GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS77.150.30

H 62

GB/T 17791-2017

Replacing GB/T 17791-2007

Seamless copper and copper alloys tube for air conditioner and refrigeration equipment

空调与制冷设备用铜及铜合金无缝管

Issued on: July 12, 2017 **Implemented on: February 01, 2018**

Issued by: General Administration of Quality Supervision, Inspection and Quarantine;

Standardization Administration of PRC.

Table of Contents

Seamless copper and copper alloys tube for air conditioner and refrigeration equipment

1 Scope

This standard specifies the requirements, test methods, inspection rules, packaging, marking, transportation, storage, quality certificates and purchase orders (or contracts) of seamless copper and copper alloys tube for air conditioner and refrigeration equipment.

This standard applies to seamless copper and copper alloys tube (hereinafter referred to as tubes) for household air conditioners, refrigerators (freezers), small and medium-sized central air conditioners, refrigeration equipment.

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

GB/T 242 Metal materials - Tube - Drift-expending test

GB/T 246 Metal materials - Tube - Flattening test

GB/T 2828.1 Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

GB/T 5121 (all parts) Copper and copper alloy - Chemical analysis methods

GB/T 5231 Designation and chemical composition of wrought copper and copper alloys

GB/T 5248-2016 Electromagnetic (eddy-current) examination of copper and copper alloy seamless tube

GB/T 8888 Wrought heavy non-ferrous metal products - Packing, marking, transportation, storing and certificate of quality

GB/T 23606 Copper - Hydrogen embrittlement test method

The flattening test of the tube is carried out according to the requirements of GB/T 246.

4.6 Eddy current flaw testing

The eddy current flaw testing of the tube shall be carried out in accordance with the provisions of GB/T 5248.

4.7 Grain size

The grain size inspection of the tube shall be carried out according to the requirements of YS/T 347.

4.8 Hydrogen embrittlement test

The hydrogen embrittlement test of the tube is carried out according to the closed bending method in GB/T 23606. The repeated bending method in GB/T 23606 is used for arbitration; the number of bending is at least 6 times.

4.9 Cleanliness

The inspection of internal surface residues (total) of tubes with an outer diameter of ≤ 30 mm shall be carried out in accordance with Appendix A. The test method for internal surface residues (total) of tubes with an outer diameter of > 30 mm shall be carried out by the method agreed between the supplier and the buyer. The inspection of oil, moisture, chloride ion (Cl^-), paraffin can be carried out according to the provisions of Appendix B, Appendix C, Appendix D, Appendix E, or according to the test method agreed by the supplier and the buyer.

4.10 Surface quality

Visually inspect the surface quality of the tube.

5 Inspection rules

5.1 Inspection and acceptance

5.1.1 The product shall be inspected by the supplier, to ensure that the product quality meets the requirements of this standard and the purchase order (or contract). Meanwhile it shall fill in the quality certificate.

5.1.2 The purchaser shall inspect the products received in accordance with the provisions of this standard. When the inspection result is inconsistent with the provisions of this standard and the purchase order (or contract), it shall be submitted to the supplier in written form; the supplier and the buyer shall negotiate and resolve. Objections related to surface quality and dimensional

h) Net weight;

i) Copper tubes for refrigerators (if they are copper tubes for refrigerators, they must be marked);

j) Implemented standards;

k) Production license number and QS identifier;

l) Others.

6.1.2 Packaging box marking

The packaging box mark of the tube shall comply with the requirements of GB/T 8888.

6.2 Packaging

6.2.1 The packaging of tubes shall meet the requirements of GB/T 8888. The coil shall be sealed after being filled with protective gas.

6.2.2 When there are special requirements for packaging, the supplier and the buyer shall negotiate and determine it.

6.3 Transport, storage and quality certificate

The transport, storage and quality certificate of the tube shall meet the requirements of GB/T 8888.

7 The content of the purchase order (or contract)

The purchase order (or contract) of the materials listed in this standard shall include the following:

a) Material name;

b) Alloy designation;

c) Status;

d) Size (diameter, wall thickness or other size requirements of the tube);

e) Delivery shape;

f) Weight;

g) Flattening test (when required);

Appendix A

(Normative)

Method for determination of residue (total) on the inner surface of copper tube

A.1 Scope

This Appendix specifies the determination method for the internal surface residue (total) of copper tubes.

This Appendix is applicable to the determination of non-volatile oil and solid residues remaining on the inner surface of copper tubes which have an outer diameter ≤ 30 mm.

A.2 Method summary

Clean the inner surface of the copper tube by the use of organic solvents such as carbon tetrachloride; extract the residue on the inner surface of the tube into the solvent. After the organic solvent is heated and evaporated in the beaker, the increase in the mass of the beaker is the residue in the tube.

A.3 Instruments and reagents

A.3.1 Ultrasonic oscillator: The power is not less than 2 kW; effective volume is not less than 70 L.

A.3.2 Analytical balance (graduation value 0.1 mg).

A.3.3 Solvent (analytical pure carbon tetrachloride or trichloroethylene).

A.4 Test procedure

A.4.1 Clean the beaker. Dry it in an oven at 105 °C ± 5 °C for 60 minutes. Take it out and put it in a desiccator. Weigh it for use after 60 minutes.

A.4.2 Cut the specimen: When the inner diameter of the tube is ≥ 5 mm, the length of the sample is 1.5 m. When the inner diameter of the tube is less than 5 mm, the length of the sample is 2 m. Use a tube cutter for cutting to avoid copper chips.

A.4.3 Bend the specimen into a U shape. Lay it flat on the bench. Then bend the two ends upward.

A.4.4 Use a syringe to inject a quantitative solvent (A.3.3) into the specimen to nearly full. Carefully put it into the ultrasonic oscillator (A.3.1). Shake it for 10

Appendix B

(Informative)

Determination method of oil content on inner surface of copper tube

B.1 Scope

This Appendix specifies the determination of trace residual oil in copper tubes.

This Appendix applies to the determination of residual oil on the inner surface of copper tubes.

B.2 Method summary

Use a special solvent to dissolve the residual oil in the tube. There is a characteristic absorption line of C-H bond at the wavelength of 3.4 μm ~ 3.5 μm in the infrared region. Perform quantitative analysis of the intensity of the spectrum, to yield the content of the oil.

B.3 Instruments and reagents

B.3.1 Oil content analyzer (analysis accuracy: 0.1 mg/L).

B.3.2 Extractant (H-997, S-316, carbon tetrachloride, etc.).

B.4 Test procedure

B.4.1 Sample preparation

Take a copper tube which has a length of 1 m. Place it at an inclination of about 70°. Use a syringe to draw 20 mL of S-316 and inject it from the upper port of the copper tube. Put a clean beaker on the lower end for receiving. Flush 4 times and receive a volume of about 80 mL.

B.4.2 Warm-up the instrument

Turn on the instrument and warm-up for 20 minutes until the heating indicator (WARM UP) goes out. Place a 200 mL beaker at the solvent discharge port, to receive and discharge the solvent.

B.4.3 Zero calibration

B.4.3.1 Press the mode key (MODE) until the calibration (CAL) light is on; press the enter key (ENT) to enter the zero calibration state.

B.4.3.2 Use a syringe to extract 20 mL of S-316 extractant; inject it from the

Appendix C

(Informative)

Method for determination of inner surface moisture of copper tube

C.1 Scope

This Appendix specifies the method for determining the inner surface moisture of copper tubes.

This Appendix applies to the determination of residual moisture on the inner surface of copper tubes.

C.2 Method summary

Dry nitrogen is used to bring the moisture in the copper tube into the detector, where it is absorbed by P_2O_5, electrolyzed into hydrogen and oxygen, then converted into moisture content by integrating the power consumption.

C.3 Instruments

Moisture analyzer (analysis accuracy: 1 mg).

C.4 Test procedure

C.4.1 Sample preparation: Take a sample of 1 m ~ 2 m long from the finished tube sealed at both ends; seal both ends of the sample.

C.4.2 Connect the gas source; first open the main valve of the nitrogen cylinder; then slowly open the pressure reducing valve, to maintain a flow rate of 70 mL/min ± 20 mL/min.

C.4.3 Turn on the power (turn the power switch on) and press the "zero" button. At this time, the instrument displays a higher value. As the air flow system gradually dries, the displayed value gradually decreases, until it drops below 0.050 mg and basically stable (the lower the better).

C.4.4 Zero adjustment: After pressing the zero adjustment key, first turn the "zero adjustment" knob to the left; when the displayed value is less than 0.050 mg (the smaller the better), turn the zero adjustment knob to the right, (clockwise) to decrease the displayed value, until the display value is 0.001 mg ~ 0.005 mg (cannot be adjusted to display 0.000 mg); after zero adjustment, the position of this knob is fixed during the following continuous measurement process.

Appendix D

(Informative)

Determination method of chloride ion (Cl^-) on the inner surface of copper tube

D.1 Scope

This Appendix specifies the determination method of chloride ion (Cl^-) on the inner surface of copper tubes.

This Appendix applies to the determination of chloride ions (Cl^-) on the inner surface of copper tubes.

D.2 Method summary

After the chloride ions on the inner surface of the tube are dissolved, the anions in the solution are separated by a high-performance chromatographic column; various components are detected in the conductivity cell; the response of the standard sample and the tested sample is compared by the conductivity cell, to determine the concentration of ions in the sample.

D.3 Instruments and reagents

D.3.1 Ion chromatograph's detection limit: 10 μg/L, instrument accuracy: 1 μg/L.

D.3.2 Eluent: 0.0035 mol/L Na_2CO_3 + 0.001 mol/L $NaHCO_3$.

D.3.3 Standard solution: NaCl standard solution, Cl^- content 50 μg/L.

D.3.4 Pure water: Conductivity is less than 0.1 μS/cm.

Note: The solvent water used in this determination method is pure water.

D.4 Test procedure

D.4.1 Sample preparation: Take a 1 m-long copper tube. Fill it with eluent (D.3.2) by a syringe. Record the volume V (mL) of eluent injected. After soaking for 2 h, pour it into a beaker that has been washed and dried in advance by pure water.

D.4.2 Turn on the power switch on the front panel of the instrument, the (Column A) light is on. Press the (Pump) button to turn on the pump power. After 2 minutes, there is water flowing out of the suppressor; press the (SRS) button to turn on the suppressor power.

Appendix E

(Informative)

Analysis method of paraffin wax on inner surface of copper tube

E.1 Scope

This Appendix specifies the quantitative and qualitative determination of residual paraffin inside copper tubes.

This Appendix applies to the determination of residual paraffin on the inner surface of copper tubes.

E.2 Method summary

Use an organic solvent to dissolve the residual organic matter in the tube. Heat the organic solvent to volatilize. Use ethanol to dissolve the residue. Place it at low temperature. Determine the paraffin residue in the tube by the amount of precipitate.

E.3 Instruments and reagents

E.3.1 Household refrigerators (freezing temperature lower than -18 °C).

E.3.2 Carbon tetrachloride (analytical grade).

E.3.3 Anhydrous ethanol (analytical purity).

E.3.4 Paraffin wax (oil content ≤ 5%).

E.4 Standard solution preparation

E.4.1 Weigh 0.1 g of paraffin wax in a 100 mL beaker. Add hot ethanol (E.3.3) to dissolve it and pour it into a 1000 mL volumetric flask. Use hot ethanol (E.3.3) to rinse the beaker and pour it into the volumetric flask. After the beaker is rinsed, the volumetric flask is cooled; use absolute ethanol to make the volume reach to 1000 mL; the paraffin concentration of this solution is 0.1 mg/mL.

E.4.2 Take out 20 mL from the volumetric flask in E.4.1 and place it in a 100 mL volumetric flask. Use absolute ethanol to make the volume reach to the mark. The paraffin concentration is 0.02 mg/mL.

E.4.3 Take out 5 mL, 10 mL, 15 mL, 20 mL, 25 mL from the 100 mL volumetric flask in E.4.2, respectively; place them in a 50 mL colorimetric tube; use absolute ethanol to make the volume reach to 25 mL, then the colorimetric tube contains 0.1 mg, 0.2 mg, 0.3 mg, 0.4 mg, 0.5 mg of paraffin respectively.

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------