New Products

Micro Vickers Hardness Testing Machines

HM-100

Refer to page M-3 for details.

Rockwell Hardness Testing Machines

HR-600

Refer to page M-5 for details.

Rockwell Hardness Testing Machines

HR-530

Refer to page M-6 for details.

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Hardness Testing Machines

Micro Vickers Hardness Testing Machines

Vickers Hardness Testing Machines

Rockwell Hardness Testing Machines

Portable Hardness Testing Instruments

INDEX

Mitutoyo

Hardness Testing Machines

Start quality control from the material — Mitutoyo's hardness testing machines can handle it

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

An inspection certificate is supplied as standard. Refer to page U-11 for details.

HM-200
SERIES 810 — Micro Vickers Hardness Testing Machines

- The latest electromagnetic force motor used in the loading mechanism enables the test force to be freely selected.
- In addition to Vickers hardness testing, Knoop (HK)* and Fracture toughness (Kc) tests can also be performed.

* For Knoop hardness testing, Knoop indenter (optional) is required.

System A
(**HM-210A / 220A**)

SPECIFICATIONS

Order No.	810-401	810-402	810-404	810-406	810-407	810-409
Model	HM-210			HM-220		
Unit (display unit)	metric	inch / mm	metric	metric	inch / mm	metric
Operation	Manual	Manual	System	Manual	Manual	System
Applicable standards	JIS B 7725, ISO 6507-2					
Test force mN (gf)	98.07 to 9807 (10 to 1000)			0.4903 to 19610 (0.05 to 2000)		
Arbitrary test force	One setting can be saved, default is HV0.025					
External dimensions (W×D×H) (excluding protrusions and stage); Main unit mass	System **A**: 315×671×595 mm, 38.5 kg System **B** / **C** / **D**: 315×586×741 mm, 37.4 kg					
Power supply (main unit)	AC100 V 50/60 Hz System **A**: 31 W System **B** / **C** / **D**: 30 W			AC100 V 50/60 Hz System **A**: 44 W System **B** / **C** / **D**: 43 W		

Note: **810-401**, **810-406**: System **A**, **810-404**, **810-409**: System **B** / **C** / **D**

System A (**HM-210A / 220A**)
All-in-one model with simple color touch-panel operation

System B (**HM-210B / 220B**)
A system equipped with automatic reading function with **AVPAK** software

System C (**HM-210C / 220C**)
In addition to the functions of System **B**, System **C** is equipped with an electric stage

System D (**HM-210D / 220D**)
In addition to the functions of System **B** and System **C**, System **D** is equipped with the auto focus function

CAUTION: The **AVPAK-20** software package is not for use within, or export to, the United States of America
The **AVPAK-10** software package is for the United States of America

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HM-100
SERIES 810 — Micro Vickers Hardness Testing Machines

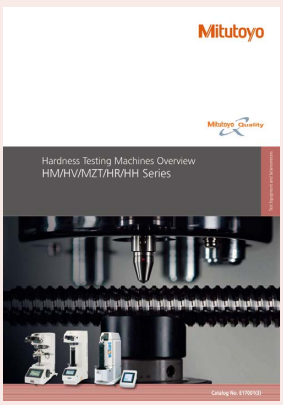
- The **HM-100** Series is an affordable line of microhardness testers able to work with very small test loads (from 98.07 mN, 10 gf, and upwards), which is perfect for evaluating the mechanical characteristics and controlling the quality of electric/electronic components.

810-959-20
HM-103

SPECIFICATIONS

Order No.	810-124-20*	810-125-20	810-959-20
Model	HM-101	HM-102	HM-103
Applicable standards	JIS B 7725, ISO 6507-2		
Test force mN (gf)	98.07 to 9807 (10 to 1000)		
External dimensions (W×D×H) (excluding protrusions and stage); Main unit mass	Main unit: 380×600×590 mm, 42 kg		
	—	Control panel: 165×235×125 mm, 1.5 kg	
	—		TV monitor: 202×29.2×175.8 mm, 1.17 kg
Power supply (main unit)	AC100 V 50/60 Hz		
	Less than 60 W		Less than 90 W

* Models which can be connected to the MeasurLink measurement data network system are only **HM-102** and **HM-103**.



Refer to the Hardness Testing Machines Brochure (**E17001**) for more details.

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PROPRIETARY INSPECTION CERTIFICATE
Mitutoyo guarantees the product quality

An inspection certificate is supplied as standard. Refer to page U-11 for details.

HV-100
SERIES 810 — Vickers Hardness Testing Machines

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- Vickers hardness testers have a wide application in testing metals, especially small heat-treated parts, and are also suitable for making special-purpose tests such as carburized case hardness, maximum hardness of spot welds, high-temperature hardness, and fracture toughness of ceramic materials.
- In addition to Vickers hardness testing, Knoop (HK)*1/Brinell (HB)*2/Fracture toughness (Kc) tests can also be performed.

*1 For Knoop hardness testing, Knoop indenter (optional) is required.
*2 For Brinell hardness testing a Brinell indenter (optional) and additional weight are required.

System A (**HV-110A / 120A**)

SPECIFICATIONS

Order No.	810-440	810-441	810-443	810-445	810-446	810-448
Model	HV-110			HV-120		
Unit (display unit)	metric	inch/mm	metric	metric	inch/mm	metric
Operation	Manual	Manual	System	Manual	Manual	System
Applicable standards	JIS B 7725, ISO 6507-2					
Test force N (kgf)	9.807 to 490.3 (1 to 50)			2.942 to 294.2 (0.3 to 30)		
External dimensions (W×D×H) (excluding protrusions and stage)	System **A**: 307×696×781 mm System **B**/**C**/**D**: 307×627×875 mm					
Main unit mass	**HV-110**: Approx. 60 kg **HV-120**: Approx. 58 kg					
Power supply (main unit)	AC100 V 50/60 Hz System **A**: 24 W System **B**/**C**/**D**: 22 W					

Note: **810-440**, **810-445**: System **A**, **810-443**, **810-448**: System **B**/**C**/**D**

System A (**HM-110A / 120A**)
All-in-one model with simple color touch-panel operation

System B (**HM-110B / 120B**)
A system equipped with automatic reading function with **AVPAK** software

System C (**HM-110C / 120C**)
In addition to the functions of System **B**, System **C** is equipped with an electric stage

System D (**HM-110D / 120D**)
In addition to the functions of System **B** and System **C**, System **D** is equipped with the auto focus function

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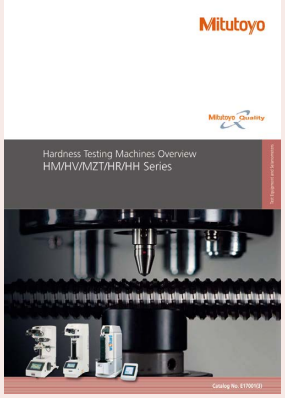

Refer to the Hardness Testing Machines Brochure (**E17001**) for more details.

M

Hardness Testing Machines

Start quality control from the material — Mitutoyo's hardness testing machines can handle it

HR-600
SERIES 810 — Rockwell Hardness Testing Machines

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- A workpiece that cannot be placed on a tester due to its large size can be placed on the table of this product and tested as is. (Maximum loading mass 100 kg)
- The motorized stage makes automatic multi-point testing at multiple places and of multiple workpieces possible.
- Plastic hardness testing is also available in addition to Rockwell/Brinell tests on metal. Brinell and Vickers indentation hardness tests which do not require vision measurement can also be performed.
- The **HR-610A/620A** main unit is operable with the touch panel display and the **HR-620B** is operable with the touch panel display and **AVPAK** software.
- Automatic testing with movement in the X-, Y- and Z-axis directions for a workpiece having uneven surfaces or steps becomes possible by adding an X-axis stage and **AVPAK** software to **HR-620B**. Also, using **FORMEio** software makes possible easy communication with PLCs for automation purposes, such as control of handling devices and work cells.

