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Metallic Brinell Hardness Testers

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Verification Regulation of Metallic Brinell Hardness Testers

1 Scope

This Regulation applies to the initial verification, subsequent verification and in-use inspection of fixed metallic Brinell hardness testers (hereinafter referred to as hardness testers).

2 References

ISO 6506-1 Metallic materials - Brinell hardness test - Part 1 Test method

GB/T 231.1-2002 Metallic materials - Brinell hardness test - Part 1: Test method

GB/T 231.2-2002 Metallic Brinell hardness test - Part 2: Verification and calibration of hardness testers

GB/T 231.3-2002 Metallic Brinell hardness test - Part 3: Calibration of hardness reference blocks

JJG 144-1992 Verification Regulation of Standard Dynamometer

When using this Regulation, care shall be taken to use the currently valid version of the above-cited references.

3 General

A Brinell hardness tester is mainly used for the determination of hardness of cast iron, steel, non-ferrous metals and soft alloys. In addition, it can also be used for the determination of hardness of certain non-metal materials such as plastic and bakelite.

Use a cemented carbide ball of a certain diameter to press into the surface of the specimen under the specified test force. After a certain retention time of the test force, remove the test force. Measure the diameter of the indentation left on the surface of the specimen. The Brinell hardness value is expressed as the average pressure on the indentation’s surface area.

The test cycle time refers to the test force holding time and the test force application time. The maximum allowable error of the test force cycle time is ±0.5 s.

6 Control of measuring instruments

Control of measuring instruments includes: initial verification, subsequent verification and in-use inspection.

6.1 Verification conditions

6.1.1 Environmental conditions

Hardness testers shall be verified under the environmental conditions of (23 ± 5) °C. During subsequent verification or in-use verification of hardness testers outside this temperature, the ambient temperature shall not be lower than 10 °C and higher than 35 °C. The temperature at the time of verification shall be indicated in the verification record and verification certificate.

6.1.2 During the verification, the surrounding environment shall be clean and free from vibration and corrosive gases.

6.1.3 Instruments for verification

See Table 4 for instruments for verification.

6.2 Verification items and verification methods

See Table 5 for verification items.

Subsequent verification of hardness testers shall be carried out in accordance with the methods in 6.2.1 and 6.2.8 for the control of measuring instruments. If the verification of indicating value is not qualified, it shall be verified and adjusted according to the methods of 6.2.2, 6.2.3, 6.2.4, 6.2.5, 6.2.6, and 6.2.7 for the control of measuring instruments.

Table 4 -- Instruments for verification

No.	Verification item	Instruments for verification	
		Name	Technical requirements
1	Levelness of test bench of hardness testers	Level	Division value: 0.2/1000
2	Perpendicularity of hardness tester's spindle and test bench surface	Calibration rod	Cylindricity is not greater than 0.01 mm, effective length is 100 mm
		Knife edge square	Grade 1: 100 m × 60 m
		Feeler	(0.02 ~ 1) mm
3	Coaxiality of lifting	Measuring	Division value: 0.01 mm, Grade II

force of the hardness tester, then adjust the zero position and start the test.

6.2.4.2 The direction of movement of the test force during verification shall be the same as the direction of movement of the test force during the test, and the test shall be performed at three positions within the entire travel range of the test force. Measure 3 times at each position.

The test force error is calculated according to (1):

$$W = \frac{K - K_0}{K_0} \times 100 \qquad (1)$$

where: W - the test force error;

K_0 - the indicating value of the standard dynamometer corresponding to the test force;

K - the reading differs most from K_0, among the 3 readings.

The verification W result of test force shall meet the requirements of 4.2.2.

6.2.5 Verification of indenter

6.2.5.1 Appearance inspection of ball indenter

Observe the surface state of the ball under a stereo microscope with a magnification of 100 times. The surface of the ball shall be free of defects such as pits, scratches, cracks, and rust. Use an interference microscope to measure its surface roughness. It shall meet the requirements of 4.3.

6.2.5.2 Test of ball diameter

The diameter of the ball shall be measured by a vertical optical length measuring instrument. The diameter shall be measured in at least three directions. The measured value of three measurements shall meet the requirements of 4.3.

6.2.5.3 Test of ball hardness

Samples shall be taken randomly from ball indenters produced in the same batch and tested with a Vickers hardness tester (HV10). The hardness value shall meet the requirements of 4.3. The ball indenter after test shall be discarded.

6.2.6 Verification of indentation measuring device

Check whether the scale of the indentation measuring device is clear and uniform.

where: H_{cf} - the indicating value repeatability of the hardness tester;

H_{max} - the maximum value of hardness at 5 points;

H_{min} - the minimum value of hardness at 5 points;

$\overline{H}_j$ - the arithmetic mean value of hardness at 5 points.

6.2.8.3 Indicating value error of hardness testers

The indicating value error of hardness testers is calculated according to formula (4):

$$\delta = \frac{\overline{H}_j - \overline{H}_k}{\overline{H}_k} \times 100\% \qquad (4)$$

where: δ - the indicating value error of the hardness tester;

$\overline{H}_j$ - the indicated value of the hardness tester (average value of hardness at 5 points);

$\overline{H}_k$ - the hardness value of the hardness block.

The indicating value repeatability and indicating value error of hardness testers shall meet the requirements of 4.5.

6.3 Processing of verification results

The hardness tester that is qualified in the verification according to the requirements of this Regulation is issued a verification certificate. The hardness tester that is unqualified in the verification is issued a verification result notice.

6.4 Verification cycle

The verification cycle of hardness testers generally does not exceed 1 year.

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