

**SECTION 808**  
**CURED-IN-PLACE-PIPE (CIPP)**

**808-1 DESCRIPTION:** This Work consists of providing labor, materials, equipment, and supervision necessary to accomplish the CIPP lining of all sewer mains designated in the Contract Documents.

**808-2 SCOPE OF WORK:**

- a. Contractor shall provide materials, labor, equipment, and services necessary for: sewer flow control, pre-installation cleaning, rehabilitation of existing sanitary sewer mains by lining, initial and final Closed Circuit Television inspection (CCTV), and final testing of the CIPP system.
- b. It is the intent of this Section to provide for the rehabilitation of existing sewer host pipe. A resin-impregnated flexible felt tube will be inserted utilizing an inversion process to fit against the original host pipe. The liner is then heated to cure the resin to a hard smooth liner.

**808-2.1 Qualifications:**

- a. CIPP Contractors shall have a minimum of three (3) years of active continuous experience installing CIPP liners in pipe of similar size, length and configuration as proposed in the project. In addition, Contractor shall have successfully installed at least 1,000,000 feet of CIPP liner product in wastewater collection system applications.
- b. Field supervisory personnel employed by the CIPP Contractor will have at least two (2) years of experience in the performance of the work and tasks as stated in the Contract Documents.

**808-3 MATERIALS:**

- a. The Contractor shall use a thermosetting resin impregnated inversion liner conforming to the requirements of the latest version of ASTM F1216 (Rehabilitate Pipelines by Inversion and Curing a Resin Impregnated Tube), ASTM D5813 (Cured-in-Place, Thermosetting Resin Sewer Pipe), and ASTM F1743 (Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)). All products shall be as shown on the Quality Products List (QPL) or approved equal.
- b. The tube shall consist of one or more layers of absorbent non-woven fabric capable of carrying resin, and capable of withstanding installation pressures and curing temperatures. The tube material shall be able to stretch to fit irregular pipe sections and negotiate bends. The outside layer of the tube shall be plastic coated with a material that is compatible with the resin system used. The tube should be fabricated to a size that will fit the internal circumference and the length of the existing pipe when installed. Allowance should be made for circumferential stretch during installation. The inside of the installed tube shall be marked along its full length at regular intervals not to exceed ten (10) feet. Markings shall also include the manufacturer of the liner that must appear in at least one location per setup.
- c. Unless otherwise specified, the Contractor shall furnish a general purpose, unsaturated, polyester or thermosetting vinyl ester resin and catalyst system compatible with the reconstruction inversion process that provides the cured physical strengths and properties specified herein. The approved thermosetting resin and catalyst systems are found in the QPL. The resin shall be cured in the presence of

steam or water as specified in the curing section in this specification.

- d. Resins shall be shipped directly to the wet-out facility from the resin manufacturer.
- e. PET resins, resin filters, resin additives, and resin enhancement agents are prohibited. Only neat resins are acceptable. Old resins and reworked resins are prohibited, regardless of whether or not they are mixed with new resin.
- f. Catalysts: Primary catalyst shall not exceed 1 percent of resin by volume; secondary catalyst shall not exceed ½ percent of resin by volume.
- g. The wall color of the interior pipe surface of the CIPP after installation shall not be of a dark or non-reflective nature that could inhibit proper closed circuit television (CCTV) inspection.
- h. The bond between all CIPP layers shall be strong and uniform. All layers, after cure, shall be completely saturated with resin.

#### **808-4 SUBMITTALS:**

- a. Prior to receiving the Notice to Proceed at the pre-construction meeting, the Contractor or manufacturer shall submit all data sheets for CIPP materials to be used on the project. These include at a minimum the tube, resin, and catalyst materials.
- b. **Qualifications:** Submit documentation showing that the Contractor and personnel meet the minimum required qualifications stated in Section 808-2.1. Include a list of projects showing Contractor's experience with the use of the same pipe material, length and diameter (or larger). Information must include, but not be limited to date and duration of work, location, pipe information (i.e. length, diameter, depth of installation, pipe material, etc.), project owner information (i.e. name, address, telephone number, contact person), and the contents handled by the pipeline (water, wastewater, etc.). **The apparent low bidder shall complete and submit the required qualifications to the Engineer within ten (10) days after the bid opening.**
- c. The Standard Dimension Ratio (SDR) is the ratio of the outside diameter (OD) of the pipe to its minimum wall thickness. All CIPP wall thicknesses, SDR's by diameters, and depth ranges corresponding to the requirements of the Contract Documents, must be submitted to the Engineer for approval prior to installation.
- d. Critical Damage Reports, if applicable.
- e. The Contractor shall submit to the Engineer, at least 24 hours prior to installation, a "wet-out" schedule detailing time and location.
- f. The manufacturer, prior to installation, shall provide the inversion pressures necessary for proper installation. Tube installation forces or pressures shall be limited so the tube is not stretched longitudinally by more than 5% of the original length.
- g. Before the installation begins, the tube manufacturer shall provide the minimum pressure required to hold the tube tight against the existing host pipe, and the maximum allowable pressure that will not damage the tube.
- h. Acceptance testing samples as described in Section 808-21.
- i. Traffic Control shall be the responsibility of the Contractor. Any necessary lane

closures shall require a permit from the Traffic Division of the DPW or the LaDOTD. Copies of the permits shall be submitted to the Engineer prior to commencing Work.

- j. Post-construction CCTV inspection videos.

#### **808-5 DESIGN PARAMETERS:**

- a. The CIPP system felt and resin composite shall have the minimum physical properties given below and in accordance with the guidelines in the appendix of the latest version of ASTM F1216.

- |   |                        |
|---|------------------------|
| 1. Design Life:   | 50 years               |
| 2. Pipe Diameters:  | Per Contract Documents |
| 3. Ovality:   | 2%                     |
| 4. Pipe Condition:  | Fully deteriorated     |
| 5. External Water:  | ground surface         |
| 6. Flexural Strength:   | 4,500 psi              |
| 7. Short Term Flexural Modules:   | 250,000 psi            |
| 8. Reduction Factor:  | 50%                    |
| 9. Long Term Flexural Modules:  | 125,000 psi            |
| 10. k Enhancement Factor:   | 7                      |
| 11. Soil Modules:   | 1,000 psi              |
| 12. Soil Density:   | 120 pcf                |
| 13. Highway Live Load:  | AASHTO HS20-44         |
| 14. Safety Factor:  | 2 minimum              |
| 15. Min. Thickness(= $<10$ " ):   | 6 mm                   |
| 16. Min. Thickness ( $>10$ " ):   | 7.5 mm                 |
| 17. If calculations require thicker wall round to the next higher multiple of 0.5 mm. |                        |

- b. Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the required design structural CIPP wall thickness.

**808-6 EQUIPMENT:** The basic equipment shall consist of a CCTV system as described in Section 815, necessary liner materials, stand pipes, pumps, regulators, valves, hoses, boilers, blowers, winches, etc. The equipment shall be capable of performing the specified operations required to install the sewer liner material.

#### **808-7 CLEANING, ROOT REMOVAL, PROTRUDING GASKET REMOVAL, AND INSPECTION:**

- a. Contractor shall notify the Engineer prior to beginning cleaning activities and pre-construction CCTV inspection. Contractor shall plan cleaning and pre-construction CCTV inspection activities far enough in advance of CIPP lining activities to allow Engineer time to review any Critical Damage Reports that may develop from the CCTV inspection results.
- b. Experienced personnel trained in locating breaks, obstacles, and service connections by CCTV will perform CCTV of pipe in accordance with Section 815. The interior of the pipe should be carefully inspected to determine the location of any conditions that may prevent proper installation of the impregnated tube, such as protruding service taps, collapsed or crushed pipe, and reductions in the cross-sectional pipe area of more than 10%. The Contractor will notify the Engineer immediately if the inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment or that will interfere with the proper installation an acceptable liner. This should be submitted to the Engineer as a Critical Damage Report (CDR). The CDR shall include all adverse conditions for each pipe segment from manhole to manhole. The CDR shall

include:

1. Two letters of transmittal.
  2. A CDR standard form including screen capture of adverse condition and location footage.
  3. A hardcopy printout of the video cut sheet (video report).
  4. A DVD containing:
    - i. Electronic pdf files of the video cut sheets
    - ii. Digital copy of the pipe video
  5. Recommendation from CIPP Contractor for each adverse condition.
- c. It shall be the responsibility of the Contractor to remove all loose debris that is located within the sewer pipe in accordance with Section 812. This cleaning will be incidental to the cost of sewer pipe lining. If an obstruction is encountered that cannot be cleared with conventional sewer cleaning equipment, the Engineer should be notified immediately.
- d. Any roots and/or protruding gaskets in the existing sewer pipe shall be cut and removed from the sewer pipe prior to the sewer liner installation. This root and/or protruding gasket cutting and removal shall be incidental to the cost of the sewer pipe lining, and there shall be no direct payment to the Contractor.

**808-8 PROTRUDING SERVICE CONNECTIONS:** When service connections protrude into the existing pipe more than ½" as measured from the inside pipe wall, then the Contractor shall remove the protruding portion of the service connection to within ½" of the inside pipe wall. Removal of the protruding portion of the service connection shall be accomplished using a television camera and internal cutting device, which shall not damage the collection line or the portion of the service line to remain in place. This work shall be accomplished prior to the installation of the liner pipe.

**808-9 RESIN IMPREGNATION:**

- a. The tube shall be vacuum-impregnated with resin (wet out) under controlled conditions. The volume of resin used should be sufficient to fill all voids in the tube material at nominal thickness and diameter. The volume should be adjusted by adding excess resin for the change in resin volume because of polymerization and to allow for any migration of resin into the cracks and joints in the original pipe. A roller system shall be used to uniformly distribute the resin throughout the tube.
- b. The Contractor shall designate a location where the CIPP will be vacuum impregnated prior to installation. The Contractor shall allow the Engineer to inspect the materials and procedures used to vacuum impregnate the tube if desired.
- c. Delivery, storage and handling of approved products are the responsibility of the Contractor. The Contractor shall keep them safe from damage and stored with the proper environmental containment as outlined by the manufacturer. No products should be used that have exceeded the designated shelf life as outlined by the manufacturer. Remove damaged products from Site. Promptly replace damaged products with new products at no additional cost to the Owner.
- d. Maintain resin-impregnated tubes in refrigerated truck trailers at a temperature below 45-degrees F to prevent premature curing. Prior to beginning inversion, no portion of

the resin-impregnated tubes liner shall be subjected to sunlight or ultraviolet radiation. Resin-impregnated tubes with signs of premature curing shall not be installed and shall be removed from the Project Site.

#### **808-10 FLOW CONTROL PRECAUTIONS:**

- a. The Contractor shall be completely responsible for preventing service line backups during the liner installation and curing period.
- b. The Contractor shall follow the additional flow control precautions in accordance with Section 813. Notification to homeowners will be made in accordance with Section 813-2(e).

#### **808-11 INSTALLATION OF CIPP:**

- a. The wet out tube shall be inserted through an existing manhole or approved access point by means of an inversion process and the application of a hydrostatic head sufficient to extend it to the next designated manhole or termination point.
- b. Alternately, the tube can be pulled into place and expanded with an inflation bladder.
- c. Once the installation has begun, the pressure shall be maintained between the minimum and maximum pressures until the installation has been completed.
- d. The existing host pipe shall be dewatered for any CIPP installation that does not use an inversion method to expand the tube against the pipe wall.

**808-12 USE OF LUBRICANT:** Lubricant shall be used to reduce friction between the host pipe and the liner during the inversion or pulled-in process. This lubricant should be poured into the water in the downtube or applied directly to the tube or inflation bladder. The lubricant used should be a nontoxic, oil-based product that has no detrimental effects on the tube, heating source and pump system, will not support the growth of bacteria, and will not adversely affect the fluid to be transported. Lubricant shall be used in processes with permeable coatings.

#### **808-13 CURING WITH WATER:**

- a. After installation is completed, suitable heat source is required to circulate heated water throughout the pipe. The equipment should be capable of delivering hot water throughout the section to uniformly raise the water temperature above the temperature required to affect a cure of the resin. Temperature gauges shall be installed in the following areas: incoming water supply; outgoing water supply and between the impregnated tube and the pipe invert at the lining termination point.
- b. Curing Time: 3 hours minimum
- c. Minimum interface temperature between liner and tube shall be 120 degrees F.
- d. Water Temperature: 180 degrees F minimum.

#### **808-14 CURING WITH STEAM:**

- a. After installation is completed, suitable heat source is required to circulate steam throughout the pipe. The equipment should be capable of delivering steam throughout the section to uniformly raise the steam temperature above the temperature required to affect a cure of the resin. Temperature gauges shall be installed in the following areas: incoming steam supply; outgoing steam supply and

between the impregnated tube and the pipe invert at the lining termination point.

- b. Curing Time: 2 hours minimum
- c. Minimum interface temperature between liner and tube shall be 120 degrees F.
- d. Steam Temperature: 230 degrees F minimum.
- e. Pressure required to keep tube inflated while curing 5 psi.

#### **808-15 COOL-DOWN:**

- a. Water cured CIPP should be cooled to a temperature below 90 F before relieving the hydrostatic head. Cool-down may be accomplished by the introduction of cool water into the CIPP to replace water being drained from the small hole made in the downstream end. Care should be taken in the release of the static head to prevent a vacuum that could damage the newly installed CIPP.
- b. Steam cured CIPP. Send air through the liner until it cools down to 120 F interface temperature. Once 120 F has been reached water may be introduced to finish cooling the line down to 90 F. Care should be taken in the release of the water to prevent a vacuum that could damage the newly installed CIPP.

**808-16 INFLATION BLADDER REMOVAL:** For pulled-in place installation techniques where the inflation bladder is designed not to bond to the CIPP, all portions of the bladder material must be removed from the CIPP.

#### **808-17 CURING WITH ULTRA VIOLET LIGHT (UV):**

- a. If this method of curing is selected the material must be a polyester needle felt or fiberglass based CIPP liner impregnated with ISO NPG. The liner is cured with the standard UV curing method. A control panel operating a UV curing unit Light chain inside an end fitting with a light chain implemented installation drum, can be pulled on a trailer attached to the UV unit.
- b. The Liner gets inverted into the pipe to be lined with the standard pressure drum. After completion of the inversion process the method does not distinguish at all from the standard method applied for the installation of the known glass liner systems. The light chain is introduced in the liner and the ends closed with the couplings.
- c. The UV liner may be stored for as much as 3 months before installation.

#### **808-18 FINISHED CIPP:**

- a. Be continuous over entire length from manhole to manhole and be free from visual defects such as foreign inclusions, dry spots, keel, boat hull, fins, pinholes, wrinkles, and other deformities. Such defects and deformities may (at the discretion of the Owner) be cause for rejection of the entire liner, in which case the lined pipe will be removed and replaced at no additional cost to the Owner.
- b. When passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by Engineer.
- c. Each pipe opening into manhole, a hydrophilic rubber joint seal shall be bonded with adhesive to the manhole and CIPP.
- d. Meet leakage requirements as specified in Section 802.

**808-19 SERVICE LINE CONNECTION RESTORATION:** The service laterals to be excavated and restored shall be done prior to the CIPP lining of the mainline in accordance with Section 802 and all re-established services shall be smoke tested prior to backfilling. After the liner has properly cured, the service line connections shall be cut without excavation using an internal cutting device and a television camera. All coupon materials from this action shall be collected at the next downstream manhole and submitted to the Engineer. Service line connections shall be fully reopened and trimmed to a neat, clean, circular opening concentric with the service line pipe, free of jagged edges, "sawteeth", resin plugs or resin shelves.

