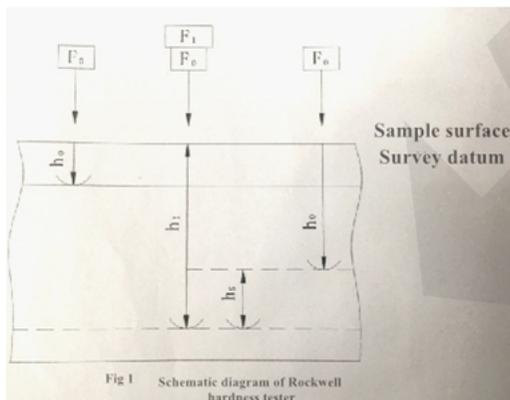


**HDT-RSR100
MANUAL ROCKWELL AND SUPERFICIAL
ROCKWELL HARDNESS TESTER
OPERATION MANUAL**



Introduction

- ◆ HDT-RSR100 Manual Rockwell And Superficial Rockwell Hardness Tester, the appearance is novel and beautiful. It integrates ordinary Rockwell hardness tester and surface Rockwell hardness tester, and expands the scope of application. It is a full Rockwell hardness tester. It is simple to change the initial test force and easy to operate. The speed of applying the test force is adjusted by the buffer, and the change of the test force is obtained by the rotation of the variable load handwheel. It is widely used for hardness measurement of hard alloy, carbide, surface hardened steel, hardened sheet, quenched steel, Quenched and tempered steel, chilled cast iron, cast iron, aluminum, copper, magnesium and other alloy steels.
- ◆ Test principle of Rockwell hardness: press the indenter (diamond cone, steel ball or cemented carbide ball) into the surface of the sample in two steps according to figure 1. After the specified holding time, remove the main test force and measure the residual indentation depth h under the initial test force.
- ◆ Calculation formula of Rockwell hardness: $HR=Q-h/S$ formula1



In Figure 1 and formula 1:

- h_0 —Indentation depth under initial test force F_0 ;
- h_1 —Indentation depth caused by main test force F_1 ;
- h_s —Elastic recovery depth after removing main test force F_1 ;
- h —Residual indentation depth
- Q —the hardness of a given scale
 - HRA、HRC、HRD、HRN、HRT is 100
 - HRB、HRE、HRF、HRG、HRH、HRK is 130
- S —Hardness unit (constant) of the given scale
 - Rockwell (scale A、B、C、D、E、F、G、H、K) is 0.002mm
 - Superficial Rockwell (scale N、T) is 0.001mm

Technical parameters

- ① Initial Test force (N): 29.4, 98
- ② Total test force (N): 147, 294, 441, 588, 980, 1471
- ③ Indenter specifications:
 - ① Diamond cone indenter
 - ② $\Phi 1.588$ mm ball indenter
- ④ Measuring range of superficial Rockwell hardness:

(70~94) HR15N	(67~93) HR15T
(42~86) HR30N	(29~82) HR30T
(20~77) HR45N	(10~72) HR45T
- ⑤ Measuring range of Rockwell hardness:

(20~88) HRA	(20~100) HRB	(70~100) HRE
(20~70) HRC	(60~100) HRF	(80~100) HRH
(40~77) HRD	(30~94) HRG	(40~100) HRK
- ⑥ Accuracy: match with GB/T230.3-2002
- ⑦ Maximum sample height (mm): 160
- ⑧ Distance from the indenter to the body (mm): 140
- ⑨ Dimensions (mm): 463x241x660

10 Weight (kg): 75

11 Rockwell hardness scale, indenter, test force and application (Table 1)

table 1

Scale	Indenter	Initial test force (N)	Main test force (N)	Application
A	Diamond cone indenter	98	588	Cemented carbide, carbon steel
D			980	Thin steel, surface hardened layer
C			1471	Quenched steel, Quenched and tempered steel, hard cast iron
F	Steel ball diameter 12.5 mm (1/2 inch)		588	Annealed copper alloy, mild steel
B			980	Mild steel, aluminum alloy, copper alloy, malleable cast iron
G			1471	Pearlitic iron, copper, nickel, zinc and nickel alloys
H		588		
E	Steel ball diameter 31.75 mm (1 1/8 inch)	29.4	980	
K			1471	
15N	Diamond cone indenter		147.1	Carburizing, nitriding, chromium plating and other chemical treatment of the surface hardness of the sheet
30N			294.2	
45N			441.3	
15T	Steel ball diameter 12.5 mm (1/2 inch)		147.1	Untreated sheet of steel, brass, bronze, etc
30T		294.2		
45T		441.3		

Note: use the scale of steel ball indenter, and add "s" after the hardness symbol.

Use the scale of cemented carbide ball indenter, and add "W" after the hardness symbol.

Installation and adjustment

1 Installation of hardness tester (Fig 2)

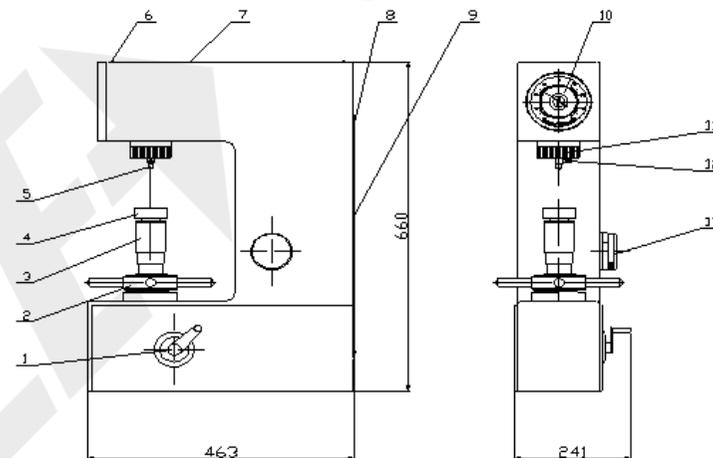


Fig 2

- 1. Load/Unload Handle
- 2. Turn wheel
- 3. Lifting Screw Cover
- 4. Anvil
- 5. Indenter
- 6. Screw for cover
- 7. Top cover
- 8. Screw for rear cover
- 9. Rear cover
- 10. Indicator
- 11. Rockwell "R"-Surface Rockwell "SR" conversion dial
- 12. Indenter Locking Screw
- 13. Weight Selector Knob

①The hardness tester shall be installed in a vibration free environment, horizontally placed on a stable worktable, and its levelness shall not exceed 1 mm/m, at the same time, a hole with a diameter of 65-75 mm shall be opened at the appropriate position of the worktable for the lifting of the lead screw (Fig 3)

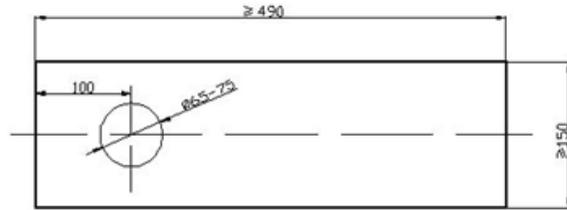


Fig 3

② After the hardness tester is placed properly, first screw out four upper cover fixing screws (6), and then take out the upper cover (7) (see Fig 2). Remove the rubber band on the small lever (1) in the body (Fig 7), and timely cover the upper cover to prevent dust from entering. Turn the rotating wheel (2) anticlockwise, take out the cushion block on the lifting lead screw, pull out the top protective cover (3) from the lifting lead screw, remove the other two protective covers, wipe the antirust oil on the lifting lead screw, and apply a small amount of thin oil for lubrication. Then install the protective cover and put it on the test bench (4). Finally, screw out the two back cover fixing screws (8), open the back cover (9), untie the white yarn fixing the moving parts, align the 147n on the load changing hand wheel (13) with the white spot beside it (Fig 2), place the five weights on the weight fork from top to bottom in the order of 1, 2, 3, 4 and 5, and observe whether they are installed correctly (Fig 4).

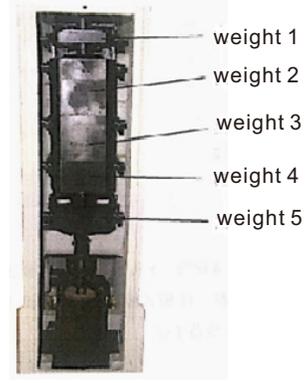
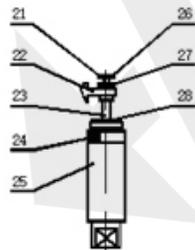


Fig 4



21. Valve Needle 22. Pull Out The Fork 23. Piston Rod 24. Cylinder Cover 25. Cylinder 26. Valve Needle Nut 27. Valve Needle Nut Locking Screw 28. Oil Seal

Fig 5

② Switch of test force

The scale (Table 1) is selected according to the hardness test requirements of the specimen, and the total test force and test mode (Rockwell s or surface Rockwell SR) are determined according to the scale. As shown in Figure 2, turn the load changing hand wheel (13) clockwise to change the main test force. Turning the mode change roller (11) can change the test mode, that is, change the initial test force of Rockwell or surface Rockwell. The surface Rockwell test mode is rotated to the right SR direction, and the Rockwell test mode is rotated to the left r direction. See Figure 6.

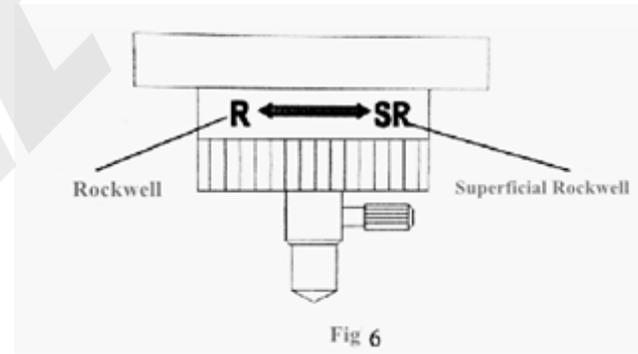


Fig 6

③ Adjustment of test force loading speed

① Oil filling method of buffer (Fig 5)

Loosen the two back cover fixing screws (8) on the back cover (9) (Fig 2), remove the back cover, pull the loading and unloading test force handle (1) forward (Fig 2), press (Fig 5) anticlockwise to loosen the needle lock nut (2), and then rotate the needle nut (1) anticlockwise to remove the oil seal (8) on the cylinder cover (6), and slowly inject No. 20 oil into the cylinder cover hole. The amount of oil injected can be adjusted When the loading and unloading test force handle is moved, there is no suction sound. Observe that the amount of oil added does not overflow the upper plane of the cylinder body (7) (the cylinder body has been filled with oil before delivery).

② Adjust the speed of loading main test force (Fig 2)

Install the diamond cone indenter (5), place the HRC hardness block on the test bench (4), adjust the mode conversion roller (11) to the Rockwell mode, and rotate the roller (2) clockwise to raise the test bench. After the hardness block contacts with the indenter, the pointer of the dial (10) starts to rotate, and the large pointer rotates three turns, so as to stop rotating the rotating wheel. Pull the loading and unloading test force handle (1) forward to observe the movement speed of the dial pointer. The time from the start of the pointer to the stop is 2-5 seconds. If the speed is fast, the buffer flow can be adjusted. Method: screw the needle nut (1) clockwise (Fig 5). Do the test again until it is adjusted to the specified time, then tighten the needle lock nut (2) clockwise, if the speed is slow, adjust it in the opposite direction.

Use of hardness tester

① Preparation before test

① The surface of the test piece shall be smooth and smooth without dirt, oxide scale, pits and obvious processing marks. The support surface and test bench of the test piece shall be clean and keep good sealing. The thickness of the test piece shall be greater than 10 times of the indentation depth (Table 2 and table 3).

Minimum thickness of Rockwell hardness test (table2)

Scale thickness hardness	Hardness value										
	20	25	30	40	50	60	67	70	80	90	100
A	/ 0.7 0.5 0.4 /										
B	/	2.0	1.9	1.7	1.5	1.3	/	1.2	1.0	0.8	0.7
C	1.5	/	1.3	1.2	1.0	0.8	0.7	/	/	/	/

Minimum thickness of surface Rockwell hardness test (table 3)

Minimum thickness dimensionmm	Rockwell hardness		
	HR15N	HR30N	HR45N
0.1524	92		
0.2032	90		
0.2540	88		
0.3048	83	82	77
0.3556	76	80	74
0.4064	68	74	72
0.4672		66	68
0.5180		57	63
0.5688		47	58
0.6196			51
0.6704			37
0.7212			20

Minimum thickness of Rockwell hardness test (continued 3)

Minimum thickness dimensionmm	HR15T	HR30T	HR45T
0.1270	93		
0.2540	90	87	
0.3810	78	77	77
0.5080		58	62
0.6350			26

② According to the shape and size of the test piece, the appropriate test bench is selected. If the test piece is abnormal, the special fixture can be designed and manufactured according to the specific geometry, so that the hardness test has accurate indication.

2 Operation sequence of hardness tester

① Select scale according to the technical requirements of the test piece (table1).

② Install the indenter in the measuring rod hole, close to the supporting surface, tighten the indenter fastening screw (12), and place the test piece on the test bench. Turn the mode conversion roller (11) to select the appropriate initial force test mode (Fig 2).

③ Turn the rotary wheel clockwise, the lifting screw rises, and the rising speed should be slow and stable when the indenter contacts the test piece. The small pointer on the dial moves from the blue point to the red point. At this time, the large pointer turns three turns to the range of zero \pm 5HR (5 cells). At this time, the initial test force has been applied.

