



# Standard Specification for Wrought Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and Other Structural Use<sup>1</sup>

This standard is issued under the fixed designation B 100; 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.

## 1. Scope \*

1.1 This specification establishes the requirements for wrought copper-alloy bearing plate and bearing sheets for application in bridges and other structures. Specifically, the plates and sheets are to be used for fixed or expansion bearings where the motion is slow and intermittent with pressures not exceeding 3 ksi (20 MPa).

1.2 The values stated in inch-pound units are the standard. SI values given in parentheses are for information only.

## 2. Referenced Documents

### 2.1 ASTM Standards:

B 248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet Strip, and Rolled Bar<sup>2</sup>

E 8 Test Methods for Tension Testing of Metallic Materials<sup>3</sup>

E 9 Compression Testing of Metallic Materials at Room Temperature<sup>3</sup>

E 10 Test Method for Brinell Hardness of Metallic Materials<sup>3</sup>

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials<sup>3</sup>

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications<sup>4</sup>

E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes<sup>5</sup>

E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric)<sup>5</sup>

E 255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition<sup>5</sup>

E 478 Test Methods for Chemical Analysis of Copper Alloys<sup>5</sup>

## 3. Ordering Information

3.1 Orders for product to this specification should include the following information:

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B-5 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.01 on Plate, Sheet and Strip.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 02.01.

<sup>3</sup> Annual Book of ASTM Standards, Vol 03.01.

<sup>4</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>5</sup> Annual Book of ASTM Standards, Vol 03.05.

3.1.1 ASTM specification designation and year of issue,  
3.1.2 Copper Alloy UNS No. designation (for example, C51000),

3.1.3 Dimensions: length, width, thickness (Section 9 and Table 1),

3.1.4 Quantity or weight for each size,

3.1.5 Temper (Section 5),

3.1.6 When product produced of Copper Alloy UNS No. C61300 is to be used in applications requiring welding (Table 2, footnote A), and

3.1.7 When product is purchased for agencies of the U.S. Government (Section 8).

3.2 The following options are available under this specification and should be specified in the contract or purchase order when required:

3.2.1 Heat identification or traceability (Section 4.1.2),

3.2.2 Certification (Specification B 248), and

3.2.3 Test Report (Specification B 248).

## 4. Material and Manufacture

### 4.1 Material:

4.1.1 The material of manufacture shall be cast bar, slab, cake, billets, etc. of Copper Alloy UNS No. C51000, C51100, C61300, C61400 or C65500 of such purity and soundness as to be suitable for processing into the products prescribed herein.

4.1.2 When heat identification or traceability is required, the purchaser shall specify the details desired in the contract or purchase order.

### 4.2 Manufacture:

4.2.1 The product shall be manufactured by hot or cold working and annealing processes as deemed necessary in order to produce a uniform wrought structure in the finished product.

4.2.2 The product shall be hot or cold worked to the finished size and subsequently annealed, when required, to meet the properties specified.

## 5. Chemical Composition

5.1 The material shall conform to the chemical requirements prescribed in Table 2 for the Copper Alloy UNS No. designation specified in the contract or purchase order.

5.2 These specification limits do not preclude the presence of other elements. Limits for unnamed elements may be established and determination required by agreement between the manufacturer or supplier and the purchaser.



**TABLE 1 Thickness and Weight Tolerances**

Ordered Weight lb/ft <sup>2</sup> (kg/m <sup>2</sup> ) <sup>A</sup>	Weight Tolerance,%		Ordered Thickness, in. (mm)	Thickness Tolerance, %	
	Over	Under		Over	Under
Plates and Sheets 20 in. (508 mm) and Under in Width					
5.0 to 7.5 (24.4 to 36.6), excl	4.5	3.5	Under 1/8 (3.18)	9	0
7.5 to 10.0 (36.6 to 48.8), excl	4	3	1/8 to 3/16 (3.18 to 4.76), excl	8	0
10.0 to 12.5 (48.8 to 61.0), excl	4	2.5	3/16 to 1/4 (4.76 to 6.35), excl	7	0
12.5 to 15.0 (61.0 to 73.2), excl	3.5	2.5	1/4 to 5/16 (6.35 to 7.94), excl	6	0
15.0 to 17.5 (73.2 to 85.4), excl	2.5	2.5	5/16 to 3/8 (7.94 to 9.52), excl	5	0
17.5 to 20.0 (85.4 to 97.6), excl	2.5	2.0	3/8 to 7/16 (9.52 to 11.1), excl	4.5	0
20 (97.6) or over	2.5	2.0	7/16 to 1/2 (11.1 to 12.7), excl	4 <sup>B</sup>	0
			1/2 to 5/8 (12.7 to 15.9), excl	3.5 <sup>B</sup>	0
			5/8 to 3/4 (15.9 to 19.0), excl	3 <sup>B</sup>	0
			3/4 to 1 (19.0 to 25.4), excl	2.5 <sup>B</sup>	0
			1 (25.4) or over	2.5 <sup>B</sup>	0
Plates and Sheets Over 20 in. (508 mm) in Width					
All weights	5.0	5.0	All thicknesses	10.0	0

<sup>A</sup> For purposes of calculating weights, cross section, etc., the density of rolled phosphor bronze (Copper Alloy UNS Nos. C51000 and C51100) shall be taken as 0.320 lb/in.<sup>3</sup>(8.86 g/cm<sup>3</sup>) and the density of rolled copper silicon alloy (Copper Alloy UNS No. C65500) as 0.308 lb/in.<sup>3</sup> (8.53 g/cm<sup>3</sup>).

<sup>B</sup> These "Over" thickness tolerances apply to plates and sheets 10 in. (254 mm) and under in width. For plates and sheets over 10 to 20 in. (254 to 508 mm), incl. in width the "Over" thickness tolerances shall be as follows:

Ordered Thickness, in. (mm).....Thickness Tolerance, Over, %	
1/16 to 5/8 (11.1 to 15.9), excl.....	4.5
5/8 to 3/4 (15.9 to 19.0), excl.....	4.0
3/4 (19.0) or over.....	3.5

**TABLE 2 Chemical Requirements**

Element	Composition %				
	C51000	C51100	C61300	C61400	C65500
Copper (incl Silver)	remainder	remainder	remainder	remainder	remainder
Phosphorus	0.03–0.35	0.03–0.35	0.15 max.	0.15 max.	...
Tin	4.2–5.8	3.5–4.9	0.20–0.50	...	...
Silicon	...	...	0.10 max.	...	2.8–3.8
Aluminum	...	...	6.0–7.5	6.0–8.0	...
Iron	0.10 max.	0.10 max.	2.0–3.0	1.5–3.5	0.8 max.
Manganese	...	...	0.20 max.	1.0 max.	0.5–1.3
Zinc, max.	0.30	0.30	0.10	0.20	1.5 max.
Lead, max.	0.05	0.05	0.01	0.01	0.05
Nickel, max.	...	...	0.15	...	0.6
Other named elements	...	...	A	...	...

<sup>A</sup> When the product is for subsequent welding applications and is so specified by the purchaser, chromium, cadmium, zirconium and zinc shall be 0.05 % max.

5.3 Copper, given as the remainder, may be taken as the difference between the sum of results of all elements analyzed and 100 %.

5.4 When all elements listed in Table 2 for the specified Copper Alloy UNS No. designation are determined, the sum of results shall be 99.5 % min except for C61300 which shall be 99.8 %.

## 6. Temper

6.1 The temper of product furnished to this specification, and as defined in Practice B 601, shall be as follows:

UNS Alloy No.	Temper
C51000	H03 (3/4 hard)
C51100	H03 (3/4 hard)
C65500	H01 (1/4 hard)
C61300	M20 (as hot rolled) or O61 (annealed)
C61400	M20 (as hot rolled) or O61 (annealed)

## 7. Mechanical Property Requirements

7.1 Product in final form shall conform to the requirements of Table 3.

7.1.1 Product in plate form less than 3/4 in. (20 mm) in thickness and product in sheet form shall conform to the tensile requirements when tested in accordance with Test Method E 8.

**TABLE 3 Mechanical Requirements**

Tension	
Tensile strength, min, ksi <sup>A</sup> (MPa <sup>B</sup> )	60 (415)
Elongation in 2 in. (50.8 mm), min, %	10
Compression	
Yield strength (0.1 % offset) min, ksi <sup>A</sup> (MPa <sup>B</sup> )	25 (170)
Permanent set under 100 ksi <sup>A</sup> (690 MPa <sup>B</sup> )%	6–20
Hardness	
Plates 1/4 in. (6.35 mm) and over in thickness, Brinell, min	130 HB
Plates under 1/4 in. (6.35 mm) in thickness, Rockwell, min	75 HRB

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

<sup>B</sup> See Appendix.

7.1.2 Product in plate form 3/4 in. (20 mm) or over in thickness shall conform to either tensile or compression requirements when tested in accordance with Test Method E 8 or Test Method E 9 respectively.

7.1.2.1 In case of dispute, Test Method E 8 shall govern.

7.1.3 The properties of product over 18 in. (460 mm) in width and over 3/4 in. (20 mm) in thickness shall be subject to agreement between the manufacturer and the purchaser.