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MILITARY SPECIFICATION

METAL CLEANER SILICATE-SOAP

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 This specification covers a silicate-soap metal cleaner for cleaning aluminum, magnesium, and other metallic surfaces.

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 to the extent specified herein:

SPECIFICATIONS

Federal

O-S-604	Sodium Metasilicate
QQ-A-355	Aluminum Alloy (24S), Plate and Sheet
QQ-M-44	Magnesium Alloy (3.0 Aluminum, 1.0 Zinc); Plate and Sheet
RR-S-366	Sieves, Standard for Testing Purposes
PPP-D-729	Drums: Metal, 55-Gallon (for Shipment of Noncorrosive Materials)
PPP-D-760	Drums and Pails, Metal (5 and 16.64 Gallon)

Military

MIL-S-7842	Sodium Trisilicate, Soluble, Powdered
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys

STANDARDS

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
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.)

FSC 6850

3. REQUIREMENTS

3.1 Materials.- The materials used in the manufacture of this product shall conform to applicable specifications and shall be as specified herein. Materials which are not covered by applicable specifications, or which are not specifically described herein, shall be of high quality and suitable for the purpose intended.

3.1.1 Form.- The cleaner shall be in the form of a nonhygroscopic granular powder, free from fatty acid soap, rosin, starch, sodium phosphate, abrasives, gritty material, or inert fillers.

3.1.2 Composition.- The chemical formulation of the metal cleaner shall be as specified in table I.

TABLE I

Chemical formulation

Ingredient	Specification	Percent by weight
Sodium metasilicate	O-S-604, type I	40.5 to 41.5
Sodium trisilicate, soluble, powdered	MIL-S-7842	53.5 to 54.5
Synthetic soap		4.9 to 5.1

3.1.2.1 Soap.- The soap included in the formulation shall be a nondeliquescent granular or powdered synthetic ingredient, soluble and stable in the silicate solution when prepared for use.

3.2 Total alkalinity.- The total alkalinity as determined by titration, using modified methyl orange indicator and calculated at Na_2O, shall be between 22.0 and 23.5 percent by weight.

3.3 Silica.- The silica, calculated as SiO_2, shall be between 43.0 and 47.0 percent. The silica content shall be between 1.85 and 2.10 times the alkalinity.

3.4 Hydrogen-ion concentration.- The pH value of a solution of 30 grams of cleaner per liter of distilled water at 23°C (73°F) shall be between 11.0 and 12.5.

3.5 Coarse particles.- Coarse particles retained on a No. 40 screen conforming to Specification RR-S-366, shall not exceed 35 percent by weight at a relative humidity of not more than 60 percent.

3.6 Surface tension.- The surface tension of a solution of 30 grams of cleaner per liter of distilled water, at 23°C (73°F) shall be not more than 32.0 dynes per centimeter.

3.7 Insoluble matter.- Matter insoluble in distilled water at a temperature of 100°C (212°F) shall not exceed 0.50 percent by weight.

3.8 Cleaning properties.- The cleaner, when used in concentration of 30 grams per liter of water, shall clean metal surfaces as required by the cleaning properties test.

3.9 Rinsing properties.- The cleaner shall be completely free rinsing, and shall leave a chemically clean surface.

3.10 Corrosiveness.- A solution of 60 grams of cleaner per liter of water shall cause no visible staining, discoloration, or attack of highly polished aluminum alloy conforming to Specification QQ-A-355, magnesium alloy conforming to Specification QQ-M-44, and anodized aluminum-alloy panels anodized in accordance with Specification MIL-A-8625 after 1 hour immersion at 96° to 100°C (205° to 212°F).

3.11 Workmanship.- The component ingredients shall be intimately assembled and processed, as required, in accordance with the best commercial practice for a high-quality material which is stable and not subject to abnormal change with age in a sealed container.

4. QUALITY ASSURANCE PROVISIONS

4.1 General.- All the tests required herein for the testing of metal cleaner are classified as Acceptance tests, for which necessary sampling techniques and methods of testing are specified in this section.

4.2 Test conditions.- Unless otherwise specified, all tests required by this specification shall be made at a normal atmospheric pressure, a temperature of 23° ±1.1°C (73° ±2°F), and a relative humidity of 50 ±4 percent.

4.3 Sampling.-

4.3.1 Inspection lot.- An inspection lot shall consist of all cleaner manufactured from the same components and offered for inspection at one time.

4.3.2 Sampling for inspection of filled containers (visual examination).- A random sample of filled containers shall be selected by the Government Inspector from each inspection lot in accordance with Standard MIL-STD-105, table III, inspection level I, acceptable quality level (AQL) of 2.5 percent defective, for visual examination as described under 4.4.1.2.

4.3.3 Sampling for tests of cleaner.- Two containers from each inspection lot shall be selected at random by the Government Inspector. A specimen of sufficient size for test purposes shall be taken from each of the two containers. Each specimen shall be placed in a clean dry metal or glass container, then sealed, marked, and forwarded to the testing laboratory designated by the Government Inspector. Each specimen shall be subjected to all the tests required by the specification as described under 4.4. If either of the two specimens representing an inspection lot fails one or more of these tests, the inspection lot shall be rejected.

4.3.4 Test reports.- The contractor shall furnish test reports, in duplicate, showing quantitative results for all tests required by this specification, and signed by an authorized representative of the contractor or laboratory, as applicable. The report shall include full details of the specific method used to determine hydrogen-ion concentration (stating indicators, types of electrodes used, etc).

4.4 Tests.-

4.4.1 Inspection.-

4.4.1.1 Examination of product.- Metal cleaner shall be examined to determine conformance to the requirements of this specification that do not involve tests.

4.4.1.2 Visual examination.- Each sample filled container shall be weighed to determine the amount of the contents, and shall be examined for defects of the container and the closure, for evidence of leakage, and for unsatisfactory markings.

4.4.2 Total alkalinity (As Na_2O).- A 1- to 2-gram sample of the metal cleaner shall be weighed into a 250-ml beaker. The sample shall be dissolved in 50 ml of boiling distilled water, cooled to room temperature, and titrated with 0.5N hydrochloric acid using modified methyl orange as the indicator. Modified methyl orange indicator is prepared by dissolving 0.1 gram methyl orange and 0.25 grams of indigo carmine in 100 ml of distilled water. This solution is preferably stored in an amber-colored bottle. A blank determination shall be run simultaneously with test samples.

Calculation:

$$\text{Percent total alkalinity } (Na_2O) = \frac{(V - V_B)\ N \times 3.1}{W} \qquad (1)$$

Where V = Volume in ml of HCl required
V_B = Volume in ml of HCl required for a blank determination
N = Normality of HCl
W = Weight of sample

4.4.3 Silica (SiO_2).-

4.4.3.1 Reagents.-

4.4.3.1.1 Gelatin solution (0.25 percent).- Two and one-half grams of gelatin, USP grade, shall be dissolved in 1 liter of distilled water at a temperature of 50° to 60°C (122° to 140°F). A few pea-sized crystals of thymol shall be added. The flask shall be shaken several times during the first hour after adding the thymol in order that a concentration of thymol sufficient to prevent microbial growth will be present throughout the whole solution.

4.4.3.1.2 Gelatin wash solution.- Twenty ml of 0.25 percent gelatin solution and 10 ml of 1:1 hydrochloric acid shall be added to 970 ml of distilled water.

4.4.3.2 Procedure.- One gram of the sample shall be placed in an ignited and weighed platinum crucible, heated slowly until most of the carbon is destroyed, then ignited until the dark color disappears and the weight becomes constant. To the residue in the crucible, approximately 4 grams of pure anhydrous sodium carbonate shall be added and fused with the mixture. The resulting fusion product shall be dissolved in 100 ml of 1:1 hydrochloric acid in a 400-ml beaker. The beaker shall be covered with a raised watch glass, placed on a hotplate, and evaporated down to 40 ml. It shall be cooled to 60°C (140°F) and 40 ml of gelatin solution and 10 ml of distilled water shall be added. The solution shall be stirred vigorously to incorporate air and form a froth. The solution shall be allowed to stand 10 minutes, filtered through a No. 40 Whatman paper or its equivalent, and washed with a hot gelatin wash solution 6 to 8 times using 5-ml portions. The filter paper and residue shall be transferred to an ignited and weighed platinum crucible and ignited at 950°C (1,742°F) to constant weight, cooled, and weighed. The percent silica shall be calculated.

Calculation:

$$\text{Percent silica} = \frac{R \times 100}{S} \qquad (2)$$

Where R = Weight of residue
S = Weight of sample

4.4.3.3 Ratio of silica to alkalinity.- The percent silica (SiO_2) shall be divided by the percent alkalinity (Na_2O) and the result reported as a ratio.

4.4.4 Hydrogen-ion concentration.- The pH value shall be determined at the specified temperature and concentration to the nearest 0.1 pH by an electrometric or colorimetric method. (See 4.3.4.)

4.4.5 Surface tension.- Surface tension of the specified solution at the required temperature shall be determined by a DuNouy Interfacial Tensiometer. A platinum-iridium ring having a mean circumference of 6 cm shall be used, and the recommended instructions of the manufacturer of this instrument shall be observed. The tensiometer should be capable of being read to 0.1 dyne per cm with a precision of ±0.05 dyne per cm.

4.4.6 Insoluble matter.- One hundred ml of distilled water shall be heated to boiling. A 10-gram sample shall be added and boiled for 15 minutes. The water lost by evaporation shall be replaced. The solution shall be filtered through a weighed medium-porosity fritted glass crucible. The residue shall be washed with small volumes of hot water not exceeding a total of 30 ml. The crucible and residue shall be dried at 105°C (221°F) for 1 hour, cooled, and weighed. The percentage of matter insoluble in distilled water shall be calculated.

Calculation:

$$\text{Percent water insoluble matter} = \frac{R \times 100}{S} \qquad (3)$$

Where R = Weight of residue
S = Weight of sample

4.4.7 Cleaning properties.- Sufficient USP white mineral oil shall be poured to cover both sides of a 3- by 6-inch smooth aluminum panel. The aluminum shall conform to Specification QQ-A-355. The panel shall be hung in a vertical position for 10 minutes to allow excess oil to drain off. The panel shall be completely submerged for 10 minutes at 100°C (212°F) in a beaker containing enough cleaner solution to cover the panel. The panel shall be removed from the beaker, rinsed in clean water, and allowed to dry. When dry, the panel shall be washed with about 100 ml of petroleum ether which shall be carefully collected and transferred to a weighed evaporating dish. The dish shall be heated on a steam bath until all the petroleum ether is driven off, and then in an oven at 100° to 105°C (212° to 221°F) for 15 minutes. It shall be allowed to cool and then weighed. The weight of residue shall be not more than 1 mg greater than that obtained from the evaporation of an equal volume of pure petroleum ether identical with that used in the extraction.

4.4.8 Rinsing properties.- A 4- by 6-inch glass panel shall be completely suspended in a beaker for 5 minutes at a temperature of 96° to 100°C (205° to 212°F). The beaker shall contain 1 liter of solution in a concentration of 30 grams of metal cleaner per liter of water. The glass panel shall be removed and allowed to dry for 15 minutes at an angle of 45 degrees. It shall be rinsed in water at about 82°C (180°F) and allowed to dry for 2 hours more. Observation shall be made for any evidence of residue. A drop of USP alcohol shall be added to the surface, allowed to evaporate, and observed for any evidence of a white deposit. The absence of residue and the failure to form a white deposit shall indicate a chemically clean surface.

4.4.9 Corrosiveness.- A beaker containing 1 liter of the metal cleaner solution shall be heated to the specified temperature. Without allowing contact with each other, 1- by 6-inch panels of the metals shall be completely immersed for the time specified. The panels shall be removed and rinsed. Any trace of attack, oxidation, or discoloration of the metal surfaces shall be reported.

4.5 Resubmitted inspection lots.- Paragraph titled "Resubmitted lots" of Standard MIL-STD-105 shall apply, except that a resubmitted inspection lot shall be inspected by the contractor under supervision of the Government Inspector using tightened inspection. For visual examination, where the original acceptance number was zero, a sample size represented by the next higher sample size code letter shall be chosen. For testing, three containers shall be sampled. Before resubmitting, full particulars concerning the cause of previous rejection and the action taken to correct the defects found in the inspection lot shall be furnished by the contractor to the Government Inspector.

5. PREPARATION FOR DELIVERY

5.1 Packaging.- Unless otherwise specified, the metal cleaner shall be packaged in metal cans, pails, or steel drums. Capacity of metal cans shall be as specified by the procuring activity. (See 6.2.)

5.2 Packing.-

5.2.1 Level A.- Forty pounds of metal cleaner shall be packed in a steel drum conforming to Specification PPP-D-760, class 1, with bolted ring cover; 440 pounds of metal cleaner shall be packed in a steel drum conforming to Specification PPP-D-729, type III.

5.2.2 Level C.- The metal cleaner shall be packed in containers of the type, size, and kind commonly used for the purpose, in a manner that will insure acceptance by common carrier and safe delivery at destination. Shipping containers shall comply with the Consolidated Freight Classification Rules, or regulations of other carriers as applicable to the mode of transportation.

5.3 Marking of shipments.- Interior packages and exterior shipping containers shall be marked in accordance with Standard MIL-STD-129. The identification shall be composed of the following information listed in the order shown:

Stock No. or other identification number as specified
in the purchase document*
METAL CLEANER, SILICATE-SOAP
Specification MIL-M-7752A

*NOTE: The contractor shall enter the Federal Stock No. specified in the purchase document or as furnished by the procuring activity. When the Federal Stock No. is not provided or available from the procuring activity, leave space therefor and enter the Stock No. or other identification when provided by the procuring activity.

5.3.1 Additional marking.- In addition, unit packages shall be marked plainly as follows:

"DIRECTIONS FOR USE: For tank cleaning of metal prior to anodizing, use a water solution containing 4 to 6 ounces of cleaner per gallon of water at a temperature of 84.5° to 100°C (184° to 212°F). The tank should be provided with a continuous overflow device to drain off accumulations of oil on the surface of the solution.

"The metal cleaner must be thoroughly dissolved before use. Keep all work completely submerged and, immediately after removal from solution, rinse thoroughly in hot water 82°C (180°F or higher). Determine solution concentration periodically by laboratory checks on alkalinity. Add sufficient fresh cleaner to maintain strength. Cleaner in dry form may be caked in drums as a result of moisture. If this is the case, break up the lumps as small as practicable and always add the cleaner to hot water when making up the solution, never vice versa. This metal cleaner may not be satisfactory where a very hard water condition exists. Where such is the case, the addition of water softener in proper concentration will make the cleaner satisfactory."

6. NOTES

6.1 Intended use.- The silicate-soap metal cleaner covered by this specification is intended for use in cleaning aluminum, magnesium, and other metallic surfaces prior to the application of organic or inorganic surface coatings.

6.2 Ordering data.- The metal cleaner shall be purchased by weight, basis being net weight in pounds. Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Total quantity desired.
(c) Capacity of metal containers.
(d) Selection of applicable levels of packing. (See 5.2.)

Custodians:
Army - Ordnance Corps
Navy - Bureau of Aeronautics

Other interest:
Army - CEMQT
Navy - OrShS

Preparing activity:
Navy - Bureau of Aeronautics