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**Methods for determination of
copper in copper and copper alloys**

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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 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 1051** : 1992 is replaced with this Standard.

In this revision, mainly, the review based on the change from the old rules for the layout and drafting of **JIS** to the new rules for the layout and drafting of **JIS** was carried out and ICP emission spectrometry as the method for determination of copper in the copper electrolytic residual solution was added, and in addition the copper electrogravimetric method by separating antimony, selenium, tin, bismuth was added as annex 1 (informative) in order to make it possible to determine copper in the on-market product of which **JIS** is scheduled to be published in the future.

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.

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Methods for determination of copper in copper and copper alloys

Introduction This Japanese Industrial Standard has been prepared based on the first editions of **ISO 1553** *Unalloyed copper containing not less than 99.90 % of copper—Determination of copper content—Electrolytic method* and **ISO 1554** *Wrought and cast copper alloys—Determination of copper content—Electrolytic method* published in 1976 and the corresponding parts, [clause 5, Copper electrogravimetric method (nitric acid · sulphuric acid) and clause 6, Copper electrogravimetric method (nitric acid · hydrofluoric acid · boric acid method)] have been prepared without modifying the technical contents. The clauses [5.5.7 b), 5.5.7 c), 6.5.6 b) and 6.5.6 c)] not given in the original International Standards, are added as provisions that are unique to the Japanese Industrial Standard.

The portions given sidelines or dotted underlines are the matters which have been added to or modified from the original International Standard. A list of modifications with the explanations is given in annex 2 (informative).

1 Scope This Standard specifies the methods for determination of copper in copper and copper alloys (rolled copper products, copper sections, base metals for castings and castings).

Remarks : The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 1553:1976 *Unalloyed copper containing not less than 99.90 % of copper—Determination of copper content—Electrolytic method* (MOD)

ISO 1554:1976 *Wrought and cast copper alloys—Determination of copper content—Electrolytic method* (MOD)

Information : Copper electrogravimetric method by separating antimony, selenium, tin, bismuth is given in annex 1 for information.

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 1012 General rules for chemical analysis of copper and copper alloys

3 General matters The general matters common to the analytical methods shall be in accordance with JIS H 1012.

4 Classification of methods for determination The method for determination of copper shall be in accordance with either one of the following.

The applicable method for determination of each alloy number or symbol of copper and copper alloys shall be as given in table 1.

a) **Copper electrogravimetric method (nitric acid · sulphuric acid method)**

This method applies to the sample not less than 54.0 % (m/m) in copper content, not containing element to generate insoluble residues in electrolyte and to the sample of low content rate of impurity element to electrodeposit together with copper. However, this method does not apply to the sample which contains selenium and/or bismuth.

Remarks : In the case where silver is contained in the sample, the silver to electrodeposit together with copper shall be reported as copper.

b) **Copper electrogravimetric method (nitric acid · hydrofluoric acid · boric acid)**

This method applies to the sample not less than 44.0 % (m/m) and not more than 96.0 % (m/m) in copper content rate. However, this method does not apply to the sample which contains selenium and/or bismuth.

Table 1 Alloy numbers or symbols and applicable methods for determination

Alloy number	Corresponding standard number (informative)	Method for determination		Alloy number	Corresponding standard number (informative)	Method for determination	
		Copper electro-gravimetric method (nitric acid • sulphuric acid)	Copper electro-gravimetric method (nitric acid • hydro-fluoric acid • boric acid)			Copper electro-gravimetric method (nitric acid • sulphuric acid)	Copper electro-gravimetric method (nitric acid • hydro-fluoric acid • boric acid)
C1011	JIS H 2123 JIS H 3510	○		C2100	JIS H 3100 JIS H 3260	○	○
C1020	JIS H 2123 JIS H 3100 JIS H 3140 JIS H 3250 JIS H 3300	○		C2200	JIS H 3100 JIS H 3260 JIS H 3300	○	○
C1100	JIS H 2123 JIS H 3100 JIS H 3140 JIS H 3250 JIS H 3260 JIS H 3300	○		C2300	JIS H 3100 JIS H 3260 JIS H 3300	○	○
				C2400	JIS H 3100 JIS H 3260	○	○
				C2600	JIS H 3100 JIS H 3250 JIS H 3260 JIS H 3300 JIS H 3320	○	○
C1201	JIS H 2123 JIS H 3100 JIS H 3140 JIS H 3250 JIS H 3260 JIS H 3300	○		C2680	JIS H 3100 JIS H 3320	○	○
				C2700	JIS H 3250 JIS H 3260 JIS H 3300	○	○
				C2720	JIS H 3100 JIS H 3260	○	○
C1220	JIS H 2123 JIS H 3100 JIS H 3140 JIS H 3250 JIS H 3260 JIS H 3300 JIS H 3320 JIS H 3401	○		C2800	JIS H 3250 JIS H 3260 JIS H 3300	○	○
				C2801	JIS H 3100	○	○
				C3501	JIS H 3260		○
C1221	JIS H 3100	○		C3560	JIS H 3100		○
C1401	JIS H 3100	○		C3561	JIS H 3100		○
C1700	JIS H 3130	○		C3601	JIS H 3260 JIS H 3260		○
C1720	JIS H 3130 JIS H 3270	○					
C2051	JIS H 3100	○					

Table 1 (continued)

Alloy number	Corresponding standard number (informative)	Method for determination		Alloy number	Corresponding standard number (informative)	Method for determination	
		Copper electro-gravimetric method (nitric acid • sulphuric acid)	Copper electro-gravimetric method (nitric acid • hydro-fluoric acid • boric acid)			Copper electro-gravimetric method (nitric acid • sulphuric acid)	Copper electro-gravimetric method (nitric acid • hydro-fluoric acid • boric acid)
C3602	JIS H 3250 JIS H 3260		○	C6161	JIS H 3100 JIS H 3250	○	○
C3603	JIS H 3250 JIS H 3260		○	C6191	JIS H 3250	○	○
				C6241	JIS H 3250	○	○
C3604	JIS H 3250 JIS H 3260		○	C6280	JIS H 3100	○	○
				C6301	JIS H 3100	○	○
C3605	JIS H 3250		○	C6711	JIS H 3100		○
C3710	JIS H 3100		○	C6712	JIS H 3100		○
C3712	JIS H 3250		○	C6782	JIS H 3250		○
C3713	JIS H 3100		○	C6783	JIS H 3250		○
C3771	JIS H 3250		○	C6870	JIS H 3300		○
C4250	JIS H 3100		○	C6871	JIS H 3300		○
C4430	JIS H 3100 JIS H 3300		○	C6872	JIS H 3300		○
				C7060	JIS H 3100	○	○
C4621	JIS H 3100		○	C7100	JIS H 3300	○	○
C4622	JIS H 3250		○	C7150	JIS H 3100 JIS H 3300	○	○
C4640	JIS H 3100		○				
C4641	JIS H 3250		○	C7164	JIS H 3300	○	○
C5102	JIS H 3110 JIS H 3270		○	C7351	JIS H 3110	○	○
				C7451	JIS H 3110 JIS H 3270	○	○
C5111	JIS H 3110 JIS H 3270		○	C7521	JIS H 3110 JIS H 3270	○	○
C5191	JIS H 3110 JIS H 3270		○				
C5210	JIS H 3130		○	C7541	JIS H 3110 JIS H 3270	○	○
C5212	JIS H 3110 JIS H 3270		○	C7701	JIS H 3130 JIS H 3270	○	○
C5341	JIS H 3270		○	C7941	JIS H 3270		○
C5441	JIS H 3270		○	CACIn201	JIS H 2202		○
C6140	JIS H 3100	○	○	CACIn202	JIS H 2202		○
				CACIn203	JIS H 2202		○

Table 1 (continued)

Alloy number	Corresponding standard number (informative)	Method for determination		Alloy number	Corresponding standard number (informative)	Method for determination	
		Copper electro-gravimetric method (nitric acid • sulphuric acid)	Copper electro-gravimetric method (nitric acid • hydro-fluoric acid • boric acid)			Copper electro-gravimetric method (nitric acid • sulphuric acid)	Copper electro-gravimetric method (nitric acid • hydro-fluoric acid • boric acid)
CACIn301	JIS H 2202		○	CAC302C	JIS H 5121		○
CACIn302	JIS H 2202		○	CAC303	JIS H 5120		○
CACIn303	JIS H 2202		○	CAC303C	JIS H 5121		○
CACIn304	JIS H 2202		○	CAC304	JIS H 5120		○
CACIn401	JIS H 2202		○	CAC304C	JIS H 5121		○
CACIn402	JIS H 2202		○	CAC401	JIS H 5120		○
CACIn403	JIS H 2202		○	CAC401C	JIS H 5121		○
CACIn406	JIS H 2202		○	CAC402	JIS H 5120		○
CACIn407	JIS H 2202		○	CAC402C	JIS H 5121		○
CACIn502	JIS H 2202		○	CAC403	JIS H 5120		○
CACIn503	JIS H 2202		○	CAC403C	JIS H 5121		○
CACIn602	JIS H 2202		○	CAC406	JIS H 5120		○
CACIn603	JIS H 2202		○	CAC406C	JIS H 5121		○
CACIn604	JIS H 2202		○	CAC407	JIS H 5120		○
CACIn605	JIS H 2202		○	CAC407C	JIS H 5121		○
CACIn701	JIS H 2202	○	○	CAC502A	JIS H 5120		○
CACIn702	JIS H 2202	○	○	CAC502B	JIS H 5120		○
CACIn703	JIS H 2202	○	○	CAC502C	JIS H 5120		○
CACIn704	JIS H 2202	○	○	CAC503A	JIS H 5120		○
CACIn801	JIS H 2202		○	CAC503B	JIS H 5120		○
CACIn802	JIS H 2202		○	CAC503C	JIS H 5121		○
CACIn803	JIS H 2202		○	CAC602	JIS H 5120		○
CAC101	JIS H 5120	○		CAC603	JIS H 5120		○
CAC102	JIS H 5120	○		CAC603C	JIS H 5121		○
CAC103	JIS H 5120	○		CAC604	JIS H 5120		○
CAC201	JIS H 5120		○	CAC604C	JIS H 5121		○
CAC202	JIS H 5120		○	CAC605	JIS H 5120		○
CAC203	JIS H 5120		○	CAC605C	JIS H 5121		○
CAC301	JIS H 5120		○	CAC701	JIS H 5120	○	○
CAC301C	JIS H 5121		○	CAC701C	JIS H 5121	○	○
CAC302	JIS H 5120		○				

Table 1 (concluded)

Alloy number	Corresponding standard number (informative)	Method for determination		Alloy number	Corresponding standard number (informative)	Method for determination	
		Copper electro-gravimetric method (nitric acid • sulphuric acid)	Copper electro-gravimetric method (nitric acid • hydro-fluoric acid • boric acid)			Copper electro-gravimetric method (nitric acid • sulphuric acid)	Copper electro-gravimetric method (nitric acid • hydro-fluoric acid • boric acid)
CAC702	JIS H 5120	○	○	CAC704	JIS H 5120	○	○
CAC702C	JIS H 5121	○	○	CAC801	JIS H 5120		○
CAC703	JIS H 5120	○	○	CAC802	JIS H 5120		○
CAC703C	JIS H 5121	○	○	CAC803	JIS H 5120		○

5 Copper electrogravimetric method (nitric acid • sulphuric acid)

5.1 Summary After the sample is decomposed with mixed acid of nitric acid and sulphuric acid, the electrolysis is performed by using platinum electrodes for the copper to be deposited on cathode and the mass is weighed. The copper amount remaining in electrolyte after completion of electrolysis is obtained according to the absorptiometry, atomic absorption spectrophotometry or, ICP emission spectrometry and the deposited copper amount is added.

5.2 Reagents Reagents shall be as follows:

- Mixed acid** Add little by little 300 ml of sulphuric acid to 750 ml of water while mixing with stirring. After cooling, add 210 ml of nitric acid and mix by stirring.
- Aqueous ammonia**
- Citric acid solution** Dissolve 200 g of citric acid monohydrate in water and make the liquid amount 1 000 ml with water.
- Acetaldehyde solution [40 % (m/m)]**
- Oxalyldihydrazide solution** Add 1 000 ml of water to 2.5 g of oxalyldihydrazide $[H_2NNH(CO)_2]_2$, gently heat to dissolve.
- Ethanol (99.5)**
- Standard copper solution (10 $\mu\text{gCu/ml}$)** Weigh out 1.00 g of copper [99.96 % (m/m) min.], transfer to a beaker (200 ml), cover with a watch glass, add 20 ml of nitric acid (1+1), gently heat and decompose. After cooling till ordinary temperature, wash the under surface of watch glass and inner wall of beaker with water, remove the watch glass, transfer the solution to 1 000 ml one mark volumetric flask by using water, dilute with water up to the mark and take it as the stock solution (1 mgCu/ml). At each time of use, dilute this stock solution of only required amount correctly 100 times with water and take it as the standard copper solution.

5.3 Appliances Appliances shall be as follows:

- a) **Electrolytic beaker** As a rule, use the electrolytic beaker shown in figure 1.
- b) **Cylindrical platinum electrode** As a rule, use the cylindrical platinum electrode shown in figure 2.
- c) **Spiral platinum electrode** As a rule, use the spiral platinum electrode shown in figure 3.
- d) **Semi-circular watch glass** As a rule, use the semi-circular watch glass shown in figure 4 (two glasses as one set).

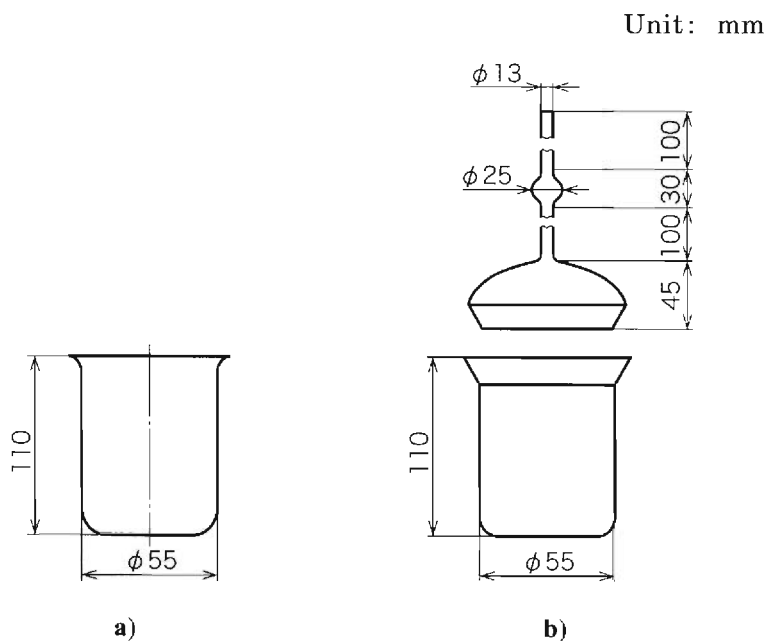


Figure 1 Electrolytic beaker