



Designation: D1434 – 23

Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting¹

This standard is issued under the fixed designation D1434; 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 test method utilizes a manometric method to determine the steady-state rate of transmission of a gas through plastics in the form of film, sheeting, laminates, and plastic-coated papers or fabrics. This test method provides for the determination of (1) gas transmission rate (GTR), (2) permeance, and, in the case of homogeneous materials, (3) permeability.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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.*

1.4 *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

D618 Practice for Conditioning Plastics for Testing

D1898 Practice for Sampling of Plastics (Withdrawn 1998)³

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

¹ This test method is under the jurisdiction of ASTM Committee F02 on Primary 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.

3.1.1 *gas transmission rate, GTR, n* —the quantity of a given gas passing through a unit of the parallel surfaces of a plastic film in unit time under the conditions of test. The SI unit of GTR is $\text{mol}/(\text{m}^2 \cdot \text{s})$. The test conditions, including temperature and partial pressure of the gas on both sides of the film, must be stated. Other factors, such as relative humidity and hydrostatic pressure, that influence the transport of the gas must also be stated. A commonly used unit of GTR is $\text{mL (STP)}/(\text{m}^2 \cdot \text{d})$ at a pressure differential of one atmosphere.

3.1.2 *permeance, P , n* —the ratio of the gas transmission rate to the difference in partial pressure of the gas on the two sides of the film. The SI unit of permeance is $\text{mol}/(\text{m}^2 \cdot \text{s} \cdot \text{Pa})$. The test conditions (see 5.1) must be stated.

3.1.3 *permeability, $\bar{P}$, n* —the product of the permeance and the thickness of a film. The permeability is meaningful only for homogeneous materials, in which it is a property characteristic of the bulk material. This quantity should not be used unless the constancy of the permeability has been verified using several different thicknesses of the material. The SI unit of $\bar{P}$ is $(\text{mol} \cdot \text{m})/(\text{m}^2 \cdot \text{s} \cdot \text{Pa}) = \text{mol}/(\text{m} \cdot \text{s} \cdot \text{Pa})$. The test conditions (see 5.1) must be stated.

NOTE 1—One milliliter (STP) is $44.62 \mu\text{mol}$, one atmosphere is 0.1013 MPa , and one day is $86.4 \times 10^3 \text{ s}$. GTR in SI units is obtained by multiplying the value in inch-pound units by 5.160×10^{-10} . Additional units and conversions are shown in Appendix X1.

3.1.4 *steady state*—the state attained when the amount of gas absorbed in the film is in equilibrium with the flux of gas through the film.

4. Summary of Test Method

4.1 The sample is mounted in a gas transmission cell so as to form a sealed semi-barrier between two chambers. One chamber contains the test gas at a specific high pressure, and the other chamber, at a lower pressure, receives the permeating gas.

4.1.1 The lower pressure chamber is initially evacuated. Following the evacuation, the low-pressure chamber is allowed to accumulate the permeating test gas. The transmission of the gas through the test specimen is determined from monitoring the slope of the increasing pressure over time.