

MIL-A-512A

22 MAY 1941

SUPERSEDING

JAN. 1-760

29 APRIL 1949

JAN. 1-512

30 SEPTEMBER 1948

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(SEE SEC. 6)

MILITARY SPECIFICATION**ALUMINUM POWDER, FLAKED, GRAINED,
AND ATOMIZED**

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

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

1.2 Classification. Powdered aluminum shall be of the following types, grades, and classes as specified (see 6.2):

Type I—Flaked

Grade A—85.0 percent aluminum

Class 1—325 mesh, nominal

Grade B—93.0 percent aluminum

Class 2—100 mesh, nominal

Class 3—20 mesh, nominal

Type II—Grained or atomized

Grade C—91.5 percent aluminum

Class 4—50 mesh, nominal

Grade D—92.5 percent aluminum

Class 5—12 mesh, nominal

Grade E—96.0 percent aluminum

Class 6—100 mesh, nominal

Type III—Atomized

Grade F—98.75 percent aluminum

Class 6—100 mesh, nominal

Class 7—40 mesh, nominal

Class 8—12 mesh, nominal

2. APPLICABLE DOCUMENTS

2.1 Government documents. The following document of the issue in effect on date of invitation for bids forms a part of this specification to the extent specified herein:

SPECIFICATIONS**MILITARY**

MIL-A-20695 — Aluminum Products, Preparation for Storage and Shipment of.

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

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2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

AMERICAN SOCIETY FOR TESTING MATERIALS
ASTM Standards.

- B214 — Method of Test for Sieve Analysis of Granular Metal Powders.
- B329 — Method of Test for Apparent Density of Refractory Metals and Compounds by the Scott Volumeter.
- D480 — Methods of Sampling and Testing Aluminum Powder and Paste.
- E34 — Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys.

(Application for copies of the above publications should be addressed to the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.)

3. REQUIREMENTS

3.1 Materials. The aluminum powder shall be made from aluminum metal of such purity that the product meets the requirements of this specification. It shall be free from grit and other harmful contamination. Mica fillers or other adulterants shall not be used. The powder shall be manufactured in the following manner:

- Type I — grinding or stamping.
- Type II — atomization or grinding.
- Type III — atomization.

3.2 Form.

3.2.1 Type I. Type I aluminum powder shall be in the form of flat flakes when examined as specified in 4.5.1.

3.2.2 Types II and III. Types II and III aluminum powder shall be in the form of spheroidal particles when examined as specified in 4.5.1.

3.3 Chemical requirements. The aluminum powder shall conform to the chemical requirements of table I when tested as specified therein.

3.4 Physical properties.

3.4.1 Particle size distribution. Types I, II, and III aluminum powder shall conform to the requirements of table II when tested as specified in 4.5.5.

3.4.2 Apparent density. The apparent density in grams per cubic centimeter when tested as specified in 4.5.6 shall be as follows:

- Class 1—0.30 max
- Class 2—no determination
- Class 3—0.50 max
- Class 4—0.90 min
- Class 5—0.90 min
- Class 6—0.95 to 1.20
- Class 7—0.95 min
- Class 8—0.95 min

4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. 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 Special provision.

4.2.1 Alternative inspection (including testing) procedures. The supplier may utilize any alternative inspection procedure which will insure equal or better quality by submitting a written proposal with justification and obtaining written approval from the Government prior to institution of the procedure. In case of dispute, the procedures of this specification will govern.

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TABLE I. Chemical requirements

Requirement	Grade A	Grade B	Grade C	Grade D	Grade E	Grade F	Test method
Al, min, % ¹	85.0	93.0	91.5	92.5	96.0	98.75	4.5.2
Cu, max, %						0.5	4.5.2
Fe, max, %		0.8			(1)	0.5	4.5.2
Si, max, %					(1)	0.5	4.5.2
Mg, max, %						0.1	4.5.2
Zn, max, %					0.5	0.25	4.5.2
Other elements, total, max, %		(2)				0.5	4.5.2
Total of all impurities, max, %	15.0	7.0	8.5	7.5	4.0	1.25	4.5.2
Alkalinity as Mg(OH), max, %						0.07	4.5.3
Nonvolatile matter, min, %	99.0	99.5	99.80	99.80	99.95	99.95	4.5.4
Easily extracted fatty and oily matter, max, %	3.0	1.5			0.2	0.2	4.5.4

¹ The permissible maximum amount of iron plus silicon is 1.5 percent.² The permissible maximum amount of other elements plus iron is 1.2 percent.³ By difference.⁴ None of the elements included in "total of all impurities" shall exceed 2.0 percent.

TABLE II. Particle size distribution

U. S. standard sieve designation	Percentage retained							
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
No. 12					0			0.5 max
No. 20			2.0 max					
No. 30					13.0 to 26.0			
No. 40							0.5 max	
No. 50				0	35.0 to 45.0			
No. 100		0.2 max	30.0 max	3.0 max		2.0 max		
No. 140					130.0 to 46.0			
No. 200		20.0 max	65.0 max	3.0 to 20.0		20.0 max		
No. 230							70.0 max	70.0 max
No. 325	1.0 max					10.0 to 35.0	50.0 min	65.0 min

¹ A maximum of 3.0 percent shall pass through this sieve.

