



Designation: D3389 – 05

Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader)¹

This standard is issued under the fixed designation D3389; 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 Department of Defense.

1. Scope

1.1 This test method covers the determination of the wear resistance of fabrics coated with rubber or plastics to abrasion. The abrasion is measured by mass loss.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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:*²

D618 Practice for Conditioning Plastics for Testing

D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries

3. Summary of Test Method

3.1 Abrasion resistance of fabrics coated with rubber or plastics is measured by subjecting the specimen to the rotary-rubbing action of two abrasive wheels under controlled conditions of pressure by the use of the rotary platform abrader. This action is maintained by the use of abrasive wheels.

4. Significance and Use

4.1 Abrasion resistance tests are intended to measure the wear resistance properties of a material. This may be correlated to expected end use performance.

¹ This test method is under the jurisdiction of ASTM Committee D11 on Rubber and is the direct responsibility of Subcommittee D11.37 on Coated Fabrics, Rubber Threads and Seals.

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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.

5. Apparatus

5.1 *Abrasion Apparatus*, comprised of a removable flat circular specimen holder, a pair of pivoted arms to which the abrasive wheels are attached, a motor for rotating the specimen holder, a vacuum unit and nozzle for removal of abraded particles during test, and a counter for indicating the revolutions of the specimen holder. The specimen holder shall be mounted to produce a circular surface travel of an essentially flat specimen in the plane of its surface at a uniform angular velocity. The abrasive wheels, which are attached to the free end of the pivoted arms, shall rotate and have, when resting on the specimen, a peripheral engagement with the surface of the specimen, the direction of travel of the periphery of the wheels and of the specimen at the contacting portions being at acute angles, and the angle of travel of one wheel periphery being opposite to that of the other. Motion of the abrasive wheels, in opposite directions, shall be provided by rotation of the specimen and the associated friction there from.

5.1.1 The specimen holder shall be supported by an adapter that is motor-driven and that provides motion for the circular travel of the specimen holder.

5.1.2 A clamping ring shall be used to secure the specimen to the specimen holder.

5.1.3 The abrasive wheels shall be mounted on independently pivoted arms, which provide free-floating action to compensate for any minor unevenness in the specimen and to ensure uniform pressure of the abrasion wheels against the specimen at all times.

5.1.4 The apparatus shall be provided with a vertical-force adjustment (weights) for varying the vertical force of the abrader wheels on the specimen. The pivoted abrader arms without auxiliary masses or counterweights apply a vertical force against the specimen of 2.45 N (250 gf) per wheel. Auxiliary masses may be used to apply a vertical force against the specimen of 4.9 N (500 gf) per wheel or 9.8 N (1000 gf) per wheel.

5.1.5 *Wheel Bearings*—The abrader wheel bearings, that is, the two pairs of bearings installed in the free end of the pivoting arms to support the abrader wheels, should not stick when caused to spin rapidly by a quick driving motion of the

forefinger. The degree of freedom of rotation of these bearings, however, is not critical.

5.1.6 Platform Position—The vertical distance from the center of the pivot point of the abrader arms to the top of the specimen holder shall be approximately 25 mm (1.0 in.). This measurement is specified to prevent possibility of errors incurred by installing a thrust bearing or the like to support the specimen platform. Adaptations shall be made such that the platform will remain at the above-specified level. The specimen platform shall rotate in the plane of its surface. If it fails to do so and exhibits a tendency to wobble, the holder and adapter shall be replaced or a thrust bearing installed to support the specimen holder.

5.1.7 Platform Speed—The speed of rotation of the platform shall be 7.5 ± 0.21 rad/s (72 ± 2 rpm) for 110 V/60 Hz or 6.9 ± 0.21 rad/s (60 ± 2 rpm) for 230 V/50 Hz operation.

5.2 Auxiliary Apparatus—Refacing discs are required for the resurfacing of rubber-based wheels. An abrasion wheel resurfacing device is recommended for resurfacing vitrified wheels, and correcting out-of-round wheel conditions.

5.3 Balance, suitable for weighing to the nearest 1 mg.

5.4 Abrasive Wheels—A wheel that is 13 mm (0.5 in.) thick and approximately 50 mm (2 in.), but no less than 44.4 mm (1.75 in.) in diameter, which is manufactured in different grades of abrasive quality.

6. Test Specimens

6.1 Unless otherwise specified, make five tests on each sample of coated fabrics.

6.2 Cut circular test specimens approximately 110 mm (4½ in.) in diameter. Cut a 6-mm (¼-in.) hole in the center of the specimen. Take care in cutting out specimens. Use the best portion of the sample to be tested. It should be free of holes, blisters, or other imperfections.

7. Procedure

7.1 Condition the specimens in accordance with Practice **D618**, paragraph 3.1.2. For thin flexible materials, adhere the specimen to a suitable substrate; use of cardboard has been found to be satisfactory.

NOTE 1—When adhesives are used to adhere the specimen, ensure that it does not have any adverse effect on the specimen. If a solvent-based system is used, allow the assembly to condition a minimum of 12 h or until the assembly maintains constant mass.

7.2 Install the wheels on their respective flanged holders as indicated by the manufacturer. Selection of abrasive wheels to be made by the customer and supplier. If no wheel is specified, the H-18 or equivalent is recommended.

7.3 Determine the original mass of the specimen or the assembly, or both. Place the test specimen with its coated side up over the rubber mat on the specimen holder. Secure the washer and knurled nut in place to hold the center of the specimen. Place the ring clamp over the specimen and tighten the screw of the ring clamp. Install auxiliary mass or counterweights as agreed upon by the customer and supplier. If no load is specified, 1000 gf is recommended. Place mounted wheels against specimen.

7.4 Adjust the vacuum suction and nozzle height as agreed upon between the customer and supplier. If none is provided,

use a vacuum nozzle height of 6.5 mm (0.25 in.) above the specimen surface, with a vacuum level of 100.

7.5 The tester is equipped with a counter that operates in conjunction with the turntable. Set the counter at zero.

7.6 Start the abrader and run to the end point or the required number of cycles as specified by the customer and supplier. The end point shall be determined by the exposure of the first yarn using a lighted magnifying glass. The specimen shall be checked periodically for yarn exposure. The quality and the thickness of the coating may influence the required vertical force needed to measure the wear resistance of the coating (unless previously specified). After establishing the required vertical force, test no less than five specimens for each sample. Do not abrade through the base fabric. This test method is for determining the wear resistance properties of the coating only.

7.7 Periodically, stop the test to remove any abrasive particles left on the specimen surface. A frequency of 300 cycles is recommended. The vacuum, cleaner, and compressed air may be used for this purpose. Wipe the rubber mat clean after each test.

7.8 At the conclusion of the test, weigh the specimen and report the mass loss as milligrams loss per revolution.

8. Calculation

8.1 Record the number of cycles taken from the counter.

8.2 If mass loss is also desired, follow the calculation procedure in Section 10, using the number of cycles noted from **8.1**.

9. Report

9.1 Report the following information:

9.1.1 Test conditions,

9.1.2 Number of specimens tested,

9.1.3 Type of wheels,

9.1.4 Total revolutions and vertical force used, and

9.1.5 Mass loss per revolutions, mg.

9.1.6 Report when yarn exposure occurred on specified number of cycle's test, if applicable.

10. Calculation

10.1 Calculate the loss in mass as follows:

Mass loss per revolution, g = original mass (before test) – final mass (after test)/number of revolutions

Example:

12.3596 Original Mass, g

12.2829 Final Mass, g

0.0767 Mass Loss, g for 500 revolutions

$$g = \frac{0.0767 \times 1000 \text{ mg/g}}{500} = 0.153 \text{ mg per revolution}$$

11. Precision and Bias ³

11.1 This precision and bias section has been prepared in accordance with Practice **D4483**. Refer to Practice **D4483** for terminology and other statistical calculation details.

³ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report **RR:D11106**.