



400 Commonwealth Drive, Warrendale, PA 15096-0001

# AEROSPACE MATERIAL SPECIFICATION

**SAE****AMS 4117G**

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Superseding AMS 4117F

Submitted for recognition as an American National Standard

## ALUMINUM ALLOY, ROLLED OR COLD FINISHED BARS, RODS, AND WIRE 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:

These products have been used typically for parts requiring moderate strength where limited formability is acceptable, but usage is not limited to such applications.

### 2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

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## 2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

- AMS 2201 Tolerances, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled or Cold Finished
- MAM 2201 Tolerances, Metric, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled, Drawn, or Cold Finished
- AMS 2355 Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
- MAM 2355 Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings, Metric (SI) Units
- AMS 2811 Identification, Aluminum and Magnesium Alloy Wrought Products
- AMS 7488 Rings, Flash Welded, Aluminum and Aluminum Alloys

## 2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products

## 2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-H-6088 Heat Treatment of Aluminum Alloys

## 3. TECHNICAL REQUIREMENTS:

## 3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS 2355 or MAM 2355.

TABLE 1 - Composition

Element	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	

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**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 under 0.500 inch (12.70 mm) in nominal diameter (R) or least distance between parallel sides shall be solution and precipitation heat treated to the -T6 temper in accordance with MIL-H-6088. Where -T6 temper is ordered, -T651 temper may be supplied.

**3.2.1.2** Bars and rods 0.500 to 8.000 inches (12.70 to 203.20 mm), inclusive, 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 to the -T6 temper in accordance with MIL-H-6088.

**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 or MAM 2355:

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

**3.3.1.1** Tensile Properties: Shall be as shown in Table 2 for rounds 8 inches (203 mm) and under in specified diameter, for square, rectangular, hexagonal, and octagonal bars 50 square inches (322 cm<sup>2</sup>) and under in cross-sectional area and 8 inches (203 mm) and under in least distance between parallel sides, and for flash welded rings 8 inches (203 mm) and under in radial thickness.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	42.0 ksi (290 MPa)
Yield Strength at 0.2% Offset	35.0 ksi (241 MPa)
Elongation in 2 Inches (50.8 mm) or 4D	10%

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- 3.3.1.1.1 Yield strength and elongation requirements do not apply to product under 0.125 inch (3.18 mm) in nominal diameter or least distance between parallel sides.
- 3.3.1.1.2 Tensile property requirements for rounds over 8 inches (203 mm) in specified diameter, for squares, rectangles, hexagons, and octagons over 8 inches (203 mm) in least distance between parallel sides and over 50 square inches (322 cm<sup>2</sup>) in cross-sectional area, and for flash welded rings over 8 inches (203 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 imperfections detrimental to usage of the product.

#### 3.5 Tolerances:

Bars, rods, and wire shall conform to all applicable requirements of AMS 2201 or MAM 2201.

#### 4. QUALITY ASSURANCE PROVISIONS:

##### 4.1 Responsibility for Inspection:

(R)

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. 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 for the following requirements are 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.