

# AERONAUTICAL MATERIAL SPECIFICATIONS

## AMS 3581

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Revised

### PLASTIC CASTINGS Methyl Methacrylate Heat Resistant

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. FORM: Cast rods, tubes, and shapes.
3. APPLICATION: Primarily for fabricated parts, formed or otherwise, requiring dimensional stability, improved heat resistance, optical clarity, good electrical properties, and excellent outdoor weatherability.
4. MATERIAL: The product shall be made from pure methacrylate monomers.
5. CONDITION: Unless otherwise specified, castings shall have a highly polished surface finish.
6. TECHNICAL REQUIREMENTS:
  - 6.1 General:
    - 6.1.1 Color: Unless otherwise specified, a colorless, transparent product shall be furnished. When so stipulated, the product shall be furnished transparent, translucent, or opaque, in the color specified.
    - 6.1.2 Weathering: When specified, the product shall have weather resistance acceptable to the purchaser as determined by a procedure agreed upon by purchaser and vendor.
    - 6.1.3 Corrosion: The product shall not have a corrosive effect on other materials when exposed to conditions normally encountered in service.
  - 6.2 Properties: The product shall conform to the following requirements: tests shall be performed on the product supplied and in accordance with listed ASTM methods, insofar as practicable.
 

6.2.1 Index of Refraction, $n \frac{73.4 F}{D}$	1.48 to 1.50	ASTM D542-50
(applicable to clear material only)		
6.2.2 Specific Gravity, $73.4/73.4 F$ (unpigmented)	1.18 to 1.20	ASTM D792-50, Method A
6.2.3 Haze, %, max (applicable to clear sections 1/2 in. thick and under only)	3.0	ASTM D1003-52, Procedure A
6.2.4 Luminous Transmittance, %, min 0.250 in. thick and under	90	ASTM D791-54

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6.2.5	Water Absorption at 73.4 F, % gain, max (1/8 in. thick specimen)	0.65	ASTM D570-54T
6.2.6	Heat Distortion Temperature (264 psi Fiber Stress), deg Fahr, min Nominal Thickness, in.		ASTM D648-56 Heating Rate: 3.6 F per min
	0.06 and under	186	
	1.0	190	
	2.0 and over	194	
	(For intermediate thicknesses, use linear interpolation.)		
6.2.7	Tensile Strength at 73.4 F, psi, min	7500	ASTM D638-56T
6.2.8	Elongation, %, min	2	ASTM D638-56T
6.2.9	Flexural Strength, psi, min	14,000	ASTM D790-49T
6.2.10	Impact Resistance, ft-lb per in. of notch, min	0.3	ASTM D256-56, Method C
6.2.11	Insulation Resistance, megohms, min	$1.0 \times 10^7$	ASTM D257-57T, Fig. 3. (See Note 1)
6.2.12	Dielectric Strength, v per mil, min Short-time	400	ASTM D149-55T (Specimens shall be 1/8 in. thick)
6.2.13	Dielectric Breakdown, kv, min Short-time (Applicable to 1/2 in. thick and heavier material only)	50	ASTM D149-55T (See Note 2)
6.2.14	Dielectric Constant at $10^6$ cycles, max	3.1	ASTM D150-54T
6.2.15	Dissipation Factor at $10^6$ cycles, max	0.03	ASTM D150-54T
6.2.16	Flammability, in. per min., max	2.4	ASTM D635-56T (Specimens shall be 1/8 in. thick)

## Note 1.

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

Note 2. Test specimens shall be 1/2 in. thick by 4 in. square. They shall have two 3/16 in. diameter through holes, centrally located 1 in. 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. apart. Holes shall be reamed to fit No. 3 American Standard tapered pins, which serve as electrodes. The electrodes shall be fitted with 1/2 in. diameter spheres on the extremities, to decrease the tendency to flashover during test. Perform dielectric breakdown test in accordance with procedure and apparatus described in ASTM D149-55T.

7. QUALITY: The product shall be uniform in quality and condition, clean, smooth, and free from foreign materials and from internal and external imperfections detrimental to fabrication, appearance, or performance of parts.

8. TOLERANCES: Unless otherwise specified, the following tolerances apply.

8.1 Rods:

Nominal Diameter Inches	Tolerances, Inch Plus and Minus
0.375 to 0.625, incl (See Note 3)	0.005
Over 0.625 to 1.250, incl	0.010
Over 1.250 to 2.000, incl	0.015
Over 2.000 to 3.000, incl	0.030

Note 3. These rods are machined and may have a frosted finish.

8.2 Tubes:

8.2.1 Outside Diameter:

Nominal OD Inches	OD Tolerance, Inch		Difference Between Max and Min OD Not to Exceed (Inch)
	Plus	Minus	
1.500 to 3.000, incl	0.010	0.020	0.025
Over 3.000 to 3.750, incl	0.015	0.030	0.040
Over 3.750 to 6.094, incl	0.015	0.045	0.060
Over 6.094 to 12.060, incl	0.015	0.065	0.080

8.2.2 Wall Thickness:

Nominal Wall Thickness Inch	Tolerance, Inch Plus and Minus
0.125 and under	0.015
Over 0.125 to 0.187, incl	0.019
Over 0.187 to 0.250, incl	0.025
Over 0.250 to 0.375, incl	0.035
Over 0.375 to 0.500, incl	0.045

9. REPORTS:

9.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report stating that the product meets the requirements of this specification. This report shall include the purchase order number, material specification number, form, size or part number, and quantity.