Introduction to Pressure Pipe Rehabilitation with CIPP

RS Technik

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THE SCIENCE OF UNDERGROUND SOLUTIONS.

RS Technik

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Introduction

- Founded in early 1990's RS Technik is a global leader in the rehabilitation of underground pipes
- RS Technik uses Cured-in-Place (CIPP) technology to repair damaged or deteriorated pipes
- RS Technik serves clients around the globe with support locations in Germany, Switzerland, the United States and Singapore

RS Technik

- Over 32 million lineal feet of pipe rehabilitated worldwide
- DOW high-performance epoxies are a key component of RS Technik's unique CIPP technology
  - Formation of a global commercial alliance with Dow Epoxy Systems in June, 2009
- Dedicated to the development and commercialization of rehabilitation systems and materials in the water and wastewater market
- Quality, optimization and innovation are top priorities in the delivery of technology and materials

RS Systems Technology

- Mobile wet-out
- Installation with water column or air inversion
- Curing with water or steam
- 100% flexibility on the job site
- Full project visibility and control

Mobile Wet Out

- Comprehensive fully mobile wet-out system
- All systems on-board:
  - Liner
  - Resin tanks
  - Vacuum system
  - Impregnation unit with roller bed
  - Computer controlled mixing system
  - Climate control materials and work area
- Mobility increases efficiencies

Quality Control and Quality Assurance

- Touch screen controlling of key system aspects
  - Resin temperature
  - Resin volume calculations and pump controls for proportioning, saturation and gap setting
  - Data logging
- Owner/Inspector full view advantage

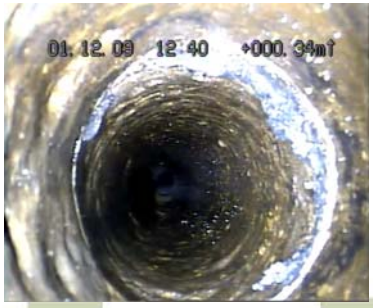
Application Know-How = Process QC

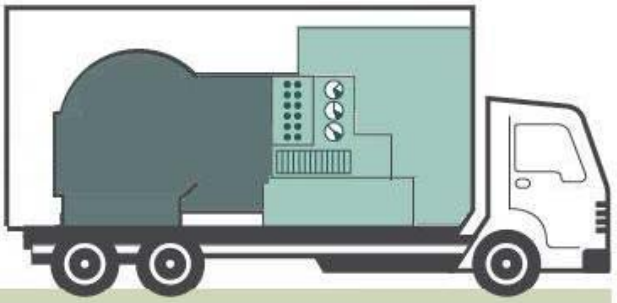
Resin Mixing

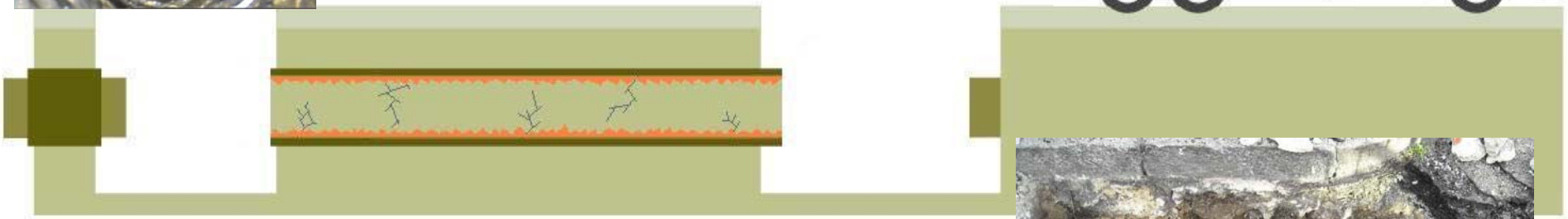
Impregnation

INSTALLATION PROCESS

Access

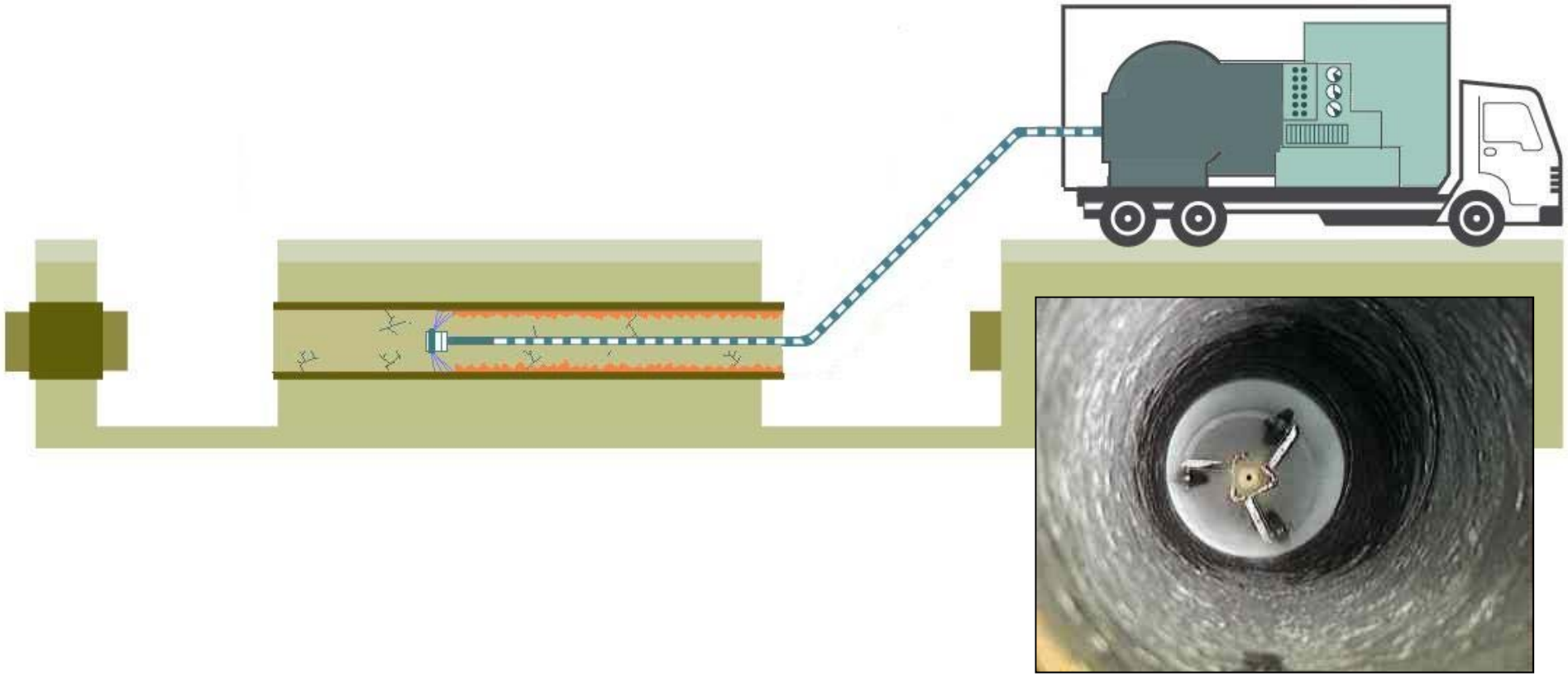






Cleaning

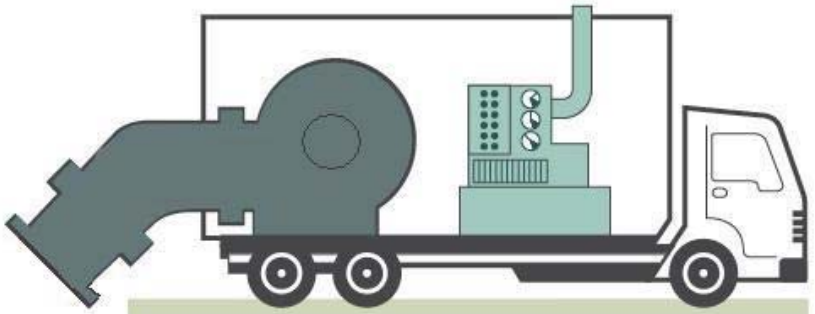
High pressure water jetting

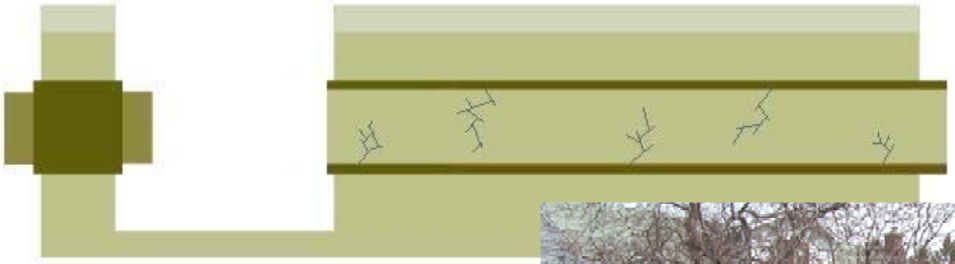


Liner Wet Out

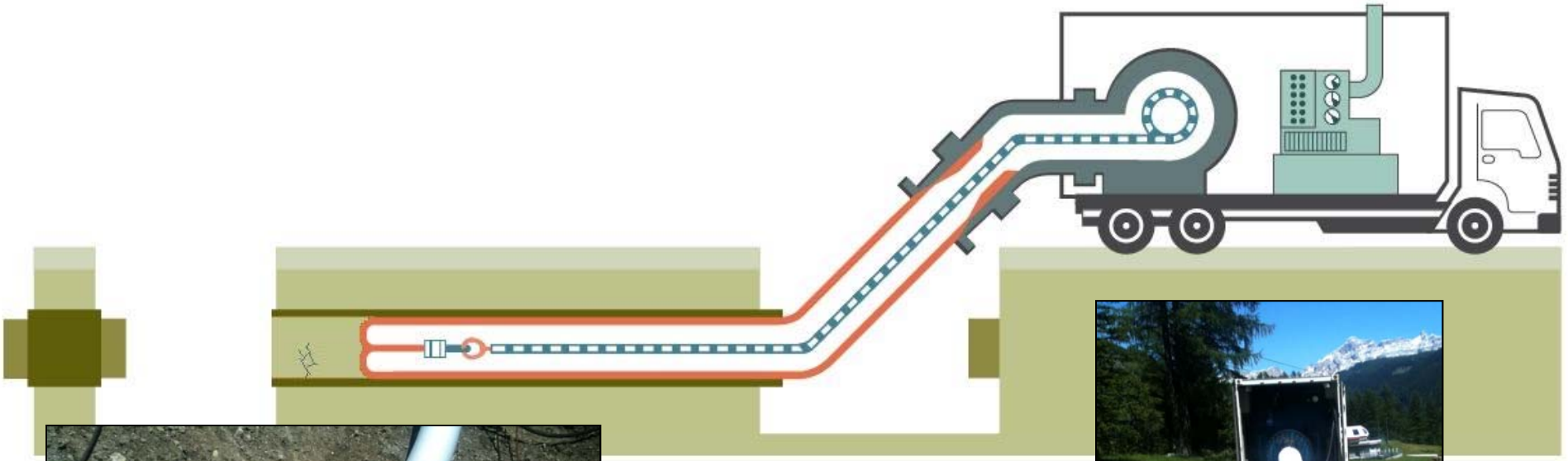
- The lining is laid out on roller bed or impregnation table
- Vacuum is applied to remove the air from the dry liner
- Resin is pumped into the lining to replace the air removed by vacuum
- Resin injection and vacuum holes are sealed and patched

