



Designation: D 5203 – 02

Standard Specification for Polyethylene Plastics Molding and Extrusion Materials from Recycled Post-Consumer (HDPE) Sources¹

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INTRODUCTION

This specification provides for the identification of post-consumer recycled high-density polyethylene plastics (HDPE) plastics molding and extrusion materials derived from specified sources. It provides for the identification of resin characteristics and certification so that the user and the supplier can agree on the acceptability of shipments of the plastic materials. This specification provides that the source of the materials be listed as an aid in identifying the material. The tests described in this specification are intended to provide additional information for identifying these materials.

1. Scope*

1.1 This specification provides for the identification of recycled post-consumer HDPE molding and extrusion materials, from specified sources, in pellet or chip form so that the supplier and the user can agree on the acceptability of lots or shipments. This specification covers post-consumer HDPE materials from the following: (1) blow molded household chemical containers, (2) blow molded milk, juice, and water containers, (3) materials from the spunbonded process, (4) thermoformed packaged food containers and personal care packages, (5) injection molded packaged food containers and beverage bottle base cups, and (6) injection molded housewares and industrial articles such as pails, crates, totes, and pallets. Other post-consumer HDPE materials may be added to this specification when such material streams are characterized.

1.1.1 The tests described in this specification are intended to provide information for identifying these materials. The separation by sources improves the usefulness of the materials.

1.1.2 It is not the function of this specification to provide specific data for design purposes.

1.2 This specification provides a procedure to certify that the materials are from post-consumer sources.

1.3 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.4 The following precautionary caveat pertains only to the test method portion, Section 10, 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.

NOTE 1—There are no ISO standards covering the primary subject matter of this specification.

2. Referenced Documents

2.1 ASTM Standards:

D 618 Practice for Conditioning Plastics for Testing²

D 638 Test Method for Tensile Properties of Plastics²

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials²

D 792 Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement²

D 883 Terminology Relating to Plastics²

D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer²

D 1505 Test Method for Density of Plastic by the Density-Gradient Technique²

D 2839 Practice for Use of Melt Index Strand for Determining Density of Polyethylene³

D 3892 Practice for Packaging/Packing of Plastics³

D 4703 Practice for Compression Molding Thermoplastic Materials into Test Specimens, Plaques, or Sheets²

D 4883 Test Method for Density of Polyethylene by the Ultrasound Technique⁴

D 5033 Guide for Development of Standards Relating to the Proper Use of Recycled Plastics⁴

¹ This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials (Section D20.15.01).

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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.

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

TABLE 1 Specification Values

Property	Specification Value				
	Source A ^A	Source B ^A	Source C ^A	Source D ^A	Source E ^A
Melt Index ^B /10 min	0.2 to 0.6	0.4 to 1.0	0.4 to 0.9	>20	4 to 20
Density (unpigmented) ^C /g/cm ³	≤0.959	>0.958	≥0.955	0.956 to 0.962	0.956 to 0.962
Added antioxidant ^D or other stabilizer	Specify level	Specify level	Specify level	Specify level	Specify level
Tensile strength ^E /MPa (psi)	14 (2030) min	20 (2900) min	20 (2900) min	17 (2500) min	17 (2500) min
Secant modulus ^F /MPa (psi)	620 (90 000) min	670 (97 000) min	670 (97 000) min	620 (90 000) min	550 (80 000) min

^A See 5.3.

^B Melt index measured at condition 190/2.16 (see Test Method D 1238).

^C The apparent density of the pigmented resin may be different (usually higher) than the density of the unpigmented resin. Only the unpigmented density is listed in Table 1.

^D Test Method D 4883 may be useful as a measure of the base resin density of pigmented recycled HDPE material.

^E The seller must specify the amount of antioxidant or other stabilizer added, if any, to repelletized material.

^F Type IV tensile bars tested at 50.8 mm/min (2 in./min) (see Test Method D 638).

^F Secant modulus at approximately 2 % strain using Method 1, Procedure B with 50.8-mm (2-in.) span on 3.2 by 12.7-mm (0.125 by 0.5-in.) specimens. (See Test Method D 790.)

D 5577 Guide for Techniques to Separate and Identify Contaminants in Recycled Plastics⁴

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁵

3. Terminology

3.1 Definitions—The definitions of terms used in this specification are in accordance with Terminology D 883 and Guide D 5033.

3.2 Descriptions of Terms Specific to This Standard:

3.2.1 *nominal density*—the density of the unpigmented high-density polyethylene resin, which may differ from the apparent density of the material due to the addition of fillers or pigments to the resin.

3.2.2 *source*—the original end use of the HDPE materials described in this specification.

3.2.3 *spunbonded*—a method of fabrication wherein a material is bonded to form a sheet-like structure during the spinning process.

4. Ordering Information

4.1 The purchase order or inquiry for these materials shall state the specification number, date of issue and desired values for the items listed in Table 1.

4.2 Further definition as may be required for the items listed in Table 1 shall be on agreement between the user and the supplier.

4.3 It is recognized that some contaminants may result in an odor being present in the recycled material. The acceptability of the type and level of odor shall be as agreed upon by the user and supplier. Methods to evaluate odors in recycled materials are being developed elsewhere in the plastics industry.

5. General Requirements

5.1 The material shall be in the form of pellets or chips.

5.2 The material shall be as free of contamination as can be achieved by good manufacturing practice. If necessary, the level of contamination may be agreed upon between the user and the supplier.

5.2.1 Guidance for the separation and identification of contaminants may be found in Guide D 5577.

5.3 The materials described in this specification are limited to high-density polyethylene from the sources indicated. Different end uses can be categorized as from the same source provided the physical properties of the HDPE meet the requirements specified in Table 1.

5.3.1 *Source A*—Post-consumer blow molded or thermoformed HDPE containers, usually from household chemicals, packaged food, or personal care packages.

5.3.2 *Source B*—Post-consumer blow molded HDPE containers usually from milk, juice, and water containers.

5.3.3 *Source C*—Post-consumer HDPE items that have been fabricated from spunbonded materials.

5.3.4 *Source D*—Post-consumer injection molded articles, usually from packaged food containers and beverage base cups.

5.3.5 *Source E*—Post-consumer injection molded articles, usually from housewares and industrial articles such as pails, crates, totes, and pallets.

6. Physical Properties

6.1 Test specimens of the materials shall conform to the requirements prescribed in Section 8 and tested as described in Section 10.

6.2 Observed or calculated values obtained from analysis, measurement or test, shall be rounded as specified in Practice E 29. Round to the nearest unit in the last right-hand place of figures used in expressing the specified limiting value. The value obtained is compared directly with the specified limiting value. Conformance or nonconformance with the specification is based on this comparison.

7. Sampling

7.1 The materials shall be sampled using adequate statistical sampling techniques. Adequate statistical sampling shall be considered as an acceptable alternative. Procedures to ensure sample homogeneity should be part of the sampling plan. A batch or lot of resin 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.

8. Specimen Preparation

8.1 Test specimens shall be molded in accordance with Procedure C of Annex A1 of Practice D 4703. If the material is

⁵ Annual Book of ASTM Standards, Vol 14.02.