

SECTION 606 - PVC MANHOLE LINER

1. GENERAL

This specification covers the supply and installation of a vacuum-formed semi-rigid liner for use in wastewater concrete structures to effectively shield the interior of the structure from corrosion.

A. The design of the liner system shall ensure that it will conform to the contour of the structure and form a permanent mechanical bond to the concrete through use of preformed horizontal ribs and dovetails. The liner shall be formed in such a manner that the joints between the structure sections will be afforded protection using a continuous PVC return into the joint for a minimum of 0.5 inches. Provisions will be made to allow the pipe penetrations. (See Section 6.B)

2. MATERIAL

Liner shall be Dura-Plate 100 as manufactured by A-LOK Products, Inc., Tullytown, Pennsylvania or approved equal.

A. Composition

1. The material used in the liner, channel joints, H-joints and corner joints shall be manufactured from an acrylic PVC Alloy.
2. The sheet compound shall be semi-rigid and capable of thermoforming to the contours of the structure with a minimum wall thickness of 0.065 inches.
3. The fabricated liner panels shall be joined together with a slotted strip of EPDM rubber between the panels in accordance with the manufacturer's recommendations.
4. Sections of lined concrete structures shall be joined together by an approved butyl strip designed to produce sufficient squeeze-out between PVC returns. Butyl compounds shall be formulated to meet the chemical resistant properties of Section 2.B.1.

B. Physical Properties.

1. All the materials shall meet the following physical and chemical resistant properties. The semi-rigid liner sheets, joint assembly components, corners and weld strips shall have the following properties when tested at 77° F \pm 5°.

Chemical Resistant:

Chemical Solution	Concentration
Sulfuric Acid (H ₂ SO ₄)	20%
Sodium Hydroxide (NaOH)	5%
Ammonium Hydroxide (NH ₃ OH)	5%
Nitric Acid (HN ₃)	1%
Ferric Chloride (FeCl ₃)	1%
Soap	0.10%
Detergent	0.10%

Physical Properties of Liner Panel:

<u>Test</u>	<u>ASTM Method</u>	<u>Minimum Value</u>
Tensile	D-638	6,100 psi
Elongation	D-638	28.5%
Tensile Modulus	D-638	325,000 psi
Flexural Strength	D-790	9,200 psi
Flexural Modulus	D-790	340,000 psi
Tensile Impact	D-1822	640 in-lb
Gardner Drop Dart	D-5420	90 ft-lb/in ²

1. The liner shall be made from Acrylic PVC Alloy sheets that resist bacteriological and fungal development. The sheet shall not readily provide a source of nutrients for bacteria and fungi. Plasticizers that allow a source of nutrients which support microbial growth for bacterial or fungal growth shall not be permitted.

2. The sheets shall be subjected to fungus resistance testing in accordance with ASTM G-21 and bacteria resistance testing in accordance with ASTM G22 – Procedure B.

C. DETAILS AND DIMENSIONS OF STANDARD LINER

1. Liner panels shall have a minimum thickness of 0.065 inches. A combination of standing ribs and mechanical dovetails shall be used to secure the liner panels to the wall of the structure and spaced no more than 6 inches apart.

2. Liner panels with a combination of standing ribs and dovetails in diameters of 48” through 60” shall be at least 0.50 inches high. Panels of 72” diameters and greater shall be at least 0.75 inches high.

3. Liners with locking extensions shall be able to withstand a test pull of 100 pounds per linear inch applied perpendicular to the concrete surface for a period of 60 seconds.

No rupture of the locking extensions or withdrawal from the embedment shall be acceptable. This test shall be made at a temperature between 70-80 degrees Fahrenheit.

4. Liner panels shall be formed to the correct radius to assure a true diameter match between joined precast sections when assembled.

5. Liner panels shall be formed with a continuous return into the joint for a minimum of 0.50 of an inch which shall afford protection between the lined precast sections.

6. All radius panels shall be vacuum tested for pinholes during the molding process and shall withstand a minimum of 25 inches of mercury for a period of 60 seconds.

7. Panel sections shall be custom formed to a specified height not to exceed 6 feet in overall length. Lengths specified shall include a tolerance ratio of +/- 0.0625 per foot.

3. PLANT INSTALLATION OF LINING

A. Installation of all lining shall be in accordance with the manufacturer's recommendations.

B. Lining coverage shall not be less than the minimum shown on the approved shop drawings or construction plans.

C. The liner panels when assembled shall form a circular cylinder that fits snugly against the inner steel core of the form. A removable extruder rubber profile or suitable one-sided tape can be used to seal the liner against the core to prevent concrete fines from washing down between the liner and steel core.

D. Concrete poured around the liner shall be distributed evenly to prevent shifting of the liner.

E. Concrete poured against the liner shall be vibrated or compacted in a manner to protect the liner and produce a dense homogenous concrete to securely anchor the assembly to the exposed surfaces on the interior of the structure.

F. When extracting the steel core, care should be taken to protect the liner from damage. Instruments with sharp or jagged edges should not be used to release the forms from the liner.

G. Visual inspection of the liner shall be made after demolding, and any cuts or tears shall be repaired by following the manufacturer's repair recommendations.

H. The concrete producer shall take all necessary measurements to prevent damage due to casting, demolding, and delivery of the lined concrete structure.

4. FIELD INSTALLATION OF LINING

A. Field installations of all lined precast sections shall be done in accordance with the recommendations of the manufacturer.

- B. The horizontal joints between sections of lined concrete structures can be made by butyl or a combination of butyl and rubber joint per the recommendation of the concrete manufacturer.
- C. Joint surfaces must be clean to ensure proper adhesion of the butyl. An application of butyl-based primer will produce the highest degree of adhesion to the joint surface.
- D. Place specified butyl material per the manufacturer's recommendations. Butt ends of material together. Material should never overlap. Butyl material shall be an approved strip per Section 2.A.4.
- E. Lined sections should be carefully centered and lowered to complete the coupling process. Apply sufficient pressure to properly seat the joint and achieve squeeze-out.
- F. After the structure is in place, care should be taken to properly plug all lift pin inserts or holes with a suitable non-shrink grout.
- G. Care shall be taken to prevent damage to the liner due to material handling, installation or equipment or material used in the installation process or material taken in or out of the structure.

5. TESTING AND INSPECTION

- A. The liner manufacturer shall test each panel to withstand a constant vacuum of 25 inches of mercury for a period of 60 seconds. Any sections failing to meet this requirement shall be rejected.
- B. In-plant inspections of panels cast into concrete sections shall be visually inspected for cuts or tears and shall be repaired following the manufacturers recommendations.

6. LINER APPURTENANCES

A. STEPS

- 1. Steps shall not be installed.

B. HOLE LINERS

- 1. Pipe penetrations through the lined wall shall be afforded protection by applying 0.125 inch trowelable, chemical and corrosion resistant epoxy mortar to the unlined exposed areas within the opening and shall overlap the liner wall a minimum of 1.5 inches. The epoxy mortar shall be Dura-Plate 100 as manufactured by A-Lok or approved equal.
- 2. Pipe penetrations through the lined wall shall use Z-Loc boot connectors as manufactured by A-Lok or approved equal.