Designation: D3786/D3786M – 09

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

This standard is issued under the fixed designation D3786/D3786M; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method describes the measurement of the resistance of textile fabrics to bursting using a hydraulic or pneumatic 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 either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

NOTE 1—For the measurement of the bursting strength by means of a ball burst mechanism, refer to Test Method D3787.

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]

D123 Terminology Relating to Textiles
D1776 Practice for Conditioning and Testing Textiles
D3787 Test Method for Bursting Strength of Textiles—Constant-Rate-of-Traverse (CRT) Ball Burst Test
D4850 Terminology Relating to Fabrics and Fabric Test Methods

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 D4850.

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 D123.

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 D3786 have not been correlated with actual performance, Test Method D3786 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 D3786 for acceptance testing, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the supplier should be determined with comparison based on testing specimens randomly drawn from one sample of material of the type being evaluated.

[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 (TAPPI), 15 Technology Parkway South, Norcross, GA 30092, http://www.tappi.org.

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 *Inflated Diaphragm Bursting Tester* [4]— A testing machine that meets the requirements of 6.1.1-6.1.4. Mounted so as to be free of externally induced vibrations.

6.1.1 *Clamps,* for firmly and uniformly securing the test specimen between two annular, parallel, and durable surfaces, without slippage during the test. Use sufficient pressure to effect the practicable minimization of slippage. The upper and lower clamping surfaces shall have a circular coaxial aperture of 31 ± 0.75 mm (1.22 ± 0.03 in.) in diameter: The surfaces of the clamps shall be durable and any edge which might cause a cutting action shall be rounded to a radius of not more than 0.4 mm. The lower clamp shall be integral with the chamber in which a pressure medium inflates 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*—A diaphragm of molded synthetic or natural rubber, 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 nominally level with the plane of the clamping surface. The diaphragm should be inspected frequently for permanent distortion and renewed as necessary.

6.1.3 *Pressure Gage*—The instrument must be fitted with a pressure measuring system, accurate throughout the entire range of its scale to within a value of 1 % of its maximum capacity. For those instruments with a Bourdon type gage 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 *Pressure System*—A means of applying controlled increasing pressure to the underside of the diaphragm until the specimen bursts. This can be achieved by two methods; hydraulic or pneumatic.

6.1.4.1 Hydraulic pressure is produced by 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.

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

6.1.4.2 Pneumatic pressure is produced by controlling the flow of clean dry air through a valve. The valve is configured as per 11.4.1

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 used 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 roll. From each roll or piece of circular knit fabric selected from the lot sample, cut a band at least 305 mm (1 ft) wide.

7.3 *Test Specimens*—Cut ten test specimens from each swatch in the laboratory sample with each specimen being 125 mm (5 in.) square.

8. Calibration

8.1 *Routine Verification of Testing Machine*—Check the operation of the testing machine at least once each month by bursting five specimens of standard aluminum sheet. The average of the indicated bursting resistance for the five specimens of aluminum sheet should be between ±5 % of that marked on the package of the pretested aluminum sheet standard.

8.2 *Calibration of Pressure Measuring System*—Calibrate the pressure measuring system, while inclined at the same angle at which it is used, by means of a dead-weight tester of the piston type. Alternatively, a traceable electronic pressure gage may be used or other calibration instrumentation recommended by the equipment manufacturer. Such calibration is preferably carried out with the gage in its normal position in the tester.

8.3 Where agreement is not attained, check the tester according to the instructions given in Tappi Method T-403 OS-74.

NOTE 6—Possible causes of low readings are gage error (bias or nonlinearity), gage expansivity too high, excessive gage pointer friction, air in hydraulic system or gage, diaphragm collapsed too far at zero, and low pumping rate (hand-driven tester). Possible causes of high readings are: gage error (bias nonlinearity), loose gage pointer (overshoot), gage

[4] Hydraulic and pneumatic bursting strength testers and accessories are commercially available.

[5] Standardized aluminum sheets are commercially available.