



Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor¹

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1. Scope

1.1 This test method covers a procedure for determining the rate of water vapor transmission through flexible barrier materials. The method is applicable to sheets and films up to 3 mm (0.1 in.) in thickness, consisting of single or multilayer synthetic or natural polymers and foils, including coated materials. It provides for the determination of (1) water vapor transmission rate (WVTR), (2) the permeance of the film to water vapor, and (3) for homogeneous materials, water vapor permeability coefficient.

NOTE 1—Values for water vapor permeance and water vapor permeability must be used with caution. The inverse relationship of WVTR to thickness and the direct relationship of WVTR to the partial pressure differential of water vapor may not always apply.

1.2 *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:*²

[D374 Test Methods for Thickness of Solid Electrical Insulation](#) (Withdrawn 2013)³

[D1898 Practice for Sampling of Plastics](#) (Withdrawn 1998)³
[E96/E96M Test Methods for Water Vapor Transmission of Materials](#)

[E104 Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

¹ This test method is under the jurisdiction of ASTM Committee F02 on Flexible Barrier Packaging and is the direct responsibility of Subcommittee F02.10 on Permeation.

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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.

³ The last approved version of this historical standard is referenced on www.astm.org.

[E178 Practice for Dealing With Outlying Observations](#)

[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

3. Terminology

3.1 *Definitions:*

3.1.1 *water vapor permeability coefficient*—the product of the permeance and the thickness of the film. The permeability is meaningful only for homogeneous materials, in which case it is a property characteristic of bulk material.

3.1.1.1 *Discussion*—This quantity should not be used unless the relationship between thickness and permeance has been verified in tests using several thicknesses of the material. An accepted unit of permeability is the metric perm centimeter, or 1 g/m² per day per mm Hg·cm of thickness. The SI unit is the mol/m²·s·Pa·mm. The test conditions (see 3.1) must be stated.

3.1.2 *water vapor permeance*—the ratio of a barrier's WVTR to the vapor pressure difference between the two surfaces.

3.1.2.1 *Discussion*—An accepted unit of permeance is the metric perm, or 1 g/m² per day per mm Hg. The SI unit is the mol/m²·s·Pa. Since the permeance of a specimen is generally a function of relative humidity and temperature, the test conditions must be stated.

3.1.3 *water vapor transmission rate (WVTR)*—the time rate of water vapor flow normal to the surfaces, under steady-state conditions, per unit area.

3.1.3.1 *Discussion*—An accepted unit of WVTR is g/m² per day. The test conditions of relative humidity and temperature where the humidity is the difference in relative humidity across the specimens, must be stated.

4. Summary of Test Method

4.1 A dry chamber is separated from a wet chamber of known temperature and humidity by the barrier material to be tested. The dry chamber and the wet chamber make up a diffusion cell in which the test film is sealed. Water vapor diffusing through the film mixes with the gas in the dry chamber and is carried to a pressure-modulated infrared sensor. This sensor measures the fraction of infrared energy absorbed by the water vapor and produces an electrical signal, the