SLOVENSKI STANDARD
SIST EN 10003-2:1996

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Kovinski materiali - Preskus trdote po Brinellu - 2. del: Preverjanje merilnikov trdote po Brinellu

Metallic materials - Brinell hardness test - Part 2: Verification of Brinell hardness testing machines

Metallische Werkstoffe - Härteprüfung nach Brinell - Teil 2: Prüfung von Härteprüfmaschinen nach Brinell

Matériaux métalliques - Essai de dureté Brinell - Partie 2: Vérification des machines d'essai de dureté Brinell

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English version

Metallic materials - Brinell hardness test - Part 2: Verification of Brinell hardness testing machines

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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of an identical text or by endorsement, at the latest by April 1995, and conflicting national standards shall be withdrawn at the latest by April 1995.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 10003 is valid to metallic materials and comprises the following parts :

Part 1 : Metallic materials - Brinell hardness test - Part 1 : Test method

Part 2 : Metallic materials - Brinell hardness test - Part 2 : Verification of Brinell hardness testing machines

Part 3 : Metallic materials - Brinell hardness test - Part 3 : Calibration of standardized blocks to be used for Brinell hardness testing machines.

1 Scope

This European Standard specifies a method for the verification of testing machines used for determining Brinell hardness in accordance with EN 10003-1.

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.

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

2 Normatives 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 force proving instruments used for the verification of uniaxial testing machines

EN 10003-1 Metallic materials - Brinell hardness test - Part 1 : Test method

EN 10003-3 Metallic materials - Brinell hardness test - Part 3 : Calibration of standardized blocks to be used for Brinell hardness testing machines

ISO 409-1 Metallic materials - Hardness test - Tables of Vickers hardness values for use in tests made on flat surfaces - Part 1 : HV 5 to HV 100

ISO 3878 Hardmetals - Vickers hardness test

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

3 General conditions

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

a) the machine is properly set up ;

b) the plunger holding the ball is capable of sliding in its guide, by its own weight, but without any appreciable clearance ;

c) the ball-holder, with a ball from a lot verified according to 4.2 is firmly mounted in the plunger ;

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

e) if the measuring device is integral with the machine :

1 - the change from removing the test force to measuring does not influence the readings,

2 - the illumination does not affect the readings,

3 - the centre of the indentation is in the centre of the field of view.

4 Direct verification

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

Direct verification involves :

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

4.1 Verification of the test force

4.1.1 Each test force shall be measured and, whenever applicable, this shall be done at not less than three positions of the plunger throughout its range of movement during testing.

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

- with a force proving instrument according to class 1 of 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 measurements shall be taken for each test force at each position of the plunger. Immediately before each measurement is taken, the plunger shall have been moved in the same direction as during testing.

4.1.4 Each measurement of a force shall be within ± 1,0 % of the nominal test force, as defined in EN 10003-1.

4.2 Verification of the indenters

The indenter consists of a ball and an indenter holder.

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

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

4.2.3 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.

4.2.3.1 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

Ball diameter	Tolerance
10	± 0,005
5	± 0,004
2,5	± 0,003
2	± 0,003
1	± 0,003

4.2.3.2 For steel balls, the hardness shall be not less than 850 HV 10, when determined in accordance with ISO 6507-1, and applying the appropriate correction for curvature given in ISO 409-1 (see table 2).

Table 2

Dimensions in millimetres

Ball diameter	Maximum value of mean diagonal length of the Vickers indentation with a test force of 98,07 N (HV 10)	
	on the steel ball	on the hardmetal ball
10	0,146	0,111
5	0,145	0,110
2,5	0,143	0,109
2	0,142	0,108
1	0,139	0,106

4.2.3.3 The characteristics of the hardmetal balls shall be the following :.

- hardness : the hardness shall be not less than 1 500 HV 10, when determined in accordance with ISO 3878,

- chemical composition :

  * tungsten carbide (WC) : balance
  * total other carbides : 2,0 % max
  * cobalt (Co) : 5,0 to 7,0 %

- density : δ = 14,8 g/cm³ ± 0,2 g/cm³.

4.3 Verification of the measuring device

The scale of the measuring device shall be graduated to permit estimation of the diameter of the indentation to within ± 0,5 %.

The measuring device shall be verified by measurements made on a stage micrometer at a minimum of five intervals over each working range. The maximum error shall not exceed 0,5 %.

NOTE : When measuring a projected area, the maximum error shall not exceed 1 %.

In addition to this direct verification, an indirect verification of the measuring device may be carried out in accordance with the procedure defined in annex A.

5 Indirect verification

The indirect verification shall be carried out by means of standardized blocks calibrated in accordance with EN 10003-3.

The test and bottom surfaces of the standardizing blocks and the surfaces of indenters shall not contain any additives or corrosion product.

5.1 The testing machine shall be verified for each test force and for each size and type of ball used. For each test force, at least two standardized blocks corresponding to the hardness ranges given in table 3, depending on the type of ball, shall be used.

Table 3

Steel ball	Hardmetal ball
100 to 200 HBS 250 to 350 HBS	100 to 200 HBW 300 to 400 HBW 500 to 600 HBW

NOTE : When the hardness test in question makes it impossible to reach the highher hardness range defined in table 3 (for 0,102 F/D^2 = 5 or 10), the verification may be carried out with only one block from the lower hardness range.

Verification shall be carried out using the same type of ball (steel or hardmetal) as will be used for testing and this verification will be valid :

- for hardnesses ≤ 350 HBS when steel balls are used

- for hardnesses ≤ 650 HBW when hardmetal balls are used.

5.2 On each standardized block, five identations shall be made and measured. The test shall be made in accordance with EN 10003-1.

5.3 For each standardized block, let d_1, d_2 ...d_5 be the mean values of the measured diameters of the indentations, arranged in increasing order of magnitude.

5.4 The repeatability of the testing machine under the particular verification conditions is determined by the following quantity :

$$d_5 - d_1$$

The repeatability of the testing machine verified is considered satisfactory if it satisfies the conditions given in table 4.

Table 4

Hardness of standardized block HBS (HBW)	Repeatability of the testing machine max	Error of the testing machine max
< 125	0,030 $\bar{d}$	3 % H
125 < HB < 225	0,025 $\bar{d}$	2,5 % H
> 225	0,020 $\bar{d}$	2 % H

where

$$\bar{d} = \frac{d_1 + d_2 + ... + d_5}{5}$$