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JIS H 3270 : 2006

(JCBA/JSA)

Copper beryllium alloy, phosphor bronze and nickel silver rods, bars and wires

ICS 77.150.30

Reference number : JIS H 3270 : 2006 (E)

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Copper and Brass Association (JCBA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS H 3270** : 2000 is replaced with this Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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In the event of any doubts arising as to the contents, the original JIS is to be the final authority.

Contents

Copper beryllium alloy, phosphor bronze and nickel silver rods, bars and wires

1 Scope This Japanese Industrial Standard specifies rolled or expanded copper beryllium alloy, phosphor bronze and nickel silver rods and bars having a round or regular hexagonal section (hereafter referred to as "bars") and wires having a round, regular hexagonal, square or rectangular section (hereafter referred to as "wires").

Remarks 1 "Bars" refer to solid products with uniform cross-section along their whole length, that are supplied in straight form.

2 "Wires" refer to solid products with uniform cross-section along their whole length, that are supplied in coiled form.

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS H 0321 *General rules for inspection of non-ferrous metal materials*

JIS H 1051 *Methods for determination of copper in copper and copper alloys*

JIS H 1052 *Methods for determination of tin in copper and copper alloys*

JIS H 1053 *Methods for determination of lead in copper and copper alloys*

JIS H 1054 *Methods for determination of iron in copper and copper alloys*

JIS H 1055 *Methods for determination of manganese in copper and copper alloys*

JIS H 1056 *Methods for determination of nickel in copper and copper alloys*

JIS H 1058 *Methods for determination of phosphorus in copper and copper alloys*

JIS H 1060 *Methods for determination of cobalt in copper and copper alloys*

JIS H 1062 *Methods for determination of zinc in copper and copper alloys*

JIS H 1063 *Methods for determination of beryllium in copper alloys*

JIS H 1292 *Methods for X-ray fluorescence spectrometric analysis of copper alloys*

JIS Z 2201 *Test pieces for tensile test for metallic materials*

JIS Z 2241 *Method of tensile test for metallic materials*

JIS Z 2244 *Vickers hardness test—Test method*

JIS Z 2245 *Rockwell hardness test—Test method*

3 Type and symbol The types and symbols of bars and wires shall be as shown in table 1.

Remarks : The symbols to indicate the temper grade shall be suffixed to the symbol given in table 1.

Table 1 Types and symbols of bars and wires

Type		Symbol	Informative	
Alloy No.	Shape		Designation	Specific characteristics and examples of use
C 1720	Bar	C 1720 B	Copper beryllium alloy	Having good corrosion resistance and high workability before age hardening treatment. Fatigue resistance and electric conductivity are increased after age hardening treatment. The age hardening treatment shall be carried out after forming process. Bars are suitable for aircraft engine parts, propellers, bolts, cams, gears, bearings, electrodes for spot welding, etc. Wires are suitable for coil springs, spiral springs, brushes, etc.
	Wire	C 1720 W		
C 5071	Wire	C 5071 W	Phosphor bronze	Having good fatigue, corrosion and abrasion resistance. Bars are suitable for gears, cams, joints, shafts, bearings, machine screws, bolts, nuts, sliding parts, connectors, hangers for trolley-wire, etc. Wires are suitable for coil springs, spiral springs, snap buttons, binding wires for electric machines, wire nettings, header materials, washers, etc.
C 5111	Bar	C 5111 B		
	Wire	C 5111 W		
C 5102	Bar	C 5102 B		
	Wire	C 5102 W		
C 5191	Bar	C 5191 B		
	Wire	C 5191 W		
C 5212	Bar	C 5212 B		
	Wire	C 5212 W		
C 5341	Bar	C 5341 B	Free-cutting phosphor bronze	Having good machinability. Suitable for machine screws, bearings, bushes, bolts, nuts, parts for ball-point pens, etc.
C 5441	Bar	C 5441 B		
C 7451	Wire	C 7451 W	Nickel silver	Having fine gloss, good fatigue and corrosion resistance. Bars are suitable for machine screws, bolts, nuts, parts for electric machines, musical instruments, medical apparatus, watches and clock parts, etc. Wires are suitable for special spring materials used for straight springs, coil springs of relays, measuring instruments, medical apparatus, decoratives, spectacles parts. Those of soft quality are suitable for header material, etc.
C 7521	Bar	C 7521 B		
	Wire	C 7521 W		
C 7541	Bar	C 7541 B		
	Wire	C 7541 W		
C 7701	Bar	C 7701 B		
	Wire	C 7701 W		
C 7941	Bar	C 7941 B	Free-cutting nickel silver	Having good machinability. Suitable for machine screws, bearings, parts for ball-point pens, spectacles parts, etc.

