UDC 620.1.05 : 620.178.152.22

Ref. No. : ISO/R 726-1968 (E)

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 726

CALIBRATION OF STANDARDIZED BLOCKS TO BE USED FOR BRINELL HARDNESS TESTING MACHINES

1st EDITION

May 1968

For each individual country the only valid standard is the national standard of that country.

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 726, *Calibration of standardized blocks to be used for Brinell hardness testing machines,* was drawn up by Technical Committee ISO/TC 17, *Steel,* the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question by the Technical Committee began in 1961 and led, in 1965, to the adoption of a Draft ISO Recommendation.

In March 1966, this Draft ISO Recommendation (No. 926), replacing Draft ISO Recommendation No. 525, was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Argentina	Israel	Sweden
Australia	Italy	Switzerland
Austria	Japan	Turkey
Belgium	Korea, Rep. of	U.A.R.
Canada	Netherlands	United Kingdom
Czechoslovakia	New Zealand	U.S.A.
Denmark	Norway	U.S.S.R.
Finland	Poland	Yugoslavia
France	Romania	
Germany	South Africa, Rep. of	
Hungary	Spain	
India		

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council which decided, in May 1968, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 726 May 1968

CALIBRATION OF STANDARDIZED BLOCKS TO BE USED FOR BRINELL HARDNESS TESTING MACHINES

INTRODUCTION

Blocks standardized according to this ISO Recommendation are adequate for the verification of all Brinell hardness testing machines. Any machine verified by these blocks may be employed, without any additional verification, for tests on a modified Brinell scale, for example using a tungsten carbide ball.

1. SCOPE

This ISO Recommendation applies to the calibration of standardized blocks for the indirect verification of hardness testing machines as described in ISO Recommendation R 156 (2nd edition), *Verification of Brinell hardness testing machines*. It does not necessarily apply to the calibration of test blocks which are used in the routine checking of the testing machine by the user, but it is not intended to preclude the use of blocks calibrated in accordance with this ISO Recommendation for the routine checking of a machine.

NOTE. – Test blocks that are used in routine checking of the testing machine may be calibrated using the load duration specified in clause 4.2 of ISO Recommendation R 79 (2nd edition), *Brinell hardness test for steel.*

2. MANUFACTURE

2.1 Each metal block to be standardized should be of a thickness not less than

16 mm (5/8 in) for 10 mm balls,
12 mm (1/2 in) for 5 mm balls,
6 mm (1/4 in) for smaller balls.

2.2 The block should 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 surface hardness. It is recommended that the fineness and regularity of grain and the uniformity of the metallurgical structure be verified by microscopical examination. A microscopical examination may also be made by the standardizing authority.

2.3 The standardized blocks should not be magnetized. It is recommended that the manufacturer should ensure that the blocks, if of steel, have been demagnetized at the end of the manufacturing process.

2.4 The flatness of the test surface and the uniformity of the thickness of the standardized block should be in accordance with Table 1 below.

TABLE 1

Diameter of ball	Maximum error in flatness of test surface	Maximum change in thickness
mm	mm	mm/50 mm
10	0.05	0.05
5	0.025	0.025
less than 5	0.005	0.010

2.5 The lower surface of the standardized block should have a ground finish.

2.6 The test surface (upper surface) should be polished and its surface roughness should not exceed 0.0003 mm (centre line average) for 10 mm balls and 0.000 15 mm (centre line average) for smaller balls. It should also be free from scratches which interfere with the measurement of the indentations.

2.7 To permit checking that no material is subsequently removed from the standardized block, its thickness at the time of standardization should be marked on it to the nearest 0.1 mm (0.004 in), or an official mark should be made on the test surface (see section 13).

3. STANDARDIZING PROCEDURE

The standardized blocks should be calibrated in a standardizing machine complying with the requirements of sections 4 to 8, at a temperature of 20 ± 2 °C in temperate climates and 27 ± 2 °C in tropical climates, using the general procedure described in ISO Recommendation R 79 (2nd edition), *Brinell hardness test for steel.*

4. STANDARDIZING MACHINE

The standardizing machine is one in which the load applied, the form of the indenter and the measuring device can be verified by fundamental measurement. The load should be applied by means of weights (masses) giving correct values of force.

