This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: E154/E154M – 08a (Reapproved 2025)

Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover[1]

This standard is issued under the fixed designation E154/E154M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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

1. Scope

1.1 These test methods[2] cover the determination of the properties of flexible membranes to be used as vapor retarders in contact with earth under concrete slabs, against walls, or as ground cover in crawl spaces. The test methods are applicable primarily to plastic films and other flexible sheets. The materials are not intended to be subjected to sustained hydrostatic pressure. The procedures simulate conditions to which vapor retarders may be subjected prior to and during installation, and in service.

1.2 The test methods included are:

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Water-Vapor Transmission of Material as Received	7
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Resistance to Puncture	10
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1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C168 Terminology Relating to Thermal Insulation

C755 Practice for Selection of Water Vapor Retarders for Thermal Insulation

D828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus

D882 Test Method for Tensile Properties of Thin Plastic Sheeting

D1709 Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method

D1985 Practice for Preparing Concrete Blocks for Testing Sealants, for Joints and Cracks

D2565 Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications

D4397 Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

E84 Test Method for Surface Burning Characteristics of Building Materials

E96/E96M Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials

E241 Guide for Limiting Water-Induced Damage to Buildings

E437 Specification for Industrial Wire Cloth and Screens (Square Opening Series) (Discontinued 2000) Replaced by E 2016 (Withdrawn 2000)[4]

[1] These test methods are under the jurisdiction of ASTM Committee E06 on Performance of Buildings and are the direct responsibility of Subcommittee E06.21 on Serviceability.

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[2] Some of these test methods were based originally on *Report No. 2040*, U.S. Forest Products Laboratory, and "Vapor Barrier Materials for Use with Slab-On-Ground Construction and as Ground Covers in Crawl Spaces," *Publication 445-1956*, Building Research Advisory Board (currently out-of-print).

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] The last approved version of this historical standard is referenced on www.astm.org.

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E631 Terminology of Building Constructions

F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

3. Terminology

3.1 *Definitions:* For definitions of terms used in these test methods, see Terminologies C168 and E631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *perm, n*—the time rate of water vapor migration through a material or a construction of 1 grain/h·ft^2·in. mercury (Hg) of vapor pressure difference.

3.2.1.1 *Discussion*—There are no SI units that can be combined to give the same mass flow rate as the inch-pound perm without a numerical coefficient. If a specification states that a one perm resistance is required, the same rate of flow will be obtained from the following relationships:

1 perm	= 1 grain/h·ft^2·in. Hg	Inch-pound units
	= 57.2·10^{-12} kg/s·m^2·Pa	SI (fundamental units)
	= 57.2 ng/s·m^2·Pa	SI (frequently used)
	= 0.66 g/24 h·m^2·mm Hg	SI (deprecated, should not be used)

The perm is a specific rate of vapor flow regardless of the units that were used in measuring the flow rate or in converting them into desired units.

3.2.2 *water-vapor permeability, n*—the time rate of water vapor flow through unit area of unit thickness of a flat material induced by unit vapor pressure difference between two parallel specified surfaces under specific temperature and humidity conditions.

3.2.2.1 *Discussion*—Since vapor flow rate does not vary directly with thickness for many materials, comparisons of vapor flow rates for retarders of various thicknesses should be made on test results of permeance rather than on permeability.

3.2.3 *water–vapor permeance, n*—the time rate of water vapor flow through unit area of the known thickness of a flat material or a construction normal to two specific parallel surfaces induced by unit vapor pressure difference between the two surfaces under specific temperature and humidity conditions; while the SI unit is kg/s·m^2·Pa, the practical unit is the perm (see 3.2.1).

3.2.4 *water-vapor transmission* (WVT), *n*—the steady water vapor flow in unit time through unit area of a flat material or a construction normal to specific parallel surfaces induced by specific temperatures, pressures, and humidities at each surface; units in SI are kilogram per second, square metre, (kg/s·m^2) [inch-pound, grain per hour, square foot, (grain/h·ft^2)].

4. Significance and Use

4.1 In service, vapor retarders may be exposed to a variety of conditions, so no one test will provide evaluations related to performance for all exposures (refer to Guide E241 and Practice C755). Neither will all test methods listed be necessary in all evaluations for specific exposures (see 16.2).

4.2 *Limitations*—Prior to use and in service, vapor retarders may be exposed to a variety of conditions so no one test will provide evaluations related to performance for all exposures (refer to Guide E241 and Practice C755). Neither will all tests be necessary in all evaluations for specific exposures. Consequently, the tests and required test results shall be agreed upon by the purchaser and the supplier (see 16.2).

5. Sampling

5.1 Obtain samples for preparation of test specimens from each of three separate rolls or packages of each type of material being tested. Samples shall be representative of the material being tested and shall be of uniform thickness. If the samples are of nonsymmetrical construction, designate the two faces by distinguishing marks and report which side was exposed to a specific condition.

6. Test Specimen

6.1 The number and size of test specimens of each material are specified in each test procedure. Great care is required to protect the test areas of the specimens against damage or contamination.

7. Water-Vapor Transmission of Material as Received

7.1 *Significance and Use*—Since the water-vapor flow rate through a material in service is significant in order for comparisons to be made of performance after specific treatments of the material, the water-vapor flow rate of the material as received is needed as a reference value. The as-received material is presumed to be representative of the material that is to be used on the purchaser's project.

7.2 *Apparatus*—The apparatus and test facilities are described in Test Methods E96/E96M and F1249.

7.3 *Procedure:*

7.3.1 Make water-vapor transmission tests on at least three specimens of each material in accordance with Test Methods E96/E96M or F1249. If the retarder material is coated or treated on one surface to improve its water-vapor resistance, make the test with this surface toward the water unless otherwise specified.

7.3.2 Where wax seals are used with the wet method, it is good procedure to heat the test dishes uniformly to 45 °C [113 °F] or slightly warmer before sealing the test sample to the dish to avoid having the wax become too viscous for good sealing.

7.4 *Precision and Bias*—The statements regarding precision and bias in Test Methods E96/E96M and F1249 shall also apply to this test method.

8. Water-Vapor Transmission after Wetting and Drying and after Long-Time Soaking

8.1 *Significance and Use*—After water-vapor retarders leave the factory, they are exposed to many conditions of wetting and drying and may be subjected to immersion or partial immersion for various periods. To indicate the potential effect of wetting and drying and relatively long-time exposure to soaking, the data from these tests will be compared with those of the material as received.

8.2 *Apparatus:*

8.2.1 *Controlled-Temperature Vessels,* of suitable size for soaking specimens and equipped with a temperature controller