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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4873E

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Submitted for recognition as an American National Standard

Superseding AMS 4873D

(R)

Aluminum Bronze Alloy, Sand Castings
85Cu - 11A1 - 3.6Fe
Solution Heat Treated and Tempered

UNS C95420

1. SCOPE:

1.1 Form:

This specification covers an aluminum bronze alloy in the form of sand castings.

1.2 Application:

These castings have been used typically for parts requiring strength and corrosion resistance at moderate temperatures, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2360 Room Temperature Tensile Properties of Castings
AMS 2694 Repair Welding of Aerospace Castings
AMS 2804 Identification, Castings

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7154 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 8	Tension Testing of Metallic Materials
ASTM E 8M	Tension Testing of Metallic Materials (Metric)
ASTM E 10	Brinell Hardness of Metallic Materials
ASTM E 29	Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
ASTM E 272	Reference Radiographics for High Strength-Copper-Base and Nickel-Copper Alloy Castings
ASTM E 478	Chemical Analysis of Copper Alloys
ASTM E 1417	Liquid Penetrant Examination

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-453	Inspection, Radiographic
MIL-STD-2175	Casting, Classification and Inspection of

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 478, by spectrochemical methods, or by other analytical methods acceptable to purchaser (see 3.4.1).

TABLE 1 - Composition

Element (3.1.1)	min	max
Copper (3.1.2)	83.5	-
Aluminum	10.5	12.0
Iron	3.0	4.3
Manganese	-	0.50
Nickel + Cobalt	-	0.50
Copper plus sum of named elements (3.1.3)	99.5	-

3.1.1 Test results may be rounded by the “rounding off” method of ASTM E 29.

3.1.2 These composition limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements by agreement between the manufacturer or supplier and supplier or purchaser.

3.1.3 The sum shall be 99.5% minimum when all the elements in the table are analyzed.

3.2 Condition:

Solution heat treated and tempered.

3.3 Castings:

Castings shall be produced from metal conforming to 3.1 determined by analysis of a specimen (3.4.1) cast after the last melt addition.

3.4 Cast Test Specimens:

Chemical analysis specimens and tensile specimens shall be cast as follows:

3.4.1 Chemical Analysis Specimen: Shall be cast from each melt after the last melt addition and shall be tested to qualify the melt lot as in 3.1. Additional samples shall be required for each additional 8 hours of holding time.

3.4.2 Tensile Specimens:

3.4.2.1 Unless specimens cut from castings are specified by the purchaser, separately cast specimens, conforming to ASTM E 8 or ASTM E 8M, shall be cast from each melt, after the last melt addition. Specimens shall be cast in molds representing the mold formulation used for castings. Chills are not permitted on test specimen cavity except on the end face of the specimen when approved in accordance with 4.4.2. A tensile specimen shall be processed with each heat treat lot and tested for conformance to 3.6.1.1.

3.4.2.2 When purchaser specifies specimens cut from castings, such specimens shall be removed after heat treatment, shall be machined to conform to ASTM E 8 or ASTM E 8M, and shall be either 0.500 inch (12.70 mm) diameter at the reduced parallel gage section, subsize specimens proportional to the standard, or standard sheet-type specimens, as required in 3.6.1.2 or 3.6.1.3.

3.5 Heat Treatment:

Castings and representative tensile specimens shall be solution heat treated and tempered in accordance with the following; unless specimens cut from a casting are specified, one or more sets of separately cast tensile specimens shall, during each stage of heat treatment, be put into a batch-type furnace with each load of castings or into a continuous furnace at intervals of not longer than three hours.

3.5.1 Castings and tensile specimens shall be heated to not lower than 1600 °F (871 °C), held at heat for the proper time for solution heat treatment, and quenched.

3.5.2 Castings and tensile specimens shall be heated to not lower than 1100 °F (593 °C), held at heat for the proper time for tempering, and cooled in air.

3.6 Properties:

Castings and representative tensile 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 E 8; or ASTM E 8M; 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: Shall be as shown in Table 2.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	85.0 ksi (586 MPa)
Yield Strength at 0.2% Offset	45.0 ksi (310 MPa)
Elongation in 4D	5% ksi

3.6.1.2 Specimens Cut From Castings: The average of not less than four, and preferably 10, specimens shall be as shown in Table 2 for sections of castings 1 inch (25 mm) and under in nominal thickness. Tensile properties of castings over 1 inch (25 mm) in nominal thickness shall be as shown in Table 3.

TABLE 3 - Minimum Tensile Properties

Property	Value
Tensile Strength	72.0 ksi (496 MPa)
Yield Strength at 0.2% Offset	36.0 ksi (248 MPa)
Elongation in 4D	5% ksi

3.6.1.2.1 When properties other than those specified in 3.6.1.2 are required, specimens machined from locations indicated on the drawing from a casting chosen at random to represent the lot, shall have the properties indicated on the drawing for such specimens. Property requirements may be designated in accordance with AMS 2360.

3.6.2 Castings shall have hardness of 200 to 235 HB or equivalent, determined in accordance with ASTM E 10.

3.7 Quality:

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

3.7.1 When acceptance standards are not specified, Grade C of MIL-STD-2175 shall apply. ASTM E 272 may be used to define radiographic acceptance standards.

3.7.2 Methods of inspection and frequency of inspection shall be as agreed upon by purchaser and vendor. A “Casting Class” of MIL-STD-2175 may be selected to specify the method and frequency of inspection.

3.7.3 Castings shall be produced under radiographic control. This control shall consist of 100% radiographic inspection of castings until process control factors (4.4.2) have been established to ensure production of acceptable castings. Unless otherwise specified by the purchaser, continued radiographic inspection of production castings shall be performed at a frequency determined by the vendor to assure continued maintenance of internal quality.

3.7.3.1 Radiographic inspection shall be conducted in accordance with MIL-STD-453, unless otherwise specified by purchaser.

3.7.4 When specified by purchaser, castings shall be fluorescent penetrant inspected using a method specified by the purchaser, or, if not specified, a method in accordance with ASTM E 1417.

3.7.5 Castings shall not be peened, plugged, impregnated, or welded unless authorized by purchaser.

3.7.5.1 When authorized by purchaser, welding in accordance with AMS 2694 or other welding program approved by the purchaser may be used.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of castings shall supply all samples for vendor’s tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the castings conform to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Except as specified in 4.2.1.1, composition (3.1), tensile properties of separately cast specimens (3.6.1.1), or, when specified, tensile properties of specimens cut from a casting (3.6.1.2), hardness (3.6.2), and quality (3.7) are acceptance tests and shall be performed to represent each melt or heat treat lot as applicable.

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

4.2.2 Periodic Tests: Radiographic inspection (3.7.3) following the establishment of process control (4.4.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by the purchaser.

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

4.3 Sampling and Testing:

Shall be in accordance with the following:

4.3.1 At least one chemical analysis specimen in accordance with 3.4.1 from each melt for conformance to 3.1.

4.3.2 Three separately-cast tensile specimens in accordance with 3.4.2 from each heat treat lot except when purchaser requires properties of specimens cut from castings as in 4.3.4.

4.3.3 One or more preproduction castings in accordance with 4.4.1 of each part number.

4.3.4 One or more castings from each heat treat lot when tensile properties of specimens machined from a casting. For determining conformance to the requirements of 3.6.1.2.1, if specimen locations are not shown on the drawing, two specimens from the thickest section and two specimens 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 or molds and the casting procedure shall be approved by purchaser before castings for production use are supplied, unless such approval be waived by purchaser.

4.4.2 Vendor shall establish, for production of sample castings of each part number, parameter for the process control factors which will produce acceptable castings; these shall constitute the approved casting procedure and shall be used for producing production castings. Vendor shall also establish a single procedure for production of separately-cast tensile specimens. Method for production of separately-cast tensile specimens shall be consistent for all material cast to this specification. Control factors for producing separately-cast tensile specimens need not be the same as those used for production of castings. If necessary to make any change in parameters for the process control factors, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, sample castings and/or test specimens. Production castings incorporating the revised operations shall not be shipped prior to receipt of reapproval.

4.4.2.1 Unless otherwise specified by purchaser, one casting from each lot shall be tested for hardness to determine conformance with 3.6.2.

4.4.2.2 Control factors for producing castings and separately-cast tensile specimens include, but are not limited to, the following. Supplier's procedures shall identify tolerances, ranges and/or control limits, as applicable. Control factors for separately cast tensile specimens must generally represent, but need not be identical to, those factors used for castings:

Type of furnace
Furnace atmosphere
Alloy additions, fluxing, deoxidation and gas removal procedures
Gating and risering practices
Mold composition and molding practice
Core composition and fabrication method, when applicable
Melt hold time
Metal pouring temperature
Solidification and cooling procedures
Solution heat treat and stabilization cycles
Straightening procedure, when applicable
Cleaning operations
Methods of inspection
Radiographic inspection sampling plan, if used

4.4.2.2.1 Any of the above process control factors for which parameters are proprietary by the vendor may be assigned a code designation. Each variation in such parameters shall be assigned a modified code designation.

4.5 Reports:

The vendor of castings shall furnish with each shipment a report showing the results of tests for chemical composition of each melt and the results of tests for tensile properties of separately-cast specimens representing each heat treat lot or, when specified, of specimens cut from a casting from each lot and the results of tests for hardness of castings from each heat treat lot. This report shall include the purchase order number, melt and heat treat lot numbers, AMS 4873E, part number, and quantity.

4.6 Resampling and Retesting:

If any specimen used in the above tests fails to meet the specified requirements, disposition of the castings may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the castings represented. Results of all tests shall be reported.