Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4049G
Superseding AMS 4049F
Issued 10-1-51
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ALUMINUM ALLOY SHEET AND PLATE, ALCLAD
5.6Zn - 1.5Mg - 1.6Cu - 0.23Cr (Alclad 7075; -T6 Sheet, -T651 Plate)

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of sheet and plate.

1.2 Application: Primarily for structural use, including machined parts subject to excessive warpage during machining. Certain design and processing procedures may cause these products to be susceptible to stress-corrosion cracking; ARP 823 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 Aerospace Material Specifications (AMS) and Aerospace Recommended Practices (ARP) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2202 - Tolerances, Aluminum-Base and Magnesium-Base Alloy Sheet and Plate
AMS 2350 - Standards and Test Methods
AMS 2355 - Quality Assurance Sampling and Testing of Aluminum-Base and Magnesium-Base Alloys, Wrought Products (Except Forgings and Forging Stock) and Flash Welded Rings

2.1.2 Aerospace Recommended Practices:

ARP 823 - Minimizing Stress Corrosion Cracking in Wrought Heat Treatable Aluminum Alloy Products

2.2 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.2.1 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

2.2.2 Military Standards:

MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

Printed in U.S.A.

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined in accordance with AMS 2355:

	Core (7075)			Cladding (7072)		
		min	max		min	max
	Zinc	5.1	6.1	Zinc	0.8	1.3
	Magnesium	2.1	2.9	Silicon + Iron	--	0.7
ø	Copper	1.2	2.0	Magnesium	--	0.10
	Chromium	0.18	0.28	Copper	--	0.10
	Iron	--	0.50	Manganese	--	0.10
	Silicon	--	0.40	Other Impurities, each	--	0.05
	Manganese	--	0.30	Other Impurities, total	--	0.15
	Titanium	--	0.20	Aluminum	remainder	
	Other Impurities, each	--	0.05			
	Other Impurities, total	--	0.15			
	Aluminum	remainder				

3.2 Condition: The product shall be supplied in the following condition; heat treatments shall be performed in accordance with MIL-H-6088:
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3.2.1 Sheet: Solution and precipitation heat treated.

3.2.2 Plate: Solution heat treated, stretched to produce a nominal permanent set of 2% but not less than 1-1/2% nor more than 3%, and precipitation heat treated.

3.2.2.1 Plate shall receive no further straightening operations after stretching.

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

3.3.1 Tensile Properties: Shall be as specified in Table I and 3.3.1.1.

TABLE I

Nominal Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
0.008 to 0.011, incl	68,000	58,000	5
Over 0.011 to 0.039, incl	70,000	60,000	7
Over 0.039 to 0.062, incl	72,000	62,000	8
Over 0.062 to 0.187, incl	73,000	63,000	8
Over 0.187 to 0.249, incl	75,000	64,000	8
Over 0.249 to 0.499, incl	75,000	65,000	9
Over 0.499 to 1.000, incl	78,000	68,000	7
Over 1.000 to 2.000, incl	77,000	67,000	6
Over 2.000 to 2.500, incl	76,000	64,000	5
Over 2.500 to 3.000, incl	72,000	61,000	5
Over 3.000 to 3.500, incl	71,000	58,000	5
Over 3.500 to 4.000, incl	67,000	54,000	3

TABLE I (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50 mm or 4D %, min
0.20 to 0.28, incl	469	400	5
Over 0.28 to 0.99, incl	483	414	7
Over 0.99 to 1.57, incl	496	427	8
Over 1.57 to 4.75, incl	503	434	8
Over 4.75 to 6.32, incl	517	441	8
Over 6.32 to 12.67, incl	517	448	9
Over 12.67 to 25.40, incl	538	469	7
Over 25.40 to 50.80, incl	531	462	6
Over 50.80 to 63.50, incl	524	441	5
Over 63.50 to 76.20, incl	496	421	5
Over 76.20 to 88.90, incl	490	400	5
Over 88.90 to 101.60, incl	462	372	3

3.3.1.1 Tensile property requirements for plate over 4.000 in. (101.60 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.2 Bending: Product 0.008 to 0.499 in. (0.20 to 12.67 mm), incl, 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 times the nominal thickness of the product with axis of bend parallel to the direction of rolling.

Nominal Thickness Inch	Nominal Thickness (Millimetres)	Bend Factor
0.008 to 0.020, incl	(0.20 to 0.51, incl)	6
Over 0.020 to 0.063, incl	(Over 0.51 to 1.60, incl)	7
Over 0.063 to 0.091, incl	(Over 1.60 to 2.31, incl)	8
Over 0.091 to 0.125, incl	(Over 2.31 to 3.18, incl)	9
Over 0.125 to 0.249, incl	(Over 3.18 to 6.32, incl)	10
Over 0.249 to 0.499, incl	(Over 6.32 to 12.67, incl)	12

3.3.2.1 Bending requirements for product over 0.499 in. (12.67 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.3 Cladding Thickness: After rolling, the average cladding thickness per side shall be as follows:

Total Thickness of Composite Product Inches	Total Thickness of Composite Product (Millimetres)	Cladding Thickness Per Side % of Total Thickness min	Cladding Thickness Per Side % of Total Thickness max
0.008 to 0.062, incl	(0.20 to 1.57, incl)	3.2	--
Over 0.062 to 0.187, incl	(Over 1.57 to 4.75, incl)	2.0	--
Over 0.187 to 0.499, incl	(Over 4.75 to 12.67, incl)	1.2	--
Over 0.499 to 4.000, incl	(Over 12.67 to 101.60, incl)	1.2	3.0

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: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2202.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.3.1), and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for bending (3.3.2) and cladding thickness (3.3.3) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with AMS 2355.

4.4 Reports:

4.4.1 The vendor of the product shall furnish with each shipment three copies of a report stating that the product conforms to the chemical composition and other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, size, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.5 Resampling and Retesting: Shall be in accordance with AMS 2355.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Each sheet and plate shall be marked on one face, in the respective location indicated below, with the alloy number and temper, AMS 4049 or applicable Federal or Military specification designation, inspection lot number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be sufficiently stable to withstand normal handling. The markings shall have no deleterious effect on the product or its performance.

5.1.1 Flat Sheet and Plate Under 6 In. (152 mm) Wide: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm). The inspection lot number may appear in the row marking or may appear at only one location on each piece.

5.1.2 Flat Sheet and Plate 0.375 In. (9.52 mm) and Under Thick, 6 - 60 In. (152 - 1524 mm), Incl, Wide, and 36 - 200 In. (914 - 5080 mm), Incl, Long: Shall be marked in lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm), the rows being spaced approximately 6 in. (152 mm) on centers across the width and staggered. Every third row shall show the manufacturer's identification and nominal thickness. The other rows shall show the alloy number and temper and AMS 4049 or applicable Federal or Military specification designation. The inspection lot number may be included in the rows with the alloy, temper, and specification designations or may appear at only one location on each piece.