



AEROSPACE MATERIAL SPECIFICATION

AMS4470™

REV. D

Issued 2009-10
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Superseding AMS4470C

Aluminum Alloy, Plate (7085-T7451),
7.5Zn - 1.6Cu - 1.5Mg - 0.12Zr,
Solution Heat Treated, Stress-Relieved, and Overaged
(Composition similar to UNS A97085)

RATIONALE

AMS4470D 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 8.4), relocate Definitions (see 2.4), and update Applicable Documents (see Section 2) and Ordering Information (see 8.5).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of plate 3.000 to 7.000 inches (76.20 to 177.80 mm) in nominal thickness (see 8.5).

1.2 Application

This product may be used in aerospace applications requiring a high level of mechanical properties and fracture toughness, good resistance to stress-corrosion cracking, and resistance to exfoliation corrosion, 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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<https://www.sae.org/standards/content/AMS4470D/>

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	Packaging/Packing 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	Standard 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	--	0.06
Iron	--	0.08
Copper	1.3	2.0
Manganese	--	0.04
Magnesium	1.2	1.8
Chromium	--	0.04
Zinc	7.0	8.0
Titanium	--	0.06
Zirconium	0.08	0.15
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.2 Condition

Heat treatment shall be in accordance with AMS2772 to the -T7451 temper (refer to ANSI H35.1/H35.1M) and as follows: solution heat-treatment and artificial age practices are proprietary. Material shall be stretched not less than 1-1/2% nor more than 3% prior to artificial aging.

3.3 Properties

Product shall conform to the following requirements, determined in accordance with AMS2355:

3.3.1 Tensile properties shall be as shown in Table 2.

Table 2A - Minimum tensile properties, inch/pound units

Nominal Thickness Inches	Grain Direction	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
3.000 to 4.000	L	73.0	68.0	11
	LT	73.0	66.0	8
	ST	72.0	61.0	4
4.001 to 5.000	L	73.0	68.0	10
	LT	73.0	66.0	7
	ST	71.0	61.0	4
5.001 to 6.000	L	72.0	68.0	9
	LT	73.0	65.0	6
	ST	70.0	61.0	4
6.001 to 7.000	L	72.0	67.0	8
	LT	72.0	64.0	5
	ST	69.0	60.0	4

Table 2B - Minimum tensile properties, SI units

Nominal Thickness Millimeters	Grain Direction	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
76.20 to 101.60	L	503	469	11
	LT	503	455	8
	ST	496	421	4
101.62 to 127.00	L	503	469	10
	LT	503	455	7
	ST	490	421	4
127.02 to 152.40	L	496	469	9
	LT	503	448	6
	ST	483	421	4
152.42 to 177.80	L	496	462	8
	LT	496	441	5
	ST	476	414	4

3.3.2 Electrical Conductivity

Shall be not lower than 40.0% IACS (International Annealed Copper Standard) (23.2 MS/m), determined on the plate surface.

3.3.3 Exfoliation-Corrosion Resistance

Specimens cut from plate shall not exhibit exfoliation corrosion at the T/2 plane greater than that illustrated by Photograph B, Figure 2, of ASTM G34.

3.3.4 Stress-Corrosion Cracking

When specified, specimens from plate 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 35 ksi (241 MPa).

3.3.5 Fracture Toughness

When specified, plane strain fracture toughness shall be tested in accordance with ASTM E399 and ASTM B645. The required test orientations shall be specified by the purchaser (see 8.5). The test specimens shall meet the following requirements:

- 3.3.5.1 For L-T and T-L test orientations of plate 3.000 to 7.000 inches (76.20 to 177.80 mm) in nominal thickness, use specimens having a width (W) of 5.0 inches (127 mm) and a thickness (B) of 2.5 inches (63.5 mm).
- 3.3.5.2 For plate 3.000 to 5.000 inches (76.20 to 127.00 mm) in nominal thickness, the L-T and T-L specimens shall be centered at T/2.
- 3.3.5.3 For plate 5.001 to 7.000 inches (127.02 to 177.80 mm) in nominal thickness, the L-T and T-L specimens shall be centered at T/4.
- 3.3.5.4 For the S-L test orientation of plate 3.000 to 3.199 inches (76.20 to 81.25 mm) in nominal thickness, use specimens having a width (W) of 2.0 inches (50.8 mm) and a thickness (B) of 1.0 inch (25.4 mm).
- 3.3.5.5 For the S-L test orientation of plate 3.200 to 3.799 inches (81.28 to 96.49 mm) in nominal thickness, use specimens having a width (W) of 2.5 inches (63.5 mm) and a thickness (B) of 1.25 inches (31.7 mm).
- 3.3.5.6 For the S-L test orientation of plate 3.800 to 5.000 inches (96.52 to 127.00 mm) in nominal thickness, use specimens having a width (W) of 3.0 inches (76.2 mm) and a thickness (B) of 1.5 inches (38.1 mm).
- 3.3.5.7 For the S-L test orientation of plate 5.001 to 7.000 inches (127.02 to 177.80 mm) in nominal thickness, use specimens having a width (W) of 4.0 inches (101.6 mm) and a thickness (B) of 2.0 inches (50.8 mm).
- 3.3.5.8 For plate 3.000 to 7.000 inches (76.20 to 177.80 mm) in nominal thickness, the S-L specimens shall be centered at T/2.
- 3.3.5.9 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 Tables 3A and 3B.

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

Thickness Inches	L-T Direction ksi/inch	T-L Direction ksi/inch	S-L Direction ksi/inch
3.000 to 4.000	36	27	27
4.001 to 5.000	32	25	26
5.001 to 6.000	29	23	24
6.001 to 7.000	29	22	23

Table 3B - Minimum fracture toughness, SI units

Thickness Millimeters	L-T Direction MPa/m	T-L Direction MPa/m	S-L Direction MPa/m
76.20 to 101.60	40	30	30
101.62 to 127.00	35	27	29
127.02 to 152.40	32	25	26
152.42 to 177.80	32	24	25

3.3.6 Mechanical property requirements for 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

Product, as received by the purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from conditions detrimental to usage of the plate. Any detrimental conditions found during the customer's manufacturing process are subject to rejection.

3.4.1 Each plate shall be subjected to ultrasonic inspection in accordance with ASTM B594 and shall meet ultrasonic Class A requirements as described in ASTM B594.

3.5 Tolerances

Shall conform to all applicable requirements of ANSI H35.2 or ANSI 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 the product 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 products conform 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), tolerances (see 3.5), ultrasonic inspection (see 3.4.1), stress-corrosion cracking when specified (see 3.3.4), and fracture toughness when specified (see 3.3.5) 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.

4.4 Reports

The producer of product shall furnish with each shipment a report stating that the product conforms to the composition, tensile properties, ultrasonic inspection, tolerances, electrical conductivity, stress-corrosion cracking when specified, and fracture toughness when specified and showing the numerical results of tests on each inspection lot to determine conformance to the other acceptance test requirements. The report shall state that the final product conforms to the other technical requirements and shall include the purchase order number, inspection lot number, AMS4470D, section identification number, mill product form, size, and quantity.