



Standard Specification for Linings for Asbestos-Cement Pipe¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers requirements for plastic linings to be applied to asbestos-cement pipe, designed for special service in carrying corrosive fluids. This specification also covers methods of testing plastic lining material as well as sections of lined pipe. The requirements established by this specification shall serve as a guide in, but not the sole basis for, judging the suitability of the product for a particular service. The selection of the material should include consideration of performance in similar applications or testing under the intended service condition.

NOTE 1—To determine the suitability of the product for a particular service or corrosive fluid, refer to the manufacturer for specific recommendations.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 The following precautionary caveat pertains only to the test method portion, Section 9, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

D 543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents²

D 714 Test Method for Evaluating Degree of Blistering of Paints³

D 2946 Terminology for Asbestos and Asbestos-Cement Products⁴

3. Terminology

3.1 Definitions:

3.1.1 *coupling*—fitting made from a larger diameter pipe of at least the same type and class, for joining asbestos-cement pipe that, when properly installed with the proper accessories, develops a joint equivalent in strength and serviceability to the pipe joined.

3.1.2 *lot*—quantity of pipe of a given size and class manufactured during the same shift.

3.1.3 *plastic lining*—a lining formed principally from thermoplastic or thermosetting polymer. The term “plastic coating” is synonymous with the term “plastic lining” with respect to composition.

3.2 Additional terminology is presented in Terminology D 2946.

4. Adhesion Requirements

4.1 Thermosetting polymer linings and those thermoplastic linings that do not rely on mechanical means to hold them to the pipe wall shall have a strong permanent bond to the pipe wall. No sign of peeling or any other form of separation of the lining from the pipe wall is permissible when tested in accordance with 9.2.1.

4.2 If bubbles or blisters appear after testing and are smaller and fewer than Reference Standard 6F of Test Method D 714, a pull-out test shall be performed in accordance with 9.2.2. The adhesion shall be considered acceptable if the results from the pull-out tests exceed 2.75-MPa (400-psi) stress or if at least 75 % of the fractured surface is covered by asbestos cement pulled from the substratum. Retesting shall be required if the failure occurs between the metal contact piece and the lining. Samples with bubbles or blisters that are larger and more dense than Reference Standard 6F shall be considered rejected.

NOTE 2—Pipes producing such bubbles or blisters during testing may be expected to exhibit similar characteristics during actual service.

5. Chemical Requirements

5.1 The plastic lining used shall be highly resistant to acids and alkalis, and shall be completely resistant to acids generated by the hydrogen sulfide corrosion cycle.

5.2 The plastic lining shall withstand a 5 mass % sulfuric acid solution and a 5 mass % sodium hydroxide solution, when

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² Annual Book of ASTM Standards, Vol 08.01.

³ Annual Book of ASTM Standards, Vol 06.01.

⁴ Annual Book of ASTM Standards, Vol 04.05.



tested in accordance with 9.1.1 and 9.1.2, without degradation or loss of its protective qualities.

5.3 The plastic lining material shall have a weight change not greater than 0.5 % after 7 days immersion and not greater than 0.9 % after 30 days immersion when tested as required in Table 1 when tested in accordance with 9.1.3.

6. Dimensions

6.1 To provide satisfactory abrasion resistance and to ensure the continuity of the lining of the plastic-lined pipe, the thickness of the plastic lining shall be not less than 0.3 mm (12 mils, or 0.012 in.) when measured in accordance with 9.3.1.

7. Workmanship, Finish, and Appearance

7.1 All lined pipe shall be free of runs, sags, blisters, or other imperfections that indicate unprotected areas. The average thickness of the lining shall not be less than specified in 6.1.

7.2 *Protection of Couplings and Machined Ends of Pipe*—Surfaces of the pipe ends and coupling areas exposed to corrosive conditions shall be protected with the same plastic liner or plastic coating.

8. Inspection, Rejection, and Rehearing

8.1 Each pipe and coupling shall be inspected by the manufacturer, prior to shipment, for compliance with the standards for workmanship and finish. Inspection and testing of the materials by the purchaser shall be as agreed upon by the manufacturer and purchaser at the time of purchase. Instead of such inspection, when requested, the manufacturer shall certify that his product conforms to the requirements of this specification.

8.2 If any specimen fails to meet the requirements of Sections 5, 4, or 6, two additional specimens shall be prepared from material manufactured during the same shift and shall be subjected to the test on which failure occurred. The failure of one of these additional specimens to meet the specification requirement shall be cause for rejection of the entire lot and class manufactured.

9. Test Methods

9.1 Chemical Resistance Tests

9.1.1 *Lined Test Specimens, Sulfuric Acid Test*—Fill a standpipe, made from a 30-cm (1-ft) section of lined pipe plugged at the bottom with an inert material, to 5 cm (2 in.) from the top with a 5 mass % solution of sulfuric acid (H_2SO_4). Maintain these conditions for a period of 45 days at room temperature at $25 \pm 5^\circ\text{C}$ ($77 \pm 10^\circ\text{F}$). After 45 days, remove the acid, wash the specimen free of acid, allow to dry, and examine the dry surface of the lining. Any blister in the lining, formed during

the test, which exceeds 3 mm (0.12 in.) in any dimension shall indicate failure of this test.

9.1.2 *Lined Test Specimens, Sodium Hydroxide Test*—Fill a standpipe, equivalent to that described in 9.1.1, to 5 cm (2 in.) from the top with a 5 mass % solution of sodium hydroxide (NaOH). Maintain these conditions for a period of 45 days at room temperature at $25 \pm 5^\circ\text{C}$ ($77 \pm 10^\circ\text{F}$). After 45 days, remove the solution and examine the lining. Any cracking, swelling, or other visible degradation shall constitute failure of this test.

9.1.3 *Lining Material*—Cast some 75 by 25 by 3.8-mm (3 by 1 by 0.125-in.) specimens from the plastic lining material. Completely immerse the specimens in the solutions required in Table 1. Test in accordance with Test Method D 543 for periods of 7 and 30 days at room temperature $25 \pm 5^\circ\text{C}$ ($77 \pm 10^\circ\text{F}$). Determine the initial and final mass of the specimens to 0.5 mg and calculate the percentage mass change to the nearest 0.01 %.

9.2 Adhesion Tests:

9.2.1 All three of the following tests require stave specimens measuring approximately 10 by 10 cm (4 by 4 in.).

9.2.1.1 *Four-Hour Boiling*—Immerse a 10 by 10 cm (4 by 4 in.) specimen in boiling distilled water for 4 h. Remove and surface-dry the specimen before examination.

9.2.1.2 *Four-Day Hot*—Immerse a 10 by 10 cm (4 by 4 in.) specimen in distilled water maintained at 65°C (150°F) for 96 h. Remove and surface-dry the specimen before examination.

9.2.1.3 *Ninety-Day Immersion*—Immerse a 10 by 10 cm (4 by 4 in.) specimen in distilled water at room temperature $25 \pm 5^\circ\text{C}$ ($77 \pm 10^\circ\text{F}$) for 90 days. Remove and surface-dry the specimen before examination.

9.2.2 *Pull-Out Tests*—Lining pull-outs tests are to be run as follows:

9.2.2.1 A solid metallic cylinder piece of known area shall be bonded with full contact to the lining of a well-cleaned sample and covering the area of highest blister density, but not closer than 1.5 cm (0.5 in.) to the edge of the sample. Means shall be provided for attachment of testing apparatus for determining pull-out force.

9.2.2.2 To avoid the influence of the adjacent plastic lining on the test results, the lining around the circumference of the contact piece shall be cut through to the surface of the substratum.

9.2.2.3 The pull-out force divided by the area of the contact piece gives the value of adhesion stress for the plastic lining to the substrate.

9.3 Thickness Measurement:

9.3.1 Carefully remove a section of the lining from the pipe by prying up the lining at the end of the pipe with a sharp tool such as a chisel. Scrape or sand away any cementitious material adhering to the back of the lining before measurement. Using a standard micrometer with a 6-mm (0.25-in.) hemispherical anvil, measure the thickness at two locations located at right angles to each other.

10. Keywords

10.1 asbestos; asbestos-cement; asbestos-cement pipe; linings; pipe

TABLE 1 Immersion Test Requirements

Test Number	Liquid Used	Concentrations, Mass%
1	distilled water, or dionized water	100
2	sulfuric acid	10
3	acetic acid	5
4	sodium hydroxide	5



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