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MIL-PRF-6864F

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SUPERSEDING

MIL-PRF-6864E

18 May 2005

## PERFORMANCE SPECIFICATION

## CLEANING COMPOUND, SOLVENT, OIL COOLER

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

## 1. SCOPE

1.1 Scope. This specification covers one type of oil cooler solvent-type cleaning compound. The oil cooler cleaning compound solvent described herein is intended for cleaning either copper or aluminum-alloy aircraft oil coolers.

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Richmond, ATTN: DSCR-VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616 or e-mailed to <a href="mailto:STDZNMGT@dla.mil">STDZNMGT@dla.mil</a> . Since contact information can change, you may want to verify the currency of this address information using the ASSIST database at <a href="https://assist.daps.dla.mil">https://assist.daps.dla.mil</a> .
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## MIL-PRF-6864F

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

## DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-A-8625	- Anodic Coatings for Aluminum and Aluminum Alloys.
MIL-D-16791	- Detergents, General Purpose (Liquid, Nonionic).
MIL-PRF-680	- Degreasing Solvent.

(Copies of these documents are available online at <https://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

## THE ALUMINUM ASSOCIATION

International Alloy Designations and Chemical Composition Limits for Wrought Aluminum and Wrought Aluminum Alloys

(Copies of this document are available online at <http://www.aluminum.org> or from The Aluminum Association, 1525 Wilson Boulevard, Arlington, VA 22209.)

## ASTM INTERNATIONAL

ASTM B 21	- Standard Specification for Naval Brass Rod, Bar, and Shapes.
ASTM B 187	- Standard Specification for Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes.
ASTM B 272	- Standard Specification for Copper Flat Products with Finished (Rolled or Drawn) Edges (Flat Wire and Strip).
ASTM D 92	- Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester.
ASTM D 97	- Standard Test Method for Pour Point of Petroleum Products.
ASTM B 209	- Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM D 460	- Standard Test Methods for Sampling and Chemical Analysis of Soaps and Soap Products.

## MIL-PRF-6864F

ASTM D 3699 - Standard Specification for Kerosine.

(Copies of these documents are available online at <http://www.astm.org/> or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

INSTITUTE FOR INTERCONNECTING AND PACKAGING ELECTRONIC  
CIRCUITS (IPC)

IPC J-STD-006 - Requirements for Electronic Grade Solder Alloys  
and Fluxed and Non-fluxed Solid Solders for  
Electronic Soldering Applications.

(Copies of these documents are available online at <http://www.ipc.org/> or from the Institute for Interconnecting and Packaging Electronic Circuits, 2215 Sanders Road, Northbrook, IL 60062-6135.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J1966 - Lubricating Oil, Aircraft Piston Engine  
(Nondispersant Mineral Oil).  
SAE AMS-QQ-A-250/4 - Aluminum Alloy 2024, Plate and Sheet.

(Copies of these documents are available online at <http://www.sae.org/> or from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements and promotes economically advantageous life cycle costs.

3.3 Materials. The cleaning compound shall be a single-phase liquid. It shall be free of silicates (except for ethyl silicate when used as a corrosion preventative) as well as abrasives, inorganic acids, cyanides, inert fillers, and undissolved material. It shall conform to the applicable requirements as specified herein.

3.4 Toxicity. The material shall contain no compounds whose degree of hazards has not been appraised nor any combination of materials that might be hazardous to health when used in accordance with the manufacturer's recommendations.

## MIL-PRF-6864F

3.5 Quantitative requirements. The cleaning compound shall conform to the following requirements when tested as specified in 4.4:

3.5.1 Moisture content. The moisture content shall be a maximum of 3.0 percent by weight (see 4.4.1).

3.5.2 Specific gravity. The specific gravity at 25/25 °C shall be a minimum of 1.20 (see 4.4.2).

3.5.3 Flash point. The flash point shall be a minimum of 26.7 °C (see 4.4.3).

3.5.4 Pour point. The pour point shall be a minimum of -29.0 °C (see 4.4.4).

3.5.5 Hydrogen ion concentration (pH). The pH in a 1 percent solution, dispersed in water, shall be between 9.3 and 10.0 (see 4.4.5).

3.6 Solubility. The compound shall be soluble to the extent that clear solutions shall form at room temperature when 10 milliliters (mL) portions of the compound are added to 90 mL of dry cleaning solvent, kerosine, and mineral spirits, respectively (see 4.4.6).

3.7 Emulsifiability. A 4 percent by volume mixture of cleaning compound with water shall form a stable emulsion that shall show no separation or creaming for at least 6 hours (see 4.4.7).

3.8 Corrosion. The cleaning compound shall cause no visible trace of corrosive attack, oxidation, or discoloration when specimens of copper tubing, brass alloy, soldered ends of copper tubing, polished aluminum alloy, and anodized aluminum alloy are immersed (see 4.4.8).

3.9 Water tolerance. The cleaning compound shall remain clear and show no thickening when diluted with water equal to 25 percent of its volume (see 4.4.9).

3.10 Carbon removal. The cleaning compound shall show ability and rate of loosening carbon equal to or greater than that of the control formula (see 4.4.10.2).

3.11 Lacquer removal. The cleaning compound shall effect the removal of hot oil lacquers equal to or better than the control formula (see 4.4.10.3.3).

3.12 Effect on Heresite. The cleaning compound shall show no signs of softening, blistering, or removal of Heresite coated surfaces (see 4.4.10.4).

## MIL-PRF-6864F

## 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. When required (see 6.2), first article inspection shall consist of all of the tests in section 4.4 of this specification. Failure of any test to meet the requirement in section 3 shall be cause for rejection. The first article sample shall consist of at least 2 liters selected at random from the cleaning compound solvent manufactured or used for filling the contract.

4.3 Conformance inspection. Conformance inspection shall be performed in accordance with inspection provisions set forth herein. The characteristics shown in 3.3 through 3.12, when tested in accordance with 4.4, shall constitute minimum inspections to be performed by the supplier prior to government acceptance or rejection of the material.

4.4 Test methods and procedures.

4.4.1 Moisture content. The moisture content of the cleaning compound shall be determined in accordance with ASTM D 460. A 25-gram sample of the cleaning compound shall be used to make the determination.

4.4.2 Specific gravity. The specific gravity of the cleaning compound shall be determined by a suitable hydrometer at 25/25 °C.

4.4.3 Flash point. The flash point of the cleaning compound shall be determined in accordance with ASTM D 92.

4.4.4 Pour point. The pour point of the cleaning compound shall be determined in accordance with ASTM D 97.

4.4.5 Hydrogen ion concentration (pH). The pH of the specified cleaning compound dispersion shall be determined with a suitable pH meter.

4.4.6 Solubility. Ten mL of cleaning compound shall be placed into each of three 100-mL graduated cylinders having ground glass stoppers. To the three cylinders, in consecutive order, add 90 mL of degreasing solvent conforming to type I or II of MIL-PRF-680, 90 mL of kerosine conforming to ASTM D 3699, and 90 mL of mineral spirits conforming to type III of MIL-PRF-680. Each cylinder shall be stoppered, shaken thoroughly, and the contents examined for conformance to the requirements of 3.6.

4.4.7 Emulsifiability. Four mL of the cleaning compound shall be placed into a 100-mL glass-stoppered graduated cylinder and diluted to 100 mL by adding distilled water. The cylinder containing the solution shall be stoppered, shaken vigorously for 30 seconds, and allowed to

## MIL-PRF-6864F

remain undisturbed at room temperature for 6 hours. The contents shall then be examined for conformance to the requirements of 3.7.

4.4.8 Corrosion. Approximately 1 liter of the cleaning compound shall be placed in a 1-liter wide mouth glass bottle having an air-proof seal. Specimens listed in table I shall be suspended out of contact with each other and completely immersed in the compound. The bottle shall be sealed and maintained at 25 °C for 24 hours. At the end of the specified time, the specimens shall be removed, rinsed with several portions of dry cleaning solvent conforming to MIL-PRF-680 until the surfaces are free of adhering cleaning compounds, and visually examined for conformance to the requirements of 3.8.

TABLE I. Corrosion test specimens.

Specimen	Requirements
Copper tubing	Conforming to ASTM B 187
Brass alloy	Conforming to ASTM B 21
Copper tubing	Conforming to ASTM B 187, whose ends have been soldered with solder conforming to IPC J-STD-006, Comp Sn50
Polished aluminum alloy	6951 aluminum conforming to Aluminum Association specification
Aluminum alloy	2024 aluminum conforming to ASTM B 209, SAE AMS-QQ-A-250/4 or Aluminum Association specifications, anodized in accordance with MIL-A-8625

4.4.9 Water tolerance. Seventy-five mL of the cleaning compound shall be placed into a 100-mL glass-stoppered graduated cylinder and diluted to 100 mL by adding distilled water in 5 mL quantities, agitating between each addition. After each addition and agitation, the contents shall be examined for conformance to the requirements of 3.9.

4.4.10 Performance.

4.4.10.1 Control formula. The control formula to be used as a standard of comparison for judging the performance of the manufacturer's product shall be compounded in strict conformance with table II.

TABLE II. Control formula.

Ingredient	Percent by weight
95 percent ethyl alcohol	10
Cresol USP	10
Methylene chloride	70
Potassium oleate	8
Wetting agent (Polyethyleneglycol monalkylarylether conforming to MIL-D-16791)	2

## MIL-PRF-6864F

4.4.10.2 Carbon removal. A used and thoroughly carbon covered tube from an approved oil cooler shall be placed in a suitable test tube. A sufficient amount of the cleaning compound under test shall be added to the test tube to totally immerse the test oil cooler tube. The test tube shall be stoppered and placed in a rack without shaking. Another tube from the same oil cooler shall be similarly treated using the control formula product. After soaking for 30 minutes, both oil cooler tubes shall be removed and rinsed under running tap water. If the carbon has not been removed sufficiently to make a satisfactory comparison, the 30 minute soaking and rinsing procedure shall be repeated and a visual comparison shall again be made to determine conformance to the requirements of 3.10.

4.4.10.3 Lacquer removal.

4.4.10.3.1 Preparation of test oil. Prepare a quantity of test oil, sufficient for performance of this test, by heating oil conforming to specification SAE J1966 at 149 °C for 1,000 hours while providing constant stirring.

4.4.10.3.2 Preparation of test panels. Two 20 mm X 100 mm X 0.6 mm panels composed of polished copper conforming to ASTM B 272 shall be cleaned by boiling for 1 minute in chemically pure (c.p.) isopropanol and 1 minute in c.p. methylethyl ketone (MEK). Four drops (approximately 8 mg) of test oil shall be evenly placed on one face of each test panel using a clean plastic spatula to uniformly distribute the oil over the entire face of the test panel. The panels shall then be placed horizontally in a muffle furnace that has been preheated to 316 °C for 10 minutes. The panels shall then be removed, cooled to room temperature, and stored in a desiccator until needed.

4.4.10.3.3 Procedure. One panel shall be placed in a 25 mm X 200 mm test tube containing 30 mL of the cleaning compound under test. The second panel shall be placed in a similar test tube containing 30 mL of the control formula. The tubes shall be corked, sealed by taping, and clamped in a double burette clamp. A horizontal shaft shall connect the burette clamp to an electric stirring apparatus fastened to a ring stand. The tubes shall be rotated at 60 to 65 rpm for 15 minutes. At the end of this period, the panels shall be removed from the tubes, rinsed under tap water, air dried, and visually examined for conformance to the requirements of 3.11.

4.4.10.4 Effect on Heresite. Two aluminum alloy cooler tubes that have been evenly coated with Heresite shall be cleaned by thoroughly rinsing in acetone. Each shall be placed in a suitable test tube to which a sufficient amount of the cleaning compound under test shall be added to totally immerse the oil cooler tube. The test tube will be stoppered and allowed to stand for 24 hours. After soaking for that time, both oil cooler tubes shall be removed, rinsed under running tap water, and visually examined for conformance with the requirements of 3.12.

## MIL-PRF-6864F

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The cleaning compound covered by this specification is intended for use at room temperature in a closed system for cleaning oil coolers.

6.1.1 Military-unique rationale. The cleaning compound covered by this specification is mandated by military maintenance manuals for the cleaning of the C-130 aircraft oil coolers and not used by commercial activities.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. The specific issue of individual documents referenced (see 2.2.1 and 2.3).
- c. First article, if required (see 3.1 and 4.2).
- d. Packaging requirements (see 5.1).

6.3 First article inspection. When first article inspection is required (see 6.2), the contracting officer should provide specific guidance to offerors concerning the requirements for testing of the pre-production sample of the offered product.

6.4 Subject term (key word) listing.

aircraft  
aluminum-alloy  
carbon  
copper  
Heresite  
lacquer



## MIL-PRF-6864F

6.5 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes, other than capitalization changes, from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:  
Army – EA  
Navy – AS  
DLA – GS

Preparing Activity:  
DLA – GS3  
  
(Project 6850-2010-008)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST database at <https://assist.daps.dla.mil>.