

L-P-394b
 June 24, 1968
~~SUPERSEDING~~
 Fed. Spec. L-P-394a
 May 19, 1964

FEDERAL SPECIFICATION
 PLASTIC MOLDING MATERIAL, (PROPYLENE PLASTICS,
 INJECTION AND EXTRUSION)

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 polypropylene and propylene copolymer injection and extrusion plastic molding materials. (See table I and 6.1).

1.2 Classification.

1.2.1 Type and grade. Polypropylene and propylene copolymers covered by this specification shall be of the following types and grades shown in table I, as specified (see 6.2.)

TABLE I. Types and grades of polypropylene and propylene copolymers.

Type	Application	Grade	Remarks
I	General purpose (see 6.1.1.1)		No additives other than those normally used for stabilization purposes
II	Weather resistant (see 6.1.1.2)	A	Light stabilized
III	Impact resistant (see 6.1.1.3)	B	Medium impact strength
IV	Impact and low temperature resistant (see 6.1.1.4)	A	High impact strength
		B	Medium impact, low temperature resistant
		B	High impact strength, lowest temperature resistant

1.2.2 Class. When specified (see 6.2), polypropylene and propylene copolymers shall be of the following class:

Class E - Electrical properties controlled.

2. APPLICABLE DOCUMENTS

2.1 Specifications and standards. The following specifications and standards of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein:

Federal Specifications:

PPP-B-576 - Boxes, Wood, Cleated, Veneer, Paper Overlaid.
 PPP-B-585 - Boxes, Wood, Wirebound.
 PPP-B-591 - Boxes, Fiberboard, Wood-Cleated.
 PPP-B-601 - Boxes, Wood, Cleated-Plywood.
 PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner.
 PPP-B-636 - Box, Fiberboard.
 PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
 PPP-B-640 - Boxes, Fiberboard, Corrugated Triple Wall.
 PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
 PPP-F-320 - Fiberboard, Corrugated and Solid, Sheet Stock
 (Container Grade) and Cut Shapes.

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Federal Standards:

- Fed. Std. No. 1 - Standard for Laboratory Atmospheric Conditions for Testing.
- Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies).
- Fed. Test Method Std. No. 406 - Plastics: Methods of testing.

(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, D.C. 20402.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D.C., Atlanta, Chicago, Kansas City, Mo. Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, Wash.

(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 Specifications:

- MIL-P-116 - Preservation, Methods of.
- MIL-C-45662 - Calibration of Standards.

Military Standards:

- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-147 - Gummed and Pressure-Sensitive Tapes, Methods of Testing.

(Copies of Military Specifications and Standards required by contractors 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 publication 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:

- D 256-56 (1961) - Impact Resistance of Plastics and Electrical Insulating Materials.
- D 570-63 - Water Absorption of Plastics.
- D 618-61 - Conditioning Plastics and Electrical Insulating Materials for Testing.
- D 621-64 - Deformation of Plastics Under Load.
- D 638-64T - Tensile Properties of Plastics.
- D 648-56 (1961) - Deflection Temperature of Plastics Under Load.
- D 746-64T - Test for Brittleness Temperature of Plastics and Elastomers by Impact.
- D 792-66 - Specific Gravity and Density of Plastics.
- D 1130-63 - Recommended Practice for Injection Molding of Specimens of Thermoplastic Materials.
- D 1505-63T - Density of Plastics by the Density-Gradient Technique.
- D 1531-62 - Dielectric Constant and Dissipation Factor of Polyethylene by Liquid Displacement Procedure.
- E 42-65 - Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Artificial Weathering Test.

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

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal Agencies.)

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, Chicago, Ill. 60606.)

National Motor Freight Classification Rules.

(Application for copies should be addressed to the National Classification Board, 1616 P Street, N.W., Washington, D.C. 20036.)

3. REQUIREMENTS

3.1 Material. The material shall be unfilled, unreprocessed polypropylene and propylene copolymers so formulated as to meet the requirements of this specification.

3.1.1 Color. Unless otherwise specified (see 6.1.1.2 and 6.2), polypropylene and propylene copolymers shall contain no color pigment.

3.1.2 Form. Polypropylene and propylene copolymers shall be furnished in the form of powder, granules, or pellets, as specified (see 6.2).

3.2 Property values. Unless otherwise specified (see table II, Izod impact strength), the values obtained for each set of specimens for any property shall be averaged (see 4.5.2), and the results so obtained shall meet the required values specified in table II, as applicable to the type and grade.

3.2.1 Class E. When class E is specified (see 6.2), specimens shall meet the requirements of tables II and IIa.

TABLE II. Property values

Property (see table IV)	Value required					
	Type I	Type II	Type III		Type IV	
			Grade A	Grade B	Grade A	Grade B
Density range, inclusive, D ^{23C} , G/ml	0.900 to 0.915			0.890 to 0.910		
Tensile yield strength, minimum, pounds per square inch (psi)	4500	4500	3800	3000	3770	2900
Impact strength, minimum, ft lb/in. of notch, 23° C.	0.6	0.6	1.0	3.0	1.0	3.0
Water absorption, maximum, percent	0.04	0.04	0.03	0.03	0.03	0.03
Weather resistance	---	1/	---	---	---	---
Deformation under load, maximum, percent, 50° C: 1000 psi (70 kg/cm ²) 2000 psi (140 kg/cm ²)	---	---	3.5	9.0	2.5	6.0
Brittleness temperature °C ^{2/}	---	---	---	---	-5	-10

^{1/}Specimens shall retain at least 50 percent of original elongation at yield.

^{2/}At least 5 of 10 specimens shall remain unbroken after the single impact blow at the temperature specified (see 4.5.3.8).

TABLE IIa. Additional property values for class E

Property (see table V)	Value required					
	Type I	Type II	Type III		Type IV	
			Grade A	Grade B	Grade A	Grade B
Dielectric constant, max, 1 mcs	2.30	2.30	2.30	2.30	2.28	2.28
Dissipation factor, max, 1 mcs	0.001	0.001	0.002	0.002	0.0008	0.0008

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.

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4.1.1 Test equipment and inspection facilities. The supplier shall establish and maintain a calibration system in accordance with MIL-C-45662.

4.2 Classification of inspection. The examination and testing of polypropylene and propylene copolymers shall be classified as follows:

(a) Quality conformance inspection (see 4.4).

- (1) Inspection of product for delivery (see 4.4.1).
- (2) Inspection of preparation for delivery (see 4.4.2).

4.3 Inspection conditions. Unless otherwise specified herein, all inspections shall be made under the conditions specified in Fed. Std. No. 1.

4.4 Quality conformance inspection.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of batch inspection (see 4.4.1.2) and periodic-batch inspection (see 4.4.1.3).

4.4.1.1 Batch. A batch of polypropylene or propylene copolymers is defined as a collection of units of product prepared for shipment, and may consist of a uniform blend of two or more "production runs" of polypropylene or propylene copolymers of the same type, grade, class, form, and color.

4.4.1.2 Batch inspection. Batch inspection shall consist of the tests specified in table III, as applicable.

TABLE III. Batch inspection

Test	Applicability	Requirement table	Method table
Density	All types, all grades))
Tensile yield strength	All types, all grades))
Impact strength	All types, all grades))
Brittleness temperature	Type IV, Grades A and B))
		II	VI

4.4.1.2.1 Sampling plan. Batch sampling and inspection shall be made on each batch (see 4.4.1.1), and shall be the basis for acceptance or rejection of the batch (see 4.5).

4.4.1.3 Periodic-batch inspection. Periodic-batch inspection shall consist of the tests specified in table IV. Shipment shall not be held up pending results of the inspection.

TABLE IV. Periodic-batch inspection.

Test	Applicability	Requirement table	Method table
Dielectric constant and dissipation factor ^{1/}	All types, all grades	IIa)
Water absorption	All types, all grades))
Weather resistance	Type II, Grade A))
Deformation under load	All types, all grades	II)
			VI

^{1/}Applies to class E only.

4.4.1.3.1 Sampling plan. Periodic-batch sampling and inspection shall be made on the first batch (see 4.4.1.1) prepared for shipment, and on every twentieth batch thereafter, or once every 2 years, whichever is more frequent (see 4.5).

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4.5.3 Test methods. Test methods shall be as specified in table VI.

TABLE VI. Test methods. ^{1/}

Test (see tables II and IIa)	Method number of Fed. Test Method Std. No. 406	ASTM publica- tion No. and Method or procedure	Modified by paragraph
Density	---	D 792-66 or D 1505-63T	4.5.3.1
Tensile yield strength	1011	D 638-64T	4.5.3.2
Impact strength	1071	D 256-56 (1961)	4.5.3.3
Dielectric constant and dissipation factor		D 1531-62	4.5.3.4
Water absorption	7031	D 570-63	4.5.3.5
Weather resistance	Procedure A	Procedure A	
Deformation under load	---	E 42-65	4.5.3.6
	1101	D 621-64	4.5.3.7
		Method A	
Brittleness temperature	2051	D 746-64T	4.5.3.8

^{1/} Either Fed. Test Method Std. No. 406 or ASTM Publications may be used, as applicable.

4.5.3.1 Density. Specimens shall be cut from the center section of tensile bars (see 4.5.3.2), with no conditioning.

4.5.3.2 Tensile yield strength. Type I specimens and speed C shall be used.

4.5.3.3 Impact strength. Specimens shall be cut from the center section of tensile bars (see 4.5.3.2).

4.5.3.4 Dielectric constant and dissipation factor. Specimens shall be conditioned in accordance with procedure D of ASTM Publication D 618-61. The test method shall be in accordance with ASTM Publications D 1531-62. The specimen shall be 0.05-inch thick, cut from compression molded blanks.

4.5.3.5 Water absorption. Specimens shall be conditioned by drying in an air oven for 48 hours at $122^{\circ} \pm 3.6^{\circ}$ F. ($50^{\circ} \pm 2^{\circ}$ C.) and cooled in a desiccator to room temperature.

4.5.3.6 Weather resistance. Type E apparatus shall be used. Specimens shall be exposed for 500 hours. Specimens shall then be subjected to the elongation test (see table V).

4.5.3.7 Deformation under load. Test temperature shall be $50^{\circ} \pm 1.1^{\circ}$ C. ($122^{\circ} \pm 2^{\circ}$ F.).

4.5.3.8 Brittleness temperature. Specimens shall be tested at 23° F. (-5° C.) for type IV, grade A and at 14° F. (-10° C.) for type IV, grade B. The tests shall be terminated after the single impact blow at the specified temperature. Specimen shall be 0.25 ± 0.02 inch wide x 0.075 ± 0.005 inch thickness.

5. PREPARATION FOR DELIVERY

5.1 Preservation and unit packaging. Preservation and unit packaging shall be Level A or C, as specified (see 6.2).

5.1.1 Level A. Material in the form of free-flowing powder shall be packed in type V, class 1, metal cans conforming to PPP-C-96 in quantities of 5 pounds net weight as specified (see 6.2).

5.1.2 Level C. Material in the form of the pellets or free-flowing powder shall be afforded preservation and packaging in accordance with the supplier's commercial practice.

5.2 Packing (see 6.2).

4.4.1.3.2 Noncompliance. If a batch fails to pass periodic-batch inspection, the supplier shall take corrective action on the materials or process, or both, as warranted, and on all batches which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, periodic-batch inspection shall be repeated. Batch inspection may be reinstated; however, final acceptance shall be withheld until the periodic-batch reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the contracting officer.

4.4.1.4 Rejection. Failure to comply with any of the requirements of this specification shall be cause for rejection of the batch represented.

4.4.2 Examination of preparation for delivery requirements. An examination shall be made to determine compliance with the packaging, packing, and marking requirements of section 5. Defects shall be scored in accordance with Table V. The sample unit shall be one shipping container fully prepared for delivery with the exception that it need not be sealed. Defects of closure shall be examined on shipping containers fully prepared for delivery. The lot size shall be the number of shipping containers in the end item inspection lot. The inspection level shall be S-2 and the acceptable quality level shall be 4.0 defects per hundred units.

TABLE V. Preparation for delivery defects

Examine	Defects
Containers	Unit and shipping containers not as specified.
Quantity	Quantity in unit package not as specified.
Strapping	Strapping not furnished when required.
Workmanship	Inadequate application of components such as container flaps loose, container bulged or distorted.
Markings	Omitted; incorrect; illegible; improper size, location, sequence, or method of application.

4.5 Methods of test.

4.5.1 Sampling. Three or more representative samples of equal size may be selected from each batch prior to packaging. If sampling is done after packaging, three containers (packages, drums) shall be selected at random from each batch (see 4.4.1.1). Containers shall be opened carefully, making sure that there is no contamination from scale, paint, shattered heads, torn liners, or from any other cause. The three representative samples shall be composited, placed in a dry metal, glass or plastic container, and tightly closed.

4.5.2 Specimens.

4.5.2.1 Number. Five specimens (except for brittleness temperature test, see table II) of the form specified in the applicable document or paragraph (see table V) shall be prepared as specified in 4.5.2.3. Specimens, as applicable, shall be not more than 1/8-inch thick.

4.5.2.2 Additional specimens. When the test result of a specimen deviates from the average of the other specimens by more than four times the average deviation of the other specimens, that specimen shall be discarded and another specimen from the same composite shall be tested and used in its place.

4.5.2.3 Molding. Unless otherwise specified in 4.5.3, specimens shall be injection molded in accordance with ASTM Standard D 1130-63 and as follows:

- (a) Mold temperature - The temperature of the mold shall be $60^{\circ} \pm 3^{\circ}$ C. ($140^{\circ} \pm 5.4^{\circ}$ F.).
- (b) Cycle - Cycle time shall be 45 seconds, maximum.
- (c) Stock temperature - The stock temperature shall be $60^{\circ} \pm 5^{\circ}$ C. ($108^{\circ} \pm 9^{\circ}$ F.) higher than the fill point temperature.
- (d) Injection pressure - The injection pressure shall be set at the maximum allowable level which does not produce flash in the test section of the specimen.
- (e) Booster - A high volume booster pump shall not be used.

5.2.1 Level A. The packaged item shall be packed in containers conforming to any of the following specifications at the option of the supplier:

Specification	Container	Class or style
PPP-B-576	Boxes, Wood, Cleated, Veneer, Paper Overlaid.	Class 2
PPP-B-585	Boxes, Wood, Wirebound	Class 2 or 3
PPP-B-591	Boxes, Fiberboard, Wood-Cleated	Class 2
PPP-B-601	Boxes, Wood, Cleated-Plywood	Overseas type
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner	Class 2
PPP-B-636	Box, Fiberboard.	Weather resistant
PPP-B-640	Boxes, Fiberboard, Corrugated Triple Wall	Class 2

Box closures and strapping shall be as specified in the applicable box specification or appendix thereto. Banding (reinforcement requirements), excluding metal, is required and will be applied in accordance with the provisions outlined in the appendix to the specification. The gross weight of wood boxes shall not exceed 200 pounds; contents of fiberboard boxes shall not exceed the limitations of the applicable box specification.

5.2.2 Level B. The material, packaged as specified in 5.1.1, shall be packed in accordance with the level B requirements in the appendix to PPP-C-96.

5.2.3 Level C. The packaged item shall be packed in containers of the type, size, and kind commonly used for the purpose, in a manner that will insure acceptance by common carrier and safe delivery at destination. Shipping containers shall comply with the requirements of the Uniform Freight Classification Rules or National Motor Freight Classification Rules, as applicable to the mode of transportation.

5.2.4 General. Exterior containers shall be uniform in shape and size, shall be of minimum cube tare consistent with the protection required, and shall contain identical quantities of identical stock numbered items.

5.3 Unitized loads. Unitized loads shall be used to the maximum extent practical and shall be commensurate with the level of packing stated in the contract or order (see 6.2).

5.3.1 Level A. The material packed as specified in 5.2.1 shall be placed on a pallet, load type 1, conforming to MIL-STD-147. A fiber-board cap shall be employed over the load, having two sides extending down the stacked load at least 12 inches to accommodate marking requirements. The cap shall conform to PPP-F-320, class weather resistant, type SF, grade W5s fiberboard. The load shall be bonded to the pallet.

5.3.2 Level B. The material packed as specified in 5.2.2 shall be unitized as cited in 5.3.1, except that pallets and caps shall be of the type, size and kind commonly used for the purpose and shall comply with the rules and regulations of the common carriers as applicable to the mode of transportation.

5.3.3 Level C. The material packed as specified in 5.2.3, shall be unitized as cited in 5.3.1, except that pallets and caps shall be of the type, size and kind commonly used for the purpose and shall comply with the rules and regulations of the common carriers as applicable to the mode of transportation.

5.4 Marking.

5.4.1 Civil agencies. In addition to markings required by the contract or order, the shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.4.2 Military activities. In addition to markings required by the contract or order, the shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use.

6.1.1 Applied thermal range. Polypropylene material is satisfactory for use at a continuous operating temperature range of 0° to 120° C. (32° to 248° F.). Propylene copolymer is satisfactory for use at continuous operating temperature range of 23° F. (-5° C.) (type IV, grade A) and 14° F. (-10° C.) (type IV, grade B) to 248° F. (120° C.).

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6.1.1.1 Type I. This type is intended for general-purpose mechanical and dielectric applications and shall contain no additives other than those normally used for stabilization purposes.

6.1.1.2 Type II. This type is intended for weather-resistant applications. Light stabilizer may be a pigmented type.

6.1.1.3 Type III. This type is intended for rugged mechanical use. Grade A possesses medium impact strength and excellent stiffness. Grade B possesses high impact strength and good stiffness. Both grades may also be used for dielectric applications.

6.1.1.4 Type IV. This type covers propylene copolymer and is intended for rugged mechanical use with combined low temperature resistance. Grade A possesses medium impact strength and low temperature resistance. Grade B possesses high impact strength with lowest temperature resistance of the propylene plastics.

6.1.1.5 Class E. This class is intended for electrical applications.

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

- (a) Title, number, and date of this specification.
- (b) Type and grade (see 1.2.1).
- (c) Class (see 1.2.2).
- (d) Color, if applicable (see 3.1.1).
- (e) Form (see 3.1.2).
- (f) Levels of preservation and unit packaging, packing, and applicable marking (see section 5).

MILITARY INTEREST:

Custodians:

Army - EL
Navy - SH
Air Force - 11

Preparing activity:

Army - EL

Civil agencies interest:

Review activities:

Army - EL, MR
Navy - AS, OS, SH, YD
Air Force - 11, 84
DSA - ES

AGR HEW
COM GPO
GSA
INT
JUS
PO
TR

User activities:

Army - ME, AT, AV
Navy - MC
Air Force - None

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