Specified Requirements of Wrinkle Free Textiles	Document No. FTTS-FA-007
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1. Purpose and Scope

This criterion is applicable to test and evaluate the wrinkle status of textile and apparel products after repeated laundering.

2. Terminology

SA: Smoothness Appearance

CR: Crease Retention

SS: Seam Smoothness

3. Classification standard

3.1 SA after repeated laundering (after 5 washing)

Table 1. SA Classification.

Grade	Classification
$4.0 \leqq SA \leqq 5.0$	Excellent
$3.5 \leqq SA \leqq 4.0$	Good
$3.0 \leqq SA \leqq 3.5$	Fair

3.2 CR after repeated laundering (5 washing)

Table 2. CR Classification.

Grade	Classification
CR=5	Excellent
$4.0 \leqq CR \leqq 5.0$	Good
$3.0 \leqq CR \leqq 4.0$	Fair

3.3 SS after repeated laundering (5 washing)

Table 3. SS Classification.

Grade	Classification
SS=5	Excellent
$4.0 \leqq SS \leqq 5.0$	Good
$3.0 \leqq SS \leqq 4.0$	Fair

3.4 Formaldehyde Content

Table 4. Formaldehyde Content Classification.

Grade	Formaldehyde content	Classification
1	ppm $<$ 45	Excellent
2	$45 <$ ppm $\leqq 75$	Good
3	$75 <$ ppm $\leqq 300$	Fair

4. Test Method

4.1 Smoothness Appearance after Laundering

4.1.1 Definition: To evaluate the smoothness appearance of fabric after repeated home laundering.

4.1.2 Application: Any washable textile.

4.1.3 Environment conditions for testing: The standard atmosphere for textile testing is as directed in ASTM D1776. The condition is 21±1 ℃, 65±25 % RH.

4.1.4 Sample preparation: For fabric sample, cut 3 specimens in 15 in. × 15 in. For garments, select 3 pieces for testing.

4.1.5 Test procedure:

(1) Select the washing and drying conditions from table 5.

Table 5. Alternative Washing and Drying Condition.

Machine Cycle	Wash Temperature	Drying Procedures
(1) Normal/Cotton Sturdy (2) Delicate (3) Permanent Press	(III) 41±3℃(105±5℉) (IV) 49±3℃(120±5℉) (V) 60±3℃(140±5℉)	(A) Tumble : i. Cotton Sturdy ii. Delicate iii.Permanent Press (B) Line (C) Drip (D) Screen

(2) Fill the washer to the specified water level (18 gal, approximate to 68 L) and adjust the water temperature.

(3) Add 66 g of 1993 AATCC Standard Reference Detergent. Then place ballast and specimens in the washer making a total load of 1.8 kg.

(4) Prior to evaluation, the specimens should be hung on an appropriate hanger with fabric warp (length) in vertical direction. Condition the specimens at 21±1 ℃, 65±25 % RH for a minimum of 4 hours.

(5) Assess the specimens under the standard environment as illustrated in Fig. 1. Three trained observers should rate each specimen independently and assign the numerical grade of the replica (SA-1 to 5, see Fig 2) which most nearly matches the smoothness appearance of the specimen.

4.1.6 Results and report : Average the nine grades (three grades on each of three specimens) and report the SA average grade to the nearest tenth of a grade (An grade SA-5 represents the smoothest appearance, while an grade SA-1 represents the poorest appearance).

4.2 Crease Retention after Laundering

4.2.1 Definition: To evaluate the retention of pressed-in creases in textile products after repeated home laundering.

4.2.2 Application: Any washable textile.

4.2.3 Environment conditions for testing :The standard atmosphere for textile testing is as directed in ASTM D1776. The condition is 21±1℃, 65±25 RH.

4.2.4 Sample preparation: Select 3 pieces of garment sample for testing.

4.2.5 Test method: Select the washing and drying conditions according to table 5 and perform the testing according to 4.1.5 (2)-(5). Assess the garment specimens under the standard environment as illustrated in Fig. 1. Mount he garments on the viewing board with the crease in vertical direction. Assign the most nearly matches numerical grade of the CR replica to the garments.

4.2.6 Results and report : Average the nine grades (three grades on each of three garment specimens) and report the CR average grade to the nearest tenth of a grade (An grade CR-5 represents the best retention, while an grade CR-1 represents the poorest retention).

4.3 Appearance of Seam after Laundering

4.3.1 Definition: To evaluate the seam smoothness of garments after repeated home laundering.

4.3.2 Application: Any washable textile.

4.3.3 Environment conditions for testing: The standard atmosphere for textile testing is as directed in ASTM D1776. The condition is 21±1 ℃, 65±25 % RH.

4.3.4 Sample preparation: Take 3 pieces of garment sample for testing.

4.3.5 Test method: Select the washing and drying conditions according to table 5 and perform the testing according to 4.1.5 (2)-(5). Assess the specimens under the standard environment as illustrated in Fig. 1. Mount he specimens on the viewing board with the seam in vertical direction. Assign the most nearly matches numerical grade of the SS replica to the specimens.

4.3.6 Results and report : Average the nine grades (three grades on each of three specimens) and report the SS average grade to the nearest tenth of a grade (An grade SS-5 represents the best level of seam appearance, while an grade SS-1 represents the poorest level of seam appearance).

4.4 Formaldehyde test

4.4.1 Definition: Resin finished textile may release the free formaldehyde which is harmful to people. This standard is established to specify the limitation of formaldehyde.

4.4.2 Application: Any resin-finished textile such as dimensional stabilization finish.

4.4.3 Environment conditions for testing: Not specified.

4.4.4 Sampling and sample preparation:

(1) Sample preparation: Weigh approximate 1 g of sample pieces in accuracy.

(2) Preparation of Nash Reagent:

(a) Dissolve 150 g of reagent grade ammonium acetate in 800 mL of distilled water.

(b) Add 3 mL of reagent grade acetic acid and 2 mL of reagent grade acetylacetone.

(c) Mix all reagents thoroughly and add water to make 1000 ml. Leave the mixed solution still for 24 hours.

4.4.5 Test procedures:

(1) Cut the sample into small pieces and put them in a 200 mL or 250 mL conical flask. Add 100 ml distilled water and stopper the flask tightly. Shake the flask in a water bath at 40± 2℃ for 1 hour. Then filtrate the liquid through filter paper into another conical flask to obtain the extract.

(2) Test solution preparation: Prepare the following solution in individual test tubes with stopper.

(a) 5 mL extract + 5 mL Nash reagent

(b) 5 mL distilled water + 5 mL Nash reagent

(c) 5 mL extract + 5 mL distilled water

(d) 5 mL distilled water + 5 mL distilled water

(3) Warm all prepared solutions in a water bath at 40±2 ℃ for 30 minutes. Then leave them still and cool down for 30 minutes.

(4) Measure the absorbency with a spectrophotometer at the maximum absorption wavelength 415 nm.

(5) A-A_0: Compare (a) and (b) to obtain the absorbency A.

Compare (c) and (d) to obtain the absorbency A_0.

$$ppm = K \times \frac{A - A_0}{A_s} \times 100 \times \frac{1}{w}$$

K : concentration of standard solution of formaldehyde (μ g/ml)

w : mass of sample (g)

A_s : absorbency of standard solution of formaldehyde

(It is also acceptable to calculate the concentration of formaldehyde contained in the sample from the calibration curves obtained on the basis of formaldehyde solutions of known concentrations.)

4.4.6 Results and report:

(1) Test results in integral.

(2) Test method and remark.

5. Mark

Table 6. Type of Mark.

Type	SA	CR	SS	Formaldehyde Content
I	4.0≦SA≦5.0	4.0≦CR≦5.0	4.0≦SS≦5.0	1
II	3.5≦SA＜4.0	3.0≦CR＜4.0	3.0≦SS＜4.0	2
III	3.5≦SA＜4.0	3.0≦CR＜4.0	3.0≦SS＜4.0	3
IV	3.0≦SA＜3.5	3.0≦CR＜4.0	3.0≦SS＜4.0	3

6. Reference

AATCC 143-2001: Appearance of Apparel and Other Textile End Products After Repeated Home Laundering

JIS L1041-2000: Test Method for Resin Finished Textile