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The Engineering Society For Advancing Mobility Land Sea Air and Space®

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 4159B

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Superseding AMS 4159A

ALUMINUM ALLOY EXTRUSIONS
7.7Zn - 2.4Mg - 1.6Cu - 0.16Cr (7049-T76511)
Solution Heat Treated, Stress Relieved, and Overaged

UNS A97049

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 structural applications requiring a combination of high strength, good exfoliation-corrosion resistance, and stress-corrosion resistance.

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 documents shall be as specified in AMS 2350.

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

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 2350 - Standards and Test Methods
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

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

ASTM B594 - Ultrasonic Inspection of Aluminum Alloys for Aerospace Applications
ASTM B660 - Packaging/Packing of Aluminum and Magnesium Products
ASTM G34 - Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)

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

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
Zinc	7.2	8.2
Magnesium	2.0	2.9
Copper	1.2	1.9
Chromium	0.10	0.22
Iron	--	0.35
Silicon	--	0.25
Manganese	--	0.20
Titanium	--	0.10
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition: Solution heat treated, stress-relieved by stretching to produce a nominal permanent set of 1.5%, but not less than 1% nor more than 3%, and overaged. Solution and overaging heat treatments shall be performed 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.

3.2.2 Extrusions may receive minor straightening, after stretching, of an amount necessary to meet the requirements of 3.5.

3.3 Properties: Extrusions 5.000 inches (127.00 mm) and under in nominal diameter or least thickness (wall thickness of tubing) shall conform to the following requirements, determined in accordance with AMS 2355 or MAM 2355; requirements for extrusions over 5.000 inches (127.00 mm) in nominal diameter or least thickness (wall thickness of tubing) shall be as agreed upon by purchaser and vendor:

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

TABLE I

Nominal Diameter or Least Thickness (Wall Thickness of Tubing) Inches	Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, minimum	Elongation in 2 Inches or 4D %, minimum
Up to 3.000, excl	Longitudinal	78,000	70,000	7
	Long-Trans.	76,000	68,000	5
3.000 to 5.000, incl	Longitudinal	76,000	68,000	7
	Long-Trans.	74,000	66,000	5

TABLE I (SI)

Nominal Diameter or Least Thickness (Wall Thickness of Tubing) Millimetres	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, minimum	Elongation in 50.8 mm or 4D %, minimum
Up to 76.20, excl	Longitudinal	538	483	7
	Long-Trans.	524	469	5
76.20 to 127.00, incl	Longitudinal	524	469	7
	Long-Trans.	510	455	5

3.3.2 Conductivity: Shall be not lower than 38.0% IACS (International Annealed Copper Standard) (22.0 MS/m).

3.3.2.1 If the conductivity is below 38.0% IACS (22.0 MS/m), the extrusions are not acceptable.

3.3.2.2 Extrusions found to be unacceptable may be given additional overaging heat treatment and if, upon completion of such treatment, they develop conductivity/property relationships conforming to 3.3.1 and 3.3.2, they shall be acceptable.

3.3.3 Exfoliation-Corrosion Resistance: Specimens cut from extrusions shall not exhibit exfoliation-corrosion, at any plane, greater than that illustrated in Photo B, Figure 2, of ASTM G34.

3.3.4 Stress-Corrosion Resistance: Specimens, cut from extrusions 0.750 inch (19.05 mm) and over in nominal diameter or least thickness, shall exhibit no evidence of stress-corrosion cracking when stressed in the short-transverse (perpendicular to grain flow) direction to 20,000 psi (138 MPa).

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 Ø When specified, extrusions shall be subjected to ultrasonic inspection in accordance with ASTM B594. Standards for acceptance shall be agreed upon between purchaser and vendor.

3.5 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. Results of such tests shall be reported to the purchaser as required by 4.4. 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.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.3.1), conductivity (3.3.2), 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 exfoliation-corrosion resistance (3.3.3) and stress-corrosion resistance (3.3.4) 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 or MAM 2355 and the following: