

MIL-E-14970B

24 September 1974

SUPERSEDING

MIL-E-14970A(MU)

6 September 1970

MILITARY SPECIFICATION

EXPLOSIVE COMPOSITION A5

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

1. SCOPE

1.1 This Military Specification covers an explosive designated as Explosive Composition A5 (see 6.5)

1.2 Classification. Explosive Composition A-5 shall be of the following classes: (see 6.7)

- Class 1 - Explosive Composition A-5 which has passed the Density/Sensitivity Test of 4.4.6 (see 6.1d)
- Class 2 - Explosive Composition A-5 which has not been subjected to the Density/Sensitivity Test of 4.4.6.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

- MIL-S-271 - Acid, Stearic
- MIL-R-398 - RDX

STANDARDS

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes (ABC-STD-105)

FSC: 1376

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MIL-STD-109 - Quality Assurance Terms and Definitions
MIL-STD-129 - Marking for Shipment and Storage
MIL-STD-650 - Explosive: Sampling Inspection and Testing
MIL-STD-1168- Lot Numbering of Ammunition
MIL-STD-1235- Single and Multilevel Continuous
Sampling Procedures and Tables
for Inspection by Attributes

DRAWINGS

U.S. ARMY

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

NAVAL ORDNANCE SYSTEMS COMMAND

2426912 - Explosive Properties Assembly (see 6.9)
2426913 - Donor Assembly (see 6.9)
2426914 - Acceptor Assembly (see 6.9)
2426917 - Attenuator (see 6.9)
LD549486 - Explosive Properties, List of Drawings,
Assemblies, Parts, Specifications, Etc.

(Copies of standards, specifications, drawings and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the Contracting Officer.)

3. REQUIREMENTS

3.1 Material

3.1.1 Explosive composition A5 shall consist of Type B RDX, complying with the requirements of MIL-R-398 for RDX and with the requirements of MIL-S-271 for stearic acid. The composition shall be made by coating the RDX with Stearic Acid by the wet slurry method. (see 6.8)

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3.2 Composition. The composition of explosive composition A5 shall be as follows when determined as specified in 4.4.1:

Ingredients	Percent	
	Min.	Max.
RDX	98.5	99.0
Stearic Acid	1.0	1.5

3.3 Insoluble particles. There shall be not more than five insoluble particles retained on a U.S. Standard Sieve No. 60 and no particles shall be retained on a No. 40 Sieve, when tested as specified in 4.4.2.

3.4 Moisture. The moisture content of Explosive Composition A5 shall be 0.10 percent, max., when determined as specified in 4.4.3 (see 6.4)

3.5 Bulk Density (see 6.1) Unless otherwise specified in the contract or purchase order (see 6.1), the Explosive Composition A-5 shall have a minimum bulk density of 0.95 g/ml when determined as specified in 4.4.4 (see 6.6).

3.6 Granulation. The granulation of explosive composition A5 shall be a minimum of 99.0 percent through U.S. Standard Sieve No. 12 and a maximum of 2.4 percent through U.S. Standard Sieve No. 200 when determined as specified in 4.4.5.

3.7 Density/Sensitivity Test. All Class 1 material must be submitted for this test (see 6.1d and 6.7).

3.7.1 Loaded Density. A representative sample of Explosive Composition A-5, when loaded as specified in 4.4.6.2 shall have an average density not exceeding 1.719 gm/ml and individual densities between 1.673 and 1.728 gm/ml.

3.7.2 Sensitivity. There shall be no acceptor explosions in any trial when tested as specified in 4.4.6. Any reaction causing a dent of 0.0020 inch or more shall be considered an explosion.

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3.8 First article testing. This specification makes provisions for first article testing. Submission of first article quantity by the contractor shall be as specified in the contract.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements. Reference shall be made to Standard MIL-STD-109 in order to define terms used herein.

4.1.1 Classification of Inspections. The following types of inspection shall be conducted on this material:

- a. First Article Inspection (see 4.2)
- b. Quality Conformance Inspection (see 4.3)
- c. Packaging Inspection (see 4.3.2 and 5.1)

4.2 First Article Inspection

4.2.1 Submission. Prior to initiation of regular production the contractor shall submit a first article sample of 25 pounds. The sample shall be taken from various portions of the batch of Composition A-5. The method of sampling shall be such as to assure that the sample is representative of the batch of Composition A-5 (see ASTM Method E300-70). The sample shall be packaged in accordance with drawing 7548645 and submitted in accordance with instructions issued by the Contracting Officer. All samples submitted shall have been produced by the contractor using the same production process, procedures and equipment as will be used in fulfilling the contract. The sample shall be accompanied by certificates of analysis. A first article quantity, or portion thereof, as directed by the Contracting Officer, shall also be submitted whenever there is a lapse in production for

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a period in excess of 90 days, or whenever a change occurs in manufacturing process material used, drawing, specification or source of supply as to significantly affect product uniformity as determined by the Government. Prior to submission, the contractor shall inspect the sample to the degree necessary to assure that it conforms to the requirements of the contract and submit a record of this inspection with the sample. A sample containing known defects will not be submitted unless specifically authorized by the Contracting Officer (see 6.1)

4.2.2 Inspections to be performed. The sample will be subjected by the Government to any or all of the examinations or tests specified in 4.3 and 4.4 of this specification and any or all requirements of the applicable drawings. All tests shall be performed as specified in 4.4.

4.2.3 Rejection. If the sample fails to comply with any of the applicable requirements, the first article sample shall be rejected. The government reserves the right to terminate its inspection upon any failure of a sample to comply with any of the stated requirements.

4.3 Quality Conformance Inspection

4.3.1 Batch and Lot Formation. This specification makes provision for a unit of inspection, a batch, and a unit for shipping purposes, a lot.

4.3.1.1 Batch Formation. Each batch shall consist of that quantity of Explosive Composition A-5 produced by a single charging of the processing unit used to coat RDX with the stearic acid. No more than one lot of each ingredient (RDX and stearic acid) shall be used to charge the process. No blending together of different batches of Composition A-5 or portions thereof shall be allowed.

4.3.1.2 Lot Formation. A lot shall be one or more batches of Explosive Composition A-5, produced by one manufacturer, in accordance with the this specification, or same specification revision, under one continuous set of operating conditions. The product shall be submitted for inspection in accordance with MIL-STD-105 (or MIL-STD-1235 when applicable). Lot numbering as required shall be in accordance with MIL-STD-1168.

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4.3.2 Examination. Sampling plans and procedures for the following classifications of defects shall be in accordance with MIL-STD-105 (ABC-STD-105). Contractor's sampling plans, if used, shall be approved by the Government and shall provide as a minimum the protection afforded the Government by the sampling plans in MIL-STD-105. Continuous sampling plans in accordance with MIL-STD-1235 may be used if approved by the procuring activity. Also, at the option of the procuring activity, AQL's and sampling plans may be applied to the individual characteristics listed, using an AQL of 0.40 percent for each Major defect and an AQL of 0.65 percent for each Minor defect.

4.3.2.1 Box or carton prior to closing (see dwg. 7548644 and 7548645)

Categories	Defects	Method of Inspection	Code No. (see 6.3)
Critical: None defined.			
Major:	AQL 0.65 percent		
101.	Foreign matter	Visual	01001
102.	Liner pierced or torn	Visual	01002
103.	Liner improperly closed	Visual	01003
Minor:	AQL 0.65 percent		
201.	Type of liner incorrect	Visual	01004

4.3.2.2 Sealed boxes (see dwg 7548644)

Categories	Defects	Method of Inspection	Code No.
Critical: None defined			
Major:	AQL 1.00 percent		
101.	Top improperly assembled	Visual/Manual	02001
102.	Box damaged	Visual	02002
103.	Lot number misleading or unidentifiable	Visual	02003
104.	Strapping missing, broken, or loose	Visual/Manual	02004

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Minor: AQL 1.50 percent

201.	Strapping improperly assembled	Visual/Manual	02005
202.	Marking misleading or unidentifiable	Visual	02006

4.3.2.3 Sealed fiberboard carton (see dwg 7548645)

Categories	Defects	Method of Inspection	Code No.
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Critical: None defined

Major: AQL 0.65 percent

101.	Assembly torn or pierced	Visual	03001
102.	Lot number misleading or unidentifiable	Visual	03002

Minor: AQL 1.50 percent

201.	Stitches missing or loose	Visual	03004
202.	Marking misleading or unidentifiable	Visual	03005
203.	Banding strips missing, broken, or improperly applied	Visual/Manual	03006

4.3.3 Testing (see 6.10)

4.3.3.1 Sampling for tests 4.4.1 through 4.4.5. A representative sample of approximately two (2) pounds of Explosive Composition A-5 shall be selected from each batch for testing. The sample shall be taken from various portions of the batch of Composition A-5. The method of sampling shall be such to assure that the sample is representative of the batch of Composition A-5 (see applicable method in ASTM Method E300-70). In case resampling is required the sample will be selected from cartons (see the applicable method in ASTM Method E300-70). If the sample fails to meet the requirements specified herein, the batch shall be rejected. The sample shall be tested for the following properties.

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Stearic Acid Content		
below minimum requirement	Critical Defect	Code No. 04001
above minimum requirement	Major Defect	Code No. 04001
RDX Content		
below minimum requirement	Major Defect	Code No. 05001
above minimum requirement	Critical Defect	Code No. 05001
Insoluble Particles	Major Defect	Code No. 06001
Moisture Content	Major Defect	Code No. 07001
Bulk Density	Major Defect	Code No. 08001
Granulation	Major Defect	Code No. 09001

4.3.3.2 Sampling for (Density/Sensitivity Test) Load Density Major Defect, Code No. 10001 and Sensitivity Critical Defect Code No. 11001. A separate representative sample of approximately 200 grams of Comp A-5 shall be obtained from each batch in the same manner described in 4.3.3.1. The inspection of batches in the lot shall be performed in accordance with MIL-STD-1235, CSP-1 Plan, Inspection Level II, AQL of 0.65% with the following restriction being applied: If any sample fails to meet the test requirement (see 3.7), the batch represented by the sample shall be rejected. In addition, all batches within the lot will be rejected until tested and found to conform with the requirements given in 3.7. The criteria for Class 1 material shall be in accordance with 6.7.

4.3.3.3 Sampling for adhesion test. Major Defect, Code No. 12001. Empty fiberboard cartons shall be sampled in accordance with Special Inspection Level S-3 in Table I of MIL-STD-105 with an AQL of 4.0 percent. (see 5.1.3)

4.3.4 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 the 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 in 4.3 and 4.4. 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 purpose.

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4.4 Test Methods and Procedures. The tests in 4.4.1 thru 4.4.5 shall be performed using prescribed analytical procedures for duplicate determinations given in standard analytical textbooks. The test in 4.4.6 (Density/Sensitivity) shall not be run in duplicate.

4.4.1 Composition

4.4.1.1 Determination of Stearic Acid, Transfer an accurately weighed portion of approximately 5 grams (gm) of the sample to a tared medium porosity, sintered glass crucible. Extract the specimen with three separate 20 milliliter (ml) portions of chloroform which have been previously saturated with RDX, maintaining each portion in contact with the residue for approximately five minutes before applying suction. Stir occasionally to break up any lumps and wash down the sides of the crucible with 20 ml portions of chloroform to insure complete removal of the stearic acid. Aspirate the residue until the odor of chloroform is no longer detectable. Place the crucible and contents in a drying oven at 100 degrees to 105°Centigrade for one half hour. Cool in a desiccator and weigh. Repeat the above extraction, drying and weighing procedure with individual 20 ml portions of chloroform until the loss in weight on subsequent extractions total less than 0.001 gm. Calculate the loss in weight of the crucible plus contents to percent stearic acid, on a moisture-free basis as follows:

$$\text{Percent stearic acid} = \frac{100A}{W}$$

Where:

A = loss in weight of the crucible plus contents
W = weight of specimen on a moisture-free basis.

4.4.1.2 Determination of stearic acid, alternate method
Add approximately 5 grams of the sample into a previously tared, clean, dry, medium porosity crucible, containing a filter pad. Reweigh crucible and contents on an analytical balance and record the total weight to the nearest .0002 gram. Place the crucible containing the sample into a stainless steel pan. Add 20 ml of aliphatic

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naphtha (Atlantic Solvent #49 manufactured by ARCO Chemical Company, Philadelphia, Pa. or equivalent) previously 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 naphtha 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 naphtha, extraction for 5 minutes with occasional stirring and filtering, two additional times. Wash the interior of the crucible with approximately 20 ml of naphtha from a wash bottle. Aspirate the residue until the naphtha 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 .0002 gram. 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

4.4.1.3 Determination of RDX. Place the residue from the determination of stearic acid in a 200 milliliter (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 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°C \pm 5°C., cool in a

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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 determination of stearic acid
- Z = Final weight of crucible and contents.
- W = Weight of original sample on a moisture-free basis.

4.4.2 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 4.4.1.3 may be used for this determination.

4.4.3 Determination of Moisture. 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(5) gram sample for this determination.

4.4.4 Bulk density. The bulk density shall be determined by the following procedure:

4.4.4.1 Apparatus. Plywood box: inside dimensions, 4 by 4 by 4 inches; padded inside top and bottom with 1/4 inch rubber foam of approximately .029 gms/cc bulk density. Hole in hinged top to fit a 250 ml graduated cylinder.

4.4.4.2 Procedure. Weigh accurately $200 \pm .02$ gm of powder. Pour the powder into a 250 ml graduated cylinder. Enclose the cylinder in the box. Lift protruding end of the cylinder until the bottom flange of the cylinder contacts the top of the box. Drop the cylinder. Again lift and drop the cylinder until 20 drops have been made, at the rate of once each five seconds. Read the volume of the compacted powder in the cylinder to the nearest ml. Calculate bulk density in gms. per ml, as follows:

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

Where: A = weight of powder (gms)
B = volume of compacted powder (ml)

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4.4.5 Determination of 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 10 minutes in accordance with local safety rules.

4.4.6 Density/Sensitivity Test. (See LD549486) A representative sample of Explosive Composition A-5 from 4.3.3.2 shall be subjected to the procedures of the following paragraphs:

4.4.6.1 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 MIL-STD-105 Inspection Level II. These donors shall be assembled in the test arrangement and fired against the block by initiation of the detonator when 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 63 and 69 mils and the standard deviation must not exceed 5.0 mils. Each block shall be used once and only once. The measurement of the indentation depth shall be made in accordance with paragraph 4.4.6.5.

4.4.6.2 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 160 milligrams 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,

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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 1.673g/ml and 1.728 gm/ml and the average density shall not exceed 1.719 g/ml.

4.4.6.3 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 4.4.6.1 and the acceptors prepared in accordance with paragraph 4.4.6.2. 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.

4.4.6.4 Test procedure. Twenty and only twenty assemblies shall be fired 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 4.4.6.5.

4.4.6.5 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

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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.

4.4.6.6 Acceptance Criteria. The explosive shall be considered to have passed the density/sensitivity test if, for the specified loading pressure, all densities fall between 1.673 and 1.728 and the average does not exceed 1.719. 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.

4.4.7 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.

5. PREPARATION FOR DELIVERY

5.1 Packing

5.1.1 Level A. The explosive composition A5 shall be packed and marked in accordance with dwg 7548644, except that the explosive composition A5 shall be packed in a paper bag coated inside with polyethylene.

5.1.2 Level B and C. The explosive composition A5 shall be packed and marked in accordance with Dwg 7548645 or 7548644, except that the explosive composition A5 shall be packed in a paper bag coated inside with polyethylene.

5.1.3 Adhesion of glued carton joints. If glued cartons are used for packaging each glued joint shall meet the requirement for fiber failure as given on dwg. 7548645 when determined as specified in 4.4.7.

5.2 Marking. Marking shall be in accordance with drawing 7548644, 7548645 or MIL-STD-129 and as required

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by the Contracting Officer. In addition, the bulk density and Class (see 1.2) of the batch shall be marked on every box in the batch.

6. NOTES

6.1 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Level of protection.
- c. Bulk density required,
- d. Class of Explosive Composition A-5 required. The Naval Sea Systems Command restricts Navy procurement to Class 1 only.
- e. Acceptance and description sheets for each batch in accordance with MIL-STD-1171 including density/sensitivity measurement results for all Class 1 material.
- f. Provisions for submission of first article sample. (see 4.2)

6.1.1 Contract Data Requirements. Data obtained in performing the Density/Sensitivity Tests (see 4.4.6) will be listed directly on a DD Form 1423 incorporated into the contract. Data Item Description DI-R-1724 shall apply except for paragraphs 3 and 4 (see 6.2).

6.2 The contractor shall supply the density/sensitivity measurements and results for all Class 1 material (see 6.1.1).

6.3 Inspection code numbers. The five digit code numbers assigned to the inspection here are to facilitate future data collection and analysis by the Government.

6.4 Propellant contamination. If the explosive composition A5 is to be utilized in an item in which the residual solvent (cyclohexenone) is capable of contaminating the propellant powder, the loading activity should re-dry the explosive composition A5 before and after pressing the composition into the item.

6.5 Intended use. Explosive Composition A-5 is intended for use as a lead, booster, and main charge explosive by the Army and as a lead and booster by the Navy.

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6.6 Previous specification classified Composition A-5 as follows:

- Type I - Bulk density 0.95 grams per ml, minimum
- Type II - Bulk density 1.00 grams per ml, minimum

6.7 Only Batches actually tested in accordance with the sampling plan given in 4.3.3.2 and passing the Density/Sensitivity Test shall be classed: Class 1. Those batches which were sampled but not tested because they fell into the "frequency" and were not subjected to the Density/Sensitivity Test shall be classified: Class 2.

6.8 Process. The following wet slurry method has been found satisfactory. Molten stearic acid at approximately 70 degrees C is added to a hot water slurry of RDX at approximately 90 degrees C, mixed, cooled, filtered and dried. The composition shall not be manufactured by blending or mixing stearic acid and RDX.

6.9 This drawing is included in LD549486.

6.10 Prior approval of the Contracting Officer is required for use of equivalent test methods. A description of the proposed method should be submitted thru the Contracting Officer to: Commander ATTN: SARPA-QA-A-P, Picatinny Arsenal, Dover, N.J. 07801. 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 and drawings of any special equipment required.

Custodian:

- Navy-OS
- Air Force -70
- Army-PA

Preparing Activity:
Army-PA

Review Activities:

- Army-MU,PA
- Navy-OS
- Air Force -70

Project Number: 1376-0113