SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS3612 REV. C

Issued 1965-09
Reaffirmed 1998-09
Revised 2010-10

Superseding AMS3612B

Polyester Film
Electrical Grade, General Purpose

RATIONALE

This document has been revised to remove specific military requirements described in former sections 4.2.2.1 and 5.1.6.

1. SCOPE

1.1 Form

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

1.2 Application

This film has been used typically for parts requiring electrical insulating properties from 60 to +150 °C (76 to +302 °F), but usage is not limited to such applications.

1.3 Safety - Hazardous Materials

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

TO PLACE A DOCUMENT ORDER:
Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS3612C

2.1 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D 149	Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
ASTM D 374	Thickness of Solid Electrical Insulation
ASTM D 618	Conditioning Plastics and Electrical Insulating Materials for Testing
ASTM D 882	Tensile Properties of Thin Plastic Sheeting

2.2 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, http://assist.daps.dla.mil/quicksearch/.

MIL-STD-2073-1	DOD Materiel, Procedures for Development and Application of Packaging Requirements

3. TECHNICAL REQUIREMENTS

3.1 Material

Film shall be made from saturated linear polyester resin.

3.2 Properties

Film shall conform to the requirements shown in Table 1; 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 D 618, Procedure A, prior to testing.

TABLE 1 - PROPERTIES

Paragraph	Property	Requirement	Test Method
3.2.1	Tensile Strength, minimum Nominal Thickness 0.0005 to 0.0140, inch, incl (0.013 to 0.356 mm, incl)	 15.0 ksi (103 MPa)	ASTM D 882
3.2.2	Elongation, minimum		ASTM D 882, Method A
	Nominal Thickness Inch / Nominal Thickness Millimeter	Requirement	
	0.0005 / 0.013	50%	
	0.0010 / 0.025	50%	
	0.0015 / 0.038	50%	
	0.0020 / 0.051	50%	
	0.0030 / 0.076	50%	
	0.0050 / 0.127	50%	
	0.0075 / 0.190	50%	
	0.0100 / 0.254	50%	
	0.0140 / 0.356	100%	
3.2.3	Shrinkage at 200 °C (392 °F), maximum		4.5.1
	Nominal Thickness Inch / Nominal Thickness Millimeter		
	0.0005 / 0.013	9.0%	
	0.0010 / 0.025	7.5%	
	0.0015 / 0.038	7.0%	
	0.0020 / 0.051	7.0%	
	0.0030 / 0.076	7.0%	
	0.0050 / 0.127	7.0%	
	0.0075 / 0.190	7.0%	
	0.0100 / 0.254	7.0%	
	0.0140 / 0.356	10.0%	
3.2.4	High-Temperature Durability	Pass 20 of 30 samples	4.5.2
3.2.5	Dielectric Breakdown Voltage, minimum		4.5.3
	Nominal Thickness Inch / Nominal Thickness Millimeter		
	0.0005 / 0.013	2.0 Kilovolts	
	0.0010 / 0.025	4.0 Kilovolts	
	0.0015 / 0.038	5.5 Kilovolts	
	0.0020 / 0.051	7.7 Kilovolts	
	0.0030 / 0.076	10.0 Kilovolts	
	0.0050 / 0.127	13.5 Kilovolts	
	0.0075 / 0.190	17.5 Kilovolts	
	0.0100 / 0.254	19.0 Kilovolts	
	0.0140 / 0.356	20.0 Kilovolts	

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 to 30 °C (68 to 86 °F):

3.4.1 Thickness

Shall be as specified in Table 2, measured using ASTM D 374, Method C, averaging not less than ten measurements over a sample at least 12 square inches (77 cm^2) in area.

TABLE 2 - THICKNESS LIMITS FOR SIZES SHOWN

Nominal Thickness Inch	Nominal Thickness Millimeter	Actual Thickness Inch	Actual Thickness Millimeter
0.0005	0.013	0.00040 to 0.00060	0.0102 to 0.0152
0.0010	0.025	0.00080 to 0.00105	0.0203 to 0.0267
0.0015	0.038	0.00125 to 0.00160	0.0318 to 0.0406
0.0020	0.051	0.00175 to 0.00220	0.0444 to 0.0559
0.0030	0.076	0.00260 to 0.00330	0.0660 to 0.0838
0.0050	0.127	0.00435 to 0.00545	0.1105 to 0.1384
0.0075	0.190	0.00670 to 0.00825	0.1702 to 0.2096
0.0100	0.254	0.00890 to 0.01090	0.2261 to 0.2769
0.0140	0.356	0.01260 to 0.01540	0.3200 to 0.3912

3.4.2 Width

Shall be as shown in Table 3.

TABLE 3A - WIDTH TOLERANCE FOR NOMINAL THICKNESS AND WIDTH RANGES SHOWN, INCH/POUND UNITS

Nominal Thickness	Tolerance Inch Up to 6, incl	Tolerance Inch Over 6 to 18, incl	Tolerance Inch 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

TABLE 3B - WIDTH TOLERANCE FOR NOMINAL THICKNESS AND WIDTH RANGES SHOWN, SI UNITS

Nominal Thickness	Tolerance Millimeter Up to 152, incl	Tolerance Millimeter Over 152 to 457, incl	Tolerance Millimeter Over 457
Up to 0.127, incl	±0.4	±0.8	±1.6
Over 0.127 to 0.356, incl	±0.4	±0.8	±0.8

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of film shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the film conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Dielectric breakdown voltage (3.2.5), quality (3.3), and tolerances (3.4) are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests

Tests for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of film to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing

Sufficient film shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement 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 square feet (139 m^2).

4.4 Approval

4.4.1 Sample film shall be approved by purchaser before film for production use is supplied, unless such approval is 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 ingredients and/or processing 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 Shrinkage

Suspend freely five specimens, 10 inches (254 mm) long by width of film but not over 10 inches (254 mm) wide, measured to the nearest 0.01 inch (0.25 mm), in an oven maintained at 200 °C ± 2 (392 °F ± 4) for 30 minutes ± 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.

4.5.2 High Temperature Durability

Suspend 30 specimens, 5 inches (127 mm) long by width of film but not over 1 inch (25 mm) wide, in an oven maintained at 125 °C ± 2 (257 °F ± 4) for 30 minutes ± 2. Samples shall support, at one end, a weight of 200 grams per 0.0010 inch (0.025 mm) thickness per 1.00 inch (25 mm) width. Raise the temperature to 220 °C ± 2 (428 °F ± 4) and maintain for 30 minutes ± 2. Cool to room temperature under load. Fold the sample 180 degrees 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.

4.5.3 Dielectric Breakdown Voltage

Shall be determined in accordance with ASTM D 149, short time test in air using 2 inch (51 mm) diameter electrodes except that 1/4 inch (6.4 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 inch (0.076 mm) and under in thickness and not more than four failures in thicker film.

4.6 Reports

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 film conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS3612C, vendor's material designation, size, and quantity.

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. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY

5.1 Packaging

5.1.1 A lot of film may be packaged in small quantities and delivered under the basic lot approval provided lot identification is maintained.

5.1.2 Packaging shall be accomplished to ensure 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:

5.1.2.1 Cores

Shall have sufficient strength to prevent collapsing during handling and shall have a 3-inch (76-mm) or 6-inch (152-mm) ID, as ordered.

5.1.3 Rolls

The OD of the slit roll and core ID shall be as shown in Table 4.

TABLE 4 - CORE ID AND OD OF ROLLS

Core ID Inches	Core ID Millimeters	OD of Roll Inches	OD of Roll Millimeters
3	76	9-1/2 ± 1/4	241 ± 6.4
6	152	11 ± 1/4	279 ± 6.4
6	152	14 ± 1/4	356 ± 6.4