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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 192

VICKERS HARDNESS TEST FOR LIGHT METALS AND THEIR ALLOYS

1st EDITION

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BRIEF HISTORY

The ISO Recommendation R 192, *Vickers Hardness Test for Light Metals and their Alloys*, was drawn up by Technical Committee ISO/TC 79, *Light Metals and their Alloys*, the Secretariat of which is held by the Association Française de Normalisation (AFNOR).

Work on this question by the Technical Committee began in 1956 and led in 1958 to the adoption of a Draft ISO Recommendation.

In December 1958, this Draft ISO Recommendation (No. 265) was circulated to all the ISO Member Bodies for enquiry. It was approved by the following Member bodies:

Austria	Hungary	Poland
Belgium	India	Portugal
Brazil	Ireland	Spain
Burma	Israel	Sweden
Canada	Italy	Switzerland
Finland	Japan	United Kingdom
France	Netherlands	U.S.S.R.
Germany	New Zealand	Yugoslavia

One Member Body opposed the approval of the Draft: Romania.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in March 1961, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 192 March 1961

VICKERS HARDNESS TEST FOR LIGHT METALS AND THEIR ALLOYS

1. PRINCIPLE OF TEST

The test consists in forcing an indenter, in the form of a right pyramid with a square base and specified angle between opposite faces at the vertex, under a load F, into the metal, and measuring the diagonal d of the indentation left in the surface after removal of the load.

The Vickers hardness is the ratio of the test load F (expressed in kilogrammes-force) to 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 penetrator.

2. SYMBOLS AND DESIGNATIONS

Number	Symbol	Designation
1	—	Angle at the vertex of the pyramidal penetrator (136°)
2	F	Test load, in kilogrammes-force
3	d	Arithmetic mean of the two diagonals, d_1 and d_2, in millimetres
4	HV	Vickers hardness $= \dfrac{\text{test load}}{\text{area of indentation}} = \dfrac{2F \sin \frac{136°}{2}}{d^2} = 1.854 \dfrac{F}{d^2}$ (approx.)

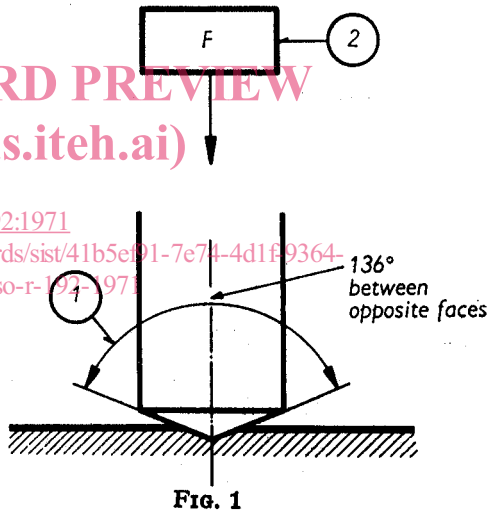

FIG. 1

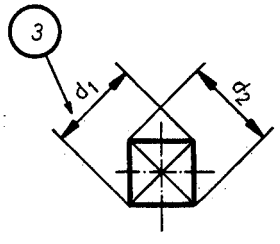

FIG. 2

NOTE

The symbol HV is supplemented by an index indicating the load and the duration of loading.

Example: HV 10 = Vickers hardness, measured under a load of 10 kgf, applied for the normal time;

HV 10/15 = Vickers hardness, measured under a load of 10 kgf, applied for 15 seconds.

3. TESTING EQUIPMENT

3.1 The indenter consists of a right diamond pyramid with a square base. The angle at the vertex between opposite faces of the indenter is 136° ± 0.5°.

3.1.1 All four faces of the indenter are equally inclined to the axis of the indenter (within 0.5°) and meet in a point, i.e. any line of junction between opposite faces is 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.

3.1.2 The indenter should be well polished and free from cracks or other surface defects.

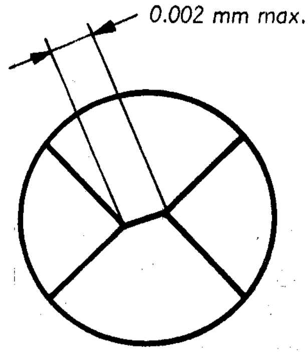

FIG. 3

4. TEST REQUIREMENTS

4.1 The test is carried out at ambient temperature, unless otherwise specified.

4.2 The indenter, when normal to and in contact with the surface to be tested, is forced, without shock or vibration, into this surface until the applied load attains the specified value in 10 seconds minimum. This load is maintained for 30 ± 2 seconds.

4.3 The test should be carried out on a surface to be tested which is sufficiently smooth and even to permit the accurate determination of the diagonal of the indentation. It should be free from foreign matter. Care should be taken in preparing the surface to avoid any prejudicial change in condition, e.g. due to heating or cold working. The finish of the surface must be such that the accuracy of measurement detailed in clause 4.9 may be obtained.

4.4 The radius of curvature of curved surfaces to be tested should be not less than 5 mm. The testing of curved surfaces with smaller radii should be the subject of special agreement.

4.5 The test piece should be placed on a rigid support. The contact surfaces should be clean and free from foreign matter (oil, dirt, etc.). It is important that the test piece lies firmly on the support, so that displacement cannot occur during the test.

4.6 The thickness of the test piece or of the layer under test should be at least 1.5 times the diagonal of the indentation. No deformation should be visible at the back of the test piece after the test.

4.7 The distance from the centre of any indentation to the edge of the test piece or the edge of any other indentation should be not less than 2½ times the diagonal of the indentation.

4.8 The standard test load is 10 kgf. It is possible to use larger or smaller loads, provided that the loads are within the range of 1 to 100 kgf. The tolerance on the test load should be $\pm$ 1 per cent.

For materials having a thickness equal to or greater than 0.5 mm, the load should be such that the diagonal of the indentation is between 0.4 and 0.6 mm. For material thinner than 0.5 mm, smaller loads may be applied. In all cases the value of the load must be quoted.

4.9 The measuring microscope or other measuring device should be capable of reading the diagonal of the indentation to an accuracy of $\pm$ 0.001 mm for indentation diagonals of less than 0.2 mm, and to an accuracy of $\pm$ 0.002 mm for indentation diagonals of 0.2 mm and over. The arithmetic mean of the lengths of the two diagonals of the indentation is taken for the calculation of the Vickers hardness.

4.10 The satisfactory condition of the indenter should 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 should be rejected.

NOTES

1. There is no general process for converting accurately Vickers hardness into other scales of hardness or tensile strength. These conversions therefore should be avoided, except for special cases where a reliable basis for the conversion has been obtained by comparison tests. Even in such cases, the relation between Vickers hardness and tensile strength or other scales of hardness is only indicative.

2. It should be noted that for anisotropic materials, such as those which have been heavily cold-worked, there will be a difference between the lengths of the two diagonals of the indentation. The specification for the product may indicate limits for such differences.

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