



AEROSPACE MATERIAL SPECIFICATION

AMS4117™**REV. L**Issued 1960-01
Revised 2020-08

Superseding AMS4117K

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)

(Composition similar to UNS A96061)

RATIONALE

AMS4117L prohibits unauthorized exceptions (3.6), revises Condition (3.2), Properties (3.3), Reports (4.4), and Identification (5.1.1.1), allows provisions for extrusion press solution heat treated (3.2.1.3), and results from a Five-Year Review and update of this specification.

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.

1.1.1 This specification covers rounds 8 inches (203 mm) and under in specified diameter, and square, rectangular, hexagonal, and octagonal bars 50 square inches (322 cm²) and under in cross-sectional area and 8 inches (203 mm) and under in least distance between parallel sides, and flash welded rings 8 inches (203 mm) and under in radial thickness (see 8.5).

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 issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

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<https://www.sae.org/standards/content/AMS4117L/>

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2355	Quality Assurance, Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings
AMS2772	Heat Treatment of Aluminum Alloy Raw Materials
AMS7488	Rings, Flash Welded, Aluminum and Aluminum Alloys
ARP1917	Clarification of Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B660	Packaging/Packing of Aluminum and Magnesium Products
ASTM B666/B666M	Identification Marking of Aluminum and Magnesium Products
ASTM B807/B807M	Extrusion Press Solution Heat Treatment for Aluminum Alloys

2.3 ANSI Accredited Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ANSI H35.1/H35.1M	Standard Alloy and Temper Designation System for Aluminum
ANSI H35.2	Dimensional Tolerances for Aluminum Mill Products
ANSI H35.2M	Dimensional Tolerances for Aluminum Mill Products (Metric)

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2355.

Table 1 - Composition

Element	Min	Max
Silicon	0.40	0.8
Iron	--	0.7
Copper	0.15	0.40
Manganese	--	0.15
Magnesium	0.8	1.2
Chromium	0.04	0.35
Zinc	--	0.25
Titanium	--	0.15
Other Elements, each	--	0.05
Other Elements, 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 under 0.500 inch (12.70 mm) in nominal diameter or least distance between parallel sides shall be solution and precipitation heat treated to the -T6 temper in accordance with 3.2.1.3. Where -T6 temper is ordered, -T651 temper may be supplied (refer to ANSI H35.1/H35.1M).

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 3.2.1.3.

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.

3.2.1.3 Heat treatment shall be classified as follows:

Class 1 - Furnace solution heat treated in accordance with AMS2772 and precipitation heat treated in accordance with AMS2772.

Class 2 - Extruded and press solution heat treated in accordance with ASTM B807/B807M and precipitation heat treated in accordance with AMS2772.

Class 1 shall be supplied unless Class 2 is specified (see 8.5).

3.2.2 Flash Welded Rings

Shall be manufactured in accordance with AMS7488 and solution and precipitation heat treated to the -T6 temper in accordance with AMS2772.

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 AMS2355 on the mill product.

3.3.1 Bars, Rods, Wire, and Flash Welded Rings

3.3.1.1 T6 and T651 Temper Tensile Properties

Shall be 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 cm²) 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 - T6 and T651 temper 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%

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 Mechanical property requirements for product outside of the range covered by 1.1.1 shall be as agreed upon between purchaser and producer.

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.

3.3.3 Response to Heat Treatment

3.3.3.1 Response to Heat Treatment (T6 or T651 to T42 Temper)

When specified, product in the T6 or T651 temper (without the subsequent imposition of cold working or forming operations), after solution heat treatment and natural aging to the T42 temper (refer to ANSI H35.1/H35.1M), in accordance with AMS2772, shall have the properties of Table 3.

3.3.3.1.1 Natural Aging Before Testing

Specimens in the T42 tempers will not be required to be tested within 4 days after completion of the solution heat treatment. If, within this period, the manufacturer elects to test specimens, which thereupon fail to meet the requirements, they can discard these original test results and test additional specimens selected after 4 days of aging. These specimens shall be selected from the same location in the production lot or sample as those tested previously in accordance with AMS2355.

3.3.3.2 Response to Heat Treatment (T6 or T651 to T62 Temper)

When specified, product in the T6 or T651 temper, after solution and precipitation heat treatment to the T62 temper (refer to ANSI H35.1/H35.1M), in accordance with AMS2772, shall have the properties shown in Table 3.

3.3.3.3 T42 and T62 Temper Tensile Properties

Shall be shown in Table 3, except as specified in 3.3.3.3.1 and 3.3.3.3.2.

Table 3 - T42 and T62 temper minimum tensile properties

Temper	Tensile Strength ksi (MPa)	Yield Strength at 0.2% Offset ksi (MPa)	Elongation in 2 Inches or 4D
T42	30.0 (207)	14.0 (97)	18
T62	42.0 (290)	35.0 (241)	10

3.3.3.3.1 Tensile property requirements shown in Table 3 apply to rounds 8.000 inches (203.20 mm) and under in nominal diameter, and to squares, rectangles, hexagons, and octagons having a cross-sectional area of 50 square inches (322 cm²) and under in cross-sectional area and 8.000 inches (203.20 mm) and under in least distance between parallel sides, and for flash welded rings 8.000 inches (203.20 mm) and under in radial thickness.

3.3.3.3.2 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.

3.3.4 Mechanical property requirements for product outside the range covered by 1.1 shall be agreed upon between purchaser and producer.

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 ANSI H35.2 or ANSI H35.2M.

3.6 Exceptions

Any exceptions shall be authorized by purchaser and reported as in 4.4.2.