



Standard Specification for Aluminum-Bronze Sand Castings¹

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

^{ε1} NOTE—Table 3 was editorially corrected in January 2001.

1. Scope *

1.1 This specification establishes requirements for sand castings produced from copper-base alloys having the alloy numbers,² commercial designations, and nominal compositions shown in Table 1.

1.2 The values stated in inch-pound units shall be regarded as the standard. Metric values given in parentheses are for information only.

2. Referenced Documents

2.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

2.2 ASTM Standards:

B 208 Practice for Preparing Tension Test Specimens for Copper Alloys for Sand, Permanent Mold, Centrifugal, and Continuous Castings³

B 824 Specification for General Requirements for Copper Alloy Castings³

E 10 Test Method for Brinell Hardness of Metallic Materials⁴

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials⁴

E 527 Practice for Numbering Metals and Alloys (UNS)⁵

3. General Requirements

3.1 Material furnished under this specification shall conform to the applicable requirements of Specification B 824.

4. Ordering Information

4.1 Orders for castings under this specification shall include the following information:

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.

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² The UNS system for copper and copper alloys (see Practice E 527) 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 Annual Book of ASTM Standards, Vol 02.01.

⁴ Annual Book of ASTM Standards, Vol 03.01.

⁵ Annual Book of ASTM Standards, Vol 01.01.

- 4.1.1 Quality of castings required,
- 4.1.2 Copper alloy number (Table 1) and temper (as-cast, heat treated, and so forth),
- 4.1.3 Specification title, number, and year of issue,
- 4.1.4 Pattern or drawing number and condition (cast, machined, and so forth),
- 4.1.5 Analysis of residual elements, if specified in the purchase order (Specification B 824),
- 4.1.6 Pressure test requirements, if specified in the purchase order (Specification B 824),
- 4.1.7 Soundness requirements, if specified in the purchase order (Specification B 824),
- 4.1.8 Certification, if specified in the purchase order (Specification B 824),
- 4.1.9 Test report, if specified in the purchase order (Specification B 824),
- 4.1.10 Witness inspection, if specified in the purchase order (Specification B 824),
- 4.1.11 Approval of weld procedure and records of repairs, if specified in the purchase order (Section 8),
- 4.1.12 ASME Boiler and Pressure Vessel Code⁶ application (9.2 and Section 11),
- 4.1.13 Castings for seawater service (5.3), and
- 4.1.14 Product marking, if specified in the purchase order (Specification B 824).

4.2 When material is purchased for agencies of the U.S. Government, the Supplementary Requirements of this specification may be specified.

5. Materials and Manufacture

5.1 For better corrosion resistance in seawater applications, castings in Copper Alloy UNS No. C95800 shall be given a temper anneal heat treatment at $1250 \pm 50^\circ\text{F}$ ($675 \pm 10^\circ\text{C}$) for 6 h minimum. Cooling shall be by the fastest means possible that will not cause excessive distortion or cracking. Propeller castings shall be exempt from this requirement.

5.2 Copper Alloy UNS Nos. C95300, C95400, C95410, and C95500 may be supplied in the heat-treated condition to obtain the higher mechanical properties shown in Table 3. Suggested

⁶ Available from the American Society of Mechanical Engineers, Headquarters, Three Park Ave., New York, NY 10016-5990.

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

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TABLE 1 Nominal Compositions

Copper Alloy UNS No.	Old Designation	Commercial Designation	Nominal Composition, %					
			Copper	Nickel	Iron	Aluminum	Silicon	Manganese
C95200	9A	Grade A	88.0	...	3.0	9.0	...	...
C95300 ^A	9B	Grade B	89.0	...	1.0	10.0	...	...
C95400 ^A	9C	Grade C	85.0	...	4.0	11.0	...	...
C95410 ^A	...	...	84.0	2.0	4.0	10.0	...	...
C95500 ^A	9D	Grade D	81.0	4.0	4.0	11.0	...	...
C95520 ^A	...	...	78.5	5.5	5.0	11.0	...	...
C95600	9E	Grade E	91.0	...	...	7.0	2.0	...
C95700	9F	Grade F	75.0	2.0	3.0	8.0	...	12.0
C95800	...	...	81.3	4.5	4.0	9.0	...	1.2
C95820	...	...	79.0	5.2	4.5	9.5	...	1.0
C95900	...	...	87.5	...	4.5	13.0	...	...

^AThese grades respond to heat treatment.

TABLE 2 Chemical Requirements

Classification	Aluminum Bronze		Nickel Aluminum Bronze			Silicon Aluminum Bronze	Manganese-Nickel Aluminum Bronze	Nickel Aluminum Bronze	Aluminum Bronze		
	C95200	C95300	C95400	C95410	C95500	C95520 ^A	C95600	C95700	C95800	C95820 ^B	C95900
Composition, %											
Copper	86.0 min	86.0 min	83.0 min	83.0 min	78.0 min	74.5 min	88.0 min	71.0 min	79.0 min	77.5 min	remainder
Aluminum	8.5–9.5	9.0–11.0	10.0–11.5	10.0–11.5	10.0–11.5	10.5–11.5	6.0–8.0	7.0–8.5	8.5–9.5	9.0–10.0	12.0–13.5
Iron	2.5–4.0	0.8–1.5	3.0–5.0	3.0–5.0	3.0–5.0	4.0–5.5	...	2.0–4.0	3.5–4.5 ^C	4.0–5.0	3.0–5.0
Manganese	...	...	0.50 max	0.50 max	3.5 max	1.5 max	...	11.0–14.0	0.8–1.5	1.5 max	1.5 max
Nickel (incl cobalt)	...	...	1.5 max	1.5–2.5	3.0–5.5	4.2–6.0	0.25 max	1.5–3.0	4.0–5.0 ^C	4.5–5.8	0.5 max
Silicon	...	...	...	...	...	0.15 max	1.8–3.2	0.10 max	0.10 max	0.10 max	...
Lead	...	...	...	...	...	0.03 max	...	0.03 max	0.03 max	0.02 max	...

^AChromium shall be 0.05 max, cobalt 0.20 max, tin 0.25 max, and zinc 0.30 max.

^BZinc shall be 0.2 max and tin 0.02 max.

^CIron content shall not exceed the nickel content.

heat treatments for these alloys and Copper Alloy UNS No. C95520 are given in Table 4. Actual practice may vary by manufacturer.

5.3 Copper Alloy UNS No. C95520 is used in the heat-treated condition only.

5.4 Copper Alloy UNS No. C95900 is normally supplied annealed between 1100°F (595°C) and 1300°F (705°C) followed by air cooling.

5.5 Copper Alloy UNS No. C95820 is supplied in the as-cast condition.

5.6 Separately cast test bar coupons representing castings made in Copper Alloy UNS Nos. C95300HT, C95400HT, C95410HT, C95500HT, C95520HT, C95800 temper annealed, and C95900 annealed shall be heat treated with the castings.

6. Chemical Composition

6.1 The castings shall conform to the chemical requirements shown in Table 2.

6.2 These specification limits do not preclude the presence of other elements. Limits may be established by agreement between manufacturer or supplier and purchaser for these 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 elements in the table are analyzed, their sum shall be as specified in the following table:

Copper Alloy UNS Number	Copper Plus Named Elements, min, %
C95200	99.0
C95300	99.0
C95400	99.5
C95410	99.5
C95500	99.5
C95520	99.5
C95600	99.0
C95700	99.5
C95800	99.5
C95820	99.2
C95900	99.5

7. Mechanical Properties

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

8. Casting Repair

8.1 Alloys included in this specification are generally weldable. Weld repairs may be made at the manufacturer's discretion provided each excavation does not exceed 20 % of the casting section or wall thickness or 4 % of the casting surface area.

8.2 Excavations that exceed those described in 8.1 may be made at the manufacturer's discretion except that when required (4.1.11) the weld procedure shall be approved by the purchaser and the following records shall be maintained: