

# **HR-150A**

## **Rockwell Hardness Tester**

### **Operation Manual**



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# 1, summarize

Hardness is a material resists the elastic deformation, plastic deformation or damage. For pressure into laws of hardness test, hardness is another relatively hard material resistance has a certain shape and size of objects the ability of its surface.

The principle of rockwell hardness test

Rockwell hardness measurement method is to use rules of pressure head, two trials in successively applied (early test force  $F_0$  and total test force  $F$ ), the pressure into the surface of the sample, the total test force to maintain a certain amount of time, after the removal of the main test force  $F_1$ , keep the early test, measuring the pressure into the depth of  $h_1$ , with pressure depth  $h_1$  and at the beginning of the test force under the action of.

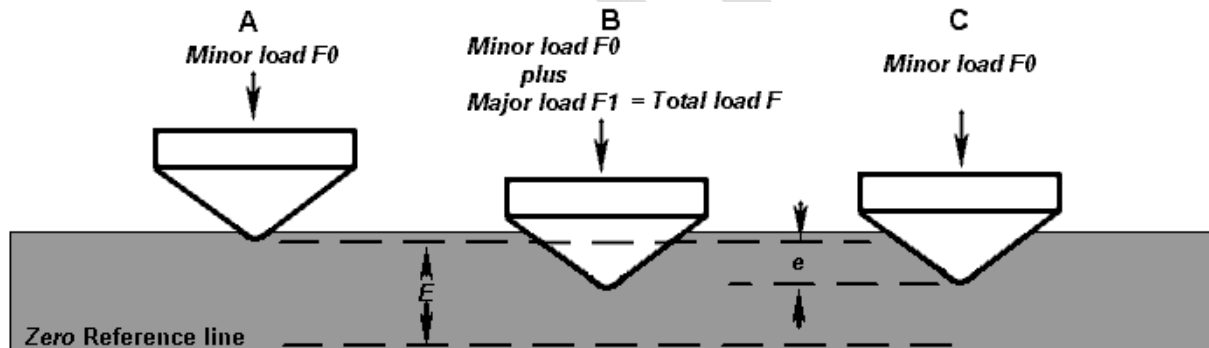
Rockwell hardness value press type gauge  $HR = K - \frac{h_1 - h_0}{C}$

Commonly used in C - type is equal to 0.002 mm

K - constant when diamond cone head is used for 100,

When ball head is used for 130

The principle diagram of the rockwell hardness test



Rockwell hardness test:

Rockwell hardness test with the method of measuring pressure depth, hardness value through instructions direct reading, therefore, simple and convenient operation, easy to grasp, high efficiency, suitable for batch parts inspection; Rockwell hardness test method, can use diamond indenter and just the ball head, is the sample of hard and soft, can be measured using a wide range, so los type hardness tester test is widely used in the production, become the inspection product quality, the main detection methods to determine the reasonable processing technology. Rockwell hardness tester is the production of enterprises, large and medium-sized institutions, scientific research institutions, hardness test, teaching and scientific research of the most commonly used test equipment.

## 2, The application of hardness tester

Rockwell hardness test according to the material hardness, thickness of the test, can choose A different head and test, and the different scale, says the most common have A, B, C scale, in the following table gives the commonly used scale test force, pressure head, constant K value and scope of application and application example.

**Rockwell hardness tester using range**

scale	Hardness symbol	Head type	Initial test force $F_0$ (kg.)	Main test force $F_1$ (kg.)	Total test force $F$ (kg.)	constant	scope	For example
A	HRA	Diamond cone head	10	50	60	100	20-88 HRA	Hard metal and tungsten carbide
B	HRB	1.5875 mm ball head	10	90	100	130	20-100 HRB	Non-ferrous metal and soft metal
C	HRC	Diamond cone head	10	140	150	100	20-70 HRC	Structural steel, tool steel heat treatment
D	HED	Diamond cone head	10	90	100	100	40-77 HRD	Surface hardened steel, steelskin
F	HRF	1.5875 mm ball head	10	50	60	130	60-100 HRF	Non-ferrous metal
G	HRG	1.5875 mm ball head	10	140	150	130	30-94 HRG	Pearlite iron, copper, nickel, zinc alloy

**A Scale:** Is suitable for the determination of more than 70 HRC hardness of metal, such as tungsten carbide, tungsten carbide, also can be used to measure the hard sheet materials and surface hardening materials.

**B Scale:** Used for testing of non-ferrous metals and their alloys, annealing steel or without hardened steel products such as soft or medium hardness materials.

**C Scale:** Used for the determination of carbon steel, tool steel and alloy steel after heat treatment of steel products, such as the hardness of materials.

### 3, The main technical parameters

1、 At the beginning of test force	98.07N (10kgf)
2、 The total test force	588.4N (60kgf) 980.7N (100kgf) 1471N (150kgf)
3、 Indicator scale	C: 0—100; B: 30—130
4、 Specimen maximum height	Screw the cases of 100 mm Do not add screw the cases of 170 mm
5、 Indentation center to machine wall distance	135mm
6、 Hardness tester size shape	466×238×630mm
7、 Hardness tester net weight	65kg

### 4, Institutions properties

The hardness tester consists of fuselage, force exerting mechanism, measuring instructions and specimen support institutions and other components (see figure 1).

Fuselage for a closed shell, in addition to the workbench, screw, control handle to reveal and other institutions are gear inside the fuselage shell, easy to keep clean.

Test force imposed by the main shaft, screw, blade, farmar buffer, farmar transformation mechanism, control handle, etc.

Early test force is mainly composed of the main shaft (1) the circular knife (2) long diamond knife (3) the lever (4) small lever (21) plunger (5), and other parts and the weight of the indicator measuring stress (24). When specimens in contact with the head and continued to rise, make the big and small lever in a horizontal position (small indicator pointer refers to the red dot, big pointer vertical) such as leverage and the weight of the indicator for measuring pressure, pressure head can be (10 kg) 98.07 N at the beginning of the test force.

Total test force by the main test force (produced by the weight of the weight) plus early test force, (7) the buffer rack shaft (8) on the plunger (9) has two farmar (10) with rings (11). When pulling the handle (15) decreased shock absorber piston rack shaft when the push rod (8) (9) rings (11) and Jordan farmar (10) along with the fall, and Jordan farmar (10) and the weight of the rings (11) has effect on the large lever (4) the effect of total test force to head.

Inside the fuselage with farmar variable load (12), when the rotation transformation (13) to different locations in hand, can get 1471 N 980.7 N or required 588.4 N three different total test force.

Adjust the oil needle (14) for applying the main test force applied to maintain a certain speed and avoid impact phenomenon.

Handle (15) is used to exert the main test force, handle (16) is used to discharge, in addition to the main test force when pulling the handle (15), the CAM gear (17) and (19) begin to spin, rack shaft (8) plunger (9) and buffer the piston down along with the rotating handle (16) counterclockwise direction at the same time, when the rings are in the process of falling in the big end of a lever small knife (20) hold, can fully exert the main test force.

Measurement institutions by the push rod (5) the little leverage (21) adjustment plate (22) extension rod (23) and indicator (24), and other parts. When rising specimen, were jacking pressure head, push rod (5) top a small lever (21) the extension rod drive the indicator pointer (23).

Specimen support institutions including the workbench (25) (26) a ball screw handwheel (27) screw (31) cases (29) of plain bearings (30). Remarkably comparing with the other manufacturer is the hardness tester increased the hardness tester cases (29) peace bearing (30) to avoid the dust sundry wait in use process touch to the bearing surface, reduced to the bearing surface wear, making operation more smooth lubrication, more accurate and stable value.

## 5, The installation of hardness tester

### 1、 Split open a case (see figure 2)

(1) 、 Open the packing cases lid, demolition of the fuselage at the bottom of the four fixed screw, can install the durometer in dry cleaning and no corrosive gas and no vibration of the room. Install the hardness tester platform should be strong, and make greater than  $\Phi$  50 mm hole diameter, for screw through。

(2) 、 According to the integrity of the packing list to check the attachment。

(3) 、 Open the machine cover (6) and the back cover (19)。

(4) 、 Loosen the nut (8) Removing the hook head screw (9)。

(5) 、 Remove the large leveraged fixed pressure block (7) and a fixed support block (1)。

(6) 、 Loosen the nut (13), removing the hook head screw (12) to remove weights fixed plate (14)

(7) 、 With the hand hold rings (10), slowly lift weight set up (17), and at the same time remove weights fixed support block (18), and then, again the weight set (17) put down gently, drop weight cylindrical pin (15) job board (16) in the groove, farmar, will hold。

(8) Loose the little leverage fastening cord (4)

(9) 、 Turn the handwheel (1) make the screw (2), remove the pressure head block (3)。

2、 Remove screw cases (30) in kerosene will apply to the screw factory, the place such as the wheel rust-proof oil wash, and then poured into a small amount of lubricating oil and screw contact with the hand wheel, and restore the screw to protect good suit。

3、 Check the lever (4) the adjustment on the block (6) whether position between two red marks, repack or should be the right place。

4、 The Pacific Ocean workbench is installed in the upper screw (26), and then level on the work surface. At the bottom of the fuselage on four points of level adjustment bolts, make the levelness of the hardness tester adjustment within 0.2/1000.

## 6, The operation method and the matters needing attention

### 1、 The preparing work before test

(1) 、 Adjust the speed of exerting the main test force: handle (16) in the unloading, hand turn (13) to the location of the 1471 n, will be 35-55 HRC standard hardness block on the worktable, rotate handwheel (27) make the hardness of the jacking axis, combined with early test force, pull the lever (15) and the main test force, observe indicator pointer, from the starting rotation to stop time should be within 4 to 8 seconds, such as does not conform to, turn the oil needle (14), repeatedly, until to the right。

(2) 、 Test force choice: choose according to need (reference - use scope) test. Turn the handle (13) chooses the test force numerical value on the red dot, but must pay attention to transform test force, handle (16) must be placed in the unloading state (i.e., limit position after)。

(3) 、 Install pressure head: according to choose the proper pressure head (scope). Installing a pressure head, should pay attention to eliminate the pressure head and the end of the spindle (1)

clearance. Elimination method is: (28) the bolt head and fixed gently, then place the standard block or specimen in the workbench, rotate the handwheel (27) combined with early test, pull the lever (15) make main test force and the pressure head, and then tighten screw (28), can eliminate the gap between head and spindle end face.

(4) 、 The preparation of specimens and selection

Sample should have a certain size and thickness, should be able to guarantee between adjacent indentation centre and creasing center to the edge of the specimen distance is greater than 3 mm, minimum thickness of the specimens should not be less than eight times the depth of indentation. After test, sample support surface can not have obvious deformation traces, the minimum thickness depends on the material and load, may refer to the following table sample minimum thickness.

The minimum thickness of sample table

scale	Hardness valueHR	The minimum thickness (mm)	scale	Hardness valueHR	The minimum thickness (mm)
A	70	0.7	B	80	1.0
	80	0.5		90	0.8
	90	0.4		100	0.7
B	25	2.0	C	20	1.5
	30	1.9		30	1.3
	40	1.7		40	1.2
	50	1.5		50	1.0
	60	1.3		60	0.8
	70	1.2		67	0.7

Sample is generally flat, if the sample is based on the experiment, and its small radius of curvature, the test results should be fixed value. On convex sample should be combined with correction, and for concave sample shall be minus correction, correction of cylindrical specimen in the table below for reference.

## Cylinder sample C, A, D, the correction of the scale

修正量 硬度值	试样直径	Cylindrical specimen diameter (mm)								
		6.4	10	13	16	19	22	25	32	38
20		6.0	4.5	3.5	2.5	2.0	1.5	1.5	1.0	1.0
25		5.5	4.0	3.0	2.5	2.0	1.5	1.0	1.0	1.0
30		5.0	3.5	2.5	2.0	1.5	1.5	1.0	1.0	1.0
35		4.0	3.0	2.0	1.5	1.5	1.0	1.0	0.5	0.5
40		3.5	2.5	2.0	1.0	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	
60		1.5	1.0	1.0	0.5	0.5	0.5	0.5		
65		1.5	1.0	1.0	0.5	0.5	0.5	0.5		
70		1.0	0.5	0.5	0.5	0.5	0.5	0.5		
75		1.0	0.5	0.5	0.5	0.5	0.5			
80		0.5	0.5	0.5	0.5	0.5				
85		0.5	0.5	0.5						
90		0.5								



## Cylinder sample B, F, G the correction of the scale

修正量 硬度值	Cylindrical specimen diameter (mm)						
	6.4	10	13	16	19	22	25
	12.5	8.5	6.5	5.5	4.5	3.5	3.0
10	12.0	8.0	6.0	5.0	4.0	3.5	3.0
20	11.0	7.5	5.5	4.5	4.0	3.5	3.0
30	10.0	6.5	5.0	4.5	3.5	3.0	2.5
40	9.0	6.0	4.5	4.0	3.0	2.5	2.5
50	8.0	5.5	4.0	3.5	3.0	2.5	2.0
60	7.0	5.0	3.5	3.0	2.5	2.0	2.0
70	6.0	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

Sample surface must pass a fine grinding or polishing, the surface roughness should be not less than 1.6, the process does not affect the hardness of the material, which should not have phenomenon of work hardening and tempering, surface roughness of support surface is not lower than 3.2, the sample working face, bearing surface and working mesa, shall be clean without pollution. Samples should be placed on the workbench, smoothly movement occur in the process of test should not be.

Installation, sample shall be guaranteed by applying experiment force perpendicular to the surface. For curved shape and other irregular shape of sample, must adopt corresponding special types of workbench, and choose the correct test position. The cylinder sample, for example, must use "V" type workbench.

### 2、Test procedure

① Is at the top of the screw (26) and choose the workbench face wipe up, up and down the workbench in screw (26) on the upper face.

② Will clean the bearing surface of the specimens, placed on the worktable, rotate handwheel (27) make workbench slowly rise, and jacking pressure head, the indicator pointer pointing to the red dot, big three turns pointer vertical so far (allowed to vary plus or minus five calibration, if more than 5 scale, void this point, to test). Note: the workbench rises, absolutely not allowed to have back.

③ Turn indicator (24) shell, make long scribed line between C and B with the thumb for is

(either clockwise or counterclockwise)。

④ Pull the loading handle (15), exert the main test force, when the indicator pointer counterclockwise direction。

⑤ When the rotation of the pointer significantly after stop, keep five seconds later, the unloading can be handle (16) with 2-3 seconds back, remove the main test force. Note: the main test force exerting and discharge is divided, must be in the condition of no impact on the slow。

⑥ Immediately corresponding scale readings from the indicator, using diamond indenter test, according to dial the blackbody reading of the outer ring, ball head test, read by number of red body inner ring of the dial。

⑦ Turn the handwheel to make specimen decline, mobile specimen again, according to the above (2) - (6) process for the new test. Note: a specimen must be moving close to countertops; B: must ensure that the indentation between the center and center adjacent to the edge of the distance is greater than 3 mm; C: usually the first point test is used to offset the bearing surface gap and the test results, should be from the second statistical results。

⑧ Screw cases (30) is to protect the screw (26) is not affected by dust that. Hardness tester when not in use or specimen height less than 100 mm, the set of outside the screw. When the specimen height is greater than 100 mm, it must be removed, in order to avoid the workbench jacking, the test is invalid。

## 7, The hardness tester maintenance and calibration

1、 Hardness tester should be in the temperature of  $25 \pm 10 \text{ }^{\circ}\text{C}$ , clean no vibration environment。

2、 Hardness tester for a long time need not when, the application of dust cover will cover machine。

3、 Regularly in the screw (26) and handwheel (27) interface into a small amount of oil。

4、 If found that the hardness tester is larger, of error (1) may be added a table to check it with screw contact surface is clean; (2) check whether screw case jacking work surface; (3) check whether the pressure head is damaged。

5、 If applying the main test force, pointer around to quickly, then slowly rotating, too little buffer in the oil, at this time can be set at the top of the buffer (7) felt pads, slowly into clean 20 # engine oil, at the same time many times pull push handle (15) (16), the piston moves up and down several times, buffer the air from the inside, until the piston down from time to time oil overflow from above. Note: due to the effect of temperature in the cylinder oil prone to rare stiff change, thus affecting loading speed, should adjust oil needle (14) in the circumstances to use requirement。

6、 Use this machine is equipped with standard hardness block check hardness tester precision value。

Clean the workbench and standard block, test on the hardness of the piece of work, not allowed to test on the surface of the support。

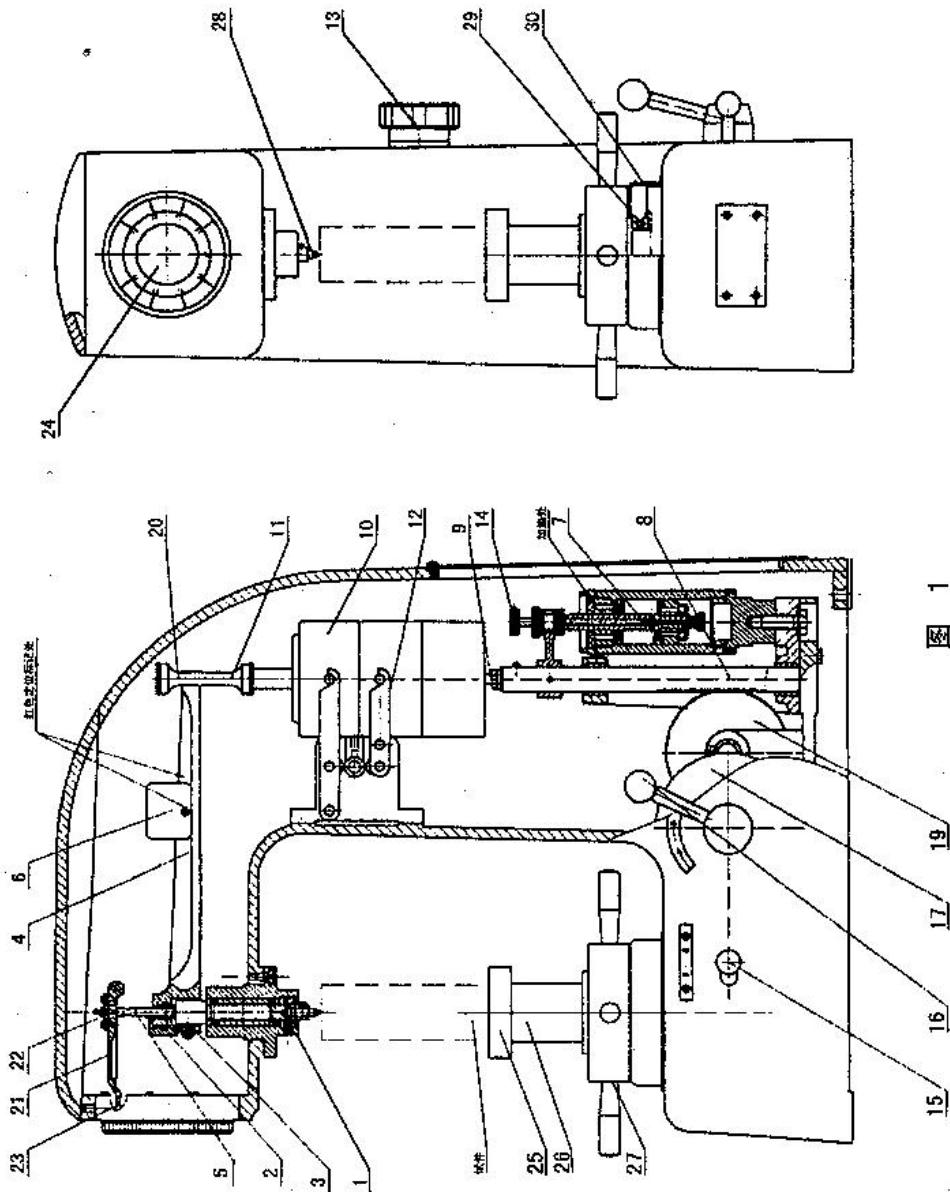
(2) If error value, in addition to according to the item 4 examination in this section, you should also check the standard hardness block bearing surface for burr, if there is burr sharpening stone lighting application。

(3) In the standard test pieces of different position, hardness block should be close to the work surface drag, it is forbidden to take away from the table。

(4) If hardness tester adjustment value: through the above work, hardness tester still larger, of error can be adjusted by plate (22) before and after the position, in order to achieve value for accuracy. Method is: loosen the adjusting plate (22) before and after the two M3 screws, back and

forth motion adjustment plate (22) location. Pay attention to while moving in the direction of indicator, increase in value, instead of decrease. After the adjustment shall be fixed tightly has two M3 screws loosen. Such as adjusted find pointer not vertical upward, can loosen the adjusting plate in the middle of the back on the M3 screw cap, rotate the screws to go to meet the requirements.

(5) If users have questions should contact manufacturer in other aspects, in order to get the right solution. It is strictly prohibited to remove and prevent unnecessary losses.



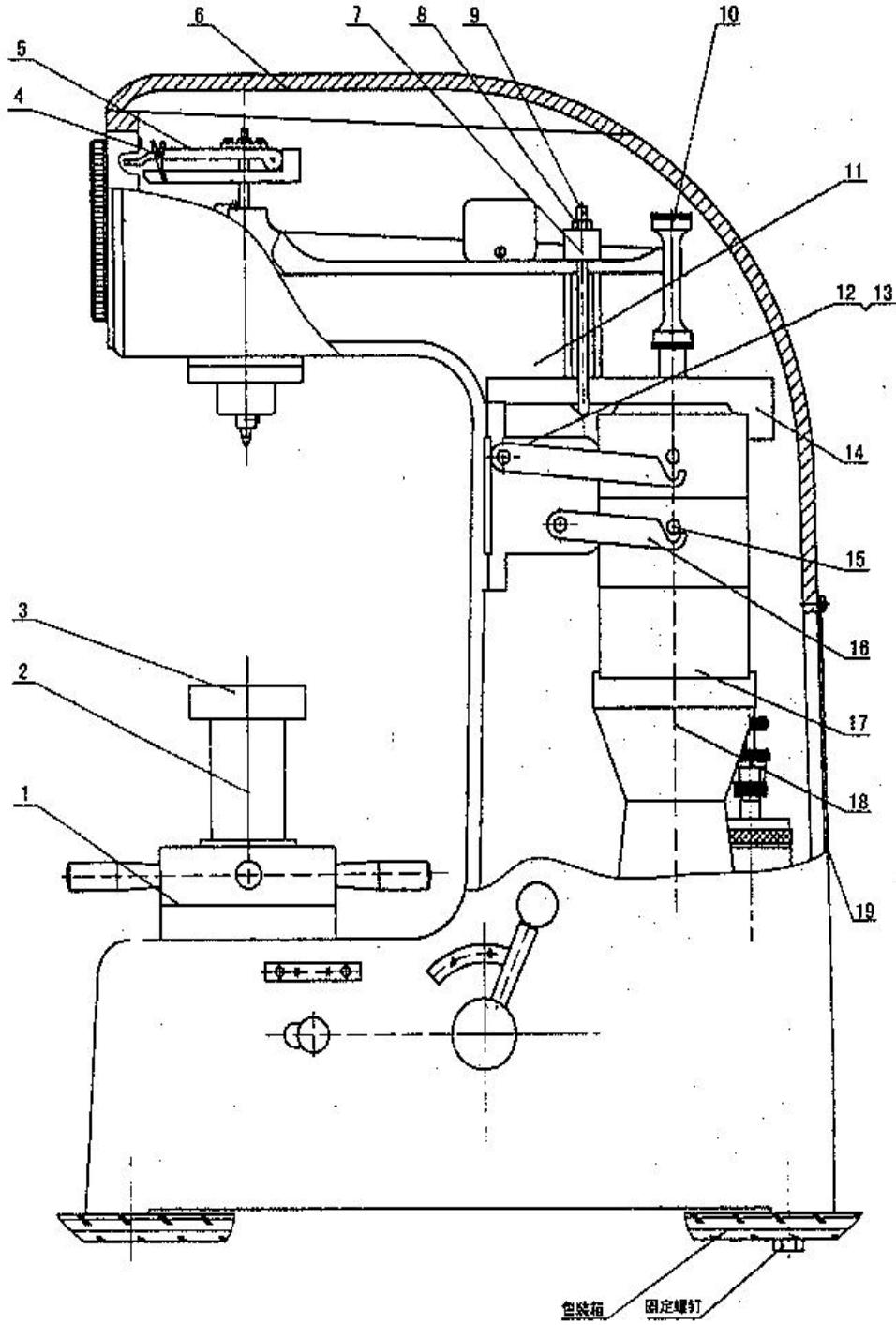


图 2

## Packing List

No	Item	Qty.
1	HR-150A Main Unit	1
2	Rockwell Diamond Indenter 120° Cone	1
3	φ1.588mm Steel Ball Indenter	1
4	φ1.588mm Steel Ball	1
5	HRA Hardness Block (80-88HRA)	1
6	HRB Hardness Tester Block (85-100HRB)	1
7	HRC Hardness Block(20-30HRC)	1
8	HRC Hardness Block(35-55HRC)	1
9	HRC Hardness Block(60-70HRC)	1
10	Large Testing Table	1
11	Small Testing Table	1
12	V Shape Testing Table	1
13	Big Screw Driver	1
14	Small Screw Driver	1
15	Accessories Box	1
16	Plastic Protection Cover	1
17	English Operation Manual	1
18	Product Certificate	1