

Cured-In-Place-Pipe (CIPP) LATERAL SEALS

PERFORMANCE SPECIFICATION GUIDELINE

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PART 1 - GENERAL

1.1 Description of work and product delivery

- 1.1 A. These Specifications include the minimum requirements for the rehabilitation of lateral connections and their interface with the main-line pipes via Cured-In-Place-Pipe (CIPP) as shown on the plans and included as part of these [contract documents]. The lateral seal will include an Owner specified length of lateral pipeline that will also be rehabilitated in conjunction with the lateral/mainline connection, as a one piece integrated system.
- 1.1 B. The rehabilitation of lateral connections and a portion of the lateral pipeline shall be accomplished by the installation of a Cured-In-Place-Pipe (CIPP) system installed from the main-line pipeline extending up the specified length of the lateral. The system may or may not require the use of cleanouts on the lateral pipeline. The installed system shall be free of all defects that will affect the design, service life and operation of the lateral interface with the main-line and the specified length of the lateral pipe.
- 1.1 C. The liner may be inverted or pulled into place from the mainline sewer.
- 1.1 D. The installed system shall eliminate water leakage into the sewer system over the entire rehabilitated length of sewer.
- 1.1 E. The prices submitted by the Contractor, shall include all costs for the various bid items necessary for furnishing and installing, complete and in place, the system in accordance with these specifications, except for those specified otherwise by the Owner.
- 1.1 F. The furnished and installed system shall include all materials, manufacturer's recommended equipment and manufacturer's installation procedures.
- 1.1 G. At the discretion of the Owner, the system manufacturer may submit to the Owner, a minimum of 14 calendar days in advance of a bid date, all required product information to obtain pre-approval system status. Those systems that have been pre-approved will not need to be re-submitted as required in the submittal section of these specifications unless any of the system components have changed from those pre-approved by the Owner. All other component products will be required to meet the submittal requirements as contained herein.
- 1.1 H. At the discretion of the Owner, the system installer may submit to the Owner, a minimum of 14 calendar days in advance of a bid date, all required qualifications information to obtain pre-approval system installer status. Those system installers that have been pre-approved will be allowed to bid on the specified project scope.
- 1.1 I. The installed system shall be free of all defects that will affect the design, service life and operation of the lateral and applicable portion of the main-line.
- 1.1 J. The installed system shall eliminate infiltration and ex-filtration over the entire length of the system.

- 1.1 K. The system shall be designed against corrosion and typical chemicals found in domestic sewage, unless otherwise specified in the detailed section of the contract documents. The manufacturer of the system shall provide testing data that supports the chemical resistance in accordance with ASTM F1216.
- 1.1 L. The mainline and lateral portion of the system shall be designed for Partially or Fully Deteriorated design conditions per ASTM F1216 as specified by the Owner. Partially deteriorated designs conditions assume the CIPP liner is designed to support groundwater loads, while fully deteriorated design conditions assume the CIPP liner is designed to structurally replace the host pipe completely. Wall thickness design calculations stamped by a registered professional engineer shall be submitted. All design must be supported by third party testing and documentation for the exact product that is being submitted.
- 1.1 M. Flow entering the lateral or main-line shall be bypassed if necessary for the installation of the system.
- 1.1 N. All materials furnished as part of this contract shall be marked with detailed product information, stored in a manner specified by the manufacturer and tested to the requirements of this contract.
- 1.1 O. Testing shall be executed by the owner or by the contractor in the presence of the owner. Testing requirements will be provided by the Owner.
- 1.1 P. Warranty inspections shall be executed by the Owner or its representative. Any defects found shall be repaired or replaced by the Contractor according to manufacturer's recommendations.

1.2 Performance Work Statement (PWS) Submittal

- 1.2 A. The Contractor shall submit, to the Owner, a Performance Work Statement (PWS) package at a predetermined time set by the Owner, which clearly defines the proposed system delivery in conformance with the requirements of the contract documents.
- 1.2 B. Clearly indicate that the system will conform to the project requirements as outlined in the Description of Work, Scope of Work Included and as further delineated in these contract documents.
- 1.2 C. Certify at the time of the bid, that the designated items included in the contract documents were visited, inspected and evaluated by the Contractor or Contractor's Representative, prior to submitting a bid.
- 1.2 D. Where the scope of work is specifically delineated in the contract documents, a detailed installation plan describing all preparation work, cleaning operations, pre-inspections, sewage flow maintenance, traffic control, installation procedure, method of curing, quality control, testing to be performed, final inspection, warranties furnished and all else necessary and appropriate for a complete system installation, shall be submitted.

- 1.2 E. A detailed installation schedule shall be prepared, submitted and conform to the requirements of these contract documents.
- 1.2 F. The manufacturer's description of the system materials is to be furnished for the project. Material descriptions shall be sufficiently detailed in the submittals to verify conformance to these specifications and/or shall conform to the pre-approved system submission.
- 1.2 G. The Contractor's experience with the system proposed for use in this contract. The name and experience of each lead individual performing work on this contract shall be submitted. If personnel are substituted after bid submittal the name and experience of the individual shall be submitted to the Owner for approval before starting any work.

1.3 Submittals (after contract award)

- 1.3 A. Product data submittals required for all rehabilitation lateral lining systems proposed for installation under this contract shall include:
 - 1. System material type and manufacturer to be used including: catalog data sheets, ASTM references, material composition, manufacturers recommended specifications, component physical properties and chemical resistance.
 - 2. Manufacturer's detailed description of the recommended procedures for handling and storing materials
 - 3. Manufacturers detailed description of the recommended system installation process
 - 4. Copies of independent testing performed on the CIPP liner composite verifying the product meets the requirements as specified in these contract documents and the manufacturers design.
 - 5. By-Pass Pumping Plan if applicable to the system being installed.
 - 6. Traffic Control plan, if applicable for the system being installed.
 - 7. Certified statement, from the manufacturer, that the contractor/installer is an approved installer of the system with certificates of completed training for each crew member involved. This requirement shall comply with the specific system requirements specified in the contract documents
 - 8. Submittal of all quality assurance documentation and test reports for system installed. (After Rehabilitation Completion)
 - 9. CIPP wall thickness design calculations based upon ASTM F1216 assuming either Fully or Partially Deteriorated conditions, as specified by the owner. The designs will be stamped by a Professional Engineer if required by the Owner.
 - 10. Wetout/cure logs per liner providing details pertaining to the resin type and quantity, catalyst type and quantity, tube type, installation pressures, temperatures

and times (as applicable to the curing lateral lining system utilized), and pertinent Owner/User project specific data.

11. Third party testing of the physical properties, corrosion resistance and sealing method.
12. Health and Safety plan detailing the site specific safety requirements.
13. Qualifications of the Contractor to install the system.
14. Qualifications of the proposed system to meet the requirements of the Contract.

1.4 Quality Control Plan (QCP)

- 1.4 A. A detailed quality assurance plan (QCP) shall be submitted to the Owner that fully represents and conforms to the quality control requirements of these specifications. At a minimum the QCP shall include the following:
 1. How the system is prepared for installation
 2. How the system is installed
 3. How the completed system is confirmed to be in compliance with the requirements of the Contract.
 4. Training/Qualifications of personnel preparing and installing the system
- 1.4 B. Proposed procedures for quality control, product sampling and testing shall be defined.
- 1.4 C. Proposed methods for product performance controls, including method of and frequency of product sampling and testing as applicable.
- 1.4 D. Proposed methods and procedures for system repair or replacement, (as defined in Section 1.6) in the event of product defects or failure.

1.5 Lateral Lining System repair/replacement

- 1.5 A. Due to defects in preparation and/or installation, systems will occasionally need to be repaired or partially replaced. The Manufacturer shall outline specific repair or replacement procedures for potential issues that may occur during the installation of the system. Repair/replacement procedures shall be as recommended by the system manufacturer and shall be submitted as part of the PWS.
- 1.5 B. Issues, that may not affect the operation and long term life of the product, shall be identified and defined by the Manufacturer.
- 1.5 C. Repairable issues that may occur in the system shall be specifically based on Manufacturer's recommendations, including a detailed step-by-step repair procedure, resulting in a finished product meeting the estimated life cycle of the component and requirements of these contract specifications.
- 1.5 D. Un-repairable issues that may occur in the system shall be clearly defined based on the Manufacturer's recommendations. The Contractor, together with the

manufacturer, shall define the best recommended procedure for the total removal and replacement of the system.

- 1.5 E. The Contractor shall receive no additional compensation for the repair or replacement of system deemed non-conforming to the requirements of these contract documents and unacceptable by the Owner.

1.6 Safety

- 1.6 A. The Contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for working conditions in compliance with the same. The Contractor shall erect such signs and other devices as are necessary for the safety of the work site.
- 1.6 B. The Contractor shall perform all of the Work in accordance with applicable OSHA safety standards. Emphasis shall be placed upon the requirements for entering confined spaces.
- 1.6 C. The Contractor shall have on the job site at all times at a minimum the following safety equipment:
1. Gas monitor capable of testing and detecting for combustible gas, oxygen deficiency and hydrogen sulfide.
 2. Confined space access and retrieval winch system.
 3. Ventilating fans with large diameter ventilating hose.
 4. Safety harness and life lines.
 5. Other equipment as may be required for a specific project
 6. All equipment to be available for use, in sufficient quantity, by the Contractor, Engineer and Owner for the duration of the project.
- 1.6 D. All entries into or work within confined spaces shall be conducted in accordance with the U.S. Department of Health and Human Services/National Institute for Occupational Safety and Health [DHHS (NIOSH)] Publication No. 87-113, A Guide to Safety in Confined Spaces.

1.7 Warranty

- 1.7 A. The materials used for the project shall be certified by the manufacturer for the specified purpose. The manufacturer shall warrant the SYSTEM materials to be free from defects in raw materials for one (1) year after installation or from the date of acceptance by the Owner, whichever is later. The Contractor shall warrant the system for a period of one (1) year.

1.8 Warranty Inspections

- 1.8 A. The Owner shall perform, at its own cost, warranty inspections with its own personnel or personnel independent of the installation contractor.

1.9 Measurement and payment

- 1.9 A. Typical bid items consist of:

1. Clean and CCTV of specified lateral, including specified length of lateral pipeline, per Each
 2. Furnish and install system, including Owner specified length of CIPP lateral liner, per EA
 3. Furnish and install CIPP lateral liner extending beyond item 2, per LF
- 1.9 B. Measurements for each item furnished and installed to the satisfaction of the Owner shall be at the units of measure contained in the Bid Proposal.
- 1.9 C. Payment for each item shall be in accordance with the contract documents at the unit or lump sum prices bid therefore in the Bid Proposal.

PART 2 - LATERAL LINING PRODUCTS

2.1 Lateral seals

2.1 A. General

1. The system seals the point of connection from a main-line pipe to a connecting lateral pipeline and is normally installed without excavation by the install of a resin-impregnated, flexible laminate installed into the existing service lateral, lapping over the main-line pipe, sealing the connection.
2. The system can be specified one of the following:
 - (a) Tee/full wrap section with a full circumferential CIPP liner inside the main pipe and a tube which shall extend continuously from the sewer main into the lateral for an Owner specified distance
 - (b) Flange/brim CIPP connection seal and tube which shall extend continuously from the sewer main into the lateral for an Owner specified distance.
 - (c) A system that is similar to those listed above and acceptable to the Owner.
3. The system shall extend an Owner specified length into the lateral.
4. The Contractor will determine the need for a clean out on the lateral(s) specified for rehabilitation.
5. The system shall be capable of sealing a combination of “tees” and “wyes” of varying angles. The resin shall be cured to form the tube into a hard impermeable pipe-within-a-pipe.
6. When cured, the system shall seal the connection of the lateral to the mainline in a continuous tight-fitting, watertight pipe-within-a-pipe to eliminate any visible leakage between the lateral and mainline and shall provide a leak-proof seal to prevent root intrusion, infiltration, and ex-filtration between the liner and host pipe.

7. Systems that use polyester and vinylester resins shall include a method of sealing the connection and the end of the laterals liner as recommended by the manufacturer of the system. The product used in the sealing method shall be installed in accordance with manufacturer's recommendations. The sealing method shall be tested by simulating groundwater pressure using a third party and stamped by an engineer.
8. Systems that use silicate or epoxy shall prepare the host pipe in accordance with manufacturer's recommendations. Third party testing shall be provided to prove the bond strength between the resin and surface it is to bond to.
9. The installation of the system will require the product to be capable of installing without access to the upstream side of the lateral pipe and capable of navigating bends or other transitions in alignment as identified by the owner in the contract bid documents.

2.1 B. References

1. ASTM F1216 – Standard practice for rehabilitation of existing pipelines and conduits by the inversion and curing of a resin-impregnated tube.
2. ASTM F1743 – Standard practice for rehabilitation of existing pipelines and conduits by pulled-in-place installation of cured in place thermosetting resin pipe.
3. ASTM D543 – Practices for evaluating the resistance of plastics to chemical reagents.
4. ASTM D790 – Test methods for flexural properties of unreinforced and reinforced plastics and electrical insulating materials.
5. ASTM D5813 – Specification for cured in place thermosetting resin sewer piping systems.
6. ASTM F2019 – Standard practice for rehabilitation of existing pipelines and conduits by the pulled in place installation of glass reinforced plastic (GRP) cured in place thermosetting resin pipe.
7. NASSCO Guideline Specification for the installation of cured in place pipe (June 2011).
8. NASSCO Guideline Specifications for cleaning and televising pipelines

2.1 C. Materials

1. Non-woven fabric tube

- (a) The fabric tube shall consist of one or more layers of absorbent non-woven felt fabric, felt/fiberglass or fiberglass and meet the requirements of ASTM F 1216, ASTM F 1743, ASTM D 5813 & ASTM F2019. The fabric tube shall be capable of absorbing and carrying resins, constructed to withstand installation pressures and curing temperatures and have sufficient strength to bridge missing pipe segments, and stretch to fit irregular pipe sections.
- (b) The wet-out fabric tube shall have a uniform thickness and excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.
- (c) The fabric tube shall be manufactured to a size that when installed will tightly fit the internal circumference, meeting applicable ASTM standards or better, of the original pipe or the existing lined pipe. Allowance shall be made for circumferential stretching during installation. The tube shall be properly sized to the diameter of the existing pipe and the length to be rehabilitated and be able to stretch to fit irregular pipe sections and negotiate bends. The Contractor shall determine the minimum tube length necessary to effectively span the designated run. The Contractor shall verify the lengths in the field prior to ordering and prior to impregnation of the tube with resin, to ensure that the tube will have sufficient length to extend the entire length of the run. The Contractor shall also measure the inside diameter of the existing pipelines in the field prior to ordering liner so that the liner can be installed in a tight-fitted condition.
- (d) The outside and/or inside layer of the fabric tube (before installation) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate vacuum impregnation and monitoring of the resin saturation during the resin impregnation (wetout) procedure.
- (e) No material shall be included in the fabric tube that may cause de-lamination in the cured CIPP. No dry or unsaturated layers shall be acceptable upon visual inspection as evident by color contrast between the tube fabric and the activated resin containing a colorant.
- (f) The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made. The hue of the color shall be dark enough to distinguish a contrast between the fully resin saturated felt fabric and dry or resin lean areas.
- (g) Seams in the fabric tube, if applicable, shall meet the requirements of ASTM D5813. H.
- (h) The outside of the fabric tube shall be marked with the name of the manufacturer of the CIPP lateral lining system, manufacturing lot and/or production footage, as applicable. The print must be visible during final CCTV inspection.
- (i) The minimum length of the fabric tube shall be that deemed necessary by the installer to effectively span the distance specified by the Owner.

- (j) The nominal fabric tube wall thickness shall be constructed, as a minimum, to the nearest 0.5 mm increment, Wall thickness transitions, in 0.5 mm increments or greater as appropriate, may be fabricated into the fabric tube between installation entrance and exit access points. The quantity of resin used in the impregnation shall be sufficient to fill all of the felt voids for the nominal felt thickness.
- (k) The liner shall be constructed with transitions where applicable.

2. Resin

- (a) The resin shall be a corrosion resistant polyester, vinyl ester, silicate or epoxy resin and catalyst system and hardener system that, when properly cured within the tube composite, meets the requirements of ASTM F1216, ASTM F1743 or F2019, the physical properties herein, and those, which are to be utilized in the design of the CIPP for this project. The resin shall produce CIPP, which will comply with or exceed the structural and chemical resistance requirements of this specification.
- (b) The method of cure may either be from a manufacturer recommended heat source, light cure or by ambient temperature. Method of cure instructions along with a cure log shall be on-site at all times.
- (c) The resin to tube ratio, by volume, shall be furnished as recommended by the manufacturer.

3. Structural requirements

- (a) The physical properties and characteristics of the finished liner will vary considerably, depending on the types of resin and tube used. It shall be the responsibility of the Contractor to provide a CIPP lateral lining system which meets or exceeds the minimum properties specified herein.
- (b) The CIPP shall be designed per ASTM F1216. The CIPP design shall assume no bonding to the original pipe wall.
- (c) The lateral CIPP shall be designed assuming the following minimum design data, unless otherwise modified by the Owner:
 - (i) Factor of Safety = 2
 - (ii) Soil Modulus = 1,000 psi
 - (iii) Soil Density = 120 pcf
 - (iv) Live Load = H20
 - (v) Depth of Cover = as specified
 - (vi) Groundwater = ½ depth of cover
 - (vii) Ovality = 2%
- (d) The design engineer shall set the long term (50 year extrapolated) Creep Retention Factor at 50% of the initial design flexural modulus as determined

by ASTM D-790 test method. This value shall be used unless the Contractor submits long term test data (ASTM D2990) to substantiate a different retention factor.

(e) The cured pipe material (CIPP) shall, at a minimum, meet or exceed the structural properties, as listed below.

- (i) Flexural modulus of elasticity: 250,000 psi
- (ii) Flexural strength: 4,500 psi

4. The structural performance of the finished pipe shall be adequate to accommodate all anticipated loads throughout its design life. No cured-in-place pipe rehabilitation technology will be allowed that requires bonding to the existing pipe for any part of its structural strength.

PART 3 - EXECUTION

3.1 Lateral seals

3.1 A. General

1. Lateral seals are typically installed from the lined main-line with a lateral CIPP portion that extends up the lateral at an Owner specified distance.
2. Clean-outs are recommended but not always required to successfully install a lateral seal. Clean-outs shall be installed at the Owners' discretion. If the Owner decides clean outs are preferred, the owner shall specify the type of cleanout.

3.1 B. Preparation

1. Preparation, cleaning, inspection, sewage by-passing and public notification are the responsibility of the Contractor, with the assistance of the Owner. The Contractor shall clean the interior of the existing host pipe prior to installation of the system. All debris and obstructions, that will affect the installation and the final product shall be removed and disposed of. All preparation shall be in accordance with the manufacturer's written installation procedures.
2. The system shall be constructed of materials and methods, that when installed, shall provide a jointless and continuous structurally sound CIPP able to withstand all imposed static and dynamic loads on a long-term basis, as specified by the Owner.
3. The Contractor may, under the direction of the Owner, utilize any of the existing manholes in the project area as installation access points or excavate access points at predetermined locations.
4. Pre-Cleaning CCTV – The Contractor shall request utility locating (as required by the Owner or local Government) to identify potential cross-bore utilities within the

proximity of the service lateral to be cleaned for rehabilitation, if applicable. Prior to cleaning, the Contractor shall to all extents possible, televise the service lateral to confirm that cleaning the lateral will not damage or breach a conflicting utility bored through the sewer lateral (such as natural gas or power) when the utility locate indicates a potential conflict.

5. Cleaning of Pipe Lines - The Contractor shall remove all internal debris from the pipe line that will interfere with the installation and the final product delivery of the system as required in these specifications. The Contractor shall make use of commercially available industry standard cleaning equipment to prepare the pipe for system installation. Solid debris and deposits shall be removed from the pipeline, if possible, and disposed of properly by the Contractor. Precaution shall be taken, by the Contractor in the use of cleaning equipment to avoid damage to the existing pipe. If the pipe cannot be cleaned sufficiently using industry standard cleaning equipment then additional cleaning will be considered changed conditions.
6. Post-Cleaning CCTV – Upon completion of the cleaning, the Contractor shall then perform a Post-Cleaning CCTV Inspection, which typically acts as the Pre-rehabilitation CCTV Inspection.
7. Existing Sewage Flows – The Contractor shall provide flow diversion or stoppage requirements to the owner to assist in developing plan including notifying upstream users to temporary stop using their water/wastewater during the system installation.
8. Bypass Existing Sewage Flows - When circumstances require continuous service, for the flow of the service connection (such as medical facilities or laboratories), the Contractor will install a temporary sewage by-pass system, if required by the Owner. Once the rehabilitation process has begun, existing sewage flows shall be maintained, until the system is fully installed. The Contractor shall coordinate sewer bypass and flow interruptions with the Owner at least 7 days in advance and with the property owners and businesses at least 1 business day in advance. The pump and bypass lines shall be of adequate capacity and size to handle typical flows.
9. Contractor shall perform post-cleaning video inspections of the pipelines. Only PACP certified personnel trained in locating breaks, obstacles and service connections by closed circuit television shall perform the inspection. The Contractor shall provide the Owner a copy of the pre-cleaning and post-cleaning video and suitable log, and/or in digital format for review prior to installation of the CIPP and for later reference by the Owner, if specifically required by the Owner.
10. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions that will interfere with the installation and long-term performance of the system. If pre-installation inspection reveals an obstruction, misalignment, broken or collapsed section or sag that was not identified as part of the original scope of work and will prohibit proper installation of the system, the Contractor may be directed by the Owner to correct the problem(s) prior to installing the system by utilizing open cut repair methods. This work will be considered

changed conditions, or if there is an existing bid item for this work, the Contractor shall be compensated under the particular pay item designated for open cut point repairs.

11. The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing and curing the CIPP. If required in the contract documents, each connection will be dye tested to determine whether or not the connection is live or abandoned. The cost for dye testing of existing service connections shall be compensated at the unit price bid. In the event the status of a service connection cannot be adequately defined, the Owner will make the final decision, prior to installation and curing of the liner, as to the status. Typically only service connections deemed “active” shall be reopened by the Contractor. Reinstatement in small diameter pipes typically requires a cleanout for external reinstatement.
12. The Contractor shall be allowed use water from an owner-approved fire hydrant in the project vicinity. Use of an approved double check backflow assembly shall be required, unless an open gap exists in the Contractor’s equipment. Contractor shall provide his own approved assembly. Contractor shall pay current market price for all water usage, unless otherwise specified by the Owner.

3.1 C. Install

1. The entire liner shall be wetout using vacuum impregnation including the lateral and mainline portions.
2. The system shall be loaded inside and/or on a pressure apparatus. The pressure apparatus, attached to a robotic device, shall be positioned in the mainline pipe at the service connection. The robotic device, together with a CCTV camera, shall be used to align the lateral portion of the system with the service connection opening. Air pressure, supplied to the pressure apparatus through an air hose, shall be used to invert or expand the resin impregnated CIPP into the lateral pipe, and push the main-line portion of the system against the main-line pipe (typically lined pipe). The pressure shall be adjusted to the manufacturer’s recommended installation pressure to fully install the CIPP into the lateral pipe and hold the system tight to the pipe walls. Care shall be taken during the curing process not to over-stress the tube.
3. After lateral CIPP installation is completed, manufacturer’s recommended pressure is maintained on the impregnated CIPP for the duration of the curing process. Curing method shall be compatible with the resin selected and shall be in accordance with manufacturer’s recommendations. The initial cure shall be deemed to complete when the CIPP has been exposed to the UV light, heat source or held in place for the time period specified by the manufacturer.
4. The Contractor shall cool (if heat cured) the hardened CIPP before relieving the pressure in the apparatus. Cool-down may be accomplished by the introduction of cool air into the pressure apparatus. Care shall be taken to maintain proper pressure throughout the cure and cool-down period.

5. If cured by ambient-cure process, the Contractor shall maintain bladder pressure until CIPP has completely cured per manufacturer's recommendations before relieving the pressure in the pressure apparatus.
6. The finished CIPP shall be free of dry spots, lifts and de-lamination. The system shall not inhibit the closed circuit television post video inspection of the mainline or service lateral pipes. Frayed ends of the system shall be removed prior to acceptance.
7. Contractor shall maintain a visible, written log of all activities in accordance with manufacturers' recommendations and shall include time/location of wet out, time of insertion, time/location of lateral insertion, bladder pressure requirements, required cure time, actual cure time, and cool down duration.
8. During the warranty period, any defects which will affect the integrity of strength of the system and allow leaks shall be repaired at the Contractor's expense in a manner mutually agreed upon by the Manufacturer, City and the Contractor.
9. After the work is completed, the Contractor will provide the City with the specified video format showing the completed work including the restored conditions.

3.1 D. Finish

1. The installed system shall be continuous over the specified length of the sewer line section (including main-line and lateral) and be free from visual defects such as foreign inclusions, dry spots, pinholes, major wrinkles and de-lamination. The system shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to inside the lined pipe.
2. Any defect, which will or could affect the structural integrity or strength of the system or allow leaks, shall be repaired at the Contractor's expense,
3. The system shall provide a watertight seal at the connection to the main-line pipe and for the length of the lateral CIPP lined. The following methods/materials are recommended for ensuring a water tight seal:
 - (a) 100% Solids Epoxy providing an adhesive bond between the system and the host pipe, installed/applied per the manufacturer's recommendations.
 - (b) Hydrophilic materials installed/applied per the manufacturer's recommendations
4. Branch lateral connections or any other pre-existing connection to the service lateral shall be reinstated by a remote controlled robotic cutting device, either from within the pipeline or externally through a cleanout. The reinstated connection shall be brushed to allow for a smooth edge.
5. Cured samples of the CIPP may be required for testing physical properties in accordance with the requirements specified herein. The test shall be performed by

an independent 3rd party laboratory, if required by the Owner and as recommended by the system manufacturer.