SECTION 330130.72 - CURED-IN-PLACE PIPE LINING

This section specifies relining of sanitary sewer piping and associated preparatory work using the cured-in-place technique.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Cleaning and flushing of existing sanitary sewers.

Taking video of existing sewers and their condition.

Installing an inverted, resin-impregnated tube pipe liner.

Reestablishing service connections.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 036000 - Grouting: Grout as required by this Section.

Section 312316 - Excavation: Excavating for utilities.

Section 330130.11 - Television Inspection of Sewers: TV inspection of pipeline and preparatory activities.

Section 330505.33 - Infiltration and Exfiltration Testing: Testing of deformed pipe liner.

Section 330505.41 - Air Testing: Testing of deformed pipe liner.

Section 330505.43 - Mandrel Testing: Testing of deformed pipe liner.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this section, with designations, numbers, and complete document titles. Edit reference standards list to include only those applicable to the project.

* + - * 1. ASTM International:

ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

ASTM D5260 - Standard Classification for Chemical Resistance of Poly(Vinyl Chloride) (PVC) Homopolymer and Copolymer Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D5813 - Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems.

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

ASTM F1743 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP).

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 (CIPP).

* + - 1. COORDINATION
				1. Coordinate Work of this Section with the Director’s Representative.
				2. Notify Director’s Representative at least **[48]** hours in advance of expected disruption of sanitary service.
				3. Notify private sanitary sewer users at least <**48**> hours in advance of expected disruption of sanitary service.
				4. Limit disruption of service to individual properties to one-time occurrence for maximum of **[eight]** hours.
				5. Do not disrupt sewer service between hours of [**5:00**] PM and **[8:00]** AM unless otherwise indicated by the Director’s Representative.
				6. Provide and maintain temporary facilities, including piping and pumps, to meet requirements.
			2. PREINSTALLATION MEETINGS
				1. Meet with the Director’s Representative a minimum [**one week**] [**<\_\_\_> weeks**] prior to commencing Work of this Section.
			3. SUBMITTALS

Only request submittals needed to verify compliance with project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combination submittals).
				4. Product Data:

Submit manufacturer information regarding liner material, curing chemicals, and lubricants.

Manufacturer’s technical data, details, and specifications giving information on material composition, physical properties, and dimensions, including certification by the manufacturer that the materials are immune to corrosion from sewage and products resulting from the biological and chemical conversion of sewage constituents. Manufacturer’s recommended procedures for handling, storing, and installation of the liner, including reinstatement of lateral service connections.

Submit complete description of proposed wet-out procedures.

* + - * 1. Shop Drawings: Indicate liner dimensions for each pipe size to be relined.
				2. Design Calculations:

For the rehabilitation of sewers by the inversion and curing of a resin-impregnated tube, submit structural design calculations and specification data sheets listing all parameters used in the liner design and thickness determinations based on Appendix X1 of ASTM F 1216. Calculations shall be stamped and signed by a New York State licensed professional Engineer.

Include following paragraph to submit physical samples to select finish, color, texture, and other properties.

* + - * 1. Samples: Submit **[two]** samples of liner material in both uncured and cured state.
				2. Digital Video Discs (DVDs) or USB Drive:

Submit video recordings of piping sections as follows:

Show condition of existing pipe and pipe joints and location of existing service connections after cleaning and prior to relining.

Show cured liner and reestablished service connections after relining Work has been completed.

Pre- and Post- CCTV inspection shall be completed in accordance with Section 330130.11 - Television Inspection of Sewers.

* + - * 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate paragraphs for additional certifications.

Include following paragraph when contractor is responsible for designing products or assemblies. List affected products when section specifies more than one product.

* + - * 1. Delegated Design Submittals: Submit Shop Drawings signed and sealed by a New York State licensed professional engineer with design calculations and assumptions for liner thickness.
				2. Test and Evaluation Reports: Submit reports certifying that liner material meets ASTM testing standards as specified in this Section.
				3. Manufacturer Instructions:

Submit detailed description of liner placement and curing procedures for piping.

Include description of procedures for sealing liner material at manholes and reestablishing service connections.

Submit manufacturer's requirements for receiving, handling, and storage of materials.

* + - * 1. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.

Test Reports: Furnish certified test data issued by an independent testing laboratory, demonstrating that the products used comply with the required physical properties.

* + - * 1. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
				2. Qualifications Statements:

Coordinate following subparagraphs with requirements specified in qualifications article.

Submit qualifications for manufacturer, installer, licensed professional, pipeline assessor, and inspector.

Submit manufacturer's approval of installer.

* + - 1. CLOSEOUT SUBMITTALS
				1. Project Record Documents: Record actual locations of each service connection.
			2. QUALIFICATIONS

Coordinate following paragraphs with requirements specified in submittals article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] years' [**documented**] experience.
				2. Workers’ Qualifications Data:

Submit the names and addresses of three (3) previous trenchless sewer rehabilitation projects comparable in all ways to this project. Briefly describe the nature of each project.

Submit a letter certifying that the Supervisor and the Workers doing the liner Work have at least 2 years’ experience each in installing sewer liners of the type specified.

* + - * 1. Licensed Professional: New York State licensed professional Engineer experienced in design of specified Work.
				2. Pipeline Assessor:

Person specializing in assessing condition of sewer pipelines prior to and following relining.

Currently certified in Pipeline Assessment and Certification Program (PACP) of the National Association of Sewer Service Companies (NASSCO).

Typically NYSOGS will hire an independent Inspector. Confirm with NYSOGS PM.

* + - * 1. Inspector:

Director’s Representative will provide a qualified inspector specializing in sewer pipeline rehabilitation.

Currently certified in Inspector Training and Certification Program (ITCP) of NASSCO.

* + - 1. DELIVERY, STORAGE, AND HANDLING
				1. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
				2. Store materials according to manufacturer instructions.
				3. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Provide additional protection according to manufacturer instructions.

* + - 1. EXISTING CONDITIONS
				1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

* + - 1. WARRANTY

This article extends warranty period beyond one year. Extended warranties may increase construction costs and State’s enforcement responsibilities. Specify warranties with caution.

* + - * 1. Furnish [**two**]-year manufacturer's warranty for liner.
1. PRODUCTS
	* + 1. PERFORMANCE AND DESIGN CRITERIA
				1. Design lining material to have sufficient structural strength to support dead loads, live loads, and groundwater load imposed, assuming existing pipe cannot share loading or contribute to structural integrity of liner.
				2. Design liner to least-possible thickness to minimize decreasing interior pipe diameter.
				3. Design liner material to provide jointless, continuous, and structurally sound construction able to withstand imposed static, dynamic, and hydrostatic loads on a long-term basis.
				4. Identify design provisions for shrinkage control to prevent future misalignment of service reconnections.
			2. INVERTED, RESIN-IMPREGNATED TUBE PIPE LINER
				1. Cured-in-Place, Resin-Impregnated Felt Liner:

Resin-Impregnated, flexible polyester felt thermally cured-in-place and meeting the following minimum physical properties:

Flexural Modulus: 300,000 psi initial; 150,000 psi long-term.

Flexural Strength: 5000 psi.

Tensile Modulus: 250,000 psi initial; 152,000 psi long-term.

Tensile Strength: 4000 psi.

* + - * 1. Custom designed by the manufacturer in accordance with ASTM F 1216 to meet the following conditions:

AASHTO H-20 live load with two trucks passing.

Soil weight 120lbs./cf.

Maximum ground water level at ground surface.

Consideration of partially or fully deteriorated pipe based on the video inspection following cleaning of the host pipe.

50-year service life.

Maximum felt content of the liner: 25 percent.

SDR of 50 or less dependent on deteriorated condition of host pipe. Wall thickness of the cured liner shall be determined by the design calculations required under Article 1.04 or this Section.

* + - * 1. Resin shall be a polyester liquid thermosetting resin with associated catalysts suitable for the design conditions and curing process.
				2. When cured the liner shall form a continuous, tight fitting, hard, impermeable lining chemically immune to corrosion from sewage and by-products, combined with a maximum abrasion resistance.
				3. Fabricate the liner to a size that when reformed will tightly fit the host pipe.

Tube shall consist of one or more layers of flexible needled felt, or an equivalent non-woven material.

Tube shall be capable of conforming to bends, offset joints, bells, and disfigured pipe sections.

Allow for longitudinal and circumferential expansion when sizing to achieve proper installation of the liner.

Verify dimensions in the field prior to delivery of the liner.

* + - * 1. Verify length of liner prior to construction to effectively carry out installation and seal the liner at the inlet and outlet of each manhole.
				2. Ensure that the correct liner is fabricated for the respective runs between each set of manholes.
				3. Acceptable Licensed Installers:

Liqui-Force Services, Inc., 28529 Goddard Rd., Ste 106, Romulus, MI 48174, (734) 955-2508 (New York Regional Office-917 1234 Layne Lane, Rt. 30 Schoharie, NY 12157, (518) 295-8288.

Insituform Technologies, Inc., 17988 Edison Ave, Chesterfield, MO 63005, (636) 530-8000.

Approved equivalent.

Insert descriptive specifications below to identify project requirements and to eliminate conflicts with products specified above. Include configuration, size, color, material composition, and other properties needed to describe product.

* + - * 1. Description:

Fabric Tube:

One or more layers of absorbent, non-woven felt fabric, felt/fiberglass, or fiberglass.

Comply with ASTM D5813, F1216, F1743, and F2019.

Capable of absorbing and carrying resins.

Resin:

Corrosion-resistant polyester or vinyl ester resin and catalyst system.

Comply with ASTM [**F1216**] [**F1743**] [**F2019**].

Wet-Out Fabric Tube:

Furnish uniform thickness and excess resin distribution that, when compressed at installation pressure, will meet or exceed design thickness after cure.

* + - 1. MIXES
				1. Grout: As specified in Section 036000 - Grouting.

Use following article for deformed pe pipe liners.

* + - 1. SOURCE QUALITY CONTROL
				1. Inspection and Testing:

Provide shop inspection and testing of completed assembly.

Chemical and Physical Testing: Test cured samples according to ASTM D5260.

Include one or both of following paragraphs to require Director’s inspection or witnessing of test at factory.

* + - * 1. Director’s Representative Inspection:

Make liner products available for inspection at manufacturer's factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] days before inspection is allowed.

* + - * 1. Director’s Representative Witnessing:

Allow witnessing of factory inspections and tests at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] days before inspections and tests are scheduled.

Include following paragraph if reliance on manufacturer's approved quality-control program is sufficient for project requirements.

* + - * 1. Certificate of Compliance:

If manufacturer is approved, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved manufacturer.

1. EXECUTION
	* + 1. EXAMINATION
				1. Verify location of piping to be relined.
			2. PREPARATION
				1. Pre-Rehabilitation Inspection: Following thorough cleaning, conduct a video survey, in the presence of the Director’s Representative, of each sewer section cleaned to verify adequacy of the cleaning in accordance with these specifications.

Conduct closed-circuit video inspection as specified in Section 330130.11 - Television Inspection of Sewers.

Determine condition of existing piping, degree of offset of joints, and locations of crushed walls and obstructions.

Determine sizes and locations of service entrances and connections.

Evaluation of pipe conditions performed by pipeline assessor.

Inspection of Work performed by a NASSCO ITCP-certified inspector. Coordinate inspection work to be provided by the Director’s Representative.

Clear obstructions, service piping protrusions, and other materials from bottom of existing pipe to ensure that inserted pipe liner directly contacts existing pipe wall.

* + - * 1. Bypassing Sewage:

Set up bypassing pump system to isolate each section of piping for relining.

Maintain bypass pumping until lining is totally formed and service connections have been reestablished.

* + - 1. CLEANING
				1. Remove foreign materials from the sewer piping as required to obtain tight seating of the new liner against a cleaned interior wall surface throughout the host pipe.

Use hydraulically propelled, high velocity jet, or mechanically powered equipment as necessary to satisfactorily remove dirt, grease, rocks, sand and other foreign materials including obstructions per Manufacturer’s recommendations.

Remove roots in a manner assuring complete removal from the joints.

Use mechanical equipment such as rodding machines, bucket machines, and winches in connection with root cutters and porcupines, plus other equipment such as high-velocity jet cleaners.

Chemical root treatment with a herbicide approved by the Director’s Representative may be used at the Contractor’s option to aid in the removal of roots. Application shall be in accordance with the manufacturer’s printed recommendations and instructions. Damaged vegetation as designated by the Director’s Representative shall be replaced at no cost to the State.

Obtain from the Director’s Representative written approval of the proposed equipment and methods to be used in the cleaning operations.

If cleaning an entire section between any two manholes cannot be successfully performed from one of the manholes, the equipment shall be set up at the other manhole and cleaning attempted from the other direction. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire distance between the two manholes, it will be assumed that a major blockage and the cleaning effort shall be abandoned until the blockage is removed by open-cut excavation. Coordinate any major blockages with the Director’s Representative.

Debris of every name and nature from sewer cleaning operation shall be legally disposed of off Site.

* + - 1. LOCALIZED (POINT) REPAIRS
				1. Localized (point) repairs shall be at the locations shown on the Contract Drawings. Coordinate with Director’s Representative following initial cleaning and CCTV inspection of any blockages/damage identified which are not shown on the Contract Drawings.
				2. Clear the existing pipeline of obstructions that will in any way prevent proper and specified installation of the liner. Offsets at the joints of more than 2 inches of inside diameter, protruding service connections, dropped joints, collapsed pipe, and other reductions in cross-sectional area of more than 20 percent of the inside diameter of the existing pipeline shall be repaired prior to lining.
				3. If an obstruction cannot be removed by conventional methods, then point repair shall be made by open-cut excavation.

Pipe used in an open-cut repair section shall be PVC, SDR 35, conforming to ASTM D 3034.

The following types of pipe couplings may be used provided they give a watertight seal, are designed to mate dissimilar pipes, and will achieve a solid connection.

Coupling adapter.

Slip-on coupling.

Split repair sleeve.

Flexible connectors are not acceptable.

* + - 1. INSTALLATION
				1. Adhere strictly to the liner manufacturer’s standard procedures for proper installation under specific conditions. Procedures for liner installation are specific to the method used and vary with liner material, liner thickness, pipe size, pipe shape, etc.
				2. Cover irregular and sharp edges of the entrance to the host pipe to prevent damage to the liner during insertion.
				3. Installation of Inverted, Resin-Impregnated Tube Liner:

Resin-Impregnation (wet-out):

Protect tube and resin areas from sunlight and moisture.

Test operation of mixing and wet-out equipment prior to resin mixing to ensure that all components are in proper working order.

Following resin mixing, verify that resin temperatures have been taken and gel tests (accelerated curing tests of the resin reactivity) have been performed for proper evaluation of the resin mixture.

Pump the resin between the innermost layers of the tube. Verify by counting the tube layers.

Do not allow air entrainment in the wet-out process.

Pass the tube through a pair of rollers to uniformly distribute the resin. Gap spacing between the rollers shall be a minimum of twice the specified wall thickness of the cured-in-place liner. Verify the gap spacing with every 100 feet of wet-out.

Inversion:

Protect the tube from injurious impact and unclean soiling matter (dirt, mud, fine debris, etc.).

Use inversion heads sized according to manufacturer’s recommendations.

Do not overstress the tube material or exceed 5 percent longitudinal stretch.

Place thermocouples at both ends of the tube and at intermediate stations as required to monitor the curing process.

Remove plastic films or coatings on the interior finish of the liner unless they are fully bonded to the absorbent tube material prior to installation.

Allow the liner to cool below 100 degrees F. before releasing the pressure and cutting the ends.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Excavate for point repairs only on emergency basis and as required by the Director’s Representative.
				2. Perform relining and reestablish service connections without need for excavation while minimizing disruptions to [**adjacent occupied buildings and traffic**].
				3. Inverted, Resin-Impregnated Tube Pipe Liner:

Coat [**outside**] [**or**] [**inside**] layer of fabric tube (before inversion or pull-in, as applicable) with an impermeable, flexible membrane that will contain resin and facilitate, if applicable, vacuum impregnation and monitoring of resin saturation during resin impregnation (wet-out) procedure.

Prior to installation, and as recommended by manufacturer, place remote temperature gages or sensors inside host pipe to monitor temperature during cure cycle.

Positioning:

Position wet-out tube in pipeline using method specified by manufacturer.

Do not damage tube during installation.

Cure installed liner by using appropriate medium according to manufacturer's recommended cure schedule.

Allow installed pipe liner to cool according to manufacturer instructions.

Annular Spaces:

Verify that no gap or annular space exists between finished liner and existing pipe.

Grout annular space, if present, to prevent damage to or collapse of liner or service connections.

Install watertight seals to host pipe at beginning and end of installed liner.

* + - * 1. Service Connections:

Reestablish existing sewer service connections through use of closed-circuit television camera and remote-controlled cutting device.

Match invert of reestablished service with previously existing invert.

Maintain minimum of 95 percent to maximum of 100 percent of original service connection opening.

Reestablish sewer service connection with uniform cuts free of burrs and sharp edges.

After reestablishing service connection, flush piping clean.

* + - 1. FIELD QUALITY CONTROL
				1. Testing of Completed Pipe Liner:

As specified in Section [**330505.33 - Infiltration and Exfiltration Testing**] [**330505.41 - Air Testing**] [**330505.43 - Mandrel Testing**].

Revise paragraph below if the State is not to provide onsite inspection. Coordinate with PM.

* + - * 1. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than [**days**] [**hours**] on Site for installation, inspection, and field testing.
				2. Post-Rehabilitation Inspection: Conduct a video survey, in the presence of the Director’s Representative, of each rehabilitated sewer section to verify adequacy of the liner installation and repairs in accordance with these specifications.
				3. Liner Acceptance:

Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

If liner fails to form, remove failed liner and install new liner.

Conduct closed-circuit video inspection of completed relining Work, indicating no visual defects, including foreign inclusions, dry spots, pinholes, cracks, or delamination.

Confirm that service connections are complete and unobstructed.

No infiltration of groundwater is permitted.

Make final adjustments to liner under direction of manufacturer's representative.

* + - * 1. Furnish installation certificate from manufacturer's representative attesting that liner has been properly installed and is ready for startup and testing.

END OF SECTION 330130.72