

Nissan Engineering Standard

N E S	Wrought Copper and Copper Alloy for Automobiles	M 4055 Revised 2001
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Applicable Standards: See page 26.

3. QUALITY

Plates and strips shall have good workmanship, uniform quality and have no detrimental defects.

3.1 Chemical composition

The chemical compositions shall be as shown in Tables 2 through 4.

Table 2 Chemical composition of copper

Material	Alloy No.	Chemical composition (%)	
		Cu	P
Tough pitch copper	C1100	99.90 min.	—
Phosphorus deoxidized copper	C1201		0.004 to 0.015
	C1220		0.015 to 0.040
	C1221	99.75 min.	0.004 to 0.040

Table 3 Chemical composition of brass

Material	Alloy No.	Chemical composition (%)				
		Cu	Pb	Fe	Fe + Sn	Zn
Brass	C2600	68.5 to 71.5	0.05 max.	0.05 max.	—	Remainder
	C2680	64.0 to 68.0				
	C2700	63.0 to 67.0				
Free-cutting brass	C3602	59.0 to 63.0	1.8 to 3.7	0.5 max.	1.2 max.	
	C3604	57.0 to 61.0	1.8 to 3.7			

Table 3-1 Chemical composition of high strength brass

Material	Alloy No.	Chemical composition (%)								
		Cu	Zn	Al	Ni	Fe	Si	Mn	Pb	Others
High-strength brass	CN6A83	60.0 to 64.0	Remainder	1.9 to 3.5	0.25 to 0.50	0.5 max.	0.6 to 1.2	2.5 to 3.5	0.15 max.	Cr: 0.10 to 0.25
High-strength brass	CN6B83	Remainder	26.0 to 32.0	3.3 to 4.3	2.0 to 4.0	0.5 to 1.3	0.5 to 1.5	—	—	Mo: 0.05 to 0.50 Co: 1.0 to 2.0

Table 4 Chemical composition of bronze

Material	Alloy No.	Chemical composition (%)		
		Sn	P	Sn + P + Cu
Phosphor bronze type 1	C5101	3.0 to 5.5	0.03 to 0.35	99.5 min.
Phosphor bronze type 2	C5191	5.5 to 7.0	0.03 to 0.35	
Phosphor bronze for springs	C5210	7.0 to 9.0	0.03 to 0.35	99.7 min.

3.2 Mechanical properties

3.2.1 Mechanical properties of plates and strips

Mechanical properties shall be as shown in Table 5 through Table 6.

No cracking shall occur during the bend test. The bend test is applicable only if requested by the Buyer.

Table 5 (Continued)

Alloy No.	Temper grade	Grade	Tensile test			Bend test			Hardness test							
			Thickness mm	Tensile strength MPa	Elonga- tion %	Thick- ness mm	Bend angle	Inside radius	Thick- ness mm	Vickers HV (0.5 min.)						
C2680	O	C2680P-O	0.3 to 1	275 min.	40 min.	2 max.	180°	Close contact	—	—						
			Over 1 to 30 incl.		50 min.				—	—						
		C2680R-O	0.3 to 1		40 min.				—	—						
			Over 1 to 30 incl.		50 min.				—	—						
	1/4H	C2680P-1/4H	0.3 to 20	325 to 410	35 min.			0.3 min.	0.5 x thickness	75 to 125						
		C2680R-1/4H	0.3 to 3						1 x thickness							
	1/2H	C2680P-1/2H	0.3 to 20	355 to 440	28 min.				1 x thickness		85 to 145					
		C2680R-1/2H	0.3 to 3						1.5 x thickness		105 to 175					
	H	C2680P-H	0.3 to 10	410 to 540	—				—		—	—	145 min.			
		C2680R-H	0.3 to 3													
	EH	C2680P-EH	0.3 to 10	520 min.	—									—	—	—
		C2680R-EH	0.3 to 3													

Temper grade symbol: O = Soft, H = Hard, 1/4 H = 1/4 Hard, 1/2 H = 1/2 Hard, EH = Extra Hard

Note (1): Close contact shall be when the inside radius is essentially zero and the bend angle is 180°.

Table 5-1 Mechanical properties of bronze

Alloy No.	Temper grade	Grade	Tensile test			Bend test		Hardness test	
			Thickness mm	Tensile strength MPa	Elongation %	Thickness mm	Inside radius	Thickness mm	Vickers HV (0.5 min.)
C5101	O	C5101P-O C5101R-O	0.3 to 5	295 min.	38 min.	1.6 max.	Close contact	—	—
	1/4H	C5101P-1/4H C5101R-1/4H		345 min.	25 min.		0.5 x thickness	0.3 min.	70 min.
	1/2H	C5101P-1/2H C5101R-1/2H		390 min.	15 min.		1 x thickness		110 min.
	H	C5101P-H C5101R-H		490 min.	7 min.		2 x thickness		135 min.
	EH	C5101P-EH C5101R-EH		540 min.	4 min.	—	—		150 min.
C5191	O	C5191P-O C5191R-O		315 min.	42 min.	1.6 max.	0.5 x thickness	—	—
	1/4H	C5191P-1/4H C5191R-1/4H		390 min.	35 min.		1 x thickness	0.3 min.	90 min.
	1/2H	C5191P-1/2H C5191R-1/2H		490 min.	20 min.		1.5 x thickness		140 min.
	H	C5191P-H C5191R-H		590 min.	8 min.		2 x thickness		170 min.
	EH	C5191P-EH C5191R-EH		635 min.	5 min.	—	—		185 min.

Temper grade symbol: O = Soft, H = Hard, 1/4 H = 1/4 Hard, 1/2 H = 1/2 Hard, EH = Extra Hard

3.2.3 Mechanical properties of tubes

Mechanical properties of seamless tubes shall be as shown in Table 8, and mechanical properties of welded tubes as shown in Table 9.

Table 8 Mechanical properties of seamless brass tubes

Alloy No.	Temper grade	Grade	Tensile test				Hardness test			
			Outside diameter mm	Wall thickness mm	Tensile strength MPa	Elongation %	Wall thickness mm	Rockwell hardness		
								HR30T	HR15T	HRF
C1220	O	C1201T-O C1220T-O	4 to 250	0.3 to 30	205 min.	40 min.	0.4 min.	—	60 max.	50 max.
	OL	C1201T-OL C1220T-OL			—			60 max.	55 max.	
	1/2H	C1201T-1/2H C1220T-1/2H		0.3 to 25	245 to 325			30 to 60	—	—
	H	C1201T-H C1220T-H	25 max.	0.3 to 3	315 min.	—	—	55 min.	—	—
			Over 25 to 50 incl.	0.9 to 4				—	—	—
			Over 50 to 100 incl.	1.5 to 6				—	—	—
C2600	O	C2600T-O	4 to 250	0.3 to 15	275 min.	45 min.	0.8 max.	40 max.	—	—
	OL	C2600T-OL					Over 0.8	—	—	80 max.
							0.8 max.	60 max.	—	—
	1/2H	C2600T-1/2H	4 to 100	0.3 to 6	375 min.	20 min.	—	53 min.	—	—
			Over 100 to 250 incl.	2.0 to 10	355 min.					
			H	C2600T-H	4 to 100					
Over 100 to 250 incl.	2.0 to 10	390 min.								
C2700	O	C2700T-O	4 to 250	0.3 to 15	295 min.	40 min.	0.8 max.	40 max.	—	—
	OL	C2700T-OL					Over 0.8	—	—	80 max.
							0.8 max.	60 max.	—	—
	1/2H	C2700T-1/2H	4 to 100	0.3 to 6	375 min.	20 min.	—	53 min.	—	—
			Over 100 to 250 incl.	2.0 to 10	355 min.					
			H	C2700T-H	4 to 100					
Over 100 to 250 incl.	2.0 to 10	390 min.								

Temper grade symbol: O = Soft, OL = Light annealed, H = Hard, 1/2 H = 1/2 Hard

4.1.2 Standard dimensions of plates of C5101, C5191 shall be as shown in Table 11.

Table 11 Standard dimensions of bronze plates

Unit: mm

Thickness	Length Width	1,200						
		100	150	180	200	250	300	365
0.1		○	○	○	—	—	—	—
0.12		○	○	○	—	—	—	—
0.15		○	○	○	—	—	—	—
0.2		○	○	○	—	—	—	—
0.2		○	○	○	—	—	—	—
0.25		○	○	○	—	—	—	—
0.3		○	○	○	○	○	—	—
0.35		○	○	○	○	○	—	—
0.4		○	○	○	○	○	—	—
0.45		○	○	○	○	○	○	○
0.5		○	○	○	○	○	○	○
0.55		○	○	○	○	○	○	○
0.6		○	○	○	○	○	○	○
0.65		○	○	○	○	○	○	○
0.7		○	○	○	○	○	○	○
0.8		○	○	○	○	○	○	○
0.9		○	○	○	○	○	○	○
1		○	○	○	○	○	○	○
1.2		○	○	○	○	○	○	○
1.5		○	○	○	○	○	○	○
1.8		○	○	○	○	○	○	○
2		○	○	○	○	○	○	○
2.3		○	○	○	○	○	○	○
2.5		○	○	○	○	○	○	○
3		○	○	○	○	○	○	○
3.2		○	○	○	○	○	○	○
4		○	○	○	○	○	○	○
4.5		○	○	○	○	○	○	○
5		○	○	○	○	○	○	○

4.2 Standard dimensions of bars

4.2.1 The standard dimensions of free-cutting brass bars (C3602 and C3604) and high-strength brass bar (CN6A83, CN6B83) shall be as shown in Table 13.

Table 13 Standard dimensions of brass bars

Unit: mm

Form A (¹)	Round	Hexagon	Square	Form A (¹)	Round	Hexagon	Square	Form A (¹)	Round	Hexagon	Square
3	○	—	—	16	○	—	—	35	○	○	○
3.5	○	—	—	17	○	○	○	36	○	○	○
4	○	○	—	18	○	—	—	38	○	—	—
4.5	○	○	—	19	○	○	○	40	○	○	○
5	○	○	○	20	○	○	○	41	—	○	○
5.5	○	○	○	21	○	○	—	42	○	—	—
6	○	○	○	22	○	○	○	45	○	○	—
7	○	○	○	23	○	○	—	46	—	○	—
8	○	○	○	24	○	○	○	48	○	—	—
9	○	○	○	25	○	○	○	50	○	○	—
10	○	○	○	26	○	—	—	60	○	—	—
11	○	○	—	27	○	○	○	70	○	—	—
12	○	○	○	28	○	—	—	80	○	—	—
13	○	○	○	29	○	—	—	90	○	—	—
14	○	—	—	30	○	○	○	100	○	—	—
15	○	○	○	32	○	○	○				

Note (¹): A is diameter for round form, side for square, and opposed sides distance for hexagon.

4.3.2 Standard dimensions for welded tubed (C2600, C2680) shall be in accordance with Table 15.

Table 15 Standard dimensions of welded brass tubes

Unit: mm

Wall thick- ness Diameter	0.4	0.5	0.6	0.7	0.8	1	1.2	1.5	2	2.5	3
4	○	○	○					—	—	—	—
5	○	○	○					—	—	—	—
6	○	○	○					—	—	—	—
6.4	○	○	○					—	—	—	—
8	○	○	○							—	—
9.5	○	○	○							—	—
12.7		○	○	○						—	—
14			○							—	—
15	○									—	—
15.8		○	○	○	○						—
16		○	○	○	○	○					—
19		○	○	○	○	○	○				—
20	○	○									—
22			○	○	○	○	○				—
25	—										
25.4	—	○				○	○	○			
26	—			○	○	○	○	○			
28	—	○	○		○						
31.3	—		○	○	○	○	○	○			
32	—		○	○	○	○	○	○	○		○
35	—			○	○	○	○				
38.1	—		○	○	○	○	○	○	○	○	
40	—			○							○
45	—	○	○	○		○					
50	—	○			○	○	○	○	○	○	○
50.8	—	○						○			○
60	—	—	○		○						
65		—	—	—		○	○	○	○	○	○
76.2			—	—		○		○	○	○	○

Remark: Thick lines indicate the manufacturing range and “○” marks indicate the standard dimension.

5. DIMENSIONAL TOLERANCE

5.1 Dimensional tolerance of plates and strips

5.1.1 Thickness tolerances of tough-pitch copper plates (C1100), phosphor deoxidized copper plates (C1221) and brass plates (C2600 and C2680) shall be as shown in Table 16.

5.1.3 Width tolerances of tough-pitch copper plates (C1100), phosphor deoxidized copper plates (C1221) and brass plates (C2600 and C2680) shall be as shown in Table 18.

Table 18 Width tolerances of copper and brass plates

Unit: mm

Thickness \ Width	Tolerance of thickness for shearing machine cut			Tolerance of thickness for saw cut	
	1,000 max.	Over 1,000 to 2,500 incl.	Over 2,500 to 4,000 incl.	200 to 1,500	Over 1,500 to 2,500 incl.
0.1 to 0.35	+3 0	—	—	—	—
Over 0.35 to 0.8 incl.	+3 0	+5 0			
Over 0.8 to 8 incl.	+5 0	+10 0			
Over 8 to 15 incl.	+10 0	+15 0	+1.2% 0	±2	±3
Over 15 to 25 incl.	+10 0	+15 0	+1.2% 0		
Over 25 to 125 incl.	—	—	—		

Remark: When the tolerance of saw cutting is designated to (+) or (-) only, the value of above shall be doubled.

5.1.4 Tolerance of tough-pitch copper strips (C1100), phosphor deoxidized copper strips (C1201, C1221) and brass strips (C2680) shall be as shown in Table 19.

Table 19 Width tolerances of copper and brass strips

Unit: mm

Thickness \ Width	100 max.	Over 100 to 200 incl.	Over 200 to 300 incl.	Over 300 to 600 incl.	Over 600 to 700 incl.
0.1 to 0.5	±0.2	±0.3	±0.4	±0.5	±0.8
Over 0.5 to 2 incl.	±0.3	±0.4	±0.5	±0.6	±0.8
Over 2 to 3 incl.	±0.5	±0.5	±0.6	±0.6	±0.8

Remark: When the tolerance is designated to (+) or (-) only, the value of above shall be doubled.

5.1.5 Length tolerances of touch-pitch copper plates (C1100), phosphor deoxidized copper (C1221) and brass plates (C2600 and C2680) shall be as shown in Table 20.

Table 20 Length tolerances of copper and brass plates

Unit: mm

Thickness \ Length	Tolerance			
	2,000 max.	Over 2,000 to 3,500 incl.	Over 3,500 to 5,000 incl.	Over 5,000 to 7,000 incl.
0.1 to 0.8	+5 0	+10 0	—	—
Over 0.8 to 8 incl.	+10 0	+15 0	—	—
Over 8 to 125 incl.	+15 0	+20 0	+25 0	+30 0