THR-150A Rockwell Hardness Tester

Instruction Manual

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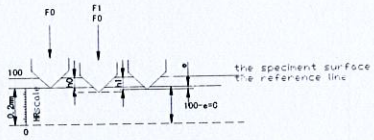
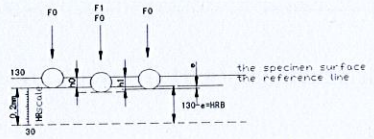
I Brief Introduction to Rockwell Hardness Tester

The Rockwell Hardness Testing Method is as follows: The instrument produces an indent on the specimen by using a conic diamond indenter or a ball steel indenter with diameter of Φ1.5875 ㎜ with an initial test force (F0) and then the main test force (F1). After the total test force F (F0+F1) is applied, it is necessary to let the test force dwell for a certain time. The difference (e) between the indent depth (h0) under the pressure of the main test force and the indent depth (hl) under the pressure of the initial test force is taken as the lasting increased value. Every pressed depth of 0.002 ㎜ is regarded as a Rockwell hardness unit. This kind of measurement is characterized by the rapid hardness test and a small indent, and hence it is widely used to test the hardness of any metal piece.



The Testing Diagram(HRC.HRA)by using a Conic Diamond Indenter



The Testing Diagram(HRB)by Using a Ball Steel Indenter ø 1.5875mm

II. The Rockwell Hardness Tester Formula, Scale, Indenters, Test Forces and Usage Field

2.1 The Test Formula

HRC (A)=100-(e/0.002) HRB= 130-(e/0.002)

2.2 The Test Scale, Indenters, Test Forces and Usage Field (Table 1)

Scale	Indenter	Initial Test Force (N)	Total Test Force (N)	Usage Field
A	Diamond Indenter Conic Angle 120° Radius of the Top Spherical Surface 0.2 ㎜		588.4	Hard Alloys
D			980.7	Thin Steel sheets, Quenched Steel
C			1471	Quenched Steel, Stamping Hardened Steel, Cast Iron

F	Diameter of the steel Ball 1.5875 ㎜ (1/16 inch)	98.07	588.4	Annealed copper Alloys, Thin and Soft Steel
B			980.7	Soft steel, Aluminum Alloys, Copper Alloys, Workable Cast Iron
G			1471	Pearlitic Iron, Copper, Nickel, Zinc, Nickel Alloy
H	Diameter of the steel Ball 3.175 ㎜ (1/8 inch)		588.4	Annealed Copper Alloys
E			980.7	Aluminum, Magnesium and Aluminum Alloy, Soft Steel, Cast Iron
K			1471	Aluminum, Zinc, Lead, Bronze, Bismath Bronze
L	Diameter of the steel Ball 6.35 ㎜ (1/4 inch)		588.4	Soft Metal, such as Aluminum, Zinc, Lead
M			980.7	Tin, Plastics, Hardboard, etc.
P			1471	
R	Diameter of the Steel Ball 12.7 ㎜ (1/16 inch)		588.4	
S			980.7	
V			1471	

There are a number of Rockwell Hardness Test Scales among which the commonly used are the Scales A, B, and C.

III The Parameters of the Hardness Tester

3.1 The Initial Test Force: 98.07N, with a tolerance of ± 2.0%

3.2.The Total Test Force: 588.4N, 980.7N, 1471 N with a tolerance of ± 0. 5%

3.3 The Specification of the Indenter

3.3.1Rockwell Conic Diamond Indenter

3.3.2 Ball Steel Diamond Indenter Φ1.5875 ㎜

3.4 The Permitted Tolerances in the Indicated Values and the Repetitiveness

Scale	Hardness Field of Standard Blocks	Permitted Tolerance in the Indicated Values	Repetitiveness Inferior to
A	20-40 HRA	±2.0 HRA	2.0 HRA
	40-75 HRA	±2.0 HRA	1.5 HRA
	75-88 HRA	±1.5 HRA	1.0 HRA
B	20-45 HRB	±4.0 HRB	3.5 HRB
	40-80 HRB	±3.0 HRB	2.0 HRB
	80-100 HRB	±2.0 HRB	1.5 HRB
C	20-30 HRC	±1.5HRC	1.5HRC
	30-55 HRC	±1.5HRC	1.2HRC
	55-70 HRC	±1.5HRC	1.0HRC

3.5 The Requirements for the Environment in the Working Room

The Temperature: 15℃-30℃

The Humidity: not superior to 70%

An environment without vibrating power supply nor corroding air

3.6 The Maximum Height of the Specimen: 70mm

3.7 The Distance from the Center of the Indenter to the Instrument Body: 165 mm

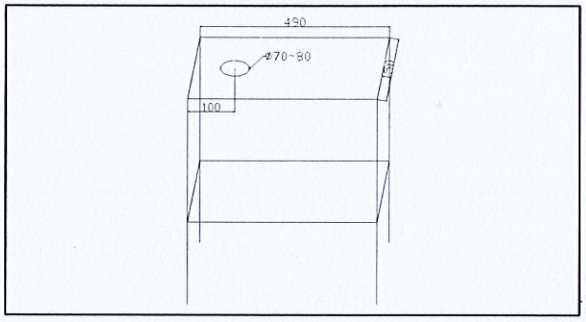
3.8 The Dimension: 150mm (width)×500mm (Depth) ×750 (Height)

3.9 The Weight : 85 kg

IV. Installment of the Hardness Tester

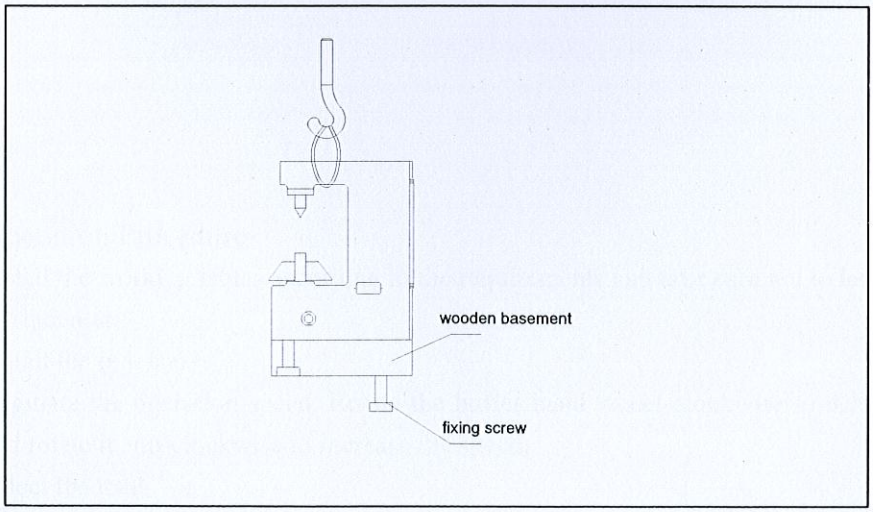
4.1 The working Table Required as that in the following Fig.

Height: the suggested height is 500 ㎜ (The operator is able to operate in the seating position.)
The table hole serves the ascending and descending lever.



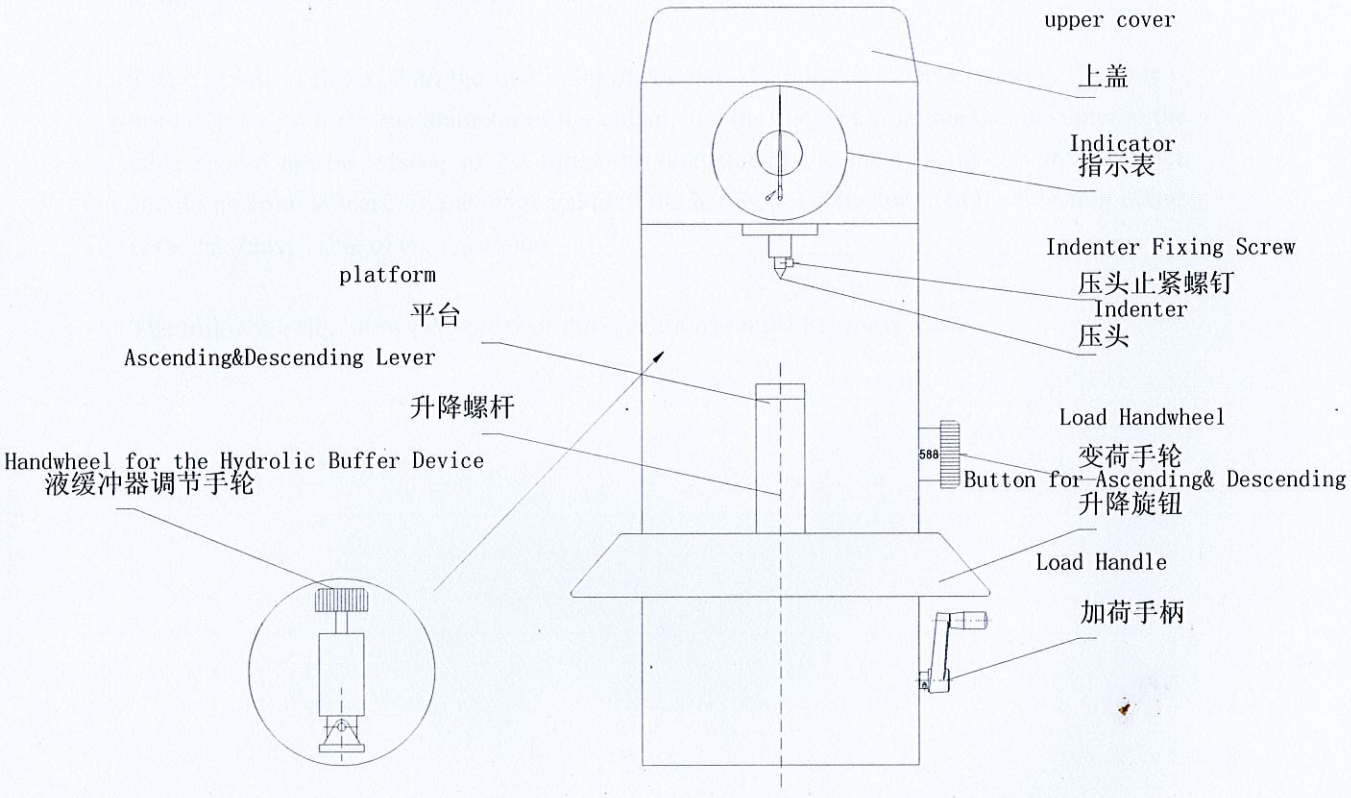
1) Take off the packing cords, the anti-humidity bag and the cartoon box.

2) Lift the Instrument to a certain height with mechanic equipments and then unfasten the wooden basement and the fixing screw on the instrument as shown by the Fig.



3) Descend the instrument slowly onto the working table.
4) Uncover the upper cover and the back cover.
5) Take the cords off the comparator, the lever and the carriage apparatus.
6) Rotate the load hand wheel to the position of 1471 and hang the weights on the hanging ear of lever.
7) Put back the upper cover and the back cover.

IV. The External Shape and Main Component Parts of the Hardness Tester



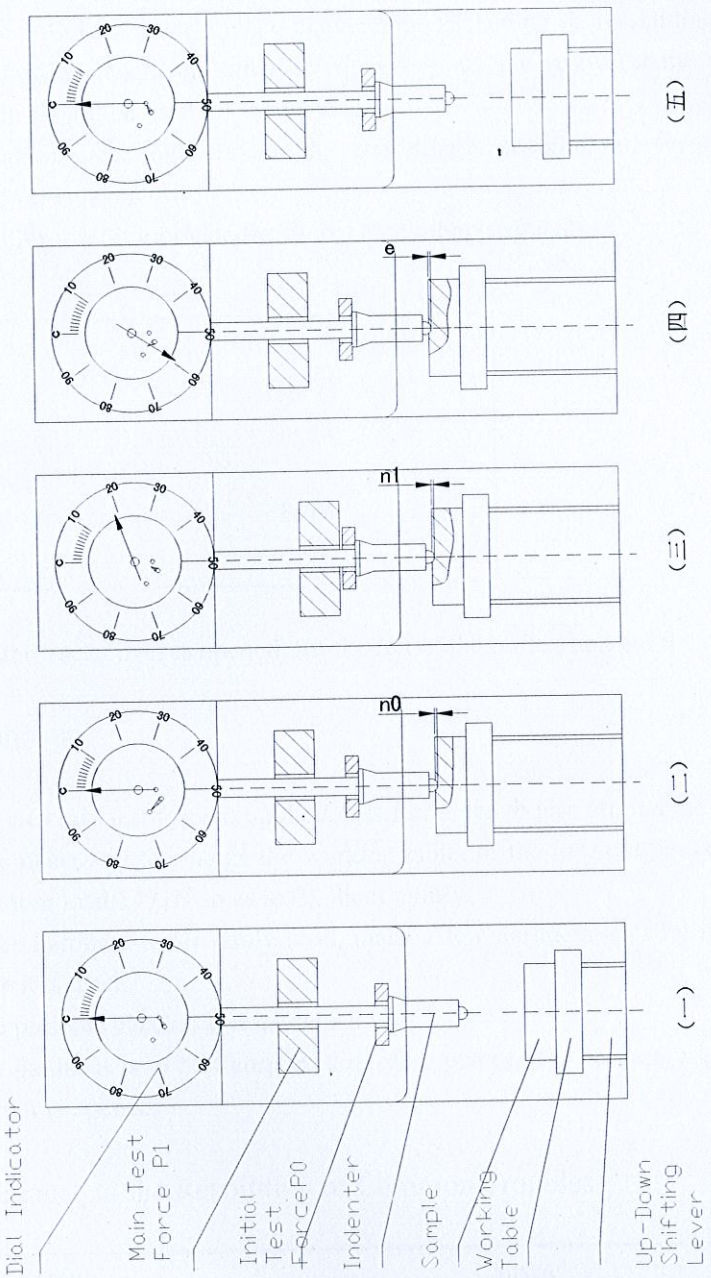
VI. Operation Procedure

1. Install the working tables according to the requirements and take care not to let the table touch the indenter;
2. Install the indenter;
3. Regulate the operation speed. Rotate the buffer hand wheel clockwise to decrease the speed and rotate it anti-clockwise to increase the speed;
4. Select the load;
5. Place the specimen on the working table;

6. Rotate the ascending & descending hand wheel to lift upward the lever and then let the specimen move slowly up to the indenter and touch it until the small hand of the indicator moves to the red dot from the black dot meanwhile the long hand rotates over 3 rounds and points at the position "C" in a perpendicular way. At this point, load the initial test force 98.07N, and the long hand should not move over 3 grades in either direction. In case the long hand moves over this range, don't rotate it back., you must do the operation anew by changing the testing point;
7. Rotate the indicator's dial to let the long hand point at the position "C";
8. Push the load handle backwards. At this point the indicator begins to move;
9. When the indicating hand stops, wait for 2 seconds and then pull the load handle back to the front;
10. The indicator shows the datum, which is the hardness value of the specimen;
11. Rotate the ascending & descending hand wheel backward to let the lever descend. Change the testing point to repeat the operation again.

Test 6 points each test with the first point uncounted. The distance between every 2 points is not inferior to 4 times the diameter of the indent, and the distance from the indent center to the edge should not be inferior to 2.5 times the diameter of the indent. Anyhow that distance should be 1mm at least. The average value of the hardness values found at the 5 testing points is the hardness value of the specimen.

The following fig. Shows the order of the operations on the hardness tester.


(五)
e
(四)
n1
(三)
n0
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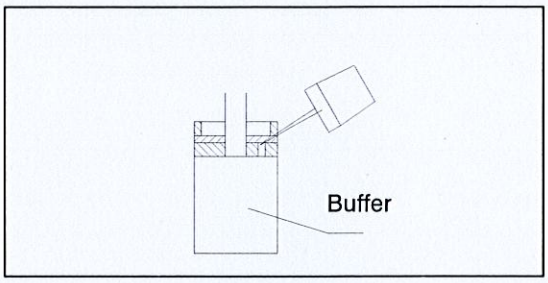
Dial Indicator
Main Test Force P1
Initial Test ForceP0
Indenter
Sample
Working Table
Up-Down Shifting Lever

VII. Maintenance of the Hardness Tester

1. Clean thoroughly the non-metal surfaces with a soft cloth and a temperate liquid cleaning agent and clean the metal surfaces with a soft cloth dipped with machine oil. The places to be cleaned with care are the place between the ascending & descending lever and that between the testing lever and the indenter when they are put ready for the operation. This time the gasoline should be used for the cleaning.
2. Lubrication: clean and lubricate the ascending & descending lever after the leather bowel of the brewer is taken off.
3. The buffer is a bit lubricated with machine oil occasionally.



After the back cover is opened, lift the felt of the buffer, and put the machine oil directly.

VIII. Cautions

1. After the main test force is applied, it is forbidden to turn around the load handle.
2. If it is necessary to change the working table, or the indenter, make a trial pressure with the maximum load 1471N so as to fix them tightly.
3. For the hardness tester rarely used, make a few hardness tests by means of a standard block before it is used.
4. Make periodic checks, at least once a year.
5. If the hardness is to be transported to other places, it is necessary to restore the packing state before it is opened.

