



Standard Test Method for Determining Water Vapor Transmission Rates Through Nonwoven and Plastic Barriers¹

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1. Scope

1.1 This test method covers a procedure for determining the rate of water vapor transmission ranging between 500 to 100,000 g/m²day through nonwoven and plastic barrier materials. The method is applicable to films, barriers consisting of single or multilayer synthetic or natural polymers, nonwoven fabric, and nonwoven fabrics coated with films up to 3 mm (0.1 in.) in thickness.

1.2 This test method provides for the determination of (1) water vapor transmission rate (WVTR), and (2) the permeance to water vapor.

1.3 The values stated in metric units are to be regarded as the standard. The acceptable units for water vapor transmission rate are usually g/m²day.

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

2. Referenced Documents

2.1 ASTM Standards:

D 123 Terminology Relating to Textiles²

D 1898 Practice for Sampling of Plastics³

D 4204 Practice for Preparing Plastic Film Specimens for a Round-Robin Study⁴

D 5729 Test Methods for Thickness of Nonwoven fabrics⁵

E 691 Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods⁶

F 1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor⁷

3. Terminology

3.1 Definitions:

3.1.1 *water vapor permeability coefficient, n* —the ratio of the permeance and the thickness.

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 thickness' of the material. The water vapor permeability is meaningful only for homogeneous materials, in which case it is a property characteristic of bulk material. An accepted unit of water vapor permeability is the metric perm centimeter, or 1g per m²per day per mm Hg-cm of thickness. The SI unit is the mol/m²-s-Pa-mm.

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

3.1.2.1 *Discussion*—An accepted unit of water vapor 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 water vapor permeance of a specimen is generally a function of relative humidity and temperature, therefore those conditions must be stated.

3.1.3 *water vapor transmission rate (WVTR), n* —the steady-state time rate of water vapor flow through unit area of a specimen, normal to the surfaces under specific conditions of temperature and humidity at each surface.

3.1.3.1 *Discussion*—A common practice accepted unit of water vapor transmission rate is metric g/m² per day. The test conditions of relative humidity and temperature where the driving force is the difference in relative humidity across the specimen must be stated.

4. Summary of Test Method

4.1 A dry chamber, guard film, and a wet chamber make up a diffusion cell in which the test film is sealed. A first test is made of the water vapor transmission rate of the guard film and air gap between an evaporator assembly that generates 100 % relative humidity. A sensor produces an electrical signal, the amplitude of which is proportional to water vapor concentration. The electrical signal is routed to a computer for processing. The computer calculates the transmission rate of the air gap and guard film and stores the value for further use. The barrier is then sealed in the test cell and the apparatus started

¹ This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.64 on Nonwoven Fabrics.

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² *Annual Book of ASTM Standards*, Vol 10.01.

³ *Annual Book of ASTM Standards*, Vol 08.03.

⁴ *Annual Book of ASTM Standards*, Vol 04.06.

⁵ *Annual Book of ASTM Standards*, Vol 07.02.

⁶ *Annual Book of ASTM Standards*, Vol 11.03.

⁷ *Annual Book of ASTM Standards*, Vol 15.09.