



Designation: B176 – 17

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

This standard is issued under the fixed designation B176; 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-alloy die castings. The alloys specified are Copper Alloy UNS Nos. C85470, C85700, C85800, C86500, C87800, C99700, and C99750.<sup>2</sup>

1.2 *Units*—The values stated in inch-pound 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.

1.3 *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>3</sup>

[B824 Specification for General Requirements for Copper Alloy Castings](#)

[B846 Terminology for Copper and Copper Alloys](#)

[E8/E8M Test Methods for Tension Testing of Metallic Materials](#)

[E18 Test Methods for Rockwell Hardness of Metallic Materials](#)

[E23 Test Methods for Notched Bar Impact Testing of Metallic Materials](#)

[E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition](#)

<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> The UNS system for copper and copper alloys (see Practice E527) is a simple expansion of the former standard designation system accomplished by the addition of a prefix “C” and a suffix “00.” The suffix can be used to accommodate composition variations of the base alloy.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

[E527 Practice for Numbering Metals and Alloys in the Unified Numbering System \(UNS\)](#)

2.2 *ADCI/NADCA Standards:*<sup>4</sup>  
[“E” Series Product Standards](#)

2.3 *Federal Standard:*<sup>5</sup>

[Fed. Std. No. 123 Marking for Shipment \(Civil Agencies\)](#)

2.4 *Military Standards:*<sup>5</sup>

[MIL-STD-129 Marking for Shipment and Storage \(Military Agencies\)](#)

[MIL-P-116 Methods of Preservation](#)

## 3. General Requirements

3.1 The following sections of Specification B824 constitute a part of this specification.

3.1.1 Terminology (Section 3),

3.1.2 Number of Tests and Retests (Section 11) (Note to users: Paragraph 10.3 of Specification B824 applies only when mechanical requirements are specified in the purchase order.),

3.1.3 Test Methods (Section 13),

3.1.4 Significance of Numerical Limits (Section 14),

3.1.5 Inspection (Section 15),

3.1.6 Rejection and Rehearing (Section 16),

3.1.7 Certification (Section 17),

3.1.8 Test Report (Section 18),

3.1.9 Product Marking (Section 19), and

3.1.10 Supplementary Requirements.

3.2 In addition, when a section with a title identical to that referenced in 3.1, above, appears in this specification, it contains additional requirements which supplement those appearing in Specification B824.

## 4. Terminology

4.1 For general terms related to copper and copper alloys, refer to Terminology B846.

<sup>4</sup> Available from North American Die Casting Association (NADCA), 3250 Arlington Heights Rd., Suite 101, Arlington Heights, IL 60004, <http://www.diecasting.org>.

<sup>5</sup> Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil/>

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

## 5. Ordering Information

5.1 Include the following information when placing orders for die castings under this specification as applicable:

- 5.1.1 Specification title, number, and year of issue,
- 5.1.2 Part name and number,
- 5.1.3 Copper Alloy UNS Number,
- 5.1.4 Quantity and delivery schedule, as required,
- 5.1.5 Engineering drawing of die casting, when required,

giving all necessary dimensions and tolerances and showing latest revisions and allowances for machining, if any. Location of ejector pin marks or parting lines shall be at the option of the manufacturer unless specifically designated on the drawing.

5.1.6 When die castings are purchased for agencies of the U.S. Government the Supplementary Requirements of Specification **B824** may be specified.

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

- 5.2.1 Inspection lot sampling (Section 9),
- 5.2.2 Soundness requirements (10.1),
- 5.2.3 Mechanical requirements (Section 7),
- 5.2.4 Special requirements (Section 10),
- 5.2.5 Certification (Specification **B824**),
- 5.2.6 Foundry test report (Specification **B824**),
- 5.2.7 Witness inspection (Specification **B824**),
- 5.2.8 Product marking (Specification **B824**), and
- 5.2.9 Packaging requirements (Section 12).

## 6. Chemical Composition

6.1 The castings shall conform to the requirements for major elements as shown in **Table 1**.

6.2 These specification composition 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 or zinc may be given as remainder and may be taken as the difference between the sum of all elements analyzed and 100 %. When all named elements in **Table 1** are analyzed, their sum shall be as specified in **Table 2**.

6.3 It is recognized that residual elements may be present in cast copper-base alloys. Analysis shall be made for residual elements only when specified in the purchase order.

**TABLE 2 Sum of All Named Elements Analyzed**

Copper Alloy UNS No.	Copper Plus Named Elements, % min
C85470	99.5
C85700	98.7
C85800	98.7
C86500	99.0
C87800	99.5
C99700	99.7
C99750	99.7

6.4 If the producer's or supplier's method of composition control is acceptable, sampling for chemical analysis may be waived at the discretion of the purchaser.

## 7. Mechanical Property Requirements

7.1 Unless specified in the purchase order, acceptance of die castings under this specification shall not depend on mechanical properties determined by tension or impact tests. **Table X1.1** shows typical mechanical properties.

7.2 When minimum mechanical properties are specified in the purchase order the mechanical properties shall be agreed upon between the manufacturer or supplier and the purchaser.

## 8. Dimensions, Mass, and Permissible Variations

8.1 Permissible variations in dimensions shall be within the limits specified on the drawings or in the contract or purchase order.

8.1.1 Any dimensions for which a tolerance is not specified shall be in accord with ADCI Product Standard Series E1 to E16 inclusive.

## 9. Sampling

9.1 An inspection lot shall consist of the production from each die or compound die on each machine for each 24 h during the first week of normal operation and the production for each 48 h thereafter of normal operation. Any significant change in the machine, composition, die or continuity of operation shall be considered as the start of a new lot. Die castings inspected by this method shall be so marked or handled during the finishing operations as not to lose their identity.

**TABLE 1 Chemical Requirements**

Copper Alloy UNS No.	Composition, % max (unless shown as a range or min)											
	Copper	Tin	Lead	Zinc	Iron	Nickel including Cobalt	Aluminum	Manganese	Antimony	Sulfur	Phosphorus	Silicon
C85470	60.0–65.0	1.0–4.0	0.09	Rem	0.20	...	0.10–1.0	...	...	...	0.02–0.25	...
C85700	58.0–64.0 <sup>A</sup>	0.50–1.5	0.8–1.5	32.0–40.0	0.7	1.0	0.8	...	...	...	...	0.05
C85800	57.0 min <sup>A</sup>	1.5	1.5	31.0–41.0	0.50	0.50	0.55	0.25	0.05	0.05	0.01	0.25 <sup>B</sup>
C86500	55.0–60.0 <sup>A</sup>	1.0	0.40	36.0–42.0	0.40–2.0	1.0	0.50–1.5	0.10–1.5	...	...	...	...
C87800	80.0 min <sup>A</sup>	0.25	0.09	12.0–16.0	0.15	0.20	0.15	0.15	0.05	0.05	0.01	3.8–4.2 <sup>B,C</sup>
C99700	54.0 min <sup>A</sup>	1.0	2.0	19.0–25.0	1.0	4.0–6.0	0.50–3.0	11.0–15.0	...	...	...	...
C99750	55.0–61.0	...	0.50–2.5	17.0–23.0	1.0 <sup>D</sup>	5.0	0.25–3.0	17.0–23.0	...	...	...	...

<sup>A</sup> In determining copper min, copper may be determined as copper plus nickel.

<sup>B</sup> Arsenic 0.05 max.

<sup>C</sup> Magnesium 0.01 max.

<sup>D</sup> Iron content above the nickel content may cause hard spots resulting in decreased machinability.