



Designation: F 510 – 93 (Reapproved 1999)

Standard Test Method for Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method¹

This standard is issued under the fixed designation F 510; 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 method² covers the laboratory procedure for determining the abrasion resistance of resilient flooring using an abrader with a grit feeder.³

1.2 The equipment used in this test method is a modification of the Taber abraser. The regular ceramic wheels are replaced by leather clad brass rollers. A grit-feeding device feeds 240-mesh aluminum oxide grit onto the specimen before it passes under the leather clad rollers. Using the exhaust system incorporated in the apparatus, the used grit and abraded material are continuously removed after passing under both rollers.

1.3 This test method employs a rotary, rubbing action caused by the dual abrading wheels. One wheel rubs the specimen from the center outward and the other from the outside toward the center. The wheels traverse a complete circle and have an abrasive action on the rotating specimen at all angles. It is felt that this action approaches the twisting action between shoe and floor that occurs when a person turns. The use of loose grit serves the function of an abradant and also aids in the rolling action felt to be characteristic of normal walking.

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.*

¹ This test method is under the jurisdiction of ASTM Committee F-6 on Resilient Floor Coverings, and is the direct responsibility of Subcommittee F06.30 on Test Methods—Performance.

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² This test method is described by W. E. Irwin in "Development of a Method to Measure Wear on Resilient Flooring," *Journal of Testing and Evaluation*, Vol 4, No. 1, January 1976, pp. 15–20.

³ This grit feed method is frequently referred to as the "Frick Grit Feed Method" because it is based on work done by Otto F. V. Frick as described in "Studies of Wear on Flooring Materials," *Wear*, Vol 14, 1969, pp. 119–131.

2. Referenced Documents

2.1 ASTM Standards:

D 618 Practice for Conditioning Plastics for Testing⁴

D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement⁴

E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality for a Lot or Process⁵

E 171 Specification for Standard Atmospheres for Conditioning and Testing Flexible Barrier Materials⁶

2.2 ANSI Standard:

B74.12 Checking the Size of Abrasive Grain for Grinding Wheels, Polishing, and General Industrial Uses⁷

3. Terminology

3.1 Definitions:

3.1.1 *abrasion*—of resilient floor coverings, a form of wear, in which a gradual removing of a flooring surface is caused by the frictional action of relatively fine hard particles.

3.1.2 *resistance to abrasion*—of resilient floor coverings, the ability of a material to withstand mechanical actions of relatively fine hard particles, which by rubbing, scraping, and eroding remove material from a floor covering surface.

4. Significance and Use

4.1 When subjected to normal in-use traffic conditions, a flooring material is exposed to abrasion caused by the destructive action of fine hard particles. This situation occurs whenever a particle-polluted intermediate layer exists between traffic bodies (that is, shoes and a flooring surface). Under continuing exposure to an "abrasive action," a flooring material may suffer a thickness loss sufficient to reduce its service life.

4.2 Abrasion resistance measurements of resilient floor coverings can be complicated since the resistance to abrasion is

⁴ *Annual Book of ASTM Standards*, Vol 08.01.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

⁶ *Annual Book of ASTM Standards*, Vol 15.09.

⁷ Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.



FIG. 1 Taber Abraser with Grit Feeder

affected by many factors. One of these is the physical properties of the material in the floor covering surface, particularly its hardness and resilience. The type and degree of added substances, such as fillers and pigments, can also affect abrasion resistance. It can also be affected by conditions of the test (for example, the type and characteristics of the abrasant and how it acts on the area of the specimen being abraded, including the development and dissipation of heat during the test cycle). The surface characteristics of the specimen, such as type, depth, and amount of embossing, can likewise affect the abrasion resistance of resilient floorings.

4.3 This test method is designed to simulate one kind of abrasive action and abrasant that a flooring may encounter in the field. However, results should not be used as an absolute index of ultimate life because, as noted, there are too many factors and interactions to consider. Also involved are the many different types of service locations. Therefore, the data from this test method are of value chiefly in the development of materials and should not be used without qualifications as a basis for commercial comparisons.

5. Apparatus

5.1 *Apparatus*,⁸ as shown in Fig. 1, shall consist of the following:

5.1.1 *Abraser*,

5.1.2 *Feeder attachment*, for the abramer.

⁸The sole source of supply of the Part No. S-38, Taber model 530 or 5130 abramer, and Model 155 grit feeder attachment (Part No. 0503-00-0155), and top-grade belt leather (Part No. S-39) known to the committee at this time is Teledyne Taber Corp., 455 Bryant St., North Tonawanda, NY 14120. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

5.1.3 Leather-covered brass wheels⁸ shall have a diameter of 1.75 in. (4.44 cm), and the width shall be 0.50 in. (1.27 cm); weight of the brass wheel shall be 5.11 oz (145 g). Width of the leather covering shall be 0.50 in. (1.27 cm), and the weight of the leather strip shall be 0.202 oz (5 g).

5.1.4 Vacuum unit,⁸ or equivalent, and a water trap as shown in Fig. 2. The purpose of the water trap is to protect the vacuum equipment motor, reduce the need to empty the vacuum bag frequently, and minimize readjustment of speed. The inlet pipe to the water trap should be far enough away from the water surface so that undue turbulence is avoided and water does not enter the exhaust line.

5.1.5 Speed control, or equivalent, for adjusting grit feed rate.

5.2 *Aluminum Oxide Grit*⁸ 240 grit, ANSI B74.12.

5.3 *Conditioning Room*, providing the standard laboratory atmosphere of $50 \pm 5\%$ relative humidity at a temperature of $73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) in accordance with Specification E 171.

5.4 *Equipment*, for determining specific gravity.

5.5 *Analytical Balance*, for weighing specimens to a precision of 0.001 g.

5.6 *Die or Knife*, for cutting specimens to designated size.

5.7 *Sieve*, No. 80 (180 μm).

5.8 *Oven*, to dry grit by heating at 180°F (82°C).

5.9 *Static Eliminator Brush*.

6. Test Specimens

6.1 The test specimen shall measure $4 \pm \frac{1}{32}$ by $4 \pm \frac{1}{32}$ in. (101.60 ± 0.8 by 101.60 ± 0.8 mm). A $\frac{1}{4} \pm \frac{1}{64}$ -in. (6.25 ± 0.4 -mm) diameter hole is drilled through the precise center of the specimen to allow fastening to the specimen holder.

6.2 The required number of specimens for each test shall be indicated in the material specification. If no number is given, four samples shall be taken from the material and one determination made on each. The average of the four or otherwise specified measurements shall be taken as the abrasion loss for the material.

7. Calibration and Standardization

7.1 Adjust the abramer with the grit feeder for proper operation using cast acrylic sheet⁸ as the standard material. The equipment, when running properly, shall produce an average weight loss of 127.5 ± 10 mg for four specimens and 127.5 ± 18 mg for an individual test at 2000 revolutions (Note 1). Operation of the equipment for calibration shall be as described in Section 9, except that specific gravity will not need to be determined.

NOTE 1—If the desired weight loss is not obtained, check on the following: grit feed rate, path of the grit, removal of the grit, condition of the leather on the wheels, free rotation of wheel bearings, specimen slippage, static charge effects, humidity control, faulty revolution counter, and weighing errors.

8. Conditioning

8.1 For those tests where conditioning is required, condition the specimens at $73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity for not less than 40 h prior to test in accordance with Practice D 618.

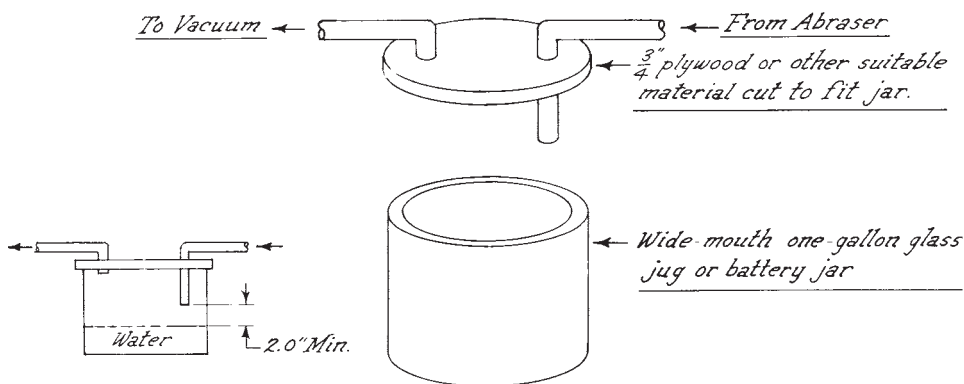
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8.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of $73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity unless otherwise specified in the test method.

9. Procedure

tions. The circular clamp may be used, if needed, to keep the specimen from lifting.

9.6 Adjust the feeder nozzle so that it is no higher than $\frac{1}{4}$ in. (6.3 mm) above the specimen and so that the stream of grit



NOTE 1—A vacuum-tight seal between the cover and jar is not required.

FIG. 2 Water Trap

9.1 Determine the specific gravity of the material to be tested in accordance with standard analytical procedures, such as Method A-1 or A-2 in Test Methods **D 792**. If the specimen as received is not homogeneous but possesses a surface that differs from the body or core, determine the specific gravity of the surface alone. If abrasion is to be carried beyond the surface of the body, also determine the specific gravity of the latter and calculate and report the abrasion resistance of the two components separately.

9.2 Screen the grit through a U.S. Standard Sieve No. 80 (180 μm) and dry for 1 h at 180°F .

9.3 Fill the grit reservoir with grit and swing the feeder out away from the abrader. Allow the feeder to run for 15 to 20 min so that the apparatus comes to running temperature. Adjust the rate of feed to 350 ± 50 mg per specimen revolution. The feed rate may be measured by holding a tared petri dish under the nozzle of the grit feeder for 100 or more specimen revolutions and weighing the amount of grit delivered. The feed rate may be controlled by adjusting the motor speed. Shutdown time should be no more than 1 min to minimize the effects of cooling. If a shutdown in excess of 1 min occurs, allow the feeder to run for 5 min and recheck the grit feed rate. It is suggested that the grit feed rate check be made after every third run.

9.4 When the specimens have been prepared and conditioned, brush with the static eliminator and record the initial values for weight to the nearest 0.001 g. Handle samples with care to eliminate contact with moisture from the hands or other environmental contact.

9.5 Secure the specimen to the specimen disk. Some samples, particularly those containing a foam layer, tend to slip on the rotating table. Such slippage can be prevented by drilling a hole through the washer under the holding screw into the table and inserting a pin through a hole in the sample into the table. This will prevent slippage of the sample and ensure that the sample and table make the same number of revolutions.

delivered will evenly cover the path covered by the rollers. This may be done by adjusting the set-screw located at the base of the feeder and should be done prior to the start of the test.

9.7 It is essential that the grit feed fall into the path of the wheels. The screws holding the grit feeder to the frame can be adjusted to move the feeder a small distance toward the front or back of the abrader. This results in a small radial movement of the point of grit feed. The correct location of the feeder can be checked by collecting grit for one revolution on a calibration plate containing concentric circles of various radii. The location of the grit pattern can then be compared with the wear path recorded on a poly(methyl methacrylate)(PMMA) or other transparent plate.

9.8 Place the 1000-g weights provided with the apparatus on each of the roller arms. Fasten the leather-covered rollers to each arm and lower to the specimen surface. The leather rollers should be replaced when one third of the original thickness of the leather clad is reached. This will occur in approximately 45 000 specimen revolutions.

9.9 Position the grit removal exhaust nozzle and adjust the settings of the adjustable-ratio transformer so that all grit will be removed after passing under the rollers.

9.10 Adjust the counter to zero and start the machine.

9.11 When the prescribed number of specimen revolutions have been reached, stop the machine, remove the specimen, clean with a filtered dry air blast, brush with the static eliminator, and reweigh.

10. Calculation and Report

10.1 Report the resistance to abrasion for the number of revolutions employed using one or more of the following equations:

$$\text{Volume loss, cm}^3 = \frac{W_1 - W_2}{S} \quad (1)$$

where: