

MIL-P-21922B
8 June 1973
SUPERSEDING
MIL-P-21922A
11 July 1966

MILITARY SPECIFICATION

PLASTIC RODS AND TUBES, POLYETHYLENE

This specification is approved for use by all departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers low, medium, and high density polyethylene rods and tubes for general purpose, dielectric, and weather resistant applications.

1.1.1 Coverage. This specification covers polyethylene rods and tubes made from material conforming to L-P-390.

1.2 Classification. Polyethylene rods and tubes shall be of the applicable type, class, and grade (see 3.1 and 6.2) in accordance with table I, as follows.

/FSC 9330, 9390, 4710, 4720/

MIL-P-21922B

Table I. Types, Classes and Grades of Rods and Tubes

Type	Application	Class	Grade	Color
I	General purpose	L and M	1	} Natural and colors, including black
			2	
		H	1	
			2	
			3	
II	Dielectric	L	1	Natural
			2	Colors, including black
			3	Natural
			4	Colors, including black
		M	1	Natural
			2	Colors, including black
		H	1	} Natural and colors, including black
			2	
			3	
			4	
III	Weather resistant	L	1	Black (carbon 0.5 ± 0.1 percent by weight)
			2	} Black (carbon 2.50 ± 0.5 percent by weight)
			3	
			4	
		M	1	Black (carbon 0.5 ± 0.1 percent by weight)
			2	} Black (carbon 2.50 ± 0.5 percent by weight)
		H	3	
			1	
2				

1/ L = low density; M = medium density; and H = high density.

Form A - Rods
Form B - Tubes

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.

MIL-P-21922B

SPECIFICATIONS

FEDERAL

- L-P-390 - Plastic, Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium and High Density)
- PPP-B-585 - Boxes, Wood, Wirebound.
- PPP-B-591 - Boxes, Fiberboard, Wood-Cleated.
- PPP-B-601 - Boxes, Wood, Cleated-Plywood.
- PPP-B-636 - Box, Fiberboard.

MILITARY

- MIL-P-116 - Preservation, Method of
- MIL-L-10547 - Liners, Case, Waterproof

STANDARDS

MILITARY

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

(Copies of specifications, standards, drawings, and publications 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 otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS:

- D618-61(1971) Conditioning Plastics and Electrical Insulating Materials for Testing.
- D1238-70 Measuring Flow Rates of Thermoplastics by Extrusion Plastometer.
- D1505-68 Density of Plastics by the Density - Gradient Technique.

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

MIL-P-21922B

National Motor Freight Traffic Association, Incorporated, Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Association, 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 Materials. Unless otherwise specified by the procuring activity (see 6.2), type I material of L-P-390 shall be used for extrusion of rods and tubes.

3.2 Property values. The rods and tubes shall conform to the property values for density and melt index specified in L-P-390 (see 4.3.2).

3.3 Dimensions and tolerances.

3.3.1 Diameter and wall thickness. The diameter of rods shall be the nominal diameter specified by the procuring activity (see 6.2) and tolerances shall be as specified in table II. The outside diameter and wall thickness of tubes shall be as specified by the procuring activity (see 6.2) and tolerances shall be as specified in table III.

MIL-P-21922B

Table II. Rod diameter tolerances, including out of roundness

Nominal diameter, inches	Tolerance		Nominal diameter, inches	Tolerance	
	Plus	Minus		Plus	Minus
1/8	0.010	0.010	1-1/4	0.025	0.020
3/16	0.010	0.010	1-1/2	0.025	0.020
1/4	0.010	0.010	2	0.040	0.020
3/8	0.010	0.018	2-1/2	0.048	0.020
1/2	0.010	0.018	3	0.250	0.000
5/8	0.010	0.018	4	0.250	0.000
3/4	0.010	0.018	5	0.250	0.000
7/8	0.010	0.020	6	0.250	0.000
1	0.010	0.020	7	0.250	0.000

1/ Intermediate diameters shall conform to the tolerances of the larger diameters.

