

HBE-3000A

Electronic Brinell Hardness Tester Operation Manual



Notes

- 1 Read the instructions carefully before using this instrument, Learn more about the operation of the instrument avoid instrument damage or safety accidents due to improper use.
- 2 Please remove the tape and shockproof tape carefully when the instrument is installed and debugged.
- 3 The power outlet of the instrument must be single-phase three-core socket, The grounding end must comply with the prescribed protective grounding requirements.
- 4 The installation position of electrical components, switches and sockets of the instrument is strictly forbidden to disassemble and assemble by itself, If disassembled without authorization, it may cause an accident.
- 5 In the process of applying or unloading the test force and maintaining the test force, the instrument can not rotate the load changing hand wheel or the rotary wheel.

The unit is committed to improving the quality of the hardness tester, constantly update the structure, if the use of instructions

The contents are slightly different from the structure of the instrument, without prior notice, please forgive me.

1. Introduction:

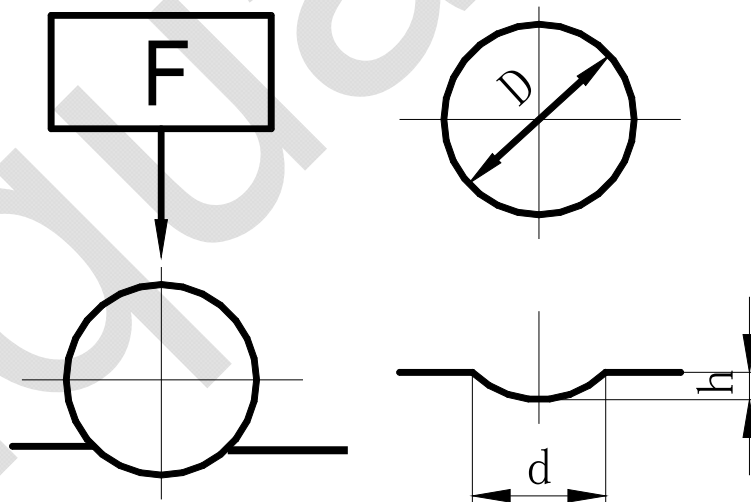
Hardness is one of the important indexes of mechanical properties of materials, Hardness test is an important means to judge the quality of metal materials or parts. So called hardness, So called hardness,

Brinell hardness test is mainly used for hardness determination of cast iron, steel, nonferrous metals and soft alloys, Brinell hardness test is mainly used for hardness determination of cast iron, steel, nonferrous metals and soft alloys,

Brinell hardness test is a steel ball of a certain diameter to specify the force of the test pressed into the surface of the subject (Fig .1), Brinell hardness test is a steel ball of a certain diameter to specify the force of the test pressed into the surface of the subject (Fig .1), Calculate the average pressure (N/mm²) on the spherical surface area of the indentation, that is, Brinell hardness Brinell hardness values can be obtained from the following formulas:

$$HB=0.102 \times \frac{2F}{\pi D (D- \sqrt{D^2-d^2})}$$

- Type:
- F—— A test force, in N., added to the specimen by a steel ball
 - D—— Ball diameter in mm.
 - d—— indentation diameter in mm.
 - 0.102—— The specified coefficient.



picture1

2 Main technical parameters:

Test force series: 612.9N (62.5kgf)	4900N (500kgf)
980N (100kgf)	7355N(750kgf)
1225N (125kgf)	9800N (1000kgf)
1839N (187.5kgf)	14700N (1500kgf)
2452N (250kgf)	29400 (3000kgf)

2.2 Hardness Test Range: 8~650HBW

2.3 Accuracy of indication value:

Standard hardness block	Maximum error of indication%(Relative relative H)	
Repeatability error		
≤125	±3	0.03 \bar{d}
125<HBW≤225	±2.5	0.025 \bar{d}
>225	±2	0.02 \bar{d}

H— Calibration hardness values of standard blocks \bar{d} — Total mean of indentation diameter

2.4 reading microscope magnification: 20times

2.5 Measuring the minimum indexing value of the micro drum: 0.005mm

2.6 Maximum height of specimen: 220mm

2.7 Maximum distance from head center to body: 135mm

2.8 Power supply voltage: AC220V/50HZ

2.9 Dimensions: (753×550×236) mm

2.10 Weight: 123kg

3. Installation and commissioning of instruments

3.1 Working conditions of the hardness tester

3.1.1 The hardness test shall be conducted at room temperature (23 ± 5) °C and, if beyond that temperature range, shall be stated in the inspection report;

3.1.2 Clean environment, no vibration;

3.1.3 Surrounding non-corrosive gases;

3.1.4 Installed on a solid bench, (Shape dimensions for reference only) And to the level, Level should not exceed 0.2/1000, A $\phi 90$ mm hole is opened in the proper seat on the workbench for wire rod lifting. Figure 2.

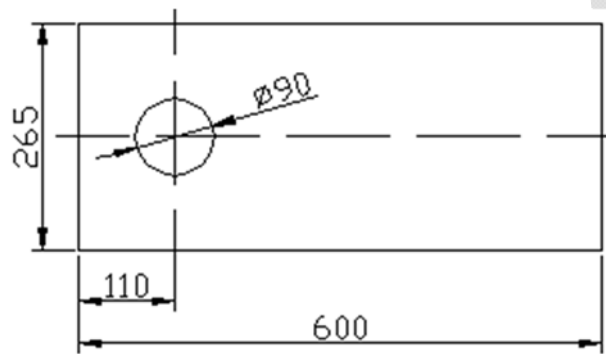


Figure2

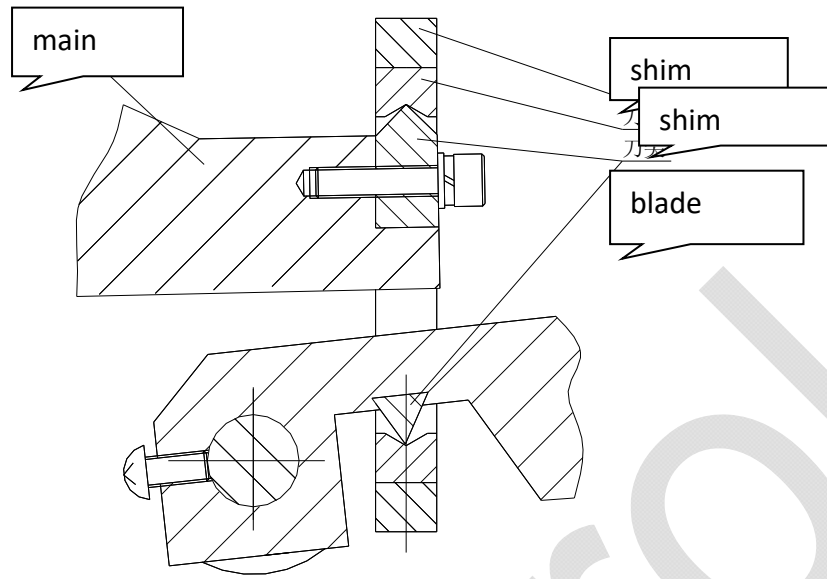
3.2 Unboxing and installation

3.2.1 Unscrew the four nuts under the outer packing box and lift the outer packing box up, Lift the hardness meter, remove the four mounting screws on the bottom plate, and place the hardness meter on the debugged table.

3.2.2 Remove the pad between the lifting rod and the head shaft, wipe the rust-proof oil on the lifting rod with gasoline, and apply proper amount of thin oil to lubricate after drying.

3.2.3 Open the upper cover and remove the shockproof foam pad on both sides of the lever. See if the blade is in the pad, If the tool holder is removed from the knife edge, press the main tool by hand to cover the tool holder on the knife edge. (This generally does not occur, only in the event of a violent vibration.) as shown in Figure III.

3.2.4 Turn on the power, turn on the switch, and the hardness meter automatically enters the working position.



Picture3

Function Description of Operation Panel

4. Panel function and introduction are as follows. (Figure 4)



Figure 4 Panel Function Description

4.1.1 The test force of Brinell hardness test of this machine according to the need of the test, There are 612.5~29400 N a total of 10 test forces, according to the selected test force corresponding to the head indicator light.

4.1.2 The test state shows that there are three stages in the test, the loading stage lamp is lit, the loading stage lamp is lit, and the unloading stage lamp is lit.

4.1.3 Key functions

<SETUP> (Adjust the Options key)

You keep pressing< SETUP >After two times, the setup interface is displayed on the LCD (see figure 7). You can press

<↓>and<↑> Select Options.

<DELETE> (Delete key) In the loading and unloading interface, press this key to return to the initial interface twice in the unloading state.

<STOP> (Stop key) Press this key to interrupt the loading and unloading state in progress and enter the computing interface.

<OK> (Confirm key) Press this key to confirm the selected operation and save the set parameters twice.

<C> (Clear key) Press this key at the initial interface to enter the calculation interface (see figure 5) and clear the value of the input error when the diameter input error occurs.

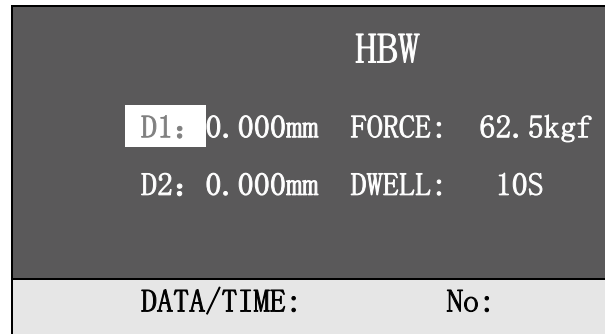


Figure 5 Computational interface

Digital keys: <0>, <1>, <9>

The formula for calculating Brinell hardness is stored in an integrated calculator of the hardness meter. You can enter the measurement reading into the calculator through the digital key to get the hardness value.

When you enter the diameter measurement reading and press the <OK>, the system will automatically convert the diameter length value, press the <OK> key to confirm, then the corresponding hardness value calculation results will be displayed on the screen.

You can press the <OK><C> key to delete the input number before pressing the <OK>.

<PRINT> (Data output keys)

If you select the native print output, press the <PRINT> key directly.
(Printers are configured according to user requirements)

4.2 Display interface

4.2.1 Turn on the power switch, hear the "drop ——" sound, then the LED light, display the initial screen (figure 6), then press the <OK> key motor micro-turn, hardness meter self-test, interface display (figure 8), indicating that self-test completed, hardness meter is normal.



Figure 6 Initial interface

4.2.2 Charge Time Setup

Enter the setup interface twice <SETUP>(see Figure 7), The holding time (1~60 seconds) is set by pressing the <↓><↓><DWELL>> and <↓><↓><↓><DWELL>>> after the cursor is moved to the <↓><DWELL>(15 S).

DWELL<S>	15S		
INDENTER	2.5	5	10
FORCE (kgf)	62.5	100	125
	187.5		
		250	500
		750	
	1000	1500	3000
ALOAD	AUTO		MANULE
<OK>:SAVE		<STOP>:EXIT	

Figure 7 Setup interface

4.2.3 Selection of press head specifications

On the setup interface (see Figure 7), after the cursor is moved to the <INDENTER> by pressing the <↑> and <↓>, the pressure head specification is selected by pressing the <INDENTER>→> and <INDENTER>←<INDENTER>→>. In the menu ,2.5,5,10 indicate the diameter of the pressure head ball as the Φ2.5、Φ5、Φ10mm(boot setting the pressure head specification as the Φ2.5).

4.2.4 Test force selection

On setting the interface (see Figure 7), after moving the cursor to the <FORCE<↓> by pressing the <↑> and <↓>, the test force is selected by pressing the <FORCE<↓>→<↓> and <FORCE<↓>→<↓>→<↓>→<↓>. The selection time scale will jump and move according to the test force corresponding to the diameter of the head ball (the test force that does not correspond will not be selected by the cursor).

Note: according to Brinell hardness test method, the diameter of the head ball is related to the test force, can not be arbitrarily selected, should meet Table 3.

4.2.5 Selection of measurement methods

On the setting interface (see Figure 7), after moving the cursor to the <ALOAD<↓> by pressing the <↑> and <↓>, the measurement mode is selected by pressing the <<↑><↓> and <<<↑><↓><↓>→>(the starting setting measurement mode is automatic AUTO).

When the setting is complete, press the <OK> key to determine the selected operation, then

press the <OK> key to save the set parameters once, the system enters the working interface , "LOADING" flicker (see figure 8).

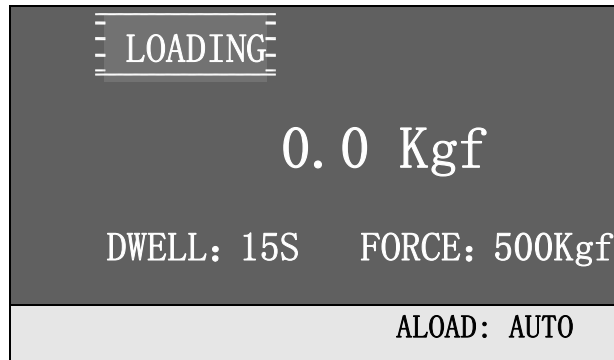


Figure 8 Work interface

Note: the original setting of the machine is 15 seconds, the diameter of the pressure head is 612.9 N of the Φ 2.5mm, test force, and the original setting is restored after each boot.

4.2.6 Alarm

If the lever position exceeds the lower limit, the system will automatically detect and jump out of the alarm menu (see figure 9). Press the <OK> key machine to unload automatically and return to the working interface after unloading successfully.



Figure 9 Alarm menu

4.3 Use of hardness meters

4.3.1 Installation of the head: install the head into the shaft hole, rotate the fastening screw (3) so that it is lightly pressed on the flat part of the head axis, then install the test table directly on the lifting wire rod, and then place the sample firmly on the test table.

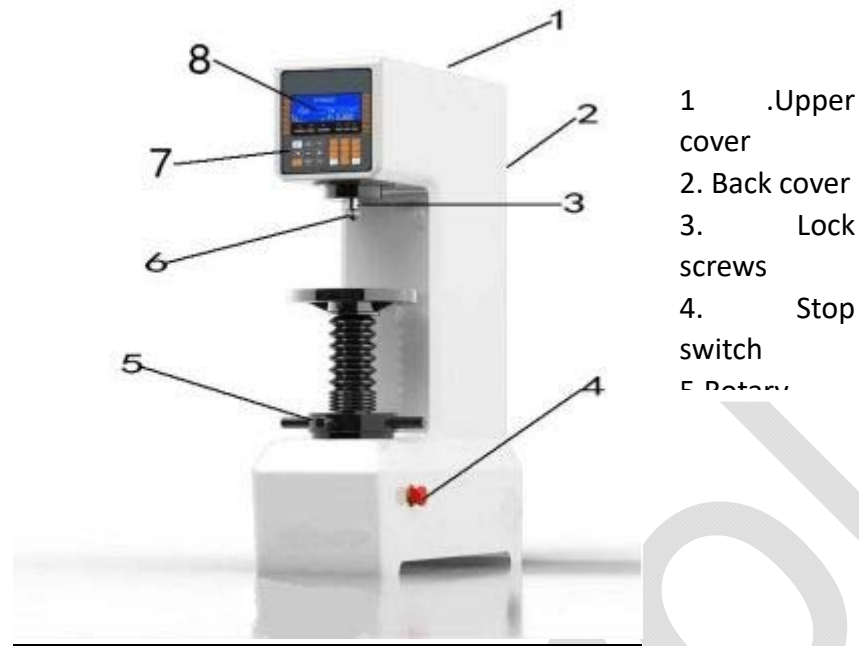


Figure 10 Shape of hardness tester

4.3.2 Turn on the power switch, the machine itself completes initialization, displays the initial interface, and the large lever automatically adjusts to the starting position of the work. Force value is set at 612.9 N (62.5Kgf) and boot time is set at 15 seconds. If you want to select other test force and load retention time, please refer to the operation panel function introduction.

4.3.3 When the instrument is ready for testing, place the specimen smoothly on the worktable and turn the handwheel, When the workpiece touches the head, the test force begins to show, When the test force is close to the automatic loading value, it must rise slowly. When the automatic loading value is reached, the instrument will make a "beep" sound, stop turning the handwheel at the same time, light up the loading indicator, load the test force automatically, and run to the selected force When the load is fixed, the load indicator lights up, the load indicator lights out, and countdown, waiting for the end of the time, the load indicator lights out, automatically unload, at the same time, the unloading indicator lights up, the indicator lights out after unloading.

The test force of this instrument is 10 grades :62.5 Kgf~250 Kgf is one file, and the automatic loading value is ≥ 40 Kgf.

500Kgf~3000 Kgf is one file, automatic loading value is ≥ 160 Kgf.

Note: the automatic loading value is the minimum force value when the hardness meter works. Do not exceed this value too much when operating the wheel, try to slightly exceed this value. When the hardness tester has just started working (force addition), the force change process on the display screen is not displayed, and only when the test force of the preview setting is reached.

Table 1

Materials	Brinell hardness	0.102F/D ²
Steel		30
Cast iron	<140	10
	≥140	30
Copper and copper alloys	<35	5
	35~130	10
	>130	30
Light metals and alloys	35	2.5
	35~80	5, 10
	>80	10

4.3.5 The minimum thickness of the specimen can be found in Table 2, and the thickness of the specimen should not be less than 8 times of the indentation depth. h indentation depth can also be obtained from the following formula:

$$\text{Basis } HB = \frac{F}{\pi Dh} \longrightarrow h = \frac{F}{\pi d HB}$$

Direct observation: if there are deformation marks on the back and edge of the sample, the test results are deemed invalid, the diameter of the steel ball or the test force should be re-selected and re-teste

Table II

Average diameter of indentation	Minimum thickness of specimen		
	Ball diameter		
	D=2.5	D=5	D=10
0.6	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

4.3.6 The direction of the test force should be perpendicular to the test surface. The retention time of the test force is: ferrous metal 10~15 seconds, nonferrous metal 30 seconds, hardness less than 35 HBW is 60 seconds.

4.3.7 The distance between the center of the indentation and the edge of the specimen should not be less than 2.5 times of the average diameter of the indentation, and the center distance of the two adjacent indentation should not be less than 3 times of the average diameter of the indentation. If the hardness is less than 35 HB, the above distance should be 3 times and 6 times of the average diameter of indentation, respectively. If we do not test according to this standard, the indentation will appear asymmetry phenomenon, the hardness value will appear high or low, can not get the correct test data. The indentation diameter should be measured in two perpendicular directions and its arithmetic average. The difference between the two diameters of the indentation should not exceed 2% of the smaller diameter.

4.3.8 If the diameter of steel ball is $\Phi 2.5\text{mm}$, the roughness of the sample should be above 0.8, so that the edge of indentation is clear and the accuracy of measurement results is ensured. The surface of the specimen shall be free of oxide skin, plating layer and surface heated or other dirt.

4.3.9 The hardness meter has multistage test force, and the nominal value specified in Table 3 should be selected for all levels of test force.

Table III

Hardness symbol	Diameter of steel ball mm	$0.102F/D^2$ (F/D^2)	Test forces F N(Kgf)
HBW 10/3000	10	30	29400(3000)
HBW 10/1500	10	15	14700(1500)
HBW 10/1000	10	10	9800(1000)
HBW 10/500	10	5	4900(500)
HBW 10/250	10	2.5	2450(250)
HBW 10/100	10	1	980(100)
HBW 5/750	5	30	7350(750)
HBW 5/125	5	5	1225(125)
HBW 2.5/187.5	2.5	30	1839(187.5)
HBW 2.5/62.5	2.5	10	613(62.5)

5. Adjustment of hardness tester and matters needing attention

In the comprehensive test of this instrument before leaving the factory, all the technical requirements have reached the national standard. After leaving the factory, if due to installation or disassembly or transportation or voltage and other reasons, it may cause some data changes in the instrument, generally can do the following processing:

5.1 29400N(3000 Kgf) test force is applied several times each time to eliminate the deformation of the instrument, the electrical components run normally and the test error is reduced.

5.2 The loading and unloading signals of the test forces at all levels of the instrument are obtained by feedback from the sensor, and the output signal of the sensor is quite weak. However, in order to ensure the normal operation of the instrument and avoid unnecessary damage, please avoid strong interference sources and shut down at the end of the test.

5.3 All screws and caps of the hardness tester are tight before leaving the factory, but since the unloading rod has been in positive and negative rotation in use, in case of abnormal sound during rotation, please check if the two parallel caps at the belt wheel are loose, If loose, use tools to cap and tighten.

5.4 Instrument power supply should be reliable grounding and voltage stabilizer.

5.5 Turn on the power switch and the lever automatically adjusts to the starting position. The lever of the electronic Brinell hardness tester has a limit position when rising and falling, and a close switch head seat is installed at the tail of the large roller. Install the upper and lower proximity switches on the right side of the body near the rear cover, Control the starting position and the total stroke of the helmet. A, B two proximity switches are close to A proximity switches when normal. During boot, the motor rotates to raise the lever, so that the upper A proximity switch gets the origin position of the large lever to the computer, and then ensures that the position of the machine head is empty and the machine sensor is zero. The motor is loaded forward to the lever loading starting position. Be careful not to change the position of the proximity switch without authorization. The following B proximity switch is set for the lower limit position. As the B approaches the switch, Play a protective role, the motor stops loading and the display screen shows "ALARM", press the <OK> key to reverse unloading. At this point : (1) 0.102 F/D2 value selection is improper, appropriate force value selection smaller. (2) There is no workpiece on the test bench. (3) Pressure sensor failure. (Factory warranty should be notified)

5.6, The instrument will make some slight noise during loading and unloading, which is a normal phenomenon.

In order to continuously improve the quality of the instrument, the company will update the structure of the instrument properly, so the instructions are slightly different from the instrument, but do not affect the operation function, without prior notice, please forgive.

6. Brinell hardness calculation

After a test, press the STOP) button to enter the Brinell hardness calculation menu, as shown in figure 20

HBW	
D1: 0.000mm	FORCE: 62.5Kgf
D2: 0.000mm	DWELL: 15S
DATA/TIME:	NO:

Figure 20

Select the test force of 612.9 N, Φ 2.5mm the ball indenter, calculate the Brinell hardness of the indentation diameter: move the cursor to the D1, enter 1.029 from the panel numeric key, press the <OK> key to confirm, Enter 1.031 from panel numeric key and press <OK> key to confirm. Figure 21

71.7 HBW	
D1: 1.029mm	FORCE: 62.5Kgf
D2: 1.031mm	DWELL: 15S
DATA/TIME:	NO: 1

Figure 21

7 Use of reading microscopes

7.1 Schematic illustration of the structure of the microscope

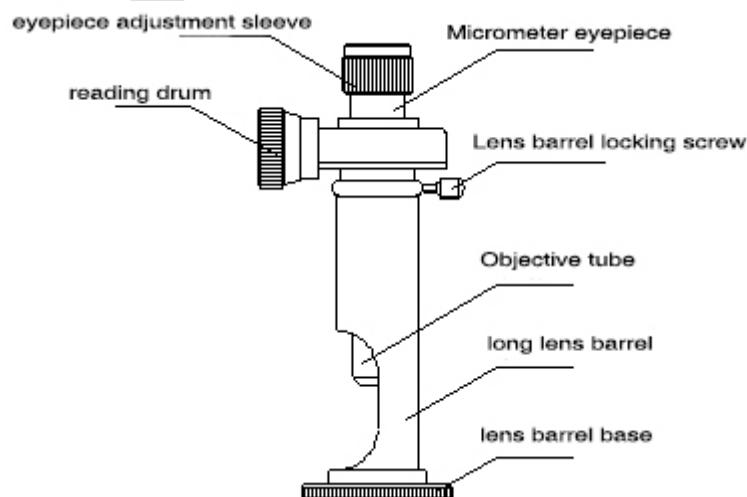


Figure 8

7.2 Purpose

The matching reading microscope is mainly used to measure Brinell hardness indentation. It has simple structure and convenient operation.

7.3 Technical parameters

Microscope magnification 20 x, field of view diameter 9 mm, effective measurement range 6 mm.

Size of eyepiece	Scratching scale of eyepiece	Minimum reading of micro drum	Measuring accuracy
1mm	8mm	0.005mm	0.005mm

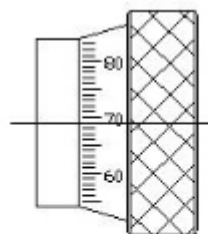
7.4 Method of use

7.4.1 Place the reading microscope on a hardness block or specimen and illuminate the notch of the long tube with natural light or light. In the field of view, we should see the words and lines on the dividing board at the same time. If the indentation is not clear, we can turn the eyepiece adjusting sleeve to be clear. The indentation on the hardness block or specimen should be clear at the same time, which has been adjusted when leaving the factory.

7.4.2 When measuring, rotate the reading drum wheel, and carve 0-90 numbers and 100 lines on the circumference of the reading drum wheel, each small lattice is 0.005 mm, and the rotation drum wheel is 0.5 mm. in a circle The drum wheel line is shown in figure 9.

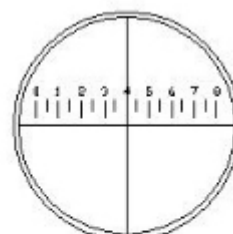
7.4.3 Inside the eyepiece are two partition boards, with numbers from 0-8 engraved on the fixed partition board, each with a digital interval of 1 mm as shown in figure 10, and a black line for measurement on the moving partition board.

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reading drum

(Figure 9)



Schematic diagram of the reticle

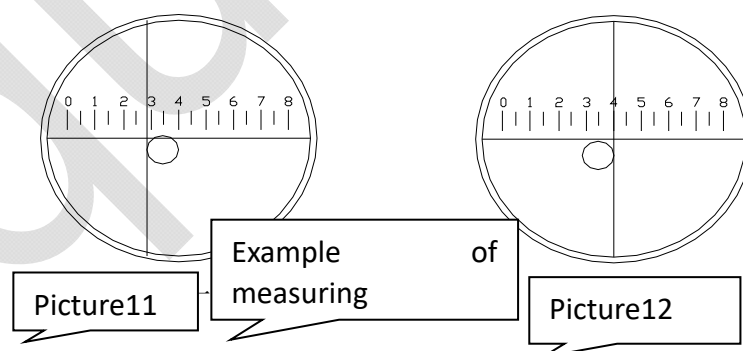
(Figure 10)

7.4.5 Test example: put the hardness block or specimen with Brinell hardness indentation on a smooth table, put the reading microscope on the hardness block or specimen, and see the www.iqualitrol.com, sales@iqualitrol.com

enlarged Brinell indentation in the field of view. Then you can start measuring their diameters in two perpendicular directions.

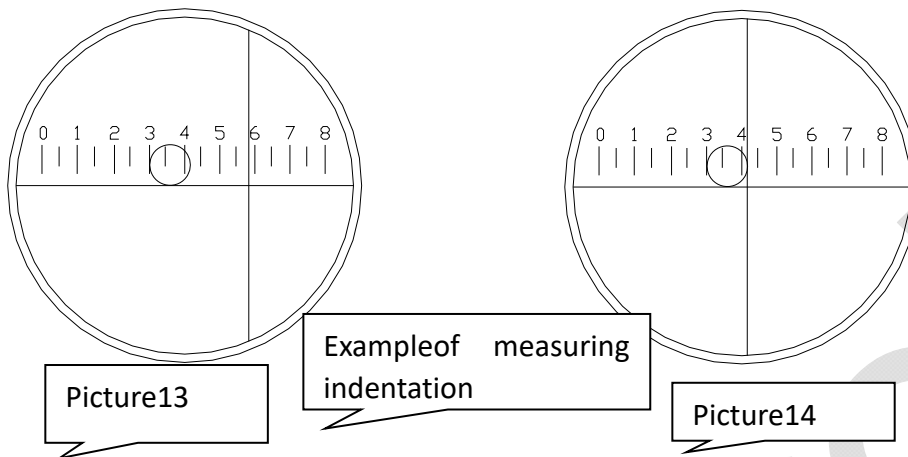
Method 1: reading microscope lattice value is 0.005 mm, drum wheel engraved with 100 lattice, turn a circle is 0.5 mm, And two turns is one mm. Move the black measurement line to the "0" position, which should also be "0" on the drum wheel. If there is a small amount of error, This error should be caused by different measuring habits and viewing angles per person. (See photo), And then turn the drum so that the inside of the black line is tangent to the side of the indentation, with a reading of 2.971 mm(see Figure 11) (The number of squares on the drum wheel is 94.2 squares and 0.2 squares is the estimated reading number, so that the total number of squares is 594.2 squares, $0.005 \times 594.2 = 2.971$ mm), Then continue to rotate the drum so that the inner side of the line is tangent to the other side of the indentation (note: during rotation, the hardness block or specimen must be consistent with the reading microscope), Another reading of 4.000 mm(see figure 12) (That is, a total of 8 turns, the total number of squares 800, $0.005 \times 800 = 4.000$ mm), Then the indentation straight through is the difference between the second reading $4.000 - 2.971 = 1.029$ mm, The reading microscope is rotated 90° and measured according to the above method in the vertical direction of indentation. The other diameter is 1.031 mm, and the average diameter of the two indentation is both diameter length. ($1.029 \div 2 = 1.030$ mm.)

When the test force of 612.9 N is selected, the $\phi 2.5$ mm ball indenter is found in the control table to have an indentation diameter of 1.030 mm and the hardness in this column is 71.7 HBW



Method 2: the inner side of the long line on the fixed partition board is tangent to the side of the indentation (see figure 13)(if 3 mm is taken, 3 mm), Cut the inside of the black line on the moving partition board into the other side of the indentation, Got a reading of 4.029 mm(see figure XIV), $4.029 - 3 = 1.029$ mm (4.029 reads like this, Fixed 4 on the partition board, mm.4 It's 5.8 on the drum, $0.005 \times 5.8 = 0.029$ mm, Length $4 + 0.029 = 4.029$ mm). Rotate the reading microscope 90° , In its vertical www.iqualitrol.com, sales@iqualitrol.com

direction According to the test force and the diameter of the ball pressure head mm, the hardness value can be obtained by looking up the table.



7.5 Note for maintenance of reading microscope

7.5.1 The accuracy of the reading microscope has been adjusted when it leaves the factory and is not allowed to disassemble and assemble by itself, which affects the reading accuracy of the microscope by the customer.

7.5.2 When reading microscope is stored and used, avoid dust, moisture and corrosive gases.

7.5.3 If there is dirt on the surface of the reading microscope lens, use soft degreasing cotton, wipe mirror paper to wipe, when touching oil stains, use degreasing cotton dip a little alcohol or ether mixture gently wipe.

8. Packing list

Serial number	Name specifications	Unit	Quantity
1	Host host	Platform	1
2	Mainframe accessories box		
3	$\phi 2.5$ 、 $\phi 5$ 、 $\phi 10$ mm indenters	Pc	1 each
4	Big and small flat test bench, V type test bench	pc	1 each
5	Standard hardness block	Block	three
6	HBW/3000/10 150-250	Block	one
7	HBW/1000/10 75-125	Block	one
8	HBW/206/2.5/187.5	Block	one
9	Fuse (2 A)	Only	three
10	Power cord	Root	one
11	20× Reading microscope	Only	one
12	Cross screwdriver	The	one
13	Word screwdriver	The	one
14	Printing paper	Volume	one
15	Product Certificate	The	one
16	Product instructions	A	one
17	Plastic dust shield	A	one

Warranty registration card	
Product model	
Host number	
Warranty telephone	
Warranty time	Warranty for one year (except accessories / breakable parts)
User information	
Date of purchase	
Name of unit	
Contact address	
Contact	
Telephone contact	
Copy of invoice sticker	