



Designation: D 3851 – 97

Standard Specification for Urethane Microcellular Shoe Soling Materials¹

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1. Scope

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

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

NOTE 1—There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 ASTM Standards:

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension²

D 624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers²

D 1052 Test Method for Measuring Rubber Deterioration—Cut Growth Using Ross Flexing Apparatus²

D 1938 Test Method for Tear Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method³

D 3489 Test Methods for Rubber—Microcellular Urethane⁴

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.

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 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.

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.

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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.

² *Annual Book of ASTM Standards*, Vol 09.01.

³ *Annual Book of ASTM Standards*, Vol 08.02.

⁴ *Annual Book of ASTM Standards*, Vol 09.02.



TABLE 1 Physical Property Requirements on Polyurethane Shoe Systems

Property	Grade			ASTM Method
	1	2	3	
Density	A	A	A	D 3489
Tensile strength, min, MPa (psi)	4.9 (700)	3.5 (500)	2.8 (400)	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, min, kN/m (lbf/in.)	11.5 (65)	7.0 (40)	4.4 (25)	D 1938
Hardness, Shore A Durometer	A	A	A	...
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

^A As agreed upon between the purchaser and the seller.

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

ANNEX

(Mandatory Information)

A1. ALTERNATIVE METHOD FOR DETERMINING MATERIAL SHRINKAGE

A1.1 Procedure

A1.1.1 Measure the length of the cavity of the mold to the nearest 0.5 mm or 0.02 in. Make the measurement with the mold at room temperature.

A1.1.2 Mold at least three sound test parts from the material to be tested under such conditions of pressure, temperature, flow rates, time, etc., as the manufacturer and the purchaser may agree are suitable for the material.

A1.1.3 After removal from the mold, allow the parts to cool to room temperature before being measured. The period of storage for initial molding shrinkage shall be 2 ± 0.25 h. Measure the length of each part to the nearest 0.5 mm or 0.02 in. Measure the parts again not less than 20 nor more than 24

h to obtain the “24-h shrinkage,” and again not less than 40 nor more than 48 h after molding, in order to determine the “48-h” or “normal” mold shrinkage.

A1.2 Calculations and Report

A1.2.1 Calculate the percent shrinkage by subtracting the dimension of the specimen from the corresponding dimension of the mold cavity in which it was molded, multiply by 100, and divide the difference by the length of the mold cavity.

A1.2.2 Repeat the initial, 24-h, and 48-h shrinkage expressed in percent and each representing the mean of values obtained on three or more specimens.

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