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

GB/T 8891-2013

Replacing GB/T 8891-2000

Tube of copper and copper alloy for heat radiator

铜及铜合金散热管

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1 Scope

The standard lays down the requirements, test methods and inspection rules for copper and copper alloy heat radiator tube, together with its marking, packaging, transport and storage, its quality certificate and the content of the contract or order form. The tube is referred to throughout by a short name.

It applies to copper and copper alloy radiator tube used in the radiators of power machinery such as tanks, motor cars, locomotives and tractors.

2 Normative references

The clause carries the usual formula on dated and undated references, followed by the list of documents: GB/T 228.1-2010 on the tensile testing of metallic materials at room temperature, a modified adoption of ISO 6892-1:2009; GB/T 2828.1 on sampling procedures for inspection by attributes, indexed by acceptance quality limit; GB/T 5121, all parts, on methods of chemical analysis of copper and copper alloys; GB/T 5231 on the chemical composition and product forms of wrought copper and copper alloys; GB/T 5248 on eddy current testing of seamless copper and copper alloy tube; GB/T 8888 on the packaging, marking, transport and storage of wrought heavy non-ferrous metal products; GB/T 10567.2 on the ammonia fumigation method for testing residual stress in wrought copper and copper alloys; GB/T 26303.1 on the inspection of the outside dimensions of wrought copper and copper alloy products, part 1 on tube; and YS/T 482 on the optical emission spectrometric method of analysis of copper and copper alloys.

3 Requirements

3.1.1 The grade, the temper and the dimensions of the tube are to conform to Table 1. That table is laid out in six columns: grade, code, temper, and three dimension columns for round tube (diameter by wall thickness), flat tube (width by height by wall thickness) and rectangular tube (long side by short side by wall thickness), followed by a length column. The grades and their codes are TU0 with code T10130, T2 with T11050, H95 with T21000, H90 with T22000, H85 with T23000, H80 with T24000, H68 with T26300, HAs68-0.04 with T26330, H65 with T27000, H63 with T27300, and HSn70-1 with T45000. TU0 is supplied in the drawn hard and the light drawn tempers; T2 and H95 in drawn hard; H90, H85 and H80 in light drawn; H68, HAs68-0.04, H65 and H63 in the light annealed temper; and HSn70-1 in the soft annealed temper. TU0 is listed for round tube only, and the length range that spans the whole table runs from 250 mm to 4 000 mm. A note allows tube of other grades or other sizes to be supplied where supplier and purchaser agree.

3.1.2 The product designation is written in the order product name, standard number, grade, temper and dimensions. Three examples are printed. A round tube of TU0, outside diameter 15 mm, wall 0.50 mm, length 517 mm, light drawn temper, ordinary class, is designated round tube GB/T 8891-TU0 H55-15 by 0.50 by 517, the diameter carrying the diameter symbol. A flat tube of H95, width 22 mm, height 4.0 mm, wall 0.25 mm, length 1

020 mm, drawn hard temper, high precision class, is designated flat tube GB/T 8891-H95 H80 high precision-22 by 4.0 by 0.25 by 1 020. A rectangular tube of H68, long side 20 mm, short side 10 mm, wall 0.30 mm, length 1 500 mm, light annealed temper, ordinary class, is designated rectangular tube GB/T 8891-H68 O50-20 by 10 by 0.30 by 1 500.

3.2 The chemical composition of the tube is to conform to the provisions for the corresponding grade in GB/T 5231.

3.3.1 Figure 1 shows the cross-sections of the three tube shapes, round, rectangular and flat, the flat tube carrying a corner radius equal to half the height. The outside dimensions and permissible deviations are to conform to Tables 2, 3 and 4. Table 2 covers round tube and is laid out in six columns: outside diameter, its permissible deviation for the ordinary class and for the high precision class, wall thickness, and its permissible deviation for the same two classes; three diameter bands and six wall thickness bands are listed. Table 3 covers flat tube and Table 4 rectangular tube, each in nine columns holding width or long side, height or short side and wall thickness, every one of them with its ordinary and high precision deviation, and each carrying four wall thickness bands. The notes under all three tables state that an order to the high precision class is to say so in the contract and that tube is supplied to the ordinary class where the contract is silent; the note under Table 2 adds that the deviation on the outside diameter takes in the deviation on roundness.

3.3.2 The length of the tube and its permissible deviation are to conform to Table 5, which sets three length bands, up to 1 000 mm, above 1 000 mm and up to 2 000 mm, and above 2 000 mm and up to 4 000 mm, against a permissible deviation that is positive and stated as not greater than a given value.

3.3.3 The straightness of the tube is to conform to Tables 6 and 7. Table 6 covers round tube in two columns, length band against straightness not greater than a stated value, with four length bands, the first three expressed over the full length and the last per metre. Table 7 covers flat and rectangular tube with the same four length bands and two straightness columns, one in the plane of the long dimension and one in the plane of the short dimension.

3.3.4 The twist of flat and rectangular tube is to conform to Table 8, laid out in the same two columns of length band against twist not greater than a stated value, again with the first three bands taken over the full length and the last per metre.

3.3.5 The ends of the tube are to be sawn flat and left free of burrs, and the obliquity of the cut end face is to conform to Tables 9 and 10. Table 9 covers round tube, with one value for outside diameters up to 16 mm and a percentage of the outside diameter above that. Table 10 covers flat and rectangular tube in the same form, the governing dimension being the width of the flat tube or the long side of the rectangular tube.

3.4 The longitudinal room-temperature mechanical properties of the tube are to conform to Table 11, which is laid out in four columns: grade, temper, tensile strength in megapascals

not less than the value given, and elongation after fracture as a percentage not less than the value given. Rows are printed for T2, TU0 in two tempers, H95, H90, H85, H80, the light annealed group and HSn70-1, and the elongation cell is left as a dash for the drawn hard rows.

3.5 The tube is to show no leakage when the air pressure test is carried out.

3.6 Where the purchaser so requires and says so in the contract, the supplier is to carry out an eddy current test, the artificial standard defect, that is the drilled hole diameter, conforming to GB/T 5248.

3.7 Where the purchaser so requires and says so in the contract, brass tube in the drawn hard and the light drawn tempers is to be given a stress relieving anneal, and is to show no cracking after the residual stress test.

3.8.1 The inner and outer surfaces of the tube are to be smooth and clean and free from cracks, pinholes, peeling, blisters, inclusions and green rust. 3.8.2 Slight, local defects such as scratches, dents and spots are allowed on the surface where they do not carry the shape of the tube or its wall thickness outside the permissible deviations.

4 Test methods

4.1 The chemical composition of the tube is analysed under GB/T 5121 and YS/T 482; in the event of arbitration, GB/T 5121 governs.

4.2 The outside dimensions of the tube are inspected under GB/T 26303.1.

4.3 The longitudinal room-temperature tensile test is carried out under GB/T 228.1-2010, the tensile specimen being selected from Table 12. That table is laid out in five columns: the outside diameter or the flat tube width, the rectangular tube long side included; the wall thickness; the annex of GB/T 228.1-2010 to be used; the table within that annex; and the specimen number. Two rows are printed, one for dimensions up to 30 mm and one for dimensions above 30 mm and up to 50 mm, the second offering a choice of two tables and two specimen numbers.

4.4 In the air pressure test the tube is kept connected to a pressurized air source, the test air pressure being 0.4 MPa. The tube is fully immersed in water and the pressure held for 60 s, during which no bubbles are to appear.

4.5 The eddy current test of the tube is carried out under GB/T 5248. 4.6 The residual stress test is carried out under GB/T 10567.2. 4.7 The surface quality of the tube is inspected visually.

5 Inspection rules

5.1.1 The tube is inspected by the technical supervision department of the supplier, which