Pen-type Hardness Tester
Operating Manual

Distinguished engineer friend!

Thank you for your trust, welcome to use the world's smallest portable pen-type Leeb hardness tester, hope it could bring you a new useful experience.

Before using this instrument, please be sure to carefully read the "Operation instructions", it will give you the correct way of using this instrument .hope we can make you satisfied.

——Solid make NDT easier!

CONTENTS

1. Summarize

The instrument is a kind of portable measuring instrument; it can be quickly, nondestructive and high accuracy when measuring common metal materials hardness. It can be used in the laboratory, as well as the on-site engineering field. It can meet the needs of a variety of measurement through instrument measuring conditions setting. The instrument can be widely used in manufacturing, metal processing industry, chemical industry, commodities inspection, and etc. It is indispensable for material nondestructive hardness testing.

This instrument meets the following criteria:

——*JJG 747-1999 Leeb Hardness Tester*

——*ASTM A956-06Standard Test Method for Leeb Hardness Testing of Steel Products*

Feature：

- **Intelligent simple**
  "fool" type operation, directly shows Leeb scale and Rockwell values
- **Small and portable**
  Small, portable instrument, integrated design without connecting cables, improves the reliability
- **Industry highlights, OLED display**
  Can clear display data under direct sunlight, suitable for all kinds of lighting conditions
- **Born colorful**
  Self-expression with unique colors, show the unique personality
- **Accurate Measurement**
  High precision of measurement circuit guarantee value error for ± 0.5%(HLD=800),repetition rate value for 0.8%
- **Support for multiple hardness standard**
  HL、HV、HRA、HRC、HRB、HB、HS
- **Massive capacity data storage**
  The unprecedented mass storage leads the technology trend. It can save 270hardness measurement data, each group including average, hardness standard.
- **Support ‘Forged Steel’ material**
  When impact type D device test sample "forged steel" it can be read directly HB values, without manual look-up table. Hardness value is preset upper and lower limit, automatic alarm beyond the scope, convenient for the user batch testing.

- **Charge as you want**

USB charging, compatible with lots cell phones and other digital product interface

Note: The above features are associated with the model; please refer to the appendix behind.

1.1 Measuring Principle

A predetermined mass of the force of the impact body, the impact surface of the sample at a constant speed, with the punch1mmaway from the sample surface at the impact velocity and rebound velocity calculated from the ratio hardness value. Calculated as follows：

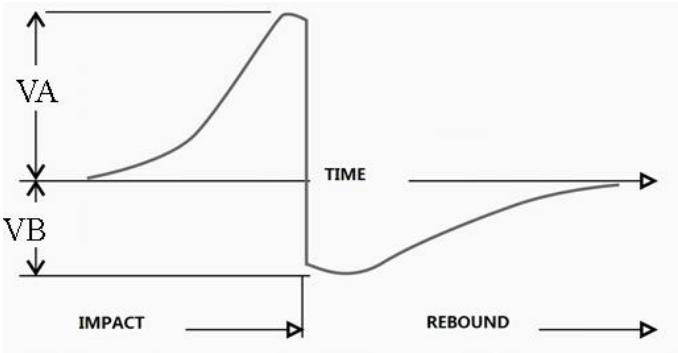
$$HL=1000\times VB/\ VA$$

HL——Leeb Hardness

VB——The speed of rebound

VA——Impacting Speed of impact body

Impact device output signal Schematic diagram is as follows:



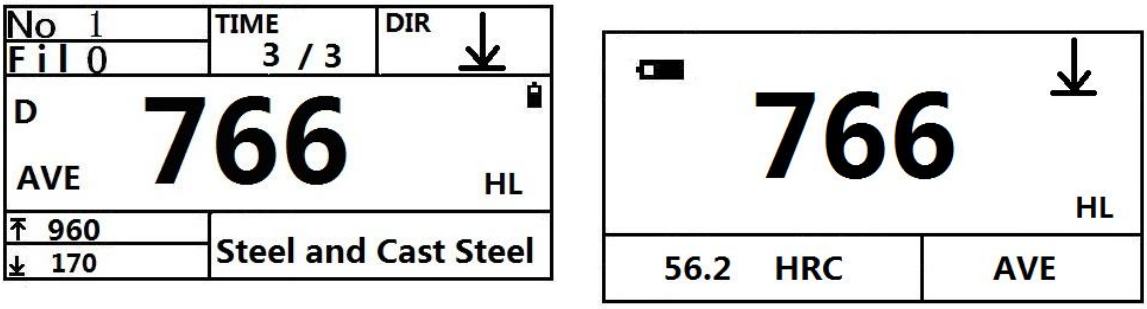
1.2 Standard Package

Name	Qty
Main Body	1
Support Ring	1
Manual	1
Brush	1
Battery Charging Head	1
Battery Charging Wire	1
Portable Bag	1

1.3 The appearance and display instrument

1.4 Screen display

The instrument will automatically enter the main display after boot, as shown below:



Main Measuring Display Interface

Hardness standard: HL or HRC shows current hardness standard

Average value: AVE

Direction:

Battery storage:

1.5 Key definitions

	Power Off		Up
	Confirm		Down

1.6 Technical parameters

Material	Hardness Standard	Impact Device	
		D	DL
Steel and cast steel	HRC	17.9 ~ 68.5	20.6 ~ 68.2
	HRB	59.6 ~ 99.6	37.0 ~ 99.9
	HRA	59.1 ~ 85.8	
	HB	127 ~ 651	81 ~ 646
	HV	83 ~ 976	80 ~ 950
	HS	32.2 ~ 99.5	30.6 ~ 96.8
Steel	HB	143 ~ 650	
CWT、ST	HRC	20.4 ~ 67.1	
	HV	80 ~ 898	
Stainless steel	HRB	46.5 ~ 101.7	
	HB	85 ~ 655	
	HV	85 ~ 802	
GC. IRON	HRC		
	HB	93 ~ 334	
	HV		
NC、IRON	HRC		
	HB	131 ~ 387	
	HV		
C．ALUM	HB	19 ~ 164	
	HRB	23.8 ~ 84.6	
BRASS	HB	40 ~ 173	
	HRB	13.5 ~ 95.3	
BRONZE	HB	60 ~ 290	
COPPER	HB	45 ~ 315	

Specification:

Testing direction
Highly accurate in any impact direction
Testing Range
(170-960)HLD,(17.9-69.5)HRC,(19-683) HB,(80-1042)HV,(30.6-102.6)HS, (59.1-88)HRA, (13.5-101.7)HRB
Hardness Standards
HL、HV、HRA、HRC、HRB、HB、HV、HS
Accuracy
HLD：±0.5% (800HLD)
Repeatability Value
HLD：0.8%　(800HLD)
Resolution
128×64 OLED display
Dimensions

148mm×40mm×30mm
Power Supply
Rechargeable lithium battery
Working Hours
About 10 hours
Working Conditions
Operating temperature: 10-50 c; Storage temperature: -30 ℃ -60 ℃; Humidity: 90% max;
Standard Equipped:
The instrument host　1 The nylon brush　1 Small bearing rings　1 The ABS instrument　1
Applicable Materials

Steel and cast steel, alloy tool steel, stainless steel, gray cast iron, nodular cast iron, cast aluminum alloy, copper zinc alloys (brass), an alloy of copper and tin, copper(bronze)
Application
Bearings and other parts; Failure analysis of pressure vessel, steam turbine generator group and equipment; Heavy workpieces; Mechanical or permanent assembly installed; The test space is very narrow; The original record of formal requirements on test results;

Impact Device		**D/DL**
The impact energy Impact of body mass		11mJ 5.5g/7.2g
Ball hardness: Ball diameter: Material of the ball:		1600HV 3mm tungsten carbide
Impact device diameter: Impact device length: Weight of the device:		20mm 86(147)/ 75mm 50g
The maximum hardness:		940HV
Surface average roughness Ra :		1.6μm
The minimum weight of specimen: Direct measurement Stable support To compact coupling		>5kg 2～5kg 0.05～2kg
The minimum thickness of specimen Dense coupling The minimum depth of hardened layer		5mm ≥0.8mm
Indentation size		
The hardness of 300HV	The indentation diameter	0.54mm 24μm
The hardness of 600HV	The indentation diameter	0.54mm 17μm
The hardness of 800HV	The indentation diameter	0.35mm 10μm
Impact device applicable scope		DL measures on elongated slot or hole; D measures conventional surveying

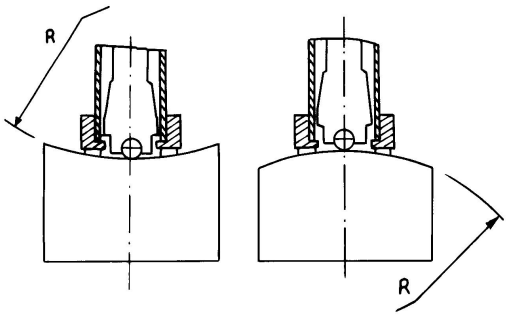
- Value error and repetition

Standard Leeb hardness block	Error	Repetition Rate
800HLD	±0.5%	0.8%

2.Operation of the machine

2.1 Specimen preparation

- In the process of preparing the sample surface, should be avoided due to heat, cold, etc. on the sample surface hardness.
- It will cause measurement errors if measured surface is too rough. Therefore, the test specimen surface must be exposed metallic luster and smooth, without oil.
- Surfaces: Test specimen surface is best plane. Measured surface radius of curvature R less than 30mm should be used in the test sample small support ring or ring-shaped support.



- Specimen support
  - For heavy samples, with no need for support;
  - Medium-sized specimen must be placed in a flat, hard, flat surface, placing the sample must be absolutely smooth, without any shaking;
- Sample should be of sufficient thickness, the minimum thickness of the specimen shall conform to Table 3.
- For samples with surface hardened layer, hardening layer depth shall comply with Table 3.
- Coupling
  - For light specimens must be sturdy supporting body tightly coupled, two coupling surfaces must be smooth, not too much amount of coupling agent, the test must be perpendicular to the direction of coupling plane;
  - When a sample was a big plate, pole, bending parts, even weight, thickness, may still cause large specimen deformation and instability, resulting in test values are not allowed, it should be back at the test point reinforced or supported.
- Sample itself should be less than 30 Gauss magnetic

2.2Measurement

- Start

-Type without keys: Push down load impact set of lock body, push the upper part of the impact device release button, the instrument self test and enter the measurement mode.

-Type with keys: Press [ON / OFF] key, then the power is turned on, the instrument auto enters measurement mode.

- Load

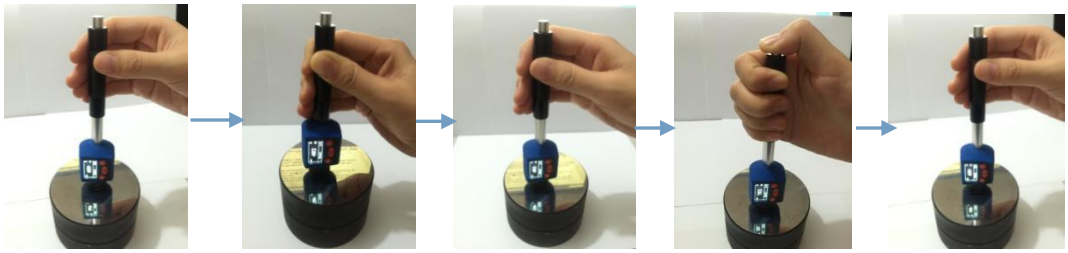
  -Push down load impact set of lock body, completes the loading at this time.

  -Put impact device supporting ring compression on the sample surface, direction of impact should be vertical with the test surface.

  (SolidNDT have installed impact device for clients)

- Measure

  5 steps to operate



  1, Put tester on the block steady.

  2, Press black impact device to bottom then release it again.

  3, Release impact device

  4, Press top button

  5, Read hardness

  -Press the upper part of the impact device release button for testing. Samples, impact device, the operator should be stable at this time, and the force direction should be through the axis of the impact device.

  - Each monitoring site should be tested three times in general.

  - Read the measured average value, as a hardness test data on the Leeb standard.

- Power off

  - If no operation for a period of time, the instrument will turn off automatically.

  -Type with keys: press "on/off" key, the instrument will turn off.

- Distance between any two indentation or any indentation center distance sample edge distance should comply with the regulations of the table below.

Distance between the two indentation Center	Distance between indentation center sample edge
≥3mm	≥5mm

- Hardness standard setting(type with keys)

  - According to the applicable range, select the hardness standard, then measure.

2.3 Menu map (Type with keys)

Setting and additional functions can be realized through the instrument parameters menu operation, in the main display screen press [menu] button to enter the main menu.

1, Exit
2,Test Set
3,Save Average
4, Delete Single
5, Calibration Average
6,Memory Manager
7,Calibrate
8,System Set

Instruction for each submenu

2.3.1 Exit

Choose “exit” back to home.

2.3.2 Test Set

2.3.2.1 Impact Direction

“ ↓ ↙ ← ↖ ↑ auto” 6 kinds direction to choose. Base on workpiece condition to choose correct direction

2.3.2.2 Average

Set calculate average times. (from 1 to 10)

2.3.2.3 Materials

Base on work piece to choose material (10 kinds material)

2.3.2.4 Hardness scale

HL HV HB HRC HS HRB HRA (Base on different materials)

2.3.2.5 Tolerance

Set min hardness and max hardness(when hardness exceed limited range the tester will alarm)

2.3.3 Save Average

Save data

2.3.4 Delete Single

Delete one data

2.3.5 Calculate Average

Calculate Average

2.3.6 Memory Manager

2.3.6.1 View file

Check file number

2.3.6.2 Delete File

2.3.6.3 Select File Number

2.3.6.4 Return

2.3.7 Calibration

Choose one standard hardness block and test 5 times. If the average hardness is not correct then choose  to adjust the hardness to standard hardness.

2.3.8 System set

2.3.8.1 Auto Save On

Auto save data, do not need manually save data each time.

2.3.8.2 Auto Delete On

Auto delete data, do not need manually delete data each time

2.3.8.3 Language Set

Chinese/English(Other language can be set base on Clients' requirements)

2.4 Charge

This machine adopts the rechargeable lithium battery, when the battery voltage is too low, please charge it in time, and the selection of random with the charging head and USB charging cable.

When the battery voltage is too low, the instrument will automatically shut down.

Whether or not the boot, charger connected can be charged, the charging head indicator light

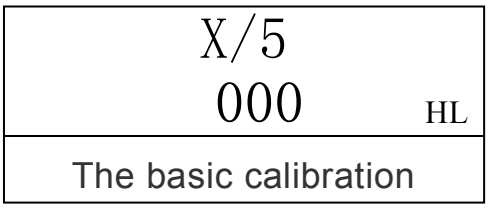
3.Calibration of the instrument

If measurement error value or repetition is too large, the available Leeb standard hardness block (optional) calibration on instruments and impact device.

- Enter the calibration menu, as shown in the form below

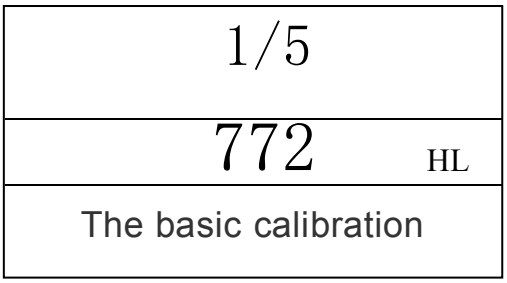
-Type with keys: press 【menu】button to enter the menu, press  【up down】 choice ‘software calibration’, press 【menu】button to enter 7.the calibration status.

-Type without keys: the empty measured five times in a row, can enter the calibration status.



- Calibration measurement

  - On the magnitude of the hardness block vertical downward average value measurement random measured at five dots.



- According to the Leeb standard hardness block of the nominal value adjust measuring values

  -Type with keys: press 【up down】 key to adjust measurements to the nominal value, press 【menu】key to complete the calibration.

  -Type without keys: on measured empty time value will minus 1, the workpiece or hardness block measurement will be measured value add 1 at a time, after the adjustment to the nominal value, no need to do any operation, automatic calibration after 5 seconds.

- Calibration range of plus or minus 15 HL.

4. Maintenance and repair

4.1 Impact device

- After the use of 1000 - 2000 times, clean up catheter and impact device with nylon brush, clean the catheter when the first supporting ring rotation, then the impact body removal, nylon brush to counterclockwise screwed pipe, the end of pull out, repeat 5 times, and then arrange on the impact body and the support ring;
- After use, should release the impact body;
- Impact device is strictly prohibited the use of various lubricants.

4.2 The normal repair process

- As for verification of Rockwell hardness standard block, errors are larger than the 2HRC, may be a ball head wear failure, and should consider replacing the ball or the impact body.
- When the hardness tester shows other abnormal phenomenon, please do not disassemble or adjust any fixed assembly parts, complete the warranty card and send it to our company maintenance department, perform warranty regulations. The instrument stay in our company is generally not more than a week.

4.3 Non warranty parts list

1 Housing	2 Impact body	3 Support ring
4 Bond film	5 Windows	6 Lithium battery

4.4 Storage conditions

- The device should be stored away from vibration, strong magnetic field, the corrosive medium, moisture, dust, should be stored at room temperature.
- In the original packaging - transport guarantee condition, can be carried out in thetertiary highways conditions.

5. Appendix

Model	Keys	Probe	Hardness Standards	Applicable materials	Impact Direction
1	**x**	D	HL/HRC	Steel and cast steel	Down
2	√	D	HL/HV/HRA/HRC/HRB/HB/HS	Steel and cast steel, alloy tool steel, stainless steel, gray cast iron, nodular cast iron, cast aluminum alloy	360º
3	√	DL	HL/HV/HRA/HRC/HRB/HB/HS	Steel and cast steel, alloy tool steel, stainless steel, gray cast iron, nodular cast iron, cast aluminum alloy	360º