

**Polytetrafluoroethylene (PTFE) Moldings and Extrusions
Unfilled, Pigmented, and Filled Components**

RATIONALE

This document has been revised to include the materials required for back-up rings to be used in AS5857 glands.

1. SCOPE

1.1 Form

This specification covers several grades of virgin polytetrafluoroethylene (PTFE) resin which may be compounded with pigment and fillers in the form of extruded or molded rods or tubes which are sintered after molding or, in the case of extrusions, sintered during the extrusion process.

1.2 Application

These products have been used typically for mechanical parts such as back-up rings, seals, and bearings requiring dimensional stability up to 450 °F (232 °C) with good mechanical properties, but usage is not limited to such applications. Each application should be considered individually.

1.3 Safety - Hazardous Materials

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 which 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.

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 supplied 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.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2006 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

2.1 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 D 792	Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D 4745	Filled Compounds of Polytetrafluoroethylene (PTFE) Molding and Extrusion Materials
ASTM D 4894	Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials

2.2 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch/>.

FED-STD-595	Colors Used in Government Procurement
-------------	---------------------------------------

3. TECHNICAL REQUIREMENTS

3.1 Detail Specifications

The requirements for a specific product shall consist of all requirements specified herein in addition to requirements specified in the applicable detail specification. In case of conflict between requirements of this specification and an applicable detail specification, requirements of the detail specification shall govern.

3.2 Material

All products shall be molded or extruded from fresh virgin or filled polytetrafluoroethylene (PTFE) powder. The virgin PTFE powder used in both unfilled and filled compounds to this specification shall conform to ASTM D 4894, Type II or Type IV. The blending of fillers with the virgin PTFE for each type shall be as shown in Table 1.

TABLE 1 - MATERIAL TYPES

Type	Description	Detail Specification
1	Virgin PTFE, Grades A and B	AMS 3678/1A
2	PTFE filled with 15% graphite	AMS 3678/2
3	PTFE filled with 15% glass fiber and 5% molybdenum disulfide	AMS 3678/3
4	PTFE filled with 25% glass fiber	AMS 3678/4
5	PTFE filled with inorganic pigment	AMS 3678/5
6	PTFE filled with 60% bronze powder	AMS 3678/6
7	PTFE filled with 23% carbon and 2% graphite	AMS 3678/7
8	PTFE filled with 10% carbon fiber	AMS 3678/8
9	PTFE filled with inorganic pigment (AS 4716 & AS 5857)	AMS 3678/9
10	PTFE filled with 15% carbon fiber	AMS 3678/10

- 3.2.1 Virgin polytetrafluoroethylene shall mean resin that has no pigment or filler added and the resin has not experienced any previous pressure or heat history.
- 3.2.2 Filled material shall mean that at least one pigment or filler has been uniformly blended with the virgin PTFE polymer prior to any pressure or heat process. The percentage(s) of pigment(s) or filler(s) added shall be measured by weight.
- 3.2.3 Pigmented material shall mean that a small percentage of inorganic pigment which may also include a color enhancing agent, total additive(s) usually less than 2% by weight, has been added to color the material and uniformly blended.

- 3.2.4 Type 1 material is used typically for backup rings and seal components for static and light duty dynamic applications. Type 1 materials can be used to seal against steel, stainless steel, chromium plating, bronze, bare or anodized aluminum and aluminum alloys, and ceramic coatings. Type 1 materials have the highest wear rate and lowest coefficients of friction. Type 1 materials are classified as Grade A and Grade B.
- 3.2.5 Type 2 material is used typically in seal components for dynamic reciprocating and rotary applications. Type 2 materials have better extrusion resistance than Type 1 materials. Type 2 materials can be used to seal against the same materials as Type 1 materials. Type 2 materials have much better wear resistance than Type 1 materials with slightly higher coefficients of friction.
- 3.2.6 Type 3 material is used typically in seal components where resistance to high temperature and pressure is required along with very good wear resistance. Type 3 materials are used to seal against steel, stainless steel, and chromium plate in a lubricated environment.
- 3.2.7 Type 4 material is used typically for dynamic seals. Type 4 materials have better extrusion resistance but slightly higher coefficients of friction than Type 3 materials. Type 4 materials are used to seal against the same materials as Type 3 materials in a lubricated environment.
- 3.2.8 Type 5 material is used typically for backup rings and seal elements in both static and dynamic applications. Type 5 materials have essentially the same physical properties as Type 1 materials with better wear resistance as a result of the presence of the inorganic pigment. Type 5 material is used to seal against steel (with the exception of nitrided steel), stainless steel, chromium plate, and anodized aluminum and aluminum alloys in both dry and lubricated environments. As opposed to Type 1 and Type 2 materials, Type 5 materials should not be used against bare aluminum or aluminum alloy.
- 3.2.9 Type 6 material is used typically for bearing and wear ring applications in a lubricated environment against steel, stainless steel, and chromium plate. Type 6 material has very good compressive strength and abrasion resistance.
- 3.2.10 Type 7 material is used in seal components for dynamic and static applications. Type 7 materials have excellent extrusion resistance and good wear resistance. Type 7 material will function well in lubricated and non-lubricated environments. Type 7 materials are used against chromium plate and steel.
- 3.2.11 Type 8 material is used in seal components for dynamic and static applications. Type 8 materials have excellent extrusion resistance and long wear life. Type 8 materials are used against chromium plate and steel.
- 3.2.12 Type 9 material is used typically for backup rings for AS 4716 and AS 5857 glands. For the AS 4716 glands the bright blue is designated for rod glands and the bright yellow for piston glands in both static and dynamic applications. For AS 5857 glands the medium brown color is designated for piston glands and the medium green color for rod glands in static applications. Type 9 materials are supplied in Grades A and B. Type 9 material is used to seal against steel (with the exception of nitrided steel), stainless steel, chromium plate, and anodized aluminum and aluminum alloys in both dry and lubricated environments. As opposed to Type 1 and Type 2 materials, Type 9 materials should not be used against bare aluminum or aluminum alloy.
- 3.2.13 Type 10 material is used in seal components for dynamic and static applications. Type 10 materials have excellent extrusion resistance and long wear life. Type 10 materials are used against chromium plate and steel.
- 3.2.14 Unless a specific type is ordered, Type 1, Grade B shall be supplied.

3.3 Properties

The product shall conform to the requirements of this specification and those shown for each type in the applicable detail specification; tests shall be performed on production product in accordance with specified test methods, insofar as practicable.

- 3.3.1 Color shall be as described for each type with no discoloration or inclusions detrimental to the performance requirements of the final components. For Type 5, color is solely dependent upon pigment chosen by the supplier.

3.4 Quality

Moldings or extrusions as received by purchaser shall be uniform in quality and color, smooth, as free from foreign material as commercially practicable, and free from internal imperfections detrimental to usage of the material.

3.5 Sizes and Tolerances

Dimensions and tolerances of moldings or extrusions shall be as agreed upon by purchaser and supplier or as stated on purchase order.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The manufacturer of moldings or extrusions shall supply all samples and shall be responsible for the performance of all required tests for each lot of moldings or extrusions. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the moldings or extrusions conform to the specified requirements. Manufacturer of machined parts shall furnish substantiating test data acquired by the manufacturer of moldings or extrusions. Purchaser of parts machined from moldings or extrusions also reserves the right to perform confirmatory testing provided the parts will yield samples that conform to the testing procedure(s) listed in 4.5.

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 or extrusions (See 4.3.1.2).

4.3 Sampling and Testing

Shall be as follows:

4.3.1 Acceptance Tests

Sufficient production moldings or extrusions or parts shall be taken at random from each lot to perform required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified, not less than three.

4.3.1.1 A batch of either virgin PTFE polymer or filled or pigmented PTFE polymer shall not exceed 4400 pounds (2000 kg).

4.3.1.2 A lot of moldings or extrusions shall be all the parts made from the same batch of compound in one continuous run and presented for manufacturer's inspection at one time.

4.3.1.3 A statistical sampling plan, acceptable to 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 Sample product shall be approved by purchaser before product for production use is supplied, unless such approval is waived by purchaser. Results of the tests on production product 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 for the process control factors, manufacturer shall submit for reapproval a statement of the proposed changes in ingredients and/or processing and, when requested, sample product.