



Designation: D4819 – 13 (Reapproved 2021)<sup>ε1</sup>

## Standard Specification for Flexible Cellular Materials Made From Polyolefin Plastics<sup>1</sup>

This standard is issued under the fixed designation D4819; 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.

<sup>ε1</sup> NOTE—Reapproved and editorially revised in July 2021.

### 1. Scope\*

1.1 This specification applies to flexible closed-cell materials made from polyolefin plastics and blends of polyolefin plastics as defined in Section 3.

1.2 Extruded or molded shapes too small to permit the cutting of standard test specimens are difficult to classify or test by standard test methods and will usually require special testing procedures or the use of standard test sheets.

1.3 In case of conflict between the provisions of this specification and those of detailed specifications for a particular product, the latter shall take precedence. These detailed specifications for the flexible closed-cell polyolefin plastic foams shall state the particular test or tests desired.

1.4 In cases involving referee decisions, SI units shall be used.

1.5 This specification does not contain test procedures or values for all the suffix letters listed in Table 1 and Table 2. Where the procedure is not described in this specification or special limits are desired, or both, the test procedures and values must be arranged between the purchaser and the supplier.

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

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

1.7 *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.*

<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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### 2. Referenced Documents

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

C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

D1596 Test Method for Dynamic Shock Cushioning Characteristics of Packaging Material

D2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

D3575 Test Methods for Flexible Cellular Materials Made from Olefin Polymers

E96/E96M Test Methods for Water Vapor Transmission of Materials

F355 Test Method for Impact Attenuation of Playing Surface Systems, Other Protective Sport Systems, and Materials Used for Athletics, Recreation and Play

#### 2.2 Federal Motor Vehicle Safety Standard:

49 CFR 571.302 - Standard No. 302 Flammability of Vehicle Interior Materials—Passenger Cars, Multipurpose Passenger Vehicles, Trucks and Buses<sup>3</sup>

#### 2.3 UL Standard:

UL1191 Standard for Components for Personal Flotation Devices<sup>4</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *blend*—mixture of polyolefin plastic(s) with other polymer(s) in which at least 51 mass % is the polyolefin plastic(s).

<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.

<sup>3</sup> Available from Superintendent of Documents, U.S. Government Printing Office, Washington DC, 20402-9371 (website: [hazmat.dot.gov](http://hazmat.dot.gov)), or <https://www.ecfr.gov/cgi-bin/ECFR?page=browse>

<sup>4</sup> Available from Underwriters Laboratories (UL), Corporate Progress, 333 Pfingsten Rd., Northbrook, IL 60062.

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

**TABLE 1 Suffix Letter Designations**

A	Heat resistance
B	Compression set under constant deflection
C	Ozone or weather resistance
D	Compression deflection
E	Oil resistance
F	Low temperature
G	Tear resistance
H	Flex resistance
I	Not assigned
J	Abrasion resistance
K	Adhesion capability
L	Water absorption
M	Flammability resistance
N	Impact resistance
O	Electrical properties
P	Staining resistance
Q	Not assigned
R <sub>1</sub>	Resilience
R <sub>2</sub>	Shock absorption
S	Thermal stability
T <sub>1</sub>	Tensile strength
T <sub>2</sub>	Ultimate elongation
U	Not assigned
V	Thermal conductivity
W	Density
X	Not assigned
Y	Not assigned
Z	Special requirements
AA	Buoyancy
BB	Compressive creep
CC	Dynamic cushioning
DD	Open cell
EE	Not assigned
FF	Water vapor transmission

3.1.2 *polyolefin plastics*—material based on polymers made by the polymerization of olefins or copolymerization of olefins with other polymers, the polyolefin being at least 51 mass %.

3.1.3 *resin*—solid, semi-solid, or pseudo-solid organic material that has an indefinite and often high molecular weight, exhibits a tendency to flow when subject to stress, usually has a softening or melting range, and usually fractures conchoidally.

#### 4. Classification (Types, Suffix Letters, and Suffix Numbers)

4.1 *Types*—This specification covers two types of flexible, closed-cell polyolefin foams designated as follows:

4.1.1 *Type I*—Closed cell foams made with polyolefin plastics and either chemically or radiation crosslinked.

4.1.2 *Type II*—Closed cell foams made with polyolefin plastics that are non-crosslinked.

4.2 *Suffix Letters*—Suffix letters shall be added to the type designation (4.1) singly or in combination to indicate the necessary requirements.

4.2.1 The significance of the approved suffix letters is given in **Table 1**.

4.2.2 Frequently used suffix letters for polyolefin foams are given in **Table 2**. Where more than one test method exists for a given property, the suffix letters shall be followed immediately by a subscript number to designate the specific procedure.

4.3 *Suffix Numbers*—Each suffix letter shall be followed by a suffix number that indicates the property limit. **Table 2** lists these suffix numbers and limiting values.

NOTE 2—Examples of the classification system are as follows:

*Specification D4819 Type I—B4D4M<sub>1</sub> 3T<sub>1</sub> 5T<sub>2</sub> 7W6Z<sub>1</sub>* is a crosslinked foam with a maximum compression set of 15 %, a minimum compression deflection of 70 kPa (10 psi), an oxygen index of 20 % minimum, minimum tensile strength of 415 kPa (60 psi), minimum ultimate elongation of 200 %, a nominal density of 80 kg/m<sup>3</sup> (5.0 lb/ft<sup>3</sup>), and a special requirement to be negotiated by the vendor and user.

*Specification D4819 Type II—D4T<sub>1</sub> 3T<sub>2</sub> 4 R<sub>2</sub> 5BB4Z<sub>1</sub> Z<sub>2</sub>* is a non-crosslinked foam with a compression deflection of 70 kPa (10 psi) minimum, a minimum tensile strength of 275 kPa (40 psi), minimum ultimate elongation of 75 %, shock absorption of 100 G's maximum, compressive creep of 6 % maximum, and two special requirements.

#### 5. Ordering Information

5.1 When ordering, the product shall be described by showing the type and suffix letters and number designations as described in Section 4.

5.2 Minimum recommended properties for either type of foam shall include requirements for Compression Deflection (Suffix *D*), Tensile Strength (Suffix *T<sub>1</sub>*), and Ultimate Elongation (Suffix *T<sub>2</sub>*).

5.3 The properties selected and values set shall be selected to ensure the required performance of the end product.

5.4 Special requirements shall be listed. Test procedures and limits shall be established by negotiation between the purchaser and the supplier. Each special requirement shall be listed as *Z* suffix letters followed by numerical subscripts.

#### 6. Materials and Manufacture

6.1 Cellular polyolefin foams furnished under this specification shall be manufactured from any resin or blend of resins that are members of the polyolefin family together with added compounding materials of such a nature and quality that the finished product complies with this specification. In permitting choice in use of those materials by the producer, it is not intended to imply that the different resins are equivalent with respect to all physical properties. Special characteristics other than those prescribed in this specification that are potentially desired for specific applications shall be listed in the product specifications, as they have the potential to influence the choice of the type of resin or other materials used.

6.2 All materials and workmanship shall be in accordance with good commercial practice and the resulting cellular polyolefin shall be free from defects affecting serviceability.

#### 7. Color

7.1 Unless otherwise specified, the color of cellular polyolefin foams shall be natural. The foam shall contain no colorants.

#### 8. Physical Properties

8.1 The polyolefin foams shall conform to the requirements given in the classification (see Section 4) and described in **Table 2** together with any special requirements.

#### 9. Test Methods

9.1 Unless specifically stated otherwise, perform all tests in accordance with the methods specified in Test Methods **D3575**.

**TABLE 2 Property Limits for Flexible Cellular Polyolefin Materials**

Suffix Letter	Property	Test Method	Units	Maximum or Minimum	Suffix Numbers and Limiting Values								
					1	2	3	4	5	6	7	8	9
<i>B</i>	Compression set	D3575	%	max	...	5	10	15	20	25	30	35	...
<i>D</i>	Compression deflection	D3575	kPa	min	15	30	40	70	105	170	275	...	...
<i>G</i>	Tear strength	D3575 or D624 <sup>A</sup>	kN/m	min	0.88	1.75	2.63	3.50	5.25	7.01	8.76	...	...
<i>L</i>	Water absorption	D3575	kg/m <sup>2</sup>	max	...	0.20	0.30	0.40	0.50	1.00	...	...	...
<i>M<sub>1</sub></i>	Flammability-ease of ignition-LOI	D3575 or D2863 <sup>A</sup>	% O <sub>2</sub>	min	...	15	20	25	30	...	...	...	...
<i>M<sub>2</sub></i>	Flammability-burn rate	MVSS-302	mm/min	max	...	...	50	100	150	255	...	...	...
<i>R<sub>2</sub></i>	Shock absorption-Procedure A	F355	G's <sup>B</sup>	max	...	25	50	75	100	150	200	...	...
<i>S</i>	25 mm (1 in.) thick samples Thermal stability-dimensions <sup>C</sup>	D3575	±% change	max	1	2	5	10	15	...	...	...	...
<i>T<sub>1</sub></i>	Tensile strength	D3575 or D412 <sup>A</sup>	kPa	min	...	140	275	345	415	550	690	...	...
<i>T<sub>2</sub></i>	Ultimate elongation	D3575 or D412 <sup>A</sup>	%	min	...	25	50	75	100	150	200	...	...
<i>V</i>	Thermal conductivity, 25 mm (1 in.) thick at 24°C (75°F), mean temperature 30°C (86°F), temperature differential	D3575 Method B or C518 <sup>A</sup>	W/(mK) (BTU-in./(1-h-ft <sup>2</sup> -°F))	max	...	0.040	0.046	0.052	0.058	0.063	...	...	...
<i>W</i>	Density	D3575	kg/m <sup>3</sup>	nominal	25	30	50	65	80	95	130	160	...
<i>AA</i>	Buoyancy, 24 h exposure at 23°C (73°F), under 50 mm (2.0 in.) water head	D3575 or UL1191 <sup>A</sup>	kg/m <sup>3</sup>	min	...	830	880	910	945	960	...	...	...
<i>BB</i>	Compressive creep, 7 kPa (1.0 psi) load at 23°C (73°F) for 1000 h	D3575	%	max	...	2.0	4.0	6.0	10	15	...	...	...
<i>CC<sub>1</sub></i>	Dynamic cushioning, 50 mm (2.0 in.) thick, 7 kPa (1 psi) loading, 600 mm (23.6 in.) drop, 23°C (73°F)	D3575 or D1596 <sup>A</sup>	G's <sup>B</sup>	max	...	...	30	40	50	60	80	...	...
<i>CC<sub>2</sub></i>	Dynamic cushioning, same conditions as <i>CC<sub>1</sub></i> , except for	D3575 or D1596 <sup>A</sup>	G's <sup>B</sup>	max	...	...	30	40	50	60	80	...	...
<i>CC<sub>4</sub></i>	14 kPa (2 psi) loading Dynamic cushioning, same conditions as <i>CC<sub>1</sub></i> , except for	D3575 or D1596 <sup>A</sup>	G's <sup>B</sup>	max	...	...	30	40	50	60	80	...	...
<i>FF</i>	28 kPa (4 psi) loading Water vapor transmission	E96/E96M	ng/(Pa-s-m) (perm-in.)	max	...	...	0.3 0.2	0.4 0.3	0.6 0.4	0.9 0.6	1.8 1.2	...	...

<sup>A</sup> Methods shown are equivalent.

<sup>B</sup> G = The dimensionless ratio of missile acceleration during impact to the acceleration of gravity (see Test Method F355).

<sup>C</sup> Plus (+) sign indicates growth, minus (-) sign indicates shrinkage.

9.2 Test methods and values for special requirements not listed in Table 2 shall be arranged between the purchaser and the supplier.

## 10. Tolerances on Dimensions

10.1 Tolerances on dimensions shall be as specified in Table 3, unless otherwise specified.

## 11. Inspection

11.1 All tests and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified. The manufacturer shall afford the inspector all reasonable facilities for tests and inspection.

11.2 It is permissible for the purchaser to make the test and inspection to govern acceptance or rejection of the material at his own laboratory or elsewhere. Such tests and inspection shall be made not later than 15 days after receipt of the material.

11.3 All samples for testing as required in Test Methods D3575 shall be visually inspected to determine compliance with the material, workmanship, and color requirements before testing.

## 12. Packaging and Package Marking

12.1 The material shall be properly and adequately packaged. Each package or container shall be legibly marked with