Designation: D 6797 – 02

Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test[1]

This standard is issued under the fixed designation D 6797; 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 for bursting strength of woven and knitted textiles taken from rolls of fabric or fabric taken from garments.

NOTE 1—For the measurement of bursting strength with a hydraulic testing machine, refer to Test Method D 3786.

1.2 *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 76 Specification for Tensile Testing Machines for Textiles[2]

D 123 Terminology Relating to Textiles[2]

D 1776 Practice for Conditioning Textiles for Testing[2]

D 3786 Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics—Diaphragm Bursting Strength Tester Method[3]

D 3787 Test Method for Bursting Strength of Knitted Goods—Constant Rate of Traverse (CRT) Ball Burst Test[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *bursting strength*, *n*—the force or pressure required to rupture a textile by distending it with a force, applied at right angles to the plane of the fabric, under specified conditions.

3.1.1.1 *Discussion*—The angle of application of force, and the area of the fabric upon which the force is applied varies continuously as the fabric stretches when it is tested as directed in this method.

3.1.2 *constant-rate-of-extension tensile testing machine (CRE)*, *n*—a testing machine in which the rate of increase of the specimen length is uniform with time.

3.1.3 *fabric*, *n*—in textiles, planar structure consisting of yarns or fibers.

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

4. Summary of Test Method

4.1 Setup the tensile tester for performing the ball burst test in accordance with the manufacture's instructions. A specimen of the fabric is securely clamped to the CRE machine without tension to the ball burst attachment. A force is exerted against the specimen by a polished, hardened steel ball until rupture occurs.

5. Significance and Use

5.1 This method is used to determine the force required to rupture textile fabric by forcing a steel ball through the fabric with a constant-rate-of-extension tensile tester.

5.2 This is a new method and therefore the history of data is very small, however the agreement of within- laboratory data suggest this method may be considered for acceptance testing of commercial shipments with caution.

5.2.1 If there are differences of practical significance between reported test results for two laboratories (or more), comparative test should be performed to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum, samples used for such comparative test should be as homogeneous as possible, drawn from the same lot of material as the samples that resulted in disparate results during initial testing, and randomly assigned in equal numbers to each laboratory. Other fabrics with established test values may also be used for these comparative test. The test results from the laboratories involved should be compared using a statistical test for unpaired data, at a probability level chosen prior to the testing series. If bias is found, either its cause must be found and corrected, or future test results for that fabric must be adjusted in consideration of the known bias.

6. Apparatus

6.1 *Tensile Testing Machine*[4], of the constant-rate-of- extension (CRE) type.

6.2 *Ball-Burst Attachment*[4], consisting of a clamping

[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.

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

[3] *Annual Book of ASTM Standards*, Vol 07.02.

[4] Apparatus is commercially available.

mechanism to hold the test specimen and a steel ball attached to the moveable member of the tensile tester.

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, Selection, and Number of Specimens

7.1 *Primary Sampling Unit*—Consider rolls, bolts or pieces of fabric, or cartons of fabric components of fabricated systems such as garments to be the primary sampling unit, as applicable.

7.2 *Laboratory Sampling Unit*—As a laboratory sampling unit take from the primary sampling unit at least one full-width piece of fabric that is 1 m (1 yd) in length along the selvage (machine direction), after removing the first 1 m (1 yd) length. For circular knit fabrics cut a band at least 300 mm (12 in.) wide. When applicable, use the entire fabric component of the fabricated systems.

7.3 *Test Specimen Selection*—From each laboratory sampling unit, take five test specimens. Specimen preparation need not be carried out in the standard atmosphere for testing. Label to maintain specimen identity.

7.3.1 When the end-use fabric component of fabricated systems is provided, take specimens from different areas. That is, if the product is a garment worn on the upper body, then take specimens from the shoulder, shirt tail, shirt back and front, and sleeve.

7.3.2 For fabric widths 125 mm (5 in.) or more, take no specimen closer than 25 mm (1 in.) from the selvage edge.

7.3.3 For fabric widths less than 125 mm (5 in.), use the entire width for specimens.

7.3.4 Cut specimens representing a broad distribution diagonally across the width of the laboratory sampling unit. Take lengthwise specimens from different positions across the width of the fabric. Take widthwise specimens from different positions along the length of the fabric.

7.3.5 Ensure specimens are free of folds, creases, or wrinkles. Avoid getting oil, water, grease, etc. On the specimen when handling.

7.3.6 If the fabric has a pattern, ensure that the specimens are a representative sampling of the pattern.

7.4 *Specimen Preparation*—As test specimens from each laboratory sampling unit, proceed as follows:

7.4.1 For fabrics, cut five specimens at least 125 × 125 mm (5 × 5 in.).

7.4.2 Garments may not require cutting if the equipment has ample room to clamp the garment in the apparatus. Five determinations should be made on each garment.

8. Conditioning

8.1 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 D 1776.

9. Procedure

9.1 Unless otherwise specified, make all tests on samples conditioned in the standard atmosphere for testing as specified in 8.1.

9.2 Place the specimen without tension in the ring clamp and fasten securely. Start the CRE machine and maintain a speed of 305 ± 13 mm/min (12 ± 0.5 in./min). Continue that speed until the specimen bursts. Record to the nearest 5 N (1.0 lbf) the ball-bursting strength of the specimen.

10. Report

10.1 State that the specimens were tested as directed in Test Method D 6797. Describe the material or product sampled, and the method of sampling used.

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

11. Precision and Bias

11.1 *Summary*—Based upon limited information from one laboratory, the single- operator and within-laboratory components of variation and critical differences shown in Tables 1 and 2 are approximate. These tables are constructed to illustrate what one laboratory found when all the observations are taken by the same well-trained operators using the same piece of equipment and specimens randomly drawn from the sample of material. For this laboratory, in comparing two averages, the differences should not exceed the single-operator precision values shown in Table 2 for the respective number of tests in 95 out of 100 cases. Differences for other laboratories may be larger or smaller.

11.2 *Single-laboratory Test Data*—A single-laboratory test was run in 1997 in which randomly-drawn samples of two woven materials were tested. Two operators in the laboratory each tested ten specimens from each mate. Five of the ten specimens were tested on one day and five specimens were tested on a second day. Analysis of the data was conducted using Practice D 2904, Practice D 2906 and the adjunct "Tex-Pac." The components of variance for Bursting Strength—Constant-Rate-Of-Extension (CRE) Ball Burst Method expressed as standard deviations were calculated to be the values listed in Table 1.

11.3 *Precision*—Because tests were conducted in only one laboratory estimates of between laboratory precision may be either underestimated or overestimated to a considerable extent and should be used with special caution. Before a meaningful 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 taken from a lot of material of the type being evaluated so as to be as nearly homogeneous as possible and then randomly assigned in equal numbers to each of the

TABLE 1 Grand Average and Components of Variance Expressed as Standard Deviations[A] for Bursting Strength—Constant-Rate-of-Extension (CRE) Ball Burst Method, lbf

Grand Average and Component	Material 1	Material 2
Grand Average	172.2	131.2
Single-Operator Component	8.1	9.0
Within-Laboratory Component	0	0

[A] The square roots of the components of variance are being reported to express the variability in the appropriate units of measure rather than as the squares of those units of measure.

TABLE 2 Critical Differences for Bursting Strength—Constant-Rate-of-Extension (CRE) Ball Burst Method, lbf, for the Conditions Noted[A]

Materials	Number of Observations in Each Average	Single-Operator Precision	Within-Laboratory Precision
Material 1	1	22.4	22.4
	2	15.9	15.9
	5	10.0	10.0
	10	7.1	7.1
Material 2	1	25.0	25.0
	2	17.7	17.7
	5	11.2	11.2
	10	7.9	7.9

[A] The critical differences were calculated using $t = 1.960$, which is based on infinite degrees of freedom.

laboratories. However when agreed upon between the contractual parties, for the approximate components of variance reported in Table 1, two averages of observed values may be considered significantly different at the 95 % probability level if the difference equals or exceeds the critical differences listed in Table 2, for Bursting Strength-Constant-Rate-of-Extension (CRE) Ball Burst Method.

11.4 *Bias*—The value of Bursting Strength-Constant-Rate-of-Extension (CRE) Ball Burst Method can only be defined in terms of a test method. Within this limitation, Test Method D 6797 has no known bias.

12. Keywords

12.1 ball burst; bursting strength