

Leeb Hardness Tester

HardyTest D600

Instruction Manual



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1 General description

1.1 Features

- LCD display of 128×64 matrix is used.
- Converts to all common hardness scales(HV ,HB,HRC,HRB,HRA,HS).
- English displaying and menu operating, the operation is easy and convenient.
- With RS232 interface, multiple communication modes are adopted to meet customized requirements of various users.
- Equipped with 7 types of impact devices which need not to be recalibrated when changing them, the system can identify the type of impact device automatically.
- Max 600 groups (impact times:32~1) of data can be stored at internal non volatile data storage.
- Upper and lower limit of hardness can be preset; When the tested value exceeds the limits, alarm will send out automatically to make convenient for the requirements of batch measurements.
- Back light display has been used to make convenient for the use in poor light.
- Test values software calibration function.
- Material of “cast steel” is added; HB values can be read out directly when D/DC impact device is used to measure “cast steel” work piece.
- Printer be separated from main unit and copies of testing results can be printed as required.
- Power is two of AA battery. Continuous working period: approx. 100 h (no back light on).
- Software of PC can be installed according to the requirements of user, the function will be more powerful to satisfy the more strict demands of quality control and management.

1.2 Main Application and Testing Range

1.2.1 Main Application

- The assembled machinery and permanently installed parts
- Die cavity of molds
- Heavy work piece
- Failure analysis of pressure vessel, steam turbo-generator set and other equipment
- Narrow testing space where work piece installed
- Bearings and other parts
- Cases which require the test result with normalized original recording
- Material identification of the metal material warehouse
- Quick tests of large range and multipoint measuring positions for heavy workpiece

1.2.2 Testing Range

Testing range see table 1 and table 2.

Table 1

Material	Hardness method	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

Material	Hardness method	Impact device					
		D/DC			D/DC		
Hammered steel	HB	143~650					
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					
Gray 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/copper-tin alloys)	HB	60~290					
Wrought copper alloys	HB	45~315					

Table 2

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

1.3 Types and specification

	No.		Remarks
Standard Delivery	1	Main unit	1
	2	D type impact device	1
	3	Small supporting ring	1
	4	Nylon brush (A)	1
	5	High value Leeb test block	1
	6	Communication cable	1
	7	HT-50 DataView Software	1
Additional Optional Delivery	8	Printer	
	9	Nylon brush (II)	In case of choosing G type impact device
	10	Various non-conventional type of impact devices	See table 3
	11	Various non-conventional type of impact supporting ring	See table 4

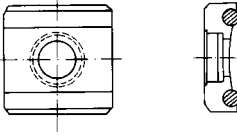
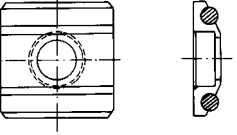
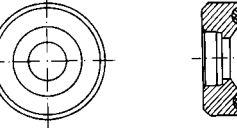
Table 3

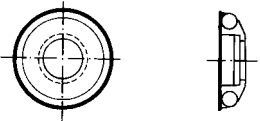
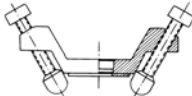
Non conventional Impact devices	DC(D)/DL	D+15	C	G	E
Impacting energy	11Mj	11mJ	2.7mJ	90mJ	11mJ
Mass of impact body	5.5g/7.2g	7.8g	3.0g	20.0g	5.5g
Test tip Hardness	1600HV	1600HV	1600HV	1600HV	5000HV
Diameter of test tip	3mm	3mm	3mm	5mm	3mm
Material of test tip	Tungsten carbide	Tungsten carbide	Tungsten carbide	Tungsten carbide	synthetic diamond
Impact device Diameter	20mm	20mm	20mm	30mm	20mm
Impact device Length	86(147)/ 75mm	162mm	141mm	254mm	155mm
Impact device Weight	50g	80g	75g	250g	80g
Max. hardness of workpiece	940HV	940HV	1000HV	650HB	1200HV
Mean roughness of workpiece surface of the Ra	1.6 μ m	1.6 μ m	0.4 μ m	6.3 μ m	1.6 μ m
Min. weight of sample					
Measure directly	>5kg	>5kg	>1.5kg	>15kg	>5kg
Need support firmly	2~5kg	2~5kg	0.5~1.5kg	5~15kg	2~5kg
Need coupling tightly	0.05~2kg	0.05~2kg	0.02~0.5kg	0.5~5kg	0.05~2kg
Min. thickness of sample coupling tightly	5mm	5mm	1mm	10mm	5mm
Min.layer thickness for surface harden	≥0.8mm	≥0.8mm	≥0.2mm	≥1.2mm	≥0.8mm

Size of tip indentation						
Hardness 300HV	Indentation diameter	0.54mm	0.54mm	0.38mm	1.03mm	0.54mm
	Indentation depth	24 μ m	24 μ m	12 μ m	53 μ m	24 μ m
Hardness 600HV	Indentation diameter	0.54mm	0.54mm	0.32mm	0.90mm	0.54mm
	Indentation depth	17 μ m	17 μ m	8 μ m	41 μ m	17 μ m
Hardness 800HV	Indentation diameter	0.35mm	0.35mm	0.35mm	--	0.35mm
	Indentation depth	10 μ m	10 μ m	7 μ m	--	10 μ m

Available type of impact device	<p>D: General test</p> <p>DC: Hole or hollow-cylindrical test</p> <p>DL: Slender narrow groove or hole test</p>	<p>D+15: groove or reentrant surface</p>	<p>C: small, light, thin parts or surface of hardened layer</p>	<p>G: large, thick, heavy or rough surface steel</p>	<p>E: super high hardness material</p>
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Table 4

No.	Code	Type	Sketch of non conventional supporting ring	Remarks
1	03-03.7	Z10-15		For testing cylindrical outside surface R10~R15
2	03-03.8	Z14.5-30		For testing cylindrical outside surface R14.5~R30
3	03-03.9	Z25-50		For testing cylindrical outside surface R25~R50
4	03-03.10	HZ11-13		For testing cylindrical inside surface R11~R13
5	03-03.11	HZ12.5-17		For testing cylindrical inside surface R12.5~R17
6	03-03.12	HZ16.5-30		For testing cylindrical inside surface R16.5~R30
7	03-03.13	K10-15		For testing spherical outside surface SR10~SR15
8	03-03.14	K14.5-30		For testing spherical outside surface SR14.5~SR30

No.	Code	Type	Sketch of non conventional supporting ring	Remarks
9	03-03.15	HK11-13		For testing spherical inside surface SR11 ~ SR13
10	03-03.16	HK12.5-17		For testing spherical inside surface SR12.5 ~ SR17
11	03-03.17	HK16.5-30		For testing spherical inside surface SR16.5 ~ SR30
12	03-03.18	UN		For testing cylindrical outside surface, radius adjustable R10 ~ ∞

1.4 Operating conditions:

Ambient temperature: -10°C ~ 40°C

Relative humidity: ≤ 90%

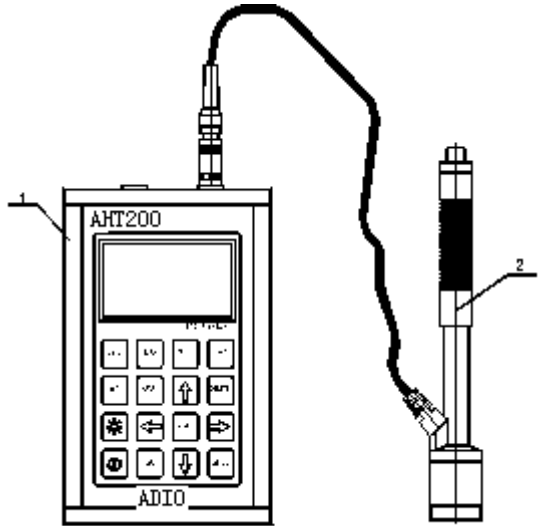
No vibration, no strong magnetic field and no corrosive medium and heavy dust in ambient environment.

2 Structure features and Testing principle

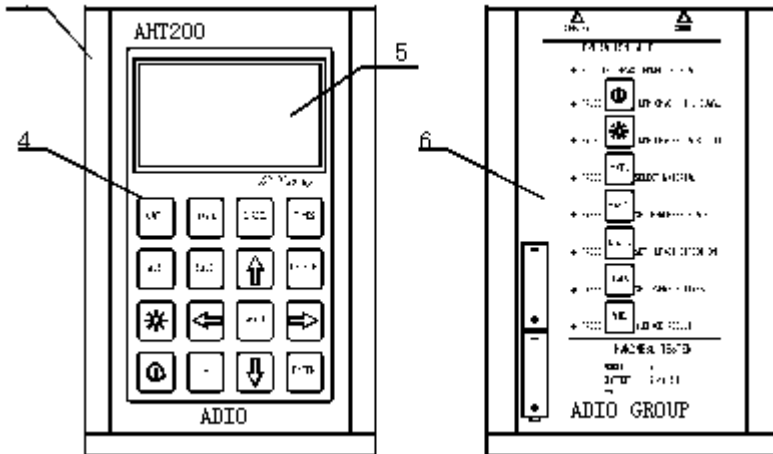
2.1 Structure features

2.1.1 Hardness Tester

- 1: Main unit
- 2: Impact device

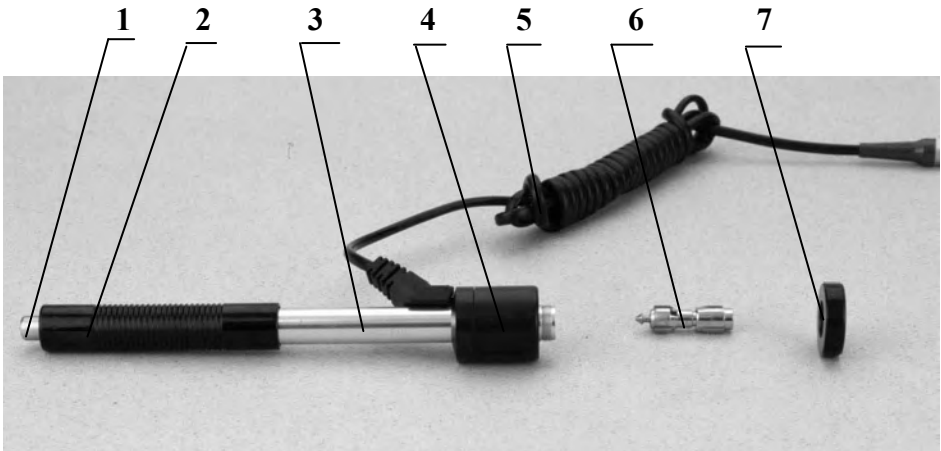


2.1.2 Main unit



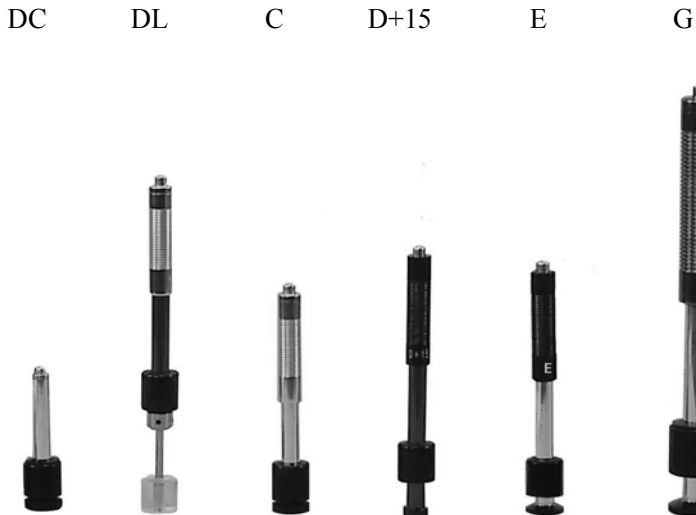
- 1: Shell
- 2: Communication socket
- 3: Impact device socket
- 4: Keypad
- 5: LCD screen
- 6: Name plate

2.1.3 D type impact device



1: Release button 2: Loading sheath 3: Guide tube 4: Coil part 5: Connection cable 6: Impact body 7: Supporting ring

2.1.4 Non conventional types of impact devices



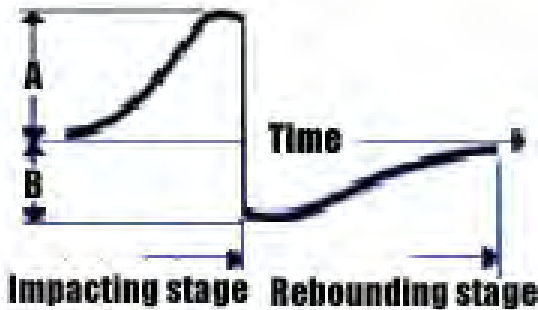
2.2 Testing principle

Let a impact body whose weight is definite rush into the surface of sample, the hardness value comes from the rate of rebound velocity and rush velocity at 1mm distance from testing surface. The calculation formula is following:

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

In which: HL——Leeb hardness value
VB——Rebounding velocity of the impact body
VA——Impacting velocity of the impact body

Output signal diagram of the impact device is as following.



3 Technical capabilities

3.1 Specifications

- Measuring range: HLD (170~960) HLD
- Measuring direction: 360°
- Hardness scale: HL, HB, HRB, HRC, HRA, HV, HS
- Display: LCD, 128×64 matrix LCD
- Data memory: 48~600 groups (impact times: 32~1)
- Range of upper and lower limit: the same as measuring range
- Working voltage: 2*1.5V
- Continuous working period: approx. 100 h (no back light on)
- Communication interface: RS232
- Accuracy and repeatability of displayed value, see table 5.

3.2 Dimension size and weight

3.2.1 Dimension 132×82×33mm (main unit)

3.2.2 Weight approx. 0.6kg (main unit);

Table 5

No.	Type of impact device	Hardness value of standard Leeb hardness block	Error of displayed value	Repeatability of displayed value
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

4 Testing

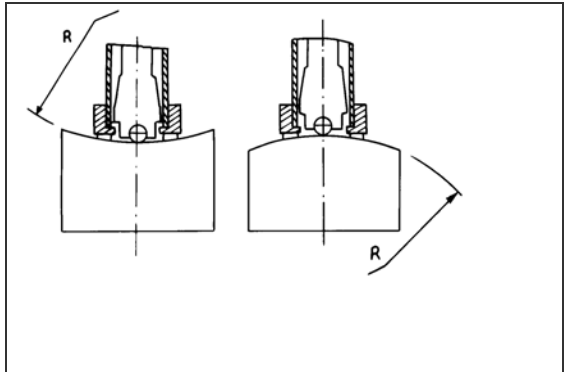
4.1 Preparation and Inspection prior to testing

4.1.1 The preparation of workpiece surface

The preparation for workpiece surface should comply with the relevant requirements specified in table 3

- During the preparation for sample, the affect to surface hardness of sample caused by overheating, cold processing and etc. should be avoided as far as possible.
- If the surface to be tested is too rough, measuring error will appear. So the surface of the sample must have metallic luster and the surface must be flat, smooth and have no oil dirt.

- Curved surface: it is better that the testing surface of workpiece is plane. When the curvature radius R of the curved surface to be tested is less than 30mm (for D, DC, D + 15, C, E and DL type impact device) and less than 50mm (for G type impact device), a small support ring or non conventional



- Support ring should be used.
- Workpiece supporting
 - Support is not necessary for heavy test workpiece
 - The workpiece with medium weight must be placed on flat and solid plane, and it must be placed stably without any shaking.
- Enough thickness of workpiece is necessary, and the min. thickness should comply with the specification in table 3.
- As for test piece with hardened surface layer, the depth of hardened layer should comply with table 3.
- Coupling
 - The workpiece with lightweight must be firmly coupled with the support; both coupled surface must be flat, smooth and the coupling agent should not be too much. The measuring direction must be vertical to the coupled surface.
 - When the workpiece is a large area plate, long rod or bending piece, it can be deformed and become unstable even the weight and the thickness is heavy and the test value may not be accurate. So it should be reinforced or supported at the back of the workpiece.
- Self magnetism of workpiece should be less than 30 Gauss.

4.1.2 System setting of tester

Specific procedures for setting, refers to 6.9.

4.1.3 Measuring condition setting of tester


Specific procedures for setting, refers to 6.5.

4.2 Testing

- A standard hardness block should be used to check the the tester prior to the testing; and the reading value error and repeatability should not be more than the specification in table 5.

Note: The hardness value of standard hardness test block can be measured via a Leeb hardness tester which had been calibrated; five times of measuring should be carried out in direction of vertical down and the arithmetic mean of five values should be used as the hardness value of standard hardness test block. If the value exceeds the standard range, it can be calibrated via user calibration function.

4.2.1 Start-up

- Insert the impact device plug into the socket of impact device located on the right of the tester.
- Press [] key to turn on the power, then the tester enters into the measuring status.

4.2.2 Loading

- Push down the loading sheath to lock the impact body; for DC type impact device, the loading bar can be attracted on testing surface and insert DC type impact device into loading bar until the stop position, then loading has been finished.
- Press tightly the support ring of impact device on the surface of test sample, the direction of impact should be vertical with testing surface.



