

**iVick-472H/M**  
**Vickers Hardness Tester**

**USAGE Instruction Manual**

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## One. Precautions

1. It is advisable to use the single-phase 3-pin plug for the electric connection on the present instrument. The grounding end must be according to the stipulated requirement for earth protecting.
2. It is necessary to read carefully the usage instruction manual before the operation of the present instrument in order to know the operational procedures and the precautions so as to avoid the damages to the instrument and the personal safety caused by the incorrect operation.
3. During the installment and the preoperational test, the sticking paper that protects the indenter against the shock during the transportation should be taken off carefully because the over-strength in doing it would affect the positional precision of the indenter.
4. It is prohibited to dismount and alternate without permission all the electric component parts and the switches as well as their fixed positions. Those who do such unwarranted actions will be responsible for their consequences.
5. During the loading process, press the "START" key immediately in case of emergency, and the instrument will stop loading automatically and return to initial position.
6. During the loading, dwelling and unloading process, press the emergency stop button immediately in case of emergency, and the instrument will stop testing automatically and return to initial position.
7. Our company tries to improve the quality of the hardness testers and renew their structure continuously. In case the contents in the usage instruction manual are a bit different with the actual structure of the instrument, it is hoped and apologized for the fact that the further notice will not be given.

## Two. Brief Introduction

1. The Vickers Hardness Tester is a new and high-tech product combining the optical, mechanical and electronic techniques, with a good aesthetic aspect, operational functions and reliability, and hence it is an ideal instrument for the testing of Vickers hardness.
2. The instrument adopts closed-loop loading control system, it makes the test accuracy improved and the repeatability and stability of the value better.
3. With the soft keys on panel board for input operation, it can preset the testing force dwell time, adjust intensity of light source and shows the indentation length, hardness value, dwell time and the test number. It has the function of automatic shifting between the indenter and objective.
4. According to the particular requirements of the client, the tester can be equipped with CCD indentation automatically measuring device. The instrument is suitable for the testing Vickers hardness value of the micro and thin pieces, permeated and coated plane surface, the crisp materials such as the agate, glass and it is, therefore, an ideal hardness measuring instrument for the scientific research institutes, the universities, the industrial production units and the metrological institutes.

### Three. External Structure

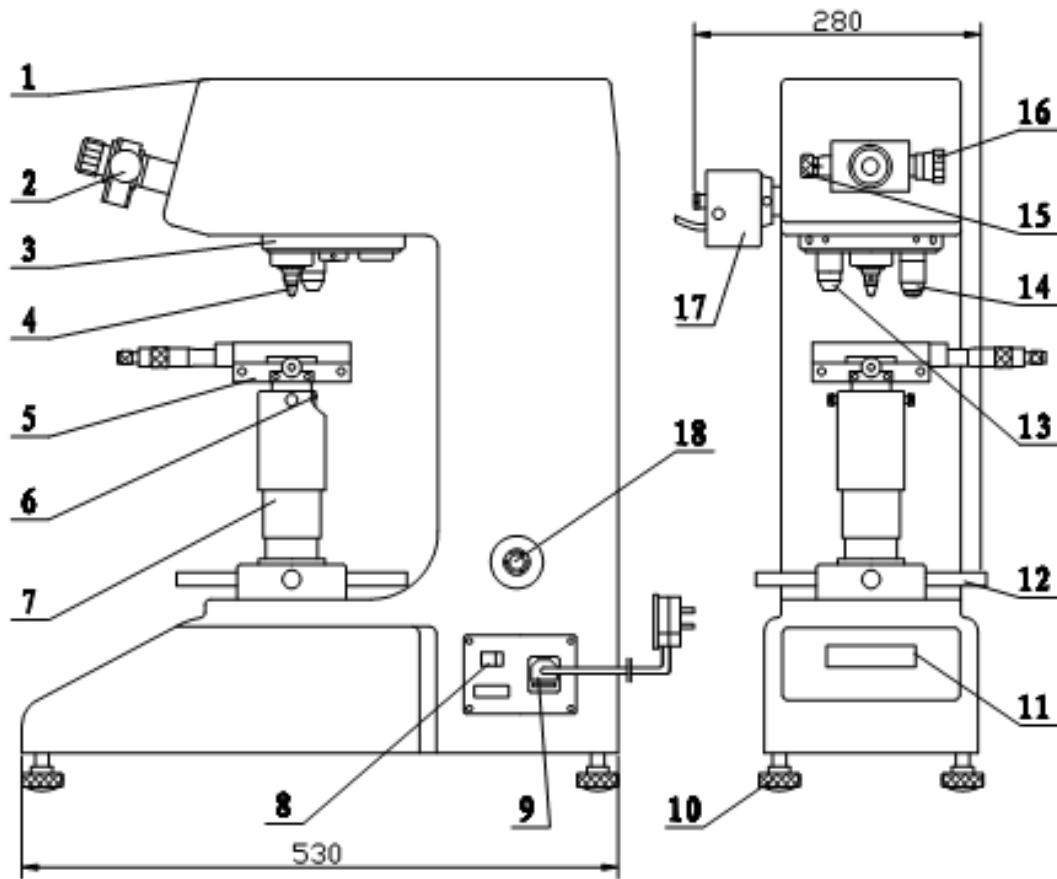


Fig 1

1. Upper Cover	2. Eyepiece	3. Automatic Turret	4. Indenter
5. Cross Test Table	6. Screw	7. Lifting Screw	8. Power Switch
9. Power Cord and Fuse	10. Regulating Screw	11. Operation Panel	12. Hand Wheel
13. 10 <sup>×</sup> Objective		14. 20 <sup>×</sup> Objective	
16. Measuring Drum Wheel		15. Position Drum Wheel	
17. Light Source		18. Emergency Stop Button	

### Four. Technical Specifications

1 Test Forces: 2.942 (0.3kg) 、 4.903 (0.5kg) 、 9.807 (1kg) 、 19.61 (2kg) 、 24.52 (2.5kg) 、 29.42 (3kg) 、 49.03 (5 kg) 、 98.07 (10kg)

## 2 Optical System:

Eyepiece	Measuring Objective	Total Amplification	Min. Test Unit
10 <sup>×</sup>	20 <sup>×</sup>	200 <sup>×</sup>	0.5 μm

Notice: 10<sup>×</sup> objective is used for observing, can't be used for measuring.  
(Both objectives can be used to measure with the CCD device.)

3 Carriage application method: Automatic loading, dwelling and unloading

4 Shifting method of objectives and indenter: Automatic shifting

5 Dwell time: 0~60s (5 seconds as a unit)

6 Power: (110~220) V, AC (60~50)Hz

7 Specimen:

- Max. height: 170 mm
- Max. depth: 130 mm (From the center)

8 Dimension(L×W×H): 530×280×630 mm

9 Net weight: 35 kg

## Five. Installation of the Instrument

### 1 Operational condition:

- 1.1 Room temperature within  $(23 \pm 5)^\circ\text{C}$ ;
- 1.2 Installed in a horizontal position on a solid basement;
- 1.3 In an environment without any shock or vibration;
- 1.4 In a surrounding without any corroding agent;
- 1.5 Relative room humidity inferior to 65%.

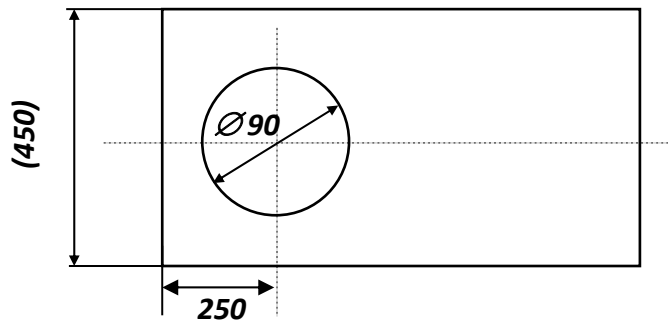


Fig 2

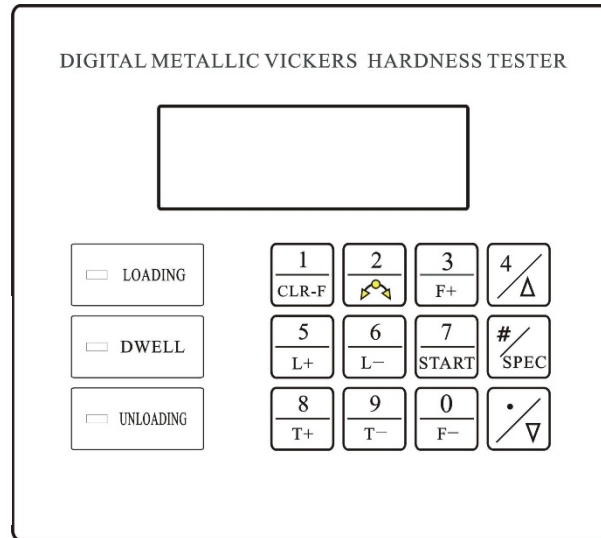
### 2 Unpacking and installation

- 2.1 Cut the packing belt, screw off the screws from bottom of packing box, and then take out the instrument and the accessories kit;
- 2.2 Place the instrument on the prepared solid working table; (for the construction of the table, see Fig.2);
- 2.3 Take out the 4 horizontal regulating screws out of the accessories kit and screw them in the holes on the base panel of the instrument. Unpack the gauze band wrapped on the lifting screw and the hand wheel;
- 2.4 Tear lightly the anti-shock sticking paper on the indenter with both the hands. Clean the indenter lightly with the lens-cleaning paper dipped with some ether (just move the lens-cleaning paper on the indenter several times by holding the paper on both ends with hands);
- 2.5 Take off the dust-protecting cover of the eyepiece tube and take the eyepiece out of the accessories kit and then put it into the eyepiece tube. And then put the plug into the 5-hole socket on the right side of the main body;
- 2.6 Insert the shaft into the hole of the lifting screw;
- 2.7 Take the level (the leveling gauge) out of the accessories kit and put it on the cross testing table, and regulate the 4 horizontal screws so as to make the water bubble stay in the center.

### Six. Function of Each Key

**1**  
CLR-F  
Upper key: Digit.  
Lower key: Zero setting key, press this key to set the rest test force zero.

**2**  
Upper key: Digit.  
Lower key: Switching key, press this key to switch the indenter and the objective.



**Fig.3**

**3**      **0**  
F+      F-  
Upper key: Digit.  
Lower key: Test force adding (reducing) key. Every pressing adds (reduces) 1 step.

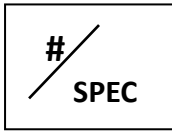
**5**      **6**  
L+      L-  
Upper key: Digit.  
Lower key: Luminosity of the light source adding (reducing) key.

**3**      **0**  
T+      T-  
Upper key: Digit.  
Lower key: Time adding (reducing) key. Every pressing adds (reduces) 5 seconds.

**4**  
Upper key: Digit.  
Lower key: After press SPEC key, press this key to let the Upper keys (digit keys) become valid and the cursor will blink.

**.**  
Upper key: radix point.  
Lower key: After press SPEC key, press this key to let the Lower keys become valid and the cursor will disappear.

**7**  
START  
Upper key: Digit.  
Lower key: Start key, press this key to start the motor and apply test force.



Double confirming key: After key in D1, double press this key to confirm D1. As the same, after key in D2, double press this key to confirm D2.

The hardness value on the screen will show the hardness value HV.

Special function key: Single press this key, then press  $\Delta$  key to let Upper keys become valid. And as the same, single press SPEC key, then press  $\nabla$  key to let Lower keys become valid.

## Seven . How to Carry Out the Test

### 1. Selection of Test Force

1.1 Connected the power cord. Turn on the power switch, and the lighting source and the LCD screen are both light up at the same time. The indenter and the objective manually (iVick-472H) or automatically (iVick-472M) shift and the measuring objective turn to the front working position. At this point, the screen shows (Fig.4):

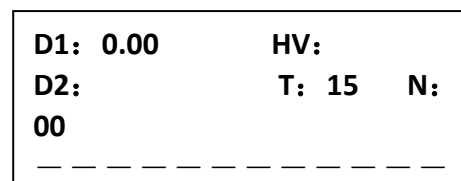


Fig 4

**D1/D2: Diagonal length of indentation; HV: Vickers hardness value; T: Dwell time; N: Numbers of measurements; F: Test force value (N);**

### 1.2 Selection of test force

- The upper and lower key is valid when the instrument turns on.
- Press “F+” key and “F-” key to select the test force.

### 1.3 Selection of light source

- Press “L+” key and “L-” key to adjust the light source.

### 1.4 Selection of dwell time

- Press “T+” key and “T-” key to revise the dwell time.

## 2. Zero-setting of Eyepiece

2.1 Rotate the eye guard to enable two graduated lines clearly observed in the eyepiece.

2.2 The zero position of the eyepiece has just calibrated before the instrument is turned out the factory.

During usage, it maybe cause an error, therefore, zero position setting should be carried out periodically. Once error appears, the zero position shall be regulated. The regulation method is as: Turn the drum wheels to enable inner sides of two graduated lines closely without limit, the light penetrate space between the inner sides of graduated lines become smaller and smaller till reach a critical state with no light slit between them to allow light penetrate. The “0” positions of right drum wheel also should be aligned as well. If the “0” positions are not aligned, loosen the screw, align the



zero positions, and then fasten the screw (Fig.5).

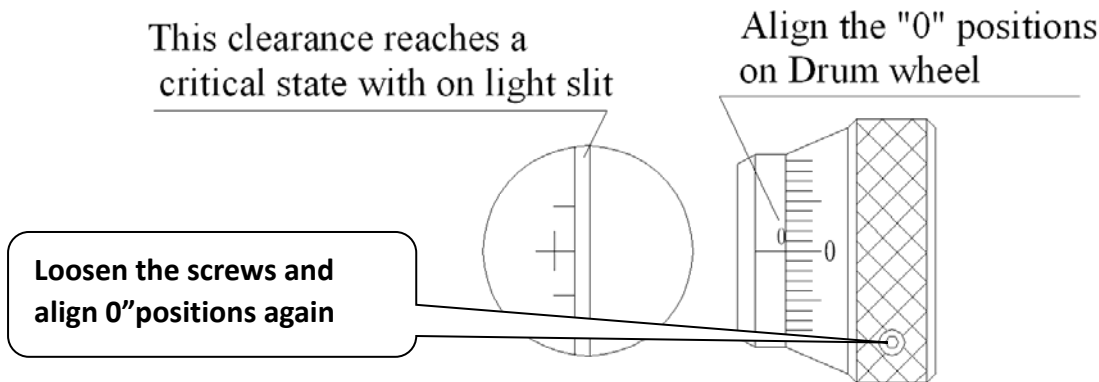


Fig 5

### 3. Start to Test

3.1 Place the specimen on the testing table and then rotate the hand wheel to raise the table to focus.

Put one of the eyes close to the eyepiece to observe, when the specimen comes into the distance of:

- 20<sup>x</sup> objective about 4mm; 10<sup>x</sup> objective about 6mm (for observation);

3.2 In the center of the vision field of the eyepiece appears a bright spot, which shows it is very close to the focusing plane. At this time raise the testing table up slowly until the block or specimen surface forms a clear image in the eyepiece, which means the focus is successful.



Caution: When you revolve the tower, avoid touching the objective and the indenter, otherwise, it would make the indentation slide and glide. When you adjust the focus, take care not to let the specimen collide the indenter or the objective. The collision would damage the components.

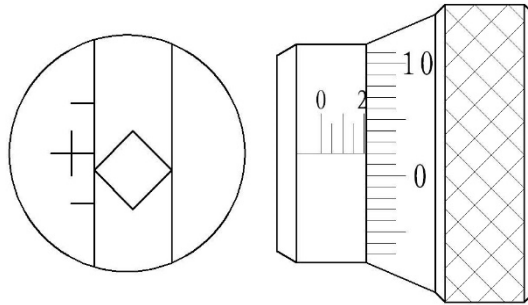
3.3 After all the parameters are set, at this time, the distance between the top of the indenter and the specimen plane is 0.4mm.

3.5 Press the "START" key on the panel board, the instrument starts to test. (If there is rest test force in the lower left corner of screen, press "CLR-F" to set zero.)

- The instrument applies the test force automatically: the (LOADING) LED glitters;
- After test force applying is completed, the (DWELL) LED lights up, and at this time, the Dwell Time indicated on the screen shows back-count of the time selected;
- After dwell time of test force is up, the (UNLOADING) LED glitters, and the instrument automatically unloads the testing force. When it becomes dark, the test force completes unloading.

3.6 The measuring objective automatically shifts to the front position.

#### 4. Measurement of Diagonal



**Fig 6**

- 4.1 Observe the indentation in the eyepiece; rotate the hand wheel to focus until the image quality of indentation become clearly.
- 4.2 Rotate the left drum wheel to enable the inner side of left graduated line tangent to the left tip of the diagonal line of the indentation. This operation makes the two graduated lines move together (Fig.6).
- 4.3 Rotate the right drum wheel to enable the inner side of right graduated line tangent to the right tip of the diagonal line of the indentation.
- 4.4 Right drum wheel turns each cycle for 50 grids. If it turns 4 cycles and over 2 grids, that means  $50 \times 4 + 2 = 202$  grids.
- 4.5 Press "SPEC" key and " $\triangle$ " key, the cursor will blink and the digit keys are valid.
- 4.6 Key in digit 202, then double press "SPEC" key to confirm D1 value. The cursor will move to D2.
- 4.7 Turn the eyepiece by  $90^\circ$ . Measure the other diagonal length just as the same way. Key in digit 203.5; double press "SPEC" key to confirm D2 value. The screen will show hardness value automatically: "HV: 451.3".
  - During the turning operation the eyepiece should move along the inner side of the tube without any space between them; otherwise it would affect the correctness of the measurement.
- 4.8 If the operator is not sure of the correctness of present measurement, please key in D1 and D2 values (grids) again.
- 4.9 After this measurement is completed, press the "SPEC" key; then press the " $\nabla$ " key to let the cursor disappear. Then take the next hardness test.
- 4.10 When the indentation observed in the eyepiece is too large or too small to measure precisely, it is necessary to re-select the testing force according to the thickness and size of the material to suit the requirements of the measurement.

## Eight. Regulation of the Light Source

1. Turn on the power switch of the hardness tester and observe the light source of the eyepiece.
2. Light intensity can be adjusted by “L+” and “L-” on the panel to enable viewing vision soft.
3. If the light source is not satisfied, fasten the Screw Two in clockwise direction to make the light beam in the vision field equality. (You can loosen the Screw Three and then fasten the Screw Two if it is necessary.) (Fig.7)
4. Loosen the Screw One and move it up and down.

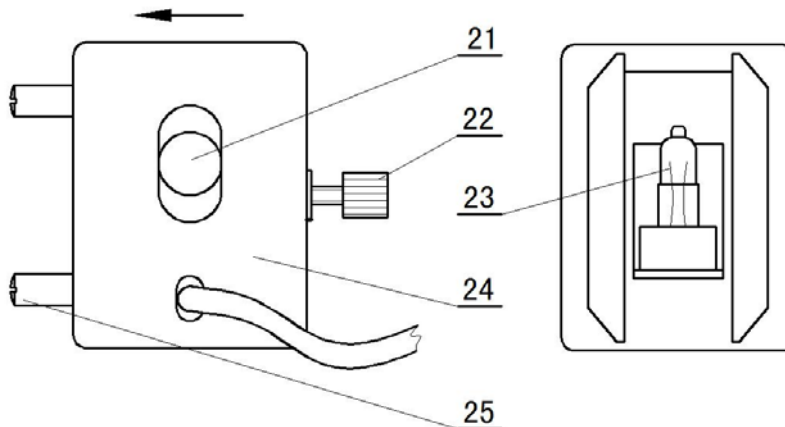


Fig 7

21. Screw One    22. Screw Two    23. Halogen Lamp    24. Back Cover    25. Screw Three

## 5. Change of the Lamp Bulbs

5.1 Following goods is required:

- New lamp (a halogen lamp, 12V, 15 ~ 20W )
- Dry and soft cloth

5.2 Unscrewing the Screw two in anti-clockwise direction, push the Back Cover in left direction as arrowhead marked and move the Back Cover down.

5.3 Take out the bad lamp and replace on a new lamp and clean the lamp surface with a soft cloth.

5.4 Equip the Back Cover returned as above mentioned procedure.



**NOTE:**

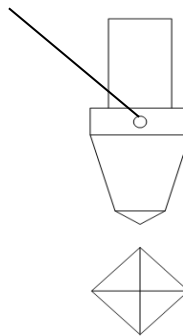
1. The power switch of the hardness tester must be shut off before the lamp replacement, because there is dangerous voltage in the inside of hardness tester.
2. The replacement lamp and original lamp must be the same size and model. It will damage the circuit of hardness meter if the improper lamp is equipped.

## Nine. Cautions

### 1 The diamond indenter

- 1.1 The diamond indenter and the indenter axis are the important parts of the instrument, and hence it is necessary to take care not to touch the indenter during the operation.
- 1.2 In order to assure the precision of the measurement, it is important to keep the indenter clean. If it is covered with grease or dust, it should be cleaned carefully with absorbent cotton dipped with alcohol or industrial ether, especially the tip of the indenter.
- 1.3 The round column of the indenter is marked with a red dot. If the indenter is once unloaded, take care to make the red dot face the frontal direction when it is reloaded, and the focus of the diagonal line of the indentation should be aligned with the red dot. It is possible to make the alignment of the cross-shaped in the microscope line with the diagonal line of the indentation. If the indentation observed is not aligned with the cross-shaped line, please unscrew the screw on the indenter, turn the indenter a bit and fasten the screw, and then make the alignment again through tests until the alignment is all right to your satisfaction (Fig.8).

**Red dot**



**Fig 8**

### 2 The eyepiece

- 2.1 Owing to the difference of the personal visions, the graduated lines observed in the vision field of the objective may seem vague. And accordingly, the observer should adjust the lens in front of the objective according to his personal visual line so as to make the graduated line observed in the vision field clear.
- 2.2 If the test force is changed or the instrument is restarted, the zero position of the eyepiece will move as well. So it is necessary to reset zero before the measurement of diagonal. Refer to the method of zero-setting above.
- 2.3 As the eyepiece is put in the eyepiece tube, it is necessary to turn the eyepiece by 90° during the measurement of the two diagonal lines of the indentation. During the turning operation the eyepiece should move along the inner side of the tube without any space between them; otherwise it would affect the correctness of the measurement.

### 3 The specimen

3.1 The surface of the specimen must be clean, as the grease or the dirt on the surface would make the edge of the image of the indentation vague, thus affecting the precision of the measurement. The specimen can be cleaned by alcohol and ether.

3.2 When thin filaments, thin pieces and small bits are used as the specimens, the filament fixture, the platelet fixture and the plane holder fixture should be used to hold the specimens respectively on the cross testing table for the measurement. If the specimen is too small to be held by the fixture, the specimen should be inlaid and polished for the measurement.

3.3 The minimum thickness of the specimen should be more than 10 times the depth of the indentation (Fig.9). There can't be visual deformation traces on the back of specimen after testing.

- Relations among the minimum thickness of the specimen—the test force—the hardness

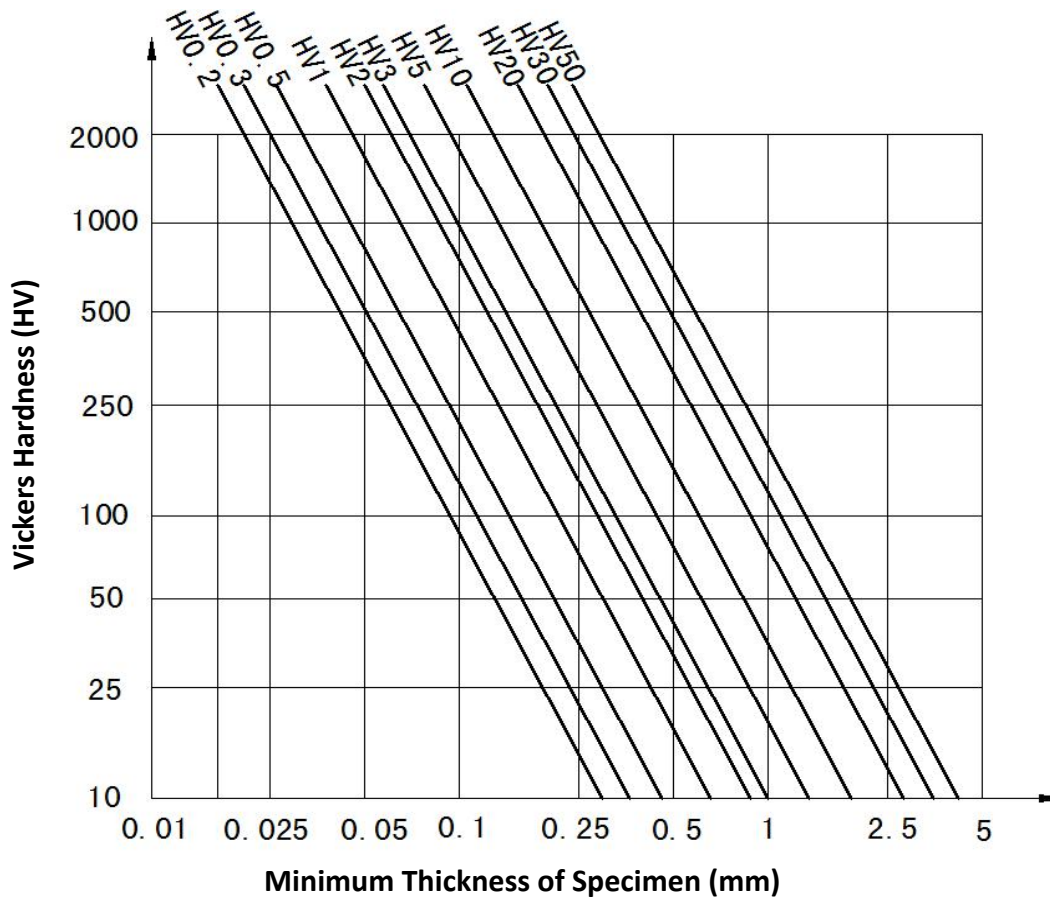


Fig 9

## Ten. Attached Tables

### 1. Repetition of the value-indication of Vickers hardness tester

**Table 1**

Standard Hardness Range	Repetition of Displayed Hardness Value (%)		
	HV5~HV100	HV0.2~<HV5	<HV0.2
≤225HV	≤3	≤6	≤9
>225HV	≤2	≤4	≤5

**HV: Vickers hardness**

### 2. Tolerance of the value-indication of Vickers hardness tester

**Table 2**

Hardness Symbol	Tolerance of the Value-indication ±%															
	Hardness HV															
	50	100	150	200	250	300	350	400	450	500	600	700	800	900	1 000	1 500
HV 0.2		4		6		8		9		10	11	11	12	12		
HV 0.3		4		5		6		7		8	9	10	10	11	11	
HV 0.5		3		5		5		6		6	7	7	8	8	9	11
HV 1		3		4		4		4		5	5	5	6	6	6	8
HV 2		3		3		3		4		4	4	4	4	5	5	6
HV 3		3		3		3		3		3	4	4	4	4	4	5
HV 5		3		3		3		3		3	3	3	3	3	4	4
HV 10		3		3		3		3		3	3	3	3	3	3	3
HV 20		3		3		3		3		3	3	3	3	3	3	3
HV 30		3		3		2		2		2	2	2	2	2	2	2
HV 50		3		3		2		2		2	2	2	2	2	2	2
HV 100				3		2		2		2	2	2	2	2	2	2

1 When the indentation diagonal length is less than 0.020 mm, the table does not display the value.

For intermediate values, the maximum allowable error can be obtained by interpolation.

3 About the Micro Hardness Tester value in the table is 0.001mm or indentation diagonal length of the average of 2% of the maximum permissible error given, please select the bigger.

### Eleven. Accessories (The Packing List)

Item	Description		Specification	Quantity
	No.	Name		
Main Instrument	1	Hardness Tester		1 set
	2	Vickers Indenter		1 piece
	3	Objective	10 <sup>x</sup> , 20 <sup>x</sup>	2 pieces
Accessories	4	Accessories Box		1 piece
	5	Eyepiece	10 <sup>x</sup>	1 piece
	6	Cross Test Table		1 piece
	7	Level Regulation Screw		4 pieces
	8	Level		1 piece
	9	Screwdriver		1 piece
	10	Internal Hexangular Spanner	2.5mm	1 piece
	11	Dust-Preventing Cover		1 piece
	12	Power Source Cable		1 piece
	13	Fuses	1A/250V, 5×20 mm	2 pieces
	14	Halogen Lamp	12V, 15~20W	1 piece
	15	Vickers Hardness Block		2 pieces
Documents	16	Usage Instruction Manual		1 copy

#### ● Optional Accessories

Platelet Fixture	Plane-holding Fixture
Filament Fixture	Knoop Indenter
Hardness Test Blocks	
Metallurgical Specimen Cutter	Metallurgical Specimen Mounting Press
Metallurgical Specimen Polisher	CCD Image Measuring System