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Precision, Quality, Innovation

## HARDNESS TESTERS



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TESTERS

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## HARDNESS TESTERS

Starrett Hardness Testers indicate the hardness of a material, usually by measuring the effect on its surface of a localized penetration by a standardized rounded or pointed indenter of diamond, carbide, or hard steel.

Hardness is a characteristic of a material, not a fundamental physical property. It is defined as the resistance to indentation, and it is determined by measuring the permanent depth of the indentation.

When using a fixed force (load) and a given indenter, the smaller the indentation, the harder the material. Indentation hardness value is obtained by measuring the depth or the area of the indentation using one of several different test methods.

### STARRETT HARDNESS TESTERS UTILIZE THE FOLLOWING HARDNESS TESTING METHODS:

#### Benchtop Hardness Testers

Rockwell

Brinell

Micro Vickers

Macro Vickers

#### Portable Hardness Testers

Leeb

Ultrasonic

### ROCKWELL HARDNESS TESTING

The Rockwell hardness tester utilizes either a carbide ball or a conical diamond and indicates hardness by determining the depth of penetration of the indenter under a known load. This depth is relative to the position under a minor initial load; the corresponding hardness number is indicated on a dial or digital display. For hardened steel, Rockwell testers with diamond indenters are particularly suitable; they are widely used in metalworking plants. The Superficial Rockwell Tester is particularly suitable for use in hardness testing of thin components and layers, or with specimens whose calculated hardness value is outside the Regular Rockwell scale. Starrett offers regular, superficial and combination units available to operate in all Rockwell scales in regular and superficial Rockwell ranges.

### BRINELL HARDNESS TESTING

Brinell hardness is determined by forcing a hardened steel or carbide ball of known diameter under a known load into a surface and measuring the diameter of the indentation with a microscope. The Brinell hardness number is obtained by dividing the load, in kilograms, by the spherical area of the indentation in square millimetres; this area is a function of the ball diameter and the depth of the indentation. The Brinell hardness test method as used to determine Brinell hardness, is defined in ASTM E10. Most commonly it is used to test materials that have a structure that is too coarse or that have a surface that is too rough to be tested using another test method, e.g., castings and forgings. Brinell testing often use a very high test load (3000 kgf) and a 10mm diameter indenter so that the resulting indentation averages out most surface and sub-surface inconsistencies.

### VICKERS HARDNESS TESTING

The Vickers hardness tester uses a square-based diamond pyramid indenter, and the hardness number is equal to the load divided by the product of the lengths of the diagonals of the square impression. Vickers hardness is the most accurate for very hard materials and can be used on thin sheets. Micro Vickers: Microhardness testing of metals, ceramics, and composites is useful for a variety of applications: testing very thin materials like foils, measuring individual microstructures within a larger matrix, or measuring the hardness gradients of a part along the cross section. The actual indenters used are Vickers (more common; a square base diamond pyramid with an apical angle of 136°) or Knoop (a narrow rhombus shaped indenter). The result for either Vickers or Knoop microhardness is reported in kg/cm<sup>2</sup> and is proportional to the load divided by the square of the diagonal of the indentation measured from the test. The load on the Vickers microhardness indenter usually ranges from a few grams to several kilograms.

Macro Vickers: In contrast, 'Macro' Vickers loads vary from 1 to 120 kg. The indentations should be as large as possible, within the confines of sample geometry, to minimize errors in measuring the indentation (hence the reported hardness). Vickers hardness is also sometimes called Diamond Pyramid Hardness (DPH) owing to the shape of the indenter.

## ULTRASONIC TESTING

Ultrasonic Contact Impedance is based on a 136 degree diamond at the end of a vibrating rod being depressed into the test surface at a fixed load. The difference in Ultrasonic vibration frequency is then calculated into a hardness value. The UCI test procedure is slower than the Dynamic Impact style, however the "UCI" method of hardness testing is portable, easy and accurate. It also has its own advantages when utilized for certain testing applications. UCI testers are not restricted to large mass items like dynamic type testers. These units can test metals as thin as 1mm and at a hardness value as low as 20HRC (75HB). They also excel at performing hardness tests on larger, harder metals as well. Another reason for the rise in popularity is due to the fact that the UCI method is categorized as "Non-Destructive". That translates into less scrap parts/ lower mfg costs due to necessary inspections.

## LEEB TESTING

The Leeb rebound hardness test method was developed in 1975 by Leeb and Brandestini to provide a portable hardness test for metals. It was developed as an alternative to the unwieldy and sometimes intricate traditional hardness measuring equipment. Very well suited for the hardness testing of ferrous and non ferrous materials. Measurements are made in the Leeb Scale and depending on the instrument can be converted to Vickers, Brinell, Rockwell C & B and Shore. Materials that can typically be tested include cast steel, alloy tool steel, stainless steel, aluminum, bronze, copper, cast irons etc.

LEEB / REBOUND testers are NOT suited for testing the hardness of very thin parts like sheet metal, thin walled or very light weight parts.

Parts down to 2mm (0.11") when very well supported/coupled to a heavier part and up to any thickness can be tested with an Ultrasonic Hardness Tester.



# QUICK REFERENCE CHART

Specifications					
Cat. No.	3814	3815	3818	3823	3824
EDP	67754	12800	72981	13017	67607
Pag. No.	8	9	10	11	12
Good - Better- Best	1	1	1	1	2
Best Seller	X				X
Description	Analog Bench Hardness Tester	"Twin Analog Bench Hardness Tester"	Superficial Rockwell Hardness Tester - Basic Analog Machine	"Digital Twin Rockwell - Superficial Rockwell Hardness Tester with Dolphin Nose, Touchscreen, Load Cell"	Digital Twin Rockwell - Superficial Rockwell Hardness Tester with Dolphin Nose, Touchscreen, Load Cell, Auto Z Axis
Hardness Type	Rockwell	Rockwell / Superficial Rockwell	Superficial Rockwell	Rockwell / Superficial Rockwell	Rockwell / Superficial Rockwell
Weighted / Load Cell	Weighted	Weighted	Weighted	Load Cell	Load Cell
Dial / Digital	Dial	Dial	Dial	Digital	Digital
Crank Wheel / Auto Load	Crank Wheel	Crank Wheel	Crank Wheel	Auto Load	Auto Load
Auto Z				No	Auto Z
Scales / Loads	A, B, C, D, E, F, G, H, K	A, B, C, D, E, F, G, H, K, L, M, HR15N, HR15T, HR30N, HR30T, HR45N, HR45Ts	HR15N, HR30N, HR45N, HR15T, HR30T, HR45T, HR15W, HR30W, HR45W, HR15X, HR30X, HR45X, HR15Y, HR30Y, HR45Y	HR15N, HR30N, HR45N, HR15T, HR30T, HR45T, HR15W, HR30W, HR45W, HR15X, HR30X, HR45X, HR15Y, HR30Y, HR45Y, HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV	HR15N, HR30N, HR45N, HR15T, HR30T, HR45T, HR15W, HR30W, HR45W, HR15X, HR30X, HR45X, HR15Y, HR30Y, HR45Y, HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV
Software Included	No	No	No	Yes	Yes
Output	No	No	No	Direct to PC	Direct to PC
Dolphin Nose				Yes	Yes

Cat. No.	3831	3833	3834	3832	3825
EDP	02041	02043	02044	02042	02045
Pag. No.	14	16	17	15	13
Good - Better- Best	2	2	2	3	1
Best Seller			X	X	
Description	Digital Rockwell Hardness Tester with Touchscreen	Digital Superficial Rockwell Hardness Tester with Touchscreen - Closed Loop Load Cell	Digital Twin Rockwell - Superficial Rockwell Hardness Tester with Touchscreen - Closed Loop Load Cell	Digital Rockwell Hardness Tester with Touchscreen - Closed Loop Load Cell	Brinell Hardness Tester
Hardness Type	Rockwell	Superficial Rockwell	Rockwell / Superficial Rockwell	Rockwell	Brinell
Weighted / Load Cell	Weighted	Load Cell	Load Cell	Load Cell	Load Cell
Dial / Digital	Digital	Digital	Digital	Digital	Digital
Crank Wheel / Auto Load	Crank Wheel	Crank Wheel	Crank Wheel	Crank Wheel	Auto Load
Auto Z					
Scales / Loads	HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV	HR15N, HR30N, HR45N, HR15T, HR30T, HR45T, HR15W, HR30W, HR45W, HR15X, HR30X, HR45X, HR15Y, HR30Y, HR45Y	HR15N, HR30N, HR45N, HR15T, HR30T, HR45T, HR15W, HR30W, HR45W, HR15X, HR30X, HR45X, HR15Y, HR30Y, HR45Y, HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV	HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV	3000kgf (29400N), 1500Kgf (14700N), 1000Kgf (9800N), 750Kgf (7355N), 500Kgf (4900N), 250Kgf (2452N), 187.5Kgf (1839N), 125Kgf (1226N), 100Kgf (980N), 62.5Kgf (612.9N)
Software Included	Yes	Yes	Yes	Yes	No
Output	Uses supplied USB Flash Drive for memory / output	Uses supplied USB Flash Drive for memory / output	Uses supplied USB Flash Drive for memory / output	Uses supplied USB Flash Drive for memory / output	No
Dolphin Nose					

Specifications				
Cat. No.	3840A	3840B	3841A	3841B
EDP	02051	02052	02053	02054
Page No.	18	18	19	19
Good - Better - Best	1	2	3	4
Best Seller				
Description	Micro Vickers Hardness Tester with Digicam - Basic Manual Software	Micro Vickers Hardness Tester with Digicam - Auto Software	Micro Vickers Hardness Tester with Digicam - Basic Manual Software	Micro Vickers Hardness Tester with Digicam - Automatic Software
Hardness Type	Micro Vickers	Micro Vickers	Micro Vickers	Micro Vickers
Software Type	Manual	Auto	Manual	Auto
Auto Turret	No - Non Upgrade	No - Non Upgrade	No	No
Testing Range:	1HV~2967HV	1HV~2967HV	1HV~2967HV	1HV~2967HV
Test Forces:	0.098N(10g), 0.246N(25g), 0.49N(50g), 0.98N(100g), 1.96N(200g), 2.94N(300g), 4.90N(500g), 9.80N(1000g)	0.098N(10g), 0.246N(25g), 0.49N(50g), 0.98N(100g), 1.96N(200g), 2.94N(300g), 4.90N(500g), 9.80N(1000g)	0.098N(10g), 0.246N(25g), 0.49N(50g), 0.98N(100g), 1.96N(200g), 2.94N(300g), 4.90N(500g), 9.80N(1000g)	0.098N(10g), 0.246N(25g), 0.49N(50g), 0.98N(100g), 1.96N(200g), 2.94N(300g), 4.90N(500g), 9.80N(1000g)

