



Standard Classification System for Thermoplastic Elastomer-Ether-Ester Molding and Extrusion Materials (TEEE)¹

This standard is issued under the fixed designation D 6835; 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 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. There may be other requirements necessary to identify particular characteristics important to specialized applications. These may be specified using the suffixes as given in Section 5.

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 should be 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 following precautionary caveat pertains only to the test methods portion, Section 11, 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 practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—This classification system is similar to ISO 14910-1/-2 1997, although the technical content is significantly different.

¹ 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.

Current edition approved November 10, 2002. Published January 2003.

2. Referenced Documents

2.1 ASTM Standards:

- D 618 Practice for Conditioning Plastics for Testing²
- D 883 Terminology Relating to Plastics²
- D 1600 Terminology for Abbreviated Terms Relating to Plastics²
- D 2240 Test Method for Rubber Property-Durometer Hardness³
- D 3418 Test Method for Transition Temperatures of Polymers by Thermal Analysis⁴
- D 3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials⁴
- D 3892 Practice for Packaging/Packing of Plastics⁴
- D 4000 Classification System for Specifying Plastic Materials⁴
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specification⁵

2.2 ISO Standards:⁶

- ISO 178:2001 Plastics-Determination of Flexural Properties
- ISO 294-1:1996 Plastics-Injection Moulding of Test Specimens of Thermoplastic Materials-Part 1: General Principles, Multipurpose-Test Specimens (ISO Mount Type A) and Bars (ISO Mould Type B)
- ISO 527-1:1993 Plastics-Determination of Tensile Properties-Part 1: General Principles
- ISO 527-2:1993 Plastics-Determination of Tensile Properties-Part 2: Test Conditions for Moulding and Extrusion Materials
- ISO 868:1985 Plastics and Ebonite-Determination of Indentation Hardness by Means of a Durometer
- ISO 1133:1997 Plastics-Determination of the Melt Mass-Flow Rate (MFR) and the Melt Volume Flow Rate (MVR) of Thermoplastics

² Annual Book of ASTM Standards, Vol 08.01.

³ Annual Book of ASTM Standards, Vol 09.01.

⁴ Annual Book of ASTM Standards, Vol 08.02.

⁵ Annual Book of ASTM Standards, Vol 14.02.

⁶ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

ISO 11357-3:1997 Plastics-Differential Scanning Calorimetry-Part 3: Determination of Temperature and Enthalpy of Melting and Crystallization

ISO 14910-1:1997 Plastics-Thermoplastic Polyester/ester and Polyether/ester Elastomers for Molding and Extrusion-Part 1: Designation System and Basis for Specification

ISO 14910-2:1997 Plastics-Thermoplastic Polyester/ester and Polyether/ester Elastomers for Molding and Extrusion-Part 2: Preparation of Test Specimens and Determination of Properties

3. Terminology

3.1 *Definitions*—The terminology used in this classification system is in accordance with Terminologies D 883 and D 1600.

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 and are further subdivided into grades by tensile properties, as shown in the basic property table (Table TEEE).

TABLE TEEE Requirements for Polyether-Ester Elastomers

Group	Class	Grade	Description ^A	Flexural Modulus ^B ISO 178 MPa	Flow Rate ^C ISO 1133 g/10 min	Flow Rate Condition °C/kg	Tensile Strength ^D ISO 527-1, -2 MPa, min	Elongation at Break ^D 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	...	...	...
	3	1		25 to 150	<55	190/2.16	15	400
		0	Other	25 to 150	<55	...	...	...
	0	0	Other	25 to 150	...	...	...	...
		0	Other	25 to 150	...	...	...	...
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
		0	Other	75 to 225	0.5 to 5	...	...	...
	2	1		75 to 225	2 to 12	190/2.16	10	300
		0	Other	75 to 225	2 to 12	...	...	...
	3	1		75 to 225	5 to 24	220/2.16	30	400
		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
		0	Other	75 to 225	5 to 24	...	...	...
0	0	Other	75 to 225	...	...	...	...
	0	Other	75 to 225	...	...	...	...
03	1	1		125 to 325	2 to 12	220/2.16	30	300
		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		Other	225 to 525	5 to 24	...	...	...
0	0	Other	225 to 525	...	...	...	...
	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
		0	Other	325 to 925	5 to 24	...	...	...
	2	1		325 to 925	<55	240/2.16	15	50
		0	Other	325 to 925	5 to 24	...	...	...
0	0	Other	325 to 925	...	...	...	...
	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	...	...	...
0	0	Other	525 to 1725	...	...	...	...
	0	Other	525 to 1725	...	...	...	...
00	0	0	Other	...	...	...	...

^ANo descriptions unless needed to describe a special grade under the class. All other grades are listed by requirement.

^BTest specimen—80 × 10 × 4 mm. Test speed—2 mm/min.

^CDry samples 3 h at 100°C in dehumidifying oven prior to running test.

^DISO 527-2 Type 1BA specimen. Test speed—50 mm/min.

NOTE 2—An example of this classification system is given as follows: The designation TEEE0311 indicates the following:

- TEEE* = polyether-ester elastomer
- 03 (group)* = flexural modulus from 125 to 325 MPa
- 1 (class)* = flow rate from 2 to 12 g/10 min
- 1 (grade)* = 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 and lubricated versions of the polyether-ester materials that are not in Table TEEE are classified in 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 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, G 33, 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 filters, 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 should be 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.

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 ^A	unspecified	10	25	75	150	250	450	1000	2000	specify value
2	Flexural modulus, ISO 178, MPa, max ^A	unspecified	25	75	150	250	450	1000	2000	4000	specify value
3	Tensile strength, ISO 527-1, -2m MPa, min ^B	unspecified	10	20	30	40	50	60	70	80	specify value
4	Elongation at break, ISO 527-1, -2, %, min ^B	unspecified	5	10	20	100	200	300	400	500	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

^ATest specimen—80 × 10 × 4 mm. Test speed—2 mm/min.

^BISO 5271-2, Type 1BA specimen.

4.2.2.1 Although the values listed are necessary to include the range of properties available in existing materials, users should 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.

5. Suffixes

5.1 When additional requirements are needed that are not covered by the basic requirements or cell-table requirements, they shall be indicated through the use of suffixes.

5.2 A list of suffixes can be found in Classification D 4000 (Table 3) and may be used for additional requirements as appropriate. Additional suffixes will be added to that classification system as test methods and requirements are developed and requested.

6. General Requirements

6.1 Basic requirements from the property or cell tables, are always in effect unless superseded by specific suffix requirements, which always take precedence.

6.2 The plastics composition shall be uniform and shall conform to the requirements specified herein.

7. Detail Requirements

7.1 The materials shall conform to the requirements in Tables TEEE and A, and suffix requirements as they apply.

7.2 For the purpose of determining conformance, all specified limits for a specification (line callout) based on this classification system are absolute limits, as defined in Practice E 29.

7.3 With the absolute method, an observed value or a calculated value is not rounded off, but is to be compared directly to the specified limiting value. Conformance or non-conformance is based on this comparison.

8. Sampling

8.1 Sampling shall be statistically adequate to satisfy the requirements of 12.4.

8.2 A batch or lot shall be constituted as a unit of manufacture as prepared for shipment and may consist of a blend of two or more “production runs.”

9. Specimen Preparation

9.1 The test specimens shall be molded in accordance with ISO 294 and Practice D 3641. Recommended processing conditions are shown in Table 1.

TABLE 1 Conditions for Injection Molding of Test Specimens

Melting Temperature, °C	D Durometer Hardness ^A	Specimen Thickness, mm	Mold Temperature, °C	Melt Temperature, °C	Average Injection Velocity, mm/s
≤160	...	2	20	^B	200 ± 100
>160	≤50	2	40	^B	200 ± 100
>160	>50	2	50	^B	200 ± 100
...	...	4	20	^B	200 ± 100

^AHardness determined by ISO 868 or Test Method D 2240.

^B30°C above melting temperature as determined by ISO 11357-3 (except the heating rate shall be 10°C/min) or Test Method D 3418.

10. Conditioning

10.1 Test specimens shall be conditioned in the standard laboratory atmosphere in accordance with Procedure A of Practice D 618 before performing the required tests.

10.2 Conduct tests in the standard laboratory atmosphere of 23 ± 2°C and 50 ± 5 % relative humidity.

11. Test Methods

11.1 Determine the properties enumerated in this classification system by means of the test methods referenced in Section 2.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).

11.1.1 The number of tests shall be consistent with the requirements of Section 8 and 12.4.

12. Inspection and Certification

12.1 Inspection and certification of the material supplied with reference to a specification based on this classification system shall be for conformance to the requirements specified herein.

12.2 Lot-acceptance inspection shall be the basis on which acceptance or rejection of the “lot” is made. The lot-acceptance inspection shall consist of the tests listed as they apply:

12.2.1 Flow rate.

12.2.2 Reinforcement content.

12.3 Periodic-check inspection with reference to a specification based upon this classification system shall consist of the tests specified for all requirements of the material under the specification. Inspection frequency shall be adequate to assure the material is certifiable in accordance with 12.4.

12.4 Certification shall be that the material was manufactured, sampled, tested and inspected in accordance with this classification system and that the average values for the lot meet the requirements of the specification line callout.

12.5 Reports of the test results shall be furnished when

requested. The report shall consist of results of the lot-acceptance inspection for the shipment and results of the most recent periodic-check inspection.

13. Packaging, Packing, and Marking

13.1 The provisions of Practice D 3892 apply to packaging, packing, and marking of containers for plastic materials.

14. Keywords

14.1 elastomers; line callout; polyether-ester; recycle