UNDERGROUND CONSTRUCTION TECHNOLOGY
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**

# UV CIPP History

1. Originally patented by Insituform in the 1980s as a potential alternative to the industry standard of heat-cured liners.

2. 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.

3. 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**

## 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

# 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

# Felt-based UV Cured CIPP

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

Real time cure monitoring during install

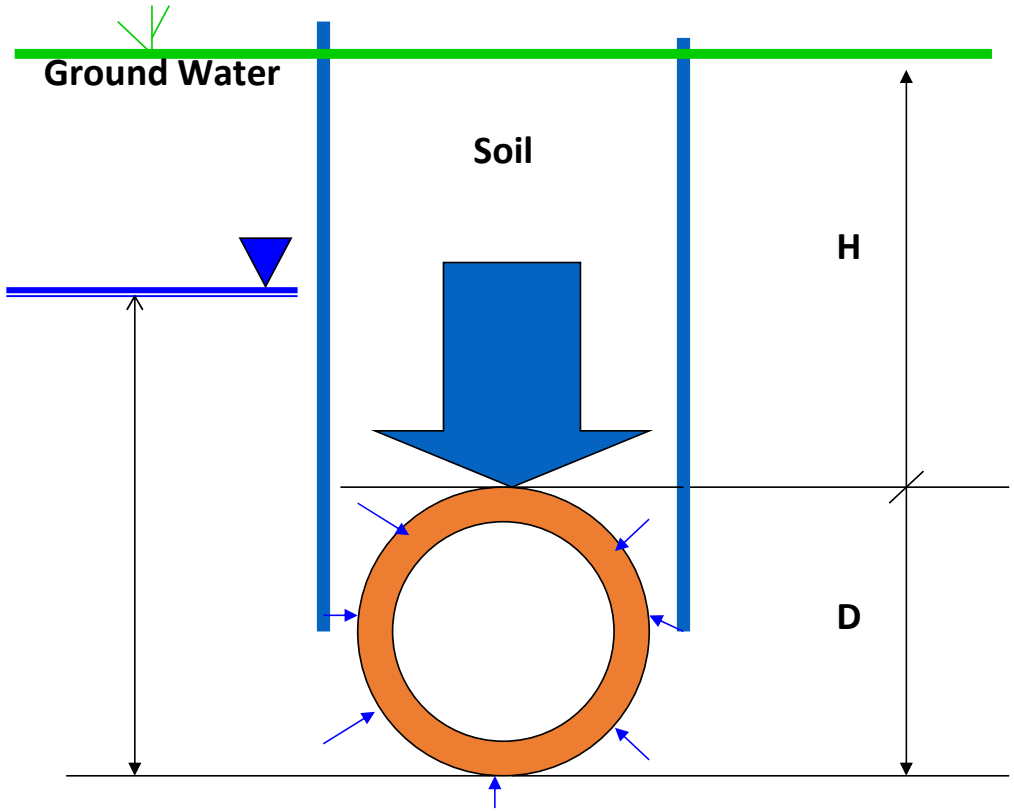
Dimples at service connections

**Next generation UV Liner that reduces costs by 30% as compared to all-glass systems**

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

Controls VOCs

# Design Parameters




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

# Applicable ASTM Standards

Designation: F1743 – 08 (Reapproved 2016)

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

TABLE 1 CIPP Initial Structural Properties[A]

| Property | Test Method | Minimum Value | |
|---|---|---|---|
| | | psi | (MPa) |
| Flexural strength | D790 | 4 500 | (31) |
| Flexural modulus | D790 | 250 000 | (1724) |
| Tensile strength (for pressure pipes only) | D638 | 3 000 | (21) |

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

Designation: F1216 – 16

## Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube[1,2]

Designation: F2019 – 11

## Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)[1]

# 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 design, material properties

**ASTM F1743** – Used for ~~UV~~ felt design, material properties, and installation (pull-in)

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

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

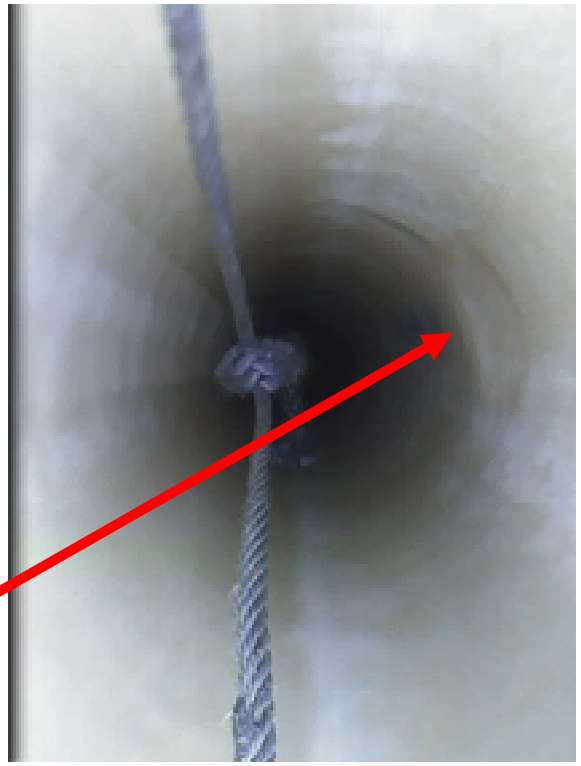
**Takeaway:** UV felt is a hybrid product that needs both F1743 and F2019 standards referenced.

# Key Benefit – Service Connections

## UV Glass

Service

## UV Felt



# UV Felt CIPP Materials

Polypropylene (PP)

Polyester fiber

PE/Nylon/PE

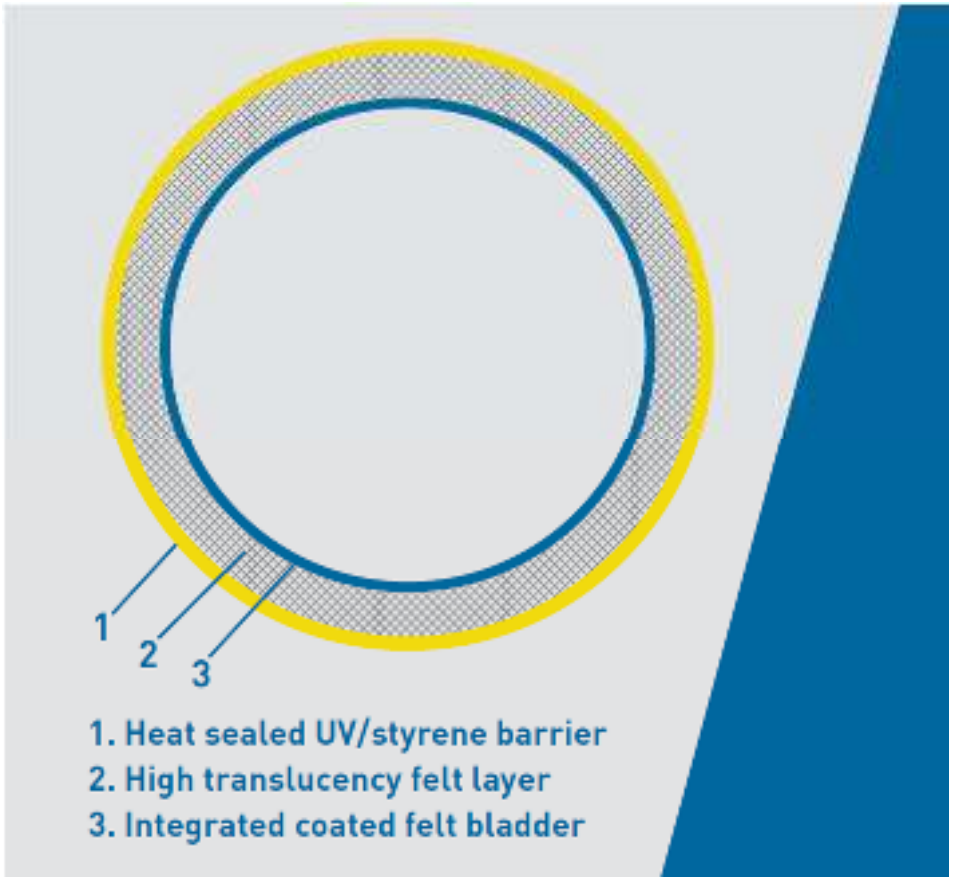
Thermoplastic Polyurethane (TPU)

Pull-in scrim

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

**Coating + felt + resin + UV encapsulating wrapper = UV felt CIPP tube** **(No Glass!)**

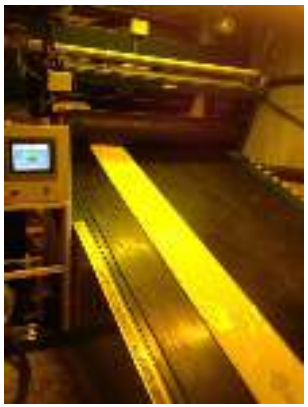
# UV Cured Felt Liner Construction



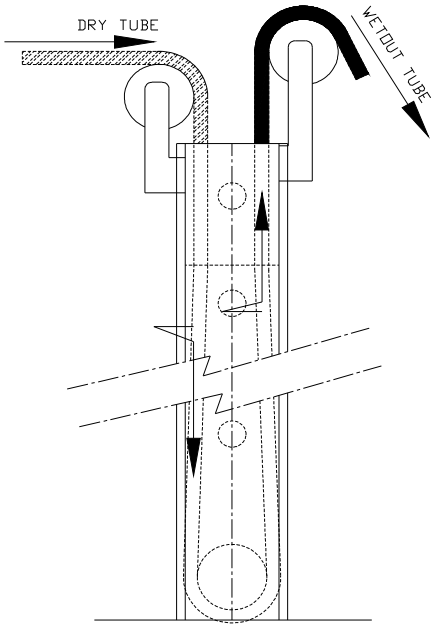
# Resin Impregnation Options

1. 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.
4. No temperature controls required during impregnation or after wet-out is complete.

# Double Slug Conveyor System

# 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.

# UV Felt Installation

Small footprint

Less Equipment

# UV Felt Installation

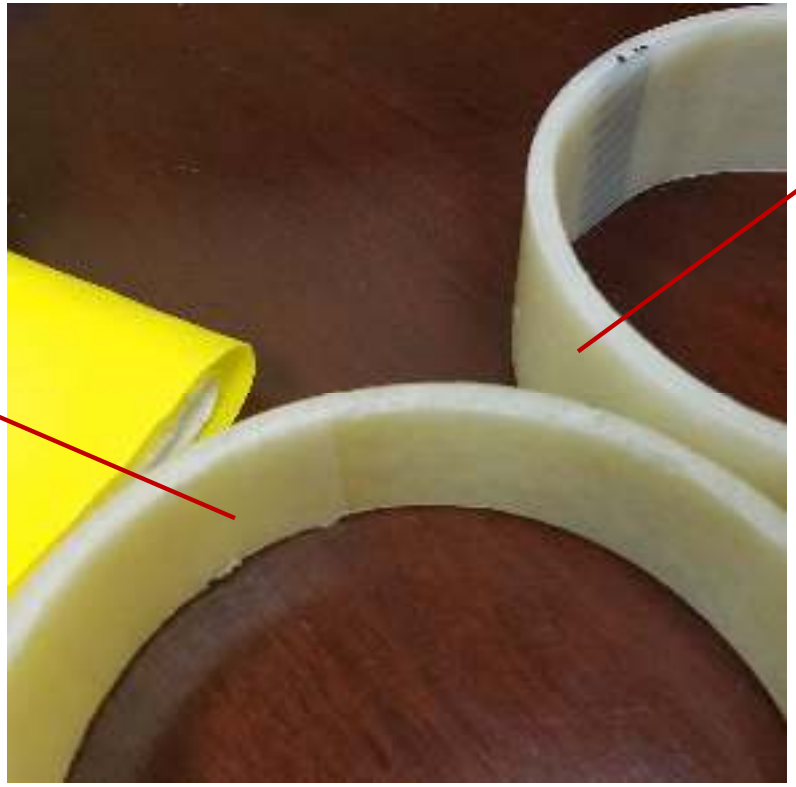
# UV Felt Installation

# UV Felt Installation

**Two installs daily – good production – curing efficiency**

# Finished Product Comparisons

UV Felt Product



Heat Cured Product

# 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 post-install 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

# UV Cured Felt CIPP—Key UV Points by NASTT

## 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

# Key Takeaways

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

## 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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