

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 191

BRINELL HARDNESS TEST FOR LIGHT METALS

AND THEIR ALLOYS

(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/d2dedaf2-12cc-4f82-afb6-97097c25c098/iso-r-191-1971>

1st EDITION

March 1961

COPYRIGHT RESERVED

The copyright of ISO Recommendations and ISO Standards belongs to ISO Member Bodies. Reproduction of these documents, in any country, may be authorized therefore only by the national standards organization of that country, being a member of ISO.

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/R 191:1971

<https://standards.iteh.ai/catalog/standards/sist/d2dedaf2-12cc-4f82-afb6-97097e35e098/iso-r-191-1971>

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/R 191:1971

<https://standards.iteh.ai/catalog/standards/sist/d2dedaf2-12cc-4f82-afb6-97097e35e098/iso-r-191-1971>

BRINELL HARDNESS TEST FOR LIGHT METALS AND THEIR ALLOYS

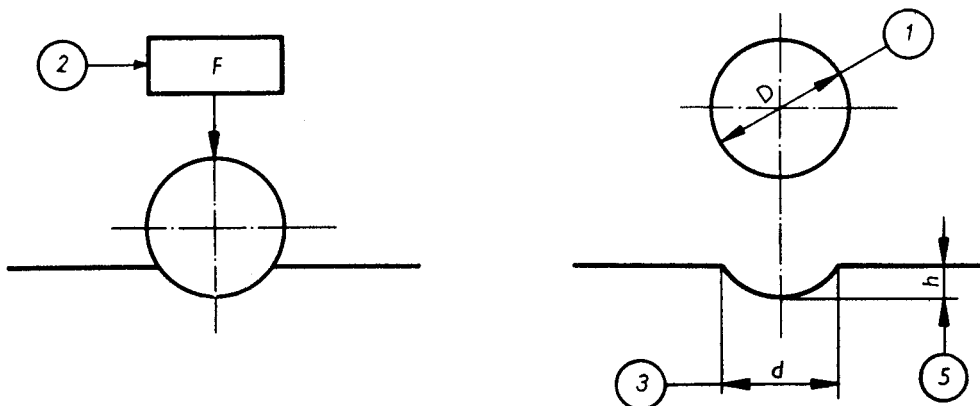
1. PRINCIPLE OF TEST

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 $= \frac{\text{test load}}{\text{surface area of indentation}}$ $= \frac{2F}{\pi D (D - \sqrt{D^2 - d^2})}$ <small>ISO/R 191:1971</small>
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	$\pm 0.003\ 5$
over 3 to 6	± 0.004
over 6 to 10	$\pm 0.004\ 5$

- 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.

iTeh STANDARD PREVIEW 4. TEST REQUIREMENTS (standards.iteh.ai)

- 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.

* 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.

- 4.5 For materials having a Brinell hardness lower than 80, the applied load expressed in kilogrammes-force should be equal to 5 times the square of the diameter of the ball expressed in millimetres, i.e. $F = 5 D^2$.

For materials having a hardness greater than 55, the applied load should be equal to: $F = 10 D^2$ or $15 D^2$.

If the expected hardness of the material to be tested lies between 55 and 80, any convenient one of these loads may be used at discretion, i.e. $F = 5 D^2$, or $10 D^2$, or $15 D^2$.

The tolerance on the load should be in every case ± 1 per cent.

- 4.6 The thickness of the test piece should be not less than 8 times the depth of indentation h . No deformation should be visible at the back of the test piece after test.

$$\text{Depth of indentation} = \frac{F}{\pi D \times \text{HB}}$$

- 4.7 As a general rule, the distance from the centre of the indentation to the edge of the test piece should be at least 3 times the diameter of the indentation, and the distance between the centres of two adjacent indentations should be at least 6 times the diameter of the indentation. The test should be carried out in such a way that nothing occurs to falsify the test result (such as bulging at the edge or distortion of the test piece).

- 4.8 The diameter of each indentation is measured in two directions at right angles, and the mean value of the two readings is used for the purpose of determining the Brinell hardness. The measuring microscope or other measuring device should be capable of measuring the diameter of indentations to an accuracy of ± 0.25 per cent of the diameter of the ball.

<https://standards.iteh.ai/catalog/standards/sist/d2dedaf2-12cc-4f82-afb6-97097e35e098/iso-r-191-1971>

NOTES

1. There is no general process for converting accurately Brinell 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 Brinell hardness and tensile strength or other scales of hardness is only indicative.
2. Experimental evidence is available to show that the Brinell hardness of most light metals and alloys will vary with the diameter of the ball and the magnitude of the indenting load.
3. It is desirable that the diameter d of the indentation should range between $0.25 D$ and $0.5 D$ ($D =$ diameter of the ball).

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/R 191:1971

<https://standards.iteh.ai/catalog/standards/sist/d2dedaf2-12cc-4f82-afb6-97097e35e098/iso-r-191-1971>