uBRV-187.5 Digital Universal Hardness Tester

Instruction Manual



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I. Introduction

This model use Large-format LCDs, adopting the menu structure for the operation panel,Has a good reliability, operability and intuitive.

Features:

Ready to work immediately, no need to install weights and run trial.

Electrical load, close-looped control.

Brinell, Rockwell, Vickers three testing methods .

Selection of plastic Rockwell scales (specific demands are supplied depending on the contract).

Conversion of different hardness scales .

Hints for indenters when the scales are selected.

Automatically apply initial pressure and main pressure.

All the hardness scales can be regulated.

Automatic correction of test force. Accuracy raised for an order of magnitude.

Export the test data as EXCEL files in USB flash disk.

II.Main Technical Specifications

Force	5~187.5kgf
Brinell scales	HBW1/5 HBW2.5/62.5 HBW1/10 HBW2.5/15.625 HBW1/30 HBW2.5/31.25 HBW2.5/62.5 HBW10/1000 HBW5/125 HBW2.5/187.5
Displayed value error	8-650HB (δ/%):±2.5
Displayed value repeatability	8-650HB (δ/%):≤3.0
Rockwell scales	HRA HRB HRC HRD HRE HRF HRG HRH HRK HRL HRM HRP HRR HRS HRV
Minimum value of accuracy	0.1HR
Displayed value error	±1HR
Displayed value repeatability	±1HR
Vickers scales	HV5 HV10 HV20 HV30 HV40 HV50 HV60 HV80 HV100 HV120 (10 grades forces for choose)
Displayed value error(%)	±2
Displayed value repeatability(%)	≤2.5
Force error	Less than 0.5%
Dwell time	0-60s
Max height of specimen	Rockwell:200mm, Brinell and Vickers:170mm
Distance between indenter and instruction body	200mm
Hardness test range	Brinell:8~650 Rockwell:20~100 Vickers:8~2900
Carry out standards	GB/T230, GB/T231, GB/T232, JJG112, ASTM
Objective	2.5X.5X(10X.20X for choose)
Value output	LCD display,USB flash disk to save
Power supply	AC220V,50~60Hz
Total size	500mm×240mm×760mm
Total weight	60kg
Force	5~187.5kgf

III.Installation and Regulation

1 The working condition of the tester

1.1 Under the room temperature between 10~30℃

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

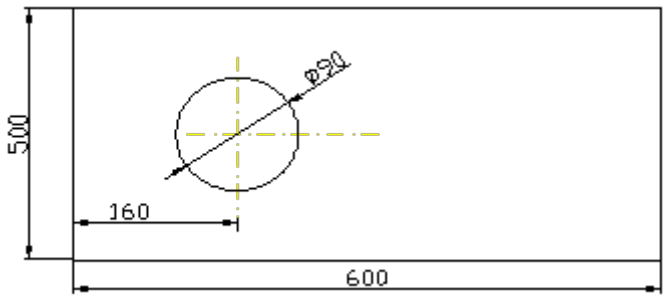
1.3 In an environment free from vibration;

2 The unpacking of the hardness tester

2.1 Cut the packing belt outside the packing box. Loosen off screws from the bottom side of packing box and remove the upper part of packing box, then take out 2 accessories kits.

2.2 Lift the bottom plate and unscrew the two M10 bolts under bottom plate with a spanner to separate the hardness tester from the bottom plate and take out the hardness tester (take care of the safety).

2.3 After unpacking, the hardness tester shall be placed on a stable working table. 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. It is advise that the height of working table should be about 500mm.



