AEROSPACE MATERIAL SPECIFICATION

AMS4201™	REV. H

Issued 1980-01
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Superseding AMS4201G

Aluminum Alloy Plate, 6.2Zn - 2.3Cu - 2.2Mg - 0.12Zr (7050-T7651), Solution Heat Treated, Stress Relieved, and Overaged (Composition similar to A97050)

RATIONALE

AMS4201H results from a Five-Year Review and update of this specification with changes to update standard language related to unauthorized exceptions (see 3.3.1.1, 4.4.1, and 8.4), relocate Definitions (see 2.4), and update Applicable Documents (see Section 2), metric elongation values consistent with testing guidance (see Table 2B), ultrasonic testing requirements consistent with industry practice (see Table 4), and Reports (see 4.4).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of plate 0.250 to 3.000 inches (6.35 to 76.20 mm), inclusive, in nominal thickness (see 8.5).

1.2 Application

This plate has been used typically for parts requiring a high level of mechanical properties and resistance to exfoliation corrosion and moderate 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.

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

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS4201H/

AS6279 Standard Practice for Production, Distribution, and Procurement of Metal Stock

AS7766 Terms Used in Aerospace Metals Specifications

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 B557 Tension Testing of Wrought and Cast Aluminum- and Magnesium-Alloy Products

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 G34 Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)

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

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

Table 1 - Composition

Element	Min	Max
Silicon	--	0.12
Iron	--	0.15
Copper	2.0	2.6
Manganese	--	0.10
Magnesium	1.9	2.6
Chromium	--	0.04
Zinc	5.7	6.7
Titanium	--	0.06
Zirconium	0.08	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 to the -T7651 temper (refer to ANSI H35.1/H35.1M) in accordance with AMS2772.

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 product in accordance with AMS2355, except as specified in 3.3.6:

3.3.1 Tensile Properties

Shall be as specified in Table 2, when tested in accordance with ASTM B557.

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 %
0.250 to 1.000, incl	Longitudinal	76.0	66.0	9
	Long-Trans.	76.0	66.0	8
Over 1.000 to 1.500, incl	Longitudinal	77.0	67.0	9
	Long-Trans.	77.0	67.0	8
Over 1.500 to 2.000, incl	Longitudinal	76.0	66.0	9
	Long-Trans.	76.0	66.0	8
Over 2.000 to 3.000, incl	Longitudinal	76.0	66.0	8
	Long-Trans.	76.0	66.0	7
	Short-Trans.	70.0	60.0	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 %
6.35 to 25.40, incl	Longitudinal	524	455	9
	Long-Trans.	524	455	8
Over 25.40 to 38.10, incl	Longitudinal	531	462	9
	Long-Trans.	531	462	8
Over 38.10 to 50.80, incl	Longitudinal	524	455	9
	Long-Trans.	524	455	8
Over 50.80 to 76.20, incl	Longitudinal	524	455	8
	Long-Trans.	524	455	7
	Short-Trans.	483	414	1.5

3.3.1.1 Mechanical property requirements for product outside the range covered by 1.1 shall be agreed upon between the purchaser and producer and reported per 4.4.1 (see 8.5).

3.3.2 Corrosion-Resistance Indicator Test

Resistance to stress-corrosion cracking and to exfoliation corrosion shall be acceptable if the plate conforms to the requirements of 3.3.2.1, 3.3.2.2, and 3.3.2.3.

3.3.2.1 Electrical Conductivity (EC)

Shall be not lower than 37.0% IACS (International Annealed Copper Standard) (21.5 MS/m), determined on the surface of the long-transverse tensile specimen.

3.3.2.2 Stress-Corrosion Susceptibility Factor (SCF)

Shall be not greater than 36.0 (248), determined by subtracting the electrical conductivity, XX.X% IACS (12 times XX.X MS/m), from long-transverse yield strength, XX.X ksi (XXX MPa).

Examples: For 1.250 inches (31.25 mm) nominal thickness:

Inch/Pound Units 74.4 ksi - 37.3% IACS = 37.1 Unacceptable
69.4 ksi - 38.2% IACS = 31.2 Acceptable

SI Units 513 MPa - 12 X 21.6 MS/m = 254 Unacceptable
480 MPa - 12 X 22.2 MS/m = 214 Acceptable

3.3.2.3 Plate not meeting the requirements of 3.3.1, 3.3.2.1, and 3.3.2.2 may be given additional precipitation heat treatment or reheat treated. After such treatment, if all specified properties are met, plate is acceptable.

3.3.3 Exfoliation-Corrosion Test

Plate shall exhibit exfoliation corrosion at a T/10 plane not greater than that illustrated by Photo B, Figure 2 of ASTM G34.

3.3.4 Stress-Corrosion Test

Specimens, cut from plate 0.750 inch (19.05 mm) and over in nominal thickness, shall show no evidence of stress-corrosion cracking when tested in accordance with ASTM G47 and stressed in the short-transverse direction to 25.0 ksi (172 MPa).

3.3.5 Fracture Toughness

Plate shall meet the values of K_{Ic} specified in Table 3, determined using specimen configurations conforming to ASTM E399. 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 3 inches (51 to 76 mm), inclusive, in nominal thickness, use 2-inch (51-mm) thick specimens centered at T/2. For the S-L test direction, the test specimens shall be centered at T/2. Required specimen orientation(s) shall be specified by the purchaser (see 8.5).

Table 3 - Fracture toughness parameters

Specimen Orientation	Nominal Thickness Inches	Nominal Thickness Millimeters	Minimum K_{Ic} ksi √inch	Minimum K_{Ic} MPa √m
L-T	1.000 to 2.000, incl	25.40 to 50.80, incl	26	28
	Over 2.000 to 3.000, incl	50.80 to 76.20, incl	24	26
T-L	1.000 to 2.000, incl	25.40 to 50.80, incl	24	26
	Over 2.000 to 3.000, incl	50.80 to 76.20, incl	23	25
S-L	Over 2.000 to 3.000, incl	50.80 to 76.20, incl	20	22

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 Each plate shall be ultrasonically inspected in accordance with ASTM B594 and shall meet the requirements shown in Table 4.

Table 4 - Ultrasonic parameters

Plate Thickness Inches	Plate Thickness Millimeters	Ultrasonic Class
0.500 to 1.500, excl	12.70 to 38.10, excl	A
1.500 to 3.000, incl	38.10 to 76.20, incl	A