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MILITARY SPECIFICATION

CLEANING COMPOUND, SOLVENT, OIL-COOLER

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 This specification covers an oil-cooler solvent-type cleaning compound intended for use at room temperature in a closed system, for cleaning either copper or aluminum-alloy aircraft oil coolers.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

P-S-661 — Solvent, Dry-Cleaning.

QQ-N-35 — Naval Brass, Rods, Bars, Wire, Shapes and Forgings and Flat Products with Finished Edges.

QQ-C-502 — Copper Rods and Shapes; and Flat Products with Finished Edges (Flat Wire, Strips and Bars).

QQ-S-571 — Solder; Soft (Tin, Tin-lead, and Lead-Silver).

TT-N-95 — Naphtha; Aliphatic.

TT-T-291 — Thinner; Paint, Volatile Mineral Spirits (Petroleum-Spirits).

TT-T-548 — Toluol (for use in Organic Coatings).

VV-K-211 — Kerosene.

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

PPP-D-760 — Drums and Pails, Metal (5 and 16.64 Gallon).

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MIL-A-8625 — Anodic Coatings, for Aluminum and Aluminum Alloys.

MIL-D-16791 — Detergents, Nonionic.

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

STANDARDS

FEDERAL

Test Method Std No. 536 — Soap and Soap-Products (Including Synthetic Detergents); Sampling and Testing.

Test Method Std. No. 791 — Lubricants, Liquid Fuels, and Related Products; Methods of Testing.

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

FSC 6850

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

(Copies of specifications and standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 **Other publications.** The following documents form a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

AMERICAN SOCIETY FOR TESTING MATERIALS STANDARD METHOD OF TEST DESIGNATIONS

D92-52 — Standard Method of Test for Flash and Fire Points by Means of Cleveland Open Cup.

D97-47 — Standard Method of Test for Cloud and Pour Points.

(Copies of ASTM publications may be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania.)

3. REQUIREMENTS

3.1 **Qualification.** The cleaning compound furnished under this specification shall be a product which has been tested and has passed the Qualification tests specified herein.

3.2 **Materials.** The cleaning compound shall be a single-phase liquid, free of abrasives, silicates (except ethyl silicate as a corrosion preventive), inorganic acids, cyanides, inert fillers, or undissolved material, and shall conform to the applicable requirements as specified herein.

3.3 **Moisture content.** The moisture content of the cleaning compound shall not exceed 3 percent by weight.

3.4 **Hydrogen ion concentration.** The pH value of a 1-percent-by-volume dispersion of cleaning compound in water shall be between 9.3 and 10.0.

3.5 **Toxicity.** The material shall contain no compounds whose degree of hazards has not been appraised nor any combination of materials which might be hazardous to health when used in accordance with the manufacturer's recommendations. The Government may run such tests as are deemed necessary, either on test samples or procured material, to verify the composition.

3.6 **Flash point.** The flash point (open cup) of the cleaning compound shall be not less than 80° F (26.7° C).

3.7 **Specific gravity.** The specific gravity of the cleaning compound at 77/77° F (25/25° C) shall be not less than 1.20.

3.8 **Pour point.** The pour point shall be no higher than —20° F (—2.9° C).

3.9 **Solubility.** The compound shall be soluble to the extent that clear solutions shall form at room temperature when 10-ml portions of the compound are added to 90 ml of dry cleaning solvent, kerosene, and mineral spirits, respectively.

3.10 **Emulsifiability.** A 4 percent by volume mixture of cleaning compound with water shall form a stable emulsion which shall show no separation or creaming for at least six hours.

3.11 **Water tolerance.** The cleaning compound shall remain clear and show no thickening when diluted with water equal to 25 percent of its volume.

3.12 **Corosion.** 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 as specified in 4.4.9.

3.13 **Carbon removal.** The cleaning compound shall show ability and rate of loosening carbon equal to or greater than that of the control formula, when tested as specified in 4.4.10.2.

3.14 "Lacquer" removal. The cleaning compound shall effect the removal of hot oil "lacquers" equal to or better than the control formula, when tested as specified in 4.4.10.3.

