

ALUMINUM ALLOY CASTINGS, SAND
4Cu - 2Ni - 1.5Mg - 0.2Cr (A142-T75)
Solution Treated and Overaged

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of 3-28-79. It is recommended that this specification not be specified for new designs.

This cover sheet should be attached to the "D" revision of the subject specification.

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REVISIONS

10/9 5/95

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AERONAUTICAL MATERIAL SPECIFICATIONS

AMS 4220D

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

Issued 1-1-42
Revised 6-15-59

ALUMINUM ALLOY CASTINGS, SAND
4Cu - 2Ni - 1.5Mg - 0.2Cr (Al42-T75)
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	3.7 - 4.5
Nickel	1.8 - 2.3
Magnesium	1.2 - 1.7
Chromium	0.15 - 0.25
Titanium	0.07 - 0.18
Iron	0.8 max
Silicon	0.6 max
Manganese	0.10 max
Zinc	0.10 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% or more, the titanium content may be as low as 0.02%.

4. CONDITION: Solution heat treated and overaged.

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5.1.1 A melt shall be the metal withdrawn from a batch furnace charge of 2000 lb or less as melted for pouring castings or, when permitted by purchaser, a melt shall be 4000 lb or less of metal withdrawn from one continuous furnace in not more than 8 consecutive hours.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

5.1.3 During melting, the metal shall be heated to not over 1450 F. The temperature of metal being poured into the mold shall not exceed 1420 F. Written permission shall be obtained from purchaser by letter or by notation on the drawing before deviating from the requirements of this paragraph.

- 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. 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 that during pouring of 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 960 - 970 F, held at heat for not less than 6 hr 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 lot, together with production castings shall, after solution heat treatment as in 5.3.1, be heated uniformly to approximately 550 F, but to not lower than 500 F, held at heat for not less than 2 hr 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 | 29,000 min |
| Elongation, % in 2 in. | 1 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 | 20,000 min |
|-----------------------|------------|
- 5.4.2.1:1 Conformance to these requirements may be used as basis for acceptance of castings.
- 5.4.2.2 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.

5.5 Hardness of Castings: Except at sprues and risers, the 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.

5.5.1 Hardness of Cylinder Heads After Assembling: Shall be Brinell 60 - 75 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or Brinell 65 - 80 using 1000 kg load and 10 mm ball. This Brinell test shall be made at the spot indicated on the drawing.

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 When castings are broken for fracture test, the fracture shall have essentially uniform color and be substantially free from oxides and other imperfections.

6.5 Cylinder head fins shall show some ductility when being fractured; surfaces of the fracture shall show a fine structure. Cylinder head castings having brittle coarse grained fins shall be rejected.

6.6 Castings shall not be repaired by plugging, welding, or other methods, without written permission from purchaser, but imperfect cylinder head fins may be accepted to the extent of 0.5% of the total fin surface according to the following:

6.6.1 Defective areas shall be smoothly blended without sharp corners.

6.6.2 After blending, the depth of the remaining portion of any fin shall be not less than 50% of the nominal depth of that fin.

6.6.3 Not more than 25% of the allowable imperfect fin surfaces shall be within any one area of 4 sq in. of the head.

6.7 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.