SAE The Engineering Society For Advancing Mobility Land Sea Air and Space

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4346

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Submitted for recognition as an American National Standard

ALUMINUM ALLOY PLATE
2.7Cu - 2.2Li - 0.12Zr (2090-T81)
Solution Heat Treated, Cold Worked, and Precipitation Heat Treated

1. SCOPE:

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

1.2 Application: Primarily for aerospace structural parts requiring the strength of 7075-T651 and 7.8% lower nominal density.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2202 - Tolerances, Aluminum and Magnesium Alloy Sheet and Plate
MAM 2202 - Tolerances, Metric, Aluminum and Magnesium Alloy Sheet and Plate
AMS 2350 - Standards and Test Methods
AMS 2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings
MAM 2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings, Metric (SI) Units

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B594 - Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM B645 - Plane-Strain Fracture Toughness Testing of Aluminum Alloys
ASTM E399 - Plane-Strain Fracture Toughness of Metallic Materials
ASTM G34 - Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)
ASTM G38 - Making and Using C-Ring Stress Corrosion Cracking Test Specimen
ASTM G44 - Alternate Immersion Stress Corrosion Testing in 3.5% Sodium Chloride Solution
ASTM G85 - Modified Salt Spray (Fog) Testing

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

2.3.2 Military Standards:

MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined in accordance with AMS 2355 or MAM 2355:

	min	max
Copper	2.4	3.0
Lithium	1.9	2.6
Zirconium	0.08	0.15
Magnesium	--	0.25
Titanium	--	0.15
Iron	--	0.12
Silicon	--	0.10
Zinc	--	0.10
Manganese	--	0.05
Chromium	--	0.05
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition: Solution heat treated, cold worked, and precipitation heat treated. Actual heat treatments are proprietary but shall be performed using furnace surveys and calibration of temperature controllers and recorders in accordance with MIL-H-6088.

3.3 Properties: The product shall conform to the following requirements, determined in accordance with AMS 2355 or MAM 2355:

3.3.1 Tensile Properties: Shall be as follows:

TABLE I

Nominal Thickness Inches	Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in. 2 in. or 4D %, min
0.500 - 1.000, incl	Longitudinal	77,000	70,000	5
Over 1.000 - 1.500, incl	Longitudinal	76,000	69,000	5
0.500 - 1.000, incl	Long-Transverse	78,000	68,000	4
Over 1.000 - 1.500, incl	Long-Transverse	77,000	67,000	4

TABLE I (SI)

Nominal Thickness Millimetres	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 2% Offset MPa, min	Elongation in 50 mm or 4D %, min
12.50 - 25.00, incl	Longitudinal	530	485	5
Over 25.00 - 37.50, incl	Longitudinal	525	475	5
12.50 - 25.00, incl	Long-Transverse	540	470	4
Over 25.00 - 37.50, incl	Long-Transverse	530	460	4

3.3.2 Exfoliation Corrosion Resistance: Plate shall not show exfoliation corrosion more severe than rating EB per Fig. 4, of ASTM G34 when exposed for two weeks to test conditions of ASTM G85, Annex A2.

3.3.3 Stress-Corrosion Resistance: C-Ring specimens machined and used in accordance with ASTM G38, cut from plate 0.750 in. (18.75 mm) and over in nominal thickness shall show no evidence of stress corrosion failure when stressed in the short-transverse direction at 20,000 psi (140 MPa) and exposed for 20 days to test conditions of ASTM G44.

3.3.4 Fracture Toughness: Plate over 1.000 to 1.500 in. (over 25.00 to 37.50 mm) in nominal thickness shall have fracture toughness not lower than 25 ksi $\sqrt{in.}$ (27.5 MPa $\sqrt{m}$), determined in accordance with ASTM B645 using specimen orientation L-T in accordance with ASTM E399. L-T stress is applied in the longitudinal grain direction with crack propagating in the long-transverse direction.

3.3.4.1 Fracture toughness requirements for plate 0.500 to 1.000 in. (12.5 to 25 mm) incl, in nominal thickness shall be as agreed upon by purchaser and vendor.

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

3.4.1 Each plate weighing 2,000 lb (900 kg) or less shall be ultrasonically inspected in accordance with ASTM B594 and shall meet the Class B acceptance limits of that speciification.

3.4.1.1 The ultrasonic class for plates weighing more than 2,000 lb (900 kg) shall be as agreed upon by purchaser and vendor.

3.5 Tolerances: Shall conform to all applicable requirements of AMS 2202 or MAM 2202.

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 performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the plate conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.

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

4.3.1 The size, type, and number of replicate specimens tested for exfoliation corrosion resistance shall be as agreed upon by purchaser and vendor.

4.4 Reports:

4.4.1 The vendor of plate shall furnish with each shipment a report stating that the plate conforms to the chemical composition, and showing the results of tests on each inspection lot to determine conformance to the other acceptance test requirements of this specification. This report shall include the purchase order number, inspection lot number, AMS 4346, size, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 4346, contractor or other direct supplier of plate, part number, and quantity. When plate for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of plate to determine conformance to the requirements of this specification and shall include in the report either a statement that the plate conforms or copies of laboratory reports showing the results of tests to determine conformance.

4.5 Resampling and Retesting: Shall be in accordance with AMS 2355 or MAM 2355.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Each plate shall be marked on the face, in the respective location indicated below, with the alloy and temper designation, AMS 4346, inspection lot number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be legible, shall be applied using a suitable marking fluid, and shall be sufficiently stable to withstand normal handling. The markings shall have no deleterious effect on the plate or its performance.

5.1.1 Plate Under 6 In. (150 mm) Wide: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 ft (900 mm). The inspection lot number may appear in the row marking or may appear at only one location on each piece.

5.1.2 Plate 0.375 In. (9.50 mm) and Under Thick, 6 - 60 In. (150 - 1500 mm), Incl, Wide, and 36 - 200 In. (900 - 5000 mm), Incl, Long: Shall be marked in lengthwise rows of characters recurring at intervals not greater than 3 ft (900 mm), the rows being spaced approximately 6 in. (150 mm) on centers across the width and staggered. Every third row shall show the manufacturer's identification and nominal thickness. The other rows shall show the alloy number and temper and AMS 4346. The inspection lot number may be included in the rows with the alloy, temper, and specification designation or may appear at only one location on each piece.