

SECTION 06012 – REHABILITATION OF SEWER LATERALS AND SEWER LATERAL CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

This section covers all materials, labor and equipment required for the rehabilitation of sanitary sewer service laterals and sewer service lateral connections to the public sewer utilizing trenchless methods. A lateral tube shall be inverted and inflated to conform to the full circumference of the host pipe. The resin shall be cured following the manufacturer's recommendations. When cured, the tube shall be a water tight, structural liner, continuous to the connection point or manhole. The Contractor is responsible for all field measurements to accurately verify the length and diameter of each sewer lateral and sewer lateral connection to the public sewer main identified for rehabilitation. For open-cut point repairs of sanitary sewer service laterals and sanitary sewer service lateral connections, see Section 02505 – Sanitary Sewer Service Lines and Connections.

1.2 RELATED SECTIONS

- A. Section 01000 – General Project Requirements.
- B. Section 01015 – Specific Project Requirements.
- C. Section 01300 – Submittals.
- D. Section 02505 – Sanitary Sewer Service Lines and Connections.
- E. Section 02676 – Sewer Line Cleaning.
- F. Section 02686 – Multi-Sensor Inspection of Gravity Lines.
- G. Section 06010 – Cured-In-Place-Pipe (CIPP), CIPP Point Repairs and End Seals.

1.3 CODES AND STANDARDS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - ASTM D903 Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - ASTM D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - ASTM D2990 Tensile, Compressive, and Flexural Creep and Creep- Rupture of Plastics.
 - ASTM D5813 Cured-in-Place Thermosetting Resin Sewer Pipe.
 - ASTM F1216 Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of Resin-Impregnated tube.
 - ASTM F2561-20 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.
 - ASTM F3240-19 Standard Practice for Installation of Seamless Molded Hydrophilic Gaskets (SMHG) for Long-Term Water Tightness of Cured-in-Place Rehabilitation of Main and Lateral Pipelines.

1.4 PACKAGING, HANDLING, SHIPPING AND STORAGE

- A. Packaging, handling, delivery and storage of materials shall be done in accordance with the manufacturer's recommendations and in accordance with Section 01000 – General Project Requirements.
- B. Contractor shall submit manufacturer's instructions for delivery and storage.

- C. Contractor shall furnish required storage facilities. Onsite storage locations shall be approved by the City.
- D. Handle materials at all times in compliance with the manufacturer's recommendations.
- E. Damaged material, as determined by the City or its Design Professional, is unacceptable for installation.

1.5 INFORMATION PROVIDED BY THE CITY

- A. As provided in the Contract Documents.

1.6 SUBMITTALS

- A. Submit as specified in Section 01300 – Submittals.
- B. Prior to commencing construction, the Contractor shall provide the following information of the proposed rehabilitation materials to the City for approval:
 - 1. Shop drawings and product data.
 - 2. The calculations, technical data, and complete physical properties of the materials related to the project.
 - 3. A work plan describing the type of rehabilitation method to be used, detailed preparation steps required for pre-installation, bypass pumping plan, methods required for point repairs, provision for continuous service, and steps and procedures for installation of rehabilitation methods.
- C. The pre-construction Closed Circuit Television Inspection (CCTV) inspection video shall be submitted to the City after pre-construction cleaning has been completed. The post-construction CCTV shall be conducted after all work in a line segment is complete (point repairs, CIPP of main line, lateral rehabilitation, later connection rehabilitation and manhole rehabilitation).

1.7 QUALITY ASSURANCE

- A. The Contractor is responsible for the quality assurance and quality control of the Work.

1.8 QUALIFICATIONS

- A. A qualified bidder for installing a lateral liner or a main line to lateral connection repair system shall have the following qualifications:
 - 1. Two years of experience in installing lateral liners.
 - 2. Two years of experience in main line to lateral connection rehabilitation.
 - 3. Performed a minimum of 500 successful installations during this time period, including 1,000 feet of lateral lining. Bidders shall be prepared to submit a list of installation projects, numbers of connections rehabilitated and lateral footage lined. Provide contact names, addresses, and telephone numbers for references.

1.9 SERVICE LATERAL CIPP LINER TYPES

- A. Standard Lateral Cured-In-Place-Pipe (CIPP) Liner from manhole, pit or cleanout: The finished CIPP liner shall be a one piece continuous tube, as specified herein, from the inversion point to the termination point. Tube shall have 2 Preformed Hydrophilic O-Rings on each end of the tube.
- B. CIPP Full Wrap Lateral Connection Liner (Short and Long Liner): The finished liner shall have a one piece 360-degree full wrap main line CIPP liner with an integral lateral connection CIPP liner that is inverted into the lateral the distance as specified on the plans or a minimum of 18 inches. Full wrap rehabilitation shall not be required on 6 inch main line pipe or main line pipe greater than 24 inches in diameter. All Full Wrap Lateral Connection

Liners shall meet ASTM F2561-20. The contractor shall submit the recommend method for sealing the lateral/main line connection in pipe greater than 24 inches in diameter to the City for approval. The sealing method shall be approved by the City prior to commencing the work.

PART 2 PRODUCTS

2.1 STANDARD LATERAL CIPP LINER FROM MANHOLE, PIT OR CLEANOUT

A. Materials:

1. The tube shall consist of one or more layers of absorbent non-woven or needled felt fabric and meet the requirements of ASTM F1216, Section 5.1. The tube shall be constructed to withstand installation pressures and temperatures, be compatible with the resin system used, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections. Tube shall have 2 Preformed Hydrophilic O-Rings on each end.
2. The wet out tube shall have a relatively uniform thickness that when compressed at installation pressures will equal or exceed the calculated minimum design thickness.
3. The tube shall be manufactured to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during inversion. Overlapped layers of felt in longitudinal seams are not allowed.
4. The tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the tube that may cause delamination in the CIPP.
5. The outside layer of the tube shall be coated with an impermeable, translucent, and flexible membrane to facilitate monitoring the resin impregnation process and post installation inspection. The interior pipe surface of the CIPP after installation shall be a light reflective color so that a clear detailed examination with the CCTV can be conducted.
6. Seams in the tube shall be as strong as the non-seamed felt material.
7. The resin system shall be a corrosion-resistant polyester, vinyl ester, 100% solids silicate or epoxy system including all required catalysts, initiators or hardeners that when cured within the tube creates a composite that satisfies the requirements of ASTM F1216 and ASTM D5813. The resin shall produce a CIPP that meets the structural and chemical resistant requirements included in this specification.

B. Structural Requirements:

1. The CIPP shall be designed per ASTM F1216, Appendix X1. The design shall assume fully deteriorated host pipe. The nominal wall thickness shall be rounded up to the nearest 0.5 mm of the designed thickness. The minimum installed and cured thickness shall be 3 mm.
2. The manufacturer must have performed long-term testing for flexural creep of the CIPP material to be installed. Testing must have been completed within the last 18 months. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. This is a performance test of the materials (tube and resin) and general workmanship of the installation and curing. A percentage of the instantaneous flexural modulus value was used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. The materials utilized for the work shall be of a quality equal to, or better than, the materials used in the long-term test with respect to the initial flexural modulus used in the CIPP design.
3. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or with the point of a knife blade so that the layers

separate cleanly or the probe or knife blade moves freely between the layers. If the layers separate during sample testing, new samples will be required to be obtained from the installed pipe. Any reoccurrence is cause for rejection of the work.

4. Any layers of the tube that are not saturated with resin, prior to insertion into the host pipe, shall not be included in the structural CIPP wall thickness computation.
5. The cured pipe material shall conform to the following structural properties:

| Property | Test Method | Cured Composite Per ASTM F1216 |
|--|-------------|--------------------------------|
| Properties Flexural Modulus of Elasticity (Short Term) | ASTM D790 | 250,000 psi |
| Flexural Strength (Short Term) | ASTM D790 | 4,500 psi |

6. The required structural CIPP wall thickness shall be based on the physical properties of the cured composite and per the design equations contained in the appendix of the ASTM standards for fully deteriorated pipe and the following design parameters:

| DESIGN PARAMETER TABLE | |
|---|--|
| Design Safety Factor | 2.0 |
| Ovality | Calculated from X1.1 of ASTM F1216, and being not less than 2% |
| Soil Modulus | 1,000 psi |
| Groundwater Depth | Fully submerged, top of pipe to surface |
| Soil Depth (above crown of existing pipe) | 16 feet |
| Live Load | HS-25 Highway |
| Soil Load | 120 pounds per cubic foot |
| Minimum Service Life | 50 years |

2.2 MAIN LINE TO LATERAL CONNECTION LINER WITH ONE PIECE FULL DIAMETER CIP LINER (SHORT OR LONG CONNECTION LINER)

A. General:

1. The CIPP main line to lateral connection liner repair system shall conform to ASTM F2561-20 and the structural properties outlined in Paragraph 2.01.B.5 and shall be:
 - a. "LCR-Liner System" as manufactured by EPROS
 - b. "Shorty" as manufactured by LMK Enterprise, Inc.
 - c. "MTH-Liner System" as manufactured by EPROS
 - d. "T-Liner" as manufactured by LMK Enterprise, Inc.
2. The service lateral connection repair shall include a minimum 16 inch length CIPP repair covering 360 degrees of the main line sewer (6 inches on either side of a 6 inch lateral) with integral CIPP lateral liner.
3. Liner Gasket system shall be per ASTM F2561-20 and F3240-19:
 - a. Two (2) each Hydrophilic preformed O-rings at the termination point of lateral tube.
 - b. One (1) each Hydrophilic Hydrohat gasket as Manufactured by LMK Technologies at the main to lateral connection of the liner.

4. The one piece full wrap lateral connection CIPP shall extend to the distance specified on the plans or a minimum of 18 inches into the lateral.
5. Install the lateral liner the distance shown in the Sewer Main and Lateral Rehabilitation Schedule in the construction contract documents.
6. The rehabilitation shall be accomplished using a non-woven textile tube of adequate length and a thermo-setting or UV cured resin with physical and chemical properties appropriate for the application. The liner shall be installed in accordance with the manufacturer's recommendations.

2.3 LATERAL CONNECTION WITH BRIM STYLE CIPP SHORT LINER (LAPEL LINER)

- A. For locations that the full wrap lateral liner is not allowed to be installed, the CIPP lateral to main connection liner repair system shall be Lateral Sealing and Repair. The Lapel Liner Lateral Sealing and Repair shall be installed as provided by LMK or City approved equal. The Contractor shall get approval from City prior to the installation of the Lapel Liner Lateral Sealing and Repair. These systems shall conform to the following structural properties:

| Property | Test Method | Cured Composite Per ASTM F1216 | Resin |
|--|-------------|--------------------------------|-------------|
| Properties Flexural Modulus of Elasticity (Short Term) | ASTM D790 | 250,000 psi | 400,000 psi |
| Flexural Strength (Short Term) | ASTM D790 | 4,500 psi | 4,500 psi |

- B. The Lapel Liner tube insert shall be fabricated to a size that when installed will key into the internal surface irregularities of the lateral joint using an Insignia Hydrophilic Hydrohat (4" and 6") or Hydrophilic Brim (8" or larger) as manufactured by LMK Technologies.
- C. The insert laminate shall seal to the inside wall of the sewer main using a Stainless Steel flange and fasteners around the lateral opening and to the lateral wall 18 inches (minimum) up into the lateral pipe from the main with two hydrophilic O-rings at the termination point in the lateral.
- D. Unless otherwise specified, the installer shall furnish a specially formulated resin and catalyst system compatible with the service lateral connection process that provides cured physical strength at least to the same level as required for the lateral liner, if specified.

2.4 MATERIAL

- A. The liner shall be continuous in length and consist of one or more layers of absorbent textile material and meet the requirements of ASTM F1216 and ASTM D5813.
- B. The outside layer of the tube shall be coated with an impermeable, translucent, and flexible membrane/coating to facilitate monitoring the resin impregnation process and post installation inspection. The interior pipe surface of the CIPP after installation shall be a light reflective color so that a clear detailed examination with the CCTV can be conducted.
- C. Grouting Material:
 1. Chemical grouts may be used for stopping active infiltration and shall be mixed and applied per manufacturer's recommendations.
 2. The use of chemical grout shall be considered incidental to the unit cost of the CIPP lateral to main connection liner repair.

D. Resin System:

1. The resin/liner system shall conform to ASTM D5813, 10,000 hour test.
2. The resin shall be a corrosion resistant polyester, vinyl ester, epoxy, or silicate resin and catalyst system that when properly cured within the composite liner assembly meets the requirements of ASTM 1216.

PART 3 EXECUTION

3.1 PREPARATORY PROCEDURES

- A. The Contractor shall comply with the following procedures unless other procedures are accepted by the City. Prior to the commencement of the actual liner tube inversion process, the Contractor shall plan its work after review of previous television inspection videos and reports. All point repairs shall be satisfactorily completed, equipment and material mobilized, and the City shall be informed of the impending work schedules.

3.2 SAFETY

- A. The Contractor shall carry out its operations in strict accordance with all OSHA and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving entering confined spaces.
- B. The Contractor shall inform City of any hazardous material encountered during this project.
- C. The Contractor shall submit a plan for each inversion for the control of gas migration from the off gassing that takes place during the curing process for all resin systems containing styrene. The plan shall include but not limited to flow through plugs and negative pressure ventilation. This plan shall be submitted to the City for approval prior to beginning of work.

3.3 PROTECTION OF PROPERTY

- A. The Contractor shall prevent damage to all public and private property. The Contractor shall provide protective measures (felt, blocks of wood, plywood, cardboard, concrete blocks, street plates, etc.) to create a barrier between the boiler/steam hoses and grass for each installation.
- B. All surfaces shall be restored to original or better condition.

3.4 CLEANING OF MAINLINE AND SERVICE LATERALS

- A. The Contractor is required to remove all internal debris from the sewer lines so the entire pipe can be thoroughly inspected and successfully reconstructed. Pipe to be lined shall be cleared of protruding service connections, debris and all other obstructions that will hinder the liner tube inversion.
- B. All sludge, dirt, sand, rocks, grease and all other solid or semi-solid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from one manhole section to another shall not be permitted.
- C. All debris resulting from cleaning operations shall be removed from the site and disposed of in the proper manner. The Contractor shall bear all costs associated with proper disposal. Disposal of the debris shall be in accordance with all local, state, and federal regulations.
- D. All debris shall be removed from the downstream manhole and the jobsite daily. No debris shall be left at the site unattended by the Contractor. Under no circumstances will the Contractor be allowed to accumulate debris beyond the stated time. In the event the Contractor leaves debris unattended at the site beyond the stated time, the Contractor will not be allowed to proceed with the work until the debris is properly removed.
- E. Contractor shall inform the City of their planned dump site during the Pre-Construction Conference.

- F. During all sewer cleaning operations, satisfactory precautions shall be taken to protect sewer lines from damage that might be inflicted by improper use of cleaning equipment. Precautions shall be taken to ensure that the cleaning operation will not cause any damage or flooding to public and/or private property being served by the sewers involved. The Contractor shall bear full costs associated with any flooding or damage to basements or structures.
- G. If necessary, Contractor shall proceed with heavy cleaning until the lateral is cleaned to the permanent easement boundary, right-of-way line or the distance specified in the Rehabilitation Schedule. The Contractor shall assume heavy cleaning may be required and no separate payment will be made for heavy cleaning. All laterals to be rehabilitated shall be cleaned 3 feet beyond the specified termination point specified on the Rehabilitation Schedule.
- H. Contractor shall inform City if lateral can't be cleaned and provide video and explanation why the lateral rehabilitation should be transferred to the open cut repair list. City shall approve the transfer prior to commencing work. The removal of roots shall not be a reason for transferring the lateral to the open cut repair list. The City may require Contractor to attempt to install a lateral liner prior to transferring the lateral to the open cut repair list.

3.5 SEWER SERVICE

- A. At no time shall wastewater be discharged on streets, alleys, or in storm drainage systems. The Contractor shall provide adequate temporary by-pass pumping for routing the flow of wastewater around the section of pipe under repair.
- B. The Contractor shall take all necessary steps to prevent the flooding of any resident or business and shall be liable for any damages incurred by basement backups.

3.6 INSPECTION OF MAINLINE AND SERVICE LATERALS

- A. The Contractor shall provide CCTV inspection of the mainline and service laterals by experienced personnel specifically trained in locating and identifying defects, breaks, obstacles including active or abandoned service laterals. The interior of the mainline and service laterals shall be carefully inspected to determine the location and extent of any structural failures, pipe deflections, offset joints or other factors that will affect the installation and performance of the liner. The location of any condition which may prevent proper installation shall be noted and immediately brought to the attention of the City so that such conditions can be corrected. CCTV inspections shall continue a minimum of 3ft beyond the termination point of the installed liner. A video and suitable log shall be supplied by the Contractor to the City. All pre and post CCTV Inspection of pipe shall be considered incidental to the Bid Price.

3.7 LINE OBSTRUCTIONS

- A. The Contractor shall identify and bring to the City's attention any repairs required (such as excessively dropped joints, intruding service connections, excessively deformed or collapsed pipe) or conditions which prevent completion of the lining process.
- B. The Contractor shall make necessary repairs to allow for liner installation or remove the repair from the liner installation schedule and then repair by open cut replacement.

