

DASQUA DIGITAL BRINELL/ROCKWELL/VICKERS
HARDNESS TESTER
USER MANUAL
CODE:1804-3611-A



Dasqua Technology Co., Ltd.

NOTES

1. The instrument's power socket must be used unidirectional three-core socket, the grounding end must comply with the specified protective grounding requirements.
2. In the use of this instrument should be carefully read before the instruction manual, a detailed understanding of the instrument operating procedures and precautions for use, to avoid damage to the instrument due to improper use or personal safety accidents.
3. The instrument's electrical components, switches, sockets installation location, is strictly prohibited to disassemble. If unauthorized disassembly, it may cause accidents.

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I Synopsis

Hardness tester has seven levels of test force, three test methods for users to choose. Vickers hardness (HV) has two levels of test force; Brinell hardness (HB) has three levels of test force; Rockwell hardness (HRA, HRB, HRC) has three levels of test force, to meet the user's needs for a variety of hardness testing.

Rockwell hardness value is read directly by the touch screen, Vickers, Brinell hardness value is measured by the digital microscope (measured in two directions perpendicular to each other) and then displayed on the screen. The loading, holding and unloading of the test force adopt the motor to control the speed automatically. The instrument has high sensitivity and stability, strong operability, widely used in workshops and laboratories.

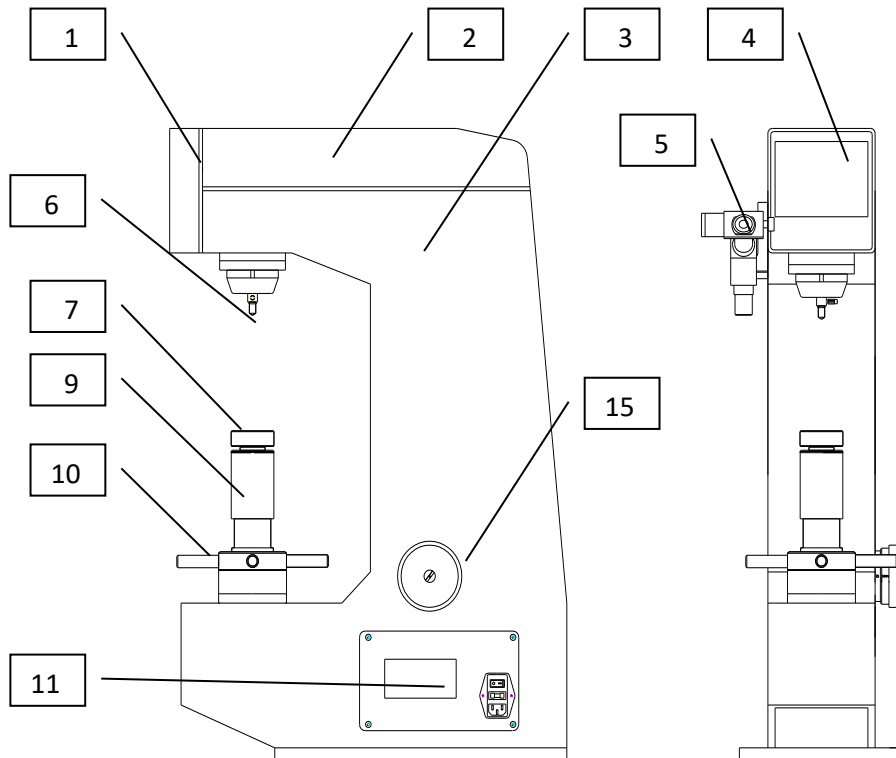


Fig 1

1. FACE-PIECE 2. SUPERSTRUCTURE 3. MAIN PART 4. TOUCHSCREENS 5. DIGITAL MICROMETER 6. INDENTER 7. TEST BENCH 9. PROTECTIVE SLEEVE FOR SCREWS 10. ROTATING DISK 11. PRINTER 15. MANUAL OVERRIDE

II Installation of the hardness tester

2.1 Operating conditions of the hardness tester

- 2.1.1 Between room temperature (23 ± 5) °C;
- 2.1.2 The relative temperature of the room is not greater than 65%;
- 2.1.3 In a vibration-free environment;
- 2.1.4 No surrounding corrosive media.

2.2 Main technical parameters and installation process

- 2.2.1 Maximum permissible height of the specimen:
 - a. Rockwell hardness:260mm;
 - b. Vickers, Brinell hardness:200mm.
- 2.2.2 Maximum distance from the center of the indenter to the machine wall: 165mm;
- 2.2.3 Test force: (294.2, 306.5, 588.4, 612.9, 980.7, 1471, 1839)N.
- 2.2.4 Microscope magnification: 37.5×, 75×;
- 2.2.5 Overall dimensions: 600 x 260 x 820mm (L x W x H);
- 2.2.6 Weight: about 80kg;
- 2.2.7 Power supply voltage: AC220/50HZ. The power socket must be a three-pronged socket, and the grounding terminal must comply with the specified protective grounding requirements.
- 2.3 Unpacking and installation
 - 2.3.1 The table on which the instrument is placed should be stable (see Fig. 2, the external dimensions are for reference only) and adjusted to the level, the level is not more than 1m/mm, and a $\phi 90$ mm hole should be opened on the suitable position of the table for the lifting and lowering of the wire rod.

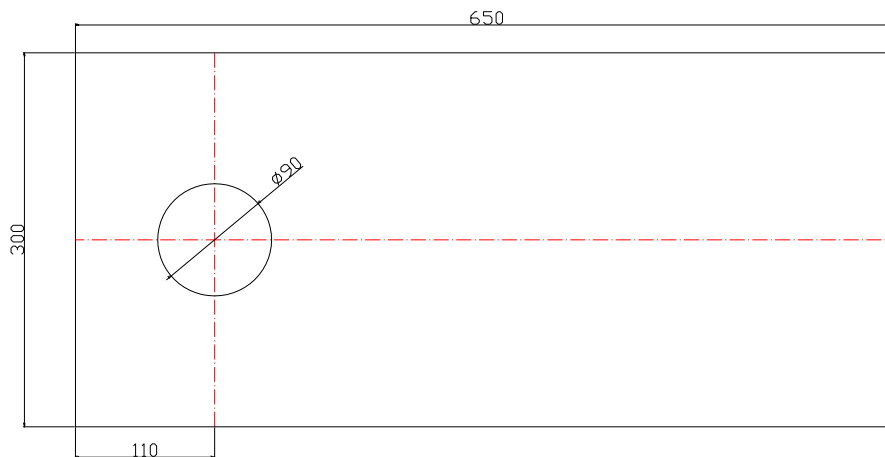


Fig 2

2.3.2 Cut the packing tape on the outside of the box, unscrew the four nuts underneath the box, lift the box upward and remove the two mounting screws on the bottom plate. Remove the two mounting screws on the bottom plate.

2.3.3 Put the hardness tester on the adjusted working table (the lifting screw of the instrument should be in the center of the $\phi 90$ mm hole of the working table).

2.3.4 Remove the sash from the rotating wheel (10), turn the wheel in the opposite direction and remove the washer between the lifting screw and the indenter shaft. Loosen the screws on both sides of the shield (9) on the outside of the lifting screw, remove the shield, wipe the anti-rust oil on the lifting screw with gasoline, apply an appropriate amount of thin oil lubrication after it dries, put on the shield, and tighten the screws (the upper plane of the shield should be the same as the plane of the lifting screw cam, and pay attention to it, not the worktable mounting plane).

2.3.5 Open the top and back covers, remove the rubber bands from the measuring levers, and remove the sash from the boom, being careful not to cause errors in the hardness values.

2.4 Installation of weight sets

2.4.1 Remove the weights from the accessory box and wipe them clean and read the numbers on the weights. Turn the handwheel (15) on the instrument to 306N.

Put the weights into the boom bracket one by one in the order of 4, 3, 2, 1, 0, the cylindrical pin on the weights should be in the groove of the fork bracket, put in the weight 4 first, turn the load change handwheel slowly, when the fork bracket and the cylindrical pin of the weights are just disengaged, see if the boom and the weights are shaking, if shaking, it means that the weights have not been put in place properly, adjust it in the horizontal and circumferential

directions until there is no shaking between the boom and the weights. Adjust in both horizontal and circumferential directions until the boom and weights do not shake (When installing the weights, do not turn the variable load handwheel, as this will cause misalignment of the gears of the instrument and mismatch of the test force.)

Put in weight 3 again, repeat the above operation, and place all four weights with the same requirement (pay attention to the level of the instrument, you can put a level meter on the working table of the instrument for calibration). (see Fig 3)

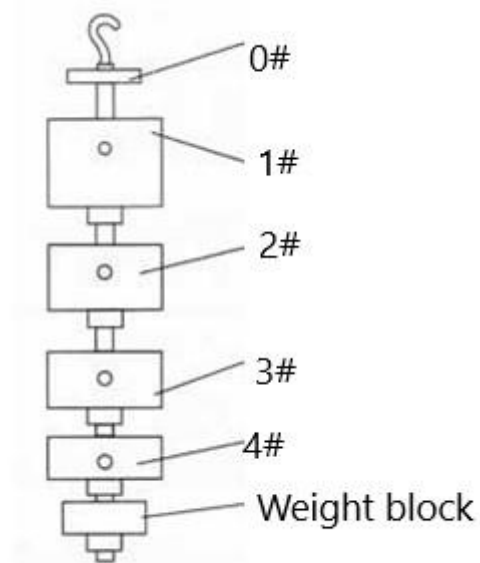


Fig 3

2.4.2 The composition of the test force is the same as the scale value on the variable load handwheel, and different scales should be used to select the corresponding test force.

The corresponding test force should be selected for different scales, see Table 1

Note: The test force of HV in the first row of Table 1 is 294.2N, while the value on the variable load handwheel is 306N, because the test force of HV30 is 294.2N, while the test force of HB31.25 is 306.5N, and the second level of the test force is quite close to that of the test force, so we adopt the method of adding or taking the weight of No.0. Please read the requirements of Table 1 clearly in the use of the user.

Table 1

| REAR SIGHT | SELECTION OF TEST FORCE (N) | VARIABLE LOAD HANDWHEEL SCALE (N) | FORCE ON WEIGHTS (WEIGHT NUMBER) | NOTE |
|------------|-----------------------------|-----------------------------------|----------------------------------|-------------------------------|
| HV | 294.2 | 306 | stick | Remove the small No. 0 weight |
| HB | 306.5 | 306 | stick + #0 | Place the No. 0 in its place |
| HRA | 588.4 | 588 | stick + #0 + #4 | |
| HB | 612.9 | 613 | stick + #0 + #3 | |
| HV/HRB | 980.7 | 980 | stick + #0 + #2 + #3 | |
| HRC | 1471 | 1471 | stick + #0 + #1 + #3 + #4 | |
| HB | 1839 | 1839 | stick + #0 + #1 + #2 + | |

III Installation of Rockwell hardness tester

3.1 Rockwell hardness test is a diamond cone indenter or a certain diameter ball indenter in the initial test force F_0 and the main test force F_1 successively under the action of compression into the specimen to the total test force $F = (F_0 + F_1)$ under the action of a certain period of time, unloading the main test force to retain the initial test force of the depth of the indentation of the initial test force h_1 and the initial test force under the action of the depth of the indentation of the difference between the depth of the indentation of h_0 $e = (h_1 - h_0)$ to indicate the depth of the indentation of the permanent increment.

The permanent increment of the indentation depth is expressed by $e = (h_1 - h_0)$. Each 0.002 mm of indentation is a Rockwell hardness unit. Rockwell hardness test is characterized by fast hardness testing, leaving a small indentation, widely used as a means of testing the hardness of the test piece.

3.2 Rockwell hardness test formula: HRA, C = $100 - e/0.002$, HRB = $130 - e/0.002$.

3.3 Commonly used Rockwell hardness test scales, indenters, test forces and application ranges (Table 2)

Table 2

| REAR SIGHT | INDENTER | INITIAL TEST FORCE (N) | TOTAL TEST FORCE (N) | APPLICATION EXAMPLES |
|------------|---|------------------------|----------------------|---|
| A C | Diamond indenter with 120° cone angle Tip spherical radius 0.2mm | 98.07N | 588.4 | Carbide, carburized steel |
| | | | 1471 | Hardened steel, tempered steel, hard cast iron |
| B | 1.5875mm ball | | 980.7 | Soft steel, aluminum alloys, copper alloys, malleable cast iron |

3.4 Rockwell hardness technical parameters

3.4.1 Initial test force: 98.07N $\pm 2.0\%$

3.4.2 Total test force: 588.4N, 980.7N, 1471N $\pm 1.0\%$

3.4.3 Indenter used

1) Diamond Cone Indenter 2) 1.5875mm ball

3.4.4 Tolerance and Repeatability Requirements for Durometers (Table 3)

Table 3

| REAR SIGHT | HARDNESS RANGE OF STANDARD BLOCKS | TOLERANCE OF DUROMETER | REPEATABLE |
|------------|--------------------------------------|-------------------------------|--------------|
| A | 20~ 40HRA 40~ 75HRA 75~ 88HRA | ±2.0HRA ±2.0HRA ±1.5HRA | ≤0.02(100-H) |
| B | 20~ 45HRB 45~ 80HRB 80~ 100HRB | ±4HRB ±3HRB ±2HRB | ≤0.04(130-H) |
| C | 20HRC~ 70HRC | ±1.5HRC | ≤0.02(100-H) |

Note: H is the average hardness value

3.5 Rockwell hardness test conditions

3.5.1 The surface of the test specimen should be smooth and clean, and the supporting surface of the test specimen should be in good contact with the test bench.

3.5.2 The test specimen shall be placed stably on the test bench and shall not be moved during the test to ensure that the test force is applied perpendicularly to the test specimen.

3.5.2 The minimum thickness of the test piece depends on the desired hardness value (Table 4), and no traces of deformation are allowed on the backside of the test piece after the test.

Table 4

| THICKNESSES REAR SIGHT | HARDNESS VALUE | | | | | | | | | | |
|---------------------------|----------------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|
| | 20 | 25 | 30 | 40 | 50 | 60 | 67 | 70 | 80 | 90 | 100 |
| HRA | | | | | | | | | 0.4 | 0.2 | / |
| HRB | | 2.1 | 2.0 | 1.8 | 1.6 | 1.4 | 1.25 | 1.2 | 1.0 | 0.8 | 0.6 |
| HRC | 1.6 | 1.5 | 1.4 | 1.2 | 1.0 | 0.8 | 0.7 | 0.6 | / | / | / |

When the test specimen is cylindrical, the "V" test stand must be used. When the test specimen diameter is less than 38mm, the test results can be corrected according to the different diameter parameters as shown in (Table 5, Table 6).

Corrections to Rockwell C and A scales for cylindrical specimens Table 5

| HARDNESS VALUE (HR) | CYLINDRICAL SPECIMEN DIAMETER (MM) | | | | | | | | |
|---------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|
| | 6 | 10 | 13 | 16 | 19 | 22 | 25 | 32 | 38 |
| | CORRECTIONS TO ROCKWELL C AND A SCALES (HR) | | | | | | | | |
| 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 |

Corrections to Rockwell B scale for cylindrical specimens Table 6

| HARDNESS VALUE (HR) | CYLINDRICAL SPECIMEN DIAMETER (MM) | | | | | | |
|------------------------|--------------------------------------|-----|-----|-----|-----|-----|-----|
| | 6 | 10 | 13 | 16 | 19 | 22 | 25 |
| | CORRECTION FOR ROCKWELL B SCALE (HR) | | | | | | |
| 0 | 12.5 | 8.5 | 6.5 | 5.5 | 4.5 | 3.5 | 3.0 |
| 10 | 12.0 | 8.0 | 6.0 | 5.0 | 4.5 | 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 |

3.6 Rockwell hardness operation.

3.6.1 Turn on the power.

3.6.2 According to the technical requirements of the test piece, select the scale according to Table 2, and turn the variable load handwheel clockwise to determine the total test force.

3.6.3 When using the diamond indenter (6), the middle finger of the hand is pressed against the head of the diamond and gently pushed toward the indenter shank hole, against the supporting surface, the indenter shank notched plane is placed against the screw, the indenter stop screw (5) is tightened slightly, and the test piece is placed on the test bench (7).

3.6.4 Rotary wheel (10) clockwise rotation, lifting screw rises, should make the specimen slowly without impact with the indenter contact, until the hardness tester issued a "beep" sound, at this time has been applied to the initial test force of 98.07N, the motor began to run, automatically loading the total test force.

3.6.5 When the total test force is held, the screen displays a countdown, the total test force holding time of Rockwell hardness test is 5 seconds, the length of time can be adjusted.

3.6.6 When the total test force holding time is up, the motor rotates and automatically removes the main test force.

3.6.7 At this time, the data displayed on the hardness tester screen is the hardness value of the tested part.

3.6.8 Reverse the rotation of the lifting screw swivel wheel to lower the test stand, replace the test point and repeat the above operation.

3.6.9 Test points on each test piece not less than five points (the first point does not count). For large-volume parts inspection, the number of test points can be appropriately reduced.

3.7 Adjustment of hardness indications (Figure 4)

The precision of the hardness tester has been calibrated before leaving the factory, if the error is caused by the transportation process, the tester can make appropriate adjustments on the basis of understanding the structural principle of the instrument. Method: Remove the upper cover, if the measured value is lower than the standard hardness block, then loosen the M4 nut (b), turn the screw (c) clockwise in a small amount, then tighten the nut, and then test the indicated value until it is adjusted to the specified error range (Table 1), if the measured value is higher than the standard hardness block value, then rotate the screw in the opposite direction.

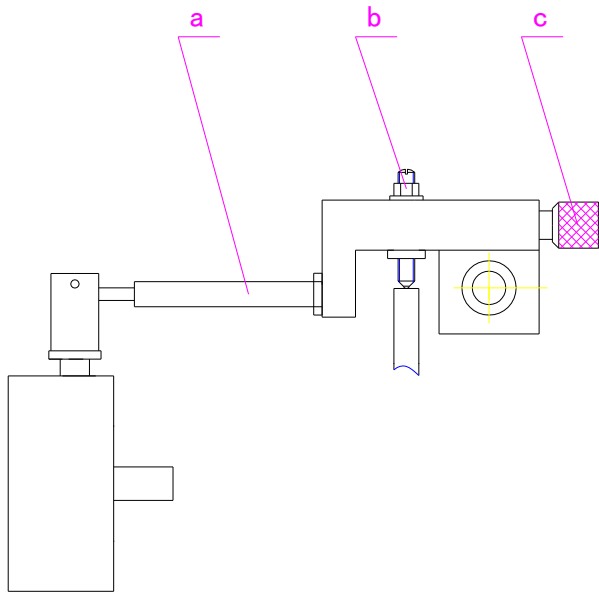
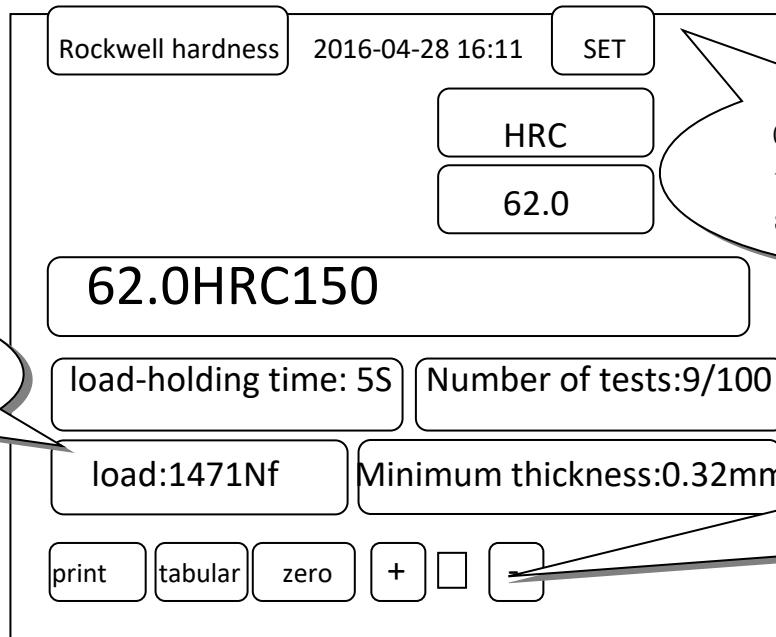
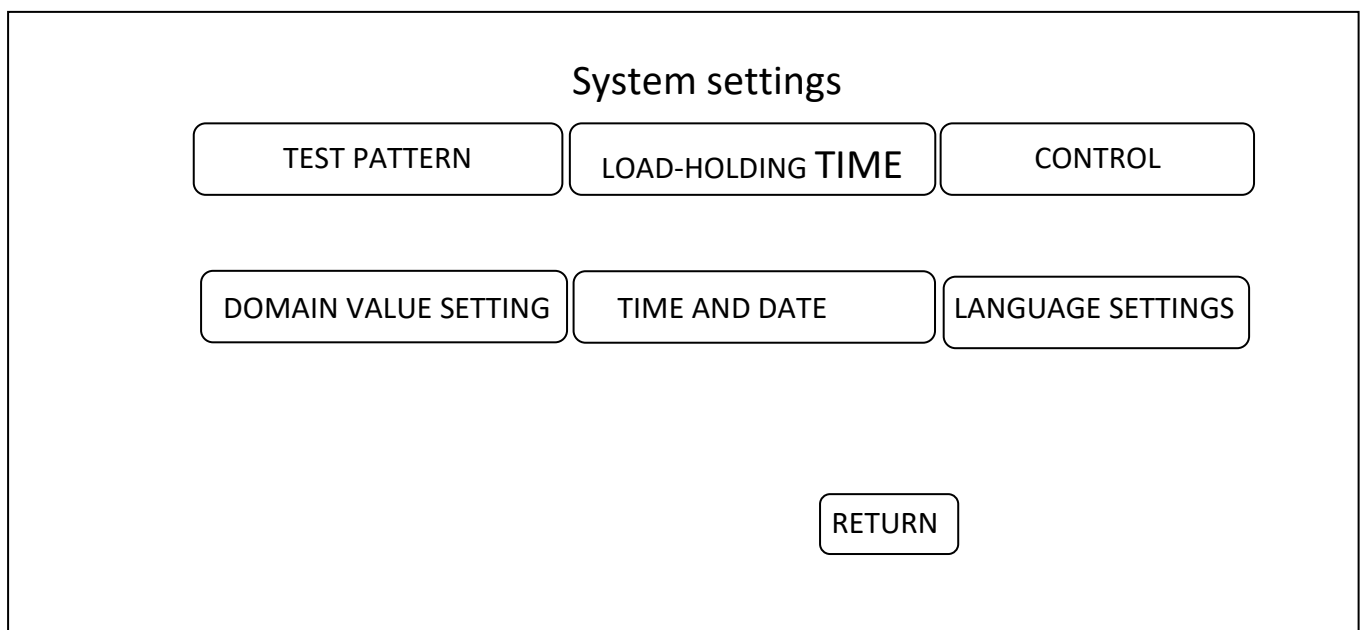


