AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
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AMS 4231B

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ALUMINUM ALLOY CASTINGS, SAND
4.5Cu (195-T6)
Solution and Precipitation Treated

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

2. COMPOSITION:

Copper	4.0 - 5.0
Silicon	1.2 max
Iron	1.0 max
Manganese	0.3 max
Zinc	0.3 max
Titanium	0.2 max
Magnesium	0.03 max
Other Impurities, each	0.05 max
Other Impurities, total	0.15 max
Aluminum	remainder

3. CONDITION: Solution and precipitation heat treated.

4. TECHNICAL REQUIREMENTS:

4.1 Casting:

4.1.1 All metal which is melted for castings shall be ingot conforming in composition to Section 2 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.

4.1.2 A melt shall be the metal withdrawn from a batch furnace charge of 2000 pounds or less as melted for pouring castings, or when permitted by the purchaser, a melt shall be 3000 pounds or less of metal withdrawn from one continuous furnace in not more than 8 consecutive hours.

4.2 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.

4.2.1 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.

4.2.2 Chemical Analysis Specimens: When required by purchaser, shall be of size and shape agreed upon by purchaser and vendor.

4.3 Heat Treatment: All castings and tensile test specimens representing them shall be heat treated as follows:

4.3.1 Tensile test specimens from each melt, together with production castings, shall be heated to the proper temperature and for the proper time for solution treatment and quenched at a rate of not faster than that produced by immersion in water which is boiling at the time of immersion. 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.

4.3.2 Tensile test specimens from each melt, together with production castings, shall, after solution treatment as in 4.3.1, be heated uniformly to not lower than 290 F, held at that temperature for not less than 1.5 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.

4.4 Tensile Properties:

4.4.1 Tensile Test Specimens:

Tensile Strength, psi	32,000 min
Yield Strength at 0.2% Offset or at 0.0079 in. in 2 in. Extension Under Load (E=10,300,000), psi	20,000 min
Elongation, % in 2 in.	3.0 min

4.4.2 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 value of all specimens selected shall conform to the following:

Tensile Strength, psi	24,000 min
Yield Strength at 0.2% Offset or at 0.0069 in. in 2 in. Extension Under Load (E=10,300,000), psi	15,000 min
Elongation (Round Specimens), % in 4D	0.7 min

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

4.5 Hardness of Castings: Except at sprues and risers the castings shall have hardness of Brinell 65-95 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or Brinell 70-100 using 1000 kg load and 10 mm ball.

5. QUALITY:

5.1 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.

5.2 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 defects, is established for each pattern, and of production castings as necessary to ensure maintenance of satisfactory quality.

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

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

5.5 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.

6. REPORTS:

6.1 Unless otherwise specified, the vendor of castings shall furnish with each shipment three copies of a report of the results of tests to determine conformance of the castings to the requirements of this specification. This report shall show the chemical composition of the castings, properties of the tensile test specimens, melt numbers, material specification number, purchase order number, part number, and quantity. If the accuracy of control is adequate, each melt need not be analyzed, but the frequency of analysis shall be as agreed upon by purchaser and vendor.

6.2 Unless otherwise specified, the vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of castings, part number, and quantity. When castings for making parts are produced or purchased by the parts vendor, that vendor shall inspect each shipment or melt of castings to determine conformance to the requirements of this specification, and shall include in the report a statement that the castings conform, or shall include copies of laboratory reports showing the results of tests to determine conformance.

7. IDENTIFICATION: Unless otherwise specified, castings shall be identified in accordance with the latest issue of AMS 2804.