Designation: D3690 – 19

Standard Performance Specification for Vinyl-Coated and Urethane-Coated Upholstery Fabrics—Indoor[1]

This standard is issued under the fixed designation D3690; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This performance specification covers performance requirements for vinyl-coated and urethane-coated upholstery fabrics produced with woven, knit, or nonwoven substrates which are used in the manufacture of new indoor furniture.

1.2 This performance specification is not applicable to fabrics used in porch, deck, or lawn furniture; nor for plain knit fabrics and plain, tufted, or flocked, woven upholstery fabrics.

1.3 These requirements apply to the length and width directions for those properties where fabric direction is pertinent.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles

D751 Test Methods for Coated Fabrics

D1175 Method of Test for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder and Uniform Abrasion); Replaced by D 4157, D 4158 (Withdrawn 1981)[3]

D1203 Test Methods for Volatile Loss From Plastics Using Activated Carbon Methods

D2097 Test Method for Flex Testing of Finish on Upholstery Leather

D2136 Test Method for Coated Fabrics—Low-Temperature Bend Test

D4157 Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)

D5034 Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)

2.2 *AATCC Standards:*[4]

TM8 Colorfastness to Crocking: AATCC Crockmeter Method

TM16.3 Colorfastness to Light: Xenon-Arc

TM116 Colorfastness to Crocking: Rotary Vertical Crockmeter Method

EP1 Gray Scale for Color Change

EP8 9-Step Chromatic Transference Scale

2.3 *Chemical Fabrics and Film Association Standards:*[5]

CFFA-5 Test for Blocking

CFFA-20 Test for Tearing Strength, Procedure B—Tongue Method

NOTE 1—Reference to test methods in this specification give only the permanent part of the designation of ASTM, AATCC, or other test methods. The current editions of each test method cited shall prevail.

3. Terminology

3.1 *Definitions:*

3.1.1 *blocking, n*—the measurement of the development of surface tack and the thermal softening point of the material.

3.1.2 *hydrolytic stability, n*—the ability to withstand the environmental effects of high humidity.

3.1.3 *tack tear, n*—the measurement of the resistance of a coated fabric to tearing under conditions simulating an installation that has been tacked in place.

[1] This performance specification is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.63 on Home Furnishings.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709, http://www.aatcc.org.

[5] Available from Chemical Fabrics and Film Association, 1230 Keith Bldg., Cleveland, OH 44115.

3.1.3.1 *Discussion*—Tack tear is intended primarily for testing vinyl-coated fabrics for furniture or automotive applications.

3.2 For definitions of other textile terms used in this specification, refer to Terminology D123 and to the Technical Manual of the American Association of Textile Chemists and Colorists.[4]

4. Significance and Use

4.1 Fabrics intended for this end-use should meet all the requirements listed in Table 1.

4.2 It should be recognized that fabric can be produced utilizing an almost infinite number of combinations of construction variables (e.g., type of fibers, percentage of fibers, yarn twist, yarn number, warp and pick count, chemical and mechanical finished). Additionally, fashion and aesthetics dictate that the ultimate consumer may find acceptable articles made from fabrics that do not conform to all of the requirements in Table 1.

4.2.1 Hence, no single performance specification can possibly apply to all the various fabrics that could be utilized for this end-use.

4.3 The uses and significance of particular properties and test methods are discussed in the appropriate sections of the specified methods.

5. Performance Requirements

5.1 The properties of vinyl-coated or urethane-coated upholstery fabrics shall conform to the specification requirements of one of the three categories in Table 1.

6. Test Methods (see Note 1)

6.1 *Breaking Force*—Determine the dry breaking force in the standard atmosphere for testing textiles, as directed in Test Method D5034, using a constant- rate- of- extension (CRE) tensile testing machine.

6.2 *Tongue Tear Strength*—Determine tongue tear strength as directed in Procedure B of CFFA Method 20 using a CRT tensile testing machine.

6.3 *Tack-Tear Resistance*—Determine the tack-tear resistance as directed in Sections 43 to 47 of Test Methods D751.

6.4 *Adhesion of Coating to Substrate:*

6.4.1 Determine the adhesion of coating to substrate as directed in Sections 39 to 42 of Test Methods D751, with the speed of the pulling clamp at 12 ± ½ in. (305 ± 13 mm)/min.

6.4.2 Report adhesion in pounds-force per inch (newtons per metre) of width.

6.5 *Surface Abrasion:*

6.5.1 Determine the surface abrasion as directed in Sections 33 to 42 of Test Methods D4157.

6.5.2 After 200 cycles, the test specimens are rated visually for color change.

TABLE 1 Performance Requirements

Property	Requirements			Section
	Grade A	Grade B	Grade C	
Breaking strength (load) (CRT Method):[A]				6.1
Length	244 N (55 lbf), min	222 N (50 lbf), min	200 N (45 lbf), min	
Width	244 N (55 lbf), min	222 N (50 lbf), min	178 N (40 lbf), min	
Tongue tear strength (CRT Method)[A]				6.2
Length	27 N (6 lbf), min	18 N (4 lbf), min	13 N (3 lbf), min	
Width	22 N (5 lbf), min	13 N (3 lbf), min	9 N (2 lbf), min	
Tack-tear resistance:				6.3
Length	133 N (30 lbf), min	111 N (25 lbf), min	67 N (15 lbf), min	
Width	133 N (30 lbf), min	89 N (20 lbf), min	67 N (15 lbf), min	
Adhesion of coating to substrate	525 N/m (3.0 lbf/in.), min	525 N/m (3.0 lbf/in.), min	525 N/m (3.0 lbf/in.), min	6.4
Surface abrasion	no appreciable color change at 200 cycles, grade A, B, and C			6.5
Resistance to flexing	no cracking or delamination at 15 000 cycles, grade A, B, and C			6.6
Blocking at elevated temperature	rating 2, min, no blocking; coating adheres slightly,grade A, B, and C			6.7
Resistance to cracking at low temperature	no cracking at – 10± 1°F (–23 ± 1°C), grade A, B, and C			6.8
Colorfastness to crocking:[B]				6.9.1
Dry	grade 4.0 min[C]	grade 4.0 min[C]	grade 4.0 min[C]	
Wet	grade 4.0 min[C]	grade 4.0 min[C]	grade 4.0 min[C]	
Colorfastness to light (xenon)[A] (120 AATCC fading units)	grade 4.0 min[D]	grade 4.0 min[D]	grade 4.0 min[D]	6.9.2
Loss of plasticizer	10 % max	10 % max	10 % max	6.10
Hydrolytic stability:				6.11
Adhesion	must maintain 75 % of original strength, grade A, B, and C			6.11.3.1
Surface abrasion	no cracking or delamination at 25 000 cycles, grade A, B, and C			6.11.3.2
Resistance to flexing	no breaks in coating at 15 000 cycles, grade A, B, and C			6.11.3.3
Flammability	pass	pass	pass	6.12

[A] There is more than one standard test method that can be used to measure breaking strength, tongue tear strength, and lightfastness. These test methods cannot be used interchangeably since there may be no overall correlation between them (see Note 2).
[B] grade in b and c is based on a numerical scale of 5 for negligible color transfer or color change to 1 for very severe color transfer or color change. The numerical rating in Table 1 or higher is acceptable.
[C] AATCC 9–Step Chromatic Transference Scale.
[D] AATCC Gray Scale for Color Change.

6.6 *Resistance to Flexing*—Determine the resistance to flexing as directed in Methods D2097 with the specimens mounted face side out.

6.7 *Blocking at Elevated Temperature*— Determine the blocking at elevated temperature as directed in CFFA Method 5.

6.8 *Resistance to Cracking at Low Temperature*—Determine the resistance to cracking at low temperature as directed in Test Method D2136 with the cold chamber temperature at – 10 ± 1°F (–23 ± 1°C).

6.9 *Colorfastness:*

6.9.1 *Crocking*—Determine the colorfastness to wet and dry crocking as directed in AATCC TM8 for solid shades and AATCC TM116 for prints.

6.9.2 *Light*—Determine the colorfastness to light as directed in AATCC TM16.3.

NOTE 2—There are distinct differences in spectral distribution between the various types of machines listed in AATCC TM16.3, with no overall correlations between them. Consequently, these machines cannot be used interchangeably. In case of controversy, results obtained with AATCC TM16.3, Option 3 shall prevail.

NOTE 3—Standardization of the xenon-arc lamp to 120 AATCC FU (or AFU or AATCC Fading Units) can be done by using six L2 Blue Wool Lightfastness Standards with a 20 AFU end point.

6.10 *Loss of Plasticizer from Plastics (Activated Carbon Method)*—Determine the loss of plasticizer as directed in Method A of Test Methods D1203.

NOTE 4—The loss of plasticizer test only applies to vinyl-coated fabrics.

6.11 *Hydrolytic Stability*—The following tests cover accelerated determinations of changes that might occur when coated fabrics are subjected to a combination of specific conditions of elevated temperature and high humidity. These tests are intended to detect changes that may occur in the coating which would reduce the surface abrasion resistance, change the adhesion of the coating to the substrate, or alter the resistance of the coating to cracking or delamination due to flexing in relation to end-use performance.

NOTE 5—Moisture alone can also cause hydrolytic degradation in the coating of these fabrics.

6.11.1 *Apparatus:*

6.11.1.1 *Laboratory Chamber,* capable of maintaining the required test temperature within ±2°F (±1°C) and maintaining the relative humidity of the test within ±5 %.

6.11.1.2 *Constant-Rate-of-Traverse (CRT) Tensile Testing Machine,* with the speed of the pulling jaw at 12 ± ½ in. (305 ± 13 mm)/min as described in Test Methods D751.

6.11.1.3 *Oscillatory Cylinder Abrasion Tester,* as described in Test Methods D1175.

6.11.1.4 *Newark Flex Tester,* as described in Methods D2097 – 69(1974).

6.11.2 *Test Specimens*—The sample to be exposed to high temperatures and humidity shall be a panel large enough to provide the specimens required for the following tests;

6.11.2.1 *Adhesion*—Four specimens, 2 in. (51 mm) wide by 8 in. (203 mm) long shall be cut, two of which shall have the longer dimensions parallel to the lengthwise direction of the fabric; and the other two specimens shall be cut with the long dimension parallel to the widthwise direction of the fabric. Adhesion shall be reported as the value per inch of width.

6.11.2.2 *Surface Abrasion*—Three specimens in the fabric length direction, each measuring 1⅞ in. (48 mm) wide by 9 in. (229 mm) long with the long dimension cut parallel to the fabric length direction.

6.11.2.3 *Resistance to Flexing*—Prepare two specimens measuring 3 by 4.5 in. (76 by 114 mm); one in the lengthwise direction and the other in the crosswise direction.

6.11.3 *Procedure*—Expose the large sample of coated fabric, from which test specimens will be taken, in the humidity chamber at 158 ± 2°F (70 ± 1°C) and 95 ± 5 % relative humidity for 15 days. Following this exposure, condition the sample for 24 h at 70 ± 2°F (21 ± 1.1°C) and 65 ± 2 % relative humidity. After conditioning for 2 h, cut the specimens for adhesion, surface abrasion, and flex testing in accordance with the sizes given in 6.11.2.

6.11.3.1 *Adhesion*—Determine the adhesion as directed in Sections 39 to 42 of Test Methods D751 with the speed of the pulling clamp at 12 ± ½ in. (305 ± 13 mm)/min.

6.11.3.2 *Surface Abrasion*—Determine the surface abrasion as directed in Sections 26 to 29 of Test Methods D1175 (Oscillatory Cylinder Method), with the following modifications:

NOTE 6—The Oscillatory Cylinder Method of Test Methods D1175 is specified due to the historical usage of this method by furniture manufacturers; and one by which they have accumulated much data which, reportedly, has correlated with end-use performance in certain cases. Nonetheless, Section 5 of Test Methods D1175 states that the procedure is not recommended for acceptance testing. Consequently, the test requirements for this performance factor should be used with caution, with the knowledge that different fabrics will not always be ranked by this test in the same order as by actual abrasive wear which takes place on specific pieces of furniture.

(*a*) The abradent to be used is a desized and bleached 100 % cotton sateen fabric,[6] 53 in. (135 cm) wide with a thread count of 96 by 60 and having a yield of 1.12 yd/lb (2.3 m/kg). Expose the face side of the fabric to the coated fabric being abraded.

(*b*) The tension on the specimen shall be 4 lbf (18 N) and the compression force shall be 3 lbf (13 N).

(*c*) Give the specimen 25 000 double rubs (cycles).

6.11.3.3 *Resistance to Flexing*—Determine the resistance to flexing as directed in Methods D2097, with the specimens mounted face side out. Flex the specimen for 15 000 cycles and then remove from the machine for examination.

6.11.4 *Report of Hydrolytic Stability Parameters*—Report the vinyl-coated or urethane-coated specimens tested for hydrolytic stability with respect to adhesion, surface abrasion, and resistance to flexing as follows:

6.11.4.1 *Adhesion*—Average the values of adhesion for the two specimens tested in each direction. Calculate *L*, the percent loss, using Eq 1:

$$L = 100\,(O - H)/O \tag{1}$$

[6] The sole source of supply of the apparatus known to the committee at this time is Testfabrics Inc., P.O. Box 118, Middlesex, NJ 08846. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

where:

O = adhesion of original fabric, and
H = adhesion after hydrolytic stability treatment.

6.11.4.2 *Surface Abrasion*—Report whether or not the skin coat has "breaks" or other surface changes.

6.11.4.3 *Resistance to Flexing*—Report whether or not the coating shows evidence of cracking or delamination from the base fabric.

6.11.5 *Precision and Accuracy:*

6.11.5.1 *Precision*—The precision of the procedures in hydrolytic stability for testing adhesion, surface abrasion, and flex abrasion have not been established.

6.11.5.2 *Accuracy*—No justifiable statements can be made about the accuracy of the procedures in hydrolytic stability for testing adhesion, surface abrasion, and resistance to flexing since the true values of the properties cannot be determined by accepted referee methods.

6.12 *Flammability*—The flammability requirements shall be as agreed upon between the purchaser and the supplier, except when regulated by applicable government mandatory standards.

NOTE 7—The technical need for an ASTM test method for determining the flammability of the types of fabrics addressed by this specification has been referred to Subcommittee D13.52 on Flammability and will be incorporated here should a test method become available.

7. Keywords

7.1 abrasion resistance; chemical properties (textiles) adhesion; coated fabric; fabric; flammability; performance; specification