

Proposed Test Method for Abrasion Resistance of Hosiery (Martindale Abrasion Tester Method)

1. Scope

- 1.1 This test method covers the determination of the resistance to abrasion of hosiery garments using the Martindale abrasion tester.
- 1.2 *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 to determine the applicability of regulatory limitations prior to use.*



2. Referenced Documents

2.1 *ASTM Standards:*

2.1.1 *D 123* Terminology Relating to Textiles

2.1.2 *D 1776* Practice for Conditioning Textiles for Testing¹

3. Terminology

3.1 *Definitions:*

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

3.1.2 *courses, n.* —in *knitted fabrics*, the series of successive loops lying crosswise of a knitted fabric, that is, lying at right angles to a line passing through the open throat to the closed end of the loops.

3.1.3 *wale, n.* —in *knitted fabrics*, a column of loops in successive courses that is parallel with the loop axes.

3.1.4 For definitions of other textile terms used in this test method, refer to Terminology D123.

3.2 *NAHM2 Foot Forms*—standard forms used in the hosiery industry for sizing garments.

4. Summary of Test Method

4.1 The fabric specimen is measured by subjecting the garment to rubbing motion in the form of a straight line. The endpoint is determined and discussed 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 condition of the tests, such as the nature of the abradant, variable action of the abradant over the area of specimen abraded, the tension of the specimen, and the dimensional changes in the specimen.

6. Apparatus and Materials

6.1 *Martindale Abrasion Tester*, with the following items:

6.1.1 *Abradant*—Trizact^{TM4}

6.1.2 *Press Cutters*6, 38 ± 1 mm ($1.5 \pm .06$ in.) and 140 ± 1 mm ($5.5 \pm .06$ in.) in diameter.

6.2 *Template*—With a diameter of 130 ± 2 mm ($5 \pm .0625$ in.), a template is prepared to measure the abrasion testing area of the garment.

6.3 *China Marker*—The China Marker is used to mark the abrasion testing area around the template.

6.4 *Toothbrush*—A medium bristle toothbrush is suggested for use of removing pills during abrasion testing.

7. Number of Specimens

7.1 Take one specimen per garment.

7.2 In the absence of applicable specifications, evaluate a minimum of three specimens.

NOTE: While data on single-operator precision are not available, the use of three specimens per test is generally accepted in the field.

8. Test Specimens

8.1 The test sample is obtained by placing the garment on a NAHM foot form. The form size used should represent the maximum size of the garment, as represented on the label. For example, a 9-11 stretch men's sock should be tested on an 11.0 M (Male) NAHM foot form (see Figure Two).

8.2 After the garment is placed on the NAHM foot form, the template (130 ± 2 mm in diameter) is used to obtain a test specimen.

8.3 Mark the circular testing area by centering the template between the toe and heel cups of the bottom of the NAHM foot form. The template should be positioned in a manner that it covers both sides of the NAHM foot form and garment.

8.4 Remove the marked garment from the NAHM form.

8.5 Cut test specimens at least 35.0 ± 5.0 mm (1.50 ± 0.125 in.) in distance from the testing area of the garment.



9. Conditioning

- 9.1 Condition the specimens under standard conditions of $65 \pm 2\%$ relative humidity and $2 \pm 1^{\circ}\text{C}$ ($70 \pm 2^{\circ}\text{F}$).

10. Preparation of Apparatus (see Figure Three)

10.1 *Installation of TrizactTM*

10.1.1 Using the press cutters, create abrading samples for the abrasion and sample holders.

10.1.2 Place the 38 ± 1 mm ($1.5 \pm .06$ in.) diameter abrasive on the abrasion holder.

10.1.3 Place the 140 ± 1 mm ($5.5 \pm .06$ in.) diameter abrasive on the sample holder.

10.2 *Adjustment of Martindale Abrasion Tester*

10.2.1 Turn the machine ON.

10.2.2 Set all cycle counters to zero.

11. Procedure

11.1 Conduct the test in the standard atmosphere for testing textiles.

11.2 Place the test specimen on the sample holder with the wales of the garment running parallel to the abradant plate's direction of travel.

11.3 Place the motion plate on the Martindale abrasion machine.

11.4 Place the abrasion holder and head weight on the motion plate.

11.5 Set the batch set counter to 100.

11.6 Push RUN button.

11.7 When the machine stops, remove head weight, abrading holder, and motion plate.

11.8 Observe the specimen.

11.9 Use a toothbrush to gently remove pills of matted fibers interfering with proper contact between the specimen and abradant during the test.

11.10 Place the motion plate, abrading holder, and head weight on the machine. Repeat steps 11.6 through 11.10 until an end point is reached.

11.11 Record the number of cycles to reach the end point.

12. Interpretation of Results

12.1 Determine the end point by one of the following methods as specified:

12.1.1 *Failure*—Abrade the specimen until all fibers in a section of the abrasion area are worn off.

12.1.2 *Visual Rating*—Abrade the specimen a specified number of cycles and evaluate visually for the effect of the abrasion on fabric structure.

13. Report

13.1 State that the specimens were tested as directed in specified test method. Describe the material or product sampled and the method of sampling used.

13.2 Report the following information:

13.2.1 Type of abradant,

13.2.2 Condition of the specimens (in equilibrium with the standard atmosphere for testing textiles),

13.2.3 Number of cycles to reach the end point and end point type,

13.2.4 Any deviations from the standard test procedure.

14. Precision and Bias

14.1 *Precision*—The precision of this test method for measuring the abrasion resistance of hosiery by the CSI Stoll Quartermaster with elastomeric pad is being established.

14.2 *Bias*—No justifiable statement can be made on the bias for abrasion resistance of hosiery, since the value varies in fiber and style characteristics.

15. Keywords

15.1 Abrasion: hosiery: NAHM: endpoint: wale

1 *Annual Book of ASTM Standards*, Vol. 07.01.

2 National Association of Hosiery Manufacturers; 447 S. Sharon Amity Rd.; Charlotte, NC 28211; tel: 704/365-0913; fax: 704/362-2056.

3 Commercially available from SDL America, Inc., 1900A Center Park Dr., Charlotte, NC 28217-2956, 704-329-0911; fax 704-329-0914. The Nu-Martindale is available from ATE(Advanced Testing Instruments Corporation) 243 E. Blackstock Rd., Ste. W; Spartanburg, SC 29301. (864) 576-1277; fax (864) 576-1298.

4 TrizactTM is a trademark abrasant of *3M Incorporated*: 3M Center; St. Paul, MN 55144-1000.

6 Available from Testing Machines, Inc., 400 Bayview Ave., Amityville, NY 11701.

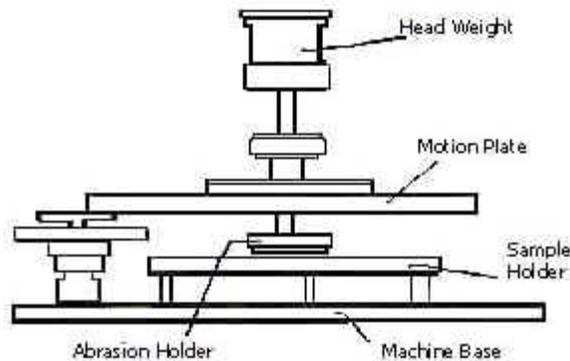


Figure Three: Schematic of Martindale Abrasion Tester
