



## Designation: **B369–09 (Reapproved 2016) B369/B369M – 20**

# Standard Specification for Copper-Nickel Alloy Castings<sup>1</sup>

This standard is issued under the fixed designation ~~B369~~B369/B369M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope\*

1.1 This specification establishes the requirements for copper-nickel alloy castings with nominal compositions shown in **Table 1**. These are as follows:

Copper Alloy-UNS No. <sup>2</sup>	Previous Designation
C96200	Alloy A
C96400	Alloy B

1.2 Castings of these alloys are used primarily for corrosion-resistance applications such as in construction and for or pressure vessels, particularly in for marine pumps, valves, and fittings.

1.3 These alloys are considered weldable, but they may be ordered with a weld test to ensure weldability. When extensive welding is to be performed on the casting, weldability tests should be specified in the ordering information (5.2.6) to ensure proper welding characteristics.

1.4 *Units*—The values stated in either inch-pound units or SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard separately as standard. Within the text, SI units are shown in brackets. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.5 The following hazard statement applies only to Section 8, Weldability Test, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and health environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

**B208 Practice for Preparing Tension Test Specimens for Copper Alloy Sand, Permanent Mold, Centrifugal, and Continuous Castings**

**B824 Specification for General Requirements for Copper Alloy Castings**

**B846 Terminology for Copper and Copper Alloys**

~~**E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)**~~

### 2.2 ASME Code:<sup>3</sup>

**ASME Boiler and Pressure Vessel Code**

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.05 on Castings and Ingots for Remelting.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

\*A Summary of Changes section appears at the end of this standard



TABLE 1 Nominal Compositions

Copper Alloy UNS No.	Composition, %					
	Copper	Nickel	Iron	Silicon	Manganese	Niobium
C96200	87.5	10.0	1.5	0.1	0.9	...
C96400	67.0	30.0	0.7	0.5	0.8	1.0

### 2.3 AWS Standard:<sup>4</sup>

[AWS A5.6 Specification for Copper and Copper-Alloy Arc-Welding Electrodes](#)

## 3. General Requirements

3.1 The following sections of Specification [B824](#) form a part of this specification. In the event of a conflict between this specification and Specification [B824](#), the requirements of this specification shall take precedence.

- 3.1.1 Terminology—(Section 3);
- 3.1.2 Other Requirements—(Section 7);
- 3.1.3 Dimensions, Mass, and Permissible Variations—(Section 8);
- 3.1.4 Workmanship, Finish, and Appearance—(Section 9);
- 3.1.5 Sampling—(Section 10);
- 3.1.6 Number of Tests and Retests—(Section 11);
- 3.1.7 Specimen Preparation—(Section 12);
- 3.1.8 Test Methods—(Section 13);
- 3.1.9 Significance of Numerical Limits—(Section 14);
- 3.1.10 Inspection—(Section 15);
- 3.1.11 Rejection and Rehearing—(Section 16);
- 3.1.12 Certification—(Section 17);
- 3.1.13 Test Report—(Section 18);
- 3.1.14 Product Marking—(Section 19); and
- 3.1.15 Packaging and Package Marking—(Section 20).

## 4. Terminology

- 4.1 For definitions of terms relating to copper alloys, refer to Terminology [B846](#).

## 5. Ordering Information

- 5.1 Orders for castings under this specification should include the following information:
  - 5.1.1 Specification title, number, and year of issue;
  - 5.1.2 Quantity of castings;
  - 5.1.3 Copper Alloy UNS Number ([Table 2](#));
  - 5.1.4 Pattern or drawing number and condition (as-cast, machined, and so forth);
  - 5.1.5 ASME Boiler and Pressure Vessel Code Requirements ([Section 12](#)); and
  - 5.1.6 When material is purchased for agencies of the U.S. Government, the Supplementary Requirements of this specification may be specified.

TABLE 2 Chemical Requirements

	Copper Alloy UNS No. C96200		Copper Alloy UNS No. C96400	
	Min, %	Max, %	Min, %	Max, %
Copper	balance		balance	
Lead	...	0.01	...	0.01
Iron	1.0	1.8	0.25	1.5
Nickel, incl cobalt	9.0	11.0	28.0	32.0
Manganese	...	1.5	...	1.5
Silicon	...	0.50	...	0.50
Niobium	...	1.0 <sup>A</sup>	0.50	1.5
Phosphorus	...	0.02	...	0.02
Sulfur	...	0.02	...	0.02
Carbon	...	0.10	...	0.15

<sup>A</sup> When product or casting is intended for subsequent welding applications, and so specified by the purchaser, the niobium content shall be 0.40 % max.

<sup>4</sup> Available from American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166-6672, <http://www.aws.org>.

5.2 The following are optional and should be specified in the purchase order when required:

- 5.2.1 Pressure test or soundness requirements (Specification B824);
- 5.2.2 Witness inspection (Specification B824);
- 5.2.3 Certification (Specification B824);
- 5.2.4 Foundry test report (Specification B824);
- 5.2.5 Product marking (Specification B824);
- 5.2.6 Weldability test (1.3, Section 8, and Table 2); and
- 5.2.7 Approval of weld procedure and records of repairs (Section 9).

**6. Chemical Composition**

6.1 The castings shall conform to the chemical requirements shown in Table 2 for the copper alloy UNS numbers specified in the purchase order.

6.2 These specification limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements agreed upon between the manufacturer or supplier and the purchaser. Copper may be given as remainder and may be taken as the difference between the sum of all elements analyzed and 100 %. When all the elements in the table are analyzed, their sum shall be 99.5 % minimum.

**7. Mechanical Properties**

7.1 Mechanical properties shall be determined from separately cast test bar castings, and shall ~~meet~~ conform to the requirements shown in Table 3.

**8. Weldability Test**

8.1 When specified in the purchase order at least one test cast as shown in Fig. 1 shall be prepared for each lot of welding grade castings (5.2.6).

8.2 The block shall be molded, gated, and risered in such a manner to produce a sound casting without defects that might interfere with welding or the interpretation of the results of the test.

8.3 The groove in the test block shall be completely filled with weld deposit metal, using the manual metallic-arc process with ~~1/8-in. (12.7-mm)~~ 0.125 in. [3.18 mm] or ~~3/32-in. (3.97-mm)~~ 0.156 in. [3.97 mm] diameter copper-nickel (70-30) coated electrodes conforming to classification AWS ECuNi of AWS Specification A5.6. The interpass temperature need not be controlled, unless it is to be controlled in fabrication.

8.4 One ~~3/8-in. (9.52-mm)~~ 0.375 in. [9.52 mm] minimum thick bend coupon (see Fig. 2), shall be removed longitudinally from the center of the welded block by machining, sawing, abrasive cutting, or other suitable means. Cut surfaces and edges should be sanded smooth if necessary. The ~~side-bend~~ ~~side-bend~~ specimen then shall be bent 180° in a guided bend jig around a mandrel ~~±1.5 1/2 in. (38.1 mm)~~ [38.1 mm] in diameter with the weld located at the center of the bend.

8.5 Cracks or other open defects exceeding ~~1/8 0.125 in. (3.2 mm)~~ [3.18 mm] measured in any direction in the fusion zone or heat-affected zone on the convex surface of the specimen after bending shall be cause for rejection. Cracks originating at weld-bead undercuts, at weld-slag inclusions, or at casting defects shall not be cause for rejection.

**TABLE 3 Mechanical Requirements**

	Copper Alloy UNS No. C96200	Copper Alloy UNS No. C96400
Tensile strength, min, ksi <sup>A</sup> [MPa]	45 [310]	60 [415]
Yield strength, <sup>B</sup> min, ksi <sup>A</sup> [MPa]	25 [170]	32 [220]
Elongation in 2 in. [50.8 mm], %	20	20

**TABLE 3 Mechanical Property Requirements**

	Copper Alloy UNS No. C96200	Copper Alloy UNS No. C96400
Tensile strength, min, ksi <sup>A</sup> [MPa]	45 [310]	60 [415]
Yield strength, <sup>B</sup> min, ksi <sup>A</sup> [MPa]	25 [170]	32 [220]
Elongation in 2 in. [50.8 mm], %	20	20

<sup>A</sup> ksi = 1000 psi.

<sup>B</sup> Yield strength shall be determined as the stress producing an elongation under load of 0.5 %, that is 0.01 in. [~~0.254 mm~~] [0.254 mm] in a gage length of 2 in. [~~50.8 mm~~] [50.8 mm].