



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, 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:

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

¹ 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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² *Annual Book of ASTM Standards*, Vol 08.02.

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

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

3. Classification

3.1 This specification covers eight grades of flexible cellular material that may be 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 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.

⁴ 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, ^A N (lbf) | Compression (comp) Set ^B After 90 % Deflection, % max | Moisture Resistance | |
|--------------------------------------|-----|---|--|---|---|
| N | lbf | | | Compression Force Deflection Loss, % max | Compression Set ^B 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 ^C | | B1 | D | J1,C | J1,D |
| Specimen size, ^D 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) |

^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 Pounding Fatigue Performance Grades

| Grade | Description | Applications | 40 % IFD ^A % 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 |

^A See Test Methods D 3574, Test I₃, Procedure B (80 000 cycles).

TABLE 3 Cushioning Performance Grades^A

| Grade Number | Description | Support Factor ^B | Resilience ^C | IFD Deflection | | |
|-----------------|----------------------------------|--------------------------------|-------------------------|----------------|-------|-------|
| | | | | 25 % | 40 % | 65 % |
| NS | Normal Support | 1.8 min | — | A | 1.397 | 2.382 |
| HS | High Support | 2.3 min | — | B | 82.31 | 93.84 |
| HS-HR | High Support- High Resilience | 2.4 min | 55 % min | | | 87.92 |

^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.

| 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 ± 14 N (21.0 ± 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 CFD to a 100-mm (4-in.) IFD can be made using the following equation:

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

| | 25 % | 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.

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 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:

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 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.

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 ^C | British Standard | British Standards Institute, 2 Park Street, London, England W1A 2B5 |

^A 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.

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

^C 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.

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 |

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

TABLE 6 Dimensional Tolerances for Furniture Cushion Inserts

| Nominal | | Thickness | | | |
|----------------|--------|-----------|------|-----|------|
| | | + | | - | |
| 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 | | |

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.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

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