
Kovinski materiali - Preskus trdote - 3. del: Kalibracija standardiziranih primerjalnih ploščic za preverjanje merilnikov trdote po Rockwellu (skale A, B, C, D, E, F, G, H, K, N, T)

Metallic materials - Hardness test - Part 3: Calibration of standardized blocks to be used for Rockwell hardness testing machines (scales A,B,C,D,E,F,G,H,K,N,T)

Metallische Werkstoffe - Härteprüfung - Teil 3: Kalibrierung von Härtevergleichsplatten für die Prüfung von Härteprüfgeräten nach Rockwell (Skalen A,B,C,D,E,F,G,H,K,N,T)

Matériaux métalliques - Essai de dureté - Partie 3: Etalonnage des blocs de référence à utiliser pour les machines d'essai de dureté Rockwell (échelles A,B,C,D,E,F,G,H,K,N,T)

Ta slovenski standard je istoveten z: EN 10109-3:1994

ICS:

77.040.10 Mehansko preskušanje kovin Mechanical testing of metals

SIST EN 10109-3:1996

en

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EUROPEAN STANDARD

EN 10109-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 1994

ICS 77.040.10

Descriptors: Metallurgical products, hardness tests, Rockwell superficial hardness, test equipment, standard measures, calibration

English version

**Metallic materials - Hardness test - Part 3:
Calibration of standardized blocks to be used for
Rockwell hardness testing machines (scales
A,B,C,D,E,F,G,H,K,N,T)**

Matériaux métalliques - Essai de dureté -
Partie 3: Etalonnage des blocs de référence à
utiliser pour les machines d'essai de dureté
Rockwell (échelles A,B,C,D,E,F,G,H,K,N,T)

Metallische Werkstoffe - Härteprüfung - Teil 3:
Kalibrierung von Härtevergleichsplatten für die
Prüfung von Härteprüfgeräten nach Rockwell
(Skalen A,B,C,D,E,F,G,H,K,N,T)

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Contents

Foreword	3
0 Introduction	3
1 Scope	4
2 Normative references	4
3 Manufacture of blocks	4
4 Standardizing machine	5
5 Standardizing procedure	6
6 Number of indentations	7
7 Uniformity of hardness	7
8 Marking	8
9 Validity	8
Annex A (normative) Uniformity of test blocks	9

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Foreword

This European Standard has been prepared by the Technical Committee ECISS/TC 1A "Mechanical and physical tests", 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 April 1995, and conflicting national standards shall be withdrawn at the latest by April 1995.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

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0 Introduction

The standard EN 10109 is valid to metallic materials and comprises the following parts :

- Part 1 : <https://standards.iteh.ai/catalog/standards/sist/8bdb96c9-d25e-465a-a1d8-c674248b32/sist-en-10109-3-1994> Metallic materials - Hardness test - Part 1 : Rockwell test (scales A, B, C, D, E, F, G, H, K) and Rockwell superficial test (scales 15N, 30N, 45N, 15T, 30T and 45T)
- Part 2 : Metallic materials - Hardness test - Part 2 : Verification of Rockwell hardness testing machines (scales A, B, C, D, E, F, G, H, K, N, T)
- Part 3 : Metallic materials - Hardness test - Part 3 : Calibration of standardized blocks to be used for Rockwell hardness testing machines (scales A, B, C, D, E, F, G, H, K, N, T).

1 Scope

This European Standard specifies a method for the calibration of standardized blocks to be used in Rockwell hardness testing machines (scales A, B, C, D, E, F, G, H, K, N, T) for the indirect verification of these machines, as described in EN 10109-2.

The normative annex A shows the uniformity requirements of the standardized blocks diagrammatically.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- EN 10109-1 Metallic materials - Hardness test - Part 1 : Rockwell test (scales A, B, C, D, E, F, G, H, K) and Rockwell superficial test (scales 15N, 30N, 45N, 15T, 30T and 45T)
- EN 10109-2 Metallic materials - Hardness test - Part 2 : Verification of Rockwell hardness testing machines (scales A, B, C, D, E, F, G, H, K, N, T)
- ISO 468 Surface roughness - Parameters, their values and general rules for specifying requirements
- ISO 6507-1 Metallic materials - Hardness test - Vickers test - Part 1 : HV 5 to HV 100.

3 Manufacture of blocks

3.1 The block shall be specially prepared and the attention of the manufacturer is drawn to the need to use a manufacturing process which will give the necessary homogeneity, stability of structure and uniformity of hardness.

3.2 Each metal block to be standardized shall be of a thickness not less than 6 mm.

3.3 The standardized 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 (before calibration).

3.4 The maximum deviation in flatness of the surfaces shall not exceed 0,010 mm. The bottom of the blocks shall not be convex.

The maximum error in parallelism shall not exceed 0,020 mm/50 mm.

3.5 The test and lower surfaces shall be free from damage such as notches, scratches, oxide layers, etc... which interfere with the measurement of the indentations. The surface roughness R_a shall not exceed 0,3 μm for the test surface and 0,8 μm for the bottom surface : sampling length $l = 0,80$ mm (see ISO 468).

3.6 To verify that no material is subsequently removed from the standardized block, its thickness at the time of standardization shall be marked on it to the nearest 0,1 mm, or an identifying mark shall be made on the test surface (see clause 8).

4 Standardizing machine

4.1 In addition to fulfilling the general requirements specified EN 10109-2, clause 3, the standardizing machine shall also meet the requirements given in 4.2.

4.2 The machine shall be verified directly. Direct verification involves :

- verification of the test force (see 4.2.1)
- verification of the indenter (see 4.2.2 and 4.2.3)
- verification of the measuring device (see 4.2.4).

4.2.1 The preliminary force F_0 as defined in EN 10109-1 shall be correct to within $\pm 0,2$ % at the initial application and after the additional force F_1 has been removed.

The total test force F shall be correct to within $\pm 0,1$ % of the nominal test force defined in EN 10109-1.

4.2.2 The diamond cone indenter shall meet the following requirements :

a) The diamond cone shall have a mean included angle of $120^\circ \pm 0,10^\circ$. In each measured section the included angle shall be $120^\circ \pm 0,17^\circ$.

The number of measured sections are as follows :

- at least eight axial section planes equidistant from each other, when the roundness of the cone is not measured

or

- two sections when the error in roundness of the cone, adjacent to the blend, measured in a section normal to the indenter axis, does not exceed 0,004 mm. These sections shall be situated at the positions of maximum and minimum error in roundness.

The error of roundness is defined as the greatest radial distance between any point on the conical surface and the circumscribing circle.

Deviations from straightness of the generatrix of the diamond cone, adjacent to the blend, shall not exceed 0,0005 mm over a minimum length of 0,40 mm.

b) The tip of the indenter is spherical. Its radius is determined from single values, measured in the axial section planes defined in 4.2.2 (a). This can be done by an actual intersection which is laid between two segments of concentric circles. The distance between the concentric circles shall not be more than 0,002 mm. The single value is the mean value of the two radii of the concentric circles. Each single value shall be within $0,200 \text{ mm} \pm 0,007 \text{ mm}$. The mean value of at least eight single values shall be within $0,200 \text{ mm} \pm 0,005 \text{ mm}$.

The surfaces of the cone and the spherical tip shall blend in a truly tangential manner.

c) The inclination of the axis of the diamond cone to the axis to the indenter holder (normal to the seating surface) shall be within $0,3^\circ$.

d) Tests shall be made in accordance with the procedure described in clause 5, on a minimum of the four following blocks :

Hardness about	Scale
20	HRC
55	HRD
43	HR45N
92	HR15N

For each block the mean hardness value of three indentations made using the indenter to be verified, shall not differ from the mean hardness value of the three indentations obtained with the standardizing indenter by more than $\pm 0,4$ Rockwell unit. The indentations with the indenter to be verified and with the standardizing indenter shall be carried out in such a way that the indentations of both indenters are in each case adjacent.

NOTE : The standardizing indenter is the indenter or the indenters being recognized as the reference indenter(s) at national level.

4.2.3 The steel ball indenter shall meet the requirements of EN 10109-2.

The diameter of the steel ball indenter (scales B, E, F, G, H, K, T) when measured at not less than three positions, shall not differ from the nominal diameter by more than

$\pm 0,002$ mm for the ball of diameter 1,587 5 mm ;

$\pm 0,003$ mm for the ball of diameter 3,175 mm.

The hardness of the steel ball shall be not less than 850 HV 10, when determined in accordance with ISO 6507-1, and applying the appropriate correction for curvature.

4.2.4 The measuring device shall be capable of measuring vertical displacements within $\pm 0,0001$ mm.

5 Standardizing procedure

5.1 The standardized blocks shall be calibrated in a standardizing machine as described in clause 4, at a temperature of $23^{\circ} \text{C} \pm 5^{\circ} \text{C}$, using the general procedure described in EN 10109-1.

5.2 The velocity of the indenter when reaching the surface shall not exceed 1 mm/s.

5.3 Bring the indenter into contact with the test surface and apply the preliminary test force F_0 without shock or vibration and without oscillation of the test force. The duration of the preliminary test force F_0 shall be not less than 1 s nor greater than 5 s.

5.4 Bring the measuring device to its datum position and without shock, vibration or oscillation, increase the force from F_0 to F in not less than 2 s nor greater than 8 s. The duration of the total force F shall be equal to $4 \text{ s} \pm 2 \text{ s}$.

5.5 The final reading shall be done not less than 3 s nor greater than 5 s after removing the additional test force F_1 .

6 Number of indentations

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

The arithmetic mean of the five hardness values characterizes the hardness value of the block.

7 Uniformity of hardness

7.1 Let h_1, h_2, h_3, h_4, h_5 be the values of the measured permanent indentation depth arranged in increasing order of magnitude.

The non-uniformity of the block under the particular conditions of standardization is characterized by :

$$h_5 - h_1$$

and expressed in percent of \bar{h}

where

$$\bar{h} = \frac{h_1 + h_2 + h_3 + h_4 + h_5}{5}$$

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7.2 The block is not sufficiently uniform in hardness for standardization purposes unless the uniformity satisfies the conditions given in table 1.

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Table 1
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Rockwell hardness scale	Maximum permissible non-uniformity $h_5 - h_1$
A	1,5 % \bar{h} or 0,4 HRA 1)
B	3 % \bar{h}
C	1,5 % \bar{h}
D	1,5 % \bar{h}
E	3 % \bar{h}
F	3 % \bar{h}
G	3 % \bar{h}
H	3 % \bar{h}
K	3 % \bar{h}
N	2 % \bar{h} or 0,6 HRN 1)
T	3 % \bar{h} or 1,2 HRT 1)

1) The greater of the two values shall apply