3.15 Effect on Heresite. The cleaning compound shall show no signs of softening, blistering, or removal of Heresite coated surfaces, when tested as specified in 4.4.10.4.

3.16 Workmanship. The component ingredients shall be intimately assembled and processed as required in accordance with the best practice for high-quality material which is stable and not subject to change with age in a sealed container.

4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified herein, the supplier is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.1.1 *Classification of tests.* The inspection and testing of cleaning compound shall be classified as follows:

(a) Qualification tests (see 4.2).

(b) Acceptance tests (see 4.3).

4.2 Qualification tests.

4.2.1 *Sampling instructions.* The Qualification test sample shall consist of 1 gallon of the cleaning compound, identified as required and forwarded to the laboratory designated in the letter of authorization from the activity responsible for qualification (see 6.3). Test samples shall be accompanied by a report of tests showing results of all tests required by this specification. (Quantitative results, when applicable, are required). The manufacturer shall furnish a certified statement specifically identifying each ingredient in the compound by a recognizable chemical or proprietary name and source. Exact percentages by weight of all ingredients affecting the toxicity of the compound must be given. The formulation shall be clearly identified by the manufacturer's formula number. The contractor shall furnish a certificate certifying that the compound is not toxic under normal conditions of usage.

4.2.2 *Tests.* Qualification Tests of cleaning compounds shall consist of all the tests of this specification as described under "Test Methods":

4.3 Acceptance inspection and tests. The acceptance inspection and tests shall consist of inspection of filled containers (see 4.3.1.2) and the following tests listed under "Test Methods":

(a)	Moisture content	(4.4.1)
(b)	Hydrogen ion concentration	(4.4.2)
(c)	Flash point	(4.4.3)
(d)	Specific gravity	(4.4.4)
(e)	Pour point	(4.4.5)
(f)	Solubility	(4.4.6)
(g)	Emulsifiability	(4.4.7)
(h)	Water tolerance	(4.4.8)
(i)	Corrosion	(4.4.9)

4.3.1 *Lot.* For purposes of sampling, a lot shall consist of all material manufactured from the same ingredients and offered for delivery at one time.

4.3.1.1 *Sampling for tests.* Two containers shall be selected at random from each inspection lot, and a specimen of sufficient amount for test purposes shall be extracted from each container. The specimens shall be placed in a clean, dry metal or glass container. Each specimen shall be subjected to all tests required by this specification. If either of the two specimens fails one or more of these tests, the inspection lot shall be rejected.

4.3.1.2 *Sampling for inspection of filled containers.* A random sample shall be selected

from each lot by the inspector in accordance with MIL-STD-105 at inspection Level I and at AQL 2.5 percent defective to verify conformance to all requirements of this specification regarding fill, closure, marking, and other requirements not involving tests.

4.3.2 *Report of tests.* The manufacturer shall submit to the inspector tests reports for each lot showing results for all Acceptance Tests specified herein.

4.3.3 *Resubmitted inspection lots.* MIL-STD-105 shall apply, except that a resubmitted inspection lot shall be inspected by the contractor under the supervision of the Government Inspector, using tightened inspection. For visual inspection, where the original acceptance number was zero, a sample size represented by the next higher sample size code letter shall be chosen. For testing, three containers shall be sampled. Before resubmitting, full particulars concerning the cause of previous rejection and the action taken to correct the defects found in the inspection lot shall be furnished by the contractor to the Government Inspector.

4.4 Test methods.

4.4.1 *Moisture content.* The moisture content of the cleaning compound shall be determined in accordance with the Distillation Method No. 202.2 of Federal Test Method STD No. 536. A 25 gram sample of cleaning compound shall be used for the determination, and the special solvent required shall be toluol conforming to Specification TT-T-548.

4.4.2 *Hydrogen ion concentration.* The hydrogen ion concentration of the specified cleaning compound dispersion shall be determined with a suitable pH meter.

4.4.3 *Flash point.* The flash point shall be determined in accordance with the requirements of Federal Test Method STD No. 791, Method 1103.5, "Flash and fire point", by means of the open-cup method (ASTM D92-52).

4.4.4 *Specific gravity.* Specific gravity of the cleaning compound shall be determined by using a suitable hydrometer.

4.4.5 *Pour point.* The pour point of the cleaning compound shall be determined in accordance with Federal Method Std. No. 791, Method 201.7, "Cloud and pour point." (ASTM D97-47).

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 100-ml graduates in consecutive order, the following shall be added: 90-ml of dry cleaning solvent, conforming with type I or II of Specification P-S-661, kerosene conforming with Specification VV-K-211, and mineral spirits conforming with Specification TT-T-291 respectively. Each cylinder shall be stoppered, shaken thoroughly, and the contents examined for conformance with the specified requirements.

4.4.7 *Emulsifiability.* Four ml of cleaning compound shall be placed into a 100-ml glass-stoppered graduated cylinder, and diluted to 100-ml by adding distilled water. The mixture shall be shaken vigorously for 30 seconds, and allowed to remain at room temperature for 6 hours. The contents shall then be examined for conformance with the specified requirements.

4.4.8 *Water tolerance.* Eighty ml of cleaning compound shall be placed in a 100-ml glass-stoppered graduated cylinder, and diluted to 100-ml by adding distilled water in 5-ml quantities, agitating between each addition. The contents shall be examined for conformance with the specified requirements after each addition and agitation.

4.4.9 *Corrosion.* Approximately 1 quart of cleaning compound shall be placed in a 1-quart Mason jar having a rubber washer and screw lid. Specimens of copper tubing conforming to Specification QQ-C-502, brass alloy conforming to Specification QQ-N-35, copper tubing conforming to Specification QQ-C-502 whose ends have been soldered conforming to Speci-

fication QQ-S-571, Comp. Sn50, polished aluminum alloy conforming to aluminum alloy No. 6951 and aluminum alloy conforming to Specification QQ-A-355, anodized in accordance with Specification MIL-A-8625, shall be suspended out of contact with each other and completely immersed in the compound and the jar sealed for 24 hours at 77° F (25° C). At the end of the specified time, the specimens shall be removed, rinsed with several portions of dry cleaning solvent conforming to Specification P-S-661, until the surfaces are free of adhering cleaning compound, and examine for any traces of corrosive attack, oxidation, or discoloration.

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 compound in strict conformance with the formula in Table I.

TABLE I. *Control formula*

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

4.4.10.2 *Carbon removal.* A used, thoroughly carbon covered tube from an approved aluminum oil cooler shall be placed in a test tube, covered with the cleaning compound under test, stoppered and then placed in a rack without shaking. Another tube from the same cooler shall be similarily treated using the control formula product. After soaking for 30 minutes, both 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 the carbon removal effect of the cleaning compound.

4.4.10.3 *"Lacquer" removal.*

4.4.10.3.1 *Preparation of test oil.* For purposes of this test, a sufficient quantity of oil in accordance with Specification MIL-L-6082, grade 1100, to perform this test shall be prepared by heating at 300° F (149° C) with constant stirring for 1,000 hours.

4.4.10.3.2 *Preparation of test panels.* Two polished copper panels measuring 3/4 inch by 4 inches by 0.025 inch shall be cleaned by boiling 1 minute in c.p. isopropanol and 1 minute c.p. benzene. Four drops (approximately 0.008 gram of oil prepared as specified above shall be evenly placed on one face of each test panel using a clean plastic spatula to distribute and uniformly spread the oil over the entire face of each panel. The panels shall then be placed horizontally for 10 minutes in a muffle furnace preheated to 600° F (316° C). 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 1¼ inch by 8-inch test tube containing 30-ml of cleaning compound under test and the second panel 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 (Fisher). 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 rmp 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 with the specified requirements.

4.4.10.4 *Effect on Heresite.* Two aluminum alloy cooler tubes evenly coated with Heresite shall be cleaned by thoroughly rinsing in acetone. Each shall be placed in a test tube, covered with the cleaning compound under test, stoppered and allowed to stand for 24 hours.

At the end of that time the tubes shall be rinsed under tap water and examined for conformance with the specified requirements.

5. PREPARATION FOR DELIVERY

5.1 **Application.** The packaging, packing and marking requirements specified in Section 5 apply only to direct purchases by or direct shipments to the government.

5.2 **Packaging.**

5.2.1 *Level A.* Unless otherwise specified, the solvent cleaning compound shall be furnished in 5-gallon or 55-gallon metal drums. The 5-gallon drum shall be fabricated of 22-gage metal and shall conform to Specification PPP-D-760 type I, class 1. The 55-gallon drum shall be the closed-top type conforming to Specification PPP-D-729, type II, and fabricated of 18-gage metal. Containers shall be new and free from contamination. If necessary before use, the unit containers shall be thoroughly cleaned of all dirt, greases, or other contaminating materials which will affect the satisfactory performance of the cleaning compound (see 6.2).

5.2.2 *Level C.* Packaging shall conform to the manufacturer's commercial practice, unless the procuring activity determines that a modification to the manufacturer's commercial practice is considered necessary to provide adequate protection.

5.3 **Packing.** Unless otherwise specified, the packaged shipping container shall be shipped without exterior packing. The packaged shipping container shall be "palletized" or shipped in an open crate as specified by the procuring agency.

5.4 **Marking.** Each drum shall be marked in accordance with Standard MIL-STD-129 and marking shall also include directions for use as listed below.

DIRECTIONS FOR USE: The oil cooler shall be cleaned in a washing machine that has a tumbling and surging action caused by pressure and vacuum. The regulators shall be so hooked up that the cleaning compound will circulate in the opposite direction to that of the flow of oil when the regulators are installed on the plane. The oil cooler shall be flushed with any standard petroleum solvent to remove residual oil and sludge. The oil cooler should not be immersed in the cleaning compound. The cooler shall then be flushed with the cleaning compound to remove the carbon deposits, engine oil, gums, lead deposits, and foreign contamination. The cooler shall then be rinsed with a standard petroleum solvent. If the oil cooler is not to be brightened, it shall be filled with a suitable preservative oil and drained prior to use or storage; otherwise, no preservative should be applied.

6. NOTES

6.1 **Intended use.** The cleaning compound covered by this specification is intended for use in cleaning oil coolers.

6.2 **Ordering data.** The material shall be purchased by volume, the unit being a US gallon at 77° F (25° C). The volume shall be determined by dividing the net weight in pounds by the weight per gallon. Requisitions, contracts, and orders should state the quantity desired, the size of the containers in which the cleaning compound is to be furnished, and the specified levels of Packaging and Packing (see Section 5). All material purchased should be used up within 1 year of date of manufacture.

6.2.1 *Qualified products list.* Products considered acceptable under this specification are listed in QPL-6864 (latest revision).

6.2.2 *Provisions for acceptance testing.* Normally, unless otherwise indicated by the bureau or technical activity concerned, contracts should state that acceptance testing to determine conformance with the specification

requirements will be the responsibility of the contractor.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the bid opening date, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date.

6.3.1 The attention of the manufacturer is called to this provision, and they are urged to arrange to have the products that they propose 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. Requests for authorization of tests should be addressed to the Director, Aeronautical Materials Laboratory, Naval Air Material Center, Philadelphia 12, Pennsylvania, the activity responsible for qualification with a copy of the Bureau of Aeronautics, Navy Department, Washington 25, D. C., and the Commander, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.

6.3.2 It is to be understood that upon receipt of the Letter of Authorization, samples shall be furnished at no cost to the Government, and that the manufacturer shall pay for the transportation charges to and from the designated point where tests are to be made. In the case of failure of the sample or samples submitted, consideration will be given to the request of the manufacturer for additional tests only after it has been clearly shown that changes have been made in the product which the Government considers sufficient to warrant additional tests.

6.3.3 It is understood that material furnished under this specification subsequent to final approval shall be of the same composition and shall be equal to the product upon which approval was originally granted. In the event that material furnished is found to deviate from the composition of the approved product or that the product fails to perform satisfactorily in service, approval of such material will be subject to immediate withdrawal.

6.4 Any questions raised regarding toxicity should be referred to the departmental medical authority.

Patent Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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