

AEROSPACE
MATERIAL
SPECIFICATION

AMS 4117E
Superseding AMS 4117D

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ALUMINUM ALLOY BARS AND FLASH WELDED RINGS
1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061; -T6, -T651)
Solution and Precipitation Heat Treated UNS A96061

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of rolled or cold-finished bars, rods, and wire and of flash welded rings and stock for flash welded rings.

1.2 Application: Primarily for parts requiring moderate strength where limited formability is acceptable.

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) 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 2201 - Tolerances, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled or Cold Finished

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 7488 - Rings, Flash Welded, Aluminum and Aluminum Alloys

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

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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
Magnesium	0.8	1.2
Silicon	0.40	0.8
Copper	0.15	0.40
Chromium	0.04	0.35
Iron	--	0.7
Zinc	--	0.25
Manganese	--	0.15
Titanium	--	0.15
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition: The product shall be supplied in the following condition:

3.2.1 Bars, Rods, and Wire: Rolled or cold finished, as ordered.

3.2.1.1 Bars, rods, and wire 0.750 in. (18.75 mm) and under in nominal diameter or least distance between parallel sides shall be solution and precipitation heat treated in accordance with MIL-H-6088 to -T6 temper.

3.2.1.2 Bars and rods 0.750 - 8.000 in. (18.75 - 200.00 mm) in nominal diameter or least distance between parallel sides shall be solution heat treated, stress-relieved by stretching to produce a nominal permanent set of 1-1/2% but not less than 1% nor more than 3%, and precipitation heat treated to -T651 temper. Heat treatments shall be in accordance with MIL-H-6088.

3.2.1.2.1 Bars and rods stress-relieved by stretching shall receive no further straightening operations after stretching unless specifically authorized by purchaser.

3.2.2 Flash Welded Rings: Shall be manufactured in accordance with AMS 7488 and solution and precipitation heat treated in accordance with MIL-H-6088 to -T6 temper.

3.2.3 Stock for Flash Welded Rings: As ordered by the flash welded ring manufacturer.

3.3 Properties: Product shall conform to the following requirements determined in accordance with AMS 2355:

3.3.1 Bars, Rods, Wire, and Flash Welded Rings:

3.3.1.1 Tensile Properties: Shall be as follows for rounds 8.000 in. (200 mm) and under in specified diameter, for square, rectangular, hexagonal, and octagonal bars 50 sq in. (325 cm²) and under in cross-sectional area and 8.000 in. (200 mm) and under in least distance between parallel sides, and for flash welded rings 8.000 in. (200 mm) and under in radial thickness:

Tensile Strength, min	42,000 psi (290 MPa)
Yield Strength at 0.2% Offset, min	35,000 psi (240 MPa)
Elongation in 2 in. (50 mm) or 4D, min	10%

3.3.1.1.1 Yield strength and elongation requirements do not apply to product under 0.125 in. (3.12 mm) in nominal diameter or distance between parallel sides.

3.3.1.1.2 Tensile property requirements for rounds over 8.000 in. (200 mm) in specified diameter, for squares, rectangles, hexagons, and octagons over 8.000 in. (200 mm) in least distance between parallel sides and over 50 sq in. (325 cm²) in cross sectional area, and for flash welded rings over 8.000 in. (200 mm) in radial thickness shall be as agreed upon by purchaser and vendor.

3.3.1.2 Hardness: Should be not lower than 80 HB/10/500 or 85 HB/10/1000 but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.3.1.1 are met.

3.3.2 Stock for Flash Welded Rings: Specimens taken from the stock after solution and precipitation heat treatment in accordance with 3.2.2 shall conform to the requirements of 3.3.1.1 and 3.3.1.2.

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 for bars, rods, and wire shall conform to all applicable requirements of AMS 2201.

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 the following requirements are classified as acceptance tests and shall be performed on each lot:

4.2.1.1 Composition (3.1) of the product.

4.2.1.2 Tensile properties (3.3.1.1) of bars, rods, wire, and flash welded rings.

4.2.1.3 Tolerances (3.5) of bars, rods, and wire.

4.2.2 Periodic Tests: Tests of bars, rods, wire, and flash welded rings to determine conformance to requirements for hardness (3.3.1.2) and of stock for flash welded rings to determine ability to develop required properties (3.3.2) 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 bars, rods, wire, and stock for flash welded rings 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 4117E, 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, 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: The product shall be identified as follows:

5.1.1 Bars, Rods, and Wire: