



Designation: ~~D2594-99a~~ Designation: D 2594 – 04 (Reapproved 2008)^{ε1}

Standard Test Method for Stretch Properties of Knitted Fabrics Having Low Power¹

This standard is issued under the fixed designation D 2594; 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.

^{ε1} NOTE—Editorial changes were made in August 2008.

1. Scope

1.1 This test method covers the measurement of fabric stretch and fabric growth of knitted fabrics intended for applications requiring low-power stretch properties.

1.2 This test method includes procedures for fabric growth and stretch and can be used individually when required by individual specifications.

1.3 This test method is not applicable to fabrics intended for support or other applications requiring high-power stretch properties.

~~NOTE 1—For information on testing high-power stretch fabrics, refer to Test Method D1775~~ NOTE 1—For information on testing high-power and woven stretch fabrics, refer to Test Methods D 3107 and D 6614.

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

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:²

D 123 Terminology Relating to Textiles ~~D1775~~ Test Method for Tension and Elongation of Wide Elastic Fabrics²

D 1776 Practice for Conditioning and Testing Textiles

D 2904 Practice for Interlaboratory Testing of a Textile Test Method ~~That that~~ Produces Normally Distributed Data

D 2906 ~~Practice for Statements on Precision and Bias for Textiles²~~ Practice for Statements on Precision and Bias for Textiles

D 3107 Test Methods for Stretch Properties of Fabrics Woven from Stretch Yarns

~~D4848~~ Terminology of Force, Deformation, and Related Properties of Textiles ~~4849~~ Terminology Related to Yarns and Fibers

D 4850 Terminology Relating to Fabric

D 6614 Test Method for Stretch Properties of Textile Fabrics CRE Method

3. Terminology

3.1 Definitions:

3.1.1 *bench marks, n*—marks placed on a specimen to define gage length, that is, the portion of the specimen that will be evaluated in a specific test.

3.1.2 *fabric stretch, n*—the increase in length of a specimen of fabric resulting from a tension force applied under specified conditions.

3.1.2.1 *Discussion*—The difference usually is expressed as a percentage of the initial length of the fabric specimen. Fabric stretch differs from fabric elongation in that the latter (up to the point of rupture) reflects the instantaneously existing amount of stretch under a constantly increasing tension force.

3.1.3 *fabric growth, n*—the difference between the original length of a specimen and its length after the application of a specified tension for a prescribed time and the subsequent removal of the tension.

¹ This test method is under the jurisdiction of ASTM Committee ~~D13~~ 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* Vol 07-01 volume information, refer to the standard's Document Summary page on the ASTM website.



3.1.3.1 *Discussion*—Fabric growth usually is expressed as a percentage of the length of the specimen prior to application of the tension (see also *permanent deformation*):

3.1.4 *Low-power stretch, n*—that property of a fabric whereby it exhibits high fabric stretch and good recovery from low tension.

3.1.5 *Stension, n*—a uniaxial force tending to cause the extension of a body or the balancing force within that body resisting the extension

3.1.6 For definitions of other textile terms used in this test method, refer to Terminologies D123 and D4848 Definitions:

3.1.1 For definition of textile terms used in this test method: bench marks, refer to Terminology D 4849.

3.1.2 For definitions of textile terms used in this test method: fabric growth; fabric stretch; low-power stretch and tension, refer to Terminology D 4850.

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

4. Summary of Test Method

4.1 *Fabric Growth*—Bench marks of a known distance are made on a fabric specimen. A specified tension is applied to a fabric specimen by a prescribed cycling technique. The tension is removed and after several specific recovery times under zero tension, the distance between the bench marks is remeasured after each time interval. The fabric growth is calculated from the length difference between the bench marks prior to application of the tension and after each respective recovery time interval.

4.2 *Fabric Stretch*—Bench marks of a known distance are made on a fabric specimen. A specified tension is applied to a fabric specimen by a prescribed cycling technique and the resulting distance between the bench marks measured. The fabric stretch is calculated from the length difference between the bench marks prior to application of the tension and under while under the tension.

5. Significance and Use

5.1 This test method specifies test conditions for measuring the fabric growth and fabric stretch of knitted fabrics intended for use in swimwear, anchored slacks, and other form-fitting apparel (also commonly known as semi-support apparel) applications, as well as test conditions for measuring the fabric growth of knitted fabrics intended for use in sportswear and other loose-fitting apparel (also commonly known as comfort stretch apparel) applications. The applicability of this test method to the measurement of fabric growth and fabric stretch of knitted fabrics intended for use in slacks, sport coats, and suits has not been determined.

5.2 This test method is not recommended for acceptance testing of commercial shipment because the between-laboratory precision is known to be poor.

5.2.1 If there are differences of practical significance between reported test results for two laboratories (or more), comparative tests should be performed to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum, ensure the test samples should be used that are as homogeneous as possible, that are drawn from the material from which the disparate test results are obtained, and that are assigned randomly in equal numbers to each laboratory 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 its cause must be found and corrected, or future test results for that material must be adjusted in consideration of the known bias.

6. Apparatus

6.1 *Frame*³, suitable for supporting the hanger assembly illustrated in Fig. 1 and tension forces applied during testing.

6.2 *Hanger Assembly*³, consisting of hangers, hanger rods, and chain.

6.3 *Lightweight Rule*³, fitted with a pin hook at the zero point of the scale for attachment to the specimen, graduated either in units of percent of original gage length of 125 mm (5 in.) or in units of 1 mm ($1/16$ in.).

6.4 *Tensiometer or Weights*³, that can be attached to the bottom hanger of the hanger assembly, capable of providing total tensions of 2.27 kgf (5 lbf) and 4.54 kgf (10 lbf) to the specimen, $\pm 1\%$.

6.5 *Turnbuckle*³, or equivalent, having a length of 25 to 75 mm (1 to 3 in.).

6.6 *Sanforized Marker*, to establish bench marks on the specimen.

6.7 *Timer*, with increments of at least 1 min.

7. Sampling and Test Specs

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

7.2 *Laboratory Sampling Unit*—As a laboratory sampling unit take from rolls at least one full-width piece of fabric that is 2 m (2 yd) in length along the selvage (machine direction), after removing a first 1 mm (1 yd) length. For fabric components of fabricated systems use the entire system.

7.3 *Test Specimens*—From each laboratory sampling unit, cut 5 wale-wise (lengthwise) and 5 course-wise (widthwise) test specimens 125 ± 3 mm (5 ± 0.1 in.) by 500 ± 10 mm (15.5 ± 0.3 in.). Cut the long dimension of the wale-wise specimens parallel

³ Annual Book of ASTM Standards, Vol 07.02.

³ For additional information on obtaining apparatus, equipment, or supplies that may be suitable for use in this standard, please visit the ASTM Manufacturers' Equipment Directory at www.astm.org.

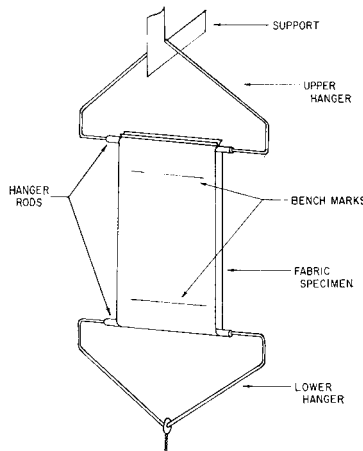


FIG. 1 Hanger Assembly

to the wale direction and the course-wise specimens parallel to the course direction. Take specimens representing a broad distribution from different positions diagonally across the width of the laboratory sampling unit. Consider the long direction as the direction of test. Label to maintain specimen identity.

7.3.1 For fabric widths 125 mm (5 in.) or more, take no specimen closer than 25 mm (1 in.) from the edges of the laboratory sampling unit.

7.3.2 For fabric widths less than 125 mm (5 in.), use the entire width of the laboratory sampling unit for specimens.

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

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

7.3.5 After cutting, fold each specimen in half lengthwise forming a loop and sew the edges opposite the fold together 6 to 13 mm (0.25 to 0.50 in.) from the cut edges and parallel to the short direction of the specimen.

7.3.6 Lay the specimen on a flat surface and place bench marks 125 ± 3 mm (5 ± 0.01 in.) apart on the central section of one face of the looped specimen establishing a gage length along the length of the specimen. Record as measurement (A).

8. Conditioning

8.1 Bring the test specimens to moisture equilibrium for testing in the standard atmosphere for testing textiles as directed in Practice D 1776, or if applicable, in the specified atmosphere in which the testing is to be performed.

9. Preparation of Test Apparatus and Calibration

9.1 Verify measuring scales and tension weights are within calibration.

10. Procedure

10.1 Test the test specimens in the standard atmosphere for testing textiles, as described in Practice D 1776.

10.2 Handle the test specimens carefully to avoid altering the natural state of the material.

10.3 Fabric Growth:

10.3.1 Slide the specimen loop over the upper hanger rod and secure the rod in the hanger such that the seam of the loop lies along the rod.

10.3.2 Slide the folded end of the loop over the lower hanger rod and secure the rod to the hanger.

10.3.3 Place the upper hanger in the slot in the top bar of the supporting frame.

10.3.4 Attach the rule to the specimen loop by inserting the rule pin hook through the face of the fabric in the center of the upper bench mark.

10.3.5 Attach the chain by means of the turnbuckle to the lower hanger and extend the specimen loop to the amount specified in Table 1, that is, such that the lower bench marks lines up with the specified percentage stretch point on the scale.

NOTE 2—If the scale is in units of measurement, it is helpful to calculate the corresponding percentage.

10.3.6 Lock the chain in the corresponding notch in the lower crossmember of the frame. Adjust the turnbuckle to make minor adjustments of the position of the lower bench mark.

TABLE 1 Specimen Stretch Percentage Points

Apparel Type	Wale Direction	Course Direction
Loose-fitting (comfort stretch)	15	30
Form-fitting (semi-support)	35	60