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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 4205A

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Superseding AMS 4205

ALUMINUM ALLOY PLATE
6.2Zn - 1.8Cu - 2.4Mg - 0.13Zr (7010-T73651)
Solution Heat Treated, Stress Relieved, 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 parts requiring higher tensile strength than AMS 4203 and good resistance to stress-corrosion cracking and exfoliation corrosion.

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 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 Alloy and Magnesium Alloy Sheet and Plate
MAM 2202 - Tolerances, Metric, Aluminum Alloy 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 ASTM, 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 B660 - Packaging/Packing of Aluminum and Magnesium Products

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

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
Zinc	5.7	6.7
Copper	1.5	2.0
Magnesium	2.1	2.6
Zirconium	0.10	0.16
Iron	--	0.15
Silicon	--	0.12
Manganese	--	0.10
Titanium	--	0.06
Nickel	--	0.05
Chromium	--	0.05
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. Heat treatments shall be performed at the proper temperatures and for the proper times to produce plate meeting the requirements of 3.3; furnace surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-H-6088.

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 and as specified herein:

3.3.1 Tensile Properties: Shall be as specified in Table I and 3.3.1.1.

TABLE I

Nominal Thickness Inches	Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 Inches or 4D %, minimum
Up to 2.000, incl	Longitudinal	71,000	62,000	9
	Long-Trans.	72,000	62,000	6
Over 2.000 to 2.500, incl	Longitudinal	71,000	62,000	9
	Long-Trans.	72,000	62,000	6
	Short-Trans.	67,000	57,000	2.5
Over 2.500 to 4.000, incl	Longitudinal	70,000	61,000	9
	Long-Trans.	71,000	61,000	6
	Short-Trans.	66,000	56,000	2
Over 4.000 to 5.000, incl	Longitudinal	68,000	59,000	9
	Long-Trans.	69,000	59,000	5
	Short-Trans.	65,000	54,000	2
Over 5.000 to 5.500, incl	Longitudinal	66,000	57,000	8
	Long-Trans.	67,000	57,000	5
	Short-Trans.	63,000	53,000	2

TABLE I (SI)

Nominal Thickness Millimetres	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, miniumum
Up to 50.80 incl	Longitudinal	490	427	9
	Long-Trans.	496	427	6
Over 50.80 to 63.50, incl	Longitudinal	490	427	9
	Long-Trans.	496	427	6
	Short-Trans.	462	393	2.5
Over 63.50 to 101.60, incl	Longitudinal	483	421	9
	Long-Trans.	490	421	6
	Short-Trans.	455	386	2
Over 101.60 to 127.00, incl	Longitudinal	469	407	9
	Long-Trans.	476	407	5
	Short-Trans.	448	372	2
Over 127.00 to 139.70, incl	Longitudinal	455	393	8
	Long-Trans.	462	393	5
	Short-Trans.	434	365	2

3.3.1.1 Tensile property requirements for plate over 5.500 inches (139.70 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.2 Conductivity: Shall be not lower than 40.0% IACS (International Annealed Copper Standard) (23.2 MS/m), determined on specimens as in 4.3.1.

3.3.2.1 If the conductivity is below 40.0% IACS (23.2 MS/m) the plate is not acceptable but may be re-heat treated or given additional precipitation heat treatment and if, upon completion of such treatment, it develops tensile property/conductivity relationships conforming to 3.3.1 and 3.3.2, it shall be acceptable.

3.3.3 Fracture Toughness: When specified, plate shall meet the values of K_{Ic} specified in Table II, determined in accordance with ASTM B645 on specimens as in 4.3.2. The required test direction shall be as specified by purchaser.

TABLE II

Nominal Thickness Inches	Test Direction	K_{Ic}, min Ksi $\sqrt{in.}$
2.000 to 5.500, incl	L-T	24.0
	T-L	22.0
	S-L	20.0

TABLE II (SI)

Nominal Thickness Millimetres	Test Direction	K_{Ic}, min MPa $\sqrt{m}$
50.80 to 139.70, incl	L-T	26.4
	T-L	24.2
	S-L	22.0

3.3.4 Exfoliation Resistance: Plate shall exhibit exfoliation corrosion not worse than an EA rating.

3.3.5 Stress-Corrosion Resistance: Specimens from plate, 0.750 inch (19.05 mm) and over in nominal thickness, shall show no evidence of stress-corrosion cracking when stressed in the short-transverse direction to 50% of the specified minimum long-transverse yield strength for nominal thicknesses 3 inches (76 mm) and under and to 35,000 psi (241 MPa) for nominal thicknesses over 3 inches (76 mm).

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 Ø When specified, plates weighing 2000 pounds (907 kg) and under, inspected in accordance with ASTM B594, shall meet the following requirements for ultrasonic class:

Nominal Thickness		Ultrasonic Class
Inches	Millimetres	
0.500 to 1.500, excl	12.70 to 38.10, excl	B
1.500 to 3.000, incl	38.10 to 76.20, incl	A
Over 3.000 to 4.500, incl	Over 76.20 to 114.30, incl	B

3.4.1.1 The ultrasonic class for plates under 0.500 inch (12.70 mm) or over 4.500 inches (114.30 mm) in nominal thickness or weighing over 2000 pounds (907 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:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.3.1), conductivity (3.3.2), fracture toughness (3.3.3) when specified, ultrasonic soundness (3.4.1) when specified, and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for exfoliation resistance (3.3.4) and stress-corrosion resistance (3.3.5) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

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

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

4.3.2 Specimens for fracture toughness testing shall be taken from the center width of at least one plate in each inspection lot for each test direction specified.

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, showing the results of tests on each inspection 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, inspection lot number, AMS 4205A, size, and quantity.