Figure 4

3.8 Rockwell hardness operation.

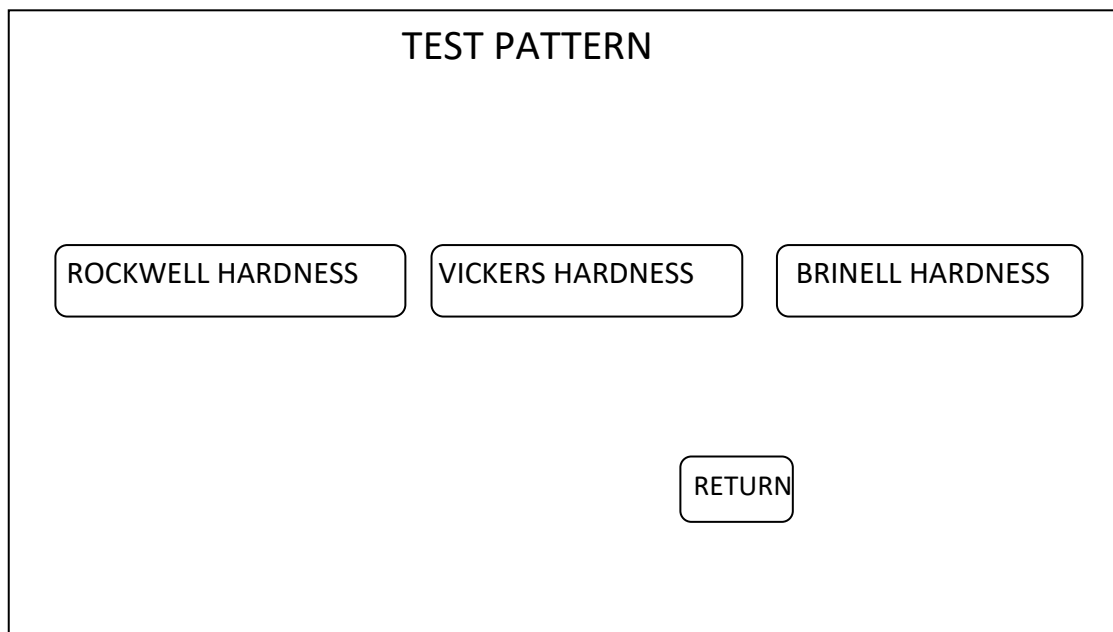


3.8.3 System settings



Note: Clicking on the buttons in the picture above will take you to the corresponding settings page.

3.8.4 Test mode page.



Note: Clicking on the buttons in the image above will take you to the corresponding test page.

IV Experimental method of Vickers hardness

4.1 The test method of Vickers hardness is to press a positive four-pronged conical diamond indenter with an angle of 136° on the opposite side into the surface of the specimen with a selected test force, and after a specified holding time (the holding time of the test force is 10–15 seconds), remove the test force, and then measure the lengths of the two diagonal lines of the indentation, d_1 and d_2 , to obtain the hardness value by means of a digital microprobe (Fig. 5).

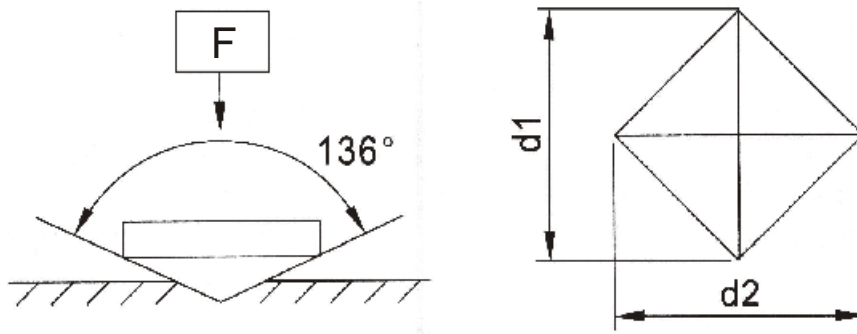


Fig. 5

4.2 Vickers hardness test formula

$$HV = 0.1891 \times \frac{F(N)}{d^2(mm^2)}$$

$$d = \frac{d1 + d2}{2}$$

4.3 Vickers hardness technical parameters

4.3.1 Test force: 294.2N, 980.7N, allowed error: ±1%

4.3.2 Indenter specification: Diamond positive quadrangular cone indenter

4.3.3 Vickers hardness measurement range: 14HV-1000HV

4.3.4 Maximum permissible error of Vickers hardness (Table 7)

Table 7

| Hardness Symbol | Hardness (HV) | Maximum Allowable Tolerance |
|-------------------------------------|---------------|-----------------------------|
| HV ₃₀ 、HV ₁₀₀ | < 300 | ±3% |
| | ≥ 300 | ±2% |

4.3.5 Durometer Repeatability (Table 8)

Table 8

| Standard block range | HV5-HV100 |
|----------------------|-----------|
| ≤ 225HV | ≤ 6.0% |
| > 225HV | ≤ 4.0% |

4.3.6 Measuring microscope magnification: 37.5x, 75x

a. When magnifying 37.5 times, use a 2.5× objective lens

b. When magnifying 75 times, use a 5× objective lens.

4.4 Vickers hardness test conditions

4.4.1 The test surface of the specimen is a smooth plane, and the surface roughness of the test surface must ensure that the diagonal of the indentation can be measured accurately, and is

generally not less than Ra0.2. The specimen shall be placed stably on the bench, and the contact surface must be clean; the specimen shall not be moved in the course of the test and the test force shall be applied perpendicularly to the specimen.

4.4.3 The thickness of the test specimen or test layer shall be at least 1.5 times the average diagonal length, and there shall be no visible signs of deformation on the backside of the test specimen after the test.

4.5 Operation of Vickers hardness (Figures 1 and 6)

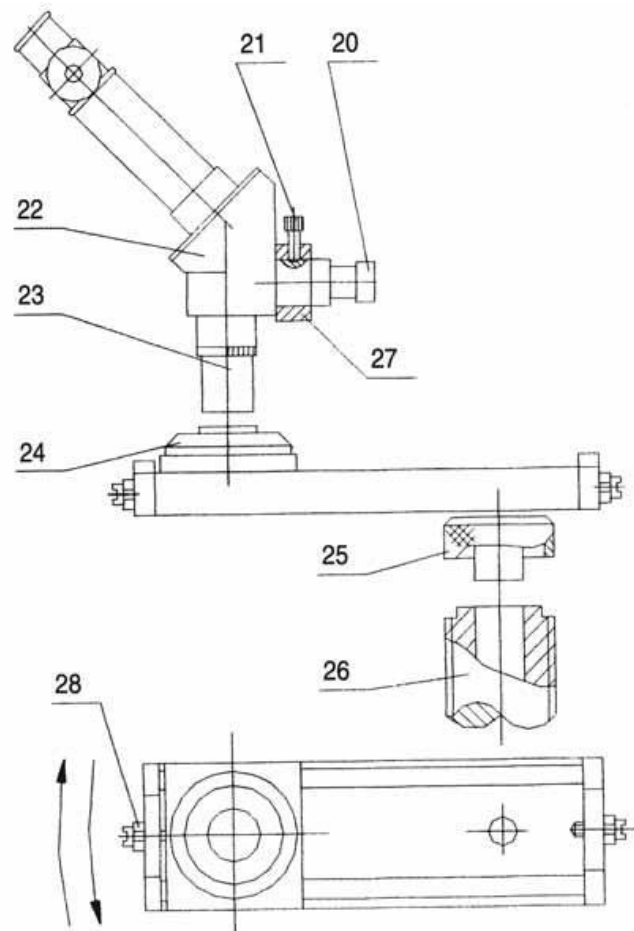


Figure 6

| | | |
|----------------------------------|----------------|-----------------------|
| 20. INTERNAL ILLUMINATION HEAD | 21. SCREWS | 22. MICROSCOPE HOLDER |
| 23. OBJECTIVE LENS | 24. TEST STAND | 25. KNURLED NUTS |
| 26. ELEVATING AND LOWERING SCREW | 27. STAND | 28. RETAINING NAILS |

4.5.1 Remove the special device from the accessory box and wipe off the rust preventive oil. Assemble the test bench (8) with the lifting screw (26) as shown in the diagram and tighten the knurled nut (25).

4.5.2 Insert the microscope holder (22) into the hole of the left bracket (27) of the hardness tester, align the pit and tighten the

screw (21). Require the lower plane of the microscope holder to be perpendicular to the test bench (24).

4.5.3 Insert the microscope eyepiece (5) and the internal illumination (20), (for Brinell hardness test use the external illumination cover). Screw the objective lens (23) into the microscope holder.

4.5.4 Place the specimen (7) on the test bench and move the upper skid plate to the outer stopper (28).

4.5.5 Turn on the power.

4.5.6 According to the test requirements of the test piece, turn the variable load handwheel to determine the test force.

4.5.7 To install a diamond tetragonal cone Vickers indenter (or ball indenter for Brinell hardness testing), place the middle finger of your hand over the head of the diamond and gently push it into the hole in the indenter rod, against the support surface, and tighten the indenter set screw slightly. Clean the indenter gently with a piece of mirror paper or a cotton ball of alcohol. Then place the test piece on the test stand (24).

4.5.8 Rotary wheel (10) clockwise rotation, lifting screw rises, should make the specimen slowly without impact with the indenter contact, until the hardness tester issued a "beep" sound, at this time has been applied to the initial test force of 98.07N, the motor began to run, automatically loading the total test force.

4.5.9 When the total test force is held, the screen displays a countdown, the total test force holding time of Vickers hardness test is 10 seconds, and the length of time can be adjusted.

4.5.10 For ferrous metals, the test force retention time is (10~15) seconds, and for non-ferrous metals (30±2) seconds.

4.5.11 Lower the test stand and move the skateboard test stand with the specimen smoothly under the microscope, leaning lightly against the retaining pegs.

4.5.13 Gradually micro-drop the test bench, and to lift the screw hole as the center, the skateboard will be turned to a certain angle, so that the skateboard and installed in the hardness tester on the left side of the objective lens alignment, and then through the microscopic eyepiece to focus, so that the indentation of the test piece on the image is clear.

4.5.14 Measure the diagonal lengths of the two indentations on the specimen. The difference between the two diagonal lengths should not be greater than 1.0% of the ratio of the shorter diagonal length.

4.5.15 Press the confirmation button on the eyepiece once for each diagonal length of the indentation and twice to display the Vickers hardness value on the screen.

4.5.16 The difference between the average hardness value measured by the above method and the standard block hardness value, and then the ratio of the hardness value to the standard block hardness value is the indication error of the hardness tester. The ratio of the difference

between the maximum value and the minimum value to the average value is the repeatability of the hardness tester, and the error and repeatability of the hardness tester shall meet the requirements of Table 7 and Table 8.

4.6 Vickers hardness operation.

The screenshot shows the Vickers hardness operation interface. At the top, it displays 'Vickers hardness', the date and time '2016-04-28 16:11', and a 'set' button. Below this, there are two columns of data: 'D1: 149.81um' and 'D2: 149.81um' on the left, and 'HRC' and '62.05' on the right. A large central display shows '747.3HV30' and 'Please enter D1!'. Below the central display, there are two buttons: 'load-holding time:10S' and 'Number of tests:9/100'. At the bottom of the main display area, there are 'Load: 294Nf' and 'Objective lens magnification: 75X'. Below the main display area, there is a row of buttons: 'print', 'table', 'zero', '+', a small square button, and '-'. Callouts provide instructions for these buttons: 'Click this button to print the test data' points to the 'print' button; 'Click this button to clear the D1/D2 value' points to the 'zero' button; 'Click on "+" and "-" to adjust the LED lighting.' points to the '+' and '-' buttons; and 'Click here to switch the objective lens magnification.' points to the 'set' button.

4.7 Load-holding time setting

The screenshot shows the load-holding time setting interface. At the top, it displays 'load-holding time'. Below this, there is a label 'load-holding' followed by a box containing '10' and the letter 'S'. To the right of this is a numeric keypad with buttons for digits 1 through 9 and 0. At the bottom of the interface, there are two buttons: 'ENTER' and 'RETURN'. A callout points to the numeric keypad with the text: 'Click here to set the time, e.g. 10 seconds, please click '1' '0'.'

V .Experimental method of Brinell hardness

5.1 Brinell hardness test is to use a certain diameter of the indenter, with the specified test force pressed into the surface of the object under test, hold for a specified period of time, remove the test force, with a readout microscope to measure the diameter of the indentation on the surface of the specimen, the calculation of the indentation of the spherical surface area of the average pressure borne by the pressure (N/mm²), i.e., the value of Brinell hardness (Figure 8).

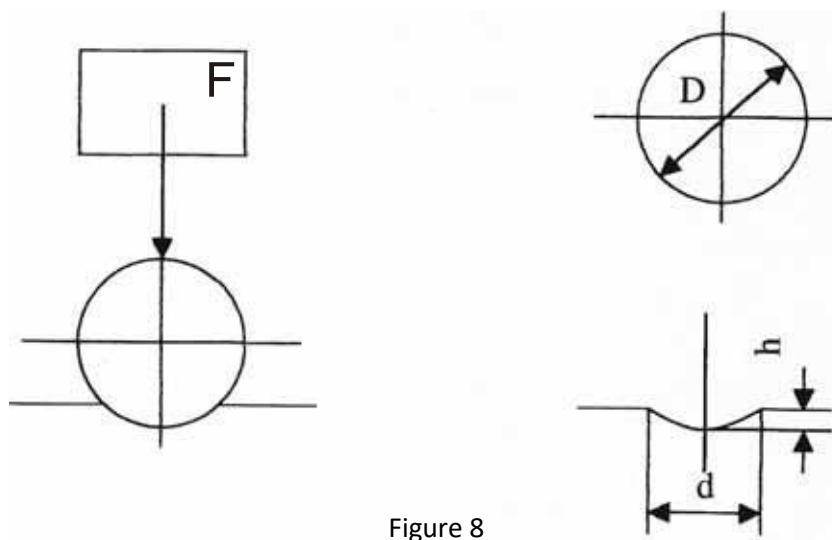


Figure 8

5.2 Brinell hardness formula: $HB = 0.102 \times \frac{2F}{\pi D (D - \sqrt{D^2 - d^2})}$

5.3 Relationship between ball indenter, test force and hardness range for Brinell hardness test (Table 9)

5.4 Brinell hardness technical parameters

5.4.1 Test force: 306.5N, 612.9N, 1839N, tolerance $\pm 1.0\%$.

5.4.2 Indenter specifications: ball indenter 2.5mm, 5mm

5.4.3 Hardness test range: 8~650HBW (carbide ball)

5.4.4 Error and repeatability requirements for Brinell hardness testers

(Table 10)

Table 10

| HARDNESS OF HARDNESS BLOCKS HBW | MAXIMUM PERMISSIBLE ERROR OF DISPLAY VALUE | MAXIMUM ALLOWABLE TOLERANCE FOR |
|------------------------------------|---|------------------------------------|
| ≤ 225 | $\pm 2.5\%$ | 0.025d |
| > 225 | $\pm 2.0\%$ | 0.020d |
| | | |

5.4.5 Measuring microscope magnification: 37.5x, 75x

- a. When magnifying 37.5 times, use a 2.5× objective lens
- b. When magnifying 75 times, use a 5× objective lens.

5.5 Brinell hardness test conditions

5.5.1 The test surface of the specimen is a smooth plane to ensure that the edge of the indentation is clear and the roughness of the surface of the specimen is not less than to ensure the accuracy of the measurement results.

5.5.2 The minimum thickness of the test piece shall not be less than 8 times the depth of the indentation. If traces of deformation appear on the back and edges of the specimen, the test result shall be considered invalid and the test force shall be re-selected and tested again.

5.5.3 The test specimen shall be placed stably on the working table, the contact surface shall be clean, the test specimen shall not be moved during the test, and the test force shall be applied vertically to the test specimen.

5.6 Operation of Brinell hardness.

5.6.1 The operation of Brinell hardness test is close to that of Vickers, with the main difference that the holding time of the test force when testing Brinell hardness is as follows: ferrous metals (10–15) seconds; non-ferrous metals (30–35) seconds, and 60 seconds when the value of Brinell hardness is less than 35.

5.6.2 The distance from the center of any indentation to the edge of the specimen shall not be less than 2.5 times the average diameter of the indentation, and the centers of the two indentations shall not be less than 3 times the average diameter of the indentation.

5.6.3 The diameter of the indentation shall be measured in two mutually perpendicular directions and averaged arithmetically, with the difference between the two diameters of the indentation not exceeding 1% of the smaller diameter.

5.6.4 The difference between the average hardness value measured by the above method and the hardness value of the standard block, and then the ratio with the hardness value of the standard block is the indication error of the hardness tester, in which the difference between the maximum and minimum indentation diameter is the indication repeatability of the hardness tester. The display value error and display value repeatability shall comply with the requirements of (Table 10).

