

AERONAUTICAL MATERIAL SPECIFICATION

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PLASTIC SHEET, COPPER FACED
Paper Reinforced Phenol-Formaldehyde

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. APPLICATION: Primarily for use in etched, printed circuits used in electrical and electronic equipment.
3. MATERIAL AND FABRICATION: The sheets shall be constructed of laminations of a suitable paper base thoroughly impregnated with a suitable phenolic resin and properly cured. Face sheets of copper foil may be applied to one or both faces during the original curing of the laminate or in a subsequent operation.

4. TECHNICAL REQUIREMENTS:

4.1 General:

4.1.1 Color: Unless otherwise specified, the color of the plastic laminate shall be natural.

4.1.2 Copper Foil Faces: The facing material shall be electrolytically deposited copper of not less than 99.50% purity.

4.2 Properties: Unless otherwise specified, 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. All tests except bond strength and solder bath resistance shall be performed on material from which the copper foil has been removed by etching in a solution of 40-50% ferric chloride. Unless otherwise specified, specimens shall be conditioned in accordance with ASTM D618-53, procedure A, after removal of the copper faces.

4.2.1 Flexural Strength, flatwise, psi, min 10,500 ASTM D790-49T

4.2.2 Compressive Strength, flatwise, psi, min 25,000 ASTM D229-49

4.2.3 Water Absorption in 24 hr, %, max ASTM D570-54T

Nominal Thickness, in. (See Note 1)

0.031	1.3
0.062	1.0
0.125	0.75

4.2.4 Dielectric Strength perpendicular to laminations, step by step, v per mil, min ASTM D149-44

Nominal Thickness, in. (See Note 1)

0.031	650
0.062	460
0.125	320

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4.2.5	Dielectric Constant at 1 megacycle, max	4.60	ASTM D150-54T
4.2.6	Solder Bath Resistance	Pass	See Note 2
4.2.7	Bond Strength, lb per in. width, min average individual		See Note 3
	Nominal Foil Thickness, in		
	0.0014	4	3
	0.0028	5	4

Note 1. For thicknesses not specified use the value for the next lower thickness.

Note 2. Solder Bath Resistance: Three specimens 1 in. square by the thickness of the material shall be tested. The specimens shall be dipped in liquid flux (rosin in alcohol) and then floated on the surface of a bath of molten solder, with the copper face to be tested down. The solder shall be at a temperature of $425\text{ F} + 10$. After 10 sec the specimen shall be removed from the solder bath and examined. The material shall not soften, split, blister, or delaminate. For material with copper on both sides, three specimens shall be tested for each side.

Note 3. Bond Strength: The strength of the bond between the copper foil and the base laminate shall be determined at 70-85 F in accordance with the following procedure. Four 1 x 4 in. specimens, two in the lengthwise direction and two in the crosswise direction, shall be cut from a sheet. The copper foil shall be peeled back from one end of the specimen for approximately 1 in., with the line of peel perpendicular to the edge of the specimen. The specimen shall be supported in a horizontal plane with the peeled copper strip down between two solid supports adjusted to provide a 3/4 in. span. The end of the peeled strip shall then be clamped between two knurled jaws to which is attached a light container. The total weight of the clamp and the container shall not exceed 1 pound. The jaws shall cover the full width of the strip and shall be clamped parallel to the line of peel. Sand shall be poured into the container at a rate of approximately 2 lb per min. until the strip begins to peel, and the container shall then be weighed. The full width of the strip shall peel, otherwise the results shall be discarded and the test repeated. For sheets that are copper faced on both sides, eight specimens shall be tested, four on each side.

5. QUALITY: The product shall be uniform in quality and condition and free from blisters, cracks, holes, cuts, wrinkles, delamination, unbonded areas, corrosion, excess bonding material, and other defects. Discoloration of the copper faces shall not be considered objectionable. The bonded copper faces shall be smooth.

6. SIZES AND TOLERANCES:

6.1 Length and Width: The length and width shall not vary more than plus 1.0 in. and minus 0 from that ordered except where test specimens have been removed; no more than 4 sq ft shall be cut from each thickness in a shipment for testing, and the size of the portion of material removed shall be stated on the outside of the package.

6.2 Thickness:

6.2.1 Copper face standard thicknesses and tolerances shall be as follows:

Nominal Thickness Inch	Tolerance, Inch	
	Plus	Minus
0.0014	0.0004	0.0002
0.0028	0.0007	0.0003

6.2.2 Sheet Thickness: The total thickness of the finished sheet, including copper faces, shall be in accordance with the following; unless otherwise specified, material conforming to the normal thickness tolerances shall be furnished. When other thicknesses are specified use the tolerance for the next greater thickness.

6.2.2.1 Normal Thickness Tolerances:

6.2.2.1.1	Nominal Thickness Inch	Tolerance, Inch
		Plus and Minus
	0.031	0.0065
	0.062	0.0075
	0.125	0.012

6.2.2.1.2 At least 90% of the sheet shall be within the tolerance given and at no point shall the thickness vary from the nominal thickness by a value greater than 125% of the specified tolerance.

6.2.2.2 Close Thickness Tolerances:

Nominal Thickness Inch	Tolerance, Inch
	Plus and Minus
0.031	0.002
0.062	0.002
0.066	0.002
0.125	0.003

6.2.3 Warp and Twist: Shall not exceed the following values, based on 36 in. length, when determined in accordance with ASTM D709-52T:

Nominal Sheet Thickness Inch	Warp or Twist, %, max		
	Copper on One Side Only		Copper on Both Sides Both Thicknesses
	0.0014 in.	0.0028 in.	
0.031	20	24	6
0.062	15	18	6
0.125	10	12	3