SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4363G

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Superseding AMS 4363F

Forgings, Magnesium Alloy
2.0Th - 0.78Mn (HM21A - T5)
Precipitation Heat Treated

M13210

CANCELLATION NOTICE

This specification has been declared “CANCELLED” by the Aerospace Materials Division, SAE, as of June, 2006. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications indicating that it has been “CANCELLED”.

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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:

These forgings have been used typically for parts requiring weldability and good strength-to-weight ratio up to 700 °F (371 °C), but usage is not limited to such applications.

1.3 Precautions:

Material covered by this specification is radioactive. All applicable rules and regulations pertaining to handling of radioactive material and all licensing provisions for use of such material should be observed.

1.4 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

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 publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2201	Tolerances, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled or Cold Finished
MAM 2201	Tolerances, Metric, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled, Drawn, or Cold Finished
AMS 2475	Protective Treatments, Magnesium Alloys
AMS 2630	Ultrasonic Inspection, Product Over 0.5 Inch (12.5 mm) Thick
AMS 2645	Fluorescent Penetrant Inspection
AMS 2750	Pyrometry
AMS 2808	Identification, Forgings

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 557	Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products
ASTM B 557M	Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)
ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E 35	Chemical Analysis of Magnesium and Magnesium Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 35, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Thorium	1.5	2.5
Manganese	0.45	1.1
Impurities, each (3.1.1)	--	0.10
Impurities, total (3.1.1)	--	0.30
Magnesium	remainder	

3.1.1 Determination not required for routine acceptance.

3.2 Condition:

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 Heat Treatment:

Forgings shall be precipitation heat treated by heating to 450 °F ± 15 (232 °C ± 8), holding at heat for not less than 16 hours, and cooling in air. Pyrometry shall be in accordance with AMS 2750.

3.4 Properties:

The product shall conform to the requirements of 3.4.1, determined in accordance with ASTM B 557 or ASTM B 557M.

3.4.1 Tensile Properties:

3.4.1.1 Die and Hand Forgings: Shall be as shown in Table 2, determined on specimens machined from forgings 4 inches (102 mm) and under in nominal thickness at time of heat treatment with axis of specimen in area of gage length varying not more than 15 degrees from parallel to 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.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	33.0 ksi (228 MPa)
Yield Strength at 0.2% Offset	25.0 ksi (172 MPa)
Elongation in 4D	3%

3.4.1.1.1 Tensile property requirements for specimens machined from forgings over 4 inches (102 mm) in nominal thickness and for specimens with orientation to axis of specimen varying more than 15 degrees from parallel to forging flow lines shall be as agreed upon by purchaser and vendor.

3.4.1.2 Rolled Rings:

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

3.4.1.2.2 Rings With OD to Wall Thickiness Ratio of 10 or Greater: As specified in Table 3. Tests are not required in any direction from which a specimen at least 2.375 inches (60.32 mm) in length cannot be obtained.

TABLE 3A - Minimum Tensile Properties

Specimen Orientation (See 3.4.1.2.2.1)	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 4D %
Tangential	30.0	23.0	5
Axial	25.0	9.0	5
Radial	25.0	9.0	5

TABLE 3B - Minimum Tensile Properties, SI

Specimen Orientation (See 3.4.1.2.2.1)	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 4D %
Tangential	207	159	5
Axial	172	62	5
Radial	172	62	5

3.4.1.2.2.1 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.

3.4.1.3 Forging Stock: When a sample of stock is forged to a test coupon and heat treated as in 3.3, specimens taken from the heat treated coupon shall conform to the requirements of 3.4.1.1. If specimens taken from the stock after heat treatment as in 3.3 conform to the requirements of 3.4.1.1, the tests shall be accepted as equivalent to tests of a forged coupon.

3.5 Quality:

The product, 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 product.

3.5.1 When specified, forgings shall be subjected to ultrasonic inspection in accordance with AMS 2630 or other method acceptable to purchaser and shall conform to the following requirements of AMS 2630:

3.5.1.1 Die forgings 0.50 to 3.00 inches (12.7 to 76.2 mm), inclusive, in nominal thickness and weighing not over 300 pounds (136 kg) shall meet Class B.

3.5.1.2 Hand forgings 1.00 to 6.00 inches (25.4 to 152.4 mm), inclusive, in nominal thickness and weighing not over 600 pounds (272 kg) shall meet Class A.

3.5.2 When specified, die forgings shall be subjected to fluorescent penetrant inspection in accordance with AMS 2645 or other method acceptable to purchaser. Acceptance standards shall be as established by purchaser.

3.6 Tolerances:

Forging stock shall conform to all applicable requirements of AMS 2201 or MAM 2201.

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. 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 for the following requirements are acceptance tests and shall be performed on each lot:

4.2.1.1 Composition (3.1) of the product.

4.2.1.2 Tensile properties of forgings (3.4.1.1) or rolled rings (3.4.1.2).

4.2.1.3 Tolerances (3.6) of forging stock.

4.2.2 Periodic Tests: Tests of forging stock to determine ability to develop specified properties (3.4.1.3) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

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 eight-hour 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 pounds (1815 kg) or less of alloy 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, tensile specimens cut from a forging representing each lot from the location designated on the drawing or as specified by purchaser.

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