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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3690B

Issued JAN 1960
Revised JAN 1993
Reaffirmed DEC 2000

Superseding AMS 3690A

Adhesive Compound, Epoxy Room Temperature Curing

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:

This adhesive compound has been used typically for non-structural bonding of metallic alloys and thermosetting plastics to themselves and to each other; it is intended primarily as an adhesive for electrical components operating at not higher than 85 °C (185 °F), 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 documents shall be the issue in effect on the date of the purchase order.

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.1 SAE Publications:

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

AMS 2825 Material Safety Data Sheets
AMS 5044 Steel Sheet and Strip, 0.15 Carbon, Maximum, Half Hard Temper

2.2 ASTM Publications:

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

ASTM D 471 Rubber Property - Effect of Liquids
ASTM D 1002 Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal)

2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging Requirements

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 exhibiting 90% of its ultimate strength within 24 hours. It shall reach its ultimate adhesive strength when cured at 24 °C ± 3 (75 °F ± 5) for not more than seven days or at 65 °C ± 3 (149 °F ± 5) for not more than four hours.

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.

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

3.2 Properties:

The product, cured in accordance with manufacturer's recommendations, shall conform to the requirements shown in Table 1, 3.2.3, and 3.2.4; 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.

TABLE 1 - Properties

Paragraph	Property	Requirement	Test Method
3.2.1	Tensile Shear at 24 °C ± 1 (75 °F ± 2), minimum		4.5.1
3.2.1.1	Cured 24 hours ± 0.5	1800 psi (12.4 MPa)	
3.2.1.2	Ultimate cure	2000 psi (13.8 MPa)	
3.2.1.3	After thermal cycling	1500 psi (10.3 MPa)	4.5.2
3.2.1.4	After thermal aging	1800 psi (12.4 MPa)	4.5.3
3.2.2	Tensile Shear at Temperature Extremes, minimum		4.5.1 1 hour ± 0.5
3.2.2.1	At -55 °C ± 1 (-67 °F ± 2)	1500 psi (10.3 MPa)	
3.2.2.2	At 85 °C ± 3 (185 °F ± 5)	1800 psi (12.4 MPa)	

3.2.3 Fluid Resistance: The adhesive, tested in accordance with ASTM D 471 using 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 adherend 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, 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. 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 for tensile shear cured 24 hours at 24 °C ± 1 (75 °F ± 2) (3.2.1.1) and quality (3.3) are acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests for all technical requirements, except shelf life (3.1.2), are preproduction tests and shall be performed prior to or on the initial shipment of the product 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:

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 pounds (227 kg).

4.3.1.2 When a statistical sampling plan has 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 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 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 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 Tensile Shear: Shall be determined in accordance with ASTM D 1002 with the following modifications. Individual test pieces shall be made of AMS 5044 steel, or equivalent, nominally 1/8 x 1 x 5 inches (3.2 x 25 x 127 mm). Tensile holding fixture shall allow sufficient offset to account for the metal thickness, and through-pin holding arrangement shall be allowable when 1/8 inch (3.2 mm) thick test pieces are used. The test piece width shall be 1 inch ± 0.1 (25 mm ± 3) and the overlap area approximately 0.5 square inch (323 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 minutes ± 5 at -55 °C ± 1 (-67 °F ± 2), 30 minutes ± 5 at 24 °C ± 1 (75 °F ± 2), 30 minutes ± 5 at 70 °C ± 1 (158 °F ± 2), and 30 minutes ± 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 85 °C ± 1 (185 °F ± 2) in a circulating-air oven for 200 hours ± 12, removed from the oven, and allowed to stabilize at test temperature for not less than two hours 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 to 0.020 inch (0.13 to 0.51 mm) thick. Thin sections on corners are acceptable. Samples shall be cured according to manufacturer's recommendations, weighed to ±0.0001 gram, and the adhesive film weight calculated. Five samples shall be subjected to each test fluid for 96 hours ± 1 at 100 °C ± 1 (212 °F ± 2). Two samples shall be aged for 96 hours ± 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 Ref. Fuel B shall be cooled to 24 °C ± 1 (75 °F ± 2) in the fuel, removed from the fuel, wiped dry, and weighed immediately. Samples subjected to Service Fluid No. 1 and Oil No. 3 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.