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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 3952-2016

Copper drawing stock for electrical purposes

电工用铜线坯

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Foreword

This standard is drafted in accordance with the rules given in GB/T 1.1-2009. This standard replaces GB/T 3952-2008 "Copper drawing stocks for electrical purposes". As compared with GB/T 3952-2008, the main technical changes of this standard are as follows: - In the normative references, DELETE GB/T 238 "Metallic materials - Wire - Reverse bend test"; ADD YS/T 464 "Methods for analytical of copper cathode - The optical emission spectrometry" and GB/T 23606 "Copper-hydrogen embrittlement test method". - MODIFY the content requirements of the impurity element Bi in the designations T2 and TU2, changing its mass fraction from 0.0006% to 0.0005%. - MODIFY the requirements of the total amount of impurities in the designation T3, changing it from 0.05% to 0.06%. - DEFINE the gauge distance for the elongation test sample at 200mm. - UNIFY the gauge distance for the sample of copper powder amount and twist off test into 250mm. - ADD the surface

oxide film indicator requirements of the copper drawing stocks; ADD the oxide film determination method, as shown in Appendix C. - CHANGE the sampling amount for the chemical composition, electrical performance, copper powder amount, and hydrogen embrittlement from every 15 rolls or 30 t into every 15 rolls or 60 ton. - MODIFY the hydrogen embrittlement test method of the oxygen-free copper drawing blanks, changing from the Appendix B hydrogen embrittlement test method of the oxygen-free copper drawing blanks into GB/T 23606 hydrogen embrittlement test method. This standard was proposed by China Nonferrous Metals Industry Association. The standard shall be under the jurisdiction of the National Nonferrous Metals Standardization Technical Committee (SAC/TC 243). The responsible drafting organizations of this standard. Jiangxi Copper Co., Ltd., Yunnan Copper Co., Ltd., Jiangsu Jiangrun Copper Co., Ltd., Tongling Nonferrous Metals Group Holdings Tongguan Electric Co., Ltd. The participating drafting organizations of this standard. Ningbo Jintian Copper (Group) Co., Ltd., Shandong Xiangrui Copper Co., Ltd., Shandong Hengyuan Copper Co., Ltd., CHALCO Kunming Copper Co., Ltd. The main drafters of this standard. Wei Limin, Xiao Hongqiang, Li Donglin, Zhu Xianming, Wang Kesheng, Wang Jianhua, Hu zheping, Wang Yongru, Liu Qingguo, Yan Zhifu, Chen Zhongliang, Yin Jie, Liu Wanrong, Wang Jinmei, Zhang Yong, Liu Haifeng, Wu Yucai, Li Gang. This Standard replaces the standard previously issued as follows: - GB/T 3952.1-1989, GB/T 3952.2-1989, GB/T 3952.3-1989, GB/T 3952-1998, GB/T 3952-2008. - GB/T 3954.1-1989. Copper drawing stock for electrical purpose

1 Scope

China's national standard for the copper rod from which electrical wire is drawn. It specifies the requirements, the test methods, the inspection rules and the marking, packaging and transport. This rod is the starting point of essentially all electrical conductor manufacture: continuously cast and rolled at eight millimetres diameter, it is drawn down through successive dies to everything from busbar to the hair-fine wire in a motor winding. Two properties define it and they pull against each other. Conductivity must be as high as possible, which means the copper must be almost free of the elements that dissolve in it and scatter electrons - phosphorus, iron, silicon and arsenic are damaging at a few parts per million. And it must draw without breaking, over reductions of several thousand times without an intermediate anneal, which depends on freedom from oxide inclusions and surface defects. A single inclusion causes a wire break that stops a machine and wastes the coil.

This standard specifies the requirements, test methods, inspection rules, marking, packaging, transport, storage, quality certificates, and orders (or contracts) contents of the copper drawing stock for electrical purposes. This standard applies to the circular cross-section copper wire stock having a diameter of

35.0 mm, which is used for further drawing to produce wire materials OR for other copper

conductors for electrical purposes.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this Standard.

GB/T 230.1 Metallic materials - Rockwell hardness test - Part

3.1 Product classification

3.1.1 Designation, status, specifications The designations, status and specifications of the copper drawing stock shall comply with the provisions of Table 1.

3.2 Chemical composition

3.2.1 The chemical compositions of the copper drawing stock having designations T1 and TU1 shall comply with the provisions of Table 2, wherein the oxygen content of T1 shall not be greater than 0.040%, AND the oxygen content of TU1 shall not be greater than 0.0010%.

3.3 Dimension and its allowable deviation

3.3.1 The diameter of copper drawing stock and its allowable deviation shall comply with the requirements in Table 5.

3.3.2 The copper drawing stock shall be supplied in rolls, each roll shall be continuous and one piece, AND it is not allowed for welding. The minimum weight of a roll shall be not less than 1 t, BUT it is allowed for both parties to determine the supply weight through negotiation.

3.4 Surface quality

3.4.1 The copper drawing stock shall be round and complete, the dimension is uniform (complying with the requirements of 3.3.1), AND it may be directly used without the need of pickling and peeling off.

3.6 Torsional performance The copper drawing stock having a diameter of

10.0 mm (M20, M07 status) shall be subjected to the twist off test, AND the torsional performance of the copper drawing stock of different designations shall comply with the provisions of Table 7.

3.8 Other requirements for copper drawing stock

3.8.1 Copper powder amount As for the copper drawing stock which is produced by the continuous casting and rolling process, if required by the user AND indicated in the contract, it shall be subjected to the copper powder amount test using the method in Appendix A (only applicable to the copper drawing stock of $\Phi 8$ mm). As for the copper drawing stock for enameled wire, the copper powder amount shall not exceed 8 mg/250 mm; AND the copper powder amount of other copper drawing stock shall not be greater than 15 mg/250 mm.

4 Test method

4.1 Chemical composition The chemical composition analysis method of copper drawing stocks may follow the requirements of GB/T 5121 (all parts) or YS/T 464. The arbitration analysis method shall be in accordance with GB/T 5121 (all parts).

4.2 Dimensional measurement The method of measuring the size of copper drawing stock shall be in accordance with the provisions of GB/T 4909.2.

4.3 Surface quality The surface quality of copper drawing stocks is visually inspected AND the surface oxide film test is carried out with reference to Appendix C.

4.6 Electrical performance

4.6.1 The test methods for the resistivity of copper drawing stock shall be in accordance with the requirements of GB/T 3048.2.

4.6.2 It shall prepare sample for the resistivity test using the following methods. CLEAN and PROCESS the sample to such an extent as having a diameter of 2 mm; REMOVE oil stain; MAKE it subjected to annealing in the 500 °C ~ 550 °C protective atmosphere for 30 min; then in the same protective atmosphere, COOL it down quickly OR quickly TRANSFER it from air into water for cooling purposes.

4.7 Amount of copper powder The test of the copper powder amount of the copper drawing stock is carried out in accordance with the method of Appendix A, OR in accordance with the OR the method determined by consultation between the supplier and the purchaser.

4.8 Hydrogen embrittlement The hydrogen embrittlement test method of the oxygen-free copper drawing stock shall be in accordance with the requirements of GB/T 23606.

5.1 Inspection and acceptance

5.1.1 The copper drawing stock shall be inspected by the quality supervision department of the supplier to ensure that the product quality complies with the requirements of this standard or the order (or contract), AND meanwhile the quality certificate shall be filled.