

INCH-POUND

MIL-P-71053 (AR)  
22 June 1994

## MILITARY SPECIFICATION

## PAX-2A EXPLOSIVE COMPOSITION

This specification is approved for use by the US Army Armament, Munitions and Chemical Command and is available for use by all Departments and Agencies of the Departments of Defense.

## 1. SCOPE

1.1 Scope. This specification covers the requirements and quality acceptance provisions for manufacture and acceptance of PAX-2A, a high energy pressable explosive composition.

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, 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

TT-E-751 - Ethyl Acetate, Technical

## MILITARY

MIL-G-155 - Graphite, Dry (For Use In Ammunition)  
MIL-H-45444 - HMX  
MIL-A-48078 - Ammunition, Standard Quality Assurance Provisions, A General Specification For  
MIL-C-005537 - Cellulose Acetate Butyrate (CAB)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document, should be addressed to: Commander, U.S. Army ARDEC, ATTN: SMCAR-BAC-S, Picatinny Arsenal, NJ 07806-5000 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 1376

**DISTRIBUTION STATEMENT A.** Approved for public release; distribution is unlimited.

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## STANDARDS

## MILITARY

- MIL-STD-109 - Quality Assurance Terms and Definitions
- MIL-STD-286 - Propellants, Solid: Sampling, Examination and Testing
- MIL-STD-650 - Explosive: Sampling Inspection and Testing.
- MIL-STD-1235 - Single and Multilevel Continuous Inspection and Testing.

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from DODSSP - Customer Service, Standardization Documents Order Desk, 700 Robbins Avenue, Bldg. 4D, 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 are those cited in the solicitation.

## DOCUMENTS

- OD26254 - Density of Casting Powder
- WS 1141 - Bis (2,2-Dinitropropyl) Acetal-Bis (2,2-Dinitropropyl) Formal, Mixture Of, (BDNPA/F)

(Copies of other Government documents, drawings and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Non-Government publications. The following documents forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of 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 E300 - 86 Recommended Practice for Sampling Industrial Chemicals.

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(Application for copies of ASTM Standards should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103)

2.3 Order of precedence. In the event of conflict between the text of this document and the references cited herein, the text of this document shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained. (See contract provisions for additional precedence criteria).

## 3. REQUIREMENTS

3.1 Materials. The explosive composition shall consist of HMX, nitroplasticizer, cellulose acetate butyrate and Titanate Coupling Agent as a processing aid and shall conform to the requirements of this specification.

3.1.1 Composition. The explosive composition shall conform to Table I.

TABLE I. Chemical Composition

	%	Tolerances (%)
HMX	85.00	± 2.00
BDNPA/F	9.00	± 1.00
CAB	6.00	± 1.00
CAB-O-SIL (TS-530)	0.50	Nominal (see note)
Graphite	0.02	0.065 max (see note)

NOTE: CAB-O-SIL (TS-530) and Graphite shall be measured on an added basis.

3.1.1.1 HMX. HMX shall be conform to the requirements of MIL-H-45444. The average particle size distribution for each sample at the 50th percentiles shall be  $4.75 \pm 2.35$  microns when tested as specified in 4.5.1.

3.1.1.2 BDNPA/F. The acetal/formal shall be in accordance with WS 1141.

3.1.1.3 CAB. The cellulose acetate butyrate shall be Type II conforming to the requirements of MIL-C-005537.

3.1.1.4 CAB-O-SIL (TS-530). The CAB-O-SIL shall be a treated fumed silica and hydrophobic.

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3.1.1.5 Graphite. The PAX-2A composition shall be graphite coated with Grade III and IV graphite conforming to the requirements of MIL-G-155.

3.1.1.6 Total volatiles. The total residual solvent content of the explosive composition shall be 0.02 percent maximum as determined in accordance with 4.5.2.

3.1.1.7 Grain density. The density of the PAX-2A grain shall be 1.724 gram/cc minimum.

3.1.1.8 Physical form. The explosive shall be in extruded strands of 0.10 inch diameter, cut to  $0.10 \pm .01$  inch on the average length.

3.1.1.9 Insoluble particles. The composition shall have no insoluble particles retained on a USS Sieve NO. 40, and not more than 5 insoluble particles retained on a USS Sieve NO. 60 when tested as specified in 4.5.5.

3.1.1.10 Ethyl Acetate. Ethyl Acetate process solvent, shall conform to TT-E-751.

3.2 First article inspection. This specification contains provisions for first article inspection. Requirements for the submission of first article samples by the contractor shall be as specified in the contract.

3.3 Foreign matter. The composition shall be free of metal inclusions, wood and other foreign matter when tested as specified in 4.4.2.1.

3.4 Process controls. The contractor shall submit a Process Control Document to the Government specifying the process variables which are considered critical for the production of the PAX-2A explosive composition. The Process Control Document shall be submitted in accordance with 4.3.4.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, 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 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.

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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 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.

4.1.2 General provisions. Unless otherwise specified herein, the provisions of MIL-A-48078 apply and form a part of this specification. Reference shall be made to MIL-STD-109 to define quality assurance terms used herein.

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

- a) First article inspection (See 4.3).
- b) Quality conformance inspection (See 4.4)

4.3 First article inspection.

4.3.1 Submission. The contractor shall submit a first article sample as designated by the Contracting Officer for evaluation in accordance with provisions of 4.3.2. The first article sample shall consist of ten (10) pounds of PAX-2A.

4.3.2 Inspection to be performed. As determined by the Government, the first article assemblies, components and test specimens may be subjected to any or all of the examinations and tests specified in this detail specification and be inspected for compliance with any or all requirements of the applicable drawings.

4.3.3 Rejection. If test specimen fails to comply with any of the applicable requirements, the first article sample shall be rejected. The Government reserves the right to terminate inspection upon any failure of a test specimen to comply with any of the requirements.

4.3.4 Process control. The contractor's quality program plan or detailed inspection plan shall include documented process controls which detail the specific procedure involved in the manufacture of PAX-2A composition. These documented process

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controls shall be submitted to the contracting Officer for review and approval by the technical agency in accordance with the approved data item description (DID) specified on the Contract Data Requirements List in the contract. The process control document shall contain a description of the process, all materials used, process conditions and procedures, production and inspection equipment used, and all methods used to ensure that the PAX-2A composition meets the requirements of this specification. In addition, whenever there is a change (change in source of materials, process conditioning procedures, etc.) from previously documented process control data, the technical agency shall be notified of the new process control data and the reason for the change.

#### 4.4 Quality conformance inspection.

4.4.1 Inspection lot formation. Inspection lots shall comply with lot formation provisions of MIL-A-48078. In addition, a lot shall consist of one or more batches of PAX-2A of one composition designation only, 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 PAX-2A that has been subjected to the same unit chemical or physical mixing process intended to make the final product homogeneous. In addition, each lot shall contain:

a. HMX of one type only, from one interfix lot number from one manufacturer only.

b. BDNPA/F from one interfix lot number from one manufacturer.

c. CAB from one interfix lot number from one manufacturer.

d. CAB-O-SIL (TS-530) from one interfix lot number from one manufacturer.

#### 4.4.2 Examination and tests.

a. Classification of characteristics. Quality conformance examinations and tests are specified in the following Classification of Characteristics paragraphs. The contractor's quality program or detailed inspection system shall provide assurance of compliance of all characteristics with the applicable drawing and specification requirements utilizing as a minimum the conformance criteria specified. When cited herein, sampling inspection shall be conducted in accordance with paragraph 4.4.2.1.

b. Alternative quality conformance provisions. Unless otherwise specified herein or provided for in the contract, alternative quality conformance procedures, methods, or

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equipment, such as statistical process control, tool control, other types of sampling procedures, etc., may be used by the contractor when they provide, as a minimum, the level of quality assurance required by the provisions, specified within. Prior to applying such alternative procedures, methods, or equipment, the contractor shall describe them in a written proposal submitted to the Government for evaluation (see 6.5). When required, the contractor shall demonstrate that the effectiveness of each proposed alternative is equal to or better than the specified quality assurance provision(s) herein. In case of dispute as to whether the contractor's proposed alternative(s) provides equivalent assurance, the provisions of this specification shall apply. All approved alternative provisions shall be specifically incorporated into the contractor's quality program or detailed inspection system, as applicable.