4 Quality

4.1 Appearance Bars and wires shall have an excellence in finish, evenness and be free from defects(1) detrimental to practical use.

Note (1) The defects detrimental to practical use shall be subject to the agreement between the purchaser and the supplier.

4.2 Chemical composition The chemical composition of bars and wires, when tested in accordance with **6.1**, shall be as given in table 2.

Table 2 Chemical composition of bars and wires

Alloy No.	Chemical composition (mass %)												
	Cu	Pb	Fe	Sn	Zn	Be	Mn	Ni	Ni +Co	Ni +Co +Fe	P	Cu+Sn +P	Cu+Be +Ni+Co +Fe
C 1720	—	—	—	—	—	1.80 to 2.00	—	—	0.20 min.	0.6 max.	—	—	99.5 min.
C 5071	—	0.02 max.	0.10 max.	1.7 to 2.3	0.20 max.	—	—	0.10 to 0.40	—	—	0.15 max.	99.5 min.(2)	—
C 5111	—	0.02 max.	0.10 max.	3.5 to 4.5	0.20 max.	—	—	—	—	—	0.03 to 0.35	99.5 min.	—
C 5102	—	0.02 max.	0.10 max.	4.5 to 5.5	0.20 max.	—	—	—	—	—	0.03 to 0.35	99.5 min.	—
C 5191	—	0.02 max.	0.10 max.	5.5 to 7.0	0.20 max.	—	—	—	—	—	0.03 to 0.35	99.5 min.	—
C 5212	—	0.02 max.	0.10 max.	7.0 to 9.0	0.20 max.	—	—	—	—	—	0.03 to 0.35	99.5 min.	—
C 5341	—	0.8 to 1.5	—	3.5 to 5.8	—	—	—	—	—	—	0.03 to 0.35	99.5 min.(3)	—
C 5441	—	3.5 to 4.5	—	3.0 to 4.5	1.5 to 4.5	—	—	—	—	—	0.01 to 0.50	99.5 min.(4)	—
C 7451	63.0 to 67.0	0.03 max.	0.25 max.	—	Residual	—	0.50 max.	8.5 to 11.0	—	—	—	—	—
C 7521	62.0 to 66.0	0.03 max.	0.25 max.	—	Residual	—	0.50 max.	16.5 to 19.5	—	—	—	—	—
C 7541	60.0 to 64.0	0.03 max.	0.25 max.	—	Residual	—	0.50 max.	12.5 to 15.5	—	—	—	—	—
C 7701	54.0 to 58.0	0.03 max.	0.25 max.	—	Residual	—	0.50 max.	16.5 to 19.5	—	—	—	—	—
C 7941	60.0 to 64.0	0.8 to 1.8	0.25 max.	—	Residual	—	0.50 max.	16.5 to 19.5	—	—	—	—	—

Notes (2) The figure is the total amount of Cu, Sn, Ni and P.

(3) The figure is the total amount of Cu, Sn, Pb and P.

(4) The figure is the total amount of Cu, Sn, Pb, Zn and P.

4.3 Test items of mechanical properties and other characteristics The test items of mechanical properties (tensile strength, elongation and hardness) and other characteristics of bars and wires shall be as given in table 3.

Table 3 Test items of mechanical properties and other characteristics of bars and wires

Unit: mm

Alloy No.	Bars				Wires			
	Diameter or width across flats	Tensile strength	Elongation	Hardness	Diameter or width across flats	Tensile strength	Elongation	Coilability
C 1720	25 max.	○	–	△	0.40 min.	○	–	–
C 5071	–	–	–	–	0.40 min.	○	○	△
C 5111	50 max.	○	○	△	0.40 min.	○	–	△
	Over 50 up to and incl. 100	–	–	○				
C 5102	50 max.	○	○	△	0.40 min.	○	–	△
	Over 50 up to and incl. 100	–	–	○				
C 5191 C 5212	50 max.	○	○	△	0.40 min.	○	–	△
	Over 50 up to and incl. 100	–	–	○				
C 5341 C 5441	50 max.	○	○	△	–	–	–	–
	Over 50 up to and incl. 100	△	△	○				
C 7451	–	–	–	–	0.40 min.	○	–	–
C 7521 C 7541 C 7701	50 max.	○	–	△	0.40 min.	○	–	–
C 7941	50 max.	○	–	△	0.40 min.	–	–	–

Remarks : ○: Mandatory △: Upon request by the purchaser

4.4 Mechanical properties The mechanical properties (tensile strength, elongation and Vickers or Rockwell hardness) of bars and wires, when tested in accordance with **6.2** and **6.3**, shall be as given in tables 4, 5, 6 and 7.

