SLOVENSKI STANDARD
SIST EN 13147:2002

01-februar-2002

Baker in bakrove zlitine - Ugotavljanje zaostalih notranjih napetosti v robnem delu rezanih trakov

Copper and copper alloys - Determination of residual stresses in the border area of slit strip

Kupfer und Kupferlegierungen - Bestimmung von Restspannungen im Schnittkantenbereich von Bändern

Cuivre et alliages de cuivre - Détermination des contraintes résiduelles sur les rives des bandes cisaillées

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ICS:

77.150.30	Bakreni izdelki	Copper products

SIST EN 13147:2002 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

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English version

Copper and copper alloys - Determination of residual stresses in the border area of slit strip

Cuivre et alliages de cuivre - Détermination des contraintes résiduelles sur les rives des bandes cisaillées

Kupfer und Kupferlegierungen - Bestimmung von Restspannungen im Schnittkantenbereich von Bändern

This European Standard was approved by CEN on 8 March 2001.

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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 Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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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of an identical text or by endorsement, at the latest by October 2001, and conflicting national standards shall be withdrawn at the latest by October 2001.

Within its programme of work, Technical Committee CEN/TC 133 requested CEN/TC 133/WG 2 "Rolled flat products" to prepare the following standard:

EN 13147, *Copper and copper alloys — Determination of residual stresses in the border area of slit strip.*

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

Rolled strips have residual stresses caused by the production processes. The direction, distribution and level of the stresses depend on the machinery, the sequence of the selected operations and on the material, the mechanical properties and the dimensions of the strip.

The effects of stresses adjacent to the slit edges have significant importance during later processing stages, e.g. stamping. The test method described below, is to measure these effects under special conditions.

This standard is used only as a reference method for determination of residual stresses and can be applied only if there is agreement between the purchaser and the supplier that the method is a suitable means for determining the influence that the stresses detected will have on subsequent processes.

1 Scope

This European Standard specifies a method for the determination of residual stresses in the areas adjacent to the slit edges of wrought copper and copper alloy strip, by measurement of the angle of twist, longitudinal curvature and sideways curvature of test pieces cut from strip.

2 Terms and definitions

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

2.1
strip
flat rolled product of rectangular cross-section and uniform thickness from 0,08 mm up to and including 0,80 mm, supplied level wound as coils, or traverse wound on cores or spools, with slit edges. The thickness does not exceed one tenth of the width

2.2
sideways curvature δ
displacement from the fixed gauge length H of the distorted test piece perpendicular to the rolling direction and in the plane of the strip

2.3
longitudinal curvature λ
displacement from the fixed gauge length H of the distorted test piece perpendicular to the rolling direction and perpendicular to the plane of the strip

2.4
edge twist β
twist angle from the fixed gauge length H of the distorted test piece

3 Principle

Test pieces are cut in the direction of rolling from the areas adjacent to the slit edges of a sample strip according to a set procedure. A test piece is clamped on the turntable of the measuring equipment described in 4.2, and the components of distortion, i.e. sideways curvature δ, longitudinal curvature λ and edge twist β, caused by the residual stresses, are measured.

4 Apparatus

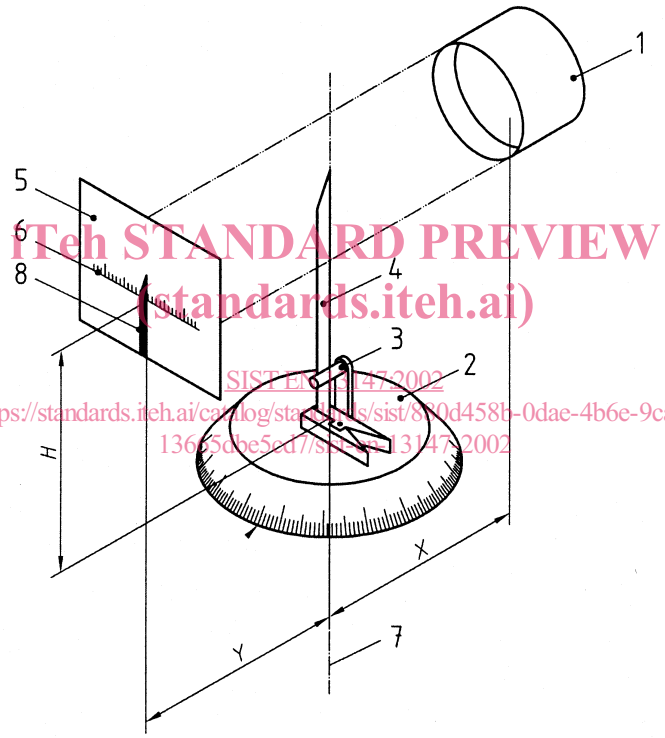
4.1 Equipment for test piece preparation

Sawing, stamping, etching or wire eroding may be used for making the slits in the sampling unit, subject to agreement between the purchaser and the supplier. Most experience has been gained using the sawing method and it should be used as a reference method in cases of dispute (see annex A).

4.2 Measuring equipment

The measuring equipment (see Figure 1) consists of a light source emitting mainly parallel light, a turntable carrying the test piece holder with the means to ensure that the original strip edge is fitted on the axis of the turntable, a scale showing the angular rotation of the turntable and a screen with an integrated scale at fixed height H. The zero point of the scale on the screen is located at the intersection of the horizontal bottom line of the scale with the axis of the turntable. The distance X of the light source from the test piece holder shall be significantly greater than the distance Y of the test piece holder to the screen, so that a clear projection of the test piece can be seen on the screen.

NOTE To show the angular rotation of the turntable it is advisable to use a digital display for the scale, which is calibrated to permit direct reading in millimetres of the deflection of the test piece.



Key

1 light source;
2 turntable with test piece holder;
3 stop for positioning the test piece;
4 test piece;
5 screen;
6 scale on the screen;
7 rotational axis of the turntable;
8 projection of the test piece;
H fixed gauge length (equivalent to the height of the monitor scale above the upper edge of the test piece holder);
X distance between the light source and the test piece holder;
Y distance between the test piece holder and the screen. X shall be significantly greater than Y.

Figure 1 — Measuring equipment

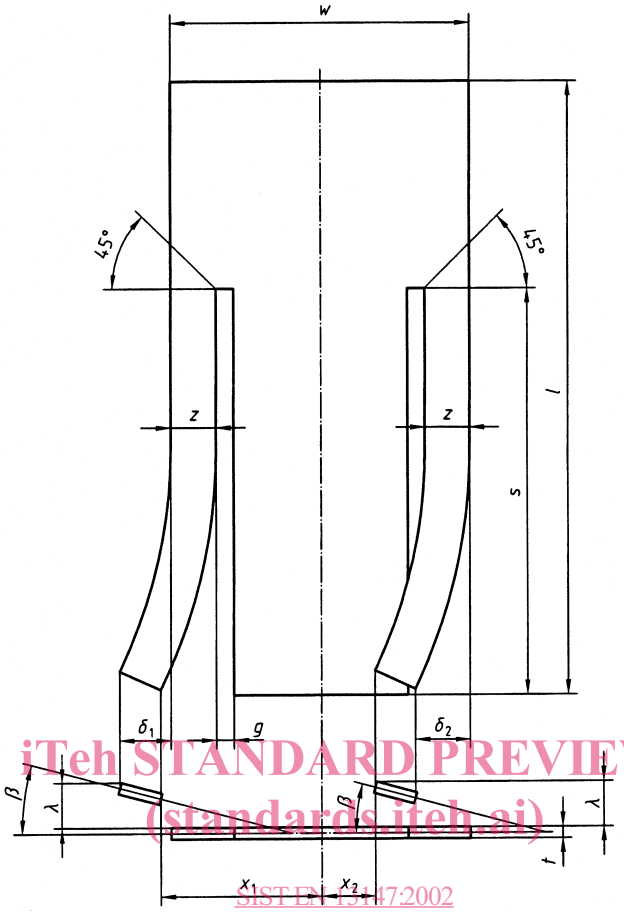
5 Preparation of test pieces

The following method shall be considered as one of the acceptable methods of test piece preparation. Other methods may be used subject to agreement between the purchaser and the supplier, e.g. etching.

Test samples with length l greater than 200 mm but less than 300 mm shall be cut from the sheared strip to be tested, exactly perpendicular to the rolling direction, using guillotine shears.

Two slits of width g 0,2 mm to 2,5 mm, shall be sawn, etched, stamped or wire eroded over a length s 150^{0}_{-10} mm, parallel to the rolling direction, and at a distance 2 mm to 5 mm from each edge of the test sample. Two test pieces shall be cut to the bottom of the slits, at 45° from these longitudinal edges. The left-hand and the right-hand test pieces shall be marked accordingly. Deformation of test pieces shall be avoided.

NOTE The preparation of the test pieces is shown diagrammatically in Figure 2. A typical sawing method for preparing test pieces is described in annex A.



$$\delta_1 = x_1 - (\frac{w}{2} - z)$$

$$\delta_2 = x_2 - (\frac{w}{2} - z)$$

Key

t	thickness of the strip;
w	width of the strip;
g	width of the saw-cut preferably 0,2 mm to 2,5 mm;
l	length of the sampling unit;
s	length of the saw-cut $150\ ^{0}_{-10}$ mm;
z	width of the test piece preferably 4,5 mm ± 0,2 mm;
x_1, x_2	distance between the construction line of the sampling unit in the longitudinal direction and the projection of the inner corner of the free end of the test piece onto the plane of the sampling unit;
β	edge twist;
λ	longitudinal curvature;
δ_1, δ_2	sideways curvature.

Figure 2 — Preparation of test pieces and possible distortion in the sampling unit