BRINELL ,ROCKWELL &VICKERS OPTICAL HARDNESS TESTER

MODEL TH722

Instruction Manual

Beijing TIME High Technology Ltd.

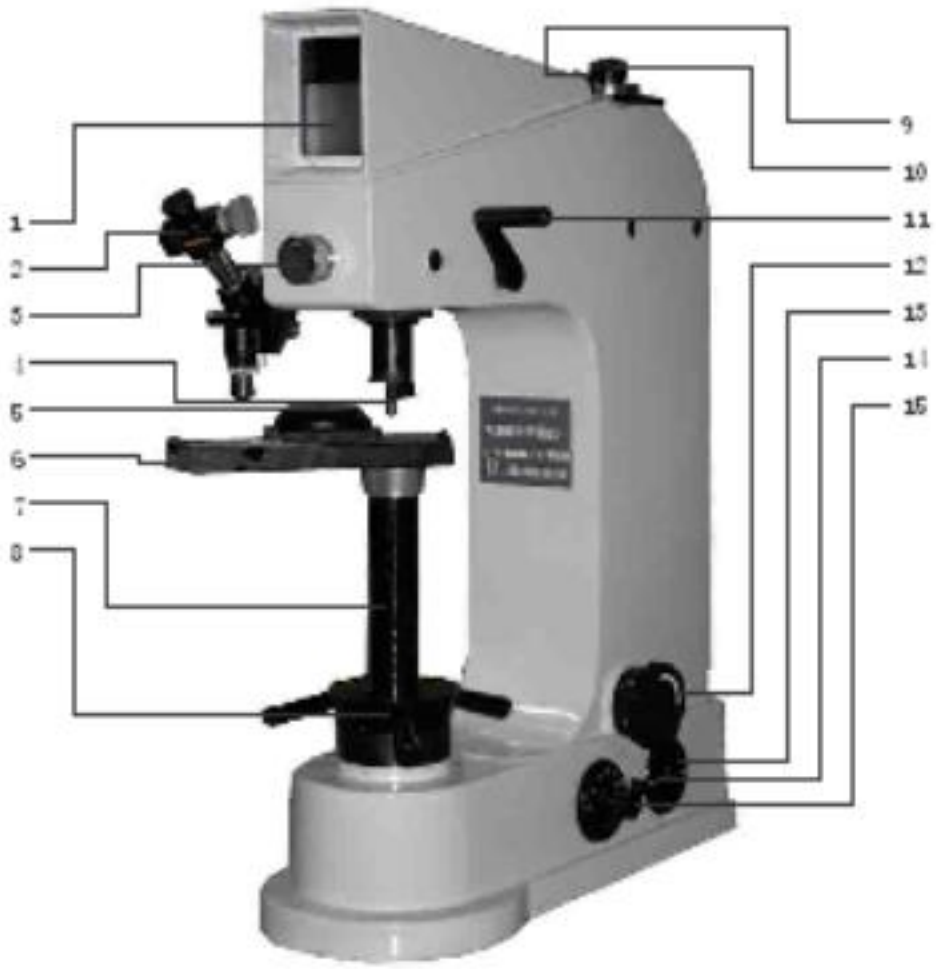

Fig. 1

1.Projection screen 2.Microscopic measurement 3.Adjusting knob 4.Indenter 5.Specimen 6.Chute board anvil 7.Endless screw 8.Movements handwheel 9.Light regulation handwheel 10.Buffer conditioning handwheel 11.Handle 12.Transfer knob 13.Outlet 14.Block fuse 15.Power Block

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1. APPLICATION

This hardness tester is designed to determine Rockwell,Brinel and Vickers hard-ness number. Among the others, Rockwell hardness test is the most popular one.

According to the Brinell hardness test method, it can be used for determining the Brinell hardness number of unquenched steels, cast iron, non-ferrous metals and soft bearing alloys, etc.

In accordance with the Rockwell hardness test method, the tester can also be used to determine the Rockwell hardness number of quenched steel parts(HRC), super-hard tool alloys(HRA), and soft or unhardened metals(HRB).

According to the Vickers hardness test method, this tester can be used for measureing the Vickers hardness number of ferrous and non-ferrous metals.

This tester is widely used in the factories of machinery and metallurgy, laboratories of colleges and scientific research institutes for hardness measurement.

2. MAIN TECHNICAL DATA

2.1. Test force

Brinell:1839, 612.9, 306.5N(187.5, 62.5, 31.25kgf)

Rockwell:Minor test force:98.07N(10kgf)

Total test force:1471, 980.7, 588.4N(150, 100, 60kgf)

Vickers:980.7, 294.2N(100, 30kgf)

2.2. Steel ball penetrator:Diameter of 1.586, 2.5, 5mm

2.3. Diamond cone penetrator: Cone apex angle 120°±30’

Spherical apex angle 0.20±0.01mm

2.4. Diamond pyramid penetrator:Face angle 136°±30’

2.5. The magniftying power used by the microscopic measurement

The magnifying power is: 75×;37.5×

2.6. The minimum value of divisible degree for measuring the micro-drum wheel:

When 75×,it is 0.002 m.m.

When 37.5×,it is 0.004 m.m.

2.7. Measuring the length(L) of the indentation

When 75×,it is 0.002 m.m.

When 37.5×,it is 2.4 m.m.

2.8. The maximum height of the specimen:

It is 200 m.m. for Rockwell's measurement and test.

It is 100 m.m. for Vicker's measurement and test.

2.9. The distance from the center of the indenter to the machine body is 195 m.m.

2.10. The power supply, voltage and power: AC primary 220V, the secondary is 6.3V 25W.

2.11. Max. height of specimen: 200mm

2.12. Depth of throat:180mm

2.13. Dimensions(L×W×H):560×260×760mm

2.14. Power supply:220V AC

3. DESCRIPTION OF MECHANISM PERFORMANCE

This hardness tester consists of frame, main shaft lever mechanism, loading and unloading mechanism, optical measuring device, load select mechanism and anvil elevating mechanism.(See Fig.1)

The frame is a closed housing, all the mechanism are in the frame except the anvil, elevating endless screw and a part of the main shaft seat. It is effective to prevent dirts and convenient to maintain.

The loading and unloading mechanism consists of main shaft lever system, weights and handle. Minor test force 98.07N(10kgf) is provided by the weight of main shaft (8), pressure of spring and the applied force of indicating system. The major test force is produced by the force of gravity of the weights placed on the weights' rack and is applied to penetrator (6) by aid of the load applying lever. The application and release of major test force are controlled with a set of connecting rod device. When control handle (11) is pushed backward, pistong (10) of the buffer is elevated and load applying lever is pushed upward by means of push rod. And the test force isn't applied to the penetrator yet. Pull handle(11) forward, the test force is applied to the penetrator

gradually by the buffer. Knob(12) on the right side of the frame serves to select the test force by turning the signal of the knob toward the selected test force and the weight is set to the weight rack automatically. (kgf is the unit of the figure on knob (12)). The test force of the tester has 7 grades; 1839, 1471, 980.7, 612.9, 588.4, 306.5, 294.2N(187.5, 150, 100, 62.5, 60, 31.25, 30kgf). When 294.2N(30kgf) test force is desired, turn the signal of the knob to 31.25 position and remove the small weight E on the weight rod. The small weight E ought to be on the rod at all the other test force grades.

The tester has a optical measuring device especially for Rockwell test. The device can project the depth of the impression on the projection screen (1) which is at the front of the tester. And the Rockwell hardness number is indicated directly on screen.

The impression may be measured by a readout microscope or other measuring device for Brinell and Vickers test. The corresponding hardness number can be detected in two Appendix Tables.

4. INSTALLATION AND ADJUSTMENT OF HARDNESS TESTER

The tester is transported without the weights and weights rack whick are packed separately. The loading lever and optical lever are kept from moving by fixing it to the body with a string so that it can not shake harmfully during transportation. To set up the tester for operation, it is necessary to carry out the instructions as following:

4.1. The hardness tester shall be set up in a room without vibration and corrosive gases, the ambient temperature shall be 10℃ to 35℃. Place the tester on a rigid table, a bore of about 80mm in diameter shall be provided in the table to accommodate the elevation screw (7) which lifts the anvil.

4.2. With the help of a screw driver, lossen the head cover and the back plate of the tester, then cut the string which is used to tight the lever, and remove the pad. Lift the asphalt felt on the top of the buffer and fill with engine oil(No. 20 engine oil is recommended), push and pull handle (11) to and fro and the air in the buffer may be exhausted.

4.3. Hang the weights' rack into position, and place weight 1, 2, 3, 4 in order (from top

to bottom). The small weight E is placed closely under the hook of the weights' rack. (See Fig.1)

4.4. Insert an anvil in the hole at the top of the endless screw, and level the tester to 0.2/1000 on the anivil, then replace the head cover and back plate.

4.5. Connect the power supply and switch on the light source switch on the right side lower position of the frame, the light projected on the projection screen shall be uniformed. If the illumination is not uniform, adjust the nut of the lamp seat at the left side upper position of the frame, or pull out or push in the lamp seat to superimpose the light source with the optical axle of the optical lens. The lamp seat can be taken off for changing of the bulb.

4.6. Adjustment of buffer

The speed of the buffer is well adjusted before delivery. In general, it is not necessary to readjust it. If the ambient temperature varies rather more, the user may readjust it.

The method of inspection of the buffer before test is as following: Select a test force of 980.7N(100kgf); place a HRB standard hardness block on the anvil; elevate it until the base line on the graduated plate coincides with the horizontal line on the projection screen; pull handle (11) forward and observe whether the duration of the image on the projection screen is 4-8 seconds or not; if not, adjust the oil pin by turning it in the direction indicated on the sign board which is located and the right lower side of the machine frame where "load speed " is designated, until the above stated requirement is satisified.

In Brinell hardness tests and Vickers hardness tests, the method of adjustment of the buffer is the same as above.

Oil in the buffer may be dirty or decomposed after a long period of operation, pour out the waste oil and refilled to about 3/4 height of the buffer. Push and pull handle (11) to and fro to exhaust air in it. Adjust the loading speed in accordance with the procedure mentioned above.

5. OPERATION

5.1. Preparation before test

5.1.1. Preparation of speciment

The surface of a speciment shall be fine finished, free from grease, oxidation and lacquer layer, scale, pits and dirts. Care should be taken in speciment preparation to avoid tempering during cleaning.

The surface of speciment shall be flat generally, the radius of curvature shall be at least 15mm. Or else, a small plane surface should be made on the speciment.

5.1.2. Selection can replacement of anvils

An anvil should be selected that is suitable for the speciment to be tested. The test surface should be vertical with the penetrator. If the anvils could not satisfy the requirements mentioned above, it is recommended to design and produce a special anvil according to the form and size of the test piece. (The dia. Of the hole on upper end of the elevating screw is ¢20H7.)

5.1.3. Pre-selection of total test force

The selection of total test force shall be achieved before test. It is not allowed to transfer test force in test, or else it may cause the damage of penetrator.

Select the corresponding total test force in accordance with the test method and relevant standard.

5.2. Test procedure(See Fig. 2)

5.2.1. Connect the power supply plug at the rear end of the frame to the electric source and turn on light switch at the right lower side of the frame so that an image may be visible clearly on the projection screen.

5.2.2. Select the penetrator according to the requirements of the test and place it into the hole of main rod, keep the shoulder of the penetrator in close contact with the end surface of the main rod; then tighten set screw properly.

5.2.3. Select the test force in accordance with the requirements of the test and turn the load transfer knob (12) at the right side of the frame to the desired test force.

5.2.4. Push control handle (11) backward, put the test piece on anvil (6), rotate the

elevating hardwheel (8) until the test piece is in contact with the penetrator, then rotate the handwheel (8) slowly and the test piece rises until the base line (transverse line) on the projection screen coincides with the graduated line mark “100” on the scale at left side (the deviation should not be more than 5 divisions).

