

INCH-POUND

MIL-E-82903(OS)
30 December 1994
SUPERSEDING
WS 32972A
23 February 1990

MILITARY SPECIFICATION

EXPLOSIVE, HNS-IV

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 requirements for the procurement of the organic compound 2,2', 4,4', 6,6' - Hexanitrostilbene, HNS-IV, which is known as small particle HNS explosive and is characterized by high thermal stability.

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

FEDERAL

PPP-T-60 Tape, Packaging, Waterproof

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, Maryland 20640-5035, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by sending a letter.

AMSC N/A

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FSC 1376

MIL-E-82903(OS)**MILITARY****MIL-T-248** Trinitrotoluene (TNT)**STANDARDS****MILITARY****MIL-STD-129** Marking for Shipment and Storage**MIL-STD-1316** Fuze, Design Safety, Criteria for

(Unless otherwise indicated, copies of Federal and military specifications and standards 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).

NAVAL SEA SYSTEMS COMMAND (CAGE Code 53711)**WS 5003** HNS Explosive

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

CODE OF FEDERAL REGULATIONS**49 CFR 100-177** Transportation

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

2.2 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 Description. HNS-IV shall be crash precipitated from HNS-II which was recrystallized from HNS-I conforming to WS 5003. HNS-II must be prepared by recrystallization from an organic solvent system (i.e., dimethylformamide - DMF certified) by the process approved by the contracting activity (see 6.2). HNS-IV shall be a superfine-particle-size material with a surface area of 5.0 to 25.0 square meters per gram (m²/g). HNS-I is a high explosive synthesized by a "one-step" process from trinitrotoluene (TNT) (MIL-T-248).

MIL-E-82903(OS)

3.2 First article. Unless otherwise specified in the contract or purchase order (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.4.

3.3 Performance. The mean flyer velocity range over which a pressed HNS-IV explosive charge can be detonated by the specified flyer assembly shall be less than or equal to 3.00 millimeters/microsecond (mm/ μ s) and greater than or equal to 2.70 mm/ μ s when tested at ambient temperature. The standard deviation of the flyer velocity shall be less than or equal to 0.15 mm/ μ s. This pressed HNS explosive charge shall have a density of 1.570 ± 0.005 grams per cubic centimeter (g/cm³). When detonated, the output of the pressed HNS explosive charge shall produce, as a minimum, a hole through the witness plate with the back surface spalled. The test procedure shall be in accordance with 4.6.9 and the Appendix.

3.4 Physical and chemical properties. The physical and chemical properties for the HNS explosive shall be as specified in table I. Use of the material should be considered only after an evaluation of test data using HNS described by the limits of this specification.

3.5 Workmanship. The HNS explosive, including all materials entering into its manufacture, shall be formulated and processed in a manner to assure compliance with all requirements of this specification. Particular attention shall be directed toward preventing foreign matter from entering the process during manufacture and packaging and exposure of bulk material, during handling and storage, to direct light for any prolonged period of time (see 6.8). This is very important since the presence of small quantities of impurities in the HNS explosive, brought about through synthesis, handling, and storage, can seriously degrade its high temperature stability characteristics.

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.

MIL-E-82903(OS)

TABLE I. Physical and chemical requirements.

Requirement	Value	Test Paragraph
1. Vacuum stability: ¹ a. cubic centimeter per gram (cm ³ /g) for first 20 minutes. b. cm ³ /g per hour for additional 2 hours	3.0 max 1.1 max	4.6.1
2. Surface moisture and volatiles, (percent (%) by weight)	0.05 max	4.6.2
3. Conductivity ²	²	4.6.3
4. Insoluble particles (% by weight)	0.1 max	4.6.4
5. Chemical analysis (%): HNS HNBiB or DPE ³ Photolysis products ⁴ DMF ⁵ Wash solvents ⁶	98.50 min 0.65 max ⁴ 0.5 max 0.1 max	4.6.5 4.6.6 4.6.7
6. Surface area (square meter per gram (m ² /g)) ⁷	⁷	4.6.8
7. Slapper test ⁸	⁸	4.6.9

- ¹ Specified values are volumes of gas at 0°C and 760 mm pressure after evolution at 260 ± 0.5°C.
- ² The conductivity of the HNS-IV shall be less than the equivalent conductivity of a 1.0 parts per million (ppm) sodium chloride (NaCl) solution.
- ³ HNBiB is hexanitrobibenzyl; DPE is dipicrylethane.
- ⁴ Total area calculated for photolysis products shall not be greater than twice the area found for the reference HNS-IV material.
- ⁵ DMF is dimethylformamide.
- ⁶ Any other wash solvents (methanol dioxane, etc.) used in the HNS-IV processing shall be less than 0.1%.
- ⁷ When HNS-IV is ordered for any application, the contract shall specify the minimum and maximum surface area required for the application. Most applications will use a surface area between 10 and 15 m²/g.
- ⁸ Mean flyer velocity shall be between 2.70 and 3.00 mm/μs with a standard deviation of less than 0.15 mm/μs when tested at ambient temperature. When detonated, the pressed charge (1.570 ± 0.005 g/cm³) shall produce, as a minimum, a hole through the witness plate with the back surface spalled.

MIL-E-82903(OS)

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)

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the applicable inspection paragraph.

4.4 First article inspection. A first article sample of HNS explosive material of sufficient amount for the tests of 4.6 shall be tested by the contractor or other designated activity (see 6.2 and 6.3) to determine compliance with all the requirements of this specification. Any defect shall be cause for the rejection of the first article.

4.5 Quality conformance inspection. Quality conformance inspection shall be as specified in table II.

TABLE II. Quality conformance tests performed by contractor.

Inspection	Requirement	Test Paragraph
Vacuum stability	3.4	4.6.1
Surface moisture and volatiles	3.4	4.6.2
Conductivity	3.4	4.6.3
Insoluble particles	3.4	4.6.4
Chemical analysis	3.4	4.6.5 4.6.6 4.6.7
Surface area	3.4	4.6.8
Slapper test	3.4	4.6.9

4.5.1 Inspection lot. For the purposes of sampling, the term "lot" shall mean "inspection lot" or "manufacturer's batch", i.e., a quantity of material formulated or processed at one time under the same conditions. Unless otherwise specified in the contract or order (see 6.2), the quantity of material contained in an inspection lot of HNS explosive shall not be less than 0.5 kilogram (kg) nor greater than 10.0 kg. Each inspection lot of material shall be retained and identified as a separate batch of material after acceptance. When a new lot or batch is formulated or batch processed, that lot or batch shall sampled in accordance with 4.5.2 and tested in accordance with table II. (Sampling and disposition of unused sample material shall be in accordance with 4.5.2.1 and 4.5.2.2, respectively.)

MIL-E-82903(OS)**4.5.2 Sampling.**

4.5.2.1 HNS-IV. Fifty-gram samples of HNS-IV explosive shall be selected at random from each inspection lot as follows:

Inspection Lot Size (kg)		Number of Samples
From	Through	
0.5	2.0	2
2.1	6.0	3
6.1	10.0	4

4.5.2.2 Disposition of unused sample material. HNS explosive required for testing shall be considered expendable and shall be destroyed following completion of testing.

4.5.3 Rejection criteria. Failure of any specimen or sample of HNS explosive to meet the requirements specified herein shall cause rejection of the lot of HNS explosive material from which it was taken.

4.6 Test procedures. The contractor shall furnish and maintain all necessary test equipment, facilities, and personnel for performing the tests of 4.6.1 through 4.6.9. The test equipment shall be adequate in quantity, and when definite requirements are not specified, they shall be of sufficient accuracy and quality to permit performance of the tests. Adequate safety precautions (see 6.4 and 6.5), shall be taken during the processing, testing, and handling of the HNS explosive to protect personnel from accidents, fires, or explosions and to limit damage to equipment and processing areas.

4.6.1 Vacuum thermal stability test. The vacuum thermal stability (VTS) of an explosive is the volume of gas, at standard conditions, produced by the constant temperature, constant volume thermal decomposition of the explosive, using a specified apparatus, heating period, and explosive weight, and an initial pressure of 2 mm Hg (266 pascals (Pa)) or less. For this test, the weight of the explosive is 0.2 g, the test temperature is $260 \pm 0.5^{\circ}\text{C}$, the heating period is 2 hours and 20 minutes, the test chamber volume is approximately 40 cm³, and the standard conditions are 1 atmosphere (0.101 MPa) and 0°C.

4.6.1.1 Specimen preparation. The batch or lot of the candidate explosive chosen to provide the material for the specimen shall be dried for 16 hours at a pressure of 2 mm Hg (266 Pa) or less and ambient temperature prior to sampling. A representative portion of the dried explosive shall be pressed or cast into a pellet by a procedure that will produce the density and physical properties required by the anticipated application. The pellet shall weigh between 0.19 and 0.21 g determined to the nearest milligram (mg). The density of another pellet made by the same procedure shall be determined at ambient temperature by the volumetric displacement method or a

MIL-E-82903(OS)

method of equivalent accuracy. A specimen shall be prepared from each of three different batches or lots of the candidate explosive.

4.6.1.2 Test apparatus. The test apparatus shall conform to the specifications shown in figure 1 and shall be fabricated from a heat resistant glass such as Pyrex. The riser is shown after the excess glass has been removed and a leak-proof seal made. The solid area represents a typical position for the mercury at the start of the test. A heating block, controlled at $260 \pm 0.5^{\circ}\text{C}$, is required to heat the test chamber; riser and length of capillary tubing is designated "a" in figure 1.

4.6.1.3 Volume measurement of the test chamber. Mark the position on the riser at which the leak-proof seal will be made. Determine the weight of water required to fill the test chamber to this mark. Convert this weight to a volume using the accepted value for the density of water at the temperature of the determination. Record this volume as "A" (in cm^3). Determine the volumetric capacity of the capillary tubing, in cm^3 per cm length, by weighing the amount of mercury required to fill a measured length of the tubing. Convert this weight to a volume using the accepted value for the density of mercury at the temperature of the determination. Record this volume as "B" (in cm^3 per cm length).

4.6.1.4 Test procedure.

- a. Place the specimen, prepared according to 4.6.1.1, in the test chamber.
- b. Make a leak-proof seal on the riser at the calibration mark (see 4.6.1.3). As a safety measure, the sample tube is protected by a section of 7.5 to 10.2 cm capped iron pipe while the glass tube is being sealed (see figure 2).
- c. Place 4.0 cm^3 of triply distilled mercury in the mercury reservoir.
- d. Tilt the apparatus at an angle that allows the mercury to flow away from, and to clear completely, the point at which the capillary tubing is sealed to the mercury reservoir. The reservoir must be firmly supported to avoid stress on the glass seals.
- e. Evacuate the test apparatus through the mercury reservoir to a pressure of 2 mm Hg (266 Pa) or less. During the evacuation, the reservoir should be tapped gently to dislodge any air bubbles that may be trapped in the mercury. While the apparatus is being evacuated, it is returned to the normal position (test chamber vertical).
- f. Then, by-pass the evacuation line, and slowly bleed air in until the height of the mercury column remains constant. If this height, h_0 , remains constant for at least 12 hours, the test assembly is leakproof and can be used to generate reliable VTS data. If the height of the mercury column drops, a leak is present. In this case, remove the mercury from the reservoir, make the defective seal leakproof, and reconstruct the mercury manometer.
- g. Then, position the test apparatus so that the test chamber, riser, and the horizontal portion of the manometer are maintained at $260 \pm 0.5^{\circ}\text{C}$ by a heating block.

MIL-E-82903(OS)

- h. Immediately after the positioning of the test assembly, record the time and barometric pressure, P_0 .
- i. After 20 minutes, record the barometric pressure, P_{20} , and the height of the mercury column above the reference level, h_{20} .
- j. After 2 hours and 20 minutes, remove the test assembly from the heating block.
- k. When the test assembly has reached ambient temperature, record the barometric pressure, P_f ; the ambient temperature in °C, t_f ; and the height of the mercury column above the reference level, h_f .
- l. Calculate the 20-minute surge for the candidate explosive at 260°C, S_{260} , from the following equation:

$$S_{260} = \frac{(h_0 - h_{20} + p_{20} - p_0)(A - g/p + aB + bB) \times 273.2}{533.2 \times 760 \times g}$$

where:

- h_{20} = Height of the mercury column above the reference level after 20 minutes, in mm Hg.
- p_{20} = Barometric pressure after 20 minutes, in mm Hg.
- h_0 = Initial height of the mercury column above the reference level, in mm Hg.
- p_0 = Initial barometric pressure, in mm Hg.
- A = Volume of the test chamber as determined by the procedure given in 4.6.1.3, in cm^3 .
- g = Weight of the specimen, in g.
- p = Density of the candidate explosive as determined by the procedure given in 4.6.1.1, in g/cm^3 .
- B = Volumetric capacity of the capillary tubing as determined by the procedure given in 4.6.1.3, in cm^3 per cm of length.
- a = Length designated by "a" in figure 1, in cm.
- b = Length designated by "b" in figure 1, in cm.

When S_{260} is calculated by the above equation, S_{260} will have units of $\text{cm}^3/\text{g}/20$ minutes. Each specimen of HNS explosive tested shall meet the requirements of table I.

- m. Calculate the VTS of the candidate explosive at 260°C, VTS_{260} , from the following equation:

$$VTS_{260} = \frac{(h_{20} - h_f + p_f - p_{20})(A - g/p + aB + bB) \times 273.2}{(t_f + 273.2) \times 760 \times g}$$

where:

- h_{20} = Height of the mercury column above the reference level after 20 minutes, in mm Hg.

MIL-E-82903(OS)

- p_{20} = Barometric pressure after 20 minutes, in mm Hg.
 h_t = Height of the mercury column above the reference level after 2 hours and 20 minutes, in mm Hg.
 p_t = Barometric pressure after 2 hours and 20 minutes, in mm Hg.
 A = Volume of the test chamber as determined by the procedure given in 4.6.1.3, in cm^3 .
 g = Weight of the specimen, in g.
 p = Density of the candidate explosive as determined by the procedure given in 4.6.1.1, in g/cm^3 .
 B = Volumetric capacity of the capillary tubing as determined by the procedure given in 4.6.1.3, in cm^3 per cm of length.
 a = Length designated by "a" in figure 1, in cm.
 b = Length designated by "b" in figure 1, in cm.

When VTS_{260} is calculated by this equation, VTS_{260} will have units of $\text{cm}^3/\text{g}/2 \text{ hr}$. Each specimen of HNS explosive tested shall meet the requirements of table I.

4.6.2 Surface moisture and volatiles content test. One 5-g specimen of HNS explosive, from each sample required by 4.5.2, shall be placed in a tared, vitreous, 100-milliliter (mL), tall form beaker, heated and evacuated in a vacuum oven at $100 \pm 5^\circ\text{C}$ for one hour. The beaker shall then be removed from the vacuum oven, placed in a desiccator until cool, and weighed. After weighing, the HNS sample shall be stored in a desiccator to be used for the insoluble particle analysis of 4.6.4. The surface moisture and volatiles content obtained by the difference in weight before and after heating shall be reported on a percentage basis. The surface moisture and volatiles content of each specimen of HNS explosive tested shall meet the requirements of table I.

4.6.3 Conductivity test. The test method given in 4.6.3.1 through 4.6.3.6 shall be used to determine the water soluble material content of the HNS.

4.6.3.1 Material required.

- a. Sodium chloride, reagent grade.
- b. Fisher distilled water, or equivalent (having conductivity less than 1.6×10^{-6} mhos).

4.6.3.2 Equipment required.

- a. Beckman Conductive Meter Model RX-16B2, or equivalent.
- b. General Radio Decade Capacitor Type 1412BC, or equivalent.
- c. Conductance cell, LSU type.
- d. Magnetic stirrer, 1/2-inch, Teflon-covered stirring bar.
- e. Beakers, Griffin, 100 mL capacity.

MIL-E-82903(OS)

- f. Glass stirring rods.
- g. Analytical balance (able to weigh to 0.01 mg).
- h. Volumetric flask, 500 mL and 1000 mL capacities.

4.6.3.3 General requirements. Concurrently with the HNS samples, run samples of distilled water and one ppm NaCl solution. The order of measuring these and the HNS samples shall be as follows:

- (1) Distilled water
- (2) HNS samples (0.75 ± 0.01 g)
- (3) One ppm NaCl solution.

The following precautions shall be adhered to during the performance of the conductivity tests:

- a. Thoroughly rinse the conductance cell in distilled water at least three times before and between measurements.
- b. Stir the sample continuously during the measurement cycle.

4.6.3.4 Sample preparation.

- a. Prepare a one ppm NaCl standard.
- b. Place approximately 3 g of NaCl in a weighing bottle, and dry it in an oven at 100°C for about 16 hours.
- c. Remove the weighing bottle from the oven, and place it in a desiccator to cool.
- d. When the NaCl reaches ambient temperature, weigh 50.00 ± 0.01 mg onto a glazed weighing paper.

NOTE: All water used during each analysis must come from a single source and meet the specifications described in 4.6.3.1b.

- e. Quantitatively transfer the 50 mg of NaCl into a clean, dry, 500-mL, volumetric flask, and dilute to the mark. The resulting solution is 100 ppm, and each mL of solution contains 0.1 mg.
- f. Thoroughly mix the standard solution, and using a 10-mL pipet, quantitatively transfer 10 mL of the solution to a clean, 1000-mL, volumetric flask. This solution contains 1.0 mg.

NOTE: The standard may be prepared ahead of time and be used for extended periods of time as it is quite stable.

MIL-E-82903(OS)

4.6.3.5 Determination of conductivity cell constant (k). The conductivity cell constant shall be determined as follows:

- a. Dry approximately 3 g of potassium chloride (KCl) in an oven at 100°C for approximately 16 hours.
- b. Remove the KCl from the oven, and place it in a desiccator to cool.
- c. When it has reached ambient temperature, weigh 0.7452 ± 0.0001 g of the KCl onto a glazed weighing paper.
- d. Quantitatively transfer the weighed KCl to a clean, 1000-mL, volumetric flask and dilute with distilled water to the mark. The conductivity of this solution is $0.0014087 \text{ ohm}^{-1} \text{ cm}^{-1}$.
- e. Using the conductance meter and decade capacitor, measure the resistance of the KCl solution. Allow the unit to warm up for 15 minutes before taking measurements.
- f. Calculate the cell constant as follows:

$$\text{Cell constant (k)} = LR$$

where:

L = Known conductance
R = Measured resistance.

For example:

The known conductance of the above solution is $0.0014087 \text{ ohm}^{-1} \text{ cm}^{-1}$, and the measured resistance is 144 ohms.

Therefore:

The cell constant (k) = 0.0014087×144 or 0.2029.

NOTE: The cell conductivity need be determined only once for any given cell. It should be rechecked any time the cell is damaged or 1 ppm NaCl results are suspect.

4.6.3.6 Measuring procedures. Distilled water from a single source is to be used for all conductivity measurements. The measurement sequence is stated in 4.6.3.3. All measurements are taken in a single beaker and the same Teflon stirring bar is used (to reduce contamination errors). The beaker and stirring bar are rinsed a minimum of three times with distilled water between samples.

- a. Turn ON the conductivity meter, and let the meter warm up for a period of approximately five minutes.
- b. Place approximately 75 mL of distilled water in a clean, 100-mL Griffin beaker containing

MIL-E-82903(OS)

- a Teflon stirring bar.
- c. Position the beaker on the magnetic stirrer and agitate at medium speed.
- d. Position the conductivity cell in the beaker, insuring that the cell is completely immersed in the liquid and does not contact the stirring bar.
- e. Using the conductivity meter and decade capacitor, determine the conductivity of the distilled water as outlined in the conductivity meter instructions.
- f. Empty the distilled water from the beaker and replace with new distilled water. Repeat this process until the conductivity of the distilled water is constant.
- g. Weigh 0.75 ± 0.01 g of HNS directly onto the glazed weighing paper.
- h. Place this sample directly into the 100-mL Griffin beaker (after emptying the distilled water).
- i. Add 75 ± 1 mL of distilled water to the beaker containing the HNS sample.
- j. Place the beaker on the magnetic stirrer and agitate at high revolutions per minute until almost total wetting occurs. (In some cases, it may be necessary to use a glass stirring rod to break up sample aggregates.)
- k. Reduce the agitation to medium, position the conductivity cell in the beaker, and determine conductivity.
- l. Repeat steps g through k with the remaining HNS samples, insuring that the conductivity cell and beaker are rinsed a minimum of three times with distilled water between samples.
- m. When all HNS samples are analyzed, determine the conductivity of the one ppm NaCl solution.
- n. Calculation of the conductivity (in mhos) is as follows:

$$\text{Conductivity (mhos)} = \text{Cell constant} \times \text{Attenuation factor} \times \text{Instrument reading} \times 10^{-6}$$

Example: Instrument Reading = 1090 micromhos
 Cell factor = 0.1000
 Attenuation factor = 0.01

$$\text{Conductivity (mhos)} = 0.1000 \times 0.01 \times 1090 \text{ micromhos} \times 10^{-6} = 1.09 \times 10^{-6} \text{ mhos}$$

4.6.4 Insoluble particle analysis. The insoluble material content shall be determined on the HNS sample remaining in the tared, vitreous, 100-mL, tall form beaker from the surface moisture and volatiles content test of 4.6.2. About 25 mL of near boiling DMF shall be added to the HNS

MIL-E-82903(OS)

sample. The sample shall be stirred for about one minute and allowed to settle. The dissolved HNS/DMF solution shall then be poured into a tared, 30-mL, coarse, sintered glass filter and removed by suction. The solution/extraction techniques shall be repeated until the HNS sample has been quantitatively transferred from the beaker to the crucible and the filtrate from the crucible is colorless with no precipitates. The crucible shall be given a final washing with acetone and dried at $100 \pm 5^{\circ}\text{C}$ for one hour. The crucible shall be cooled to room temperature and weighed. The increase in weight of the crucible shall be reported as percent insoluble matter. The insoluble material content of the HNS explosive tested shall meet the requirements of table I.

4.6.5 Chemical analysis. The purity of HNS-IV shall be determined by the methods of 4.6.5.1 through 4.6.5.4. The purity of each specimen of HNS-IV explosive tested shall meet the requirements of table I.

4.6.5.1 Apparatus. A liquid chromatograph manufactured by Waters Associates, Milford, Massachusetts (Model ALC 202), equipped with a solvent delivery system (Model 6000A) and a 254-nanometer (nm) ultraviolet (UV) absorbance detector (Model 440), or any equivalent high performance liquid chromatography (HPLC) system with a suitable method to record the UV signals (e.g., 10-millivolt strip chart recorder), shall be used.

4.6.5.2 Materials. Analytical reverse-phase column (e.g., Whatman Partisil PXS10/25 ODS-2); methanol (HPLC grade); distilled water; dimethylsulfoxide (DMSO), reagent grade; phenolphthalein (Merck U.S.P. or equivalent) shall be used. A sample of HNBiB (DPE) as described in 6.7.2 shall be used as a reference material. A sample of HNS, >99% pure, shall be used as a reference material and shall meet the following requirements:

- a. Melting point - equal to or greater than 316°C .
- b. Vacuum stability test of 4.6.1.
- c. HPLC - no other peaks visible in the chromatogram with unit set at the highest sensitivity setting, as described in 4.6.5.4.

NOTE: The following description of instrument parameters and sample size is given for information only, since each instrument and column will require conditions specific to the instrument used.

CAUTION: When using the following conditions, HNS samples of greater than 1.2 mg in 10 mL of DMSO tend to overload the Whatman analytical reverse-phase column. Therefore, final HNS concentrations should be kept below 1.2 mg per 10 mL.

Depending on the size of the HNS crystals, heating the HNS-DMSO solutions on a steam bath may be necessary to obtain complete solution. Since HNS and some of the HNS impurities are subject to photolysis, solid, and solutions of HNS should be stored in the dark.

4.6.5.3 Conditions. Set range at appropriate sensitivity, mobile solvent phase at 70% methanol:30% distilled water, by volume, and isocratic solvent flow rate of 2.0 mL per minute.

MIL-E-82903(OS)

4.6.5.4 Procedure.

- a. The sample solutions shall be made by dissolving 10.0 mg of HNS, weighed to 0.1 mg, and 20 mg of phenolphthalein as the internal standard, in 10 mL of DMSO (see figure 3 - HPLC trace of HNS, internal standard and possible impurities).
- b. A 1.0-mL aliquot of the HNS stock solution shall be diluted to 10 mL with DMSO.
- c. A 25-microliter (μ L) sample of the diluted HNS solution shall then be injected into the HPLC with the flow rate set at 2.0 mL per minute, a 70% methanol and 30% distilled water solvent phase, and the recorder set at 0.5 cm per minute.
- d. To determine the percent of HNS impurities (e.g., HNBiB, etc.) in the sample, the HPLC UV detector shall be placed at the greatest sensitivity setting, 0.005 absorbance units full-scale (AUFS).
- e. To determine the percent HNS, sensitivity shall be set at an appropriate range setting (0.05 AUFS) to give a maximum absorption signal on the recorder.
- f. The percentage of HNS, HNBiB, and all other impurities will be calculated from the integration of their respective peak areas relative to the internal standard.
- g. A 25- μ L sample of the DMSO solvent shall also be chromatographed with the HPLC unit set at the greatest sensitivity to determine the position and area of any peaks which are due to the solvent alone.
- h. The calculations of the HNS and HNBiB are as follows:

(1) HNS Determination

$$A = \frac{\text{Area of HNS component in sample solution}}{\text{Area of internal standard in reference solution}}$$

$$B = \frac{\text{Area of internal standard in reference solution}}{\text{Area of known HNS in reference solution}}$$

$$C = \frac{\text{Weight of known HNS in reference solution}}{\text{Weight of internal standard in reference solution}}$$

$$D = \frac{(100)(\text{Weight of internal standard in sample solution})}{\text{Weight of sample}}$$

MIL-E-82903(OS)

$$A \times B \times C \times D = \text{--- \% of HNS}$$

(2) HNBiB Determination

$$A = \frac{\text{Area of HNBiB component in sample solution}}{\text{Area of internal standard in sample solution}}$$

$$B = \frac{\text{Area of internal standard in reference solution}}{\text{Area of known HNBiB in reference solution}}$$

$$C = \frac{\text{Weight of known HNBiB in reference solution}}{\text{Weight of internal standard in reference solution}}$$

$$D = \frac{(100)(\text{Weight of internal standard in sample solution})}{\text{Weight of sample}}$$

$$A \times B \times C \times D = \text{--- \% of HNBiB}$$

All other impurities shall be calculated in a like manner.

4.6.6 HNS-IV photolysis product analysis. The following (HPLC) procedure is used to determine the percentage of photolysis and decomposition products found on the surface of HNS-IV crystals.

4.6.6.1 Materials and equipment required.

- a. HPLC grade methanol.
- b. HNS-IV reference sample.
- c. Sonic cleaning bath.
- d. Any HPLC system equipped with a 254-nm UV absorbance detector and a suitable method to record the UV signals.
- e. Balance to weigh accurately to 0.1 mg.
- f. Small glass vials with caps (total volume approximately 10 mL).

MIL-E-82903(OS)**4.6.6.2 HNS-IV reference sample preparation.**

- a. Weigh approximately 1.0 g of HNS-IV into a 150-mL actinic glass container.
- b. To this sample, add 100 mL of methanol.
- c. Place the sample in a sonic bath for approximately one-half hour.
- d. After removing from the sonic bath, let the sample settle overnight.
- e. Pour off the methanol.
- f. Repeat steps b through e, three more times.
- g. Dry the HNS-IV sample until all the methanol is removed.
- h. Use this sample as the reference material.

4.6.6.3 HPLC conditions. Range setting at appropriate sensitivity, mobile solvent phase 70% methanol:30% distilled water by volume, isocratic solvent flow rate of 0.5 mL per minute.

4.6.6.4 Procedure.

- a. Accurately weigh 0.1 g of the HNS-IV to be analyzed into a glass vial.
- b. To this sample, accurately pipette in 5.0 mL of HPLC grade methanol.
- c. Place the sample vial in a sonic bath for approximately 15 minutes.
- d. After removing the sample from the bath, let the sample settle overnight (away from room light).
- e. Filter the sample through a fine porosity sintered glass filter.
- f. Inject 2 μ L of the methanol filtrate into the HPLC.
- g. Calculate the area under all the peaks in the sample.
- h. From this value, subtract the areas of the HNS and HNBiB peaks.
- g. Compare this final value to the value obtained from a reference HNS-IV sample which was tested in the same manner. The value obtained from the sample HNS-IV must be no greater than twice the value found for the reference HNS-IV.

4.6.7 DMF and HNS wash solvents used in HNS-IV preparation. The following GC procedure is for a chromatographic analysis of methanol, DMF, dioxane, and any other solvent used

MIL-E-82903(OS)

in the preparation of HNS-IV.

4.6.7.1 Material and equipment required.

- a. Dioxane, methanol, reagent grade DMF, and DMSO, or other suitable HNS solvent.
- b. Helium used as the carrier gas.
- c. Balance to weigh accurately to 0.1 mg.
- d. HP3396A integrator or equivalent.
- e. Column: 6' X 1/4", Chromosorb 103, or other suitable column.
- f. Chromatograph with flame ionization detector, or equivalent.
- g. A 10- μ L syringe.

4.6.7.2 Operation. The sequence of steps is not mandatory. Unless otherwise indicated, all numerical values may be considered as approximations only. Instrument settings may be deviated from as necessary to optimize output.

4.6.7.2.1 Methanol, DMF, and dioxane settings. The settings used for the methanol, DMF, and dioxane analysis are as follows:

Run time	20 minutes
Oven temperature	190°C
Detector temperature	220°C
Inlet temperature	200°C
Sample	1 μ L injection
Detector	FID
Gas flow rate	32 to 34 pounds per square inch (approximate)
Attenuation	2 X 10 ⁻¹
Chart speed	0.5 cm/minute

4.6.7.3 Methanol, dioxane, DMF, and solvent calibration reference preparation. Pipette 2 μ L of each solvent (methanol, dioxane, DMF, etc.) into the same 200-mL volumetric flask. Dilute to the mark with reagent grade DMSO. Use this solution as the methanol, dioxane, DMF, or other solvent calibration references to be injected into the chromatograph. See figure 4 for GC chromatogram of reference solution.

4.6.7.4 Sample preparation. Samples for methanol, dioxane, DMF, or other solvent analysis shall be prepared as follows:

- a. Weigh approximately 100 mg (weighed to the nearest 0.1 mg) HNS-IV sample into a 50-mL, volumetric flask.

MIL-E-82903(OS)

- b. Dilute to the mark with reagent grade DMSO.
- c. Shake until all the HNS-IV is in solution.

The specific limits for methanol, dioxane, and DMF can be found in table I.

4.6.7.5 Calibration and sample runs. Perform the calibration and sample runs as follows:

- a. Inject 2 μL of the calibration reference solution into the chromatograph.
- b. Use either the peak height or the integrator to calculate the concentration of each of the three components.
- c. Make additional injections until unit heights on consecutive runs repeat to the desired precision for each of the three components.
- d. Inject 1 μL of the HNS-IV sample solution into the chromatograph.

4.6.7.6 Calculations. The percentage of each component is calculated by the following equations:

- a. When using the integrator:

$$\% = \frac{\text{mg (from integrator)} \times 100}{\text{Sample weight (mg)}}$$

- b. When using peak height:

$$\frac{\text{mg (ref)}}{\text{ph (ref)}} = \frac{A}{\text{ph (sample)}}$$

where:

A = mg (from peak height)

$$\% = \frac{A \times 100}{\text{sample weight (mg)}}$$

4.6.8 Surface area analysis. The surface area of crystalline HNS-IV is measured using a single point procedure.

4.6.8.1 Materials and equipment required.

- a. Micromeritics Flowsorb II Model 2300 or equivalent surface area analyzer.
- b. Standard materials (appropriate reference sample).

MIL-E-82903(OS)

- c. Materials needed for proper operation of surface area unit, e.g., gases or gas mixtures and coolants.

4.6.8.2 Sample preparation. Samples shall be prepared in accordance with the procedure detailed in the instruction manual of the specific surface area unit used. The Micromeritics Flowsorb II Model 2300 surface area analyzer works best on samples having a surface area between 0.5 and 25 m².

4.6.8.3 Procedure. The operational and analysis procedures contained in the instruction manual of the surface area analyzer used shall be followed.

4.6.8.4 Calculations. The surface area shall be calculated in m²/g using the following formula:

$$m^2/g = \text{Meter reading (square meters)/sample weight in g}$$

The surface area shall be calculated in cm²/cm³ using the following formula:

$$cm^2/cm^3 = m^2/g \times 10,000 \times 1.74$$

where:

10,000 = Conversion factor

1.74 = Density of HNS

The surface area of each specimen of HNS explosive tested shall meet the minimum and maximum surface area requirement for the specific application.

4.6.9 Slapper test. This test involves the impact of a selected flyer on an HNS-IV sample. The variable is the flyer velocity. This test is not run on each of the samples required by 4.5.2 but rather on a composite sample. This sample shall be prepared by taking equal weights of HNS from each of the samples required by 4.5.2 and mixing them to form a homogenous composite sample of a minimum of 30 g. The test shall be performed in accordance with the test and calculations given in the appendix. The requirements for this test are detailed in 3.3.

4.7 Inspection of packaging. The packaging, packing, and marking shall be visually inspected for conformance to section 5.

5. PACKAGING

5.1 Packaging HNS-IV. HNS-IV shall be packaged in plastic, opaque bottles or jars containing approximately 25 g each of HNS-IV.

5.2 Packing. Packing shall be level A or B as specified in the contract or purchase order (see 6.2).

5.2.1 Level A. The HNS explosive shall be packed in wooden boxes in accordance with Code of Federal Regulations, 49 CFR 173 for high explosives with no liquid explosive ingredient nor any

MIL-E-82903(OS)

chlorate. Wooden boxes shall be lined with strong paper or cloth bags of capacity not exceeding 11.5 kg, packed with filling holes up. Gross weight of the wooden boxes shall not exceed 63.6 kg.

5.2.2 Level B. Level B packing shall be as specified in 5.2.2.1 or 5.2.2.2.

5.2.2.1 Drums. A maximum of 23 kg of HNS explosive shall be packed in a fiber drum complying with the requirements of 49 CFR 173. After the drum has been filled, the cap (cover) and the body (shell) seam shall be secured with tape complying with PPP-T-60. The tape shall be at least 2 inches wide.

5.2.2.2 Bottles or jars. Quantities of HNS explosive not exceeding 113.5 g may be shipped in securely closed opaque bottles or jars that are cushioned to prevent breakage. See 49 CFR 173 for details.

5.3 Marking.

5.3.1 Special markings. Containers shall be marked to ensure safe handling as required by Code of Federal Regulations, Interstate Commerce Commission Regulations for Transportation of Explosives and Other Dangerous Articles. Containers prepared for Level B packing shall be marked LTD MIL PK or MIN MIL PK, as applicable. When specified, exterior containers for overseas shipment shall be marked with Ordnance Corps symbol and the SM group of the item.

5.3.2 Standard markings. In addition to any special marking requirements of the contract or order (see 6.2), all markings shall be in accordance with 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. HNS explosives are intended for use in high temperature resistant explosive devices. HNS-IV is acceptable for use beyond the fuze train interrupter for explosive train design (MIL-STD-1316). HNS-IV is used in slapper detonators. When HNS-IV is ordered for any application, the contract shall specify the minimum and maximum surface area tolerance required for each application.

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).
- c. The organic solvent system to be used for the recrystallization along with the authority who must approve the system to be used (see 3.1).

MIL-E-82903(OS)

- d. If first article inspection is not required (see 3.2).
- e. Activity to perform inspections if other than as specified (see 4.1).
- f. The quantity of material in an inspection if other than as specified in 4.5.1.
- g. Level of packing required (see 5.2).
- h. Any special marking required (see 5.3.2).
- i. Safety precaution requirements (see 6.4 to 6.6).

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, standard production item from the contractor's current inventory (see 3.2), and the quantity 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 Explosives safety precautions. The safety precaution requirements of the "Contractor's 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" (OP 5) should be made applicable.

6.5 Toxicity. Table III contains toxicity information on materials, used in the reaction or the products from the reaction, which are suspected as human health hazards, and also identifies the Toxic Hazard Rating as given in Dangerous Properties of Industrial Materials, Fifth Edition, by N. Irving Sax.

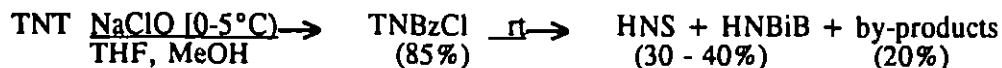
CAUTION: Precaution should be taken during the transfer of dry HNS. Half mask shall be worn to prevent inhaling the dust, and rubber gloves shall be used to prevent any material from being adsorbed into the skin by solvent action.

6.6 High temperature degradation. The presence of small quantities of impurities in the HNS explosive, brought about by synthesis, handling, and storage, can seriously degrade its high temperature stability characteristics.

MIL-E-82903(OS)

6.7 Process documentation.

6.7.1 The Shipp method of synthesis for HNS-I. The Shipp process for the synthesis of hexanitrostilbene (HNS) is defined by procedures consistent with the following reaction scheme:



where:

TNBzCl = stable intermediate (Trinitrobenzyl Chloride)

rt = room temperature

All percentages are approximations.

6.7.1.1 Materials. Trinitrotoluene (TNT), tetrahydrofuran (THF), methanol (MeOH), 5% aqueous sodium hypochlorite (NaClO), distilled water.

6.7.1.2 Procedure. Ten grams of TNT is added to a solution of 100 mL of THF and 50 mL of MeOH. This solution is then chilled to 0°C and added quickly, with thorough mixing, to 100 mL of NaClO, which has also been chilled to 0°C. The solution turns a bright cherry-red as the TNT solution is added. This color deepens to a dark red-brown during the one-minute reaction period. The temperature of the mixture is held between 12 to 15°C by chilling in an ice-salt bath. After approximately one minute, when the temperature begins to drop, the reaction mixture is removed from the ice-salt bath and allowed to stand at ambient temperature until the precipitation of a fine crystalline product (HNS) is complete (approximately 15 to 30 minutes at ambient temperature). The HNS product is filtered off, the resulting filter cake is washed with MeOH until the washings are colorless, and then dried in an oven at 100°C overnight.

6.7.1.3 HNS synthesis impurities. The characterization and analysis of the by-products (impurities) found in the Shipp HNS process are detailed in the Journal of Energetic Materials, Volume 1, pages 325-348 (1983).

6.7.2 Method of synthesis and recrystallization of HNBiB. The method of synthesis and recrystallization for HNBiB is given in the Journal of Organic Chemistry, Volume 31, page 857 (1966).

6.7.2.1 Materials. Materials used in the process are TNT, THF, MeOH, 5% NaClO, distilled water, sodium hydroxide (NaOH), acetone, and activated charcoal.

6.7.2.2 Procedure. A solution prepared by adding 35 mL of NaClO to 65 mL of water containing 0.5 g of NaOH is added drop-wise, with rapid stirring (during a 5 to 10 minute period), to a TNT solution containing 10 g of TNT in 50 mL of THF. The mixture turns dark red-brown. Formation of the crystalline product is heavy by the end of the NaClO addition. The mixture is allowed to stand for approximately 15 minutes and is filtered with suction. The filter cake is washed thoroughly with MeOH and dried. The material is recrystallized by dissolving in hot acetone with

MIL-E-82903(OS)

activated charcoal, filtering the hot solution, adding water to the cloud point, and chilling.

6.8 Light sensitivity. HNS-IV can undergo chemical changes with prolonged exposure to light. Only minimal light shall be used during manufacture and processing of HNS-IV. HNS-IV shall be stored in opaque containers or trays to reduce exposure to light.

6.9 Subject term (key word) listing.

Dimethylformamide (DMF)
Dipicrylethane (DPE)
Flyer assembly
Hexanitrobibenzyl (HNBiB)
Impact sensitivity
Slapper test
Vacuum stability

Preparing activity:
Navy - OS
(Project 1376-N481)

MIL-E-82903(OS)

TABLE III. Hazardous materials used in HNS processing.

Material	State	Fire Hazard ¹	Toxic Hazard Rating ¹
Acetone	Liquid	Dangerous when exposed to heat or flame.	MOD via oral, ip and inhalant routes; very low via dermal route. Some skin irritation resulting from defatting action.
Acetonitrile (Methyl Cyanide)	Liquid	Dangerous when exposed to heat, flame, or oxidizing agents. Emits toxic fumes of cyanides.	MOD via oral, ip, inhale, and dermal routes.
Methyl Alcohol	Liquid	Dangerous; will react vigorously with oxidizing materials.	Toxic when taken internally. Can be absorbed through skin.
Sodium Hypochlorite	Liquid	Anhydrous salt explosive. Violent reaction with amines. (Emits toxic chloride fumes when heated.)	Corrosive and irritant via ingestion and inhalant.
Tetrahydrofuran	Liquid	Dangerous; emits toxic fumes when heated to decomposition. (Can react with oxidizing materials.)	MOD via oral, ip, and inhalant routes reported as causing injury to liver and kidneys.
Toluene	Liquid	Slight, when exposed to heat, flame or oxidizers. When heated emits toxic fumes.	MOD via oral, inhalant and ip routes. Acute poisoning from exposure to high concentrate. Low via the dermal route.
Trinitrotoluene	Solid	Detonates under strong shock. (Burns quietly when unconfined.)	HIGH via skin contact route and MOD via oral and dermal routes. Has been implicated in aplastic anemia.
Chlorine Dioxide ²	Gas	Dangerous. Powerful oxidizer.	HIGH irritant via inhalant route.
Chloropicrin	Liquid	Dangerous when heated to decomposition, emits toxic fumes.	HIGH via oral, inhalant ocular routes. Caused lachrymation, vomiting, bronchitis, and pulmonary edema. Known carcinogen. ³

MIL-E-82903(OS)

TABLE III. Hazardous materials used in HNS processing - Continued.

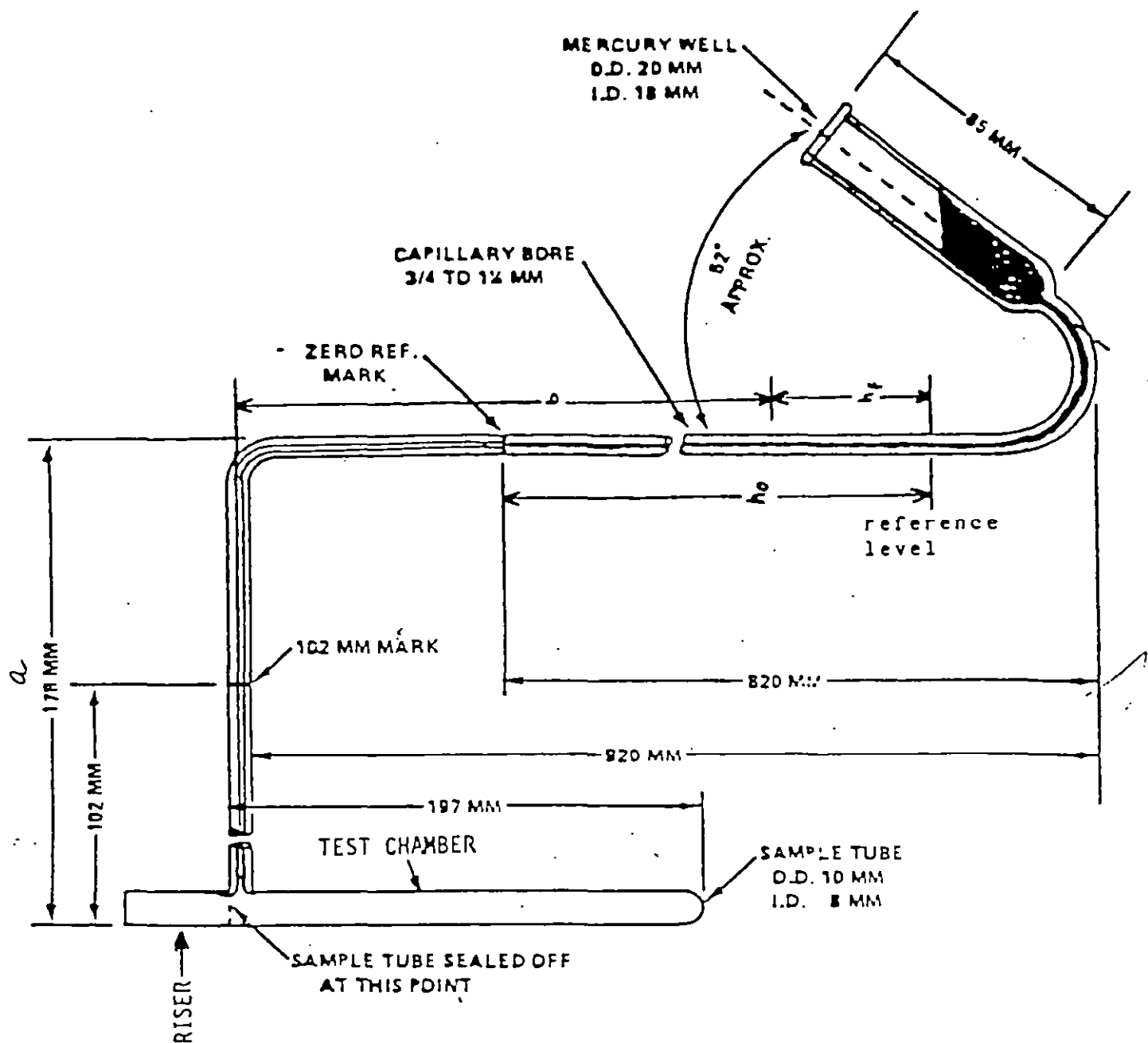
Material	State	Fire Hazard ¹	Toxic Hazard Rating ¹
Hexanitrostilbene containing Hexanitrobibenzyl	Solid	(Dangerous; will detonate on strong shock.)	Unknown; (Results of mutagenicity study by SRI - Positive bio activity of HNS in Ames test, HNS with no impurity.)
Hexanitrostilbene	Solid	(Dangerous; will detonate on strong shock.)	(Results of mutagenicity study by SRI - Positive bio activity of HNS in Ames test, HNS with no impurity.)
Methyl Nitrite	Gas	Dangerous when exposed to heat or flame. Emits highly toxic fumes of NO _x when heated.	HIGH via inhalant route. (Causes cyanosis, palpitation, and headaches.)
Tetranitromethane ²	Liquid	Severe when shocked or exposed to heat.	HIGH via inhalant route. Can cause pulmonary edema, and fatty degeneration of liver and kidneys.
Trinitrobenzene	Solid	Severe when shocked or exposed to heat.	MOD - HIGH via oral route.
Xylene o, m, p	Liquid	Dangerous when exposed to heat, flame, or oxidizing materials.	MOD via oral, inhalant, ip, and sc routes.
Dimethylformamide	Liquid	Dangerous when exposed to heat, flame, or oxidizing materials.	Vapors harmful, may be absorbed through skin. Highly irritating to skin, eyes, and mucous membranes.
Dioxane	Liquid	Dangerous when exposed to heat, flame, or oxidizing materials.	NCI carcinogenesis bioassay; results positive may cause CNS depression, necrosis of liver and kidneys; may be irritating to skin, lungs, and mucous membranes.

¹ The fire hazard and toxic hazard ratings and the abbreviations are taken from "Dangerous Properties of Industrial Materials," Fifth Edition, N. Irving Sax, 1979.

² Possible by-products of strong TNT/alkali chemical reactions.

³ Cancer causing substance.

MIL-E-82903(OS)

FIGURE 1. Loaded vacuum stability sample tube.

MIL-E-82903(OS)

Clear Lexane Shield

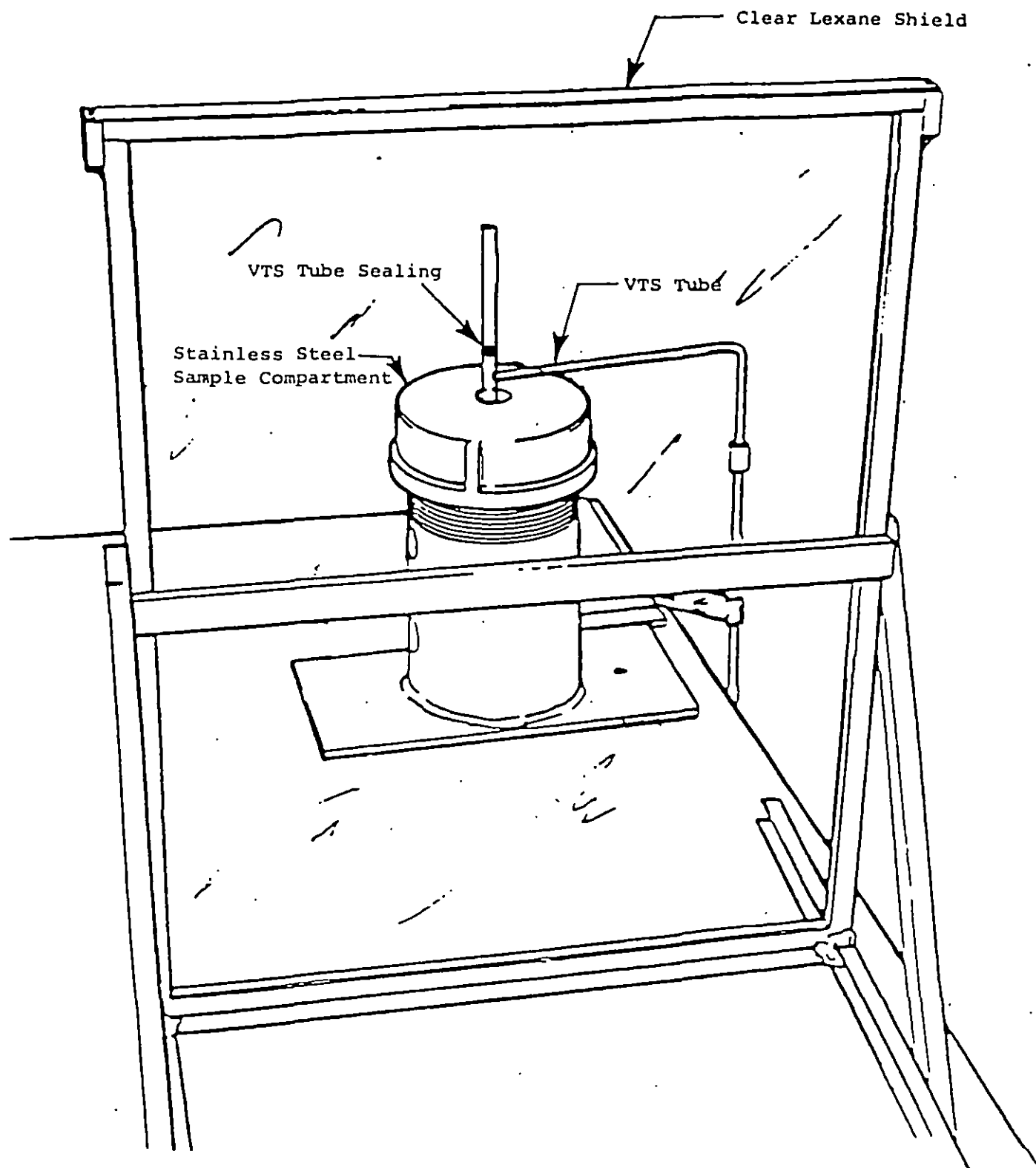


FIGURE 2. Hazard protection in vacuum thermal stability test.

MIL-E-82903(OS)

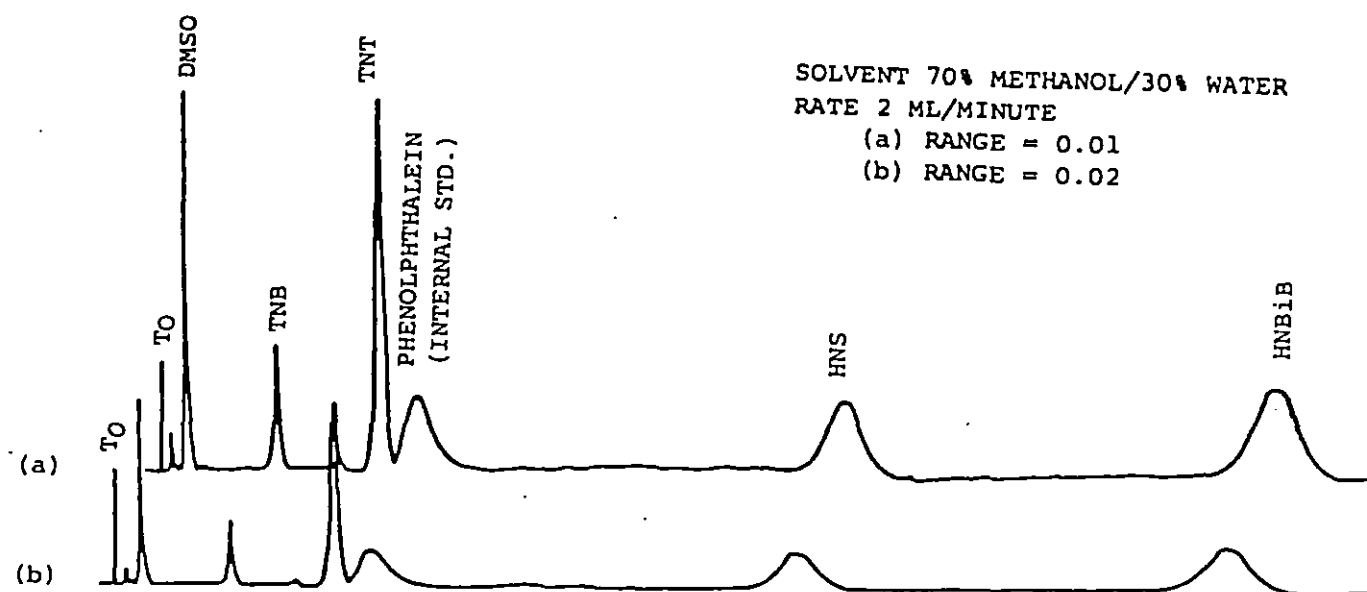


FIGURE 3. HPLC trace of HNS and possible impurities.

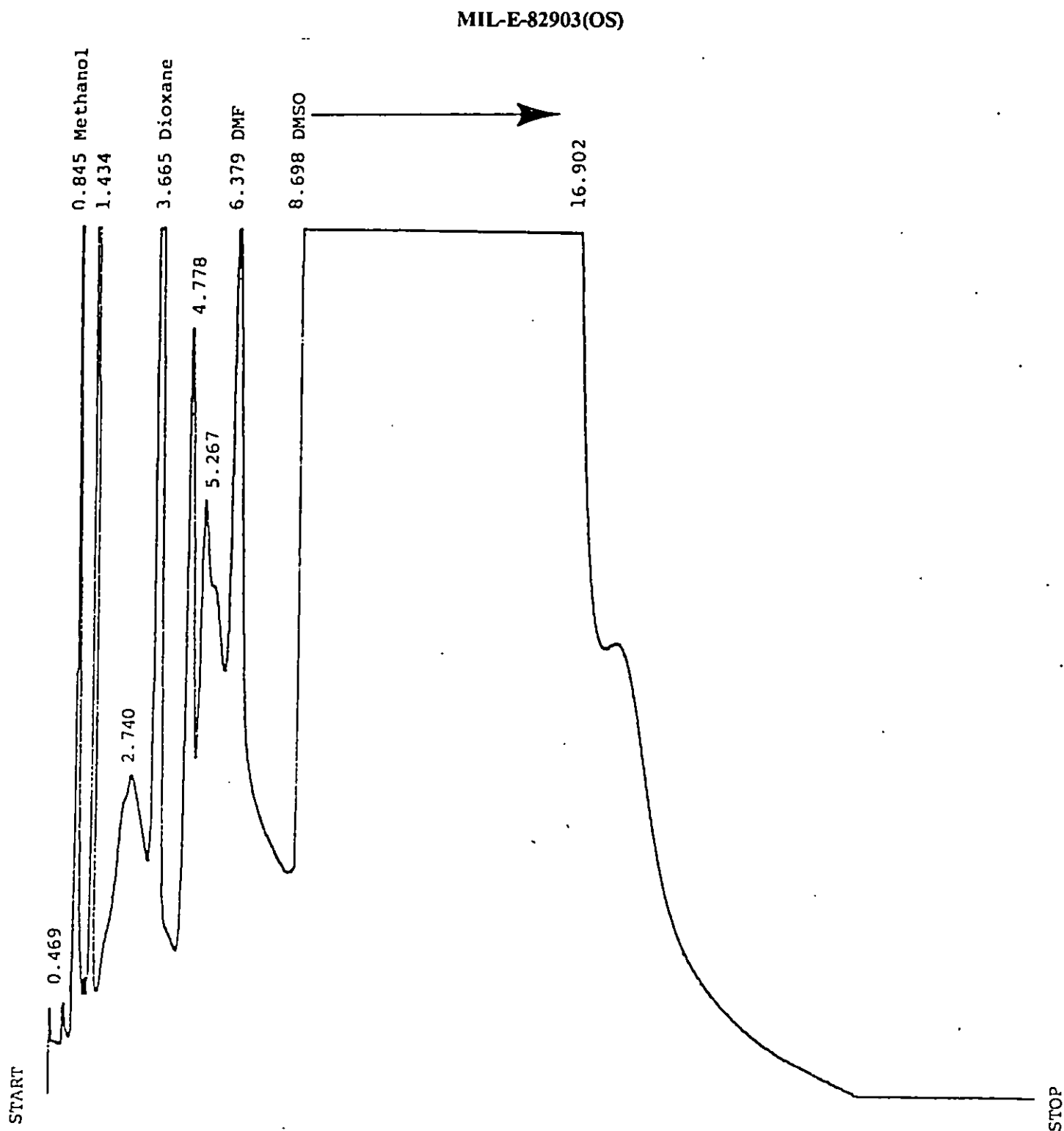


FIGURE 4. GC Chromatogram of reference solution containing methanol, dioxane and DMF.

