~~Designation:D7436–11~~ Designation: D7436 – 12

Standard Classification System for Unfilled Polyethylene Plastics Molding and Extrusion Materials with a Fractional Melt Index Using ISO Protocol and Methodology[1]

This standard is issued under the fixed designation D7436; 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.

INTRODUCTION

This material specification is intended to provide a callout system for polyethylene utilizing specimen preparation procedures and test methods based primarily on ISO standards.

1. Scope*

1.1 This classification system provides for the identification of unfilled polyethylene plastics molding and extrusion materials, with a melt index of <1g/10 min, in such a manner that the supplier and the user agree on the acceptability of different commercial lots or shipments. The tests involved in this specification are intended to provide information for identifying materials in accordance with the groups, classes, and grades covered. It is not the function of this classification system to provide specific engineering data for design purposes.

1.2 This classification system allows for the use of recycled polyethylene materials 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, will not be covered in this specification.

NOTE 1—See Guide D7209 for information and definitions related to recycled plastics.

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 shall be agreed upon between the user and the supplier by using the suffixes given in Section 5.

1.4 This classification system and subsequent line callout (specifications) 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 requirements 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 regarded as the standard.

1.6 The following precautionary caveat pertains to the test method portion only, Section 12 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.*

1.7 For information regarding plastic pipe materials, see Specification D3350. For information regarding wire and cable materials, see Specification D1248. For information regarding classification of PE molding and extrusion materials using ASTM test methods, see Specification D4976.

NOTE 2—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

---

[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 Nov. 15, 2011. Published December 2011. DOI:10.1520/D7436-11.~~

Current edition approved Aug. 1, 2012. Published September 2012. Originally approved in 2011. Last previous edition approved in 2011 as D7436 - 11. DOI:10.1520/D7436-12.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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

D883 Terminology Relating to Plastics
D1248 Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
D1600 Terminology for Abbreviated Terms Relating to Plastics
D1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics
D2565 Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications
D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials
D3763 Test Method for High Speed Puncture Properties of Plastics Using Load and Displacement Sensors
D3892 Practice for Packaging/Packing of Plastics
D4000 Classification System for Specifying Plastic Materials
D4329 Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastics
D4703 Practice for Compression Molding Thermoplastic Materials into Test Specimens, Plaques, or Sheets
D4976 Specification for Polyethylene Plastics Molding and Extrusion Materials
D6436 Guide for Reporting Properties for Plastics and Thermoplastic Elastomers
D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *ISO Standards:*

ISO 293 Plastics—Compression Molding of Test Specimens of Thermoplastic Materials
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 1133 Plastics—Determination of the Melt Mass-Flow Rate (MFR) and Melt Volume-Flow Rate (MVR) of Thermoplastics
ISO 1183-2 Plastics—Methods for Determining the Density and Relative Density of Non-Cellular Plastics—Density Gradient Column Method
ISO 1872-2 Plastics—Polyethylene (PE) Moulding and Extrusion Materials—Part2: Preparation of Test Specimens and Determination of Properties
ISO 2818 Preparation of Test Specimens by Machining
ISO 3167 Dimensions of Test Specimens

2.3 *SAE Standards:*

SAE J2412 Accelerated Exposure of Automotive Interior Trim Components Using a Controlled Irradiance Xenon-Arc Apparatus
SAE J2527 Performance Based Standard for Accelerated Exposure of Automotive Exterior Materials Using a Controlled Irradiance Xenon-Arc Apparatus

3. Terminology

3.1 *Definitions*—For definitions of technical terms pertaining to plastics used in this specification, see Terminology D883 and Terminology D1600.

4. Classification

4.1 Unfilled polyethylene plastic materials are classified into groups in accordance with molecular structure. These groups are subdivided into classes and grades as shown in Table PE (Basic Property Table). Material classification callouts used in this system and in Specification D4976 look similar but decode into dramatically different materials. In order to differentiate materials classified under this system from those classified under other systems, materials classified herein are preceded with the classification system D7436.

NOTE 3—An example of this classification system is as follows: The designation D7436 PE 232 would indicate PE, polyethylene as found in Terminology D1600, 2 (group) linear, 3 (class) high density, 2 (grade) >7 to ≤ 11 melt flow rate (190°C/21.6Kg).

NOTE 4—It is recognized that some high-density polyethylene plastics of very high molecular weight may have densities slightly less than 0.960, yet in all other respects they are characteristic of Class 4 materials. Similarly, there are other polyethylene plastics of very high molecular weight having densities less than 0.941 that, in all other aspects, are more characteristic of Class 2 than of Class 3 materials.

NOTE 5—Use the following terms in describing polyethylene plastics:

Class 1 (0.910 to 0.925) = low density
Class 2 (>0.925 to 0.940) = medium density
Class 3 (>0.940 to 0.960) = high density-low range
Class 4 (>0.960) = high density-high range

TABLE PE Basic Requirement of Polyethylene Plastics

Group	Description	Class	Description	Grade	Melt Flow Rate[A]	Melt Flow Rate[B]	Tensile Stress at Yield,[C] MPa, min	Nominal Strain at Break,[C] %, min	Tensile Modulus,[D] MPa, min
1	Branched	1	Low Density 0.910 ≤ 0.925	1	≤7	...			
				2	>7 ≤11				
				3	>11				
				4		0.1 ≤ 0.4	9.5	400	
				5		0.4 ≤ 1	9.5	300	
				0					
		2	Medium Density >0.925 ≤0.940	1	≤7				
				2	>7 ≤11				
				3	>11				
				4		0.1 ≤ 0.4	11	400	
				5		0.4 ≤ 1	11	200	
				0					
		0	other	0					
2	Linear	1	Low Density 0.910 ≤ 0.925	1	≤7				
				2	>7 ≤11				
				3	>11				
				4		0.1 ≤ 0.4	11	500	
				5		0.4 ≤ 1	11	400	200
				0					
		2	Medium Density >0.925 ≤ 0.940	1	≤7				
				2	>7 ≤ 11				
				3	>11				
				4		0.1 ≤ 0.4	16	400	600
				5		0.4 ≤ 1	16	200	500
				0					
		3	High Density >0.940 ≤0.960	1	≤7		20		700
				2	>7 ≤ 11		23		900
				3	>11		23		900
				4		0.1 ≤ 0.4	24	600	1000
				5		0.4 ≤ 1	25	400	1100
				0					
		4	High Density >0.960	1	≤7				
				2	>7 ≤ 11				
				3	>11				
				4		0.1 ≤ 0.4	28	400	
				5		0.4 ≤ 1	28	300	1200
				0					
		0	other	0					
00	Other	0	other	0					

[A] ISO 1133 melt flow rate = g/10 min at 190°C/21.6 Kg.
[B] ISO 1133 melt flow rate = g/10 min at 190°C/2.16 Kg.
[C] ISO 3167, Type 1B tensile bars, HDPE and MDPE tested at 50 mm/min. For densities ≤ 0.925 test at 500 mm/min.
[D] ISO 527-1 and ISO 527-2 at 1 mm/min strain rate, chord modulus between 0.05 % and 0.25 % strain.

TABLE A Detail Requirements[A] for Polyethylene Plastics

Designation or Order No.	Property	0	1	2	3	4	5	6	7	8	9
1	Tensile stress at yield,[B] MPa ISO 527-1 and ISO 527-2, min	unspecified	4	8	12	16	21	30	35		specify value[C]
2	Nominal strain at break,[B] %, ISO 527-1 and ISO 527-2, min	unspecified	25	50	200	400	600	800	1000		specify value[C]
3	Tensile Modulus,[D] MPa, ISO 527-1 and ISO 527-2, min	unspecified	50	100	200	400	600	800	1000		specify value[C]
~~4~~	~~Environmental stress-crack resistance, hrs, min F_{50},[E] Test Method D1693~~	~~unspecified~~	~~24~~	~~48~~	~~96~~	~~168~~	~~336~~	~~672~~	~~1008~~	—	~~specify value[C]~~
4[E]	Environmental stress-crack resistance, hrs, min F_{50},[F] Test Method D1693	unspecified	24	48	96	168	336	672	1008	—	specify value[C]