

MIL-Z-21353 (NOrd)

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Superseding

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## MILITARY SPECIFICATION

### ZIRCONIUM HYDRIDE

#### 1. SCOPE

1.1 Scope. This specification covers powdered zirconium hydride for use in military pyrotechnics.

1.2 Classification. This specification covers one grade and one class of zirconium hydride.

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids, form a part of this specification:

#### SPECIFICATIONS

##### Federal

PPP-D-760

Drums and Pails, Metal (5 and 16.64)

PPP-B-601

Boxes, Wood, Cleated Plywood

PPP-B-621

Boxes, Wood, Nailed and Lock-Corner

#### STANDARDS

##### Military

MIL-STD-129

Marking for Shipment and Storage

MIL-STD-707

Air Permeability Fineness

FSC 1375

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2.2 Other publications. The following document forms a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

CODE OF FEDERAL REGULATIONS

49 CFR 71-78

Interstate Commerce Commission  
Rules and Regulations for the  
Transportation of Explosive 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, Government Printing Office, Washington 25, D.C. Orders for the above publications should cite '49 CFR 71-78' latest edition and supplements thereto.)

3. REQUIREMENTS

3.1 Material. Zirconium hydride furnished under this specification shall be a material which has been tested and has passed the tests in section 4.

3.2 Chemical requirements. Zirconium hydride shall conform to the applicable chemical requirements specified in Table I.

TABLE I

CHEMICAL REQUIREMENTS

Property	Percent Minimum	Percent Maximum
Zirconium plus Hafnium	95.5	
Hydrogen	1.85	2.10

3.3 Physical requirements. The average particle diameter of zirconium hydride shall be less than 10 microns.

4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified herein the supplier is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any

commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.2 Lot. A lot shall consist of the material produced by one manufacturer in not more than 24 consecutive hours under essentially the same manufacturing conditions and with no change in materials, providing the operation is continuous. In the event the process is a batch operation, each batch shall constitute a lot. (See 6.2)

4.3 Sampling. A representative 1/4 pound specimen shall be removed from each of five representative containers taken from the lot by the Government inspector. If there are fewer than five containers in the lot, a specimen shall be removed from each container. Each specimen shall be placed in a separate, clean, dry container sealed and labeled to identify the specimen with the lot and container represented. Each specimen shall be tested separately as specified in 4.4 and 4.5.

#### 4.4 Chemical tests

4.4.1 Determination of zirconium-hafnium content. Transfer an accurately weighed portion of approximately 0.2 gm of the dried sample to a 100 ml tall form beaker, and add 5 ml of concentrated sulfuric acid. Add dropwise, 5 ml of a dilute hydrofluoric acid solution, prepared by adding 1 ml of hydrofluoric acid (47 percent) to 19 ml water. Heat the beaker and contents on a hot plate until fumes of sulfur trioxide are copiously evolved. Allow to cool, wash down sides of beaker with distilled water and transfer the contents of the beaker to a 600 ml beaker. Dilute to 250 ml with water and heat to boiling. Make the solution distinctly alkaline with concentrated ammonium hydroxide using methyl red as an indicator. Allow the precipitate to settle, and decant the solution through a filter paper using a No. 40 Whatman or equivalent filter paper rejecting the filtrate. Add 200 ml of hot water to the precipitate in the beaker, stir, and allow to settle. Decant the solution, using the same filter paper. Transfer the precipitate to the filter paper and wash several times with hot water. Transfer the paper and precipitate to a previously tared and ignited porcelain crucible. Burn off the paper cautiously to avoid loss of zirconium oxide. Caution should be exercised to prevent the mechanical loss of the light and fluffy zirconium oxide. Cool in a desiccator and weigh. Calculate the total

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zirconium content as follows:

$$\text{Percent of zirconium-hafnium} = \frac{74.03A}{W}$$

Where:

A - gm of residue

W - gm of sample

4.4.2 Determination of hydrogen. Weigh out approximately 0.5 gm of previously dried zirconium hydride into a combustion boat and place in a combustion train through which dry oxygen can be passed. Heat the tube by placing it in an electrically heated combustion furnace, gradually bringing the temperature to a dull red heat. The water evolved from the oxidation of the zirconium hydride is collected in a tared tube containing a magnesium perchlorate water absorbent. After all the moisture is swept into the absorbent, weigh the tube to obtain the water absorbed. Calculate the percentage of hydrogen as follows:

$$\text{Percent of hydrogen} = \frac{\text{Wt. of water absorbed} \times 11.12}{\text{Sample Weight}}$$

#### 4.5 Physical tests

4.5.1 Determination of average particle diameter. Determine the average particle diameter according to Standard MIL-STD-707.

#### 4.6 Acceptance criteria

4.6.1 Chemical requirements. A lot shall be accepted for the chemical requirements of paragraph 3.2 provided that all samples meet the requirements. A lot shall be rejected if one or more samples fail to meet the chemical requirements.

4.6.2 Physical requirements. A lot shall be accepted for the average particle diameter requirements of paragraph 3.3 provided that all samples meet the requirements. A lot shall be rejected if one or more samples fail to meet the physical requirements.

4.7 Resubmission and retest. The contractor shall have the option of having a partial or complete analysis made on samples from each batch in a lot, at no expense to the Government, if

the contractor elects to resubmit a rejected lot, the contractor shall remove the defective portions of a lot and present it as a resubmitted lot. On a resubmitted lot, samples shall be taken as specified in 4.5. The resubmitted lot shall be accepted provided that all samples pass the tests required by this specification. If one or more samples fail to comply with the requirements of this specification, the lot shall be rejected and may not be offered for resubmission again.

## 5. PREPARATION FOR DELIVERY

### 5.1 Preservation and packaging.

5.1.1 Level A. In addition to the following, packaging shall be in accordance with the Code of Federal Regulations '49 CFR 71-78' for Sodium Hydride.

5.1.1.1 Cleaning, drying, preservative application. Not applicable.

5.1.1.2 Unit packaging. Twenty-five (25) lbs of zirconium hydride shall be packaged in an hermetically sealed drum type, 37A or 37B in accordance with the Code of Federal Regulations '49 CFR 71-78' and Specification PPP-D-760, Type II Class 1 or 2 sealed as required for sodium hydride in '49 CFR 71-78'.

5.1.1.3 Intermediate package. Not applicable

5.1.1.4 Cushioning. The pack shall incorporate sufficient cushioning material, bracing, or other adequate shock absorber devices, to ensure that the hermetic seal and container will not rupture. At the time of packaging or packing, the moisture content of the cushioning material shall be no more than 5%. The pH range of the material shall be between 6.0 and 8.0.

5.1.2 Level B. Not applicable

5.1.3 Level C

5.1.3.1 Cleaning, drying and preservative application. Not applicable.

5.1.3.2 Unit packaging. Unit packaging shall be in accordance with the Code of Federal Regulations for Sodium Hydride.

5.1.3.3 Intermediate package. Not applicable

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## 5.2 Packing

5.2.1 Level A. In addition to the following, packing shall be in accordance with the Code of Federal Regulations '49 CFR 71-78', for Sodium Hydride.

5.2.1.1 Exterior containers. Four (4) drums packaged as described in 5.1.1.2, shall be packed in an overseas type wood box in accordance with Specification PPP-B-601 or PPP-B-621.

5.2.2 Level B. In addition to the following, packing shall be in accordance with the Code of Federal Regulations '49 CFR 71-78' for Sodium Hydride.

5.2.2.1 Exterior containers. Four (4) drums packaged as described in 5.1.1.2, shall be packed in a domestic type wood box in accordance with Specification PPP-B-601 or PPP-B-621.

5.2.3 Level C. Zirconium hydride, packaged in accordance with 5.1.3.2 shall be packed to afford protection against damage during direct shipment from the supply source to the first receiving activity for immediate use. Containers shall comply with Uniform Freight Classification Rules or other common carrier regulations applicable to the mode of transportation and with the Code of Federal Regulations '49 CFR 71-78' (for sodium hydride).

## 5.3 Marking

5.3.1 Special markings. All containers shall be marked as follows:

"CAUTION: REACTS EXPLOSIVELY WITH WATER".

5.3.2 Normal markings. In addition to the markings required by contract or order, unit packages, intermediate packages (when used), and shipping containers shall be marked in accordance with the requirements of MIL-STD-129 and of the Code of Federal Regulations '49 CFR 71-78' (for sodium hydride).

## 6. NOTES

6.1 Intended use. The zirconium hydride covered by this specification is intended for use in the manufacture of pyrotechnic compositions.

6.2 Batch. A batch is defined as that quantity of material which has been subjected to some unit chemical process or

physical mixing process intended to make the final product substantially uniform.

6.3 Ordering data. Procurement documents should specify the following:

- a. Title, symbol and date of this specification.
- b. Quantity required.
- c. Packaging and packing required.

6.3.1 Criteria for use of proper level of preservation, packaging and packing shall be as follows:

For Level A. This level shall be used for those items which are to be shipped to indeterminate destinations or stored under indeterminate conditions for redistribution anywhere.

For Level B. This level shall be used only when it is definitely known that the item will be held in covered storage in overseas locations for 6 months or less or in domestic locations for an indefinite period.

For Level C. This level shall be used only when it is definitely known that the packaged item is to be shipped to domestic installations for immediate use at the first receiving activity.

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 U. S. Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way 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.



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