

JIS

This English version is for information purpose only.
The original Japanese text of this Standard was
revised in Mar., 2000

JAPANESE INDUSTRIAL STANDARD

Copper and copper alloy rods and bars

Ⓔ JIS H 3250—1992

Translated and Published

by

Japanese Standards Association

92

**In the event of any doubt arising,
the original Standard in Japanese is to be final authority**

Errata for JIS (English edition) are printed in *Standardization Journal*, published monthly by the Japanese Standards Association.

Errata will be provided upon request, please contact:
Business Department,
Japanese Standards Association
4-1-24, Akasaka, Minato-ku,
Tokyo, JAPAN 107
TEL. 03-3583-8002
FAX. 03-3583-0462

Errata are also provided to subscribers of JIS (English edition) in *Monthly Information*.

389



1. Scope

This Japanese Industrial Standard specifies extended copper and copper alloy rod and bar having round, regular hexagonal, square or rectangular section (hereinafter referred to as the "rods").

Remarks 1. The term rod denotes those extended solid articles of a uniform cross section all along their length and supplied in a straight form.

2. The Standards cited in this Standard are as follows.

JIS H 0321-General Rules for Inspection of Non-Ferrous Metal Materials

JIS H 0505-Measuring Methods for Electrical Resistivity and Conductivity of Non-Ferrous Materials

JIS H 1012-General Rules for Chemical Analysis of Copper and Copper Alloys

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 1057-Methods for Determination of Aluminium in Copper and Copper Alloys

JIS H 1058-Methods for Determination of Phosphorus in Copper and Copper Alloys

JIS H 1062-Methods for Determination of Zinc in Copper Alloys

JIS H 1291-Method for Atomic Absorption Spectrochemical Analysis of Copper and Copper Alloys

JIS H 1292-Method for Fluorescent X-ray Analysis of Copper Alloys

JIS K 8085-Ammonia Solution

JIS Z 2201-Test Pieces for Tensile Test for Metallic Materials

JIS Z 2241-Method of Tensile Test for Metallic Materials

JIS Z 2243-Method of Brinell Hardness Test

JIS Z 2244-Method of Vickers Hardness Test

3. Corresponding International Standards to this Standard are as follows:

ISO 196:1978 Wrought copper and copper alloys - Detection of residual stress - Mercury (1) nitrate test

ISO 426-1:1983 Wrought copper-zinc alloys - Chemical composition and forms of wrought products
Part 1: Non-leaded and special copper-zinc alloys

ISO 426-2:1983 Wrought copper-zinc alloys - Chemical composition and forms of wrought products
Part 2: Leaded copper-zinc alloys

ISO 428:1983 Wrought copper-aluminium alloys - Chemical composition and forms of wrought products

ISO 1337:1980 Wrought coppers (having minimum copper contents of 99.85 %) - Chemical composition and forms of wrought products

ISO 1637:1987 Wrought copper and copper alloy rod and bar - Technical conditions of delivery

ISO 2626:1973 Copper - Hydrogen embrittlement test

ISO 3488:1982 Wrought copper and copper alloys - Extruded round, square or hexagonal bars - Dimensions and tolerances

ISO 6958:1984 Wrought copper and copper alloys - Drawn rectangular bars - Dimensions and form tolerances

ISO 7756:1984 Wrought copper and copper alloys - Drawn round bars - Symmetric plus and minus tolerances on diameter and form tolerances

ISO 7757:1984 Wrought copper and copper alloys - Drawn hexagonal bars - Symmetric plus and minus tolerances on width across flats and form tolerances

ISO 7758:1984 Wrought copper and copper alloys - Drawn square bars - Symmetric plus and minus tolerances on width across flats and form tolerances

2. Grade and designation

The grade and designation of rods shall be as given in Table 1.

Table 1. Grade and designation

Grade		Designation	Informative reference	
Alloy No.	Shape		Name	Specific character and examples of use
C 1020	Extruded rod	C 1020 BE ⁽¹⁾	Oxygen free copper	Having good electric and heat conductivity, and workability, and also having good weldability, corrosion and weathering resistance. Free from hydrogen embrittlement heated at elevated temperature in reducing atmosphere. Applicable to electrical parts, chemical industry, etc.
	Drawn rod	C 1020 BD ⁽¹⁾		
C 1100	Extruded rod	C 1100 BE ⁽¹⁾	Tough-pitch copper	Having good electric and heat conductivity, workability, corrosion and weathering resistance. Applicable to electrical parts, chemical industry, etc.
	Drawn rod	C 1100 BD ⁽¹⁾		
C 1201	Extruded rod	C 1201 BE	Phosphorus deoxidized copper	Having good workability, weldability, corrosion and weathering resistance and heat conductivity. For C 1220, free from hydrogen embrittlement heated at elevated temperature in reducing atmosphere. C 1201 has better electric conductivity than C 1220. Applicable to socket, fitting, chemical industry, etc.
	Drawn rod	C 1201 BD		
C 1220	Extruded rod	C 1220 BE		
	Drawn rod	C 1220 BD		
C 2600	Extruded rod	C 2600 BE ⁽¹⁾	Brass	Having good cold forgeability and rolling threadability. Applicable to machine parts, electrical parts, etc.
	Drawn rod	C 2600 BD ⁽¹⁾		
C 2700	Extruded rod	C 2700 BE ⁽¹⁾		
	Drawn rod	C 2700 BD ⁽¹⁾		
C 2800	Extruded rod	C 2800 BE ⁽¹⁾		Having good hot formability. Applicable to machine parts, electrical parts, etc.
	Drawn rod	C 2800 BD ⁽¹⁾		

Table 1. (Continued)

Grade		Designation	Informative reference	
Alloy No.	Shape		Name	Specific character and examples of use
C 3601	Drawn rod	C 3601 BD ⁽²⁾	Leaded brass	Having excellent machinability. Both C 3601 and C 3602 have good workability. Applicable to bolts, nuts, machine screws, spindles, gears, valves, lighter, clock and watch, camera parts, etc.
C 3602	Extruded rod	C 3602 BE		
	Drawn rod	C 3602 BD ⁽²⁾		
C 3603	Drawn rod	C 3603 BD ⁽²⁾		
C 3604	Extruded rod	C 3604 BE		
	Drawn rod	C 3604 BD ⁽²⁾		
C 3605	Extruded rod	C 3605 BE		
	Drawn rod	C 3605 BD ⁽²⁾		
C 3712	Extruded rod	C 3712 BE	Forging brass	Having good hot forgeability. Applicable to precision forging. Applicable to machine parts, etc.
	Drawn rod	C 3712 BD		
C 3771	Extruded rod	C 3771 BE		Having good hot forgeability and machinability. Applicable to valves, machine parts, etc.
	Drawn rod	C 3771 BD		
C 4622	Extruded rod	C 4622 BE	Naval brass	Having good corrosion resistance, especially marine water-proof property. Applicable to ships parts, shaft, etc.
	Drawn rod	C 4622 BD		
C 4641	Extruded rod	C 4641 BE		
	Drawn rod	C 4641 BD		
C 6161	Extruded rod	C 6161 BE	Aluminum bronze	Having high strength, good wear and corrosion resistance. Applicable to gear pinion, shaft, bushing, etc. for machinery of vehicles, mechanical, chemical industry and ship use.
	Drawn rod	C 6161 BD		
	Forged rod	C 6161 BF		
C 6191	Extruded rod	C 6191 BE		
	Drawn rod	C 6191 BD		
	Forged rod	C 6191 BF		
C 6241	Extruded rod	C 6241 BE		
	Drawn rod	C 6241 BD		
	Forged rod	C 6241 BF		

Table 1. (Continued)

Grade		Designation	Informative reference	
Alloy No.	Shape		Name	Specific character and examples of use
C 6782	Extruded rod	C 6782 BE	High strength brass	Having high strength, good hot forgeability and corrosion resistance. Applicable to propeller shaft, pump shaft, etc. for ship use.
	Drawn rod	C 6782 BD		
C 6783	Extruded rod	C 6783 BE		
	Drawn rod	C 6783 BD		

Notes (1) For electric conduction use, the letter "C" shall be suffixed to the designation given in the above table.

(2) For automatic controlled machinery use, the letter "S" shall be suffixed to the letter "D" denoting the drawn rod.

Remarks: The designation to express the temper grade shall be suffixed to the designation given in the above table.

3. Quality.

3.1 Appearance Rods shall have an accurate cross-section, a workmanlike finish, unheterogeneity and be free from defects that are detrimental to practical use.

3.2 Chemical composition The chemical composition of rods shall be as given in Table 2.

Table 2. Chemical composition

Alloy No.	Chemical composition %									
	Cu	Pb	Fe	Sn	Zn	Al	Mn	Ni	P	Cu+Al+Fe +Mn+Ni
C 1020	99.96 min.	-	-	-	-	-	-	-	-	-
C 1100	99.90 min.	-	-	-	-	-	-	-	-	-
C 1201	99.90 min.	-	-	-	-	-	-	-	0.004 to 0.015 excl.	-
C 1220	99.90 min.	-	-	-	-	-	-	-	0.015 to 0.040	-
C 2600	68.5 to 71.5	0.05 max.	0.05 max.	-	Residual	-	-	-	-	-

Table 2. (Continued)

Alloy No.	Chemical composition %									
	Cu	Pb	Fe	Sn	Zn	Al	Mn	Ni	P	Cu+Al+Fe+Mn+Ni
C 2700	63.0 to 67.0	0.05 max.	0.05 max.	-	Re-sidual	-	-	-	-	-
C 2800	59.0 to 63.0	0.10 max.	0.07 max.	-	Re-sidual	-	-	-	-	-
C 3601	59.0 to 63.0	1.8 to 3.7	0.30 max.	Fe+Sn 0.50 max.	Re-sidual	-	-	-	-	-
C 3602	59.0 to 63.0	1.8 to 3.7	0.50 max.	Fe+Sn 1.2 max.	Re-sidual	-	-	-	-	-
C 3603	57.0 to 61.0	1.8 to 3.7	0.35 max.	Fe+Sn 0.6 max.	Re-sidual	-	-	-	-	-
C 3604	57.0 to 61.0	1.8 to 3.7	0.50 max.	Fe+Sn 1.2 max.	Re-sidual	-	-	-	-	-
C 3605	56.0 to 60.0	3.5 to 4.5	0.50 max.	Fe+Sn 1.2 max.	Re-sidual	-	-	-	-	-
C 3712	58.0 to 62.0	0.25 to 1.2	Fe+Sn 0.8 max.		Re-sidual	-	-	-	-	-
C 3771	57.0 to 61.0	1.0 to 2.5	Fe+Sn 1.0 max.		Re-sidual	-	-	-	-	-
C 4622	61.0 to 64.0	0.30 max.	0.20 max.	0.7 to 1.5	Re-sidual	-	-	-	-	-
C 4641	59.0 to 62.0	0.50 max.	0.20 max.	0.50 to 1.0	Re-sidual	-	-	-	-	-
C 6161	83.0 to 90.0	-	2.0 to 4.0	-	-	7.0 to 10.0	0.50 to 2.0	0.50 to 2.0	-	99.5 min.
C 6191	81.0 to 88.0	-	3.0 to 5.0	-	-	8.5 to 11.0	0.50 to 2.0	0.50 to 2.0	-	99.5 min.
C 6241	80.0 to 87.0	-	3.0 to 5.0	-	-	9.0 to 12.0	0.50 to 2.0	0.50 to 2.0	-	99.5 min.
C 6782	56.0 to 60.5	0.50 max.	0.10 to 1.0	-	Re-sidual	0.20 to 2.0	0.50 to 2.5	-	-	-
C 6783	55.0 to 59.0	0.50 max.	0.20 to 1.5	-	Re-sidual	0.20 to 2.0	1.0 to 3.0	-	-	-

3.3 Items of mechanical and physical properties The items of mechanical and physical properties of rods shall be as given in Table 3.

Table 3. Items of mechanical and physical properties

Alloy No.	Designation	Items indicating mechanical and physical properties						
		Tensile strength	Elongation	Hardness		Electric conductivity and volume resistivity	Hydrogen embrittlement	Season crack
				Vickers	Brinell			
C 1020	C 1020 BE	○	○	—	—	△	○	—
	C 1020 BD	○	○	—	—	△	—	—
C 1100	C 1100 BE	○	○	—	—	△	—	—
	C 1100 BD	○	○	—	—	△	—	—
C 1201	C 1201 BE	○	○	—	—	—	△	—
	C 1201 BD	○	○	—	—	—	△	—
C 1220	C 1220 BE	○	○	—	—	—	—	—
	C 1220 BD	○	○	—	—	—	—	—
C 2600	C 2600 BE	○	○	—	—	△	—	—
	C 2600 BD	○	○	—	—	△	—	○
C 2700	C 2700 BE	○	○	—	—	△	—	—
	C 2700 BD	○	○	—	—	△	—	○
C 2800	C 2800 BE	○	○	—	—	△	—	—
	C 2800 BD	○	○	—	—	△	—	○
C 3601	C 3601 BD	○	○	△	—	—	—	○
C 3602	C 3602 BE	△	△	△	—	—	—	—
	C 3602 BD	△	△	△	—	—	—	○
C 3603	C 3603 BD	○	○	△	—	—	—	○
C 3604	C 3604 BE	△	△	△	—	—	—	—
	C 3604 BD	△	△	△	—	—	—	○
C 3605	C 3605 BE	△	△	△	—	—	—	—
	C 3605 BD	△	△	△	—	—	—	○
C 3712	C 3712 BE	○	○	—	—	—	—	—
	C 3712 BD	○	○	—	—	—	—	○
C 3771	C 3771 BE	○	○	—	—	—	—	—
	C 3771 BD	○	○	—	—	—	—	○
C 4622	C 4622 BE	○	○	—	—	—	—	—
	C 4622 BD	○	○	—	—	—	—	○

Table 3. (Continued)

Alloy No.	Designation	Items indicating mechanical and physical properties						
		Tensile strength	Elongation	Hardness		Electric conductivity and volume resistivity	Hydrogen embrittlement	Season crack
				Vickers	Brinell			
C 4641	C 4641 BE	○	○	—	—	—	—	—
	C 4641 BD	○	○	—	—	—	—	○
C 6161	C 6161 BE							
	C 6161 BD	○	○	—	○	—	—	—
	C 6161 BF							
C 6191	C 6191 BE							
	C 6191 BD	○	○	—	○	—	—	—
	C 6191 BF							
C 6241	C 6241 BE							
	C 6241 BD	○	○	—	○	—	—	—
	C 6241 BF							
C 6782	C 6782 BE	○	○	—	—	—	—	—
	C 6782 BD	○	○	—	—	—	—	○
C 6783	C 6783 BE	○	○	—	—	—	—	—
	C 6783 BD	○	○	—	—	—	—	○

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

3.4 Mechanical properties The mechanical properties (tensile strength, elongation and hardness) of rods shall be as given in Table 4. However, when the specification of hardness is applied to rods of C 3601, C 3602, C 3603, C 3604, C3605, those of tensile strength and elongation shall not be applied.

Table 4. Mechanical properties

Alloy No.	Temper Grade	Designation	Diameter, side length or width across flats mm	Tensile test		Hardness test	
				Tensile strength N/mm ²	Elongation %	Vickers ⁽³⁾ HV	Brinell HBS 10/3000
C 1020 C 1100 C 1201 C 1220	F	C 1020 BE-F	6 and over	195 min.	25 min.	-	-
		C 1100 BE-F					
		C 1201 BE-F					
		C 1220 BE-F					
	O	C 1020 BD-O	6 and over, up to and incl. 75	195 min.	30 min.	-	-
		C 1100 BD-O					
		C 1201 BD-O					
		C 1220 BD-O					
	1/2H	C 1020 BD-1/2H	6 and over, up to and incl. 25	245 min.	15 min.	-	-
		C 1100 BD-1/2H					
		C 1201 BD-1/2H	Over 25, up to and incl. 50	225 min.	20 min.	-	-
		C 1220 BD-1/2H					
	H	C 1020 BD-H	6 and over, up to and incl. 25	275 min.	-	-	-
		C 1100 BD-H					
		C 1201 BD-H	Over 25, up to and incl. 50	245 min.	-	-	-
		C 1220 BD-H					

Table 4. (Continued)

Alloy No.	Temper Grade	Designation	Diameter, side length or width across flats mm	Tensile test		Hardness test	
				Tensile strength N/mm ²	Elongation %	Vickers ⁽³⁾ HV	Brinell HBS 10/3000
C 2600	F	C 2600 BE-F	6 and over	275 min.	35 min.	-	-
	O	C 2600 BD-O	6 and over, up to and incl. 75	275 min.	45 min.	-	-
	1/2H	C 2600 BD-1/2H	6 and over, up to and incl. 50	355 min.	20 min.	-	-
	H	C 2600 BD-H	6 and over, up to and incl. 20	410 min.	-	-	-
C 2700	F	C 2700 BE-F	6 and over	295 min.	30 min.	-	-
	O	C 2700 BD-O	6 and over, up to and incl. 75	295 min.	40 min.	-	-
	1/2H	C 2700 BD-1/2H	6 and over, up to and incl. 50	355 min.	20 min.	-	-
	H	C 2700 BD-H	6 and over, up to and incl. 20	410 min.	-	-	-
C 2800	F	C 2800 BE-F	6 and over	315 min.	25 min.	-	-
	O	C 2800 BD-O	6 and over, up to and incl. 75	315 min.	35 min.	-	-
	1/2H	C 2800 BD-1/2H	6 and over, up to and incl. 50	375 min.	15 min.	-	-
	H	C 2800 BD-H	6 and over, up to and incl. 20	450 min.	-	-	-

C

C

Table 4. (Continued)

Alloy No.	Temper Grade	Designation	Diameter, side length or width across flats mm	Tensile test		Hardness test	
				Tensile strength N/mm ²	Elongation %	Vickers ⁽³⁾ HV	Brinell HBS 10/3000
C 3601	O	C 3601 BD-O	6 and over, up to and incl. 75	295 min.	25 min.	-	-
	1/2H	C 3601 BD-1/2H	6 and over, up to and incl. 50	345 min.	-	95 min.	-
	H	C 3601 BD-H	6 and over, up to and incl. 20	450 min.	-	130 min.	-
C 3602	F	C 3602 BE-F C 3602 BD-F	6 and over, up to and incl. 75	315 min.	-	75 min.	-
C 3603	O	C 3603 BD-O	6 and over, up to and incl. 75	315 min.	20 min.	-	-
	1/2H	C 3603 BD-1/2H	6 and over, up to and incl. 50	365 min.	-	100 min.	-
	H	C 3603 BD-H	6 and over, up to and incl. 20	450 min.	-	130 min.	-
C 3604	F	C 3604 BE-F C 3604 BD-F	6 and over, up to and incl. 75	335 min.	-	80 min.	-
C 3605	F	C 3605 BE-F C 3605 BD-F	6 and over, up to and incl. 75	335 min.	-	80 min.	-
C 3712 C 3771	F	C 3712 BE-F C 3712 BD-F C 3771 BE-F C 3771 BD-F	6 and over	315 min.	15 min.	-	-

Table 4. (Continued)

Alloy No.	Temper Grade	Designation	Diameter, side length or width across flats mm	Tensile test		Hardness test	
				Tensile strength N/mm ²	Elongation %	Vickers ⁽³⁾ HV	Brinell HBS 10/3000
C 4622	F	C 4622 BE-F	6 and over, up to and incl. 50	345 min.	20 min.	-	-
		C 4622 BD-F	6 and over, up to and incl. 50	365 min.	20 min.	-	-
C 4641	F	C 4641 BE-F	6 and over, up to and incl. 50	345 min.	20 min.	-	-
		C 4641 BD-F	6 and over, up to and incl. 50	375 min.	20 min.	-	-
C 6161	F	C 6161 BE-F	6 and over, up to and incl. 50	590 min.	25 min.	-	130 min.
		C 6161 BD-F	6 and over, up to and incl. 50	590 min.	25 min.	-	130 min.
		C 6161 BF-F	6 and over, up to and incl. 50	590 min.	25 min.	-	130 min.
C 6191	F	C 6191 BE-F	6 and over, up to and incl. 50	685 min.	15 min.	-	170 min.
		C 6191 BD-F	6 and over, up to and incl. 50	685 min.	15 min.	-	170 min.
		C 6191 BF-F	6 and over, up to and incl. 50	685 min.	15 min.	-	170 min.
C 6241	F	C 6241 BE-F	6 and over, up to and incl. 50	685 min.	10 min.	-	210 min.
		C 6241 BD-F	6 and over, up to and incl. 50	685 min.	10 min.	-	210 min.
		C 6241 BF-F	6 and over, up to and incl. 50	685 min.	10 min.	-	210 min.
C 6782	F	C 6782 BE-F	6 and over, up to and incl. 50	460 min.	20 min.	-	-
		C 6782 BD-F	6 and over, up to and incl. 50	490 min.	15 min.	-	-
C 6783	F	C 6783 BE-F	6 and over, up to and incl. 50	510 min.	15 min.	-	-
		C 6783 BD-F	6 and over, up to and incl. 50	540 min.	12 min.	-	-

Note (3) The minimum test load shall be 4.903 N.

Remarks: The mechanical properties of rods having a dimension other than specified in this standard shall be as agreed upon between the parties concerned with delivery.

3.5 Electric conductivity and volume resistivity The electric conductivity and volume resistivity of rods shall be as given in Tables 5 (1) and (2).

Table 5 (1). Electric conductivity

Alloy No.	Temper Grade	Designation	Electric conductivity % (20°C)
C 1020 C 1100	F	C 1020 BEC-F C 1100 BEC-F	100 min.
	O	C 1020 BDC-O C 1100 BDC-O	100 min.
	1/2H	C 1020 BDC-1/2H C 1100 BDC-1/2H	98 min.
	H	C 1020 BDC-H C 1100 BDC-H	97 min.

Table 5 (2). Volume resistivity
Unit: cm

Alloy No.	Designation	Volume resistivity (20°C)
C 2600	C 2600 BEC	6.3 ^{+0.7} -0.3
	C 2600 BDC	
C 2700	C 2700 BEC	6.5 ^{+0.7} -0.3
	C 2700 BDC	
C 2800	C 2800 BEC	6.4 ^{+0.7} -0.3
	C 2800 BDC	

3.6 Season cracking The surface of rods shall be free from cracks when season cracking test is carried out on them in accordance with the requirements of 5.5. This test, however, shall not be applied to the temper grade "O" of drawn rods, extruded rods, and also C 1020, C 1100, C 1201, C 1220, C 6161, C 6191 and C 6241.

This test may be omitted by agreement with the purchaser.

3.7 Hydrogen embrittlement When the hydrogen embrittlement test specified in 5.6 is carried out, rods of C 1020 and C 1201 shall be free from amounts of blowholes or open grain structure characteristic of hydrogen embrittlement at the vicinity of grain boundaries. However, for C 1201, this test shall be applied only when required by the purchaser.

4. Dimensions and tolerances

4.1 Preferred dimension The preferred dimensions on diameter, side length or width across flats for rods shall be as given in Table 6.

Table 6. Preferred dimensions
(C 3601·C 3602·C 3603·C 3604·C 3605)

Unit: mm

Shape A(°)	Round	Regular hexagon	Square	Shape A(°)	Round	Regular hexagon	Square	Shape A(°)	Round	Regular 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 (°) "A" means the diameter for round rod, side length for square rod and width across flats for regular hexagonal rod.

4.2 Tolerance on diameter, side length or width across flats faces
The tolerances on diameter, side length or width across flats for rods shall be as given in Tables 7 (1), (2) and (3).

Table 7 (1). Tolerances on diameter, side length or width across flats for drawn rods⁽⁵⁾

Unit: mm

Diameter, side length or width across flats	Shape	Tolerance		
		Round	Regular hexagon, square, rectangle	Round for automatic controlled machine ⁽⁶⁾
1 and over, up to and incl. 3		± 0.03	± 0.05	0 -0.03
Over 3, up to and incl. 6		± 0.04	± 0.06	0 -0.04
Over 6, up to and incl. 10		± 0.04	± 0.08	0 -0.05
Over 10, up to and incl. 20		± 0.06	± 0.11	0 -0.07
Over 20, up to and incl. 35		± 0.08	± 0.18	0 -0.08
Over 35, up to and incl. 50		± 0.10	± 0.25	0 -0.12
Over 50		$\pm 0.3 \%$	$\pm 0.6 \%$	-

Notes ⁽⁵⁾ The tolerances shall be applied to rods of 20 mm and under for C 6161, C 6191, and C 6241.

⁽⁶⁾ The tolerances on round rods for automatic controlled machine shall be applied to C 3601 BDS, C 3602 BDS, C 3603 BDS, C 3604 BDS and C 3605 BDS.

- Remarks 1. When the tolerance is specified by only either plus or minus side, the value in the above table shall be doubled, provided that, excluding round rods for automatic controlled machine.
2. The tolerances for rods having a dimension outside the range of the specified dimensions shall be as agreed upon between the parties concerned with delivery.

Table 7 (2). Tolerances on diameter, side length or width across flats for extruded rods

(C 2600, C 2700, C 2800, C 3601, C 3602, C 3603
C 3604, C 3605, C 3712, C 3771, C 4622, C 4641
C 6782, C 6783)

Diameter, side length or width across flats mm	Alloy No.	Shape	Tolerances	
			C 2600 C 2700 C 2800	C 3601, C 3602 C 3603, C 3604 C 3605, C 3712 C 3771, C 4622 C 4641, C 6782 C 6783
			Round, regular hexagon, square, rectangle	
6 and over up to and incl. 25			± 0.3 mm	± 0.3 mm
Over 25 up to and incl. 100			± 1.2 %	± 1.0 %

Table 7 (3). Tolerances on diameter, side length or width across flats for extruded or forged rods

(C 1020, C 1100, C 1201, C 1220, C 6161, C 6191, C 6241)

Diameter, side length or width across flats mm	Alloy No.	Tolerances		
		C 1020 C 1100 C 1201 C 1220	C 6161 C 6191 C 6241	
	Finishing process	Extruded rod	Extruded rod	Forged rod
	Shape	Round, regular hexagon, square, rectangle	Round, regular hexagon, square	Round, regular hexagon, square
6 or over up to and incl. 15		± 0.3 mm	± 0.3 mm	-
Over 15 up to and incl. 20		± 2 %		
Over 20 up to and incl. 25				
Over 25			± 1.2 %	± 4 % $- 2$ %

Remarks 1. When the tolerance is specified by only either plus or minus side, the value in the above table shall be doubled.

2. The tolerances for rods having a dimension exceeding the range of the specified dimensions shall be as agreed upon between the parties concerned with delivery.

4.3 Tolerance on roundness The tolerances on roundness⁽⁷⁾ of round rods shall be as follows:

- (1) The tolerance for drawn rods is 1/2 or less of the tolerance for the concerned diameter given in Table 7 (1).
- (2) The tolerance for extruded rods is the same as or less than the tolerance for the concerned diameter given in Tables 7 (2) and (3).

Note (7) The roundness is the difference between the greatest and the smallest in diameters measured on an arbitrarily chosen cross section of the round rod.

4.4 Tolerance on length When specified, the tolerance on length of rods shall be $\begin{smallmatrix} +15 \\ 0 \end{smallmatrix}$ mm. When unspecified, the length shall be any for rods of lengths 1 m or more.

4.5 Maximum permissible bend The permissible maximum value on bend⁽⁸⁾ for drawn rods shall be as given in Tables 8 (1) and (2). However, the permissible maximum value on bend shall not be applied to those of temper grade "0".

Table 8 (1). Permissible maximum value on bend⁽⁸⁾

(C 1020, C 1100, C 1201, C 1220, C 2600,
C 2700, C 2800, C 3712, C 3771, C 4622,
C 4641, C 6161, C 6191, C 6241, C 6782, C 6783)

Unit: mm

Diameter, side length or width across flats	Length	Maximum value	
		Round	Regular hexagon, square, rectangle
8 and over, up to and incl. 50	Up to and incl. 1000	2 per full length	4 per full length
	Over 1000, up to and incl. 2000	2 per 1 m	4 per 1 m
	Over 2000, up to and incl. 5000	5 per 2 m	10 per 2 m

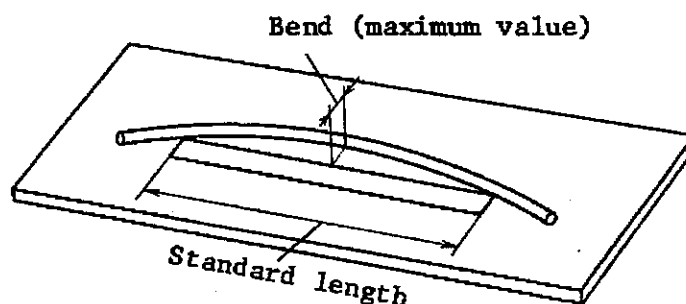
Note (8) The term bend is the depth of the arc for the standard length.

Table 8 (2). Permissible maximum value on bend⁽⁸⁾

(C 3601, C 3602, C 3603, C 3604, C 3605)

Unit: mm

Diameter, side length or width across flats	Length	Shape	Maximum value	
			Round	Regular hexagon, square, rectangle
8 and over, up to and incl. 50	Up to and incl. 1000		2 per full length	4 per full length
	Over 1000, up to and incl. 2000		1 per 1 m	4 per 1 m
	Over 2000, up to and incl. 5000		3 per 2 m	10 per 2 m



Remarks: The permissible maximum value for rods having a dimension exceeding the range of the specified dimensions shall be as agreed upon between the parties concerned with delivery.

4.6 Maximum value of corner radius The maximum values of corner radii of regular hexagonal, regular square, and rectangular drawn rods shall be as given in Table 9.

Table 9. Maximum value of corner radius

Unit: mm

Diameter, side length or width across flats	Maximum value
1 or over up to and incl. 3	-
Over 3 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

5. Test

5.1 Chemical analysis test The analytical method of chemical composition shall conform to any one of the following standards:

JIS H 1012	JIS H 1054	JIS H 1058
JIS H 1051	JIS H 1055	JIS H 1062
JIS H 1052	JIS H 1056	JIS H 1291
JIS H 1053	JIS H 1057	JIS H 1292

5.2 Tensile test The tensile test shall conform to JIS Z 2241. The test piece, in this case, shall be No. 4 test piece specified in JIS Z 2201 and be taken in longitudinal direction. However, the test piece of rods not less than 35 mm in diameter, side length or distance between parallel faces shall be taken from the part near the surface of the test specimen.

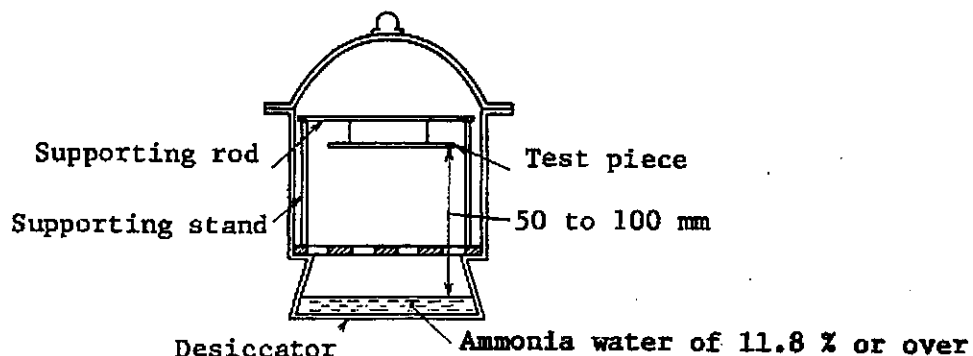
5.3 Hardness test The hardness test shall conform to one of JIS Z 2243, or JIS Z 2244. Vickers hardness test shall be made along the circumference with a radius of about 1/3 time of radius for rod in the cross section.

5.4 Electric conductivity and volume resistivity tests The electric conductivity and volume resistivity tests shall conform to JIS H 0505.

5.5 Season cracking test The season cracking test shall be conducted conforming to either of the following by means of visual examination.

- (1) Method A Cut out a test piece in length approx. 75 mm or over from the rod, degrease and dry it, put it in a desiccator contained ammonia solution with a concentration of 11.8 % or over (which is obtained by diluting ammonia water specified in JIS K 8085 with equivalent amount of pure water) from 50 to 100 mm above the liquid surface, and then keep it in this ammonia atmosphere at ordinary temperature for 2 h. (See Informative reference Figure 1). After 2 h, take out the test piece, immediately polish its surface by washing it with 10 % sulfuric acid or, in the case of a round bar 25 mm or under in diameter, bend it with an inside radius twice the diameter to about angle 15° and then examine the degree of cracking.

Informative reference Fig. 1



- (2) Method B Cut out the test piece 75 mm or over in length from a rod, immerse it in mercurous nitrate solution for 15 min, and then examine the degree of cracking.

The mercurous nitrate solution to be used shall contain 100 g of mercurous nitrate and 13 ml of nitric acid (a specific gravity of 1.42) per liter hereto.

5.6 Hydrogen embrittlement test The hydrogen embrittlement test shall be conducted by heating the test piece in hydrogen gas current at $850 \pm 25^{\circ}\text{C}$ for 30 min followed by polishing and etching, and then examined by means of a microscope of 75 to 200 magnifications.

6. Inspection

The inspection shall be carried out as follows:

- (1) Rods shall be inspected on appearance and dimensions in addition to the tests conforming to the requirements of 5., and their results shall comply with the specifications of 3. and 4.
- (2) One representative rod for the tensile test, hardness test, electric conductivity test, volume resistivity test, hydrogen embrittlement test and season cracking test shall arbitrarily be, as a rule, taken from every 3000 kg or the fraction of each lot consisting of rods of the same grade, temper grade, finishing process rolled to the same sectional dimensions. And the test piece shall be made from the rod mentioned above.
- (3) When the product belongs to the same lot tested already, the result of electric conductivity and volume resistivity test carried out by the manufacturer may be considered as the representative value for the test.
- (4) Other general requirements shall comply with JIS H 0321.

7. Marking

Rods shall be marked with the following items on each package, on each coil, or on each rod by a suitable means.

- (1) Grade, temper grade, or their designation
- (2) Dimensions
- (3) Manufacturing number
- (4) Manufacturer's name or its abbreviation

H 3250-1992
Edition 3

Japanese Text

Established by Minister of International Trade and Industry

Date of Establishment: 1977-05-01

Date of Revision: 1992-07-01

Date of Public Notice in Official Gazette: 1992-07-22

Investigated by: Japanese Industrial Standards Committee

Divisional Council on Non-ferrous Metals

This English translation is published by:
Japanese Standards Association
1-24, Akasaka 4, Minato-ku,
Tokyo 107 Japan
© JSA, 1993

Printed in Tokyo by
Hohbunsha Co., Ltd.

