SLOVENSKI STANDARD
oSIST prEN ISO 6507-2:2016

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Kovinski materiali - Preskus trdote po Vickersu - 2. del: Preverjanje in umerjanje naprav za preskušanje (ISO/DIS 6507-2:2016)

Metallic materials - Vickers hardness test - Part 2: Verification and calibration of testing machines (ISO/DIS 6507-2:2016)

Metallische Werkstoffe - Härteprüfung nach Vickers - Teil 2: Überprüfung und Kalibrierung der Prüfmaschinen (ISO/DIS 6507-2:2016)

Matériaux métalliques - Essai de dureté Vickers - Partie 2: Vérification et étalonnage des machines d'essai (ISO/DIS 6507-2:2016)

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77.040.10 Mehansko preskušanje kovin Mechanical testing of metals

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Metallic materials — Vickers hardness test —

Part 2: Verification and calibration of testing machines

Matériaux métalliques — Essai de dureté Vickers —

Partie 2: Vérification et étalonnage des machines d'essai

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ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

ISO 6507-2 was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 3, *Hardness testing*.

This fourth edition cancels and replaces the third edition (ISO 6507-2:2005), which has been technically revised.

ISO 6507 consists of the following parts, under the general title *Metallic materials — Vickers hardness test*:

— *Part 1: Test method*

— *Part 2: Verification and calibration of testing machines*

— *Part 3: Calibration of reference blocks*

— *Part 4: Tables of hardness values*

Metallic materials — Vickers hardness test — Part 2: Verification and calibration of testing machines

1 Scope

This part of ISO 6507 specifies a method of verification and calibration of testing machines and diagonal measuring system for determining Vickers hardness in accordance with ISO 6507-1.

It specifies a direct verification method for checking the main functions of the machine operation, and an indirect method suitable for the overall checking of the machine. The indirect method may be used on its own for periodic routine checking of the machine in service.

If a testing machine is also to be used for other methods of hardness testing, it shall be verified independently for each method.

This part of ISO 6507 is also applicable to portable hardness testing machines but not applicable to hardness testing machines based on different measurement principles, *e. g.*, ultrasonic impedance method.

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*

ISO 3878, *Hardmetals — Vickers hardness test*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6507-3, *Metallic materials — Vickers hardness test — Part 3: Calibration of reference blocks*

3 General conditions

Before a Vickers hardness testing machine is verified, the machine shall be checked to ensure that it is properly set up in accordance with the manufacturer's instructions:

Especially, it should be checked that:

a) the plunger holding the indenter is capable of sliding in its guide without any friction or excess side play;

b) the indenter-holder is firmly mounted in the plunger;

c) the test force can be applied and removed without shock, vibration or overshoot and in such a manner that the readings are not influenced;

d) the diagonal measuring system:

— if integral with the machine, the change from removing the test force to measuring mode does not influence the readings,

— the illumination device of the measuring microscope produces uniform lighting of the whole observed field with enough contrast between the indentation and the surrounding surface to determine the boundary clearly,

— the centre of the indentation is in the centre of the field of view, if necessary.

4 Direct verification

4.1 General

4.1.1 Direct verification should be carried out at a temperature of (23 ± 5) °C. If the verification is made outside this temperature range, this shall be stated in the verification report.

4.1.2 The instruments used for verification and calibration shall be traceable to national standards.

4.1.3 Direct verification involves:

a) calibration of the test force;

b) verification of the indenter;

c) calibration and verification of the diagonal measuring system;

d) verification of the testing cycle.

4.2 Calibration of the test force

4.2.1 Each test force used within the working range of the testing machine shall be measured. Whenever applicable, this shall be done at not less than three positions of the plunger uniformly spaced throughout its range of movement during testing. The minimum difference between the three positions for the test force shall cover the range of the indentation depth.

For testing machines whose test force is apparently not influenced by the position of the plunger, *e*. *g*., closed-loop controlled loading system, the test force can be calibrated in one position.

4.2.2 The test force shall be measured by one of the following two methods:

— by means of an elastic proving device in accordance with ISO 376, class 1 or better, or

— by balancing against a force, accurate to ± 0,2 %, applied by means of calibrated masses or another method with the same accuracy.

Evidence should be available to demonstrate that the output of the force-proving device does not vary by more than 0,2 % in the period 1 s to 30 s following a stepped change in force.

4.2.3 Three readings shall be taken for each test force $\boldsymbol{F}$ at each position of the plunger. Immediately before each reading is taken, the indenter shall be moved in the same direction as during testing. All readings shall be within the maximum permissible percent relative error ΔF_{rel} defined in Table 1.

The percent relative error ΔF_{rel} of each measurement of the force F is calculated according to Formula (1):

$$\Delta F_{\text{rel}} = 100 \times \frac{F - F_{\text{RS}}}{F_{\text{RS}}} \quad (1)$$

where

F is the measured test force

F_{RS} is the nominal test force

Table 1 – Test force tolerances

Ranges of the nominal test force, F_{RS} N	Maximum permissible relative error, ΔF_{rel}, %
0,009 807 ≤ F_{RS} < 0,098 07	± 2,0
0,098 07 ≤ F_{RS} < 1,961	± 1,5
F_{RS} ≥ 1,961	± 1,0

4.3 Verification of the indenter

4.3.1 The four faces of the square-based diamond pyramid shall be polished and free from surface defects.

4.3.2 The verification of the shape of the indenter can be made by direct measurement or optical measurement. The device used for the verification shall be accurate to within ± 0,07°.

4.3.3 The angle between the opposite faces at the vertex of the diamond pyramid shall be 136° ± 0,5° (see Figure 1).

NOTE The angle between the opposite faces may also be determined by the angle between the opposite edges; this value is 148,11° ± 0,76°.

4.3.4 The angle between the axis of the diamond pyramid and the axis of the indenter-holder (normal to the seating surface) shall be less than 0,5°.

4.3.5 The four faces shall meet at a point; the maximum permissible length of the line of conjunction, *a*, between opposite faces is given in Table 2 (see also Figure 2).

NOTE For indents less than 0,020 mm, the maximum permissible length of the line of conjunction should be proportionally less. The line of conjunction may be determined by measuring an indentation.

4.3.6 A valid calibration certificate shall exist which confirms the geometrical deviations of the indenter

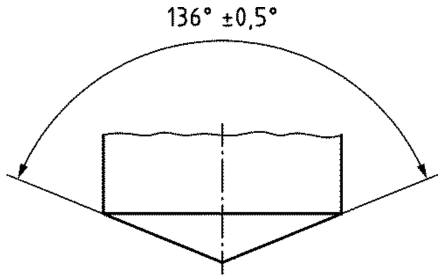
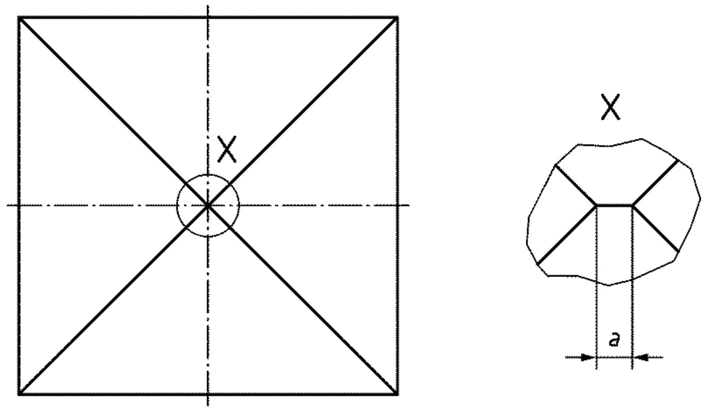


Figure 1 — Angle of the diamond pyramid



Key

a length of line of conjunction

Figure 2 — Line of conjunction on the top of the indenter (schematic)

Table 2 – Line of conjunction tolerance

Ranges of test force, *F* N	**Maximum permissible length of the line of conjunction,** *a* mm
0,009 807 ≤ F < 1,961	0,000 5
1,961 ≤ F < 49,03	0,001
F ≥ 49,03	0,002

4.4 Calibration and verification of the diagonal measuring system

4.4.1 The system for measuring the diagonal of the indentation shall be verified at each magnification and for each incorporated line scale to be used in two perpendicular measurement axis (if applicable), by performing measurements on an accurately ruled stage micrometer. Measurements shall be made at a minimum of four evenly spaced intervals, arranged centrally in the field of view, covering each working range.

The uncertainty of the line intervals on the stage micrometer shall be 0,000 2 mm or 0,1 %, whichever is greater.

4.4.2 Three measurements shall be made at each of the evenly spaced intervals. The maximum permissible error of **each** of the three **measurements** at each interval shall not exceed the **greater of 0,000** 6 mm or 1,0% of the length measured. If necessary, a calibration factor can be applied to comply with this tolerance.

4.4.3 All systems shall also be verified by making measurements of certified reference indentations, such as those on hardness reference blocks calibrated in accordance with ISO 6507-3. At least two indentations,

covering the working range of diagonals, shall be measured by each objective lens. No measured diagonal shall differ from the certified diagonal of the reference indentation by more than 0,000 8 mm or 1,25 % of the indentation length, whichever is greater.

4.5 Verification of the testing cycle

The testing cycle shall be timed within an uncertainty of 1 s and shall conform to the testing cycle of ISO 6507-1.

4.6 Uncertainty of calibration/verification

Uncertainty of the calibration/verification results shall be determined. An example is given in Annex B.

5 Indirect verification

5.1 Verification temperature

Indirect verification should be carried out at a temperature of (23 ± 5) °C by means of reference blocks calibrated in accordance with ISO 6507-3. If the verification is made outside this temperature range, this shall be reported in the verification report.

5.2 Test force and hardness levels

The machine shall be verified at each test force that is used. For each test force, two reference blocks calibrated in accordance with ISO 6507-3 shall be selected from a different hardness range as specified below. The blocks shall be chosen so that at least one reference block in each hardness range is used for the verification. At least one of the reference blocks should be from a hardness range for which the machine is used at that specific test force. When verifying testing machines using only one test force, three reference blocks shall be used, one from each of the three hardness ranges specified below. At each test force, the difference in hardness between any pair of reference blocks used shall exceed 100 HV.

— < 250 HV

— 400 HV to 600 HV

— > 700 HV

For special purposes, a hardness testing machine may be verified at one hardness value only, corresponding approximately to that of the tests to be made.

5.3 Measurement of reference indentation

One of the reference indentations from the current calibration period on each reference block shall be measured. For each indentation, the difference between the mean measured value and the certified mean diagonal length shall not exceed the greater of 0,000 8 mm or 1.25 % of the reference indentation length. If preferred, this check may instead be made on a similarly-sized indentation in a different reference block with similar hardness.

5.4 Number of indentations

On each reference block, five indentations shall be made and measured. The test shall be carried out in accordance with ISO 6507-1.