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## Standard Specification for Urethane Microcellular Shoe Soling Materials<sup>1</sup>

This standard is issued under the fixed designation D 3851; 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.

~~ε<sup>1</sup>Note—Editorially added Test Method D2240 for reference in March 2003.~~

### 1. Scope <sup>\*</sup>

~~1.1 This specification covers urethane microcellular materials for shoe soling applications. It provides properties and dimensional requirements and test methods for specific properties.~~

1.1 This specification covers urethane microcellular materials for shoe soling applications. It provides physical property requirements and identifies test methods for determining those specific properties.

1.2 SI units are to be regarded as the preferred units of measurements for values. The inch-pound values in brackets can be used if there is an agreement between the contractual parties.

~~NOTE—There is no similar or equivalent ISO standard.~~ 1—There is no known ISO equivalent to this standard.

### 2. Referenced Documents

#### 2.1 ASTM Standards: <sup>2</sup>

~~D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension Test Methods for Vulcanized Rubber and Thermoplastic Elastomers~~ Tension

~~D 624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers~~<sup>2</sup> Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

~~D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement~~

~~D 1052 Test Method for Measuring Rubber Deterioration—Cut Growth Using Ross Flexing Apparatus~~<sup>2</sup> Test Method for Measuring Rubber Deterioration Cut Growth Using Ross Flexing Apparatus

~~D 1622 Test Method for Apparent Density of Rigid Cellular Plastics~~

~~D 1938 Test Method for Tear-Propagation Resistance (Trouser Tear) of Plastic Film and Thin Sheeting by a Single-Tear Method~~

~~D 2240 Test Method for Rubber Property—Durometer Hardness~~

~~D 3489 Test Methods for Rubber—Microcellular Urethane—Test Methods for Microcellular Urethane Materials~~

### 3. Classification

3.1 This specification covers three grades of microcellular urethane materials that may be selected for use according to abrasion resistance, cut-growth resistance, and other physical properties. The grades are classified as Grade 1, Grade 2, and Grade 3.

### 4. Ordering Information

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

### 5. Physical Requirements

5.1 The material shall conform to requirements for physical properties prescribed in Table 1.

<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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This revision includes the addition of an ISO equivalency statement and a keyword section. It also establishes SI units as the preferred units but allows for the use of inch-pound units.

<sup>2</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>3</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.

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

**TABLE 1 Physical Property Requirements on Polyurethane Shoe Systems**

Property	Grade			ASTM Method
	1	2	3	
Density	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	D 3489
Density	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	D 792
	—	—	—	or D 1622
Tensile strength, min, MPa [psi]	4.9 [700]	3.5 [500]	2.8 [400]	D 412
Tensile strength, min, MPa [psi]	4.9 [700]	3.5 [500]	2.8 [400]	D 412
Ultimate elongation, min, %	300	275	250	D 412
Ultimate elongation, min, %	300	275	250	D 412
Tear, Die C, min, kN/m [lbf/in.]	22.0 [125]	22.0 [125]	17.5 [100]	D 624
Tear, Die C, min, kN/m [lbf/in.]	22.0 [125]	22.0 [125]	17.5 [100]	D 624
Tear, min, kN/m [lbf/in.]	11.5 [65]	7.0 [40]	4.4 [25]	D 1938
Tear, min, kN/m [lbf/in.]	11.5 [65]	7.0 [40]	4.4 [25]	D 1938
Hardness, Shore A Durometer	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	D 2240
Hardness, Shore A Durometer	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	D 2240
Cut-growth resistance, minimum cycles at:	—	—	—	D 1052
Cut-growth resistance, minimum cycles at:	—	—	—	D 1052
–20°F	30 000	10 000	10 000	
0°F	75 000	30 000	20 000	
75°F	150 000	75 000	50 000	
Shrinkage, min, %	—1.0	—1.5	—1.5	6.2 and Annex A1
Taber abrasion (wear index), H-18 wheel, 1000 g, 1000 cycles	100	200	300	D 3489
Taber abrasion (wear index), H-18 wheel, 1000 g, 1000 cycles	100	200	300	D 3489

<sup>A</sup> As agreed upon between the purchaser and the seller.

## 6. Test Methods

6.1 The physical tests shall be in accordance with Test Method D 3489.

~~6.2 Material Shrinkage—After removal from the mold, allow the part to cool to room temperature. Measure the largest dimensions of the part and the mold at room temperature to the nearest 0.02 mm or 0.001 in. Calculate the percent change as follows:~~

$$\% \text{change in length} = \frac{L_m - L_p}{L_m} \times 100 \quad (1)$$

where:

$L_m$  = length of mold at room temperature, and

$L_p$  = length of molded part at room temperature.

~~NOTE 2—An alternative method for determining material shrinkage is given in Annex A1.~~

## 7. Inspection

7.1 Inspection of the material shall be agreed upon in writing between the purchaser and the seller/supplier as part of the purchase contract.

7.2 Testing for conformance to requirements shall be done in accordance with this specification and Test Methods D 3489.

## 8. Retest and Rejection

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

## 9. Packaging, Marking, and Labeling

9.1 *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.

9.2 *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.

9.3 *Labeling*—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.

9.3.1 “This product conforms to all the requirements for Grade \_\_\_ established in ASTM Standard Specification D 3851. Full responsibility for conformance of this product with the standard is assumed by (name and address of converter or distributor).”

## 10. Keywords

10.1 microcellular; polyurethane; shoe soling; urethane