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1 Introduction

1.1 Principle

The tester measuring principle is physically a rather simple, dynamic hardness tester.

An impact body with a hard metal test tip is propelled by spring force against the surface of the test piece. Surface deformation takes place when the impact body hits the test surface, which will result in loss of kinetic energy.

This energy loss is calculated by velocity measurements when the impact body is at a precise distance from the surface for both the impact and rebound phase of the test. The permanent magnet in the impact device generates an induction voltage in the single coil of the impact device. The voltage of the signal is proportional to the velocity of the impact body, and signal processing by the electronics provides the hardness reading for display and storage.

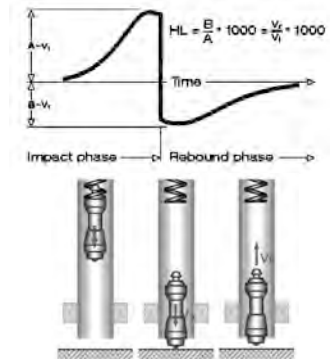
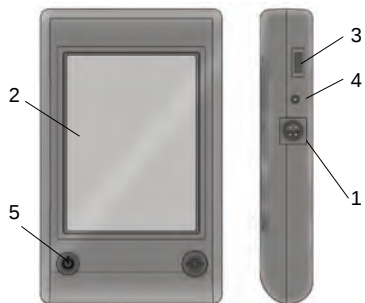


Fig.1-1

1.2 Structure

1) Display



1. Sensor jack 2. LCD screen 3. Mini USB jack
4. Charger jack 5. Power Button

Fig 1.2

2) Impact Device(type D)

The display unit can connect to almost every type of Leeb and can identify them automatically.

It is type D as shown in Fig.1-3, the others see appendix for detail.

Unit

1. Impact Body
2. Support Ring
3. Coil
4. Cable
5. Catch Chuck
6. Loading Tube
7. Release Button

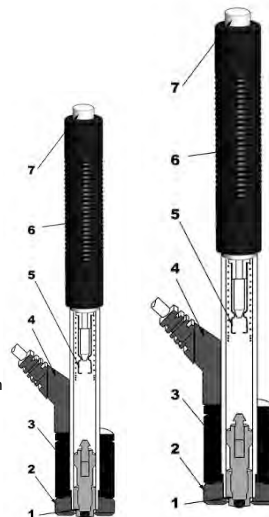


Fig.1-3

impact device,
Fig.1-2

3) Displayer

THE Hardness Tester has a large LCD with touchpad. (Fig. 1-4)

1. Impact device type: the type of impact device used. it can be identified automatically or be setup.
2. Material: The material of test piece.

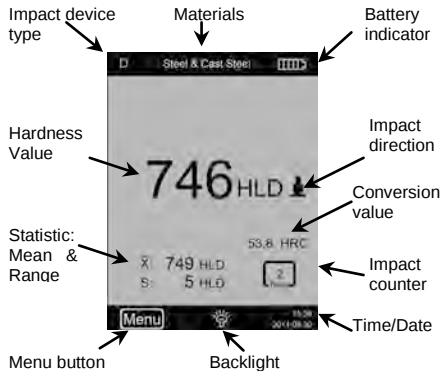


Fig.1-4

3. Battery indicator: Showing the battery power.

4. Conversion value: The conversion value of measured value "L".

Note: When "---" appear at this position, means the conversion is out of range.

5. Impact direction: Set it per the impact direction.

6. Hardness value: Measured hardness value L (Leeb).

7. Statistic values: X: Mean value. S: The range.

8. Statistic times: The impact times in a statistic data group

9. Impact times counter: Finished times of impact

10. Backlight: Touch it will turn on or off the backlight.

1.3 Specifications

- HL Display Range: 0 ~ 999HLD
- Accuracy: ± 6 HL
- Displayer: large LCD, backlight, touch screen
- Internal Data Storage: 500 measured value
- Resolution: 1 (for HL, HV, HB, HSD, MPa); 0.1 (for HRC,HRB)
- Battery: Rechargeable Ni-MH battery
- Operating Temperature: 0°C~+50°C (32°F~122°F)
- Storage Temperature: -10°C~+60°C (14°F~140°F)
- Dimension: 130 x 87 x 28 mm
- Weight: 240g

1.4 Application Range

- Good for all metals, Ideal for production level testing
- Best suited for on-site testing of heavy, big or already installed parts
- Handy for difficult to access or confined test locations
- Automatic compensation for impact direction
- Excellent for material selection and acceptance tests
- Easy to use and accurate on curved test surfaces ($R > 10$ mm)
- Metal production & processing, Automotive & transportation, Machinery & power plants, Petro-chemical, refineries, Aerospace & shipyard, Metal constructions, Testing services & laboratories

2 Test

2.1 Instrument preparation

1) Connecting

Use the signal cable to connect between display unit and sensor. (Fig.

2-1)

2) Charge the Battery

The tester should be charged before using it for the first time.

3) Turn on the power

Press  to switch on the instrument.

4) Calibrate the Instrument

Or you should calibrate the tester using the test block for the first time. (See 4.3 Calibration)

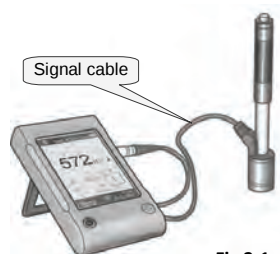


Fig 2-1

2.2 Specimen preparation

Inappropriate specimen will bring the error measured results. It should be the necessary processing and preparation according to the original conditions of specimen. The preparation of specimen shall be annexed the basic requirements for the following:

1) In the process of the test surface preparation, should be avoided cold, heat processing on the specimen surface.

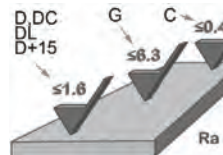


Fig.2-2

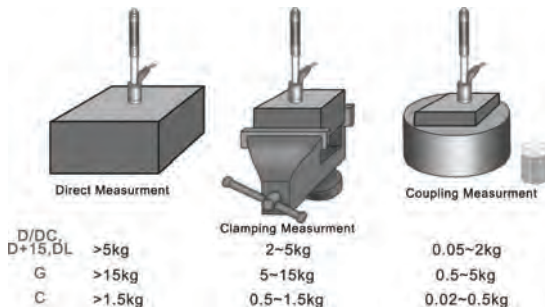


Fig.2-3

surface hardening layer) should be thick enough.

6) If the test surface is not flat, the radius of test area should be larger than 30mm(50mm for type G). And should mount a appropriate support ring.

7) The specimen should not be with magnetic.

2) Test surface should be flat with metallic luster, and no oxide skin and other dirt.

3) The roughness of test surface

4) The specimen must be of sufficient mass and rigidity. If insufficient, the displacement or move will be produced in the process of impact, it can cause large error.

Generally, the mass of the specimen is greater than or equal to 5kg can be carried out the test directly.

5) The thickness of specimen and thickness of homogeneous layer (or

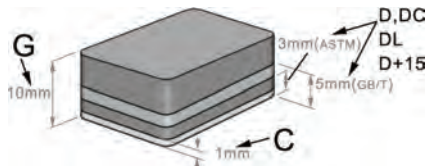


Fig.2-4

2.3 Test procedure

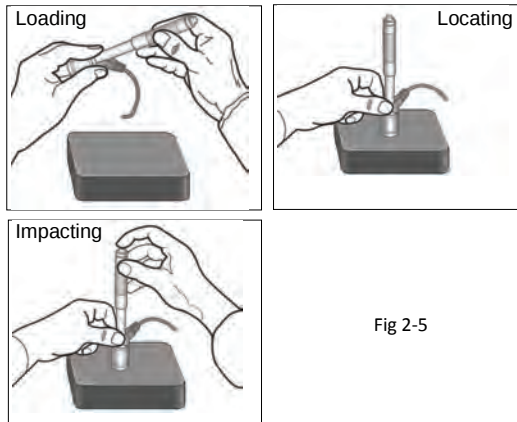


Fig 2-5

1) Loading

Simply load the impact device by sliding the loading tube forward.

2) Locating

Then place and hold the impact device on the surface of the test piece at the desired test point. Impact indirection should be vertical with the test of surface.

3) Impacting (Measuring)

Trigger the impact by pressing the release button. The hardness value will be instantaneously displayed.

4) Read test result

Read out the test result from LCD at Fig. 1-4.

Note:

Generally, each measurement location of sample is conducted for the five tests. The range (difference of maximum value and minimum value) values should be less than 15HL. The distance between any two impact point should be ≥ 3 mm ; the distance between impact position and the edge of the sample should be ≥ 3 mm.

2.4 Browse

The tester can save hardness values, you can browse them after testing. Enter the menus to select the browse mode that you wish.(see 3.2.3 for detail)

2.5 Print test report

The tester can be linked to a wireless printer to print a report. Place the printer near the tester(within 2 metres), and turn it's power on.



Fig 2-6

Test Report			

Impact Unit Type: D			
Material : Steel&Caststeel			
1	808 HLD	▲	61.2 HRC
Date: 31-07-06 Time: 18:21:27			
2	808 HLD	▲	61.2 HRC
Date: 31-07-06 Time: 18:21:27			
3	805 HLD	▲	60.8 HRC
Date: 31-07-06 Time: 18:21:27			
4	808 HLD	▲	61.2 HRC
Date: 31-07-06 Time: 18:21:27			
5	805 HLD	▲	60.8 HRC
Date: 31-07-06 Time: 18:21:27			

n = 3	HLD	80.4	HRC
Σ	806 HLD	61.0	HRC
Printed: 31-07-06 18:21:27			

Fig 2-7

The test report is shown as Fig 2.7. The specific contents of the report can be setup in Items menu. (See 3.2.2)

3 Setup

The tester uses a touch pad, most of common settings can be arranged in the main interface directly. Some functions need to enter the menus to set or operate.

3.1 Setting in main interface

The tester has been equipped a touch pad, some common test parameters can set on the main interface simply(Fig.3-1).

3.2 Setting in menus

Testing Setup	Material Group	System Setting	Custom Mate.
	Impact Direction		Auto Print ON/OFF
	Scale		Gross Error ON/OFF
	Limit Values		Key Sound ON/OFF
	Statistic		Alarm ON/OFF
	Workpiece		Language: EN
Printing Setup	Items	Calibration	Date/Time
	Print Memory		Backlight Time
	Print All		Test Calibration
Memory	Browse A To Z	Information	Touch Calibration
	Browse Z To A		
	Browse Selected		
	Upload Data		
	Delete Selected		
	Delete All		

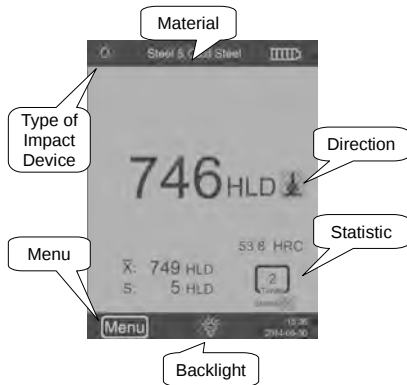


Fig. 3-1 Setting in main interface

In main interface, touch **Menu** to enter the menus. Then select the item you wish to set by touch it.

In menus:

touch “**▲**” or “**▼**” to page up or page down.

touch **Back** to the upper menu , or return to main interface.

3.2.1 Testing Setup

1) Material Group

Material Group is for select the materials that you test. It only

determines the

conversion to
other hardness

scale. If Leeb is
needed only, may
not care about it.

If the material is
not list in the
menu, refer to the
materials



Fig. 3-4

handbook to select a similar material type.

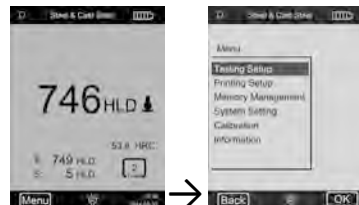


Fig. 3-2

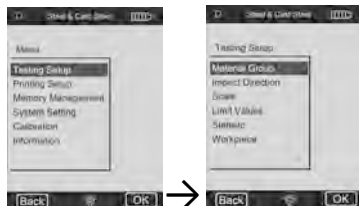


Fig. 3-3

2) Impact Direction

Fig 3-6

3) Scale

HB-Brinell hardness; **HRB**- Rockwell scale B

HRC- Rockwell scale C; **HV**- Vickers Hardness

MPa- Tensile strength.

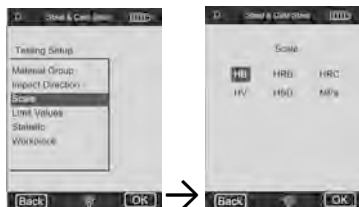


Fig. 3-7

If the type G impact device is connected, there are HB,HRB only.

Note:

① Because there are different valid ranges between

the different hardness scales, sometime the conversion cannot be performed, at this time, the “---”will be displayed.

② The material group must be reset when you set to tensile strength (MPa).

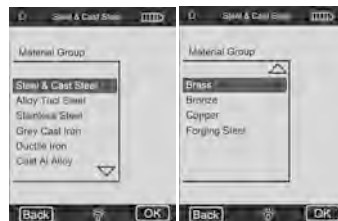


Fig. 3-5

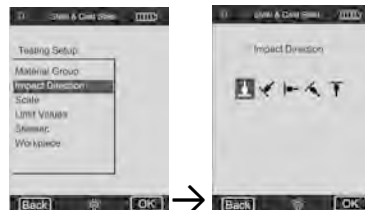


Fig. 3-6

③ As we all know, the conversion is for reference only. To obtain precise conversion may have to be through the comparison test.

4) Limit Values

You can set the maximum limit and minimum limit of tolerance. Once the hardness values measured is out of the range, the display unit will be alarm and send out a prompt. You can set the maximum and minimum limit by using a digital keyboard(Fig.3-)

Touch  or  can move to other item or other digit.

5) Statistic

The tester has automatic statistic function.

Here you can set the statistic times to calculate out mean value($\bar{x}$) and range value(S).

Note:

① The statistic times value range is 1 ~ 99, when “1” is set, the system has no statistic process.

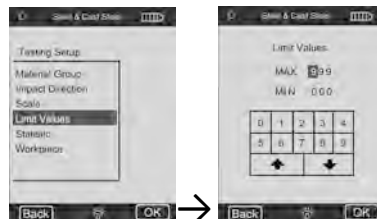


Fig. 3-8

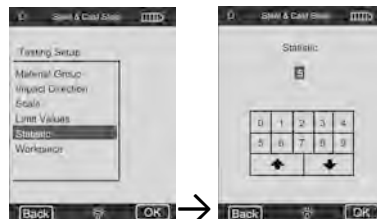


Fig. 3-9

② When some items (Material Group etc) was reset, it will count from “0”.

6) Workpiece

Sometimes, maybe you need to distinguish between the different materials or different test sample. Can code on them, in order to browse, print or data processing.

The workpiece code range is 1-50, it can be saved.

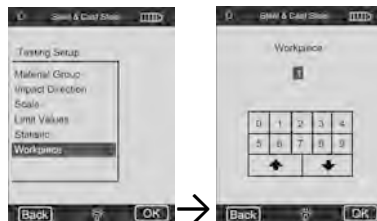


Fig. 3-10

3.2.2 Printing Setup

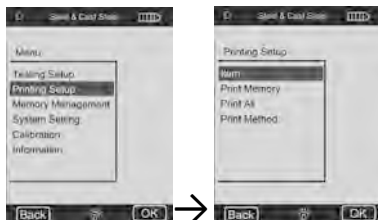


Fig. 3-11

Here you can adjust the format of test report, and print test date saved in memory.

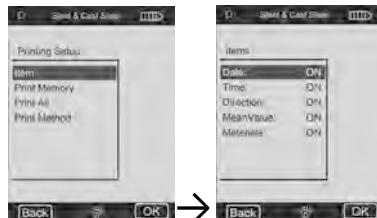


Fig. 3-12

1) Items

2) Print Memory The range of data that you wish to print can be selected here.

3) Print All

All of measured data in memory can be printed.



Fig. 3-13

3.2.3 Memory Management

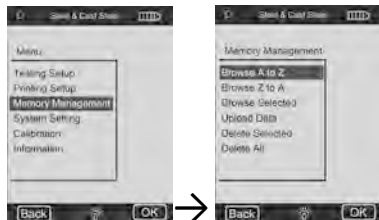


Fig. 3-15

You can browse and delete data in the memory. The test data saved in memory

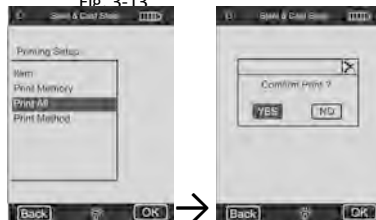


Fig. 3-14

included all test information. It can store up to 500 data. When it is full, the new data will squeeze the earliest data.

Therefore, should be save the useful timely in other ways(such as printing or upload to PC) to prevent accidental

loss of data.

1) Browse

This tester has provided three browser modes:

A To Z, Browse Z To A and Browse Selected.

Touch  or  to page up/down.

Touch  to delete selected group of data.

Touch  to print selected group of data.

Click OK to show the test time of selected group of data.

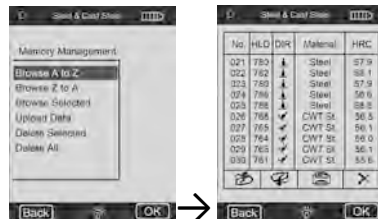


Fig. 3-16

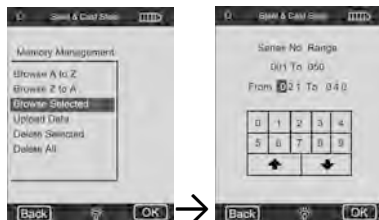


Fig. 3-17 Browse Selected



Fig. 3-18

2) Delete

You can do a bulk deletion or delete all data in memory.

Deleting a single data in browse is recommend.

NOTE: Once the data is deleted, will not be able to recover. So be careful with the delete function.

3) Upload Data

Data in memory can be loaded to PC.

Connect to PC, open the data acquisition software(Ehard).

Enter **Upload Data**,

then you can receive or treat data on PC software side.

See manual of software for detail.

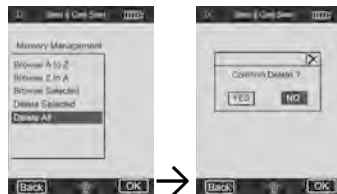


Fig. 3-19

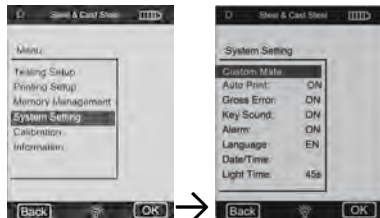


Fig. 3-21

3.2.4 System Setting

System Setting contains some system function switches; you can setup various switch according to the requirements.

1) Custom Mate

You can

customize your conversion table, and select them in "Material A", "Material B" and "Material C".

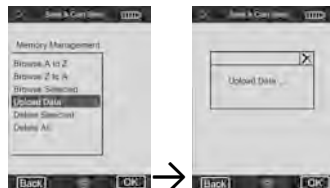


Fig. 3-20

You can select the scale and input the conversion table.(Fig.3-22)

2) Auto Print

If Auto Print is set to "ON", when the test of a statistic group is finished, the tester will print the report automatically (the printer must be turned on).

3) Gross Error

When **Gross Error** is set to **ON**, gross errors will be shown out according to Grubbs criteria as the **Statistic Times Value** have been completed.

4) Key Sound

5) Alarm

If it is set to **ON**, when measured value is out of the limit values or gross errors appear, the buzzer will beep twice.

6) Language

7) Date / Time (Fig.3-22.)

8) Backlight Time

If there is no any operation, after the time specified by Light Time, the backlight will shut down automatically.



Fig. 3-22

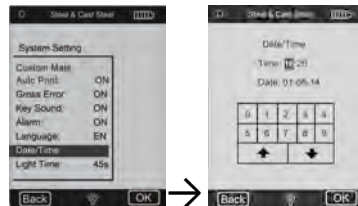


Fig. 3-23

4 Maintenance

4.1 Routine maintenance

1) General considerations

Impact device should avoid collision, the weight stack in the use and storage. Put into the case after use. The impact body should be in release state when storage.

Should avoid close to the strong magnetic. Any of the components can't stick any kinds of oil or lubricant.

2) Clean the impact body

General every 1~2 thousands of times after test, the impact device tube and impact should be cleaned up.

Method: Rotate off the support ring, release and remove the impact body. use the nylon brush to clean up the tube and impact body.

3) Replacement impact ball

For long-term use, the impact ball may be worn, it should be replaced when affect the test precision.

4.2 Charging

It need to recharge batteries when batteries are used for the first time and exhaustion of electricity arises.

The capacity of battery will show as empty after exhausting use (3 columns as full), and show a word "Power Shortage!"

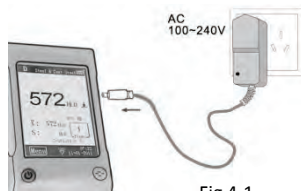


Fig 4-1

Besides, the buzzer will beep once in two seconds to tell the user it's time to charge.

Firstly, insert the plug of charger into the charger jack of display unit, and then connect the charger with AC socket (100~240V/47~63Hz) to start charging. Meanwhile, the screen of display unit will display "charging...".

At the end of charging, "charging complete" will be displayed.

If you press **ON/OFF** button at this time, the tester won't be turned off, because it is on a supervision mode.

Note: Please use the exclusive charger.

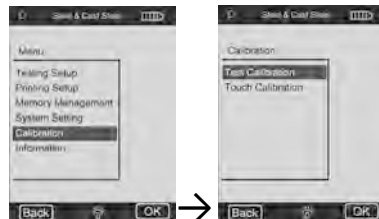


Fig. 4-2

4.3 Calibration

The **Calibration** contains the **Test Calibration** and **Touch Calibration**.

1) Test Calibration

It is used to calibrate the tester, in order to further reduce the error.

Enter **Test Calibration**. Select the type of impact device.

Then choose a scale you want to calibrate in.

If HL is selected, can enter calibration interface directly.

If the other scale is selected, the material type of test piece used for a standard must be chosen.



Fig. 4-3

Carry on 5 effective tests on the test block. (when **Alarm** is set to ON, and the number of impact times is less than 5, touch OK will display a prompt to show operating errors), the measured values will be displayed (you can delete the wrong data and return).



Fig. 4-4

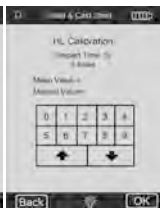


Fig. 4-5



Fig. 4-6

2) Touch

Calibration

The Touch

Calibration is actually used to calibrate the consistency

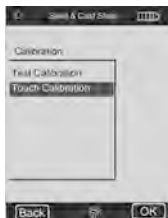


Fig. 4-7



Fig 4-8

between touch screen sensor and LCD coordinates. If there is a deviation existing between the actual position of touch screen presses and the position of presses figures displayed by LCD, users should conduct Touch Calibration. Just click the center of cross line or a square frame according to the prompt shown.

Appendix

A-1 Type of Impact Device

Type D



The basic type, it is suitable for almost all applications.

Type DC



The shorted D, can measure into the more narrow space..

Type DL



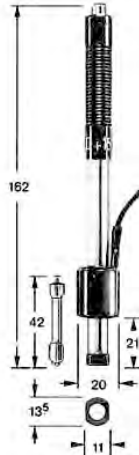
For in extremely confined spaces or at the base of grooves.

Type C

Surface hardened components, coatings, thin walled or impact sensitive components



Type D+15



Particularly slim front section and with measuring coil moved back. Suit for hardness measurements in grooves and on recessed surfaces.

Type G



Heavy castings and forgings solid parts.

A-2 Scale Range

Type D & DC

Materials	HV	HB	HRC	HRB	HSD	MPa
Steel & Cast Steel	81~955	81~654	20.0-68.4	38.4~99.5	32.5~99.5	375~639
Alloy Tool Steel	80~898		20.4~67.1			375~2639
Stainless Steel	85~802	85~655	19.6~62.4	46.5~101.7		740~1725
Grey Cast Iron		63-336				
Ductile Iron		140-387				
Cast Al Alloys		19-164		23.8-84.6		
Brass		40-173		13.5-95.3		
Bronze		60-290				
Copper		45-315				
Forging Steel	83-976	142-651	19.8-68.5	59.6-99.6	26.4-99.5	

Type DL

Material	HLDL	HRC	HRB	HB	HV	HSD
Steel	560~950	20~68.4	38.4~99.5	81~654	81~955	32.5~97.9

Type C

Material	HLC	HRC	HB	HV	HSD
Steel	350~960	20.0~69.5	80~683	80~996	31.9~102

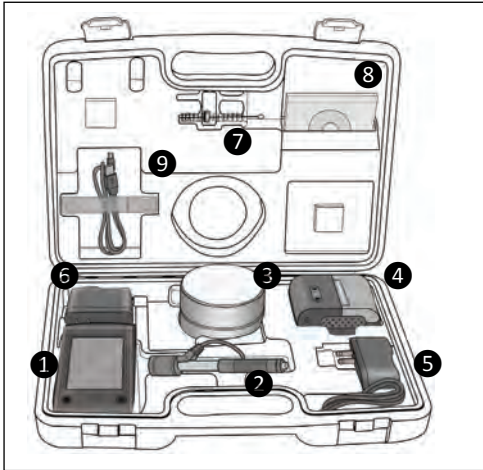
Type D+15

Material	HLD+15	HRC	HB	HV	HSD
Steel	481~850	20~64	188~654	192~825	32.5~88.4

Type G

Materials	HLG	HRB	HB
Steel	300~750	47.7~99.9	90~646
Grey Cast Iron	340~600		92~326
Ductile Iron	340~600		127~364

A-3 Packing List



- ① Display Unit
- ② Impact Device
- ③ Test Block
- ④ Mini-Printer
- ⑤ Charger(for Printer)
- ⑥ Charger(for tester)
- ⑦ Little Support Ring,
Cleaning Brush
- ⑧ User's Manual
Certificate
- ⑨ Carrying Case