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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-4156

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Superseding AMS-4156G

Submitted for recognition as an American National Standard

EXTRUSIONS, ALUMINUM ALLOY
0.68Mg - 0.40Si (6063-T6)
Solution and Precipitation Heat Treated

UNS A96063

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 good surface finish and for hollow, partially enclosed, and intricate shapes for which an alloy having good extruding characteristics is required.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

2.1.1 Aerospace Material Specifications:

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

MAM-2205 - Tolerances, Metric, Aluminum Alloy and Magnesium Alloy Extrusions

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

MAM-2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings, Metric (SI) Units

AMS-2811 - Identification, Aluminum and Magnesium Alloy Wrought Products

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2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 594 - Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications

ASTM B 660 - Packaging/Packing of Aluminum and Magnesium Products

2.3 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

3. TECHNICAL REQUIREMENTS:

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

	min	max
Magnesium	0.45	0.9
Silicon	0.20	0.6
Iron	-	0.35
Copper	-	0.10
Chromium	-	0.10
Manganese	-	0.10
Titanium	-	0.10
Zinc	-	0.10
Other Impurities, each	-	0.05
Other Impurities, total	-	0.15
Aluminum	remainder	

3.2 Condition: Solution and precipitation heat treated.

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

3.3 Heat Treatment: Shall be as specified in 3.3.1 and 3.3.2. Furnace surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-H-6088.

3.3.1 Solution Heat Treatment: Quench in water or air directly from the extrusion press, or heat to $970^{\circ}\text{F} \pm 10$ ($521^{\circ}\text{C} \pm 6$) and quench in water or air.

3.3.2 Precipitation Heat Treatment: Heat to $350^{\circ}\text{F} \pm 10$ ($177^{\circ}\text{C} \pm 6$) and hold at heat for 8 hours ± 0.5 .

3.4 Properties: Extrusions shall conform to the following requirements, determined in accordance with AMS-2355 or MAM-2355:

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3.4.1 Tensile Properties: Shall be as specified in Table I and 3.4.1.1.

TABLE I

Nominal Diameter or Least Thickness (rods, bars, wire, shapes) or Nominal Wall Thickness (tubing) Inch	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 Inches or 4D %, min
Up to 0.125, excl	30,000	25,000	8
0.125 to 1.000, incl	30,000	25,000	10

TABLE I (SI)

Nominal Diameter or Least Thickness (rods, bars, wire, shapes) or Nominal Wall Thickness (tubing) Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 3.18, excl	207	172	8
3.18 to 25.40, incl	207	172	10

3.4.1.1 Tensile property requirements for extrusions over 1.000 inch (25.40 mm) in nominal diameter or least thickness (wall thickness of tubing) shall be as agreed upon by purchaser and vendor.

3.4.2 Hardness: Should be not lower than 60 HB/10/500 or 66 HB/10/1000 but the extrusions shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.5 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.

3.5.1 When specified, extrusions shall be subjected to ultrasonic inspection in accordance with ASTM B 594. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.6 Tolerances: Shall conform to all applicable requirements of AMS-2205 or MAM-2205.

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 performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the extrusions conform to the requirements of this specification.

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4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for composition (3.1), tensile properties (3.4.1), ultrasonic inspection (3.5.1) when specified, and tolerances (3.6) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests for hardness (3.4.2) 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 AMS-2355 or MAM-2355.
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4.4 Reports: The vendor of extrusions shall furnish with each shipment 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, lot number, AMS-4156H, size or section identification number, and quantity.

4.5 Resampling and Retesting: Shall be in accordance with AMS-2355 or MAM-2355.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Shall be in accordance with AMS-2811.
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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.
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5.2.2 For direct U.S. Military procurement, packaging shall be in accordance with ASTM B 660, Commercial Level, unless Level A is specified in the request for procurement.

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 modifications authorized by purchaser, 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 inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.