



# SLOVENSKI STANDARD

## SIST EN 10002-4:1997

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**Kovinski materiali - Natezni preskus - 4. del: Preverjanje ekstenzometrov, ki se uporabljajo pri enoosnem preskušanju**

Metallic materials - Tensile test - Part 4: Verification of extensometers used in uniaxial testing

Metallische Werkstoffe - Zugversuch - Teil 4: Prüfung von Längenänderungs-Meßeinrichtungen für die Prüfung mit einachsiger Beanspruchung

Matériaux métalliques - Essai de traction - Partie 4: Vérification des extensiometres utilisés lors d'essais uniaxiaux

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**ICS:**

77.040.10 Mehansko preskušanje kovin Mechanical testing of metals

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EUROPEAN STANDARD

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EUROPÄISCHE NORM

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English version

**Metallic materials - Tensile test - Part 4:  
Verification of extensometers used in uniaxial  
testing**

Matériaux métalliques - Essai de traction -  
Partie 4: Vérification des extensomètres  
utilisés lors d'essais uniaxiaux

Metallische Werkstoffe - Zugversuch - Teil 4:  
Prüfung von Längenänderungs-Meßeinrichtungen  
für die Prüfung mit einachsiger Beanspruchung

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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.

The European Standards exist 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

**CEN**

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

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

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**Foreword**

This European Standard was prepared by the Technical Committee ECISS/TC 1A "Mechanical and physical tests" of which the secretariat is held by AFNOR.

The text incorporates ISO 9513 prepared by ISO/TC 164/SC 1 "Metallic materials - Uniaxial testing" with some amendments, the main one of which is the addition of a class 0,2.

ECISS/TC 1A decided to submit the final draft for formal vote by its resolution 183/1993. The result was positive.

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 1995, and conflicting national standards shall be withdrawn at the latest by May 1995.

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

**0 Introduction**

The Standard EN 10002 is valid to metallic materials and comprises the following parts :

**0 Introduction****iTeh STANDARD PREVIEW**

The Standard EN 10002 is valid to metallic materials and comprises the following parts :

- Part 1 : **Metallic materials - Tensile test -  
Method of test (at ambient temperature).**
- Part 2 : **Metallic materials - Tensile test -  
Verification of the force measuring system of the tensile testing machine.**
- Part 3 : **Metallic materials - Tensile test -  
Calibration of proving devices used for the verification of uniaxial testing machines.**
- Part 4 : **Metallic materials - Tensile test -  
Verification of extensometers used in uniaxial testing.**
- Part 5 : **Metallic materials - Tensile test -  
Method of test at elevated temperatures.**

## 1 Scope

This European Standard specifies a method for the static verification of extensometers used in uniaxial testing.

The term "extensometer" is understood to mean the displacement measuring device and the system for indicating or recording this displacement.

## 2 Symbols and designations

(See table 1)

Table 1 - Symboles and designations

Symbol	Designation	Unit
$L_e$	Nominal value of gauge length of extensometer	mm
$L'_e$	Measured value of gauge length of extensometer	mm
$E_{max}$	Maximum limit of verification range	mm
$E_{min}$	Minimum limit of verification range	mm
$l_i$	Displacement indicated by extensometer	$\mu\text{m}$
$l_t$	True displacement given by calibration apparatus	$\mu\text{m}$
$q_{Le}$	Relative gauge length error	%
$q$	Relative bias error of extensometer	%
$r$	Resolution of extensometer	$\mu\text{m}$

## 3 Principle

The verification of an extensometer involves a comparison of the readings given by the extensometer with known variations in length provided by a calibration apparatus.

## 4 Calibration apparatus

The calibration apparatus which allows a known displacement  $l_t$  to be applied to the extensometer, may consist of a rigid frame with suitable coaxial spindles or other fixtures to which the extensometer can be attached. The calibration apparatus shall comprise a mechanism for moving at least one of the axial spindles and a device for measuring accurately the change in length produced. The variations in length can be measured, for example, using an interferometer or gauge blocks and a comparator or a screw micrometer. The gauge blocks, comparator, micrometer or interferometer used shall be calibrated by a method which is traceable to the international unit (SI) of length and their accuracy shall be known. The error of the calibration apparatus shall not be greater than one-third of the permissible error of the extensometer (see table 2).

The resolution of the calibration apparatus shall be as in accordance with table 2.

## 5 Procedure

### 5.1 Position of the extensometer

The extensometer shall be placed in the calibration apparatus in the same position and orientation in which it is used during uniaxial testing so as to avoid errors due to loss of equilibrium or deformation of any part of the extensometer.

