PERMA-LINER INDUSTRIES, LLC.

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NOTE:
This guide specification covers the requirements for cured-in-place pipe lining, including applicable industry standards, installation, and performance verification for interior and exterior piping systems.

PART 1 GENERAL

This specification addresses the procedures for the rehabilitation of pipelines and conduits, 2 to 12 in. diameter, by the inversion installation of a resin-impregnated, scrim reinforced flexible fabric tube into an existing conduit and secondarily inflated through the inversion of a calibration hose by the use of a hydrostatic head or air pressure.

1.1 REFERENCES

ASTM D543	(2006) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D638	(2010) Standard Test Method for Tensile Properties of Plastics
ASTM D790	(2010) Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM F1216	(2009) Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

1.2 SUBMITTALS

- Inversion Installation Equipment
- CIPP Scrim Reinforced Lining Tube
- 100% Solids Epoxy Resin
- Calibration Tube
- Manufacture’s Installation Instructions
- Manufacturer’s Warranty

1.3 PROJECT/SITE CONDITIONS

Inspect the line with CCTV and determine the overall condition of the pipe prior to starting the Pre-conditioning of the pipe.

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PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide new cured-in-place-pipe (CIPP) lining for the existing [roof drain leader piping from the roof to floor level] [horizontal & vertical drain piping] [electrical conduit] [process piping] [ventilation] [wastewater piping] complete and ready for operation.

Perform the rehabilitation using a tube of one or more layers of scrim reinforced flexible needle perforated felt, of specified length, and a 100% solids epoxy resin with physical and chemical properties appropriate for the application, in conformance with ASTM F1216. Submit product data for 100% epoxy resin, Scrim Reinforced liner materials, and Inversion installation equipment.

2.2 PIPE LINING MATERIALS

2.2.1 CIPP Lining Tube

Provide a liner tube consisting of one or more layers of scrim reinforced flexible needle perforated felt, continuous in length with uniform wall thickness. Overlapping sections are not allowed in the length of the liner. Ensure that the liner tube is capable of conforming to bends, offset joints, bells, and disfigured pipe sections.

Provide an integrated bladder within the felt tube that is made from Material’s compatible with the felt and resin systems used and capable of withstanding the required installation pressure.

The liner tube will consist of scrim reinforcement and needled felt. The liner tube will be fabricated together using a butt stitched seam sealing process with a heat welded sealing tape to ensure airtight seal. The liner tube is to be manufactured in the United States by Perma-Liner Industries, LLC. The liner tube will be capable of carrying resin and withstanding installation pressures and curing temperatures. The liner tube will be lined on one side with a translucent impermeable chemically resistant polyvinylchloride (PVC) waterproof coating. This coating will be on the inner lateral collection lined pipe after curing is completed. The coating will provide a smooth and seamless inner wall.

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The scrim reinforced / seam stitched / heat welded seam tape / felt liner tube and resin will upon installation meet and/or exceed minimum testing standards as required by ICC, ASTM, IAPMO and ANSI/NSF International. All materials must have 3rd party testing provided by independent laboratory. The materials must be ANSI/NSF Standard-14 approved, IAPMO Certified for small diameter pipe lining in Sewer Pipes and Vents, and must be certified by the International Code Council for the International Plumbing Code and the International Residential Code. The scrim reinforced / seam stitched / heat welded seam tape / felt liner tube and resin must have NSF Standard 14, and ICC-ES denoted on the tube.

Materials must be manufactured in the United States of America by Perma-Liner Industries, LLC, Clearwater, Florida USA and produce a Scrim Reinforcement in the Needle Punched Felt Liner Tube for stretch resistance. Non Scrim Reinforced Liner Materials Will Not Be Accepted.

2.2.2 Resin

Provide 100% solids epoxy resin impregnated, cured tube that is resistant to shrinkage, corrosion, oxidation, and is resistant to abrasion from solids, grit, sand in rainwater, and is solvent free. Use a resin with proven resistance to storm water and ultra-violet light (sunlight) at any stage prior to installation. Polyester or vinyl ester resins are not acceptable.

Ensure the proposed resin system does not contain silicones, stearates,
and/or natural waxes that would adversely affect the adhesives properties or any other chemical or physical properties of the CIPP liner.

The resin will be a two-part, 100% solids epoxy containing no styrene. The epoxy resin shall be formulated to have a gel (pot) life of approximately 30 minutes with a set cure time of three (3) hours. The epoxy shall ambient cure by internal exothermic chemical reaction and/or heat assisted using steam or hot water.

100% Solids Epoxy Resin must be formulated in the United States of America by Perma-Liner Industries, LLC, Clearwater, Florida USA.

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2.2.3 CIPP Properties

Provide CIPP with minimum chemical resistance requirements in accordance with ASTM D543. Conduct exposure to the chemical solutions listed in Table 1 at temperatures of up to 23.9 degrees C 75 degrees F. Conduct this test for a minimum period of one month. Loss result cannot exceed 20 percent of the initial structural properties.

TABLE 1 - CHEMICAL RESISTANCE REQUIREMENTS

Chemical Solution Concentration	Percent
Tap Water (pH 6-9)	100.0
Nitric Acid	5.0
Phosphoric Acid	10.0
Sulfuric Acid	10.0
Gasoline	100.0
Vegetable Oil	100.0
Detergent or Soap	0.1

Ensure the CIPP meets the minimum structural properties listed in Table 2 below:

TABLE 2 - CIPP INITIAL STRUCTURAL PROPERTIES - ASTM F1216 & NSF Standard - 14

Property	ASTM Test Method	Minimum Value
Flexural Strength	ASTM D790	4,500 psi
Flexural Modulus	ASTM D790	250,000 psi
Tensile Strength	ASTM D638	3,000 psi
Tensile Elongation	ASTM D638	5 psi
Compressive Strength	ASTM D695	4,000
Chemical Resistance	ASTM D543	<20% loss
Leakage Test*	NSF Standard 14	0/gal/day

* Leakage test performed by ANSI/NSF International

All final test results are to be performed by an A2LA accredited laboratory.

Manufacturer must have United States based manufacturing headquarters. The manufacturer must have at least 15 years of manufacturing / supplying C.I.P.P. Air Inversion Liner Tube and Materials in the United States. The manufacturing plant must have a Quality Assurance / Quality Control program in place and overseen by NSF International and IAPMO R&T Laboratories.

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PART 3 EXECUTION

3.1 INSTALLATION

Provide installation of CIPP system, including materials, workmanship, fabrication, assembly, erection, examination, and inspection.

3.1.1 General

NOTE: Use the first paragraph for roof drains only.

[Inform the Contracting Officer of temporary roof drain flow stoppage] For access at the bottom of the pipe sections, remove pipe sections near the floor at the appropriate point on the vertical rain leader in accordance with the design drawings.

3.1.2 Deviations

Should pre-installation inspection reveal conditions in the rain leader to be substantially different than those used in the design of wall thickness, liner tube construction, liner tube length, or resin system; notify the Contracting Officer and provide a videotape recording of existing conditions and design data. Do not proceed without direction from Contracting Officer.

3.1.3 Pipe Preparation

Perform pre-conditioning of the pipe section, including preparatory cleaning, corrosion removal, removal of grease buildup, or any other obstruction that may interfere with lining operations. Leave obstructions that are less than 15 percent of the pipe diameter, that can not be removed from the pipe, in place and line over. CCTV inspect the line immediately prior to lining and after the cleaning is complete to ensure that the pipe is ready for lining.

3.1.4 CIPP Installation Procedure

3.1.4.1 Wet Out

Accurately calculate and measure the amount of resin and catalyst required. Thoroughly mix the resin and catalyst. Thoroughly saturate/impregnate the flexible felt tube with the pre-calculated amount of epoxy resin prior to installation. Handle the resin impregnated flexible tube to retard or prevent resin setting until it is ready for insertion.

3.1.4.2 Insertion

Install the liner/bladder system using the Inversion method. Invert the liner/bladder system to the specified location in the pipe. Inflate the bladder using compressed air to a pressure adequate to form the liner to tightly fit the internal circumference of the pipe and to cause the resin to migrate into pipe joints, voids and defects.

Install the liner at minimum low pressure.

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3.1.4.3 Curing

Inflate the bladder using compressed air and leave the liner in place until the resin curing cycle is complete. Curing occurs at ambient temperature within three hours and one and half hours using steam.

When the curing process is complete, release the pressure and pull out the inflation bladder. Ensure the cured composite liner remains in place within the host pipe and provides a smooth bore interior that conforms to the existing pipe [eliminating rain water leakage]. Ensure the tube is continuous in length, wall thickness, and is uniform.

3.1.4.4 Service Connections / Reinstatements

All CIPP lined over branch pipeline connections, tye-ins, drain pipe connections, and vents must be opened using a robotic reinstatement cutter. The cutter must be able to provide video relay of the reinstatement cutting operation from start to finish. The reinstatement of all branch pipelines must be conducted from the inside of the lined pipe or from inside the branch line. The branch pipe opening connection must be cut to allow 100% flow from the branch pipelines. The reinstatement robotic cutting must be completed by using Reinstatement Equipment supplied by Perma-Liner Industries, LLC, Clearwater, Florida USA. Only equipment supplied by Perma-Liner Industries, LLC will be accepted.

3.1.4.5 Finish

Do not leave in the host pipe, any barriers, coatings, or any material other than the cured liner tube/resin composite, specifically designed for desirable physical and chemical resistance properties. Remove any materials used in the installation, other than the cured liner tube/resin composite. Remove any cured liner tube/resin composite pipe left protruding from the service connection. Ensure that the finished CIPP is continuous and free from visual defects such as foreign inclusions, dry spots, pinholes, and delimitation.

3.1.5 Liner Inspection

Perform a final Closed-Circuit Television (CCTV) inspection to verify proper cure and integrity of the composite liner.

3.2 FIELD QUALITY CONTROL

Test system in accordance with ASTM F1216 and NSF Standard 14, as supplemented and modified by CIPP manufacturer's written installation instructions.

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Upon completion, submit the DVD records of pre-lining inspection and post-lining inspection, along with the written report summarizing the extent of pipe lining performed. Update pipe lining contract record drawings to reflect the as-built condition after lining is complete and submit to the Contracting Officer. The Contracting Officer may review the video and documentation, and may inspect the work site to determine that the scope of work is complete, that the work is satisfactory, and the site has been returned to its original condition.

3.3 ADJUSTING AND CLEANING

After liner installation has been completed and accepted, clean the entire project area and restore the site to its original condition prior to the commencement of work. Dispose of all excess material and debris not incorporated into the permanent installation.

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