

L-P-380C
August 24, 1973
SUPPERSADING
Fed. Spec L-P-380B
January 5, 1968

FEDERAL SPECIFICATION

PLASTIC MOLDING MATERIAL, METHACRYLATE

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. Scope. This specification covers methacrylate molding compounds which are suitable for compression, injection, and extrusion molding.

1.2 Classification.

1.2.1 Types and classes. Methacrylate molding and extrusion compounds covered by this specification shall be of the following types and classes, as specified (see 6.2).

Type I - General purpose.

Type II - Electrical type material.

Class 1 - Lowest deflection temperature range.

Class 2 - Middle deflection temperature range.

Class 3 - Highest deflection temperature range.

2. APPLICABLE DOCUMENTS

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

Federal Specifications:

PPP-D-723 - Drums, Fiber.

PPP-D-729 - Drums, Shipping and Storage, Steel, 55-gallon.

Federal Standard:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civil Agencies).

Fed. Std. No. 595 - Color.

(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).

L-P-380C

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 149-64 (1970) - Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies.
 D 150-70 - A-C Loss Characteristics and Dielectric Constant (Permittivity) of Solid Electrical Insulating Materials.
 D 257-66 (1972) - D-C Resistance or Conductance of Insulating Materials.
 D 542-50 (1970) - Index of Refraction of Transparent Organic Plastics.
 D 570-63 (1972) - Water Absorption of Plastics.
 D 618-61 (1971) - Conditioning Plastics and Electrical Insulating Materials for Testing.
 D 638-72 - Tensile Properties of Plastics.
 D 648-72 - Deflection Temperature of Plastics Under Flexural Load.
 D 792-66 (1970) - Specific Gravity and Density of Plastics by Displacement.
 D 1003-61 (1970) - Haze and Luminous Transmittance of Transparent Plastics.
 G 21-70 - Resistance of Synthetic Polymeric Materials to Fungi.

(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.

(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.)

3. REQUIREMENTS

3.1 Material. The methacrylate material shall consist of virgin compression, injection or extrusion molding compounds to which no scrap or reworked material has been added. The methacrylate material shall consist of resins made by polymerization of acrylic monomers containing at least 80 percent methyl methacrylate. Pelletizing shall not be considered reworking.

3.2 Property values. When tested as specified in the applicable procedure of 4.3, type I material shall conform to the property values specified in tables I and II.

L-P-380C

TABLE I. Property values, excluding electrical properties

Property	Property values for types I and II		
	Class 1	Class 2	Class 3
Specific gravity 23°/23°C. (73.4°/73.4°F.):			
Maximum	1.19	1.19	1.19
Minimum	1.18	1.18	1.18
Index of refraction <u>2/</u> (N _D 23°C.)			
Maximum	1.50	1.50	1.50
Minimum	1.48	1.48	1.48
Total luminous transmittance, <u>3/</u> 1/8 inch thickness, percent, <u>minimum</u>	90	90	90
Water absorption, 24 hour immersion, percent, maximum:			
Weight gain plus soluble matter loss	0.5	0.5	0.5
Soluble matter loss	0.1	0.1	0.1
Deflection temperature under load <u>1/</u> , at 264 pounds per square inch stress 1/8 inch thick annealed specimen:			
°C. (°F.) minimum	67 (153)	76 (169)	85 (185)
°C. (°F.) maximum	75 (167)	84 (183)	----
1/4 inch thick annealed specimen:			
°C. (°F.) minimum	69 (156)	80 (176)	87 (189)
°C. (°F.) maximum	79 (174)	86 (187)	----
Tensile strength, pounds per sq. inch, minimum	8000	8000	9000

- 1/ Either thickness may be used for determining this property.
2/ Applicable only to colorless and to those transparent colors which transmit at the sodium D line. Otherwise, a correction must be made.
3/ Applicable to colorless material only. Correction must be made for colored material.

TABLE II. Electrical property values (for type II only)

Property	Property value for type II, all classes
Insulation resistance, megohms, minimum	10 ⁷
Dielectric strength, flatwise, step-by-step, volts per mil., minimum	350
Dielectric constant, maximum:	
At 60 Hz <u>1/</u>	4.5
1 KHz	4.0
Dissipation factor, maximum:	
At 60 Hz <u>1/</u>	0.06
1 KHz	0.05

1/ 1 hertz equals 1 cycle per second.

3.3 Fungus resistance. When specified by the procuring agency (see 6.2), the material shall be fungus resistant as shown by zero percent growth when examined visually.

3.4 Color. Unless otherwise specified by the procuring agency, the material and specimens or plaques molded therefrom shall be colorless as determined by visual inspection. When required by the procuring agency (see 6.2) a specific method for determining colorless material shall be specified by the agency. When color is specified (see 6.2) it shall be determined visually by comparison of molded plaques with the appropriate color number shown in Fed. Std. No. 595.

3.5 Form and uniformity. The form shall be as specified by the procuring agency. (see 6.3). Each lot of molding and extruding compound shall be uniform in form.

3.6 Residual monomer. The amount of residual methacrylate monomer in plastic molding material, methacrylate, shall not exceed 0.5 percent by weight.

L-P-380C

3.7 Workmanship. Each lot of molding and extruding compound shall be clean and free of foreign particles and other 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 and class 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, 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. A supplier's certificate of compliance with 3.1 and 3.5 shall be furnished.

4.2.2 Inspection of material.

4.2.2.1 Examination of the material. Examination of the material shall be made in accordance with the list of defects, inspection levels and acceptable quality levels (AQL) 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 300 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 the material for defects in appearance and workmanship. The sample unit for this examination, specified in table III, shall be approximately one pound.

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

Examine	Defects
Appearance and workmanship	Not colorless, unless otherwise specified. Color not as specified when color required. Form or color not uniform. Form not as specified. Not clean, presence of foreign material or other contamination.

4.2.2.1.2 Inspection of preparation for delivery requirements. An inspection shall be made to determine whether the packing and marking comply with the requirements in section 5. Defects shall be scored in accordance with table IV. The sample unit for this inspection shall be one shipping container fully prepared for shipment. When specified by the procuring agency, the shipping container shall be selected just prior to the closing operation. Sampling and inspection shall be in accordance with 4.2.2.1.3.

L-P-390C

TABLE IV. Examination of preparation for delivery

Examine	Defect
Packing	Not level specified; not in accordance with contract. Any nonconforming component, component missing, damaged or otherwise defective affecting serviceability. Liner in fiber drums not properly sealed. Closure improper.
Quantity of material	Other than specified.
Markings	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 AQL's for examinations. The inspection levels for determining the sample size and the 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 characteristics listed in tables I and II, as applicable, 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 300 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 defects. The results for each test shall be the averaged results of the specimens.

4.3 Test methods.

4.3.1 Specimen preparation and conditioning. Specimens shall be prepared by injection molding under conditions specified by the manufacturer.

4.3.1.1 Specimen annealing. Specimens to be used for deflection temperature under load, and tensile strength tests shall be conditioned at the temperatures shown in table V in a forced air circulation oven. Specimens 1/8 inch thick shall be conditioned 2 hours, and specimens 1/4 inch thick shall be conditioned 4 hours. Upon removal from the oven, the specimens shall be placed in an air-tight container, and protected with a blanket of insulation to allow slow cooling to room temperature. The specimens shall remain in the container until ready to test. (Annealing is optional for specimens to be used for other tests.)

TABLE V. Annealing temperatures

Class 1/	Annealing temperatures	
	(°C.)	(°F.)
1	60 ± 3	140 ± 5.4
2	71 ± 3	160 ± 5.4
3	82 ± 3	180 ± 5.4

1/ Applicable to types I and II.

4.3.1.2 Specimen conditioning. Specimens for all tests other than those specified in 4.3.1.1, shall be conditioned in accordance with procedure A of ASTM D 618-61 (1971) and the minimum conditioning time shall be 24 hours.

L-P-380C

4.3.2 Testing conditions. Unless otherwise specified by the applicable test method, all tests shall be performed at $23 \pm 2^\circ\text{C}$. ($73.4 \pm 3.6^\circ\text{F}$.) and 50 ± 5 percent relative humidity.

4.3.3 Specific gravity. One specimen shall be tested in accordance with method A-1 or A-2 of ASTM D 792-66 (1970).

4.3.4 Index of refraction. One specimen shall be tested in accordance with ASTM D 542-50 (1970).

4.3.5 Total luminous transmittance. One specimen, $1/8 + 1/100$ inch thick, shall be tested in accordance with procedure A of ASTM D 1003-61 (1970).

4.3.6 Water absorption. One specimen shall be tested in accordance with ASTM D 570-63 (1972).

4.3.7 Deflection temperature under load. Three specimens, each either $1/8 + 1/100$ inch, or $1/4 + 1/100$ inch thick, shall be tested in accordance with ASTM D 648-72.

4.3.8 Tensile strength. Five specimens, each $1/8 + 1/100$ inch thick shall be tested in accordance with ASTM D 638-72, using testing speed B. Dimensions of each specimen shall conform to type I of figure 1 of ASTM D 638-72.

4.3.9 Insulation resistance (for type II material only). Three specimens shall be tested in accordance with ASTM D 257-66 (1972) using the electrodes specified in figure 3 of this test method.

4.3.10 Dielectric strength (for type II material only). Three specimens shall be tested in accordance with ASTM D 149-64, using electrodes as specified in table I of this test method, and the short time test. Tests shall be made under oil which conforms to the specified in ASTM D 149-64 (1970).

4.3.11 Dielectric constant and dissipation factor (for type II material only). Three specimens shall be tested in accordance with ASTM D 150-70, using any electrode system specified in this test method.

4.3.12 Fungus resistance (applicable only when specified by the procuring agency). Three specimens shall be prepared and tested in accordance with ASTM G 21-70. Specimens shall be 2 by 2 inch pieces as specified in ASTM G 21-70.

5. PREPARATION FOR DELIVERY

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

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

- a. Fiber drums conforming to PPP-D-723, type II, grade A, or type III, grade A in quantities of 200 pounds maximum.
- b. Metal drums conforming to PPP-D-729, type III, or type IV, in quantities of 400 pounds maximum.

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 0.004 inch thick polyethylene liner properly heat sealed.

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

- a. Fiber drums conforming to PPP-D-723, type I, grade A in quantities of 200 pounds maximum.
- b. Metal drums conforming to PPP-D-729, type III or type IV, in quantities of 400 pounds maximum.

L-P-380C

Insofar as practical, drums shall be of uniform shape and size, with minimum cube 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 0.004 inch thick polyethylene liner heat sealed.

5.1.3 Level C. Packing shall be in a manner to insure acceptance and safe delivery at destination at the lowest transportation rate for such supplies. Containers shall be in accordance with Uniform Freight Classification Rules or National Motor Freight Classification Rules, as applicable.

5.2 Marking.

5.2.1 Civil agencies. In addition to any special marking specified in the contract or order, shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.2.2 Military agencies. In addition to any special marking specified in the contract or order, containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Methacrylate plastics may be used in applications requiring excellent clarity and transparency, resistance to sunlight and outdoor weathering, and an optimum combination of flexibility with shatter resistance and rigidity. Examples are edge lighted cockpit and interior control panels. The classes having higher heat distortion temperatures may be used for applications requiring greater heat resistance. A chief disadvantage of these plastics is a lack of abrasion resistance and a tendency to craze under stress, particularly when simultaneously exposed to active solvents or wetting agents. The materials are not for shipboard use.

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. Types and classes required (see 1.2.1).
- c. Fungus resistance when specified (see 3.3), including type and class of material.
- d. When required, specific method for determining colorless material (see 3.4).
- e. Color, if required (see 3.4).
- f. Form required (see 3.5).
- g. Selection of applicable level of packing (see 5.1).
- h. If other container is required (see 5.1.1 and 5.1.2).

6.3 Form. Injection molding and extrusion material is supplied, usually in the form of 1/8 inch pellets. For compression molding, material is usually supplied as minute spherical granules.

6.4 International standardization agreement. Certain provisions of this specification are the subject of international standardization agreement ABC-NAVY-17C. When amendment, revision, or cancellation of this specification is proposed which will effect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

L-P-380C

MILITARY INTERESTS:

Army - MR
Air Force - 11

Review activities:

Army - EL, MI, MD, MU
Navy - SK
Air Force - S4

User activities:

Army - MI
Navy - OS, AS
Air Force - 17

Preparing activity:

Army - MR

CIVIL AGENCY COORDINATING ACTIVITIES:

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★U. S. GOVERNMENT PRINTING OFFICE : 1973 O - 544-603/1341

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