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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 according to the proposal for revision of Japanese Industrial Standard submitted by Japan Precision Measuring Instruments Manufacturers Association (JMA)/ 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 7533**:1990 is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

Dial test indicators (lever type)

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 9493** published in 2010 with some modifications of the technical contents to ensure suitability for actual production and use.

The portions given sidelines or dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies the design specification and characteristics of dial test indicators.

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

ISO 9493 : 2010 *Geometrical product specifications (GPS) — Dimensional measuring equipment : Dial test indicators (lever type) — Design and metrological characteristics* (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 standard (including amendments) indicated below shall be applied.

JIS B 0641-1 *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1 : Decision rules for proving conformance or nonconformance with specifications*

NOTE : Corresponding International Standard : ISO 14253-1 *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1 : Decision rules for proving conformance or non-conformance with specifications* (IDT)

JIS B 0642 *Geometrical product specifications (GPS) — General concepts and requirements for GPS measuring equipment*

NOTE : Corresponding International Standard : ISO 14978 *Geometrical product specifications (GPS) — General concepts and requirements for GPS measuring equipment* (MOD)

JIS B 0680..... *Geometrical Product Specifications (GPS) — Standard reference temperature for geometrical product specification and verification*

JIS Z 8103..... *Glossary of terms used in measurement*

ISO 14253-2 *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 2 : Guidance for the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*

ISO/TR 14253-6 *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 6 : Generalized decision rules for the acceptance and rejection of instruments and workpieces*

ISO/IEC Guide 98-3 *Uncertainty of measurement — Part 3 : Guide to the expression of uncertainty in measurement (GUM : 1995)*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS B 0641-1**, **JIS B 0642**, JIS Z 8103, and the following apply.

3.1 dial test indicator (lever type)

measuring instrument in which the displacement of a pivoting stylus is transmitted and magnified by suitable mechanical means to a pointer which rotates in front of a circular scale

3.2 error of indication

value obtained by subtracting the true value as a corresponding input quantity from the indicated value of dial test indicator

NOTE : For the true value, since it can not be determined, an agreed true value is used.

3.3 fixed zero method

method to determine error of indication of dial test indicator, which determines and expresses errors of indication between displacements by setting the starting point close to the rest point in each displacement of stylus as its reference point where the error of indication and indication itself are adjusted to zero

3.4 arbitrary reference point

reference point in general manner to measure displacement by adjusting an arbitrary point in the indication range of the dial test indicator to be zero, according to the size of object to be measured

NOTE : Dial test indicators are often used for comparative measurement by using an arbitrary reference point.

3.5 transferring zero method

performance evaluation method by data processing, which determines the error of in-

dication by data processing to displace the reference point to the measurement point where the maximum error of indication or the minimum error of indication is obtained on the diagram illustrated by fixed zero method

3.6 error of indication per entire measuring range in forward direction

error of indication evaluated in the entire measuring range in the forward direction

3.7 error of indication per 10 scale divisions

error of indication evaluated in the range of every adjacent 10 scale divisions

3.8 error of indication per one revolution

error of indication evaluated in the range of every one revolution

3.9 hysteresis error

maximum of the difference between indications at the same point of the stylus when the stylus is operated in the forward direction and backward direction

3.10 repeatability

repeatability of indications when it is measured several times repeatedly at the same arbitrary point in the measuring range

4 Design characteristics

4.1 General

The specification of dial test indicators shall comply with the requirements of this Standard under all orientations of operation.

4.2 Type

Dial test indicators are commonly manufactured in three types [see Figure 1 a), b) and c)]. These types have the following names.

- a) **Type S (Standard)** Where the dial face is mounted on the body of the dial test indicator, in a plane perpendicular to the plane in which the stylus moves.
- b) **Type H (Horizontal)** Where the dial face is mounted on the body of the dial test indicator, in a plane parallel to the plane in which the stylus moves.
- c) **Type V (Vertical)** Where the dial face is mounted at the end of the dial test indicator opposite that of the stylus.

NOTE 1 The above-mentioned list of three named types **a)** to **c)** includes those that are the most common. Although less common, configurations of dial test indicators, which do not fall into the above three categories, exist.

NOTE 2 Stems are shown by the two-dot chain line.

NOTE 3 Some dial test indicators have the ability to measure in both directions without external adjustments and some dial test indicators are provided with a bias lever to change the measuring direction.

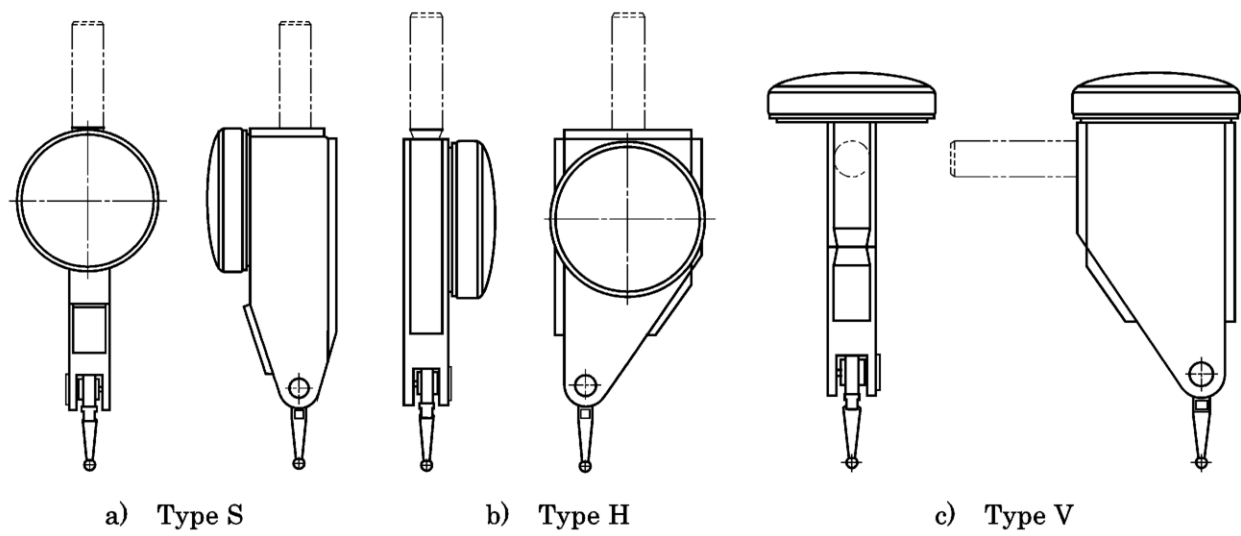


Figure 1 Types of dial test indicators

4.3 Nomenclature

Design features of dial test indicators are shown in Figure 2. The descriptions in this Standard use the nomenclature shown in Figure 2.

