SAE The Engineering Resource For Advancing Mobility®

400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 4389E

Issued 6-30-60
Revised 1-1-86

Superseding AMS 4389D

MAGNESIUM ALLOY EXTRUSIONS
3.0Th - 1.5Mn (HM31A-T5)
Precipitation Heat Treated

UNS M13312

1. SCOPE:

1.1 Form: This specification covers a magnesium alloy in the form of extruded bars, rods, wire, and shapes.

1.2 Application: Primarily for parts requiring weldability and good strength-to-weight ratio up to 600°F (315°C).

1.3 Precautions: Alloy covered by this specification is radioactive. All applicable rules and regulations, including those of the Nuclear Regulatory Agency, pertaining to handling of radioactive material and all licensing provisions for use of such material should be observed.

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 Specification:

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 E9 - Compression Testing of Metallic Materials at Room Temperature
ASTM E21 - Elevated Temperature Tension Tests of Metallic Materials

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-M-6857 - Magnesium Alloy Castings, Heat Treatment of

2.3.2 Military Standards:

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

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
Thorium	2.5	3.5
Manganese	1.2	--
Other impurities, each	--	0.10
Other impurities, total	--	0.30
Magnesium	remainder	

3.2 Condition: Precipitation heat treated.

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 Heat Treatment: Extrusions shall be precipitation heat treated by heating to 425°F ± 10 (220°C ± 5), holding at heat for 16 hr ± 0.5, and cooling in air. Furnace surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-M-6857.

3.4 Properties: Extrusions up to 4 sq in. (25 cm^2), excl, in cross-sectional area shall conform to the following requirements; property requirements for extrusions 4 sq in. (25 cm^2) and over in cross-sectional area shall be as agreed upon by purchaser and vendor:

3.4.1 Tensile Properties: Shall conform to 3.4.1.1 and, when specified, to 3.4.1.2, determined on specimens from bars, rods, wire, and solid shapes in either the longitudinal or transverse direction except that testing in the transverse direction applies only to product from which a tensile specimen not less than 2.50 in. (62.5 mm) in length can be obtained; testing in the longitudinal direction is not required on product tested in the transverse direction.

3.4.1.1 At Room Temperature: Shall be as follows, determined in accordance with AMS 2355 or MAM 2355:

Tensile Strength, min	37,000 psi (255 MPa)
Yield Strength at 0.2% Offset, min	26,000 psi (180 MPa)
Elongation in 4D, min	4%

3.4.1.2 At 600°F (315°C): Shall be as follows, determined in accordance with ASTM E21 on specimens heated to 600°F + 5 (315°C ± 2), held at heat for 20 - 30 min., and tested at 600°F ± 5 (315°C ± 2):

Tensile Strength, min	12,000 psi (80 MPa)
Elongation in 4D, min	10%

3.4.2 Compressive Properties: Shall be as follows, determined in accordance with ASTM E9 on specimens taken in the longitudinal direction from bars, rods, and solid shapes:

Compressive Yield Strength at 0.2% Offset, min	19,000 psi (130 MPa)

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.

3.6 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 at room temperature (3.4.1.1) and at 600°F (315°C) when specified (3.4.1.2), 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 tensile properties at 600°F (315°C) when not specified as an acceptance test and for compressive properties (3.4.2) 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.

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, AMS 4389E, lot number, 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 4389E, 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: Extrusions shall be identified as follows:

5.1.1 Each straight bar and rod 0.500 in. (12.50 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. (12.50 mm) wide recessed not more than 1/8 in. (3 mm) below the outline of the shape shall be marked in a row of characters recurring at intervals not greater than 3 ft (900 mm) with the alloy number and temper, AMS 4389 or applicable Military specification designation, and manufacturer's identification. The inspection lot number shall be included in the row marking or shall be marked near one end. The characters shall be of such size as to be 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.