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**Rockwell hardness test — Calibration of
reference blocks**

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In the event of any doubts arising as to the contents,
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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Testing Machinery Association (JTM)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS B 7730:2010** is replaced with this Standard.

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Rockwell hardness test — Calibration of reference blocks

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 6508-3 : 2015**, Edition 3, with some modifications of the technical contents to reflect the local needs and situations in Japan.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JB.

1 Scope

This Standard specifies a method for calibration of reference blocks of scales A to H, K, N, and T, to be used for the indirect verification and daily checks and maintenance of Rockwell hardness testing machines specified in **JIS B 7726** (hereafter referred to as reference blocks).

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 6508-3 : 2015 *Metallic materials — Rockwell hardness test — Part 3 : Calibration of reference blocks* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0601 *Geometrical Product Specifications (GPS) — Surface texture : Profile method — Terms, definitions and surface texture parameters*

NOTE : Corresponding International Standard : ISO 4287 *Geometrical Product Specifications (GPS) — Surface texture : Profile method — Terms, definitions and surface texture parameters*

JIS B 0621 *Definitions and designations of geometrical deviations*

JIS B 7726 *Rockwell hardness test — Verification and calibration of testing machines and indenters*

NOTE : Corresponding International Standard : ISO 6508-2 *Metallic materials — Rockwell hardness test — Part 2 : Verification and calibration of testing machines and indenters*

JIS B 7728 *Calibration of force-proving instruments used for the verification of uniaxial testing machines*

NOTE : Corresponding International Standard : ISO 376 *Metallic materials — Calibration of force-proving instruments used for the verification of uniaxial testing machines*

JIS Z 2245 *Rockwell hardness test — Test method*

NOTE : Corresponding International Standard : ISO 6508-1 *Metallic materials — Rockwell hardness test — Part 1 : Test method*

JIS Z 8103 *Glossary of terms used in measurement*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in JIS Z 8103 apply.

4 Manufacture and shape of reference blocks

4.1 Manufacture

The manufacture of reference blocks shall be as follows.

- a) The material of reference blocks shall be selected based on consideration of necessary homogeneity of hardness.
- b) The reference blocks shall be given heat treatment to obtain the required hardness, and manufactured in such a way that they become uniform in hardness and free from deterioration.
- c) The reference blocks made of steel shall be free of magnetism.
- d) The reference blocks shall be free from flaws or other defects that may interfere with the hardness measurement.

4.2 Shape and dimensions

The shape and dimensions of the reference blocks shall be as given in Table 1. The definition of surface roughness is provided in JIS B 0601. The definitions of parallelism and flatness are provided in JIS B 0621.

Only one surface of the reference block shall be used as the test surface. In the test surface, the area not less than 4 mm inside from the edges shall be used as the tested area.

Table 1 Shape and dimensions of reference blocks

Thickness		6 mm min.
Flatness (test surface)		10 μm max.
Parallelism (to the lower surface)		20 μm /50 mm max.
Tolerance on surface roughness R_a	Test surface	0.3 μm
	Lower surface	0.8 μm
NOTE : Each reference block shall be of a thickness not less than 6 mm. To minimize the effect of hardness change with increasing number of indents, thicker blocks should be used.		

5 Calibration machine

5.1 General

In addition to fulfilling the general conditions specified in **JIS B 7726**, the calibration machine shall also meet the requirements given in **5.2** to **5.6**, and shall be verified directly in intervals not exceeding 12 months. Verification shall be conducted at $(23 \pm 5)^\circ\text{C}$, using instruments that are traceable to national standards.

NOTE : The procedure for maintenance of calibration machine is illustrated in Annex JA.

5.2 Test force

Each test force shall be measured by means of a force-proving instrument Class 0.5 or better specified in **JIS B 7728**, and shall agree with the nominal preliminary test force to within $\pm 0.2\%$ and the nominal total test force to within $\pm 0.1\%$. The position of the indenter holder for measuring the test force shall be the reference position and the hardness indication position.

5.3 Diamond cone indenter

Indirect verification of a diamond cone indenter shall be made at a frequency of no greater than 12 months, and direct verification no greater than 5 years. The diamond indenter shall be measured on at least eight unique axial section planes equidistant from each other.

- The diamond cone shall have, in each measured section including the centre axis, the included angle of $120^\circ \pm 0.17^\circ$, and a mean included angle of $120^\circ \pm 0.1^\circ$.
- Deviations from straightness of the generatrix of the diamond cone shall not exceed 0.000 5 mm over a minimum length of 0.4 mm.
- The radius of the tip of the indenter shall be determined from single values, measured in at least eight axial section planes including the centre axis. The radius of each section shall be $0.200\text{ mm} \pm 0.007\text{ mm}$ and the mean value shall be $0.200\text{ mm} \pm 0.005\text{ mm}$. Further, the distance between two concentric circles shall not be more than 0.002 mm.

NOTE : The tip of the diamond indenter is usually not truly spherical, but often varies in radius across its surface. Depending on the crystallo-

graphic orientation of the diamond stone with respect to the indenter axis, diamond tends to preferentially polish away more easily or with more difficulty at the tip, producing an increasingly flat or sharp surface in the central indenter axis region. The sphericity of the diamond tip can be better evaluated by measuring multiple measurement windows of varying width. The measurement window would be bounded by widths measured along a line normal to the indenter axis. For example, the following window sizes can be evaluated :

- between $\pm 80 \mu\text{m}$ from the indenter axis;
 - between $\pm 60 \mu\text{m}$ from the indenter axis;
 - between $\pm 40 \mu\text{m}$ from the indenter axis.
- d) The inclination of the axis of the diamond cone to the seating surface of holder shall be within $90^\circ \pm 0.3^\circ$.
- e) The surfaces of the cone and the spherical tip shall blend in a smooth tangential manner. The blend area of the cone and the spherical tip, i.e. the portion of the diamond surface between $90 \mu\text{m}$ and $110 \mu\text{m}$, shall be ignored.
- f) The diamond cone indenter hardness characteristics shall be such that the deviation of the mean hardness value of three indentations from that determined using the reference indenter is $\pm 0.4 \text{ HR}$. The test blocks shall be calibrated at the hardness levels given in Tables 2 to 5. The requirements for reference diamond indenter are given in Annex C.

Table 2 Hardness levels for indenters to be used for calibrating Rockwell regular and superficial scale test blocks (A, C, D and N)

Scale	Nominal hardness	Ranges
HRC	23	20 to 26
HRC	55	52 to 58
HR45N	43	40 to 46
HR15N	91	88 to 94

Table 3 Alternate hardness levels for indenters to be used for calibrating Rockwell regular and superficial scale test blocks (A, C, D and N)

Scale	Nominal hardness	Ranges
HRC	25	22 to 28
HRC	63	60 to 65
HR30N	64	60 to 69
HR15N	91	88 to 94