SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2525C

Issued 1972-05
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Superseding AMS 2525B

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 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-PRF-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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
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Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

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

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. 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).

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 a suitable degreasing method.

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: Heat specimen to 2000 °F ± 25 (1093 °C ± 14) and hold at temperature for 5 minutes ±5, air cool to room temperature and hold for 60 minutes ±5, followed by immersion in liquid nitrogen for 60 minutes ±5. Remove the specimens from the liquid nitrogen and permit the specimen to return to room temperature and examine. There shall be no evidence of damage to the coating or loss of bond to the basis material. The coating shall be green to blue/black in color and shall exhibit no voids in the coating exposing the basis material.

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 processor shall supply all samples for processor's tests and shall be responsible for the performance of 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 specified requirements.

4.2 Classification of Tests:

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

4.2.2 Periodic Tests: 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: 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.

4.3 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: Shall be as shown in Table 1. Test samples shall be randomly selected from all parts in the lot.

TABLE 1 - Sampling for Acceptance

Number of Parts in Lot	Quality	Adhesion
1 to 6	All	2
7 to 15	7	2
15 to 40	10	2
41 to 110	15	3
111 to 300	25	3
301 to 500	35	4
501 to 700	50	4
Over 700	75	5

4.3.2 For Periodic Tests: Sample size and frequency of testing shall be at the discretion of the processor unless a test frequency is specified by the purchaser.

4.3.3 Sample Configuration: Nondestructive testing shall be performed whenever practical and authorized herein. Except as noted, actual parts shall be selected as samples for test.

4.3.4 Specimens: Specimens for adhesion (3.3.1), thickness (3.3.2), and thermal stability (3.3.4) shall be as follows and shall be coated in accordance with 3.2, excluding the application of the preservative coating as in 3.2.5.

4.3.4.1 Adhesion: Specimens shall be panels, approximately 0.20 x 1 x 4 inches (5 x 25 x 102 mm), and shall be fabricated from same generic class of material as the parts.

4.3.4.2 Thickness: Specimens shall be panels, approximately 0.20 x 1 x 4 inches (5 x 25 x 102 mm), fabricated from cold rolled low carbon sheet.

4.3.4.3 Thermal Stability: Specimens shall be panels, approximately 0.20 x 1 x 4 inches (5 x 25 x 102 mm), fabricated from a corrosion resistant steel.

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

4.3.5.1 Test Procedure:

4.3.5.1.1 Prepare specimens in accordance with 3.2 excluding the application of the preservative coating as in 3.2.5.

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

4.3.5.1.3 Load coated specimens (ring and block) on the wear tester, adjust counters to zero and run the tester for five seconds ±3 to ensure alignment of the ring and block..

4.3.5.1.4 Place a one-pound (454 gram) weight on the bale rod and run the tester for 60 seconds ±5.

4.3.5.1.5 Place a second one-pound (454 g) weight on the bale rod and run to failure. Total test time shall include the time accumulated in 4.3.4.1.4 and 4.3.4.1.5.

4.3.5.2 Results: The average of not less than two specimens shall meet the wear rate requirements 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 processor 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.

4.4.3 Control factors shall include, but not be limited to the following:

Cleaning procedure
Surface preparation
Type of coating material
Control of coating process
Type of preservative, if applied
Periodic test plan

4.5 Reports:

The processor 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 2525C, part number of the coated parts, and quantity.