164

INTERNATIONAL STANDARD

ISO 640-2

First edition
1993-07-15

Metallic materials — Calibration of standardized blocks to be used for Vickers hardness testing machines —

Part 2:
Less than HV 0,2

Matériaux métalliques — Étalonnage des blocs de référence à utiliser pour les machines d'essai de dureté Vickers —
Partie 2: Inférieure à HV 0,2

Reference number
ISO 640-2:1993(E)

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 640-2 was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Sub-Committee SC 3, *Hardness testing*.

ISO 640 consists of the following parts, under the general title *Metallic materials — Calibration of standardized blocks to be used for Vickers hardness testing machines*:

— *Part 1: HV 0,2 to HV 100* (Actually published as ISO 640:1984)

— *Part 2: Less than HV 0,2*

Annex A of this part of ISO 640 is for information only.

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Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Metallic materials — Calibration of standardized blocks to be used for Vickers hardness testing machines —

Part 2:
Less than HV 0,2

1 Scope

This part of ISO 640 specifies a method for the calibration of standardized metal blocks to be used for the indirect verification of Vickers hardness testing machines used for determining Vickers hardness using test forces of less than 1,961 N (HV 0,2) in accordance with ISO 146-2.

The method is applicable only for indentations with diagonals ⩾ 20 µm.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 640. 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 640 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 146-2:1993, *Metallic materials — Verification of Vickers hardness testing machines — Part 2: Less than HV 0,2.*

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

ISO 6507-3:1989, *Metallic materials — Hardness test — Vickers test — Part 3: Less than HV 0,2.*

3 Manufacture

3.1 The block shall be specially prepared using procedures which will give the necessary homogeneity, stability of structure and uniformity of surface hardness.

3.2 Each metal block to be standardized shall be of a thickness not less than 5 mm.

3.3 The standardized blocks shall be free of magnetism.

3.4 The maximum deviation in flatness of the surfaces shall not exceed 0,005 mm.

The maximum error in parallelism shall not exceed 0,025 mm/50 mm.

3.5 The test surface shall be free from scratches which interfere with the measurement of the indentations. The surface roughness R_a shall not exceed 0,05 µm for the test surface and 0,8 µm for the bottom surface. The sampling length l shall be 0,80 mm (see ISO 468).

3.6 To allow verification that no material is subsequently removed from the standardized block, its thickness at the time of standardization 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 Standardizing machine

4.1 In addition to fulfilling the general requirements specified in ISO 146-2:1993, clause 3, the standardizing machine shall also meet the requirements given in 4.2 of this part of ISO 640. Examples of procedures for adjustment of illumination systems are given in annex A.

4.2 The machine shall be verified directly. Direct verification involves

— verification of the test force (see 4.2.1);

— verification of the indenter (see 4.2.2 to 4.2.5);

— verification of the measuring device (see 4.2.6).

The equipment used to verify the standardizing machine shall have a certified traceability to the international system of units.

4.2.1 Each test force shall not deviate from the nominal value by more than ± 0,5 %.

4.2.2 The four faces of the square-based diamond pyramid shall be highly polished, free from surface defects, and the deviation from flatness of the faces shall not exceed 0,25 µm over a length of 80 µm from the tip of the indenter.

4.2.3 The angle between opposite faces at 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 not exceed 0,3°. The four faces shall meet in a point, with any line of junction between opposite faces being less than 0,25 µm.

4.2.4 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°.

4.2.5 The measuring device shall permit estimation of the length of the diagonals of the indentation to within ± 0,2 µm.

4.2.6 The device for measuring the diagonals of the indentation shall be calibrated against an accurately ruled line-scale (stage micrometer) or device of equivalent accuracy. The errors of the line-scale shall be known within an uncertainty of 0,2 µm.

4.2.7 The maximum permissable error of the measuring device shall be ± 1,0 % or 0,4 µm, whichever is the greater.

Alternatively when using a calibration factor or curve, it shall be chosen such that the error scatter does not exceed 0,4 µm.

4.2.8 Maximum allowable vibrational acceleration reaching the machine shall be less than $0{,}005 \times g$ (where g is the acceleration due to gravity = 9,806 65 m/s^2).

5 Standardizing procedure

The standardized blocks shall be calibrated in a standardizing machine as described in clause 4, at a temperature of 23 °C ± 5 °C, using the general procedure described in ISO 6507-3.

The time from the initial application of force until the full test force is reached shall not exceed 10 s. The approach velocity of the indenter shall be 15 µm/s to 70 µm/s. The duration of the test force shall be 13 s to 15 s.

6 Number of indentations

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

7 Uniformity of hardness

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

The non-uniformity of the block under the particular conditions of standardization is characterized by

$$d_n - d_1$$

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

$$\bar{d} = \frac{d_1 + d_2 + \ldots + d_n}{n}$$

7.2 The block is not sufficiently uniform in hardness for standardization purposes unless the non-uniformity is less than or equal to $0{,}04\,\bar{d}$ or 1 µm, whichever is the greater.

8 Marking and test certificate

8.1 Each standardized block shall be marked with the following:

a) serial number of block;

b) name or mark of supplier;

c) thickness of the block, or an identification mark on the test surface.

8.2 The following information shall be marked on the test block or on an accompanying test certificate:

a) serial number of block;

b) name or mark of standardizing authority;

c) year of calibration;

d) arithmetic mean of the hardness values found in the standardization test, for example 249 HV 0,1.

8.3 Any mark put on the side of the block shall be upright when the test surface is the upper face.

Annex A
(informative)

Adjustment of Abbé-Nelson or Kohler illumination systems

While some optical systems are permanently aligned, others have adjustment controls. To gain the utmost in resolution, the following adjustments should be made.

A.1 Abbé-Nelson illumination

A.1.1 Focus to critical sharpness the surface of a flat polished specimen.

A.1.2 Centre the illuminating source.

A.1.3 Centrally align the field and aperture diaphragms.

A.1.4 Ajust the lamp so that the filament is in sharp focus in the specimen plane.

A.1.5 Close the field diaphragm so that a thin, dark ring circles the field of view.

A.1.6 Close the aperture diaphragm until the glare just disappears. Never close the diaphragm to the point where diffraction phenomena appear.

A.1.7 Place a diffusing disc at the back of the field diaphragm if the lamp is not a ribbon-filament type.

A.1.8 If the light is too strong for eye comfort, reduce the intensity by use of an appropriate neutral density filter or rheostat control.

A.2 Kohler illumination

A.2.1 Focus to critical sharpness the surface of a flat polished specimen.

A.2.2 Centre the illuminating source.

A.2.3 Centrally align the field and aperture diaphragms.

A.2.4 Open the field diaphragm so that it just disappears from the field of view.

A.2.5 Remove the eyepiece and examine the rear focal plane of the objective. If all the components are in their proper places, the source of illumination and the aperture diaphragm will appear in sharp focus.

A.2.6 A full-aperture diaphragm is preferred for maximum resolving power. If glare is excessive, reduce the aperture. Never use less than a quarter of the opening since resolution would be decreased and diffraction phenomena could lead to false measurements.

A.2.7 If the light is too strong for eye comfort, reduce the intensity by use of an appropriate neutral density filter or rheostat control.

UDC 669:620.178.152.3.05:53.089.6

Descriptors: metals, tests, hardness tests, Vickers hardness, test equipment, blocks, reference sample, calibration, marking.

Price based on 4 pages