5.7 Brinell hardness operation

| | | |
|-------------------------------|-----------------------------------|----------------|
| Brinell hardness | 2016-04-28 16:11 | set |
| D1: 1290um | Diameter of steel ball | HRC |
| D2: 1292um | 2.5mm | exceed a limit |
| 300.5HB187.5 Please enter D1! | | |
| Holding time:10S | Number of tests:9/100 | |
| Load:1839Nf | Objective lens magnification: 75X | |
| print | table | zero |
| | + | - |

Click this button to print the test data

Click this button to clear the D1/D2 value

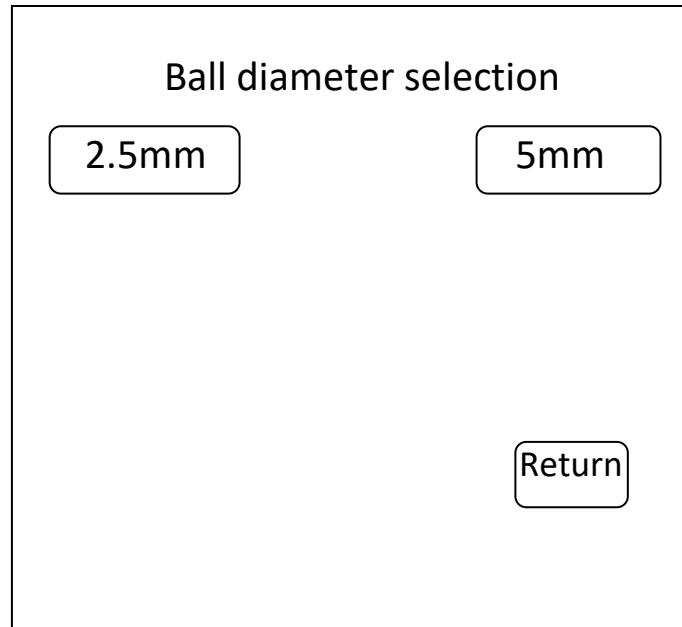
Click on "+" and "-" to adjust the LED lighting.

5.8 System Setup

| System setting | | |
|------------------------|-------------------|------------------|
| TEST PATTERN | LOAD-HOLDING TIME | CONTROL HARDNESS |
| DOMAIN VALUE SETTING | DATE | LANGUAGE SETTING |
| DIAMETER OF STEEL BALL | | |
| | | RETURN |

Note: Clicking on the buttons in the picture above will take you to the corresponding settings page.

5.9 Ball Diameter Selection Page



Note: Click on the buttons in the picture above to select the appropriate ball.

VI. Precautions

6.1 Before using the instrument, you should read the instruction manual carefully and understand the operation steps and precautions in detail. If the instrument is damaged or a safety accident occurs due to improper use, you will be responsible for the consequences.

6.2 It is strictly prohibited to dismantle or install the electrical components, switches and sockets of this instrument without authorization, and you will be responsible for any accidents caused by unauthorized dismantling or installation.

6.3 Do not turn the variable load handwheel while the test force is applied or before the test force is removed during the hardness test.

6.4 When the test force is applied to the specimen, it is strictly prohibited to lower and raise the screw to avoid damage to the indenter.

6.5 The hardness tester should be carried on its bottom and not allowed

to fall sideways. Whenever removing weights or replacing fuses, the power plug should be removed first.

6.6 The operator should observe the operating instructions and calibrate the hardness tester with a standard block before testing. If the instrument is not used frequently, the hardness measurement should be carried out several times after start-up, and after stabilization, the hardness test of the specimen should be carried out again.

6.7 Hardness blocks may only be used on the working surface and their use is valid for one year.

6.8 The hardness tester should be checked on a cyclical basis, once a year, to ensure the accuracy of the hardness tester.

6.9 We are committed to improving the quality of our hardness testers and updating the appearance of our instruments. We apologize for slight variations in the contents of the instruction manual from the actual sample, which may occur without prior notice

When the hardness tester fails, contact the relevant unit for repair, general common faults can be solved by themselves. (Table 11)

Table 11

| IMPUNITY | POSSIBLE CAUSES | METHODS OF ELIMINATION |
|--|---|---|
| Indicator light does not light up when powering on | <ol style="list-style-type: none"> 1. Power failure 2. Blown fuses | <ol style="list-style-type: none"> 1. Check that the power cord is conducting. 2. Remove and replace the fuse in the accessory box. |
| High deviation of hardness value | <ol style="list-style-type: none"> 1. Damage to the indenter 2. Weights installed in reverse order 3. the hardness tester is not placed horizontally and the weights rub against the inner wall of the body 4. Protective cover above the upper plane of the lifting screw 5. Wrong choice of total test force or indenter | <ol style="list-style-type: none"> 1. Replace diamond or ball indenter. 2. Install the weight set as shown in Figure 3. 3. Calibrate the hardness tester with a level in accordance with 2.3.1. 4. Back off the protective cover below the upper plane of the lifting screw and tighten the screw. 5. Select the test force and indenter as required by Table 2. |

VII. Packing list

7.1 Mainframe accessory case

| Part No | Name | Quantity |
|---------|--|----------|
| 1 | Diamond Cone Indenter | 1 |
| 2 | Diamond Tetragonal Cone Indenter | 1 |
| 3 | φ1.5875mm Carbide ball indenter | 1 |
| 4 | φ2.5mmCarbide ball indenter | 1 |
| 5 | φ5mmCarbide ball indenter | 1 |
| 6 | Large flat test bench | 1 |
| 7 | Flat test bench | 1 |
| 8 | “V” type test bench | 1 |
| 9 | Brinell hardness blocks | 1 |
| 10 | Rockwell hardness block HRC high and low | 1 each |
| 11 | Rockwell Hardness Block HRB | 1 |
| 12 | Vickers hardness block | 1 |
| 13 | 0# small weights | 1 |
| 14 | Weights 1, 2, 3, 4 | 4 |
| 15 | Fuse 1 A | 2 |
| 16 | power cable | 1 |
| 17 | Dustproof plastic cover | 1 |
| 18 | Product Instruction Manual | 1 |
| 19 | Product qualification certificate | 1 |
| 20 | Spare LED lighting bulbs | 2 |

7.2 Microscope accessory case

| Part No | Name | Quantity |
|---------|------------------------------|----------|
| 1 | Microscopium (constellation) | 1 |
| 2 | 15× Micrometer Eyepiece | 1 |
| 3 | 2.5× objective lens | 1 |
| 4 | 5× objective lens | 1 |
| 5 | Skateboard test bench | 1 |
| 6 | cone-shaped test bench | 1 |
| 7 | V-shaped test bench | 1 |
| 8 | Internal Lighting Head | 1 |
| 9 | Exterior light covers | 1 |