The extensometer shall be attached in the same way as during uniaxial testing.

### 5.2 Temperature at which the verification is made

In general, the verification of the extensometer shall be carried out at a temperature stable to within  $\pm 2^\circ \text{C}$ ; this temperature shall be within the range between  $18^\circ \text{C}$  and  $28^\circ \text{C}$ .

For extensometers used for uniaxial testing at temperatures inside the range  $10^\circ \text{C}$  to  $35^\circ \text{C}$ , it is recommended that the verification be carried out at or near the test temperature, if facilities exist.

The extensometer shall be placed near the calibration apparatus or mounted on it for a sufficient length of time prior to its verification so that the parts of the extensometer and of the calibration apparatus which are in contact shall attain the verification temperature.

### 5.3 Accuracy of gauge length of the extensometer

The gauge length of the extensometer can be measured directly or indirectly. The following indirect method is given as an example.

The extensometer is placed on a soft metal test piece in such a way that the blades or points of the extensometer leave their marks. Once the extensometer is removed, the distance between the marks on the test piece is measured.

The relative error on the gauge length,  $q_{Le}$ , calculated from the following formula shall not exceed the values given in table 2 :

$$q_{Le} = \frac{L'_e - L_e}{L_e} \times 100 \quad (1)$$

In the case of an extensometer having several gauge lengths, the verification shall be carried out for each of the gauge lengths required by the user.

For extensometers where gauge length is defined by the test piece then the gauge length of this test piece shall be measured to an accuracy consistent with the class of extensometer to be used.

### 5.4 Range of verification

The verification range shall be defined by the user to cover the measuring range required to determine a given material property. The maximum and minimum limits  $E_{\max}$  and  $E_{\min}$  of the verification range shall be such that

$$5 \leq \frac{E_{\max}}{E_{\min}} \leq 10 \quad (2)$$

If several ranges are specified by the user, each one shall be verified. An example of verification ranges is given in annex A. The ranges of verification shall be noted in the verification report.

## 5.5 Verification procedure

5.5.1 When the temperature has stabilized, it is recommended that, before verification, the extensometer be exercised at least twice by the verification apparatus over the verification range of the extensometer. If possible, the displacement is taken to a slightly negative value and returned to zero. Where appropriate, the extensometer is reset to zero.

5.5.2 The verification consists first of one series of at least 10 measurements,  $h_i$ , distributed approximately evenly throughout the verification range of the extensometer. The extensometer is removed and then placed back on the calibration apparatus. A second series of measurements is then made in the same manner as the first. Depending on the expected use of the extensometer, the two series of measurements are made for increases in length or for decreases in length or for both.

For each measurement point, the relative bias error is calculated (see 5.6.2).

## 5.6 Determination of the characteristics of the extensometer

### 5.6.1 Resolution

The resolution,  $r$ , is the smallest quantity which can be read on the instrument. The values of the resolution of the extensometer shall be in accordance with the values given in table 2.

### 5.6.2 Relative bias error

The relative bias error,  $q$ , for a given displacement,  $h$ , is calculated from the formula :

$$q = \frac{h_i - h}{h} \times 100 \quad (3)$$

## 6 CLASSIFICATION OF THE EXTENSOMETER

Table 2 gives the maximum permissible values for the relative gauge length error, the resolution and the relative bias error.



Table 2 - Classification of extensometers

Class of extensometer	Extensometer (maximum values)				Calibration apparatus (maximum values)				
	Relative error on the gauge length $q/L_e$ %	Resolution (1)		Bias (1)		Resolution (1)		Bias error (1)	
		Percentage of readings $r/l_i$ %	Absolute value $r$ $\mu\text{m}$	Relative error $q$ %	Absolute error $l_i - l_t$ $\mu\text{m}$	Relative value %	Absolute value $\mu\text{m}$	Relative error %	Absolute value $\mu\text{m}$
0,2	$\pm 0,2$	0,1	0,2	$\pm 0,2$	$\pm 0,6$	0,05	0,1	$\pm 0,06$	$\pm 0,2$
0,5	$\pm 0,5$	0,25	0,5	$\pm 0,5$	$\pm 1,5$	0,12	0,25	$\pm 0,15$	$\pm 0,5$
1	$\pm 1,0$	0,50	1,0	$\pm 1,0$	$\pm 3,0$	0,25	0,50	$\pm 0,3$	$\pm 1,0$
2	$\pm 2,0$	1,0	2,0	$\pm 2,0$	$\pm 6,0$	0,5	1,0	$\pm 0,6$	$\pm 2,0$

(1) Whichever value is the greater.