

POLYESTER FILM, COPPER CLAD

1. SCOPE:

1.1 Form: This specification covers a polyester resin in the form of a film clad on one or both sides with copper foil.

1.2 Application: Primarily as a base material for fabrication of flexible printed wiring for electronic circuit applications to be operated between -65° and +105°C (-85° and 220°F).

1.3 Classification: This specification covers two types of copper clad polyester film, as follows; the type supplied shall be as specified on the drawing or purchaser order:

Type I - Copper clad on one face  
Type II - Copper clad on both faces

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 SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

AMS 3612 - Polyester Film, Electrical Grade, General Purpose

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2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

- ASTM D149 - Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies
- ASTM D150 - A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials
- ASTM D257 - D-C Resistance or Conductance of Insulating Materials
- ASTM D618 - Conditioning Plastics and Electrical Insulating Materials for Testing
- ASTM D1825 - Etching and Cleaning Copper-Clad Electrical Insulating Materials and Thermosetting Laminates for Electrical Testing
- ASTM D1876 - Peel Resistance of Adhesives (T-Peel Test)

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19103.

2.3.1 Military Specifications:

MIL-F-55561 - Foil, Copper, Cladding for Printed Wiring Boards

2.3.2 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall consist of a polyester film to which copper foil is bonded with a suitable adhesive. Face sheets of copper may be applied to one (Type I) or both faces (Type II) in a subsequent operation.

3.1.1 Polyester Film: Shall conform to AMS 3612.

3.1.2 Copper Foil: Shall be electrolytically deposited, conforming to MIL-F-55561, Type I.

3.2 Properties: Sheet shall conform to the following requirements; tests shall be performed on the sheet supplied and in accordance with specified ASTM methods, insofar as practicable. Specimens shall be conditioned in accordance with ASTM D618, Procedure A, prior to testing. Specimens for determination of dielectric strength (3.2.1) and dielectric constant (3.2.2) shall have the copper removed in accordance with ASTM D1825 prior to conditioning. Where requirements vary with thickness, use the value for the next lower thickness for thicknesses not specified.

3.2.1 Dielectric Strength, min	1600	ASTM D149, short time test, on
V per mil	(63,000)	0.0075 in. (1.905 mm) film
(V/mm)		

3.2.2	Dielectric Constant at 60 Hz, max	3.25	ASTM D150
3.2.3	Dissipation Factor, max At 1 MHz At 1 kHz	0.03 0.006	ASTM D150
3.2.4	Surface Resistance, ohm, min	$1 \times 10^{10}$	ASTM D257
3.2.5	Peel Strength to Copper, min lb per in. of width (N/m of width)	3 (525)	ASTM D1876

3.3 Quality: The product, as received by purchaser, shall be uniform in quality and free from foreign materials, visible pits, and scratches and from internal and external imperfections detrimental to usage of the product.

3.4 Sizes and Tolerances:

3.4.1 The product shall be supplied in the following standard combinations of film and copper thicknesses; the nominal total thicknesses shown assume a 0.0015 in. (0.0381 mm) thick adhesive layer per side clad:

<u>Nominal Total Thickness</u>		<u>Polyester Film Thickness</u>		<u>Copper Foil Weight</u>	
Inch	(Millimetre)	Inch	(Millimetre)	Oz per sq ft	g/dm <sup>2</sup>
<b>Clad One Side (Type I)</b>					
0.004	(0.10)	0.001	(0.03)	1	(3.2)
0.005	(0.13)	0.002	(0.05)	1	(3.2)
0.006	(0.15)	0.003	(0.07)	1	(3.2)
0.006	(0.15)	0.001	(0.03)	2	(6.3)
0.008	(0.20)	0.005	(0.13)	1	(3.2)
0.008	(0.20)	0.003	(0.08)	2	(6.3)
0.010	(0.25)	0.005	(0.13)	2	(6.3)
<b>Clad Two Sides (Type II)</b>					
0.007	(0.18)	0.001	(0.03)	1	(3.2)
0.008	(0.20)	0.002	(0.05)	1	(3.2)
0.010	(0.25)	0.003	(0.08)	1	(3.2)
0.010	(0.25)	0.001	(0.03)	2	(6.3)
0.012	(0.30)	0.005	(0.13)	1	(3.2)
0.012	(0.30)	0.003	(0.08)	2	(6.3)
0.014	(0.36)	0.005	(0.13)	2	(6.3)

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3.4.2 The tolerance on thickness shall be  $\pm 10\%$  of the nominal value, measured by means of a micrometer or dial indicator and reported as the average of five measurements made at least 0.060 in. (1.5 mm) from any edge.

## 4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of sheet shall supply all samples for vendor's tests 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 sample and to perform any confirmatory testing deemed 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 dielectric constant (3.2.2), dissipation factor (3.2.3), peel strength (3.2.5), and sizes and tolerances (3.4) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for dielectric strength (3.2.1) and surface resistance (3.2.4) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

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

4.2.3.1 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: Sufficient film shall be taken at random from each lot to perform all required tests. The number of specimens for each test shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1 A lot shall be all film produced in a single production run from the same batches of raw materials and presented for vendor's inspection at one time. A lot shall not exceed 1500 sq ft (140 m<sup>2</sup>).

#### 4.4 Approval:

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

#### 4.5 Reports:

- 4.5.1 The vendor of film shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the acceptance test requirements and, when performed, to the periodic test requirements, and stating that the film conforms to the other technical requirements of this specification. This report shall include the purchase order number, AMS 3613A, type number, vendor's material designation, form or part number, and quantity.
- 4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 3613A, contractor or other direct supplier of film, supplier's compound number, part number, and quantity. When film for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of film to determine conformance to the requirements of this specification, and shall include in the report a statement that the film conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.
- 4.7 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the film may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the film represented and no additional testing shall be permitted. Results of all tests shall be reported.