

MIL-C-87895 (USAF)
12 Dec 1983

MILITARY SPECIFICATION

COMPOUND, POLYMERIC BASED, HOT-MELT (Cavity Lining),
(FOR INTERNAL USE IN AMMUNITION)

1. SCOPE

1.1 This specification covers one type of polymeric based hot-melt general purpose bomb cavity lining material for coating the internal wall of bombs prior to loading with EAK & EALK explosives. (See 6.1)

2. APPLICABLE DOCUMENTS

FEDERAL

FED-STD-141 - Paint, Varnish, Lacquer, and Related Materials;
Methods of Inspection, Sampling, and Testing

MILITARY

MIL-STD-331A - Fuze & Fuze Components, Environmental Testing for
Performance

MIL-STD-650 - Explosive: Sampling, Inspection
and Testing

3. REQUIREMENTS

3.1 General Material Requirements

The material shall be composed of two parts: a base, Part A, and a plasticizer, Part B. Part A shall consist of a pure amorphous polypropylene hot melt thermoplastic, conforming to the requirements set forth in table I, and Part B shall consist of an Isobutylene-butene copolymer (commonly known as polybutenes) conforming to the requirements set forth in table II.

3.1.1 Character

Part A - The pure amorphous polypropylene hot melt thermoplastic shall conform to the following requirements:

FSC: 1325

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TABLE I

Characteristic	Requirement	Test Paragraph
Specific Gravity @ 73°F	.86±.04	4.3.7.1
Viscosity @ 375°F	3500±500 Centipoise	4.3.7.2
Softening point	295±5°F	4.3.7.3
Flash point	500°F min	4.3.7.5
Fire point	500°F min	4.3.7.5
Volatile Matter	.5% max	4.3.7.6
Ash Content	.5% max	4.3.7.7
Acidity	.1% max	4.3.7.8
Glass Transition Temp	-40°F min	4.3.7.13

Part B - The Isobutylene-butene copolymer shall conform to the following requirements.

TABLE II

Characteristic	Requirement	Test Paragraph
Specific Gravity	.91±.04	4.3.7.1
Viscosity @ 210°F	3200±200 centipoise	4.3.7.2
Flash point	450°F min	4.3.7.5
Fire point	500°F min	4.3.7.5
Acidity	0.1% max	4.3.7.8
Glass Transition Temperature	-65°F min	4.3.7.13

3.1.2 Formulation

Parts A and B shall be combined in a ratio of 65±.1 parts A to 35±.1 parts B. The materials shall be combined via melt blending at a temperature of 350°F. Blending shall be sufficient to produce a homogeneous mixture.

3.1.3 Product Characteristics

The compound (combined material) when prepared shall consist of a Hot Melt thermoplastic and conform to the requirements set forth in Table III when tested as specified in 4.3.7.

Table III

Characteristic	Requirement	Test Paragraph
Penetration	200 gm/60 sec/0°C (32°F) 5 min	4.3.7.4
	100 gm 5 sec/25°C (77°F) 15 min	
	50 gm/5 sec/45°C (115°F) 90 max	
Fire Point	500°F min	4.3.7.5
Flash Point	450°F min	4.3.7.5
Specific Gravity	.86 [±] .04	4.3.7.1
Viscosity @ 375°F	1500 [±] 500 centipoise	4.3.7.2
Softening Point	220°F min	4.3.7.3
Glass Transition Temp	-65°F max	4.3.7.13

3.1.4 Chemical, Electrical & Mechanical Properties

3.1.4.1 Flexibility - A dried film of the compound on a metal panel shall show no chipping, scaling or cracking when tested as specified in 4.3.7.9.

3.1.4.2 Chemical Requirements - The compound shall conform to the chemical requirements of Table IV as specified therein.

TABLE IV

Requirement	Maximum Value	Test Paragraph
Volatile matter	.5%	4.3.7.6
Ash Content	.5%	4.3.7.7
Acid content	.1%	4.3.7.8

3.1.5 Environmental Conditions

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3.1.5.1 Temperature & Humidity Cycling

The formulation compound must withstand (show no chipping, cracking or loss of adhesion) temperature extremes from 160°F to -65°F, as specified in 4.3.7.12.

3.1.5.2 Thermal Shock - The compound must withstand (show no chipping, cracking, or loss of adhesion) thermal shock cycling in accordance with MIL-STD-810 Method 503.1.

3.1.6 Stability - When subjected to vacuum thermal stability test, as specified in 4.3.7.10, the reactivity of the polymeric compound with EAK and EALK explosives shall not exceed 2.0 milliliters of gas over and above that generated by the controls when the test is conducted at 100±.5°C for 48 hours. The explosives tested shall be in accordance with EAK and EALK formulation guidelines established by AFATL/DLJE.

3.1.7 Identification and Markings

Not Applicable

3.1.8 Workmanship - The compound ingredients shall be processed in such a manner that will produce the high quality material necessary to meet the requirements of this specification. The finished product shall be homogeneous, and free of contamination from foreign matter.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection - Unless otherwise specified in the contract or purchase order, the supplier is responsible for 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.

4.2 Classification of Inspection

The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.3)
- b. Quality conformance inspection (4.4)

4.3 Qualification Provisions

4.3.1 Qualification Samples - The contractor shall submit a qualification sample consisting of ten (10) lbs of the hot melt compound and 1 lb of each ingredient used in formulating the compound.

4.3.2 Product Identification - At the time of submission of a product lot to the Government for acceptance, the contractor shall supply the following information accompanied by a certificate of compliance to this specification:

(a) A statement of compliance of compound with all requirements & quality assurance provisions of this specification.

(b) Specification number and date.

(c) Quantity of product in lot.

(d) Date submitted.

(e) Name and address of contractor and site of manufacture.

(f) The certificate shall be signed by a responsible agent of the certifying organization. The initial certificate submitted shall be substantiated by evidence of the agent's authority to bind his principal. Substantiation of the agent's authority with subsequent certificates shall not be required unless during the course of the contract, this authority is vested in another agent of the certifying organization.

4.3.3 Sample Submission - In accordance with the instructions issued by the contracting officer for evaluation, and as specified in paragraph 4.3.5, all samples submitted shall have been produced by the contractor (or furnished by a supplier) using the same production processes, procedures and equipment as will be used in fulfilling the contract. All materials will be obtained from the same sources of supply as will be used in regular production. The sample shall be accompanied by certificates of conformance. The qualification sample, or portion thereof, as directed by the Contracting Officer shall be submitted whenever there is a lapse in production for a period in excess of 90 days, or wherever a change occurs in manufacturing process, material used, specification or source of supply as to significantly, affect product uniformity as determined by the Government. Prior to submission, the contractor shall inspect the sample to the degree necessary to assure that it conforms to the requirements of the contract and submit a record of this inspection with the sample. A sample containing known defects will not be submitted unless specifically authorized by the Contracting Officer.

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4.3.4 Lot Formation - A lot shall consist of one batch of hot-melt produced by one manufacturer in accordance with the same specification, or same specification revision under one continuous set of operating conditions. Each batch shall consist of that quantity of the hot-melt that has been subjected to the same unit chemical or physical mixing process intended to make the final product homogeneous.

4.3.5 Qualification Inspection - The qualification inspection shall consist of a review for approval of the contractor's submitted record of inspection subjecting the qualification sample (4.3.1) to examination and testing to determine conformance to the requirements of this specification.

4.3.6 Qualification Rejection - Any sample failing to comply with any of the specification requirements shall be rejected. The government reserves the right to terminate its inspection upon failure of a sample to comply with any one of the stated requirements. In the event of rejection, the government reserves the right to require the contractor to take corrective action and submit a new qualification sample or portion thereof. Until acceptance of qualification, the contractor is in no way authorized by the government to resume regular production unless otherwise directed by the Contracting Officer.

4.3.7 Test Methods

4.3.7.1 Specific Gravity - the specific gravity of the compound shall be determined in accordance with FED-STD-141, Method 4185, except that 95% ethyl alcohol (.810 specific gravity at 25°/25°C) shall be used instead of water. Calculate the specific gravity of the sample as follows:

$$\text{Specific Gravity} = \frac{A}{(A-B)/0.810}$$

Where:

A = weight of sample

B = weight of sample immersed in alcohol

4.3.7.2 Viscosity - The viscosity of the compound shall be determined in accordance with FED-STD-141, method 4287, except that the temperature of the sample shall be 375[±]1°F and a No. 3 spindle at 20 rpm shall be used.

4.3.7.3 Softening Point. The softening point of the compound shall be determined in accordance with FED-STD-141, method 4495.

4.3.7.4 Penetration - the penetration values of the compound shall be determined in accordance with FED-STD-141, Method 4273.

4.3.7.5 Flash Point, Fire Point - The open cup flash and fire points of the compound shall be determined in accordance with FED-STD-141, Method 4294.

4.3.7.6 Volatile Matter - The volatile matter of the compound shall be determined in accordance with FED-STD-141, Method 4041.1.

4.3.7.7 Ash Content - The ash content of the compound shall be determined in accordance with FED-STD-141, Method 5261.

4.3.7.8 Acidity or Alkalinity - Dissolve 5 gm sample of the compound in 10 ml of toluene which is neutral to phenolphthalein. Shake the solution with 100 ml of distilled water in a 250 ml separatory funnel for at least 5 minutes. Filter and titrate with N/100 H₂SO₄ or N/100 NaOH as necessary using phenolphthalein as indicator. A blank shall be run on an equal volume of the water used. Calculate the acidity or alkalinity of the sample as follows:

$$\text{Acidity as sulfuric acid, percent by weight} = \frac{4.9 (C-B) N}{W}$$

$$\text{Alkalinity as sodium hydroxide, percent by weight} = \frac{4.0 (A-B) N}{W}$$

Where: A = milliliters of H₂SO₄ solution required for the titration of sample.

B = milliliters of standard solution required for the blank.

C = milliliters of NaOH solution required for the titration of sample.

N = normality of the standard H₂SO₄ or NaOH

W = weight of sample in grams

4.3.7.9 Flexibility - A strip of No. 30 gauge hot rolled steel sheet 12 by 8 inches, shall be cleaned by washing with benzol & thoroughly dried. It shall be coated on one side to a thickness of 1/16" by flowing on the molten compound and then cooled at room temperature for a period of 48 hours. With the coating on the outside, bend the test panel rapidly 180 degrees over a mandrel one inch in diameter. No cracking of any kind shall be visible after the bending test.

4.3.7.10 Reactivity - The reactivity of the compound in contact with EAK & EALK Explosives shall be determined using the vacuum thermal stability test according to method 504.1 of MIL-STD-650 at 100^{+0.5}°C (212⁺¹°F) for 48 hours.

4.3.7.11 Thermal Shock - Thermal Shock resistance shall be determined in accordance with MIL-STD-810, Method 503.1.

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4.3.7.12 Temperature and Humidity Cycling - Temperature and humidity cycling resilience shall be determined in accordance with MIL-STD-331A 105.1 except that the test will be modified such that the minimum temperature at any point during the test shall not be below -65°F.

4.3.7.13 Glass Transition Temperature - The Glass Transition Temperature shall be determined by Thermomechanical Analysis.

4.4 Quality Conformance Inspection - Upon qualification of any material to the requirements of this specification a quality conformance inspection shall be performed at intervals not exceeding 6 months, whenever a lapse in production for a period in excess of 90 days has occurred, whenever any change occurs in manufacturing process, materials used, or source of supply, to ensure the continued conformance to the Qualification requirements set forth in this specification. The Quality Conformance Inspection shall consist of those tests as specified in paragraph 4.3 of this specification.

5. PREPARATION FOR DELIVERY

5.1 Packing - Unless otherwise specified in the contract or purchase order, the material shall be packed in the form of solid slats for the polypropylene and in a 50 gallon drum for the polybutene. The materials shall be packed to afford protection against damage during direct shipment from supply source to the first receiving activity for immediate use.

5.1.1 At the time of delivery, the following information shall be supplied at the point of delivery:

- (A) Contractors name
- (B) Project designation
- (C) Lot number
- (D) Date of Manufacture
- (E) Number of this specification.

6. NOTES

6.1 Intended Use - The hot melt polymeric compound covered by this specification is intended for use as a protective coating for fabricated metal cases in applications where charges of high explosives are melt cast into the case of a weapon.

6.2 Ordering Data - Procurement documents should specify the following:

- (A) Title, number and date of this document
- (B) Quantity in Pounds
- (C) Provisions for submission of qualification sample.

6.3 Materials Source - One type material which satisfactorily fulfills the requirement of part "A" is Eastabond G92, a pure amorphous polypropylene, available from Eastman Chemical Products, Inc, Plastics Products Division, P O Box 431, Kingsport, TN 37662. One type of material which satisfactorily fulfills the requirements of part "B" is Indopol H1500, a polybutene polymer, available from AMOCO Chemicals Corporation, 200 East Randolph Drive, Chicago, IL 60601. Use of similar materials from other sources must be approved by the Air Force Armament Laboratory, Eglin Air Force Base, FL 32542, Attn. DLJE, prior to usage.

6.4 Material Name - The formulated liner material shall be commonly referred to as the Polyaubert bomb liner.

Custodian:

Air Force - 99

Preparing activity:

Air Force - 18

Review activity:

Air Force - 70

Project Number: 1325-0160

User activities:

Air Force - 70

Agent:

AFATL/DLJE

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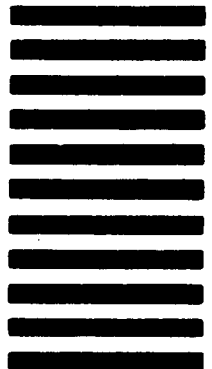
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b. ADDRESS <i>(Street, City, State, ZIP Code)</i>			
5. PROBLEM AREAS a. Paragraph Number and Wording: b. Recommended Wording: c. Reason/Rationale for Recommendation: 			
6. REMARKS			
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