Designation: B36/B36M – 23

Standard Specification for Brass Plate, Sheet, Strip, And Rolled Bar[1]

This standard is issued under the fixed designation B36/B36M; 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 brass (copper-zinc alloy) plate, sheet, strip, and rolled bar of the following alloys:

Copper Alloy UNS No.	Type of Metal
C21000	Gilding
C22000	Commerical Bronze
C22600	Jewerly Bronze
C23000	Red Brass
C24000	Low Brass
C26000	Cartridge Brass
C26800	Yellow Brass
C27200	...
C28000	Muntz Metal

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

1.3 The following safety hazard caveat pertains only to the test method(s) 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]

B248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar

B248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar (Metric)

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

B846 Terminology for Copper and Copper Alloys

E8/E8M Test Methods for Tension Testing of Metallic Materials

E112 Test Methods for Determining Average Grain Size

E478 Test Methods for Chemical Analysis of Copper Alloys

3. General Requirements

3.1 The following sections of Specification B248 or B248M constitute a part of this specification:

3.1.1 Terminology
3.1.2 Materials and Manufacture
3.1.3 Dimensions, Mass, and permissible Variations
3.1.4 Workmanship, Finish, and Appearance
3.1.5 Sampling
3.1.6 Number of tests and Retests
3.1.7 Specimen Preparation
3.1.8 Test Methods
3.1.9 Significance of Numerical Limits
3.1.10 Inspection
3.1.11 Rejection and Rehearing
3.1.12 Certification
3.1.13 Test Reports
3.1.14 Packaging and Package Marking

3.2 In addition, when a section with a title identical to that referenced in 3.1, appears in this specification, it contains additional requirements which supplement those appearing in Specification B248 or B248M.

[1] This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the 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 Document Summary page on the ASTM website.

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

4. Terminology

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

5. Ordering Information

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

5.1.1 ASTM designation and year of issue;

5.1.2 Copper alloy UNS No. designation;

5.1.3 Temper (Section 7);

5.1.4 Dimensions: thickness, width, and edges;

5.1.5 How furnished: straight lengths or coils;

5.1.6 Quantity: total weight or total length or number of pieces of each size; and

5.1.7 Intended application.

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

5.2.1 Heat identification or traceability details,

5.2.2 Certification,

5.2.3 Test Report,

5.2.4 If product is purchased for agencies of the U.S. Government (see the Supplemental Requirements section of Specification B248 or B248M for additional requirements, if specified).

6. Chemical Composition

6.1 The material shall conform to the chemical compositional requirements in Table 1 for the copper alloy UNS No. designation 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 between the sum of results of all other elements determined and 100 %. When all elements in Table 1 are determined, the sum of the results shall be as shown in the following table:

Copper Alloy UNS No.	Copper Plus Named Elements, % min
C21000	99.8
C22000	99.8
C22600	99.8
C23000	99.8
C24000	99.8
C26000	99.7
C26800	99.7
C27200	99.7
C28000	99.7

7. Temper

7.1 *As Hot Rolled Temper M20*—The standard temper of sheet and plate and produced by hot rolling as designated in Table 2 or Table 3.

7.2 *Cold Rolled Tempers H01 to H10*—The standard tempers of cold rolled material are as designated in Table 2 or Table 3 with the prefix "H." Former designations and the standard designations as detailed in Classification B601 are shown.

7.3 *Annealed Tempers OS015 to OS120*—The standard tempers of annealed material are as designated in Tables 4 and 5. Nominal grain size and the standard designations are detailed in Classification B601 are shown.

7.4 *Annealed-To-Temper O81 or O82*—The standard tempers of annealed-to-temper material are as designated in Table 6 or Table 7 with the prefix "O." Former designations and the standard designations as detailed in Classification B601 are shown.

7.5 Special or nonstandard tempers are subject to negotiation between the manufacturer and purchaser (see 5.1.3).

8. Grain Size for Annealed Tempers

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

8.2 Acceptance or rejection based upon grain size shall depend only on the average grain size of a test specimen taken from each of two sample portions, and each specimen shall be within the limits prescribed in Table 4 when determined in accordance with Test Methods E112.

8.3 The average grain size shall be determined on a plane parallel to the surface of the product.

TABLE 1 Chemical Requirements

Copper Alloy UNS No.	Copper, %	Lead, max, %	Iron, max, %	Zinc
C21000	94.0 to 96.0	0.05	0.05	remainder
C22000	89.0 to 91.0	0.05	0.05	remainder
C22600	86.0 to 89.0	0.05	0.05	remainder
C23000	84.0 to 86.0	0.05	0.05	remainder
C24000	78.5 to 81.5	0.05	0.05	remainder
C26000	68.5 to 71.5	0.07	0.05	remainder
C26800[A]	64.0 to 68.5	0.09	0.05	remainder
C27200[B]	62.0 to 65.0	0.07	0.07	remainder
C28000[C]	59.0 to 63.0	0.09	0.07	remainder

[A] Material shall be free from beta constituent when examined at a magnification of 75 diameters.
[B] Small amounts of beta constituent, if present, may interfere in some instances with severe forming or drawing; therefore, suitability for forming or drawing should be established between manufacturer and purchaser.
[C] It is anticipated that this material will contain the beta constituent that may interfere with severe forming or drawing operations.

