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Standard Test Method for Tension and Elongation of Wide Elastic Fabrics (Constant- Rate-of-Load Type Tensile Testing Machine)¹

This standard is issued under the fixed designation D 1775; 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 covers the measurement of tension and elongation characteristics of wide elastic fabrics made from natural or man-made elastomers, either alone or in combination with other textile yarns, when tested with a constant-rate-of-loading (CRL) type tensile testing machine.

NOTE 1—For determination of similar testing using the constant-rate-of-extension (CRL) type tensile testing machine, refer to Test Method D 4964.

1.1.1 This test method is not applicable to narrow elastic fabrics.

1.2 The use of this test method requires the selection of, or mutual agreement upon, tension(s) and elongation(s) at which the test results will be determined.

1.3 In testing laundered elastic fabrics, the laundering procedures require mutual agreement on the selection of temperature and number of washing cycles and drying cycles to be used.

1.4 The values stated in 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 must be used independently of the other, without combining values in any way.

1.5 *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 Textiles²

D 123 Terminology Relating to Textiles²

D 1776 Practice for Conditioning Textiles for Testing²

D 4964 Test Method for Tension and Elongation of Elastic Fabrics (Constant-Rate-of-Extension Type Tensile Testing Machine)³

2.2 AATCC Method:

124 Appearance of Durable Press Fabrics after Repeated Home Laundering⁴

3. Terminology

3.1 Definitions:

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

3.1.2 *constant-rate-of-load tensile testing machine (CRL)*, *n*—a testing machine in which the rate of increase of the load being applied to the specimen is uniform with time after the first 3 s.

3.1.3 *effective carriage mass*, *n*—in *CRL-type tensile testing machine*, the force actually applied to a specimen by the mass of the carriage.

3.1.4 *elastic fabric*, *n*—a textile fabric made from an elastomer either alone or in combination with other textile materials.

3.1.5 *elongation*, *n*—the ratio of the extension of a material to the length of the material prior to stretching, expressed as a percent.

3.1.6 *extension*, *n*—the change in length of a material due to stretching.

3.1.7 *extension-recovery chart*, *n*—in *elastic materials testing*, a continuously plotted graph of tension versus extension resulting from an extension-recovery cycle.

3.1.8 *force*, *n*—a physical influence exerted by one body on another which produces acceleration of bodies that are free to move and deformation of bodies that are not free to move.

3.1.9 *loop tension*, *n*—in *elastic material testing*, the total tension at any specified extension that is exerted on a specimen in a loop formation.

3.1.10 *narrow elastic fabric*, *n*—an elastic fabric that is less than 150 mm or 6 in. wide.

3.1.11 *tension*, *n*—a uniaxial force tending to cause the stretching of a material.

3.1.12 *tension-recovery chart*, *n*—in *tension testing*, a continuously plotted graph of tension versus extension resulting from a tension-recovery cycle.

3.1.13 *tension test*, *n*—in *textiles*, a test designed to measure the tautness in a textile strand or fabric.

3.1.14 *wide elastic fabric*, *n*—an elastic fabric that is at least 150 mm or 6 in. wide.

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

¹ This test method is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.24 on Elastomeric Yarns and Fabrics.

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

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

⁴ Available from American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

4. Summary of Test Method

4.1 Tension at Specified Elongation(s)—A conditioned loop specimen is mounted in a CRL-type tensile testing machine. The specimen is then subjected to specified tension using a specified effective carriage mass and returned to zero tension. The cycle is repeated two more times to give a total of three cycles. During the test, extension-recovery curves may be plotted by an automatic recorder for all or only the third cycle. The tension at specified elongation(s) is calculated from the graph of the third cycle.

4.2 Elongation at Specified Tension—A conditioned loop specimen is mounted in a CRL-Type tensile testing machine. The specimen is subjected to a specified tension and cycled as in 4.1. During the test, tension-recovery curves may be plotted by an automatic recorder for all or only the third cycle. The elongation at a specified tension is calculated from the graph of the third cycle.

5. Significance and Use

5.1 This method for testing tension and elongation of elastic fabrics is considered satisfactory for acceptance testing of commercial shipments of wide elastic fabrics because the test method is used in the trade for acceptance testing.

5.1.1 In the case of a dispute arising from differences in reported test results when using this test method for acceptance testing of commercial shipments, the parties should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are as homogeneous as possible and that are from a lot of material of the type in question. The test specimens should then be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using Student's *t*-test for unpaired data and an acceptable probability level chosen by the two parties before the testing is begun. If bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results in the light of the known bias.

5.2 This test method specifies CRL-Type tensile testing machines of the inclined-plane type which was the type used in the interlaboratory tests performed to determine the reproducibility and reliability of these procedures.

5.3 Users of this test method are cautioned that tension test data obtained using this test method are not comparable to tension test data obtained using Test Method D 4964 because of the differences in testing machines. Test Method D 4964 uses a CRE-Type tensile testing machine.

5.4 The tension and extension relationship of an elastic fabric is an important criterion for judging the suitability of the fabric for various end uses, such as: foundation garments, brassieres, and swimsuits.

5.5 The test for measuring tension at specified elongation(s) is used to determine the tension of an elastic fabric when subjected to a specified elongation which is less than the elongation required to rupture the fabric. The test prescribes points of measurement on the extending (outgoing) cycle only.

5.6 The test for measuring elongation at specified tension(s) is used to determine the elongation of an elastic fabric

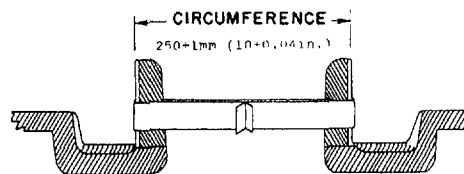


FIG. 1 Loop Specimen in Place on Pins

when subjected to a specified tension which is less than the tension required to rupture the fabric. The test prescribes points of measurement on the loading (outgoing) cycle only.

5.7 The tension and extension recorded for any fabric will vary appreciably with differences in the effective mass of the testing machine because of the differences in the rate of loadings. As a consequence, the effective carriage mass must be specified before testing and reported with the test results.

6. Apparatus

6.1 Tensile Testing Machine, CRL-Type,⁵ equipped with recording pen and chart recording device and conforming to Specification D 76.

6.2 Pins or Rods, for holding loop specimen during testing. See Fig. 1.

6.3 Single-Needle Sewing Machine.

6.4 Rule, or other measuring device, at least 300 mm, or 12 in., long and graduated in 1-mm, or 0.02-in., units.

6.5 Stop watch, to read in seconds.

7. Sampling

7.1 Lot Sample—As a lot sample for acceptance testing, take at random the number of rolls of fabric as 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 2—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability between rolls of fabric, and the variability 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 2-m, or 2-yd, long from the end of each roll of fabric in the lot sample, after first discarding a minimum of 1-m, or 1-yd, of fabric from the very outside of the roll.

7.3 Test Specimens—Take test specimens as follows:

7.3.1 If the purchaser and the supplier agree to test the fabric in only one direction, cut five specimens from each swatch in the laboratory sample with the long dimension of the specimens parallel to the direction of test.

⁵ Suppliers of suitable machines:

IP-4 Machine
Precision Scientific Co.
3737 W. Cortland St.
Chicago, IL 60647

E. H. Benz Co.
283 Whitford Ave.
Providence, RI 02904

Both machines are equipped with clamps and recording charts.