



# Standard Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers<sup>1</sup>

This standard is issued under the fixed designation B 171/B 171M; 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 Department of Defense.*

## 1. Scope\*

1.1 This specification<sup>2</sup> establishes the requirements for copper-alloy plate and sheet for pressure vessels, condensers, and heat exchangers. The following alloys are covered:

Copper Alloy	Previously Used Designation
C36500	Leaded Muntz Metal
C44300	Admiralty, Arsenical
C44400	Admiralty, Antimonial
C44500	Admiralty, Phosphorized
C46400	Naval Brass, Uninhibited
C46500	Naval Brass, Arsenical
C61300	Aluminum Bronze
C61400	Aluminum Bronze D
C63000	10 % Aluminum-Nickel Bronze
C63200	9 % Aluminum-Nickel Bronze
C70600	90-10 Copper Nickel
C70620	90-10 Copper Nickel -(modified for welding)
C71500	70-30 Copper Nickel
C71520	70-30 Copper Nickel-(modified for welding)
C72200	...

1.2 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

## 2. Referenced Documents

2.1 The following documents in the current issue of the Book of Standards form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards*:<sup>3</sup>

- B 248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip and Rolled Bar
- B 248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip and Rolled Bar [Metric]
- B 601 Classification for Temper Designations for Copper and Copper Alloys-Wrought and Cast
- B 846 Terminology for Copper and Copper Alloys
- E 8 Test Methods for Tension Testing of Metallic Materials
- E 8M Test Methods for Tension Testing of Metallic Materials [Metric]
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specification
- E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes<sup>4</sup>
- E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Method)
- E 255 Practice for Sampling Copper and Copper Alloys for Determination of Chemical Composition
- E 478 Test Methods for Chemical Analysis of Copper Alloys
- E 527 Practice for Numbering Metals and Alloys (UNS)

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology B 846.

## 4. Ordering Information

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

- 4.1.1 ASTM Specification B 171/B 171M, year of issue,
- 4.1.2 Whether inch-pound or SI units are applicable (see 1.2),
- 4.1.3 Copper Alloy UNS. No. (see Section 6, Table 1),
- 4.1.4 Whether the alloy ordered will be used in applications requiring it to be welded (see Table 1, footnotes B and C for

<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 B5.01 on Plate, Sheet, and Strip.

Current edition approved May 1, 2004. Published May 2004. Originally approved in 1942. Last previous edition approved in 1999 as B 171/B 171M – 99<sup>ε2</sup>.

<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications, see related Specification SB-171 in Section II of that Code.

<sup>3</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>4</sup> Withdrawn.

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

**TABLE 1 Chemical Requirements**

Copper Alloy UNS No. <sup>A</sup>	Composition, % max (Unless Shown as a Range)									
	Copper, incl Silver	Tin	Nickel, incl Cobalt	Manganese, max	Lead	Iron	Zinc	Aluminum	Chromium	Other Named Elements
C36500	58.0-61.0	0.25	...	...	0.25-0.7	0.15	remainder	...	...	...
C44300	70.0-73.0	0.8-1.2	...	...	0.07	0.06	remainder	...	...	0.02-0.06 As
C44400	70.0-73.0	0.8-1.2	...	...	0.07	0.06	remainder	...	...	0.02-0.10 Sb
C44500	70.0-73.0	0.8-1.2	...	...	0.07	0.06	remainder	...	...	0.02-0.10 P
C46400	59.0-62.0	0.5-1.0	...	...	0.20	0.10	remainder	...	...	...
C46500	59.0-62.0	0.5-1.0	...	...	0.20	0.10	remainder	...	...	0.02-0.06 As
C61300 <sup>B</sup>	remainder	0.20-0.50	0.15	0.20	0.01	2.0-3.0	0.10 <sup>C</sup>	6.0-7.5	...	0.10 Si 0.015 P
C61400	remainder	...	...	1.0	0.01	1.5-3.5	0.20	6.0-8.0	...	0.015 P
C63000	remainder	0.20	4.0-5.5	1.5	...	2.0-4.0	0.30	9.0-11.0	...	0.25 Si
C63200	remainder	...	4.0-4.8 <sup>D</sup>	1.2-2.0	0.02	3.5-4.3 <sup>D</sup>	...	8.7-9.5	...	0.10 Si
C70600	remainder	...	9.0-11.0	1.0	0.05 <sup>C</sup>	1.0-1.8	1.0 <sup>C</sup>	...	...	...
C70620	86.5 min	...	9.0-11.0	1.0	0.02	1.0-1.8	0.50	...	...	0.05 C 0.02 P 0.02 S
C71500	remainder	...	29.0-33.0	1.0	0.05 <sup>C</sup>	0.40-1.0	1.0 <sup>C</sup>	...	...	0.05 C
C71520	65.0 min	...	29.0-33.0	1.0	0.02	0.40-1.0	0.50	...	...	0.02 P 0.02 S
C72200	remainder	...	15.0-18.0	1.0	0.05 <sup>C</sup>	0.50-1.0	1.0 <sup>C</sup>	...	0.03-0.70	0.03 Si 0.03 Ti <sub>c</sub>

<sup>A</sup> Designation established in accordance with Practice E 527.

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

<sup>C</sup> When the product is for subsequent welding applications, and is so specified by the purchaser, zinc shall be 0.50 % max, lead 0.02 % max, phosphorus 0.02 % max, sulfur 0.02 % max, and carbon 0.05 % max.

<sup>D</sup> Iron content shall not exceed the nickel content.

UNS Nos. C61300 and C72200, respectively, and UNS Nos. C70620 and C71520 in place of UNS Nos. C70600 and C71500),

- 4.1.5 Whether plate is to be machined (see 9.1.3),
- 4.1.6 How tolerance is specified (Table 2 Footnote A),
- 4.1.7 Certification, if required (Section 17),
- 4.1.8 Weight (total for each size),
- 4.1.9 Mill test report, if required (Section 18),
- 4.1.10 Special marking, if required (Section 19), and
- 4.1.11 Whether 0.2 yield offset strength is required.

## 5. Materials and Manufacture

5.1 *Material*—The material and manufacture shall be cast cake of the Copper Alloy UNS No. specified in the purchase order and shall be of such shape and soundness so as to be suitable for processing into the final product.

5.2 *Manufacture*—The product shall be manufactured by hot rolling or forging and finished by such cold working and annealing as may be necessary to achieve the required dimensions and properties.

## 6. Chemical Composition

6.1 The materials shall conform to the chemical compositional requirements specified in Table 1 for the copper alloy UNS designations specified in the ordering information..

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

6.3 For the alloys listed below, depending on analytical methodology, either copper or zinc, respectively, may be taken as the difference between the sum of all the elements analyzed

**TABLE 2 Thickness Tolerances**

Thickness, in. [mm]	Thickness Tolerances, Plus and Minus, <sup>A,B</sup> in. [mm] for Diameters or Widths			
	36 in. [1000 mm] or Under, incl	Over 36 to 60 in. [1000 to 1500 mm], incl	Over 60 to 96 in. [1500 to 2500 mm], incl	Over 96 to 132 in. [2500 to 3500 mm], incl
Over 0.125 to 0.250 [3.0 to 6.0 mm], incl	0.010 [0.25]	0.012 [0.30]	0.022 [0.56]	0.028 [0.71]
Over 0.250 to 0.500 [6.0 to 12.0 mm], incl	0.025 [0.64]	0.027 [0.69]	0.029 [0.74]	0.031 [0.79]
Over 0.500 to 0.750 [12.0 to 19.0 mm], incl	0.028 [0.71]	0.030 [0.76]	0.032 [0.81]	0.035 [0.89]
Over 0.750 to 1.000 [19.0 to 25.0 mm], incl	0.033 [0.84]	0.035 [0.89]	0.037 [0.94]	0.040 [1.0]
Over 1.000 to 1.500 [25.0 to 38.0], incl	0.038 [0.97]	0.040 [1.0]	0.042 [1.1]	0.045 [1.1]
Over 1.500 to 1.750 [38.0 to 44.0 mm], incl	0.043 [1.1]	0.045 [1.1]	0.047 [1.2]	0.050 [1.3]
Over 1.750 to 2.000 [44.0 to 50.0 mm], incl	0.050 [1.3]	0.055 [1.4]	0.062 [1.6]	0.065 [1.7]
Over 2.000 to 5.000 [50.0 to 127 mm], incl	0.058 [1.5]	0.062 [1.6]	0.065 [1.7]	...

<sup>A</sup> When tolerances are specified as all plus or all minus, double the values given.

<sup>B</sup> See 9.1.2 for specific alloys with a difference tolerance.

and 100 %. When all the elements in Table 1 are analyzed their sum shall be as shown below:

Copper Alloy UNS No.	Copper Plus Named Elements, % min
C36500	99.6
C44300	99.6
C44400	99.6
C44500	99.6
C46400	99.6
C46500	99.6

6.3.1 For the alloys listed below, copper may be taken as the difference between the sum of all the elements and 100 %. When all of the elements in Table 1 are analyzed, their sum shall be as shown below:

Copper Alloy UNS No.	Copper Plus Named Elements, % min
C61300	99.8
C61400	99.5
C63000	99.5
C63200	99.5
C70600	99.5
C70620	99.5
C71520	99.5
C71500	99.5
C72200	99.8

## 7. Temper

7.1 Tempers available under this specification, and as described in Classification B 601, are As Hot Rolled (M20) and Hot Rolled and Annealed (O25) as given in Table 3.

7.1.1 Products manufactured for *ASME Boiler and Pressure Vessel Code* applications must be certified to the O25 temper.

7.1.2 Products manufactured for other than *ASME Boiler and Pressure Vessel Code* applications may be produced in either the M20 or O25 temper.

## 8. Mechanical Property Requirements

8.1 The plates and sheet shall conform to the tensile property requirements as prescribed in Table 3.

## 9. Dimensions, Mass, and Permissible Variations

### 9.1 Thickness:

9.1.1 The thickness tolerances for plates of Copper Alloy UNS Nos. C36500, C44300, C44400, C44500, C46400, and C46500 shall be as prescribed in Table 2.

9.1.2 The thickness tolerances for plates of Copper Alloy UNS Nos. C61300, C61400, C63000, C63200, C71500, C70620, C71520, and C72200 shall be 25 % greater than those prescribed in Table 2.

9.1.3 If plates are machined, the thickness tolerances shall apply to the machined portion only.

9.1.4 Closer thickness tolerances than those prescribed in Table 2 can be furnished by surface machining. This is a special product and is subject to agreement between the manufacturer and the purchaser. This special product shall apply only when specified by the purchaser in the contract or order.

9.1.5 Unless otherwise agreed to by the manufacturer and the purchaser, the thickness of plate to this specification shall be determined by measuring along the length of the plate up to a distance of 7 in. [180 mm] from the edge.

9.2 *Diameters, Lengths, or Widths*—The diameters, lengths, or widths of plates shall be not less than those specified. The diameters, lengths, or widths of plates may exceed those specified by the amounts shown in Table 4.

NOTE 1—For the purpose of determining conformance with the dimensional requirements prescribed in this specification, any measured value outside the specified limiting values for any dimension may be cause for rejection.

9.3 *Flatness*—The flatness tolerances of individual plates shall not exceed those prescribed in Table 5. The tolerances shown are the total permissible variations for plates as ordered, and do not apply to the 7-in. [180-mm] marginal area at the edge of the plate. Inspection for flatness shall be made by placing the plate on a flat surfaced table with the side marked “Straight Side” up, applying a 72-in. [2-m] straightedge when the size permits, or a shorter one equal to the dimensions to be inspected, and measuring the depth of arc between the straight-edge and the plate.

**TABLE 3 Tensile Requirements—M20 and O25 Tempers**

Copper Alloy UNS No.	Thickness, in. [mm]	Tensile Strength, min, ksi <sup>A</sup> [MPa]	Yield Strength, <sup>B</sup> min, ksi <sup>A</sup> [MPa]	Yield Strength <sup>C</sup> 0.2 % Offset, min, ksi <sup>A</sup> [MPa]	Elongation in 2 in. [50.0 mm], min, %
C36500	2 [50.0] and under	50 [345]	20 [140]	20 [140]	35 [35]
	over 2 to 3.5 [50.0 to 100.0], incl	45 [310]	15 [105]	15 [105]	35 [35]
	over 3.5 to 5 [100.0 to 140.0], incl	40 [275]	12 [85]	12 [85]	35 [35]
C44300, C44400, and C44500	4 [100.0] and under	45 [310]	15 [105]	15 [105]	35 [35]
C46400, C46500	3 [80.0] and under	50 [345]	20 [140]	20 [140]	35 [35]
	over 3 to 5 [80.0 to 140.0], incl	50 [345]	18 [125]	18 [125]	35 [35]
C61300	2 [50.0] and under	75 [520]	37 [255]	36 [250]	30 [30]
	over 2 to 3 [50.0 to 80.0], incl	70 [485]	30 [205]	28 [195]	35 [35]
	over 3 to 5 [80.0 to 140.0], incl	65 [450]	28 [195]	26 [180]	35 [35]
C61400	2 [50.0] and under	70 [485]	30 [205]	28 [195]	35 [35]
	over 2 to 5 [50.0 to 140.0], incl	65 [450]	28 [195]	26 [180]	35 [35]
C63000 and C63200	2 [50.0] and under	90 [620]	36 [250]	34 [235]	10 [10]
	over 2 to 3.5 [50.0 to 100.0], incl	85 [585]	33 [230]	31 [215]	10 [10]
	over 3.5 to 5 [100.0 to 140.0], incl	80 [550]	30 [205]	28 [195]	10 [10]
C70600 and C70620	2.5 [60.0] and under	40 [275]	15 [105]	15 [105]	30 [30]
	over 2.5 to 5 [60.0 to 140.0], incl	40 [275]	15 [105]	15 [105]	30 [30]
C71500 and C71520	2.5 [60.0] and under	50 [345]	20 [140]	20 [140]	30 [30]
	over 2.5 to 5 [60.0 to 140.0], incl	45 [310]	18 [125]	18 [125]	30 [30]
C72200	2.5 [60.0] and under	42 [290]	16 [110]	16 [110]	35 [35]

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

<sup>B</sup> Yield strength is determined as the stress producing an elongation of 0.5 % or under load, that is 0.01 in. [0.254 mm] in a gage length of 2 in. [50.0 mm].

<sup>C</sup> See 4.1.9.



**TABLE 4 Diameter, Length, or Width Tolerances**

Diameter, Length, or Width in. [mm]	Permissible Excess in Diameter, Length, or Width, in. [mm]
36 [1000] or under	3/64 [1.2]
Over 36 to 60 [1000 to 1500], incl	1/16 [1.6]
Over 60 to 96 [1500 to 2500], incl	3/32 [2.4]
Over 96 to 132 [2500 to 3500], incl	7/64 [2.8]

**TABLE 5 Flatness Tolerances**

Copper Alloy UNS No.	Flatness Tolerances (Depth of Arc) Not to Exceed, in. [mm], for Diameters, Lengths, or Widths Shown		
	36 in. [1000 mm] or Under	Over 36 to 60 in. [1000 to 1500 mm], incl	Over 60 to 132 in. [1500 to 3500 mm], incl <sup>A</sup>
C36500, C46400, and C46500	0.050 [1.3]	0.055 [1.4]	0.060 [1.5]
C44300, C44400, and C44500	0.050 [1.3]	0.065 [1.7]	0.075 [1.9]
C61300, C61400, C63000, and C63200	0.060 [1.5]	0.075 [1.9]	0.090 [2.3]
C70600, C71500, C72200, C70620, and C71520	0.060 [1.5]	0.075 [1.9]	0.090 [2.3]

<sup>A</sup> Tolerance applies to any 72-in. [1.83-m] chord.

9.4 *Plate and Sheet Lot Weight for Pressure Vessels*—When plate or sheet of Copper Alloy UNS Nos. C70600, C70620, C71500, C71520, or C72200 are ordered for pressure vessels exclusively, the maximum lot weight restriction in Table 6 shall apply in addition to the thickness tolerance requirement of Table 2. The weight of each lot of five or more plates or sheets shall not exceed the nominal weight by more than the amount prescribed in Table 6. Plate and sheet of lots of less than five shall be governed solely by the thickness tolerances of Table 2. For purposes of calculating weights, the densities used shall be as listed in Table 7.

**10. Workmanship, Finish and Appearance**

10.1 The material shall be free of injurious defects and have a smooth clean surface, such as results from rolling operation, unless otherwise specified.

**11. Sampling**

11.1 The lot size, portion size, and selection of pieces shall be as follows:

**TABLE 6 Lot Weight Tolerances in Percentage of Theoretical Weight, All Plus Copper Alloy UNS Nos. C70600, C71500, C72200, C71520, and C70620 for Use in Pressure Vessels Exclusively**

Specified Thicknesses, in. [mm]	Permissible Excess in Average Weights of Lots, Expressed in Percentage of Nominal Weights					
	48 in. [1200 mm] and Under in Width	Over 48 to 60 in. [1200 to 1500 mm] in Width, incl	Over 60 to 72 in. [1500 to 1800 mm] in Width, incl	Over 72 to 96 in. [1800 to 2500 mm] in Width, incl	Over 96 to 120 in. [2500 to 3000 mm] in Width, incl	Over 120 to 132 in. [3000 to 3400 mm] in Width, incl
Over 1/8 to 3/16 [3.0 to 5.0], incl	6.5	8	9	11	...	...
Over 3/16 to 1/4 [5.0 to 6.0], incl	6.5	8	9	11	12	...
Over 1/4 to 5/16 [6.0 to 8.0], incl	6.5	7.75	8.75	11	12	13
Over 5/16 to 3/8 [8.0 to 10.0], incl	6.25	7.5	8.5	11	12	13
Over 3/8 to 1/2 [10.0 to 12.0], incl	6	6	8	10	11	12
Over 1/2 to 5/8 [12.0 to 16.0], incl	5.75	6.5	7.5	9	10	11
Over 5/8 to 3/4 [12.0 to 20.0], incl	5.5	6	7	8	9	10
Over 3/4 to 1 [20 to 25.0], incl	5	5	6.25	7	8	9
Over 1 to 2 [25.0 to 50.0], incl	3.5	4	5	6	7	8

**TABLE 7 Densities**

Copper Alloy UNS Nos.	Density lb/in. <sup>3</sup> [g/cm <sup>3</sup> ]
C36500	0.304 [8.41]
C44300, C44400, and C44500	0.308 [8.53]
C46400, C46500	0.304 [8.41]
C61300, C61400	0.285 [7.89]
C63000 and C63200	0.274 [7.58]
C70600, C71500, C72200, C70620, and C71520	0.323 [8.94]

11.1.1 *Lot Size*—10 000 lbs [4550 kg] or less material of the same mill form, alloy, temper, and thickness, subject to inspection at one time.

11.1.2 *Portion Size*—Four individual sample pieces shall be selected as representative of each lot. If the lot consists of less than four pieces, samples shall be selected so as to be representative of each piece.

11.2 *Chemical Analysis*—A sample for chemical analysis shall be taken and prepared in accordance with Practice E 255. Drillings, millings, and so forth, shall be taken in approximately equal weight from each of the sample pieces selected in accordance with 11.1.2 and combined into one composite sample. The minimum weight of the composite sample that is to be divided into three equal parts shall be 150 g.

11.2.1 Instead of sampling in accordance with Practice E 255, the manufacturer shall have the option of determining conformance to chemical composition by analyzing samples taken at the time castings are poured or samples taken from the semi-finished product. If the manufacturer determines the chemical composition of the material during the course of manufacture, he shall not be required to sample and analyze the finished product. The number of samples taken for determination of chemical composition shall be as follows:

11.2.1.1 When samples are taken at the time the castings are poured, at least one sample shall be taken for each group of castings poured simultaneously from the same source of molten metal.

11.2.1.2 When samples are taken from the semi-finished product, a sample shall be taken to represent each 10 000 lbs [4550 kg] or fraction thereof, except that not more than one sample shall be required per piece.

11.2.2 Because of the discontinuous nature of the processing of castings into wrought products, it is not practical to keep specific casting analysis identified with a specific quantity of finished material.

11.2.3 In the event that heat identification or traceability is required, the purchaser shall specify the details desired.

**12. Number of Tests and Retests**

12.1 *Tests:*

12.1.1 *Chemical Analysis*—Chemical composition shall be determined as the per element mean of results from at least two replicate analyses of the sample(s), and the results of each replication shall meet the requirements of the product specification.

12.2 *Other Tests*—For other tests, a specimen shall be taken from two of the sample pieces selected in accordance with 11.1.2. The required tests shall be made on each of the specimens so selected.

12.3 *Retests:*

12.3.1 If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

12.3.2 If the percent elongation of any test specimen is less than that specified, and any part of the fracture is outside the middle two-thirds of the gage length, or in a punched or scribed mark within the reduced section, a retest shall be allowed.

12.3.3 If one of the tests made to determine any of the mechanical properties fails to meet a specified limit, this test shall be repeated on two of the remaining pieces selected in accordance with 11.1.2, and the results of both of these tests shall comply with the specified requirements.

12.3.4 If the chemical analysis fails to conform to the specified limits, analysis shall be made on a new composite sample prepared from the pieces selected in accordance with 11.1.2. The results of this retest shall comply with the specified requirements.

**13. Test Methods**

13.1 The properties and chemical compositions enumerated in this specification shall, in case of disagreement, be determined in accordance with the following ASTM test methods:

13.1.1 *Tension*—E 8(A) or E 8M(A).

13.1.2 *Chemical Analysis*—In accordance with the following:

Element	Test Method
Copper	E 478
Aluminum	E 478
Antimony	E 62
Arsenic	E 62
Iron	
<1.3 %	E 478
>1.3 %	E 54
Lead	E 478 (AA)
Manganese	E 62
Nickel:	
<5 %	E 478 (photometric)
>5 %	E 478 (gravimetric)
Phosphorus	E 62
Silicon	E 54 (perchloric acid)
Tin	E 478
Zinc	
<2 %	E 478 (AA)

Element	Test Method
>2 %	E 478 (titrametric)

NOTE 2—The tension test specimen shall conform to the dimensions shown in Figs. 7 or 8 of Test Methods E 8 or E 8M.

13.2 In case of disagreement, the sulfur content of the alloys covered in this specification shall be determined in accordance with the method given in the annex to Specification B 248 or B 248M.

**14. Significance of Numerical Limits**

14.1 For purposes of determining compliance with the specified limits for requirements of the properties listed in the following table and for dimensional tolerances, an observed or a calculated value shall be rounded as indicated in accordance with the rounding method of Practice E 29:

Property	Rounded Unit for Observed or Calculated Value
Chemical composition	nearest unit in the last right hand significant digit used in expressing the limiting value
Tensile strength	nearest ksi [nearest MPa]
Yield strength	nearest ksi [nearest MPa]
Elongation of 5 % and over	nearest 1 %

**15. Inspection**

15.1 The manufacturer shall inspect and perform the tests necessary to verify that the product furnished conforms to the requirements of this specification.

15.2 If, in addition, source inspection of the material by the purchaser is agreed upon by the manufacturer and the purchaser as part of the purchase contract, the nature of the facilities needed to satisfy the inspector representing the purchaser that the product is being furnished in accordance with this specification shall be included in the agreement. All tests and the inspection shall be conducted so as not to interfere unnecessarily with the operation of the works.

15.3 The manufacturer and the purchaser, by mutual agreement, may accomplish the final inspection simultaneously.

**16. Rejection and Rehearing**

16.1 *Rejection*—Material that fails to conform to the requirements of this specification when inspected or tested by the purchaser or his agent may be rejected. Rejections shall be reported to the manufacturer or supplier promptly. In addition, a written notification or rejection shall follow.

16.2 *Rehearing*—In case of dissatisfaction with the results of the test, the manufacturer or supplier may make claim for rehearing.

**17. Certification**

17.1 When specified on the purchase order, the manufacturer shall furnish to the purchaser a certificate stating that each lot has been sampled, tested, and inspected in accordance with this specification and has met the requirements.

