



# Standard Test Method for Bursting Strength of Textiles—Constant-Rate-of-Traversal (CRT) Ball Burst Test<sup>1</sup>

This standard is issued under the fixed designation D 3787; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 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 SI units are to be regarded as the standard.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as the standard. Within the test, the inch-pound units are shown in parenthesis. The values stated in each system are not exact equivalents; therefore, each system may be used independently of the other. Combining values from the two systems may result in nonconformance within the specification.

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

1.4 *This standard may involve hazardous materials, operations and equipment. 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

D 123 Terminology Relating to Textiles<sup>2</sup>

D 1776 Practice for Conditioning Textiles for Testing<sup>2</sup>

D 3786 Test Method for Hydraulic Bursting Strength of Textile Fabrics Hydraulic Diaphragm Bursting Strength Tester Method<sup>3</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *bursting strength, n*—the distending force, which is applied at right angles to the plane of the fabric, under specific conditions, which will result in the rupture of a textile.

3.1.1.1 *Discussion*—the angle of the 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-traversal tensile testing machine (CRT), n*—a testing machine in which the pulling clamp moves at a uniform rate and the load is applied through the other clamp which moves appreciably to actuate a weighing mechanism, so that the rate of increase of load or elongation is dependent upon the extension characteristics of the specimen.

3.1.3 *fabric, knitted, n*—a structure produced by interlooping one or more ends of yarn or comparable material.

3.1.4 *fabric, nonwoven, n*—a textile structure produced by bonding or interlocking of fibers, or both, accomplished by mechanical, chemical, or solvent means and combinations thereof.

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

## 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-traversal (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 In the case of test results obtained using the procedures in Test Method D 3787 have not been correlated with actual performance. Test Method D 3787 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 D 3787 for acceptance testing, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the seller

<sup>1</sup> 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.

Current edition approved Dec. 10, 2001. Published March 2002.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 07.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 07.02.

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 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. As a minimum, the test samples used should be as homogeneous as possible; that are drawn from the material from which the disparate test results were obtained; and that are 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 D 76, with a ball-

burst attachment replacing the clamp assembly.

6.2 *Ball-Burst Attachment*,<sup>4</sup> 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). Movement of the ring clamp pushes the fabric in the ring clamp against the steel ball.

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

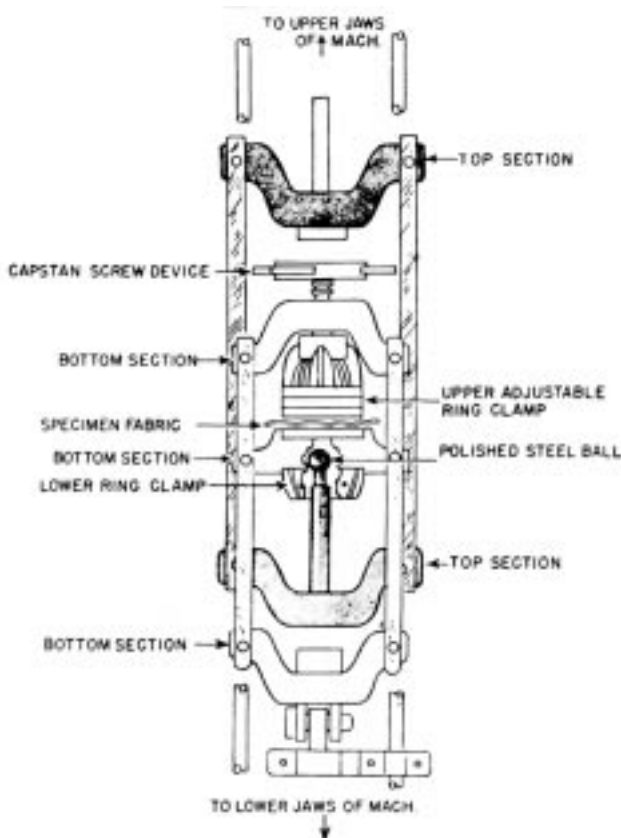
**7. Sampling**

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

<sup>4</sup> The Ball Bursting Attachment, manufactured by the Physical Testing Equipment Services 2 Morgan Mill Road Central Industrial Park Johnson, RI 02919 or equivalent, has been found satisfactory.



**FIG. 1 Ball Burst Attachment**

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 ten 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.

## 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 D 1776.

## 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  $12 \pm 0.5$  in./min ( $305 \pm 13$  mm/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 D 3787. 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

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.

NOTE 3—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 4).

NOTE 4—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.<sup>5</sup>

## 14. Keywords

14.1 bursting strength; knitted fabric; nonwoven fabric

<sup>5</sup> ASTM Research Report RR D13-1086. A copy is available from ASTM Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

**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

**TABLE 2 Critical Difference for Bursting Strength for the  
Materials Noted, Pounds**

	Number of Observations In Each Average	Single Operator Precision	Within Laboratory Precision	Between Laboratory Precision
Single Material	5	5.9	5.9	10.5
	10	4.2	4.2	9.6
	15	3.4	3.4	9.3
	20	3.0	3.0	9.1
Multi-Material	5	5.9	5.9	14.9
	10	4.2	4.2	14.3
	15	3.4	3.4	14.1
	20	3.0	3.0	13.9

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*