SLOVENSKI STANDARD
SIST EN ISO 7500-1:2004

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Kovinski materiali - Preverjanje statiļnih enoosnih preskuġevalnih strojev - 1. del: Preskuġevalni stroji za natezni/tlaļni preskus - Preverjanje in umerjanje sistema za merjenje sile (ISO 7500-1:2004)

Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Verification and calibration of the force-measuring system (ISO 7500-1:2004)

Metallische Werkstoffe - Prüfung von statischen einachsigen Prüfmaschinen - Teil 1: Zug - und Druckprüfmaschinen - Prüfung und Kalibrierung der Kraftmesseinrichtung (ISO 7500-1:2004)

Matériaux métalliques - Vérification des machines pour essais statiques uniaxiaux - Partie 1: Machines d'essai de traction/compression - Vérification et étalonnage du systeme de mesure de force (ISO 7500-1:2004)

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Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Verification and calibration of the force-measuring system (ISO 7500-1:2004)

Matériaux métalliques - Vérification des machines pour essais statiques uniaxiaux - Partie 1: Machines d'essai de traction/compression - Vérification et étalonnage du système de mesure de force (ISO 7500-1:2004)

Metallische Werkstoffe - Prüfung von statischen einachsigen Prüfmaschinen - Teil 1: Zug- und Druckprüfmaschinen - Prüfung und Kalibrierung der Kraftmesseinrichtung (ISO 7500-1:2004)

This European Standard was approved by CEN on 16 July 2004.

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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN ISO 7500-1:2004) has been prepared by Technical Committee ISO/TC 164 "Mechanical testing of metals" in collaboration with Technical Committee ECISS/TC 1 "Steel - Mechanical testing", the secretariat of which is held by AFNOR.

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 February 2005, and conflicting national standards shall be withdrawn at the latest by February 2005.

This document supersedes EN ISO 7500-1:1999.

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

Endorsement notice

The text of ISO 7500-1:2004 has been approved by CEN as EN ISO 7500-1:2004 without any modifications.

INTERNATIONAL STANDARD

ISO 7500-1

Third edition
2004-08-15

Metallic materials — Verification of static uniaxial testing machines —

Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system

Matériaux métalliques — Vérification des machines pour essais statiques uniaxiaux

Partie 1: Machines d'essai de traction/compression — Vérification et étalonnage du système de mesure de force

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7500-1 was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 1, *Uniaxial testing*.

This third edition cancels and replaces the second edition (ISO 7500-1:1999) which has been technically revised.

ISO 7500 consists of the following parts, under the general title *Metallic materials — Verification of static uniaxial testing machines*:

— *Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

— *Part 2: Tension creep testing machines — Verification of the applied load*

Metallic materials — Verification of static uniaxial testing machines —

Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system

1 Scope

This part of ISO 7500 specifies the verification of tension/compression testing machines.

The verification consists of

— a general inspection of the testing machine, including its accessories for the force application;

— a calibration of the force-measuring system.

NOTE This part of ISO 7500 addresses the static verification of the force-measuring systems. The calibration values are not necessarily valid for high-speed or dynamic testing applications. Further information regarding dynamic effects is given in the Bibliography.

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.

ISO 376, *Metallic materials — Calibration of force-proving instruments used for the verification of uniaxial testing machines*

3 Terms and definitions

For the purposes of this document, the following term and definition apply.

3.1
calibration
set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards

See VIM[1].

NOTE 1 The result of a calibration permits either the assignment of values of measurands to the indications or the determination of corrections with respect to indications.

NOTE 2 A calibration may also determine other metrological properties such as the effect of influence quantities.

NOTE 3 The result of a calibration may be recorded in a document, sometimes called a calibration certificate or a calibration report.

4 Symbols and their meanings

Symbols and their meanings are given in Table 1.

Table 1 — Symbols and their meanings

Symbol	Unit	Meaning
a	%	Relative resolution of the force indicator of the testing machine
b	%	Relative repeatability error of the force-measuring system of the testing machine
f_0	%	Relative zero error of the force-measuring system of the testing machine
F	N	True force indicated by the force-proving instrument with increasing test force
F'	N	True force indicated by the force-proving instrument with decreasing test force
F_c	N	True force indicated by the force-proving instrument with increasing test force, for the complementary series of measurements for the smallest range used
F_i	N	Force indicated by the force indicator of the testing machine to be verified, with increasing test force
F'_i	N	Force indicated by the force indicator of the testing machine to be verified, with decreasing test force
$\overline{F}_i$, $\overline{F}$	N	Arithmetic mean of several measurements of F_i and F for the same discrete force
$F_{i\,max}$, $F_{i\,min}$ F_{max}, F_{min}	N	Highest or lowest value of F_i or F for the same discrete force
F_{ic}	N	Force reading on the force indicator of the testing machine to be verified, with increasing test force, for the complementary series of measurements for the smallest range used
F_{i0}	N	Residual indication of the force indicator of the testing machine to be verified after removal of force
F_N	N	Maximum capacity of the measuring range of the force indicator of the testing machine
g_n	m/s^2	Local acceleration due to gravity
q	%	Relative accuracy error of the force-measuring system of the testing machine
r	N	Resolution of the force indicator of the testing machine
v	%	Relative reversibility error of the force-measuring system of the testing machine
ρ_{air}	kg/m^3	Density of air
ρ_m	kg/m^3	Density of the dead weights

5 General inspection of the testing machine

The verification of the testing machine shall only be carried out if the machine is in good working order. For this purpose, a general inspection of the machine shall be carried out before calibration of the force-measuring system of the machine (see Annex A).

NOTE Good metrological practice requires a calibration run prior to any maintenance or adjustments to the testing machine.

6 Calibration of the force-measuring system of the testing machine

6.1 General

This calibration shall be carried out for each of the force ranges used and with all force indicators in use. Any accessory devices (e.g. pointer, recorder) that may affect the force-measuring system shall, where used, be verified in accordance with 6.4.6.

If the testing machine has several force-measuring systems, each system shall be regarded as a separate testing machine. The same procedure shall be followed for double-piston hydraulic machines.

The calibration shall be carried out using force-proving instruments with the following exception. If the force to be verified is below the lower limit of the smallest capacity force-proving device used in the calibration procedure, use known masses.

When more than one force-proving instrument is required to calibrate a force range, the maximum force applied to the smaller device shall be the same as the minimum force applied to the next force-proving instrument of higher capacity. When a set of known masses is used to verify forces, the set shall be considered as a single force-proving instrument.

The calibration should be carried out with constant indicated forces, F_i. When this method is not feasible, the calibration can be carried out with constant true forces.

NOTE 1 Calibration can be carried out using a slowly increasing force. The word “constant” signifies that the same value of F_i (or F) is used for the three series of measurements (see 6.4.5).

The instruments used for the calibration shall have a certified traceability to the international system of units.

The force-proving instrument shall comply with the requirements specified in ISO 376. The class of the instrument shall be equal to or better than the class for which the testing machine is to be calibrated. In the case of dead weights, the relative error of the force generated by these weights shall be less than or equal to ± 0,1 %.

NOTE 2 The exact equation giving the force, F, in newtons, created by the dead weight of mass m, in kilograms, is:

$$F = mg_n \left[1 - \frac{\rho_{air}}{\rho_m}\right] \quad (1)$$

This force can be calculated using the following approximate formula:

$$F = mg_n \quad (2)$$

The relative error of the force can be calculated, using the formula:

$$\frac{\Delta F}{F} = \frac{\Delta_m}{m} + \frac{\Delta g_n}{g_n} \quad (3)$$

6.2 Determination of the resolution

6.2.1 Analogue scale

The thickness of the graduation marks on the scale shall be uniform and the width of the pointer shall be approximately equal to the width of a graduation mark.

The resolution, r, of the indicator shall be obtained from the ratio between the width of the pointer and the centre-to-centre distance between two adjacent scale graduation marks (scale interval). The recommended ratios are 1:2, 1:5 or 1:10, a spacing of 2,5 mm or greater being required for the determination of one-tenth of a scale division.