

AEROSPACE MATERIAL SPECIFICATION



AMS 4306A

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Superseding AMS 4306

Aluminum Alloy, Plate
6.4Zn - 2.4Mg - 2.2Cu - 0.12Zr (7150-T6151)
Solution Heat Treated, Stress Relieved, and Aged

UNS A97150

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 moderate resistance to exfoliation corrosion (see 8.2), but usage is not limited to such applications.

1.2.1 Certain design and processing procedures may cause this plate to become susceptible to stress-corrosion cracking; ARP823 recommends practices to minimize such conditions.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2202	Tolerances, Aluminum Alloy and Magnesium Alloy Sheet and Plate
MAM 2202	Tolerances, Metric, Aluminum Alloy and Magnesium Alloy Sheet and Plate
AMS 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings

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2.1 (Continued):

- MAM 2355 Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings, Metric (SI) Units
- ARP823 Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

- ASTM B 594 Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
- ASTM B 645 Plane Strain Fracture Toughness Testing of Aluminum Alloys
- ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products
- ASTM E 602 Sharp-Notch Tension Testing with Cylindrical Specimens
- ASTM E 1304 Plain-Strain (Chevron Notch) Fracture Toughness of Metallic Materials

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

- MIL-H-6088 Heat Treatment of Aluminum Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS 2355 or MAM 2355.

TABLE 1 - Composition

Element	Min	Max
Zinc	5.9	6.9
Magnesium	2.0	2.7
Copper	1.9	2.5
Zirconium	0.08	0.15
Iron	--	0.15
Silicon	--	0.12
Manganese	--	0.10
Titanium	--	0.06
Chromium	--	0.04
Other Impurities, each	--	0.05
Other Impurities, 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 aged. Solution heat treatment shall be performed in accordance with MIL-H-6088 except that solution heat treatment temperature and times shall be as shown for alloy 7050.

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 AMS 2355 or MAM 2355 except as specified in 3.3.3.1.1 and 3.3.3.1.2.

3.3.1 Tensile Properties: Shall be as specified in Table 2. Tensile requirements apply in the long-transverse direction except when purchaser specifies that both longitudinal and long-transverse properties apply.

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 %
0.750 to 1.000, incl	Longitudinal	85.0	79.0	9
	Long-Trans.	84.0	78.0	9
Over 1.000 to 1.500, incl	Longitudinal	86.0	80.0	9
	Long-Trans.	85.0	77.0	9

TABLE 2B - Minimum Tensile Properties, SI Units

Nominal Thickness mm	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
19.05 to 25.40, incl	Longitudinal	586	545	9
	Long-Trans.	579	538	9
Over 25.40 to 38.10, incl	Longitudinal	593	552	9
	Long-Trans.	586	531	9

3.3.2 Corrosion Resistance: Electrical conductivity, determined on the surface of the plate, shall be 29.0 to 33.5% IACS (International Annealed Copper Standard) (16.8 to 19.4 MS/m). (See 8.3).

3.3.3 Fracture Toughness: When tested, plate 0.750 to 1.500 inch (19.05 to 38.10 mm), inclusive, in nominal thickness shall have K_{Ic} not lower than 22 ksi $\sqrt{\text{inch}}$ (24 MPa $\sqrt{\text{m}}$), determined in the L-T direction using full thickness specimens and specimen configurations conforming to ASTM B 645.

3.3.3.1 Notch Tensile Strength/Tensile Yield Strength (NTS/TYS) Ratios: The producer may guarantee that plate meets the fracture toughness (K_{Ic}) requirements based on correlation with notch tensile strength/tensile yield strength (NTS/TYS) ratio, determined in accordance with 3.3.3.1.1, or correlation with the short-bar fracture toughness results, determined in accordance with 3.3.3.1.2 in lieu of determining fracture toughness (3.3.3), provided that correlation between the two tests for the plate has been established.

3.3.3.1.1 For plate 0.750 to 1.500 inch (19.05 to 38.10 mm), inclusive, in nominal thickness, notch tensile strength shall be determined in accordance with ASTM E 602 on specimens taken in the longitudinal direction. The longitudinal notch tensile strength shall be divided by the tensile yield strength, determined for the same direction, to obtain the NTS/TYS ratio.

3.3.3.1.2 Short-Bar Fracture Toughness: Shall be not lower than 22 ksi $\sqrt{\text{inch}}$ (24 MPa $\sqrt{\text{m}}$), determined in accordance with ASTM E 1304.

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 Plate 0.750 to 1.500 inches (19.05 to 38.10 mm), inclusive, in nominal thickness and weighing 2000 pounds (907 kg) and under shall be ultrasonically inspected in accordance with ASTM B 594 and shall meet ultrasonic class A.

3.4.1.1 The ultrasonic class for plate under 0.750 inch (19.05 mm) or over 1.500 inches (38.10 mm) in nominal thickness or weighing over 2000 pounds (907 kg) may 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. 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:

4.2.1 Acceptance Tests: Tests for composition (3.1), long-transverse tensile properties (3.3.1) and, when specified, longitudinal tensile properties (3.3.1), ultrasonic soundness (3.4.1), and tolerances (3.5) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests for corrosion resistance (3.3.2) and fracture toughness (3.3.3) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

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

4.3.1 Tensile specimens shall be taken with the axis of specimens in the long-transverse direction and, when specified, in the longitudinal direction.