SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4194 | REV. D

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Superseding AMS4194C

Aluminum Alloy, Sheet and Plate, Alclad
4.4Cu - 1.5Mg - 0.60Mn (2024 -T361 Sheet/Plate with 1½% Alclad)
Solution Heat Treated, 6% Cold Worked and Naturally Aged
(Composition similar to UNS A82024)

RATIONALE

AMS4194D is being returned to active status and revised to delete the thin sheet portion of the document (0.008 to 0.187 inch) (Tables 2, 3 and 4) and supersede those requirements by the new AMS4466. Cautionary notes were added concerning this specification as it pertains to "thin" clad (1 ½%) for material over 0.187 inch due to potential for reduced corrosion resistance at reduced cladding thickness. This specification is not equivalent to historical AMS-QQ-A-250/5 applications for thicker gages.

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of alclad sheet and plate supplied in the -T361 temper.

1.2 Supersession Notice

Requirements for thin gage sheet (0.008 to 0.187 inch) in accordance with AMS4194 are hereby superseded by AMS4466. AMS-QQ-A-250/5 and AMS4466 have the same requirements for alclad thickness and tensile properties for material less than 0.187 inch in thickness.

1.2.1 AMS4194 covers alclad material for sheet greater than 0.187 inch, and plate. The cladding thickness is minimized to provide a commensurate increase in tensile properties for this alclad reduction. Use of this product is not recommended without proper evaluation of corrosion resistance.

1.3 Application

These products have been used typically for high strength parts requiring higher yield strength than is afforded by naturally aged tempers of this alloy and maximum corrosion resistance and whose fabrication does not involve welding, but usage is not limited to such applications.

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http://www.sae.org/technical/standards/AMS4194D

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2355 Quality Assurance, Sampling and Testing, Aluminum Alloys and Magnesium Alloy, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings

AMS2772 Heat Treatment of Aluminum Alloy Raw Materials

AS1990 Aluminum Alloy Tempers

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B 594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products for Aerospace Applications

ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products

ASTM B 666/B 666M Identification Marking of Aluminum and Magnesium Products

2.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036, Tel: 212-642-4900, www.ansi.org.

ANSI H 35.2 Dimensional Tolerances for Aluminum Mill Products

ANSI H 35.2M Dimensional Tolerances for Aluminum Mill Products (Metric)

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight as shown in Tables 1, determined in accordance with AMS2355.

TABLE 1A – COMPOSITION, CORE (2024)

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

TABLE 1B – COMPOSITION, CLADDING (1230)

Element	min	max
Iron + Silicon	--	0.70
Copper	--	0.10
Manganese	--	0.05
Magnesium	--	0.05
Zinc	--	0.10
Titanium	--	0.03
Other Elements, each	--	0.03
Aluminum	99.30	--

3.2 Condition

The product shall be supplied in the following condition:

3.2.1 Sheet

Solution heat treated, cold worked approximately 6% and naturally aged to the T361 temper in accordance with AMS2772 (See AS1990).

3.2.2 Plate

Solution heat treated, cold worked approximately 6%, stretched to produce a nominal permanent set of 2% but not less than 1-1/2% nor more than 3%, and naturally aged to the T361 temper in accordance with AMS2772 (See AS1990).

3.2.2.1 Plate shall receive no further straightening operations after stretching.

3.3 Properties

The product shall conform to the following requirements, determined in accordance with AMS2355 on the mill produced size.

3.3.1 Tensile Properties

Shall be as shown in Table 2.

TABLE 2A – MINIMUM TENSILE PROPERTIES, INCH/POUND UNITS

Temper	Nominal Thickness, Inches	Tensile Strength, ksi	Yield Strength at 0.2% Offset, ksi	Elongation In 2 Inches or 4D, %
-T361	Over 0.187 to 0.249, incl	65.0	49.0	9
	Over 0.249 to 0.499, incl	65.0	48.0	9
	0.500	66.0	49.0	10

TABLE 2B – MINIMUM TENSILE PROPERTIES, SI UNITS

Temper	Nominal Thickness, Millimeters	Tensile Strength, MPa	Yield Strength at 0.2% Offset, MPa	Elongation In 50.8 mm or 4D, %
-T361	Over 4.750 to 6.324, incl	448	338	9
	Over 6.324 to 12.675, incl	448	331	9
	12.700	455	338	10

3.3.2 Bending

Product shall withstand, without cracking, bending at room temperature through an angle of 180 degrees around a diameter equal to the bend factor shown in Table 3 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

TABLE 3 – BENDING PARAMETERS

Nominal Thickness; Inches	Nominal Thickness; Millimeters	Bend Factor
Over 0.187 to 0.249, incl	Over 4.750 to 6.324, incl	8

3.3.3 Cladding Thickness

The aluminum alloy plates that are bonded to the two sides of the aluminum alloy (2024) ingot or slab, to form a composite that is to be rolled, shall each have a thickness as specified in Table 4.

TABLE 4 – CLADDING THICKNESS

Nominal Thickness, Inch	Nominal Thickness, mm	Average Cladding Thickness Per Side; % of Total Thickness; minimum	Average Cladding Thickness Per Side; % of Total Thickness; maximum
Over 0.187 to 0.499, incl	Over 4.750 to 12.675, incl	1.2	--
0.500	12.700	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.