

MIL-C-372C

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SUPERSEDING

MIL-C-372B

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MILITARY SPECIFICATION

CLEANING COMPOUND, SOLVENT
(FOR BORE OF SMALL ARMS AND AUTOMATIC AIRCRAFT WEAPONS)

This specification is approved for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 This specification covers one type of bore cleaner for use in the removal of primer salts and as a temporary preservative for metallic items.

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

Q-M-232 - Methanol (Methyl Alcohol)
QQ-S-698 - Steel, Sheet and Strip, Low-Carbon
RR-S-366 - Sieves, Standard for Testing Purposes
TT-N-95 - Naphtha, Aliphatic
PPP-C-96 - Cans, Metal, 28 Gage and Lighter

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-290 - Packaging of Petroleum and Related Products

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: DRXMR-SSS, 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.

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(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 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DODIBS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS

- D 56 - Flash Point by Tag Closed Tester
- D 270 - Sampling Petroleum and Petroleum Products
- D 445 - Kinematic Viscosity of Transparent and Opaque Liquids
(and the Calculation of Dynamic Viscosity), Test for
- D 1748 - Rust Protection by Metal Preservatives in the Humidity Cabinet

(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 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 Qualification. The bore cleaner furnished under this specification shall be a product which has been tested and passed the qualification tests specified herein (see 4.5.1 and 6.6), and has been listed on or approved for listing on the applicable qualified products list.

3.2 Material. The bore cleaner shall be made of such materials as shall meet all requirements of this specification. The cleaner shall contain no ingredients which may be injurious to personnel using it, under reasonable safety precautions.

3.3 Physical requirements. The cleaner shall have the following physical requirements (see 4.6):

Flash Point, °C, minimum 49 (120°F)

Kinematic viscosity, centistokes (cSt) [square meters per second (m^2/s)]

- a. 38°C (100°F), Max - 15 cSt (0.000015 m^2/s)
- b. -29°C (-20°F), Max - 1500 cSt (0.0015 m^2/s)

3.4 Stability.

3.4.1 Freezing. The cleaner shall show no separation after storage throughout a temperature range of -54°C (-65°F) to 25°C (77°F) (see 4.7.1).

3.4.2 Heating. The cleaner shall show no separation after storage at 66°C (150°F) (see 4.7.2).

3.5 Residue and fluidity at low temperature. The residue remaining after evaporation at 54°C (130°F) shall be free from solid particles and not tacky and shall permit movement at -54°C (-65°F) when tested as specified in 4.8.

3.6 Appearance. The cleaner shall be clear and transparent when viewed by transmitted light (see 4.9).

3.7 Odor. The cleaner shall be free from disagreeable and offensive odors when tested as specified in 4.10. (An obvious strongly offensive odor shall be cause for immediate rejection without conducting the test.)

3.8 Corrosion protection.

3.8.1 Performance (primer salts removal). The cleaner shall remove primer salts and prevent rusting. The presence of a discoloration shall not be cause for rejection (see 4.11.1).

3.8.2 Humidity cabinet. The cleaner shall be capable of protecting parts against corrosion during continuous condensation on parts at temperatures up to 49°C (120°F) (see 4.11.2).

3.8.3 Water displacement and water stability. The cleaner, after storage in contact with water, shall satisfactorily displace water as evidenced by the absence of rust, mottling, or other abnormal surface stains on the test specimens (see 4.11.3).

3.8.4 Container corrosion. The cleaner shall not produce visually evident corrosive effects or a weight gain or loss in excess of the following (see 4.11.4):

Container finish	Milligrams per square centimeter
Electrolytic tinplate 0.25 lbs (113.4 gms) per base box	0.3
Electrolytic tinplate 0.50 lbs (226.7 gms) per base box	0.3
Electrolytic tinplate 0.75 lbs (340.2 gms) per base box	0.3
Hot dipped tinplate 1.25 lbs (567.0 gms) per base box	0.4

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3.9 Toxicity. When used for its intended purpose, the cleaner shall have no adverse effect on the health of personnel (see 6.5).

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 specifications where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Lot. An inspection lot shall consist of cleaner of a single batch or composition, manufactured under essentially the same condition, and presented for inspection at the same time. However, a lot shall not exceed 5,000 gallons (19 cubic meters) in any case.

4.3 Sampling.

4.3.1 Sampling material for testing. Each lot of material shall be sampled in accordance with ASTM D 270.

4.3.2 Qualification test samples. Qualification samples shall consist of two one-gallon (0.95 liter) containers of the cleaner.

4.3.2.1 The qualification samples shall be accompanied by test data indicating results of all tests except the container corrosion test.

4.4 Inspection.

4.4.1 Inspection of material. Inspection shall be in accordance with MIL-STD-105.

4.4.2 Inspection of packaging. The containers shall be inspected for fill, closure, evidence of leakage, and marking to determine compliance with MIL-STD-290.

4.5 Classification of tests.

4.5.1 Qualification tests. Qualification tests shall consist of all the tests of this specification.

4.5.2 Acceptance tests. Acceptance tests shall consist of all the tests of this specification except the odor test (see 4.10) and the container corrosion test (see 4.11.4).

4.6 Physical and chemical tests. Physical and chemical tests shall be conducted in accordance with ASTM Methods as follows:

- a. Flash Point - D 56
- b. Kinematic Viscosity - D 445

4.7 Stability.

4.7.1 Freezing. A sample of the cleaner shall be placed in a pour point tube, stoppered, and subjected to $-54 \pm 3^{\circ}\text{C}$ ($-65 \pm 5^{\circ}\text{F}$) for 16 hours followed by 8 hours at $25 \pm 3^{\circ}\text{C}$ ($77 \pm 5^{\circ}\text{F}$). This cycle shall be repeated for a total of three times. Following this procedure the sample shall be inverted once, permitted to stand at $25 \pm 3^{\circ}\text{C}$ ($77 \pm 5^{\circ}\text{F}$) for 16 hours, and then examined for separation. Any evidence of separation in this sample shall be cause for rejection.

4.7.2 Heating. A sample of the cleaner shall be placed in a pour point tube, loosely stoppered, and subjected to 66°C (150°F) for 30 minutes. Upon completion of the heating period the sample is permitted to cool to $25 \pm 3^{\circ}\text{C}$ ($77 \pm 5^{\circ}\text{F}$) and examined for separation. Any evidence of separation in the sample shall be cause for rejection.

4.8 Residue and fluidity at low temperature. Twenty-five milliliters (ml) of the cleaner shall be placed in a flat bottom petri dish, approximately 10 centimeters (cm) in diameter, and heated in an oven maintained at $54 \pm 3^{\circ}\text{C}$ ($130 \pm 5^{\circ}\text{F}$) for 40 hours. At the end of the heating period, the sample shall be cooled to $25 \pm 3^{\circ}\text{C}$ ($77 \pm 5^{\circ}\text{F}$) and examined for tackiness by touching the residue. A visual examination shall be made for solid particles. A sufficient quantity of the residue shall be placed upon the end of a glass slide approximately 1 by 3 inches (2.5 by 7.6 cm). Another slide shall be placed over the residue so that an overlap of approximately one square inch (6.45 square centimeters) is formed. A one-kilogram weight is placed on the test area for 30 seconds. The weight is then removed and the slides subjected to $-54 \pm 3^{\circ}\text{C}$ ($-65 \pm 5^{\circ}\text{F}$) for 24 hours. While at a temperature of -54°C (-65°F) the two slides shall be separated by hand, using a sliding action. If no movement is detected within a period of one second the material shall be rejected.

4.9 Appearance. A pour point tube shall be filled to the mark with the sample to be tested. The sample, when viewed by transmitted light, shall be clear and transparent.

4.10 Odor.

4.10.1 Procedure. Twenty ml of the cleaner is placed in a weighing bottle, 70 mm I.D. and 30 mm in height, sealed with a ground-glass stopper, and maintained in an oven at $38 \pm 3^{\circ}\text{C}$ ($100 \pm 5^{\circ}\text{F}$) for 30 minutes. Immediately after removal from the oven, the container is transferred to a draft-free area, the stopper is removed, and the vapors rated by each of three operators, as to being agreeable or offensive (see 4.10.2) according to the following procedure:

a. The operator should not be more than 2-3 inches (5.1 - 7.6 cm) from the weighing bottle when removing the stopper and smelling the vapors.

(Note. In case strong odors are present, it is recommended that the operator partially fill his lungs with air prior to removing stopper to only permit exposure to sufficient vapors for odor detection.)

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b. The operator should breathe carefully while exposed to the vapors for 15 seconds after removing stopper.

c. The operator shall determine the length of time he can sense or notice the odor after completion of the 15-second exposure period.

4.10.2 Rating the odor. Each operator shall rate the odor as follows as to category and/or type:

Category 1 - Agreeable

- Type A - Pleasant
- Type B - No odor
- Type C - Neutral odor

Category 2 - Offensive

- Type A - Nauseous
- Type B - Repellent
- Type C - Burning
- Type D - Strongly penetrating
- Type E - Causing drying
- Type F - Lachrymatory
- Type G - Persistent after 15 seconds exposure
- Type H - Causing dizziness
- Type I - Causing sneezing
- Type J - Causing other adverse effects

4.10.3 Criterion for failure. If any 2 of 3 operators rate the odor as offensive, the material shall be considered unsatisfactory for use and rejected.

4.11 Corrosion protection.

4.11.1 Performance (primer salts removal).

4.11.1.1 Test panels. The test panels shall be 2 by 4 by 1/8 inch (5.1 by 10.2 by 0.32 cm); low carbon, cold-rolled 1020 steel conforming to QQ-S-698. Badly rusted stock shall not be used for making test panels. The edges of the panels shall be rounded and suspension holes reamed in accordance with ASTM D 1748 prior to cleaning.

4.11.1.2 Cleaning test panels. The test surfaces of the panels shall be cleaned with naphtha, conforming to TT-N-95, and methanol, conforming to O-M-232, Grade A, as follows:

a. While cleaning the test panels, they shall be handled with hooks or forceps at all times. All precautions shall be taken to guard against impurities on the test panels by avoiding contact with any type of contaminated surfaces. The utensils and solvents used must be cleaned and free of contamination.

b. The solvents shall be maintained at a temperature high enough to keep the temperature of the panels above the dew point during handling operations when they are not submerged in solvent or stored in a desiccator.

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c. Wipe the surfaces clean with solvent-soaked rags and scrub with surgical gauze swabs in a beaker of hot naphtha.

d. Rinse in a beaker of hot methanol. Air-dry the panels and store in a desiccator until further processing.

4.11.1.3 Sandblasting test panels. The unnumbered side of the test panels shall be sandblasted to a fresh, uniformly abraded surface with clean, white, dry, sharp sand, of a size that will allow all of it to pass through a number 10 sieve, a minimum of 90 percent to pass through a number 20 sieve, and not more than 10 percent to pass through a number 50 sieve. The size designation of all sieves shall conform to RR-S-366. Immediately after sandblasting, the panels shall be placed into a container of anhydrous methanol. Remaining residue and contamination shall be removed by holding the panels in a rack at 20° from the vertical and spraying downward with naphtha. Flush the test surface, then the back of the panel and the test surface again. The panels shall then be rinsed in hot naphtha and hot methanol. After the panels are dry they shall be stored in a desiccator and used the same day as prepared.

4.11.1.4 Test procedure. Three test panels shall have a Cal. .30 primed, (corrosive) empty cartridge case fired at the center of each (see 6.3). The primed case shall be held in a rigid manner at a 45-degree inclination with a distance of one inch (2.5 cm) between the cartridge and the test panel. The panels shall then be slushed in approximately 800 ml of the cleaner under test for 2 minutes. The panels shall then be suspended by stainless steel or Monel hooks and exposed in the humidity cabinet specified in ASTM D 1748 for 3 days. The slushing of the panels in the test cleaner shall be accomplished mechanically by use of a reciprocal stroking machine. The panels shall be mounted in the test holder in a vertical position, with one on each side of the holder, so that the contaminated side of the panels is in a plane perpendicular to the path of the slushing motion. The length of the stroke shall be $2 + \frac{1}{4}$ inch (5.1 x 0.63 cm) and the slushing shall be conducted at 30 ± 1 cycles per minute. After exposure of the panels in the humidity cabinet for 3 days, their significant areas shall be examined, as defined in ASTM D 1748. At least two of the panels shall be free of corrosion and the third panel shall have no more than three corrosion dots, none of which exceed one milliliter in diameter. Corrosion in excess of this shall be cause for rejection.

4.11.2 Humidity cabinet.

4.11.2.1 Test panels. Three test panels for the humidity cabinet test shall be of the same size and materials as specified in 4.11.1.1, and cleaned and sandblasted as specified in 4.11.1.2 and 4.11.1.3.

4.11.2.2 Test Procedure. The test panels shall be dipped in the test cleaner at a temperature of $25 \pm 3^{\circ}\text{C}$ ($77 \pm 5^{\circ}\text{F}$) and agitated gently for one minute. The panels shall then be suspended by means of stainless steel or Monel hooks and drained for two hours at that temperature. The panels shall then be subjected to 7 days of the humidity cabinet test specified in ASTM D 1748. At the end of the 7 day exposure period the panels shall be removed, deoiled with naphtha and examined in the significant area of the panels as defined in ASTM D 1748. At least two of the panels shall be free of corrosion and the third panel shall have no more than three corrosion dots, none of which exceed one millimeter in diameter. Corrosion in excess of this amount shall be cause for rejection.

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4.11.3 Water displacement and water stability.

4.11.3.1 Test panels. Four panels for this test shall be 2 by 3 by 1/16 inch (5.1 by 7.6 by 0.16 cm) of the same material specified in 4.11.1.1, and cleaned and sandblasted as specified in 4.11.1.2 and 4.11.1.3.

4.11.3.2 Preparation of compound. Fifty ml of the test compound shall be placed in a 125 ml Erlenmeyer flask, 5 ml of distilled water added, and the mixture thoroughly shaken. The stopper flask shall be stored in an oven at $54 \pm 3^{\circ}\text{C}$ ($130 \pm 5^{\circ}\text{F}$) for 16 hours and then cooled to $25 \pm 3^{\circ}\text{C}$ ($77 \pm 5^{\circ}\text{F}$) for testing.

4.11.3.3 Test procedure. Three test panels shall be dipped into distilled water momentarily and drained in a vertical position for not more than five seconds, with the bottom edge in contact with absorbent paper. The panels shall be immersed horizontally and without agitation for 15 seconds in a petri or evaporating dish containing 50 ml of the test compound. After draining momentarily, the panels shall be placed in a static humidity chamber, (for example, a desiccator body containing distilled water), for one hour at $25 \pm 3^{\circ}\text{C}$ ($77 \pm 3^{\circ}\text{F}$). The fourth panel shall be used as the control and stored in a desiccator while the test proceeds. At the completion of the static humidity exposure the panels shall be decoated with naphtha and compared to the control panel. The presence of rust, mottling or other abnormal surface stains shall be cause for rejection.

4.11.4 Container corrosion.

4.11.4.1 Test containers. This test shall be conducted utilizing the following containers: round, 6-fluid-ounce (177.5 milliliters) capacity, conforming to PPP-C-96:

- a. Electrolytic tinplate - 0.25, 0.50, and 0.75 lbs (0.11, 0.02, and 0.34 kgs) per case box
- b. Hot-dipped tinplate - 1.25 lbs (0.57 kgs) per base box

4.11.4.2 Preparation of test containers. The containers shall be rinsed in hot naphtha followed by a rinse in hot methyl alcohol. The containers shall be permitted to cool to $24 \pm 3^{\circ}\text{C}$ ($75 \pm 5^{\circ}\text{F}$) prior to further processing. Avoid touching containers with the hands after the cleaning process.

4.11.4.3 Test procedure. Weigh each container and add 110 ml of the compound under test. The lids shall be securely attached and the containers placed in an oven at $54 \pm 3^{\circ}\text{C}$ ($130 \pm 5^{\circ}\text{F}$) for 7 days. Upon completion of the test, the cleaner shall be removed and the containers rinsed in hot naphtha and hot methyl alcohol. After cooling to $24 \pm 3^{\circ}\text{C}$ ($75 \pm 5^{\circ}\text{F}$) reweigh the containers and calculate the change in weight in milligrams per square centimeter (see 6.4).

5. PREPARATION FOR DELIVERY

5.1 Packaging and packing. The bore cleaner shall be furnished in 2-fluid-ounce (59.2 milliliters), 6-fluid-ounce (177.5 milliliters), 1-quart (0.95 liter), 1-gallon (3.79 liters) screwtop cans, 5-gallon (18.95 liter) pails, and 55-gallon (208 liter) drums as specified by the procuring activity (see 6.2). Unless otherwise specified in the contract or order, packaging and packing shall be in accordance with MIL-STD-290. The level of packaging shall be level A or C, and the level of packing shall be level A, B or C, as specified (see 6.2).

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5.2 Marking. The unit shipping containers shall be marked for shipment in accordance with MIL-STD-290.

6. NOTES

6.1 Intended use. The bore cleaner covered by this specification is a highly penetrating, mobile liquid and is intended for use in cleaning the bores of small arms and automatic aircraft weapons. The material provides a temporary rust-resistant coating for the cleaned surface.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title and number of this specification
- b. Level of packaging and level of packing required
- c. Size and type of container
- d. Any special marking required
- e. Quantity desired

6.3 Primed cartridge cases. Primed (corrosive), empty cartridge cases required for the performance test (par. 4.11.1.4) may be obtained from Commanding Officer, ARRADCOM, ATTN: DRDAR-SCM-O, Bldg 183, Dover, New Jersey 07801.

6.4 The surface areas of the containers can be determined by utilizing the following formulas:

$$\begin{aligned}\text{Area of circle} &= \pi r^2 \\ \text{Area of cylinder} &= 2\pi rh\end{aligned}$$

where r (centimeters) = radius of bottom of container
and h (centimeters) = height of liquid in container

The total surface area can be obtained by combining the individual values.

6.5 Any questions raised regarding toxicity should be referred by the procuring agency to the departmental medical authority. In the case of Army procurement, the Surgeon General will act as advisor to the procuring agency.

6.6 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is US Army Materials and Mechanics Research Center, ATTN: DRDMR-SS, Watertown, MA 02172 and information pertaining to qualification of products may be obtained from that activity.

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