

AEROSPACE MATERIAL SPECIFICATION

SAE AMS4101

REV. D

Issued 1978-07
Reaffirmed 2006-04
Revised 2009-12

Superseding AMS4101C

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

RATIONALE

AMS4101D removes the provision for alternatives to fracture toughness testing, revises the frequency of acceptance testing (4.2.1), the frequency of testing specimens for stress corrosion resistance (4.2.2, 4.3.2) and results from a Five Year Review and update of this specification.

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 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 of Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
AMS2772 Heat Treatment of Aluminum Alloy Raw Materials

ARP 823 Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products
AS1990 Aluminum Alloy Tempers

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<http://www.sae.org/technical/standards/AMS4101D>**

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 Examination of Aluminum-Alloy Wrought Products for Aerospace Applications
 ASTM B 645 Linear-Elastic Plane-Strain Fracture Toughness Testing of Aluminum Alloys
 ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products
 ASTM B 666/B 666M Identification Marking of Aluminum and Magnesium Products
 ASTM E 399 Linear-Elastic Plane-Strain Fracture Toughness K_{Ic} of Metallic Materials
 ASTM G 47 Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy 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 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 AMS2355.

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 AMS2772 as applicable to 2024-T851 plate (See AS1990).

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 AMS2355 and as specified herein.

3.3.1 Tensile Properties

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

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 specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.3.1), ultrasonic soundness (3.3.3), tolerances (3.5) and, when specified, standard fracture toughness (3.3.4), are acceptance tests, and shall be performed on each lot.

4.2.2 Periodic Tests

Stress-corrosion resistance (3.3.2) is a periodic test and shall be performed at a frequency to maintain demonstrated capability as selected by the vendor unless frequency of testing is specified by purchaser. Typical frequency is one lot per month per gauge range produced.

4.3 Sampling and Testing

Shall be in accordance with AMS2355 and the following:

4.3.1 Specimens for tensile tests shall be taken in the longitudinal, long-transverse, and short-transverse directions.

4.3.2 Specimens for stress-corrosion testing shall be taken parallel to the short-transverse grain direction from the center width.