Designation: B36/B36M – 13

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 Department of Defense.

1. Scope*

1.1 This specification establishes the requirements for brass plate, sheet, strip, and rolled bar of the following alloys:[2]

Copper Alloy UNS No.	Previous Trade Name	Nominal Composition Copper, %	Zinc, %
C21000	Gilding, 95 %	95	5
C22000	Commerical Bronze, 90 %	90	10
C22600	Jewerly Bronze, 87½ %	87.5	12.5
C23000	Red Brass, 85 %	85	15
C24000	Low Brass, 80 %	80	20
C26000	Cartridge Brass, 70 %	70	30
C26800	Yellow Brass, 66 %	66	34
C27200	...	63	37
C28000	Muntz Metal, 60 %	60	40

1.2 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. 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.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

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.

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.

[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] SAE Specifications CA210, CA220, CA230, CA240, CA260, CA268, and CA272 conform to the requirements for Copper Alloy UNS Nos. C21000, C22000, C23000, C24000, C26000, C26800, and C27200, respectively.

[3] 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**

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.

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 Mill Test Report,

5.2.4 If product is purchased for agencies of the U.S. Government (see the Supplemental Requirements section of Specifications 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 O80, 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 Method E112.

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

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 Method E8/E8M. The test specimens shall be taken so 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 Method 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*

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 to 0.036 in. incl		Over 0.036 in.		0.012 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 to 0.036 in. incl		Over 0.036 in.		0.012 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.

9.3.1 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.*

10.3 *Width:*
10.3.1 *Slit Metal and Slit Metal With Rolled Edges.*
10.3.2 *Squared Sheared Metal.*
10.3.3 *Sawed Metal.*

10.4 *Length:*
10.4.1 *Length Tolerance for Straight Lengths.*
10.4.2 *Schedule for Minimum Lengths and Maximum Weights of Ends for Specific Lengths with Ends, and Stock Lengths with Ends.*
10.4.3 *Length Tolerance for Square Sheared Metal.*
10.4.4 *Length Tolerance for Sawed Metal.*

10.5 *Straightness:*
10.5.1 *Slit Metal or Slit Metal Either Straightened or Edge Rolled.*
10.5.2 *Square Sheared Metal.*
10.5.3 *Sawed Metal.*

10.6 *Edges Contours:*
10.6.1 *Square Corners.*
10.6.2 *Rounded Corners.*
10.6.3 *Rounded Edges.*
10.6.4 *Full-Rounded Edges.*

11. Test Methods

11.1 *Chemical Analyses:*

11.1.1 In cases of disagreement, test methods for chemical analysis shall be determined as follows or by another method as agreed upon between the manufacturer or supplier and purchaser:

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 No. C23000; UNS No. C24000; UNS No. C26000; UNS No. C26800; UNS No. C27200; UNS No. C28000

TABLE 3 Tensile Strength (SI 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, MPa[A]		Approximate Rockwell Hardness[B]							
Temper Designation				B Scale				Superficial 30-T			
Standard	Former	Min	Max	0.50 to 0.90 mm incl		Over 0.90 mm		0.30 to 0.70 mm incl		Over 0.70 mm	
				Min	Max	Min	Max	Min	Max	Min	Max
Copper Alloy UNS No. C21000											
M20	As hot-rolled	220	290	...	...	...	...	...	...	...	...
H01	Quarter hard	255	325	20	48	24	52	34	51	37	54
H02	Half-hard	290	355	40	56	44	60	46	57	48	59
H03	Three-quarter-hard	315	385	50	61	53	64	52	60	54	62
H04	Hard	345	405	57	64	60	67	57	62	59	64
H06	Extra hard	385	440	64	70	66	72	62	66	63	67
H08	Spring	415	470	68	73	70	75	64	68	65	69
H10	Extra spring	420	475	69	74	71	76	65	69	66	70
Copper Alloy UNS No. C22000											
M20	As hot-rolled	230	295	...	...	...	...	...	...	...	...
H01	Quarter-hard	275	345	27	52	31	56	34	51	37	54
H02	Half-hard	325	395	50	63	53	66	50	59	52	61
H03	Three-quarter-hard	355	425	59	68	62	71	55	62	58	64
H04	Hard	395	455	65	72	68	75	60	65	62	67
H06	Extra hard	440	495	72	77	74	79	64	68	66	69
H08	Spring	475	530	76	79	78	81	67	69	68	70
H10	Extra spring	495	550	78	81	80	83	68	70	69	71
Copper Alloy UNS No. C22600											
H01	Quarter-hard	290	355	29	58	29	58	39	58	39	58
H02	Half-hard	330	400	52	68	52	68	54	64	54	64
H03	Three-quarter-hard	365	435	61	73	61	73	59	68	59	68
H04	Hard	400	460	67	77	67	77	64	70	64	70
H06	Extra hard	450	505	74	81	74	81	68	73	68	73
H08	Spring	485	540	78	83	78	83	71	74	71	74
H10	Extra spring	510	565	81	86	81	86	73	76	73	76
Copper Alloy UNS No. C23000											
M20	As hot-rolled	255	325	...	...	...	...	...	...	...	...
H01	Quarter-hard	305	370	33	58	37	62	42	57	45	60
H02	Half-hard	350	420	56	68	59	71	56	64	58	66
H03	Three-quarter-hard	395	460	66	73	69	76	63	68	65	70
H04	Hard	435	495	72	78	74	80	67	71	68	72
H06	Extra hard	495	550	78	83	80	85	70	74	71	75
H08	Spring	540	595	82	85	84	87	74	76	75	77
H10	Extra spring	565	620	84	87	86	89	75	77	76	78
Copper Alloy UNS No. C24000											
M20	As hot-rolled	285	350	...	...	...	...	...	...	...	...
H01	Quarter-hard	330	400	38	61	42	65	42	57	45	60
H02	Half-hard	380	450	59	70	62	73	56	64	58	66
H03	Three-quarter-hard	420	490	69	76	72	79	63	68	65	70
H04	Hard	470	530	76	82	78	84	68	72	69	73
H06	Extra hard	540	600	83	87	85	89	72	75	73	76
H08	Spring	585	640	87	90	89	92	75	77	76	78
H10	Extra spring	615	670	88	91	90	93	76	78	77	79
Copper Alloy UNS No. C26000											
M20	As hot-rolled	285	350	...	...	...	...	...	...	...	...
H01	Quarter-hard	340	405	40	61	44	65	43	57	46	60
H02	Half-hard	395	460	60	74	63	77	56	66	58	68
H03	Three-quarter-hard	440	510	72	79	75	82	65	70	67	72
H04	Hard	490	560	79	84	81	86	70	73	71	74
H06	Extra hard	570	635	85	89	87	91	74	76	75	77
H08	Spring	625	690	89	92	90	93	76	78	76	78
H10	Extra spring	655	715	91	94	92	95	77	79	77	79
Copper Alloy UNS No. C26800											
M20	As hot-rolled	275	345	...	...	...	...	...	...	...	
H01	Quarter-hard	340	405	40	61	44	65	43	57	46	60
H02	Half-hard	380	450	57	71	60	74	54	64	56	66
H03	Three-quarter-hard	425	495	70	77	73	80	65	69	67	71
H04	Hard	470	540	76	82	78	84	68	72	69	73
H06	Extra-hard	545	615	83	87	85	89	73	75	74	76
H08	Spring	595	655	87	90	89	92	75	77	76	78
H10	Extra spring	620	685	88	91	90	93	76	78	77	79
Copper Alloy UNS No. C27200											
M20	As hot-rolled	285	350	...	...	...	...	...	...	...	...
H01	Quarter-hard	340	405	40	61	44	65	43	57	46	60
H02	Half-hard	385	455	57	74	60	76	54	67	56	68

TABLE 3 *Continued*

Rolled Temper		Tensile Strength, MPa[A]		Approximate Rockwell Hardness[B]							
Temper Designation				B Scale				Superficial 30-T			
Standard	Former	Min	Max	0.50 to 0.90 mm incl		Over 0.90 mm		0.30 to 0.70 mm incl		Over 0.70 mm	
				Min	Max	Min	Max	Min	Max	Min	Max
H03	Three-quarter-hard	435	505	71	78	74	81	64	70	66	71
H04	Hard	485	550	76	82	78	84	67	72	68	73
H06	Extra hard	560	625	82	87	85	89	71	75	72	76
Copper Alloy UNS No. C28000											
M20	As hot-rolled	275	380	...	...	...	...	...	...	...	...
H01	Quarter-hard	345	425	40	65	45	70	45	65	45	70
H02	Half-hard	400	485	50	75	52	80	50	70	50	75
H03	Three-quarter-hard	415	515	55	80	55	82	52	78	55	80
H04	Hard	485	585	60	85	60	87	55	80	55	82
H06	Extra hard	565	655	65	92	65	90	60	85	60	85

[A] MPa (Mega Pascals) See Appendix X1.
[B] Rockwell hardness values apply as follows: the B scale values apply to metal 0.50 mm and over in thickness, and the 30-T scale values apply to metal 0.30 mm and over in thickness.

TABLE 4 Grain Size Requirements for Annealed (OS) Product

Copper Alloy UNS No.	Standard Temper Designation (Classification B601)	Grain Size, mm		
		Nominal	Min	Max
C21000	OS050	0.050	0.035	0.090
	OS035	0.035	0.025	0.050
	OS025	0.025	0.015	0.035
	OS015	0.015	[A]	0.025
C22000	OS050	0.050	0.035	0.090
	OS035	0.035	0.025	0.050
	OS025	0.025	0.015	0.035
	OS015	0.015	[A]	0.025
C22600	OS050	0.050	0.035	0.090
	OS035	0.035	0.025	0.050
	OS025	0.025	0.015	0.035
	OS015	0.015	[A]	0.025
C23000	OS070	0.070	0.050	0.100
	OS050	0.050	0.035	0.070
	OS035	0.035	0.025	0.050
	OS025	0.025	0.015	0.035
	OS015	0.015	[A]	0.025
C24000	OS070	0.070	0.050	0.120
	OS050	0.050	0.035	0.070
	OS035	0.035	0.025	0.050
	OS025	0.025	0.015	0.035
	OS015	0.015	[A]	0.025
C26000 and C26800	OS120	0.120	0.070	...
	OS070	0.070	0.050	0.120
	OS050	0.050	0.035	0.070
	OS035	0.035	0.025	0.050
	OS025	0.025	0.015	0.035
	OS015	0.015	[A]	0.025
C27200	OS035	0.035	0.025	0.050
	OS025	0.025	0.015	0.035
	OS015	0.015	[A]	0.025
C28000	OS035	0.035	0.025	0.050
	OS025	0.025	0.015	0.035
	OS015	0.015	[A]	0.025

[A] Although no minimum grain size is required, this material must be fully recrystallized.

TABLE 5 Approximate Rockwell Hardness of Annealed (OS) Product

Anneal Temper, Nominal Grain Size	Standard Temper Designation (Classification B601)	Approximate Rockwell Hardness[A]			
		F Scale		Superficial 30-T	
		Min	Max	Min	Max
UNS No. C21000					
0.050-mm	OS050	40[B]	52[B]	...	4
0.035-mm	OS035	47[B]	54[B]	...	7
0.025-mm	OS025	50[B]	61[B]	1	17
0.015-mm	OS015	54[B]	65[B]	7	23
UNS No. C22000					
0.050-mm	OS050	50	60	1	16
0.035-mm	OS035	54	64	7	21
0.025-mm	OS025	58	70	13	31
0.015-mm	OS015	62	75	19	39
UNS No. C22600					
0.050-mm	OS050	48	58	6	18
0.035-mm	OS035	52	62	10	23
0.025-mm	OS025	55	67	14	29
0.015-mm	OS015	58	76	18	40
UNS No. C23000					
0.070-mm	OS070	53	60	6	...
0.050-mm	OS050	56	63	10	...
0.035-mm	OS035	58	76	13	24
0.025-mm	OS025	60	72	16	34
0.015-mm	OS015	62	79	19	48
UNS No. 24000					
0.070-mm	OS070	53	64	2	21
0.050-mm	OS050	57	67	8	27
0.035-mm	OS035	61	72	16	35
0.025-mm	OS025	63	77	20	42
0.015-mm	OS015	66	83	25	50
UNS Nos. C26000 and C26800					
0.120-mm	OS120	50	62	...	21
0.070-mm	OS070	52	67	3	27
0.050-mm	OS050	61	73	20	35
0.035-mm	OS035	65	76	25	38
0.025-mm	OS025	67	79	27	42
0.015-mm	OS015	72	85	33	50
UNS No. C27200					
0.035-mm	OS035	65	76	25	38
0.025-mm	OS025	67	79	27	42
0.015-mm	OS015	72	85	33	50
UNS No. C28000					
0.035-mm	OS035	65	80	26	44
0.025-mm	OS025	68	83	28	48
0.015-mm	OS015	72	90	30	55

[A] Rockwell hardness values apply as follows: The F scale applies to metal 0.020 in. or 0.50 mm in thickness and over; the 30-T scale applies to metal 0.015 in. or 0.38 mm in thickness and over.

[B] This alloy in these several annealed tempers is too soft for Rockwell F hardness tests below 0.030 in. or 0.75 mm in thickness.

TABLE 6 Tensile Strength (inch-pound units) Requirements and Approximate Rockwell Hardness Values for Annealed-to-Temper (O) Product

NOTE 1—Required properties for other tempers shall be agreed upon between the manufacturer and the purchaser at the time of placing the order.

Annealed-to-Temper		Tensile Strength, ksi		Approximate Rockwell Hardness[A]			
Temper Designation		Min	Max	B Scale		Superficial 30-T	
Standard	Former			Min	Max	Min	Max
Copper Alloy UNS No. C22000							
O81	Quarter-hard	40	50	...	45	28	52
Copper Alloy UNS No. C22600							
O81	Quarter-hard	42	52	20	50	30	54
Copper Alloy UNS No. C23000							
O81	Quarter-hard	44	54	30	53	35	54
Copper Alloy UNS No. C24000							
O81	Quarter-hard	48	58	33	53	38	54
Copper Alloy UNS No. C26000							
O81	Quarter-hard	49	59	32	55	36	53
O82	Half-hard	57	67	52	72	50	66
Copper Alloy UNS No. C26800							
O81	Quarter-hard	49	59	33	55	37	55
O82	Half-hard	55	65	52	72	51	67

[A] Rockwell hardness values apply as follows: The B scale applies to metal 0.020 in. in thickness and over; the 30T applies to metal 0.015 in. in thickness and over.

TABLE 7 Tensile Strength (SI units) Requirements and Approximate Rockwell Hardness Values for Annealed-to-Temper (O) Product

NOTE 1—Required properties for other tempers shall be agreed upon between the manufacturer and the purchaser at the time of placing the order.

Annealed-to-Temper		Tensile Strength, MPa[A]		Approximate Rockwell Hardness[B]			
Temper Designation		Min	Max	B Scale		Superficial 30-T	
Standard	Former			Min	Max	Min	Max
Copper Alloy UNS No. C22000							
O81	Quarter-hard	275	345	...	45	28	52
Copper Alloy UNS No. C22600							
O81	Quarter-hard	290	355	20	50	30	54
Copper Alloy UNS No. C23000							
O81	Quarter-hard	305	370	30	53	35	54
Copper Alloy UNS No. C24000							
O81	Quarter-hard	330	400	33	53	38	54
Copper Alloy UNS No. C26000							
O81	Quarter-hard	340	405	32	55	36	53
O82	Half-hard	395	460	52	72	50	66
Copper Alloy UNS No. C26800							
O81	Quarter-hard	340	405	33	55	37	55
O82	Half-hard	380	450	52	72	51	67

[A] MPa (Mega Pascals) See Appendix X1

[B] Rockwell hardness values apply as follows: The B scale applies to metal 0.50 mm in thickness and over; the 30T applies to metal 0.38 mm in thickness and over.

APPENDIX

(Nonmandatory Information)

X1. METRIC EQUIVALENTS

X1.1 The SI unit for strength properties now shown is in accordance with the International System of Units (SI). The derived SI unit for force is the newton (N), which is defined as that force which when applied to a body having a mass of one kilogram gives it an acceleration of one metre per second squared ($N = kg \cdot m/s^2$). The derived SI unit for pressure or stress is the newton per square metre (N/m^2), which has been named the pascal (Pa) by the General Conference on Weights and Measures. Since 1 ksi = 6 894 757 Pa the metric equivalents are expressed as megapascal (MPa), which is the same as MN/m^2 and N/mm^2.

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B36/B36M – 08a) that may impact the use of this standard. (Approved Oct. 1, 2013.)

(1) Various changes made to make sure the standard conforms to proper form and style.