4.2.3 Testing

- Press down the release button on the top of the impact device to make a test. At this point, the test sample, impact device and the operator are all required to be stable; and the force direction should comply with the axis of the impact device.
- Five measurements should be carried out per measuring position of test sample. The divergence of data should be not exceeds $\pm 15HL$ of mean value.
- Distance between any two indentations, or the distance between any indentation center and the edge of test sample should be in accordance with the specification of table 6.
- For any special material, a comparative test must be performed to obtain relevant conversion relation if Leeb hardness value accurately conversing to other type of hardness value is required. Procedures are as following: tests are made on the same test sample via Leeb hardness tester which recalibrated well and relevant hardness meter respectively; for each hardness value, five points which uniformly distributed around hardness indentation should be chosen to make tests, and tests for three (at least) indentations should be made; the mean value of Leeb hardness and the mean value of relevant hardness will be act as relevant values respectively to make a comparative hardness curve. Three groups corresponding data should be included at least in comparative curve.

Table 6


Type of impact device	The distance of two indentations center	The distance between indentation center and edge of test piece
	No less than	No less than
D、DC	3	5
DL	3	5
D+15	3	5
G	4	8
E	3	5
C	2	4

4.2.4 Read measured value

4.2.5 Print out result

For specific setting method, see 6.3.3 and 6.6.

4.2.6 Shut-Off

Press [] key to turn off.

4.2.7 The processing of testing results

The mean value of five valid testing points can be served as a testing data of Leeb hardness.

4.2.8 The express of testing results

- Hardness value will be displayed ahead of HL (the symbol of Leeb Hardness), and type of impact device will be displayed back of HL. For example, 700HLD expresses that the Leeb hardness is 700 by means of the measurement made by D type impact device.
- For other type hardness which changed from Leeb Hardness value, corresponding hardness symbol should be added ahead of Leeb hardness symbol. For example, 400HVHLD expresses that the Vickers hardness value is 400, which changed from Leeb hardness value measured by D type impact device.

Note: HL values which measured by various impact devices are various. For example: 700HLD ≠ 700HLC.

5 Special prompts


- Replacing impact device must be performed under the condition of turn off, otherwise the impact device type can not be identified automatically, and even it is possible to cause the damage of circuit board of the tester.
- In normal condition, the current measured value can be printed or stored if the [Impact times] value which had been set is not satisfy. If the printing and storing are required at this point, [Average] key can be press down to finish measurement, then printing can be carried out.
- The functions of [Auto Save], [Auto Print], and [Auto Trans.] will be inactive in case of pressing down [Average] key to finish measurement in

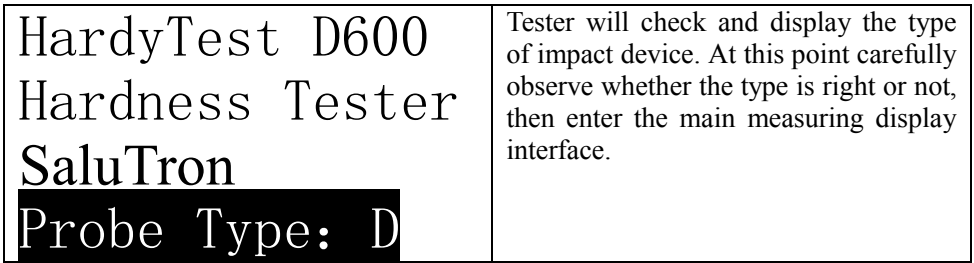
advance.

- Only D and DC type impact device have strength measuring function so that [Hard/ σ_b] setting can not be changed if other type impact devices are used; if the setting has been changed into [σ_b] via D/DC type impact device, the [Hard/ σ_b] setting will be changed into [Hard] when other impact devices had been installed instead of D/DC type impact device.
- When [σ_b] has been set, hardness scale will not been set (cursor will skip off [Hardness Scale]).
- Not all materials can be changed into every hardness scale, hardness scale will return to Leed hardness (HL) automatically after material has been changed. So [Material] will be set firstly when setting measurement parameters, and [Hardness Scale] should be set subsequently.

6 Detail Testing procedures

6.1 Start-up

Press [] key to turn on the equipment, following interface will be displayed.

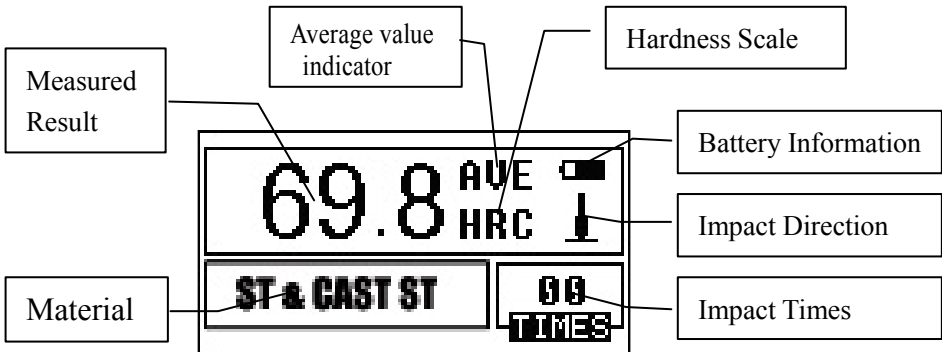


6.2 Turn On or turn off

Tester can be turn on or trun off by press [] key in any display status.

6.3 Testing

The tester will enter the main display interface after turn on, as the following figure.



The measured values are displayed with big font in this interface, and multiple shortcut key operation functions supplied.

6.3.1 Explanation of the main display interface

Battery information: displaying rest capacity when no charging, and displaying charging degree when charging.

Impact direction: current impact direction.

Average value indicator: average value will be displayed when impact times

setting has been achieved.

Hardness scale: the hardness scale of current measuring value.

Measured value: current single measured value (without average value indicator), current average value (with average value indicator). It expresses the value is more than conversion or measuring range when ↑ is displayed; and it expresses the value is lower than conversion or measuring range when ↓ is displayed.

Material: material that has been set currently.

Impact times: impact times that has been finished will be displayed when measuring; Impact times that has been set will be displayed when impact times is been set by shortcut key, and the times which corresponding to single measured value will be displayed when viewing single measured value.

6.3.2 Testing procedures

Testing can be carried out under this interface status, and the current measured value will be displayed whenever one measurement is finished. The counting of impact times will add 1 per measurement is performed. The buzzer will send out a long sound provided that the value exceeds tolerance limit; and the buzzer will send out two short sound if the impact times which has been set is achieved. After 2 seconds waiting, average value will be displayed with a short sound given out by buzzer.

6.3.3 Key operation

- Press [SAVE] key to save current group data. The key can only be active after average value has been displayed; furthermore the save can be done only once.
- Press [DELETE] key , the latest single measured value can be deleted, but the deletion should be confirmed in the following interface.

<pre>===== Confirm delete? ===== Yes No</pre>	<p>Press [←] [→] key to move cursor to[YES]; then press [ENTER] key to confirm the deletion of latest single measuring value.</p> <p>Press [←] [→] key to move cursor to [NO]; then press [ENTER] key to cancel the deletion. Deletion can be canceled by press [ESC] key wherever the cursor.</p>
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- Single measured value can be viewed by press [↑] [↓] key, and the

average value or latest measured value can be showed again by press [ESC] key. The viewing sequence is different by press [▲] [▼] key.

- Measurement can be finished by press [Average] key in case of impact times setting has not been achieved, and the average value will be displayed.
- LCD back light can be turn on or off by press [☼] key.
- Press [MENU] or [ENTER] key to return to main interface.
- Press [MENU] key to enter main menu interface.

Shortcut key setting:

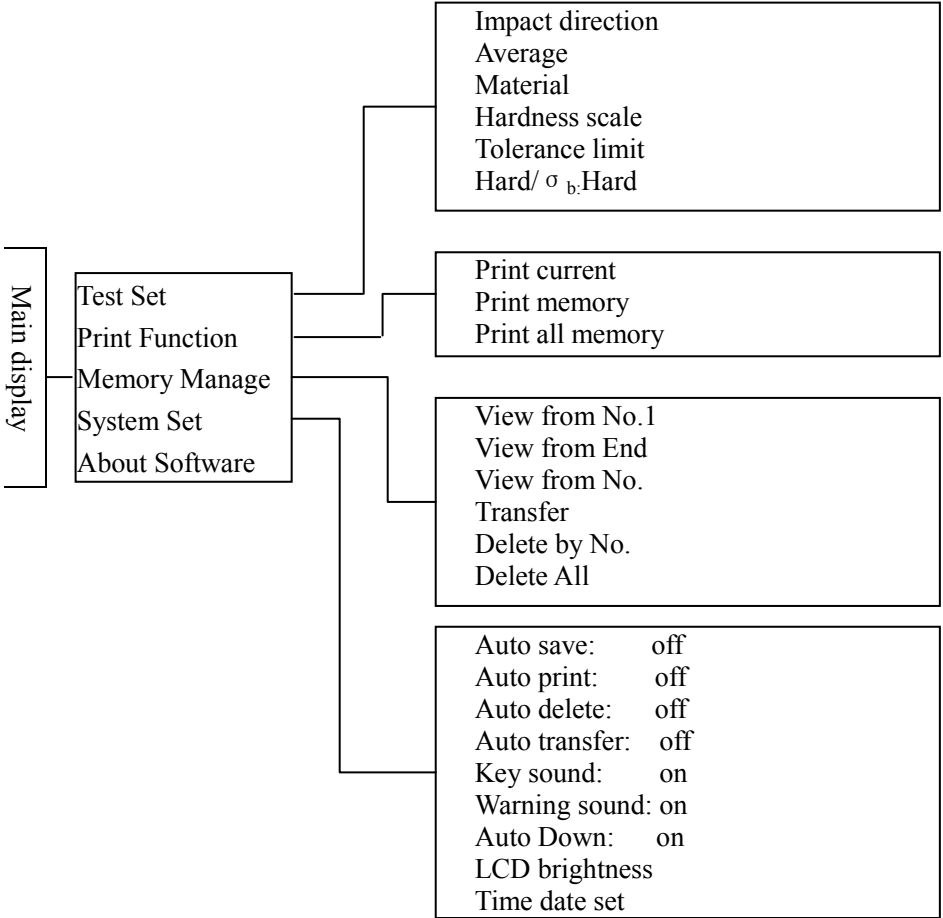
- Impact direction setting can be changed by press [DIREC.] key.
- Impact times setting can be changed by press [TIMES] key, the current impact times can be showed by press [TIMES] at the first time; the counting will add 1 when press [TIMES] once, and it will return to 1 if times of 32 is achieved.
- Hardness scale setting can be changed by press [HARD] key. Whenever press the key once, a circulating conversion among all hardness scales that available to current material and impact device will be performed. The hardness scale will be changed into Leeb hardness if the current setting is strength measurement.
- Material setting can be changed by press [MAT'L] key. Whenever press the key once, the circulating conversion among all material setting will be performed, and hardness scale will be changed into Leeb hardness, therefore, material should be set firstly when measuring, then hardness scale should be set.

Note: what is called “conversion” refers to the corresponding relationship of Leeb Hardness and other hardness for a certain material, which established on basis of abundant tests.

According to the conversion relationship, the Leeb hardness value which measured will be changed into other hardness scale value automatically via calculating by hardness tester.

6.4 Menu structure diagram

The parameter setting and additional function of equipment can both realized by menu operating. At the main display interface, pressing [MENU] key to enter the main menu.

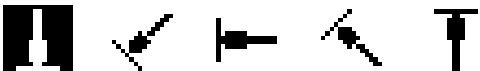


6.5 Measuring condition setting

When in main display interface, pressing [MENU] key to enter the main menu.

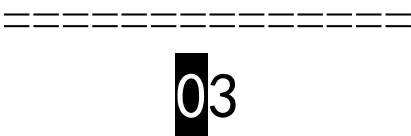
<p>Test Set Print Function Memory Manager System Set</p>	<p>Press [ENTER] key to enter [TEST Set]menu. Press [↑] [↓] key to move cursor to the item which will be set, then press [ENTER] key.</p>
<p>Impact Direc. Average Material Hardness Scale Tolerance Limit Hard/ σ b: Hard</p>	<p>Note: 1. If the [Hard/ σ b] is set to [Hard], hardness scale could not be selected obviously. Therefore, the cursor will skip over the item [Hardness] while moving.</p>
<p>2. Only D/DC type impact device is provided with the function of strength measuring, therefore, cursor can not be moved to item[Hard/ σ b] when other type of impact device is used.</p> <p>3. The symbol ↓ on the left bottom of menu shows the menu is not end, which can be paged down by press [↓] key; The symbol ↑ on the top of menu shows the menu is not end, which can be paged up by press [↑].</p>	

6.5.1 Impact direction setting

<p>Impact Direction</p> <p>=====</p>	<p>Press [←] [→] key to move cursor to the direction which will be set.</p>
	<p>Press [ENTER] key to finish the change. Press [ESC] key to cancel the change.</p>

6.5.2 Mean times setting

<p>Mean Times</p>	<p>The mean times can be modified in the range of 1~32.</p>
-------------------	---

	Press number key to input the value, and the cursor can move in circles to right automatically.
Press [ENTER]key to finish the change. Press [ESC]key to cancel the change.	

6.5.3 Material setting

6.5.3.1 [Hard/ σ b] is set to[Hard

Following available materials will be displayed in case of [Hard/ σ b] is set to[Hard]:

(Cast Steel) CWT. Steel STAIN. Steel GC. Iron NC. Iron Cast Alumin Copper- Zinc Copper- Alumin Wrought Copper	Press [↑] [↓] key to move cursor to the material which will be set. Press [ENTER] key to finish the change. Press [ESC] key to cancel the change.
---	---

Note: 1. Afte the material setting had been changed, hardness scale setting will return to HL automatically.

2. Material should be chosen prior to the hardness scale.

3. The symbol ↓ on the left bottom of menu shows the menu is not end, which

can be paged down by press [↓] key; The symbol ↑ on the top of menu shows the menu is not end, which can be paged up by press [↑].

6.5.3.2 of [Hard/σ b] is set to [σ b]

Following available materials will be displayed in case of [Hard/σ b] is set to [σ b]:

Mild Steel High- C Steel Cr Steel Cr- V Steel Cr- Ni Steel Cr- Mo Steel Cr- Ni- Mo Steel Cr- Mn- Si Steel Super ST. Steel STAIN. Steel	Press [↑] [↓] key to move cursor to the material which will be set. Press [ENTER] key to finish the change. Press [ESC] key to cancel the change.
---	---

Note 1: The symbol ↓ on the left bottom of menu shows the menu is not end, which can be paged down by press [↓] key; The symbol ↑ on the top of menu shows the menu is not end, which can be paged up by press [↑]

6.5.4 Hardness scale setting

Hard of Material	Press [←] [→] or [↑] [↓] key to move cursor to the hardness scale which will be set.
------------------	--

<p>=====</p> <p>HV HB HRC HS HRB</p> <p>HRA</p>	<p>Press [ENTER] key to finish the change.</p> <p>Press [ESC] key to cancel the change</p>
--	--

Note:

- 1. For the current selected impact device and material, only the hardness scale which can be conversed will be displayed; hardness which can be conversed will not be displayed.**
- 2. Material should be chosen prior to the hardness scale.**
- 3. After the material setting had been changed, hardness scale setting will return to HL.**

6.5.5 Tolerance limit setting

<p>Tolerance limit</p> <p>*****</p> <p>Min Max</p> <p>0170 0960</p>	<p>Press number key to input the value, and the cursor can move in circles to right automatically.</p> <p>Press [ENTER] key to finish the change.</p> <p>Press [ESC] key to cancel the change.</p>
--	--

- Note:**
- 1. If the setting exceeds the measuring range, the tester will ask operator to reset.**
 - 2. Exchanging will be done automatically if the Min. tolerance limit is more than Max. tolerance limit.**

6.5.6 Hardness/ σ_b setting

<p>↑ Material</p> <p>Hardness Scale</p> <p>Tolerance limit</p> <p>Hard/ σ_b: Hard</p>	<p>Press [ENTER] key to perform the selection between [Hard/ σ_b], and the cursor will exchange between hardness and strength.</p> <p>Note: Only D/DC type impact device is provided with the function of strength measuring. Therefore, the item can only be set to [Hard] if the impact device is not D or DC type.</p>
--	---

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6.6 Print function

If it is in main display interface, press [MENU] key to enter main menu.

Test Set Print Function Memory Manager System Set	Press [▲] [▼] key to move cursor to [Print Function]. Press [ENTER] key to enter [Print Function] menu.
---	--

Print Current Print Memory Print All Mem	Press [▲] [▼] key to move the cursor to the print function required, then press [ENTER] to print.
---	---

print out:

```
HardyTest D600
Hardness Tester
-----No.:

Operator:

Time:13:40:46
Date:08/08/2007
-----
Probe Type: D
Impact direc.:+90 Deg
Mean Times:05
Material:Matl of Roller
-----
51.4 50.9 51.5 51.6
 51.7
Average= 51.4HSD
-----
```

6.6.1 Printing current value

Note: Information about serial number and operator should be filled by manual.

6.6.2 Print Memory value

<p>Select Group (001 to 010)</p> <p>=====</p> <p>From 001 to 001</p>	<p>As for [Print Memory], the group range is necessary to be selected firstly, and the group range which saved in memory will be displayed at the same time.</p> <p>Press number key to input the value, and the cursor can move in circles to right automatically.</p>
---	---

Press [ENTER] key to confirm print.

Press [ESC] key to cancel print.

<pre> HardyTest D600 Hardness Tester ----- No.: Operator: ***** Date:01/01/2007 Probe Type: D Impact direc.:+90 Deg Average:03 Material: Steel and Cast Steel ----- No.:0002 550 549 548 Average= 549HL No.:0003 529 527 533 Average= 530HL ***** </pre>	<p>Information to be printed includes: tester name, date, type of impact device, impact direction, average times, material, group No., single measured value and average value.</p> <p>If the information in the group is as the same as that in the previous group, such as date, type of impact device, impact direction, average times, material and hardness scale, only group No., single measured value and average value can be printed, otherwise date and measuring conditions can also be printed out.</p>
--	--

- Note: 1. Actual number of groups will be printed in case of the number which had been set exceeds the actual range.***
- 2. No difference for the sequence to print the starting and ending group, that is to say if 1~5 groups will be printed, the sequence can be set from 1 to 5 or from 5 to 1.***
- 3. Wider the range of groups, shows the nearer the group from current; on the contrary, it will be further.***

6.6.3 Print all memory

Press [Print All Mem]key to print the values of all groups in the memory in the same format.

6.7 Memory manager

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

<p>Test Set Print Function System Set ↓ Memory Manager</p>	<p>Press [↑] [↓] key to move the cursor to [Memory Manager]. Press [ENTER] key to enter menu [Memory Manager].</p> <p style="text-align: center;">↓</p>
---	---

<p>View from No.1 View from End View form No. Transfer Delete by No. Delete All</p>	<p>If no data in the memory, “No Memory!” will be showed, and return subsequently.</p> <p>Press [↑] [↓] key to move the cursor to the function required, then press [ENTER] key.</p>
---	--

6.7.1 Viewing from the No.1 group/ Viewing from the end group

Press [View from No.1] key to display data in memory from the No.1 group.

Press [View from End] key to display data in memory from the end group.

6.7.2 Viewing from selected group

<p>Select Group From 001 to 010</p> <p>=====</p> <p>01</p>	<p>Press [View from No.] key, selecting interface will be displayed Press number key to input the value. Press [ENTER] key to display data in memory from the starting group selected. Press [ESC] key to cancel operation.</p>
--	---

6.7.3 Transferring data

Press [Transfer] key to output the data in memory via RS232 interface in text format.

6.7.4 Deleting selected group

<p>Select Group (001 to 010)</p> <p>=====</p> <p>From 01 to 001</p>	<p>Press [Delete by No.] key, a interface including group range to be deleted will be showed. Press number key to input digital value. Press [Enter] key to cancel selected group. Press [Esc] key to cancel the operation.</p>
---	---

- Note:**
- 1. If the input group number exceeds the actual range, then deletes the actual group among them.**
 - 2. No difference for the sequence to the starting and ending group, that is to say if 1~5 groups will be deleted, the sequence can be set from 1 to 5 or from 5 to 1.**
 - 3. Data group No. saved in memory will be reordered after deletion.**
 - 4. When deleting data, especially small group data, because the following data needs to be moved, max 30 seconds(approx.) may be required. Never to turn off power at this time, or data confusion can be caused.**

6.7.5 Delete all

Press [Delete All] to cancel all data in memory.

6.7.6 Confirm deletion

<pre>===== Confirm Delete? ===== YES NO</pre>	<p>Confirming interface will be displayed when deleting data in memory.</p> <p>Press [←] [→] key to move cursor to [YES], then press [ENTER] key to delete the data.</p> <p>Press [←] [→] key to move cursor to [NO], then press [ENTER] key to cancel the operation.</p>
---	---

6.8 Viewing interface

<pre>No. 001 02/07 62.4HSD No. 002 03/07 77.6HSD No. 003 03/07 546HL No. 004 03/07 483HL No. 005 04/07 666HL No. 006 06/07 787HL No. 007 06/07 690HL No. 008 08/07 820HL</pre>	<p>The No., dates and average values of 8 groups data can be displayed at most in the same interface.</p> <p>Press [↑] [↓] key to turn over pages.</p> <p>Press [ESC] key to exit view.</p> <p>By pressing [ENTER] key, cursor will be showed and furthermore detail can be viewed.</p> <p>Press [↑] [↓] key to select the group in this interface.</p> <p>Press [ESC] key to return to the previous viewing interface.</p> <p>Press [ENTER] key to view detail information in this group.</p>
--	--

<pre>No. 007 06/07/07 Average = 690HL D ↓ 05 Times (Cast) Steel</pre>	<p>Press [↑] [↓] key to turn over pages to view average value, measuring condition or single measured value.</p>
<pre>569 568 562 ↑ 564 565</pre>	<p>Press [ESC] key to return to the previous viewing interface.</p>

6.9 System Set

When in the main display interface, press [ESC] key to enter the main menu.

<p>Test Set Print Function Memory Manager ↓ System Set</p>	<p>Press [▲] [▼] key to move cursor to[System Set]. Press [ENTER] key to enter [System Set] menu.</p>
--	---

<p>Auto Save: Off Auto Print: Off Auto Delete: Off Auto Trans.: Off Key Sound: On Warn. Sound: On Auto Down: On LCD Brightness Time Date Set</p>	<p>Press [▲] [▼] key to move cursor to the item to be set. Press [ENTER] key to directly change, or enter corresponding changing interface. Press [ESC] key to return. For items of [Auto Save], [Auto Print], [Auto Delete], [Auto Trans.], [Key Sound] and [Warn. Sound], [ENTER] key can be pressed to selected [On] or [Off].</p>
--	---

If [Auto Save] is set to [On], the current group data can be saved automatically after measuring finished and average value displayed.

If [Auto Print] is set to [On], the current data can be printed out after measuring finished and average value displayed.

If [Auto Delete] is set to [On], gross error can be deleted automatically when average times had been achieved or measurement had been finished in advance by pressing [AVE.]key according to 3^σ rule. If some data had been cancelled, additional measurement should be carried out to satisfy the times set.

If [Auto Trans.] is set to [On], the current group data can be output in text format via RS232 after measuring finished and average value displayed.

If [Key Sound] is set to [On], buzzer will send out a short sound with each pressing.

If [Warn. Sound] is set to [On], buzzer will send out a long sound in case of measured value exceeds the tolerance limit, data deletion or other cases.

If [Auto Down] is set to [On], Power will turn off if neither measurement nor any key operation is performed within 5 minutes.

6.9.1 LCD brightness Set

<p>LCD Brightness</p> <p>=====</p> <p>Bright: Press [↑]</p> <p>Dark: Press [↓]</p>	<p>Press [↑] key to increase brightness. Press [↓] key to reduce brightness. Press [ENTER] key to finish change. Press [ESC] key to cancel change. The brighter of brightness, the deeper of color; The darker of brightness, the lighter of color;</p>
--	--

6.9.2 Time and Date Set

<p>Time Date Set</p> <p>=====</p> <p>08/18/2009 14:32</p>	<p>When in this interface, current time and date will be displayed on the screen, the format is “mm/dd/yy”.</p> <p>Press [↑] [↓] key to input the value, and the cursor can move in circles to right automatically. Press [ENTER] key to finish the change, which current time and date will be replaced by time and date set.</p> <p>Press [ESC] key to cancel the change.</p>
--	---

6.10 About software

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

<p>↑ Print Function</p> <p>Memory Manager</p> <p>System Set</p>	<p>Press [↑] [↓] key to move cursor to [About Software]. Press [ENTER] key to enter [About Software].</p>
---	--

<p>About Software</p> <p>HardyTest D600</p>	<p>Information about the tester and embedded software will be displayed on this interface.</p> <p>The software version and embedded</p>
--	---

<p>Version:2.1A Code:R0050121A SN:R00507080018</p>	<p>software identification are subjected to change due to the upgrading of software without notifying in advance.</p>
--	---

6.11 Software calibration

The tester and impact device must be calibrated with a standard Leeb hardness test block prior to the first use, or reusing after a long term idle.

One time calibration is enough for each type of impact device which equipped with a main unit; recalibration is not necessary after the replacement of impact device later.

Press [ENTER] key as well as [] key at the same time to enter the interface of software calibration

<p style="text-align: center;">Calibration</p> <p>=====</p> <p>Average=550</p> <p>Nominal=55</p>	<p>Impact direction should be set to [↓].</p> <p>Fi ↓ points should be measured vertically down on the Leeb hardness test block.</p> <p>Average value will be showed after measuring.</p> <p>Press [↑] [↓] key to input nominal value.</p>
--	--

Press [ENTER] Key to finish calibration.
Press [ESC] key to cancel calibration.
Calibration range is ±15HL.

6.12 Back light

The LCD display is equipped with an Led Back Light, which supplied for easily use in dark light condition. The Back Light can be turn on or trun off by pressing [☼] at any time when the tester is in operation.

6.13 Turn off the power automatically


- Auto turn off function is supplied to save the energy of battery.
- If neither measurement nor any key operation is performed within 5 minutes,



the tester will turn off automatically, a flash showing for 20 seconds on the LCD screen prior to switch off. At this time, any key except [] can be pressed to stop the flash of LCD screen, and cancel the turn off operation.

- In case of too low battery voltage, “Battery Empty!” will be displayed and turn off automatically.

6.14 Battery replacement

Battery symbol will flash  if battery capacity runs out. At this point, User can replace the damaged battery according to the following procedures.

- Turn off the Power of main unit.
- Unscrew the screw. Remove the battery cover, take out damaged batteries.
- Install the new batteries in their place (pay attention to orientation of install battery, take caution not to connect the anode and cathode inversely).
- Put back the battery cover, then turn on the power to check if the tester is in normal operation or not.

6.15 The connection of data communication cable

The small 4-pin plug which located on the end of communication cable should be inserted in the RS232 socket on the left side of main unit, and D type 9-pin RS232 port 9-pin port should be inserted in PC communication or the serial port printer case.

7 Trouble shooting

Failure	Cause	Solution
Failure in starting	Battery empty	Replace battery
No measuring value	Probe cable open circuit	Replace Probe cable
Value is inaccurate	Calibration data lose	over again Calibration

8 Maintenance

8.1 Impact device

- After using the impact device for 1000-2000 times, use the nylon brush provided to clean the guide tube and the impact body of the impact device. To clean the guide tube, unscrew the support ring and then take out the impact body, spiral the nylon brush in the counter-clock direction into the guide tube. When the brush reaches the bottom, draw it out. Repeat this action for 5 times and mount the impact body and the support ring.
- Remember to release the impact body after use.
- Any lubricating agent is absolutely banned to use inside the impact device.

8.2 Standard maintenance procedures

- If the error is $> 2\text{HRC}$ when using standard Rockwell hardness block to test, maybe the test tip is disabled. Changing the test tip or impact body should be considered.
- If other abnormal phenomena occur, user should not disassemble or adjust any part which used for fixing. You can return the hardness tester to the service department of our company.

9. Notice of Transportation and Storage.

The tester should be stored in room temperature, away from vibration, strong magnetic field, corrosive medium, dampness and dust.

10. Non-warranty part

- 1 Sheath of HardyTest D600 2 Panel 3 Impact body
4 Support ring 5 Probe cable 6. Battery.

Certificate of Approval

Products Name: _____

Products Type: _____

Main unit No: _____

Impact device No: _____

The product accords with the technical criteria and is allowed to sell.

Quality Control Engineer: _____

Inspection date: _____

SaluTron Messtechnik GmbH

Leeb Hardness Tester

HardyTest D600[®]

Packing List

No	Appellation	Num	
1	HardyTest D600 [®] Main unit	1	
2	D type impact device	1	
3	Small supporting ring	1	
4	Nylon brush (A)	1	
5	High value Leeb test block	1	
6	Communication cable	1	
7	AA battery	2	
8	Screwdriver	1	
9	Instruction Manual	1	
10	DataView Software	1	
11	Box of instrument	1	
12	Printer		Optional
13	Printer cable		Optional



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