INTERNATIONAL STANDARD

ISO 6507-3

Second edition
1997-11-15

Metallic materials — Vickers hardness test —

Part 3:
Calibration of reference blocks

Matériaux métalliques — Essai de dureté Vickers —
Partie 3: Étalonnage des blocs de référence

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.

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.

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

This second edition of ISO 6507-3 cancels and replaces ISO 640:1984 and ISO 640-2:1993 as follows:

— Combination of the two different International Standards for the calibration of the hardness reference blocks (ISO 640:1984 and ISO 640-2:1993) into this part of ISO 6507.

— Addition of a new figure 1 for the demonstration of the permissible difference of the sectional planes of the square form of the indenter.

— Addition of a new table (table 1) for the estimation capability and the maximum permissible error of the measuring device.

— Changing of the values for the maximum permissible value of non-uniformity of the reference blocks in table 3.

— Addition of a new clause 9 concerning the validity of the reference blocks.

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

— *Part 1: Test method*

— *Part 2: Verification of testing machines*

— *Part 3: Calibration of reference blocks*

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Metallic materials — Vickers hardness test —

Part 3:
Calibration of reference blocks

1 Scope

This part of ISO 6507 specifies a method for the calibration of reference blocks to be used for the indirect verification of Vickers hardness testing machines, as specified in ISO 6507-2.

The method is applicable only for indentations with diagonals ⩾ 0,020 mm.

The force values in this part of ISO 6507 were calculated from kilogram force values. They were introduced before the SI-system was adopted. It was decided to keep the values based on the old units for this edition, but for the next revision it will be necessary to consider the advantage of introducing rounded values of test force and the consequence on the hardness scales.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 6507. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 6507 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 376:—[1)], *Metallic materials — Calibration of force-proving instruments used for the verification of uniaxial testing machines.*

ISO 468:1982, *Surface roughness — Parameters, their values and general rules for specifying requirements.*

ISO 4287:1997, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters.*

ISO 6507-1:1997, *Metallic materials — Vickers hardness test — Part 1: Test method.*

ISO 6507-2:1997, *Metallic materials — Vickers hardness test — Part 2: Verification of testing machines.*

1) To be published. (Revision of ISO 376:1987)

3 Manufacture of reference blocks

3.1 The block shall be specially prepared and the attention of the manufacturer is drawn to the need to use a manufacturing process which will give the necessary homogeneity, stability of structure and uniformity of surface hardness.

3.2 Each metal block to be calibrated shall be of a thickness not less than 6 mm.

3.3 The reference blocks shall be free of magnetism. It is recommended that the manufacturer shall ensure that the blocks, if of steel, have been demagnetized at the end of the manufacturing process.

3.4 The maximum deviation in flatness of the test and support surfaces shall not exceed 0,005 mm. The maximum error in parallelism shall not exceed 0,010 mm in 50 mm.

3.5 The test surface shall be free from scratches which interfere with the measurement of the indentations. The surface roughness shall not exceed R_a 0,05 µm for the test surface and R_a 0,10 µm for the support surface (see ISO 468). The sampling length l shall be 0,80 mm (see ISO 4287).

3.6 In order to check that no material has been subsequently removed from the reference block, its thickness at the time of calibration shall be marked on it to the nearest 0,01 mm, or an identifying mark shall be made on the test surface (see clause 8).

4 Calibrating machine

4.1 In addition to fulfilling the general requirements specified in ISO 6507-2, the calibrating machine shall also meet the requirements of 4.2.

4.2 The calibrating machine shall be verified directly at intervals not exceeding 12 months.

Direct verification involves

a) verification of the test force;
b) verification of the indenter;
c) verification of the measuring device;
d) verification of the testing cycle.

The equipment used to verify the calibrating machine shall have a certified traceability to the International System of Units (SI).

4.2.1 Each test force shall be accurate to within

— ± 0,1 % for the normal and low-force hardness;
— ± 0,5 % for the microhardness;

of the nominal test force specified in ISO 6507-1.

The force shall be measured with force-proving instruments of class 0,5 according to ISO 376 or by another method having the same accuracy.

4.2.2 The four faces of the square-based diamond pyramid shall be highly polished, free from surface defects, and flat within 0,000 3 mm.

4.2.3 The angle between the opposite faces of the vertex of the diamond pyramid shall be 136° ± 0,1°.

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 0,3°.

4.2.4 The point of the diamond indenter shall be examined with a high-power measuring microscope or preferably with an interference microscope and, if the four faces do not meet in a point, the line of conjunction between opposite faces shall be less than 0,001 mm in length. For microhardness testing, the length shall not exceed 0,000 25 mm.

4.2.5 It shall be verified that the quadrilateral which would be formed by the intersection of the faces with a plane perpendicular to the axis of the diamond pyramid has angles of 90° ± 0,2° (see figure 1).

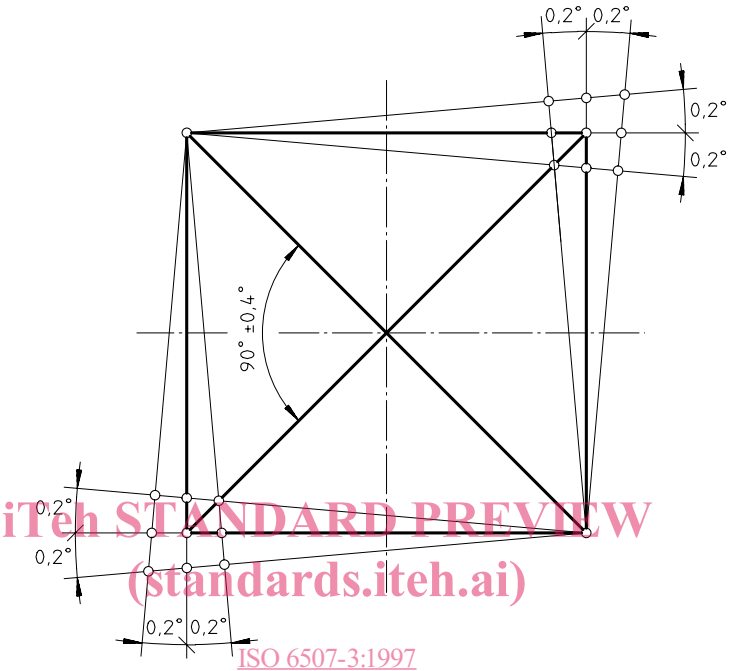

Figure 1 — Permissible difference of the sectional planes of the square form

4.2.6 The estimation capability required of the measuring device depends on the size of the smallest indentation to be measured.

The scale of the measuring device shall be graduated to permit estimation of the diagonals of the indentation in accordance with table 1.

Table 1

Diagonal length d mm	**Estimation capability of the measuring device**	**Maximum permissible error**
$d \leqslant 0{,}040$	0,000 1 mm	0,000 2 mm
$d > 0{,}040$	0, 25 % of d	0,5 % of d

4.2.7 The measuring device shall be verified by measurements made on a stage micrometer at a minimum of five intervals over each working range.

The maximum permissible error shall not exceed the values given in table 1.

4.2.8 For microhardness testing, the maximum allowable vibrational acceleration reaching the calibration machine shall be 0,005 g_n (g_n equals the standard acceleration of free fall: $g_n = 9{,}806\ 65\ m/s^2$).

4.2.9 The time from the initial application of force until the full test force is reached and the approach velocity of the indenter shall meet the requirements given in table 2.

Table 2

Ranges of test force, F N	Time for application of the test force s	Approach velocity of the indenter mm/s
$F < 1{,}961$	$\leqslant 10$	0,05 to 0,2
$1{,}961 \leqslant F < 49{,}03$	$\leqslant 10$	0,05 to 0,2
$F \geqslant 49{,}03$	6 to 8	0,05 to 1

The duration of application of the test force shall be 13 s to 15 s.

5 Calibration procedure

The reference blocks shall be calibrated in a calibrating machine as described in clause 4, at a temperature of (23 ± 5) °C, using the general procedure specified in ISO 6507-1.

6 Number of indentations

On each reference block, five indentations shall be made, uniformly distributed over the test surface.

7 Uniformity of hardness

7.1 Let d_1, d_2, .., d_5 be the arithmetic mean values of the measured diagonals, arranged in increasing order of magnitude.

The uniformity of the block under the particular conditions of calibration is characterized by the difference

$$d_5 - d_1$$

and is expressed as a percentage of $\overline{d}$, where

$$\overline{d} = \frac{d_1 + d_2 + \ldots + d_5}{5}$$

7.2 The maximum permissible value of non-uniformity of a reference block is given in table 3.

Table 3

Hardness of block	Maximum permissible value of non-uniformity % of $\bar{d}$		
	< HV 0,2	HV 0,2 to < HV 5	HV 5 to HV 100
⩽ 225 HV	4,0 or 0,001 mm[1)]	3,0	2,0
> 225 HV		2,0	1,0
1) Whichever is the greater.			

8 Marking

8.1 Each reference block shall be marked with the following particulars:

a) arithmetic mean of the hardness values found in the calibration test, for example 249 HV 30;
b) name or mark of the supplier or manufacturer;
c) serial number;
d) name or mark of the calibrating agency;
e) thickness of the block or an identifying mark on the test surface (see 3.6);
f) year of calibration, if not indicated in the serial number.

8.2 Any mark put on the side of the block shall be the right way up when the test surface is the upper face.

8.3 Each delivered reference block shall be accompanied with a document giving at least the following information:

a) the reference to this part of ISO 6507;
b) the identity of the block;
c) the date of calibration;
d) the arithmetic mean of the hardness values and the value characterizing the uniformity of the block.

NOTE — One of the five indentations may be selected as a reference indentation for the indirect verification of the measuring device as described in annex A of ISO 6507-2:1997. Therefore, it should be identified with a permanent mark in line with one of the measured indentation diagonals.

9 Validity

The reference block is only valid for the test force for which it was calibrated and provided that the block fulfils the requirements of clause 3.

NOTE — It is recommended that the duration of the calibration validity should be limited to 5 years.

ICS 77.040.10

Descriptors: metallurgical products, tests, hardness tests, Vickers hardness, indentation hardness tests, test equipment, calibration, marking.

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