
INTERNATIONAL STANDARD



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Hardmetals — Vickers hardness test

Métaux durs — Essai de dureté Vickers

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

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.

International Standard ISO 3878 was drawn up by Technical Committee ISO/TC 119, *Powder metallurgical materials and products*, and was circulated to the Member Bodies in July 1975.

It has been approved by the Member Bodies of the following countries :

Australia	Germany	Sweden
Austria	Italy	Turkey
Brazil	Mexico	United Kingdom
Bulgaria	Portugal	U.S.A.
Canada	Romania	U.S.S.R.
Czechoslovakia	South Africa, Rep. of	
France	Spain	

No Member Body expressed disapproval of the document.

Hardmetals — Vickers hardness test

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the method for carrying out the Vickers hardness test for hardmetals.

2 REFERENCE

ISO/R 81, *Vickers hardness test for steel*.

NOTE — Attention is drawn to an agreement between the Secretariats of the ISO Technical Committees for metals (ISO/TC 17, 25, 26, 79, 119 and 155) to establish an integration of the existing ISO Recommendations and Standards for Vickers hardness testing into one single International Standard which will apply to all metallic materials. Depending on the results of this co-ordination work, this International Standard may be revised or withdrawn within a few years.

3 PRINCIPLE

A diamond indenter in the form of a right pyramid with a square base and with a specified angle between opposite faces at the vertex is forced into the test piece under a load F and the diagonal d of the indentation left in the surface after removal of the load is measured.

The Vickers hardness HV is the quotient obtained by dividing the test load (expressed in newtons or in kilograms-force) by the sloping area (expressed in square millimetres) of the indentation, considered as a right pyramid with a square base, of diagonal d , and having at the vertex the same angle as the indenter.

4 SYMBOLS AND DESIGNATIONS

See figures 1 and 2, and the accompanying table.

5 APPARATUS

5.1 Testing machine capable of applying a predetermined load or loads within the range of 9,81 to 491 N (1 to 50 kgf) to an accuracy of $\pm 1,0\%$.

5.2 Measuring device capable of measuring indentation diagonals to the following accuracy :

$$\begin{aligned}d < 100 \mu\text{m} &: \pm 0,2 \mu\text{m} \\100 \mu\text{m} \leq d < 200 \mu\text{m} &: \pm 1,0 \mu\text{m} \\d \geq 200 \mu\text{m} &: \pm 0,5 \%\end{aligned}$$

5.3 Indenter consisting of a diamond in the shape of a right pyramid with a square base. The angle at the vertex between opposite faces of the indenter shall be $136 \pm 0,5^\circ$. (See ISO/R 81 and figures 1 and 2.)

5.3.1 All four faces of the indenter shall be equally inclined to the axis of the indenter (within $\pm 0,5^\circ$) and meet in a point, i.e. any line of junction between opposite faces shall be less than 0,002 mm in length. A common form of point, when examined under high magnification, is shown in figure 3. The limiting length of 0,002 mm is shown in the same figure.

5.3.2 The indenter shall be well polished and free from cracks or other surface defects.

6 SAMPLING AND PREPARATION OF TEST PIECES

6.1 The thickness of the layer removed from the surface of the test piece shall be not less than 0,2 mm.

The test shall be carried out on a surface which is sufficiently smooth and even to permit the accurate determination of the diagonals of the indentation.

Preparation shall be carried out in such a way that any alteration of the surface due to heat or cold working is minimized.

When determining the hardness of a test piece with a curved surface, a flat surface shall be prepared on the test piece on which to carry out the test.

6.2 The prepared test piece shall be at least 1 mm thick.

The thickness of the test piece shall be sufficient to allow the test to be carried out without breaking or deforming the test piece under the chosen load. For test pieces of small cross-section or of irregular shape, it may be necessary to provide some form of additional support, for example mounting in plastics material.

7 PROCEDURE

7.1 The test load shall be within the range of 9,81 to 491 N (1 to 50 kgf), the preferred load being 294 N (30 kgf).

7.2 The test piece shall be placed firmly on a rigid support. The contact surfaces shall be clean. It is important that the test piece lies firmly on the support so that displacement cannot occur during the test.

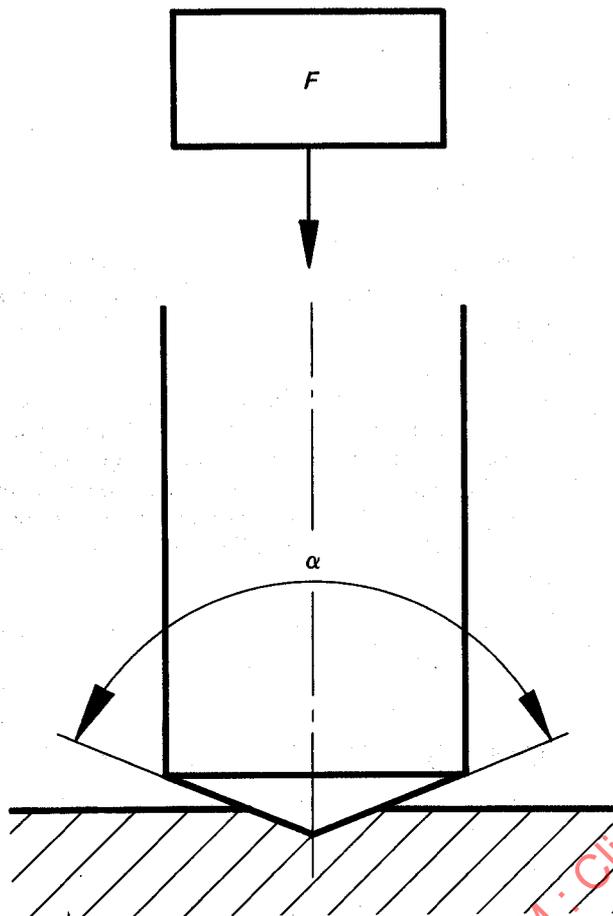


FIGURE 1

Symbol	Designation
α	Angle at the vertex of the pyramidal indenter (136°)
F	Test load, in newtons or in kilograms-force
d	Arithmetic mean of the two diagonals d_1 and d_2 , in millimetres
HV	Vickers hardness
	$= \frac{\text{test load}}{\text{area of indentation}}$ $= \frac{0,102 \times 2 F \sin \frac{136^\circ}{2}}{d^2} \approx 0,1891 \frac{F}{d^2}$ when the test load F is expressed in newtons, or
	$= \frac{2 F \sin \frac{136^\circ}{2}}{d^2} \approx 1,854 \frac{F}{d^2}$ when the test load F is expressed in kilograms-force

NOTE -The symbol HV is preceded by the hardness value and supplemented by an index indicating the load in kilograms-force.

Example : 1 600 HV 30 = Vickers hardness of 1 600 measured under a load of 294 N (30 kgf).

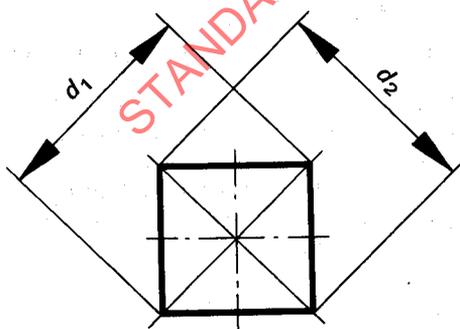


FIGURE 2

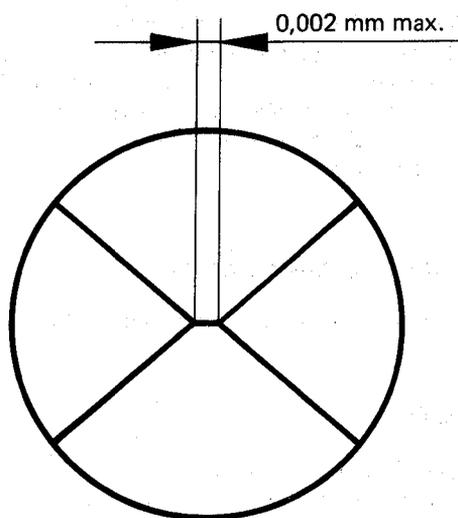


FIGURE 3

7.3 The indenter shall be forced, without shock or vibration, perpendicularly into the surface to be tested, until the applied load attains the specified value. This load shall be maintained for 10 to 15 s.

7.4 If possible, at least three hardness determinations shall be made on the test piece.

7.5 The distance from the centre of any indentation to the edge of the test piece or to the edge of any other indentation shall be not less than 2,5 times the diagonal of the indentation.

7.6 The satisfactory condition of the indenter shall be verified frequently. Any irregularities in the shape of the indentation may indicate poor condition of the indenter. If the examination of the indenter confirms this, then the test shall be rejected and the indenter renewed.

8 EXPRESSION OF RESULTS

The arithmetical mean of the lengths of the two diagonals of the indentation shall be taken for the calculation of the Vickers hardness.

Report the arithmetical mean of the hardness values obtained, rounded to the nearest 10 HV.

9 TEST REPORT

The test report shall include the following information :

- a) reference to this International Standard;
- b) all details necessary for identification of the test sample;
- c) result obtained;
- d) all operations not specified by this International Standard, or regarded as optional;
- e) details of any occurrence which may have affected the result.

NOTE — There is no general process for accurately converting Vickers hardness into other scales of hardness. These conversions, therefore, should be avoided, except for special cases where a reliable basis for the conversion has been obtained by comparison tests.

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