



Designation: D 1434 – 82 (Reapproved 1998)

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

This standard is issued under the fixed designation D 1434; 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 covers the estimation of 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 Two procedures are provided:

1.2.1 *Procedure M*— Manometric.

1.2.2 *Procedure V*— Volumetric.

1.3 The values stated in SI units are to be regarded as the standard.

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 618 Practice for Conditioning Plastics for Testing²

D 1898 Practice for Sampling of Plastics³

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *gas transmission rate, GTR*— 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 $1 \text{ mol}/(\text{m}^2 \cdot \text{s})$. 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. The inch-pound unit of GTR, a commonly used unit of GTR, is $1 \text{ mL (STP)}/(\text{m}^2 \cdot \text{d})$ at a pressure differential of one atmosphere.

3.1.2 *permeance, P*—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 $1 \text{ mol}/(\text{m}^2 \cdot \text{s} \cdot \text{Pa})$. The test conditions (see 5.1) must be stated.

3.1.3 *permeability, P*—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 P is $1 \text{ mol}/(\text{m} \cdot \text{s} \cdot \text{Pa})$. The test conditions (see 3.1) must be stated.

NOTE 1—One millilitre (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. For Method V this is obtained when the GTR is constant.

4. Summary of Test Method

4.1 The sample is mounted in a gas transmission cell so as to form a sealed semibarrier 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. Either of the following procedures is used:

4.1.1 *Procedure M*— In Procedure M the lower pressure chamber is initially evacuated and the transmission of the gas through the test specimen is indicated by an increase in pressure.

4.1.2 *Procedure V*— In Procedure V the lower pressure chamber is maintained near atmospheric pressure and the transmission of the gas through the test specimen is indicated by a change in volume.

5. Significance and Use

5.1 These measurements give semiquantitative estimates for the gas transmission of single pure gases through film and sheeting. Correlation of measured values with any given use, such as packaged contents protection, must be determined by experience. The gas transmission rate is affected by conditions not specifically provided for in these tests, such as moisture content (Note 2), plasticizer content, and nonhomogeneities. These tests do not include any provision for testing seals that

¹ This test method is under the jurisdiction of ASTM Committee F-2 on Flexible Barrier Materials and is the direct responsibility of Subcommittee F02.30 on Test Methods.

Current edition approved July 30, 1982. Published November 1982. Originally published as D 1434 – 56 T. Last previous edition D 1434 – 75.

² *Annual Book of ASTM Standards*, Vol. 08.01.

³ *Discontinued*, see 1997 *Annual Book of ASTM Standards*, Vol. 08.01.