Featured Products

Micro Vickers Hardness Testing Machines

HM 200 series Type A

Refer to page K-4 for details.

Micro Vickers Hardness Testing Machines

HM-200 Series Type B and Type D

Refer to page K-5 for details.

Vickers Hardness Testing Machines

HV-100 Series

Refer to page K-6 for details.

Rockwell Hardness Testing Machines

HR-300/HR-400

Refer to page K-9 for details.

Rockwell Hardness Testing Machines

HR-530/530L

Refer to page K-10 for details.

Rockwell Hardness Testing Machines

HR-600

Refer to page K-11 for details.

Portable Hardness Testing Instruments

Hardmatic HH-V400

Refer to page K-14 for details.

INDEX

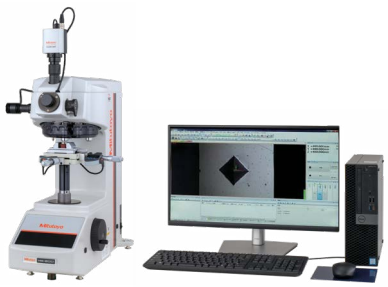
Lineup of Hardness Testing Machines

Hardness testing machines provide the simplest and most economical testing methods among many material testing machines, playing an important role in research activities, production activities, and commercial transactions.

Mitutoyo offers a choice of standard hardness testing machines that are optimal for hard materials such as metals to soft materials such as plastic and rubber, as well as custom-designed testers such as in line-type automatic machines and labor-saving machines required on the shop floor.

Microhardness (Micro-Vickers)

Automatic Vickers Hardness Testing



Rebound Type Portable

Rockwell

Rockwell Superficial

Vickers

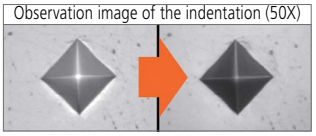
For Rubber and Plastic

Find a Distributor

HM-210 / 220 Type A

SERIES 810 — Micro Vickers Hardness Testing Machines

- The electromagnetic force motor used in the loading mechanism enables the test force to be freely selected (see test force specifications) over the wide range of 0.4903mN to 19610mN (0.05gf to 2 kgf). It is also possible to freely set load dwell times. Now your desire for absolute control over the indentation size in Vickers hardness testing can be satisfied. The HM-200 series always offers the test force most appropriate for the specimen material and shape.
- Newly-designed 'MH Plan' objectives are optimized for measuring indentation images. The lineup includes 6 types of long working distance objectives: 10X, 20X, 50X and 100X for measuring indentation images, and 2X and 5X for enabling wide-range measurement around indentations.
- The long working distance objectives enable a comfortable working distance between the objective and the specimen surface. This greatly reduces the possibility of collision between the specimen and the objective during focusing operations. (e.g. for 50X objectives: 1.1mm for conventional models, 2.5mm for HM-200 series).
- LEDs, which have a longer life, produce less heat, consume less power and are more energy efficient than incandescent bulbs, are employed for the illumination system.
- The motorized turret allows for up to 4 objective lenses and 2 indenter assemblies to be mounted at the same time.



Observation image of the indentation (50X)

Stray light reduction around the indentation

HM-210A

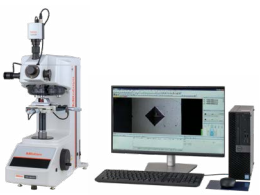
SPECIFICATIONS

TYPE A Digital Hardness Tester

Model No.	HM-210 Type A	HM-210 Type A V/K	HM-220 Type A	HM-220 Type A V/K
Order No.	**64AAB305PA**	**64AAB306PA**	**64AAB307PA**	**64AAB308PA**
Fixed test force (mN)	98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807 (10gf-1000gf)		0.4903, 0.9807, 1.961, 2.942, 4.903, 9.807, 19.61, 29.42, 49.03, 98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807, 19610 (0.05 gf-2kgf)	
Arbitrary test force	≤100 gf in 1 gram increments, > 100gf in 10 gram increments		< 1 gf in .1 gf increments, ≤100 gf in 1 gram increments, > 100gf in 10 gram increments	
Test force control	Force generation by electromagnetic and automatic control (load, dwell, unload)			
Control unit	Color LCD Touch Screen			
Loading rate	60 μ/ sec		60μm/s, Variable between 2 and 60μm/s. ≤ 30 gf.	
Load dwell time	0-999 sec			
Indenter	Vickers	Vickers and Knoop	Vickers	Vickers and Knoop
Objective lenses	10x, 50x	10x, 20x, 50x	10x, 50x, 100x	10x, 50x, 100x
Objective turret	Motor driven and manual operation			
Filar eye piece	Dual Line, 10X, .01μ min			

With TV camera unit 810-454-20A (selectable with HM-210A/220A)

Measurement of indentation dimensions on a TV monitor reduces eye fatigue, which leads to improvement in operation efficiency in multi-point testing.



Technical Data

Test force range:
HM-210A: 9 steps + arbitrary test force
HM-220A: 19 steps + arbitrary test force
Load dwell time: 0 - 999s
Manual XY stage unit
Stage size: 100x100mm
Travel range: 25x25mm
with Digimatic in/mm micrometer heads
Resolution: 0.001mm
Max. specimen height: 133mm (Stage size: 25 x 25mm)
Max. specimen height: 121mm (Stage size: 50 x 50mm)
Max. specimen depth: 160mm (from the center of indenter)
Optical path: 4-port objectives switching system of Infinity-correction optical system
Resolution: 0.01μm (When using objectives of X40 or more)
Data output: Serial interface (RS-232), Digimatic interface, USB 2.0
Power supply: 39VA 100-125/220-240V AC, 50/60Hz
Dimensions: (W x D x H): 315x671x595mm
Mass: 43kg

Optional Accessories (Factory-installed option)

11AAE665: Objective lens unit 2X
11AAE666: Objective lens unit 5X
11AAE667: Objective lens unit 10X
11AAE668: Objective lens unit 20X
11AAE669: Objective lens unit 100X
11AAE677: Measuring microscope (Digital ocular)
11AAE670: Knoop Indenter Assembly (HM-210 Series)
11AAE671: Knoop Indenter Assembly (HM-220 Series)

Optional Accessories

810-454-20A: TV camera unit (8.4 inch LCD)
19BAA058: Diamond indenter for Vickers (HM210 Series standard test force)
19BAA059: Diamond indenter for Vickers (HM220 Series low test force)
19BAA061: Diamond indenter for Knoop (HM210 Series)
19BAA062: Diamond indenter for Knoop (HM220 Series)
810-013: Specimen (thin plate) holder
810-014-1: Specimen (wire) holder
810-015-1: Specimen (wire or ball) holder
810-016: 50 mm Vise
810-017: 100 mm Vise
810-019: Specimen tilting holder
810-020: Universal specimen holder
810-018: Rotary table
810-084: Rotatable universal specimen holder
810-085: Adjustable specimen (thin plate) holder
810-095: Rotatable specimen stage
375-056: Stage Micrometer (glass) Micro-scale
810-650-1: Resin mold specimen stage ø25.4
810-650-2: Resin mold specimen stage ø30
810-650-3: Resin mold specimen stage ø31.75
810-650-4: Resin mold specimen stage ø38.1
810-650-5: Resin mold specimen stage ø40
810-641: Vibration Isolator
810-420: 25x25mm stage (metric only)
810-423: 50x50mm stage (metric only)
810-424: 1"x1" in/mm stage (standard)
810-427: 2"x2" in/mm stage

Power turret with up to 2 indenter mounts and 4 objective mounts (manual operation possible)

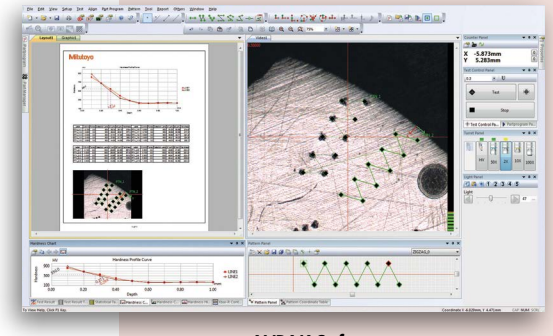
Touch-screen type control panel

K

HM-200 Series with AVPAK software

For semi and fully automatic Type B and D Systems

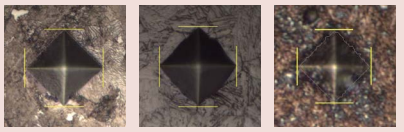
System B (HM-210B/220B)



AVPAK Software

System B is equipped with **AVPAK-10**, a software package that automatically measures the diagonal length of an indentation and calculates the corresponding hardness value. This means that measurement error caused by variation in operator interpretation is eliminated, thereby reducing costs.

Automatic measurement of indentation/ manual stage



Indentation-reading example

System D (HM-210D/220D)

In addition to the functions of System B, System D is equipped with the autofocus function and motorized x-y stage. This function allows for automatic hardness testing, thereby increasing efficiency and reducing labor costs.

Automatic measurement of indentation / motorized XY stage / Autofocusing

System D Technical Data

Motorized X-Y Stage	Travel Max	50 x 50 mm*
	Travel Min	1µ
	Table Size	130 x 130mm
	Speed Max	25mm/ sec
Motorized Focusing Stage	Max Range	1.4mm
	Min Unit	.1µ
	Max Speed	1mm/ sec
Joystick Controller Functions	Functions	X and Y Lock out
	Axis	X, Y and Z (Focus)
	Speed Control	Adjustable H,M,L
	Tester Control	Indent, Turret Position
	Other	Emergency Stop

*Optional 100 x 100 mm

SPECIFICATIONS

TYPE B PC-Driven Test System TYPE D PC-Driven Test System with motorized stage and auto focus

Model No.	HM-210 Type B	HM-210 Type B V/K	HM-220 Type B	HM-220 Type B V/K
Order No.	**64AAB323PA**	**64AAB324PA**	**64AAB325PA**	**64AAB326PA**
Model No.	HM-210 Type D	HM-210 Type D V/K	HM-220 Type D	HM-220 Type D V/K
Order No.	**64AAB380PA**	**64AAB381PA**	**64AAB382PA**	**64AAB383PA**
Fixed test force (mN)	98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807 (10gf-1000gf)		0.4903, 0.9807, 1.961, 2.942, 4.903, 9.807, 19.61, 29.42, 49.03, 98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807, 19610 (0.05 gf-2kgf)	
Arbitrary test force	≤100 gf in 1 gram increments, > 100gf in 10 gram increments		< 1 gf in .1 gf increments, ≤100 gf in 1 gram increments, > 100gf in 10 gram increments	
Test force control	Force generation by electromagnetic and automatic control (load, dwell, unload)			
Control unit	None, By PC*			
Loading rate	60 µ/ sec		60µm/s, Variable between 2 and 60µm/s. ≤ 30 gf.	
Load dwell time	0-999 sec			
Indenter	Vickers	Vickers and Knoop	Vickers	Vickers and Knoop
Objective lenses	10x, 50x	10x, 20x, 50x	10x, 50x, 100x	10x, 50x, 100x
Objective turret	Motor-driven and manual operation			
Filar eye piece	None			
CCTV camera	3 megapixel, 1/2"		3 megapixel, 1/2"	
Software	AV Pak		AV Pak	

*Must use specified PC

Refer to **HM-200** Series Brochure **2055(2)** for more details.

Series 810—Vickers Hardness Testing Machines – Type A

- Heavy load Vickers testing machines feature motorized force selection from 1-50kgf or .3 to 30kgf. Fully adjustable long-life LED illumination runs cool.
- A dual-line filar eyepiece combines with a color touch-screen LCD to create accurate measurements with the touch of a button.
- The motorized turret can accommodate up to 3 long working distance objective lenses for an even wider range of materials and a wide variety of anvils and x-y stages are also available.

HV120 show with optional **810-545-20A** CCTV Camera

Optional Accessories

Lens:

11AAC712	OBJECTIVE LENS 2X
11AAC713	OBJECTIVE LENS 5X
11AAC714	OBJECTIVE LENS 20X
11AAE675	OBJECTIVE LENS 50X
11AAE676	OBJECTIVE LENS 100X

Stage

810-423	MANUAL STAGE 50X50
810-427	MANUAL STAGE 2"X 2"(In/mm)
936937	SPC cable (1m / 40")

Optical

11AAC711	"C" mount CAMERA ADAPTER
810-454-20A	CCTV System

Indenters

19BAA060	DIAMOND INDENTER (VICKERS TYPE)
19BAA063	KNOOP DIAMOND INDENTER
06AFM380D	USB Input Tool Direct for data entry into Excel

SPECIFICATIONS

Model	HV110	HV120
Order No.	**810-441A**	**810-446A**
Test force	9.807N (1kgf),19.61N (2kgf),29.42N (3kgf), 49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf)294.2N (30kgf), 490.3N (50kgf)	2.942N (0.3kgf),4.903N (0.5kgf), 9.807N (1kgf),24.51N (2.5kgf),49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf)294.2N (30kgf)
Supported test method	HV, HK, HB (Light Force*), Kc	
Test force selection	Motorized	
Loading accuracy	±1%	
Load control	60µ/s, 150µ/s Automatic (loading, duration, unloading)	
Load rate	5~999 sec.	
Objective lens	2X, 5X, 10X (standard), 20X, 50X, 100X	
Measuring microscope	10X Dual-line filar	
Total magnification	20-1000X (100X Standard)[1]	
Field of view	1,400µ (10X Lens) Type A	
Minimum reading	< 50x = 0.1µm, ≥50x = 0.01µm	
Display	Color LCD touch-screen	
Scaled conversion:	8 Types (ASTM, ISO, JIS, SAE and BS)	
Statistics:	N, Max., Min., Average, Range, High, Low, Good, Over, Under, SD(n-1), SD(n-1), SD(n) Go/No-go judgment,	
Curvature correction:	0.01 to 200.00mm	
Maximum sample height	210mm Type A	
Maximum sample depth	160mm	
Maximum sample weight	20 Kg Anvil, 10 Kg with x-y Stage	
Optical path	100% Eyetube or Camera	
Output	Rs232, SPC, USB2.0	
Power supply	120 Volt AC/ 60 Hz	
Dimensions main unit (WxDxH)	9.9"x 24.7"x30.7 " (252x627x781mm)	
Mass	110lbs. (50kg)	

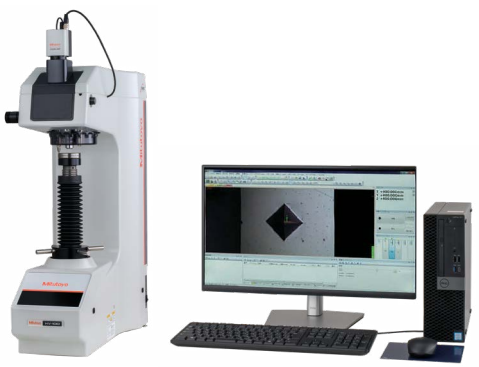
* Optional test forces may be required.
1: 10x eyepiece included.
Contact Mitutoyo for more information.

Got Questions?

HV110 / HV120

Series 810—Vickers Hardness Testing Machines – Type B / D

- The Type B HV110/ HV120 Vickers hardness testers add computer control to make measurements even more repeatable.
- A high-resolution 3 mega-pixel camera produces crisp images that are automatically measured in less than .3 seconds.
- Various software functions such as automatic light intensity, simple-to-use report generator and programming wizards make tedious and repetitive testing requirements more accurate than manual testing and eliminates common operator errors.
- The Type D HV110 / 120 adds a motorized X-Y stage with up to 100mm x 100mm of travel for large samples. A motorized focusing platform is also utilized for a complete walk away system.



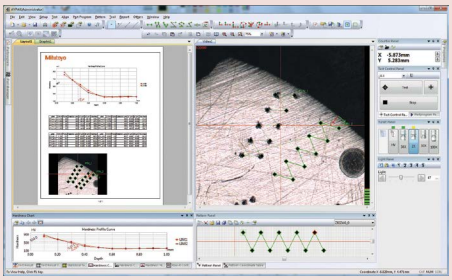
Type B System
show with optional PC

Type D System
show with optional PC

SPECIFICATIONS

Model	HV110 Main Unit Only	HV120 Main Unit Only
Order No.	**810-443A**	**810-448A**
Test force	9.807N (1kgf),19.61N (2kgf),29.42N (3kgf), 49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf)294.2N (30kgf), 490.3N (50kgf)	2.942N (0.3kgf),4.903N (0.5kgf), 9.807N (1kgf),24.51N (2.5kgf),49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf)294.2N (30kgf)
Supported test method	HV, HK, HB (Light Force**), Kc	
Measuring microscope	Optional	
Field of View w/ 10X Lens	590 x 443 µm	
Display	Via PC	
Curvature correction:	0.01 to 200.00mm	
Maximum sample height	172mm Type B, 132mm Type D	
Maximum sample depth	160mm	
Maximum sample weight	10 Kg Type B, 3 kg Type D	
Optical path	100% Eyetube or Camera	
Output	USB2.0	
Mass	110lbs. (50kg)	

*Other specifications as Type A testers
** Optional test forces may be required



Basic Configuration	Type B	Type D
Main Unit	810-443A or 810-448A	810-443A or 810-448A
AVPak-10 Software	11AAE268-USE	11AAE268-USE
PC***	***	***
Automatic Focus Stage		810-465
Motorized X-Y Stage 50x50		810-461-10
Motorized X-Y Stage 100x100		810-462-10

*** PC not included

Talk to Sales

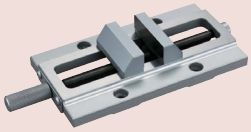
Optional Accessories

Micro-Vickers/Vickers Hardness Testing Machine

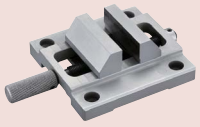
50x50mm travel stage

Manual XY Stage Unit 50 x 50
Manual XY Stage Unit 2"x 2"
810-423 Metric
810-427 Inch/Metric

Clamping devices (Vises)

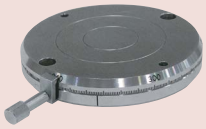


Vise
Max. opening: 3.94"(100mm)
810-017



Vise
Max. opening: 2"(51mm)
810-016

Rotary Table



Rotary Table
810-018

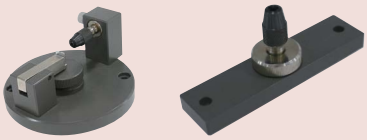
Round Tables

Dimensions: 7.08"(180mm)
810-037

Specimen (thin plate) Holder

Secures a plate with a thickness of .197"(5mm) or less, or foil-like specimens.
810-013

Specimen (wire) Holder



Used to horizontally or vertically secure a wire or needle specimen that has a diameter of .126"(3.2mm) or less.
810-014-1 horizontal
810-015-1 vertical

Test Blocks

Order No.	Description	Load
64HAA375	Vickers 100HV Test Block	100gf
64HAA376	Vickers 200HV Test Block	100gf
64HAA377	Vickers 300HV Test Block	100gf
64HAA378	Vickers 400HV Test Block	100gf
64HAA379	Vickers 500HV Test Block	100gf
64HAA380	Vickers 600HV Test Block	100gf
64HAA381	Vickers 700HV Test Block	100gf
64HAA382	Vickers 800HV Test Block	100gf
64HAA383	Vickers 900HV Test Block	100gf
64HAA384	Vickers 100HV Test Block	300gf
64HAA388	Vickers 500HV Test Block	300gf
64HAA385	Vickers 200HV Test Block	300gf
64HAA386	Vickers 300HV Test Block	300gf
64HAA387	Vickers 400HV Test Block	300gf
64HAA389	Vickers 600HV Test Block	300gf
64HAA390	Vickers 700HV Test Block	300gf
64HAA391	Vickers 800HV Test Block	300gf
64HAA392	Vickers 900HV Test Block	300gf
64HAA393	Vickers 100HV Test Block	500gf
64HAA394	Vickers 200HV Test Block	500gf
64HAA395	Vickers 300HV Test Block	500gf
64HAA396	Vickers 400HV Test Block	500gf
64HAA397	Vickers 500HV Test Block	500gf
64HAA398	Vickers 600HV Test Block	500gf
64HAA399	Vickers 700HV Test Block	500gf
64HAA400	Vickers 800HV Test Block	500gf
64HAA401	Vickers 900HV Test Block	500gf
64HAA402	Vickers 100HV Test Block	1,000gf
64HAA403	Vickers 200HV Test Block	1,000gf
64HAA404	Vickers 300HV Test Block	1,000gf
64HAA405	Vickers 400HV Test Block	1,000gf
64HAA406	Vickers 500HV Test Block	1,000gf
64HAA407	Vickers 600HV Test Block	1,000gf
64HAA409	Vickers 800HV Test Block	1,000gf
64HAA408	Vickers 700HV Test Block	1,000gf
64HAA410	Vickers 900HV Test Block	1,000gf
64HAA411	Knoop 100HK Test Block	100gf
64HAA412	Knoop 200HK Test Block	100gf
64HAA413	Knoop 300HK Test Block	100gf
64HAA414	Knoop 400HK Test Block	100gf
64HAA415	Knoop 500HK Test Block	100gf
64HAA416	Knoop 600HK Test Block	100gf
64HAA417	Knoop 700HK Test Block	100gf
64HAA418	Knoop 800HK Test Block	100gf
64HAA419	Knoop 100HK Test Block	500gf
64HAA420	Knoop 200HK Test Block	500gf
64HAA421	Knoop 300HK Test Block	500gf
64HAA422	Knoop 400HK Test Block	500gf
64HAA423	Knoop 500HK Test Block	500gf
64HAA424	Knoop 600HK Test Block	500gf
64HAA425	Knoop 700HK Test Block	500gf
64HAA426	Knoop 800HK Test Block	500gf
64HAA427	Knoop 100HK Test Block	1,000gf
64HAA428	Knoop 200HK Test Block	1,000gf
64HAA429	Knoop 300HK Test Block	1,000gf
64HAA430	Knoop 400HK Test Block	1,000gf
64HAA431	Knoop 500HK Test Block	1,000gf
64HAA434	Knoop 800HK Test Block	1,000gf
64HAA432	Knoop 600HK Test Block	1,000gf
64HAA433	Knoop 700HK Test Block	1,000gf
64HAA435	Vickers 100HV Test Block	10kgf
64HAA436	Vickers 200HV Test Block	10kgf
64HAA437	Vickers 300HV Test Block	10kgf
64HAA438	Vickers 400HV Test Block	10kgf
64HAA439	Vickers 500HV Test Block	10kgf
64HAA440	Vickers 600HV Test Block	10kgf
64HAA441	Vickers 700HV Test Block	10kgf
64HAA442	Vickers 800HV Test Block	10kgf
64HAA443	Vickers 100HV Test Block	30kgf
64HAA444	Vickers 200HV Test Block	30kgf
64HAA445	Vickers 300HV Test Block	30kgf
64HAA446	Vickers 400HV Test Block	30kgf
64HAA447	Vickers 500HV Test Block	30kgf
64HAA448	Vickers 600HV Test Block	30kgf
64HAA449	Vickers 700HV Test Block	30kgf
64HAA450	Vickers 800HV Test Block	30kgf

*Other hardness ranges and test forces available

Indenters

Order No.	Type	Model
19BAA058	Vickers Indenter	HM-210 Series
19BAA059	Vickers Indenter	HM220
19BAA061	Knoop Indenter	HM-210 Series
19BAA062	Knoop Indenter	HM220
19BAA060	Vickers Indenter	HV Series
19BAA063	Knoop Indenter	HV Series

Universal Specimen Holder

Used to secure a specimen that has a measuring surface that is hard to stabilize perpendicular to the indenter axis.

810-020

Mounted Specimen Vise

1.5" (39mm) Max Height	Diameter	
810-650-1	1"	25.4mm
810-650-2		30mm
810-650-3	1.25"	31.75mm
810-650-4	1.5"	38.1mm
810-650-5		40mm

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Mitutoyo

Rockwell Hardness Testing Machines

HR-300/400 Series

HR-320MS

Dual type (Rockwell/ Rockwell superficial) hardness testing machine

Changing of weights is required. Motor drive controls loading sequence. Loading navigator provides feedback for applying preliminary force.

HR-430MR

Rockwell hardness testing machine

Equipped with automatic brake handle for auto start feature. Motor drive controls loading sequence.

HR-430MS

Dual type (Rockwell/ Rockwell superficial combined use) hardness testing machine

Equipped with automatic brake handle for auto start feature. Motor drive controls loading sequence.

The digital type (HR-430MR and HR-430MS) with the adoption of the automatic brake handle and load sequence.

Features

- The newly designed frame provides maximum clearance for positioning the workpiece. A flat table is all that is needed for mounting these testing machines.
- The digital type (HR-320MS, HR-430MR and HR-430MS) has digimatic output and our Digimatic Mini-Processor (DP-1VA LOGGER) to print and input tools (USB-ITN-E) to connect to a PC and use for data transfer.

SPECIFICATIONS

Model		HR-320MS	HR-430MR	HR-430MS
Order No		**810-192-31A**	**810-193-31A**	**810-193-31A**
Type of hardness test		Rockwell		
		Rockwell superficial	–	Rockwell superficial
Preliminary test force (N)		29.42, 98.07 (3Kgf, 10Kgf)	98.07 (10Kgf)	29.42, 98.07)3Kgf, 10Kgf)
Test force (N)	Superficial	147.1, 294.2, 441.3 (15Kgf, 30Kgf, 45Kgf)	–	147.1, 294.2, 441.3 (15Kgf, 30Kgf, 45Kgf)
	Rockwell	588.4, 980.7, 1471 (60Kgf, 100Kgf, 150Kgf)		
Standard		IS B 7726 ISO6508-2 ASTM E18		
Display		Digital		
Minimum reading		0.1 HR graduation		
Preliminary test force (handling support)		Loading navigator indication	Automatic brake handle	
Preliminary test force setting		Dial Switching	–	Dial switching
Total test force setting		Weight change	Dial switching	
Total test force control		Motor drive, Button start	Motor drive, Automatic start	
Test force duration		3-5.5 s setting, Manual	1-99 s setting, Manual	
Maximum specimen dimensions		Height 180 mm (100 mm if the cover is attached), depth 165 mm (from indenter axis to the frame)		
Function		Success or failure decision function		
		Offset revision function		
		Hardness converstion function		
Data output		Digimatic RS-232C		
Power supply		AC Input : 100-240 V, 50-60 Hz, 1.8 A, DC Output: 12 V – 4.17 A		
Dimensions		214 (W) x 512 (D) x 780 (H) mm		
Mass		Approximately 47kg	Approximately 50kg	

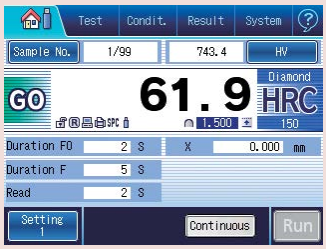
Hardness Testers are compliant with ASTM requirements
810-192-21A and **810-194-21A** come with diamond indenter, 1/16" carbide ball indenter, HRC30 Block, HRC63 Block, HRBW95 Block, HR30N 60 Block and HR30TW 70 Block
810-193-31A comes with diamond indenter, 1/16" carbide ball indenter, HRC30 Block, HRC63 Block, and HRBW95 Block

HR-530
(810-233-33A)

SERIES 810 — Rockwell Type Hardness Testing Machines

- Closed Loop Test Force Control allows for a wide variety of hardness testing including Rockwell, Superficial and Light Force Brinell (6.25 to 187.5 kgf).
- Hardness testing of plastics according to ASTM D785 (Proceedure A and B) and ISO 2039-2 are also possible.
- Projected nose type tester allows testing of interior parts
- 5 display formats are possible to show you the information you need. Statistics and graphs can also be displayed on the color touch screen control panel.
- Machine, blocks, and indenters are ASTM E18 compliant.
- Simple-to-use automatic brake-start system begins the test automatically when initial force is reached
- The HR-530 is available in 9.8" (250mm) or 15.5" (395mm) height capacity models.
- Complete with a combination diamond indenter, a 1/16" carbide ball indenter, one flat and one V anvil, 2 HRC, 1 HRBW, 1 HR30TW and 1 HR30N test block.

5.7-inch color LCD



Standard operating display

SPECIFICATIONS

Model		HR-530	HR-530L
Order No.		**810-233-33A**	**810-333-33A**
Hardness testing methods		Rockwell/Rockwell Superficial/Brinell/Plastics hardness	
Initial test force (N)		29.42N (3kgf), 98.07N (10kgf)	
Test force (N)	Rockwell Superficial	147.1N (15kgf), 294.2N (30kgf), 441.3N (45kgf)	
	Rockwell	588.4N (60kgf), 980.7N (100kgf), 1471N (150kgf)	
	Light Force Brinell	61.29 (6.25kgf), 98.07 (10kgf), 153.2 (15.625kgf), 245.2 (25kgf), 294.2 (30kgf), 306.5 (31.25kgf), 612.9 (62.5kgf), 980.7 (100kgf), 1226 (125kgf), 1839 (187.5kgf)	
Test force control		Automatic (load/hold/unload)	
Table up/down mechanism		Manual (automatic braking and load sequencing)	
Control unit		Color touch-panel	
Test force switching		Operated with the display unit	
Test force hold time		1 to 120s (Selectable in units of 1s)	
Maximum specimen size		Height: 9.8" (250 mm) Depth: 5.9" (150 mm)	Height: 15.5" (395 mm) Depth: 5.9" (150 mm)
Permissible inside diameter of a tube specimen		Minimum hole diameter: 1.38" (35 mm) (when using the special indenter: .87" (22 mm))	
Maximum table loading		45 lb (20 kg)	
Ball indenter		Tungsten carbide ball indenter	
Unit (display unit)		inch	
Display		Hardness value, test condition, go/no-go judgment result, statistical calculation result, X-R control chart, hardness conversion value	
		Conversion function [HV, HK, HR (Rockwell hardness A, B, C, D, F, G / Rockwell Superficial 15T, 30T, 45T, 15N, 30N, 45N), HS, HB, tensile strength]	
		Go/no-go judgment function	
		Continuous test function (for specimens with the same thickness)	
		Cylindrical correction, spherical correction, offset correction, multi-point correction functions	
		Statistical calculation function (maximum value, minimum value, mean value, standard deviation, upper limit value, lower limit value, go count, range, no-go count)	
		Graph generation function (X-R control chart)	
Language support		Japanese, English, German, French, Italian, Spanish, Korean, Chinese (simplified characters/traditional characters), Turkish, Portuguese, Hungarian, Polish, Dutch and Czech	
External data output		RS-232C, SPC, USB2.0	
Power supply		AC120V	
External dimensions	Main unit	9.84" x 26.38" x 23.82" (250(W)×667(D)×621(H) mm)	11.8" x 26.2" x 30.1" (300(W)×667(D)×766(H) mm)
	Touch-panel display	191(W)×147(D)×71(H) mm	
Mass		Approx. 60 kg	Approx. 69 kg

Note: Plastic testing may not be enabled, depending on the material.

Fine-adjustment table for Jominy testing
810-700

Optional Accessories: See page K-11, 12

Function: Touch-screen type
- Touch-screen operation with a back-lit LCD graphic display.
- Remote selection of the test force linked to the hardness scale selection.
- Choice of message language in English, German, French, Spanish, Italian and Japanese.
- Cylindrical and spherical surface compensation.
- Data offset.
- Conversion to other hardness scales.
- Powerful statistical processing with flexible data point editing and 1024 data memory.
- Measured data editing
- Go/no-go tolerance judgment.
- Statistical processing, histogram and $\bar{x}$-R chart

Hardness Testing Machines

HR-600
SERIES 810 — CNC Rockwell Hardness Testing Machines

- A workpiece that cannot be placed on a tester due to its large size can be placed on the stage 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.
- ASTM E18 compliant
- The **HR-610A**/**620A** is operable with a touch panel display (some functions are operable with **AVPAK** software) and the **HR-620B** is operable with a touch panel display and **AVPAK** software.
- Automatic testing by moving in the X-, Y- and Z-axis directions for workpieces with uneven surfaces or steps is made possible by adding X-axis stage and **AVPAK** software to **HR-620B**, which is equipped with a motorized Y-axis stage as standard. Also, using **FORMEio** software makes easy communication with PLCs for automation purposes, such as control of handling devices and work cells, possible.

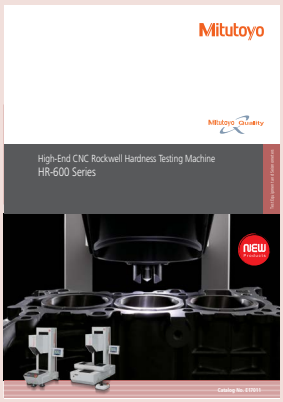
HR-610A
(Motorized X-axis stage is available)

HR-620B
(With a motorized Y-axis stage as standard and an optional motorized X-axis stage)

SPECIFICATIONS

Model		HR-610A	HR-620A	HR-620B
Order No.		**810-512-23A**	**810-522-23A**	**810-527-21A**
Unit (display unit)		Rockwell/Rockwell Superficial/Brinell/Plastics hardness		
Indenter type *1		Diamond indenter and 1/16th inch carbide ball indenter		
Test force range		29.42 - 1839 N (3 - 187.5 kgf)	9.807 - 2452 N (1 - 250 kgf)	
Specimen height (Z-axis stroke)		40 - 250 mm		
Testable workpieces	Minimum surface dimensions	18 × 4 mm		
	Minimum inner diameter of pipe-type workpiece	ø400 mm		
	Concave workpiece	R25 mm or more, Height 20 mm or less		
	Minimum outside diameter	ø20 mm (See Figure 4)		
Z-axis speed		Approx. 10 mm/s		
Maximum depth (from indenter center)		220 mm		
X-axis stroke		None (Option: 160 mm or 300 mm)		
Y-axis stroke		None		160 mm (±80 mm)
Y-axis speed		–		Approx. 50 mm/s
Y-axis feed error		–		±0.1 mm or less
Maximum table loading		100 kg		
Power supply		AC100 - 200 V 50/60 Hz		
Mass		176 kg	181 kg	205 kg

Hardness Testers are compliant with ASTM requirements
All HR-600 machines come with diamond indenter, 1/16" carbide ball indenter, HRC30 block, HRC 63 block, HRBW 95 block, HR30N 60 block, and HR30TW 70 block

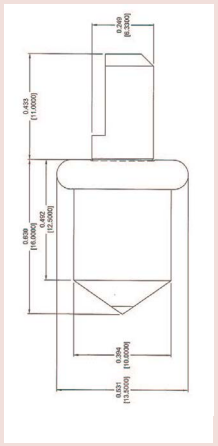


Refer to the **HR-600** Series Brochure (**2295**) for more details.

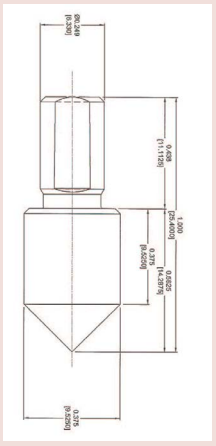
Optional Accessories

Rockwell Type Diamond Indenters

Scale	Mitutoyo Round Style Order No.	Universal w/ Flat Style Order No.
C	64HAA105	64HAA100
N	64HAA106	64HAA101
C&N	64HAA107	64HAA104
A		64HAA102
"A" for Carbides		64HAA103



Round Style



Universal with Flat

Where to Buy

Test Blocks and Diamond Indenters

Test Blocks

Rockwell Test Blocks

Order No.	Hardness
64HAA145	HRA22 Rockwell Test Block
64HAA147	HRA30 Rockwell Test Block
64HAA149	HRA39 Rockwell Test Block
64HAA151	HRA49 Rockwell Test Block
64HAA153	HRA63 Rockwell Test Block
64HAA155	HRA68 Rockwell Test Block
64HAA157	HRA73 Rockwell Test Block
64HAA159	HRA78 Rockwell Test Block
64HAA161	HRA83 Rockwell Test Block
64HAA163	HRBW0 Rockwell Test Block
64HAA164	HRBW10 Rockwell Test Block
64HAA165	HRBW20 Rockwell Test Block
64HAA166	HRBW30 Rockwell Test Block
64HAA167	HRBW40 Rockwell Test Block
64HAA168	HRBW50 Rockwell Test Block
64HAA169	HRBW60 Rockwell Test Block
64HAA170	HRBW70 Rockwell Test Block
64HAA171	HRBW80 Rockwell Test Block
64HAA172	HRBW95 Rockwell Test Block
64BAA124	HRC40/45 Rockwell Test Block
64BAA123	HRC30/35 Rockwell Test Block
64BAA158	HRC20/25 Rockwell Test Block
64HAA173	HRC25 Rockwell Test Block
64HAA174	HRC30 Rockwell Test Block
64HAA175	HRC35 Rockwell Test Block
64HAA176	HRC40 Rockwell Test Block
64HAA177	HRC45 Rockwell Test Block
64HAA178	HRC50 Rockwell Test Block
64HAA179	HRC55 Rockwell Test Block
64HAA180	HRC60 Rockwell Test Block
64HAA181	HRC63 Rockwell Test Block
64HAA182	HRC65 Rockwell Test Block
64HAA183	HRC67 Rockwell Test Block
64HAA193	HREW57 Rockwell Test Block
64HAA194	HRE62 Rockwell Test Block
64HAA195	HRE68 Rockwell Test Block
64HAA196	HRE75 Rockwell Test Block
64HAA197	HRE81 Rockwell Test Block
64HAA198	HRE87 Rockwell Test Block
64HAA199	HRE93 Rockwell Test Block
64HAA200	HRE99 Rockwell Test Block
64BAA156	HR15T61/63 Rockwell Test Block

* Please inquire for other hardness ranges

Test Blocks

Superficial Test Blocks

Order No.	Hardness
64HAA251	HR15N 72 Rockwell Test Block
64HAA253	HR15N 78 Rockwell Test Block
64HAA255	HR15N 83 Rockwell Test Block
64HAA257	HR15N 88 Rockwell Test Block
64HAA259	HR15N 91 Rockwell Test Block
64HAA261	HR15N 94 Rockwell Test Block
64HAA262	HR30N 46 Rockwell Test Block
64HAA264	HR30N 55 Rockwell Test Block
64HAA266	HR30N 64 Rockwell Test Block
64HAA268	HR30N 73 Rockwell Test Block
64HAA270	HR30N 80 Rockwell Test Block
64HAA272	HR30N 86 Rockwell Test Block
64HAA273	HR45N 25 Rockwell Test Block
64HAA276	HR45N 43 Rockwell Test Block
64HAA278	HR45N 55 Rockwell Test Block
64HAA280	HR45N 67 Rockwell Test Block
64HAA282	HR45N 72 Rockwell Test Block
64HAA284	HR15TW 61 Rockwell Test Block
64HAA286	HR15TW 67 Rockwell Test Block
64HAA288	HR15TW 73 Rockwell Test Block
64HAA290	HR15TW 80 Rockwell Test Block
64HAA292	HR15TW 86 Rockwell Test Block
64HAA294	HR30TW 15 Rockwell Test Block
64HAA296	HR30TW 28 Rockwell Test Block
64HAA298	HR30TW 43 Rockwell Test Block
64HAA300	HR30TW 56 Rockwell Test Block
64HAA302	HR30TW 70 Rockwell Test Block
64HAA304	HR45TW 2 Rockwell Test Block
64HAA306	HR45TW 23 Rockwell Test Block
64HAA308	HR45TW 42.5 Rockwell Test Block
64HAA310	HR45TW 67 Rockwell Test Block
64HAA278	HR45N 55 Rockwell Test Block
64HAA280	HR45N 67 Rockwell Test Block
64HAA282	HR45N 72 Rockwell Test Block

Calibration Set

Order No. 64HAA462	Order No. 64HAA463	Order No. 64HAA464	Order No. 64HAA465
HRC Scale	HRBW Scale	HR30N Scale	HR30TW Scale
Test Blocks	Test Blocks	Test Blocks	Test Blocks
64HAA181	64HAA172	64HAA270	64HAA303
64HAA177	64HAA170	64HAA266	64HAA301
64HAA173	64HAA168	64HAA262	64HAA299
Universal Style Indenter with Flat			
64HAA100	64HAA119	64HAA101	64HAA119

Carbide Ball Indenters

Description	Mitutoyo Round Style Order No.	Universal w/ Flat Style Order No.	Tapered w/Flat Style Order No.
1/16" Carbide ball indenter	64HAA120	64HAA119	64HAA129
1/8" Carbide ball indenter		64HAA122	
1/4" Carbide ball indenter		64HAA124	
1/2" Carbide ball indenter		64HAA126	
1/16" Carbide ball (10pc.)		64HAA131	
1/8" Carbide ball (1pc.)		64HAA133	
1/4" Carbide ball (1pc.)		64HAA135	
1/2" Carbide ball (1pc.)		64HAA137	

Steel Indenters/Balls Available Upon Request

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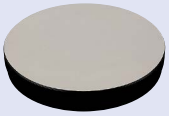
Optional Accessories

For Rockwell/Rockwell Superficial Type Hardness Testing machine

Round table
810-038 Outside ø250 mm

For large specimens such as molded items

Round table
810-037 Outside ø180 mm



For large specimens such as molded items

V-anvil (large)
810-040
(Outside ø40 mm,
Groove width 30 mm)

For round specimens (max. ø60 mm)

V-anvil (small)
810-041
(Outside ø40 mm,
Groove width 6 mm)

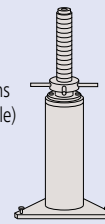
For shaft materials (max. ø8.4 mm)

Spot anvil
810-043
(Outside ø12 mm)

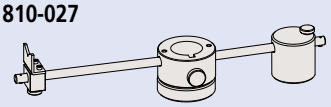
Spot anvil
810-044
(Outside ø5.5 mm)

For sheet specimens

Jack rest
810-028
For supporting long specimens
(Used with anvil or round table)

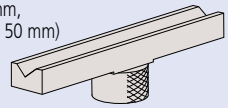


VARI-REST
810-027



For testing long specimens (commonly used for the anvil)

Special V-anvil
810-029
(Length 400 mm,
Groove width 50 mm)



For round specimens ø14-98 mm

Diamond-spot anvil
810-030
(Outside ø10 mm)
For sheet specimens

*Dedicated to the Rockwell Superficial hardness test

Small V-anvil
810-042
(Outside ø10 mm)

For round specimens (max. ø16 mm)

Testing machine table
11AAD186
Supplied with
stability bracket

Vibration isolator
810-643
Only for mounting hardness testing machines

Foot switch
11AAD537

Digimatic mini-processor
DP-1VA
264-505A

Connection cable not supplied. (To be ordered separately.)

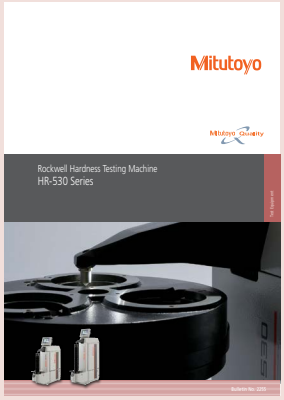
937386

936937

Optional Accessories

HM200 and HR-530 Series:

06AFM380D: USB input tool – Tester to PC
936937: Tester to DP1-VA Printer



Refer to **HR-530** Series Brochure (**2255**) for more details.

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Hardmatic HH-V400

SERIES 810 — Impact Type Hardness Testing Unit

HH-V400 is Mitutoyo's newly designed rebound-type portable tester for metals with a compact body & high operability.

- LCD Interface
- Ability to store 1800 measurements
- Maintain up to 100 control groups
- Preform statistical analysis on measured data
- Rechargeable - No Batteries Required

810-306: HH-V400 ASTM compliant rebound tester

Includes Display unit - **11AAE901** & D Type Detector **11AAE902**

Standard Accessories

11AAE901: Display unit
12BAS450: AC adapter
12BAS451: USB 2.0 cable (Type A-C)
11BAB687: Handle
11AAA857: Small support ring (ø14 mm)
05CAA952: Phillips screwdriver
11PAA429: Storage box
99MBG538B: Quick start guide
99MBG537A: Instruction manual

Optional Accessories

11AAE902: Detector D
11AAE903: Detector DC
11AAE904: Detector D +15
11AAE905: Detector DL
11AAD240: Hardness test block
19BAA248: Support ring for convex cylindrical surfaces (R10 to 20 mm)
19BAA249: Support ring For concave cylindrical surfaces (R14 to 20 mm)
19BAA250: Support ring for convex spherical surfaces (R10 to 27.5 mm)
19BAA251: Support ring for concave spherical surfaces (R13.5 to 20 mm):)
19BAA457: Carbide ball for Detectors D, DC, and D +15
19BAA458: Replacement ball shaft for Detector DL

Calibration Blocks

64HAA467: 520 HLD range leeb hardness standard
64HAA468: 630 HLD range leeb hardness standard
64HAA469: 730 HLD range leeb hardness standard
64HAA470: 800 HLD range leeb hardness standardl

Get a Quote

SPECIFICATIONS

Model		HH-V400
Order No.		**810-306**
Testing hardness and range		Leeb hardness: 100.0 to 999.9 HLD
Testing direction		Omnidirectional (with automatic angle-correcting function)
Hardness scale conversion function* (Conversion range varies depending on material)		Vickers hardness: 43 to 950 HV
		Brinell hardness: 20 to 655 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 (ASTM) 13.2 to 98.6 HS (JIS)
		Tensile strength: 390 to 1999 MPa
Sample conditions		Minimum thickness: 5 mm
		Minimum mass: 5 kg
		Testing position: At least 5 mm from the edge of the sample and at least 3 mm between test points
		Surface roughness: Ra 2.0 or less
Functions		Automatic angle correction, offset setting, acceptance judgment, hardness scale conversion, data memory storage (1800 points), statistical calculation function, eco mode, auto power-off, backlight
Detector	Type	Detector D (standard type), impact hammer, with carbide ball at the tip
	Dimensions	ø28 x 175 mm (excluding cable)
	Mass	Approx. 150 g
Display unit	Screen	2.83'' (240 x 320 pixels), RGB color LCD
	Dimensions	174 x 68 x 32 mm
	Mass	Approx. 250 g
Power supply		C adapter, built-in battery (Ni-MH) (Up to 8 hours of operation after 100 minutes of charging)

* HH-V400 guarantees the indicated values based on Leeb hardness. Converted values are for reference only.

Detector Convversion Ranges

Detector D, DC

Material	HV/Vickers	HB/Brinell	HRC/Rockwell C	HRB/Rockwell B	HS (ASTM)/Shore	VHS (JIS)/Shore	MPa/Tensile strength
Iron and steel	80 to 940	80 to 647	20.0 to 68.0	38.4 to 99.5	30.1 to 99.5	13.2 to 98.0	390 to 1999
Alloyed tool-steel	80 to 898	—	20.4 to 67.1	—	—	—	—
Gray iron	—	93 to 334	—	—	—	—	—
Spherical graphite cast iron	—	131 to 387	—	—	—	—	—
Stainless steel	85 to 802	85 to 655	19.6 to 62.4	46.5 to 101.7	—	—	—
Brass	43 to 196	40 to 173	—	13.5 to 95.3	—	—	499 to 701
Casting copper-based alloys	—	45 to 315	—	—	—	—	—
Casting aluminum-based alloys	—	20 to 159	—	—	—	—	—
Copper-tin-based alloys	—	60 to 290	—	—	—	—	—

Detector D +15

Material	HV/Vickers	HB/Brinell	HRC/Rockwell C	HRB/Rockwell B	HS (ASTM)/Shore	VHS (JIS)/Shore	MPa/Tensile strength
Iron and steel	80 to 937	80 to 638	19.3 to 67.9	—	33.3 to 99.3	35.3 to 97.8	394 to 1991
Tool steels for cold-work	80 to 935	—	19.8 to 68.2	—	—	—	—

Detector DL

Material	HV/Vickers	HB/Brinell	HRC/Rockwell C	HRB/Rockwell B	HS (ASTM)/Shore	VHS (JIS)/Shore	MPa/Tensile strength
Iron and steel	80 to 950	81 to 638	20.6 to 68.2	37.0 to 99.9	30.6 to 96.8	32.3 to 98.6	390 to 1976

K

Hardmatic HH-300

SERIES 811 — Durometers for Rubber and Plastics Hardness Testing

Digital / Dial Durometers are suitable for testing the nature of the following materials like natural rubber, neoprene, polyesters, P.V.C., leather, nitrite rubber, wax, vinyl, cellulose acetates, glass polystyrene, etc.

Compact Digital
Compact Dial

811-336-10
811-335-10

Long Leg Digital
Long Leg Dial

811-332-10
811-331-10

Technical Data

- Designed in accordance with the ASTM D 2240, ISO868, ISO 7619, DIN 53 505, JIS K 6253, and JIS K 7215 specifications.
- Units are available in both Shore A and Shore D scales, and will test a wide variety of applications.
- The Digital Durometer is provided with data hold function, permitting the operator to make an error-free reading on the LCD screen.
- The Dial Durometer is provided with a peak retaining hand for error-free reading.

SPECIFICATIONS

Model No.	Digital	HH-330	HH-336	HH-336	HH-332	HH-338	HH-338	HH-334
	Dial	HH-329	HH-335	HH-335	HH-331	HH-337	HH-337	HH-333
Order No.	Digital	**811-330-10**	**811-336-10**	**811-336-11**	**811-332-10**	**811-338-10**	**811-338-11**	**811-334-10**
	Dial	**811-329-10**	**811-335-10**	**811-335-11**	**811-331-10**	**811-337-10**	**811-337-11**	**811-333-10**
Scale		Shore E	Shore A			Shore D		
Applications		Soft Rubber, Sponge, Felt, Hard Foam	Natural rubber, soft elastomers, etc.			Hard elastomers, plastics, hard rubber, ebonite, etc.		
Resolution		0.1 (digital) or 1 (dial)				0.1 (digital) or 1 (dial)		
Range		HA: 10 - 90				HD: 20 - 90		
Standards	ASTM D 2240	—	3	3		3	3	
	ISO 868	—	3	3		3	3	
	ISO 7619	—	3	3		3	3	
	DIN 53 505	—	—	3		—	3	
	JIS K 6253	3	3	3		3	3	
	JIS K 7215	—	3	3		3	3	
Pressure foot		44 x 18mm	44 x 18mm	ø18mm		44 x 18mm	ø18mm	
Spring force (mN)		WE=550+HE	WA=550+75HD (HA:Reading 10-90)			WD=444.5HD (HD:Reading 20-90)		
Indenter		Sphere (Tip diameter: 0.79mm)	Blunt taper (Tip diameter: 0.79mm)			Sharp point (Tip curvature: 0.1±0.01mm)		
Tip angle		—	35°±0.25°			30°±0.5°		
Indenter diameter		5mm	1.25mm					
Indenter protrusion		2.5mm						
Functions		Digital: Data hold, Zero -setting, SPC output, Power ON/OFF (Power supply: SR44 x 1pc.) Analog Durometer: Peak retaining hand						
Type		Compact	Compact		Long-leg	Compact		Long-leg
Dimensions (WxDxH)	Digital	60 x 28.5 x 151	60 x 28.5 x 151mm		60 x 28.5 x 193mm	60 x 28.5 x 151mm		60 x 28.5 x 193mm
	Dial	56 x 33.5 x 144mm	56 x 33.5 x 144mm		56 x 33.5 x 186mm	56 x 33.5 x 144mm		56 x 33.5 x 186mm
Mass	Digital	290g	290g		310g	290g		310g
	Dial	300g	300g		320g	300g		320g

K

Test Block Set

Testing stand applications

These stands are used to mount Durometers. They allow constant-pressure hardness measurement by pressing the Durometer vertically on a workpiece.

- Anyone can perform repeatable hardness measurement due to fewer possibilities of human error and measurement variations.
- The supplied weights can be attached directly to a Durometer and allow constant-pressure hardness measurement of large samples for which a stand cannot be used.
- The supplied weights are used for calibrating the spring tension of Durometers.

64AAA964

64AAA963

905693

811-332-10

264-505A

Order No.	Description
64AAA964	Calibration Set (Shore A Scale) Test Block 30* DURO (Blue) Test Block 60* DURO (Yellow) Test Block 90* DURO (Gray) Mahogany Box
64AAA590	Calibration Set (Shore D Scale) Test Block 20* DURO (Blue) Test Block 40* DURO (Gray) Test Block 80* DURO (Black)
64AAA962	"A" Scale Durometer Stand
64AAA794	"A" Scale Durometer Stand with Air Damper
64AAA796	Combination "D" & "A" Scale Durometer Stand
64AAA963	O-Ring Fixture Set 1/16", 3/32", 1/8", 3/16" and 1/4" O-Ring cross sections
264-505A	Digimatic Miniprocessor with printer
905693	Connecting Cable 40" (1m) for Durometer and Digimatic Miniprocessor

* Values shown are nominal only. Test Block Size 2" x 2" x 1/4"

Need Support?

Hardness Testing Machines

Hardness Test Methods and Guidelines for Selection of a Hardness Testing Machine

Material / Test Method	Micro Vickers	Micro surface material characteristics	Vickers	Rockwell	Rockwell Superficial	Durometer	Rebound type portable	Brinell	Shore
IC wafer	●	●							
Carbide, ceramics (cutting tool)		▲	●	●					
Steel (heat-treated material, raw material)	●	▲	●	●	●		●		●
Non-ferrous metal	●	▲	●	●	●		●		
Plastic		▲		●		●			
Grinding wheel				●					
Casting								●	
Sponge, rubber						●			
Shape									
Thin metal sheet (safety razor, metal foil)	●	●	●		●				
Thin film, plating, painting, surface layer (nitrided layer)	●	●							
Small parts, acicular parts (clock hand, sewing-machine needle)	●	▲							
Large specimen (structure)							●	●	●
Metallic material configuration (hardness for each phase of multilayer alloy)	●	●							
Plastic plate	▲	▲		●		●			
Sponge, rubber plate						●			
Inspection, judgment									
Strength or physical property of materials	●	●	●	●	●	●	▲	●	●
Heat treatment process	●		●	●	●		▲		▲
Carburized case depth	●		●						
Decarburized layer depth	●		●		●				
Flame or high-frequency hardening layer depth	●		●	●					
Hardenability test			●	●					
Maximum hardness of a welded spot			●						
Weld hardness			●	●					
High-temperature hardness (high-temperature characteristics, hot-workability)			●						
Fracture toughness (ceramics)	●		●						

Key: ● Well-suited ▲ Reasonably suited

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 9.807N (1kgf). 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.

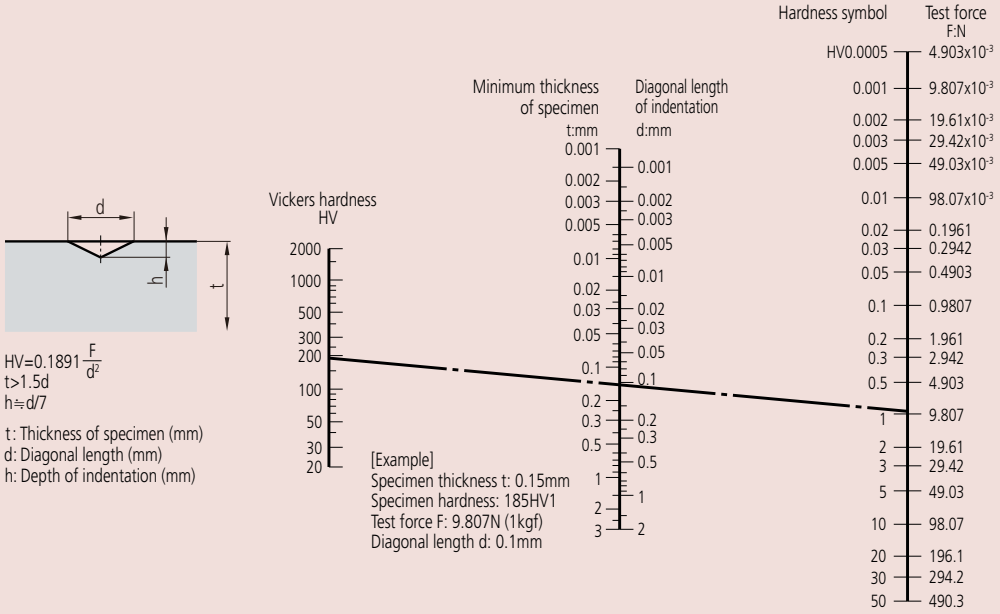
$$HK=k\frac{F}{A}=0.102\frac{F}{A}=0.102\frac{F}{cd^2}=1.451\ \frac{F}{d^2}$$

F:N
d:mm
c:Constant

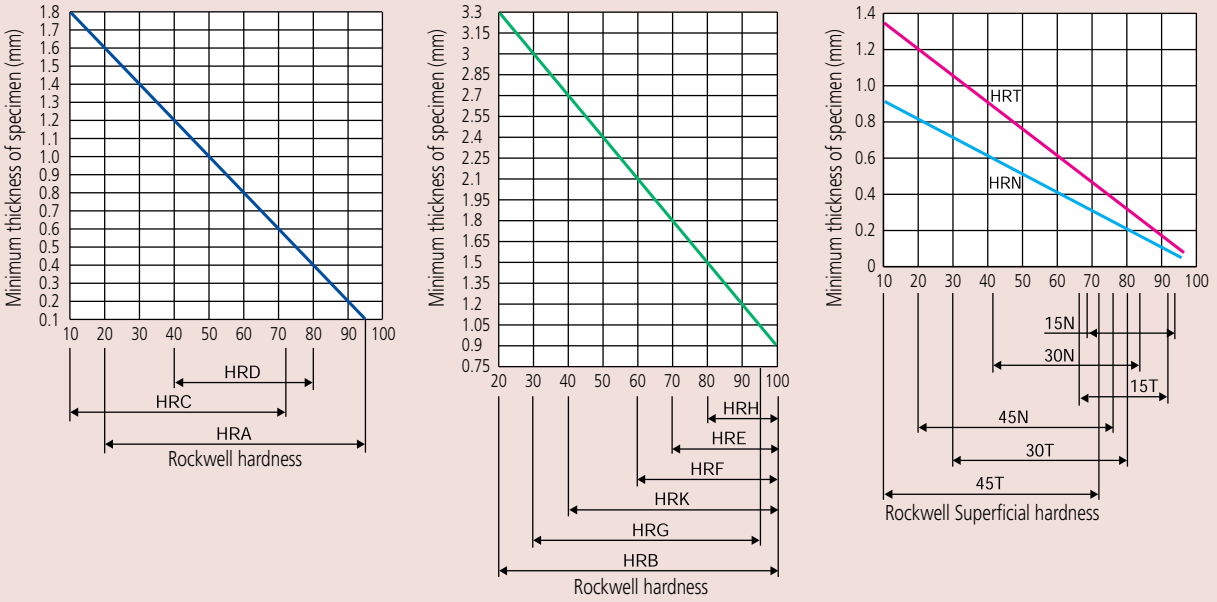
(3) Rockwell and Rockwell Superficial

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: 0.2mm) 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 98.07N, and Rockwell Superficial 29.42N. 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	588.4N	Carbide, sheet steel
D		980.7N	Case-hardened steel
C		1471N	Steel (100HRB or more to 70HRC or less)
F	Sphere of 1.5875mm diameter	588.4N	Bearing metal, annealed copper
B		980.7N	Brass
G		1471N	Hard aluminum alloy, beryllium copper, phosphor bronze
H	Sphere of 3.175mm diameter	588.4N	Bearing metal, grinding wheel
E		980.7N	Bearing metal
K		1471N	Bearing metal
L	Sphere of 6.35mm diameter	588.4N	Plastic, lead
M		980.7N	
P		1471N	
R	Sphere of 12.7mm diameter	588.4N	Plastic, lead
S		980.7N	
V		1471N	

Rockwell Superficial Hardness Scales

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

K