MILITARY SPECIFICATION

HMX/KEL-F RESIN MOLDING POWDER (FOR USE IN AMMUNITION)

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

1. SCOPE

1.1 This specification covers a high-energy solid explosive composed of cyclotetramethylenetetranitramine (HMX) and a polymer of trifluorochloroethylene, which acts as a binder for the HMX (see 6.3).

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-H-45444 - HMX

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes (ABC-STD-105)
MIL-STD-109 - Quality Assurance Terms and Definitions
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

FSC: 1376

7548645 - Carton, Packing, Reusable, Collapsible for High Explosives

(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).

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM Designation: E300 - 70 Recommended Practice for Sampling Industrial Chemicals

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

3. REQUIREMENTS

3.1 Material. The molding powder shall be a free-flowing white material in the form of small agglomerates consisting of white grains of HMX (complying with Grade II, Class A, of MIL-H-45444A) surrounded and held together by a resin-like binder (see 6.4).

3.2 Bulk density. The bulk density of the molding powder shall be 0.78 grams (g) per cubic centimeter (cc), min., when determined as specified in 4.4.1.

3.3 Volatiles. The moisture and other volatiles content of the molding powder shall be 0.10 percent, maximum, when determined as specified in 4.4.2.

3.4 Composition. The composition of the molding powder shall be as specified in Table I, when determined as specified in applicable paragraphs of 4.4.3.

TABLE I

Constituent	Percent by Weight	Applicable Paragraphs
Binder	5.0 ± 0.4	4.4.3.1
HMX	95.0 ± 0.4	4.4.3.2

3.5 Vacuum Stability Test (120°C). The volume of gas evolved from 5 grams of the molding powder heated at 120°C for 40 hours in the 120°C Vacuum Stability Test shall not exceed 0.8 milliliter, when determined as specified in 4.4.4.

3.6 Granulation. The molding powder shall comply with the following granulation requirements when determined as specified in 4.4.5.

U.S. Standard Sieve No.	Cumulative Percent Retained
4	0.2 max.
6	1.0 max.
35	90.0 min.
100	98.5 min.

3.7 Workmanship. The material shall be free from metal or wooden particles, paper and other foreign material.

3.8 First article testing. The 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 the terms used herein.

4.1.1 Submission of product. At the time the completed lot of product is submitted to the Government for acceptance the contractor shall supply the following information accompanied by a certificate which attests that the information provided is correct and applicable to the product being submitted:

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

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

c. Certificates of analysis on all material used directly by the contractor when such material is controlled by Government specifications, shall be made available upon request by the contracting officer.

d. Quantity of product in the lot.

e. Date submitted.

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

4.2 First Article Inspection

4.2.1 Submission. Prior to initiation of regular production the contractor shall submit a first article sample consisting of 2 pounds of molding powder in accordance with instructions issued by the Contracting Officer for evaluation in accordance with paragraph 4.2.2. All samples submitted shall have been produced by the contractor using the same production processes, procedures, and equipment as will be used in fulfilling the contract. All materials, including packaging and packing, shall be obtained from the same sources of supply as will be used in regular production. The sample shall be accompanied by certificates of analysis. A first article quantity, shall also be submitted whenever there is a lapse in production for 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.

4.2.3 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 stated requirements.

4.3 Inspection Provisions

4.3.1 Lot formation. A lot shall consist of one or more batches of molding powder 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 molding powder that has been subjected to the same unit chemical or physical mixing process intended to make the final product homogeneous. The product shall be submitted for inspection in accordance with MIL-STD-105. The criteria and procedures for the assignment of lot numbers shall be in accordance with MIL-STD-1168.

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 6.2)
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 0.65 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
Minor:	AQL 1.00 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.
Critical:	None defined.		

Major:	AQL 0.40 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	03003
202.	Marking misleading or unidentifiable.....	Visual	03004
203.	Banding strips missing, broken or improperly applied.....	Visual/Manual	03005

4.3.3 Sampling for test 4.4.1 through 4.4.5. Approximately 500 grams of molding powder shall be selected from each batch to be sampled using ASTM Procedures E300-70 for solids. Samples shall be selected for inpsection in accordance with MIL-STD-1235, CSP-1 Plan, Inspection Level II, AQL 6.5%. 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 4.4. 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 as required by MIL-STD-1235. The classification and code number shall be as given in Table I.

TABLE I
CLASSIFICATION OF DEFECTS

Category	Defect	Code No.
Bulk Density	Major	04001
Volatiles	Major	05001
Composition	Major	06001
Vacuum Stability Test	Major	07001
Granulation	Major	08001

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 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.

4.4 Test Methods and Procedures

4.4.1 Bulk density

4.4.1.1 Apparatus. A plywood box having inside dimensions 4 by 4 by 4 inches, padded inside on top and bottom with 1/4 inch foam rubber, and having a hole in a hinged top large enough to fit a 250 ml graduated cylinder.

4.4.1.2 Procedure. Pour an accurately weighed 180 gram portion of the sample into a 250-ml graduated cylinder. Enclose the cylinder in the box. Lift the 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 about one per second. Read the volume of the compressed powder in the cylinder. Calculate bulk density in grams per cubic centimeter as follows:

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

where:

A = weight of the powder in the cylinder, in grams
B = volume of the compressed powder, in cubic centimeters

4.4.2 Volatiles. Transfer approximately 30 grams of the sample to a pre-dried accurately weighed 100 mm by 15 mm Petri dish and determine the weight of the dish and contents to the nearest milligram. Place the dish in a vacuum oven maintained at 100°C and heat under vacuum for two hours. Place the dish in a desiccator and let it

cool to room temperature. Weigh the dish and determine the loss in weight(1). Calculate the volatiles content as as follows:

$$\text{Percent volatiles} = \frac{A \times 100}{B}$$

where:

A = loss in weight, in grams, to the nearest milligram
B = original weight of the sample, in grams, to the nearest milligram

(1) Save the dried sample for use in the composition determination.

4.4.3 Composition (Caution: see 6.5)

4.4.3.1 Binder. Crush the dried sample from the volatiles determination with an agate mortar and pestle so that the entire sample passes easily through a No. 30 U.S. Standard sieve. Blend the screened sample to ensure uniformity. Then transfer three 3-gram portions of the blended sample to three accurately weighed 250-milliliter pyrex beakers and determine the weight of each of the three 3-gram test samples accurately. Add 150 milliliters of concentrated C.P. nitric acid to each beaker. Place a teflon-coated magnetic stirring bar in each beaker, cover the beakers with watch glasses, and place them on a cold electric hot plate-stirrer having a predetermined setting to produce a temperature of 60 ± 2°C in the contents of the beakers and a minimum of stirring. Activate the hot plate-stirrer and heat and stir the contents of the beakers for two hours starting from the cold state. Then decant the hot nitric acid from the beaker to a tared coarse porosity sintered glass filtering crucible set up on a filtering flask connected to a vacuum line. Place a second filtering flask containing some water in the line between the flask holding the crucible and the vacuum source to act as a trap. Transfer the residue (the resin binder) from the beaker to the filtering crucible with the aid of a stream of hot concentrated nitric acid from a wash bottle. Rinse the beaker and the stirring bar with hot concentrated nitric acid and transfer the rinsings to the crucible. Wash the beaker

and the stirring bar with a stream of distilled water and transfer the washings to the crucible. Carefully scrape off any resin adhering to the stirring bar and transfer quantitatively to the crucible. Place the crucible in a vacuum oven maintained at 100°C and dry for one hour. Let the crucible cool to room temperature in a desiccator. Weigh the crucible and determine the weight of its contents. Calculate the binder content of the test sample as follows:

$$\text{Percent binder} = \frac{A}{W} \times 100$$

where:

A = weight of the residue in the crucible, in grams
W = weight of the test sample, in grams

4.4.3.2 HMX content. Add the binder content values obtained for the three test samples (see 4.4.3.1) and divide by three to find the binder content of the molding powder. Subtract this value from 100 to find the HMX content.

4.4.4 Vacuum Stability Test. The vacuum stability test at 120°C shall be determined in accordance with Method 503. 1 of the latest revision of MIL-STD-650.

4.4.5 Granulation. The granulation of the molding powder shall be determined in accordance with Method 204.1 of the latest revision of MIL-STD-650.

5. PREPARATION FOR DELIVERY

5.1 Packing

5.1.1 Level A. Packing shall be in accordance with Drawing 7548644.

5.1.2 Level B and C. Packing shall be in accordance with Drawing 7548645.

5.2 Marking. Marking shall be in accordance with Drawings 7548644 or 7548645 as applicable.

6. NOTES

6.1 Ordering data.-Procurement documents shall specify the following:

a. Title, number and date of this document.

b. Description sheets shall be prepared for each lot in accordance with MIL-STD-1171.

c. Provisions for submission of first article samples.

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

6.3 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.

6.4 A binder which has been found satisfactory in this composition is KEL-F Resin 800, a product manufactured by Minnesota Mining and Manufacturing Company. The material is a fluorine-containing polymer which has the following typical resin physical properties:

Specific Gravity, 75°F	2.02
Form	White Granular Powder
Solubility	Soluble in ketones, esters and cyclic ethers

6.5 Caution: Grinding the dried sample from the volatiles determination with an agate mortar and pestle should be carried out remotely behind a barricade.

CUSTODIAN:
ARMY-PA

PREPARING ACTIVITY:
ARMY-PA

Project Number: 1376-016

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1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?
   A. GIVE PARAGRAPH NUMBER AND WORDING.

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

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