INCH-POUND
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SUPERSEDING
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MILITARY SPECIFICATION

EXPLOSIVE, PLASTIC-BONDED, CAST PBXN-103

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the minimum requirements for procurement of one type of plastic-bonded explosive, cast PBXN-103, for use in ordnance.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-A-192	Ammonium Perchlorate, Technical
MIL-E-255	Ethyl Centralite (Carbamite)
MIL-R-22578	Resorcinol

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Indian Head Division, Naval Surface Warfare Center, Standardization Branch (Code 8420), 101 Strauss Avenue, Indian Head, MD 20640-5035 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or sending a letter.

AMSC N/A FSC 1376

MIL-A-82728 Aluminum Powder, Atomized (For Use In Explosives)

STANDARDS

MILITARY

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

MlL-STD-129 Marking for Shipment and Storage

MIL-STD-286 Propellants, Solid: Sampling, Examination and Testing

(Unless otherwise indicated, copies of military specifications, standards, and handbooks are available from: Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation (see 6.2).

WEAPON SPECIFICATIONS

NAVAL SEA SYSTEMS COMMAND (CAGE Code 53711)

WS 12236 Ammonium Perchlorate (For Use In Rocket Motors)

WS 12794 Ammonium Perchlorate

WS 12797 Triethylene Glycol Dinitrate

WS 12798 Metriol Trinitrate

WS 12799 Pelletized Nitrocellulose

WS 18485 Ammonium Perchlorate (For Use in PBX Explosives)

(Application for copies should be addressed to the Commander, Naval Service Warfare Center, Indian Head Division (Code 8410P), 101 Strauss Avenue, Indian Head, MD 20640-5035.)

PUBLICATIONS

CODE OF FEDERAL REGULATIONS (CFR)

49 CFR Parts 100 to 199 Transportation

(Application for copies of CFRs should be addressed to the Superintendent of Documents, U.S.

Government Printing Office, Washington, D.C. 20402.)

2.2 Non-Government publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of the document which is DOD adopted is that listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

CHEMICAL PROPULSION INFORMATION AGENCY

CPIA Publication No. 21 Solid Propellant Mechanical Behavior Manual

(Copies may be obtained from the Chemical Propulsion Information Agency, Applied Physics Laboratory, Johns Hopkins University, 8621 Georgia Avenue, Silver Spring, Maryland 20910.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. Unless otherwise specified in the contract or order (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.4. This first article sample shall be manufactured in accordance with the formulation of table I using the procedures, techniques, and facilities proposed for production.

3.2 Formulation. The formulation of PBXN-103 shall comply with the requirements of table I and 3.2.1 when tested in accordance with 4.6.1, 4.6.2, or 4.6.3 as applicable. The raw materials for the explosive shall conform to the specifications listed in table I.

3.2.1 Mixed plasticizer. The mixed plasticizer, which may be supplied as a single ingredient, shall consist of triethylene glycol dinitrate (TEGDN), metriol trinitrate (MTN), ethyl centralite (EC), and resorcinol. The mixed plasticizer shall provide the chemical analysis listed in table I when determined in accordance with 4.6.1, 4.6.2, or 4.6.3 as applicable. The total moisture content of the mixed plasticizer shall be no greater than 0.2 percent when determined as specified in 4.5.1 and 4.6.4.

3.3 Product characteristics. PBXN-103 shall meet the requirements of 3.3.1 through 3.4 when tested in accordance with section 4.

3.3.1 Moisture content. The total moisture content of the explosive material shall be no greater than 0.15 percent when determined as specified in 4.6.4.

TABLE I. PBXN-103 formulation.

