Designation: D 2581 – 96

An American National Standard

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
Reprinted from the Annual Book of ASTM Standards. Copyright ASTM

Standard Specification for Polybutylene (PB) Plastics Molding and Extrusion Materials[1]

This standard is issued under the fixed designation D 2581; 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 provides for the identification of polybutylene plastics molding and extrusion materials in such manner that the manufacturer and the purchaser can agree on the acceptability of different lots or shipments. The tests involved in this specification are intended to provide information for identifying materials according to types and categories. It is not the function of this specification to provide specific engineering data for design purposes.

1.2 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 similar or equivalent ISO standard.

1.3 The following safety hazards caveat pertains only to the test methods portion, Section 9, of this specification: *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.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 638 Test Method for Tensile Properties of Plastics[2]

D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement[2]

D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer[2]

D 1505 Test Method for Density of Plastics by the Density-Gradient Technique[2]

D 1603 Test Method for Carbon Black in Olefin Plastics[2]

D 1898 Practice for Sampling of Plastics[2]

D 3892 Practice for Packaging/Packing of Plastics[3]

D 5033 Guide for the Development of Standards Relating to the Proper Use of Recycled Plastics[4]

2.2 *Military Standard:*

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes[5]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *internal recycled material*—clean rework material generated from the manufacturer's own resin production.

3.1.2 *polybutylene plastics*—plastics prepared by the polymerization of no less than 85 % butene-1 and no less than 95 % of total olefins by weight.

4. Classification

4.1 This specification recognizes that polybutylene plastics are identified on the basis of two characteristics, that is, density and flow rate. The former is the criterion for assignment as to type, the latter for designation as to category.

4.2 *Types*—This specification provides for two types of polybutylene molding and extrusion materials in accordance with the requirements in Table 1. Material supplied under these types shall be of such nominal density, within the ranges given, as agreed upon between the manufacturer and the purchaser and subject to tolerances likewise agreed upon.

4.3 *Categories*—This specification provides for six grades of polybutylene on the basis of flow rate ranges in accordance with the requirements of Table 2. Material supplied under these grades shall be of such nominal flow rate, within the ranges given, as agreed upon between the manufacturer and the purchaser and subject to tolerances likewise agreed upon.

4.4 *Classes*—Each of the two types is subdivided into three classes, according to use and composition, as follows:

4.4.1 *Class A*—General-purpose and dielectric, unpigmented.

4.4.2 *Class B*—General-purpose and dielectric, in colors (including black and white).

4.4.3 *Class C*—Weather-resistant (black) containing not less than 2 % carbon black. The carbon black shall be of a kind and particle size (Note 1), and dispersed by such means and to such degree, as agreed upon between the manufacturer and the purchaser.

NOTE 2—Carbon black, 20 nm or less in average particle diameter, is used, as required, in black electrical and jacketing materials to impart maximum weather resistance.

---

[1] This specification is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.12 on Olefin Plastics.

Current edition approved Aug. 10, 1996. Published October 1996. Originally published as D 2581 – 67. Last previous edition D 2581 – 95.

[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.02.

[4] *Annual Book of ASTM Standards*, Vol 08.03.

[5] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

TABLE 1 Classification of Polybutylene Molding and Extrusion Materials According to Type

Type	Density Range, kg/m^3
I	0.905 to 0.909
II	0.910 to 0.920
II, colored and filled	0.920 to 0.940

TABLE 2 Classification of Polybutylene Molding and Extrusion Materials According to Category

Category	Flow Rate, g/10 min
0	<0.25
1	0.25 to 0.75
2	0.76 to 2.5
3	2.6 to 10
4	> 10 to 25
5	> 25

4.5 As agreed upon between the manufacturer and the purchaser, material in any of the preceding three classes may be without any antioxidant or other additive, or it may contain such antioxidant or other additives as agreed upon.

5. General Requirements

5.1 The compound, in the form of molding powder, granules, or pellets, shall be of uniform composition and so formulated as to conform to the requirements of this specification.

5.2 The compound shall be free of foreign matter to such a contamination level as may be agreed upon between the manufacturer and the purchaser.

6. Detail Requirements

6.1 *Extrusion and Molding Compound*—Molded test specimens shall conform to the requirements prescribed for the particular type and category in Table 1, Table 2, and Table 3.

6.2 Unless otherwise specified, test specimens shall be compression-molded under conditions recommended by the manufacturer.

7. Sampling

7.1 Unless otherwise agreed upon between the manufacturer and the purchaser, the compound shall be sampled in accordance with the sampling procedure described in Practice D 1898. Adequate statistical sampling prior to packaging shall be considered an acceptable alternative. A batch or lot of molding material shall be considered as a unit of manufacture as prepared for shipment, and may consist of a blend of two or more production runs of material.

TABLE 3 Detail Requirements for Polybutylene Molded Test Specimens

Property	Type I	Type II	Type II, Colored and Filled
Density, kg/m^3	0.905 to 0.909	0.910 to 0.920	0.920 to 0.940
Tensile strength, min, MPa (psi)	20.7 (3000)	20.7 (3000)	20.7 (3000)
Yield strength, min, MPa (psi)	10.3 (1500)	13.8 (2000)	13.8 (2000)
Elongation at break, min, %	300	300	280

8. Number of Tests

8.1 One set of test specimens, as prescribed in the test methods cited in Section 9, shall be considered sufficient for testing each batch or lot. The average result for the specimens tested shall conform to the requirements prescribed in this specification.

9. Test Methods

9.1 The properties enumerated in this specification shall be determined in accordance with the following test methods:

9.1.1 *Conditioning*— 240/23/50-molded test sheets shall be held at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5 % relative humidity for 10 days prior to the performance of any test. Test specimens shall be cut after this aging period.

9.1.2 *Test Conditions*—Tests shall be conducted in the standard laboratory atmosphere of 23 ± 2°C (73.4± 3.6°F) and 50± 5 % relative humidity as defined by Practice D 618.

9.1.3 *Density*—Test Method D 1505 or Test Methods D 792.

9.1.4 *Flow Rate*—Test Method D 1238, using Condition 190/2.16. It may be necessary to dry samples containing carbon black before running this test, if reproducible results are to be obtained. The manufacturer's recommendation should be followed.

9.1.5 *Tensile Properties*—Test Method D 638, 500 mm (20 in.)/min. Specimens shall conform to the dimensions given for Type IV in Test Method D 638, with their thicknesses to be 1.9 ± 0.2 mm (0.075 ± 0.008 in.). Bench mark separation shall be 25.40 ± 0.38 mm (1.000 ± 0.015 in.). Percentage elongation at break shall include the cold drawing distance. Test results for specimens that break outside the gage marks after extensive cold drawing need not be discarded unless the break occurs between the contact surfaces of a grip.

9.1.6 *Carbon Black Content*—Test Method D 1603.

10. Inspection

10.1 Inspection of the material shall be made as agreed upon between the purchaser and the manufacturer as part of the purchase contract.

11. Packaging and Package Marking

11.1 *Packaging*—The material shall be packaged in standard commercial containers, so constructed as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the point of delivery, unless otherwise specified in the contract or order.

11.2 *Marking*—Unless otherwise agreed upon between the manufacturer and the purchaser, shipping containers shall be marked with the name of the material and its manufacturer, type, quantity contained, the manufacturer's lot number, and the number of the order.

11.3 All packing, packaging, and marking provisions of Practice D 3892 shall apply to this specification.

12. Keywords

12.1 polybutylene; recycled; specification

QUALITY ASSURANCE PROVISIONS FOR GOVERNMENT/MILITARY PROCUREMENT

SUPPLEMENTARY REQUIREMENTS

These requirements apply *only* to federal/military procurement, not domestic sales or transfers.

S1. Sampling for inspection and testing shall be carried out in accordance with the recommendations of Practice D 1898.

S2. Selection of Acceptable Quality Level (AQL) and of Inspection Level (IL) shall be made, with consideration of the specific use requirements. This is discussed in the sections on Means and Standard Deviations and Comparison of Sampling Plans of the above document, with reference to MIL-STD-105.

S3. In the absence of contrary requirements, the following values shall apply:

	IL	AQL
Defects of appearance and workmanship	II	2.5
Defects of preparation for delivery	S-2	2.5
Testing (products)	S-1	1.5
Testing (polymer, unfabricated)	S-1[A]	...

[A] Samples shall be drawn from the required number of units and pooled for preparation of molded samples for mechanical properties evaluation.