

INCH-POUND

MIL-DTL-14970D
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DETAIL SPECIFICATION

EXPLOSIVE COMPOSITION A-5

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

1. SCOPE

1.1 Scope. This specification covers requirements, examinations and tests for an explosive designated as Explosive Composition A-5.

1.2 Classification. Explosive Composition A-5 will be of the following classes,(see 6.1):

Class 1 - Explosive Composition A-5 which has not been subjected to density/sensitivity test (sampling inspection, see 4.5.3.1). Class 1 Composition A-5 may use a maximum of 50% by weight of recycled RDX and a minimum of 50% by weight of virgin RDX in its feedstock for Composition A-5 production (see 3.2.1.1 and 6.5).

Class 2 - Explosive Composition A-5 which has passed the density/sensitivity test (100% inspection, see 4.5.3.1 & 4.5.3.2). Class 2 Composition A-5 will use only virgin RDX (see 6.12.1) in its feedstock for Composition A-5 production.

Comments, suggestions, or questions on this document should be addressed to:Commander, U.S. Army ARDEC, ATTN: AMSRD-AAR-AIC-S, Picatinny Arsenal, New Jersey 07806-5000. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are needed to meet the requirements specified in sections 3, 4 and 5 of this specification. This section does not include documents in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all requirements documents cited in sections 3, 4 and 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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

DEPARTMENT OF DEFENSE

MIL-S-271	-	Stearic Acid, Technical
MIL-DTL-398	-	RDX (Cyclotrimethylenetrinitramine)

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-650	-	Explosive: Sampling Inspection and Testing
MIL-STD-1168	-	Ammunition Lot Numbering and Ammunition Data Card
MIL-STD-1171	-	Acceptance and Description Sheets(For Propellants and Explosives)
MIL-STD-1916	-	DOD Preferred Methods for Acceptance of Product

(Unless otherwise indicated, copies of the above specifications, standards and handbooks are available from DODSSP - Customer Service, Standardization Documents Order

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Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094.)

2.2.2 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.

DRAWINGS

NAVAL ORDNANCE SYSTEMS COMMAND

LD549486	-	Explosive Properties, List of Drawings, Assemblies, Parts, Specifications, Etc.
2426912	-	Explosive Properties Assembly
2426913	-	Donor Assembly
2426914	-	Acceptor Assembly
2426917	-	Attenuator

(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.)

2.3 Non-government publications. The following document(s) 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)

ASTM E300	-	Standard Practice for Sampling Industrial Chemicals
ASTM D2905	-	Standard Practice for Statements on Number of Specimens for Textiles

(Applications for copies should be addressed to the American Society for Testing Materials, 100 Bar Harbor Drive, West Conshohocken, PA 19428-2959.)

AMERICAN NATIONAL STANDARDS INSTITUTE

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ANSI/ISO/ASQC A8402-1994 - Quality Management and
Quality Assurance
Vocabulary

(Application for copies should be addressed to American Society for Quality Control, 611 East Wisconsin Ave, Milwaukee, WI 53202.)

2.4 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 in the contract or purchase order (see 6.2), a sample shall be subjected to first article inspection in accordance with the technical provisions herein (see 4.4).

3.2 Material.

3.2.1 Composition A-5. Composition A-5 shall consist of Type II RDX, Class 1, (or Class 1 nominal) complying with the requirements of MIL-DTL-398 for RDX and Stearic Acid complying with the requirements of MIL-S-271. The composition shall be made by the wet slurry method by coating the RDX with stearic acid dissolved in cyclohexanone (see 6.8).

3.2.1.1 Limitation on the use of recycled RDX in feedstock for Composition A-5, Class 1. Composition A-5, Class 1 may be produced using RDX which has been recrystallized from a feedstock consisting of a maximum of 50 percent (%) by weight of recycled RDX from the RDX acid removal process only (see 6.12.2) and a minimum of 50% by weight of virgin RDX (see 6.12.1). The RDX shall meet all the requirements of MIL-DTL-398.

3.2.2 Chemical and physical tests. Unless otherwise specified in the contract or purchase order, Composition A-5 shall conform to the requirements specified in Table I when tested as specified by the applicable test methods.

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TABLE I. Physical and chemical requirements

<u>Property</u>	<u>Requirement</u>		<u>Test Method Paragraph</u>
	<u>Class 1</u>	<u>Class 2</u>	
Composition			4.6.1
RDX, %			
Min.	98.5	98.5	
Max.	99.0	99.0	
Stearic Acid, %			
Min.	1.0	1.0	
Max.	1.5	1.5	
Insoluble Particles			4.6.2
No. Particles Retained on USSS 40, Max.	0	0	
No. Particles Retained on USSS 60, Max.	5	5	
Moisture, % Max.	0.10	0.10	4.6.3
Cyclohexanone, % Max.	0.30	0.30	4.6.4
Bulk Density, g/ml Min.	0.95	0.95	4.6.5
Granulation, % Passing			4.6.6
USSS 12, Min.	99.0	99.0	
USSS 200, Max.	2.4	2.4	
Density/Sensitivity			4.6.7
Density, g/cc			
Min.	-	1.645	
Max.	-	1.730	
Average, Max.	-	1.723	
Sensitivity			
Explosions, No.	-	0	

3.3 Process controls. The contractor shall submit a Process Control Document to the Government specifying the process variables which are considered crucial for the production of Composition A-5. The Process Control Document shall be submitted 30 days prior to commencement of production in accordance with 4.1.

