AEROSPACE
MATERIAL SPECIFICATIONS
SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

AMS 4418A

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MAGNESIUM ALLOY CASTINGS, SAND
2.5Ag - 2Di - 1Zr (QE22A-T6)
Solution and Precipitation Heat Treated

1. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

2. APPLICATION: Primarily for parts requiring high yield strength at temperatures up to 600 F (315 C).

3. COMPOSITION:

Silver	2.0 - 3.0
Didymium (Total Rare Earths)	1.75 - 2.5
Zirconium, total	0.40 - 1.0
Zirconium, soluble	0.40 min
Copper, if determined	0.10 max
Nickel, if determined	0.01 max
Other Impurities, total	0.30 max
Magnesium	remainder

3.1 Soluble zirconium is that portion of the zirconium which is soluble in 1:4 hydrochloric acid held below its boiling point. Routine determinations for soluble zirconium are not required.

4. CONDITION: Solution and precipitation heat treated.

5. TECHNICAL REQUIREMENTS:

5.1 Casting: Castings shall be produced in lots from metal conforming to Section 3. Metal remelted from previously analyzed ingot may be poured directly into castings. Furnace or ladle additions of grain refining or alloying elements are permissible. Unless otherwise agreed upon by purchaser and vendor, 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 until the composition of a sample taken after the last addition to the melt has been found to conform to Section 3.

5.1.1 A melt shall be the metal withdrawn from a batch furnace charge of 2000 lb or less as melted for pouring castings, or when permitted by the purchaser, a melt shall be 4000 lb or less of metal withdrawn from one continuous furnace in not more than 8 consecutive hours.

5.1.2 A lot shall consist of castings poured from a single melt in not more than 8 consecutive hours.

5.2 Cast Test Specimens: Tensile test specimens, and chemical analysis specimens when required, shall be cast as follows and, when requested, shall be supplied with the castings.

5.2.1 Tensile Test Specimens: Shall be cast with each lot of castings, shall be standard (0.5 in. diameter at the reduced parallel section), and shall be cast to size in molds made with the regular foundry mix of green sand without using chills. Metal for the specimens shall be part of the melt which is used for the castings and shall be subjected to the same grain-refining or alloying treatment given the metal for the castings.

5.2.2 Chemical Analysis Specimens: When required by purchaser, shall be cast from each melt and shall be of size and shape agreed upon by purchaser and vendor.

5.3 Heat Treatment: All castings and tensile test specimens shall be heat treated as follows:

5.3.1 Tensile test specimens from each melt, together with production castings, shall be heated to the proper temperature and for the proper time for solution heat treatment and quenched, by immersion or spray, in water at 140 - 160 F (60 - 71.1 C). At least one set of tensile test specimens shall be put into a batch-type furnace with each load of castings or into a continuous furnace at intervals of not longer than 3 hours.

5.3.2 Specimens from each lot, together with production castings, shall, after solution heat treatment as in 5.3.1, be heated to a temperature not higher than 400 F (204 C), unless otherwise specified, for the proper time for precipitation heat treatment and cooled in air. At least one set of tensile test specimens shall be put into a batch-type furnace with each load of castings or into a continuous furnace at intervals of not longer than 3 hours.

5.4 Tensile Properties:

5.4.1 Cast Test Specimens:

Tensile Strength, psi	35,000 min
Yield Strength at 0.2% Offset or at 0.0117 in. in 2 in. Extension Under Load (E = 6,500,000), psi	25,000 min
Elongation, % in 2 in.	2 min

5.4.2 Specimens Cut From Castings:

5.4.2.1 When tensile properties of actual castings are determined for acceptance, not less than 4, and preferably 10, tensile test specimens shall be cut from thick and thin sections. The average value of all specimens selected shall conform to the following:

Tensile Strength, psi	32,000 min
Yield Strength at 0.2% Offset or at 0.0111 in. in 2 in. Extension Under Load (E = 6,500,000), psi	23,000 min
Elongation, % in 4D	2 min

5.4.2.1.1 Any specimen cut from a casting shall conform to the following:

Tensile Strength, psi	28,000 min
Yield Strength at 0.2% Offset or at 0.0102 in. in 2 in. Extension Under Load (E = 6,500,000), psi	20,000 min
Elongation, % in 4D	2 min

5.4.2.2 Conformance to these requirements may be used as a basis for acceptance of castings.

5.4.2.3 When specified on the order, tensile test specimens taken in locations indicated on the drawing, from a casting chosen at random to represent the lot, shall have the properties indicated on the drawing for each specimen.

5.4.3 Tensile Properties at 600 F (315.6 C): Material shall be capable of meeting the following requirements as applicable to the type of specimen tested. Tensile test specimens shall be heated to 600 F ± 5 (315.6 C ± 2.8), held at 600 F ± 5 (315.6 C ± 2.8) for 10 min. before testing, and tested at 600 F ± 5 (315.6 C ± 2.8) at a rate not greater than 0.05 in. per in. per min. up to the yield strength and at a rate of 0.11 - 0.14 in. per in. per min. above the yield strength.

Test Specimen	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min
Separately Cast	13,000	10,000
Cut from Casting	10,000	8,000

5.4.4 When a dispute occurs between purchaser and vendor over the yield strength value, yield strength determined by the offset method shall apply.

5.5 Hardness of Castings: Except at sprues and risers, castings shall have hardness of Brinell 70 - 85 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or Brinell 75 - 90 using 1000 kg load and 10 mm ball.

6. QUALITY:

6.1 Castings shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts. Castings shall have smooth surfaces and shall be well cleaned.

6.2 Radiographic and other quality standards shall be as agreed upon by purchaser and vendor.

6.3 Unless otherwise specified, castings shall be produced under radiographic control. This shall consist of radiographic examination of castings 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.

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

6.5 Castings shall not be impregnated, chemically treated, or coated to prevent leaking, unless specified or allowed by written permission which states the method to be used. Impregnated castings shall be marked IMP.