

# Dimensional Changes of Fabrics after Home Laundering

Developed in 1970 by AATCC Committee RA42; reaffirmed 1973, 2000; revised 1978, 1987, 1995, 2001, 2003 (with title change), 2004; editorially revised 1982, 1985, 1989, 1990, 1991, 1996, 1997, 2006; editorially revised and reaffirmed 1992. Related to ISO 3759.

## 1. Purpose and Scope

1.1 This test method is intended for the determination of dimensional changes of fabrics when subjected to home laundering procedures used by consumers. Four washing temperatures, three agitation cycles, two rinse temperatures and four drying procedures cover the common home care options available to consumers using current laundering machines.

## 2. Principle

2.1 The dimensional changes of fabric specimens subjected to home laundering care are measured using pairs of benchmarks applied to the fabric before laundering.

## 3. Terminology

3.1 **dimensional change**, *n.*—a generic term for changes in length or width of a fabric specimen subjected to specified conditions. The change is usually expressed as a percentage of the initial dimension of the specimen.

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

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

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

## 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 Automatic washing machine (see 12.1).

5.2 Automatic tumble dryer (see 12.2).

5.3 Conditioning/drying racks with pull-out screens or perforated shelves (see 12.3).

5.4 Facilities for drip drying and line drying.

5.5 1993 AATCC Standard Reference Detergent (see 12.10 and 12.11).

5.6 Ballast of 920 × 920 mm (36 × 36 in.) hemmed pieces of bleached cotton sheeting (Wash load ballast type 1), or 50/ 50 polyester/cotton bleached plain weave (Wash load ballast type 3) (see 12.4 and 12.11).

5.7 Indelible ink marking pen (see 12.5) for use with suitable rule, tape, marking template or other marking device (see 12.6). Sewing thread may be used for making benchmarks.

5.8 Measuring devices.

5.8.1 Tape or rule marked in millimeters, eighths or tenths of an inch.

5.8.2 Tape or ruled template marked directly in percent dimensional change to 0.5% or smaller increment (see 12.6).

5.8.3 Digital Imaging System (see 12.7).

5.9 Scale with at least 5.0 kg (10.0 lb) capacity.

## 6. Test Specimens

6.1 Sampling and Preparation.

6.1.1 Samples from which dimensional change specimens are to be taken should be representative of the fabric processing stage, finishing treatment, research lab trial, pallet, lot or end-product stage.

6.1.2 Fabrics that are distorted in their unlaundered state may give deceptive dimensional change results when laundered by any procedure. In such cases, it is recommended that specimens not be taken from any distorted area of a fabric sample.

6.1.3 Tubular knitted samples should be slit and handled flat in a single layer. Only circular knitted fabrics produced on body-width machines are to be used as

specimens in their tubular form. Circular knitted fabrics made on body-width machines are ones to be used in garments with no side seams. Body-width tubular circular knitted garments and seamless garments (knit-to-wear) should be tested according to AATCC Method 150, Dimensional Changes of Garments after Home Laundering.

6.1.4 If fraying of specimens is expected in laundering, see 12.8.

6.1.5 Prior to marking, condition test specimens as directed in ASTM D 1776, Standard Practice for Conditioning and Testing Textiles. Condition each specimen for at least 4 h in an atmosphere of  $21 \pm 1^\circ\text{C}$  ( $70 \pm 2^\circ\text{F}$ ) and  $65 \pm 2\%$  RH by laying each test specimen separately on a screen or perforated shelf of a conditioning rack.

6.1.6 Lay the sample on a flat surface. Do not allow any section of the sample to hang over the edge of the work table. Using a template for the selected test size, mark specimens parallel to the selvage or fabric length direction. Avoid use of the sample area within ten percent of the sample width. Specimens should be taken from areas with different lengthwise and widthwise yarns (see Fig. 1). Identify the length direction of the specimens before cutting them out of the sample. When possible, three specimens from each fabric should be used. One or two specimens may be used when insufficient fabric sample is available.

6.2 Marking.

6.2.1 Option 1: 250 mm (10.0 in.) benchmarks. Mark each 380 × 380 mm (15 × 15 in.) test specimen with three 250 mm (10 in.) pairs of benchmarks parallel to the test specimen length and three 250 mm (10 in.) pairs of benchmarks parallel to the test specimen width. Each benchmark must be at least 50 mm (2 in.) from all test specimen edges. Pairs of bench-

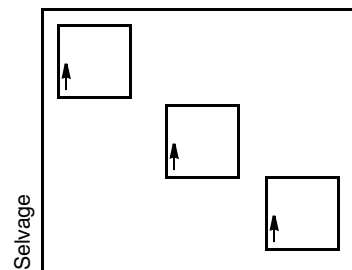


Fig. 1—Diagram for cutting fabric specimens.

marks in the same direction must be spaced approximately 120 mm (5 in.) apart.

6.2.2 Option 2: 460 mm (18.0 in.) benchmarks. Mark each 610 × 610 mm (24.0 × 24.0 in.) test specimen with three 460 mm (18.0 in.) pairs of benchmarks parallel to the test specimen length and three 460 mm (18.0 in.) pairs of benchmarks parallel to the test specimen width. Each benchmark must be at least 50 mm (2.0 in.) from all test specimen edges. Pairs of benchmarks in the same directions must be spaced approximately 250 mm (10 in.) apart.

#### 6.2.3 Narrow Fabrics.

6.2.3.1 For test specimens greater than 125 mm (5 in.) and less than 380 mm (15 in.) wide, take full width of test fabrics and cut each specimen 380 mm (15 in.) long. Mark the length as in 6.2.1. Measurement of the width is optional.

6.2.3.2 For test specimens 25-125 mm (1-5 in.) wide, take full width of test fabrics and cut each specimen 380 mm (15 in.) long. Use only two pairs of benchmarks parallel to the length. Measurement of the width is optional.

6.2.3.3 For test specimens less than 25 mm (1 in.) in width, take full width of test fabrics and cut each specimen 380 mm (15 in.) long. Use only one pair of benchmarks parallel to the length. Measurement of the width is optional.

#### 6.3 Original Measurements and Specimen Size.

6.3.1 Specimen size and benchmark distances used must be indicated in the report.

6.3.2 Dimensional change results may not be comparable when different specimen sizes, different benchmark lengths, different number of specimens, or different number of benchmarks are used.

6.3.3 To improve the accuracy and precision of the dimensional change calculations based on the benchmarks applied to the fabrics as instructed in 6.2, measure and record the distance between each pair of benchmarks with suitable tape or rule to nearest millimeter, eight or tenth of an inch. This is measurement A. In case of narrow fabrics less than 380 mm (15 in.) wide, measure and record width if width measurement will be used. If using a calibrated template for marking and measuring in percent dimensional change directly, an initial measurement is not needed.

### 7. Test Procedure

7.1 Tables I, II and III summarize alternative washing, rinsing and drying conditions and settings. Additional information on the machine and laundering conditions may be found in the monograph, *Standardization of Home Laundry Test Conditions*, elsewhere in this TECHNICAL MANUAL.

#### 7.2 Washing.

7.2.1 Weigh test specimens and enough ballast to make a  $1.8 \pm 0.1$  kg ( $4.00 \pm 0.25$  lb) load. An alternative load size of  $3.6 \pm 0.1$  kg ( $8.00 \pm 0.25$  lb) may be used. Dimensional change results obtained using a 1.8 kg (4 lb) load weight may not be equal to those obtained with a 3.6 kg (8

lb) load weight and should not be compared.

7.2.2 Select the specified water level, the desired water temperature for the washing cycle and a rinse temperature of less than 29°C (85°F). If this rinse temperature is not attainable, record available rinse temperature. Fill the washing machine to the  $18 \pm 0.5$  gal water level. For alternate load size, fill washing machine to the  $22.0 \pm 0.5$  gal water level.

7.2.3 Add  $66.0 \pm 1$  g of 1993 AATCC Standard Reference Detergent to an  $18 \pm 0.5$  gal wash load. For alternative load size of  $22.0 \pm 0.5$  gal, add  $80 \pm 1$  g of 1993 AATCC Standard Reference Detergent. Agitate water briefly to dissolve detergent. Stop the machine agitation. It should be noted that in soft water areas, the amount of detergent used may be reduced to avoid excessive sudsing.

7.2.4 Add test specimens and ballast to machine. Set the washer for the selected washing cycle and time (see Tables I and II).

7.2.5 For specimens to be dried by procedures A, B or D, allow washing to proceed through the final spin cycle. Remove the test specimens immediately after the final spin cycle, separate tangled pieces, taking care to minimize distortion, and dry by procedure A, B or D (see Tables I and III).

7.2.6 For specimens to be dried by procedure C, Drip Dry, allow washing to proceed through to the final rinse cycle. Remove the specimens from the washer just before the water begins to drain for the final rinse cycle. Remove specimens soaking wet.

#### 7.3 Drying.

7.3.1 For drying procedures B, C and D, do not blow air directly on specimens as it may cause fabric distortion.

7.3.2 (A) Tumble Dry. Place the washed load (test specimens and ballast) in the tumble dryer, and set the temperature control to generate the correct exhaust temperatures as specified in Table III. For fibers that are heat sensitive, lower temperatures consistent with producer's care recommendations should be used and reported. Allow the dryer to operate until the total load is dry. Remove the load immediately after the dryer stops.

7.3.3 (B) Line Dry. Hang each specimen by two corners with the fabric length in the vertical direction. Allow the test specimen to hang in still air at room temperature not greater than 26°C (78°F) until dry.

7.3.4 (C) Drip Dry. Hang each dripping wet specimen by two corners, with the fabric length in the vertical direction. Allow the specimens to hang in still air at room temperature not greater than 26°C (78°F) until dry.

7.3.5 (D) Screen Dry. Spread each

**Table I—Alternative Washing and Drying Conditions (see 7.1)**

| Machine Cycle            | Washing Temperature                                          | Drying Procedure     |
|--------------------------|--------------------------------------------------------------|----------------------|
| (1) Normal/Cotton Sturdy | (II) $27 \pm 3^\circ\text{C}$ ( $80 \pm 5^\circ\text{F}$ )   | (A) Tumble           |
| (2) Delicate             | (III) $41 \pm 3^\circ\text{C}$ ( $105 \pm 5^\circ\text{F}$ ) | i. Cotton Sturdy     |
| (3) Permanent Press      | (IV) $49 \pm 3^\circ\text{C}$ ( $120 \pm 5^\circ\text{F}$ )  | ii. Delicate         |
|                          | (V) $60 \pm 3^\circ\text{C}$ ( $140 \pm 5^\circ\text{F}$ )   | iii. Permanent Press |
|                          |                                                              | (B) Line             |
|                          |                                                              | (C) Drip             |
|                          |                                                              | (D) Screen           |

**Table II—Washing Machine Conditions Without Load (see 7.1)**

|                     | Normal           | Delicate         | Permanent Press  |
|---------------------|------------------|------------------|------------------|
| (A) Water Level     | $18 \pm 1$ gal   | $18 \pm 1$ gal   | $18 \pm 1$ gal   |
| (B) Agitator Speed  | $179 \pm 2$ spm  | $119 \pm 2$ spm  | $179 \pm 2$ spm  |
| (C) Washing Time    | 12 min           | 8 min            | 10 min           |
| (D) Spin Speed      | $645 \pm 15$ rpm | $430 \pm 15$ rpm | $430 \pm 15$ rpm |
| (E) Final Spin Time | 6 min            | 4 min            | 4 min            |

**Table III—Dryer Setting Conditions (see 7.1)**

|                     | Cotton Sturdy                                                   | Delicate                                            | Permanent Press                                                 |
|---------------------|-----------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------------------|
| Exhaust Temperature | High<br>$66 \pm 5^\circ\text{C}$ ( $150 \pm 10^\circ\text{F}$ ) | Low<br>$< 60^\circ\text{C}$ ( $140^\circ\text{F}$ ) | High<br>$66 \pm 5^\circ\text{C}$ ( $150 \pm 10^\circ\text{F}$ ) |
| Cool Down Time      | 10 min                                                          | 10 min                                              | 10 min                                                          |