SLOVENSKI STANDARD
SIST EN 1971-2:2012

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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 test coil 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 une bobine interne sur la paroi interne

Ta slovenski standard je istoveten z: **EN 1971-2:2011**

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

EN 1971-2

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ICS 23.040.15; 77.150.30

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 European Standard was approved by CEN on 5 November 2011.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 1971-2:2011) 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of an identical text or by endorsement, at the latest by June 2012, and conflicting national standards shall be withdrawn at the latest by June 2012.

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Within its programme of work, Technical Committee CEN/TC 133 requested CEN/TC 133/WG 3 "Copper tubes (installation and industrial)" to prepare the following document:

EN 1971-2, *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*

This is one of two parts of the standard for the eddy current test for measuring defects on seamless round copper and copper alloy tubes. The other part is:

EN 1971-1, *Copper and copper alloys — Eddy current test for measuring defects on seamless round copper and copper alloy tubes — Part 1:Test with an encircling test coil on the outer surface*

Introduction

The eddy current test with internal probe described in this standard 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 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 European Standard 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 European Standard 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 EN 1971-1

or

— with an internal probe on the inner surface according EN 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 recommended to use eddy current test with internal probe as described in this standard.

2 Normative references

The following referenced documents are indispensable for the application 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 473, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

EN ISO 12718, *Non-destructive testing — Eddy current testing — Vocabulary (ISO 12718:2008)*

3 Terms and definitions

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

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 473.

4.2 Condition of tube to be tested

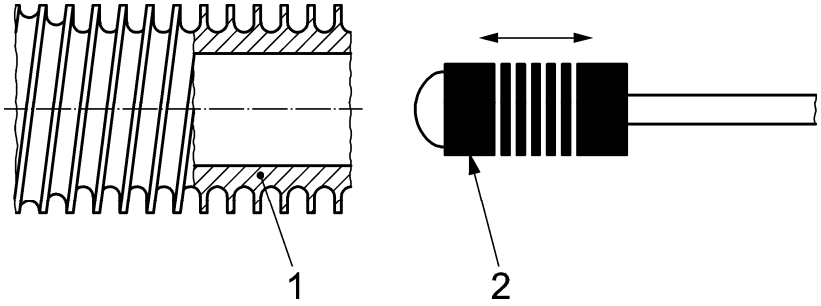
Tubes shall be sufficiently clean and straight to permit satisfactory operation of optionally drive mechanism and eddy current test equipment.

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.

NOTE 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 internal 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.

NOTE 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.