



# Poly-Triplex<sup>®</sup> Liner System Specifications

Cured-In-Place Pipe

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## SECTION 1

## CURED-IN-PLACE PIPE (CIPP)

### PART 1- GENERAL

#### 1.1 INTENT

It is the intent of this specification to provide for the trenchless reconstruction of corrugated metal and concrete culvert pipelines by the installation of an epoxy resin impregnated fiberglass and PVC vinyl liner tube, which is formed to the host structure by use of air pressure and steam heat injection or hydrostatic head pressure. The resin is cured using steam heat under air pressure, or heated or ambient temperature water under hydrostatic pressure within the tube. The Cured-In-Place Pipe (CIPP) will be continuous and tight fitting. The system is fully contained in a reinforced PVC non-porous fabric "cocoon", and may be installed in dry, wet, or completely submerged conditions of the host pipe.

#### 1.2 SCOPE OF WORK

Installation of a Cured-In-Place Pipe (CIPP) liner in \_\_\_\_ Feet of \_\_\_\_ Diameter Culvert, installed in \_\_\_\_ sections.

#### 1.3 REFERENCED DOCUMENTS

- A. ASTM F1743 (Rehabilitation of pipelines by pulled-in-place installation of a cured-in-place thermosetting resin pipe), which made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.
- B. ASTM D5813-95 (Standard specification for cured-in-place thermosetting resin sewer pipe), which made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.
- C. ASMT D-790 (Test methods for flexural properties of non-reinforced plastics) which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

## PART 2 - PRODUCT, MANUFACTURER/INSTALLER QUALIFICATION REQUIREMENTS

### 2.1 PRODUCT

- A. Product used shall have a 50-year design life, with substantial long term track record. Product Manufacturer and Installer shall provide a minimum five (5) year, non-prorated warranty, labor and materials.
- B. Cured-in-place lining (CIPP) shall be the Poly-Triplex<sup>®</sup> Liner System as manufactured by Poly-Triplex Technologies, 495 St. Johns Road, Bonifay, Florida 32425, p. (850) 547-9999.
- C. Installer of the product must provide certification that they are currently authorized or licensed by the CIPP manufacturer to install the approved process. Installer must satisfy all insurance requirements of the Owner, and must have a "Certificate of Certification" from the manufacturer in the installation of the product bid.

### 2.2 MATERIALS

- A. Tube - The sewn tube shall consist of one non-porous inner membrane with polyester felt mechanically bonded to both sides, layered between four structural layers of 24-oz. fiberglass woven roving, and shall meet or exceed the requirements of ASTM F1743, Section 5. The Tube may be constructed with zipper or other fastening device(s) so that the tube can be opened for thorough wet-out of both sides of the liner. Tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and contour to fit irregular pipe sections. Tube shall have an outer layer of reinforced PVC non-porous fabric to encase the liner in a "cocoon" for insertion in dry, wet, or fully submerged conditions of the host pipe.
- B. The Tube shall be sewn to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential changes or contour.
- C. No material shall be included in the Tube that may cause de-lamination in the cured CIPP. No dry or unsaturated layers shall be evident.
- D. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed inspection may be made.

### 2.3 RESIN SYSTEM

- A. The resin system shall be a corrosion resistant 100% solids 2-part epoxy resin/catalyst combination, polyester or vinyl-ester resin that when properly cured within the tube composite meets the requirements of ASTM F1743, and the physical properties herein. The resin shall produce CIPP, which will comply with the structural and chemical resistance requirements of this specification.
- B. Flow Analysis: In industrial areas, which may be subject to chemical waste discharges that can damage thermosetting plastics, the owner will have chemical analysis of samples of the stream flow. This analytical report will be supplied to the Contractor for his information and use.

## 2.4 STRUCTURAL REQUIREMENTS

- A. The layers of the cured CIPP shall be uniformly bonded together and shall have a minimum average wall thickness of 150 mils.
- B. The required structural CIPP wall thickness shall be controlled during the manufacture of the liner Tube. Except where otherwise agreed upon by the owner and contractor, Tube shall consist of (4) 24-oz layers of woven roving fiberglass with one 20-oz non-porous inner membrane material with felt impregnated on both sides. An outside layer of 14 mil reinforced PVC non-porous fabric and an interior removable 20 mil unreinforced vinyl inflation bladder form the “cocoon” to protect the liner from environmental conditions of the host structure during the insertion and curing process. Manufacturer shall make available inspection reports that tube is manufactured in accordance with the design parameters of this specification.
- C. Liner Material and Cured Lining: The tube and the resin system shall meet the liner manufacturer’s standards. Minimum Physical Properties of the cured composite shall conform to the structural properties as listed below.

<u>Property</u>	<u>Test Method</u>	<u>Result</u>
Flexural Strength	ASMT D-790	49,912 psi
Flexural Modulus	ASTM D-790	1,783,142 psi

- D. Deviations: The deterioration and corrosion of culvert pipelines is an ongoing process. Should pre-lining inspections reveal the pipes to be in substantially different conditions than those stated in the design considerations, then the Contractor shall request a change in liner thickness supporting such request with the design data in accordance with the liner manufacturer’s standard design policies. The added or reduced cost for the deviations, if approved, shall be negotiated separately with the Owner.

## PART 3 - EXECUTION

### 3.1 TESTING REQUIREMENTS

- A. Chemical Resistance - CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples incorporate materials and resins which will withstand the corrosive effects of the normal existing effluents, liquids or gases, and shall meet or exceed the chemical resistance test requirements of ASTM D5813-95, Table 1.
- B. Hydraulic Capacity - Overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

### 3.2 INSTALLATION RESPONSIBILITIES FOR INCIDENTAL ITEMS

- A. It shall be the responsibility of the Owner to locate and designate all access points open and accessible for the work, and provide rights of access to these points. If a street must be closed to traffic, the Owner shall institute the actions necessary to do this for the mutually agreed time period. The Owner shall also provide free access to water hydrants for cleaning, and other work items requiring water.
- B. Cleaning of Culvert Pipe - The Contractor, when required, shall remove all internal debris out of the line that will interfere with the installation of CIPP. The Owner shall also provide a dumpsite for all debris removed from the structures during the cleaning operation. Any hazardous waste material encountered during this project will be considered as a changed condition.
- C. Stream Flow Diversion - The Contractor, as required for successful installation of the CIPP, shall provide for the diversion of the flow from sections of culvert pipe designated for repair.
- D. Inspection of Culvert Pipelines – The interior of the pipeline shall be carefully inspected in accordance with AASHTO guidelines to determine the location of any conditions, which may prevent proper installation of CIPP into the pipelines. If television inspection is used, a copy of the videotape and suitable log shall be provided to the Owner.
- E. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP.

### 3.3 INSTALLATION

CIPP installation shall be in accordance with ASTM F1743, Section 6, with the following modifications:

- A. Resin Impregnation - The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for loss of resin through cracks and irregularities in the original pipe wall. Contractor shall use appropriate quantity as recommended and supplied by Manufacturer of the CIPP process. An onsite manual impregnation process shall be used and visual inspection made by an authorized licensed installer of the CIPP process.
- B. Tube Insertion – The wet-out tube shall be positioned in the pipeline using a pull-in method. When pulled into place, a winch should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.
- C. A dual inflation canister system will be attached to the liner on each end. Air pressure and steam heat will be injected from one end and the other end will be equipped with an exhaust valve to control the amount of pressure within the structure. Temperature gauges shall be placed inside the tube to monitor the temperatures during the cure cycle.
- D. Point repairs may be necessary to provide a smooth surface to receive the insertion of the liner through the pipe.
- E. Curing shall be accomplished by using a system of pressurized air and steam heat injection, or pressurized air at ambient temperature, or with heated or ambient temperature water, under hydrostatic pressure. Curing shall be in accordance with the manufacturer's recommended curing procedures and schedule.

### 3.5 INSPECTION

- A. CIPP samples shall be prepared and physical properties tested in accordance with ASTM D5813. CIPP samples shall be of the same material as those proposed for this project. The flexural properties must meet or exceed the values listed herein.
- B. Visual inspection of the CIPP shall be in accordance with ASTM F1743, Section 8.6. The installation may be inspected visually if appropriate, or by closed-circuit television if visual inspection cannot be accomplished. No infiltration of groundwater should be observed. All service entrances should be accounted for and be unobstructed.

### 3.6 CLEAN-UP

Upon acceptance of the installation work and testing, the Contractor shall restore the project area affected by the operations to a condition equal to that existing prior to the work.

### 3.7 PAYMENT

Payment for the work included in this section will be in accordance with the prices set forth in the proposal for the quantity of work performed. Progress payments will be made monthly based on the work performed during that period.

### 3.8 US PATENT NOTIFICATION

The herein described product and installation process is protected under one or more of the following US Patents:

6,368,025

5,915,886

5,490,744

5,265,981

Therefore, this product must be installed by Poly-Triplex Technologies, Inc., or one of its Authorized Licensed Installers.