Designation: ~~B508 – 16~~ B508 – 22

Standard Specification for Copper Alloy Strip for Flexible Metal Hose[1]

This standard is issued under the fixed designation B508; 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 specification establishes the requirements for annealed copper-alloy strip for the manufacture of flexible metal hose produced from Copper Alloy UNS Nos. C41100 and C50500.

1.1.1 The nominal compositions are as follows:

Copper Alloy UNS No.	Copper	Zinc	Tin
C41100	91.0	8.5	0.5
C50500	98.7	...	1.3

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. Grain size is given in SI units.

~~1.3 The following precautionary statement pertains only to the test method portion, Section 13, of this specification:*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 and health practices and determine the applicability of regulatory limitations prior to use.*~~

1.3 The following safety hazard caveat pertains only to the test methods portion, Section 14, described in this specification:

1.3.1 *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:*[2]

B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

[1] This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is direct responsibility of Subcommittee B05.01 on Plate, Sheet, and Strip.

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[2] 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**

B846 Terminology for Copper and Copper Alloys
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)[3]
E112 Test Methods for Determining Average Grain Size
E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition
E478 Test Methods for Chemical Analysis of Copper Alloys

3. Terminology

3.1 *Definitions:*

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

4. Ordering Information

4.1 Include the following specific choices when placing orders for product under this specification, as applicable:

4.1.1 ASTM designation and year of issue,

4.1.2 Copper Alloy UNS designation (see Section 1 and Table 1),

4.1.3 Temper (~~see~~(Section ~~7.1~~7 and Table 2),

4.1.4 Quantity, number of pieces or total weight of each alloy and size, and

4.1.5 *Dimensions*—Thickness and width; and length, if applicable (see ~~8.2~~9.2 and ~~8.3~~9.3).

4.1.6 *How furnished*—Coils (inside and outside diameters), pounds per inch of width; stock or specific lengths, with or without ends;

4.1.7 *Packing*—Type of pallet, skid, or box: interleaving, banding, maximum weight, and so forth;

4.2 The following options are available but may not be included unless specified at the time of placing of the order when required:

4.2.1 Heat identification and traceability details;

4.2.2 Certification;

4.2.3 ~~Mill~~ Test Report;

4.2.4 Special surface condition requirements, if any (see ~~9.3~~10.3).

5. Materials and Manufacture

5.1 ~~*Material:*~~*Materials:*

TABLE 1 Chemical Requirements

Element	Composition, %	
	Copper Alloy UNS Nos.	
	C41100	C50500
Copper	89.0–92.0	remainder
Tin	0.30–0.7	1.0–1.7
Phosphorus	...	0.03–0.35
Iron, max	0.05	0.10
Lead, max	0.09	0.05
Zinc	remainder	0.30 max

[3] The last approved version of this historical standard is referenced on www.astm.org.

TABLE 2 Grain Size Requirements

~~Temps Standard Designation~~Temper Codes[A]	Grain Size, mm		
	Nominal	Minimum	Maximum
OS050	0.050	0.035	0.090
OS035	0.035	0.025	0.050
OS025	0.025	0.015	0.035
OS015	0.015	[B]	0.025

[A] ~~Standard designations~~Temper codes defined in Classification B601.
[B] Although no minimum grain size is required, this material must be fully recrystallized.

5.1.1 The ~~material~~materials of manufacture shall be cast bar, slab, cake, billet, or so forth of Copper Alloy UNS No. C41100 or C50500 of such purity and soundness as to be suitable for processing into the products prescribed herein.

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

NOTE 1—~~Because of~~Due to the discontinuous nature of the processing of castings into wrought products, it is not always practical to identify specific casting analysis with a specific quantity of finished material.

5.2 *Manufacture:*

5.2.1 The product shall be manufactured by such hot-working, cold-working, and annealing processes as to produce a uniform wrought structure in the finished product.

5.2.2 The product shall be hot- or cold-worked to the finished size, and subsequently annealed, ~~if~~when required, to meet the temper properties specified.

5.2.3 *Edges*—Slit edges shall be furnished unless otherwise specified in the contract or purchase order.

6. Chemical Composition

6.1 The material shall conform to the chemical composition requirements in Table 1 for the ~~alloy~~ copper [alloy] UNS No. specified in the ordering information.

6.2 These composition limits do not preclude the presence of other elements. By agreement between the manufacturer and purchaser, limits may be established and analysis required for unnamed elements.

6.3 For alloys in which zinc is listed as "remainder," either copper or zinc may be taken as the difference ~~of~~ between the sum of results of all other elements determined and 100 %.

6.4 When all elements in Table 1 are determined, the sum of results for Copper Alloy UNS C41100 shall be 99.7 % minimum and 99.5 % minimum for Copper Alloy UNS C50500.

7. Temper

7.1 The standard temper for products described in this specification are given in Table 2.

7.2 Annealed tempers OS015 to OS050.

8. Grain Size of Annealed Tempers

8.1 Grain size shall be the standard requirement for all product in the annealed tempers.

8.2 ~~The~~ Acceptance or rejection based upon grain size shall depend only on the average grain size of a test specimen taken from each of two ~~samples~~ sample portions of annealed material, as determined on a longitudinal cross section, and each specimen shall be within the limit prescribed ~~of the four nominal grain sizes listed~~ in Table 2 when ~~tested~~determined in accordance with ~~ASTM Standard~~ Test ~~Method~~Methods E112.

8.3 In the case of thin-gage material 0.010 in. (0.25 mm) and under, there shall exist no less than six grains per stock thickness, averaged for five locations one thickness apart.

9. Dimensions, Mass, and Permissible Variations

9.1 *General*—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.

9.2 *Thickness*—The standard method of specifying thickness shall be in decimal fractions of an inch. For material 0.021 in. (0.533 mm) and under in thickness, it is recommended that the nominal thickness be stated not closer than the nearest 0.0005 in. (0.013 mm). For example, specify ~~0.006~~0.006 in. or 0.0065 in. ~~(0.152~~(0.152 mm or 0.165 mm), but not 0.0063 in. (0.160 mm). For material over 0.021 (0.533 mm) in thickness, it is recommended that the nominal thickness be stated not closer than the nearest 0.001 in. (0.025 mm). For example, specify ~~0.128~~0.128 in. or 0.129 in. ~~(3.25~~(3.25 mm or 3.28 mm) but not 0.1285 in. (3.26 mm). A list of preferred thickness is shown in Appendix X1. The thickness tolerances shall be those shown in Table 3.

9.3 *Width*—The width tolerances shall be those shown in Table 4.

9.4 *Straightness*—The straightness tolerances shall be those shown in Table 5.

10. Workmanship, Finish, and Appearance

10.1 The product shall be ~~uniform in quality and soundness and free of internal and external defects. However, surface blemishes~~ free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable.

TABLE 3 Thickness Tolerances

Thickness, in. (mm)	Thickness Tolerances, plus and minus,[A] in.					
	Copper Alloy UNS No. C41100			Copper Alloy UNS No. C50500		
	8 in. and under in Width in. (mm)	Over ~~8~~8 in. to 14 in., incl in Width in. (mm)	Over ~~14~~14 in. to 20 in., incl in Width in. (mm)	8 in. and under in Width in. (mm)	Over ~~8~~8 in. to 14 in., incl in Width in. (mm)	Over 14 to 20 in., incl in Width in. (mm)
0.004 (0.102) and under	0.0003 (0.008)	0.0006 (0.015)	...	0.0004 (0.010)	0.0008 (0.020)	...
Over 0.004 to 0.006 (0.102 to 0.152), incl	0.0004 (0.010)	0.0008 (0.020)	0.0013 (0.033)	0.0006 (0.015)	0.0010 (0.025)	0.0015 (0.038)
Over 0.006 to 0.009 (0.152 to 0.229), incl	0.0006 (0.015)	0.0010 (0.035)	0.0015 (0.038)	0.0008 (0.020)	0.0013 (0.033)	0.002 (0.051)
Over 0.009 to 0.013 (0.229 to 0.330), incl	0.0008 (0.020)	0.0013 (0.033)	0.0018 (0.046)	0.0010 (0.025)	0.0015 (0.038)	0.0025 (0.064)
Over 0.013 to 0.017 (0.330 to 0.432), incl	0.0010 (0.028)	0.0015 (0.038)	0.002 (0.051)	0.0013 (0.033)	0.002 (0.051)	0.0025 (0.064)
Over 0.017 to 0.021 (0.432 to 0.533), incl	0.0013 (0.033)	0.0018 (0.046)	0.002 (0.051)	0.0015 (0.038)	0.0025 (0.064)	0.003 (0.076)
Over 0.021 to 0.026 (0.533 to 0.660), incl	0.0015 (0.038)	0.002 (0.051)	0.0025 (0.064)	0.002 (0.051)	0.0025 (0.064)	0.003 (0.076)
Over 0.026 to 0.037 (0.660 to 0.940), incl	0.002 (0.051)	0.002 (0.051)	0.0025 (0.064)	0.0025 (0.064)	0.003 (0.076)	0.0035 (0.089)
Over 0.037 to 0.050 (0.940 to 1.270), incl	0.002 (0.051)	0.0025 (0.064)	0.003 (0.076)	0.003 (0.076)	0.0035 (0.089)	0.004 (0.102)
Over 0.050 to 0.073 (1.270 to 1.854), incl	0.0025 (0.064)	0.003 (0.076)	0.0035 (0.084)	0.0035 (0.089)	0.004 (0.102)	0.0045 (0.114)
Over 0.073 to 0.130 (1.854 to 3.302), incl	0.003 (0.076)	0.0035 (0.089)	0.004 (0.102)	0.004 (0.102)	0.0045 (0.114)	0.005 (0.127)
Over 0.130 to 0.188 (3.302 to 4.775), incl	0.0035 (0.089)	0.004 (0.102)	0.0045 (0.114)	0.0045 (0.114)	0.005 (0.127)	0.006 (0.152)

[A] When tolerances are specified as all plus or all minus, double the values given.

TABLE 4 Width Tolerances

Width, in. (mm)	Width Tolerances,[A] plus and minus, in. (mm)		
	For Thicknesses 0.004 (0.102 mm) to 0.032 in. (0.813 mm), incl	For Thicknesses Over 0.032 (0.813 mm) to 0.125 in. (3.18 mm), incl	For Thicknesses Over 0.125 (3.18 mm) to 0.188 in. (4.78 mm), incl
2 (50.8) under	0.005 (0.13)	0.010 (0.25)	0.012 (0.30)
Over 2 to 8 (50.8 to 203), incl	0.008 (0.20)	0.013 (0.33)	0.015 (0.38)
Over 8 to 20 (203 to 508), incl	1/64 (0.40)	1/64 (0.40)	1/64 (0.40)

[A] If tolerances are specified as all plus or all minus, double the values given.

TABLE 5 Straightness Tolerances for Silt Metal

NOTE 1—Maximum edgewise curvature (depth of arc) in any 72 in. (1.82 m) portion of the total length.

Width, in. (mm)	Straightness Tolerance, in. (mm)
Over 1/4 to 3/8 (6.35 to 9.53) incl	2 (51)
Over 3/8 to 1/2 (9.53 to 12.7) incl	1 1/2 (38)
Over 1/2 to 1 (12.7 to 25.4) incl	1 (25)
Over 1 to 2 (25.4 to 50.8) incl	5/8 (16)
Over 2 to 4 (50.8 to 102) incl	1/2 (13)
Over 4 (102)	3/8 (9.5)

10.2 The product shall be well cleaned and free of dirt.

10.3 A superficial film or residual light lubricant shall be permissible, unless otherwise specified in the contract or purchase order.

11. Sampling

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

11.1.1 *Lot Size*—10 000 lb, (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*—A portion shall be four or more pieces selected as to be representative of each lot. If the lot consists of less than four pieces, representative samples shall be taken from each piece.

11.2 *Chemical Analysis*—A sample for chemical analysis shall be taken and prepared in accordance with Practice E255.

11.2.1 Instead of sampling in accordance with Practice E255, the manufacturer shall have the option of determining conformance to chemical composition as follows: Conformance shall be determined by the manufacturer by analyzing samples taken at the time the castings are poured or samples taken from the semifinished product. If the manufacturer determined 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 semifinished product, a sample shall be taken to represent each 10 000 lb (4550 kg) or fraction thereof, except that not more than one sample shall be required per piece.

11.3 *Grain Size*—Samples for grain size shall be taken from material in the finished condition. A sample shall be taken to represent each 10 000 lb (4550 kg) or fraction thereof, except that not more than one sample shall be required per piece.