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## Standard Classification System for Thermoplastic Elastomer-Ether-Ester Molding and Extrusion Materials (TEEE)<sup>1</sup>

This standard is issued under the fixed designation D6835; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

### 1. Scope\*

1.1 This classification system covers segmented block copolyether-ester elastomers suitable for molding and extrusion.

1.2 This classification system allows for the use of segmented block copolyether-ester elastomers that are recycled provided that the requirements as stated in this classification system are met. The proportions of recycled material used, as well as the nature and amount of any contaminant, however, cannot be covered practically in this specification.

1.3 The properties included in this classification system are those required to identify the compositions covered. It is possible that there are other requirements necessary to identify particular characteristics important to specialized applications. One way of specifying them is by using the suffixes as given in Section 55.

1.4 This classification system and subsequent line callout (specification) are intended to provide a means of calling out plastic materials used in the fabrication of end items or parts. It is not intended for the selection of materials. Material selection is best made by those having expertise in the plastic field after careful consideration of the design and the performance required of the part, the environment to which it will be exposed, the fabrication process to be employed, the costs involved, and the inherent properties of the material other than those covered by this classification system.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 The following precautionary caveat pertains only to the test methods portion, Section 11H<sub>2</sub>, of this classification system. *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~~safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—This standard, ISO 14910-1:20029-1, and ISO 14910-2:20029-2 address the same subject matter, but differ in technical content.

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 classification system is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials.

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

## 2. Referenced Documents

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

- D618 Practice for Conditioning Plastics for Testing
- D883 Terminology Relating to Plastics
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D2240 Test Method for Rubber Property—Durometer Hardness
- D3418 Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry
- D3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials
- D3892 Practice for Packaging/Packing of Plastics
- D4000 Classification System for Specifying Plastic Materials
- E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

### 2.2 ISO Standards:<sup>3</sup>

- ISO 178 Plastics—Determination of Flexural Properties
- ISO 294-1 Plastics—Injection Moulding of Test Specimens of Thermoplastic Materials-Part 1: General Principles and Moulding of Multipurpose and Bar Test Specimens
- ISO 527-1 Plastics—Determination of Tensile Properties-Part 1: General Principles
- ISO 527-2 Plastics—Determination of Tensile Properties-Part 2: Test Conditions for Moulding and Extrusion Plastics
- ISO 868 Plastics and Ebonite—Determination of Indentation Hardness by Means of a Durometer (Shore Hardness)
- ISO 1133 Plastics—Determination of the Melt Mass-Flow Rate (MFR) and the Melt Volume-Flow Rate (MVR) of Thermoplastics
- ISO 11357-3-AMD+ Plastics—Differential Scanning Calorimetry (DSC)-Part 3: Determination of Temperature and Enthalpy of Melting and Crystallization
- ISO 14910-1-20029-1 Plastics—Thermoplastic Polyester/ester and Polyether/ester Elastomers for Moulding and Extrusion-Part 1: Designation System and Basis for Specifications
- ISO 14910-2-20029-2 Plastics—Thermoplastic Polyester/ester and Polyether/ester Elastomers for Moulding and Extrusion-Part 2: Preparation of Test Specimens and Determination of Properties
- ISO 20753 Plastics—Test Specimens

## 3. Terminology

3.1 *Definitions*—The terminology used in this classification system is in accordance with Terminologies D883 and D1600.

## 4. Classification

4.1 Polyether-ester elastomers are classified into groups in accordance with flexural modulus. These groups are subdivided into classes by viscosity range (flow rate) and are further subdivided into grades by tensile properties, as shown in the basic property table (Table TEEE).

NOTE 2—AN EXAMPLE OF THIS CLASSIFICATION SYSTEM IS GIVEN AS FOLLOWS: THE DESIGNATION TEEE0311 INDICATES THE FOLLOWING:

<i>TEEE</i>	=	polyether-ester elastomer
<i>03 (group)</i>	=	flexural modulus from 125 to 325 MPa
<i>1 (class)</i>	=	flow rate from 2 to 12 g/10 min
<i>1 (grade)</i>	=	property requirements as given in Table TEEE

4.1.1 To facilitate the incorporation of future or special materials, the other category for group (00), class (0), and grade (0) is shown in Table TEEE.

4.2 Reinforced, filled, and/or lubricated versions of the polyether-ester materials that are not in Table TEEE are classified in

<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 American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

accordance with Tables TEEE and A. Table TEEE is used to specify the group of polyester materials and Table A is used to specify the property requirements after the addition of reinforcements or lubricants at the nominal level indicated (see 4.2.1).

4.2.1 Reinforced, filled, and/or lubricated versions of the basic materials are identified by a single letter that indicates the reinforcement or filler used and two digits that indicate the nominal quantity in percent by weight. Thus, a letter designation G for glass-reinforced and 33 for % of reinforcement, G33, specifies a filled material with a nominal glass level of 33 %. The reinforcement letter designations and associated tolerance levels are shown in the following table:

Symbol	Material	Tolerance
C	carbon and graphite fiber	±2 %
G	glass	±2 %
L	lubricants (for example, PTFE, graphite, silicone, and molybdenum disulfide)	depends upon material and process—to be specified
M	mineral	±2 %
R	combination of reinforcements or fillers, or both	±3 %

NOTE 3—This part of the classification system uses the percent of reinforcements or additives, or both, in the control of the modified basic material. The types and percentages of reinforcements and additives are sometimes shown on the supplier’s technical data sheet unless they are proprietary in nature. If necessary, additional callout of these reinforcements and additives can be accomplished by the use of the suffix part of the system (see Section 5).

4.2.2 Specific requirements for reinforced, filled, or lubricated polyether-ester materials shall be shown by a six-character designation. The designation will consist of the letter “A” and the five digits comprising the cell numbers for the property requirements in the order as they appear in Table A.

4.2.2.1 Although the values listed are necessary to include the range of properties available in existing materials, users shall not infer that every possible combination of the properties exists or can be obtained.

4.2.3 When the grade of the basic material is not known or is not important, the use of “0” grade classification will be used for reinforced materials in this system.

NOTE 4—An example of a reinforced polyether-ester elastomer of this classification system is as follows. The designation TEEE0310G-20A45630 would indicate the following material requirements from Table A:

- TEEE0310 = polyether-ester elastomer from Table TEEE
- G20 = glass reinforced at 20 % nominal (see 4.2.1)
- A = Table A property requirements
- 4 = flexural modulus of 150 MPa, min
- 5 = flexural modulus of 450 MPa, max
- 6 = tensile strength of 60 MPa, min
- 3 = elongation at break of 20 %, min
- 0 = unspecified

If no properties are specified, the designation would be TEEE0310G20A00000.

**TABLE A Detail Requirements Polyether-Ester Elastomers**

Designation Order No.	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Flexural modulus, ISO 178, MPa, min <sup>A</sup>	unspecified	10	25	75	150	250	450	1000	2000	specify value
2	Flexural modulus, ISO 178, MPa, max <sup>A</sup>	unspecified	25	75	150	250	450	1000	2000	4000	specify value
3	Tensile strength, ISO 527-1, –2 MPa, min <sup>B</sup>	unspecified	10	20	30	40	50	60	70	80	specify value
4	Elongation at break, ISO 527-1, –2, %, min <sup>B</sup>	unspecified	5	10	20	100	200	300	400	500	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

<sup>A</sup>Test specimen—80 × 10 × 4 mm. Test Speed—2 mm/min.

<sup>B</sup>Tensile strength shall be determined using a Type A12 test specimen as described in ISO 20753. Test Speed—50 mm/min

**TABLE TEEE Requirements for Polyether-Ester Elastomers**

Group	Class	Grade	Description <sup>A</sup>	Flexural Modulus <sup>B</sup> ISO 178 MPa	Flow Rate <sup>C</sup> ISO 1133 g/10 min	Flow Rate Condition °C/kg	Tensile Strength <sup>D</sup> ISO 527-1, -2 MPa, min	Elongation at Break <sup>D</sup> ISO 527-1, -2, % min	
01	1	1	Blow Molding	25 to 150	0.5 to 5	230/2.16	20	150	
		0	Other	25 to 150	0.5 to 5	...	...	...	
	2	1		25 to 150	2 to 12	220/2.16	5	300	
		2		25 to 150	2 to 12	220/2.16	15	300	
		3		25 to 150	2 to 12	190/2.16	15	250	
		0	Other	25 to 150	2 to 12	...	...	...	
		1		25 to 150	<55	190/2.16	15	400	
		0	Other	25 to 150	<55	...	...	...	
	02	1	1	Blow Molding	75 to 225	0.5 to 5	230/2.16	25	250
			2	Blow Molding	75 to 225	0.5 to 5	230/2.16	20	200
3			Blow Molding	75 to 225	0.1 to 1.0	220/2.16	25	250	
4			Blow Molding	75 to 225	<5	220/2.16	20	375	
5			Blow Molding	75 to 225	<5	230/2.16	25	150	
0			Other	75 to 225	0.5 to 5	...	...	...	
2			1		75 to 225	2 to 12	190/2.16	10	300
2		2		75 to 225	2 to 12	220/2.16	25	450	
		0	Other	75 to 225	2 to 12	...	...	...	
		1		75 to 225	5 to 24	220/2.16	30	400	
3		2		75 to 225	5 to 24	220/2.16	15	50	
		3		75 to 225	5 to 24	230/2.16	20	400	
		4		75 to 225	5 to 24	230/2.16	15	100	
		5		75 to 225	5 to 24	230/2.16	10	250	
		0	Other	75 to 225	5 to 24	...	...	...	
		0	Other	75 to 225	...	...	...	...	
		03	1	1		125 to 325	2 to 12	220/2.16	30
2				Heat Stabilized	125 to 325	2 to 12	220/2.16	30	300
0				Other	125 to 325	2 to 12	...	...	...
2			1		125 to 325	5 to 24	220/2.16	35	400
	2			125 to 325	5 to 24	220/2.16	15	150	
	3			125 to 325	5 to 24	230/2.16	25	300	
	0		Other	125 to 325	5 to 24	...	...	...	
0	0		Other	125 to 325	...	...	...	...	
	0		Other	125 to 325	...	...	...	...	
04	1		1		225 to 525	2 to 12	230/2.16	30	250
		0	Other	225 to 525	2 to 12	...	...	...	
	2	1		225 to 525	5 to 24	240/2.16	30	400	
		2		225 to 525	5 to 24	240/2.16	20	50	
	0	0	Other	225 to 525	5 to 24	...	...	...	
		0	Other	225 to 525	...	...	...	...	
05	1	1		325 to 925	5 to 24	240/2.16	40	200	
		2		325 to 925	5 to 24	240/2.16	30	400	
		3	Heat Stabilized	325 to 925	5 to 24	240/2.16	30	300	
		0	Other	325 to 925	5 to 24	...	...	...	
		2	1		325 to 925	<55	240/2.16	15	50
	0	0	Other	325 to 925	5 to 24	...	...	...	
		0	Other	325 to 925	...	...	...	...	
06	1	1		525 to 1725	5 to 24	240/2.16	35	50	
		2		525 to 1725	5 to 24	240/2.16	25	200	
	0	Other	525 to 1725	5 to 24	...	...	...		
07	1	0	Other	525 to 1725	...	...	...	...	
		1		5 to 75	2 to 15	190/2.16	5	150	
		2		5 to 75	2 to 15	190/2.16	10	150	
		3		5 to 75	2 to 15	190/2.16	15	500	
	0	Other	5 to 75	2 to 15	...	...	...		
00	0	0	Other	5 to 75	...	...	...	...	
		0	Other	...	...	...	...	...	

<sup>A</sup>No descriptions are listed unless needed to describe a special grade under the class. All other grades are listed by requirements.

<sup>B</sup>Test specimen—80 × 10 × 4 mm. Test speed—2 mm/min.

<sup>C</sup>Dry samples 3 h at 100°C in dehumidifying oven prior to running test.

<sup>D</sup>Tensile strength shall be determined using a Type A12 test specimen as described in ISO 20753. Test speed—50 mm/min.