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400 COMMONWEALTH DRIVE WARRENDALE PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3658B
Superseding AMS 3658A

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POLYTETRAFLUOROETHYLENE EXTRUSIONS
Premium Strength, Stress-Relieved, Radiographically Inspected

1. SCOPE:

1.1 Form: This specification covers one grade of polytetrafluoroethylene resin in the form of extruded rods, tubes, and shapes.

1.2 Application: Primarily for mechanical parts, such as seals, back-up rings, and bearings, requiring chemical inertness and dimensional stability up to 260°C (500°F) and better mechanical and electrical properties than AMS 3656.

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 SAE, 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 Solid Electrical Insulating Materials at Commercial Power Frequencies

ASTM D638 - Tensile Properties of Plastics

ASTM D792 - Specific Gravity and Density of Plastics by Displacement

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

Printed in U.S.A.

3. TECHNICAL REQUIREMENTS:

3.1 Material: The product shall be extruded from polytetrafluoroethylene powder without admixture of fillers, pigments, or adulterants, and shall be sintered and stress-relieved.

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

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

3.3.1 Tensile Strength at 23°C ± 1 (73°F ± 2), min		4.5.1
3.3.1.1 Rods and Shapes		
Nominal Diameter or Distance Between Parallel Sides		
Inches	Millimetres	
Up to 0.500, excl	Up to 12.50, excl	1800 psi (12.5 MPa)
0.500 to 1.500, incl	12.50 to 37.50, incl	1900 psi (13.0 MPa)
Over 1.500	Over 37.50	2000 psi (14.0 MPa)
3.3.1.2 Tubes, All Sizes		1800 psi (12.5 MPa)
3.3.2 Elongation at 23°C ± 1 (73°F ± 2), min		4.5.1
3.3.2.1 Rods and Shapes		
Nominal Diameter or Distance Between Parallel Sides		
Inches	Millimetres	
Up to 0.500, excl	Up to 12.50, excl	150%
0.500 to 1.500, incl	12.50 to 37.50, incl	175%
Over 1.500	Over 37.50	200%
3.3.2.2 Tubes, All Sizes		150%
3.3.3 Specific Gravity at 23°/23°C (73°/73°F)		ASTM D792 add 2 drops of wetting agent to the water

3.3.3.1 Rods and Shapes

Nominal Diameter or Distance Between Parallel Sides		
Inches	Millimetres	
Up to 0.500, excl	Up to 12.50, excl	2.14 - 2.19
0.500 to 1.500, incl	12.50 to 37.50, incl	2.15 - 2.20
Over 1.500	Over 37.50	2.15 - 2.20

3.3.3.2 Tubes, All Sizes 2.14 - 2.19

3.3.4 Dielectric Strength, Short Time Test, min 4.5.2

3.3.4.1 Rods and Shapes

Nominal Diameter or Distance Between Parallel Sides		
Inches	Millimetres	
Up to 0.500, excl	Up to 12.50, excl	700 V per mil (27,600 V/mm)
0.500 to 1.500, incl	12.50 to 37.50, incl	750 V per mil (29,500 V/mm)
Over 1.500	Over 37.50	800 V per mil (31,500 V/mm)

3.3.4.2 Tubes, All Sizes 700 V per mil (27,600 V/mm)

3.3.5 Dimensional Stability: Rods and shapes up to 1.500 in. (37.50 mm), incl, in nominal diameter or distance between parallel sides and all tubes shall not change in length by more than 1.5% and in diameter or distance between parallel sides by more than 0.5%, determined as in 4.5.3. Dimensional stability of rods and shapes over 1.500 in. (37.50 mm) in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.4 Quality: Extrusions, as received by purchaser, shall be uniform in quality and condition, clean, smooth, and free from foreign materials and from internal and external imperfections detrimental to usage of the extrusions.

3.4.1 Extrusions shall be radiographically inspected. Radiographic procedures and standards for acceptance shall be as agreed upon by purchaser and vendor.

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

3.5.1 Rods and Shapes:

TABLE I

Nominal Diameter or Distance Between Parallel Sides Inches	Tolerance, Inch plus only
Up to 0.250, incl	0.008
Over 0.250 to 0.500, incl	0.016
Over 0.500 to 0.750, incl	0.020
Over 0.750 to 1.000, incl	0.024
Over 1.000 to 1.250, incl	0.030
Over 1.250 to 1.500, incl	0.038
Over 1.500 to 1.750, incl	0.046
Over 1.750 to 2.000, incl	0.052
Over 2.000 to 2.250, incl	0.068
Over 2.250 to 2.500, incl	0.076

TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Tolerance, Millimetres plus only
Up to 6.25, incl	0.20
Over 6.25 to 12.50, incl	0.40
Over 12.50 to 18.75, incl	0.50
Over 18.75 to 25.00, incl	0.60
Over 25.00 to 31.25, incl	0.75
Over 31.25 to 37.50, incl	0.95
Over 37.50 to 43.75, incl	1.15
Over 43.75 to 50.00, incl	1.30
Over 50.00 to 56.25, incl	1.75
Over 56.25 to 62.50, incl	1.95

3.5.2 Tubes:

TABLE II

Nominal OD or ID Inches	ID Tolerance, Inch minus only	OD Tolerance, Inch plus only
Over 0.187 to 2.000, incl	0.062	0.062

TABLE II (SI)

Nominal OD or ID Millimetres	ID Tolerance, Millimetres minus only	OD Tolerance, Millimetres plus only
Over 4.75 to 50.00, incl	1.55	1.55

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of extrusions 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 any confirmatory testing deemed necessary to ensure that the extrusions 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 prior to or on the initial shipment of extrusions to a purchaser, when a change in material or processing, or both, 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 extrusions 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 extrusions 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 extrusions of the same configuration made from the same batch of compound in one production run and presented for vendor's inspection at one time.

4.3.1.2 An inspection lot shall be not more than 200 lb (90 kg) of extrusions. A lot may be packaged or delivered in small quantities under the basic lot approval provided the lot identification is maintained.

4.3.1.3 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 extrusions shall be approved by purchaser before extrusions for production use are supplied, unless such approval be waived by purchaser. Results of tests on production extrusions 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 extrusions which are essentially the same as those used on the approved sample extrusions. 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 material or processing, or both, and, when requested, sample extrusions. Production extrusions 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 a testing speed of 2 in. (50 mm) per min. and measuring elongation over a 2 in. (50 mm) gage length. The test specimen for rod, and for shapes where size permits, shall conform to Fig. 1 of this specification except that rods 0.250 in. (6.25 mm) and under in diameter may be tested in full cross-section.

4.5.2 Dielectric Strength: Shall be determined in accordance with ASTM D149 on specimens 0.040 in. ± 0.001 (1.00 mm ± 0.02) thick. The test shall be conducted under oil using 0.062 in. (1.55 mm) diameter corrosion-resistant steel electrodes with rounded edges. If flash-over is a problem on small diameter rod or on shapes, specimens shall be prepared by drilling holes from opposite ends of a piece of product, leaving a web 0.040 in. ± 0.001 (1.00 mm ± 0.02) thick in the middle of the specimen. Electrodes shall be the same as used for the wafer specimen and shall be inserted in the holes in the specimen.

4.5.3 Dimensional Stability: Cut specimens from the product, each 1.000 in. ± 0.005 (25.00 mm ± 0.12) in length, and measure their length and their diameter or distance between parallel sides at midlength to the nearest 0.001 in. (0.02 mm). Mark the points of original measurement so that measurements after heating and cooling can be made at the same points. Place the specimens in a heating chamber which is at approximately 23°C (73°F) and raise the temperature of the chamber to 290°C ± 3 (555°F ± 5). The heating medium may be either oil or air. Hold the specimens at 290°C ± 3 (555°F ± 5) for 120 min. ± 5. Lower the temperature at a rate not greater than 30 C (55 F) deg per hr to approximately 23°C (73°F). Measure the length and diameter of the specimens to the nearest 0.001 in. (0.02 mm) at the same points as used for the original measurements. Calculate the changes in dimensions by the following equation and average the results for each dimension:

$$D = \frac{L_n - L_i}{L_i} \times 100$$

where, D = dimensional change in %
L_n = dimension of section after heating
L_i = dimension of section before heating

4.6 Reports:

4.6.1 The vendor of extrusions shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the tensile strength, elongation, specific gravity, and dielectric strength requirements and stating that the extrusions conform to the other technical requirements of this specification. This report shall include the purchase order number, lot number, AMS 3658B, 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, AMS 3658B, contractor or other direct supplier of extrusions, supplier's compound number, part number, and quantity. When extrusions for making parts are produced or purchased by the parts vendor, that vendor shall inspect each lot of extrusions to determine conformance to the requirements of this specification and shall include in the report either a statement that the extrusions conform or 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 extrusions 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 extrusions 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 extrusions, during shipment and storage, will not be permanently distorted and will be protected against damage from exposure to weather or any other normal hazard.

5.1.2 Each package shall be permanently and legibly marked to show not less than the following information:

POLYTETRAFLUOROETHYLENE EXTRUSIONS
Premium Strength, Stress-Relieved, Radiographically Inspected
AMS 3658B
SIZE OR PART NUMBER _____
LOT NUMBER _____
PURCHASE ORDER NUMBER _____
QUANTITY _____
MANUFACTURER'S IDENTIFICATION _____

5.1.3 Ø Packages shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the extrusions to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.1.4 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1.3 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Extrusions not conforming to this specification or to modifications authorized by purchaser will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (Ø) symbol is used to indicate technical changes from the previous issue of this specification.