

MACHINE SPIRAL WOUND PVC LINER USING THE SPR™ EX METHOD

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for machine spiral wound polyvinyl chloride (PVC) pipe liner using the SPR™ EX installation method.

1.2 SUMMARY

- A. Machine spiral wound PVC liner is intended for use in the rehabilitation of sanitary and storm sewers without excavation. The lining process uses a continuous one-piece PVC profile strip, which is machine wound directly into the deteriorated pipeline from an existing access chamber or manhole.
- B. The system consists of a single, one-part PVC profile strip with “T” shaped ribs on one side. The edges of the strip interlock as it is spirally wound to form a liner inside the host pipe.
- C. A range of PVC profiles are available with different profile, rib and thickness configurations to match project design requirements.
- D. The winding process is continuous until the complete length of the existing pipe between access points or manholes has been lined.
- E. The liner is wound at a fixed diameter, leaving an annular space between the liner and host pipe wall. It is then radially expanded by mechanical means, without the applications of heat, until the liner makes contact with the inside wall of the existing pipe.

1.3 REFERENCES

- A. ASTM D 256: Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
- B. ASTM D 638: Standard Test Method for Tensile Properties of Plastics
- C. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- D. ASTM D 1784: Standard Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds
- E. ASTM F 1697-18: Standard Specification for Poly Vinyl Chloride (PVC) Profile Strip for Machine Spiral-Wound Liner Pipe Rehabilitation of Existing Sewers and Conduits

- F. ASTM F 1741-18: Standard Practice for Installation of Machine Wound Poly Vinyl Chloride (PVC) Liner Pipe for Rehabilitation of Existing Sewers and Conduits

PART 2 - MATERIALS

2.1 MATERIAL COMPOSITION

- A. The extruded profile strip shall be made from unplasticised PVC compounds meeting the minimum requirements for cell classification 13354 or higher, as defined in ASTM D 1784.
- B. PVC profile strip for machine spiral wound liner pipe rehabilitation of existing sewers shall comply with ASTM F 1697-18, except as modified herein.

2.2 MATERIAL AND EQUIPMENT ACCEPTANCE

- A. At the time of manufacture, each lot of extruded profile strip shall be inspected for defects and tested for physical properties as specified. A “lot” is defined as a continuous extrusion run of a given profile designation on a spool.
- B. PVC profile strip minimum dimensions and initial stiffness factors shall be in accordance with Table 1 below. In accordance with ASTM F 1697-18, other profile configurations are permitted, provided similar details are provided as in Table 1.

TABLE 1

Profile Type	Minimum Width		Minimum Height		Minimum Waterway Wall		Minimum Initial Stiffness Factor (EI)	
	mm	(in.)	mm	(in.)	mm	(in.)	MPa-mm ³	(in ³ – lbf/in ²)
1	51.0	2.00	5.5	0.216	1.4	0.0551	21.2x10 ³	188.0
2	80.0	3.14	8.0	0.314	1.4	0.0551	63.4x10 ³	561.0
3	121.0	4.76	13.0	0.511	1.6	0.0630	242.7x10 ³	2148.0
7	121.0	4.76	19.0	0.748	2.1	0.0830	450x10 ³	3983.0

Note: Initial Stiffness Factors are derived from testing in accordance with ASTM D 790 as modified by ASTM F1697-18, using flat strips of profile

- C. The following values of modulus of elasticity of PVC shall be used in design:
 Short Term: 400,000psi (2,750 MPa)
 Long Term: 116,000psi (800 MPa)
- D. Design stiffness values for a specific PVC profile strip are available from the manufacturer.

- E. Sealants and gaskets necessary for effective interlocking of the edges of PVC strip are pre-applied at the time of manufacture. They shall be suitable for use in a sewer environment.

2.3 MATERIAL TESTING

- A. Before installation of the liner has commenced, a sample of profile from each production run shall be tested to confirm that the value of initial stiffness factor detailed in Table 1 exceeds specified minimum values.

2.4 MARKING

- A. Each PVC profile strip shall be distinctly marked on its inside surface at intervals not to exceed 60 inches with a code number identifying the manufacturer, plant, date of manufacture and shift, and profile type. This information shall also appear on each reel.

PART 3 - EXECUTION

3.1 INSTALLATION AND FIELD INSPECTION

- A. Installation of machine spiral wound PVC liner pipe for rehabilitation of existing sewers shall comply with ASTM F 1741-18 except as modified herein.
- B. The existing pipeline shall be cleaned of any obstructions, to a standard suitable for installation of the liner, and televised. All existing live service connections shall be precisely located longitudinally and radially and logged for subsequent reinstatement following installation of the liner.
- C. Bypass pumping is not mandatory for installation of the spiral wound liner. The Contractor shall be responsible for deciding the need for flow diversion to allow successful liner installation.
- D. During installation the winding machine shall perform the following operations simultaneously:
 - A continuous ribbed liner profile strip is supplied from a reel and fed down through the existing manhole to the winding machine positioned at the base of the manhole
 - Joint lubricating sealant shall be placed into the primary lock of the self-interlocking edges of the ribbed profile (Note: An elastomeric adhesive, which prevents the liner from expanding prematurely during winding, is applied to the secondary lock during manufacture of the ribbed profile)
 - High tensile wire shall be inserted (Note: The wire remains only temporarily as it is pulled out during the expansion stage)
 - The winding machine winds the PVC strip into a liner pipe by interlocking the edges

- Winding continues until the full length of the deteriorated pipe between manholes has been lined
 - The liner is then radially expanded by mechanical means, without the application of heat, until the liner makes contact with the inside wall of the existing pipe
- E. End seals between the liner pipe and the existing pipe shall be installed with a sealing material that is compatible with the liner pipe material.
- F. The transition between the liner invert and the invert in the manhole base shall be rendered smooth to reinstate the sewer flow line.

3.2 SERVICE CONNECTIONS

- A. The Contractor shall reinstate all live junctions immediately after installation of the liner. Service connections may be reinstated by excavation or internally.
- B. The service connection openings shall conform to the shape and size of the inside diameter of the existing service connection. Service connection openings shall be reinstated to 95 -100% of their diameter and free from rough edges or protrusions.

3.3 POST INSTALLATION INSPECTION

- A. A closed-circuit television (CCTV) inspection shall be carried out after installation to establish that the lining has been installed as specified and all live junctions have been reinstated.
- B. The finished lining shall be free of defects that would affect long term strength or hydraulic performance.