



AEROSPACE MATERIAL SPECIFICATION

AMS 4200

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

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Revised

ALUMINUM ALLOY PLATE 7.7Zn - 2.4Mg - 1.6Cu - 0.16Cr (7049-T7351)

1. SCOPE:

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

1.2 Application: Primarily for parts requiring high strength and resistance to stress-corrosion.

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

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2202 - Tolerances, Aluminum and Magnesium Alloy Sheet and Plate

AMS 2350 - Standards and Test Methods

AMS 2355 - Quality Assurance Sampling and Testing of Aluminum-Base and Magnesium-Base Alloys, Wrought Products (Except Forgings and Forging Stock) and Flash Welded Rings

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

ASTM G47 - Determining Susceptibility to Stress-Corrosion Cracking of High Strength 7XXX Aluminum Alloy Products

2.3 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

MIL-I-8950 - Inspection, Ultrasonic, Wrought Metals, Process for

2.3.2 Military Standards:

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

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3. TECHNICAL REQUIREMENTS:

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

	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: Plate shall be heat treated in accordance with 3.3.1, 3.3.2, and 3.3.3, using equipment and controls specified in MIL-H-6088.

3.3.1 Solution Heat Treatment: Heat to 875° F \pm 10 (468° C \pm 6), hold at heat for 1 - 4.5 hr, 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 \pm 10 (121° C \pm 6), hold at heat for 24 hr \pm 0.25, further heat to 330° F \pm 10 (166° C \pm 6), hold at heat for 12 - 14 hr, and cool in air.

3.4 Properties: Plate shall conform to the following requirements, determined in accordance with AMS 2355 and as specified herein:

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

TABLE I

Nominal Thickness Inches	Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 4D %, min
0.750 to 1.000, incl	Long Trans.	74,000	65,000	8
	Long Trans.	73,000	64,000	8
Over 1.000 to 1.500, incl	Long Trans.	73,000	64,000	7
	Long Trans.	73,000	63,000	6
Over 1.500 to 2.000, incl	Long Trans.	73,000	63,000	6
	Long Trans.	72,000	62,000	6
Over 2.000 to 2.500, incl	Longitudinal	70,000	60,000	6
	Long Trans.	70,000	60,000	5
	Short Trans.	65,000	56,000	2
Over 2.500 to 3.000, incl	Longitudinal	68,000	58,000	6
	Long Trans.	68,000	58,000	5
	Short Trans.	63,000	54,000	2
Over 3.000 to 4.000, incl	Longitudinal	68,000	58,000	5
	Long Trans.	68,000	58,000	5
	Short Trans.	63,000	54,000	2
Over 4.000 to 4.500, incl	Longitudinal	68,000	58,000	5
	Long Trans.	68,000	58,000	5
	Short Trans.	63,000	54,000	2
Over 4.500 to 5.000, incl	Longitudinal	68,000	58,000	5
	Long Trans.	68,000	58,000	5
	Short Trans.	63,000	54,000	2

TABLE I (SI)

Nominal Thickness Millimetres	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 4D %, min
19 to 25, incl	Long Trans.	510	448	8
Over 25 to 38, incl	Long Trans.	503	441	8
Over 38 to 51, incl	Long Trans.	503	441	7
Over 51 to 64, incl	Long Trans.	503	434	6
Over 64 to 76, incl	Long Trans.	496	427	6
Over 76 to 102, incl	Longitudinal	483	414	6
	Long Trans.	483	414	5
	Short Trans.	448	386	2
Over 102 to 114, incl	Longitudinal	469	400	6
	Long Trans.	469	400	5
	Short Trans.	434	372	2
Over 114 to 127, incl	Longitudinal	469	400	5
	Long Trans.	469	400	5
	Short Trans.	434	372	2

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

3.4.2 Conductivity: Shall be not lower than 38% IACS (International Annealed Copper Standard). In addition, the tensile properties shall meet the requirements of Table I and the long transverse yield strength shall not exceed the specified minimum value by more than 11,900 psi (82 MPa).

3.4.2.1 If the conductivity is below 38% IACS, or if the long transverse yield strength exceeds the specified minimum value by more than 11,900 psi (82 MPa), regardless of the conductivity, the plate is suspect.

3.4.2.2 Plate found to be suspect may be given additional precipitation heat treatment and if, upon completion of such treatment, it develops conductivity/property relationships conforming to 3.4.2, it shall be acceptable.

3.4.3 Stress-Corrosion Resistance: Specimens from plate, processed to meet the requirements of 3.4.1 and 3.4.2 and stressed to 45,000 psi (310 MPa), shall meet the requirements of ASTM G47.

3.4.4 Ultrasonic Soundness: When specified, each plate shall be inspected in accordance with MIL-I-8950 and shall meet the following requirements:

3.4.4.1 Unless otherwise specified, plates weighing 2000 lb (908 kg) or less shall meet the requirements for ultrasonic class shown below:

Plate Thickness		Ultrasonic Class
Inches	(Millimetres)	
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 lb (908 kg) or over 4.500 in. (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 internal and external imperfections detrimental to usage of the plate.

3.6 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2202.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of plate shall supply all samples 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 perform such confirmatory testing as he deems necessary to ensure that the plate conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to composition (3.1), tensile property (3.4.1), conductivity (3.4.2), and, when specified, ultrasonic soundness (3.4.4) requirements are classified as acceptance tests.

4.2.2 Periodic Tests: Tests to determine conformance to stress-corrosion resistance (3.4.3) requirements are classified as periodic tests.

4.3 Sampling: Shall be in accordance with AMS 2355 and the following; a lot shall be all plate of the same nominal thickness which has been heat treated together and submitted for vendor's inspection at the same time. The frequency and extent of sampling and the locations from which specimens are taken for periodic tests shall be as agreed upon by purchaser and vendor.

4.3.1 Specimens for tensile tests shall be taken with axis of specimens parallel to each applicable grain flow direction specified in Table I.

4.3.2 Specimens for conductivity testing shall be taken from the same samples used for tensile testing.

4.4 Reports:

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

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, 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 a statement that the plate conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

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

5. PREPARATION FOR DELIVERY:

5.1 Identification: Each plate shall be marked on one face, in the respective location indicated below, with the alloy number and temper, AMS 4200, inspection lot number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be sufficiently stable to withstand normal handling. The marking shall have no deleterious effect on the plate or its performance.