

AEROSPACE MATERIAL SPECIFICATION



AMS 3731B

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Submitted for recognition as an American National Standard

POTTING COMPOUND, EPOXY Bisphenol A-Type

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of July, 1992. It is recommended, therefore, that this specification not be specified for new designs.

This cover sheet should be attached to revision "A" of the subject specification.

"NONCURRENT" refers to those materials which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, however, does not recommend these as standard materials for future use in new designs. Each of these "NONCURRENT" specifications is available from SAE upon request.

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**AEROSPACE
MATERIAL
SPECIFICATION**

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AMS 3731A

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POTTING COMPOUND, EPOXY
Bisphenol A-Type

1. SCOPE:

- 1.1 Form: This specification and its supplementary detail specifications cover epoxy resin formulations based on diglycidyl ether of bisphenol A with an epoxide equivalent of 175 - 195. When properly mixed and cured, these resins produce a rigid or flexible product.
- 1.2 Application: Primarily for cast shapes; for encapsulation of electronic parts, transformers, coils, and conductors; and for sealing.
- 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.
- 1.4 Classification: The resin system shall be classified by application and processing criteria as shown in each detail specification.
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.

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2.1.1 Aerospace Material Specification:

- AMS 2350 - Standards and Test Methods
- AMS 2825 - Material Safety Data Sheets
- AMS 3751 - Microspheres, Hollow Glass

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

- ASTM D149 - Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
- ASTM D150 - A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials
- ASTM D256 - Impact Resistance of Plastics and Electrical Insulating Materials
- ASTM D257 - D-C Resistance or Conductance of Insulating Materials
- ASTM D570 - Water Absorption of Plastics
- ASTM D635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
- ASTM D648 - Deflection Temperature of Plastics Under Flexural Load
- ASTM D695 - Compressive Properties of Rigid Plastics
- ASTM D696 - Coefficient of Linear Thermal Expansion of Plastics
- ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- ASTM D792 - Specific Gravity and Density of Plastics by Displacement
- ASTM D1002 - Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal)
- ASTM D1674 - Testing Polymerizable Embedding Compounds Used for Electrical Insulation
- ASTM D1824 - Apparent Viscosity of Plastics and Organosols at Low Shear Rates by Brookfield Viscometer
- ASTM D2240 - Rubber Property - Durometer Hardness

2.3 U.S. 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 Detail Specifications: The requirements for a specific compound shall consist of all requirements specified herein in addition to requirements specified in the applicable detail specification. In case of conflict between requirements of this basic specification and an applicable detail specification, requirements of the detail specification shall govern.

3.2 Material: Shall be on an epoxy-based polymer with a curing agent. Each may contain fillers or other ingredients necessary to yield compounds meeting the requirements of 3.3.

- 3.2.1 Storage Life: The resin base and hardener shall meet the requirements of 3.3 at any time up to one year from date of receipt by purchaser when stored below 38°C (100°F) in the original unopened containers.
- 3.3 Cured Properties: The components, mixed and cured in accordance with manufacturer's instructions, cast into appropriate shapes as required for testing, and cured as recommended by the manufacturer, shall produce products which conform to the following requirements and those of the detail specification; tests shall be performed at 20°C - 30°C (70° - 85°F) in accordance with test methods specified in 4.5.
- 3.3.1 Dielectric Strength, step by step, min 300 V per mil (11,800 V/mm)
- 3.3.2 Hydrolytic Stability
- 3.3.2.1 Hardness After Conditioning Not more than 10% reduction in number of points from original value
- 3.4 Quality: Compound, as received by purchaser, shall be uniform in quality and condition, and free from foreign materials detrimental to usage of the compound.
- 4 QUALITY ASSURANCE PROVISIONS:
- 4.1 Responsibility for Inspection: The vendor of the compound shall supply all samples for vendor's tests 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 sample and to perform any confirmatory testing deemed necessary to ensure that the compound conforms to the requirements of this specification.
- 4.2 Classification of Tests:
- 4.2.1 Acceptance Tests: Tests to determine conformance to requirements for flexural strength and hardness where applicable, mixed viscosity, heat deflection temperature, and quality (3.4) are classified as acceptance tests and shall be performed on each lot.
- 4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of a compound 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, contracting officer, or request for procurement.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Each lot shall be sampled at random to provide sufficient compound 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 compound produced in a continuous production run from the same batches of raw materials under the same fixed conditions and presented for vendor's inspection at one time. A lot shall not exceed 6000 lb (2700 Kg) of compound and may be packaged in smaller quantities and delivered under the basic lot approval provided the lot identification is maintained.

4.3.1.2 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 4.6.1 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor. The sample size is normally not less than one gallon (4 L).

4.4 Approval:

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

4.4.2 Vendor shall use ingredients, manufacturing procedures and processes, and methods of inspection on production compound which are essentially the same as those used on the approved sample compound. 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, processing, or both and, when requested, sample compound. Production compound made by the revised procedure shall not be shipped prior to receipt-of reapproval.

4.5 Test Methods: Shall be in accordance with the following:

Requirement	Test Method
Flexural Strength	ASTM D790
Izod Impact Strength	ASTM D256
Compressive Strength	ASTM D695
Insulation Resistance	ASTM D257
Dielectric Strength	ASTM D149
Dielectric Constant	ASTM D149
Dissipation Factor	ASTM D150
Heat Deflection Temperature	ASTM D648
Coefficient of Linear Expansion	ASTM D696
Water Absorption	ASTM D570
Specific Gravity	ASTM D792
Thermal Shock Resistance	ASTM D1674
Hardness	ASTM D2240
Flammability	ASTM D635
Hydrolytic Stability	4.5.1
Bond Strength to Aluminum	4.5.2
Peak Exotherm Temperature	4.5.3
Viscosity	4.5.4

- 4.5.1 Hydrolytic Stability: Hardness shall be determined in accordance with ASTM D2240 and insulation resistance in accordance with ASTM D257 on specimens as cured and after aging at $71^{\circ}\text{C} \pm 2$ ($160^{\circ}\text{F} \pm 4$) and $95\% \pm 5$ relative humidity. The aged specimens shall be cooled to, and held-at, $23^{\circ}\text{C} \pm 2$ ($73^{\circ}\text{F} \pm 4$) and $50\% \pm 5$ relative humidity for $2 \text{ hr} \pm 0.25$ prior to being tested. The specimens shall be tested for instantaneous hardness, using a Type D Durometer on rigid or semirigid products and a Type A Durometer on flexible products, and for insulation resistance after 0, 28, 56, 84, and 120 days. The specimens for insulation resistance shall be approximately 4 in. (100 mm) in diameter and 1/8 in. (3 mm) thick. The specimens for hardness testing shall be approximately 2 in. (50 mm) in diameter by 1/4 in. (6 mm) thick.
- 4.5.2 Bond Strength to Aluminum: Shall be determined in accordance with ASTM D1002. No primer shall be used for this test. Tests shall be run on grit blasted aluminum specimens with a nominal 1/2 in. (12 mm) overlap. Grit size shall be 100 - 200 mesh (150 - 75 μm).
- 4.5.3 Peak Exotherm Temperature: A 100 mL paper cup shall be filled with the mixed resin and hardener. A thermocouple shall be inserted at the geometric center of the mass and connected to a recorder. The highest temperature recorded shall be the peak exotherm temperature.
- 4.5.4 Viscosity: Shall be determined in accordance with ASTM D1824 with the following exceptions: the sample quantity shall be taken from a container of compound in a homogeneous state. The samples shall be brought to the test temperature and shall be stirred to fully disperse filler and to combine all ingredients immediately before being tested. The spindle shall be at the test temperature when the test is started. The viscosity reading shall be taken during the 10th revolution of the spindle.