SAE 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 4157B

Issued 12-15-74
Revised 10-1-88

Superseding AMS 4157A

ALUMINUM ALLOY EXTRUSIONS
7.7Zn - 2.4Mg - 1.6Cu - 0.16Cr (7049-T73511)
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 parts in structural applications requiring a combination of high strength with good stress-corrosion resistance.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications 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 American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B594 - Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM B660 - Packaging/Packing of Aluminum and Magnesium Products

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 permanent set of 1% to 3%, and overaged.

3.2.1 Extrusions may receive minor straightening, after stretching, of an amount necessary to meet the requirements of 3.6.

3.2.2 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 Heat Treatment: Shall be as follows:

3.3.1 Solution Heat Treatment: Heat to 875°F ± 10 (468°C ± 6), hold at heat for a time commensurate with section thickness but not less than 60 minutes, and quench in water at room temperature. Hold at room temperature for not less than 48 hours.

3.3.2 Recommended Overaging Heat Treatment: Heat to 250°F ± 10 (121°C ± 6), hold at heat for 24 hours ± 1, heat to 330°F ± 5 (166°C ± 3), hold at heat for 12 - 21 hours depending on furnace equipment, load, configuration, etc, and cool in air.

3.3.3 Furnace surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-H-6088.

3.4 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 and as specified in 3.4.3; 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:

3.4.1 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	Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 Inches or 4D %, min
Up to 3.000, excl	Longitudinal	74,000	64,000	7
	Long-Trans.	70,000	60,000	5
3.000 to 5.000, incl	Longitudinal	72,000	62,000	7
	Long-Trans.	68,000	58,000	5

TABLE I (SI)

Nominal Diameter or Least Thickness (bars, rods, wire, shapes) or Nominal Wall Thickness (tubing) Millimetres	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 76.20, excl	Longitudinal	510	441	7
	Long-Trans.	483	414	5
76.20 to 127.00, incl	Longitudinal	496	427	7
	Long-Trans.	469	400	5

3.4.2 Stress-Corrosion Resistance: Specimens cut from extrusions shall meet the Ø conductivity test of 3.4.2.1 and shall exhibit no evidence of stress-corrosion cracking when tested in accordance with 3.4.2.2. The test of 3.4.2.2 need not be performed on extrusions meeting the requirements of 3.4.2.1.

3.4.2.1 Conductivity: Shall be not lower than 40.0% IACS (International Annealed Copper Standard) (23.2 MS/m).

3.4.2.1.1 If the conductivity is below 40.0% IACS (23.2 MS/m), the extrusions Ø may be given additional precipitation heat treatment as in 3.3, and if, upon completion of such treatment, extrusions develop conductivity/tensile property relationships conforming to 3.4.1 and 3.4.2.1, extrusions shall be acceptable.

3.4.2.2 Stress-Corrosion Resistance: Specimens, cut from extrusions 0.750 inch Ø (19.05 mm) and over in nominal diameter or least thickness, shall show no evidence of stress-corrosion cracking when stressed in the short-transverse (perpendicular to grain flow) direction to 65% of the specified minimum longitudinal (parallel to grain flow) yield strength.

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 Ø accordance with ASTM B594 and shall meet Class A acceptance limits of that specification.

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. 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 (3.4.1), stress-corrosion resistance (3.4.2), ultrasonic inspection (3.5.1) when specified, and tolerances (3.6) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for stress-corrosion resistance (3.4.2.2) 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 Ø following:

4.3.1 For Tensile Properties: From extrusions having a nominal weight of less than 1 pound per linear foot (1.5 kg/m), one sample shall be selected from each lot weighing 1000 pounds (454 kg) or less; from lots weighing more than 1000 pounds (454 kg) one additional sample shall be taken from each 1000 pounds (454 kg) or fraction thereof in excess of the first 1000 pounds (454 kg). From extrusions having a nominal weight of 1 pound per linear foot (1.5 kg/m) or over, one sample shall be taken from each lot consisting of 1000 feet (305 m) or less; from lots consisting of more than 1000 feet (305 m), one additional sample shall be taken for each 1000 feet (305 m) or fraction thereof in excess of the first 1000 feet (305 m). Only one sample shall be taken from any one piece when more than one piece is available.

4.3.2 For Electrical Conductivity: Specimens for electrical conductivity Ø testing (3.4.2.1) shall be the samples used for tensile testing. Electrical conductivity shall be determined on the surface of test specimens 0.100 inch (2.54 mm) and under in nominal diameter and subsurface on test specimens over 0.100 inch (2.54 mm) in nominal thickness.

4.4 Reports:

4.4.1 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 4157B, size or section identification number, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 4157B, 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 either a statement that the extrusions conform or copies of laboratory reports showing the results of tests to determine conformance.

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

5. PREPARATION FOR DELIVERY:

5.1 Identification: Shall be as follows: