</td>
<td>1,000h</td>
<td>passed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 bar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GasLiner®
Burst pressure.

- Pressure test
  after previous weight drop test at 0 degrees C and 24 h internal pressure 3 bar

<table>
<thead>
<tr>
<th>Burst pressure test</th>
<th>DIN EN 744:1995</th>
<th>3 bar</th>
<th>31 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 °C</td>
<td></td>
</tr>
</tbody>
</table>
Hygiene Institut
der Rohprodukte

November 19

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AQUA.UV® CIPP
Approvals/Certificates.

TEST CERTIFICATE

Enhancement of Microbial Growth on Materials to Come into Contact with Drinking Water

Test pursuant to EN 12056-1 Technical Standard in [ ], November 2007

Client: RELINEAPTEC GmbH

Test material: AQUA.UV CIPP

Method: [ ]

According to test report No. 12056/01-13 of [ ], this material AQUA.UV CIPP is

زمینلیمیت

The Director

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Production in the proven winding process
▪ Production in the proven winding process
Differences between gravity drainage and pressure mains

Accessibility through manholes generally possible at any time

Accessibility very limited or not possible at all; Necessary excavation of pits respectively.
- Re-connecting techniques
▪ Re-connecting techniques
▪ Liner end sleeves
▪ Locally produced liner connection
  ▪ Re-connection with flanged couplings
  ▪ e.g. GRP coupling with lose or fixed flange
  ▪ manually wrapped (necessary lamination skills)
  ▪ or monolithic produced and locally assembled
- Re-connecting techniques

- Liner end sleeves
  - EPDM gasket with stainless steel pressure rings
  - Berlin, sewer rising main DN750, 10bar service pressure, AlphalinerPN-7,2mm, December 2016
RELINEAPTEC Engineering.

- Re-connecting techniques
  - GRP monolithic pipe coupling with loose flange
  - Assembly and connection **during** liner installation and curing
• Re-connecting techniques

  ❖ GRP monolithic pipe coupling with fixed flange
  ✓ Assembly and connection after liner installation and curing
RELINEAPTEC
Case studies.

Berlin, Renovation of sewer rising main,
DN750, service pressure 10bar, AlphalinerPN-7,2mm, December 2016
RELINEAPTEC
Case studies.

Berlin, DN 750, 43 m

- AlphalinerPN, WT = 7.2 mm
- Service pressure 10 bar
- Testing pressure 12 bar
RELINEAPTEC
Case studies.

Berlin, DN 750, 43 m

- AlphalinerPN, WT = 7.2 mm
- UV-light curing 6 x 2500 W
- Curing time 24 min
RELINEAPTEC
Case studies.

Le Havre - Harfleur, DN 600, 109 m; 144 m; 81 m and 66 m

- AlphalinerPN, WT = 6.5 mm
- Service pressure 6 bar
- Testing pressure 9 bar
RELINEAPTEC
Case studies.

Le Havre - Harfleur, DN 600, 109 m; 144 m; 81 m and 66 m

- AlphalinerPN, WT = 6.5 mm
- UV-light curing 6 x 2000 W
- Curing time 2 h; 2.7 h; 1.5 h and 1.2 h
Case studies.

Fuhlendorf, DN 200, 38 m
DN 250, 42 m

- AlphalinerPN, WT = 3.0 and 3.7 mm
- Service pressure 2 bar
- Testing pressure 6 bar
Case studies.

Fuhlendorf, DN 200, 38 m
DN 250, 42 m

- AlphalinerPN, WT = 3,0 and 3,7 mm
- Uvlight curing with 10 x 400 W and 10 x 500 W
- Curing time 28 min and 29 min
Fuhlendorf, DN 200, 38 m
DN 250, 42 m

• AlphalinerPN, WT = 3,0 and 3,7 mm
• Re-connection with GRP coupling PN6
• Fixing with lose flange to PVC pipe
RELINEAPTEC Case studies.

London, DN 800, 168 m
DN 800, 90 m

- AlphalinerPN, WT = 14.9 mm
- Service pressure 9 bar
- Testing pressure 12 bar
RELINEAPTEC
Case studies.

London, DN 800, 168 m
DN 800, 90 m

- AlphalinerPN, WT = 14,9 mm
- UV-light curing 6 x 3000 W
- Curing time 4,7 h und 2,5 h
Case studies.

London, DN 800, 168 m
DN 800, 90 m

- AlphalinerPN, WT = 14.9 mm
- Re-connection with GRP flanged coupling PN10
- GRP flanged coupling with overlapping of host pipe
RELINEAPTEC
Case studies.

Montluel, usine Carrier,
DN 150, 51 m

- AQUA.UV®, WT = 3,0 mm
- Service pressure 9 bar
- Testing pressure 12 bar
Montluel, usine Carrier, DN 150, 51 m

- AQUA.UV®, WT = 3,0 mm
- UV-light curing with 10 x 300 W
- Curing time 39 min
Montluel, usine Carrier,
DN 150, 51 m

• AQUA.UV®, WT = 3,0 mm
• Sealing with inner sleeves
• Re-connection to steel pipe with appropriate multi-range pipe couplings
Global solutions for no-dig renovation of

- Sewer rising mains – AlphalinerPN
- Gas pipelines – GasLiner®
- Potable water mains – AQUA.UV®

Including

- Design and calculation
- Re-connection techniques
- Know-how transfer and site support
Thank you very much for the attention!

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