SPECIFICATION

SECTIONAL CONNECTION LINER

INSTALLATION PRACTICE FOR REHABILITATION OF A SECTION OF MAINLINE SEWER PIPE AND SEWER SERVICE LATERAL USING A ONE-PIECE MAIN-TO-LATERAL CURED-IN-PLACE LINER ASSEMBLY AND AIR INVERSION

#1652 V.0, 2/16 (16-02-503)

Section 02770
CURED-IN-PLACE PIPE LINING – Laterals
and/or
Section XXXXX
CURED-IN-PLACE PIPE LINING – Spot Repair

1.0 INTENT

1.1 This specification covers material requirements, installation practices, and test methods for the reconstruction of a sewer service lateral pipe and a section of the mainline without excavation. The pipe renovation shall be accomplished by the inversion and inflation of a resin impregnated, single-piece cured-in-place (CIPP) lateral and mainline spot repair liner outfitted with engineered, molded hydrophilic gasket seals that are designed specifically for sealing the main-to-lateral interface and its lateral. When cured, the liner extends over a predetermined length of the service lateral and a predetermined length of the main pipe. The materials and finished product shall, at a minimum, adhere to the requirements of ASTM F2561-11 "Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One-Piece Main and Lateral Cured-in-Place Liner" and the installation practice shall adhere to the methods outlined in ASTM F2599-11 "Standard Practice for Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner".

1.2 This specification takes precedence over any other similar specification that may be found in other sections of the bid documents.

2.0 GENERAL

2.1 The reconstruction shall be accomplished using a resin absorbent textile mainline tube of particular length and lateral tube and while using a thermo-set resin with physical and chemical properties according to ASTM F1216. The launching device and launching hose is winched through the mainline and positioned at the appropriate service lateral connection and section of mainline pipe. The mainline tube and bladder assembly is inverted and the bladder presses the liner against the main pipe while the lateral tube simultaneously inverts up into the lateral pipe by the action of the inversion bladder. The resin-saturated liner is cured with the molded gaskets embedded in-place between the host pipe and the new liner. After the resin is fully cured the inversion bladder and launching device are removed from the pipe.

3.0 PRODUCT AND INSTALLER ACCEPTABILITY

3.1 All sewer products must provide a 50 year design life, stamped by a licensed Professional Engineer (P.E.) in order to minimize the owner's long term risk of failure. Only skilled contractors/installers utilizing products that are manufactured in a controlled factory environment with substantial successful long term track records and/or manufacturer's certification of training completion will be considered.

3.4 All sewer rehabilitation products submitted for approval must provide third party test results supporting the long term performance and structural strength of the product and such data shall be satisfactory to the owner. Test results are to include the mainline and laterals, and hydrophilic molded gasket seals. Test samples shall be prepared so as to simulate installation methods and trauma of the product. No product will be approved without testing verification for all components proposed.

3.5 The Installer (the licensed company or subcontractor bidding) must meet the minimum requirements or be pre-approved by the owner. This is a company requirement; personal history is valuable, however will not be considered in evaluating the company's ability to meet the minimum requirements of this specification.

4.0 MATERIAL

4.1 Liner Assembly - The liner assembly shall be continuous in length and consist of one or more layers of absorbent needle punched felt, circular knit or circular braid that meet the requirements of ASTM F1216 and ASTM D5813 Sections 6 and 8. No intermediate or encapsulated elastomeric layers shall be in the textile that may cause delamination in the CIPP. The textile tubes shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe segments, and flexibility to fit irregular pipe sections. The resin saturated textile tubes shall meet ASTM F1216, 7.2 as applicable, and the tube shall have 5% to 10% excess resin distribution (full resin contact with the host pipe) that when compressed and cured will meet or exceed the design thickness.

4.2 Mainline Liner Tube - The main liner tube shall be a continuous absorbent material as long as two feet to six feet suitable for CIPP. The interior of the textile tube shall be laminated with an impermeable, translucent flexible membrane. The mainline tube shall have compressible ends which provide a tapered transition to the host pipe.

4.3 Lateral Liner Tube - The exterior of the lateral liner tube shall be laminated with an impermeable, translucent flexible membrane. Longitudinal seams in the tube shall be stitched and thermally sealed. The lateral tube will be continuous in length. The lateral tube will be capable of conforming to offset joints, bends, bells and disfigured pipe sections. For pipe configurations that contain pipe diameter transitions, the transition liner tube must be formed by the manufacturer prior to installation to ensure proper wall thickness per ASTM F1216.

4.4 Mainline Connection - The main tube and lateral tube shall form a one-piece assembly by stitching the lateral tube to the main tube aperture. The connecting end of the lateral tube shall be shaped to match the aperture and curvature of the main tube. The lateral tube and main tube shall be sealed by use of a flexible UV cured adhesive/sealant applied in a factory controlled setting. The main/lateral tube assembly shall take the shape of a "TEE" or "WYE" with corresponding dimensions such as a curved circle or a curved elliptical opening in the pipefitting.

4.5 Hydrophilic Gasket Seals - The mainline tube shall include four molded hydrophilic O-rings at the mainline termination ends. The gasket(s) must be a minimum of 2.5mm thick and must retain this consistent thickness under installation pressures. The lateral tube shall include two molded hydrophilic O-ring gaskets attached six-inches from the terminating end of the lateral tube. The hydrophilic gasket seals must be manufactured in a controlled factory environment with strict quality control and quality assurance protocols. A liquid sealant, adhesives or other fluid like materials having paste like consistency will not be accepted.

4.6 Mainline End Seal Test Data - The hydrophilic gasket seals shall include test data that supports substantial expansion properties so to form a watertight compression end seal at the terminating ends of the CIP-lateral liner. The test protocol shall simulate subterranean conditions and hydraulic loading at surface. Gasket seal submittals must include tests data simulating hydration/dehydration conditions for a period of 10,000-hours and the test results

must successfully demonstrate and document long-term performance without deterioration, loss of material, flexibility, and expansion of the gasket during repeated cycles of hydration and dehydration.

4.7 Bladder Assembly - The liner assembly shall be surrounded by a second impermeable, inflatable, invertible, flexible translucent membrane bladder that will form a liner/bladder assembly. The translucent bladder shall facilitate vacuum impregnation while monitoring the resin saturation process.

5.0 RESIN SYSTEM

5.1 The resin/liner system shall conform to ASTM D5813 Section 8.2.2.

5.2 The resin shall be a corrosion resistant polyester, vinyl ester or epoxy resin and catalyst system that when properly cured within the composite liner assembly, meets the requirements of ASTM F1216, the physical properties herein, and those which are to be utilized in the design of the CIPP, for this project.

5.3 The resin shall produce a CIPP, which will comply with the structural and chemical resistance requirements of ASTM F1216.

5.5 CIPP Initial Structural Properties per Table 1

TABLE 1		
PROPERTY	**STANDARD**	**MINIMUM VALUE**
Flexural Strength	ASTM D790	4,500 psi (31 MPa)
Flexural Modulus	ASTM D790	250,000 psi (1,724 MPa)

6.0 DESIGN CONSIDERATIONS

6.1 The CIPP shall be designed per ASTM F1216, Appendix X1.

6.2 The CIPP design for the lateral and main tubes shall assume no bonding to the original pipe.

6.3 The resin saturated lateral tube and the main tube must place the resin in full contact with the host pipe. The cured liner must provide coating on the interior of the lateral piping for an improved flow rate.

6.4 The liner must be smooth and have an average roughness coefficient “n” factor of 0.013 or lower.

7.0 REFERENCES

7.1 ASTM F2561 - Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One-Piece Main and Lateral Cured-In-Place Liner.

7.2 ASTM F2599 – Standard Practice for Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner.

7.3 ASTM F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.

7.4 ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

7.5 ASTM D792 - Standard Test Methods for Density and Specific Gravity of Plastics by displacement.

7.6 ASTM D2990 - Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.

7.7 ASTM D5813 - Standard Specification for Cured-in Place Thermosetting Resin Sewer Pipe.

NOTE: ASTM F2561-11 references several complementing standards; one of which is ASTM F1216. The ASTM F1216 standard is referenced for purposes of tube design considerations for a CIPP liner. ASTM F1216 is not an applicable standard for the sealing of lateral connections where the lateral CIPP forms a verifiable non-leaking connection to the mainline CIPP. ASTM F2561 is the industry standard for renewing lateral pipes and main/lateral connections using full-hoop CIPP liners and pre-molded compression gaskets.

8.0 INSTALLATION RECOMMENDATIONS

8.1 Access Safety - Prior to entering access areas such as manholes, an excavation pit, performing inspection or cleaning operations, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen shall be undertaken in accordance with local, state, or federal safety regulations.

8.2 Cleaning and Inspection - As per NASSCO Standards.

8.3 Accessing the Lateral Pipe - A cleanout is strongly recommended and is required to be located on the exterior of the building. The cleanout fitting shall be TEE shaped so to allow upstream and downstream access to the lateral pipe. The cleanout shall be located within two (2) feet of where the finished liner is to terminate. [A cleanout is strongly recommended, to ensure a successful installation and reduce risk of resin slugs, but when installing through a cleanout is not possible, camera access is recommended to ensure proper location and placement of the liner.]

8.4 Plugging – When steaming through the outside cleanout, the upstream side of the cleanout shall be plugged during insertion and curing of the liner/bladder assembly to ensure no flow enters the pipe and no air, steam, or odors will enter the building. When required, the main pipe flow will be by-passed. The pumping system shall be sized for peak flow conditions. The upstream manhole shall be monitored at all times and an emergency deflating system will be incorporated so that the plugs may be removed at any time without requiring confined space entry.