3.4 Workmanship. The manufacturer shall use procedures and controls which assure that the Composition A-5 produced does not contain foreign material such as dirt, rust, paint

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or metal chips, etc., and that the safety and reliability of the explosive are not compromised. Compliance with this requirement shall be as specified in 4.6.8.

3.5 Product certification. No Composition A-5 material whether produced for military or commercial use may be represented as meeting the requirements of this detail specification unless it complies with all requirements contained in Section 3. The process control document (see 3.3), test data for first article inspection (see 4.4) and conformance inspection (see 4.5) shall be submitted to the Technical Agency (see 6.13) for evaluation, approval and certification on compliance with MIL-DTL-14970. (See 6.11).

4. VERIFICATION

TABLE II. REQUIREMENTS/VERIFICATION CROSS REFERENCE MATRIX

METHOD OF VERIFICATION				CLASSES OF VERIFICATION				
1- Analysis 2- Demonstration (end item test) 3- Examination 4- Test				A - First Article B - Conformance				
Section 3 Requirements	Description	Verification Method				Verification Class		Section 4
		1	2	3	4	A	B	
3.1	First Article	X		X	X	X		4.4
3.2	Material	X		X	X	X	X	4.6
3.3	Process controls			X			X	4.1
3.4	Workmanship			X		X	X	4.6.8
3.5	Product certification			X		X	X	4.4/4.5

4.1 Submission of process control document. A Process Control Document shall be submitted to the Technical Agency (see 6.14). The document shall contain a description of the process, all materials used, process conditions/procedures and production/inspection equipment used to produce Composition A-5 meeting the requirements of this specification (see 6.3). In addition, whenever there is a change that requires lot interfix change (per MIL-STD-1168) such as the source of material, process conditions, procedures, etc. from those in the previous process control document, the Technical Agency (see 6.13) shall be notified

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of the new process control change(s) and the reason for the change(s) within 10 business days from the change.

4.2 Classification of inspections. The following types of inspections shall be conducted on this item.

- a. First article inspection (see 4.4)
- b. Conformance inspection (see 4.5)

4.3 Verification conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.5.

4.4 First article inspection.

4.4.1 Submission. When specified in the contract or purchase order, the contractor shall submit a first article sample as designated by the Contracting Officer for evaluation in accordance with provisions of 4.4.2. The first article sample shall be ten (10) pounds of Composition A-5. The sample shall be obtained from the first production lot which has been produced by the contractor using the same production process, procedures and equipment as will be used in fulfilling the contract. All materials shall be obtained from the same sources of supply as will be used in regular production. A first article quantity, or portion thereof, as directed by the Contracting Officer in accordance with contract provision: Instruction Regarding Submission of First Article, shall also be submitted whenever there is a lapse in production of a period in excess of 90 days, or whenever a change occurs in manufacturing process, or in sources of constituents or process materials, drawings or specifications which could affect product uniformity as determined by the Government. A sample containing known defects will not be submitted unless specifically authorized by the Contracting Officer (see 6.2).

4.4.2 Inspections to be performed. The sample may be subjected by the Government to any or all of the examinations or tests specified in 4.5.2.1 and 4.6 of this specification and any or all requirements of the applicable drawings. (See MIL-STD-1916 for definitions of critical, major and minor classification of characteristics.)

4.4.3 First article rejection. If any sample fails to comply with any of the applicable requirements, the first article quantity shall be rejected. The Government reserves the right to terminate its inspection upon any failure of a sample to comply with any of the requirements.

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4.5 Conformance inspection.

4.5.1 Inspection lot formation. A lot shall consist of one or more batches of Composition A-5 produced by one manufacturer, in accordance with the same specification, or specification revision, under one continuous set of operating conditions. Each batch shall consist of that quantity of Composition A-5 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. RDX from one manufacturer only.
- b. Stearic acid from one manufacturer only.

Units of product selected for inspection shall represent only the inspection lot from which they are drawn and shall not be construed to represent any prior or subsequent quantities presented for inspection. Homogeneity shall be considered to exist provided the lot meets the above homogeneity criteria. All material submitted for inspection in accordance with this specification shall comply with the homogeneity criteria specified herein, regardless of the type of inspection procedure which is being applied to determine conformance with requirements. The lot shall be submitted for inspection in accordance with MIL-STD-1916 when applicable. The criteria and procedures for the assignment of lot numbers shall be in accordance with MIL-STD-1168

4.5.2 Examinations and tests.

a. Classification characteristics. 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 in this specification (4.5.2.2 to 4.5.2.6), attributes sampling inspection shall be conducted in accordance with Table III below, using the inspection levels stated in the classification of characteristics paragraphs. (See MIL-STD-1916 for the definitions of critical, major and minor classification of characteristics.)

