

Test Method for Dimensional Changes of Fabrics: Accelerated

Developed in 2000 by AATCC Committee RA42; reaffirmed 2001, 2002; revised 2004, 2013; editorially revised 2006, 2008, 2011, 2019; editorially revised and reaffirmed 2009. Related to ISO 23231.

1. Purpose and Scope

1.1 This test method is an accelerated procedure for determination of the dimensional change of fabrics. The procedure uses an apparatus with programmable settings that simulate multiple home or commercial launderings or wet processing.

1.2 This method does not replace dimensional change test methods currently in use.

2. Principle

2.1 Dimensional changes are determined by comparing the distances between length and width direction benchmark marks before and after a programmed test cycle.

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 a specimen.

3.2 **growth**, *n.*—of textile materials, 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 subsequent rinsing, extracting and drying.

3.3 **shrinkage**, *n.*—of textile materials, 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 Manufacturer's safety recommendations should be followed when operating accelerated testing equipment.

5. Uses and Limitations

5.1 Although data have been generated comparing the dimensional change of some textile fabrics after home laundering and this accelerated apparatus, the user will find it necessary to determine the correlation between the results from a selected program for this apparatus and the dimensional change results from other chosen test methods or wet processes (see 14.4).

5.2 While the term "laundering" includes the use of an aqueous detergent (during washing) and subsequent drying, this accelerated method does not use detergents.

6. Apparatus and Materials

6.1 Accelerated laundering apparatus (see 14.1).

6.2 Indelible ink marking pen. Select marking pens with the smallest tip (see 14.2).

6.3 Tape or ruler marked in millimeters.

6.4 A tape or ruled template marked with, or from which, percent dimensional change to 0.5% or smaller increment can be directly read (see 14.2).

6.5 Digital Imaging System (see 14.3).

7. Sampling

7.1 Take a sufficient number of samples from a lot to provide an adequate number of data points to generate satisfactory precision.

7.2 It is recommended that a minimum of four specimens with different length and widthwise yarns in each specimen be taken from each sample.

8. Specimens

8.1 Cut specimens parallel to the lengthwise fabric direction as shown in Fig. 1a. Diagonal alignment of specimens may be selected to minimize the need for over-edges specimens and to obtain larger bench mark dimensions (see Fig. 1b).

8.2 The size of specimens may depend upon the model of the apparatus and the type, number and configuration of its basket chambers.

8.2.1 Specimens, 190 × 190 mm, aligned with the fabric length and width directions and marked with 125 mm bench mark distances are recommended by the instrument manufacturer. Alternatively, 255 × 255 mm specimens can be

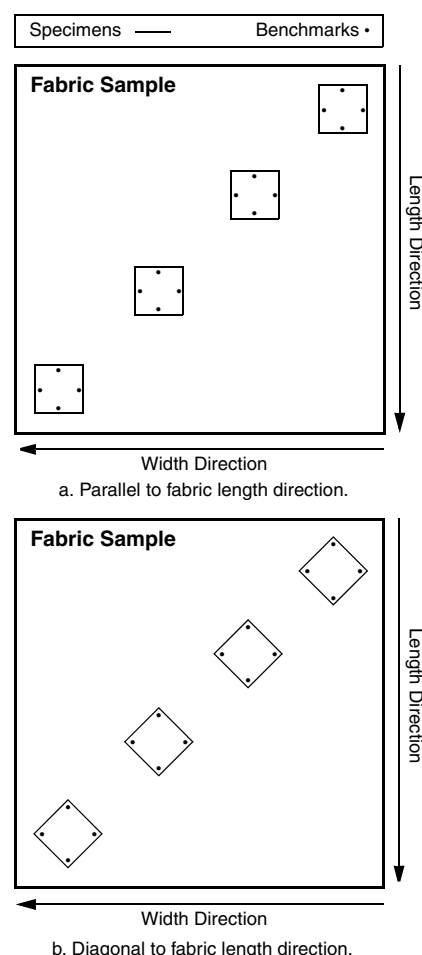


Fig. 1—Specimen and bench mark placement.

cut diagonally to accommodate 255 mm bench marks distances that are aligned with the actual length and width directions of the fabric (see Fig. 1b).

8.3 The use of standard textile conditioning prior to or after a test cycle program completion is not required.

8.4 To improve the accuracy and precision of dimensional change calculations based on the bench mark distances applied to the specimens as in 8.2.1, measure and record the distance between each pair of bench marks with suitable tape or ruler to the nearest millimeter before starting the test. This is measurement A. If using a template from which direct percent dimensional change can be read, verify that the original bench mark distances are exact.

9. Test Procedure

9.1 Using the program in Table I, de-

termine whether the results obtained from this program correlate with testing the same fabric by selected end-use test procedure. If the program in Table I does not generate satisfactory correlation with dimensional change results from the selected end-use test procedure, alter program elements such as number of rinses and drying time.

9.2 Follow the equipment manufacturer's recommendations for the number of specimens to be tested in each basket chamber.

9.3 Start the machine and allow the program to run through to completion.

9.4 Ensure that specimens are completely dry at the end of the drying program. If specimens hang up in the chamber during drying, they will not be completely dry. If repeated tests with the same program cycles results in specimens hanging up in the chamber, the users should try an alternate program.

9.4.1 If test specimens continue to hang up, contact the equipment manufacturer for other possible alternate programs.

9.5 After completion of the selected program, remove specimens and place them on a flat surface for a minimum of 5 min prior to measurement.

10. Measurement

10.1 Measure and record bench mark distances for each specimen in each fabric direction to the nearest increment of the ruler or device used. This is measurement B (see 11.2).

10.2 Measure and record, to the nearest incremental unit in each fabric direction, the percent dimensional change from the ruler or device used.

11. Calculation

11.1 If measurements were taken in units of percent dimensional change, average the measurements in each direction separately to the nearest 0.1%.

11.2 If bench mark measurements were taken, calculate the individual and average dimensional change results in each

direction separately to the nearest 0.1% as follows:

$$\%DC = 100[(B-A)/A]$$

where:

DC = Dimensional change

A = Original bench mark distance

B = Bench mark distance after laundering test cycle

11.3 A final measurement smaller than the original measurement indicates negative dimensional change which is shrinkage (minus sign). A final measurement larger than the original measurement indicates positive dimensional change which is growth (plus sign).

12. Report

12.1 For each sample tested, report:

(a) Individual and average percent length and width dimensional change, separately, to the nearest 0.1% with the appropriate dimensional sign (shrinkage negative/growth positive);

(b) Program used; and

(c) Specimen size, alignment (see Figs. 1a or 1b) and number of specimens in each basket chamber.

13. Precision and Bias

13.1 *Precision.*

13.1.1 In a preliminary multiple lab study, five fabrics were tested in ten labs. One operator tested samples on two different days in each lab. Study samples were: 80 cotton/20 polyester knit fleece, 100% cotton twill, 50 cotton/50 polyester knit jersey, 100% cotton oxford and 100% cotton knit pique. Lab results were reported as the average of ten specimens for each fabric. Lab results were obtained on two different days for each fabric. While the total study included test results from five accelerated cycles, the data used in this precision analysis were the reported dimensional change results obtained from only the first accelerated test cycle.

13.1.2 The reported precision was obtained from a component of variance analysis. Two different standard deviations were calculated: the standard deviation of within lab variation (Se) and the standard deviation of lab-to-lab and within lab variations combined (Sc).

tion of within lab variation (Se) and the standard deviation of lab-to-lab and within lab variations combined (Sc).

13.1.3 The preliminary precision was obtained from a component of variance analysis. Tables II and III show the interaction of the analysis and standard deviations: the standard deviation of within-lab variation (Se) and the standard deviation of lab-to-lab and within-lab variations combined (Sc) for each fabric direction. Average dimensional change percent and component of variance analysis for each sample is shown in Appendix A.

13.1.4 Tables IV and V show single fabric and multiple fabric *within-* and *between-laboratory* standard error (SE) and critical difference (CD) values.

13.2 *Bias.*

13.2.1 Dimensional change (%) can be defined only in terms of a test method or procedure. This test method has no known bias.

14. Notes

14.1 Quickwash Plus™ System may be obtained from SDL Atlas L.L.C., 3934 Airway Dr., Rock Hill, SC 29732-9200, tel: +1.803.329.2110, fax: +1.803.329.2133; e-mail: info@sdlatlas.com; web site: www.sdlatlas.com.

14.2 Marking pens are available from AATCC, P.O. Box 12215, Research Triangle Park NC 27709, tel: +1.919.549.8141; fax: +1.919.549.8933; e-mail: ordering@aatcc.org; web site: www.aatcc.org. Measuring ruler available from AATCC.

14.3 A digital imaging system may be used as a measuring device in place of the prescribed manual measurement devices if it is established that its accuracy is equivalent to the manual devices.

14.4 Dimensional changes exhibited by articles produced from textile fabrics are primarily (but not entirely) dependent on dimensional changes exhibited by the fabric.

Table I—Accelerated Machine Program Settings*

Program Operation	Number of Cycles	Time per Cycle, s	Temperature, °C
Wash**	1		60°C
Agitation time		165 s	
Rinse/dry	3		60°C
Agitation time		45 s	
Spin time		35 s	
Dry time		240 s	
Air pressure, 3.8 bars			
Water level, 3 L			

*According to the machine manufacturer, prior tests have established that this program generates 95% of the total dimensional change in 95% of fabrics tested.

**The term "wash" implies the use of detergent, but correlation tests by users have shown that the addition of detergent is not necessary in this accelerated test. Due to the nature of the action of the accelerated test procedure, even a slight amount of detergent foams and impedes the test.

Table II—Component of Variance Analysis

COV	Variance Length	Variance Width
Lab V(L)	0.26	0.11
Fab/Lab V(FL)	0.32	0.23
Days W/I Fabric V(D(F))	0.36	0.00
Samples W/I Days and Fabric V(S(DF))	0.00	0.08
Error V	0.19	0.08

Table III—Within Lab and Combined Lab-to-Lab and Within Lab Percent Dimensional Change at the 95% Probability Level = 2Se and 2Sc

FABRIC	LENGTH		WIDTH	
	Se	Sc	Se	Sc
Knit Fleece	0.49	0.69	0.38	0.70
Twill	0.34	1.01	0.20	0.35
Knit Jersey	0.34	0.95	0.37	0.52
Oxford	0.53	0.88	0.55	1.06
Knit Pique	0.29	0.66	0.17	0.48