SLOVENSKI STANDARD
SIST EN 1971:1999

01-november-1999

Baker in bakrove zlitine - Metoda preskuġanja cevi z vrtinļ nimi tokovi

Copper and copper alloys - Eddy current test for tubes

Kupfer und Kupferlegierungen - Wirbelstromprüfung an Rohren

Cuivre et alliages de cuivre - Méthode de contrôle de tubes par courants de Foucault

Ta slovenski standard je istoveten z: **EN 1971:1998**

ICS:

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

SIST EN 1971:1999 **en**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1971

November 1998

ICS 23.040.15; 77.150.30

Descriptors: copper, copper alloys, copper tubes, seamless tubes, non-destructive testing, inspection methods, eddy current tests, acceptability

English version

Copper and copper alloys - Eddy current test for tubes

Cuivre et alliages de cuivre - Méthode de contrôle de tubes par courants de Foucault

Kupfer und Kupferlegierungen - Wirbelstromprüfung an Rohren

This European Standard was approved by CEN on 14 October 1998.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents

Foreword

This European Standard 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of an identical text or by endorsement, at the latest by May 1999, and conflicting national standards shall be withdrawn at the latest by May 1999.

Within its programme of work, Technical Committee CEN/TC 133 requested CEN/TC 133/WG 3.3 "Eddy current test" to prepare the following standard:

EN 1971
Copper and copper alloys – Eddy current test for tubes

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The eddy current test described in this 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 is less sensitive to defects on the inner surface than to defects on the outer surface when the test coil is outside the tube.

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 eddy current testing of seamless round copper and copper alloy tubes.

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

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 473
Qualification and certification of NDT personnel – General principles

EN 1330-5
Non-destructive testing – Terminology – Part 5: Terms used in Eddy Current testing

3 Definitions

For the purposes of this standard, the definitions of EN 1330-5 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

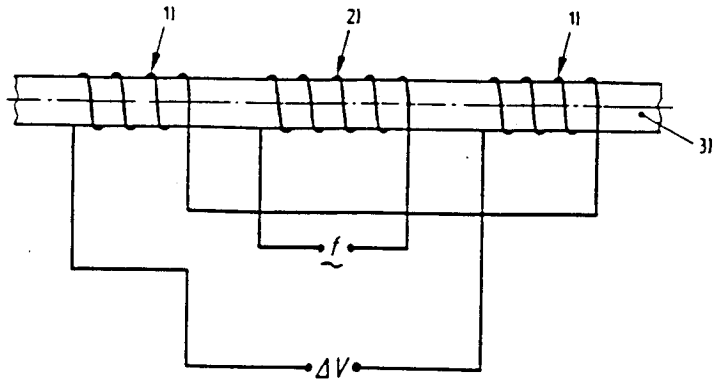
Tubes shall be sufficiently clean and straight to permit satisfactory operation of the drive mechanism and eddy current test equipment.

4.3 Equipment

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

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

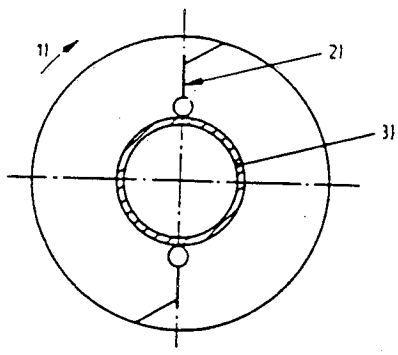
Either encircling test coils or a system that involves relative rotational motion between the tube and either one or several surface probes can be used for testing (see figures 1 and 2).

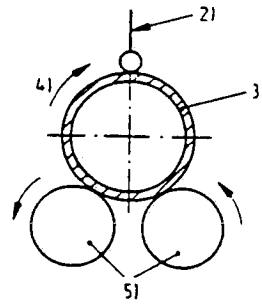


1) secondary coil
2) primary coil
3) tube

Figure 1: Representation of eddy current control using encircling coils

NOTE 1: Figure 1 is a simplified representation of a device with multiple coils that can include primary coils, secondary coils, absolute coils, etc.





1) direction of rotation of the probe
2) surface probe
3) tube
4) direction of rotation of the tube
5) rollers

Surface probe rotating with linear motion of the tube — 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 variousconfigurations.

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 or, when setting equipment, due account should be taken of 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 tester 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.