

MIL-C-46156A(MR)

8 March 1985

MIL-C-46156(MR)

21 January 1972

MILITARY SPECIFICATION

CORROSION REMOVING COMPOUND, SODIUM HYDROXIDE BASE, FOR IMMERSION APPLICATION

This specification is approved for use by the Army Materials and Mechanics Research Center, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers a corrosion removing compound, containing sodium hydroxide, chelating and sequestering agents, wetting agents and detergents, a polyhydroxy compound, inhibitors and accelerating agents. A solution of this compound at elevated temperature will remove rust, paint, scale, grease, dirt, asphalt and carbon by immersion, from ferrous surfaces. An additive composition to be used for the purpose of prolonging the tank life of the product, is also covered by this specification.

1.2 Classification. Corrosion removing compound covered by this specification shall be of the following types as specified:

Type I - Corrosion removing compound.

Type II - Rejuvenating additive (for use in replenishment of Type I solutions).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, US Army Materials and Mechanics Research Center, ATTN: AMXMR-SMS, Watertown, MA 02172 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-C-46156A(MR)

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-D-729 - Drums; Metal, 55-Gallon (for Shipment of Noncorrosive Materials).

MILITARY

MIL-L-6082 - Lubricating Oil, Aircraft Reciprocating Engine (Piston).

STANDARDS

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

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

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

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 First article. When specified by the procuring activity, before production is commenced, the supplier shall submit or make ready for the contracting officer, one or more drum lot samples of the finished compound for inspection. Approval of the preproduction sample authorizes the commencement of production but does not relieve the supplier of responsibility for compliance with all applicable provisions of this specification. The preproduction sample shall be manufactured by the supplier in the same facilities, using the same raw materials, in the same proportions as used for the manufacture of the production items.

3.2 Materials and form. The raw materials used in the manufacture of these compounds shall be of technical grade, intimately assembled and processed to produce a free-flowing, granular, non-dusting compound and show no evidence of caking during handling and storage (see 6.2).

MIL-C-46156A(MR)

3.3 Composition. The corrosion removing compound and the rejuvenating additive shall be formulated according to the percentages by weight shown in Tables I and II. When tested as required in 4.5, they shall meet the percent by weight analytical requirements of Table III. All detergents used in the manufacture of the compounds with the exception of the fluorochemical surfactant FC-128, shall be at least 90 percent biodegradable. An affidavit to this effect shall be furnished by the manufacturer with each lot of compound submitted for acceptance.

3.3.1 Certification. The manufacturer shall certify that the material is formulated to conform to the composition requirements of Table I or Table II, as applicable. When specified by the procuring activity the detailed formulation and sample of each ingredient material identified by manufacturer and manufacturer's code shall be furnished.

TABLE I. Type I - Corrosion removing compound, percent by weight

| Ingredient | Requirement | |
|---|-------------|---------|
| | Minimum | Maximum |
| Sodium hydroxide | 65.0 | -- |
| Mineral seal oil | 0.75 | 1.00 |
| Fluorochemical surfactant | 0.02 | -- |
| Sodium carbonate | 1.50 | 2.00 |
| Sodium salt of sulfonated oleic acid | 1.00 | 1.50 |
| Sodium gluconate or glucoheptonate dihydrate | 20.0 | -- |
| Sodium resinate | 0.25 | 0.30 |
| Trisodium salt of N-hydroxyethylethylenediamine-triacetic acid, dihydrate | 6.50 | -- |
| Sodium linear alkyl (aryl) sulfonate (85%) ^{1/} | 1.00 | 1.50 |
| Sodium metasilicate (anhydrous) | 0.10 | 0.30 |
| Zinc silicofluoride, hexahydrate | 1.50 | 1.55 |
| Methyl naphthalene sulfonate | 0.50 | 1.00 |
| Ferric chloride, hexahydrate | 0.01 | -- |

^{1/}2.00 to 3.00 percent of a 40 percent active material may be used providing the remaining material is sodium sulfate.

MIL-C-46156A(MR)

TABLE II. Type II - Rejuvenating Additive, percent by weight

| Ingredient | Requirement | |
|---|-------------|---------|
| | Minimum | Maximum |
| Trisodium phosphate ($\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$) | 37.00 | -- |
| Mineral seal oil | 0.75 | 1.00 |
| Fluorochemical surfactant | 0.02 | -- |
| Sodium carbonate | 1.50 | 5.00 |
| Sodium gluconate or glucoheptonate dihydrate | 27.0 | -- |
| Trisodium salt of N-hydroxyethylethylenediamine-triacetic acid | 7.00 | -- |
| Zinc silico fluoride, hexahydrate | 2.00 | 2.05 |
| Sodium metasilicate (anhydrous) | 0.20 | 0.40 |
| Sodium linear alkyl (aryl) sulfonate (85%) ^{1/} | 1.00 | 1.50 |
| Sodium sulfate | -- | 15.00 |
| Sodium hexametaphosphate | 5.00 | -- |

^{1/}2.00 to 3.00 percent of a 40 percent active material may be used providing the remaining material is sodium sulfate.

TABLE III. Quantitative Requirements, percent by weight^{1/}

| Component | Type I | Type II | Test Paragraph |
|---|-----------------------------|------------------------|----------------|
| | Corrosion Removing Compound | Rejuvenator Additive | |
| Sodium hydroxide | 60.0 min. | -- | 4.5.7 |
| Sodium gluconate or glucoheptonate dihydrate | 18.0 min. | 24.0 min. | 4.5.8 |
| Trisodium salt of N-hydroxyethylethylenediaminetriacetic acid | 3.8 min. ^{2/} | 3.9 min. ^{2/} | 4.5.9 |
| Total phosphate (as PO_4) | -- | 13.0 min. | 4.5.10 |
| Sodium sulfate | -- | 16.0 max. | 4.5.11 |
| Zinc (as zinc silicofluoride) | 1.3 min. | 1.7 min. | 4.5.12 |

^{1/}Requirements are based on approximate purity of technical grade materials.

^{2/}Minimum requirements are for "available" HEDTA as some chelation occurs in the formulation and reduces the amount of excess agent.

3.4 Performance. The corrosion removing compound shall be equal to or superior in effectiveness to the type I comparison formula of 6.4 in all respects, when tested simultaneously as specified in 4.6.1, 4.6.2 and 4.6.3.

3.4.1 Bluing. When tested as specified in 4.6.1, the compound shall not impart a blue color lighter in appearance than that produced by the comparison compound of 6.4.

MIL-C-46156A(MR)

3.4.2 Rust removal. When tested as specified in 4.6.2, the panels cleaned by the compound shall not exhibit a more rusted appearance than exhibited by panels cleaned by the comparison formula of 6.4.

3.4.3 Stability. When tested as specified in 4.6.3, the panels cleaned by the corrosion removing compound shall not appear more rusted than those cleaned by the comparison formula of 6.4.

3.4.4 Cleaning efficiency. When tested as specified in 4.6.4, the compound shall completely remove mineral oil from steel test panels, the removal being indicated by the absence of any residue or residue stains.

3.4.6 Dust-forming properties. When tested as specified in 4.6.5, the dust-forming properties shall be such that dust must settle within a period of 6 seconds.

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.

4.2 Classification.

4.2.1 Classification inspection. The inspection requirements specified herein are classified as follows:

- a. First article inspection
- b. Quality conformance inspection (acceptance)

4.3 First article inspection.

4.3.1 First article inspection samples. The first article inspection sample shall consist of one drum of compound. Samples shall be identified with the manufacturer's production code number. Instructions for submittal of samples shall be furnished by the procuring activity.

4.3.1.1 First article tests. First article tests shall consist of all the test specified in 4.6.

4.3.1.2 Quality conformance (acceptance) inspection. The acceptance examination under 4.4, 4.5 and the tests under 4.6 shall serve as a basis for the acceptance of individual production lots.

MIL-C-46156A(MR)

4.3.2 Reports. The manufacturer shall furnish the following data with the preproduction sample:

a. Results of all specification tests.

b. A certified statement specifically identifying each ingredient in the compound by a readily recognizable chemical name, purity, source and percentage by weight. The Government will run such tests as are deemed necessary to verify the composition.

4.4 Sampling for lot acceptance tests.

4.4.1 Lot. A lot of corrosion removing compound shall consist of that quantity produced by one manufacturer, in not more than 24 consecutive hours of continuous production, with no change in facilities, materials or process which would change the chemical or physical properties of the compound. In the event the process is a batch operation, the batch of first article inspection shall constitute a lot.

4.4.2 Sampling for nondestructive examination. A random sample of filled containers shall be selected in accordance with MIL-STD-105 at inspection level S-4 and acceptable quality level (AQL) equal to 1.0 percent defective to verify compliance with all requirements of this specification regarding physical form, fill, container, closure and marking.

4.4.3 Sampling for tests. A representative sample shall be taken from each of the filled containers of 4.4.2 and the samples composited. Two one-gallon samples of this composite shall then be packed in clean, dry, airtight, metal containers and sealed and marked for identification.

4.5 Inspection.

4.5.1 Lot acceptance tests. The samples taken as specified in 4.4.3 shall be subjected to the tests specified in 4.6. Failure of the samples to comply with any of the tests specified herein shall reject the lot or batch. Rejected lots shall not be resubmitted.

4.5.2 Reporting results. In lieu of reporting analytical results on the composition of the corrosion removing compound or additive (paragraphs 4.6.7 through 4.6.12) the manufacturer may report such results as 'calculated' under the condition that he has carefully described by separate report, attached to the manufacturer's test reports, the character and detail of his production methods which in his opinion guarantee that any suitable analysis made by the Government will yield acceptable results.

4.6 Test procedures.

4.6.1 Bluing.

4.6.1.1 Preparation of test panels. The panels, each measuring 2 1/2 by 2 1/2 by 1/32 inches, shall be cut from AISI 1020 cold rolled steel. A 1/4

MIL-C-46156A(MR)

inch hole shall be drilled in one corner of each panel. Degrease the panels with acetone and polish both faces with emery cloth, stroking in one direction only. Wash with acetone, using a swab of absorbent cotton, dry with paper toweling, dip in absolute ethyl alcohol and dry again with paper toweling.

4.6.1.2 Preparation of solution. In 1200 ml. stainless steel beakers, prepare 900 ml. each of 36.0% (36.0 grams of compound in 100 ml. of solution) solutions in distilled water of both submitted sample and the type I comparison formula of 6.4.

4.6.1.3 Procedure. Bring the solutions prepared as specified in 4.6.1.2 to a vigorous boil and maintain this temperature throughout the test. Maintain the solution levels by additions of boiling distilled water. Suspend a panel, prepared as in 4.6.1.1, in each solution by means of an iron hook, one end of which passes through the 1/4 inch hole and the other end over a glass rod placed across the top of the beaker. After 60 minutes immersion, remove the panels and rinse for 1 minute in 2 liters of boiling tap water contained in a 3-liter beaker. Allow the panels to dry at room temperature and compare the color as described in 3.4.1.

4.6.2 Rust removal.

4.6.2.1 Preparation of rusted panels. Cut panels measuring 2 1/2 by 1/2 by approximately 1/20 inches, from AISI 1010 or 1020 cold-rolled steel that has been thoroughly cleaned with acetone and exposed to the outside atmosphere for 5 months. For each test, 4 panels shall be fastened together with iron wire (approximately 0.01 inch diameter) interwoven to make a flat assembly measuring 2 by 2 1/2 inches.

4.6.2.2 Procedure. Prepare fresh solutions of the sample and comparison formula of 6.4 as specified in 4.6.1.2. Bring solutions to a boil and maintain this temperature throughout the test. Maintain the solution levels by additions of boiling distilled water. Suspend a panel assembly (see 4.6.2.1) in each solution by means of an iron wire connecting adjacent corners and extending over a glass rod placed across the top of the beaker. After 30 minutes immersion, remove the panels and rinse under a hot water tap while brushing lightly with a fiber brush. Dry the panels with paper toweling and examine the rusted appearance. Check for compliance with paragraph 3.4.2.

4.6.3 Stability.

4.6.3.1 Procedure. Boil the solutions used in 4.6.2.2 for 8 hours. Maintain the solution levels by additions of boiling distilled water, then repeat the rust removal test of 4.6.2.2 with unused panel assemblies. Examine and compare the panels for rusted appearance as before.

4.6.4 Cleaning efficiency.

4.6.4.1 Preparation of soiled panels. The soiling material shall be 1065 grade mineral oil conforming to MIL-L-6082. Suspend a panel prepared as in 4.6.1.1 on a wire hook and dip into a 400 ml. beaker of the oil at a temperature of $25 \pm 2^{\circ}\text{C}$. (77°F). Remove the panel and allow to drain at the same temperature for 30 minutes. Touch the lower corner of panel with absorbent cotton to remove the hanging drop of oil.

MIL-C-46156A(MR)

4.6.4.2 Procedure. In a fresh boiling solution of the sample compound prepared as specified in 4.6.1.2, suspend a soiled panel (4.6.4.1) by means of an iron hook, one end of which passes through the 1/4 inch hole and the other end over a glass rod placed across the top of the beaker. After 3 minutes immersion, remove the panel and rinse by immersing twice for 6 seconds each time with a 4-second drain between rinses. The rinsing solutions shall consist of two 1 liter beakers, each containing about 800 ml. of distilled water at $25 \pm 2^{\circ}\text{C}$. (77°F). Dry the rinsed panel in a vertical position at $50 \pm 1^{\circ}\text{C}$. (122°F). for 15 minutes and examine for residue as required in 3.4.4. Run this test in triplicate.

4.6.5 Dusting.

4.6.5.1 Procedure. Place 25 grams of a sample of the compound in a clean, dry, glass-stoppered 250 ml. graduate. Stopper, invert and immediately return to an upright position. After 5 seconds, remove the stopper and suspend a moistened piece of red litmus paper inside so as not to touch the sides of the graduate. After 60 seconds, remove the indicator paper and examine for color change. Excessive dusting is indicated by any change in the litmus paper from red to blue.

4.6.6 Chemical analysis.

4.6.6.1 Preparation of stock solution (corrosion removing compound). Carefully weigh 100 grams of the compound as rapidly as possible into a liter breaker. While stirring, add 800 ml. of distilled water. Heat the mixture to near boiling and stir to dissolve all the soluble ingredients. Transfer the solution quantitatively to a liter volumetric flask with water. After cooling to room temperature, fill the flask to the mark and mix well. Filter a large portion of this solution, stopper and set aside for the withdrawal of aliquots as needed in the analytical procedures that follow.

4.6.6.2 Preparation of stock solution (rejuvenating additive). Carefully weight 100 grams of the compound as rapidly as possible into a liter beaker and add 800 ml. of distilled water. While stirring, adjust the pH of the solution to 3.5 to 4.0 by the addition of concentrated hydrochloric acid (about 25 ml.). Heat to boiling, transfer to a liter volumetric flask with water and proceed as in 4.6.6.1, including the filtration of a portion for aliquot withdrawal.

4.6.7 Sodium hydroxide.

4.6.7.1 Preparation of 0.5 N sulfuric acid. Carefully dilute 14 ml. of concentrated sulfuric acid to 1 liter with distilled water, mix thoroughly and standardize.

4.6.7.2 Procedure. Place 300 ml. of absolute ethyl alcohol and 30 drops of thymol blue indicator (0.1 percent in ethyl alcohol) in a 500 ml. beaker. From a 25 ml. buret, add 10 ml. of the standardized 0.5 N sulfuric acid to the beaker. While stirring, add 5 ml. of the filtered stock solution (4.6.6.1) from a pipet. Titrate the residual sodium hydroxide with the 0.5 N acid from the same buret.

MIL-C-46156A(MR)

Calculation:

$$\text{Percent NaOH} = 8.0 \times \text{ml. of acid} \times \text{normality of acid}$$

4.6.8 Sodium gluconate or glucoheptonate dihydrate.

4.6.8.1 Preparation of 0.1 N sodium thiosulfate. Dissolve 25 grams of reagent grade sodium thiosulfate crystals in distilled water that has been previously boiled and cooled, and dilute to 1 liter. Add 1.0 gram of sodium carbonate, mix and allow to stand a minimum of 24 hours before standardizing with resublimed iodine or reagent grade potassium chromate.

4.6.8.2 Periodic acid, 0.05 M. Dissolve 11.4 grams of reagent grade periodic acid dihydrate in distilled water and dilute to 1 liter.

4.6.8.3 Potassium iodide, 20 percent. Dissolve 200 grams of potassium iodide crystals in water and dilute to 1 liter volume.

4.6.8.4 Procedure (for corrosion removing compound only). Pipette 35 ml. of the filtered stock solution (4.6.6.1) into a 100 ml. volumetric flask and dilute to the mark with distilled water. Pipet 5 ml. of this diluted sample into a 500 ml. glass-stoppered flask. Simultaneously prepare two blanks each containing 5 ml. of water in place of the aliquot of sample. Add 2 drops of methyl purple indicator to each flask and make acid by the dropwise addition of 6 N sulfuric acid. Pipet 15 ml. of the periodic acid solution into each flask, stopper and swirl. Allow the sample and blanks to stand for one hour at room temperature in a dark place. At the end of this time, add 100 ml. of water, 25 ml. of 6 N sulfuric acid, and 30 ml. of potassium iodide solution. Titrate with the standard 0.1 N sodium thiosulfate solution, stirring constantly. When the solution is pale yellow, add several milliliters of starch solution and continue to titrate to colorless.

Calculation:

$$\text{Percent sodium gluconate or glucoheptonate dihydrate} = \frac{(\text{ml. thiosulfate for blank} - \text{ml. for sample}) \times \text{normality thiosulfate} \times 15.6}{\text{ml. sample}}$$

4.6.8.5 Procedure (for rejuvenating additive only). Pipette 35 ml. of the filtered stock solution (4.6.6.2) into a 100 ml. volumetric flask and dilute to the mark with distilled water. Pipette 3 ml. of this diluted sample into a 500 ml. glass-stoppered flask and proceed as in 4.5.8.4 except omit the acidification step and calculate as follows:

Calculation:

$$\text{Percent sodium gluconate or glucoheptonate dihydrate} = \frac{(\text{ml. thiosulfate for blank} - \text{ml. for sample}) \times \text{normality thiosulfate} \times 26.0}{\text{ml. sample}}$$

MIL-C-46156A(MR)

4.6.9 Trisodium salt of N-hydroxythylenediaminetriacetic acid dihydrate
(3Na.HEDTA.2H₂O)

4.6.9.1 Preparation of buffer solution (pH 10). Add 54 grams of ammonium chloride and 350 ml. of ammonium hydroxide to a liter flask, dilute to the mark with distilled water and mix.

4.6.9.2 Zinc oxide solution. Weigh exactly 2.0345 grams of oven-dried reagent grade zinc oxide into a 500 ml. volumetric flask. Dissolve the oxide in some of the buffer solution (4.6.9.1) and dilute to the mark with buffer solution.

4.6.9.3 Eriochrome black T indicator, 0.5 percent. Dissolve 0.50 gram of eriochrome black T and 2.2 grams of hydroxylamine hydrochloride in 100 ml. of methanol.

4.6.9.4 Procedure (for corrosion removing compound only). Pipet 30 ml. of the filtered stock solution into a 600 ml. beaker containing 5 drops of thymol blue indicator (0.1 percent). Add concentrated hydrochloric acid dropwise until the pale blue color changes to yellow. Add 25 ml. of the buffer solution and dilute to 300 ml. with distilled water. Add 10 drops of eriochrome black T indicator and titrate with the standard zinc oxide solution to a wine-red endpoint.

Calculation:

$$\text{Percent } 3\text{Na.HEDTA.2H}_2\text{O} = \text{ml. zinc oxide standard} \times 0.633$$

4.6.9.5 Procedure (for rejuvenating additive only). Proceed as in paragraph 4.6.9.4 but omit the addition of thymol blue and hydrochloric acid.

4.6.10 Total phosphate.

4.6.10.1 Ammonium molybdate solution. Mix 55 grams of ammonium molybdate tetrahydrate and 50 grams of ammonium nitrate with 18 ml. of 15 N ammonium hydroxide and 20 ml. of water. Stir, dilute to about 700 ml. with distilled water, and heat for 30 minutes with occasional stirring until all of the salts have dissolved. Dilute to 1 liter, let stand overnight, filter, but do not wash the residue.

4.6.10.2 Procedure. Pipet 10 ml. of the filtered stock solution from paragraph 4.6.6.2 into a 400 ml. beaker. Add 20 ml. of concentrated nitric acid and boil gently for 15 minutes. Dilute to 75 ml. and add 10 grams of ammonium nitrate and warm and stir until all salt has dissolved. If the solution is not clear, filter through fine filter paper using about 25 ml. of water for washing. If filtration is not required, add 25 ml. of water to the sample. Place the beaker in a 60°C. water bath along with a beaker containing 100 ml. of molybdate solution. Allow the contents of the beakers to reach the temperature of the bath. While stirring, pour the reagent into the sample and leave in the bath for 15 minutes. Remove the sample from the bath and allow to stand for at least 1 1/2 hours. Filter through a tared

MIL-C-46156A(MR)

Gooch crucible containing a mat of asbestos. Transfer the precipitate with 1 percent nitric acid; wash the precipitate by filling the crucible 3 times with 1 percent nitric acid followed by one filling with water. Dry at 110°C. (230°F) for 1-1/2 hours, cool and weigh.

Calculation:

Percent phosphate (as PO₄) = weight of precipitate x 5.029

4.6.11 Sodium sulfate.

4.6.11.1 Barium chloride solution. Dissolve 100 grams of barium chloride in distilled water and dilute to 1 liter.

4.6.11.2 Procedure. Pipet 20 ml. of the filtered stock solution from paragraph 4.6.6.2 into a 600 ml. beaker. Dilute to 300 ml. with water and add 5 ml. of concentrated hydrochloric acid. Filter if cloudy. Heat to boiling and add 15 ml. of barium chloride solution slowly from a pipet, continue the boiling for 5 minutes. Remove the beaker from the heat and allow to stand for at least 2 hours. Filter the precipitate through a tared, pre-ignited Gooch crucible containing a mat of asbestos. Transfer and wash the precipitate with 200 ml. of hot water. Ignite the crucible at 700°C. for 1 hour, cool and weigh.

Calculation:

Percent sodium sulfate = weight of precipitate x 30.43

4.6.12 Zinc silicofluoride.

4.6.12.1 Formic acid mixture. Mix together in a liter volumetric flask 200 ml. of formic acid, 30 ml. of ammonium hydroxide and 250 grams of ammonium sulfate. Dilute to volume with water.

4.6.12.2 Procedure. Pipet into a 400 ml. beaker, a 50 ml. aliquot of the compound (4.6.6.1) or additive (4.6.6.2). Acidify with sulfuric acid and add 50 ml. of concentrated sulfuric acid and 25 ml. of concentrated nitric acid. Evaporate to fumes of sulfuric acid, let cool and add 10 ml. of concentrated nitric acid. Repeat the additions of nitric acid and fuming until the solution remains light colored on fuming. Continue the fuming until most of the sulfuric acid has been expelled. Dilute the sample, wash and filter through medium porosity paper, washing the beaker and paper thoroughly with water. Add 25 ml. of a 25 percent solution of tartaric acid. Neutralize the solution with ammonium hydroxide using indicator paper. Add 25 ml. of the formic acid mixture, dilute to 300 ml. and adjust the pH to 2.5 with sulfuric acid, using a pH meter. Pass a rapid stream of hydrogen sulfide into the solution for 30 minutes. Allow to stand for at least 30 minutes and filter through a weighed Gooch crucible that was prepared with a thick mat of asbestos and pre-ignited at 800°C. Transfer the precipitate and wash the beaker and crucible with 0.1 N formic acid that is saturated with hydrogen sulfide. Dry the crucible at 110°C. for 30 minutes and ignite in a muffle furnace at 800°C. for 30 minutes. Cool and weigh.

MIL-C-46156A(MR)

Calculation:

Percent zinc silicofluoride = weight of precipitate x 77.586

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or Industrial, as specified.

5.1.1 Level A. The corrosion removing compound shall be packaged in 55-gallon steel drums conforming to type III of PPP-D-729. Inside the drum the powder shall be inclosed in sealed polyethylene bag liners with a minimum thickness of 0.003 inch. The volume of the drum shall not exceed the volume of the contents by more than 5 percent.

5.1.2 Industrial. The corrosion removing compound shall be packaged in steel drums in the size and kind specified in the contract or order. Inside the drum the powder shall be inclosed in sealed polyethylene bag liners with a minimum thickness of 0.003 inch. Protection shall be such as to prevent deterioration during shipment and to ensure safe delivery at destination.

5.2 Packing. Unless otherwise specified, overpacking of the containers is not required.

5.3 Marking. Containers shall be marked in accordance with MIL-STD-129. In addition, each container shall be durably and legibly marked with the following warning notice and instructions for use (see note):

WARNING:

Causes severe burns to skin and eyes. Wear goggles or face shield when handling. Avoid dust and fumes. Keep away from food products. In case of eye or skin contact, flush immediately with plentiful amounts of water for at least 15 minutes and get immediate medical attention.

INSTRUCTIONS FOR USE:

Use for removal of rust, paints, scale, carbon, grease and dirt from ferrous metals. Precleaning by solvents, steam, etc. is recommended to prolong the life of the tank charge. It may be used in mild steel tanks with heating coils and some form of agitation. Mix corrosion removing compound, type I, with water at rate of 3 pounds per gallon of solution. Maintain bath temperature at 93°C. (200°F) or up to boiling.

Immerse parts until clean. May require up to 60 minutes immersion time.

Rinse parts thoroughly in clean water. After drying, the parts may be painted with no further treatment.

MIL-C-46156A(MR)

Rejuvenator: For extending tank life rejuvenator, type II may be added when rust removing power diminishes appreciably. Add rejuvenator at rate of one (1) pound per gallon of solution.

(Note: The corrosion removing compound manufacturer shall revise or add additional instructions for use as deemed necessary to obtain optimum cleaning efficiency.)

6. NOTES

6.1 Intended use (corrosion removing compound). This material is designed to remove rust, paints, scale, carbon, grease and dirt from ferrous metals when used as directed in "Intended for use" (see 5.3). Immersion times are usually from 20 to 60 minutes. This material may be used in lieu of MIL-C-14460, type I for immersion application. due to excessive foaming, the material is not recommended for use as an electrolytic cleaner.

6.1.1 Use of rejuvenating additive. This material is designed to rejuvenate tanks of the corrosion removing compound that have diminished in rust-removing power. It may be added directly to the tank at the rate of one pound of additive for each gallon of solution in the tank.

6.2 Formulation. Acceptable procedures for preparing 1,000-pound quantities of the corrosion removing compound and of the rejuvenating additive are as follows:

6.2.1 Corrosion removing compound. Put 660 pounds of freshly opened sodium hydroxide crystals into a dry blender. While the mixer is turning, spray or sprinkle 10 pounds of mineral seal oil containing 91 grams of FC-128 surfactant dispersed in it over the alkali crystals to obtain a uniform protective coating on each crystal. Sprinkle 16.2 pounds of the sodium carbonate so as to cover the oil-coated crystals and adhere to each crystal. While the mixer is turning, add the remainder of the ingredients in the order listed, allowing only sufficient time for each material to be thoroughly spread:

10 pounds of the sulfonated oleic acid poured evenly over the surface of the blend

200 pounds of sodium gluconate

2-1/2 pounds of sodium resinate

65 pounds of trisodium salt of N-hydroxyethylethylenediaminetri-acetic acid

10 pounds of sodium linear alkyl sulfonate

1 pound of anhydrous sodium metasilicate

15 pounds of zinc sillicofluoride

10 pounds of methyl naphthalene sulfonate

45 grams of ferric chloride, powdered fine before adding

Keep the mixer covered as much as possible. Do not hammer mill when mixing is complete. Draw into steel drums which have been fitted with plastic liner. Liners should be closed and sealed and drums closed as rapidly as feasible.

MIL-C-46156A(MR)

6.2.2 Rejuvenating additive. Put 370 pounds of trisodium phosphate into a dry blender. While mixer is turning, spray or sprinkle 10 pounds of mineral seal oil in which has been dispersed 91 grams of FC-128 surfactant, in such a manner as to thoroughly cover the crystals of the phosphate. Add 50 pounds of the sodium carbonate and mix to cover the oiled phosphate crystals. While still mixing, add the remainder of the ingredients in the order listed, mixing only long enough to insure complete blending.

270 pounds of sodium gluconate
70 pounds of the trisodium salt of N-hydroxyethylethylenediamine-triacetic acid
20 pounds of zinc silicofluoride
2 pounds of anhydrous sodium metasilicate
10 pounds of sodium linear alkyl sulfonate
147.8 pounds of sodium sulfate
50 pounds of sodium hexametaphosphate

Proceed as in paragraph 6.2.1.

6.3 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Type of compound (see 1.2).
- c. Level of packaging required (5.1).
- d. Size and type of container if level C is specified (5.1.2).

6.4 Comparison formula (for performance testing, paragraph 3.4). The following composition is used for the comparison testing described in paragraphs 3.4 and 4.5. The ingredients are to be mixed percent by weight on a laboratory size level, in the same order and a similar manner as in the procedures of paragraphs 6.2.1 and 6.2.2.

MIL-C-46156A(MR)

TABLE IV - Comparison formula, percent by weight

| Ingredient | Type I Corrosion Removing Compound | Type II Rejuvenator Additive |
|--|---|------------------------------------|
| 1. Sodium hydroxide (see description) | 66.0 | -- |
| 2. Mineral seal oil | 1.00 | 1.00 |
| 3. Fluorochemical surfactant | 0.02 | 0.02 |
| 4. Sodium carbonate | 1.62 | 5.00 |
| 5. Sodium salt of sulfonated oleic acid | 1.00 | -- |
| 6. Sodium gluconate | 20.00 | 27.00 |
| 7. Sodium resinate | 0.25 | -- |
| 8. Trisodium salt of N-hydroxyethylethylene- diaminetriacetic acid, dihydrate | 6.50 | 7.00 |
| 9. Sodium linear alkyl (aryl) sulfonate (85%) | 1.00 | 1.00 |
| 10. Sodium metasilicate (anhydrous) | 0.10 | 0.20 |
| 11. Zinc silicofluoride, hexahydrate | 1.50 | 2.00 |
| 12. Methyl naphthalene sulfonate | 1.00 | -- |
| 13. Ferric chloride, hexahydrate | 0.01 | -- |
| 14. Trisodium phosphate | -- | 37.00 |
| 15. Sodium sulfate | -- | 14.78 |
| 16. Sodium hexametaphosphate | -- | 5.00 |

Ingredient Description

1. Commercial grade of crystal caustic soda.
2. Commercial product available from solvent suppliers such as Chevron Oil Co. Mineral Seal Oil. No. 28.
3. FC-128 from Minnesota Mining and Mfg. Co.
4. Commercial grade of anhydrous, powdered soda ash.
5. Sulfonate OA-5, supplied by Tennessee Corporation, or equal.
6. Commercial grade of anhydrous, crystalline sodium gluconate.
7. Dresinate TX, supplied by Hercules Powder Company.
8. Commercial grade of HEDTA, trisodium salt.
9. Commercial form of linear alkyl sulfonate, 85 percent active, a biodegradable form of the sodium salt, Witco Chemical Co. Sulframin 85 flakes.
10. Commercial form of anhydrous sodium metasilicate.
11. Commercial grade of hexahydrate granules.
12. Methyl naphthalene sulfonate, such as Petro BA, from Petrochemicals Co., Inc.
13. $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ from any laboratory chemical supply house.
14. Commercial grade of crystalline trisodium phosphate, $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$.
15. Commercial grade of anhydrous, granular sodium sulfate.
16. Commercial grade of granular sodium hexametaphosphate, such as Hooker 5-920-S.

MIL-C-46156A(MR)

Custodian:

Army - MR
Air Force - 68

Review interest:

Army - AR

User interest:

Navy - SH

Preparing activity:

Army - MR

Project No. 6850-A702

(KBWP# ID-0280A/DISK 0103A. FOR AMMRC USE ONLY)

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE ARMY



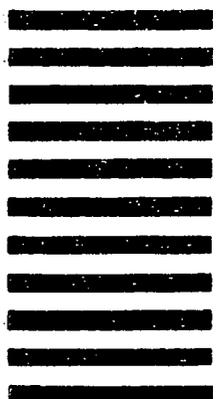
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 12062 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE ARMY

Director
US Army Materials & Mechanics Research Center
ATTN: DRXMR-SMS
Watertown, MA 02172



STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

| | | | |
|---|--|--|--|
| 1. DOCUMENT NUMBER MIL-C-46156A | | 2. DOCUMENT TITLE | |
| 3a. NAME OF SUBMITTING ORGANIZATION | | 4. TYPE OF ORGANIZATION (Mark one) | |
| b. ADDRESS (Street, City, State, ZIP Code) | | <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____ | |
| 5. PROBLEM AREAS | | | |
| a. Paragraph Number and Wording: | | | |
| b. Recommended Wording: | | | |
| c. Reason/Rationale for Recommendation: | | | |
| 6. REMARKS | | | |
| 7a. NAME OF SUBMITTER (Last, First, MI) - Optional | | b. WORK TELEPHONE NUMBER (Include Area Code) - Optional | |
| c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional | | 8. DATE OF SUBMISSION (YYMMDD) | |