Designation: D 3786 – 06

Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method[1]

This standard is issued under the fixed designation D 3786; 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 describes the measurement of the resistance of textile fabrics to bursting using the hydraulic diaphragm bursting tester. This test method is generally applicable to a wide variety of textile products.

1.2 This test method may also be applicable for stretch woven and woven industrial fabrics such as inflatable restraints.

1.3 The values stated in S. I. Units are to be regarded as the standard.

NOTE 1—For the measurement of the bursting strength by means of a ball burst mechanism, refer to Test Method D 3787.

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 1776 Practice for Conditioning and Testing Textiles

D 3787 Test Method for Bursting Strength of Textiles—Constant-Rate-of-Traverse (CRT) Ball Burst Test

D 4850 Terminology Relating to Fabric

2.2 *Other Standard:*

TAPPI T 403, OM.91 Bursting Strength of Paper[3]

3. Terminology

3.1 For all terminology related to D13.59, Fabric Test Methods, see Terminology D 4850.

3.1.1 The following terms are relevant to this standard: bursting strength, knitted fabric, nonwoven fabric. stretch woven fabric, woven fabric.

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

4. Summary of Test Method

4.1 A specimen is clamped over an expandable diaphragm. The diaphragm is expanded by fluid pressure to the point of specimen rupture. The difference between the total pressure required to rupture the specimen and the pressure required to inflate the diaphragm is reported as the bursting strength.

5. Significance and Use

5.1 This method for the determination of diaphragm bursting strength of knitted, nonwoven and woven fabrics is being used by the textile industry for the evaluation of a wide variety of end uses.

5.2 In cases where test results obtained using the procedures in Test Method D 3786 have not been correlated with actual performance, Test Method D 3786 is considered satisfactory for acceptance testing of commercial shipments of textile fabrics for bursting strength since the method has been used extensively in the trade for acceptance testing. In cases where disagreement arising from differences in values reported by the purchaser and the supplier when using Test Method D 3786 for acceptance testing, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the supplier

[1] This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.59 on Fabric Test Methods. General.

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[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.

[3] Available from Technical Association of the Pulp and Paper Industry, 1 Dunwoody Park, Atlanta, GA 30341.

should be determined with comparison based on testing specimens randomly drawn from one sample of material of the type being evaluated.

NOTE 2—The kind of load transfer and stretch that occur when knitted goods and nonwoven fabrics are worn are prevented by clamping them as described in this method.

6. Apparatus and Materials

6.1 *Hydraulic Diaphram Bursting Tester*[4]— A testing machine that meets the requirements of 6.1.1-6.1.4. In cases of dispute, a motor-driven tester shall be used unless the purchaser and the supplier agree otherwise.

6.1.1 *Clamps*, for firmly and uniformly securing the test specimen between two annular, plane, parallel, and preferably stainless steel surfaces, without slippage during the test. Use sufficient pressure to effect the practicable minimization of slippage.

6.1.1.1 The upper and lower clamping surfaces shall have a circular opening at least 75 mm (3 in.) in diameter and coaxial apertures of 31 ± 0.75 mm (1.22 ± 0.03 in.) in diameter: The surfaces of the clamps between which the specimen is placed shall have concentric grooves spaced not less than 0.8 mm (1/32 in.) apart and shall be of a depth not less than 0.015 mm (0.0006 in.) from the edge of the aperture. The surfaces of the clamps shall be metallic and any edge which might cause a cutting action shall be rounded to a radius of not more than 0.4 mm (1/64 in.). The lower clamp shall be integral with the chamber in which a screw shall operate to force a liquid pressure medium at a uniform rate of 95 ± 5 mL/min against the rubber diaphragm.

NOTE 3—Since the clamping mechanism and clamping surfaces are subject to considerable wear and distortion, they should be examined periodically and repaired or replaced when necessary. The effectiveness of grooving the clamping surfaces in the manner specified has not been determined.

