

ALUMINUM ALLOY PLATE
7.7Zn - 2.4Mg - 1.6Cu - 0.16Cr (7049-T7351)
Solution Heat Treated, Stress Relieved, and Precipitation Heat Treated

UNS A97049

1. SCOPE:

1.1 Form:

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

1.2 Application:

This product has been used typically for parts requiring high strength and resistance to stress-corrosion, but usage is not limited to such applications.

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 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

AMS 2811 Identification, Aluminum and Magnesium Alloy Wrought Products

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2.2 ASTM Publications:

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

ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products
 ASTM B 594 Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications

2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-H-6088 Heat Treatment of Aluminum Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

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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	7.2	8.2
Magnesium	2.0	2.9
Copper	1.2	1.9
Chromium	0.10	0.22
Iron	--	0.35
Silicon	--	0.25
Manganese	--	0.20
Titanium	--	0.10
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition:

Solution heat treated, stress-relieved by stretching to produce a nominal permanent set of 2%, but not less than 1-1/2% nor more than 3%, and precipitation heat treated.

3.2.1 Plate shall receive no further straightening operations after stretching.

3.3 Heat Treatment:

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Plate shall be heat treated in accordance with 3.3.1, 3.3.2, and 3.3.3. Furnace surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-H-6088.

3.3.1 Solution Heat Treatment: Heat to 875 °F ± 10 (468 °C ± 6), hold at heat for 1 - 4.5 hours, and quench in room temperature water.

3.3.2 Preaging: Maintain at room temperature for not less than 48 hours.

3.3.3 Precipitation Heat Treatment: Heat to 250 °F ± 10 (121 °C ± 6), hold at heat for 24 hours ± 0.25, further heat to 330 °F ± 10 (166 °C ± 6), hold at heat for 12 - 14 hours, and cool in air.

3.4 Properties:

Plate shall conform to the following requirements and as specified herein:

3.4.1 Tensile Properties: Shall be as specified in Table 2 and 3.4.1.1.

TABLE 2A - Tensile Properties, Inch/Pound Units

Nominal Thickness Inches	Specimen Orientation	Tensile Strength ksi, min	Yield Strength at 0.2% Offset ksi, min	Elongation in 4D %, min
0.750 to 1.000, incl	Long Trans.	74.0	65.0	8
Over 1.000 to 1.500, incl	Long Trans.	73.0	64.0	8
Over 1.500 to 2.000, incl	Long Trans.	73.0	64.0	7
Over 2.000 to 2.500, incl	Long Trans.	73.0	63.0	6
Over 2.500 to 3.000, incl	Long Trans.	72.0	62.0	6
Over 3.000 to 4.000, incl	Longitudinal	70.0	60.0	6
	Long Trans.	70.0	60.0	5
	Short Trans.	65.0	56.0	2
Over 4.000 to 4.500, incl	Longitudinal	68.0	58.0	6
	Long Trans.	68.0	58.0	5
	Short Trans.	63.0	54.0	2
Over 4.500 to 5.000, incl	Longitudinal	68.0	58.0	5
	Long Trans.	68.0	58.0	5
	Short Trans.	63.0	54.0	2

TABLE 2B - Tensile Properties, SI Units

Nominal Thickness	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 4D %, min
19.05 to 25.40, incl	Long Trans.	510	448	8
Over 25.40 to 38.10, incl	Long Trans.	503	441	8
Over 38.10 to 50.80, incl	Long Trans.	503	441	7
Over 50.80 to 63.50, incl	Long Trans.	503	434	6
Over 63.50 to 76.20, incl	Long Trans.	496	427	6
Over 76.20 to 101.60, incl	Longitudinal	483	414	6
	Long Trans.	483	414	5
	Short Trans.	448	386	2
Over 101.60 to 114.30, incl	Longitudinal	469	400	6
	Long Trans.	469	400	5
	Short Trans.	434	372	2
Over 114.30 to 127.00, incl	Longitudinal	469	400	5
	Long Trans.	469	400	5
	Short Trans.	434	372	2

3.4.1.1 Tensile property requirements for plate under 0.750 inch (19.05 mm) or over 5.000 inches (127.00 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4.2 Corrosion Resistance: Resistance to stress-corrosion cracking and to exfoliation-corrosion shall be acceptable if the plate conforms to the requirements of 3.4.2.1 and 3.4.2.2.

3.4.2.1 If the conductivity is 38.0% IACS (International Annealed Copper Standard) or higher, tensile properties meet the requirements of Table 2, and the long-transverse yield strength does not exceed the specified minimum value by more than 11.9 ksi (82.0 MPa), the plate is acceptable.

3.4.2.2 If the requirements of 3.4.2.1 are not met, the plate is unacceptable but may be re-heat treated or given additional precipitation heat treatment and if, upon completion of such treatment, the plate develops tensile property/conductivity relationship conforming to 3.4.2.1, the plate shall be acceptable.

3.4.3 Stress-Corrosion Resistance: Specimens from plate shall show no evidence of stress-corrosion cracking when stressed in the long-transverse direction to 45.0 ksi (310 MPa).

3.4.4 Ultrasonic Soundness: When specified, each plate shall be inspected in accordance with ASTM B 594 and shall meet the following requirements:

- 3.4.4.1 Plates weighing 2000 pounds (907 kg) or under shall meet the requirements for ultrasonic class shown in Table 3:

TABLE 3 - Ultrasonic Class

Plate Thickness Inches	Plate Thickness Millimeters	Ultrasonic Class
0.500 - 1.500, excl	12.70 - 38.10, excl	B
1.500 - 3.000, incl	38.10 - 76.20, incl	A
Over 3.000 - 4.500, incl	Over 76.20 - 114.30, incl	B

- 3.4.4.2 The ultrasonic class for plates weighing over 2000 pounds (907 kg) or over 4.500 inches (114.30 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.5 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.

3.6 Tolerances:

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

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

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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.

4.2 Classification of Tests:

- 4.2.1 Acceptance Tests: Tests for composition (3.1), tensile properties (3.4.1), conductivity (3.4.2), and, when specified, ultrasonic soundness (3.4.4) are acceptance tests and shall be performed on each lot.
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- 4.2.2 Periodic Tests: Tests for stress-corrosion resistance (3.4.3) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.
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