

UNI-T®



UT347A Leeb Hardness Tester User Manual

P/N:110401111116X

PREFACE

Thank you for purchasing the new UT347A Leeb hardness tester. In order to use this product safely and correctly, please read this manual thoroughly, especially the Safety Instructions part.

After reading this manual, it is recommended to keep the manual at an easily accessible place, preferably close to the device, for future reference.

LIMITED WARRANTY AND LIABILITY

Uni-Trend guarantees that the product is free from any defect in material and workmanship within one year from the purchase date. This warranty does not apply to damages caused by accident, negligence, misuse, modification, contamination and improper handling. The dealer shall not be entitled to give any other warranty on behalf of Uni-Trend. If you need warranty service within the warranty period, please contact your seller directly.

This warranty is the only compensation you can obtain. Uni-Trend will not be responsible for any special, indirect, incidental or subsequent damage or loss caused by any reason or speculation. As some areas or countries do not allow limitations on implied warranties and incidental or subsequent damage, the above limitation of liability and stipulation may not apply to you.

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1. Overview

UT347A is a tester designed to detect the metal material hardness based on the principle of the Leeb hardness test method.

Applications:

- Heavy and large workpieces;
- Bearings and other parts;
- Quality control of heat-treated parts;
- Machine guide rails and car chassis;
- Installed machinery or permanently assembled parts;
- Die cavity of molds and other workpieces with very narrow test space;
- Failure analysis of pressure vessel, steam generator and other equipment;
- Metal material identification.

Range of application:

- Refer to Attached Table 1 and Attached Table 2.

Functions:

- Test details can be recorded. The tester has the camera function and can store up to 900 records.
- The integrated thermal micro printer supports real-time printing and batch printing. The print definition is adjustable.
- The tester has a USB interface and a BLE Bluetooth module. With them, the tester can connect to computers or mobile phones and upgrade firmware;
- 2.8" TFT color screen with a resolution of 320x240;
- English/Chinese optional and easy-to-operate menu;
- Adjustable backlight brightness;
- The tester has the custom material function. Different materials have exclusive hardness conversion tables.
- The threshold alarm can be turned on/off. When it is on: higher than the upper threshold: yellow; lower than the lower threshold: red; normal: green.
- Built-in lithium battery, control circuit and USB Type-C interface for charging;
- Calibration function.

2. Accessories

Unpack the box and carefully check whether the following accessories are missing or damaged:

1. Leeb hardness tester-----	1 PCS
2. Type-D impact device-----	1 PCS
3. Standard Leeb hardness block-----	1 PCS
4. Nylon brush-----	1 PCS
5. Type-C USB cable-----	1 PCS
6. User manual-----	1 PCS
7. Download guideline-----	1 PCS
8. Printing paper-----	2 rolls

3. Specifications

● Units:
HL, HB, HRC, HRB, HV, HS

● Range:
170~960 HLD

● Indicating value error and repeatability: (see Table 1 below)

NO.	Impact device type	Hardness of standard Leeb hardness block	Indicating value error	Indicating value repeatability
1	D	790±40HLD	±6HLD	6HLD
		530±40HLD	±10HLD	10HLD
2	DC	790±40HLDC	±6HLDC	6HLDC
		530±40HLDC	±10HLDC	10HLDC
3	DL	894±40HLDL	±12HLDL	12HLDL
		736±40HLDL		
4	D+15	795±40HLD+15	±12HLD+15	12HLD+15
		544±40HLD+15		
5	G	590±40HLG	±12HLG	12HLG
		500±40HLG		
6	E	755±40HLE	±12HLE	12HLE
		508±40HLE		
7	C	851±40HLC	±12HLC	12HLC
		590±40HLC		

● Display:
2.8" TFT color screen with a resolution of 320x240

● Camera:
Effective pixel 640×480, focus free

● Flashlight:
White light, 0.5W LED

● Printing paper:
Thermal paper of 57mm width

● Data storage:
900 groups

● Alarm indicator light:
Higher than the threshold: yellow
Lower than the threshold: red
Normal: green

● Auto power off:
The meter will automatically shut down after a period of no operation. The auto power off time can be adjusted. The function can be turned off.

● Operating voltage:
Built-in lithium battery 3.7V

● Charging time:
About 2~4h

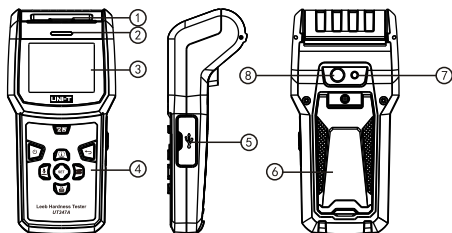
● Charging source:
DC 5V 2A

● Operating time:
About 4~8h (not print)

● Environmental requirements:
Operating: 0~40℃ ≤80%RH;
Storage: 10~50℃ ≤75%RH.
There is no strong vibration, strong magnetic field, corrosive medium and lots of dust in the surrounding environment.

4. Product Introduction

4.1 Structure



NO.	Description	NO.	Description
1	Printing paper export	5	USB and impact device interface
2	Indicator light	6	Bracket
3	Display	7	Flashlight
4	Buttons	8	Camera

4.2 Buttons

Operation	Short press		Long press	
Mode	In the main interface	Menu/other setting interfaces	In the main interface	Menu/Records interface
	/	/	Power on/off	Power on/off
	Record the current data	Take photos	/	/
	/	Return	Delete the current value	/
	Switch the probe direction	Up	Turn on/off the flashlight	Scroll up
	Switch the hardness unit	Left	/	Delete data
SET	Enter the menu interface	Confirm	/	Print data
	Switch the material	Right	/	Jump to a data
	Print the current data	Down	Export the printing paper	Scroll down

5. Operating Principle

Under the action of elastic force, the impact body of specified mass impacts the sample surface at a certain speed, and the hardness value is calculated by the ratio of the rebound speed and impact speed of the punch at 1mm away from the sample surface. The calculation formula is as follows:

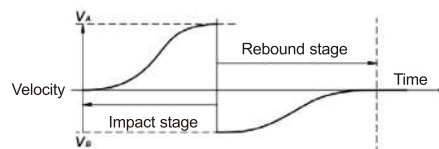
$$HL=1000 \cdot VB/VA$$

HL--Leeb hardness

VB--Rebound velocity

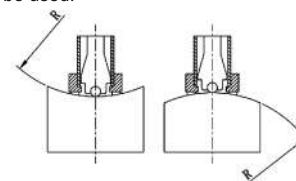
VA --Impact velocity

Output signal of impact device is shown in schematic diagram:



6. Preparation and Inspection

- The sample surface should conform to the requirements in Attached Table 3.
- The sample should not be heated or frozen; otherwise its surface hardness will be affected. Please place it at room temperature for a period of time before measuring.
- The sample surface must be smooth and glossy without oil stains.
- Heavy samples do not need to be supported. A sample with overhang, thin-wall and a weight less than 5kg should be supported by an object to avoid the sample deformation, bending and movement caused by the impact force. Medium samples must be placed on a smooth and solid surface.
- Curved sample: The optimal test surface is a plane. If a sample whose surface curvature radius R is less than 30mm (D, DC, D+15, C, E, DL type impact device) or less than 50mm (type-G impact device) is being tested, a small supporting ring or special-shaped supporting ring should be used.



- The minimum thickness of the sample should conform to the requirements in Attached Table 3.
- For samples with a surface hardening layer, the depth of the hardening layer should conform to the requirements in Attached Table 3.
- Coupling: Light samples must be closely coupled with a solid support. The coupling surfaces must be smooth. The coupling agent dosage should not be too much. The test direction must be perpendicular to the coupling plane. When the sample is a large area of plate, long rod or bending parts, it may still cause sample deformation and instability even if the sample weight and thickness is large, so it should be strengthened or supported on the back of the test point.

- The magnetism of the sample should be less than 30Gs.
- Before measurement, the tester can be inspected with the standard Leeb hardness block, and the indicating value error and repeatability should not be greater than those specified in Table 1.

Note: The standard Leeb hardness block is measured five times with a calibrated Leeb hardness tester, and the average is taken as its hardness value. If the hardness value obtained by measuring the hardness block with the Leeb hardness tester does not match this value, the tester should be calibrated first.

7. Quick Operation

Note: Turn off the tester before replacing the impact device.

7.1 Startup

- When the tester is not turned on, insert the impact device into the interface on the right side of the tester.
- Long press  to power on.

7.2 Loading

Push the loading tube down until the impact body is locked. For type-DC impact device, the loading tube can be sucked on the test surface, and the impact device is inserted into the loading tube until reaching the stop position, and then the loading is completed.

7.3 Localization

Press the support ring of the impact device firmly on the sample surface. The impact direction should be perpendicular to the test surface, as shown in the figure below.



7.4 Measurement

- Press the release button on the impact device. The sample, impact device and operator should be stable and the action direction should pass the axis of the impact device.
- Each test part of the sample usually should take 5 measurements. The data dispersion should not exceed mean value $\pm 15HL$.
The distance between any two indentations or the distance between the indentation center and the sample edge should conform to the regulations in Table 2.
- For specific materials, if the Leeb hardness values are to be accurately converted to other hardness values, comparative tests must be done to obtain the corresponding conversion relation. Use a certified Leeb hardness tester and a corresponding hardness tester to test on the same sample respectively. For each hardness value, five points of Leeb hardness should be measured uniformly around three or more hardness indentations to be converted. With the average Leeb hardness and the average corresponding hardness as comparison values respectively, make the hardness comparison curve. The comparison curve should include at least three groups of comparison data.

Type of impact device	Distance between centers of two indentations	Distance between indentation center and sample edge
	No less than (mm)	No less than (mm)
D、DC	3	5
DL	3	5
D+15	3	5
G	4	8
E	3	5
C	2	4

(Table 2)

7.5 Read Measured Values

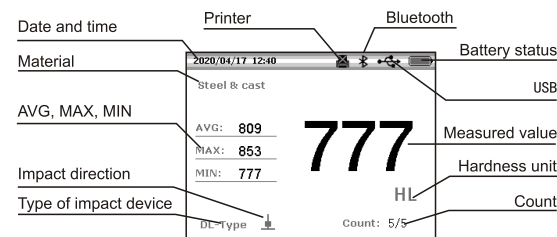
- Take the average hardness of several test points as the hardness value of the measured object.
- The measured values will show on the screen. The values measured by different types of impact devices are different, as shown in Table 1.

8. Detailed Operation

8.1 Power on/off

Long press  to power on/off. The tester will automatically shut down after a period of time without operation

8.2 Main Interface



8.3 Take Measurements

Take a measurement in the main interface, and the measured value, AVG, MAX and MIN will show on the screen. The number of impact times will increase by one, and the buzzer will sound a short beep. If the measured value is out of the range, the buzzer will sound a long beep. After reaching the set number of impact, the buzzer will sound two short beeps.

8.4 Buttons (in the main interface)

- Short press to save the current group of data, which is valid only after reaching the set impact times, and can only be saved once. After saving, press this button again to print the data or take a photo.
- In the camera interface, press to take a photo. An icon is automatically generated in the photo to indicate the current measurement average. Short press the direction (Up/Down/Left/Right) buttons to move the icon, and long press the direction buttons to quickly move it, as shown below:



- Long press to delete the last measured value.
- Short press to change the impact direction, and long press to turn on/off the flashlight.
- Short press to step through the hardness units.

Note:

- For different materials, the optional hardness units are also different.
 - After changing the material, the hardness unit will automatically change to HL.
 - This operation is invalid for the strength measurement.
- Short press the **SET** button to enter the menu interface.
 - Short press to select the material.
- Hardness: Steel & cast, Alloy steel, St. steel, Forged steel, Cast Al. alloy, Copper-zinc alloy, Copper-tin alloy, Grey cast iron, Nodular iron, Pure copper
 Strength: C steel, Cr steel, CrV steel, CrNi steel, CrMo steel, CrNiMo steel, CrMnSi steel, SS steel, S steel.



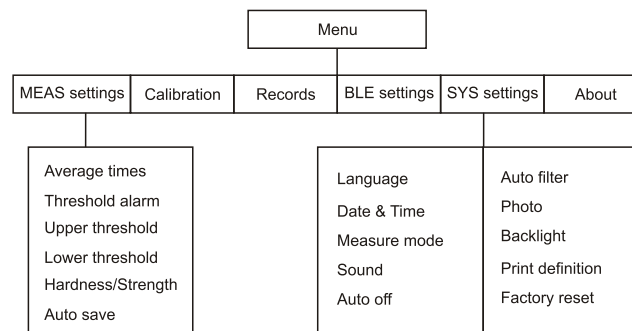
Press the Up/Down button to move the cursor. Press the SET button to confirm. Press to cancel.

Note: After changing the material, the current measured data will be cleared.

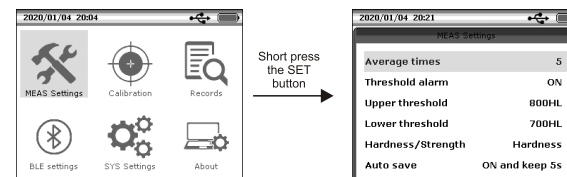
- Short press to print the current data, which is valid only after reaching the set impact times, and long press to control the export of printing paper.

8.5 Menu

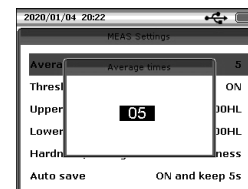
In the main interface, short press the SET button to open the menu:



8.6 MEAS Settings



- Average times



In the MEAS settings interface, press the Up/Down button to select "Average times", and then press the SET button to set the average times. Press the Right button to move the cursor to the units digit, and press the Up/Down button to add/subtract the value. Press the SET button to confirm. Press to cancel.

- Threshold alarm

The threshold alarm can be turned on/off. When it is on:

Higher than the upper threshold: yellow

Lower than the lower threshold: red

Normal: green

- Upper threshold

- Lower threshold

Press the Left/Right button to move the cursor, and press the Up/Down button to change the value. Press the SET button to confirm. Press $\leftarrow$ to cancel.

Note:

1. If the upper threshold is smaller than the lower threshold or the lower threshold is larger than the upper threshold, press the SET button and there will be no response. Reset the value or press  to cancel.

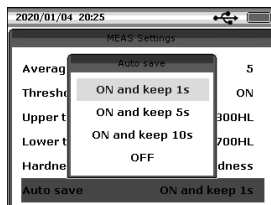
2. After changing the hardness unit, the upper and lower thresholds will automatically restore to the default values.

- Hardness/Strength

Switch between the hardness and strength measurements.

Note: The strength measurement is available only when type D and DC impact devices are used.

- Auto save



- In the MEAS settings interface, press the Down button to select "Auto save", and then press the SET button to set the function.

ON and keep 1s: After the measurement is completed, the tester will automatically save data and return to the main interface after 1 second;

ON and keep 5s: After the measurement is completed, the tester will automatically save data and return to the main interface after 5 seconds:

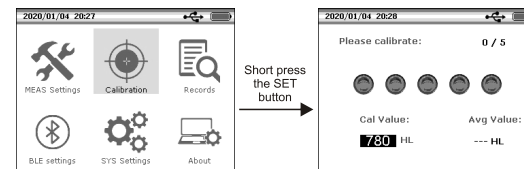
ON and keep 10s: After the measurement is completed, the tester will automatically save data and return to the main interface after 10 seconds;

OFF: Disable the auto save function.

Note: Users can choose whether to take photos or print data before the countdown ends

8.7 Calibration

The tester and impact device must be calibrated with the standard Leeb hardness block before using the instrument for the first time or before using the instrument again after a long period of time.

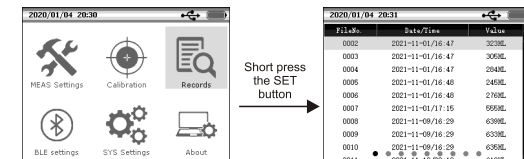


After taking 5 measurements, the average value will show on the screen. Input the calibration value according to the hardness marked by the standard Leeb hardness block, and then short press the SET button to confirm. Press  to re-measure and calibrate. The calibration range is $\pm 15\text{HL}$.

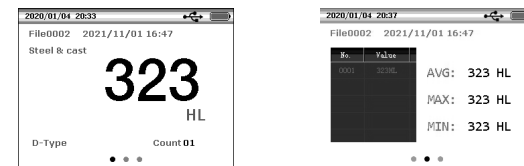
Note: After the impact device is replaced, the tester needs to be recalibrated before being used. The default probe is type-D. If users want to calibrate other types of probes, they need to refer to the hardness conversion table of different types of probes before inputting the calibration value.

8.8 Records

In the menu, press the Up/Down/Left/Right button to select "Records", and then press the SET button to enter its setting interface.

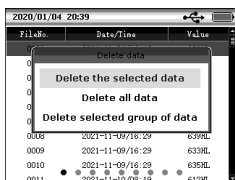


- Press the Up/Down button to move the cursor. Press and hold the Up/Down button to scroll up/down.
- Press the Left/Right button to turn the page. There are 100 pieces of data per page, up to 9 pages.
Dots at the bottom of the screen indicate the number of pages: ● ● ● ● ● ● ● ● ● ●
- Press the SET button to view the selected record.



Press the Left/Right button to turn the page for detailed information.

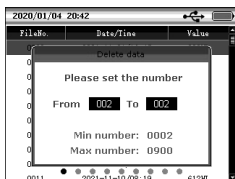
- Long press  to open the "Delete data" interface.



Press the Up/Down button to select an option, and press the SET button to delete.

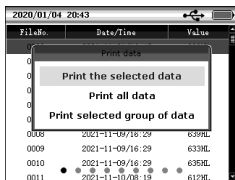
Press  to cancel.

Select "Delete selected group of data" and press the SET button.



Press the Left/Right button to move the cursor. Press the Up/Down button to adjust the number. After setting the number in the first window, press the SET button to set the number of the next window. Press the SET button to delete data. Press  to cancel.

- Long press the SET button to open the "Print data" interface.

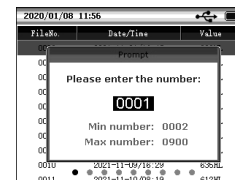


The operation of "Print data" is similar to "Delete data".

Note:

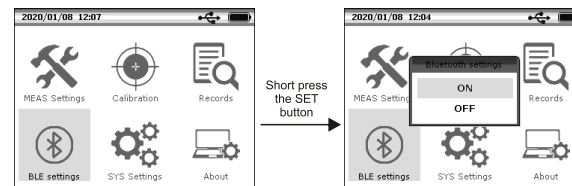
1. Press  to stop printing after the current group is printed.
2. If the printer is short of paper or overheated, the printing will be automatically interrupted, and message prompts will pop up (press the SET button to exit). The icon  (short of paper) or  (overheated) will flash. Please change the paper or wait for the printer to cool down until the above icon no longer flashes. If the "Print data" dialog box is not exited, the printing can continue from the break.
3. Ordinary thermal paper has a short storage time. If users want to print data that needs to be stored for a long time, please choose long lasting thermal paper.
4. Do not store the printing paper in a place of high temperature or direct sunlight. If it has been unsealed, store it in a place away from light.

- Long press  to jump to a data.



Press the Left/Right button to move the cursor. Press the Up/Down button to adjust the number. Press the SET button to jump to the data of the set number. Press  to cancel.

8.9 BLE Settings

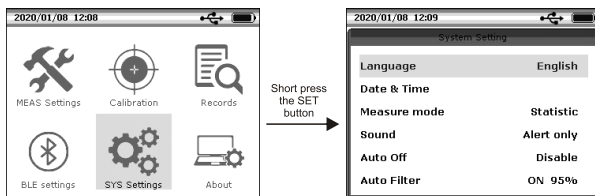


Press the Up/Down button to select ON/OFF, and press the SET button to confirm. Press  to cancel.

8.10 Bluetooth App specification

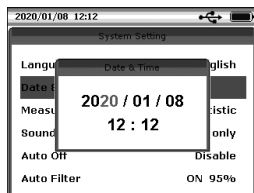
1. To connect Bluetooth, you need to install the application (Smart Report- Hardness Tester).
2. IOS device access it in App Store, Android device access it in Play Store or Please login www.uni-trend.com to download.

8.10 SYS Settings



- Language
The optional languages are English and Chinese.

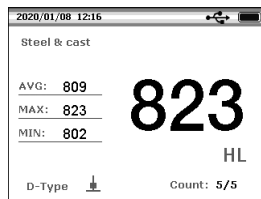
- Date & Time



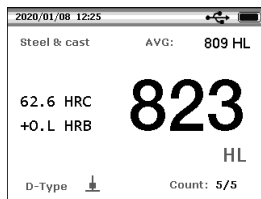
Press the Left/Right button to move the cursor. Press the Up/Down button to adjust the value. Press and hold the Up/Down button to quickly change the selected value. Press the SET button to confirm. Press $\leftarrow$ to cancel.

- Measure mode

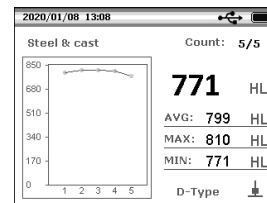
Press the Up/Down button to select Statistic/MultiMode/LinecMode/HistoMode.



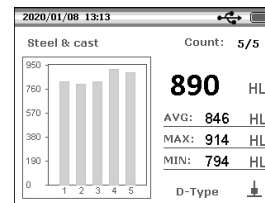
Statistic



MultiMode

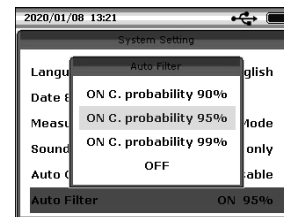


LinecMode



HistoMode

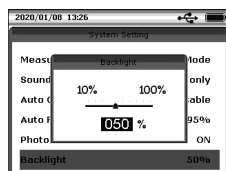
- Sound
Press the Up/Down button to select Key & Alert/Alert only/Key only/Off.
- Auto off
Press the Up/Down button to select 1 minute/5 minutes/10 minutes/30 minutes/ Disable.
- Auto filter



When the auto filter function is turned on, after the set average number of measurements is completed, the tester will automatically filter big errors according to Grubbs Criterion. If any data is filtered, supplementary measurements are required to reach the set number. There are three probabilities to choose from: 90%, 95% and 99%. The lower the probability, the easier it is to trigger auto filter.

Note: When the count is set to less than 3 times, the auto filter function is disabled by default.

- Photo
Enable/disable the camera function.
- Backlight
The backlight brightness can be adjusted.

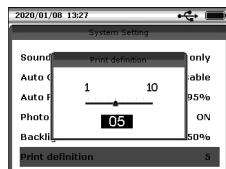


Press the Left/Right button to adjust, and press the SET button to confirm.
Press $\leftarrow$ to cancel.

Note: If the brightness is too high, the battery life will be affected.

- Print definition

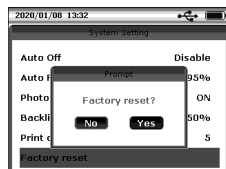
The print definition can be adjusted according to the needs of different thermal paper.



Press the Left/Right button to adjust, and press the SET button to confirm.
Press $\leftarrow$ to cancel.

Note: Too high definition can lead to shorter print head life and overheating of the printer.

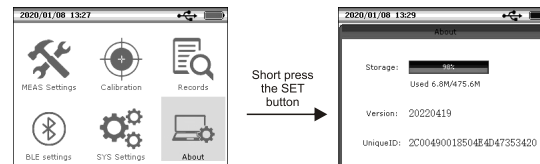
- Factory reset



Press the SET button, and a dialog box "Factory reset?" will pop up. Press the Right button to select "Yes", and press the SET button to confirm.

Note: All saved data will be cleared after restoring factory settings.

8.11 About



In this interface, users can view the storage information, version and unique ID.

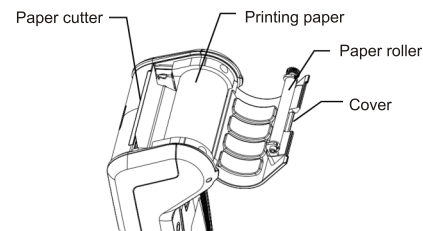
- Storage: Remaining percentage, used memory, and total memory;
- The version changes with the firmware upgrade;
- The unique ID of each tester is different.

9. Printer Paper Installation

- Open the cover first.
- If the paper roller falls off, please reassemble it. Be careful not to damage its rubber part.
- Install the printing paper into the printer, pull out the paper and press it at the cutter. The length of the printing paper should exceed the cutter.

Note: The general thermal paper can only be printed on one side. If the paper is inverted, it will be impossible to print.

- Close the cover, and the printing paper is installed.



10. Troubleshooting

Phenomenon	Reason	Solution
The tester cannot be turned on or shuts down automatically after a while.	Low battery	Charge the tester
The battery life significantly decreases.	Battery failure	Return to the factory to replace battery
The tester cannot take measurements.	Impact probe cable malfunction	Change impact probe cable

11. Maintenance

- After the tester has been used for 1000 to 2000 times, please use the nylon brush to clean the impact device. Unscrew the support ring first and then take out the impact body. Spiral the nylon brush in counter-clockwise direction into the bottom of guide tube and take it out. Repeat above steps for 5 times, and install the impact body and support ring.
- Release the impact body after use.
- Do not use lubricants in the impact device.
- When measuring the hardness of the standard Leeb hardness block, if all the errors are greater than 2HRC, please change the impact body.
- When the hardness tester has other abnormalities, please do not disassemble it.
- When the tester is not in use for a long time, it should be fully charged every 3 months.

12. Storage and Transport

- Keep the tester away from vibration, strong magnetic field, corrosive medium, dampness and dust, and store it at room temperature.
- With original packing, transport is allowed on tertiary highways.

Attached Table 1

Material	Hardness unit	Impact device					
		D/DC	D+15	C	G	E	DL
Steel and cast steel	HRC	17.9~68.5	19.3~67.9	20.0~69.5		22.4~70.7	20.6~68.2
	HRB	59.6~99.6			47.7~99.9		37.0~99.9
	HRA	59.1~85.8				61.7~88.0	
	HB	127~651	80~638	80~683	90~646	83~663	81~646
	HV	83~976	80~937	80~996		84~1042	80~950
	HS	32.2~99.5	33.3~99.3	31.8~102.1		35.8~102.6	30.6~96.8
Forged steel	HB	143~650					
Alloy steel	HRC	20.4~67.1	19.8~68.2	20.7~68.2		22.6~70.2	
	HV	80~898	80~935	100~941		82~1009	
Stainless steel	HRB	46.5~101.7					
	HB	85~655					
	HV	85~802					
Grey cast iron	HRC						
	HB	93~334			92~326		
	HV						
Nodular cast iron	HRC						
	HB	131~387			127~364		
	HV						
Cast aluminium alloy	HB	19~164		23~210	32~168		
	HRB	23.8~84.6		22.7~85.0	23.8~85.5		
Brass	HB	40~173					
	HRB	13.5~95.3					
Bronze	HB	60~290					
Pure copper	HB	45~315					

Attached Table 2

NO.	Material	HLD Leeb hardness HLD	(MPa) Strength σ_b (MPa)
1	Mild steel	350 ~ 522	374 ~ 780
2	C steel	500 ~ 710	737 ~ 1670
3	Cr steel	500 ~ 730	707 ~ 1829
4	CrV steel	500 ~ 750	704 ~ 1980
5	CrNi steel	500 ~ 750	763 ~ 2007
6	CrMo steel	500 ~ 738	721 ~ 1875
7	CrNiMo steel	540 ~ 738	844 ~ 1933
8	CrMnSi steel	500 ~ 750	755 ~ 1993
9	SS steel	630 ~ 800	1180 ~ 2652
10	S steel	500 ~ 710	703 ~ 1676

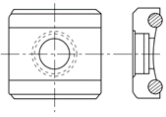
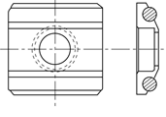
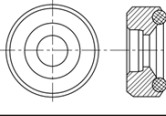
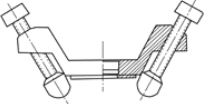
Attached Table 3

Type of impact device	DC/D/DL	D+15	C	G
Impact energy	11mj	11mj	2. 7mj	90mj
Impact body weight	5. 5/5.5/7.2g	7.8g	3.0 g	20 g
Impact body head hardness	1600 HV	1600 HV	1600 HV	1600 HV
Impact body head diameter	3 mm	3 mm	3 mm	5 mm
Impact body head material	Tungsten carbide	Tungsten carbide	Tungsten carbide	Tungsten carbide
Impact device diameter	20/20/6mm	20mm	20mm	30mm
Impact device length	86/147/202mm	162mm	141mm	254mm
Impact device weight	50/75/60g	80g	75g	250g
Maximum sample hardness	940 HV	940 HV	1000 HV	650 HB
Average roughness of sample surface Ra	1.6 μ m	1.6 μ m	0.4 μ m	6.3 μ m
Minimum sample weight	>5kg	>5kg	>1.5kg	>15kg
Need support firmly	2~5kg	2~5kg	0.5~1.5kg	5~15kg
Need coupling tightly	0.05~2kg	0.05~2kg	0.02~0.5kg	0.05~5kg
Minimum sample thickness	5mm	5mm	1mm	10mm
Minimum depth of hardened layer	$\geq$ 0.8mm	$\geq$ 0.8mm	$\geq$ 0.2mm	$\geq$ 1.2mm

Indentation size

Hardness 300HV	Indentation diameter	0.54mm	0.54mm	0.38mm	1.03mm
	Indentation depth	24 μ m	24 μ m	12 μ m	53 μ m
Hardness 600HV	Indentation diameter	0.54mm	0.54mm	0.32mm	0.90mm
	Indentation depth	17 μ m	17 μ m	8 μ m	41 μ m
Hardness 800HV	Indentation diameter	0.35mm	0.35mm	0.35mm	
	Indentation depth	10 μ m	10 μ m	7 μ m	
Impact device application range		Type-DC: Hole or cylinder; Type-DL: Slender groove or hole; Type-D: Routine measurement	Type-D+15: groove or recessed surface	Type-C: Small parts and surface of hardened layer	Type-G: Large and rough-surface castings and forgings

Attached Table 4

NO.	Model	Sketch of abnormal support ring	Remarks
1	Z10-15		Measure the outer cylinder R10~R1 5
2	Z14. 5-30		Measure the outer cylinder R14. 5~R30
3	Z25-50		Measure the outer cylinder R25~R50
4	HZ11-13		Measure the inner cylinder R11~R13
5	HZ12.5-17		Measure the inner cylinder R12. 5~R17
6	HZ16. 5-30		Measure the inner cylinder R16. 5~R30
7	K10-15		Measure the spherical outside surface Sr10~SR15
8	K14.5-30		Measure the spherical outside surface SR14. 5~SR30
9	HK11-13		Measure the spherical inside surface Sr11~SR13
10	HK12. 5-17		Measure the spherical inside surface SR12. 5~SR17
11	HK16. 5-30		Measure the spherical inside surface SR16. 5~SR30
12	UN		Measure the outer cylinder, radius adjustable R10~∞

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