

MIL-S-12210A

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SUPERSEDING

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MILITARY SPECIFICATION

STRONTIUM OXALATE

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 strontium oxalate for use in the manufacture of pyrotechnic compositions.

1.2 **Classification.** Strontium oxalate shall be of the following grades as specified (see 6.1):

Grade A—anhydrous strontium oxalate
Grade B—hydrated strontium oxalate

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

RR-S-366 —Sieves; Standard, for Testing Purposes.

MILITARY

MIL-G-2550—General Specification for Ammunition Except Small Arms Ammunition.

STANDARDS

MILITARY

MIL-STD-129—Marking for Shipment and Storage.

(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.)

3. REQUIREMENTS

3.1 **Material.** Strontium oxalate shall conform to the requirements specified hereafter.

3.1.1 *Physical and chemical properties.* Strontium oxalate shall conform to the physical and chemical properties listed in table I for the specified grade, when tested as specified in 4.4.

3.1.2 *Impurities.* Strontium oxalate shall be free of barium compounds, and shall contain not more than a slight amount of calcium compounds. Conformance with these requirements shall be determined by the flame test specified in 4.4.7.

TABLE I. *Chemical and physical properties.*

| Property | Grade A | Grade B | Test paragraph |
|-------------------------------------------------|---------|---------|----------------|
| Color | White | White | |
| Moisture, percent, maximum (max.)..... | 0.25 | 10.0 | 4.4.2 |
| Strontium oxalate, percent, minimum (min.)..... | 94.0 | 84.0 | 4.3.3 |
| Iron, percent, max..... | 0.01 | | 4.4.4 |
| Ammonium compounds, percent..... | None | | 4.4.5 |
| Granulation | | | 4.4.6 |
| Through No. 60 sieve, percent, min..... | | 99.0 | |
| Through No. 140 sieve, percent, min..... | 99.0 | | |

MIL-S-12210A**4. QUALITY ASSURANCE PROVISIONS**

4.1 Lot. A lot shall consist of strontium oxalate of the same grade, from not more than one manufacturing batch. A batch shall consist of 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.

4.2 Sampling. Ten percent of the containers comprised in a lot, but in no case more than 10 containers, shall be selected so as to be representative of the lot. Approximately 4 ounces of the material shall be removed from each container in such manner as to obtain portions from the top, middle, and bottom levels of the container. Each sample shall be mixed separately with all lumps in the material broken up so that the entire sample passes through a No. 10 U.S. sieve conforming to Specification RR-S-366. Each sifted sample shall be divided in half, with one portion placed in a bottle labeled so that the container from which the sample was obtained can be identified. The remaining portions of the primary samples shall be combined, mixed thoroughly, and quartered successively until a composite sample weighing approximately 4 ounces is obtained. This sample shall be placed in a glass bottle, tightly sealed with a rubber stopper, and the bottle labeled to show the name and grade of the material, name of manufacturer, plant, and contract or order number. All acceptance tests (see 4.4) shall be performed on the composite sample. However, if it becomes apparent during sampling that the lot is not uniform, the inspector may require that any of the primary samples be tested for compliance with the requirements of this specification. All primary samples shall be held for future testing should the composite sample fail to comply with the requirements.

4.3 Inspection. Inspection shall be as specified in Specification MIL-G-2550.

4.4 Test procedures.

4.4.1 Reagents. Analytical reagent grade chemicals and distilled water shall be used

throughout the tests. Blank determinations shall be run in parallel with each test, using the same quantities of reagents used in the test, and corrections shall be applied when significant.

4.4.2 Moisture. The total moisture content (water of crystallization and surface moisture) of the material shall be determined as follows: Weigh approximately 5 grams (gm) of the sample, to the nearest milligram, in a tared weighing dish that has been previously dried at 100° to 105°C. Dry the sample for 12 hours in a vacuum of at least 25 inches of mercury and at a temperature of 55° ± 1°C. At the end of the 12-hour period remove the dish from the oven, cool in a desiccator, and weigh. Calculate the loss in weight of the sample to percent moisture content of the material. (Note: Keep the dried material for use in the strontium oxalate test (see 4.4.3).)

4.4.3 Strontium oxalate. The strontium oxalate content shall be determined as follows: Weigh accurately, in a tared porcelain or platinum crucible that has been previously ignited, a 1-gram portion of the dry material saved from the moisture determination (see 4.4.2). Add 5 ml. of concentrated sulfuric acid and 5 ml. of concentrated nitric acid. Cover the crucible with a watch glass and carefully evaporate the solution on a hot plate until white fumes are evolved. Remove from the hot plate, cool, add 5 ml. of concentrated nitric acid, and again carefully evaporate to white fumes. Continue heating until the fumes practically cease, then carefully heat to dryness over an open flame, and ignite for 15 minutes at dull red heat. Cool in a desiccator and weigh. Calculate the weight of strontium sulfate to percentage of strontium oxalate in the dried sample, as follows:

$$\text{Percent strontium oxalate} = \frac{95.65A}{W}$$

where:

A = weight of strontium sulfate, in grams.
W = weight of sample, in grams.

4.4.4 Iron (Grade A only). The iron content of Grade A material shall be determined as follows: Dissolve an accurately weighed portion of approximately 1 gram of the sample in 5 ml. of concentrated sulfuric acid. (Iron-free reagents should be used throughout this determination. Sulfuric acid containing a trace of iron may be used without causing appreciable error if the portions of acid, used as directed, are accurately measured, and taken from the same source.) Heat to complete solution, except for a slight amount of carbon, and cool. Add a few milliliters of concentrated nitric acid and heat until fumes of sulfur trioxide appear. Repeat the treatment with nitric acid until the resulting solution is either colorless or has a light straw color when finally brought to fumes. Cool and cautiously add approximately 25 ml. of distilled water. Allow the precipitate to settle out and decant through a filter into a 100-ml. volumetric flask. Add 5 ml. of concentrated sulfuric acid to the residue in the beaker, heat to solution, cool, add approximately 25 ml. of distilled water, and filter into the same flask. Wash the precipitate with distilled water. Add dilute potassium permanganate solution (0.1N concentration is satisfactory) to the combined filtrate and washings in the flask, until a faint pink coloration persists for several minutes, and then dilute to the 100-ml. mark. Use 2 suitable colorless-glass cylinders of 100-ml. capacity for comparison of the color standard and the sample solutions. In one of the cylinders measure accurately 5 ml. of a standard sulfuric acid-iron solution, containing a known quantity of approximately 0.00001 gram of ferric iron per ml., and add 40 ml. of 25-percent sulfuric acid solution. (Note: A standard solution containing 0.00001 gram of ferric iron per ml. may be conveniently prepared as follows: Weigh accurately a portion of ferrous ammonium sulfate ($\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$), of known purity, to equal 0.0703 gram of the pure salt. Add 50 ml. of 1-to-3 sulfuric acid solution. Warm slightly and add dilute potassium permanganate solution dropwise until a faint pink color persists for several minutes. Di-

lute the solution to 1 liter with distilled water). To the second cylinder add 50 ml. of the sample solution and 20 ml. of the 25-percent sulfuric acid-iron solution. Have the solutions in both cylinders at about 25°C. and add to each solution, avoiding delay between additions, 10 ml. of normal ammonium sulfocyanate solution (containing 76.1 grams of the sulfocyanate per liter of solution). Dilute to the 100-ml. mark, mix thoroughly, and compare colorimetrically at once. (Note: The coloration fades rapidly if the solutions are hot, but slowly at room temperature. Therefore heat should be avoided and colorimetric comparison made immediately upon the addition of the ammonium sulfocyanate solution). Report the sample as containing less than 0.01 percent iron if the color of the standard solution is darker than that of the sample.

4.4.5 Ammonium compounds (Grade A only). The presence of ammonium compounds in the material shall be determined as follows: Warm a small portion (approximately 1 gram) of the sample with a few milliliters of 20-percent potassium hydroxide solution. Report the presence of ammonium compounds if the odor of ammonia is detected.

4.4.6 Granulation. Place a portion of the sample weighing 25.0 ± 0.1 grams on the specified standard testing sieve conforming to Specification RR-S-366 (see table 1). Shake and rub the sample lightly with a spatula so as to break up aggregates of the material, working as much of the sample as possible through the sieve. Determine the weight of the material retained on the sieve, and calculate the percentage that has passed through.

4.4.7 Impurities. The presence of impurities in the material shall be determined by flame test as follows: Ignite a portion of the sample to destroy the organic matter. Moisten with concentrated hydrochloric acid and subject to a flame test, using a platinum wire. The flame shall show the scarlet coloration characteristic of strontium, with no detectable green coloration due to barium. Only

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a short flash of yellowish-red coloration, due to calcium, is permissible.

4.8 Resubmission and retest. If the composite sample, or any primary sample subjected to test, fails to pass the test, the lot shall be rejected. The contractor shall have the option of having a partial or complete analysis made on samples from any or all of the containers in the lot at no expense to the Government. The contractor may then remove the defective portions of the lot and resubmit the lot for acceptance. The resubmitted lot shall be accepted provided that new samples, selected in accordance with 4.2, pass all the tests required by this specification and that 3 additional primary samples pass any test or tests failed by material on original submission.

5. PREPARATION FOR DELIVERY**5.1 Packaging.**

5.1.1 Level C. Unless otherwise specified, strontium oxalate shall be packaged in commercial packages.

5.2 Packing.

5.2.1 Level C. Unless otherwise specified, unit packages of the material (see 5.1) shall be packed in standard commercial containers, so constructed as to insure acceptance by common or other carriers, for safe transportation, at the lowest rate of the carrier, to the specified point of delivery.

5.3 Marking. In addition to any special markings required by the contract or order, the unit packages and the shipping 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) Grade of material required (see 1.2).
- (c) Any special markings required (see 5.3).

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 incur 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 be in any way related thereto.

Preparing activity:

Custodians: Army—Ordnance Corps
Army—Ordnance Corps
Navy—Bureau of Ordnance

Other interest:
Army—C