North America’s Leading Polymer Spray Lining Pipe Rehabilitation Company Introduces The Latest Development In Polymeric Spray Lining – A High Build, Rapid Setting Polyurethane
Why Rip Out The Old Pipe?

Every year thousands of feet of cast iron water mains are replaced needlessly.

The technology to rehabilitate these pipes, in place, exists.

Eliminate social disruption, save time and money by adopting In-Situ Spray Lining.
**Process History**

**Cement Mortar**
- Introduced in the 1800’s
- 24 hour cure
- Increases PH
- Can have detrimental effect on Water quality
- Increases lead leachate levels (from services)
- Class 1 lining

**Epoxy resins (UK)**
- Introduced mid-1980’s
- 16 hour cure by Regulation
- No detrimental effect on Water quality
- Class 1 lining

**Fast-setting resins (UK)**
- Introduced in 1999
- Based on isocyanates
- Maximum 2 hour cure
- Now most used product
- Class 1 lining

**Fast-setting High Build resins (UK)**
- Introduced in 2010
- Semi-structural lining
- One pass high build (~3mm)
- 1 hour full cure time
- Aim to seal leaks
- Class 3 lining
Triton is pleased to introduce the latest development in in-situ polymeric pressure pipe rehabilitation – Fast Line Plus (FLP) a Class 3 spray applied lining system.

Although the product is new to NA it has and is being used extensively in the United Kingdom and Europe with in excess of 700,000 linear feet of pipe lined.

It also has drinking water approvals and been used in the following countries: Russia, France, Slovakia & Korea.
Why Spray Line A Pipe?

- Remove tuberculation
- Eliminate discoloration & improve water quality
- Prevent main bursts & leaks
- Restore carrying capacity
- Eliminate the need to excavate at service connections
Cross Section Of Corroded Cast Iron Water Pipe

Causing poor flow, reduced carrying capacity, discolored water & loss of chlorine residual, pipe degradation and eventual failure
Pipe Cleaning / Drag Scraping

Pipe scrapers and plungers are pulled through the line several times to remove the tuberculation and buildup, followed by swabbing to flush & dry the pipe.
Quality & Repeatability

Computerized monitoring systems ensure quality of applied product and assured lining thickness

A hard copy of all lining data is recorded for QA
Resin delivery System

- Umbilical lining hose
- Static mixer hose & elements
- Spray head & skids
- Spray application
The resin flow rate, calibrated with the hose withdraw speed, allows precise control over the lining thickness.
Lined Pipe

Carrying capacity restored, increased hydraulic efficiency, long term corrosion protection, elimination of discolored water, no loss of chlorine residual, leaks sealed, enhanced structural integrity

Service connections remain open
No Service Connection Digging
Working on a lined pipe

The cured resin lining will not suffer any damage due to the following:

Service tapping
Cutting with ‘Reed’ cutters
Cutting with pipe crackers
Cutting with a power saw (providing water is used)

No cutting or reconnection methods that require heat can be used on any lined pipe. (ie. Torching, welding etc.)
Process Benefits

Fast-setting resin for lining water mains and other pressure pipes, return to service time – 2 hours

No leachate risk

Same material can be used for both low-build (1.0mm, Class 1 corrosion barrier) and high-build (3-5mm, Class 3 semi structural liner) applications – increased design flexibility

Flexible, hi-build lining seals leaks, gaps and withstands typical distribution pressures

Certified to NSF 61 standard
Fast – Line Plus Key Questions

- What size of existing holes & gaps could FLP span? (Could the high build lining help reduce existing leakage from the pipe?)

- What happens if the host pipe corrodes externally after the high build lining has been applied? (Could the lining withstand internal pipe line pressure, and if so, how much?)
Hole and Gap Spanning - Trials

Fast - Line Plus 3mm thick lining

Open holes
- 3mm & 5mm holes blocked in all clock positions
- Some 10mm & 15mm holes blocked at 9 and 3 o’clock
- 10mm invert / 6 o’clock holes occasionally blocked
- 15mm invert / 6 o’clock holes not blocked
- 10mm & 15mm holes at crown / 12 o’clock did not block

Open gaps
- 3mm gaps fully filled
- Wider gaps partially/not filled
- Clear open waterways

DN150mm (6”) ductile iron pipe sample array

The “pepper pot”

open gaps 3, 5, 10 & 15mm - 1/8, 3/16, 3/8, 5/8” wide

½” services
Hole and Gap Spanning - Trials

Flush-backed 15mm - 5/8” wide gap after stripping

10mm – 3/8” and 15mm – 5/8” dia. bolt-backed flush holes

15mm dia. flush-filled gap rigid host pipe assembly

15mm – 5/8” flush-filled gap pressurisation test

10mm and 15mm dia. flush-backed holes pressurisation test

Sample failure at 40 bar (600psi)

No sample failure at 40 bar (600psi)
Fast-Line Plus - Adhesion Test

Workshop test

- 6m (20’) DN150 steel pipe
- Grit blasted to SA 2½
- 1 and 3mm thick linings of Fast-Line Plus
- Pressurised to 50 bar (750psi) for 1.5h
- Full vacuum (-1barg) for 1.5 h
- Result - no lining distress (no disbondment or blistering)
Flexibility / Squeeze Test

Squeeze test on 2mm High Build lining in 90mm OD PVC-u pipe ring

Lining deflected 30mm without failure
# Material properties

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Property</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength</td>
<td>40.6 MPa (5,887psi)</td>
<td>BS EN ISO 527</td>
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<tr>
<td>Tensile strain at break</td>
<td>3.8 %</td>
<td>BS 2782:1005</td>
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<tr>
<td>Flexural modulus</td>
<td>2,838 MPa (411,510psi)</td>
<td>BS EN ISO 178</td>
</tr>
<tr>
<td>Adhesion (stainless steel/SA 2½)</td>
<td>&gt;21 MPa (3,045psi)</td>
<td>ASTM D4541</td>
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<tr>
<td>Shrinkage</td>
<td>none</td>
<td></td>
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Projects & Applications Performed

The Triton Lining Technologies process has been used to line more than 500,000 linear feet of pipe with a range of Polymeric products in North America during the past 12 years.

A full project reference list is available upon request.