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

AMS 4442A

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# MAGNESIUM ALLOY CASTINGS, SAND
## 3.3Ce - 2.5Zn - 0.7Zr (EZ33A-T5)
## Aged

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 operating at 300 - 500 F.

3. COMPOSITION:

| | | |
|---|---|---|
| | Cerium (Total Rare Earths) | 2.5 - 4.0 |
| | Zinc | 2.0 - 3.1 |
| ø | 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: Aged.

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5.1.1 A melt shall be the metal withdrawn from a batch furnace charge of 2000 lb or less as melted for pouring castings or, when permitted by purchaser, a melt shall be 4000 lb or less of metal withdrawn from one continuous furnace in not more than 8 consecutive hours.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 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 superheating or other grain-refining 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 lot, together with production castings, shall be heated to a temperature not higher than 475 F, unless otherwise specified, for the proper time for aging 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 Tensile Test Specimens:

| | |
|---|---|
| Tensile Strength, psi | 20,000 min |
| Yield Strength at 0.2% Offset or at 0.0083 in. in 2 in. Extension Under Load (E = 6,500,000), psi | 14,000 min |
| Elongation, % in 2 in. | 2 min |

5.4.2 Tensile Properties of 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 | 15,000 min |
| ø | Yield Strength at 0.2% Offset or at 0.0078 in. in 2 in. Extension Under Load (E = 6,500,000), psi | 12,500 min |
| | Elongation, % in 4D | 1.0 min |

5.4.2.1.1 The tensile properties of any specimen cut from a casting shall conform to the following:

| | | |
|---|---|---|
| ø | Tensile Strength, psi | 13,000 min |
| | Yield Strength at 0.2% Offset or at 0.0074 in. in 2 in. Extension Under Load (E = 6,500,000), psi | 11,000 min |

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

5.4.2.2 When specified, 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.

5.4.2.3 Tensile Properties at 500 F: Material shall be capable of meeting the following requirements as applicable to the type of specimen tested. Tensile test specimens shall be heated to 500 F ± 5, held at 500 F ± 5 for 10 min. before testing, and tested at 500 F ± 5 at a rate not greater than 0.05 in. per in. per min. up to the yield strength and at 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 | 8,000 |
| Cut from Casting | 10,000 | 6,000 |

5.4.3 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, the castings shall have hardness of Brinell 48 - 60 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or Brinell 57 - 72 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.

7. REPORTS:

7.1 Unless otherwise specified, the vendor of castings shall furnish with each shipment three copies of a report of the results of tensile tests on test specimens from each lot and a statement that the chemical composition of the castings conforms to the requirements of this specification. This report shall include the purchase order number, lot number, material specification number, part number, and quantity.