

AEROSPACE MATERIAL SPECIFICATION



AMS 3084B

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Superseding AMS 3084A

LUBRICANT, SOLID FILM
Minimal Outgassing

1. SCOPE:

1.1 Form:

This specification covers a solid film lubricant in the form of a ready-to-use, sprayable suspension.

1.2 Application:

This lubricant has been used typically in temperature environments ranging from -300 to +750 °F (-184 to +399 °C) and in applications requiring minimal outgassing characteristics, 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.

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on this Technical Report, please visit
<http://www.sae.org/technical/standards/AMS3084B>**

2.1 SAE Publications:

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

AMS 4029 Aluminum Alloy, Sheet and Plate, 4.5Cu - 0.85Si - 0.80Mn - 0.50Mg, (2014 -T6 Sheet, 2014 -T651 Plate), Solution and Precipitation Heat Treated

AMS 5515 Steel, Corrosion Resistant, Sheet, Strip, and Plate, 18Cr - 8.5Ni (SAE 30302), Solution Heat Treated, High Ductility

AMS 6440 Steel Bars, Forgings, and Tubing, 1.45Cr (0.98 - 1.10C) (SAE 52100), for Bearing Applications

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 2510 Adhesion of Solid Film Lubricants

ASTM D 2512 Compatibility of Materials with Liquid Oxygen (Impact Sensitivity Threshold and Pass-Fail Techniques)

ASTM D 2625 Endurance (Wear) Life and Load-Carrying Capacity of Solid Film Lubricants (Falex Pin and Vee Method)

ASTM E 595 Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall consist of molybdenum disulfide in a sodium silicate binder at spraying consistency.

3.2 Properties:

The lubricant shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified test methods:

3.2.1 Curing: The lubricant shall cure to a solid lubricant film by air-drying at 77 °F ± 5 (25 °C ± 3) for 30 to 40 minutes, heating in an oven at 180 °F ± 5 (82 °C ± 3) for 2 hours ± 0.2, further heating in an oven at 275 °F ± 5 (135 °C ± 3) for 6 hours ± 0.25, and cooling in air.

3.2.2 Film Adhesion: The lubricant film, cured as in 3.2.1, shall not be lifted from the test panel during testing in accordance with ASTM D 2510, Procedure B.

3.2.3 Thermal Stability: The lubricant film shall not flake, crack, or soften, and shall meet the requirements of 3.2.2, determined in accordance with 4.4.1.

3.2.4 Endurance Life: The lubricant film, cured as in 3.2.1 and tested in accordance with ASTM D 2625, Procedure A, shall have an average endurance life of at least 100 minutes at 1000 pounds (4448 N). The endurance life of any single run shall be not less than 80 minutes.

- 3.2.5 Vacuum Performance: The lubricant film, cured as in 3.2.1, shall have maximum average coefficient of friction of 0.14, determined at a reduced pressure of 10^{-7} to 10^{-10} Torr in accordance with 4.4.2.
- 3.2.6 Shock Sensitivity to Liquid Oxygen: The lubricant film, cured as in 3.2.1, shall show no adverse reactions to 20 test drops at 70 foot-pounds (95 Nm), determined in accordance with ASTM D 2512.
- 3.2.7 Storage Stability: The lubricant shall form a lubricant film conforming to the film adhesion (3.2.2), thermal stability (3.2.3), and endurance life (3.2.4) requirements after six-months storage and application and curing as in 4.4.3.
- 3.2.8 Vacuum Weight Loss: Shall be not greater than 1.0%, determined in accordance with ASTM E 595.
- 3.2.9 Volatile Condensable Material: Shall be not greater than 0.1%, determined in accordance with ASTM E 595.

3.3 Quality:

The lubricant, as received by purchaser, shall be homogeneous and shall show no evidence of gelation. The cured lubricant film, examined macroscopically, shall be smooth and uniform in color and shall show no evidence of foreign matter, grit, rough particles, separation of ingredients, and other imperfections detrimental to usage of the lubricant film.

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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests:

- 4.2.1 Acceptance Tests: Film adhesion (3.2.2), thermal stability (3.2.3), endurance life (3.2.4), and shock sensitivity to liquid oxygen (3.2.6) are acceptance tests and shall be performed on each lot.
- 4.2.2 Periodic Tests: Vacuum performance (3.2.5), storage stability (3.2.7), vacuum weight loss (3.2.8), and volatile condensable material (3.2.9) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient lubricant shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified, not less than three.

4.3.1.1 A lot shall be all lubricant produced in a single production run from the same batches of raw materials under the same fixed conditions, or all material subjected to the same unit chemical and physical process intended to make the final product homogeneous, and presented for vendor's inspection at one time.

4.3.2 For Periodic Tests: Shall be acceptable to purchaser.

4.4 Test Methods:

4.4.1 Thermal Stability:

4.4.1.1 Test Panels: Shall be AMS 5515 corrosion-resistant steel with a No. 2D finish, approximately 0.036 x 3 x 6 inches (0.91 x 76 x 152 mm).

4.4.1.2 Precleaning: Clean panels in a suitable solvent and abrasively blast clean with 120 mesh (125 μm) alumina (Al_2O_3). After abrasive cleaning, rinse the panels in isopropyl alcohol and dry thoroughly in a stream of dry, oil-free air.

4.4.1.3 Application of Lubricant: Spray the panels, using as many coats as required to provide a solid film thickness of 0.0002 to 0.0005 inch (5 to 12.7 μm). Cure as in 3.2.1.

4.4.1.4 Exposure: Expose the coated panels to 750 °F $\pm$ 10 (399 °C $\pm$ 6) for 3 hours $\pm$ 0.25, followed by 60 seconds $\pm$ 10 at - 300° F $\pm$ 25 (-184° C $\pm$ 14). Remove panels and allow to reach room temperature.

4.4.1.5 Adhesion Test: Determine adhesion in accordance with ASTM D 2510, Procedure B.

4.4.2 Vacuum Performance:

4.4.2.1 Test Specimens: Each set of specimens shall consist of the following:

4.4.2.1.1 One AMS 4029 aluminum alloy sheet specimen, approximately 0.22 inch (5.6 mm) thick and 3.5 inches (89 mm) square, having a countersunk 0.19-inch $\pm$ 0.01 (4.8-mm $\pm$ 0.3) diameter mounting hole through the center. Spray with the lubricant, using as many coats as required to provide a solid film thickness of 0.0002 to 0.0005 inch (5 to 12.7 μm). Cure as in 3.2.1. Burnish the film with metallographic felt.

- 4.4.2.1.2 Three AMS 6440 steel pins having hardness of 60 to 65 HRC and measuring 0.250 inch + 0.000, - 0.001 (6.35 mm + 0.00, - 0.03) in diameter by 0.75 inch $\pm$ 0.003 (19.0 mm $\pm$ 0.08) long. The pins shall have a 1/2-inch (12.7-mm) spherical radius on one end. Polish the spherical tips using metallographic techniques. Polish with 600 grit alumina and clean with a suitable solvent.
- 4.4.2.2 Friction Test Machine: Shall consist of the following:
- 4.4.2.2.1 A movable platform to carry one half of the friction pair. This platform shall be suspended from the frame by four flexible steel ribbons. A shaft shall be attached to one end of the platform and shall pass through a bellows seal in the door of the vacuum chamber to the exterior drive mechanism.
- 4.4.2.2.2 A holder for three pins which are the other half of the friction pair. This holder also supports weights which press the pins against the plate.
- 4.4.2.2.3 Two load beams for measuring the frictional force between pins and plate. Four electrical strain gages shall be bonded to the load beams and wired in a conventional Wheatstone bridge configuration, with wires passing through a seal in the vacuum chamber to amplifier and recorder equipment.
- 4.4.2.3 Procedure: Mount the plate and the pins in the friction test machine and apply a 6.0 pound $\pm$ 0.2 (2.72 kg $\pm$ 0.09) mass to press the pins against the lubricated plate. Close the vacuum chamber and evacuate to a reduced pressure of 10^{-10} torr or lower. Expose the specimen to this reduced pressure for not less than 100 hours and determine the kinetic coefficient of friction at ambient temperature, using a sliding speed of 0.025 inch $\pm$ 0.010 (0.64 mm $\pm$ 0.25) per second. Record the frictional force on a strip chart recorder. The kinetic coefficient of friction is equal to the frictional force divided by the load pressing the pins against the plate. Make a minimum of five friction measurements and determine the average coefficient of friction.
- 4.4.3 Storage Stability: Store a full, closed, 1-quart (1-L) container of the product at 77 °F $\pm$ 3 (25 °C $\pm$ 2) for six months. Agitate the closed container in an agitator-type liquid mixer. Open the container and examine for homogeneity. Apply the lubricant as in 4.4.1.3 and cure as in 3.2.1.
- 4.5 Reports:
- The vendor of the lubricant shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the lubricant conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 3084B, vendor's compound number, and quantity.