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**Metallic materials - Test method for rapid indentation
(Brinell type) hardness testing**

金属材料 快速压入 (布氏型) 硬度试验方法

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Metallic materials - Test method for rapid indentation (Brinell type) hardness testing

1 Scope

This Standard specifies the principle, symbols, test equipment, specimens, test procedures, determination of extreme hardness values, factors affecting the accuracy of measurement results, and test reports for rapid indentation (Brinell type) hardness testing of metallic materials.

This Standard is applicable to the rapid Brinell type hardness testing on the parts on the production site by the rapid indentation (Brinell type) hardness tester.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 231.1-2018, *Metallic materials - Brinell hardness test - Part 1: Test method*

GB/T 231.2, *Metallic materials - Brinell hardness test - Part 2: Verification and calibration of testing machines*

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

GB/T 13634, *Metallic materials - Calibration of force-proving instruments used for the verification of uniaxial testing machines*

JJG 144, *Verification Regulation of Standard Dynamometers*

3 Terms and definitions

There are no terms and definitions that need to be defined in this document.

test force can also be used. If the initial test force is used, the size of the initial test force is determined by the hardness tester manufacturer.

6.2.2 The indenter used for the rapid indentation (Brinell type) hardness test shall be a tungsten carbide alloy ball that meets the requirements of GB/T 231.2.

6.3 Indentation depth measuring device

6.3.1 The indentation depth measuring device shall meet the requirements of A.3.3.2. The method of measuring the indentation depth is determined by the hardness tester manufacturer.

6.3.2 The display of the hardness tester shall include the measured indentation depth value and the corresponding Brinell hardness value. The Brinell hardness value displayed shall be the Brinell hardness value of the corresponding scale converted from the measured indentation depth. The method of converting the measured indentation depth into the Brinell hardness value is determined by the hardness tester manufacturer.

7 Specimens

7.1 General requirements

The specimens tested by the rapid press-in (Brinell type) hardness tester are mainly mass-produced parts that need to quickly test the Brinell hardness at the production site. The parts can be flat or curved. Any part that can be tested by the test method specified in GB/T 231.1-2018 can be tested with a rapid indentation (Brinell type) hardness tester.

7.2 Specimen surface processing

In order to accurately measure the indentation depth, and to remove the surface conditions (such as decarburization, oxide layer) that affect the authenticity of the hardness measurement of the specimen, if necessary, the surface of the specimen shall be polished, cut or polished. When processing the surface of the specimen, attention shall be paid to minimize the impact on the surface hardness of the specimen (for example, due to overheating or cold processing). When using a supporting measuring table, the surface of the specimen in contact with the measuring table shall be clean, and there shall be no conditions that may affect the test results.

7.3 Specimen thickness

The thickness of the specimen shall be at least 8 times the total indentation depth to ensure that there will be no bumps or other marks on the back of the specimen caused by the test force. Under different hardness test conditions,

the relationship between the minimum thickness of the test specimen and the indentation diameter can be found in Annex A of GB/T 231.1-2018.

8 Test procedures

8.1 Selection of test conditions

The selection of the total test force and the diameter of the indenter shall meet the requirements of GB/T 231.1-2018. It shall be the same as the Brinell hardness test conditions to be replaced.

8.2 Indentation interval

The distance from the center of the indentation to the edge of the sample or the edge of another indentation shall be at least 2.5 times the diameter of the indentation.

8.3 Application of test force

Move the indenter perpendicular to the surface of the specimen, without impact, vibration and overloaded contacting the test surface. The axis of the indenter and the direction of force shall be perpendicular to the test surface.

8.4 Indentation depth measurement

Measure the indentation depth according to the manufacturer's instructions. When using this test method to detect the hardness of parts, it is recommended to record the measured indentation depth value.

9 Determination of extreme hardness

The rapid indentation (Brinell type) hardness test is usually only used to measure a limited range of Brinell hardness. In order to determine the acceptable hardness extremes (maximum and minimum) for a given part, it shall use a rapid indentation (Brinell type) hardness tester to measure samples that represent the extreme value of the acceptable range. The measurement result can be used as the extreme value of the measurement range of the rapid indentation (Brinell type) hardness test.

10 Factors affecting the accuracy of measurement results

Certain factors will affect the accuracy of the measurement results, see Annex

Annex A

(normative)

Inspection and calibration of rapid indentation (Brinell type) hardness tester

A.1 General

A.1.1 There are three inspection methods for the rapid indentation (Brinell type) hardness tester: direct inspection, indirect inspection and daily inspection.

A.1.2 Direct inspection is to directly measure the test force, indentation depth measuring device and indenter and check whether the key parts of the hardness tester are within the tolerance range.

A.1.3 Indirect inspection is to use standard hardness blocks or parts or samples with known hardness to perform periodic inspection of the performance of the hardness tester.

A.1.4 Daily inspection is to use standard hardness blocks or parts or samples with known hardness, during the indirect inspection period, to monitor the performance of the hardness tester.

NOTE 1: It may be necessary to refer to the manufacturer's instructions for some of the inspections specified in this appendix.

NOTE 2: The sample is usually taken from the part to be tested.

A.2 General requirements

A.2.1 It shall, under the specified conditions, in accordance with the cycle interval specified in Table A.1, or in the event of a situation that may affect the performance of the hardness tester, inspect the hardness tester.

A.2.2 A thermometer with a resolution of at least 1°C shall be used to measure the temperature of the inspection site. It is recommended to monitor the temperature during the entire test period. Record and report significant temperature changes. In daily inspections, there is no need to measure the temperature of the inspection site.

A.2.3 When the user has traceability requirements, all measuring instruments used for measurement in accordance with the requirements of this appendix shall be traceable to national standards.

A.2.4 The indirect inspection of the hardness tester shall be carried out at the

A.4.6 The accuracy of the displayed value of the indentation depth specified in 6.3.2 shall meet the technical parameters given by the manufacturer. When the rapid indentation (Brinell type) hardness tester shows the Brinell hardness value, the deviation between the displayed value of each test and the marked value of the standard hardness block or part (or sample) shall not be more than 3%.

A.5 Daily inspection

A.5.1 Daily inspection is an important means for users of the hardness tester to monitor the performance of the hardness tester during the indirect test cycle. As a minimum requirement, the daily inspection shall be performed on each combination of total test force and indenter diameter to be used in accordance with the schedule given in Table A.1.

A.5.2 The daily inspection procedure is the same as the indirect inspection. However, daily inspection only requires the use of a standard hardness block or a part (or sample) with a known hardness value for at least one test. The maximum allowable deviation specified in A.4.5 and A.4.6 applies to daily inspection. It is recommended that the hardness value of the standard hardness block or part (or sample) used in daily inspection is close to the middle value of the hardness range to be used. When it is necessary to detect curved parts, parts (or samples) with known hardness with the same radius of curvature shall be used to conduct daily inspection on the hardness tester.

A.6 Inspection report

A.6.1 General requirements

The inspection report shall be filled out by the inspector. Both direct inspection and indirect inspection need to provide inspection report. No inspection report is required for daily inspection.

A.6.2 Inspection report information

A.6.2.1 The inspection report for direct inspection shall contain the following information:

- a) Reference to this Standard;
- b) The identification information of the rapid indentation (Brinell type) hardness tester, including the model and serial number;
- c) The identification information of all equipment used in the inspection, including the identification information of the number and its value traceability to the superior standard;
- d) The temperature during inspection shall be at least 1°C;

- e) The measurement results and calculation results used to determine whether the hardness tester meets the inspection requirements;
- f) If the hardness tester has been adjusted or repaired, a description of the adjustment or repair;
- g) Date of inspection and name of inspection agency;
- h) Inspector identification information.

A.6.2.2 The inspection report of the indirect inspection shall contain the following information:

- a) Reference to this Standard;
- b) The identification information of the rapid indentation (Brinell type) hardness tester, including the model and serial number;
- c) The identification information of all equipment used in the inspection, including the identification information of the number and its value traceability to the superior standard;
- d) The temperature during inspection shall be at least 1°C;
- e) The combination of tested test force and indenter;
- f) The measurement results and calculation results used to determine whether the hardness tester meets the inspection requirements;
- g) If the hardness tester has been adjusted or repaired, a description of the adjustment or repair;
- h) Date of inspection and name of inspection agency;
- i) Inspector identification information.

A.6.3 Daily inspection

Daily inspection does not require inspection report. It is recommended to keep daily inspection records, including inspection date, measurement results, calibration value of standard hardness block, standard hardness block number, and identification information of the inspector. These records can be used to evaluate the long-term performance of the hardness tester.

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