Positioning of Installation Unit

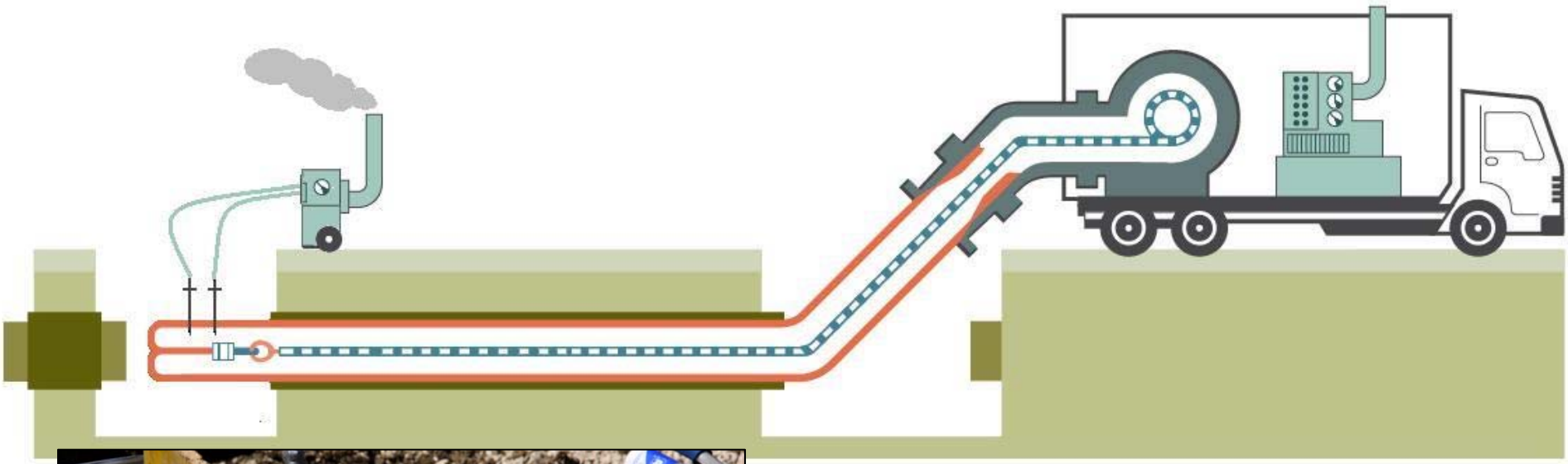


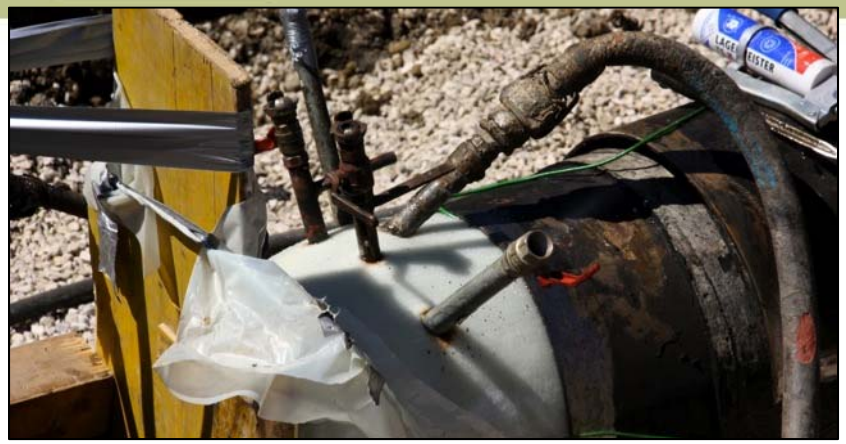


Installation of CIPP by Air Inversion



Curing by Controlled Steam





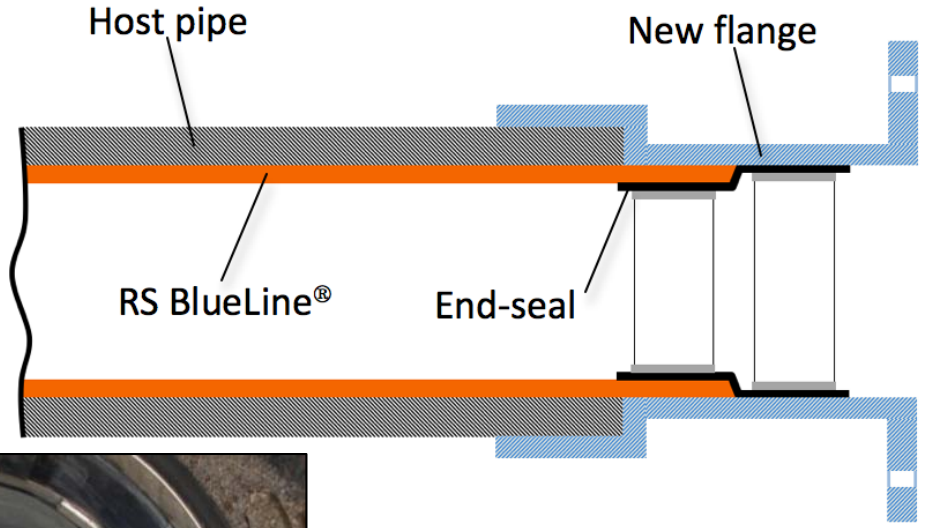
Water Inversion and Cure

- As the liner is wet-out, it is immediately inverted into the host pipe using a water column
- Inversion water is then circulated and heated through a boiler, which in turn cures the liner in place

Air Inversion and Steam Cure

- After wet-out, the liner is inverted into the pipe using an air inversion unit (drum or shooter unit)
- Once inversion is complete, controlled steam is used to elevate the temperature of the air to cure the liner
- Time and energy savings can be realized

Connection Techniques



Product and Design

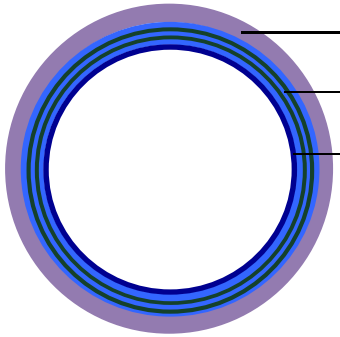
RS BlueLine®

- Fully structural pipe-within-a-pipe solution for pressure pipe,
- Final product has inherent ring stiffness and full external and internal load bearing capacity, surviving host pipe failure
- Can be designed as partially deteriorated if host pipe condition allows
- Designed in accordance with ASTM F1216
- 4” – 40” diameter
- Class III and IV per AWWA M28
- Compatible with all host pipe materials
- Optional Class II application with bonded liner if pipe condition allows

Key Facts

- Polyolefin coating
- Polyester needle felt with a single or multiple glass layer
- Epoxy resin
- Partially and fully deteriorated structural conditions
- Fulfilling criteria for Class III and IV (AWWA M28)

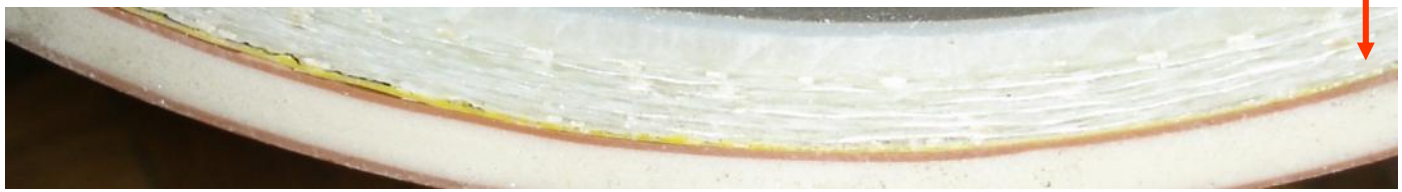
- Intrinsic stiffness
- No dependence on bond to host pipe
- Prevents future leakage and corrosion
- Improves or replaces structural integrity of host pipe
- Diameter range from 4 – 40-inch



Application and Use

- Where to Use?
  - Pipe condition not structurally sound
  - Leaking and deflected joints
  - Any pipe material
  - Pipe is failing with frequent bursts

- The Key?
  - The liner has a homogenous felt/glass structure, diminishing the impact of imperfections like deflections and bends.



Connection Techniques

Connection Technique Overview

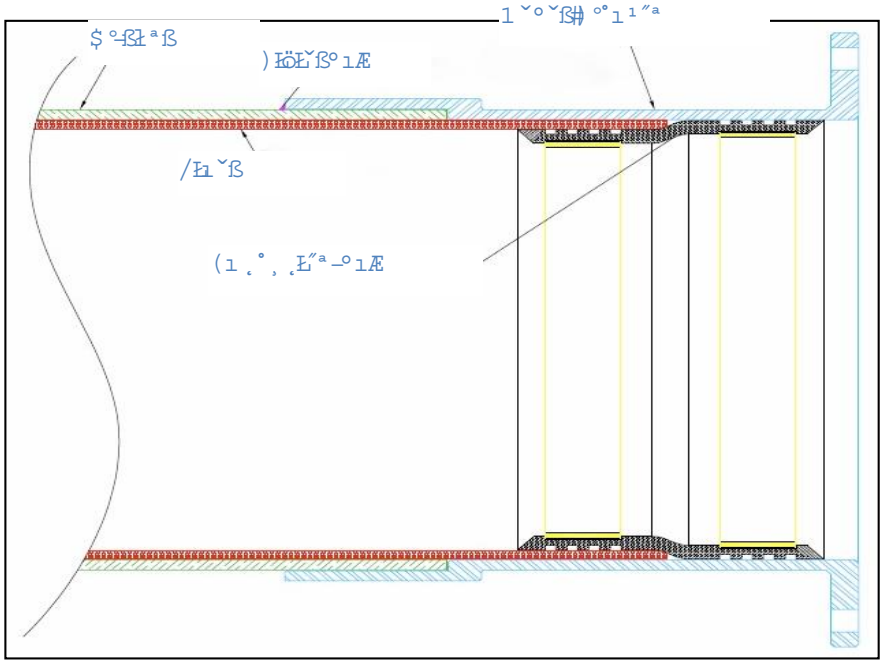
Diameter	RS BlueLine Pull-In			RS BlueLine Inversion		
	Multi/Joint	End-seal with Flange	Saddle coupling	Multi/Joint	End-seal with Flange	Saddle coupling
4"	X		X			
6"	X		X			
8"	X		X			
10"	X					
12"		X			X	
16"		X			X	
20"		X			X	
24"		X			X	
28"		X			X	
32"		X			X	

Connections and Couplings

Coupling

End Seal

Connections



If the liner needs to be completely independent from the existing pipe and end-seal is used, a new flange can be installed prior to liner installation.

T-connection with saddle coupler

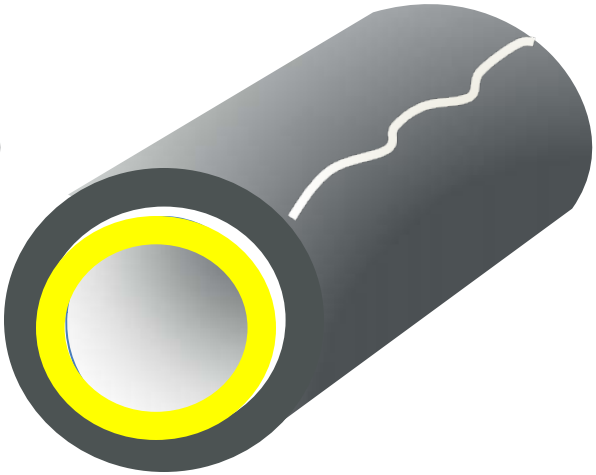
Pressure Pipe Product Classification

Classification per AWWA M28

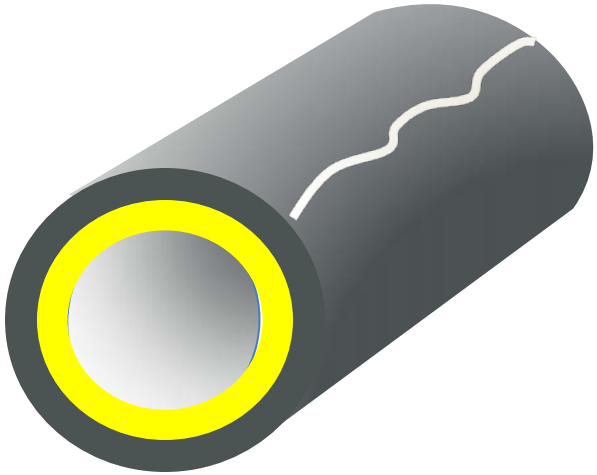
	Non-Structural	Semi-Structural		Fully Structural
	Internal Coating	Internal Lining	Lining with load bearing	Bears full loads
Liner Characteristics according to AWWA	Class I	Class II	Class III	Class IV
Internal corrosion protection	Yes	Yes	Yes	Yes
Hole and gap span at MAOP	No	Yes	Yes	Yes
Inherent ring stiffness	No	No	Yes	Yes
PN Liner ≥ MAOP	No	No	No	Yes
Liner survives host pipe failure	No	No	No	Yes

AWWA M28 Classification

- Bonded Lining Class II
- Woven Textile hose with Epoxy resin
- Sometimes combined with a felt layer



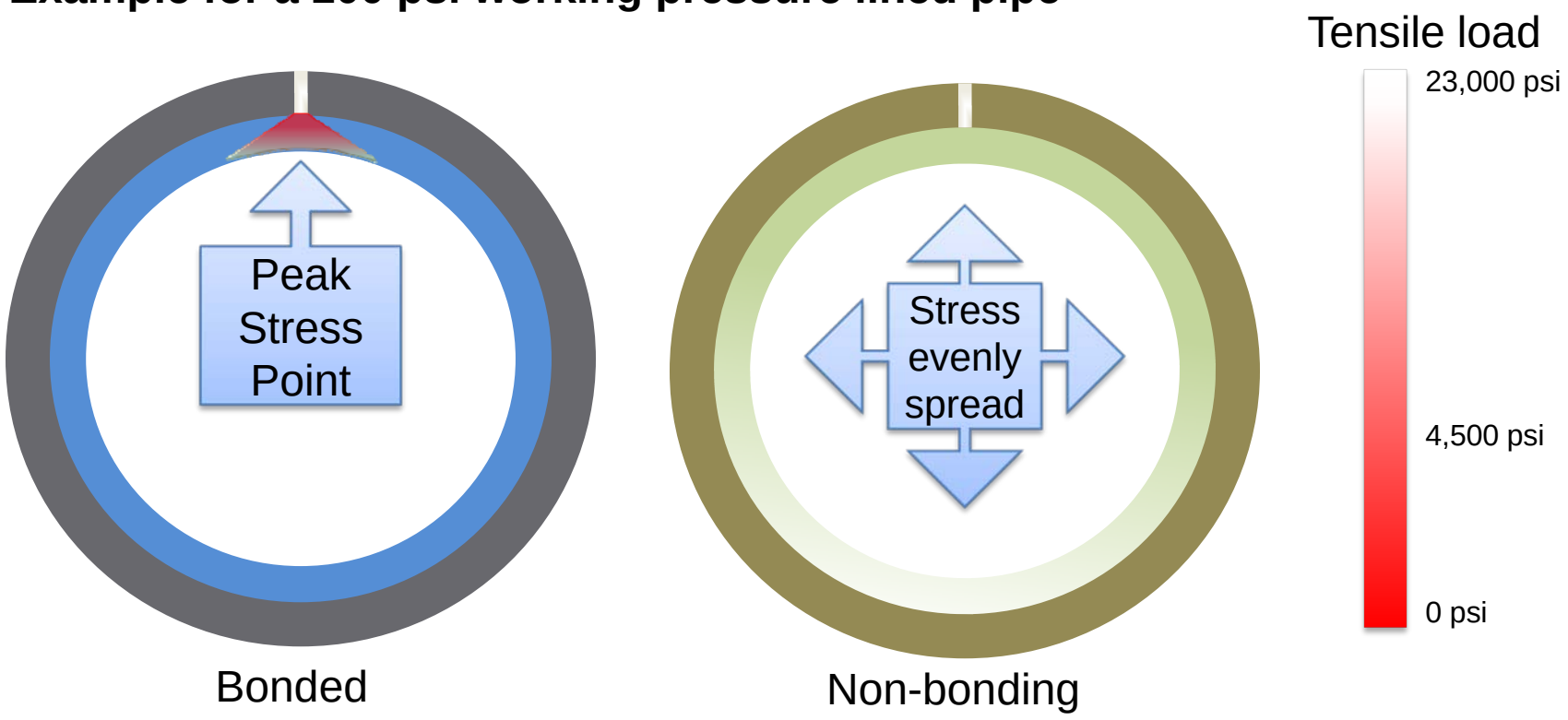
- Loose fit structural Liner Class III and IV
- Sliplining with plastic pipes
- Gap between host pipe and new pipe



- Close fit structural Liner Class III and IV
- CIPP, Fold in Form, Rolldown, Swagelining
- No gap between host pipe and new pipe

Structural CIPP Linings – Bonded or Non-bonding?

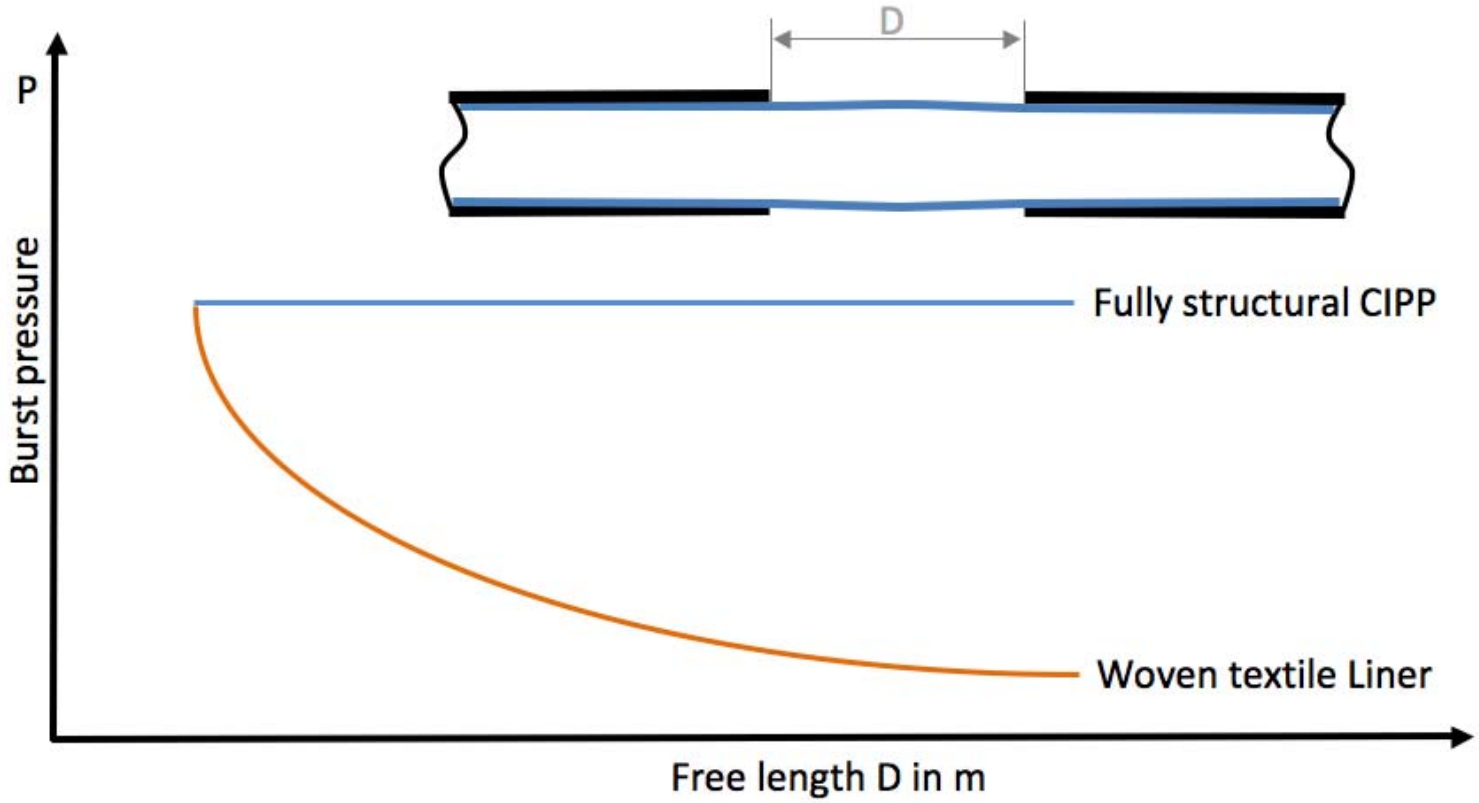
Example for a 100 psi working pressure lined pipe



Any Class III or IV CIPP liner bonding onto the host pipe has limited capabilities for internal pressure resistance, and relies entirely on the structural integrity of the host pipe for its pressure resistance. A bonded liner can never be a fully structural solution because it is not independent of the host pipe.

Comparison of Pressure Resistance

Circular woven textile hose versus fully structural glass reinforced CIPP Liner



Hydropower Case Study

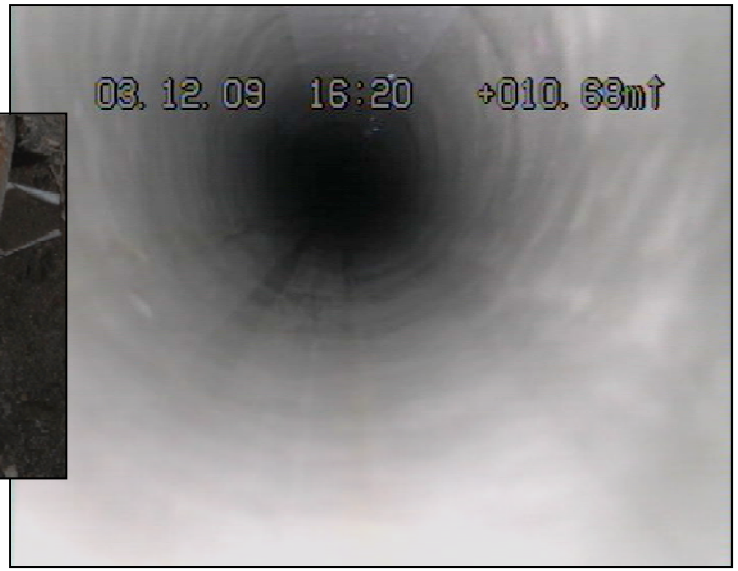
- Hydropower supply pipe in Italy
- 20” diameter, 1,650 lf with slope > 20%
- Pressure pipe, 70 psi with high static load in longitudinal direction

Potable Water Case Study

- 4” potable water case rion pipe in Cagliari, Italy with 7 service connections, 1 T-connection

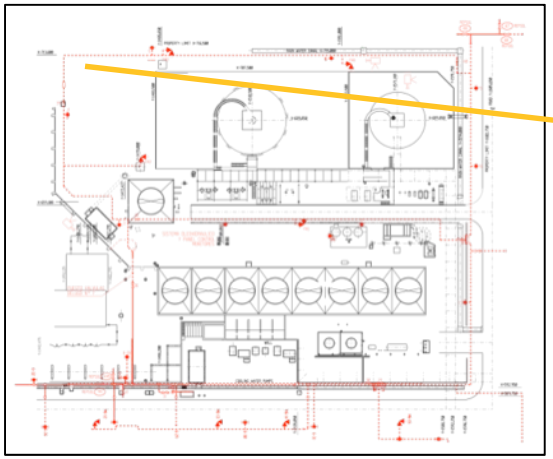
Before

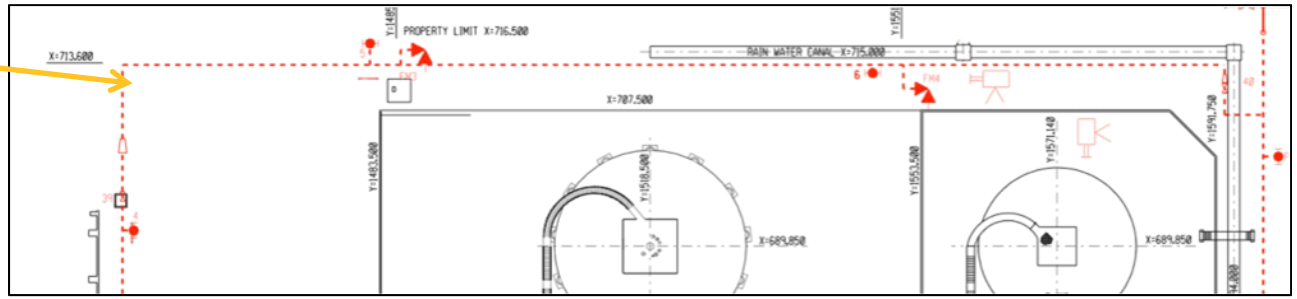
After



Fire Main Case Study

- 10” steel pipe, 230 psi working pressure
- 530 feet total length, through a 90 degree bend, plus 4 connections in 2“ and 4“ to be opened internally with remotely controlled robot





Fire Main Project – Installation Equipment

Computer controlled mixing and impregnation equipment

Pressure drum installation and steam equipment

Hydraulically driven robot

Fire Main Project - Installation

Difficult truck position – 3 bends before pipe access

Fire Main Project – Access Pit after Install

Fire Main Project – Before and After

Before cleaning

After cleaning

After lining

The 90° bend

Green and Energy Efficient

- No styrene
- No VOCs
- Non-toxic
- No excavation
- No landfill materials
- 50-year design life
- Low energy demand
- Reduced carbon footprint

Sustainable Solutions for Aging and Deteriorating Pipe

- Minimize traffic, trenching and disruption or damage to adjacent infrastructure and environment
- Extend the service life of infrastructure
- High performing, durable epoxy resins
- Technically proven processes
- Professional contractor performing installation consistently and reliably

Thank you!

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