

# AEROSPACE MATERIAL SPECIFICATION

**SAE AMS4117**

**REV. J**

Issued 1960-01  
Revised 2009-07

Superseding AMS4117H

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

(Composition similar to UNS A96061)

## RATIONALE

AMS4117J results from a Five Year Review and update of this specification in order to permit supersession of AMS-QQ-A-225/8A to 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.

#### 1.2 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.

#### 2.1 SAE Publications

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

|         |                                                                                                                                                                   |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AMS2355 | Quality Assurance Sampling and Testing of 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                                                                                                                 |

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2009 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

**TO PLACE A DOCUMENT ORDER:** Tel: 877-606-7323 (inside USA and Canada)  
Tel: +1 724-776-4970 (outside USA)  
Fax: 724-776-0790  
Email: [CustomerService@sae.org](mailto:CustomerService@sae.org)  
**SAE WEB ADDRESS:** <http://www.sae.org>

**SAE values your input. To provide feedback  
on this Technical Report, please visit  
<http://www.sae.org/technical/standards/AMS4117J>**

## 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](http://www.astm.org).

ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products  
ASTM B 666/666M Identification Marking of Aluminum and Magnesium Products

## 2.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036, Tel: 212-642-4900, [www.ansi.org](http://www.ansi.org).

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 AMS2772. 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 AMS2772.

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 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 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 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%                |

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.

### 3.3.2 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 Re-heat Treatment (T4 to T42)

The product, as received by purchaser, without the subsequent imposition of cold working or forming operations, shall have the properties of Table 3, after proper solution heat treatment and natural aging to the T42 condition (See AS1990) in accordance with AMS2772.

##### 3.3.3.1.1 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 four 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 to –T62 Condition

The product shall have the following properties (Table 3) after being aged in accordance with AMS2772 to the –T62 condition (See AS1990).

### 3.3.3.3 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 - MINIMUM TENSILE PROPERTIES

| Temper | Tensile Strength ksi<br>(MPa) | Yield Strength at 0.2%<br>Offset ksi (MPa) | Elongation in 2 inches<br>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 (322cm<sup>2</sup>) 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.

### 3.4 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.

## 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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

### 4.2 Classification of Tests

#### 4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.3.1.1), and tolerances (3.5) are acceptance tests and, except for composition, shall be performed on each lot.

#### 4.2.2 Periodic Tests

The ability of stock for flash welded rings to develop required properties (3.3.2) and response to heat treatment of all product forms (3.3.3) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

### 4.3 Sampling and Testing

Shall be in accordance with AMS2355.