OPERATION MANUAL

BMS 150-CM

Analogue Motorized Rockwell Hardness Tester

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1 Overview

Hardness is an important indicator of material mechanical properties. It refers to the ability of a material to resist the indentation of another object without residual deformation. In the mechanical performance test, the Rockwell hardness test is one of the simplest, fastest and most economical methods. Because it can directly indicate the hardness value, the test efficiency is the highest. In many cases, it can complete tasks that other mechanical properties cannot. At present, with the rapid development of scientific research and industry in our country, the Rockwell hardness test method has been widely used in national defense, scientific research, laboratories and factory workshops.

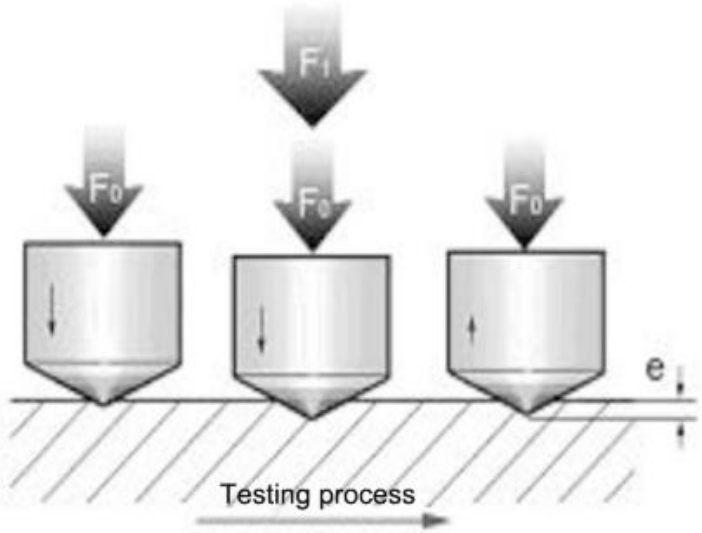

Figure 1 Test principle of Rockwell hardness tester

2 Use range

In the test, the indenter and total test force should be selected according to the following table.

Ruler	Pressure head	Total test force N（kgf)	Mark	Measuring range
B	Φ1.588mm steel ball	980.7（100）	HRB	20—100
C	120°Diamond	1471（150）	HRC	20—70
A	120°Diamond	588.4（60）	HRA	20—88

A scale: used to measure metals whose hardness exceeds 70HRC (such as tungsten carbide, cemented carbide, etc.), and can also measure hard sheet materials and hardened surface layer materials.

C scale: used to determine the hardness of heat-treated steel products.

B scale: Used to measure softer or medium-hard metals and unhardened steel products.

3 Parameters

3.1. Initial test force……98.07N（10kgf)

3.2. Total test force……588.4N(60kgf) 980.7N(100kgf)1471N(150kgf)

3.3. Indicator scale……C:0—100；B:30—130

3.4. Maximum height of specimen……210mm、

3.5. Distance from indentation center to machine wall……165mm

3.6. Dimensions of Hardness Tester……220*510*694mm

3.7 Voltage……220V/50HZ

3.8.Net weight……90kg

4 Test principle

The Rockwell hardness is measured by using a diamond cone with an apex angle of 120° or a quenched steel ball with a diameter of Φ1.588 mm as the indenter, and pressing it into the surface of the sample with a prescribed test force. During the test, the initial test force is added first, and then the main test force. After pressing into the surface of the sample, the main test force is removed. With the initial test force retained, the difference between the indentation depth under the total test force on the sample surface and the indentation depth under the initial test force is used to determine the Measure the Rockwell value of metal materials. To indicate the level of Rockwell hardness, the greater the depth, the lower the hardness value. The measured depth of 0.002mm is 1 Rockwell unit. The Rockwell hardness symbol is represented by HR, and the scale used is A, B, C, etc. Such as HRA, HRB, HRC, etc.

The calculation formula：$$HR = \frac{h_1 - h_2}{c}$$

formula：c---Constant, equal to 0.002mm；

h_1 —Depth of indenter under total test force;

h_2 —Indenter depth under the initial test force;

K—Constant, scale A and C are 100, scale B is 130

In actual use, the hardness of the material can be directly read from the scale on the Rockwell special table.

5 Brief description of mechanism performance

The hardness tester is composed of a body, a loading mechanism, a measurement indicating mechanism, and a test piece support mechanism. The body is a closed shell. Except for the exposed worktable, lead screw and variable load handle, other mechanisms are installed on the machine. Inside the body shell, it is easy to keep clean. The loading mechanism is composed of a spindle, a lever, a weight, an electric lifting mechanism, a weight changing mechanism, and a control circuit. The initial test force is mainly generated by the weight of the spindle, indenter, circular knife, long prismatic knife, large lever, small lever, ejector rod, etc. and the measuring pressure of the indicator. When the test piece contacts the indenter and continues to rise When the large and small levers are in the horizontal position (the small pointer of the indicator points to the red dot and the large pointer is vertically upward), due to the weight of the lever and the measuring pressure of the indicator, the pressure head can be subjected to 98.07N (10kgf) Initial test force. The total test force is composed of the main test force (produced by the weight of the weight) plus the initial test force. There are three weights and hoisting rings in the electric lifting mechanism. When the start button on the panel is pressed, the hoisting ring weights will also drop. When the hoisting ring is installed at the end of the large lever during the descending process, the main test force will be stabilized by the large lever. Act on the pressure head. Then the weight of the weight and the hoisting ring will act on the large lever, so that the indenter is subjected to the total test force. A weight changer is installed in the fuselage. When the load-changing handle is rotated to different positions, three different total test forces of 1471N (150), 980.7N (100) or 588.4N (60) can be obtained. The test force holding time can be adjusted by adjusting the TIME on the panel. When the hardness of the sample is low, the holding time can be appropriately extended. The sample retention time is generally 3-8S. It is strictly prohibited to set the holding time to 0 seconds, at this time the hardness tester program will get out of control. When the holding time is over, the electric lifting mechanism automatically rotates to remove the main test force. The measuring indicating mechanism is composed of ejector rod, small lever, adjusting plate, adjusting screw and indicator. When the indenter of the rising test piece is pushed up, the push rod will push up the small lever and drive the pointer of the indicator to rotate through the adjusting screw.

The test piece support mechanism includes parts such as worktable, lead screw, hand wheel and so on.

6 Installation

6.1 Unboxing

① After opening the top cover of the packing box and the surrounding baffles, remove the 4 fixing screws at the bottom of the fuselage, and then the hardness tester can be placed in a dry and clean room without corrosive gas and vibration-free surroundings. The table on which the hardness tester is installed should be sturdy, and a hole with a diameter greater than Φ50 mm should be made for the lead screw to pass through.
②Check the completeness of the spare accessories according to the packing list.
③Open the top and back cover of the machine.
④Pinch the lifting ring with your hand and slowly lift up the weight set and at the same time take out the weight fixed support block, and then gently put down the weight set, so that the weight cylindrical pin falls into the groove of the pallet, and the weight Yard support.
⑤Unfasten the small lever to tighten the cord.
⑥Turn the hand wheel to lower the lead screw and take out the indenter block.
6.2. Remove the lead screw protective cover, use kerosene to clean the anti-rust oil applied to the lead screw, hand wheel, etc. before leaving the factory, then pour a small amount of lubricating oil on the contact point between the lead screw and the hand wheel, and re-install the lead screw good protection kit.
6.3. Check whether the position of the adjustment block on the large lever is between the two red marks, otherwise it should be reinstalled in the correct position.
6.4. Install the large flat workbench on the upper end of the lead screw, and then put the level meter on the workbench surface and adjust so that the level of the hardness tester is within 0.2/1000.

7 Operation method

7.1 Preparation before the test:

To select the test force, turn the variable load handle to make the selected test force align with the red dot, but it must be placed in an unloaded state when changing the test force.
Install the indenter: When installing the indenter, pay attention to eliminating the gap between the indenter and the end face of the spindle. The elimination method is: install the indenter and lightly fix it with screws, then place the standard block or test piece on the workbench, rotate the handwheel to apply the initial test force, and press the start button to make the main test force applied to the indenter, then loosen and tighten the screws to eliminate the gap between the indenter and the end face of the spindle. (Note that the test force holding time should be appropriately longer during adjustment).

7.2 Test procedure:

① Wipe clean the top surface of the screw and the upper and lower ends of the selected workbench, and place the workbench on the screw.
② Wipe the supporting surface of the test piece clean, place it on the workbench, rotate the hand wheel to slowly rise the workbench, and lift the indenter until the small pointer points to the red dot, and the large pointer rotates three times vertically upwards (allowable difference ± 5 scales, if more than 5 scales, this point should be invalidated and re-test).
③Rotate the indicator shell to align the long-engraved line between C and B (zero point) with the large pointer (clockwise or counterclockwise rotation is acceptable).
④Press the start button on the panel to apply the main test force, and the large pointer of the indicator rotates counterclockwise.
⑤When the main test force is applied, it enters the test force holding state, the digital tube counts down, and the main test force is removed after the timer ends.

⑥ Reading from the corresponding scale on the indicator: when using the diamond indenter test, it is read according to the black letters on the outer circle of the dial, and when using the ball indenter test, it is read according to the red letters on the inner circle of the dial.

⑦Turn the handwheel to lower the test piece, then move the test piece, and perform a new test according to the above procedures ②～⑥.

⑧ The lead screw protective cover is set to protect the lead screw from dust. When the hardness tester is not in use or the height of the test piece is less than 100 mm, put it on the outside of the screw. When the height of the test piece is greater than 100 mm, put it on the outside of the screw. When the height of the test piece is greater than 100 mm, it must be removed to avoid lifting the workbench and invalidating the test.

8 Maintenance and repair of hardness tester

8.1. When the hardness tester is not used for a long time, cover the machine with a dust cover.

8.2. Periodically inject a small amount of oil into the contact between the screw) and the handwheel.

8.3. Before using the hardness tester, clean the top surface of the screw and the upper end surface of the worktable.

8.4. If the hardness indication error is found to be large. ① Take down the workbench and check whether the contact surface with the lead screw is clean. ②Check whether the lead screw protective cover is jacked up on the workbench. ③Check whether the indenter is damaged.

8.5. If the power supply is turned on, and there is no display on the panel, check whether the fuse is blown and whether the power supply is normal.

8.6. Regularly check the accuracy of the hardness tester with the standard hardness block carried by this machine.

① Wipe the workbench and the standard hardness block clean, and test on the working surface of the hardness block. Never test on the supporting surface.

② If the indication error is large, in addition to the inspection according to item 4 of this section, check whether there are burrs on the supporting surface of the standard hardness block. If there are burrs, use oil stone to polish.

③When testing at different positions of the standard hardness block, the hardness block should be dragged on the workbench and should not be taken away from the workbench.

9 Packing List

No.	Name	Specification	Unit	Qty
1	Electric Rockwell Hardness Tester	HRD-150	Set	1
2	Dapping workbench		Piece	1
3	Xiaoping workbench		Piece	1
4	V-shaped workbench		Piece	1
5	Diamond indenter	120°	Piece	1
6	HRB pressure head	Steel ball indenter	Piece	1
7	HRB steel ball	φ1.588mm	Piece	5
8	Standard Rockwell hardness block	20-30HRC	Piece	1
9	Standard Rockwell hardness block	35-55 HRC	Piece	1
10	Standard Rockwell hardness block	60-70 HRC	Piece	1
11	Standard Rockwell hardness block	80-88HRA	Piece	1
12	Standard Rockwell hardness block	85-100HRB	Piece	1
13	screwdriver		Piece	2
14	Dust cover		Piece	1
15	Accessory box		Piece	1
16	Manual		Copy	1
17	Certificate of conformity		Copy	1
18	Packing List		Copy	1