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Table III. Attributes sample inspection

Lot Size	Inspection Levels		
	I	II	III
2 to 8	*	*	*
9 to 15	*	*	*
16 to 25	*	*	*
26 to 50	*	*	32
51 to 90	*	*	32
91 to 150	*	125	32
151 to 280	*	125	32
281 to 500	*	125	32
501 to 1200	*	125	80
1201 to 3200	*	125	80
3201 to 10000	1250	125	125
10001 to 35000	1250	315	125
35001 to 150000	1250	315	125
150001 to 500000	1250	500	200
500001 and over	1250	500	200

Numbers under inspection levels indicate sample size; asterisks (*) indicate one hundred percent inspection. If sample size exceeds lot size, perform one hundred percent inspection. Accept on zero and reject on one or more for all inspection levels.

b. Alternative conformance inspection provisions. Unless otherwise specified herein or provided for in the contract, alternative conformance inspection procedures, methods or equipment, such as statistical process control, tool control, variables sampling or other types of sampling plans, etc., may be used by the contractor when they provide, as a minimum, the level of verification required by the provisions herein. 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 6.10). When required, the contractor shall demonstrate that the effectiveness of each proposed alternative is equal to or better than the specified conformance inspection provision(s) herein. In cases 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.

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CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE	SHEET 1 OF 1		DRAWING NUMBER
4.5.2.1	Explosive Composition A-5			N/A
				NEXT HIGHER ASSEMBLY
CATEGORY	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE/ INSPECTION METHOD
<u>Critical</u>				
1	Stearic acid content below minimum requirement	4.5.3.1	3.2	4.6.1
2	RDX content above maximum requirement	4.5.3.1	3.2	4.6.1
<u>Major</u>				
101	Stearic acid content above maximum requirement	4.5.3.1	3.2	4.6.1
102	RDX content below minimum requirement	4.5.3.1	3.2	4.6.1
103	Insoluble particle	4.5.3.1	3.2	4.6.2
104	Moisture content	4.5.3.1	3.2	4.6.3
105	Solvent content	4.5.3.1	3.2	4.6.4
106	Bulk density	4.5.3.1	3.2	4.6.5
107	Granulation	4.5.3.1	3.2	4.6.6
108	Density/sensitivity (for Class 2 Comp A-5 only)	4.5.3.2	3.2	4.6.7
109	Workmanship	4.5.3.1	3.5	4.6.8
<u>Minor</u>	None defined			

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CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE		SHEET 1 OF 1	DRAWING NUMBER
4.5.2.2	Filled box prior to closing			NEXT HIGHER ASSEMBLY 7548645
CATEGORY	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE/ INSPECTION METHOD
<u>Critical</u>	None defined			
<u>Major</u>				
101	Foreign matter	Level II*	3.5 & 5.1	Visual
102	Liner pierced or torn	Level II	3.5 & 5.1	Visual
103	Liner improperly closed	Level II	3.5 & 5.1	Visual
104	Liner bottom seal broken	Level II	3.5 & 5.1	Visual
<u>Minor</u>				
201	Type of line incorrect	Level II	3.5 & 5.1	Visual

* Note: See Table III on page 9 for inspection levels.

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CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE		SHEET 1 OF 1	DRAWING NUMBER
4.5.2.3	Sealed wooden box			7548644
				NEXT HIGHER ASSEMBLY
CATEGORY	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE/ INSPECTION METHOD
<u>Critical</u>	None defined			
<u>Major</u>				
101	Box damaged	Level II	3.5 & 5.1	Visual
102	Lot number incorrect or illegible	Level II	3.5 & 5.1	Visual
103	Board broken or split	Level II	3.5 & 5.1	Visual/manual
104	Strapping missing, broken, or loose	Level II	3.5 & 5.1	Visual/manual
105	Top improperly assembled			Visual/manual
<u>Minor</u>				
201	Nail protruding	Level II	3.5 & 5.1	Visual
202	Marking incorrect or illegible	Level II	3.5 & 5.1	Visual
203	Strapping improperly assembled	Level II	3.5 & 5.1	Visual/manual

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CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE		SHEET 1 OF 1	DRAWING NUMBER
4.5.2.4	Sealed fiberboard box			7548644
				NEXT HIGHER ASSEMBLY
CATEGORY	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE/ INSPECTION METHOD
<u>Critical</u>	None defined			
<u>Major</u>				
101	Assembly torn or pierced	Level II	3.5 & 5.1	Visual
102	Lot number incorrect or illegible	Level II	3.5 & 5.1	Visual
103	Binding strips broken, missing or loose	Level II	3.5 & 5.1	Visual/manual
104	Improper grade of fiberboard	Level II	3.5 & 5.1	Visual
<u>Minor</u>				
201	Marking incorrect or illegible	Level II	3.5 & 5.1	Visual
202	Score lines missing or incorrectly applied	Level II	3.5 & 5.1	Visual/manual
203	Flaps improperly located	Level II	3.5 & 5.1	Visual/manual
204	Delamination of scoreline at edge more than one inch	Level II	3.5 & 5.1	Visual/manual

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CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE		SHEET 1 OF 1	DRAWING NUMBER
4.5.2.5	Sealed multiwall bag			12972281
				NEXT HIGHER ASSEMBLY
CATEGORY	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE/ INSPECTION METHOD
<u>Critical</u>	None defined			
<u>Major</u>				
101	Bag damaged or leaking	Level II	3.5 & 5.1	Visual
102	Valve opening not securely taped	Level II	3.5 & 5.1	Visual
103	Lot number incorrect or illegible	Level II	3.5 & 5.1	Visual
<u>Minor</u>				
201	Marking incorrect or illegible	Level II	3.5 & 5.1	Visual

CONFORMANCE INSPECTION

CLASSIFICATION OF CHARACTERISTICS

PARAGRAPH	TITLE			DRAWING NUMBER
4.5.2.6	Fiberboard box (empty)		SHEET 1 OF 1	7548645
				NEXT HIGHER ASSEMBLY
CATEGORY	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	PARAGRAPH REFERENCE/ INSPECTION METHOD
<u>Critical</u>	None defined			
<u>Major</u>				
101	Tears longer than 1 inch along score lines if not at open edge	Level III	Dwg. 7548645 (See 6.4.5a)	Gage
102	Tears or cuts longer than ½ inch if at open edge	Level III	Dwg. 7548645	Gage
103	Tears, cuts or hole which would expose bag liner to view	Level III	Dwg. 7548645	Visual
104	Noticeable weakening from exposure to moisture or weather	Level III	Dwg. 7548645	Visual
105	Contamination from explosive material, oil or grease on interior or exterior (see note below)	Level III	Dwg. 7548645	Visual
106	Defacing interfering with legibility of printed matter making further marking impracticable	Level III	3.5 & 5.1	Visual
107	Failure of box joints	Level III	3.5 & 5.1	Visual
108	More than 50% failure of any glued joint	%5 of boxes & up to 20 boxes (See 6.4.1.2.2)	5.1	4.6.9
<u>Minor</u>	None defined			

Note: A slight amount of explosive dust on the interior of the box may be permitted to the extent that it does not create a safety hazard or result in classification of empty boxes as dangerous material thus causing higher freight rates.

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4.5.3 Sampling for tests.Hazard Notice

The materials described herein are flammable or explosive or both. Consequently, they present hazards in manufacture, handling, storage and shipment. The contractor should recognize these hazards and take appropriate measures to guard and protect against fire, explosion, adverse environment, corrosive atmosphere, rough handling and electrically-induced incidents.

4.5.3.1 Sampling of Composition A-5. The tests in 4.6 shall be performed on samples representative of the batch which were taken in accordance with ASTM E300, for solids. Approximately 1 kg sample shall be obtained from each batch produced.

4.5.3.1.1 Sampling of Composition A-5, Class 1. The selection of batches for testing for Composition A-5, Class 1 shall be in accordance with MIL-STD-1916 except that in lieu of Table IV (MIL-STD-1916), the following continuous sampling plan shall be used: $i=7$, $f=1/3$ and there shall be no reduced or tightened inspection level. 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 paragraph 4.6, unless otherwise directed by the contracting officer. If any of these batches fail to meet any of the test requirements, that batch shall also be rejected. In addition, after any failure of a batch the contractor will return to 100% inspection until "i" successive batches are accepted in accordance with MIL-STD-1916.

4.5.3.1.2 Sampling of Composition A-5, Class 2. Testing for Composition A-5, Class 2 shall be conducted on 100% of the batches. If the sample for a batch fails to meet any of the test requirements, the batch shall be rejected.

4.5.3.2 Sampling for density/sensitivity test. A representative sample of approximately 200 grams Composition A-5 shall be taken from the sample obtained in accordance with 4.5.3.1. The inspection samples for Class 2 Composition A-5 shall be 100%. If any sample fails to meet the test requirements of 4.6.7 the batch represented by the sample shall be rejected as Class 2 material.

4.5.4 Product testing. Unless otherwise specified, the samples obtained in 4.5.3 shall be subjected to the tests listed in 4.5.2.1. Unless otherwise specified in the contract (see 6.2) the results of the tests shall be reported in accordance with MIL-STD-1171. (See 6.11)

4.5.5 Inspection equipment. For the performance of all tests and examinations specified in 4.5 and 4.6, commercial inspection equipment should be employed. The contractor shall have available, and utilize correctly, this equipment and is charged with the responsibility of assuring that proper calibration procedures are followed. Government approval of all inspection equipment is required prior to its use for acceptance purposes (see 6.7).

4.6 Methods of inspection. The following tests shall be performed using prescribed analytical procedures for replicate determinations given in standard analytical textbooks or ASTM D2905 method. Also, unless otherwise specified herein, all chemicals and reagents shall be ACS or reagent grade. The density/sensitivity test (4.6.7) shall not be run in duplicate. (See 6.6 for the use of equivalent test methods.)

4.6.1 Composition.

4.6.1.1 Stearic acid content. Place an approximately 5 g portion weighed to the nearest 0.1 mg of the dried sample in a tared, clean, dry, medium porosity filtering crucible containing a filter pad. Place the crucible containing the sample into a stainless steel pan. Add 20 ml of aliphatic naptha saturated with RDX into the crucible and allow the solvent to remain in contact with the explosive, at room temperature, for approximately 5 minutes. Stir the contents of the crucible to break up lumps and to aid in extraction of the sample. Perform all extractions and dispensing of naptha under a fume hood. Remove the crucible from the pan and place it on a vacuum source to filter off the solvent. Repeat the addition of 20 ml of naptha, extraction for 5 minutes with occasional stirring and filtering, two additional times. Wash the interior of the crucible with approximately 20 ml of naptha from a wash bottle. Aspirate the residue until the naptha solvent is no longer detectable (approx. 2 minutes). Dry the crucible and residue in a drying oven at 90°C to 105°C for approximately 30 minutes. Remove the crucible and residue from the oven and allow it to cool to room temperature in a desiccator and weigh to the nearest 0.0002 g. Calculate the percent of stearic acid on a moisture free basis as follows:

$$\text{Percent, stearic acid} = \frac{100 (X-Y)}{W}$$

Where:

X = initial weight of crucible and contents

Y = final weight of crucible and contents

W = weight of specimen on a moisture free basis

RDX content may be determined by subtracting the % stearic acid from 100:

$$\% \text{ RDX} = 100 - \% \text{ stearic acid}$$

4.6.1.2 RDX content. Place the residue from the determination of stearic acid in a 200 ml beaker and add 100 ml of acetone. Cover the beaker with a watch glass and heat the beaker and contents on a steam bath until the material is dissolved. Filter the contents of the beaker through a tared medium filtering crucible. The crucible shall have been previously prepared by washing with acetone, igniting and weighing. Care shall be taken to transfer all insoluble matter into the crucible. Wash the residue 3 times with 30 ml portions of acetone. Dry the crucible for 30 minutes in an oven at $105^{\circ}\text{C} \pm 5^{\circ}\text{C}$, cool in a desiccator and weigh. Calculate the percent of RDX as follows:

$$\text{Percent, RDX} = \frac{100 (Y-Z)}{W}$$

Where:

Y = Final weight of crucible and contents from the determinations of stearic acid

Z = Final weight of crucible and contents

W = Weight of original sample on a moisture-free basis

4.6.2 Insoluble particles. The insoluble particles shall be determined in accordance with MIL-STD-650, Method 106.1 with acetone as the solvent. The material previously obtained in 4.6.1.2 may be used for this determination.

4.6.3 Moisture content. The moisture content shall be determined in accordance with Method 101.4 of MIL-STD-650, with methanol as the special solvent. Use a five gram sample for this determination.

4.6.4 Solvent content. The solvent content of Composition A-5 shall be determined with a gas chromatograph

(GC) equipped with a flame ionization detector (FID) and an electronic integrator. If the electronic integrator is not capable of printing out a chromatogram a strip chart recorder shall also be used. The GC shall be fitted with a 1/8 inch O.D. stainless steel column of a suitable length (3 ft or 6 ft may be used) packed with 80-100 mesh Porapak P (see 6.11) or a 1/8 inch O.D. Teflon lined aluminum column of suitable length (3 ft or 6 ft may be used) packed with 80-100 mesh Porapak P-S (see 6.9). Prior to performing the solvent content determination a calibration curve of peak area versus concentration shall be prepared using cyclohexanone standards of known concentrations. The standards shall be made up by appropriate dilutions of a standard stock solution prepared by accurately weighing 1.0 g to the nearest 0.0001 g into a tared 100 ml volumetric flask, filling the flask with acetone to the 100 ml mark and inverting several times to thoroughly mix the solution. The standard stock solution will contain 0.01 g of cyclohexanone per ml. Suggested GC conditions are as follows: Carrier gas pressure 50 psig (suggested for a 3 ft or 6 ft column); injection temperature 135 to 150°C, oven temperature 190 to 210°C; detector and outlet manifold temperature 200 to 210°C; recorder (if used) chart speed 0.5 cm/min and injection volume 1.0 microliters. Appropriate calibration solutions shall first be injected and their peak areas determined. The calibration curve shall be constructed. An approximate 5.0 g sample of Composition A-5 shall be weighed to the nearest 0.0001 g and transferred to a 100 ml volumetric flask and acetone shall be added to below the 100 ml mark in order to dissolve the sample. After the sample has dissolved acetone shall be added to the 100 ml mark and the flask inverted several times to thoroughly mix the solution. A 1.0 microliter portion of the sample shall be injected into the GC. The percent of cyclohexanone solvent shall be calculated using the following equation:

$$\text{Cyclohexanone solvent, percent} = \frac{100 (A \times C)}{B \times S}$$

Where:

- A = the cyclohexanone peak area in integrator units(IU) of the sample
- B = the average peak area in IU of the standard sample injection having a peak area nearest to the sample peak area
- C = the concentration in g/ml of cyclohexanone in the standard sample as above and

