



Designation: D1653 – 13 (Reapproved 2021)

Standard Test Methods for Water Vapor Transmission of Organic Coating Films¹

This standard is issued under the fixed designation D1653; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 These test methods cover the determination of the rate at which water vapor passes through films of paint, varnish, lacquer, and other organic coatings. The films may be free films or they may be applied to porous substrates.

1.2 A similar, but more generally applicable test method is Test Methods E96 which should be considered when other materials are involved.

1.3 Two test methods are covered in Test Methods D1653 as follows:

1.3.1 *Test Method A*—Dry Cup Method, and

1.3.2 *Test Method B*—Wet (Payne) Cup Method.

1.3.3 Agreement should not be expected between results obtained by different methods or test conditions. The method that most closely approaches the conditions of use should be selected.

1.4 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. Factors for conversion are stated in 13.2.1.2 and 13.2.2.2.

1.5 There are instruments on the market that purport to measure water vapor transmission of films more easily and rapidly than the methods described in Test Methods D1653 and E96. They run essentially the same kinds of tests as in the ASTM methods, but do so instrumentally. However, it appears that no side-by-side tests have been run comparing results from measurements with such instruments to these ASTM methods for precision and accuracy.

1.6 *This standard does not purport to address 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 These test methods are under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and are the direct responsibility of Subcommittee D01.23 on Physical Properties of Applied Paint Films.

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1.7 *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

D823 Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panels

D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers

D1193 Specification for Reagent Water

D4708 Practice for Preparation of Uniform Free Films of Organic Coatings

E96 Test Methods for Water Vapor Transmission of Materials

E104 Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *water vapor transmission rate, WVT, n*—the steady water vapor flow in unit time through unit area of a body, between two specific parallel surfaces, under specific conditions of temperature and humidity at each surface. Accepted inch-pound unit is grains per square foot per hour. Accepted SI unit is grams per square metre per 24 h.

3.1.2 *water vapor permeance, WVP, n*—the steady water vapor flow in unit time through unit area of a body (WVT) induced by unit vapor pressure difference (Δp) between the two surfaces of a coating. Therefore, $WVP = WVT/\Delta p$. Accepted inch-pound unit is grains per square foot per hour per inch of mercury (called a perm). Accepted SI unit is grams per square metre per 24 h per millimetre of mercury (called a metric perm).

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.