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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2525B

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Superseding AMS 2525A

Graphite Coating, Thin Lubricating Film Impingement Applied

1. SCOPE:

1.1 Form:

This specification covers a coating consisting of finely-powdered graphite in a heat-resistant inorganic binder.

1.2 Application:

This coating has been used typically on metal parts and selected nonmetallic materials requiring a coating under 0.0001 inch (2.5 µm) thick for reducing wear or minimizing galling, but usage is not limited to such applications.

1.2.1 This lubricating film may be applied to surfaces of ferrous and nonferrous metals and alloys, thermoplastic and thermosetting polymers, and rubber (O-rings, seals, etc). Aluminum, magnesium, and ferrous alloys, other than corrosion-resistant types, either coated or in contact with other parts having this coating, may be susceptible to corrosion.

1.2.2 This lubricating film has been shown to be compatible with such fluids as distilled water, MIL-H-5606 hydraulic fluid, SAE phosphate ester test fluid #1, silicone fluid, UDMG-compatible grease, IFRNA-compatible grease, solid rocket propellants, nitrogen tetroxide, and liquid oxygen.

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.

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2. APPLICABLE DOCUMENTS:

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

2.1 ASTM Publications:

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

ASTM D 1186	Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base
ASTM D 2510	Adhesion of Solid Film Lubricants
ASTM D 2714	Calibration and Operation of the Alpha Model LFW-1 Friction and Wear Testing Machine

2.2 U.S. Government Publications:

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

MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-2073-1	DOD Materiel, Procedures for Development and Application of Packaging Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Coating Material:

Shall consist of finely-powdered graphite in a heat-resistant inorganic binder. The coating, properly applied, shall form a lubricating film conforming to the requirements of 3.3.

3.2 Procedure:

3.2.1 Cleaning: Before applying the coating, surfaces of the basis material shall be thoroughly cleaned with minimum abrasion or erosion. The cleaned surfaces shall be free from oxides and from foreign materials detrimental to coating adhesion.

3.2.2 Surface Finishing: Surfaces of parts to be coated shall be honed with 120 to 400 mesh aluminum oxide powder to prepare the basis material for coating. To provide the proper surface for bearing applications, remove all residual metallic particles, whether mechanically or electrostatically held.

3.2.3 Coating: The coating material shall be applied to all specified surfaces by spraying at high velocity (impinging) under controlled conditions.

3.2.4 Curing: Curing temperature shall not exceed 310 °F (154 °C). Substrate material properties shall not be affected by the cure cycle.

3.2.5 Preservation: Unless otherwise specified by purchaser, a supplementary preservative treatment shall be applied to metallic parts after curing. The preservative treatment shall be removable by vapor degreasing.

3.3 Properties:

The coating shall conform to the following requirements:

3.3.1 Adhesion: A pressure-sensitive film-backed tape, with an adhesion of not less than 45 ounces per inch (12.5 N/25.4 mm), shall be applied to a flat surface of a coated specimen, rolled in place, and then rapidly removed in accordance with ASTM D 2510, Procedure B. The lifting of flakes or particles of the coating from the specimen exposing the basis metal is not acceptable. A uniform deposit of powdery material clinging to the tape is acceptable.

3.3.2 Thickness: Shall be not greater than 0.0001 inch (2.5 µm), determined in accordance with ASTM D 1186 or by a method acceptable to purchaser when ASTM D 1186 is not applicable.

3.3.3 Wear Rate: The time to failure shall be not less than five minutes average, determined in accordance with 4.3.4.

3.3.4 Thermal Stability: Evidence of damage to the coating shall not be visible on specimens of a corrosion-resistant steel heated to 2000 °F ± 25 (1093 °C ± 14), held at heat for five minutes ± 0.5, air cooled to room temperature, held at room temperature for 60 minutes immersed in liquid nitrogen for 60 minutes ± 5, removed, warmed to room temperature, and examined. Coating shall exhibit a uniform coating that is green to blue/black in appearance and shall not exhibit voids due to coating failure.

3.4 Quality:

Coating on parts, as received by purchaser, shall be uniform in color, smooth, adherent to basis material, and free from surface imperfections detrimental to performance of the coating. Evidence of porosity or other conditions detrimental to performance of the coating is not acceptable.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The coating vendor shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Actual parts, when required for tests, shall be supplied by purchaser. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the coating conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for adhesion (3.3.1) and quality (3.4) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests for thickness (3.3.2), wear rate (3.3.3), and thermal stability (3.3.4) are periodic tests and shall be performed at a frequency selected by the coating vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of a coated part to a purchaser, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.3.1 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 in accordance with the following; a lot shall be all parts of the same material, size, and shape, coated in a continuous series of operations in not more than eight consecutive hours, cured at the same time under the same conditions, and presented for vendor's inspection at one time.

4.3.1 For Acceptance Tests:

4.3.1.1 Adhesion: When size and/or configuration prevents testing of parts, two specimens shall be processed with each lot and tested as in 3.3.1.

4.3.1.2 Quality: Visual inspection samples shall be selected at random in accordance with MIL-STD-105, Level S-4.

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

4.3.3 Specimens: Specimens for adhesion (3.3.1), thermal stability (3.3.4), and thickness (3.3.2) shall be of the following materials:

4.3.3.1 Adhesion: Test specimens, approximately 0.20 x 1 x 4 inches (5 x 25 x 102 mm), shall be made from 3003-H14 aluminum alloy.

4.3.3.2 Thermal Stability: Test specimens, approximately 0.20 x 1 x 4 inches (5 x 25 x 102 mm), shall be made from corrosion-resistant steel.

4.3.3.3 Thickness: Test specimens, approximately 0.20 x 2 x 4 inches (5 x 51 x 102 mm), shall be made from cold-rolled low-carbon steel.

4.3.4 Wear Rate: Test shall be conducted in accordance with ASTM D 2714, Procedure A, and the following:

4.3.4.1 Test Procedure:

4.3.4.1.1 Prepare specimens in accordance with 3.2.

4.3.4.1.2 Prepare wear tester in accordance with ASTM D 2714, Procedure A.

4.3.4.1.3 Load coated specimens (ring and block) on machine.

4.3.4.1.4 Adjust counters to zero.

4.3.4.1.5 Run machine for five seconds ± 3 to ensure alignment of ring and block.

4.3.4.1.6 Place a one-pound (454 g) weight on the bale rod. Do not overload. Run machine for 60 seconds ± 5.

4.3.4.1.7 Place a second one-pound (454 g) weight on bale rod and run to failure. Test time starts at the time of the loading of the first weight. Each one pound (454 g) weight is equal to 30 pounds (13.6 kg) at ring and block due to configuration of the testing machine.

4.3.4.2 Results: The average of not less than two specimens shall meet the wear rate requirement of 3.3.3.

4.4 Approval:

4.4.1 The process and control procedures, or a preproduction sample part, or both, whichever is specified by purchaser, shall be approved by the cognizant engineering organization before production parts are supplied.

4.4.2 The supplier shall make no significant change to materials, processes, or controls from those on which the approval was based, unless the change is approved by the cognizant engineering organization. A significant change is one which, in the judgment of the cognizant engineering organization, could affect the properties or performance of the parts.

4.5 Reports:

The vendor of coated parts shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the coating conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 2525B, part number of the coated parts, and quantity.