



# AEROSPACE MATERIAL

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

## SPECIFICATION

### AMS 3608A

Superseding AMS 3608

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#### PLASTIC SHEET Methyl Methacrylate, General Purpose

#### 1. SCOPE:

- 1.1 Form: This specification covers one grade of cast methyl methacrylate plastic in the form of sheet.
- 1.2 Application: Primarily for fabricated parts, formed or otherwise, requiring dimensional stability, optical clarity, and excellent outdoor weatherability.
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 D256 - Impact Resistance of Plastics and Electrical Insulating Materials
- ASTM D542 - Index of Refraction of Transparent Organic Plastics
- ASTM D570 - Water Absorption of Plastics
- ASTM D635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
- ASTM D637 - Surface Irregularities of Flat Transparent Plastic Sheets
- ASTM D638 - Tensile Properties of Plastics
- ASTM D648 - Deflection Temperature of Plastics Under Flexural Load
- 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

#### 3. TECHNICAL REQUIREMENTS:

- 3.1 Material: Shall be made from pure methacrylate monomers.
- 3.2 Color and Condition: Colorless and transparent with a highly polished surface finish, unless otherwise specified, except that, when so ordered, sheet shall be transparent, translucent, or opaque, in the color specified.

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade or their use by governmental agencies is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment 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 report are responsible for protecting themselves against liability for infringement of patents."

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

3.3.1 Index of Refraction:  $n \frac{23^{\circ}\text{C}}{\text{D}}$  ( $n \frac{73.4^{\circ}\text{F}}{\text{D}}$ ) 1.48 to 1.50 ASTM D542  
(Applicable only to clear sheet)

3.3.2 Specific Gravity, 23°/23° C (73°/73° F) 1.18 to 1.20 ASTM D792, Method A

3.3.3 Haze, max 3.0% ASTM D1003, Procedure A  
(Applicable only to clear sheet 1/2 in. (13 mm) and under in nominal thickness)

3.3.4 Water Absorption (gain) at 23° C (73° F), max (specimens 1/8 in. (3.2 mm) in nominal thickness) 0.65% ASTM D570

3.3.5 Luminous Transmittance, min ASTM E308  
(Applicable to transparent, colorless sheet only)

| Nominal Thickness         |                           |     |
|---------------------------|---------------------------|-----|
| Inches                    | (Millimetres)             |     |
| Up to 0.187, incl         | Up to 4.75, incl          | 91% |
| Over 0.187 to 1.000, incl | Over 4.75 to 25.40, incl  | 89% |
| Over 1.000 to 2.000, incl | Over 25.40 to 50.80, incl | 87% |

3.3.6 Displacement Factor (Optical), max ASTM D637  
(Applicable to flat sheets only)  
Nominal Thickness  
Inches (Millimetres)  
(\*Measurement made at least 3 in. (76.2 mm) from the edge of sheet)

|                           |                             |      |
|---------------------------|-----------------------------|------|
| 0.060 to 0.250, incl      | (1.52 to 6.35, incl)        | 50   |
| Over 0.250 to 0.500, incl | (Over 6.35 to 12.70, incl)  | 50*  |
| Over 0.500 to 1.000, incl | (Over 12.70 to 25.40, incl) | 80*  |
| Over 1.000 to 2.000, incl | (Over 25.40 to 50.80, incl) | 125* |

3.3.7 Heat Distortion Temperature, min ASTM D648  
(264 psi (1.82 MPa) fiber stress)  
Nominal Thickness  
Inch (Millimetres)  
(Heating Rate 2° C (3.6° F) per min)

|                  |                   |                  |
|------------------|-------------------|------------------|
| Up to 0.06, incl | (Up to 1.5, incl) | 61.5° C (143° F) |
| 1.0              | (25.4)            | 70° C (158° F)   |
| 2.0 and over     | (25.4 and over)   | 71.5° C (161° F) |

(For intermediate thicknesses, use linear interpolation)

3.3.8 Tensile Strength, min 6800 psi (46.9 MPa) ASTM D638

3.3.9 Elongation, min 2% ASTM D638

3.3.10 Impact Resistance, per unit of notch, min 0.3 ft-lb per in. (16J/m) ASTM D256, Method C

3.3.11 Flammability, max  
(See 8.2)

2.4 in. per min.  
(1.02 mm/s)

ASTM D635;  
Use specimens  
1/8 in. (3.2 mm)  
in nominal thickness

3.3.12 Shrinkage, max

1.0%

4.5.1

3.3.13 Weathering: When specified, sheet shall have weather resistance acceptable to the purchaser, determined by a procedure agreed upon by purchaser and vendor.

3.3.14 Corrosion: Sheet 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: Sheet 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.

