

Plastic, Molding and Extrusion Material
Polyethylene and Copolymers (Low, Medium, and High Density)

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of April, 2003, and has been superseded by ASTM D 4976, Polyethylene Plastics Molding and Extrusion Materials. The requirements of the latest issue of ASTM D 4976 shall be fulfilled whenever reference is made to the cancelled AMS-L-P-390. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, noting that it is superseded by ASTM D 4976.

Cancelled specifications are available from SAE. Copies of ASTM D 4976 are available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959 or www.astm.org.

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This document has been taken directly from U.S. Military Specification L-P-390C, Notice 1, Amendment 2 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace L-P-390C, Notice 1, Amendment 2. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

1. SCOPE AND CLASSIFICATION:

1.1 Scope:

This specification covers low, medium, and high density polyethylene and copolymers molding and extrusion material for general purpose use, for use as dielectric material, and for weather-resistant applications (see 6.1). For the purpose of this specification, the term polyethylene is used when referring to any of the types, classes, grades, and categories.

- 1.1.1 Coverage: This specification does not cover all the types, classes, grades, and categories of polyethylene, but only those that are most generally used by the Federal Government.

1.2 Classification:

- 1.2.1 Types, classes, grades, and categories (see table III): Polyethylene shall be of the types, classes, grades, and categories shown in tables I and II, as specified (see 6.2).

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 U.S. Government Publications:

Available from DODSSP Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

Fed. Std. No. 123	Marking for Shipment (Civil Agencies)
Fed. Test Method Std. No. 406	Plastics: Methods of Testing
Fed. Test Method Std. No. 601	Rubber: Sampling and Testing

MIL-P-116	Preservation, Methods of
MIL-STD-45662	Calibration System Requirements

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-147	Palletized and Containerized Unit Loads 40" x 48" Pallets, Skids, Runners, or Pallet-Type Base

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

ASTM D 746	Method of Test for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 1238	Method of Measuring Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D 1505	Method of Test for Density of Plastics by the Density-Gradient Technique

2.2 (Continued):

ASTM D 1531	Method of Test for Dielectric Constant and Dissipation Factor of Polyethylene by Liquid Displacement Procedure
ASTM D 1603	Method of Test for Carbon Black in Ethylene Plastics
ASTM D 1693	Method of Test for Environmental Stress-Cracking of Type I Ethylene Plastics
ASTM D 1928	Method for Preparation of Compression - Molded Polyethylene Test Samples
ASTM E 60	Recommended Practice for Photometric Methods for Chemical Analysis of Metals

TABLE I. Types, classes, and grades

Type	Application	Class 1/	Grade	Color
I	General purpose (see 6.1.1)	L and M	1	Natural and colors, including black
			2	
		H	1	
			2	
			3	
II	Dielectric (see 6.1.2)	L	4	Natural Colors, including black
			5	
			1	
			2	
		M	1	Natural Colors, including black
			2	
			3	
			4	
III	Weather resistant (see 6.1.3)	L	5	Natural and colors, including black
			1	
			2	
			3	
		M	4	Black (carbon 0.5 ± 0.1 percent by weight)
			1	
			2	
			3	
		H	4	Black (carbon 2.50 ± 0.5 percent by weight)
			1	
			2	
			3	

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

TABLE II. Categories

Category	Melt-index 1/ (nominal flow rate) grams/10 minutes
1	25
2	10 to 25, inclusive
3	1.0 to 10, inclusive
4	0.4 to 1.0, inclusive
5	0.4 maximum

1/ See 3.2.1.

2.3 Rural Electrification Administration (REA) Publication:

Available from United States Department of Agriculture, Rural Electrification Administration, Washington, DC 20402.

PE-200 Polyethylene Raw Material

3. REQUIREMENTS:

3.1 Material:

The material shall be virgin polyethylene or a copolymer of at least 90 percent ethylene and other olefin monomers, containing a lubricant if necessary, and formulated to meet the requirements of this specification. The material shall be suitable for molding or extrusion.

3.1.1 Color: Colors, as applicable (see table I), shall be as specified (see 6.2). Standards for color shall be in accordance with the color notations of REA Publication PE-200.

3.1.2 Transparency: Polyethylene shall be either translucent or opaque, as specified (see 6.2).

3.1.3 Form: Polyethylene shall be in the form of powder, granules, or pellets, as specified (see 6.2).

3.1.4 Contamination: When examined as specified in 4.6.3.1, polyethylene shall be free from contamination (dirt, foreign matter, and burnt, streaked, or off-color pellet).

3.1.5 Carbon-black: In accordance with suitable commercial milling procedures as recommended by the supplier, type III polyethylene shall contain uniformly well dispersed channel or furnace carbon-black.

3.1.5.1 Particle size: When tested as specified in 4.6.3.2, the average particle size shall be 20 nanometers (nm) or less.

3.1.5.2 Concentration: When tested as specified in 4.6.3.3, the concentration shall be 0.5 ± 0.1 percent by weight for classes L and M, grade 1 and 2.50 ± 0.5 percent by weight or class L, grades 2, 3, and 4; class M, grades 2 and 3; and class H, grades 1 and 2 (see 6.1.3 and 6.3).

3.1.5.3 Absorption coefficient: When tested as specified in 4.6.3.4, the absorption coefficient shall be not less than 3200.

3.1.6 Antioxidant: Types II and III polyethylene shall contain an antioxidant for milling stability (see 3.2.2 and 6.4).

3.2 Property values:

Unless otherwise specified (see table III (brittleness)), the values obtained from each set of specimens for any property shall be averaged (see 4.6.2.3), and the results obtained shall meet the requirements specified in table III.

TABLE III. Property values

Property	Class	Value required																	
		Type I Grade						Type II Grade						Type III Grade					
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3
Density, annealed, range, incl, D23C, g/ml 1/	L	0.910 to 0.925	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	M	0.926 to 0.940	---	---	---	---	0.926 to 0.940	---	---	---	---	0.910 to 0.925	---	---	---	---	0.910 to 0.925	---	---
	H	0.941 to 0.985	---	---	---	---	0.941 to 0.985	---	---	---	---	0.941 to 0.985	---	---	---	---	0.926 to 0.940	---	---
Tensile strength, minimum, lb _f /in ²	L	1,200	1,400	---	---	---	1,400	1,400	1,400	1,400	---	---	---	---	---	---	1,400	1,400	1,400
	M	1,600	1,800	---	---	---	1,800	1,800	---	---	---	---	---	---	---	---	1,800	1,800	1,800
	H	2,800	2,800	3,500	3,500	4,000	2,800	2,800	3,500	3,500	4,000	2,800	3,500	3,500	4,000	4,000	2,800	3,500	---
Ultimate elongation, minimum, percent	L	400	400	---	---	---	400	400	400	400	---	400	400	400	400	---	400	400	400
	M	400	400	---	---	---	400	400	400	400	---	400	400	400	400	---	400	400	400
	H	---	---	---	---	---	400	400	400	400	---	400	400	400	400	---	400	400	400
Brittleness temperature °C, maximum	L	-50	-55	---	---	---	-60	-55	-60	-55	---	-55	-60	-55	-55	---	-50	-50	-50
	M	-50	-55	---	---	---	-60	-55	-60	-55	---	-55	-60	-55	-55	---	-50	-50	-50
	H	-55	---	-55	---	---	-55	---	-55	---	---	-55	---	-55	---	---	-55	-55	---
Dielectric constant, maximum, 1 MHz	L	---	---	---	---	---	2.35	2.35	2.35	2.35	---	2.35	2.35	2.35	---	---	2.50	2.75	2.80
	M	---	---	---	---	---	2.35	2.35	2.35	---	---	2.35	2.35	---	---	---	2.50	2.75	2.80
	H	---	---	---	---	---	2.38	2.38	2.38	2.38	---	2.38	2.38	2.38	---	---	2.75	2.75	---
Dissipation factor, maximum, 1 MHz	L	---	---	---	---	---	0.0005	0.0005	0.0005	0.0005	---	0.0005	0.0005	0.0005	---	---	0.003	0.007	0.007
	M	---	---	---	---	---	0.0005	0.0005	0.0005	0.0005	---	0.0005	0.0005	0.0005	---	---	0.003	0.007	0.01
	H	---	---	---	---	---	0.0005	0.0005	0.0005	0.0005	---	0.0005	0.0005	0.0005	---	---	0.005	0.007	---

1/ Uncolored, unfilled, specimens shall be used.

3.2.1 Melt-index: The melt-index (nominal flow rate) shall be within the ranges given for the specific category (see table II) for the type, class, and grade specified; and shall be as agreed to between the manufacturer and the purchaser (see 6.2). Melt-index values below 1.0 shall have ± 30 percent tolerance and ± 20 percent for values of 1.0 or greater. The values for each sample batch shall be recorded (see 6.5). For all wire and cable applications, all Types, Classes and Grades shall have a melt index in accordance with Category 4 or 5.

3.2.2 Milling stability: When specimens are prepared as specified in 4.6.3.10, these specimens shall meet the dielectric constant and dissipation factor requirements (see table III).

3.2.3 Crack resistance:

3.2.3.1 Crack failure (class L only): When tested as specified in 4.6.3.11.1, crack failure shall be as defined in ASTM method D 1693.

3.2.3.2 Crack failure (class H only): When tested as specified in 4.6.3.11.2, there shall be no cracks visible to the unaided eye. (For natural-color polyethylene specimens, flaws generally first appear as small white dots that are characteristic of a discontinuity in the refractive index and act like small scattering centers. The white area enlarges with time as the temperature is held constant and a crack appears within this region. This crack is always transverse to the direction of the applied stress and propagated in the same direction.)

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 use 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.

4.1.1 Test equipment and inspection facilities: Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The supplier shall establish calibration of inspection equipment to the satisfaction of the Government. Calibration of the standards that control the accuracy of the inspection equipment shall comply with the requirements of MIL-STD-45662.

4.2 Classification of examinations and tests:

The examination and testing of polyethylene shall be classified as follows:

- a. Materials inspection (see 4.3).
- b. Quality conformance inspection (see 4.5).

4.3 Materials inspection:

Materials inspection shall consist of certification supported by verifying data that the items listed in table IV are in accordance with the applicable referenced specifications or requirements.

TABLE IV. Materials inspection

Material	Requirement paragraph	Applicable specification
Percent content of ethylene and other olefin monomers	3.1	---
Color of material	3.1.1	PE-200

4.4 Inspection conditions:

Unless otherwise specified herein, all inspection shall be made under the conditions specified in Fed. Test Method Std. No. 406.

4.5 Quality conformance inspections:

4.5.1 Inspection of product for delivery: Inspection of product for delivery shall consist of batch inspection (see 4.5.1.2) and periodic-batch inspection (see 4.5.1.3).

4.5.1.1 Batch: A batch shall be defined as a unit of product prepared for shipment, and may consist of a uniform blend of two or more "production runs" of polyethylene of the same type, class, grade, category, color, transparency, and form.

4.5.1.2 Batch inspection: Batch inspection shall consist of the examination and tests specified in table V, as applicable.