5. LOADS

The loads should be correct within ± 0.1 %.

6. BALL INDENTER

6.1 The diameter of the ball should not vary from the nominal diameter by more than ± 0.001 mm. It should be ascertained that the ball is free from lobing and that the entire surface lies inside an annular tolerance zone 0.003 mm wide.

NOTE. – For a full explanation of these tolerances, see definition 5.3 in ISO Recommendation R ..., * *Indication on drawings of tolerances of form and of position – Part I : Generalities, symbols, indication on drawings.*

* At present Draft ISO Recommendation No. 1016.

6.2 The ball used should be of hardened and tempered steel with a Vickers hardness of at least 850 HV 10, taking into account the curvature of the ball (see clause 2.2 of ISO Recommendation R 156 (2nd edition), *Verification of Brinell hardness testing machines*).

TABLE 2

Diameter of ball	Maximum value of mean diagonal of the Vickers indentation made at 10 kgf*
mm	mm
10	0.146
5	0.145
2.5	0.143
2	0.142
1	0.139

* Balls for ball bearings normally satisfy these requirements.

6.3 The ball should be polished and free from surface defects.

7. APPLICATION OF LOAD

7.1 The load should be applied and removed without shock.

NOTE. – External vibrations may affect the results of the calibration.

7.2 The mechanism which controls the application of the load should ensure that the speed of approach of the ball immediately before it touches the block and the speed of penetration are not more than 1 mm/s.

8. DURATION OF APPLICATION OF FULL LOAD

The full load should be applied for 30 to 35 seconds.

9. NUMBER OF INDENTATIONS

On each block of area up to and including 100 cm^2 (16 in^2), at least five indentations should be made randomly distributed over the entire test surface. If the area of the block is greater than 100 cm^2 (16 in^2), at least eight indentations should be made.

10. MEASUREMENT OF THE DIMENSIONS OF THE INDENTATIONS

10.1 The illuminating system of the measuring microscope should be adjusted to give uniform intensity over the field of view and maximum contrast between the indentation and the undisturbed surface of the block.

10.2 The scale of the measuring microscope should be graduated to read to 0.002 mm for indentations made with 10 and 5 mm balls and 0.001 mm for indentations made with balls of less than 5 mm diameter.

10.3 The measuring microscope should be checked by a stage micrometer or by other suitable means, to ensure that the difference between readings corresponding to any two graduation lines of the instrument is correct

- within ± 0.001 mm for balls of less than 5 mm diameter and
- within ± 0.002 mm for 5 mm and 10 mm diameter balls.

10.4 Each indentation should be measured by at least two observers.

11. REPEATABILITY

Let d_1, d_2, ... d_n be the values of the mean measured diameters, arranged in increasing order of magnitude.

The repeatability of the block under the particular conditions of standardization is defined as expressed by the following quantity :

$$d_n - d_1$$

where $n = 5$ or 8 (see section 9).

12. UNIFORMITY OF HARDNESS

The block is not sufficiently uniform in hardness for standardization purposes unless the repeatability satisfies the following conditions :

TABLE 3

Hardness of blocks	Maximum permissible repeatability
HB	mm
less than 225	$\frac{2}{100}\bar{d}$
more than 225	$\frac{1}{100}\bar{d}$

where $\bar{d} = \frac{d_1 + d_2 + \ldots d_n}{n}$

See Appendix for examples.

13. MARKING

13.1 Each standardized block should be marked with the following :

(a) the arithmetic mean of the hardness values found in the standardizing tests, e.g. 400 HB 5/750/30 (see ISO Recommendation R 79 (2nd edition), *Brinell hardness test for steel*);

(b) the name or mark of the supplier;

(c) the serial number;

(d) the name or mark of the standardizing authority;

(e) the thickness of the standardized block or an official mark on the test surface;

(f) the symbol of the hardness.

13.2 At least one of the marks, or a special mark, should be on the test surface. Alternatively, the marking may be on the side of the standardized block, the marking being upright when the test surface is the upper face.