

The Underground Utilities Event | July 13-15, 2021 | Music City Center | Nashville, TN

Glass UV Liner Alternatives: Field Applications of UV-Cure Felt CIPP for Small-Diameter Sewer Rehabilitation



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What to Expect

- UV Cured CIPP Basics
 - Why UV Cure?
 - Benefits
- UV Felt Alternatives to Glass
 - Technical Envelope
 - Materials
 - Design
 - Standards
- Field Applications



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UV CIPP History

- Originally patented by Insituform in the 1980s as a potential alternative to the industry standard of heat-cured liners.
- Since their inception, UV CIPP liners have traditionally been comprised of an all-glass material composition, to allow for the penetration of UV light for curing.
- Glass related UV CIPP liners are now estimated to be approximately 7 to 12 percent of the overall worldwide CIPP market.



Early UV-Cure Install German Paper Mill, c. 1989



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Why Agencies Adopt UV Cured CIPP

4 Key Points:

Environmental - Reduced/eliminated styrene emissions

Continuous monitoring of cure cycle

Reduced project footprint

Enhanced physical properties



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Building on Success

IPLUS INFUSION®



- Pull-in installation (F-1743)
- All felt composition
- 5+ million LF installed
- Heat-initiated catalyst

IPLUS INFUSION" UV



- Pull-in installation (F-1743)
- All felt composition
- High translucency felt fiber
- UV-initiated catalyst



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Felt-based UV Cured CIPP

Internal scrim layer controls pull-in stress loads and prevents liner damage

Outer styrene/UV barrier film protects liner during pull-in

Next generation
UV Liner that
reduces costs
by 30% as
compared to allglass systems

Real time cure monitoring during install

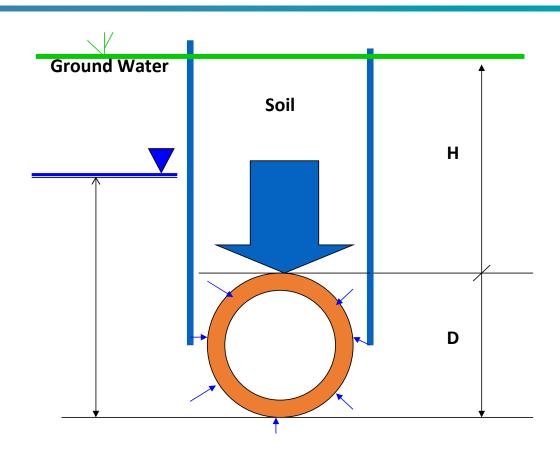
Dimples at service connections

Controls VOCs



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Design Parameters



- ASTM F1216/F1743
- External design:
 - Soil, groundwater, depth, traffic and other live loads
- Other factors:
 - Ovality, diameter, safety factors, etc.



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Applicable ASTM Standards



Designation: F1743 - 08 (Reapproved 2016)

Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulledin-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)¹

TABLE 1 CIPP Initial Structural Properties⁴

Property	Tost Mothod -	Minimum Value	
		pai	(MPa)
Floxural strength	D790	4 500	(31)
Flexural modulus	D790	250 000	(1724)
Tensile strength	D638	3 000	(21)
(for pressure pipes only)			

[&]quot;The values in Table 1 are for field inspection. The purchaser should consult the manufacturer for the long-term structural properties.





Designation: F2019 - 11

Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic

Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)¹

Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube^{1,2}



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Hybrid Material – Needs Both Standards

UV Felt integrates design and installation from a variety of ASTM standards that govern CIPP applications:

ASTM F1216 – Used for felt <u>design</u>, material properties

ASTM F1743 – Used for UV <u>felt design</u>, <u>material properties</u>, and <u>installation</u> (pull-in)

ASTM F2019 – Used for <u>UV</u> felt design, material properties, <u>installation</u> & <u>curing</u> (pull-in / UV cure)

UV felt cannot be held to **material properties or modified designs** of ASTM F2019 – (composite-based standard)

Takeaway: UV felt is a hybrid product that needs both F1743 and F2019 standards referenced.



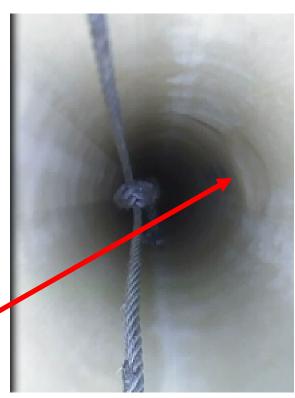
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Key Benefit – Service Connections

UV Glass



UV Felt



Service



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UV Felt CIPP Materials



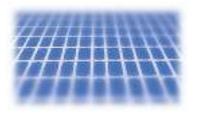
Polypropylene (PP)



Thermoplastic Polyurethane (TPU)



Polyester fiber



Pull-in scrim



PE/Nylon/PE



Polyester (PE); Vinyl Ester (VE) Styrene Free & Potable water Certified

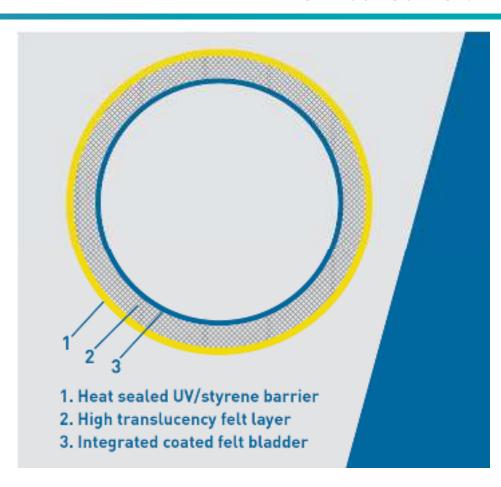
Coating + felt + resin + UV encapsulating wrapper = UV felt CIPP tube

(No Glass!)



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UV Cured Felt Liner Construction





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Resin Impregnation Options

- Liners can be wet out on a specially modified conveyor system (double-slug) or through a resin tank impregnation system.
- 2 Method used depends on overall liner length.
- 3 Uses UV cured polyester resin and/or styrene-free vinyl ester resin.
- No temperature controls required during impregnation or after wet-out is complete.



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Double Slug Conveyor System









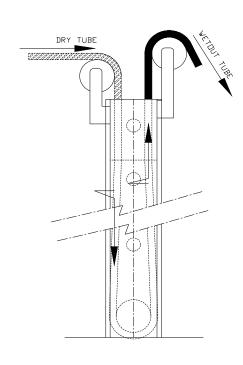






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Resin Tank Impregnation System





For longer production runs, we can utilize a patented resin tank impregnation system that allows for more a more economical, continuous resin injection method.



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UV Felt Installation



Small footprint

Less Equipment



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UV Felt Installation







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UV Felt Installation



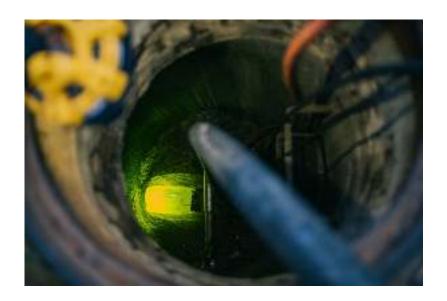




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UV Felt Installation



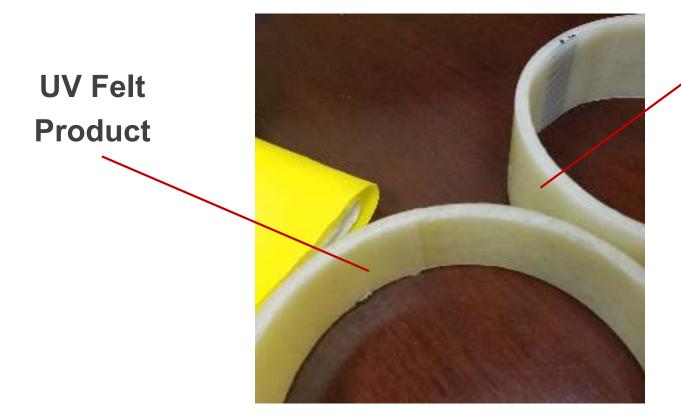


Two installs daily – good production – curing efficiency



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Finished Product Comparisons



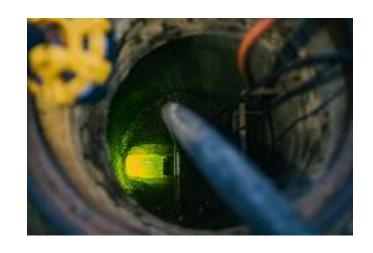
Heat Cured Product



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Technical Envelope

- Diameter ranges: 6 inches to 15 inches
- Maximum thickness 18mm
- Thicknesses relevant to design per ASTM F1216 (F1743)
 - Typical thickness ranges are 4.5mm to 9mm
- Installation lengths up to 750 feet
- Integrated PP coating/inflation bladder No need for postinstall removal
- Styrene barrier film meets ASTM F2019
- ~30% less material costs than "all glass" UV versions on the market
- Can be installed with standard UV equipment





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UV Cured Felt CIPP—Key UV Points by NASTT



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Key Comparisons:

- ✓ Styrene/VOC containment
- ✓ Monitoring of cure
- ✓ Inner bladder
- ✓ Dimples in services
- ✓ Cure times
- ✓ Refrigeration
- ✓ Wet tube life of six months
- ✓ Cure water or steam condensation discharge

11 INTERNATIONAL PURE



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Key Takeaways

- 1 UV felt systems encapsulate styrene just like UV glass systems
- 2 UV felt systems dimple at service connections
- UV felt materials are approximately 30% more cost effective than all-glass UV systems (same install time)
- UV felt systems meet much of ASTM F1743, and portions of ASTM F2019 (hybrid system)
- UV felt provides same benefits of UV glass (VOC control, installation monitoring, smaller footprint) without high price tag and excessive physical properties



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Questions?

Thank you!!!



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Booth #605

- UV Felt Information
- Trenchless Applications
- Specifications
- Experience Requirements
- Budgetary Assistance
- Feasibility
- Engineering
- Gravity & Pressure
- Wetout/Manufacturing Tours

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