The mechanical properties of bars and wires having other dimension than the range of specified dimensions shall be subject to the agreement between the purchaser and the supplier.

Remarks : In the case where hardness is applied, tensile strength need not be applied.

Table 4 Mechanical properties of bars

Alloy No.	Temper grade	Symbol	Diameter or width across flats	Tensile test		Hardness test		
				Tensile strength	Elongation	Vickers hardness	Rockwell hardness	
			mm	N/mm²	%	HV	HRB	HRC
C 1720	O	C 1720 B-O	3.0 or over up to and incl. 6	410 to 590	—	90 to 190	—	—
			Over 6 up to and incl. 25	410 to 590	—	90 to 190	45 to 85	—
	H	C 1720 B-H	3.0 or over up to and incl. 6	645 to 900	—	180 to 300	—	—
			Over 6 up to and incl. 25	590 to 900	—	175 to 330	88 to 103	—
C 5111	H	C 5111 B-H	3.0 or over up to and incl. 6	490 min.	—	140 min.	—	—
			Over 6 up to and incl. 13	450 min.	10 min.	125 min.	—	—
			Over 13 up to and incl. 25	410 min.	13 min.	115 min.	—	—
			Over 25 up to and incl. 50	380 min.	15 min.	105 min.	—	—
			Over 50 up to and incl. 100	—	—	—	60 to 80	—
C 5102	H	C 5102 B-H	3.0 or over up to and incl. 6	540 min.	—	150 min.	—	—
			Over 6 up to and incl. 13	500 min.	10 min.	135 min.	—	—
			Over 13 up to and incl. 25	460 min.	13 min.	125 min.	—	—
			Over 25 up to and incl. 50	430 min.	15 min.	115 min.	—	—
			Over 50 up to and incl. 100	—	—	—	65 to 85	—
C 5191	½H	C 5191 B-½H	3.0 or over up to and incl. 6	510 min.	—	150 min.	—	—
			Over 6 up to and incl. 13	460 min.	13 min.	135 min.	—	—
			Over 13 up to and incl. 25	430 min.	15 min.	125 min.	—	—
			Over 25 up to and incl. 50	410 min.	18 min.	120 min.	—	—
			Over 50 up to and incl. 100	—	—	—	70 to 85	—

Table 4 (continued)

Alloy No.	Temper grade	Symbol	Diameter or width across flats mm	Tensile test		Hardness test		
				Tensile strength N/mm²	Elongation %	Vickers hardness HV	Rockwell hardness HRB	Rockwell hardness HRC
C 5191	H	C 5191 B-H	3.0 or over up to and incl. 6	635 min.	—	180 min.	—	—
			Over 6 up to and incl. 13	590 min.	10 min.	165 min.	—	—
			Over 13 up to and incl. 25	540 min.	13 min.	150 min.	—	—
			Over 25 up to and incl. 50	490 min.	15 min.	140 min.	—	—
			Over 50 up to and incl. 100	—	—	—	75 to 90	—
C 5212	½H	C 5212 B-½H	3.0 or over up to and incl. 6	540 min.	—	155 min.	—	—
			Over 6 up to and incl. 13	490 min.	13 min.	140 min.	—	—
			Over 13 up to and incl. 25	440 min.	15 min.	130 min.	—	—
			Over 25 up to and incl. 50	420 min.	18 min.	125 min.	—	—
			Over 50 up to and incl. 100	—	—	—	72 to 87	—
	H	C 5212 B-H	3.0 or over up to and incl. 6	735 min.	—	195 min.	—	—
			Over 6 up to and incl. 13	685 min.	10 min.	180 min.	—	—
			Over 13 up to and incl. 25	635 min.	13 min.	170 min.	—	—
			Over 25 up to and incl. 50	560 min.	15 min.	150 min.	—	—
			Over 50 up to and incl. 100	—	—	—	80 to 95	—
C 5341 C 5441	H	C 5341 B-H C 5441 B-H	0.5 or over up to and incl. 3	470 min.	—	125 min.	—	—
			Over 3.0 up to and incl. 6	440 min.	—	125 min.	—	—
			Over 6 up to and incl. 13	410 min.	10 min.	115 min.	—	—
			Over 13 up to and incl. 25	375 min.	12 min.	110 min.	—	—
			Over 25 up to and incl. 50	345 min.	15 min.	100 min.	—	—
			Over 50 up to and incl. 100	320 min.	15 min.	—	60 to 90	—

Table 4 (continued)

Alloy No.	Temper grade	Symbol	Diameter or width across flats mm	Tensile test		Hardness test		
				Tensile strength N/mm²	Elongation %	Vickers hardness HV	Rockwell hardness HRB	Rockwell hardness HRC
C 7521	½H	C 7521 B-½H	3.0 or over up to and incl. 6	490 to 635	—	145 min.	—	—
			Over 6 up to and incl. 13	440 to 590	—	130 min.	—	—
	H	C 7521 B-H	3.0 or over up to and incl. 6	550 to 685	—	145 min.	—	—
			Over 6 up to and incl. 13	480 to 620	—	125 min.	—	—
			Over 13 up to and incl. 25	440 to 580	—	115 min.	—	—
			Over 25 up to and incl. 50	410 to 550	—	110 min.	—	—
C 7541	½H	C 7541 B-½H	3.0 or over up to and incl. 6	440 to 590	—	135 min.	—	—
			Over 6 up to and incl. 13	390 to 540	—	120 min.	—	—
	H	C 7541 B-H	3.0 or over up to and incl. 6	570 to 705	—	150 min.	—	—
			Over 6 up to and incl. 13	520 to 645	—	135 min.	—	—
			Over 13 up to and incl. 25	450 to 590	—	115 min.	—	—
			Over 25 up to and incl. 50	390 to 540	—	100 min.	—	—
C 7701	½H	C 7701 B-½H	3.0 or over up to and incl. 6	520 to 665	—	150 min.	—	—
			Over 6 up to and incl. 13	470 to 620	—	130 min.	—	—
	H	C 7701 B-H	3.0 or over up to and incl. 6	620 to 775	—	160 min.	—	—
			Over 6 up to and incl. 13	550 to 685	—	140 min.	—	—
			Over 13 up to and incl. 25	510 to 645	—	140 min.	—	—
			Over 25 up to and incl. 50	480 to 620	—	130 min.	—	—

Table 4 (concluded)

Alloy No.	Temper grade	Symbol	Diameter or width across flats mm	Tensile test		Hardness test		
				Tensile strength N/mm²	Elongation %	Vickers hardness HV	Rockwell hardness HRB	Rockwell hardness HRC
C 7941	H	C 7941 B-H	3.0 or over up to and incl. 6	550 to 685	—	150 min.	—	—
			Over 6 up to and incl. 13	480 to 620	—	130 min.	—	—
			Over 13 up to and incl. 20	460 to 600	—	120 min.	—	—
			Over 20 up to and incl. 25	440 to 580	—	120 min.	—	—
			Over 25 up to and incl. 50	410 to 550	—	110 min.	—	—

Remarks : 1 N/mm² = 1 MPa

Table 5 Mechanical properties of bars of C 1720 after age hardening treatment(5)

Alloy No.	Temper grade	Symbol	Diameter or width across flats mm	Tensile test		Hardness test		
				Tensile strength N/mm²	Elongation %	Vickers hardness HV	Rockwell hardness HRB	Rockwell hardness HRC
C 1720	O	—	3.0 or over up to and incl. 6	1 100 to 1 370	—	300 to 400	—	—
			Over 6 up to and incl. 13	1 100 to 1 370	—	300 to 400	—	34 to 40
	H	—	3.0 or over up to and incl. 6	1 270 to 1 520	—	340 to 440	—	—
			Over 6 up to and incl. 13	1 210 to 1 470	—	330 to 430	—	37 to 45

Note (5) The mechanical properties herein are the properties which are obtained when bars of C 1720 in table 4 is treated by age hardening of **6.5** by the purchaser. These properties shall be also applied to the case where a test piece is age hardened by the manufacturer for confirmation of the performance.

Remarks : 1 N/mm² = 1 MPa

Table 6 Mechanical properties of wires

Alloy No.	Temper grade	Symbol	Tensile test		
			Diameter or width across flats mm	Tensile strength N/mm^2	Elongation %
C 1720	O	C 1720 W-O	0.40 min.	390 to 540	—
	1/4 H	C 1720 W-1/4 H	0.40 or over up to and incl. 5.0	620 to 805	—
	3/4 H	C 1720 W-3/4 H	0.40 or over up to and incl. 5.0	835 to 1070	—
C 5071	O	C 5071 W-O	0.40 min.	275 min.	20 min.
	1/8 H	C 5071 W-1/8 H	0.40 or over up to and incl. 5.0	345 to 440	10 min.
	1/4 H	C 5071 W-1/4 H	0.40 or over up to and incl. 5.0	390 to 510	5 min.
	1/2 H	C 5071 W-1/2 H	0.40 or over up to and incl. 5.0	490 to 610	—
	3/4 H	C 5071 W-3/4 H	0.40 or over up to and incl. 5.0	590 to 705	—
	H	C 5071 W-H	0.40 or over up to and incl. 5.0	685 to 805	—
	EH	C 5071 W-EH	0.40 or over up to and incl. 5.0	785 min.	—
C 5111	O	C 5111 W-O	0.40 min.	295 to 410	—
	H	C 5111 W-H	0.40 or over up to and incl. 5.0	490 min.	—
C 5102	O	C 5102 W-O	0.40 min.	305 to 420	—
	H	C 5102 W-H	0.40 or over up to and incl. 5.0	635 min.	—
C 5191	O	C 5191 W-O	0.40 min.	315 to 460	—
	1/8 H	C 5191 W-1/8 H	0.40 or over up to and incl. 5.0	435 to 585	—
	1/4 H	C 5191 W-1/4 H	0.40 or over up to and incl. 5.0	535 to 685	—
	1/2 H	C 5191 W-1/2 H	0.40 or over up to and incl. 5.0	635 to 785	—
	3/4 H	C 5191 W-3/4 H	0.40 or over up to and incl. 5.0	735 to 885	—
	H	C 5191 W-H	0.40 or over up to and incl. 5.0	835 min.	—
C 5212	O	C 5212 W-O	0.40 min.	345 to 490	—
	1/2 H	C 5212 W-1/2 H	0.40 or over up to and incl. 5.0	685 to 835	—
	H	C 5212 W-H	0.40 or over up to and incl. 5.0	930 min.	—
C 7451	O	C 7451 W-O	0.40 min.	345 to 490	—
	1/4 H	C 7451 W-1/4 H	0.40 or over up to and incl. 5.0	400 to 550	—
	1/2 H	C 7451 W-1/2 H	0.40 or over up to and incl. 5.0	490 to 635	—
	H	C 7451 W-H	0.40 or over up to and incl. 5.0	635 min.	—
C 7521	O	C 7521 W-O	0.40 min.	375 to 520	—
	1/4 H	C 7521 W-1/4 H	0.40 or over up to and incl. 5.0	450 to 600	—
	1/2 H	C 7521 W-1/2 H	0.40 or over up to and incl. 5.0	520 to 685	—
	H	C 7521 W-H	0.40 or over up to and incl. 5.0	665 min.	—
C 7541	O	C 7541 W-O	0.40 min.	365 to 510	—
	1/2 H	C 7541 W-1/2 H	0.40 or over up to and incl. 5.0	510 to 665	—
	H	C 7541 W-H	0.40 or over up to and incl. 5.0	635 min.	—

Table 6 (concluded)

Alloy No.	Temper grade	Symbol	Tensile test		
			Diameter or width across flats mm	Tensile strength N/mm²	Elongation %
C 7701	O	C 7701 W-O	0.40 min.	440 to 635	—
	¼H	C 7701 W-¼H	0.40 or over up to and incl. 5.0	500 to 650	—
	½H	C 7701 W-½H	0.40 or over up to and incl. 5.0	635 to 785	—
	H	C 7701 W-H	0.40 or over up to and incl. 5.0	765 min.	—

Remarks : 1 N/mm² = 1 MPa

Table 7 Mechanical properties of wires of C 1720 after age hardening treatment(6)

Alloy No.	Temper grade	Symbol	Tensile test	
			Diameter or width across flats mm	Tensile strength N/mm²
C 1720	O	—	0.40 min.	1 100 to 1 320
	¼H	—	0.40 or over up to and incl. 5.0	1 210 to 1 420
	¾H	—	0.40 or over up to and incl. 5.0	1 300 to 1 590

Note (6) The mechanical properties herein are the properties which are obtained when wires of C 1720 in table 6 is treated by age hardening of **6.5** by the purchaser. These properties shall be also applied to the case where a test piece is age hardened by the manufacturer for confirmation of the performance.

Remarks : 1 N/mm² = 1 MPa

4.5 Coilability For the wires of C 5071, C 5111, C 5102, C 5191 and C 5212 of less than 1.5 mm in diameter, cracking shall not be produced on the surface of wires when the coiling test in **6.4** is carried out. The coilability shall be applied only when requested by the purchaser.

Remarks : The coiling test shall not be applied to the temper grade O.

5 Dimensions and their tolerances

5.1 Standard dimensions The standard dimensions of bars and wires shall be as given in tables 8 to 10.

Table 8 Standard dimensions of diameter or width across flats of bars

Unit: mm

Diameter or width across flats	Alloy No.						Diameter or width across flats	Alloy No.					
	C 1720		C 5111 C 5102 C 5191 C 5212		C 5341 C 5441 C 7521 C 7541 C 7701 C 7941			C 1720		C 5111 C 5102 C 5191 C 5212		C 5341 C 5441 C 7521 C 7541 C 7701 C 7941	
	Shape		Shape		Shape			Shape		Shape		Shape	
	Round	Regular hexagonal	Round	Regular hexagonal	Round	Regular hexagonal		Round	Regular hexagonal	Round	Regular hexagonal	Round	Regular hexagonal
3.0	○	–	○	–	○	–	26	–	–	○	○	○	–
3.2	○	–	–	–	–	–	27	–	–	○	○	○	–
3.5	○	–	○	–	○	–	28	–	–	○	○	○	–
4.0	○	–	○	–	○	–	30	–	–	○	○	○	–
4.5	○	–	○	–	○	–	32	–	–	○	○	○	–
5.0	○	–	○	–	○	–	34	–	–	○	○	○	–
5.5	○	–	○	–	○	–	35	–	–	○	○	○	–
6	○	–	○	○	○	–	36	–	–	○	○	○	–
7	○	–	○	○	○	–	38	–	–	○	○	○	–
8	○	–	○	○	○	–	40	–	–	○	○	○	–
9	○	–	○	○	○	–	41	–	–	○	–	–	–
10	○	–	○	○	○	–	42	–	–	○	–	–	–
11	○	–	○	○	○	–	44	–	–	○	–	–	–
12	○	–	○	○	○	–	45	–	–	○	–	–	–
13	○	–	○	○	○	–	46	–	–	○	–	–	–
14	○	–	○	○	○	–	50	–	–	○	–	–	–
15	○	–	○	○	○	–	55	–	–	○	–	–	–
16	○	–	○	○	○	–	60	–	–	○	–	–	–
17	–	–	○	○	○	–	65	–	–	○	–	–	–
18	○	–	○	–	○	–	70	–	–	○	–	–	–
19	○	–	○	○	○	–	75	–	–	○	–	–	–
20	○	–	○	○	○	–	80	–	–	○	–	–	–
21	–	–	○	○	○	–	85	–	–	○	–	–	–
22	○	–	○	○	○	–	90	–	–	○	–	–	–
23	–	–	○	○	○	–	95	–	–	○	–	–	–
24	○	–	○	○	○	–	100	–	–	○	–	–	–
25	○	–	○	○	○	–							

Table 9 Standard dimensions of diameter or width across flats of wires

Unit: mm

Diameter or width across flats	Alloy No.				Diameter or width across flats	Alloy No.			
	C 1720		C 5071・C 5111 C 5102・C 5191 C 5212・C 7451 C 7521・C 7541 C 7701			C 1720		C 5071・C 5111 C 5102・C 5191 C 5212・C 7451 C 7521・C 7541 C 7701	
	Round	Regular hexagonal, square, rectangular	Round	Regular hexagonal, square, rectangular		Round	Regular hexagonal, square, rectangular	Round	Regular hexagonal, square, rectangular
0.40	○	—	○	○	2.6	○	—	○	—
0.45	○	—	○	○	2.8	○	—	○	—
0.50	○	—	○	○	3.0	○	—	○	—
0.55	○	—	○	○	3.2	○	—	○	—
0.60	○	—	○	○	3.5	—	—	○	—
0.65	○	—	○	○	4.0	—	—	○	—
0.7	○	—	○	—	4.5	—	—	○	—
0.8	○	—	○	○	5.0	—	—	○	—
0.9	○	—	○	○	5.5	—	—	○	—
1.0	○	—	○	○	6.0	—	—	○	—
1.2	○	—	○	○	6.5	—	—	○	—
1.4	○	—	○	—	7	—	—	○	—
1.6	—	—	○	—	8	—	—	○	—
1.8	○	—	○	—	9	—	—	○	—
2.0	○	—	○	—	10	—	—	○	—
2.3	○	—	○	—	11	—	—	○	—
2.5	○	—	○	—	12	—	—	○	—

Remarks : For wires of rectangular cross sections, the width across flats shall be the length of the shortest side.

Table 10 Standard dimensions of length of bars

Unit: mm

Diameter or width across flats	Alloy No.	
	C 1720	C 5111・C 5102・C 5191・C 5212・C 5341 C 5441・C 7521・C 7541・C 7701・C 7941
50 max.	1 000, 2 000	
Over 50	—	500, 1 000

5.2 Dimensional tolerances The dimensional tolerances of bars and wires shall be as follows.

The tolerances of bars and wires having other dimension than the range of specified dimensions shall be subject to the agreement between the purchaser and the supplier.

a) **Tolerances on diameter or width across flats** The tolerances on diameter or width across flats of bars and wires shall be as shown in tables 11 and 12.

Table 11 Tolerances on diameter or width across flats of bars

Unit: mm

Diameter or width across flats	Alloy No.			
	C 1720	C 5111・C 5102・C 5191・C 5212・C 5341・C 5441・C 7521・C 7541・C 7701・C 7941		C 5341・C 5441・C 7941
	Round	Round (excluding those for automatically controlled machine)	Regular hexagonal	Round for automatically controlled machine
1.0 or over up to and incl. 2.5	±0.03	±0.03	±0.05	0 −0.03
Over 2.5 up to and incl. 3.5	⊥0.04	⊥0.04	⊥0.06	0 −0.04
Over 3.5 up to and incl. 5.0	+0.05	⊥0.05	⊥0.06	0 −0.05
Over 5.0 up to and incl. 10	+0.06	+0.06	+0.08	0 0.07
Over 10 up to and incl. 20	±0.08	+0.07	+0.10	—
Over 20 up to and incl. 35	±0.10	±0.08	±0.12	—
Over 35 up to and incl. 40	⊥0.12	⊥0.10	⊥0.14	—
Over 40 up to and incl. 50	—	±0.10	±0.14	—
Over 50 up to and incl. 100	—	±0.2 %	±0.3 %	—

Remarks : When the tolerance is specified for only either plus or minus side, the value in the table shall be doubled.

Table 12 Tolerances on diameter or width across flats of wires

Unit: mm

Diameter or width across flats	Alloy No.		
	C 1720	C 5071・C 5111・C 5102・C 5191・C 5212・C 7451・C 7521・C 7541・C 7701	
	Round	Round	Regular hexagonal, square, rectangular
0.40 or over up to and incl. 0.50	±0.015	±0.010	±0.015
Over 0.50 up to and incl. 1.0	±0.020	±0.015	±0.020
Over 1.0 up to and incl. 2.0	±0.020	±0.020	±0.030
Over 2.0 up to and incl. 3.5	+0.025	+0.025	+0.040
Over 3.5 up to and incl. 5.0	—	±0.035	±0.050
Over 5.0 up to and incl. 10	—	±0.05	±0.075
Over 10 up to and incl. 20	—	+0.07	+0.100

Remarks : When the tolerance is specified for only either plus or minus side, the value in the table shall be doubled.

b) **Circularity of bars** The circularity(7) of round bars shall not be greater than one half the tolerances on diameter in table 11.

Note (7) The circularity means a difference between the maximum and the minimum diameters which are measured on an arbitrary cross section of a round bar.

c) **Tolerance on length of bars** When the length of bars is designated, the tolerance shall be $^{+10.0}_{0}$ mm.

5.3 Maximum permissible curvature of bars The maximum permissible curvature(8) of bars shall be as given in table 13. However, the table shall not be applied to the bars of temper grade O.

The tolerances of bars having other dimension than the range of specified dimensions shall be subject to the agreement between the purchaser and the supplier.

Note (8) The term "curvature" means, as shown in figure 1, the depth of the arc for a reference length.

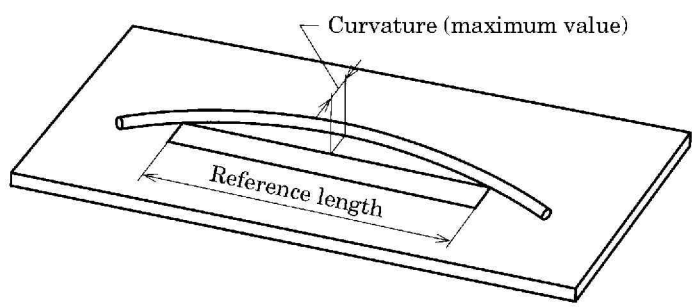

Figure 1 Curvature of bar

Table 13 Maximum permissible curvature of bars

Unit: mm

Diameter or width across flats	Length	Shape		
		Round (excluding those for automatically controlled machine)	Regular hexagonal	Round for automatically controlled machine
8 or over up to and incl. 50	1 000 max.	1 per whole length	6 per whole length	1 per whole length
	Over 1 000 up to and incl. 2 000	2 per 1 m	6 per 1 m	1 per 1 m
	Over 2 000 up to and incl. 5 000	5 per 2 m	15 per 2 m	3 per 2 m

5.4 Maximum value of angular radius The maximum value of the angular radius(9) of a regular hexagonal bar shall be as given in table 14.

Note (9) The angular radius means the radius at an intersection part of side to side.

Table 14 Maximum value of angular radius of regular hexagonal bars

Unit: mm

Width across flats	Maximum value
Over 3.0 up to and incl. 6	0.6
Over 6 up to and incl. 10	0.8
Over 10 up to and incl. 20	1.2
Over 20 up to and incl. 35	2.0
Over 35 up to and incl. 50	2.8
Over 50	4.0

6 Test

6.1 Chemical analysis The analytical method of chemical composition shall conform to the following. **JIS H 1292** may also be applied if the elements or determination range of the chemical composition to be determined are covered in the said standard.

JIS H 1051, JIS H 1052, JIS H 1053, JIS H 1054, JIS H 1055, JIS H 1056, JIS H 1058, JIS H 1060, JIS H 1062, JIS H 1063

6.2 Tensile test The tensile test shall conform to **JIS Z 2241**. The test piece, in this case, shall be in accordance with **JIS Z 2201**. The test piece for bars shall be No. 4 test piece taken in the longitudinal direction.

However, the test piece for bars of not less than 35 mm in diameter or width across flats shall be taken from the vicinity of the surface of the sample.

The test piece for wires shall be No. 9 test piece.

6.3 Hardness test

6.3.1 Vickers hardness test The Vickers hardness test shall be carried out in accordance with **JIS Z 2244**. The minimum test load shall be 4.903 N. The Vickers hardness shall be measured along the circumference with a radius of about 1/3 the radius of bars. However, the Vickers hardness of the bars of C 1720 after age hardening treatment may be measured on the surface of the bars.

6.3.2 Rockwell hardness test The Rockwell hardness test shall be in accordance with **JIS Z 2245**. The Rockwell hardness shall be measured at 3 points along the circumference of a sector obtained by dividing the circle with a radius of about 1/3 the radius of bars into 3 equal parts.

6.4 Coiling test Coiling test of wires shall be carried out by coiling the wire not less than 3 turns around a rod having the diameter twice that of the wire.

6.5 Age hardening treatment The age hardening treatment temperature for bars and wires of C 1720 shall be at 315 °C ± 5 °C, and the duration shall be as given in table 15.

Table 15 Duration of age hardening treatment

Shape	Diameter (mm)	Time (min)			
		Temper grade			
		O	¼H	¾H	H
Bar	19 max.	180	—	—	120
	Over 19 up to and incl. 25	180	—	—	180
Wire	0.40 min.	180	120	60	—

7 Inspection The inspection shall be carried out as follows:

a) General requirements shall comply with **JIS H 0321**.

b) Bars and wires shall be inspected on appearance and dimensions in addition to the tests according to the requirements of clause **6**, and their results shall comply with the requirements of clauses **4** and **5**.

c) One representative bar for the tensile test and hardness test shall be taken at random from each lot normally 1 000 kg in mass or the fraction consisting of bars of the same grade and temper grade rolled to the same sectional dimensions. And the test piece shall be made from the bar mentioned above.

d) One representative wire for the tensile test and coiling test shall be taken at random from each lot of normally 10 coils (1 000 kg in mass if 10 coils are less than 1 000 kg in mass) or the fraction consisting of wires of the same grade and temper grade rolled to the same diameter. And the test piece shall be made from the coil mentioned above.

8 Marking Bars and wires shall be marked with the following items on each package, each bundle, each coil or each product by a suitable means such as labelling.

a) Reference to this Standard, type and temper grade, or their symbols

Example : **JIS H 3270** C 7541 B-½H

b) Dimensions

c) Manufacturing number

d) Manufacturer's name or its identifying brand

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