SLOVENSKI STANDARD
SIST EN 1971-1:2012

01-februar-2012

Nadomešča:
SIST EN 1971:1999

Baker in bakrove zlitine - Metoda preskušanja z vrtinčnimi tokovi za merjenje napak na nevarjenih okroglih ceveh iz bakra in bakrovih zlitin - 1. del: Preskus s preskusno tuljavo, ki obdaja zunanjo površino

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

Kupfer und Kupferlegierungen - Wirbelstromprüfung an Rohren zur Messung von Fehlern an nahtlos gezogenen runden Rohren aus Kupfer und Kupferlegierungen - Teil 1: Prüfung mit umfassender Spule auf der Außenseite

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 1: Essai avec une bobine encerclante sur la paroi externe

Ta slovenski standard je istoveten z: **EN 1971-1:2011**

ICS:

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

SIST EN 1971-1:2012 **en,fr,de**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1971-1

December 2011

ICS 77.150.30

Supersedes EN 1971:1998

English Version

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

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 1: Essai avec une bobine encerclante sur la paroi externe

Kupfer und Kupferlegierungen - Wirbelstromprüfung an Rohren zur Messung von Fehlern an nahtlos gezogenen runden Rohren aus Kupfer und Kupferlegierungen - Teil 1: Prüfung mit umfassender Spule auf der Außenseite

This European Standard was approved by CEN on 5 November 2011.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 1971-1:2011: E

Contents

Page

Figures

Foreword

This document (EN 1971-1:2011) 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.

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 1971:1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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

EN 1971:1998, *Copper and copper alloys — Eddy current test for tubes*

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 1971-2, *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*

In comparison with the first edition of EN 1971:1998, the following significant technical changes were made:

— split of and extension in two parts;

— modification of Scope – introduction of the choice of test method with encircling coil or internal probe.

Introduction

The eddy current test described in this European Standard has the objective of detecting during production 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 encircling test coil on the outer surface is less sensitive to defects on the inner 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 part of this European Standard specifies a procedure for the eddy current test with an encircling test coil for measuring defects on the outer surface of seamless round copper and copper alloy tubes.

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.

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

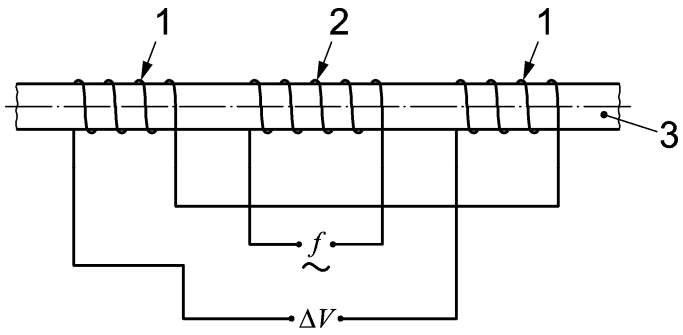
Tubes shall be sufficiently clean and straight to permit satisfactory operation of the drive mechanism and eddy current test equipment.

4.3 Equipment

The driving mechanism shall drive the tube through the encircling coil as concentrically and vibration-free as possible.

The variation in test sensitivity due to changes of speed and tube position within the encircling coil shall be maintained within ± 2 dB.

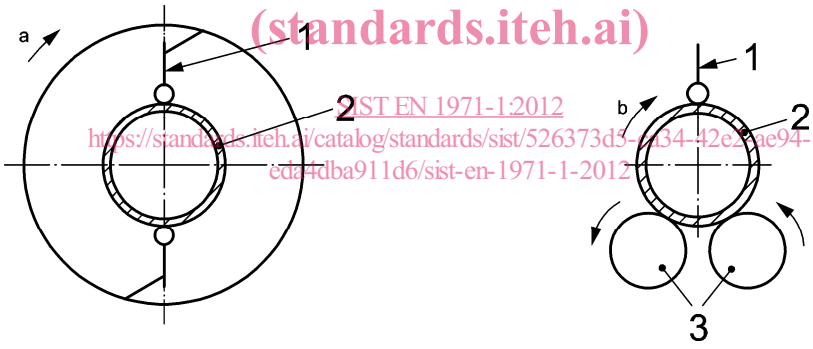
Either encircling test coils or a system that involves relative rotational motion between the tube and either one or several surface probes can be used for testing (see Figures 1 and 2).



Key
1 secondary coil
2 primary coil
3 tube
$\tilde{f}$ frequency
ΔV difference of the measured voltage

Figure 1 — Representation of eddy current control using encircling coils

NOTE 1 Figure 1 is a simplified representation of an encircling coil with one primary coil and secondary coils (differential measurement)



Key
a direction of rotation of the probe
1 surface probe
2 tube

a) Surface probe rotating with linear motion of the tube

Key
b direction of rotation of the tube
1 surface probe
2 tube
3 rollers

b) Tube rotating with linear motion of the probe

Figure 2 — Representation of eddy current systems that involve a relative rotational motion between the tube and the probe (helicoidal control of the tube)

NOTE 2 The surface probe can have different forms, for example single coil or multiple coils with various configurations.

Test speed shall be compatible with the coil excitation frequency.

In the case of a test with relative rotational motion between the tube and the surface probe only, the linear speed shall be adjusted in order to test the whole surface of the tube.

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

NOTE 3 For encircling coils, 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) for in-line installations:

- the reference standard tube should be passed through the test equipment at the normal line operating speed; or
- 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 passed through the encircling coil three times with the tube 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 coils systems

Local discontinuities of the tubes, including beginning and end of long regular discontinuities and variations of long discontinuities, are detected as defects with encircling coils 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 encircling coils 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: