

MIL-P-00387B  
7 November 1967  
USED IN LIEU OF  
MIL-P-387A  
9 January 1957

MILITARY SPECIFICATION  
PENTAERYTHRITE TETRANITRATE  
(PETN)

This limited coordination Military Specification has been prepared by the Army based upon currently available technical information, but it has not been approved for promulgation as a revision of Joint Army-Navy Specification MIL-P-387A. It is subject to modification. However, pending its promulgation as a coordinated Military Specification, it may be used for procurement.

1. SCOPE

1.1 This specification covers pentaerythrite tetranitrate (PETN) for use in the manufacture of detonating cord, primers for small arms ammunition, pentolite, blasting caps and detonators.

1.2 Classification. PETN shall be of the following classes as follows (see 6.1):

- Class 1 - For use in detonating cord.
- Class 2 - For use in primers for small arms ammunition.
- Class 3 - For use in pentolite.
- Class 4 - For use in blasting caps and detonators.

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  
FEDERAL

RR-S-366 - Sieves, Standard for Testing Purposes

STANDARDS  
MILITARY

- MIL-STD-109 - Quality Assurance Terms and Definitions
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-286 - Propellants, Solid: Sampling, Examination and Testing
- MIL-STD-650 - Explosive: Sampling, Inspection and Testing

FSC: 1375

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

2.2 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 shall apply.

#### CODE OF FEDERAL REGULATIONS

49 CFR 71-90 - Interstate Commerce Commission Rules and Regulations for Transportation of Explosives and Other Dangerous Articles.

(The Interstate Commerce Commission Rules are now a part of the Code of Federal Regulations (1949 Edition and Revisions) available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Orders for the above publication should cite "49 CFR 71-90 (latest revision.)"

#### 3. REQUIREMENTS

3.1 Melting Point.-The melting point of PETN shall be 140.5 degrees Centigrade ( $^{\circ}\text{C}$ ) plus or minus  $0.5^{\circ}\text{C}$  when determined as specified in 4.2.3.3.

3.2 Nitrogen Content.-The nitrogen content of PETN shall be 17.50 percent minimum (min.) when determined as specified in 4.2.3.4.

3.3 Acetone insoluble material.-The acetone insoluble material of PETN shall be 0.10 percent maximum (max.) when determined as specified in 4.2.3.5.

3.4 Insoluble particle.-There shall be no evidence of insoluble particles in PETN when determined as specified in 4.2.3.5.

3.5 Acidity or Alkalinity.-The acidity or alkalinity shall not exceed 0.003 percent max. when determined as specified in 4.2.3.6.

3.6  $120^{\circ}\text{C}$  vacuum stability.-The maximum amount of gas evolved in 20 hours test time when determined as specified in 4.2.3.7 shall be 5 milliliters (ml.).

3.7 Granulation.-The PETN shall comply with the granulation requirements shown in Table I when tested as specified in 4.2.3.8, except that the granulation requirements for Class 3 PETN shall not apply to PETN used in co-precipitated pentolite.

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TABLE I  
Granulation Requirements

U.S. Standard Sieve No.	Percent Passing Specified Sieve			
	Class 1	Class 2	Class 3	Class 4
30	---	---	95 min.	100 min.
80	100 min.	---	---	---
100	---	---	---	20 max.
100	85 min.	96 min.	---	5 min.
140	55 max.	---	---	---
200	30 max.	80 max.	30 max.	---
200	---	65 min.	---	---

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 General quality assurance provisions.-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, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 Contractor quality assurance system.-If the contractor desires to utilize a quality assurance system which is at variance with the quality assurance provisions of 4.2 and other documents referenced herein, he shall submit a written description of the system to the contracting officer for approval prior to initiation of production. It shall include a description covering controls for lot formation and identification, inspections to be performed, inspection stations, sampling procedures, methods of inspection (measuring and testing equipment), and provisions for control and disposition of non-conforming material. The written description will be considered acceptable when, as a minimum, it provides the quality assurance provisions required by the provisions of 4.2. and the other documents referenced herein. The contractor shall not be restricted to the inspection station or method of inspection listed in the approved quality assurance procedure. In cases of disputes as to whether certain procedures of the contractor's system provide equal assurance, the comparable procedure of this specification shall apply. The contractor shall notify the Government of, and obtain approval for, any changes to the written procedure that affects the degree of assurance required by this specification or other documents referenced herein.

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4.1.2 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 quality assurance provisions specified within this specification.
- b. Number of product batches inspected (shall be made available upon request by the Contracting Officer.)
- c. Results obtained, by defect code, for all inspections performed.
- d. Drawing, specification number and date, together with an identification and date of changes.
- e. Certificates of conformance on all material purchased by the contractor when such material is controlled by Government or commercial specifications referenced in any of the contractual documents.
- f. Number of items in the lot.
- g. 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.

4.1.3 Government verification.-Using the contractor's written quality assurance procedure (see 4.1.1), this detail specification, and other contractual documents as a guide, the Government Inspector shall verify all quality assurance operations performed by the contractor. Verification shall be in accordance with a or b as applicable, the decision being the responsibility of the procuring activity. In either case, the inspector shall also ascertain, prior to acceptance, that all quality assurance provisions of other specifications referenced in any of the contractual documents have been complied with. Deviations from prescribed or agreed-upon procedures discovered by the Government Inspector shall be brought to the attention of the supplier. Disposition of the product and remedial action shall be as directed by the Government Inspector, and depending on the nature of the deviation, may consist of lot rejection, screening, re-sampling, re-instruction of the supplier's employees, or other appropriate action.

- a. Verification at the point of manufacture shall be accomplished at unscheduled intervals in accordance with 4.1.3.1 and 4.1.3.2.
- b. Verification at the point of delivery shall be in accordance with 4.1.3.2.

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4.1.3.1 Surveillance.-Surveillance shall include, but is not limited to:

- a. Observation of procedures concerning lot formation and identification.
- b. Observation of sampling procedures and application of acceptance criteria.
- c. Determination that all required examinations and tests are performed in accordance with the prescribed procedures of this specification, or of approved equivalents thereto.
- d. Review of procedures for control and disposition of non-conforming material.

4.1.3.2 Product inspection.-Product inspection shall consist of Government inspection of product which has been previously inspected by the contractor and found to meet the quality assurance provisions of this specification. The inspection by the Government shall be performed in order to determine that the product is of the quality required by this specification and that the contractor's records are reliable.

## 4.2 Inspection Provisions

4.2.1 Lot formation.-The term "lot" as used throughout this specification refers to an inspection lot, which is defined as an essentially homogeneous quantity of explosive from which a representative sample (see 4.2.2.1) is drawn and inspected to determine conformance of the lot with applicable requirements. The sample selected shall represent only that quantity of explosive from which the sample is drawn and shall not be construed to represent any prior or subsequent quantities presented for inspection. A lot shall consist of only one batch of explosive produced by one manufacturer, in accordance with the same specification, and same specification revision under one continuous set of operating conditions. Each lot shall consist of that quantity of explosive which has been subjected to the same unit chemical or physical process intended to make the final product homogeneous. The criteria and procedures for the assignment of lot numbers shall be in accordance with Standard MIL-STD-1168. The lot size of explosive deliverable under contract shall not be less than the smallest weekly estimate of quantities contractually scheduled for production nor more than the largest monthly quantity contractually scheduled for delivery during the contract period, unless otherwise approved by the contracting officer.

### 4.2.2 Testing

4.2.2.1 Sampling.-Two (2) samples weighing approximately 120 grams each (dry weight) shall be randomly selected from individual containers. Both samples shall be chosen from the same batch and

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shall be representative of that batch. The individual samples shall be packaged separately in suitable containers for Government inspection. Each of the two samples shall be tested and shall pass all of the requirements of 3.1 through 3.7. If one sample fails to meet any of the requirements, the batch it represents shall be rejected.

4.2.2.2 Retest and payment for samples.-A rejected lot may upon application from the manufacturer and approval of the contracting officer, be retested once. All expenses incident to such retest shall be borne by the contractor. Test samples representing finally rejected lots shall not be paid for under any condition. Surveillance samples requested individually or as part of the chemical sample shall be paid for only if the lot is finally accepted.

#### 4.2.3 Test methods and procedures.

4.2.3.1 Air dried sample.-The sample of wet PETN shall be mixed to insure uniform distribution of the various size particles and then a portion of the sample consisting of approximately 120 grams (gm) of PETN (dry basis) shall be transferred to a Buchner funnel previously fitted with a Number 42 Whatman filter paper or equivalent. Air shall be drawn through the funnel and contents for approximately 10 minutes. The PETN shall be transferred to a large sheet of paper and mixed again with a wooden spatula to insure uniform moisture content.

4.2.3.2 Oven dried sample.-The wet sample shall be air dried only if there is evidence of free liquid on top of the sample. Approximately 1 gram of the air dried sample shall be transferred to a glass dish. The dish and its contents shall be weighed and then dried in an oven at  $43^{\circ}$  plus or minus  $2^{\circ}\text{C}$  for 3 hours. The remaining sample shall be placed on a steam grid at  $53^{\circ}$  plus or minus  $2^{\circ}\text{C}$  for 16 hours and then dried at  $100^{\circ}$  plus or minus  $2^{\circ}\text{C}$  until constant weight is obtained. The dish and contents shall be cooled in a desiccator.

4.2.3.3 Melting point, Major Defect, Code No. 01001, (see 6.2) The melting point shall be determined as specified in MIL-STD-650, Method 209.1 with the exception of the following paragraph:

Apparatus.-The bath shall consist of a suitable beaker that is about three-fourths full of an appropriate oil.

4.2.3.4 Nitrogen content, Major defect, Code No. 02001.-The nitrogen content shall be determined as specified in MIL-STD-286 Method 209.3, with the exception of the following paragraph:

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Scope.-This method is used for determining the nitrogen content of PETN.

Specimens.-The specimen shall consist of an accurately weighed portion of the sample containing 0.78 to 0.80 gm. of material crushed to pass through a No. 100 U.S. Standard Sieve and dried by a suitable method.

Procedure.-A weight of sample calculated by difference is acceptable.

4.2.3.5 Insolubility and insoluble particles, Major Defect, Code No. 03001.-A weighed portion of approximately 50 gm. of the dried sample shall be placed in a beaker and dissolved in 250 mls. of acetone at room temperature. The solution shall be filtered through a tared filtering crucible, and the residue washed 3 times with acetone. The crucible shall be dried in an oven at  $100^{\circ}$  plus or minus  $2^{\circ}\text{C}$ , cooled in a desiccator and weighed. The increase in weight shall be calculated as percentage of insoluble material in the sample. The crucible shall be shaken over a U.S. Standard Sieve Number 40 to release any particles retained in the crucible. Count any particles that do not pass through the sieve.

4.2.3.6 Acidity and alkalinity, Major Defect, Code No. 04001.-Weigh exactly 10 g. plus or minus 0.01 g. of dried PETN and place it in a 250 ml. beaker. Dissolve the PETN in 50 ml. of reagent grade acetone. Slowly add 100 ml. of distilled water with stirring and allow the precipitate to settle. Add 2 ml. of 0.02N  $\text{H}_2\text{SO}_4$  and stir briefly. Add 8 to 10 drops of methyl red/methylene blue indicator (0.1 g. of methyl red and 0.05 g. methylene blue in 100 ml. of 95% ethyl alcohol) and titrate at once, without filtering, using 0.02 N sodium hydroxide. For this purpose, use a 5 ml. semimicroburette, graduated in 1/50 ml. Add the 0.02 N NaOH solution drop by drop to the beaker, stirring until the indicator end point is reached (first indication of green). A reagent blank is carried through the entire procedure with the time of standing or stirring duplicated.

$V_b$  = Volume of NaOH needed to titrate blank.

$V_s$  = Volume of NaOH needed to titrate sample.

If  $V_b$  is greater than  $V_s$ , then the difference shall be calculated as  $\text{Na}_2\text{CO}_3$ . If  $V_s$  is greater than  $V_b$ , then the difference shall be calculated as  $\text{HNO}_3$ . In case of dispute or question, the titration shall be conducted as above except a pH meter shall be used instead of the indicator and a pH of 7.0 shall be taken as the equivalence point.

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If the volume of NaOH required to titrate the sample is greater than the volume of NaOH required to titrate the blank, calculate the percent acidity of the sample as follows:

$$\text{Acidity, as \% HNO}_3 = \frac{(V_s - V_b)(N)(0.063) \times 100}{W}$$

where:

- $V_s$  = ml of NaOH required to titrate sample
- $V_b$  = ml of NaOH required to titrate blank
- $N$  = normality of NaOH
- $W$  = weight of sample, gms.

If the volume of NaOH required to titrate the blank is greater than the volume of NaOH required to titrate the sample, calculate the alkalinity of the sample as follows:

$$\text{Alkalinity, as \% Na}_2\text{CO}_3 = \frac{(V_b - V_s)(N)(0.053) \times 100}{W}$$

4.2.3.7 120° vacuum stability, Major Defect, Code No. 05001.- Stability shall be determined as specified in MIL-STD-650, Method 503.1, with the exception of the following paragraphs:

Sample preparation.-Place a weighed portion of approximately 5 gm. of the sample in a mortar with an equal weight of distilled water. Grind the material with a pestle to such fineness that all will pass through a U.S. Standard No. 200 sieve. Pass the wet ground material through the sieve using a minimum amount of distilled water. (Approximately 100 ml. of water has been found to be sufficient.) Transfer the PETN and water to a Buchner-type funnel, apply suction to remove the water, aspirate to near dryness, and finally dry at 100° to 105°C for 4 hours.

Apparatus.-Constant temperature bath. An aluminum heating block may be substituted as an alternate method.

Procedure.-Place 2.3 grams of the dried specimen in the heating tube.

Procedure.-Calculate the volume of gas (at standard temperature and pressure) liberated during the test as follows:

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$$\text{Vol. of gas, ml.} = (A + CB) \left[ \frac{273 (P-H)}{760(273+t)} \right] - (A + C_1B) \left[ \frac{273 (P_1-H_1)}{760(273+t_1)} \right]$$

where:

A = Volume of heating tube minus (sample weight) in cubic centimeters, to allow for the specimen.  
(1.773)

4.2.3.8 Granulation, Major Defect, Code No. 06001.-Prepare a 75% alcohol solution saturated with PETN by mixing 7500 ml. of 95% 2B ethyl alcohol and 2500 ml. of distilled water and then adding 25 grams of PETN. Allow the mixture to stand for 8 to 16 hours with occasional shaking. Filter to remove any undissolved PETN. Weigh the individual sieves (three-inch diameter, U.S. Standard sieves conforming to Specification RR-S-366) to the nearest 0.01 gram. Nest one into the other, the finest on the bottom, the next finest, etc., with the coarsest on top. Weigh five grams of the dried sample and transfer it to the top screen. Set the rest of the screens on a Buchner funnel (Coors No. 2, with a 75mm plate.) Wash the material back and forth across the screen with ethyl alcohol solution using a wash bottle and gentle suction. Wash with a total of about one liter of alcohol solution or until no more material seems to pass through the screen. Remove the top screen and wash the PETN in the next screen with about one liter of the washing alcohol in a similar manner. Remove each screen in succession and continue the process. Place the sieves on sheets of clean paper and dry for two to four hours at 40° - 50°C. A steam grid is convenient for this drying. When dry, beginning with the coarsest screen, tap it gently over the next finer screen to sift through any fine adhering particles, then weigh the screen and its contents. Repeat with each successive screen. Obtain the weight of the material retained on each of these screens by difference from their respective tares. Calculate the percentages retained on each sieve. Obtain the percentage through the finest screen by difference from 100% after determining the sum of the percentages retained on all the sieves. Wet the screened material down immediately and dispose of it in the usual manner. Report the percentage retained on each sieve and the percentage through the finest sieve.

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## 5. PREPARATION FOR DELIVERY

5.1 PETN shall be packaged, packed and marked in accordance with the Code of Federal Regulations CFR 41-49, paragraph 73.77. In addition, the following requirements shall apply.

## 5.2 Packaging

5.2.1 Level A.-The water-alcohol solution shall be used. Not more than 50 pounds, dry weight, shall be placed in an inner bag.

5.2.2 Level C.-When mutually agreed between supplier and procurer, alcohol may be omitted from the wetting solution and weight per inner bag may be adjusted for manufacturing conditions.

## 5.3 Packing

5.3.1 Level A.-Container No. ICC5 or ICC5B only shall be used.

5.3.2 Level C.-Any authorized ICC container may be used.

5.4 Marking.-Marking shall comply with Military Standard MIL-STD-129.

## 6. NOTES

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

- a. Title, number and date of this specification.
- b. Packing required (see 5.2).
- c. Process.-Details of the manufacturing process and the equipment used by the contractor will be submitted to the procuring activity in writing prior to manufacture.

6.2 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-MU

Preparing Activity:  
Army-MU

Project Number: 1375-A001

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SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004
<b>INSTRUCTIONS</b>		
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.		
SPECIFICATION		
ORGANIZATION		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?		
A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS, FOR CORRECTING THE DEFICIENCIES		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE?		
<input type="checkbox"/> YES <input type="checkbox"/> NO    IF "YES", IN WHAT WAY?		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE

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