AEROSPACE MATERIAL SPECIFICATION

AMS4365™	REV. A
Issued 2017-06 Revised 2022-12 Superseding AMS4365	

Aluminum Alloy, Plate
7.9Zn - 1.2Cu - 2.1Mg - 0.10Zr (7097-T7651)
Solution Heat Treated, Stress Relieved, and Overaged

RATIONALE

AMS4365A results from a Five-Year Review and update of this specification with changes to update wording to prohibit unauthorized exceptions (3.3.1.1, 3.6, 8.4), update applicable documents (Section 2), and allow the use of the immediate prior specification revision (8.3).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of plate from 3.000 to 8.000 inches (76.20 to 203.20 mm) in thickness (see 8.5).

1.2 Application

This plate has been used typically for parts requiring a high level of tensile properties in conjunction with good fracture toughness and moderate resistance to stress-corrosion cracking, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2355	Quality Assurance, Sampling and Testing, Aluminum Alloys and Magnesium Alloy, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings
AMS2772	Heat Treatment of Aluminum Alloy Raw Materials
AS7766	Terms Used in Aerospace Metals Specifications

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS4365A/

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products

ASTM B660 Packing/Packaging of Aluminum and Magnesium Products

ASTM B666/B666M Identification Marking of Aluminum and Magnesium Products

ASTM E466 Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials

ASTM G34 Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)

ASTM G47 Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products

2.3 ANSI Accredited Publications

Copies of these documents are available online at https://webstore.ansi.org/.

ANSI H35.1/H35.1M Alloy and Temper Designation Systems for Aluminum

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products

ANSI H35.2M Dimensional Tolerances for Aluminum Mill Products (Metric)

2.4 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Composition shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2355.

Table 1 - Composition

Element	Min	Max
Silicon	--	0.12
Iron	--	0.15
Copper	0.8	1.6
Manganese	--	0.04
Magnesium	1.6	2.6
Chromium	--	0.04
Zinc	7.4	8.4
Titanium	--	0.06
Zirconium	0.05	0.15
Other Elements, each	--	0.05
Other Elements, 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 precipitation heat treated to the T7651 temper (refer to ANSI H35.1/H35.1M). Solution and precipitation heat treatment shall be performed in accordance with AMS2772 as applicable to 7XXX alloys. The actual practices are considered proprietary.

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 AMS2355 on the mill produced size and as specified herein.

3.3.1 Tensile Properties

Shall be as specified in Table 2.

3.3.1.1 Mechanical properties for product outside the range covered by Table 2 shall be agreed upon between purchaser and producer and reported per 4.4.1 (see 8.5).

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 %
3.000 to 4.000, incl	Longitudinal	74.0	71.0	12
	Long Trans.	77.0	71.0	7
	Short Trans.	75.0	66.0	4
4.001 to 5.000, incl	Longitudinal	74.0	71.0	11
	Long Trans.	76.0	70.0	6
	Short Trans.	74.0	65.0	3
5.001 to 6.000, incl	Longitudinal	74.0	71.0	9
	Long Trans.	76.0	69.0	4
	Short Trans.	73.0	65.0	3
6.001 to 7.000, incl	Longitudinal	74.0	70.0	8
	Long Trans.	75.0	68.0	3
	Short Trans.	72.0	64.0	3
7.001 to 8.000, incl	Longitudinal	73.0	69.0	6
	Long Trans.	74.0	67.0	3
	Short Trans.	71.0	63.0	3

Table 2B - Minimum tensile properties, SI units

Nominal Thickness Millimeters	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
76.20 to 101.60, incl	Longitudinal	510	490	12
	Long Trans.	531	490	7
	Short Trans.	517	455	4
Over 101.60 to 127.00, incl	Longitudinal	510	490	11
	Long Trans.	524	483	6
	Short Trans.	510	448	3
Over 127.00 to 152.40, incl	Longitudinal	510	490	9
	Long Trans.	524	476	4
	Short Trans.	503	448	3
Over 152.40 to 177.80, incl	Longitudinal	510	483	8
	Long Trans.	517	469	3
	Short Trans.	496	441	3
Over 177.80 to 203.20, incl	Longitudinal	503	476	6
	Long Trans.	510	462	3
	Short Trans.	490	434	3

3.3.2 Electrical Conductivity

Shall be not lower than 39.0% IACS (International Annealed Copper Standard) (22.6 MS/m), as determined on the surface of the plate.

3.3.2.1 Plate not meeting the requirements of 3.3.2 may be given additional precipitation heat treatment or reheat treated. After such treatment, if all specified properties are met, the plate is acceptable.

3.3.3 Exfoliation Corrosion Resistance

Plate shall not exhibit exfoliation-corrosion greater than that illustrated by Photo B, Figure 2, when tested in accordance with ASTM G34.

3.3.4 Stress Corrosion Cracking

Specimens shall be tested in accordance with ASTM G47 and shall show no evidence of stress corrosion cracking when stressed in the short transverse direction to 26.0 ksi (179 MPa) for a duration of 20 days.

3.3.5 Fatigue Resistance

When specified, 5.001 to 8.000 inches (127.00 to 203.20 mm), inclusive, thick plate shall be tested in accordance with ASTM E466. When tested at a stress ratio of R = 0.1 at a maximum stress of 35.0 ksi (241 MPa), the fatigue life shall meet the requirements of Table 3.

Table 3 - Fatigue life requirements

Minimum cycles per test	90000 cycles
Lot log average of four tests, minimum	120000 cycles
Runout	150000 cycles

3.3.6 Fracture Toughness

When specified, plane strain fracture toughness shall be tested in accordance with ASTM E399 and ASTM B645 for plate 3.000 to 8.000 inches (76.20 to 203.20 mm), inclusive, in nominal thickness. A valid K_{Ic} meeting the requirements of ASTM E399 or a K_Q "useable for lot release" in accordance with ASTM B645 shall meet or exceed the values specified in Table 4.

Table 4A - Minimum K_{Ic} or K_Q "useable for lot release" fracture toughness, inch/pound units

Nominal Thickness Inches	L-T ksi √inch	T-L ksi √inch	S-L ksi √inch
3.000 to 4.000, incl	29	25	24
4.001 to 5.000, incl	28	24	23
5.001 to 6.000, incl	27	23	22
6.001 to 7.000, incl	26	22	22
7.001 to 8.000, incl	25	21	21

Table 4B - Minimum K_{Ic} or K_Q "useable for lot release" fracture toughness, SI units

Nominal Thickness Millimeters	L-T MPa √m	T-L MPa √m	S-L MPa √m
76.20 to 101.60, incl	32	27	26
Over 101.60 to 127.00, incl	31	26	25
Over 127.00 to 152.40, incl	30	25	24
Over 152.40 to 177.80, incl	29	24	24
Over 177.80 to 203.20, incl	27	23	23

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 When specified, each plate 3.000 to 8.000 inches (76.20 to 203.20 mm) shall be ultrasonically inspected in accordance with ASTM B594 and shall meet the requirements of 3.4.1.1.

3.4.1.1 Plates shall meet the requirements for ultrasonic Class A for plate 3.000 to 8.000 inches (76.20 to 203.2 mm) in nominal thickness.

3.5 Tolerances

Shall conform to all applicable requirements of ANSI H35.2 or H35.2M.

3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of plate shall supply all samples for producer's tests and shall be responsible for the performance of 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 specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.3.1), electrical conductivity (3.3.2), tolerances (3.5), when specified, fatigue resistance (3.3.5), when specified, fracture toughness (3.3.6), and when specified, ultrasonic soundness (3.4.1) are acceptance tests and except for composition, shall be performed on each inspection lot.

4.2.2 Periodic Tests

Exfoliation corrosion resistance (3.3.3) and stress corrosion cracking (3.3.4) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2355 and the following:

4.3.1 Tensile Testing

Tensile specimens shall be taken with axis of specimens parallel to each applicable grain flow direction specified in Table 2.

4.3.2 Fatigue Resistance Testing

Two specimens for fatigue testing shall be taken from each end of the parent plate in the long transverse grain direction. These specimens are to be removed from the T/2, W/2 location. Fatigue testing shall be conducted in air at 70 °F ± 5 °F (21 °C ± 3 °C) with a relative humidity of 30 to 50% using a frequency of 10 to 50 Hz. The test specimens shall meet the following requirements:

4.3.2.1 Fatigue Specimen Design

Fatigue samples shall be machined to ASTM E466, Figure 1. The specimen shall have a 0.500 inch (12.70 mm) gage diameter, a 2.00 inch (50.80 mm) gage section, and 3.0 inch (76.20 mm) fillet radius. The grip section may be varied to fit different grip configurations, but should have no less than a 1.0 inch (25.4 mm) diameter.