SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4194	REV. C

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Superseding AMS4194B

Aluminum Alloy Sheet and Plate, Alclad 4.4Cu - 1.5Mg - 0.60Mn (Alclad 2024 and 1-1/2% Alclad 2024-T361 Flat Sheet; 1-1/2% Alclad 2024-T361 Plate) Solution Heat Treated and Cold Worked

UNS A82024

RATIONALE

AMS4194C has been reaffirmed to comply with the SAE five-year review policy.

NONCURRENCY NOTICE

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of February, 2005. It is recommended, therefore, that this specification not be specified for new designs.

"NONCURRENT" refers to those specifications which have previously been widely used and which may be required for production or processing of existing designs in the future. The Aerospace Materials Division, however, does not recommend these specifications for future use in new designs.

"NONCURRENT" specifications are available from SAE upon request.

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http://www.sae.org/technical/standards/AMS4194C

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of flat sheet and plate 0.500 inch (12.70 mm) and under in nominal thickness.

1.2 Application: Primarily for structural parts requiring a combination of good strength and maximum corrosion resistance. These products, when re-solution heat treated by the user, may not have the tensile properties shown. Certain design and processing procedures may cause these products to become susceptible to stress-corrosion cracking; ARP823 recommends practices to minimize such conditions.

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

2.1.2 Aerospace Recommended Practices:

ARP823 - Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products

2.2 ASTM Publications: Available from ASTM, 1915 Race Street, Philadelphia, PA 19103.

ASTM B660 - Packaging/Packing of Aluminum and Magnesium Products

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 Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

3. TECHNICAL REQUIREMENTS :

3.1 Composition: Shall conform to the following percentages by weight, determined in accordance with AMS 2355 or MAM 2355:

Core (2024)	min	max
Copper	3.8	4.9
Magnesium	1.2	1.8
Manganese	0.30	0.9
Iron	--	0.50
Silicon	--	0.50
Zinc	--	0.25
Titanium	--	0.15
Chromium	--	0.10
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

Cladding (1230)	min	max
Iron + Silicon	--	0.7
Copper	--	0.10
Zinc	--	0.10
Manganese	--	0.05
Magnesium	--	0.05
Vanadium	--	0.05
Titanium	--	0.03
Other Impurities, each	--	0.03
Aluminum, by difference	99.30	--

3.2 Condition: Solution heat treated in accordance with MIL-H-6088 and cold reduced approximately 6% in thickness.

3.3 Properties: The product shall conform to the following requirements, determined in accordance with AMS 2355 or MAM 2355:

3.3.1 Tensile Properties: Shall be as specified in Table I.

TABLE I

Nominal Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset Psi, minimum	Elongation in 2 Inches or 4D %, minimum
0.020 to 0.062, incl	61,000	47,000	8
Over 0.062 to 0.187, incl	64,000	48,000	9
Over 0.187 to 0.249, incl	65,000	49,000	9
Over 0.249 to 0.500, excl	65,000	48,000	9
0.500	66,000	49,000	10

TABLE I (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, minimum	Elongation in 50.8 mm or 4D %, minimum
0.51 to 1.57, incl	421	324	8
Over 1.57 to 4.75, incl	441	331	9
Over 4.75 to 6.32, incl	448	338	9
Over 6.32 to 12.70, excl	448	331	9
12.70	455	338	10

3.3.2 Bending: Product 0.020 to 0.249 inch (0.51 to 6.32 mm), incl, in nominal thickness shall withstand, without cracking, bending at room temperature through an angle of 180 degrees around a diameter equal to the bend factor times the nominal thickness of the product with axis of bend parallel to direction of rolling.

Nominal Thickness		Bend Factor
Inch	Millimetres	
0.020 to 0.062, incl	0.51 to 1.57, incl	4
Over 0.062 to 0.187, incl	Over 1.57 to 4.75, incl	6
Over 0.187 to 0.249, incl	Over 4.75 to 6.32, incl	8

3.3.2.1 Bending requirements for plate over 0.249 inch (6.32 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.3 Cladding Thickness: After rolling, the average cladding thickness shall conform to the requirements of Table II.

TABLE II

Total Thickness of Composite Product		Cladding Thickness Per Side % of Total Thickness	
Inch	Millimetres	min	max
0.020 to 0.062, incl	0.51 to 1.57, incl	4.0	--
Over 0.062 to 0.187, incl	Over 1.57 to 4.75, incl	2.0	--
Over 0.187 to 0.500, excl	Over 4.75 to 12.70, excl	1.2	--
0.500	12.70	1.2	3.0

3.4 Quality: The product, 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 product.

3.5 Tolerances: Shall conform to all applicable requirements of AMS 2202 or MAM 2202.

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 4.4. 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 composition (3.1), tensile properties (3.3.1), and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for bending (3.3.2) and cladding thickness (3.3.3) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with AMS 2355 or MAM 2355.

4.4 Reports:

4.4.1 The vendor of the product shall furnish with each shipment a report stating that the product conforms to the chemical composition and other technical requirements of this specification. This report shall include the purchase order number, lot number, AMS 4194B, 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 4194B, contractor or other direct supplier of product, part number, and quantity. When product for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of product to determine conformance to the requirements of this specification and shall include in the report either a statement that the product conforms or copies of laboratory reports showing the results of tests to determine conformance.

4.5 Resampling and Retesting: Shall be in accordance with AMS 2355 or MAM 2355.