

Electronic Rockwell Hardness Tester

Instruction Manual

Vexus SHR-150E



Precautions

1. Many thank for punching our electronic Rockwell hardness tester Vexus SHR-150E you are requested to read the Instruction Manual before you use the present instrument and get to know thoroughly the operation procedure and the usage precautions so as to avoid the damages to the instrument and the safety accidents caused by the improper operation.
2. All the bands and the anti-shock tapes should be carefully removed before the instrument is installed and calibrated.
3. The single-phase 3-pin socket should be used for the power source and the ground connecting cable should meet the safety requirements.
4. It is strictly prohibited to dismount and alternate without permission all the electric component parts, switches and sockets of the instrument, as well as their fixed position; otherwise the instrument may be caused accidents.
5. It is to be avoided to turn the Load-switch Hand Wheel or the Rotating Wheel during the loading and unloading operations and the dwell time of the test force.
6. Our company tries to improve the quality of the hardness testers and renew their structure. In case the contents in the USAGE Instruction Manual are a bit different with the actual structure of the instrument, it is hoped and apologized for the fact that the further notice will not be given.

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Brief Introduction

1. Hardness is one of the important characteristics which indicate the mechanic performance of material, while the hardness testing is an important method to judge the quality of the metal material or its component parts. Due to the hardness of the metal is correspondent to its mechanic characteristics, and so its mechanic characteristics such as the strength, tiredness, wriggling and wearing out can be calculated out approximately through its hardness testing.
2. The Electronic Rockwell Hardness Tester Vexus SHR-150E is adopted a mechanism to automatically load and unload the test force, rotated the Load-Switch Hand Wheel to exchange test force, therefore the operation for this instrument is very simple, easy and prompt. Setting zero to dial, there is no man made error. The instrument is with high sensitivity and stability, so as suitable for usage in workshop and testing laboratory.

Technical Specifications:

- 2.1 The Test Force: 98.07N (10kg); Tolerance: $\pm 2.0\%$
- 2.2 The Total Test Force: 588.4N(60kg),980.7N(100kg),1471N(150Kg); Tolerance: $\pm 1.0\%$
- 2.3 The Indenter Specification:
 - 2.3.1 The Diamond Rockwell Indenter
 - 2.3.2 The $\phi 1.5875$ mm Ball Indenter
- 2.4 The Power Source: AC220V $\pm 5\%$ /50Hz; AC110V $\pm 5\%$ /60Hz
- 2.5 Time-delayed control: 2-60 seconds, adjustable
- 2.6 The Max. Height of the Specimen: 175 mm
- 2.7 The Distance from the Indenter Center to the Instrument Body: 165mm.
- 2.8 The Overall Dimension of the Tester: 520 \times 215 \times 700mm (Length \times Width \times Height).
- 2.9 The Net Weight of the Tester: 78kg (Approx).
- 2.10 The Allowable Tolerance of Hardness Display Value of the Hardness Tester (Table 1).

Table 1

Hardness Scale	Hardness Range of the Standard Hardness Blocks	Max. Tolerance of Hardness Display Value
HRA	(20~75)HRA	± 2 HRA
	(>75~88)HRA	± 1.5 HRA
HRB	(20~45)HRB	± 4 HRB
	(>45~80)HRB	± 3 HRB
	(>80~100)HRB	± 2 HRB
HRC	(20~70)HRC	± 1.5 HRC
HRD	(40~70)HRD	± 2 HRD
	(>70~77)HRD	± 1.5 HRD
HRE	(70~90)HRE	± 2.5 HRE
	(>90~100)HRE	± 2 HRE
HRF	(60~90)HRF	± 3 HRF
	(>90~100)HRF	± 2 HRF
HRG	(30~50)HRG	± 6 HRG
	(>50~75)HRG	± 4.5 HRG
	(>75~94)HRG	± 3 HRG
HRH	(80~100)HRH	± 2 HRH
HRK	(40~60)HRK	± 4 HRK
	(>60~80)HRK	± 3 HRK
	(>80~100)HRK	± 2 HRK

Rockwell Scale, Indenter, Test Force and Applicable Range of the Rockwell Hardness Testing(Table 2)

Table 2:

Scale	Indenter	Initial Test Force	Total Test Force (N)	Application Range
HRA	Diamond Indenter	98.07 N (10kg)	588.4(60kg)	Hard alloy, carbide steel, surface-quenched steel, carburized steel sheet
HRD			980.7(100kg)	Thin steel sheet, surface-quenched steel
HRC			1471(150kg)	Quenched steel, tempered steel, hard cast iron
HRF	Ball Indenter φ1.5875m m (1/16 inch)		588.4(60kg)	Cast iron, aluminum, magnesium alloy, bearing alloy, annealed copper alloy, mild steel sheet
HRB			980.7(100kg)	Mild steel, aluminum alloy, copper alloy, malleable cast, annealed steel
HRG			1471(150kg)	Phosphor bronze, beryllium bronze, malleable cast
HRH	Ball Indenter φ3.175mm (1/8 inch)		588.4(60kg)	Aluminum, zinc, lead, etc
HRE			980.7(100kg)	Bearing alloy, tin, hard plastic and other soft materials
HRK			1471(150kg)	

The normal test scales of Rockwell hardness are A, B and C of 3 kinds scales.

Installation of Hardness Tester Vexus SHR-150E

4.1 The working condition of the hardness tester

4.1.1 Under the room temperature between 10~30°C;

4.1.2 The relative humidity in the test room shall not be over 65%;

4.1.3 In an environment free from vibration and shock; without corrosive in surroundings.

4.2 The Unpacking of the Hardness Tester

4.2.1 Cut the belts on packing box, loosen off the screws at bottom of packing box, remove the upper body of packing box, and take out accessories kit.

4.2.2 Unscrew two (2) M10 outer hexagonal bolts under the bottom plate with a spanner, to separate the hardness tester from the bottom plate (take care of the safety).

4.2.3 After unpacking, the hardness tester shall be placed on a stable working table horizontally, with horizontal deviation less than 1mm/m. A hole shall be drilled at an appropriate location on the working table (see Fig.1) to enable the Up and Down Lead Screw to operate properly. We suggest the height of working table should be about 500mm.

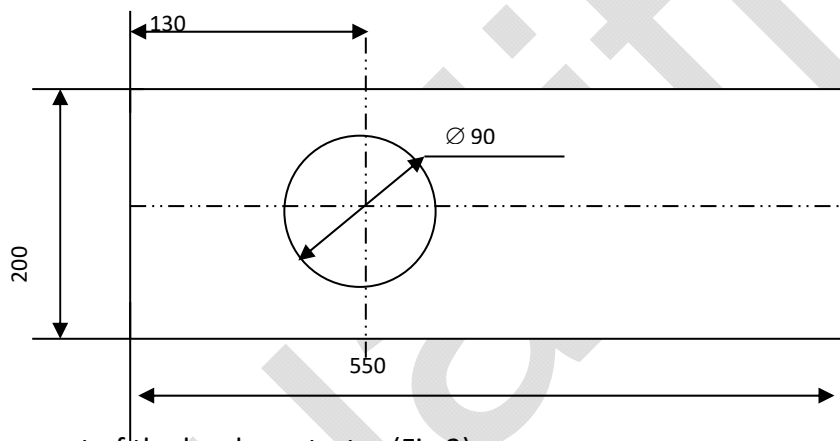


Fig.1

4.3 The placement of the hardness tester (Fig.2)

After the hardness tester is properly placed, open the Upper Cover (13) and the Back Cover (12). Untie the fastening rubber tape on the Connecting Rod (21)(Fig.5), and draw out the foam block under the Protecting Gasket(24) and Lever(14). Untie all the white gauzes bands on moving parts and then recover the Upper Cover and Backer Cover to keep away dust.

1. Touch Panel
2. Dial Gauge
3. Fastening Screw of Indenter
4. Indenter
5. Testing anvil
6. Up and Down Lead Screw
7. Load-Change Hand Wheel
8. Rotating Wheel
9. Horizontal Regulating Screw
10. Power Cord and Fuse
11. Power Switch
12. Back Cover
13. Upper Cover

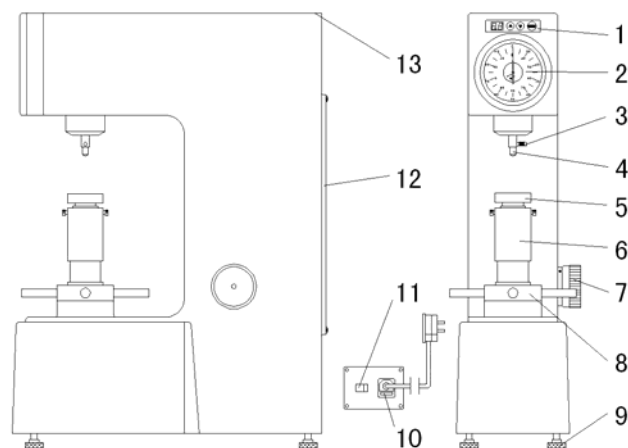


Fig. 2

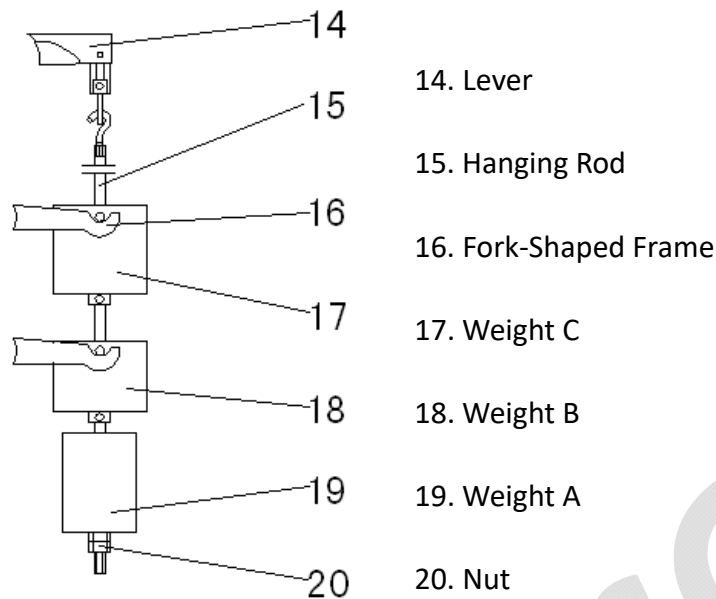


Fig.3

4.4 The Installation of the Weight Group (Fig.3)

4.4.1 During installation of weights, the instrument should be in the state without any test force.

4.4.2 Take the weight group out of the accessories kit and clean them thoroughly. Rotate the Load-Change Hand Wheel (7) to the place number 588.4, then take out the Hanging Rod (15) from the Back Cover and insert it into the hole of Weight A (19), fasten the Nut (20) at the tail of the Hanging Rod. Hook the Hanging Rod in the ear of the tail of the Lever (14). Place the Weight B(18) and Weight C(17) separately on two Fork-Shaped Frames (16), then rotate the Load-Change Hand Wheel clockwise for a whole cycle and observe the round pegs on both sides of the weight and see if they are properly placed in the groove of the Fork-Shaped Frame. The weights should be in center and should not touch with any component in inside wall of the instrument body.

4.5 The Test Force Selected in Correspondence with the Weight (Table 3)

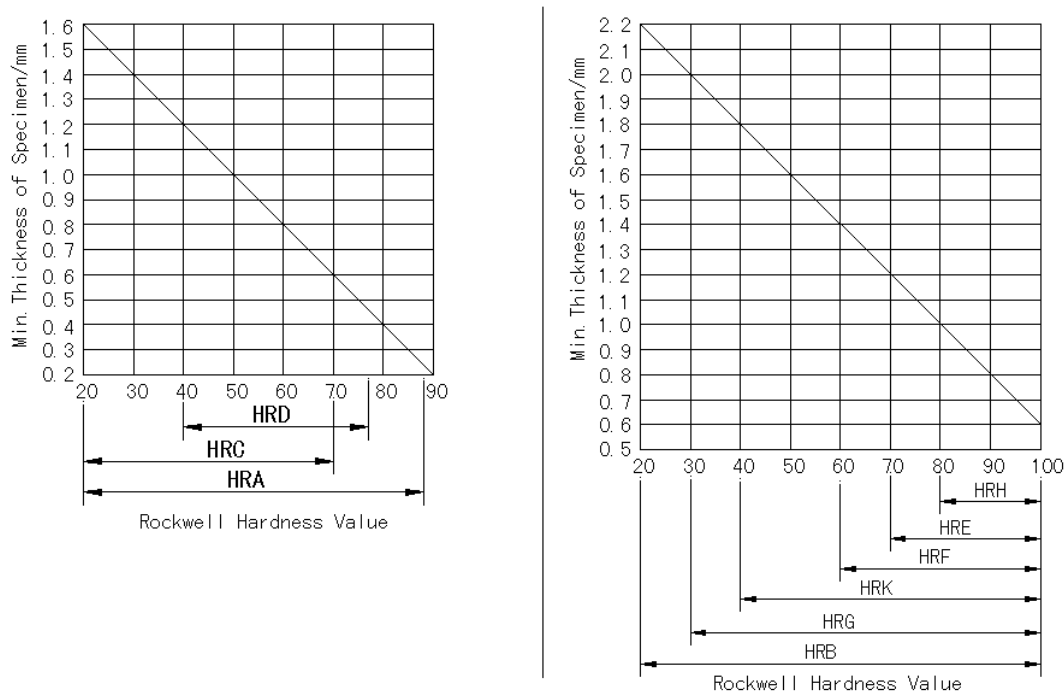
Scale	Test Force (N)	Graduated Value on The Load-switch Hand Wheel	Force on the Weight (Weight Code)
HRA	588.4(60kg)	588.4 (60)	Hanging Rod + Weight A
HRB	980.7(100kg)	980.7 (100)	Hanging Rod + Weight A +Weight B
HRC	1471(150kg)	1471 (150)	Hanging Rod + Weight A +Weight B + Weight C

Correct Usage of Hardness Tester

5.1 Do all the preparatory work before the Use

- 5.1.1 The surface of the specimen should be smooth and clean without any feculence, oxidized peels, concaves, and the outstanding processing signs. The supporting plane of specimen and testing table should be clean to assure a good smoothness between them.
- 5.1.2 The Min. thickness of the specimen should be superior to 10 times depth of the indentation. After the test, the back of the specimen should not have any visible signs of deformation (Fig.4).

Fig.4



- 5.1.3 The specimen should be stably placed on the testing table. There should be no any movement of the specimen during the loading and unload of test force and the test force should be loaded perpendicularly on the specimen.
- 5.1.4 The testing table should be chosen according to the shape and size of the specimen. If the specimen has irregular shape, a special holder should be made accordance with the particular geometrical shape, so as to measure out correct hardness displaying value.
- 5.1.5 When the specimen is columned in shape, the V-shaped testing table must be used. When the diameter of specimen is less 38(25) mm, the results of the test should be revised. The revised values are all positive values. The revised values of Rockwell hardness scale for column specimen are as table 4 (Table 4).

Hardness Value (HR)	Diameter (mm) of the Columned Specimen								
	6	10	13	16	19	22	25	32	38
	Revised Value of Rockwell Scales A, C, D (HR)								
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
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
Hardness Value (HR)	Diameter (mm) of Columned Specimen								
	6	10	13	16	19	22	25		
	Revised Value of Rockwell Scales B, F, G (HR)								
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	1.0	0.5		

5.2 The Operation Procedure of The Hardness Tester

5.2.1 Connect the Power Cord (10) with the power source; turn on the ship-shaped Switch (11), the nixie tube of the Touch Panel (1) will light up.

5.2.2 According to hardness grade of specimen material, select Scale from Table 2. Turn the Load-Change Hand Wheel clockwise to select and confirm the total test force.

5.2.3 Push the Indenter (4) into the hole of main spindle closely against the supporting plane and make the caved plane of the indenter handle face to the screw. Fasten slightly the Fastening Screw of Indenter (3), and then place the specimen on the Testing Table (5).

5.2.4 Turn the Rotating Wheel (8) clockwise, lift the Up and Down Lead Screw (6) to enable the specimen slowly touch the indenter without any shock until the short pointer in Dial (2) of the hardness tester move from black point to red point, at this time, the long pointer turn 3 cycles then indicate to position "C" (When test HRB hardness value, the long pointer will indicate to position "B"), at this point, the initial test force 98.07N has been loaded. The offset of long pointer could not exceed over 5 division values of hardness. If offset of long pointer exceed over

5 division value, the Rotating Wheel should not be turned in opposite direction, and testing position shall be changed for another test again.)

- 5.2.5 Rotate the Dial of the instrument to enable the long pointer to indicate to “C” position.
- 5.2.6 Press the START key on the Touch Panel; the motor begin to run to load the main test force automatically, the dwell time of total test force is 5 seconds, and the screen will show the back-counting of dwell time to 0, the motor run to unload the main test force automatically, but keep the initial test force.
- 5.2.7 At this time, the data indicated by long pointer in Dial is the hardness value of specimen tested.



Note: During the loading and unloading of the test force, it is prohibited to rotate the Load-Change Hand Wheel. The force rotation would make the components inside the instrument dislocated, and cause the disorder to the test force.

- 5.2.8 For Rockwell hardness testing, the dwell time of test force can be selected by pressing up and down keys on the Touch Panel.
- 5.2.9 Turn the Rotating Wheel in opposite direction and lower down the Testing Table. And then change the points to be tested, repeat the operation described above.
- 5.2.10 The number of the points to be tested is not less than 5 (the first point is not included) on each specimen. The number of the points to be tested may be reduced a bit for the specimen tested in a serial.

5.3 The Regulation of Displayed Hardness Value (Fig.5)

The precision of the displayed hardness value of the hardness tester is just calibrated before the instrument is turned out of the factory. If an error is caused due to the transportation, the operator may regulate it based on the understanding of the instrument structure and principle. The method is as follows: Remove the Upper Cover. If the displayed hardness value is inferior to the hardness value of standard hardness block, withstand a screwdriver into the groove of the M4 Screw Rod (22) and unscrew the nut a little. Rotate the Screw (23) clockwise to forward a bit (about rotate it half cycle, the hardness value is 1 degree higher), then calibrate the zero position (C position) for dial indicator, withstand the Screw Rod and fasten the nut. Do the test and display hardness value until the displayed hardness value stands in the tolerance range (Table 1). If the displayed value is higher than the hardness value of the standard hardness block, rotate the Screw in the opposite direction. (There are screwdriver and spanner in the accessories kit.)

- 21. Connecting Rod
- 22. Screw Rod
- 23. Screw
- 24. Protecting Gasket

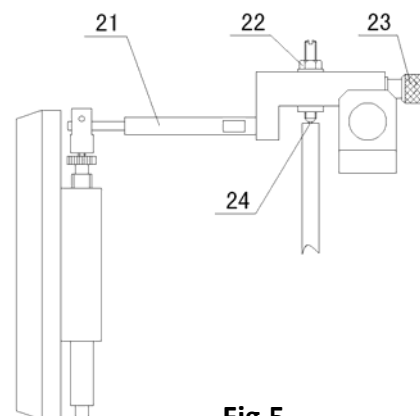


Fig.5

Maintenance and Precautions

Table 5:

Phenomenon	Possible Causes	Method Used
When the hardness tester is started on, the nixie tube is not light up.	1 The current is blocked. 2 The fuse is broken.	1 Check the power cable. 2 Get out the fuse from accessories kit for replacement.
The long pointer is offset, not indicate to "C" position	After regulate the display value of hardness, it causes the long pointer offset.	According to Fig.5, loosen the nut (22), Rotate the M4 Screw a bit, enable the Dial aim to "C" position, fix the screw and fasten the nut.
The Up and Down Lead Screw road is blocked	The fit-clearances of Up and Down Lead Screw are too small; they are blocked by the thread ends or dirt.	Remove the protecting cover of the Up and Down Lead Screw and clean the teeth of the screw with a clean cloth and than held Rotating Wheel with two hands to pull the Up and Down Lead Screw up and down. (it is prohibit to clean the UP and Down Lead Screw with abrasive paper)
The deviation of the displayed hardness value is too great.	1 The indenter is damaged 2 The weights are not arranged in proper order. 3 The hardness tester is not placed in the horizontal level, the weights have friction touch with the inside wall of the instrument body. 4 The total test force or the indenter is wrongly chosen.	1 Change the diamond indenter or the ball indenter. 2 Install the weights according to Fig.3 3 Calibrate the hardness tester with a level on the Testing Table according to section 4.2.3 in the Chapter IV. 4 Select the tester force and the indenter according to the requirements in Table 2

6.1 The operator should observe the operation regulations and calibrate the instrument with the standard hardness block before and after the test. If the hardness tester is rarely used, the several tests should be carried out on the standard hardness block to make the hardness tester stable after start the instrument, and then carry out the necessary tests for specimen.

6.2 The standard hardness block should be used only on the working plane with the distance of the two neighboring indentations and of the center of the indentations to their edges are not inferior to 3 mm. The life period of the standard hardness blocks is 2 years.

6.3 During the transportation of the hardness tester, the hardness tester should be fixed with the Connecting Rod, with the weights and the Hanging Rod discharged. Disconnect the power source before the weights and the Hanging Rod are taken out.

6.4 Keep the hardness tester clean and cover it with anti-dust bag after the hardness tester is used, lubricate the hardness blocks and ball indenters with the rust protecting oil to avoid rust.

6.5 Carry out periodic inspection of the hardness tester, at least once a year in order to assure the correct operation of the hardness tester.

6.6 The Treatment of the Common Malfunctions of the hardness tester

When the hardness tester is in trouble state, it is advisable to get in touch with the relative units for the repair. The normal and common malfunctions should be dealt with by user's self. (Table 5)

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