

**RH-150 Rockwell  
Portable Hardness Tester**

**Operation Instruction**

**G & R Technology Inc.**

# General Description

The G & R RH-150 Rockwell portable Hardness Testers are advanced instruments distinguished by their friendly operation, high accuracy, durability, repeatability, reliability, and versatility. They are used for testing the hardness of a variety of metals in various locations.

The RH-150 Hardness Tester has digital readouts for direct hardness readings in HRA, HRB, HRC, HV, and HB scales. The RH-150 has an IrDA communication function that can transmit data to a micro printer or a PDA system to produce a hard copy of the test results.

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# 1. Technical Specifications

<b>Testing</b>	<b>Range:</b>
HRA	20-88
HRB	20-100
HRC	15-70

## **Scale**

HRA, HRB, HRC

## **Tensile Strength**

110 - 363 Lb/in<sup>2</sup>

77 - 266 Kg/cm<sup>2</sup>

## **Converting Hardness Scales:**

HB, HV

## **Accuracy and Variation:**

+/- 0.5% Point (based on the average of five measurements around 60HRC)

+/- 0.5% Point (based on the difference of the maximum reading and minimum reading of five measurements around 60HRC)

## **Temperature:**

Operating Temperature: 32°F to 104°F (-10°C to 40°C)

Storage Temperature: - 4°F to 122°F (-20°C to 50°C)

## **Data Storage:**

Automatic recording and storage of up to 500 test results, including readings, conversion results, and averages.

## **Clock:**

Real time and date with a ten-year calendar.

## **Power Supply:**

Two 1.5V AA Batteries

## **Battery Life:**

Work life: 60 hours continuous

Shelf life: 1 year continuous

## **Tester Weight:**

2.4 Lb (1.1kg)

## **Tester Dimensions:**

7" x 3.25" x 1.25" (182mm x 84mm x 34mm)

## **2. Check Package**

### **RH-150 tester package includes:**

RH-150 Hardness Tester

Standard test block

- 20-30 HRC
- 35-55 HRC
- 59-65 HRC

Diamond Indenter

Carbide ball indenter

Plane supporter

V type supporter

Plastic carrying case

1" (25mm) retaining frame

2" (50mm) retaining frame

3" (75mm) retaining frame

4" (100mm) retaining frame

2 AA batteries

Pin wrench

Hex key

### **RH-150 optional equipment & accessories**

Micro IrDA Printer

Standard test block

HRB

HRC

Special Tools

### 3. Functional Description

Figure 1.1 illustrates the RH-150 hardness testers.

