Designation: D3787 – 16 (Reapproved 2020)

Standard Test Method for Bursting Strength of Textiles—Constant-Rate-of-Traverse (CRT) Ball Burst Test[1]

This standard is issued under the fixed designation D3787; 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 U.S. Department of Defense.

1. Scope

1.1 This test method describes the measurement for bursting strength with a ball burst strength tester of textiles or garments that exhibit a high degree of ultimate elongation.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

NOTE 1—For the measurement of bursting strength with a hydraulic testing machine, refer to Test Method D3786.

NOTE 2—Constant Rate of Traverse (CRT) machines and Constant Rate of Extension (CRE) machines have been shown to provide different results. When using a CRE device, refer to Test Method D6797.

1.3 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D76 Specification for Tensile Testing Machines for Textiles

D123 Terminology Relating to Textiles

D1776 Practice for Conditioning and Testing Textiles

D3786 Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method

D4850 Terminology Relating to Fabrics and Fabric Test Methods

D6797 Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test

3. Terminology

3.1 For all terminology relating to D13.59, Fabric Test Methods, General, refer to Terminology D4850.

3.1.1 The following terms are relevant to this standard: bursting strength, constant–rate-of-traverse (CRT) tensile testing machine, fabric, knitted, fabric, nonwoven.

3.2 For all other terminology related to textiles, refer to Terminology D123.

4. Summary of Test Method

4.1 A specimen is securely clamped without tension between grooved, circular plates of the ball burst attachment secured to the pulling (movable) jaw for the constant-rate-of-traverse (CRT) testing machine. A force is exerted against the specimen by a polished, hardened steel ball that is attached to the pendulum-actuating (fixed) clamp of the machine, until rupture occurs.

5. Significance and Use

5.1 This test method for the determination of ball bursting strength of textiles is being used by the textile industry for the evaluation of a wide variety of fabrics.

5.2 Test results obtained using the procedures in Test Method D3787 have not been correlated with actual performance. Test Method D3787 is considered satisfactory for acceptance testing of commercial shipments of textiles fabrics for bursting strength since the method has been used extensively in the trade for acceptance testing. In cases of disagreement arising from differences in values reported by the purchaser and the seller when using Test Method D3787 for acceptance testing, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the seller

[1] This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of 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.

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

NOTE 3—The kind of force transfer and strength that occur when knitted goods are worn is prevented by clamping them as directed in this test method.

5.2.1 If there are differences of practical significance between reported test results for two (or more) laboratories, comparative tests should be performed to determine if there is a statistical bias between them. The test samples used should be as homogeneous as possible, drawn from the material from which the disparate test results were obtained, and randomly assigned in equal numbers to the laboratories for testing. Other materials with established test values may be used for this purpose. The test results from the two laboratories should be compared using a statistical test for unpaired data at a probability level chosen prior to the testing series. If a bias is found, either the cause must be determined and corrected or future test results must be adjusted in consideration of known bias.

6. Apparatus

6.1 *Constant-Rate-of-Traverse (CRT) Tensile Testing Machine (CRT),* as specified in Specification D76, with a ball-burst attachment replacing the clamp assembly.

6.2 *Ball-Burst Attachment,*[3] consisting of an attachment having a polished steel ball that replaces the fixed clamp of the tensile tester and of a ring-clamp mechanism that replaces the pulling (moving) clamp of the tensile tester (see Fig. 1 and Fig. 2). Movement of the ring clamp pushes the fabric in the ring clamp against the steel ball.

[3] Apparatus and accessories are available commercially.

6.2.1 The polished steel ball shall have a diameter of 25.400 ± 0.005 mm (1.0000 ± 0.0002 in.) and shall be spherical within 0.005 mm (0.0002 in.). The ring clamp shall have an internal diameter of 44.450 ± 0.025 mm (1.750 ± 0.001 in.).

7. Sampling

7.1 *Lot Sample*—Take a lot sample as directed in the applicable material specification. In the absence of such a specification, randomly select the rolls or pieces of fabric that constitute the lot sample using the following schedule:

Number of Rolls or 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 % or a maximum of 10 of the rolls or pieces

7.2 *Laboratory Samples*—From each roll or piece of fabric selected from the lot sample, cut at least one laboratory sample the full width of the fabric and at least 1 m (1 yd) along the selvage. From each roll or piece of circular knit fabric selected from the lot sample, cut a band at least 300 mm (1 ft) wide.

8. Selection and Number of Specimens

8.1 Unless otherwise agreed upon, as when specified in an applicable material specification, take five specimens of the laboratory sample(s) of fabric. Each specimen shall be at least 125 mm (5 in.) square, or a circle 125 mm (5 in.) in diameter. Specimens need not be cut for testing. No two specimens should contain the same warp and filling or wale and course yarns. Take no specimens nearer the selvage than one tenth the fabric width. This restriction does not apply to tubular knitted fabric.

FIG. 1 Ball Burst Attachment

FIG. 2 Ball Burst Attachment

9. Conditioning

9.1 Bring the specimens (or laboratory samples) from the prevailing atmosphere to moisture equilibrium for testing textiles in the standard atmosphere for testing as prescribed in Practice D1776.

10. Procedure

10.1 Make all tests on samples conditioned in the standard atmosphere for testing as specified in 9.1.

10.2 Place the specimen without tension in the ring clamp and fasten securely by means of the screw or lever device. Start the CRT tensile testing machine, using a pulling clamp speed of 305 ± 13 mm/min (12 ± 0.5 in./min), and continue at that speed until the specimen bursts. Record to the nearest 0.5 N (0.1 lb) the ball-bursting strength of the specimen.

11. Calculation

11.1 Calculate the average bursting force to the nearest 0.5 N (0.1 lb) for each laboratory sample and for the lot.

12. Report

12.1 State that the specimens were tested as directed in ASTM Test Method D3787. Describe the material or product sampled, and the method of sampling used.

12.2 Report the bursting strength of each specimen and the average bursting strength of the five specimens from each laboratory sample to the nearest 0.1 lbf (0.5 N).

13. Precision and Bias[4]

13.1 *Interlaboratory Test Data*—an interlaboratory test was run in 1990 in which randomly drawn specimens of three fabrics were tested in each of four laboratories. The fabrics were circular knit, stabilized knit, and brushed knit fabrics. The components of variance for bursting strength results expressed as variance are reported in Table 1.

TABLE 1 Components of Variance for Bursting Strength Expressed as Variance

	Within Laboratory Component	Between Laboratory Component
Cotton Circular Knit	2.31	6.75
Brushed Warp Knit	0.76	5.22

NOTE 4—The difference in variability between the two groups of fabrics is attributed to the differences between the source yarns rather than the type of equipment on which the fabrics were knit. There is no objective evidence to support this supposition.

13.2 *Critical Differences*—For the components of variance reported in 13.1, two averages of observed values should be considered significantly different at the 95 % probability level if the difference equals or exceeds the critical differences listed in Table 2 (Note 5).

NOTE 5—The tabulated values of the critical differences should be considered to be a general statement particularly with respect to between-laboratory precision. Before a statement can be made about two specific laboratories, the amount of statistical bias, if any, between them must be established, with each comparison being based on recent data obtained on specimens randomly drawn from a sample taken at random from a lot of the material to be evaluated.

13.3 *Bias*—The procedure of this test method produces a test value that can be defined only in terms of a test method. There is no independent, referee method by which bias may be determined. This test method has no known bias.

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D13-1086.