Ingredient	Percent by Weight			Specification
	Theoretical	Minimum	Maximum	
Pelletized nitrocellulose (PNC) (percentage as nitrocellulose)[1]	6.0	6.0	7.5	WS 12799, Grade A, Type I or II, Classes 2 or 3, 1-30 second viscosity
Ammonium perchlorate (AP)	40.0	38.0	42.0	WS 18485, WS 12794, MIL-A-192, Grade C, Class 4, or WS 12236, Class 1
Aluminum	27.0	25.0	29.0	MIL-A-82728
Mixed Plasticizer				
Resorcinol	0.2	0.2	0.4	MIL-R-22578
MTN	23.0	21.0	25.0	WS 12798
TEGDN	2.5	2.0	3.0	WS 12797
EC[1]	1.3	1.3	1.7	MIL-E-255, Class 3

[1] WS 12799, Pelletized Nitrocellulose will contain EC. The amount of PNC used must account for the fact that part of it is EC. The composition limits are a minimum of 6.0 and a maximum of 7.5 percent nitrocellulose. The EC percentage in the mixed plasticizer must be adjusted (reduced) by the amount added with the PNC.

3.3.2 Tensile strength. Tensile strength shall be determined using either a cut or cast sample of PBXN-103. Tensile strength of a cut sample of PBXN-103 shall be greater than 60 pounds per square inch (psi) when determined as specified in 4.6.5.1. Tensile strength of a cast sample of PBXN-103 shall be greater than 90 psi when determined as specified in 4.6.5.2. Strain at maximum stress for cut and cast samples shall not be less than 9 percent.

3.3.3 Vacuum stability. The PBXN-103 vacuum stability shall not exceed 1.00 mL/g in 40 hours at 100•C when tested in accordance with 4.6.6.

3.4 Workmanship. The PBXN-103 explosive shall be free from foreign materials and shall be manufactured in a manner to assure compliance with all the requirements of this specification. The workmanship exhibited in the first article sample shall be evaluated to determine acceptability. The approved standards of workmanship will thereby become a minimum requirement for all material offered for acceptance.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements (examinations and tests) 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

a. First article inspection (see 4.4)

b. Quality conformance inspection (see 4.5)

c. Periodic in-process quality conformance inspection (see 4.5.1)

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

a. Temperature between 70 and 80•F

b. Humidity: Ambient (but not exceeding 95 percent, relative)

c. Altitude: Ground elevation of the test facility

4.4 First article inspection. A representative sample of 500 pounds of material, or any amount equivalent to the weight required to fill ten units of the ordnance items to be loaded, shall be manufactured in accordance with 3.1. First article inspection shall consist of subjecting the sample taken according to 4.5.2 and 4.5.3 to all of the examinations and tests specified in 4.6. Failure of the first article sample to pass any inspection or to meet the requirements of this specification shall be cause for rejection of the first article sample. Prior to approval of the sample, acquisition of materials or the initiation of production will be at the sole risk of the contractor.

4.5 Quality conformance inspection. The quality conformance inspection shall consist of subjecting the samples taken according to 4.5.2 and 4.5.3 to all of the tests and examinations specified in 4.6. Lot definition, formation, and size shall be in accordance with MIL-STD-105 and shall consist of a

single batch. A batch shall be defined as in 6.4.1. Failure of any test result or examination to meet any requirement of this specification shall be cause for rejection of the lot.

4.5.1 Periodic in-process production inspection. Unless otherwise specified in the contract or purchase order (see 6.2), a sample of mixed plasticizer shall be taken once per month and subjected to the test given in 4.6.4. Failure to meet the requirements of that test shall be cause for rejection of the batch and shall require repeating the periodic in-process tests on the next batch.

4.5.2 Sampling for cured explosive. After addition of all ingredients, thorough mixing, and removal of the mixing agent, a sample shall be taken from each lot and ladled into a CAPLUG number 1120, or equivalent container, until the container is full. This sample shall be cured under the same temperature and cure conditions as the explosive-loaded ordnance item. The sample shall be prepared for testing as follows:

a. The test specimens for the tensile test of 4.6.5.1 shall be cut from the center of the cured sample. The tests specified in 4.6.1 (or 4.6.2), 4.6.6, and 4.6.7 shall be run on the remaining two pieces.

b. The test specimens for 4.6.5.2 shall be cast into an appropriate mold, and the tests specified in 4.6.1 (or 4.6.2), 4.6.6, and 4.6.7 shall be run on the casting after the test specified in 4.6.5.2 has been performed.

4.5.3 Sampling for uncured explosive. After addition of all ingredients, thorough mixing, and removal of the mixing agent, a sample shall be taken from each lot and placed into a non-porous container. The sample shall be subjected to testing in accordance with 4.6.3 and 4.6.4.

4.6 Test procedures. The subsequent procedures shall be used to determine that the requirements of this document have been met. Any proposed change in test procedures or equipment shall necessitate, before adoption, prior approval of the contracting activity. In case of dispute between the results from any proposed method or equipment and what is cited herein, the results using the methods and the equipment specified in this specification shall prevail. Unless otherwise specified, all tests shall be run in duplicate. The average of the two results shall be taken as the test result.

4.6.1 Cured PBXN-103 ingredient analysis. The chemical composition of the cured PBXN-103 shall meet the requirements of table I when tested by the methods described in 4.6.1.1 through 4.6.1.7 or in 4.6.2.

4.6.1.1 Sample preparation. Cut the sample from 4.5.2 into thin slices with a knife. Accurately weigh a 5-gram sample to ± 1 mg, place in an extraction thimble, and extract with methylene chloride in a soxhlet extraction apparatus for 16 hours. Transfer the methylene chloride extract to a 500-mL separatory funnel, and extract with two successive 50-mL portions of 5 percent sodium carbonate solution.

4.6.1.2 Resorcinol. Determine the resorcinol content by measuring the absorbance of the sodium carbonate solution at 288 millimicrons (•) with a Beckman DK-2 Spectrophotometer, or an equivalent instrument, using the following procedure:

a. Prepare a standard curve (see step e) as follows: Weigh 25.0 ± 0.2 mg of pure resorcinol and dissolve in 100 mL of 5 percent sodium carbonate solution. Dilute with water to exactly 250 mL and use as a stock solution to make the dilutions for the standard curve.

b. Place 4, 6, 8, and 10 mL of the stock solution in 100 mL volumetric flasks and dilute to the mark with water. These standards contain 0.4, 0.6, 0.8, and 1.0 mg resorcinol.

c. Prepare a sodium carbonate solution for the reference cell by diluting 100 mL of 5 percent sodium carbonate solution from step a to 250 mL with water, then further diluting 10 mL of this solution to 100 mL with water.

d. Before scanning, zero the instrument at 288 • with the sodium carbonate reference solution in both the reference cell and the sample cell. With the sodium carbonate reference solution in the reference cell, scan each of the standards (from step b) in matched 1-cm silica cells from 300 to 275 •. Determine the maximum absorbance at about 288 •.

e. Plot each absorbance versus mg resorcinol. The best straight line through the four points is the standard curve.

f. Combine the sodium carbonate extraction above (see 4.6.1.1) and dilute to 250 mL in a volumetric flask.

g. Dilute a 15-mL aliquot of this solution with water to 100 mL, scan in the spectrophotometer as described in step d above for the standard, and refer this figure to the standard curve to obtain A, the milligrams of resorcinol per 100 mL of the final dilution of the sample.

h. Calculate the percentage resorcinol in the sample as follows:

$$\text{Περχεντταγε οφ ρεσορχινολ} \quad \frac{\text{A (250)}}{\text{15 Ω}} \Xi \frac{100}{1000}$$

where:

W = Weight of sample in grams

A = The milligrams of resorcinol per 100 mL of the final dilution of the sample

4.6.1.3 EC, MTN, and TEGDN. Evaporate the methylene chloride solution from the sodium carbonate extractions in a stream of air until the methylene chloride is completely removed. Transfer the residue to a 250-mL volumetric flask with acetic acid. Dilute to volume with acetic acid and save for the tests in 4.6.1.3.1 and 4.6.1.3.2.

4.6.1.3.1 EC. Determine the EC content by volumetric bromination of a 50-mL aliquot of the above acetic acid solution in accordance with MIL-STD-286, Method 202.2.3 for EC.

4.6.1.3.2 MTN and TEGDN. Transfer a 25-mL aliquot of the acetic acid solution to a nitroglycerin reduction flask, and complete the nitrate ester determination in accordance with MIL-STD-286, Method 208.1.3. The esters are determined as a sum, and it is necessary to make an assumption as to the ratio of

the MTN and TEGDN. This ratio is 23:2.5. The factor in the calculation, Section 5.14 of Method 208.1.3, is 2.917.

4.6.1.4 Alternate method for EC, MTN, and TEGDN. Evaporate a sample, extracted with methylene chloride as in 4.6.1.1, to near dryness and dilute to 3 mL with methylene chloride. Transfer approximately 1 mL of the sample to a nuclear-magnetic-resonance (NMR) sample tube with an eyedropper. Add tetramethylsilane as an internal reference. (Since this analysis is based on internal standards, weighing is unnecessary.) Agitate the mixture in the tube well enough to assure homogeneity, precondition to instrument operating temperature for approximately 10 minutes, and then transfer to the probe. Screen the sample and integrate under the instrument conditions deemed best by the operator to ensure high optimization. Suggested settings for Hitachi R20A Model NMR are as follows:

Sweep width	600 cycles per second
Sweep time	250 seconds
Time constant	0.1
H_1 level	4×10^3 Hz
Scan sensitivity	4 X 1
Integral sensitivity	1

4.6.1.4.1 Calculations. The quantitative analysis is as given in table II.

4.6.1.5 AP. Dry the thimble and residue from the methylene chloride extraction above, place in a clean soxhlet extraction unit, and extract with 150 mL of 90 percent ethyl alcohol for 6 hours. Transfer the extract to a 250-mL volumetric flask and dilute to the mark with alcohol. Place a 25-mL aliquot of the alcohol solution into a 250-mL beaker, add 30-mL dimethyl formamide and 5 drops of 0.2 percent thymol blue indicator, and titrate with a 0.1 molar sodium methoxide solution to a blue color change. Take a color change to last 5 seconds as the end point. Determine the AP equivalent of sodium methoxide solution by weighing an approximately 300 mg sample of pure, dry AP to ± 0.2 mg. Place in a 250-mL beaker, add 25-mL of 95 percent ethyl alcohol, 30 mL of dimethyl formamide, and titrate with the sodium methoxide solution as with the sample.

a. Calculate the AP equivalent of the sodium methoxide solution as follows:

$$E\theta \quad \frac{\mu\gamma \ \text{ομμονιυμ} \ \pi\varepsilon\rho\chi\lambda\omega\rho\alpha\tau\varepsilon \ \tau\alpha\kappa\varepsilon\nu}{\mu\Lambda \ \sigma\omega\delta\iota\upsilon\mu \ \mu\varepsilon\theta\eta\omega\xi\iota\delta\varepsilon \ \sigma\omega\lambda\upsilon\tau\iota\omega\nu}$$

b. Calculate the percentage AP in the sample as follows:

$$\Pi\varepsilon\rho\chi\varepsilon\nu\tau\alpha\gamma\varepsilon \ \text{ομμονιυμ} \ \pi\varepsilon\rho\chi\lambda\omega\rho\alpha\tau\varepsilon \quad \frac{E\theta \ A}{\Omega}$$

where:

A = mL sodium methoxide solution required for titration of sample
W = Weight of sample in grams

TABLE II. Calculations for EC,MTN, and TEGDN.

