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INTERNATIONAL
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-S-83474

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Submitted for recognition as an American National Standard

Shims, Molded, Filled Resin Compound and Sheet Prepreg

NOTICE

This document has been taken directly from U.S. Military Specification MIL-S-83474, and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-S-83474. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this technical report.

1. SCOPE:

1.1 Scope:

This specification covers the requirements for filled, resinous thermosetting compound and sheet prepreg to fabricate shims for use during assembly of aircraft components and parts.

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1.2 Classification:

The material shall be classified in the three types as specified:

Type I - A two component material (base and accelerator) which, after mixing and application of heat (350°F), will cure to a hard, strong resin.

Type II - A precatalyzed (B-staged) sheet material which will cure to a hard, strong resin with the application of heat.

Type III - A precatalyzed (B-staged) material supplied frozen in a tube from which it can be extruded and cured to a hard strong resin with the application of heat (200°F).

2. APPLICABLE DOCUMENTS:

The following publications, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 U.S. Government Publications:

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

MIL-Y-1140	Yarn, Cord, Sleeving, Cloth and Tape Glass
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-S-8949	Steel Bars, Plates, Sheets, Billets, and Reforging Stock Type D6AC
MIL-T-81533	Trichloroethane 1,1,1 (Methyl Chloroform Inhibited, Vapor Degreasing
MIL-A-83377	Adhesive Bonding for Aerospace Systems, Guidelines for
O-S-809	Sulfuric Acid, Technical
O-S-595	Sodium Dichromate, Dihydrate, Technical
TT-M-261	Methyl Ethyl Ketone Technical
MMM-A-132	Adhesive, Heat Resistant, Airframe Structural, Metal to Metal
QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet
QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet
FED-STD-151	Metal; Test Methods
FED-STD-406	Plastics, Methods of Testing

3. REQUIREMENTS:

3.1 Qualification:

The materials furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.2 and 6.2).

3.2 Type I:

Type I material shall meet all of the requirements specified in Table I when cured for 60-70 minutes at 180°-190°F plus 60-70 minutes at 350°-360°F or cured to the manufacturers recommended step cure cycle.

3.3 Types II & III:

Types II & III materials shall meet all of the requirements specified in Table I when cured for 120-130 minutes at 200-210°F or to the manufacturers recommended cure cycle.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspections requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

4.2 Quality conformance inspection:

4.2.1 Acceptance tests:

(a) Lap shear strength at room temperature and 350°F for Type I and room temperature and 270°F for Types II and III. Metal shall be 2024-T81 clad.
(b) Ultimate compression strength at room temperature and at 350°F for Type I and at room temperature and 270°F for Types II & III.
(c) Density

4.2.2 Tests and test specimens shall be in accordance with this specification. Results shall meet the applicable requirement of Table I. Three test specimens shall be used for each property requirement specified in Table I for each type of material except that the sheer strength specimens shall be in accordance with Figure 1 and 4.5.2.4. Specimens of each type shall be tested for each shipment of each batch if a shipment consists of more than 1 batch. Data from test shall be forwarded with the shipment.

4.2.3 Retests shall automatically be accomplished in the event of a test failure. Failure of the retest shall result in rejection of the represented material.

4.2.4 Verification of any test in Table I may be conducted at the option of the Purchaser on any material received on production orders. Failure of the compound to meet test requirements shall result in rejection of the lot and necessary action to correct the discrepancy.

4.3 Cleaning of Adherends:

4.3.1 Aluminum (except where use of release agent is specified - no cleaning required in that case).

4.3.1.1 Remove all surface dyes and other foreign material by solvent wiping with methyl-ethyl-ketone conforming to Federal Specification TT-M-261.

4.3.1.2 Vapor degrease parts with 1,1,1 Trichloroethane, inhibited conforming to Specification MIL-T-81533. The parts shall be suspended in vapor until condensation ceases.

4.3.1.3 The parts shall be immersed 9 to 15 minutes in a solution of the following composition which is maintained at temperature of 145-160°F. (Solution composition shall be maintained within ±10%).

Water (tap)	30 parts by weight
Sulphuric Acid (66° Be) Fed. Spec. O-S-595	10 parts by weight
Sodium DIchromate Fed. Spec. O-S-595	4 parts by weight

4.3.1.4 Rinse the parts in clean tap water at room temperature for a minimum of 2 minutes, followed by a spray rinse for a minimum of two minutes in clean distilled or demineralized water at room temperature. If an air supply is used for spray rinsing, the air shall be filtered.

4.3.1.5 The panels shall be observed to make sure they hold a continuous film of water on the areas to be bonded. They shall be recleaned if the water film is not continuous.

4.3.1.6 The parts shall be dried in circulating air at 150°F or below.

4.3.1.7 Specimens shall be assembled and bonded within 72 hours of the completion of the cleaning process. Cleaned metal shall be protected from contamination during that time.

4.4 Curing of specimens:

4.4.1 Specimens shall be cured in accordance with the applicable cure cycle as required by 3.2 or 3.3 or in accordance with the manufacturer's recommended cure cycle. When applying heat, the time from room temperature to the applicable cure temperature shall be not less than 10 minutes or more than 60 minutes.

4.4.2 All lap shear specimens and sandwich panel specimens shall be cured under 25 psi ±5 psi pressure. One layer of Fabric 1165, MIL-Y-1140 glass fabric, plain weave shall be used as a bond line spacer in lap shear specimens. Bond line thickness shall be .005 to .010 for lap shear tests.

4.5 Specimen configuration and test procedure:

4.5.1 Shrinkage and weight loss of molded specimens:

TABLE I. Property requirements (Page 1 of 2 pages)

PROPERTY	MATERIAL		TEST METHOD
	TYPE I	TYPES II & III	
Weight Loss, %, 350° 10 Hours, Max. Avg.	.5	.5	4.5.1
Shore D Hardness After Cure, Min. Avg.	95	93	Fed. Test Method Std. 406 Method 1083
Exposure Shrinkage, %, 350°F, 10 Hours, Max. Avg.	.2	.2	4.5.1
Cure Shrinkage, %, Max. Avg.	.35	.2	4.5.1
Density After Cure, lb/ft^3, Avg.	101	98	4.5.4
Lap Shear Fluid Resistance Strength, psi, Min. Avg.			4.5.2 4.5.3
(a) Salt Spray:			
Aluminum	1500	1500	
(b) Humidity:			
Aluminum	1700	1650	
(c) 180°F JP-4:			
Aluminum	1800	1850	
Minimum Average Compressive Strength, psi			4.5.4
(a) Ultimate at:			
-65°F	35,000	30,000	
Room Temp.	23,000	21,000	
270°F	12,500	10,000	
350°F	8,000	8,000	
420°F	5,500	----	

TABLE I. Property requirements (Page 2 of 2 pages)

PROPERTY	MATERIAL TYPE I	MATERIAL TYPES II & III	TEST METHOD
(b) Proportional Limit at:			
-65°F	16,000	15,000	4.5.4
Room Temp.	10,000	9,000	
270°F	7,500	4,000	
350°F	6,000	----	
420°F	4,500	----	
(c) Minimum Modulus 10^5 psi at:			
-65°F	6.0	7.5	4.5.5
Room Temp.	5.0	6.5	
270°F	2.0	3.0	
350°F	1.1	1.1	
420°F	0.95	0.95	

4.5.1.1 A closed steel mold with a rectangular cavity approximately 16” x 1.5” x .5” is to be used to prepare specimens. Catalyzed material is to be injected into the mold until it is completely filled.

4.5.1.2 The material shall be cured using the specified time-temperature cycle, then cooled to approximately 75°F and removed from the mold.

4.5.1.3 The length of the specimen shall be determined to the nearest .001”, and its weight to the nearest 0.1 gram.

4.5.1.4 The length of the mold cavity shall be determined to the nearest .001”.

4.5.1.5 Shrinkage “as molded” is calculated by: % shrinkage

$$(\text{as molded}) = \left(\frac{\text{length of cavity - length as molded}}{\text{length as molded}}\right)$$

4.5.1.6 The specimen shall be exposed to the specified temperature condition (unrestrained).

4.5.1.7 At the end of the exposure, the specimen shall be allowed to cool to room temperature, (70-80°F) and its weight and length determined to the previous accuracies.

4.5.1.8 Time required to raise specimen to exposure temperature shall not be included in exposure time.

4.5.1.9 % Weight loss at each test interval shall be calculated by:

$$\%\ \text{weight loss} = \frac{(\text{weight as molded} - \text{weight after exposure})}{\text{weight as molded}} \times 100$$

4.5.10 % Shrinkage after exposure shall be calculated by:

$$\% \text{ shrinkage} = \frac{(\text{length as molded} - \text{length after exposure})}{\text{length as molded}} \times 100$$

4.5.2 Lap shear test - fluid exposure: See Figure 1.

4.5.2.1 Prepunched panels (finger panels) in accordance with MMM-A-132 or precut individual pieces shall be used for all lap shear tests.

4.5.2.2 Metal to be 2024-T81 clad (.064").

4.5.2.3 Specimens 1 and 6 are controls and shall be removed and held while exposure portion of panel is exposed to specified environment.

4.5.2.4 After proper exposure as specified in 4.5.3, specimens 2, 3, 4 and 5 shall be tested with controls, within 6 hours.

4.5.2.5 Load specimens with clamp type jaws using a loading rate of 600-700 lb/min.

4.5.2.6 Calculate shear in psi, τ, by $\tau = \frac{P}{LW}$

Where: P = failing load in lbs, L = overlap in inches, and
W = width of specimen in inches.

4.5.2.7 L and W shall be determined to the nearest .001".

4.5.3 Fluid resistance test exposure conditions:

4.5.3.1 Salt water spray condition:

4.5.3.1.1 Use FED-STD-151 Method 811.1 except as follows:

4.5.3.1.2 Suspend panel vertically by means of a non-metallic material, eg, waxed string, through a 1/8" diameter hole drilled in the trim area.

4.5.3.1.3 The plane of the panel is to be parallel to the principal direction of flow of the water spray.

4.5.3.1.4 Panels are not to be in contact with each other or any metallic object during exposure.

4.5.3.1.5 Exposure duration is to be 30 days ± 2 hours.

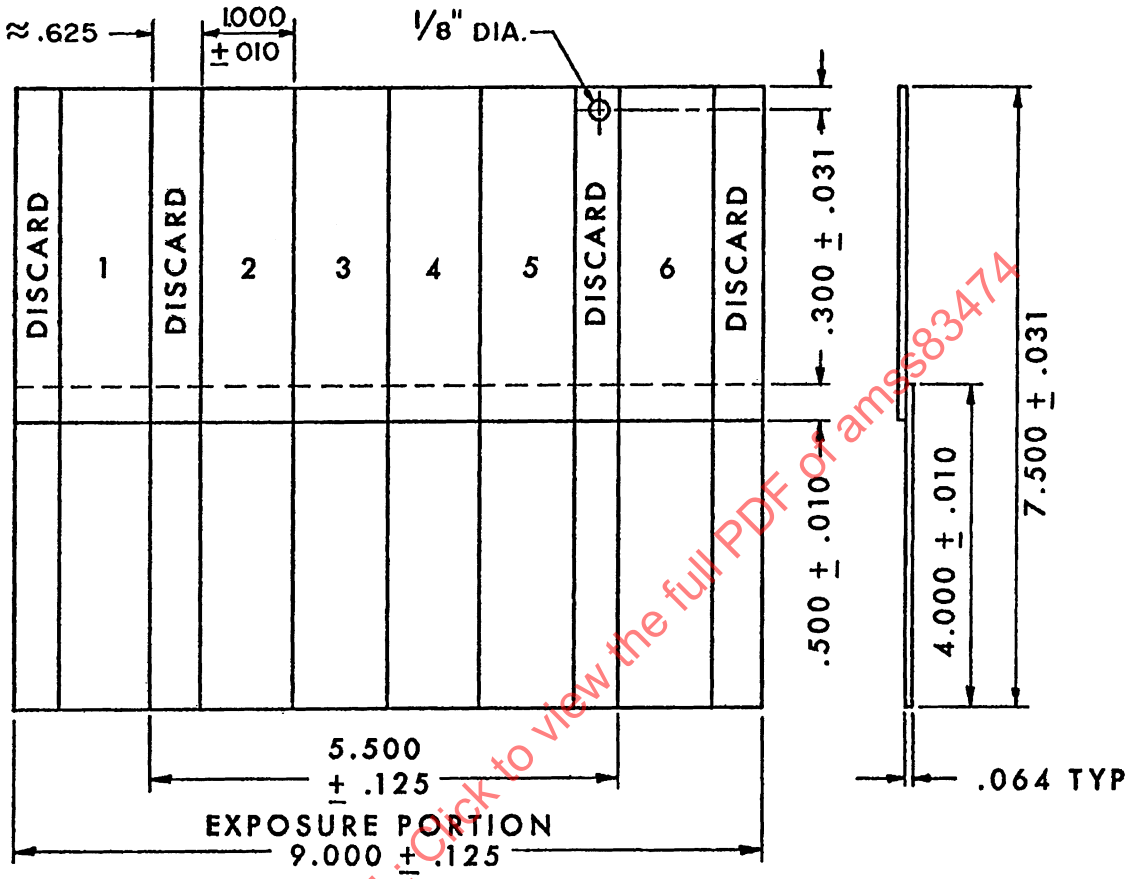

Figure 1

4.5.3.2 High humidity condition:

4.5.3.2.1 Panels are to be suspended (as above) in a humidity cabinet in which the exposure zone of the closed humidity chamber is maintained at 120°F ± 5°F and 95-100% relative humidity. The temperature of the cabinet shall be recorded at least twice each working day.

4.5.3.2.2 Condensate from one panel shall not drip upon other panels.

4.5.3.2.3 Distilled water containing not more than 200 ppm of total solids shall be used to maintain the humidity.

4.5.3.2.4 During exposure, panels shall not contact the water used, or any metallic material, or any material that might act as a wick.

4.5.3.2.5 Exposure shall be continuous for 30 days ± 2 hours. Continuous exposure means that the chamber shall be closed and the humidity maintained continuously except for brief interruptions necessary to inspect, rearrange, or removal panels, or to check or replenish the reservoir.