

# ASTM B36 / ASME SB36

## Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar

This specification covers brass plate, sheet, strip, and rolled bar of UNS Alloys C21000, C22000, C22600, C23000, C24000, C26000, C26800, C27200, and C28000.

### A. General Requirements :-

- Products furnished under this specification shall conform to the applicable requirements of the current edition of Specification B 248/ B 248M.

### B. Chemical Composition :-

The material shall conform to the chemical composition prescribed in Table 1.

**Table 1**

Copper Alloy UNS No.	Copper	Lead, max	Iron, max	Zinc
C21000 (95 Cu, 5 Zn)	94.0-96.0	0.03	0.05	remainder
C22000 (90 Cu, 10 Zn)	89.0-91.0	0.05	0.05	remainder
C22600 (87.5 Cu, 12.5 Zn)	86.0-89.0	0.05	0.05	remainder
C23000 (85 Cu, 15 Zn)	84.0-86.0	0.05	0.05	remainder
C24000 (80 Cu, 20 Zn)	78.5-81.5	0.05	0.05	remainder
C26000 (70 Cu, 30 Zn)	68.5-71.5	0.07	0.05	remainder
C26800 <sup>A</sup> (66 Cu, 34 Zn)	64.0-68.5	0.15	0.05	remainder
C27200 <sup>B</sup> (63 Cu, 37 Zn)	62.0-65.0	0.07	0.07	remainder
C28000 <sup>C</sup> (60 Cu, 40 Zn)	59.0-63.0	0.30	0.07	remainder

<sup>A</sup> Material shall be free from beta constituent when examined at a magnification of 75 diameters.

<sup>B</sup> Small amount 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 & purchaser.

<sup>C</sup> It is anticipated that material will contain the beta constituent that may interfere with severe forming or drawing operations.

### C. Temper :-

- Hot-Rolled (M20) Material.
- Rolled (H) Material.
- Annealed (OS) Material.

4. Annealed-To-Temper (O) Material.

**D. Mechanical Properties :-**

1. Tensile Strength of Rolled Tempers:
  - i. Products ordered to this specification shall conform to the tensile strength requirements prescribed in Table 2 when tested in accordance with Test Methods E 8M.
2. Tensile Strength of Annealed-To-Tempers:
  - i. Products ordered to this specification shall conform to the tensile strength requirements prescribed in Table 5 when tested in accordance with Test Methods E 8.
3. Rockwell Hardness:
  - i. The approximate Rockwell hardness values for the each tempers are given in Table 2, Table 4 and Table 5 for general information and assistance in testing.

**TABLE 2 Tensile Strength Requirements and Approximate Rockwell Hardness Values for Rolled Tempers.**

Rolled Temper		Tensile Strength,				Approximate Rockwell Hardness <sup>B</sup>							
Temper Designation						ksi <sup>A</sup>		MPa		B Scale			
						0.020 (0.508) to 0.036 in. (0.914 mm) incl		Over 0.036 in. (0.914 mm)		0.012 (0.305) to 0.028 in. (0.711 mm) incl		Over 0.028 in. (0.711 mm)	
Standard	Former	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Copper Alloy UNS No. C21000													
M20	as hot-rolled	32	42	220	290	...	...	...	...	...	...	...	...
H01	quarter hard	37	47	255	325	20	48	24	52	34	51	37	54
H02	half hard	42	52	290	355	40	56	44	60	46	57	48	59
H03	three-quarter-hard	46	56	315	385	50	61	53	64	52	60	54	62
H04	hard	50	59	345	405	57	64	60	67	57	62	59	64
H06	extra hard	56	64	385	440	64	70	66	72	62	66	63	67
H08	spring	60	68	415	470	68	73	70	75	64	68	65	69
H10	extra spring	61	69	420	475	69	74	71	76	65	69	68	70
Copper Alloy UNS No. C22000													
M20	as hot-rolled	33	43	230	295	...	...	...	...	...	...	...	...
H01	quarter hard	40	50	275	345	27	52	31	56	34	51	37	54

H02	half hard	47	57	325	395	50	63	53	66	50	59	52	61
H03	three-quarter-hard	52	62	355	425	59	68	62	71	55	62	58	64
H04	hard	57	66	395	455	65	72	68	75	60	65	62	67
H06	extra hard	64	72	440	495	72	77	74	79	64	68	66	69
H08	spring	69	77	475	530	76	79	76	81	67	69	68	70
H10	extra spring	72	80	495	550	78	81	80	83	68	70	69	71
Copper Alloy UNS No. C22600													
H01	quarter hard	42	52	290	355	29	58	29	58	39	58	39	58
H02	half hard	48	58	330	400	52	68	52	68	54	64	54	64
H03	three-quarter-hard	53	63	365	435	61	73	61	73	59	68	59	68
H04	hard	58	67	400	460	67	77	67	77	64	70	64	70
H06	extra hard	65	73	450	505	74	81	74	81	68	73	68	73
H08	spring	70	78	485	540	78	83	78	83	71	74	71	74
H10	extra spring	74	82	510	565	81	86	81	86	73	76	73	76
Copper Alloy UNS No. C24000													
M20	as hot-rolled	41	51	285	350	...	...	...	...	...	...	...	...
H01	quarter hard	48	58	330	400	38	61	42	65	42	57	45	60
H02	half hard	55	65	380	450	59	70	62	73	56	64	58	66
H03	three-quarter-hard	61	71	420	490	69	76	72	79	63	68	65	70
H04	hard	68	77	470	530	76	82	78	84	68	72	69	73
H06	extra hard	78	87	540	600	83	87	85	89	72	75	73	76
H08	spring	85	93	585	640	87	90	89	92	75	77	76	78
H10	extra spring	89	97	615	670	88	91	90	93	76	78	77	79
Copper Alloy UNS No. C26000													
M20	as hot-rolled	41	51	285	350	...	...	...	...	...	...	...	...
H01	quarter hard	49	59	340	405	40	61	44	65	43	57	46	60
H02	half hard	57	67	395	460	60	74	63	77	56	66	58	68
H03	three-quarter-hard	64	74	440	510	72	79	75	82	65	70	67	72
H04	hard	71	81	490	560	79	84	81	86	70	73	71	74
H06	extra hard	83	92	570	635	85	89	87	91	74	76	75	77

H08	spring	91	100	625	690	89	92	90	93	76	78	76	78
H10	extra spring	95	104	655	715	91	94	92	95	77	79	77	79
Copper Alloy UNS No. C26800													
M20	as hot-rolled	40	50	275	345	...	...	...	...	...	...	...	...
H01	quarter hard	49	59	340	405	40	61	44	65	43	57	46	60
H02	half hard	55	65	380	450	57	71	60	74	54	64	56	66
H03	three-quarter-hard	62	72	425	495	70	77	73	80	65	69	67	71
H04	hard	68	78	470	540	76	82	78	84	68	72	69	73
H06	extra hard	79	89	545	615	83	87	85	89	73	75	74	76
H08	spring	86	95	595	655	87	90	89	92	75	77	76	78
H10	extra spring	90	99	620	685	88	91	90	93	76	78	77	79
Copper Alloy UNS No. C27200													
M20	as hot-rolled	41	51	285	350	...	...	...	...	...	...	...	...
H01	quarter hard	49	59	340	405	40	61	44	65	43	57	46	60
H02	half hard	56	66	385	455	57	74	60	76	54	67	56	68
H03	three-quarter-hard	63	73	435	505	71	78	74	81	64	70	66	71
H04	hard	70	80	485	550	76	82	78	84	67	72	68	73
H06	extra hard	81	91	560	625	82	87	85	89	71	75	72	76
Copper Alloy UNS No. C28000													
M20	as hot-rolled	40	55	275	380	...	...	...	...	...	...	...	...
H01	quarter hard	50	62	345	425	40	65	45	70	45	65	45	70
H02	half hard	58	70	400	485	50	75	52	80	50	70	50	75
H03	three-quarter-hard	60	75	415	515	55	80	55	82	52	78	55	80
H04	hard	70	85	485	585	60	85	60	87	55	80	55	82
H06	extra hard	82	95	565	655	65	92	65	90	60	85	60	85

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

<sup>B</sup> Rockwell hardness values apply as follows: The B scale values apply to metal 0.020 in. (0.508 mm) and over in thickness, and the 30-T scale hardness values apply to metal 0.012 in. (0.305 mm) in thickness and over.

**TABLE 3 Grain Size Requirements for Annealed Material**

Copper Alloy UNS No.	Standard Temper Designation (B 601)	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 & 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

<sup>A</sup> Although no minimum grain size is required, this material shall be fully recrystallized.

**TABLE 4 Approximate Rockwell Hardness of Annealed Material**

Anneal Temper, Nominal Grain Size	Standard Temper Designation (B 601)	Approximate Rockwell Hardness <sup>A</sup>			
		F Scale		Superficial 30-T	
		Min	Max	Min	Max
UNS No. C21000					
0.050 mm	OS050	40 <sup>B</sup>	52 <sup>B</sup>	...	4
0.035 mm	OS035	47 <sup>B</sup>	54 <sup>B</sup>	...	7
0.025 mm	OS025	50 <sup>B</sup>	61 <sup>B</sup>	1	17
0.015 mm	OS015	54 <sup>B</sup>	65 <sup>B</sup>	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. C24000					
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 No. C26000 & 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

<sup>A</sup> Rockwell hardness values apply as follows: The F scale apply to metal 0.020 in. (0.508 mm) and over in thickness and over and the 30-T scale hardness values apply to metal 0.015 in. (0.381 mm) in thickness and over.

<sup>B</sup> This alloy in these several annealed tempers is too soft for Rockwell F hardness tests below 0.03 in.(0.762) in thickness.

**TABLE 5 Tensile Strength Requirements and Approximate Rockwell Hardness Values for Annealed-to-Tempers**

Annealed-to-Temper Temper Designation	Tensile Strength, ksi <sup>A</sup>	Tensile Strength, MPa	Approximate Rockwell Hardness <sup>B</sup>	
			B Scale	Superficial 30-T

Standard	Former	Min	Max	Min	Max	Min	Max	Min	Max
Copper Alloy UNS No. C22000									
O81	quarter hard	40	50	275	345	...	45	28	52
Copper Alloy UNS No. C22600									
O81	quarter hard	42	52	290	355	20	50	30	54
Copper Alloy UNS No. C23000									
O81	quarter hard	44	54	305	370	30	53	35	54
Copper Alloy UNS No. C24000									
O81	quarter hard	48	58	330	400	33	53	38	54
Copper Alloy UNS No. C26000									
O81	quarter hard	49	59	340	405	32	55	36	53
O82	half hard	57	67	395	460	52	72	50	66
Copper Alloy UNS No. C26800									
O81	quarter hard	49	59	340	405	33	55	37	55
O82	half hard	55	65	380	450	52	72	51	67

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

<sup>B</sup> Rockwell hardness values apply as follows: The B scale values apply to metal 0.020 in. (0.058 mm) and over in thickness, and the 30-T scale hardness values apply to metal 0.015 in. (0.381 mm) in thickness and over.

**E. Grain Size of Annealed Temper :-**

1. The average grain size of each of two samples of annealed material as determined on a plane parallel to the surface of the material shall be within the limits prescribed in Table 3.

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