



# AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.  
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

## AMS 4161C

Superseding AMS 4161B

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ALUMINUM ALLOY EXTRUSIONS  
1.0Mg - 0.60Si - 0.30Cu - 0.20Cr (6061-T4)

### 1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of extruded bars, rods, wire, shapes, and tubing.

1.2 Application: Primarily for parts requiring moderate strength, especially where such parts and assemblies require brazing or welding during fabrication.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

#### 2.1.1 Aerospace Material Specifications:

AMS 2205 - Tolerances, Aluminum-Base and Magnesium-Base Alloy Extrusions

AMS 2350 - Standards and Test Methods

AMS 2355 - Quality Assurance Sampling and Testing of Aluminum-Base and Magnesium-Base Alloys, Wrought Products (Except Forgings and Forging Stock) and Flash Welded Rings

AMS 2630 - Ultrasonic Inspection

AMS 2770 - Heat Treatment of Aluminum and Aluminum Alloys

2.2 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

#### 2.2.1 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

#### 2.2.2 Military Standards:

MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

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3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined in accordance with AMS 2355:

	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	

3.2 Condition: Solution heat treated in accordance with MIL-H-6088.

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

3.3 Properties: Extrusions shall conform to the following requirements, determined in accordance with AMS 2355:

3.3.1 As Solution Heat Treated:

3.3.1.1 Tensile Properties: Shall be as follows:

Tensile Strength, min	26,000 psi (179 MPa)
Yield Strength at 0.2% Offset, min	16,000 psi (110 MPa)
Elongation in 2 in. (50 mm) or 4D, min	16%

3.3.1.2 Hardness: Should be not lower than 55 HB/10/500, 55/HB/14.3/1000, or 60 HB/10/1000 but the extrusions shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.3.2 After Precipitation Heat Treatment: Extrusions precipitation heat treated in accordance with AMS 2770 shall have the following properties:

3.3.2.1 Tensile Properties: Shall be as specified in Table I.

TABLE I

Nominal Diameter or Least Thickness (bars, rods, wire, shapes) or Nominal Wall Thickness (tubing) Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Up to 0.250, excl	38,000	35,000	8
0.250 and over	38,000	35,000	10

TABLE I (SI)

Nominal Diameter or Least Thickness (bars, rods, wire, shapes) or Nominal Wall Thickness (tubing) Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50 mm or 4D %, min
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 internal and external imperfections detrimental to usage of the extrusions.

3.4.1 When specified, extrusions shall be subjected to ultrasonic inspection in accordance with AMS 2630. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.5 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2205.

4: QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of extrusions shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the extrusions conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties as solution heat treated (3.3.1.1), ultrasonic inspection (3.4.1) when specified, and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for hardness as solution heat treated (3.3.1.2) and tensile properties after precipitation heat treatment (3.3.2.1) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with AMS 2355.

4.4 Reports:

4.4.1 The vendor of extrusions shall furnish with each shipment three copies of a report stating that the extrusions conform to the chemical composition and other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, size or section identification number, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of extrusions, part number, and quantity. When extrusions for making parts are produced or purchased by the parts vendor, that vendor shall inspect each lot of extrusions to determine conformance to the requirements of this specification, and shall include in the report a statement that the extrusions conform, or shall include copies of laboratory reports showing the results of tests to determine conformance.

∅ 4.5 Resampling and Retesting: Shall be in accordance with AMS 2355.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Extrusions shall be identified as follows:

5.1.1 Each straight bar, rod, and tube 0.500 in. (12.70 mm) and over in nominal OD or least width of flat surface and each straight shape with configuration allowing access to a flat surface at least 0.500 in. (12.70 mm) wide recessed not more than 1/8 in. (3.2 mm) below the outline of the shape shall be marked in a row of characters recurring at intervals not greater than 3 ft (914 mm) with the alloy number and temper, AMS 4161 or applicable Federal or Military specification designation, and manufacturer's identification. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be sufficiently stable to withstand normal handling. The markings shall have no deleterious effect on the extrusions or their performance.

∅ 5.1.2 All straight extrusions other than those of 5.1.1 shall be securely bundled, boxed, or secured on lifts and identified by two durable tags marked with the information of 5.1.1 and attached, not farther than 2 ft (610 mm) from each end, to the extrusions in each bundle, box, or lift.

∅ 5.1.3 Coiled bar, rod, wire, and tubing shall be identified with the information of 5.1.1 marked on a durable tag attached to each coil or directly on one flange of each spool.

5.2 Packaging:

∅ 5.2.1 Extrusions shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the extrusions to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

∅ 5.2.2 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-649, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.2.1 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Extrusions not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (∅) symbol is used to indicate technical changes from the previous issue of this specification.

8.2 Dimensions and properties in U.S. Conventional units are primary; dimensions and properties in SI units are shown as the equivalents of the U.S. Conventional units and are not to be construed as standard for extrusions produced to SI dimensions.