Australian Standard®

Methods of test for textiles

Method 2.27: Physical tests—Determination of abrasion resistance of textile fabrics (inflated diaphragm method)

PREFACE

This Standard was prepared by the Standards Australia Committee on Testing of Textiles, under the direction of the Textile Standards Board.

In the preparation of this Standard, cognizance was taken of the following Standard:

ASTM D 3886 *Abrasion resistance of textile fabrics (inflated diaphragm method)*

The method is based upon the development described by R.G. Stoll in *Improved multipurpose abrasion test and its application for the wear resistance of textiles,* Textile Research Journal, July 1949, p. 394.

FOREWORD

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 inherent mechanical properties of the fibres; the dimensions of the fibres; the structure of the yarns; the construction of the fabrics; and the type, kind and amount of finishing material added to the fibres, yarn or fabrics.

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

Abrasion tests are all subject to variation due to changes in the abradant during specific tests. Accordingly the abradant is discarded at frequent intervals or checked periodically against a standard. With disposable abradants, the abradant is used once only 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 during 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 accordingly are 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 judgement of the operator.

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 durability as experienced in 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.

These general observations apply to all types of fabrics, including woven, non-woven, 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, methods of evaluation of abrasion resistance, and interpretations of results.

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 methods now most widely in use.

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

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 methods is uncertain. Accordingly this Standard is not recommended for acceptance testing in contractual agreements between purchaser and seller because of the poor between-laboratory precision of the method.

METHOD

1 SCOPE. This Standard sets out a method for the determination of the resistance to abrasion of textile fabrics using the inflated diaphragm tester. The method is applicable to woven and knitted textile fabrics. It is not applicable to floor coverings.

2 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS	
1199	Sampling procedures and tables for inspection by attributes
2001	Methods of test for textiles
2001.1	Method 1: Conditioning procedures

3 DEFINITIONS. For the purpose of this Standard, the definition below applies.

Abrasion—the wearing away of any part of a material by rubbing against another surface.

4 PRINCIPLE. A test specimen is abraded by rubbing either unidirectionally or multidirectionally against an abradant having specified surface characteristics, while the specimen is held in a fixed position when supported by an inflated diaphragm which is held under constant pressure. Resistance to abrasion is evaluated by various means.

5 REAGENTS.

5.1 Water—filtered tap water shall be used.

5.2 Wetting agent—ethoxylated derivative of a synthetic alcohol (non-ionic) wetting agent* shall be used.

6 APPARATUS.

6.1 Inflated diaphragm tester† (see Figure 1). An inflated diaphragm tester with the essential following parts shall be used:

(a) *Surface abrasion head.* A surface abrasion head comprising a circular clamp (i.e. a clamping ring and a tightening collar) over a rubber diaphragm shall be provided. The height from the surface of the clamped-in specimen to the upper edge of the tightening collar shall not exceed 9.5 mm. The clamping area of the body of the clamp and the ring shall have gripping surfaces to prevent the slipping of the test specimen and leakage of air pressure during the test. Means shall be provided for supplying air pressure to the body of the clamp so that the pressure under the diaphragm can be controlled between 0 and 41 kPa with an accuracy of ± 5% of range.

* Teric BL8, produced by ICI Australia Ltd, is a suitable wetting agent.

† The Stoll-Quartermaster has been found suitable and is available from Custom Scientific Instrument Inc., 13 Wing Drive, Whippany, N.J. 07981, U.S.A.

(b) *Diaphragm.* A rubber diaphragm (1.40 ±0.25 mm in thickness) with a metallic contact pin (3.2 mm in diameter) sealed into the centre flush with the diaphragm surface shall be provided. Provision shall be made for a flexible electrical connection from this contact pin to the ground of the machine. The strain distribution on the diaphragm shall be uniform so that, when inflated without the test specimen, it assumes the shape of a section of a sphere. Pressure shall be controllable from 0 to 41 kPa.

(c) *Driving mechanism.* A driving mechanism with a design such that the circular clamp makes a reciprocal motion of 115 ±15 double strokes per minute of 25 mm stroke length shall be provided. Provision shall be made for rotation of the clamp, in addition to the reciprocating motion, so that one revolution can be completed in not less than 40 nor more than 100 double strokes.

(d) *Balanced head and abradant plate.* A balanced head and abradant plate, comprising an abradant mounted upon a plate, shall be provided. The plate shall be rigidly supported by a double-lever parallelogram to provide free movement in a direction perpendicular to the plane of the reciprocating clamp. The abradant plate assembly shall be well balanced to maintain a vertical pressure equivalent to a weight of 0 to 21.5N (2.2 kgf) by means of dead weights. Provision shall be made to mount different abradants, such as abrasive paper, fabrics, on this plate, and to stretch them into an even position. An electrically insulated contact pin, adjustable to the thickness of the abradant, shall be mounted into this plate on the length axis at one of the turning points of the centre of the clamp.

(e) *Machine stopping mechanism.* A machine stopping mechanism, such that contact between the adjustable pin on the lower side of the abradant plate and the contact pin inserted into the centre of the diaphragm closes a low-voltage circuit and stops the machine, shall be provided.

(f) *Indicator.* An indicator shall be provided for indicating the diaphragm pressure and the number of abrasion cycles (1 cycle = 1 double stroke).

6.2 Water bath. Where wet specimens are to be tested, a shallow water bath, which completely immerses the mounted test specimen, shall be used.

7 SAMPLE AND TEST SPECIMENS.

7.1 General. Care should be taken to ensure that the operator's hands are dry. Excessive handling of the sample and test specimen should be avoided.

7.2 Sample.

7.2.1 *Lot sampling.* A lot sample shall be selected in accordance with the relevant material specification.

Where there is no material specification, the sample shall be selected using a sampling plan developed in accordance with AS 1199.

NOTE: To provide a sampling plan with a meaningful producer's risk and consumer's risk, an adequate specification needs to take into account the variability between rolls of fabric, and between specimens from a sample taken from a roll of fabric.

7.2.2 *Laboratory sample.* A sample shall be taken from the outside of each roll of fabric in the lot sample, after first discarding all fabric that contains creases fold marks, delamination and disturbed weave.

7.3 Test specimens. Test specimens shall be selected so that no two specimens contain the same wales or courses in knitted fabrics, or the same warp and weft yarns in woven fabrics.

7.4 Conditioning. Except where testing wet specimens, all test specimens shall be conditioned and tested all in accordance with AS 2001.1.

7.5 Dimensions of test specimens. Test specimens shall be circular, 112 mm in diameter.

7.6 Number. Five test specimens shall be tested.

7.7 Wet test specimens. Where it is required that test specimens are to be tested in the wet state, the test specimens shall be placed, already prepared (see Clauses 7.5 to 7.6), in the water bath containing water (see Clause 5.1) and a wetting agent (see Clause 5.2) at a concentration of 0.2 g/L. The test specimens shall be allowed to sink under their own weight, or shall be forcibly immersed, for 1 h. The test specimens shall be rinsed for half a minute in water prior to testing.

8 PROCEDURE. The procedure shall be as follows:

(a) Place the test specimen over the rubber diaphragm in a smooth condition, and clamp it in place without distorting it.