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Koppar och kopparlegeringar – Förbränningsmetod för bestämning av kolhalten på innerytan i kopparrör och kopplingar

Copper and copper alloys – Combustion method for determination of the carbon content on the inner surface of copper tubes or fittings

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Denna standard ersätter SS-EN 723, utgåva 1.

The European Standard EN 723:2009 has the status of a Swedish Standard. This document contains the official English version of EN 723:2009.

This standard supersedes the Swedish Standard SS-EN 723, edition 1.

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EUROPEAN STANDARD
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EN 723

April 2009

ICS 77.150.30

Supersedes EN 723:1996

English Version

Copper and copper alloys - Combustion method for determination of the carbon content on the inner surface of copper tubes or fittings

Cuivre et alliages de cuivre - Méthode de détermination par combustion de la teneur en carbone à la surface interne des tubes ou des raccords en cuivre

Kupfer und Kupferlegierungen - Verfahren zur Bestimmung des Kohlenstoffs auf der Innenoberfläche von Kupferrohren oder Fittings durch Verbrennen

This European Standard was approved by CEN on 19 March 2009.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Contents

Page

Foreword 3
1 Scope 4
2 Terms and definitions 4
3 Principle 4
4 Preparation of samples and test pieces 4
4.1 Preparatory procedures 4
4.1.1 General 4
4.1.2 Residual carbon content 5
4.1.3 Total carbon content 5
4.1.4 Potential carbon content 5
4.2 Preparation of samples 5
4.2.1 Tubes 5
4.2.2 Fittings 5
4.3 Cleaning of sample surfaces 5
4.3.1 Cleaning of inner surface of sample 5
4.3.2 Cleaning of outer surface of sample 6
4.4 Preparation of test pieces 7
4.4.1 Tubes 7
4.4.2 Fittings 8
5 Method for carbon content determination 9
5.1 General 9
5.2 Determination of the carbon content 10
5.3 Determination of the blank value 10
6 Expression of results 10
7 Calibration 11
8 Test report 11
Bibliography 12

Foreword

This document (EN 723:2009) has been prepared by Technical Committee CEN/TC 133 “Copper and copper alloys”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2009, and conflicting national standards shall be withdrawn at the latest by October 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 723:1996.

In comparison with the first edition of EN 723:1996, the following significant technical changes and one significant editorial change were made:

— improvement of the accuracy of the method;

— extension of the scope of the standard to fittings of copper alloys;

— simplification by limitation to only one method for carbon content determination, namely that of infrared absorption spectrometry:

  [Method using tetrabutylammonium hydroxide (HTBA) and Method of determination by measurement of differential electrical conductivity (coulometric) deleted];

— simplification by limitation to only one cutting method for tubes with diameters exceeding the furnace diameter by deletion of the "longitudinal cutting method";

— change of Clause 2 "Normative References" into "Bibliography" with renumbering.

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1 Scope

This European Standard specifies a combustion method for determining the carbon content, if any, on the inner surface of tubes of copper or fittings of copper or copper alloys.

This standard applies only to seamless, round copper tubes as specified for example in EN 1057 and EN 13348 or fittings of copper or copper alloys as specified in EN 1254 (all parts).

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

2.1
residual carbon
C_R
carbon present in the chemical form of elemental carbon

2.2
potential carbon
C_P
carbon present in the chemical form of organic compounds

EXAMPLE Organic compounds: oils, greases, etc.

2.3
total carbon
C_T
sum of residual carbon and potential carbon

3 Principle

Combustion of the carbon present on the inner surface of a tube or fitting sample, carried out at a given temperature in an oxygen flow.

Determination, by infrared absorption spectrometry, of the residual or total carbon content, or both, by measurement of the carbon dioxide generated. Calculation of potential carbon content is by subtraction of the residual carbon content from the total carbon content.

4 Preparation of samples and test pieces

4.1 Preparatory procedures

4.1.1 General

Carry out the procedures in 4.1.2, 4.1.3 or 4.1.4 depending on the carbon to be determined and taking account of the following precautions:

a) metal cutting tool shall be free from protective paint;

b) clamps shall be flat and consist of copper, aluminium, steel or an alternative material. Alternative materials shall not be detrimental to their cleanliness;

c) all tools and implements used for cutting or clamping samples shall be degreased before sample preparation;

d) degreasing shall be done by wiping with a lint-free cloth containing absorbed tetrachloroethylene, trichloroethylene or trichloroethane or, because of potential for environmental harm, other solvents of equivalent performance, e.g. acetone. These solvents shall also be used for cleaning/immersion of samples where appropriate;

e) suitable protective gloves should be used to ensure skin contact with the surface under test is avoided;

f) between the cleaning operation and the combustion operation, the test pieces shall be kept in a non-contaminating environment, such as a clean laboratory or in a desiccator containing sodium hydroxide pellets. The tests shall be completed within approximately 5 h of cleaning the sample, or if not, the sample shall be re-cleaned.

4.1.2 Residual carbon content

a) prepare samples (see 4.2);
b) clean inner and outer surface of sample (see 4.3.1 and 4.3.2);
c) prepare test pieces (see 4.4).

4.1.3 Total carbon content

a) prepare samples (see 4.2);
b) clean outer surface of sample (see 4.3.2);
c) prepare test pieces (see 4.4).

4.1.4 Potential carbon content

Prepare separate samples and test pieces following the procedures in 4.1.2 and 4.1.3.

4.2 Preparation of samples

4.2.1 Tubes

Cut a sample approximately 30 cm long from a tube, using a metal-cutting saw or a pipe cutter. Deburr the outer and inner edges of the sample ends, using a smooth file or a trimming blade, take care that any burrs removed do not fall into the bore of the tube.

4.2.2 Fittings

Select sufficient fittings from the batch in order to be able to cut test pieces from them having a minimum total internal surface area of 10 cm^2.

4.3 Cleaning of sample surfaces

4.3.1 Cleaning of inner surface of sample

The following steps shall be performed in a fume cupboard. Immerse the sample, for a minimum of 2 min in an agitated bath of boiling chlorinated solvent, for example, analytical grade trichloroethylene or trichloroethane, that shall be used as reference in case of dispute ensuring that the solvent baths are kept topped up, such that the sample remains totally immersed in the solvent. Immerse the sample in a second, boiling solvent bath for at least 30 s.

Remove the sample from the bath and place it vertically under a fume hood or on a grease-free plate in an oven operating at a temperature of at least 80 °C for a minimum of 60 s, until the solvent has totally evaporated.

Refresh both baths periodically, as appropriate, in accordance with written internal procedures.

4.3.2 Cleaning of outer surface of sample

4.3.2.1 General

Degrease the outside surface of the sample by wiping with a clean, lint-free, solvent-containing cotton cloth, taking care to ensure that no fibres remain on the sample after wiping.

Clean the sample by chemical cleaning method, see 4.3.2.2, or for tubes in R250 and R290 material conditions[1)] only, the alternative mechanical cleaning method, see 4.3.2.3, except in cases of dispute or preparation for blank value determination, may be used.

4.3.2.2 Chemical cleaning

4.3.2.2.1 Sealing

a) For annealed tubes only:

Squashing/flattening a 20 mm (approx.) portion of the tube extending from one end, between clamps (see 4.1) placed between the jaws of a vice. The squashed end is then folded over and also squashed/flattened against the adjacent, 20 mm (approx.) length of tube, again using clamps (see 4.1) fixed between the jaws of a vice.

This method shall be used for reference testing.

b) For tubes or fittings:

Seal one tube end or all fitting ends by inserting appropriately-sized, silicone or neoprene plugs.

NOTE If necessary, the ends of tubes in annealed material condition should firstly be re-rounded using an appropriate, degreased re-rounding tool, in order to obtain a leak-tight seal with the plug.

4.3.2.2.2 Cleaning

Place the degreased sample in a clean beaker containing fresh diluted nitric acid for half starting from 50 % concentrated nitric acid. The temperature of the acid shall be at least 20 °C and for handling reasons, care has to be taken to control the exothermic reaction, if necessary by cooling the beaker.

a) For tubes:

The beaker shall contain sufficient solution to cover between 75 mm and 125 mm of the length of the sample (the smaller the diameter of the tube being tested, the greater the depth of immersion required to ensure a sufficiently covered surface area).

b) For fittings:

The beaker shall contain a sufficient quantity of solution to cover the sample. Refresh the acid bath weekly or after preparation of about forty samples (whichever is the sooner).

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1) see EN 1173 for the explanation of R250 and R290.

Ensure that the sample remains in the acid solution for at least 30 s so that copious quantities of brown fumes (NO_2) are expelled. This step of operation shall be performed in a fume cupboard.

Withdraw the sample from the acid solution and rinse thoroughly with deionised water.

Transfer the sample to a bath containing boiling deionised water for a duration between 30 s and 60 s, which, before use shall have been boiled for approx. 5 min to ensure a complete degassing of the water, or rinse the sample with hot (min. 50 °C) running water for at least 30 s. Take care to ensure that the useful part of the sample is fully immersed in the water bath. Due to an uptake of CO_2 from the air, refresh the deionised water every day or after the preparation of about forty samples (whichever is sooner).

Remove the sample from the bath and place it vertically under a fume hood or on a grease-free plate in an oven operating at a temperature of at least 80 °C for a minimum of 60 s, until the water has totally evaporated or let it dry on air.

4.3.2.3 Mechanical cleaning

Hold the tube in a vice and remove all traces of the outer surface in the area to be tested, using a degreased file.

Alternatively, a thin layer from the outer surface may be removed by turning on a lathe using a tool with a degreased tip.

All tools used for mechanical cleaning shall be free of organic contamination. The tools shall not be used for other mechanical operation.

4.4 Preparation of test pieces

4.4.1 Tubes

4.4.1.1 General

Carry out the procedure given in 4.4.1.2 or 4.4.1.3, depending on the tube diameter, and taking account of the precautions described in 4.1.

4.4.1.2 Tubes with diameters not exceeding the furnace diameter

From the cleaned sample, cut and discard a 2,5 cm length, from one end which, in the case of a chemically cleaned outer surface, shall be from the plugged or flattened end of the tube (having firstly removed the plug from the tube end if appropriate).

Measure the required length of tube using a clean measuring device to yield an internal surface area between 20 cm^2 and 25 cm^2.

Cut off the required length using either a clean, square-cut auto-saw used only for such purposes or a degreased, fine-toothed hacksaw, avoiding overheating the sample. If the test piece is longer than the zone of incandescence of the combustion device described in 5.1 c), cross-cut the test piece into two, in order that both pieces may be fed simultaneously into the zone of incandescence. Take care to ensure that the cut is square. If using an auto-saw, take also care to ensure that all surfaces with which the tube is in contact are thoroughly degreased. When filing and cutting tubes, take care to ensure that the section of tube being held in position (e.g. between the jaws of a vice) is not excessively distorted.

Determine the internal surface area of the test piece from its mean internal diameter and mean length, measured to an accuracy of ± 0,1 mm.

NOTE If the cross-cut leads to a loss of length, it should be taken into account for the surface area determination.