NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

GB/T 230.2-2022

Metallic materials - Rockwell hardness test - Part 2: Verification and calibration of testing machines and indenters

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1 Scope

This document specifies two inspection methods (direct inspection and indirect inspection) of the Rockwell durometer, for determining the Rockwell hardness, according to GB/T

230.1; specifies the inspection method of the Rockwell hardness indenter.

The direct test method is suitable for checking whether the main parameters related to the function of the durometer are within the specified tolerances, such as test force, depth measurement, test cycle time. The indirect test method is suitable for using a set of calibrated reference blocks, to determine the performance of the durometer, when measuring materials with known hardness.

The indirect test method can be used alone for regular routine inspections, using medium durometers.

If the durometer can also be used for the hardness test of other hardness test methods, the durometer shall be tested separately, according to each method.

This document applies to both stationary durometers and portable durometers.

Note that tungsten carbide alloy ball indenters have been considered as Rockwell hardness standard ball indenters. The steel ball indenter is limited to use, under the conditions of Appendix A in GB/T 230.1-2018.

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text. Among them, for dated references, only the version corresponding to the date applies to this document; for undated references, the latest version (including all amendments) applies to this document.

GB/T 230.1-2018 Metallic materials - Rockwell hardness test - Part 1: Test method (ISO 6508-1:2016, MOD)

GB/T 230.3-2022 Metallic materials - Rockwell hardness test - Part 3: Calibration

5.2 Calibration and inspection of test force

5.2.1 Measurements shall be made, for each initial test force F0 (see 5.2.4) and each total test force F (see 5.2.5) used. As far as practicable, in the entire movement range of the spindle during the test, the above-mentioned force measurements are made at least three positions, at certain intervals. The initial test force shall be maintained for at least

2 s.

5.2.2 At each position of the spindle, three readings shall be taken at each test force.

Before each measurement reading, the direction of movement of the spindle shall be consistent with the direction of movement during the test.

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

- Use a standard force measuring instrument, at grade 1 or better than grade 1, that meets

the requirements of GB/T 13634, AND whose return performance has been calibrated;

- Apply a force within +/- 0.2% of indication error, by means of weight of calibrated mass or other means of equivalent accuracy, so that this force is in balance with the test force to be detected.

Evidence should be provided to prove that the output of the force-measuring device does not change by more than 0.2%, during the period of 1 s ~ 30 s, after the step change of the test force.

5.2.4 Before the main test force F1 is applied and after it is removed, the maximum tolerance for each measurement of the initial test force F0 shall be +/-2.0% of its nominal value, see formula (B.2). The variation range (maximum value minus minimum value)

of all measured values of initial test force shall not be greater than 1.5% of the nominal value of F0.

5.2.5 The maximum tolerance for each measurement of the total test force F shall be +/-1.0% of its nominal value. The variation range (maximum value minus minimum value) of all measured values of the total test force shall not be greater than 0.75% of the nominal value of F.

5.3 Calibration and inspection of indentation depth measuring device

5.3.1 The indentation depth measuring device shall be calibrated, by making the indenter or indenter seat produce known displacement increments.

5.3.2 When calculated at a 95% confidence level, the expanded uncertainty of the instrument or gauge block, which is used to test the indentation depth measuring device, shall not exceed 0.0003 mm.

5.3.3 The indentation depth measuring device shall be tested, at least 4 positions evenly distributed within the entire working depth range of the durometer, during normal measurement. For conventional Rockwell hardness scales (A, C, D, B, E, F, G, H, K), the working depth is 0.25 mm; for superficial Rockwell hardness scales (N, T), the working depth is 0.1 mm.

5.3.4 The indentation depth measuring device of some durometers has a large stroke;

the position of the working range of the measuring device will change with the thickness of the specimen. This type of durometer shall be able to be checked electronically, to ensure continuous operation of the indentation depth measuring device, throughout the entire travel range. This durometer shall be inspected according to the following steps:

a) Select the three positions of the highest point, the center point, the lowest point of the total range of the measuring device. Near each of the three positions, use not less than four displacement increments, at equal intervals of about 0.05 mm, to test the indentation depth measuring device;

b) Operate the drive and monitor whether the measurement of the displacement is continuous, over the entire travel range of the drive. The displacement indication shall be displayed continuously, throughout the entire travel range.

5.3.5 For scales A to K, the indication value of the indentation depth measuring device shall be accurate to +/-0.001 mm, within the measurement range of each scale. For scales N and T, it shall be accurate to +/-0.0005 mm, within the measurement range of each scale, that is, no more than +/-0.5 Rockwell hardness units.

5.4 Calibration and inspection of test cycle time

5.4.1 The test cycle time shall be verified by the manufacturer of the durometer, during production or after maintenance that may affect the test cycle time. At other times, the complete test cycle time is not required as part of the direct inspection, see Table 10.

5.4.2 The test cycle time shall comply with the provisions of GB/T 230.1-2018.

5.4.3 For durometers, that automatically control the test cycle time, the measurement expanded uncertainty (k = 2) of the timing instrument, which is used to check the test cycle time, shall not exceed 0.2 s. It is recommended that the measured value of the test cycle time, plus or minus the expanded uncertainty of measurement (k = 2) of the calibration instrument, does not exceed the time limit specified in GB/T 230.1-2018.

5.4.4 For durometers that require the operator to manually control the test cycle time, it shall be checked whether the durometer can achieve the specified test cycle time.

7.2.2.1 The diamond conical surface and top spherical surface, which are corresponding to the indentation depth range of 0.3 mm, shall be polished; the combination of the two surfaces shall be smooth and tangent. Both faces shall be free from surface defects.

7.2.2.2 The shape of the indenter can be checked, by direct measurement or optical measurement. The detection shall be carried out on at least 4 equally spaced different axial sections (e.g., 0°, 45°, 90°, 135°) of the axis of the indenter. It is also possible to use a collimator for measurement, in which case it should measure at least 4 central angles; it shall include a central angle of 120°.

The position, where the top spherical surface of the diamond indenter combines with the cone, will change due to the difference in the radius of the top spherical surface and the angle of the cone. Theoretically, the junction point of a perfect indenter geometry, which is measured along a perpendicular line to the indenter axis, shall be located at a position 100 um away from the indenter axis. In order to avoid including the combined area of the two in the measurement of the top spherical radius and the cone angle, the 80 um ~ 120 um part of the diamond surface can be ignored.

7.2.2.3 When calculated according to the 95% confidence level, the expanded uncertainty of the instrument, which is used to test the geometry of the diamond indenter, shall not be