Hardness Testing Instruments
Product Line Overview
Hardness Tester Series Overview

Rockwell Hardness Testers

FH30 Series  FH31 Series  FH1 Series  FH2 Series  FH10 Series  FH11 Series  FH12 Series

Vickers Hardness Testers

FH1 Series  FH2 Series  FH4 Series  FH5 Series  FH9 Series  FH10 Series  FH11 Series  FH12 Series

Brinell Hardness Testers

FH31 Series  FH1 Series  FH2 Series  FH9 Series  FH10 Series  FH11 Series  FH12 Series

Universal Hardness Testers

FH1 Series  FH2 Series  FH10 Series  FH11 Series  FH12 Series

KEY
- Equipment Supplied As Standard With
- Optional Accessories For Equipment
HARDNESS

Hardness is the property of a material enabling it to resist plastic deformation, usually by penetration of another object. The term “hardness” may also refer to stiffness, temper or resistance to bending, scratching, abrasion or cutting.

Scientists and journalists often confuse stiffness with hardness and is demonstrated by, for example, the element Osmium which is stiffer than diamond, but not as hard as diamond.

In materials science there are three principal operational definitions of hardness:
- Scratch hardness: Resistance to fracture or plastic (permanent) deformation due to friction from a sharp object
- Indentation hardness: Resistance to plastic (permanent) deformation due to a constant load from a sharp object
- Rebound hardness: Height or speed of the bounce of an object dropped on the material, related to elasticity.

MEASURING HARDNESS

Hardness is not an intrinsic material property. There are no precise definitions in terms of fundamental units of mass, length, and time. A hardness property value is the result of a defined measurement procedure.

Hardness of materials has probably long been assessed by resistance to scratching or cutting. An example would be material B scratches material C, but not material A. Alternatively, material A scratches material B slightly and scratches material C heavily. The usual method to obtain a hardness value is to measure the depth or area of an indentation left by an indenter of a specific shape, with a specific force applied for a specific time. There are several principal standard test methods to express the relationship between hardness and the size of the impression or the rebound velocity on specific materials. Vickers, Rockwell, Brinell, and Leeb are the most common scales. For practical and calibration reasons, each of these methods is divided into a range of scales, defined by a combination of applied load and indenter geometry or in case of the rebound method, by the weight of the impact body.

MOST COMMON HARDNESS TESTS

Rockwell (HR scales)

Indenting the test material with a diamond cone (HRC) or hardened (tungsten) steel ball indenter (HRB etc.) applying a preload of 10 kgf first and a main test force of 60, 100, or 150 kgf.

Rockwell Superficial (HR scales)

Indenting the test material with a diamond cone or hardened (tungsten) steel ball indenter, depending on the scale preliminary set. The Superficial Rockwell scales use lower force and shallower impressions on brittle and very thin materials. Applying a preload of 3 kgf first and a main test force of 15, 30, or 45 kgf.

Vickers (HV)

Indenting the test material with a diamond indenter, in the form of an upside down perfect pyramid with a square base and an angle of 136 degrees between opposite faces, subjected to test forces of 1 to 120 kgf. A microscope or USB camera is used to visualize and measure the indentation.

Micro-Vickers (HV)

Indenting the test material with a diamond indenter, in the form of an upside down perfect pyramid with a square base and an angle of 136 degrees between opposite faces, subjected to test forces usually not exceeding 1 kgf. A precision microscope or high resolution USB camera is used to visualize and measure the indentations, magnifications up to 600x are most common.

Knoop (HK)

Indenting the test material with a “elongated” diamond pyramid, subjected to test forces usually not exceeding 1 kgf. A precision microscope or high resolution USB camera is used to visualize and measure the indentations, magnifications up to 600x are most common.

Brinell (HB)

Indenting the to be tested material with a 1, 2.5, 5, or 10 mm diameter hardened steel or carbide ball subjected to a load/force ranging from 1 to 3000 kgf. A microscope or USB camera is used to visualize and measure the rather large indentations.

Leeb (HL) (rebound method)

Portable hardness testing. An impact body which has a spherical tungsten carbide tip, is impelled onto the test surface by spring force. The impact creates a plastic deformation of the surface, an indentation, due to which the impact body loses part of its original speed (or energy). Consequently, the softer the material is, the more speed will be lost at rebound of the impact body. Applicable for a wide variety of components, minimum test requirements should be obeyed.

Ultrasonic (UCI)

Portable hardness testing. A Vickers shaped diamond indenter fixed on a vibrating rod that presses on the test surface with a specific force and then measures its hardness by applying ultrasonic vibrations and analyzing its damping effect. Commonly used for small, thin components that cannot be tested by rebound hardness testers.

Shore (HS scales)

Portable (rubber/plastics) hardness testing. The hardness value is determined by pressing the indenter foot firmly onto the sample. The indenter is connected to a linear measuring device and measures the indent depth which is then converted through a mechanical or an electronic system to the Shore value. The deeper the indent, the softer the material.

IRHD

Measures the indentation resistance of elastomeric or rubber materials based on the depth of penetration of a ball indenter. An initial contact force is applied to a 1, 2.5 or 5 mm ball indenter and the penetration is set to zero. The force is increased to a specified total load and the depth of the penetration is measured. The IRHD value is related to the depth of indenter penetration. The method is commonly used for testing small parts and O-rings.

Webster

Portable hardness testing. The object to be tested is placed between the anvil and the penetrator. Pressure is then applied to the handles until “bottom” is felt, at which time the dial indicator is read. There are different types of indenters and different force settings for different materials.

Less common hardness scales

The following hardness methods are less frequently used or superseded by other methods:
- HM - Martens (formerly HU ~ universal hardness)
- HVT - modified Vickers method, depth measurement
- HBT - modified Brinell method, depth measurement
FH-30 Series
Rockwell Hardness Testers

FH-30 Series Features
- Load cell based, closed loop operation
- Advanced user interface
- Automatic testing procedure
- Conversion to Brinell, Vickers, Leeb, and UTM hardness scales
- Shape correction settings for curved surfaces
- Scale resolution (depth) of 0.1 micron
- Database for test programs
- Large workpiece accommodation
- On-line statistics
- USB output

Model FH-30-0
Rockwell & Superficial Rockwell
- Load range - 2.5 to 150 kgf (330 lbf)

Model FH-30-1
Rockwell, Superficial Rockwell, and Brinell
- Same features as FH-30-0, but with additional Brinell scales
- Additional Scales:
  Brinell - HB1/1, 2.5, 5, 10, 30 kgf;
  HB2.5/6.25, 15.625, 31.25, 62.5, 87.5 kgf;
  HB5/25, 62.5, 125, 250 kgf;
  HB10/100 kgf
- Load range - 2.5 to 187 kgf (413.36 lbf)

Supplied As Standard With
- V-anvil
- Flat Anvil 60 mm (2.36“)
- Round testing table 150 mm diameter
- Brinell microscope for FH30-1
- Power cable
- Four adjustable feet
- Certificate
- Operation manual

Optional Accessories For FH30 Series
- Certified hardness test blocks
- Certified indenters
- V-Anvil 60 mm (2.36“)
- Long indenters
- Goose neck indenter holder
- Large testing table 300 x 200 mm (11.81 x 7.87“) with T-slot
- Custom testing tables
- Precision vices, V-blocks, and special clamps
**FH-31 Series Features**

- Load cell based, closed loop operation
- Advanced user interface
- Automatic testing procedure
- Conversion to Brinell, Vickers, Leeb, and UTM hardness scales
- Shape correction settings for curved surfaces
- Scale resolution (depth) of 0.1 micron
- Database for test programs
- Large workpiece accommodation
- On-line statistics
- USB output

**Model FH-31-0**

**Rockwell & Superficial Rockwell**

- Scales:  
- Load range - 2.5 to 150 kgf (330 lbf)

**Model FH-31-1**

**Rockwell, Superficial Rockwell, and Brinell**

- Same features as FH-31-0, but with additional Brinell scales
- Additional Scales:  
  - Brinell - HB1/1, 2.5, 5, 10, 30 kgf; HB2.5/6.25, 15.625, 31.25, 62.5, 87.5 kgf; HB5/25, 62.5, 125, 250 kgf; HB10/100 kgf
- Load range - 2.5 to 197 kgf (413.36 lbf)

**Supplied As Standard With**

- V-anvil
- Flat Anvil 60 mm (2.36")
- Round testing table 150 mm diameter
- Brinell microscope for FH31-1
- Power cable
- Four adjustable feet
- Certificate
- Operation manual

**Optional Accessories For FH31 Series**

- Certified hardness test blocks
- Certified indenters
- V-Anvil 60 mm (2.36")
- Long indenters
- Goose neck indenter holder
- Large testing table 300 x 200 mm (11.81 x 7.87") with T-slot
- Custom testing tables
- Precision vices, V-blocks, and special clamps
FH-1 Series

FH-1 Series Features

- Load cell based, closed loop operation
- Advanced user interface
- Automatic testing procedure
- Conversion to all other hardness scales
- Convex and concave test modes
- Database for test programs
- Large workpiece accommodation
- On-line statistics
- USB output

Model FH-1-1
Rockwell and Superficial Rockwell

- Scales:
- Load range - 1 to 187.5 kgf (2.2 to 413 lbf)

Model FH-1-2
Rockwell, Superficial Rockwell, and Brinell

*Same features as FH-1-1*, but with additional Brinell scales

- Additional Scales:
  *Brinell* - HB1/1, 2.5, 5, 10, 30 kgf; HB2.5/6.25, 15.625, 31.25, 62.5, 87.5 kgf; HB5/25, 62.5, 125, 250 kgf; HB10/100, 250 kgf
- Load range - 1 to 187.5 kgf (2.2 to 413 lbf)
- Brinell microscope with LED ring light

Model FH-1-3
Rockwell, Superficial Rockwell, Brinell, Vickers, HBT, and HVT

*Same features as FH-1-2*, but with additional Vickers scales

- Scales
  *Brinell* - HB2.5/62.5, 187.5 kgf; HBTS/250 kgf;
  *Vickers* - HV 1, 2, 3, 5, 10, 20, 30, 50, 100, 120; HVT 50, 100 kgf
- Brinell microscope with LED ring light
- Built-on electronic digital microscope for Brinell, and Vickers indent measurement
- Objectives 2.5x, 5x, 10x magnification
- Adjustable LED illumination
- LED ring light (optional)
- Precision workpiece sliding table
- Large workpiece accommodation

Optional Accessories For FH 1 Series

- Certified hardness testers blocks
- Certified indenters
- FH-2-29 Motorised elevator spindle for FH1 and FH2
- FH-50-25 V-Anvil 80 mm diameter for 3.3 - 20 mm
- Goose neck indenter holder
- Large testing table 300 x 200 mm (11.81 x 7.87”) with T-slot
- Custom testing tables
- Precision vices, V-blocks, and special clamps

Supplied As Standard With

- V-Anvil 60 mm diameter for 3.3 - 20 mm
- FH-50-26 V-Anvil 80 mm diameter for 12 - 80 mm
- FH-50-27 V-Anvil 80 mm diameter for 20 - 140 mm
- Operation manual

Fig 3. Model FH-1-1

Fig 4. Model FH-1-3 from side

Fig 5. Model FH-1-3 from side
FH-2 Series Rockwell And Universal Hardness Testers

FH-2 Series Features
- Full color multi-function touch screen controller
- Load cell based, closed loop operation
- Advanced user interface
- Automatic testing procedure
- Conversion to all other hardness scales
- Convex and concave test modes
- Database for test programs
- Large workpiece accommodation
- On-line statistics
- USB output

Model FH-2-0  Rockwell, Superficial Rockwell, HBT, HVT, and H ball indentation
- Scales:
  - Superficial Rockwell - 15N, 30N, 45N, 15T, 30T, 45T, 15W,
    30W, 45W, 15X, 30X, 45X, 15Y, 30Y, 45Y;
  - Brinell - HB1/2.5, 6.25, 187.5 kgf; HB15/250 kgf;
  - Vickers - HV 1, 2, 3, 5, 10, 20, 30, 50, 100, 120;
- Built-on electronic digital microscope for Brinell, and Vickers indent measurement
- Objectives 2.5x, 5x, 10x magnification
- Adjustable LED illumination
- Precision workpiece sliding table

Model FH-2-1  Rockwell, Superficial Rockwell, Brinell, Vickers, Knoop, HBT, and HVT
Same features as FH-2-0 but with the following additional features:
- CCD - USB Video system, manual, and automatic measurement of Brinell & Vickers/Knoop indentations, indent Video zoom function
- Scales:
  - Brinell - HB1/1, 2.5, 5, 10, 30 kgf;
    HB2.5/6.25, 15.625, 31.25, 62.5, 187.5 kgf; HB5/25, 62.5, 125,
    250 kgf; HB10/100, 250 kgf; HB2.5/62.5, 187.5 kgf; HB5/250 kgf;
  - Vickers - HV 1, 2, 3, 5, 10, 20, 30, 50, 100, 120;
- Built-on electronic digital microscope for Brinell, and Vickers indent measurement
- Objectives 2.5x, 5x, 10x magnification
- Adjustable LED illumination
- Precision workpiece sliding table

Supplied As Standard With
- V-Anvil 60 mm diameter for 3.3 - 20 mm
- FH-50-26 V-Anvil 80 mm diameter for 12 - 80 mm
- FH-50-27 V-Anvil 80 mm diameter for 20 - 140 mm
- Operation manual

Optional Accessories For FH 2 Series
- Certified hardness test blocks
- Certified indenters
- FH-2-29 Motorised elevator spindle for FH1 and FH2
- FH-50-25 V-Anvil 80 mm diameter for 3.3 - 20 mm
- Goose neck indenter holder
- Large testing table 300 x 200 mm (11.81 x 7.87”) with T-slot
- Custom testing tables
- Precision vices, V-blocks, and special clamps
- FH-2-31 LED Ring light for enhanced Brinell viewing on model FH-1-3
The Rockwell Hardness test is a hardness measurement based on the net increase in depth of impression when a load is applied. Hardness values are commonly given in the A, B, C, R, L, M, E and K scales. The higher the value in each of the scales the harder the material.

Hardness has been variously defined as resistance to local penetration, scratching, machining, wear or abrasion. In the Rockwell method of hardness testing, the depth of penetration of an indenter under certain arbitrary test conditions is determined. The indenter may either be a steel (carbide) ball of some specified diameter or a spherical diamond-tipped cone of 118° angle and 0.2 mm tip radius also called indenter. The type of indenter and the test load determine the hardness scale (A, B, C, etc.).

A minor load of 3 kg or 10 kg is first applied, causing an initial penetration and holding the indenter in place. Then, the dial is set to zero and the major load is applied. Upon removal of the major load, the depth reading is taken while the minor load is still on. The hardness number may then be read directly from the scale.

The Rockwell scale characterizes the indentation hardness of materials through the depth of penetration of an indenter, loaded on a material sample and compared to the penetration in some reference material. It is one of several definitions of hardness in materials science. Its hardness values are noted by HR’X’ is the letter for the scale used. Hardness relation to strength is that both are measures of the pressure it takes to get plastic deformation to occur in materials.

The Rockwell hardness test was devised by metallurgist Stanley P. Rockwell in Syracuse, NY, around 1919, in order to quickly determine the effects of heat treatment on steel bearing races. The Brinell hardness test, invented in 1900 in Sweden, was slow, not useful on fully hardened steel, and left too large impressions to be considered non-destructive. Rockwell collaborated with an instrument manufacturer to commercialize his invention and develop standardized testing machines.

Operation
The determination of the Rockwell hardness of a material involves the application of a minor load followed by a major load, and then noting the depth of penetration, converted to a hardness value directly from a dial or display, in which a harder material gives a higher number. The major advantage of Rockwell hardness is its ability to display hardness values directly, thus obviating tedious calculations involved in other hardness measurement techniques. Also, the relatively simple and inexpensive set-up enables installation under various conditions.

Rockwell testers are typically used in engineering, metallurgy and industrial environments. The commercial popularity arises from its speed, reliability, robustness, resolution and small area of indentation.

Good Practices
Cleaning indenter and test-piece to be clear of dirt, grease, rust or paint. Measuring on a perpendicular, flat surface (round work correction factors are invoked to adjust for test-piece curvature). Ensuring that the thickness of the test-piece is at least 10 times the depth of the indentation. Maintaining an adequate spacing between multiple indentations. Controlling the speed of indentation and assuring that the load duration (dwell) time is applied correctly.

Scales and Values
The most common used are the “C”, and “B” scales. Both express hardness as an arbitrary dimensionless number.

The B-scale is used for softer materials (such as aluminum, brass, and softer steels). It employs a tungsten carbide ball as the indenter and a 100-kg weight to obtain a value expressed as “HRB”.

The C-scale, for harder materials, uses a diamond cone and a 150-kg weight to obtain a value expressed as “HRC”. There are several alternative scales for other purposes.

The superficial Rockwell scales use lower loads and shallower impressions on brittle and very thin materials. The 45N scale employs a 45-kg load on a diamond cone-shaped Brale indenter, and can be used on dense ceramics. The 15T scale employs a 15-kg load on a 1/16-inch diameter hardened steel ball, and can be used on sheet metal. Readings below HRC 20 are generally considered unreliable, as are readings much above HRB 100.

Typical Values
Very hard steel (e.g. a good knife blade): HRC 55 - HRC 62; Axes, chisels, etc.: HRC 40 - 45
Several other scales, including the extensive A-scale, are used for specialised applications. There are special scales for measuring case-hardened specimens.
Vickers Hardness and Brinell Hardness Explained

VICKERS HARDNESS TEST

The Vickers hardness test was developed in 1924 by Smith and Sandland at Vickers Ltd as an alternative to the Brinell method to measure the hardness of materials.

The Vickers test is often easier to use than other hardness tests, since the required calculations are independent of the size of the indenter, and the indenter can be used for all materials irrespective of hardness.

The basic principle, as with all common measures of hardness, is to observe the questioned material’s ability to resist plastic deformation from a standard source.

The Vickers test can be used for all metals and has one of the widest scales among hardness tests. The unit of hardness given by the test is known as the Vickers Pyramid Number (HV) or Diamond Pyramid Hardness (DPH).

The hardness number is determined by the load over the surface area of the indentation and not the area normal to the force, and is therefore not a pressure.

The hardness number is not really a true property of the material and is an empirical value that should be seen in conjunction with the experimental methods and hardness scale used.

When doing the hardness tests the distance between indentations must be more than 2.5 indentation diameters apart to avoid interaction between the work-hardened regions.

Implementation

An indentation left in case-hardened steel after a Vickers hardness test. It was decided that the indenter shape should be capable of producing geometrically similar impressions, irrespective of size; the impression should have well defined points of measurement; and the indenter should have high resistance to self-deformation. A diamond in the form of a square-based pyramid satisfied these conditions.

It had been established that the ideal size of a Brinell impression was 3/8 of the ball diameter. As two tangents to the circle at the ends of a chord 3d/8 long intersect at 136°, it was decided to use this as the included angle of the indenter. The angle was varied experimentally and it was found that the hardness value obtained on a homogeneous piece of material remained constant, irrespective of load. Accordingly, loads of various magnitudes are applied to a flat surface, depending on the hardness of the material to be measured.

The HV number is then determined by the ratio F/A where F is the force applied to the diamond in kilograms-force and A is the surface area of the resulting indentation in square millimeters. A can be determined by the formula which can be approximated by evaluating the sine term to give where d is the average length of the diagonal left by the indenter.

Vickers hardness numbers are reported as xxxHVyy, e.g., 440HV30, or xxxHVyy/zz if duration of force differs from 10s to 15s, e.g., 440HV30/20, where:

- 440 is the hardness number,
- HV gives the hardness scale (Vickers),
- 30 indicates the load used in kg.
- 20 indicates the loading time if it differs from 10s to 15s

Vickers values are generally independent of the test force, they will come out the same for 500 gf and 50 kgf, as long as the force is at least 200 gf.

Examples of HV values for various materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>316L stainless steel</td>
<td>140HV30</td>
</tr>
<tr>
<td>347L stainless steel</td>
<td>180HV30</td>
</tr>
<tr>
<td>Carbon steel</td>
<td>55–120HV5</td>
</tr>
<tr>
<td>Iron</td>
<td>30–80HV5</td>
</tr>
</tbody>
</table>

BRINELL HARDNESS TEST

The Brinell scale characterizes the indentation hardness of materials through the scale of penetration of an indenter, loaded on a material test-piece. Proposed by Swedish engineer Johan August Brinell in 1900, it was the first widely used and standardized hardness test in engineering and metallurgy.

The typical tests use a 10, 5, 2.5 or 1 mm diameter steel ball as an indenter with a test force starting at 1kgf up to 3,000 kgf (29 kN) force. For softer materials, a lower force is used; for harder materials, a tungsten carbide ball is substituted for the steel ball.

After the impression is made, a measurement of the diameter of the resulting round impression (d) is taken. It is measured to plus or minus 0.05 mm using a low-magnification microscope. The hardness is calculated by dividing the load by the area of the curved surface of the indention, (the area of a hemispherical surface is arrived at by multiplying the square of the diameter by 3.14159 and then dividing by 2).

Common values

The standard format for specifying tests can be seen in the example “HBW 10/3000”. “HBW” means that a tungsten carbide (from the chemical symbol for tungsten) ball indenter was used, as opposed to “HBS”, which means a hardened steel ball. The “10” is the ball diameter in millimeters. The “3000” is the force in kilograms force.

Standards

- European and international EN ISO 6506-1
- American ASTM E10-08
FH-4 Series Micro-Vickers Hardness Testers

**FH-4 Series Features**
- Micro-Vickers and Knoop
- Test loads - w10 gr-2 kgf
- Electronic microscope, digital value transfer
- Large LCD display shows measured values, on-line statistics, memory overview, tester settings
- Large workpiece accommodation
- RS-232 output
- Built-in printer

**Model FH-4-0**
- Motorised turret, 2 objectives

**Model FH-4-1**
- Motorised turret, 3 objectives

**Supplied As Standard With**
- Manual X-Y stage
- Objectives according to model (10x and 40x or 10x, 20x and 40x)
- Digital Electronic microscope 15x
- Built-in silent thermal printer
- RS-232 data output
- Set of workpiece fixtures, vice, chuck, clamp
- Level gauge
- 4 adjustable feet
- Spare halogen lamp
- Operation manual
- Certificate

**Optional Accessories**
- See Below For Different Levels Of Automation
- Certified indenters
- Certified hardness test blocks
- FH-50-62 5x Objective
- FH-50-65 40x Objective
- FH-50-64 20x Objective
- Horizon manual or automatic measuring and filing systems

**Six Levels of Increasing Automation**

<table>
<thead>
<tr>
<th>First Level</th>
<th>Second Level</th>
<th>Third Level</th>
<th>Fourth Level</th>
<th>Fifth Level</th>
<th>Sixth Level</th>
</tr>
</thead>
</table>
| Part # FH-50-96
Includes Horizon on-screen measurement, CCD camera and touchscreen display | Part # FH-50-97
Includes Horizon on-screen measurement, CCD camera, touchscreen display and manual X-Y stage with manual micrometers | Part # FH-50-98
Includes Horizon on-screen measurement, CCD camera, touchscreen display and manual X-Y stage with one digital micrometer for either X or Y stage | Part # FH-50-99
Includes Horizon on-screen measurement, CCD camera, touchscreen display and manual X-Y stage with two digital micrometers | Part # FH-4-35
Includes Horizon on-screen measurement, CCD camera, touchscreen display and precision motorised XY stage 100 x 100 mm and 25 x 25 mm travel, 3 kg max load | Part # FH-4-36 Includes Horizon on-screen measurement, CCD camera, touchscreen display and precision motorised XY and Z stage 100 x 100 mm and 25 x 25 mm travel, 3 kg max load |
FH-5 Series Vickers Hardness Testers

FH-5 Series Features
- Load cell, closed loop, force feedback system
- Motorised turret with 2 or 3 objectives
- Test loads - 20 gr-31.25 kgf
- Conversion to other hardness scales including Tensile Strength
- Digital eyepiece and camera adaptor
- Large LCD display shows measured values, on-line statistics, memory overview, tester settings

Model FH-5-0 - Vickers and Knoop
- Test loads of: 1, 2, 2.5, 3, 4, 5, 10, 20, 30 kgf

Model FH-5-1 - Vickers and Brinell
(low force with 1 and 2mm ball)
- Test loads of: 1, 2, 2.5, 3, 4, 5, 6.25, 10, 15.625, 20, 31.25 kgf

Model FH-5-2 - Micro / Macro Vickers and Knoop
- Test loads of: 0.2, 0.3, 0.5, 1, 2, 2.5, 3, 4, 5, 10, 20, 30 kgf

Model FH-5-3 - Micro / Macro Vickers and Knoop
- Test loads of: 0.02, 0.025, 0.05, 0.1, 0.2, 0.3, 0.5, 1, 2, 2.5, 3, 4, 5, 10, 20, 30 kgf

Model FH-5-4 - Micro / Macro Vickers Knoop and Brinell
- Test loads of: 0.02, 0.025, 0.05, 0.1, 0.2, 0.3, 0.5, 1, 2, 2.5, 3, 4, 5, 10, 20, 30 kgf

Model FH-5-5 - Macro Vickers and Knoop
- Test loads of: 1, 2, 2.5, 3, 4, 5, 10, 20, 30, 50 kgf

Model FH-5-6 - Vickers and Brinell
(low force with 1,2 and 5 mm ball)
- Test loads of: 1, 2, 2.5, 3, 4, 5, 6.25, 10, 15.625, 20, 31.25, 62.5 kgf

Model FH-5-7 - Micro / Macro Vickers and Knoop
- Test loads of: 0.2, 0.3, 0.5, 1, 2, 2.5, 3, 4, 5, 10, 20, 30, 50 kgf

Model FH-5-8 - Micro / Macro Vickers and Knoop
- Test loads of: 0.1, 0.2, 0.3, 0.5, 1, 2, 2.5, 3, 4, 5, 10, 20, 30, 50 kgf

Model FH-5-9 - Micro / Macro Vickers, Knoop, and Brinell
- Test loads of: 0.1, 0.2, 0.3, 0.5, 1, 2, 2.5, 3, 4, 5, 6.25, 10, 15.625, 20, 30, 31.25, 50, and 62.5 kgf

First Level
Part # FH-50-96
Includes Horizon on-screen measurement, CCD camera and touchscreen display

Second Level
Part # FH-50-97
Includes Horizon on-screen measurement, CCD camera, touchscreen display and manual XY stage with manual micrometers

Third Level
Part # FH-50-98
Includes Horizon on-screen measurement, CCD camera, touchscreen display and manual XY stage with one digital micrometer for either X or Y stage

Fourth Level
Part # FH-50-99
Includes Horizon on-screen measurement, CCD camera, touchscreen display and manual XY stage with two digital micrometers

Fifth Level
Part # FH-5-55
Includes Horizon on-screen measurement, CCD camera, touchscreen display and precision motorised XY stage 100 x 100 mm and 25 x 25 mm travel, 3kg max load

Sixth Level
Part # FH-5-56
Includes Horizon on-screen measurement, CCD camera, touchscreen display and precision motorised XY and Z stage 100 x 100 mm and 25 x 25 mm travel, 3kg max load

Supplied As Standard With:
- Manual X-Y stage
- Flat anvil 60mm
- Objectives 5x, 10x, 20x or 10x, 20x, 40x
- Electronic digital eyepiece 15x
- Set of workpiece fixtures, vice, chuck, clamp
- Built-in thermal printer
- RS-232 data output
- 4 adjustable feet
- Spare halogen lamp
- Fuse
- Operation manual

Optional Accessories
- Certified indenters
- Certified hardness test blocks
- FH-50-62 6x Objective
- FH-50-65 40x Objective
- Horizon measuring and filing systems
- See Below for Different Levels of Automation

Six Levels of Increasing Automation

First Level
Part # FH-50-96
Includes Horizon on-screen measurement, CCD camera and touchscreen display

Second Level
Part # FH-50-97
Includes Horizon on-screen measurement, CCD camera, touchscreen display and manual XY stage with manual micrometers

Third Level
Part # FH-50-98
Includes Horizon on-screen measurement, CCD camera, touchscreen display and manual XY stage with one digital micrometer for either X or Y stage

Fourth Level
Part # FH-50-99
Includes Horizon on-screen measurement, CCD camera, touchscreen display and manual XY stage with two digital micrometers

Fifth Level
Part # FH-5-55
Includes Horizon on-screen measurement, CCD camera, touchscreen display and precision motorised XY stage 100 x 100 mm and 25 x 25 mm travel, 3kg max load

Sixth Level
Part # FH-5-56
Includes Horizon on-screen measurement, CCD camera, touchscreen display and precision motorised XY and Z stage 100 x 100 mm and 25 x 25 mm travel, 3kg max load
FH9 Series Brinell Hardness Testers

FH-9 Series Features
Brinell and Vickers
- Load cell, closed loop system
- Test loads - 30 kgf - 3000 kgf
- LCD display showing Brinell and Vickers value, statistics on tester settings
- Simultaneous conversion to Rockwell, Vickers, Brinell, and Leeb
- External microscope with analogue scale for indentation measurement or external ELECTRONIC digital microscope for automatic indentation measurement

Model FH-9-0
Brinell
- Load cell, closed loop system
- Test loads - 30 kgf - 3000 kgf

Model FH-9-26
Brinell and Vickers
- As Model FH-9-0 but with portable CCD camera, Horizon automatic measuring and filing system, and supplied with three objectives.

Supplied As Standard With:
- FH-9-24 Analogue measuring microscope with 20x (analogue series)
- V-anvil ø80 mm (3.1496")
- Large flat anvil ø200 mm (7.87401")
- Fuse 2A (3 pcs)
- RS-232 data output
- Adjustable feet (4 pcs)
- Certificate
- Operation manual

Optional Accessories:
- Certified indenters
- Certified hardness test blocks
- FH-9-8 Digital microscope with 10x, 25x and 100x magnification (digital series) for automatic measurement
- FH-50-79 Large testing table 350 mm x 250 mm (13.8" x 9.8") with two T slots, 250 kgf maximum load
- FH-20 Video measuring and database system
- Motorised X-Y stage
- Brinell video microscope system.

Fig 10. Model FH-9-26
Fig 11. Model FH-9-0
FH9 Series

Brinell Hardness Testers

EXTENDED FRAME DETAILS

FH-9 Series Features

Brinell and Vickers
- Load cell, closed loop system
- Extended frame 450 mm workpiece height, 250 mm throat depth
- Test loads - 30 kgf - 3000 kgf
- LCD display showing Brinell and Vickers value, statistics and tester settings
- Simultaneous conversion to Rockwell, Vickers, Brinell, and Leeb
- External microscope with analogue scale for indentation measurement or external ELECTRONIC digital microscope for automatic indentation measurement

Model FH-9-1
Brinell
- Load cell, closed loop system
- Test loads 30 kgf - 3000 kgf

Model FH-9-17
Brinell
- As Model FH-9-1 but with motorised spindle

Model FH-9-27
Brinell and Vickers
- As Model FH-9-1 but with portable CCD camera, Horizon automatic measuring and filing system, and supplied with three objectives

Model FH-9-28
Brinell and Vickers
- As Model FH-9-27 but with motorised spindle.

Model FH-9-20
Brinell and Vickers
- As Model FH-9-28 but with motorised turret, CCD camera and Horizon touchscreen software.

Supplied As Standard With:
- FH-9-24 Analogue measuring microscope with 20x (analogue series)
- V-anvil ø80 mm (3.1496”)
- Large flat anvil ø200 mm (7.87401”)
- Fuse 2A (3 pcs)
- RS-232 data output
- Adjustable feet (4 pcs)
- Certificate
- Operation manual

Optional Accessories:
- Certified indenters
- Certified hardness test blocks
- FH-9-8 Digital microscope with 10x, 25x and 100x magnification (digital series) for automatic measurement
- FH-50-79 Large testing table 350 mm x 250 mm (13.8” x 9.8”) with two T slots, 250 kgf maximum load
- FH-20 Video measuring and database system
- Motorised X-Y stage
- Brinell video microscope system.
Screen 1. Results from a five location hardness test showing the mean and standard deviation of the results.

Screen 2. Showing the user defined pattern/sequence of hardness measurement locations.

Screen 3. Showing the test selection menu.

Screen 4. Showing the filar lines option to manually define the precise edges of the indent, along with the zoom measurement option.

Screen 5. Showing the conversion options between the different scales.

Screen 6. Showing the report generation process. These reports are printed directly from the tester.

Sample screenshots from our Horizon hardness software that show the simple menu driven simplicity of the software.
FH11 Series

Universal Hardness Testers

FH-11 Series Features

- Rockwell, Superficial Rockwell, Brinell, Vickers, Knoop, Ball Indentation, and HVT, HBT
- Superior range of test loads/force application ranging from 500 gf (1.1 lb) to 3000 kgf (6614 lbf) (over 3 models)
- Fixed workpiece position (no spindle)
- Descending test head with automatic workpiece detection
- Free definable, manual or motorised 6-position turret for objectives and indenters at choice
- High definition optical system for images of 0.7x to 1000x magnification
- Large, adjustable 15" (381 mm) industrial touch screen or mouse with normal 22" (559 mm) LCD screen at choice
- Automatic or manual focus, manual, or fully automatic indent measurement, standard
- LAN, WLAN, USB-2, RS-232, Printer, and DVI connectivity, standard
- Built-in driver for (optional) motorised X-Y stage, standard
- Free definable test patterns case depth, traverse, free style, etc., optional
- Machine covers made of shock, damage and fire proof recyclable materials
- Large testpiece accommodation H=300 mm (11.8"), D=220 mm (8.7"), can be upgraded to a taller frame of for instance H=450 mm (17.7"), D=220 mm (8.7"), or 300 mm (11.8"); even years after purchasing the tester

Model FH-11-0
- Load cell, force feedback, closed loop system
- Test loads - 1 - 250 kgf (2.2 - 551 lbf)

Model FH-11-32
- Rockwell Only
- Load cell, force feedback, closed loop system - no turret and no optical system
- Test loads - 1 - 250 kgf (2.2 - 551 lbf) - when used with XY tables allows automatic Jominy and pattern testing

Model FH-11-1
- Load cell, force feedback, closed loop system
- Test loads - 1 - 750 kgf (2.2 - 1,653 lbf)

Model FH-11-37
- Same as FH-11-1 but with extended head travel of 300 mm and large working area.
- Test loads - 1 - 3,000 kgf (2.2 - 6,600 lbf)

Model FH-11-2
- Load cell, force feedback, closed loop system
- Test loads - 1 - 3,000 kgf (2.2 - 6,600 lbf)

Supplied As Standard With:
- Objective for 70x magnification
- Objective for 140x magnification
- Clamping protection nose
- Testing table ø80mm (3.15")
- Power cable
- Operation manual
- Certificate
- Motorised turret with 6 positions
- Built-in 3 axis support driver
- Large testing table

Optional Accessories
- Certified indenters
- Certified hardness test blocks
- Built-in 5 axis support driver
- Long Vickers indenter
- Precision vices, V-blocks and special clamps
- Objectives for 10x, 20x, 44x magnification
- FH-50-25 V-Anvil ø80 mm (3.15") for 3.3 to 20 mm
- FH-50-26 V-Anvil ø80 mm (3.15") for 12 to 80 mm
- FH-50-27 V-Anvil ø120 mm (4.72") for 20 to 140 mm
- FH-50-31 Testing table ø335 mm (9.25")
- FH-50-79 Large testing table 350 mm x 250 mm (13.8" x 9.8") with two T slots, 250kgf maximum load
- FH-10-26 Manual XY-stages
FH10 Series

Universal Hardness Testers

FH-10 Series Features

Model FH-10-0

Rockwell, Superficial Rockwell, Brinell, Vickers, HVT, and HBT

- Load cell, force feedback, closed loop system
- Test loads - 1 kgf-250 kgf
- Complies to all applicable EN/ISO and ASTM standards
- Optical system high precision optical path, mat screen diameter 135 mm
- Shape correction for curved surfaces
- High accuracy depth measuring system (Rockwell, HBT, HVT)
- Large LCD display shows measured values, online statistics, memory overview, tester settings
- User-friendly, low training requirements
- Direct printer and/or PC connections via RS-232 and USB-2
- Large workpiece accommodation (H=300 mm)

Supplied As Standard With:

- Objective for 70x magnification
- Objective for 140x magnification
- Nose clamp protection
- Testing table ø80mm (3.15")
- Power cable
- Operation manual
- Certificate

Optional Accessories

- Certified indenters
- Certified hardness test blocks
- Objectives for 10x, 20x, 44x magnification
- Testing table ø150 mm (5.9")
- FH-50-31 Testing table ø235 mm (9.25")
- FH-50-25 V-Anvil ø80 mm (3.15") for 3.3 to 20 mm
- FH-50-26 V-Anvil ø80 mm (3.15") for 12 to 80 mm
- FH-50-27 V-Anvil ø120 mm (4.72") for 20 to 140 mm
- FH-50-79 Large testing table 350 mm x 250 mm (13.8" x 9.8") with two T slots, 250 kgf maximum load
- FH-10-26 Manual XY-stages
FH12 Series

FH-12 Series Features

Brinell, Vickers, Rockwell, HVT, and HBT

FH-12 a universal hardness tester most suitable for heavy duty testing. Built for tough environments and extra large workspace accommodation and suitable for parts up to 500 kg.

The floor type frame reaches a height of 2 meters and offers a workspace of not less than 650 mm height and a throat depth of 300 mm. Rockwell, Vickers and Brinell, but also pure depth test methods such as H, HVT and HBT are part of the standard test procedures of the FH-12. 3 models cover a range of test loads either up to 250, 750 or 3000 kg.

The FH-12 has a motorised elevator spindle allowing each test piece to be tested on an ergonomic working height. The test head is equipped with a 6 positions modular turret (indenters and objectives) and an optical zoom video system with a 5MP HD camera.

High performance PC driven automatic and manual indent measurement with automatic filing and storage functions. Refined algorithms for automatic measurement on materials normally less suitable for automatic measurement.

Model FH-12-0
- Load range from 1 to 250 kgf

Model FH-12-1
- Load range from 1 to 750 kgf.

Model FH-12-2
- Load range from 1 to 3,000 kgf

Supplied As Standard With:
- Motorised turret with 6 positions
- Objectives for 0.7x - 1000x magnification
- Built-in 3 axis support driver
- Toolset
- Large testing table
- Certificate
- Operation manual

Optional Accessories
- Certified indenters
- Certified hardness test blocks
- Objectives for 10x, 20x, 44x magnification
- Testing table ø150 mm (5.9”)
- FH-50-31 Testing table ø235 mm (9.25”)
- FH-50-25 V-Anvil ø80 mm (3.15”) for 3.3 to 20 mm
- FH-50-26 V-Anvil ø80 mm (3.15”) for 12 to 80 mm
- FH-50-27 V-Anvil ø120 mm (4.72”) for 20 to 140 mm
- FH-50-79 Large testing table 350 mm x 250 mm (13.8” x 9.8”) with two T slots, 250 kgf maximum load
- FH-10-26 Manual XY-stages
### Certified Indenters, XY Tables, Clamps

#### UKAS Certified Brinell Indenters
- **FH-200-0015** 1.0 mm, includes carbide ball
- **FH-200-0016** 1.0 mm, includes carbide ball for FH-4 & FH-5 series
- **FH-200-0017** 2.5 mm, includes carbide ball
- **FH-200-0018** 2.5 mm, includes carbide ball
- **FH-200-0019** 5.0 mm, includes carbide ball
- **FH-200-0020** 10 mm, includes carbide ball
- **FH-200-0024** spare tungsten carbide ball 1 mm
- **FH-200-0025** spare tungsten carbide ball 2.5 mm
- **FH-200-0026** spare tungsten carbide ball 5 mm
- **FH-200-0027** spare tungsten carbide ball 10 mm

#### UKAS Certified Vickers and Knoop Indenters
- **FH-200-0021** Vickers indenter, L 17 mm
- **FH-200-0022** Micro Vickers indenter, L 7 mm
- **FH-200-0023** Knoop indenter

#### UKAS Certified Rockwell Indenters
- **FH-200-0028** A C scale indenter interface shaft diameter 6.35 L 17 mm
- **FH-200-0031** Indenter 1/16” carbide ball, shaft dia 6.35 L 29 mm
- **FH-200-0039** Indenter 1/4” carbide ball, shaft dia 6.35 L 28 mm
- **FH-200-0040** Indenter 1/2” carbide ball, shaft dia 6.35 L 28 mm
- **FH-200-0041** spare carbide balls 1/16”
- **FH-200-0042** spare carbide balls 1/8”
- **FH-200-0043** spare carbide balls 1/4”
- **FH-200-0044** spare carbide balls 1/2”

**NOTE:** UKAS certified steel ball indenters available on request.

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**Fig 22.** 200mm Circular Flat Anvil

**Fig 23.** Large Testing Table, 350 x 250 mm, With Two T Slots

**Fig 24.** Manual XY Testing Table With Analogue Micrometer Movement

**Fig 25.** Large Capacity Motorised XY Testing Table Controlled By Horizon Software

**Fig 26.** Micro / Macro Large Motorised XY Table

**Fig 27.** Micro / Macro Large Motorised XY Table With Specimen Mounting Options
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<tr>
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Certified Hardness Blocks

We also have hardness verification kits available
Model FH-20 - Brinell Optical Scanning System

Portable video scanning system to automatically measure Brinell indents and determine the Brinell hardness value. Excellent solution for quick and easy measurement of Brinell hardness values with ball diameters 1, 2, 2.5, 5 and 10 mm and for applied loads of 1 to 3000 kg.

- Includes (removable) magnetic base for accurate and precise measuring
- Easy to use - simply position the scanning system and press the button to determine the relative hardness and diameter of the indentation
- Accuracy of the measured diameter up to 0.001µm
- Operator defined tolerance limits for for simple Go/No Go
- Able to show the last 5 measurements taken
- Automatic storage of images and accompanying measurement data files, including operator id, time & date, hardness parameters, measured hardness values, location of stored image

Software Features

- Measures the indentation automatically or by hand
- Saves the image of the indentation in a dedicated format and folder
- Test results can be imported into Excel
- Each measurement is filed with information about the ball diameter, applied load, load duration

Fig 28. Model FH20 Optical Scanning System for Brinell Measurements