AEROSPACE MATERIAL SPECIFICATION

AMS4413™	REV. C
Issued 2007-10 Revised 2023-12 Superseding AMS4413B	

Aluminum Alloy, Plate
3.5Cu - 1.0Li - 0.40Mg - 0.35Mn - 0.45Ag - 0.12Zr (2050-T84)
Solution Heat Treated, Stress Relieved, and Artificially Aged
(Composition similar to UNS A92050)

RATIONALE

AMS4413C results from an update of this specification with changes to increase the maximum product thickness to 8.000 inches (203.20 mm) (see 1.1, Table 2, and Table 3), update SI unit elongation values for consistency with AMS editorial guidalines (see Table 2B), remove S-L fracture toughness from 0.50- to 1.500-inch (12.50- to 38.20-mm), inclusive, thick product because the specimen is not supported (see Table 3), update wording to prohibit unauthorized exceptions (see 3.3.4, 4.4.1, and 8.3), Applicable Documents (see Section 2), Ordering Information (see 8.5), and relocate Definitions (see 2.4).

1. SCOPE

1.1 Form

This specification covers an aluminum-lithium alloy in the form of plate 0.500 to 8.000 inches (12.70 to 203.20 mm), inclusive, in thickness (see 8.5).

1.2 Application

This plate has been used typically for parts where low density is needed in combination with a high level of mechanical properties and very good resistance to stress-corrosion cracking, 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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS4413C/

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (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

AS7766 Terms used in Aerospace Metal specification.

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 B594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products

ASTM B660 Packing/Packaging of Aluminum and Magnesium Products

ASTM B666/B666M Identification Marking of Aluminum and Magnesium Products

ASTM E399 Linear-Elastic Plane-Strain Fracture Toughness of Metallic Materials

ASTM G47 Determining Susceptibility to Stress Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products

2.3 ANSI Accredited Publications

Copies of these documents are available online at https://webstore.ansi.org/.

ANSI H35.1/H35.1M Standard Alloy and Temper Designation System for Aluminum

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products

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

2.4 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Table 1 - Composition

Element	Min	Max
Silicon	--	0.08
Iron	--	0.10
Copper	3.2	3.9
Manganese	0.20	0.50
Magnesium	0.20	0.60
Chromium	--	0.05
Zinc	--	0.25
Titanium	--	0.10
Zirconium	0.06	0.14
Silver	0.20	0.70
Lithium	0.7	1.3
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 3.5% but not less than 3.0% nor more than 4.5%, and precipitation heat treated to the T84 temper (refer to ANSI H35.1/H35.1M). Solution and precipitation heat treatment shall be performed in accordance with AMS2772. Actual solution heat-treatment temperatures and aging time/temperatures are proprietary.

3.2.1 Plate shall receive no further straightening operations after stretching.

3.3 Properties

Plate shall conform to the following requirements, determined in accordance with AMS2355 on the mill produced size and as specified herein:

3.3.1 Tensile Properties

Shall be as specified 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 %
0.500 to 1.500, incl	Longitudinal	73.0	69.0	9
	Long Trans.	74.0	67.0	7
Over 1.500 to 2.000, incl	Longitudinal	72.0	67.0	9
	Long Trans.	73.0	65.0	7
	Short Trans.	71.0	61.0	2
Over 2.000 to 3.000, incl	Longitudinal	72.0	67.0	8
	Long Trans.	72.0	65.0	6
	Short Trans.	71.0	61.0	2
Over 3.000 to 4.000, incl	Longitudinal	71.0	67.0	7
	Long Trans.	72.0	65.0	4
	Short Trans.	70.0	60.0	1.5
Over 4.000 to 5.000, incl	Longitudinal	71.0	66.0	6
	Long Trans.	71.0	64.0	3
	Short Trans.	69.0	59.0	1.5
Over 5.000 to 6.500, incl	Longitudinal	71.0	66.0	5
	Long Trans.	71.0	64.0	3
	Short Trans.	69.0	59.0	1.5
Over 6.500 to 7.000, incl	Longitudinal	70.0	66.0	4
	Long Trans.	70.0	63.0	3
	Short Trans	68.0	58.0	1.5
Over 7.000 to 8.000, incl	Longitudinal	69.0	65.0	3
	Long Trans.	69.0	62.0	2
	Short Trans	66.0	57.0	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 %
12.70 to 38.10, incl	Longitudinal	503	476	9
	Long Trans.	510	462	7
Over 38.10 to 50.80, incl	Longitudinal	496	462	9
	Long Trans.	503	448	7
	Short Trans.	490	421	2
Over 50.80 to 76.20, incl	Longitudinal	496	462	8
	Long Trans.	496	448	6
	Short Trans.	490	421	2
Over 76.20 to 101.60, incl	Longitudinal	490	462	7
	Long Trans.	496	448	4
	Short Trans.	483	414	1.5
Over 101.60 to 127.00, incl	Longitudinal	490	455	6
	Long Trans.	490	441	3
	Short Trans.	476	407	1.5
Over 127.00 to 165.10, incl	Longitudinal	490	455	5
	Long Trans.	490	441	3
	Short Trans.	476	407	1.5
Over 165.10 to 177.80, incl	Longitudinal	483	455	4
	Long Trans.	483	434	3
	Short Trans.	469	400	1.5
Over 177.80 to 203.20, incl	Longitudinal	476	448	3
	Long Trans.	476	427	2
	Short Trans.	455	393	1.5

3.3.2 Stress-Corrosion Test

Specimens machined and tested in accordance with ASTM G47 from plate 0.750 inch (19.05 mm) and over in nominal thickness shall show no evidence of stress-corrosion cracking when stressed in the short-transverse direction at 45.0 ksi (310 MPa) for 30 days.

3.3.3 Fracture Toughness

Fracture toughness shall be determined in accordance with ASTM E399 and, when specified, shall meet the values for K_{Ic} specified in Table 3. For T-L and L-T test directions on plate 2 inches (51 mm) and under in nominal thickness, use full-thickness specimens; for plate over 2 to 4 inches (51 to 102 mm), inclusive, in nominal thickness, use specimens 2-inch (51-mm) minimum thickness centered at T/2; and for plate over 4 inches (102 mm) in nominal thickness, use specimens 2-inch (51-mm) minimum thickness centered at T/4. For the S-L test direction, the test specimen shall be centered at T/2. Required specimen orientation(s) shall be specified by the purchaser.

Table 3A - Minimum fracture toughness parameters, inch/pound units

Nominal Thickness Inches	L-T ksi $\sqrt{\text{inch}}$	T-L ksi $\sqrt{\text{inch}}$	S-L ksi $\sqrt{\text{inch}}$
0.500 to 1.500, incl	33	29	
Over 1.500 to 2.000, incl	31	27	23
Over 2.000 to 3.000, incl	28	25	23
Over 3.000 to 4.000, incl	26	23	21
Over 4.000 to 5.000, incl	25	21	21
Over 5.000 to 6.000, incl	22	20	18
Over 6.000 to 6.500, incl	22	19	16
Over 6.500 to 7.000, incl	22	18	16
Over 7.000 to 8.000, incl	20	16	15

Table 3B - Minimum fracture toughness parameters, SI units

Nominal Thickness Millimeters	L-T MPa $\sqrt{\text{m}}$	T-L MPa $\sqrt{\text{m}}$	S-L MPa $\sqrt{\text{m}}$
12.70 to 38.10, incl	36	32	
Over 38.10 to 50.80, incl	34	30	25
Over 50.80 to 76.20, incl	31	28	25
Over 76.20 to 101.60, incl	29	25	23
Over 101.60 to 127.00, incl	28	23	23
Over 127.00 to 152.00, incl	24	22	20
Over 152.00 to 165.10, incl	24	21	18
Over 165.10 to 177.80, incl	24	20	18
Over 177.80 to 203.20, incl	22	18	16

3.3.4 Mechanical property requirements for plate outside the thickness range of 1.1 shall be as agreed upon by the purchaser and producer and reported per 4.4.1 (see 8.5).

3.4 Quality

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

3.4.1 Plate shall be ultrasonically inspected in accordance with ASTM B594 and shall meet the requirements of 3.4.1.1.

3.4.1.1 Plates shall meet the requirements for ultrasonic class A.

3.5 Tolerances

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