



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENOALE, PA. 15096

AMS 3627A

Superseding AMS 3627

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PLASTIC MOLDINGS AND EXTRUSIONS Methyl Methacrylate, Heat-Resistant

1. SCOPE:

- 1.1 Form: This specification covers one type of methyl methacrylate resin in the form of heat-resistant extrusions, compression moldings, and injection moldings.
- 1.2 Application: Primarily for parts requiring good dimensional stability, better heat resistance than that of AMS 3626, a high degree of optical clarity, and good resistance to outdoor weathering. Moldings are applicable to electronic and associated equipment.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

- 2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

- 2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D149 - Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies

ASTM D150 - A-C Loss Characteristics and Dielectric Constant (Permittivity) of Solid Electrical Insulating Materials

ASTM D256 - Impact Resistance of Plastics and Electrical Insulating Materials

ASTM D257 - D-C Resistance or Conductance of Insulating Materials

ASTM D542 - Index of Refraction of Transparent Organic Plastics

ASTM D570 - Water Absorption of Plastics

ASTM D635 - Flammability of Self-Supporting Plastics

ASTM D638 - Tensile Properties of Plastics

ASTM D648 - Deflection Temperature of Plastics Under Flexural Load

ASTM D790 - Flexural Properties of Plastics

ASTM D792 - Specific Gravity and Density of Plastics by Displacement

ASTM D1003 - Haze and Luminous Transmittance of Transparent Plastics

ASTM E308 - Spectrophotometry and Description of Color in CIE 1931 System

- 2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

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3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be an unfilled, heat-resistant, methyl methacrylate resin.

3.2 Color and Condition: Colorless, transparent, unless otherwise specified. When specified, the product shall be furnished translucent or opaque and in the color specified.

3.3 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified test methods insofar as practicable:

3.3.1	Index of Refraction, $n \frac{23^{\circ}\text{C}}{\text{D}} \left(n \frac{73.4^{\circ}\text{F}}{\text{D}} \right)$	1.48 to 1.50	ASTM D542
3.3.2	Specific Gravity, $23^{\circ}/23^{\circ}\text{C}$ ($73.4^{\circ}/73.4^{\circ}\text{F}$), max	1.20	ASTM D792
3.3.3	Haze, max	3%	ASTM D1003
3.3.4	Luminous Transmittance, min	91%	ASTM E308; use 1/8-in. (3.2-mm) thick specimens
3.3.5	Water Absorption (24 hr immersion), max		ASTM D570
	Gain	0.50%	
	Soluble Loss	0.12%	
3.3.6	Heat Distortion Temperature (264 psi (1.82 MPa) Fiber Stress), min		ASTM D648
	Moldings	84°C (183°F)	
	Extrusions	72°C (162°F)	
3.3.7	Tensile Strength, min		ASTM D638
	Moldings	8600 psi (59.3 MPa)	
	Extrusions	7300 psi (50.3 MPa)	
3.3.8	Flexural Strength, min		ASTM D790
	Moldings	13,000 psi (89.6 MPa)	
	Extrusions	11,000 psi (75.8 MPa)	
3.3.9	Impact Resistance, min		ASTM D256
	Ft-lb per in. of notch	0.2	
	(N·m per metre of notch)	(10.7)	
3.3.10	Insulation Resistance, megohms, min	1.0×10^7	4.5.1
3.3.11	Dielectric Strength, min		ASTM D149
	Short-time	400 V per mil (15,750 V/mm)	
	Step-by-step	350 V per mil (13,780 V/mm)	
3.3.12	Dielectric Breakdown, min		4.5.2
	Short-time	50 kV	
	Step-by-step	45 kV	

- 3.3.13 Dielectric Constant, max ASTM D150
 At 1×10^6 Hz 3.3
 At 30×10^6 Hz 2.9
- 3.3.14 Dissipation Factor, max ASTM D150
 At 1×10^6 Hz 0.03
 At 30×10^6 Hz 0.02
- 3.3.15 Flammability, max 2.4 in. per min. ASTM D635
 (See 8.2) (61 mm/min.)
- 3.3.16 Weathering: When specified, the product shall have weather resistance acceptable to the purchaser, determined by a procedure agreed upon by purchaser and vendor.
- 3.3.17 Corrosion: The product shall not have a corrosive effect on other materials when exposed to conditions normally encountered in service. Discoloration of metal shall not be considered objectionable.
- 3.4 Quality: The product shall be uniform in quality and condition, clean, sound, smooth, and free from foreign materials and from internal and external imperfections detrimental to fabrication, appearance, or performance of parts.
4. QUALITY ASSURANCE PROVISIONS:
- 4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.
- 4.2 Classification of Tests:
- 4.2.1 Acceptance Tests: Tests to determine conformance to index of refraction (3.3.1), specific gravity (3.3.2), water absorption (3.3.5), heat distortion temperature (3.3.6), impact resistance (3.3.9), and dielectric strength (3.3.11) requirements are classified as acceptance tests.
- 4.2.2 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests.
- 4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, qualification test material shall be submitted to the cognizant qualification agency as directed by the procuring activity, the contracting officer, or the request for procurement.
- 4.3 Sampling: Sufficient product shall be selected from each lot to perform each acceptance test on at least one specimen; a lot shall be all product produced in a single production run from the same batch of raw materials under the same fixed conditions and submitted for vendor's inspection at one time.
- 4.4 Approval:
- 4.4.1 Sample material shall be approved by purchaser before material for production use is supplied, unless such approval be waived. Results of tests on production material shall be essentially equivalent to those on the approved sample.
- 4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production material which are essentially the same as those used on the approved sample material. If any change is necessary in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material and processing and, when requested, sample material. Production material made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Insulation Resistance:

4.5.1.1 Attachment of Lead Wires: Drill necessary holes and solder lead wires into the holes, using a pencil-type soldering iron or gun and water-white, unactivated resin flux, filling the hole with a plug of solder. Remove excess flux and other contaminants by rinsing in a clean mixture of 90% ethanol and 10% distilled water by volume. Air dry. Care should be exercised to avoid touching critical areas of the clean specimen with bare hands.

4.5.1.2 Insulation Resistance Measurement: Mount test specimens and expose for $18 \text{ hr} \pm 1$ in a circulating-air humidity chamber (provided with suitable specimen lead wire insulators on the chamber) maintained at $92\% \pm 2$ relative humidity and $65^\circ \text{C} \pm 2$ ($149^\circ \text{F} \pm 4$). Lower the relative humidity to $87\% \pm 2$ while holding the temperature constant and stabilize the specimens at this condition for $2 - 2\frac{1}{4}$ hours. Apply 500 V DC between terminal leads and maintain electrification time for 1 min. ± 0.1 . Immediately thereafter, measure insulation resistance in accordance with ASTM D257, using a megohm bridge (General Radio Type 544B or equivalent). Measurements shall be performed while the relative humidity is $87\% \pm 1$.

4.5.2 Dielectric Breakdown: Test specimens shall be nominally $\frac{1}{2}$ in. (13 mm) thick by 4 in. (100 mm) square. They shall have two $\frac{3}{16}$ -in. (5 mm) diameter through-holes, centrally located 1 in. (25 mm) apart, and perpendicular to the face of the specimens. Each specimen shall have three pairs of such holes, at random locations, spaced no closer than 1 in. (25 mm) apart. Holes shall be reamed to fit No. 3 American Standard tapered pins which serve as electrodes. The electrodes shall be fitted with $\frac{1}{2}$ -in. (13-mm) diameter spheres on the extremities, to decrease the tendency to flashover during test. Perform dielectric breakdown test in accordance with procedures and apparatus described in ASTM D149.

4.6 Reports:

4.6.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the product conforms to the other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, vendor's compound number, form and size or part number, and quantity.

4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, supplier's material designation, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.7 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Product Identification:

5.1.1 Molded Parts: Each molded part of suitable size shall have the part number molded or permanently impressed therein. If size precludes integral marking, parts of each different part number shall be packed in separate, suitable containers marked with the part number.