



Designation: ~~D5446-02 (Reapproved 2007)~~ Designation: D 5446 – 08

Standard Practice for Determining Physical Properties of Fabrics, Yarns, and Sewing Thread Used in Inflatable Restraints¹

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1. Scope

1.1 This practice 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 manufacturer 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 practice 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	
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 practice 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 practice 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*

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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:²

- D 123 Terminology Relating to Textiles
- D 204 Test Methods for Sewing Threads
- D 276 Test Methods for Identification of Fibers in Textiles
- D 737 Test Method for Air Permeability of Textile Fabrics
- D 751 Test Methods for Coated Fabrics
- D 1059 Test Method for Yarn Number Based on Short-Length Specimens
- D 1388 Test Method for Stiffness of Fabrics
- D 1424 Test Method for Tearing Strength of Fabrics by Falling-Pendulum Type (Elmendorf) Apparatus
- D 1423 Test Method for Twist in Yarns by Direct-Counting
- D 1777 Test Method for Thickness of Textile Materials
- D 1907 Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method
- D 2256 Test Method for Tensile Properties of Yarns by the Single-Strand Method
- D 2257 Test Method for Extractable Matter in Textiles
- D 2261 Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine)
- D 3773 Test Methods for Length of Woven Fabric
- D 3774 Test Method for Width of Textile Fabric
- D 3775 Test Method for Warp (End) and Filling (Pick) Count of Woven Fabrics
- D 3776 Test Methods for Mass Per Unit Area (Weight) of Fabric
- D 3786 Test Method for Bursting Strength of Textile Fabrics Diaphragm Bursting Strength Tester Method
- D 3882 Test Method for Bow and Skew in Woven and Knitted Fabrics
- D 3990 Terminology Relating to Fabric Defects
- D 4032 Test Method for Stiffness of Fabric by the Circular Bend Procedure
- D 4157 Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)
- D 4851 Test Methods for Coated and Laminated Fabrics for Architectural Use
- D 5034 Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
- D 5427 Practice for Accelerated Aging of Inflatable Restraint Fabrics
- D 5587 Test Method for Tearing Strength of Fabrics by Trapezoid Procedure
- D 6476 Test Method for Determining Dynamic Air Permeability of Inflatable Restraint Fabrics
- D 6478 Test Method for Determining Specific Packability of Fabrics Used in Inflatable Restraints [e73/astm-d5446-08](https://www.astm.org/standards/d5446-08)
- D 6479 Test Method for Determining the Edgecomb Resistance of Woven Fabrics Used in Inflatable Restraints
- D 6613 Practice for Determining the Presence of Sizing in Nylon or Polyester Fabric
- D 6799 Terminology Relating to Inflatable Restraints
- F 778 Methods for Gas Flow Resistance Testing of Filtration Media

2.2 Federal Standards:³

Motor Vehicle Safety Standard 302—Flammability

2.3 SAE Standards:⁴

J912-A Resistance to Blocking

J1351 Determination of Odor

2.4 Ford Motor Company Standards:⁵

FLTM BO116-03 Fogging Standard

FLTM BN13-1 Coating Adhesion

2.5 AATCC Methods:⁶

Method 81 pH of Water—Extract from Wet Processed Textiles

3. Terminology

3.1 Definitions:

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 Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20525.

⁴ Available from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

⁵ Available from Ford Motor Company, Engineering Department, Body Engineering Building, Room 1145, 21500 Oakwood Boulevard, Dearborn, MI 48124.

⁶ Available from American Association of Textiles Chemists and Colorists, PO Box 12215, Research Triangle Park, NC 27709.

3.2 For definitions of other terms used in this practice, refer to Terminology D123, Terminology D3990 and Terminology D6799.
Definitions:

3.2 For all terminology relating to D13.20, Inflatable restraints, refer to Terminologies D 3990 and D 6799.

3.2.1 The following terms are relevant to this standard: coated fabric, inflatable restraint.

3.3 For all other terms related to textiles, see Terminology D 123.

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 practice may contain sections pertaining to their particular significance and use.

5.2 The physical testing procedures in this practice 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 practice 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 fabric properties, material handling equipment, or inflatable restraint system design dictate otherwise.

6. Apparatus

6.1 Periodic laboratory certification of test equipment used in accordance with this practice is required to reduce test variability due to precision and bias.

6.2 For inflatable restraints, all test equipment used in accordance with the procedures referenced in this practice shall be certified for calibration annually by an independent agency or equipment manufacturer whose results are traceable to National Institute of Science and Technology (NIST) or other national standards laboratory. The test parameters of the equipment shall be tested within the operating ranges covered in the material specification or equivalent document.

7. Sampling

7.1 Lot Sample:

7.1.1 For the size of an acceptance sampling lot of fabric for inflatable restraints, use the number of fabric rolls in a shipment of a single fabric style unless otherwise agreed upon between the purchaser and supplier. If the fabrics are one piece woven, use the number of units in the shipment as the acceptance sampling lot.

7.1.2 Unless otherwise agreed upon by purchaser and supplier, take as a lot sample all of the rolls or one piece woven units in a shipment of fabric. Consider rolls of fabric to be the primary sampling units.

7.1.3 For the size of an acceptance lot of yarn, use the lot determination and sample plan agreed upon by purchaser and supplier.

7.2 Laboratory Sample:

7.2.1 An entire roll of fabric or a full-width cut from the end of a roll within a lot sample or one piece woven units constitutes a laboratory sample depending on which physical property is to be tested.

7.2.1.1 For fabric width, fabric bow, and fabric length, the rolls in the lot sample serve as the laboratory sample.

7.2.1.2 For all other physical properties, take as the laboratory sample a full width cut of fabric 2 m (2 yd) long from the end of each roll in the lot sample if there is no evidence that the fabric is distorted; if there is evidence of physical distortion on the outside of the fabric roll, take a sample cut from the resulting end of the roll after removing and discarding the distorted portion of fabric.

7.2.2 An entire yarn package constitutes a laboratory sample for yarn testing.

7.3 Test Specimens:

7.3.1 Test specimens are the pieces of yarn or fabric units that actually undergo testing. The fabric units may be entire fabric rolls, one piece woven units or fabric pieces cut from the laboratory sample in accordance with physical testing requirements of a specific test method.

7.3.2 For fabric width, fabric bow, and fabric length, the rolls in the lot sample serve as the test specimens. For all other physical properties to be tested, the test specimens are the fabric pieces cut from the laboratory sample in accordance with the respective test method.

7.3.3 Take specimens from different positions across the roll width or one piece woven units when testing physical properties oriented in the warp direction; take specimens from different positions along the roll length or one piece woven units when testing physical properties oriented in the filling direction.