810-510-11
HR-610A
(Motorized X-axis table is available)

810-525-11
HR-620B
(Equipped with motorized Y-axis table. Motorized X-axis table is also available.)

MeasurLink® ENABLED
Data Management Software by Mitutoyo

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page U-11 for details.

Refer to the **HR-600** Series Brochure (**E17011**) for more details.

SPECIFICATIONS

Order No.		810-510-11	810-510-13	810-511-11	810-511-13	810-512-11	810-512-13	810-520-11	810-520-13	810-521-11	810-521-13	810-522-11	810-522-13	810-525-11	810-526-11	810-527-11
Model		HR-610A						HR-620A						HR-620B		
Unit (display unit)		metric	inch/mm	metric	inch/mm	metric	inch/mm	metric	inch/mm	metric	inch/mm	metric	inch/mm	—	—	—
Indenter type*1		Diamond 1/16" Steel ball		Diamond 1/16" Tungsten carbide ball		—	—	Diamond 1/16" Steel ball		Diamond 1/16" Tungsten carbide ball		—	—	Diamond 1/16" Steel ball	Diamond 1/16" Tungsten carbide ball	—
Hardness testing methods	Rockwell	JIS B 7726, ISO 6508-2, ASTM E18*2														
	Brinell*3	JIS B 7724, ISO 6506-2, ASTM E10														
	Plastic							ISO 2039-1								
		JIS K 7202-2, ISO 2039-2, ASTM D785														
	Indentation Brinell hardness	VDI/VDE 2616														
	Indentation Vickers hardness							VDI/VDE 2616								
Initial test force N (kgf)	Rockwell	29.42 (3) 98.07 (10)														
	Plastic							9.807 (1)								
		98.07 (10)														
	Indentation Brinell hardness	98.07 (10) 490.3 (50)														
	Indentation Vickers hardness							9.807 (1)								
Test force N (kgf)	Rockwell	147.1 (15) 294.2 (30) 441.3 (45) 588.4 (60) 980.7 (100) 1471 (150)														
	Brinell	49.03 (5) to 1839 (187.5)						9.807 (1) to 2452 (250)								
	Plastic							49.03 (5) 132.4 (13.5) 358.0 (36.5) 962.1 (98.1)								
		588.4 (60) 980.7 (100) 1471 (150)														
	Indentation Brinell hardness	612.9 (62.5) 1839 (187.5) 2452 (250)														
	Indentation Vickers hardness							294.2 (30) 490.3 (50)								
Power supply		AC100 to 200 V 50/60 Hz														
Mass		176 kg						181 kg						205 kg		

*1 Supplied as standard.
*2 Please contact us for information on ASTM standards.
*3 For Brinell hardness testing, an indenter (optional) and a measurement microscope are required.
Note: Plastic testing may not be enabled depending on the material. For Brinell hardness, indentation Brinell hardness, and plastic hardness testing, other special accessories are required.

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Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page U-11 for details.

HR-530
SERIES 810 — Rockwell Hardness Testing Machines

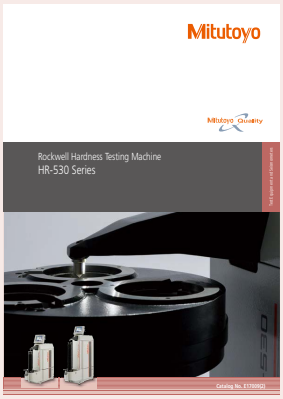
MeasurLink® ENABLED
Data Management Software by Mitutoyo

- Unique electronic control makes the **HR-530** Series of hardness testers extremely versatile by enabling Brinell hardness testing* as well as load-sequence hardness testing of plastics, plus Rockwell and Rockwell Superficial hardness testing.

* For Brinell hardness testing, an indenter (optional) and a measurement microscope are required.

810-331 / 332 / 336 / 337
HR-530L

- This series can test the hardness of the inside wall of a ring, a test that is only possible using ordinary hardness testers by cutting the ring into pieces. (All models)
- The touch-panel display unit can be mounted on top of the tester, providing significant convenience if the machine installation space is restricted. (All models) Use the optional display mounting bracket to mount the unit.
- This series allows numeric display of statistical analysis results such as maximum and minimum values, mean value and graphic display of $\bar{X}$-R control charts and histograms required for hardness evaluation.



Refer to the **HR-530** Series Brochure (**E17009**) for more details.

SPECIFICATIONS

Order No.		810-231*1	810-232*1	810-236*2	810-237*2	810-233-11	810-233-13	810-331*1	810-332*1	810-336*2	810-337*2	810-333-11	810-333-13
Model		HR-530						HR-530L					
Unit (display unit)		metric	inch/mm	metric	inch/mm	metric	inch/mm	metric	inch/mm	metric	inch/mm	metric	inch/mm
Indenter type		1/16" Steel ball		1/16" Tungsten carbide ball		—	—	1/16" Steel ball		1/16" Tungsten carbide ball		—	—
Applicable standards		JIS B 7726, ISO 6508-2											
Hardness testing methods		Rockwell/Rockwell Superficial/Brinell/Plastics hardness											
Initial test force	N(kgf)	29.42 (3) 98.07 (10)											
Test force N(kgf)	Rockwell	588.4 (60) 980.7 (100) 1471 (150)											
	Rockwell Superficial	147.1 (15) 294.2 (30) 441.3 (45)											
	Brinell	61.29 (6.25) 98.07 (10) 153.2 (15.625) 245.2 (25) 294.2 (30) 306.5 (31.25) 612.9 (62.5) 980.7 (100) 1226 (125) 1839 (187.5)											
Power supply		AC100/120/220/240 V Auto-selection											
External dimensions (W×D×H)	Main unit	250×667×621 mm						300×667×766 mm					
	Touch-panel display unit	191×147×71 mm											
Mass		Main unit: Approx. 60 kg Display: Approx. 1.1 kg						Main unit: Approx. 69 kg Display: Approx. 1.1 kg					

*1 1/16" steel ball indenter is equipped as a standard accessory.
*2 1/16" carbide ball indenter is equipped as a standard accessory.
Note: Plastic testing may not be enabled depending on the material.
For Brinell hardness, indentation Brinell hardness, and plastic hardness testing, other special accessories are required.

M

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Hardness Testing Machines

Start quality control from the material — Mitutoyo's hardness testing machines can handle it

HR-100/200/300/400 SERIES 963 — Rockwell Hardness Testing Machines

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- A series of economical Rockwell hardness testing machines. The lineup consists of 5 models including a digital display type and an analog display type.

963-210
HR-110MR

963-241
HR-430MS

SPECIFICATIONS

Order No.	963-210*	963-220*	963-240	963-231	963-241
Model	HR-110MR	HR-210MR	HR-430MR	HR-320MS	HR-430MS
Applicable standards	JIS B 7726, ISO 6508-2				
Supported hardnesses	Rockwell hardness				
	—			Rockwell Superficial hardness	
Preliminary test force N (kgf)	98.07 (10)			29.42 (3) 98.07 (10)	
Test force N (kgf) Rockwell	588.4 (60) 980.7 (100) 1471 (150)				
Test force N (kgf) Superficial	—			147.1 (15) 294.2 (30) 441.3 (45)	
External dimensions (W×D×H) (excluding protrusions and stage)	296×512×780 mm	214×512×780 mm			
Main unit mass	49 kg	46 kg	49 kg	47 kg	50 kg
Power supply	No power required	AC100 to 240 V 1.2 A (DC adapter DC12 V 3.5 A)			

* Models which can be connected to the MeasurLink measurement data network system are only **HR-320MS**, **HR-430MR** and **HR-430MS**.

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Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

PROPRIETARY INSPECTION CERTIFICATE

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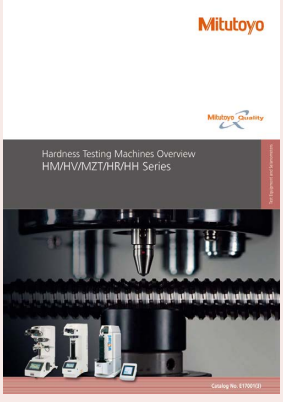

Refer to the Hardness Testing Machines Brochure (**E17001**) for more details.

MeasurLink ENABLED
Data Management Software by Mitutoyo

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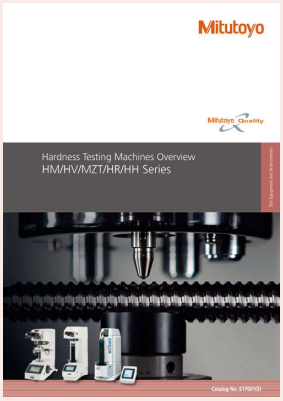


Refer to the Hardness Testing Machines Brochure (**E17001**) for more details.

HARDMATIC HH-411
SERIES 810 — Rebound Type Portable Hardness Tester

MeasurLink ENABLED
Data Management Software by Mitutoyo

- Excellent operability that performs hardness tests with the touch of a key and a compact body allows users to measure hardness in the field. This instrument is best suited for on-site hardness tests such as large molds, railroad track, and welded spots in structures.

SPECIFICATIONS

Order No.	810-299-10	810-299-11	810-298-10	810-298-11
Model	HH-411			
Standard	JIS		ASTM	
Detector	Impact hammer with integrated detector and carbide-ball tip (D type)			
Display unit	7-segment LCD			
Hardness display range	Leeb hardness: 1 to 999 HL			
Display range (This display range varies depending on the conversion table used.)	Vickers hardness: 43 to 950 HV Brinell hardness: 20 to 896 HB Rockwell hardness (C scale): 19.3 to 68.2 HRC Rockwell hardness (B scale): 13.5 to 101.7 HRB		Shore hardness: 30.1 to 99.5 HS Tensile strength: 499 to 1999 MPa	
Power supply	Alkaline AA battery 2 pcs. (battery life: 70 hours) or optional AC adapter	Optional AC adapter	Alkaline AA battery 2 pcs. (battery life: 70 hours) or optional AC adapter	Optional AC adapter
External dimensions/Mass	Detector: ø28×175 mm in length, 120 g Display (W×D×H): 70×110×35 mm, 200 g			

HARDMATIC HH-300
SERIES 811 — Durometers for Sponge, Rubber, and Plastics

MeasurLink ENABLED
Data Management Software by Mitutoyo

Compact type

811-329-10 HH-329
811-335-10 HH-335
811-337-10 HH-337

811-330-10 HH-330
811-336-10 HH-336
811-338-10 HH-338

Long type

811-331-10 HH-331
811-333-10 HH-333

811-332-10 HH-332
811-334-10 HH-334

- Hardness measurement by durometer is simply performed by holding the instrument against the surface of a specimen and reading the indicated value. This type of hardness tester is most widely used for hardness testing of sponge, rubber, plastics and other soft materials.

SPECIFICATIONS

Order No.		811-329-10	811-330-10	811-331-10	811-332-10	811-333-10	811-334-10	811-335-10	811-336-10	811-337-10	811-338-10
Model No.		HH-329*	HH-330	HH-331*	HH-332	HH-333*	HH-334	HH-335*	HH-336	HH-337*	HH-338
Type		Compact		Long				Compact			
Display specification		Analog	Digital	Analog	Digital	Analog	Digital	Analog	Digital	Analog	Digital
Measurement target		Soft rubber, sponge, felt, hard film, winder		General rubber, soft plastic		hard rubber, hard plastic, ebonite		General rubber, soft plastic		hard rubber, hard plastic, ebonite	
Classification by specification		Type E		Type A		Type D		Type A		Type D	
Needle shape	Shaft diameter	—		ø1.25 mm							
	Tip shape	Semi-sphere		Circular truncated cone		Cone		Circular truncated cone		Cone	
	Tip angle	—		35°		30°		35°		30°	
	Tip diameter	ø5 mm		ø0.79 mm		—		ø0.79 mm		—	
	Tip curvature	—		—		0.1 mm		—		0.1 mm	
Power supply		—	Button silver oxide battery SR44	—	Button silver oxide battery SR44	—	Button silver oxide battery SR44	—	Button silver oxide battery SR44	—	Button silver oxide battery SR44
External dimensions (W×D×H)		68×34×146 mm	59×40×147 mm	Analog, long type : 68×35×188 mm Digital, compact type: 59×41×190 mm				Analog, long type : 68×34×146 mm Digital, compact type: 59×40×147 mm			
Mass		300 g	290 g	320 g	310 g	320 g	310 g	300 g	290 g	300 g	290 g

* Models which can be connected to the MeasurLink measurement data network system are only Digital types.

Optional Accessories for Dual-purpose Stand CTS Series

Order No.	811-019	811-012	811-013
Model	CTS-101	CTS-102	CTS-103
Applicable models	HH-331/32	HH-333/34/37/38	HH-335/36

M

Methods of Hardness Measurement

(1) Vickers

Vickers hardness is a test method that has the widest application range, allowing hardness inspection with an arbitrary test force. This test has an extremely large number of application fields particularly for hardness tests conducted with a test force less than 9.807 N (1 kgf). As shown in the following formula, Vickers hardness is a value determined by dividing test force F (N) by contact area S (mm^2) between a specimen and an indenter, which is calculated from diagonal length d (mm, mean of two directional lengths) of an indentation formed by the indenter (a square pyramidal diamond , opposing face angle θ=136˚) in the specimen using a test force F (N). k is a constant ($1/g$=1/9.80665).

$$HV=k\frac{F}{S}=0.102\frac{F}{S}=0.102\frac{2F\sin\frac{\theta}{2}}{d^2}=0.1891\frac{F}{d^2}$$ F: N, d: mm

The error in the calculated Vickers hardness is given by the following formula. Here, Δd_1, Δd_2, and 'a' represent the measurement error that is due to the microscope, an error in reading an indentation, and the length of an edge line generated by opposing faces of an indenter tip, respectively. The unit of $\Delta\theta$ is degrees.

$$\frac{\Delta HV}{HV} \fallingdotseq \frac{\Delta F}{F} - 2\frac{\Delta d_1}{d} - 2\frac{\Delta d_2}{d} - \frac{a^2}{d^2} 3.5\times10^{-3}\Delta\theta$$

(2) Knoop

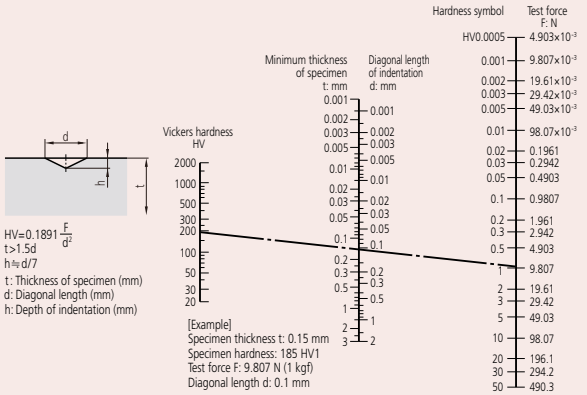
As shown in the following formula, Knoop hardness is a value obtained by dividing test force by the projected area A (mm^2) of an indentation, which is calculated from the longer diagonal length d (mm) of the indentation formed by pressing a rhomboidal diamond indenter (opposing edge angles of 172˚30' and 130˚) into a specimen with test force F applied. Knoop hardness can also be measured by replacing the Vickers indenter of a microhardness testing machine with a Knoop indenter.

$$HK=k\frac{F}{A}=0.102\frac{F}{A}=0.102\frac{F}{cd^2}=1.451\frac{F}{d^2}$$ F: N, d: mm, c: Constant

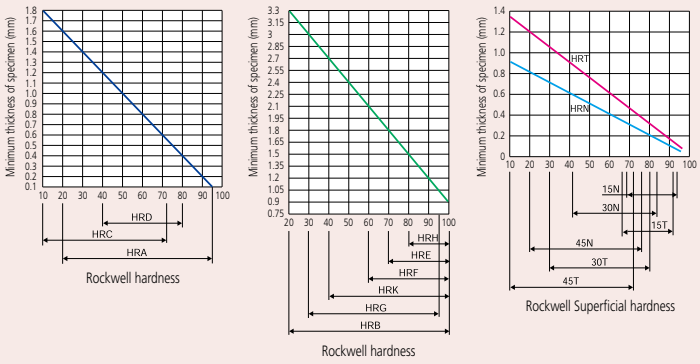
(3) Rockwell and Rockwell Superficial

To measure Rockwell or Rockwell Superficial hardness, first apply a preload force and then the test force to a specimen and return to the preload force using a diamond indenter (tip cone angle: 120˚, tip radius: 0.2 mm) or a sphere indenter (steel ball or carbide ball). This hardness value is obtained from the hardness formula expressed by the difference in indentation depth h (µm) between the preload and test forces. Rockwell uses a preload force of 98.07 N, and Rockwell Superficial 29.42 N. A specific symbol provided in combination with a type of indenter, test force, and hardness formula is known as a scale. Japanese Industrial Standards (JIS) define various scales of related hardness.

Relationship between Vickers Hardness and the Minimum Allowable Thickness of a Specimen



Relationship between Rockwell / Rockwell Superficial Hardness and the Minimum Thickness of a Specimen



Rockwell Hardness Scales

Scale	Indenter	Test force	Application
A	Diamond	588.4 N	Carbide, sheet steel
D		980.7 N	Case-hardened steel
C		1471 N	Steel (100 HRB or more to 70 HRC or less)
F	Sphere of 1.5875 mm diameter	588.4 N	Bearing metal, annealed copper
B		980.7 N	Brass
G		1471 N	Hard aluminum alloy, beryllium copper, phosphor bronze
H	Sphere of 3.175 mm diameter	588.4 N	Bearing metal, grinding wheel
E		980.7 N	Bearing metal
K		1471 N	Bearing metal
L	Sphere of 6.35 mm diameter	588.4 N	Plastic, lead
M		980.7 N	
P		1471 N	
R	Sphere of 12.7 mm diameter	588.4 N	Plastic
S		980.7 N	
V		1471 N	

Rockwell Superficial Hardness Scales

Scale	Indenter	Test force	Application
15-N	Diamond	147.1 N	Thin surface-hardened layer on steel such as carburized or nitrided
30-N		294.2 N	
45-N		441.3 N	
15-T	Sphere of 1.5875 mm diameter	147.1 N	Sheet of mild steel, brass, bronze, etc.
30-T		294.2 N	
45-T		441.3 N	
15-W	Sphere of 3.175 mm diameter	147.1 N	Plastic, zinc, bearing alloy
30-W		294.2 N	
45-W		441.3 N	
15-X	Sphere of 6.35 mm diameter	147.1 N	Plastic, zinc, bearing alloy
30-X		294.2 N	
45-X		441.3 N	
15-Y	Sphere of 12.7 mm diameter	147.1 N	Plastic, zinc, bearing alloy
30-Y		294.2 N	
45-Y		441.3 N	