MIL-C-82633(OS)
27 August 1973
See Section 6

MILITARY SPECIFICATION

COMPOUND, POLYMERIC ELASTOMER, THERMOSETTING (FOR USE AS BOMB TAIL PAD)

This specification has been approved by the Naval Ordnance Systems Command, Department of the Navy.

1. SCOPE

1.1 Scope. This specification covers a two-part, cured-in-place, polymeric thermosetting compound having elastomeric and thermal properties for sealing or padding the tail portion of the explosive cavities of bombs. Curing takes place at room temperature with a minimum of exotherm.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifica-tions, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

Federal

SS-R-406	Road and Paving Materials, Methods of Sampling and Testing
PPP-D-729	Drums, Metal, 55-Gallon (For of Noncorrosive Material)
PPP-P-704	Pail, Shipping, Steel (1 Through 12 Gallon)

AMSC N/A FSC 3438

Military

MIL-T-248	Trinitrotoluene (TNT)
MIL-A-512	Aluminum Powder, Flake, Grained, and Atomized
MIL-E-22267	Explosive Compositions, HBX Type

STANDARDS

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-147	Palletized and Containerized Unit Loads 40 Inch X 48 Inch Pallets, Skids, Runners, or Pallet Type Base

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from Military Specifications and Standards, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2.).

American Society for Testing and Materials

ASTM D 70	Specific Gravity of Road Oils, Road Tars, Asphalt Cements, and Soft Tar Pitches
ASTM D 395	Compression Set of Vulcanized Rubber
ASTM D 1084	Viscosity of Adhesives
ASTM D 2471	Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Plastic Compositions

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

Society of Plastics Industry, Inc.

ERF 22	Method of Test for Determination of Thermal Conductivity of Cured Epoxy Resins Systems

(Application for copies should be addressed to Society of Plastics Industry, Inc., Epoxy Resin Formulation Division, 253 Park Ave., New York, N.Y. 10017.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services).

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General.

3.1.1 Qualification. The polymeric compound furnished under this specification shall be a product which meets all the requirements specified herein and has been listed on or approved for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.4).

3.1.2 Material. The two-component material shall polymerize in situ at room temperature when thoroughly blended together in equal parts by weight. The thermosetting compound may contain a hydroxy-modified, polydiene-isocyanate system polymerized by a curing agent, with asphalt as a filler material.

3.1.3 Workmanship. The individual components shall contain no volatiles nor toluene diisocyanate ingredient (TDI) and shall be products of high quality, suitable for the purpose intended, and so manufactured as to meet all the requirements specified herein. Both components furnished under this specification shall be uniform in quality and consistency after stirring and free of agglomerates or foreign particles. The cured compound shall be free of low or high density areas and shall present an appearance of smooth homogeneity.

3.1.4 Storage (shelf) life. The cured compound (see 6.3.2) shall meet all the requirements of this specification when produced from components that have been stored in unopened original containers no longer than 8 months at ambient temperature.

3.2 Product characteristics.

3.2.1 Physical properties of components. The components shall have the physical properties specified in table I.

Table I

Property	Component A	Component B	Test procedure
Specific gravity	0.91 ± 0.03	0.96 ± 0.03	4.6.1
Viscosity, cp (at 75° ± 5° F)	7,200 maximum	12,0001 maximum	4.6.2
Flash point, “F	500 minimum	400 minimum	4.6.3

[1]Not to exceed 25,000 centipoises (cp) after 8 months of storage.

3.2.2 Exothermic temperature. The peak exothermic temperature of the reacting polymeric compound shall not exceed 100° F when tested in accordance with 4.6.4.

3.2.3 Gel time. The gelation (reaction) time of the reacting components shall be 6 ± 1-1/2 minutes when tested in accordance with 4.6.5.

3.2.4 Slump test. The gelled compound (see 6.3.3) shall not slump beyond the edge of the test container when tested in accordance with 4.6.6.

