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400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 3692A

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Superseding AMS 3692

ADHESIVE COMPOUND, EPOXY
High Temperature Application

1. SCOPE:

1.1 Form: This specification covers a two-component compound, an epoxy resin base and a hardener in the form of a paste.

1.2 Application: Primarily for non-structural bonding of metallic alloys and thermosetting plastics to themselves and to each other. It is primarily intended as an adhesive for electrical components and devices operating at not higher than 260°C (500°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 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 5044 - Steel Sheet and Strip, 0.15 max Carbon, Half Hard Temper

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

ASTM D471 - Rubber Property - Effect of Liquids
ASTM D1002 - Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal)

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 Material: Shall consist of two components; an epoxy resin base and a hardener. Fillers and modifiers may be included in either component.

3.1.1 Curing: When mixed and cured at room temperature in accordance with manufacturer's recommendations, formulation shall polymerize to a uniform adhesive. The adhesive shall require less than 10 psi (70 kPa) pressure on the bond surface to achieve bond strength conforming to the requirements of this specification.

3.1.2 Shelf Life: Resin base and hardener, stored in unopened containers at not higher than 32°C (90°F) for up to one year, shall meet the requirements of 3.2 after being mixed and cured as in 3.1.1. Ø

3.1.3 Pot Life: Adhesive in 100-g batches, mixed in accordance with manufacturer's recommendations, shall have a useful pot life of not less than 40 min. when maintained at not higher than 24°C (75°F). Ø

3.2 Properties: The product, when cured to obtain maximum properties in accordance with manufacturer's recommendations, shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified methods, insofar as practicable. Reported values shall be the average of five or more specimens.

3.2.1 Tensile Shear at 24°C ± 1 (75°F ± 2), min:		4.5.1
3.2.1.1 As Cured	2000 psi (14 MPa)	
3.2.1.2 After thermal cycling	2000 psi (14 MPa)	4.5.2
3.2.1.3 After thermal aging	1000 psi (7.0 MPa)	4.5.3
3.2.2 Tensile Shear at Temperature Extremes, min:		4.5.1
3.2.2.1 At -55°C ± 1 (-65°F ± 2)	1500 psi (10.5 MPa)	
3.2.2.2 At 260°C ± 3 (500°F ± 5)	1000 psi (7.0 MPa)	
3.2.2.3 At 260°C ± 3 (500°F ± 5) after thermal aging	1000 psi (7.0 MPa)	4.5.3

3.2.3 Fluid Resistance: The adhesive, subjected to ASTM D471, Service Fluid No. 1, Oil No. 3, and Reference Fuel B, shall not show a weight change greater than 2.0%, determined in accordance with 4.5.4.

3.2.4 Corrosion: The product shall not have a corrosive effect on adherent surfaces when exposed to conditions normally encountered in service, determined by a procedure agreed upon by purchaser and vendor. Discoloration of metals shall not be considered objectionable.

3.3 Quality: The product, as received by purchaser, shall be uniform in quality and condition, clean, and free from foreign materials and from imperfections detrimental to usage of the product.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product 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 product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for tensile shear as cured 24 hr at 24°C ± 1 (75°F ± 2) (3.2.1.1) and quality (3.3) 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 the product 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 product 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 five.

4.3.1.1 A lot shall be all adhesive produced in a single production run from the same batches of raw materials and presented for vendor's inspection at one time. An inspection lot shall not exceed 500 lb (225 kg) and may be packaged and delivered in smaller quantities under the basic lot approval provided lot identification is maintained.

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) have Ø 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.

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 Vendor shall use ingredients, manufacturing procedures, processes, and Ø methods of inspection on production adhesive which are essentially the same as those used on the approved sample adhesive. 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 adhesive. Production adhesive made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Tensile Shear: Shall be determined in accordance with ASTM D1002 with the following modifications. Individual test pieces shall be made of AMS 5044 steel, or equivalent, nominally 1/8 x 1 x 5 in. (3 x 25 x 125 mm) in size. Tensile holding fixture shall allow sufficient offset to account for the metal thickness, and through-pin holding arrangement shall be allowable when 1/8 in. (3 mm) thick test pieces are used. The test piece width shall be 1 in. ± 0.1 (25 mm ± 0.2) and the overlap area 0.5 sq in. (320 mm^2). Bonding fixtures used shall give identical pressure on the adhesive joint from batch to batch. Bonding surface shall be freshly sandblasted to obtain a uniformly roughened surface and shall be thoroughly washed with a suitable solvent.

4.5.2 Thermal Cycling: Samples shall be subjected to 10 thermal cycles in air as follows and tested at room temperature. One cycle shall consist of 30 min. + 5 at -55°C + 1 (-65°F + 2), 30 min. + 5 at 24°C + 1 (75°F ± 2), 30 min. ∓ 5 at 100°C ∓ 1 (212°F ∓ 2), and 30 min. + 5 at 24°C + 1 (75°F + 2). The cycle may be extended during any 24°C (75°F) conditioning period.

4.5.3 Thermal Aging: Samples shall be maintained at 260°C + 3 (500°F + 5) in a circulating-air oven for 200 hr ± 12, removed from the oven, and allowed to stabilize at test temperature for not less than 2 hr before testing.

4.5.4 Fluid Resistance: Seventeen samples shall be prepared by dip, spray, or brush coating both sides and all edges of one half of a tared standard glass microscope slide with a uniform, bubble-free film of adhesive 0.005 - 0.020 in. (0.12 - 0.50 mm) thick. Thin sections on corners are acceptable. Samples shall be cured according to manufacturer's recommendations, weighed to ±0.0001 g, and the adhesive film weight calculated. Five samples shall be subjected to each test fluid for 96 hr ± 1 at 100°C ± 1 (212°F ± 2). Two samples shall be aged for 96 hr ± 1 at 100°C ± 1 (212°F ± 2) in a circulating-air oven. Thermal aged samples shall be cooled, allowed to stabilize at 24°C ± 1 (75°F ± 2) in a desiccator, and weighed. Samples subjected to volatile solvents shall be cooled to 24°C ± 1 (75°F ± 2) in the solvent, removed from the solvent, wiped dry, and weighed immediately. Samples subjected to non-volatile fluids shall be cooled to 24°C ± 1 (75°F ± 2), washed free of excess material with a suitable solvent, allowed to stabilize to constant weight, and weighed immediately. The initial and final average weights of samples exposed to each fluid and to hot air shall be determined and the difference expressed as percent weight change. Results shall be recorded as the difference between the percent weight change of the air aged samples and the fluid aged samples.

4.6 Reports:

4.6.1 Ø The vendor 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 of this specification. This report shall include the purchase order number, AMS 3692A, vendor's material designation, lot number, and quantity.

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

4.6.2 Ø The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 3692A, contractor or other direct supplier of adhesive, supplier's material designation, part number, and quantity. When adhesive for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of adhesive to determine conformance to the requirements of this specification and shall include in the report either a statement that the adhesive conforms or copies of laboratory reports showing the results of tests to determine conformance.