(Fig. 1)

IV. Introduction to the control interface

1. introduction

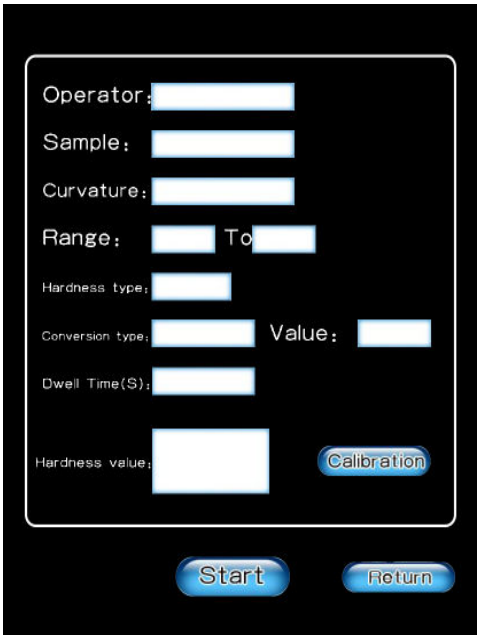
Plug in the socket,insert the USB flash disk,turn on the boat-shaped switcher, the main screen lights. Attention: when the tester is turned on, it will begin initializing. You can not operate it until initialization is over.

"operator, sample, range, load, dwell time, conversion" Textboxes beside these words are used to enter the respective information.

2 information entry

2.1 Entry of operator and sample name.

Click the  to the right side of Operator and Sample,enter the names respectively by the keyboard, then click OK to confirm. You can also click the ESC to return if you don't need to change the existing names. As Fig.3



(Fig. 2)



(Fig. 3)

IV. Introduction to the control interface

2.2Entry of range and dwell time

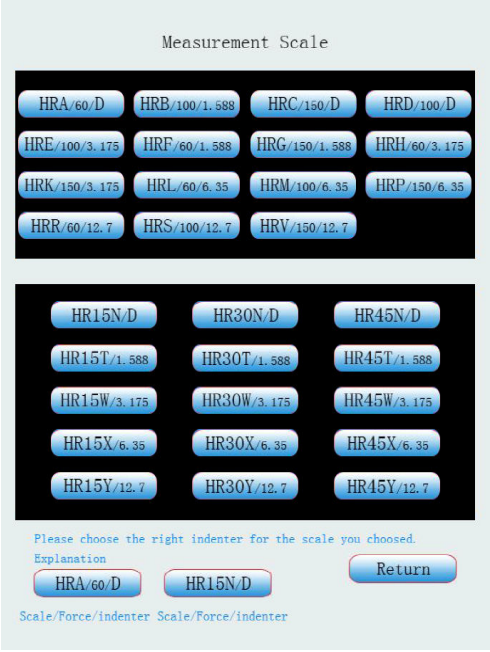
Click the [ ] to the right side of Operator and Sample, enter the numbers respectively by the keyboard, then click OK to confirm. Click ESC to return (Fig.4)



(Fig. 4)

2.3 Choose the type of hardness

Click [ ] to the right of force and diameter. Then choose the type of hardness scale on the scale interface. If there is no need to change, click Return at the bottom to return to main interface. Scales available is shown as Fig.5

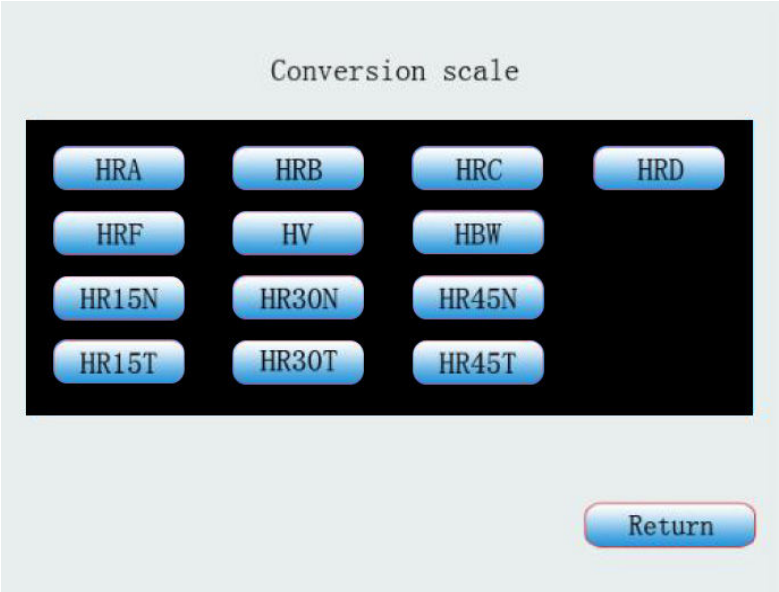


(Fig. 5)

IV. Introduction to the control interface

2.4 Conversion of scale

Click conversion then choose the type of scale. If there is no need for changing, click Return to return to main interface. Scales available is shown as Fig. 6



Notice: Calibrate electric shock dislocation of the touchscreen. To be in the boot state. Complete the following steps.

1.Quickly click on the touch screen 20 times in 4 seconds. (except the textbox)

2. Buzzer blow for 1 seconds. Stop click when buzzer blow.

3. Enter the calibration mode, according to the cross line click the location on the touch screen to calibrate touch screen.

4.Calibration over, back to operation page.

V.The usage of hardness tester

1 Do all the preparatory work before the use

1.1The surface of the specimen should be smooth and clean without any oxidized peels and concaves, dirty things and outstanding processing signs. The supporting plane of specimen and the working table should be clean to assure good tight between them

1.2 The Min. thickness of the specimen should be 10 times superior to the depth of the indentation. After the test, the back of the specimen should not have any visible signs of deformation.

1.3 The specimen should be stably fixed on the working table. There should be no any movement of the specimen during the loading of test force and the test force should be loaded perpendicularly on the specimen.

1.4 the working table should be chosen according to the shape and size of the specimen. If the specimen has an irregular shape, a special holder should be made in accordance with the particular geometrical shape to make the value correct.

VI. Brinell hardness

1. The Technical Specification of Brinell Hardness Tester（Table.1）

Table. 1

<table>
<tr><td rowspan="5">Testing force</td><td colspan="3">294.2N（30kg）</td><td rowspan="5">Tolerance
±1.0%</td></tr>
<tr><td colspan="3">306.5N（31.25kg）</td></tr>
<tr><td colspan="3">612.9N（62.5kg）</td></tr>
<tr><td colspan="3">980.7N（100kg）</td></tr>
<tr><td colspan="3">1839N（187.5kg）</td></tr>
<tr><td>Indenter</td><td colspan="4">φ2.5mm、φ5mm Ball indenter</td></tr>
<tr><td rowspan="2">Scales</td><td>HBW1/30</td><td>HBW2.5/31.25</td><td colspan="2">HBW2.5/62.5</td></tr>
<tr><td>HBW5/62.5</td><td>HBW10/100</td><td colspan="2">HBW2.5/187.5</td></tr>
<tr><td>Eyepiece magnification</td><td colspan="4">15×</td></tr>
<tr><td>Objective magnification</td><td colspan="4">2.5×（resolution 0.4μm）、5×（resolution 0.2μm）</td></tr>
<tr><td>Max Height of Sample</td><td colspan="4">For 2.5× objective: 170mm
For 5× objective：180mm</td></tr>
</table>

2.Brinell hardness testing range:8HBW~650HBW

3. The Tolerance and Repetition of Displayed Value for Brinell Hardness Tester(Table. 2)

Table. 2

HardnessBlock(HBW)	Tolerance(%)	Repeatability(%)
≤125	±3	3
125 ＜ HBW≤125	±2.5	2.5
＞ 225	±2	2

4. Table of Brinell Hardness Testing Scales, Indenters, Testing Forces and Range(Table. 3)

VI. Brinell hardness

Table. 3

Sign	Diameter D(mm)	Testing Force F	0.102 F/D2	Indenter Diameter (mm)	Hardness Range (HBW)	Objective
HBW 10/100	10	980.7N (100kg)	1	2.4~6	21.8~3.8	2.5×
HBW 5/62.5	5	612.9N (62.5kg)	2.5	1.2~3	54.5~8	
HBW 2.5/187.5	2.5	1839N (187.5kg)	30	0.6~1.5	653~95	2.5× 5×
HBW 2.5/62.5	2.5	612.9N (62.5kg)	10	0.6~1.5	218~32	5×
HBW 2.5/31.25	2.5	306.5N (31.25kg)	5	0.6~1.5	109~16	
HBW 1/30	1	294.2N (30kg)	30	0.24~0.6	653~95	
Testing force should let the indentation diameter at the range of 0.25 < d < 0.6D, when d=0.37D, the hardness value is exactly (d=indentation diameter, D=indenter diameter)						

5. According to materials and Brinell Hardness value select 0.102F/D2(Table. 4)

Table. 4

Materials	Brinell Hardness Value	0.102F/D2
Steel, nickel alloy, titanium alloy	——	30
cast iron	< 140	10
	≥140	30
Copper, copper alloy	< 35	5
	35~130	10
	> 130	30
Soft Metal	35	2.5
	35~80	5or10
	> 80	10
F—Testing force(N) D—Diameter of Ball Indenter(mm)		

6. Installation of Microscope and Moveable Anvil(fig7)

6.1Take out the moveable anvil (33)and rub-up antirust oil, install the moveable anvil (33) and circumrotate the locknut(Fig.10);

VI. Brinell hardness

6.2Insert microscope socket(30) in the right of microscope frame(5), make sure microscope stand upright with test anvil and fasten screw(28)

6.3Insert eyepiece(29), then insert 5× (or 2.5×) objective(31) under microscope stand. When test Brunel Hardness value, the outside light should be installed,cable should be inserted into the right socket of machine.

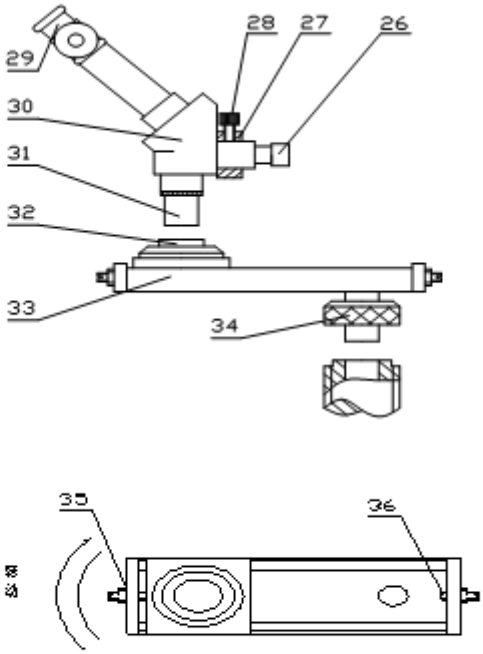


fig7

26.inside light; 27. Frame; 28.screw; 29.eyepiece ;30. stand of microscope; 31 .objective; 32. specimen ;33 .moveable test anvil ;34. fasten screw; 35 .out ward off pin; 36 .in ward off pin

7. The Operation Procedure of The Brinel Hardness Tester

For example: 2.5× objective, Ball indenter is Dia 2.5mm, testing force is 1839N(187.5kg)to test Brunel hardness value.

7.1Click"Return"to menu, choose Brinell scale 2.5/187.5.

7.2 Install the outside light upon 2.5×objective, fasten slightly the Screw.

7.3 Push the 2.5mm indenter 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 for the Indenter.

7.4 Put sample on the test anvil, move to indenter and near the inside

ward off pin.(36).

7.5 Turn the Rotating Wheel clockwise, lift the Up and Down Moving Shaft, stop when distance between indenter and sample is about 0.5-1mm.

7.6 Click"load" Instrument automatic test.

7.7. Motor start, automatic main test force, Dwell time countdown to zero.

Note:Dwell time of Brinell: Black metal 10~15 seconds, non-ferrous metal 30~35 seconds, when the hardness value below 35, dwell time is 60 seconds.

7.8 Automatic unloading total test force, buzzer sound.

7.9 Counter-clockwise rotate, descend test anvil.(For 2.5× objective, descend about 30mm, for 5× objective descend about 10mm)

7.10 Move anvil and sample below objective, slightly near out ward off

pin.(1)

7.8 Measure diameter of indentation (measure the length of diagonal of indentation for Vickers diameter measurement)

7.8.1 Before measure diameter of indentation, rotate eyepiece drum and make sure the two lines clear(fig. 8)

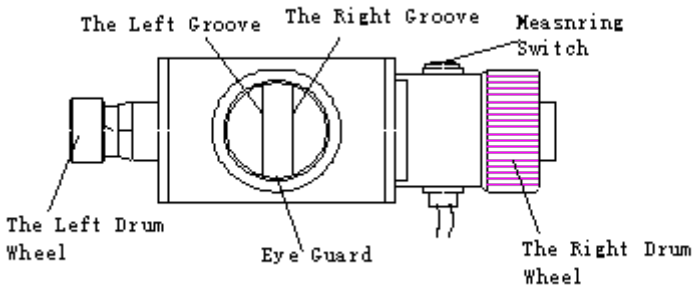


fig.8

7.8.2 As the center of Upper and Down Moving Shaft hole, slowly rotate moveable test anvil to go up and down the test table until the indentation is clear in the eyepiece, and adjust the indentation to get to the middle of the eyepiece , then focus process is over, and then fasten the screw.(34)

7.8.3 Rotate left and right drum of the eyepiece, let two lines close(fig8-2). When two lines close infinitely, gap between them becomes little and tend to no gap critical state, but the two lines must not overlap(fig 8-3).,then press "CLR", d1:0000.000 on the screen display 0.

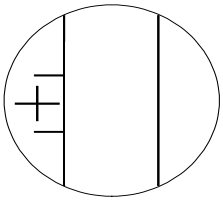


fig8-1

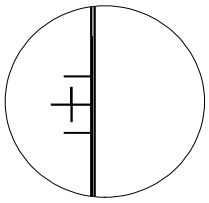


fig8-2

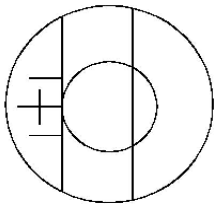


fig8-3

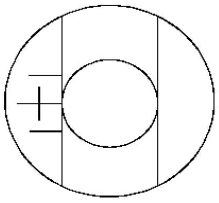


fig8-4

7.8.4 Rotate left drum, and make the left line with left edge indentation tangent.(fig8-3)

7.8.5 Rotate right drum, and make the right line with right edge indentation tangent(fig8-4)

7.8.6 Press button on the eyepiece and there is D1 on display.

7.8.7 Rotate eyepiece 90° clock-wise, eyepiece should be pasted on tube of eyepiece without gap, and otherwise it affects accuracy. Same press button on eyepiece get D2 on display. You can get HB187.5 value on display and there is measuring times NO. 1be saved since the second time testing.

7.9 Brinell hardness Take Notes

7.9.1 The surface of specimen and the indenter shall be kept clean, any oil or dust may have impact on the accuracy of measurement. Use ether or ethanol to clean specimen and indenter.

7.9.2Samples should be kept on anvil and avoid any movement, make sure indenter is uprightly impact on samples.

7.9.3Diameter of indentation must be in the range of $0.25D < d < 0.6D$, when d=0.375D,

the testing accuracy is excellent（d=diameter of indentation, D=diameter of ball indenter）.

7.9.4The thickness of samples must be 10 times higher than depth of indentation, no trace on the back of samples Table 5.

Table 5

mean diameter of indentation	Minimum thickness of the sample			
	The diameter of ball			
	D=1	D=2.5	D=5	D=10
0.2	0.08			
0.3	0.18			
0.4	0.33			
0.5	0.54			
0.6	0.8	0.29		
0.7		0.4		
0.8		0.53		
0.9		0.67		
1		0.83		
1.1		1.02		
1.2		1.23	0.58	
1.3		1.46	0.69	
1.4		1.72	0.8	
1.5		2	0.92	
1.6			1.05	
1.7			1.19	
1.8			1.34	
1.9			1.5	
2			1.67	
2.2			2.04	
2.4			2.46	1.17

2.6			2.92	1.38
2.8			3.43	1.6
3			4	1.84
3.2				2.1
3.4				2.38
3.6				2.68
3.8				3
4				3.34
4.2				3.7
4.4				4.08
4.6				4.48
4.8				4.91
5				5.36
5.2				5.83
5.4				6.33
5.6				6.86
5.8				7.42
6				8

7.9.5 The ratio between standard hardness value and its difference with average tested value is the displayed value error with the hardness tester. The ratio between the largest difference and average value among tested values is the repeatability of the hardness tester. These values must correspond with Table. 2

7.9.6 When test hardness values on specimen, the distance between two centers of neighborhood indentations should be not less than 3 times diameter of the indentation. The distance from the center of indentation to the edge of specimen should be not less than 2.5 times diameter of indentation. If don’t test according to this statement, the indentation will be not symmetrical, and hardness value measured will be not correct.

7.9.7 For each indentation, the measure should be done on two directions that perpendicular to each other.

7.9.8 The effective measuring range for eyepiece is 60% .

Regulation of Brinell hardness value

The precision of the hardness displaying value of the hardness tester is just calibrated before the instrument is turned out of the factory. Make an indentation on the standard block, then click"calibration"Fig. 12,Click ,enter the standard hardness value by the keyboard. Measure the indentation, click "save calibration".

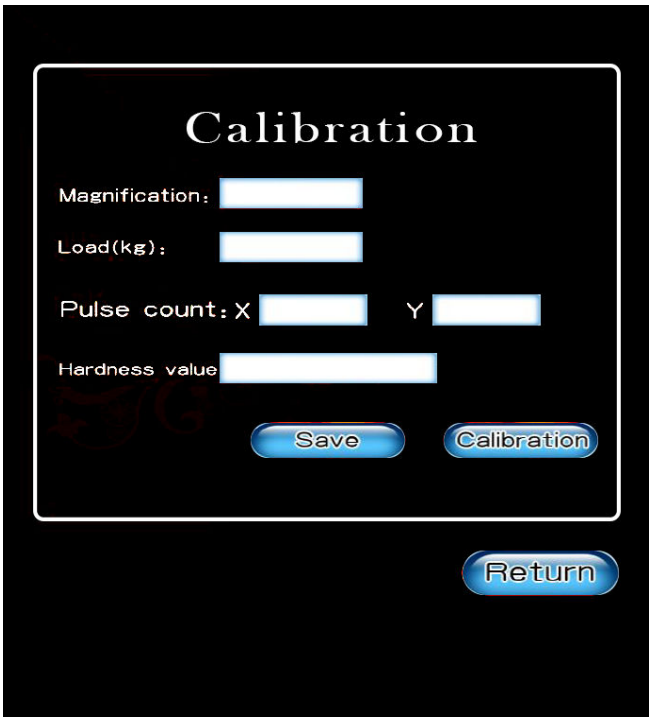


Fig. 12

VII. Rockwell hardness

1. The Scales, Indenters, Test Force and Application Fields of the Rockwell Hardness Tester (Table.6)

Table.6

Scale	Indenter	Initialtestforce	Totaltestforce	application
HRA	Diamond indenter	98.07 N (10kg)	60kgf(588.4N)	Hard alloy, carbide surface quenched steel, carburized steel plate(sheet)
HRD			100kgf(980.7N)	Steel sheet, surface quenched steel
HRC			150kgf(1471N)	Quenched steel tempered steel hard cast iron
HRF	Ball indenter φ1.5875mm (1/16 inch)		60kgf(588.4N)	Cast iron aluminum magnesium alloy bearing alloy annealed copper alloy mild steel sheet
HRB			100kgf(980.7N)	Mild steel aluminum alloy copper alloy malleable cast iron annealed steel
HRG			150kgf(1471N)	Phosphoresced bronze beryllium bronze malleable cast iron
HRH	Ball indenter φ3.175mm (1/8 inch)		60kgf(588.4N)	Aluminum zinc lead etc.
HRE			100kgf(980.7N)	Bearing alloy tin hard plastics and other soft materials
HRK			150kgf(1471N)	
HRL	Ball indenter φ6.35mm (1/4 inch)		60kgf(588.4N)	hard plastics、hard rubber、Aluminum、surname、copper、Mild steel、plastic resin, fricative materials
HRM			100kgf(980.7N)	
HRP			150kgf(1471N)	
HRR	Ball indenter φ12.7mm (1/2 inch)		60kgf(588.4N)	
HRS			100kgf(980.7N)	
HRV			150kgf(1471N)	

VII. Rockwell hardness

2. Scales, hardness range of the Standard blocks, max. Tolerance of displaying value of Rockwell. (Table. 7)

Table.7

Scale	Hardness range of the standard blocks	Max tolerance of displaying value
HRA	(20~75)HRA	±2HRA
	(> 75~88)HRA	±1.5HRA
HRB	(20~45)HRB	±4HRB
	(> 45~80)HRB	±3HRB
	(> 80~100)HRB	±2HRB
HRC	(20~70)HRC	±1.5HRC
HRD	(40~70)HRD	±2HRD
	(58~69)HRE	±2..2HRE
HRE	(> 70~94)HRE	±2HRE
	(> 90~100)HRE	±2HRE
HRF	(60~90)HRF	±3HRF
	(> 90~100)HRF	±2HRF
HRG	(30~50)HRG	±6HRG
	(> 50~75)HRG	±4.5HRG
	(> 75~94)HRG	±3HRG
HRH	(80~100)HRH	±2HRH
HRK	(40~60)HRK	±4HRK
	(> 60~80)HRK	±3HRK
	(> 80~100)HRK	±2HRK
HRL	(100~120)HRL	±1.2HRL
HRM	(85~110)HRM	±1.5HRM
HRR	(114~125)HRR	±1.2HRR

Scales, hardness range of the Standard blocks, max tolerance of displaying value, repeated deviations of Plastic Rockwell. （Table. 8）

Table.8

Scales	Hardness range of the Standard blocks	Max. tolerance of displaying value	Repeated deviation is equal or lesser than
HRE	70~94HRE	±2.0HRE	2.5HRE
HRL	100~120HRL	±1.2HRL	1.5HRL
HRM	85~110HRM	±1.5HRM	2.0HRM
HRR	114~125HRR	±1.2HRR	1.5HRR

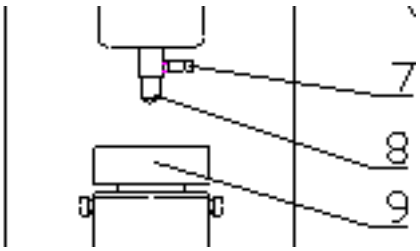
VII. Rockwell hardness

4 The Operation Procedure of the Hardness Tester

4.1 Use large or V-shaped test table. According to the extent of soft and hard of standard block, select scales According to Table.6 to select indenter according to scales.

For example to test the hardness of HRC:

4.2 Put the indenter (8) into the hole of main spindle closely against the supporting plane and make the caved plane (8) of the indenter handle face the screw. Fasten slightly the indenter screw (7).



4.3 Turn on the switch.

4.4 Click the hardness scale, choose HRC: Click the hardness scale if there is need to change.

4.5 Fix the working table, put the specimen on the working table, turn the rotating wheel to lift up the working table slowly. Stop rotating when the distance between top of the indenter and the specimen surface is about 0.5~1mm.

4.6 Click"START"then the tester begin loading.

Attention: The indenter may unable to touch the surface of the specimen. In that case, the indenter will return automatically. This means the distance is too far. Ascending the test table to decrease the distance, then click "START" again.

