SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3661C

Issued MAR 1966
Revised JAN 1993
Reaffirmed JAN 2006

Superseding AMS 3661B

Polytetrafluoroethylene (PTFE) Film
Premium Grade

1. SCOPE:

1.1 Form:

This specification covers one grade of polytetrafluoroethylene (PTFE) resin in the form of film and film tape.

1.2 Application:

This product has been used typically for gaskets and other parts requiring exacting performance in mechanical, electrical, or chemical service up to 260 °C (500 °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 following publications form a part of this specification to the extent specified herein. The applicable issue of referenced publications shall be the issue in effect on the date of the purchase order.

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

2.1 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 149	Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
ASTM D 638	Tensile Properties of Plastics
ASTM D 638M	Tensile Properties of Plastics (Metric)
ASTM D 792	Specific Gravity (Relative Density) and Density of Plastics by Displacement
ASTM D 1389	Dielectric Proof-Voltage Testing of Thin Solid Electrical Insulating Materials
ASTM D 1708	Tensile Properties of Plastics by Use of Microtensile Specimens

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

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

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Film shall be produced by skiving billets molded or extruded from polytetrafluoroethylene powder without admixture of fillers, pigments, or adulterants.

3.2 Color:

Shall be opaque white. Minor discolorations or contamination shall not in themselves be unacceptable.

3.3 Properties:

Film shall conform to the requirements shown in Table 1 and 3.3.5; tests shall be performed on the film supplied and in accordance with specified test methods, insofar as practicable.

TABLE 1 - Properties

Paragraph	Property	Requirement	Test Method
3.3.1	Tensile Strength at 23 °C ± 1 (73 °F ± 2), minimum		4.5.1
	Nominal Thickness Inch / Nominal Thickness Millimeter		
	Up to 0.005, excl / Up to 0.13, excl	3600 psi (24.8 MPa)	
	0.005 and over / 0.13 and over	4000 psi (27.6 MPa)	
3.3.2	Elongation (Applicable Only to Widths 0.375 inch (9.52 mm) and over) at 23 °C ± 1 (73 °F ± 2), minimum		4.5.1
	Nominal Thickness Inch / Nominal Thickness Millimeter		
	Up to 0.005, excl / Up to 0.13, excl	270%	
	0.005 and over / 0.13 and over	300%	
3.3.3	Specific Gravity at 23/23 °C (73/73 °F)	2.14 to 2.21	ASTM D 792 Add two drops of wetting agent to the water
3.3.4	Dielectric Strength, Short Time Test, minimum		4.5.2
	Specimen Thickness Inch / Specimen Thickness Millimeter		
	0.003 / 0.08	2580 volts per mil (102 kV/mm)	
	0.005 / 0.13	2000 volts per mil (78.7 kV/mm)	
	0.010 / 0.25	1410 volts per mil (55.5 kV/mm)	

3.3.5 Electrical Flaws: When specified, film 0.003 to 0.010 inch (0.08 to 0.25 mm), inclusive, in nominal thickness and 2 inches (51 mm) and over in width shall show not more than 50 electrical flaws per 100 feet (30.5 m) of length, determined in accordance with ASTM D 1389 at a film-movement speed of 25 feet per minute ± 5 (127 mm/second ± 25). Other methods of test may be used when agreed upon by purchaser and vendor.

3.4 Quality:

Film, as received by purchaser, shall be uniform in quality and condition, smooth, and free from foreign materials and from imperfections detrimental to usage of the film.

3.5 Tolerances:

Shall be as shown in Table 2, determined at 23 to 30 °C (73 to 86 °F).

TABLE 2A - Tolerances, Inch/Pound Units

Nominal Thickness Inch	Nominal Width Inches	Thickness Tolerance Inch plus	Thickness Tolerance Inch minus
0.002 to 0.003, incl	Up to 2, incl	0.0005	0.0003
Over 0.003 to 0.005, incl	2 to 12, incl	0.0005	0.0005
Over 0.005 to 0.015, incl	2 to 12, incl	0.0010	0.0010
Over 0.015 to 0.040, incl	2 to 12, incl	0.0015	0.0015
Over 0.040 to 0.061, incl	2 to 12, incl	0.0020	0.0020
Over 0.061 to 0.125, incl	2 to 12, incl	0.005	0.005

TABLE 2B - Tolerances, SI Units

Nominal Thickness Millimeters	Nominal Width Millimeters	Thickness Tolerance Millimeter plus	Thickness Tolerance Millimeter minus
0.05 to 0.08, incl	Up to 51, incl	0.013	0.008
Over 0.08 to 0.13, incl	51 to 305, incl	0.013	0.013
Over 0.13 to 0.38, incl	51 to 305, incl	0.025	0.025
Over 0.38 to 1.02, incl	51 to 305, incl	0.038	0.038
Over 1.02 to 1.55, incl	51 to 305, incl	0.051	0.051
Over 1.55 to 3.18, incl	51 to 305, incl	0.13	0.13

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 performing all required tests. 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:

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

4.2.1 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, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: 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.

4.3.1.1 A lot shall be all film of the same thickness made from the same batch of compound in one production run and presented for vendor's inspection at one time.

4.3.1.2 A lot shall be not more than 200 pounds (91 kg) of film.

4.3.1.3 When a statistical sampling plan has been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

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 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:

4.5.1 Tensile Strength and Elongation: Shall be determined in accordance with ASTM D 638 or ASTM D 638M, using the microtensile specimen of ASTM D 1708. The initial jaw separation shall be 0.875 inch ± 0.005 (22.22 mm ± 0.13) and the speed of testing shall be 2 inches per minute (0.85 mm/s). Specimens shall be cut with the long axis parallel to the skive marks. Product over 0.062 inch (1.57 mm) thick shall be machined to 0.062 inch ± 0.016 (1.57 mm ± 0.41) thick before cutting specimens.

4.5.2 Dielectric Strength: Shall be determined in accordance with ASTM D 149 on specimens sufficiently large to prevent flashover and using electrodes of corrosion-resistant steel, nominally 0.25 inch (6.4 mm) in diameter with 0.031 inch (0.79 mm) radius at the edges. Tests shall be conducted in air for specimens up to 0.010 inch (0.25 mm), inclusive, in thickness and under oil for thicker specimens. The dielectric strength requirement for thicknesses other than those specified in 3.3.4 shall be calculated in accordance with Equation 1:

$$S = 1000\sqrt{\frac{K}{t}} \qquad \text{(Eq. 1)}$$

where, S = Dielectric strength in volts per mil (volts/mm)
K = 20 in inch/pound units or 787.4 in SI units
t = film thickness in mils (mm)

4.6 Reports:

The vendor of film shall furnish with each shipment a report showing the results of tests to determine conformance to the technical requirements. This report shall include the purchase order number, lot number, AMS 3661C, vendor's compound number, 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.