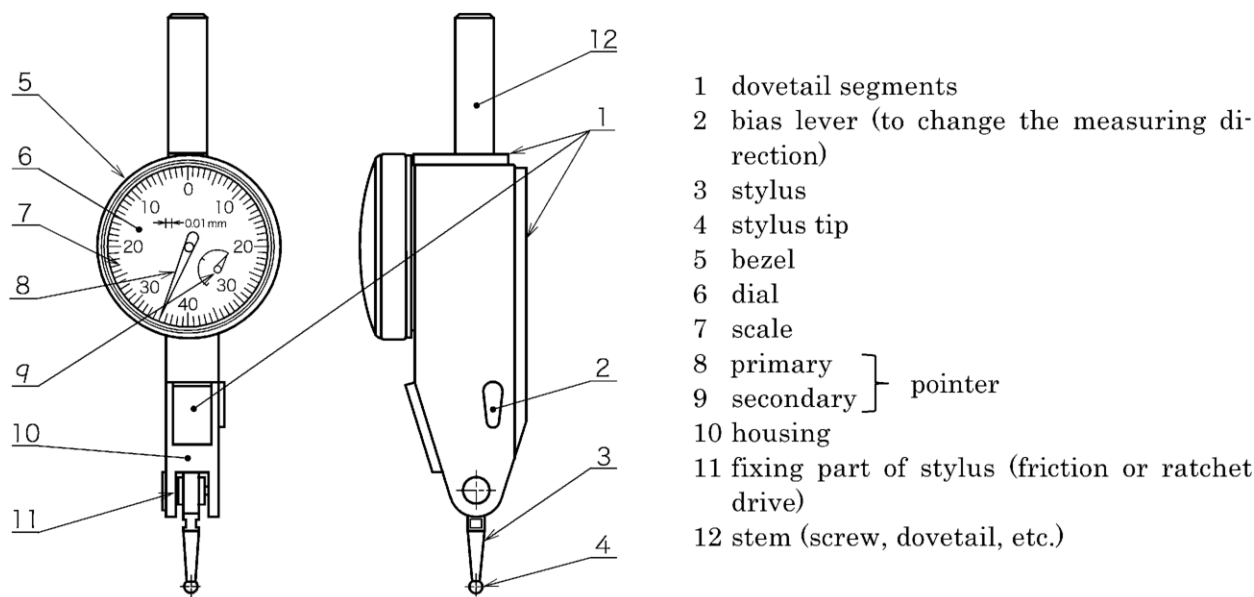


Figure 2 Nomenclature of main parts of dial test indicators

4.4 Shapes and dimensions of stem and dovetail segment

Dial test indicators shall be provided with a means to facilitate attachment to test stands or similar devices. This is often accomplished by means of screw stem (see Figure 3 a) and dovetail stem (see Figure 3 b).

Diameters of clamping stems include 6 mm and 8 mm. A portion of the stem L_3 no shorter than 12 mm shall be held to the fit tolerance h8 (see Figure 3 and Table 2).

The location of these dovetail segments whose stem is clamped on the body is left to the manufacturer's discretion (for dimensions of dovetail segments, see Figure 4).

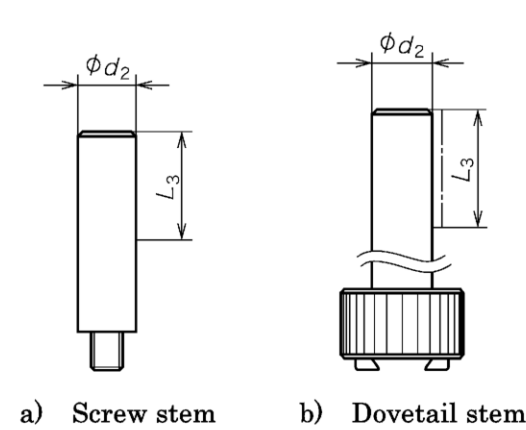


Figure 3 Examples of clamping stem

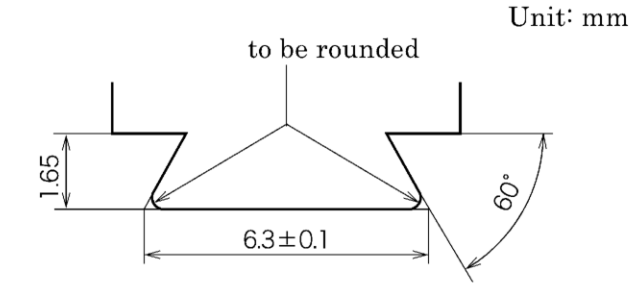


Figure 4 Dimensions of dovetail segment

4.5 Scale and primary pointer

The scale interval and its unit shall be labelled in the dial. Examples of scale layouts are shown in Figure 5 (scale intervals of 0.01 mm, 0.002 mm, and 0.001 mm). At rest, the primary pointer shall be revolution counterclockwise at least five graduations from the point representing the beginning of measuring. This beginning point is normally the 12 o'clock or the 6 o'clock position on the dial. The primary pointer shall move at least one full revolution beyond this beginning point of the measuring range, to the next occurrence of this point, plus at least another five graduations of revolution before reaching the end of its travel. This range before the measuring range begins is called pre-span, and the range after one full revolution is called post-span. The pre-span and post-span movements shall not be considered in the measuring range of the dial test indicator.

- NOTE 1 The width of graduation line and that of the primary pointer tip should be equal.
- NOTE 2 The width of the primary pointer tip should not be exceeding 20 % of the width of one graduation, considering the distance between graduation lines is read.

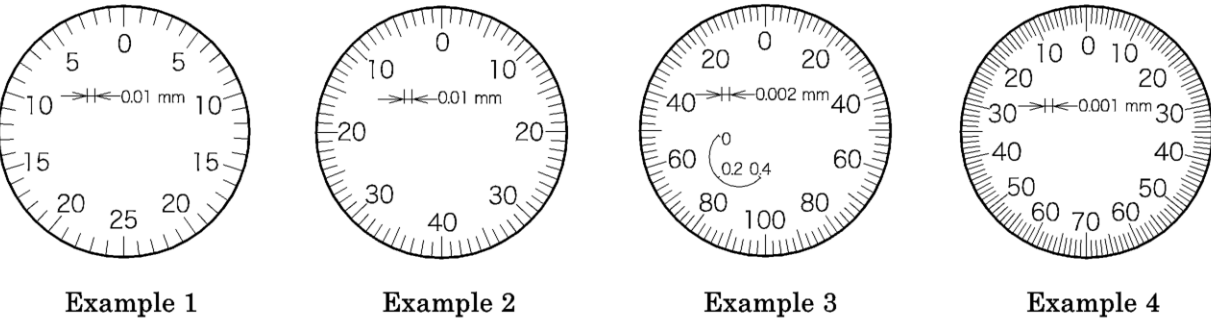


Figure 5 Example of scale layout

4.6 Secondary pointer

When a secondary pointer is provided, the secondary pointer shall indicate the appropriate division on its scale within $\pm 25\%$ between graduation lines when the primary pointer is at the beginning point (the 12 o'clock or the 6 o'clock) on each of the revolutions.

4.7 Revolution direction of primary pointer

The relation between moving direction of stylus and revolution direction of primary pointer of dial test indicator shall be in accordance with Table 1.

Table 1 Relation between moving direction of stylus and revolution direction of primary pointer

Type	Revolution direction
Type S	The primary pointer rotates clockwise when stylus is operated from back to front of dial face.
Type H	The primary pointer rotates clockwise when stylus is operated from right to left of dial face.
Type V	The primary pointer rotates clockwise when stylus is operated from the screw stem attached side to the opposite side.
When the stylus is operated toward the opposite direction to the above, the primary pointer may rotate clockwise or counterclockwise.	

4.8 Stylus

4.8.1 General

The stylus shall be easily interchangeable.

The stylus shall have a spherical stylus ball. The stylus ball shall be manufactured from hard, wear-resistant material. It shall be well finished and free of flats or other irregularities which could affect the accuracy of the instrument.

The length of the stylus is an integral part of the accuracy of the instrument. When replacing the stylus, the user shall ensure that the replacement stylus is of the same length as the original.

4.8.2 Friction linkage force

The stylus of a dial test indicator is affixed to a friction linkage or ratchet mechanism, which allows the stylus to be positioned over a wide range of possible positions.

The linkage force by the friction or ratchet mechanism shall be sufficiently higher than the measuring force, so as to allow use of the dial test indicator at any position of the stylus or any orientation of the body, without introducing errors to the measurement.

NOTE : The linkage force (friction force) without introducing errors to the measurement, means the force to work upon the stylus ball, and is usually 2 N to 8 N.