④ Turn the dial (10) to zero (Fig 2).

⑤ After the initial test force is applied, slowly pull the loading and unloading test force handle forward within 3 seconds to ensure that the main test force is applied within 2-5 seconds. The total test force is kept for 4 s \pm 2 s, and then the loading and unloading test force handle is pushed back smoothly in 2-3 s to remove the main test force and maintain the initial test force. After a short period of stability, read the hardness indication from the corresponding scale.

Note: according to the different scales you test, the reading rings are also different. The outer ring of the dial (white characters on black background) is the surface Rockwell hardness value (i.e. N and T scales)(Diamond indenter test), and the inner ring is the Rockwell hardness value(ball indenter test). The inner ring of the dial (red characters on white background) is the HRB hardness value, and the middle ring is the HRC and HRA hardness value.

⑥ When the test bench is lowered, one test cycle ends. If it is necessary to continue the test, it can be operated in the order of ③ - ⑥.

3 Hardness tester calibration (Fig 7)

If the indication error of the hardness tester is large (\pm 5HR), the front and back position of the number adjusting plate (2) on the small number adjusting lever (1) can be used to achieve the indication accuracy requirements. The method is: gently loosen the front and rear M3 screws (3) on the number adjusting plate (2), and move the position of the number adjusting plate (2) back and forth. Note that when moving towards the indicator, the indication increases, otherwise, the indication decreases. After the adjustment, tighten the two M3 screws (3) that have been loosened. If it is found that the pointer of the indicator is not vertically upward, loosen the nut on the M3 (4) zero adjusting screw in the middle of the number adjustment board, rotate the screw to meet the requirement of the pointer vertically upward, and then fasten the nut.

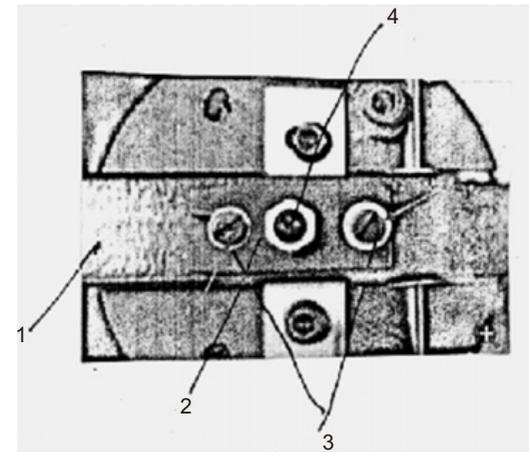


Fig 7

Common faults and troubleshooting

Symptom	Possible causes(s)	Corrective Action
Incorrect hardness measurement	<p>Contaminants effecting measurement</p> <p>Elevation screw cover & top, are interfering with specimen, anvil or elevation screw.</p> <p>Indentor is damaged.</p> <p>Dash pot is low on oil.</p>	<p>Be sure the anvil, top of elevation screw, threaded collar, indentor and specimen are all clean and free of oil, grease, dirt, shavings, debris, etc.</p> <p>Be sure elevation screw cover and top is clean and free of any dirt, oil, grease, etc. Position cover properly on the elevation screw.</p> <p>Inspect indentor for damage, replace diamond indentor if chipped or broken, replace 1/16" steel ball if deformed or damaged.</p> <p>Refill dash pot, see Maintenance, above.</p>
When using the test block, a different hardness is measured at different locations on the block.	<p>Burrs on bottom of test block.</p> <p>Air trapped under test block.</p>	<p>Use oil sharpening stone to remove burrs.</p> <p>When testing different locations on a test block, slide test block on anvil, maintaining contact between anvil and block.</p>
Dial indicator needle rotates too fast at start of test	<p>1. Dash pot is low on oil.</p>	<p>Refill dash pot</p> <p>See Maintenance, above.</p>

Maintenance and precautions

- 1 The test personnel should abide by the operating procedures, and often calibrate the instrument with standard block before and after the test.
- 2 The hardness block can only be used on the working face, and the distance between the test points of each test should be greater than 2mm.
- 3 When changing the test force, the hardness tester should be in the state of removing the test force. (handle in back position).
- 4 When carrying, it should be carried by supporting the bottom. It is not allowed to cross to the bottom. When carrying, the measuring lever should be fastened with a rubber band.
- 5 The hardness tester shall be kept clean and covered with dust cover after the test. The hardness block and steel ball indentor shall be coated with anti rust oil to prevent corrosion.
- 6 Periodic verification of hardness tester should be done at least once a year to ensure the accuracy of hardness tester.