4.2.2 Supplemental evidence. The supplier shall provide evidence acceptable to the contracting officer that the requirements of 3.1 and section 5 have been satisfied.

4.3 Lotting. Provided the operation is continuous, a lot shall consist of the aluminum powder of the same type, grade, and class offered for acceptance at one time and produced by one manufacturer at one plant under essentially the same manufacturing conditions with no change in materials. In the event that the process is a

batch operation, each batch shall constitute a lot (see 6.3).

4.4 Sampling for test. Sample containers shall be taken at random from each lot as follows:

Lot size	Sample size
1	1
2- 275	2
276- 545	3
546- 900	4
901-1345	5
1346-1875	6
1876-2500	7

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Sample size for lots exceeding 2500 containers shall be calculated using the following equation:

where: $n = 0.15 \sqrt{N}$
 n = sample size, and
 N = lot size.

A specimen shall be removed 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 4.5.

4.5 Tests. 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:

4.5.1 Form.

4.5.1.1 Type I, grade A. Place a small portion of the specimen on a glass slide and examine the material under a high power microscope. A microscope equipped with an oil immersion lens and having a magnification of approximately 930 has been found to be suitable. Type I, grade A aluminum powder shall consist of irregular flattened particles with frayed irregular contours.

4.5.1.2 Type I, grade B. Place a small portion of the specimen on a glass slide and examine under a 20 to 30 power microscope. Type I, grade B aluminum powder shall consist of irregular flattened particles with frayed irregular contours.

4.5.1.3 Types II and III. Place a small portion of the sample on a glass slide and examine under a 20 to 30 power microscope. Types II and III aluminum powder shall consist of granular particles of nodular or spheroidal form.

4.5.2 Chemical composition. The chemical analysis shall be made in accordance with ASTM E34.

4.5.3 Alkalinity as magnesium hydroxide. Weigh accurately approximately 2 grams (g) of the specimen, transfer to a 300-milliliter (ml) Erlenmeyer flask, and add 200 ml of cold water. Shake the flask every 2 minutes and after 15 minutes filter through a dry neutral filter paper.

Titrate 100 ml of the filtrate with N/20 sulfuric or hydrochloric acid using five drops of bromothymol blue as an indicator. Run a blank at the same time. Calculate alkalinity to percentage magnesium hydroxide in the specimen.

$$\text{Alkalinity, percent} = \frac{2.92 N (A - B)}{W}$$

where: A = milliliters of acid required for sample,
 B = milliliters of acid required for blank,
 N = normality of acid, and
 W = weight of the specimen.

4.5.4 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 D480.

4.5.5 Particle size distribution.

4.5.5.1 Class 1. The particle size distribution shall be determined in accordance with ASTM D480, using a No. 325 (44 micron) sieve.

4.5.5.2 All other classes. The particle size distribution shall be determined in accordance with ASTM B214.

4.5.6 Apparent density.

4.5.6.1 Classes 1 and 4. The apparent density shall be determined in accordance with ASTM B329.

4.5.6.2 All other classes. Place a funnel having a $\frac{1}{4}$ -inch-inside-diameter stem in a 100-ml tared cylinder, the stem having been cut so that its tip is just above the uppermost graduation of the cylinder. Fill the cylinder to the 100-ml mark by pouring small quantities of the sample on the side of the funnel, allowing it to fall by gravity through the stem. Avoid jarring or tapping the cylinder. Weigh the cylinder and report the gain in weight divided by 100 as the apparent density.

4.6 Acceptance/rejection criteria. If any specimen fails to meet the test requirements of this specification, the lot represented shall be rejected.

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5. PREPARATION FOR DELIVERY

5.1 Packing. Aluminum powder shall be packed in accordance with the requirements of Specification MIL-A-20695 (see 6.2).

5.2 Marking. In addition to any marking required by the contract or order, shipments shall be marked in accordance with Specification MIL-A-20695.

6. NOTES

6.1 Intended use. The intended uses are set forth in table III.

TABLE III. *Uses*

Type and grade	Intended use
Type I, grade A	Primer composition
Type I, grade B	Pyrotechnics
Type II, grade C	Pyrotechnics
Type II, grade D	Plain incendiary thermite
Type II, grade E	High explosive incendiary projectiles
Type III, grade F	Heavy explosives

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type, grade, and class of material desired.
- (c) Level of packing required.

Custodians:

Army—CmlC
Navy—Wep

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

6.4 Supersession data. A cross-reference for the classifications used in this document and in the superseded ones is as follows:

Former designation	Present designation
JAN-A-289—type A, class a . . .	type I, grade B, class 2
type A, class b . . .	type I, grade B, class 3
type B, class c . . .	type II, grade E, class 6
type C, class d . . .	type III, grade F, class 7
type C, class e . . .	type III, grade F, class 8
JAN-A-512—grade I	type II, grade C, class 4
grade II	type II, grade D, class 5
JAN-A-667—	type I, grade A, class 1

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 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.

Preparing activity:

Army—CmlC

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004
<p style="text-align: center;"><u>INSTRUCTIONS</u></p> <p>This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).</p>		
SPECIFICATION		
ORGANIZATION (of submitter)		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?		
A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE?		
<input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE

FOLD

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