

AEROSPACE MATERIAL SPECIFICATION



AMS 4101C

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Reaffirmed APR 2006

Superseding AMS 4101B

Aluminum Alloy, Plate
4.4Cu - 1.5Mg - 0.60Mn (2124-T851)
Solution Heat Treated, Stretched, and Precipitation Heat Treated
(Composition similar to UNS A92124)

1. SCOPE:

1.1 Form:

This specification covers an aluminum alloy in the form of plate.

1.2 Application:

This plate has been used typically for parts requiring a high level of mechanical properties up to 300 °F (149 °C), but usage is not limited to such applications.

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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
MAM 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings, Metric (SI) Units
AMS 2772	Heat Treatment of Aluminum Alloy Raw Materials

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2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 594	Ultrasonic Examination of Aluminum-Alloy Wrought Products for Aerospace Applications
ASTM B 645	Plane Strain Fracture Toughness Testing of Aluminum Alloys
ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E 399	Plane-Strain Fracture Toughness of Metallic Materials
ASTM E 602	Sharp-Notch Tension Testing with Cylindrical Specimens
ASTM G 47	Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products

2.3 ANSI Publications:

Available from ANSI, 11 West 42nd Street, New York NY 10036-8002.

ANSI H35.2	Dimensional Tolerances for Aluminum Mill Products
ANSI H35.2M	Dimensional Tolerances for Aluminum Mill Products (Metric)

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS 2355 or MAM 2355.

TABLE 1 - Composition

Element	min	max
Silicon	--	0.20
Iron	--	0.30
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	

3.2 Condition:

Solution heat-treated, stretched to produce a nominal permanent set of 2% but not less than 1-1/2% nor more than 3%, and precipitation heat-treated. Heat treatments shall be performed in accordance with AMS 2772 as applicable to 2024-T851 plate.

3.2.1 Plate shall receive no further straightening operations after stretching.

3.3 Properties:

Plate shall conform to the following requirements determined on the mill produced size in accordance with AMS 2355 or MAM 2355 and as specified herein.

3.3.1 Tensile Properties: Shall be as shown in Table 2.

TABLE 2A - Minimum Tensile Properties, Inch/Pound Units

Nominal Thickness Inches	Specimen Orientation	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 inches or 4D %
1.5 to 2, incl	Longitudinal	66.0	57.0	6
	Long-Trans.	66.0	57.0	5
	Short-Trans.	64.0	55.0	1.5
Over 2 to 3, incl	Longitudinal	65.0	57.0	6
	Long-Trans.	65.0	57.0	4
	Short-Trans.	63.0	55.0	1.5
Over 3 to 4, incl	Longitudinal	65.0	56.0	5
	Long-Trans.	65.0	56.0	4
	Short-Trans.	62.0	54.0	1.5
Over 4 to 5, incl	Longitudinal	64.0	55.0	5
	Long-Trans.	64.0	55.0	4
	Short-Trans.	61.0	53.0	1.5
Over 5 to 6, incl	Longitudinal	63.0	54.0	5
	Long-Trans.	63.0	54.0	4
	Short-Trans.	58.0	51.0	1.5

TABLE 2B - Minimum Tensile Properties, SI Units

Nominal Thickness Millimeters	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
38 to 51, incl	Longitudinal	455	393	6
	Long-Trans.	455	393	5
	Short-Trans.	441	379	1.5
Over 51 to 76, incl	Longitudinal	448	393	6
	Long-Trans.	448	393	4
	Short-Trans.	434	379	1.5
Over 76 to 102, incl	Longitudinal	448	386	5
	Long-Trans.	448	386	4
	Short-Trans.	427	372	1.5
Over 102 to 127, incl	Longitudinal	441	379	5
	Long-Trans.	441	379	4
	Short-Trans.	421	365	1.5
Over 127 to 152, incl	Longitudinal	434	372	5
	Long-Trans.	434	372	4
	Short-Trans.	400	352	1.5

- 3.3.2 Stress-Corrosion Resistance: Specimens cut from plate shall show no evidence of stress-corrosion cracking when stressed in the short-transverse direction to 50% of the specified minimum long-transverse yield strength, determined in accordance with ASTM G 47.
- 3.3.3 Ultrasonic Soundness: Each plate, 1.5 to 4.5 inches (38 to 114 mm) in nominal thickness, shall be inspected in accordance with ASTM B 594 and shall meet Class A ultrasonic requirements.
- 3.3.4 Fracture Toughness: When specified, plate, 1.5 to 6 inches (38 to 152 mm), inclusive, in nominal thickness, shall meet the values of K_{IC} , shown in Table 3, determined in accordance with ASTM E 399 and ASTM B 645. The required test directions shall be as specified by purchaser.

TABLE 3 - Minimum Fracture Toughness Values

Test Direction	K_{IC}	K_{IC}
	ksi $\sqrt{\text{inch}}$	MPa $\sqrt{\text{m}}$
L - T	24	26.4
T - L	20	22.0
S - L	18	19.8

3.3.5 Alternate Testing for Demonstration of Fracture Toughness: When specified, the producer shall guarantee that plate meets the fracture toughness requirements based on correlation of notch tensile strength/tensile yield strength (NTS/TYS) ratio, determined in accordance with 3.3.5.1 in lieu of fracture toughness testing (3.3.4). Sampling and testing requirements, and lot acceptance criteria shall be as agreed upon by purchaser and vendor.

3.3.5.1 Notch Tensile Strength/Tensile Yield Strength (NTS/TYS) Ratio: For plate 1.5 to 6 inches (38 to 152 mm), inclusive, in nominal thickness, notch tensile strength shall be determined in accordance with ASTM E 602. Acceptance values for NTS/TYS shall be specified based on evidence of documented correlation between the NTS/TYS ratio and fracture toughness values (3.3.4) as demonstrated and maintained by the producer.

3.4 Quality:

Plate, 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 plate.

3.5 Tolerances:

Shall conform to all applicable requirements of ANSI H35.2 or ANSI H35.2M.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of plate shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the plate conforms to the specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), tensile properties (3.3.1), stress-corrosion resistance (3.3.2), ultrasonic soundness (3.3.3), tolerances (3.5) and, when specified, standard fracture toughness (3.3.4) or alternate testing for demonstration of fracture toughness (3.3.5), are acceptance tests and, except for composition, shall be performed on each inspection lot.

4.2.2 Periodic Tests: When alternate testing for demonstration of fracture toughness (3.3.5) is specified, standard fracture toughness (3.3.4) is a periodic test and shall be performed at a frequency to maintain demonstrated correlation as selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2355 or MAM 2355 and the following: