



Ameron Arrow-Lock[®]

Sheet Lining System

Patent #5,580,406

Specifications

1. General

This specification covers the supply and installation of a lining system, including a PVC sheet lining with locking extensions, a two-part epoxy mastic and epoxy mastic primer, for the rehabilitation of corroded, but structurally sound, concrete structures such as manholes, lift stations, digesters, primary effluent channels, sludge wet wells, primary sedimentation tanks, headworks and other such areas. To accomplish this the liner must be continuous and free of pinholes both across the joints and in the liner itself.

All work, for and in connection with the installation of the lining and the field sealing and welding of joints, shall be done in strict conformity with all applicable specifications, instructions and recommendations of the lining manufacturer.

The manufacturer of the lining shall furnish an affidavit attesting to the successful use of its PVC lining material in similar service for a minimum period of 50 years in sewage conditions recognized as corrosive or otherwise detrimental to concrete.

2. Materials

2.1 Description

- 2.1.1 Liner shall be Arrow-Lock Sheet Liner as manufactured by Ameron Protective Lining Products, Brea, California.
- 2.1.2 Primer for use prior to application of intermediate layer shall be Arrow-Lock Mastic Primer No. 5101 as supplied by Ameron Protective Lining Products, Brea, California.
- 2.1.3 Mastic for intermediate layer shall be Arrow-Lock Mastic, No. 9912 2:1 epoxy gel mastic as supplied by Ameron Protective Lining Products, Brea, California.
- 2.1.4 Application/Installation - All specified materials shall be installed in strict accordance with the manufacturer's application or installation instructions.

NOTE:

If external ground water is present, de-watering procedures must be continued for a minimum of 24 hours after final installation of mastic, Arrow-Lock and welding strips.

2.2 Materials Composition

- 2.2.1 The material used in the liner, welding strips, joint strips and other accessory items, shall be a combination of polyvinyl chloride resin, pigments and plasticizers, specially compounded to remain flexible. Polyvinyl chloride resin shall constitute not less than 99 percent, by weight, of the resin used in the formulation. Copolymer resins will not be permitted. Recycled materials may not be purchased for use in the composition.

2.3 Physical Properties

- 2.3.1 All plastic liner plate sheets, welding strips, joint strips and other accessory items, shall have the following physical properties when tested at 77°F± 5° (25°C±3°).

Property	Initial	(Par. 2.4)
Tensile Strength	2200 psi min. (15 MPa min.)	2100 psi min. 14.5 MPa min.)
Elongation at break	200% min.	200% min.
Shore durometer, Type D (with respect to initial test result)	1-sec. 50-60 10-sec. 35-50	±5 ±5
Weight change		1.5%

- 2.3.2 Tensile specimens shall be prepared and tested in accordance with ASTM D412 using Die B. Weight change specimens shall be 1-inch (25-mm) by 3-inch (75-mm) samples. Specimens for testing of initial physical properties may be taken from liner plate sheet and welding strip at any time prior to final acceptance of the work.
- 2.3.3 Liner plate locking extensions embedded in mastic shall withstand a test pull of at least 20 pounds per linear inch (3.58 kg/cm), applied perpendicularly to the concrete surface for a period of one minute, without rupture of the locking extensions or withdrawal from the intermediate mastic layer or delamination of the mastic from the concrete substrate. This test shall be made at a temperature of 70° - 80°F (21° - 27°C) inclusive and not before mastic has cured at least 7 days.
- 2.3.4 All plastic liner sheets, including locking extensions, all joint, corner and welding strips shall be free of cracks, cleavages or other defects adversely affecting the protective characteristics of the material. The engineer may authorize the repair of such defects by approved methods.

2.3.5 The PVC lining shall have good impact resistance, shall be flexible and shall have an elongation sufficient to bridge up to 1/4" (6mm) settling cracks, which may occur in the concrete or in joints after installation without damage to the lining.

2.3.6 The lining shall be repairable at any time during the life of the rehabilitated structure.

2.4 Chemical resistance

2.4.1 General

NOTE: This is to be used as a pre-qualification test and a requalification test when material formulations are changed.

2.4.2 Sheet Lining

After conditioning to constant weight at 110°F (43°C), tensile specimens and weight change specimens shall be exposed to the following solutions for a period of 112 days at 77°F±5° (25°C±3°).

At 28-day intervals, tensile specimens and weight change specimens shall be removed from each of the chemical solutions and tested in accordance with paragraph 2.3.2.

If any specimen fails to meet the 112-day requirements before completion, the material will be subject to rejection.

Chemical Solution	Concentration
Sulfuric acid	20%**
Sodium hydroxide	5%
Ammonium hydroxide	5%**
Nitric acid	1%**
Sodium hypochlorite	1%
Ferric chloride	1%
Soap	0.1%
Detergent (linear alkyl benzyl sulfonate or LAS)	0.1%
Bacteriological	BOD not less than 700 ppm.

**Volumetric percentages of concentrated C.P. grade reagents

2.5 Details and dimensions of basic size sheets (4-foot widths)

2.5.1 Liner sheets shall be a minimum of 0.065 inch (1.65 mm) in thickness. Locking extensions (arrow-shaped) of the same material as that of the liner shall be integrally extruded with the sheet. Continuous locking extensions shall be approximately 2 inches (51mm) apart and shall be approximately 1/4" (6-mm) high.

2.5.2 Sheets shall have a nominal width of 48 inches (1220 mm) and a length of not more than 96 inches (2440 mm), except that longer lengths may be supplied on special order. Lengths specified shall include a tolerance at a ratio of ±1/4" (6mm) for each 100 inches (2540 mm).

2.5.3 Sheets not used for shop fabrication into larger sheets shall be shop tested for pinholes using an electrical spark tester set between 18,000 and 22,000 volts. Any holes shall be repaired and retested.

2.5.4 Special sized, factory prewelded and tested sheets shall be available on special order.

3. Installation of Lining

3.1 General

3.1.1 Installation of the lining, including preheating of sheets in cold weather and the welding of all joints, shall be done in accordance with the recommendations of the liner manufacturer.

3.1.2 Coverage of the lining shall not be less than the minimum shown on the plans.

3.1.3 The lining is normally installed with the locking extensions running vertically in the structure.

3.1.4 All cut, torn and seriously abraded areas in the lining shall be patched according to manufacturer's instructions.

3.1.5 Hot joint compounds, such as coal tar, shall not be poured or applied to the lining until all welding has been completed.

3.1.6 The contractor shall take all necessary measures to prevent damage to installed lining from equipment and materials used in or taken through the work.

3.2 Joints in Lining

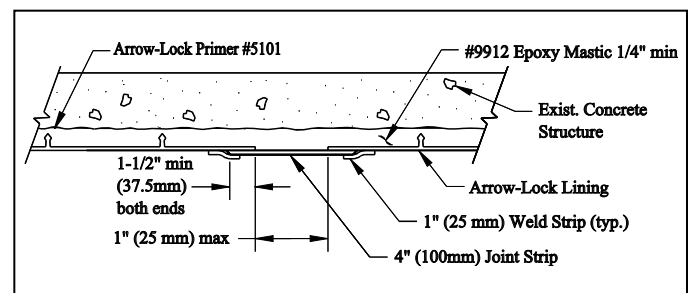
3.2.1 Lining at joints shall be free of all mortar and other foreign material and shall be clean and dry before joints are made.

3.2.2 Field joints in the lining shall be of the following described types, used as prescribed:

Type AL-1:

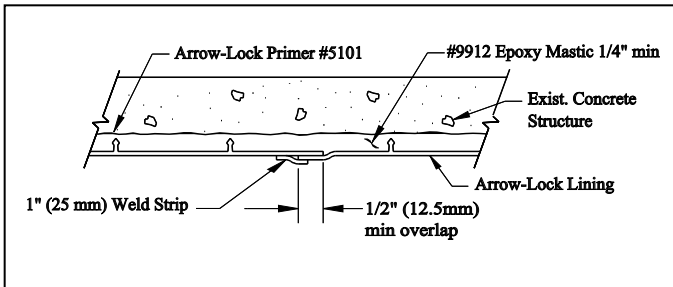
The joint shall be made with a separate 4-inch (100 mm) wide joint strip. The spacing between the two lining sheets to be joined shall not exceed 1 inch. A 1-inch (25 mm) weld strip shall be fuse-welded on each side of the (100 mm) wide joint strip in strict accordance with the manufacturer's instructions. (Ref. Ameron PLP Dwg. No. PLD-AL-010)

Figure 1 - Type AL-1 Joint



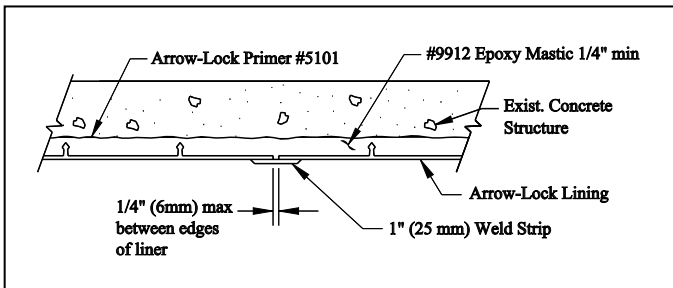
Type AL-2: The joint shall be made with a 1-inch (25mm) wide weld strip. The two lining sheets to be joined shall be overlapped a minimum of 1/2" (12.5 mm). The upstream sheet shall overlap the one downstream (if applicable). The lap shall be heat-sealed into place prior to fuse welding on the 1-inch wide weld strip. (Ref. Ameron Protective Lining Division DWG. No. PLD-AL-010)

Figure 2 - Type AL-2 Joint



Type AL-3: The joint shall be made with a 1-inch (25mm) wide weld strip. The two lining sheets to be joined shall be aligned with a 1/4 inch (6 mm) maximum gap between the sheets. The weld strip shall be centered over the gap and hot-air fuse-welded according to the manufacturer's instructions. (Ref. Ameron Protective Lining Division DWG. No. PLD-AL-010)

Figure 3 - Type AL-3 Joint



3.2.3 All welding is to be in strict conformance with the specification of the lining manufacturer.

3.2.4 Refer to Arrow-Lock application instructions ALL.

3.3 Testing and repairing damaged surfaces

3.3.1 After the lining is installed, all surfaces covered with lining, including welds, shall be visually inspected for integrity of welds and lining surfaces. Any loose joints, punctures or tears in lining shall be repaired using method approved by the lining manufacturer.

3.3.2 All welds shall be physically tested by a nondestructive probing method using a blunt instrument such as a putty knife.

Warranty

Ameron warrants that this product conforms to the specific description in Ameron trade literature as to character and quality of raw materials, workmanship and adaptability for recommended use. Within one year from date of purchase, Ameron shall supply replacement material for this product or any portion thereof, or at its option equivalent material, F.O.B. Ameron manufacturing facility, if it fails to meet the foregoing warranty, provided that installation and application of the product have been properly accomplished and that Ameron has been promptly notified of the defect.

The preceding constitutes the sole remedy of the Buyer and the sole liability of Ameron for product defect.

No other express or implied warranties, whether of merchantability or of fitness for any particular purpose or use, shall apply. Ameron shall not be responsible for consequential damages.

Ameron's Standard Terms and Conditions of Sale apply to purchase of this product.

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Ameron Protective Lining Products • 201 North Berry Street, P.O. Box 1629 • Brea, California 92822
Phone: (714) 256-7755 • Fax: (714) 256-7750 • E-mail: t-lock@ameron.com • www.amerontlock.com

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