SLOVENSKI STANDARD
oSIST prEN 1971-2:2019

01-april-2019

Baker in bakrove zlitine - Metoda preskušanja z vrtinčnimi tokovi za merjenje napak na nevarjenih okroglih ceveh iz bakra in bakrovih zlitin - 2. del: Preskus z notranjo preskusno tuljavo ob notranji površini

Copper and copper alloys - Eddy current test for measuring defects on seamless round copper and copper alloy tubes - Part 2: Test with an internal probe on the inner surface

Kupfer und Kupferlegierungen - Wirbelstromprüfung an Rohren zur Messung von Fehlern an nahtlos gezogenen runden Rohren aus Kupfer und Kupferlegierungen - Teil 2: Prüfung mit Innensonde auf der Innenseite

Cuivre et alliages de cuivre - Méthode de contrôle par courants de Foucault pour le mesurage des défauts des tubes ronds sans soudure en cuivre et alliages de cuivre - Partie 2 : Essai avec un capteur interne sur la paroi interne

Ta slovenski standard je istoveten z: **prEN 1971-2**

ICS:

23.040.15	Cevi iz neželeznih kovin	Non-ferrous metal pipes
77.150.30	Bakreni izdelki	Copper products

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 1971-2

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ICS 23.040.15; 77.150.30

Will supersede EN 1971-2:2011

English Version

Copper and copper alloys - Eddy current test for measuring defects on seamless round copper and copper alloy tubes - Part 2: Test with an internal probe on the inner surface

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 133.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN 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-CENELEC Management Centre has the same status as the official versions.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 1971-2:2019) has been prepared by Technical Committee CEN/TC 133 “Copper and copper alloys”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1971-2:2011.

The following modifications were implemented in this new edition of EN 1971-2:

— updated Normative references.

Introduction

The eddy current test with internal probe described in this document has the objective of detecting potential leaks and serious defects in seamless round copper and copper alloy tubes.

The eddy current test is able to detect material inhomogeneities and their positions throughout the length of tubes. The eddy current signals of material inhomogeneities are compared with reference signals of artificially produced test defects. It is possible to identify these inhomogeneities on the inner and outer surfaces as well as within the tube wall.

Since the distribution of eddy currents decreases as the distance from the test coil increases, the amplitude of defect signals also decreases with increasing distance from the test coil. Thus the eddy current test with internal probe on the inner surface is less sensitive to defects on the outer surface.

The purpose of this European Standard is not to define a method of measuring the actual extent of the material inhomogeneities as the signal amplitude is dependent on, amongst other factors, volume, form and position of the inhomogeneity.

Due to end effects, it is not possible to effectively test the ends of the tubes. The purchaser and the supplier could agree that the end effect may be overcome by cutting to length after testing.

1 Scope

This document specifies a procedure for the eddy current test with an internal probe for measuring defects on the inner surface of seamless round copper and copper alloy tubes.

This document applies particularly for finned tubes with high fins according to EN 12452.

NOTE The eddy current test method(s) required, together with the size range and acceptance level, are defined in the relevant product standard.

The choice of the method for eddy current test:

— with an encircling test coil on the outer surface according to prEN 1971-1

or

— with an internal probe on the inner surface according to prEN 1971-2

is at the discretion of the manufacturer if there are no other agreements between the purchaser and the supplier.

Especially for finned tubes according to EN 12452 with high fins, it is suggested to use eddy current test with internal probe as described in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN ISO 9712, *Non-destructive testing - Qualification and certification of NDT personnel (ISO 9712)*

EN ISO 12718, *Non-destructive testing - Eddy current testing - Vocabulary (ISO 12718)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12718 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 General requirements

4.1 Personnel qualification

The eddy current test shall be made by operators trained in this technique and it shall be done under the responsibility of qualified staff.

When agreed upon between the purchaser and the supplier, qualification of the personnel shall be certified according to EN ISO 9712.

4.2 Condition of tube to be tested

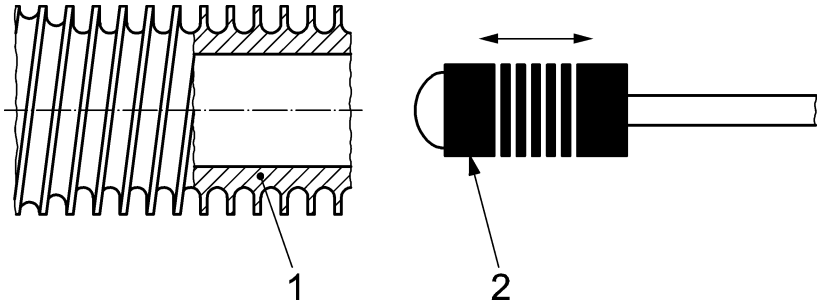
Tubes shall be sufficiently clean and straight to permit satisfactory operation of optionally drive mechanism and eddy current test equipment.

4.3 Equipment

The internal probe shall be moved through the tubes as vibration-free as possible.

The variation in test sensitivity due to changes of speed and internal probe position within the tubes shall be maintained within ± 2 dB.

The internal probe can be moved manually or by using a drive mechanism (see Figure 1).



Key

1 tube with fins on the outside

2 internal probe

Figure 1 — Simplified representation of eddy current testing using internal probe

Test speed over the length of the tube shall be as constant as possible.

The distance between the probe and the inner surface of the tube shall be kept as small as possible so that the sensitivity of the test is sufficient.

NOTE For internal probes, the usual frequencies are in the range 1 kHz to 125 kHz.

5 Reference standard tube

Unless otherwise specified in the relevant product standard, a reference standard tube is made of a defect-free tube of the same dimensions and specified properties as the tube to be tested.

During the reference test, the influence of dynamic conditions shall be taken into account.

The producer can ensure that this requirement is met by the appropriate option subject to the type of the installation, such as:

a) for control devices not in-line with production, the reference tube should be long enough to ensure the same dynamic conditions for the reference test as for normal line operating speed;

or

b) the control devices should include a dynamic effect compensating unit to take into account the speed differences between the reference tube throughput speed and the normal line operating speed.

Either the reference standard tube shall have three holes located on three generating lines at 120°, or only one hole. If a reference standard tube with three holes is used, the holes shall be spaced from each

other and from each end, sufficiently to obtain separate signals from each hole without interference from the tube ends. If a reference standard tube with only one hole is used, then this tube shall be used three times being turned by 120°.

The maximum drill diameter for the various dimension ranges is defined in the relevant product standards.

Other reference standard tube types may be considered if they are demonstrated as more relevant for certain products; they shall be defined in the relevant product standards.

6 Acceptance criteria

6.1 Detection of local discontinuities by encircling probes systems

Local discontinuities of the tubes, including beginning and end of long regular discontinuities and variations of long discontinuities, are detected as defects with internal probes systems.

The sorting limit shall be the smallest amplitude of the three signals produced by the hole or holes in the reference standard tube.

6.2 Detection of non-local discontinuities by internal probes systems with lower detection levels

Non-local discontinuities of the tube could be identified as defects by one of the methods defined for this purpose, according to the requirements of the relevant product standards.

Some discontinuities of the tube, which individually are not considered as defective, might cause signals lower than the detection threshold of the normal sorting limit for local defects but higher than a second selected lower detection threshold S_l. The signals for the lower and normal detection thresholds are related by a ratio K_2, which shall be determined by the manufacturer of the tube, as follows:

$$K_2 = \frac{S_l}{S_n} \tag{1}$$

where

S_l is the signal for the lower detection threshold;

S_n is the signal for the normal detection threshold.

A maximum density of defects d_0 shall be calculated as follows:

$$d_0 = \frac{N_0}{L_0} \tag{2}$$

where

N_0 is the maximum permissible number of discontinuities in a pre-set length;

L_0 is the pre-set length.

Both N_0 and L_0 should be determined by the tube manufacturer if they are not specified in the relevant product standard.

Discontinuity signals ranging between the two sorting limits of the lower and normal detection thresholds along the pre-set length L_0 shall be counted as N.

When the real density $d = N/L_0$ exceeds d_0, the entire pre-set length affected shall be considered defective.

6.3 Other test methods

For other test methods the acceptance criteria shall be defined specifically, such as for a system involving relative rotational motion between the tube and the surface probe. Equal or higher sensitivity shall be demonstrated.

7 Instrument adjustment

The test system shall be adjusted, using a reference standard tube in accordance with Clause 5.

If the test instrument operates with phase selection, the signals from the defects to be detected shall lie within the determined phase ranges.

The sensitivity of the instrument shall be adjusted so that the smallest of the three signals exceeds the response threshold of the sorting limit.

Adjustment of the instrument shall be carried out and checked for each change of product and at regular intervals of not more than 8 h during periods of continuous operation.

If any check shows that a loss of sensitivity exceeding 2 dB has occurred, all the tubes tested since the last check shall be considered as not tested.