

AERONAUTICAL MATERIAL SPECIFICATIONS

AMS 3609

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

Issued 8-15-58
Revised

PLASTIC SHEET
Methyl Methacrylate
Heat Resistant

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. **FORM:** Cast sheets.
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, sheets 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 sheets 1/2 in. thick and under only)	3.0	ASTM D1003-52, Procedure A

including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no attempt to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the reports

Section 7C of the SAE Technical Board rules provides that: "All technical reports including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no attempt to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the reports

6.2.4	Luminous Transmittance, %, min Nominal Thickness, in. 0.187 and under Over 0.187 to 1.000, incl Over 1.000 to 2.000, incl (applicable to clear and colorless sheets only)	91 89 87	ASTM D791-54
6.2.5	Displacement Factor (Optical), max Nominal Thickness, in. 0.060 to 0.250, incl Over 0.250 to 0.500, incl Over 0.500 to 1.000, incl Over 1.000 to 2.000, incl (applicable to flat sheets only)	50 50* 30* 125*	ASTM D637-50 (*Measurements to be made at least 3 in. from edge of sheet)
6.2.6	Water Absorption at 73.4 F, % gain, max (1/8 in. thick specimen)	0.65	ASTM D570-54T
6.2.7	Heat Distortion Temperature (264 psi Fiber Stress), deg Fahr, min Nominal Thickness, in. 0.06 and under 1.0 2.0 and over (For intermediate thicknesses, use linear interpolation)	186 190 194	ASTM D648-56 Heating Rate: 3.6 F per min.
6.2.8	Tensile Strength at 73.4 F, psi, min	7500	ASTM D638-56T
6.2.9	Elongation, %, min	2	ASTM D638-56T
6.2.10	Flexural Strength, psi, min	14,000	ASTM D790-49T
6.2.11	Impact Resistance, ft-lb per in. of notch, min	0.3	ASTM D256-56, Method C
6.2.12	Insulation Resistance, megohms, min	1.0×10^7	ASTM D257-57T, Fig. 3 (See Note 1)
6.2.13	Dielectric Strength, v per mil, min Short-time	400	ASTM D149-55T (Specimens shall be 1/8 in. thick)
6.2.14	Dielectric Breakdown, kv, min Short-time (applicable to 1/2 in. thick and heavier sheet only)	50	ASTM D149-55T (See Note 2)
6.2.15	Dielectric Constant at 10^6 cycles, max	3.1	ASTM D150-54T
6.2.16	Dissipation Factor at 10^6 cycles, max	0.03	ASTM D150-54T
6.2.17	Flammability, in. per min., max	2.4	ASTM D635-56T (Specimens shall be 1/8 in. thick)
6.2.18	Shrinkage, %, max	1.0	See Note 3

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 $2 - 2\frac{1}{4}$ 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 $\frac{1}{2}$ in. thick by $\frac{1}{4}$ in. square. They shall have two $\frac{3}{16}$ 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 $\frac{1}{2}$ in. 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 D149-55T.

Note 3. Using a 12 x 18 in. test specimen, at one end mark off a 12 x 12 in. test area and use the remainder of the specimen for supporting attachments during the heating period. Scribe 2 fine lines at right angles to each other entirely across the test area from the mid-points of opposite sides. Across each of these lines scribe fine gage marks 2 in. in from the edges of the test area. Measure and average the distances between these pairs of gage marks to the nearest 0.01 inch. Suspend the specimen from the support end in a circulating air oven and heat for 30 min. at $284\text{ F} \pm 2$. For thicknesses above 0.250 in., extend the time in proportion to 1.3 times the direct ratio of the thickness to 0.250 inch. Remove the specimen from the oven and allow to cool to room temperature while still suspended. Remeasure the distance between the pairs of gage marks and average the results. Calculate the shrinkage as the percentage change in distance between gage marks based upon the original distance.

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.

Nominal Thickness Inches	Tolerance, Inch		
	Plus and Minus, Except as Indicated		
	Size 1	Size 2	Size 3
0.060 and under	+0.020 -0.012	--	--
Over 0.060 to 0.080, incl	+0.018 -0.012	0.030	--
Over 0.080 to 0.100, incl	0.012	0.030	--
Over 0.100 to 0.125, incl	0.015	0.030	0.050
Over 0.125 to 0.150, incl	0.017	0.030	0.050
Over 0.150 to 0.187, incl	0.020	0.030	0.05Q
Over 0.187 to 0.220, incl	0.025	0.030	0.050
Over 0.220 to 0.250, incl	0.030	0.035	0.050
Over 0.250 to 0.312, incl	0.035	0.040	0.060
Over 0.312 to 0.375, incl	0.045	0.045	0.070
Over 0.375 to 0.500, incl	0.060	0.060	0.080
Over 0.500 to 0.625, incl	0.065	0.065	0.085
Over 0.625 to 0.750, incl	0.070	0.070	0.090
Over 0.750 to 0.875, incl	0.075	0.075	0.095
Over 0.875 to 1.000, incl	0.080	0.080	0.100
Over 1.000 to 1.125, incl	0.100	--	--
Over 1.125 to 1.250, incl	0.100	--	--
Over 1.250 to 1.375, incl	0.120	--	--
Over 1.375 to 1.500, incl	0.120	--	--
Over 1.500 to 1.625, incl	0.140	--	--
Over 1.625 to 1.750, incl	0.140	--	--
Over 1.750 to 1.875, incl	0.160	--	--
Over 1.875**	0.160	--	--

** Sheets 2.000 in. thick and over are available in 0.250 in. increments to a maximum thickness of 4.000 in. (unfinished grade) with a tolerance of ± 0.080 in. per in. of nominal thickness.