SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2515D

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Superseding AMS 2515C

Polytetrafluoroethylene (PTFE) Resin Coating Low Build, 370 to 400 °C (698 to 752 °F) Fusion

1. SCOPE:

1.1 Purpose:

This specification establishes the engineering requirements for producing thin coatings of polytetrafluoroethylene (PTFE) resin on parts and the properties of such coatings.

1.2 Application:

Primarily to provide dry lubrication, high heat stability, and corrosion protection on parts which operate at not higher than 275 °C (527 °F) for limited periods or not higher than 245 °C (473 °F) for extended periods. This coating may also be used as a release film for molds.

1.2.1 This coating should not be specified for use on parts made of, or coated with, metals, such as cadmium, lead, tin, and zinc, having melting points below or only slightly above the fusing temperature of 3.4.

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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

2.1.1 Aerospace Material Specifications:

AMS 5045 Steel Sheet and Strip, 0.25 max Carbon, Hard Temper

2.2 ASTM Publications:

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

ASTM A 108 Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM B 117 Salt Spray (Fog) Testing

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 Military Standards:

MIL-STD-202 Test Methods for Electronic and Electrical Component Parts
MIL-STD-794 Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material:

The coating materials (primer and finish coating) shall be dispersions of polytetrafluoroethylene (PTFE) resin solids in a water medium, The primer may be either pigmented or unpigmented. The finish resin coating material shall be unpigmented unless colored material is specified by purchaser.

3.2 Preparation:

3.2.1 Cleaning: Surfaces, other than anodized aluminum or magnesium, to be coated shall be degreased, chemically cleaned or lightly abrasive blasted, cleaned to remove abrasive particles, and air dried. Anodized aluminum or magnesium surfaces need only be degreased and dried.

3.2.2 Preheating: Immediately prior to coating, metals other than aluminum, magnesium, and copper, shall be preheated to 400 °C ± 5 (752 °F ± 9) to produce a light oxide film and remove any organic contamination and air cooled. Preheating of aluminum, magnesium, and copper is not required. (See 8.2).

3.3 Coating:

3.3.1 Primer: A primer resin coat of 0.0002 to 0.0007 inch (5 to 18 µm) dry film thickness shall be applied to the prepared surfaces and fused as in 3.4.

3.3.2 Finish: The finish resin coating material shall be applied to the primed surfaces in increments not greater than 0.001 inch (25 µm) as required to yield a total dry film thickness not greater than 0.006 inch (152 µm). Each coat shall be fused as in 3.4 before application of the succeeding coat.

3.3.2.1 For best corrosion resistance, coated surfaces shall be sanded with 300 to 400 grit paper and cleaned between coats.

3.4 Fusing:

The resin coating shall be air-dried to a dry, non-glossy appearance or forced-heat dried at 65 to 95 °C (149 to 203 °F) for 5 - 10 minutes. Each intermediate coat shall be fused at 300 to 330 °C (572 to 626 °F). The final dried coating shall be fused at 370 to 400 °C (698 to 752 °F) until fusing is complete. Fusing is complete when the milk-white (for unpigmented material), air-dried film changes to a clear, fused film. Fusing time will vary depending on the mass of metal being coated. Unless otherwise permitted by purchaser, the fused coating shall be quenched in cold water, after the final fusing cycle, to provide maximum coating toughness. Adequate ventilation shall be provided in furnace areas to prevent inhalation of toxic fumes.

3.5 Repair of Damaged Areas:

Damaged areas shall be sanded to a feather edge. If basis metal is exposed, a new primer coat shall be applied. As many coats as required to build the film to its original thickness shall be applied, observing the coating thickness requirements of 3.3.2. Each coat shall be fused before application of the subsequent coat. Care shall be taken to remove any overspray of primer from the original top coat and to apply the resin coating well beyond the perimeter of the damaged area. After air drying, repaired areas shall be fused by means of an open flame. In fusing, heating to a temperature above that at which the coating changes to a clear, fused film shall be avoided; bright, glowing spots in the film are evidence of overheating and decomposition of the resin. Flame fusing shall be performed only under a hood or forced draft ventilation.

3.6 Properties:

The fused coating shall conform to the following requirements, determined on representative test panels or on parts chosen at random to represent the lot:

3.6.1 Coating Thickness: Shall be as specified on the drawing, determined by micrometer measurement, thickness gage, or other method agreed upon by purchaser and vendor.

3.6.2 Adhesion: A representative coated 0.250-inch (6.35-mm) diameter ASTM A 108 steel rod, processed with each lot of parts, shall show no evidence of chalking, blistering, or loss of adhesion, determined by cycling in accordance with MIL-STD-202, Method 102, Condition C, except that the cycling temperature range shall be -60 to +260 °C (-76 to +500 °F).

3.6.3 Coefficient of Friction: Shall be not higher than 0.1, determined on a Timken tester or equivalent at 20 to 30 °C (68 to 86 °F), a speed of 25 feet/minute ± 2 (125 mm/s ± 10), and a load of 10 pounds force ± 0.1 (45 N ± 0.4).

3.6.4 Corrosion Resistance: A representative part or test panel of AMS 5045, low-carbon steel processed to a dry film thickness of 0.003 to 0.004 inch (76 to 102 µm) shall withstand, without evidence of deterioration of the coating or corrosion of the basis metal, exposure for not less than 168 hours to salt spray corrosion test conducted in accordance with ASTM B 117.

3.6.5 Water Vapor Resistance: A panel of AMS-5045 low-carbon steel processed to a dry film thickness of 0.0045 to 0.0060 inch (114 to 152 µm) shall show no blisters in the film and no incipient rusting of the basis metal after exposure to boiling water vapor for not less than five hours. Specimens shall be placed horizontally, with coated side down, across the top of a 400-mL beaker maintained approximately half-full of gently boiling water.

3.6.5.1 By starting with the beaker somewhat more than half full, properly regulating the boiling rate, and allowing the water level to drop somewhat below the half-full point, the test of 3.6.5 can run unattended for approximately eight hours.

3.7 Quality:

Coatings on parts, as received by purchaser, shall be smooth, uniform, and free from craters, pin holes, sags, runs, bubbles, heavy edges, foreign materials, and other imperfections detrimental to performance of the coating.

3.7.1 When multiple coatings are applied, each coat shall be free from cracks after fusing, determined by examination under 40X magnification.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of coated parts 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 coated parts conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for thickness (3.6.1), adhesion (3.6.2), water vapor resistance (3.6.5), and appearance (3.7.1) are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of coated parts 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: Sufficient coated parts or specimens shall be selected 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 therein, not less than three.

4.3.1.1 A lot shall be all parts coated with the same batch of coating material processed under the same fixed conditions and presented for vendor's inspection at one time. An inspection lot shall not exceed 500 pounds (227 kg) and may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.3.1.2 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 4.5 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 coated parts shall be approved by purchaser before coated parts for production use are supplied, unless such approval be waived by purchaser. Results of tests on production coated parts shall be essentially equivalent to those on the approved samples.

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

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 coated parts conform to the other technical requirements. This report shall include the purchase order number, AMS 2515D, vendor's material designation, lot number, quantity, and identification of the resin system bake cycle used.