Digital Display Manual Rockwell Hardness Tester

HR-150AS

Contents

I Summary

1, What is Hardness

It is the ability of material to resist elastic deformation, plastic deformation or destructive force. For indentation hardness tests, hardness is the ability of a substance to resist the indentation of another harder object of a certain shape and size into its surface.

2, The principle of Rockwell hardness Test

The Rockwell hardness measurement method is to press the test force F1 into the surface of the specimen under the action of two test forces (initial test force Fo and total test force F) applied successively with a specified pressure head. After the total test force is maintained for a certain period of time, the main test force F1 is removed. Retaining the initial test force, measuring the indentation depth H 1, indicating the Rockwell hardness by the difference between the indentation depth H 1 and the indentation depth ho under the action of the initial test force, and taking the axial displacement of the head as a Rockwell hardness unit, Generally read directly from the dial, the principle of which is shown in the following figure.

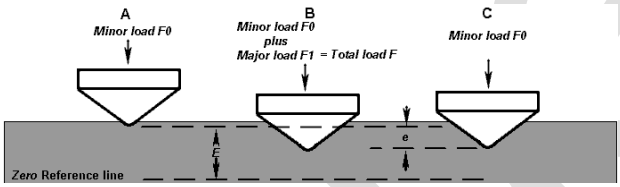
Rockwell hardness is shown by the following formula HR=K-

Type center C——Commonly used equal to 0.002mm

K——Constant when the diamond cone holder is used to 100，

When the ball head is used 130

Rockwell hardness test principle diagram



3, Characteristics of Rockwell hardness test

Rockwell hardness test adopts the method of measuring indentation depth, hardness value is read out directly by indication, so it is simple and easy to operate, easy to master, high work efficiency, suitable for the inspection of batches of parts and components.

Rockwell hardness test method can be used to measure hard and soft samples with diamond head and rigid ball head. Therefore, Rockwell hardness test has been widely used in production and has become a test of product quality. Determine the main testing means of reasonable processing technology. Rockwell hardness tester is the most commonly used testing instrument for hardness test, teaching and research work in production enterprises, universities and colleges and scientific research institutions.

II Application of Hardness Tester

Rockwell hardness test can choose different pressure head and test force according to the range of， material hardness and different test thickness, and use different scale to express it.

The most common used scale is HRA, HRB, HRC scales. The test force and pressure head of common scale are given in the following table. The numerical value of constant K and its Application range and an example of its Application.

Range of use of Rockwell hardness meter

Rockwell hardness scale	Hardness symbol	Head type	Initial test force Fo（kg.）	Main test force F1（kg.）	Total test force F（kg.）	constant	scope of application	Application example
A	HRA	Diamond cone head	10	50	60	100	20-88HRA	Hard metals and cemented carbides
B	HRB	Diameter 1.5875mm ball head	10	90	100	130	20-100HRB	Nonferrous metals and soft metals
C	HRC	Diamond cone head	10	140	150	100	20-70HRC	Heat-treated structural steel, tool steel
D	HED	Diamond cone head	10	90	100	100	40-77HRD	Surface quenched steel
F	HRF	Diameter 1.5875mm ball head	10	50	60	130	60-100HRF	nonferrous metal
G	HRG	Diameter 1.5875mm ball head	10	140	150	130	30-94HRG	Pearlite iron, copper-nickel, zinc alloy

HRA：Suitable for the determination of metals whose hardness exceeds 70HRC, such as tungsten carbide, cemented carbides, hard sheet materials and surface hardened materials.

HRB：Used for the determination of soft or medium hardness materials such as non-ferrous metals and their alloys, annealed steel or unhardened steel products.

HRC：Used to determine the hardness of heat-treated steel products such as carbon steel, tool steel and alloy steel.

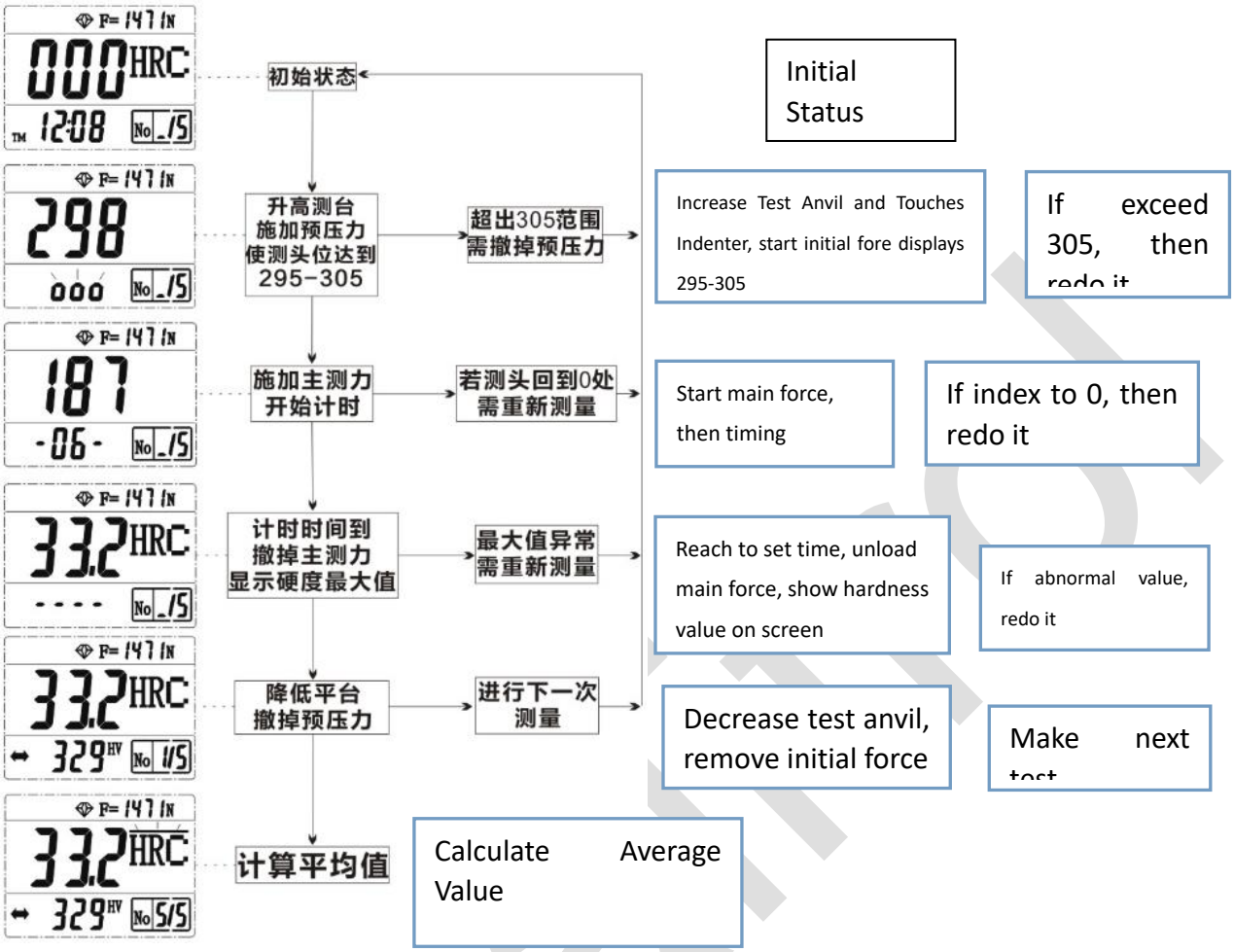
III Main technical parameters

1、Initial test force 98.07N（10kgf）
2、Total test force 588.4N（60kgf）980.7N（100kgf）1471N（150kgf)
3、indicator Digital display
4、Maximum height of specimen When the lead screw protector is added100mm
Without a lead screw cover170mm
5、Indentation center distance to machine wall 135mm
6、Hardness gauge shape dimensions 466×238×630mm
7、Hardness gauge net weight 65kg

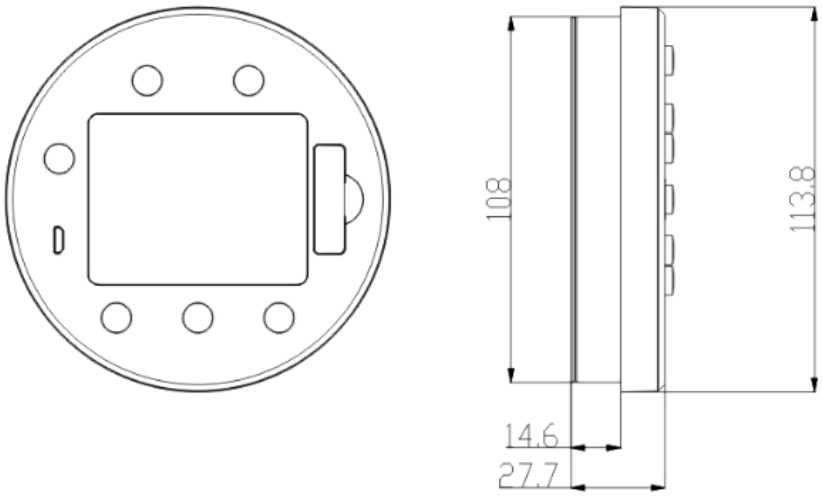
IV Performance index

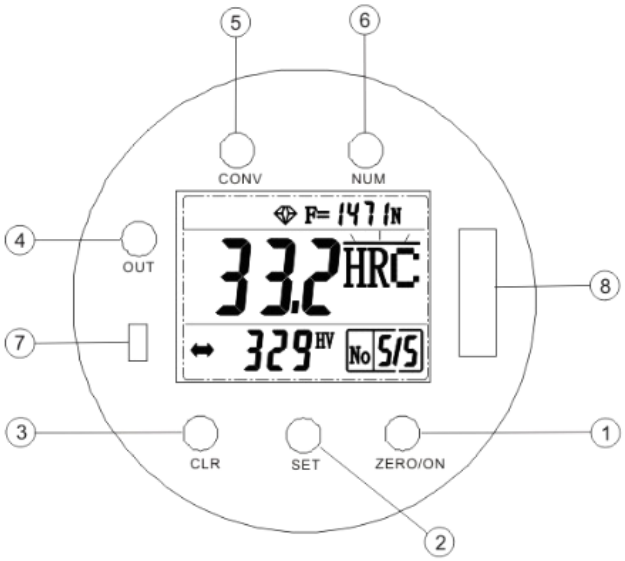
1、Support HRA, HRB, HRC hardness scales;
2、Very low power consumption, long service time, this product is powered by CR2450 battery.
3、with HV,HB hardness conversion function.
4、the resolution is 0.1HR.
5、with time display.
6、with data output function, can be connected to the computer or serial micro printer;

V Direction for use



VI Product appearance





1、ZERO/ON keystroke: short press reset, long press shut down;
2、Set key: short press select scales, long press clock setting;
3、CLR key: short press clear current measurement data;
4、Out key: long press output data;(recording data to a predetermined number of effective)
5、COVN key: short click average, long by switching conversion unit;
6、number button: set the average of test counts, max 9;
7、data output;
8、battery box

1、conversion units
2、 conversion results
3、Time indication
4、Unit conversion mark
5、 power shortage alert
6、hardness value
7、head type
8、force applied
9、unit of force
10、Mean value mark
11、surveyor's rod type
12、Surface Rockwell type supplement
13、average total
14、average current count

Print output format

Hardness data output to printer or computer in ASCII code, baud rate 38400,n,8,1，The output format is as follows：

2014-9-27 16:40（time）

No HRC（Serial number）

01 61.2（first hardness test）

02 61.0 （second hardness test）

03 60.8 （3rd hardness test）Avg 61.0

VII Brief introduction of Mechanism performance

The hardness gauge consists of a fuselage, a test force applying mechanism, a measuring indicator mechanism and a test piece support mechanism (see figure 1).

The fuselage is a closed shell. Except for the table, the lead screw and the handling handle, the other mechanisms are all installed in the fuselage shell to keep clean.

The test force exerting mechanism consists of spindle, lead screw, blade, weight buffer, weight transform mechanism, handle and so on.

The initial test force is mainly caused by the weight of parts such as spindle (1) circular knife (2) long diamond knife (3) large lever (4) and small lever (21) and the measuring pressure of indicator (24). When the specimen is in contact with the pressure head and continues to rise so that the large and small lever is in the horizontal position (indicator small pointer refers to Yu Hong point, the large pointer is vertical up) due to the weight of the lever, etc., and the measuring pressure of the indicator, The head can be subjected to (10kg) 98.07N of the initial test force.

The total test force is composed of the main test force (generated bythe weight of the weight) plus the initial test force, and two weights (10) and a hanger ring (11) are arranged on the rack shaft (8) of the buffer (7). When the piston of the buffer is lowered by the pull handle (15), the rack shaft (8) top rod (9) and the hanger ring (11) weight (10) are also lowered with the pull handle (15), The weight of the weight (10) and the ring (11) acts on the large lever (4) so that the head is subjected to the total test force.

The fuselage is equipped with a weight variable load frame (12). When the handle (13) is rotated to different positions, three different total test forces of 1471N or 980.7N or 588.4N can be obtained.

The oil needle (14) is used to apply the main test force to maintain a certain speed and to avoid the impact phenomenon.

The handle (15) is used to apply the main test force, and the handle (16) is used to remove the main test force. When the handle (15) is pulled, the cam (17) and the gear (19) begin to rotate, and the rack shaft (8) push rod (9) and the buffer piston fall with each other, At the same time, the handle (16) is rotated counterclockwise, and the main test force can be fully applied when the ring is supported by a small knife (20) at the end of a large lever during the descent.

The measuring index mechanism is composed of a small lever (21), a lever (5), an adjusting plate (22), a connecting rod (23) and an indicator (24), etc. When the head of the rising specimen is pushed up, the lever (5) pushes up the small lever (21) to rotate the pointer of the indicator through the connecting rod (23).

The specimen support mechanism includes a worktable (25), a lead screw (26), a handwheel (27), a lead screw seat (31), a protective sleeve (29), a flat bearing (30). It is worth mentioning that compared with the same type of hardness meter of other manufacturers, the hardness meter has increased the protective cover (29) and the plain bearing (30) to avoid dust and debris sticking to the support surface during use, thus reducing the wear on the support surface. Thus, the operation is more lubricating and smooth, and the indication value is more accurate and stable.

VIII Installation of hardness gauge

1、Unpacking(see figure 2)

（1）、By opening the top cover of the box and removing the four screws at the bottom of the fuselage, the hardness meter can be installed in a dry, clean, non-corrosive gas and vibration-free room. The hardness gauge table should be sturdy and make holes larger than Φ 50 mm in diameter for the lead screw to pass through.

（2）、Check the completeness of accessories according to packing list.

（3）、open the upper cover (6) and the rear cover (19).

（4）、 loosen nut (8) remove hook head screw (9).

（5）、 remove the large lever fixed block (7) and the fixed support block (1).

（6）、 release nut (13) remove hook head screw (12) remove weight fixed pressure plate (14)

（7）、 hold the ring (10) with your hand and slowly lift up the weight group (17) and remove the weight fixing support block (18) at the same time, then gently drop the weight group (17). The weight cylinder pin (15) falls into the groove of the bracket plate (16) to hold the weight.

（8）、release of small lever fastening cord (4)

（9）、 turn the handwheel (1) to lower the lead screw (2) and remove the pressure head pad (3).

2、Unload the screw protector (30) with kerosene to wash the rust oil from the lead screw, handwheel, etc., then pour a small amount of lubricating oil into the contact place between the screw and the handwheel, and reapply the screw protection suit.

3、Check that the position of the adjustment block (6) on the large lever (4) is between two red marks, otherwise it should be reloaded into the correct position.

4、Install the large flat table on the top of the lead screw (26) and place the level on the surface of the table. Four bottom angle horizontal adjustment bolts are mounted on the bottom of the fuselage to adjust the levelness of the hardness meter to within 0.2 / 1000.

IX Operating methods and precautions

1、Preparatory work before the test

（1）、Adjust the application speed of the main test force: the handle (16) is placed in the unloading position, the hand (13) is transferred to the 1471N position, the standard hardness block of the 35-55HRC is placed on the worktable, the hand wheel (27) rotates the hardness block up the spindle, and the initial test force is added. Pull the handle (15) with the main test force, observe the large pointer of the indicator, and the time from start to stop shall be within the range of 4-8 seconds. If it does not conform, the rotating oil needle (14) shall be adjusted and repeated until the appropriate time.

（2）、Choice of test force: select test force according to need (reference-range of use). Turn (13) to point the selected test force at the red dot, but it must be noted that the handle (16) must be placed in the unloading state (that is, the post-limit position) when changing the test force.

（3）、Install head: select the appropriate head according to the range of use. When installing the head, attention should be paid to eliminating the gap between the head and the end face of the spindle (1). The elimination method is to install the pressure head and screw (28) to fix it gently, then place the standard block or specimen on the worktable, rotate the handwheel (27) with the initial test force, pull the handle (15) so that the main test force is applied to the pressure head, Tighten the screw (28) and eliminate the gap between the head and the spindle face.

（4）、Preparation and selection of specimen

The specimen should have a certain size and thickness, and the distance between the adjacent indentation center and the edge of the specimen should be more than 3 mm, and the minimum thickness of the specimen should not be less than eight times of the indentation depth. After the test, there shall be no obvious deformation marks on the supporting surface of the specimen. The minimum thickness of the specimen depends on the material and the load used. Please refer to the following table of the minimum thickness of the specimen.

Sample minimum thickness table

surveyor's rod	hardness value HR	minimum gage （mm）	surveyor's rod	hardness value HR	minimum gage （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

Generally, the specimen is plane. If the surface specimen is tested, if the curvature radius is small, the test result should be corrected. For convex specimens, corrections should be added, and for concave specimens, corrections should be subtracted. The correction of cylindrical specimens can be referred to below table。

TABLE A6.1 Corrections to be Added to Rockwell C, A, and D Values Obtained on Convex Cylindrical Surfaces of Various Diameters[A]

Dial Reading	Diameters of Convex Cylindrical Surfaces								
	¼ in. (6.4 mm)	⅜ in. (10 mm)	½ in. (13 mm)	⅝ in. (16 mm)	¾ in. (19 mm)	⅞ in. (22 mm)	1 in. (25 mm)	1¼ in. (32 mm)	1½ in. (38 mm)
	Corrections to be Added to Rockwell C, A, and D Values[B]								
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	0.5
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	1.5	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

[A] When testing cylindrical specimens, the accuracy of the test will be seriously affected by alignment of elevating screw, V-anvil, indenters, surface finish, and the straightness of the cylinder.
[B] These corrections are approximate only and represent the averages to the nearest 0.5 Rockwell number, of numerous actual observations.

TABLE A6.2 Corrections to be Added to Rockwell B, F, and G Values Obtained on Convex Cylindrical Surfaces of Various Diameters[A]

Hardness Reading	Diameters of Convex Cylindrical Surfaces						
	¼ in. (6.4 mm)	⅜ in. (10 mm)	½ in. (13 mm)	⅝ in. (16 mm)	¾ in. (19 mm)	⅞ in. (22 mm)	1 in. (25 mm)
	Corrections to be Added to Rockwell B, F, and G Values[B]						
0	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

[A] When testing cylindrical specimens, the accuracy of the test will be seriously affected by alignment of elevating screw, V-anvil, indenters, surface finish, and the straightness of the cylinder.
[B] These corrections are approximate only and represent the averages to the nearest 0.5 Rockwell number, of numerous actual observations.

The table surface of the specimen must be polished or polished, the roughness of the table surface shall be not less than 1.6, and the hardness of the material shall not be affected during processing, that is, the working-hardening or tempering should not occur, the roughness of the table surface of the supporting surface shall not be less than 3.2, and the working face of the specimen, The supporting surface and the working table surface should be clean and free from oil pollution. The sample should be placed smoothly on the worktable, and no movement should occur during the test.

The specimen must be installed to ensure that the applied test force is perpendicular to the test surface. For specimens with bending and other irregular shapes, the appropriate type of special worktable must be adopted and the correct test position should be selected. For example, for cylindrical specimens, a "V" worktable must be used.

2、Test procedure

① Wipe the top face of the lead screw (26) and the upper and lower face of the selected worktable, and place the worktable on the upper side of the lead screw (26).

② Wipe the test piece support surface and place it on the workbench. Rotate the handwheel (27) to make the table rise slowly, and push up the indenter. The small pointer to the indicator points to the red dot, and the large pointer rotates three times vertically upwards (allows a difference of ±5 scales, if more than 5) Scale, this point is void, retest). Note: When the

workbench is raised, there is absolutely no backlash.

③ Display (24) Digital Clear Press the zero button on the display .

④ Pull the loading handle (15) and apply the main test force, when the display number drops.

⑤ The unloading handle (16) can be pushed back in 2-3 seconds to remove the main test force after the display digital change has been significantly stopped and maintained for 15 seconds. Note: the application and removal of the main test force should be carried out slowly and without impact.

⑥ Turning the handwheel causes the specimen to drop, then move the specimen, and carry out the new test according to the (2)-(6) process above. Note: the specimen must be moved close to the working table. B: must ensure that the distance between the adjacent indentation center and the center to the edge is more than 3 mm; C: normally, the first test is only used to offset the gap between the supporting surfaces, the test results are not counted, should be from the second point statistical test results.

⑦ The lead screw cover (30) is designed to protect the lead screw (26) from dust. When the hardness meter is not in use or when the specimen height is less than 100 mm, cover it outside the lead screw. When the height of the specimen is more than 100 mm, it must be removed so as not to raise the table and invalidate the test.

X Maintenance and Adjustment of hardness Meter

1、The hardness meter should be used in a clean, vibration-free environment with a temperature of 25 ±10 ℃.

2、Cover the machine with a dust-proof cover when the hardness meter is not used for a long time.

3、Regular injection of a small amount of oil at the interface between the lead screw (26) and the handwheel (27).

4、If it is found that the indication error of the hardness meter is large, (1) the worktable can be removed to check whether the contact surface with the lead screw is clean; (2) the lead screw protective sleeve is checked to raise the working table surface; and (3) the pressure head is checked whether the head is damaged or not.

5、If the main test force is applied, the display number starts to rotate quickly and then slowly,

indicating that there is too little oil in the buffer. At this time, the felt pad at the upper end of the buffer (7) can be lifted, and the clean oil 20# is slowly injected. At the same time, the handle (15) (16) is pulled multiple times so that the piston moves up and down many times, leaving all the air in the buffer out until oil overflows from the top when the piston sinks to the end. Note: due to the influence of temperature on the oil in the cylinder oil is easy to produce thin and thick changes, thus affecting the loading speed, the oil needle (14) should be adjusted according to the situation to meet the use requirements.

6、Check the precision of the hardness meter regularly with the standard hardness block worn by the machine。

Wipe the worktable and standard block clean, test on the hardness block working face, never allow the test on the supporting surface.

（2）If the error of indication is great, in addition to checking according to item 4 of this section, we should also check if there are burrs on the support surface of standard hardness blocks, and if there are burrs, use oil stone to polish。

（3）If the error of indication is great, in addition to checking according to item 4 of this section, we should also check if there are burrs on the support surface of standard hardness blocks, and if there are burrs, use oil stone to polish。

（4）The indication value adjustment of the hardness meter: if through the above work, the indication error of the hardness meter is still large, and the precision requirement of the indication value can be achieved by adjusting the front and back position of the plate (22). The method is to loosen two M 3 screws on the adjusting plate (22) and move the position of the adjusting plate (22) back and forth. Note that when moving toward the indicator direction, the indication value increases, otherwise the value decreases. After adjustment, fasten the two M 3 screws that have been released. If it is found that the pointer of the indicator is not vertically upward, the back cap on the M3 screw in the middle of the adjusting plate can be loosened, and the screw can be rotated to make the pointer meet the requirements.

（5）If the user has any other questions, contact the manufacturer in time to get the correct solution. It is strictly forbidden to disassemble by oneself to prevent unnecessary loss.

XI State description

1.Power on initial state

Short press [SET] key to set surveyor's rod type, head type and obvious with change, long press [SET] key to set the time limit, detailed operation see step 7, press [NUM] key, can change the average total, range of 1, 9, Press [CLR] key to clear the most recent measurement data, long press [OUT] key output data, the number of times when the keys are valid, the third row show "TM12:08" table current time is 12:08；

2、Preloading

If the third row "OOO;" continues to increase initially, the third row flashes the EEE warning error when it exceeds 305. After the error, the processing of the next step will not be entered, until the initial measurement is completely removed, the displacement of the probe is 0, and the initial state of the power on is restored. If the probe leaves the component completely and the data is likely to be below zero or negative, press the [ZERO] key to reset, and the [HRC] symbol begins to appear.

3、Applying the main test

After the initial preloading is in place, the main measurement will be applied, the displacement data of the probe will change, and the third row will begin to show the main test addition time, in seconds, the most measured time is 99S.

Note: in this process, if the head displacement continues to decrease back to zero, the system will judge that the operation is incorrect, and the hardness meter will return to the initial state of electrification, requiring a new measurement.

4、Remove the main test

When the timing time comes, the main test can be removed, the second time display disappears, the HRC symbol is lit up, the hardness meter starts to show the actual hardness value, at this time, the system will show the maximum value recorded in the measurement process; After the stability of the most measured values, the [NUM] bond and [CONV] bond can be long pressed into the lever correction state, and the body operation can be seen in step 8. During this process, if the hardness value display exceeds 100.0 or 130, the third row flash EEE, needs to withdraw the initial remeasurement.

5、Remove preloading

When the data is stabilized, after removing the preload, the probe will begin to decrease, the displacement data will change, but the hardness display position will remain the original data, and the measurement result will be explicit. In the average window, the counting value will be

added 1; At this time, press [CLR] key to give up the measured data, the calculated value will be reduced by 1, show the last measurement results, reduced to 0 time back to the initial bound; When the measurement result is explicit, the long press [CONV] key can switch the conversion unit, and the conversion value will change accordingly, but beyond the range will show the FFFF; when the calculated value is equal to the total number of the average, the short press [CON] V] key hardness value will show the average value, and the "-" symbol on the HR will flash, then press [CONV] key to exit the average value display, and the symbol will stop flashing; if the measurement continues, the count will remain the same, and the measured data will not be stored. At this point, you can long press the [OUT] key to output data to a printer or computer.

6、Next measurement

The probe will be lifted again, and when it comes to the next measurement, jump to step 2; You can also press [ZERO] to jump to step 1, that is, to return to the initial state of electrification, and in the process of steps 1 to 4, if you press the [ZERO] key, the hardness meter returns to the initial state of electrification.

7、Time setting

Press the [SET] key at the initial state length and enter the clock setting state, as shown in the figure：

The position of the dot matrix is Ytable year, the third row is the year.

Of which "14" flashed，

Short press or long press [CLR] to add 1; continue to press SET shortly

The keys will flash M, D, H, m in sequence.

Time division, short press in the process

[CLR] key corresponds to flashing data plus 1, long press

[CLR] button can be added quickly; shortly press [SET] after the minute setting is completed. Key, exit time modification and save, return to the initial state; throughout the process

Press the [ZERO] key to exit the time modification without saving.

8、Leverage correction

In step 4, press the [NUM] key and the [CONV] key to enter the lever correction state.

The third row will be corrected in length, and the initial correction will be 1.000. Press [CONV] to repair.

Is increasing by 0.001, long press is increasing continuously;

[NUM] key correction minus 0.001, long

Press to decrease continuously. The hardness value will change with the coefficient of the example.

The corresponding changes. When the hardness value is adjusted to the value,

Press the [SET] key momentarily to save the correction factor and exit the correction status.

Go back to step 4. If you withdraw the initials during this process

The hardness tester will exit the lever correction to display the current measurement result.

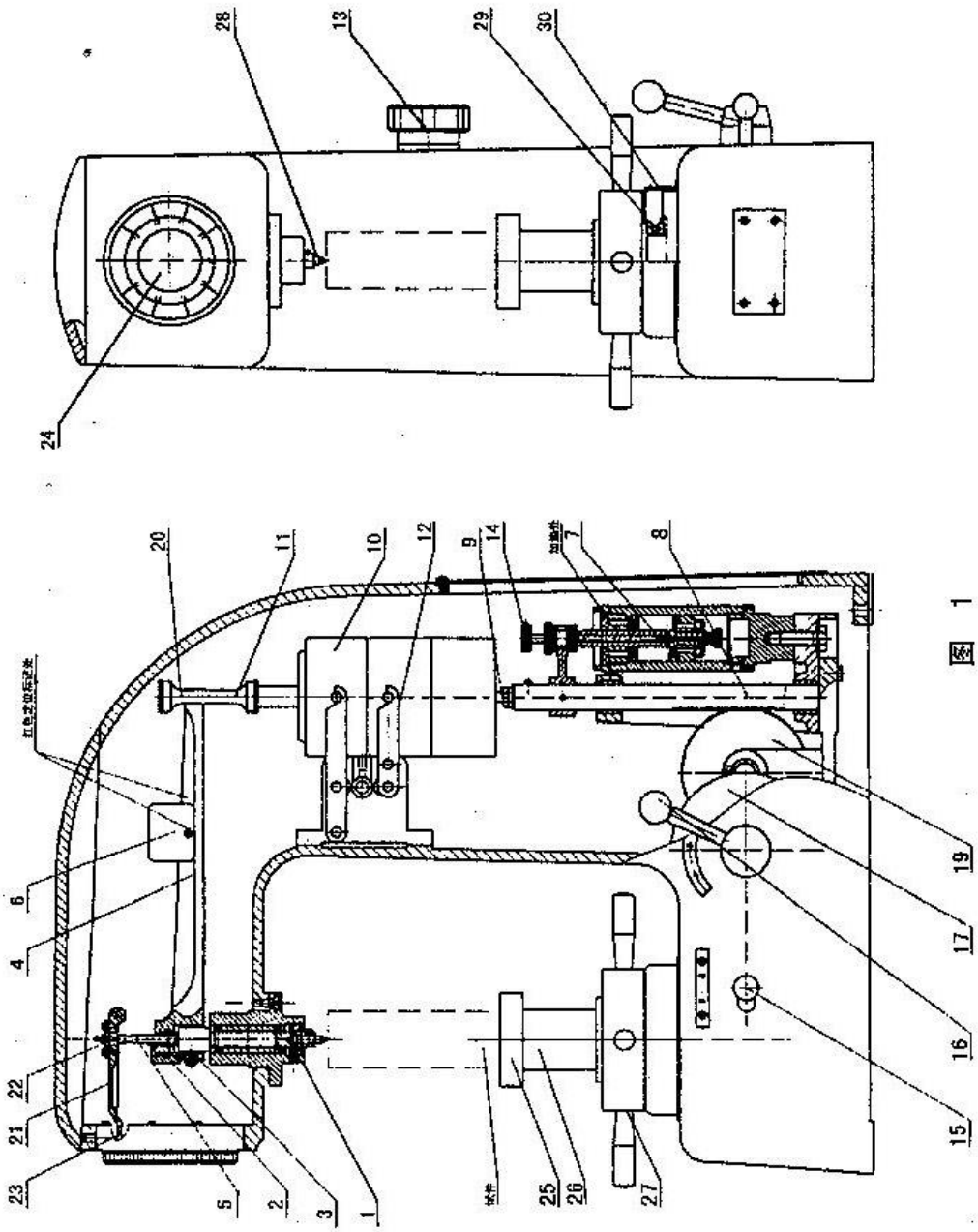


图 1

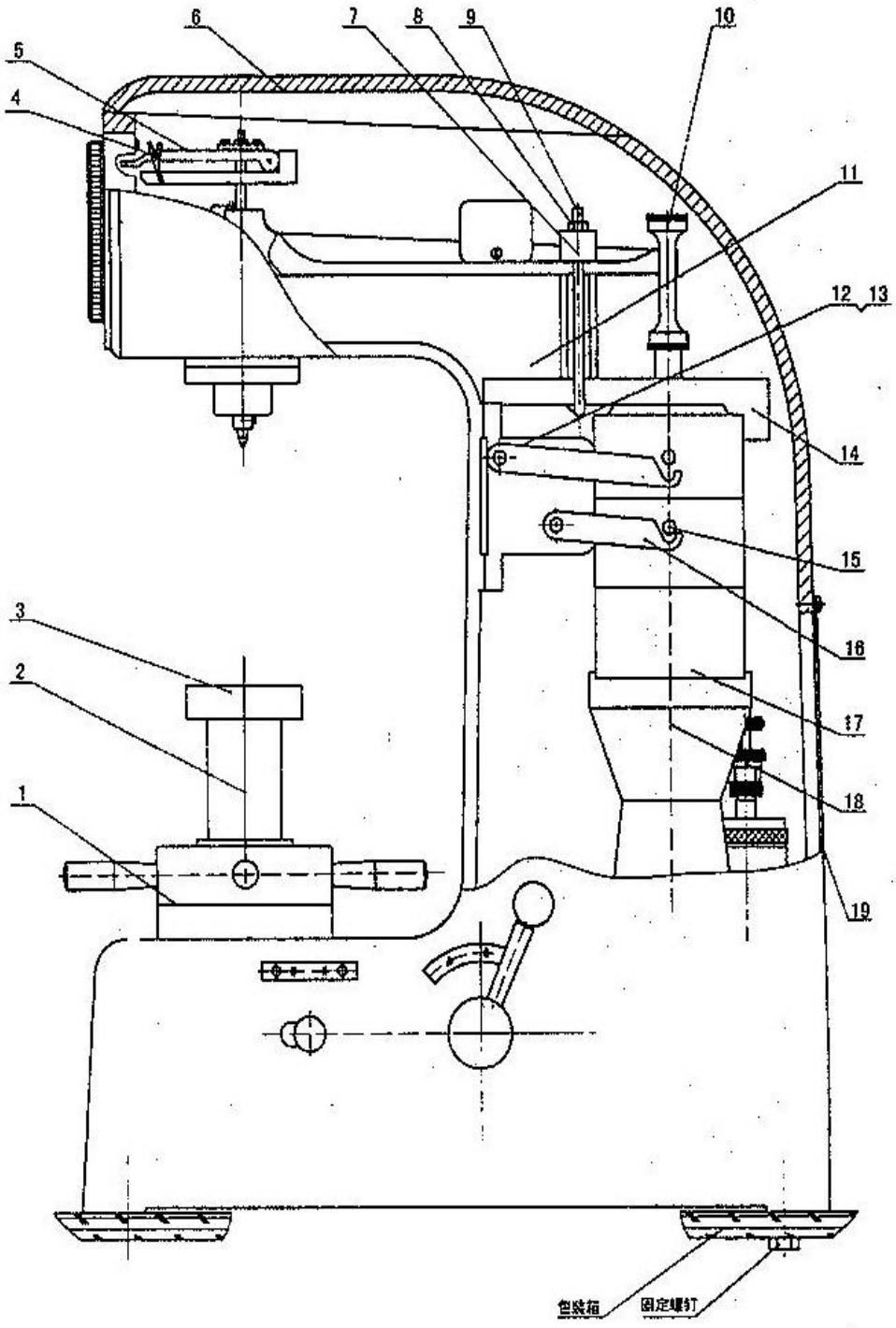


图 2