



Designation: E1745 – 17 (Reapproved 2023)

Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs¹

This standard is issued under the fixed designation E1745; 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.

1. Scope

1.1 This specification covers flexible, preformed sheet membrane materials to be used as vapor retarders in contact with soil or granular fill under concrete slabs.

1.1.1 This specification does not cover bituminous vapor retarders. See Specification E1993/E1993M for information on bituminous vapor retarders.

1.2 The specified tests are conducted on new materials and materials that have been conditioned or exposed to simulate potential service conditions.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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:²

C168 Terminology Relating to 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

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

E154/E154M Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

E631 Terminology of Building Constructions

E1643 Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

E1993/E1993M Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs

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 this specification, 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 one grain per hour, square foot, inch of mercury pressure difference.

3.2.1.1 *Discussion*—If a specification states that a one perm limit is required, the same flow rate will be obtained from the following relationships:

$$\begin{aligned} 1 \text{ perm} &= 1 \text{ grain/h} \cdot \text{ft}^2 \text{ in.} \cdot \text{Hg (inch-pound)} \\ &= 57.2 \cdot 10^{-12} \text{ kg}/(\text{Pa} \cdot \text{s} \cdot \text{m}^2) \text{ (SI fundamental units)} \\ &= 57.2 \text{ ng}/(\text{Pa} \cdot \text{s} \cdot \text{m}^2) \text{ (SI frequently used)} \\ &= 0.66 \text{ g}/24 \text{ h} \cdot \text{m}^2 \cdot \text{mm Hg (SI has been used but is now obsolete)} \end{aligned}$$

3.2.2 *vapor retarder, n*—(formerly vapor barrier) a material or construction that impedes the transmission of water vapor under specified conditions.

3.2.3 *water vapor permeability, n*—a property of material which is water vapor permeance through unit thickness. Since materials that provide resistance to vapor flow are never used in unit thickness, the preferred evaluation of both materials and constructions is the permeance.

3.2.4 *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. See *perm*.

¹ This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.21 on Serviceability.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Classification

4.1 Materials shall be specified to conform to one of these three classes: A, B, or C, or specific requirements shall be specified in one or more of the properties listed in **Table 1**.

5. Specifying Information

5.1 Specifications for materials shall include the following:

- 5.1.1 This specification number.
- 5.1.2 Class A, B, or C, or alternatively, specific performance requirements for each of the properties listed in **Table 1**.
- 5.1.3 Performance requirements, if any, for special conditions (see **7.4**).
- 5.1.4 Execution or installation requirements with reference to Practice **E1643**.

6. Lap Sealing

6.1 The producer shall provide instructions for lap sealing, including minimum width of lap, method of sealing, and either supply or specify suitable products for lap sealing.

7. Properties

7.1 *Permeance*—Material shall conform to the requirements listed in **Table 1** under the following conditions: when tested in accordance with Test Methods **E154/E154M**, Section 7 (based on Test Methods **E96/E96M**), or Test Method **F1249**, test temperature shall be 73.4 °F (23 °C) and test humidity shall be 50 % ± 2 %.

- 7.1.1 *Permeance of New Material*—No conditioning.
- 7.1.2 *Permeance after Wetting, Drying, and Soaking*—Refer to Test Methods **E154/E154M**, Section 8.
- 7.1.3 *Permeance after Heat Conditioning*—Refer to Test Methods **E154/E154M**, Section 11.

7.1.4 *Permeance after Low Temperature Conditioning*—Refer to Test Methods **E154/E154M**, Section 12.

7.1.5 *Permeance after Soil Organism Exposure*—Refer to Test Methods **E154/E154M**, Section 13.

7.2 *Tensile Strength of New Material*—Refer to Test Methods **E154/E154M**, Section 9. (The apparatus shall be that described in either Test Methods **D828** or **D882**.)

7.3 *Resistance to Puncture of New Material*—Refer to Test Methods **D1709**, Test Method B.

7.4 *Special Conditions*—When specifically required by the buyer, due to special conditions which dictate properties of fire resistivity, prolonged exposure to sunlight, or resistance to deterioration from hydrocarbons, the material shall conform to the following:

7.4.1 *Flame Spread*³—Refer to Test Methods **E154/E154M**, Section 16, as follows:

Class A	0–25
Class B	26–75
Class C	76–200

7.4.2 *Permeance after Soil Poison Petroleum Vehicle Exposure*—Refer to Test Methods **E154/E154M**, Section 14 (based on Test Methods **E96/E96M**), or Test Method **F1249**. Conform to permeance requirements in **Table 1**.

7.4.3 *Permeance after Exposure to Ultraviolet Light*—Refer to Test Methods **E154/E154M**, Section 15. Conform to permeance requirements in **Table 1**.

8. Sampling

8.1 For each complete set of tests, obtain all samples from a single production roll of material. Samples shall be representative of the material being sold to the end user.

9. Certification

9.1 When specified in the purchase order or contract, the purchaser shall be furnished with certification that samples representing each lot have been either tested or inspected as directed in this specification and that requirements have been met.

9.2 Upon the request of the purchaser in the contract or order, the certification of an independent third party (testing laboratory) indicating conformance to the requirements of this specification may be considered.

³ The classes and values shown are distinct from the performance classes listed in **Table 1**.

TABLE 1 Properties for Specified Performance Classes^A

	Class A		Class B		Class C	
	IP Units	SI Units	IP Units	SI Units	IP Units	SI Units
Water vapor permeance (Test Methods E154/E154M , Section 7, or Test Method F1249), max	0.1 perms (0.1 gr/[h·ft ² ·in.·Hg])	(6 ng/[s·m ² ·Pa])	0.1 perms (0.1 gr/[h·ft ² ·in.·Hg])	(6 ng/[s·m ² ·Pa])	0.1 perms (0.1 gr/[h·ft ² ·in.·Hg])	(6 ng/[s·m ² ·Pa])
Tensile strength (Test Methods E154/E154M , Section 9), ^B min	45.0 lbf/in.	7.9 kN/m	30.0 lbf/in.	5.3 kN/m	13.6 lbf/in.	2.4 kN/m
Puncture resistance (Test Methods D1709 , Test Method B), min	no inch-pound equivalent used	2200 g	no inch-pound equivalent used	1700 g	no inch-pound equivalent used	475 g

^A Refer to Practice **E1643** for assessing suitability of use based on reported perm rating of material.
^B Tensile strength per unit width for the total sample thickness is used instead of tensile strength per unit area because vapor retarder materials are never used in unit thickness.