

MIL-W-3688C
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SUPERSEDING
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1 February 1982

MILITARY SPECIFICATION

WAX EMULSION (RUST INHIBITING)

This specification is approved for use within the 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 type of wax emulsion suitable for use as a rust inhibiting coating for general weatherproofing when applied to articles (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks 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.

SPECIFICATIONS

FEDERAL

QQ-S-698 - Steel, Sheet and Strip, Low Carbon
TT-C-490 - Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings.
PPP-T-60 - Tape; Packaging, Waterproof

STANDARDS

FEDERAL

FED-STD-141 - Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling and Testing.

AMSC N/A

/FSC 8030/

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-290 - Packaging, of Petroleum and Related Products.
- MIL-STD-1190 - Minimum Guidelines for Level C Preservation, Packing and Marking

(Copies of specifications, standards, handbooks, drawings, publications and other Government documents, 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 document(s) 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- B117 Spray Salt (Fog) Testing, Standard Method
- D823 Paint, Varnish and Related Products on Test Panels, Producing Films of Uniform Thickness, Standard Methods of
- D1951 Acids, Fatty and Oils, Drying, Ash-in
- D3951 Packaging, Commercial

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

(Non-govt standards and other publications are normally available the organizations which prepare or which distribute the documents. These documents may also be available in or through libraries or other information 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 Material. The material furnished under this specification shall be a uniform, stable aqueous emulsion of waxes, resins, and emulsifying agents, together with suitable rust inhibitors capable of meeting all the requirements of this specification. The emulsion shall be supplied ready for application at room temperature ($77^{\circ} \pm 5^{\circ}\text{F.}$) ($25^{\circ} \pm 2^{\circ}\text{C}$) by spray, dip or brush methods.

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3.2 pH value. The pH of the wax emulsion shall be between 8.0 and 9.0 when tested as specified in 4.5.1.

3.3 Volatile matter. The emulsion shall be free from volatile organic solvents when tested as specified in 4.5.2. The volatile should be water with not more than 1.0 percent by weight perfume or perfume solvents.

3.4 Nonvolatile matter (total solids). The nonvolatile content of the wax emulsion shall be not less than 12 percent by weight when tested as specified in 4.5.3.

3.5 Wax and resin content. The wax and resin content of the emulsion shall be not less than 8 percent by weight when tested as specified in 4.5.4.

3.6 Ash content. The ash content of the wax emulsion shall not exceed 0.5 percent when tested as specified in 4.5.5.

3.7 Free alkali. There shall be no free alkali present when tested as specified in 4.5.6.

3.8 Softening point (dropping point). The softening point of the wax shall be not less than 165°F. (74°C.) when tested as specified in 4.5.7.

3.9 Stability to centrifuging. The emulsion shall be free from particles, granules and foreign agents as shown by centrifuging as in 4.5.8. The material shall remain homogeneous and no more than 3 percent by weight shall settle out.

3.10 Drying time. The wax emulsion shall dry to a hard flexible surface within 20 minutes and shall form a nontacking film when tested as specified in 4.5.9.

3.11 Appearance of dried film. A film of the wax, prepared and tested as specified in 4.5.10, shall show no signs of whiteness and shall have a smooth, lustrous finish. The film shall be clear, free from particles and practically colorless.

3.12 Dipping properties. The unreduced wax emulsion shall dip and flow out in a continuous film and shall deposit 0.30 grams maximum per square foot of coating when prepared and tested as in 4.5.11.

3.13 Spraying properties. The unreduced wax emulsion shall spray and flow out in a continuous film and shall deposit 0.30 grams maximum per square foot of coating when prepared and tested as in 4.5.12.

3.14 Brushing properties. The unreduced wax emulsion shall brush and flow out in a continuous film and shall deposit 0.30 grams maximum per square foot of coating when prepared and tested as in 4.5.13.

3.15 Adhesion of tape to wax film. When tested, both before and after aging, as specified in 4.5.14, the adhesion of the tape shall be not less than 12 ounces per inch width.

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3.16 Flexibility. The wax coating shall not crack or chip from the panel when tested as specified in 4.5.15.

3.17 Resistance to salt spray corrosion. When examined visually there shall be no corrosion of the wax coated steel panels after exposure to salt spray as specified in 4.5.16.

3.18 Accelerated storage stability. The wax emulsion shall remain stable and shall show no caking, thickening or any other significant change in properties after storage as specified in 4.5.17.

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 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 that 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 Lot. For purposes of sampling and testing, a lot shall consist of one batch of wax emulsion, produced by one manufacturer, in accordance with the same specification revision. Each batch shall consist of that quantity of wax emulsion that has been subjected to the same unit chemical or physical mixing process intended to make the final product homogeneous.

4.3 Sampling.

4.3.1 Sampling for inspection of filled containers. A random sample of filled containers shall be selected in accordance with MIL-STD-105 at inspection level 1 and acceptable quality level equal to 2.5 percent defective to verify compliance with this specification in regard to fill, closure and other requirements not involving tests.

4.3.2 Sampling for tests. From each inspection lot (see 4.2), two containers shall be selected at random. From each of the two containers, 1-quart samples shall be taken and placed in separate clean dry metal containers, and then sealed, marked and forwarded to the testing laboratory.

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4.4 Inspection.

4.4.1 Inspection of filled containers. Each sample filled container, as specified in 4.3.1, shall be examined for defects of the closure and for evidence of leakage; each filled container shall also be weighed to determine the amount of contents. Any container having one or more defects or under required fill shall be rejected and if the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, the lot represented by the sample shall be rejected.

4.4.2 Testing for lot acceptance tests. The samples selected in accordance with 4.3.2 shall be subjected to all the tests specified in 4.5. Acceptance of the wax emulsion by the Government shall be based upon compliance of the material with the requirements of this specification.

4.5 Test methods.

4.5.1 pH value. Add 10 ml. of distilled water to 10 ml. of the wax emulsion and determine the pH with a meter using a calomel electrode and a sleeve-tip type of glass electrode. Check for compliance with 3.2.

4.5.2 Volatile matter. About 100 ml. of the wax emulsion shall be distilled and the distillate tested for specific gravity. Check for compliance with 3.3.

4.5.3 Nonvolatile matter (total solids). Accurately weigh 2 to 3 grams of the sample in a tared flat-bottom dish about 8 centimeters in diameter and provided with a tightly fitted cover. Spread the material over the bottom. Heat with the cover removed in an oven at 221° to 230°F (105° to 110°C) for about 4 hours. Replace the cover and cool. Remove the cover for an instant, replace it and weigh the dish and contents. Repeat the heating until the last two weighings do not differ by more than 0.5 milligram. (Usually a second heating of 2 hours will be sufficient.) Calculate the percentage of nonvolatile matter as follows and check for compliance with 3.4.

$$\text{Percent nonvolatile} = \frac{B}{A} \times 100$$

where A = weight (in grams) before drying
B = weight (in grams) after drying

4.5.4 Wax and resin content. Weigh from 2 to 5 grams of the emulsion into a 250 ml. Erlenmeyer or round-bottom flask. Add several anti-bumping stones or Berl saddles and 75 ml. of toluene. Attach a Dean-Stark trap and condenser. Reflux on a hot plate or mantle until the trap is filled with the mixed water and toluene, then continue for an additional hour. Cool and filter the contents of the flask through paper of medium porosity into a weighed 250-ml. beaker. Wash with toluene and evaporate the toluene in a hot water bath with the aid of a current of air, then dry in a (140°F) 60°C. oven for several hours. Cool in a desiccator and weigh. Calculate the percent of wax and resin combined and check for compliance with 3.5. Retain for softening point test (see 4.5.7).

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4.5.5 Ash content. Determine the ash content of the emulsion using a sample of about 10 grams according to ASTM D 1951. Check for compliance with 3.6.

4.5.6 Free alkali. Twenty milliliters of distilled water shall be added to a 10 ml. sample of the wax emulsion and the mixture boiled, keeping the volume constant by the addition of water, until any ammonia vapor has been driven off. After all ammonia has been removed as determined by testing periodically by wet indicator paper held over the sample, the sample shall be cooled, 100 ml. of neutral ethyl alcohol (94% or higher) added and the mixture agitated. It shall then be allowed to settle and the liquid decanted through filter paper. A few drops of phenolphthalein indicator shall be added. If any pink color appears, the emulsion contains free alkali and fails to meet the requirements for free alkali in compliance with 3.7.

4.5.7 Softening point. A small amount of the material isolated in paragraph 4.5.4 shall be tested for softening point by sandwiching between two micro cover glasses and placing on the stage of a Fisher-Johns melting point apparatus. The temperature increase should not exceed 2°C. per minute and the temperature is recorded at which the sample is completely liquified. Check for compliance with 3.8.

4.5.8 Stability to centrifuging. A sample of the wax emulsion shall be centrifuged for 15 minutes at a temperature of 100° + 2°F. (38° + 1°C.) and a speed of 750 revolutions per minute. Check for compliance with 3.9.

4.5.9 Drying time. Draw down a film of wax emulsion with a 0.0015-inch (0.003-inch gap clearance film) applicator on clear plate glass prepared as in Method 2021 of Fed. Std. No. 141. Test "free from after-tack" as in Method 4061 of Fed. Std. No. 141 for compliance with 3.10.

4.5.10 Appearance of dried film. Glass plates with wax emulsion, prepared and dried as in 4.5.9, shall be viewed through the under side with bright daylight transmitted through it. The film shall comply with the requirements of 3.11.

4.5.11 Dipping properties. Treat with a phosphate coating conforming to TT-C-490 Type 1, two standard rust-free 4 by 12-inch (10 by 30 cm) SAE 1020 steel panels conforming to QQ-S-698. Record weight of phosphate-coated panel and begin dip application under conditions according to ASTM D823 method B. One minute after immersion, withdraw panel instantly and keep it in a vertical position for approximately 30 minutes. Air dry to constant weight. Subtract weight of phosphate-coated panel from weight of wax coated panel and record difference as weight of wax coating. Compute grams per square foot of coating, based on a test area coverage of 2/3 square foot. Observe dipping properties for compliance with 3.12.

4.5.12 Spraying properties. Prepare two phosphate-coated 4 by 12 inch panels as in 4.5.11, record weight, and spray the unreduced wax emulsion on both sides of the panel according to Method 2131 of Fed. Std. No. 141. Dry the panel in a vertical position and compute weight per square foot of coatings as in 4.5.11. Observe spraying properties for compliance with 3.13.

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4.5.13 Brushing properties. Prepare two phosphate-coated 4 by 12 inch (10 by 30 cm) panels as in 4.5.11, record weight, and brush the unreduced wax emulsion on both sides of the panel according to Method 2141 of Fed. Std. No. 141. Dry the panel in a vertical position and compute weight per square foot of coating as in 4.5.11. Observe brushing properties for compliance with 3.14.

4.5.14 Adhesion of tape to wax film.

4.5.14.1 Apparatus.

- (a) Eight panels, each 1-1/2 by 4-1/2 inches (3.8 by 11.4 cm), of SAE 1020 steel conforming to QQ-S-698.
- (b) Eight strips of tape, each 1 by 8-1/2 inches (2.5 by 22cm), conforming to PPP-T-60, Type IV.
- (c) A rubber covered roller, 3.25 ± 0.1 inches (8.3 cm) in total diameter and 2.50 ± 0.5 inches (6.4 cm) in width, covered with rubber approximately 1/4 inch (0.64 cm) in thickness and having a Shore durometer hardness of 70 to 80. The weight of the roller proper, which applies pressure to the specimen, shall be 4.5 ± 0.1 pounds. It shall be constructed so that the weight of the handle is not added to the weight of the roller during use. The cylindrical surface of the roller should be a true surface void of any concave or convex deviations so that the roller will apply uniform pressure across the width of its entire surface.

4.5.14.2 Preparation of test specimens. The eight steel panels (see 4.5.14.1a) shall be treated with a phosphate coating conforming to type 1 of TT-C-490. The panels shall be dipped in wax emulsion and allowed to dry for 30 minutes at room temperature ($77^\circ \pm 5^\circ\text{F.}$) ($25^\circ \pm 2^\circ\text{C.}$). Apply a tape strip (see 4.5.14.1b) to each coated panel with the adhesive face down and in a manner such that 4-1/2 inches (11.4 cm) of the tape extends beyond one end of the panel. Pass the roller twice over the surface of the tape, once in each direction, using only the weight of the roller in applying the tape to the panel.

4.5.14.3 Unaged. Using four of the test specimens prepared as in 4.5.14.2, double the free end of the tape and pull the adhering tape from the panel at a rate of 20 inches per minute. The test shall be performed at a temperature of 70° to 80°F. (21° to 27°C.) and a relative humidity of 50 to 60 percent. The test shall be conducted within 2 minutes after the tape has been applied to the panel.

4.5.14.4 Aged. Four of the test specimens, prepared as in 4.5.14.2, shall be aged in a drying oven maintained at $145^\circ \pm 5^\circ\text{F.}$ ($63^\circ \pm 3^\circ\text{C.}$) and not less than 50 percent humidity for 24 hours. At the end of 24 hours, remove the panels from the oven and allow to stand for two hours at 70° to 80°F. (21° to 27°C.). They shall then be tested for adhesion as specified in 4.5.14.3.

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4.5.15 Flexibility. Two panels as specified in 4.5.14.1a, No. 20 U.S. Standard gage (0.0375 inch thick) (0.10 cm) shall be prepared as outlined in 4.5.14.2 except that they shall be allowed to dry for 48 hours at room temperature ($77^{\circ} + 20^{\circ}\text{F}$) ($25^{\circ} + 20^{\circ}\text{C}$). At the end of 48 hours, subject the panels to a 180° bend over a stationary 1/8-inch (0.32 cm) diameter mandrel. Examine for compliance with 3.16.

4.5.16 Resistance to salt spray corrosion. Prepare two panels as in 4.5.11, two as in 4.5.12 and two as in 4.5.13 and air dry for 72 hours. After air drying, expose the unscored panels to 5 percent salt spray for 6 hours according to ASTM B117. Upon removal, examine for corrosion. Strip the wax coating from the panels by solvent cleaning as in Method 2011 of Fed. Std. No. 141. Re-examine for compliance with 3.17.

4.5.17 Accelerated storage stability. A one-quart container of the wax emulsion (see 4.3.2) shall be stored at $145^{\circ} + 5^{\circ}\text{F}$ ($63^{\circ} + 20^{\circ}\text{C}$) for a period of 15 days. At the end of this time, the sample shall be examined for compliance with 3.18.

5. PACKAGING

5.1 Packaging. The wax emulsion shall be packaged in accordance with MIL-STD-290. The level of protection shall be level A, B, or C when military packaging is required (see 6.2). Commercial packaging, when used shall be as specified by ASTM D3951 (see 6.2). The wax emulsion shall be furnished in 1-gallon screw cap cans, 5-gallon tight head pails or 55-gallon tight head steel drums as specified (see 6.2).

5.2 Marking. In addition to any special marking required in the contract or order, shipments shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The rust inhibiting wax emulsion covered by this specification is intended for use as a combination preservative and lubricant on small arms ammunition clips, links, etc. and wherever a rust inhibiting coating for general weatherproofing is required.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Size of containers required (see 5.1).
- (c) Levels of protection required (see 5.1). NOTE: Commercial packaging is not applicable to acquisitions for Army use. Level C for Army use shall be in accordance with MIL-STD-1190, Minimum Guidelines for Level C Preservation, Packing, and Marking.
- (d) Marking, if different from that specified (see 5.2).
- (e) Subject term, (key word), listing

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6.3 Subject term, (key word), listing.

Coating
Wax-emulsion
Rust-inhibiting
Weather proofing

Custodian:

Army - MK
Navy - YD
Air Force - 99

Preparing activity:

Army - MR

Review Activities:

Army - ME, AR, SM, GL
Air Force - 20, 99

Project No. 8030-0593

User activities:

Army - AT
Navy - SA, MC

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