5.2.5. Turn the adjusting knob (3) under the projection screen in order that the graduated line “100” on the graduated plate may exactly coincide with the transverse line on the projection screen. And the minor test force 98.07N (10kgf) is applied on the test piece(see Fig.2II).

5.2.6. Pull control handle (11) to apply major test force gradually, the scale on the projection screen moves backward gradually and stops at a certain position. The indicated depth of impression includes the elastic deformation of the specimen under total test force, so it does not represent the hardness number (see Fig.2III).

5.2.7. Push the control handle (11) backward to remove major test force, and minor test force 98.07N(10kgf) is still applied on the specimen, thus the elastic deformation of the impression is recovered. Thus the transverse line on the projection screen coincides with the number of the scale and Rockwell hardness number is determined (see Fig. 2 Ⅳ). If the diamond cone pentrator is used and the applied test force is 588.4N(60kgf) or 1471N (150kgf), the reading from the left side of the projection screen is the hardness number of HRA or HRC. If the steel ball penetrator with diameter of 1.588mm is used and the applied test force is 980.7N (100kgf), the reading from the right side of the projection screen is the hardness number of HRB.

5.2.8. Lower the anvil and remove the test piece (see Fig.2 Ⅴ).

5.2.9. The procedure for determining Brinell hardness number and Vickers hardness number is just the same.

Measure the diameter (for Brinell method) or diagonal (for Vickers method) of the impression with a readout microscope or other measuring device, and detect the corresponding hardness number in the conversion table.

5.2.10. In Rockwell, Brinell or Vickers tests, select the penetrator, test force and duration of loading in accordance with the specifications decribed in relevant test

method.

5.2.11. To avoid the penetrator from damage, descrend the elevating screw while replacing the anvil.

5.3. Attentions

5.3.1. The test force applied should be normal to the test surface of the specimen, with out vibration and impact.

5.3.2. After the replacement of penetrators or anvils it is appropriate to carry out the hardness test after several times of training.

5.3.3. In the hardness test, at least three impressions should be made on each specimen.

5.3.4. When the minor test force is applying, the anvil should move upward only, until it is applied. To move the anvil downward in the midway and then move it upward is not permitted.

5.4. The installation of susveying microscope:

The surveying microscope which possesses internal lighting system is installed on the left support of the hardness tester, by means of the coordination with the hardness chute board platform, it may carry out the Vicker’s hardness survey for the metal.

5.4.1. When carrying out the Vicker’s test, install the chute board stand into the axis hole of the lifting and lowering threaded rod, and fin it by nuts.

5.4.2. The microscope shall be perpendicularly fixed on the support.

5.4.3. Play into the socket power, the lamp socket is on the left side of the machine body.

5.4.4. Mount the objective.

5.4.5. Several trial blows will be hit on the standardized block to get some Vicker’s indentation, then unload the test force. Remove the upper chute board from below the indenter to the microscope, and look for indentation, until the indentation is situated at the centre of the visual field, then screw tightly the nut. When looking for indentations , it has to take consideration of the following two points.

a. The lifting and lowering threaded rod shall make careful adjustment and align to the focus.

b. The entire chute board may take the theaded rod axis as the centre, and make cricumferential movement so as to mutually coordinate with the microscope , thus make the indentation quickly under the the center of the visual field ,.(Fig 3)

5.5. Inspecting the precision of shown value:

After the apparatus is mounted and adjusted according the above mentioned method, finally execute the precision inspection for the shown value .

5.5.1 The superficial Rockwell:

Measure and determine 7 points on the different positions of the standardized block, disregarding the first and second two points, then find out the deviation existed between the mean value of the other 5 points and the shown value of the standardized block, and this is the shown value error of the hardness tester . The error shall not exceed ±1.0OHRH for the N staff gauge , and that for T staff gauge , not exceed ±1.2HRT .The different between the maximum value and minimum value shall, for N staff gauge, not exceed 1.2HRH ,and for T gauge, not exceed 1.5HRT.

5.5.2. Vicker:

Measure 5 points on the different parts of the standardizid block, take the deviation between the mean value and the standardized block and divide it by the hardness value of two equal blocks, it shall comply with the following specifications .

When the teat force F is ≤ 98N, the tolerance allowed is ±3% ;when the test force P is >98N , the allowable tolerance is ±2%.

The mean value which is obtained by dividing the difference between the maximum value of the hardness value of 5 points by 5 shall not exceed 3.5% for test force not larger than 98N ;the hardness value for test force which is greater than 98N shall not exceed 2%; the precision for the hardness tester shown value has been adjusted before it left the factory. In case the error occurred is done to the vibration during transportation, the test member, on the basis of understanding structural

principle of the apparatus, shall make adequate adjustment , i.e. take down the upper cap, if the shown value measured is lower than the hardness block, then a screwdriver may be used to turn counterclockwisely a degree of an angle for the srew which is on the spring leaf of the optical lever , meantime, turn clock-wisely the previous another screen which is screwed a degree of an angle , ,and carry out the test for shown value again , ,until it is adjusted within the specified scope of error , If the shown value measured is higher than the standardized block, then the direction of turning round is just the opposite.(Fig 4)

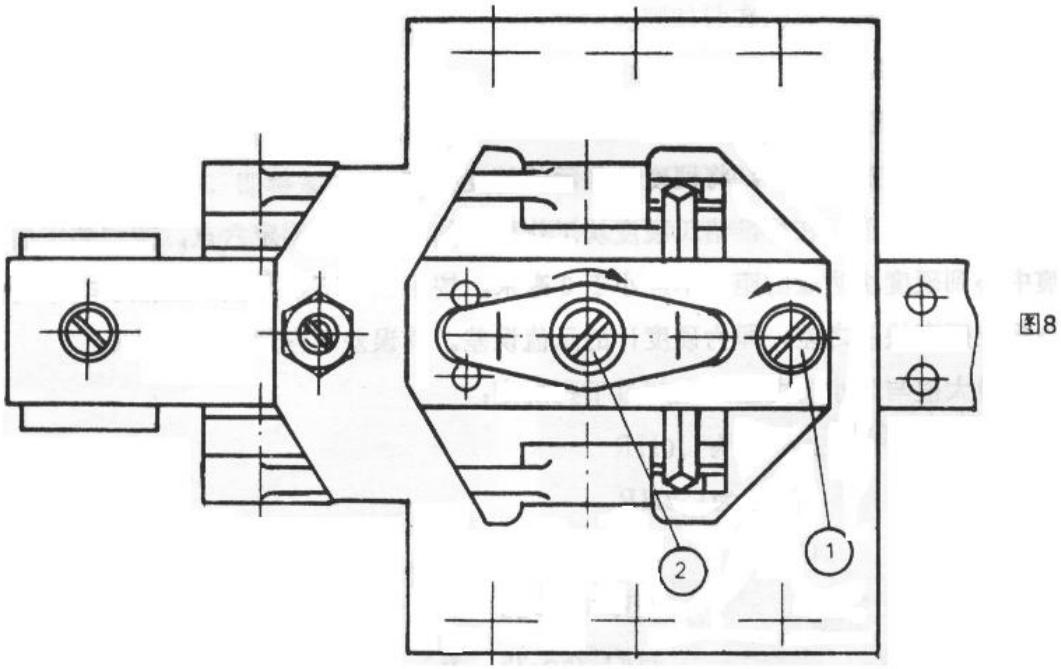

Fig. 4

6. MAINTENANCE

6.1. The mounting of the hardness tester requires a vibrationless, without corrosive gases and dry place.

6.2. To avoid the penetrator from damage, use the tester according to the specified measuring ranges described in test method. If the hardness range of the speciment is uncertained, carry on the test with lighter test force primarily.

6.3. Push the handle (11) backward after test. Clean the penetrator with a piece of soft cloth, and coat a bit of pickling oil on the steel ball penetrator to avoid corrosion.

6.4. Inject a bit of lube to the frictional component of the weights applying and reducing parts, connecting rod of the buffer and elevating parts of the anvil. There need not to lubricate on the other parts.

6.5. The tester shall be kept clean often. After testing, the tester shall be convered with a plastic cover or a wooden box to keep it away from dusty.