

# AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.  
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Revised

### PLASTIC SHEET, POST-FORMING Cotton Fabric Reinforced Phenol-Formaldehyde

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1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. **APPLICATION:** The sheet, with mechanical and impact properties predominating, is primarily intended for drawing and bending into formed parts by the post-forming method.
3. **MATERIAL AND FABRICATION:** Flat sheets, consisting of laminations of cotton fabric which have been impregnated with a thermosetting, phenolic type of synthetic resin, and properly cured.
4. **TECHNICAL REQUIREMENTS:** (a) General.-
  - (1) **Color.-** Unless otherwise specified the color shall be natural. Supplementary coloring, when specified, shall be substantially uniform throughout the sheet. The faces of the sheets shall be free from streaks or stains.
  - (2) **Finish.-** The finish of all sheets shall be semi-gloss.
  - (3) **Weathering.-** When specified, a weathering test shall be conducted as agreed between the purchaser and the vendor.
  - (4) **Corrosion.-** The sheet and parts made therefrom shall not have a corrosive or other deleterious effect on other materials when exposed to conditions normally encountered in the operation of aircraft. Discoloration of metals shall not be considered objectionable.(b) **Physical Properties.-** The sheet shall conform to the following requirements as received unless otherwise indicated:

	<u>Warp</u> <u>Min</u>	<u>Fill</u> <u>Min</u>	<u>Test</u> <u>Method</u>
Tensile Strength, psi	7,500	7,500	ASTM D229-43
Modulus of Elasticity in Tension, psi	910,000	940,000	ASTM D638-44T
Ultimate Compressive Strength Flatwise, psi	30,000	30,000	ASTM D229-43
Flexural Strength, Flatwise, psi	16,000	16,000	ASTM D790-45T
Impact Strength, Edgewise, (Notched Izod) ft-lb per in. of notch	1.5	1.5	ASTM D256-43T

tion 7C of the SAE Technical Board rules provides that: "All technical reports, including reports prepared and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adopt 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."

	<u>Value</u>	<u>Test Method</u>
Density, g per cc	1.35 ± 0.05	ASTM D634-41T
Water Absorption, (24 hr immersion) per cent., max		ASTM D570-42
1/32 in. thickness	7.5	
1/16	4.4	
3/32	3.2	
1/8	2.5	
3/16	1.9	
1/4	1.6	
3/8	1.4	

(c) Bending Test.- A one inch wide specimen cut from any direction of sheet shall not split, crack, craze or delaminate when bent 180 degrees at room temperature around a diameter equal to 80 times the nominal thickness of the sheet.

(d) Post-Forming Test.- Specimens 6-in. square shall be heated in a forced-circulation type air oven at 475 to 525 F for the optimum time within the limits given below. Following the heating period, the specimens shall be immediately (within 10 seconds) bent (with an inside radius as specified) between wooden or cast resin forms to a 90 degree angle. The specimens shall be allowed to cool in the forms.

<u>Thickness inches</u>	<u>Heating Time Range Limits<sup>a</sup> seconds</u>	<u>Inside Radius, inches</u>
1/32	20 to 30	1/32
1/16	40 to 60	3/32
3/32	60 to 90	3/16
1/8	80 to 120	5/16
3/16	130 to 200	9/16
1/4	180 to 260	1
3/8	275 to 410	2-1/4

<sup>a</sup>The optimum heating time for each acceptable material shall have at least a five second spread within the acceptable time range limits. The manufacturer shall record the optimum time for his material as provided in paragraphs 8 and 10.

After the heating period, and after bending and cooling the specimens shall show no signs of splitting, cracking, crazing, blistering, or delamination. After removal from the forms, the specimens shall retain an angle not over 93 degrees. These forming requirements shall be met by bends made in any direction with respect to the warp threads.

(e) Drawing Test.- Specimens 6 in. in diameter shall be heated as specified in paragraph 4(d). Following the heating period the specimens shall be drawn in a suitable jig having a steel mandrel and draw ring. The mandrel (male die) shall be a 3-in. diameter cylinder with a 1-1/2 in. spherical radius on the contact end. The draw ring (female die) shall have a cylindrical hole (diameter equal to 3 in. + 2-1/2 x thickness of sheet) through which the mandrel travels in making the draw, and shall be maintained at a temperature of 275 to 300 F. A draw radius of 1/8 in. shall be provided on the inside of the draw ring. The specimen shall be clamped at 20 psi against the draw ring before the draw begins. Under these conditions, the sheet shall produce satisfactory draws as follows:

Thickness, inches	Depth of Draw, inches
1/16	1
3/32	13/16
1/8	5/8

5. **QUALITY:** (a) The sheet shall be uniform in quality and condition, free from blisters, wrinkles, cracks, crazing and surface roughness, and reasonably free from other small defects such as scratches and dents. Sheet in which harmful defects are revealed during fabrication will be subject to rejection.

(b) Sheet, at room temperature, shall not split, crack, chip or delaminate when punched in thickness up to and including 3/16 in. or when drilled, sawed or machined in any thickness.

6. **SIZES AND TOLERANCES:** Unless otherwise specified, the following shall apply:

(a) **Sizes.-** Sheets shall be furnished in manufacturers' standard sheet sizes. The length and width of sheets may vary  $\pm 1$  in. from the nominal dimensions.

(b) **Thickness.-** Standard thicknesses and tolerances shall be as follows:

Thickness, inches	Tolerance, inches
1/32	$\pm 0.0065$
3/64	$\pm 0.0075$
1/16	$\pm 0.0075$
3/32	$\pm 0.009$
1/8	$\pm 0.010$
5/32	$\pm 0.011$
3/16	$\pm 0.0125$
7/32	$\pm 0.014$
1/4	$\pm 0.030$
	-0.000
5/16	$\pm 0.035$
	-0.000
3/8	$\pm 0.040$
	-0.000

(c) **Warp and Twist.-** The warp and twist are determined by suspending the sheet in a vertical position against a horizontal straight edge at least 36 in. long and measuring the greatest deviation. The deviation from the straight edge shall not exceed 1% for thicknesses up to and including 1/4 in., or 0.5% for thicknesses over 1/4 in. and including 1/2 in. Warp or twist shall be stated as a percentage of the 36 inch length in the direction measured.