STATE **OF** **TENNESSEE**

May 17, 2021 January 1, 2021

SPECIAL PROVISION

REGARDING

FOLDED PVC PIPE LINER

Description

This work consists of furnishing, installing, and providing all labor, materials, and equipment necessary to rehabilitate existing roadway pipe by the heating, insertion, and expansion of folded polyvinyl chloride (PVC) pipe liner.

The required hydraulic capacity of the host pipe shall be determined and then improved or maintained by this rehabilitation.

Material

A. Folded Polyvinyl Chloride (PVC) Pipe Liner

The folded PVC pipe liner shall be manufactured with virgin or reworked PVC compounds meeting the properties for classifications 12334, 13223, 32334, 32111, 12111, or 33223 in ASTM D1784.

The folded PVC pipe liner shall be fabricated to a size that will fit the internal circumference of the pipe as specified by the Engineer. Allowance for circumferential expansion during installation shall be made.

The folded PVC pipe liner material shall be made from a compound meeting the following requirements:

Table 607FP-1: PVC Physical Properties:

Impact Strength (Izod)	0.65 ft-lb/in. of notch
Tensile Strength	4,500 psi
Tensile Modulus	360,000 psi
Flexural Strength	7,500 psi
Flexural Modulus	360,000 psi

The recommended nominal folded PVC pipe liner sizes are applicable for a range of host pipe inside diameters as indicted in **Table 607FP-2.**

Table 607FP-2: Recommended Range of Use

Folded PVC Liner Pipe O.D. (nominal), inches	Recommended Host Pipe I.D., inches	Folded PVC Liner Pipe wall thickness (nominal), inches	Dimension Ratio
18	17.6 - 18.2	0.300 – 0.500	60 - 35
24	23.5 - 24.3	0.300 – 0.500	80 - 48
30	29.5 - 30.3	0.300 – 0.500	100 - 60
36	35.5 - 36	0.300 – 0.500	120 - 72

B. Grouts

Grouts used for the reestablishment of pipe inverts shall meet the requirements of **921.09** – Type 1. Alternate grouts recommended by the manufacturer may be used upon approval of the Engineer.

Certification

When requested by the Engineer, furnish a manufacturer's signed certification that the folded PVC pipe liner material was manufactured, sampled, tested, and inspected, and meets requirements. If requested, submit a report of the test results certification signed by an authorized agent of the manufacturer.

Installation of folded PVC pipe liner shall be performed by personnel who are recognized by the manufacturer as an authorized installer.

Product Marking

The folded PVC pipe liner shall be clearly marked at intervals of 5 feet or less as follows:

1. Manufacturer's name or trademark and code,
2. Nominal outside diameter,
3. The legend "DR XX Folded PVC Pipe,"
4. Production date code

Packaging

The full length and wall thickness of the folded PVC pipe liner is heated and coiled onto a reel in a continuous length in a reduced cross section of either a "C" or an "H" at the time of manufacture for storage and shipping in accordance with the manufacturer's recommendations.

Equipment

Provide all necessary equipment for satisfactory completion of the work including restoration of the site.

Construction Requirements

A. Inspection of Existing Pipelines

Inspection of existing pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television.
The interior of the pipeline shall be inspected carefully to determine the location of any conditions that may prevent proper installation of the folded PVC pipe liner, such as protruding service taps, collapsed or crushed pipe, out-of-roundness, significant line sags, and deflected joints. These conditions should be noted and corrected prior to installation.

The existing pipeline shall be clear of obstructions that will prevent the proper insertion and full expansion of the folded PVC pipe liner such as offset joints of more than 12.5 % of inside pipe diameter service connections that protrude into the pipe more than 12.5 % of the inside pipe diameter or 1 inch, whichever is less; and, other reductions in cross-sectional area of more than 10 % based on the inside diameter of the existing pipe.

If inspection reveals an obstruction that cannot be removed by conventional equipment, then a point repair excavation shall be made to uncover and remove or repair the obstruction. Typically, bends along the pipe length in excess of 30° and changes in pipe size cannot be accommodated along an insertion length of the folded pipe.

Such conditions require access at these points for termination and start of a new insertion.

B. Installation

1. Insertion

The method of installation shall be compatible with the manufacturer's recommended practices. Verify the lengths in the field before insertion of the folded PVC pipe liner. The minimum folded PVC pipe liner length shall span the distance from the inlet to the outlet of the existing pipe.

