

MIL-P-46120B

11 July 1983

SUPERSEDING

MIL-P-46120A(MR)

28 September 1973

MILITARY SPECIFICATION

PLASTIC MOLDING AND EXTRUSION MATERIALS, POLYSULFONE

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers polysulfone thermoplastic materials.

1.2 Classification. The polysulfone materials shall be of the following types and classes, as specified (see 6.2):

Type I - Polysulfone resin, unreinforced

Class 1 - Molding material

Class 2 - Extrusion material

Type II - Polysulfone resin, glass fiber reinforced (GFR)

Class 1 - 10% GFR

Class 2 - 20% GFR

Class 3 - 30% GFR

Class 4 - 40% GFR

Type III - Polysulfone resin, for medical applications

Type IV - Polysulfone resin, carbon-fiber reinforced (CFR)

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, US Army Materials and Mechanics Research Center, ATTN: DRXMR-SMS, Watertown, MA 02172 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 9330

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SPECIFICATIONS

FEDERAL

- PPP-D-723 - Drums, Fiber
- PPP-D-729 - Drums, Metal, 55-Gallon (for Shipment of Noncorrosive Material)

STANDARDS

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-129 - Marking for Shipment and Storage

HANDBOOKS

MILITARY

- MIL-HDBK-700 Plastics

(Copies of specifications, standards, and handbooks required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 149 - Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies
- ASTM D 150 - A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials
- ASTM D 256 - Impact Resistance of Plastics and Electrical Insulating Materials
- ASTM D 570 - Water Absorption of Plastics
- ASTM D 638 - Tensile Properties of Plastics
- ASTM D 648 - Deflection Temperature of Plastics Under Flexural Load
- ASTM D 696 - Coefficient of Linear Thermal Expansion of Plastics
- ASTM D 792 - Specific Gravity and Density of Plastics by Displacement
- ASTM D 955 - Measuring Shrinkage from Mold Dimensions of Molded Plastics
- ASTM D 1238 - Flow Rates of Thermoplastics by Extrusion Plastometer
- ASTM D 3951 - Commercial Packaging
- ASTM F 702 - Polysulfone Resin for Medical Applications

(Application for copies of ASTM publications should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

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UNDERWRITERS LABORATORIES (UL)

UL 94 - Tests for Flammability of Plastic Materials for Parts in
Devices and Appliances

(Applications for copies of UL publications should be addressed to the Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Material. The material shall consist of thermoplastic polysulfone resin with or without fiber reinforcement (see MIL-HDBK-700A). Unreinforced polysulfone resins (Types I and III) and unreinforced polysulfone resins used in the preparation of reinforced polysulfone resins (Types II and IV), shall yield an infrared transmittance spectrum which exhibits major transmittance bands only at the same wavelengths as appear in the reference spectrum of polysulfone (see Figure 1).

3.2 Physical properties. Unless otherwise specified (see 6.2), the properties of the polysulfone materials shall conform to the requirements specified herein, when tested in accordance with 4.2.3.

3.2.1 Polysulfone resin, unreinforced. Type I polysulfone resins shall conform to the requirements in table I for type I materials.

3.2.2 Polysulfone resin, glass fiber reinforced. Type II polysulfone resins shall conform to the requirements in table I for type II materials.

3.2.3 Polysulfone resin for medical applications. Type III polysulfone resins shall conform to the requirements in ASTM F 702.

3.2.4 Polysulfone resin, carbon fiber reinforced. Type IV polysulfone resins shall conform to the requirements specified in the contract or order (see 6.2).

3.3 Color. The color, and clarity or opaqueness, shall be as specified by the procuring activity (see 6.2) and shall be determined visually. If color is not specified, the pellets shall be natural in color, which is straw or light amber, and transparent.

3.4 Uniformity and form. All material shall be uniform in form and color as determined visually. The form shall be pellets.

3.5 Workmanship. The material shall be clean and free of foreign particles and other contamination.

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4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Sampling for inspection and acceptance. Sampling for inspection shall be performed in accordance with the provisions set forth in MIL-STD-105, except where otherwise indicated. For purposes of sampling, an inspection lot for examination and tests shall consist of all materials of the same kind manufactured by one line under continuous steady process conditions, submitted for delivery.

4.2.1 Inspection of materials and components. In accordance with 4.1 above, the contractor is responsible for insuring that materials and components used were manufactured, tested and inspected in accordance with the requirements of referenced subsidiary specifications and standards to the extent specified, or, if none, in accordance with this specification. In the event of conflict, this specification shall govern.

4.2.2 Inspection of material.

4.2.2.1 Examination of the material. Examination of the material shall be made in accordance with the classification of defects, inspection levels and acceptable quality levels (AQL's) set forth below. The lot size, for purpose of determining the sample size in accordance with MIL-STD-105, shall be expressed in units of 50 pounds (22 kg) for examination in 4.2.2.1.1, and in units of shipping containers for examination in 4.2.2.1.2.

4.2.2.1.1 Examination of the material for defects in appearance and workmanship. The sample unit for this examination specified in table II shall be approximately one pound (0.45 kg).

4.2.2.1.2 Examination of the packaging requirements. An examination shall be made in accordance with table III, to determine that packing and marking comply with section 5 requirements. The sample unit for this examination shall be one shipping container fully packed, selected just prior to the closing operation. Shipping containers fully packaged shall be examined for closure defects.

4.2.2.1.3 Inspection levels and acceptable quality levels (AQLs) for examinations. The inspection levels for determining the sample size and the acceptable quality level (AQL) expressed as defects per 100 units shall be as follows:

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Examination paragraph	Inspection level	AQL
4.2.2.1.1	II	2.5
4.2.2.1.2	S-2	2.5

4.2.3 Testing. The material shall be tested for the applicable properties listed in table I in accordance with the test methods specified in table I. The lot size, for the purpose of determining sample size for testing shall be expressed in units of 100 pounds (45 kg) of material. The sample unit of product shall consist of sufficient material to prepare all required specimens. The inspection level shall be S-1, with an acceptance number of zero. The results for each test shall be the averaged results of the specimens, unless only one specimen is required for testing.

4.2.3.1 Classification of tests. All tests shall be classified as follows:

- a. Lot acceptance tests (see 4.2.3.2).
- b. Periodic lot check tests (see 4.2.3.3).
- c. Electrical property tests (see 4.2.3.4).

4.2.3.2 Lot acceptance tests. Lot acceptance tests shall be made on each lot of material and shall be the basis for acceptance or rejection of the lot, except when periodic lot check tests are also required. Lot acceptance tests shall consist of tests for specific gravity, melt flow rate (type I only), and heat deflection temperature.

4.2.3.3 Periodic lot check tests. Periodic lot check tests shall be made on the first lot of material furnished under this specification, and on any subsequent lot specified by the procuring activity (see 6.2). If not specified by the procuring activity, periodic lot check tests shall be repeated at least once every year. Periodic lot check tests shall consist of all tests specified in table I. When periodic lot check tests are made, they shall be included in the basis for acceptance or rejection of the lot.

4.2.3.4 Electrical property tests. Electrical property tests shall be made on any lot specified by the procuring activity (see 6.2), and shall be included in the basis for acceptance or rejection of the lot.

5. PACKAGING

5.1 Packing. Packing shall be level A, or Industrial, as specified (see 6.2).

5.1.1 Level A. Unless otherwise specified, the material shall be packed in one of the following types of containers:

- a. Fiber drums conforming to PPP-D-723, type II, grade A, or type III, grade A in quantities of 200 pounds (90 kg), maximum.
- b. Metal drums conforming to PPP-D-729, type III or type IV, in quantities of 400 pounds (181 kg), maximum.

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Insofar as practical, drums shall be of uniform shape and size, with minimum cube and tare consistent with the protection required. Drums shall contain identical quantities and shall be closed in accordance with the applicable container specification. Fiber drums shall be furnished with a 4 mil thick polyethylene liner properly heat sealed.

5.1.2 Industrial. The material shall be packed in accordance with ASTM D 3951.

5.2 Marking. In addition to any special marking required by the contract or purchase order, shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Polysulfone is used in the electrical and electronic areas for integrated circuit carriers, meter housings, switches and connectors. It is used in automobiles for under-the-hood switch and relay bases and for aircraft-cabin interior parts because of its self-extinguishing and low smoke density characteristics.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Type and class of material.
- c. Physical property requirements if other than in 3.2.
- d. Requirements for CFR resins if applicable (see 3.2.4).
- e. Color and clarity or opaqueness, if required (see 3.3).
- f. Periodic lot check tests, when required (see 4.2.3.3).
- g. Electrical property tests, if required (see 4.2.3.4 and table I).
- h. Level of packing required (see Section 5).

Custodians:

Army - MR
Navy - EC

Preparing Activity:

Army - MR
Project No. 9330-B056

Review Activities:

Army - GL, MD, ER, SM, EA, ME, AR, AV

User Activities:

Army - AT

(WP# ID-0503A/DISK 0010A. FOR AMMRC USE ONLY)

TABLE I. Physical Properties.

Properties	Type I		Type II				Test Method
	(Unreinforced)		(Glass Fiber Reinforced)				
	Class 1 (molding)	Class 2 (extrusion)	Class 1 (10% GFR)	Class 2 (20% GFR)	Class 3 (30% GFR)	Class 4 (40% GFR)	
Electrical:							
Dielectric constant, at 1 MHz, max	3.2	3.2	3.4	3.5	3.5	3.5	ASTM D 150
Dissipation factor, at 1 MHz, max	0.006	0.006	0.005	0.005	0.005	0.005	ASTM D 150
Dielectric strength, 3-mm (1/8-in) specimen, volts per mil, min	350	350	480	480	480	480	ASTM D 149
Mechanical/Physical:							
Specific gravity, at 23°C	1.23-1.25	1.23-1.25	1.33±0.02	1.40±0.02	1.49±0.02	1.57±0.02	ASTM D 792
Izod impact strength, at 22°C of 3-mm (1/8-in) specimen, J/m (ft-lb/in) of notch, min	53 (1.0)	53 (1.0)	48 (0.9)	53 (1.0)	58 (1.1)	64 (1.2)	ASTM D 256
Mold shrinkage, m/m	0.007	0.007	0.004	0.003-0.004	0.002-0.003	0.0015-0.002	ASTM D 955
Tensile elongation at break, %, min	20	20	4	3	2	1.7	ASTM D 638
Tensile strength at yield, MPa (psi), min	65 (9500)	65 (9500)	73 (10,500)	90 (13,000)	96 (14,000)	110 (16,000)	ASTM D 638
Water absorption, 24 h, % max	0.35	0.35	0.50	0.50	0.50	0.50	ASTM D 570
Thermal:							
Coefficient of linear thermal expansion, in/in/°F	3.1 x 10 ⁻⁵	3.1 x 10 ⁻⁵	2.5 x 10 ⁻⁵	1.7 x 10 ⁻⁵	1.4 x 10 ⁻⁵	1.2 x 10 ⁻⁵	ASTM D 696
Heat deflection temperature at 1820 kPa (264 psi), unannealed °C (°F), min	168 (335)	168 (335)	176 (350)	176 (350)	179 (355)	182 (360)	ASTM D 648
Melt flow, at 343°C (650°F), 298 kPa (43 psi), g/10 min	4.5-9.0	2.0-4.5	-----	-----	-----	-----	ASTM D 1238
Flammability ^{1/} :	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0	UL 94

^{1/} This numerical rating is not intended to reflect hazards presented by this material under actual fire conditions.

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TABLE II. Examination for defects in appearance and workmanship.

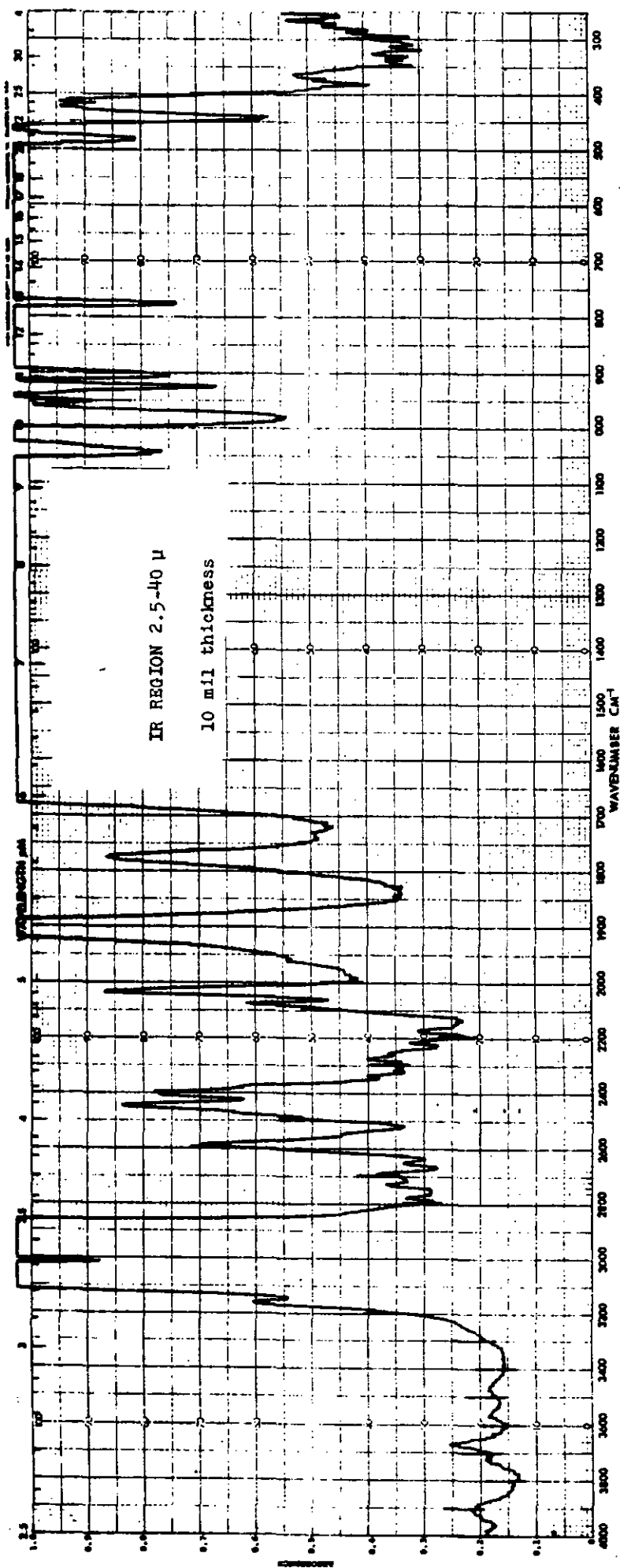
<u>Examine</u>	<u>Defect</u>
Appearance and workmanship	Color not as required.
	Clarity not as required, if specified
	Opaqueness not as required, if specified.
	Form not as required.
	Not clean, presence of foreign material.
	Form or color not uniform.

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TABLE III. Examination of packaging.

Examine	Defect
Packing	Not level specified; not in accordance with contract requirements. Any nonconforming component, component missing, damaged or other defect affecting serviceability. Inadequate application of components such as: incomplete closures of case liners; container flaps, loose or inadequate strappings, bulged or distorted container.
Quantity of material	Less than specified or indicated quantity.
Weight	Gross weight exceeds specified requirements.
Markings	Interior or exterior markings omitted, illegible, incorrect, incomplete, of improper size, location, sequence, method of application, or not in accordance with contract requirements.

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FIGURE 1. Infrared spectrum of polysulfone.

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NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL*(See Instructions - Reverse Side)*

1. DOCUMENT NUMBER MIL-P-46120B		2. DOCUMENT TITLE Plastic Molding and Extrusion Materials, Polysulfone	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify): _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	