SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4470 REV. A

Issued 2009-10
Revised 2012-12

Superseding AMS4470

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

AMS4470A adds 3.000-4.000 thickness 7085-T7451 aluminum plate to this document, modifies tensile (Table 2) and fracture toughness properties (Table 3) for expanded gage ranges, and revises fracture toughness specimen criteria (3.3.5).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of plate.

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 724-776-4970 (outside USA), www.sae.org.

AMS2355 Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock and Rolled, Forged, or Flash Welded Rings

AMS2772 Heat Treatment of Aluminum Alloy Raw Material

AS1990 Aluminum Alloy Tempers

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**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS4470A

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 B 594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products for Aerospace Applications

ASTM B 645 Linear-Elastic Plane-Strain Fracture Toughness Testing of Aluminum Alloys

ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products

ASTM B 666/B 666M Identification Marking of Aluminum and Magnesium Products

ASTM E 399 Linear-Elastic Plane-Strain Fracture Toughness K_{IC} of Metallic Materials

ASTM G 34 Exfoliation Corrosion Susceptibility in 2xxx and 7xxx Series Aluminum Alloys (EXCO Test)

ASTM G 47 Determining Susceptibility to Stress-Corrosion Cracking of High Strength Aluminum Alloy Products

2.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036, Tel: 212-642-4900, www.ansi.org.

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products

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

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 (see AS1990) 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 2A and 2B.

TABLE 2A - MINIMUM TENSILE PROPERTIES, INCH/POUND UNITS

Nominal Thickness Inch	Grain Direction	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
3.000 - 4.000	L	73.0	68.0	11
	LT	73.0	66.0	8
	ST	72.0	61.0	4
4.001 - 5.000	L	73.0	68.0	10
	LT	73.0	66.0	7
	ST	71.0	61.0	4
5.001 - 6.000	L	72.0	68.0	9
	LT	73.0	65.0	6
	ST	70.0	61.0	4
6.001 - 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 - 101.60	L	503	469	11
	LT	503	455	8
	ST	496	421	4
101.62 - 127.00	L	503	469	10
	LT	503	455	7
	ST	490	421	4
127.02 - 152.40	L	496	469	9
	LT	503	448	6
	ST	483	421	4
152.42 - 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 G 34.

3.3.4 Stress Corrosion Cracking

When specified, specimens from plate shall be tested in accordance with ASTM G 47 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 E 399 and ASTM B 645. The required test orientations shall be specified by the purchaser. 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 inches (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) or 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_{1C} meeting the requirements of ASTM E399, or a K_Q "usable for lot release" in accordance with ASTM B 645 shall meet or exceed the values shown in Table 3A and 3B.

TABLE 3A – MINIMUM FRACTURE TOUGHNESS – INCH/POUND UNITS

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

TABLE 3B – MINIMUM FRACTURE TOUGHNESS – SI UNITS

Thickness mm	L-T direction MPa√m	T-L direction MPa√m	S-L direction MPa√m
76.20 - 101.60	40	30	30
101.62 - 127.00	35	27	29
127.02 - 152.40	32	25	26
152.42 - 177.80	32	24	25

3.4 Quality

Products, as received by 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 B 594 and shall meet ultrasonic Class A requirements, as described in ASTM B 594.