

MAGNESIUM ALLOY SHEET AND PLATE

2.0Th - 0.78Mn (HM21A-T8)

Solution Heat Treated, Cold Worked, and Precipitation Heat Treated

UNS M13210

1. SCOPE:

1.1 Form: This specification covers a magnesium alloy in the form of sheet and plate.

1.2 Application: Primarily for components requiring good weldability and good strength-to-weight ratio up to 700°F (370°C).

1.3 Precautions: Product 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 Specifications:

AMS 2202 - Tolerances, Aluminum Alloy and Magnesium Alloy Sheet and Plate

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

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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 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:

	min	max
Thorium	1.5	2.5
Manganese	0.45	1.1
Other Impurities, each	--	0.10
Other Impurities, total	--	0.30
Magnesium		remainder

3.2 Condition: The product shall be supplied in the following condition:

3.2.1 Product 0.500 In. (12.50 mm) and Under in Nominal Thickness: Solution heat treated, cold worked, precipitation heat treated, and pickled.

3.2.2 Product Over 0.500 In. (12.50 mm) in Nominal Thickness: Solution heat treated, cold worked, and precipitation heat treated.

3.3 Properties: The product shall conform to the following requirements:

3.3.1 Longitudinal and Long-Transverse Tensile Properties:

3.3.1.1 At Room Temperature: Shall be as specified in Table I and 3.3.1.1.1, determined in accordance with AMS 2355.

TABLE I

Nominal Thickness Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
0.016 to 0.250, incl	33,000	18,000	6
Over 0.250 to 0.500, incl	32,000	21,000	6
Over 0.500 to 3.000, incl	30,000	21,000	6

TABLE I (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50 mm or 4D %, min
0.40 to 6.25, incl	230	125	6
Over 6.25 to 12.50, incl	220	145	6
Over 12.50 to 75.00, incl	205	145	6

3.3.1.1.1 Tensile property requirements for product under 0.016 in. (0.40 mm) or over 3.000 in. (75.00 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.1.2 At 600°F (315°C): Shall be as follows, for product 0.016 to 0.250 in. (0.40 to 6.25 mm), excl, in nominal thickness, determined in accordance with ASTM E21 on specimens heated to 600°F \pm 5 (315°C \pm 3), held at heat for 10 to 20 min. before testing, and tested at 600°F \pm 5 (315°C \pm 3) at a rate not greater than 0.05 in./in. per min. (0.05 mm/mm per min.) through the 0.2% offset and at a rate of 0.11 - 0.14 in./in. per min. (0.11 - 0.14 mm/mm per min.) above the 0.2% offset:

Tensile Strength, min	11,000 psi (75 MPa)
Elongation in 2 in. (50 mm) or 4D, min	8%

3.3.1.2.1 Tensile property requirements for product under 0.016 in. (0.40 mm) or 0.250 in. (6.25 mm) and over in nominal thickness shall be as agreed upon by purchaser and vendor.

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3.3.2 Longitudinal and Long-Transverse Compressive Properties: Shall be as specified in Table II and 3.3.2.1, determined in accordance with ASTM E9.

TABLE II

Nominal Thickness Inches	Yield Strength at 0.2% Offset psi, min
0.063 to 0.250, incl	15,000
Over 0.250 to 0.500, incl	20,000
Over 0.500 to 1.000, incl	17,000
Over 1.000 to 2.000, incl	15,000
Over 2.000 to 3.000, incl	14,000

TABLE III

Nominal Thickness Millimetres	Yield Strength at 0.2% Offset MPa, min
1.60 to 6.25, incl	105
Over 6.25 to 12.50, incl	140
Over 12.50 to 25.00, incl	115
Over 25.00 to 50.00, incl	105
Over 50.00 to 75.00, incl	95

3.3.2.1 Compressive property requirements for product under 0.063 in. (1.60 mm) or over 3.000 in. (75.00 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4 Quality: The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from segregation and foreign materials and from imperfections detrimental to usage of the product.

3.5 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2202.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product 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 product conforms 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), room-temperature tensile properties (3.3.1.1), 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 elevated-temperature tensile properties (3.3.1.2) and compressive properties (3.3.2) 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.

4.4 Reports:

- 4.4.1 The vendor of the product shall furnish with each shipment a report stating that the product conforms to the chemical composition and other technical test requirements of this specification. The report shall include the purchase order number, inspection lot number, AMS 4390G, size, 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 4390G, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification and shall include in the report either a statement that the material conforms 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.

5. PREPARATION FOR DELIVERY:

- 5.1 Identification: Each sheet and plate shall be marked on one face, in the respective location indicated below, with the alloy number and temper, AMS 4390 or applicable Military specification designation, inspection lot number, manufacturer's identification, and nominal thickness. 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 product or its performance.
- 5.1.1 Flat Sheet and Plate Under 6 In. (150 mm) Wide: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 ft (900 mm). The inspection lot number may appear in the row marking or may appear at only one location on each piece.