



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.

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

SPECIFICATION

AMS 4051D

Superseding AMS 4051C

Issued 3-1-55

Revised 11-15-72

ALUMINUM ALLOY SHEET AND PLATE, ALCLAD
6.8Zn - 2.7Mg - 2.0Cu - 0.30Cr (Alclad 7178-0)

1. SCOPE:

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

1.2 Application: Primarily for structural use, including machine tapered parts. Certain design and processing procedures may cause this material to be susceptible to stress-corrosion cracking after solution and precipitation heat treatment; 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.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2202 - Tolerances, Aluminum-Base and Magnesium-Base Alloy
Sheet and Plate

AMS 2355 - Quality Assurance Sampling and Testing of Wrought Aluminum
and Magnesium Alloys Products, Except Forgings

2.1.2 Aerospace Recommended Practices:

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

3. TECHNICAL REQUIREMENTS:

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

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

Core (7178)

Cladding (7072)

	min	max		min	max
Zinc	6.3	7.3	Zinc	0.8	1.3
Magnesium	2.4	3.1	Silicon + Iron	--	0.7
Copper	1.6	2.4	Copper	--	0.10
Chromium	0.18	0.35	Magnesium	--	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: Annealed.

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

3.3.1 As Annealed:

3.3.1.1 Tensile Properties:

TABLE I

Nominal Thickness Inch	Tensile Strength psi, max	Yield Strength at 0.2% Offset psi, max	Elongation in 2 in. or 4D, %, min
0.015 to 0.062, incl	36,000	20,000	10
Over 0.062 to 0.187, incl	38,000	20,000	10
Over 0.187 to 0.500, excl	40,000	21,000	10
0.500	40,000	--	10

TABLE I (SI)

Nominal Thickness Millimeters	Tensile Strength MPa, max	Yield Strength at 0.2% Offset MPa, max	Elongation in 50.8 mm or 4D, %, min
0.38 to 1.57, incl	248	138	10
Over 1.57 to 4.75, incl	262	138	10
Over 4.75 to 12.70, excl	276	145	10
12.70	276	-	10

3.3.1.1.1 Thicknesses Over 0.500 In. (12.70 mm): Tensile property requirements for plate over 0.500 in. (12.70 mm) thick shall be as agreed upon by purchaser and vendor.

3.3.2 After Solution and Precipitation Heat Treatment: The product as received by the purchaser shall, after proper solution heat treatment at 875 F ± 10 (468.3 C ± 5.6) and proper precipitation heat treatment at 250 F ± 10 (121.1 C ± 5.6) for 24 hr, have the following properties:

3.3.2.1 Tensile Properties:

TABLE II

Nominal Thickness Inch	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D, %, min
0.015 to 0.044, incl	76,000	66,000	7
Over 0.044 to 0.062, incl	78,000	68,000	8
Over 0.062 to 0.187, incl	80,000	70,000	8
Over 0.187 to 0.500, excl	82,000	71,000	8
0.500	84,000	73,000	6

TABLE II (SI)

Nominal Thickness Millimeters	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D, %, min
0.38 to 1.12, incl	524	455	7
Over 1.12 to 1.57, incl	538	469	8
Over 1.57 to 4.75, incl	552	483	8
Over 4.75 to 12.70, excl	565	490	8
12.70	579	503	6

3.3.2.1.1 Thicknesses Over 0.500 In. (12.70 mm): Tensile property requirements for plate over 0.500 in. (12.70 mm) thick shall be as agreed upon by purchaser and vendor.

3.3.3 Cladding Thickness: After rolling, the average cladding thickness shall conform to the requirements shown in Table III, determined by microscopic examination at 100X magnification:

TABLE III

Nominal Thickness		Cladding Thickness Per Side % of Total Thickness	
Inches	(Millimeters)	min	max
0.015 to 0.062, incl	(0.38 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 0.500, excl	(Over 4.75 to 12.70, excl)	1.2	-
0.500	(12.70)	1.2	3.0

3.4 Quality: The product 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.

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 assure that the product conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.

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 technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, thickness, 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 4051 or applicable Federal or Military specification designation, 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.

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).

5.1.2 Flat Sheet and Plate 0.375 In. (9.52 mm) and Under Thick, 6 - 60 In. (152 mm - 1.52 m), Incl. Wide, and 36 - 200 In. (914 mm - 5.08 m), 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 4051 or applicable Federal or Military specification designation.

5.1.3 Flat Sheet and Plate Over 0.375 In. (9.52 mm) Thick, or Over 60 In. (1.52 m) Wide, or Over 200 In. (5.08 m) Long: Shall be marked as in 5.1.2 above or, at vendor's discretion, shall be marked in one or two rows of characters recurring at intervals not greater than 3 ft (914 mm) and running around the periphery of the piece. If one row is used, it shall show all information of 5.1. If two rows are used, one row shall show the alloy number and temper and AMS 4051 or applicable Federal or Military specification designation; the second row shall show the manufacturer's identification and nominal thickness.

5.1.3.1 If peripheral marking is applied to the full piece as produced but partial sheets or plates are supplied, an arrow shall also be applied near one corner indicating the direction of rolling.

5.1.4 Coiled Sheet: Shall be marked near the outside end of the coil. The inside end of the coil shall also be marked or shall have attached a tag or label marked with the information of 5.1.

5.1.5 Circles: Shall be marked with the information of 5.1 if the circle is 24 in. (610 mm) or more in diameter. Circles less than 24 in. (610 mm) in diameter shall be identified as agreed upon by purchaser and vendor.

5.2 Preservation: Flat sheet, plate, and circles 12 in. (305 mm) or more in diameter shall be protected during shipment and storage by interleaving with suitable paper sheets. Circles under 12 in. (305 mm) in diameter shall be protected as agreed upon by purchaser and vendor.