# iRocky-150M
# Manual Rockwell Hardness Tester

## Instruction Manual




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# 1.Overview

Hardness is an important index of mechanical properties. It is the ability of a material to resist another hard object with certain shape and size without residual deformation.

Rockwell hardness test is the most rapid, simple and economical test method in mechanical property test.It not only has simple operation and high test efficiency, but also can directly obtain the test results.In many cases, tests that cannot be completed by other mechanical performance tests can be completed.With the rapid development of China's industry, Rockwell hardness test has been widely used.

This hardness tester is equipped with diamond conical indenter andφ1.588mm steel ball indenter is available according to user's needsφ3.175mm steel ball indenter.

# 2.Scope Of Application

The hardness scale, hardness symbol, indenter type and test range used in the hardness tester test are listed in Table 1.

Table 1

| Ruler | Hardness symbol | Indenter type | Initial test force | Main test force | Total test force | Rockwell hardness range |
|---|---|---|---|---|---|---|
| A | HRA | Diamond cone | 98.07N | 490.3N | 588.4N | 22-88 HRA |
| B | HRB | φ1.588mm steel ball | 98.07N | 882.6N | 980.7N | 20-100 HRB |
| C | HRC | Diamond cone | 98.07N | 1373N | 1471N | 20-70 HRC |
| D | HRD | Diamond cone | 98.07N | 882.6N | 980.7N | 40-77 HRD |
| E | HRE | φ3.175mm steel ball | 98.07N | 882.6N | 980.7N | 70-100HRE |
| F | HRF | φ1.588mm steel ball | 98.07N | 490.3N | 588.4NN | 60-100HRF |
| G | HRG | φ1.588mm steel ball | 98.07N | 1373N | 1471N | 39-94 HRG |
| H | HRH | φ3.175mm steel ball | 98.07N | 490.3N | 588.4N | 80-100HRH |
| K | HRK | φ3.175mm steel ball | 98.07N | 1373N | 1471N | 40-100 HRK |

## 2.Scope Of Application

Application scope of common ruler:

A scale: It is suitable for the test of thin plate material or surface layer, and also for metals with hardness exceeding 70hrc, such as cemented carbide.The test range shall not exceed 88hra.

B scale: Applicable to non-ferrous metals and their alloys and annealed steel low hardness test pieces.The test range is 20 ~ 100hrb.

C scale: It is suitable for testing the hardness of steel specimens after heat treatment.The test range is 20 ~ 70hrc.

## 3.Main Technical Parameters

1.Initial test force: 98.07n (10kgf)

2.Total test force: 588.4n (60kgf) 980.7n (100kgf) 1471kn (150kgf)

3.Indicator scale: C: O ~ 100 B: 30 ~ 130

4.Maximum distance from indentation center to machine wall: 130mm

5.Maximum height of test piece: 170mm

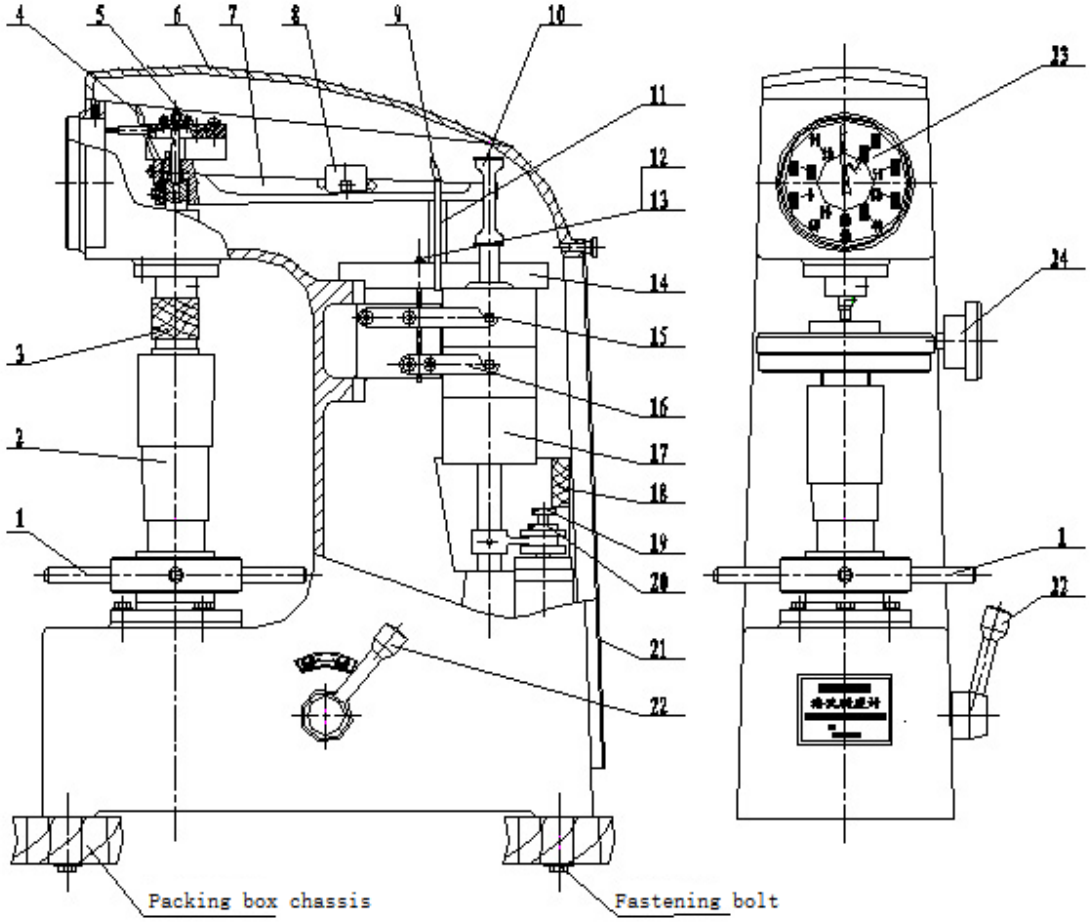
6.Overall dimension of hardness tester 457×two hundred and forty×629mm

7.Net weight of hardness tester: 75kg

# 4.Installation(See Structure Diagram)

1.After unpacking, remove the four fastening bolts at the bottom of the machine body.

2.The hardness tester shall be installed in the environment with room temperature l0 ~ 35 ℃, no corrosive medium, no vibration and humidity no more than 70%. The hardness tester shall be installed on a stable workbench that can be lifted and lowered by the lead screw.




Structure Diagram

(1).Lifting hand wheel (2). Lead screw protective cover (3). Cushion block (4). Nylon tie wire (5). Measuring lever

(6) Upper cover(7) Load lever (8). Weight adjusting block (9). Nylon tie wire (10) Lifting ring (11). Fixed support block (12). Hook head screw (13) Nut (14).. Weight fixing pressing plate (15). Weight cylindrical pin (16).. Support plate (17).. Weight (18).. Weight support

## 4.Installation(See Structure Diagram)

block (19). Adjusting valve (20).Lock nut (21). rear cover (22). loading and unloading handle (23). indicator (24).load changing handwheel

3.Remove the upper cover (6) and the rear cover (21), cut and take out the load lever binding nylon cable (9), and take out the load lever fixing support block (11).

4. Loosen the nut(13),remove the hook head screw(12), and remove the weight fixing pressing plate (14).

5. Lift the lifting ring (10) upward, take out the weight support block (18) under the weight group (17), and then gently put down the weight group, so that the cylindrical pins (15) on both sides of the weight fall into the center of the groove of the support plate (16) and hold the weight.

6. Cut and take out the measuring lever and bind the nylon tie wire (4).

7. Rotate the lifting hand wheel (1) counterclockwise to lower the lead screw and take out the cushion block (3).

8. Remove the dust cover (2) of the lead screw and wipe the lead screw and its upper end face, the lower end face of the main shaft and the upper end face of the lead screw seat. Inject an appropriate amount of lubricating oil at the contact between the lead screw and the hand wheel, and reinstall the dust cover of the lead screw.

9. Check the position of the weight adjusting block (8) on the load lever (7). If it is in the middle of the two paint seals, the test can be carried out.If the weight adjusting block is displaced, it shall be adjusted to the middle of the two paint seals and fixed.

10. Take out the large flat test bench from the accessory box, clean the oil stain on the surface with kerosene, install it on the lead screw and tighten it, then place the level on the test bench, and adjust the levelness to within 0.2/1000 by inserting an inclined iron of appropriate thickness into the bottom of the fuselage.

## 5.Sample

1. During the preparation of the sample, the influence of heating and cold working on the surface hardness of the sample shall be avoided as far as possible.

2. The test surface of the sample shall be flat without oxide scale and other dirt, and the surface roughness Ra shall not be greater than 0.80μm.

3. The thickness of the specimen or specimen layer shall be greater than 10 times the indentation depth.There shall be no visible deformation trace on the back of the sample after the test.

## 6.Test

1.Select test force: the test force of this machine has three levels, namely 588.4N (60kgf) of test scale A, 980.7N (100kgf) of test scale B and 1471N (150kgf) of test scale C.During the test, the test force shall be selected according to the scale.When changing the test force, only rotate the load changing handwheel (24) to obtain different test forces.When the test force is changed, the loading and unloading handle (21) shall be placed in the unloading position.

2.Adjust the loading speed of the main test force: the application speed of the main test force can be adjusted within (2 ~ 8) s depending on the hardness of the material. During adjustment, place the sample on the test bench, turn the hand wheel (1) until the small needle of the indicator (23) is at the red mark (3mm) and the large pointer is at the zero position (C, b) ± 5hr.Pull the loading and unloading handle (22) to apply the main test force, and observe the time from the start to the stop of the large pointer, which is the loading speed,The speed can be adjusted through the adjusting valve (19). During adjustment, loosen the lock nut (20), turn the adjusting valve clockwise to slow down

the loading speed, and turn the adjusting valve counterclockwise to speed up the loading speed. Tighten the lock nut after adjustment.

3.Verification of hardness: before the test, a standard Rockwell hardness block similar to the hardness of the sample shall be used to verify the hardness tester.After verification, the hardness test can be carried out only when the indication error of the hardness tester meets the requirements of JJG112-2003 verification regulation of metal Rockwell hardness tester.(see Table 2)

Table 2 maximum allowable error of hardness tester indication 《JJG112—2003》

| Hardness Scales | Rockwell Hardness Range | Maximum Allowable Error Of Indication Error |
|---|---|---|
| A | (20~75)HRA | ±2HRA |
| | (>75~88)HRA | ±1.5HRA |
| B | (20~45)HRB | ±4HRB |
| | (>45~80)HRB | ±3HRB |
| | (>40~100)HRB | ±2HRB |
| C | (20~70)HRC | ±1.5HRC |

4.Test: place the sample on the test bench and select the test position.Turn the lifting hand wheel (1), raise the test bench to make the indenter contact with the sample, and continue to turn the hand wheel until the small pointer of the indicator (23) is at the red mark and the large pointer is at the zero position (C, b) ± 5hr.Rotate the indicator housing so that the zero point (C, b) of the dial coincides with the large pointer.Pull the loading and unloading handle (22) to apply the main test force, maintain the specified holding time according to the requirements of the sample, then push the loading and unloading handle (22) back to the original position smoothly within 2S, remove the main test force, maintain the initial test force, and then quickly read out the hardness value from the corresponding scale.

# 7.Test Precautions

1.The test is generally carried out at room temperature of 10~35 ℃.For the test chamber with high accuracy requirements, the temperature shall be controlled at 23±5 ℃.

2.The test surface, support surface, test bench surface and indenter surface of the sample shall be clean.The sample shall be firmly placed on the test bench to ensure no displacement and deformation during the test.

3.In any case, the indenter is not allowed to touch the test bench, and there shall be no indentation on the supporting surface of the sample and the working surface of the test bench.

4.During the test, the test force direction must be perpendicular to the sample surface.

5.During the test, the hardness tester and sample shall not be impacted and vibrated.

6.When applying the initial test force, the large pointer shall not exceed ± 5hr, otherwise the test bench shall be lowered to remove the initial test force, and another position shall be selected for retest.

7.When the large pointer is within ± 5hr, the indicator housing shall be rotated to zero, and the lifting worktable is not allowed to zero.

8.The total test force holding time is recommended as follows:

For the sample that does not continue to deform with time after applying the main test force,the holding time is 1~3s;

For the sample that deforms slowly with time after applying the main test force,the holding time is 6~8s;

For the sample that deforms obviously with time after applying the main test force,the holding time is 20~25s;

9.The distance between two adjacent indentation centers shall be at least 4 times the indentation diameter,but not less than 2mm.The distance between the center of any indentation and the edge of the specimen shall be at least 2.5 times the diameter of the

indentation, but not less than 1mm.

10.The cylindrical and spherical test specimens shall be corrected, and the correction values shall refer to attached Tables 1,2 and 3.

Attached table 1 correction value of Rockwell hardness of convex sphere (HRC)

| Rockwell hardness number | Sphere diameter (mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 4 | 6.5 | 8 | 9.5 | 11 | 12.5 | 15 | 20 | 26 |
| 55HRC | 6.4 | 3.9 | 3.2 | 2.7 | 2.3 | 2.0 | 1.7 | 1.3 | 1.0 |
| 60HRC | 5.8 | 3.6 | 2.9 | 2.1 | 2.1 | 1.9 | 1.5 | 1.2 | 0.9 |
| 65HRC | 5.2 | 3.2 | 2.6 | 1.9 | 1.9 | 1.7 | 1.4 | 1.0 | 1.8 |

Table 2 correction value of Rockwell hardness of convex cylindrical surface

Diamond cone indenter test

(HRA、HRC、HRD)

| Rockwell hardness number | Surface radius mm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | 5 | 6.5 | 8 | 9.5 | 11 | 12.5 | 16 | 19 |
| 20 | | | | 2.5 | 2.0 | 1.5 | 1.5 | 1.0 | 1.0 |
| 25 | | | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 | 1.0 | 1.0 |
| 30 | | | 2.5 | 2.0 | 1.5 | 1.5 | 1.0 | 1.0 | 0.5 |
| 35 | | 3.0 | 2.0 | 1.5 | 1.5 | 1.0 | 1.0 | 0.5 | 0.5 |
| 40 | | 2.5 | 2.0 | 1.5 | 1.0 | 1.0 | 1.0 | 0.5 | 0.5 |
| 45 | 3.0 | 2.0 | 1.5 | 1.0 | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 |
| 50 | 2.5 | 2.0 | 1.5 | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 | 0.5 |
| 55 | 2.0 | 1.5 | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0 |
| 60 | 1.5 | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0 | 0 |
| 65 | 1.5 | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0 | 0 |
| 70 | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0 | 0 |

## 7.Test Precautions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 75 | 1.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0 | 0 | 0 |
| 80 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0 | 0 | 0 | 0 |
| 85 | 0.5 | 0.5 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 90 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

fuseΦ1.588 Steel ball test

(HRB、HRF、HRG)

| Rockwell hardness number | Surface radius mm | | | | | | |
|---|---|---|---|---|---|---|---|
| | 3 | 5 | 6.5 | 8 | 9.5 | 11 | 12.5 |
| 20 | | | | 4.5 | 4.0 | 3.5 | 3.0 |
| 30 | | | 5.0 | 4.5 | 3.5 | 3.0 | 2.5 |
| 40 | | | 4.5 | 4.0 | 3.0 | 2.5 | 2.5 |
| 50 | | | 4.0 | 3.5 | 3.0 | 2.5 | 2.0 |
| 60 | | 5.0 | 3.5 | 3.0 | 2.5 | 2.0 | 2.0 |
| 70 | | 4.0 | 3.0 | 2.5 | 2.0 | 2.0 | 1.5 |
| 80 | 5.0 | 3.5 | 2.5 | 2.0 | 1.5 | 1.5 | 1.5 |
| 90 | 4.0 | 3.0 | 2.0 | 1.5 | 1.5 | 1.5 | 1.0 |
| 100 | 3.5 | 2.5 | 1.5 | 1.5 | 1.0 | 1.5 | 0.5 |

# 8.Certificate

Inspection

1. The appearance, indenters and test force accuracy are inspected and fulfilled the standard of ISO 6508-2:1999, Metallic materials—Rockwell hardness test---Part 2: Verification and calibration of testing machine (scale A, B, C, D, E, F, G, H, K, N, T).

2. Accuracy of hardness value:

| Indenter | Steel ball ( ¢ 1.588 mm ) | 120 º Diamond cone | | | |
|---|---|---|---|---|---|
| Test force N ( kgf ) | 980.7 (100) | 588.4(60) | 1471(150) | | |
| Nominal value ofStandard Block | HRB | HRA | HRC | HRC | HRC |
| Measured value( average ) | HRB | HRA | HRC | HRC | HRC |

The permitted tolerances of the Standard are as follows:

| Scale | Range of hardness | Tolerance |
|---|---|---|
| A | 20HRA < ~≤75HRA | ±2 HRA |
| A | 75HRA < ~≤88HRA | ±1.5 HRA |
| B | 20HRB < ~≤45HRB | ±4 HRB |
| B | 45HRB < ~≤80HRB | ±3 HRB |
| B | 80HRB < ~≤100HRB | ±2 HRB |
| C | 20HRC < ~≤70HRC | ±1.5 HRC |

Conclusion

This hardness tester is inspected and complies with the technical requirements.

# 9.Packing List

| No. | Description | Specification | Quantity | Remark |
|---|---|---|---|---|
| 1 | Rockwell hardness tester | iRocky-150M | 1 set | |
| 2 | Large flat test anvil | | 1 pc. | |
| 3 | Small flat test anvil | | 1 pc. | |
| 4 | V-shaped test anvil | | 1 pc. | |
| 5 | Diamond cone indenter | 120° | 1 pc. | |
| 6 | Steel ball indenter | 1.588mm | 1 pc. | Mounted on the main shaft |
| 7 | Steel ball | 1.588mm | 5 pcs. | Spare parts |
| 8 | Rockwell standard block | 80-88HRA | 1 pc. | |
| 9 | Rockwell standard block | 85-95HRB | 1 pc. | |
| 10 | Rockwell standard block | 60-70HRC | 1 pc. | |
| 11 | Rockwell standard block | 35-55HRC | 1 pc. | |
| 12 | Rockwell standard block | 20-30HRC | 1 pc. | |
| 13 | screw driver | | 1 pc. | |
| 14 | Accessory box | | 1 pc. | |
| 15 | Dust cover | | 1 pc. | |
| 16 | Operation instruction | | 1 pc. | |
| 17 | Certificate | | 1 pc. | |
| 18 | Packing list | | 1 pc. | |

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