Portable Hardness Tester

HardyTest D700®

User's Manual

Content

1 Overview

1.1 Advantages

- Wide measuring range. Based on the principle of Leeb hardness testing theory. It can measure the Leeb hardness of all metallic materials.
- Large screen (128×64 dot matrix LCD), showing all functions and parameters.
- Test at any angle, even upside down.
- Direct display of hardness scales HRB, HRC, HRA, HV, HB, HS, HL.
- Seven impact devices are available for special application. Automatically identify the type of impact devices.
- Large capacity memory could store 500 groups (Relative to average times 32～1) information including single measured value, mean value, testing date, impact direction, impact times, material and hardness scale etc.
- Upper and lower limit can be preset. It will alarm automatically when the result value exceeding the limit.
- Battery information indicates the rest capacity of the battery and the charge status.
- User calibration function.
- Software to connect with PC via USB port.
- With EL background light.
- Thermal printer integrated, convenient for in field printing.
- NI-MH rechargeable battery as the power source. Charge circuit integrated inside the instrument. Continuous working period of no less than 150 hours (EL off and no printing).
- Auto power off to save energy.
- Outline dimensions：212mm×80mm×32mm

1.2 Main Application &Testing Range

1.2.1 Main Application

- Die cavity of molds
- Bearings and other parts
- Failure analysis of pressure vessel, steam generator and other equipment
- Heavy work piece
- The installed machinery and permanently assembled parts
- Testing surface of a small hollow space
- Material identification in the warehouse of metallic materials
- Rapid testing in large range and multi-measuring areas for large-scale work piece

1.2.2 Testing Range

Testing range refer to Table 1 and Table 2 in the Appendix.

1.3 Configuration

Table 1-1

	No.	Item	Quantity	Remarks
Standard Configuration	1	Main Unit	1	
	2	D type impact device	1	With cable
	3	Standard test block	1	
	4	Cleaning brush (I)	1	
	5	Small support ring	1	
	6	Battery Charger	1	9V 500mA
	7	Paper for printing	1	
	8	Manual	1	
	9	Instrument case	1	
Optional Configuration	11	Cleaning brush (II)	1	For use with G type impact device
	12	Other type of impact devices and support rings		Refer to Table 3 and Table 4 in the appendix.
	13	DataPro software	1	
	14	Communication cable	1	
	15			
	16			

1.4 Working Conditions

- Working temperature： -10°C～＋50°C;
- Storage temperature：-30°C～＋60°C;
- Relative humidity: ≤ 90％;
- The surrounding environment should avoid of vibration, strong magnetic field, corrosive medium and heavy dust.

1.5 Safety Instructions

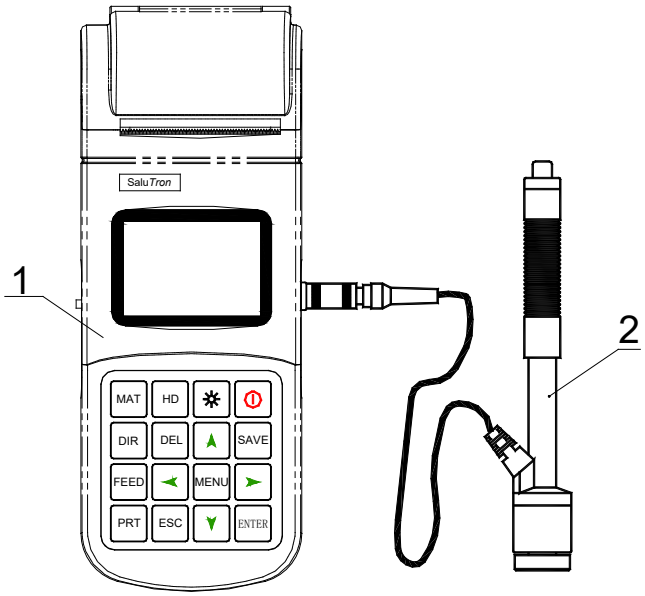
- The instrument can only work with the specially designed battery pack and power adapter (charger) supplied by us. Working with others may result in damage of the instrument, battery leakage, fire or even explosion.
- Do not cast the battery pack into fire and do not short circuit, disassemble or heat the battery pack, otherwise battery leakage, fire or even explosion may occur.
- Do not open the cover of the paper compartment or come into contact with the heating head of the printer by hand or any part of your body to avoid burns due to high temperature when the printer is printing.

2 Structure Feature &Testing Principle

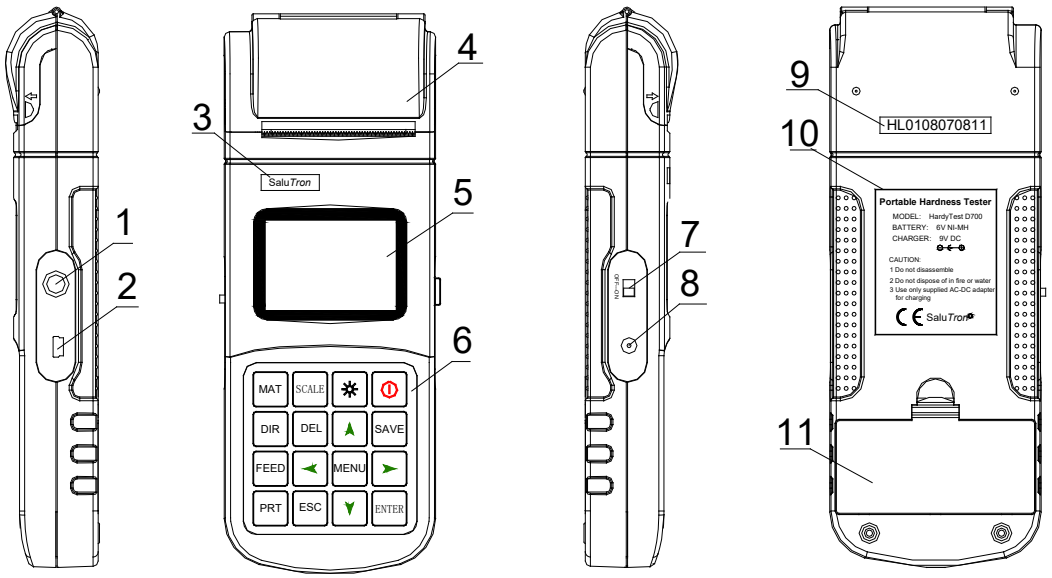
2.1 Structure Feature

2.1.1 The Hardness Tester Appearance

1. Main unit
2. Impact device

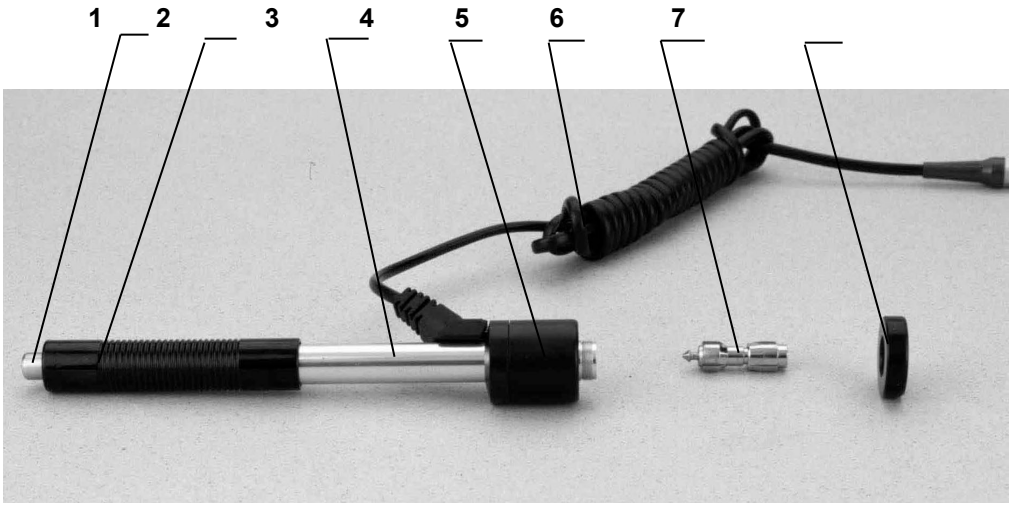


2.1.2 Parts of the Main body



1 Socket of impact device 2 Socket of USB 3 LOGO 4 Paper compartment cover 5 LCD display 6 Keypad 7 Battery switch 8 Power jack 9 Serial Number 10 Product label 11 Battery compartment cover

2.1.3 D Type Impact Device



1 Release button 2 Loading tube 3 Guide tube 4 Coil unit

5 Connection cable 6 Impact body 7 Support ring

2.1.4 Different Types of Impact Device

D DC DL C D+15 E G

2.2 Leeb Hardness Testing Principle

The basic principle is: use an impact body of certain weight impacts against the testing surface under certain test force, then measure the impacting velocity and the rebounding velocity of the impact body respectively when the spherically test tip is located 1mm above the testing surface.

The calculation formula is as follows: HL= VB / VA

HL—— Leeb hardness value, VB—— Rebounding velocity of the impact bodyand VA—— Impacting velocity of the impact body

3 Technical Specifications

- Error and repeatability of displayed value see Table 3-1.

Table 3-1

No.	Type of impact device	Hardness value of Leeb standard hardness block	Error of displayed value	Repeatability
1	D	760±30HLD 530±40HLD	±6 HLD ±10 HLD	6 HLD 10 HLD
2	DC	760±30HLDC 530±40HLDC	±6 HLDC ±10 HLDC	6 HLD 10 HLD
3	DL	878±30HLDL 736±40HLDL	±12 HLDL	12 HLDL
4	D+15	766±30HLD+15 544±40HLD+15	±12 HLD+15	12 HLD+15
5	G	590±40HLG 500±40HLG	±12 HLG	12 HLG
6	E	725±30HLE 508±40HLE	±12 HLE	12 HLE
7	C	822±30HLC 590±40HLC	±12 HLC	12 HLC

- Measuring range：HLD（170～960）HLD
- Measuring direction：360°
- Hardness Scale：HL, HB, HRB, HRC, HRA, HV, HS
- Display：dot matrix LCD, 128×64 dots
- Data memory： 500 groups max.（relative to impact times 32～1）
- Printing paper: width is （57.5 ± 0.5）mm, diameter is 30mm
- Battery pack: 6V NI-MH
- Battery charger: 9V/500mA
- Continuous working period：about 150 hours（With backlight off, no printing）
- Communication interface：USB1.1

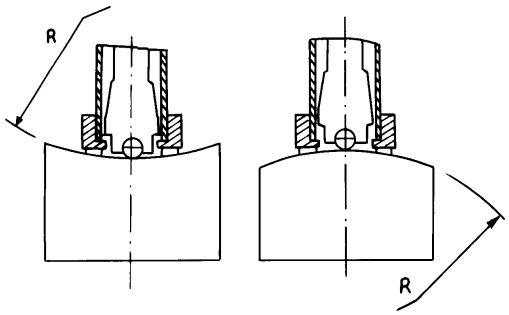
4 Preparation & Testing

4.1 Preparation & Inspection before Testing

4.1.1 Preparation of Sample Surface

Preparation for sample surface should conform to the relative requirement in the Appendix Table 3.

- In the preparation processing for sample surface, the hardness effect of being heated or cold processing on the surface of sample should be avoided.
- Too big roughness of the being measured surface could cause measure error. So, the surface of the sample to be measured must appear metallic luster, smoothing and polish, without oil stain.
- Support of test sample. Support is no necessary for heavy sample. Medium-weight parts must be set on the smoothing and stable plane. The sample must set absolutely equability and without any wobble.
- Curved surface: The best testing surface of sample is flat. When the curvature radius R of the surface to be tested is smaller than 30mm (D, DC, D+15,C, E and DL type of impact device) and smaller than 50mm (G type of impact device), the small support ring or the shaped support rings should be chosen.



- The sample should have enough thickness, minimum thickness of sample should conform to Table 3.
- For the sample with hardened layer on surface, the depth of hardened layer should conform to Table 3.
- Coupling. Light-weight sample must be firmly coupled with a heavy base plate. Both coupled surface must be flat and smooth, and there is no redundant coupling agent existing. The impact direction must be vertical to the coupled surface. When the sample is a big plate, long rod or bending piece, it can be deformed and become unstable, even though its weight and thickness is big enough, and accordingly, the test value may not be accurate. So the sample should be reinforced or supported at its back.
- Magnetism of the sample itself should be avoided.

4.1.2 System Setting

See 6.9 for details.

4.1.3 Presetting Testing condition

See 6.5 for details.

4.2 Testing Program

Verification of the tester is by using standard test block. The error and repeatability of displayed value should be within the regulation of Appendix table 2.

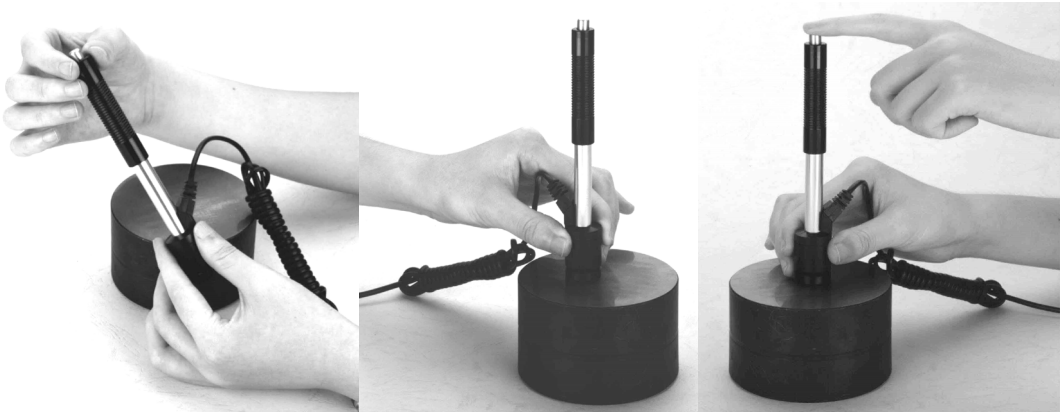
> **Note :** *Use a calibrated hardness tester, test the standard test block downward vertically for 5 times, the arithmetical average value compare with the value of standard test block. If this value exceeds the standard value, could use the function of software calibration to adjusting.*

4.2.1 Start-Up

- Insert the plug of the impact device into the socket of impact device on the tester.
- Press [⏻]key，now power is connected. The instrument is in testing condition.

4.2.2 Loading

Pushing the loading-tube downwards until contact is felt. Then allow it to slowly return to the starting position or using other method locking the impact body.



4.2.3 Localization

Press the impact device supporting ring on the surface of the sample firmly, the impact direction should be vertical to the testing surface.

4.2.4 Testing

- Press the release button on the upside of the impact device to test. The sample and the impact device as well as the operator are all required to be stable now. The action direction should pass the axis of the impact device.
- Each measure area of the sample usually need 5 times of testing operation. The result data dispersion should not more than mean value±15HL.
- The distance between any two impact points or from the center of any impact point to the edge of testing sample should conform to the regulation of Table 4-1.
- If want accurate conversion from the Leeb hardness value to other hardness value, contrastive test is needed to get conversion relations for the special material. Use inspection qualified Leeb hardness tester and corresponding hardness tester to test at the same sample respectively. For each hardness value, each measure homogeneously 5 points of Leeb hardness value in the surrounding of more than

three indentations which need conversion hardness, using Leeb hardness arithmetic average value and corresponding hardness average value as correlative value respectively, make individual hardness contrastive curve. Contrastive curve at least should include three group of correlative data.

Table 4-1

Type of Impact Device	Distance of center of the two indentations	Distance of center of the indentation to sample edge
	Not less than (mm)	Not less than (mm)
D, DC	3	5
DL	3	5
D+15	3	5
G	4	8
E	3	5
C	2	4

4.2.5 Read measured value

4.2.6 Power Off

Press [⏻]key to turn off the instrument.

5 Advice

- Replacing the impact device must be done during Power off. Otherwise the main body can not identify the type of the impact device, and it can damage the circuit board of the main body.
- You could not save the current test value if the test times are less than the presetting times value.
- Only type D and type DC of impact device have the function of strength measure option. You can not modify the [Set hardness or6b]setting when using other types of impact device. The [Set hardness or6b]setting would be set to [Hardness] automatically after replacing the impact device whether the setting is [Hardness] or not before.
- Not all materials could convert to all hardness style value. The hardness style is reset to HL automatically after changing the material. So select material first before changing the hardness style.

6 Operation in Details

6.1 Power On

Press [⏻] to power on the system. The screen shows as below:

The system would automatically detect the type of the impact device during power up, and would display this information on the screen. Users should pay attention to the probe type displayed on the screen. After pausing for several second, the screen will exit and enter the main display interface.

Note: If the instrument is in power off condition, it will turns on automatically after the charge power is connected.

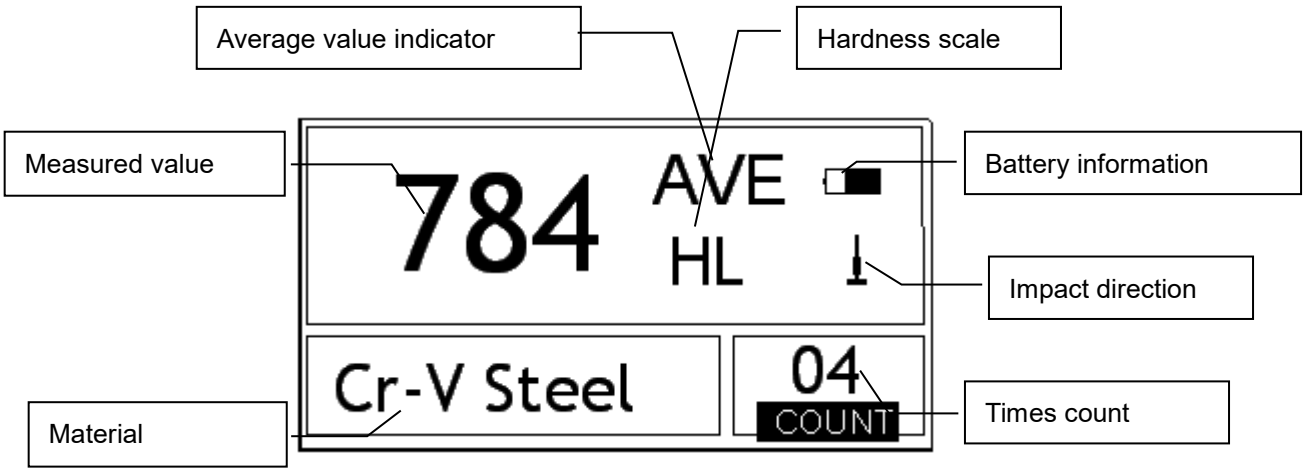
6.2 Power Off

Press key [⏻] could power off the system in any conditions.

Note: If the charge power is connected, the instrument will turns on automatically after pressing the power off key.

6.3 Testing

Below is the main display interface:



6.3.1 Instruction of the Main Display Interface

Battery information： Display the information of the rest capacity of the battery, and the charging status.

Impact direction： The present impact direction.

Average value indicator： It appears to show the mean value of the samples when reaching

the presetting impact times.

Hardness scale： Hardness method of the present measured value.

Measured value：Display present single time measured value（without mean value indicator），or display the present mean value (with average value indicator prompting). ↑ means over conversion or measure range. ↓ means lower than conversion or measure range.

Material： The present presetting material.

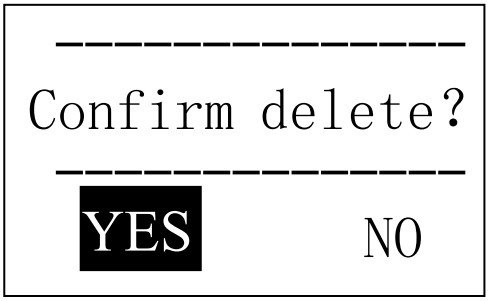
Impact times count： Times that have been impacted.

6.3.2 Testing Operation at the Main Display Interface

Testing operation could be carried out under this interface. After each impact operation, it can display the current measured value, impact times count plus one, the buzzer would alert a long howl if the measured value is not within the tolerance limit. When reaching the presetting impact times, the buzzer will alert a long howl. After 2 seconds, the buzzer will alert a short howl, and display the mean value.

6.3.3 Key Operation at the Main Display Interface

- Press key [SAVE]to store present group of measured value into memory. This operation is only valid after displaying the mean value.
- Press key [DEL]to delete the latest single measured value. After pressing this key, the screen will displays as below:



Press key **[⮟]** or **[⮝]** to move the cursor to [YES]or [NO].

Press key [ENTER] to confirm operation. Press key [ESC]to cancel delete operation.

- Press key **[⮜]** or **[⮞]** could display single measured value.
- Press key [☼]could switch on of off the background light of LCD.
- Press key [MENU]could enter the system presetting menu.
- Press key [DIR]to set the impact direction.
- Press key [CNT]to change the impact times in one group. The impact times count item will be highlighted when first pressing the key [CNT], and the impact times count value will plus one with each pressing. The value will roll back to 1 when it reaches 32.
- Press key [SCALE]to change the hardness scale.
- Press key [MAT]to change the material set. Presetting hardness scale recovers to HL automatically after material presetting changed.

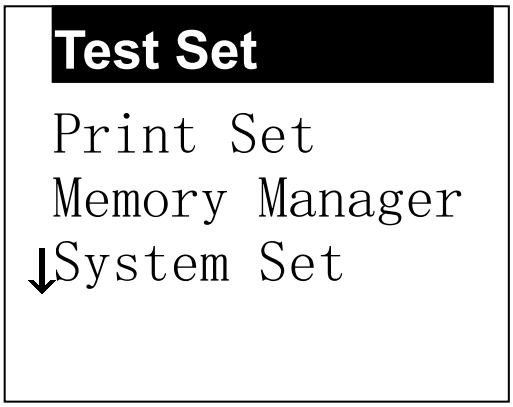
6.4 Menu Structure

Both presetting system parameters and the additional function could come true by menu operation. At the main display interface, press key [MENU] into the main menu.

The Main Display Interface	Test Set	Impact Direc.
		Average
		Material
	Print Set	Print Current
		Print Memory
		Print All Mem
	Memory Manager	View From No.1
		View From End
		View From No.
		Transfer
		Delete by No.
		Delete All
	System Set	Auto Save：
		Auto Print：
		Auto Delete：
		Auto Trans.：
	Software Info	

6.5 Test Set

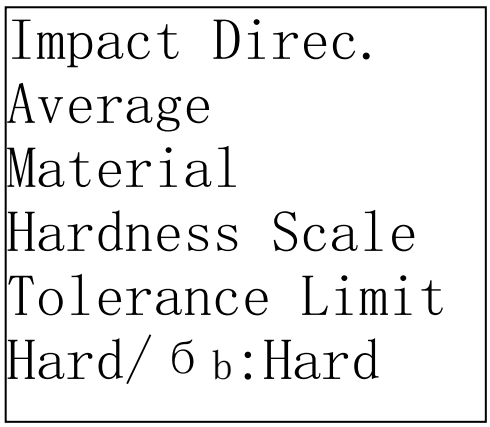
At the main display interface, press key [MENU] to enter the main menu.



Press key [ENTER] to enter Test Set Menu.

The symbol ↓ at the left side of underside menu indicates that the menu has not ended. Press key **[⮟]**could continuously glance downward. The symbol ↑ at the left side of the upside menu indicates that the menu has not ended. Press **[⮝]** could continuously glance upward.

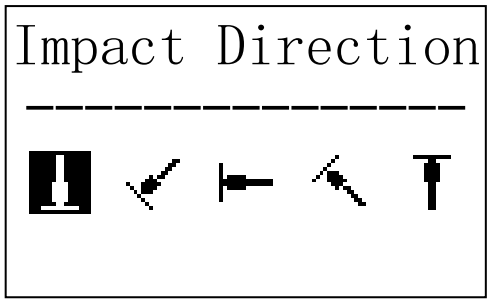
Press key **[⮟]** or **[⮝]** to move the cursor to the line you want to set, and press key [ENTER]to confirm it.



Note: 1. When [Hard/бb] is switched to бb, the hardness scale could not be selected. The cursor will skip over [Hardness Scale] while moves the cursor.

2. Only D type of impact device has the function of бb measure. So the cursor could not move to [Hard/бb]while use other impact device.

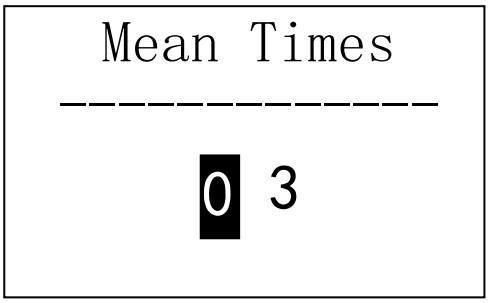
6.5.1 Impact Direction Setting



Press key **[⮜]** or **[⮞]** to move the cursor to the impact direction that you will preset. Press key [ENTER] to confirm it.

Press key [ESC] to cancel it.

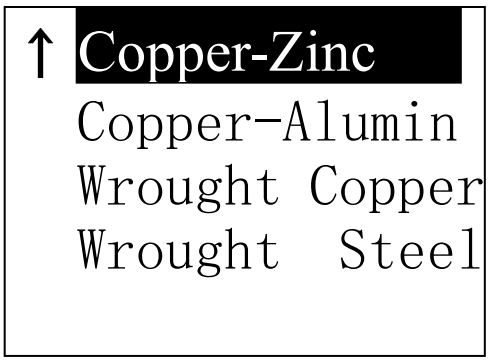
6.5.2 Average Times Setting



Press **[▼]** or **[▲]** to move the cursor. Press **[◄]** or **[►]** to change the number. Press key [ENTER]to confirm it. Press key [ESC]to cancel it.

6.5.3 Material Setting

When [Hard/бb]is preset to hardness, it will display the following material: Steel and Cast Steel, Cold Work Tool Steel, Stainless Steel, Gray Cast Iron, Nodular Cast Iron, Cast Aluminum Alloys, Copper-Zinc Alloys, Copper-Aluminum Alloys, Wrought Copper and Wrought Steel.



Press key **[▼]** or **[▲]** to move the cursor to the material you want to preset.

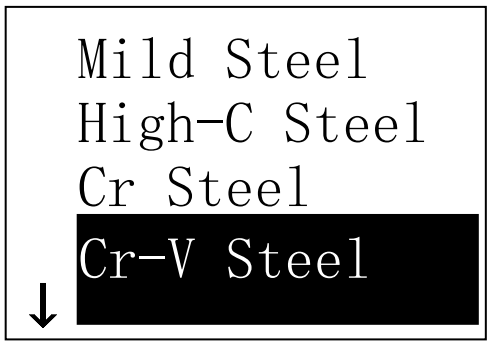
Press key [ENTER]to confirm it.

Press key [ESC]to cancel it.

Note 1. Presetting hardness scale recovers to HL automatically after material presetting is changed.

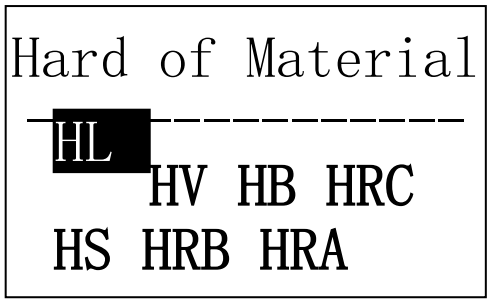
2. Please select material first, then select hardness scale.

When [Hard/ бb]is preset to бb, it will display the following material: Mild Steel, High-Carbon Steel, Cr Steel, Cr-V Steel, Cr-Ni Steel, Cr-Mo Steel, Cr-Ni-Mo Steel, Cr-Mn-Si Steel, Super Strength Steel and Stainless Steel.



Press key [▼] or [▲] to move the cursor to the material to want to preset.
Press key [ENTER]to confirm it.
Press key [ESC]to cancel it.

6.5.4 Hardness Scale Setting



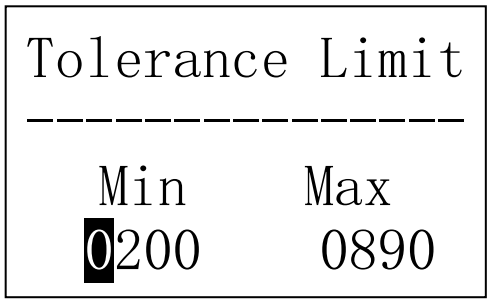
Press key [▼] or [▲] to move the cursor to the hardness scale you want to preset.
Press [ENTER] to confirm setting.
Press [ESC] to cancel setting.

Note：1. Here only displays the valid hardness scale for the present selected impact device and material. It would not display the hardness scale which is not valid.

2. Please select material first, then select hardness scale.

3. Presetting hardness scale recovers to HL automatically after presetting material is changed.

6.5.5 Tolerance Limit Setting

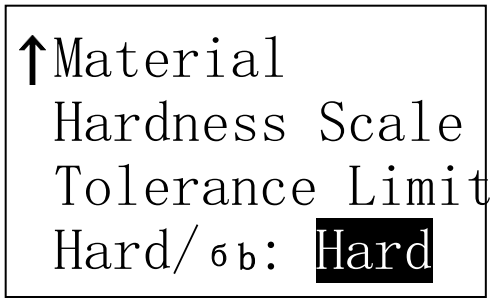


Press [▼] or [▲] to move the cursor.
Press [◀] or [▶] to change the number.
Press [ENTER] to confirm setting.
Press [ESC] to cancel setting.

Note:1. If the setting value exceeds the measure range, the instrument will remind you to reset.

2. If the bottom limit is larger than the upper limit, they will exchange automatically.

6.5.6 Hardness/6b Setting



Press [ENTER] to switch between Hard and 6b .

Note: Only D and DC type of impact device has the function of 6b measure. So hard is the only selection if the impact device is not D or DC type.

6.6 Print Function

At the main display interface, press [MENU] to enter the main menu. **[⮟]** or **[⮝]** to move the cursor to print menu and press [ENTER]to enter the print menu.

Note:

- ***Printing function is unavailable while charging.***
- ***Printing can be stopped by pressing the [ESC]key.***
- ***Do not open the cover of the paper compartment during printing. Otherwise the instrument may not print normally.***
- ***Over high ambient humidity (above 85% of relative humidity) or over low ambient humidity (below 20% of relative humidity) may reduce the print quality.***
- ***Printing with paper that has been stored for over long period of time or of poor quality may reduce the print quality or even damage the printer.***

6.6.1 Print Current

Print out the data report just finished testing. If the instrument hasn't been switched off, and hasn't changed any testing condition during continuous printing process, it will only print out single measured value and average value when printing again.

6.6.2 Print Memory

Print out the selected group of measured value stored inside the instrument.

6.6.3 Print All Memory

Print out all the measured value stored inside the instrument.

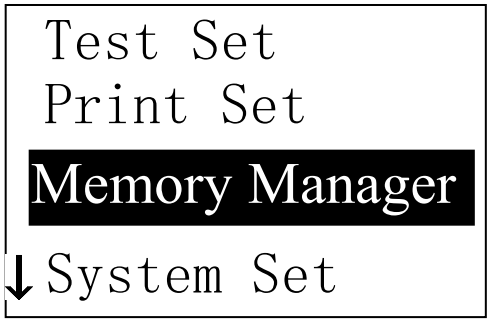
6.6.4 Paper Feeding

When the printer is powered on and ready for printing, press [FEED] key then the instrument will start manual paper feeding. Press and keep holding the [FEED] key to start paper feeding, while releasing the key to stop paper feeding.

Note: Manual paper feeding is unavailable while charging.

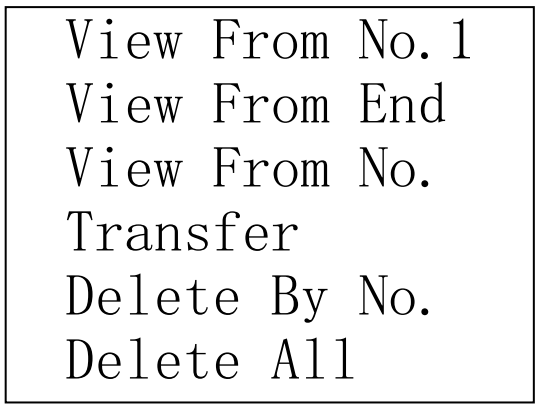
6.7 Memory Manager

At the main display interface, press key [MENU] enter the main menu.



Press key **[⮟]** or **[⮝]** to move the cursor to [Memory Manager].Press key [ENTER]into [Memory Manager]menu.

If there is no data in the memory, displays: <No Data!>. Then return.



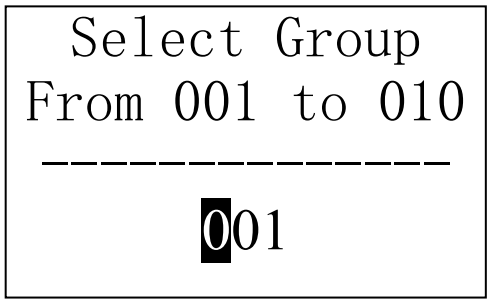
Press key [▼] or [▲] to move the cursor to the function wanted, then press key [ENTER]to confirm.

6.7.1 View from No.1 Group/View from Ending Group

[View from No.1] Start display values in the memory from the first group.

[View from End] Start display values in the memory from the ending group.

6.7.2 View from Selected No. Group

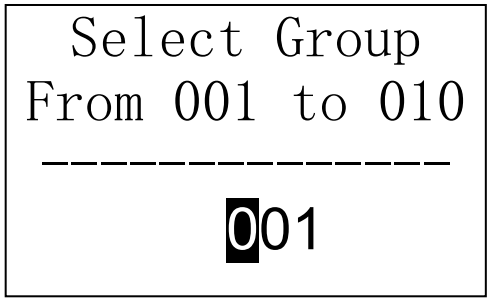


Press [▼] or [▲] to move the cursor. Press [◄] or [►] to change the number. Press key [ENTER] to start displaying memory data from the selected beginning group. Press key [ESC]to cancel current operation.

6.7.3 Data Transfer

[Transfer]export the values stored in the memory as text format to PC through USB port. This function is not available now.

6.7.4 Delete by Group No.



[Delete by No.]displays selecting the range of deleting groups.

Press [▼] or [▲] to move the cursor. Press [◄] or [►] to change the number. Press key [ENTER]to delete the selected groups. Press key [ESC]to cancel operation.

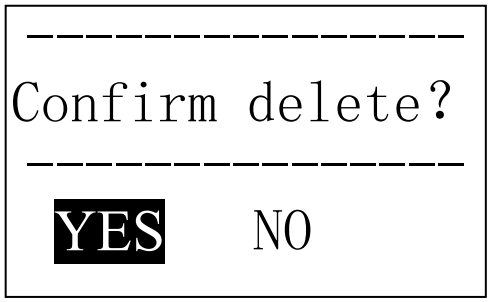
Note: 1. If the preset group number exceeds the actual range, then deletes the actual groups among them.

2. Do not shut down the instrument while deleting data. It could lead to unpredicted consequence if shutting down while deleting.

6.7.5 Delete All Data

[Delete All]will delete all the data in the memory.

6.7.6 Deletion Confirmation

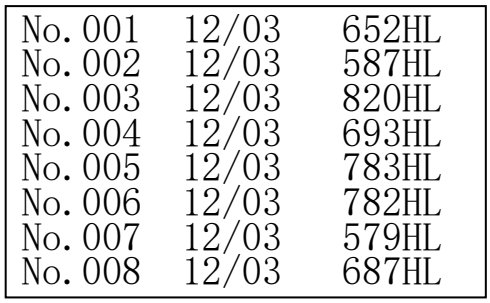


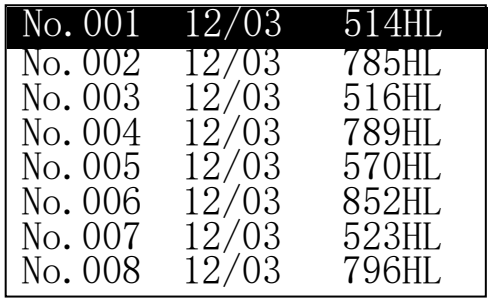
Press **[◄]** or **[►]** to move the cursor to [YES] and press key [ENTER]to confirm deleting operation.

Press **[◄]** or **[►]** to move the cursor to [NO]and press key [ENTER] to cancel deleting operation.

Press key [ESC]could cancel deleting operation, no matter where the cursor is.

6.8 Browsing Memory Data Groups

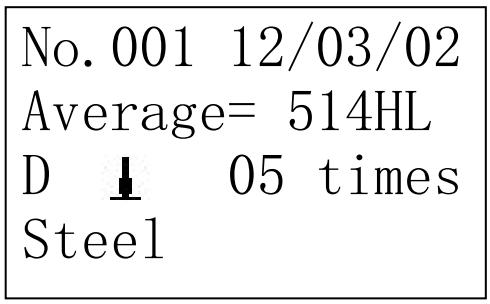




Press **[▼]** or **[▲]** to see previous or next page.

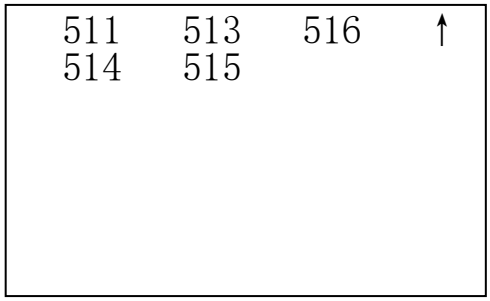
Press key [ESC]to exit browsing.

Press key [ENTER], then press **[▼]** or **[▲]** to move the cursor to the line which you want to see details. Press [ENTER]to see details of that group.



Press **[▼]** or **[▲]** to browse details including average value, test set and each single value.

Press [ESC] to return to previous display.



6.9 System Set

At the main display interface, press key [MENU] enter the main menu.

Press key **[⮟]** or **[⮝]** to move the cursor to [System Set]Menu.

Press key [ENTER]to enter [System Set]menu.

Press key **[⮟]** or **[⮝]** to move the cursor to the item wanted.

Press key [ENTER]to modify the setting directly or into corresponding screen.

Press key [ESC]to exit.

[Auto Save] [Auto Delete] [Auto Trans] [Key Sound] [Warn. Sound] could be switched on or off.

When [Auto Save]is set to <On>, could store the data of current group automatically after measuring and displaying average value.

When [Auto Print]is set to <On>, could print the data of current group automatically after measuring and displaying average value.

When [Auto Delete]is set to <On>, according to 3σ rule, could cancel gross error automatically after having measured presetting average times or pressing end in advance. If there is data canceled, it needs supplemental measure to reach presetting times.

When [Auto Trans.]is set to <On>，could export the value of present group through communication port after measuring and displaying average value. It’s not available now.

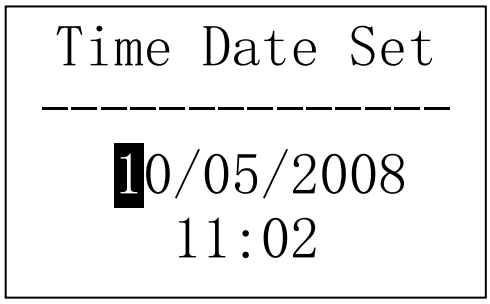
When [Key Sound]is set to <On>, the buzzer would make a short hoot while press key each time.

When [Warn. Sound]is set to <On>, if the measured value exceeds the tolerance limit, reached the presetting average times or deleting data, the buzzer would make a long hoot.

6.9.1 LCD Brightness Set

Press key **[▲]** to enhance the brightness.
Press key **[▲]** to weaken the brightness.
Press key [ENTER]to confirm the modifying. Press key [ESC]to cancel the modifying.

6.9.2 Time Date Set

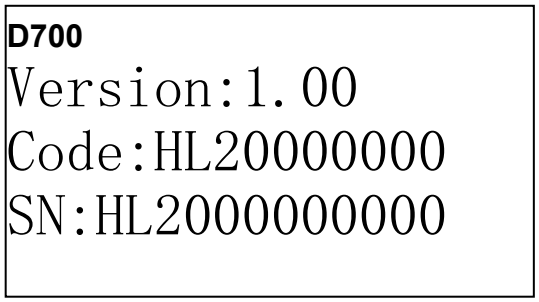


Present time and date is displayed as"M/D/Y H/M". Press the figure **[▼]** or **[▲]** keys to modify the present figure. Move the cursor by pressing the **[◀]** or **[▶]** keys. Press key [ENTER]to confirm modifying. Press key [ESC]to cancel modifying and exit.

6.10 Software Information

At the main display interface, press key [MENU] enter the main menu.

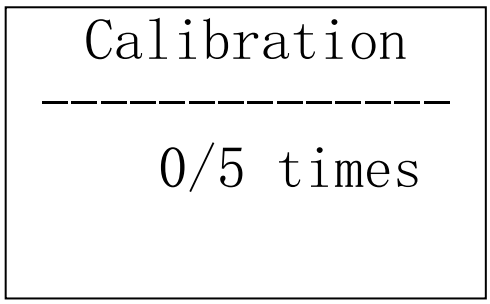
Press figure **[▼]** or **[▲]** to move the cursor to [Software Info].
Press key [ENTER]into [Software Info]screen.



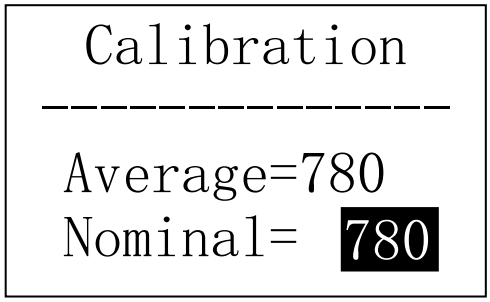
This screen displays the information about the main body and the firmware. The version, the Code and the SN would change with the firmware.

6.11 System Calibration

The tester and impact device must be calibrated using hardness block before use as the first time, or having not been used for a long time, or having reset the system.
Press key [⏻], meanwhile pressing [ENTER]to power on the system. Then the software calibration screen shows as below.



Set the impact direction as [ ]. Measure 5 points on the standard hardness block.



It would display the average value after measuring 5 times.

Press key figure **[▼]** or **[▲]** to input the nominal value.

Press key [ENTER]to confirm.

Press key [ESC]to cancel this operation.

Range of adjustment: ±15HL.

6.12 EL Background Light

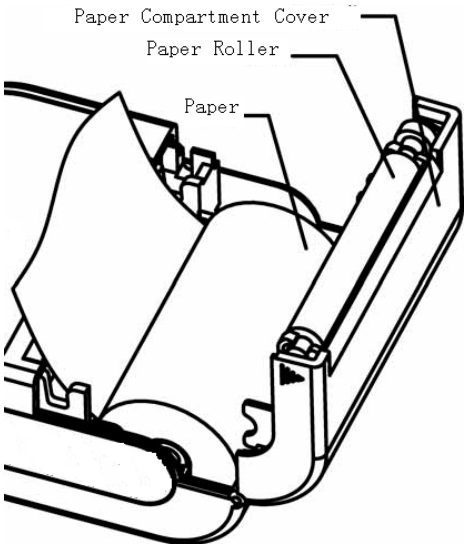
With the background light, it is convenient to work in the dark condition. Press key [☼]to switch on or switch off the background light at any moment as you like after power on.

6.13 Auto Power Off

- The instrument has the function of powering off automatically to save power.
- The system would power down automatically if there's neither measuring nor any key operation within 5 minutes. Except key [⏻], press any key could stop the twinkle of LCD screen and stop the operation of power off at the moment.
- While the voltage of the battery is too low, the screen will show < Battery Empty!>, then power off automatically.
- When the instrument is being charged, the Auto Power Off will not function.

6.14 Paper Loading

- Hold Both ends of the paper compartment with fingers and open the compartment cover with moderate strength.
- According to the illustration, put the paper into the paper compartment with attention to the paper direction. If the paper is misplaced, the instrument will fail to print.
- Pull a trip of paper out of the compartment.
- Make sure that the paper is well in place and close the paper compartment cover.



6.15 Battery Charge

The instrument uses a NI-MH battery pack as its power source. When the battery pack almost runs out, the battery symbol on the display will glint  . It needs charging as soon as possible. Try to drain your battery pack as fully as possible before it is charged for longest battery service.

- The battery switch should be at 'ON' condition before charging.
- Plug the power adapter into the mains supply power socket and then plug the charger connector into the power jack of the instrument. If the instrument is in power off condition, it will turns on automatically after the charger plug is inserted into the power jack. The battery symbol will alternately shows between  and  when charging. The more of the dark part indicates the more close to full capacity.
- When the battery is fully charged, the battery symbol on the display will glint  .
- Please use the configured AC-DC adapter to charge the battery pack.

Warning: When the battery pack is being charged, printing or paper feeding is unavailable.

6.16 Battery Replacement

When the battery pack fails to be charged, the user should replace the batteries following the program below:

- Power down the instrument.
- Take off the battery compartment cover and take out the battery pack.
- Insert the connection plug of the new battery pack into the socket on the circuit board.
- Reset the battery cover.
- Turn on the instrument to check.

Warning: Please pay much attention to the polarity of the battery during battery replacement.

6.17 Connection of Data Transmission Cable

Insert one connection plug of the transmission cable into the USB socket on the right side of main body, and insert the another plug into the USB port on the back of computer box. Refer to the manual of the DataPro software for detailed information.

7 Fault Analysis & Evacuation

Fault Appearance	Fault Analysis	Handling method
Charge failure	Battery failure	Replace the battery with a new pack
	The battery is switched off	Switch on the battery
No measured value	Impact device cable failure	Replace the cable
Failure power on	Battery exhaustion	Charge the battery
	The battery is switched off	Switch on the battery

8 Servicing & Maintenance

8.1 Impact Device Servicing

After the impact device has been used for 1000--2000 times, please use the nylon brush provided to clean the guide tube and impact body. When cleaning the guide tube, unscrew the support ring first, then take out the impact body, spiral the nylon brush in counter-clock direction into the bottom of guide tube and take it out for 5 times, and then install the impact body and support ring again.

- Release the impact body after use.
- Any lubricant is absolutely prohibited inside the impact device.

8.2 Normal Maintenance Program

When using standard Rockwell hardness block to testing, if all the error is bigger than 2 HRC, it may be the invalidation of impacted ball top caused by abrasion. Changing the spherical test tip or impact object should be considered.

When the hardness tester appears some other abnormal phenomena, please do not dismantle or adjust any fixedly assembled parts. Fill in and present the warranty card to us. The warranty service can be carried on.

9 Calibration Time

Calibration is needed every 1 year.

10 Notice of Transport and Storage Conditions

- Keep it away from vibration, strong magnetic field, corrosive medium, dumpiness and dust. Storage in ordinary temperature.
- With original packing, transport is allowed on the third grade highway.

APPENDIX

Table 1 Hardness Values Materials

Material	Hard-ness scale	Impact device					
		D/DC	D+15	C	G	E	DL
Steel and cast steel	HRC	20-68.5	19.3-67.9	20.0-69.5		22.4-70.7	20.6-68.2
	HRB	38.4-99.6			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
Cold work tool 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 aluminum alloys	HB	19-164		23-210	32-168		
	HRB	23.8-84.6		22.7-85.0	23.8-85.5		
Brass (copper-zinc alloys)	HB	40-173					
	HRB	13.5-95.3					
BRONZE (copper-aluminum /tin alloys)	HB	60-290					
Wrought copper alloys	HB	45-315					

Table 2 Material Strength

No.	Material	HLD	Strength σ_b(MPa)
1	Mild steel	350～522	374～780
2	High-Carbon steel	500～710	737～1670
3	Cr steel	500～730	707～1829
4	Cr-V steel	500～750	704～1980
5	Cr-Ni steel	500～750	763～2007
6	Cr-Mo steel	500～738	721～1875
7	Cr-Ni-Mo steel	540～738	844～1933
8	Cr-Mn-Si steel	500～750	755～1993
9	Super strength steel	630～800	1180～2652
10	Stainless steel	500～710	703～1676

Table 3 Technical Details Impact Devices

Type of impact device		D, DC, DL	D+15	C	G	E
Impacting energy: Mass of impact body:		11mJ 5.5g/7.2g	11mJ 7.8g	2.7mJ 3.0g	90mJ 20.0g	11mJ 5.5g
Test tip hardness: Dia. Test tip: Material of test tip:		1600HV 3mm Tungsten carbide	1600HV 3mm Tungsten carbide	1600HV 3mm Tungsten carbide	1600HV 5mm Tungsten carbide	5000HV 3mm synthetic diamond
Impact device diameter: Impact device length: Impact device weight:		20mm 86(147)/ 75mm 50g	20mm 162mm 80g	20mm 141mm 75g	30mm 254mm 250g	20mm 155mm 80g
Max. hardness of sample:		940HV	940HV	1000HV	650HB	1200HV
Mean roughness value of sample surface Ra:		1.6µm	1.6µm	0.4µm	6.3µm	1.6µm
<u>Min. weight of sample:</u> Measure directly Need support firmly Need coupling tightly		 > 5kg 2-5kg 0,05-2kg	 > 5kg 2-5kg 0,05-2kg	 > 1,5kg 0,5-1,5kg 0,02-0,5kg	 > 15kg 5-15kg 0,5-5kg	 > 5kg 2-5kg 0,05-2kg
Min. thickness of sample Coupling tightly: Min. layer thickness for surface hardening:		5mm ≥ 0.8mm	5mm ≥0.8 mm	1mm ≥ 0.2mm	10mm ≥ 1.2mm	5mm ≥ 0.8mm
Size of tip indentation						
Hardness 300HV	Indentation diameter: Depth of indentation:	0.54mm 24µm	0.54mm 24µm	0.38mm 12µm	1.03mm 53µm	0.54mm 24µm
Hardness 600HV	Indentation diameter: Depth of indentation:	0.54mm 17µm	0.54mm 17µm	0.32mm 8µm	0.90mm 41µm	0.54mm 17µm
Hardness 800HV	Indentation diameter: Depth of indentation:	0.35mm 10µm	0.35mm 10µm	0.35mm 7µm	-- --	0.35mm 10µm
Available type of impact device:		**D:** normal test **DC:** for hole or hollow cylindrical; **DL:** for slender narrow groove or hole	**D+15**: fot groove or reentrant surface	**C:** for small, light or thin parts and surface of hardened layer	**G:** for large, thick, heavy and rough surface steel	**E:** for super high hardness material

Table 4 Supporting Rings

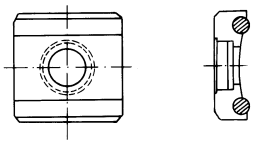
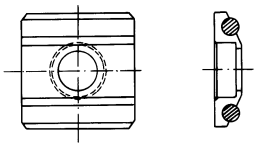
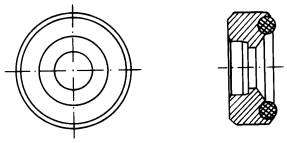
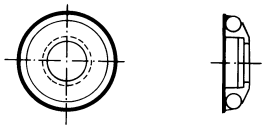
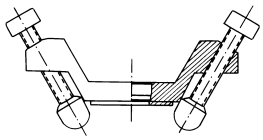
No.	Type	Sketch of non-conventional Supporting ring	Remarks
1	Z10-15		For testing cylindrical outside surface R10～R15
2	Z14.5-30		For testing cylindrical outside surface R14.5～R30
3	Z25-50		For testing cylindrical outside surface R25～R50
4	HZ11-13		For testing cylindrical inside surface R11～R13
5	HZ12.5-17		For testing cylindrical inside surface R12.5～R17
6	HZ16.5-30		For testing cylindrical inside surface R16.5～R30
7	K10-15		For testing spherical outside surface SR10～SR15
8	K14.5-30		For testing spherical outside surface SR14.5～SR30
9	HK11-13		For testing spherical inside surface SR11～SR13
10	HK12.5-17		For testing spherical inside surface SR12.5～SR17
11	HK16.5-30		For testing spherical inside surface SR16.5～SR30
12	UN		For testing cylindrical outside surface,radius adjustable R10～∞

Table 5 Specifications

Specifications	
HardyTest D700®	
Specifications are subject to change without prior notice.	
Hardness units:	HL (Leeb), HB (Brinell), HRB (Rockwell B), HRC (Rockwell C), HV (Vickers), HS (Shore D)
Measuring range:	170 – 960 HLD
Measuring direction:	360°
Standard impact device:	D
Memory size:	Max. 500 groups (relative to 1 - 32 impact times)
Statistics:	Number of measurements, date, average value, impact device, material, measured value, hardness unit
Setting of limits:	Acoustic signal when exceeding preset min. und max. limits
Weight of sample:	> 5 kg solid material; 2-5 kg on stable surface; < 2 kg with coupling paste on stable surface
Memory function:	Manually oder automatically
Data transfer:	USB-cable and software
Menu languages:	English and german
Display:	128 × 64 Dot-Matrix-LCD
Backlight:	Adjustable brightness
Battery capacity:	150 hours (without backlight and printing)
Power supply:	Battery-pack (6V NI-MH) with integrated charging circuit and
	charging cable
Battery charging cable:	9 V / 500 mA
Print-out paper (length x width):	57,5 (± 0,5 mm) x 30 mm
Storage temperature:	-30°C to + 60°C
Relative humidity:	≤ 90%
Working temperature:	-10°C to + 50°C
Weight:	340 g (with batteries)
Size (length x width x height):	212 x 80 x 32 mm

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