

AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
29 West 39th Street
New York City

AMS 4222C

Issued 12-1-42

Revised 10-1-51

ALUMINUM ALLOY CASTINGS, SAND
4Cu - 2Ni - 1.5Mg (142-T77)
Solution Treated and Overaged

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 air-cooled cylinder heads.

3. COMPOSITION:

Copper	3.5 - 4.5
Nickel	1.7 - 2.3
Magnesium	1.2 - 1.8
Titanium	0.07 - 0.18
Iron	0.8 max
Silicon	0.6 max
Manganese	0.1 max
Zinc	0.1 max
Other Impurities, each	0.05 max
Other Impurities, total	0.15 max
Aluminum	remainder

3.1 If boron is present in the amount of 0.001 per cent or more, the titanium content may be as low as 0.02 per cent.

4. CONDITION: Solution heat treated and overaged.

5. TECHNICAL REQUIREMENTS:

5.1 Castings:

5.1.1 All metal which is melted for castings shall be ingot conforming in composition to Section 3 above; gates, risers and rejected castings may be used but shall first be converted into such ingot. Furnace or ladle additions of small amounts of grain refining elements or alloys are permissible. When permitted by purchaser, molten metal may be taken from the alloying furnaces for pouring into castings without first casting into ingot and remelting provided that a sample for chemical analysis is taken after the last addition of metal to the furnace prior to removal of the alloy to the holding furnace or pouring ladle.

5.1.2 A melt shall be the metal withdrawn from a batch furnace charge of 2000 pounds or less as melted for pouring castings, or when permitted by the purchaser, a melt shall be 3000 pounds or less of metal withdrawn from one continuous furnace in not more than 8 consecutive hours.

5.2 Test Specimens: Tensile test specimens, and chemical analysis specimens when required, shall be cast with each melt of metal for castings, and when requested, shall be supplied with the castings.

Section 7C of the SAE Technical Board rules provides 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."

- 5.2.1 Tensile Test Specimens: Shall be standard (0.5-inch 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. 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 length of time as the molten metal for castings. The temperature of the metal during pouring of the specimens shall be not lower than the temperature of the metal during pouring of the castings.
- 5.2.2 Chemical Analysis Specimens: When required by purchaser, shall be of size and shape agreed upon by purchaser and vendor.
- 5.3 Heat Treatment: All castings and tensile test specimens representing them shall be heat treated as follows:
- 5.3.1 Tensile test specimens from each melt, together with production castings, shall be heated to 960-970 F for the proper time for solution 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.
- 5.3.2 Tensile test specimens from each melt, together with production castings, shall, after solution treatment as in 5.3.1, be heated uniformly to 625-675 F, held at heat for not less than 2 hours 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 Tensile Test Specimens:
- | | |
|------------------------|------------|
| Tensile Strength, psi | 21,500 min |
| Elongation, % in 2 in. | 1.0 min |
- 5.4.2 Tensile Properties of Castings: 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 values of all specimens selected shall conform to the following:
- | | |
|-----------------------|------------|
| Tensile Strength, psi | 16,000 min |
|-----------------------|------------|
- Note. Conformance to this requirement may be used as basis for acceptance of castings.
- 5.5 Hardness of Castings: Except at sprues and risers the castings shall have hardness of Brinell 65-85 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or Brinell 70-90 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 defects detrimental to fabrication or to performance of parts. Castings shall have smooth surfaces and shall be well cleaned.