If internal cuts to existing lined pipes are required by the Contract Documents in order to re-establish service line connections, the work shall be done similarly as described above. This work is in association with rehabilitation of pipes that have been previously lined and payment for this work will be included under the removal of protruding service connection pay item.

**808-20 PARTIAL (SPOT REPAIR) CIPP LINERS:**

- a. The partial CIPP liner shall be installed in accordance with ASTM F 2599 and same requirements as for a full length liner.
- b. The dimensions of the liner shall be fabricated to a size that when installed, will neatly fit the circumference of the existing conduit. The materials and physical properties of the partial liner shall conform to the same requirements as for a full length liner.
- c. The tube, in good condition, shall be vacuum impregnated with the thermo-set resin. All air in the tube shall be removed by vacuum allowing resin to thoroughly impregnate the tube. A resin-impregnated sample shall be retained by the installer for each installation to provide verification of the curing process taking place in the host pipe. This sample shall be hung in the entry manhole to simulate ambient conditions of the host pipe.
- d. The saturated tube along with the inversion bladder will be inserted into the carrying device and pulled into the host pipe. The pull is complete when the end of the launching device is aligned with the beginning of the section to be repaired. The resin and tube shall be completely protected during the pull such that no resin is lost by contact with manhole walls or pipe. The resin that provides a structural seal shall not contact the pipe until positioned at the point of repair.
- e. The installer shall be capable of viewing the beginning of the liner contacting the host pipe verifying the exact placement of the liner. No measuring from a CCTV counter or estimating will be allowed.
- f. The tube will be extracted out of the carrying device by controlled air or water pressure. The tube is held tightly in place against the wall of the host pipe by the pressure until the cure is complete.
- g. Once the sample piece in the manhole has cured, the inflation bladder is deflated, and bladder and launching device are removed from the host pipe. Any materials used in the installation other than the CIPP liner is to be removed from the host pipe by the installer. Contractor shall recover the sample piece and label with upstream and downstream manhole numbers and footage from upstream manhole to service connection. Sample shall be submitted for testing in accordance with Section 808-21.
- h. Any service lateral connections covered by the sectional repair are to be restored in accordance with Section 808-19.

**808-21 INSPECTION AND TESTING:**

- a. **PROPERTIES TEST:** The following test requirements apply to all CIPP installations, regardless of installation method, for each setup:
  - 1. One minimum 12 inch long restrained pipe section shall be cut from the cured liner and labeled with upstream and downstream manholes numbers for that setup. Contractor shall submit the sample to the Owner and measurements of sample thickness will be taken by the Owner from four locations on each section. The average thickness of the measurements shall be equal to or greater than the required minimum or design thickness (whichever is greater). In addition, Contractor shall collect the coupons from the service line connection restoration for each setup, label with upstream and downstream manhole numbers, and submit to the Owner. These coupons may also be used for testing. Failure of the thickness test shall be grounds for rejection of the CIPP liner.
  - 2. "Wet-out" facility resin mixing equipment shall have a valve downstream of the mixing functions and immediately upstream of the application of the mixed resin to the tube where the Owner can draw resin samples. Contractor's batch mix facilities, if any, shall provide for sampling of the mixed batch. Submitted "wet-out" schedule cannot be modified without 24-hour notice to Owner. Resin samples shall be drawn at times determined by Owner. The Owner representative drawing the samples will arrive unannounced and shall be afforded immediate access to the equipment.
  
- b. **CCTV VISUAL TEST:** The Contractor and the Engineer shall inspect each installation visually by CCTV. Variations from true line and grade may be inherent because of the conditions of the original piping. No infiltration of groundwater should be observed. All service entrances should be accounted for and be fully functional unless otherwise directed by the Engineer in writing. No visible leak around liner at manhole connection will be allowed. The pre- and post-installation documentation in DVD format will become the property of the Owner.
  
- c. Contractor shall correct failed liner or liner deemed unacceptable by the Owner as a result of the post-video inspection and/or thickness test. Remedy for failed thickness test shall be defined as shown in the following table. Where pipe removal and replacement is required, it shall be for the entire segment length from manhole to manhole and payment shall be made in full for the cured-in-place pipe. No payment will be made to construct a new sewer segment (i.e. pipe replacement). The test shall be repeated at no additional cost to the Owner until the results are satisfactory to the Engineer.

<b>PIPE CORRECTION</b>			
<b>Test</b>	<b>Required Value</b>	<b>Test Result</b>	<b>Remedy</b>
Thickness	Minimum or Design, whichever is greater	≥ 90% to 100%	No Unit Price Reduction
		≥ 80%, but less than 90%	15% Unit Price Reduction
		< 80%	Pipe Replacement



**808-22 POST INSTALLATION CLEANING:** At the conclusion of the work, the Contractor shall thoroughly clean the entire new pipe by flushing with water or other means to remove all dirt, stones, and pieces of wood or other material that may have entered during the construction period. Debris cleaned from the lines shall be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed.

**808-23 PATENTS:** The Contractor shall warrant and hold harmless the Owner against all claims of patent infringement and any loss thereof for any type of sewer pipe lining process used in the work.

**808-24 MEASUREMENT:**

- a. **Sewer CIPP Lining:** Measurement for installed cured-in-place pipe lining shall be on a linear foot basis, to the nearest whole foot, measured from center of manhole to center of manhole, for the host pipe sizes listed under this item in the Contract Documents.
- b. **Sewer CIPP Partial Lining:** Measurement for installed cured-in-place pipe partial lining shall be on a linear foot basis (6 foot minimum), to the nearest whole foot, for the host pipe sizes and repair lengths listed under this item in the Contract Documents.
- c. **Remove Protruding Service Connections:** Measurement for the removal of the protruding portion of a service connection shall be the actual count of protruding service connections internally removed from the host pipe.

**808-25 PAYMENT:**

- a. **Sewer CIPP Lining:** Payment for this item will be full compensation for sewer flow control, public notification, traffic control, any required excavation and restoration, uncovering buried manhole covers, sewer pipe cleaning, root removal, installation of the liner, inspection, pre- and post-construction CCTV inspection, equipment retrieval, service line connection restoration, coupon retrieval, testing, and clean-up in accordance with the Contract Documents. Payment for point repairs necessary prior to lining will be paid for separately under the appropriate Bid Items.
- b. **Sewer CIPP Partial Lining:** Payment for this item will be full compensation for sewer flow control, public notification, traffic control, any required excavation and restoration, uncovering buried manhole covers, sewer pipe cleaning, root removal, installation of the partial liner, inspection, pre- and post-construction CCTV inspection, equipment retrieval, service line connection restoration, coupon retrieval, testing, and clean-up in accordance with the Contract Documents.
- c. **Remove Protruding Service Connections:** Payment for this Item will be full compensation for all equipment, labor, materials, and incidentals required to internally remove the protruding portion of a service connection from the host pipe.

**808-26 PAY ITEMS:**

Pipe Diameter Schedule

A = 4" Pipe	N = 27" Pipe
B = 6" Pipe	O = 30" Pipe
C = 8" Pipe	P = 32" Pipe
D = 10" Pipe	Q = 36" Pipe
E = 12" Pipe	R = 42" Pipe
F = 14" Pipe	S = 48" Pipe
G = 15" Pipe	T = 54" Pipe
H = 16" Pipe	U = 60" Pipe
I = 18" Pipe	V = 64" Pipe
J = 20" Pipe	W = 66" Pipe
K = 21" Pipe	X = 72" Pipe
L = 24" Pipe	Y = 76" Pipe
M = 26" Pipe	Z = 80" Pipe

<u>Item No.</u>	<u>Item</u>	<u>Unit</u>
808100_	__" Diameter Sewer CIPP Lining	Linear Foot
808110_	__" Diameter Sewer CIPP Partial Lining	Linear Foot
8082000	Remove Protruding Service Connections	Each