

Submitted for recognition as an American National Standard

**MANGANESE BRONZE CASTINGS, SAND AND CENTRIFUGAL  
58Cu - 39Zn - 1.2Fe - 1.0Al - 0.80Mn (CDA 86500)  
As Cast**

UNS C86500

**1. SCOPE:**

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

1.2 **Application:** Primarily for parts requiring strength, toughness, and corrosion resistance.

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

2.1 **SAE Publications:** Available from SAE, 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 2694 - Repair Welding of Aerospace Castings
- 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 E54 - Chemical Analysis of Special Brasses and Bronzes

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

2.3.1 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,  $\emptyset$  determined by wet chemical methods in accordance with ASTM E54 or by spectrochemical or other analytical methods approved by purchaser:

	min	max
Copper	55.0	60.0
Zinc	36.0	42.0
Iron	0.40	2.0
Aluminum	0.50	1.5
Manganese	0.10	1.5
Tin	--	1.0
Nickel + Cobalt	--	1.0
Lead	--	0.40
Copper plus Sum of Named Elements	99.0	--

3.1.1 Limits may be established and analysis required for elements not listed  $\emptyset$  in 3.1 when agreed upon by purchaser and vendor.

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 (450 kg) of castings.

3.4 Test Specimens: Chemical analysis specimens and tensile 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.

3.4.2 Tensile 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. The temperature of the metal during pouring of the coupons shall be not lower than that during pouring of 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 sand without using chills or baked sand core molds. Coupons shall be machined to standard tensile 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 to allow machining of standard tensile 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 tensile 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; conformance to the requirements of 3.5.1.1 shall be used as the basis for acceptance of castings except when purchaser specifies that the requirements of 3.5.1.2 apply.
- 3.5.1.1 Separately-Cast Specimens:
- |                                    |                      |
|------------------------------------|----------------------|
| Tensile Strength, min              | 65,000 psi (450 MPa) |
| Yield Strength at 0.2% Offset, min | 25,000 psi (170 MPa) |
| Elongation in 4D, min              | 20%                  |
- 3.5.1.2 Specimens Cut from Any Area of a Casting: Shall meet the requirements of 3.5.1.1.
- 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 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. 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, to contrast dye penetrant inspection in accordance with AMS 2646, or to both.
- 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 in accordance with AMS 2694.

#### 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 any confirmatory testing deemed 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 melt or lot as applicable.

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 prior to or on the first-article shipment of a casting to a purchaser, when a change in material, processing, or both 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 At least one chemical analysis specimen in accordance with 3.4.1 from each melt or a casting from each lot.

4.3.2 Two separately-cast tensile specimens in accordance with 3.4.2 from each lot except when purchaser requires tensile properties of specimens cut from castings.

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 by purchaser.

4.4.2 Vendor shall establish for production of sample castings of each part number parameters 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. 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, test specimens, sample 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

Metal pouring temperature; variation of  $\pm 50^{\circ}\text{F}$  ( $\pm 30^{\circ}\text{C}$ ) from the established limit is permissible

Mold set-up, parting agent, and rotational speed for centrifugal castings

Solidification and cooling procedures

Cleaning operations

Methods of inspection

4.4.2.1.1 Any of the above process control factors 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 Reportsm

4.5.1 The vendor of castings shall furnish with each shipment a report showing the results of tests for chemical composition of at least one casting or of separately-cast specimens from each melt and the results of tests for tensile properties of separately-cast coupons representing each lot or of specimens cut from castings from each lot and stating that the castings conform to the other technical requirements of this specification. This report shall include the purchase order number, lot number, AMS 4860C, part number, and quantity.