



Designation: E 2203 – 02

Standard Specification for Dense Thermoplastic Elastomers Used for Compression Seals, Gaskets, Setting Blocks, Spacers and Accessories¹

This standard is issued under the fixed designation E 2203; 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.

1. Scope

1.1 This specification describes products composed of dense thermoplastic elastomers that are fabricated into gaskets and accessories (such as compression seals, setting blocks, spacers, and shims) for use in sealing and glazing applications in building construction. These products are used to seal or serve as components of compression sealing systems between mechanically restrained surfaces in building construction.

1.2 The values stated in metric (SI) units are to be regarded as the standard. The inch-pound values given in parentheses are provided for information purposes only.

1.3 Test Method C 1166, as referenced in this specification, 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 that takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.

1.4 *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 requirements prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- C 717 Terminology of Building Seals and Sealants²
- C 864 Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers²
- C 1087 Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems²
- C 1166 Test Method for Flame Propagation of Dense and Cellular Elastomeric Gaskets and Accessories²

¹ This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.21 on Serviceability.

Current edition approved May 10, 2002. Published August 2002.

² Annual Book of ASTM Standards, Vol 04.07.

- D 395 Test Methods for Rubber Property-Compression Set³
- D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension³
- D 573 Test Method for Rubber-Deterioration in an Air Oven³
- D 624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers³
- D 792 Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement⁴
- D 925 Test Methods for Rubber Property-Staining of Surfaces (Contact, Migration, and Diffusion)³
- D 1149 Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber³
- D 1566 Terminology Relating to Rubber³
- D 2000 Classification System for Rubber Products in Automotive Applications³
- D 2137 Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics³
- D 2240 Test Method for Rubber Property—Durometer Hardness³
- D 3182 Practice for Rubber-Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets³

2.2 Other Documents:

- Rubber Manufacturers Association (RMA) Standard; Rubber Handbook, Fourth ed. December 1984⁵
- Uniform Freight Classification Rules⁶
- National Motor Freight Classification Rules⁷

3. Terminology

3.1 Refer to Terminology C 717 for definitions of the following terms used in this specification: compound, compression gasket, edge spacer, elastomer, elastomeric, expansion gasket, gasket, hardness, seal, setting block, shim spacer, and spacer.

³ Annual Book of ASTM Standards, Vol 09.01.

⁴ Annual Book of ASTM Standards, Vol 08.01.

⁵ Available from the Rubber Manufacturers Association, 1400 K Street, NW, Washington, DC 20005.

⁶ Available from the Western Railroad Association, Department of Services and Supply, Room 1150, 222 S. Riverside Plaza, Chicago, IL 60606-5945.

⁷ Available from the National Motor Freight Association, 2200 Mill Road, Alexandria, VA 22314.

3.2 Refer to Terminology **D 1566** for definitions of the following terms used in this specification: compression set, ultimate elongation, tear strength, tensile strength, and polymer.

4. Significance and Use

4.1 This specification describes types (based on resistance to tearing and compression set), grades (based on durometer hardness), class (based on flame propagation requirements), and surfaces (based on surface characteristics) of products as listed in Section 5 for various applications. It is essential, therefore, that the applicable type, grade, class, and surface be specified, as well as other options stated, so that the proper product is provided for the intended use.

5. Classification

5.1 The products described by this specification are classified by type, hardness, class, and surface.

5.2 Type:

5.2.1 *Type T, Tear Resistant*—In general these products have a higher level of tear resistance. This type is applicable where finished products are intended to bridge or to cover a space (for example, expansion joint gaskets), or where high tear strength is required due to conditions of exposure or usage.

5.2.2 *Type C, Compression Set Resistant*—In general, these products have a higher level of compression set resistance. This type is applicable where finished products are used as compression gaskets, or where low compression set is required due to conditions of exposure or usage; and as setting blocks, spacers, shims, or other accessories in glazing and sealing systems.

5.3 *Grade*—Each type described in 5.2 is subdivided into various hardnesses, based on nominal durometer hardness as shown in **Tables 1 and 2**. For example, Grade H3 is 30 durometer.

5.4 Class:

5.4.1 Flame propagation characteristics of the finished products can be varied depending on the degree of exposure, expected usage, and intended durability desired. Products described by this specification shall be classified as to flame propagation as follows:

5.4.1.1 *Class F*—Resistance to flame propagation is required (reference Specification **C 864**, 4.1, Table 1).

