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**H 62**

**Nonferrous Metals Industry Standard of the People's Republic of China**

**YS/T 1100-2016**

**Free-cutting copper-nickel-zinc alloy wire for ball pen tips**

**圆珠笔芯用易切削锌白铜线材**

*(English Translation)*

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**FOREWORD**

SAC/TC243 is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

This standard was proposed by China Nonferrous Metals Industry Association./National Nonferrous Metals Standardization Technical Committee.

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard was prepared by National Standardization Technical Committee of Non-ferrous Metals (SAC/TC 243).

**Free-cutting copper-nickel-zinc alloy wire for ball pen tips**

1. **Scope**

This standard specify the requirement，test method, inspection rule and marks，package，transportation，storage，quality and the order (or contract) of the free-cutting copper-nickel-zinc alloy wire for ball pen tips.

This standard is applicable for the free-cutting round copper-nickel-zinc alloy wire (hereinafter referred to as wire) which is used to manufacture the ball pen tips in the field of manufacturing industry.

1. **Normative References**

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 228.1-2010 Metallic materials — Tensile testing — Part 1: Method of test at room temperature

GB/T 2828.1 Counting sampling test procedure Part 1：batch –by –batch sampling plan searched by AQL

GB/T 5121(All parts) Chemical analysis method of copper and copper alloys

GB/T 5231 Designation and chemical composition of the processing copper and copper alloys

GB/T 8888 Packaging, marks transportation, storage and the quality certificate of heavy non-ferrous Metals

GB/T 10567.1 Wrought copper and copper alloys—Detection of residual stress—Mercury nitrate test

GB/T 10567.2 Wrought copper and copper alloys—Detection of residual stress—Ammonia test

GB/T 26048-2010 Free-cutting copper alloy wire

GB/T 26303.2 Method of testing outer dimension of the machinable copper and copper alloy

YS/T 336 Method for testing the copper, nickel and their alloy pipes and bars

YS/T 482 Copper and copper alloy analysis method Photoelectron emission spectroscopy

YS/T 483 Copper and copper alloy analysis method X-ray fluorescence spectrometry (wavelength dispersion type)

YS/T 668 Copper and copper alloys physical and chemical detection sampling method

YS/T 815 Preparation method of mechanical property and processing property of the copper and copper alloys

**3. Requirements**

**3.1 Production classification**

**3.1.1 Designation, Temper,** **and Specification**

The designation, temper and specification of the product shall conform to Table 1.

**Table 1 Designation, Status, and Specification of the product**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Designation | Code | Temper | Diameter/mm | Shape |
| BZn12-37-1.5 | C79860 | 1/2 Hard(H02),  Hard(H04) | 0.5~9.0 | 微信截图_20190308101216.png |
| Bzn12-38-2 | - |
| Note: After consultation of both parties ,the wires can be straight or U-shape | | | | |

**3.1.2 Marking of Products**

The product label is expressed in the order of product name, standard number, designation (code name), status and specification. The example of the label is as follows:

**Example 1:** The round wire made of the BZn12-37-1.5(C79860), the status is hard, the diameter is 2.3mm, can be marked as:

Round wire YS/T 1100-BZn12-37-1.5H04φ2.3

Or Round wire YS/T 1100-C79860TH04–φ2.3

**Example 2:** The hexagon wire made of the BZn12-38-2，the status is 1/2 hard and the diameter is 1.6mm ,can be marked as :

Round wire YS/T 1100–BZn12-38-2H02-φ2.3

**3.2 Chemical composition**

The chemical composition of BZn12-37-1.5(C79860) shall conform to the rules in GB/T 5231.

The chemical composition of BZn12-38-2 shall conform to the rules in Table 2.

**Table 2 Chemical composition of** BZn12-37-1.5(C79860) **wire**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Designation | Chemical composition(mass fraction) | | | | | | | | | |
| Cu | Ni+Co | Mn | Pb | Fe | Si | P | Sn | Zn | Total impurity |
| Bzn12-38-2 | 42.5~44.0 | 11.0~12.3 | 5.0~6.0 | 1.2~2.2 | 0.20 | 0.06 | 0.02 | 0.10 | Margin | 0.56 |
| Note: The elements listed in the list and AI, Cd, Cr, Bi, Sb, As, S was included in total impurity. | | | | | | | | | | |

**3.3 Dimension and the tolerances**

**3.3.1** The diameter of the wire and the tolerances should conform to the regulation of Table 3.

**Table 3 Diameter of wire and tolerance**

Unit : mm

|  |  |
| --- | --- |
| Diameter | Tolerance |
| 0.5~2.0 | ±0.01 |
| ＞2.0~6.0 | ±0.02 |
| ＞6.0~9.0 | ±0.03 |
| Note 1: By mutual agreement between the supplier and the purchaser, the wire with other dimensions and tolerances can be supplied. | |
| If the purchaser requires unidirectional upper and lower tolerances, the values are the double of the corresponding value in the table. | |

**3.3.2** Roundness of the wire should not more than half of the tolerance of diameter.

**3.3.3** The curvature of wire rod shall conform to the requirement in Table 4

**Table 4 Curvature**

Unit: mm

|  |  |
| --- | --- |
| Diameter | Curvature |
| 0.5~9.0 | ≤30 |
| Curvature refers to the maximum height at which a wire is placed on a flat surface and the end of the wire is lifted. | |

**3.4 Mechanical properties**

The longitudinal mechanical properties of the wire rod at the room temperature shall conform to the requiremensts in Table 5.

**Table 5 The longitudinal mechanical properties of the wire**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Designation | Status | Diameter/mm | Tensile strength Rm  MPa | Elongation A100mm  % |
| BZn12-37-1.5  BZn12-38-2 | H02 | 0.5~9.0 | 600~700 | ≥5 |
| H04 | 0.5~9.0 | 650~750 | ≥2 |

**3.5 Residual stress**

Residual stress of wire rod could be tested.

**3.6 Fracture**

The fracture of the wire rod shall be dense without shrinking pores stratification and inclusions. Allow the existing of light defect which has no influence on operating requirement. For the rod with diameters less than 5.0mm, the size and quantity of defects shall conform to the requirements in Table 6. For the rod with diameter not less than 5.0mm, the size and quantity of the defect shall conform to requirements of YS/T 336.

**Table 6 Size and quantity of the defect**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Diameter/mm | Negligible defect diameter/mm | Allowed existing defects | | Distance between two defects /mm |
| Diameter /mm | Quantity |
| 0.5~2.0 | ≤0.01 | ＞0.01～0.05 | ≤2 | ≥0.2 |
| ＞2.0～＜5.0 | ≤0.05 | ＞0.05～0.1 | ≤2 | ≥0.5 |

**3.7 Machinability**

Machinability of wire rod could be tested, the relative cutting rate shall more than 85% (based on the 100% machinability index of the world-recognized US C36000 alloy).

**3.8 Surface quality**

The surface of wire shall be bright and clean. Not allow the existing defect which has influence on the usage of user.

**3.9 Weight of coil (spool)**

**3.9.1** The weight of coil (spool) shall conform to the requirements in Table 7.

**Table 7 Weight of the coil (spool)**

|  |  |  |
| --- | --- | --- |
| Diameter/ mm | Weight of each coil (spool) /kg | |
| Standard coil | Lighter coil |
| 0.5~1.0 | 12±1 | 8±1 |
| ＞1.0～2.0 | 22±1 | 18±1 |
| ＞2.0～4.0 | 25±1 | 22±1 |
| ＞4.0～9.0 | 60±1 | 30±1 |

**3.9.2** The weight of each lot of delivery approved shall not more than 10% of the lighter wire rod coil (spool).

**3.9.3** If buyer has special requirements for the weight of the wire rod coil (spool), the mutual negotiation can be implemented.

**4. Experiment method**

**4.1 Chemical composition**

The analysis method of chemical composition of wires shall conform to the requirements in GB/T 5121 (all parts) or YS/T 482 or YS/T 483. The arbitration of chemical component of wire analysis shall conform to the requirements in GB/T5121 (all parts).

**4.2 Dimension and tolerances**

The measuring method of the external dimensions of the wire shall conform to the requirement in GB/T26303.2.

**4.3 Mechanical property**

The measuring method of mechanical properties at room temperature of the wire rod shall conform to the requirements in GB/T228.1─2010. The wire rod with diameter less than or equal to 4mm, the sampling number shall conform to the requirement in GB/T 288.1-2010, Appendix C, R9; the tensile method of the sample of the wire rod with the diameter more than 4mm shall conform to the requirements in YS/T 815, and crossing the total samples, the original gauge length is 100mm.

**4.4 Residual stress**

The detecting method of the residual stress of wire rod shall conform to the requirement in GB/T 10567.1 or GB/T 10567.2. The arbitration analysis shall conform to the requirement in GB/T 10567.1.

**4.5 Fracture**

The inspection of the wire rod should conform to the requirement in YS/T 336.

**4.6 Machinability**

The mechinability method of the wire rod shall conform to the requirement in GB/T 26048-2010, Appendix B.

**4.7 Surface quality**

The surface quality of wire rod should checked by visual inspection.

**4.8 Weight of the wire coil (spool)**

The weight of the wire coil (spool) shall be detected by the corresponding precision of detection tools.

**5 Conformity with standards**

**5.1 Inspection and acceptance**

**5.1.1** The wire rod shall be inspected by the quality control department of the supplier to ensure the products are in conformity with this standard and with the stipulations of the order (or contract). A quality certificate shall be filled out accordingly.

**5.1.2** Inspection of the products received shall be carried out by the purchaser in accordance with the requirements of this standard. In case of non-conformity with the requirements of this standard or with the stipulations of the contract (or order), the purchaser shall make complaints in writing to the supplier for a solution which shall be discussed and agreed between the two parties within three months after the date of receiving the products. In case of arbitration, sampling shall be carried out by both parties.

**5.2 Lot**

The wire rod shall be inspected in lots with the same designation, temper and specification. The weight of each lot shall not exceed 1000Kg.

**5.3 Inspection Items**

**5.3.1**Each lot of wire shall be detected in chemical component,dimensions,mechanical property,surface quality and the weight of coil (spool).

**5.3.2** If necessary, each batch of wire shall be detected in the fracture, cutting and the residual stress according to the requirement of buyer.

**5.4 Sampling**

The sampling of the wire shall conform to the requirement in Table 8 .The sampling method shall conform to the requirement in YS/T 668 .The preparation for detection of mechanical property shall conform to the requirement in YS/T 815.

**Table 8 Sampling**

|  |  |  |  |
| --- | --- | --- | --- |
| Inspection | Sampling stipulation | Requested chapters number | The chapter number of testing methods |
| Chemical composition | The supplier shall take one specimen from each furnace, while the purchaser shall take one specimen from each lot. | 3.2 | 4.1 |
| Dimensions and tolerances | The specimen shall be taken in accordance with GB/T 2828.1 (test level Ⅱ or the level agreed between the supplier and the purchaser). The acceptance quality limit (AQL) is 2.5. | 3.3 | 4.2 |
| Mechanical properties | Take two coils (spools ) from each lot randomly, one specimen from each coil (spool ) | 3.4 | 4.3 |
| Residual stress | Take two coils (spool ) from each lot randomly, one specimen from each coils (spool ) | 3.5 | 4.4 |
| Fracture | Take two coils (spool) from each lot randomly, one specimen from each coils (spool ) | 3.6 | 4.5 |
| Cutting | Take two coils (spool ) from each lot randomly, one specimen from each coils (spool ) | 3.7 | 4.6 |
| Surface quality | The specimen shall be taken in accordance with GB/T 2828.1 ( the level agree between the supplier and the purchaser). The acceptance quality limit (AQL) is 2.5. | 3.8 | 4.7 |
| Weight of the coil (spool) | Coil by coil (spool by spool) | 3.9 | 4.8 |

**5.5 Evaluation of Inspection Results**

**5.5.1** If the chemical composition of the wire fails to conform to this standard, the entire lot shall be considered as unqualified.

**5.5.2** If the dimensions, tolerances and surface quality of a wire rod fail to conform to this standard, the coil (spool) shall be considered as unqualified. When the quantity of unqualified products in each lot exceeds the AQL, the entire lot shall be considered as unqualified, or the supplier shall inspect the products piece by piece and deliver the qualified products.

**5.5.3** If any test of mechanical properties, residual stress, fracture, and machinability test fails to conform to this standard, double additional specimens shall be taken from the tested lot with one from the unqualified wire, and tested again. If the tests of these double additional specimens meet requirements of this standard, the entire lot shall be considered as qualified. If either of these double additional specimens is substandard, the entire lot shall be considered as unqualified, or the lot shall be re-treated by the supplier.

**5.5.4** If the weight of coil (spool) fails to conform to this standard, the wire shall be discussed and agreed between the two parties

**6 Marking, Packaging, Transportation, Storage and Certificate of Quality**

The marking, packaging, transportation, storage and certificate of quality of the wire shall be in accordance with GB/T 8888.

**7. Contract or Ordering Information**

When ordering the material listed in this standard, the contents of the contract or purchase order shall include the following information:

1. Product name;
2. Designation;
3. Temper;
4. Specification;
5. Weight;
6. Residual stress, fracture, machinability(when required by the purchaser);
7. This standard serial number,YS/T 1100-2016d;
8. Others