

INCH-POUND

MIL-DTL-248D
w/AMENDMENT 1
27 June 2007
SUPERSEDING
MIL-DTL-248D
14 May 2002

DETAIL SPECIFICATION

TRINITROTOLUENE (TNT)

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

1. SCOPE

1.1 Trinitrotoluene (TNT). TNT covered by this specification is a high explosive intended for use in ammunition (see 6.1).

1.2 Classification.. TNT shall be of the following types and forms as specified (see 6.1.1 and 6.1.2):

- Type I - Flake or Crystalline Form with a solidification point of 80.20°C min.
- Type II - Fine Crystalline Form with a solidification point of 80.40°C min.
- Type III - TNT which is recovered/reclaimed through means of an autoclave process, or equivalent technique, in which the TNT is heated to its melting point by means of non-contacting steam and allowed to free-flow from a TNT, Type I (solely)-containing munition item. Type III TNT is in either flake or crystalline form with a solidification point of 80.20°C min.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to: Commander, U.S. Army ARDEC, ATTN: AMSRD-AAR-QES-E, Picatinny, New Jersey 07806-5000 or e-mailed to pica-stdzn@pica.army.mil. Since contact information can change, you may want to verify the currency of this information using ASSIST Online database at <http://assist.daps.dla.mil>.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in solicitation or contract.

INTERNATIONAL STANDARDIZATION AGREEMENT

AOP -7 - Manual of Data Requirements and Tests for the Qualification of Explosive Materials for Military Use

FEDERAL STANDARDS

FED-STD-595 - Colors

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-650 - Explosives: Sampling, Inspection and Testing

MIL-STD-1168 - Ammunition Lot Numbering and Ammunition Data Card

MIL-STD-1916 - DOD Preferred Methods for Acceptance of Product.

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 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 of these documents are those cited in the solicitation (see 6.2).

U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER (ARDEC) DRAWINGS (See 6.4.5)

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

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

12972281 - Packing and Marking for Bag, Multiwall for Explosives

(Copies of other Government documents, drawings, and publications required by contractors in connection with specific acquisition functions should be obtained from U.S. Army TACOM-ARDEC, AMSTA-AR-QAW, Picatinny Arsenal, NJ 07806-5000.)

DEPARTMENT OF DEFENSE

TB 700-2 - Department of Defense Explosives Hazard
Classification Procedures

(Copies of the above document are available from Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building 1, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.)

2.3 Non-Government publications. The following documents form a part of this document to extent specified herein. Unless otherwise specified, the issues of these documents are those cited in solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM Designation E300 - Recommended Practice for Sampling Industrial
Chemicals

(Address application for copies to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 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. When specified in contract order (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Material. Trinitrotoluene (Type I, II and III) shall conform to the requirements of Table I when tested in accordance with applicable paragraphs of 4.4. Trinitrotoluene that has been reworked because of non-compliance with specification requirements shall be considered for acceptance.

TABLE I. Physical and chemical requirements for TNT

<u>Property</u>	<u>Requirement</u>		<u>Applicable Paragraph</u>
	Type I or Type III	Type II	
Form	Flake or Crystalline Form	Crystalline Form	4.4.1.1
Color	No darker than No. 30257	Light Yellow	4.4.1.2
Solidification Point, Degree centigrade (°C)	80.20 min	80.40 min	4.4.2
Moisture, percent	0.10 max	0.10 max	4.4.3
Acidity (as sulphuric acid), %	0.02 max	0.02 max	4.4.4
Alkalinity	None	None	4.4.5
Insoluble matter, percent	0.05 max	0.05 max	4.4.6
Sodium, percent	0.001 max	0.001 max	4.4.7

The following tests (explosive safety and performance) are for Type III (reclaimed TNT) only, flake or crystalline form:

ERL impact	Equivalent to virgin TNT (see note)	4.4.12
ABL friction sensitivity	Equivalent to virgin TNT (see note)	4.4.13
Vacuum thermal stability	Equivalent to virgin TNT (see note)	4.4.14
Large scale gap test	Equivalent to virgin TNT (see note)	4.4.15
Detonation velocity	Equivalent to virgin TNT (see note)	4.4.16

Note: Samples for reclaimed TNT shall be tested side-by-side with virgin TNT as control sample(s). The values obtained for the reclaimed TNT for these tests must be equivalent to test results from the control sample(s). Test data shall be evaluated by ARDEC.

3.3 Thickness of flake (applicable to Type I and Type III in flake form only). The average thickness of the flakes shall be not more than 0.025 inch and the thickness of any individual flake shall be not more than 0.04 inch, when determined as specified in 4.4.8 (see 6.6).

3.4 Granulation (applicable to crystalline form only). The TNT shall conform to the granulation requirements of Table II when determined in accordance with 4.4.9.

TABLE II. Granulation

Distribution	Percent by Weight, Min.	
	Types I & III	Type II
Through US Standard Sieve No. 14	95	100
Through US Standard Sieve No. 100	--	95

3.4.1 Flake/granule size for all Types. When screened in accordance with 4.4.11.1, TNT flakes/granules shall be 100% passing through a sieve with an opening that is equal to or smaller than a 3/8" square opening.

3.5 Workmanship. The material shall be processed in a manner that will produce the high quality material necessary to meet the requirements of this specification. The material shall be free of dirt, chips, and other foreign matter so that the safety and reliability of the explosive product are not compromised.

3.6 100% process screening (applicable to Type III only). The reclaimed TNT material shall be 100% inspected for ferrous and non-ferrous contaminants in accordance with 4.4.11.

4. VERIFICATION

4.1 Classification of Verification. The verification requirements specified herein are classified as follows:

- a. First Article Inspection (see 4.2)
- b. Conformance Inspection (see 4.3)

4.1.1 Verification conditions. Unless otherwise specified, all verifications shall be performed in accordance with the test conditions specified in section 4 of this specification.

4.2 First Article Inspection.

4.2.1 Submission.

4.2.1.1 For continuous process. Prior to initiation of sustained production and after the process has been completely debugged, the contractor shall contact the Contracting Officer (see 6.2) for first article testing in accordance with the provisions of 4.3.3.1. The testing shall apply only to TNT that has been produced by the contractor using the same production process, procedures, and equipment that will be used in fulfilling the contract. All materials, except packaging, shall be obtained from the same sources as will be used in regular production. The first article tests shall be witnessed by the Government representative as designated by the Contracting Officer. The first article testing shall also apply wherever a change occurs in the manufacturing process, material used, drawing, specification or source of supply as to significantly affect product uniformity as determined by the Government and whenever there is a lapse in production for a period in excess of 90 days. Prior to submission, the contractor shall inspect the sample to the degree necessary to assure that it conforms to the requirements of the contract and submit a record of this inspection with the sample.

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4.2.1.2 For batch process. Prior to initiation of sustained production, the contractor shall submit a first article sample as designated by the Contracting Officer (see 6.2) for evaluation in accordance with the provisions of 4.3.3.2. All samples submitted shall have been produced by the contractor using the same production processes, procedures, and equipment as will be used in fulfilling the contract. All materials, except packaging, shall be obtained from the same sources as will be used in regular production. The sample shall be accompanied by certificates of analysis. A first article quantity, or portion thereof, as directed by the Contracting Officer, shall also be submitted wherever there is a lapse in production for a period in excess of 90 days or wherever a change occurs in the manufacturing process, material used, drawing, specification or source of supply as to significantly affect product uniformity as determined by the Government. Prior to submission, the contractor shall inspect the sample to the degree necessary to assure that it conforms to the requirements of the contract and submit a record of this inspection with the sample.

4.2.2 Inspections to be performed. The sample shall be subjected by the Government to any or all of the examinations or tests specified in 4.3 and 4.4 of this specification and any or all requirements of the applicable drawings.

4.2.3 First Article Rejection. If any sample fails to comply with any of the applicable requirements, the first article quantity shall be rejected. The Government reserves the right to terminate inspection upon any failure of a sample to comply with any of the stated requirements.

4.3 Conformance Inspection.

4.3.1 Lot formation.

4.3.1.1 Lot formation for continuous process. A lot shall consist of TNT produced by one manufacturer in accordance with the same specification or same specification revision under one continuous set of operating conditions. Each interfix series shall consist of that quantity of TNT that has been subjected to the same chemical process intended to make the final product homogeneous. The product shall be submitted for inspection in accordance with MIL-STD-1916.

4.3.1.1.1 Lot interfix. The interfix series as described in MIL-STD-1168 shall be controlled in the following way. The interfix series shall be changed whenever there is a significant change in the raw materials, process or equipment. A significant change to the raw materials, process and equipment shall be jointly defined by the Contractor and Contracting Officer.

4.3.1.1.2 Serial lot. A lot shall consist of the maximum amount of TNT loaded from one loading dock in a 24-hour period, manufactured under a continuous set of conditions without a significant process interruption or change during the manufacture of the lot (each transportation unit used will be identified as a subplot). Each box shall be serially marked. A significant process interruption or change may be defined by the contracting officer.

4.3.1.2 Lot formation for batch process. The following shall apply to TNT produced by the Batch Process: The term "lot" as used throughout this specification, refers to an inspection lot which is defined as an essentially homogeneous collection of batches of product from which representative samples are drawn and inspected to determine conformance of the selected batches with applicable requirements. The sample selected shall represent only that batch from

which the sample was drawn and shall not be construed to represent any prior or subsequent batches presented for inspection. A lot shall consist of batches of TNT produced by one manufacturer in accordance with the same specification or same specification revision under one continuous set of operating conditions. The criteria and procedures for assignment of lot numbers shall be in accordance with MIL-STD-1168.

4.3.2 Examination.

a. Classification of characteristics. Unless otherwise specified, sampling inspection for quality conformance characteristics listed in the classification of characteristic paragraph shall be conducted in accordance with MIL-STD-1916 using attribute sampling plans in MIL-STD-1916 and the verification levels as specified in the classification of characteristics paragraphs. (See MIL-STD-1916 for definitions of critical, major and minor classification of characteristics.)

b. Alternative conformance inspection provisions. Unless otherwise specified herein or provided for in the contract, alternative conformance procedures, methods or equipment, such as statistical process control, tool control, variables sampling or other types of sampling plans, etc., may be used by the contractor when they provide, as a minimum, the level of verification required by the provisions herein. Prior to applying such alternative procedures, methods or equipment, the contractor shall describe them in a written proposal submitted to the Government for evaluation (see 6.7). When required, the contractor shall demonstrate that the effectiveness of each proposed alternative is equal to or better than the specified conformance inspection provision(s) herein. In case of dispute as to whether the contractor's proposed alternative(s) provides equivalent assurance, the provisions of this specification shall apply. All approved alternative conformance inspection provisions shall be specifically incorporated into the contractor's quality program or inspection system, as applicable.

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4.3.2.1 Classification of characteristics - Filled box prior to closing (see dwg. 7548644 and 7548645).

<u>Classification</u>	Examination/test	Conformance criteria	Requirement paragraph	Inspection method reference
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Critical: None defined

Major:

101.	Foreign matter	Level IV	3.5 & 5.1	Visual
102.	Bag liner pierced or torn.	Level IV	3.5 & 5.1	Visual
103.	Bag liner improperly closed	Level IV	3.5 & 5.1	Visual
104.	Plastic bag liner bottom seal	Level IV	3.5 & 5.1	Visual

Minor:

201.	Type of liner incorrect	Level II	3.5 & 5.1	Visual
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4.3.2.2 Classification of characteristics - Sealed Wooden Boxes (see dwg 7548644).

<u>Classification</u>	Examination/test	Conformance criteria	Requirement paragraph	Inspection method ref.
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Critical: None defined

Major:

101.	Top improperly assembled	Level IV	3.5 & 5.1	Visual/Manual
102.	Box damaged	Level IV	3.5 & 5.1	Visual
103.	Lot number misleading or unidentifiable	Level IV	3.5 & 5.1	Visual
104.	Strapping missing, broken or loose	Level IV	3.5 & 5.1	Visual/Manual
105.	Board broken or split	Level IV	3.5 & 5.1	Visual

Minor:

201.	Strapping improperly assembled	Level II	3.5 & 5.1	Visual/Manual
202.	Marking misleading or unidentifiable	Level II	3.5 & 5.1	Visual
203.	Nail protruding.	Level II	3.5 & 5.1	Visual

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4.3.2.3 Classification of characteristics - Fiberboard Box (see dwg 7548645).

<u>Classification</u>	Examination/test	Conformance criteria	Requirement paragraph	Inspection method ref.
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Critical: None defined

Major:

101.	Proper Grade of Fiberboard	Level IV	3.5 & 5.1	Visual
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Minor:

201.	Score lines missing or incorrectly applied	Level II	3.5 & 5.1	Visual
202.	Flaps improperly located	Level II	3.5 & 5.1	Visual
203.	Delamination of scoreline at edge more than one inch	Level II	3.5 & 5.1	Visual

4.3.2.4 Classification of characteristics - Sealed Multiwall Bag (see dwg 12972281).

<u>Classification</u>	Examination/test	Conformance criteria	Requirement paragraph	Inspection method ref.
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Critical: None defined

Major:

101.	Bag damaged or leaking	Level IV	3.5 & 5.1	Visual
102.	Valve opening not securely taped	Level IV	3.5 & 5.1	Visual
103.	Lot number incorrect or illegible	Level IV	3.5 & 5.1	Visual

Minor:

201.	Marking incorrect or illegible	Level II	3.5 & 5.1	Visual
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4.3.2.5 Classification of characteristics - Fiberboard box.

<u>Classification</u>	<u>Examination/test</u>	<u>Conformance criteria</u>	<u>Requirement paragraph</u>	<u>Inspection method ref..</u>
<u>Critical:</u> None Defined				
<u>Major:</u>				
101.	Tears longer than 1 inch along score lines if not at open edge	Level IV	Dwg. 7548645 (see 6.4.5a)	Gage
102.	Tears or cuts longer than ½ inch if at open edge.	Level IV	Dwg. 7548645	Gage
103.	Tears, cuts or holes which would expose bag liner to view.	Level IV	Dwg. 7548645	Visual
104.	Noticeable weakening from exposure to moisture or weather.	Level IV	Dwg. 7548645	Visual
105.	Contamination from explosive material, oil or grease on interior or exterior (8).	Level IV	Dwg. 7548644	Visual
106.	Defacing interfering with legibility of printed matter making further marking impracticable.	Level IV	3.5 & 5.1	Visual
107.	Failure of box joints	Level IV	3.5 & 5.1	Visual
108.	A slight amount of explosive dust on the interior may be permitted to the extent that it does not create a safety hazard or result in classification of empty boxes as dangerous material thus causing higher freight rates.	Level IV	3.5 & 5.1	Visual
109.	More than 50 percent failure of any glued joint	Level IV	3.5 & 5.1 (see 6.4.1.2.2)	4.4.10

Minor: None defined

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4.3.2.6 Classification of characteristics - Sealed Fiberboard Box (see dwgs. 7548645).

<u>Classification</u>	<u>Examination/test</u>	<u>Conformance criteria</u>	<u>Requirement paragraph</u>	<u>Inspection method ref..</u>
<u>Critical:</u> None defined				
<u>Major:</u>				
101.	Assembly torn or pierced	Level IV	3.5 & 5.1	Visual
102.	Liner pierced or torn	Level IV	3.5 & 5.1	Visual
103.	Liner improperly closed	Level IV	3.5 & 5.1	Visual
104.	Lot number misleading or unidentifiable	Level IV	3.5 & 5.1	Visual
105.	Strapping or banding strips missing, broken, or loose.	Level IV	3.5 & 5.1	Visual/manual
<u>Minor:</u>				
201.	Type of liner incorrect	Level II	3.5 & 5.1	Visual
202.	Marking misleading or unidentifiable	Level II	3.5 & 5.1	Visual
203.	Strapping or banding strips improperly assembled	Level II	3.5 & 5.1	Visual
204.	Flaps improperly closed (as applicable).	Level II	3.5 & 5.1	Visual

4.3.2.7 Classification of characteristics - TNT. (See 6.7 & 6.8)

<u>Classification</u>	<u>Examination/test</u>	<u>Conformance criteria</u>	<u>Requirement paragraph</u>	<u>Inspection method ref..</u>
<u>Critical:</u> None defined				
<u>Major:</u>				
101.	Form	4.3.3.1/4.3.3.2	3.2	4.4.1.1
102.	Color		3.2	4.4.1.2
103.	Solidification Point	4.3.3.1/4.3.3.2	3.2	4.4.2
104.	Moisture	4.3.3.1/4.3.3.2	3.2	4.4.3
105.	Acidity	4.3.3.1/4.3.3.2	3.2	4.4.4
106.	Alkalinity	4.3.3.1/4.3.3.2	3.2	4.4.5
107.	Insoluble matter	4.3.3.1/4.3.3.2	3.2	4.4.6
108.	Sodium	4.3.3.1/4.3.3.2	3.2	4.4.7
109.	Thickness of flake	4.3.3.1/4.3.3.2	3.3	4.4.8
110.	Granulation	4.3.3.1/4.3.3.2	3.4	4.4.9
111.	Flake size	100%	3.4.1	4.4.11.1

4.3.2.8 Classification of characteristics - Additional tests for reclaimed TNT (Type III)
(Note tests in 4.3.2.7 are also required for reclaimed TNT)

Classification	Examination	Conformance criteria	Requirement paragraph	Inspection method ref.
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Critical: None defined

Major:

101.	Impact sensitivity	4.3.3.3.3	3.2 (Table 1)	4.4.12
102.	Friction sensitivity	4.3.3.3.3	3.2 (Table 1)	4.4.13
103.	Vacuum thermal stability	4.3.3.3.3	3.2 (Table 1)	4.4.14
104.	Large scale gap test	4.3.3.3.3	3.2 (Table 1)	4.4.15
105.	Detonation velocity	4.3.3.3.3	3.2 (Table 1)	4.4.16
106.	Process screening	100%	3.5 & 3.6	4.4.11

4.3.3 Sampling/Testing. Representative sample(s) (as detailed below) shall be taken from each batch of TNT in accordance with ASTM E300 for solids. The product shall be submitted for inspection to determine compliance with all the requirements in section 3. Failure of a sample to comply with any of the requirements shall be considered a major defect and will result in rejection of the lot.

4.3.3.1 Continuous nitration process sampling.

4.3.3.1.1 Pre-production sampling. After the debugging process has been completed, samples shall be selected every hour for the first 8 hours production from each line and subjected to the test specified in 4.4. If any sample fails to comply with the test requirements, the production shall be rejected and the contractor shall go through the debugging process again to bring the product within specification.

4.3.3.1.2 Samples for regular production (lot acceptance). After the testing for the Pre-production has been completed, samples that represent a sub-lot (a transportation unit regardless of its size) shall be selected from each line and subjected to the solidification test specified in 4.4.2 and tests specified in 4.4.1 and 4.4.3 through 4.4.9. If any samples fail to comply with the test requirements, the sub-lot shall be rejected. The sub-lot data will be recorded on the lot acceptance sheet of each lot.

4.3.3.1.2.1 Normal Sampling. An individual sample, consisting of approximately 8 ounces shall be randomly selected from each four hours of production, from each line. These samples shall be subjected to all tests specified in Table I, paragraph 3.3 and paragraph 3.4. Each sample shall be analyzed separately (no composite sampling) and evaluated independently. If any sample fails to comply with any requirement, all material since the last acceptable material produced shall be sampled at approximately 20 box intervals. Normal sampling can be resumed after seven consecutive samples tested (1 sample/20 boxes interval) satisfy the previously failed requirement. All boxes preceding or succeeding a failed sample shall be removed and rejected.

4.3.3.2 Batch Process Sampling. For TNT produced by the batch process, two representative samples of approximately 8 ounces each shall be randomly selected from each

batch and independently subjected to the tests depicted in 4.4.1 and 4.4.3 through 4.4.9. In addition, the test depicted in 4.4.2 shall be performed on individual samples obtained from ten percent of the number of boxes in each batch. If any sample fails to meet any test requirement, the batch represented by the sample shall be rejected.

4.3.3.3 Sampling for Type III (reclaimed) TNT. Lot formation shall be in accordance with 4.3.1, lot formation. Sampling for those tests not specified by the following subparagraphs shall be in accordance with 4.3.3.1 or 4.3.3.2.

4.3.3.3.1 Flake thickness. 100 flakes shall be collected from each day's operation. Samples will be collected throughout the day with a minimum of 10 flakes collected from each hour's operation. These samples will be tested in accordance with 4.4.8.

4.3.3.3.2 Moisture content. TNT flakes shall be sampled and tested for moisture content thirty minutes after start-up of flaking operations and again thirty minutes prior to shut-down. Moisture tests shall be conducted in triplicate. If the flaking operation goes on longer than an 8 hour normal shift, additional sampling for moisture test shall be performed for each additional 4 hour interval of flaking operation.

4.3.3.3.3 Explosive safety and performance tests. One independent (composite) sample of appropriate size (approximately 20 lbs) shall be obtained from each week's TNT reclaimed operation for the ERL impact test, ABL friction sensitivity test, large scale gap test, vacuum thermal stability test, and detonation velocity test. Tests shall be conducted in accordance with 4.4.12 to 4.4.16 respectively. The sample should be composed of samples collected from a number of reclaimed TNT hold tank batches representing no more than 71,280 lbs TNT material. If test results for the sample indicate that the composite sample material is inferior to the standard TNT material (after confirmation tests), the TNT material represented by the sample shall be rejected.

4.3.4 Inspection equipment. For the performance of all tests and examinations specified in 4.3 and 4.4, commercial inspection equipment should be employed. The contractor shall have available, and utilize correctly this equipment, and is charged with the responsibility of insuring that proper calibration procedures are followed. Government approval of all inspection equipment is required prior to its use for acceptance purposes. (See 6.8).

4.4 Test Methods and Procedures (see 6.7). ACS recommended practice with respect to blanks, reagents, and standards shall be utilized to avoid degradation, contamination and change in concentration due to prolong storage of these chemical solutions.

4.4.1 Form and color.

4.4.1.1 Form. The form of the applicable type of TNT shall be determined by visual examination.

4.4.1.2 Color. The color of the applicable type of TNT shall be determined by visual examination. The color for Type I and Type III TNT shall be determined in accordance with FED-STD-595, Color Number 30257.

4.4.2 Determination of solidification point. The solidification point shall be determined in accordance with Method 210.1 of MIL-STD-650 except that a National Bureau of Standard Thermometer with a range of 79-82 degrees Centigrade shall be used. (See Figure 1).

4.4.3 Moisture. The moisture shall be determined in accordance with MIL-STD-650, Method 101.4.

4.4.4 Acidity. Transfer an accurately weighed portion of 10.0 grams of sample to 250 mL glass-stoppered iodine flask or equivalent. Add 40 ml methylene chloride from a graduated cylinder to the sample and also to an empty flask which will serve as a blank. Stopper the flask. Swirl the sample flask until dissolution is complete. Put 0.75 ml (approx. 20 drops) of bromothymol blue indicator in a 100 ml graduated cylinder and dilute to the mark with CO₂ - free distilled water. Stopper the flask containing the CO₂ - free water. Transfer the 100 ml of water containing the indicator to the blank flask and replace stopper. Repeat this procedure with the sample flask. Swirl both sample and blank flasks vigorously for 10-20 seconds to ensure interaction of methylene chloride and water layers.

NOTE: Too vigorous swirling or shaking must be avoided or an emulsion will be produced which may take hours to disperse.

Titrate the blank solution first. If the lower (aqueous) layer is blue, add a measured amount of 0.01 N H₂SO₄ dropwise until it turns green or yellow and add an equal amount to the sample. If the solution is green or yellow at the start, begin to titrate with 0.01 N NaOH. Add the NaOH dropwise, stoppering the flask after each addition and swirling vigorously for 5-10 seconds (see note above). The end point is taken as a blue color which persists for 2 minutes after the methylene chloride and water have separated into distinct layers and which persists after one additional 5-10 second swirling.

NOTE: The blue color may fade somewhat or acquire a trace of green coloring after the final swirl but this is acceptable.

The sample is now titrated in a manner similar to that of the blank titration. The end point is a persistent blue color as described in the blank determination but care must be taken to look through the aqueous layer horizontally against a white or colorless background since transmitted or reflected light from the yellow methylene chloride solution will cause a green coloration. In addition, incomplete separation of methylene chloride and water may result in a cloudiness which may also impart a slight green cast to the aqueous layer.

Experience with the method should allow a determination of the end point to within ± 0.05 ml NAOH.

$$\% \text{ Acidity (as H}_2\text{SO}_4) = \frac{4.9 (A-B) N}{W}$$

Where:

A = ml NaOH for sample

B = ml NaOH for blank

N = Normality of NaOH

W = Sample wt., grams

4.4.5 Alkalinity. The specimen shall be considered unsatisfactory with respect to alkalinity when B is greater than A in the calculations under "Acidity", para. 4.4.4.

4.4.6 Insoluble matter. The insoluble matter shall be determined in accordance with MIL-STD-650, Method 105.1 using methylene chloride as the solvent. Furthermore, the residue in the filtering crucible shall be dried in an oven at $100 \pm 5^\circ\text{C}$

4.4.7 Sodium.

4.4.7.1 Atomic absorption spectrophotometric methods for the determination of sodium.

4.4.7.1.1 Apparatus. Any satisfactory Flame (FAA) or Graphite Furnace Atomic Absorption (GFAA) Spectrophotometer

4.4.7.1.2 Reagents. Reagent Grade ACS sodium chloride and sodium-free distilled water shall be used. All references in this method to distilled water means sodium-free distilled water.

4.4.7.1.3 Preparation of sodium standard solutions.

4.4.7.1.3.1 Stock solution prepared from sodium chloride preparation. Accurately weigh 127 mg of reagent grade sodium chloride (or equivalent of other suitable sodium standard) to the nearest 0.1 mg on an analytical balance and transfer to a clean dry 1000 ml volumetric flask. Dissolve in sodium-free distilled water and make up to the mark. This solution contains approximately 50 parts per million of sodium. Calculate exact concentration.

$$W_{Na_{Sample}} = W_{NaCl} \times \frac{AW_{Na}}{MW_{NaCl}}$$

Where:

$W_{Na_{Sample}}$ = mg Na in Sample

W_{NaCl} = mg NaCl used

AW = Atomic Weight of Na (23)

MW = Molecular Weight of NaCl (58)

Initial ppm may be expressed as:

$$C_{Na_1} = \frac{W_{Na}}{V_{total}} \times 1000$$

4.4.7.1.3.2 Alternate stock solution. Prepare a 50 ppm sodium stock standard from a commercially available certified sodium standard.

4.4.7.1.3.3 Stock solution prepared from sodium chloride (for GFAA). Transfer a 10 ml aliquot of the Stock Solution from 4.4.7.1.3.1 or 4.4.7.1.3.2 (above) from the 1000 ml volumetric flask into another 1000 ml volumetric flask and dilute to the mark with sodium-free

distilled water. Final sodium concentration will be approximately 0.5 ppm sodium. Calculate exact concentration according to the following:

$$C_{Na_1} = \frac{V_{S \text{ tan dard}} \times C_{S \text{ tan dard}}}{V_{total}}$$

Where :

$C_{S \text{ tan dard}}$ = Concentration of Standard (ppm)

$$C_{Na_2} = \frac{VA_1}{1000} \times C_{Na_1}$$

Where :

VA_1 = Volume of Aliquot of Stock Solution from 4.4.7.1.3. 1 or 4.4.7.1.3.2

4.4.7.1.3.4 Standard sodium solutions for FAA. Only sodium-free distilled water shall be used in these solutions. Transfer 0.5 ml, 1.0 ml, 1.5 ml, and 2.0 ml (equivalently 500, 1000, 1500, 2000 μ l) aliquots of the stock solution from 4.4.7.1.3.1 or 4.4.7.1.3.2 into 100 ml volumetric flasks and dilute to volume with distilled water. These solutions will contain approximately 0.25, 0.50, 0.75, and 1.00 ppm sodium, respectively. The concentration of the standards may be adjusted to cover the ranges experienced in the test samples. Calculate the exact concentration according to the following:

$$C_{Na_f} = \frac{VA_1}{100} \times C_{Na_2}$$

Where :

VA_1 = Volume of Each Aliquot From 4.4.7.1.3.1 or 4.4.7.1.3. 2

4.4.7.1.3.5 Standard sodium solutions for GFAA. Only sodium-free distilled water shall be used in these solutions. Transfer 2 ml, 4 ml, 6 ml, and 8 ml aliquots of the stock solution from 4.4.7.1.3.3 into 100 ml volumetric flasks and dilute to volume with distilled water. These solutions will contain approximately 0.01, 0.02, 0.03, and 0.04 ppm sodium, respectively. The concentration of the standards may be adjusted to cover the ranges experienced in the test samples. Calculate the exact concentration according to the following:

$$C_{Na_f} = \frac{VA_2}{100} \times C_{Na_2}$$

Where:

VA_2 = Volume of Each Aliquot From 4.4.7.1.3.3

4.4.7.1.4 Adjustment of instrument for analysis of sodium. The instrument used shall be adjusted according to the manufacturer's prescribed settings. A nominal wavelength of 589 nanometers should be used for sodium.

4.4.7.1.5 Calibration of spectrophotometer. Zero the instrument with sodium-free distilled water. Measure absorbance of standards, and prepare a plot of absorbance versus exact concentration.

4.4.7.1.6 Preparation of glassware. Add sodium-free water to 50-ml glass test tubes and place the tubes in a hot-water bath. Heat until boiling. Remove the test tubes, and let cool. Run sodium analysis by AA. Note sodium concentration reading. Repeat the process until the sodium content is diminished to an acceptable level. When the level has stabilized, the tubes are ready for use.

4.4.7.1.7 Preparation of sample. Weigh 5 g TNT sample into test tube. Add 15-ml sodium free water. Place in hot water bath. Heat until TNT melts. Stir vigorously with plastic coated stir rod. Remove rod. Remove test tube from hot-water bath and place in cold-water bath. Prepare 50-ml plastic volumetric flasks with plastic funnel and pre-washed fast-flow filter paper. When TNT has solidified, filter water from test tubes into flasks. Add 3-ml sodium free water to test tubes. Return to hot-water bath and heat until TNT melts. Stir vigorously. Let cool until TNT solidifies. Decant water into volumetric flask. Fill volumetric flask to mark. Cap. Mix. Let solid settle out.

4.4.7.1.8 Analysis of sample by FAA. Run AA sodium flame test of the water extract according to instrument's manufacturers instructions. Determine the ppm sodium in the water extract from the calibration curve. (Note: If the sodium concentration of the water extract is less than 1 ppm, the linear limit for sodium, then the TNT passes. If not, it fails. A failed assay should be repeated. It could be due to contamination.) Calculate the sodium concentration in the TNT as follows:

$$\% \text{ sodium} = \frac{\text{ppm sodium in water extract}}{\text{TNT weight (g)} \times 200}$$

4.4.7.1.9 Analysis of sample by GFAA. Transfer a 10 ml aliquot of the sample from 4.4.7.1.7 into a 100 ml volumetric flask and dilute to the mark. Run AA sodium flame test of the water extract according to instrument's manufacturers instructions. Determine the sodium concentration (ppm) in the water extract from the calibration curve. Calculate the sodium concentration in the TNT as follows:

$$\% \text{ sodium} = \frac{\text{ppm sodium in water extract}}{\text{TNT weight (g)} \times 20}$$

4.4.8 Thickness of flake (applicable to Type I and Type III TNT only). The thickness of each of 100 flakes of TNT shall be measured by means of a micrometer accurate to at least 0.001 inch. The maximum thickness shall be noted and the average thickness calculated. (see 6.6).

4.4.9 Granulation. The granulation of the TNT shall be determined in accordance with Method 204.1 of MIL-STD-650.

4.4.10 Adhesion of glued carton joints. The glued carton shall be torn apart by lifting a corner of the glued flap and tearing it from the side wall. Examine the manner of separation of the joint and note the percentage of fiber failure. (see 6.4.1.2.2).

4.4.11 100% process screening.

4.4.11.1 All TNT Types. TNT of all Types shall be screened 100% through a sieve or screen which shall have an opening equal to or smaller than a 3/8" square opening.

4.4.11.2 Reclaimed TNT. Additionally, reclaimed TNT shall be screened/inspected 100% by using an acceptable method(s) such as metal detectors, magnets, electronic scanning, mechanical screening, etc. to remove contaminants/foreign matters. The screening/inspection system shall have the capability to detect and remove metallic (ferrous and nonferrous) contaminants with size as small as 0.5 mm. Equipment selection and calibration standards/procedures shall be submitted to ARDEC for approval. Industry accepted established procedures for operation of these equipment shall also be submitted to ARDEC for approval. (see 6.7).

4.4.12 ERL, Type 12, impact test. The ERL impact test shall be conducted in accordance with AOP-7, Method 201.01.001 with the use of noisemeter for detection of reactions made optional. The TNT samples shall be conditioned for 2 hours at 55 deg. C. The samples shall then be tested on an ERL, Type 12 impact tester. The height resulting in 50% probability of reaction for the TNT explosive is obtained in the test.

4.4.13 ABL friction sensitivity. The ABL friction sensitivity test shall be conducted in accordance with TB 700-2, Paragraph 5-4b.

4.4.14 Vacuum thermal stability. Vacuum thermal stability test shall be conducted in accordance with MIL-STD-286C, Method 403.1.3 (at 100 deg. C).

4.4.15 Large scale gap test. The large scale gap test shall be conducted in accordance with Army TB700-2. The TNT is cast-loaded into a steel cylinder tube of 1.5" diameter x 5.0" height. A detonator and Composition A-3 pellets (as booster) are used as donator. The card gap shall be obtained for the 50% probability of detonation point. A detonation is defined by a clean cut hole in the witness plate.

4.4.16 Detonation velocity. The detonation velocity test is to be conducted using the ARDEC test equipment and procedure. A 5" diameter acrylic tube filled with TNT sample shall be used. Fiber optic wires are to be inserted into five holes distributed throughout the length of the tube. A witness plate is placed under the bottom of the tube. When detonated, the explosion propagates from the top to the bottom. A digital scope is used to measure the time of arrival of the detonating wave from each of the five positions via the fiber optic wires. The detonation velocity is calculated from the distance and time relation. Test result must be confirmed by retest(s). A minimum of one additional test that generates collaborating data will be required.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DOD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity. (See 6.4)

6. NOTES

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

6.1 Intended use.

6.1.1 Type I and Type III. Type I and Type III TNT are intended for use in loading of shells and bombs and in the manufacture of demolition blocks and explosive mixtures.

6.1.2 Type II. Type II TNT is intended for use in primer mixtures and in special compositions that require either high purity TNT or fine crystalline form.

6.2 Acquisition requirements. Procurement documents should 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.
- c. Acceptance and description sheets shall be prepared for each lot in accordance with MIL-STD-1171.
- d. Provisions for submission of first article samples.
- e. Type and form of the trinitrotoluene.
- f. Levels of preservation and packing.
- g. Item hazard classification.
- h. Requirements for submission of inspection equipment design(s).

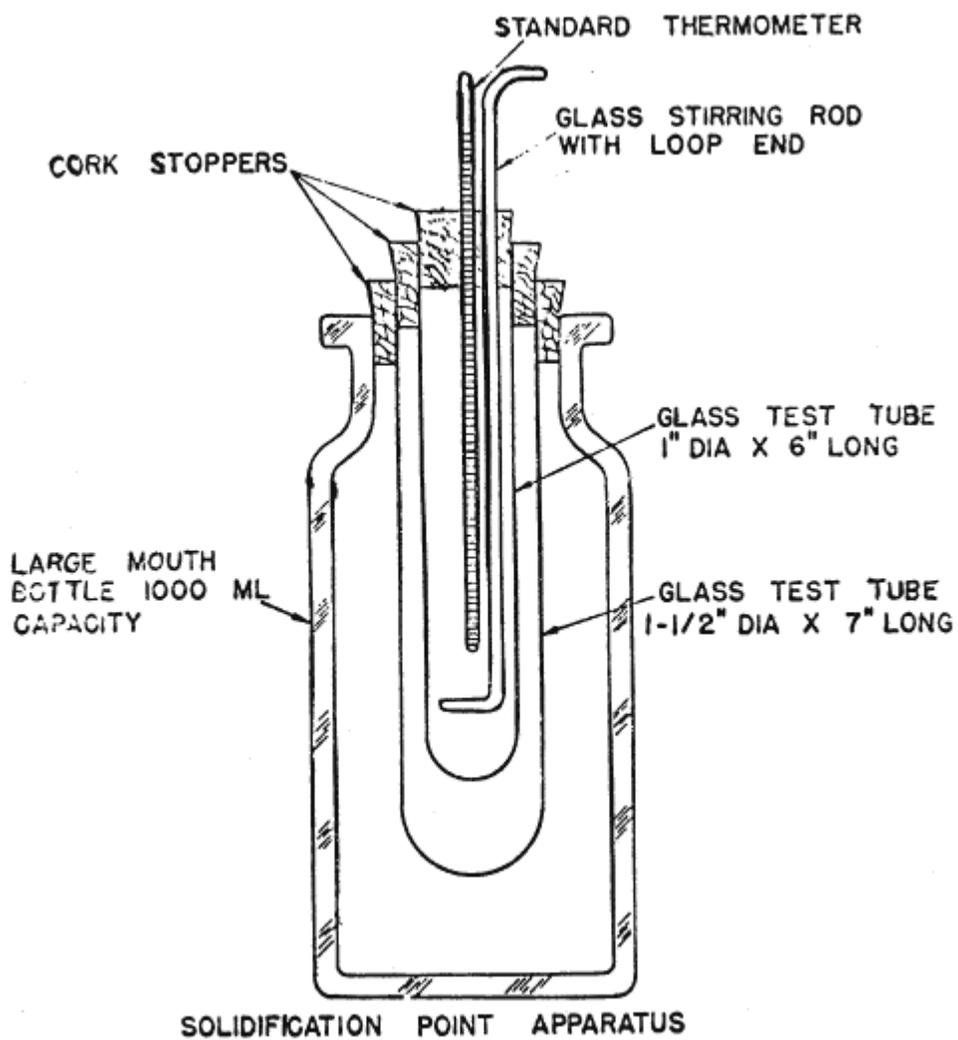


FIGURE 1. Solidification Point Apparatus

6.3 Consideration of data requirements. When this specification is used in a procurement contract, which incorporates DD Form 1423, contract data requirements list, acceptance and description sheets (for explosives) are required for each lot. These sheets should be prepared and submitted by the contractor in accordance with MIL-STD-1171 or otherwise as directed by the contract. In reporting the density/sensitivity test results, all individual sample densities and sensitivities should be included. In addition, the following data requirements should be considered when this specification is applied on a contract, per the Contract Data Requirements List, DD Form 1423:

Reference	DID Number	DID Title
6.4.3	DI-PACK-81059	POP Test Report

6.4 Acceptable packaging requirements. The following packing and marking requirements have been used for packaging TNT, and are found to be acceptable to the Government. These requirements should be included in the contract or order for the procurement of TNT because TNT is a hazardous energetic material. (Caution: If the following paragraphs are to be incorporated in a contract, they must be modified, using standard contract language, to make them compulsory requirements.)

6.4.1 Preservation and packaging.

6.4.1.1 Packing Level A. The trinitrotoluene (TNT) shall be packed in accordance with Dwg. 7548644.

6.4.1.2 Packing Level B. The trinitrotoluene (TNT) shall be packed in accordance with Dwg. 7548645 or Dwg. 12972281.

6.4.1.2.1 Fiberboard Carton, Dwg. 7548645. When assembling the body or cover, the flap edges shall not be more than 1/8 inch above or below the edge of the part. Delamination of the fiberboard which may occur where diagonal scores meet the edge of the part will be acceptable, provided the width of the delamination does not exceed one inch.

6.4.1.2.2 Adhesion of glued carton joints. Each glued joint shall meet the requirements for fiber failure as given on Dwg. 7548645 when determined as specified in 4.4.10.

6.4.2 Marking. The marking shall be in accordance with Dwg. 7548644, Dwg. 7548645 and Dwg. 12972281.

6.4.3 Performance oriented packaging (POP). The exterior packs cited above should meet all of the POP test requirements in accordance with the Code of Federal Regulations, Title 49 (49 CFR), including testing, and retesting as specified in paragraph 178.601 (e) of 49 CFR. A POP test report should be generated in accordance with DI-PACK-81059 following the tests. POP testing may be waived if an acceptable non-government analogy can be made IAW 49 CFR to another pack which has successfully completed the testing. This analogy must also be documented IAW DI-PACK-81059. When completed, either the contractor generated POP test or non-government analogy must be kept on file by the contractor and must also be submitted to

the U.S. Army Research Development and Engineering Center, ATTN: AMSTA-AR-WEP, Picatinny Arsenal, NJ 07806-5000. (NOTE: If a POP test report is prepared against an acceptable analogy; the analogous POP test report must also be submitted to AMSTA-AR-WEP). The POP marking symbol applied to the exterior pack should be that belonging to the organization which conducted the POP testing.

6.4.4 Item hazard classification. All U.S. manufacturers should make certain that the item is tested in accordance with Part 173, Subpart C, Section 173.58 (a) of 49 CFR, Parts 106-180 to assign proper Class and Division for all explosives (Division 1.1, 1.2, 1.3 and 1.4 Explosives). Registration with the Associate Administrator of Hazardous Materials Safety is required in accordance with Part 173, subpart C, Section 173.56 (b) (1) or 173.56 (c) of 49 CFR so that proper markings in accordance with Part 172, Subpart D, Section 172.301 (a) and 172.320 (a) are met.

All foreign manufacturers should make certain that the dangerous goods are tested in accordance with United Nations Committee of Experts on the Transportation of Dangerous Goods (as published in UN Document ST/SG/AC.10.11 latest revision, Recommendations for the Transport of Dangerous Goods - Tests and Criteria) to determine the proper class and division (Class 1-9 and Division 1.1 -1.6 for explosives). Registration for air and vessel transport is required with each manufacturing country's National Competent Authority which is issued in accordance with part 2, paragraph 1.3 of the International Civil Aviation Organization (ICAO) technical instructions which approves the hazard classification and compatibility group assignment and assigns the appropriate shipping name to the dangerous goods. The proper packaging, marking and labeling is contained in the United Nations Committee of Experts on the Transport of Dangerous Goods (as published in UN Document ST/SG/AC.10.1, latest revision, recommendations on the Transport of Dangerous Goods).

For air transport the dangerous goods must comply with the provisions of the International Air Transport Associate (IATA) Dangerous Goods Regulations and for vessel transport, the dangerous goods must comply with the provisions of the Intergovernment Maritime Organization's International Maritime Dangerous Goods (IMDG) Code.

6.4.5 Referenced documents for packaging. The following list of documents referenced in 6.4 should be included in the contract or purchase order as requirement documents. Document users are cautioned that they must meet all requirements of these documents if cited in the contract or purchase order.

a. Government documents, drawings and publications. Unless otherwise specified, the issues of documents are those cited in the solicitation.

DRAWINGS

U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER (ARDEC)

7548644	-	Box, Packing for High Explosives; Assembly Details, Packing and Marking
7548645	-	Carton, Packing, Reusable-Collapsible for High Explosives; Assembly, Details

12972281 - Packing and Marking
Packing and Marking for Bag, Multiwall
for Explosives

(Copies of other Government documents, drawings, and publications required by contractors in connection with specific acquisition functions should be obtained from the US Army TACOM-ARDEC, AMSTA-QAW-E, Picatinny Arsenal, NJ 07806-5000.).

b. CODE OF FEDERAL REGULATIONS

49 CFR 100-199 - Department of Transportation Rules
and Regulations for the Transportation
of Explosives and other Dangerous
Articles

(The Interstate Commerce Commission Regulations are now a part of the Code of Federal Regulations, available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Orders for the above publication should cite, "49 CFR 100-199 (latest revision)".)

6.5 International standardization agreement. Certain provisions, Section 3 and 4.4, of this specification are subject to international standardization agreement of STANAG 4025 and ABC-ARMY-STD-118. When an amendment, revision, or cancellation of this specification is proposed, the departmental custodians will inform their respective Departmental Standardization Offices so that appropriate action may be taken with respect to the international agreement concerned.

6.6 Flake thickness. This test is applicable to the Process evaluation testing and the first ten lots of production. After the process is under control, as evidenced by the first ten lots meeting the flake thickness requirement, testing for this requirement will be discontinued.

6.7 Equivalent test method. Prior approval of the Contracting Officer is required for use of equivalent test methods. A description of the proposed method should be submitted thru the Contracting Officer to: Commander, TACOM-ARDEC, ATTN: AMSTA-AR-QAT-P, Picatinny Arsenal, N.J., 07806-5000, and ATTN: AMSTA-AR-WEP-R, Rock Island, Illinois, 61299. This description should include but not be limited to the procedures used, the accuracy and precision of the method, test data to demonstrate the accuracy and precision and drawings of any special equipment required.

6.8 Submission of inspection equipment designs for approval. Submit inspection equipment design(s) for approval through the procurement contracting officer to: Commander, TACOM-ARDEC, ATTN: AMSTA-AR-QAT-P, Picatinny Arsenal, NJ 07806-5000.

6.9 Subject term (key word) listing.

Bomb fill explosive
Demolition explosive material
Explosive material
Melt-pour explosive

6.10 Change from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in anyway supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto,

Custodians:
Army-AR
Navy-OS
Air Force -70

Preparing Activities:
Army-AR

(Project 1376-2007-004)

Review Activities:
Navy-AS, NP
GSA-FSS

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil>