MIL-P-663A (MU)
20 March 1968
SUPERSEDES
JAN-P-663
20 August 1948
JAN-P-540
17 December 1947

MILITARY SPECIFICATION

POWDER, FUZE

1. SCOPE

1.1 Scope.-This Military Specification covers two types of fuze powder for use in the loading of time fuzes.

1.2 Classification.-The fuze powder shall be of the following types as specified (see 6.1).

Type I - Powder, Fuze
Type II - Powder, Black, Slow Burning

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids, or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

RR-S-366 - Sieves; Standard for Testing Purposes

MILITARY

MIL-C-178 - Charcoal (For Use in Munitions).
MIL-P-156 - Potassium Nitrate.

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes (ABC-STD-105).
MIL-STD-109 - Quality Assurance Terms and Definitions.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-1234 - Pyrotechnics Sampling Inspection and Testing
MIL-STD-1235 - Single and Multilevel Continuous Sampling Procedures and Tables for Inspection By Attributes

FSC: 1376

DRAWINGS

ARMY

73-3-154 - Fuze, Time and Superquick, M54, Assembly
73-3-155 - Fuze, Time and Superquick, M55A3, Assembly
9205598 - Fuze, Time, M84, Assembly
73-3-171 - Fuze, Time, M77, Assembly
9207568 - Fuze, Time, M65A1, Assembly
7548321 - Drum, Steel, Packing for Black Powder; Assembly, Details, Packing and Marking

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

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

INTERSTATE COMMERCE COMMISSION

49 CFR 71 to 90 - Interstate Commerce Commission Rules and Regulations for the Transportation of Explosives and Other Dangerous Articles

(The Interstate Commerce Commission regulations are now a part of the Code of Federal Regulations (1949 Edition-Revised 1950) available from the Superintendent of Documents, Government Printing Office, Washington, D.C. Orders for the above publications should cite "49 CFR 71-90 (rev 1950).").

3. REQUIREMENTS

3.1 Material.-The constituent materials used in the manufacture of the powders purchased under this specification shall comply with the following requirements:

3.1.1 Potassium nitrate.-The potassium nitrate shall comply with Specification MIL-P-156, Class 1.

3.1.2 Charcoal (applicable to type I only).-The charcoal shall comply with Specification MIL-C-178, Class a.

3.1.3 Sulfur.-The sulfur shall be Commercial Grade with the following requirements:

Form: -Lumps.
Purity 98.5 percent
Ash 0.1 percent
Organic impurities 0.1 percent when tested as specified in 4.3.8.

3.1.4 Coal (applicable to type II only).-The coal shall be semibituminous, of such fineness that 100 percent passes through a Number (No.) 140 United States (U.S.) Standard sieve and not less than 45 percent passes through a No. 200 U.S. Standard sieve, and shall have complied with the chemical requirements specified in Table I.

TABLE I

Chemical Requirements of Coal

Constituent	Percent
Moisture, (max.)	0.75
Volatile matter	18.0 ± 1.0
Fixed carbon	70.5 ± 3.5
Ash	11.0 ± 1.5
Sulfur	3.0 ± 0.5

3.2 Moisture content.-The moisture content of the fuze powder shall be 0.70 percent max. when determined as specified in 4.3.2.

3.3 Composition.-The composition, exclusive of moisture, shall be as specified in table II, when determined as specified in the applicable subparagraphs of 4.3.3.

TABLE II

Chemical Requirements of Coal

Constituent	Percent	
	Type I	Type II
Potassium nitrate	74.0 ± 2.0	70.0 ± 2.0
Sulfur	10.4 ± 1.5	16.0 ± 1.5
Charcoal	15.6 ± 1.5	----------
Coal	----------	14.0 ± 1.5

3.4 Gritty or fibrous particles.-The fuze powder shall be free of gritty or fibrous particles when examined as specified in 4.3.4.

3.5 Ash content (applicable to type I only).-The ash content of type I fuze powder shall be 0.60 percent max. when determined as specified in 4.3.5.

3.6 Granulation.-The fuze powder shall be of such a fineness that three percent max. is retained on a No. 140 U.S. Standard sieve and 85 percent max. passes through a No. 200 U.S. Standard sieve when determined as specified in 4.3.6.

3.7 Static burning time.-When loaded in the fuze of any one of the types listed in the static burning time of the fuze powder shall be as indicated in table III, when tested as specified in 4.3.7.

TABLE III

Static Burning Time

Fuze	Average Burning Time (seconds)	
	Type I	Type II Minimum
M54, M55A3, M77 or M84	18.0 to 23.0	35.0
M65A1	9.0 to 13.0	18.0

4. QUALITY ASSURANCE PROVISIONS

4.1 General quality assurance provisions.-Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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. Reference shall be made to Standard MIL-STD-109 in order to define the terms used herein.

4.1.1 Submission of product.-At the time the completed lot of product is submitted to the Government for acceptance, the contractor shall supply the following information accompanied by a certificate which attests that the information provided is correct and applicable to the product being submitted:

a. A statement that the lot complies with all quality assurance provisions of the approved current written description of the system.

b. Quantity of product inspected.

c. Results obtained for all inspections performed.

d. Specification number and date, together with an identification and date of changes.

e. Certificates of analysis on all material procured directly by the contractor, when such material is covered by referenced Government specification.

f. Quantity of product in the lot.

g. Date submitted.

The certificate shall be signed by a responsible agent of the certifying organization. The initial certificate submitted shall be substantiated by evidence of the agent's authority to bind his principal. Substantiation of the agent's authority will not be required with subsequent certificates unless, during the course of the contract, this authority is vested in another agent of the certifying organization.

4.2 Inspection provisions

4.2.1 Lot formation.-The term "lot" as used throughout this specification, refers to an inspection lot, which is defined as an essentially homogeneous quantity of powder from which a representative sample is drawn and inspected to determine conformance of the lot with applicable requirements. The sample selected shall represent only that quantity of powder from which the sample was drawn and shall not be construed to represent any prior or subsequent quantities presented for inspection. A lot shall consist of one or more batches produced by one manufacturer, in accordance with the same specification, and same specification revision under one continuous set of operating conditions. Each lot shall consist of that quantity of powder which has been subjected to the same unit chemical or physical process intended to make the final product homogeneous. The classification of defects shall be in accordance with Standard MIL-STD-105.

4.2.2 Testing

4.2.2.1 Static burning time.-Ten samples weighing 200 grams each shall be randomly selected from individual containers. The individual samples shall be packed separately in suitable containers and shipped to the testing laboratory specified in the contract.

(see 6.4). When the lot is comprised of less than ten containers all containers shall be sampled. Duplicate sampling of containers shall be accomplished if necessary to prepare the required number of samples. If any sample fails to comply with the requirement of 3.7, the lot shall be rejected (see 6.3).

4.2.2.2 Sampling for chemical test.-Five samples weighing 100 grams each shall be randomly selected from individual containers The individual samples shall be blended to form two composited samples. The two composited samples shall be tested in accordance with paragraph 4.3. The lot shall be rejected if any sample fails to meet the requirement (see 6.3).

4.2.2.3 Examination.-Inspection for critical defects shall be 100 percent. Sampling plans and procedures for major and minor defects shall be in accordance with MIL-STD-105 except that continuous sampling plans in accordance with Standard MIL-STD-1235 may be used if approved by the procuring activity. Also, at the option of the procuring activity, AQL's and sampling plans may be applied to individual characteristics listed using an AQL of 0.65 percent for each minor defect and an AQL of 0.40 percent for each major defect except when 100 percent inspection is specified.

4.2.2.3.1 Drum, steel, packing for black powder (filled and sealed) (see drawing F7548321).

Categories	Defects	Method of Inspection	Code No. (see 6.2)
Major:	AQL 0.40 percent		
101.	Air test failure.....	Approved Testing Device	01001
102.	DOD symbol misleading or unidentifiable.....	Visual	01002
Minor:	AQL 1.00 percent		
201.	Total weight,)max.).....	Approved Scale	01003
202.	Head and locking ring assembly insecure.....	Manual	01004
203.	Car seal not sealed.....	Visual	01005
204.	Marking misleading or unidentifiable.....	Visual	01006
205.	Exterior paint damaged.....	Visual	01007

4.3 Test procedures.

4.3.1 Preparation of fuze powder for analysis.-Two to four ounces of the one pound portion of the composite samples shall be selected for analysis. If, upon visual examination, the sample exhibits lumps or clusters, it shall be ground, in small quantities, in a suitable mortar to pass a No. 60 U.S. sieve. The sieve shall conform to Specification RR-S-366. All precautions shall be taken to avoid unnecessary exposure of the sample to the air; hence, as soon as a quantity is ground, it shall be put in a bottle and tightly stoppered. If the grinding and sifting does not require more than three minutes per quantity, there will be no appreciable change in the moisture content due to hygroscopicity. The powdered sample shall be well mixed and blended before analysis.

4.3.2 Determination of moisture content, Major defect, Code No. 02001.-An accurately weighed portion of approximately two grams (gm.) of the sample shall be transferred to a tared weighing dish or watch glass. The container and contents shall be dried for four hours in an oven at 70 degrees centigrade (^{o}C.) The dish shall then be removed, covered, cooled in a desiccator, and weighed. (As an alternative, the sample may be dried for 72 hours at room temperature in a desiccator over concentrated sulfuric acid.) The loss in weight shall be calculated to percentage of moisture in the sample.

4.3.3 Determination of composition.

4.3.3.1 Potassium nitrate.-Major defect, Code No. 03001.- An accurately weighed portion of approximately 10 gm of the sample shall be transferred to a 400 milliliter (ml) beaker. Two hundred ml of distilled water shall be added to the beaker, brought to a boil, and held for 15 minutes on a steam bath. The solution shall then be filtered through a tared porcelain crucible and washed with succesive portions of 10 to 15 ml of hot water. The wash water passing through the crucible shall be tested with an excess of concentrated sulfuric acid, containing a few crystals of diphenylamine, until there is no blue color. (The blue color indicates the presence of nitrate). The crucible shall be dried for four hours in an oven at 70^{o}C, cooled in a desiccator and weighed. The loss in weight represents moisture in potassium nitrate. The percentage of potassium nitrate shall be calculated on a moisture-free basis utilizing the result obtained in 4.3.2.

4.3.3.2 Sulfur.-Major defect, Code No. 03002.-The crucible retained from the determination of potassium nitrate shall be placed in an extractor on a water bath and extracted with carbon disulfide for four hours for type I fuze powder, or for one hour for type II fuze powder. After the extraction, the crucible shall be washed once with alcohol and once with ether, using suction, dried for one hour in an oven at 100°C., cooled in a desiccator and weighed. The loss in weight shall be calculated by subtracting this weight from the weight obtained from the potassium nitrate determination. This loss in weight shall be calculated as percent sulfur on a moisture-free basis. The crucible and contents shall be retained for the determination of gritty or fibrous particles and for the determination of ash content of type I powder.

4.3.3.3 Charcoal content (applicable to type I) or coal content (applicable to type II), fuze powder, Major defect, Code No. 03003.-After the determination of sulfur (see charcoal for type I fuze powder, or coal for type II fuze powder. The original weight of the crucible shall be subtracted from the weight of the crucible and residue obtained from the determination of sulfur. This difference in weight shall be calculated as percent charcoal, or percent coal, as applicable, on a moisture-free basis.

4.3.4 Determination of gritty or fibrous particles.-Major defect, Code No. 04001.-The residue remaining in the crucible after the determination of sulfur shall be examined visually to determine whether or not it is free of gritty or fibrous particles.

4.3.5 Determination of ash content (applicable to type I only.), Major defect, Code No. 05001.-The crucible with the residue retained after the determination of gritty or fibrous particles shall be ignited in a muffle furnace or over a Bunsen burner until all the carbon is burned off. The crucible and contents shall be cooled in a desiccator and weighed. The original weight of the filtering crucible shall be subtracted from the weight of the crucible and remaining residue. This difference shall be calculated as percent ash. If it is desired to perform the ash content determination independently of the composition analysis, a separate accurately weighed portion of approximately 5 gm of the sample shall be transferred to a 400 ml beaker. The potassium nitrate shall be extracted, the residue ignited and the ash content determined.

4.3.6 Determination of granulation.-Major defect, Code No. 06001.-A sieve assembly composed of a No. 140 U.S. standard sieve superimposed above a No. 200 U.S. standard sieve with a bottom pan shall be prepared. The sieves shall conform to Specification RR-S-366. An accurately weighed quantity of approximately 100 gm of the one pound portion of the composite sample shall be placed on the No. 140 sieve and a cover shall be attached to the assembly. The test shall be determined in accordance with Method 201.1 of Standard MIL-STD-1234.

4.3.7 Determination of static burning time.-Major defect, Code No. 07001.-The samples shall be conditioned by spreading the powder in trays to a depth of approximately 1/16 inch (in a conditioning cabinet or room) for two hours in air at a temperature of 75 $\pm$ 2 degrees Fahrenheit (^{o}F.) and a relative humidity of 40 $\pm$ 2 percent. The time train rings of ten M54, M55A3, M65A1, M77 or M84 time fuzes shall be loaded with the powder and assembled in accordance with drawing 73-3-154, 73-3-155, 9207568, 73-3-171 or 9205598 as applicable, using a loading pressure on the time train charge of 68,000 $\pm$ 500 pounds per square inch with the press adjusted to a 1 1/2 to 2 second approach and a 5 second dwell. In the case of any of the time fuzes except the M65A1 fuze, the graduated ring shall be set at "25" (for the M65A1 fuze, no special setting is possible) and a torque of 450 inch-pounds applied in assembling the head assembly (closing cap assembly on M54 and M55A3 fuze). The fuze shall be tested statically using an approved static burning time fuze tester which can be read directly to at least the nearest 0.05 second. Each burning time value obtained shall be corrected to standard pressure conditions by use of the following formula:

$$Tc = \frac{To\ (B)\ 1/2}{5.48}$$

where:

Tc = time of burning in seconds corrected to standard pressure conditions (30.0 inches of mercury).

To = actual observed time of burning in seconds.

(B) 1/2 = square root of the barometric pressure, in inches of mercury, at the time of the test.

4.3.8 Sulfur

"4.3.8.1 Organic impurities and ash.-Weigh approximately 15 grams of the dried sample, into a tared porcelain dish. Ignite the sample with a small pin flame. The sulfur, once ignited, will burn evenly and clean unless organic matter is present. If organic matter is present, a film of melted asphalt or oily matter forms over the surface of the molten sulfur and shuts off the air so that the flame from the burning sulfur is extinguished. When a film of dark oily matter is first noticed, touch it lightly with the pin flame and it will usually break or char, allowing the sulfur to burn evenly. Toward the end of the burning, apply a very gentle heat to the dish and thus char the organic matter but keep the temperature well below red heat so that the organic matter is not ignited. When all the sulfur is burned off, as indicated by lack of sulfur dioxide odor, cool the dish in a desiccator and weigh. This weight (A) represents the combined organic impurities and ash. Ignite the residue in the dish to burn off the organic impurities, cool in a desiccator and weigh. This weight (B) represents the ash, and the difference between the two (A-B) represents the organic impurities. Calculate the percentage of organic impurities and of ash as follows:

$$\text{Percent organic impurities} = \frac{(A - B) \times 100}{\text{weight of sample}}$$

$$\text{Percent ash} = \frac{B \times 100}{\text{weight of sample}}$$

4.3.8.2 Organic impurities retest.-If the percentage of organic impurities exceeds 0.1 percent as determined in 4.3.8.1, the percentage of sulfur contained in the residue shall be determined by the following procedure: weigh the same weight of sample as used in 4.3.8.1 into a tared porcelain dish. Ignite and burn the sample using the same procedure used in 4.3.8.1 until all the sulfur is burned off as indicated by lack of sulfur dioxide fumes. Prepare an oxidizing agent by melting 4 gm of potassium hydroxide and 0.5 grams of potassium nitrate in a large silver crucible with the addition of a little water. Cool the mixture and transfer the residue quantitatively from the tared porcelain dish to the large silver crucible. Heat gradually, stirring the mixtures frequently with a silver wire until all the organic matter is decomposed. Cool and dissolve the melt in approximately 300 milliliters of water. Make the solution just acid with hydrochloric acid. Heat to boiling and add 5 milliliters of a 10-percent barium chloride solution.

Filter the solution through a tared Gooch crucible. Dry the precipitate in an oven for 1 hour, then in a muffle furnace to a dull red heat. Cool in a desiccator and weigh. The true percentage of organic impurities may be calculated as follows:

$$\text{Percent sulfur in residue } \frac{A \times 100 \times 0.1373}{\text{weight of sample}}$$

True percent organic impurities = B - C

where:

A = weight of barium sulfate precipitate

B = Percent organic impurities as determined in 4.3.8.1

C = Percent sulfur in residue as determined in this paragraph.

4.3.8.3 Sulfur.-Determine the percent of sulfur as follows:

Percent sulfur (dry basis) = 100 - (percent organic impurities plus percent ash.)

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging, Levels A, B and C.-Not applicable.

5.2 Packing. (see 6.1).

5.2.1 Level A, military pack.-Fuze powder shall be packed in exterior steel drums that conform to drawing F7548321, except that the marking requirements shall not apply. The gross weight shall not exceed 50 pounds.

5.2.2 Level B, limited military pack.-Fuze powder shall be packed as specified in 5.2.1

5.2.3 Level C, minimum military pack.-Unless otherwise specified, fuze powder shall be packed in commercial metal kegs of 20 pound capacity, complying with the requirement of Specification Number 13 of the Interstate Commerce Commission Regulations (49 CFR 71-90) for the Transportation of Explosives and Other Dangerous Articles. Kegs shall be packed for shipment in conformance with consolidated freight classification rules and container specifications for rail shipments, or with National Freight classification rules and containers specifications for truck shipments.

5.3 Marking.-Exterior containers shall be marked in accordance with Standard MIL-STD-129.

6. NOTES

6.1 Ordering data.-Procurement documents should specify the following:

(a) Title, number and date of this specification.
(b) Type required (see 1.2).
(c) Levels of protection (see 5.2).

6.2 Inspection code numbers.-The five-digit code numbers assigned to the inspections herein are to facilitate future data collection and analysis by the Government.

6.3 Test results.-A copy of the test results should be forwarded to Commanding Officer, ATTN: SMUPA-ND2, Picatinny Arsenal, Dover, New Jersey, 07801.

6.4 Burning time test.-The contracting officer should request the loading plant which has the fuze production contract to perform the burning time test.

Custodian:
Army-MU

Preparing Activity:
Army-MU

Project Number: 1376-A-010

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004

INSTRUCTIONS

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.

SPECIFICATION

ORGANIZATION	CITY AND STATE

CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT
		$

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ 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?

☐ YES ☐ 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

DD FORM 1 OCT 64 1426

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