Designation: B 370 – 98

Standard Specification for Copper Sheet and Strip for Building Construction[1]

This standard is issued under the fixed designation B 370; 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 establishes the requirements for rolled copper sheet and strip in flat lengths or coils in ounce-weight thicknesses for roofing, flashing, gutters, downspouts, and general sheet metal work in building construction.

1.1.1 Products produced to this specification are not intended for electrical applications.

1.2 Values given in inch-pound units are to be regarded as the standard. Values given in parentheses are provided for information only.

NOTE 1—Specification B 101 is a companion specification for lead-coated copper sheets.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

B 101 Specification for Lead-Coated Copper Sheets and Strip for Building Construction[2]

B 248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar[2]

B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast[2]

B 846 Terminology for Copper and Copper Alloys[2]

E 3 Methods of Preparation of Metallographic Specimens[3]

E 8 Test Methods for Tension Testing of Metallic Materials[3]

E 53 Methods for Chemical Analysis of Copper[4]

E 112 Test Methods for Determining Average Grain Size[3]

E 255 Practice for Sampling Copper and Copper Alloys for Determination of Chemical Composition[4]

E 478 Chemical Analysis of Copper Alloys[5]

3. General Requirements

3.1 The following sections of Specification B 248 constitute a part of this specification:

3.1.1 Terminology,
3.1.2 Materials and Manufacture,
3.1.3 Workmanship, Finish, and Appearance,
3.1.4 Specimen Preparation,
3.1.5 Test Methods,
3.1.6 Significance of Numerical Limits,
3.1.7 Inspection,
3.1.8 Certification,
3.1.9 Mill Test Report,
3.1.10 Packaging and Package Marking, and
3.1.11 Supplementary Requirements.

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 B 248.

4. Terminology

4.1 *Definitions*—For definitions of terms related to copper and copper alloys, refer to Terminology B 846.

4.1.1 *coil, n*—a length of the product wound into a series of connected turns. The unqualified term "coil" as applied to "flat product" usually refers to a coil in which the product is spirally wound, with the successive layers on top of one another (sometimes called a "roll").

4.1.2 *lengths, mill, n*—straight lengths, including ends, that can be manufactured conveniently in the mills. Full length pieces usually are 8 or 10 ft (2.4 or 3.0 m) and subject to established length tolerances.

4.1.3 *lengths, specific, n*—straight lengths that are uniform in length, as specified, and subject to established length tolerances.

4.1.4 *length, stock, n*—straight lengths that are mill cut and stored in advance of orders. They usually are 8 or 10 ft (2.4 or 3.0 m) and subject to established length tolerances.

4.1.5 *sheet, for building construction, n*— a rolled flat product over 24 in. (610 mm) in width and of ounce-weight thickness from 8 to 48 oz (225 to 1360 g).

4.1.6 *strip, for building construction, n*— a rolled flat product up to 24 in. (610 mm), inclusive, in width and of ounce-weight thickness from 8 to 48 oz (225 to 1360 g).

4.1.7 *ounce-weight, n*—the weight of copper sheet or strip

[1] 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, Strip, and Rolled Bar.

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[2] *Annual Book of ASTM Standards*, Vol 02.01.
[3] *Annual Book of ASTM Standards*, Vol 03.01.
[4] *Annual Book of ASTM Standards*, Vol 03.05.
[5] *Annual Book of ASTM Standards*, Vol 03.06.

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

expressed in ounces per square foot.

5. Ordering Information

5.1 Contracts or purchase orders for products supplied under this specification should include the following information:

5.1.1 ASTM designation and year of issue (for example, B 370–XX),

5.1.2 Temper (Section 8),

5.1.3 Dimensions: tolerances (Section 12),

5.1.4 How furnished: flat lengths or coils (4.1.1-4.1.4),

5.1.5 Quantity: total weight or number of pieces of each form and size, and

5.1.6 When product is purchased for agencies of the U.S. Government (Section 11).

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

5.2.1 Heat identification or traceability details,

5.2.2 Certification, and

5.2.3 Mill test report.

6. Materials and Manufacture

6.1 *Materials*—

6.1.1 The material shall be any copper conforming with the chemical composition requirements (Section 7).

6.2 *Manufacture*:

6.2.1 *Sheet*—The product shall be manufactured in flat sheets.

6.2.2 *Strip*—The product may be manufactured in flat lengths or in coils (rolls) of one single continuous length not less than 25 ft (7.5 m) wound into a cylindrical spiral.

7. Chemical Composition

7.1 The material may be any copper with a minimum copper content, including silver, of 99.5 %.

7.1.1 Limits may be established and analysis required for unnamed elements by agreement between the manufacturer and the purchaser.

8. Temper

8.1 Copper sheet and strip produced to this specification is available in the following tempers as defined in Specification B 601: O60 (soft annealed), H00 (⅛hard), H01 (¼ hard), H02 (½ hard), H03 (¾ hard), and H04 (hard).

NOTE 2—The purchaser should confer with the manufacturer or supplier concerning the availability of a specific temper and form.

9. Physical Properties

9.1 *Grain Size*—Although no grain size has been established for temper O60, the product shall be recrystallized fully as determined by Test Method E 112.

10. Mechanical Properties Requirements

10.1 *Tensile and Yield Strength Requirements*:

10.1.1 The product shall conform to the requirements specified in Table 1 for the specific temper when subjected to test in accordance with Test Methods E 8.

10.1.2 Acceptance or rejection for mechanical properties shall be based upon the results of the tensile and yield strength tests.

10.2 *Rockwell Hardness*:

10.2.1 The approximate Rockwell values are given in Table 1 for general information and assistance in testing and shall not be a basis for rejection.

NOTE 3—The Rockwell hardness test offers a quick and convenient method of checking for general conformity to the specification requirements for temper and tensile strength.

11. Purchases for U.S. Government Agencies

11.1 When identified in the contract or purchase order, product purchased for agencies of the U.S. Government shall conform to the special government requirements stipulated in the Supplemental Requirements.

12. Dimensions, Mass, and Permissible Variations

12.1 The product shall conform to the following requirements:

12.1.1 *Thickness*:

12.1.1.1 *Tolerances of Sheet and Strip*—The standard method for specifying thickness shall be by ounce-weight. The theoretical thickness for standard ounce-weights and the minimum thickness, measured at any point, shall be as specified in Table 2.

12.1.2 *Weight*:

12.1.2.1 Weight tolerances shall be as specified in Table 2.

12.1.3 *Width*:

12.1.3.1 *Tolerances for Slit Metal*—Table 3.

12.1.3.2 *Tolerance for Square-Sheared Metal*—Table 4.

12.1.4 *Length*.

12.1.4.1 *Tolerances for Specific and Stock*—Table 5.

12.1.4.2 *Tolerances for Square-Sheared Metal*—Table 6.

12.1.5 *Straightness*.

12.1.5.1 *Tolerances or Slit Metal*—Table 7.

TABLE 1 Mechanical Properties

Temper Designation		Tensile Strength, ksi[A] (MPa)		Yield Strength, at 0.5 % Extension Under Load, min ksi[A] (MPa)	Approximate Rockwell Hardness[B] (For Information Only)	
Standard	Former	Min	Max		F Scale	Superficial 30 T
O60	soft	30 (205)	38 (260)	. . .	up to 65	up to 31
H00	cold-rolled	32 (220)	40 (275)	20 (135)	54–82	15–49
H01	cold-rolled, high yield	34 (235)	42 (290)	28 (190)	60–84	18–51
H02	half hard	37 (255)	46 (315)	30 (205)	77–89	43–57
H03	three-quarter hard	41 (285)	50 (345)	32 (220)	82–91	47–59
H04	hard	43 (295)	52 (360)	35 (240)	86–93	54–62

[A] ksi = 1000 psi.

[B] Rockwell hardness values apply as follows: The F scale applies to metal 0.020 in. (0.508 mm) and over in thickness; the superficial 30T scale applies to metal 0.012 in. (0.305 mm) to 0.020 in. (0.508 mm) in thickness.

TABLE 2 Thickness and Weight Tolerances of Sheet and Strip

Ounce-Weight/ft^2	Theoretical Thickness,[A] in. (mm)	Minimum Thickness at Any Point, in. (mm)	Lot-Weight Tolerances, Plus and Minus %[B]
6	0.0081 (0.206)	0.0071 (0.180)	10
8	0.0108 (0.274)	0.0097 (0.246)	8
10	0.0135 (0.343)	0.0124 (0.315)	6
12	0.0162 (0.411)	0.0150 (0.381)	5
16	0.0216 (0.549)	0.0204 (0.518)	4
20	0.0270 (0.686)	0.0258 (0.655)	3.5
24	0.0323 (0.820)	0.0308 (0.782)	3.5
32	0.0431 (1.09)	0.0411 (1.04)	3
48	0.0646 (1.64)	0.0621 (1.58)	2

[A] Based on a density of 0.322 lb/in.^{3} (8.91 g/cm^3).
[B] Lot-weight tolerances are the permissible deviation from the theoretical weight of the number of sheets comprising a case or crate (normally approximately 1000 lb or 450 kg).

TABLE 3 Width Tolerances for Slit Metal

Width, in. (mm)	Width Tolerances, Plus and Minus, in. (mm)
Up to 24 (610), incl	1/64 (0.40)
Over 24 to 36 (610 to 914), incl	3/64 (1.2)

TABLE 4 Width Tolerances for Square-Sheared Metal

Width, in. (mm)	Width Tolerances, Plus and Minus, in. (mm)
Up to 24 (610), incl	1/32(0.79)
Over 24 to 36 (610 to 914), incl	3/64 (1.2)
Over 36 (914)	1/16(1.6)

TABLE 5 Length Tolerances for Specific and Stock Lengths

Length, in. (m)	Length Tolerance (Applicable Only to Full-Length Pieces), in. (mm)
Specific lengths 120 (3) and under	1/4 (6.4) (all plus)

TABLE 6 Length Tolerances for Square-Sheared Metal

Length, in. (m)	Length Tolerance Plus and Minus, in. (mm)
Over 36 to 120 (0.9 to 3), incl	1/16 (2)

TABLE 7 Straightness Tolerances for Slit Metal

NOTE 1—Maximum edgewise curvature (depth of arc) in any 72-in. (1.83-m) portion of the total length.

Width, in. (mm)	Straightness Tolerance, in. (mm)
Over 4 to 24 (102 to 610), incl	1/2 (13)

12.1.5.2 *Tolerances for Square-Sheared Metal*—Table 8.

13. Sampling

13.1 *Sampling*—The lot size, portion size, and selection of sample pieces shall be as follows.

TABLE 8 Straightness Tolerances for Square-Sheared Metal

NOTE 1—Maximum edgewise curvature (depth of arc) in any 72-in. (1.83-m) portion of the total length (not applicable to metal over 120 in. (3.05 m) in length.

	Straightness Tolerances, in. (mm)	
	Up to 10 in. (254 mm.) Incl, in Width	Over 10 in. (254 mm) in Width
All thicknesses	1/16 (1.6)	1/32 (0.79)

13.1.1 *Lot Size*—An inspection lot shall be 10 000 lb or less of product of the same mill form, alloy, temper, and nominal dimensions, subject to inspection at one time, or shall be the product of one cast bar from a single melt charge whose weight shall not exceed 25 000 lb that has been processed continuously and subject to inspection at one time.

13.1.2 *Portion Size*— A portion shall be four or more pieces selected as to be representative of the lot. Should the lot consist of less than four pieces, representative samples shall be taken from each piece.

13.2 *Chemical Analysis*:

13.2.1 The sample for chemical analysis shall be taken from the pieces selected and combined into one composite sample in accordance with Practice E 255 for product in its final form. The minimum weight of the composite sample shall be 150 g.

13.2.2 Instead of sampling in accordance with Practice E 255, the manufacturer shall have the option of taking samples at the time the castings are poured or by taking samples from the semifinished product.

13.2.2.1 When composition of the material has been determined during the course of manufacture, sampling of the finished product by the manufacturer is not required.

13.2.3 The number of samples to be taken for determination of chemical composition shall be as follows.

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

13.2.3.2 When sampled from the semifinished product, at least one sample shall be taken to represent each 10 000 lb, or fraction thereof, except that not more than one sample shall be required per piece.

13.2.3.3 Only one sample need be taken from the semifinished product of one cast bar from a single furnace melt charge continuously processed.

13.3 *Samples for All Other Tests*:

13.3.1 Samples for all other tests shall be taken from the sample portions of 13.1.2 and be of a convenient size to accommodate the test and comply with the requirements of this specification.

14. Number of Test and Retests

14.1 *Tests*:

14.1.1 *Chemical Analysis*—Composition shall be determined as the mean of results from at least two replicate analyses of the sample and the results of each replication shall meet the requirements of this specification.

14.1.2 *Mechanical Properties Tests*—Tensile strength for temper O60 and tensile strength and yield strength for all other tempers shall be reported as the results obtained from specimens prepared from a sample piece and the results must meet the requirements of this specification.

14.2 *Retests*:

14.2.1 When requested by the manufacturer or supplier, a retest shall be permitted should test results obtained by the purchaser fail to conform with specification requirements.

14.2.2 Retesting shall be as directed in this specification for the initial test(s) except that the number of test specimens shall be twice that required for the initial test.

14.2.3 Test results for all specimens shall conform to the requirements of this specification in retest and failure to conform shall be cause for lot rejection.

15. Specimen Preparation

15.1 *Chemical Analysis*

15.1.1 Preparation of the analytical specimen shall be the responsibility of the reporting laboratory.

15.2 *Grain Recrystalization*—The test specimen shall be prepared in accordance with Methods E 3.

15.3 *Mechanical Properties Tests*:

15.3.1 The test specimen shall conform to the requirements prescribed for the specific product described in the Test Specimen section of Test Methods E 8.

15.3.1.1 The test specimen shall be taken so that the longitudinal axis is parallel to the direction of rolling.

16. Test Methods

16.1 *Chemical Composition*:

16.1.1 Chemical composition shall be determined, in case of disagreement, in accordance with Test Methods E 478.

16.1.2 Test method(s) used for the determination of element(s) required by contractual or purchase order agreement shall be as agreed upon between the manufacturer and the purchaser.

16.2 *Grain Recrystalization*—Recrystalization shall be determined in accordance with Test Methods E 112.

16.3 *Mechanical Requirements*:

16.3.1 *Tensile Strength*— Tensile strength shall be determined in accordance with Test Methods E 8.

16.3.2 *Yield Strength*— Yield strength shall be determined at 0.5 % extension-underload of Test Methods E 8.

16.3.3 Test results are not seriously affected by variations in speed or testing. A considerable range of testing speed is permitted; however, the rate of stressing to the yield strength should not exceed 100 ksi/min. Above the yield strength the movement per minute of the testing machine head under load should not exceed 0.5 in./in. of gage length (or distance between grips for full section specimens).

17. Rejection and Rehearing

17.1 *Rejection*:

17.1.1 Material that fails to conform to the requirements of this specification when inspected or tested by the purchaser, or purchaser's agent, may be rejected.

17.1.2 Rejection shall be reported to the manufacturer, or supplier, promptly and in writing.

17.1.3 The manufacturer, or supplier, may make claim for a rehearing when dissatisfied with test results upon which rejection was based.

17.2 *Rehearing*:

17.2.1 As a result of product rejection, the manufacturer or supplier may make claim for a retest to be conducted by the manufacturer, or supplier, and the purchaser.

17.2.2 Samples of the rejected product will be taken in accordance with this specification and tested by both parties using the test method(s) specified in this specification, or, alternatively, upon agreement of both parties, an independent laboratory may be selected for the test(s) using the specified test methods.

18. Keywords

18.1 building construction; copper sheet; copper strip; downspouts; flashing; gutters; roofing; sheet/strip in flat lengths/coils for building construction

SUMMARY OF CHANGES

This section identifies the location of selected changes to this specification that have been incorporated since the 1992 issue.

(*1*) The sections referenced in Specification B 248 identified and listed in Section 3.
(*2*) Minimum copper content changed to 99.5 %.
(*3*) Sampling section revised.
(*4*) The Number of Tests and Retests section revised.
(*5*) Individual test methods identified.
(*6*) The Rejection and Rehearing section revised.
(*7*) New sections added are: Terminology and Purchases for U.S. Government.