The folded PVC pipe liner shall be brought to the work site in an apparatus suitable for applying heat to the PVC pipe. To make the folded PVC pipe liner pliable enough to be easily removed from the coil and to remove any “reel set”, the coil shall be heated to a temperature as determined by the manufacturer. The temperature shall be maintained in the heating chamber for a minimum of 1 hour to fully heat the length of folded PVC pipe liner to be inserted. Shorter insertion lengths may be fully heated over a shorter time period.

The folded PVC pipe liner shall be inserted into the pipe through existing structures, if needed, without modification of the structures.

A cable shall be strung through the existing pipe and attached to the folded PVC pipe. The folded PVC pipe liner shall be heated along the entire length and fed through the insertion point. The heated folded PVC pipe liner shall be pulled into the existing pipe using a cable from a winch connected through the lumen of the existing pipe and attached to the end of the folded PVC pipe.

Maintain the feed with the folded PVC pipe reel to avoid stretching the material with the winch cable. Pulling forces shall be monitored so as not to exceed the axial strain limits of the folded PVC pipe material. Pull enough material to allow for insertion of a flow-through plugs at the termination points.

After insertion is complete, cycle down the steam temperature to allow the folded PVC pipe liner to relax and reduce tensile stress on the material. During the relaxation cycle, the ends of the will tend to contract. It may take several heating/cooling cycles until the folded PVC pipe material liner has relaxed and is no longer contracting.

2. Expansion

Steam monitoring methods and forming period shall be recommended by the manufacturer.

The equipment shall be capable of delivering steam through the folded PVC pipe liner to uniformly raise the temperature and pressure to effect forming of the PVC pipe. This temperature and pressure shall be determined by the system employed. The heat source shall be fitted with suitable monitors to gauge the steam temperature and pressure at the input and exhaust ends of the folded PVC pipe.

Insert flow-through plugs into ends of folded PVC pipe liner. Ensure plugs are adequately restrained. Through the use of heat and pressure, the folded PVC pipe liner shall be expanded fully.

Expansion pressures shall be sufficient to unfold the PVC pipe liner, press it against the wall of the existing pipe, and form dimples at service connections. Folded PVC pipe expansion pressures typically are in the range of 0.25 to 3 psi, but not to exceed 5 psi (safety measure), depending on liner size, or other site conditions.

3. Cool Down

The formed PVC pipe liner shall be cooled to a temperature below 100°F before relieving the pressure required to hold the PVC pipe against the existing pipe wall. After the formed PVC pipe liner has cooled down, where applicable the terminating ends shall be trimmed to at least 2 inches beyond the existing pipe.

4. Connections

After the formed PVC pipe liner has been installed, the existing connections shall be reconnected. This should be done without excavation from the interior of the pipeline by means of a television camera and a remote-control cutting device unless otherwise specified by the Engineer.

5. Inspection and Acceptance

The installation may be inspected by closed-circuit television. The formed PVC pipe liner shall be continuous over the entire length of the insertion and conform to the walls of the existing pipe by visible joint definition and mirroring of existing pipe irregularities. The formed PVC pipe liner shall be as free as practical from visual defects such as foreign inclusions and pin holes.

Variations from true line and grade may be inherent because of the conditions of the existing pipeline. No infiltration of groundwater through the formed pipe wall should be observed. All service entrances should be accounted for and be unobstructed.

If the PVC pipe liner fails to install properly, as determined by the Engineer, remove the failed liner, if not able to be reprocessed, and replace it with a new PVC pipe liner at no additional cost to the Department.

6. **Sealing at Structures:**

If, due to broken or offset pipe at the structure wall, the PVC pipe liner fails to make a tight seal, apply a seal at that point. The seal shall be of a material compatible with the PVC pipe liner material.

7. Clean-up:

Restore or replace removed or damaged structures disturbed by the work. Restore the project area to a condition equal to that before the work began, to the satisfaction of the Engineer, and shall furnish all labor and material incidental.

Surplus PVC pipe material, tools and temporary structures shall be removed after completion of the work. All dirt and trash from the operation shall be legally disposed of , and the work site shall be left clean to the satisfaction of the Engineer.

Method of Measurement

The Department will measure the Folded PVC Pipe Liner by the linear feet complete in place and accepted.

Basis of payment

The Department will pay for accepted quantities, complete in place, at the contract prices as follows:

Item No.	Description	Unit
607-67.10	18” FOLDED PVC PIPE LINER	LINEAR FEET
607-67.11	24” FOLDED PVC PIPE LINER	LINEAR FEET
607-67.12	30” FOLDED PVC PIPE LINER	LINEAR FEET
607-67.13	36” FOLDED PVC PIPE LINER	LINEAR FEET

Such payment will be full compensation for all work specified including labor, materials, equipment, tools, and incidentals to complete the work.