



Designation: **D4032–94 (Reapproved 2001)** Designation: D 4032 – 08

Standard Test Method for Stiffness of Fabric by the Circular Bend Procedure¹

This standard is issued under the fixed designation D 4032; 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 stiffness of fabrics by the circular bend procedure.

1.2 This test method is generally applicable to all types of fabrics, including woven, knitted and nonwovens, of any fiber content.

NOTE 1—For other methods of testing for stiffness, refer to Test Methods D 1388.

1.3 The values stated in SI units are to be considered as standard; the values in inch-pound units are included for information only.

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:*²

D 123 Terminology Relating to Textiles

D 1388 Test Method for Stiffness of Fabrics

D 1776 Practice for Conditioning Textiles for Testing—Practice for Conditioning and Testing Textiles

D 4850 Terminology Relating to Fabric

3. Terminology

3.1 *Definitions:*

3.1.1 *circular bend, n*—simultaneous, multidirectional deformation of a fabric in which one face of a flat specimen becomes concave and the other becomes convex.

3.1.2 *stiffness, n*—resistance to bending.

3.1.3 *stiffness, n*—with regard to the circular bending of textiles, resistance to multidirectional bending.

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

3.1 For all terminology relating to D 13.60, Fabric Test Methods, Specific, refer to Terminology D 4850.

3.1.1 The following terms are relevant to this standard: circular bend, stiffness.

3.2 For all other terminology related to textiles, see Terminology D 123.

4. Summary of Test Method

4.1 A plunger forces a flat, folded swatch of fabric through an orifice in a platform. The maximum force required to push the fabric through the orifice is an indication of the fabric stiffness (resistance to bending).

5. Significance and Use

5.1 Test Method D 4032 for testing stiffness of fabrics is considered satisfactory for quality control testing. It may also be used for acceptance testing of commercial shipments since the test method has been used extensively in the trade field. In cases of differences in values reported by purchaser and seller using Test Method D 4032 for acceptance testing, the statistical bias, if any, between the laboratories of the purchaser and the seller should be determined with each comparison being based on the testing of specimens taken homogeneously from a lot of material of the type being evaluated. Specimens should be randomly assigned in equal numbers to each of the laboratories.

¹ This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.60 on Fabric Test Methods, Specific. Current edition approved Jan. 15, 1994. Published April 1994. Originally published as D4032–81. Last previous edition D4032–93. Current edition approved June 1, 2008. Published July 2008. Originally approved in 1981. Last previous edition approved in 2001 as D 4032 – 94(2001).

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

5.2 The circular bend procedure gives a force value related to fabric stiffness, simultaneously averaging stiffness in all directions. The stiffness tests in Test Methods D 1388 are of the single directional type.

5.3 The circular bend procedure is simple to perform and may be used for knitted, woven, or nonwoven fabrics, provided gage capacity is in keeping with fabric range tested.

6. Apparatus

6.1 *Circular Bend Stiffness Tester*,³ (Figs. 1 and 2), having the following parts:

6.1.1 *Platform*, 102 by 102 by 6 mm (4 by 4 by ¼ in.) smooth-polished chrome-plated steel plate with a 38.1-mm (1.50-in.) diameter orifice. The lap edge of the orifice should be at a 45° angle to a depth of 4.8 mm (¾ in.) (see Fig. 3).

6.1.2 *Plunger*, 25.4-mm (1.00-in.) diameter, mounted concentric with orifice, 6.4 mm (0.25 in.) clearance on all sides. The bottom of the plunger should be set at 3 mm (⅛ in.) above the top of the orifice plate. From this position, the downward stroke length is 57 mm (2¼ in.).

6.1.3 *Force-Measurement Gage*, dial or digital type (see 9.3).

6.1.3.1 Dial gages with maximum reading pointer in different capacities ranging from 1 to 50 lbf, 0.5 to 25 kgf, or 5 to 200 N with 100 graduations minimum; or

6.1.3.2 Digital gage with maximum reading “hold” feature and capacity of 100 lbf, 50 kgf, or 500 N, with 1000 graduations minimum.

6.1.4 *Actuator*, manual or pneumatic.

6.2 *Specimen Marking Template*, (102 by 204 mm) 4.0 by 8.0 in.

6.3 *Stop Watch*, for checking stroke speed.

³ Available from J. A. King and Co., Inc., 2620 High Point Road, Greensboro, NC27420.

³ Apparatus is commercially available.



FIG. 1 King Manual Operated Dial Model