3.2.5 Alkalinity. The cured compound shall have a pH value of 7.0 or less when tested in accordance with 4.6.7.

3.2.6 Acidity. The cured compound shall have less than 0.01 percent acidity when tested in accordance with 4.6.8.

3.2.7 Thermal conductivity. The cured compound shall have a thermal conductivity less than 3.5 X 10^{-4} cal-cm/sec-sq cm-deg C when tested in accordance with 4.6.9.

3.2.8 Stability. The cured compound shall show no evidence of oil or other materials leaching out when tested in accordance with 4.6.10.

the contract or purchase order, the contractor 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all require-ments of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.4)
b. Quality conformance inspection (see 4.5).

4.3 Sampling.

4.3.1 Qualification sample. The qualification sample shall consist of 3 gallons of each component. The material shall be packaged in suitable containers and forwarded to the Commanding Officer, Naval Weapons Station, Yorktown, Va. 23491, Attn: NEDE Department. Each sample submitted shall be plainly identified by securely attached durable labels marked with the following information:

a. Compound, Polymeric Elastomer, Thermosetting
b. Components A and B
c. Name and address of manufacturer
d. Location and identity of the plant which produced the samples
e. Manufacturer's identification
f. Date of manufacture
g. Submitted by (name), (date), for qualification tests in accordance with the requirements of MIL-C-82633.

4.3.2 Quality conformance samples. The quality conformance samples shall consist of a sample for tests and a sample for examination of filled containers. The sample for test shall be labeled with complete information on each component designation, on the lot and batch number, date of sampling, contract number, and applicable specification.

4.3.2.1 Inspection lot. An inspection lot shall consist of the same type polymeric compound produced by one manufacturer, at one plant, from the same materials, and under essentially the same manufacturing conditions.

4.3.2.2 Sample for tests. A 2-gallon sample of each component shall be taken at random from each lot in accordance with method 101.11 of SS-R-406 and subjected to tests of 4.6. Unless otherwise specified, the values specified in section 3 apply to the average of the results obtained from duplicate determinations for each particular test. The lot shall be unacceptable if a sample fails to meet all the requirements of this specification except as noted in 4.5.

4.3.2.3 Sample for examination of filled containers. A random sample of filled containers shall be selected from each lot of compound in accordance with MIL-STD-105 at inspection level I and with an acceptable quality level (AQL) of 2.5 percent defective and examined for fill, closure and damaged or leaking container, improper container, and marking. The sample containers shall be shipped as part of the lot if the lot is accepted.

4.3.2.4 Conformance of the compound to the requirement for workmanship and any other requirements not covered by specific tests shall be determined by appropriate visual examination.

4.4 Qualification inspection. The qualification inspection shall consist of all the tests of this specification as described in 4.6. The qualification sample shall be examined and tested for all the requirements of this specification. The cognizant agency (see 6.3.1) reserves the right to accept the manufacturer's certification of testing, when available, in lieu of Government testing.

4.5 Quality conformance inspection. For each inspection lot of compound submitted for acceptance, the quality conformance inspection shall consist of an examination for acceptability of quality control methods used by the manufacturer, an examination of filled containers for conformance to packaging, packing, and marking requirements, and examinations and tests of samples for all the requirements of 3.1.2 through 3.3.2 (except 3.2.7), of this specification. The reactivity requirement of 3.4 may be a requirement for qualIty conformance inspection if at any time during a contract the cognizant agency determines the material submitted under contract to be suspect.

4.6 Test methods.

4.6.1 Specific gravity. The specific gravity for both component A and component B shall be determined by the pycnometer method for roads, oils, and tars described in ASTM D 70.

4.6.2 Viscosity. The viscosity in centipoises of both component A and component B shall be determined by method B of ASTM D 1084. A 1-pint paint can shall be used as the standard container and the Brookfield viscosimeter shall be used without cylindrical calibration sleeves. Samples shall be conditioned at 75 $\pm$ 5þF for a minimum of 2 hours prior to determining the viscosity. A Brookfield Synchrolectric Viscosimeter, Model RVT or RVF, may be used. For both components, use spindle No. 5 at 10 revolutions per minute (rpm).

4.6.3 Flash point. The flash point of component A and component B shall be determined in a Cleveland Open Cup in accordance with method 217.01 of SS-R406.

4.6.4 Exothermic temperature. The peak exothermic temperature of the reacting component A and component B shall be determined in accordance with ASTM D 2471, except conditioning of each component prior to mixing shall be 4 hours at 75 $\pm$ 5þF, without a constant temperature bath. One-gallon cans shall be used to contain the two components and to contain the final mixture. One and one-half pounds of each component shall be weighed into the mixing container and slowly stirred by hand with a wooden paddle for 3 minutes.

4.6.5 Gel time. The gel time of the reacting component A and component B shall be determined in accordance with ASTM D 2471 with a sample size of 100 grams of each component. The gel time shall be the elapsed time from start of mixing until the reacting mass no longer flows off the probing applicator stick back into the container. This is the point at which the gelled material is no longer pourable.

4.6.6 Slump test. Hand mix thoroughly for 1 minute 100 grams (g) of component A with 100 g of component B. Pour mixture immediately into a 3-ounce ointment can or other suitable container (2-1/8 inches in diameter by 1-3/8 inches deep) filling to within 3/8 inch of top. Measure time from start of mixing. After IS minutes place container on its side. Reacting mixture shall not have slumped beyond the edge of the container when observed 30 minutes after start of mixing. Entire procedure shall be conducted at an ambient temperature of 75 $\pm$ 5þF.

4.6.7 Alkalinity. Break or dice into small pieces (approximately 1/16 by 1/16 inch) the cured material retained from the slump test of 4.6.6. Weigh accurately approximately l0 g of the sample into a 250-ml beaker. Add 100 ml of distilled water; boil for 30 to 45 minutes. Wash down sides of beaker with 10 to 20 ml of distilled water. Allow to cool to room temperature. Test the solution with red litmus paper. If paper does not become blue (pH 7) the sample shall be considered to have no alkalinity. Proceed with the acidity test of 4.6.8.

4.6.8 Acidity. Add 5 drops of phenolphthalein to the solution from 4.6.7. Titrate with 0.01 N sodium hydroxide to the endpoint. Pink color should last for 30 seconds. Run a blank. Calculate percent acidity (as H_2SO_4) as follows:

$$\text{Percent acid} = \frac{4.9\ (A - B)\ N}{W}$$

where:

A = nil of sodium hydroxide for the sample
B = nil of sodium hydroxide for the blank
N = normality of the sodium hydroxide
W = weight of sample, g.

4.6.9 Thermal conductivity. The thermal conductivity of the cured material shall be determined in accordance with SPl Epoxy Test Method ERF 22.

4.6.10 Stability. For the stability test the test specimens of the compression set tests of 4.6.12 (a) shall be used. After heat treating at 160þF for 48 hours, the specimens shall be examined for evidence of oil or other materials leaching out.

4.6.11 Resistance to cold temperature. Mold a disc of cured compound approximately 2-3/8 inches in diameter by 1/2 inch thick. Subject the thoroughly cured sample to -65þF for 3 hours. Immediately upon removal from cold chamber, impact test the disc with a Gardner impact tester using 150 inch-pounds impact. (Gardner Impact Tester, Variable, Cat. No. 1G-1120, 160 inch-pound range, with a 4-pound rod as accessory.) Sample shall be examined for signs of cracking, chipping, or other deterioration.

4.6.12 Compression set. The compression set of the material shall be determined in accordance with ASTM D 395, method B, using 1.75 ± 0.02 inches in diameter by 0.38 ± 0.02 inch thick molded specimens, with the following exceptions:

a. Specimens shall be heat treated at 160þF for 48 hours.

b. Additional specimens shall be subjected to -65þF for 48 hours.

c. Specimens shall remain at ambient temperature for 60 minutes prior to final thickness measurements.

d. Spacer bars shall be 0.250 ± 0.002 inch thick.

4.6.13 Fast cookoff test. The thermally protected bombs loaded to the bomb sealing suitability requirement of 3.3.3 shall be subjected to the fast cookoff test defined for the Mk 82 Mod 2 Bomb by the Naval Weapons Laboratory, Dahlgren, Va.