8.5 Inspection of Pipelines - The interior of the pipeline shall be carefully inspected to determine the location of any condition that shall prevent proper installation, such as roots, severe offsets, and collapsed or crushed pipe sections. Experienced personnel trained in locating breaks,

obstacles, and service connections by closed circuit television shall perform inspection of pipelines.

8.6 Line Obstructions - The existing lateral pipe shall be clear of obstructions that prevent the proper insertion and expansion of the lining system. Changes in pipe size shall be accommodated, if the lateral tube is sized according to the pipe diameter and condition. Obstructions may include dropped or offset joints of no more than 20% of inside pipe diameter.

8.7 Resin Impregnation -The liner is encapsulated within the translucent bladder (liner/bladder assembly), the entire connection liner shall be saturated with the resin system (wet-out) under controlled vacuum conditions. The volume of resin used shall be sufficient to fill all voids in the textile lining material at nominal thickness and diameter. The volume shall be adjusted by adding 5% to 10% excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe. No dry or unsaturated area in the main or lateral tube shall be acceptable upon visual inspection.

8.8 Liner Insertion -The connection liner and bladder assembly shall be inserted into the launching hose. The launching device is inserted into the pipe and pulled to the point of repair. The main and lateral tubes are completely protected during the pull. The connection liner/bladder assembly shall not be contaminated or diluted by exposure to dirt or debris during the pull.

8.9 Bladder - The mainline tube and lateral tube are inverted through the main tube aperture by the action of the lateral bladder extending into the pipe. The bladder assembly shall extend beyond each end of the liner, so the liner remains open-ended and no cutting shall be required.

9.0 CIPP PROCESSING

9.1 Curing - After the main and lateral liner tubes have been fully deployed; pressure is maintained pressing the liner firmly against the inner pipe wall until the liner is cured at ambient temperatures or accelerated by steam. The heating equipment shall be capable of delivering a mixture of steam and air throughout the liner/bladder assembly to uniformly raise the liner temperature above the temperature required to cure the resin. The curing of the CIPP shall take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of the soil). The heat source temperatures shall be monitored and logged during the cure and cool down cycles. The manufacturer's recommended cure schedule shall be submitted and followed.

9.2 CIPP Processing - Curing shall be complete without pressure interruption with air or a mixture of air and steam for the proper duration of time per the resin manufacturer's recommendations. The curing process is complete when the temperature of the CIPP falls back to 100 degrees Fahrenheit or less.

10.0 FINISH

10.1 The Finished CIPP - It shall be a homogenous CIPP liner assembly located in the mainline and extending into the lateral pipe to a predetermined point. The CIPP shall be smooth with minimal wrinkling and shall increase flow rate. The profile of the hydrophilic molded gaskets should be visible and verifiable during post-video inspection on liners 6mm or thinner thickness. The CIPP shall be free of dry spots, lifts, and delamination. The CIPP shall include a textile taper

at each end providing a smooth transition to the host mainline liner for accommodating video equipment and maintaining proper flow in the mainline. After the work is completed, the installer will provide the owner with video footage documenting the repair and the visual markings on the CIPP liner assembly identifying the building address. The finished product shall provide a verifiable one-piece, non-leaking connection.

11.0 RECOMMENDED INSPECTION AND TESTING PRACTICES

11.1 Sampling - As designated in the purchase agreement, the preparation of a CIPP sample is required. The sample shall be prepared by securing a flat plate mold using the textile tube material and resin system as used for the rehabilitated pipe.

11.2 Pressure - The pressure applied on the plate sample will be equal to the normal pressure exerted on the main and lateral tubes during the cure process.

11.3 Length - The minimum length of the sample must be able to produce at least five specimens for testing in accordance with ASTM D790-03.

11.4 Conditioning - Condition the test specimens at 73.4 ± 3.6º F (23 ± 2ºC) and 50 ± 5% relative humidity for not less than 40 hours prior to test in accordance with Practice ASTM D618, for those tests where conditioning is required.

11.5 Short-Term Flexural (Bending) Properties – The initial tangent flexural modulus of elasticity and flexural stress shall be measured for gravity and pressure pipe applications in accordance with Test Method D790 and shall meet the minimum requirements of Table 1.

11.6 Gravity Pipe Leakage Testing - If required by the owner in the contract documents or purchase order, gravity pipes should be tested using an air test method where a test plug is placed adjacent to the upstream and downstream ends of the main sheet CIPP and at the upper most end of the lateral tube. This test should take place no less than 72-hours after returning the lateral pipe back into service. This test is limited to pipe lengths with no service connections. The test pressure shall be 4-PSI for a test time of three-minutes; the pressure shall not drop below 3.5 PSI.

12.0 WARRANTY

12.1 All CIPP liners shall be certified by the manufacturer for specified material properties for the repair. The manufacturer warrants the liner to be free from defects in raw materials for ten years from the date of installation. During the warranty period, any defects which affect the integrity, strength or water tightness of the installed pipe shall be repaired at the contractor's expense.

– END OF SECTION –