

METRICDOD-P-51455
3 October 1979

MILITARY SPECIFICATION

POTASSIUM CARBONATE, ANHYDROUS, TECHNICAL (METRIC)

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

1. SCOPE

1.1 Scope. This specification covers two types of technical grade
anhydrous potassium carbonate (K_2CO_3).

1.2 Classification. Potassium carbonate shall be of the following
types as specified (see 6.2):

Type I - Granular form.
Type II - Powder form.

2. APPLICABLE DOCUMENTS

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

FSC 6810

: beneficial comments (recommendations, additions, deletions) and any :
: pertinent data which may be of use in improving this document should be :
: addressed to: Commander, US Army Armament Research and Development :
: Command, Attn: DRDAR-TSC-S, Aberdeen Proving Ground, MD 21010 by us- :
: ing the self-addressed Standardization Document Improvement Proposal :
: (DD Form 1426) appearing at the end of this document or by letter. :

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SPECIFICATIONS

FEDERAL

- PPP-D-705 - Drum, Shipping and Storage: Steel, 16 and 30 Gallon Capacity.
- PPP-D-729 - Drums, Shipping and Storage, Steel, 55-Gallon (208 Liters).
- PPP-P-704 - Pails, Metal: (Shipping, Steel, 1 through 12 Gallons).

MILITARY

- MIL-B-117 - Bags, Sleeves and Tubing - Interior Packaging.

STANDARDS

FEDERAL

- Fed. Test Method Std. No. 101 - Preservation, Packaging, and Packing Materials: Test Procedures.

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-147 - Palletized Unit Loads for 40" x 48" Pallets.
- MIL-STD-1188 - Commercial Packaging of Supplies and Equipment.

(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 to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

UNIFORM FREIGHT CLASSIFICATION RULES

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

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AMERICAN CHEMICAL SOCIETY (ACS)

Reagent Chemicals, American Chemical Society Specifications.

(Application for copies should be addressed to the American Chemical Society, 1155 16th Street, N.W., Washington, DC 20036.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS

D501 - Sampling and Chemical Analysis of Alkaline Detergents.
 D1193 - Reagent Water.
 E11 - Wire-Cloth Sieves for Testing Purposes.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Chemical and physical characteristics. Types I and II potassium carbonate shall conform to the applicable chemical and physical characteristics of table I when tested as specified therein.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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.

4.2 Quality conformance inspection.

4.2.1 Lotting. A lot shall consist of one type of potassium carbonate produced by one manufacturer, at one plant, from the same materials, and under essentially the same manufacturing conditions provided the operation is continuous. In the event the process is a batch operation, each batch shall constitute a lot (see 6.3).

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TABLE I. Chemical and physical characteristics

Characteristic	Type I		Type II		Test paragraph
	Minimum	Maximum	Minimum	Maximum	
Assay (as K_2CO_3 , equivalent to total alkalinity), percent by weight	99.0	---	99.0	---	4.2.4.1
Loss on heating, percent by weight	---	1.0	---	1.0	4.2.4.2
Apparent density, grams per cubic centimeter	0.85	1.33	0.85	0.90	4.2.4.3
Particle size distribution, percent by weight:					
Retained on No. 8 sieve	---	0	---	---	4.2.4.4
Retained on No. 16 sieve	0	1	---	---	
Retained on No. 20 sieve	0.6	12	---	0	
Retained on No. 40 sieve	40	80	0	5	
Retained on No. 70 sieve	18	50	5	15	
Retained on No. 100 sieve	0	15	5	15	
Passed through No. 100 sieve	0	2	---	---	
Retained on No. 200 sieve	---	---	5	15	
Passed through No. 200 sieve	---	---	60	85	

4.2.2 Sampling.

4.2.2.1 For examination of packaging. Sampling shall be conducted in accordance with MIL-STD-105.

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4.2.2.2 For potassium carbonate test. Sampling shall be conducted in accordance with table II. A representative specimen of approximately 450 grams (g) shall be removed from each sample container and placed in a suitable clean, dry container labeled to identify the lot and container from which it was taken.

TABLE II. Sampling for test

Number of containers in batch or lot	Number of sample containers
2 to 25	2
26 to 150	3
151 to 1,200	5
1,201 to 7,000	8
7,001 to 20,000	10
Over 20,000	20

4.2.2.3 For container leakage test. Sampling shall be conducted in accordance with MIL-STD-105.

4.2.3 Inspection procedure.

4.2.3.1 For examination of packaging. The sample unit shall be one filled unit, intermediate, or shipping container, as applicable, ready for shipment. Sample unit, intermediate, and shipping containers shall be examined for the following defects using an AQL of 2.5 percent defective:

- (a) Contents per container not as specified
- (b) Container not as specified
- (c) Container closure not as specified
- (d) Container damaged or leaking
- (e) Unit pack interior dirty, rusty or contaminated
- (f) Liner bag missing or not as specified
- (g) Exterior of unit pack contaminated with potassium carbonate
- (h) Marking incorrect, missing, or illegible
- (i) Unitization not as specified

4.2.3.2 For potassium carbonate test. Approximately equal portions of all of the specimens taken in 4.2.2.2 shall be thoroughly mixed to form a composited specimen of no less than 450 g. The composited specimen shall be tested as specified in 4.2.4. Each test shall be conducted in duplicate analysis. Failure of either analysis of any test shall be cause for rejection of the lot represented.

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4.2.3.3 For container leakage test. The sample unit shall be one container. The sample containers selected in 4.2.2.3 shall be tested as specified in 4.2.5 using an AQL of 2.5 percent defective.

4.2.4 Potassium carbonate tests. Water in accordance with ASTM D1193 and 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:

4.2.4.1 Assay. Standardize $1N$ hydrochloric solution against anhydrous reagent primary standard sodium carbonate using methyl red indicator. Standardize $1N$ potassium hydroxide solution against the $1N$ hydrochloric acid solution. Weigh to the nearest milligram (mg) approximately 10 g of the composited specimen and transfer to a 250-milliliter (ml) volumetric flask. Dissolve in carbon dioxide-free distilled water, dilute to the volume mark, and shake well. Pipet a 50-ml aliquot into a 500-ml Erlenmeyer flask, add 0.5 ml of methyl red indicator (5 g per liter in ethyl alcohol), and titrate with $1N$ hydrochloric acid to a red color. Boil the solution several minutes, cool, and if there is a color change, titrate again to the red color. Add 2 ml excess $1N$ hydrochloric acid and boil 3 minutes. Cool. Back titrate with $1N$ potassium hydroxide solution to a yellow end point. Calculate the percent potassium carbonate as follows:

$$\text{Percent potassium carbonate} = \frac{34.55 (AB - CD)}{W}$$

where: A = Milliliters of hydrochloric acid used,
 B = Normality of the hydrochloric acid solution,
 C = Milliliters of potassium hydroxide used,
 D = Normality of the potassium hydroxide solution, and
 W = Weight of the specimen in grams.

4.2.4.2 Loss on heating. Determine, to the nearest milligram, the tare weight of a porcelain evaporating dish which has been dried to a constant weight at $200^{\circ} \pm 5^{\circ}C$ and cooled in a desiccator over a desiccant. Transfer approximately 5 g of the specimen, weighed to the nearest milligram, to the tared porcelain dish, and heat at $200^{\circ} \pm 1^{\circ}C$ to a constant weight. Cool in a desiccator and weigh. Calculate the percent loss on heating as follows:

$$\text{Percent loss on heating} = \frac{100 (A - B)}{W}$$

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where: A = Weight of dish and contents before heating in grams,
 B = Weight of dish and contents after heating in grams, and
 W = Weight of the specimen in grams.

4.2.4.3 Apparent density. Determine the apparent density of the specimen in accordance with ASTM D501 using the method for determining apparent density of soda ash. Convert the result to grams per cubic centimeter by multiplying by 0.016.

4.2.4.4 Particle size distribution. Nest tared sieves of the sizes specified in table I and conforming to ASTM E11 in order of increasing fineness with the No. 8 sieve on top for the type I specimen, and the No. 20 sieve on top for the type II specimen. Place on a bottom pan. Transfer 100 g of the specimen, weighed to the nearest 0.01 g, to the top sieve. Cover the assembly and place in a mechanical shaker geared to produce 300 ± 15 gyrations and 150 ± 10 striker taps per minute. Shake for 10 minutes. (The material may also be brushed through the sieves with a camel's hair brush.) Weigh each sieve, the bottom pan, and their retained contents. Calculate the percent retained on each sieve and the pan as follows:

$$\text{Percent retained} = \frac{100 (A - B)}{W}$$

where: A = Weight of the sieve and contents in grams,
 B = Tare weight of the sieve in grams, and
 W = Weight of the specimen in grams.

Calculate the percent passed through the bottom sieve from the weight of contents in the bottom pan.

4.2.5 Container leakage test. Test the containers for leakage in accordance with method 5007 of Fed. Test Method Std. No. 101.

5. PACKAGING

5.1 Unit packing. Potassium carbonate shall be unit packed, level A, B or commercial as specified (see 6.2).

5.1.1 Level A. Potassium carbonate shall be unit packed, level A in an 11.3 kilogram (kg), 45 kg, or 136 kg quantity as specified (see 6.2).

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5.1.1.1 Quantity of 11.3 kg. A quantity of 11.3 kg (+1 or -0 percent) of potassium carbonate shall be unit packed in a clean, dry steel pail having a minimum capacity of 13.25 liters and conforming to PPP-P-704, type II, class 2. Each pail shall be furnished with a bag liner of a size to fit the pail and conforming to MIL-B-117, type II, class B, style optional. The bag shall be closed by tying, knotting, or heat sealing. The pail shall be closed and shall not leak when tested as specified in 4.2.5. There shall be no visual evidence of potassium carbonate on the exterior of the container.

5.1.1.2 Quantity of 45 kg. A quantity of 45 kg (+1 or -0 percent) of potassium carbonate shall be unit packed as specified for the 11.3 kg quantity in 5.1.1.1, except that the container shall have a minimum capacity of 57 liters and shall conform to PPP-D-705, type IV.

5.1.1.3 Quantity of 136 kg. A quantity of 136 kg (+1 or -0 percent) of potassium carbonate shall be unit packed as specified for the 11.3 kg quantity in 5.1.1.1, except that the container shall have a minimum capacity of 170 liters and shall conform to a Uniform Freight Classification (UFC) Rule 40 steel drum with gasketed fully removable head except that the entire exterior of the drum shall be finished as specified for the drums conforming to PPP-D-729.

5.1.2 Level B. Potassium carbonate shall be packed level B in the same unit quantities as specified for level A in 5.1.1 (see 6.2).

5.1.2.1 Quantity of 11.3 kg. A quantity of 11.3 kg (+1 or -0 percent) of potassium carbonate shall be unit packed as specified in 5.1.1.1, except that the container shall conform to a UFC Rule 40 steel pail or to a UFC Rule 51 water vapor proof fiber drum.

5.1.2.2 Quantity of 45 kg. A quantity of 45 kg (+1 or -0 percent) of potassium carbonate shall be unit packed as specified in 5.1.1.2 except that the container shall conform to a UFC Rule 40 steel drum with gasketed fully removable head or to a UFC Rule 51 water vapor proof fiber drum.

5.1.2.3 Quantity of 136 kg. A quantity of 136 kg (+1 or -0 percent) of potassium carbonate shall be unit packed as specified in 5.1.1.3 except that the container shall conform to a UFC Rule 40 steel drum with gasketed fully removable head or to a UFC Rule 51 water vapor proof fiber drum.

5.1.3 Commercial. Potassium carbonate shall be unit packed in the specified quantity (see 6.2) in accordance with MIL-STD-1188.

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5.2 Packing. Potassium carbonate, unit packed as specified in 5.1, shall require no further protection by packing.

5.3 Unitization. Level A and B unit packs shall be unitized in accordance with the applicable palletization requirements of MIL-STD-147.

5.4 Marking. Containers that are protected level A or B and pallet loads shall be marked in accordance with MIL-STD-129. Commercial packs shall be marked in accordance with MIL-STD-1188. Each container shall be marked to show the lot or batch number and the date of pack of the potassium carbonate.

6. NOTES

6.1 Intended use. Potassium carbonate is intended for use as a carbon dioxide absorbent.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Type of potassium carbonate required (see 1.2).
- (c) Level of packing required (see 5.1).
- (d) Unit quantity required (see 5.1.1, 5.1.2, and 5.1.3).

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 operation intended to make the final product substantially uniform.

6.4 Significant places. For the purpose of determining conformance with this specification, an observed or calculated value should be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding-off method of ASTM E29.

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Army - EA
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