SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4021 | REV. G

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Superseding AMS4021G

(R) Aluminum Alloy, Alclad Sheet and Plate, 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (Alclad 6061-0) Annealed

UNS A86061

RATIONALE

AMS4021G has been reaffirmed to comply with the SAE five-year review policy.

NONCURRENCY NOTICE

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of February, 2005. It is recommended, therefore, that this specification not be specified for new designs.

"NONCURRENT" refers to those specifications which have previously been widely used and which may be required for production or processing of existing designs in the future. The Aerospace Materials Division, however, does not recommend these specifications for future use in new designs.

"NONCURRENT" specifications are available from SAE upon request.

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http://www.sae.org/technical/standards/AMS4021G

1. SCOPE:

1.1 Form:

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

1.2 Application:

These products have been used typically for formed structural parts which will be subsequently heat treated and which are required to exhibit maximum corrosion resistance, but usage is not limited to such applications.

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.

2.1 SAE Publications:

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

AMS 2202	Tolerances, Aluminum Alloy and Magnesium Alloy Sheet and Plate
MAM 2202	Tolerances, Metric, Aluminum Alloy and Magnesium Alloy Sheet and Plate
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 2770	Heat Treatment of Aluminum and Aluminum Alloys
AMS 2811	Identification, Aluminum and Magnesium Alloy Wrought Products

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-H-6088	Heat Treatment of Aluminum Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1 and Table 2, determined in accordance with AMS 2355 or MAM 2355.

TABLE 1 - Composition, 6061 Core

Element	min	max
Magnesium	0.8	1.2
Silicon	0.40	0.8
Copper	0.15	0.40
Chromium	0.04	0.35
Iron	--	0.7
Zinc	--	0.25
Manganese	--	0.15
Titanium	--	0.15
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

TABLE 2 - Composition, 7072 Cladding

Element	min	max
Zinc	0.8	1.3
Silicon + Iron	--	0.7
Magnesium	--	0.10
Copper	--	0.10
Manganese	--	0.10
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition:

Annealed in accordance with MIL-H-6088.

3.3 Properties:

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

3.3.1 As Annealed:

3.3.1.1 Tensile Properties: Shall be as specified in Table 3.

TABLE 3A - Tensile Properties, Inch/Pound Units

Nominal Thickness Inches	Tensile Strength ksi, max	Yield Strength at 0.2% Offset ksi, max	Elongation in 2 Inches or 4D %, min
0.010 to 0.020, incl	20.0	12.0	14
Over 0.020 to 0.128, incl	20.0	12.0	16
Over 0.128 to 0.499, incl	20.0	12.0	18
Over 0.499 to 1.000, incl	20.0	--	18
Over 1.000 to 3.000, incl	20.0	--	16

TABLE 3B - Tensile Properties, SI Units

Nominal Thickness mm	Tensile Strength MPa, max	Yield Strength at 0.2% Offset MPa, max	Elongation in 50.8 mm or 4D %, min
0.25 to 0.50, incl	138	82.7	14
Over 0.50 to 3.25, incl	138	82.7	16
Over 3.25 to 12.67, incl	138	82.7	18
Over 12.67 to 25.40, incl	152	--	18
Over 25.40 to 76.20, incl	152	--	16

3.3.1.2 Bending: Product 0.010 to 0.499 inch (0.25 to 12.67 mm), inclusive, in nominal thickness 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 4 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

TABLE 4 - Bending Parameters

Nominal Thickness Inch	Nominal Thickness mm	Bend Factor
0.010 to 0.128, incl	0.25 to 3.25, incl	1
Over 0.128 to 0.249, incl	Over 3.25 to 6.32, incl	2
Over 0.249 to 0.499, incl	Over 6.32 to 12.67, incl	4

3.3.2 Response to Heat Treatment: The product, as received by purchaser, shall have the following properties after solution and precipitation heat treatment in accordance with AMS 2770:

3.3.2.1 Tensile Properties: Shall be as specified in Table 5.

TABLE 5A - Minimum Tensile Properties, Inch/Pound Units

Nominal Thickness Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi, max	Elongation in 2 Inches or 4D %
0.010 to 0.020, incl	38.0	32.0	8
Over 0.020 to 0.499, incl	38.0	32.0	10
Over 0.499 to 1.000, incl	42.0	35.0	9
Over 1.000 to 2.000, incl	42.0	35.0	8
Over 2.000 to 3.000, incl	42.0	35.0	6

TABLE 5B - Minimum Tensile Properties, SI Units

Nominal Thickness mm	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
0.25 to 0.51, incl	262	221	8
Over 0.51 to 12.67, incl	262	221	10
Over 12.67 to 25.40, incl	290	241	9
Over 25.40 to 50.80, incl	290	241	8
Over 50.80 to 76.20, incl	290	241	6

3.3.2.2 Bending: Product 0.010 - 0.499 inch (0.25 - 12.67 mm), inclusive, in nominal thickness 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 6 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

TABLE 6 - Bending Parameters

Nominal Thickness Inch	Nominal Thickness mm	Bend Factor
0.010 to 0.036, incl	0.25 to 0.91, incl	3
Over 0.036 to 0.064, incl	Over 0.91 to 1.63, incl	4
Over 0.064 to 0.128, incl	Over 1.3 to 3.25, incl	5
Over 0.128 to 0.249, incl	Over 3.25 to 6.32, incl	6
Over 0.249 to 0.499, incl	Over 6.32 to 12.67, incl	10

3.3.3 Cladding Thickness: After rolling, the average cladding thickness per side shall be not less than 4% of the total composite thickness.

3.4 Quality:

The 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 AMS 2202 or MAM 2202.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for composition (3.1), tensile properties as annealed (3.3.1.1), tensile properties after heat treatment (3.3.2.1), and tolerances (3.5) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests for bending as annealed (3.3.1.2), bending after heat treatment (3.3.2.2), and cladding thickness (3.3.3) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2355 or MAM 2355.

4.4 Reports:

The vendor of the product shall furnish with each shipment a report stating that the product conforms to the chemical composition and showing the results of tests to determine conformance to the other acceptance tests and, when performed, to the periodic test requirements. This report shall include the purchase order number, lot number, AMS 4021G, size, and quantity.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2355 or MAM 2355.