Component	Area Measurement (10 ppm scale)[1]	Area[1]	Adjusted Area[2]	Factor[3]	Relative Weight	Relative Percentages[4]
Resorcinol	6.4 to 6.7	0.22	0.22	-	-	-
EC	6.8 to 7.4	1.06-(0.3 x Res)	1.00	26.80	26.80	4.18
TEGDN	3.6 to 4.0	2.20-(0.4 x EC)	1.80	30.00	54.00	8.43
MTN	0.9 to 1.4	7.18-(0.1 x EC)	6.58	85.00	559.30	87.37

1 Area measurements are typical examples, not limits or requirements.

2 When there is an overlapping of peaks as in the case of EC with TEGDN and MTN, the area attributed to EC must be subtracted from the area of TEGDN and MTN, respectively.

3 The multiplication factor is based on the area-per-unit-proton technique. The factor is a result of dividing the molecular weight of the components by the number of protons causing the spectral configuration used for the analysis.

4 The relative percentages are used to calculate the actual percentages in the plasticizer once the resorcinol percentage is known.

4.6.1.6 Aluminum. Dry thimble and residue from the ethanol extraction above (4.6.1.5) at 105•C for 1 hour, and determine weight of residue (see 4.6.1.7). Place in a 250-mL beaker, and add 100 mL of dimethyl formamide. (NOTE: Since dimethyl formamide is somewhat toxic, this filtration should be performed in a hood.) Heat on a steam bath until all solids except the aluminum go into solution. Filter through a tared medium porosity filtering crucible. Wash the aluminum residue with dimethyl formamide, then with alcohol. Dry crucible and aluminum at l05•C for 2 hours and weigh.

$$\text{Περχενταγε οφ αλυμινυμ} \quad \frac{A\ X}{\Omega} \Xi\ 100$$

where:

A = Weight of crucible and aluminum in grams
C = Weight of tared crucible in grams
W = Weight of sample from 4.6.1.1 in grams

4.6.1.7 Nitrocellulose. Calculate the percentage of nitrocellulose in dried residue from ethanol

extraction (4.6.1.6) as the portion of residue material soluble in DMF.

$$\text{Percentage of pelletized nitrocellulose} \quad \frac{B\ \Delta}{\Omega} \times 100$$

where:

B = Weight of residue from thimble 4.6.1.6 in grams
D = Weight of aluminum from 4.6.1.6 in grams
W = Weight of sample from 4.6.1.1 in grams

4.6.2 Alternate method for cured PBXN-103 ingredient analysis. Cut the sample from 4.5.2 into small pieces no larger than 2 mm square. Weigh a 5-gram sample of small pieces to the accuracy of ± 0.1 mg in an extraction thimble (22 mm X 80 mm).

4.6.2.1 Mixed plasticizer. Extract the mixed plasticizer with 250 mL of methylene chloride in a soxhlet extraction apparatus for 6 hours. Place the thimble in a beaker, and allow it to air dry. Weigh the thimble plus the residue.

$$\text{Percent mixed plasticizer} \quad \frac{(A\ B\ X)}{A} \times 100$$

where:

A = Weight of sample in grams
B = Weight of thimble in grams
C = Weight of thimble plus residue in grams.

4.6.2.2 PNC. Place the residue from the thimble together with a stirring rod in a tared medium porosity crucible. Place the crucible with the residue in a 250-mL beaker, and add 150 mL of isobutyl acetate. Let the solution stand for 1 hour. Place the beaker on a hot plate, and heat it to just below boiling (110•C) until it does not appear sticky, stirring the residue in the crucible periodically. Extract the PNC using the tared crucible on a vacuum filtrator. Wash the residue in the crucible twice with 15 mL of hot isobutyl acetate. Dry the crucible and residue in a 100 ± 5•C oven for 15 minutes, and cool it to room temperature. Weigh the crucible plus second residue.

$$\text{Percent pelletized nitrocellulose} \quad \frac{(\Delta\ E)}{A} \times 100$$

where:

D = Weight of crucible and rod plus residue of 4.6.2.1 in grams
E = Weight of crucible and rod plus second residue in grams
A = Weight of sample in grams

4.6.2.3 AP and aluminum. Extract the remaining residue with five 20-mL portions of hot distilled

water using vacuum filtration. Rinse the crucible and residue with a few milliliters of acetone to speed the drying time. Dry the crucible in a 100 ± 5•C oven for 15 minutes, and cool it to room temperature. Weigh the crucible plus third residue.

$$\text{Percent ammonium perchlorate} \quad \frac{(E - F)}{A} \times 100$$

where:

E = Weight of crucible and rod plus second residue of 4.6.2.2 in grams
F = Weight of crucible and rod plus third residue in grams
A = Weight of sample in grams

$$\text{Percent aluminum} \quad \frac{(F - G)}{A} \times 100$$

where:

F = Weight of crucible and rod plus third residue in grams
G = Weight of crucible plus rod in grams
A = Weight of sample in grams

4.6.2.4 Resorcinol. Determine the resorcinol content by using a UV/VIS spectrophotometer and the following procedure:

a. Prepare a standard curve (see step e) as follows: weigh a 25.0 ± 2.0 mg sample of pure resorcinol, and dissolve it in 100 mL of 5 percent sodium carbonate (25 grams of sodium carbonate dissolved in 475 grams of distilled water). Dilute the dissolved resorcinol with distilled water to 250 mL, and use this as the stock solution to make the following dilutions for the standard curve.

b. Pipette 1, 2, 4, 6, and 8 mL of the stock solution to 100 mL volumetric flasks, and dilute them with distilled water to the mark. These standards contain 0.1, 0.2, 0.4, 0.6, and 0.8 mg of resorcinol.

c. Prepare a reference solution by diluting 100 mL of 5 percent sodium carbonate solution from step a to 250 mL with distilled water and then further diluting 10 mL of this solution to 100 mL with distilled water.

d. Set the instrument to zero at 288 • with the reference solution in both the reference and sample cells. With the reference solution in the reference cell, read the absorbance of the standard solutions (from step b) in a matched, 1-cm silica cell.

e. Plot the absorbance versus the concentration (mg of resorcinol per 100 mL of solution). The best straight line through the points is the standard curve.

f. Transfer the methylene chloride extract (from 4.6.2.1) to a 500-mL separatory funnel, and wash it with two 50-mL portions of 5 percent sodium carbonate solution. Collect the

methylene chloride portion in a 250-mL beaker and save for the EC determination (4.6.2.5). Place the sodium carbonate extract in a 250-mL volumetric flask, and dilute it to the mark with distilled water. Dilute a 15-mL aliquot of this solution to 100 mL with distilled water.

g. Prepare a reference solution by diluting 100 mL of the 5 percent sodium carbonate solution to 250 mL with distilled water and then further diluting a 15-mL aliquot of this to 100 mL with distilled water.

h. Determine the absorbance of the sample at 288 • as previously described in step d. Refer to the standard curve (step e) to obtain the concentration.

i. Calculate percent resorcinol as follows:

$$\text{Percent resorcinol} \quad \frac{5H}{3A}$$

where:

H = Concentration (mg resorcinol per 100 mL solution)
A = Weight of sample in grams

4.6.2.5 EC. Determine the EC content as follows:

a. Evaporate the methylene chloride layer from the resorcinol extraction (4.6.2.4) to dryness.

b. Transfer the residue to a 250-mL flask (equipped with a stopper) using 50 mL of glacial acetic acid.

c. Add, by pipette, 25 mL of potassium bromate-bromide solution which has been prepared as follows:

(1) Add 5.6 grams of potassium bromate, which has been dried at 100•C for 2 hours, to a beaker.

(2) Add 30 grams of potassium bromide.

(3) Add about 300 mL of distilled water to the beaker to dissolve the content, and dilute the solution to 1 liter.

d. Wet the stopper of the flask with a drop of 15 percent potassium iodide solution which has been prepared by adding 15 grams of potassium iodide to 85 mL of distilled water.

e. Add 5 mL of concentrated hydrochloric acid to the flask. Stopper the flask, swirl the contents, and allow bromination to proceed for 1 minute.

f. Immediately add 10 mL of 15 percent potassium iodide solution. Swirl the contents of the flask.

g. Wash down the gutter and walls of the flask with distilled water.

h. Titrate the sample with 0.1N sodium thiosulfate solution until it changes to dark yellow.

i. Add 5 mL of starch indicator solution which has been prepared by adding 1 gram of starch to 100 mL of distilled boiling water.

j. Continue titration of the sample until the blue color changes to colorless.

k. Run a blank as described above for the sample.

l. Calculate the percent EC as follows:

$$\text{Percent ethyl centralite} \quad \frac{(6.71)(J - K)(N)}{A}$$

where:

J = mL of 0.1N sodium thiosulfate used in blank
K = mL of 0.1N sodium thiosulfate used in sample
N = Normality of 0.1N sodium thiosulfate solution
A = Weight of sample in grams.

4.6.2.6 METN and TEGDN. The percent MTN and TEGDN is found by subtracting the percentages of all the other components (resorcinol, EC, nitrocellulose, AP, and aluminum) from 100%. The esters, MTN and TEGDN, are determined as a sum, and it is necessary to make an assumption as to the ratio of the MTN and TEGDN. The assumption is that the ratio is 23:2.5.

4.6.3 Uncured PBXN-103 composition analysis. The chemical composition of the uncured PBXN-103 shall meet the requirements of table I when tested by the methods of 4.6.3.1 through 4.6.3.7.

4.6.3.1 Sample preparation. Weigh a 2-gram sample from 4.5.3 to the accuracy of ± 0.1 mg into a tared medium porosity 30-mL crucible equipped with a stirring rod.

4.6.3.2 Mixed plasticizer. Extract the mixed plasticizer at room temperature on a vacuum filtrator with five 20-mL portions of reagent grade methylene chloride. Save this filtrate for resorcinol and EC determinations. The extraction should have a stirring time of 1 minute with the vacuum off. Do not draw residue dry until after the last extraction. Dry the sample for 30 minutes in a 100 ± 5•C oven, and then cool it to room temperature. Weigh the crucible plus the residue.

$$\text{Percent mixed plasticizer} \quad \frac{(A - B - X)}{A} \times 100$$

where:

A = Weight of sample in grams
B = Weight of crucible plus rod in grams
C = weight of crucible and rod plus residue in grams

4.6.3.3 PNC. Place the crucible with the residue in a 250-mL beaker. Add about 15 mL of isobutyl acetate to the crucible. Add enough isobutyl acetate to the beaker to bring the level even with the liquid in the crucible. Place a watch glass on the beaker. Place the beaker on a hot plate, and heat it to just below boiling (110•C) for 30 minutes, stirring the residue in the crucible periodically. Place the crucible on a vacuum filtrator to extract the PNC. Pour the remaining hot solvent in the beaker into the crucible, and aspirate the crucible and residue. Dry the crucible and residue in a 100 ± 5•C oven for 15 minutes, and cool it to room temperature. Weigh the crucible plus second residue.

$$\text{Percent pelletized nitrocellulose} \quad \frac{(X\ \Delta)}{A} \times 100$$

where:

C = Weight of crucible and rod plus residue of 4.6.3.2 in grams
D = Weight of crucible and rod plus second residue in grams
A = Weight of sample in grams

4.6.3.4 AP and aluminum. Determine the percent AP and aluminum as specified in 4.6.2.3.

4.6.3.5 Resorcinol. Determine the resorcinol content as specified in 4.6.2.4 except in step 4.6.2.4f, use methylene chloride extract from 4.6.3.2 instead of 4.6.2.1. Also, use a 30-mL aliquot instead of a 15-mL aliquot.

4.6.3.6 EC. Determine the percent EC as specified in 4.6.2.5.

4.6.3.7 MTN and TEGDN. Determine the percent MTN and TEGDN as specified in 4.6.2.6.

4.6.4 Moisture content. The total moisture of the material shall be determined in accordance with MIL-STD-286, Method 101.5.

4.6.5 Tensile strength.

4.6.5.1 Cut specimens. The tensile properties of the cut PBXN-103 explosive shall be determined in accordance with CPIA Publication 21 (1983), paragraph 4.3.2.3, with the standard JANNAF die cut from one-half inch slabs.

4.6.5.2 Cast specimens. The tensile properties of the cast PBXN-103 shall be determined in accordance with CPIA Publication 21 (1983), paragraph 4.3.2.3, using a dog bone cast to the standard JANNAF dimensions.

4.6.6 Vacuum stability. The vacuum stability of the PBXN-103 explosive shall be determined in accordance with MIL-STD-286, Method 403.1.3, except reduce sample size to 1.0 gram, change capillary arm length to either 15 cm or 26 cm, and change heating time to 48 hours.

4.6.7 Visual examination. Each lot of PBXN-103 shall be visually examined for conformance to 3.4.

4.7 Inspection of packaging. Packaging of PBXN-103 shall be inspected for conformance to section

5.

5. PACKAGING

5.1 Packaging. The explosive material shall be packaged in accordance with the manufacturer's best commercial practice and applicable State and Federal regulations.

5.2 Packing. The material, packaged as specified in 5.1, shall be packed to insure carrier acceptance and safe delivery to the destination at the lowest applicable rate.

5.3 Marking.

5.3.1 Special marking. Precautionary and explosive markings shall be in accordance with Code of Federal Regulation, Title 49, CFR Parts 171 to 178.

5.3.2 Normal markings. In addition to any special markings required by the contract or order (see 6.2), unit packages, intermediate packages, and shipping containers shall be marked in accordance with the requirements of MIL-STD-129.

6. NOTES

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

6.1 Intended use. PBXN-103 is a high-energy explosive intended for use in ordnance.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1 and 2.2).

c. Whether a first article inspection is required (see 3.1).

d. The agency that is to perform the inspection (see 4.1).

e. Periodic in-process inspection if other than as specified (see 4.5.1).

f. That the safety precaution requirements of the "Contractors' Safety Manual for Ammunition, Explosives and Related Dangerous Material" (DOD 4145.26M) are applicable (see 6.7).

6.3 First article. When a first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from

the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.4. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Definitions.

6.4.1 Batch. A batch shall consist of a product of the same composition, manufactured under essentially the same conditions, and at essentially the same time, and not to exceed a 24-hour period of manufacture. A change of an ingredient lot shall change the batch.

6.5 Explosive preparation. It is suggested that the explosive be mixed in the presence of at least three percent by weight mixing agent. This material should be Phillips 99 mole percent heptane or a heptane of equal or better purity. After mixing, the majority of the heptane should be decanted. The remaining heptane should be removed during a vacuum degassing or casting step.

6.6 Experimental mixes. In producing a product which will meet the requirements herein, the supplier should be guided by his own background or experience plus the results from any experimental mixes of this explosive, in deciding upon the exact quantities of the materials specified in table I for use in any given batch of PBXN-103.

6.7 Safety precautions. The safety precaution requirements of the "Contractors' Safety Manual for Ammunition, Explosives and Related Dangerous Material" (DOD 4145.26M) are applicable and should be specified in the contract as required by the Federal Acquisition Regulation (FAR) 23.3.

NOTE: When this document is used as part of the description of work to be accomplished by a Government activity, the safety precaution requirements of "Ammunition and Explosives Ashore" (OP5) should be made applicable.

6.8 Subject term (key word) listing.

Ethyl centralite (EC)
Explosive
Impact sensitivity
Metriol trinitrate (MTN)
Ordnance
Plasticizer
Resorcinol
Triethylene glycol dinitrate (TEGDN)

Preparing activity:
Navy - OS
(Project 1376-N472)