

MIL-T-13405E  
 23 February 1984  
 SUPERSEDING  
 MIL-T-13405D(EA)  
 25 July 1977

MILITARY SPECIFICATION  
 TITANIUM, TECHNICAL: POWDER

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

1. SCOPE

1.1 Scope. This specification covers two types of titanium powder.

1.2 Classification. Titanium powder shall be of the following types as specified (see 6.2):

- Type I - For use in pyrotechnic mixtures
- Type II - For use in M36 Bomb Clusters

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

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: Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Armament Research and Development Center, US Army Armament, Munitions and Chemical Command, ATTN: DRSMC-TSC-S(A), Aberdeen Proving Ground, MD 21010 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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FSC 6810

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## SPECIFICATIONS

## FEDERAL

- NN-P-71 - Pallets, Material Handling, Wood, Stringer Construction,  
2-Way and 4-Way (Partial)
- PPP-P-704 - Pails, Metal: (Shipping, Steel, 1 Through 12 Gallons)

## MILITARY

- MIL-B-117 - Bags, Sleeves and Tubing - Interior Packaging

## STANDARDS

## MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by  
Attributes
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-147 - Palletized Unit Loads
- MIL-STD-1168 - Ammunition Lot Numbering
- MIL-STD-1233 - Procedures for Determining Particle Size, Particle  
Size Distribution, and Packed Density of Powdered  
Materials

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein.

## CODE OF FEDERAL REGULATIONS (CFR)

- 49 CFR 171 to 179 - Department of Transportation Hazardous Materials  
Regulations

(The Code of Federal Regulations is available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Orders for the above publication should cite "49 CFR 171 to 179.")

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

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

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UNIFORM FREIGHT CLASSIFICATION RULES

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

NATIONAL MOTOR FREIGHT CLASSIFICATION RULES

(Application for copies should be addressed to the American Trucking Associations, Inc., Traffic Department, 1616 P Street, NW, Washington, DC 20036.)

ASTM STANDARDS

- D1193 - Reagent Water
- E11 - Wire-Cloth Sieves For Testing Purposes

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

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

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Type I titanium powder.

3.1.1 Assay. Type I titanium powder shall contain no less than 94.0 percent by weight titanium when tested as specified in 4.2.4.1.

3.1.2 Burning time. Type I titanium powder shall burn completely in no less than 40 or more than 180 seconds when tested as specified in 4.2.4.2.

3.1.3 Particle size. No less than 95 percent by weight of the type I titanium powder shall pass through a 75-micrometer sieve when tested as specified in 4.2.4.3.

3.2 Type II titanium powder.

3.2.1 Assay. Type II titanium powder shall contain no less than 96.5 percent by weight titanium when tested as specified in 4.2.4.1.

3.2.2 Burning time. Type II titanium powder shall burn completely in no less than 90 or more than 220 seconds when tested as specified in 4.2.4.2.

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3.2.3 Particle size. No less than 95 percent by weight of the type II titanium powder shall pass through a 75-micrometer sieve when tested as specified in 4.2.4.3.

3.2.4 Mean surface diameter. Type II titanium powder shall have a mean surface diameter of no less than 5 or more than 12 micrometers when tested as specified in 4.2.4.4.

#### 4. QUALITY ASSURANCE PROVISIONS

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

#### 4.2 Quality conformance inspection.

4.2.1 Lotting. A lot shall consist of the titanium powder of one type, produced by one manufacturer, at one plant, from the same materials, and under essentially the same manufacturing conditions provided the operation is continuous. In the event the process is a batch operation, each batch shall constitute a lot (see 6.3). When specified (see 6.2), lot numbering shall be in accordance with MIL-STD-1168.

#### 4.2.2 Sampling.

4.2.2.1 For examination of packaging. Sampling shall be conducted in accordance with MIL-STD-105.

4.2.2.2 For test. See 6.8 for sampling and testing precautions. Three containers shall be randomly selected from each lot. A representative specimen of approximately 450 (g) shall be removed from each sample container and placed in a clean, dry container labeled to identify the lot and container from which it was taken.

#### 4.2.3 Inspection procedure.

4.2.3.1 For examination of packaging. The sample unit shall be one filled unit container. Sample unit containers shall be examined for the following defects using an AQL of 2.5 percent defective:

- (a) Contents per container not as specified
- (b) Container not as specified
- (c) Container closure not as specified
- (d) Container damaged or leaking

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- (e) Bag liner missing or not as specified
- (f) Bag liner not securely closed
- (g) Marking incorrect, missing, or illegible

4.2.3.2 For test. The three specimens taken in 4.2.2.2 shall be individually tested as specified in 4.2.4. Failure of any test by any individual specimen shall be cause for rejection of the lot represented.

4.2.4 Tests. See 6.8 for sampling and testing precautions. Water in accordance with ASTM D1193 and reagent grade chemicals shall be used throughout the tests. Where applicable, blank determinations shall be run and corrections applied where significant. Tests shall be conducted as follows:

4.2.4.1 Assay. Weigh 0.2000 to 0.2200 g of specimen which has been previously dried at  $104^{\circ} \pm 2^{\circ}\text{C}$  into a 250-milliliter (mL) beaker. Treat with 1 to 3 sulfuric acid and simmer until all traces of hydrogen evolution are gone and the solution is clear and free of all solids. Maintain the volume at approximately 100 mL. Wash out a Jones reductor (see 6.5) with 50 mL of 1 to 19 sulfuric acid at a uniform rate requiring 5 to 10 minutes for passage. Leave sufficient solution in the reductor to cover the zinc. Collect the washings in a 1-liter (L) flask containing 100 mL of ferric ammonium sulfate solution (345 g of ferric ammonium sulfate dodecahydrate diluted to 1 L with 2N sulfuric acid). These washings should require no more than 1 or 2 drops of 0.1N potassium permanganate solution to obtain a pink color. Follow this by adding the specimen solution at a uniform rate requiring 10 minutes for passage. Take care to keep the tip of the reductor below the surface of the liquid in the flask to prevent oxidation of the titanium. Wash with 100 mL of 1 to 19 sulfuric acid. Follow with 100 mL of water. Make sure that the reductor is always filled with solution or water to the upper level of the zinc. Titrate the contents of the flask with standardized 0.1N potassium permanganate solution (see 6.6) to the appearance of a light pink color that persists for 30 seconds. A few milliliters before the end point, add 5 mL of o-phosphoric acid to improve end point detection. Calculate the percent by weight titanium as follows:

$$\text{Percent titanium} = \frac{4.79AB}{W}$$

where: A = Milliliters of standardized potassium permanganate solution used,  
 B = Normality of the standardized potassium permanganate solution, and  
 C = Weight of specimen in grams.

4.2.4.2 Burning time. Dry the specimen to constant weight at  $104^{\circ} \pm 2^{\circ}\text{C}$ . Place sufficient dried specimen in a kraft paper laminated tube, closed on one end, 10 inches long,  $0.328 \pm 0.006$  inch inside diameter, and  $0.440 \pm 0.008$  inch outside diameter (see 6.7). Fill the tube completely but do not consolidate the powder. Record the weight of the specimen. Lay the filled tube horizontally on an earthen or ceramic surface and insert approximately 2 inches of a 10-inch length of quick-match into the open end of the tube. Ignite the

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quick-match and record as burning time the period from the ignition of the specimen to the appearance of the characteristic white glow at the opposite end of the tube.

4.2.4.3 Particle size. Weigh a 75-micrometer sieve conforming to ASTM E11 and a bottom pan. Place the sieve on the bottom pan. Weigh to the nearest 0.1 g approximately 100 g of the specimen into a tared beaker, transfer onto the sieve, and cover the assembly. Shake for 3 minutes by means of a mechanical shaker geared to produce  $300 \pm 10$  taps of the striker per minute. Weigh the specimen retained and passed by the sieve and calculate the percent by weight of specimen which passed through the sieve.

4.2.4.4 Mean surface diameter (type II only). Determine the mean surface diameter of the specimen in accordance with method 100 of MIL-STD-1233.

## 5. PACKAGING

5.1 Unit packing. Titanium powder shall be unit packed level A, B or C as specified (see 6.2).

5.1.1 Level A. A quantity of 50 (+1 or -0) pounds (1b) of titanium powder, furnished as 20 percent by weight titanium powder in a water slurry, shall be unit packed in accordance with Department of Transportation (DOT) regulations in a nominal 5-gallon capacity removable-head steel pail furnished with an electrostatic-free bag liner. The bag liner shall conform to type I, class A, style 1 or 2 of MIL-B-117. The bag liner shall be closed by tying or knotting. The pail shall conform to type II, class 10 of PPP-P-704, and shall be closed as specified in PPP-P-704.

5.1.2 Level B. Titanium powder shall be unit packed level B in the same manner as for level A above, except that the pail shall merely conform to DOT Specification 37A.

5.1.3 Level C. A quantity of 50 (+1 or -0) lb of titanium powder, furnished as 20 percent by weight titanium powder in a water slurry, shall be unit packed in a pail in accordance with DOT regulations.

5.2 Packing. Titanium powder, unit packed as specified in 5.1 above, shall require no further protection for shipment other than unitization.

5.3 Unitization. Uniform quantities of packs of titanium powder shall be unitized per pallet. Level A or B packs of titanium powder shall be palletized in accordance with the applicable requirements for load type III of MIL-STD-147, using the softwood pallet conforming to type IV of NN-P-71. The grade B preserved pallet shall be used for level A protected packs. Level C packs shall be unitized in a manner to protect the contents, assure carrier acceptance, conformance to DOT regulations and be in accordance with Uniform Freight Classification Rules, National Motor Freight Classification Rules, and the rules applicable to any other intended mode of transportation.

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5.4 Marking. Unit packs, packs and unitized loads shall be marked in accordance with DOT regulations and MIL-STD-129, and shall as a minimum show the lot or batch number and date of manufacture of the titanium powder.

## 6. NOTES

6.1 Intended use. Titanium powder is intended for use in pyrotechnic mixtures and in M36 Bomb Clusters.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification,
- (b) Type of titanium powder required (see 1.2),
- (c) If lot numbering in accordance with MIL-STD-1168 is required (see 4.2.1), and
- (d) Level of unit packing required (see 5.1).

6.3 Batch. A batch is defined as that quantity of material which has been manufactured by some unit chemical process or subjected to some physical mixing operation intended to make the final product substantially uniform.

6.4 Significant places. For the purpose of determining conformance with this specification, an observed or calculated value should be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding-off method of ASTM E29.

6.5 Jones reductor. Directions for preparing a Jones reductor may be found in The Chemical Analysis of Iron, A. A. Blair, eighth edition, pages 88 and 89; Analytical Chemistry, Treadwell and Hall, Volume 2, fifth edition; Scott's Standard Methods of Chemical Analysis, sixth edition, volume 1, page 1102; and Applied Inorganic Analysis, Hillebrand, Lundell, Bright, and Hoffman, second edition, page 108.

6.6 Standardization of solutions of potassium permanganate. Directions for preparing standard solutions of potassium permanganate may be found in Applied Inorganic Analysis, Hillebrand, Lundell, Bright, and Hoffman, second edition, page 185.

6.7 Kraft paper tubes. A suggested source for the kraft paper laminated tube used for the burning time test is the Ajax Paper Tube Company, 2210 W. Superior Viaduct, Cleveland, OH 44113.

6.8 Sampling and testing precautions. This specification covers the handling and testing of titanium powder, which is an explosion and fire hazard when exposed to heat, flame, or sparks or by chemical reaction. All applicable safety rules should be followed when testing with this chemical material.

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Custodian:

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Preparing activity:

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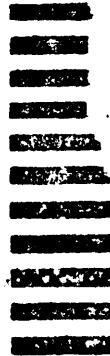
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<b>3a. NAME OF SUBMITTING ORGANIZATION</b>	<b>4. TYPE OF ORGANIZATION (Mark one)</b> <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____
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