3.8 SERVICE LATERALS

- A. Prior to installation of the service lateral liner, active service laterals shall be reinstated to one hundred percent (100%) capacity prior to installing service lateral connection liners, in accordance with Section 06010 – Cured-In-Place- Pipe (CIPP) Liner. The reinstated lateral opening shall be perfectly round with no jagged edges. All jagged edges shall be ground smooth.
- B. Only active service connections shall be reinstated. If the Contractor reinstates an inactive

- service, then the Contractor shall repair the CIPP liner or main at no additional cost to the City.
- C. After the service laterals have been inspected by a lateral launch CCTV inspection from the main line, Contractor shall coordinate with City to determine if the lateral can be lined. The intent of the CCTV inspection is to launch the camera from the main line into the service lateral to assist in identifying active service connections and inspect the service laterals for conditions that prevent installation of the CIPP liner.
 - D. Reinstatement tools shall be onsite at all times when CIPP work is being performed.

3.9 REHABILITATION OF LATERAL AND LATERAL CONNECTION

A. CIPP for Lateral Rehabilitation:

1. Installation of CIPP for Lateral Rehabilitation shall be in accordance with ASTM F1216, with the following modifications:
 - a. 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 polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall.
 - b. Vacuum impregnation process is required and shall be used to insure thorough resin saturation throughout the length of the liner tube. The point of vacuum shall be no further than 25 feet from the point of initial resin introduction. The leading edge of the resin slug shall be as near to perpendicular to the longitudinal axis of the tube as possible. A roller system shall be used to uniformly distribute the resin throughout the tube.
 - c. The wet out tube shall be positioned in the pipeline using the inversion method. The tube should be inverted through an approved access point and fully extend to the next designated termination point.
 - d. Any protruding liner into the main shall be removed by remote robotic cutting equipment or other approved method.
 - e. After the liner is inverted, the liner shall be cured as recommended by the resin manufacturer.
 - f. Contractor shall cool down the CIPP once curing is complete in accordance with the manufacturer's recommendations. Temperatures and curing data shall be monitored and recorded by the Contractor throughout the curing process and delivered to the City, if requested.

B. Lateral Connection With One Piece Full Wrap CIPP Liner:

1. A cleanout, if applicable, shall be located or constructed as indicated on the Drawings. Cleanouts shall not be installed without City documentation and approval. The upstream side of the cleanout shall be plugged during the insertion and curing of the liner assembly ensuring no flows enters the pipe and no air, steam or odors will enter the building. All cost associated with the installation of a cleanout shall be considered incidental and included in the unit cost for lateral connection with one piece full wrap CIPP liner.
2. The lateral liner shall be sized according to the existing pipe diameter and condition.
3. The lateral liner and main line sheet shall be installed in accordance with the manufacturer's recommendations. The system shall be encapsulated within the bladder and vacuum impregnated with resin under controlled conditions. The volume of resin used shall be sufficient to fill all voids in the lining material at nominal thickness and diameter. No dry or unsaturated area in the main line sheet or lateral liner shall be acceptable upon visual inspection.

4. The main line bladder shall be inflated and the lateral liner shall be positioned in the pipeline using the inversion method. Pressure is maintained throughout the curing period. The liner shall be cured by an approved heat source or UV light, if necessary, to reduce the time required for curing. The heat source temperatures shall be monitored and logged during the curing process.
5. The finished CIPP liner shall be continuous over the scheduled length of the rehabilitated service lateral and 16 inches of the main pipe (6 inches on either side of 6 inch lateral). The CIPP liner shall be smooth and free of dry spots, lifts, and delaminated portions. The CIPP liner shall taper at each end providing a smooth transition. The finished product shall result in an airtight and watertight connection between the main line sewer and lateral per ASTM 2561-20.

3.10 INSPECTION

- A. Verification of the mainline, lateral liner and lateral connection being watertight and free from defects shall be confirmed during the post lining CCTV inspection performed by the Contractor. Both the pre and post CCTV lateral inspection shall be conducted by the use of CCTV equipment. The CCTV inspection shall include a 360 degree view of the mainline and the entire lateral liner.
- B. After the work is completed, the Contractor shall provide the City with the pre and post construction CCTV footage. The finished liners shall be free from leakage and visual defects such as foreign inclusions, dry spots, fins, pinholes, significant wrinkles or other deformities. The Contractor shall allow enough time in the schedule for a thorough evaluation of the inspection footage.

3.11 CLEANUP

- A. Upon completion and acceptance of the installation, the Contractor shall restore the project area to an equal or better condition that existed prior to starting the work.

3.12 REJECTION

- A. Materials and installation may be rejected by the City for failure to meet all the requirements of this Section.

END OF SECTION