SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4100 REV. E

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Superseding AMS4100D

Aluminum Alloy, Alclad, Sheet
5.7Zn - 2.2Mg - 1.6Cu - 0.22Cr (Alclad 7475-T761)
Solution and Precipitation Heat Treated

(Composition similar to UNS A87475)

RATIONALE

AMS4100E corrects an error in the fracture toughness specimen size (3.3.2).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of alclad sheet.

1.2 Application

This sheet has been used typically for structural applications requiring material with high strength and resistance to exfoliation-corrosion, moderate fatigue strength, and high fracture toughness, 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), or 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

AS1990 Aluminum Alloy Tempers

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http://www.sae.org/technical/standards/AMS4100E

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, or www.astm.org.

ASTM B 646	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 338	Sharp-Notch Tension Testing of High-Strength Sheet Materials
ASTM G 34	Exfoliation Corrosion Susceptibility in 2xxx and 7xxx Series Aluminum Alloys (EXCO Test)

2.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, 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 1A - COMPOSITION, CORE (7475)

Element	min	max
Silicon	--	0.10
Iron	--	0.12
Copper	1.2	1.9
Manganese	--	0.06
Magnesium	1.9	2.6
Chromium	0.18	0.25
Zinc	5.2	6.2
Titanium	--	0.06
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

TABLE 1B - COMPOSITION, CLADDING (7072)

Element	min	max
Silicon + Iron	--	0.7
Copper	--	0.10
Manganese	--	0.10
Magnesium	--	0.10
Zinc	0.8	1.3
Other Elements, Each	--	0.05
Other Elements, Total	--	0.15
Aluminum	remainder	

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3.2 Condition

Solution and precipitation heat treated in accordance with AMS2772 to the T761 temper (See AS1990).

3.3 Properties

Sheet 0.040 inch (1.02 mm) and over in nominal thickness shall conform to the following requirements, determined in accordance with AMS2355 on the mill produced product. Tensile properties, and fracture toughness requirements for sheet under 0.040 inch (1.02 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.1 Long Transverse Tensile Properties

Shall be as shown in Table 2.

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

Nominal Thickness Inch	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D
0.040 to 0.062, incl	66.0	55.0	9
Over 0.062 to 0.187, incl	68.0	57.0	9
Over 0.187 to 0.249, incl	70.0	60.0	9

TABLE 2B - MINIMUM TENSILE PROPERTIES, SI UNITS

Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm
1.02 to 1.57, incl	455	379	9
Over 1.57 to 4.75, incl	469	393	9
Over 4.75 to 6.32, incl	483	414	9

3.3.2 Fracture Toughness

Plane-stress fracture toughness, K_C, shall be as shown in Table 3 when tested according to ASTM B 646 using recommended 16-inch (40.6 mm) wide specimens.

TABLE 3 - MINIMUM FRACTURE TOUGHNESS PROPERTIES

Nominal Thickness Inch	Nominal Thickness Millimeters	Specimen Orientation	K_C ksi $\sqrt{in}$	K_C MPa $\sqrt{m}$
0.040 to 0.125, incl	1.02 to 3.18, incl	T-L	87.0	95.6
0.040 to 0.125, incl	1.02 to 3.18, incl	L-T	100.0	110.0
Over 0.125 to 0.249, incl	Over 3.18 to 6.32, incl	T-L	80.0	87.9

3.3.3 Alternate Testing for Demonstration of Fracture Toughness

When specified, the producer shall guarantee that sheet meets the fracture toughness requirements based on correlation of notch tensile strength/tensile yield strength (NTS/TYS) ratio, determined in accordance with 3.3.3.1 in lieu of fracture toughness testing (3.3.2). Sampling and test requirements, and lot acceptance criteria shall be as agreed upon.

3.3.3.1 Notch tensile strength in the long-transverse direction shall be determined in accordance with ASTM E 338 to obtain the NTS/TYS ratio. The values shall be divided by the long-transverse tensile yield strength to obtain the NTS/TYS ratio. Acceptance values for NTS/TYS shall be specified based on evidence of statistical correlation between the NTS/TYS ratio and fracture toughness values (3.3.2) as demonstrated and maintained by the producer.

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3.3.4 Corrosion Resistance Indicator Test

The cladding shall be removed from the test surface.

3.3.4.1 If the electrical conductivity is 39.0% IACS (International Annealed Copper Standard) (22.6 MS/m) or higher and the yield strength does not exceed the specified minimum by 9.0 ksi (62 MPa) or more, the sheet is acceptable.

3.3.4.2 If the electrical conductivity is 39.0% IACS (22.6 MS/m) or higher and the yield strength exceeds the specified minimum by 9.0 ksi (62 MPa) or more, or if the conductivity is at least 38.0% IACS (22.0 MS/m) but less than 39.0% IACS (22.6 MS/m) and tensile properties meet specified requirements, sheet shall be given additional precipitation heat treatment and then retested.

3.3.4.3 If the electrical conductivity is lower than 38.0% IACS (22.0 MS/m), sheet shall be aged additional time and retested for compliance to all specified properties.

3.3.5 Exfoliation Corrosion Resistance

The cladding shall be removed from the test surface. For sheet 0.100 inch (2.54 mm) or thicker, 10% of the thickness shall be removed by machining one surface. The cladding present on the surface opposite the test surface shall also be removed or masked off.

3.3.5.1 Sheet shall not exhibit exfoliation corrosion at test plane greater than that illustrated by Photo B, Figure 2, of ASTM G 34.

3.3.6 Cladding Thickness Per Side

Shall be as shown in Table 4.

TABLE 4 - AVERAGE CLADDING THICKNESS

Nominal Sheet Thickness Inch	Nominal Sheet Thickness Millimeters	Average Cladding Thickness % of Sheet Thickness Nominal	Average Cladding Thickness % of Sheet Thickness Minimum Average
Up to 0.062, incl	Up to 1.57, incl	4.0	3.2
Over 0.062 to 0.187, incl	Over 1.57 to 4.75, incl	2.5	2.0
Over 0.187 to 0.249, incl	Over 4.75 to 6.32, incl	1.5	1.2

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3.4 Quality

Sheet, 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 sheet.

3.5 Tolerances

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

4. QUALITY ASSURANCE PROVISIONS

4.1 4.1 Responsibility for Inspection

The vendor of sheet shall supply all samples for vendor'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 sheet conforms to specified requirements.