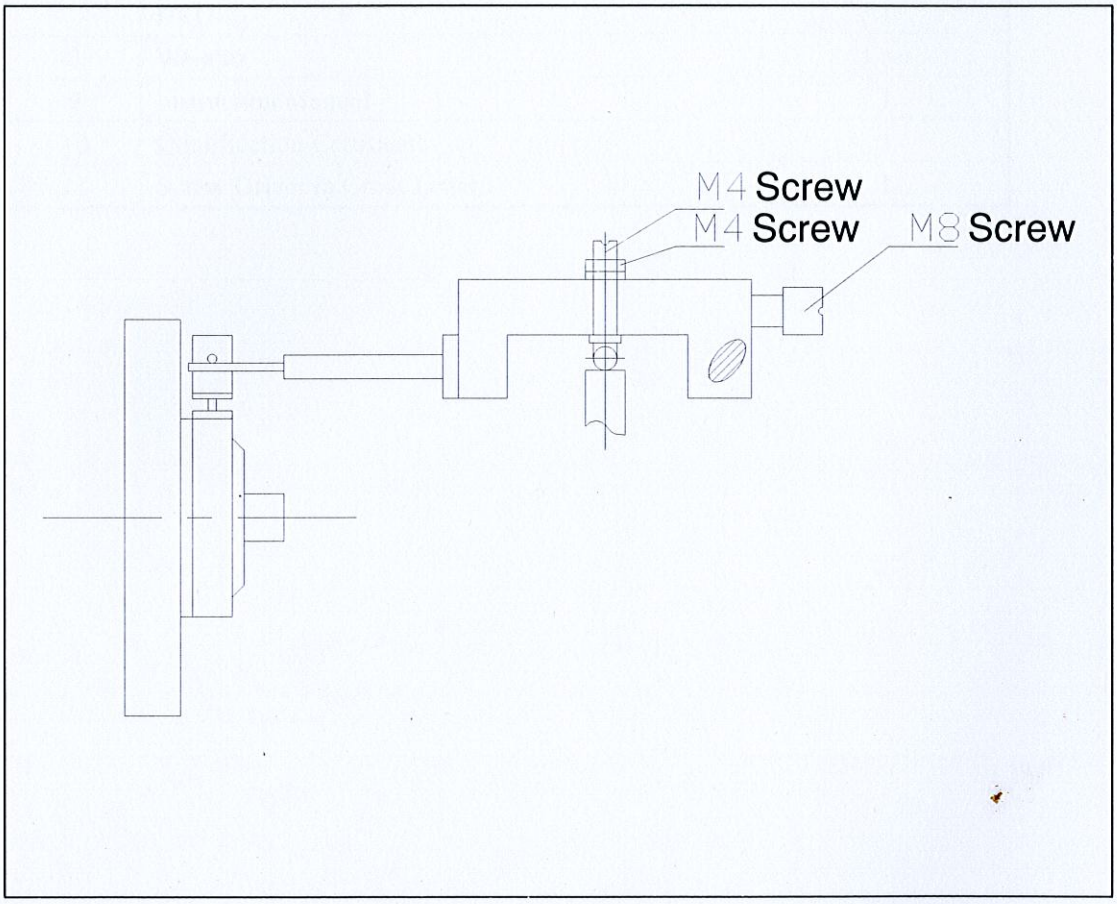
IX Guidance to the Resolution of Common Troubles

Table 3

Trouble	Causes	Ways to Get Rid of the Trouble
The ascending & Descending Lever Blocked	The lever is blocked by rusty or rubbish	Cleaning See Chap.VII.1.
Impossibility of Applying the Loads	The Pin valve of the buffer is fastened too hard.	Adjustment See Chap. VI.3.
Errors in Indicating The Values	1. The indenter is broken. 2. The load is wrong. 3. The working table and the indenter are not installed properly. 4. The specimen is not even.	Change the indenter. Check the load. Install them again. The thickness of the specimen

	The specimen is too thin. The specimen is angular. 5. The precision of the tester is lost.	should be 10 times the depth of the indent, the plane of the specimen should be perpendicular with the indenter at a right angle of 90° It is to be regulated according to Chapter 10.

X Adjustment of the Value Indication of the Hardness Tester



The precision of indicating the hardness value is already checked and regulated before the instrument is carried out of the factory . But there might be some tolerances caused during the transportation. The operator may regulate it on the basis of understanding the structure of the instrument.

The Method: After lifting off the upper cover, if the value indicated is too low, unscrew the screw M4 and turn clockwise the screw M8 a bit. Then fasten the screw M4 to test the indication until the indication is within the prescribed range. If the value indicated is too high, turn the screw M4 anticlockwise so as to make the long hand point at the position “C”.

XI Packing List

No.	Description	Quantity
1	120° Conic Diamond Indenter	1
2	Ball Steel Indenter Φ1.5875mm	1
3	Steel Balls Φ1.5875mm	5
4	Platform Φ60	1
5	V-shaped Platform '	1
6	Working Table	
7	Standard Blocks HRB HRC	 1 1
8	Weights	1 set
9	Instruction Manual	1
10	Qualification Certificate	1
11	Screw Driver in Cross Letter	1