

**POLYESTER FILM
Electrical Grade, General Purpose**

1. SCOPE:

1.1 Form: This specification covers a polyester resin in the form of film and film tape.

1.2 Application: Primarily for parts requiring electrical insulating properties from -60° to +150°C (-75° to +300°F).

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications 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

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 Solid Electrical Insulating Materials at Commercial Power Frequencies

ASTM D374 - Thickness of Solid Electrical Insulation

ASTM D618 - Conditioning Plastics and Electrical Insulating Materials for Testing

ASTM D882 - Tensile Properties of Thin Plastic Sheeting

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

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2.3.1 Military Standards:

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

3. TECHNICAL REQUIREMENTS:3.1 Material: Film shall be made from saturated linear polyester resin.3.2 Properties: Film shall conform to the following requirements; tests shall be performed on the film supplied and in accordance with specified ASTM methods, insofar as practicable. Linear property requirements apply in the machine direction, and in the transverse direction when width permits testing. Test specimens shall be conditioned in accordance with ASTM D618, Procedure A, prior to testing.3.2.1 Tensile Strength, min 4.5.1
Nominal Thickness

0.0005 to 0.0140, in., incl (0.012 to 0.035 mm, incl)	15,000 psi (105 MPa)
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3.2.2 Elongation, min ASTM D882, Method A

Nominal Thickness		
Inch	Millimetre	

0.0005	0.012	50%
0.0010	0.025	50%
0.0015	0.038	50%
0.0020	0.050	50%
0.0030	0.075	50%
0.0050	0.125	50%
0.0075	0.188	50%
0.0100	0.250	50%
0.0140	0.350	100%

3.2.3 Shrinkage at 200°C (390°F), max 4.5.2

Nominal Thickness		
Inch	Millimetre	

0.0005	0.012	9.0%
0.0010	0.025	7.5%
0.0015	0.038	7.0%
0.0020	0.050	7.0%
0.0030	0.075	7.0%
0.0050	0.125	7.0%
0.0075	0.188	7.0%
0.0100	0.250	7.0%
0.0140	0.350	10.0%

3.2.4 High-Temperature Durability Pass 20 of 30 samples 4.5.3

3.2.5 Dielectric Breakdown Voltage, min

4.5.4

Nominal Thickness		
Inch	Millimetre	
0.0005	0.012	2.0 Kv
0.0010	0.025	4.0 Kv
0.0015	0.038	5.5 Kv
0.0020	0.050	7.7 Kv
0.0030	0.075	10.0 Kv
0.0050	0.125	13.5 Kv
0.0075	0.188	17.5 Kv
0.0100	0.250	19.0 Kv
0.0140	0.350	20.0 Kv

3.3 Quality: Film, as received by purchaser, shall be uniform in quality and free from foreign materials, visible pits, and imperfections detrimental to usage of the film.

3.4 Tolerances: Shall be as follows, determined at 20° - 30°C (68° - 86°F):

3.4.1 Thickness: Shall be measured using ASTM D374, Method C, averaging not less than ten measurements over a sample at least 12 sq in. (135 cm²) in area.

Nominal Thickness		Actual Thickness			
		Inch		Millimetre	
Inch	Millimetre	min	max	min	max
0.0005	0.012	0.00040	0.00060	0.0102	0.0152
0.0010	0.025	0.00080	0.00105	0.0203	0.0267
0.0015	0.038	0.00125	0.00160	0.0308	0.0406
0.0020	0.050	0.00175	0.00220	0.0444	0.0559
0.0030	0.075	0.00260	0.00330	0.0660	0.0838
0.0050	0.125	0.00435	0.00545	0.1105	0.1384
0.0075	0.188	0.00670	0.00825	0.1702	0.2096
0.0100	0.250	0.00890	0.01090	0.2261	0.2769
0.0140	0.350	0.01260	0.01540	0.3200	0.3912

3.4.2 Width: Shall be as shown in Table I.

TABLE I

Nominal Thickness Inch	Width Tolerance, Inch		
	For Width Ranges Shown, Inches		
	Up to 6, incl	Over 6 to 18, incl	Over 18
Up to 0.0050, incl	+1/64	+1/32	+1/16
Over 0.0050 to 0.0140, incl	+1/64	+1/32	+1/32

3.4.2 (Continued):

TABLE I (SI)

Nominal Thickness Millimetre	Width Tolerance, Millimetre		
	For Width Ranges Shown, Millimetres		
	Up to 150, incl	Over 150 to 450, incl	Over 450
Up to 0.125, incl	+0.4	+0.8	+1.6
Over 0.125 to 0.350	<u>+0.4</u>	<u>+0.8</u>	<u>+0.8</u>

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of film shall supply all samples \emptyset 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 film conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for \emptyset dielectric breakdown voltage (3.2.5), quality (3.3), and tolerances (3.4) are classified as acceptance tests and shall be performed on each lot.

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

4.2.2.1 \emptyset 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 \emptyset all required tests. The number of determination for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1 \emptyset 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 m²).

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. 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, processing, or both and, when requested, sample film. Production film made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods: Shall be in accordance with the following:

4.5.1 Tensile Testing: Shall be in accordance with ASTM D882; thickness shall be measured in accordance with ASTM D374, Method C.

4.5.2 Shrinkage: Suspend freely five specimens, 10 in. (250 mm) long by width of film, but not over 10 in. (250 mm) measured to the nearest 0.01 in. (0.25 mm), in an oven maintained at $200^{\circ}\text{C} + 2$ ($392^{\circ}\text{F} + 4$) for 30 min. ± 2 . Average 15 measurements for each direction by taking three in each direction on each specimen at room temperature before and after heating. The three measurements shall be made at the center and midway between the center and the edge along each side, respectively. Bench mark or pinpoint marking may be used for location of measurements.

4.5.3 High Temperature Durability: Suspend 30 specimens, 5 in. (125 mm) long by width of film but not over 1 in. (25 mm) wide, in an oven maintained at $125^{\circ}\text{C} + 2$ ($255^{\circ}\text{F} + 4$) for 30 min. ± 2 . Samples shall support, at one end, a weight of 200 g per 0.0010 in. (0.025 mm) thickness per 1.00 in. (25 mm) width. Raise the temperature to $220^{\circ}\text{C} + 2$ ($430^{\circ}\text{F} + 4$) and maintain for 30 min. ± 2 . Cool to room temperature under load. Fold the sample 180 deg in the machine direction. Crease under moderate finger pressure and unfold. Repeat test with fold and crease in the transverse direction. Film shall not crack. Film samples shall be taken from one mill roll lot number and shall be taken at random across the roll.

4.5.4 Dielectric Breakdown Voltage: Shall be determined in accordance with ASTM D149, short time test in air using 2 in. (50 mm) diameter electrodes except that 1/4 in. (6.25 mm) diameter electrodes may be used when narrow film is supplied. In tests of 40 specimens, there shall be not more than three failures in film 0.0030 in. (0.75 mm) and under in thickness and not more than four failures in thicker film.

4.6 Reports:

4.6.1 The vendor of film shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the product conforms to the other technical requirements of this specification. This report shall include the purchase order number, AMS 3612A, vendor's material designation, lot number, size, and quantity.

4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 3612A, contractor or other direct supplier of film, vendor's material designation, 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 either a statement that the material conforms or 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.

5. PREPARATION FOR DELIVERY:

5.1 Packaging: Shall be accomplished in such a manner that the film, during shipment and storage, will not be permanently distorted, and will be protected against damage from exposure to weather or any other normal hazard. Film shall be wound on cores meeting the following requirements:

5.1.1 Cores: Shall have sufficient strength to prevent collapsing during handling and shall have 3 in. (75 mm) or 6 in. (150 mm) ID, as ordered.

5.1.2 Rolls: The OD of the slit roll and core ID shall be as follows:

Core ID		OD of Roll	
Inches	Millimetres	Inches	Millimetres
3	75	9-1/2 + 1/4	240 + 6
6	150	11 + 1/4	275 + 6
6	150	14 + 1/4	350 + 6

5.1.2.1 Cores shall be flush with the roll face, or core width shall be not more than 1/8 in. (3 mm) greater than film width. The outside and starting ends shall be fastened to prevent unwinding. Roll sides shall be smooth and even, and no portion of the film shall extend more than 1/16 in. (1.5 mm) from a straight edge laid across the diameter of the roll.

5.1.3 Splices: Shall be located not less than 100 ft (30 m) from beginning or end of a roll and not less than 100 ft (30 m) apart within a roll. There shall be no more than two splices per 9-1/2 or 11 in. (240 or 275 mm) OD roll, or six splices per 14 in. (350 mm) OD roll.