www.pce-industrial-needs.com

Tursdale Technical Services Ltd
Unit N12B
Tursdale Business Park
Co. Durham
DH6 5PG
United Kingdom
Phone: +44 (0) 191 377 3398
Fax: +44 (0) 191 377 3357
info@tursdaletechnicalservices.co.uk
http://www.industrial-needs.com/

INSTRUCTION MANUAL
PCE-HT 500

Contents

1. Overview

1.1 Scope of application

PCE-HT500 Rockwell hardness tester adopts ROCKWELL measurement principle (see appendix 1), it can measure the Rockwell hardness directly, and has may favorable features, such as simple operation, stable display value, and easy maintenance. It is very suitable for Rockwell hardness measurement to carbide, carbon steel, alloy steel, cast iron, non-ferrous metal, and other materials. It can be used in the inspection, research and production for many industries, such as measuring, mechanical manufacturing, metallurgy, and building material.

The voluntary standards for this machine: ISO6508.2 “Metal material, Rockwell hardness test, inspection and calibration for hardness tester”. Europe standard BSEN10109-96 “Hardness test for metal material”, international standard.

1.2 Scope of hardness measurement

20~88HRA, 20~100HRB, 20~70HRC

2. Main performance parameters

- Initial test force: 98.1N (10kgf)
- Total test force: 588.4N (60kgf), 980.7N (100kgf), 1471N (150kgf)
- Scale label for Rockwell hardness: HRC 0~100, HRB 0~100
- Test resolution: 0.5 Rockwell unit
- Maximal test space in vertical direction: 180mm
- The distance between front wall and axial line of indenter in horizontal direction: 160mm
- Maximal external dimension: 580mm×270mm×740mm
- Net weight: 100kg

3. Basic configuration and structure

3.1 Standard configuration

Host machine	1
Standard test block of A scale	1
Standard test block of B scale	1
Standard test block of C scale	1
Φ1.5875mm ball indenter	1
Φ1.5875mm backup ball	3
120° diamond cone indenter	1
Holding screw for indenter	1
φ60mm plane specimen table	1
φ60mm V-shape specimen table	1
Dustproof cover	1

Optional attachments:

Φ70mm plane specimen table	1
Φ70mm V-shape specimen table	1
Φ80mm plane specimen table	1
Φ80mm V-shape specimen table	
Φ120mm plane specimen table	
Φ150mm plane specimen table	
Small V-shape/spot specimen table	
Standard test blocks for other hardness scale	

3.2 Structural representation

Please see figure 3.1 for the outline of PCE-HT500 Rockwell hardness tester, and figure 3.2 for hardness indicating gauge.

Figure 3.1

Figure 3.2

4. Installation and adjustment

4.1 The installation environment of hardness tester shall be dry and clean, free of corrosive medium and strong magnetic field interference, and at temperature (10~35) .Please see figure 4.1 for the holing position relative to base of hardness tester.

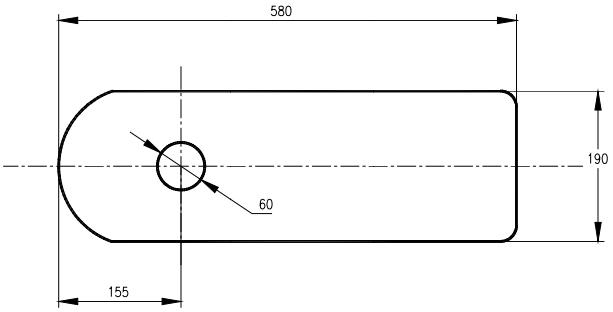


Figure 4.1

4.2 Dismantle holding screws on the bottom pallet used to fix the bottom of hardness tester after unpacking. Do not remove hardness tester from crosstie at this time, but shall mount four footing screws provided with the machine. After mounting footing screws, the hardness tester can be moved to the prepared platform. Hold its bottom when moving, and it is not allowed to move it via holding other part.
Special tip: PCE-HT500 is big in volume and heavy in weight, so proper lifting device and reliable fixing method shall be used when making installation, delivery, and transportation, aiming to prevent accident. Remove weight set when transportation will be made. If long distance transportation is required, the original packing shall be resumed, the indenter shall be dismantled, and elastic device shall be used to fix main axle and lever to prevent the component from damaging.

4.3 Rotate hand wheel counterclockwise, drop down specimen table, remove shockproof cushion, put water level gauge with 0.2mm/m accuracy on the specimen table, adjust footing screws of hardness tester, and tighten fixing nuts after adjustment.

4.4 Open upper cover and back cover of hardness tester, and remove all bandages or elastic devices for shockproof and loose-proofing during the transportation. Hang weight set on the loop V-shape groove at the end of lever. Ensure that the knife edge is mounted in V-shape groove correctly. Please see figure 4.2.

Figure 4.2

4.5 The loading time can be adjusted via screw in or screw out needle valve of buffer. Method: mount ball pressure head, choose 980.7N test force, put B-scale hardness block on specimen table, and lift up specimen table. Apply initial test force until the small pointer of hardness indicating gauge points at red point and larger pointer points at point B, please see figure 4.3.

Figure 4.3

Push the loading handle to loading direction, check the time used when larger pointer rotates counterclockwise until stopping, and record. If the time is not in the range of 3~6s, adjust it via screwing in or screwing out needle valve of buffer. If the time for screwing in is prolonged, the time for screwing out will be shortened. Tighten the needle valve after adjustment.

4.6 Mount top cover and back cover.

5. Operation method

5.1 Test preparation

According to the material of specimen to be tested and the range of hardness, select proper hardness scale, and choose test parameters accordingly. In table 5.1, the measurable scale parameters and suitable materials for this machine are listed.

Table 5.1

Scale	Indenter	Test force (N)		Scale mark of hardness indicating gauge	Scale Range	Common Range	Application material Example
		Initial test force	Total test force				
HRA	Diamond cone	98.1	588.4	C (Black)	0 ~ 100	20 ~ 88	Carbide, surface carburization hardened steel
HRB	Φ1.5875mm ball indenter	98.1	980.7	B (Red)	0 ~ 100	20 ~ 100	Soft steel, Al alloy, Cu alloy, malleable cast iron
HRC	Diamond cone indenter	98.1	1471	C (Black)	0 ~ 100	20 ~ 70	Hardened steel, quenched and tempered steel, alloys

5.2 Install Indenter

The indenter is mounted in main axial hole. During the mounting of indenter, ensure that all of main axial hole, end plane, and the indenter are clean and free of foreign matter. When mounting, first use holding screws for indenter to fix it at the tail plane slightly, and then apply major test force. When the total test force is applied, keep it under the total test force, tighten the holding screw for indenter, and finally unload the test force. By then, the pressure installation finished.

5.3 Selection of test force

The selection of test force is made via test force selection knob at the right side of hardness tester, please see figure 5.1, and there are three kinds of test forces: 588.4N (60kgf), 980.7N (100kgf), and 1471N (150kgf).Notes: the test force switching must be made under unloading status, else, the indenter may be damaged.

Figure 5.1

5.4 Hardness test

5.4.1 Put the specimen to be tested on specimen table, keep the specimen close fitting to the surface of specimen table, and rotate hand wheel clockwise to lift up specimen table. After the specimen contacts with the indenter, rotate hand wheel continuously, until the small pointer of hardness indicating gauge points to read point and the larger pointer of hardness indicating gauge points to the site near C or B, and the offset shall be less than ±5 hardness value. Move adjustment handle, and let larger pointer points to C or B, please see figure 5.2. else, change test point, and re-start the test.

Figure 5.2

5.4.2 Push the loading handle to loading direction, apply main test force, until the rotation speed of pointer slows down and stops. The total test force shall be kept in the range of 2~6s.The keeping time for specimen with higher hardness can be shortened, and the time for specimen with less hardness shall be longer in general. Turn the loading handle back to unloading position, and remove main test force.

5.4.3 Read harness value based on the scale pointed by larger pointer of hardness indicating gauge. For HRC and HRA scales, read value according to the black word marked with C at the outer circle of dial gauge; for HBR scale, read value according to the red word marked with B at the inner circle of dial gauge. As shown in figure 5.3, when testing HRC (that is, the test parameter is diamond cone pressure head, and the test force is 1471N), the hardness value is 64.5HRC; when testing HRA (that is, the test parameter is diamond cone pressure head, and the test force is 588.4N), the hardness value is 64.5HRA; when testing HRB (that is, the test parameter is Φ1.5875mm ball pressure head, and the test force is 980.7N), the hardness value is 94.5HRB.

Figure 5.3

5.4.4 Drop down specimen table, and unload all test forces, which means the test finishes.

5.5 Precautions

5.5.1 In general cases, after changing indenter, specimen table or specimen, the first 1~2 tests are invalid, and calculate average value for later tests, then the value may be more accurate.

5.5.2 For the results of tests made on convex cylinder surface and convex sphere surface, they shall be corrected according to relevant stipulation in ISO6508.2

6. Maintenance, repair, and precautions

6.1 Check the error of hardness indicating gauge with standard block periodically. If the error is beyond the permitted scope specified in ISO6508.2, further check whether the test force is accurate, or the indenter is defective and deformed. The periodic certification and calibration for hardness tester shall be made according to relevant standards.

6.2 Carefully mount and dismount indenter, ensure its top is free of damage and pollution, and the mounting plane is clean and free of foreign matter. If it will not be used for long time, dismantle it and keep it under proper environment, and paint rust-proof oil.

6.3 The surface of specimen table and standard hardness block shall be free of pollution, scratch, scotch, and bruising. Paint rust-proof oil for storage.

6.4 During the test, the specimen to be tested must be placed stable, and the support shall be reliable, aiming to guarantee that there is no displacement and deformation during the test.

6.5 Lubricate lifting leading screw periodically. Method: remove specimen and sheath of leading screw, inject several drops of light lubricant oil into leading screw, and let the lubricating oil be distributed evenly. Then, mount sheath and other parts. Please note, the lubricating oil shall be proper but not excess.

6.6 For daily operation and after shutdown, you should consider issues related with dust proofing and corrosion proofing. Rust proofing issue shall be considered in humid environment.

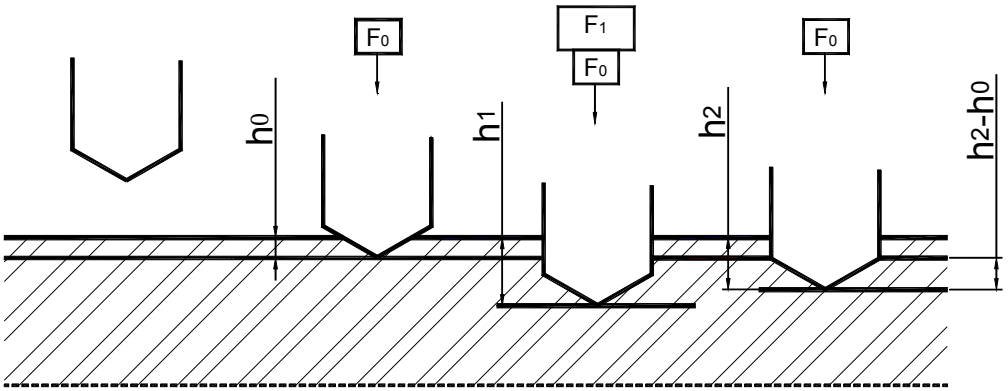
6.7 For the transportation of hardness tester, the weight set and indenter must be dismantled, and shock proofing cushion shall be used between base of indentere and specimen table. For long distance transportation, the original packing shall be resumed, and proper protection measures shall be taken.

6.8 After long time operation of buffer, the oil may be consumed or deteriorate, if so, it shall be replaced with new oil. The replace method: screw out the oil drain screw at the bottom, discharge dirty oil, and screw in oil drain screw again. Then inject 30# machine oil into buffer via the top of buffer. During the oil injection, pull loading handle several times to discharge air in buffer.

6.9 If abnormal phenomenon occurs in hardness tester, do not dismantle it or adjust any fixed mounting spare parts. Fill in the warranty card, and delivered it to maintenance of company.

Appendix 1: Rockwell hardness measurement method and principle

The Rockwell hardness testing will measure the depth of indentation in fact, and convert the depth of indentation measured under the specified condition into hardness value. The specific procedure is described below. Please see attached figure 1.



Attached figure 1

(1) Apply initial test force F0 first, press the indenter (diamond cone indenter or ball indenter) into the surface of specimen, and record the initial displacement h0.

(2) Apply main test force F1 then, keep it fir certain time, record the displacement h1 of pressure head at this time, and remove main test force F1.

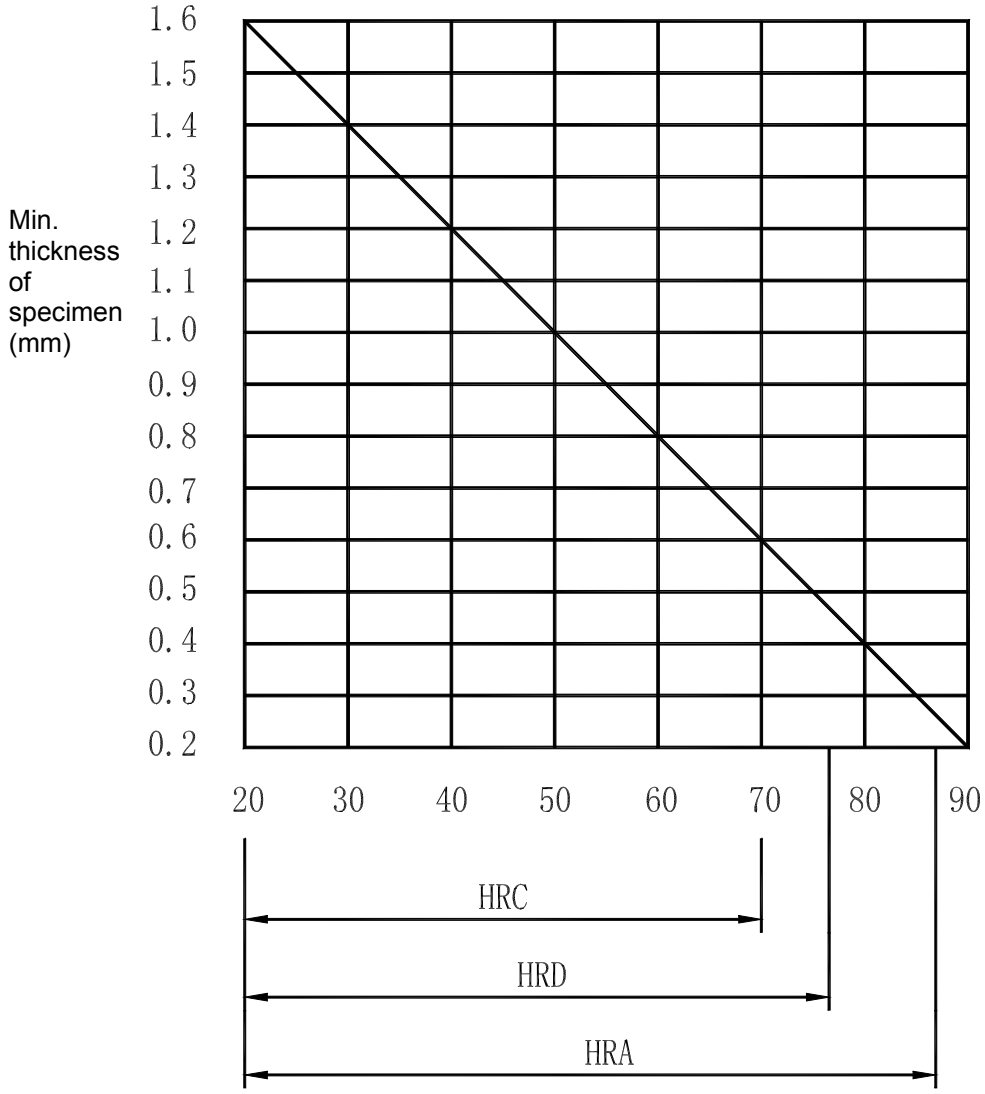
(3) Maintain the initial test force F0, and measure the displacement h2 of indenter at this time.

(4) Calculate Rockwell hardness value according to the following formula (where, the unit of displacement is mm):

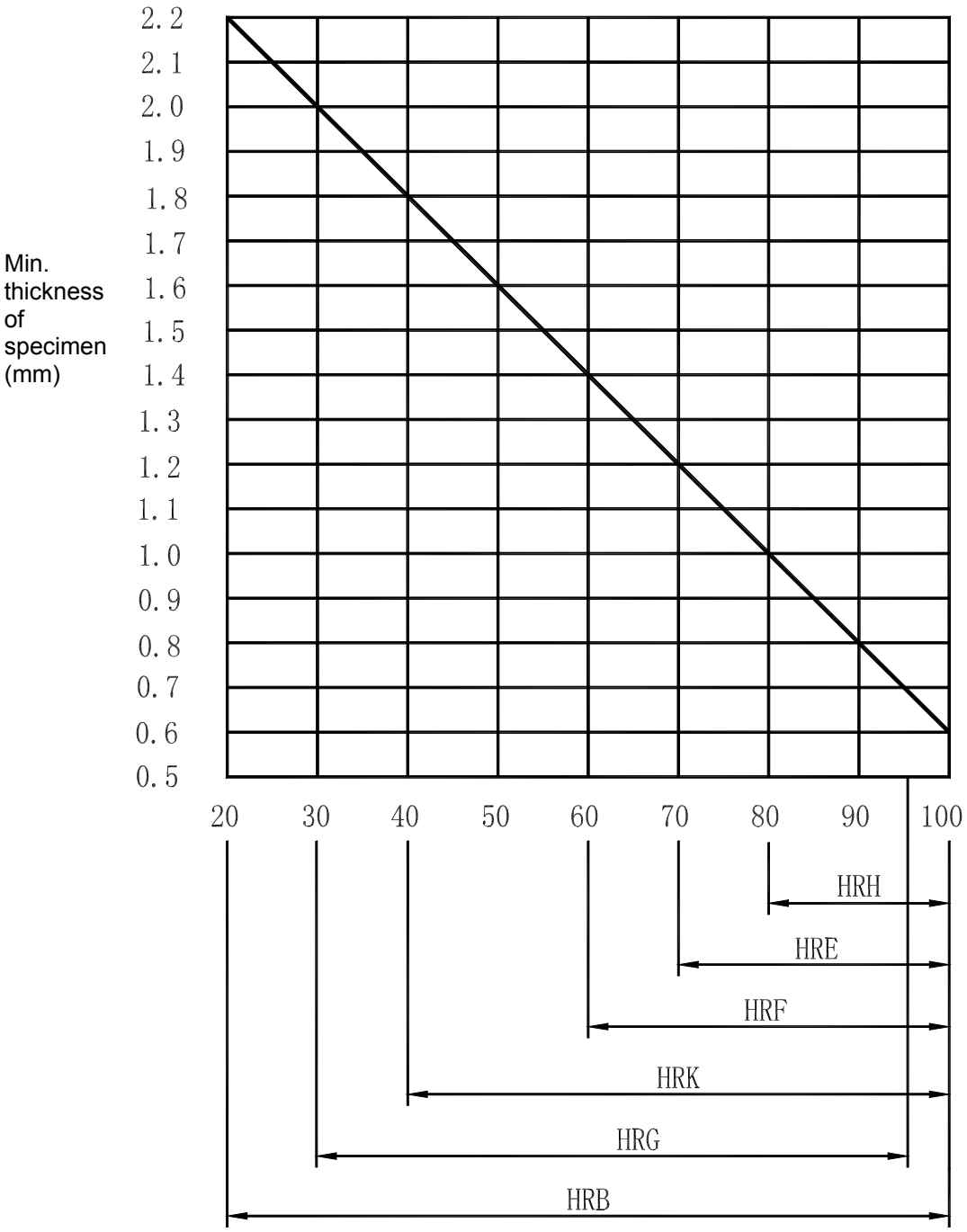
Scale	Applied formula
A, D, C	HR=*100- ($h_2 - h_0$) /0.002*
E, B, G, H, F, K, P, M, L, R, S, V	HR=*130- ($h_2 - h_0$) /0.002*

Appendix 2: Requirements for minimal thickness of specimen

The minimal thickness of specimen depends on the hardness of material and the scale used. In general, no visual deformation mark shall exist on the back surface of specimen after test.
For the relation among minimal thickness of specimen, hardness of material, and scale use, please refer to attached figure 2 and 3.



Attached figure 2: Test with diamond cone pressure head (HRA, HRC, HRD)



Attached figure 3: Test with steel-ball pressure head (HRB, HRE, HRF, HRG, HRH, HRK)

In this direction will find a vision of the measurement technique:
http://www.industrial-needs.com/measuring-instruments.htm

NOTE: "This instrument doesn't have ATEX protection, so it should not be used in potentially explosive atmospheres (powder, flammable gases)."