



Designation: **D 3453 – 9601**

Standard Specification for Flexible Cellular Materials—Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications¹

This standard is issued under the fixed designation D 3453; 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.

This standard has been approved for use by agencies of the 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, ~~and dynamic 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 and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—There is no equivalent ISO standard.

2. Referenced Documents

2.1 ASTM Standards:

¹ This specification is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.22 on Cellular Materials-Plastics and Elastomers.

Current edition approved ~~July~~ November 10, 1996; 2001. Published ~~September~~ 1996; January 2002. Originally published as D 3453 – 76. Last previous edition ~~D 3453 – 91~~.

Modifications to the current edition include the following: addition of a safety caveat and ISO equivalency statement to the scope, correction of title changes in referenced documents, additions to keywords, and better test method references in the tables; D 3453 – 96.

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

D 3574 Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams²
 D 3675 Test Method for Surface Flammability of Flexible Cellular Materials Using a Radiant Heat Energy Source²

2.2 *Other Documents:*

CFR Title 16, Part 1632, (Previously DoC FF4-72), Standard for the Flammability of Mattresses³
 DOT MVSS 302 DoT Motor Vehicle Safety Standard³
 DOT Federal Aviation Regulation (FAR), Part 25.853, Paragraph (b), and Appendix F³
 Simplified Practice Recommendations R2-62 Bedding Products and Components (Mattresses, Springs, Bedsteads, and Cots)⁴

3. Classification

3.1 This specification covers ~~six~~ eight grades of flexible cellular material that may be selected for use ~~according to~~ in accordance with load bearing and general physical properties, Table 1; four grades based on ~~dynamic fatigue~~ pounding-fatigue properties, Table 2; three grades based on ~~static fatigue~~ 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 Table 4 lists applicable government regulations on burning characteristics of material used in specified applications.

6. Dimensions

6.1 *For Use as Mattress Inserts:*

6.1.1 *Sizes*—The standard thickness and tolerance are specified in Table 5. 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 6.

7. Test Methods

7.1 The physical tests shall be in accordance with Test Methods D 3574.

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.

² Annual Book of ASTM Standards, Vol 098.02.

³ Available from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

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

TABLE 1 Specific Physical Properties of Flexible Cellular Material

Grade Number		25 % Indentation Force Deflection (IFD) Values, ^A N (lbf)	Indentation Force Ratio 65 %/25 %, min	Compression (comp) Set ^B After 90 % Deflection, % max	Moisture Resistance	
SI, N	Inch-Pound, lbf				Compression Force Deflection Loss, % max	Compression S
245	55	245 ± 18 (55 ± 4)	15	20	20	
196	44	196 ± 18 (44 ± 4)	1.9	15	20	
151	34	151 ± 14 (34 ± 3)	1.9	15	20	
120	27	120 ± 14 (27 ± 3)	1.9	15	20	
93	21	93 ± 14 (21 ± 3)	1.9	15	20	
67	15	67 ± 14 (15 ± 3)	1.8	20	20	
40	9	40 ± 14 (9 ± 3)	1.8	25	—	
22	5	22 ± 14 (5 ± 3)	30	—	35	
Test method sections ^C		B1	B4	D	J1,C	
Specimen size, ^D mm (in.)		380 × 380 × 100 (15 × 15 × 4)	380 × 380 × 100 (15 × 15 × 4)	50 × 50 × 25 (2 × 2 × 1)	50 × 50 × 25 (2 × 2 × 1)	

^A Tolerances have been established to provide for grade designations. Closer tolerances, when desirable for specific applications, may be agreed upon between the purchaser and the seller.

^B To be expressed as a percent of the original thickness.

^C See Section 7 for an explanation of the test methods referenced.

^D See 9.3 when indicated specimen sizes are not available.

TABLE 2 DyPounamdicng Fatigue Performance Grades

Grade	Description	FLNApplications	40 % IFD ^A % Loss, max
AD	Heavy-duty use	30; max-nsportation seating	20
AP	Heavy-duty use	transportation seating	20
BD	Normal-duty use	34 to 5ns, mattresses	30
BP	Normal-duty use	cushions, mattresses	30
GD	Light-duty use	54 to 70 s, seat backs	35
CP	Light-duty use	arm rests, seat backs	35
DD	Unclassified	74 to 10us padding	40
DP	Unclassified	miscellaneous padding	40

^A See Test Methods D 3574, Test I₂₃, Procedure B (280 000 cycles).

**TABLE 3 StatCushic Fatoningue Performance Grades of
Uncored Slab Urethane Foam^A**

Grade Number	Description	ASuppleiort Factionr ^B	25 % IFD LoRese, maxilience ^{A,C}
AS	Heavy-duty	cushions, mattresses	20
NS	Normal Support	1.8 min	—
BS	Normal-duty	ar-m-rests, seat-backs	30
HS	High Support	2.3 min	—
GS	Light-duty	miscellaneous padding	40
HS-HR	High Support- High Resilience	2.4 min	55 % min

^A Grades also subject to specific physical properties in Table 1.

^B 65 % / 25 % IFD; See Test Methods D 3574, Section 21 and Appendix X3.1.

^C Ball Rebound; see Test Methods D 3574, Sections 68–72.

9.2 Testing for conformance to requirements shall be done in accordance with the appropriate sections of Test Methods D 3574. 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 in the reference are listed in Table 4.

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 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 $94 \pm 14 \text{ N}$ ($21.0 \pm 3.0 \text{ lbf}$) = 80 to 108 N (18.0 to 24.0 lbf).

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

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

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

This conversion may be useful in the carpet cushion, packaging, and other specialties.

10. Retest and Rejection

10.1 If any failure occurs, the materials may 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

TABLE 4 Applicable Government Regulation for Specified Applications^A

Types	Application	Regulation		
1	Automotive	DOT MVSS 302	Government Documents	Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402
2	Mattress and cushion	CFR Title 16, Part 1632 DOC FF 4-72 CAL TB 117 CAL TB 133 ^B NFPA 260 ^B NFPA 261 ^B BS 5852 ^B	California	California Bureau of Home Furnishings and Thermal Insulation, 3485 Orange Grove Ave, North Highlands, CA 95660
3	Aviation	FAR Part 25.853, Paragraph (b), and Appendix F FAA Oil Burner Test	National Fire Protection Association	1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269
4	Miscellaneous	Test Method D 3675 ^A	British Standard	British Standards Institute, B5
4	Miscellaneous	Test Method D 3675 ^C	British Standard	British Standards Institute, 2 Park Street, London, England W1A 2B5

^A Various governmental bodies have issued regulations based on Test Method D 3675. The regulations are not the same for all bodies issuing them. Here, the regulation of the government having jurisdiction should be consulted.

^B Composite test. Foam, fabric and other components may have a synergistic effect on each other.

^C This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.

TABLE 5 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 6 Dimensional Tolerances for Furniture Cushion Inserts

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

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 that purchasers may identify products complying with all requirements of this specification, producers choosing to produce such products in conformance with this voluntary specification may 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 D 3453”. 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

SUMMARY OF CHANGES

This section identifies the location of selected changes to this specification. For the convenience of the user, Committee D20 has highlighted those changes that may impact the use of this specification. This section may also include descriptions of the changes or reasons for the changes, or both.

D 3453 – 01:

- (1) Added two additional grades based on IFD in Table 1; 22N on the low end and 245N on the high end.
- (2) Removed Support Factor requirements from Table 1.
- (3) Changed Table 2 from grades based on Roller Shear Fatigue and TLN to grades based on Constant Force Pounding Fatigue.
- (4) Changed Table 3 from performance grades based on Static Fatigue to grades based on Support Factor and Resilience.
- (5) Expanded the list of combustion test regulations in Table 4.

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