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

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**Reference number** : **JIS H 1056** : 1997 (E)

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## Methods for determination of nickel in copper and copper alloys

**Introduction** ISO 1810, *Copper alloys—Determination of nickel (low contents)—Dimethylglyoxime spectrophotometric method* published in 1976 as the first edition, ISO 4742, *Copper alloys—Determination of nickel content—Gravimetric method* and ISO 4743, *Copper alloys—Determination of nickel content—Titrimetric method* published in 1984 respectively as the first edition are the International Standards corresponding to this Standard, but ISO 1810 and ISO 4743 in which chloroform is specified to be used as reagent are not adopted in this Standard in view of the environmental protection.

Copper separation dimethylglyoxime nickel gravimetric method in ISO 4742 is included as a part of Japanese Industrial Standard without changing its technical content.

Moreover, three determination methods of copper separation dimethylglyoxime precipitate separation disodium dihydrogen ethylenediaminetetraacetate and zinc back titration method, atomic absorption method and ICP emission spectral method which are not specified in the International Standards are included in this Standard.

**1 Scope** This Japanese Industrial Standard specifies the methods for determination of nickel in copper and copper alloys (rolled copper products, foundry pig iron and casting).

Remarks 1 Normative reference in this Standard:

JIS H 1012 *General rules for chemical analysis of copper and copper alloys*

2 The following are the International Standards corresponding to this Standard:

ISO 1810 : 1976 *Copper alloys—Determination of nickel (low contents)—Dimethylglyoxime spectrophotometric method*

ISO 4742 : 1984 *Copper alloys—Determination of nickel content—Gravimetric method*

ISO 4743 : 1984 *Copper alloys—Determination of nickel content—Titrimetric method*

**2 General matters** General matters common to the analysis methods shall be as specified in JIS H 1012.

**3 Classification of determination methods** The determination of nickel shall be made by any one of the following methods and the numbers or symbols of the alloys to which each determination method applies are shown in Table 1.

(1) **Copper separation dimethylglyoxime nickel gravimetric method** This method applies to the test sample of nickel content 2.0 % (m/m) and over up to and including 50 % (m/m).

- (2) **Copper separation dimethylglyoxime precipitate separation disodium dihydrogen ethylenediaminetetraacetate and zinc back titration method** This method applies to the test sample of nickel content 1.0 % (m/m) and more up to and including 35 % (m/m).
- (3) **Atomic absorption method** This method applies to the test sample of nickel content 0.01 % (m/m) and over up to and including 7.0 % (m/m).
- (4) **ICP emission spectral method** This method applies to the test sample of nickel content 0.01 % (m/m) and over up to and including 7.0 % (m/m).

**Table 1 Methods for determination and number or symbol of alloys to be analyzed**

| Alloy number or symbol | Number of corresponding standard (for reference) | Method for determination                                     |                                                                                                                                          |                          |                              |
|------------------------|--------------------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------|
|                        |                                                  | Copper separation dimethylglyoxime nickel gravimetric method | Copper separation dimethylglyoxime precipitate separation disodium dihydrogen ethylenediaminetetraacetate and zinc back titration method | Atomic absorption method | ICP emission spectral method |
| C1401                  | JIS H 3100                                       |                                                              |                                                                                                                                          | ○                        | ○                            |
| C1700                  | JIS H 3130                                       |                                                              |                                                                                                                                          | ○                        | ○                            |
| C1720                  | JIS H 3130<br>JIS H 3270                         |                                                              |                                                                                                                                          | ○                        | ○                            |
| C6161                  | JIS H 3100<br>JIS H 3250                         |                                                              | ○ <sup>(2)</sup>                                                                                                                         | ○                        | ○                            |
| C6191                  | JIS H 3250                                       |                                                              | ○ <sup>(2)</sup>                                                                                                                         | ○                        | ○                            |
| C6241                  | JIS H 3250                                       |                                                              | ○ <sup>(2)</sup>                                                                                                                         | ○                        | ○                            |
| C6280                  | JIS H 3100                                       | ○                                                            | ○                                                                                                                                        | ○                        | ○                            |
| C6301                  | JIS H 3100                                       | ○                                                            | ○                                                                                                                                        | ○                        | ○                            |
| C6872                  | JIS H 3250                                       |                                                              |                                                                                                                                          | ○                        | ○                            |
| C7060                  | JIS H 3100<br>JIS H 3300                         | ○                                                            | ○                                                                                                                                        |                          |                              |
| C7100                  | JIS H 3300                                       | ○                                                            | ○                                                                                                                                        |                          |                              |
| C7150                  | JIS H 3100<br>JIS H 3300                         | ○                                                            | ○                                                                                                                                        |                          |                              |
| C7164                  | JIS H 3300                                       | ○                                                            | ○                                                                                                                                        |                          |                              |
| C7351                  | JIS H 3110                                       | ○                                                            | ○                                                                                                                                        |                          |                              |
| C7451                  | JIS H 3110<br>JIS H 3270                         | ○                                                            | ○                                                                                                                                        |                          |                              |
| C7521                  | JIS H 3110<br>JIS H 3130<br>JIS H 3270           | ○                                                            | ○                                                                                                                                        |                          |                              |
| C7541                  | JIS H 3110<br>JIS H 3130<br>JIS H 3270           | ○                                                            | ○                                                                                                                                        |                          |                              |
| C7701                  | JIS H 3130<br>JIS H 3270                         | ○                                                            | ○                                                                                                                                        |                          |                              |
| C7941                  | JIS H 3130<br>JIS H 3270                         | ○                                                            | ○                                                                                                                                        |                          |                              |
| YB5CIn1                | JIS H 2202                                       |                                                              |                                                                                                                                          | ○ <sup>(3)</sup>         | ○ <sup>(3)</sup>             |
| YB5CIn2                | JIS H 2202                                       |                                                              |                                                                                                                                          | ○ <sup>(3)</sup>         | ○ <sup>(3)</sup>             |
| YB5CIn3                | JIS H 2202                                       |                                                              |                                                                                                                                          | ○ <sup>(3)</sup>         | ○ <sup>(3)</sup>             |

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Table 1 (continued)

| Alloy number<br>or symbol | Number of<br>corresponding<br>standard<br>(for reference) | Method for determination                                              |                                                                                                                                                     |                                |                                 |
|---------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------------|
|                           |                                                           | Copper separation<br>dimethylglyoxime<br>nickel gravimetric<br>method | Copper separation dimethylglyoxime<br>precipitate separation disodium dihy-<br>drogen ethylenediaminetetraacetate<br>and zinc back titration method | Atomic<br>absorption<br>method | ICP emission<br>spectral method |
| BCIn1                     | JIS H 2203                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BCIn2                     | JIS H 2203                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BCIn3                     | JIS H 2203                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BCIn6                     | JIS H 2203                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BCIn7                     | JIS H 2203                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| PBCIn2                    | JIS H 2204                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| PBCIn3                    | JIS H 2204                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsCIn1                   | JIS H 2205                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsCIn2                   | JIS H 2205                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsCIn3                   | JIS H 2205                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsCIn4                   | JIS H 2205                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| AlBCIn1                   | JIS H 2206                                                |                                                                       |                                                                                                                                                     | ○                              | ○                               |
| AlBCIn2                   | JIS H 2206                                                | ○ <sup>(1)</sup>                                                      | ○                                                                                                                                                   | ○                              | ○                               |
| AlBCIn3                   | JIS H 2206                                                | ○                                                                     | ○                                                                                                                                                   | ○                              | ○                               |
| AlBCIn4                   | JIS H 2206                                                | ○ <sup>(1)</sup>                                                      | ○                                                                                                                                                   | ○                              | ○                               |
| LBCIn2                    | JIS H 2207                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| LBCIn3                    | JIS H 2207                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| LBCIn4                    | JIS H 2207                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| LBCIn5                    | JIS H 2207                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| YBsC1                     | JIS H 5101                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| YBsC2                     | JIS H 5101                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| YBsC3                     | JIS H 5101                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsC1                     | JIS H 5102                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsC1C                    | JIS H 5102                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsC2                     | JIS H 5102                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsC2C                    | JIS H 5102                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsC3                     | JIS H 5102                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsC3C                    | JIS H 5102                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |

Table 1 (continued)

| Alloy number<br>or symbol | Number of<br>corresponding<br>standard<br>(for reference) | Method for determination                                              |                                                                                                                                                     |                                |                                 |
|---------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------------|
|                           |                                                           | Copper separation<br>dimethylglyoxime<br>nickel gravimetric<br>method | Copper separation dimethylglyoxime<br>precipitate separation disodium dihy-<br>drogen ethylenediaminetetraacetate<br>and zinc back titration method | Atomic<br>absorption<br>method | ICP emission<br>spectral method |
| HBsC4                     | JIS H 5102                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| HBsC4C                    | JIS H 5102                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC1                       | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC1C                      | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC2                       | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC2C                      | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC3                       | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC3C                      | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC6                       | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC6C                      | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC7                       | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| BC7C                      | JIS H 5111                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| PBC2                      | JIS H 5113                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| PBC2B                     | JIS H 5113                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| PBC2C                     | JIS H 5113                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| PBC3B                     | JIS H 5113                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| PBC3C                     | JIS H 5113                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| A1BC1                     | JIS H 5114                                                |                                                                       |                                                                                                                                                     | ○                              | ○                               |
| A1BC1C                    | JIS H 5114                                                |                                                                       |                                                                                                                                                     | ○                              | ○                               |
| A1BC2                     | JIS H 5114                                                | ○ <sup>(1)</sup>                                                      | ○                                                                                                                                                   | ○                              | ○                               |
| A1BC2C                    | JIS H 5114                                                | ○ <sup>(1)</sup>                                                      | ○                                                                                                                                                   | ○                              | ○                               |
| A1BC3                     | JIS H 5114                                                | ○                                                                     | ○                                                                                                                                                   | ○                              | ○                               |
| A1BC3C                    | JIS H 5114                                                | ○                                                                     | ○                                                                                                                                                   | ○                              | ○                               |
| A1BC4                     | JIS H 5114                                                | ○ <sup>(1)</sup>                                                      | ○                                                                                                                                                   | ○                              | ○                               |
| LBC2                      | JIS H 5115                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| LBC3                      | JIS H 5115                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| LBC3C                     | JIS H 5115                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| LBC4                      | JIS H 5115                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |

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**Table 1 (concluded)**

| Alloy number<br>or symbol | Number of<br>corresponding<br>standard<br>(for reference) | Method for determination                                              |                                                                                                                                                     |                                |                                 |
|---------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------------|
|                           |                                                           | Copper separation<br>dimethylglyoxime<br>nickel gravimetric<br>method | Copper separation dimethylglyoxime<br>precipitate separation disodium dihy-<br>drogen ethylenediaminetetraacetate<br>and zinc back titration method | Atomic<br>absorption<br>method | ICP emission<br>spectral method |
| LBC4C                     | JIS H 5115                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| LBC5                      | JIS H 5115                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |
| LBC5C                     | JIS H 5115                                                |                                                                       |                                                                                                                                                     | ○ <sup>(3)</sup>               | ○ <sup>(3)</sup>                |

Notes (1) Does not apply to the sample of nickel content less than 2.0 % (m/m).

(2) Does not apply to the sample of nickel content less than 1.0 % (m/m).

(3) Does not apply to the sample of nickel content less than 0.01 % (m/m).

#### 4 Copper separation dimethylglyoxime nickel gravimetric method

**4.1 Summary** After decomposing the test portion in nitric acid and adding amidosulphuric acid or after decomposing the test portion in mixed acid of nitric acid and sulphuric acid, deposit and separate the copper on the cathode by electrolyzing using platinum electrode. After adding citric acid to the solution and alkalifying it by adding aqueous ammonia, add dimethylglyoxime, filter the precipitate of generated dimethylglyoxime nickel and weigh its mass.

**4.2 Reagents** The reagents shall be as follows:

- (1) Nitric acid
- (2) Nitric acid (1+1, 1+99)
- (3) Perchloric acid
- (4) Hydrobromic acid
- (5) Sulphuric acid (1+100)
- (6) Mixed acid Add 60 ml of sulphuric acid to 150 ml of water little by little by stirring. After cooling down to room temperature, add 42 ml of nitric acid and stir.
- (7) Aqueous ammonia
- (8) Amidosulphuric acid solution (100 g/l)
- (9) Citric acid solution Dissolve 27 g of citric acid monohydrate in water and make the volume of the solution 100 ml with water.
- (10) Dimethylglyoxime solution Dissolve 10 g of dimethylglyoxime into 1 l of ethanol (99.5).

**4.3 Apparatus** The apparatus shall be as follows:

- (1) Electrolytic beaker shown in Fig. 1 is used.

- (2) Cylindrical platinum electrode shown in Fig. 2 is used.
- (3) Spiral platinum electrode shown in Fig. 3 is used.
- (4) Semicircular watch glass shown in Fig. 4 (a set of two glasses) is used.
- (5) Glass filter (1G3)

Unit: mm

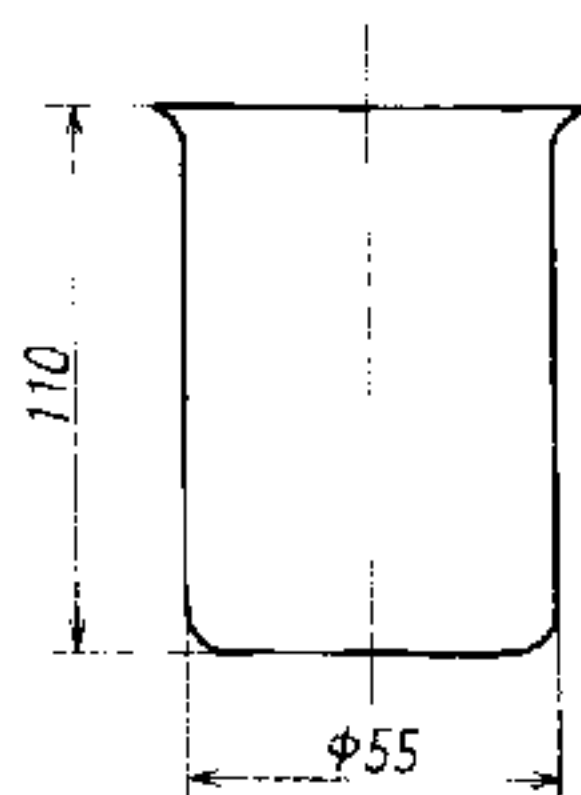


**Fig. 1 Electrolytic beaker**

Unit: mm

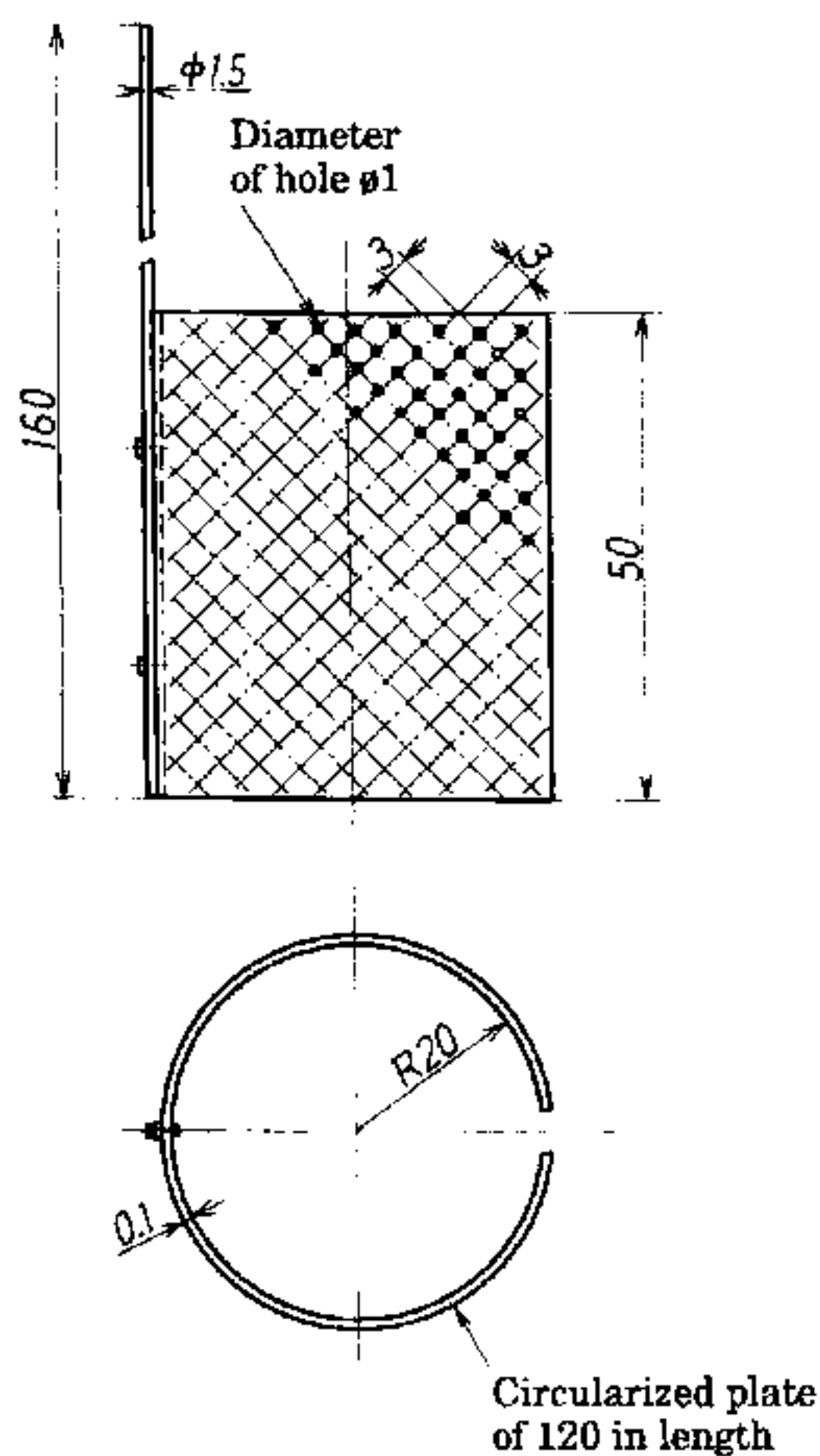


**Fig. 2 Cylindrical platinum electrode**

Unit: mm

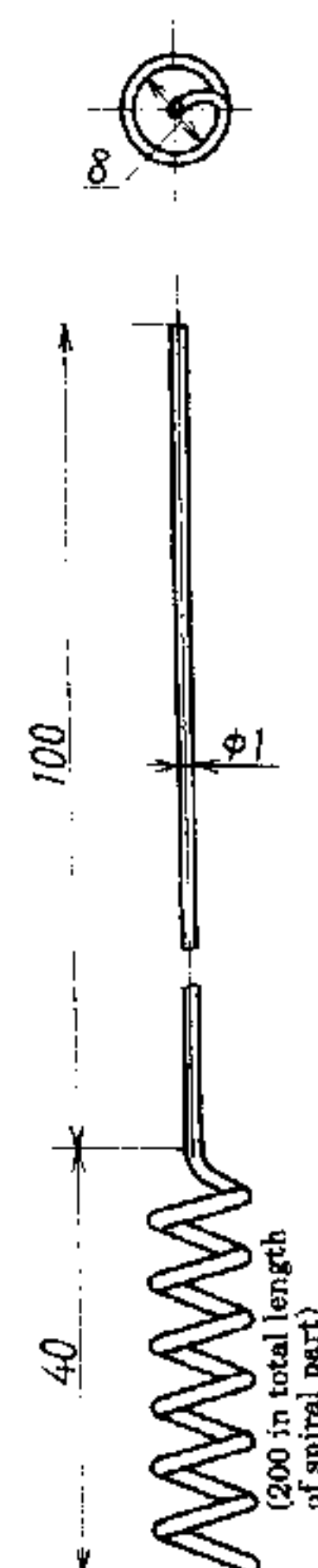


**Fig. 3 Spiral platinum electrode**