Cat. No.	3841C	3841D	3842A	3842B
EDP	02055	02056	02057	02058
Page No.	19	19	20	20
Good - Better - Best	5	6	1	2
Best Seller		X		X
Description	Micro Vickers Hardness Tester with Auto Turret - Basic Software and Turret Control	Micro Vickers Hardness Tester with Auto Turret - Auto Software and Turret Control	Macro Vickers with Digicam - Basic Software	Macro Vickers with Digicam - Automatic Software
Hardness Type	Micro Vickers	Micro Vickers	Macro Vickers	Macro Vickers
Software Type	Manual	Auto	Manual	Auto
Auto Turret	Yes	Yes	NA	NA
Testing Range:	1HV~2967HV	1HV~2967HV	1HV~2967HV	1HV~2967HV
Test Forces:	0.098N(10g), 0.246N(25g), 0.49N(50g), 0.98N(100g), 1.96N(200g), 2.94N(300g), 4.90N(500g), 9.80N(1000g)	0.098N(10g), 0.246N(25g), 0.49N(50g), 0.98N(100g), 1.96N(200g), 2.94N(300g), 4.90N(500g), 9.80N(1000g)	9.807, 19.61, 24.52, 29.42, 49.03, 98.07, 196.1, 249.2, 490.3 N 1, 2, 2.5, 3, 5, 10, 20, 30, 50 kgf	9.807, 19.61, 24.52, 29.42, 49.03, 98.07, 196.1, 249.2, 490.3 N 1, 2, 2.5, 3, 5, 10, 20, 30, 50 kgf

# BENCH HARDNESS TESTERS

## 3814 ANALOG BENCH HARDNESS TESTERS

The 3814 Hardness Tester provides reliable Rockwell Hardness values on all types of metal and alloys, hard or soft, and in many shapes. This reliable bench hardness tester has a high quality casting, is ergonomically designed for easy operation and is engineered to ensure accurate results. It is an ideal basic hardness solution, economically priced to suit a variety of lab, workshop, toolroom and inspection department applications. The 3814 conforms to ASTM E-18 standard.

### FEATURES

- Ability to handle Rockwell Scales A through H & K
- Stable cast iron construction
- Ideal basic hardness testing for many typical applications
- Digital readout available



3814 Hardness Testers		
Cat. No.	EDP	Description
3814	67754	Analog hardness tester
3814E	72974	Digital readout replacement
PT06145	72519	Hardness tester stand
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

Accessories Included	
Diamond indenter	
Ball indenter - 1/16" (1.6mm)	
3 certified test blocks	
4 test tables - 5.87" (149mm)	
Flat anvils - 2.5" (63.5mm)	
Spot anvil - 5/8" (15.9mm)	
Standard vee anvil	
Accessory case	

Specifications	
Minor Load	10Kgf
Major Load	A: 60Kgf, B: 100Kgf, C: 150Kgf
Test Force Application	(Dead weight applies test force)
Test Force Control	Hydraulic Dashpot System
Results Display	Analog – Dial Gage
Throat Depth	6.6" (168mm)
Maximum Test Height	6.69" (169.9mm) *
Unit Height/Width/Depth	30 x 8.5 x 20" (762 x 216 x 508mm)
Unit Weight	261lb (118kg)

\* Requires bench alteration.



# BENCH HARDNESS TESTERS

## 3815 TWIN ANALOG BENCH HARDNESS TESTER

### MEASURES ROCKWELL & SUPERFICIAL ROCKWELL HARDNESS

The 3815 Twin Analog Hardness Tester features state-of-the-art design and rugged construction. It is engineered to provide highly sensitive, accurate readings and excellent repeatability in all Rockwell and Superficial Rockwell hardness scales.

The 3815 is ideal for heat treatment facilities, tool rooms, workshops, laboratories and inspection labs.

#### FEATURES

- Direct analog dial reading
- Advanced design provides Rockwell and Rockwell Superficial testing
- Easy to operate
- Engineered to provide highly sensitive and accurate readings
- Conforms to ASTM E-18
- Tests Rockwell Scales: A, B, C, D, E, F, G, H, K, L, M
- Tests Superficial Rockwell Scales: HR15N, HR15T, HR30N, HR30T, HR45N, HR45Ts

#### 3815 Twin Analog Bench Hardness Tester

Cat. No.	EDP	Description
3815	12800	3815 Bench Hardness Tester
PT06145	72519	Hardness Tester Stand
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

#### Accessories Included

Diamond conical indenter
Ball indenter - 1/16" (1.6mm)
HRC, HRB, HR15N, HR30N, and HR45T certified test blocks
Test table - 5.87" (149mm)
Flat anvils - 2.5" (63.5mm)
Standard vee anvil
Accessory case and dust cover

#### Specifications

Minor Load	10 Kgf
Minor Load – Superficial	3 Kgf
Major Load	60/100/150 Kgf
Major Load – Superficial	15/30/45 Kgf
Test Force Application	Dead Weight
Test Force Control	Manual
Results Display	Dual Scale Dial
Vertical Capacity	6.0" (15.2mm)
Throat Depth	5.5" (14mm)
Height	26.0" (66mm)
Width	18.2" (46.2mm)
Depth	9.4" (23.9mm)
Weight	250 lbs (113kg)



## ROCKWELL HARDNESS TESTER

### 3818 SUPERFICIAL ROCKWELL HARDNESS TESTER - BASIC ANALOG MACHINE

The 3818 Superficial Rockwell Hardness Tester comprises "state of the art" design and dynamic precision only found at Starrett. Used for testing thin and soft material in the Superficial Rockwell Hardness scales, this hardness tester is ruggedly engineered to obtain highly sensitive and accurate readings. Utilizing guidelines for ASTM E-18 Superficial Rockwell Hardness standards, this hardness tester will offer unmatched repeatability in all Superficial Rockwell Hardness scales. A perfect performer suited for any environment including heat treat facilities, tool rooms, workshops, laboratories and inspection labs.

#### FEATURES

- Direct analog dial reading
- Engineered to obtain highly sensitive and accurate readings
- Perfect for laboratories, workshops, tool rooms, inspection labs, etc.
- For testing thin, soft metals in the Superficial Rockwell scales

Superficial Rockwell Hardness Tester		
Cat. No.	EDP	Description
3818	72981	Superficial Rockwell Hardness Tester
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

#### Accessories Included

N-scale Diamond Indentor  
 1/16" Steel Ball Indentor  
 3- Certified HRN Test Blocks  
 3- Certified HRT Test Blocks  
 Test Table 5.87" (150mm)  
 Flat Anvil 2.5" (63mm)  
 Spot Anvil .38" (10mm)  
 Std. Vee Anvil  
 Accessory Case  
 Dust Cover

#### Specifications

Minor Load	10 Kgf
Major Load	15 Kgf, 30 Kgf, 45 Kgf
Test Force Application	Dead Weight
Test Force Control	Hydraulic Dash Pot
Results Display	Analog Dial
Vertical Capacity	6.7"
Throat Depth	6.6"
Height	28"
Width	8.9"
Depth	19.6"
Weight (Net/Shipping)	155lbs / 250lbs



# ROCKWELL HARDNESS TESTER

## 3823 DIGITAL TWIN ROCKWELL - SUPERFICIAL ROCKWELL HARDNESS TESTER

The 3823 test force is applied via a closed-loop control unit with a load cell, a DC motor and an electronic measurement and control unit that replace traditional dead weights. The result is highly accurate hardness test measurements at all test loads up to 0.5%. Simple plug - and - play technology allows for much more quick and easy installation than traditional dead weight type machines. Extended dolphin nose allows vertical hardness test height of 11.8" and throat depth of 8.6". Design includes a built-in Micro-Printer.

### FEATURES

- Horizontal Dolphin Nose Indenter is suitable for internal and external hardness testing
- Rockwell hardness testing on surfaces difficult to reach and Hardness Testing internal surface of rings and tubes
- Provided with many features such as high measuring precision, wide measuring range with 30 Rockwell scales
- The Rockwell hardness tester is suitable for testing of carbon steel, alloy steel, cast iron, non-ferrous metals
- Measuring results digitally displayed and can be printed with its built-in thermal Mini-Printer
- Test Rockwell value can be converted to the value of HB, HV, HK and ifb value



Digital Rockwell/Superficial Rockwell Hardness Tester		
Cat. No.	EDP	Description
3823	13017	Digital Rockwell/Superficial Rockwell Hardness Tester
PT3823	62504	Replacement Paper
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

Accessories Included	
Certified Hardness Blocks for B, C, 30N and 30T scales	
Ball Indenter (1/16")	
120° Cone Diamond Indenter with mounting screws	
Flat Anvil	
"V" shape Anvil	
Screwdriver for indenter mounting	
Dust Cover	

Specifications	
Preload	29.4N (3kgf), 98.1N (10kgf)
Total Test Force	147.1N(15kgf), 294.3N(30kgf), 441.3N(45kgf), 588.4N (60kgf), 980.7N (100kgf), 1471N (150kgf)
Dwell Time	2~50s, can be set and stored
Resolution	0.1HR
Display	High definition backlight LCD
Operation	Menu selectable, Membrane keypad
Upper/Lower Limits Setting & Alarming	Yes
Data Atstatistics	Avg., Max., Min., S, R
Curved Surface Auto Correction	Yes
Memory	400 items of test results stored automatically
Testing Capacity	vertical 11.8" (300mm), depth 8.6" (220mm)
Dimensions	28 x 11 x 34" (690mm x 280mm x 860mm)
Power Supply	AC, 220V/110V, 50~60Hz, 4A (convertible)
Weight (Net/Shipping)	285lbs / 350lbs
Scales Range	HR15N, HR30N, HR45N, HR15T, HR30T, HR45T, HR15W, HR30W, HR45W, HR15X, HR30X, HR45X, HR15Y, HR30Y, HR45Y, HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV

# ROCKWELL HARDNESS TESTER

## 3824 DIGITAL TWIN ROCKWELL - SUPERFICIAL ROCKWELL HARDNESS TESTER

This Digital Rockwell/Superficial Rockwell hardness tester with fully automated load/unload procedures affords highly sensitive and accurate readings. Closed-loop control unit with a load cell, a DC motor and an electronic measurement and control unit replace traditional dead weights. The result is highly accurate measurements at all test loads up to 0.5%. The Digital Rockwell Hardness tester offers programmable scale conversions, dwell times, statistical capabilities and test counter. Capable of testing in all of the regular Rockwell hardness scales.

### FEATURES

- Automated Z-Axis - just press START key, entire test process is finished automatically
- Dolphin Nose Design: vertical height 11.8" & throat depth 8.6"
- Tests carbon steel, alloy steel, cast iron and non-ferrous metals
- Suitable for internal and external testing
- Built-In Micro-Printer
- Wide range with 30 Rockwell Scales
- Touch screen control
- USB Output
- PC based software included



Digital Rockwell/Superficial Rockwell Hardness Tester		
Cat. No.	EDP	Description
3824	67607	Digital Rockwell/Superficial Rockwell Hardness Tester
3824 WE-18Cert	62334	Digital Rockwell/Superficial Rockwell Hardness Tester with E18 certification
PT3824	62505	Replacement Paper
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

Accessories Included	
Certified Hardness Test Blocks for B, C, 30N and 30T scales	
Ball Indenter (1/16")	
120° Cone Diamond Indenter with mounting screws	
Flat Anvil	
"V" shape Anvil	
Screwdriver for indenter mounting	
Dust Cover	

Specifications	
Hardness Scales	HR15N, HR30N, HR45N, HR15T, HR30T, HR45T, HR15W, HR30W, HR45W, HR15X, HR30X, HR45X, HR15Y, HR30Y, HR45Y, HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV
Preload	29.4N (3kgf), 98.1N (10kgf)
Total Test Force	147.1N(15kgf), 294.3N(30kgf), 441.3N(45kgf), 588.4N (60kgf), 980.7N (100kgf), 1471N (150kgf)
Dwell Time	2~50s, can be set and stored
Resolution	0.1HR
Display	High definition backlight LCD
Operation	Menu selectable, Membrane keypad
Upper/Lower Limits Setting & Alarming	Yes
Data Statistics	Avg., Max., Min., S, R
Curved Surface Auto Correction	Yes
Memory	Max 400 items of test results stored automatically
Testing Capacity	vertical 11.8" (300mm), depth 8.6" (220mm)
Power Supply	AC, 220V/110V, 50~60Hz, 4A (convertible)
Dimensions	28 x 11 x 34" (690mm x 280mm x 860mm)
Weight (Net/Shipping)	285lbs / 350lbs

# ROCKWELL HARDNESS TESTER

## 3825 BRINELL HARDNESS TESTER

This hardness tester incorporates the latest innovative closed-loop technology. The test load is applied via a closed-loop control unit with a load cell, a DC motor and an electronic measurement and control unit. The result is highly accurate Brinell hardness measurements at all test loads up to 0.5%. The common load overshoot or undershoot as known from traditional dead weight, or open-loop systems is eliminated. The absence of mechanical weights not only eliminates friction problems but also makes the equipment less sensitive to misalignments caused by vibrations. Perfect for laboratories, workshops, tool rooms and inspection labs.

### FEATURES

- Suitable for castings, very soft metals (copper, zinc, brass, aluminum, etc.) and steel
- The whole weight of the 3825 tester is 50% less than a traditional dead weight tester
- Test load selection by keyboard and LCD screen
- Fully automatic test cycles, load application, holding, unloading, is performed fully automatically
- Selectable dwell times by screen. The indenter, load, and other test information are shown clearly on the large LCD screen
- Equipped with a 20X optical microscope to measure the diameter of Brinell indentation.
- Brinell Hardness Calculator (BHC) makes the Brinell hardness value calculation easier and convenient



Digital Rockwell/Superficial Rockwell Hardness Tester		
Cat. No.	EDP	Description
3825	02045	Digital Motorized Brinell Hardness Tester
3000 - Cover	62335	Cover for Bench Top Testers

AA broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

Accessories Included
Certified Test Blocks: 125-350HBW10/3000, 125-350HBW10/1000
Flat Anvil
"V" Shaped Anvil
Mounting Screws for Indenter
Screwdriver for Indenter Mounting
Dust Cover

Specifications	
Certified Blocks	125-350HBW10/3000, 125-350HBW10/1000
Brinell Loads	3000kgf (29400N), 1500Kgf (14700N), 1000Kgf (9800N), 750Kgf (7355N), 500Kgf (4900N), 250Kgf (2452N), 187.5Kgf (1839N), 125Kgf (1226N), 100Kgf (980N), 62.5Kgf (612.9N)
Dwell Time	2s~99s, can be set and stored
Tungsten Carbide Ball indenter	10mm, 5mm, and 2.5mm
Measuring Range	8-650HBW
Magnification	20X
Resolution	0.005mm
Max Measurable Height	9" (228mm)
Max Measurable Depth	5.5" (140mm)
Power Supply	220/110 V, 50/60 Hz, 4A Prior to ship, please advise power setting needed
Dimensions	21 × 10.5 × 29.5" (535mm x 267mm x 750mm)
Weight (Net/Shipping)	242lbs / 275lbs

# ROCKWELL HARDNESS TESTER

## 3831 DIGITAL ROCKWELL HARDNESS TESTER

This Digital Rockwell Hardness Tester can be used directly to measure the most popular regular Rockwell hardness scales and it can quickly convert that hardness value into HB, HV, HLD, HK and many other scales. Loaded with many useful features such as ultra precise results, wide measuring range, scale and test force selectable, automatic main test force loading/unloading, high resolution digital display and USB data storage. The 3831 is suitable for testing hardness of carbon steel, alloy steel, cast iron, non-ferrous metals and engineering plastics.

### FEATURES

- Direct digital reading
- Engineered to obtain highly sensitive and accurate readings
- Perfect for laboratories, workshops, tool rooms, inspection labs, etc.
- Touch screen controlled microcomputer
- USB data output



Digital Rockwell Hardness Tester		
Cat. No.	EDP	Description
3831	02041	3831 Hardness Tester,
3000 - Cover	62335	Cover Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

Accessories Included	
C-scale Diamond Indentor	
1/16" Ball Indentor	
3- Certified HRC Test Blocks	
1- Certified HRB Test Block	
Test Table 5.87" (150mm)	
Flat Anvil 2.5" (63mm)	
Std. V-Anvil	
Dust Cover	
Accessory Case	

Specifications	
Minor Load	10 Kgf
Major Load	60 Kgf, 100 Kgf, 150 Kgf
Test Force Application	Dead Weight
Test Force Control	Motorized
Resolution	0.1 HR
Vertical Capacity	8.0" (203mm)
Throat Depth	7.8" (198mm)
Upper/Lower Limits Setting & Alarming	Yes
Height	22" (560mm)
Width	8" (200mm)
Depth	31" (790mm)
Weight (Net/Shipping)	175lbs / 250lbs
Operation Temperature	50°-95°F (10°-35°C)
Power Supply	Single Phase, AC, 110-220 with manual change, 50-60Hz, 4A

# ROCKWELL HARDNESS TESTER

## 3832 DIGITAL ROCKWELL HARDNESS TESTER

This Digital Rockwell Hardness Tester with fully automated load/unload procedures affords highly sensitive and accurate readings. Micro computer controlled Touch screen with USB data output. The 3832 Digital Rockwell Hardness tester offers programmable scale conversions, dwell times, statistical capabilities and test counter. Capable of testing in all of the regular Rockwell hardness scales.

### FEATURES

- Direct loading method with load-cell instead of dead-weight system
- High speed test cycle
- Extremely accurate loading control
- Cast iron body
- Touch screen controlled microcomputer
- Automatic conversions to HB, HV, Superficial Rockwell Scales
- USB data output

### Digital Rockwell Hardness Tester

Cat. No.	EDP	Description
3832	02042	3832 Hardness Tester
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

### Accessories Included

C-scale Diamond Indentor  
 1/16" Ball Indentor  
 3- Certified HRC Test Blocks  
 1- Certified HRB Test Block  
 Test Table 5.87" (150mm)  
 Flat Anvil 2.5" (63mm)  
 Std. V-Anvil  
 Dust Cover  
 Accessory Case

### Specifications

Minor Load	10 Kgf
Major Load	60 Kgf, 100 Kgf, 150 Kgf
Test Force Application	Load cell closed loop
Test Force Control	Motorized
Resolution	0.1HR
Vertical Capacity	8.0" (203mm)
Throat Depth	7.8" (198mm)
Upper/Lower Limits Setting & Alarming	Yes
Height	22" (560mm)
Width	8" (200mm)
Depth	31" (790mm)
Weight (Net/Shipping)	225lbs / 250lbs
Operation Temperature	50°-95°F (10°-35°C)
Power Supply	Single phase, AC, 110-220 with manual change, 50-60Hz, 4A



# ROCKWELL HARDNESS TESTER

## 3833 DIGITAL SUPERFICIAL ROCKWELL HARDNESS TESTER

This Digital Superficial Rockwell Hardness Tester with fully automated load/unload procedures affords highly sensitive and accurate readings. Micro computer controlled touch screen with USB data output. The 3833 Digital Superficial Rockwell Hardness Tester offers programmable scale conversions, dwell times, statistical capabilities and test counter. Capable of testing in all of the Superficial Rockwell hardness scales.

### FEATURES

- Direct loading method with load-cell instead of dead-weight system
- High speed test cycle
- Extremely accurate loading control
- Cast iron body
- Touch screen controlled microcomputer
- Automatic conversions to HB, HV, Regular Rockwell Scales
- USB data output

### Digital Rockwell Hardness Tester

Cat. No.	EDP	Description
3833	02043	3833 Hardness Tester
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

### Accessories Included

N-scale Diamond Indentor
1/16" Ball Indentor
2- Certified HRN Test Blocks
3- Certified HRT Test Blocks
Test table 5.87" (150mm)
Flat anvil 2.5" (63mm)
Std. V-Anvil
Dust Cover
Accessory Case

### Specifications

Minor Load	3 Kgf
Major Load	15 Kgf, 30 Kgf, 45 Kgf
Test Force Application	Load cell closed loop
Test Force Control	Motorized
Resolution	0.01HR
Vertical Capacity	8.0" (203mm)
Throat Depth	7.8" (198mm)
Upper/Lower Limits Setting & Alarming	Yes
Height	22" (560mm)
Width	8" (200mm)
Depth	31" (790mm)
Weight (Net/Shipping)	225lbs / 250lbs
Operation Temperature	50°-95°F (10°-35°C)
Power Supply	Single phase, AC, 110-220 with manual change, 50-60Hz, 4A





# ROCKWELL HARDNESS TESTER

## 3834 DIGITAL TWIN ROCKWELL - SUPERFICIAL ROCKWELL HARDNESS TESTER

The 3834 Digital Rockwell Hardness Tester with fully automated load/unload procedures affords highly sensitive and accurate readings. Microcomputer controlled touch screen with USB data output. The 3834 Digital Rockwell Hardness Tester offers programmable scale conversions, dwell times, statistical capabilities and test counter. Capable of testing in all of the regular Rockwell and Superficial Rockwell hardness scales.

### FEATURES

- Direct loading method with load-cell instead of dead-weight system
- High speed test cycle
- Extremely accurate loading control
- Cast iron body
- Touch screen controlled microcomputer
- Automatic conversions to HB, HV, Regular Rockwell Scales
- USB data output

Digital Rockwell Hardness Tester		
Cat. No.	EDP	Description
3834	02044	3834 Hardness Tester
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

Accessories Included	
C/N-scale Diamond Indentor	
1/16" Ball Indentor	
3- Certified HRC Test Blocks	
1- Certified HRN Test Block	
1- Certified HRB Test Block	
1 - Certified HRT Test Block	
Test Table 5.87" (150mm)	
Flat Anvil 2.5" (63mm)	
Std. V-Anvil	
Dust Cover	
Accessory Case	

Specifications	
Minor Load	3 Kgf, 10 Kgf
Major Load	15 Kgf, 30 Kgf, 45 Kgf, 60 Kgf, 100 Kgf, 150 Kgf
Test Force Application	Load cell closed loop
Test Force Control	Motorized
Resolution	0.1HR
Vertical Capacity	8.0" (203mm)
Throat Depth	7.8" (198mm)
Upper/Lower Limits Setting & Alarming	Yes
Height	22" (560mm)
Width	8" (200mm)
Depth	31" (790mm)
Weight (Net/Shipping)	225lbs / 250lbs
Operation Temperature	50°-95°F (10°-35°C)
Power Supply	Single phase, AC, 110-220 with manual change, 50-60Hz, 4A



# VICKERS HARDNESS TESTER

## 3840A AND 3840B MICRO VICKERS HARDNESS TESTER

The 3840 Micro Vickers Hardness Testers are precise testing systems suitable for hardness analysis of metallic specimens in metallography laboratories or production environments. These Micro Vickers Hardness Testers are versatile and user-friendly systems, designed for the accurate hardness testing of small precision parts, thin materials, coatings, wires and case depth determinations.

### FEATURES

- Includes video cam, adapter, and USB output cable
- High speed test cycle
- Choice of 2-variants of measurement software
- Load range from 10g to 1kg
- Conforms to ASTM E-384/92
- USB Data output



Vickers Hardness Tester		
Cat. No.	EDP	Description
3840A	02051	Vickers Hardness Tester w/ Manual Measurement Software
3840B	02052	Vickers Hardness Tester w/ Auto Measurement Software
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

Accessories Included
Base Machine
X-Y Stage w/ Micrometer
Mini Thin Part Holding Fixture
Mini Drill Chuck Fixture
Mini Vise Fixture
Video Cam w/adapter
Measurement Software
USB Cable

Specifications	
Testing Range	1HV~2967HV
Test Force	0.098N(10g), 0.246N(25g), 0.49N(50g), 0.98N(100g) 1.96N(200g), 4.90N(500g), 9.80N(1000g)
Max Height of Specimen	2.8" (70mm)
Max Distance from the Indenter Center to Instrument Panel	3.7" (95mm)
Lens/Indenters with	Hand Turret
Carriage Control	Automatic (loading /holding-up of the load/unloading)
Amplification of the Microscope	100x, 400x
Dwell Time	(5-60)S
Min. Graduation Value of the Testing Drum Wheel	0.25µm
Dimension of the XY Table	100 x 100mm
Movement Field of the XY Table	25 x 25mm
Light Source/Power Supply	110/220v, 60/50Hz - Cold Light Source
Weight (Net/Shipping)	80lbs / 155lbs
Dimensions	17 x 10 x 20" (430mm x 254mm x 510mm)

# VICKERS HARDNESS TESTER

## 3841A, 3841B, 3841C AND 3841D MICRO VICKERS HARDNESS TESTER WITH DIGICAM AND AUTO TURRET

The 3841 Micro Vickers Hardness Testers are precise testing systems suitable for hardness analysis of metallic specimens in metallography laboratories or production environments. These Micro Vickers Hardness Testers are versatile and user-friendly systems, designed for the accurate hardness testing of small precision parts, thin materials, coatings, wires and case depth determinations.

### FEATURES

- Includes video cam, adapter, and USB output cable
- High speed test cycle
- Choice of 4-variants of measurement software
- Load range from 10g to 1kg
- Conforms to ASTM E-384/92
- USB data output

Vickers Hardness Tester		
Cat. No.	EDP	Description
3841A	02053	Vickers Hardness Tester w/ Manual Measurement Software
3841B	02054	Vickers Hardness Tester w/ Auto Measurement Software
3841C	02055	Vickers Hardness Tester w/ Turret Control - Manual Measurement Software
3841D	02056	Vickers Hardness Tester w/ Turret Control - Auto Measurement Software
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

Accessories Included
Base Machine
X-Y Stage w/ Micrometer
Mini Thin Part Holding Fixture
Mini Drill Chuck Fixture
Mini Vise Fixture
Video Cam w/Adapter
Measurement Software
USB Cable

Specifications	
Testing Range	1HV~2967HV
Test Force	0.098N(10g), 0.246N(25g), 0.49N(50g), 0.98N(100g) 1.96N(200g), 4.90N(500g), 9.80N(1000g)
Max Height of Specimen	2.8" (70mm)
Max Distance from the Indenter Center to Instrument Panel	3.7" (95mm)
Lens/Indenter with	Hand Turret
Carriage Control	Automatic (loading /holding-up of the load/unloading)
Amplification of the Microscope	100x, 400x
Dwell Time of the Test Force	(5-60)S
Min. Graduation Value of the Testing Drum Wheel	0.25µm
Dimension of the XY Table	100 x 100mm
Movement Field of the XY Table	25 x 25mm
Light Source/Power Supply	110/220v, 60/50Hz - Cold Light Source
Weight (Net/Shipping)	80lbs / 155lbs
Dimensions	17 x 10 x 20" (430mm x 254mm x 510mm)



# VICKERS HARDNESS TESTER

## 3842A AND 3842B MACRO VICKERS

The 3842 Macro Vickers Hardness Testers are precise testing systems suitable for hardness analysis of metallic specimens in laboratories or production environments. These Macro Vickers Hardness Testers are versatile and user-friendly systems, designed for the accurate hardness testing of small precision parts, thin materials, case hardened layers and all sorts of steel components. The 3842 Vickers Hardness Tester, which includes precision video and measurement software, is engineered to produce a clear indentation and a more precise measurement. By means of a load cell, closed circuit system for control, the CPU controls testing force to load/dwell/unload, allowing for the highest degree of accuracy. The large LCD shows the measuring methods, the testing force, the indentation length, hardness value, the dwell time of the testing force as well as the number of the measurement on its screen. All information such as diagonal lines length of indentation, hardness values, data statistics and hardness conversions can be displayed on the LCD as well as your laptop or PC.

### FEATURES

- Includes video cam, adapter, and USB output cable
- Choice of 2-variants of measurement software
- Load range from 1kg - 50kg
- Conforms to ASTM E-384/92
- RS232 Output

Vickers Hardness Tester		
Cat. No.	EDP	Description
3842A	02057	Vickers Hardness Tester w/ Manual Measurement Software
3842B	02058	Vickers Hardness Tester w/ Auto Measurement Software
3000 - Cover	62335	Cover for Bench Top Testers

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

### Accessories Included

- Base Machine
- Video Cam w/ Adapter
- Measurement Software
- Large Test Table
- "V" Shape Test Table
- 10X Digital Micro Lens
- Bullseye Level
- Adjustable Screw
- Vicker Hardness Block
- RS232 Interface Line

### Specifications

Testing Range	1HV~2967HV
Test Force	9.807, 19.61, 24.52, 29.42, 49.03, 98.07, 196.1, 249.2, 490.3 N 1, 2, 2.5, 3, 5, 10, 20, 30, 50 kgf
Max Height/Width of Specimen	6.7"/5.1" (170mm/130mm)
Lens Indentor Switch	w/ Manual Turret
Carriage Control	Automatic (loading /holding-up of the load/unloading)
Amplification of the Microscope	100x, 200x
Dwell Time	(0-60)S
Min. Graduation Value of the Testing Drum Wheel	0.125µm
Output	Built-in RS-232 data output
Objective	10x, 20x, 40x selectable
Light Source/Power Supply	110/220v, 60/50Hz - Cold Light Source
Dimensions	21 x 9 x 23" (535mm x 230mm x 585mm)
Weight (Net/Shipping)	110lbs / 155lbs



# HARDNESS TESTER ACCESSORIES

## TEST BLOCKS AND ACCESSORIES FOR HARDNESS TESTERS

Starrett blocks can be used to test Rockwell, Brinell or Vickers scales. They are available in steel, brass and aluminum. Each block is serialized, with a certificate detailing the environmental conditions used to test the block.

Actual readings are given, with the averages of these readings: min. reading, max reading and a repeatability figure. The blocks are calibrated according to ASTM E-18 standards, ANSI (NCSL) Z540-1, (ISO) 10012-1, ISO/IEC 17025 and Mil-std 45662A.

Starrett hardness test blocks are manufactured from square steel or brass plates, as opposed to the more common round bar stock. The use of the plate gives a more accurate and consistent surface for inspection. Metallurgical tests have proven that during the production of round bar stock, suspended carbides in the mix migrate to the center of the rod. The scientific name for this condition is carbide segregation and results in different readings being found in the center of a rod rather than at its outer edges. Some manufacturers remedy this situation by removing the centers from their blocks.

Hardness test blocks are designed to be used only on one side and the indents should be more than .010" from the centers of two indents or no closer to the block's edge than .040".

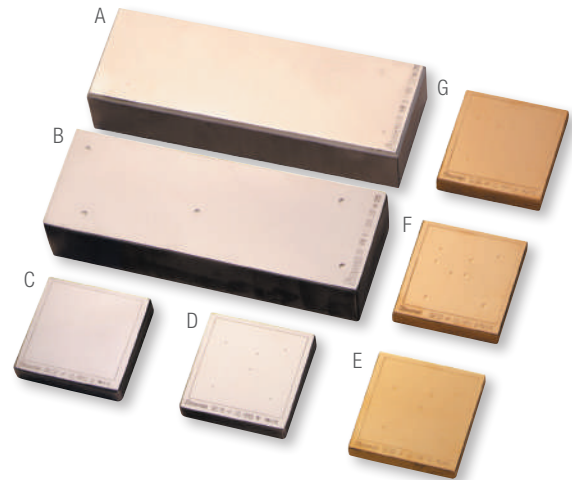
Calibration kits are also available from Starrett. No facility with a hardness tester in use should be without a calibration kit. These kits come with from 3 to 20 calibrated test blocks and the serialized penetrator that was used to inspect each of the blocks in the set. When a discrepancy is detected in a tester, these kits allow you to determine the direction to proceed to resolve the issue.

Rockwell Test Blocks	
Part No.	Description †
PT05050	RC63 Test Block
PT05051	RC60 Test Block
PT05052	RC55 Test Block
PT05053	RC50 Test Block
PT05054	RC45 Test Block
PT05055	RC40 Test Block
PT05056	RC35 Test Block
PT05057	RC30 Test Block
PT05058	RC25 Test Block
PT05059	RB90 Test Block
PT05060	RB80 Test Block
PT05061	RB70 Test Block
PT05062	RB60 Test Block
PT05063	RB50 Test Block
PT05064	RB40 Test Block
PT05065	RB30 Test Block
PT05067	RB20 Test Block
PT05068	RB10 Test Block
PT05069	RA80 Test Block
PT05091	RA70 Test Block
PT05092	RA60 Test Block
PT05100	RF100 Test Block
PT05101	RF90 Test Block
PT05102	RF80 Test Block
PT05103	RF70 Test Block
PT05104	RF60 Test Block
PT05105	RF50 Test Block
PT05106	RE100 Test Block
PT05107	RE90 Test Block
PT05108	RE80 Test Block
PT05112	RE70 Test Block
PT05113	RE60 Test Block

† Values expressed are not exact but will range within acceptable limits

Rockwell Test Blocks	
Part No.	Description †
PT05114	RE50 Test Block
PT05115	HR30N80 Test Block
PT05122	HG30N70 Test Block
PT05123	HR30N60 Test Block
PT05124	HR30N50 Test Block
PT05125	HR30N40 Test Block
PT05127	HR30T80 Test Block
PT05128	HR30T70 Test Block
PT05129	HR30T60 Test Block
PT05130	HR30T50 Test Block
PT05177	HR30T40 Test Block
PT05178	HR30T30 Test Block
PT05179	HR30T20 Test Block
PT05180	HR30T10 Test Block
PT05181	HR15N90 Test Block
PT05182	HR15N80 Test Block
PT05183	HR15N70 Test Block
PT05184	HR15T90 Test Block
PT05185	HR15T80 Test Block
PT05186	HR15T70 Test Block
PT05187	HR15T60 Test Block
PT05188	HR45T70 Test Block
PT05189	HR45T60 Test Block
PT05191	HR45T50 Test Block
PT05192	HR45T40 Test Block
PT05193	HR45T20 Test Block
PT05194	HR45T10 Test Block
PT05195	HRH90 Test Block
PT05196	HRH80 Test Block
PT05197	HRR120 Test Block
PT05198	HR30Y Test Block
PT05199	HRM Test Block
PT05200	HR15W Test Block

† Values expressed are not exact but will range within acceptable limits



Rockwell and Brinell test blocks at a variety of hardness levels. (A) Aluminum Brinell, (B) Steel Brinell, (C) Vickers, (D) Rockwell, (E) 187.5kg/2.5mm Brinell, (F) Extra-Soft Rockwell and (G) Brass Rockwell.

# HARDNESS TESTER ACCESSORIES

## TEST BLOCKS AND ACCESSORIES FOR HARDNESS TESTERS

### Brinell Test Blocks

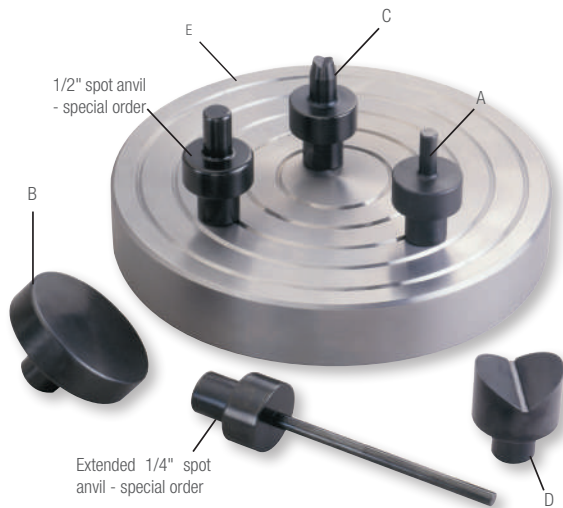
Part No.	EDP	Description
PT05257	67956	3000kg High Brinell Test Block
PT05258	67957	3000kg Low Brinell Test Block
PT05259	67958	500kg High Brinell Test Block
PT05260	67959	500kg Low Brinell Test Block

### Master Calibration Kits

Part No.	EDP	Description
PT05272	67969	HRC 3-Block Master Calibration Kit
PT05273	67970	HR30N 3-Block Master Calibration Kit
PT05276	67971	HRB 3-Block Master Calibration Kit
PT05277	67972	C&B Scale 20-Block Master Calibration Kit
PT05278	67973	C&30N Scale 6-Block Master Calibration Kit



PT05272 HRC 3-Block Master Calibration Kit



Standard and special anvils

### Anvils and Table

Letter	Part No.	EDP	Description
A	PT05267	67964	Pedestal Anvil
B	PT05268	67965	2-1/2" Flat Anvil
C	PT05269	67966	Small "V" Anvil
D	PT05270	67967	Large "V" Anvil
E	PT05271	67968	8" Anvil Testing Table

### Penetrators

Letter	Part No.	EDP	Description
E	PT05245	67944	C Regular, No Thread
E	PT05246	67945	Indentron with Internal Thread
G	PT05247	67946	Versitron/New Age with External Thread
E	PT05248	67947	N Regular, No Thread
D	PT05249	67948	1/16" (1.6mm) Ball with Holder
C	PT05250	67949	1/8" (1.7mm) Ball Complete with Holder
B	PT05251	67950	1/4" (6.4mm) Ball Complete with Holder
A	PT05252	67951	1/2" (12.7mm) Ball Complete with Holder
	PT05253	67952	1/16" (1.6mm) Carbide Ball Only, with Certification
	PT05254	67953	1/8" (1.7mm) Carbide Ball, with Certification
	PT05255	67954	1/4" (6.4mm) Carbide Ball, with Certification
	PT05256	67955	1/2" (12.7mm) Carbide Ball, with Certification
	PT05261	67960	Heavy Load 5kg, 110RV5 Vickers Test Block
F	PT05264	67961	Heavy Load Indentor Vickers
	PT05265	67962	Min. Brinell 2 1/2mm Ball
	PT05266	67963	Min. Brinell Block 187 1/2kg, 2-1/2mm Ball



Penetrators - Contact Starrett for more information

# HARDNESS TESTERS

## 3811A COMPACT HARDNESS TESTER

The 3811A is a state of the art, digital portable hardness tester, designed to test the hardness of large, hard metal parts.

The 3811A combines fast test speeds with ample memory and output. It performs tests that easily convert to most popular hardness scales such as Rockwell, Brinell, Vickers and Shore.

This compact hardness tester is loaded with useful functions usually found only on high priced models.



Includes base instrument, impact device D, calibrated test block, custom carry case, cleaning brush and operation manual

### SPECIFICATIONS

- Accuracy:  $\pm 0.5\%$  (referred to  $L=800$ )
- Repeatability accuracy:  $\pm 4L$  units ( $L=Leeb$ )
- Measuring range: 200-960 HL
- For steel and cast steel, alloy tool steel, stainless steel, grey cast iron, spheroidal iron, cast aluminum, brass, bronze, wrought copper alloy
- Tool steel should be about 1" thick solid material or larger
- Operating temperature: 5-104 °F
- Dimensions: 5.96 x 2.938 x 1.270" (150 x 74 x 32mm)
- Weight: 8.6 oz. (245 grams)

### FEATURES

- Leeb style tester designed for large, hard parts – load the impact body and place the impact device on your test piece
- Easy to use keypad operation – push the button to begin testing and obtain reading
- Auto identification of impact device
- Large LCD display with back light
- USB output
- Automatic conversions to Rockwell, Brinell, Vickers and Shore
- Automatic mean value as well as Min and Max values
- Uses two AA alkaline batteries with low power indicator
- Memory capacity (100 groups)
- Optional impact devices and special support rings

### 3811A Hardness Tester and Accessories

Cat. No.	EDP	Description
3811A	69881	Digital portable hardness tester with impact device D, calibrated test block, cleaning brush and carry case
HT-1800-110	20940	D+15 Impact Device
HT-1800-115	20941	DL Impact Device
HT-1800-125	20942	G Impact Device
HT-1800-130	20943	C Impact Device
HT-1800-120	20944	DC Impact Device
HT-1800-100	20945	Replacement D Impact Device
HT-1800-102	20946	Replacement Cable For All Impact Devices
HT-2500-105	20947	Replacement Impact Body
HT-1300-01	20948	Leeb D Test Block
HT-1100G-01	20949	Leeb G Test Block
S38R	67285	Support Ring Set

### 3811A Portable Hardness Tester with Integrated, Multi-functional Features

Style	Applications
D+15	Very narrow contact area with a set backed measurement coil. Measures hardness in grooves and recesses. Weight: 80g
DC	Extremely short impact device. Used for very confined spaces such as, holes, cylinders and internal measurements
C	Reduced impact energy probe (2 ft-lb) for measuring hardness of coatings, surface hardened, thin wall or impact sensitive components. Applies superficial indentation. Weight: 75g
G	Enlarged test tip and increased impact energy range (72 ft-lb – approx. 9 times the D). For lower quality finishes measuring in the Brinell range only (max. 650 HB). Designed for components like heavy castings, forgings. Weight: 250g
DL	Needle front section with 4mm diameter and 50mm length. Ideal for testing in confined spaces, the base of grooves and special components like gear wheels. Steel/Cast steel

Optional Remote Impact Devices



# HARDNESS TESTER

## 3821 & 3822 HARDNESS TESTER

The 3821 and 3822 units produce non-destructive hardness testing results and are built for the shop floor. They are effectively the same unit, differentiated by the probe type (2kg & 5 kg, respectively). The 2 Kg (3821) probe is suitable for surfaces with an Ra below 200 µin and the 5 Kg(3822) probe is suitable for surfaces with an Ra below 400 µin. The other key feature about these units is that they perform very well on thin materials. For example, it can successfully measure hardness on steel parts which are down to 0.08” (2mm) in thickness.

3821/3822 Ultrasonic Thickness Tester		
Description	Cat. No.	EDP
3821 Ultrasonic Hardness Tester	3821	72978
3822 Ultrasonic Hardness Tester	3822	72979

A broad range of test blocks and other hardness tester accessories are available. See pages 20-21.

3821/3822 Ultrasonic Thickness Tester		
Cat. No.	EDP	Item: Product Title
HT-6000-221	20005	Motorized Probe - 0.3kg, Ultrasonic Hardness Testers
HT-6000-241	20006	Motorized Probe - 0.8kg, Ultrasonic Hardness Testers
HT-6000-301	20007	Replacement Cable - Ultrasonic Hardness Tester Probes
HT-6000-310	20001	Manual Probe - 10kg, Ultrasonic Hardness Testers
HT-6000-400	20002	Manual Probe - 1kg, Ultrasonic Hardness Testers
HT-6000-400-01	20000	Support Handle - Ultrasonic Portable Hardness Testers
HT-6000-711	20003	Standard Probe Cap - Ultrasonic Hardness Tester Probes
HT-6000-721	20004	Deep Hole Probe Cap - Ultrasonic Hardness Tester Probes
HT-6000-MAN	20206	Support Stand - Ultrasonic Hardness Testers

## FEATURES AND SPECIFICATIONS

- Non-Destructive hand held hardness tester
- Combines UCI and Leeb hardness testing in one state of the art device
- Test steel with min thickness of .08” and unlimited max thickness
- Rockwell, Brinell Vickers conversions shown on display
- Large Memory w/USB Output
- Choice of manual UCI probes; 2kg and 5kg
- Optional Motorized Probes: .30kg, .80kg, & 1kgf
- Available Impact Devices(Leeb) D, DC, D+15, G & DL





# HARDNESS TESTERS

## 3810A Digital Portable Hardness Tester

The 3810A is a state-of-the-art digital instrument designed to test the hardness of large hard metal parts. Loaded with useful functions such as USB output and a built in printer, the 3810A is an ideal choice for fast, accurate hardness testing.

This versatile tester can perform tests that easily convert to the most popular hardness scales, including Rockwell, Brinell, Vickers and Shore.

The tester is easy to use. Simply load the impact body, place the impact body on your test piece, then push the button to begin testing.

The 3810A is designed to test large hard parts that cannot be brought to a bench top machine. For example, tool steel should be close to 1" thick of solid material. The 3810A comes with a D impact device, calibration block, cleaning brush, manual and a carrying case.



### SPECIFICATIONS

- Accuracy:  $\pm 0.5\%$  (referred to L=800)
- Repeatability accuracy:  $\pm 4L$  units (L=Leeb)
- Measuring range: 200-960 HL
- Materials: steel & cast steel, alloy tool steel, stainless steel, grey cast iron, spheroidal iron, cast aluminum, brass, bronze, wrought copper alloy
- Battery type: AA alkaline (4)
- Operating temperature: 5-104 °F
- Dimensions: 150 x 74 x 32mm
- Weight: 245 grams
- Includes 3810A tester, impact device D, calibration test block, cleaning brush, operation manual, custom carry case
- Available options include DC, D+15, DL, G, C impact devices, and special support rings

### FUNCTIONS

- Easy to use keypad operation
- Auto identification of impact device
- Large LCD display with back light
- USB output
- Automatic conversions to: Brinell, Rockwell B & C, Vickers and Shore
- Automatic mean value as well as Min & Max values
- Battery indicator
- Memory capacity (100 groups)

3810A Hardness Tester and Accessories		
Cat. No.	EDP	Description
3810A	69871	Tester, D impact device, calibration block, cleaning brush, operation manual, custom carry case
HT-1800-110	20940	D+15 impact device. Very narrow contact area with set backed measurement coil. Measures hardness in grooves and recesses.
HT-1800-115	20941	DL impact device. Needle front section with 4mm diameter and 50mm length. For testing in confined spaces such as groove bases and special components such as gear wheels.
HT-1800-125	20942	G impact device. For components such as heavy castings and forgings. Enlarged test tip and increased impact energy range. For lower quality finishes measuring in the Brinell range only. G block required.
HT-1800-130	20943	C impact device. Reduced impact energy probe for measuring hardness of coatings and surface hardened, thin wall or impact-sensitive components. Applies superficial indentation.
HT-1800-120	20944	DC impact device. Very short for confined areas such as internal bores for various inside measurements.
HT-1800-100	20945	Replacement D impact device. Universal standard probe for a wide variety of applications.
HT-1800-102	20946	Replacement cable for all impact devices
HT-2500-105	20947	Replacement impact body D
HT-1300-01	20948	Leeb D test block
HT-1100G-01	20949	Leeb G test block
S38R	67285	Support ring set



3810A

# HARDNESS TESTERS

## TECHNICAL DATA FOR STARRETT HARDNESS IMPACT DEVICES

Technical Data for Impact Devices		D/DC/DL	D+15	C	G
Impact Energy		11 Nmm	11 Nmm	3 Nmm	90 Nmm
Mass of the Impact Body		5.5g	7.8g	3.0g	20g
Test Tip	Hardness	1600 HV	1600 HV	1600 HV	1600 HV
DL: 7.3 g	Diameter	3mm	3mm	3mm	5mm
	Material	Tungsten carbide	Tungsten carbide	Tungsten carbide	Tungsten carbide
	Impact Device	Diameter	20mm	20mm	20mm
Impact Device	Length	147/86mm	162mm	141mm	254mm
	Weight	75/50 g	80 g	75 g	250 g
	Max. Hardness of Sample	940 HV	1000 HV	650 HB	
Preparation of Surface	Roughness class ISO	N7	N7	N5	N9
	Max. roughness depth Rt	10µm	10µm	2.5µm	30µm
	Average roughness Ra	2µm	2µm	0.4µm	7µm
Min. Weight of Sample	Of compact shape	5kg	5kg	1.5kg	15kg
	On solid support	2kg	2kg	0.5kg	5kg
	Coupled on plate	0.1kg	0.1kg	0.02kg	0.5kg
Min. Thickness of Sample	Coupled	3mm	3mm	1mm	10mm
	Min. thickness of layers	0.8mm	0.8mm	0.2mm	—
Indentation of Test Tip with 300 HV	Diameter	0.54mm	0.54mm	0.38mm	1.03mm
	Depth	24µm	24µm	12µm	53µm
Indentation of Test Tip with 600 HV	Diameter	0.45mm	0.45mm	0.32mm	0.90mm
	Depth	17µm	17µm	8µm	41µmC
Indentation of Test Tip with 800 HV	Diameter	0.35mm	0.35mm	0.30mm	—
	Depth	10µm	10µm	7µm	—

## APPLICATION AND HARDNESS RANGES FOR STARRETT HARDNESS IMPACT DEVICES

Optional Impact Devices					
Material	HRC	HRB	HB	HV	HSD
<b>Impact Device – D, DC Measuring Range 200-900<sup>†</sup></b>					
Steel	20.0-67.9	59.6-99.5	80-647	80-940	32.2-99.5
C.W. Tool Steel	20.4-67.1			80-898	
Gray Cast Iron			93-334		
Nodular Cast Iron			131-387		
Cast Aluminum			30-159		
Brass		13.5-95.3	40-173		
Bronze			60-290		
Copper			45-315		
<b>Impact Device – D+15, Measuring Range 300-900<sup>†</sup> (not shown)</b>					
Steel and Cast Steel	19.3-67.9		80-638	80-937	33.3-99.3
<b>Impact Device – C, Measuring Range 350-950<sup>†</sup></b>					
Steel and Cast Steel	20.0-69.5		80-683	80-996	31.9-99.6
<b>Impact Device – G, Measuring Range 300-750<sup>†</sup></b>					
Steel and Cast Steel		47.7-99.9	90-646		
Gray Cast Iron			92-326		
Nodular Cast Iron			127-364		
<b>Impact Device – DL, Measuring Range 300-900<sup>†</sup></b>					
Steel and Cast Steel	20-68	37-100	80-650	80-940	30-97

<sup>†</sup> Leeb Measuring Range

## HARDNESS SCALE OVERVIEW

**Rockwell:** In the Rockwell test, an indenter is pushed into a metallic surface with a given force. The hardness is inversely proportional to the depth of penetration.

**Superficial Rockwell:** It is particularly suitable for use in hardness testing of thin components and layers, or with specimens whose calculated hardness value is outside the Regular Rockwell scale.

**Brinell:** The Brinell hardness test method is defined in ASTM E10. Most commonly it is used to test materials that have a structure that is too coarse or that have a surface that is too rough to be tested using another test method, e.g., castings and forgings. Brinell testing often use a very high test load (3000 kgf) and a 10mm diameter indenter so that the resulting indentation averages out most surface and sub-surface inconsistencies.

**Micro Vickers:** Microhardness testing of metals, ceramics, and composites is useful for a variety of applications for which 'macro' hardness measurements are unsuitable: testing very thin materials like foils, measuring individual microstructures within a larger matrix, or measuring the hardness gradients of a part along the cross section. Microhardness testing per ASTM E-384 gives an allowable range of loads for testing with a diamond indenter; the resulting indentation is measured and converted to a hardness value. The actual indenters used are Vickers (more common; a square base diamond pyramid with an apical angle of 136°) or Knoop (a narrow rhombus shaped indenter). The result for either Vickers or Knoop microhardness is reported in kg/cm<sup>2</sup> and is proportional to the load divided by the square of the diagonal of the indentation measured from the test. The load on the Vickers microhardness indenter usually ranges from a few grams to several kilograms.

**Macro Vickers:** In contrast, 'Macro' Vickers loads vary from 1 to 120 kg. The indentations should be as large as possible, within the confines of sample geometry, to minimize errors in measuring the indentation (hence the reported hardness). Vickers hardness is also sometimes called Diamond Pyramid Hardness (DPH) owing to the shape of the indenter.

## HARDNESS CONVERSION CHART

Rockwell						Rockwell Superficial				Brinell		Vickers	Shore	Approx Tensile Strength (psi)
A	B	C	D	E	F	15-N	30-N	45-N	30-T	3000 kg	500 kg	136		
60kg Brale	100kg 1/16" Ball	150kg Brale	100kg Brale	100kg 1/8" Ball	60kg 1/16" Ball	15kg Brale	30kg Brale	45kg Brale	30 kg 1/16" Ball	10mm Ball Steel	10mm Ball Steel	Diamond Pyramid	Sciuroscope	
86.5	---	70	78.5	---	---	94	86	77.6	---	---	---	1076	101	---
86	---	69	77.7	---	---	93.5	85	76.5	---	---	---	1044	99	---
85.6	---	68	76.9	---	---	93.2	84.4	75.4	---	---	---	940	97	---
85	---	67	76.1	---	---	92.9	83.6	74.2	---	---	---	900	95	---
84.5	---	66	75.4	---	---	92.5	82.8	73.2	---	---	---	865	92	---
83.9	---	65	74.5	---	---	92.2	81.9	72	---	739	---	832	91	---
83.4	---	64	73.8	---	---	91.8	81.1	71	---	722	---	800	88	---
82.8	---	63	73	---	---	91.4	80.1	69.9	---	705	---	772	87	---
82.3	---	62	72.2	---	---	91.1	79.3	68.8	---	688	---	746	85	---
81.8	---	61	71.5	---	---	90.7	78.4	67.7	---	670	---	720	83	---
81.2	---	60	70.7	---	---	90.2	77.5	66.6	---	654	---	697	81	320,000
80.7	---	59	69.9	---	---	89.8	76.6	65.5	---	634	---	674	80	310,000
80.1	---	58	69.2	---	---	89.3	75.7	64.3	---	615	---	653	78	300,000
79.6	---	57	68.5	---	---	88.9	74.8	63.2	---	595	---	633	76	290,000
79	---	56	67.7	---	---	88.3	73.9	62	---	577	---	613	75	282,000
78.5	120	55	66.9	---	---	87.9	73	60.9	---	560	---	595	74	274,000
78	120	54	66.1	---	---	87.4	72	59.8	---	543	---	577	72	266,000
77.4	119	53	65.4	---	---	86.9	71.2	58.6	---	525	---	560	71	257,000
76.8	119	52	64.6	---	---	86.4	70.2	57.4	---	500	---	544	69	245,000
76.3	118	51	63.8	---	---	85.9	69.4	56.1	---	487	---	528	68	239,000
75.9	117	50	63.1	---	---	85.5	68.5	55	---	475	---	513	67	233,000
75.2	117	49	62.1	---	---	85	67.6	53.8	---	464	---	498	66	227,000
74.7	116	48	61.4	---	---	84.5	66.7	52.5	---	451	---	484	64	221,000
74.1	116	47	60.8	---	---	83.9	65.8	51.4	---	442	---	471	63	217,000
73.6	115	46	60	---	---	83.5	64.8	50.3	---	432	---	458	62	212,000
73.1	115	45	59.2	---	---	83	64	49	---	421	---	446	60	206,000
72.5	114	44	58.5	---	---	82.5	63.1	47.8	---	409	---	434	58	200,000
72	113	43	57.7	---	---	82	62.2	46.7	---	400	---	423	57	196,000

Rockwell						Rockwell Superficial				Brinell		Vickers	Shore	Approx Tensile Strength (psi)
A	B	C	D	E	F	15-N	30-N	45-N	30-T	3000 kg	500 kg	136		
60kg Brale	100kg 1/16" Ball	150kg Brale	100kg Brale	100kg 1/8" Ball	60kg 1/16" Ball	15kg Brale	30kg Brale	45kg Brale	30 kg 1/16" Ball	10mm Ball Steel	10mm Ball Steel	Diamond Pyramid	Sciero-scope	
71.5	113	42	56.9	---	---	81.5	61.3	45.5	---	390	---	412	56	191,000
70.9	112	41	56.2	---	---	80.9	60.4	44.3	---	381	---	402	55	187,000
70.4	112	40	55.4	---	---	80.4	59.5	43.1	---	371	---	392	54	182,000
69.9	111	39	54.6	---	---	79.9	58.6	41.9	---	362	---	382	52	177,000
69.4	110	38	53.8	---	---	79.4	57.7	40.8	---	353	---	372	51	173,000
68.9	110	37	53.1	---	---	78.8	56.8	39.6	---	344	---	363	50	169,000
68.4	109	36	52.3	---	---	78.3	55.9	38.4	---	336	---	354	49	165,000
67.9	109	35	51.5	---	---	77.7	55	37.2	---	327	---	345	48	160,000
67.4	108	34	50.8	---	---	77.2	54.2	36.1	---	319	---	336	47	156,000
66.8	108	33	50	---	---	76.6	53.3	34.9	---	311	---	327	46	152,000
66.3	107	32	49.2	---	---	76.1	52.1	33.7	---	301	---	318	44	147,000
65.8	106	31	48.4	---	---	75.6	51.3	32.5	---	294	---	310	43	144,000
65.3	105	30	47.7	---	---	75	50.4	31.3	---	286	---	302	42	140,000
64.7	104	29	47	---	---	74.5	49.5	30.1	---	279	---	294	41	137,000
64.3	104	28	46.1	---	---	73.9	48.6	28.9	---	271	---	286	41	133,000
63.8	103	27	45.2	---	---	73.3	47.7	27.8	---	264	---	279	40	129,000
63.3	103	26	44.6	---	---	72.8	46.8	26.7	---	258	---	272	39	126,000
62.8	102	25	43.8	---	---	72.2	45.9	25.5	---	253	---	266	38	124,000
62.4	101	24	43.1	---	---	71.6	45	24.3	---	247	---	260	37	121,000
62	100	23	42.1	---	---	71	44	23.1	82	240	201	254	36	118,000
61.5	99	22	41.6	---	---	70.5	43.2	22	81.5	234	195	248	35	115,000
61	98	21	40.9	---	---	69.9	42.3	20.7	81	228	189	243	35	112,000
60.5	97	20	40.1	---	---	69.4	41.5	19.6	80.5	222	184	238	34	109,000
59	96	18	---	---	---	---	---	---	80	216	179	230	33	106,000
58	95	16	---	---	---	---	---	---	79	210	175	222	32	103,000
57.5	94	15	---	---	---	---	---	---	78.5	205	171	213	31	100,000
57	93	13	---	---	---	---	---	---	78	200	167	208	30	98,000
56.5	92	12	---	---	---	---	---	---	77.5	195	163	204	29	96,000
56	91	10	---	---	---	---	---	---	77	190	160	196	28	93,000
55.5	90	9	---	---	---	---	---	---	76	185	157	192	27	91,000
55	89	8	---	---	---	---	---	---	75.5	180	154	188	26	88,000
54	88	7	---	---	---	---	---	---	75	176	151	184	26	86,000
53.5	87	6	---	---	---	---	---	---	74.5	172	148	180	26	84,000
53	86	5	---	---	---	---	---	---	74	169	145	176	25	83,000
52.5	85	4	---	---	---	---	---	---	73.5	165	142	173	25	81,000
52	84	3	---	---	---	---	---	---	73	162	140	170	25	79,000
51	83	2	---	---	---	---	---	---	72	159	137	166	24	78,000
50.5	82	1	---	---	---	---	---	---	71.5	156	135	163	24	76,000
50	81	0	---	---	---	---	---	---	71	153	133	160	24	75,000
49.5	80	---	---	---	---	---	---	---	70	150	130	---	---	73,000
49	79	---	---	---	---	---	---	---	69.5	147	128	---	---	---
48.5	78	---	---	---	---	---	---	---	69	144	126	---	---	---
48	77	---	---	---	---	---	---	---	68	141	124	---	---	---
47	76	---	---	---	---	---	---	---	67.5	139	122	---	---	---
46.5	75	---	---	---	99.5	---	---	---	67	137	120	---	---	---
46	74	---	---	---	99	---	---	---	66	135	118	---	---	---
45.5	73	---	---	---	98.5	---	---	---	65.5	132	116	---	---	---
45	72	---	---	---	98	---	---	---	65	130	114	---	---	---
44.5	71	---	---	100	97.5	---	---	---	64.2	127	112	---	---	---
44	70	---	---	99.5	97	---	---	---	63.5	125	110	---	---	---
43.5	69	---	---	99	96	---	---	---	62.8	123	109	---	---	---
43	68	---	---	98	95.5	---	---	---	62	121	107	---	---	---
42.5	67	---	---	97.5	95	---	---	---	61.4	119	106	---	---	---
42	66	---	---	97	94.5	---	---	---	60.5	117	104	---	---	---
41.8	65	---	---	96	94	---	---	---	60.1	116	102	---	---	---
41.5	64	---	---	95.5	93.5	---	---	---	59.5	114	101	---	---	---
41	63	---	---	95	93	---	---	---	58.7	112	99	---	---	---
40.5	62	---	---	94.5	92	---	---	---	58	110	98	---	---	---
40	61	---	---	93.5	91.5	---	---	---	57.3	108	96	---	---	---
39.5	60	---	---	93	91	---	---	---	56.5	107	95	---	---	---

Rockwell						Rockwell Superficial				Brinell		Vickers	Shore	Approx Tensile Strength (psi)
A	B	C	D	E	F	15-N	30-N	45-N	30-T	3000 kg	500 kg	136		
60kg Brale	100kg 1/16" Ball	150kg Brale	100kg Brale	100kg 1/8" Ball	60kg 1/16" Ball	15kg Brale	30kg Brale	45kg Brale	30 kg 1/16" Ball	10mm Ball Steel	10mm Ball Steel	Diamond Pyramid	Sciero-scope	
39	59	---	---	92.5	90.5	---	---	---	55.9	106	94	---	---	---
38.5	58	---	---	92	90	---	---	---	55	104	92	---	---	---
38	57	---	---	91	89.5	---	---	---	54.6	102	91	---	---	---
37.8	56	---	---	90.5	89	---	---	---	54	101	90	---	---	---
37.5	55	---	---	90	88	---	---	---	53.2	99	89	---	---	---
37	54	---	---	89.5	87.5	---	---	---	52.5	---	87	---	---	---
36.5	53	---	---	89	87	---	---	---	51.8	---	86	---	---	---
36	52	---	---	88	86.5	---	---	---	51	---	85	---	---	---
35.5	51	---	---	87.5	86	---	---	---	50.4	---	84	---	---	---
35	50	---	---	87	85.5	---	---	---	49.5	---	83	---	---	---
34.8	49	---	---	86.5	85	---	---	---	49.1	---	82	---	---	---
34.5	48	---	---	85.5	84.5	---	---	---	48.5	---	81	---	---	---
34	47	---	---	85	84	---	---	---	47.7	---	80	---	---	---
33.5	46	---	---	84.5	83	---	---	---	47	---	79	---	---	---
33	45	---	---	84	82.5	---	---	---	46.2	---	79	---	---	---
32.5	44	---	---	83.5	82	---	---	---	45.5	---	78	---	---	---
32	43	---	---	82.5	81.5	---	---	---	44.8	---	77	---	---	---
31.5	42	---	---	82	81	---	---	---	44	---	76	---	---	---
31	41	---	---	81.5	80.5	---	---	---	43.4	---	75	---	---	---
30.8	40	---	---	81	79.5	---	---	---	43	---	74	---	---	---
30.5	39	---	---	80	79	---	---	---	42.1	---	74	---	---	---
30	38	---	---	79.5	78.5	---	---	---	41.5	---	73	---	---	---
29.5	37	---	---	79	78	---	---	---	40.7	---	72	---	---	---
29	36	---	---	78.5	77.5	---	---	---	40	---	71	---	---	---
28.5	35	---	---	78	77	---	---	---	39.3	---	71	---	---	---
28	34	---	---	77	76.5	---	---	---	38.5	---	70	---	---	---
27.8	33	---	---	76.5	75.5	---	---	---	37.9	---	69	---	---	---
27.5	32	---	---	76	75	---	---	---	37.5	---	68	---	---	---
27	31	---	---	75.5	74.5	---	---	---	36.6	---	68	---	---	---
26.5	30	---	---	75	74	---	---	---	36	---	67	---	---	---
26	29	---	---	74	73.5	---	---	---	35.2	---	66	---	---	---
25.5	28	---	---	73.5	73	---	---	---	34.5	---	66	---	---	---
25	27	---	---	73	72.5	---	---	---	33.8	---	65	---	---	---
24.5	26	---	---	72.5	72	---	---	---	33.1	---	65	---	---	---
24.2	25	---	---	72	71	---	---	---	32.4	---	64	---	---	---
24	24	---	---	71	70.5	---	---	---	32	---	64	---	---	---
23.5	23	---	---	70.5	70	---	---	---	31.1	---	63	---	---	---
23	22	---	---	70	69.5	---	---	---	30.4	---	63	---	---	---
22.5	21	---	---	69.5	69	---	---	---	29.7	---	62	---	---	---
22	20	---	---	68.5	68.5	---	---	---	29	---	62	---	---	---
21.5	19	---	---	68	68	---	---	---	28.1	---	61	---	---	---
21.2	18	---	---	67.5	67	---	---	---	27.4	---	61	---	---	---
21	17	---	---	67	66.5	---	---	---	26.7	---	60	---	---	---
20.5	16	---	---	66.5	66	---	---	---	26	---	60	---	---	---
20	15	---	---	65.5	65.5	---	---	---	25.3	---	59	---	---	---
---	14	---	---	65	65	---	---	---	24.6	---	59	---	---	---
---	13	---	---	64.5	64.5	---	---	---	23.9	---	58	---	---	---
---	12	---	---	64	64	---	---	---	23.5	---	58	---	---	---
---	11	---	---	63.5	63.5	---	---	---	22.6	---	57	---	---	---
---	10	---	---	62.5	63	---	---	---	21.9	---	57	---	---	---
---	9	---	---	62	62	---	---	---	21.2	---	56	---	---	---
---	8	---	---	61.5	61.5	---	---	---	20.5	---	56	---	---	---
---	7	---	---	61	61	---	---	---	19.8	---	56	---	---	---
---	6	---	---	60.5	60.5	---	---	---	19.1	---	55	---	---	---
---	5	---	---	60	60	---	---	---	18.4	---	55	---	---	---
---	4	---	---	59	59.5	---	---	---	18	---	55	---	---	---
---	3	---	---	58.5	59	---	---	---	17.1	---	54	---	---	---
---	2	---	---	58	58	---	---	---	16.4	---	54	---	---	---
---	1	---	---	57.5	57.5	---	---	---	15.7	---	53	---	---	---
---	0	---	---	57	57	---	---	---	15	---	53	---	---	---

## MORE STARRETT SOLUTIONS

Starrett manufactures a complete line of dimensional and non-dimensional metrology measurement devices that contain the latest technology. Contact us for more information!



### COATING THICKNESS GAGES

State-of-the-art thickness gage that utilizes the characteristics of both eddy current and magnetic induction to perform two types of thickness calculation.

### DUROMETERS

Designed to fit comfortably and firmly in your hand. Its large LED display and simple three button control make our Durometer easy to use.

### SURFACE ROUGHNESS TESTERS

full-featured, powerful and versatile surface roughness tester. It can be used either freestanding or bench mounted with fixturing for batch measurement and laboratory applications.

FOR MORE INFORMATION VISIT:

[starrett.com](http://starrett.com)



### COMPARATORS

Manufactured without compromise, Starrett optical comparators provide time tested, cost effective solutions for non-contact measurement.

### FORCE MEASUREMENT

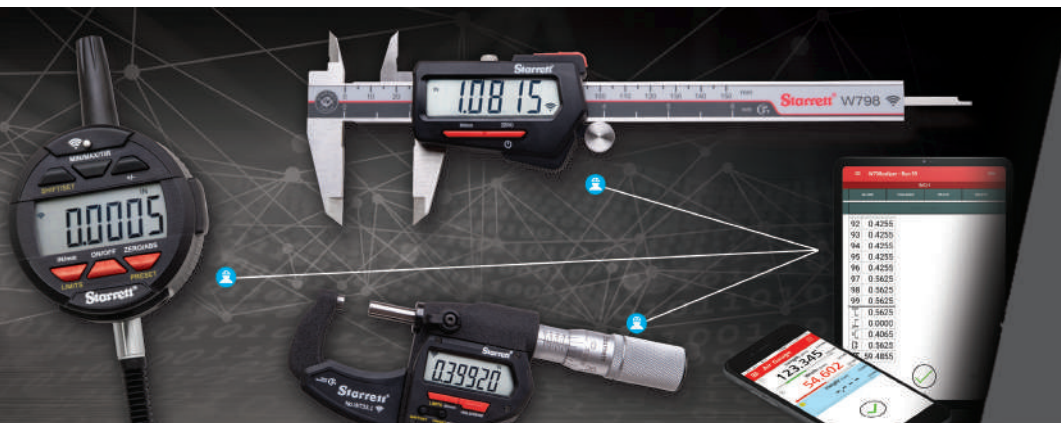
Starrett Force and Material test solutions range from simple hand-held measurements to highly advanced applications with extreme accuracy.

### HEIGHT GAGES

We offer a full range of height gages. Used from a flat surface such as a Starrett granite surface plate, these measure the distance from the reference surface to some feature of a part, and can do so with exceptional accuracy.

FOR MORE INFORMATION VISIT:

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### NEW DATASURE 4.0!!

The most complete, scalable, secure and robust Wireless Data Collection System. The new Starrett DataSure 4.0 System operates on the latest wireless networking technology that uses short-wave radio frequencies to interconnect cell phones, computers and wireless electronic devices, enabling much faster speed, greater bandwidth and longer range for higher data throughput.

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## HOW TO ORDER

For prompt delivery, technical support and assistance, contact your nearest industrial distributor.

## PRODUCT DEMONSTRATION

All Starrett manufacturing and branch locations and many distributors can demonstrate an array of Starrett products at work. Contact your local distributor to learn more.



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Jobsite & Workshop Tools

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