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O-W-1284B
February 25, 1977
SUPERSEDING
Int. Fed. Spec. O-W-001284A (GSA-FSS)
June 26, 1968

FEDERAL SPECIFICATION

WATER DISPLACING COMPOUND (WITH CORROSION INHIBITOR)

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers two types of liquid compound which displace water from wet electrical, electronic and mechanical equipment and deposit a rust inhibiting film (see 6.1).

1.2 Classification. Water displacing compound shall be of the following types and classes, as specified (see 6.2).

Type I - For normal equipment (heavy rust inhibiting film).
Type II - For delicate equipment (light rust inhibiting film).

Class 1 - Liquid.
Class 2 - Aerosol.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Specifications:

QQ-A-250/4 - Aluminum Alloy 2024, Plate and Sheet.
QQ-C-576 - Copper Flat Product with Slit, Slit and Edge-Rolled, Sheared, Sawed or Machined Edges (Plate, Bar, Sheet, and Strip).
QQ-S-635 - Steel Plate, Carbon.
PPP-B-636 - Boxes, Shipping, Fiberboard.
PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
PPP-D-729 - Drums, Shipping and Storage, Steel, 55-Gallon.
PPP-P-704 - Pails, Metal: (Shipping, Steel, 1 Through 12 Gallon).

Federal Standard:

Fed. Std. No. 123 - Marking for Shipment (Civil Agencies).

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

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(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

Laws and Regulations:

16 CFR 1500 - Federal Hazardous Substances Act Regulations.
49 CFR 170-179 - Department of Transportation, Hazardous Materials Regulations Board.

(The Code of Federal Regulations (CFR) and the Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Associations, Inc., Tariff Order Section, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

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

American Society for Testing and Materials (ASTM) Standards:

D 56 - Flash Point by Tag Closed Tester.
D 525 - Oxidation Stability of Gasoline (Induction Waiting Period).
D 1500 - Color of Petroleum Products (ASTM Color Scale).
D 3069 - Delivery Rate of Aerosol Products.
D 3094 - Seepage Rate of Aerosol Products.

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

Chemical Specialities Manufacturers Association (CSMA):

Aerosol Guide.

(Application for copies should be addressed to the Chemical Specialties Manufacturers' Association, 1001 Connecticut Avenue, NW, Washington, D.C. 20036.)

3. REQUIREMENTS

3.1 Finished product. The finished product shall be a clear and homogeneous solution which is formulated to displace water from wet metal surfaces and deposit a hydrophobic film that hinders rewetting. There shall be no suspended matter or sediment in the finished product.

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3.2 Displacement of water layer. When tested as specified in 4.3.2, a drop (0.025 ml) of water displacing compound shall penetrate and displace a layer of water 1 mm thick and no less than 4 cm in diameter. The area of water displacement shall not be rewetted after the solvent in the water displacing compound has evaporated.

3.3 Tackiness of deposited film. When tested as specified in 4.3.3, the film left after the evaporation of the solvent from the water displacing compound shall be nontacky.

3.4 Rust inhibition (type I). When tested as specified in 4.3.4, type I water displacing compound shall prevent rusting on a steel panel.

3.5 Corrosiveness. When tested as specified in 4.3.5, the water displacing compound shall not cause visible evidence of etching, pitting, or other corrosion of the metal specimens.

3.6 Resistance to oxidation. When tested as specified in ASTM D 525, the water displacing compound shall have an induction period of not less than 48 hours.

3.7 Flash point. When tested as specified in ASTM D 56, the water displacing compound shall have a flash point of not less than 35° C.

3.8 Color. When tested as specified in ASTM D 1500, the color of the water displacing compound shall not exceed No. 3 ASTM.

3.9 Aerosol container. When class 2 is specified, the water displacing compound shall be packaged with a suitable propellent in an aerosol can with valve assembly and cover as specified in 3.9.1, 3.9.2 and 3.9.3. The use of vinyl chloride as a propellent is prohibited. Each can shall contain not less than 16 ounces avoirdupois (454 grams) of dispensable contents, when tested as specified in 4.3.6.

3.9.1 Aerosol can. The aerosol can shall conform to PPP-C-96, type IX, class 2.

3.9.2 Valve assembly. The can shall be fitted with a valve assembly with the valve performance characteristics specified in table I when tested as specified in 4.2.4. The valve stem shall be fitted with a side discharge plastic actuator. The direction of discharge shall be indicated either by the shape of the actuator or by a mark on it. The valve assembly shall be constructed of materials which are not affected by the contents. The valve shall produce the desired aerosol spray when actuated by finger pressure and automatically shut off when the pressure is removed. The valve assembly will be designed and located so that when activated, none of the contents shall impinge on any part of the container. On operating the valve, the contents shall be ejected only through the discharge orifice.

TABLE I. Valve performance characteristics

Characteristic	Requirement
Delivery rate at 27° C, maximum	4.0 grams per second (g.p.s.)
Discharge form at 27° C.	Spray.
Leakage in 48 hours, maximum	3.0 ml

3.9.3 Protective cap. The valve assembly shall be protected from accidental activation by a snug fitting cap of metal or sturdy plastic. The cap shall provide a clearance of not less than 1/8 inch above the valve assembly.

3.10 Filled aerosol container stability to pressure. The filled aerosol containers shall not exhibit leakage, distortion, or other pressure related defects after being heated at 130° F (54.4° C) for a period of 1 hour.

3.11 Laws and regulations. The finished product and its labeling shall comply with Federal Hazardous Substances Act Regulations and Department of Transportation, Hazardous Materials Regulations Board regulations.

3.12 Directions for use. The unit containers (specified in 3.9, 5.1.1.1, 5.2.1.1.2 and 5.2.1.1.3) shall be marked or labeled with the manufacturer's normal commercial directions for use.

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4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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.

4.2 Quality conformance inspection.

4.2.1 Inspection of the end item. Components and materials shall be inspected and tested in accordance with all the requirements of referenced specifications, drawings and standards unless otherwise excluded, amended, or qualified in this specification or applicable purchase documents.

4.2.2 Examination of preparation for delivery. Packaging, packing and marking shall be examined to determine compliance with the requirements of section 5. Defects shall be scored in accordance with table II. Sampling and acceptance shall be in accordance with MIL-STD-105, inspection level S-2, acceptable quality level (AQL) of 4.0 percent defective. The sample unit shall be one shipping container fully prepared for delivery. The lot shall be all shipping containers presented for delivery at one time.

TABLE II. Examination of preparation for delivery

Examine	Defect
Containers	Not as specified.
Contents	Not as specified.
Markings	Omitted; incorrect; illegible; improper size, location, sequence, or method of application.
Materials	Component missing or damaged.
Workmanship	Bulging or distortion of containers; cushioning inadequate, improper, or missing.

4.2.2.1 Examination of closure, waterproofing and banding of containers. When shipping containers are required to comply with PPP-B-636, PPP-C-96 (one gallon containers only) or PPP-P-704, examination for defects in closure, waterproofing and banding shall be made in accordance with the appendix to that specification.

4.2.3 Testing of aerosol containers for stability at 130° F. The filled aerosol containers shall be tested for stability at 130° F (54.4° C). The lot shall consist of all containers presented for delivery at one time. The sample unit shall be one filled container. Select the number of containers specified below at random from the lot. Test the containers as specified in 4.3.9. Failure of any container to pass the requirement of 3.10 shall result in rejection of the lot.

Lot size	Sample size
2 - 15	2
16 - 50	3
51 - 150	5
151 - 500	8
501 - 3200	13
3201 - 35000	20
35001 - 500000	32
500001 and up	50

4.2.4 Testing of the filled aerosol containers. The filled containers shall be tested as specified in table III. Sampling and acceptance shall be in accordance with MIL-STD-105, inspection level S-4, AQL of 2.5 percent defective. The sample unit shall be one filled container (see 3.9). The lot shall consist of all containers presented for delivery at one time.

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TABLE III. Instructions for testing the filled aerosol containers

Property	Specification Reference Requirement	Test Method	Results reported
Delivery rate	table I	4.3.8	Numerically to nearest 0.05 g
Discharge form	table I	4.3.8	As pass/fail
Leakage	table I	4.3.7	Numerically to nearest 0.1 ml
Spray impingement on container	3.9.2	4.3.8	As pass/fail
Discharge other than through discharge orifice	3.9.2	4.3.8	As pass/fail
Net Weight of dispensable contents	3.9	4.3.6	Numerically to nearest 0.5 g

4.2.5 Testing of the water displacing compound. The water displacing compound shall be tested as specified in table IV. The tests shall be performed on a composite sample obtained as specified in 4.2.5.1 or 4.2.5.2. Each test shall be performed twice. The lot shall be rejected if the composite sample fails any of the tests.

4.2.5.1 Composite sample, class 1. Sampling shall be in accordance with MIL-STD-105, inspection level S-1. The sample unit shall be 1 gallon of water displacing compound. Each sample unit shall be selected from a different container. The lot shall consist of all water displacing compound of the same type presented for delivery at one time. The sample units shall be thoroughly mixed and one gallon of the mixture taken for the composite sample, placed in an air tight container, sealed and marked with the lot number and date.

4.2.5.2 Composite sample, class 2. Six aerosol cans shall be taken at random from not less than four separate shipping containers. The cans shall be punctured, or otherwise handled to remove the propellent only. The liquid water displacing compound remaining in the cans shall be thoroughly mixed and placed in an air-tight container, sealed, and marked with the identifying lot number and date.

TABLE IV. Instructions for testing the water displacing compound

Property tested	Specification reference Requirement	Test method	Results reported
Displacement of water	3.2	4.3.2	As pass/fail
Film tackiness	3.3	4.3.3	As pass/fail
Rust inhibition (type I)	3.4	4.3.4	As pass/fail
Corrosiveness	3.5	4.3.5	As pass/fail
Oxidation resistance	3.6	ASTM D 525	To nearest hour
Flash point	3.7	ASTM D 56	To nearest 1° C
Color	3.8	ASTM D 1500	To nearest 0.5 ASTM Color No.

4.3 Test methods.

4.3.1 Preparation of metal plates for testing. Polish all surfaces of metal plates with No. 320 emery cloth until the entire plate is bright, shiny, and free from any visible oxide film or tarnish. Wash plates with distilled water and then with 95 percent ethyl alcohol. Allow to air dry.

4.3.2 Displacement of layer of water. A test panel shall be prepared as specified in 4.3.1. The panel shall be made of a mild carbon steel conforming to QQ-S-635 and shall have minimum dimensions of 2-3/4 inches length and 2-3/4 inches width. Place the cleaned panel horizontally in a rectangular tray. Add tap water until the panel is uniformly covered by a layer of water 1 mm ± 0.1 mm deep. The volume of water necessary to cover the panel with a 1 mm layer of water may be calculated by subtracting the volume of the panel from the volume of water necessary to fill the empty tray to a depth of 1 mm more than the thickness of the panel. Using a suitable syringe or pipet, place one drop (0.025 ml) of water displacing compound on the surface of the water surface near the center of the panel. Record the diameter in centimeters, of the area of bare metal exposed by the displaced water after 30 seconds. Allow to stand at 23° ± 2° C for 2 hours. The area of the metal plate from which the water had been displaced shall not have been rewetted by the water.

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4.3.3 Tackiness of rust inhibitor film. Prepare a 3 x 6 x 1/8 inch mild carbon steel panel conforming to QQ-S-635 as specified in 4.3.1. Place the specimen horizontally on a level surface and spread 3 ml of the water displacing compound evenly over the entire surface. Allow to dry for 24 hours at 24° ± 3° C in a room with good circulation of air and a relative humidity of 50 to 90 percent. Examine the surface of the specimen for tackiness to touch. The film deposited by the type II water displacing compound shall be very thin so as not to affect the operation of electrical equipment.

4.3.4 Rust inhibition (type I). Prepare a 3 x 1/2 x 1/8 inch mild carbon steel panel conforming to QQ-S-635 as specified in 4.3.1. Suspend the specimen on a glass hook in or near a ventilating hood at 24° ± 3° C. Using an atomizer, such as De Vilbiss, and type I water displacing compound, spray each side of the panel thoroughly and allow to dry 2 hours. Spray each side a second time and allow to dry 2 hours. Using the glass hook, suspend the panel in a suitable glass vessel so that the panel is completely submerged in distilled water. After immersion for 24 hours at 24° ± 3° C examine the panel visually for evidence of rusting.

4.3.5 Corrosion. Test strips 3 x 1/2 x 1/8 inch of aluminum alloy, conforming to QQ-A-250/4 temper 3 or 4; copper conforming to QQ-C-576 and mild carbon steel conforming to QQ-S-635 shall be prepared as specified in 4.3.1 Place the specimens in individual test tubes and add sufficient water displacing compound to completely submerge the specimens. The test tubes shall be tightly stoppered and allowed to stand vertically at a temperature of 95 ± 5° F for a period of 168 hours. The metal specimens shall be examined visually for evidence of discoloration, and under a magnification of 10 to 20 diameters for evidence of etching, pitting, or other corrosion.

4.3.6 Net weight of dispensable contents. Weigh each dispenser to the nearest 0.1 gram. Next perform the tests specified in 4.3.7 and 4.3.8. Holding the aerosol can upright and shaking occasionally, spray the remainder of the contents into a sink or other appropriate container until the can is completely exhausted. Reweigh the can to the nearest 0.1 g. Record the difference in weights as the net weight of the dispensable contents.

4.3.7 Leakage. Determine the leakage in accordance with ASTM D 3094, Seepage Rate of Aerosol Products.

4.3.8 Delivery rate. Determine the delivery rate in accordance with ASTM D 3069, Delivery Rate of Aerosol Products. Report the average of three determinations. During the performance of this test, observe if any part of the spray impinges on the can or if any of the contents are discharged other than through the discharge orifice. The discharge form shall be a spray.

4.3.9 Filled container stability to pressure at 130° F. Submerge containers in an automatic control, circulating, constant temperature bath at room temperature. Place a safety shield in front of the bath in case a container ruptures. Program the bath for 54° ± 1° C and allow the temperature to rise. Keep the containers in the bath at 54° ± 1° C for a period of 1 hour after the bath temperature has reached 54° ± 1° C. Using leather gloves and a face shield, remove the container from the bath and examine them. There shall be no leakage, distortion, or other pressure related defects.

4.3.10 Optional test for vinyl chloride. Insert the aerosol can in a modified can piercing pressure measuring device (CSMA Aerosol Guide: "Method for Internal Pressure Determination of Aerosol Products") which has a 1/8 inch Swagelock fitting. Pierce the can in a closed hood since a can may occasionally tear when pierced. Connect the apparatus and can to a gas sampling valve on a programmable gas chromatograph. Operate the gas chromatograph under the following conditions: gas sampling valve temperature of 110° C helium carrier flow of approximately 80 ml/min; programmed temperature rise of 6° C per min. from 100° C to 200° C with a 2 minute post injection hold at 100° C, flame ionization detector temperature of 240° C. Use 1/8 inch outer diameter stainless steel columns packed with 60 - 200 mesh silica gel. Use a known sample of vinyl chloride to calibrate the gas chromatograph. Run the sample through the gas chromatograph. There shall be no detectable material in the product having the same retention time as vinyl chloride.

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5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A, B, or C, as specified (see 6.2).

5.1.1 Level A and B. Unit container.

5.1.1.1 Class 1. One (1) gallon of water displacing compound of one type only shall be furnished in a can conforming to PPP-C-96, type V, class 4, oblong. The cans shall be closed in accordance with the appendix to PPP-C-96. The five gallon or fifty-five gallon quantity does not require packaging.

5.1.1.2 Class 2. Water displacing compound of one type only, furnished as specified in 3.9, does not require packaging.

5.1.2 Level C. The water displacing compound of one description shall be packaged to afford adequate protection against damage during shipment from the supply source to the first receiving agency.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

5.2.1 Level A. Shipping container.

5.2.1.1 Class 1.

5.2.1.1.1 One (1) gallon cans. Six (6) one gallon cans shall be packed as specified in the appendix of PPP-C-96 for Level A packing.

5.2.1.1.2 Five (5) gallon quantity. Five (5) gallons of water displacing compound of one type only, shall be packed in a pail conforming to PPP-P-704, type 1, class 1 through 5. The pail shall be closed in accordance with PPP-P-704.

5.2.1.1.3 Fifty-five (55) gallon quantity. Fifty-five (55) gallons of water displacing compound of one type only shall be packed in a drum conforming to PPP-D-729, type I.

5.2.1.2 Class 2. Twelve (12) cans shall be packed in a box conforming to PPP-B-636, class weather resistant. The box shall be closed, waterproofed and banded in accordance with the appendix to PPP-B-636.

5.2.2 Level B. Shipping container.

5.2.2.1 Class 1.

5.2.2.1.1 One (1) gallon quantity. Six (6) one gallon cans shall be packed as specified in the appendix of PPP-C-96 for Level B packing.

5.2.2.1.2 Five (5) gallon quantity. Five (5) gallons of water displacing compound of one type only, shall be packed as specified in 5.2.1.1.2.

5.2.2.1.3 Fifty-five (55) gallon quantity. Fifty-five (55) gallons of water displacing compound of one type only, shall be packed as specified in 5.2.1.1.3.

5.2.2.2 Class 2. Twelve cans shall be packed in a box conforming to PPP-B-636, class domestic. The box shall be closed in accordance with the appendix of PPP-B-636.

5.2.3 Level C. The water displacing compound, packaged as specified in 5.1, shall be packed in a manner to insure carrier acceptance and safe delivery at destination. Containers shall comply with Uniform Freight Classification or National Motor Freight Classification, as applicable.

5.3 Marking. The unit and shipping containers shall be marked in accordance with 3.11, 3.12 and Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies, as applicable.

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6. NOTES

6.1 Intended use. The water displacing compounds are intended for use in removing water or moisture from electronic, electrical, or mechanical equipment. Type I is intended for use with normal equipment. Type I can be used on ferrous metals to give a nontacky, temporary protective film against rust. Two coats, applied one or two hours apart, will furnish protection in unheated warehouse storage for 60 to 90 days. Type II is intended for delicate equipment where a heavy film of rust inhibitor would impair the operation of the equipment. Class 1 regular, is intended for use in relatively large scale operations. Class 2, aerosol, is intended for emergency drying in the field, or for small drying operations.

6.2 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

(a) Title, number, and date of this specification.
(b) Type and class required (see 1.2).
(c) Quantities required.
(d) Levels of packaging and packing required (see 5.1 and 5.2).
(e) Marking document required (see 5.3).

MILITARY COORDINATING ACTIVITY:

Air Force - 68

Civil Agency Coordinating Activity:

GSA-FSS

Preparing Activity: GSA-FSS

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