



AEROSPACE MATERIAL SPECIFICATION

AMS4378™**REV. A**Issued 2018-10
Revised 2024-04

Superseding AMS4378

Aluminum Alloy, Plate (7160-T7651),
7.0Zn - 2.2Cu - 1.5Mg - 0.10Zr,
Solution Heat Treated, Stress Relieved, and Overaged

RATIONALE

AMS4378A results from a Five-Year Review and update of this specification with changes to update wording to prohibit unauthorized exceptions (see 3.3.6 and 8.3), update Applicable Documents (see Section 2), relocate Definitions (see 2.4), and allow the use of the immediate prior specification revision (see 8.4).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of plate 1.000 to 6.000 inches (25.40 to 152.40 mm), inclusive, in nominal thickness (see 8.5).

1.2 Application

This plate has been used typically for parts requiring a high level of mechanical properties 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

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For more information on this standard, visit
<https://www.sae.org/standards/content/AMS4378A>

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 B645	Linear-Elastic Plane Strain Fracture Toughness Testing of Aluminum Alloys
ASTM B660	Packing/Packaging of Aluminum and Magnesium Products
ASTM B666/B666M	Identification Marking of Aluminum and Magnesium Products
ASTM E399	Linear-Elastic Plane-Strain Fracture Toughness 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 System 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

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

Table 1 - Composition

Element	Min	Max
Silicon	--	0.10
Iron	--	0.10
Copper	1.9	2.5
Manganese	--	0.05
Magnesium	1.0	2.0
Zinc	6.7	7.3
Titanium	--	0.06
Zirconium	0.04	0.15
Other elements, each	--	0.05
Other elements, total	--	0.15
Aluminum	remainder	

3.2 Condition

Solution heat treated, stress relieved by stretching to produce a nominal permanent set of 1-1/2 to 3%, and artificially aged to 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.

3.3 Properties

Plate shall conform to the following requirements, determined in accordance with AMS2355 on the mill-produced product and as specified herein.

3.3.1 Tensile Properties

Shall be as specified in Table 2.

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 %
1.000 to 1.500, incl	Longitudinal	79.0	74.0	13
	Long-Trans.	78.0	72.0	13
Over 1.500 to 2.000, incl	Longitudinal	78.0	74.0	12
	Long-Trans.	78.0	72.0	12
	Short-Trans.	75.0	66.0	6
Over 2.000 to 3.000, incl	Longitudinal	76.0	72.0	12
	Long-Trans.	77.0	71.0	11
	Short-Trans.	74.0	65.0	5
Over 3.000 to 4.000, incl	Longitudinal	75.0	72.0	12
	Long-Trans.	77.0	70.0	10
	Short-Trans.	73.0	64.0	4
Over 4.000 to 5.000, incl	Longitudinal	74.0	71.0	11
	Long-Trans.	76.0	69.0	9
	Short-Trans.	73.0	64.0	4
Over 5.000 to 6.000, incl	Longitudinal	74.0	70.0	10
	Long-Trans.	75.0	68.0	8
	Short-Trans.	72.0	63.0	4

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 %
25.40 to 38.10, incl	Longitudinal	545	510	13
	Long-Trans.	538	496	13
Over 38.10 to 50.80, incl	Longitudinal	538	510	12
	Long-Trans.	538	496	12
	Short-Trans.	517	455	6
Over 50.80 to 76.20, incl	Longitudinal	524	496	12
	Long-Trans.	531	490	11
	Short-Trans.	510	448	5
Over 76.20 to 101.60, incl	Longitudinal	517	496	12
	Long-Trans.	531	483	10
	Short-Trans.	503	441	4
Over 101.60 to 127.00, incl	Longitudinal	510	490	11
	Long-Trans.	524	476	9
	Short-Trans.	503	441	4
Over 127.00 to 152.40, incl	Longitudinal	510	483	10
	Long-Trans.	517	469	8
	Short-Trans.	496	434	4

3.3.2 Electrical Conductivity

Shall be not lower than 38% IACS (International Annealed Copper Standard) (22.0 MS/m), determined on the surface of the tensile coupon.

3.3.3 Exfoliation-Corrosion Test

Material shall not exhibit exfoliation corrosion greater than that illustrated by Photograph EB of Figure 2 of ASTM G34.

3.3.4 Stress-Corrosion Test

When specified, specimens shall show no evidence of stress-corrosion cracking when stressed in the short-transverse direction at 25.0 ksi (172 MPa) for 20 days in accordance with ASTM G47 (see 8.5).

3.3.5 Fracture Toughness

When specified (see 8.3), plane strain fracture toughness shall be tested in accordance with ASTM E399 and ASTM B645. A valid K_{IC} meeting the requirements of ASTM E399, or a K_Q "usable for lot release" in accordance with ASTM B645, shall meet or exceed the values shown in Table 3. For T-L and L-T test directions for plate over 4 inches (102 mm) in nominal thickness, use specimens 2 inches (51 mm) minimum thickness centered at T/4. For the S-L test direction, the test specimen shall be centered at T/2. Required specimen orientation(s) shall be specified by the purchaser (see 8.5).

Table 3A - Minimum fracture toughness parameters, inch/pound units

Nominal Thickness Inches	L-T ksi $\sqrt{\text{inch}}$	T-L ksi $\sqrt{\text{inch}}$	S-L ksi $\sqrt{\text{inch}}$
1.000 to 2.000, incl	34	29	--
Over 2.000 to 3.000, incl	32	27	29
Over 3.000 to 4.000, incl	29	26	28
Over 4.000 to 5.000, incl	25	24	26
Over 5.000 to 6.000, incl	22	23	24

Table 3B - Minimum fracture toughness parameters, SI units

Nominal Thickness Millimeters	L-T MPa $\sqrt{\text{m}}$	T-L MPa $\sqrt{\text{m}}$	S-L MPa $\sqrt{\text{m}}$
25.4 to 50.80, incl	37	32	--
Over 50.80 to 76.20, incl	35	30	32
Over 76.20 to 101.60, incl	32	29	31
Over 101.60 to 127.00, incl	27	26	29
Over 127.00 to 152.40, incl	24	25	26

3.3.6 Mechanical property requirements for sheet and plate outside the thickness range of 1.1 shall be as agreed upon by the purchaser and producer and reported per 4.4.1 (see 8.5).

3.4 Quality

Plate, as received by the 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 Each plate 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 nominal thickness of 1.000 to 6.000 inches (25.40 to 152.40 mm).

3.5 Tolerances

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

3.6 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 the producer's tests and shall be responsible for the performance of all required tests. The purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the plate conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (see 3.1), tensile properties (see 3.3.1), electrical conductivity (see 3.3.2), stress-corrosion resistance (when specified; see 3.3.4), fracture toughness (when specified; see 3.3.5), tolerances (see 3.5), and ultrasonic soundness (see 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 (see 3.3.3) is a periodic test and shall be performed at a frequency selected by the producer unless frequency of testing is specified by the purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2355 and the following: