



BSI Standards Publication

Metallic materials — Rockwell hardness test

Part 2: Verification and calibration of testing machines and indenters

National foreword

This British Standard is the UK implementation of EN ISO 6508-2:2023. It is identical to ISO 6508-2:2023. It supersedes BS EN ISO 6508-2:2015, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/101/5, Indentation hardness testing.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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English Version

**Metallic materials - Rockwell hardness test - Part 2:
Verification and calibration of testing machines and
indenters (ISO 6508-2:2023)**

Matériaux métalliques - Essai de dureté Rockwell -
Partie 2: Vérification et étalonnage des machines
d'essai et des pénétrateurs (ISO 6508-2:2023)

Metallische Werkstoffe - Härteprüfung nach Rockwell -
Teil 2: Überprüfung und Kalibrierung der
Prüfmaschinen und Eindringkörper (ISO 6508-2:2023)

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EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (EN ISO 6508-2:2023) has been prepared by Technical Committee ISO/TC 164 "Mechanical testing of metals" in collaboration with Technical Committee CEN/TC 459/SC 1 "Test methods for steel (other than chemical analysis)" the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2024, and conflicting national standards shall be withdrawn at the latest by June 2024.

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

This document supersedes EN ISO 6508-2:2015.

Any feedback and questions on this document should be directed to the users' national standards body/national committee. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Endorsement notice

The text of ISO 6508-2:2023 has been approved by CEN as EN ISO 6508-2:2023 without any modification.

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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 document 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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This document was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 3, *Hardness testing*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 459, *ECISS - European Committee for Iron and Steel Standardization*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 6508-2:2015), which has been technically revised.

The main changes are as follows:

- removed all statements of requirements, permissions, and recommendations from the Scope of the document ([Clause 1](#));
- addition of [Clause 3](#), Terms and definitions;
- modification of the requirements for the calibration and verification of the force and depth measuring systems ([Clause 4](#));
- added a requirement for the hardness of the indenter ball holder ([Clause 6](#));
- changed the layout of [Table 8](#) ([Clause 6](#));
- modified the requirements for direct and indirect calibration and verification ([Clause 7](#));
- modified the information related to the determination of uncertainty of measurement ([Annex B](#)).

A list of all parts in the ISO 6508 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Metallic materials — Rockwell hardness test —

Part 2: Verification and calibration of testing machines and indenters

1 Scope

This document specifies two separate methods of verification of testing machines (direct and indirect) for determining Rockwell hardness in accordance with ISO 6508-1, together with a method for verifying Rockwell hardness indenters.

The direct verification method is used to determine whether the main parameters associated with the machine function, such as applied force, depth measurement, and testing cycle timing, fall within specified tolerances. The indirect verification method uses a number of calibrated reference hardness blocks to determine how well the machine can measure a material of known hardness.

This document is applicable to stationary and portable hardness testing machines.

Attention is drawn to the fact that the use of tungsten carbide composite for ball indenters is considered to be the standard type of Rockwell indenter ball.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Metallic materials — Calibration of force-proving instruments used for the verification of uniaxial testing machines*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*

ISO 6508-3, *Metallic materials — Rockwell hardness test — Part 3: Calibration of reference blocks*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 General conditions

Before a Rockwell hardness testing machine is verified, the machine shall be checked to ensure that it is properly set up and operating in accordance with the manufacturer's instructions.

Especially, it should be checked that the test force can be applied and removed without shock, vibration, or overload and in such a manner that the readings are not influenced.

5 Direct verification of the testing machine

5.1 General

5.1.1 Direct verification involves calibration and verification of the following:

- a) test forces;
- b) depth-measuring system;
- c) testing cycle;
- d) machine hysteresis test.

5.1.2 Direct verification should be carried out at a temperature of $(23 \pm 5) ^\circ\text{C}$. If the verification is made outside of this temperature range, this shall be reported in the verification report.

5.1.3 The instruments used for calibration shall be traceable to national standards.

5.1.4 An indirect verification according to [Clause 6](#) shall be performed following a successful direct verification.

5.2 Calibration and verification of the test force

5.2.1 Each preliminary test force, F_0 , (see [5.2.4](#)) and each total test force, F , used (see [5.2.5](#)) shall be measured, and, whenever applicable, this shall be done at not less than three positions of the plunger spaced throughout its range of movement during testing. For testing machine designs where the force is not influenced by the position of the plunger, e.g. controlled loading systems with closed-loop control, the test force can be calibrated in one position. The preliminary test force shall be held for at least 2 s.

5.2.2 Three readings shall be taken for each force at each position of the plunger. Immediately before each reading is taken, the plunger shall be moved in the same direction as during testing.

5.2.3 The forces shall be measured by one of the following two methods:

- by means of a force-proving device according to ISO 376 class 1 or better and calibrated for reversibility;
- by balancing against a force, accurate to $\pm 0,2 \%$, applied by means of calibrated masses or by another method having the same accuracy.

Evidence should be available to demonstrate that the output of the force-proving device does not vary by more than 0,2 % in the period 1 s to 30 s following a stepped change in force.

5.2.4 A relative error value, expressed as a percentage, shall be calculated for each measured force by the general [Formula \(1\)](#):

$$\Delta F_{\text{rel},i,j} = 100 \times \frac{F_{i,j} - F_{\text{RS}}}{F_{\text{RS}}} \quad (1)$$

where $\Delta F_{\text{rel},i,j}$ is the relative error of each force measurement value, $F_{i,j}$, (whether it is a preliminary force value, F_0 , or the total force value, F) with respect to the reference force value, F_{RS} , to be measured.

The indices i and j of the force measurement value, $F_{i,j}$ indicate the j -th force measurement at the i -th plunger height position.

5.2.5 The maximum permissible relative error on each measurement of the preliminary test force, F_0 , (before application and after removal of the additional test force, F_1) as calculated by [Formula \(1\)](#) shall be $\pm 2,0$ %. The range of all force measurements (highest value minus lowest value) at each measurement position shall be $\leq 1,5$ % of F_0 .

5.2.6 The maximum permissible relative error on each measurement of the total test force, F , as calculated by [Formula \(1\)](#), shall be $\pm 1,0$ %. The range of the force measurements (highest value minus lowest value) shall be $\leq 0,75$ % of F .

5.3 Calibration and verification of the depth-measuring system

5.3.1 The depth-measuring system shall be calibrated by making known incremental movements of the indenter or the indenter holder.

5.3.2 The instrument or gauge blocks used to verify the depth-measuring system shall have a maximum expanded uncertainty of 0,000 3 mm when calculated with a 95 % confidence level.

NOTE The use of gauge blocks to verify the depth measuring system may not be appropriate for all types of Rockwell hardness machines.

5.3.3 Calibrate the testing machine's depth measurement system at not less than four evenly spaced intervals covering the full range of the normal working depth for the required scales to be calibrated in the testing machine. Three cycles of depth readings shall be taken over the evenly spaced intervals of the depth measuring system.

NOTE The maximum depth required for each scale is different, ranging from 0,25 mm for Rockwell regular scale B to 0,04 mm for Rockwell superficial scale 15N.

5.3.4 Some testing machines have a long-stroke depth measuring system where the location of the working range of the depth measuring system varies to suit the sample. This type of testing machine shall be able to electronically verify that the depth measuring device is continuous over the full range. These types of testers shall be verified using the following steps:

- a) at the approximate top, midpoint and bottom of the total stroke of the measuring device, verify the depth measurement system at no less than four evenly spaced intervals of approximately 0,05 mm at each of the three locations;
- b) operate the actuator over its full range of travel to monitor whether the displacement measurement is continuous. The displacement indication shall be continuously indicated over the full range.

5.3.5 Calculate the difference, $\Delta L_{i,j}$, between each depth measurement value, $L_{i,j}$ and the reference value of the calibration device, L_{RS} , in accordance with the general [Formula \(2\)](#):

$$\Delta L_{i,j} = L_{i,j} - L_{RS} \quad (2)$$

The indices i and j of the depth measurement value, $L_{i,j}$ indicate the j -th depth measurement at the i -th interval of the depth measuring system.

The depth-measuring system shall correctly indicate within $\pm 0,001$ mm for the scales A to K and within $\pm 0,000 5$ mm for scales N and T, i.e. within $\pm 0,5$ of a scale unit, over each range.