ITEM 929

CURED-IN-PLACE LINING OF EXISTING SANITARY SEWERS

926.1 General:

A. Scope: This item shall govern for Cured-In-Place (CIP) lining of existing sanitary sewers for the purpose of restoring these lines to an acceptable, usable condition. Such CIP lining shall be constructed in accordance with this item.

B. Related Specification Items:

Item 901 - St. Augustine Block Sodding

Item 165 - Hydro-Mulch Seeding

Item 925 - By-Pass Pumping

Item 933 - Sanitary Service Leads and Connections

Item 936 - Smoke Testing, Cleaning, and Television Inspection of Sanitary Gravity Sewer Lines

Item 932 - Point Repairs to Sanitary Sewer Lines

The Contractor's attention is directed to the fact that portions of these sewers may be in poor condition. It will be necessary that the Contractor exercise extreme caution at these locations during the CIP lining operation to prevent further damage and to keep the sewers in service.

The installation of the CIP lining shall be accomplished by the use of the Insituform, KM Inliner, National Liner, or other specified equal process. (See Paragraph 15 - PREQUALIFICATION in Instruction to Bidders.) CIP lining consists of rehabilitating sanitary sewer lines by insertion of a flexible polyester felt liner. The liner shall be saturated with a thermosetting resin and inserted into the existing sewer line. Curing shall be accomplished by circulating hot water, or steam, to cure the resin/felt liner into a hard impermeable pipe. When cured and complete the hardened liner should extend from end to end of the section being lined in a continuous tight-fitting watertight "pipe-within-a-pipe."

Though the installation process may be licensed or proprietary in nature, the Contractor SHALL NOT change any material, thickness, design values, or procedural matters stated or approved in the submittals, without the Engineer's prior knowledge and preapproval. The Contractor shall submit, in writing, full details about component

materials, their properties, and installation procedures and abide by them fully during the entire course of the project.

C. Liner Material: The finished liner in place shall be fabricated from materials which, when cured, will be chemically resistant to withstand internal exposure to sewage gases containing hydrogen sulfide, carbon monoxide, carbon dioxide, methane, dilute sulfuric acid, external exposure to soil bacteria, and chemical attack which may be due to materials in the surrounding ground or sewage within.

D. Liner Sizing: The liner shall be fabricated to a size that when installed will neatly fit the internal circumference of the sewer line which is to be lined and as shown on the plans and specifications. Allowance for circumferential stretching during insertion shall be made as per manufacturer's standards. Contractor shall verify size of existing sewer prior to fabrication of liner.

E. Liner Length: The Contractor shall verify the lengths in the field before cutting the liner to length. Individual runs can be made over one or more manhole to manhole sections as determined in field by Contractor and approved by Engineer.

926.2 Material Specification:

A. The polyester felt tubing, including the polyurethane or polyvinyl chloride covered felt and the thermosetting resin, shall meet the manufacturer's required standards and specifications. ASTM standards which are made a part hereof by such reference shall be the latest edition thereof.

B. The lining material shall be a polyester fiber felt tubing, lined with polyurethane and fully impregnated with a liquid thermosetting resin as specified. The cured lining shall conform to the minimum structural standards as below:

Liner Material Test Cured Liner	Standard	Results
Tensile Strength	ASTM D368	4,500 psi
Modulus of Elasticity	ASTM D790	250,000 psi

C. The line thickness shall be as per the attached table entitled minimum CIPP thickness, unless otherwise stated.

D. Before beginning work, the Contractor shall submit to the Engineer for approval, the vendor's specific technical data with complete physical properties of pipe and pipe dimensions pertinent to this job.

E. Design life calculations shall be submitted based on 50 year design life using field conditions at site of work as to soil conditions, depth, etc.

926.3 Installation Procedures:

A. Safety: The Contractor shall carry out his operations in strict accordance with all OSHA and manufacturers safety requirements. Particular attention is drawn to those safety requirements involving working with scaffolding and entering confined spaces.

B. Cleaning of Sewer Line: Prior to any lining of a pipe so designated, it shall be the responsibility of the Contractor to remove all internal debris out of the sewer line. The cleaning shall be done in accordance with Specification Item 936.

C. Inspection of Pipelines: Prior to any lining and after cleaning, a closed circuit inspection of pipelines shall be performed in accordance with Specification Item 936 by experienced personnel specially trained in locating breaks, obstacles, and service connections.

D. By-Pass Pumping: The Contractor shall provide for the flow of wastewater around the section, or sections, of pipe that are to be lined. The pump and bypass lines shall be of adequate capacity and size to handle the flow and in accordance with Specification Item 925.

E. Line Obstructions: It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, dropped joints, protruding service connections, or collapsed pipe that will prevent the proper insertion of the liner. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then the Contractor shall make an excavation point repair in accordance with Specification Item 932.

F. Notification of Utility Companies: The Contractor shall be responsible for notifying all utility companies of work on the sewer facilities. The Contractor shall notify appropriate utility departments so that all above and underground utilities can be protected at their locations identified prior to excavation. Any damage done to utilities by the Contractor shall be replaced by the Contractor at no cost to the OWNER.

G. Restoration of Surfaces: The Contractor shall be responsible for removal, protection, and replacement of all fences, shrubs, signs, pavement, etc. that interferes with the construction repair. The Contractor shall replace or repair sidewalks, driveways, culverts, inlets, curbing, gutters, shrubbery, trees, fences, improved sod, and other like obstructions removed or disturbed, to a condition equivalent to that existing prior to commencement of this work. Restoration of

asphalt topped flexible base and concrete base streets, driveways, and sidewalks shall be as specified in Specification Item 530.

H. Material Availability: The Contractor will be required to have all materials necessary for sewer rehabilitation, reconstruction, repair, or replacement on site prior to beginning excavation or installation.

926.4 Installation of Liner:

A. The Contractor shall designate a location where the uncured resin in the original containers and the unimpregnated liner will be impregnated prior to installation. The Contractor shall allow the OWNER to inspect the materials and "wet out" procedure. A resin and catalyst system compatible with the requirement of this method shall be used. The quantities of the liquid thermosetting materials shall be per the manufacturer's recommendations in order to provide the lining thickness as per the attached table.

B. The wet out liner material shall be inserted through an existing manhole, or other approved access, to fully extend the liner to the next designated manhole.

C. Liner Curing: After insertion is completed, the Contractor shall supply a suitable heat source and recirculation equipment. The equipment shall be capable of delivering hot water or steam to the far end of the liner, to uniformly raise the temperature in the entire line above the temperature required to effect a cure of the resin. This temperature shall be determined by the resin/catalyst system employed.

The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat. Thermocouples shall be placed between the liner and the invert at near and far manholes to determine the temperature of the liner and the time of exotherm. The temperature in the line during the cure period shall be per the resin manufacturer's recommendations.

Initial cure shall be deemed to be completed when inspection of the exposed portions of the liner appear to be hard and sound, and the thermocouples indicate that an exotherm has occurred. The cure period shall be of a duration recommended by the resin manufacturer.

D. Cool-Down: The Contractor shall cool the hardened liner to a temperature below 100° F before relieving the pressure in the tube. Cool-down may be accomplished by the introduction of cool water into the tube to replace the water, or steam, being drained from a small hole made in the end of the liner at the far manhole. Care shall be taken in the release of the static head such that a vacuum will not be developed that could damage the newly installed liner.

E. Finish: The finished lining shall be continuous over the entire length of an insertion run between two (2) manholes and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground, or from the ground to the inside of the lined pipe.

Any defects which will affect, in the foreseeable future or any warranty period, the integrity or strength of the linings shall be repaired at the Contractor's expense in a manner mutually agreed by the OWNER and the Contractor.

926.5 Sealing Liner in Manholes: If due to broken or misaligned pipe at the manhole wall, the lining fails to make a tight seal the Contractor shall apply a seal at that point. The seal shall be of a resin mixture compatible with the liner.

926.6 Service Lead: After the liner has been cured in place the Contractor shall reconnect the existing active service connections as designated by the OWNER. This shall generally be done by excavating and installing external taps. Remove a portion of the existing sewer around each service connection to expose liner pipe and provide sufficient working space for making new service connection. Connect service lead in accordance to Specification Item No. L306. Any by-pass pumping that is required to maintain service to residences, offices, shops, or any other facility shall be provided at no additional cost.

Maximum diameter service lead of four inches (4") permitted on six-inch (6") sewer line. Six-inch (6") stub-outs permitted on sewers eight inches (8") and larger. Unless otherwise approved, new service leads to be of same size as existing service leads. Provide adapters as may be required for transition from saddle to PVC pipe.

External service lead reconnection includes extending lead to structurally good condition existing pipe. Prior to backfilling where the existing sewer has been broken open, any adjacent annular space between the existing sewer and the new liner shall be sealed to preclude migration of the backfill material into this annular space. This annular space shall be sealed with cement grout.

926.7 Liner Testing: The watertightness of the liner shall be gauged while the liner is curing and under a positive head. After the work is completed the Contractor will provide the OWNER with a videotape showing both the before lined and after lined conditions including the restored connections.

926.8 Clean-Up: Upon completion of the installation work, and after required testing indicates the lining is acceptable, the Contractor shall restore the project area affected by his operation to condition equal to, or better than, that

which existed prior to construction operations, including solid sodding of St. Augustine grass areas. Solid sodding to be in accordance with Specification Item 901; hydro mulch other grassy area disturbed in accordance with Specification Item 165.

926.9 Measurement and Payment:

A. Cleaning and Televising of Sanitary Sewers: Cleaning and televising shall be paid for in accordance with Specification Item 936.

B. CIP Lining: The unit price bid for CIP lining a sanitary sewer shall be full compensation for all labor, materials, and equipment required to complete this project as per plans and specifications.

C. Lines Testing: Cost of lines testing including final television and video tape of the CIP lines complete in place shall be included in the unit price of the CIP lining.

D. Point Repairs: Point repairs shall be paid for in accordance with Specification Item 932. Terminal clean-outs or plugs, located at the upstream end of a section of line that are removed or excavated to facilitate cleaning, televising, and rehabilitation, will be paid for as a point repair under Specification Item 932 and shall include cost for the replacement of a new clean-out.

E. Service Lead Connection: Payment for reconnection of house, or building service leads, or stacks in accordance with Specification Item 933. Payment shall be full compensation for all materials, labor, and equipment necessary to locate and make these connections. Any number of houses or buildings discharging into common point of the sewer line will be counted as one, and only one, house connection. Service reconnections within limits of a point repair considered as incidental to point repair and no separate payment will be allowed.

F. Service Lead Extension: Pay for service lead extension of all sizes in accordance with Specification Item 933.

G. Removal and Replacement of Pavement: Driveways or sidewalk removal and replacement of pavement shall be paid for in accordance with Specification Item 530.

H. Restoration of Surfaces: No compensation for restoration of surfaces. Include cost in bid items for which it is a component.

I. By-Pass Pumping: By-pass pumping shall be paid for in accordance with Specification Item 925.

MINIMUM CIPP THICKNESS								
NOMINAL SEWER DIAMETER (INCHES)	PIPE INVERT DEPTH							
	UP TO 10 FEET		10-15 FEET		15-20 FEET		20-25 FEET	
	(INCHES)	(MM)	(INCHES)	(MM)	(INCHES)	(MM)	(INCHES)	(MM)
6	0.177	4.5	0.177	4.5	0.177	4.5	0.236	6.0
8	0.236	6.0	0.236	6.0	0.236	6.0	0.295	7.5
10	0.236	6.0	0.236	6.0	0.295	7.5	0.354	9.0
12	0.236	6.0	0.295	7.5	0.354	9.0	0.413	10.5
15	0.295	7.5	0.354	9.0	0.413	10.5	0.472	12.0
18	0.354	9.0	0.472	12.0	0.531	13.5	0.591	15.0
21	0.413	10.5	0.531	13.5	0.591	15.0	0.650	16.5
24	0.472	12.0	0.591	15.0	0.650	16.5	0.768	19.5
30	0.591	15.0	0.709	18.0	0.827	21.0	0.945	24.0
36	0.650	16.5	0.827	21.0	0.945	24.0	1.122	28.5
42	0.768	19.5	0.945	24.0	1.122	28.5	1.299	33.0
48	0.886	22.5	1.122	28.5	1.299	33.0	1.417	36.0
54	1.004	25.5	1.181	30.0	1.417	36.0	1.654	42.0
60	1.122	28.5	1.358	34.5	1.535	39.0	1.772	45.0