

AEROSPACE MATERIAL SPECIFICATION



AMS3646

REV. D

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Superseding AMS3646C

Sheet, Polychlorotrifluoroethylene (PCTFE)
Molded, Unplasticized

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

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1. SCOPE:

1.1 Form:

This specification covers a 100% homopolymer of polychlorotrifluoroethylene (PCTFE) in the form of molded sheet 0.250 inch (6.35 mm) and under in nominal thickness.

1.2 Application:

Primarily for parts requiring chemical inertness and toughness up to 200 °C (392 °F) or high frequency electrical insulating properties up to 165 °C (329 °F). This product may also be used at cryogenic temperatures.

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.

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2.1 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM D 149	Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
ASTM D 618	Conditioning Plastics and Electrical Insulating Materials for Testing
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 1430	Polychlorotrifluoroethylene (PCTFE) Plastics
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.

2.2.1 Military Standards:

MIL-STD-2073-1	DOD Materiel, Procedures for Development and Application of Packaging Requirements
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3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall be manufactured from virgin, unplasticized, 100% homopolymer of polychlorotrifluoroethylene (PCTFE).

3.2 Condition:

Annealed.

3.3 Color:

May range from natural translucent white to gray; localized discoloration resulting from processing will be acceptable.

3.4 Properties:

Sheet shall conform to the following requirements; tests shall be performed on the sheet supplied and in accordance with specified test methods, insofar as practicable:

3.4.1 Tensile Strength at $23 \pm 1^\circ\text{C}$ ($73 \pm 2^\circ\text{F}$), minimum average	4800 psi (33.1 MPa)	4.5.1
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3.4.2	Elongation at 23 °C ± 1 (73 °F ± 2), minimum	100%	4.5.1
3.4.3	Dielectric Strength at 23 °C ± 1 (73 °F ± 2), minimum	450 Volts per mil (17,717 V/mm)	4.5.2
3.4.4	Specific Gravity at 23°/23 °C (73°/73 °F)	2.08 to 2.18	ASTM D 792, Method A
3.4.5	Zero Strength Time at 250 °C ± 2 (482 °F ± 4), minimum	300 seconds	ASTM D 1430
3.4.6	Dimensional Stability: No dimension of sheet or fabricated parts shall change more than 0.003 inch per inch (0.003 mm/mm), measured at 20 to 30 °C (68 to 86 °F) before and after being held for 48 hours ± 5 at 70 °C ± 5 (158 °F ± 9).		

3.5 Quality:

Sheet, as received by purchaser, shall be uniform in quality and condition, smooth, and free from foreign materials and, except as specified in 3.5.1 and 3.5.2, free from imperfections detrimental to usage of the sheet.

- 3.5.1 Contamination: Sheet 0.062 inch (1.57 mm) and under in nominal thickness and parts made from such sheet shall have no foreign particles spaced closer than 2 inches (51 mm) to each other or over 1/32 inch (0.8 mm) in the largest dimension. Sheet over 0.062 inch (1.57 mm) in nominal thickness and parts made from such sheet shall have no particles spaced closer than 2 inches (51 mm) to each other or over 1/16 inch (1.6 mm) in the largest dimension. Particles, if present, shall be completely imbedded in the sheet.
- 3.5.2 Voids: Sheet shall contain no imperfections which will prevent fabrication of void-free parts. Fabricated parts shall contain no voids, fissures, or bubbles of entrapped gas.

3.6 Tolerances:

Shall be as follows; measurements shall be made at 20 to 30 °C (68 to 86 °F):

- 3.6.1 Length and Width: May vary from -0 to +10% of the specified dimension.
- 3.6.2 Thickness: Shall not vary more than specified in Table I, measured to within the nominal length or width.

TABLE I

Nominal Thickness Inch	Tolerance, Inch					
	Sheet with Largest Dimension Up to 6 in., excl		Sheet with Largest Dimension 6 to 9 in., incl		Sheet with Largest Dimension Over 9 in.	
	plus	minus	plus	minus	plus	minus
0.011 to 0.030, incl	0.003	0.002	0.006	0.002	0.008	0.002
Over 0.030 to 0.070, incl	0.003	0.002	0.006	0.002	0.010	0.002
Over 0.070 to 0.100, incl	0.006	0.002	0.008	0.002	0.012	0.004
Over 0.100 to 0.250, incl	0.008	0.004	0.012	0.006	0.016	0.008

TABLE I (SI)

Nominal Thickness Millimeters	Tolerance, Millimeter					
	Sheet with Largest Dimension Up to 152 mm, excl		Sheet with Largest Dimension 152 to 229 mm, incl		Sheet with Largest Dimension Over 229 mm	
	plus	minus	plus	minus	plus	minus
0.28 to 0.76, incl	0.08	0.05	0.15	0.05	0.20	0.05
Over 0.76 to 1.78, incl	0.08	0.05	0.15	0.05	0.25	0.05
Over 1.78 to 2.54, incl	0.15	0.05	0.20	0.05	0.30	0.10
Over 2.54 to 6.35, incl	0.20	0.10	0.30	0.15	0.41	0.20

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. 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:

Tests for all technical requirements are acceptance tests and preproduction tests and shall be performed prior to or on the initial shipment of sheet 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 sheet 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 sheet produced in a single production run from the same batch of raw material and presented for vendor's inspection at one time. An inspection lot shall not exceed 500 pounds (227 kg). A lot may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.3.1.2 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 sheet shall be approved by purchaser before sheet for production use is supplied, unless such approval be waived by purchaser. Results of tests on production sheet 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 sheet which are essentially the same as those used on the approved sample sheet. 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 sheet. Production sheet 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 machined Type I or Type II specimens, at a testing speed of 1.0 inch (25 mm) per minute. If product size does not permit obtaining such specimens, tests shall be conducted in accordance with ASTM D 1708 at a testing speed of 1.0 inch (25 mm) per minute.

4.5.2 Dielectric Strength: Shall be determined in accordance with ASTM D 149, short time test, using 2-inch (51-mm) rod electrodes on 0.062-inch (1.57 mm) thick specimens conditioned in accordance with ASTM D 618, Procedure A, and using a voltage rise of 500 to 600 volts per second to breakdown.