MIL-E-82903(OS)**APPENDIX****SLAPPER TEST (HNS-IV)****10. SCOPE**

10.1 Scope. This appendix details the procedure for conducting the slapper Test. The slapper test shall be run with a standardized flyer device that propels a Kapton disc into the explosive surface. This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS**20.1 Government documents.**

20.1.1 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 DODISS and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS**FEDERAL**

L-P-504 Plastic Sheet and Film, Cellulose Acetate

STANDARDS**MILITARY**

MIL-STD-331 Fuze and Fuze Components, Environmental and Performance Tests for

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

30. SLAPPER TEST METHOD

30.1 General. The slapper test shall be run with a standardized flyer device that propels a Kapton (Type H or V only) disc into the explosive charge. The Kapton disc shall be 0.015 inch in diameter and 0.0009 ± 0.0001 inch thick, electroplated (Microclad) with a 0.165 ± 0.010 milliinch thickness of 1/8 ounce of copper. The thickness of the copper shall not vary by more than $\pm 6\%$. The diameter of the disc is formed by a 0.0150 ± 0.0005 inch diameter barrel. The pellet shall be pressed to a specified density (± 0.005 g/cm³) as calculated using the pellet measured volume and weight. The punch (high density end) of the pellet shall be marked. The marked end of the pellet shall be placed against a 0.125-inch-thick, 6061-aluminum witness plate. An acceptable go reaction

MIL-E-82903(OS)

shall produce a hole blown through the aluminum witness plate with the back surface spalled as a minimum. All other witness damage shall be considered a no-go.

30.2 Materials.

30.2.1 Flyer device. The copper/kapton material shall be Fortin Lamination Corp., (or equivalent) electroplated copper on Kapton (Microclad). The bridge configuration shall be 0.016 inch minimum wide and 0.016 inch minimum long. The thickness shall be a relative number from a beta backscatter instrument and measured at a position next to the bridge. The copper thickness shall not vary by more than $\pm 6\%$. The Kapton also shall not vary in thickness from a mean value by more than $\pm 6\%$. Only Type H or V Kapton may be used. Type HN or VN Kapton shall not be used.

30.2.2 Barrel. The sapphire barrel may be ordered from William Langer Jewel Bearing Plant, Rolla, North Dakota, and specified as sapphire ring jewel, straight hole ID 0.0150 ± 0.0005 inch diameter and thickness 0.015 ± 0.001 inch. The hole-to-flat-surface intersection shall be sharp. The OD shall be specified to the device requirements.

30.2.3 Isolator. Plastic shim stock with a thickness of 0.0050 ± 0.0002 inch shall be per L-P-504 or equivalent. A producer is Artus Corp., Englewood, New Jersey 07631. The isolator shall have a nominal 1/8-inch ID and an OD consistent with the flyer device.

30.2.4 Witness plate. The material shall be aluminum plate (6061) 1/8 inch thick. The plate shall be 3/4 by 3/4 inch minimum. Larger plates are acceptable.

30.2.5 Tamper stock. The tamper stock shall be polished glass having a thickness of $0.040 +0.015 -0.000$ inches.

30.2.6 Adhesive stock. The adhesive shall be dry film adhesive (0.001 or 0.002 inch).

30.3 Requirements for assembly of device components.

30.3.1 Gluing. The bridge element shall be glued to the tamper using dry film adhesive. The glue shall coat the copper bridge and glass tamper with no visible air bubbles present within 0.010 inch of the barrel bore location, and a continuous filling of adhesive 0.005 inch wide or greater around the bridge edges.

30.3.2 Stacking. The barrel, isolator, and flyer assembly in the slapper test shall stack to within 0.001 inch of their combined thickness.

30.3.3 Assembling. Assemble components per assembly cross-sectional view in figure 5.

30.4 Test series. A test series shall be 18 tests, minimum, using the Langlie one-shot method for establishing levels of tests for the complete series. The test data shall be statistically evaluated in accordance with the Langlie selection described in of MIL-STD-331, Test D2 to obtain the mean (50% threshold point) as related to flyer velocity. Standard deviations and probability limits at 0.05 confidence level shall be calculated.

MIL-E-82903(OS)

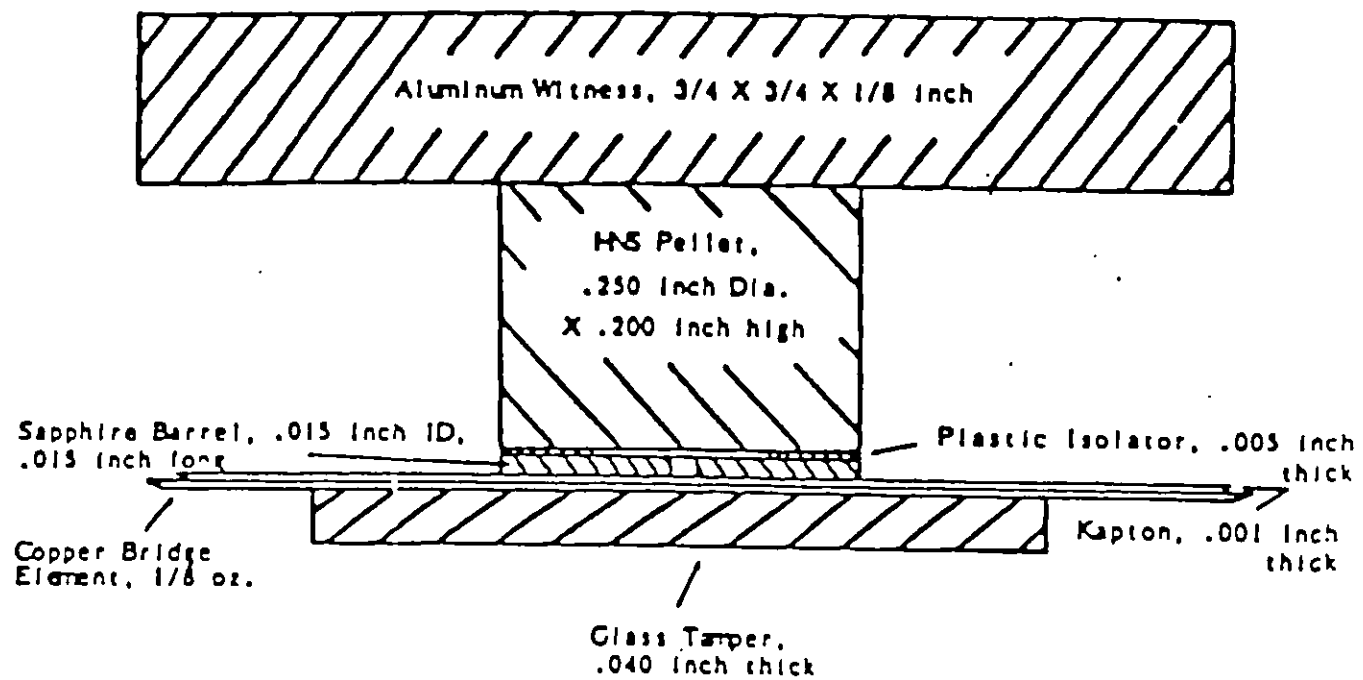


FIGURE 5. Slapper test assembly (cross-sectional view).

MIL-E-82903(OS)

30.5 Flyer calibration. The flyer device shall be calibrated using a velocity interferometer system for any reflector (VISAR) or Fabry-Perot velocity interferometer system. At least eight tests shall be conducted over the charge voltage range expected during sensitivity testing. A straight line fit to the data shall be calculated using linear regression. The linear equation ($V_g = K_1 + K_2 V_c$) will then be used to translate the charge voltage used in the test to a flyer velocity.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:		1. DOCUMENT NUMBER MIL-E-82903(OS)	2. DOCUMENT DATE (YYMMDD) 941230
3. DOCUMENT TITLE MILITARY SPECIFICATION EXPLOSIVE, HNS-IV			
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)			
5. REASON FOR RECOMMENDATION			
6. SUBMITTER			
a. NAME (Last, First, Middle Initial)		b. ORGANIZATION	
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY			
a. NAME COMMANDER, INDIAN HEAD DIVISION NAVAL SURFACE WARFARE CENTER		b. TELEPHONE (Include Area Code) (1) Commercial 301-743-4358/4510 (2) AUTOVON 354-4358/4510	
c. ADDRESS (Include Zip Code) 101 STRAUSS AVE., (CODE 8420) INDIAN HEAD, MD 20640-5035		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	