



Designation: D4060 – 14

Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser¹

This standard is issued under the fixed designation D4060; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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

1. Scope*

1.1 This test method covers the determination of the resistance of organic coatings to abrasion produced by the Taber Abraser on coatings applied to a plane, rigid surface, such as a metal panel.

1.2 The values stated in SI units are to be regarded as the standard, with the exception of mils when determining coating thickness.

1.3 This standard is similar in content (but not technically equivalent) to ISO 7784–2.

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:*²

[D823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels](#)

[D968 Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive](#)

[D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers](#)

[D2240 Test Method for Rubber Property—Durometer Hardness](#)

[D3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials](#)

[D7091 Practice for Nondestructive Measurement of Dry](#)

[Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals](#)

[G195 Guide for Conducting Wear Tests Using a Rotary Platform Abraser](#)

2.2 *Other Standards:*

[ISO 7784–2 Paints and varnishes—Determination of resistance to abrasion—Part 2: Rotating abrasive rubber wheel method](#)³

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 Abrasion resistance can be expressed as one or more of the following terms:

3.1.2 *wear index, n*—1000 times the loss in weight in milligrams per cycle.

3.1.3 *weight loss, n*—the loss in weight in milligrams, determined at a specified number of cycles.

3.1.4 *wear cycles per mil, n*—the number of cycles of abrasion required to wear a film through to the substrate per mil (0.001 in.) of film thickness.

4. Summary of Test Method

4.1 The organic coating is applied at uniform thickness to a plane, rigid panel and, after curing, the surface is abraded using rotary rubbing action under controlled conditions of pressure and abrasive action. The test specimen, mounted on a turntable platform, turns on a vertical axis, against the sliding rotation of two abrading wheels. One abrading wheel rubs the specimen outward toward the periphery and the other, inward toward the center. The resulting abrasion marks form a pattern of crossed arcs over an area of approximately 30 cm².

4.2 Abrasion resistance is calculated as loss in weight at a specified number of abrasion cycles, as loss in weight per cycle, or as number of cycles required to remove a unit amount of coating thickness.

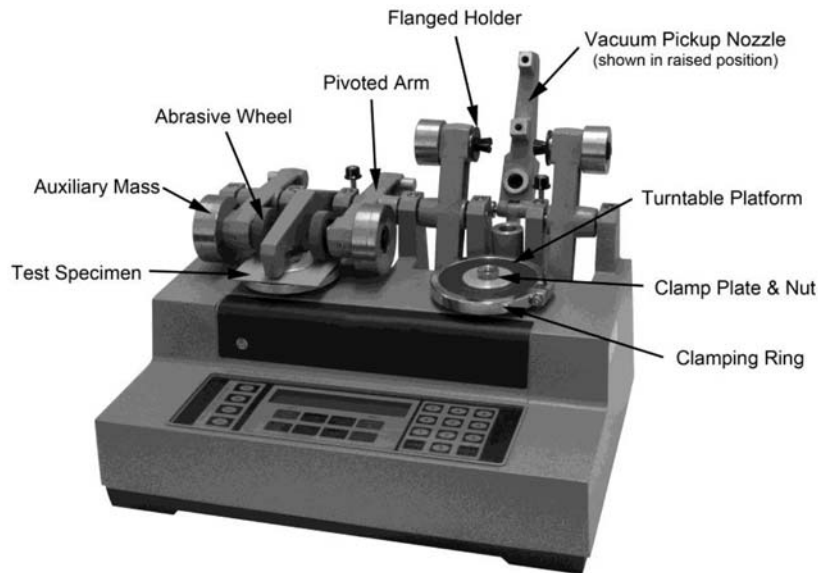
¹ This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.23 on Physical Properties of Applied Paint Films.

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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 Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

*A Summary of Changes section appears at the end of this standard



Note: Vacuum Suction System not shown.

FIG. 1 Taber Abraser

5. Significance and Use

5.1 Coating on substrates can be damaged by abrasion during manufacturing and service. This test method has been useful in evaluating the abrasion resistance of coatings. Ratings produced by this test method have correlated well with ratings produced by the falling abrasive values in Test Method D968.

5.2 For some materials, abrasion tests utilizing the Taber Abraser may be subject to variation due to changes in the abrasive characteristics of the wheel during testing. Depending on abradant type and test specimen, the wheel surface may change (that is, become clogged) due to the adhesion of debris generated during the test and must be resurfaced at more frequent intervals as agreed upon by the interested parties. To determine if more frequent resurfacing is required, plot the total weight loss every 50 cycles. If a significant negative change in slope is observed prior to 500 cycles, the point at which the slope changes determines the resurfacing frequency.

6. Apparatus

6.1 *Taber Abraser*⁴ (Fig. 1), as described in Guide G195 and consisting of the following elements:

6.1.1 A horizontal turntable platform; comprised of a rubber pad, clamp plate, and nut to secure the specimen to the turntable. A clamping ring is provided to secure the resurfacing medium

6.1.2 A motor capable of rotating the turntable platform at a speed of either 72 ± 2 r/min for 110v/60Hz or 60 ± 2 r/min for 230v/50Hz,

6.1.3 A pair of pivoted arms, to which the abrasive wheels and auxiliary masses may be attached; loads of 250, 500, or 1000 g on each wheel may be obtained by use of these changeable masses. Counterweight attachments of 125 or 175

g are available to reduce the load against the specimen, and can be used with or without the auxiliary masses.

NOTE 1—Without auxiliary masses or counterweights, each arm will apply a load against the specimen of 250 g per wheel (exclusive of the mass of the wheel itself).

6.1.4 A vacuum suction system and vacuum pick-up nozzle to remove debris and abrasive particles from the specimen surface during testing. The height of the vacuum pickup nozzle shall be adjustable, and the nozzle openings shall be 8 mm in diameter. The vacuum system shall operate when testing commences.

6.1.5 A counter to record the number of cycles (revolutions) made by the turntable platform.

6.2 *Abrasive Wheels*—Resilient Calibrase wheels No. CS-10 or CS-17, as required, shall be used unless otherwise agreed upon by the interested parties. Because of the slow hardening of the bonding material, resilient wheels should not be used after the date marked on them, or one year after their purchase if the wheels are not dated.

6.2.1 The wheels shall be 12.7 ± 0.3 mm thick and have an external diameter of 51.9 ± 0.5 mm when new, and in no case less than 44.4 mm.

NOTE 2—The hardness of the wheels can be checked by Test Method D2240. Measure at least four points equally spaced on the side surface of the wheel. The reading shall be taken 10 s after full application of the pressure, and then averaged. An acceptable hardness for both types of wheels is 81 ± 5 units on Shore Durometer A-2 Scale.

NOTE 3—The CS-17 wheels produce a harsher abrasion than the CS-10 wheels.

6.3 *Resurfacing Medium*, an S-11 abrasive disk, used for resurfacing the abrasion wheels.

7. Test Specimens

7.1 Apply a uniform coating of the material to be tested to a rigid panel having both surfaces substantially plane and

⁴ Available from Taber Industries, 455 Bryant St., North Tonawanda, NY 14120.