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(JCBA/JSA)

**Copper and copper alloy seamless
pipes and tubes**

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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 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 3300:2009** is replaced with this Standard.

However, **JIS H 3300:2009** may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until October 21, 2013.

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- Date of registration of establishment: 2006-04-21
- Patent number: 3794971
- Patent holder: Kobelco Co., Ltd
2-7-1 Nishishinjuku, Shinjuku-ku, Tokyo
- Name of invention: Seamless copper alloy tube for heat exchanger excellent in 0.2 % proof stress and fatigue strength
- Date of registration of establishment: 2002-05-10
- Patent number: 3303778
- Patent holder: Mitsubishi Materials Co., Ltd
1-3-2 Ôtemachi, Chiyoda-ku, Tokyo
- Name of invention: Heat resistant copper alloy materials
- Date of registration of establishment: 2006-11-10
- Patent number: 3878640
- Patent holder: Mitsubishi Shindoh Co., Ltd
4-7-35 Kitashinagawa, Shinagawa-ku, Tokyo
- Name of invention: Seamless tube
- Date of registration of establishment: 2009-07-31
- Patent number: 4349640
- Patent holder: Sumitomo Light Metal Industries, Ltd
5-11-3 Shinbashi, Minato-ku, Tokyo

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Copper and copper alloy seamless pipes and tubes

1 Scope

This Japanese Industrial Standard specifies expanded copper and copper alloy seamless pipes and tubes (hereafter referred to as “tubes”), having a round section.

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 0500 *Glossary of terms used in wrought copper and copper alloys*
- JIS H 0501 *Methods for estimating average grain size of wrought copper and copper alloys*
- JIS H 0502 *Method of eddy current testing for copper and copper alloy pipes and tubes*
- JIS H 0505 *Measuring methods for electrical resistivity and conductivity of non-ferrous 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 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 1059 *Methods for determination of arsenic in copper and copper alloys*
- JIS H 1060 *Methods for determination of cobalt in copper and copper alloys*
- JIS H 1061 *Methods for determination of silicon in copper and copper alloys*
- JIS H 1062 *Methods for determination of zinc in copper and copper alloys*
- JIS H 1074 *Copper and copper alloys—Determination of zirconium content*
- JIS H 1292 *Methods for X-ray fluorescence spectrometric analysis of copper alloys*
- JIS K 0116 *General rules for atomic emission spectrometry*
- JIS K 8085 *Ammonia solution*
- JIS S 3200-1 *Equipment for water supply service—Test methods of hydrostatic pressure*

JIS S 3200-7 *Equipment for water supply service—Test methods of effect to water quality*

JIS Z 2241 *Metallic materials—Tensile testing—Method of test at room temperature*

JIS Z 2244 *Vickers hardness test—Test method*

JIS Z 2245 *Rockwell hardness test—Test method*

JIS Z 2611 *General rules for photoelectric emission spectrochemical analysis of metal materials*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in **JIS H 0500** apply.

4 Grade, class and designation

The grade (hereafter expressed as alloy No.), class and designation of tubes shall be in accordance with table 1. A product designation shall consist of the designation symbol given in table 1 and the symbol of temper grade suffixed to it (see table 3 to table 6).

Table 1 Grade, class and designation of tubes

Alloy No.	Class	Designation	Informative	
			Name	Characteristics and application examples
C 1020	Common	C 1020 T ^{a)}	Oxygen-free copper	Excellent electric and heat conductivity, workability and drawability, and good weldability, corrosion resistance and weathering resistance. Free from hydrogen embrittlement when heated to an elevated temperature in the reducing atmosphere. Applicable to heat exchangers, electric or chemical industries use.
	Special	C 1020 TS ^{a)}		
C 1100	Common	C 1100 T ^{a)}	Touch-pitch copper	Excellent electric and heat conductivity, good drawability, corrosion resistance and weathering resistance. Applicable to electric parts, etc.
	Special	C 1100 TS ^{a)}		
C 1201	Common	C 1201 T	Phosphorus deoxidized copper	Good flaring and bending properties, drawability, weldability, corrosion resistance, weathering resistance and heat conductivity. C 1220 is free from hydrogen embrittlement when heated to an elevated temperature in reducing atmosphere. C 1201 has better electric conductivity than C 1220. Applicable to heat exchangers, chemical industries use, gas pipes, etc. C 1220 is also applicable to water supply and hot water supply.
	Special	C 1201 TS		
C 1220	Common	C 1220 T		
	Special	C 1220 TS		
Note ^{a)} For tubes for electric conduction use, the letter “C” shall be suffixed to the designation in this table.				

Table 1 (concluded)

Alloy No.	Class	Designation	Informative	
			Name	Characteristics and application examples
C 1565	Common	C 1565 T	High strength copper	Good flaring and bending properties, drawability, weldability, corrosion resistance and weathering resistance, and higher strength than phosphorus deoxidized copper. C 1565 has excellent heat conductivity. C 1862 has excellent thermal resistance. C 5010 and C 5015 have excellent ductility. Applicable to heat exchangers, piping, parts of various apparatuses, pressure vessels, general freezers and air conditioners, high pressure cooling medium heat pump type hot water supply, etc.
	Special	C 1565 TS		
C 1862	Common	C 1862 T		
	Special	C 1862 TS		
C 5010	Common	C 5010 T		
	Special	C 5010 TS		
C 5015	Common	C 5015 T		
	Special	C 5015 TS		
C 2200	Common	C 2200 T	Red brass	Fine gloss, good flaring and bending properties, drawability and weathering resistance. Applicable to cosmetics cases, water supply and drain pipes, joints, etc.
	Special	C 2200 TS		
C 2300	Common	C 2300 T		
	Special	C 2300 TS		
C 2600	Common	C 2600 T	Brass	Good flaring and bending properties, drawability and properties on plating. Applicable to heat exchangers, curtain rods, sanitary tubes, parts for various apparatuses and machinery, antenna rods, etc. C 2800 has high strength. Applicable to sugar plants, ship, parts for various apparatuses and machinery.
	Special	C 2600 TS		
C 2700	Common	C 2700 T		
	Special	C 2700 TS		
C 2800	Common	C 2800 T		
	Special	C 2800 TS		
C 4430	Common	C 4430 T	Brass for condenser	Good corrosion resistance. Especially, C 6870, C 6871 and C 6872 have excellent sea water resistance. Applicable to condensers for steam and nuclear power plant, condensers for ship, heater and water supply, distillater, oil coolers, heat exchangers for desalinators, etc.
	Special	C 4430 TS		
C 6870	Common	C 6870 T		
	Special	C 6870 TS		
C 6871	Common	C 6871 T		
	Special	C 6871 TS		
C 6872	Common	C 6872 T		
	Special	C 6872 TS		
C 7060	Common	C 7060 T	Cupronickel for condenser	Good corrosion resistance, especially against sea water, and suitable for use at relatively high temperature. Applicable to condensers for ships, heater and water supply, chemical industries use, desalinators, etc.
	Special	C 7060 TS		
C 7100	Common	C 7100 T		
	Special	C 7100 TS		
C 7150	Common	C 7150 T		
	Special	C 7150 TS		
C 7164	Common	C 7164 T		
	Special	C 7164 TS		

5 Quality

5.1 Appearance

Tubes shall have a workmanlike finish and homogeneity, and straight tubes shall be free from defects detrimental to practical use. Tubes in coil may be marked clearly at such detrimental defects, so that the defects can be removed at the time of use.

Judgement of defects detrimental to practical use and marking of such defects shall be subject to the agreement between the purchaser and the manufacturer.

5.2 Chemical composition

The chemical composition of tubes, when tested by 7.2, shall satisfy the requirements given in table 2.

Table 2 Chemical composition of tubes

Unit: %

Alloy No.	Cu	Pb	Fe	Sn	Zn	Al	As	Mn	Ni	P	Si	Co	Cu + Fe + Mn + Ni	Others
C 1020	99.96 min.	—	—	—	—	—	—	—	—	—	—	—	—	—
C 1100	99.90 min.	—	—	—	—	—	—	—	—	—	—	—	—	—
C 1201	99.90 min.	—	—	—	—	—	—	—	—	0.004 or over to and excl. 0.015	—	—	—	—
C 1220	99.90 min.	—	—	—	—	—	—	—	—	0.015 to 0.040	—	—	—	—
C 1565	99.90 min.	—	—	—	—	—	—	—	—	0.020 to 0.040	—	0.040 to 0.055	—	—
C 1862	99.40 min.	—	—	0.07 to 0.12	0.02 to 0.10	—	—	—	0.02 to 0.06	0.046 to 0.062	—	0.16 to 0.21	—	—
C 5010	99.20 min.	—	—	0.58 to 0.72	—	—	—	—	—	0.015 to 0.040	—	—	—	—
C 5015	99.00 min.	—	—	0.58 to 0.72	—	—	—	—	—	0.004 to 0.015	—	—	—	Zr: 0.04 to 0.08
C 2200	89.0 to 91.0	0.05 max.	0.05 max.	—	Re-sidual	—	—	—	—	—	—	—	—	—
C 2300	84.0 to 86.0	0.05 max.	0.05 max.	—	Re-sidual	—	—	—	—	—	—	—	—	—
C 2600	68.5 to 71.5	0.05 max.	0.05 max.	—	Re-sidual	—	—	—	—	—	—	—	—	—
C 2700	63.0 to 67.0	0.05 max.	0.05 max.	—	Re-sidual	—	—	—	—	—	—	—	—	—

Table 2 (concluded)

Unit: %

Alloy No.	Cu	Pb	Fe	Sn	Zn	Al	As	Mn	Ni	P	Si	Co	Cu + Fe + Mn + Ni	Others
C 2800	59.0 to 63.0	0.10 max.	0.07 max.	—	Re-sidual	—	—	—	—	—	—	—	—	—
C 4430	70.0 to 73.0	0.05 max.	0.05 max.	0.9 to 1.2	Re-sidual	—	0.02 to 0.06	—	—	—	—	—	—	—
C 6870	76.0 to 79.0	0.05 max.	0.05 max.	—	Re-sidual	1.8 to 2.5	0.02 to 0.06	—	—	—	—	—	—	—
C 6871	76.0 to 79.0	0.05 max.	0.05 max.	—	Re-sidual	1.8 to 2.5	0.02 to 0.06	—	—	—	0.20 to 0.50	—	—	—
C 6872	76.0 to 79.0	0.05 max.	0.05 max.	—	Re-sidual	1.8 to 2.5	0.02 to 0.06	—	0.20 to 1.0	—	—	—	—	—
C 7060	—	0.05 max.	1.0 to 1.8	—	0.50 max.	—	—	0.20 to 1.0	9.0 to 11.0	—	—	—	99.5 min.	—
C 7100	—	0.05 max.	0.50 to 1.0	—	0.50 max.	—	—	0.20 to 1.0	19.0 to 23.0	—	—	—	99.5 min.	—
C 7150	—	0.05 max.	0.40 to 1.0	—	0.50 max.	—	—	0.20 to 1.0	29.0 to 33.0	—	—	—	99.5 min.	—
C 7164	—	0.05 max.	1.7 to 2.3	—	0.50 max.	—	—	1.5 to 2.5	29.0 to 32.0	—	—	—	99.5 min.	—

5.3 Mechanical properties and physical properties test items

The test items of mechanical properties (tensile strength, elongation and hardness) and physical properties of tubes shall be as given in Annex A.

5.4 Mechanical properties

The mechanical properties (tensile strength, elongation and hardness) of tubes, when tested by 7.3 and 7.4, shall satisfy the requirements in table 3. High strength copper tubes and copper alloy tubes for pressure vessels shall be tested by 7.3, and the resultant minimum proof strength shall satisfy the requirement in table 4. The hardness test shall be performed only when requested by the purchaser, and if the hardness test is applied, the tensile strength and elongation need not be applied.

The mechanical properties of tubes outside the specified range shall be subject to the agreement between the purchaser and the manufacturer.

Table 3 Mechanical properties of tubes

Alloy No.	Temper grade	Product designation	Tensile test				Hardness test ^{a)}				
			Division of out-side diameter mm	Division of wall thickness mm	Tensile strength N/mm ²	Elongation %	Division of wall thickness mm	Vickers hardness HV ^{b)}	Rockwell hardness ^{c)}		
									HR30TS or HR30TW	HR15TS or HR15TW	HRFS or HRFW
C 1020	O	C 1020 T-O C 1020 TS-O	4 or over up to and incl. 100	0.25 or over up to and incl. 30	205 min.	40 min.	0.25 min.	69 max.	—	60 max.	50 max.
	OL	C 1020 T-OL C 1020 TS-OL	4 or over up to and incl. 100	0.25 or over up to and incl. 30	205 min.	40 min.	0.25 min.	73 max.	—	65 max.	55 max.
	½H	C 1020 T-½H C 1020 TS-½H	4 or over up to and incl. 100	0.25 or over up to and incl. 25	245 to 325	—	—	70 to 110	30 to 60	—	—
	H	C 1020 T-H C 1020 TS-H	25 or under Over 25 up to and incl. 50 Over 50 up to and incl. 100	0.25 or over up to and incl. 3 0.9 or over up to and incl. 4 1.5 or over up to and incl. 6	315 min.	—	—	100 min.	55 min.	—	—
						—	—	—	—	—	—
						—	—	—	—	—	—
C 1100	O	C 1100 T-O C 1100 TS-O	5 or over up to and incl. 250	0.5 or over up to and incl. 30	205 min.	40 min.	—	—	—	—	—
	½H	C 1100 T-½H C 1100 TS-½H	5 or over up to and incl. 250	0.5 or over up to and incl. 25	245 to 325	—	—	70 to 110	30 to 60	—	—
	H	C 1100 T-H C 1100 TS-H	5 or over up to and incl. 100	0.5 or over up to and incl. 6	275 min.	—	—	88 min.	—	—	80 min.
				Over 6 up to and incl. 10	265 min.	—	—	83 min.	—	—	75 min.
C 1201 C 1220	O	C 1201 T-O C 1201 TS-O C 1220 T-O C 1220 TS-O	4 or over up to and incl. 250	0.25 or over up to and incl. 30	205 min.	40 min.	0.25 min.	69 max.	—	60 max.	50 max.
		C 1201 T-OL C 1201 TS-OL C 1220 T-OL C 1220 TS-OL									
	OL	C 1201 T-OL C 1201 TS-OL C 1220 T-OL C 1220 TS-OL	4 or over up to and incl. 250	0.25 or over up to and incl. 30	205 min.	40 min.	0.25 min.	73 max.	—	65 max.	55 max.
	½H	C 1201 T-½H C 1201 TS-½H C 1220 T-½H C 1220 TS-½H	4 or over up to and incl. 250	0.25 or over up to and incl. 25	245 to 325	—	—	70 to 110	30 to 60	—	—

Table 3 (continued)

Alloy No.	Temper grade	Product designation	Tensile test				Hardness test ^{a)}				
			Division of outside diameter mm	Division of wall thickness mm	Tensile strength N/mm ²	Elongation %	Division of wall thickness mm	Vickers hardness HV ^{b)}	Rockwell hardness ^{c)}		
									HR30TS or HR30TW	HR15TS or HR15TW	HRFS or HRFW
C 1201 C 1220	H	C 1201 T-H C 1201 TS-H C 1220 T-H C 1220 TS-H	25 or under	0.25 or over up to and incl. 3	315 min.	—	—	100 min.	55 min.	—	—
			Over 25 up to and incl. 50	0.9 or over up to and incl. 4				—	—	—	—
			Over 50 up to and incl. 100	1.5 or over up to and incl. 6				—	—	—	—
			Over 100 up to and incl. 200	2 or over up to and incl. 6	275 min.	—	—	—	—	—	
			Over 200 up to and incl. 350	3 or over up to and incl. 8	255 min.	—	—	—	—	—	—
C 1565	O	C 1565 T-O C 1565 TS-O	4 or over up to and incl. 250	0.15 or over up to and incl. 30	240 min.	35 min.	0.15 min.	73 max.	—	65 max.	—
	½H	C 1565 T-½H C 1565 TS-½H	4 or over up to and incl. 250	0.15 or over up to and incl. 25	270 to 350	—	—	70 to 120	30 to 65	—	—
	¾H	C 1565 T-¾H C 1565 TS-¾H	4 or over up to and incl. 250	0.15 or over up to and incl. 25	295 to 420	—	—	75 to 150	35 to 75	—	—
	H	C 1565 T-H C 1565 TS-H	25 or under	0.15 or over up to and incl. 3	400 min.	—	—	100 min.	55 min.	—	—
			Over 25 up to and incl. 51	0.15 or over up to and incl. 4							
			Over 51 up to and incl. 100	0.3 or over up to and incl. 6	350 min.	—	—	—	—	—	
	C 1862	O	C 1862 T-O C 1862 TS-O	4 or over up to and incl. 250	0.15 or over up to and incl. 30	270 min.	30 min.	0.15 min.	110 max.	—	80 max.
½H		C 1862 T-½H C 1862 TS-½H	4 or over up to and incl. 250	0.15 or over up to and incl. 25	305 to 385	—	—	75 to 150	35 to 75	—	—
¾H		C 1862 T-¾H C 1862 TS-¾H	4 or over up to and incl. 250	0.15 or over up to and incl. 25	325 to 470	—	—	80 to 165	40 to 80	—	—
H		C 1862 T-H C 1862 TS-H	25 or under	0.15 or over up to and incl. 3	450 min.	—	—	110 min.	60 min.	—	—
			Over 25 up to and incl. 51	0.15 or over up to and incl. 4							
Over 51 up to and incl. 100	0.3 or over up to and incl. 6	400 min.	—	—	—	—	—				