

Dimensional Changes in Commercial Laundering of Woven and Knitted Fabrics Except Wool

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1. Purpose and Scope

1.1 This test method is used to determine the dimensional changes in woven and knitted fabrics made of fibers other than wool when subjected to laundering procedures commonly used in a commercial laundry. A range of laundering test procedures from severe to mild is provided to allow simulation of the various types of commercial launderings available. Five drying test procedures are established to cover the drying techniques used.

1.2 These tests are not accelerated and must be repeated to determine dimensional changes after multiple launderings.

2. Principle

2.1 The dimensional change of woven and knitted fabric specimens subjected to washing, drying and restoration procedures typical of commercial laundering are determined by measuring changes in bench mark distances applied to the fabric before laundering.

3. Terminology

3.1 **commercial laundering**, *n.*—a process by which textile products or specimens may be washed, rinsed, bleached, dried and pressed in commercial laundering equipment, typically at higher temperatures and pHs and longer times than used for home laundering.

3.2 **dimensional change**, *n.*—a generic term for changes in length or width of a fabric specimen subjected to specified conditions. (see also *shrinkage* and *growth*).

3.3 **growth**, *n.*—a dimensional change resulting in an increase in the length or width of a specimen.

3.4 **laundering**, *n.*—of textile materials, a process intended to remove soils and/or stains by treatment (washing) with an aqueous detergent solution that normally includes rinsing, extracting and drying.

3.5 **shrinkage**, *n.*—a dimensional change resulting in a decrease in the length or width of a specimen.

3.6 **wool**, *n.*—used in the generic sense,

fiber from the fleece of the sheep or lamb, hair from the Angora or Cashmere goat, rabbit hair and the specialty hair fibers from camel, alpaca, llama and vicuna.

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas.

4.2 The 1993 AATCC Standard Reference Detergent may cause irritation. Care should be taken to prevent exposure to skin and eyes.

4.3 Manufacturer's safety recommendations should be followed when operating laboratory testing equipment.

5. Apparatus and Materials

5.1 Apparatus.

5.1.1 Wash wheel of the reversing type (see 12.1).

5.1.2 Flatbed press measuring 60 × 125 cm or larger. Any flatbed press capable of pressing specimen 55 cm square may be used as an alternative. The flatbed press is maintained at a temperature not less than 135°C (see 12.2).

5.1.3 Dryer of the rotary tumble type, having a cylindrical basket approximately 75 cm in diameter and 60 cm in length and rotating at approximately 35 rpm. The dryer is provided with a means of maintaining a drying temperature of 60 ± 11°C measured in the exhaust vent as close as possible to the drying chamber.

5.1.4 Conditioning/drying rack with pull-out screen or perforated shelves (see 12.3).

5.1.5 Facilities for drip and line drying.

5.1.6 Hydro-extractor, centrifugal extractor of the laundry type with a perforated basket, 29.0 cm deep × 51.0 cm diameter with an operating speed of 1700 rpm (see 12.4).

5.1.7 Ballast of 92 × 92 ± 3 cm hemmed pieces of bleached cotton sheeting (Wash load ballast type 1) or 50/50 polyester/cotton bleached and mercerized

plain weave (Wash load ballast type 3) (see 12.12 and 12.13).

5.2 Measuring devices.

5.2.1 Indelible ink marking pen (see 12.5) for use with suitable rule, tape, marking template (see 12.6).

5.2.2 Tape or rule with divisions in millimeters or smaller increment (see 12.6).

5.2.3 Needle and sewing thread can be used to make bench marks (see 12.11).

5.2.4 Digital Imaging System (see 12.14).

5.3 Materials.

5.3.1 Detergent, alkylarylsulfonate type, or 1993 AATCC Standard Reference Detergent (see 12.7 and 12.13).

5.3.2 Hand iron, electric, steam or dry, weighing approximately 1.4 kg.

6. Test Specimens

6.1 Sampling.

6.1.1 Test three specimens of each sample. Where possible, each specimen should contain different groups of lengthwise and widthwise yarns.

6.1.2 Fabrics that are badly distorted in their unlaundered state may give deceptive dimensional change results when laundered by any procedure. Therefore, it is recommended that the specimen not be taken from such areas or, if used, the results considered as indicative only.

6.1.3 In cases of dispute or litigation: Pre-condition test specimens as directed in ASTM D 1776, Standard Practice for Conditioning and Testing Textiles, prior to conditioning. Otherwise, condition test specimens for at least 4 h in an atmosphere of 21 ± 1°C and 65 ± 2% RH by laying each test specimen separately on a conditioning rack.

6.2 Size, Preparation and Marking.

6.2.1 The size and preparation of test specimens will vary depending upon the type of fabric being tested.

6.2.2 For woven and warp knit fabrics at least 60 cm wide: Preferably, cut three 60 × 60 cm test specimens. Mark each specimen with three 46 cm pairs of bench marks parallel to the length of the fabric, and three 46 cm pairs of bench marks parallel to the width of the fabric. Each bench mark must be at least 8 cm from all edges of the test specimens. Pairs of bench marks in the same direction must be approximately 15 cm apart (see Fig. 1). Alternatively, if sample size is limited, cut three 40 × 40 cm test specimens. If using this size, mark each specimen with three 25 cm pairs of bench marks parallel to the length of the fabric, and three 25

cm pairs of bench marks parallel to the width of the fabric (see 12.8). Each bench mark must be at least 5 cm from all edges of the test specimens. Pairs of bench marks in the same direction must be approximately 12 cm apart (see Fig. 1).

6.2.3 For woven and warp knit fabrics under 60 cm wide: Cut three test specimens that are each 60 cm in length and the full width of the fabric. Mark each test specimen with 46 cm bench marks parallel to the length of the fabric. The bench marks should be at least 12 cm apart and at least 5 cm from the fabric edges. For the width direction select bench mark distances that fit within 5 cm in from the edges. Place three such bench marks on each test specimen in the width direction. Bench marks in the width direction should be at least 15 cm apart and at least 8 cm from the top and bottom edges of the fabric (see Fig. 2).

6.2.4 Flat and circular knit fabrics: Tubular finished knit fabric samples representing goods used in the tubular state; i.e., underwear, sweat shirts, polo shirts, etc., should be tested in the tubular state. Cut three specimens, each 60 cm in length. Tubular finished knit fabrics representing goods used in the slit open width state; i.e., dresses, slacks, suits, etc., are to be slit and handled flat. After slitting fabric, cut three test specimens according to 6.2.2 or 6.2.3. Mark specimens as in 6.2.2 or 6.2.3. For fabrics which will run or ladder, it is suggested that the edges be sewn with stitch type 505 (see 12.11).

6.3 Original Measurement.

6.3.1 Measure by using one of the following options:

Option 1: Measure and record the distance between each pair of bench marks with suitable tape or rule to the nearest millimeter or smaller increments. This is Measurement A.

Option 2: If using a tape or template ruled directly in percent dimensional change, original measurements are not re-

quired. In case of narrow fabrics less than 38 cm wide, measure and record width.

7. Procedure

7.1 Table I summarizes the alternative laundering, drying and restoration procedures. Details of laundering procedures are summarized in Table II.

7.2 Washing.

7.2.1 Place the specimens in the wash wheel with sufficient ballast or other fabrics similar to test specimens to make a 1.80 ± 0.07 kg load for Tests Ic, IIc, IIIc, IVc and Vc. For Test VIc, a load consisting of test specimens and ballast to make a load of 9.0 ± 0.2 kg shall be used. Add 66 ± 1 g of 1993 AATCC Standard Reference Detergent (see 12.7). In soft water areas this may be reduced to avoid excessive sudsing. Start wash wheel and note the time. Immediately add water at $41 \pm 3^\circ\text{C}$ to the wheel to a level of 18.0 ± 1.0 cm. When this water level has been reached, inject steam into the wheel until the temperature reaches that shown in Row B, Table II. This level will be increased by condensed steam.

7.2.2 Test Ic. Stop the wash wheel after 15 min (Row A, Column 1 of Table II) and drain. Refill the machine to a level of 22.0 ± 1.0 cm with water at a temperature at $41 \pm 36^\circ\text{C}$ and start the machine. Inject steam, if necessary, to maintain that temperature during the rinse. Stop the machine at the end of the time shown in Row C, Column 1 of Table II. Repeat this procedure for the second rinse using the times and temperatures shown in Rows E and F, Column 1 of Table II.

7.2.3 Tests IIc, IIIc, IVc and Vc. The machine runs continuously for the time shown in Row L of Table II. Begin to drain off the detergent solution at the end of the suds cycle at a rate that substantially empties the wash wheel of solution at the end of the time shown in Row A of Table II. Measure the time elapsed from

the time the wash was started in 7.2. Refill the machine to a level of 22.0 ± 1.0 cm with water at a temperature of $41 \pm 3^\circ\text{C}$. When this water level has been reached, inject steam, if necessary, to maintain that temperature during the rinse. Drain off the water at a rate that substantially empties the wash wheel at the end of the sum of the times shown in Rows A and C measured from the time the wash wheel was started. Immediately refill the wash wheel to a level of 22.0 ± 1.0 cm with water at $41 \pm 3^\circ\text{C}$. When the water level has been reached, inject steam, if necessary, to maintain that temperature during the rinse. Drain off the water at a rate that substantially empties the wash wheel at the end of the sum of the times from the time the wash wheel was started.

7.2.4 Test IIc or Test IIIc. The wash wheel is stopped after the second rinse water has drained. For the wet tumble cycle in Tests IVc and Vc, the wash wheel continues to run without further addition of water and is stopped 60 min from the time the wash wheel is started. In each of the above operations, the draining time is included in the running time. Draining is to be completed by the end of the time shown in Row L. The time to fill and drain the wash wheel is included in the time of the suds cycle and the two rinses in Tests IIc, IIIc, IVc and Vc, in which the machine is run continuously from the start of the test.

7.2.5 Test VIc. Stop the wash wheel after 10 min (Row A, Column 6 of Table II) and drain. Refill the machine to a level of 22.0 ± 1.0 cm with water at a temperature at $60 \pm 3^\circ\text{C}$ and start the machine. Inject steam, if necessary, to maintain that temperature during the rinse. Stop the machine at the end of the time shown in Row C, Column 6 of Table II. This procedure is repeated for the second, third and fourth rinses using the times and temperatures shown in Rows E-J, Column 6 of Table II.

7.3 Drying.

7.3.1 The specimens may be dried by

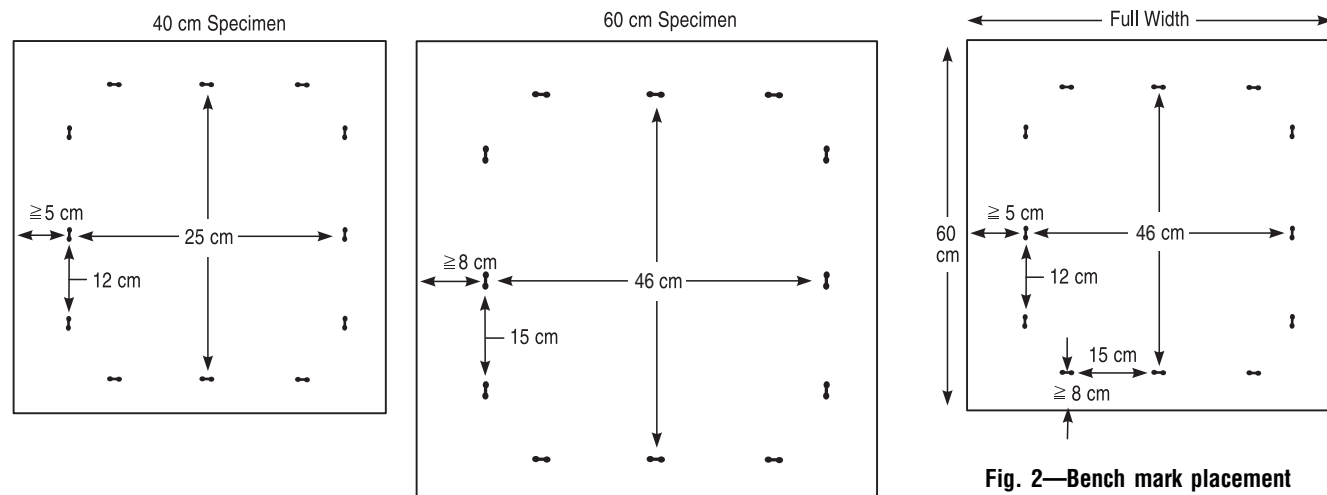


Fig. 1—Bench mark placement (woven and warp knit fabrics at least 60 cm wide).

Fig. 2—Bench mark placement (woven and warp knit fabrics under 60 cm wide).