

ITEM 05603.1899 M - POLYESTER FORMED-IN-PLACE PIPE LINER

DESCRIPTION:

This work shall consist of sealing pipe joints, cleaning the existing pipe and furnishing and installing a one piece flexible felt tube liner impregnated with a thermosetting resin. The thermosetting resin shall be cured by circulating hot water to cure the liner into a rigid, tight-fitting, continuous impermeable pipe. The existing pipes to be lined are shown on the plans.

MATERIALS:

The flexible liner shall be fabricated from one or more layers of polyester felt into a single piece. A 0.254 mm thick layer of polyurethane, polyvinyl chloride, or similar impermeable material approved by the Engineer shall be bonded to the outside of the felt liner. Once inverted, the impermeable plastic membrane will become the inside of the pipe liner.

The one piece liner shall be fabricated to a size that, when installed, will neatly fit the internal circumference of the pipe and be of the thickness or thicknesses, specified on the plans. Allowance shall be made for circumferential stretching during insertion.

The minimum length shall be that deemed necessary by the Contractor and approved by the Engineer to effectively span the distance from access point to access point unless otherwise specified. The Contractor shall measure the lengths, diameters and all dimensions of the system to assure an exact fit before impregnation. One inversion run shall be made for the entire length of the culvert.

Concrete grout shall meet all requirements of Section 701-05, Concrete Grouting Material, of the New York State Standard Specifications for Construction and Materials.

Resin System. Unless otherwise specified, the Contractor shall furnish an unsaturated polyester resin and catalyst system compatible with the lining process. The mixture shall have the following physical characteristics:

PROPERTY	STANDARD	RESULTS
Tensile Stress	ASTM D-638	20,700 kPa
Flexural Stress	ASTM D-790	31,100 kPa
Flexural Modulus of Elasticity	ASTM D-790	1,725,000 kPa

Corrosion Requirements. The finished, in-place liner shall be fabricated from materials which, when cured, will be chemically resistant and able to withstand internal exposure to the chemical characteristics of the material flowing through it.

The Contractor shall furnish satisfactory written certification that the materials comply with the above material requirements.

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CONSTRUCTION DETAILS:

Sealing Pipe Joints. The Contractor shall clean and seal pipe joints with concrete grout to prevent any external material from leaking into the existing pipe. At the time of liner installation, no material shall be leaking into the pipe.

Cleaning of Line. After sealing the pipe joints, the Contractor shall clean the lines to the satisfaction of the Engineer immediately prior to the installation of the liner.

Inspection of Lines. Inspection of pipelines shall be performed by experienced personnel. Obstacles, breaks, and any connecting pipes shall be located by closed circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any conditions which may prevent proper installation of liner into the pipelines, and it shall be noted so that these conditions can be corrected.

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 insertion of the liner. If inspection reveals an obstruction that cannot be removed by conventional cleaning equipment, then the Contractor shall make point repair excavation to uncover and remove or repair the obstruction. Such excavation work and payment therefore shall be approved in writing by the Engineer prior to the commencement of the work.

Maintaining Flow The Contractor, when required, shall provide for maintaining flow around the sections of pipe designated for lining. A bypass shall be made by blocking off the system at an existing upstream location and pumping the flow into an alternate system and plugging any laterals at their upstream access points. The pump and bypass lines shall be of adequate capacity and size to handle the flow.

Installation of Liner. The Contractor shall designate a location where the uncured resin in the original containers will be vacuum-impregnated into the unimpregnated felt liner tube prior to installation. The Contractor shall allow the Engineer to inspect the materials and vacuum-impregnation procedure. A resin and catalyst system meeting the Materials requirements of this specification shall be used. The expiration date of acceptance of this material shall be one year after the date of manufacture.

The prepared liner form shall be inserted through an existing manhole or other approved access point by means of an inversion process and the application of a hydrostatic head sufficient to fully extend it to the next designated access point.

The liner form shall be inserted into the vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, the liner form shall be turned inside out and attached to the standpipe so that a leak proof seal is created. The hydrostatic head will be adjusted to be of sufficient height to invert the impregnated liner form from access point to access point, hold the liner tight to the pipe wall, and produce dimples at side connections. The use of the liner manufacturer's approved lubricant is recommended. Care shall be taken during the elevated curing temperature so as not to over stress the felt fiber.

The Contractor may propose other methods to install the liner which may be used upon approval by the Engineer.

In certain cases, the Contractor may elect to use a top inversion. In this method, the liner form is pre-

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inverted to a distance that corresponds to the required hydrostatic head and instead of attaching to an elbow at the base of the vertical inversion standpipe, it is attached to a top ring and the standpipe is formed from the liner form.

Curing. After inversion is completed, the Contractor shall supply a suitable heat source and water recirculation equipment. The equipment shall be capable of delivering hot water throughout the section to be cured by means of a perforated, pre-strung hose, to uniformly raise the water temperature above the temperature required to effect a cure of the resin. This temperature shall be recommended by the resin manufacturer.

Heat Source. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supplies. Another such gauge shall be placed between the impregnated liner form and the pipe invert at the remote access point to determine the temperature during cure.

Initial cure shall be deemed to be completed when inspection of the exposed portion of the liner reveal a hardened, impermeable liner and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the liner process. The water temperature shall remain constant for the duration of the cure period.

Cool Down. The Contractor shall cool the hardened liner to a temperature below 37°C before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end. Care shall be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed liner.

Finish. The finished liner shall be continuous over the entire length of the inversion run and free from visual defects, such as foreign inclusions, dry spots, pinholes and delaminations. It shall also meet the leakage requirements and pressure test specified below.

Any defects which will affect the integrity or strength of the liner shall be repaired at the Contractor's expense, in a manner acceptable to the Engineer.

Sealing Ends of Liner. If the liner fails to make a tight seal at termination points, the Contractor shall supply a seal at that point. The seal shall be of a resin mixture compatible with the liner and approved by the Engineer.

Connecting Pipes. After the liner has been cured in place, the Contractor shall reconnect the existing active connecting pipes as designated by the Engineer. This shall generally be done without excavation and in the case of non-man entry pipes, from the interior of the pipeline, by means of a television camera, and a cutting device that re-establishes connections to not less than 90 percent capacity.

Liner Testing. The water tightness of the liner shall be gauged while curing under a positive head. After the work is completed, the Contractor will provide the Engineer with a video tape showing the completed work, including the restored condition. The Contractor shall also submit a 0.6 m x 0.6 m long sample cut from the end of the inversion length. The sample shall be sent to the Materials Bureau Director.

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Clean Up Upon acceptance of the finished liner, the Contractor shall restore the project area affected by his operations.

METHOD OF MEASUREMENT:

Payment for this work shall be made on a lump sum basis.

BASIS OF PAYMENT:

The lump sum price bid shall include the cost of furnishing all labor, materials and equipment necessary for maintaining flow, measuring the culvert for proper fit of the liner, closed circuit television inspection, sealing pipe joints, cleaning of pipes, including necessary water, all water required for the installation of the liner and all other labor, materials and equipment necessary and required to complete the work and make the system function to the satisfaction of the Engineer except that any unanticipated excavation shall be paid separately.

Payment will be made under:

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>PAY UNIT</u>
05603.1899nn M	Polyester Formed In-Place Pipe Liner	LS

Note: "nn" denotes serialized item, see Subsection 101-53.