JAN-M-454

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JOINT ARMY-NAVY SPECIFICATION

MAGNESIUM-ALUMINUM ALLOY, POWDERED

This specification was approved by the War Department and the Navy Department for use of procurement services of the Army and the Navy.

A. APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

A–1. *Specifications.*—The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification:

U. S. ARMY SPECIFICATIONS

50–0–1—General Specification for Ammunition except Small Arms Ammunition.[1]

100–2—Standard Specification for Marking Shipments by Contractors.[1]

NAVY DEPARTMENT SPECIFICATION

General Specifications for Inspection of Material.[2]

FEDERAL SPECIFICATION

RR–S–366—Sieves; Standard, Testing.

A–2. *Other publications.*—The following publications, of the issue in effect on date of invitation for bids, form a part of this specification.

BUREAU OF SUPPLIES AND ACCOUNTS PUBLICATION

Navy Shipment Marking Handbook.[2]

INTERSTATE COMMERCE COMMISSION REGULATIONS

Regulations for the Transportation of Explosives and Other Dangerous Articles, etc.

B. TYPES

B–1. This specification covers the following types of magnesium-aluminum alloy powder as specified in the contract or order. (See par. H–2.)

Type A—50/50
Type B—65/35

C. MATERIAL AND WORKMANSHIP

C–1. Primary aluminum shall be used in the manufacture of type A alloy powder. Primary or secondary aluminum may be used in the manufacture of type B alloy powder.

D. GENERAL REQUIREMENTS

D–1. See section E.

[1] Applicable only to Army purchases.
[2] Applicable only to Navy purchases.

E. DETAIL REQUIREMENTS

E–1. *Composition.*—Magnesium-aluminum alloy powder shall conform to the compositions shown in table I.

TABLE I.—*Composition.*

	Type A	Type B
	Percent	*Percent*
Magnesium	50.0 ± 2.0	65.0 ± 2.0
Aluminum	50.0 ± 2.0	35.0 ± 2.0
Total magnesium and aluminum (min.)	98.0	98.0
Oxides as AL_2O_3 (max.)	2.0	2.0
Iron as Fe (max.)	0.75	0.75
Silicon as Si (max.)	0.5	0.5
Other metals (max.)	0.5	0.5
Zinc as Zn (max.)	0.1	0.1
Grease and fats (max.)	0.01	0.01
Moisture (max.)	0.05	0.05
Grit (max.)	0.1	0.1

E–2. *Granulation.*—Magnesium-aluminum alloy powder shall conform to the requirements shown in table II using U. S. Standard sieves conforming to the requirements of Federal Specification RR–S–366.

TABLE II.—*Granulation.*

Through sieve No.	Type A		Type B	
	minimum	maximum	minimum	maximum
	Percent	*Percent*	*Percent*	*Percent*
100	99.5	..	90	..
120	98	..	80	..
230	45	65	40	60

F. METHODS OF SAMPLING, INSPECTION, AND TESTS

F–1. *Size of lots.*—Maximum, 10,000 pounds.

F–2. *Sampling.*—

F–2a. *Primary sample basis.*—The inspector shall designate the number of containers, the location of the individual containers, and the method of sampling which shall be representative of the lot. In any case, not less than 10 containers shall be selected to represent the lot. The supplier shall be given no prior information to indicate which particular containers will be selected. A representative primary sample shall be taken from each batch. (See par. H–3.) Blend the contents of each selected container as thoroughly as practicable and by means of a thief, remove portions from each container. Insert the thief vertically to remove material from top to bottom and from at least three positions across the diameter of the container. Each primary sample shall be mixed thoroughly, divided into two portions, and transferred to approved sample containers so labeled that the shipping containers from which these samples were taken can be identified readily. One portion shall

be taken for laboratory examination and the other portion shall be retained for possible check analysis. Spot check samples shall be taken from time to time, from any portion of the lot, by the inspector.

F–2b. *Composite sample basis.*—When acceptance on basis of primary sample anlysis is not feasible or advisable in the opinion of the Chief of the bureau or agency concerned, the acceptance tests shall be made on a composite sample prepared by blending equal portions taken from each of the primary samples and reducing the blend to obtain a composite sample weighing approximately 1 pound. The remaining portions of the primary samples shall be held by the inspector for possible future examination should the composite sample fail to meet the requirements.

F–2c. *Marking of sample containers.*—Each sample container shall be labeled to show the name of the material, manufacturer, plant, contract or order number, number of pounds in the lot, lot number and, when applicable, the batch or container number.

F–3. *Inspection.*—

F–3a. *Army.*—Inspection shall be made in accordance with U. S. Army Specification 50–0–1 and unless otherwise specified in the contract or order shall be made at the point of delivery.

F–3b. *Navy.*—Inspection shall be made at the point of delivery unless otherwise specified in the contract or order.

F–3c. *Lot acceptance.*—Acceptance of the lot shall be based on the analysis of primary samples and spot check samples, or the composite sample, selected to represent the lot. Primary samples and spot check samples shall be examined and tested as completely as necessary to provide reasonable assurance to the inspector that all portions of the lot comply with each one of the specification requirements. No lot shall be accepted when the analysis of any primary sample or spot check sample or composite sample shows non-compliance with any requirement of this specification. Each batch shall comply with the requirements specified in section E. The contractor's record of batch analyses shall be available at all times for examination by the inspector.

F–4. *Tests.*—Tests to determine compliance with the requirements of this specification shall be made in accordance with the following paragraphs as applicable. For Navy purchases, the tests shall be made at a Government laboratory unless otherwise specified in the contract or order.

F–4a. *Moisture.*—Transfer a portion of approximately 5 gm. of the sample to a tared shallow weighing container provided with a cover. Weigh the dish and sample. Remove the cover and place in a sulfuric acid vacuum desiccator for 24 hours. Cover and weigh. Calculate the loss in weight as percent moisture.

F–4b. *Grease and fats.*—Extract a weighed portion of approximately 20 gm. of the sample with ether in a Soxhlet or similar extractor using a tared flask. When extraction is complete, evaporate the ether and dry the flask and contents at 90° C. to constant weight. Cool in a desiccator and weigh. Calculate the weight of residue as percent grease and fats.

F–4c. *Aluminum.*—

F–4c(1). *Preparation of solutions.*—

F–4c(1)a. *8-Hydroxyquinoline solution.*—Dissolve 5 gm. of 8-hydroxyquinoline in 10 ml. of glacial acetic acid. Dilute to 100 ml. with water and filter if necessary.

F–4c(1)b. *Bromphenol blue indicator.*—Dissolve 0.100 gm. of bromphenol blue powder in 20 ml. of 95-percent ethyl alcohol and dilute to 100 ml. with water.

F–4c(2). *Procedure.*—Transfer an accurately weighed sample of 1.000 ± 0.0500 gm. of type A alloy or 0.7700 ± 0.0300 gm. of type B alloy to a 250 ml. beaker. Add 10 ml. of water, cover the beaker with a watch glass and add, dropwise, 20 ml. of concentrated HCl through the opening at the lip of the beaker. After the reaction subsides, heat to boiling to assure complete solution. Wash the watch glass thoroughly and drain the washings back to the beaker. Filter through a No. 41 Whatman or equivalent filter paper and catch the filtrate in an accurately calibrated, 1-liter volumetric flask. Wash the filter paper thoroughly with hot water and make up to volume with water. Transfer a 100-ml. aliquot to a 250-ml. beaker using an accurately calibrated buret or pipet. Add three drops of bromphenol blue indicator and neutralize the solution by adding dropwise and with constant stirring, a filtered 1:1 NH_4OH solution until the yellow color changes to blue. Then add two drops of NH_4OH solution in excess Heat to boiling and add 18 ml. of the 8-hydroxyquinoline solution in small portions stirring after each addition to dissolve the precipitate that forms. Disregard any precipitate remaining after the completion of the addition of reagent. Heat to boiling and add 40 ml. of 2M ammonium acetate solution (154 gm. per liter) dropwise with vigorous stirring. Place on a steam bath for 30 minutes. Filter with suction through a tared, fine-porosity, fritted-glass bottom crucible. Wash the precipitate eight times with 15-ml. portions of water releasing the suction before each addition and allowing the precipitate to remain in contact with the wash water for at least 1 minute prior to the application of suction. Dry for 3 hours in an oven at 120° to 140°C., cool in a desiccator and weigh as $Al(C_9H_6ON)_3$

$$\text{Percent aluminum} = \frac{(A - 0.0874BW)5.87}{W}$$

where A = grams of precipitate
B = percent iron (see par. F–4g)
W = grams of sample contained in the aliquot.

F–4d. *Magnesium.*—Transfer a 100-ml. aliquot of the solution, prepared in accordance with paragraph F–4c(2), to a 400-ml. beaker by means of an accurately calibrated buret or pipet. Add three drops of bromphenol blue indicator and neutralize the solution with filtered 1:1 NH_4OH solution until the yellow color changes to blue. Add 1 gm. of ammonium chloride and 1 ml. of glacial acetic acid to the solution. Add 20 ml. of hot 10-percent, ammonium benzoate solution slowly while stirring. Heat on a hot plate and boil gently for 5 minutes. Filter through a 11 cm. Whatman No. 41, or equivalent, filter paper catching the filtrate in a 600 ml. beaker.

Wash the precipitate 10 times with a hot wash solution containing 1 gm. of ammonium benzoate and 2 ml of glacial acetic acid per 100 ml. of solution. Any crystallization that occurs in the filtrate as it cools should be disregarded. Make the combined filtrate and washing alkaline to phenolphthalein with filtered concentrated NH_4OH solution. Add 5 ml. NH_4OH solution in excess. Heat to 60° to 70° C. and add 15 ml. of 8-hydroxyquinoline solution rapidly by drops from a buret. Stir the liquid vigorously with a thermometer keeping the temperature of the solution at 60° to 70°C. during titration. Heat almost to boiling with frequent stirring and transfer to a steam bath for 20 minutes. Filter by means of a tared, fine-porosity, sintered-glass-bottom crucible. Disconnect the suction and apply 10 ml. of warm 1:100 NH_4OH wash solution to the precipitate with a wash bottle agitating the precipitate as much as possible with the force of the stream of wash solution Apply the suction until the precipitate remains only moist enough to prevent cracking. Repeat 7 times and finally wash with two 10 ml. portions of cold water as described herein. Dry to constant weight in an oven at 155° to 160°C. Cool in a dessicator and weigh.

$$\text{Percent magnesium} = \frac{7.78A}{W}$$

where A = grams of precipitate
W = grams of sample contained in the aliquot.

F–4e. *Total magnesium and aluminum.*—Add the percentages of aluminum and magnesium as determined in paragraphs F–4c and F–4d.

F–4f. *Silicon.*—Place a weighed portion of approximately 2 gm. in a beaker. Cautiously add 70 ml. of a solution made by mixing 475 ml. of water, 125 ml. of 95 percent H_2SO_4, 200 ml. of 70-percent HNO_3, and 200 ml. of 38-percent HCl. Evaporate until heavy fumes of SO_3 have been evolved for a few minutes. Cool and add 10 ml. of 50-percent H_2SO_4. Dilute to 150 ml. with hot water, heat until salts are dissolved and transfer the insoluble residue to a paper filter. Wash the residue thoroughly with hot water. Retain the filtrate and washings for use in the determination of iron. (See par. F–4g.) Ignite the residue in a platinum crucible, cool, and weigh. Moisten the residue with a few drops of 50-percent H_2SO_4 and add 2 ml. of 47-percent HF. Evaporate to dryness, ignite, cool and weigh. Calculate the loss in weight, which represents silicon dioxide, to percent silicon.

$$\text{Percent silicon} = \frac{46.7A}{W}$$

where A = Loss in weight between weighings
W = grams of sample.

F–4g. *Iron.*—Pass H_2S gas for 20 minutes through the combined filtrate and washings from the determination of silicon. (See par. F–4f.) Filter and wash the precipitate with H_2S water acidified with 1 percent H_2SO_4. Boil the combined filtrate and washings vigorously for 25 to 30 minutes to remove the H_2S. Cool the solution and titrate with N/10 $KMnO_4$ solution. Retain the solution after titration for the determination of zinc. (See par. F–4h.) Calculate the percent iron as follows:

$$\text{Percent iron} = \frac{55.8\ VN}{W}$$

where V = ml. standard $KMnO_4$ solution used in titration
N = normality of $KMnO_4$ solution used
W = grams of sample taken in paragraph F–4f.

F–4h. *Zinc.*—Using the solution from the iron determination (see par. F–4g), add 25 ml. of 25-percent tartaric acid solution and dilute to 250 ml. Neutralize with NH_4OH solution using methyl red indicator. Add 25 ml. of a solution of ammonium formate prepared by diluting 200 ml. of 90-percent formic acid to 970 ml. with water and adding 30 ml. of 28-percent NH_4OH solution. Heat the solution almost to boiling and pass in a rapid stream of H_2S for 30 minutes. Warm the solution until the precipitate has coagulated. Filter and wash the precipitate with a solution prepared by diluting to 1 liter, 25 ml. of the ammonium formate solution described herein, and saturating it with H_2S. Dissolve the precipitate on the paper by means of a hot 10-percent HCl solution and wash thoroughly. Boil the filtrate and washings for 5 minutes. Cool to some extent, add 5 ml. of a 25-percent solution of tartaric acid and make just alkaline to methyl red with NH_4OH. Dilute to 100 ml. and heat almost to boiling. Pass H_2S through the solution for 3 minutes, add 10 ml. of the undiluted ammonium formate solution as originally prepared, and continue to pass H_2S through the solution for 5 minutes and any additional time required to coagulate the precipitate. Filter and wash with diluted ammonium formate solution. Ignite the precipitate at approximately 700°C. in a tared porcelain crucible. Cool and weigh as zinc oxide.

$$\text{Percent zinc} = \frac{80.3A}{W}$$

where A = grams of precipitate
W = grams of sample.

F–4i. *Other metals.*—If the presence of metals other than those determined in paragraph F–4c through F–4h is indicated, standard procedures for the analysis of such metals shall be used and their percentages reported.

F–4j. *Grit.*—Transfer a weighed portion of approximately 5 gm. of the sample to a 250 ml. beaker. Add cautiously 75 ml. of a solution made by mixing 10 ml. of 70 percent HNO_3 and 30 ml. of 38 percent HCl. Boil for 15 minutes. Dilute to 200 ml. with hot water, filter and wash the insoluble material with hot water.

Ignite the residue gently in a crucible, transfer it to a beaker and add 10 ml. of 50-percent solution of NaOH. Boil for 10 minutes, cool, and dilute to 100 ml. with hot water. Filter and wash with hot water until the washings are free of alkali. Ignite the residue in a tared crucible, cool and weigh. Calculate the increase in weight as percent grit.

F–4k. *Oxides.*—From 100 percent, subtract the sum of the percentages of metals, moisture, grease and fats, and grit. The remainder shall be considered to be percent combined oxygen. Calculate to percent aluminum oxide as follows:

Percent aluminum oxide = 2.12 X percent oxygen.

F–4l. *Granulation.*—Place a weighed portion of approximately 50 gm. of the sample on the nest of sieves specified in paragraph E–2, properly superimposed and assembled with a cover and a bottom pan. Shake for 30 minutes by means of a mechanical shaker geared to produce 300 ± 15 gyrations and 150 ± 10 taps of the striker per minute. Weigh the material remaining on each sieve and bottom pan and calculate the percent passing through each sieve.

F–5. *Resubmission.*—If the lot or any portion of the lot fails to pass the inspection tests, the manufacturer shall have the option of having additional analyses made, without expense to the Government to effect complete segregation of all defective portions of the lot. The manufacturer may then remove or replace defective portions of the lot and resubmit the lot for acceptance, provided that the markings on the containers are such that complete removal or replacement of defective portions of the lot can be made to the satisfaction of the Government inspector. New samples shall be taken from the entire resubmitted lot and subjected to all of the inspection tests required by this specification.

G. PACKAGING, PACKING, AND MARKING FOR SHIPMENT

G–1. *Packaging and packing.*—Unless otherwise specified, packaging and packing shall conform to the requirements for shipment of inflammable solids and oxidizing materials contained in the Interstate Commerce Commission Regulations for the Transportation of Explosives and Other Dangerous Articles, etc.

G–1a. When specified, the material shall be packed in unlined, full open head steel drums protected against corrosion. Drums shall contain a maximum of 110 pounds of material. Each drum shall be provided with a tubular rubber gasket firmly cemented in place. When the jackscrew is tightened, the rim shall be tapped with a mallet to insure complete and proper sealing of the gasket. When drums are re-used, new gaskets shall be used each time and the drums shall be able to meet the requirements for the new drums. Drums conforming to ICC specifications 6A, 6B, 6C, 17E, 37D, 37E, or 37F shall be used.

G–2. *Marking.*—In addition to any special marking required by the contract or order, shipments for the Army shall be marked in accordance with the requirements of the U. S. Army Specification 100–2; for the Navy in accordance with the requirements of the Navy Shipment Marking Handbook.

H. NOTES

H–1. *Use.*—Powdered magnesium-aluminum alloy is intended for use in ammunition.

H–2. Requests, requisitions, schedules, and contracts or orders should contain the following features:

(a) Title, number, and date of the specification.

(b) Type required. (See par. B–1.)

H–3. A batch is defined as that quantity of material which has been subjected to some unit chemical or physical mixing process intended to make the final product substantially uniform.

H–4. This specification replaces Picatinny Arsenal Tentative Specification PXS–885.

H–5. Copies of Joint Army-Navy specifications and Federal specifications (required for Army purchases) and U. S. Army specifications may be obtained as indicated in the "Index of United States Army, Joint Army-Navy, and Federal Specifications Used by the War Department." Copies of this Index may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Agencies within the War Department will obtain copies of Joint Army-Navy, U. S. Army, and Federal specifications through established War Department channels. Both the title and identifying symbol number should be stipulated when requesting copies of specifications.

H–6. Copies of Joint Army-Navy specifications and Federal specifications (required for Navy purchases), Navy Department specifications and the Navy Shipment Marking Handbook may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington 25, D. C., except that Naval activities should make application to the Supply Officer in Command, Naval Supply Depot, Bayonne, N. J. Both the title and identifying symbol number should be stipulated when requesting copies of specifications

H–7. Copies of this Joint Army-Navy specification (required for Army purchases) may be obtained from the Office, Chief of Ordnance, War Department, Washington 25, D. C.

ARMY: O.
NAVY: OS.

[JAN-M-454]