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Standard Specification for Finished Parts Made from Polyimide Resin¹

This standard is issued under the fixed designation D6456; 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 is intended to be a means of calling out finished plastic parts ready for industrial or consumer use.
- 1.2 This specification covers finished parts and shapes from which parts are machined, made from a semi-crystalline polyimide (PI).
- 1.3 This specification is intended to replace MIL-R-46198 and Provisional Standard Specification PS 93.

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

1.4 This specification covers parts made from semi-crystalline polyimide, which is a thermosetting material that shows no softening or melting by DMA (D4065) at or below 260°C (500°F).

1.5 Since PI is a thermoset resin, no provisions are included for recycled products.

1.6 The classification system outlined in this specification is intended to be identical to that used by Department of Defense for over 20 years. No changes are intended at this time.

1.7 The values are stated in SI units and are regarded as the standard in all property and dimensional tables. For reference purposes, inch-pound units are stated in parentheses.

1.8 *Application*—Parts in this specification are generally used for applications requiring the following combination of properties: low coefficient of friction, and low thermal expansion coupled with heat resistance for continuous operation at temperatures up to 260°C (500°F) and for short-term excursions upward to 482°C (900°F).

1.9 The following precautionary caveat pertains only to the test method portion, Section 12, 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:²

- D638 Test Method for Tensile Properties of Plastics
- D695 Test Method for Compressive Properties of Rigid Plastics
- D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D883 Terminology Relating to Plastics
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D1708 Test Method for Tensile Properties of Plastics by Use of Microtensile Specimens
- D3892 Practice for Packaging/Packing of Plastics
- D4065 Practice for Plastics: Dynamic Mechanical Properties: Determination and Report of Procedures
- E8 Test Methods for Tension Testing of Metallic Materials

2.2 ANSI Standard:

- Z1.4 Standard for Sampling Plans and Tables for Inspection by Attributes^{3,4}

2.3 Military Standards:

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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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁴ Replaced MIL-STD-105.

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

MIL-R-46198⁵

MIL-STD-129⁵

MIL-R-46198 Resin, Polyimide, Hot Pressed or Pressed and Sintered

MIL-STD 129 Standard Practice, Military Marking for Shipment and Storage

3. Terminology

3.1 *Definitions*—Terms are defined in accordance with Terminologies D883 and D1600 unless otherwise indicated.

4. Classification

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

4.2 The type of product shall be categorized by type and class depending on resin and filler compositions defined as follows:

Type I		Unfilled base resin
Type II	Class 1	Resin with graphite filler
	Class 2	15 % by weight graphite filler, nominal
	Class 3	40 % by weight graphite filler, nominal
		15 % by weight graphite and 10 % by weight fluorocarbon fillers, nominal
Type III		15 % by weight molybdenum disulfide filler, nominal

NOTE 2—Filler contents shown above are approximate. See Table 1 for exact composition.

4.3 Polymer compositions shall be specified by use of type/class designations as described in Table 1.

4.4 Manufacturing method and product form shall be specified by use of a suffix letter as described in Table 2.

4.5 When applying the suffix letter, the type/class designation shall precede the letter.

5. Ordering Information

5.1 All shapes covered by this specification shall be ordered using the proper callout designation (see Section 4).

6. Material

6.1 The base material shall consist of semi-crystalline polyimide resins with a base polymer structure derived from pyromellitic dianhydride and 4,4'-diaminodiphenylether.

6.2 The base material shall conform to the composition requirements of Table 1. The base material, depending on type and class, may contain up to 50 wt % pigments, fillers or lubricants, or a combination thereof, and no fibrous reinforcement.

6.3 Recycle of unworked resin, such as spills, shall be permitted to the extent that the resultant material meets all property requirements specified herein.

6.4 No reground material shall be permitted.

6.5 The basic material shall be free of major defects and contaminants that would be detrimental to fabrication or performance of a finished part.

7. Physical Property Requirements

7.1 The physical property values listed within this specification's tables are to be considered minimum specification values. Any requirement for specific test data for a given production lot should be specified at the time of order.

⁵ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

TABLE 1 Polymer Composition and Form

Type/Class	Polymer Composition	Processing Release Agent
Type I	Unfilled polyimide polymer	0.5 % by weight of PTFE, ^A max
Type II	Filled polyimide polymer	0.5 % by weight of PTFE, ^A max
Class 1	Containing 14–16 % by weight graphite	
Type II	Filled polyimide polymer	2.0 % by weight of PTFE, ^A max
Class 2	Containing 35–39 % by weight graphite	
Type II	Filled polyimide polymer	N/A
Class 3	Containing 12–14 % by weight graphite and 9–11 % by weight PTFE ^A	
Type III	Filled polyimide polymer containing 14–16 % by weight molybdenum disulfide	N/A

^APolytetrafluoroethylene compound.