SLOVENSKI STANDARD
oSIST prEN ISO 6506-1:2023

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Kovinski materiali - Preskus trdote po Brinellu - 1. del: Preskusna metoda (ISO/DIS 6506-1:2023)

Metallic materials - Brinell hardness test - Part 1: Test method (ISO/DIS 6506-1:2023)

Metallische Werkstoffe - Härteprüfung nach Brinell - Teil 1: Prüfverfahren (ISO/DIS 6506-1:2023)

Matériaux métalliques - Essai de dureté Brinell - Partie 1: Méthode d'essai (ISO/DIS 6506-1:2023)

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Metallic materials — Brinell hardness test —

Part 1: Test method

Matériaux métalliques — Essai de dureté Brinell —

Partie 1: Méthode d'essai

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 3, *Hardness testing*.

This Fourth edition cancels and replaces the third edition (ISO 6506-1:2014), which has been technically revised.

ISO 6506 consists of the following parts, under the general title *Metallic materials — Brinell hardness test*:

— *Part 1: Test method*

— *Part 2: Verification and calibration of testing machines*

— *Part 3: Calibration of reference blocks*

— *Part 4: Table of hardness values*

Metallic materials — Brinell hardness test —

Part 1: Test method

1 Scope

This part of ISO 6506 specifies the method for the Brinell hardness test for metallic materials. It is applicable to both fixed location and portable hardness testing machines.

For some specific materials and/or products, particular International Standards exist (e.g. ISO 4498) and make reference to this International Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4498, *Sintered metal materials, excluding hardmetals — Determination of apparent hardness and microhardness*

ISO 6506-2:2023, *Metallic materials — Brinell hardness test — Part 2: Verification and calibration of testing machines*

ISO 6506-3:2023, *Metallic materials — Brinell hardness test — Part 3: Calibration of reference blocks*

ISO 6506-4, *Metallic materials — Brinell hardness test — Part 4: Table of hardness values*

3 Principle

An indenter (tungsten carbide composite ball with diameter, *D*) is forced into the surface of a test piece and, after removal of the force, *F*, the mean diameter of the indentation, *d*, left in the surface is calculated from a number of diameter measurements. .

The Brinell hardness is proportional to the quotient obtained by dividing the test force by the curved surface area of the indentation. The indentation is assumed to take the shape of the unloaded ball indenter, and its surface area is calculated from the mean indentation diameter and the ball diameter, using the formula given in Table 1.

4 Symbols and abbreviated terms

4.1 See Figure 1 and Table 1.

Table 1 — Symbols and abbreviated terms

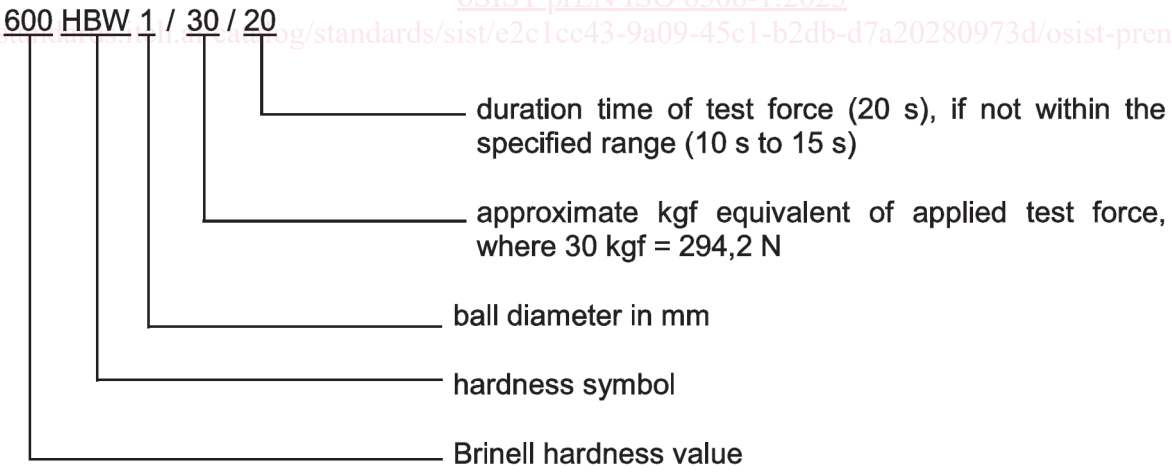
Symbol/ abbreviated term	Definition	Unit
D	Diameter of the ball	mm
F	Test force	N
d_i	Mean diameter of the indentation $d_i = (d_1 + d_2 \ldots d_n)/n$ At least 2 indentation diameters measured at equal rotational spacing.	mm
d_1, d_2	Indentation diameters measured at approximately 90°	mm
h	Depth of indentation $h = \frac{D}{2}\left(1 - \sqrt{1 - \frac{d^2}{D^2}}\right)$	mm
HBW	Brinell hardness $= \text{constant (see Note)} \times \frac{\text{Test force}}{\text{idealized surface area of indentation}}$ $\text{HBW} = 0{,}102 \times \frac{2F}{\pi D^2\left(1 - \sqrt{1 - \frac{d^2}{D^2}}\right)}$	
$0{,}102 \times F/D^2$	Force-diameter index	

NOTE constant = $0{,}102 \approx \frac{1}{9{,}806\,65}$, where 9,806 65 is the conversion factor from kgf to N.

4.2 The following is an example of the designation of Brinell hardness, HBW.

EXAMPLE

Amend to show correct spacing 600 HBW 1/30/20



NOTE In former editions of this International Standard, when use of a steel ball was permitted, the Brinell hardness was denoted by HB or HBS.

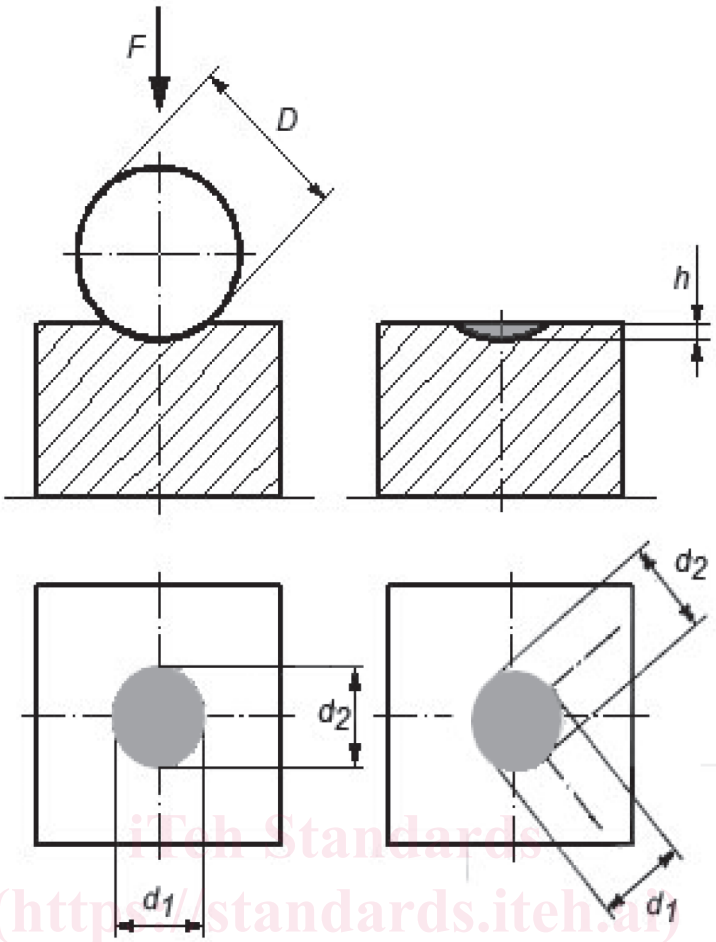


Figure 1 — Principle of test

For symbols, see Table 1.

5 Apparatus

5.1 The direct calibration of equipment shall be performed only when a requirement is realised, as defined in table 4 of ISO 6506-2:XXXX — Direct verifications of hardness testing machines.

5.2 Testing machine, capable of applying a predetermined test force or test forces within the range of 9,807 N to 29,42 kN, and calibrated and verified in accordance with the requirements of ISO 6506-2.

5.3 Indenter, a polished tungsten carbide composite ball, as specified in ISO 6506-2.

5.4 Indentation diameter measuring system, as specified in ISO 6506-2.

6 Test piece

6.1 The test shall be carried out on a surface which is smooth and even, free from oxide scale, foreign matter and, in particular, completely free from lubricants, unless otherwise specified in product

standards. The test piece shall have a surface finish that will allow a measurement of the diameter of the indentation with a variability that is low enough for the intended purpose of the test result.

Surfaces to be indented with the smaller ball indenters, may be polished or lapped prior to making the indentation to reduce the uncertainty of the diameter measurement.

6.2 Any test piece preparation performed prior to testing shall be carried out in such a way that any alteration of the surface, for example, due to excessive heating or cold-working, is minimized.

6.3 The thickness of the test piece shall be at least eight times the depth of indentation, *h*, and a thickness of at least ten times is recommended. Values for the minimum thickness of the test piece in relation to the mean diameter of indentation are given in Annex B.

Visible deformation at the back of the test piece can indicate that the test piece is too thin.

7 Procedure

7.1 In general, the test should be carried out at ambient temperature within the limits of 10 °C to 35 °C. However, because temperature variation can affect the results, users of the Brinell test can choose to control the temperature within a tighter range, such as 23 °C ± 5 °C.

7.2 Before performing any tests, confirm that verification has been performed in accordance with Annex A.

7.3 The test forces given in Table 2 shall be used. Other test forces and force-diameter indices can be used by special agreement.

Table 2 — Test forces for the different testing conditions

Hardness symbol	Ball diameter D mm	Force-diameter index $0{,}102 \times F/D^2$	Test force value F N
HBW 10/3 000	10	30	29 420
HBW 10/1 500	10	15	14 710
HBW 10/1 000	10	10	9 807
HBW 10/500	10	5	4 903
HBW 10/250	10	2,5	2 452
HBW 10/100	10	1	980,7
HBW 5/750	5	30	7 355
HBW 5/250	5	10	2 452
HBW 5/125	5	5	1 226
HBW 5/62,5	5	2,5	612,9
HBW 5/25	5	1	245,2
HBW 2,5/187,5	2,5	30	1 839
HBW 2,5/62,5	2,5	10	612,9
HBW 2,5/31,25	2,5	5	306,5
HBW 2,5/15,625	2,5	2,5	153,2
HBW 2,5/6,25	2,5	1	61,29
HBW 1/30	1	30	294,2
HBW 1/10	1	10	98,07
HBW 1/5	1	5	49,03