4.4.2.1 Sampling for chemical and physical testing. Sampling for test 4.5.1 through 4.5.6. Approximately 500 grams of explosive composition shall be selected from each batch to be sampled using ASTM Procedures E300-86 for solids. Samples shall be sampled for inspection in accordance with MIL-STD-1235, CSP-1 Plan, Inspection Level II. If any sample fails to meet any test requirement the batch represented by the sample shall be rejected. All batches produced between the time that the last batch was tested and accepted and the batch which failed shall be tested in accordance with the applicable methods given in 4.5. If any of these batches fail to meet any of the test requirements, that batch shall also be rejected. The classification of defects shall be as shown Table II.

Table II Chemical and Physical Testing

<u>Inspection/Requirement</u>	<u>Defect Classification</u>
Composition (see 3.1.1)	Major
Volatiles (see 3.1.1.6)	Major
Physical form (see 3.1.1.8)	Major
Insoluble Particles (see 3.1.1.9)	Major

4.4.3 Inspection equipment. The Government reserves the right to inspect the contractor's equipment and determine that he has available and utilizes correctly, measuring and test equipment of the required accuracy and precision and that test instruments are of the proper type and range to make measurements of the required accuracy. Commercial inspection equipment shall be employed, where applicable for all tests and examinations specified. The contractor is responsible for assuring proper calibration procedures are followed. Government approval of all inspection equipment is required prior to its use for acceptance purposes.

4.5 Methods of inspection. The tests in 4.5.1 thru 4.5.6 shall be performed, using prescribed analytical procedures for replicate determination given in standard analytical textbooks.

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4.5.1 HMX particle size. The particle size shall be determined by using the Laser Analyzer Method.

4.5.2 Volatiles. The residual solvent shall be determined in accordance with method 101.6 of MIL-STD-650 or method 103.5.2 of MIL-STD-286.

4.5.3 Graphite (glaze). The graphite content shall be determined in accordance with Method 309.1.2 of MIL-STD-286.

4.5.4 Density. The density of PAX-2A shall be determined in accordance with Method 203.1 of MIL-STD-650 or the method in OD26254.

4.5.5 Insoluble Particles. The insoluble particles shall be determined in accordance with Method 106.1 of the latest revision of MIL-STD-650.

4.5.6 COMPOSITION ANALYSIS.

4.5.6.1 Apparatus

- a. High performance liquid chromatography, Varian VISTA 5500 or equivalent.
- b. Fourier transform infrared spectrophotometer, Beckman FT 1100 or equivalent.
- c. Infrared cell, 1.5 mm path length
- d. Volumetric flask, 250 ml, 100ml
- e. Pipette, 5 ml

4.5.6.2 Chromatographic Conditions

- a. Column - 22 cm RP8, 5 micron, 4.6 mm diameter
- b. Detector - UV, 210 nm
- c. Mobile Phase - 35 water/65 acetonitrile (v/v %)
- d. Temperature - 35 degree C
- e. Flow Rate - 1.5 ml/min
- f. Chart Speed - 1.0 ml/min
- g. Injection Volume - 10 ul (loop)

4.5.6.3 Procedure Prepare 1 gm synthetic PAX-2A, using chemical balance and semimicro balance for the ingredients weighing over and below 100 mg accurately to 0.1 mg and 0.01 mg,



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respectively, into a 100 ml volumetric flask and dissolve in acetonitrile by ultasonication with cooling for five minutes. Make up to volume with acetonitrile. Prepare 1 gm PAX-2A solution in a similar manner. Determine the absorbency of both the synthetic and the sample solution at approximately 1750  $\text{cm}^{-1}$  (at the maximum wave number for alkyl carboxylates of cellulose acetate butyrate) using a 1.5 mm path length cell. Use acetonitrile as the blank. Compute the wt. % of cellulose acetate butyrate (CAB) as follows:

$$(\text{CAB})_s = \{A_s W_r (\text{CAB})_r\} / (A_r W_s)$$

Where:

$A_s$  = Net absorbency of sample solution  
 $A_r$  = Net absorbency of synthetic mixture solution  
 $W_s$  = Weight of sample in grams  
 $W_r$  = Weight of synthetic mixture solution  
 $(\text{CAB})_s$  = Wt. % of CAB in sample  
 $(\text{CAB})_r$  = Wt. % of CAB in synthetic mixture solution

Dilute 5 ml aliquots of both the synthetic and the sample PAX-2A solution with acetonitrile to 250 ml using a 5 ml pipette and 250 ml volumetric flasks. Determine the contents HMX, BDNPA/F by reversed-phase high performance liquid chromatography using the following conditions. Quantitation based on integrated area and the bracketing technique are recommended. Compute the wt. % of HMX, BDNPA/F as follows:

$$(\text{COMP}_i)_s = \{A_s W_r (\text{COMP}_i)_r\} / (A_r W_s)$$

Where:

$A_s$  = Integrated area of HMX or BDNPA/F in sample solution  
 $A_r$  = Integrated area of HMX or BDNPA/F in synthetic mixture solution  
 $W_s$  = Weight of sample in grams  
 $W_r$  = Weight of synthetic mixture in grams  
 $(\text{COMP}_i)_s$  = Wt. % of HMX or BDNPA/F in sample  
 $(\text{COMP}_i)_r$  = Wt. % of HMX or BDNPA/F in synthetic mixture.

## 5. PACKAGING

### 5.1 Packing.

#### 5.1.1 Level A. - To be determined.

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5.1.2 Level B. - To be determined.

5.1.3 Level C. Packing shall be in accordance with Provisional Packaging Instructions No. 92-21.

5.2 Marking - Marking shall be in accordance with Provisional Packaging Instructions No. 92-21.

6. NOTES

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

6.1 Intended use. The material covered in this specification is intended to be used for application as an explosive where high energy and good thermal stability are needed in ammunition items.

6.2 Acquisition requirements. Acquisition documents should 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 the individual document referenced (see 2.2).
- c. Levels of packaging and packing (see 5.1 and 5.2).
- d. Special marking, when specified.
- e. Provisions for the submission of first article samples.

6.3 Contract data requirements. In addition to the normal distribution of records, when the explosive is procured by the Department of the Army, one copy of the Explosive Description Sheet shall be forwarded to Commander, US Army Armament Research, Development, and Engineering Center (ARDEC), ATTN: PA&TD, SMCAR-QAR-R, Picatinny Arsenal, New Jersey 07806-5000.

6.4 Equivalent test methods. The test methods given in this specification are the official methods to be used. The contractor may request using other methods providing that the proposed method is equivalent (accuracy and precision) to the method given in this specification. Prior approval of the Contractor Officer is required for use of equivalent test methods. A description of the proposed method should be submitted through the Contractor Officer to: ARDEC, ATTN: PA&TD, SMCAR-QAR-R, Picatinny Arsenal, New Jersey 07806-5000. This description should include, but not be limited to, the accuracy and precision of the method, test data to demonstrate the accuracy and precision and drawings of any special equipment required.

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6.5 Submission of alternative quality conformance provisions. All contractor proposed alternative quality conformance provisions will be submitted to the Government for evaluation/approval by the technical activity responsible for the preparation of this specification.

6.6 Subject term (key word) listing.

CAB-O-SIL  
BDNPA/F  
Fourier  
Chromatographic  
Mobile  
Spectrophotometer

Custodian:  
Army-AR

Preparing activity:  
Army-AR

(Project 1376-A431)

# 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.

<b>I RECOMMEND A CHANGE:</b>	1. DOCUMENT NUMBER MIL-P-71053 (AR)	2. DOCUMENT DATE (YYMMDD) 940622
3. DOCUMENT TITLE PAX-2A EXPLOSIVE COMPOSITION		
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets if 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) (1) Commercial (2) AUTOVON (if applicable)	e. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY		
a. NAME U.S ARMY ARDEC STANDARDIZATION OFFICE	b. TELEPHONE (Include Area Code) (1) Commercial 201-724-6675 (2) AUTOVON DSN-880-6675	
c. ADDRESS (Include Zip Code) ATTN: SMCAR-BAC-S PICATINNY ARSENAL, NJ 07806-5000	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	