



| | | |
|---|---|---------------|
| AEROSPACE MATERIAL SPECIFICATION | AMS4161™ | REV. J |
| | Issued 1960-01 Reaffirmed 2010-05 Revised 2020-12 Superseding AMS4161H | |
| Aluminum Alloy, Extrusions 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-T4) Solution Heat Treated and Naturally Aged (Composition similar to UNS A96061) | | |

RATIONALE

AMS4161J prohibits unauthorized exceptions (3.6), revises Condition (3.2), Response to Heat Treatment (3.3.2), Reports (4.4.1), and Identification (5.1.1), 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 extruded bars, rods, wire, shapes, profiles, and tubing.

1.1.1 Tubing

Tubing shall be additionally classified as follows:

- Type I - Seamless tubing extruded from hollow billets using die and mandrel
- Type II - Tubing extruded from solid billets using porthole or spider die or similar tooling

When no Type is specified, Type I shall apply.

1.2 Application

These products have been used typically for parts requiring moderate strength, especially where such parts require brazing or welding during fabrication, but usage is not limited to such applications. Brazed or welded parts may require additional heat treating to restore properties depending on application.

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.

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 revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2020 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
 http://www.sae.org

SAE WEB ADDRESS:

For more information on this standard, visit
<https://www.sae.org/standards/content/AMS4161J/>

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 Alloy, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings
- AMS2772 Heat Treatment of Aluminum Alloy Raw Materials
- 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 B594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products
- 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
- ASTM E10 Brinell Hardness of Metallic Materials

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

Solution heat treated and naturally aged to the T4 temper (refer to ANSI H35.1/H35.1M).

3.2.1 Extrusions shall be supplied with the as-extruded surface finish; light polishing to remove minor surface imperfections is permissible provided such imperfections can be removed within specified dimensional tolerances.

3.2.2 Heat treatment shall be classified as follows:

Class 1 - Furnace solution heat treated in accordance with AMS2772

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

If no Class is specified, either Class may be provided.

3.3 Properties

Extrusions shall conform to the following requirements, determined in accordance with AMS2355.

3.3.1 As Solution Heat Treated and Naturally Aged

3.3.1.1 Tensile Properties

Shall be as shown in Table 2.

Table 2 - Minimum tensile properties

| Property | Value |
|--|--------------------|
| Tensile Strength | 26.0 ksi (179 MPa) |
| Yield Strength at 0.2% Offset | 16.0 ksi (110 MPa) |
| Elongation in 2 Inches (50.8 mm) or 4D | 16% |

3.3.2 Response to Heat Treatment

Extrusions, precipitation heat treated in accordance with AMS2772 to the T62 temper (refer to ANSI H35.1/H35.1M), shall have the following properties:

3.3.2.1 Tensile Properties

Shall be as shown in Table 3.

Table 3A - Minimum tensile properties, inch/pound units

| Nominal Diameter or Least Thickness (Bars, Rods, Wire, Shapes) or Nominal Wall Thickness (Tubing), Inches | Tensile Strength ksi | Yield Strength at 0.2% Offset ksi | Elongation in 2 Inches or 4D % |
|---|----------------------------|---|--------------------------------------|
| Up to 0.250, excl | 38.0 | 35.0 | 8 |
| 0.250 and over | 38.0 | 35.0 | 10 |

Table 3B - Minimum tensile properties, SI units

| Nominal Diameter or Least Thickness (Bars, Rods, Wire, Shapes) or Nominal Wall Thickness (Tubing), Millimeters | Tensile Strength MPa | Yield Strength at 0.2% Offset MPa | Elongation in 50.8 mm or 4D % |
|--|----------------------------|---|-------------------------------------|
| Up to 6.35, excl | 262 | 241 | 8 |
| 6.35 and over | 262 | 241 | 10 |

3.4 Quality

Extrusions, 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, extrusions shall be subjected to ultrasonic inspection in accordance with ASTM B594. Standards for acceptance shall be as agreed upon by purchaser and producer.

3.5 Tolerances

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 4.4.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of extrusions shall supply all samples for producer'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 as solution heat treated and naturally aged (3.3.1.1), 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.

4.2.2 Periodic Tests

Tensile properties after precipitation heat treatment (3.3.2.1) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2355.

4.3.1 Additional Sampling and Testing of Material Press Solution Heat Treated

Compliance with the requirements of Table 2 shall be determined by hardness tests followed by tension tests performed on samples from the two softest extrusions in the inspection lot. The method of hardness testing shall be left to the discretion of the producer.