

INCH-POUND

MIL-E-82898(NAVY)
30 December 1994
SUPERSEDING
AS 4513C
5 September 1991
(See 6.7)

MILITARY SPECIFICATION

EXPLOSIVE, PLASTIC-BONDED, CAST, PBX(AF)-108

This specification is approved for use by the Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the requirements for one type of cast plastic-bonded explosive designated as "PBX(AF)-108".

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards 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

MILITARY

MIL-R-398 RDX

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Indian Head Division, Naval Surface Warfare Center, Standardization Branch (Code 8420), Indian Head, MD 20640-5035 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by sending a letter.

AMSC N/A

FSC 1376

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MIL-T-23624	Tolylene-2,4-Diisocyanate
MIL-P-47067	2,4-Pentanedione
DOD-M-82730	4, 4-Methylenebis (2,6-Di-Tert-Butylphenol)
MIL-C-85293	Copper Sulfate, Anhydrous

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the DODSSP - Customer Service, Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues shall be those cited in the solicitation.

DOCUMENTS

NAVAL AIR SYSTEMS COMMAND (CAGE Code 30003)

AS 2319	Polypropylene Glycol, Plastics Grade
AS 2323	Ferric Acetylacetonate
AS 2324	Hexamethylene Diisocyanate
AS 2328	Isodecyl Pelargonate
AS 2333	Sulfur, Flowers of
AS 4662	Polymethylene Polyphenylisocyanate

(Application for copies should be addressed to the Commander, Naval Air Systems Command, Code AIR-51122E, Arlington, VA 22243-5110.)

NAVAL SEA SYSTEMS COMMAND (CAGE Code 10001)

OD 44811	Safety and Performance Tests for Qualification of Explosives
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(Application for copies should be addressed to the Commander, Port Hueneme Division, Naval Surface Warfare Center, NAVSEA Data Support Activity (Code 5H30), Port Hueneme, CA 93043-5007.)

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).

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CHEMICAL PROPULSION INFORMATION AGENCY (CPIA)

**CPIA Publication No. 21 JANNAF Solid Propellant Mechanical Behavior Manual
(Supplement)**

(Application for copies should be addressed to the Chemical Propulsion Information Agency, Applied Physics Laboratory, Johns Hopkins University, Johns Hopkins Road, Laurel, MD 20810.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 792 Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement (DOD adopted)

ASTM D 2240 Standard Test Method for Rubber Property-Durometer Hardness (DOD adopted)

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

(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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.3.

3.2 Formulation and chemical composition. The formulation and chemical composition of PBX(AF)-108 shall be in accordance with table I.

3.2.1 Exceptions to AS 2323. Toluene may be used in place of benzene to determine the percent of insoluble material.

3.2.2 Exceptions to DOD-M-82730. Exceptions are as follows:

- a. The melting point maximum shall not apply.
- b. Toluene may be used in place of benzene to determine the percent of insoluble material.
- c. The water content shall be a maximum of 0.5 percent by weight.

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TABLE I. *Formulation and chemical composition of PBX(AF)-108.*

Ingredient	Applicable document	Percent by weight ¹
Symmetrical cyclotrimethylenetrinitramine (RDX)	MIL-R-398 Type II, Class A	62.0 ± 1.3
Ferric acetylacetonate (FeAA)	Type II, Class E AS 2323	20.0 ± 0.4 — ²
4,4'-Methylenebis (2,6-di-tert-butylphenol)	DOD-M-82730	0.50 ± 0.01
Isodecyl pelargonate (IDP)	AS 2328	5.3 ± 0.1
Polypropylene glycol (PPG)	AS 2319 Type I	(see 3.2.6)
2,4 (79%); 2,6 (21%) Toluene diisocyanate (TDI)	MIL-T-23624 Grade B	(see 3.2.6)
1,6 Hexamethylene diisocyanate (HDI)	AS 2324	0.250 ± 0.008
Polymethylene polyphenylisocyanate (PPI)	AS 4662	0.375 ± 0.100
Sulfur	AS 2333	0.100 ± 0.002
Copper sulfate (anhydrous, powdered)	MIL-C-85293	0.100 ± 0.002
2,4-Pentanedione (acetylacetone) (HAA)	MIL-P-47067	0.000 to 0.004 ³

¹ Tolerances include weighing and material handling limitations.

² The FeAA content for each lot of explosive may be adjusted within the limits of 0.005 to 0.015 percent by weight to achieve the desired curing characteristics. Additions or subtractions of FeAA are to be made at the expense of IDP.

³ The HAA content for each lot of explosive may be adjusted within the specified limits to increase the explosive pot life.

3.2.3 Exceptions to MIL-T-23624. The freezing point requirement of TDI shall not apply.

3.2.4 Exceptions to AS 2324. The freezing point requirement of HDI shall not apply.

3.2.5 FeAA particle size. The FeAA shall have a particle size such that 95 percent will pass through a 325-mesh screen.

3.2.6 Isocyanate/hydroxol (NCO/OH) ratio. The TDI content and the PPG content shall be adjusted so as to maintain a total isocyanate to hydroxyl (NCO/OH) equivalents ratio of 1.05 ± 0.05 . The tolerance on PPG percent by weight shall be ± 0.2 ; the tolerance on TDI percent by weight shall be ± 0.012 (see 6.5).

3.3 Physical and chemical requirements of cured PBX(AF)-108. The physical and chemical properties of PBX(AF)-108 shall meet the requirements of table II when cured for a minimum of 48 hours at 64 ± 5 degrees Celsius ($^{\circ}\text{C}$).

3.4 Workmanship. The PBX(AF)-108 shall be free from foreign materials that would render it unsuitable for the purpose intended. The standards of workmanship exhibited by an approved first article sample shall determine the minimum requirements for production lots.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements

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specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

TABLE II. *Physical and chemical properties of cured PBX(AF)-108.*

Property	Requirement		Test method
	Minimum	Maximum	
Density, grams per cubic centimeter (g/cm ³), 25°C	1.54	1.58	4.5.1
Maximum stress, pounds per square inch (psi), 25°C ¹	20	—	4.5.2
Strain, at maximum stress, percent (%), 25°C ¹	15	—	4.5.2
Modulus, psi, 25°C ¹	70	—	4.5.2
Shore A hardness, 25°C	25	—	4.5.3
Vacuum thermal stability, cm ³ of gas/g/48 hours, 100°C	—	0.5	4.5.4
Average composition, % RDX	80.3	83.7	4.5.5

¹ Either the stress and strain requirements must be met or the modulus requirement must be met.

4.1.1 Responsibility for compliance. All items shall meet all requirements 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. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.2.1 Inspection conditions. Unless otherwise specified, inspections shall be conducted under the following conditions:

- a. Temperature: 25 ± 3°C
- b. Altitude: Normal ground level
- c. Humidity: 65 percent relative, maximum

4.3 First article inspection. Unless otherwise specified in the contract or purchase order (see 6.2), two first article samples shall be taken from a batch which has been manufactured using the processing methods and equipment proposed for production. These samples shall be subjected to the tests specified in 4.5.

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4.4 Quality conformance inspection. Two 2,000-g samples shall be taken from each batch of PBX(AF)-108. One 2,000-g sample shall be subjected to the tests specified in 4.5. The second sample shall be retained. Each sample shall be stored in a sealed container and shall be labeled as follows:

- a. Complete explosive designation
- b. Lot number
- c. Lot weight, in pounds
- d. Manufacturer's name and plant designation
- e. Contract number
- f. Date sample prepared.

4.5 Examinations and tests. The following examinations and tests shall be performed:

4.5.1 Density test. Density shall be determined for three specimens cut from the cured explosive sample using the procedure specified in ASTM D 792. Hexane may be used as an alternate immersion liquid. The lot shall be rejected if the mean taken from the three specimens tested does not meet the density requirements of table II.

4.5.2 Stress and strain, or modulus test. Stress and strain, or modulus, shall be determined for a minimum of five cut or stamped specimens in accordance with CPIA Publication 21, Supplement/Section 4.3.2, October 1988, "Uniaxial Tensile Tests at Constant Strain Rate." The mean value of the five specimens, tested for stress at maximum load (σ_m) and strain at maximum load (ϵ_m), or tested for modulus (E_o), shall meet the requirements of table II.

4.5.3 Shore A hardness test. Specimens for the Shore A hardness test shall be cut from the cured explosive sample and tested in accordance with ASTM D 2240. Specimens having a resin-rich surface shall not be tested. Hardness shall be determined for a minimum of five specimens. The lot shall be rejected if the mean taken from the five specimens tested does not meet the Shore A hardness requirements of table II.

4.5.4 Vacuum thermal stability test. The vacuum thermal stability test shall be determined in accordance with OD 44811. The volume of gas evolved per gram of specimen shall be within the limit specified in table II.

4.5.5 RDX composition test. The RDX content shall be determined by extracting with acetone, evaporating the solution, and extracting the residue with carbon tetrachloride. The test shall be performed in triplicate on each of two samples as follows:

- a. Weigh 1.5 g of PBX(AF)-108 to the nearest 0.1 mg. Transfer to a coarse fritted glass extraction thimble. Extract using a Soxhlet apparatus with acetone for 24 hours.

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- b. Transfer the acetone extraction solution to a 400-mL beaker. Evaporate the solution using an air stream in a hood.
- c. Extract the residue with 150 mL of boiling carbon tetrachloride and filter through a previously weighed medium porosity porcelain filter crucible. Repeat the extraction three additional times, transferring the solid quantitatively.
- d. Dry the crucible for at least 1 hour at 100°C, cool, and weigh.
- e. Calculate the RDX content as follows:

$$\text{Percent RDX} = 100 \frac{(A - B)}{C}$$

where:

- A = Weight of crucible plus residue, g
- B = Initial weight of crucible, g
- C = Weight of original specimen, g

- f. The average percent RDX of the triplicate determinations for each sample shall be within the limits specified in table II.

5. PACKAGING

(This section is not applicable to this specification.)

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful but is not mandatory).

6.1 Intended use. PBX(AF)-108 is a high-energy explosive intended for use as a warhead main charge.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1, 2.1.2, and 2.2)
- c. Whether a first article sample is required (see 3.1, 4.3, and 6.3)
- d. The facility designated to perform inspections if other than the contractor (see 4.1)

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e. Safety precaution requirements (see 6.4).

6.3 First article. When a first article sample is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Safety precautions. The safety precaution requirements of the "DOD Contractors' Safety Manual for Ammunition and Explosives" (DOD 4145.26M) are applicable and should be specified in the contract as required by the Federal Acquisition Regulation (FAR) 23.3.

NOTE: When this document is used as part of the description of work to be accomplished by a Government activity, the safety precaution requirements of "Ammunition and Explosives Ashore" (OP 5) should be made applicable.

6.5 TDI content. The TDI content may be adjusted to maintain a total isocyanate to hydroxyl (NCO/OH) equivalents (eq) ratio of 1.05 ± 0.05 . The total percent by weight of PPG plus TDI is 11.370.

$$\frac{eq \text{ TDI} + eq \text{ HDI} + eq \text{ PPI}}{eq \text{ PPG}} = \frac{1.05 \pm 0.05}{1.00}$$

Sample calculation:

$$1.05 \pm 0.05 = \frac{\frac{X \text{ g TDI}}{87 \text{ g TDI/eq}} + \frac{0.250 \text{ g HDI}}{84 \text{ g HDI/eq}} + \frac{0.375 \text{ g PPI}}{133 \text{ g PPI/eq}}}{\frac{Y \text{ mg KOH/g PPG}}{56,100 \text{ mg KOH/eq}}} \times (11.370 - X) \text{ g PPG}$$

Substitute the laboratory value of Y for the specific lot of PPG and solve for X. As a check, the nominal value of X is 0.62. The tolerance on PPG percent by weight shall be ± 0.2 ; the tolerance on TDI percent by weight shall be ± 0.012 .

6.6 Subject term (key word) listing.

Cast material
Material, cast

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6.7 Supersedure information. MIL-E-82898 incorporates the following engineering change proposal (ECP) and notice of revision (NOR):

ECP
NEDED-351R1 (1/15/93)

NOR
504.36R1 (1/15/93)

Custodian:
Navy-OS

Preparing activity:
Navy - OS
(Project 1376-N478)

Review activity:
Navy-AS

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-E-82898 (NAVY)

2. DOCUMENT DATE (YYMMDD)
941230

3. DOCUMENT TITLE

EXPLOSIVE, PLASTIC-BONDED, CAST, PBX(AF)-108

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

7. DATE SUBMITTED
(YYMMDD)

(1) Commercial
(2) AUTOVON
(If applicable)

8. PREPARING ACTIVITY

a. NAME

COMMANDER, INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER

b. TELEPHONE (Include Area Code)

(1) Commercial

(2) AUTOVON

301-743-4358/4510

354-4358/4510

c. ADDRESS (Include Zip Code)

101 STRAUSS AVE., (CODE 8420)
INDIAN HEAD, MD 20640-5035

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

Defense Quality and Standardization Office
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 756-2340 AUTOVON 289-2340