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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3703A

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Superseding AMS 3703

Submitted for recognition as an American National Standard

ADHESIVE, ELECTRICALLY NONCONDUCTIVE
Moderately Rapid Cure

1. SCOPE:

1.1 Form:

This specification covers an adhesive in the form of a liquid or paste.

1.2 Application:

This adhesive has been used typically for bonding electrical and electronic components to printed wiring boards to prevent vibration damage, but usage is not limited to such applications.

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.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2825 Material Safety Data Sheets
AMS 3599 Plastic Sheet, Copper Faced, Glass Fabric Reinforced Epoxy Resin, Flammability Controlled

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM D 257 D-C Resistance or Conductance of Insulating Materials
ASTM D 1002 Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal)
ASTM D 1338 Working Life of Liquid or Paste Adhesives by Consistency and Bond Strength
ASTM D 3482 Determining Electrolyte Corrosion of Copper by Adhesives

2.3 U.S. Government Publications:

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

MIL-R-39008/4 Resistor, Fixed, Composition (Insulated), Established Reliability, Style RcrO5
MIL-I-46058 Insulating Compound, Electrical (for Coating Printed Circuit Assemblies)
MIL-R-55182/7 Resistor, Fixed, Film, Established Reliability, Style Rnr50

MIL-STD-202 Test Methods for Electronic and Electrical Component Parts
MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Material:

The adhesive shall be formulated from resins, elastomers, catalysts, fillers or thixotropic agents, and other ingredients to produce a product which is nonconductive and useful over a range of -55 to +125 °C (-67 to +257 °F) and meets the requirements of 3.2.

3.2 Properties:

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

3.2.1 Shelf Life: Adhesive, stored in waterproof, sealed containers at a temperature not exceeding 30 °C (86 °F) shall meet the requirements of 3.2.2 through 3.2.9 when tested at any time up to six months from date of receipt by purchaser.

3.2.2 Working Life: Not less than one stirring cycle, determined in accordance with ASTM D 1338, Method A.

3.2.3 Tensile Shear: Shall be not less than 1500 psi (10.3 MPa) tested at 24 °C ± 3 (75 °F ± 5) and not less than 150 psi (1.03 MPa) tested at 105 °C ± 3 (221 °F ± 5), determined in accordance with ASTM D 1002 using steel panels.

3.2.4 Electrolytic Corrosion: Copper wire specimens, tested in accordance with ASTM D 3482, shall not exhibit any green corrosion product.

3.2.5 Volume Resistivity: Film specimens cast in polytetrafluoroethylene molds shall exhibit a volume resistivity of not less than 10^{10} ohm-cm, determined in accordance with ASTM D 257.

3.2.6 Hydrolytic Stability: Adhesive, tested in accordance with 4.5.1, shall show no evidence of softening, exudate, tackiness, cracking, loss of adhesion, or reversion to liquid state.

3.2.7 Temperature Resistance: Adhesive applied to test specimens prepared in accordance with 4.5.1.1 and exposed to five temperature cycles in accordance with MIL-STD-202, Method 107, Test Condition B, shall show no evidence of cracking, blistering, crazing, or loss of adhesion.

3.2.8 Compatibility: Adhesives shall be compatible with materials and components used in electronic fabricated assemblies and shall not exhibit softening, wrinkling, cracking, or loss of adhesion between the substrate, components, and overcoat when coated with an approved conformal coating and tested in accordance with 4.5.2.

3.2.9 Removal: Adhesive removed from circuit board material specimens in accordance with 4.5.3 shall not cause delamination or removal of any of the substrate material. Color change of the base material where adhesive is removed and small amounts of residual adhesive remaining on the substrate are acceptable.

3.3 Quality:

Adhesive, as received by purchaser, shall be uniform in quality, homogeneous, and free from foreign materials and from other contaminants detrimental to usage of the adhesive.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:
(R)

The manufacturer of adhesive shall supply all samples for required 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 adhesive conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for working life (3.2.2), tensile shear (3.2.3), and volume resistivity (3.2.5) 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 adhesive 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:
(R)

Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient adhesive shall be taken 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 adhesive produced from the same batches of raw
(R) materials in a single production run under the same fixed conditions and presented for manufacturer's inspection at one time.

4.3.1.2 When a statistical sampling plan has been agreed upon by purchaser and
(R) supplier, 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 supplier.

4.4 Approval:

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

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

4.5 Test Methods:

4.5.1 Hydrolytic Stability:

4.5.1.1 (R) Preparation of Specimens: Specimens shall be fabricated from AMS 3599 glass epoxy laminate, nominally 0.062 inch (1.57 mm) thick, having a nominal copper thickness of 0.0028 inch (0.071 mm) on one face. The circuit pattern shall be etched in accordance with Figure 1, using 60-40 tin-lead alloy electroplate as a resist. After pattern etch, reflow the tin-lead electroplated surface. Clean the specimen in a suitable solvent and dry. Immerse the specimens for 10 seconds in a mixture of one part by volume hydrochloric acid to four parts by volume distilled water. Rinse in flowing tap water, rinse in flowing distilled water, and dry with filtered air or inert gas. Mount one each MIL-R-55182/7 and MIL-R-39008/4 resistor on the unclad side of the specimen and solder the leads to the pads provided, using tin-lead eutectic solder and water-white rosin flux. Apply a uniform fillet of adhesive to the full length of both sides of each resistor, forming a bond between the resistor and the plastic panel. Cure the adhesive in accordance with manufacturer's instructions and scrub both faces of the specimens in isopropyl alcohol to remove residual flux and other soil. Rinse in clean isopropyl alcohol and dry in a circulating-air oven for at least one hour at 120 °C ± 2 (248 °F ± 4). Store in a clean, dry container.

4.5.1.2 Test Procedure: Prepare four specimens as described in 4.5.1.1. One specimen shall be maintained as a control at 25 °C ± 1 (77 °F ± 2) and 50% ± 4 relative humidity (RH). The three remaining panels shall be subjected to not less than 120 days at 85 °C ± 1 (185 °F ± 2) and 95% RH ± 4 and examined visually with the unaided eye corrected to 20/20 acuity according to the following schedule. After 28, 56, and 84 days of exposure, respectively, the test specimens shall be returned to room temperature and approximately 50% RH ± 4 and held for approximately two hours. The panels shall be examined in respect to the conditions referenced in 3.2.6 and the observations noted. Return the specimens to

4.5.1.2 (Continued):

the humidity chamber and complete the 120 days of exposure. Remove the specimens from the humidity chamber and condition at 25 °C ± 1 (77 °F ± 2) and 50% RH ± 4 for 7 days ± 0.1. Examine visually with the unaided eye corrected to 20/20 acuity and compare with the control specimen. Report results of observations.

4.5.2 Compatibility: Ten specimens shall be prepared in accordance with 4.5.1.1. The specimens shall be divided into five sets and each set shall be coated with one of the MIL-I-46058 conformal coatings. The coatings shall be applied and cured in accordance with manufacturer's instructions. One panel from each set shall be maintained as a control at 25 °C ± 1 (77 °F ± 2) and 50% RH ± 4. The remaining five panels shall be tested in accordance with 4.5.1.2.

4.5.3 Removal:

4.5.3.1 Specimen Preparation: Specimens shall be fabricated in accordance with 4.5.1.1. After pattern etch, clean the specimens in a suitable solvent and dry. Apply a layer of adhesive, approximately 1/16 inch (1.6 mm) thick by 1/4 inch (6.4 mm) wide covering the parallel lines of the test pattern. Cure the adhesive in accordance with manufacturer's instructions. Allow the specimens to stabilize at room temperature for at least one hour.

4.5.3.2 Test Procedure: Using a 50-watt heated, chisel head, putty remover, carefully remove the adhesive and examine the underlying surface.

4.6 Reports:

The supplier of adhesive shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the adhesive conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 3703A, manufacturer's compound number, and quantity.

4.6.1 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 adhesive for production use. Each request for modification of adhesive formulation shall be accompanied by a revised data sheet for the proposed formulation.

4.7 Resampling and Retesting:

(R)

If any specimen used in the above tests fails to meet the specified requirements, disposition of the adhesive 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 adhesive represented. Results of all tests shall be reported.