Table 1 Specification of Standard blocks

<table>
<thead>
<tr>
<th>Assortment</th>
<th>Hardness value</th>
<th>Tolerance</th>
<th>Calibration number(%)</th>
<th>Variation (R = Max-Min)</th>
<th>Material (JIS notation)</th>
<th>Dimension (mm)</th>
<th>Finished surface</th>
<th>Standard based</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMV (1, 0.1)</td>
<td>1600</td>
<td>±10%</td>
<td>6 (2x2)</td>
<td>5% (Rvmax-Rvmin)</td>
<td>SK65</td>
<td>25X8 (2)</td>
<td>-</td>
<td>25X8</td>
</tr>
<tr>
<td>HMV (1.0, 0.01)</td>
<td>900, 500, 700, 600, 500</td>
<td>±15</td>
<td>6 (2x2)</td>
<td>5% (Rvmax-Rvmin)</td>
<td>SK65</td>
<td>25X8 (2)</td>
<td>-</td>
<td>25X8</td>
</tr>
<tr>
<td>UV0</td>
<td>400, 300, 200 (for Duplex)</td>
<td>±15</td>
<td>6 (2x2)</td>
<td>5% (Rvmax-Rvmin)</td>
<td>SK65</td>
<td>25X8 (2)</td>
<td>-</td>
<td>25X8</td>
</tr>
<tr>
<td>AUM (0.01, 0.001)</td>
<td>100 (2x2)</td>
<td>±10</td>
<td>7 (2x2)</td>
<td>10% (Rvmax-Rvmin)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>UV0 (0.01, 0.001)</td>
<td>500, 200</td>
<td>±10</td>
<td>4 (2x2)</td>
<td>10% (Rvmax-Rvmin)</td>
<td>SK65</td>
<td>25X8 (2)</td>
<td>-</td>
<td>25X8</td>
</tr>
</tbody>
</table>

- Nano-indentation hardness blocks
  - APPR020 (Hard-Cut, New) Tungsten (W: 9X8)
  - HVO001 JIS B 7735

- HV (300, 2.5) 1000 (100, 200, 500, 1000, 300, 2000, 5000) ±15 6 (2x2) HVO30, 10, 1.5% SK65 49X15 - JIS B 7735
- HV (10, 1) 600, 500, 400, 300, 200 (100, 1500, 6500) ±15 6 (2x2) HVI 49X10 - JIS B 7735

- HS 100 (90, 80) 50, 70, 60, 50, 30 ±15 H30 (100) H31 ±15X (100, 1) JIS B 7731
- HS 20 (100) 70, 60, 50, 30, 20 ±15 HS10 (200) H31 ±15X (100, 1) JIS B 7731

- HL HLEUW800, 800, 700, 600, 500 ±15 HLEW (90, 80) 70, 60, 50, 30 ±15 X (100, 1) JIS B 7731
- HLDW800, 800, 700, 600, 500 ±15 HLDW (90, 80) 70, 60, 50, 30 ±15 X (100, 1) JIS B 7731
- HS10 (200) H30 ±15X (100, 1) JIS B 7731

- HR C ±1 10 (2x2) 0.2 SK65 49X15 - JIS B 7730
- R 57, 55, 50, 45, 40, 35, 30, 25, 20, 10 40 (HRC and below 0.3) SK65 49X10 - JIS B 7730
- A 87, 85, 83, 81, 78, 75, 71, 65, 56 0.3 Same as HRC
- A 83, 81, 78, 73, 67, 60, 55, 50, 41 0.6 -
- R 92, 90, 87, 85, 80, 75, 43 (23) -

- HRB S 100, 95, 90 ±2 10 (2x2) 0.8 SK65 49X10 - JIS B 7730
- R 82, 75, 62, 52, 42, 32 (50HRB and below 1.0) C250H0P -
- R 78, 72, 62, 52, 42, 38, 32 1.0 Same as HRB
- R 87, 82, 78 -
- R 62, 55, 51, 45, 40, 35, 30, 25, 20, 10, 15, 10, 5 15X (100, 1) JIS K 7202
- HRD (100/3000) 600, 550, 500, 450, 400, 350 ±15 6 (2x2) 15X (100, 1) JIS B 7736
- R 300, 250, 220 (50HRB, 200, 180) -
- R 2500, 220, 190, 160, 135, 125, 105, 95, 90 2.5% S45C
- H80W800/100, H8W800/100, H8W800/100 -
- H8W800/100 3% S10C

- HRC 57, 64, 62, 60 ±1 6 (2x2) 50.8X ±2 (3X2) S45C DIN 1614
- R 55, 50, 45, 40, 35, 30, 25, 20 -

- Finished test surface: □ Fine grinding, □ Plate lapping, □ Buffing, □ Super finish, □ Super finish (fine), New Test Blocks (N. T. B.) (for Spot Anvil) □ Export only

Charpy V-Notch Test Blocks
In compliance with JIS B7740-1999
Feature: Extremely small irregularity in Charpy absorption energy (CV: 3% or less)
Material: SNOM439.71 (complying with JIS test piece No. 4)
NK verification provided.

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

Hardnester Standard File for Scratch Hardness
Pat. No. 196592
Manual with CD-ROM
To measure metal hardness of various parts from steel material to thin layers simply and sensibly.

- Hardnester Manual with CD-ROM
  - With a special content method for each hardness
  - Standard Piece for Spark Test Manual with CD-ROM
  - Based on Japanese standard JIS G 0560-1980
  - Designed for educational or field use for machine assembly and heat treatment processes.
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 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

<table>
<thead>
<tr>
<th>Class &amp; Standard</th>
<th>Hardness range</th>
<th>n</th>
<th>Standard of testers</th>
<th>Allowance of variation</th>
<th>Standard of blocks</th>
<th>Tolerance of standard value</th>
<th>variation (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rockwell standard for testers</td>
<td>&gt;75 to ≤ 88HRA</td>
<td>5 ± 1.5</td>
<td>[5×2] (± 0.6)</td>
<td>0.4</td>
<td>1.0</td>
<td>0.4</td>
<td>1.2</td>
</tr>
<tr>
<td>(JIS B 7726, ISO/DIS 6508)</td>
<td>&gt;50 to ≤ 100HRB</td>
<td>5 ± 2</td>
<td>(± 0.8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rockwell standard for blocks</td>
<td>20 to ≤ 70HRC</td>
<td>5 ± 1.5</td>
<td>(± 0.6)</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(JIS B 7730, ISO/DIS 6508)</td>
<td>HR 30N</td>
<td>5 ± 2</td>
<td></td>
<td></td>
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<td></td>
<td>HR 30T</td>
<td>5 ± 3</td>
<td></td>
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<tr>
<td>Shore standard for testers</td>
<td>≥ 75 HS</td>
<td>5 ± 1.5</td>
<td>VHS HS (±6.0)</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(JIS B 7727)</td>
<td>&lt; 75 HS</td>
<td>5 ± 1.5</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Shore standard for blocks</td>
<td>≥ 75 HS</td>
<td>5 ± 1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(JIS B 7731)</td>
<td>VHS HS</td>
<td>5 ± 1.5</td>
<td></td>
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<tr>
<td>Vickers standard for testers</td>
<td>7.0 HV</td>
<td>5 ± 11%</td>
<td>(± 5.3%)</td>
<td>4%</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(JIS B 7725)</td>
<td>1kgf</td>
<td>5 ± 5%</td>
<td>(± 2.5%)</td>
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<td></td>
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<tr>
<td>Vickers standard for blocks</td>
<td>10kgf</td>
<td>5 ± 3%</td>
<td>(± 4%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(JIS B 7735)</td>
<td>30kgf</td>
<td>5 ± 2%</td>
<td></td>
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<tr>
<td>Brinnell standard for testers</td>
<td>≤ 125 HBW</td>
<td>5 ± 3%</td>
<td>(± 2%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(JIS B 7724)</td>
<td>&gt;125 to &lt; 225 HBW</td>
<td>5 ± 2.5%</td>
<td>(± 2.5%)</td>
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<tr>
<td>Brinnell standard for blocks</td>
<td>≥ 225 HB</td>
<td>5 ± 2%</td>
<td>(± 1%)</td>
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<tr>
<td>(JIS B 7736)</td>
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</tbody>
</table>

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: The result of durability

<table>
<thead>
<tr>
<th>Hardness</th>
<th>60HRC</th>
<th>30HRC</th>
<th>90HRC</th>
<th>60HRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durable Limit (approx.)</td>
<td>500</td>
<td>260</td>
<td>250</td>
<td>200</td>
</tr>
</tbody>
</table>

(The 14th Japan Hardness Research Association)