



AEROSPACE MATERIAL SPECIFICATION

AMS4094™**REV. E**

Issued	1969-11
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Superseding AMS4094D

Aluminum Alloy, Sheet and Plate, Alclad
6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti
Alclad 2219-T81 Sheet
Solution Heat Treated, Cold Worked, and Precipitation Heat Treated
Alclad 2219-T851 Plate
Solution Heat Treated, Stress Relieved, and Precipitation Heat Treated
(Composition similar to UNS A822190)

RATIONALE

AMS4094E results from a Five-Year Review and update of this specification with changes to update wording to prohibit unauthorized exceptions (see 3.3.1.1, 3.6, and 8.4), relocate Definitions (see 2.4), and update Applicable Documents (see Section 2).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of sheet and plate 0.020 to 0.499 inch (0.51 to 12.67 mm), inclusive, in nominal thickness, clad on two sides (see 8.5).

1.2 Application

These products have been used typically 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; 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.

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2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (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, High-Strength Aluminum Alloy Products
AS7766	Terms Used in Aerospace Metals Specifications

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 B660	Packaging/Packing of Aluminum and Magnesium Products
ASTM B666/B666M	Identification Marking of Aluminum and Magnesium Products

2.3 ANSI Accredited Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ANSI H35.1/H35.1M	Standard Alloy and Temper Designation System for Aluminum
ANSI H35.2	Dimensional Tolerances for Aluminum Mill Products
ANSI H35.2M	Dimensional Tolerances for Aluminum Mill Products (Metric)

2.4 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Tables 1 and 2, determined in accordance with AMS2355.

Table 1 - Composition, core (2219)

Element	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)

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	

3.2 Condition

Product shall be supplied in the following condition (refer to ANSI H35.1/H35.1M); solution and precipitation heat treatment shall be performed in accordance with AMS2772:

3.2.1 Sheet

Solution heat treated, cold worked, and precipitation heat treated to the -T81 temper (refer to ANSI H35.1/H35.1M).

3.2.2 Plate

Solution heat treated, stress relieved by stretching 1-1/2 to 3%, and precipitation heat treated to the -T851 temper (refer to ANSI H35.1/H35.1M).

3.3 Properties

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

3.3.1 Tensile Properties

Shall be as shown in Table 3.

Table 3A - Minimum tensile properties, inch/pound units

Nominal Thickness Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
0.020 to 0.039, incl	49.0	37.0	6
Over 0.039 to 0.099, incl	55.0	41.0	7
Over 0.099 to 0.249, incl	58.0	43.0	7
Over 0.249 to 0.499, incl	58.0	42.0	8

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 %
0.51 to 0.99, incl	338	255	6
Over 0.99 to 2.51, incl	379	283	7
Over 2.51 to 6.32, incl	400	296	7
Over 6.32 to 12.67, incl	400	290	8

- 3.3.1.1 Mechanical property requirements for sheet and plate outside the thickness range of 1.1 shall be as agreed upon by the purchaser and producer and reported per 4.4.1 (see 8.5).

3.3.2 Cladding Thickness

After rolling, the average cladding thickness shall be as shown in Table 4.

Table 4 - Average cladding thickness

Total Thickness of Composite Product Inches	Total Thickness of Composite Product Millimeters	Average Cladding Thickness per Side, Percent of Thickness Minimum	Average Cladding Thickness per Side, Percent of Thickness Maximum
0.020 to 0.039, incl	0.51 to 0.99, incl	8	--
Over 0.039 to 0.099, incl	Over 0.99 to 2.51, incl	4	--
Over 0.099 to 0.499, incl	Over 2.51 to 12.67, incl	2	--
Over 0.499	Over 12.67	2	3

3.4 Quality

The product, as received by the 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.

3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for the producer's tests and shall be responsible for the performance of all required tests. The 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 (see 3.1), tensile properties (see 3.3.1), and tolerances (see 3.5) are acceptance tests, and except for composition, shall be performed on each inspection lot.

4.2.2 Periodic Tests

Cladding thickness (see 3.3.2) is classified as a periodic test and shall be performed at a frequency selected by the producer unless frequency of testing is specified by the purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2355.

4.4 Reports

The producer of the product shall furnish with each shipment a report stating that the product conforms to the composition requirements and tolerances and showing the numerical results of tests on each inspection lot to determine conformance to the other acceptance test requirements. This report shall include the purchase order number, inspection lot number, AMS4094E, size, and quantity. The report shall also identify the producer, the product form, and the size of the mill product.