Designation: D6479 – 15

Standard Test Method for Determining the Edgecomb Resistance of Woven Fabrics Used in Inflatable Restraints[1]

This standard is issued under the fixed designation D6479; 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 test method covers the procedures for determining the resistance to edgecombing of a woven fabric used in inflatable restraints.

1.2 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.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1776 Practice for Conditioning and Testing Textiles

D123 Terminology Relating to Textiles

D2904 Practice for Interlaboratory Testing of a Textile Test Method that Produces Normally Distributed Data (Withdrawn 2008)[3]

D2906 Practice for Statements on Precision and Bias for Textiles (Withdrawn 2008)[3]

D5035 Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)

D5822 Test Method for Determining Seam Strength in Inflatable Restraint Cushions

D6799 Terminology Relating to Inflatable Restraints

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 For all terminology relating to D13.20, Inflatable restraints, refer to Terminology D6799.

3.1.1 The following terms are relevant to this standard: edgecombing, inflatable restraint, seam slippage, yarn slippage

3.2 For all other terms related to textiles, see Terminology D123.

3.3 *Definitions:*

3.4 For definitions of other terms used in this standard, refer to Terminology D123 and Terminology D6799.

4. Summary of Test Method

4.1 One end of a test specimen is clamped within one jaw of a CRE tensile testing machine and a special fixture pierces a row of equally spaced needle holes through the opposite end of the specimen. In accordance with Test Method D5035, a tensile force is applied to the specimen until rupture occurs. The measurement of the force required to cause rupture is the measurement of edgecomb resistance.

5. Significance and Use

5.1 A measurement of a fabric's edgecomb resistance indicates the relative tendency of a fabric to pull apart under seam stress or similar action. The related concepts of yarn slippage and seam slippage are limited to sewn seams, whereas the measurement of edgecomb resistance is made at the edge of a cut part in the absence of a sewn seam. The absence of a sewn seam in this test method eliminates the effect that a particular stitch might have on the tendency of a yarn to slip near an edge of a cut part

5.2 This test method is useful for material design evaluations in such applications as airbags in which seam stress is a major concern.

5.3 This method may be used as a complement to Test Method D5822.

6. Apparatus

6.1 *Tensile Testing Machine*—A constant-rate-of-extension (CRE) type, that is designed for the tensile forces anticipated,

[1] This test method is under the jurisdiction of ASTM Committee D13 on Textiles and are the direct responsibility of Subcommittee D13.20 on Inflatable Restraints.

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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.

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that is operated at a rate of 200 ± 10 mm/min, that has a force range selected such that the anticipated break occurs between 10 and 90 % of full scale load, and that has jaws and grip faces as agreed upon by purchaser and supplier.

6.2 *Clamps,* jaws with smooth, flat, parallel faces a minimum of 60 mm wide by 25 mm tall. The jaws may be padded or coated under the jaw face area and should be mounted in the upper position in the tensile testing machine.

6.3 *Fixture,* compatible with tensile tester, equipped with twelve equally spaced 1 mm diameter pins with sharp points, 8 mm in length and corresponding 1.5 mm diameter holes with a stop located 5 mm from the center of the holes (Fig. 1). The fixture should be properly centered with the upper clamps and their surfaces should be aligned (not twisted).

6.4 *Load Cell,* whose rated capacity is between 110 and 1000 % of expected stripping load. A2000 N load cell is generally used for inflatable restraints.

6.5 For inflatable restraints, all test equipment used in accordance with this test method 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 cushion specification or equivalent document.

7. Sampling and Specimen Preparation

7.1 Edgecomb resistance testing is a destructive test. If used in conjunction with lot testing, sampling is required.

7.2 For acceptance testing the lot size is the number of rolls of fabric produced in one production day, or as specified in the applicable material specification.

7.3 From the end of each roll of fabric taken from the lot sample, cut a 1 m long, full width sample of fabric.

7.4 From the laboratory sample, select five test specimens each from the warp and fill directions (Fig. 2).

7.5 *Specimen Cut:*

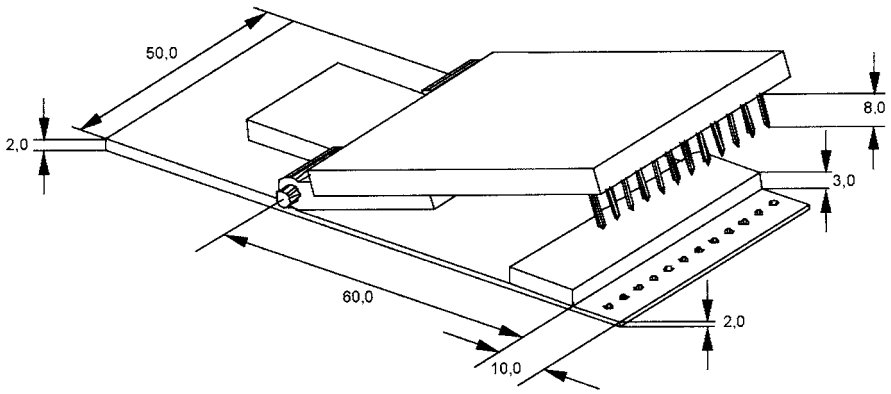
7.5.1 *Cut Edge Method:*

7.5.1.1 Without sealing or unraveling the edges, cut each specimen 50 ± 1 mm wide and 300 ± 5 mm long, with the long dimension parallel to the warp yarns for a warp-oriented test, and parallel to the fill yarns for a fill-oriented test.

7.5.2 *Ravel Edge Method:*

7.5.2.1 Cut each specimen 60 ± 1 mm wide and 300 ± 5 mm long, with the long dimension parallel to the warp yarns for a warp-oriented test, and parallel to the fill yarns for a fill-oriented test.

7.5.2.2 Ravel each specimen to give a testing width of 50 ± 1 mm wide by removing an approximately equal number of yarns from each side.



Description:
- 50,0 mm total width for baseplate of the specimens holder
- 70,0 mm total length for moveable arm of the specimens holder
- 3,0 mm distance from centre of the first needle to edge of specimens holder
- 4,0 mm distance between centres of the needles
- 1,0 mm diameter of needles
- 12 grounded needles
- 8,0 mm length of visible needles
- 10,0 mm total lock distance for specimens
- 5,0 mm distance between centre od drillings to edge of specimen holder
- 1,5 mm diameter of drillings at the base plate
- Connection between specimens holder and testing device to be fitted due to the needs of the testing device

FIG. 1 Fixture

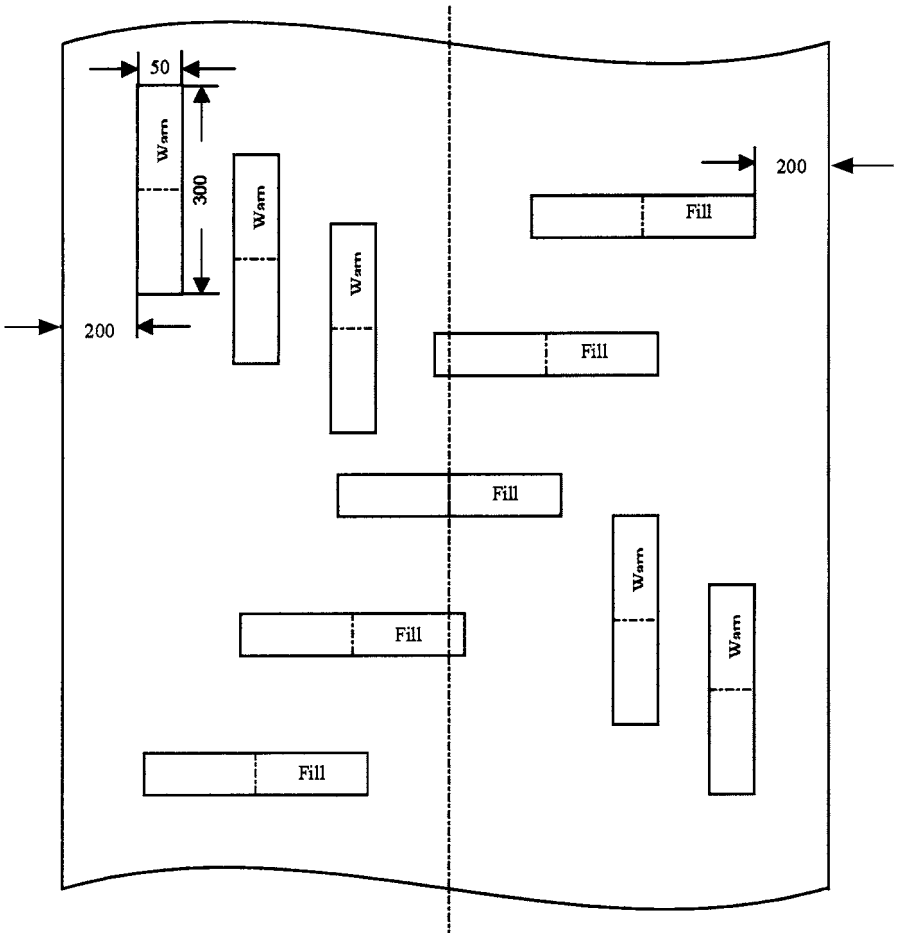


FIG. 2 Test Specimens

7.6 A final cut should be made to the edge that is inserted into the edgecomb fixture to ensure a continuous full yarn is present.

8. Conditioning

8.1 Specimens for edgecomb resistance testing shall be conditioned at the standard atmosphere for testing textiles for at least 4 h prior to test in accordance with Test Method D1776.

9. Procedure

9.1 Prepare the tensile testing machine in accordance with Test Method D5035.

9.2 Set the gage length between the bottom edge of the upper clamp to the top surface of the edge comb fixture to 200 ± 1 mm.

9.3 Select the force range of the testing machine for the break to occur between 10 and 90 % of full-scale force. Calibrate or verify the testing machine for this range.

9.4 Set the testing machine for a loading rate of 200 ± 10 mm/min.

9.5 Ensure proper clamping as directed by Test Method D5035.

9.6 Mount one end of the specimen into the bottom clamp position of the edgecomb fixture, ensuring that the end of the specimen abuts flatly and evenly against the alignment block, parallel to and behind the pinholes.

9.7 Pierce the end of the specimen with the 12 1.0 mm pins and secure the hinge.

9.8 Mount the opposite end of the specimen securely in the opposite clamp of the testing machine in accordance with Test Method D5035. Ensure that the specimen is not pulled and the yarns displaced. Ensure specimen alignment is adjusted to present a 90° angle where the specimen intersects the grip or fixture, or both.

9.9 Operate the machine and break the specimen in accordance with Test Method D5035.

9.10 Record the breaking force separately for both the warp and fill directions. Determine the median of the break forces observed for all specimens tested.

10. Report

10.1 State that the tests were conducted in accordance with this test method.

10.2 State that the tests were performed by either the cut strip or the ravel strip method.

10.3 If deviation from this test method occurred, any reference to this standard shall state: "Testing was performed in accordance with ASTM D6479, with the following changes:"

10.4 The purchaser and supplier shall determine the exact form of the test report. Unless otherwise specified, the form shall provide the following information:

10.4.1 Lot identification,

10.4.2 Date of report,

10.4.3 Name of person certifying report,

10.4.4 Relevant specification,

10.4.5 Number of specimens used in each test

10.4.6 Tests performed and data obtained,

10.4.7 Laboratory conditions if other than standard, and

10.4.8 Deviations from standard procedures and apparatus.

11. Precision and Bias

11.1 An interlaboratory test was conducted in accordance with Practice D2904 and Practice E691.

11.2 *Raw Data Table:*

data in N force		Fabric A PA 6,6 470 dtex 18×18 25 gsm Si		Fabric B PA 6,6 470 dtex 21×21 Uncoated		Fabric C PA 6,6 700 dtex 16×16 25 gsm Si	
		Warp	Fill	Warp	Fill	Warp	Fill
Lab 1	Specimen 1	303	308	705	474	303	308
	Specimen 2	319	306	780	394	320	306
	Specimen 3	324	278	679	530	324	278
	Specimen 4	326	275	585	430	326	275
	Specimen 5	313	304	678	516	313	304
Lab 2	Specimen 1	352	351	970	815	469	416
	Specimen 2	343	341	904	895	469	428
	Specimen 3	341	329	990	865	442	424
	Specimen 4	350	339	931	807	458	418
	Specimen 5	358	337	942	936	467	414
Lab 3	Specimen 1	375	325	861	714	419	356
	Specimen 2	359	325	942	663	415	368
	Specimen 3	356	318	939	887	399	398
	Specimen 4	349	312	1058	923	402	374
	Specimen 5	352	340	1003	1000	427	377
Lab 4	Specimen 1	349	340	683	648	446	420
	Specimen 2	363	340	693	653	433	432
	Specimen 3	352	346	687	636	465	420
	Specimen 4	354	334	670	673	437	456
	Specimen 5	346	342	750	599	452	406
Lab 5	Specimen 1	346	328	731	615	436	417
	Specimen 2	356	334	760	629	428	387
	Specimen 3	361	314	800	613	404	403
	Specimen 4	359	335	970	743	430	416
	Specimen 5	359	332	787	702	449	399
Lab 6	Specimen 1	376	517	791	746	438	462
	Specimen 2	391	390	867	882	381	504
	Specimen 3	389	414	876	1258	486	470
	Specimen 4	344	355	867	1141	425	446
	Specimen 5	370	393	962	661	437	516
Lab 7	Specimen 1	340	325	836	773	561	425
	Specimen 2	333	341	927	713	600	433
	Specimen 3	333	293	863	697	513	388
	Specimen 4	344	317	841	746	474	412
	Specimen 5	345	311	834	774	496	418
Lab 8	Specimen 1	341	342	873	722	448	381
	Specimen 2	359	361	924	789	454	428
	Specimen 3	353	335	840	866	444	432
	Specimen 4	334	391	861	742	412	403
	Specimen 5	352	340	919	819	461	418
Lab 9	Specimen 1	309	291	589	448	388	315
	Specimen 2	321	290	670	402	314	297
	Specimen 3	292	279	605	389	325	314
	Specimen 4	314	282	704	418	342	338
	Specimen 5	296	284	665	489	322	363
Lab 10	Specimen 1	330	289	885	616	393	397
	Specimen 2	347	293	821	725	438	399
	Specimen 3	331	308	818	705	403	420
	Specimen 4	324	318	774	693	417	446
	Specimen 5	351	311	771	752	436	414
Lab 11	Specimen 1	316	305	701	718	417	438
	Specimen 2	329	371	843	753	428	441
	Specimen 3	348	320	794	676	443	436
	Specimen 4	356	312	860	791	433	407
	Specimen 5	326	307	821	717	437	431

11.3 The precision statement below was generated by The ASTM E691 software package.

11.3.1 The number of laboratories, materials, and determinations in this study DOES NOT meet the minimum requirements for determinating precision prescribed in ASTM Practice E691:

	This Study	ASTM E691 Minimum
Laboratories	11	6
Materials	3	4
Determinations	5	2

11.3.2 *Precision Statement for Test Method: Warp-N*—Precision, characterized by repeatability, S_r, r, and reproducibility, S_R, R has been determined for the materials to be:

Materials	Avg.	S_r	S_R	r	R
18×18 470 Sil	342.67	11.45	21.63	32.05	60.58
21×21 470 Unc	816.36	57.31	115.91	160.48	324.55
16×16 700 Sil	423.62	24.36	60.93	68.21	170.60

11.3.3 *Precision Statement for Test Method: Fill-N*—Precision, characterized by repeatability, S_r, r, and reproducibility, S_R, R has been determined for the materials to be:

Materials	Avg.	S_r	S_R	r	R
18×18 470 Sil	329.05	23.37	40.54	65.45	113.50
21×21 470 Unc	708.75	98.47	179.12	275.72	501.55
16×16 700 Sil	397.85	22.55	58.49	63.13	163.77

11.3.4 This precision statement is provisional. Within five years, additional data will be obtained and processed which does meet the requirements of E691.

12. Keywords

12.1 airbag; break force; edgecomb resistance; inflatable restraint

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