S = the concentration of Composition A-5 in g/ml
of the sample injected

4.6.5 Bulk density. The bulk density shall be determined using a 200 gram sample with a 250 ml graduated cylinder and a 4 inch by 4 inch plywood box which is padded on the inside surfaces with rubber foam having a density of approximately 0.029g/ml. The top of the box shall have a circular hole cut in the center of sufficient diameter so that the cylindrical portion of the graduate fits easily through it. To determine the bulk density of the sample pass the cylindrical portion of the graduate through the hole in the top of the box so that the base of the graduate is in contact with the inside of the box top. Place the top on the box enclosing the bottom portion of the graduated cylinder inside the box. Place the box on a firm flat surface and transfer an accurately weighed to the nearest 0.1 g portion of the sample to the graduate. Lift the protruding portion of the graduate until the base comes into contact with the top of the box and release allowing the base of the graduate to strike the padded bottom of the box. Repeat the lifting and dropping procedure until twenty drops have been completed. Read the volume of the compacted powder in the cylinder to the nearest ml. Calculate bulk density in grams per ml, as follows:

$$\text{Bulk density} = \frac{A}{B}$$

Where:

A = weight of powder (g)

B = volume of compacted powder (ml)

4.6.6 Granulation. Use method specified in Method 204.1 of MIL-STD-650 using the following sieves in the nest:

USS Sieve No. 12

USS Sieve No. 200

The nest of sieves shall be shaken for 3 minutes with a mechanical shaker in accordance with local safety rules.

4.6.7 Density/sensitivity test. (See Dwg. LD549486) A representative sample of Explosive Composition A-5 from 4.5.3.1 shall be subjected to the procedures of the following paragraphs:

4.6.7.1 Loading and calibration of donor assemblies. A minimum batch of twenty-five donor assemblies shall be

prepared in accordance with NAVORD Drawing 2426913. Sample donors shall be selected from each batch in accordance with Table III, Inspection Level II. These donors shall be assembled in the test arrangement and fired against the block by initiation of the detonator with a 50 volts DC (minimum) 20 amperes (minimum) power supply. To be acceptable for use in the sensitivity test, the average depth of dent produced in the block by the donors must be between 0.063 and 0.069 inch and the standard deviation must not exceed 0.005 inch. Each block shall be used once and only once. The measurement of the indentation depth shall be made in accordance with 4.6.7.5.

4.6.7.2 Preparation of acceptor specimens and measurement of density. The Explosive Composition A-5 shall be loaded in eight equal weight increments and each consolidated at $16,000 \pm 1,000$ psi. The first trial loading shall be with increment weights of 0.16 g of the explosive. The acceptor body (NAVORD Drawing 2426914) shall be weighed before and after loading. If all eight increments fit in the acceptor body with room to spare, adjust the subsequent acceptor by measuring the remaining unloaded column height and increasing equally the weight of each increment to meet the tolerance shown in NAVORD Drawing 2426914. If all eight increments do not fit into the acceptor body, adjust equally the individual increment weights based on the actual weight of explosive contained in the body such that the tolerances shown in NAVORD Drawing 2426914 are obtained. Load another test body to assure that the drawing tolerance has been met. When the adjustment is satisfactory, load the acceptor bodies to form a total of exactly 20 acceptors meeting the tolerance shown in NAVORD Drawing 2426914. The acceptors shall be weighed before and after loading and the density of each individual acceptor shall be determined and reported to three decimal places. The individual densities shall be between 1.645 g/cc and 1.730 g/cc and the average density shall not exceed 1.723 g/cc.

4.6.7.3 Sensitivity test assemblies. Twenty explosive properties assemblies shall be prepared in accordance with NAVORD Drawing 2426912 from a random selection of the acceptable donors prepared in accordance with paragraph 4.6.7.1 and the acceptors prepared in accordance with paragraph 4.6.7.2. The concentricity of the acceptor to the dent block shall be within 0.250 inch. The longitudinal axis of the donor, acceptor and barrier shall be made concentric by taping with two wraps of masking tape around the periphery of these pieces to form a single unit.

4.6.7.4 Test procedure. Twenty and only twenty assemblies shall be tested using 3.5 decibang attenuators (NAVORD Drawing 2426917 Pc. No. 41). The dents produced in the witness blocks shall be measured in accordance with paragraph 4.6.7.5.

4.6.7.5 Measurement of indentation depth. Depth of indentation made in the block by the explosion of the donor or acceptor as applicable, shall be measured with a dial indicator accurate to 0.0001 inch or better. The point of the dial indicator probe shall have an approximate 30 degree included angle and the end of the point shall have a radius of 0.025 ± 0.002 inch. Before measuring the depth of indentation in the block, remove any foreign material, such as deposits, from the dent. Zero the indicator with the point of the probe in the deepest part of the dent. Then take the readings on the surface of the block at four points near the periphery of the block. These points shall be approximately 0.125 inch away from the periphery and 90 degrees apart. The dent shall be computed as the average of the four readings.

4.6.7.6 Acceptance criteria. The explosive shall be considered to have passed the density/sensitivity test if, for the specified loading pressure, all densities fall between 1.645 and 1.730 g/cc and the average does not exceed 1.723 g/cc. The explosive shall be considered to have passed the sensitivity test, if there are no acceptor explosions in the 20 trials. Any reaction causing a dent of 0.0020 inch or more shall be considered an explosion.

4.6.8 Workmanship. Visually examine the production of Composition A-5 and all samples submitted for testing to verify compliance with the requirements given in 3.5.

4.6.9 Adhesion of glued carton joints. The glued carton shall be torn apart by lifting a corner of the glued flap and tearing it from the side wall. Examine the manner of separation of the joint and note the percentage of fiber failure. (see 6.4.1.2.2).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2 and 6.4). When actual packaging of materiel is to be performed by DOD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense

Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity. (See 6.4)

6. NOTES

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

6.1 Intended use. Composition A-5, Class 1 is intended for use as a main charge explosive. Composition A-5, Class 2 is intended to be used as a lead or booster explosive. (See 6.2e)

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of the specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1 and 2.2).
- c. Provisions for submission/resubmission of first article samples.
- d. Quantity required and delivery schedules.
- e. Class required (see 1.2, 3.2 and 6.5).
- f. Levels of preservation, packing and marking (see 5. and 6.4).
- g. Acceptance and description sheets (see 6.3).
- h. Item hazard classification (see 6.4.4.).

6.3 Consideration of data requirements. When this specification is used in a procurement contract which incorporates DD Form 1423, contract data requirements list, acceptance and description sheets (for explosives) are required for each lot. These sheets should be prepared and submitted by the contractor in accordance with MIL-STD-1171 or otherwise as directed by the contract. In reporting the density/sensitivity tests results all individual sample densities and sensitivities should be included. In

addition, the following data requirements should be considered when this specification is applied on a contract, per the Contract Data Requirements List, DD Form 1423:

Reference	DID Number	DID Title
6.4.4	DI-PACK-81059	POP Test Report

6.4 Acceptable packaging requirements. The following packing and marking requirements have been used for packaging Composition A-5, and are found to be acceptable to the Government. These requirements should be included in the contract or order for the procurement of Composition A-5 because Composition A-5 is a hazardous energetic material. (Caution: If the following paragraphs are to be incorporated in a contract, they must be modified, using standard contract language, to make them compulsory requirements.)

6.4.1 Preservation and packaging.

6.4.1.1 Packing Level A. The Composition A-5 should be packed in accordance with Dwg. 7548644.

6.4.1.2 Packing Level B. The Composition A-5 should be packed in accordance with Dwg. 7548645 or Dwg. 12972281.

6.4.1.2.1 Fiberboard Carton, Dwg. 7548645. When assembling the body or cover, the flap edges should not be more than 1/8 inch above or below the edge of the part. Delamination of the fiberboard which may occur where diagonal scores meet the edge of the part will be acceptable, provided the width of the delamination does not exceed one inch.

6.4.1.2.2 Adhesion of glued carton joints. Each glued joint should meet the requirements for fiber failure as given on Dwg. 7548645 when determined as specified in 4.6.9.

6.4.2 Marking. The marking should be in accordance with Dwg. 7548644, Dwg. 7548645 and Dwg. 12972281.

6.4.3 Performance oriented packaging (POP). The exterior packs cited above should meet all of the POP test requirements in accordance with the Code of Federal Regulations, Title 49 (49 CFR), including testing, and retesting as specified in paragraph 178.601 (e) of 49 CFR. A POP test report should be generated in accordance with DI-PACK-81059 following the tests. POP testing may be waived if an acceptable non-government analogy can be made IAW 49 CFR to another pack which has successfully completed the testing. This analogy must also be documented IAW DI-PACK-81059. When completed, either the contractor generated POP

test or non-government analogy must be kept on file by the contractor and must also be submitted to the U.S. Army ARDEC, ATTN: AMSTA-AR-WEP, Picatinny Arsenal, NJ 07806-5000. (NOTE: If a POP test report is prepared against an acceptable analogy; the analogous POP test report must also be submitted to AMSTA-AR-WEP). The POP marking symbol applied to the exterior pack should be that belonging to the organization which conducted the POP testing.

6.4.4 Item hazard classification. All U.S. manufacturers should make certain that the item is tested in accordance with Part 173, Subpart C, Section 173.58 (a) of 49 CFR, Parts 106-180 to assign proper Class and Division for all explosives (Division 1.1, 1.2, 1.3 and 1.4 Explosives). Registration with the Associate Administrator of Hazardous Materials Safety is required in accordance with Part 173, subpart C, Section 173.56 (b) (1) or 173.56 (c) of 49 CFR so that proper markings in accordance with Part 172, Subpart D, Section 172.301 (a) and 172.320 (a) are met.

All foreign manufacturers should make certain that the dangerous goods are tested in accordance with United Nations Committee of Experts on the Transportation of Dangerous Goods (as published in UN Document ST/SG/AC.10.11 latest revision, Recommendations for the Transport of Dangerous Goods - Tests and Criteria) to determine the proper class and division (Class 1-9 and Division 1.1 -1.6 for explosives). Registration for air and vessel transport is required with each manufacturing country's National Competent Authority which is issued in accordance with part 2, paragraph 1.3 of the International Civil Aviation Organization (ICAO) technical instructions which approves the hazard classification and compatibility group assignment and assigns the appropriate shipping name to the dangerous goods. The proper packaging, marking and labeling is contained in the United Nations Committee of Experts on the Transport of Dangerous Goods (as published in UN Document ST/SG/AC.10.1, latest revision, recommendations on the Transport of Dangerous Goods).

For air transport the dangerous goods must comply with the provisions of the International Air Transport Associate (IATA) Dangerous Goods Regulations and for vessel transport, the dangerous goods must comply with the provisions of the Intergovernment Maritime Organization's International Maritime Dangerous Goods (IMDG) Code.

6.4.5 Referenced documents for packaging. The following list of documents referenced in 6.4 should be included in the contract or purchase order as requirement documents. Document users are cautioned that they must meet all requirements of these documents if cited in the contract or purchase order.

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a. Government documents, drawings and publications. Unless otherwise specified, the issues of documents are those cited in the solicitation.

DRAWINGS

U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER (ARDEC)

7548644	-	Box, Packing for High Explosives; Assembly Details, Packing and Marking
7548645	-	Carton, Packing, Reusable-Collapsible for High Explosives; Assembly, Details Packing and Marking
12972281	-	Packing and Marking for Bag, Multiwall for Explosives

(Copies of other Government documents, drawings, and publications required by contractors in connection with specific acquisition functions should be obtained from the U.S. Army ARDEC, AMSTA-QAW-E, Picatinny Arsenal, NJ 07806-5000.).

b. CODE OF FEDERAL REGULATIONS

49 CFR 100-199 - Department of Transportation Rules and Regulations for the	Transportation
of Explosives and other Dangerous Articles	

(The Interstate Commerce Commission Regulations are now a part of the Code of Federal Regulations, available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Orders for the above publication should cite, "49 CFR 100-199 (latest revision)".)

6.5 Navy acquisition. If specified in the contract or purchase order Composition A-5 for Navy acquisition may be supplied from those batches which have been subjected to and have passed the requirement of the density/sensitivity test (see 4.6.7). The Naval Sea Systems Command (91WM) restricts Navy procurement to Class 2 only.

6.6 Approval of 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 contracting officer is required for use of equivalent test methods. A description of the proposed method should be submitted through the Contracting Officer to: Commander, ARDEC, ATTN: AMSTA-AR-QAT-P, Picatinny Arsenal, NJ 07806-5000 This description should include, but not be limited to, the procedures used, the accuracy and precision of the method, test data to demonstrate the accuracy and precision of any special equipment required (see MIL-I-45028).

6.7 Submission of inspection equipment designs for approval. Submit designs as required to the technical agency for approval, (see 6.12).

6.8 Process. The following wet slurry method has been found satisfactory. Molten stearic acid is added concurrently with Cyclohexanone to a RDX water slurry in which the RDX was previously recrystallized with cyclohexanone. The solvent is then removed and the Composition A-5 slurry is cooled, filtered and dried.

6.9 Porapak P and Porapak P-S. Porapak P and Porapak P-S are products of Alltech Associates, Bellefonte, PA.

6.10 Submission of alternative conformance inspection provision(s). Unless otherwise specified in the contract, proposed alternative conformance inspection provisions should be submitted by the contractor for evaluation by the Technical Agency responsible for preparation of this specification. (See 6.12)

6.11 Submission of product. At the time each completed lot of items deliverable under the contract is submitted to the Government for acceptance, the contractor will supply the following information accompanied by a certificate which attests that the information provided is correct and applicable to the product being submitted (see 6.3):

a. A statement that the lot complies with all of the quality assurance provisions specified in this specification.

b. Specification number and date, together with identification and date of changes thereto.

c. Certificates of analysis on all materials used directly by the contractor when such material is controlled by Government specifications will be made available upon request by the Contracting Officer.

d. Class and number of pounds of Composition A-5 in the lot.

e. Date submitted.

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

6.12 Virgin RDX and recycled RDX.

6.12.1 Virgin RDX. Feedstock (crude RDX) to recrystallizer is composed of slurried RDX coming directly from the RDX synthesis process.

6.12.2 Recycled RDX. Feedstock (crude RDX) to the recrystallizer is composed of slurried RDX recovered from (1) the HMX or RDX acid removal process and (2) the acetic acid recovery process.

6.13 Technical Agency. Picatinny Arsenal is the Technical Agency that is responsible for the preparation and revision of the specification. All correspondences to the Technical Agency should be submitted through the contracting officer to: Commander, ARDEC, ATTN: AMSTA-AR-QAT-P, Picatinny Arsenal, NJ 07806-5000.

6.14 Subject term (key word) listing.

- Explosive composition
- RDX-based composition
- RDX
- Cyclotrimethylenetrinitramine
- Stearic acid
- Desensitized RDX

Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility

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nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in anyway supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodians

Army-AR

Navy-OS

Air Force-99

Preparing Activity:

Army-AR

(Project 1376-0096)

Review activities:

Air Force-70

Navy-AS,NP

Note: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using ASSIST Online database at www.dodssp.daps.mil