4.7 System will calculate the hardness value automatically and the screen will display the Rockwell value.

5 Regulation of Hardness Value

The precision of the hardness displaying value of the hardness tester is just

VII. Rockwell hardness

calibrated before the instrument is turned out of the factory. If a deviation is caused due to the transportation or according to the various requirements of the client, the hardness value may be revised by pressing input keys. Click Calibration on the interface shown as Fig.9



Table.9

Test force	294.2N(30kg)	Tolerance: ±1.0%
	980.7N(100kg)	
Indenter	Diamond Vickers indenter	
Scale	HV30	HV100
Eyepiece magnification	15×	
Objective magnification	5×(Resolution 0.25μm)	
Max height of specimen	About 170mm	

Place the standard hardness block on the testing table

1.Enter standard hardness value into box behind "standard hardness value"

Enter the same value into the box behind "measured hardness value"

Click "test" to measure the actual hardness value, if there is any deviation,enter the actual value into "measured hardness value" , then click "save"

4 Regulation of test force:Please contact us.

VIII.Vickers hardness value

1.Technical Specifications of Vickers Hardness(Table.9)

2.Vickers hardness value testing range :5HV~3000HV

3.The Tolerance and Repetition of Displayed Value for Vickers Hardness Tester(Table. 10)

Table.10

Tolerance of Displayed Value			Repetition of Displayed Value	
Hardness scale	Value of Hardness Block	Tolerance of Displayed Value	Value of Hardness Block	Repetition of Displayed Value
HV30 HV100	≤250HV	±3%	≤225HV	6%
	300~1000HV	±2%	＞225HV	4%

4 Usage of Vickers Hardness

4.1 Click"BACK"to Vickers scales, choose the appropriate scale.

4.2 Insert the floodlight into the hole behind the microscope.

4.3 Procedure of Vickers hardness value

4.3.1 Installation of microscope and the test table is the same as Brinell hardness mode

4.3.2The working procedure is almost the same as Brinell test

4.3.3 The measure of indentation diagonals is the same as Brinell test

5 Vickers hardness measurement considerations

5.1 The surface of the specimen must be clean, as the grease or the dirt on the surface would make the edge of the image of the indentation vague, thus affecting the precision of the measurement. Please clean the specimen and test table with alcohol or ether. Make sure to measure diagonal length of indentation precisely, the degree of finish should >0.8

5.2 Samples should be kept on anvil and avoid any movement, make sure indenter is uprightly impact on samples.

5.3 Measurement of diagonal length of indentation shall be measured along two perpendicular axes.

5.4 Tolerance of hardness tester is the ratio between differences of average value and standard hardness value and standard hardness value. Repeatability is the ratio between max difference and average hardness value. Tolerance and Repeatability conforms table. 10

IX. Maintenance and Precaution

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

2.During the transportation of the tester, the tester should be fixed with the Connecting Rod, with the Weights and the Handing Rod discharged. Disconnect the power source before the Weights and the Hanging Rod are taken out.

3.The hardness block should be used only on the working plane, and the life time of the hardness blocks is 2 years.

4.Keep the tester clean and cover the tester after the use, lubricate the hardness blocks and ball indenters with the rust preventing oil.

5.The use and storage of measurement systems, should avoid dust, moisture and corrosive gases in the environment.

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

7.When malfunction occurs, please contact us.

X. Accessories (The Packing List)

1 Accessories Kit of Main Body

No.	Item	Quantity
1	Diamond Cone Rockwell Indenter、Diamond Cone Vickers Indenter	Each 1
2	Φ1.5875mm、2.5mm、5mm indenter	3
3	Large Testing Table、Medium Testing Table、"V" Shaped Testing Table	3
4	Standard Rockwell Hardness Block HRC (High, Lower),HRB HBW2.5/187.5,HV30	Each 1
5	Standard Vickers Hardness Block	1
6	Standard Brinell Hardness Block	1
7	Level bolt	4
8	Gradienter	1
9	Power line	1
10	Fuse 2A	2
11	USB flash disk、Touch Pen	Each 1
12	Instruction Manual	1
13	Plastic Anti-dust Bag	1

2 Accessories Kit of Microscope

No.	Item	Quantity
1	Digital eyepiece	1
2	Seat of Microscope	1
3	Outside Light	1
4	Inside Light	1
5	2.5× objective	1
6	5× objective	1
7	Slipped Testing Table	1

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