



Designation: D5178 – 13

# Standard Test Method for Mar Resistance of Organic Coatings<sup>1</sup>

This standard is issued under the fixed designation D5178; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers the determination of the mar resistance on smooth, flat surfaces. Results are expressed in terms of force-to-mar films of organic coatings such as paint, varnish, and lacquer when applied to smooth, flat planar panel surfaces.

1.2 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.

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

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

**D609** Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products

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

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

**D1186** Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base (Withdrawn 2006)<sup>3</sup>

**D1400** Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base (Withdrawn 2006)<sup>3</sup>

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.23 on Physical Properties of Applied Paint Films.

Current edition approved May 15, 2013. Published May 2013. Originally approved in 1991. Last previous edition approved in 2008 D5178 – 98 (2008). DOI: 10.1520/D5178-13.

<sup>2</sup> 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.

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

**D2691** Method for Microscopical Measurement of Dry Film Thickness of Coatings on Wood Products (Withdrawn 1992)<sup>3</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *mar resistance, n*—the ability of a coating to resist damage caused by light abrasion. As just defined, it is a resistance of the surface of the coating to permanent deformation, resulting from the application of a dynamic mechanical force.

## 4. Summary of Test Method

4.1 The materials under test are applied at uniform thickness to flat panels of uniform surface texture. After drying/curing, the mar resistance is determined by pushing the panels beneath a rounded stylus or loop that is loaded in increasing amounts until the coating is marred.

## 5. Significance and Use

5.1 In some situations, marring of coatings applied to substrates under typical use conditions is unacceptable. This test method has been found useful in differentiating the degree of marring of coatings on substrates. It is most useful in providing relative ratings for a series of coated panels exhibiting significant differences in marring.

5.2 In a limited laboratory study, meaningful mar results were impossible when powder coatings were tested. The mar marking, that is, scratches, became less perceptible with time. Therefore, powder coatings may not be applicable coatings for this test method.

## 6. Apparatus

6.1 *Application Equipment*, as described in Practices **D823**.

6.2 *Film-Thickness Measuring Apparatus*, as described in Test Methods **D1005**, **D1186**, **D1400**, or **D2691**.

6.3 *Balanced Beam Scrape Adhesion and Mar Tester* (Fig. 1 and Fig. 2), consisting of a balanced beam to which is secured a platform for supporting weights, and a rod at an angle of 45° that holds the scraping loop. The rod shall be set so that the scraping loop contacts test surfaces directly below the weights. The loop shall be 1/16-in. (1.6 mm) diameter rod, bent into a “U” shape with an outside radius of 0.128 ± 0.002 in. (3.25 ±