Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3137A
Superseding AMS 3137

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RESIN, CONFORMAL COATING, URETHANE

1. SCOPE:

1.1 Form: This specification covers a two-component system composed of a urethane resin and a hardener, supplied in kit form.

1.2 Application: Primarily for conformally coating printed-circuit-board assemblies where thin coatings, good moisture resistance, thermal-vacuum stability, mechanical damping characteristics, and elastomeric properties are required over the temperature range -55°C to +95°C (-65°F to +205°F).

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

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 3601 - Plastic Sheet, Copper Faced, Glass Fabric Reinforced Epoxy Resin

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

ASTM D150 - A-C Loss Characteristics and Dielectric Constant (Permittivity) of Solid Electrical Insulating Materials
ASTM D257 - D-C Resistance or Conductance of Insulating Materials
ASTM D618 - Conditioning Plastics and Electrical Insulating Materials for Testing
ASTM D792 - Specific Gravity and Density of Plastics by Displacement
ASTM D2240 - Rubber Property - Durometer Hardness
ASTM F74 - Determining Hydrolytic Stability of Plastic Encapsulants for Electronic Devices

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

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be a thermosetting urethane system. The product shall contain no 4,4'-methylene-bis-2-chloraniline.

3.2 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified test methods, insofar as practicable:

3.2.1 Working Life: The viscosity at 23°C ± 2 (73°F ± 4) of the product one hour after mixing shall not exceed twice the original viscosity at that temperature.

3.2.2 Storage Life: The product shall meet the requirements of 3.3 at any time up to six months from date of receipt by the purchaser when stored in the original unopened containers at temperatures not higher than 30°C (86°F).

3.3 Cured Resin: Shall have the following properties:

3.3.1 Hardness, Durometer A	40 - 80	ASTM D2240
3.3.2 Moisture Absorption, max	0.38%	4.5.1
3.3.3 Surface Adhesion	Pass	4.5.2
3.3.4 Thermal-Vacuum Stability, weight loss, max	0.55%	4.5.3
3.3.5 Volume Resistivity, min	1.0×10^{14} Ω-cm	ASTM D257
3.3.6 Dielectric Constant at 1 MHz, max	3.5	ASTM D150
3.3.7 Hydrolytic Stability at 85°C (185°F) and 95% RH	Maximum decrease in 50 days of 20% change in Durometer hardness with no evidence of exudate, tackiness, or embrittlement	ASTM F74
3.3.8 Specific Gravity	0.95 to 1.1	ASTM D792

3.4 Quality: The product shall be uniform in quality and condition, clean, homogeneous, and free from foreign materials and from imperfections detrimental to fabrication, appearance, or performance of parts.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to working life (3.2.1) and to hardness (3.3.1) and specific gravity (3.3.8) of the cured product requirements are classified as acceptance tests.

4.2.2 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests and may be the basis for approval of the compound (See 4.4.1).

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, qualification test material shall be submitted to the cognizant qualification agency as directed by the request for procurement, the procuring activity, or the contracting officer.

4.3 Sampling: Shall be as follows; a batch shall be the quantity of compound run through a mill or mixer at one time:

4.3.1 Acceptance Tests: Sufficient product shall be taken from each batch to perform the acceptance tests of 4.2.1.

4.3.2 Qualification Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

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

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

4.5 Test Methods:

4.5.1 Moisture Absorption: Three specimens, approximately 1/8 x 3 x 1 in. (3 x 75 x 25 mm) shall be placed in a desiccator over dry calcium chloride for not less than 96 hr at 23°C ± 2 (73°F ± 4). After conditioning, specimens shall be weighed, exposed to 95% ± 3 relative humidity for 240 hr ± 1, reweighed, and the moisture absorption calculated as the percent increase in weight.

4.5.2 Surface Adhesion: Five test panels shall be prepared from AMS 3601, Type I laminate having nominal copper thickness of 0.0028 in. (0.071 mm). The test panels shall be etched in accordance with AMS 3601 to develop the test pattern shown in Fig. 1 of this specification, immersed in trichlorethylene at room temperature, dried at room temperature, immersed in dilute hydrochloric acid (sp gr 1.033) for 10 sec ± 1, rinsed in distilled water, and dried with clean air or inert gas. Panels shall then be coated to 0.002 in. ± 0.001 (0.05 mm ± 0.025) coating thickness and cured in accordance with the manufacturer's recommendations. The coated specimens shall be heated in an oven controlled at 105°C ± 3 (221°F ± 5) for 30 min. ± 1, plunged into an alcohol/dry ice bath at -55°C ± 3 (-67°F ± 5), left for 10 min. ± 1, removed, and the alcohol wiped off. Cycling shall continue until the specimens fail or until 10 cycles have been completed. Specimens which show cracks, checks, blisters, or separation from the substrate in 10 cycles or less shall be considered to have failed.

4.5.3 Thermal-Vacuum Stability: Three specimens, approximately 1/8 x 3 x 1 in. (3 x 75 x 25 mm) shall be dried in accordance with ASTM D618, Condition B. The dried specimens shall be weighed and suspended for 168 hr ± 1 in an oven controlled at 85°C ± 3 (185°F ± 5) and a pressure not greater than 2 x 10^{-5} mm Hg (26.66 mPa). The specimens shall be removed from the oven, and allowed to cool to room temperature in a desiccator in accordance with ASTM D618, and weighed to determine the percent loss in weight. Specimens shall show no evidence of blistering, flowing, or charring.

4.6 Reports:

4.6.1 Ø The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the product conforms to the other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, vendor's compound number, batch number, and quantity.

4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of material, supplier's compound number, part number, and quantity. When material for coating parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.7 Ø Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 Ø Material shall be supplied in kit form with the base resin formulation and hardener in separate containers. The containers in each kit shall provide each component in the quantity required for mixing in accordance with the manufacturer's recommendations.

5.1.2 Ø Each container shall be legibly marked to show this specification number and its revision letter, component identification, manufacturer's identification, formula number, batch number, date of manufacture, quantity, directions for mixing, and precautions for storage.

5.1.3 Ø Containers shall be prepared for shipment in accordance with commercial practice to ensure carrier acceptance and safe transportation to the point of delivery and in compliance with applicable regulations pertaining to the handling, packaging, and transportation of this material. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.1.4 Ø For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1.3 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (Ø) symbol is used to indicate technical changes from the previous issue of this specification.