Table III. Tolerances for tube diameter and wall thickness

Nominal outside diameter of tubes, inches <u>1/</u>	Tolerances, plus or minus, inches <u>2/</u>					
	On outside diameter, inches	On wall thickness, inches <u>3/</u>				
		1/32	1/16	3/32	1/8	3/16
3/8 <u>4/</u>	0.0075	0.005	0.006	0.008	0.009	-----
1/2	0.010	0.005	0.007	0.009	0.010	0.012
5/8	0.011	0.005	0.007	0.009	0.010	0.012
3/4	0.0125	0.005	0.007	0.009	0.010	0.012
1	0.015	0.006	0.008	0.010	0.010	0.013
1-1/4	0.0175	0.006	0.008	0.010	0.010	0.013
1-1/2	0.020	0.006	0.008	0.010	0.010	0.014
2	0.025	0.006	0.009	0.010	0.011	0.015
2-3/4	0.035	0.006	0.010	0.010	0.012	0.015
2-1/2	0.030	0.006	0.009	0.010	0.012	0.015

1/ Intermediate sizes shall conform to the tolerances of the larger size.

2/ Tolerances for diameter apply to the average outside diameter as determined by averaging two mutually perpendicular diameters in the same cross sectional plane. Tolerance for wall thickness applies to the maximum and minimum wall thickness measured at any point around the circumference and includes eccentricity.

3/ Tolerances for wall thickness greater than 3/16 inch shall be as specified by the procuring activity.

4/ Tolerances for tubes smaller than 3/8 inch or larger than 2-3/4 inches outside diameter, shall be as specified by the procuring activity (see 6.2).

MIL-P-21922B

3.3.2 Length of rods. Unless otherwise specified by the procuring activity (see 6.2), rods shall be furnished in lengths of 48 or 72 inches depending upon which is more nearly standard for the diameter specified. When both lengths are standard, the longer one shall be preferred. Tolerances for length shall be plus 1.0, minus 0.0 inches for rods 1 inch or less in diameter, and plus 2.0, minus 0.0 inches for rods greater than 1 inch in diameter (see 6.2). Rods shall be supplied in straight lengths.

3.3.3 Length of tubes. Unless otherwise specified by the procuring activity (see 6.2), tubes shall be furnished in straight lengths of 72 plus 1.0, minus 0.0 inches (see 6.2).

3.4 Color. The color of the rods and tubes shall be as specified by the procuring activity (see 6.2).

3.5 Centerless grinding. When specified by the procuring activity, rods and tubes shall be extruded oversize and then centerless ground to the outside diameter specified. The rods or tubes shall be held to the outside diameter tolerance and surface finish specified in the contract or purchase order. The wall thickness shall be as specified, plus or minus the acceptable tolerances.

3.6 Certification. The manufacturer shall present certification that the material used in preparing the rods and tubes conforms to the applicable type, class, and grade of material specified in L-P-390 (see 6.2). The certificate shall state the material designation, color, and type, grade, and class of L-P-390 to which it conforms. The certificate shall be presented prior to, or at the time of delivery of the lot, and shall be signed by a responsible agent of the supplier, and shall be accompanied by evidence of the agent's authority to bind his principal.

3.7 Workmanship. The rods and tubes shall be free from kinks (see 6.3), blisters, cracks, bubbles, discolorations, craze, surface scratches that form definite indentations, wrinkles, dents, die or heat marks.

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 in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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 supplies and services conform to prescribed requirements.

MIL-P-21922B

4.1.1 Inspection of materials and components. In accordance with 4.1 above, the supplier is responsible for insuring that materials and components used were manufactured, tested and inspected in accordance with the requirements of referenced, subsidiary specifications and standards to the extent specified. In the event of conflict, this specification shall govern.

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 rods of one nominal diameter, or tubes of one nominal outside diameter and wall thickness of the same type, class and grade of material, submitted for delivery at one time.

4.3 Inspection of the rods and tubes.

4.3.1 Examination of the rods and tubes. Examination shall be made in accordance with the classification of defects, inspection levels and acceptable quality levels (AQLs) set forth below. The lot size, for purposes of determining the sample size in accordance with MIL-STD-105, shall be expressed in units of packages of plastic rods or tubes as applicable, for examination in 4.3.1.1, 4.3.1.2, 4.3.1.3 and in units of shipping containers for examination under 4.3.1.4.

4.3.1.1 Examination of the rods and tubes for defects in color, centerless grinding, and workmanship. The sample unit for this examination, specified in table IV, shall be one rod or one tube, as applicable. Not more than five sample units shall be taken from any one package of rods or tubes.

Table IV. Examination for defects in color, centerless grinding, and workmanship

Examine	Defect
Color and Centerless grinding	Color improper Centerless grinding improper
Workmanship	Not free from kinks, blisters, cracks, bubbles, discolorations, craze, surface scratches forming indentations, wrinkles, dents, die or heat marks.

4.3.1.2 Examination of the rods and tubes for dimensional defects. The sample unit for this examination, specified in table V, shall be one rod or tube, as applicable.

MIL-P-21922B

Table V. Examination for dimensional defects

Examine	Defect
Diameter of rods	Nominal diameter improper or varies more than tolerances specified in table I.
Outside diameter and wall thickness of tubes	Improper outside diameter or wall thickness. Tolerances not within that specified in table II.
Length of rods	Improper length. Not within tolerances specified for length of rods.
Length of tubes	Improper length Not within tolerances specified for length of tubes.

4.3.1.3 Examination of the rods and tubes for defects in the count for package. The sample unit for this examination, specified in table VI shall be one package.

Table VI. Examination for defects in the count for package

Examine	Defect
Rods and tubes	Average count per package less than specified.

4.3.1.4 Examination of preparation for delivery requirements. An examination shall be made in accordance with table VII to determine that packaging, packing and marking comply with the requirements of Section 5. The sample unit for this examination shall be one shipping container, fully packed, selected just prior to the closing operation. Shipping containers fully prepared for delivery shall be examined for closure defects.

Table VII. Examination of preparation for delivery

Examine	Defect
Packaging	Not level specified; not in accordance with contract requirements. Rods or tubes not unit wrapped and packaged as specified. Packaging material not as specified; closures not accomplished by specified or required methods or materials.

MIL-P-21922B

Table VII. Examination of preparation for delivery (cont'd)

Examine	Defects
Packing	<p>Not level specified; not in accordance with contract requirements.</p> <p>Any nonconforming component; component missing, damaged or otherwise defective affecting serviceability.</p> <p>Container not as specified; closures not accomplished by specified or required methods of materials.</p> <p>Inadequate application of components, such as: incomplete closures of case liners or container flaps, loose or inadequate strappings, bulged or distorted containers, improper taping or inadequate stapling.</p>
Count	Less than specified or indicated quantity of packages per shipping container.
Weight	Gross or net weight exceeds specified requirements.
Markings	Interior or exterior markings (as applicable) omitted, illegible, incorrect, incomplete, of improper size, location, sequence, method of application, or not in accordance with contract requirements.

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

Examination Paragraph	Inspection Level	AQL
4.3.1.1	I	1.5
4.3.1.2	S-3	2.5
4.3.1.3	S-2	---
4.3.1.4	S-2	4.0

MIL-P-21922B

4.3.2 Testing. The rods or tubes shall be tested for the density and melt index characteristics specified in 3.2 for each lot submitted for inspection, in accordance with the test methods specified herein. The lot size for the purpose of determining sample size for testing shall be expressed in units of packages of rods or tubes. The sample unit shall consist of approximately two feet of rod or tube. 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.

4.4 Test methods.

4.4.1 Specimen preparation. Specimens shall be die cut or machined from rods or tubes for density determinations. For melt index determinations, specimens may be in any of the forms specified in ASTM D 1238-70.

4.4.2 Conditioning test specimens. The specimens shall be conditioned in accordance with procedure A of ASTM method D618-61(1971). Testing shall be at $23^{\circ} \pm 2^{\circ}\text{C}$ ($73.4^{\circ} \pm 3.6^{\circ}\text{F}$) and 50 ± 5 percent relative humidity.

4.4.3 Density. Duplicate determinations shall be made using two separate specimens. Testing shall be in accordance with ASTM D 1505-68.

4.4.4 Melt index. Three determinations shall be made for melt index (flow rate) in accordance with ASTM method D1238-70, using condition E.

5. PREPARATION FOR DELIVERY

Application. The requirements of section 5 apply only to purchase by or direct shipment to the Government.

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

5.1.1 Level A.

5.1.1.1 Unit packaging. Unless otherwise specified in the contract or purchase order (see 6.2) rods and tubes shall be packaged in quantities specified by the procuring activity in accordance with method III of MIL-P-116. Rods or tubes of only one set of nominal dimensions shall be placed in one package.

