UDC 669.7.0

Ref. No. : ISO/ R 191-1961 (E)

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION
R 191

BRINELL HARDNESS TEST FOR LIGHT METALS AND THEIR ALLOYS

1st EDITION

March 1961

For each individual country the only valid standard is the national standard of that country.

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 191, *Brinell 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 1955 and led in 1958 to the adoption of a Draft ISO Recommendation.

In December 1958, this Draft ISO Recommendation (No. 264) was circulated to all the ISO Member Bodies for enquiry. It was approved by the following Member Bodies:

Austria	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
Hungary	Poland	

Two Member Bodies opposed the approval of the Draft:

Belgium 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 191 March 1961

BRINELL HARDNESS TEST FOR LIGHT METALS AND THEIR ALLOYS

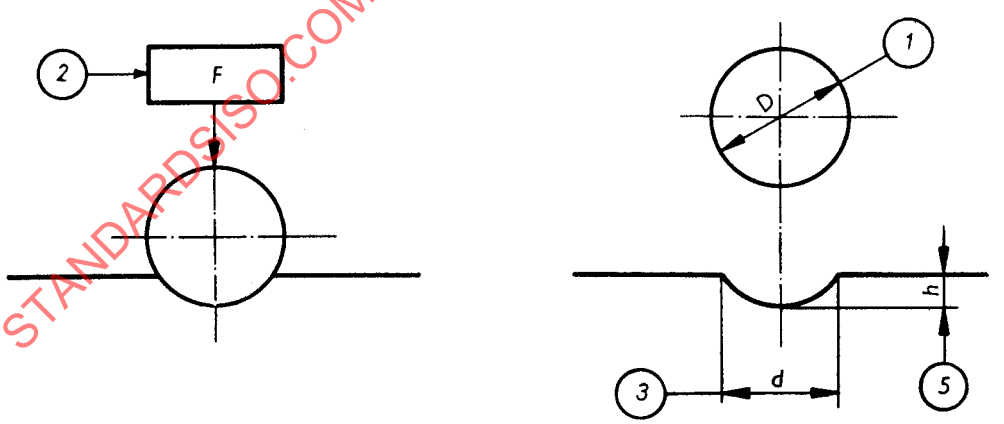
1. PRINCIPLE OF TEST

The test consists in forcing a steel ball of diameter D, under a load F, into the test piece, and measuring the diameter d of the indentation left in the surface after removal of the load.

The Brinell hardness HB is the ratio of the test load F (expressed in kilogrammes-force) to the curved surface area of the indentation (expressed in square millimetres) which is assumed to be spherical and of diameter D.

2. SYMBOLS AND DESIGNATIONS

Number	Symbol	Designation
1	D	Diameter of the ball, in millimetres
2	F	Test load, in kilogrammes-force
3	d	Diameter of indentation, in millimetres
4	HB	Brinell hardness $= \dfrac{\text{test load}}{\text{surface area of indentation}} = \dfrac{2F}{\pi D (D - \sqrt{D^2 - d^2})}$
5	h	Depth of indentation, in millimetres



NOTE

The Brinell hardness is denoted by the symbol HB supplemented by an index indicating the test conditions in the following order:

diameter of ball,
load,
duration of loading.

Example: HB 5/250/30 = Brinell hardness measured with a ball of 5 mm diameter and with a load of 250 kgf applied for 30 s.

3. TESTING EQUIPMENT

3.1 The nominal diameter of the ball should be not less than 1 mm, unless otherwise specified. A 10 mm ball is preferred, when the thickness of the test piece permits. No diameter of the ball should differ from the nominal diameter by more than the following:

Diameter of ball Millimetres	Tolerance * Millimetres
from 1 to 3	± 0.003 5
over 3 to 6	± 0.004
over 6 to 10	± 0.004 5

3.2 The ball is of hardened steel** with a hardness of at least 850 HV (taking into account the curvature of the ball, when testing); it should be polished and free from surface defects. Any ball showing any deformation after the test greater than the tolerance specified under clause 3.1 above, or any surface defect, should be rejected, and the corresponding test discarded.

4. TEST REQUIREMENTS

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

4.2 The ball is placed against the surface of the test piece. Pressure is gradually applied to the ball normal to the surface, without sudden shocks, until the test load is attained within 10 seconds minimum. The test load is maintained for 30 ± 2 seconds.

For magnesium and magnesium alloys, the test load is maintained for 120 ± 5 seconds.

4.3 The test should be carried out on a surface which is sufficiently smooth and even to permit the accurate determination of the diameter 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.

In order that the accuracy of the measurements shall be in agreement with the requirements of clause 4.8, it is recommended that the surface finish be such that the diameter of the indentation can be determined to ± 0.01 mm.

4.4 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.

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* These tolerances correspond to Grade 6 of the ISA System (ISA Bulletin 25). Balls for ball bearings normally satisfy these tolerances.

** If for any reason a ball of material other than hardened steel is used, the test should be described as a modified Brinell hardness test, and the symbol HB should not be employed.