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## Standard Specification for Ultra-High-Molecular-Weight Polyethylene (UHMW-PE) Solid Plastic Shapes<sup>1</sup>

This standard is issued under the fixed designation D6712; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### INTRODUCTION

This specification is intended to be a means of defining Ultra-High-Molecular-Weight<sup>2</sup> Polyethylene (UHMW-PE) solid plastic shapes for commercial use.

#### 1. ~~Scope~~ Scope\*

1.1 This specification covers requirements and test methods for the material and properties of solid plastic shapes manufactured from UHMW-PE.

1.2 The properties included in this specification are those required for the compositions covered and are derived from molded samples or fabricated from sheet, rod and profiles. Requirements necessary to identify particular characteristics important to specialized applications ~~may be~~ are described by using the classification system given in Section 4.

1.3 This specification allows for the use of recycled plastics (as defined in Guide [D5033](#)).

1.4 The values are stated in SI units and are to be regarded as the standard in all property tables. For reference purposes, English units are also included in Table S-UHMW-PE and Table ~~A~~A and are not necessarily exact equivalents.

1.5 The following precautionary caveat pertains only to the test method portions 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 requirements prior to use.*

NOTE 1—There is no known ISO equivalent to this standard.

#### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>3</sup>

[D618 Practice for Conditioning Plastics for Testing](#)

[D638 Test Method for Tensile Properties of Plastics](#)

[D883 Terminology Relating to Plastics](#)

[D1600 Terminology for Abbreviated Terms Relating to Plastics](#)

[D3892 Practice for Packaging/Packing of Plastics](#)

[D4000 Classification System for Specifying Plastic Materials](#)

[D4020 Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials](#)

[D5033 Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics \(Withdrawn 2007\)](#)<sup>4</sup>

2.2 *ISO Standard:*

[ISO 11542-2 Ultra-High-Molecular Weight Polyethylene \(PE-UHMW\) Moulding Materials—Part 2: Preparation of Test Specimens and Determination of Properties](#)

#### 3. Terminology

3.1 *Definitions:*

<sup>1</sup> This specification 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 ~~Feb. 1, 2009~~ March 1, 2017. Published ~~March 2009~~ March 2017. Originally approved in 2001. Last previous edition approved in ~~2001~~ 2009 as [D6712–01: D6712–01\(2009\)](#). DOI: ~~10.1520/D6712-01R09~~ 10.1520/D6712-17.

<sup>2</sup> Ultra High Molecular Weight refers to a polyethylene resin meeting the requirements of Specification [D4020](#).

<sup>3</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>4</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

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

3.1.1 For definitions of other technical terms pertaining to plastics used in this specification, see Terminology **D883**, **D1600**, or Guide **D5033**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *additive, n*—any material added to the polymer such as processing aids, stabilizers, and colorants.

3.2.2 *recycled-plastic shape, n*—a product made from up to 100 % post-consumer material.

3.2.3 *regrind (plastic), n*—a product or scrap such as edge trim that have been reclaimed by shredding and granulating for use in-house.

3.2.4 *rod, n*—an extruded solid cylindrical shape with a minimum diameter of 1/16 in.

3.2.5 *sheet, n*—flat stock greater than 10 mils thickness.

3.2.6 *solid plastic shape, n*—a product of various geometries made up of UHMW-PE, such as sheet, rod, and so forth.

**TABLE S-UHMW-PE Physical Property Requirements for Ultra High Molecular Weight Polyethylene Solid Plastic Shapes**

Description	Type	Class	Description	Grade	Applicable Specification Callout	Description	Izod impact, Test Method for <b>D4020</b> , min, kJ/m <sup>2</sup> (ft-lbs/in. <sup>2</sup> )	Elongational Stress, Test Method for ISO 11542-2 (Annex 1), min, Mpa	Tensile Elongation, Test Method for <b>D638</b> , % at break, min
UHMW-PE	01	1	unfilled	1	ASTM <b>D4020</b>	General purpose	37 (18)	>0.20	200
				2		Recycled	...	...	...
		0	as specified	1	see Table A	General purpose	...	...	...
				2		Recycled	...	...	...
Other UHMW-PE	00	0	...	0	...	...	...	...	

**4. Classification and Material**

4.1 Product shape and size as defined in the applicable purchase order.

4.2 This standard covers product as listed in Table S-UHMW-PE.

4.2.1 The type of a UHMW-PE product may be is categorized by grade and type depending on resin and additives present, as defined in Table S-UHMW-PE.

4.2.2 Every type of UHMW-PE solid plastic shape may be are categorized into one of two grades as follows:

4.2.2.1 *Grade 1: General Purpose (Virgin) UHMW-PE*—UHMW-PE solid plastic shapes are made using only 100 % virgin UHMW polyethylene resin which meets the requirements of Specification **D4020**. ~~If appropriate, the resin may contain additives, such as processing aids, stabilizers and colorants. Virgin product should~~ Virgin product shall not contain materials of unknown origin or composition.

NOTE 2—If appropriate, the resin can contain additives, such as processing aids, stabilizers, and colorants.

4.2.2.2 *Grade 2: Recycled/Regrind UHMW-PE*—UHMW-PE solid plastic shapes are made using any amount up to 100 percent of recycled, or regrind UHMW-PE plastic, or both.

**TABLE A Additional Requirements for UHMW-PE Solid Plastic Shapes**

NOTE 1—The values listed in Table A are minimum values.

Designation Order Number	Property	0	1	9
1	Izod impact, Test Method for <b>D4020</b> , min KJ/m <sup>2</sup> (ft-lbs/in. <sup>2</sup> )	Unspecified	30 (14)	Specify value
2	Elongational stress, Test Method for ISO 11542-2 (Annex 1), min, MPa	Unspecified	>0.20	Specify value
3	Elongation at break, Test Method for <b>D638</b> , %, min	Unspecified	200	Specify value
4	To be determined	...	...	...

4.3 *Property Tables:*

4.3.1 Table S-UHMW-PE may is to be used to describe UHMW-PE solid plastic shapes.

4.3.2 To facilitate the incorporation of future UHMW-PE or special UHMW-PE formulations not covered by Table A, the “as specified” category (00) for grade is shown on the table with the basic properties to be obtained from Table S-UHMW-PE, as they apply.

4.4 *Callout Designation*—A one-line system shall be used to specify polyethylene materials covered by this specification.

4.4.1 The system uses pre-defined cells to refer to specific aspects of this specification as illustrated below in Examples 1–3:

4.4.2 *Example 1*—Product made from virgin Type UHMW-PE resin.