

L-P-403C

February 13, 1976

SUPERSEDING

Fed. Spec. L-P-403B

June 28, 1968

FEDERAL SPECIFICATION

PLASTIC MOLDING MATERIAL, POLYTETRAFLUOROETHYLENE (TFE-FLUOCARBON)

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers molding and extrusion material of TFE-fluorocarbon resin. It does not cover items molded or extruded from the material.

1.2 Classification. TFE-Fluorocarbon material shall be of the following types and classes as specified (see 6.1 and 6.2).

Type I - Granular powder for general purpose molding and extrusion.

Classes 1, 2, 3, 4, 5 and 6, as specified in tables I and II.

Type II - See 6.4

Type III - Powder produced from a coagulated dispersion for extrusion, commonly used with a volatile extrusion aid.

Classes 1, 2 and 3, as specified in tables I and II.

Type IV - Granular powder for molding and extrusion for highest mechanical properties in end use.

Classes 1, 2, 3, 4, 5, 6, 7 and 8, as specified in tables I and II.

Type V - Granular powder having a better balance of handling characteristics for molding and extrusion, and higher physical properties than type I.

Type VI - Granular powder for molding and extrusion for substantially improved resistance to creep and stress relaxation in end use.

Classes 1 and 2, as specified in tables I and II.

Grade E. Electrical grade. This grade is applicable to all types and classes where electrical applications are required.

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2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Specification:

PPP-D-723 - Drums, Fiber.

Federal Standards:

Fed. Std. No. 123 - Marking for Shipment (Civil Agencies).
Fed. Std. No. 356 - Commercial Packaging of Supplies and Equipment.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

- D 150 - A-C- Capacitance, Dielectric Constant, and Loss Characteristics of Electrical Insulating Materials.
- D 618 - Conditioning Plastics and Electrical Insulating Materials for Testing.
- D 638 - Tensile Properties of Plastics.
- D 792 - Specific Gravity and Density of Plastics by Displacement.
- D 1457 - TFE-Fluorocarbon Resin Molding and Extrusion Materials.
- D 1708 - Tensile Properties of Plastics by Use of Microtensile Specimens.
- D 2990 - Tensile Creep and Creep Rupture of Plastics.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

National Motor Freight Traffic Association, Inc., Agent:**National Motor Freight Classification.**

(Application for copies should be addressed to the American Trucking Associations Inc., Tariff Order Section, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:**Uniform Freight Classification.**

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

3. REQUIREMENTS

3.1 **Material.** The material shall be TFE-fluorocarbon resin and shall contain no additives such as colors, fillers, or plasticizers (see 6.3). Material reprocessed from fabricated articles or waste shall not be included.

3.2 **Property values for material before processing.** The TFE-fluorocarbon material in powder form shall conform to the requirements of table I when tested in accordance with the applicable procedure of 4.3.

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TABLE I. Property requirements for tests on powders

Type	Class	Apparent density, g/liter	Particle size, average diameter, μm	Retention on No. 230 (63- μm) screen, max. percent	Water, content, max. percent
I	1	500 \pm 50	575 \pm 150	--	0.03
	2	625 \pm 50	550 \pm 75	--	0.03
	3	500 \pm 50	350 \pm 50	--	0.03
	4	550 \pm 50	325 \pm 75	--	0.03
	5	625 \pm 50	275 \pm 100	--	0.03
	6	675 \pm 50	375 \pm 75	--	0.03
III	1	475 \pm 100	500 \pm 150	--	0.04
	2	--	500 \pm 150	--	0.04
	3	--	425 \pm 150	--	0.04
IV	1	250 \pm 75	--	12	0.04
	2	300 \pm 50	--	12	0.04
	3	325 \pm 50	--	8	0.04
	4	475 \pm 75	--	8	0.04
	5	575 \pm 50	650 \pm 75	--	0.04
	6	575 \pm 50	--	--	0.04
	7	875 \pm 75	--	--	0.04
	8	750 \pm 50	--	--	0.04
V		720 \pm 75	--	--	0.04
VI	1	400 \pm 50	--	8	0.04
	2	650 \pm 50	--	--	0.04

3.3 Property values for molded test specimens. When tested as specified in the applicable procedure of 4.3, all specimens shall conform to the property values specified in table II. When grade E material is specified, all specimens shall conform to the property values specified in tables II and III.

TABLE II. Property requirements for tests on molded specimens

Type	Class	Melting point, deg C	Thermal instability index, max	Specific gravity		Tensile strength		Elongation, min percent	Tensile ^{1/} creep strain max, percent
				min	max	MPa	psi		
I	1	327 ± 10	50	2.13	2.18	13.8	2000	140	--
	2	327 ± 10	50	2.13	2.18	13.8	2000	140	--
	3	327 ± 10	50	2.13	2.18	17.2	2500	200	--
	4	327 ± 10	50	2.13	2.18	13.8	2000	140	--
	5	327 ± 10	50	2.13	2.18	13.8	2000	140	--
	6	327 ± 10	50	2.13	2.18	17.2	2500	200	--
III	1	327 ± 10	50	2.19	2.24	18.6	2700	400	--
	2	327 ± 10	50	2.15	2.20	20.7	3000	200	--
	3	327 ± 10	50	2.17	2.23	20.7	3000	200	--
IV	1	327 ± 10	50	2.13	2.19	27.6	4000	300	--
	2	327 ± 10	50	2.13	2.19	27.6	4000	300	--
	3	327 ± 10	50	2.13	2.19	27.6	4000	300	--
	4	327 ± 10	50	2.13	2.19	27.6	4000	300	--
	5	327 ± 10	50	2.13	2.19	27.6	4000	300	--
	6	327 ± 10	50	2.13	2.19	27.6	4000	300	--
	7	327 ± 10	50	2.13	2.19	27.6	4000	300	--
	8	327 ± 10	50	2.13	2.19	27.6	4000	300	--
V		327 ± 10	50	2.13	2.19	27.6	4000	300	--
VI	1	327 ± 10	50	2.16	2.22	20.7	3000	300	4.0
	2	327 ± 10	50	2.16	2.22	17.9	2600	240	4.0

^{1/}Values are based on testing for 100 hours duration.

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TABLE III. Electrical requirements for molded test specimens^{1/}

Type	Class	Dielectric constant at 10 ³ hertz, max.	Dissipation factor at 10 ³ hertz, max.
I	1	All classes 2.1	All classes 0.0003
	2		
	3		
	4		
	5		
	6		
III	1	--	--
	2	--	--
	3	--	--
IV	1	All classes 2.1	All classes, less than 0.0003
	2		
	3		
	4		
	5		
	6		
	7		
	8		
V		All classes 2.1	All classes, less than 0.0003
VI	1	All classes 2.1	All classes, less than 0.0003
	2		

^{1/}Applicable only to grade E material.

3.4 Color. The material shall be white in color and opaque as determined by visual inspection.

3.5 Uniformity. The material shall be uniform in form, color, and all appearances within each container and from container to container.

3.6 Workmanship. The material shall be clean and free of contamination.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Sampling for inspection and acceptance. Sampling for inspection and acceptance shall be performed in accordance with the provisions set forth in MIL-STD-105, except where otherwise indicated. For purposes of sampling, an inspection lot for examination and tests shall consist of all material of the same type, class, and grade (if applicable) submitted for delivery at one time.

4.2.1 Inspection of materials and components. In accordance with 4.1, the supplier is responsible for insuring that materials and components used, were manufactured, examined and tested, in accordance with the requirements of this specification and to the extent specified of referenced specifications and standards. In the event of conflict this specification shall govern. A supplier's certificate of compliance with 3.1 shall be furnished.

4.2.2 Inspection of material.

4.2.2.1 Examination of material. Examination of material shall be made in accordance with the classification of defects, inspection levels and acceptable quality levels (AQLs) set forth below. The lot size, for purpose of determining the sample size in accordance with MIL-STD-105, shall be expressed in units of 100 pounds for examination in 4.2.2.1.1, and in units of shipping containers for examination in 4.2.2.1.2.

4.2.2.1.1 Examination of material for defects in color, form, appearance and workmanship. The sample unit for this examination, specified in table IV shall be approximately one pound.

TABLE IV. Examination of the material for defects
in appearance and workmanship

Examine	Defect
Appearance and workmanship	Color improper. Not opaque. Not uniform in appearance. Not clean, presence of foreign particles.

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4.2.2.1.2 Examination of the preparation for delivery. An examination shall be made in accordance with table V to determine that packing and marking comply with specified contract requirements. The sample unit for this examination shall be one shipping container fully packed, selected after the closing operation. Shipping containers fully prepared for delivery shall be examined for closure defects.

TABLE V. Examination of preparation for delivery

Examine	Defects
Packing	Not level specified; not in accordance with contract requirements. Any nonconforming component, component missing, damaged, or otherwise defective affecting serviceability. Inadequate application of components such as: Incomplete closures of case liners; container flaps, loose or inadequate strappings, bulged, or distorted containers.
Quantity of material	Less than specified or indicated quantity.
Weight	Gross weight exceeds specified requirements.
Markings	Interior or exterior markings omitted, illegible, incorrect, incomplete, of improper size, location, sequence, method of application, or not in accordance with contract requirements.

4.2.2.1.3 Inspection levels and acceptable quality levels (AQLs) for examinations. The inspection levels for determining the sample size and the acceptable quality level (AQL) expressed as defects per 100 units shall be as follows:

Examination paragraph	Inspection level	AQL
4.2.2.1.1	II	2.5
4.2.2.1.2	S-2	2.5

4.2.3 Testing. The material shall be tested for the applicable characteristics listed in tables I, II, and III in accordance with the test methods specified herein. The lot size, for the purpose of determining the sample size for testing shall be expressed in units of 100 pounds. The sample unit shall consist of sufficient material to prepare all required specimens. The inspection level shall be S-1, with an acceptance number of 0. The results for each test shall be the averaged results of the specimens.

4.2.3.1 Classification of tests. All tests shall be classified as follows:

- a. Lot acceptance tests (see 4.2.3.2).
- b. Periodic lot check tests (see 4.2.3.3).

4.2.3.2 Lot acceptance tests. Lot acceptance tests shall be made on each lot of material and in conjunction with the above examination shall be the basis for acceptance or rejection of the lot, except when periodic lot check tests are required. Lot acceptance tests shall consist of the test specified in table I plus testing for specific gravity (see table II). For grade E material, lot acceptance tests shall consist of the test specified in tables I and III plus testing for specific gravity.

4.2.3.3. Periodic lot check tests. Periodic lot check tests shall be made on the first lot of material furnished under this specification, and on every twentieth lot thereafter. Periodic lot check tests shall consist of all tests specified in tables I, II, and III. When periodic lot check tests are made, they shall be included in the basis for acceptance or rejection of the lot.

4.3 Test methods.

4.3.1 Preparation of test specimens. Unless otherwise specified by the procuring agency, test specimens shall be prepared as follows: Types I, IV, V, and VI test specimens shall be cut from molded test billets prepared in accordance with ASTM D 1457, except that billet shall be prepared at 5,000 psi for class 8 of type IV and type V, and class 2 of type VI material. Test specimens for type III material shall be cut from molded disks as specified in ASTM D 1457.

4.3.2 Test conditions. Unless otherwise specified in the applicable test method, tests shall be conducted at $23^{\circ} \pm 2^{\circ}\text{C}$. ($73.4^{\circ} \pm 3.6^{\circ}\text{F}$.). Test specimens for specific gravity, tensile strength and elongation shall be conditioned in accordance with procedure A of ASTM D 618 for a minimum time period of 4 hours prior to testing.

4.3.3 Apparent density. Determination of apparent density shall be made on the material in powder form. Testing shall be in accordance with the applicable procedure specified in ASTM D 1457.

4.3.4 Particle size. Determination of particle size shall be made on the material in powder form. Testing shall be in accordance with the applicable procedure specified in ASTM D 1457.

4.3.5 Retention of material on No. 230 sieve. Determination of material retention on No. 230 (63 micron) sieve shall be made on the material in powder form. Testing shall be in accordance with the applicable procedure specified in ASTM D 1457, except that a No. 230 sieve shall be used.

4.3.6 Water content. Determination of water content shall be made on the material in powder form. Testing shall be in accordance with the applicable procedure specified in ASTM D 1457.

4.3.7 Melting point. One shaving shall be tested in accordance with the applicable procedure of ASTM D 1457.

4.3.8 Thermal instability index. Three test specimens shall be tested in accordance with the applicable procedure of ASTM D 1457.

4.3.9 Specific gravity. One test specimen shall be tested in accordance with method A-1 or A-2 of ASTM D 792. Two drops of a wetting agent shall be added to the water in order to reduce the surface tension and insure complete wetting of the disc.

4.3.10 Tensile strength and elongation. Three microtensile test specimens shall be cut with the microtensile die described in D 1708. The die shall be of the steel rule type with radius of curvature of $5/32 \pm 1/32$ inch (4 ± 0.8 mm.) Tensile properties shall be determined in accordance with the procedures described in ASTM D 638, except that the specimens shall be as detailed above, and the initial jaw separation shall be 0.875 ± 0.005 inch (22.2 ± 0.13 mm.). The speed of testing shall be at 2 inches (51 mm) per minute rate. The specimen shall be clamped with essentially equal lengths in each jaw. Elongation shall be determined from the chart, expressed as a percentage of the initial jaw separation.

4.3.11 Tensile creep. Three specimens of type V material shall be tested in accordance with ASTM D 2990. Testing shall be at 800 psi stress for a minimum period of 100 hours.

4.3.12 Dielectric constant and dissipation factor. Five test specimens shall be conditioned in accordance with 4.3.2 except that the minimum conditioning period shall be 24 hours. Testing shall be in accordance with ASTM D 150.

5. PREPARATION FOR DELIVERY

5.1 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

5.1.1 Level A. Unless otherwise specified, the material in the quantity specified (see 6.2) shall be packed in one of the following types of containers:

Fiber drums conforming to PPP-D-723, type II, grade A, or type III, grade A. For types I and II material, maximum quantity shall be 225 pounds per drum. For types III, IV, and V material, maximum quantity shall be 115 pounds, per drum.

Insofar as practical, drums shall be of uniform shape and size, with minimum cube and tare consistent with the protection required. Drums shall contain identical quantities and shall be closed in accordance with the applicable container specification. Fiber drums shall be furnished with a polyethylene liner of 3 mil minimum thickness, properly heat sealed at the bottom and properly tied off at the top. For type III material only, the polyethylene liner shall be integral with the drum interior.

5.1.2 Level B. Unless otherwise specified, the material in the quantity specified (see 6.2), shall be packed in one of the following types of containers:

Fiber drums conforming to PPP-D-723, type I, grade A. For types I and II fluorocarbon material, maximum quantity shall be 225 pounds per drum. For types III, IV, and V fluorocarbon material, maximum quantity shall be 115 pounds per drum.

Insofar as practical, drums shall be of uniform shape and size with minimum cube and tare consistent with the protection required. Drums shall contain identical quantities and shall be closed in accordance with the applicable container specification. Fiber drums shall be furnished with a polyethylene liner of 3 mil minimum thickness, properly heat sealed at the bottom and properly tied off at the top. For type III material only, the polyethylene liner shall be integral with the drum interior.

5.1.3 Commercial packing. Packing shall be in accordance with commercial practice adequate to ensure acceptance and delivery by the carrier for the mode of transportation employed. Containers shall comply with the requirements of the Uniform Freight Classification Rules or National Motor Freight Classification Rules, as applicable.

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5.2 Marking.

5.2.1 Civil agencies. Shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.2.2 Military agencies. Containers shall be marked in accordance with MIL-STD-129 with the exception that commercial marking in accordance with Fed. Std. No. 356 applies for commercial packaging only.

6. NOTES

6.1 Intended use. Items fabricated from TFE-fluorocarbon materials possess extreme resistance to chemical attack, very high thermal stability, low dielectric loss and high dielectric strength nonadhesion, and low frictional characteristics. Type I material is used for general items such as gaskets, seals, rings, packing, and bearings. Type III material is used not only for moldings but for extrusion of insulation on electrical wire. Type III material also is used for extruded tubing to be used as slip-on insulation and as hose liners. Types IV and V material are used for very high quality void-free moldings for skived tape applications, and are suitable for extrusions also. Types IV and V material also may be used for moldings and extrusions where highest mechanical properties are required in end use. Type VI material is used where substantially improved resistance to creep and stress relaxation are required in end use.

6.2 Ordering data. Purchasers should select the preferred options offered herein and include the following information in procurement documents:

- a. Title, number, and date of this specification.
- b. Type and class of material required (see 1.2).
- c. Grade E if required for electrical applications (see table III).
- d. Level of packing (see 5.1).
- e. Whether other types of containers are required (see 5.1.1 and 5.1.2).
- f. Quantity in container (see 5.1.1 and 5.1.2)
- g. Special markings required (see 5.2.1 and 5.2.2)

6.3 Finished products. Finished products such as extruded tubing and molded shapes may have additions of color, filler, or extrusion aids. These additions may affect property values.

6.4 Type II material. Type II materials have been discontinued commercially. Type II materials covered granular powder of somewhat finer particle size than type I for general purpose molding and extrusion.

6.5 Cross index. Table VI shows the classification of material covered by L-P-403C and the corresponding classification of material specified in L-P-403b. Because of technological changes, properties may not be exactly equivalent.

TABLE VI. Classification in this document and corresponding classification in L-P-403b

Classification in L-P-403C	Classification in L-P-403b
Type I	Type I
None	Type II
Type III	Type III
Type IV	Type IV
Type V	Type V
Type VI	None
Grade E	None
Type 1, classes 3, 4, 5 and 6	None
Type IV, classes 2, 5, 6, 8 and 9	None
None	Type IV, class 4

MILITARY INTEREST:

Army - MR
Navy - SH
Air Force - 11

Preparing activity:

Army - MR

CIVIL AGENCY COORDINATING ACTIVITIES:

Review activities:

Army - PA, EL, ME, WC
Navy - SH
Air Force - 84
DSA - GS

ERDA
GSA-PSS
VA-DMS

User activities:

Navy - OS, EC

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