

AERONAUTICAL MATERIAL SPECIFICATION

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COMPOUND, CORROSION-PREVENTIVE Soft Film, Hot Application

1. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. TYPE: A stable, non-volatile, petroleum-base compound suitable for application by dipping at 160-170 F.
3. APPLICATION: Protection of metal parts where a soft, readily-removable film is desired and additional protective packaging is provided.
4. TECHNICAL REQUIREMENTS:
 - 4.1 Abrasiveness: Compound shall not contain abrasive substances.
 - 4.2 Toxicity: Compound shall contain no materials of known toxicity. The vapor shall not cause discomfort or injury to workmen engaged in the application of the compound.
 - 4.3 Coverage: Compound shall provide a continuous, completely protective film on metal parts under normal conditions of storage in all climates.
 - 4.4 Setting: Compound as applied to metal parts shall set to a firm, soft film in 24 hr at room temperature (77 F $\pm$ 7).
 - 4.5 Removability: Compound shall be readily removed by dipping in, or spraying with, Petroleum Solvent, AMS 3160, or by wiping with cloths saturated with the solvent.
 - 4.6 Corrosion: Compound shall not corrode polished steel, copper, magnesium, aluminum, or cadmium plate when maintained in contact with those metals for 4 hr at 210 F $\pm$ 2.
 - 4.7 Properties: Compound shall conform to the following requirements; test shall be performed in accordance with listed ASTM methods:

Property	Value	Test Method
Melting Point, deg Fahr	125-150	ASTM D127-49
Flash Point, deg Fahr, min	350	ASTM D92-46
Consistency	200-325	4.7.1

- 4.7.1 Consistency: Shall be determined in accordance with ASTM D217-48, except that the sample shall be prepared as follows: After the melting point of the compound has been determined, the consistency tests shall be made on a sample that has been heated to 25 F $\pm$ 3 above the melting point and poured at that temperature into a glass dish (100x50 mm) up to a height of 40 millimeters. The sample shall then be allowed to cool and set at a temperature of 77 F $\pm$ 7 for 24 hours.

Section 7C of the SAE Technical Board rules provides that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

- 4.8 Ash: The percentage (by weight) of ash in each different compound shall be established on the approval sample in accordance with ASTM D482-46, using a one-gram sample. If the established value is 0.15% or less, the ash for succeeding shipments shall not exceed the established value by more than 20.0% of that value; if the established value is over 0.15%, the ash for succeeding shipments shall not deviate from the established value by more than plus or minus 10.0% of that value.
- 4.9 Percentage of Non-Volatile Matter: Compound shall contain not less than 99.0% (by weight) non-volatile matter when determined as follows:
- 4.9.1 Five grams of compound shall be weighed to the nearest milligram into a tared evaporating dish and the dish and contents heated for 24 hr in an oven at 221-230 F. After heating, the dish shall be cooled to room temperature and reweighed, and the non-volatile matter calculated from the residual weight.
- 4.10 Acidity: Compound shall show no evidence of the presence of inorganic acid when tested as follows:
- 4.10.1 Twenty-five to 50 g of compound shall be introduced into a 250-ml separatory funnel followed by 100 ml of boiling distilled water. The funnel shall be shaken vigorously and after compound and water have separated, the water layer shall be drained into a 500-ml casserole. Compound in the funnel shall be washed twice by vigorously shaking with 50-ml portions of boiling distilled water. After each washing and separation, the water layer shall be drained into the casserole. One drop of 1% solution of phenolphthalein shall be added to the 200 ml of accumulated water and the water then boiled. A change in color to pink indicates the solution is alkaline. If addition of phenolphthalein causes no change in color, two drops of 0.1% solution of methyl orange shall be added. A change to red or pink in such instances indicates the presence of inorganic acid.
- 4.11 Miscibility: Compound shall be miscible in all proportions with aircraft engine lubricating oil as evinced by passing the following test:
- 4.11.1 A mixture of 95 parts by volume of aircraft engine lubricating oil and 5 parts by volume of compound shall be heated to 170 F + 5 for 15 min., examined for miscibility, cooled to room temperature, and re-examined after 24 hr for any separation.
- 4.12 Oxidation: Compound shall not cause a decrease in pressure of more than 10 psi in 100 hr when tested as follows:
- 4.12.1 Apparatus: Unless otherwise specified, the apparatus shall conform generally to Fig. 1. The equipment shall consist of a pressure-tight steel bomb and a constant-temperature bath thermostatically controlled to provide an overall temperature variation of 1F. Oil used in the bath shall be circulated in order to obtain the necessary temperature control. Glass sample dishes and bombs shall be clean; otherwise, erratic results may be obtained. This oxygen used shall be dry and of the highest purity.

4.12.2 Preparation of Disks:

4.12.2.1 Five 1-5/16 in. diameter disks shall be cut from 0.050 in. thick brass sheet having the following composition:

Copper	67.00 - 73.00
Silicon	0.07 max
Iron	0.01 max
Nickel	0.01 max
Lead	0.003 max
Zinc	remainder

4.12.2.2 Disks shall be washed in a suitable alkaline cleaner, rinsed in cold running tap water, and then immersed for 20 sec in the following etching solution:

Water	450 ml
Conc. Nitric Acid	225 ml
Conc. Sulfuric Acid	300 ml
Conc. Hydrochloric Acid	8 ml

4.12.2.3 After etching as in 4.12.2.2, disks shall be rinsed in cold running tap water and subsequently dipped in the following solution:

Water	770 ml
Sodium Dichromate	68 g
Sulfuric Acid	15 ml

4.12.2.4 Disks shall be rinsed with distilled water and dried for 30 min. in an oven maintained at 250 ± 2 F.

4.12.3 Procedure: A clean, brass disk shall be placed in the bottom of each glass dish and $20.0 \text{ g} \pm 0.1$ of compound shall be equally distributed over the disk in uniform layers having plane surfaces. The bomb shall be assembled, closed and cleared of air by introducing oxygen slowly to a pressure of 100 psi and releasing slowly two times. The oxygen pressure shall be raised to 100 psi a third time and the bomb allowed to stand over night to ensure the absence of leaks. The bomb shall then be placed in the bath and the oxygen bled off until a constant pressure of 110 psi is reached in about 2 hours. The temperature of the bath shall then be maintained at $210 \text{ F} \pm 1$ for 100 hr and the drop in pressure noted.

4.13 Stability: Compound shall remain homogeneous with age and when tested as follows:

4.13.1 A 15-g sample of compound shall be placed in a test tube, heated to 220 ± 2 F, and maintained at that temperature for 1 hour. Tube and compound shall be cooled at room temperature for 1 hr, then further cooled to $-40 \text{ F} \pm 2$ and maintained at that temperature for 1 hour. Compound, after returning to room temperature, shall be examined for homogeneity.

4.14 Film Thickness: Film thickness of applied compound shall be 0.001-0.002 in. when tested as follows:

- 4.14.1 Two, or more, 2x4x1/16 in. polished and alkaline-cleaned panels of low carbon steel sheet, AMS 5042 or equivalent, shall be weighed to the nearest milligram. Panels shall be immersed for 3 min. in compound at $167\text{ F} \pm 3$, withdrawn at the rate of 4 in. per min. and suspended vertically in an atmosphere of not more than 60% relative humidity at a temperature of $77\text{ F} \pm 7$ for 24 hours. Panels shall be weighed to determine the weight of film. Film thickness shall be calculated as follows:

$$\text{Film Thickness} = \frac{\text{Weight of Film (grams)} \times 0.062}{\text{Density (g/cc)} \times \text{Total Surface Area of Panel (sq in.)}}$$

Where: 0.062 = Factor to convert from cc to cu in.
Density = Density of Compound

- 4.15 Wetting Properties and Low Temperature Adhesion: Compound shall thoroughly wet the surface of test panels, shall form a smooth, unbroken film, and shall evince satisfactory adhesion when tested as follows:
- 4.15.1 Two 2x4x1/16 in. polished and alkaline-cleaned panels of low carbon steel sheet, AMS 5042 or equivalent, shall be immersed for 3 min. in compound at $167\text{ F} \pm 3$, withdrawn at the rate of 4 in. per min. and suspended vertically in an atmosphere of not more than 60% relative humidity at a temperature of $77\text{ F} \pm 7$ for 24 hours. Panels shall be cooled to $0\text{ F} \pm 2$ and maintained at that temperature for 1 hour. While at $0\text{ F} \pm 2$, four parallel scratches about 1/8 in. apart and 1 in. long shall be made in the compound film with a pointed knife blade and four similar scratches which intersect the first four at right angles. There shall be no flaking of the film within the area bounded by the scratches.
- 4.16 Humidity Protection: Compound shall protect metal panels from corrosion and pitting for 30 days when exposed to humid atmosphere as follows:
- 4.16.1 Test panels 2x4x1/16 in. shall be prepared. There shall be two freshly sandblasted panels and two polished and alkaline-cleaned panels of low carbon steel sheet, AMS 5042 or equivalent. All panels shall be immersed for 3 min. in compound at $167\text{ F} \pm 3$, withdrawn at the rate of 4 in. per min. and suspended vertically in an atmosphere of not more than 60% relative humidity at a temperature of $77\text{ F} \pm 7$ for 24 hours.
- 4.16.2 After the 24-hr conditioning in 4.16.1, all panels shall be suspended vertically in humid atmosphere for 30 days in accordance with ARP 362 (Humidity Cabinet). Upon completion of the exposure, panels shall be removed from the cabinet, cleaned with solvent, and examined. Visible corrosion or pitting of any surface shall be cause for rejection of the compound. If corrosion occurs, but to no greater extent than three spots no larger than 1 mm in diameter, the compound may be retested. If, on retesting, no corrosion spots occur, the compound shall be acceptable. In any case, corrosion within 1/8 in. of an edge shall be disregarded.
- 4.17 Salt Spray Protection: Compound shall protect metal panels from corrosion and pitting for 14 days when exposed to salt spray as follows: