Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4363C
Superseding AMS 4363B
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MAGNESIUM ALLOY FORGINGS
2.0Th - 0.78Mn (HM21A-T5)

1. SCOPE:

1.1 Form: This specification covers a magnesium alloy in the form of die forgings, hand forgings, rolled rings, and forging stock.

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

1.3 Precautions: Material 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 (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2201 - Tolerances, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled or Drawn
AMS 2350 - Standards and Test Methods
AMS 2375 - Approval and Control of Critical Forgings
AMS 2475 - Protective Treatments, Magnesium Base Alloys
AMS 2630 - Ultrasonic Inspection
AMS 2645 - Fluorescent Penetrant Inspection
AMS 2808 - Identification, Forgings

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B557 - Tension Testing Wrought and Cast Aluminum and Magnesium Alloy Products
ASTM E35 - Chemical Analysis of Magnesium and Magnesium-Base Alloys

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

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

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 by wet chemical methods in accordance with ASTM E35, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	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 Die Forgings, Hand Forgings, and Rolled Rings: Precipitation heat treated.

3.2.2 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties: The product shall conform to the following requirements, determined in accordance with ASTM B557:

3.3.1 Tensile Properties:

3.3.1.1 Die and Hand Forgings: Shall be as follows, determined on specimens machined from forgings 4 in. (102 mm) and under in nominal thickness at time of heat treatment with axis of specimen in the area of gage length within 15 deg of parallel to the forging flow lines, on specimens machined from separately-forged coupons or from forging stock representing the forgings and, in either case, heat treated with the forgings, or on specimens machined from prolongations on heat treated die forgings:

Tensile Strength, min	33,000 psi (228 MPa)
Yield Strength at 0.2% Offset, min	25,000 psi (172 MPa)
Elongation in 4D, min	3%

3.3.1.1.1 Tensile property requirements for specimens machined from forgings over 4 in. (102 mm) in nominal thickness and for specimens with orientation to the axis other than within 15 deg of parallel to the forging flow lines shall be as agreed upon by purchaser and vendor.

3.3.1.2 Rolled Rings:

3.3.1.2.1 Rings With OD to Wall Thickness Ratio Less Than 10: As agreed upon by purchaser and vendor.

3.3.1.2.2 Rings With OD to Wall Thickness Ratio of 10 or Greater: As specified in Table I. Tests are not required in any direction from which a specimen at least 2.375 in. (60.32 mm) cannot be obtained.

TABLE I

Specimen Orientation (See 3.3.1.2.2.1)	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 4D %, min
Tangential	30,000	23,000	5
Axial	25,000	9,000	5
Radial	25,000	9,000	5

TABLE I (SI)

Specimen Orientation (See 3.3.1.2.2.1)	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 4D %, min
Tangential	207	159	5
Axial	172	62	5
Radial	172	62	5

3.3.1.2.2.1 Tangential test requirements apply to specimens machined with axis of specimen tangential to the ring OD (parallel to the direction of rolling). Axial test requirements apply to specimens machined with axis parallel to the axis of the ring (long transverse to the direction of rolling). Radial test requirements apply to specimens machined with axis of specimen parallel to the radius of the ring (short transverse to the direction of rolling). All specimens shall be machined from the core of the ring.

3.3.1.3 Forging Stock: When a sample of stock is forged to a test coupon and heat treated in the same manner as forgings, specimens taken from the heat treated coupon shall conform to the requirements of 3.3.1.1. If a specimen taken from the stock after heat treatment in the same manner as forgings conforms to the requirements of 3.3.1.1, the test shall be accepted as equivalent to tests of a forged coupon. The forging stock supplier, however, shall not be required to conduct such tests.

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

3.4.1 When specified, forgings and rolled rings shall be subjected to fluorescent penetrant inspection in accordance with AMS 2645 and/or to ultrasonic inspection in accordance with AMS 2630. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.5 Tolerances: Unless otherwise specified, tolerances for forging stock shall conform to all applicable requirements of AMS 2201.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to perform such confirmatory testing as he deems 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 the following requirements are classified as acceptance tests:

4.2.1.1 Composition (3.1) of the product.

4.2.1.2 Tensile properties (3.3.1.1 or 3.3.1.2) of forgings or rolled rings.

4.2.1.3 Tolerances (3.5) of forging stock.

4.2.2 Periodic Tests: Tests of forging stock to demonstrate ability to meet specified properties (3.3.1.3) are classified as periodic tests.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests.

4.2.3.1 For direct U.S. Military procurement of forgings and rolled rings, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows; a lot shall be all forgings or rolled rings of the same nominal cross section and configuration heat treated in the same batch furnace load or consecutively in a continuous furnace during an 8-hr period.

4.3.1 Composition: At least one sample shall be taken by the producer from each group of ingots poured simultaneously from the same source of molten metal.

4.3.1.1 Unless compliance with 4.3.1 is established, an analysis shall be made for each 4000 lb (1816 kg) or less of material comprising the lot except that not more than one analysis shall be required per piece.

4.3.2 Tensile Properties:

4.3.2.1 Die Forgings: At least one separately-forged coupon or one forging prolongation heat treated with each lot of forgings.

4.3.2.1.1 In lieu of a prolongation or separately-forged coupon, specimens cut from a forging representing each lot from the location designated on the drawing.

4.3.2.2 Hand Forgings: At least two specimens taken from a forging or forging prolongation representing the lot.

4.3.2.3 Rolled Rings: Except when testing in one or more directions is not required by 3.3.1.2.2, test specimens in the tangential, axial, and radial directions shall be taken from a ring or ring prolongation representing the lot.

4.3.2.4 Forging Stock: As agreed upon by purchaser and vendor.

4.4 Approval: When specified, approval and control of forgings shall be in accordance with AMS 2375.

4.5 Reports:

4.5.1 The vendor of forgings shall furnish with each shipment three copies of a report stating that the chemical composition conforms to the specified requirements, showing the results of tests on each lot of forgings or rolled rings to determine conformance to the tensile property requirements, and stating that the forgings conform to the other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, size or part number, and quantity.

4.5.2 The vendor of forging stock shall furnish with each shipment three copies of a report stating that the chemical composition of the stock conforms to the requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, size, and quantity.

4.5.3 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of forgings or rings, part number, and quantity. When forgings or rings for making parts are produced or purchased by the parts vendor, that vendor shall inspect each lot of forgings or rings to determine conformance to the requirements of this specification, and shall include in the report a statement that the forgings or rings conform, or shall include copies of laboratory reports showing the results of tests to determine conformance.