



# Standard Blocks for Hardness

Based on ISO·JIS Standards

## BEST QUALITY SAVES YOUR COST

ROCKWELL  
ROCKWELL SUPERFICIAL  
SHORE  
VICKERS  
MICRO VICKERS  
BRINELL  
NANOINDENTATION



YAMAMOTO SCIENTIFIC TOOL LABORATORY

ISO 9001



QJA-2078

# YAMAMOTO Standard Blocks for Hardness

To verify hardness testers to be in good working, with a given standard (ISO, JIS...)

## 1. Standard Blocks

To control various industrial hardness testers, it is important to verify all related factors, including indenters, static and dynamic loads, indentation measurement, and sample pieces. Hardness blocks allow overall control of these complicated factors in the field. Therefore, it is imperative that a uniform surface hardness is displayed by all our test blocks, that the main factors of secular change are eliminated and, if possible, that the characteristics of their materials are similar to those of materials in practical use.

Our company, which was established in 1939 by Shoichi Yamamoto, is the first dedicated manufacturer of standard test blocks in Japan, and has maintained its reputation as the best and the foremost company in this field.

## 2. ISO 9001 Quality System

We received a certificate dated December 26, 1997, issued by Japan Quality Assurance Organization (JQA), stating that Yamamoto's quality management system for hardness blocks complies with the requirements of the following standards. The register certificate No. is JQA-2078 ISO 9001-2000 / JIS Q 9001:2000.

## 3. Characteristics of Our Hardness Blocks

Table 1 (back) shows detailed specifications of our test blocks and their materials.

### 3.1 Materials and manufacturing process

To maintain one highly uniform surface hardness, strict quality control of materials must be ensured for each test method. Our blocks are first cut from a plate material to avoid being affected by center segregation.

Next, after machining to the required shapes, heat treatment is carefully applied to the blocks to get a stable microstructure and the required hardness level. For such cases, a very accurate conversion relationship has been already obtained especially between Shore hardness (HS), which is the Japanese original standard, and Vickers hardness (HV) values using eutectoid carbon steel.

After heat treatment is completed, the blocks are ground, lapped, and then undergo a through

polishing process, followed by wet buffing to improve measuring precision and achieve the most accurate and consistent hardness available in the world. Care is taken so that the surface is not adversely affected, which could result in surface hardness irregularities, and a routine microscopic structure inspection is performed as required across the finished test surface for possible variations caused in the processes.

### 3.2 Hardness measurement of standard blocks

Each 20-block lot that has undergone heat treatment and other finishing processes is subjected to hardness tests to check for variations in hardness, and to determine reliable, measurement-based reference values.

## 4. Integrated Precision of Hardness Testers and Hardness Blocks

Force, indenter, indentation measurement and movement conditions, etc., should be separately inspected to metrically verify the integrated precision of hardness testers.

Industrial adjustments of these conditions focus upon ISO standards.

On the other hand, indirect verification of a tester with test blocks is used to integrally verify these respective conditions. It is quite natural, therefore, the uncertainty factor due to the material to be additionally considered, as well as metrical accuracy values. We do our utmost in material selection, heat treatment, and other processes to achieve the world's highest accuracy.

(See Table 2.)

## 5. Best Use of Test Blocks

### 5.1 Choice of test blocks

Normally, the general accuracy of a tester needs to be indirectly verified with blocks for at least the three ranges — high, middle, and low ranges of scales — in which a tester is being used. Routine inspections should be performed with blocks in the high frequency ranges in use.

### 5.2 Notes

Concerning hardness management with blocks, testers should be directly verified in

advance.

In this case, at least three readings should be taken, and a  $\bar{X}$ -R controlling method adopted. Measuring locations should be selected over the working surface to represent the hardness of the whole block surface.

Serial No. (side), hardness value, and inspection date of hardness blocks are checked against the attached inspection sheet.

The warranty period shall be three years from

the inspection date, although the blocks are considered to be effective for five years. Flaws and attachments on the front or back surface, as well as re-processing of blocks, are strictly forbidden. (This similarity applies to anvils used.)

## 6. Durability of Our Blocks

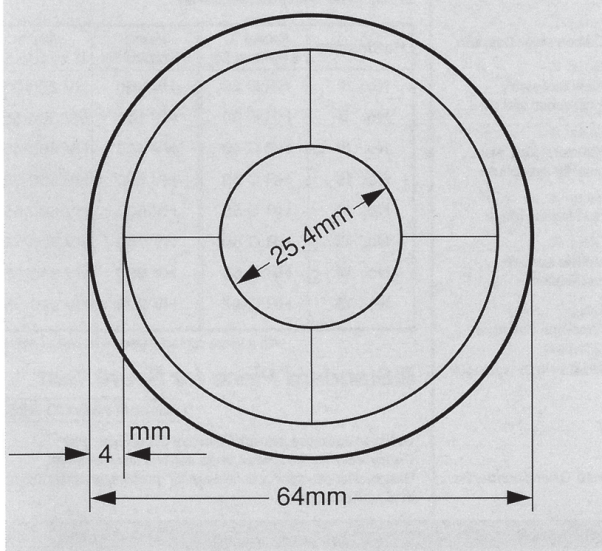
Secular changes of all our blocks are eliminated by a sufficient heat treatment process, regardless of the block type. Due to

Table 2 The allowance of indirect verification of testers with blocks

Class & Standard	Hardness range	Standard of testers		Standard of blocks			
		n	Standard value - Average value E	Allowance of variation R	(n)	Tolerance of standard value	variation (R)
Rockwell standard for testers (JIS B 7726,ISO/DIS 6508)	>75 to ≤ 88HRA	5	± 1.5	Refer to JIS, ISO Standard	(5×2)	(± 0.6)	0.4
	>80 to ≤ 100HRB	∕	± 2		( ∕ )	(± 0.8)	1.0
	Rockwell standard for blocks (JIS B 7730,ISO/DIS 6508)	20 to ≤ 70 HRC	∕	± 1.5	( ∕ )	(± 0.6)	0.4
		HR 30N	∕	± 2	( ∕ )	(± 1.0)	0.6
	HR 30T	∕	± 3	( ∕ )	(± 1.3)	1.2	
Shore standard for testers (JIS B 7727)	≥ 75 HS	5	± 1.5	2.0	VHS HS (5×2) (±0.5)	±0.6	1.5
Shore standard for blocks (JIS B 7731)	< 75 HS	∕	∕	1.5	( ∕ )	±0.4	1.2
Vickers standard for testers (JIS B 7725)	700 HV	5	± 11%	10%	(3×2)	(± 5.3%)	4%
Vickers standard for blocks (JIS B 7735)	0.2kgf	∕	± 5%	8%	( ∕ )	(± 2.5%)	∕
	1kgf	∕	± 3%	4%	(5×2)	(± 1.0%)	2%
	10kgf 30kgf	∕	± 2%	∕	( ∕ )	( ∕ )	∕
Brinell standard for testers (JIS B 7724)	≤ 125 HBW	5	± 3%	6% *	(3×2)		2% *n=5
Brinell standard for blocks (JIS B 7736)	>125 to < 225 HBW	∕	± 2.5%	5% *	( ∕ )	(± 2%)	∕
	≥ 225 HB	∕	± 2%	4% *	( ∕ )	( ∕ )	∕

1. Each value is based on JIS testers and blocks.
2. The values in parentheses are measured by our laboratory.
3. The tolerance of standard values should not over the above-mentioned values, due to our comparative testing results.
4. If the difference between standard, average values, and variations over each allowance, testers are needed to examine their accuracy.
5. The repeatability of indentation diameter measurements prescribed in JIS B7724: 1999 is converted into the repeatability (R) of hardness values.

Fig. An example of the working surface divided into five (n=5)



work hardening near and around the perimeters of indentations, the usable test area is limited, as JIS prescribes it to be 4d (d=diameter of the indentation) as spaces between indentations.

To make the maximum use of a block, indentations should be made evenly over the test surface. For this purpose, we recommend dividing the working surface. (See the figure at the left.)

For the durable limits specified in Table 3, reduce the numbers to half if the highest level of accuracy is required.

Table 3. Useful life of rockwell hardness blocks

Hardness	60HRC	30HRC	90HRB	60HRB
The Upper Limit of Test Points (approx.)	500	260	250	200

(The 14th Japan Hardness Research Association)

# BLOCKS FOR RELIABLE HARDNESS TEST

Table 1 Specification of Standard blocks

YSTL

Assortment	Hardness value	Tolerance	Calibration number(n)	Variation (R=Max.-Min)	Materials (JIS notation)	Dimension (mm)	Finished surface	Standard based
HMV (1, 0.1)	1600	±10%	4 (2x2)	2% (HV1)	Si <sub>3</sub> N <sub>4</sub>	□10×5	□	JIS B 7735
HMV (1,0.1,0.01)	900, 800, <b>700</b> , 600, 500, 400, 300	±15	6 (3x2)	5% (HV0.1)	SK85	φ25×6	□	JIS B 7735
◇	<b>200</b> (Be Copper)	±15	◇	◇	C1720P	φ25×6(2)	□	◇
◇	100 (C2600P), 40 (C1020P)	±10	◇	7 (100HV0.1), 4 (40HV0.1)	←	φ25×5※	□	◇
HMV (0.1,0.01,0.001)	30(AU)	±10	◇	4 (HV0.1)	Au	φ25×5(0.8)	□	◇
UMV (0.01, 0.002)	900, 700, 500 (Berkovich 9.8mN tested)	±20%	6 (3x2)	10% (HV0.01)	SK85	φ25×6	■	JIS B 7735
◇ (0.01, 0.002)	200 ( )	◇	◇	◇	C1720P	φ25×6(2)	■	◇
★HN-W for Nano indentation	Approx.400HV		6 (3x2 HV, Nano)		Single Crystal Tungsten	φ25×6 (W: φ9×6)	■	JIS B 7735
(HV0.01, 0.001 Berkovich 9.8mN tested)								
HV (30, 1)	1000(SK120), 900, 800, <b>700</b>	±15	10 (5x2) /HV30,10	1.5%	SK85	φ64×15	○	JIS B 7735
HV (10,1)	600, <b>500</b> ,400,300, <b>200</b> ,150,100	◇	6 (3x2) /HV1	◇	SK85, etc.	◇	○	◇
◇	40	±10		(150HV and below 2.2%)	C1020P	φ64×10	○	◇
HS	100(SK120), 95, <b>90</b> , 80, 70, <b>60</b> , 50, 40, <b>30</b>	±2	HV10 (5x2)	VHS ≤ 1.5 (70HS and below 1.2)	SK85	φ64×15	○	JIS B 7731
◇	20 (S20C), 7 (C1020P φ64×10)	◇	HS10 (5x2)	∠HS(HS-VHS) ≤ 0.5	←	◇	○	◇
HL	HLE (Dia) 850, 800, 700, 600, 500	±15	(HV Calibration)		SK85	φ115×33	○	JIS B 7731
◇	HLD (Wc) 880, 830, 730, 630, 520	◇			◇	◇	○	Related
HR C	70 (SK120), 67, 64, 62, <b>60</b>	±1	10 (5x2)	0.2	SKS3	φ64×15	○	JIS B 7730
◇	57, 55, <b>50</b> , 45, <b>40</b> , 35, <b>30</b> , 25, 20, 10	◇	◇	(40HRC and below 0.3)	SK85	◇	○	◇
HR A	87, 85, 83, <b>81</b> , 78, 75, 71, <b>65</b> , 56	◇	◇	0.3	Same as HRC	◇	○	◇
HR30N	83, <b>81</b> , 78, 73, <b>67</b> , 60, 55, 50, 41	◇	◇	0.6	◇	◇	○	◇
HR15N (45N)	92, <b>90</b> , 87, 85, <b>80</b> , 75 (43) (23)	◇	◇	◇	◇	◇	○	◇
HRB W	100, 95, <b>90</b>	±2	10 (5x2)	0.8	SK85	φ64×10	△	JIS B 7730
◇	<b>82</b> , 72	◇	◇	◇	Other steel	φ64×15	△	◇
◇	<b>62</b> , 52, <b>42</b> , 32	◇	◇	(50HRB and below 1.0)	C2600P	φ64×10	△	◇
HR30T W	78, 72	◇	◇	1.0	Other steel	φ64×15	○	◇
◇	<b>62</b> , <b>52</b> , 42, 38, 32	◇	◇	◇	C2600P	φ64×10	○	◇
HR15T W	87	◇	◇	◇	S35C	φ64×15	○	◇
◇	<b>82</b> , <b>78</b>	◇	◇	◇	C2600P	φ64×10	○	◇
HR (E·M·L·R·F·S) W	HRE <b>90</b> HRM107 HRL118 HRR123 HRF90	◇	◇	◇	(100HV)	◇	○	JIS K 7202
◇	HRM67 HRL92 HRR <b>105</b> HRS90	◇	◇	◇	(40HV)	◇	○	◇
HBW (10/3000)	600, 550, 500, 450, <b>400</b> , 350	±15	6 (3x2)	1.5%	SK85	φ115×18	●	JIS B 7736
◇	<b>300</b> , 250, 229 (d=4mm), <b>200</b> , 180	◇	◇	◇	◇	◇	●	◇
	HBW (10/3000) 150, HBW (10/500) 125	◇	◇	2.5%	S45C	◇	●	◇
	HBW (10/500) 100	◇	◇	3%	S10C	◇	●	◇

Finished test surface; ●Fine grinding, △plate lapping, ○Buffing, □Super finish, ■Super finish(fine),

※To be changed to φ25×6

The appearance and specifications of these products are subject to change without notice for improvement purposes.

## Charpy V-Notch Test Blocks

In compliance with JIS B7740-1990  
 Feature: Extremely small irregularity in Charpy absorption energy (CV: 3% or less)  
 Material: SNCM439.Q.T (complying with JIS test piece No. 4)  
 NK verification provided.



Type A Energy Level approx. 30J  
 Type B approx. 100J  
 Type C approx. 160J  
 5 pieces each energy levels per 1set

## Standard Microstructure

Standard pieces of metal material microstructures, and detailed explanations with photographs and CD-ROM.



Group 1~6 : 25 types each  
 Group 7 : 23 types

- Group 1. Carbon steel, Cast iron
- Group 2. Alloy tool steel, High-speed tool steel
- Group 3. Structural alloy steel, steel for special use
- Group 4. Non-ferrous alloys
- Group 6. Metallic surface, modifications
- Group 7. Abnormal structure

## Hardnester

Standard File for Scratch Hardness

PAT.NO.196592

Manual with DVD

To measure metal hardness of various parts from steel material to thin layers simply and sensitively.

Hardnester	Rocwell "C" 8 Hardness Set	Vickers 8 Hardness Set	Vickers 16 Hardness Set
No. I	HR C 20	HV 200	HV 200-250
No. II	HR C 30	HV 300	HV 300-350
No. III	HR C 40	HV 400	HV 400-450
No. IV	HR C 50	HV 500	HV 500-550
No. V	HR C 55	HV 600	HV 600-650
No. VI	HR C 60	HV 700	HV 700-750
No. VII	HR C 65	HV 800	HV 800-850
No. VIII	HR C 67	HV 900	HV 900-950

with a spare contact measure for each hardness

■ Standard Piece for Spark Test

Manual with CD-ROM

Based on Japanese Industrial standard JIS G 0566-1980  
 Clearly identifies the species of JIS iron and steel materials.  
 Designed for educational or field use for machine assembly and heat treatment processes.