



Designation: D 5446 – 01

# Standard Practice for Determining Physical Properties of Fabrics, Yarns, and Sewing Thread Used in Inflatable Restraints<sup>1</sup>

This standard is issued under the fixed designation D 5446; 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 standard is a listing of the test methods commonly employed in determining the physical properties of fabrics and yarns used in the manufacture of inflatable restraints.

1.2 Fabrics used in the manufacture of inflatable restraints may be coated or uncoated, and may be comprised of spun yarns, continuous filament yarns, or a combination thereof.

1.3 Fabrics used in the manufacture of inflatable restraints may be either flat or one piece woven. For the one-piece woven, follow the sampling section of D 5446 and the individual test method.

1.4 In Section 9, this standard lists in alphabetical order the procedures associated with conducting physical testing of the following fabric or yarn properties of concern to the design and manufacture of inflatable restraints.

Yarn	Section
Denier (Yarn Number)	9.3.1
Fiber Content	9.3.2
Finish (Extractable Material)	9.3.3
Strength and Elongation	9.3.4
Twist	9.3.5
Fabric	Section
Air Permeability	9.3.6
Abrasion Resistance	9.3.7
Blocking	9.3.8
Bow and Skew	9.3.9
Breaking Force & Elongation	9.3.10
Burst Strength	9.3.11
Coating Adhesion	9.3.12
Coating Weight	9.3.13
Count of Woven Fabric	9.3.14
Dynamic Air Permeability	9.3.28
Edgecomb Resistance	9.3.29
Flammability	9.3.15
Fogging (Volatility)	9.3.16
Length	9.3.17
Mass per Unit Area	9.3.18
Non-Fibrous Material	9.3.19
Odor	9.3.20
Packability	9.3.30
pH	9.3.21
Stiffness	9.3.22
Tear Strength	9.3.23
Thickness	9.3.24

Warp Size Content & Residual Sizing	9.3.25
Width	9.3.26
Thread	
Sewing Thread	9.3.27

1.5 This standard may be used in conjunction with Practice D 5427 which prescribes standard practices for the accelerated aging of inflatable restraint fabrics when comparative results of physical properties before and after accelerated aging are required.

1.6 Procedures and apparatus other than those stated in this standard may be used by agreement of purchaser and supplier with the specific deviations from the standard practice acknowledged in the report.

1.7 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore, each system must be used independent of the other.

1.8 *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 and health practices and determine the applicability of regulatory limitations prior to use.* See Note 3.

## 2. Referenced Documents

### 2.1 ASTM Standards:

- D 123 Terminology Relating to Textiles<sup>2</sup>
- D 204 Test Methods for Sewing Thread<sup>2</sup>
- D 276 Test Methods for Identification of Fibers in Textiles<sup>2</sup>
- D 737 Test Method for Air Permeability of Textile Fabrics<sup>2</sup>
- D 751 Test Methods for Testing Coated Fabric<sup>3</sup>
- D 1059 Test Method for Yarn Number Based on Short-Length Specimens<sup>2</sup>
- D 1388 Test Methods for Stiffness of Fabrics<sup>2</sup>
- D 1422 Test Method for Twist in Yarns by the Untwist Retwist Method<sup>2</sup>
- D 1423 Test Method for Twist in Yarns by Direct Count Method<sup>2</sup>
- D 1777 Test Method for Measuring Thickness of Textile Materials<sup>2</sup>
- D 1907 Test Method for Yarn Number by the Skein Method<sup>2</sup>

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.20 on Inflatable Restraints.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 07.01

<sup>3</sup> Annual Book of ASTM Standards, Vol 09.02.

- D 2256 Test Method for Tensile Properties of Yarns by the Single Strand Method<sup>2</sup>
- D 2257 Test Method for Extractable Matter in Textiles<sup>2</sup>
- D 2261 Test Method for Tearing Strength of Woven Fabrics by the Tongue (Single Rip) Method (Constant-Rate-of-Extension Tensile Testing Machine)<sup>2</sup>
- D 3773 Test Method for Length of Woven Fabric<sup>4</sup>
- D 3774 Test Method for Width of Woven Fabric<sup>4</sup>
- D 3775 Test Method for Fabric Count of Woven Fabric<sup>4</sup>
- D 3776 Test Method for Mass Per Unit Area (Weight) of Woven Fabric<sup>4</sup>
- D 3786 Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics—Diaphragm Bursting Strength Tester Method<sup>4</sup>
- D 3882 Test Method for Bow and Skewness in Woven and Knitted Fabrics<sup>4</sup>
- D 3990 Terminology Relating to Fabric Defects<sup>4</sup>
- D 4032 Test Method for Stiffness of Fabric by the Circular Bend Procedure<sup>4</sup>
- D 4157 Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)<sup>4</sup>
- D 4851 Test Method for Coated and Laminated Fabrics for Architectural Use<sup>4</sup>
- D 5034 Test Method for Breaking Force and Elongation of Textile Fabrics (Grab Test)<sup>4</sup>
- D 5427 Practice for Accelerated Aging of Inflatable Restraint Fabric<sup>4</sup>
- D 5587 Test Method for Trapezoid Tearing Strength of Textiles<sup>4</sup>
- F 778 Methods for Gas Flow Resistance Testing of Filtration Media<sup>5</sup>
- D 6476 Test Method for Determining Dynamic Air Permeability of Inflatable Restraint Fabric<sup>4</sup>
- D 6478 Test Method for Determining Specific Packability of Fabrics Used in Inflatable Restraint<sup>4</sup>
- D 6479 Test Method for Determining Edgcomb Resistance of Woven Fabrics Used in Inflatable Restraints<sup>4</sup>
- D 6613 Practice for Determining the Presence of Sizing in Nylon and Polyester Fabric Used in Inflatable Restraints<sup>4</sup>
- 2.2 *Federal Standards*.<sup>6</sup>
- Motor Vehicle Safety Standard 302—Flammability
- 2.3 *SAE Standards*.<sup>7</sup>
- J912-A Resistance to Blocking
- J1351 Determination of Odor
- 2.4 *Ford Motor Company Standards*.<sup>8</sup>
- FLTM BO116-03 Fogging Standard
- FLTM BN13-1 Coating Adhesion
- 2.5 *AATCC Methods*.<sup>9</sup>

Method 81 pH of Water—Extract from Wet Processed Textiles

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *coated fabric, n*—a flexible material composed of a textile fabric and an adherent polymeric material applied to one or both sides.

3.1.2 *inflatable restraint, n*—a vehicular safety device designed to cushion an occupant or equipment during collision; airbag.

3.1.3 *one-piece woven, adj*—for inflatable restraints, a descriptive related to either 1) a tubular woven fabric composed of two layer inflatable sections, visible lines where the two layers initially interlace, and non-inflatable sections, or 2) the cushion cut from such fabric.

3.1.3.1 *Discussion*—a weaving machine is capable of simultaneously weaving two separate layers of fabric, one over the other, with tight interfacing selectively woven between them. Where the layers are not interlaced, the fabric is capable of being inflated; where they are interlaced, inflation is not possible. Although the pattern in the fabric described by the visible line where the two inflatable layers interlace may be a complex shape other than a tube, the construction is commonly referred to as tubularly woven. Such weaving methods are sometimes used to minimize sewn seams in the manufacture of inflatable restraint cushions.

3.2 For definitions of other terms used in these test methods, refer to Terminology D 123 and Terminology D 3990.

### 4. Summary of Test Method

4.1 Test specimens are taken from sample rolls of fabric and tested using prescribed laboratory procedures, conditions and equipment by the supplier to determine the physical properties of the fabric in accordance with the requirements of the purchaser.

### 5. Significance and Use

5.1 Every ASTM test method listed in 2.1 contains a section describing its particular significance and use. Other test methods listed in 2.1 of this standard may contain sections pertaining to their particular significance and use.

5.2 The physical testing procedures in this standard can be used in conjunction with lot sampling procedures as a basis for acceptance testing of commercial shipments of inflatable restraint fabrics. They may be used to establish the criteria by which inflatable restraint fabrics will be tested by the supplier to determine whether a lot of material is acceptable for shipment to the purchaser.

5.3 This standard addresses all the physical properties that describe inflatable restraint fabrics and their commonly used test methods. Unless otherwise specified by agreement of purchaser and supplier, these standard test methods shall constitute the test conditions, procedures, and equipment used to determine the physical properties of fabrics used in inflatable restraints. It is intended to be used as a guideline in establishing a written material specification. The specification or agreement of purchaser and supplier may deviate from the practices described herein when (based on experience) considerations of

<sup>4</sup> Annual Book of ASTM Standards, Vol 07.02.

<sup>5</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>6</sup> Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20525.

<sup>7</sup> Available from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

<sup>8</sup> Available from Ford Motor Company, Engineering Department, Body Engineering Building, Room 1145, 21500 Oakwood Boulevard, Dearborn, MI 48124.

<sup>9</sup> Available from American Association of Textiles Chemists and Colorist, PO Box 12215, Research Triangle Park, NC 27709.