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JIS Z 3231 : 1999

**Copper and copper alloy  
covered electrodes**

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**Descriptors** : copper, copper alloys, covered electrodes, arc welding

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## Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently **JIS Z 3231 : 1989** is replaced with **JIS Z 3231 : 1999**.

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.

This revision employs **JIS Z 3200 : 1999** *Welding consumables—Technical delivery conditions for welding filler metals—Type of product, dimensions, tolerances and marking* as the normative reference.

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# Copper and copper alloy covered electrodes

- 1 Scope** This Japanese Industrial Standard specifies the covered electrodes used for obtaining deposited metal of copper and copper alloy (hereafter referred to as “electrodes”).
- 2 Normative references** The standards listed in Attached Table 1 contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards shall be applied.
- 3 Classes and types of electrodes** The classes and types of the electrodes shall be as specified in Table 1.

Table 1 Classification of electrodes

| Electrode          |                          |      | Kind of current |
|--------------------|--------------------------|------|-----------------|
| Class of electrode | Constituent system       | Type |                 |
| DCu                | Copper                   | DC   | DC (+)          |
|                    |                          | AC   | AC or DC (+)    |
| DCuSiA<br>DCuSiB   | Silicon bronze           | DC   | DC (+)          |
|                    |                          | AC   | AC or DC (+)    |
| DCuSnA<br>DCuSnB   | Phosphor bronze          | DC   | DC (+)          |
|                    |                          | AC   | AC or DC (+)    |
| DCuAl              | Aluminium bronze         | DC   | DC (+)          |
|                    |                          | AC   | AC or DC (+)    |
| DCuAlNi            | Special aluminium bronze | DC   | DC (+)          |
|                    |                          | AC   | AC or DC (+)    |
| DCuNi-1<br>DCuNi-3 | Cupro-nickel             | DC   | DC (+)          |
|                    |                          | AC   | AC or DC (+)    |

Remarks : The meaning of the symbols for the kind of current is as follows:

AC: alternating current, DC (+): direct current (electrode positive)

- 4 Quality**
- 4.1 Coating** The coating shall be in accordance with 3 of JIS Z 3200.
- 4.2 Chemical composition** The chemical composition of the deposited metal shall comply with the requirements of Table 2 when tested in accordance with 6.2.

Table 2 Chemical composition of deposited metal

Unit : %

| Class of electrode | Chemical composition of deposited metal |            |             |             |               |               |                |             |              |    |                                                       |
|--------------------|-----------------------------------------|------------|-------------|-------------|---------------|---------------|----------------|-------------|--------------|----|-------------------------------------------------------|
|                    | Cu (including Ag)                       | Sn         | Si          | Mn          | P             | Pb            | Al             | Fe          | Ni           | Zn | Total of components <sup>(2)</sup> marked with sign * |
| DCu                | 95.0<br>min.                            | —          | 0.5<br>max. | 3.0<br>max. | 0.30<br>max.  | *0.02<br>max. | *              | *           | *            | *  | 0.50<br>max.                                          |
| DCuSiA             | 93.0<br>min.                            | —          | 1.0 to 2.0  | 3.0<br>max. | 0.30<br>max.  | *0.02<br>max. | *              | —           | *            | *  | 0.50<br>max.                                          |
| DCuSiB             | 92.0<br>min.                            | —          | 2.5 to 4.0  | 3.0<br>max. | 0.30<br>max.  | *0.02<br>max. | *              | —           | *            | *  | 0.50<br>max.                                          |
| DCuSnA             | Remainder                               | 5.0 to 7.0 | *           | *           | 0.30<br>max.  | *0.02<br>max. | *              | *           | *            | *  | 0.50<br>max.                                          |
| DCuSnB             | Remainder                               | 7.0 to 9.0 | *           | *           | 0.30<br>max.  | *0.02<br>max. | *              | *           | *            | *  | 0.50<br>max.                                          |
| DCuAl              | Remainder                               | —          | 1.0<br>max. | 2.0<br>max. | —             | *0.02<br>max. | 7.0 to 10.0    | 1.5<br>max. | 0.5<br>max.  | *  | 0.50<br>max.                                          |
| DCuAlNi            | Remainder                               | —          | 1.0<br>max. | 2.0<br>max. | —             | *0.02<br>max. | 7.0 to 10.0    | 2.0 to 6.0  | 2.0<br>max.  | *  | 0.50<br>max.                                          |
| DCuNi-1<br>(1)     | Remainder                               | —          | 0.5<br>max. | 2.5<br>max. | 0.020<br>max. | *0.02<br>max. | Ti 0.5<br>max. | 2.5<br>max. | 9.0 to 11.0  | *  | 0.50<br>max.                                          |
| DCuNi-3<br>(1)     | Remainder                               | —          | 0.5<br>max. | 2.5<br>max. | 0.020<br>max. | *0.02<br>max. | Ti 0.5<br>max. | 2.5<br>max. | 29.0 to 33.0 | *  | 0.50<br>max.                                          |

- Notes (1) S (sulfur) of DCuNi-1 and DCuNi-3 shall be not more than 0.015 %.
- (2) Where it is foreseeable that the amount of the constituent with the sign \* is negligible, its analysis may be omitted.

4.3 Hardness The hardness of the deposited metals of DCuAl and DCuAlNi shall be tested in accordance with 6.2 and the results shall comply with the requirements of Table 3.

Table 3 Hardness of deposited metal

| Class of electrode | HB       |
|--------------------|----------|
| DCuAl              | 100 min. |
| DCuAlNi            | 120 min. |

4.4 Mechanical properties The tensile strength and elongation of deposited metal shall be tested in accordance with 6.3 and the results shall comply with the requirements of Table 4.

**Table 4 Mechanical properties of deposited metals**

| Class of electrode | Tensile test                          |                 |
|--------------------|---------------------------------------|-----------------|
|                    | Tensile strength<br>N/mm <sup>2</sup> | Elongation<br>% |
| DCu                | 180 min.                              | 20 min.         |
| DCuSiA             | 250 min.                              | 22 min.         |
| DCuSiB             | 270 min.                              | 20 min.         |
| DCuSnA             | 250 min.                              | 15 min.         |
| DCuSnB             | 270 min.                              | 12 min.         |
| DCuAl              | 390 min.                              | 15 min.         |
| DCuAlNi            | 490 min.                              | 13 min.         |
| DCuNi-1            | 270 min.                              | 20 min.         |
| DCuNi-3            | 350 min.                              | 20 min.         |

**4.5 Bendability** The bendability of welded joint shall be tested in accordance with 6.4 and the bent outer surface shall be free from cracks exceeding 3.0 mm in length or defects regarded as harmful extending in any direction.

**5 Dimensions and tolerances** The dimensions and tolerances shall be in accordance with 2 of **JIS Z 3200**. The representative dimensions are given in Table 5.

**Table 5 Representative dimensions of electrodes**

Unit : mm

| Diameter | Length |     |         |
|----------|--------|-----|---------|
| 2.6      | 300    | 350 |         |
| 3.2      | 300    | 350 |         |
| 4.0      |        | 350 | 400 450 |
| 5.0      |        | 350 | 400 450 |
| 6.0      |        |     | 400 450 |

## 6 Tests

### 6.1 Test in general

**6.1.1 Test plate** The test plate shall be as follows.

- The test plate used for chemical analysis test, hardness test and tensile test of the deposited metal shall meet either SS400 of **JIS G 3101** or SM400A to C of **JIS G 3106**.
- The test plate used for guide bend test shall have a thickness of 6 mm and shall correspond to the phosphor deoxidized copper plate (C 1201 or C 1220) specified in **JIS H 3100** for DCu, to the phosphor bronze plate (C 5101) specified in **JIS H 3110** for DCuSnA and DCuSnB, to the cupro-nickel plate (C 7060) specified