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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4253B

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Superseding AMS 4253A

Aluminum Alloy-Aramid Fiber Reinforced-Laminated Sheet
5.7Zn - 2.2Mg - 1.6Cu - 0.22Cr (7475-T61)
3, 5, 7, or 9 Ply

RATIONALE

AMS 4253B places this specification in cancelled status.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of September, 2006. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications indicating that it has been "CANCELLED".

Cancelled specifications are available from SAE.

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1. SCOPE:

1.1 Form:

This specification covers aluminum alloy sheet laminated with one or more layers of unidirectional aramid fiber/epoxy prepreg.

1.2 Application:

Primarily for structural parts requiring a combination of high strength, fatigue crack growth resistance and damage tolerance properties.

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 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 2202	Tolerances, Aluminum Alloy and Magnesium Alloy Sheet and Plate
MAM 2202	Tolerances, Metric, Aluminum Alloy and Magnesium Alloy Sheet and Plate
AMS 2350	Standards and Test Methods
AMS 2355	Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings
MAM 2355	Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings, Metric (SI) Units
AMS 2468	Hard Coating Treatment of Aluminum Alloys
AMS 2470	Anodic Treatment of Aluminum Alloys, Chromic Acid Process
AMS 4084	Aluminum Alloy Sheet, 5.7Zn - 2.2Mg - 1.6Cu - 0.22Cr (7475-T61), Solution and Precipitation Heat Treated

2.2 ASTM Publications:

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

ASTM B557	Tension Testing Wrought and Cast Aluminum-and Magnesium-Alloy Products
ASTM B557M	Tension Testing Wrought and Cast Aluminum-and Magnesium-Alloy Products (Metric)
ASTM B660	Packaging/Packing of Aluminum and Magnesium Products
ASTM D3167	Floating Roller Peel Resistance of Adhesives
ASTM E338	Sharp-Notch Tension Testing of High-Strength Sheet Materials

2.3 U.S. Government Publications:

Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Specifications:

MMM-A-132 Adhesive, Heat Resistant, Airframe Structural, Metal to Metal

3. TECHNICAL REQUIREMENTS:

3.1 Material:

3.1.1 The sheet layers shall be 0.012 inch (0.30 mm) thick AMS 4084 aluminum alloy. When specified by purchaser, one or both outside plies of the laminate shall be alclad one side aluminum alloy sheet with the cladding being the exposed surface.

3.1.2 Interior layers of the laminate shall consist of one or more layers of unidirectional aramid fibers preimpregnated with epoxy resin adhesive, hereafter referred to as prepreg. If more than one layer of prepreg is used, they shall be separated by sheets of aluminum as described in 3.2.1.

3.2 Laminating:

3.2.1 The faying (bonding) surfaces of the aluminum sheets, before assembly as a laminate, shall be cleaned, rinsed, and anodized, but not sealed, in accordance with AMS 2468, AMS 2470, or other process agreed upon by purchaser and vendor. All anodized surfaces shall be primed prior to lay-up with prepreg.

3.2.2 The epoxy adhesive in the prepreg shall conform to Federal MMM-A-132, Type I. The aramid fiber and the quality characteristics of the prepreg shall be as agreed upon by purchaser and vendor. The prepreg shall be laid-up in the laminate assembly so that the fibers of all layers are oriented longitudinally, corresponding to the rolling direction of the aluminum sheets.

3.2.3 Assembly sequence or lay-up of the laminate components, with aluminum sheet represented by A and prepreg represented by p, is as follows:

Thickness		Alternate	Lay-up
inch	mm	Nomenclature	Sequence
0.032	0.81	Type 2/1	A/p/A
0.053	1.35	Type 3/2	A/p/A/p/A
0.073	1.85	Type 4/3	A/p/A/p/A/p/A
0.094	2.39	Type 5/4	A/p/A/p/A/p/A/p/A

3.2.4 After lay-up, laminates shall be cured (bonded) using heat and pressure by a process, such as autoclaving, to produce the required properties. A typical practice is one hour at 260°F ± 10 (127°C ± 6) at a pressure of 70 - 75 psi (483 - 517 KPa).

3.2.5 The laminate shall be processed to adjust residual stresses (ARS) by causing the aluminum components to be in longitudinal compression rather than in tension. Adjustment shall be accomplished by stretching after curing, or by other means, to achieve 0.35 to 0.5% permanent set. (See 8.1)

3.2.6 When specified, exterior surfaces of laminates shall be anodized and primed.

3.3 Properties:

Laminated sheet shall conform to the following requirements:

3.3.1 Tensile Properties: Shall be as specified in Table I, determined in accordance with ASTM B557 or ASTM B557M using reduced section specimens with a 3 inch (76 mm) fillet radius.

TABLE I

Nominal Thickness Inch	Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, minimum
0.032	Longitudinal	98,000	81,000
	Long-Transverse	53,000	46,000
0.053	Longitudinal	104,000	84,000
	Long-Transverse	50,000	44,000
0.073	Longitudinal	104,000	84,000
	Long-Transverse	48,000	42,000
0.094	Longitudinal	104,000	84,000
	Long-Transverse	46,000	40,000

TABLE I (SI)

Nominal Thickness Millimeters	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, minimum
0.81	Longitudinal	676	558
	Long-Transverse	365	317
1.35	Longitudinal	717	579
	Long-Transverse	345	303
1.85	Longitudinal	717	579
	Long-Transverse	331	290
2.39	Longitudinal	717	579
	Long-Transverse	317	276

3.3.2 Notch Tensile Strength: Shall be determined in accordance with ASTM E338 using a center-cracked 3-inch (76-mm) wide specimen. Acceptance standards shall be as agreed upon by purchaser and vendor.

3.3.3 Roller Peel Strength: Adhesion of either outer layer shall be determined in accordance with ASTM D3167. Acceptance standards shall be as agreed upon by purchaser and vendor.

3.4 Quality:

Laminated sheet, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the sheet.

3.4.1 Each laminated panel shall be 100% inspected for anomalies and continuity of bond using either transmission or immersion ultrasonic techniques compatible with ASTM standards. Ultrasonic transducers shall operate with a minimum frequency of 5 megahertz regardless of the inspection method employed. Imperfections that produce, in a single pass through the panel, a 50% or greater attenuation of ultrasound at 5 megahertz frequency over an area not to exceed 0.25 inch (6.4 mm) in diameter are not acceptable.

3.5 Tolerances:

Sheet shall conform to all applicable requirements of AMS 2202 or MAM 2202 except as specified in 3.5.1.

3.5.1 Thickness tolerances shall be as follows:

Type 2/1 ±0.0025 inch (0.064 mm)

Types 3/2 and 4/3	±0.003 inch (0.08 mm)
Types 5/4	±0.0035 inch (0.089 mm)

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the sheet 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 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the sheet conforms to the requirements of this specification.

4.2 Classification of Tests:

Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.

4.3 Sampling:

Shall be in accordance with AMS 2355 or MAM 2355, and the following; an inspection lot shall be an identifiable quantity of laminated sheet of the same type (thickness) containing bare aluminum sheet from one heat treat lot, alclad one side aluminum sheet, if any, from one heat treat lot; prepreg from one manufacturer's-batch lot, cured in the same lamination cycle, and presented for vendor's inspection at one time.

4.3.1 Tensile Properties: One sample from each 1000 pounds (453 kg) or part thereof in an inspection lot in full thickness in both the longitudinal and the long-transverse directions.

4.3.2 Notch Tensile Test: One sample from each inspection lot in the longitudinal direction.

4.3.3 Roller Peel Test: One sample from each inspection lot in the long-transverse direction.

4.4 Reports:

4.4.1 The vendor of laminated sheet shall furnish with each shipment a report showing the results of tests on each inspection lot to determine conformance to the acceptance test requirements. This report shall include the purchase order number, type designation, inspection lot number, AMS 4253A, size, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 4253A, size, contractor or other direct supplier of laminated sheet,