

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard



AMS 4296

Issued

SEP 1997

Aluminum Alloy, Alclad Sheet and Plate
4.3Cu - 1.4Mg - 0.60Mn (Alclad 2524-T3)
Solution Heat Treated and Cold Worked

UNS A82524

1. SCOPE:

1.1 Form:

This specification covers an aluminum alloy in the form of sheet and plate clad on both sides.

1.2 Application:

These products have been used typically for formed structural aircraft parts requiring improved resistance to fatigue crack growth and high toughness with strength similar to Alclad 2024-T3, but usage is not limited to such applications.

- 1.2.1 Certain design and processing procedures may cause these products to become susceptible to stress-corrosion cracking; ARP823 recommends practices to minimize such conditions.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

- AMS 2355 Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
- MAM 2355 Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings, Metric (SI) Units
- AMS 2772 Heat Treatment of Aluminum Alloy Raw Materials
- ARP823 Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

- ASTM B 666/B 666M Identification Marking of Aluminum and Magnesium Products
- ASTM E 647 Measurement of Fatigue Crack Growth Rates

2.3 ANSI Publications:

Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

- 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 Tables 1 and 2, determined in accordance with AMS 2355 or MAM 2355.

TABLE 1 - Composition, Core (2524)

Element	min	max
Copper	4.0	4.5
Magnesium	1.2	1.6
Manganese	0.45	0.7
Zinc	--	0.15
Iron	--	0.12
Titanium	--	0.10
Silicon	--	0.06
Chromium	--	0.05
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

TABLE 2 - Composition, Cladding (1230)

Element	min	max
Iron + Silicon	--	0.7
Copper	--	0.10
Zinc	--	0.10
Manganese	--	0.05
Magnesium	--	0.05
Vanadium	--	0.05
Titanium	--	0.03
Other Impurities, each	--	0.03
Aluminum, by difference	99.3	--

3.2 Condition:

Solution heat treated in accordance with AMS 2772 and cold worked to T3 temper.

3.3 Properties:

Product shall conform to the following requirements, determined in accordance with AMS 2355 or MAM 2355:

3.3.1 Long-Transverse Tensile Properties: Shall be as shown in Table 3.

TABLE 3A - 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 %
0.032 to 0.062, incl	59.0	39.0	15
Over 0.062 to 0.128, incl	61.0	40.0	15
Over 0.128 to 0.310, incl	62.0	40.0	15

TABLE 3B - Minimum Tensile Properties, SI Units

Nominal Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
0.81 to 1.57, incl	407	269	15
Over 1.57 to 3.25, incl	421	276	15
Over 3.25 to 7.87, incl	427	276	15

3.3.2 Fatigue Crack Growth Rate (FCGR): Shall be not higher than the rate (da/dN) shown in Table 4, determined in the T-L orientation in accordance with ASTM E 647, and using the center-cracked tension M(T) specimen, a DK of 30 ksi $\sqrt{\text{inch}}$ (33 MPa $\sqrt{\text{m}}$), a K gradient of zero, a stress ratio (R) of plus 0.1, and a testing frequency between 2 to 10 Hertz.

TABLE 4 - Maximum Fatigue Crack Growth Rate

Nominal Thickness Inch	Nominal Thickness Millimeters	da/dN inch/cycle	da/dN mm/cycle
0.032 to 0.310, incl	0.81 to 7.87, incl	1.2×10^{-4}	3.05×10^{-3}

- 3.3.3 Bending: Product shall withstand, without cracking, bending at room temperature through an angle of 180 degrees around a diameter equal to the bend factor shown in Table 5 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

TABLE 5 - Bending Parameters

Nominal Thickness Inch	Nominal Thickness Millimeters	Bend Factor
0.032 to 0.040, incl	0.81 to 1.02, incl	4
Over 0.040 to 0.128, incl	Over 1.02 to 3.25, incl	5
Over 0.128 to 0.249, incl	Over 3.25 to 6.32, incl	8
Over 0.249 to 0.310, incl	Over 6.32 to 7.87, incl	10

- 3.3.4 Minimum Average Cladding Thickness: Shall be as shown in Table 6.

TABLE 6 - Minimum Average Cladding Thickness

Nominal Thickness Inch	Nominal Thickness Millimeters	Cladding Thickness Per Side % of Total Thickness
0.032 to 0.062, incl	0.81 to 1.57, incl	4.0
Over 0.062 to 0.310, incl	Over 1.57 to 7.87, incl	2.0

- 3.4 Quality:

Product, 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 product.

- 3.5 Tolerances:

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