



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AMS 4873B

Superseding AMS 4873A

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ALUMINUM BRONZE CASTINGS, SAND

85Cu - 11Al - 3.6Fe

Solution Heat Treated and Tempered

1. SCOPE:

1.1 Form: This specification covers one type of aluminum bronze in the form of sand castings.

1.2 Application: Primarily for parts, such as bearings or gears, requiring strength and corrosion resistance at moderate temperatures.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

AMS 2360 - Room Temperature Tensile Properties of Castings

AMS 2635 - Radiographic Inspection

AMS 2645 - Fluorescent Penetrant Inspection

AMS 2646 - Contrast Dye Penetrant Inspection

AMS 2804 - Identification, Castings

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E8 - Tension Testing of Metallic Materials

ASTM E10 - Brinell Hardness of Metallic Materials

ASTM E272 - Reference Radiographs for High Strength Copper-Base and Nickel-Copper Alloy Castings

ASTM E478 - Chemical Analysis of Copper Alloys

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.2 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

- 3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E478, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	min	max
Ø		
Copper	83.5	--
Aluminum	10.3 - 11.5	
Iron	3.0 - 4.25	
Manganese	--	0.50
Nickel	--	0.50
Other Elements, each	--	0.10
Other Elements, total	--	0.30

- 3.1.1 If composition is determined by instrumental methods, such as spectrographic, x-ray, or atomic absorption, copper may be reported as "remainder."

- 3.2 Condition: Solution heat treated and tempered.

- 3.3 Castings: Castings shall be produced in lots from metal conforming to 3.1. Metal remelted from previously analyzed ingot may be poured directly into castings. Furnace or ladle additions 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 unless the composition of a sample taken after the last addition to the melt has been found to conform to 3.1.

- 3.3.1 A melt shall be the metal withdrawn from a batch furnace charge of 2000 lb (908 kg) or less as melted for pouring castings or, when permitted by purchaser, a melt shall be 4000 lb (1816 kg) or less of metal withdrawn from one continuous furnace in not more than 8 consecutive hours.

- Ø 3.3.2 A lot shall be all castings poured from a single melt in not more than 8 consecutive hours.

- 3.4 Cast Test Specimens: Chemical analysis specimens and tensile test specimens shall be cast as follows and, when requested, shall be supplied with the castings:

- 3.4.1 Chemical Analysis Specimens: Shall be cast from each melt and shall be of any convenient size, shape, and form for vendor's tests. When chemical analysis specimens are required by purchaser, specimens shall be cast to a size, shape, and form agreed upon by purchaser and vendor.

- 3.4.2 Tensile Test Specimens: Shall be cast with each lot of castings, shall be of standard proportions conforming to ASTM E8 with 0.500 in. (12.5 mm) diameter at the reduced parallel gage section, and shall be cast to size in molds made of the regular foundry mix of 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.

- 3.5 Heat Treatment: Castings and representative tensile test specimens shall be solution heat treated and tempered in accordance with the following; at least one set of tensile test specimens shall, during each stage of heat treatment, be placed into a batch-type furnace with each load of castings or into a continuous furnace at intervals of not longer than 3 hours:

- 3.5.1 Castings and tensile test specimens shall be heated to not lower than 1600° F (870° C) for the proper time for solution heat treatment and quenched.

3.5.2 Castings and tensile test specimens shall be heated to not lower than 1100° F (595°C) for the proper time for tempering and cooled in air.

3.6 Properties: Castings and representative tensile test specimens produced in accordance with 3.4.2 shall conform to the following requirements:

3.6.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8; conformance to the requirements of 3.6.1.1 shall be used as the basis for acceptance of castings except when purchaser specifies that the requirements of 3.6.1.2 apply:

3.6.1.1 Separately-Cast Specimens:

Tensile Strength, min	85,000 psi (586 MPa)
Yield Strength at 0.2% Offset, min	45,000 psi (310 MPa)
Elongation in 4D, min	5%

3.6.1.2 Specimens Cut from Castings:

3.6.1.2.1 When tensile properties of actual castings are determined for acceptance, the average of not less than 4, and preferably 10, specimens shall be as in 3.6.1.1 for sections of castings 1 in. (25 mm) and under in nominal thickness. Tensile properties of castings over 1 in. (25 mm) in nominal thickness shall be as follows:

Tensile Strength, min	72,000 psi (496 MPa)
Yield Strength at 0.2% Offset, min	36,000 psi (248 MPa)
Elongation in 4D, min	5%

3.6.1.2.2 When properties other than those specified in 3.6.1.2.1 are required, specimens as in 4.3.4 cut from castings at locations indicated on the drawing shall have the properties indicated on the drawing for such specimens. Property requirements may be designated in accordance with AMS 2360.

3.6.2 Hardness of Castings: Castings, except at sprue and riser locations, should have hardness of 200 - 235 HB or equivalent, determined in accordance with ASTM E10, but castings shall not be rejected on the basis of hardness if the tensile property requirements of 3.6.1.2 are met.

3.7 Quality:

3.7.1 Castings, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the castings.

3.7.1.1 Castings shall have smooth surfaces and shall be well cleaned.

3.7.2 Castings shall be produced under radiographic control, unless otherwise specified. This control shall consist of radiographic examination of castings in accordance with AMS 2635 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.

3.7.3 When specified, castings shall be subjected to fluorescent penetrant inspection in accordance with AMS 2645 or to contrast dye penetrant inspection in accordance with AMS 2646.

3.7.4 Radiographic, fluorescent penetrant, contrast dye penetrant, and other quality standards shall be as agreed upon by purchaser and vendor. ASTM E272 may be used to define radiographic acceptance standards.

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

3.7.5.1 When permitted in writing by purchaser, defects in castings may be removed and the castings repaired by welding provided the weld repair area has properties comparable to those of the parent metal. Repair welds shall be subjected to the same inspection procedures and acceptance standards required of the casting. Weld repair areas shall be suitably marked to facilitate inspection. Repair welding shall be performed prior to any heat treatment and nondestructive testing specified herein.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of castings shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the castings conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Except as specified in 4.2.1.1, tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.

4.2.1.1 Tensile properties of specimens cut from castings shall be determined only when specified by purchaser or when separately-cast specimens are not available. Tensile properties of separately-cast specimens need not be determined when properties of specimens cut from castings are determined.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed on the first-article shipment of a casting to a purchaser, when a change in material or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Two chemical analysis specimens in accordance with 3.4.1 from each melt and/or a casting from each lot.

4.3.2 Three tensile test specimens in accordance with 3.4.2 from each lot.

4.3.3 Two preproduction castings in accordance with 4.4.1 of each part number.

4.3.4 One or more castings selected at random from each lot when tensile properties of specimens cut from castings are required. Specimens shall conform to ASTM E8 and shall be either 0.500 in. (12.50 mm) diameter at the reduced parallel gage section, subsize specimens proportional to the standard, or standard sheet-type specimens. For determining conformance to the requirements of 3.6.1.2.2, if specimen locations are not shown on the drawing, not less than four tensile specimens, two from the thickest section and two from the thinnest section, shall be cut from a casting or castings from each lot.

4.4 Approval:

4.4.1 Sample castings from new or reworked patterns and the casting procedure shall be approved by purchaser before castings for production use are supplied, unless such approval be waived.