

AERONAUTICAL MATERIAL SPECIFICATIONS

AMS 3691

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Revised

ADHESIVE COMPOUND, EPOXY Medium Temperature Application

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. FORM: The adhesive shall contain an epoxy resin as the basic ingredient. It shall consist of two components: an epoxy resin base and a hardener. Fillers and modifiers may be included in either component.
3. APPLICATION: An adhesive for non-structural bonding of aluminum, corrosion resistant steel, brass, and many thermosetting plastics to themselves and to each other. It is primarily intended as an adhesive for electrical components in devices operating at temperatures not higher than 250 F.
4. TECHNICAL REQUIREMENTS:
 - 4.1 General:
 - 4.1.1 Curing: When mixed and cured in accordance with manufacturer's recommendations at not higher than 200 F, formulation shall polymerize to a uniform material. The material shall require less than 10 psi pressure on the bond surface during cure to achieve optimum strength. It shall reach its ultimate strength in not more than 4 hr at recommended cure temperature.
 - 4.1.2 Pot Life: Material in 100 g batches, when mixed in accordance with manufacturer's recommendations, shall have a useful pot life of not less than 4 hr when maintained at not higher than 75 F.
 - 4.1.3 Corrosion: The product shall not have a corrosive effect on other materials when exposed to conditions normally encountered in service. Discoloration of metal shall not be considered objectionable.
 - 4.2 Properties: The product, when cured to obtain maximum properties, shall conform to the following requirements; tests shall be performed in accordance with listed ASTM methods or as noted. Test specimens may be furnished by the vendor or fabricated by the user. The results shall be taken as the average value of not less than 5 samples, except as otherwise specified.
 - 4.2.1 Adhesive Strength: The material shall exhibit a minimum average tensile shear value of 2,000 psi when tested in accordance with Note 1 and under each of the following conditions:

SECTION 10 OF THE SAE TECHNICAL BOARD'S RULES PROVIDES THAT: ALL TECHNICAL REPORTS... use by anyone engaged in industry or trade is entirely voluntary. There is no... to conform to or be guided by any technical report. In formulating and approving... patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents.

Treatment	Conditioning		Test Temperature
	Time	Temperature	
As cured	1/2 hr min	75 F + 2	75 F + 2
As cured	1/2 hr min	-65 F ± 2	-65 F ± 2
As cured	1/2 hr min	250 F ± 5	250 F ± 5
Thermal Cycling	10 cycles	See Note 2	75 F ± 2
Thermal Aging	200 hr	See Note 3	75 F + 2
Thermal Aging	200 hr	See Note 3	250 F ± 5
Water Immersion	200 hr	See Note 4	75 F ± 2

Note 1. Tests shall be conducted in accordance with ASTM D1002-53T with the following modifications. Individual test pieces 1 x 5 x 1/8 in. may be used in sample preparation. The metal shall be AMS 5044 or equivalent steel. The 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. thick test pieces are used. The test piece width shall be 1 in. and the overlap area 0.5 sq inch. 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.

Note 2. Samples shall be subjected to 10 thermal cycles in air as described below and then tested at room temperature. Time at the temperature extremes shall be regulated to + 5 minutes. One cycle shall consist of 1/2 hr at -65 F ± 2, 1/2 hr at 75 F + 2, 1/2 hr at 212 F + 2, and 1/2 hr at 75 F ± 2. The cycle may be extended during any 75F conditioning period.

Note 3. Samples shall be maintained at 250 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.

Note 4. Samples shall be maintained at 212 F ± 2 in a temperature controlled, circulating distilled water bath for 200 hr ± 12, removed from the bath, wiped dry, and allowed to stabilize at room temperature for not less than 2 hr before testing at room temperature.

4.2.2 Fluid Resistance: The material shall be subjected to di-2-ethylhexyl sebacate +0.5% phenothiazine, ASTM Oil No. 3, and ASTM Reference Fuel B.

Weight change, %, max	2.0	Note 5
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Note 5. 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. thick. Thin sections on corners shall be acceptable. Samples shall be cured according to manufacturer's recommendations, weighed accurately to ± 0.0001 g, and the adhesive film weight calculated. Five samples shall be subjected to each test fluid for 96 hr at 212 F ± 2. Two samples shall be aged for 96 hr at 212 F + 2 in a circulating air oven. Thermal aged samples shall be cooled, allowed to stabilize at 75 F in a desiccator, and weighed. Samples subjected to volatile solvents shall be cooled to 75 F in the solvent, removed from the solvent, wiped dry, and weighed immediately. Samples subjected to non-volatile fluids shall be cooled to 75 F, washed free of excess material with a suitable solvent, allowed to stabilize to a constant weight, and weighed immediately. The initial and final average weight 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.