

MIL-C-51511

22 August 1985

SUPERSEDING

O-C-105D

February 10, 1976

MIL-C-13573D

24 August 1983

## MILITARY SPECIFICATION

## CALCIUM CHLORIDE, TECHNICAL

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

## 1. SCOPE

1.1 Scope. This specification covers one type of technical calcium chloride, dihydrate and one type and three grades of technical calcium chloride, anhydrous.

1.2 Classification. Calcium chloride shall be of the following types and grades as specified (see 6.2):

Type I - Dihydrate, 77 percent, flake

Type II - Anhydrous

Grade A - 94 percent, flake, pellet, or other granular

Grade B - 90 percent, lump

Grade C - 95 percent

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

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: Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSMC-TDC-S (A), Aberdeen Proving Ground, MD 21010-5423 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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MIL-C-51911

## SPECIFICATIONS

## FEDERAL

- NN-P-71 - Pallets, Material Handling, Wood, Stringer Construction, 2-Way and 4-Way (Partial)
- UU-S-48 - Sacks, Shipping, Paper
- PPP-B-636 - Boxes, Shipping, Fiberboard
- PPP-C-2020 - Chemicals, Liquid, Dry, and Paste: Packaging of
- PPP-D-723 - Drums, Fiber
- PPP-F-320 - Fiberboard: Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes

## STANDARDS

## FEDERAL

- Fed. Std. No. 313 - Material Safety Data Sheets Preparation and the Submission of

## 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
- MIL-STD-650 - Explosive: Sampling, Inspection and Testing
- MIL-STD-1168 - Ammunition Lot Numbering

(Copies of specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the non-government documents which is current on the date of the solicitation.

## ASTM STANDARDS

- C 136 - Sieve Analysis of Fine and Coarse Aggregates (DOD Adopted)
- D 345 - Calcium Chloride for Roads and Structural Applications
- D 1193 - Reagent Water (DOD Adopted)
- D 3951 - Commercial Packaging (DOD Adopted)
- E 11 - Wire-Cloth Sieves For Testing Purposes (DOD Adopted)
- E 449 - Analysis of Calcium Chloride

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Appearance. Calcium chloride shall not be caked or sticky and shall be free from the presence of dirt or other foreign matter when tested as specified in 4.2.4.1.

3.2 Chemical characteristics. Calcium chloride shall conform to the chemical characteristics of table I when tested as specified therein.

TABLE I. Chemical characteristics

Characteristic	Percent by weight					Test paragraph
	Type I	Type II				
		Grade A	Grade B	Grade C		
Calcium chloride content, minimum	77.0	94.0	90.0	95.0	4.2.4.2	
Alkali chlorides as NaCl, maximum	8.0	5.0	8.0	--	4.2.4.2	
Magnesium chloride (MgCl <sub>2</sub> ), maximum	0.5	0.5	0.5	--	4.2.4.2	
Other impurities (not including water), maximum	1.0	1.0	1.0	--	4.2.4.2	
Volatile matter, maximum	--	--	--	4.0	4.2.4.3	
Acidity (as HCl)	--	--	--	0.005	4.2.4.4	
Alkalinity [as Ca(OH) <sub>2</sub> ]	--	--	--	0.3	4.2.4.4	

3.3 Particle size characteristics. Calcium chloride shall conform to the particle size characteristics of table II when tested as specified in 4.2.4.5 except that type II, grade C calcium chloride shall be tested as specified in 4.2.4.6.

3.4 Grit or insoluble particles in type II, grade C calcium chloride. For type II, grade C calcium chloride, no more than 5 particles shall be retained on a 250-micrometer sieve and no particles shall be retained on a 425-micrometer sieve when tested as specified in 4.2.4.7.

TABLE II. Particle size characteristics

Sieve size	Percent by weight passing				
	Type I	Type II			
		Grade A	Grade B	Grade C	
25.0 millimeter	--	--	100 min	--	
9.5 millimeter	100 min	100 min	--	--	
4.75 millimeter	80 min	80 min	5 max	--	
1.70 millimeter	--	--	--	100 min	
850 micrometer	10 max	10 max	--	--	

3.5 Material Safety Data Sheets. Material Safety Data Sheets for calcium chloride shall be prepared and submitted by the contractor as specified in Fed. Std. No. 313 (see 6.6).

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other 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.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

#### 4.2 Quality conformance inspection.

4.2.1 Lotting. A lot shall consist of the calcium chloride of one type and grade 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). Each lot of type II, grade C calcium chloride shall be identified and controlled in accordance with MIL-STD-1168.

4.2.2 Sampling. See 6.5 for sampling and testing precautions.

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

4.2.2.2 For calcium chloride test. Sampling shall be conducted in accordance with table III. A representative specimen of approximately 1,200 grams (g) shall be removed from each sample container using the sampling procedures for solid calcium chloride in ASTM D 345 and placed in a suitable clean, dry, sealed container labeled to identify the lot and container form which it was taken. The entire contents from 1-pound (lb) sample bottles shall be composited as necessary to produce as many 1,200-g specimens as the number of 1-lb bottles allows. Exposure to atmospheric moisture shall be minimized during sampling.

TABLE III. Sampling for calcium chloride test

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

4.2.3 Inspection procedure. See 6.5 for sampling and testing precautions.

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

AQL 1.0 percent defective

- (a) Container damaged or leaking

AQL 2.5 percent defective

- (b) Contents per container not as specified
- (c) Container not as specified
- (d) Container closure not as specified
- (e) Fiberboard pads, partitions, or liners missing or not as specified
- (f) Unitization not as specified
- (g) Marking incorrect, missing, or illegible

4.2.3.2 For calcium chloride test. Each sample specimen or composited 1-lb bottle specimen taken in 4.2.2.2 shall be tested as specified in the applicable portions of 4.2.4. Failure of any test by any specimen or composited specimen shall be cause for rejection of the lot represented.

4.2.4 Tests. See 6.5 for sampling and testing precautions. Water in accordance with ASTM D 1193 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 Appearance. Visually examine the specimen for caking, clumping, and the presence of dirt or other foreign matter.

4.2.4.2 Calcium chloride content, alkali chlorides, magnesium chloride, and other impurities. Determine the percent by weight calcium chloride content, alkali chlorides, magnesium chloride, and other impurities in the specimen in accordance with the applicable test procedures in ASTM E 449. Other impurities are those compounds other than water, not determined in the analysis of calcium chloride by ASTM E 449.

4.2.4.3 Volatile matter. Transfer approximately 5 g of the specimen into a tared glass-stoppered weighing bottle and weigh to the nearest 0.1 milligram (mg). Remove the stopper and place the bottle and contents in an oven maintained at 200° to 205°C for 2 hours. Replace the stopper, cool to room temperature in a desiccator, and weigh to the nearest 0.1 mg. Calculate the percent by weight volatile matter as follows:

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

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

4.2.4.4 Acidity or alkalinity. Weigh to the nearest 0.01 g approximately 5 g of the specimen, which has been previously dried for 2 hours at 200° to 205°C, and dissolve in 50 milliliters (mL) of water. Add a few drops of phenolphthalein indicator solution. If the solution remains colorless, titrate it with 0.1N sodium hydroxide solution and calculate the percent by weight acidity as follows:

$$\text{Percent acidity} = \frac{3.647AB}{W}$$

where: A = Milliliters of sodium hydroxide solution used,  
B = Normality of sodium hydroxide solution, and  
W = Weight of dried specimen in grams.

If the solution turns red, titrate it with 0.1N hydrochloric acid and calculate the percent by weight alkalinity as follows:

$$\text{Percent alkalinity} = \frac{3.705AB}{W}$$

where: A = Milliliters of hydrochloric acid used,  
B = Normality of hydrochloric acid, and  
W = Weight of dried specimen in grams.

4.2.4.5 Particle size characteristics (excluding type II, grade C calcium chloride). Determine the particle size characteristics of approximately 1,000 g the specimen in accordance with ASTM C 136 using sieves conforming to ASTM E 11 of the applicable sizes specified in table II. Set the sieve shaker for 145 to 155 taps per minute and 290 to 310 rotations per minute. Complete the sieving within 5 minutes and complete the weighing as quickly as possible due to the hygroscopic nature of calcium chloride.

4.2.4.6 Particle size characteristics of type II, grade C calcium chloride. Weigh to the nearest 0.01 g approximately 25 g of the specimen, which has previously dried for 2 hours at 200° to 205°C, stoppered, and stored in a desiccator, and place it on a 1.70-millimeter sieve conforming to ASTM E 11. Tape a bottom pan under the sieve and cover with a tightly fitting cover. Shake for 10 minutes by hand or for 5 minutes in a mechanical shaker geared to produce  $300 \pm 15$  gyrations and  $150 \pm 10$  taps of the striker per minute. Weigh any material retained on the sieve as quickly as possible and calculate the percent by weight passing.

4.2.4.7 Grit or insoluble particles. Determine the grit or insoluble particles in 50 g of the specimen in accordance with MIL-STD-650, method 106.1, using 200 mL of water plus 5 mL of 1 to 1 hydrochloric acid as the solvent.

## 5. PACKAGING

5.1 Preservation. Calcium chloride shall be preserved level A, level B, or commercial as specified (see 6.2). Quantity tolerance shall be +1 or -0 percent of the specified weight.

### 5.1.1 Level A.

5.1.1.1 Unit packing. A 1-lb or 5-lb quantity of calcium chloride as specified (see 6.2) shall be unit packed in a glass bottle in accordance with the level A preservation requirements for type I, class 1 containers in PPP-C-2020. A 50-lb, 80-lb, or 100-lb quantity of calcium chloride as specified (see 6.2) shall be unit packed in appropriate size sacks conforming to construction number 17 or 17X, MB2 of UU-S-48, or in fiber drums conforming to type III, grade A of PPP-D-723 as specified (see 6.2). Fiber drums shall be provided with a polyethylene bag liner or other suitable waterproof liner or interior coating.

5.1.1.2 Intermediate packing. Intermediate packing of 1-lb quantities of calcium chloride unit packed as specified in 5.1.1.1 shall be in accordance with the level A intermediate packing requirements of PPP-C-2020. Larger unit pack quantities of calcium chloride do not require intermediate packing.



### 5.1.2 Level B.

5.1.2.1 Unit packing. A 1-lb or 5-lb quantity of calcium chloride as specified (see 6.2) shall be unit packed in a glass bottle in accordance with the level B preservation requirements for type I, class 1 containers in PPP-C-2020. A 50-lb, 80-lb, or 100-lb quantity of calcium chloride as specified (see 6.2) shall be unit packed in appropriate size sacks conforming to construction number 16 or 16X, MB2 of UU-S-48, or in fiber drums conforming to type I, grade A of PPP-D-723 as specified (see 6.2). Fiber drums shall be provided with a polyethylene bag liner or other suitable waterproof liner or interior coating.

5.1.2.2 Intermediate packing. Intermediate packing of 1-lb quantities of calcium chloride unit packed as specified in 5.1.2.1 shall be in accordance with the level B intermediate packing requirements of PPP-C-2020. Larger unit pack quantities of calcium chloride do not require intermediate packing.

5.1.3 Commercial. A quantity of calcium chloride as specified (see 6.2) shall be unit packed in accordance with ASTM D 3951.

5.2 Packing. Calcium chloride shall be packed level A, level B, or commercial as specified (see 6.2).

### 5.2.1 Level A.

5.2.1.1 One-lb quantity. One-lb quantities of calcium chloride intermediately packed as specified in 5.1.1.2 shall be packed in accordance with the level A packing requirements of PPP-C-2020.

5.2.1.2 Five-lb quantity. Five-lb quantities of calcium chloride unit packed as specified in 5.1.1.1 shall be packed upright in three rows of four bottles per row in a close-fitting fiberboard box conforming to type CF, class weather-resistant, grade V3c of PPP-B-636. Separator pads and dividers fabricated from fiberboard conforming to type CF, grade W6c of PPP-F-320 shall be used to separate the rows and the individual bottles.

5.2.1.3 Quantities of 50, 80, and 100 lb. Quantities of 50, 80, and 100 lb of calcium chloride unit packed as specified in 5.1.1.1 require no further packing for shipment.

### 5.2.2 Level B.

5.2.2.1 One-lb quantity. One-lb quantities of calcium chloride intermediately packed as specified in 5.1.2.2 shall be packed in accordance with the level B packing requirements of PPP-C-2020.

5.2.2.2 Five-lb quantity. Five-lb quantities of calcium chloride unit packed as specified in 5.1.2.1 shall be packed as specified for level A in 5.2.1.2 except that the box shall be constructed from class domestic, grade 275 fiberboard.



5.2.2.3 Quantities of 50, 80, and 100 lb. Quantities of 50, 80, and 100 lb of calcium chloride unit packed as specified in 5.1.2.1 require no further packing for shipment.

5.2.3 Commercial. A quantity of calcium chloride as specified (see 6.2) shall be packed in accordance with ASTM D 3951.

5.3 Unitization. Uniform quantities of level A or B packs of calcium chloride shall be palletized in accordance with the applicable requirements for load type I of MIL-STD-147 using a softwood pallet conforming to type IV of NN-P-71. Commercial packs of calcium chloride shall be palletized in accordance with ASTM D 3951.

5.4 Marking. Unit, intermediate, and shipping containers shall be marked in accordance with MIL-STD-129 for level A and B shipments and in accordance with ASTM D 3951 for commercial shipments. In addition, each container of calcium chloride shall be durably and legibly marked with the following precautionary information:

WARNING: CAUSES EYE AND SKIN IRRITATION

HARMFUL IF SWALLOWED

Will burn skin and eyes.  
Avoid contact with eyes, skin and clothing.  
Wear rubber overclothing, including gloves.  
Wash thoroughly after handling.  
If swallowed will cause nausea and vomiting.  
Avoid breathing dust.  
Keep container closed.  
Use with adequate ventilation.

FIRST AID: In case of contact, flush affected areas with plenty of water. If in eyes, hold eyelids open and flush with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. If swallowed and victim is conscious, have victim drink water or milk. If swallowed and victim is unconscious or having convulsions do nothing except keep victim warm. Call for immediate medical attention. If inhaled, remove to fresh air, if discomfort persists, get medical attention.

## 6. NOTES

6.1 Intended use. Type I and type II, grade A calcium chloride are intended for use as road construction material, admixtures for concrete, refrigerating mediums, and other technical uses. In addition, both types may be used for

snow and ice control on sidewalks and driveways of buildings. Type II, grade B calcium chloride is intended for use as a deicating agent. Type II, grade C calcium chloride is intended for use as a dehydrating agent for aluminized high explosives. Calcium chloride should not be used as an antifreeze material in the water cooling systems of internal combustion engines.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification
- (b) Type and grade of calcium chloride required (see 1.2)
- (c) Level of preservation and packing required (see 5.1 and 5.2)
- (d) Unit quantity required (see section 5)
- (e) Type of container required for 50-lb, 80-lb, and 100-lb unit quantities (see 5.1.1.1 and 5.1.2.1)

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 E 29.

6.5 Sampling and testing precautions. This specification requires inspection of chemical material (calcium chloride) which is potentially hazardous to personnel (see 5.4). All applicable safety rules, regulations, and procedures must be followed in the handling and processing of this material.

6.6 Material Safety Data Sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with Fed. Std. No. 313. The pertinent mailing addresses for submission of data are listed in appendix B of Fed. Std. No. 313.

6.7 Supersession data. This specification supersedes and includes the requirements of O-C-105D, Calcium Chloride, Dihydrate and Calcium Chloride, Anhydrous: Technical, dated July 21, 1974 and Amendment 1, dated February 10, 1976 and MIL-C-13573D, Calcium Chloride, Anhydrous, dated 24 August 1983. Specific replacement information is listed in table IV.

TABLE IV. Replacements for O-C-105D and MIL-C-13573D material

Former designation	Replacement designation
O-C-105D, type I	MIL-C-51511, type I
O-C-105D, type II, grade A	MIL-C-51511, type II, grade A
O-C-105D, type II, grade B, class 1	None (not commercially available)
O-C-105D, type II, grade B, class 2	MIL-C-51511, type II, grade B
MIL-C-13573D	MIL-C-51511, type II, grade C

Custodians:

Army - EA  
Navy - OS  
Air Force - 68

Preparing activity:

Army - EA  
Project No. 6810-B517

Review activities:

Army - AR, MD, ME  
DLA - GS





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