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Document Name: AATCC 124: Appearance of Durable Press Fabrics After Repeated Home Laundering

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Appearance of Fabrics after Repeated Home Laundering

Developed in 1967 by AATCC Committee RA61; revised 1969, 1975, 1982, 1989 (with title change), 1992, 1996; editorially revised 1974, 1983, 1985, 1988, 1991, 1997; reaffirmed 1973; editorially revised and reaffirmed 1978, 1984. Technically equivalent to ISO 7768.

1. Purpose and Scope

1.1 This test method is designed for evaluating the smoothness appearance of flat fabric specimens after repeated home laundering.

1.2 Any washable fabric may be evaluated for smoothness appearance using this method.

1.3 Fabrics of any construction, such as woven, knit and nonwoven, may be evaluated according to this method.

1.4 This test method shall not be construed to provide a standard of performance for any textile item, but only a standard method by which to evaluate performance of the item.

2. Principle

2.1 Flat fabric specimens are subjected to standard home laundering practices. A choice is provided of hand or machine washing, alternative machine wash cycles and temperatures, and alternative drying procedures. Evaluation is performed using a standard lighting and viewing area by rating the appearance of specimens in comparison with appropriate reference standards.

3. Terminology

3.1 **ballast,** n.—*in procedures for processing or testing of textiles*, material that is used to bring the total weight or volume of the textiles to an amount specified in the procedure.

3.2 **dryer creases,** n.—sharp folds or lines running in any direction in a laundered or dried specimen.

NOTE: Dryer creases are an unintended result of restricted movement of specimens in the washer or the dryer.

3.3 **durable press,** adj.—having the ability to retain substantially the initial shape, flat seams, pressed-in creases and unwrinkled appearance during use and after laundering or drycleaning.

3.4 **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, extracting and drying.

3.5 **smoothness appearance,** n.—*in fabrics*, the visual impression of planarity of a specimen quantified by comparison with a set of reference standards.

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 All chemicals should be handled with care.

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

5. Uses and Limitations

5.1 This test method is designed to be used only for evaluating the appearance of washable fabrics after repeated home laundering.

5.2 The test procedure is designed to reflect the capabilities of home laundry equipment which is currently used by consumers. In general, it is preferable to conduct the test under relatively severe laundering conditions.

5.3 Prints and patterns may mask the mussiness present in fabrics. The rating process is, however, based on the visual appearance of specimens including such effects.

5.4 The small specimen sizes used for fabric tests occasionally will cause wrinkles or creases (dryer creases) to develop which are not considered to be characteristic of fabric performance in use. Precautions are given in the text of the method to reduce the occurrence of dryer creases.

5.5 The interlaboratory reproducibility of the results of this test method depends upon mutual agreement by users of the method on the washing and drying conditions as outlined in 8.1.

6. Apparatus and Materials

6.1 Automatic washing machine (see 12.1).

6.2 Automatic tumble dryer (see 12.1).

6.3 Drip dry and line dry facilities.

6.4 A 9.5 L (10.0 qt) pail.

6.5 1993 AATCC Standard Reference Detergent (see 12.2 and 12.8).

6.6 Ballast of 92 × 92 cm (36 × 36 in.) hemmed pieces of bleached cotton sheeting (Wash load ballast type 1) or 50/50 polyester/cotton bleached and mercerized poplin (Wash load ballast type 2), or 50/50 polyester/cotton plain weave (Wash load ballast type 3) (see 12.3).

6.7 Lighting and evaluation area in an otherwise darkened room using the overhead lighting arrangement shown in Fig. 1 (see 12.4). It has been the experience of many observers that light reflected from the side walls near the viewing board can interfere with the rating results. It is recommended that the side walls be painted matte black (85° gloss less than 5 units) or that blackout curtains be mounted on both sides of the viewing board to eliminate the reflective interference.

6.8 Standard AATCC Three-Dimensional Smoothness Appearance Replicas, set of six (see Fig. 2 and 12.2).

6.9 Steam or dry iron with appropriate fabric temperature settings.

6.10 Detergent (for hand wash).

6.11 Scale with at least 5 kg or 10 lb capacity.

7. Test Specimens

7.1 Three representative 38 × 38 cm (15 × 15 in.) fabric specimens cut parallel to the fabric length and width are prepared. Where possible, each specimen should contain different groups of lengthwise and widthwise yarns. The specimens should be marked to indicate the lengthwise direction. If fraying is expected in laundering, see 12.5.

8. Procedure

8.1 Tables II, III and IV summarize the alternate washing 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.

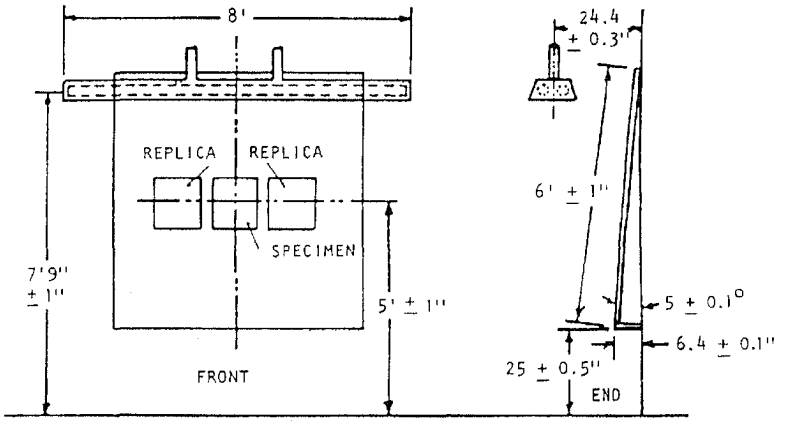

Fig. 1—Lighting equipment for viewing test specimens.

Materials list: (a) Two 8-ft Type F96 CW (Cool White) preheat Rapid Start fluorescent lamps (without baffle or glass). (b) One white enamel reflector (without baffle or glass). (c) One general type swatch mount, spring loaded. Fabricate using light sheet metal (22 ga.). (d) One 1/4 in. plywood mounting board painted to match No. 2 gray chip on AATCC Gray Scale for Staining.

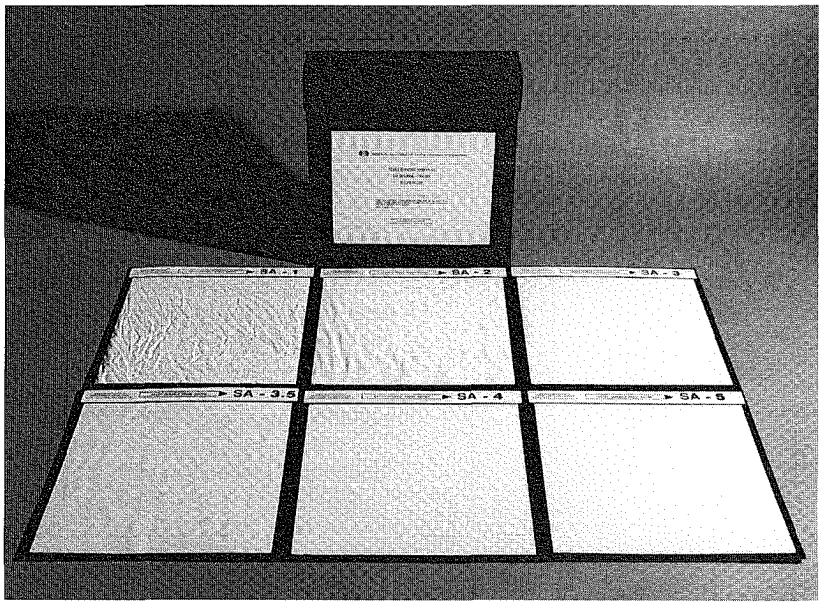

Fig. 2—AATCC 3-D smoothness appearance replicas.

8.1.1 It is recognized that special cycles or features are available on current washing machines and dryers to achieve improved performance on certain items; i.e., gentle cycles with reduced agitation to protect delicately constructed items, and durable press cycles, with cool-down or cold rinses and reduced spin speeds, to minimize wrinkling. In evaluating appearance retention, however, the more severe Normal or Cotton Sturdy machine cycle is considered most appropriate. If modifications to any of the cycles (see 8.2) are used, these must be reported in the results (see Section 10).