5.4.1.2 Class designation is not needed when flame propagation resistance is not required.

5.5 Surface:

5.5.1 Consideration of product surface requirements may be necessary. During the production of these products the use of various lubricants, release agents, dusting agents, and other

solutions may be required. It may be necessary to remove these materials from the surfaces of the product because of appearance fabrication, or usage requirements. All products do not require removal of these materials or removal to the same degree of cleanliness.

5.5.2 Products may also be required to develop adhesion or to not develop adhesion to sealants with which they are in contact.

5.5.3 Products described by this specification shall be classified as to surface condition as follows:

5.5.3.1 *Surface S1*—The surface of the product shall be smooth, clean, free from any foreign matter, and shall not allow adhesion of sealants (see **Note 1**).

5.5.3.2 *Surface S2*—The surface of the product shall be smooth, clean, free from any foreign matter, and shall allow adhesion of sealants (see **Note 1**).

NOTE 1—Applied treatments, such as dusting or coating to the adhesion surface may be necessary to meet this requirement.

5.5.3.3 *Surface S3*—The product shall have a surface that is smooth, clean, and free from any foreign matter.

5.5.4 Surface designation code is not needed for products not requiring special cleaning for removal of processing agents and materials.

5.6 The following is an illustration of the use of the classification system for a line call-out. Expansion gaskets shall be ASTM C 115, TH5FS3.

5.6.1 Other examples of line call-outs would be: edge spacers for structural thermoplastic glazing shall be ASTM C 1115, CH6S1; compression seal gaskets shall be ASTM C 115, CH7S2; and setting blocks shall be ASTM C 115, CH9. These examples are not to be construed as a specification for these items.

6. Materials and Manufacture

6.1 The products described by this specification shall be a preformed extrusion manufactured from a thermoplastic vulcanizate (TPV). This TPV shall be classified under Classification System **D 2000**.

6.1.1 The pre-compounded TPV shall be manufactured from virgin polymer, that when properly extruded, will result in an elastomer that will comply with this specification.

6.2 The compound in its final shape shall be free of visible internal porosity, surface defects, and dimensional irregularities that affect serviceability and durability.

6.3 Unless otherwise specified, the compound color shall be black. If colors other than black are specified, the compound in the color specified shall also meet the requirements of this specification.

TABLE 1 Requirements for Fully Cured Elastomeric Alloy Injection Molded Plaques

Property	Requirement						Test Method
	Type I	Type II	Type III	Type IV	Type V	Type VI	
Tensile strength, min, MPa (psi)	13.8 (2000)	9.7 (1400)	7.2 (1050)	6.0 (870)	5.8 (850)	5.8 (850)	D 412
Elongation at break, min, %	500	460	380	350	340	340	D 412
Hardness, Type A durometer, points (5 s delay)	87 ± 3	80 ± 3	73 ± 3	70 ± 3	67 ± 3	64 ± 3	D 2240
Relative Density at 23°C (73°F)	0.95 ± 0.02	0.96 ± 0.02	0.97 ± 0.02	0.97 ± 0.02	0.97 ± 0.02	0.97 ± 0.02	D 792
100% Modulus, min, MPa (psi)	6.1 (890)	3.8 (550)	2.8 (400)	2.2 (320)	1.9 (280)	1.9 (280)	D 412
Mass gain, max. %, (24 h at 121°C (250°F) ASTM No.3 Oil)	60	75	80	90	95	95	D 471

TABLE 2 Material Requirements for Finished Products

Property	Requirement						Test Method
	Type I	Type II	Type III	Type IV	Type V	Type VI	
Tensile strength, min, MPa (psi)	13.8 (2000)	9.7 (1400)	7.2 (1050)	6.0 (870)	5.8 (850)	5.8 (850)	D 412
Elongation at break, min, %	500	460	380	350	340	340	D 412
Hardness, Type A durometer, points (5 s delay)	87 ± 3	80 ± 3	73 ± 3	70 ± 3	67 ± 3	64 ± 3	D 2240
Ozone resistance 1 ppm 100 h at 40°C (104°F) 7× mag	No cracks	No cracks	No cracks	No cracks	No cracks	No cracks	D 792
Compression set, % max. 22 h at 100°C (212°F)	45	40	38	35	35	35	D 412
Compression set, % max, 70h at 100°C (212°F)	50	45	43	40	40	40	D 471
Heat Aging, 70h at 100°C (212°F) change in:							D 865
Hardness, Shore A, max, points (5 s delay)	3	3	3	3	3	3	
Ultimate Tensile Strength max, % loss	5	5	5	5	5	5	
Ultimate Elongation max, % loss	5	5	5	5	5	5	
Tear resistance, min, N/mm (lb/in.)	45 (257)	30 (171)	20 (114)	20 (114)	20 (114)	20 (114)	D 624
Brittleness temperature, min, °C (°F)	-61 (-78)	-62 (-80)	-60 (-76)	-56 (-69)	-62 (-81)	-62 (-81)	D 746
Water absorption, max, % loss/gain	5	5	6	6	7	7	D 471

7. Requirements

7.1 The TPV supplied in plaque form shall conform to the material requirements prescribed in **Table 1**.

7.2 The finished product shall conform to the material requirements prescribed in **Table 2**.

7.3 The physical, mechanical, and performance properties of the material shall conform to the requirements as described by **Tables 1 and 2**.

8. Dimensions and Permissible Variations

8.1 The size, shape, and internal structure of the product shall be as agreed upon by the purchaser and the producer or supplier.

8.2 Dimensions can be affected by distortions induced by conditions of storage or shipping as well as temperature and humidity variations. Prior to measuring the product, it shall be unpacked and conditioned in an unstressed state for 24 h at 23 ± 2°C (73 ± 4°F) and 50 ± 5 % relative humidity.

8.3 Tolerance for cross-sectional dimensions of extruded products shall be as described by **Table 3** unless otherwise agreed upon between the purchaser and the supplier.

8.4 Tolerances for squareness and flatness are not included in this specification, due to the difficulty of establishing meaningful limits to satisfy a wide variety of applications. These tolerances should be as agreed upon between the supplier and purchaser.

8.5 The color of the seal shall be as agreed upon by the purchaser and the producer or supplier.

8.6 The finished product shall be free of defects in workmanship.

8.6.1 Surface imperfections are acceptable provided they are less than 3 mm (0.125 in.) in diameter and less than 5 % of the depth of the cross-sectional thickness.

8.6.2 Defects in the extrusion shall consist of the following:

8.6.2.1 Holes greater than **8.6.1**,

8.6.2.2 Air bubbles greater than **8.6.1**, and

TABLE 3 Standards for Cross Sectional Tolerance

NOTE 1—The closer tolerance classes outlined below should not be specified unless required by the final application and they should be restricted to critical dimensions. The closer tolerances demanded, the tighter the control which must be exercised during manufacture and hence higher costs.

NOTE 2—When particular physical properties are required in the product, it is not always possible to provide them in a combination which is capable of fabrication to close tolerances. It is necessary, in these circumstances, that consultation take place between the customer and supplier. In general, softer materials need greater tolerances than harder ones. Where close tolerances are required, a specific technique of measurement should be agreed upon between purchaser and manufacturer.

NOTE 3—Tolerances on dimensions above 100 mm (3.94 in.) should be agreed on by supplier and user. General cross sectional dimensions below 1 mm (0.04 in.) are impractical.

NOTE 4—In general, softer materials and those requiring a post cure need greater tolerances.

RMA Class		1 High Precision	2 Precision	3 Commercial
Drawing Designation		E1	E2	E3
Dimensions, mm (in.)				
Above	Up to			
0 (0)	1.5 (0.06)	± 0.15 (± 0.006)	± 0.25 (± 0.010)	± 0.40 (± 0.015)
1.5 (0.06)	2.5 (0.10)	± 0.20 (± 0.008)	± 0.35 (± 0.014)	± 0.50 (± 0.020)
2.5 (0.10)	4.0 (0.16)	± 0.25 (± 0.010)	± 0.40 (± 0.016)	± 0.70 (± 0.027)
4.0 (0.16)	6.3 (0.25)	± 0.35 (± 0.014)	± 0.50 (± 0.020)	± 0.80 (± 0.031)
6.3 (0.25)	10 (0.39)	± 0.40 (± 0.016)	± 0.70 (± 0.027)	± 1.00 (± 0.039)
10 (0.39)	16 (0.63)	± 0.50 (± 0.020)	± 0.80 (± 0.031)	± 1.30 (± 0.051)
16 (0.63)	25 (0.98)	± 0.70 (± 0.027)	± 1.00 (± 0.039)	± 1.60 (± 0.063)
25 (0.98)	40 (1.57)	± 0.80 (± 0.031)	± 1.30 (± 0.051)	± 2.00 (± 0.079)
40 (1.57)	63 (2.48)	± 1.00 (± 0.039)	± 1.60 (± 0.063)	± 2.50 (± 0.098)
63 (2.48)	100 (3.94)	± 1.30 (± 0.051)	± 2.00 (± 0.079)	± 3.20 (± 0.126)