SAE The Engineering Resource For Advancing Mobility®

400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 3132E

Issued 5-1-48
Revised 1-1-87

Superseding AMS 3132D

VARNISH, PHENOLIC RESIN
Corrosion-Preventive

1. SCOPE:

1.1 Type: This specification covers a colored but unpigmented varnish based on a phenolic resin.

1.2 Application: Primarily as a corrosion-preventive coating on interior parts of aircraft engines.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2825 - Material Safety Data Sheets
AMS 3170 - Thinner, Alcohol-Ester

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B117 - Salt Spray (Fog) Testing
ASTM D154 - Testing Varnishes
ASTM D445 - Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
ASTM D471 - Rubber Property - Effect of Liquids
ASTM D1640 - Drying, Curing, or Film Formation of Organic Coatings at Room Temperature
ASTM D1748 - Rust Protection by Metal Preservatives in the Humidity Cabinet

10-91

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Specifications:

PPP-P-1892 - Paint, Varnish, Lacquer and Related Materials; Packaging, Packing, and Marking of

2.4 ANSI Publications: Available from American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

ANSI B46.1 - Surface Texture

2.5 AATCC Publications: Available from American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

Color Index, Volume 3, Part 4

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

3.1.1 Varnish (by weight):

Nonvolatile	28 - 32%
Volatile	68 - 72%

3.1.1.1 Nonvolatile: Shall consist of a thermosetting phenolic resin plus sufficient blue dye, Victoria Blue B Base, Spirit Soluble, Color Index No. 729 (American Association of Textile Chemists and Colorists), to provide dye content, in the completed product, of 0.09 - 0.11% by weight, determined in accordance with 4.5.2.

3.1.1.2 Volatile: Shall consist of the alcohols and diluents used by the resin manufacturer in preparation of the basis resin solution plus AMS 3170 thinner in such proportions as will, when combined with the basis resin solution, produce a varnish meeting all requirements of this specification.

3.2 Properties: Varnish shall conform to the following requirements:

3.2.1 Product Properties:

3.2.1.1 Viscosity: Shall be 20 - 50 centipoises (0.02 - 0.05 Pa·s) at 77°F (25°C), determined in accordance with ASTM D445.

3.2.1.2 Stability: Seeding out of resin material shall not occur within 30 days of date of manufacture. Skinning and livering shall be absent in 1/4-filled closed containers at any time up to one week of standing.

3.2.2 Applied Film Properties: Shall be as specified in 3.2.2.1, 3.2.2.2, and 3.2.2.3, determined on panels prepared as in 4.5.1.

3.2.2.1 Appearance: Coating shall be a homogeneous film, free from craters, particles of hardened material, and other imperfections causing discontinuity of the coating.

3.2.2.2 Air Drying: Coating shall have a set-to-touch time not longer than 15 min. at 77°F ± 5 (25°C ± 3), determined in accordance with ASTM D1640.

3.2.2.3 Hot Oil Resistance: Films exposed to hot oil as in 4.5.3 shall be hard, tough, and free from bubbles, pin holes, and other film irregularities.

3.2.3 Cured Film Properties: Shall be as specified in 3.2.3.1 through 3.2.3.5, determined on panels prepared as in 4.5.1.

3.2.3.1 Color and Appearance: The cured film shall be green in color and sufficiently transparent that underlying metal surfaces will be clearly discernible. It shall be hard, tough, and free from bubbles, craters, pin holes, and other surface irregularities.

3.2.3.1.1 The film shall not be wrinkled or removed by immersion in hot phenol, determined in accordance with 4.5.4; discoloration or slight surface softening of the film is acceptable.

3.2.3.2 Removability: Film shall be completely removed within 10 min. by immersion in cleaning solution, determined in accordance with 4.5.5.

3.2.3.3 Adhesion: Film shall not crack, chip, or peel when a panel is bent rapidly at room temperature through an angle of 180 deg around a diameter equal to 18 times the nominal thickness of the panel, except that slight cracking on the bent portion is acceptable. Scratching with a blade or thin metal object shall produce a fine, powdered residue but any flaking or peeling is not acceptable. Sand blasting of the film shall result in the film wearing away by abrasion without chipping or peeling.

3.2.3.4 Corrosion Resistance: There shall be no more than scattered pin points of corrosion of panels except within 1/8 in. (3 mm) of any edge and within 1/16 in. (1.5 mm) of the scratches on panels tested in accordance with 4.5.6; films shall show no softening, peeling, blistering, or other evidence of poor adhesion.

3.2.3.5 Solvent Resistance: Panels shall change in weight not more than 0.2 mg per sq in. (0.031 mg/cm^2) after exposure to fuel, determined in accordance with 4.5.7.

3.3 Quality: The varnish, as received by purchaser, shall be homogeneous and free from bubbles, grit, and rough particles. It shall be free from ingredients of respiratory toxicity under normal conditions of use. When applied by brushing, spraying, or dipping, varnish shall be free-working, with leveling properties acceptable to purchaser.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of varnish shall supply all Ø samples for vendor's tests and shall be responsible for peforming 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 varnish conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for Ø composition (3.1), viscosity (3.2.1.1), air-drying (3.2.2.2), color and appearance (3.2.3.1), adhesion (3.2.3.3), and solvent resistance (3.2.3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical Ø requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of varnish to a purchaser, when a change in material, processing, or both 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, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient varnish shall be taken at random from Ø each lot to permit making the following numbers of tests; a lot shall be all varnish produced in one continuous manufacturing operation from the same lots of raw materials and presented for vendor's inspection at one time. A lot may be packaged and delivered in small quantities under the basic lot approval provided lot identification is maintained.

Property	Reference Paragraph	Number of Tests
Composition	3.1	1
Viscosity	3.2.1.1	1
Air Drying	3.2.2.2	4 (See 4.3.1.1)
Color and Appearance	3.2.3.1	4 (See 4.3.1.1)
Adhesion	3.2.3.3	2
Solvent Resistance	3.2.3.5	2

4.3.1.1 These requirements are to be determined on the panels prepared for other tests.

4.3.1.2 Ø When a statistical sampling plan and acceptance quality level (AQL) have 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 4.6 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 Varnish shall be approved by purchaser before varnish for production use is supplied, unless such approval be waived by purchaser. Results of tests on production varnish shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use the same ingredients and manufacturing procedures for production varnish as for approved sample varnish. If necessary to make any change in ingredients or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material, processing, or both and, when requested, sample varnish. Production varnish made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Ø Panel Preparation: Panels shall be of low carbon steel buffed to produce surface texture not rougher than 16 microin. (0.4 μm), determined in accordance with ANSI B46.1. Edges and corners of panels shall be rounded and smooth. Panels shall, immediately after buffing, be degreased, cleaned in water solution containing approximately 1% of trisodium phosphate and 1% of a suitable wetting agent and maintained at 180°F ± 5 (80°C ± 3), rinsed successively in cold water, in hot water, and in acetone, and dried. Unless panels are used immediately for testing, they shall be coated with a suitable corrosion-preventive compound, stored in desiccator until they are to be used, and then cleaned as before. Panels shall be completely coated, by spraying or dipping, with varnish thinned with AMS 3170 thinner to 24.5 - 25.5% nonvolatile content to produce, after air-drying and curing, a film thickness of 0.0003 - 0.0005 in. (7.5 - 12.5 μm); air-drying and curing shall be performed as follows:

4.5.1.1 Air-Drying: Films shall be air-dried at room temperature for not less than 15 min. except that films for determination of hot oil resistance shall be dried for 16 - 24 hours.

4.5.1.2 Curing: Films, air-dried as in 4.5.1.1, shall be heated either at 335°F ± 5 (170°C ± 3) for 20 - 25 min. or at 290°F ± 5 (145°C ± 3) for 50 - 60 minutes.

4.5.2 Nonvolatile Content: Shall be determined in accordance with ASTM D154 except that the sample shall be heated for not less than 1 hr at 295° - 305°F (145° - 150°C) instead of 3 hr at 220° - 230°F (105° - 110°C).

4.5.3 Hot Oil Resistance: Panels shall be immersed in unused ASTM Oil No. 1 (ASTM D471) at 350°F ± 10 (175°C ± 5) for not less than 15 minutes.

4.5.4 State of Cure: Panels or parts shall be immersed in C.P. phenol at 300°F ± 10 (150°C ± 5) for 5 min. ± 0.2.

4.5.5 Removability: Panels shall be submerged in the cleaning solution described below, maintained at 200°F + 5 (95°C + 3). A soft bristle brush may be used, if necessary, to facilitate removal. Cleaning solution shall be prepared by dissolving the following mixture in the proportions of 8 oz per gal (60 g/L) of water; commercial grades of materials may be used:

	Parts by Weight
Sodium resinate	1
Sodium metasilicate	3
Trisodium phosphate	1
Sodium carbonate	2
Sodium hydroxide	4

4.5.6 Corrosion Resistance: Films on panels shall be cross-scratched X on one face with a sharp instrument so that the underlying metal is exposed and each leg of the X is approximately 1-1/2 in. (40 mm) long. Separate panels shall then be exposed to the following:

4.5.6.1 Salt spray test in accordance with ASTM B117 for not less than 250 hours.

4.5.6.2 Cycles of 8 hr + 0.1 in atmosphere of approximately 100% relative humidity at 120°F + 5 (50°C + 3) followed by 16 hr + 0.2 in air at -65°F + 5 (-55°C + 3) for a total of not less than 168 hours. Test may be interrupted at the end of any 8- or 16-hr period of exposure. Humidity exposure shall be in accordance with ASTM D1748.

4.5.7 Solvent Resistance: Panels shall be suspended in a flask fitted with a reflux condenser and containing ASTM Reference Fuel B (ASTM D471) so as to be exposed, either continuously or intermittently, to vapors and condensate of the boiling liquid for not less than 24 hr, removed, and air dried. Weight loss shall be determined by the difference in weight of panel before and after exposure divided by the total surface area.

4.6 Reports: The vendor of varnish shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the varnish conforms to the other technical requirements of this specification. This report shall include the purchase order number, AMS 3132E, formula number, lot number, and quantity.

4.6.1 Ø A material safety data sheet conforming to AMS 2825, or equivalent, shall be supplied to each purchaser prior to, or concurrent with, the report of preproduction test results or, if preproduction testing be waived by purchaser, concurrent with the first shipment of varnish for production use. Each request for modification of varnish formulation shall be accompanied by a revised data sheet for the proposed formulation.