8.2 Standard washing.

8.2.1 Hand Wash—(see 12.6). Dissolve 20.0 ± 0.1 g of 1993 AATCC Standard Reference Detergent in 7.57 ± 0.06 L (2.00 ± 0.02 gal) of water at 41 ± 3C (105 ± 5F) in a 9.5 L (10.0 qt) pail and then add the three fabric test specimens. Wash for 2.0 ± 0.1 min with no twisting or wringing. Rinse once using 7.57 ± 0.06 L (2.00 ± 0.02 gal) of water at 41 ± 3C (105 ± 5F). Remove the specimens and dry by Procedure C, Drip (see 8.3.3).

8.2.2 Machine Wash—Use specified water level, the selected water temperature for the washing cycle and a rinse temperature of less than 29C (85F). If this rinse temperature is not attainable, record available rinse temperature.

8.2.3 Add 66 ± 0.1 g of 1993 AATCC Standard Reference Detergent. In soft water areas this may be reduced to avoid excessive sudsing, but in that case the amount should be stated in the report of test results.

8.2.4 Add test specimens and enough ballast to make a 1.8 ± 0.06 kg (4.00 ± 0.13 lb) load. Set the washer for the selected washing cycle and time (see Tables II and III). Normal or Cotton Sturdy is recommended. For very critical evaluations and in arbitration, limit the number of specimens per washer load to those from one sample.

8.2.5 For specimens to be dried by Procedures A, B or D, allow washing to proceed automatically 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 II and IV).

8.2.6 For specimens to be dried by Procedure C, Drip Dry, remove the specimens from the washer just before the water begins to drain for the final rinse cycle. Remove specimens soaking wet.

8.2.7 Washer creases. Specimens may be in a folded or creased conformation after removal from the washer. Such creases present after laundering should be straightened out prior to drying.

8.3 Drying.

8.3.1 (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 IV. For fibers that are heat sensitive, lower temperatures consistent with producers' recommendations are required, and must be reported. Operate the dryer until the total load is dry. Remove the load immediately after the machine stops. Avoid overdrying. Static cling becomes a problem with overdrying, particularly with lightweight fabrics, because it prevents the specimens from tumbling freely.

8.3.2 (B) Line Dry. Hang each fabric specimen by two corners with the fabric length in the vertical direction. Allow specimens to hang in still air at room temperature until dry.

8.3.3 (C) Drip Dry. Hang each dripping wet fabric specimen by two corners with the fabric length in the vertical direction. Allow specimens to hang in still air at room temperature until dry.

8.3.4 (D) Screen Dry. Spread each specimen on a horizontal screen or perforated surface, removing wrinkles but not distorting or stretching the specimen. Allow the specimen to dry in still air at room temperature.

8.3.5 Dryer creases. If specimens are folded or creased after any drying cycle but the last, they should be rewet and an attempt should be made to remove the creases prior to additional washing and drying. No attempt to remove wrinkles or creases should be made after the fifth

Table I—Wash Load Ballast: Finished Fabric Specification

Fiber Content	Wash Load Ballast Type 1 100% Cotton	Wash Load Ballast Type 2 50/50 ± 3% poly/cotton	Wash Load Ballast Type 3 50/50 ± 3% poly/cotton
Yarns	16/1 ring spun	16/1 ring spun	30/2 ring spun
Fabric Construction	52 (± 2) × 48 (± 2)	52 (± 2) × 48 (± 2)	48 (± 2) × 48 (± 2)
Fabric Weight	155 ± 5 g/m² (4.55 ± 0.15 oz/yd²)	155 ± 5 g/m² (4.55 ± 0.15 oz/yd²)	155 ± 5 g/m² (4.55 ± 0.15 oz/yd²)
Piece Size	92.0 × 92.0 cm (36.0 × 36.0 in.)	92.0 × 92.0 cm (36.0 × 36.0 in.)	92.0 × 92.0 cm (36.0 × 36.0 in.)
Piece Weight	130 ± 10 g	130 ± 10 g	130 ± 10 g

Table II—Alternative Washing and Drying Conditions (see 8.1)

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

Table III—Washing Machine Conditions (see 8.1)

	Normal/Cotton Sturdy	Delicate	Permanent Press
Water Level	18 ± 1 gal	18 ± 1 gal	18 ± 1 gal
Agitator Speed	179 ± 2 spm	119 ± 2 spm	179 ± 2 spm
Washing Time	12 min	8 min	10 min
Spin Speed	645 ± 15 rpm	430 ± 15 rpm	430 ± 15 rpm
Final Spin Cycle	6 min	4 min	4 min

Table IV—Dryer Conditions (see 8.1)

	Cotton Sturdy	Delicate	Durable Press
Exhaust Temperature	High 66 ± 5C (150 ± 10F)	Low < 60C (140F)	High 66 ± 5C (150 ± 10F)
Cool Down Time	10 min	10 min	10 min

Table V—Fabric Smoothness Grades by SA Replica Equivalents

Grade	Description
SA-5	Equivalent to the SA-5 Replica. Very smooth, pressed, finished appearance.
SA-4	Equivalent to the SA-4 Replica. Smooth, finished appearance.
SA-3.5	Equivalent to the SA-3.5 Replica. Fairly smooth but nonpressed appearance.
SA-3	Equivalent to the SA-3 Replica. Mussed, nonpressed appearance.
SA-2	Equivalent to the SA-2 Replica. Rumpled, obviously wrinkled appearance.
SA-1	Equivalent to the SA-1 Replica. Crumpled, creased and severely wrinkled appearance.

cycle of drying.

8.4 Repeat the selected washing and drying cycles four more times or to an agreed number of cycles.

8.5 Prior to evaluation, precondition and then condition test specimens as directed in ASTM D 1776, Conditioning Textiles for Testing (see 12.7). Condition the test specimens for a minimum of 4 hr in the standard atmosphere for textile testing [21 ± 1C (70 ± 2F) and 65 ± 2% RH], hanging each specimen from two corners with the fabric length in vertical direction to avoid distortion.

9. Evaluation

9.1 Three trained observers should rate each test specimen independently.

9.2 The overhead fluorescent light should be the only light source for the viewing board. All other lights in the room should be turned off.

9.3 The observer is to stand directly in front of the specimen 120 ± 3 cm (4 ft ± 1 in.) away from the board. It has been found that normal variations in the height of the observer above and below the arbitrary 1.5 m (5.0 ft) eye level have no significant effect on the grade given.

9.4 Mount the test specimen on the viewing board as illustrated in Fig. 1, with the fabric length in the vertical direction. Place the most similar three-dimensional plastic replicas on each side of the test specimen to facilitate comparative rating.

9.5 Although the 3-D Smoothness Appearance (SA) replicas were cast from woven fabrics, it is understood that these wrinkled surfaces do not duplicate all possibilities of fabric surfaces. The replicas are to be used as guides which represent various levels of fabric smoothness or freedom from wrinkles. The observer should mentally integrate degree and frequency of wrinkles in the specimen to determine a level of smoothness that can be identified with the SA replica number which most nearly represents that smoothness appearance level; see Table V.

9.6 Assign the numerical grade of the replica which most nearly matches the smoothness appearance of the test specimen, or assign a grade midway between those whole-number standards which have no half-number standards separating them (SA-1.5, SA-2.5, SA-4.5) if the appearance of the test specimen warrants it.

9.7 An SA-5 grade is equivalent to the SA-5 replica and represents the smoothest appearance, while an SA-1 replica represents very poor appearance.

9.8 If dryer creases are present on any specimens to be evaluated, take care in rating the specimens. Some dryer creases can be disregarded (commonly called "reading out"). When the grade of a dryer creased specimen differs from the other specimens by more than one grade, the test should be repeated with new specimens, taking all precautions to avoid the occurrence of dryer creases.

10. Report

10.1 Average the nine observations made on each test fabric (three grades on each of three test specimens). Report the average to the nearest tenth of a grade. This average is the unit of measure of this test method.

10.2 State washing procedure (Arabic number and Roman numeral) and drying procedure (capital letter and subscript) from Table II, as well as type of wash load ballast (Arabic number). Any deviations from stated procedures, such as use of a modified wash cycle, a reduced amount of detergent or a higher than usual load limit, should be explained completely.

10.2.1 For example, smoothness appearance grade SA-3.8 (1-IV-A(a)-2) denotes a smoothness appearance grade of 3.8 for specimens washed using a Normal (Cotton Sturdy) cycle at 49C (120F) with Wash load ballast type 2 and tumble dried using the Normal (Cotton Sturdy) cycle.

11. Precision and Bias

11.1 *Interlaboratory tests.* Tests were conducted in 1980 with eight laboratories evaluating four fabrics under washing and drying conditions 1-III-A and 1-IV-A of AATCC Method 124. The analysis of variance technique was judged not to be applicable to this data set because its distribution was not normal, and because of the limited and discontinuous scale of replica grades. The data were analyzed by calculating expected laboratory test results from the distribution of individual specimen grades. This analysis has been deposited for reference in the RA61 committee files.

11.2 *Observer repeatability.* From the data it was determined that single observers rated three specimens on the following frequency:

3 specimens to same replica 0.55
2 specimens to same replica and one different 0.40
3 specimens different 0.05

Only rarely did the separation in specimen grades exceed the next replica step. This is indicative of the high degree of repeatability in observer rating of smoothness appearance.

11.3 *Laboratory test result distribution (within-laboratory repeatability).* From the observed grade distribution, a distribution of laboratory test results was calculated for each replica level with half grades included. Precision over the whole SA replica range was improved.

11.4 *Precision.* From the frequency distribution of laboratory test results, a calculation was made of the critical difference, D, between two laboratory test results. With laboratories at the same level:

Critical Difference	Confidence Level
$D > 0.17$	$P \geq 0.95$
$D \geq 0.25$	$P \geq 0.99$

When two or more laboratories wish to compare test results, it is recommended that laboratory level be established between them prior to commencing test comparisons. Fabrics of known history and performance may be used for this purpose.

Differences between laboratory test results (on the same fabric, under the same washing and drying conditions) equal to or greater than a quarter replica unit are statistically significant at $P \geq 0.99$. A difference of this magnitude or greater suggests a difference in laboratory levels and indicates the need for laboratory level comparisons.

11.5 *Bias.* The true value of smoothness appearance in durable press fabrics after repeated home launderings can be defined only in terms of a test method. There is no independent method for determining the true value. As an estimate of this property, this test method has no known bias.

12. Notes

12.1 Contact AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail: orders@aatcc.org, for model number(s) and source(s) of approved washer(s) and dryer(s). Any other washer or dryer which is known to give comparable results can be used. Washing machine conditions given in Table III represent the actual speeds and times available on the current specified model(s). Other washers can vary in one or more of these settings. Dryer machine conditions given in Table IV represent the actual temperatures and cool-down times available on the current specified model(s). Other dryers can vary in one or more of these settings.

12.2 Available from AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail: orders@aatcc.org.

12.3 Ballast are available from Testfabrics Inc., P.O. Box 26, 415 Delaware St., W. Pittston PA 18643; tel: 570/603-0432; fax: 570/603-0433; and Textile Innovators Corp., P.O. Box 8, Windsor NC 27983; tel: 252/794-9703; fax: 252/794-9704. Ballast fabrics should conform to specifications in Table I.

12.4 The use of 8-ft fixtures for viewing laundered specimens is specified in this method. It is recognized, however, that physical limitations in certain laboratories will prevent the use of 8-ft fixtures. In those situations, 4-ft lights may be used but replicas identified as SA-4, SA-3 and SA-1 should always be placed on the left side of the viewing board as the board is viewed from the front. Replicas identified as SA-5, SA-3.5 and SA-2 should always be placed on the viewing board to the right side as the board is viewed from the front.

12.5 If excessive fraying occurs in laundering, specimen edges should be pinked, slashed or stitched as appropriate. If edges of laundered specimens appear distorted, clip as necessary before evaluating.

12.6 Like other hand wash procedures, this procedure has inherent limitations; e.g., limited reproducibility of the type of action involved due to the human element.

12.7 ASTM standards are available from ASTM, 100 Barr Harbor Dr., West Conshohocken PA 19428; tel: 610/832-9500; fax: 610/832-9555.

12.8 The AATCC Technical Center conducted a study to compare the 1993 AATCC Standard Reference Detergent, AATCC Standard Reference Detergent 124 and two different types of fabrics (current and proposed) to be used as ballast, under the following test conditions:

Machine cycle: (1)—Normal/Cotton Sturdy
Washing Temp: (V)—60 ± 3C (140 ± 5F)
Drying Procedure: (A)i—Tumble dry, cotton sturdy cycle
Fabrics tested: White Twill (100% cotton)
Beige Twill (100% cotton)
Grey Poplin (100% cotton)
Blue Twill (50/50 poly/cotton)

No significant differences were found in the results using either detergent or ballast load fabrics.