



# AEROSPACE MATERIAL SPECIFICATION

**AMS4353**

Issued 2014-12

Aluminum Alloy, Extruded Round Rod  
3.5Cu - 1.0Li - 0.40Mg - 0.45Ag - 0.12Zr (2050-T84)  
Solution Heat Treated, Stress Relieved by Stretching, and Artificially Aged

## RATIONALE

AMS4353 is a new specification to cover aluminum alloy 2050-T84 extruded round rod.

### 1. SCOPE:

#### 1.1 Form

This specification covers an aluminum alloy in the form of extruded round rods.

1.1.1 This specification covers products from 1.750 to 5.900 inches (44.45 to 150.00 mm) in diameter (See 8.4).

#### 1.2 Application

This product has typically been used for parts where low density is needed in combination with a high level of mechanical properties and good resistance to stress-corrosion cracking, 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, Aluminum Alloys and Magnesium Alloy, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings |
| AMS2772 | Heat Treatment of Aluminum Alloy Raw Materials                                                                                                                   |
| ARP823  | Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products                                                                           |
| AS1990  | Aluminum Alloy Tempers                                                                                                                                           |

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## 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 594        | Ultrasonic Inspection of Aluminum-Alloy Wrought Products for Aerospace Applications              |
| ASTM B 645        | Linear-Elastic Plane-Strain Fracture Toughness Testing of Aluminum Alloys                        |
| ASTM B 660        | Packaging/Packing of Aluminum and Magnesium Products                                             |
| ASTM B 666/B 666M | Identification Marking of Aluminum and Magnesium Products                                        |
| ASTM E 399        | Linear-Elastic Plane-Strain Fracture Toughness $K_{Ic}$ of Metallic Materials                    |
| ASTM G 47         | Determining Susceptibility to Stress-Corrosion Cracking of High Strength Aluminum Alloy Products |

## 2.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, [www.ansi.org](http://www.ansi.org).

|              |                                                            |
|--------------|------------------------------------------------------------|
| ANSI H 35.2  | Dimensional Tolerances for Aluminum Mill Products          |
| ANSI H 35.2M | 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               | --        | 0.08 |
| Iron                  | --        | 0.10 |
| Copper                | 3.2       | 3.9  |
| Manganese             | 0.20      | 0.50 |
| Magnesium             | 0.20      | 0.6  |
| Chromium              | --        | 0.05 |
| Nickel                | --        | 0.05 |
| Zinc                  | --        | 0.25 |
| Titanium              | --        | 0.10 |
| Gallium               | --        | 0.05 |
| Lithium               | 0.7       | 1.3  |
| Silver                | 0.20      | 0.7  |
| Vanadium              | --        | 0.05 |
| Zirconium             | 0.06      | 0.14 |
| Other Elements, each  | --        | 0.05 |
| Other Elements, total | --        | 0.15 |
| Aluminum              | remainder |      |

### 3.2 Condition

Solution heat-treated, stretched to produce a nominal permanent set of 4.0% but not less than 3.5% nor more than 5%, and precipitation heat treated to the T84 temper (See AS1990). Solution and precipitation heat treatment shall be performed in accordance with AMS2772. Actual solution heat treatment temperatures and aging time/temperatures are proprietary.

### 3.3 Properties

Product shall conform to the following requirements, determined in accordance with AMS2355 on the mill produced size and as specified herein.

3.3.1 Mechanical property requirements for product outside of the range covered by Tables 2 and 3 shall be agreed upon between purchaser and producer.

#### 3.3.2 Tensile Properties

3.3.2.1 Longitudinal and transverse tensile properties shall be as specified in Table 2.

**TABLE 2A - Minimum Tensile Properties, Inch/Pound Units**

| Nominal Diameter<br>Inches | Specimen<br>Orientation | Tensile<br>Strength,<br>ksi | Yield Strength at<br>2% Offset<br>ksi | Elongation in 2<br>Inches or 4D<br>% |
|----------------------------|-------------------------|-----------------------------|---------------------------------------|--------------------------------------|
| 1.750-5.900, incl          | Longitudinal            | 85.0                        | 82.0                                  | 9                                    |
|                            | Transverse              | 71.0                        | 64.0                                  | 4                                    |

**TABLE 2B - Minimum Tensile Properties, SI Units**

| Nominal Diameter<br>Millimeters | Specimen<br>Orientation | Tensile<br>Strength<br>MPa | Yield Strength<br>at 2% Offset<br>MPa | Elongation in 50.8<br>mm, 5D or 5.65√A<br>% |
|---------------------------------|-------------------------|----------------------------|---------------------------------------|---------------------------------------------|
| 44.45 to 150.00, incl           | Longitudinal            | 585                        | 565                                   | 8                                           |
|                                 | Transverse              | 490                        | 440                                   | 3                                           |

#### 3.3.3 Stress-Corrosion Test

Specimens, cut from material 1.75 inches (44 mm) and over in nominal diameter, shall show no evidence of stress-corrosion cracking when tested in accordance with ASTM G 47 and stressed in the transverse direction to 58.0 ksi (400 MPa) for 30 days.

#### 3.3.4 Fracture Toughness

When specified, plane strain fracture toughness shall be tested in accordance with ASTM E 399 and ASTM B 645 for rod 1.750 to 5.900 inches (44.45 to 150.00 mm) inclusive in nominal diameter. A valid K<sub>Ic</sub> meeting the requirements of ASTM E399 or a K<sub>Q</sub> "useable for lot release" in accordance with ASTM B 645 shall meet or exceed the values specified in Table 3. The required specimen orientation(s) shall be specified by purchaser.

**TABLE 3A - Minimum Fracture Toughness Parameters, Inch/Pound Units**

| Nominal Diameter<br>Inches | L-R<br>ksi√inch | R-L<br>ksi√inch |
|----------------------------|-----------------|-----------------|
| 1.750-5.900, incl          | 32              | 19              |

**TABLE 3B - Minimum Fracture toughness parameters, SI Units**

| Nominal Diameter<br>Millimeters | L-R<br>MPa√m | R-L<br>MPa√m |
|---------------------------------|--------------|--------------|
| 44.45 to 150.00, incl           | 35           | 21           |

### 3.4 Quality

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 extrusions.

3.4.1 When specified, rod shall be ultrasonically inspected to meet class A requirements in accordance with ASTM B 594. All extrusions in the inspection lot shall be inspected.

### 3.5 Tolerances

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 extrusions 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 extrusions conform to specified requirements.

### 4.2 Classification of Tests

#### 4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.3.2.1), stress corrosion resistance, when specified (3.3.3), fracture toughness, when specified (3.3.4), quality (3.4), ultrasonic inspection, when specified (3.4.1), and tolerances (3.5) are acceptance tests and, except for composition, shall be performed on each inspection lot.

### 4.3 Sampling and Testing

Shall be in accordance with AMS2355.

### 4.4 Reports

The vendor of the product shall furnish with each shipment a report stating that the product conforms to the chemical composition, tolerances, and ultrasonic testing when specified, showing the numerical results of tests on each inspection lot to determine conformance to the other acceptance test requirements and stating that the product conforms to the other specified requirements. This report shall include the purchase order number, inspection lot number, AMS4353, size, and quantity. The report shall also identify the producer, the mill product form, and the mill produced size.

4.4.1 When the product size is outside the range covered by Table 2, the report shall contain a statement to that effect.

### 4.5 Resampling and Retesting

Shall be in accordance with AMS2355.

## 5. PREPARATION FOR DELIVERY

### 5.1 Identification

Shall be in accordance with ASTM B 666/B 666M.