SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4096 REV. C

Issued 1969-11
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Superseding AMS4096B

Aluminum Alloy Sheet and Plate, Alclad
6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti (Alclad 2219-O)
Annealed

(Composition similar to UNS A92219)

RATIONALE

AMS4096C results from a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

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

1.2 Application

This specification has been used typically for parts requiring high strength up to 600 °F (315 °C). These products are also well suited for cryogenic applications and where welding and maximum corrosion resistance are required, 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 after heat treatment; ARP823 recommends practices to minimize such conditions.

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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS4096C

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 Alloy, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings

AMS2772 Heat Treatment of Aluminum Alloy Raw Materials

ARP823 Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products

AS1990 Aluminum Alloy Tempers

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 660 Packaging/Packing of Aluminum and Magnesium Products

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

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 Tolerance for Aluminum Mill Products

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

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the following percentages by weight shown in Table 1 and Table 2, determined in accordance with AMS2355:

TABLE 1 - COMPOSITION, CORE (2219)

Elements	min	max
Silicon	--	0.20
Iron	--	0.30
Copper	5.8	6.8
Manganese	0.20	0.40
Magnesium	--	0.02
Zinc	--	0.10
Titanium	0.02	0.10
Vanadium	0.05	0.15
Zirconium	0.10	0.25
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

TABLE 2 - COMPOSITION, CLADDING (7072)

Elements	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	

3.2 Condition

Annealed to the -O condition (See AS1990) in accordance with AMS2772.

3.3 Properties

The product shall conform to the following requirements, determined in accordance with AMS2355 on the mill product.

3.3.1 As Annealed

3.3.1.1 Tensile Properties

Product 0.020 to 2.000 inch (0.50 to 50.00 mm), inclusive, in nominal thickness shall meet the requirements of Table 3.

TABLE 3 - TENSILE PROPERTIES

Tensile Strength, max	32.0 ksi (220 MPa)
Yield Strength at 0.2% Offset, max	16.0 ksi (110 MPa)
Elongation in 2 in. (50 mm) or 4D, min	12%

3.3.1.2 Bending

Product 0.020 to 0.499 inch (0.50 to 12.50 mm) in nominal thickness shall withstand, without cracking, bending at room temperature through an angle of 180 deg 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 - BEND FACTORS

Nominal Thickness Inch					Nominal Thickness Millimeters					Bend Factor
	0.020	to	0.249,	incl	0.50	to	6.25,	incl		4
Over	0.249	to	0.499,	incl	Over 6.25	to	12.50,	incl		6

3.3.2 After Solution and Precipitation Heat Treatment

The product, as received by purchaser, shall have the following properties after solution and precipitation heat treatment in accordance with AMS2772 to -T62 temper (See AS1990):

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, min	Yield Strength at 0.2% Offset ksi, min	Elongation in 2 Inches or 4D %, min
	0.020	to	0.039,	incl	44.0	29.0	6
Over	0.039	to	0.099,	incl	49.0	32.0	7
Over	0.099	to	0.249,	incl	51.0	34.0	7
Over	0.249	to	0.499,	incl	51.0	34.0	8
Over	0.499	to	1.000,	incl	54.0	36.0	8
Over	1.000	to	2.000,	incl	54.0	36.0	7

TABLE 5B - MINIMUM TENSILE PROPERTIES, SI UNITS

Nominal Thickness Millimeters					Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50 mm or 4D %, min
	0.50	to	1.00,	incl	303	200	6
Over	1.00	to	2.50,	incl	338	221	7
Over	2.50	to	6.25,	incl	352	234	7
Over	6.25	to	12.50,	incl	352	234	8
Over	12.50	to	25.00,	incl	372	248	8
Over	25.00	to	50.00,	incl	372	248	7

3.3.2.2 Bending

Product 0.020 to 0.499 inch (0.50 to 12.50 mm) in nominal thickness shall withstand, without cracking, bending at room temperature through an angle of 180 deg 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 - BEND FACTORS

Nominal Thickness Inch					Nominal Thickness Millimeters					Bend Factor
	0.020	to	0.062,	incl		0.50	to	1.55,	incl	8
Over	0.062	to	0.249,	incl	Over	1.55	to	6.25,	incl	12
Over	0.249	to	0.499,	incl	Over	6.25	to	12.50,	incl	16

3.3.3 Cladding Thickness

After rolling, the average cladding thickness shall conform to the requirements shown in Table 7.

TABLE 7 - CLADDING THICKNESS

Nominal Thickness Inch					Nominal Width Inches					Average Cladding Thickness Per Side % of Total Thickness min	Average Cladding Thickness Per Side % of Total Thickness max
	0.020	to	0.039,	incl		0.50	to	1.00,	incl	8	--
Over	0.039	to	0.099,	incl	Over	1.00	to	2.50,	incl	4	--
Over	0.099	to	0.499,	incl	Over	2.50	to	12.50,	incl	2	--
Over	0.499				Over	12.50				2	3

3.4 Quality

The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the product.

3.5 Tolerances

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

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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties as annealed (3.3.1.1) and after solution and precipitation heat treatment (3.3.2.1), and tolerances (3.5) are classified as acceptance tests and, except for composition, shall be performed on each lot.