



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AMS 3645A

Superseding AMS 3645

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POLYCHLOROTRIFLUOROETHYLENE, COMPRESSION MOLDED Heavy Sections, Unplasticized

1. SCOPE:

- 1.1 Form: This specification covers polychlorotrifluoroethylene in the form of sheet over 0.250 in. (6.35 mm) in thickness, rod, heavy wall tubing, and large molded and machined parts.
- 1.2 Application: Primarily for parts requiring chemical inertness and toughness up to 200°C (390°F) or high-frequency electrical insulating properties up to 165°C (330°F). The material also may be used at cryogenic temperatures.

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 Society of Automotive Engineers, Inc., 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 Electrical Insulating Materials at Commercial Power Frequencies
ASTM D618 - Conditioning Plastics and Electrical Insulating Materials for Testing
ASTM D638 - Tensile Properties of Plastics
ASTM D792 - Specific Gravity and Density of Plastics by Displacement
ASTM D1430 - Polychlorotrifluoroethylene (PCTFE) Plastics
ASTM D1708 - Tensile Properties of Plastics by Use of Microtensile Specimens

- 2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

- 3.1 Material: Shall be manufactured from virgin, unplasticized, polymer of polychlorotrifluoroethylene.
- 3.2 Condition: Sheet, rod, tubing, and molded parts shall be annealed. Rods and tubing shall be machined on the outside diameter. Machined parts shall be annealed when so ordered.

SAE Technical Board rules provide that: "All technical reports, including standards, specifications, and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

- 3.3 **Color:** May range from natural translucent white to gray; localized discoloration resulting from processing will be acceptable.
- 3.4 **Properties:** The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified test methods, insofar as practicable:
- 3.4.1 Tensile Strength at $23^{\circ}\text{C} \pm 1$ ($73^{\circ}\text{F} \pm 2$),
min avg 5000 psi 4.5.1
(34.5 MPa)
- 3.4.2 Elongation at $23^{\circ}\text{C} \pm 1$ ($73^{\circ}\text{F} \pm 2$),
min 4.5.1
- Average 50%
Individual 30%
- 3.4.3 Dielectric Strength at $23^{\circ}\text{C} \pm 1$ ($73^{\circ}\text{F} \pm 2$), min 500 V per mil 4.5.2
(19,700 V/mm)
- 3.4.4 Specific Gravity at $23^{\circ}/23^{\circ}\text{C}$ ($73^{\circ}/73^{\circ}\text{F}$) 2.12 - 2.17 ASTM D792,
Method A
- 3.4.5 Zero Strength Time at
 $250^{\circ}\text{C} \pm 2$ ($482^{\circ}\text{F} \pm 4$), min 260 sec ASTM D1430
- 3.4.6 **Dimensional Stability:** No dimension of raw stock or fabricated parts shall change more than 0.003 in. per in. (0.003 mm/mm), measured at $20^{\circ} - 30^{\circ}\text{C}$ ($68^{\circ} - 86^{\circ}\text{F}$) before and after being held for $48\text{ hr} \pm 5$ at $70^{\circ}\text{C} \pm 5$ ($158^{\circ}\text{F} \pm 9$).
- 3.5 **Quality:** The product shall be uniform in quality and condition, clean, smooth, and free from foreign materials and from internal and external imperfections detrimental to fabrication, appearance, or performance of parts.
- 3.6 **Tolerances:** Unless otherwise specified, the following tolerances shall apply; measurements shall be made at $20^{\circ} - 30^{\circ}\text{C}$ ($68^{\circ} - 86^{\circ}\text{F}$) except that closer temperature control may be required for large parts:
- 3.6.1 **Molded and Machined Parts:** Shall be within the tolerances specified on the applicable drawing.
- 3.6.2 **Sheet and Discs:** Thickness tolerance shall be +10%, -0 for all thicknesses.
- 3.6.3 **Rods:**

TABLE I

Nominal Diameter Inches	Diameter Tolerance, Inch plus only
0.250 to 1.000, incl	0.025
Over 1.000 to 2.000, incl	0.050
Over 2.000 to 3.500, incl	0.070
Over 3.500	As specified by purchaser

TABLE I (SI)

Nominal Diameter Millimetres	Diameter Tolerance, Millimetres plus only
6.35 to 25.40, incl	0.64
Over 25.40 to 50.80, incl	1.27
Over 50.80 to 88.90, incl	1.78
Over 88.90	As specified by purchaser

3.6.4 Tubes 0.250 In. and Over in Wall Thickness:

TABLE II

Nominal Outside Diameter Inches	ID Tolerance Inch minus only	Wall Thickness Tolerance Inch plus only
1.000 to 1.500, incl	0.060	0.120
Over 1.500 to 3.000, incl	0.120	0.150
Over 3.000 to 5.000, incl	0.188	0.188
Over 5.000 to 8.000, incl	0.250	0.250
Over 8.000	As specified by purchaser	

TABLE II (SI)

Nominal Outside Diameter Millimetres	ID Tolerance Millimetres minus only	Wall Thickness Tolerance Millimetres plus only
25.40 to 38.10, incl	1.52	3.05
Over 38.10 to 76.20, incl	3.05	3.81
Over 76.20 to 127.00, incl	4.78	4.78
Over 127.00 to 203.20, incl	6.35	6.35
Over 203.20	As specified by purchaser	

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of the product shall supply all samples 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 perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.
- 4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and as qualification tests.
- 4.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, qualification test material shall be submitted to the cognizant qualification agency as directed by the procuring activity, the contracting officer, or the request for procurement.
- 4.3 Sampling: Sufficient product shall be taken from each lot to perform all required tests in triplicate; a lot shall be all product produced in a single production run from the same batch of raw material and presented for vendor's inspection at one time.

4.4 Approval:

- 4.4.1 Sample material shall be approved by purchaser before material for production use is supplied, unless such approval be waived. Results of tests on production material shall be essentially equivalent to those on the approved samples.
- 4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production material which are essentially the same as those used on the approved sample material. If any change is necessary 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 material. Production material 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 D638, using machined Type I or Type II specimens, at a testing speed of 1.0 in. (25 mm) per minute. If product size does not permit obtaining such specimens, tests shall be conducted in accordance with ASTM D1708, at a testing speed of 1.0 in. (25 mm) per minute.
- 4.5.2 Dielectric Strength: Shall be determined in accordance with ASTM D149, short time test, using 2-in. (51-mm) rod electrodes on 0.062-in. (1.57-mm) thick specimens conditioned in accordance with ASTM D618, Procedure A, and a voltage rise of 500 - 600 V per sec to breakdown.

4.6 Reports:

- 4.6.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, vendor's compound number, form and size or part number, and quantity.
- 4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, supplier's compound number, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material 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 product 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 product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

- 5.1.1 Packaging shall be accomplished in such a manner as to ensure that the product, during shipment and storage, will not be permanently distorted and will be protected against damage from exposure to weather or any normal hazard.