Reinforced CIPP for Pressure Pipe Rehabilitation





Stronger. Safer. Infrastructure."

Cured-in-place Pipe (CIPP)

- Resin impregnated tube with:
 - Glass reinforced felt
 - Woven polyester jacket
- Inversion or Pull-in installation methods
- Water, steam, or UV curing methods
- Tight fitting = greater flow maximization
- Joint less, pipe-within-a-pipe that protects against corrosion, build-up, and leakage





Applications



Technical Envelope

- Diameter = 6" to 96"
- Max. Operating Pressure = >250 psi
- Bends = up to 45°
- Effluent Temp. = up to 150° F
- Physical Properties = exceed ASTM F1216 / AWWA M28

Diameter & Pressure Capabilities



0	Pipe Diameter																		
	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"	42"	48"	54"	60"	66"	72"	84"	96"
—Glass	258	195	160	255	220	195	175	161	256	227	190	165	145	130	115	108	100	90	80
Woven	150	150	150	135	135	135	120	120	120										

Design Standards

Design Parameters



- ASTM F1216 / AWWA M28
- Internal design:
 - Operating pressure, transients, vacuum
- External design:
 - Soil, groundwater, traffic, and other live loads
- Other factors:
 - Ovality, bends, services
- Unrestrained burst testing
 - Validates safety factor
 - Safety factors vary by manufacturer.

CIPP Liners – Gravity vs. Pressure

CIPP Liners are comprised of:

- 1. Thermosetting resin
- 2. Felt Tube
- 3. Coating

• Primary Concern: Buckling from External Loading

Polyester Resin / Standard Felt

• Felt has minimal contribution to cured physical properties

- Primary Concerns: External Loading AND Internal (Tensile) Stresses
- Vinyl Ester or Epoxy Resins
- Felt Tube Reinforced with Fibers

Pressure Pipe Systems

Emphasis on Resin

Gravity

Sewer

Systems

Emphasis on Resin AND Tube

Tube Construction

Glass Composite Structure

- Epoxy/polyester felt structure
 - Provides for external load capacity
 - Layer thickness can be varied depending on loading conditions

C = 140

PP/TPU coating

- Water contact surface
- Coating also provides water barrier for installation processes & handling
- Epoxy/fiberglass structure

Resin / Fiberglass layer(s)

Resin/polyester felt layers

Liner coating wetted surface

- Provides high tensile strength
- Number of layers vary depending on diameter and internal pressure

Woven Jacket Structure



C = >120

General Woven Jacket Liner Construction

- 1. Polymeric Membrane
- 2. Woven Liner + Epoxy
- 3. Woven Liner + Epoxy

Liner Terminations

Liner Terminations – Two Schools of Thought





End Termination - Adhesive

- End prepared prior to lining
 - SSPC-SP7 / NACE 4
- Resin application
 - Acts as a bonding agent b/t liner and host pipe
- CIPP liner installation / curing
- Liner cut flush with existing pipe
- Mechanical fittings connected to existing host pipe for closure

* This process relies solely on the integrity of the host pipe (long term) in order to maintain water tightness



End Termination - FRP

- Precast FRP composite pipe
 - Interior abraded and primed with bonding agent
 - CIPP inserted through FRP and cured to obtain a watertight bond
- Eliminates need to connect back to the host pipe
- Promotes the use of standard mechanical joint fittings



End Termination - FRP



End Termination – Hymax Compression Fitting



ZERO RELIANCE ON HOST PIPE FOR CLOSURE

End Termination – Hymax Compression Fitting



Service Connections

Service Connections – Two Schools of Thought





- Step 1 intense cleaning to prepare pipe surface for resin
- Step 2 plugging of existing service connection
- Step 3 locating of the existing service (after lining)
- Step 4 reinstatement of the existing service (via drilling)

* This process relies solely on the integrity of the host pipe (long term) in order to maintain water tightness



- Robotic reinstatement of service connections
- Reduces/Eliminates need for costly excavations
- Does not rely on host pipe for water tightness



- Step 1 reverse threading (internal) of protruding service
- Step 2 plugging of existing service connection
- Step 3 locating and drilling of the existing service (after lining)



• Step 4 – installation of mechanical connection

Pressure Testing

Pressure Testing – ASTM F1216



...recommended pressure and leakage test would be at twice the known working pressure or at the working pressure plus 50 psi, whichever is less.







Thank you!

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