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

AEROSPACE MATERIAL SPECIFICATION

AMS 4031C
Superseding AMS 4031B

Issued 6-30-62
Revised 10-15-79

UNS A92219

ALUMINUM ALLOY SHEET AND PLATE
6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti (2219-0)

1. SCOPE:

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

1.2 Application: Primarily for parts requiring high strength up to 600°F (315°C). These products are also well suited for cryogenic applications and where welding is required. Certain design and processing procedures may cause these products to be susceptible to stress-corrosion cracking after 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. 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
AMS 2770 - Heat Treatment of Aluminum and Aluminum Alloys

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 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:

	min	max
Copper	5.8	6.8
Manganese	0.20	0.40
Zirconium	0.10	0.25
Vanadium	0.05	0.15
Titanium	0.02	0.10
Iron	--	0.30
Silicon	--	0.20
Zinc	--	0.10
Magnesium	--	0.02
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: Shall be as follows for product 0.020 to 2.000 in. (0.51 to 50.80 mm), incl, in nominal thickness:

Tensile Strength, max	32,000 psi (221 MPa)
Yield Strength at 0.2% offset, max	16,000 psi (110 MPa)
Elongation in 2 in. (50 mm) or 4D, min	12%

3.3.1.1.1 Tensile property requirements for product less than 0.020 in. (0.51 mm) or over 2.000 in. (50.80 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.1.2 Bending: Product 0.020 to 1.000 in. (0.51 to 25.40 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		Bend
Inch	(Millimetres)	Factor
0.020 to 0.250, incl	(0.51 to 6.35, incl)	4
Over 0.250 to 0.750, incl	(Over 6.35 to 19.05, incl)	6
Over 0.750 to 1.000, incl	(Over 19.05 to 25.40, incl)	8

3.3.1.2.1 Bending requirements for product less than 0.020 in. (0.51 mm) or over 1.000 in. (25.40 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

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 AMS 2770:

3.3.2.1 Tensile Properties: Shall be as specified in Table I and 3.3.2.1.1.

TABLE I

Nominal Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
0.020 to 0.039, incl	54,000	36,000	6
Over 0.039 to 0.249, incl	54,000	36,000	7
Over 0.249 to 1.000, incl	54,000	36,000	8
Over 1.000 to 2.000, incl	54,000	36,000	7

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
0.51 to 0.99, incl	372	248	6
Over 0.99 to 6.32, incl	372	248	7
Over 6.32 to 25.40, incl	372	248	8
Over 25.40 to 50.80, incl	372	248	7

3.3.2.1.1 Tensile property requirements for product less than 0.020 in. (0.51 mm) or over 2.000 in. (50.80 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.2.2 Bending: Product 0.020 to 0.499 in. (0.51 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
0.020 to 0.062, incl	(0.51 to 1.57, incl)	8
Over 0.062 to 0.250, incl	(Over 1.57 to 6.35, incl)	12
Over 0.250 to 0.499, incl	(Over 6.35 to 12.67, incl)	16

3.3.2.2.1 Bending requirements for product less than 0.020 in. (0.51 mm) or over 0.499 in. (12.67 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

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 as annealed (3.3.1.1), properties after solution and precipitation heat treatment (3.3.2), 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 as annealed (3.3.1.2) 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 4031 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. 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).

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 - 2000 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 4031 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. (1524 mm) Wide, or Over 200 In. (5080 mm) Long: Shall be marked as in 5.1.2 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 4031 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.