

AEROSPACE
MATERIAL
SPECIFICATION

AMS 4199

Issued 11-1-70
Revised 4-1-85

ALUMINUM ALLOY SHEET AND PLATE, ALCLAD
4.3Zn - 3.3Mg - 0.6Cu - 0.20Mn - 0.17Cr (7011 Alclad 7079; -T6 Sheet, -T651 Plate)

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of 4-6-84. It is recommended that this specification not be specified for new designs.

This cover sheet should be attached to the original issue of the subject specification.

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Society of Automotive Engineers, Inc. SPECIFICATION

TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

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- 1. ACKNOWLEDGMENT:** A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
- 2. APPLICATION:** Primarily for structural use, including machined parts subject to excessive warpage during machining, where fatigue strength and tensile properties higher than those provided by Alclad 7079-T6 and -T651 are required. Certain design and processing procedures may cause this material to be susceptible to stress corrosion cracking; ARP 823 recommends practices to minimize such conditions.

3. COMPOSITION:

	Core (7079)			Cladding (7011)	
	min	max		min	max
Zinc	3.8	4.8	Zinc	4.0	5.5
Magnesium	2.9	3.7	Magnesium	1.0	1.6
Copper	0.40	0.8	Manganese	0.10	0.30
Manganese	0.10	0.30	Chromium	0.05	0.20
Chromium	0.10	0.25	Iron	--	0.20
Iron	--	0.40	Silicon	--	0.15
Silicon	--	0.30	Copper	--	0.05
Titanium	--	0.10	Titanium	--	0.05
Other Impurities, each	--	0.05	Other Impurities, each	--	0.05
Other Impurities, total	--	0.15	Other Impurities, total	--	0.15
Aluminum	remainder		Aluminum	remainder	

4. CONDITION:

- 4.1 Sheet:** Solution and precipitation heat treated.
- 4.2 Plate:** Solution heat treated, stress relieved by stretching, and precipitation heat treated.
 - 4.2.1** Plate shall be stretched in the solution heat treated condition to produce a nominal permanent set of 2% but not less than 1-1/2% nor more than 3%.
 - 4.2.2** Plate shall receive no further straightening operations after stretching.

5. TECHNICAL REQUIREMENTS:

The product shall conform to the following requirements; tensile properties shall be determined in accordance with the latest issue of AMS 2355.

- 5.1 Cladding Thickness:** After rolling, the average cladding thickness shall be as shown. Routine measurements are not required.

Total Thickness of Composite Product Inch	Cladding Thickness Per Side % of Total Thickness	
	min	max
0.015 to 0.062, incl	3.2	-
Over 0.062 to 0.187, incl	2.0	-
Over 0.187 to 0.500, excl	1.2	-
0.500 to 1.000, incl	1.2	3.0

5.2 Tensile Properties:

Nominal Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset or at Extension Indicated (See 5.2.1)		Elongation % in 2 in. or 4D, min
		psi, min	Extension Under Load in. in 2 in.	
0.015 to 0.039, incl	69,000	60,000	0.0158	7
Over 0.039 to 0.249, incl	72,000	63,000	0.0164	8
Over 0.249 to 0.500, excl	73,000	64,000	0.0165	8
0.500 to 1.000, incl	74,000	65,000	0.0166	8

5.2.1 Tensile properties of plate over 1.000 in. in nominal thickness shall be as agreed upon by purchaser and vendor.

5.2.2 Extension under load is based upon the following values of E:

Nominal Thickness Inches	E
0.015 to 0.500, excl	10,200,000
0.500 to 1.000, incl	10,300,000

5.2.3 When a dispute occurs between purchaser and vendor over the yield strength values, yield strength determined by the offset method shall apply.

5.3 Bending: Material shall be capable of withstanding, without cracking, bending at room temperature through an angle of 180 deg around a diameter equal to the bend factor times the nominal thickness of the material with axis of bend parallel to direction of rolling.

Nominal Thickness Inch	Bend Factor
0.015 to 0.020, incl	7
Over 0.020 to 0.062, incl	8
Over 0.062 to 0.091, incl	9
Over 0.091 to 0.125, incl	10
Over 0.125 to 0.249, incl	11
Over 0.249 to 0.500, excl	14

6. QUALITY: Material shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

7. TOLERANCES: Unless otherwise specified, tolerances shall conform to all applicable requirements of the latest issue of AMS 2202.