



Standard Test Method for Stiffness of Nonwoven Fabrics Using the Cantilever Test¹

This standard is issued under the fixed designation D 5732; 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 stiffness properties of nonwoven fabrics by employing the principle of cantilever bending of the fabric under its own weight. Bending length is measured and flexural rigidity calculated.

1.2 This test method applies to most nonwoven fabrics that are treated or untreated, including those heavily sized, coated, or resin-treated.

1.3 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses may be approximate.

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.*

2. Referenced Documents

2.1 ASTM Standards:

- D 123 Terminology Relating to Textile Materials²
- D 1776 Practice for Conditioning Textiles for Testing²
- D 2904 Practice for Interlaboratory Testing of a Textile Test Method That Produces Normally Distributed Data²

3. Terminology

3.1 Definitions:

3.1.1 *bending length, n*—in textiles, a measure of the interaction between fabric weight and fabric stiffness as shown by the way in which a fabric bends under its own weight.

3.1.1.1 *Discussion*—Bending length reflects the stiffness of a fabric when bent in one plane under the force of gravity and is one component of drape.

3.1.2 *cross-machine direction, CD, n*—the direction in the plane of the fabric perpendicular to the direction of manufacture.

3.1.2.1 *Discussion*—In nonwoven fabrics, the term cross-machine direction is used to refer to the direction analogous to crosswise or filling direction in a woven fabric.

3.1.3 *flexural rigidity, n*—a measure of stiffness, the couple on either end of a strip or unit width bent into unit curvature,

in the absence of any tension.

3.1.4 *machine direction, MD, n*—the direction in the plane of the fabric parallel to the direction of manufacture.

3.1.4.1 *Discussion*—In nonwoven fabrics, the term machine direction is used to refer to the direction analogous to lengthwise or warp direction in a woven fabric.

3.1.5 *nonwoven fabric, n*—a textile structure produced by bonding or interlocking of fibers, or both, accomplished by mechanical, chemical, thermal, or solvent means, or combination thereof.

3.1.6 *stiffness, n*—resistance to bending.

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

4. Summary of Test Method

4.1 A specimen is slid at a specified rate in a direction parallel to its long dimension, so that its leading edge projects from the edge of a horizontal surface. The length of the overhang is measured when the tip of the specimen is depressed under its own weight to the point where the line joining the top to the edge of the platform makes a 0.785 rad (41.5°) angle with the horizontal. The stiffer the fabric, the longer it takes to bend, thus, the higher numbers indicate a stiffer fabric.

5. Significance and Use

5.1 This test method may be used for acceptance testing of commercial shipments of nonwoven fabrics, however, caution is advised since information about between-laboratory precision is incomplete. A comparative test as directed in 5.1.1 may be advisable.

5.1.1 In case of a dispute arising from differences in reported test results when using this test method for acceptance testing of commercial shipments, the purchaser and the supplier should conduct a comparative test to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are as homogeneous as possible and that are from a lot of material of the type in question. Test specimens should then be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using the appropriate Student's *t*-test and an acceptable probability level chosen by the two parties before testing is begun. If a bias is found, either its cause must be found and corrected or the purchaser and the

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

supplier must agree to interpret future test results in the view of the known bias.

5.2 This test method measures the drape stiffness of the nonwoven fabric. This test is not, however, suitable for very limp fabrics or those that show a marked tendency to curl or twist.

6. Apparatus

6.1 *Cantilever Bending Tester*³ (Fig. 1):

6.1.1 *Horizontal Platform*, with a minimum area of 38 by 200 mm (1.5 by 8 in.) and having a smooth low-friction, flat surface such as polished metal or plastic. A leveling bubble shall be incorporated in the platform.

6.1.2 *Indicator*, inclined at an angle of 0.724 rad (41.5°) below the plane of the platform surface.

6.1.3 *Movable Slide*, consisting of a metal bar not less than 25 by 200 mm (1 by 8 in.) by approximately 3 mm (1/8 in.) thick and having a mass of 270 ± 5 g (0.6 ± 0.01 lb).

6.1.4 *Scale and Pointer*, to measure the length of the overhang.

6.1.5 *Motorized Specimen Feed Unit*, set for 120 mm/min (4 3/4 in./min), preferred. Manual units are permitted.

6.2 *Analytical Balance*, having a capacity and sensitivity to weigh within ± 0.1 % of the weight of the specimens being tested.

6.3 *Cutting Die*, 25 by 200 mm ± 1 mm (1 by 8 in. ± 0.002 in.).

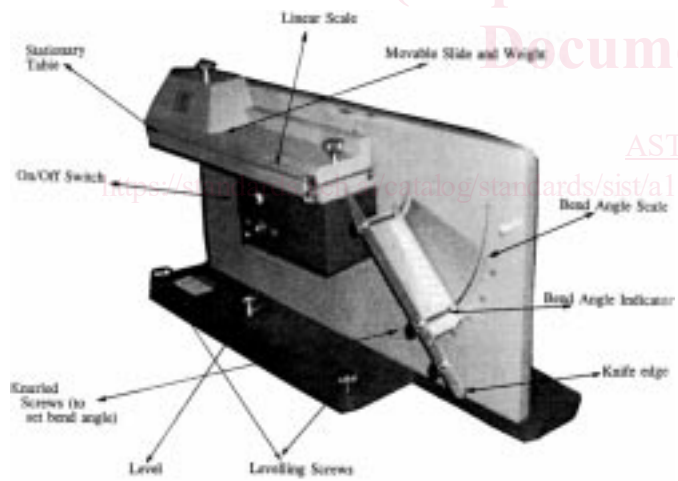


FIG. 1 Cantilever Bending Tester

7. Sampling and Test Specimens

7.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls, or pieces, of fabric directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider the rolls, or

³ The F.R.L. cantilever bending tester has been found suitable and is available from Testing Machines, Inc., 400 Bayview Ave., Amityville, NY 11710; U.S. Testing, 1415 Park Ave., Hoboken, NJ 07030; and FAST (The Wool Bureau, Inc., U.S. Branch-International Wool Secretariat, Technical Service Center), 225 Crossways Park Drive, Woodbury, NY 11797-0403.

pieces, of fabric to be the primary sampling units. In the absence of such an agreement, take the number of fabric rolls specified in Table 1.

NOTE 1—An adequate specification or other agreement between the purchaser and supplier requires taking into account the variability between rolls or pieces of fabric and between specimens from a swatch from a roll or pieces of fabric to provide a sampling plan with a meaningful producer’s risk, consumer’s risk, acceptable quality level, and limiting quality level.

7.2 *Laboratory Sample*—For the laboratory sample, take a swatch extending the width of the fabric and approximately 1 m (1 yd) along the machine direction from each roll, or piece, in the lot sample. For rolls of fabric, take a sample that will exclude fabric from the outer wrap of the roll or the inner wrap around the core.

7.3 *Test Specimens*—From each laboratory sampling unit, take five specimens from the machine direction and five specimens from the cross-machine direction as applicable to a material specification or contract order. For nonwoven fabrics, take specimens only in the machine direction unless otherwise specified.

7.3.1 *Direction of Test*—Consider the long dimension as the direction of the test.

7.3.2 *Specimen Size and Direction of Test*—Cut test specimens 25 by 200 mm ± 1 mm (1 by 8 in. ± 0.002 in.). Take the specimens for the measurement of the machine direction from different positions across the fabric width with the longer dimension parallel to the machine direction. Take the specimens for the measurement of the cross-machine direction from different positions along the length of the fabric with the longer dimension parallel to the cross-machine direction. Label to maintain specimen identity.

7.3.2.1 Cut specimens representing a broad distribution across the width of the laboratory sample and no nearer the edge than one tenth its width. Ensure specimens are free of folds, creases, or wrinkles. Avoid getting oil, water, grease, and so forth, on the specimens when handling.

8. Conditioning

8.1 No conditioning is required unless otherwise specified in a material specification or contract order.

8.2 When specified, precondition the specimens by bringing them to approximate moisture equilibrium in the standard atmosphere for preconditioning textiles as directed in Practice D 1776.

8.3 After preconditioning, bring the test specimens to moisture equilibrium for testing in the standard atmosphere for testing textiles as directed in Practice D 1776 or, if applicable, in the specified atmosphere in which the testing is to be performed.

TABLE 1 Number of Rolls, or Pieces, of Fabric in the Lot Sample

Number of Rolls, Pieces in Lot, Inclusive	Number of Rolls or Pieces in Lot, Sample
1 to 3	all
4 to 24	4
25 to 50	5
over 50	10 % to a maximum of ten rolls or pieces