4.6.14 Reactivity tests. The reactivity with H-6 and Tritonal explosives shall be determined for each component and the final cured compound in accordance with vacuum compatibility test procedures below.

4.6.14.1 Vacuum compatibility test. The vacuum compatibility test is carried out in a glass unit, figure 1. The vacuum compatibility test chamber may consist of an aluminum block or oil bath with thermo-regulator capable of maintaining a test temperature of 100 ± 0.5þ centigrade (C) when testing with H-6 and Tritonal explosives.

4.6.14.1.1 Calibration of glass tube. Determine the volume in milliliters of the 15.5-centimeter (cm) heating tube (Scientific Glass Apparatus, Cat. No. JV-6850 or equivalent) by running in mercury from a burette until the tube is filled to the level at which the ground glass joint of the capillary tube will make contact with the mercury. Subtract from the indicated burette readings, the volume of explosive used in the test. The difference shall be represented by the symbol A. Transfer 7.0 ml of mercury to the cup at the lower end of the capillary tube. Clamp the tube in an upright vertical position and measure the height in millimeters (mm) of the mercury column in the capillary tube (approximately 25 mm). Measure the length in millimeters of each of the three parts of the capillary tube and add these values to obtain total length. From the total length subtract the height of the mercury column in the cup as previously obtained. Represent this difference by the symbol B1 From the total length subtract the height of the column of mercury in the cup measured at the end of the test described in 4.6.14.1.2. Represent this difference by the symbol B. Determine the capacity of the capillary tube per unit of length as follows: Transfer an accurately weighed sample of approximately 10 g of mercury to the cup at the lower end of the capillary tube. Manipulate the tube so that when it is horizontal, mercury is contained in a continuous section of the longest part of the tube and measure the length of the mercury column. Repeat this twice with the mercury in two other parts of the long section of the tube. Calculate the average of the three measured lengths of the mercury column. Represent the unit capacity in ml/mm of the capillary tubing by the symbol C. This can be obtained from the formula:

$$C = \frac{W}{DL}$$

where:

C = unit capacity of capillary tubing, ml/mm
W = weight of mercury, g
D = density of mercury at temperature of determination, g/ml
L = average measured lengths of mercury column, mm.

4.6.14.1.2 Test procedure. Use 2 N + 1 (where N equals the number of explosives used) tubes similar to the heating tube portion of the apparatus shown in the vacuum compatibility test method. For controls, add 0.2 g of the inert compound to one tube and 0.2 g of each explosive to additional individual tubes. Place uniform mixtures of 0.2/0.2 g of the inert compound and each of the explosives specified in the test in single separate tubes. Clamp the apparatus so that the long section of the capillary tube is in a nearly vertical position. Transfer 7.0 ml of mercury to the cup at the lower end of the capillary tube. Connect a vacuum pump to the lower end of the capillary tit be and evacuate the system until the pressure is reduce to approximately 5 mm of mercury. (Evacuation of the capillary tube

is facilitated by placing the cup of the tube in a horizontal position so that mercury does not block the capillary opening.) After evacuation, disconnect the pump. Seal the connection between the capillary tube and the heating tube with I ml of mercury. Measure the total vertical height of the column of mercury in the capillary tube. Measure and subtract the vertical height of the mercury in the cup. The difference shall be represented by the symbol H1 Note the room temperature (t1) and the barometric pressure. Subtract the value H1 from the barometric pressure in millimeters Represent this difference by the symbol P Insert the heating tube in the vacuum stability test chamber. Maintain at the proper test temperature for 48 hours. Remove the heating tube and capillary tube assembly from the bath and allow to cool to room temperature. Measure the total vertical height of the column of mercury in the capillary tube and subtract the vertical height of the mercury in the cup. This difference shall be represented by the symbol H. Note the room temperature (t) and the barometric pressure in millimeters. Subtract the value H from the final barometric pressure in millimeters; represent this difference by the symbol P.

4.6.14.1.3 Calculation of liberated gas volume. Calculate the volume of gas in milliliters liberated in the test, at standard conditions, using the following formula:

$$V = \frac{[A + C(B - H)]\ 273P}{760(273 + t)} - \frac{[A + C(B1 - H1)]\ 273P1}{760(273 + t1)}$$

where

A = volume of heating tube minus volume of explosive in test, ml

B = total length of capillary tube minus height of mercury column in the cup measured at end of test, mm

B1 = total length of capillary tube minus height of mercury column in the cup measured before the test, mm

C = unit capacity of capillary tubing, ml per mm

H = total vertical height of column of mercury in capillary tube minus the vertical height of the mercury in the cup after test, mm

H1 = total vertical height of column of mercury in capillary tube minus the vertical height of the mercury in the cup before test, mm

P = the value H subtracted from the final barometric pressure, mm

P1 = the value H1 subtracted from the initial barometric pressure, mm

t = temperature of the room after test, þC

t1 = temperature of the room before test, þC

4.6.14.1.4 Calculation of reactivity. Calculate the reactivity gas of each of the explosive materials with each inert compound as follows; convert all individual volumes (X, Y, and Z) to a 1-gram basis:

$$\text{Reactivity gas, ml} = X - \frac{(Y + Z)}{2}$$

where:

x = gas produced by the mixture of explosive material and inert compound, ml

Y = gas produced by the explosive material alone, ml

Z = gas produced by the inert compound alone, ml

4.6.14.2 Differential thermal analysis. When this test is required (see 4.4), the explosive laboratory of the cognizant agency shall determine the procedure to be used and interpret the results.

5. PREPARATION FOR DELIVERY

5.1 Packing. Unless otherwise specified, the polymeric components shall be packed Level B utilizing steel shipping pails, PPP-P-704, or 55-gallon metal drums, PPP-D-729. The inside surfaces shall be treated, as required, to preclude content contamination. Each container

shall be furnished with a tight fitting top heading. Pals shall be palletized in accordance with MIL-STD-147.

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

6. NOTES

6.1 Intended use. The polymeric compound covered by this specification is intended for use as a nonexplosive reactive material either for sealing, padding, or a combination of both, in the tail portion of the explosive cavity of bombs where application is made by means of mixing-dispensing equipment.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification
b. Quantity of polymeric compound ordered (specify each component amount)
c. Cognizant agency designated to perform qualification testing
d. Test data to be furnished procuring activity on quality conformance testing
e. Type and degree of contractor quality assurance program required
f. Whether material is to be packed in pails or drums
g. Special marking, if any (see 5.2).

6.3 Definitions.

6.3.1 Cognizant agency. The "cognizant agency" is defined in this specification as the Naval Explosives Development Engineering Department of the Naval Weapons Station, Yorktown, Va. 23691.

6.3.2 Cured compound. The polymeric compound is considered the "cured compound" approximately 16 hours after mixing.

6.3.3 Gelled compound. The polymeric compound is considered the "gelled compound" from the time the reacting components gel until approximately 16 hours after mixing.

6.3.4 Thermally protected bombs. "Thermally protected bombs" is defined in this specification as bombs coated, prior to explosive loading, with insulating materials-exterior or interior or combination of both-that provide a heat resistant barrier between the explosive charge and the elevated temperature environment of a fuel fire. The coating system used on bombs explosive loaded to meet the bomb sealing suitability requirement of this specification shall be determined by the cognizant agency.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable qualified products list, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Naval Ordnance Systems Command, Department of the Navy, Washington, D. C. 20360; however, information pertaining to qualification of products may be obtained from the Commanding Officer, Naval Weapons Station, Yorktown, Va. 23491, Attn: NEDE Department.

6.4.1 The polymeric compound furnished under contract shall be identical in every respect to the qualification samples which have been inspected and approved. In the event that the polymeric compound furnished under contract is found to deviate from the composition of the approved product or that the product fails to perform satisfactorily, approval of such product will be subject to immediate withdrawal from the qualified products list.

6.5 Supersession data. This specification includes the requirements of WS 13584 dated 10 September 1971. When drawings and other documents refer to WS 13584, this specification applies.

Preparing activity:
NAVY OS
(Project No. 8030-N052)