TABLE 2 Tensile Strength (inch-pound units) Requirements and Approximate Rockwell Hardness Values for Rolled Temper (H) Product

NOTE 1—Plate is generally available in only the as hot-rolled (M20) temper. Required properties for other tempers shall be agreed upon between the manufacturer and the purchaser at the time of placing the order.

Rolled Temper		Tensile Strength, ksi		Approximate Rockwell Hardness[A]							
Temper Designation				B Scale				Superficial 30-T			
Standard	Former	Min	Max	0.020 in. to 0.036 in. incl		Over 0.036 in.		0.012 in. to 0.028 in. incl		Over 0.028 in.	
				Min	Max	Min	Max	Min	Max	Min	Max
Copper Alloy UNS No. C21000											
M20	As hot-rolled	32	42	...	...	...	...	...	...	...	...
H01	Quarter hard	37	47	20	48	24	52	34	51	37	54
H02	Half-hard	42	52	40	56	44	60	46	57	48	59
H03	Three-quarter-hard	46	56	50	61	53	64	52	60	54	62
H04	Hard	50	59	57	64	60	67	57	62	59	64
H06	Extra hard	56	64	64	70	66	72	62	66	63	67
H08	Spring	60	68	68	73	70	75	64	68	65	69
H10	Extra spring	61	69	69	74	71	76	65	69	66	70
Copper Alloy UNS No. C22000											
M20	As hot-rolled	33	43	...	...	...	...	...	...	...	...
H01	Quarter-hard	40	50	27	52	31	56	34	51	37	54
H02	Half-hard	47	57	50	63	53	66	50	59	52	61
H03	Three-quarter-hard	52	62	59	68	62	71	55	62	58	64
H04	Hard	57	66	65	72	68	75	60	65	62	67
H06	Extra hard	64	72	72	77	74	79	64	68	66	69
H08	Spring	69	77	76	79	78	81	67	69	68	70
H10	Extra spring	72	80	78	81	80	83	68	70	69	71
Copper Alloy UNS No. C22600											
H01	Quarter-hard	42	52	29	58	29	58	39	58	39	58
H02	Half-hard	48	58	52	68	52	68	54	64	54	64
H03	Three-quarter-hard	53	63	61	73	61	73	59	68	59	68
H04	Hard	58	67	67	77	67	77	64	70	64	70
H06	Extra hard	65	73	74	81	74	81	68	73	68	73
H08	Spring	70	78	78	83	78	83	71	74	71	74
H10	Extra spring	74	82	81	86	81	86	73	76	73	76
Copper Alloy UNS No. C23000											
M20	As hot-rolled	37	47	...	...	...	...	...	...	...	...
H01	Quarter-hard	44	54	33	58	37	62	42	57	45	60
H02	Half-hard	51	61	56	68	59	71	56	64	58	66
H03	Three-quarter-hard	57	67	66	73	69	76	63	68	65	70
H04	Hard	63	72	72	78	74	80	67	71	68	72
H06	Extra hard	72	80	78	83	80	85	70	74	71	75
H08	Spring	78	86	82	85	84	87	74	76	75	77
H10	Extra spring	82	90	84	87	86	89	75	77	76	78
Copper Alloy UNS No. C24000											
M20	As hot-rolled	41	51	...	...	...	...	...	...	...	...
H01	Quarter-hard	48	58	38	61	42	65	42	57	45	60
H02	Half-hard	55	65	59	70	62	73	56	64	58	66
H03	Three-quarter-hard	61	71	69	76	72	79	63	68	65	70
H04	Hard	68	77	76	82	78	84	68	72	69	73
H06	Extra hard	78	87	83	87	85	89	72	75	73	76
H08	Spring	85	93	87	90	89	92	75	77	76	78
H10	Extra spring	89	97	88	91	90	93	76	78	77	79
Copper Alloy UNS No. C26000											
M20	As hot-rolled	41	51	...	...	...	...	...	...	...	...
H01	Quarter-hard	49	59	40	61	44	65	43	57	46	60
H02	Half-hard	57	67	60	74	63	77	56	66	58	68
H03	Three-quarter-hard	64	74	72	79	75	82	65	70	67	72
H04	Hard	71	81	79	84	81	86	70	73	71	74
H06	Extra hard	83	92	85	89	87	91	74	76	75	77
H08	Spring	91	100	89	92	90	93	76	78	76	78
H10	Extra spring	95	104	91	94	92	95	77	79	77	79
Copper Alloy UNS No. C26800											
M20	As hot-rolled	40	50	...	...	...	...	...	...	...	
H01	Quarter-hard	49	59	40	61	44	65	43	57	46	60
H02	Half-hard	55	65	57	71	60	74	54	64	56	66
H03	Three-quarter-hard	62	72	70	77	73	80	65	69	67	71
H04	Hard	68	78	76	82	78	84	68	72	69	73
H06	Extra-hard	79	89	83	87	85	89	73	75	74	76
H08	Spring	86	95	87	90	89	92	75	77	76	78
H10	Extra spring	90	99	88	91	90	93	76	78	77	79
Copper Alloy UNS No. C27200											
M20	As hot-rolled	41	51	...	...	...	...	...	...	...	...
H01	Quarter-hard	49	59	40	61	44	65	43	57	46	60
H02	Half-hard	56	66	57	74	60	76	54	67	56	68

TABLE 2 *Continued*

Rolled Temper		Tensile Strength, ksi		Approximate Rockwell Hardness[A]							
Temper Designation				B Scale				Superficial 30-T			
Standard	Former	Min	Max	0.020 in. to 0.036 in. incl		Over 0.036 in.		0.012 in. to 0.028 in. incl		Over 0.028 in.	
				Min	Max	Min	Max	Min	Max	Min	Max
H03	Three-quarter-hard	63	73	71	78	74	81	64	70	66	71
H04	Hard	70	80	76	82	78	84	67	72	68	73
H06	Extra hard	81	91	82	87	85	89	71	75	72	76
Copper Alloy UNS No. C28000											
M20	As hot-rolled	40	55	...	...	...	...	...	...	...	...
H01	Quarter-hard	50	62	40	65	45	70	45	65	45	70
H02	Half-hard	58	70	50	75	52	80	50	70	50	75
H03	Three-quarter-hard	60	75	55	80	55	82	52	78	55	80
H04	Hard	70	85	60	85	60	87	55	80	55	82
H06	Extra hard	82	95	65	92	65	90	60	85	60	85

[A] Rockwell hardness values apply as follows: the B scale values apply to metal 0.020 in. and over in thickness, and the 30-T scale values apply to metal 0.012 in. and over in thickness.

9. Mechanical Property Requirements

9.1 *Tensile Strength Requirements of Cold Rolled Tempers*

9.1.1 Product furnished under this specification shall conform to the tensile requirements prescribed in Table 2 or Table 3 when tested in accordance with Test Methods E8/E8M. The test specimens shall be taken so that the longitudinal axis of the specimen is parallel to the direction of rolling.

9.1.2 Acceptance or rejection based upon mechanical properties shall depend only on tensile strength.

9.2 *Tensile Strength Requirements of Annealed-to-Tempers*

9.2.1 Product furnished under this specification shall conform to the tensile requirements prescribed in Table 6 or Table 7 when tested in accordance with Test Methods E8/E8M. The test specimens shall be taken so the longitudinal axis of the specimen is parallel to the direction of rolling.

9.2.2 Acceptance or rejection based upon mechanical properties shall depend only on tensile strength.

9.3 *Rockwell Hardness Requirement*

9.3.1 The approximate Rockwell hardness values given in Table 2, Table 3, Table 5, Table 6, or Table 7 are for general information and assistance in testing and shall not be used as a basis for product rejection.

NOTE 1—The Rockwell hardness test offers a quick and convenient method of checking for general conformity to the specification requirements for temper, tensile strength and grain size.

10. Dimensions, Mass, and Permissible Variation

10.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B248 or B248M with particular reference to the following related paragraphs:

10.2 *Thickness*—Table 1.

10.3 *Width:*

10.3.1 *Slit Metal and Slit Metal With Rolled Edges*—Table 4.

10.3.2 *Squared Sheared Metal*—Table 5.

10.3.3 *Sawed Metal*—Table 6.

10.4 *Length:*

10.4.1 *Length Tolerance for Straight Lengths*—Table 7.

10.4.2 *Schedule for Minimum Lengths and Maximum Weights of Ends for Specific Lengths with Ends, and Stock Lengths with Ends*—Table 8.

10.4.3 *Length Tolerance for Square Sheared Metal*—Table 9.

10.4.4 *Length Tolerance for Sawed Metal*—Table 10.

10.5 *Straightness:*

10.5.1 *Slit Metal or Slit Metal Either Straightened or Edge Rolled*—Table 11.

10.5.2 *Square Sheared Metal*—Table 12.

10.5.3 *Sawed Metal*—Table 13.

10.6 *Edges Contours:*

10.6.1 *Square Corners*—Table 14.

10.6.2 *Rounded Corners*—Table 15.

10.6.3 *Rounded Edges*—Table 16.

10.6.4 *Full-Rounded Edges*—Table 17.

11. Test Methods

11.1 *Chemical Analyses:*

11.1.1 In cases of disagreement, test methods for chemical analysis shall be subject to agreement between the manufacturer or supplier and the purchaser. The following table is a list of published methods, some of which may no longer be viable, which along with others not listed, may be used subject to agreement:

Element	Method
Copper	E478
Iron	E478
Lead	E478 (AA)
Zinc	E478 (Titrimetric)

11.1.2 Test method(s) to be followed for the determination of element(s) resulting from contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and purchaser.

12. Keywords

12.1 brass plate; brass rolled bar; brass sheet; brass strip; UNS No. C21000; UNS No. C22000; UNS No. C22600; UNS