



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
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AMS 4444A

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MAGNESIUM ALLOY CASTINGS, SAND 6Zn - 1Zr (ZK61A-T5)

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 and good elongation.
3. COMPOSITION: Castings shall conform to the following:

	min	max
Zinc	5.5	6.5
Zirconium, total	0.6	1.0
Zirconium, soluble (1)	0.6	--
Copper (1)	--	0.10
Nickel (1)	--	0.01
Other Impurities, total	--	0.30
Magnesium		remainder

(1) Determination not required for routine acceptance.

- 3.1 Soluble zirconium is that portion of the zirconium which is soluble in 1:4 hydrochloric acid held below its boiling point.

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- 5.1.1 A melt shall be the metal withdrawn from a batch furnace charge of 2000 lb or less as melted for pouring castings or, when permitted by purchaser, a melt shall be 4000 lb or less of metal withdrawn from one continuous furnace in not more than 8 consecutive hours.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

SAE Technical Board rules provide that: "All technical reports, including standards, approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

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 the proper temperature and 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 Tensile Test Specimens:

Tensile Strength, psi	39,000 min
Yield Strength 0.2% Offset or at 0.0120 in. in 2 in. Extension Under Load (E = 6,500,000), psi	26,000 min
Elongation, % in 2 in.	5 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	34,000 min
Yield Strength at 0.2% Offset or at 0.0114 in. in 2 in. Extension Under Load (E = 6,500,000), psi	24,000 min
Elongation, % in 2 in. or 4D	3 min

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

Tensile Strength, psi	30,000 min
Yield Strength at 0.2% Offset or at 0.0105 in. in 2 in. Extension Under Load (E = 6,500,000), psi	21,000 min
Elongation, % in 2 in. or 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 When a dispute occurs between purchaser and vendor over the yield strength values, yield strength determined by the offset method shall apply.

5.5 Hardness of Castings: Except at sprues and risers, castings shall have hardness not lower than Brinell 65 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or not lower than Brinell 70 using 1000 kg load and 10 mm ball.

6. QUALITY:

6.1 Castings shall be uniform in quality and condition, sound, and free from internal and external imperfections detrimental to fabrication or to performance of parts. Unless otherwise permitted by purchaser, castings cleaned by blasting shall be pickled in a sulfuric or sulfuric-nitric acid solution to remove not less than 0.002 in. of metal before treatment as in Section 9.

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