

International Standard



640

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Metallic materials — Hardness test — Calibration of standardized blocks to be used for Vickers hardness testing machines HV 0,2 to HV 100

Matériaux métalliques — Essai de dureté — Étalonnage des blocs de référence à utiliser pour les machines d'essai de dureté Vickers HV 0,2 à HV 100

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 640 was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*.

It cancels and replaces ISO Recommendation R 640-1967, of which it constitutes a technical revision.

Metallic materials — Hardness test — Calibration of standardized blocks to be used for Vickers hardness testing machines HV 0,2 to HV 100

1 Scope and field of application

This International Standard specifies a method for the calibration of standardized blocks to be used in Vickers hardness testing machines for test forces from 1,961 to 980,7 N (HV 0,2 to HV 100), for the indirect verification of these machines, as specified in ISO 146.

2 References

ISO 146, *Metallic materials — Hardness test — Verification of Vickers hardness testing machines HV 0,2 to HV 100.*

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

ISO 6507, *Metallic materials — Hardness test — Vickers test —*

Part 1: HV 5 to HV 100.

Part 2: HV 0,2 to less than HV 5.

3 Manufacture

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 standardized shall be of a thickness not less than 6 mm.

3.3 The standardized 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 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 R_a shall not exceed 0,05 μm for the test surface and 0,8 μm for the bottom surface; the sampling length, l is 0,80 mm (see ISO 468).

3.6 In order to check that no material has been 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 conditions specified in ISO 146, the standardizing machine shall also meet the requirements of 4.2.

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).

4.2.1 Each test force shall be accurate to within $\pm 0,2\%$ of the nominal test force. (See table 1).

Table 1

Hardness symbol	Nominal test force, <i>F</i> N
HV 0,2	1,961
HV 0,3	2,942
HV 0,5	4,903
HV 1	9,807
HV 2	19,61
HV 2,5	24,52
HV 3	29,42
HV 5	49,03
HV 10	98,07
HV 20	196,1
HV 30	294,2
HV 50	490,3
HV 100	980,7

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 opposite faces of the vertex of the diamond pyramid shall be $136 \pm 0,1^\circ$.

The inclination of the axis of the diamond pyramid to the axis of the indenter holder (normal to the seating surface) shall be less than $0,3^\circ$.

4.2.4 The point of the diamond shall be examined with a high power microscope or preferably in a interference microscope and, if the four faces do not meet in a point, the line of junction between opposite faces shall be less than 0,001 mm in length.

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 $90 \pm 0,2^\circ$.

4.2.6 The scale of the measuring microscope shall be graduated to permit subdivision for estimation of the diagonals of the indentation to within 0,1 % of *d* for *d* > 0,2 mm and to within 0,000 2 mm for *d* ≤ 0,2 mm.

The scale of the measuring microscope shall be verified by measurements made on a stage micrometer or any other suitable measuring device at a minimum of five intervals over each working range. The difference between readings corresponding to any two graduation lines of the measuring microscope shall be correct to within $\pm 0,1$ % of *d* for *d* > 0,5 mm and to within $\pm 0,000$ 5 mm for *d* ≤ 0,5 mm.

5 Standardizing procedure

The standardized blocks shall be calibrated in a standardizing machine as described in clause 4, at a temperature of $23 \pm 5^\circ\text{C}$, using the general procedure specified in ISO 6507/1 or ISO 6507/2.

The time from the initial application of force until the full test force is reached and the approach velocity (alternative 1) or the controlled speed of the indenter at the end of the penetration (alternative 2) shall meet the requirements given in table 2.

Table 2

Test force, <i>F</i> N	Alternative 1		Alternative 2
	Time for application of the force s	Approach velocity of the indenter mm/s	Controlled speed of the indenter at the end of penetration μm/s
$1,96 \leq F < 49,03$	No requirement	0,05 to 0,2	5 to 10
$49,03 \leq F \leq 980,7$	6 to 8	0,05 to 1	5 to 10

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

6 Number of indentations

On each standardized block five indentations shall be made, uniformly distributed over the entire 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 non-uniformity of the block under the particular conditions of standardization is characterized by the difference

$d_5 - d_1$

and expressed in percent of $\bar{d}$,

where

$$\bar{d} = \frac{d_1 + d_2 + \dots + d_5}{5}$$

7.2 The block is not sufficiently uniform in hardness for standardization purposes unless the uniformity satisfies the conditions given in table 3.

Table 3

Hardness of block	Maximum permissible non-uniformity of <i>d</i> %	
	HV 0,2 to less than HV 5	HV 5 to HV 100
≤ 225 HV	3,0	2,0
> 225 to 400 HV	1,5	1,0
> 400 HV	2,0	1,5