SAE The Engineering Resource For Advancing Mobility
400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4203

Issued 7-1-82
Revised

ALUMINUM ALLOY PLATE
6.2Zn - 1.8Cu - 2.4Mg - 0.13Zr (7010-T7351)
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 a combination of good tensile properties, resistance to stress-corrosion cracking, exfoliation, and fracture toughness.

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 SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2202 - Tolerances, Aluminum Alloy 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 B645 - Plane-Strain Fracture Toughness Testing of Aluminum Alloys
ASTM G47 - Determining Susceptibility to Stress-Corrosion Cracking of High-Strength Aluminum Alloy 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
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

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined in accordance with AMS 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 using equipment and procedural controls 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 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 in. or 4D %, min
Up to 2.000, incl	Longitudinal	67,000	55,000	9
	Long Trans.	68,000	55,000	7
Over 2.000 to 3.000, incl	Longitudinal	67,000	55,000	9
	Long Trans.	68,000	55,000	7
	Short Trans.	63,000	49,000	3
Over 3.000 to 4.000, incl	Longitudinal	66,000	54,000	9
	Long Trans.	67,000	54,000	7
	Short Trans.	62,000	48,000	3
Over 4.000 to 5.000, incl	Longitudinal	65,000	53,000	9
	Long Trans.	66,000	53,000	6
	Short Trans.	61,000	47,000	3
Over 5.000 to 5.500, incl	Longitudinal	64,000	52,000	9
	Long Trans.	65,000	52,000	5
	Short Trans.	60,000	46,000	3

TABLE I (SI)

Nominal Thickness Millimetres	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50 mm or 4D %, min
Up to 50, incl	Longitudinal	460	380	9
	Long Trans.	470	380	7
Over 50 to 75, incl	Longitudinal	460	380	9
	Long Trans.	470	380	7
	Short Trans.	435	340	3
Over 75 to 100, incl	Longitudinal	455	370	9
	Long Trans.	460	370	7
	Short Trans.	425	330	3
Over 100 to 125, incl	Longitudinal	450	365	9
	Long Trans.	455	365	6
	Short Trans.	420	325	3
Over 125 to 140, incl	Longitudinal	440	360	9
	Long Trans.	450	360	5
	Short Trans.	415	315	3

3.3.1.1 Tensile property requirements for plate over 5.5 in. (140 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.2 Conductivity: Shall be not lower than 41.0% IACS (International Annealed Copper Standard), determined on specimens as in 4.3.1.

3.3.2.1 If the conductivity is below 41.0% IACS, the plate is not acceptable.

3.3.2.2 Plate found to be unacceptable may be 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: 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 directions shall be as specified by purchaser.

TABLE II

Nominal Thickness Inches	Test Direction	K_{Ic}, min Ksi $\sqrt{in.}$
Over 2 to 4, incl	L-T	29.0
	T-L	26.0
	S-L	23.0
Over 4 to 5.5, incl	L-T	26.0
	T-L	24.0
	S-L	22.0

TABLE II (SI)

Nominal Thickness Millimetres	Test Direction	K_{Ic}, min MPa $\sqrt{m}$
Over 50 to 100, incl	L-T	31.9
	T-L	28.6
	S-L	25.3
Over 100 to 140, incl	L-T	28.6
	T-L	26.4
	S-L	24.2

3.3.4 Exfoliation Resistance: Plate processed to meet the requirements of 3.3.1 and 3.3.2 shall exhibit exfoliation corrosion not worse than an EA rating.

3.3.5 Stress-Corrosion Resistance: Specimens from plate 0.750 in. (19 mm) and over in nominal thickness, processed to meet the requirements of 3.3.1 and 3.3.2, shall meet the requirements of ASTM G47 when stressed in the short-transverse direction to 75% of the specified minimum long-transverse yield strength.

3.4 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.

3.4.1 When specified, each plate weighing 2000 lb (900 kg) and under, inspected in accordance with MIL-I-8950, shall meet the following requirements for ultrasonic class:

Nominal Thickness		Ultrasonic Class
Inches	(Millimetres)	
0.500 to 1.500, excl	(12.50 to 37.50, excl)	B
1.500 to 3.000, incl	(37.50 to 75.00, incl)	A
Over 3.000 to 4.500, incl	(Over 75.00 to 112.50, incl)	B

3.4.1.1 The ultrasonic class for plates under 0.500 in. (12.50 mm) or over 4.500 in. (112.50 mm) in nominal thickness or weighing over 2000 lb (900 kg) shall be as agreed upon by purchaser and vendor.

3.5 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 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), 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 and the following:

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

4.3.2 When fracture toughness testing is required, specimens for testing shall, unless otherwise specified, 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 three copies of a report stating that the plate conforms to the chemical composition specified, 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 4203, size, and quantity.