3.5 Tolerances: Unless otherwise specified, thickness tolerances shall be as specified in Table I.

TABLE I

| Nominal Thickness<br>Inches | Tolerance, Inch                     |                       |        |
|-----------------------------|-------------------------------------|-----------------------|--------|
|                             | Plus and Minus, Except as Indicated |                       |        |
|                             | Size 1                              | Size 2<br>(See 3.5.1) | Size 3 |
| Up to 0.060, incl           | +0.020<br>-0.012                    | --                    | --     |
| Over 0.060 to 0.080, incl   | -0.018<br>-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                 | 0.050  |
| 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 1.250, incl   | 0.100                               | --                    | --     |
| Over 1.250 to 1.500, incl   | 0.120                               | --                    | --     |
| Over 1.500 to 1.750, incl   | 0.140                               | --                    | --     |
| Over 1.750 (See 3.5.2)      | 0.160                               | --                    | --     |

TABLE I (SI)

| Nominal Thickness<br>Millimetres | Tolerance, Millimetres<br>Plus and Minus, Except as Indicated |        |        |
|----------------------------------|---------------------------------------------------------------|--------|--------|
|                                  | Size 1                                                        | Size 2 | Size 3 |
| Up to 1.52, incl                 | +0.51<br>-0.30                                                | --     | --     |
| Over 1.52 to 2.03, incl          | +0.46<br>-0.30                                                | 0.76   | --     |
| Over 2.03 to 2.54, incl          | 0.30                                                          | 0.76   |        |
| Over 2.54 to 3.18, incl          | 0.38                                                          | 0.76   | 1.27   |
| Over 3.18 to 3.81, incl          | 0.43                                                          | 0.76   | 1.27   |
| Over 3.81 to 4.75, incl          | 0.51                                                          | 0.76   | 1.27   |
| Over 4.75 to 5.59, incl          | 0.64                                                          | 0.76   | 1.27   |
| Over 5.59 to 6.35, incl          | 0.76                                                          | 0.88   | 1.27   |
| Over 6.35 to 7.92, incl          | 0.88                                                          | 1.02   | 1.52   |
| Over 7.92 to 9.23, incl          | 1.14                                                          | 1.14   | 1.78   |
| Over 9.23 to 12.70, incl         | 1.27                                                          | 1.29   | 2.03   |
| Over 12.70 to 15.88, incl        | 1.65                                                          | 1.65   | 2.16   |
| Over 15.88 to 19.05, incl        | 1.78                                                          | 1.78   | 2.29   |
| Over 19.05 to 22.22, incl        | 1.91                                                          | 1.91   | 2.42   |
| Over 22.22 to 25.40, incl        | 2.03                                                          | 2.03   | 2.54   |
| Over 25.40 to 31.75, incl        | 2.54                                                          | --     | --     |
| Over 31.75 to 38.10, incl        | 3.04                                                          | --     | --     |
| Over 38.10 to 44.45, incl        | 3.56                                                          | --     | --     |
| Over 44.45 (See 3.5.2)           | 4.06                                                          | --     | --     |

## 3.5.1 Sizes 1, 2 and 3 are as follows:

Size 1: Up to and including 36 x 60 in. (910 x 1524 mm) and 40 x 50 in. (1016 x 1270 mm).

Size 2: Larger than size 1 up to and including 53 x 60 in. (1346 x 1524 mm) and 60 x 72 in. (1524 x 1829 mm).

Size 3: Larger than size 2 up to and including 67 x 102 in. (1702 x 2591 mm) and 72 x 72 in. (1829 x 1829 mm).

3.5.2 Sheet 2.000 in. (50.80 mm) and over in nominal thickness is available in 0.250 in. (6.35 mm) increments to a maximum thickness of 4.000 in. (101.60 mm) (unfinished grade) with a tolerance of  $\pm 0.080$  in. per in. ( $\pm 0.080$  mm/mm) of nominal thickness.

4. QUALITY ASSURANCE PROVISION

4.1 Responsibility for Inspection: The vendor of sheet 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 sheet conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for specific gravity (3.3.2), water absorption (3.3.4), heat distortion temperature (3.3.7) and impact resistance (3.3.10) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed on the initial shipment of sheet to a purchaser, when a change in material or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient product shall be taken at random from each lot to perform all required tests. The number of tests for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.1 A lot shall be all sheet of the same nominal thickness produced from the same batch of raw material in a single production run under the same fixed conditions and presented for vendor's inspection at one time but shall not exceed 1500 sq ft (140 m<sup>2</sup>).

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6.1 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample sheet shall be approved by purchaser before sheet for production use is supplied, unless such approval be waived. Results of tests on production sheet 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 sheet which are essentially the same as those used on the approved sample sheet. 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 sheet. Production sheet made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Shrinkage: Using a 12 x 18 in. (300 x 450 mm) test specimen, at one end mark off a 12 x 12 in. (300 x 300 mm) test area and use the remainder of the specimen for supporting attachments during the heating period. Scribe two fine lines at right angles to each other entirely across the test area from the midpoints of opposite sides. Across each of these lines, scribe fine gage marks 2 in. (50 mm) in from the edges of the test area. Measure and average the distances between these pairs of gage marks to the nearest 0.01 in. (0.3 mm). Suspend the specimen from the support end in a circulating-air oven and heat for 30 min.  $\pm 1$  at  $125^{\circ}\text{C} \pm 1$  ( $257^{\circ}\text{F} \pm 2$ ). For nominal thicknesses over 0.250 in. (6.35 mm), extend the time in proportion to 1.3 times the direct ratio of the thickness to 0.250 in. (6.35 mm). 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.