



Standard Practice for Tests to Evaluate the Chemical Resistance of Geotextiles to Liquids¹

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1. Scope

1.1 This practice describes the procedures used for testing geotextiles for chemical resistance to liquids.

1.2 This practice describes test methods for measuring changes in planar dimensions, tensile properties, and other optional physical, mechanical, and hydraulic properties caused by immersion in test liquids which may be representative of anticipated end-use conditions. This practice may be used to assess the extent to which a product's as-manufactured properties are affected by such immersion.

1.3 This practice is intended to be used in conjunction with either Practices D 5322 or D 5496. The scope of this practice is limited to testing and reporting procedures for unexposed and exposed geotextile samples.

1.4 Evaluation or interpretation of test data is beyond the scope of this practice.

1.5 *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.* For specific warning statements, see Section 7.

2. Referenced Documents

2.1 ASTM Standards:

- D 76 Specification for Tensile Testing Machines for Textiles²
- D 123 Terminology Relating to Textiles²
- D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer³
- D 1776 Practice for Conditioning Textiles for Testing²
- D 3786 Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics—Diaphragm Bursting Strength Tester Method⁴
- D 3895 Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry⁵

¹ This practice is under the jurisdiction of ASTM Committee D-35 on Geosynthetics and is the direct responsibility of Subcommittee D35.02 on Endurance Properties.

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² Annual Book of ASTM Standards, Vol 07.01.

³ Annual Book of ASTM Standards, Vol 08.01.

⁴ Discontinued 1996; Vol 07.02.

⁵ Annual Book of ASTM Standards, Vol 08.02.

D 4439 Terminology for Geotextiles⁶

D 4491 Test Methods for Water Permeability of Geotextiles by Permittivity⁶

D 4533 Test Method for Trapezoid Tearing Strength of Geotextiles⁶

D 4595 Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method⁶

D 4603 Test Method for Determining Inherent Viscosity of Poly(ethylene Terephthalate) (PET)⁷

D 4632 Test Method for Grab Breaking Load and Elongation of Geotextiles⁶

D 4716 Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head⁶

D 4751 Test Method for Determining the Apparent Opening Size of a Geotextile⁶

D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products⁶

D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes⁶

D 5261 Test Method for Measuring Mass per Unit Area of Geotextiles⁶

D 5322 Practice for Immersion Procedures for Evaluating the Chemical Resistance of Geosynthetics to Liquids⁶

D 5496 Practice for In-Field Immersion Testing of Geosynthetics⁶

D 5747 Practice for Tests to Evaluate the Chemical Resistance of Geomembranes to Liquids⁶

D 5885 Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry⁶

3. Terminology

3.1 Definitions:

3.1.1 *chemical resistance, n*—for geosynthetics, the extent to which a material or product retains its as-manufactured physical and chemical characteristics when subjected to immersion or contact with a foreign substance (see Practice D 5747).

3.1.2 *geosynthetic, n*—a planar product manufactured from polymeric material used with foundation soil, rock, earth, or

⁶ Annual Book of ASTM Standards, Vol 04.09.

⁷ Annual Book of ASTM Standards, Vol 08.03.

any other geotechnical engineering related material as an integral part of a manmade project, structure, or system (see Terminology D 4439).

3.1.3 *geotextile, n*—any permeable textile used with foundation, soil, rock, earth, or any other geotechnical material as an integral part of manmade product, structure, or system (see Terminology D 4439).

3.1.4 For definitions of other terms used in this practice, refer to Terminologies D 123 and D 4439.

4. Summary of Practice

4.1 This practice defines test methods and procedures for evaluating the resistance of geotextiles to liquid exposure by monitoring physical and chemical properties of geotextiles specimens immersed in a test liquid. The physical condition of the geotextile is monitored as a function of cumulative exposure time by means of dimensional measurements and physical property tests.

5. Significance and Use

5.1 This practice provides a test procedure for determining the resistance of a geotextile with a liquid waste, leachate, or chemical. This practice should be used in the absence of other specifications required for the particular situation being addressed.

5.2 The specification of test procedures in this practice is intended to serve as a guide for those wishing to compare or investigate the chemical resistance of a geotextile to a potentially harsh chemical environment.

5.3 This practice is for the chemical resistance assessment of geotextiles and is written in parallel to similar standard practices for geomembranes, geogrids, geonets, and geopipes. Each standard is to be considered individually for the geosynthetic under investigation and collectively for all geosynthetics exposed to the potentially harsh chemical environment under consideration.

6. Apparatus

6.1 *Analytical Balance*, capable of weighing accurately to 0.001 g.

6.2 *Measuring Equipment*, such as scales or calipers, suitable for determining dimensions of geotextiles.

6.3 All other required equipment is specified in Section 2. Refer to the appropriate standards for a description of the apparatus necessary to perform each test.

7. Hazards

NOTE 1—Warning: The solutions used in this practice may contain hazardous chemicals. Appropriate precautions must be taken when handling hazardous waste, chemicals, and the immersion solutions. Protective equipment suitable for the chemicals being used must be worn by all personnel handling or exposed to the chemicals. Particular care should be taken when opening storage vessels at elevated temperatures due to the increased volatility of organics and the increased activity of acids and bases. Care also must be taken to prevent the spilling of hazardous materials, and provisions must be made to clean up any accidental spills that occur.

7.1 Before carrying out any test, safety precautions and disposal procedures for hazardous waste, chemicals, or immersion liquids, and any contaminated geotextile materials should

be identified and implemented to provide full protection to all personnel and to comply with applicable disposal regulations.

8. Sampling⁸

8.1 Determine the number of the test specimens according to the requirements of the property monitoring test and the number of test intervals.

8.2 Cut individual test specimens randomly in the roll and in the cross directions along the length of the roll of geotextile, staying at least 150 mm away from the selvage.

8.3 Mix or shuffle specimens in a random fashion, keeping the roll and cross roll specimens separate. From the shuffled specimens, select specimens for assignment to unexposed (baseline) testing and for immersion in the test liquid for testing after exposure.

9. Conditioning

9.1 *Conditioning*—Samples must be conditioned at a temperature of $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$) and a relative humidity between 50 and 70 % for a period not less than 40 h prior to weighing or baseline testing and immersion, or a combination thereof.

9.2 Condition the test liquid, that is, immersion liquid, in the exposure tank, with stirring, as recommended in Practices D 5322 or D 5496, or both.

10. Procedure

10.1 Immerse the samples in the liquid according to either Practices D 5322 or D 5496.

10.2 *Testing for Baseline Values*—The unexposed specimens (not exposed to the test liquid) shall be moist when tested. Each specimen shall be immersed in water for 24 h prior to testing. Excess water to drain from each of the specimens prior to testing. Conduct testing prior to commencement of the immersions.

10.3 *Exposed Sample Testing*—Test the exposed specimens moist. Allow excess liquid to drain from the specimens. Store the exposed specimens in leak-free polyethylene bags until testing can be conducted. Commence testing within 24 h of removal from the liquid. Testing will be conducted after each period of exposure.

10.4 *Dimensions*—Before exposure to the liquid, measure the length of a minimum of two 20 000-mm² (100 × 200-mm) specimens in both the machine and cross machine directions using a vernier caliper, marking the exact points measured using reference markers. Reference markers will consist of indelible ink or other insoluble material. Track the specimens' dimensions for the entire duration of the test, by measuring their dimensions after each immersion period. Immediately after measurement, the specimens shall be returned to the immersion vessel for exposure.

NOTE 2—Some tests may require the use of “dry” specimens. In these cases, an exposed specimen may be rinsed in tap water and dried to constant weight in an air oven prior to testing. While drying temperatures may vary depending on specimen condition and chemical makeup after exposure, it is recommended that the same drying procedure be used for all testing periods.

⁸ Unlike some other geosynthetics, such as geomembranes, geotextile test specimens are cut directly from the roll before immersion, not from already-immersed coupons.

11. Testing: Required, Recommended, and Nonapplicable

11.1 Tables 1 and 2 present additional tests according to the geotextile's function and polymer. Required testing is indicated as^A in Table 1. Nonapplicable tests are indicated as N/A in both tables. All other tests are recommended.

NOTE 3—Determination of intrinsic viscosity (IV) and carboxyl end group (CEG) count for polyester have been performed in accordance with a variety of test procedures. The users of this practice are encouraged to investigate and use IV and CEG test procedures most appropriate for their objectives.

12. Report

12.1 State that the immersion procedure was performed as directed in either Practices D 5322 or D 5496.

12.2 Describe the material or product tested and the material's condition prior to immersion, including any imperfections or observed physical characteristics which could influence test results.

12.3 Describe the method used to sample the product for the immersion procedure.

TABLE 2 Geotextile Polymer

Geotextile Property	Polyolefin (PP, PE)	Polyester
Oxidative induction time (D 3895, D 5885)	D 3895, D 5885	N/A
Melt flow index	D 1238	N/A
Intrinsic viscosity (D 4603)	N/A	D 4603
Carboxyl end group ^A	N/A	^A

^ASee EPA/600/2-88/052.
N/A = Nonapplicable tests.

12.4 Report which test procedures were used for evaluating the geotextile and any deviations from the procedures.

12.5 Report all raw data, averages, and standard deviations.

12.6 Report the percent changes from the original unexposed test values for the exposed materials.

12.7 Evaluation or interpretation is beyond the scope of this practice.

13. Keywords

13.1 chemical resistance; geosynthetics; geotextiles

TABLE 1 Function of Geotextile

Geotextile Property	Separation	Protection	Reinforcement	Drainage	Filtration
Grab strength	D 4632 ^A	D 4632 ^A	D 4632	D 4632	D 4632 ^A
Puncture resistance	D 4833 ^A	D 4833 ^A	D 4833	D 4833	D 4833 ^A
Trapezoidal tear strength	D 4533 ^A	D 4533 ^A	D 4533	D 4533	D 4533 ^A
Wide width tensile	N/A	D 4595	D 4595 ^A	D 4595	D 4595 ^A
Apparent opening size	D 4751 ^A	N/A	N/A	D 4751 ^A	D 4751 ^A
Permittivity	D 4491 ^A	N/A	N/A	N/A	D 4491 ^A
Transmissivity	N/A	N/A	N/A	D 4716 ^A	N/A
Thickness	D 5199	D 5199 ^A	D 5199	D 5199	D 5199
Mass unit area	D 5261	D 5261 ^A	D 5261	D 5261	D 5261

^ARequired testing.
N/A = Nonapplicable tests.

APPENDIX

(Nonmandatory Information)

X1. RATIONALE

This practice is intended to provide a standardized procedure for conducting chemical resistance tests for geotextile. The term "chemical compatibility" also has been used to describe such tests. The need for this practice was established by ASTM Subcommittee D35.02 with the objective to provide a group of related standards for defining test procedure specifications for chemical resistance studies covering various kinds of geosynthetics. The purpose of such testing is to assess the effects of immersion in liquid waste, leachate, or chemical on geosynthetic materials and products, which will contact the fluids in a waste containment facility. Such testing may be performed as part of the design or regulatory review process.

EPA Method 9090A (SW 846)⁹ has been used widely as a reference describing procedures for chemical resistance testing of geomembranes. This practice is intended to extend the concept and rationale behind EPA Method 9090A to address geotextiles. The practice addresses test methods applicable to geotextiles, and it should be used together with either Practices D 5322 or D 5496, which define immersion procedures for geosynthetics in waste fluids.

Evaluation or interpretation is beyond the scope of this practice and should be conducted by the owner or one's agent, or by an appropriate expert. In general, the facility owner, designer, or geosynthetics user is responsible for defining chemical resistance criteria. Such criteria generally are considered to be site and application specific.

⁹ EPA/600/2-88/052, Lining of Waste Containment and Other Impoundment Facilities [23] *Determination of Carboxyl End Groups in a Polyester, Polyethylene Terephthalate*, Analytical Chemistry, Vol 26, No. 10, October 1954.

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