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

AEROSPACE MATERIAL SPECIFICATION

AMS 3534

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Revised

ETHYLENE TETRAFLUOROETHYLENE MOLDINGS
Stress-Relieved

1. SCOPE:

1.1 Form: This specification covers a melt-processible, copolymer resin of ethylene and tetrafluoroethylene (ETFE) in the form of molded rods, tubes, and shapes.

1.2 Application: Primarily for parts such as seals, insulators, back-up rings, valve liners, and bearings requiring good mechanical, chemical, electrical, environmental (including radiation resistance), and elevated-temperature properties. ETFE offers improved mechanical properties compared to both polytetrafluoroethylene and polyfluoroethlene propylene, while offering essentially the same outstanding chemical, electrical, and environmental performance of these other materials. It is capable of continuous operation up to 150° C (300° F) and, depending on exposure time, load, and environment, can be used intermittently up to 200° C (390° 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 (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 D638 - Tensile Properties of Plastics
ASTM D792 - Specific Gravity and Density of Plastics by Displacement
ASTM D1708 - Tensile Properties of Plastics by Use of Microtensile Specimens

2.3 U.S. 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 molded from ethylene tetrafluoroethylene copolymer resin pellets without admixture of fillers, pigments, or adulterants.

3.1.1 Moldings shall be stress-relief annealed after molding for dimensional stability.

3.2 Color: Shall be translucent white, unless otherwise specified by purchaser. Minor discoloration will be acceptable.

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

3.3.1	Tensile Strength at 23° C ± 1 (73° F ± 2), min	5500 psi (38 MPa)	4.5.1
3.3.2	Elongation at 23° C ± 1 (73° F ± 2), min	225%	4.5.1
3.3.3	Specific Gravity at 23°/23° C (73°/73° F)	1.68 - 1.73	ASTM D792; add 2 drops of wetting agent to the water
3.3.4	Dielectric Strength, Short Time Test, min	1800 V per mil (70,870 V/mm)	4.5.2

3.3.5 Dimensional Stability: Rods and shapes up to 2.000 in. (50.80 mm), incl, in nominal diameter or distance between parallel sides and all tubes shall not change in length, diameter, or distance between parallel sides by more than 0.5%, determined as in 4.5.3. Dimensional stability of rods and shapes over 2.000 in. (50.80 mm) in nominal diameter of distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.4 Quality: Moldings 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.

3.5 Tolerances: Unless otherwise specified, the following tolerances apply at 23° - 30° C (73° - 86° F):

3.5.1 Rods:

TABLE I

Nominal Diameter Inches	Tolerance, Inch plus only
0.750 to 2.000, incl	0.062
Over 2.000 to 3.000, incl	0.125
Over 3.000 to 5.000, incl	0.187
Over 5.000 to 12.000, incl	0.250
Over 12.000	As agreed upon by purchaser and vendor.

TABLE I (SI)

Nominal Diameter Millimetres	Tolerance, Millimetres plus only
19.05 to 50.80, incl	1.57
Over 50.80 to 76.20, incl	3.18
Over 76.20 to 127.00, incl	4.75
Over 127.00 to 304.80, incl	6.35
Over 304.80	As agreed upon by purchaser and vendor

3.5.2 Tubes:

TABLE II

Nominal OD or ID Inches	ID Tolerance, Inch minus only	OD Tolerance, Inch plus only
Up to 2.000, incl	0.062	0.062
Over 2.000 to 3.000, incl	0.125	0.125
Over 3.000 to 5.000, incl	0.187	0.187
Over 5.000 to 12.000, incl	0.250	0.250

TABLE II (SI)

Nominal OD or ID Millimetres	ID Tolerance, Millimetres minus only	OD Tolerance, Millimetres plus only
Up to 50.80, incl	1.57	1.57
Over 50.80 to 76.20, incl	3.18	3.18
Over 76.20 to 127.00, incl	4.75	4.75
Over 127.00 to 304.80, incl	6.35	6.35

3.5.3 Shapes: As agreed upon by purchaser and vendor.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of moldings shall supply all samples 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 such confirmatory testing as he deems necessary to ensure that the moldings conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.

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

4.2.2.1 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, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient moldings shall be taken at random from each lot to perform all required tests. The number of tests 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 moldings produced in a single production run from the same batch of raw material and presented for vendor's inspection at one time but shall not exceed 200 lb (90 Kg).

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) have 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 4.6.1 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 moldings shall be approved by purchaser before moldings for production use are supplied, unless such approval be waived. Results of tests on production moldings shall be essentially equivalent to those on the approved sample moldings.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production moldings which are essentially the same as those used on the approved sample moldings. 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 moldings. Production moldings 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 the microtensile specimen of ASTM D1708. The initial jaw separation shall be 0.875 in. ± 0.005 (22.22 mm ± 0.13) and the speed of testing shall be 2 in. (50 mm) per minute. Specimens shall be prepared from slices 0.031 in. ± 0.002 (0.79 mm ± 0.05) thick cut from the product.

4.5.2 Dielectric Strength: Shall be determined in accordance with ASTM D149 under oil on 0.020-in. ± 0.002 (0.50-mm ± 0.05) thick specimens. When practicable, specimens shall be 1 in. (25 mm) in nominal diameter but may be 0.50 in. (12.7 mm) in nominal diameter if 1 in. (25 mm) diameter specimens cannot be obtained from the molding. Electrodes shall be of corrosion-resistant steel, nominally 0.25 in. (6.4 mm) in diameter with 0.031 in. (0.79 mm) radius at the edges for 1-in. (25-mm) diameter specimens and nominally 0.062 in. (1.57 mm) in diameter with rounded edges for 0.5-in. (12.7-mm) diameter specimens.