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AEROSPACE MATERIAL SPECIFICATION

SAE AMS3090 REV. B

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Superseding AMS3090A

Lubricant, Dry Film, Heat Cured, For Fasteners Polysulfide Sealant Compatible

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

STABILIZED NOTICE

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1. SCOPE:

1.1 Form:

This specification covers a dry film lubricant in the form of lubricating solids dispersed in a resin binder and suitable solvents to produce a sprayable liquid.

1.2 Application:

This product has been used typically for lubrication of fasteners in the area of aircraft fuel tanks where contact with fuel tank sealants is likely, but usage is not limited to such applications.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2470 Anodic Treatment of Aluminum Alloys, Chromic Acid Process
AMS 2629 Fluid, Jet Reference
AMS 2825 Material Safety Data Sheets
AMS 3100 Adhesion Promoter for Polysulfide Sealing Compounds
AMS 3819 Cloths, Cleaning, for Aircraft Primary and Secondary Structural Surfaces
AMS 4041 Aluminum Alloy Sheet and Plate, Alclad, 4.4Cu - 1.5Mg - 0.60Mn (Alclad 2024 and 1-1/2% Alclad 2024-T3 Flat Sheet; 1-1/2% Alclad 2024-T351 Plate)
AMS 5515 Steel Sheet, Strip, and Plate, Corrosion Resistant, 18Cr - 8.5Ni (SAE 30302), Solution Heat Treated, High Ductility
AS1241 Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM D 1193 Reagent Water
ASTM D 2510 Adhesion of Solid Film Lubricants
ASTM D 2511 Thermal Shock Sensitivity of Solid Film Lubricants
ASTM D 2625 Endurance Life of Solid Film Lubricants (Falex)
ASTM D 2649 Corrosion Characteristics of Solid Film Lubricants

2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

VV-D-1078 Damping Fluid, Silicone Base (Dimethyl Polysiloxane)
CCC-C-419 Cloth, Duck, Cotton, Unbleached, Plied-yarns, Army and Numbered
FED STD 791 Lubricant, Liquid Fuel and Related Products, Methods of Testing
MIL-C-372 Cleaning Compound, Solvent, For Bore of Small Arms and Automatic Aircraft Weapons
MIL-L-2104 Lubricating Oil, Internal Combustion Engine, Tactical Service
MIL-L-7808 Lubricating Oil, Aircraft Turbine Engines, Synthetic Base, NATO Code Number 0-148
MIL-A-8243 Anti-icing and Deicing-Defrosting Fluid
MIL-S-8802 Sealing Compound, Temperature-resistant, Integral Fuel Tanks and Fuel Cell Cavities, High-adhesion
DOD-P-16232 Phosphate Coating, Heavy, Manganese or Zinc Base (For Ferrous Metals)
MIL-C-38736 Compound, Solvent, For Use in Integral Fuel Tanks
MIL-T-81533 Trichloroethane, 1,1,1, (Methyl Chloroform) Inhibited, Vapor Degreasing
MIL-H-83282 Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, NATO Code Number H-537
MIL-STD-290 Packaging of Petroleum and Related Products

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

Component materials used in the manufacture of this lubricant shall consist essentially of finely-powdered lubricating solids dispersed in a suitable binder. The lubricant shall contain no graphite, powdered metal, fluorocarbon solvents, or silicones.

3.1.1 The vendor of lubricant shall submit a notarized certification attesting that no graphite, powdered metal, fluorocarbon solvents, or silicones are present in the product furnished under this specification.

3.1.2 The applied film, when applied as specified in 4.5.1.2, shall cure within 60 minutes at 300 °F ± 5 (149 °C ± 3) and shall conform to the requirements of 3.2.

3.2 Properties:

The bonded solid film lubricant shall conform to the following requirements:

3.2.1 Film Appearance and Thickness:The lubricant, examined in accordance with 4.5.2, shall appear uniform in color and shall be smooth, free from cracks, scratches, pinholes, blisters, bubbles, runs, sags, foreign matter, grit, rough particles, separation of ingredients, or other surface imperfections. The thickness of the cured film shall be 0.0002 to 0.0005 inch (5 to 12.7 μm), determined in accordance with FED-STD-791, Method 3816, on panels air dried and baked at 300 °F ± 5 (149°C ± 3) for 60 minutes ± 5.

3.2.2 Film Adhesion: The lubricant, tested in accordance with ASTM D 2510, Procedure A, shall not be lifted to expose any bare metal surface. A uniform deposit of powdery material clinging to the tape shall not be objectionable.

3.2.3 Resistance to Fluids: The lubricant, after immersion in each of the fluids listed in Table 1, shall not be lifted by the tape to expose any bare metal surface; nor shall the lubricant soften, lift, blister, crack, or peel, determined in accordance with ASTM D 2510, Procedure C. A uniform deposit of powdery material clinging to the tape shall not be objectionable.

TABLE 1 - Test Fluids

Fluid	Specification
Hydraulic Fluid	MIL-H-83282
Lubricating Oil	MIL-L-2104, Grade 10
Jet Reference Fluid	AMS 2629, Type 1
Lubricating Oil	MIL-L-7808
Damping Fluid	VV-D-1078
Trichloroethane	MIL-T-81533
Anti-icing Fluid	MIL-A-8243
Cleaning Compound	MIL-C-372
Phosphate Ester Hydraulic Fluid	AS1241
Reagent Water	ASTM D 1193, Type III

3.2.4 Thermal Stability: Lubricant, tested in accordance with ASTM D 2511, shall not flake, crack, or soften. Any condensation shall be removed with clean, dry compressed air. The dried panel shall then be subjected to the film adhesion test of 3.2.2.

3.2.5 Endurance Life: The lubricant shall have an average endurance life of 250 minutes at 1000-pounds force (4448-N) load, determined in accordance with ASTM D 2625, Procedure A. Surface of the specimen shall be pretreated in accordance with DOD-P-16232 or grit blasted with No. 120 (125 μm) steel grit to 50 to 60 μm, RMS, surface texture.

3.2.6 Load-Carrying Capacity: The lubricant shall have a load-carrying capacity of at least 2500 pounds force (11,121 N), with no single test result less than 2250 pounds force (10,008 N), determined in accordance with ASTM D 2625, Procedure B, on specimens prepared as in 3.2.5.

3.2.7 Aluminum Corrosion Resistance: The lubricant on anodized aluminum panels (See 4.5.1.2) shall not show or cause discoloration, pitting, formation of white deposits, or other evidence of corrosion when subjected to heat and high humidity for not less than 500 hours, determined in accordance with ASTM D 2649.

3.2.8 Sulfurous Acid - Salt Spray Resistance: Dry steel specimens (See 4.5.1.2) coated with lubricant, exposed for four cycles to sulfurous acid- salt spray in accordance with FED-STD-791, Method 5331, shall show no resultant pitting, visible corrosion, or staining.

3.2.9 Storage Stability: The lubricant, after storage as in 4.5.3, shall conform to the requirements for endurance life (3.2.5) and sulfurous acid - salt spray resistance (3.2.8).

3.2.10 Bond Strength With Polysulfide Sealant: Adhesion failure is not acceptable between the lubricant and MIL-S-8802, Class I and Class II, polysulfide sealants, when tested as specified in 4.5.5. At 100% cohesive failure, the peel strength shall be not less than 20 pounds force/inch (3503 N/m). Bubbles, knife cuts, and other imperfections that are obviously not the fault of the sealing compound or the lubricant coating are acceptable in the 100% cohesive failure requirement. The lubricant shall not be removed from the panel. Any failure due to sealant shall invalidate the test.

3.3 Quality:

Lubricant, as received by purchaser, shall be uniform in quality and condition and free from foreign materials and from imperfections detrimental to usage of the lubricant.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the lubricant shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the lubricant conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: **Tests for film adhesion** (3.2.2), endurance life (3.2.5), load carrying capacity (3.2.6), bond strength (3.2.10, 7-day soak), and quality (3.3) are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests for all technical requirements except storage stability (3.2.9) are preproduction tests and shall be performed prior to or on the initial shipment of lubricant to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: Each lot of lubricant shall be visually examined for quality and sampled at random for the other acceptance tests; the number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.1 The sample for test shall consist of four separate quarts (liters) of lubricant.

4.3.1.2 A lot shall be all lubricant manufactured in one production run from the same batches of raw materials under the same fixed conditions and presented for vendor's inspection at one time. An inspection lot shall not exceed 500 pounds (227 kg).

4.3.1.3 When a statistical sampling plan has been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample lubricant shall be approved by purchaser before lubricant for production use is supplied, unless such approval be waived by purchaser. Results of tests on production lubricant shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production lubricant which are essentially the same as those used on the approved sample. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in ingredients and/or processing and, when requested, sample lubricant. Production lubricant made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

Shall be as follows:

4.5.1 Specimen Preparation and Test Conditions:

4.5.1.1 Test Conditions: All examinations and tests shall be performed at 77 °F ± 2 (25 °C ± 1) and at a relative humidity of 50% ± 5. Values specified in 3.2.5 and 3.2.6 apply to the average of the determinations made on the samples.

4.5.1.2 Preparation of Test Panels: Panels shall be made from AMS 4041 aluminum alloy anodized in accordance with AMS 2470, approximately 0.020 x 3 x 6 inches (0.51 x 76 x 152 mm), and AMS 5515 corrosion-resistant steel sheet, approximately 0.036 x 3 x 6 inches (0.91 x 76 x 152 mm). Prior to application of the lubricant, the panels shall be precleaned with MIL-C-38736 four-part cleaner. Application shall be performed in a well-ventilated area or hood where no flames or ignition sources are present. Only one side of each panel shall be fully coated, except that two of the anodized aluminum panels shall have the lubricant applied to a 1-inch (25-mm) wide strip to enable measurement of film thickness. A spray application technique shall be used to coat the panels for the tests specified herein. The solid film lubricant thickness, after cure, shall be 0.0002 to 0.0005 inch (5 to 12.7 μm). Not more than three coats shall be required to obtain the desired film thickness. Air dry at 77 °F ± 5 (25 °C ± 3) for not less than 10 minutes between coats. After the final coat has been applied, the coated specimens shall be allowed to air dry for not less than 30 minutes. The coated specimens shall then be placed in a circulating-air oven at 300 °F ± 5 (149 °C ± 3) for 60 minutes ± 5. The coated specimens shall be removed from the oven and allowed to cool to room temperature. At least two test panels shall be used for each test.

4.5.2 Sealant Cure: For preproduction testing, the sealing compound shall be cured for 14 days at 77°F ± 2 (25 °C ± 1) and 50% ± 5 relative humidity. For acceptance testing, the sealing compound shall be given an accelerated cure for 48 hours at 77 °F ± 2 (25 °C ± 1) and 50% ± 5 relative humidity plus 24 hours at 140 °F ± 5 (60 °C ± 3). Tests on the cured sealing compound shall commence not more than two days after completion of the specified cure.

4.5.3 Film Appearance: Test panels as in 4.5.1.2 shall be visually and microscopically examined at 12X magnification for uniformity of color, smoothness, and evidence of cracks, scratches, pinholes, blisters, bubbles, runs, sags, foreign matter, grit, rough particles, separation of ingredients, and any other surface imperfections.

4.5.4 Storage Stability: Set aside a 1-quart (1-L) preproduction sample of as-manufactured lubricant in storage at 77 °F ± 5 (25 °C + 3) for 1 year ± 7 days. At the end of the storage period, determine conformance to endurance life (3.2.5) and sulfurous acid- salt spray resistance (3.2.8).

4.5.5 Peel Strength: Panels listed in Table 2, prepared as in 4.5.1.2, shall be used for evaluation of peel strength. Prior to application of sealants to lubricants, the lubricants shall be cleaned by scrubbing and rinsing using MIL-C-38736 solvent and clean AMS 3819, Grade A, cloth which is free of sizing or any other contaminant. The panels shall be immediately wiped dry with cloth. AMS 3100 adhesion promoter shall be applied by means of clean cloth immediately after cleaning. Allow the promoter to dry at least 30 minutes. At least 5 inches (127 mm) of the panels shall be coated on one side with a 1/8 inch ± 1/64 (3.2 mm ± 0.4) thickness of sealing compound. A 2-3/4 by 12-inch (69.8 by 305-mm) strip of 20 to 40 mesh (850 to 425 μm) aluminum or monel wire fabric or CCC-C-419, Type III, cotton duck shall be impregnated with sealant so that approximately 5 inches (127 mm) at one end is completely covered on both sides. The sealant shall be worked well into the fabric. The sealant-impregnated end of the fabric shall be placed on the sealant coated panel and smoothed down on the layer of the sealant, taking care not to trap air beneath the fabric. An additional 1/32-inch (0.8-mm) thick coating of sealing compound shall be applied over the fabric. After allowing the sealant to cure in accordance with 4.5.2, the panels shall be placed in covered glass vessels and completely immersed in the fluids and under the conditions listed in Table 2. Immersion in wide-mouth quart (liter) jars with two panels in each jar is suitable. After specified exposure at 140 °F ± 2 (60 °C ± 1), the panels shall be cooled in the fluid for 24 hours at standard conditions. The peel strength shall be measured within 10 minutes after removal from the test fluid. Two 1-inch (25-mm) wide sections shall be cut through the fabric and sealing compound on each panel. The specimens shall be stripped back at an angle of 180 degrees to the metal panel in a suitable tensile testing machine having a jaw separation rate of 2 inches (51 mm) per minute. During peel strength testing, three cuts shall be made through the sealing compound to the panel in an attempt to promote adhesive failure. The cuts shall be at approximate 1-inch (25-mm) intervals. The results shall be the numerical average of the peak loads. Failure of the sealing compound to the fabric shall not be included in the peel strength values.