SLOVENSKI STANDARD
SIST EN 10109-2:1996

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Kovinski materiali - Preskus trdote - 2. del: Preverjanje merilnikov trdote po Rockwellu (skale A, B, C, D, E, F, G, H, K, N, T)

Metallic materials - Hardness test - Part 2: Verification of Rockwell hardness testing machines (scales A,B,C,D,E,F,G,H,K,N,T)

Metallische Werkstoffe - Härteprüfung - Teil 2: Prüfung von Härteprüfmaschinen nach Rockwell (Skalen A,B,C,D,E,F,G,H,K,N,T)

Matériaux métalliques - Essai de dureté - Partie 2: Vérification des machines d'essai de dureté Rockwell (échelles 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

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of an identical text or by endorsement, at the latest by April 1995, and conflicting national standards shall be withdrawn at the latest by April 1995.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.

0 Introduction

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

Part 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)

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 of verification of testing machines for determining Rockwell hardness (scales A, B, C, D, E, F, G, H, K, N, T) in accordance with EN 10109-1.

It describes a direct verification method for checking the main functions of the machine and an indirect verification method suitable for the overall checking of the machine. The indirect verification method may be used on its own for periodic routine checking of the machine in service.

If a testing machine is also to be used for other methods of hardness testing, it shall be verified independently for each method.

The normative annex A gives some information concerning diamond indenters. Annex B gives the diagrams for the repeatability for the testing machines.

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 10002-3 Metallic materials - Tensile test - Part 3 : Calibration of proving devices used for the verification of uniaxial testing machines

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 10109-3 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)

ISO 6507-1 Metallic materials - Hardness test - Vickers test - Part 1 : HV 5 to HV 100.

3 General conditions

Before a Rockwell hardness testing machine is verified, it shall be checked to ensure that :

- the machine is properly set up

- the plunger holding the indenter is capable of sliding in its guide, by its own weight, but without any appreciable clearance

- the indenter-holder is firmly mounted in the plunger

- the test force can be applied and removed without shock or vibration and in such a manner that the readings are not influenced

- the readings are not affected either by movements of the test piece or by deformation of the frame. When a device is supplied, which locks the test piece against the upper part of the frame, the locking force shall exceed the total test force. The influence of deformations may be checked by using a plain plunger instead of the indenter, bearing directly against the anvil and using the locking device when it is supplied. The readings of the measuring device (with preliminary force applied) before application and after removal of the additional

force shall not differ by more than 1,5 Rockwell units (without locking equipment) and 0,5 Rockwell unit (with locking equipment).

4 Direct verification

Direct verification involves :

- verification of the test force,
- verification of the indenter,
- verification of the measuring device.

The instrument used for verification shall have a certified traceability using the international system of units (SI).

4.1 Verification of the test force

The machine shall be designed in such a way that it can be verified.

4.1.1 The preliminary test force F_0 (see 4.1.4) and each total test force F used (see 4.1.5) 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. The preliminary test force shall be held for at least 2 s.

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

- measuring with a force proving device of class 2 according to EN 10002-3

or

- balancing against a force, accurate to ± 0,2 %, applied by means of standardized masses with mechanical advantage.

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

4.1.4 The tolerance on the preliminary test force F_0 (before application and after removal of the additional test force F_1) shall be ± 2,0 %.

4.1.5 The tolerance on the total test force F shall be ± 1 %. Each individual value of F shall be within this tolerance.

4.2 Verification of the indenters

4.2.1 Diamond cone indenter (scales A, C, D, N)

4.2.1.1 The surfaces of the diamond cone and spherical tip shall be polished for a penetration depth of 0,3 mm and shall blend in a truly tangential manner. Both surfaces shall be free from surface defects.

4.2.1.2 The verification of the shape of the indenter can be made by direct measurement or by measurement of its projection on a screen. The verification shall be made at not less than four equispaced sections.

4.2.1.3 The diamond cone shall have an included angle of 120° ± 0,35°.

Deviations from straightness of the generatrix line of the diamond cone, adjacent to the blend, shall not exceed 0,001 mm over a minimum length of 0,40 mm.

4.2.1.4 The angle between the axis of the diamond cone and the axis of the indenter-holder (normal to the seating surface) shall not exceed 0,5°.

4.2.1.5 The tip of the indenter is spherical. Its radius is determined from single values, measured in the axial section planes defined in 4.2.1.2. 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 0,004 mm. The single value is the mean value of the two radii of the concentric circles. Each single value shall be within 0,200 mm ± 0,015 mm. The mean value out of at least 4 single values shall be within 0,200 mm ± 0,010 mm.

4.2.1.6 The hardness values given by the testing machine do not depend only on the dimensions given in 4.2.1.3 and 4.2.1.5, but also on the surface roughness and the position of the crystallographic axes of the diamond, and the seating of the diamond in its holder.

For this reason, an indirect verification of the indenter is considered necessary. The performance of the indenter in a standardizing machine, which complies with clause 4 of EN 10109-3 shall be compared with the performance of the machine's own standardizing indenter.

Tests shall be made on 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 ± 0,8 unit. The indentations with the indenter to be verified and with the standardizing indenter should be carried out in such a way that the indentations of both indenters are in each case adjacent. The test shall be made in accordance with EN 10109-1.

4.2.2 Steel ball indenter (scales B, E, F, G, H, K, T)

4.2.2.1 For the purpose of verifying the size and the hardness of the steel balls, it is considered sufficient to test one sample selected at random from a batch. The ball(s) verified for hardness shall be discarded.

4.2.2.2 The ball shall be polished and free from surface defects.

4.2.2.3 The user shall either measure the balls to ensure that they meet the following requirements, or he shall obtain balls from a supplier who can certify that the following conditions are met.

4.2.2.3.1 The diameter, when measured at not less than three positions, shall not differ from the nominal diameter by more than the tolerance given in table 1.

Table 1

Dimensions in millimetres

Rockwell hardness scale	Ball diameter	Tolerance
B F G T	1,587 5 1,587 5 1,587 5 1,587 5	± 0,003 5 ± 0,003 5 ± 0,003 5 ± 0,003 5
E H K	3,175 3,175 3,175	± 0,004 ± 0,004 ± 0,004

4.2.2.3.2 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 as given in annex B of that standard (see table 2).

Table 2

Dimensions in millimetres

Ball diameter	Maximum value of mean diagonal made on the ball with a Vickers indenter at 98,07 N (HV 10)
3,175	0,144
1,587 5	0,141

4.3 Verification of the measuring device

The depth-measuring device shall be verified over not less than three intervals, including the intervals corresponding to the lowest and highest hardnesses for which the scales are normally used, by making known incremental movements of the indenter in the direction of increasing hardness values.

The instrument used to verify the depth-measuring device shall have an accuracy of 0,000 2 mm. The depth-measuring device shall correctly indicate within ± 0,001 mm for the scales A to K and within ± 0,000 5 mm for the scales N and T, i.e. within ± 0,5 of a scale unit, over each range.

If it is not possible to verify directly the depth-measuring device, a modified indirect verification can be done by the hardness test with standardized blocks with a standardizing indenter (see 5.1).

5 Indirect verification

Indirect verification may be carried out by means of standardized blocks calibrated in accordance with EN 10109-3.