



Designation: D3453 – 20

# Standard Specification for Flexible Cellular Materials—Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications<sup>1</sup>

This standard is issued under the fixed designation D3453; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope\*

1.1 This specification covers flexible cellular urethane materials intended for such uses as inserts for furniture cushions, mattresses, and similar applications.

1.2 This specification provides material and dimensional requirements and methods of tests for specific properties of load bearing, compression set, humid age resistance, pounding fatigue resistance, support factor and resilience.

1.3 This specification includes references to government regulations for burning characteristics of flexible cellular material used in specified applications.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 *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.*

NOTE 1—There is no equivalent ISO standard.

1.6 *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:<sup>2</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.22 on Cellular Materials - Plastics and Elastomers.

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

D3574 Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams

D3675 Test Method for Surface Flammability of Flexible Cellular Materials Using a Radiant Heat Energy Source

### 2.2 Federal Documents:<sup>3</sup>

16CFR1632 (Previously Doc FF4-72) Standard for the Flammability of Mattresses and Mattress Pads

16CFR1633 Standard for the Flammability (Open Flame) of Mattress Sets

49CFR571.302 Federal Motor Vehicle Safety Standards, Flammability of Interior Materials

14CFR25.853 Airworthiness Standards: Transport Category Airplanes, Compartment Interiors (DOT Federal Aviation Regulation, (FAR), Part 25.853), Paragraph (b), and Appendix F

Simplified Practice Recommendations R2-62 Bedding Products and Components (Mattresses, Springs, Bedsteads, and Cots)<sup>4</sup>

## 3. Classification

3.1 This specification covers eight grades of flexible cellular material that have been selected for use in accordance with load bearing and general physical properties, **Table 1**; four grades based on pounding-fatigue properties, **Table 2**; three grades based on cushioning performance properties, **Table 3**.

## 4. Basis of Purchase

4.1 Any product represented as complying with this specification shall meet all the requirements listed herein for its particular classification.

## 5. Burning Characteristics

5.1 Several fire performance requirements applicable to flexible cellular materials can be found in regulations, codes and specifications, including the following (which is provided for information purposes but is not intended to be a comprehensive list).

<sup>3</sup> Available from the Superintendent of Documents, U. S. Government Publishing Office, Washington, DC 20402, <http://www.govinfo.gov>, <http://www.ecfr.gov>.

<sup>4</sup> Available from the Clearing House for Federal Scientific and Technical Information, 5285 Port Royal Rd., Springfield, VA 22151.

\*A Summary of Changes section appears at the end of this standard

**TABLE 1 Specific Physical Properties of Flexible Cellular Material**

Grade Number		25 % Indentation Force Deflection (IFD) Values, <sup>A</sup> N (lbf)	Compression (comp) Set <sup>B</sup> After 90 % Deflection, % max	Moisture Resistance	
N	lbf			Compression Force Deflection Loss, % max	Compression Set <sup>B</sup> After Deflection, % max
245	55	245 ± 18 (55 ± 4)	15	20	20
196	44	196 ± 18 (44 ± 4)	15	20	20
151	34	151 ± 14 (34 ± 3)	15	20	20
120	27	120 ± 14 (27 ± 3)	15	20	20
93	21	93 ± 14 (21 ± 3)	15	20	20
67	15	67 ± 14 (15 ± 3)	20	20	25
40	9	40 ± 14 (9 ± 3)	25	—	30
22	5	22 ± 14 (5 ± 3)	30	—	35
Test method sections <sup>C</sup>		B1	D	J1,C	J1,D
Specimen size, <sup>D</sup> mm (in.)		380 × 380 × 100 (15 × 15 × 4)	50 × 50 × 25 (2 × 2 × 1)	50 × 50 × 25 (2 × 2 × 1)	50 × 50 × 25 (2 × 2 × 1)

<sup>A</sup> Tolerances have been established to provide for grade designations. Closer tolerances, when desirable for specific applications, shall be agreed upon between the purchaser and the seller.

<sup>B</sup> To be expressed as a percent of the original thickness.

<sup>C</sup> See Section 7 for an explanation of the test methods referenced.

<sup>D</sup> See 9.3 when indicated specimen sizes are not available.

**TABLE 2 Pounding Fatigue Performance Grades**

Grade	Description	Applications	40 % IFD <sup>A</sup> % Loss, max
AP	Heavy-duty use	transportation seating	20
BP	Normal-duty use	cushions, mattresses	30
CP	Light-duty use	arm rests, seat backs	35
DP	Unclassified	miscellaneous padding	40

<sup>A</sup> See Test Methods D3574, Test I<sub>3</sub>, Procedure B (80 000 cycles).

**TABLE 3 Cushioning Performance Grades<sup>A</sup>**

Grade Number	Description	Support Factor <sup>B</sup>	Resilience <sup>C</sup>
NS	Normal Support	1.8 min	—
HS	High Support	2.3 min	—
HS-HR	High Support- High Resilience	2.4 min	55 % min

<sup>A</sup> Grades also subject to specific physical properties in Table 1.

<sup>B</sup> 65 % / 25 % IFD; See Test Methods D3574, Section 21 and Appendix X3.1.

<sup>C</sup> Ball Rebound; see Test Methods D3574, Sections 68–72.

5.1.1 FMVSS 302 (49 CFR 571.302) is used by the National Highway Transit Safety Administration for automotive interiors; source [www.ecfr.gov](http://www.ecfr.gov)

5.1.2 16 CFR 1632 is used by the Consumer Product Safety Commission for mattress components; source [www.cpsc.gov](http://www.cpsc.gov)

5.1.3 16 CFR 1633 is used by the Consumer Product Safety Commission for mattresses; source [www.cpsc.gov](http://www.cpsc.gov)

5.1.4 14 CFR 25.853 (FAR Part 25.853, Paragraph b and Appendix F) is used for some aviation materials; source [www.ecfr.gov](http://www.ecfr.gov)

5.1.5 State of California Technical Bulletin 117-2013 is used for flexible cellular materials used in upholstered furniture and mattresses.

## 6. Dimensions

### 6.1 For Use as Mattress Inserts:

6.1.1 *Sizes*—The standard thickness and tolerance are specified in Table 4. These sizes have been adopted for mattress inserts to coordinate the insert with mattress ticking and other bed constructions. The other dimensions are specified in Table 7A of Simplified Practice Recommendations R2-62.

6.1.2 *For Use as Furniture Cushion Inserts*—The allowable tolerances on dimensions of furniture cushion inserts shall be as shown in Table 5.

## 7. Test Methods

7.1 The physical tests shall be in accordance with Test Methods D3574.

## 8. Physical Requirements

8.1 The material shall conform to the requirements for physical properties prescribed in Tables 1-3.

## 9. Inspection

9.1 Inspection of the material shall be agreed upon in writing by the purchaser and the seller as part of the purchase contract.

9.2 Testing for conformance to requirements shall be done in accordance with the appropriate sections of Test Methods D3574. The specific test methods in this reference to be used for each test shall be as listed in Tables 1-3, except as specified in 9.3. Burning tests shall be agreed upon by the purchaser and the seller. Some flammability standards are listed in Section 2.

9.3 If a specimen 380 by 380 by 100 mm (15 by 15 by 4 in.) cannot be obtained, an appropriate size, as well as its corresponding indentation force deflection (IFD) value, shall be agreed upon between the purchaser and the seller. In those

**TABLE 4 Thickness and Tolerance for Mattress Inserts**

Nominal Thickness		Plus		Minus	
mm	in.	mm	in.	mm	in.
100	4	4.8	3/16	1.6	1/16
125	5	4.8	3/16	1.6	1/16
150	6	4.8	3/16	3.2	1/8

TABLE 5 Dimensional Tolerances for Furniture Cushion Inserts

Nominal		Thickness					
		+			-		
mm	in.	mm	in.	mm	in.	mm	in.
25 to 75	1 to 3	3.2	1/8	1.6	1/16		
Over 75 to 125	3 to 5	4.8	3/16	1.6	1/16		
Over 125	over 5	4.8	3/16	3.2	1/8		

  

Nominal		Length and Width			
		±			
mm	in.	mm	in.	mm	in.
25 to 305, incl		1 to 12, incl	3.2		1/8
Over 305 to 610, incl		12 to 24, incl	6.4		1/4
Over 610 to 1220, incl		24 to 48, incl	9.6		3/8
Over 1220		over 48	12.7		1/2

cases where foams having thicknesses of 100 mm (4 in.) are not available, the following reduced IFD values are suggested:

Thickness	25 % IFD	65 % IFD	
75 mm (3 in.)	88 %	88 %	of 100 mm (4 in.) IFD value
50 mm (2 in.)	78 %	76 %	of 100 mm (4 in.) IFD value
25 mm (1 in.)	68 %	62 %	of 100 mm (4 in.) IFD value

In all cases, the IFD tolerances specified in Table 1 shall apply. For example, a 50-mm (2-in.) thick Grade 120-N (12 kg/27-lb) foam will have a 25 % IFD value of  $94 \pm 14$  N ( $21.0 \pm 3.0$  lbf) = 80 to 108 N (18.0 to 24.0 lbf).

9.3.1 If an IFD specimen cannot be obtained, an approximation from the 50 % CFD in accordance with Test Methods D3574 to a 100-mm (4-in.) IFD can be made using the following equation:

$$IFD = CFD \times \frac{(A + B)}{IFD \text{ Deflection}}$$

	25 %	40 %	65 %
A	1.397	2.382	5.32
B	82.31	93.84	87.92

9.3.2 If a 25% CFD value in psi is needed it can be estimated by using the 25% IFD value (lb.) in the following expression:

$$25\% \text{ CFD} = (25\% \text{ IFD} + 5) / 87$$

These conversions are useful for carpet cushion, packaging, and other specialty foams.

### 10. Retest and Rejection

10.1 If any failure occurs, the materials shall be retested to establish conformity in accordance with agreement between the purchaser and the seller.

### 11. Packaging, Marking, and Labeling

11.1 *Packaging*—The material shall be packed in standard commercial containers, so constructed as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the point of delivery, unless otherwise specified in the contract or order.

11.2 *Marking*—The shipping container shall be marked with the name, type, and quality of material in accordance with the contract or order under which the shipment is made. The shipping container shall also be marked with the name of the manufacturer and the contract or order number.

11.3 *Label*—In order for purchasers to identify products complying with all requirements of this voluntary specification, it is recommended that producers choosing to produce such products include a statement in conjunction with their name and address on labels, invoices, sales literature, and the like. The following statement is suggested:

11.3.1 “This product conforms to all the requirements for Grade , performance grade, established in ASTM Standard Specification D3453”. Full responsibility for the conformance of this product with the standard is assumed by (name and address of producer or distributor).

### 12. Precision and Bias

12.1 See referenced methods for precision and bias information.

### 13. Keywords

13.1 automotive; bedding; flexible cellular; furniture; urethane