SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS3140 REV. B

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Superseding AMS3140A

Coating, Urethane, Aliphatic Isocyanate Polytetrafluoroethylene Filled

RATIONALE

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

STABILIZED NOTICE

This document has been declared "Stabilized" by SAE G-8, Aerospace Organic Coatings Committee, and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. SCOPE:

1.1 Type:

This specification covers a two-component, polytetrafluoroethylene-filled polyurethane coating material supplied in kit form.

1.2 Application:

Primarily for use on surfaces where a low-friction coating having exceptional abrasion, impact, and chemical resistance is required for general service within the range -55 to +120 °C (-65 to +250 °F) with intermittent exposure up to 165 °C (325 °F).

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 SAE Publications:

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

AMS 2350	Standards and Test Methods
AMS 2473	Chemical Treatment for Aluminum Alloys, General Purpose Coating
AMS 2825	Material Safety Data Sheets
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)

2.2 ASTM Publications:

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

ASTM B 117	Salt Spray (Fog) Testing
ASTM D 471	Rubber Property - Effect of Liquids
ASTM D 822	Light and Water-Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products
ASTM D 1640	Drying, Curing, or Film Formation of Organic Coatings at Room Temperature
ASTM D 2247	Testing Coated Metal Specimens at 100 Percent Relative Humidity
ASTM D 2832	Determining Non-Volatile Content of Paint and Paint Materials
ASTM D 3359	Measuring Adhesion by Tape Test
ASTM D 3389	Testing Coated Fabrics - Abrasion Resistance (Rotary Platform, Double-Head Abrader)

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094 or www.dsp.dla.mil.

QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet
TT-M-261	Methyl Ethyl Ketone, Technical
PPP-P-1892	Paint, Varnish, Lacquer, and Related Materials, Packaging, Packing, and Marking of
MIL-C-38334	Corrosion Removing Compound, Prepaint, for Aircraft Aluminum Surfaces

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall be a two-component formulation: component I being a polytetrafluoroethylene resin pigment dispersed in a pigmented or non-pigmented polyester resin and component II being a clear, aliphatic, isocyanate reactant thinner material.

3.1.1 Component I in freshly opened, full containers shall be free of lumps, skins, grit, and coarse particles and shall produce a smooth, homogeneous mixture after agitation.

3.1.2 Component II shall be clear, clean, and free of skins, particulate matter, and moisture contamination.

3.1.3 Volatile matter of component I and component II shall be non-photochemically reactive solvents only; a non-photochemically reactive solvent is any solvent with an aggregate of less than 20% of its total volume composed of the chemical compounds classified in 3.1.3.1, 3.1.3.2, and 3.1.3.3 or which does not exceed any of the individual percentage composition limitations shown therein as referred to the total volume of solvent?

3.1.3.1 A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketones having an olefinic or cycloolefinic type unsaturation: 5%.

3.1.3.2 A combination of aromatic compounds with either 8 or more carbon atoms to the molecule, except ethylbenzene: 8%.

3.1.3.3 A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene, or toluene: 20%.

3.1.4 Storage Life: The components in full, unopened containers shall meet the requirements of 3.2 after storage for any time up to one year at 20 to 30 °C (70 to 90 °F).

3.2 Properties:

The coating material shall conform to the following requirements:

3.2.1 Mixed Coating Material: The product, mixed in accordance with manufacturer's instructions, shall have the following properties:

3.2.1.1 Mass Per Unit Volume: Shall be within ±2% of the value established on the preproduction test sample as in 4.2.3 and/or 4.4.1.

3.2.1.2 Solids Content: Shall be within ±2% of the value established on the preproduction test sample as in 4.2.3 and/or 4.4.1, determined in accordance with ASTM D 2832.

3.2.1.3 Viscosity: Shall be 16 - 25 sec immediately after mixing and after standing for 4 hours ± 0.25 at 24 °C ± 3 (75 °F ± 5) after mixing, determined by #2 zahn cup at 24 °C ±1 (75 °F ± 2).

3.2.1.4 Odor: Shall not be obnoxious.

3.2.1.5 Settling: The product, after standing undisturbed for 60 min. ± 5, shall be free of curdling, precipitates, and separation which cannot easily be dispersed by shaking on a mechanical paint mixer.

3.2.2 Applied Film: The product, mixed in accordance with manufacturer's instructions, shall have the following properties, determined on test panels prepared as in 4.5.1.

3.2.2.1 Application: The product shall exhibit good working properties and acceptable leveling characteristics when spray-applied to a smooth, vertical, primed metal surface.

3.2.2.2 Color: Shall match the color specified by purchaser and as established or the preproduction test sample as in 4.4.1.

3.2.2.3 Drying Time: Shall. not exceed 30 min. for the dry-to-recoat condition, 2 hours for the set-to-touch condition, and 8 hours for the dry-hard condition, determined in accordance with ASTM D 1640.

3.2.2.4 Adhesion: Panels shall show no loss of adhesion after being tested as follows: Panels shall be immersed in distilled water at 25 °C ± 5 (77 °F ± 9) for 24 hours ± 0.25, removed from the water, and wiped-dry with a soft cloth; immediately after drying, two parallel scratches, approximately 1 in. (25 mm) apart, shall be made by a sharp stylus on the coated surface. The panels shall be tape tested in accordance with ASTM D 3359, Method A.

3.2.2.5 Flexibility: Panels, tested at 25 °C ± 3 (77 °F ± 5), shall show no evidence of flaking at the bend, determined on test panels bent over a l/4 in. (6 mm) diameter mandrel. Fine cracks are permissible.

3.2.2.6 Coefficient of Friction: Shall be not greater than 0.1, determined on a Timken Tester or equivalent at 20 to 30 °C (68 to 86 °F), at a speed of 25 fpm ± 2 (125 mm/sec ± 10), and a force of 10 lb ± 1 (45 N ± 0.5).

3.2.2.7 Corrosion Resistance: Coated panels, scribed down to basis metal, with an "X" from corner to corner, shall show no blistering, loss of adhesion, or loss of paint more than 1/8 in. (3 mm) from each side of scribe marks after exposure for 2000 hours to 5% salt spray test in accordance with ASTM B 117.

3.2.2.8 Humidity Resistance: Coated panels shall evince no blistering, lifting, or other loss: of adhesion after exposure in accordance with ASTM D 2247 for 720 hours ± 1 at 40 °C ± 3 (105 °F ± 5) to 95% ± 1 relative humidity.

3.2.2.9 Fuel Resistance: Coated panels- shall show no evidence of blistering, softening, or loss of adhesion after immersion for 7 days at 25 °C ± 5 (77 °F ± 9) in ASTM D 471, Fuel C, test fluid.

3.2.2.10 Solvent Resistance: Coated panels shall withstand, without blistering, softening, or loss of adhesion, wiping 50 times with a cloth saturated with TT-M-261 methyl ethyl ketone using moderate pressure. Slight discoloration of the cloth after wiping is permissible.

3.2.2.11 Phosphate Ester Resistance: Coated panels, scribed down to basis metal with an "X" from corner to corner, shall show no wrinkling, blistering, discoloration, cracking, or loss of adhesion after immersion in SAE phosphate ester test fluid No. 1A (See 8.1) for 30 days at 65 °C ± 5 (150 °F ± 9).

3.2.2.12 Abrasion Resistance: Coated panels shall show no evidence of bare metal after 14,000 cycles, determined in accordance with ASTM D 3389, using a CS-17 wheel and a 1000 g weight. The wheel shall be cleaned after every 250 cycles.

3.2.2.13 Impact Resistance: Coated panels shall withstand, without cracking or loss of adhesion, 60 in.-lb (7 N.m) forward and reverse impact at 25 °C ± 3 (77 °F ± 5) using a Gardner Laboratory Impact tester or equivalent.

3.2.2.14 Heat Resistance: Coated panels shall evince no blistering, wrinkling, cracking, or peeling after being heated for 72 hours ± 1 at 175 °C ± 5 (350 °F ± 10).

3.2.2.15 Weathering Resistance: Coated panels shall meet the flexibility (3.2.2.5) and impact resistance (3.2.2.13) requirements after 500 hours exposure to accelerated weathering in accordance with ASTM D 822.

3.3 Quality:

The coating, mixed and applied in accordance with manufacturer's recommendations, shall be smooth, uniform, and free from tackiness, craters, pinholes, sags, runs, bubbles, heavy edges, foreign materials, and other imperfections detrimental to performance of the coating.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of coating material shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the coating material conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for condition in containers (3.1.1 and 3.1.2), mass per unit volume (3.2.1.1), solids content (3.2.1.2), viscosity (3.2.1.3), application (3.2.2.1), color (3.2.2.2), drying time (3.2.2.3), adhesion (3.2.2.4), and quality (3.3) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for volatile matter (3.1.3), settling (3.2.1.5), flexibility (3.2.2.5), coefficient of friction (3.2.2.6), corrosion resistance (3.2.2.7), humidity resistance (3.2.2.8), fuel resistance (3.2.2.9), solvent resistance (3.2.2.10), phosphate ester resistance (3.2.2.11), abrasion resistance (3.2.2.12), impact resistance (3.2.2.13), heat resistance (3.2.2.14), and weathering resistance (3.2.2.15) are classified as periodic tests and shall be performed at a frequency selected by the manufacturer unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed on the initial shipment of the coating material 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, the contracting officer, or the request for procurement.

4.3 Sampling:

Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient coating material shall be taken at random from each lot to perform all required tests. The number of tests 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 coating material produced in one continuous manufacturing operation from the same batches of raw materials and presented for vendor's inspection at one time.

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

4.4 Approval:

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

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

4.5 Test Methods:

4.5.1 Preparation of Test Panels:

4.5.1.1 Material: Shall be aluminum alloy conforming to AMS 4041 or QQ-A-250/5, temper T3, approximately 0.020 x 3 x 6 in. (0.50 x 75 x 150 mm).

4.5.1.2 Surface Preparation:

4.5.1.2.1 Wipe surfaces of test panels with a clean cloth saturated with TT-M-261 methyl ethyl ketone.

4.5.1.2.2 Apply MIL-C-38334 corrosion removing compound, diluted 1:1 with water, using clean white cloths. Continue wiping the surfaces for 10 to 15 minutes. Before the surfaces dry, thoroughly rinse the panels with tap water under pressure. Check for "water-break-free" surfaces during the rinsing operation. If a "water-break" is noticed, repeat the solvent wipe and acid cleaning.

4.5.1.2.3 Apply a chemical conversion coating to the panels in accordance with AMS 2473. Apply the solution liberally over the panel surfaces and allow it to remain until a perceptible golden color develops. Rinse immediately with tap water before the solution dries or before a powdery coating develops.

4.5.1.2.4 Allow the treated panel surfaces to dry for 2 to 12 hours before priming.

4.5.1.3 Primer Application: Apply one coat of an epoxy amine fluid-resistant primer, as specified by the purchaser, to the treated panels to a dry-film thickness of 0.0006 to 0.0009 in. (15 to 23 m). Allow to air dry for not less than 2 hours at 25 °C ± 5 (75 °F ± 10) or force dry by air drying for not less than 3 min. at 25 °C ± 5 (75 °F + 10) followed by oven drying for not less than 10 min. at 65 °C ± 5 (150 °F + 10) prior to final coating.