17.2 When material is specified to meet the requirements of *ASME Boiler and Pressure Vessel Code*, the certification requirements are mandatory.

**18. Mill Test Report**

18.1 When specified on the purchase order, the manufacturer shall furnish to the purchaser a test report showing results of tests required by the specification.

## 19. Packaging and Package Marking

19.1 The material shall be separated by size, composition, and temper, and prepared for shipment in such a manner as to ensure acceptance by common carrier for transportation and to afford protection from the normal hazards of transportation.

19.2 Each shipping unit shall be legibly marked with the purchase order number, metal or alloy designation, temper, size, shape, gross and net weight, and name of supplier. The specification number shall be shown, when specified.

19.3 *Product Identification*—For *ASME Boiler and Pressure Vessel Code* applications, the name or trademark of the manufacturer and the manufacturer's lot identification number shall be legibly stamped or stenciled on each finished plate and sheet in two places not less than 12 in. [300 mm] from the edges. If the plate and sheet are too small to locate the

markings in this way, the markings may be placed near the center of the plate and sheet. In the case of butt straps, the markings may be placed 12 in. [300 mm] from the end. The plate number and type shall be legibly stamped on each plate and on each test specimen.

## 20. Keywords

20.1 admiralty metal plate and sheet; aluminum bronze plate and sheet; aluminum-nickel bronze plate and sheet; copper nickel plate and sheet; muntz metal plate and sheet; naval brass plate and sheet; plate and sheet for pressure vessels; UNS No. C36500; UNS No. C43300; UNS No. C44400; UNS No. C44500; UNS No. C46400; UNS No. C46500; UNS No. C61300; UNS No. C61400; UNS No. C63000; UNS No. C63200; UNS No. C70600; UNS No. C70620; UNS No. C71500; UNS No. C71520

## SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order, for agencies of the U.S. government.

### S1. Reference Documents

S1.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent herein:

S1.1.1 *Federal Standards*:<sup>5</sup>

102 Preservation, Packaging and Packing Levels

123 Marking for Shipment (Civil Agencies)

185 Identification Marking of Copper and Copper-Base Alloy Mill Products

S1.1.2 *Military Standard*<sup>5</sup>

MIL-C-3993 Packaging of Copper and Copper-Base Alloy Mill Products

### S2. Quality Assurance

S2.1 *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection and test requirements specified. Except as otherwise specified in the contract or purchase order, the manufacturer shall use any suitable facilities for the performance of the inspection and test requirements unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to

perform any of the inspections or tests set forth when such inspections and tests are deemed necessary to assure that the material conforms to prescribed requirements.

### S3. Identification Marking

S3.1 All material shall be properly marked for identification in accordance with Fed. Std. 185 except that the ASTM specification number and the alloy number shall be used.

### S4. Preparation for Delivery

S4.1 *Preservation, Packaging, and Packing*:

S4.1.1 *Military Agencies*—The material shall be separated by size, composition, grade, or class and shall be preserved and packaged, Level A or C, and packed, Level A, B, or C, as specified in the contract or purchase order in accordance with the requirements of MIL-C-3993.

S4.1.2 *Civil Agencies*—The requirements of Fed. Std. 102 shall be referenced for definitions of the various levels of packaging protection.

S4.2 *Marking*:

S4.2.1 *Military Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with MIL-STD-129.

S4.2.2 *Civil Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with Fed. Std. 123.

<sup>5</sup> Available from Standardization Documents Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, ATTN NPODS.

**SUMMARY OF CHANGES**

Committee B05 has identified the location of selected changes to this standard since the last issue (B 171/B 171M – 99<sup>e2</sup>) that may impact the use of this standard. (Approved May 1, 2004.)

- (1) Changed precision of tin limit in UNS Alloy No. C36500 in Table 1 from 0.250 to 0.25.
- (2) Added UNS Alloy Nos. to Keywords.
- (3) Clarified paragraph 4.1.4 in Ordering Information to use new CDA alloy designations.
- (4) Minor editing to conform to Committee B05 *Outline of Form*, which do not impact the use of the standard.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*