5.1.1.2 Intermediate packaging. When required, specified quantities of unit packages shall be intermediately packaged as specified in the contract or purchase order (see 6.2).

5.1.2 Level C. Rods or tubes shall be preserved and packaged to afford adequate protection against deterioration and damage during shipment from the supply source to the first receiving activity.

MIL-P-21922B

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

5.2.1 Level A. Rods or tubes packaged as specified in 5.1.1 shall be packed in containers conforming to PPP-B-585 (overseas type), PPP-B-601 (overseas type) or PPP-B-636 (class weather resistant). Unless otherwise specified containers shall be provided with a case liner conforming to MIL-L-10547. Closure shall be in accordance with the applicable container specifications or appendix thereto. The gross weight of wood or wood cleated boxes shall not exceed 200 pounds.

5.2.2 Level B. Rods or tubes packaged as specified in 5.1.1 shall be separated by thickness and shall be packed in domestic class or type shipping containers conforming to PPP-B-591, PPP-B-601, or PPP-B-636. Closure shall be in accordance with the applicable container specification or appendix thereto. The gross weight of the containers shall not exceed 150 pounds except for the PPP-B-636 box which shall not exceed the weight limitations of the box specification.

5.2.3 Level C. Rods and tubes packaged as specified in 5.1, shall be packed in a manner to ensure carrier acceptance and safe delivery at destination at lowest transportation rate for such supplies. Containers shall be in accordance with Uniform Freight Classification Rules or National Motor Freight Classification Rules, as applicable.

5.3 Marking. In addition to any special marking required by the contract or order, interior packages and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The bulk of polyethylene rods and straight length tubes are intended for use as machine shop stock for machining into components of electrical and corrosion resistant equipment and items. Small diameter tubes, usually furnished in coils, may be used as laboratory tubing for carrying water and corrosive liquids. Smaller diameter rods may be used for decorative beading.

6.2 Ordering data. Procurement documents should specify:

6.2.1 Procurement requirements.

- a. Title, number, and date of this specification.
- b. Type if other than type I, class, and grade of material required (see 1.2).
- c. Outside diameter required (see 3.3.1).
- d. Tube wall thickness required (see 3.3.1).
- e. Length required (see 3.3.2 and 3.3.3).
- f. Color required (see 3.4).
- g. Centerless grinding and surface finish, if required (see 3.5).
- h. Tube diameter and wall thickness tolerances, when centerless grinding is specified (see 3.5).
- i. Packaging and packing required including unit packaging quantities, if required (see 5.1 and 5.2).

MIL-P-21922B

6.2.2 Contract data requirements. Data specified in paragraphs 3.2 and 3.6 will be listed directly on a DD Form 1423 incorporated into the contract.

6.3 Kinked and bowed. Rods and tubes containing a bend that is not a uniform bow are considered kinked. Rods and tubes uniformly curved over the entire length are considered bowed. Unless otherwise specified, bowed rods and tubes are acceptable, and kinked rods and tubes are unacceptable. Numerical limits for bowing may be specified by the procuring activity.

6.4 Degradation of material. Extrusion under excessive temperature conditions may cause degradation of the material as evidenced by a change in appearance and an increase in melt index.

6.5 Coils. The procuring activity may specify that small diameter tubes be supplied in coils of specified lengths. Usual coil lengths are 50 feet and 100 feet. Because of the tendency for coiled tubes to contain coil set and kinking, it is recommended that only tubes supplied in straight lengths be ordered for use as machine shop stock.

Custodians:

Army - MR
Navy - AS
Air Force - 11

Preparing activity:

Army - MR
(Project No. 9330-0377)

Review activities:

Army - EL, MI, GL, MU, ME
Navy - SH
Air Force - 11, 84

User activities:

Navy - YD

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Army Materials and Mechanics Research Center
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SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R094
INSTRUCTIONS		
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.		
SPECIFICATION		
MIL-P-21922B, Plastic Rods and Tubes, Polyethylene		
ORGANIZATION	CITY AND STATE	
CONTRACT NO	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT
		\$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1 HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?		
A GIVE PARAGRAPH NUMBER AND WORDING		
B RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES		
2 COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3 IS THE SPECIFICATION RESTRICTIVE?		
<input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?		
4 REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.)		
SUBMITTED BY (Printed or typed name and activity)		DATE

DD FORM 1426
1 APR 63

REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE