

METRIC

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6 July 1998
SUPERSEDING
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DETAIL SPECIFICATION

ALUMINUM POWDER, FLAKED, GRAINED, AND ATOMIZED

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

1. SCOPE

1.1 Scope. This specification covers aluminum powder for use in pyrotechnics, incendiaries, propellants, and explosives.

1.2 Classification. The aluminum powder types, grades, and classes will be as follows (see 6.2):

Type I - Flaked
Grade A, class 1
Grade B, class 2
Grade B, class 3

Beneficial comments (recommendations, additions, deletions) and any other data which may be of use in improving this document should be addressed to: Defense Supply Center Richmond (DSCR), ATTN: DSCR-VBD, 8000 Jefferson Davis Highway, Richmond, VA 23297-5610 by using Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 6810

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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Type II - Grained or atomized

Grade C, class 4

Grade D, class 5

Grade E, class 6

Type III - Atomized

Grade F, class 6

Grade F, class 7

Grade F, class 8

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 cited 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 specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following standard forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of this document is in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

STANDARD

DEPARTMENT OF DEFENSE

MIL-STD-1233 - Procedures for determining particle size, particle size distribution,
and packed density of powdered material

(Unless otherwise indicated, copies of the above standard are available 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 document forms a part of this document to the extent specified herein.

DODISS

Department of Defense Index of Specifications and Standards

(Copies of the DODISS are available on a yearly subscription basis either from the Superintendent of Documents, U. S. Government Printing Office, North Capitol & "H" Streets,

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N. W., Washington, DC 20402-0002 or the DODSSP Subscription Services, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM B 214 - Sieve Analysis of Granular Metal Powders (DOD Adopted)
- ASTM B 329 - Apparent Density of Metal Powders Using the Scott Volumeter (DOD Adopted)
- ASTM B 417 - Apparent Density of Non-Free-Flowing Metal Powders
- ASTM D 480 - Sampling and Testing of Aluminum Powders and Pastes (DOD Adopted)
- ASTM E 11 - Wire-Cloth Sieves for Testing Purposes (DOD Adopted)
- ASTM E 34 - Chemical Analysis of Aluminum and Aluminum Base Alloys (DOD Adopted)

(Application for ASTM publications should be addressed 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 Material. Aluminum powder shall be manufactured from aluminum metal of such purity that the product meets the requirements of table I.

TABLE I. Chemical characteristics.

Chemical requirement	Type (percent by weight)		
	Type I	Type II	Type III
Aluminum Al, min.	99	99	99
Iron Fe, max.		0.25	0.25
Silicon Si, max.		0.15	0.15
Other Metals Each, max.		0.05	0.05
Other Metals Total, max.		0.15	0.15
Nonvolatile Content, min.	99		

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3.2 Form.

3.2.1 Type I. Type I aluminum powder shall be in the form of irregular flat flakes when examined as specified in 4.4.2.1.

3.2.2 Type II and III. Types II and III aluminum powder shall be in the form of spheroidal particles when examined as specified in 4.4.2.1.

3.3 Particle size distribution. Types I, II, and III aluminum powder shall conform to the requirements of table II.

TABLE II. Particle size distribution.

Classes	Sieve Sizes	Percent retained	Percent pass	Density (Gram/cubic centimeter)
Class 1	45 μ m (325 mesh)	0.1 max.		0.30 max.
Class 2	45 μ m (325 mesh)	6.0 max.		No determination
Class 3	45 μ m (325 mesh)	20 max.		0.50 max.
Class 4	150 μ m (100 mesh) 75 μ m (200 mesh)	3.0 max.	80 - 97	0.90 min.
Class 5	1.7mm (12 mesh) 600 μ m (30 mesh)	0	74 - 87	0.90 min.
Class 6	150 μ m (100 mesh) 45 μ m (325 mesh)	0 - 0.2 max.	75 - 85	0.95 to 1.20
Class 7	425 μ m (40 mesh) 45 μ m (325 mesh)	0 - 0.2 max.	25 - 50	0.95 min.
Class 8	1.7mm (12 mesh) 45 μ m (325 mesh)	0 - 0.5 max.	35	0.95 min.

NOTE: All percentages shall be by weight using sieves conforming to ASTM E 11, "Standard Specification for Wire-Cloth Sieves for Testing Purposes." The powder shall pass through the required sieves readily without balling or the particles clinging together. Density of the aluminum powder is determined in accordance with ASTM B 329, "Standard Test Method for Apparent Density of Refractory Metals and Compounds by the Scott Volumeter."

3.4 Average particle size (class 7 only). The average particle size in micrometer (μ m), when tested as specified in 4.4.2.6, shall be within the ranges of 20 to 34.

3.5 Apparent density. The apparent density in grams per cubic centimeter shall conform to the requirements of table II, in accordance with the method described in ASTM B 329.

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4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as conformance inspection (see 4.3).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed on a lot. A lot shall consist of one or more batches of the aluminum powder of the same type, grade, and class offered for acceptance at one time and produced by one manufacturer, in accordance with the same specification, or same specification revision, under one continuous set of operating conditions. Each lot shall consist of that quantity of aluminum powder that has been subjected to the same unit chemical or physical mixing process intended to make the final product homogeneous. In the event the process is a batch operation, each batch shall be a lot (see 6.3).

4.3 Conformance inspection. Conformance inspection shall be performed in accordance with inspection provisions set forth herein. The characteristics shown in 3.1, 3.2 and 3.3, when tested in accordance with 4.4, shall constitute minimum inspections to be performed by the supplier prior to Government acceptance or rejection by lot. Sample containers shall be obtained at random from each lot of aluminum powder in accordance with table III. When lots exceed 2,500 containers, the sample size shall be calculated using the following equation:

$$n = 0.15 \sqrt{N}$$

where: n = sample size

N = lot size

A specimen shall be obtained from each container in the sample and placed in a clean, dry container labeled to identify the lot and the container from which it was taken. Each specimen shall be tested as specified in 4.4. Failure of any test, by any sample, shall be cause for rejection of the lot represented. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies, submitted to the Government for acceptance, comply with all requirements of the contract.

TABLE III. Sampling.

Lot size	Sample size
1	1
2 to 275	2
276 to 545	3
546 to 900	4
901 to 1345	5
1346 to 1875	6

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4.4 Test methods.

4.4.1 Component and material inspection. In accordance with 4.3, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

4.4.2 Test. Distilled water and analytical 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:

4.4.2.1 Form. Place a small portion of the sample on a glass slide and examine the material under a 20 to 30 power microscope.

4.4.2.2 Chemical composition. The aluminum powder shall meet the requirements of ASTM E 34. The following method shall be used as alternate method for chemical analysis:

4.4.2.2.1 Equipment. Use Atomic Absorption Spectrophotometer (Perkin Elmers, Model #290) for analysis of the following metals within indicated ranges:

<u>Element</u>	<u>Equipment Range</u>	<u>Analysis Range</u>
Cu	2.0 - 20 PPM	.05% - .50%
Fe	2.0 - 20 PPM	.05% - .50%
Mg	0.2 - 2.0 PPM	.01% - .10%
Zn	0.2 - 3.0 PPM	.025% - .25%

4.4.2.2.2 Standardization. The following standards shall be obtained for the initial calibration of the equipment: NIST alloys, number 86C, 87A, 85B. A high purity ingot standard shall be obtained from Alcoa: Standard No. S-A, 1906-21 - this Alcoa standard provides a high purity matrix from which a series of secondary calibration standards shall be prepared within the range allowed in MIL-DTL-512B. The secondary standard shall be prepared to yield the maximum limits of the metals to be analyzed as follows:

<u>Element</u>	<u>Standard PPM</u>	<u>Standard</u>
Cu	10.0	0.50%
Fe	10.0	0.50%
Mg	2.0	0.10%
Zn	5.0	0.25%

4.4.2.2.3 Procedure. Prior to each element analysis, the equipment shall be calibrated with the appropriate standard. Manual adjustments allow the equipment to be null set at "0 reading" with distilled water and full scale set at "100% reading" with the standard representing the maximum allowable amount present. This procedure provides an immediate test of acceptability if the "unknown" reading is less than 100%. Actual values of amount present shall be read directly from the indicated reading and calculated by ratio to the actual percent present as follows:

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$$\frac{\text{Std. PPM}}{100\% \text{ Reading}} \times X\% \text{ Reading} = X \text{ PPM}$$

$$\frac{X \text{ PPM}}{2000 \text{ PPM Sample}} \times 100 = X\% \text{ Present}$$

4.4.2.3 Nonvolatile matter and fatty and oily matter. The nonvolatile matter and the easily extracted fatty and oily matter shall be determined in accordance with ASTM D 480.

4.4.2.4 Particle size distribution. Determine the particle size distribution of class 1 material in accordance with ASTM D 480 using a No. 325 (45µm) sieve. For all other classes, the particle size distribution shall be determined in accordance with ASTM B 214.

4.4.2.5 Apparent density. Determine the apparent density of classes 1 and 4 material in accordance with ASTM B 329. For all other classes, the apparent density shall be determined in accordance with ASTM B 417.

4.4.2.6 Average particle size. Determine the average particle size of class 7 material in accordance with MIL-STD-1233, Method 100 (Fisher Sub Sieve Sizer). The weight of the sample used shall be 2.7 grams.

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 material 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.

6. NOTES

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

6.1 Intended use. Aluminum powder covered by this specification is intended for use as listed in table IV.

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TABLE IV. Intended use.

Type and Grade	Intended use
Type I Grade A Grade B	Primer composition Pyrotechnics
Type II Grade C Grade D Grade E	Pyrotechnics Plain incendiary thermite High explosive incendiary projectiles
Type III Grade F Grade F Class 7	Heavy explosive Minol and Tritonal loaded items

6.1.2 Military unique. Aluminum powder covered by this specification is a technical grade aluminum used in military applications such as pyrotechnics, explosives, and primer. The particle size, moisture content, and other chemical characteristics required herein are significant.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type, grade, and class required (see 1.2).
- c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2 and 2.3).
- d. Packaging requirements (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 intended to make the final product substantially uniform.

6.4 Part or identifying number (PIN). The PIN to be used for compressors acquired to this specification is created as follows:

<u>MILDTL</u>	<u>512B-</u>	<u>XXX</u>	<u>X</u>	<u>X</u>
Prefix for military specification	Specification number	Type (see 1.2)	Grade (see 1.2)	Class (see 1.2)

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extend of the changes.

Custodian:
Army - GL1

Preparing Activity:
DLA - GS

(Project 6810-1481)

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-DTL-512B

2. DOCUMENT DATE (YYMMDD)
980706

ALUMINUM POWDER, FLAKED, GRAINED, AND ATOMIZED

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
DEFENSE SUPPLY CENTER RICHMOND (DSCR)

b. TELEPHONE (Include Area Code)
(1) Commercial (2) AUTOVON

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