

MIL-E-81111B  
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 SUPERSEDING  
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## MILITARY SPECIFICATION

### EXPLOSIVE, PLASTIC-BONDED MOLDING POWDER (PBXN-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 a dimensionally stable, high strength, explosive composed of cyclotetramethylenetetranitramine (HMX) and a copolymer of vinylidene fluoride and hexafluoropropylene. The plastic-bonded explosive is referred to herein as "PBXN-5".

**1.2 Classification.** PBXN-5 covered by this specification shall be of two types and three classes (see tables I and II).

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

**2.1.1 Specifications and standards.** The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

#### SPECIFICATIONS

##### Federal

P-P-105	Paper, Abrasive, Flint
RR-S-366	Sieve, Standard for Testing Purposes

##### Military

MIL-T-339	Tetryl
MIL-H-45444	HMX

#### STANDARDS

##### Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-286	Propellants, Solid: Sampling, Examination and Testing

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Ordnance Station, Standardization Division (524), Indian Head, Maryland 20640-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 1376

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MIL-STD-650 Explosive; Sampling, Inspection and Testing

MIL-STD-1167 Ammunition Data Card

**2.1.2 Drawings and publications.** The following drawings and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

## DRAWINGS

Naval Sea Systems Command (Code Ident 53711)

LD70518 Impact Machine, Parts and Specifications for (Code Ident 10001)

1560935 Copolymer, Vinylidene Fluoride and Hexafluoropropylene

Army Munitions Command (Code Ident 19200)

7548644 Box, Packing for High Explosives, Assembly Details, Packing and Marking

7548645 Carton, Packing, Reuseable-Collapsible for High-Explosives, Assembly, Details, Packing and Marking

## PUBLICATIONS

Code of Federal Regulations

49 CFR 100-177 Transportation

49 CFR 178-199 Transportation

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.)

(Copies of specifications, standards, drawings and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting officer).

**2.2 Other publications.** The following document forms a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplements thereto, if applicable.

American Society for Testing and Materials

ASTM E 300 Recommended Practice for Sampling of Industrial Chemicals

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

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

**2.3 Order of Precedence.** In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

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## 3. REQUIREMENTS

## 3.1 General material requirements.

## 3.1.1 Materials. Composition of PBXN-5 shall be as shown in table I.

TABLE I. Composition.

Ingredient	Document	Percent by weight	
		Batch <sup>1/</sup>	Lot
Copolymer (vinylidene fluoride and hexafluoropropylene) from one manufacturer	Drawing 1560935	4.2 to 5.8	4.5 to 5.5
HMX	MIL-H-45444 <sup>2/</sup>	Remainder by difference	

<sup>1/</sup> Each batch must meet the requirements of 3.1.2.4.

<sup>2/</sup> HMX used for Type I shall be Grade B, Class 5; HMX used for Type II shall be Grade B and consist of  $75.0 \pm 3.0$  parts by weight of Class 1 and  $25.0 \pm 3.0$  parts by weight of Class 5.

**3.1.2 Product characteristics.** When tested in accordance with section 4 of this specification, PBXN-5 shall meet the following product characteristics.

**3.1.2.1 Moisture content.** Moisture content of PBXN-5 shall not be more than 0.15 percent by weight.

**3.1.2.2 Density.** The density of PBXN-5 shall be greater than 96.5 percent of the theoretical maximum density (TMD).

**3.1.2.3 Granulation.** Granulation of PBXN-5 shall meet the requirements of table II.

TABLE II. Granulation for types I and II.

Characteristic	Class 1		Class 2		Class 3	
	Percent by weight		Percent by weight		Percent by weight	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Particle size <sup>1/</sup>						
Through No. 4 sieve	98	100	100	100	100	100
Through No. 20 sieve	-	-	50	100	100	100
Through No. 40 sieve	0	5	0	2	-	-
Through No. 50 sieve	-	-	-	-	0	5

<sup>1/</sup> U.S. Standard sieve in accordance with RR-S-366.

**3.1.2.4 Impact sensitivity.** The PBXN-5 shall exhibit an impact sensitivity height (50 percent point) equal to, or greater than, the impact sensitivity height of a comparison sample of tetryl, which complies with MIL-T-339.

**3.1.2.5 Vacuum thermal stability (VTS) at 120° Celsius (°C).** The volume of gas evolved by 5 grams (g) of PBXN-5 at 120°C during 48 hours of test shall not exceed 0.5 milliliter (ml) per gram.

**3.1.2.6 Dry bulk density.** The dry bulk density of the PBXN-5 shall be not less than 0.7 g per ml.

**3.1.2.7 Autoignition temperature.** The autoignition temperature shall be 225°C or above.

**3.1.2.8 Abrasion resistance.** When tested in accordance with 4.4.4.9, the weight loss of PBXN-5 pellets shall not exceed 2.0 percent.

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**3.1.2.9 Machinability.** The PBXN-5 shall be machinable with water as a coolant and shall not crumble or fracture during such operation and not be defective as determined by 4.4.4.10.1.

**3.2 First article.** When specified, a sample shall be subjected to first article inspection (see 4.1.2.1 and 6.3).

**3.3 Workmanship.** The PBXN-5 shall be of uniform quality and shall be manufactured in accordance with accepted industry standards for the production of high quality explosive materials. The PBXN-5 shall be free from metal inclusions, wooden particles, and other foreign materials (other than those permitted for HMX in accordance with MIL-H-45444).

#### 4. QUALITY ASSURANCE PROVISIONS

**4.1 Responsibility for inspection.** Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

**4.1.1 Classification of inspections.** The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.1.2.1).
- b. Quality conformance inspection (see 4.2).

##### 4.1.2 Special tests and examinations.

**4.1.2.1 First article inspection.** When specified in the contract or purchase order (see 6.3), a first article sample shall be subjected to all the requirements of table III. Failure to meet any of the requirements shall be cause for rejection of the first article sample.

**4.1.2.2 Disposition of first article sample.** Disposition of the first article sample shall be as specified in the contract or purchase order (see 6.2.1).

TABLE III. First article and quality conformance inspections.

Test or examination	Req. para.	Test para.	First article	Quality conformance	
				Lot	Batch
Composition	3.1.1	4.4.4.1	x	x	x
Moisture	3.1.2.1	4.4.4.2	x	x	
Density	3.1.2.2	4.4.4.3	x		
Granulation	3.1.2.3	4.4.4.4	x	x	
Impact	3.1.2.4	4.4.4.5	x	x	x
VTS at 100°C	3.1.2.5	4.4.4.6	x	x	
Bulk density	3.1.2.6	4.4.4.7	x	x	
Autoignition	3.1.2.7	4.4.4.8	x	x	
Abrasion resistance	3.1.2.8	4.4.4.9	x		
Machinability	3.1.2.9	4.4.4.10	x		
Workmanship	3.3	4.4.4.11	x	x	x

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**4.2 Lot size.** A lot shall consist of a blend of one or more batches of molding powder produced by one manufacturer, in accordance with the same specification or specification revision, under one continuous set of operating conditions. The maximum lot size shall be 5,000 pounds. A batch is defined in 6.4.1. Each lot shall be tested in accordance with those tests specified in table III.

**4.3 Acceptance sampling.**

**4.3.1 Sampling by lot.** Sampling shall be performed as specified herein and in accordance with ASTM E 300 for solids. A minimum of 4.5 kilograms (kg) of PBXN-5 shall be sampled from each lot as follows:

a. A primary sample shall be taken from three or more locations throughout each container into which the lot is placed. The weight of the material taken from each location shall be at least 1.5 kg. Each sample thus taken shall be thoroughly mixed.

b. The primary samples shall be mixed together thoroughly, then divided into two equal portions to prepare two composite samples. Each composite sample shall be placed in a clean, dry container. These containers shall be sealed and shall be marked with the identity of the sample, including the material name, supplier's name, contract number and lot number. One of the composite samples shall be stored in a safe place accessible to the testing facility in the event it is needed for testing. The remaining composite samples shall be subjected to all of the specified chemical and physical tests in accordance with table III.

**4.3.2 Sampling by batch.** An inspector shall select a sample of not less than 454 g (1 pound), representative of the batch, from each batch, in accordance with ASTM E 300. The sample shall be submitted for the determination of the tests in accordance with table III. Batches not meeting the requirements defined in 3.1.1, 3.1.2.4 and 3.3 shall be rejected.

**4.3.3 Examination of filled containers.** Sampling plans and procedures for the following classifications of defects shall be in accordance with MIL-STD-105.

Wooden box or fiberboard carton, prior to closing (see Drawing 7548644 or 7548645 as applicable).

Category	Defect	Method of Inspection	Code No. (see 6.5)
Critical			
None defined			
Major	AQL 0.65 percent		
101	Liner pierced or torn	Visual	01001
102	Liner improperly closed	Visual	01002
103	Foreign matter	Visual	01003

Sealed wooden box (see Drawing 7548644).

Critical			
None defined			
Major	AQL 0.65 percent		
101	Box damaged	Visual	02001
102	Top improperly assembled	Visual	02002
103	Strapping broken or loose	Visual/Manual	02003
Minor	AQL 1.50 percent		
201	Nail protruding	Visual	02004
202	Marking misleading or unidentifiable	Visual	02005
203	Strapping improperly assembled	Visual/Manual	02006

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## Sealed fiberboard carton (see Drawing 7548645)

Critical  
None defined

Major		AQL 0.65 percent	
101	Assembly torn or pierced	Visual	03001
102	Lot number misleading or unidentifiable	Visual	03002
103	Strapping broken or loose	Visual/Manual	03003
Minor			
201	Marking misleading or unidentifiable	Visual	03004

**4.4 Acceptance tests.** The test procedures of 4.4.4 shall be used to determine that the requirements of this specification have been met. Any change in the test procedures employed shall be subject to prior approval of the contracting activity. Unless otherwise specified, all tests shall be performed in triplicate. The average of the three results shall be taken as the test result.

**4.4.1 Special test equipment.** The following items of special test equipment are required to perform the acceptance tests set forth in this specification. Items of laboratory test equipment in general use will be referenced in the individual test procedures.

- a. ERL-Bruceton type drop test machine, 220 centimeters (cm) maximum drop height (calibrated in 0.1 log units), and equipped with "type 12 tools" (see LD70518 and 4.4.4.5).
- b. Circulating-air oven with an accurate control temperature ( $\pm 2^{\circ}\text{C}$ ) in the range of  $60^{\circ}\text{C}$  to a maximum of  $150^{\circ}\text{C}$ .
- c. General Radio Noise Meter, Type 1982-9710 or equal.
- d. Vacuum stability apparatus (see 4.4.4.6).
- e. Autoignition temperature apparatus (see 4.4.4.8.1).

**4.4.2 Test conditions.** Unless otherwise specified herein, the following test conditions shall apply:

- a. Temperature: Ambient (between  $18^{\circ}$  and  $35^{\circ}\text{C}$ )
- b. Altitude: Normal ground elevation of test facility
- c. Humidity: Ambient (not exceeding 95 percent relative).

**4.4.3 Preparation of test samples.**

**4.4.3.1 Density, abrasion resistance and machinability.** Prepare from one composite sample (selected in accordance with 4.3.1) 35 cylindrical pellets having approximate dimensions of 0.5 inch diameter by 0.85 inch length [20 for density (see 4.4.4.3), 5 for abrasion resistance (see 4.4.4.9), and 10 for machinability (see 4.4.4.10)] as follows:

- a. Dry the PBXN-5 for a minimum of 24 hours in a desiccator containing a fresh indicating-type desiccant.
- b. Remove the sample from the desiccator. Weigh out 5 g of PBXN-5 (weighed to the nearest 0.05 g) for each test pellet to be pressed. Place the weighed charges in individual containers (small, stainless steel or aluminum beakers).

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- c. Place the individual charges into a circulating-air oven, previously stabilized at  $120^{\circ} \pm 2^{\circ}\text{C}$ . Preheat the charges for a minimum of 1 hour (but not more than 3 hours) before pressing.
- d. Adjust the temperature of the die to  $120^{\circ} \pm 2^{\circ}\text{C}$ .
- e. To facilitate pressing, the interior die surfaces may be coated with a silicone or zinc stearate dry powder spray mold release. If the silicone mold release is used, wipe off any excess with a clean cotton cloth so that only a light coating remains on the die surfaces. Repeat this step for at least every three pellets pressed.
- f. Pour the preheated sample into the die cavity.
- g. Close the die. Evacuate the cavity to an absolute pressure of 8 millimeters (mm) mercury (Hg) or less. Maintain this pressure for 2 minutes just prior to pressing a pellet.
- h. Press the pellets to  $30,000 \pm 500$  psi and maintain that pressure for a period of not less than 4 nor more than 5 minutes. The pressing conditions (time and pressure) shall be recorded with the test data (see 4.5).
- i. Remove the pressed pellet from the mold and cool in a desiccator containing a fresh indicating-type desiccant. Retain the pellets in the desiccator until tested.

**4.4.3.2 Impact sensitivity test samples.** From each sample selected in accordance with 4.3.1 or 4.3.2, prepare 35 samples for the impact sensitivity test as follows:

- a. Prepare approximately 4 g of PBXN-5 (which has passed a 20-mesh U.S. Standard screen but which has been retained on a 80-mesh screen).
- b. Weigh powder into  $35 \pm 2$  milligram (mg) portions.
- c. Place the samples in a vacuum desiccator containing fresh indicating-type desiccant. Maintain an absolute pressure of 0.5 to 1.0 mm Hg in the desiccator for 30 minutes. Close off desiccator from the vacuum source and allow the sample to remain in the desiccator until the time the tests are to be conducted (not less than 4 hours).

**4.4.3.3 Chemical composition, vacuum thermal stability, and autoignition test samples.** Approximately 200 g of representative sample selected from one composite sample in accordance with 4.3.1 shall be used for the preparation of chemical composition, vacuum thermal stability, and autoignition test samples.

**4.4.3.4 Autoignition test samples.** From the sample submitted to the laboratory in accordance with 4.4.3.3, prepare samples for the autoignition test as follows:

- a. Put the sample through a grounded "riffle" to divide the sample into two sections. Save one section and continue reducing the remainder by halves until approximately 3 to 5 g are obtained. Recombine the unused fractions into one stock sample.
- b. Dry the material in accordance with 4.4.3.2 c.

#### 4.4.4 Test procedures.

**4.4.4.1 Chemical composition.** The chemical composition of PBXN-5 shall be determined on divided samples prepared in accordance with 4.4.3.4 a with the exception that three 5 to 10 g riffled portions shall be prepared.

- a. Weigh a clean, dry extraction thimble to the nearest 0.1 mg. Transfer approximately 1.0 g of the prepared sample into the extraction thimble. Weigh the extraction thimble containing the sample and record the weight of the sample to the nearest 0.1 mg.

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- b. Ensure the fume hood is operating. In the fume hood, transfer the extraction thimble containing the sample to a 250-ml beaker containing approximately 50 ml of reagent grade 70 percent nitric acid (room temperature). Allow the sample to soak in the acid for approximately 30 minutes. Laboratory tongs are used to handle all material exposed to strong acid.
- c. Transfer the extraction thimble containing the sample into a tube of the Soxhlet apparatus containing from 100 to 170 ml of reagent grade 70 percent nitric acid and equipped with an antibumping device. Adjust the heat source and the condenser water flow to allow 50 to 60 drops of acid to fall from the condenser per minute. Allow the extraction to continue until the residue appears translucent (approximately 8 hours).
- d. Turn the heat source power switch off and allow the acid to cool for approximately 30 minutes.
- e. Lift the extraction thimble containing the residue approximately 2 inches to allow the acid to drain from the thimble into the Soxhlet tube (approximately 1 minute). Place the extraction thimble containing the residue on a vacuum flask and apply vacuum.
- f. Wash the acid from the extraction thimble and residue with distilled water from a wash bottle. Transfer the extraction thimble and residue to an oven, and dry at about 100°C until constant weight is reached (approximately 4 hours).
- g. Remove the extraction thimble and residue from the oven, and allow it to cool to room temperature in a desiccator (approximately 15 minutes).
- h. Weigh the extraction thimble and the residue and record the weight of the residue to the nearest 0.1 mg.

Calculation:

Calculate the percentage binder as follows:

$$\text{Binder, percent} = \frac{r \times 100}{W - (MW)}$$

where

r = weight of the residue, g

W = weight of the sample, g

M = moisture in sample expressed as a decimal fraction as determined in 4.4.4.2

This analysis shall be determined in duplicate. If the difference between the two determinations is greater than 0.25 percent, a third determination shall be made. The percentage explosive may be calculated by subtracting the percent binder from 100,

**4.4.4.1.1 Acceptance criteria.** The lot or batch represented shall be rejected if the chemical composition does not meet the requirements of 3.1.1.

**4.4.4.2 Moisture.** This test shall be performed in accordance with MIL-STD-286, Method 101.5, except that dry air may be used in place of nitrogen. Sample weight shall be 5 g. The granular sample shall be digested for 5 minutes in the Karl Fisher reagent, methanol solution (minimum of 40 ml of solution in the titration vessel at the zero point before the explosive sample is added) before titration with the Karl Fisher reagent begins.

**4.4.4.2.1 Acceptance criteria.** The lot represented shall be rejected if the moisture content exceeds the requirements of 3.1.2.1.

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**4.4.4.3 Density determination.** The density of 20 of the pellets prepared in accordance with 4.4.3.1 shall be determined as follows:

- a. The diameter measurement shall be the average of six measurements taken 90° from each other at both ends and in the middle of each pellet. Each measurement shall be accurate to within 0.001 inch.
- b. The height measurement shall be the average of three measurements taken near the center of the pellet. Each measurement shall be accurate to within 0.001 inch.
- c. Weight of each pellet shall be determined to the nearest mg.

Calculation:

Calculate the density of the pellet in grams per cubic centimeter (g/cm<sup>3</sup>) as follows:

$$\text{Density, g/cm}^3 = \frac{0.0777 W}{d^2 \times h}$$

where

W = weight of pellet, g  
 d = average diameter of pellet, inches  
 h = average height of pellet, inches

**4.4.4.3.1 TMD calculation.** The TMD of each pellet shall be calculated using the following formula and the chemical composition determined in 4.4.4.4.1:

$$\text{TMD, g/cm}^3 = \frac{100}{\frac{\% \text{ copolymer}}{1.815} + \frac{\% \text{ HMX}}{1.90}}$$

**4.4.4.3.2 Acceptance criteria.** The lot represented shall be accepted if a minimum of 17 of the 20 pellets have a density, expressed as a percentage of TMD, greater than that specified in 3.1.2.2.

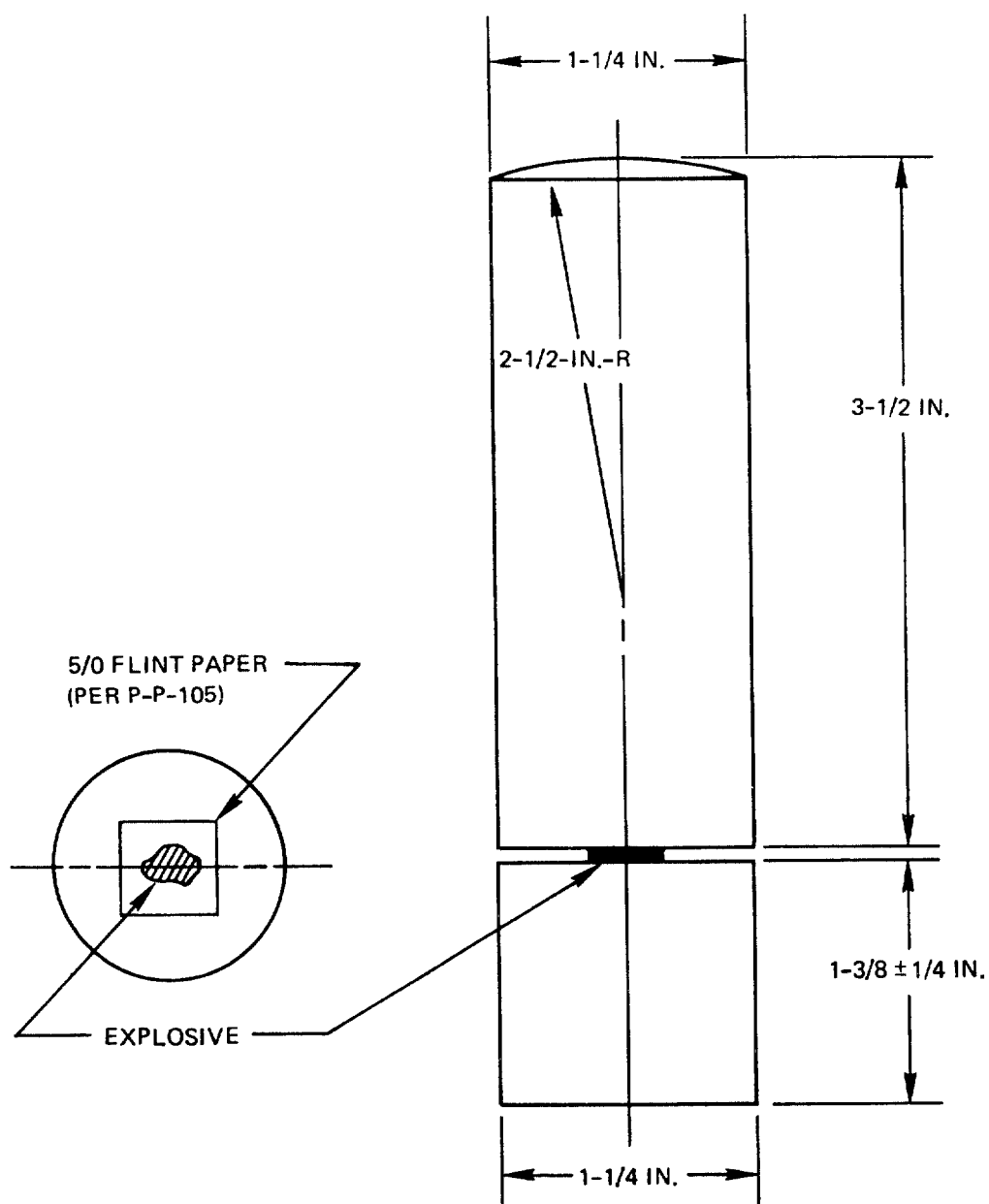
**4.4.4.4 Determination of granulation.** Determination of granulation shall be in accordance with MIL-STD-650, Method 204.1.

**4.4.4.4.1 Acceptance criteria.** The lot represented shall be rejected if granulation does not meet the requirements of table II.

**4.4.4.5 Impact sensitivity.** Impact sensitivity tests shall be performed on the samples prepared in accordance with 4.4.3.2 using a drop test machine specified in 4.4.1 a (see figure 1). The peak reading noisemeter specified in 4.4.1 c shall be used in conjunction with the drop test machine to determine when an explosion occurs.

- a. Adjust the noisemeter so that room noise is zeroed out and noise (created by striker falling upon a 35 mg sample of inert powder from a height of 200 cm) will cause the indicator needle to rest at an average reading, which is one-fourth total scale. (In any test, a reading above this average one-fourth-scale reading shall be classified as an explosion).
- b. Prepare inert samples from tripentaaerythritol (technical grade) in accordance with the procedure specified in 4.4.3.2.
- c. Test each sample of PBXN-5 on a fresh, 1-inch square piece of flint paper conforming to P-P-105, Class 1, Grade 5/0. (The grade and manufacturer of flint paper used is critical to the impact sensitivity results obtained).

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NOTE: ALL TOLERANCES SHALL BE  $\pm 1/32$  INCH, UNLESS OTHERWISE SPECIFIED

FIGURE 1. Drop-test firing tools.

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- d. Clean the anvil and striker with acetone and dry with a clean cloth after each drop. (Resurface the anvil and striker after every 30 explosions).
- e. Determine explosion point and nonexplosion point by dropping the striker from various heights (beginning at 40 cm or 1.6 log units), raising or lowering the drop heights as required until an explosion or nonexplosion is obtained. The drop height shall be raised or lowered in increments of 0.1 log units. A fresh sample shall be used for each drop. After an explosion is obtained, the drop height shall be lowered the specified increment or increments until an explosion is not obtained. When the approximate heights of explosion and nonexplosion are determined, 25 samples shall be tested. Starting from the approximate nonexplosion height, raise the striker one increment at a time, using a fresh sample for each drop, until an explosion occurs. At this point lower the striker in progressive 0.1 log units until a fresh sample does not explode. Repeat the process until all 25 samples have been tested.
- f. Determine the impact sensitivity of tetryl using the same procedure.

**4.4.4.5.1 Calculation of test results.** An explosion shall be recorded as a plus sign (+) and a nonexplosion as a minus sign (-). The 50 percent explosion point or height shall be calculated using the drop heights recorded for those conditions (explosions or nonexplosions, whichever occurred the least number of times). For example, if more nonexplosions occurred than explosions, the drop heights associated with each explosion will be used in the calculation. The terms for the 50 percent explosion point calculations shall be obtained from a table similar to table IV which is complete with test values as follows:

- a. In column "a" the drop heights in log increments are recorded, beginning with the lowest drop height at which a test (explosion or nonexplosion) was observed.
- b. In column "i" arbitrary consecutive numbers have been listed.
- c. In column " $n_i$ " the number of tests observed at each corresponding drop height are recorded.
- d. In column " $in_i$ " record the quantities obtained by multiplying the values listed in column " $n_i$ " times the number listed in column "i" for each corresponding drop height.

TABLE IV. Summary of fire, no-fire chart.

a	i	$n_i$	$in_i$
	0		
	1		
	2		
	3		
	4		
		N =	A =

Calculation:

Calculate the 50 percent point using the following formulas:

$$\text{Log of 50 percent point in cm} = C + 0.1 [A/N + \frac{1}{2}]$$

(if nonexplosion values are used)

$$\text{Log of 50 percent point in cm} = C + 0.1 [A/N - \frac{1}{2}]$$

(if explosion values are used)

where

C = Log of the lowest drop height for which a value used in the calculations was recorded in column "a".

N = the sum of the test values listed in column " $n_i$ ".

A = the sum of the quantities listed in column " $in_i$ ".

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**4.4.4.5.2 Acceptance criteria.** The lot represented shall be accepted if the impact sensitivity is not more sensitive than tetryl as specified in 3.1.2.4.

**4.4.4.6 Vacuum thermal stability at 120°C.** This test shall be performed in duplicate using samples prepared in accordance with 4.4.3.3. The test shall be performed in accordance with MIL-STD-650, Method 503.1.1. The test time shall be 48 hours.

**4.4.4.6.1 Acceptance criteria.** The lot represented shall pass the vacuum thermal stability test if the value obtained is no greater than that specified in 3.1.2.5.

**4.4.4.7 Dry bulk density.** The bulk density of PBXN-5 shall be determined in accordance with MIL-STD-650, Method 201.1.1.

**4.4.4.7.1 Acceptance criteria.** The lot represented shall be accepted if the dry bulk density is not less than that specified in 3.1.2.6.

**4.4.4.8 Autoignition temperature.** The autoignition temperature shall be determined on samples prepared in accordance with 4.4.3.4.

**4.4.4.8.1 Test equipment.**

- a. A 100-volt, 2000-watt hot plate with an 8-inch diameter top, or the alternate heating arrangement shown in figure 2.
- b. Test block (see figure 2).
- c. Multichannel temperature recorder.
- d. Glass-insulated 30-gage iron-constantan thermocouples, or equivalent.
- e. A 110-volt, 2-kilovolt-ampere variable auto transformer.

**4.4.4.8.2 Test procedure.**

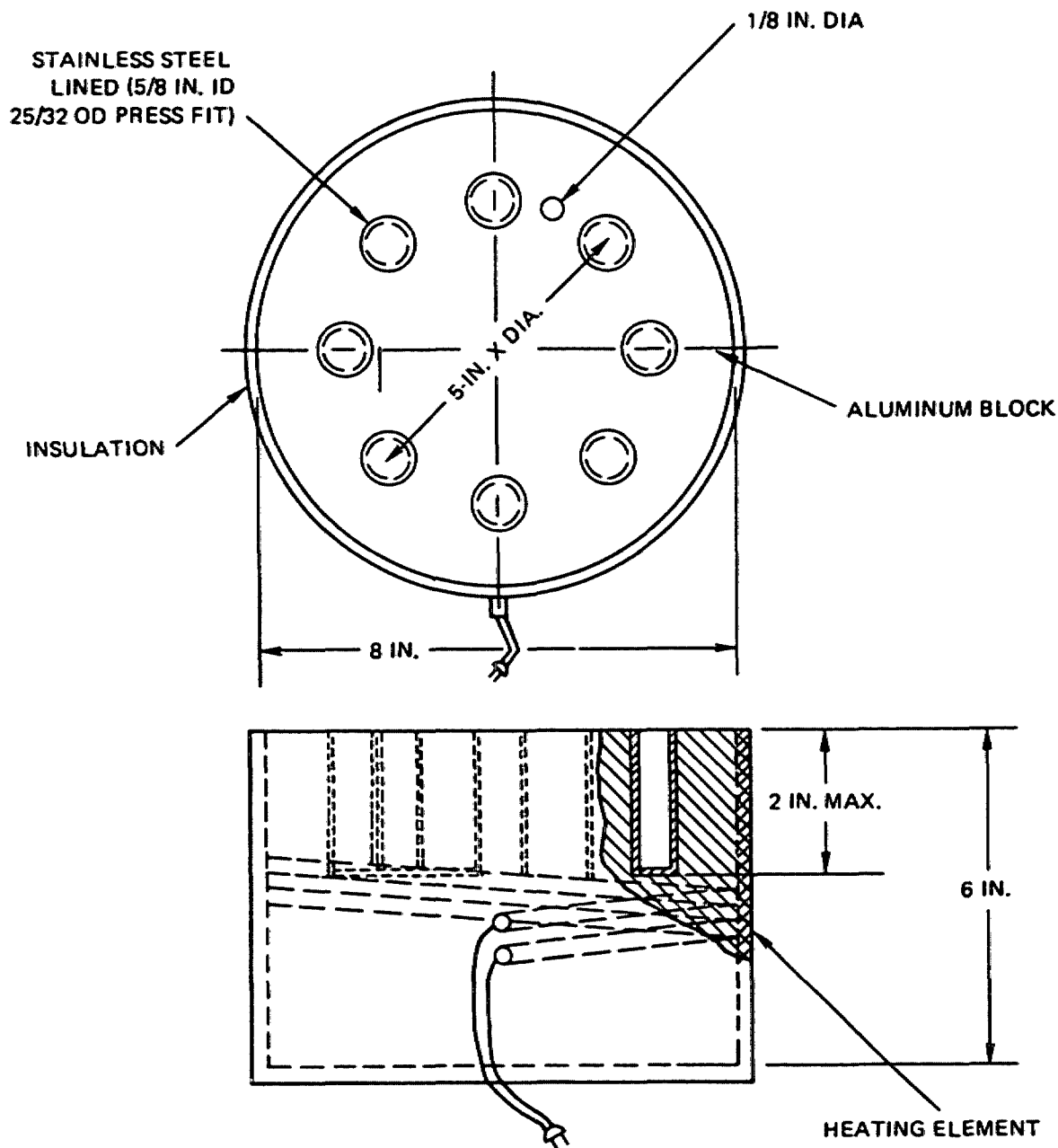
- a. Wrap approximately 1 g of sample in a piece of aluminum (3 inch × 3 inch) foil with a thermocouple inserted into the sample. Place the wrapped sample into the heating block.
- b. Install a thermocouple in the 1/8-inch hole in the aluminum block. Connect the thermocouple to the temperature recorder.

NOTE: It is desirable to connect the thermocouples in the sample differentially with the one in the block.

- c. Place the aluminum block on the hot plate or turn the heating element on, as appropriate. Adjust the heating rate of the block so that it increases at a uniform rate of approximately 2°C per minute (the temperature of the block will normally be 1° to 3°C higher than that of the sample until exothermic reaction begins).
- d. Note and record the temperature of the block at the time ignition of the sample occurs. This temperature is taken as the autoignition temperature.

**4.4.4.8.3 Acceptance criteria.** The lot represented shall pass the autoignition temperature test if the value obtained is equal to or greater than the value specified in 3.1.2.7.

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FIGURE 2. Typical autoignition test apparatus.

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**4.4.4.9 Abrasion resistance.** Abrasion resistance shall be determined in accordance with the following procedure:

- a. Select five pellets in accordance with 4.4.3.1.
- b. Weigh the pellets and place all five in a single 1-quart cardboard ice-cream container.
- c. Rotate the container end-over-end for 60 minutes at  $20 \pm 2$  rpm.
- d. After 60 minutes, remove the pellets from the container, wipe the pellets free of dust and re-weigh.
- e. Weight loss shall be expressed as percent of the total original weight of the five pellets.

**4.4.4.9.1 Acceptance criteria.** Failure of the PBXN-5 to meet the requirements of 3.1.2.8 shall reject the lot.

**4.4.4.10 Machinability.** The machinability test shall be performed on 10 pellets of PBXN-5 from the sample prepared in accordance with 4.4.3.1 and shall be machined in accordance with figure 3. The machining speed recommended is 158 revolutions per minute (rpm), feed rate 0.005 inch per revolution, and a cut of 1/8 inch.

NOTE: The pellet shall be faced and then turned to diameter. Machining shall be done with water as a cooling agent. Cooling water shall be applied to the cutting tip of the tool and surface of the sample.

**4.4.4.10.1 Determination of defective.** A pellet of PBXN-5 shall be considered defective if:

- a. The requirements of figure 3 are not met.
- b. Pellet cracks or breaks during machining.
- c. Surface pitting or breaking of edges occurs during machining.

**4.4.4.10.2 Acceptance criteria.** The lot represented shall be rejected if any of the 10 pellets fail to meet the requirements of 3.1.2.9.

**4.4.4.11 Workmanship.** The PBXN-5 shall be visually inspected to ensure freedom from foreign matter. The PBXN-5 shall meet the requirements of 3.3 to be acceptable.

**4.5 Test data records.** The manufacturer shall record the results of all tests performed in accordance with this specification (see 6.2.2).

## 5. PACKAGING

### 5.1 Packing.

**5.1.1 Level A.** PBXN-5 shall be packed in containers conforming to Drawing 7548644. The containers shall be of 50-pound capacity and lined with strong moisture-proof paper bags. Level A packing shall comply with 49 CFR 171-179.

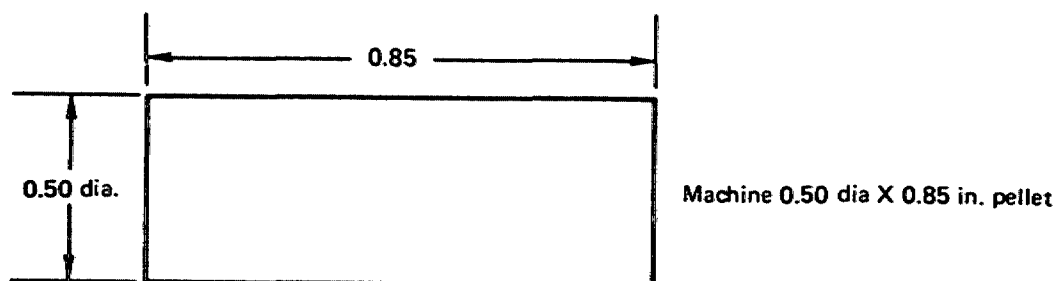
**5.1.2 Level B.** PBXN-5 shall be packed and marked in accordance with Drawing 7548645. Level B packing shall comply with 49 CFR 171-179.

**5.1.3 Level C.** PBXN-5 shall be packed and marked in accordance with Drawing 7548645. Level C packing shall comply with 49 CFR 171-179.

**5.2 Marking.** In addition to any special marking required by the contract or purchase order, shipments shall be marked in accordance with MIL-STD-129 and Drawing 7548644 or Drawing 7548645, as applicable.

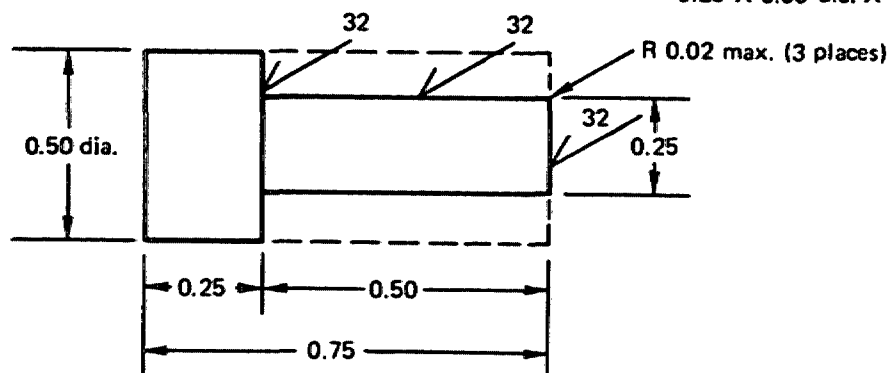
MIL-E-81111B

0.50 X 0.85 Cylindrical PBXN-5 pellet



to

0.25 X 0.50 dia. X 0.75 in. pellet



All dimensions are in inches.

FIGURE 3. Machining configuration.

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**5.3 Data card.** When specified in the contract or purchase order (see 6.2.2), one data card, conforming to MIL-STD-1167, shall be included with each container.

## 6. NOTES

**6.1 Intended use.** PBXN-5 is intended for application as an explosive where high strength and high temperature resistance is needed. Unless otherwise specified, type I shall be used. The impact sensitivity of PBXN-5 may preclude its use as a warhead main charge filler.

### 6.2 Ordering data.

**6.2.1 Acquisition requirements.** Acquisition documents should specify the following:

- a. Title, number and date of this specification
- b. Type and class (see 1.2)
- c. Responsibility for inspection and test facility, if other than contractor (see 4.1)
- d. Disposition of first article sample (see 4.1.2.2)
- e. That the contractor shall forward two copies of test records of all tests performed in accordance with this specification to the appropriate contracting activity (see 4.5)
- f. Special packing or marking, if required (see 5.1 and 5.2)
- g. Whether an ammunition data card is required (see 5.3)
- h. That the safety precaution requirements of the "Contractor's Safety Manual for Ammunition, Explosives, and Related Dangerous Material," DoD 4145.26M are applicable.

**6.2.2 Data requirements.** When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of 27.410-6 of the DoD FAR Supplement are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.

Paragraph no.	Data requirement title	Applicable DID noOption
4.5	Reports, Test	DI-T-2072
5.3	Ammunition Data Card	DI-MISC-80043

(Data item descriptions related to this specification, and identified in this section will be approved and listed as such in DoD 5000.19L., Vol.II, AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

**6.3 First article.** When a first article inspection is required, the PBXN-5 will be tested and should be a first article sample. The first article should consist of between 250 and 500 pounds of PBXN-5. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, test approval of the documents first article, and disposition of the first article sample.

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### 6.4 Definition.

**6.4.1 Batch.** A batch is defined as that quantity of material which has been subjected to one or more chemical or physical processes (or combinations thereof) intended to produce a desired product having substantially uniform characteristics.

**6.5 Inspection code numbers.** The five-digit code numbers assigned to the inspections herein are to facilitate future data collection and analysis by the Government.

Custodian:  
Army - AR

Review:  
Army - MI

Preparing activity:  
Navy - OS  
Project number 1376-0283

**STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL***(See Instructions - Reverse Side)*

1. DOCUMENT NUMBER MIL-E-81111B		2. DOCUMENT TITLE Explosive, Plastic Bonded Molding Powder (PBXN-5)	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)  <input type="checkbox"/> VENDOR  <input type="checkbox"/> USER  <input type="checkbox"/> MANUFACTURER  <input type="checkbox"/> OTHER (Specify): _____	
b. ADDRESS (Street, City, State, ZIP Code)			
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	