



AEROSPACE MATERIAL SPECIFICATION

AMS4201**REV. F**

Issued 1980-01
Reaffirmed 2008-05
Revised 2014-07

Superseding AMS4201E

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

AMS4201F removes the requirement for alternate testing of fracture toughness as well as the weight limit on ultrasonic testing, revises Classification of Tests (4.2) and is 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 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 canceled 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 Alloys, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings

AMS2772 Heat Treatment of Aluminum Alloy Raw Materials

AS1990 Aluminum Alloy Tempers

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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 557	Tension Testing of Wrought and Cast Aluminum and Magnesium Alloy Parts
ASTM B 594	Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM B 660	Packing/Packaging of Aluminum-Alloy Products for Aerospace Applications
ASTM B 666/666M	Identification Marking of Aluminum and Magnesium Products
ASTM E 399	Linear-Elastic Plane-Strain Fracture Toughness K_{Ic} of Metallic Materials
ASTM E 1304	Plane-Strain (Chevron-Notch) Fracture Toughness of Metallic Materials
ASTM G 34	Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)
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 10036-8002, 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	--	0.12
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 1½% nor more than 3%, and precipitation heat treated to the -T7651 temper (See AS1990) 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 B 557.

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 %	Elongation in 50.8 mm or 5D %
6.35 to 25.40, incl	Longitudinal	524	455	9	8
	Long-Trans.	524	455	8	7
Over 25.40 to 38.10, incl	Longitudinal	531	462	9	8
	Long-Trans.	531	462	8	7
Over 38.10 to 50.80, incl	Longitudinal	524	455	9	8
	Long-Trans.	524	455	8	7
Over 50.80 to 76.20, incl	Longitudinal	524	455	8	7
	Long-Trans.	524	455	7	6
	Short-Trans.	483	414	1.5	1.5

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 re-heat 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 G 34.

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 G 47 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 E 399. 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 purchaser.

TABLE 3 - FRACTURE TOUGHNESS PARAMETERS

Specimen Orientation	Nominal Thickness Inches	Nominal Thickness Millimeters	Minimum ksi $\sqrt{\text{inch}}$	K_{Ic} MPa $\sqrt{\text{m}}$
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 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 B 594 and shall meet the requirements shown in Table 4.