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An American National Standard

# Standard Test Method for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)[1]

This standard is issued under the fixed designation D 3884; 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.

## 1. Scope

1.1 This test method covers the determination of the abrasion resistance of textile fabrics using the rotary platform, double-head tester (RPDH).

NOTE 1—Other procedures for measuring the abrasion resistance of textile fabrics are given in Test Methods D 3885, D 3886, D 1775, and AATCC 61.

1.2 The values stated in SI units are to be regarded as standard: the values in English units are provided as information only and are not exact equivalents.

1.3 *This standard does not purport to address all of the safety problems, 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:*

D 123 Terminology Relating to Textiles[2]

D 1682 Test Methods for Breaking Load and Elongation of Textile Fabrics[2]

D 1775 Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinger and Uniform Abrasion Methods)[2]

D 1776 Practice for Conditioning Textiles for Testing[2]

D 3885 Test Method for Abrasion Resistance of Textile Fabrics (Flexing and Abrasion Method)[3]

D 3886 Test Method for Abrasion Resistance of Textile Fabrics (Inflated Diaphragm Method)[3]

2.2 *Other Documents:*

AATCC 61 Impeller Tumble Method[3]

## 3. Terminology

3.1 *Definitions:*

3.1.1 *abrasion, n*—the wearing away of any part of a material by rubbing against another surface.

3.2 For definitions of other textile terms used in this test method, refer to Terminology D 123.

## 4. Summary of Test Method

4.1 A specimen is abraded using rotary rubbing action under controlled conditions of pressure and abrasive action. The test specimen, mounted on a 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 $cm^2$. Resistance to abrasion is evaluated by various means which are described in Section 12.

## 5. Significance and Use

5.1 The measurement of the resistance to abrasion of textile and other materials is very complex. The resistance to abrasion is affected by many factors, such as the inherent mechanical properties of the fibers; the dimensions of the fibers; the structure of the yarns; the construction of the fabrics; and the type, kind, and amount of finishing material added to the fibers, yarns, or fabric.

5.2 The resistance to abrasion is also greatly affected by the conditions of the tests, such as the nature of abradant, variable action of the abradant over the area of specimen abraded, the tension of the specimen, the pressure between the specimen and abradant, and the dimensional changes in the specimens.

5.3 Abrasion tests are all subject to variation due to changes in the abradant during specific tests. The abradant must accordingly be discarded at frequent intervals or checked periodically against a standard. With disposable abradants, the abradant is used only once or discarded after limited use. With permanent abradants that use hardened metal or equivalent surfaces, it is assumed that the abradant will not change appreciably in a specific series of tests. Similar abradants used in different laboratories will not change at the same rate, due to differences in usage. Permanent abradants may also change due to pick up of finishing or other material from test fabrics and must accordingly be cleaned at frequent intervals. The measurement of the relative amount of abrasion may also be affected by the method of evaluation and may be influenced by the judgment of the operator.

5.4 The resistance of textile materials to abrasion as measured on a testing machine in the laboratory is generally only one of several factors contributing to wear performance or

[1] This test method is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.60 on Fabric Test Methods, Specific.

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[2] *Annual Book of ASTM Standards*, Vol 07.01.

[3] *Annual Book of ASTM Standards*, Vol 07.02.

durability as experienced in the actual use of the material. While "abrasion resistance'' (often stated in terms of the number of cycles on a specified machine, using a specified technique to produce a specified degree or amount of abrasion) and "durability'' (defined as the ability to withstand deterioration or wearing out in use, including the effects of abrasion) are frequently related, the relationship varies with different end uses, and different factors may be necessary in any calculation of predicted durability from specific abrasion data. Laboratory tests may be reliable as an indication of relative end-use performance in cases where the difference in abrasion resistance of various materials is large, but they should not be relied upon where differences in laboratory test findings are small. In general, they should not be relied upon for prediction of actual wear-life in specific end uses unless there are data showing the specific relationship between laboratory abrasion tests and actual wear in the intended end-use.

5.5 These general observations apply to all types of fabrics, including woven, nonwoven, and knit apparel fabrics, household fabrics, industrial fabrics, and floor coverings. It is not surprising, therefore, to find that there are many different types of abrasion testing machines, abradants, testing conditions, testing procedures, methods of evaluation of abrasion resistance and interpretation of results.

5.6 All the test methods and instruments so far developed for measuring abrasion resistance may show a high degree of variability in results obtained by different operators and in different laboratories; however, they represent the test methods now most widely in use.

5.7 Since there is a definite need for measuring the relative resistance to abrasion, standardized test methods are needed and useful and may clarify the problem and lessen the confusion.

5.8 Before definite predictions of fabric usefulness can be drawn from an abrasion test as made on the rotary platform, double-head (RPDH) abraser (Fig. 1), actual end-use trials should be conducted and related to the abrasion test. Different types of wear (for example, wear on men's clothing at cuffs, crotch, etc.) may correspond to different ratings of the RPDH test.

**FIG. 1 Rotary Platform Double Head Abraser**

5.9 In making a comparison of different fabrics (that is, of different fibers, weights, etc.) the RPDH test will not always reveal a difference known to exist when the fabrics are actually used. Therefore, end-use trials should be conducted in conjunction with the RPDH abrasion test, at least as a guide for future testing of these fabrics.

5.10 Uncontrolled manufacturing or finishing variations occurring within a fabric or within lots of the same style of fabric can, however, be detected satisfactorily with the RPDH tester.

5.11 Because of the conditions mentioned above, technicians frequently fail to get good agreement between results obtained on the same type of testing instrument both within and between laboratories, and the precision of these test methods is uncertain. This test method is accordingly not recommended for acceptance testing in contractual agreements between purchaser and seller because of the poor between-laboratory precision of the test method. In such a case, if there is a disagreement arising from differences in values reported by the purchaser and the seller when using this test method for acceptance testing, the statistical bias, if any, between the laboratory of the purchaser and laboratory of the seller should be determined with each comparison being based on testing specimens randomly drawn from one sampling unit of material of the type being evaluated.[4]

## 6. Apparatus

6.1 *Rotary Platform, Double-Head (RPDH) Abraser* (Fig. 1),[5] comprised of a housing of compact design, a removable flat-circular specimen holder, a pair of pivoted arms to which the abrasive wheels are attached, a motor for rotating the platform and specimen, a fan for cooling the motor, a vaccum nozzle and vacuum cleaner for removal of lint from specimen, and a counter for indicating the revolutions of the specimen holder. The specimen holder should be mounted so as to produce a circular surface travel of an essentially flat specimen in the plane of its surface.

6.1.1 The abrasive wheels, which are attached to the free end of the pivoted arms, 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 angles of travel of one wheel periphery being opposite to that of the other. Motion of the abrasive wheels, in opposite directions, is provided by rotation of the specimen and the associated friction therefrom.

6.1.2 The abrasive wheels[6] are either rubber-based or vitrified-based. Both types of wheels are manufactured in

[4] Available from American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

[5] The Taber Abraser Model 503 has been found suitable and is available from Teledyne Taber, 455 Bryant St., North Tonawanda, NY 14120.

[6] Abrasive wheels of both the rubber-base type (trade name Calibrase) and the vitrified-base type (trade name Calibrade) are manufactured by Teledyne Taber, 455 Bryant St., North Tonawanda NY 14120.