AEROSPACE MATERIAL SPECIFICATION

AMS3660™	REV. F

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Superseding AMS3660E

Polytetrafluoroethylene (PTFE) Moldings General Purpose Grade, As Sintered

RATIONALE

This document is being revised to correct the ASTM D4894 resin types that are permitted to be used to produce AMS3660 material.

1. SCOPE

1.1 Form

This specification covers virgin, unfilled polytetrafluoroethylene (PTFE) in the form of molded rods, tubes, and shapes. This specification does not apply to product over 12 inches (305 mm) in dimension parallel to the direction of applied molding pressure, rods under 0.750 inch (19.05 mm) in diameter, and tubes having wall thickness under 0.500 inch (12.70 mm).

1.2 Application

These moldings have been used typically for parts such as bushings and insulators requiring chemical inertness and good mechanical and electrical properties up to 500 °F (260 °C), but usage is not limited to such applications. For applications such as bearings, seals, and backup rings that do not require dielectric properties, it is recommended to use AMS3678/1 Grade A.

1.3 Safety - Hazardous Material

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 that 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.

1.4 Types 1 and 2, which were defined in previous revisions of this specification, have been combined. For documentation that specifies Type 1 or Type 2 of this specification, all of the requirements of this specification now apply.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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For more information on this standard, visit
https://www.sae.org/standards/content/AMS3660F/

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS3678/1 Type 1, Virgin Polytetrafluoroethylene (PTFE) Moldings and Extrusions

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D149 Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

ASTM D792 Specific Gravity (Relative Density) and Density of Plastics by Displacement

ASTM D4894 Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials

3. TECHNICAL REQUIREMENTS

3.1 Material

The product shall be molded by either compression or isostatic process from virgin polytetrafluoroethylene (PTFE) powder conforming to ASTM D4894 Type II, Type IV, or Type V without admixture of fillers, pigments, or adulterants, and sintered. “Virgin” shall mean no previous heat or pressure history.

3.2 Color

Shall be predominantly white. Surface discoloration from sintering and/or annealing may vary from white to mottled gray or brown. Small gray, brown, or black spots shall not in themselves be unacceptable provided they do not have a detrimental effect on the end usage of the finished product.

3.3 Properties

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

3.4 Quality

Moldings, as received by the purchaser, shall be uniform in quality and condition, smooth, and free from foreign materials and from imperfections detrimental to usage of the moldings. Surface discoloration from the molding and/or sintering process shall not be considered detrimental.

3.5 Tolerances

Unless otherwise agreed between the purchaser and the supplier, the tolerances shown in Tables 2, 3, and 4 apply at 73 to 86 °F (23 to 30 °C).

Table 1 - Properties

Paragraph	Property	Requirement	Test Method
3.3.1	Tensile Strength at 73 °F ± 2 °F (23 °C ± 1 °C), minimum	3000 psi (20.7 MPa)	4.5.1
3.3.2	Elongation at 73 °F ± 2 °F (23 °C ± 1 °C), minimum	200%	4.5.1
3.3.3	Specific Gravity at 73 °F ± 2 °F (23 °C ± 1 °C)	2.14 to 2.19	ASTM D792; add 2 drops of wetting agent to the water
3.3.4	Dielectric Strength Short Time Test, minimum (applicable only to Type 1 moldings)	750 volts per mil (29.5 kV/mm)	4.5.2

3.5.1 Rods

3.5.1.1 Diameter

Shall be as shown in Table 2.

Table 2 - Diameter tolerances

Nominal Diameter or Distance Between Parallel Sides Inches	Nominal Diameter or Distance Between Parallel Sides Millimeters	Tolerance Inch (Millimeters) plus only
0.750 to 2.000, incl	19.05 to 50.80, incl	0.062 (1.57)
Over 2.000 to 3.000, incl	Over 50.80 to 76.20, incl	0.125 (3.18)
Over 3.000 to 5.000, incl	Over 76.20 to 127.00, incl	0.187 (4.75)
Over 5.000 to 12.000, incl	Over 127.00 to 304.8, incl	0.250 (6.35)

3.5.2 Tubes

3.5.2.1 Diameter

Shall be as shown in Table 3.

Table 3 - Diameter tolerances

Nominal Diameter or Distance Between Parallel Sides Inches	Nominal Diameter or Distance Between Parallel Sides Millimeters	ID Tolerance Inch (Millimeters) minus only	OD Tolerance Inch (Millimeters) plus only
Up to 2.000, incl	Up to 50.80, incl	0.062 (1.57)	0.062 (1.57)
Over 2.000 to 3.000, incl	Over 50.80 to 76.20, incl	0.125 (3.18)	0.125 (3.18)
Over 3.000 to 5.000, incl	Over 76.20 to 127.00, incl	0.187 (4.75)	0.187 (4.75)
Over 5.000 to 12.000, incl	Over 127.00 to 304.8, incl	0.250 (6.35)	0.250 (6.35)

3.5.2.2 Out of Roundness

Shall be as shown in Table 4.

Table 4 - Maximum out-of-roundness tolerances

Nominal ID Inches	Nominal ID Millimeters	Variation from Concentricity Inch (Millimeters) (See 3.4.2.1)
Up to 2.000, incl	Up to 50.80, incl	0.062 (1.57)
Over 2.000 to 3.000, incl	Over 50.80 to 76.20, incl	0.093 (2.36)
Over 3.000 to 5.000, incl	Over 76.20 to 127.00, incl	0.125 (3.18)
Over 5.000 to 8.000, incl	Over 127.00 to 203.20, incl	0.187 (4.75)
Over 8.000 to 12.000, incl	Over 203.20 to 304.80, incl	0.250 (6.35)

3.5.2.2.1 Out of round is half the difference of the largest and smallest OD measurements (total indicator reading) at locations 90 degrees apart at any distance along a rod or tube.

3.5.3 Shapes

As agreed upon by the purchaser and the supplier.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The manufacturer of moldings shall supply test coupons and shall be responsible for the performance of all required tests for each lot of moldings. The purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the moldings conform to specified requirements. The manufacturer of machined parts shall furnish substantiating test data acquired by the manufacturer of moldings. The purchaser of parts machined from moldings also reserves the right to perform confirmatory testing provided the parts will yield test coupons that conform to the testing procedure(s) listed in 4.3.

4.2 Classification of Tests

4.2.1 Acceptance Tests

All technical requirements are acceptance tests and shall be performed on each lot of moldings (see 4.3.1).

4.3 Sampling and Testing

Shall be as follows:

4.3.1 Sufficient test coupons shall be taken at random from each production lot of moldings to perform all required tests. Otherwise, test samples shall be machined from a test or other suitable molding from the same resin lot. 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.

4.3.2 A lot of moldings shall be all rods or tubes of the same configuration made from the same batch of PTFE resin in one production run and presented for the manufacturer's inspection at one time. A lot shall consist of not more than 200 pounds (91 kg) of moldings. Where multiple shipments are made from one lot of moldings, lot traceability shall be maintained.

4.3.3 A statistical sampling plan, acceptable to the purchaser, may be used in lieu of sampling as in 4.3.1, and the report of 4.6 shall state that such plan was used.

4.4 Approval

4.4.1 Test results from sample product shall be approved by the purchaser before production moldings are supplied, unless such approval is waived by the purchaser. Results of the tests on samples from the production lot shall be essentially equivalent to those on the approved sample. Production product made by a revised procedure shall not be shipped prior to receipt of reapproval. If necessary to make any change in parameters or the process control factors, the manufacturer shall submit for reapproval a statement of the proposed changes in ingredients and/or processing and, when requested, sample product or test coupons shall be provided.

4.4.2 The manufacturer of the product shall make no significant change in material, processes, or control factors from those on which the approval was based, unless the change is approved by the purchaser's engineering department. A significant change is one which, in the judgment of the purchaser's engineering department, could affect the properties or performance of the product.

4.5 Test Methods

Shall be as follows:

4.5.1 Tensile strength and elongation shall be determined in accordance with ASTM D4894, and the test specimens shall be prepared from either a production molding as specified or, if not possible, from a sample molding of sufficient size from the same resin batch. Test specimens for rods and tubes, where size permits, shall conform to ASTM D4894, Figure 11. Specimens shall be prepared from slices 0.031 inch ± 0.002 inch (0.79 mm ± 0.05 mm) thick cut from the product. Rods 0.250 inch (6.35 mm) and under in diameter may be tested in full cross section. The initial jaw separation shall be 0.875 inch ± 0.005 inch (22.2 mm ± 0.13 mm), and the speed of testing shall be 2 inches (50 mm) per minute. All results shall be reported.

4.5.2 For compression molded product, the tensile strength coupon shall be pulled in the direction of molding (axial direction); for isostatically molded product, the tensile strength coupon may be pulled in either the axial or circumferential direction. Values shown are the minimum values required.

4.5.3 Specific gravity shall be determined in accordance with ASTM D792, Method A, with two drops of wetting agent added to the water.

4.5.4 Dielectric strength shall be determined in accordance with ASTM D149 under oil on 0.020 inch ± 0.002 inch (0.51 mm ± 0.05 mm) thick specimens. When practicable, specimens shall be 1 inch (25 mm) in nominal diameter but may be 0.50 inch (12.7 mm) in nominal diameter if 1-inch (25-mm) diameter specimens cannot be obtained from the product. Electrodes shall be of corrosion-resistant steel, nominally 0.25 inch (6.35 mm) in diameter with 0.031-inch (0.79-mm) radius at the edges for 1-inch (25-mm) diameter specimens and nominally 0.062 inch (1.57 mm) in diameter with rounded edges for 0.50-inch (12.7-mm) diameter specimens.

4.6 Reports

The supplier of moldings shall furnish with each shipment a report showing the results of tests on each lot to determine conformance to tensile strength, elongation, specific gravity, and dielectric strength and stating that the moldings conform to the other technical requirements. This report shall include the purchase order number, lot number, AMS3660F, vendor's compound number, form and size or part number, and quantity.

4.7 Resampling and Retesting

If any specimen used in the above tests fails to meet the specified requirements, disposition of the moldings 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 moldings represented. Results of all tests shall be reported.