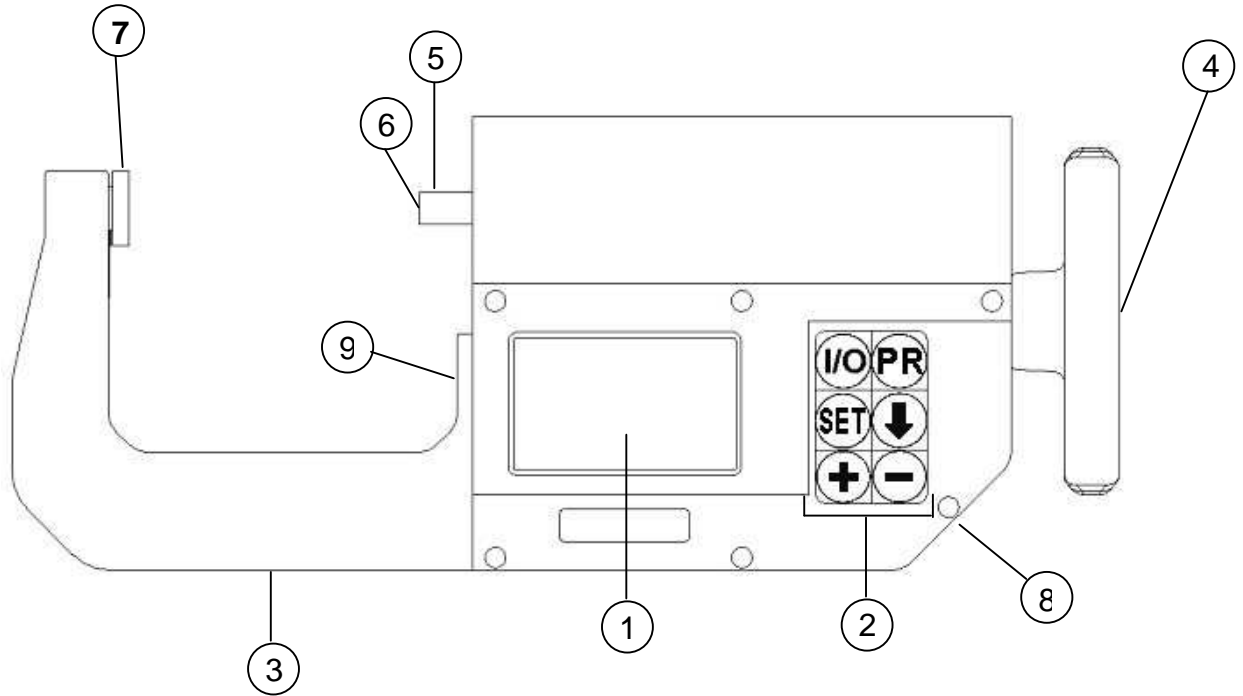


Figure 1

1. LCD Monitor – the graphical LCD monitor can display test results and operation descriptions and prompts.
2. Keys
  - **I/O** key: power on/off – the RH-150 hardness tester has a power save function: it will automatically turn off if inactive for 5 minutes.
  - **PR** key: infrared transmission – press this key to send data to the printer or a PDA system.
  - **SET**, **↓**, **+**, and **-** keys: these function keys are used for various operations as defined on the LCD monitor.
3. Retaining Frame - holds the test piece. The user can select and switch different sized retaining frames according to the size of the test piece.
4. Hand Wheel – twist clockwise to load test force and twist counterclockwise unload test force.
5. Positioner - fixes the test piece in position.
6. Indenter – indents into the test piece.
7. Adjust Supporter – helps fix the test piece in place
8. IrDA window - transmits infrared rays to the printer or PDA systems.
9. Socket Head Screws – fixes the retaining frame in position.

## 4. Pre-Treatment of the Test Piece

Preparation of the test piece surface prior to testing will help insure accuracy.

- a. The test should be carried out on a clean surface that is free from oxide scale, foreign matter, and especially free of lubricants.
  
- b. Preparation should be carried out in such a way that minimizes alteration of the surface hardness (for example, heat or cold-working).
  
- c. The thickness of the test piece should be no less than 0.08 in (2mm).
  
- d. The test piece should have a smooth even surface. The test surface should be polished so that a metallic luster appears. Measurement errors could result from the roughness of the test surface. The roughness (Ra) of the surface must be limited to  $\leq 1.6 \mu\text{m}$ .

# 5. Basic Operations

## Powering on the device

Press the **I/O** key to turn on the power. The LCD monitor will display the main window. The main window will show the last test results:

<b>MAX 62.7</b>	<b>MIN 62.7</b>
<b>AVE 62.7</b>	<b>HV 764.9</b>
<b>1 005</b>	<b>62.7 HRC</b>

## Setup a New Test

1. At the main window, press the **SET** key to start and set up a new test. You will now select the operating parameters. The LCD monitor will prompt for a number of test results in the test group:

<b>AVE 04</b>
---------------

2. Press the **+** key repeatedly to cycle through 1 to 10. After you have selected a number, press the **SET** key to input that number and select a testing scale.
3. The LCD monitor will now prompt for a testing scale. Press the **+** key repeatedly to cycle through HRA, HRB, or HRC. The LCD monitor will display one of the following windows based on the currently selected testing scale:

<b>HRA</b> <b>60KG DIAMOND</b>
-----------------------------------

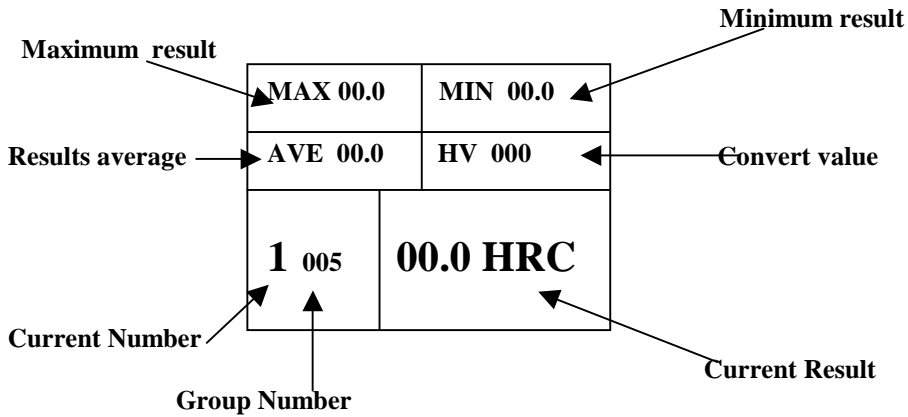
<b>HRB</b> <b>100KG BALL</b> <b>HRB</b> <b>HV: ST SS BR CO AL</b> <b>HB: ST SS BR CO AL</b> <b>LBI: ST</b> <b>KGM: ST</b>
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<b>HRC</b> <b>150KG DIAMOND</b> <b>HRC</b> <b>HV: ST SS</b> <b>HB: ST SS</b> <b>LBI: ST</b> <b>KGM: ST</b>
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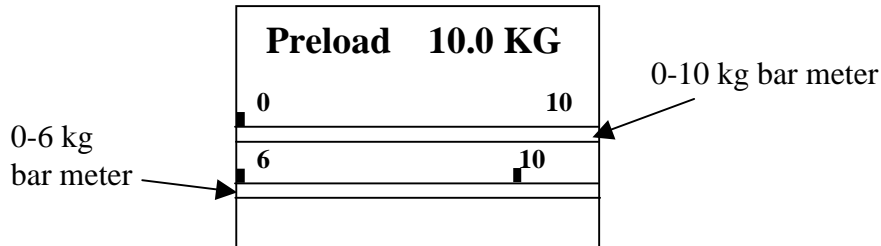
ST----Steel                      CO-----Copper  
 SS----Stainless Steel        AL-----Aluminum  
 BR----Brass  
 LBI---Lb/in<sup>2</sup>                    KGM----Kg/cm<sup>2</sup>

4. When the LCD window displays the correct testing scale, it may prompt for converting hardness scales. Press the **↓** key repeatedly to cycle through these scales. The selected scale will flash.
5. When the converting hardness scale you want to edit is flashing, repeatedly press the **←** key to cycle through the test material options. The selected option will flash.
6. Press the **SET** key again to finish set up and the LCD monitor will return to the main window:

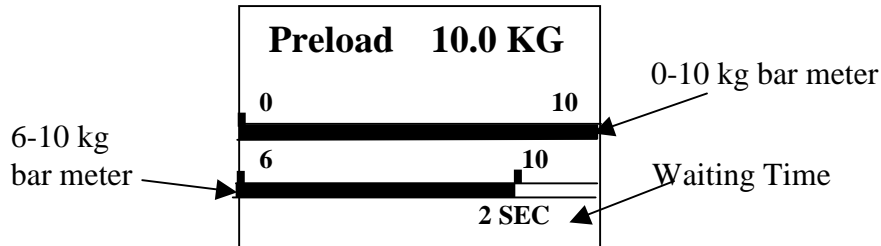


## Testing Procedure

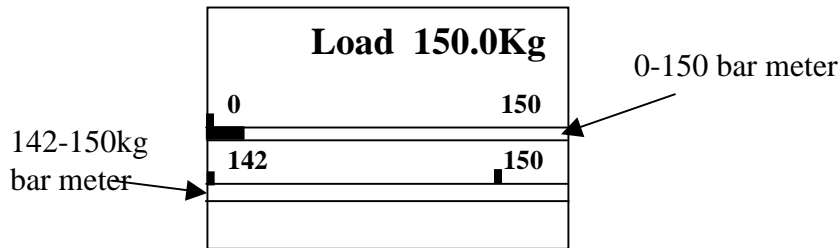
1. Start in the main window. Place the test piece between the adjust supporter and positioner, then turn the hand wheel clockwise to hold the test piece. The LCD monitor will display:



The top bar meter on the screen visually shows how much force is applied. When the real force exceeds 6 kg, the more precise bar meter on the bottom will show the amount of applied force. Continue turning the hand wheel, until the real force goes up to 10 kg. The monitor will display a waiting time.



After 1 to 5 seconds (depending on the setup settings – see p. 14: RH-150 set up), the LCD monitor will automatically display the total test force: 60kg (HRA), 100kg (HRB) or 150kg(HRC):

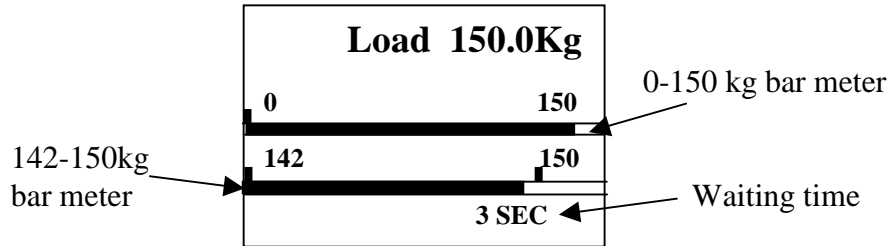


Note: After the waiting time, if the real force exceeds the preload force by 2.0 kg, then the display will give an overforce warning:



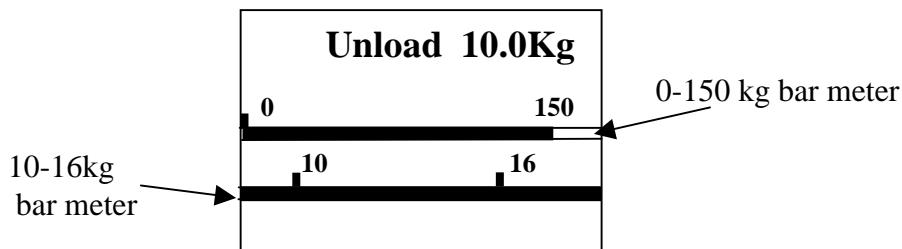
2. The top bar meter visually shows how much force is applied. When the real force exceeds 52kg(HRA), 92kg(HRB) or 142kg(HRC), the more precise bar meter on

the bottom will also visually show the amount of applied force. Continue turning the hand wheel until the real force increases to the total test force. The monitor will display a waiting time.

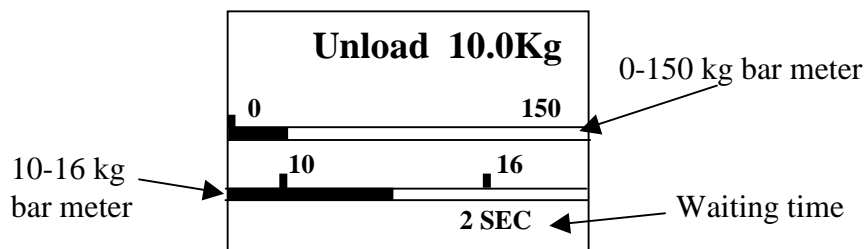


Note: After the waiting time, if the real force exceeds the total force by 2.5 kg, then the display will give an overforce warning.

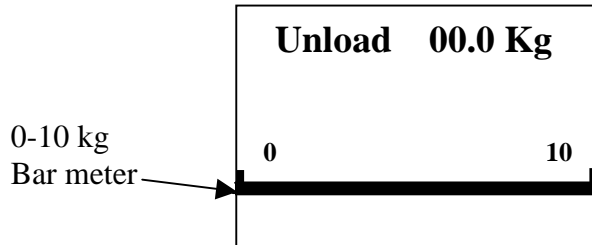
After 2 to 9 seconds (dependent on the setup settings – see p. 14: RH-150 set up), the LCD monitor will automatically display the unload force:



3. The top bar meter visually shows how much force is applied. When the real force falls below 16 kg, the more precise bar meter on the bottom will also visually show the amount of applied force. Turn the hand wheel counterclockwise until the real force decreases to 10 kg. The monitor will display a waiting time.



Wait 1 to 5 seconds (depending on the setup settings – see p. 14: RH-150 set up), the LCD monitor will automatically display :



Note: After the waiting time, if the real force decreases below  $-2.0\text{kg}$ , then the display will give an overforce warning.

- Continue turning the hand wheel counterclockwise to release the test piece. The bar meter visually shows how much force is applied. The LCD monitor will display the test result:

MAX 62.7	MIN 62.7
AVE 62.7	HV 764.9
1 005	<b>62.7 HRC</b>

Note: Please do not touch the test piece during testing. Doing so will yield inaccurate results.

### Search & Delete Tested Results

- Search data in the current test group

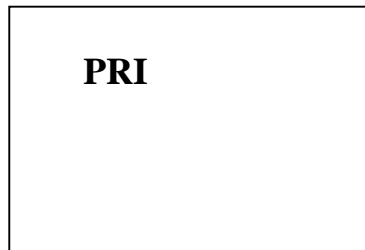
From the main window, press the **+** key to search and cycle through the test results in the current group. If you want delete the displaying data, press the **-** key. This data will be deleted from memory and you will return to the main window. The LCD monitor will now display the last test result. If you want to return to the main

window without deleting anything, press the **SET** key. The last test result will be displayed.

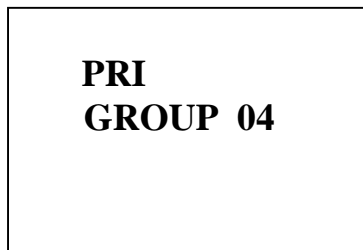
2. Delete current test result  
From the main window, press the **—** key to delete current test result.

### **Transmit Data to Printer or PDA system using IrDA**

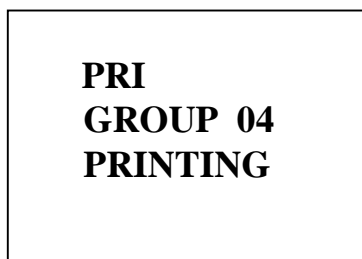
Press the **PR** key to start the data transmit procedure and the LCD window will display:



1. If you want print test results, press the **PR** key again and the LCD window will display the current test group number. Press the **+** key to cycle through and select the group number you want to print.



Turn on your printer and align the IrDA window of the printer with the IrDA window of the RH-150 tester. Then press the **PR** key again to send the data to the printer, and the LCD monitor will display following:



2. If you want transmit the data to a Palm PDA system or PC system , press the **SET** key and the LCD window will display the current test group number. Press the **+** key to cycle through and select the group number you want to transmit.

**PDA  
GROUP 04**

Turn on your PDA system or PC system and aims the IrDA window of the RH-150 tester at the IrDA window of the PDA system or PC system. Then press the **PR** key again and The LCD monitor will display following information, and the data will be transmitted to PDA system or PC system.

**PDA  
GROUP 04  
PRINTING**

If the printer or PDA system successfully receives the data, the RH-150 hardness tester will return to the main window.

If the RH-150 hardness tester does not successfully communicate with the printer or PDA system, the LCD monitor will display:

**PLEASE CHECK  
PRINTER STATUS**

After 30 seconds, RH-150 hardness tester will return to main window.

If unsuccessful, the printer or PDA system may not be turned on or the IrDA window of the RH-150 hardness tester is not in range with the IrDA window of the printer.

Note: the printer is preconfigured for protocol IrDA. If the configuration is changed incorrectly, the printer needs to be reconfigured. Reconfiguration instructions are in the printer user manual. The printer should setup following:

Mode Protocol IrDA  
Baud rate 9600 Hz  
8 Data Bit  
No Parity  
1 Stop Bit  
Density Medium

The printer user manual can be downloaded at: <http://www.woosimsystems.com>

Click on the link “Mobile Printers” Then click on the link “PORTI-S30/40” Then download the user manual.

The printer configuration is detailed on page 16: “2.5 Setting Operation Mode”

## 6. RH-150 Set Up

### 1. Memory Reset

This function resets the whole memory. First, start with the power off. Simultaneously hold down the **SET** and **+** keys. Then hold down the **I/O** key, and then release the **I/O** key. Finally, release the function **SET** and **+** keys. The whole memory will be reset. The LCD monitor will display:

<b>MAX 00.0</b>	<b>MIN 00.0</b>
<b>AVE 00.0</b>	<b>HV 000</b>
<b>1 001</b>	<b>00.0 HRC</b>

### 2. Timer set up and adjust offset

The RH-150 hardness tester has a timer function to record the test time and an adjust offset function to offset correct test results according to the standard test block. First, start with the power off. Simultaneously hold down the **SET** and **-** keys. Then hold down the **I/O** key, and then release the **I/O** key. Finally, release the **SET** and **-** keys. The LCD monitor will display:

<b>DATE FMT</b>	<b>USA</b>
	<b>EUR</b>

Press the **↓** key to select USA or European date format. The selected one will flash. Then press the **SET** key to set the selected format. The LCD monitor will now display the current time:

<b>YEAR</b>	<b>06</b>
<b>MONTH</b>	<b>06</b>
<b>DAY</b>	<b>21</b>
<b>HOUR</b>	<b>05 AM</b>
<b>MINUTE</b>	<b>23</b>



You can adjust the time according to your requirement. Press the **↓** key to cycle through and select Year, Month, Day, Hour and Minute. The selected parameter will flash. Press the **+** or **-** key to increase or decrease the value for that parameter.

Press the **SET** key again to finish time set up and the LCD monitor will display:

<b>OFFSET</b>	
<b>HRA</b>	<b>+00</b>
<b>HRB</b>	<b>+00</b>
<b>HRC</b>	<b>+03</b>

You can adjust the offset parameter according to the standard test block. Press the **↓** key to cycle through and select HRA, HRB, or HRC. The selected one will flash. Press the **+** key to increase the offset number. Press the **-** key to decrease the offset number. Then press the **SET** key to finish offset adjustment and the LCD monitor will display load waiting time:

<b>LOAD TIMER</b>	
<b>PRELOAD</b>	<b>5</b>
<b>LOAD</b>	<b>8</b>
<b>UNLOAD</b>	<b>4</b>

Press the **↓** key to cycle through and select Preload, Load or Unload. The selected one will flash. Press the **+** key to increase the waiting time. Press the **-** key to decrease the waiting time. Then press the **SET** key to finish waiting time set up and the LCD monitor will return to the main window.

**Note:** Must set up RH-150 Hardness tester after change batteries.

## 7. Changing Accessories

### **Retaining Frame**

The user should select a retaining frame according to the size of the test piece.

Use a Hex key to remove the socket head screw from the retaining frame. Slide off the retaining frame. Then slide on the new retaining frame. Screw on the socket head screw with a Hex key.

### **Indenter**

The user should select an indenter according to the test scale. The HRA and HRC scales use the diamond indenter, and the HRB scale uses the ball indenter.

First, use the Pin Wrench to remove the positioner. Remove the indenter from the positioner. Place the new indenter into the positioner. Then screw tight the positioner onto the RH-150 hardness tester with the Pin Wrench.

### **Supporter**

The RH-150 hardness tester has two standard supporters. One is the plane supporter, the other is the V type supporter. The user should select a supporter according to the test piece.

First, remove the retaining frame, then remove the supporter with a screwdriver. Attach the new supporter with a screwdriver, then replace the retaining frame.

## 8. Hardness Tester Maintenance

### Tester Storage and Operating Precautions

The HT-1000A/HT-2000A testers are precision instruments. When storing or operating the tester, avoid the following:

1. Dropping the tester or hitting it with another object.
2. Dropping or spilling any oil, grease, or other liquid onto the tester.
3. An environment with heavy dust or gas that could cause damage to the tester.
4. The indenter and the positioner should be clean, without any oil, grease or dirt.
5. When testing big and heavy parts, the user should keep the RH-150 hardness tester stable.

### Replacing Batteries

The battery life is 60 hours. The battery life will vary with the frequency of use. If the monitor displays the **LOW POWER** symbol, the batteries should be replaced using the following guidelines:

1. Use two 1.5 AA batteries.
2. Insert the batteries; the terminals should correspond with the diagram on the battery holder.
3. Voltage levels of the two batteries should be similar. Replace both batteries at the same time.

**Caution: After changing batteries in the tester, turn the tester power ON, then turn the power OFF to allow the tester to enter the sleeping procedure.**

## 9. Rockwell Measurement and Application

The general principles of the Rockwell hardness test are illustrated in Fig. 2 (tested with a diamond indenter).

A 120° angle diamond or 1/16" (1.588mm) diameter hard steel ball indenter is pressed into the test piece surface with a preliminary force  $P_0$  (10kgf) at a depth  $D_0$ . Then, a main force  $P_1$  is added until the total test force,  $P = P_0 + P_1$ , is 60kgf for HRA, 100kgf for HRB and 150kgf for HRC, and the indenter rises to a depth  $D_2$ . Then, the preliminary force  $P_0$  is unloaded, and the indenter decreases to a depth  $D_1$ . This results in a depth increase,  $e = D_1 - D_0$ , measured in units of 0.002mm. The hardness reading for HRA and HRC is  $100 - e$ , and for HRB is  $130 - e$ .

A diamond indenter with an (1) angle of 120° at the tip or a ball indenter with (2) radius of curvature of 0.200 mm at the tip presses the surface of the test piece under (3) a preliminary test force  $P_0$  10kgf (98N) and has a (6) depth of penetration.

Then the indenter presses an additional force, (4)  $P_1$ , of 140 kgf (1373N) and is kept like so for a short time (2 to 5 seconds). The indenter now has an (7) increase in the depth of penetration, and the (5) total test force,  $P = P_0 + P_1 = 10 + 140 = 150$  kgf.

(8)  $e$  is defined as the permanent increase in depth of penetration under preliminary test force after removal of additional force.  $e$  is expressed in units of 0.002 mm. (9) xx HRC Rockwell C hardness =  $100 - e$ .

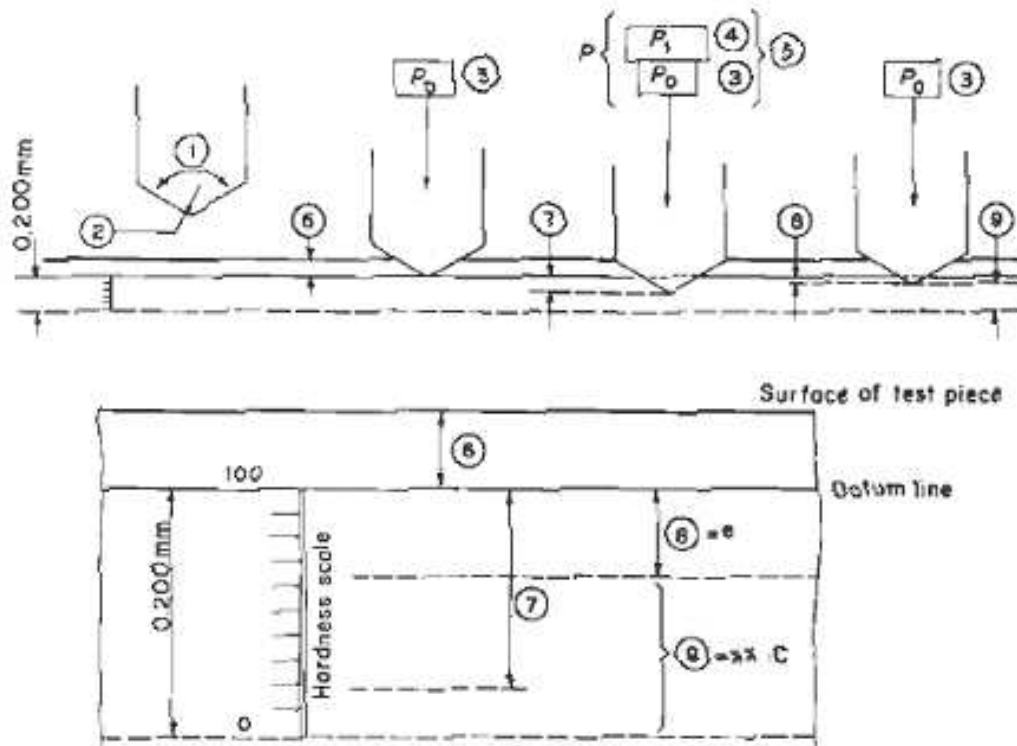


Figure 2

The general principles of the Rockwell B hardness test are illustrated in Fig. 3 (tested with a ball indenter).

A ball indenter of (1) D diameter 1/16 in. (1.588 mm) presses the surface of the test piece under (3) a preliminary test force  $P_0$  of 10kgf (98N) and has a (6) depth of penetration.

Then the indenter presses (4) an additional force  $P_1$  of 90 kgf (883N) and is kept like so for a short time (2 to 5 seconds). The indenter now has (7) an increase in depth of penetration, and the (5) total test force,  $P = P_0 + P_1 = 10 + 90 = 100$  kgf (981N).

(8) e is defined as the permanent increase in depth of penetration under preliminary test force after the removal of additional force and is expressed in units of 0.002 mm . (9) xx HRB Rockwell B hardness = 130 - e.

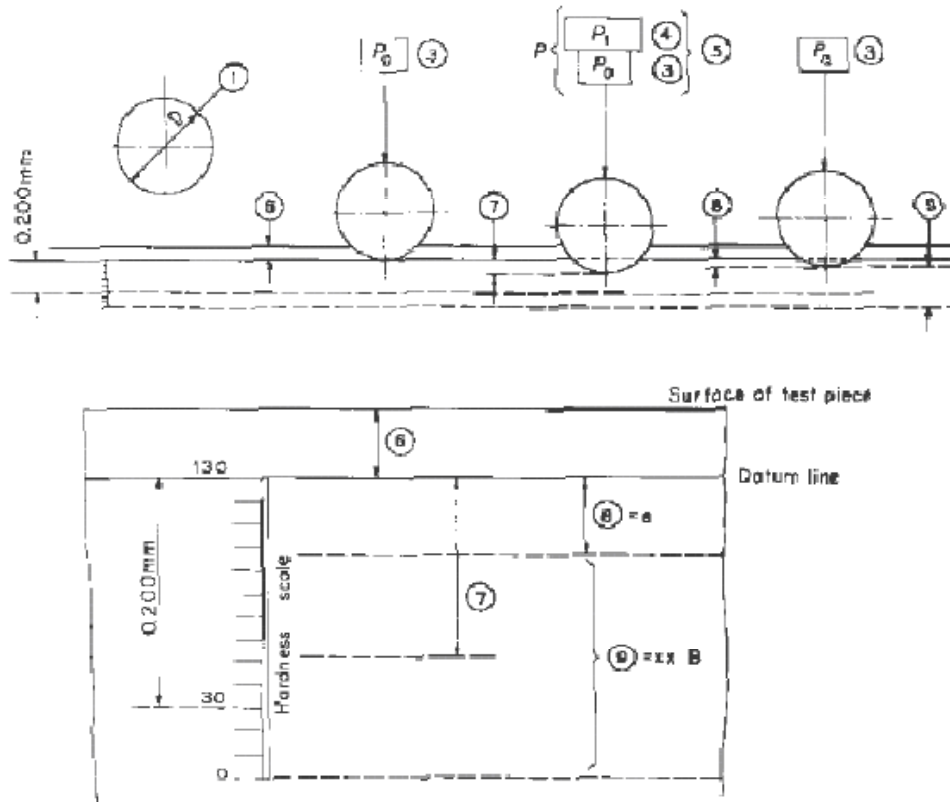


Figure 3