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400 COMMONWEALTH DRIVE WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4028E
Superseding AMS 4028D

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ALUMINUM ALLOY SHEET AND PLATE
4.4Cu - 0.85Si - 0.80Mn - 0.50Mg (2014-0)
Annealed

UNS A92014

1. SCOPE:

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

1.2 Application: Primarily for formed parts requiring high strength after heat treatment. Certain design and processing procedures may cause these products to become 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 SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

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

2.1.2 Aerospace Recommended Practices:

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

2.2 U.S. 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

3. TECHNICAL REQUIREMENTS:

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

	min	max
Copper	3.9	5.0
Silicon	0.50	1.2
Manganese	0.40	1.2
Magnesium	0.20	0.8
Iron	--	0.7
Zinc	--	0.25
Titanium	--	0.15
Chromium	--	0.10
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition: Annealed in accordance with MIL-H-6088.

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 specified in Table I and 3.3.1.1.1.

TABLE I

Nominal Thickness Inch	Tensile Strength psi, max	Yield Strength at 0.2% Offset psi, max	Elongation in 2 in. or 4D %, min
0.020 to 0.499, incl	32,000	16,000	16
Over 0.499 to 1.000, incl	32,000	--	10

TABLE I (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, max	Yield Strength at 0.2% Offset MPa, max	Elongation in 50 mm or 4D %, min
0.50 to 12.50, incl	220	110	16
Over 12.50 to 25.00, incl	220	--	10

3.3.1.1.1 Tensile properties of plate over 1.000 in. (25.00 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.1.2 Bending: Product 0.020 - 0.499 in. (0.50 - 12.50 mm) 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	Millimetres	Bend Factor
0.020 to 0.124, incl	0.50 to 3.00, incl	2
Over 0.124 to 0.249, incl	Over 3.00 to 6.25, incl	4
Over 0.249 to 0.499, incl	Over 6.25 to 12.50, incl	6

3.3.1.2.1 Bending requirements for product over 0.499 in. (12.50 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 II and 3.3.2.1.1.

TABLE II

Nominal Thickness Inch	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
0.020 to 0.039, incl	64,000	57,000	6
Over 0.039 to 0.249, incl	66,000	58,000	7
Over 0.249 to 0.499, incl	67,000	59,000	7
Over 0.499 to 1.000, incl	67,000	59,000	6

TABLE II (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, max	Yield Strength at 0.2% Offset MPa, max	Elongation in 50 mm or 4D %, min
0.50 to 1.00, incl	440	395	6
Over 1.00 to 6.25, incl	455	400	7
Over 6.25 to 12.50, incl	460	405	7
Over 12.50 to 25.00, incl	460	405	6

3.3.2.1.1 Tensile properties of plate over 1.000 in. (25.00 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.2.2 Bending: Product 0.020 - 0.499 in. (0.50 - 12.50 mm) 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	Millimetres	Bend Factor
0.020 to 0.039, incl	0.50 to 1.00, incl	5
Over 0.039 to 0.050, incl	Over 1.00 to 1.25, incl	6
Over 0.050 to 0.124, incl	Over 1.25 to 3.00, incl	8
Over 0.124 to 0.249, incl	Over 3.00 to 6.25, incl	10
Over 0.249 to 0.499, incl	Over 6.25 to 12.50, incl	12

3.3.2.2.1 Bending requirements for product over 0.499 in. (12.50 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 for vendor's tests 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 sample and to perform any confirmatory testing deemed 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) and after solution and precipitation heat treatment (3.3.2.1), 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 as annealed (3.3.1.2) and after solution and precipitation heat treatment (3.3.2.2) 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, AMS 4028E, 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, AMS 4028E, 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 either a statement that the material conforms or 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 4028, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be 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. (150 mm) Wide: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 ft (900 mm).