

**Installation Specifications
for
Cured in-Place Sectional Lining
(as provided by LMK Enterprises)**

1. INTENT

It is the intent of this specification to provide for the reconstruction of a particular section of sewer pipe without excavation.

2. GENERAL

The reconstruction will be accomplished using a non-woven fabric tube of particular length and a thermo-set resin with physical and chemical properties appropriate for the application. The tube within a translucent inversion bladder is vacuum impregnated with the resin then placed inside a protective carrying device and winched into the existing sewer. When the carrying device is properly positioned, the end is opened and the resin-saturated tube is inverted through the damaged section using air or water pressure by the action of the inversion bladder.

Once the tube/resin composite is cured, the inversion bladder and the carrying device are removed. The process shall be Performance Liner® or equal.

3. MATERIAL

The tube will consist of one or more layers of flexible needled felt or an equivalent non-woven material. The tube will be continuous in length exhibiting a uniform minimum wall thickness based upon design calculations found in ASTM F1216 appendix XI. No overlapping sections shall be allowed in the circumference or the length of the liner. The tube will be capable of conforming to offset joints, bells, and disfigured pipe sections. The resin will be polyester or vinyl ester with proper catalysts as designed for the specific application. The cured-in-place pipe shall provide a smooth bore interior. Each installation shall have a design report documenting the design criteria for a fully deteriorated pipe section, relative to the hydrostatic pressures, depth of soil cover, and type of soil.

The composite of the materials above will, upon installation inside the host pipe, exceed the minimum test standards specified by the American Society for Testing Methods.

Test Standards for CIPP

FLEXURAL STRENGTH (ASTM D-790)-----4,500 PSI
FLEXURAL MODULUS (ASTM D-790)-----250,000 PSI

4. INSTALLATION PROCEDURE (ASTM F 2599-06) Standard Practice for Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner.

- 4.1** When required, the flow shall be by-passed. The pumping system will be sufficiently sized for normal to peak flow conditions. The up stream manhole is monitored at all times and an emergency deflate system will be incorporated so that the plugs may be removed at any time without requiring confined space entry.
- 4.2** Installer will clean and inspect the line immediately prior to lining utilizing a pan/tilt camera capable of verifying active or inactive service connections and the overall structural condition of the pipeline. All roots, debris, and protruding service connections will be removed prior to reconstruction. The current condition of the pipe will be compared to the original designed condition to verify that design parameters have not changed. See Item 6, Deviations.
- 4.3** The tube is inspected for tears and frayed sections. The tube, in good condition, will be vacuum impregnated with the thermo-set resin. The resin will be introduced into the tube creating a slug of resin at the beginning of the tube. A set of calibration rollers will assist the resin slug to move throughout the tube. All air in the tube shall be removed by vacuum allowing the resin to thoroughly impregnate the tube. All resin shall be contained to ensure no public property or persons are exposed to the liquid resin. A resin-impregnated sample (wick), shall be retained by the installer to provide verification of the curing process taking place in the host pipe.
- 4.4** The saturated tube along with the inversion bladder will be inserted into the carrying device. The entire carrying device is pulled into the pipe using a cable winch. The pull is complete when the end of the launching device is aligned with the beginning of the section being reconstructed. The resin and tube are completely protected during the pull. No resin shall be lost by contact with manhole walls or the pipe during the pull. The resin should not be contaminated or diluted by exposure to dirt, debris, or water during the pull. The resin that provides a structural seal shall not contact the pipe until positioned at the point of repair.
- 4.5** The installer shall be capable of viewing the beginning of the liner contacting the host pipe verifying the exact placement of the liner. Video documentation of the placement, prior to curing, shall be provided to the owner. No measuring from a CCTV counter or estimating will be allowed. The liner must be installed at low pressure (not to exceed 10-PSI) to prevent damage or further damage to the host pipe.
- 4.6** The tube will be inverted out of the carrying device by controlled air or water pressure. The installer shall be capable of viewing the entire liner contacting the host pipe from the beginning to the end of the liner verifying the liner has covered the entire damaged section. Video documentation of the entire liner contacting the host pipe, prior to curing shall be provided to the owner. The tube is held tightly in place against the wall of the host pipe by the pressure until the cure is complete.

- 4.7** When the curing process is complete, the pressure will be released. The inflation bladder and launching device shall be removed from the host pipe with the winch. No barriers, coatings, or any material other than the cured tube/resin composite, specifically designed for desirable physical and chemical resistance properties, should ever be left in the host pipe. Any materials used in the installation other than the cured tube/resin composite is to be removed from the pipe by installer.
- 4.8** Any service lateral connections covered by the sectional repair are to be opened using a hydraulic powered robotic cutting device specifically designed for cutting cured-in-place pipe made from these materials.
- 4.9** A second CCTV inspection is performed to verify the proper cure of the material, the proper opening of service laterals, and the integrity of the seamless pipe. The owner will receive a VHS videotape documenting the inspection and a written report documenting the project.
- 5.** The by-pass pumping system is removed and the sewer flows restored to normal flow conditions.
- 6. DEVIATIONS**
Should the pre-installation inspection reveal conditions in the sewer to be substantially different than those used in the design of wall thickness, tube construction, tube length, and resin system; the installer is required to request appropriate changes, supporting such requests with videotape recording of existing conditions and design data. The deviation, if approved, will be reflected by an appropriate addition or deduction in the original proposal price for the scope of work.
- 7. CLEAN-UP**
The site will always be left clean and the property restored to conditions equal to site conditions prior to the pipeline reconstruction project undisturbed.
- 8. FINAL ACCEPTANCE**
Upon completion, the installer will deliver the videotape and report to the owners. The owners should review the documentation and the site to determine that the scope of work is complete and the work is satisfactory.
- 9. PAYMENT**
Payment for the work will be in accordance with the prices as set forth in the proposal for the scope of the work performed. Progress payments will be made monthly based on the work completed in that period.

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