SLOVENSKI STANDARD
oSIST prEN ISO 6508-1:2023

01-januar-2023

Kovinski materiali - Preskus trdote po Rockwellu - 1. del: Preskusna metoda (ISO/DIS 6508-1:2022)

Metallic materials - Rockwell hardness test - Part 1: Test method (ISO/DIS 6508-1:2022)

Metallische Werkstoffe - Härteprüfung nach Rockwell - Teil 1: Prüfverfahren (ISO/DIS 6508-1:2022)

Matériaux métalliques - Essai de dureté Rockwell - Partie 1: Méthode d'essai (ISO/DIS 6508-1:2022)

Ta slovenski standard je istoveten z: **prEN ISO 6508-1**

ICS:

77.040.10 Mehansko preskušanje kovin Mechanical testing of metals

oSIST prEN ISO 6508-1:2023 **en,fr,de**

DRAFT INTERNATIONAL STANDARD
ISO/DIS 6508-1

ISO/TC **164**/SC **3** Secretariat: **DIN**

Voting begins on:
2022-11-03

Voting terminates on:
2023-01-26

Metallic materials — Rockwell hardness test —

Part 1:
Test method

Matériaux métalliques — Essai de dureté Rockwell —

Partie 1: Méthode d'essai

ICS: 77.040.10

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 6508-1:2022(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html .

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 6508-1:2015), of which it constitutes a minor revision in order to clarify the scope of this part of ISO 6508.

ISO 6508 consists of the following parts, under the general title *Metallic materials — Rockwell hardness test*:

— *Part 1: Test method*

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

— *Part 3: Calibration of reference blocks*

Metallic materials — Rockwell hardness test —

Part 1: Test method

1 Scope

This part of ISO 6508 specifies the method for Rockwell regular and Rockwell superficial hardness tests for scales A, B, C, D, E, F, G, H, K, 15N, 30N, 45N, 15T, 30T, and 45T for metallic materials and is applicable to stationary and portable hardness testing machines.

For specific materials and/or products, other specific International Standards apply (for instance, ISO 3738-1 and ISO 4498).

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 6508-2, *Metallic materials — Rockwell hardness test — Part 2: Verification and calibration of testing machines and indenters*

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

3 Principle

An indenter of specified size, shape, and material is forced into the surface of a test specimen under two force levels using the specific conditions defined in Clause 7. The specified preliminary force is applied and the initial indentation depth is measured, followed by the application and removal of a specified additional force, returning to the preliminary force. The final indentation depth is then measured and the Rockwell hardness value is derived from the difference, h, in the final and initial indentation depths and the two constants N and S (see Figure 1, Table 1, and Table 2) as shown in Formula (1):

$$\text{Rockwell hardness} = N - \frac{h}{S} \tag{1}$$

4 Symbols, abbreviated terms and designations

4.1 See Table 1, Table 2, Table 3, and Figure 1.

Table 1 — Rockwell Regular scales

Rockwell Regular hardness scale	Hardness symbol Unit	Type of indenter	Preliminary force F_0	Total force F	Scaling Constant S	Full Range Constant N	Applicable range of application (Rockwell Regular hardness scales)
A	HRA	Diamond cone	98,07 N	588,4 N	0,002 mm	100	20 HRA to 95 HRA
B	HRBW	Ball 1,587 5 mm	98,07 N	980,7 N	0,002 mm	130	10 HRBW to 100 HRBW
C	HRC	Diamond cone	98,07 N	1,471 kN	0,002 mm	100	20 HRC[a] to 70 HRC
D	HRD	Diamond cone	98,07 N	980,7 N	0,002 mm	100	40 HRD to 77 HRD
E	HREW	Ball 3,175 mm	98,07 N	980,7 N	0,002 mm	130	70 HREW to 100 HREW
F	HRFW	Ball 1,587 5 mm	98,07 N	588,4 N	0,002 mm	130	60 HRFW to 100 HRFW
G	HRGW	Ball 1,587 5 mm	98,07 N	1,471 kN	0,002 mm	130	30 HRGW to 94 HRGW
H	HRHW	Ball 3,175 mm	98,07 N	588,4 N	0,002 mm	130	80 HRHW to 100 HRHW
K	HRKW	Ball 3,175 mm	98,07 N	1,471 kN	0,002 mm	130	40 HRKW to 100 HRKW

[a] The applicable range of application can be extended to 10 HRC if the surfaces of the diamond cone and spherical tip are polished for a penetration depth of at least 0,4 mm.

Table 2 — Rockwell Superficial scales

Rockwell Superficial hardness scale	Hardness symbol Unit	Type of indenter	Preliminary force F_0	Total force F	Scaling Constant S	Full Range Constant N	Applicable range of application (Rockwell Superficial hardness scales)
15N	HR15N	Diamond cone	29,42 N	147,1 N	0,001 mm	100	70 HR15N to 94 HR15N
30N	HR30N	Diamond cone	29,42 N	294,2 N	0,001 mm	100	42 HR30N to 86 HR30N
45N	HR45N	Diamond cone	29,42 N	441,3 N	0,001 mm	100	20 HR45N to 77 HR45N
15T	HR15TW	Ball 1,587 5 mm	29,42 N	147,1 N	0,001 mm	100	67 HR15TW to 93 HR15TW
30T	HR30TW	Ball 1,587 5 mm	29,42 N	294,2 N	0,001 mm	100	29 HR30TW to 82 HR30TW
45T	HR45TW	Ball 1,587 5 mm	29,42 N	441,3 N	0,001 mm	100	10 HR45TW to 72 HR45TW

Scales using indenter balls with diameter 6,350 mm and 12,70 mm may also be used, if specified in the product specification or by special agreement. See ASTM E18 [11] for additional scales using these ball sizes.

NOTE 1 For certain materials, the applicable range of application might be narrower than those indicated.

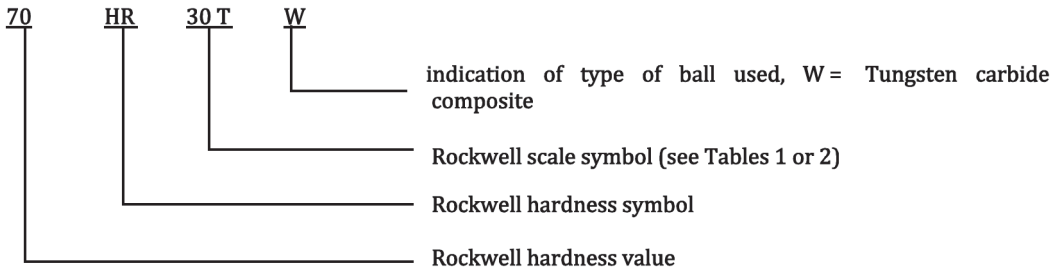
NOTE 2 The numbers representing the test forces were originally based on units of kgf. For example, the total test force of 30 kgf has been converted to 294,2 N.

Table 3 — Symbols and abbreviated terms

Symbol/ Abbreviated term	Definition	Unit
F_0	Preliminary test force	N
F_1	Additional test force (total force minus preliminary force)	N
F	Total test force	N
S	Scaling constant, specific to the scale	mm
N	Full range constant, specific to the scale	-
h	Permanent depth of indentation under preliminary test force after removal of additional test force (permanent indentation depth)	mm
HRA HRC HRD	Rockwell Regular hardness $= 100 - \frac{h}{0{,}002}$	
HRBW HREW HRFW HRGW HRHW HRKW	Rockwell Regular hardness $= 130 - \frac{h}{0{,}002}$	
HRN HRTW	Rockwell Superficial hardness $= 100 - \frac{h}{0{,}001}$	

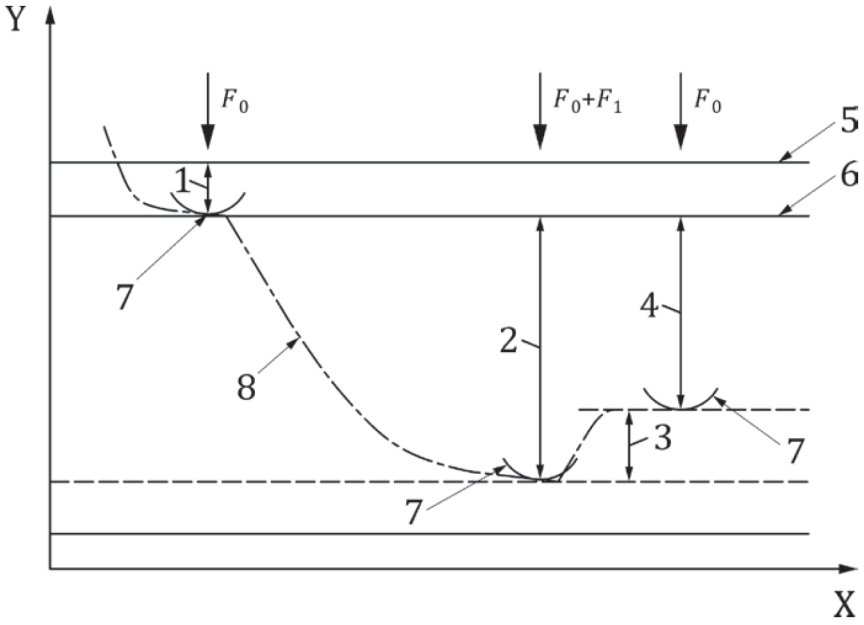
4.2 The following is an example of the designation of Rockwell hardness.

EXAMPLE



NOTE 1 Previous versions of this part of ISO 6508 allowed the use of steel indenter balls, which required the suffix S.

NOTE 2 For the HR30TSm and HR15TSm scales defined in Annex A, a capital S and a lower-case m is used indicating the use of steel indenter balls and a diamond spot specimen holder.



Key

X time
Y indenter position
1 indentation depth by preliminary force, F_0
2 indentation depth by additional test force, F_1
3 elastic recovery just after removal of additional test force, F_1
4 permanent indentation depth, h
5 surface of specimen
6 reference plane for measurement
7 position of indenter
8 indentation depth vs. time curve

Figure 1 — Rockwell principle diagram

5 Testing machine

5.1 Testing machine, shall be capable of applying the test forces for some or all of the Rockwell hardness scales as shown in Table 1 and Table 2, performing the procedure defined in Clause 7, and complying with all of the requirements defined in ISO 6508-2.

5.2 Spheroconical diamond indenter, shall be in accordance with ISO 6508-2, with an included angle of 120° and radius of curvature at the tip of 0,2 mm. Diamond indenters shall be certified for use for either

— only the regular Rockwell diamond scales,

— only the superficial Rockwell diamond scales, or

— both the regular and the superficial Rockwell diamond scales.

5.3 Ball indenter, shall be tungsten carbide composite in accordance with ISO 6508-2, with a diameter of 1,587 5 mm or 3,175 mm (see NOTE 1 and NOTE 2).

NOTE 1 Ball indenters normally consist of a spherical ball and a separate appropriately designed holder. Single-piece spherically tipped indenters are allowed, provided that the surface of the indenter that makes contact with the test piece meets the size, shape, finish, and hardness requirements for the calibration and verification of the ball indenter as defined in ISO 6508-2, and meets the performance requirements for the indirect verification of the ball holder assembly as defined in ISO 6508-2.

NOTE 2 Attention is drawn to the fact that the use of tungsten carbide composite for ball indenters is the standard type of Rockwell indenter ball. Steel indenter balls can only be used when performing Rockwell HR30TSm and HR15TSm tests according to Annex A.

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 specified otherwise in product or materials standards.

An exception is made for reactive metals, such as titanium, which might adhere to the indenter. In such situations, a suitable lubricant such as kerosene may be used. The use of a lubricant shall be reported on the test report.

6.2 Preparation shall be carried out in such a way that any alteration of the surface hardness due to excessive heating or cold-working for example, is minimized.

This shall be taken into account, particularly in the case of low-depth indentations.

6.3 The thickness of the test piece, or of the layer under test (minimum values are given in Annex B), shall be at least 10 times the permanent indentation depth for diamond indenters and 15 times the permanent indentation depth for ball indenters, unless it can be demonstrated that the use of a thinner test piece does not affect the measured hardness value.

In general, no deformation should be visible on the back of the test piece after the test, although not all such marking is indicative of a bad test.

See Annex A for special requirements for testing very thin sheet metal using the HR30TSm and HR15TSm scales.

6.4 For tests on convex cylindrical surfaces and spherical surfaces, see 7.11.

7 Procedure

7.1 This part of ISO 6508 has been developed with a laboratory temperature requirement of 10 °C to 35 °C.

For environments outside the stated requirement, it is the responsibility of the testing laboratory to assess the impact on testing data produced with testing machines operated in such environments. When testing is performed outside the recommended temperature limits of 10 °C to 35 °C, the temperature shall be recorded and reported.

NOTE If significant temperature gradients are present during testing and/or calibration, measurement uncertainty can increase and out of tolerance conditions can occur.

7.2 The daily verification defined in Annex E shall be performed before the first test of each day for each scale to be used.

The condition of diamond indenters should be checked according to Annex F.

7.3 After each change, or removal and replacement, of the indenter, indenter ball, or test piece support, perform at least two tests and discard the results, then determine that the indenter and the test piece support are correctly mounted in the machine by performing the daily verification process defined in Annex E.

7.4 The diamond or ball indenter shall have been the indenter used during the last indirect verification.

If the indenter was not used during the indirect verification and is being used for the first time, it shall be verified in accordance with the daily verification given in Annex E using at least two test blocks (one from the low and high ranges as defined by the table in ISO 6508-2 titled "Hardness ranges for different scales") for each Rockwell scale that is normally used. This does not apply to replacing a ball.

7.5 The test piece shall be placed on a rigid support and supported in such a manner that the surface to be indented is in a plane normal to the axis of the indenter and the line of the indenting force, as well as to avoid a displacement of the test piece.

Products of cylindrical shape shall be suitably supported, for example, on centering V-block or double cylinders made of material with a Rockwell hardness of at least 60 HRC. Special attention shall be given to the correct seating, bearing, and alignment of the indenters, the test piece, the centering V-blocks, and the specimen holder of the testing machine, since any perpendicular misalignment might result in incorrect results.

7.6 Bring the indenter into contact with the test surface and apply the preliminary test force, F_0, without shock, vibration, oscillation, or overload.

The preliminary force application time should not exceed 2 s. The duration of the preliminary test force, F_0, shall be $3\,^{+1}_{-2}$ s.

NOTE The requirements for the time durations are given with asymmetric limits.

EXAMPLE $3\,^{+1}_{-2}$ s indicates that 3 s is the ideal time duration, with an acceptable range of not less than 1 s (3 s - 2 s) to not more than 4 s (3 s + 1 s).

7.7 Measure the initial indentation depth.

For many manual (dial-indicator) machines, this is done by setting the indicating dial to its set-point or zero position. For many automatic (digital) machines, the depth measurement is made automatically without the user's input and might not be displayed.

7.8 Apply the additional force F_1 without shock, vibration, oscillation, or overload to increase the force from F_0 to the total force, F.

For the regular Rockwell scale tests, apply the additional test force, F_1, in not less than 1 s and not more than 8 s. For all HRN and HRTW Rockwell superficial test scales, apply the additional test force, F_1, in less than or equal to 4 s. It is recommended to perform the same test cycle used during indirect verification.

NOTE There is evidence that some materials might be sensitive to the rate of straining which causes small changes in the value of the yield stress. The corresponding effect on the termination of the formation of an indentation can make an alteration in the hardness value.

7.9 The total test force, F, shall be maintained for a duration of $5\,^{+1}_{-3}$ s. Remove the additional test force, F_1, and, while the preliminary test force, F_0, is maintained, after $4\,^{+1}_{-3}$ s, the final reading shall be made.

As an exception for test materials exhibiting excessive plastic flow (indentation creep) during the application of the total test force, special considerations might be necessary since the indenter will continue to penetrate. When materials require the use of a total force duration that exceeds the 6 s allowed by the tolerances, the actual extended total force duration used shall be reported following the test results (for example, 65 HRF/10 s).

