AEROSPACE MATERIAL SPECIFICATION

AMS4426	REV. B

Issued 1990-04
Revised 2013-09

Superseding AMS4426A

Castings, Sand, Magnesium Alloy 5.1Y - 3.0Re - 0.70Zr (WE54A - T6) Solution and Precipitation Heat Treated (Composition similar to UNS M18410)

RATIONALE

AMS4426B revises chemical analysis standards (3.1), sampling requirements for chemical analysis (4.3.1), removes the requirement for determination of soluble zirconium (Table 1, 3.1.2), revises Packaging (5.2.1), and is a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

This specification covers a magnesium alloy in the form of sand castings.

1.2 Application

These castings have been used typically for parts requiring high yield strength up to 570 °F (299 °C) and excellent corrosion resistance, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2360 Room Temperature Tensile Properties of Castings

AMS2361 Elevated Temperature Tensile Properties of Castings

AMS2475 Protective Treatments, Magnesium Alloys

AMS2694 In-Process Welding of Castings

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS4426B

AMS2750 Pyrometry

AMS2804 Identification, Castings

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

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 B 953 Sampling Magnesium and Magnesium Alloys for Spectrochemical Analysis

ASTM B 954 Analysis of Magnesium and Magnesium Alloys by Atomic Emission Spectrometry

ASTM E 21 Elevated Temperature Tension Tests of Metallic Materials

ASTM E 155 Reference Radiographs for Inspection of Aluminum and Magnesium Castings

ASTM E 1417/E 1417M Liquid Penetrant Testing

ASTM E 1742/E 1742M Radiographic Examination

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined by spectrochemical methods in accordance with ASTM B 954, or by other analytical methods acceptable to purchaser:

TABLE 1 - COMPOSITION

Element	min	max
Yttrium	4.75	5.5
Rare Earths (See 3.1.1)	2.0	4.0
Zirconium Total	0.40	1.0
Zinc	--	0.2
Lithium	--	0.2
Manganese	--	0.15
Copper	--	0.03
Iron	--	0.01
Silicon	--	0.01
Nickel	--	0.005
Other Impurities, total (3.1.2)	--	0.30
Magnesium	remainder	

3.1.1 Rare earths consist of neodymium 1.5 to 2.0% by weight, remainder being principally heavy rare earths ytterbium, erbium, dysprosium, and gadolinium. Heavy rare earth fraction is directly related to the yttrium content of the alloy (i.e. yttrium is present as nominal 80% by weight, 20% by weight HRE mixture).

3.1.2 Determination not required for routine acceptance.

3.2 Condition

Solution and precipitation heat treated.

3.3 Casting

Furnace or ladle additions of grain-refining elements or alloys are required. Castings shall be produced from metal conforming to 3.1. Molten metal taken from alloying furnaces, with or without additions of foundry operating scrap (gates, sprues, risers, and rejected castings), shall not be poured into castings unless first converted to ingot, analyzed, and remelted or unless the composition of a sample taken after the last addition to the melt conforms to 3.1.

3.3.1 A melt shall be the metal withdrawn from a batch-furnace charge of 2000 pounds (907 kg) or less as melted for pouring castings or, when permitted by purchaser, a melt shall be 4000 pounds (1814 kg) or less of metal withdrawn from one continuous furnace in not more than eight consecutive hours.

3.3.2 A lot shall be all castings poured from a single melt in not more than eight consecutive hours and solution and precipitation heat treated in the same heat treat batch.

3.4 Cast Test Specimens

Chemical analysis specimens and tensile specimens shall be cast as follows:

3.4.1 Chemical Analysis Specimens

Shall be cast from each melt after the last melt addition and shall be tested to qualify the melt lot as in 3.1.

3.4.2 Tensile Specimens

Shall be cast with each lot of castings, shall be of standard proportions conforming to ASTM B 557 or ASTM B 557M with 0.500 inch (12.70 mm) diameter at the reduced parallel gage section, and shall be cast to size in molds made with the regular foundry mix of sand without using chills. Metal for the specimens shall be part of the melt which is used for the castings. If the metal for castings is given any treatment, such as fluxing or cooling and reheating, the metal for the specimens shall be a portion of the metal so treated and, during such treatment, shall be heated to the same maximum temperature and held for approximately the same time as the molten metal for the castings. Temperature of the metal during pouring of the specimens shall be not lower than that during pouring of the castings.

3.5 Heat Treatment

Castings and representative tensile specimens shall be heated to a temperature not exceeding 985 °F (529 °C), held at heat for the proper time for solution heat treatment, and quenched as required, reheated to a temperature between 470 to 490 °F (243 to 254 °C), and held at heat for the proper time for precipitation heat treatment. At least one set of tensile specimens shall, during each stage of heat treatment, be put into a batch-type furnace with each load of castings or into a continuous furnace at intervals of not longer than three hours. Pyrometry shall be in accordance with AMS2750.

3.6 Properties

Castings and representative separately-cast tensile specimens produced in accordance with 3.4.2 shall conform to the following requirements:

3.6.1 Tensile Properties

Conformance to the requirements of 3.6.1.1.1 shall be used as the basis for acceptance of castings except when purchaser specifies that the requirements of 3.6.1.1.2 apply:

3.6.1.1 At Room Temperature

Shall be as shown in Table 2, determined in accordance with ASTM B 557 or ASTM B 557M:

3.6.1.1.1 Separately-Cast Specimens

TABLE 2 - MINIMUM TENSILE PROPERTIES

Property	Value	
Tensile Strength	36.0 ksi	(248 MPa)
Yield Strength at 0.2% offset	25.0 ksi	(172 MPa)
Elongation in 4D	2.0%	

3.6.1.1.2 Specimens Cut From Castings

Shall be as shown in Table 3, determined on specimens as in 4.3.4:

TABLE 3 - MINIMUM TENSILE PROPERTIES

Property	Value	
Tensile Strength	35.0 ksi	(241 MPa)
Yield Strength at 0.2% offset	25.0 ksi	(172 MPa)
Elongation in 4D	2.0%	

3.6.1.2 At 480 °F (249 °C)

Shall be as shown in Tables 4 and 5, determined in accordance with ASTM E 21 on specimens heated to 480 °F + 5 (249 °C ± 3), held at heat for not less than 10 minutes before testing, and tested at 480 °F ± 5 (249 °C + 3):

3.6.1.2.1 Separately-Cast Specimens

TABLE 4 - MINIMUM TENSILE PROPERTIES

Property	Value	
Tensile Strength	30.0 ksi	(207 MPa)
Yield Strength at 0.2% offset	23.0 ksi	(159 MPa)

3.6.1.2.2 Specimens Cut From Castings

TABLE 5 - MINIMUM TENSILE PROPERTIES

Property	Value	
Tensile Strength	28.0 ksi	(193 MPa)
Yield Strength at 0.2% offset	22.0 ksi	(152 MPa)

3.6.1.3 When properties other than those specified in 3.6.1.1.2 and 3.6.1.2.2 are required, tensile specimens as in 4.3.4 taken from locations indicated on the drawing, from a casting or castings chosen at random to represent the lot, shall have the properties indicated on the drawing for such specimens. Property requirements for such specimens may be designated in accordance with AMS2360, AMS2361, or both.

3.7 Quality

3.7.1 Castings, 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 castings.

3.7.1.1 Castings shall have smooth surfaces and be sufficiently cleaned to permit fluorescent penetrant inspection.

3.7.1.2 Castings cleaned by blasting shall, prior to nondestructive inspection, be pickled in a sulfuric or sulfuric-nitric acid solution to remove not less than 0.002 inch (0.05 mm) of metal before protective treatment as in 5.2.

3.7.2 Castings shall be produced under radiographic control. This control shall consist of radiographic examination of castings in accordance with ASTM E 1742/E1742M until proper foundry technique, which will produce castings free from harmful internal imperfections, is established for each part number and of production castings as necessary to ensure maintenance of satisfactory quality.

3.7.3 When specified, castings shall be subjected to fluorescent penetrant inspection in accordance with ASTM E 1417/E 1417M.

3.7.4 Radiographic, fluorescent penetrant, and other quality standards for acceptance shall be as agreed upon by purchaser and vendor. ASTM E 155 may be used to define radiographic acceptance standards.

3.7.5 Castings shall not be repaired by peening, plugging, welding, impregnation, or other methods without written permission from purchaser.

3.7.5.1 When authorized by purchaser, defects in castings may be removed and the castings reworked by welding in accordance with AMS2694.

3.7.6 Castings shall not be impregnated, chemically treated, or coated to prevent leakage unless specified or allowed by written permission of purchaser, designating the method to be used.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of castings shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the castings conform to the specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Except as specified in 4.2.1.1, composition (3.1), tensile properties at room temperature (3.6.1.1), and quality (3.7) are acceptance tests and shall be performed to represent each melt or lot as applicable.

4.2.1.1 Tensile properties of specimens cut from castings shall be determined only when specified by purchaser or when separately-cast specimens are not available. Tensile properties of separately-cast specimens need not be determined when tensile properties of specimens cut from castings are determined.

4.2.2 Periodic Tests

Tensile properties at 480 °F (249 °C) (3.6.1.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests

All technical requirements are preproduction tests and shall be performed prior to or on the first-article shipment of a casting to a purchaser, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing

Shall be in accordance with the following:

4.3.1 At least one chemical analysis specimen in accordance with 3.4.1 and ASTM B 953 from each melt for conformance to 3.1.