6.1.2 *Diaphragm*[4]—A 48 mm (1.875 in) diaphragm of molded synthetic rubber, 1.80 ± 0.05 mm (0.070 ± 0.002 in.) in thickness with reinforced center, clamped between the lower clamping plate and the rest of the apparatus so that before the diaphragm is stretched by pressure underneath it the center of its upper surface is below the plane of the clamping surface. The pressure required to raise the free surface of the diaphragm plane shall be 30 ± 5 kPa (4.3 ± 0.8 psi). This pressure shall be checked at least once a month. To test, a bridge gage[4] may be used, the test being carried out with the clamping ring removed. The diaphragm should be inspected frequently for permanent distortion and renewed as necessary.

6.1.3 *Pressure Gage*—A maximum-reading pressure gage of the Bourdon type of appropriate capacity graduated in pounds and accurate throughout the entire range of its scale to within a value of 1 % of its maximum capacity. The capacity of the gage shall be such that the individual readings will be not less than 25 % nor more than 75 % of the total capacity of the gage.

6.1.4 *Hydraulic Pressure System*—A mean of applying controlled increasing hydrostatic pressure to the underside of the diaphragm until the specimen bursts through a fluid displaced at the rate of 95 ± 5 mL/min. The fluid is displaced by a piston in the pressure chamber of the apparatus. The recommended chamber fluid is USP chemically pure 96 % glycerin. The hydraulic system, including the gages shall be mounted so as to be free of externally induced vibrations. Means shall be provided at the instant of rupture of the specimen for stopping any further application of the loading pressure and for holding unchanged the contents of the pressure chamber until the total bursting pressure and the pressure required to inflate the diaphragm indicated on the gage have been recorded.

NOTE 4—Ethylene glycol may be substituted for the glycerine if desired.

6.1.5 *Aluminum Foil For Calibration of Tester*[5]—Pieces of pretested aluminum sheet having a known bursting strength in the range of 70 to 790 kPa (10 to 115 psi) are use for checking the overall performance of the tester.

6.1.6 Pressure Recording.

6.1.6.1 *Hydraulic Instruments*—Means shall be provided at the instant of rupture of the specimen for stopping any further application of the loading pressure and for holding unchanged the contents of the pressure chamber until the total bursting pressure and the pressure required to inflate the diaphragm indicated on the gage have been recorded.

6.1.6.2 *Pneumatic Instruments*—Means shall be provided for recording the loading pressure at the point of rupture. Diaphragm correction (tare pressure) is achieved by inflating the diaphragm to the same distension recorded at bursting and recording the amount of pressure to achieve this.

7. Sampling

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

NOTE 5—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability between rolls of fabric and between specimens from a swatch from a roll 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*—As a laboratory sample for acceptance testing, take a full width swatch 1 m (1 yd) long from the end of each roll of fabric in the lot sample, after first discarding a minimum of 1 m (1 yd) of fabric from the very outside of the

[4] The Hydraulic Diaphragm Bursting Testers, hand driven Model LC (Fig. 1A) and motor driven Models C (Fig. 1B) and (Fig. 1C), and accessories, manufactured by B. F. Perkins & Son, Inc., have been found satisfactory. The motor driven Model A (Fig. 1D) has been found to be satisfactory for heavyweight fabrics, but may be unsuitable for some lightweight fabrics. Model C and Model A have different pumping rates and different diaphragms therefore it is not likely these two machines will give the same result. The testers also can be obtained from Testing Machines, Inc., 400 Bayview Ave., Amityville NY

[5] Standardized aluminum sheets for this purpose, bursting over the range from 51 to 150 psi (350 to 1035 kPa) may be obtained from the Pulp and Paper Research Institute of Canada, 3420 University St., Montreal, Canada; from Testing Foil Service, 304 N. Stevens St., Rhinelander, WI 54501; and from Testing Machines, Inc., 400 Bayview Ave., Amityville, NY 11701.