

900-365 Digital Rockwell Hardness Tester

Instruction Manual



PHASE II MACHINE & TOOL INC.

www.phase2plus.com

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1 General description

The 900-365 Digital Rockwell Hardness Tester can be used directly to measure all regular Rockwell hardness scales and it can quickly convert that hardness value into HB, HV, HLD, HK and σ_b value. Loaded with many useful features such as ultra precise results, wide measuring range, automatic test force change according the scale selection, automatic main test force loading/unloading, high resolution digital display, automatic printing, and USB Output to print to PC. The 900-365 is suitable for testing hardness of carbon steel, alloy steel, cast iron, non ferrous metals and engineering plastics.

The tester meets the following standard: ASTM E18, ISO 6508-2, and BS EN ISO6508-2.

2 Key performance parameters

- **Preload** : 98.1N (10kgf)
- **Total test force** : 588.4N(60kgf) , 980.7N(100kgf) , 1471N(150kgf),
- **Scales** : HRA , HRB , HRC , HRD , HRE , HRF , HRG , HRH , HRK , HRL , HRM , HRP , HRR , HRS , HRV
- **Load cycle** : 3 ~ 8s
- **Load dwell duration** : 2 ~ 50s
- **Resolution** : 0.1HR
- **Display** : High definition backlight LCD
- **Operation** : Menu selectable, Membrane keypad
- **Auxiliary functions** : Upper/lower limits setting& alarming,
Data statistics, Avg., Max., Min., S, R,
Scale conversion, HV, HB, σ_b ,
Curved surface Auto Correction
- **Data output**: Print out, or output to PC through USB port
- **Memory**: Max 500 items of test results stored automatically
- **Testing Capacity** : *Vertical*: 7.87” *Throat Depth*: 6.50”
- **Dimensions** : *Height*: 28.34” *Width*: 7.87” *Depth*: 21.60” (550mm×200mm×720mm)
- **Power supply**: single phase, AC, 110V, 50 ~ 60Hz, 4A
- **Net weight** : 220 lbs (100kg)

3 Basic configuration and structure

3.1 Standard configuration

Base Machine	1
Standard hardness block for B scale	1
Standard hardness block for C scale	3
1/16" Carbide ball indenter	1
120° cone diamond indenter	1
Mounting screws for indenter	2
Flat anvil	1
"V" shape anvil	1
Power supply plug	1
Screwdriver	1
Dust cover	1

3.2 Structure schematic diagram



1- screen and keyboard

2- indenter

3- anvil

4- leadscrew and protecting sleeve

5- handwheel

6- weights(in the tester)

7- switch and power panel

8- printer

Figure 3.1

4 Installation and adjustment

- 4.1 Remove wood crate top by removing 1 each bolt from bottom left and right side of crate and lifting up crate, then remove the three M10 screws from the underside of the base. Lift the machine very carefully from the bottom. Remove the tool kit containing the weights and other accessories.
- 4.2 The machine should be mounted on a firm bench or table in a clean area, free from vibration or shock, recommended height is 30". A hole must be drilled in the top of the work bench to allow maximum travel of lead screw. Refer to figure 4.1.
- 4.3 Place the tester on the prepared bench, turn the hand wheel counter-clockwise to lower the anvil, remove the anti vibration pad; then place a flat anvil in the lead screw and place a level with the precision of 0.2mm/m on the anvil, adjust the levelling feet of tester to make the level within +/- 1mm/m, then lock the nuts. **Note: This is very important. The load change will be affected if the machine is not leveled properly**

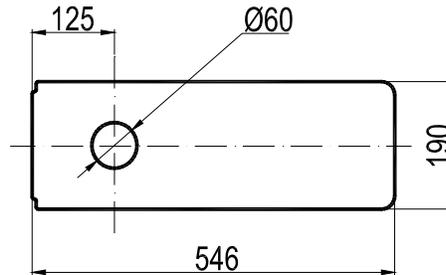


Figure 4.1

- 4.4 For installation, open the upper cover and back cover of tester, then remove all the packing materials and suspending weight at the V groove of the lever. Make sure the blade should be correctly placed in the V groove.
- 4.5 Reinstall the upper and back cover and connecting the power supply wire.

5 Operating methods

5.1 Testing preparation

Switch on the machine and then the tester will self check. The relative information such as type, series number, software version will be displayed on screen. Tester will come to main menu after self-checking; current test parameters will be displayed on screen, and the status at the previous test will be automatically stored. Figure 5.1.1 is a typical status of Rockwell C testing parameter; showing the current scale, indenter type should be selected according to the current scale, test force, load dwell duration, as well as current time.



Figure 5.1.1

When selecting a particular scale, pay attention to the Indenter that is shown on the display. If the display shows Diamond as above, then you must install the supplied Diamond Indenter in the machine. When installing indenter, make sure the surface of the diamond shank is clean. Install diamond and tighten set screw.

The test force selection is automatically done by the machine once a scale has been chosen.

See details in 5.2.1.

The test can be performed directly according to the procedure 5.3 if all parameters match your requirements; following procedures should be observed if the modification is necessary.

5.2 Test parameters setting

Press “Setup” key, figure 5.2.1 will be showed on screen, the parameter setting is ready.

5.2.1 Scale selection Press “” or “” key to move cursor to “1” in figure 5.2.1, press “”

key ,then the cursor move to “ HRC” . Press “” or “” key at this time the optional 15 Rockwell

scales HRC、HRA、HRB、HRD、HRE、HRF、HRG、HRH、HRK、HRL、HRM、HRP、

HRR、HRS、HRV will be appear in sequence. When the desired scale appears as figure 5.2.2,

press “”to confirm. At this time test force will be changed automatically according the confirmed scale.

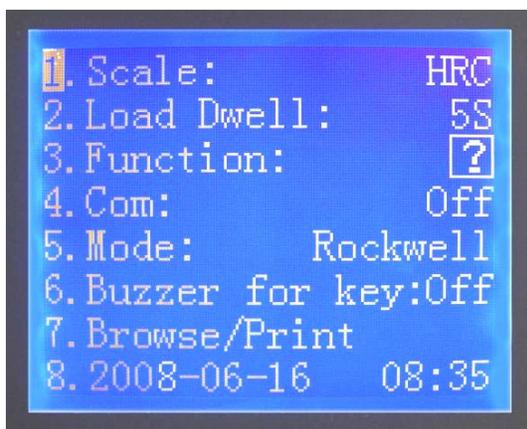


Figure 5.2.1



Figure 5.2.2

Press “**Setup**” key to return to figure 5.1.1 ; or press “**↶**” or “**↷**” key to reset the other parameters.

5.2.2 Load dwell setting

Load dwell refers to the duration of total test force (i.e. time of primary test force and main test force). For samples such as steel, cast iron and aluminum, dwell times should be set at **5 seconds** for optimal performance. Changing the dwell time rate will affect the hardness values. An increase of dwell time will produce lower hardness values caused by creep due to the elasticity of the material.

Press “ **↶** ” or “ **↷** ” key to move cursor to “2” in figure 5.2.1, press “ **←** ” key ,then the cursor move to “ 5S” as figure 5.2.3. Press “ **↶** ” or “ **↷** ” key at this time to select the dwell time range from 2s ~ 50s, then press “ **←** ” to finish the setting.

Press “**Setup**” key to return to figure 5.1.1 ; or press “**↶**” or “**↷**” key to reset the other parameters.

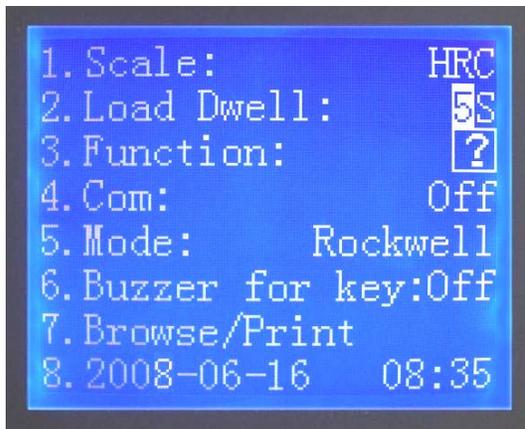


Figure 5.2.3

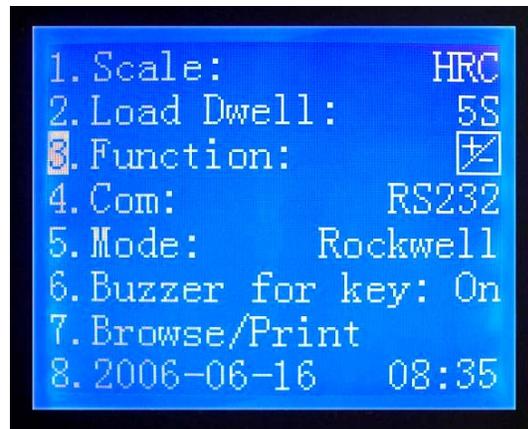


Figure 5.2.4

5.2.3 Auxiliary functions

The tester has four auxiliary functions, which can be used individually, multi selected or all selected. Press “ **↶** ” or “ **↷** ” key to move cursor to “3” in figure 5.2.1, press “ **←** ” key ,then the cursor move to the position of “ [?] ” and change to “ [] ” as figure 5.2.4. Press “ **↶** ” or “ **↷** ” key at this time to select the desired auxiliary functions, then press “ **←** ” to confirm and go into next menu as 5.2.5~5.2.9. There four auxiliary functions marked as “ [] , [Σ] , [] , [∅] ” , which represent limit setting, data statistics, scale conversion and curved surface correcting respectively.

5.2.3.1 Limit setting

Press “ \uparrow ” or “ \downarrow ” key to set the value of upper limit and the value of lower limit in the figure 5.2.5, then press “ \leftarrow ” to confirm.

The upper limit and lower limit will be shown simultaneously with the display of each measuring result once the function setting has been completed. As figure 5.2.6, the testing result is 59.9HRC, upper limit is set as 62.0HRC, lower limit is 56.0HRC. If the result is beyond the limitation setting, a warning on the display and buzzing will occur simultaneously.



Figure 5.2.5



Figure 5.2.6

5.2.3.2 Data statistics

The statistics for one group data is available; press “ \uparrow ” or “ \downarrow ” key to determine the value of N (the applicable scope is 2 ~ 99) in figure 5.2.7; then press “ \leftarrow ” to confirm.

The values of serial number n and N will be showed simultaneously with the displaying of measuring result each time after the function setting has been taken into effect. Refer to figure 5.2.6, 5 measurements will be performed totally, and the current measurement is the 2nd. In case of n=N, that is to say the last measurement had been completed, the tester will automatically calculate the average \bar{X} , standard deviation S, maximum (Max), minimum (Min) and the range R as figure 5.2.8 showing after the hand wheel had been unloaded by turning in anti direction.

Of which, the mean value, standard deviation and range can be calculated according to the following equation.



Figure 5.2.7



Figure 5.2.8

$$\bar{X} = \frac{1}{N} \sum X_i ,$$

$$S = \sqrt{\frac{1}{N-1} \sum (\bar{X} - X_i)^2}$$

$$R = \text{Max-Min}$$

Normally, the serial number will plus 1 after each measurement until the n is equal to N (i.e. all of the N measurements were finished), then begin with statistical calculation. In event one of the current measurements must be deleted, press “↕” or “⬇” key in the figure 5.2.6 when the “√” change to “x”, then unload (i.e. Lowdown the anvil). For this condition, n will not be added by 1, and the current measurement will not take part in the statistical calculation.

5.2.3.3 Scale conversion

This function can convert the measured Rockwell hardness value to other scales or strength. Such as changing the value of HRA scale into HBS, HBW, HV and HK value; changing the value of HRB scale into HB10, HB30, HV, HLD, σ_b and HK value; changing the value of HRC scale into HBS, HBW, HV, HLD, σ_b and HK value; changing the value of HRD scale into HV, HK, HB value; changing the value of HRE scale into HV, HK, HB value; changing the value of HRF scale into HV, HB value.

For instance, if we intend to convert the HRC value to HV value, press “↕” or “⬇” key to move the cursor to “3. HRC—HV” in figure 5.2.9, and then press “←” to confirm. The conversion value will be showed simultaneously with the displaying of measuring result each time after the function setting has been set. As figure 5.2.6, the hardness value measured is 59.9HRC, conversion value is 696HV. Each change is performed within the applicable scope when change is possible; “E” will be shown on the display if setting is incorrect or not obtainable.



Figure 5.2.9



Figure 5.2.10

5.2.3.4 Curved surface correcting

The testing results should be corrected if the surface of sample measured is the external surface of cylindrical or spherical. Press “” or “” key to select cylindrical surface or spherical surface, then press “” to confirm as figure 5.2.10.

After that, press “” or “” key to determine curvature radius or the diameter of sphere, and press “” to confirm.

Once this parameter has been set, the measuring result as well as correcting value will be shown on the display. **Note:** screen will display respective hardness value (the direct testing result without correction) as well as the corrected value. As figure 5.2.6, the measuring result is 59.9HRC and the correcting value is “+1.0” HRC.

5.2.3.5 Press “**Setup**” key to return to figure 5.1.1 ; or press “” or “” key to reset the other parameters.

5.2.4 Communication status setting

The 900-365 is provided with a digital communication USB port (transmission rate 9600bps), which can be connected with external computer. After setting, test results of each time will be sent to external computer.

Press “” or “” key to move cursor to “4” in figure 5.2.1, press “” key then move the cursor to “Off”.

Press “” or “” key at this time, the options “Printer”, “USB”, “Off” will be appear in sequence. When the desired option appears, press “” to complete the selection.

Press “**Setup**” key to return to figure 5.1.1 ; or press “” or “” key to reset the other parameters.

5.2.5 Buzzer for key

Press “” or “” key to move cursor to “6” in figure 5.2.1, press “” key, then the cursor move to “Off”. Press “” or “” key to select the “On” or “Off” for the key buzzer, press “” key to confirm finally.

Press “**Setup**” key to return to figure 5.1.1 ; or press “” or “” key to reset the other parameters.

5.2.6 Browse through/print from memory

Press “ \uparrow ” or “ \downarrow ” key to move cursor to “7” in figure 5.2.1, then press “ \leftarrow ” key. The latest 8 test results will display on the screen as figure 5.2.11. The serial number and time of the test are displaying simultaneity. There are 500 items of record in maximum. Press “ \uparrow ” or “ \downarrow ” key to scroll the items. The item of record which the cursor pointed can be printed by press “ \leftarrow ” key.

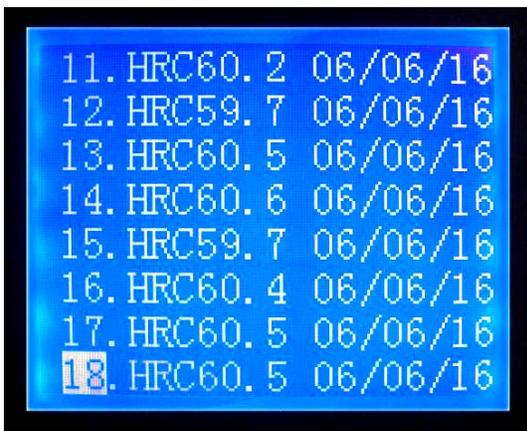


Figure 5.2.11



Figure 5.2.12

Press “**Setup**” key to return to figure 5.1.1 ; or press “ \uparrow ” or “ \downarrow ” key to reset the other parameters.

5.2.7 Time setting

Press “ \uparrow ” or “ \downarrow ” key to move cursor to “8” in figure 5.2.1, press “ \leftarrow ” key, figure 5.2.12 appears. Press “ \uparrow ” or “ \downarrow ” key to move cursor to “1” in figure 5.2.12, then press “ \leftarrow ” key, press “ \uparrow ” or “ \downarrow ” to select the year, and press “ \leftarrow ” key to confirm. The month, also the date, hour, minute and second can be reset in the same way.

Press “**Setup**” key to return to figure 5.1.1 ; or press “ \uparrow ” or “ \downarrow ” key to reset the other parameters.

5.3 Testing

5.3.1 Preload

Place the sample to be tested on the anvil, and rotate the hand wheel clockwise to raise the anvil as figure 5.3.1, showing the anvil moving course. Rotate the hand wheel smoothly until the anvil in figure reaches the end position as figure 5.3.2. the machine will buzz when it reaches its peak. Do not turn handle any further as an error will occur.

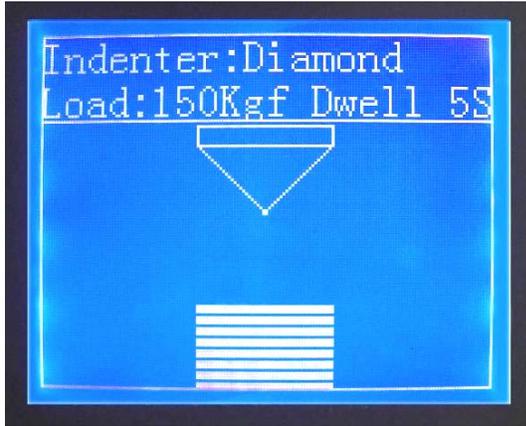


Figure 5.3.1



Figure 5.3.2

5.3.2 Automatic testing

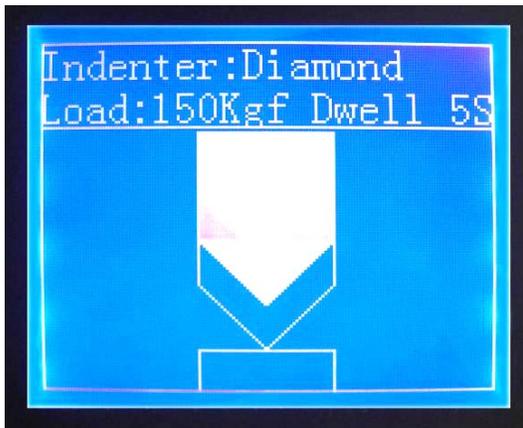


Figure 5.3.3



Figure 5.3.4

After the preload has been set, the test will be performed automatically as follows: loading main test force, as figure 5.3.3; holding with dwell time and counting down after loading, refer to figure 5.3.4. Finally, unloading is performed immediately when the dwell time has finished. Test results will be showed on screen, refer to figure 5.2.6.

5.3.3 Unloading

Once the test has been completed, you should rotate the hand wheel counter-clockwise to lower the anvil to unload the machine; the screen returns to figure 5.1.1, The machine is now ready to perform the next test. All parameters are saved and should not need to be modified at this time.

5.4 Shut down

Remove the test force completely, and switch off the power supply. Disconnect power cord if not being used for an extended period of time.

Warning: Do not test any specimen that cannot be safely and properly positioned on and supported by the tester anvil.

6 Maintenance and Service

6.1 When the hardness tester is to be moved or transported, the weights and assembly **MUST** be removed from the inside of the machine. Store in supplied tool kit.

6.2 When performing any adjustments, the power supply must be disconnected

6.3 Pay careful attention to your indenter. Be sure the shank is clean and free of rust, dirt or metal chips prior to installation.

6.4 The surface of anvil and test blocks should be clean. No oil, dirt, dust, rust or metal chips should be on these surfaces as it will cause erroneous readings.

6.5 Always keep the dust cover on the machine when not in use. Never store in damp area.

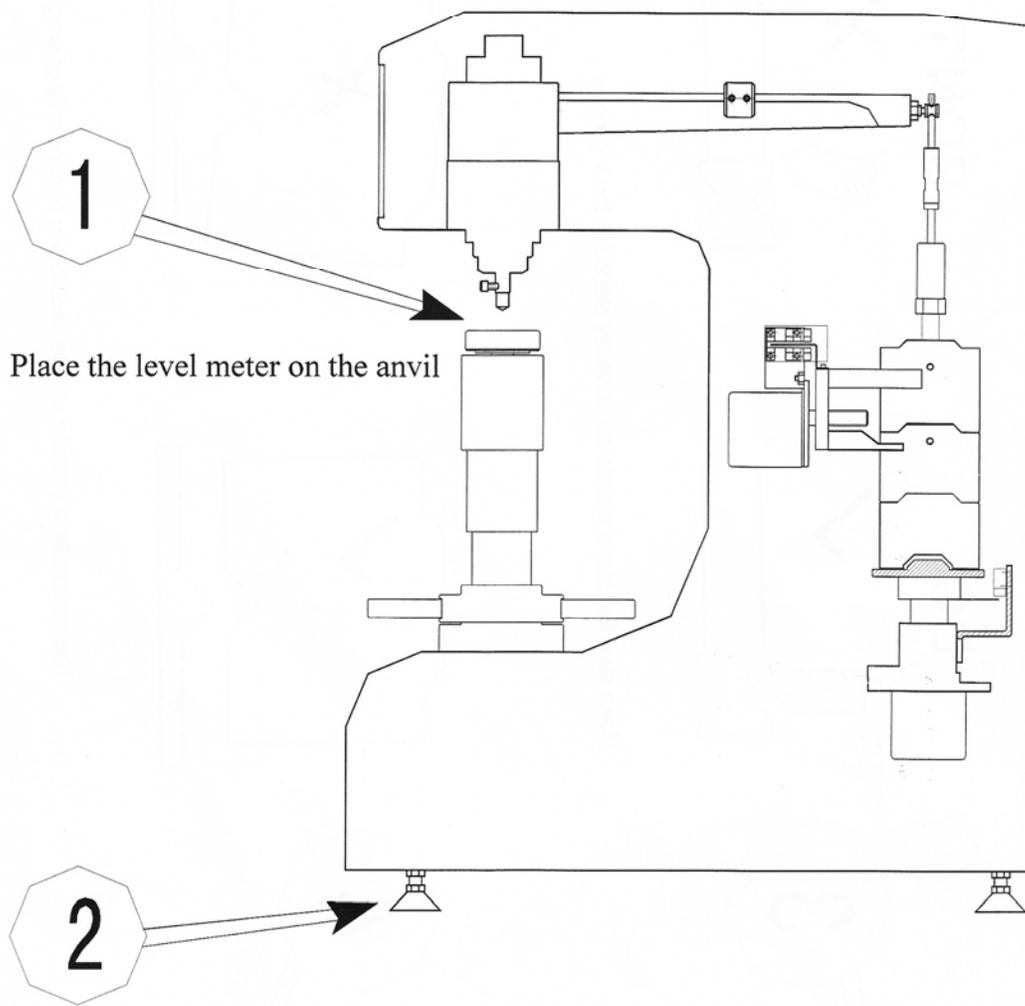
6.6 The leadscrew of the anvil should be lubricated periodically. Apply a few drops of light machine oil, then run the leadscrew up and down a few times to distribute the oil.

6.7 Never disassemble any fixed parts as this will automatically void any stated or implied warranties. If you need service, please contact Phase II directly at (201) 933-6300.

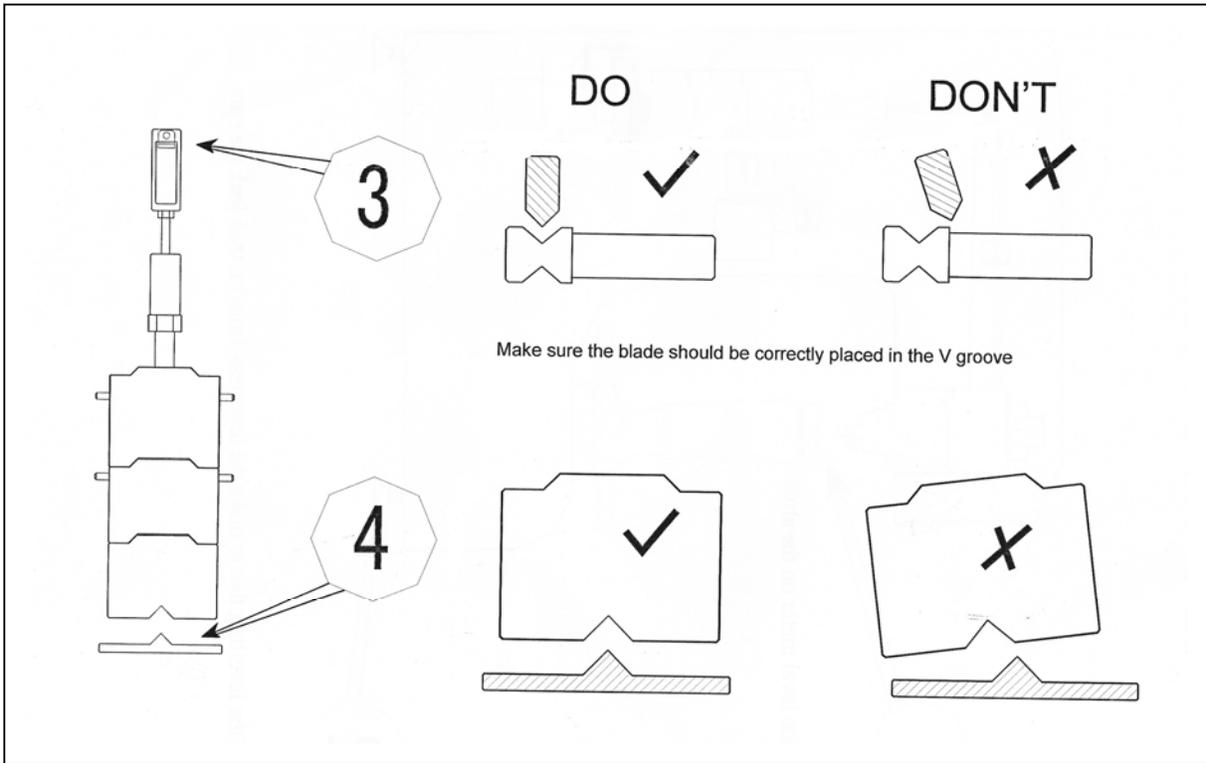
Rockwell Hardness Scales

Scale	Indentor	Load/ KG	Application	Brinell L Value	Working Range
A	Diamond	60	Carbides, Thin Steel, Shallow case-hardened steel Case carburized surfaces	Over HB 400	40-91 for hardness greater than C 65
B	1/16" Ball	100	Aluminum alloys, copper alloy, unhardened steel, in rolled, drawn, extruded or cast metal	HB 100-240	30-100 for hardness lower than C 20
C	Diamond	150	Hard cast irons, pearlitic malleable iron, steel deep case hardened steel, titanium	Over HB 230	20-70 for material harder than HRB 100
D	Diamond	100	Pearlitic malleable iron, Thin steel, Medium case Hardened Steel	Over HB 400	40-77 for intermediate load between A & C Scale
E	1/8" Ball	100	Cast Iron, Aluminum and Magnesium alloys, Bearing Metals	Below HB 125	50-100 for hardness lower than HRB 0
F	1/16" Ball	60	Thin soft sheet metals Annealed copper alloys	HB 50-120	30-100 for hardness lower than HRB 0
G	1/16" Ball	150	Copper-Nickel-Zinc and Cupro-Nickel alloys, Malleable irons	HB 120-280	30-90 for hardness slightly > than HRB 100 Upper limit=G92
H	1/8" Ball	60	Lead, Zinc, Aluminum Magnesium alloys	HB 30-50	70-100
K	1/8" Ball	150	Bearing metals, very soft or thin metals	HB 100-200	40-100
L	1/4" Ball	60	Plastic materials: Bakelite, Vulcanized Fibre		Variations in hardness Reduced by testing with the largest indentor Consistent with overall hardness of the material
M	1/4" Ball	100	Nylon, Polystyrene, Flexiglass		See Above
P	1/4" Ball	150			
R	1/2" Ball	60	Rigid sheet metal & plate Materials used for Electrical insulation are tested by M & L scales		Moulded Finish will give a higher reading than a machined face
S	1/2" Ball	100			
V	1/2" Ball	150			

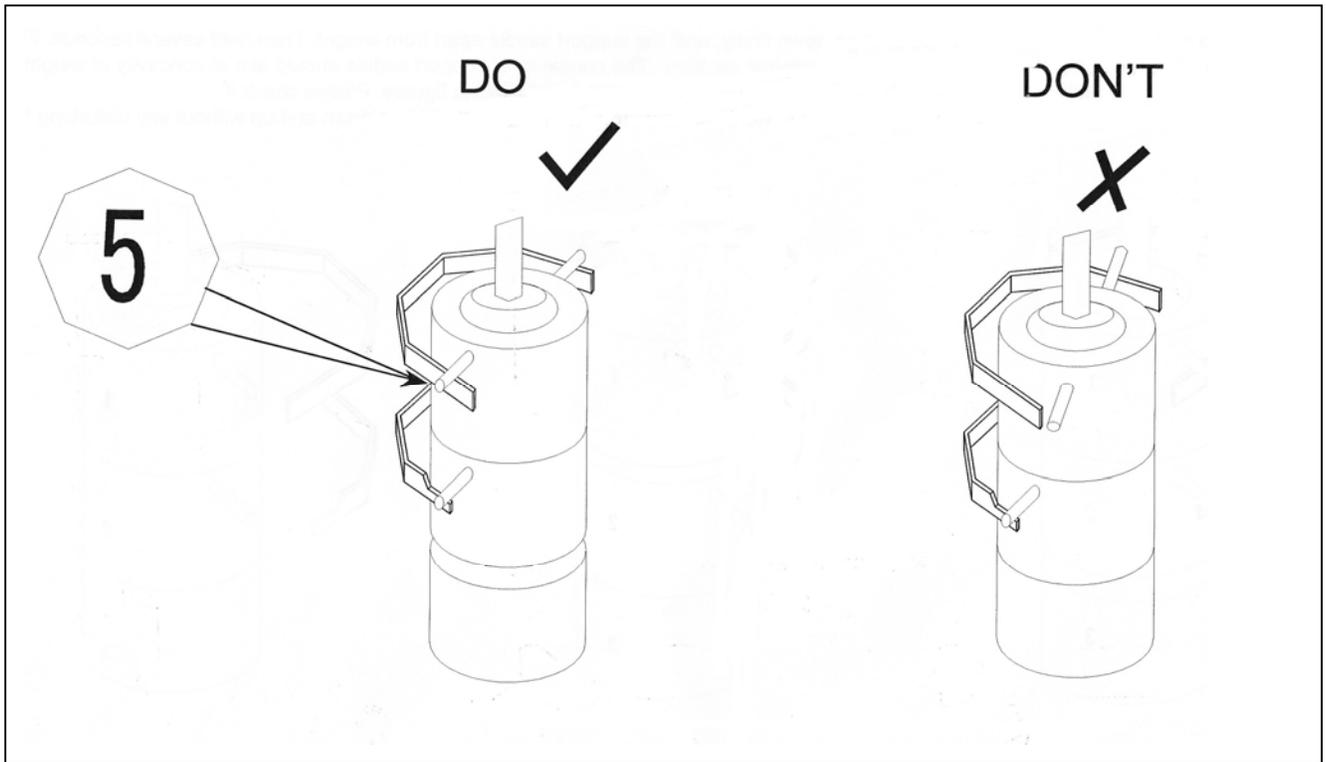
VERY IMPORTANT!



Use adjustable feet to level the machine. Be sure to lock nuts when completed

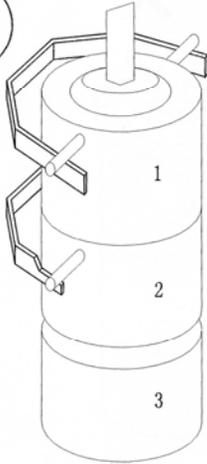


The weights must sit flush in the groove of the support saddle

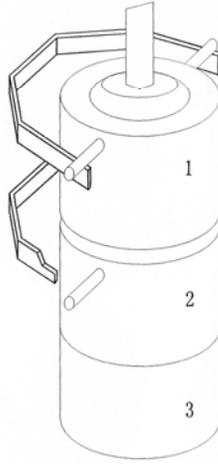


**The two pins in the weights should be symmetric.
Don't turn in any other direction.**

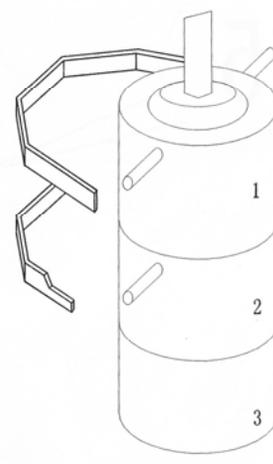
6



When testing on HRA scale, the load is 60Kgf. Weight No.1 & 2 are supported. Only weight No.3 is in use.



When testing on HRB scale, the load is 100Kgf. Weight No.1 is supported. Weights No.2 & 3 are in use.



When testing on HRC scale, the load is 150Kgf. All the weights No.1, 2 & 3 are in use.

All weights should unobstructed while taking a test.

The chart above explains which weights get supported when taking a particular Rockwell test.



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