
**Metallic materials — Brinell hardness
test —**

**Part 3:
Calibration of reference blocks**

*Matériaux métalliques — Essai de dureté Brinell —
Partie 3: Étalonnage des blocs de référence*

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ISO 6506-3:2005

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6506-3 was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 3, *Hardness testing*.

This second edition cancels and replaces the first edition (ISO 6506-3:1999) which has been technically revised.

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

- *Part 1: Test method* <https://standards.iteh.ai/catalog/standards/sist/0d309803-d115-4974-a954-2f462f9fbfda/iso-6506-3-2005>
- *Part 2: Verification and calibration of testing machines*
- *Part 3: Calibration of reference blocks*
- *Part 4: Table of hardness values*

Introduction

Attention is drawn to the fact that in this part of ISO 6506, only the use of the hardmetal ball indenter is specified.

The designation of the Brinell hardness is HBW and should not be confused with the former designation HB, or HBS when a steel ball indenter was used.

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Metallic materials — Brinell hardness test —

Part 3: Calibration of reference blocks

1 Scope

This part of ISO 6506 specifies a method for the calibration of reference blocks to be used in the indirect verification of Brinell hardness testing machines as described in ISO 6506-2.

2 Normative references

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

ISO 376:2004, *Metallic materials — Calibration of force-proving instruments used for verification of uniaxial testing machines*

ISO 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO 6506-1:2005, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6506-2:2005, *Metallic materials — Brinell hardness test — Part 2: Verification and calibration of testing machines*

3 Manufacture of reference blocks

3.1 The block shall be specially manufactured for use as a hardness-reference block.

NOTE Attention is drawn to the need to use a manufacturing process which will give the necessary homogeneity, stability of structure and uniformity of surface hardness.

3.2 Each metal block to be calibrated shall be of a thickness not less than:

- 16 mm for 10 mm balls;
- 12 mm for 5 mm balls;
- 6 mm for smaller balls.

NOTE 12 mm for 10 mm balls may be used only if the hardness of the reference block is greater than 150 HBW.

3.3 The reference blocks shall be free of magnetism. It is recommended that the manufacturer shall ensure that the blocks, if of steel, have been demagnetized at the end of the manufacturing process.

3.4 The flatness of the two surfaces and the parallelism of the reference block shall be in accordance with Table 1.

Table 1 — Requirements for the reference blocks

Diameter of ball mm	Tolerance in flatness of the surfaces mm	Tolerance in parallelism mm over 50 mm	Permissible surface roughness, R_a^a μm	
			Test surface	Bottom surface
10	0,040	0,050	0,3	0,8
5	0,030	0,040	0,2	0,8
< 5	0,020	0,030	0,1	0,8

^a Sampling length: $l = 0,80$ mm (see ISO 4287).

3.5 The test surface shall be free from scratches which interfere with the measurement of the indentations (see Table 1).

3.6 To verify that no material is subsequently removed from the reference block, the thickness at the time of calibration shall be marked on it to the nearest 0,1 mm, or an identifying mark shall be made on the test surface [see 8.1.e)].

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4 Calibration machine

4.1 In addition to fulfilling the general requirements specified in Clause 3 of ISO 6506-2:2005, the calibration machine shall also meet the requirements given in 4.2 to 4.8.

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4.2 The machine shall be verified directly in intervals not exceeding twelve months.

Direct verification involves:

- a) calibration of the test force;
- b) verification of the indenter;
- c) calibration of the measuring device;
- d) verification of the testing cycle, if this is not possible, at least the force versus time behaviour.

4.3 The instruments used for verification and calibration shall be traceable to national standards.

4.4 Each test force shall be measured using an elastic proving device (of ISO 376:2004, Class 0,5 or better) and the measurement shall agree with the nominal value to within $\pm 0,1$ %.

4.5 The indenters shall be verified and shall meet the requirements given in 4.3 of ISO 6506-2:2005, with the exception that the tolerances on the diameter of the balls shall meet requirements given in Table 2.

Table 2 — Tolerances for different ball diameters

Ball diameter mm	Tolerance mm
10	± 0,003
5	± 0,002
2,5	± 0,001
1	± 0,001

4.6 The scale of the measuring microscope shall be graduated to read to 0,002 mm for indentations made with 10 mm and 5 mm balls and 0,001 mm for indentations made with balls of less than 5 mm diameter.

The scale of the measuring microscope shall be verified by measurements made on a stage micrometer at a minimum of five intervals over each working range. The accuracy of the measuring device in relation to the diameters of indentation shall be as given in Table 3.

Table 3 — Accuracy of the measuring device

Diameter of indentation mm	Accuracy mm
$d < 1$	± 0,000 5
$1 \leq d < 2,5$	± 0,001 0
$d \geq 2,5$	± 0,002 0

4.7 The testing cycle shall conform to the testing cycle described in ISO 6506-1 and shall be timed with an uncertainty less than ± 0,5 s.

4.8 The characteristics of the hardmetal balls are specified in 4.3.4.2 of ISO 6506-2:2005.

5 Calibration procedure

The reference blocks shall be calibrated in a calibration machine as described in Clause 4, at a temperature of $(23 \pm 5) ^\circ\text{C}$, using the general procedure described in ISO 6506-1.

During calibration, the thermal drift should not exceed $1 ^\circ\text{C}$.

The time from the initial application of force to the time the full test force is reached shall not be less than 6 s nor greater than 8 s. The duration of the test force shall be 10 s to 15 s.

The mechanism which controls the application of the force shall ensure that the speed of approach of the ball immediately before it touches the block is not more than 1 mm/s.

6 Number of indentations

On each reference block, five indentations shall be made uniformly distributed over the entire test surface.

To reduce the measurement uncertainty, more than five indentations should be made.