AEROSPACE
MATERIAL SPECIFICATIONS

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AMS 3659

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Revised

# POLYTETRAFLUOROETHYLENE EXTRUSIONS
## Premium Strength, Stress Relieved

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. FORM: Extruded rods, tubes, and shapes.

3. APPLICATION: Primarily for parts, such as seals, bearings, insulators, and back-up rings, for use up to 260 C (500 F) requiring chemical inertness and dimensional stability with higher mechanical and electrical properties than AMS 3656.

4. MATERIAL: Shall be extruded from polytetrafluoroethylene powder without admixture of fillers, pigments, or adulterants.

5. TECHNICAL REQUIREMENTS:

5.1 General:

5.1.1 Color: May vary from white to mottled gray or brown. Small gray, brown, or black spots shall not in themselves be cause for rejection.

5.2 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with the issue of specified ASTM methods listed in the latest issue of AMS 2350 insofar as practicable.

| | | |
|---|---|---|
| 5.2.1 Tensile Strength at 23 C ± 1 (73.4 F ± 1.8), psi, min | | See Note 1 |
| Nominal Diameter, Inches | | |
| Up to 0.500, excl, and all tubes | 1800 | |
| 0.500 to 1.500, incl | 1900 | |
| Over 1.500 | 2000 | |
| 5.2.2 Elongation at 23 C ± 1 (73.4 F ± 1.8), %, min | | See Note 1 |
| Nominal Diameter, Inches | | |
| Up to 0.500, excl, and all tubes | 150 | |
| 0.500 to 1.500, incl | 175 | |
| Over 1.500 | 200 | |
| 5.2.3 Specific Gravity at 23 C/23 C (73.4 F/73.4 F) | | ASTM D792 Add 2 drops of a wetting agent to the water |
| Nominal Diameter, Inches | | |
| Up to 0.500, excl, and all tubes | 2.14-2.19 | |
| 0.500 to 1.500, incl | 2.15-2.20 | |
| Over 1.500 | 2.15-2.20 | |
| 5.2.4 Dielectric Strength (Short time test), v per mil, min | | ASTM D149 (See Note 2) |
| Nominal Diameter, Inches | | |
| Up to 0.500, excl, and all tubes | 700 | |
| 0.500 to 1.500, incl | 750 | |
| Over 1.500 | 800 | |

| | | |
|---|---|---|
| 5.2.5 Dimensional Stability | | See Note 3 |
| Length Change, %, max | | |
| Nominal Diameter, Inches | | |
| Up to 1.500, incl, and all tubes | 1.5 | |
| Diameter Change, %, max | | |
| Nominal Diameter, Inches | | |
| Up to 1.500, incl, and all tubes | 0.5 | |

Note 1. Tensile strength and elongation shall be determined in accordance with ASTM D638 using a testing speed of 2 in. per min. and measuring elongation over a 2 in. gage length. The test specimen for rod shall conform to Fig. 1 of this specification except that rods 0.250 in. and under in diameter may be tested in full cross-section.

Note 2. Specimens shall be 0.040 in. ± 0.001 thick. Test under oil using 1/16 in. diameter corrosion resistant steel electrodes with rounded edges. If flashover is a problem on small diameter rod, specimens shall be prepared by drilling holes from opposite ends of a rod section, leaving a web 0.040 in. ± 0.001 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.

Note 3. Cut two specimens of rod each 1.000 in. ± 0.005 in length, and measure their length and diameter to the nearest 0.001 in. at the center point. Mark these points of original measurement so that measurements after heating and cooling are made at the same points. Place the specimens in a heating chamber at approximately 23 C (73 F), raise the temperature of the chamber to 290 C ± 3 (554 F ± 5.4). The heating medium may be either oil or air. Hold the specimens at 290 C ± 3 (554 F ± 5.4) for 2 hr, then lower the temperature at a rate not exceeding 30 C (54 F) deg per hour to approximately 23 C (73 F). Again measure the length and diameter of the specimens to the nearest 0.001 in. at the center points. Calculate the change in dimensions by the following equation and average the results:

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

where: D = dimensional change in percent

$L_h$ = dimension of specimen after heating

$L_i$ = initial dimension of specimen

6. QUALITY: The product shall be uniform in quality and condition, clean, smooth, as free from foreign materials as commercially practicable, and free from imperfections detrimental to fabrication, appearance, or performance of parts.

7. TOLERANCES: Unless otherwise specified, the following tolerances apply at 23 - 30 C (73.4 - 86 F):

7.1 Rod:

| Nominal Diameter 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 |

7.2 Tubing:

| Nominal OD or ID Inches | ID Tolerance, Inch Minus Only | OD Tolerance, Inch Plus Only |
|---|---|---|
| Over 0.187 to 2, incl | 0.062 | 0.062 |

8. REPORTS:

8.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report stating that the product conforms to the requirements of this specification. This report shall include the purchase order number, material specification number, vendor's compound number, form or part number, and quantity.

8.2 Unless otherwise specified, 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, 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.

9. 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.

10. IDENTIFICATION: Each package shall be permanently and legibly marked with the following:

POLYTETRAFLUOROETHYLENE EXTRUSIONS
Premium Strength, Stress Relieved
AMS 3659
SIZE _____
LOT NUMBER _____
PURCHASE ORDER NUMBER _____
QUANTITY _____
MANUFACTURER'S IDENTIFICATION _____

11. APPROVAL:

11.1 To assure adequate performance characteristics, compounds 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 sample.

11.2 Vendor shall use the same compound and manufacturing processes for production material as for approved sample material. If necessary to make any change in compound or processing which could unfavorably affect any characteristics of the material, vendor shall obtain written permission from purchaser prior to incorporating such change.

12. REJECTION: Material not conforming to this specification or to authorized modifications will be subject to rejection.