



Designation: ~~B427–09 (Reapproved 2015)~~ **B427 – 21**

Standard Specification for Gear Bronze Alloy Castings¹

This standard is issued under the fixed designation B427; 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 (ϵ) 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 specification² establishes requirements for alloys whose copper alloy numbers and ~~nominal~~ compositions are shown in **Table 1**. The castings may be furnished as one of three types: static chill, centrifugal chill, or sand cast.

1.2 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 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 environmental practices and determine the applicability of regulatory limitations prior to use.

1.4 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.³

[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](#)

[B950 Guide for Editorial Procedures and Form of Product Specifications for Copper and Copper Alloys](#)

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

[E10 Test Method for Brinell Hardness of Metallic Materials](#)

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

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

3. General Requirements

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

¹ 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.

Current edition approved ~~May 1, 2015~~ April 1, 2021. Published ~~June 2015~~ April 2021. Originally approved in 1965. Last previous edition approved in ~~2009~~ 2015 as ~~B427–09~~ B427 – 09 (2015). DOI: ~~10.1520/B0427-09R15~~ 10.1520/B0427-21.

² 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.

³ 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~~ standard’s Document Summary page on the ASTM website.

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

TABLE 21 Chemical Requirements

Element	Composition, max % (Unless Shown as a Range or Minimum) Copper Alloy UNS No.				
	C90700 ^A	C90800 ^A	C91700C91600 ^A	C90700 ^A	C91600C91700 ^A C92900 ^A
Copper	85.0–89.0 ^B	84.0–87.0 ^B	88.0–90.0 ^B	86.0–89.0 ^B	82.0–86.0 ^B
Copper	88.0–90.0 ^B	85.0–89.0 ^B	86.0–89.0 ^B	84.0–87.0 ^B	82.0–86.0 ^B
Tin	11.0–13.0	11.3–12.5	10.0–12.0	9.7–10.8	9.0–11.0
Tin	10.0–12.0	11.0–13.0	9.7–10.8	11.3–12.5	9.0–11.0
Lead	0.25	0.25	0.50	0.25	2.0–3.2
Lead	0.50	0.25	0.25	0.25	2.0–3.2
Zinc	0.25	0.25	0.50	0.25	0.25
Zinc	0.50	0.25	0.25	0.25	0.25
Iron	0.15	0.20	0.15	0.20	0.20
Iron	0.15	0.15	0.20	0.20	0.20
Antimony	0.20	0.20	0.20	0.20	0.25
Nickel (incl. cobalt)	0.50	1.2–2.0	0.50	1.2–2.0	2.8–4.0
Nickel (incl. cobalt)	0.50 ^C	0.50 ^C	1.2–2.0 ^C	1.2–2.0 ^C	2.8–4.0 ^C
Sulfur	0.05	0.05	0.05	0.05	0.05
Phosphorus	0.30	0.30	0.30	0.30	0.50
Aluminum	0.005	0.005	0.005	0.005	0.005
Silicon	0.005	0.005	0.005	0.005	0.005

^A Ingot for remelting specifications vary from the ranges shown.

^B In determining Cu min., Cu may be calculated as Cu + Ni.

^C Ni value includes Co.

3.1.1 Terminology (Section 4)

3.1.2 Materials and Manufacture

3.1.3 Sampling

3.1.4 Number of Tests and Retests

3.1.5 Specimen Preparation

3.1.6 Certification

3.1.7 Test Reports standards.iteh.ai/catalog/standards/sist/91ca29c4-9c39-4155-805c-98b40c88906c/astm-b427-21

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 Terminology B846**.

4. Terminology

4.1 For definitions of terms related to copper and copper alloys, refer to Terminology **B846**.

5. Ordering Information

5.1 Include the following information when placing in orders for product under this specification: product:

5.1.1 Quantity of castings required; ASTM designation and year of issue (for example, B427 – 09);

5.1.2 Copper Alloy UNS No. (for **Table 1**), example, C90800);

5.1.3 Specification title, number, and year of issue; Dimensions: inside diameter, outside diameter, thickness, and width;

5.1.4 Form: cross-section, such as tube, round, hexagon, octagon, square, or rectangle;

5.1.5 Pattern or drawing number and casting type; Tolerances, agreed upon with producer and consumer (Section **18**);

5.1.6 Length (including length tolerance if other than mill lengths);

~~5.1.7 Repair~~Number of castings (Section ~~or 9~~);total weight for each size and form; and

~~5.1.8 Certification, if specified in the purchase order (Specification~~When castings are purchased for agencies of the U.S. government, the Supplementary Requirements of Specification ~~B824~~); may be specified.

~~5.1.7 Foundry test report, if specified in the purchase order (Specification B824), and~~

~~5.1.8 Witness inspection, if specified in the purchase order (Specification B824).~~

~~5.2 When product is purchased for agencies of the U.S. Government, the Supplementary Requirements of Specification~~The following requirements are optional and should be specified in the purchase order, when required:~~B824 may be specified.~~

~~5.2.1 Chemical analysis of residual elements (Section 6 and Specification B824),~~

~~5.2.2 Mechanical requirements (Section 7 and Test Methods E8/E8M),~~

~~5.2.3 Witness inspection (Specification B824).~~

~~5.2.4 Certification (Specification B824),~~

~~5.2.5 Foundry test report (Specification B824),~~

~~5.2.6 Product marking (Specification B824), and~~

~~5.2.7 Approval of weld repair and records of repair (Section 9).~~

6. Chemical Composition

~~6.1 The castings shall conform to the requirements as to chemical composition requirements prescribed in Table 21 for the alloy specified~~copper [alloy] UNS No. specified in the ordering information.

~~6.2 These specification~~composition limits do not preclude the presence of other elements. ~~Limits~~By agreement between the manufacturer and purchaser, limits may be established by agreement between manufacturer or supplier and purchaser for these and analysis required for unnamed elements. 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 named elements in Table 21 are analyzed, their sum shall be as specified in Table 32.

7. Mechanical Property Requirements

~~7.1 Mechanical properties shall be determined from separately cast test bar eastings and shall meet the requirements shown in castings~~Table 4:

~~7.1.1 When specified in the contract or purchase order, the product shall conform to the tensile, yield, and elongation requirements prescribed in Table 3, when tested in accordance with Test Methods E8/E8M.~~

TABLE 32 Copper Plus Sum of All Named Elements Analyzed

Copper Alloy UNS No.	Copper Plus Named Elements, % min
C90700	99.4
C90800	99.4
C91700	99.4
C91600	99.4
C90700	99.4
C91600	99.4
C91700	99.4
C92900	99.3

TABLE 43 Mechanical Requirements^A

NOTE 1—The properties of a separate cast test specimen shall meet the following *minimum* values:

	Copper Alloy UNS Nos. C90700, C90800, C91700	Copper Alloy UNS No. C91600	Copper Alloy UNS Nos. C90700, C90800, C91600, C91700	Copper Alloy UNS No. C92900
	Static or Centrifugally Chill Cast, ksi ^B (MPa) ^C	Static or Centrifugally Chill Cast, ksi ^B (MPa) ^C	Sand Cast, ksi ^B (MPa) ^C	Sand or Chill Cast, ksi ^B (MPa) ^C
Tensile strength, min	50 (345)	45 (310)	35 (241)	45 (310)
Yield strength, at 0.5 % extension, min	28 (193)	25 (172)	17 (117)	25 (172)
Elongation in 2 in. (50.8 mm), min, %	12	10	10	8
Brinell-500 kg on bar or casting, min	95	85	65	75

^A Test taken in accordance with Test Methods E8/E8M.

^B ksi = 1000 psi.

^C See Appendix X1.

7.1.2 When specified in the contract or purchase order, the product shall conform to the Brinell hardness requirement prescribed in Table 3, when tested in accordance with Test Method E10.

8. Dimensions, Mass, and Permissible Variations

8.1 Variations in dimensions and weights shall be as agreed upon between the producer and the consumer but shall not be more than 3 % in the as-cast condition.

8.2 The manufacturer shall not be responsible for the dimensional accuracy of patterns or molds furnished by the purchaser.

9. Casting Repair

9.1 The castings shall not be repaired, plugged, welded, or burned-in without the written approval of the purchaser.

10. Sampling

10.1 Sampling shall be in accordance with requirements of Practice E255.

10.2 Test bar casting representing sand castings in the Copper Alloy UNS Nos. under this specification shall be cast to the form and dimensions shown in Figs. 2, Figs. 3, or Figs. 4 of Practice B208.

10.3 Test bar castings representing castings produced in chill molds of metal or graphite may be cast in open keel-block molds of the same material as the molds used for the castings.

10.4 Separate centrifugally cast test bars shall be made in accordance with Practice B208.

10.5 At the ~~manufacturer's option~~ manufacturer's option, test bar specimens may be removed from centrifugal castings instead of separate centrifugally cast test coupons (~~10.310.4~~).

11. Number of Tests

11.1 One Brinell hardness reading shall be made for each lot of castings.

12. Test Methods

12.1 Analytic chemical methods are given in Specification B824 (Section 13).

12.2 Tensile strength, yield strength, and elongation properties shall be determined from separately cast test bar castings in accordance with Test Methods E8/E8M.