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

AEROSPACE MATERIAL SPECIFICATION

AMS 4862C
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MANGANESE BRONZE CASTINGS, SAND AND CENTRIFUGAL
High Strength
63Cu - 24Zn - 6.2Al - 3.8Mn - 3.0Fe (CDA 863)

1. SCOPE:

1.1 Form: This specification covers one type of high-strength manganese bronze in the form of sand and centrifugal castings.

1.2 Application: Primarily for parts requiring high strength, toughness, and corrosion resistance. These castings have higher strength and lower ductility than castings of AMS 4860.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specification (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 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 B208 - Preparing Tension Test Specimens for Copper-Base Alloys for Sand Castings
ASTM E8 - Tension Testing of Metallic Materials
ASTM E10 - Brinell Hardness of Metallic Materials
ASTM E54 - Chemical Analysis of Special Brasses and Bronzes

2.3 U.S. 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 E54, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	min	max
Copper	60.0	66.0
Aluminum	5.0	7.5
Manganese	2.5	5.0
Iron	2.0	4.0
Nickel	--	1.0
Tin	--	0.20
Lead	--	0.20
Other Elements, each (3.1.1)	--	0.05
Other Elements, total (3.1.1)	--	0.20
Zinc	remainder	

3.1.1 Determination not required for routine acceptance.

3.2 Condition: As cast.

3.3 Casting: Castings shall be produced in lots from metal conforming to 3.1.

3.3.1 A lot shall be all castings produced from one furnace melt or crucible melt. When two or more furnace melts or crucible melts or combination thereof are used to charge a ladle for pouring, the castings therefrom shall constitute a lot. A lot shall be not more than 1000 lb (454 kg) of castings.

3.4 Test Specimens: Chemical analysis specimens and tensile test coupons 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 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 Coupons: Shall be cast with each lot of castings and in accordance with 3.4.2.1 and 3.4.2.2. Metal for the coupons 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 coupons 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 time as the molten metal for the castings.

3.4.2.1 Sand Cast: Coupons from which specimens are machined shall be standard keel blocks conforming to ASTM B208 cast in molds made with the regular foundry mix of green sand without using chills or baked sand core molds. Coupons shall be machined to standard tensile test specimens conforming to ASTM E8 with 0.500 in. (12.50 mm) diameter at the reduced parallel gage section.

3.4.2.2 Centrifugally Cast: Coupons from which specimens are machined shall be cylindrical bars of such size as to allow machining of standard tensile test specimens conforming to ASTM E8 with 0.500 in. (12.50 mm) diameter at the reduced parallel gage section.

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

3.5.1 Tensile Properties: Shall be as specified in 3.5.1.1 or 3.5.1.2, as applicable, determined in accordance with ASTM E8.

3.5.1.1 Separately-Cast Specimens:

Tensile Strength, min	110,000 psi (758 MPa)
Yield Strength at 0.2% Offset, min	60,000 psi (414 MPa)
Elongation in 4D, min	12%

3.5.1.2 Specimens Cut from Castings: Test specimens cut from any area of a casting shall meet the requirements of 3.5.1.1.

3.5.2 Hardness: Castings shall have hardness of 217 - 269 HB/10/3000 or equivalent, determined in accordance with ASTM E10.

3.6 Quality:

3.6.1 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.

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

3.6.2 Castings shall be produced under radiographic control, when 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.

3.6.3 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.

3.6.4 Radiographic, fluorescent penetrant, contrast dye penetrant, and other quality standards shall be as agreed upon by purchaser and vendor.

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

3.6.5.1 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 nondestructive testing specified herein.

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 performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and 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 requirements for composition (3.1), tensile properties (3.5.1), and quality (3.6) 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 coupons are not available. Tensile properties of separately-cast coupons need not be determined when tensile 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, substantitating 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 One chemical analysis specimen in accordance with 3.4.1 from each melt and/or a casting from each lot.

4.3.2 Two 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 from each lot when properties of specimens machined from castings are required. Specimens shall conform to ASTM E8 and shall be either 0.500 in. (12.50 mm) in 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 3.5.1.2, if specimen locations are not shown on the drawing, not less than two tensile specimens, one from the thickest section and one 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.

4.4.2 Vendor shall establish for production of sample castings of each part number parameters for the control factors of processing which will produce acceptable castings; these shall constitute the approved casting procedure and shall be used for producing production castings. If necessary to make any change in parameters for the control factors of processing, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, sample test specimens, castings, or both. Production castings incorporating the revised operations shall not be shipped prior to receipt of reapproval.

4.4.2.1 Control factors for producing castings include, but are not limited to, the following:

Type of furnace
Furnace atmosphere
Fluxing or deoxidation procedure
Gating and risering practices
Pouring temperature (variation of ±50°F (±30°C) from the established limit is permissible)
Mold rotational speed for centrifugal castings
Solidification and cooling procedures
Cleaning operations
Methods of routine inspection

4.4.2.1.1 Any of the above control factors of processing for which parameters are considered 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: