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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 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 7503**:2011 is replaced with this Standard.

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.

Mechanical dial gauges

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 463** published in 2006, with some modifications of the technical contents made for the purpose of bringing the contents in line with the actual production and use in Japan and thereby enhancing usability of this Standard.

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 JE.

1 Scope

This Standard specifies the design specification (design characteristics) and performance (metrological characteristics) of mechanical dial gauges with scale intervals of 0.01 mm, 0.005 mm, 0.002 mm and 0.001 mm.

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

ISO 463:2006 *Geometrical Product Specifications (GPS)—Dimensional measuring equipment—Design and metrological characteristics of mechanical dial gauges* (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/IEC Guide 98-3 *Uncertainty of measurement—Part 3: Guide to the expression of uncertainty in measurement* (GUM:1995)

NOTE : For Japanese translation of this Guide, the corresponding technical specification, **TS Z 0033**:2012, can be referred to.

3 Terms and definitions

For the purposes 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 mechanical dial gauge

measuring instrument in which the axial displacements of a plunger comprising a contact element are transmitted and magnified by suitable mechanical means to a pointer which rotates in front of an analogue circular scales

NOTE : It may also be provided with a revolution-counting device, e.g. in which a pointer rotates in front of a scale which indicates the number of revolutions of the pointer or the axial displacement of the contact element.

3.2 dial gauge with multiple revolutions

dial gauge with more than one pointer revolution

3.3 dial gauge with partial revolution

dial gauge with less than one pointer revolution

3.4 error of indication

value obtained by subtracting the true value of the corresponding input quantity from the indication of a mechanical dial gauge

NOTE : In practice, the agreed reference value is substituted for the true value.

3.5 fixed zero method

method for determining the error of indication of a mechanical dial gauge

3.6 transferring zero method

method for evaluating the performance of a mechanical dial gauge by data processing using the error of indication determined by the fixed zero method

3.7 forward direction

direction of a plunger when it is pressed into the stem

3.8 retrace direction

direction of a plunger when it retracts from the stem

3.9 error of indication over the whole measuring range

error of indication determined over the whole measuring range

3.10 error of indication over 1/10 revolution

error of indication determined over a range of 1/10 revolution

NOTE : For dial gauge with partial revolution, this error is determined over a range of 10 scale divisions.

3.11 error of indication over 1/2 revolution

error of indication determined over a range of 1/2 revolution

3.12 error of indication over one revolution

error of indication determined over a range of one revolution

3.13 hysteresis error

error calculated as the difference between instrument indications at the same point in the forward and retrace directions

3.14 repeatability

precision of instrument indication determined by repeated measurements of the same quantity

3.15 rest point of pointer

point where the pointer comes to a rest with the contact element not pressed in

3.16 dead-end point of pointer

point where the pointer comes to a halt when the contact element, beyond the measuring range, is pressed in further

3.17 starting point

lower limit of the measuring range

3.18 end point

upper limit of the measuring range

3.19 measuring range

range of measurement from the starting point to the end point

3.20 pre-span

range extending from the starting point to the rest point of the pointer

3.21 post-span

range extending from the end point to the dead-end point of the pointer

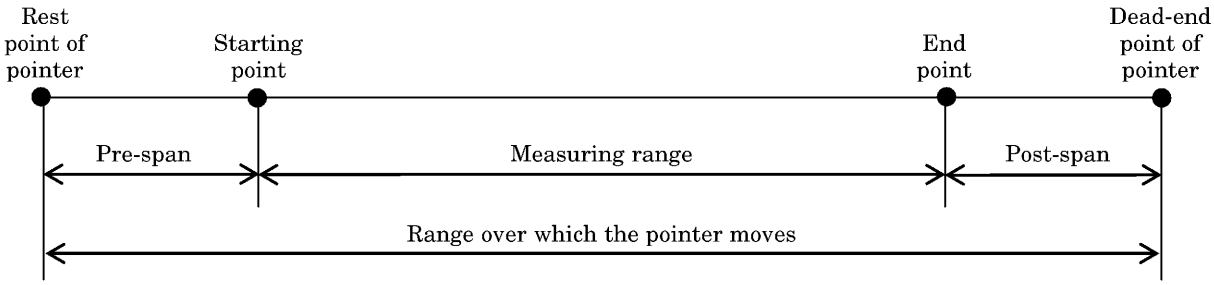


Figure 1 Diagram for explanation of the terms related to dial gauge (3.15 to 3.21)

4 Design specification (design characteristics)

4.1 General

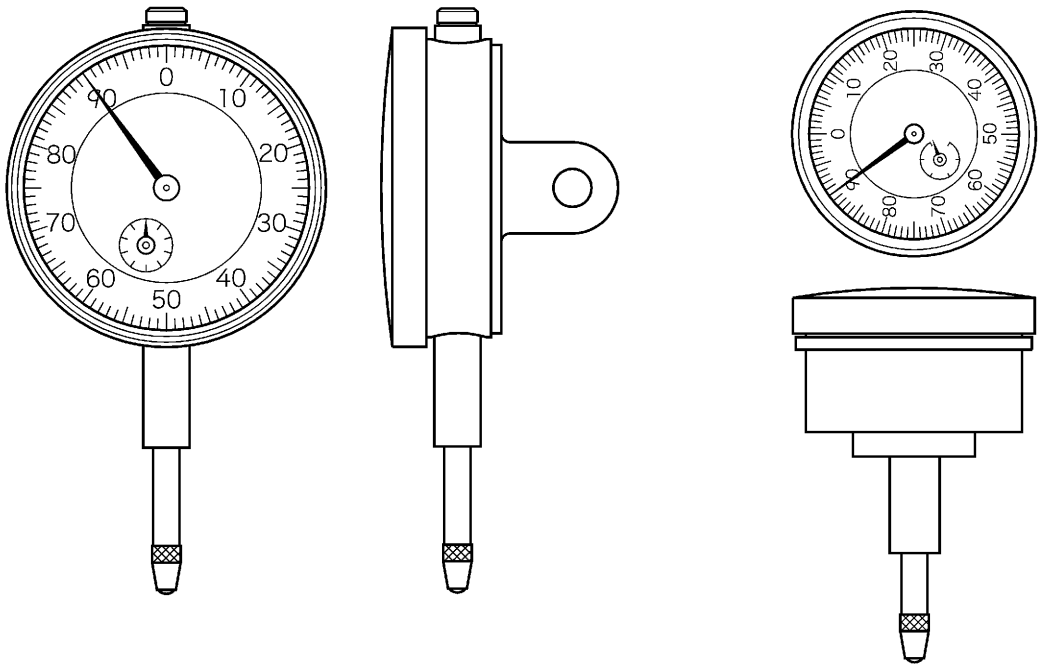
The specification of the dial gauge shall comply with the requirements of this Standard at any orientation.

4.2 Configurations

The dial gauge shall have either of the following two configurations [see Figure 2 a) and b)].

a) **Vertical (Standard type)**, with the dial face mounted on the body of the dial gauge, in a plane parallel to the plane in which the contact element moves.

b) **Horizontal (Back plunger type)**, with the dial face mounted on the body of the dial gauge, in a plane perpendicular to the plane in which the contact element moves.



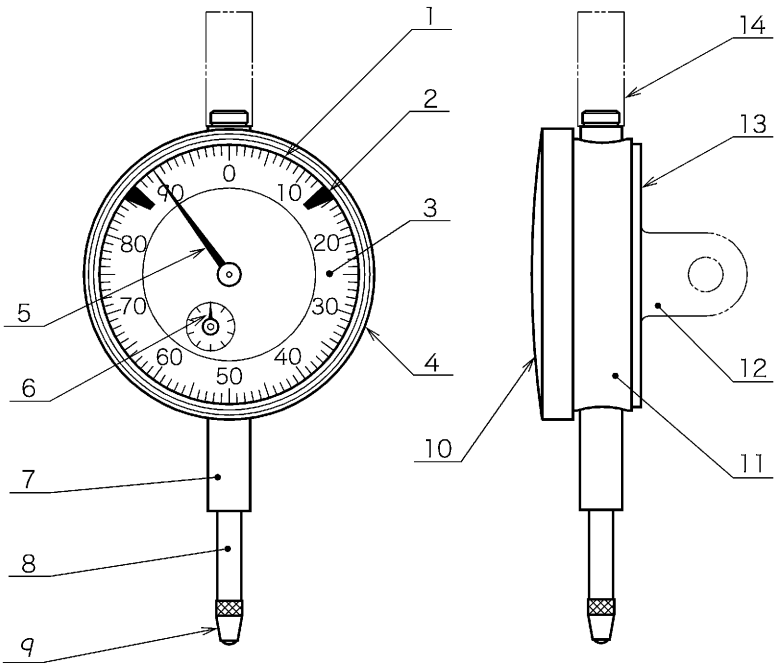
a) Vertical (Standard type) **b) Horizontal (Back plunger type)**

Figure 2 Configurations of mechanical dial gauge

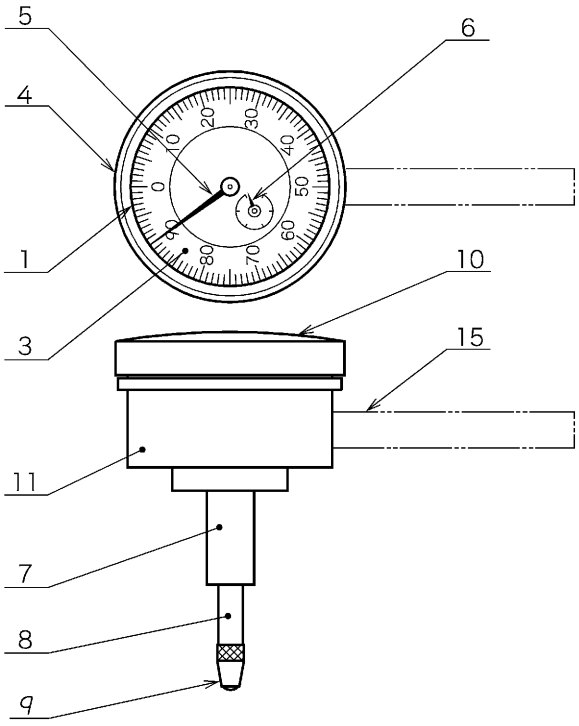
4.3 Nomenclature

The nomenclature and general design of a mechanical dial gauge are shown in Figure 3.

The back plate (with a lug), clamping arm and cap are indicated by dashed double-dotted lines.



a) Vertical (Standard type)



b) Horizontal (Back plunger type)

1 Scale
2 Limit indicator
3 Dial
4 Bezel
5 Pointer } Indicating pointer
6 Revolution counting device } Indicating pointer
7 Stem
8 Plunger (spindle)
9 Contact element
10 Dial cover
11 Inner frame
12 Back plate (with lug)
13 Back plate (without lug)
14 Cap
15 Clamping arm

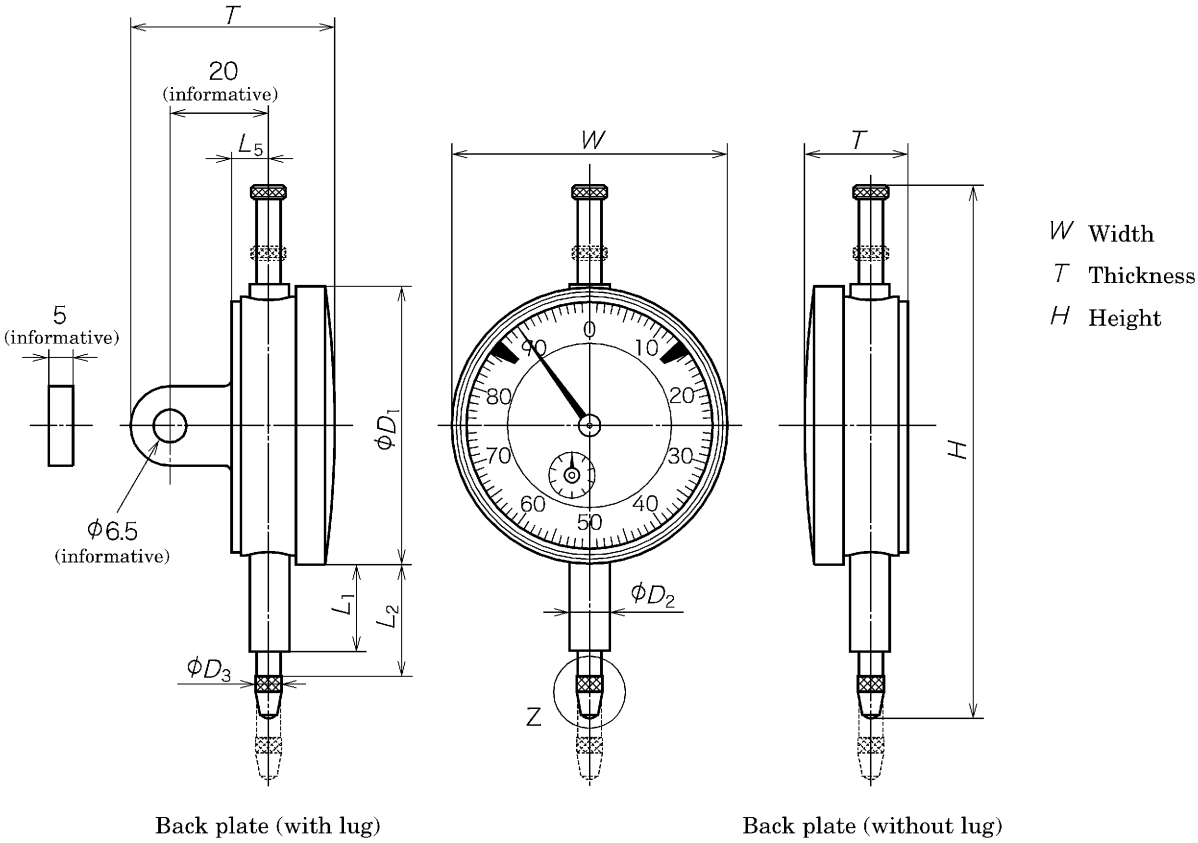
Figure 3 Nomenclature of mechanical dial gauge

4.4 Fixing of mechanical dial gauge

The mechanical dial gauge shall be provided with a means to facilitate attachment to test stands or similar devices. This is often accomplished by means of a stem or a back plate (with lug). Dimensions of the stem and back plate (with lug) are shown in Figure 4 and Table 1. The rigidity of the stem shall be such that the freedom of the movement of the plunger is not impaired by clamping the stem of the instrument.

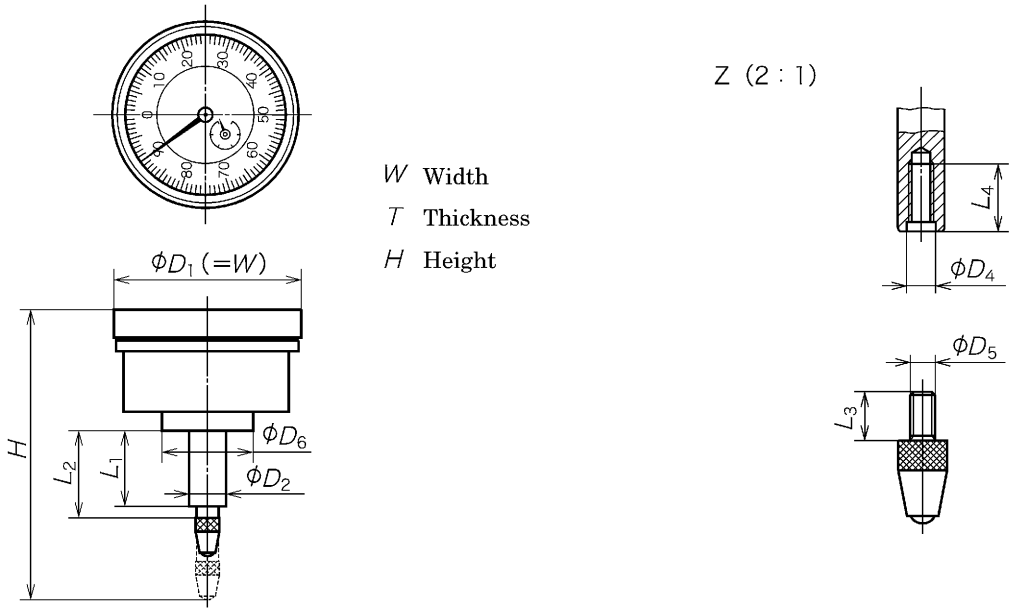
4.5 Dimensions

The dial gauge shall conform to the dimensions specified in Figure 4 and Table 1 to ensure interchangeability.



a) Vertical (Standard type)

Figure 4 Dimensions of mechanical dial gauge



b) Horizontal (Back plunger type) **c) Contact element**

Figure 4 (concluded)

Table 1 Main dimensions

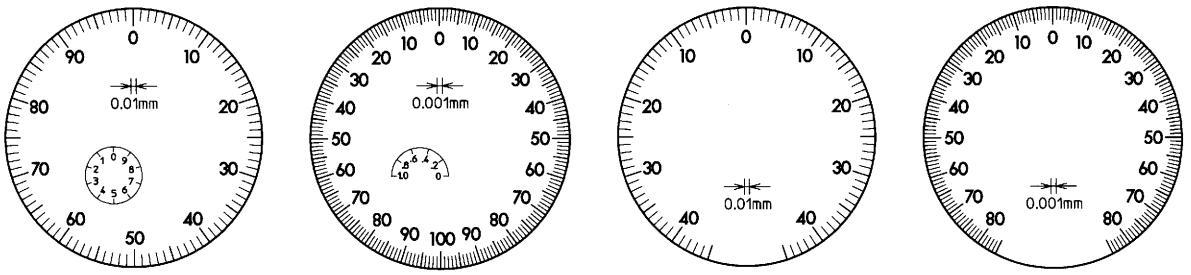
Unit: mm

Size classification	Bezel diameter D_1				
	30	40	60	80	100
Range of diameter D_1 [a]	28 to 36	37 to 50	51 to 70	71 to 89	90 to 115
Stem diameter D_2	8 h6				
Contact element outside diameter D_3	≤7.5				
Thread size D_4	M2.5-6H				
Thread size D_5	M2.5-6g				
Clamp diameter D_6 [b]	28 h6				
Stem length L_1	≥8.5	≥10	≥12	≥15.5	≥9.5
Plunger length L_2 [c]	≤12	≤28	≤34	[d]	[d]
Thread length L_3	≤5				
Thread length L_4	≥6				
Distance from a plunger centre axis to a back plate (without lug) L_5	≤10				

Notes [a] Actual bezel diameter equals width (W).
[b] The clamp diameter D_6 is optional.
[c] Plunger pressed in.
[d] Depending on the measuring range.

4.6 Scale

The circular scale shall be graduated in scale intervals. The scale interval and its unit shall be clearly identified. Two examples of scale layouts are shown in Figure 5 (scale interval: 0.01 mm, 0.001 mm).



a) Scale for multiple revolutions **b) Scale for partial revolution**

Figure 5 Examples of scale layouts

4.7 Pointer

The pointer shall move in a clockwise direction when the plunger is pressed into the gauge.

NOTE 1 The width of the pointer tip and that of the graduation line should be equal.

NOTE 2 The width of the pointer tip should be 20 % or smaller of the width of one scale division, so that reading between the graduation lines is not impaired.

4.8 Revolution counting device

A revolution counting device, when provided, shall indicate the appropriate division on its scale within ± 25 % between graduation lines when the pointer is at the beginning point (12 o'clock) on each of its revolutions.

4.9 Contact element

The contact element shall be replaceable.

It shall have a spherical, rigid, and wear-resistant measuring surface and shall be well finished and free from irregularities which could affect the accuracy of the instrument.

4.10 Zero adjustment

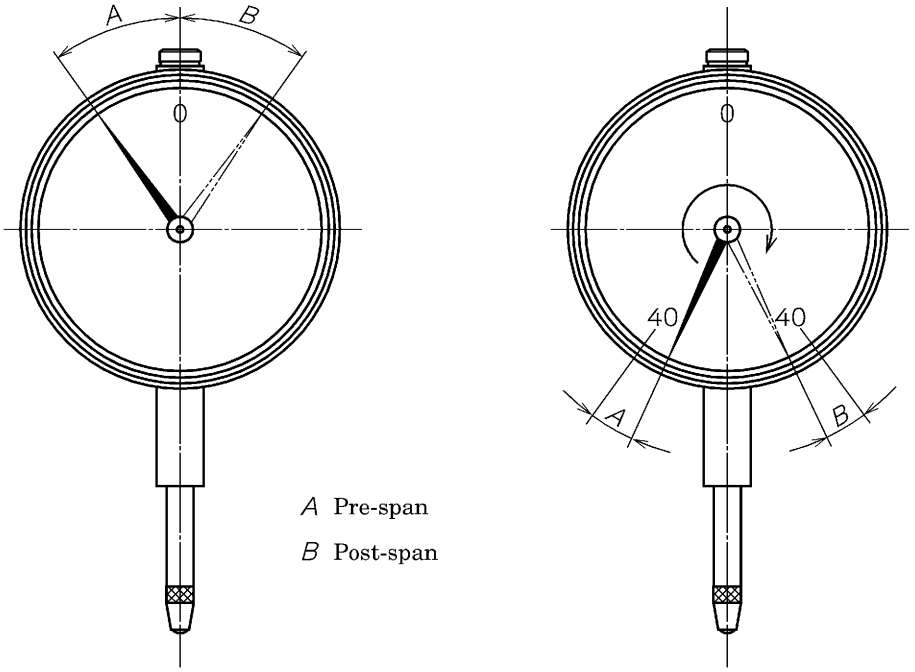
Each mechanical dial gauge shall be provided with a means of resetting the gauge to zero. When this is achieved by making the bezel linked to the dial rotatable, the construction of the bezel shall be such that adjustment can be easily made. In general, a frictional resistant bezel is used.

NOTE 1 Zero adjustment may be provided with a bezel locking device such as a clamp which, once adjustment is complete, fixes the bezel firmly in place.

NOTE 2 The basic zero positions on the scale plate are as shown in Figure 3.

4.11 Pre-span and post-span

The pre-span and post-span shall be over a range of at least 1/10th of revolution [see Figure 6 a)] for dial gauge with multiple revolutions, and over a range of at least three scale intervals [see Figure 6 b)] for dial gauge with partial revolution. Pre-span and post-span ranges shall not overlap with each other on the scale.



a) Dial gauge with multiple revolutions **b) Dial gauge with partial revolution**

Figure 6 Example of pre-span and post-span

4.12 Movable limit indicators

Limit indicators, where provided, shall not unduly impair visibility of the scale markings (see Figure 3).

4.13 Design specification by the manufacturer or the supplier

As a minimum requirement the manufacturer or the supplier shall present at least the information set out in Table 2 (see Figure 4 and Annex JD).

Table 2 Design specification

External dimensions (mm)	Width (W)	
	Thickness (T)	
	Height (H)	
Measuring range (mm)		
Scale interval (mm)		
Plunger lifting device (lifter)		Yes/No
Back plate		With lug/Without lug
Fluid and dust protection [a)]		Yes/No
Shock proof		Yes/No
Note [a)] IP code (see **JIS C 0920**) may be used for specification.		

5 Performance (metrological characteristics)

5.1 Maximum permissible error (MPE) and maximum permissible limit (MPL)

Unless otherwise specified by the manufacturer or the supplier, the performance of the dial gauge, when tested by the methods given in Annex JA, shall comply with the error of indication, hysteresis error, and repeatability values given in Tables 3 and 4 and measuring force MPL values given in Table 5 at any position within the measuring range and at any orientation of the dial gauge.

Table 3 Performance of vertical (standard type) dial gauges with bezel diameters not less than 50 mm [maximum permissible error (MPE)]

Performance		Scale interval (mm)											
		0.01								0.005	0.001		
		Measuring range (mm)											
		1 or under	Over 1 up to and incl. 3	Over 3 up to and incl. 5	Over 5 up to and incl. 10	Over 10 up to and incl. 20	Over 20 up to and incl. 30	Over 30 up to and incl. 50	Over 50 up to and incl. 100	5 or under	1 or under	Over 1 up to and incl. 2	Over 2 up to and incl. 5
Error of indication (MPE) (μm)	1/10 revolution	5	5	5	5	8	10	10	12	5	2	2	3.5
	1/2 revolution	8	8	9	9	10	12	12	17	9	3.5	4	5
	One revolution	8	9	10	10	15	15	15	20	10	4	5	6
	Whole measuring range	8	10	12	15	25	30	40	50	12	5	7	10
Hysteresis error (MPE_H) (μm)		3	3	3	3	5	7	8	9	3	2	2	3
Repeatability (MPE_R) (μm)		3	3	3	3	4	5	5	5	3	0.5	0.5	1
For the MPE of dial gauge with partial revolution, the error of indication over 1/2 revolution or one revolution is not specified.													

Table 4 Performance of dial gauges with bezel diameters less than 50 mm and horizontal (back plunger type) dial gauges [maximum permissible error (MPE)]

Performance		Scale interval (mm)						
		0.01				0.005	0.002	0.001
		Measuring range (mm)						
		1 or under	Over 1 up to and incl. 3	Over 3 up to and incl. 5	Over 5 up to and incl. 10	5 or under	1 or under	1 or under
Error of indication (MPE) (μm)	1/10 revolution	8	8	8	9	6	2.5	2.5
	1/2 revolution	11	11	12	12	9	4.5	4
	One revolution	12	12	14	14	10	5	4.5
	Whole measuring range	15	16	18	20	12	6	5
Hysteresis error (MPE_H) (μm)		4	4	4	5	3.5	2.5	2
Repeatability (MPE_R) (μm)		3	3	3	3	3	1	1
For the MPE of dial gauge with partial revolution, the error of indication over 1/2 revolution or one revolution is not specified.								

Table 5 Measuring force of mechanical dial gauge [maximum permissible limit (MPL)]

Performance	Measuring range (mm)			
	10 or under	Over 10 up to and incl. 30	Over 30 up to and incl. 50	Over 50 up to and incl. 100
Maximum (N)	2.0 max.	2.5 max.	3.0 max.	3.5 max.
Minimum (N)	To be defined by the manufacturer.			
Hysteresis (N)				

5.2 Measuring forces

The manufacturer or the supplier shall define the minimum measuring force and hysteresis of measuring force as given in Table 5. The specification of measuring forces shall be in accordance with **7.5.5** of **JIS B 0642**.

6 Proving conformance with specification

6.1 General

For proving conformance/non-conformance with specification, **JIS B 0641-1** or an internationally accepted criterion where the specification zone equals the acceptance zone applies.

Uncertainty evaluation should be performed according to **ISO 14253-2** and **ISO/IEC Guide 98-3**.

NOTE : Internationally accepted criterion referred to above is **ISO/TR 14253-6**: 2012.

6.2 Measurement and performance evaluation

Measurement and evaluation of performance (metrological characteristics) of mechanical dial gauge shall be made in accordance with the procedure specified in Annex JA. An example of a diagram of errors of indication drawn using actual data obtained by measurements is shown in Annex JB.

6.3 Data processing by transferring zero method

Mechanical dial gauges are often used to measure the dimensions of parts at an arbitrary starting point. The transferring zero method, in which data processing is performed using the errors of indication obtained in the fixed zero method by transferring the starting point (zero point) for the purpose of performance evaluation, is explained in Annex JC.

This method focuses on the maximum and minimum value points in the diagram of errors of indication shown in Annex JB, and is effective in evaluating the performance (metrological characteristics) of a dial gauge.

6.4 Standard temperature

Each performance (metrological characteristics) values specified in this Standard shall be assumed as values at the standard temperature 20 °C specified in **JIS B 0680**.

7 Marking

The mechanical dial gauge shall be provided with a marking containing the following information, which shall be readable and permanent, and shall be placed on the dial gauge surface such that it will not impair the quality.

a) Manufacturing number (serialized alpha-numeric identification)

b) Name of manufacturer or supplier, or its abbreviation

Annex JA (normative)
Measurement and performance evaluation

Table JA.1 shows the methods for measurement and performance evaluation of mechanical dial gauge.

Table JA.1 Measurement and performance evaluation

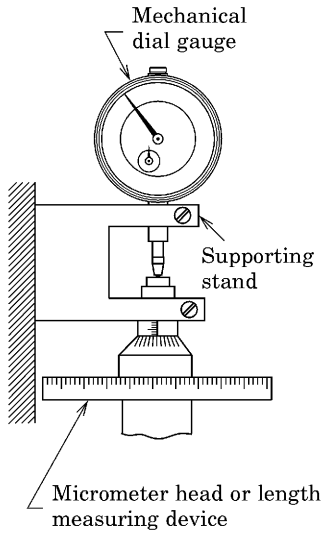
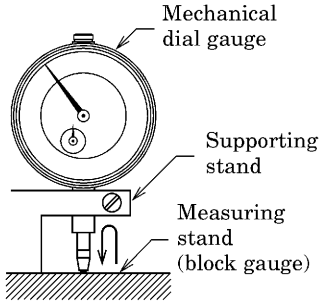
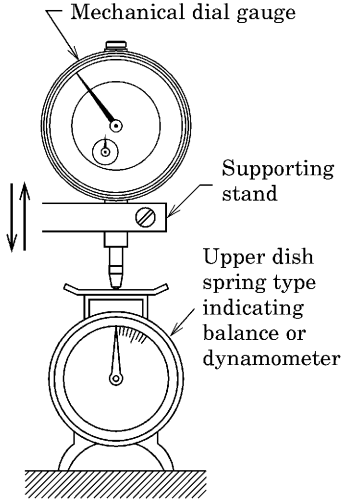
<table>
<tr><th colspan="2">Measurement item</th><th>Applicable type</th><th>Measuring method
(Fixed zero method)</th><th>Evaluation method
(Transferring zero method)</th><th>Example of measurement</th></tr>
<tr><td rowspan="5">Error of indication</td><td>Error of indication over the whole measuring range</td><td rowspan="2">Dial gauge with multiple revolutions and dial gauge with partial revolution</td><td rowspan="5">Fix the dial gauge rigidly in a supporting stand, move the contact element successively in the forward direction, and read the errors of indication [a] at the following measuring points.
• From the starting point to 2nd revolution, at every 1/10 revolution of the pointer [b]
• From 2nd to 5th revolution, at every 1/2 revolution of the pointer
• From 5th to 10th revolution, at every one revolution of the pointer
• From 10th to 50th revolution, at every 5 revolutions
• From 50th revolution and onward, at every 10 revolutions
After pressing in the contact element so that the pointer shifts by three or more scale divisions from the end point of the measuring range, move the contact element in the retrace direction successively and read the errors of indication at the same points as measured in the forward direction.</td><td>Obtain the difference between the maximum and minimum errors of indication at all measuring points in both forward and retrace directions.</td><td rowspan="5"> 
</td></tr>
<tr><td>Error of indication over 1/10 revolution</td><td>Obtain the maximum value of difference in errors of indication between any two adjacent measuring points at every 1/10 rotation from the starting point to 2nd revolution in both forward and retrace directions [c].</td></tr>
<tr><td>Error of indication over 1/2 revolution</td><td rowspan="3">Dial gauge with multiple revolutions</td><td>Obtain the maximum value of difference between the largest and smallest errors of indication read at every 1/2 revolution within the measuring range from the starting point to 5th revolution, in both forward and retrace directions.</td></tr>
<tr><td>Error of indication over one revolution</td><td>Obtain the maximum value of difference between the largest and smallest errors of indication read at every one revolution within the measuring range from the starting point to 10th revolution, in both forward and retrace directions.</td></tr>
<tr><td>Hysteresis error</td><td>Dial gauge with multiple revolutions and dial gauge with partial revolution</td><td>Obtain the maximum value of difference between errors of indication taken in the forward direction and those taken at the corresponding measuring points in the retrace direction.</td></tr>
</table>

Table JA.1 (concluded)

Measurement item	Applicable type	Measuring method (Fixed zero method)	Evaluation method (Transferring zero method)	Example of measurement
Repeatability	Dial gauge with multiple revolutions and dial gauge with partial revolution	Fix the dial gauge in a supporting stand, and after pressing in the contact element to a desired position within the measuring range, allow it to retract quickly or slowly five times and take a reading at each point.	Determine the maximum difference between the five indications obtained.	
Measuring force		Fix the dial gauge in a supporting stand, and move the contact element in the forward and retrace directions continuously and gradually and take measurements of the measuring force at the starting point and end point.	Determine the maximum value of the readings (maximum measuring force) and minimum value of the readings (minimum measuring force) and also determine the differences in the readings between corresponding measuring points in forward and retrace directions.	

Notes
a) For reading of errors, either read the input quantity of the measuring device with the pointer of the dial gauge adjusted at a scale graduation, or read the indication of the dial gauge according to the displacement of the measuring device.

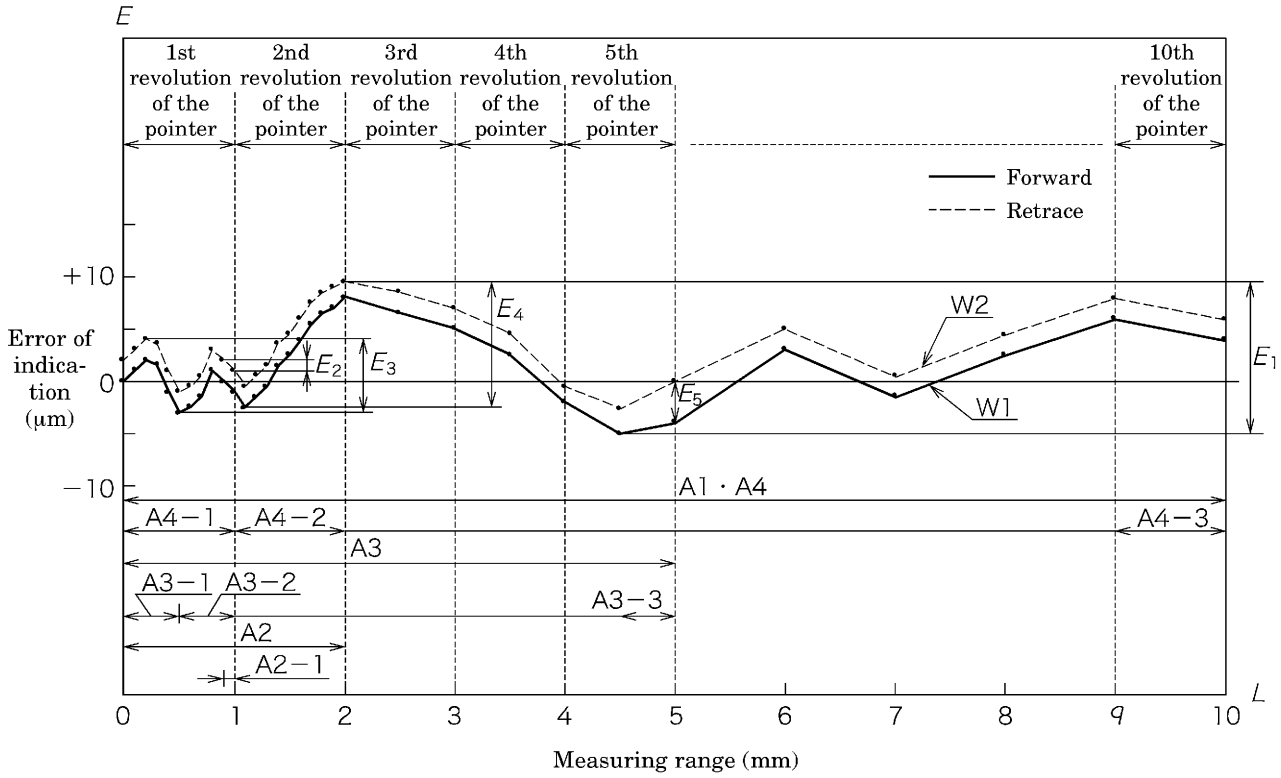
b) For dial gauge with partial revolution, read errors at every 10 scale divisions.

c) For dial gauge with partial revolution, obtain the maximum value of difference in errors of indication between any two adjacent measuring points at every 10 scale divisions.

Annex JB (informative)
Example diagram of errors of indication

Figure JB.1 shows an example diagram of errors of indication obtained by the fixed zero method.

A diagram of errors of indication is also called an error diagram.



Applicable instrument

- Scale interval 0.01 mm
- Measuring length of one revolution 1 mm
- Measuring range 10 mm
- Number of revolutions 10 revolutions

E: error of indication (μm)

W1: error curve (forward direction)

W2: error curve (retrace direction)

A1: evaluation range for error of indication over the whole measuring range

A2: evaluation range for error of indication over 1/10 revolution

A2-1: evaluation range at one particular point

A3: evaluation range for error of indication over 1/2 revolution

A3-1: evaluation range for error of indication at 0.5th revolution

A3-2: evaluation range for error of indication from 0.5th to the first revolution

A3-3: evaluation range for error of indication from 4.5th to the 5th revolution

A4: evaluation range for error of indication over one revolution

A4-1: evaluation range for error of indication at the first revolution

A4-2: evaluation range for error of indication at the second revolution

A4-3: evaluation range for error of indication at the 10th revolution

E_1: error of indication over the whole measuring range (μm)

E_2: error of indication over 1/10 revolution (μm) (point E_2 in the diagram shows a hysteresis error at one particular point)

E_3: error of indication over 1/2 revolution (point E_3 in the diagram shows error at 0.5th revolution) (μm)

E_4: error of indication over one revolution (point E_4 in the diagram shows error at the second revolution) (μm)

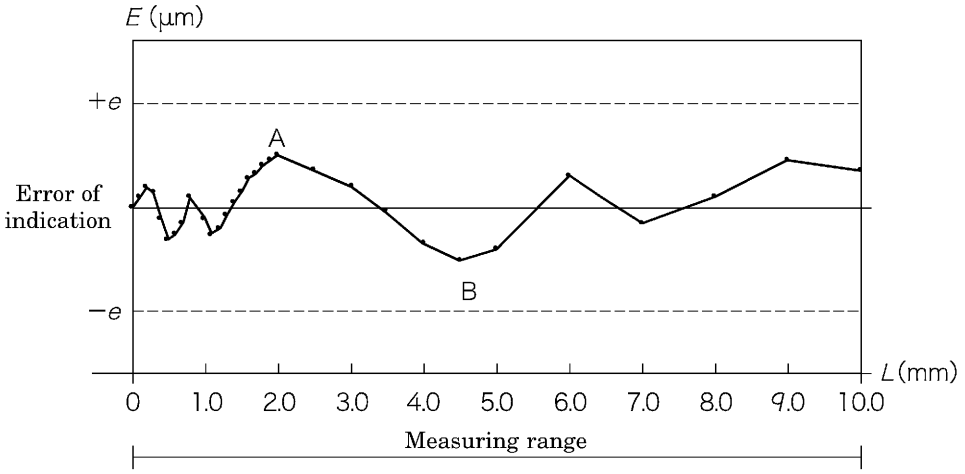
E_5: hysteresis error (point E_5 in the diagram shows an error at one particular point) (μm)

Figure JB.1 Example diagram of errors of indication by fixed zero method

Annex JC (informative)
Transferring zero method (performance evaluation method by data processing)

Mechanical dial gauges are often used to measure the dimensions of parts at an arbitrary starting point. In order to determine the error of indication over the whole measuring range, the starting point has to be displaced within the measuring range many consecutive times until the whole range over which the errors disperse can be found. This naturally requires massive amount of data. As an alternative to this approach, the data processing using the diagram of errors of indication obtained by the fixed zero method can be applied, in which the starting point is displaced to the measurement points at which the minimum and maximum errors are found on the said diagram to find the range of dispersion of errors. This approach is referred to as the transferring zero method by data processing.

Further, errors of indication in a specific measuring range can be determined by performing data processing in that range (see Figures JC.1 to JC.3).



Applicable instrument

• Scale interval	0.01 mm	• Measuring range	10 mm
• Measuring length of one revolution	1 mm	• Number of revolutions	10 revolutions

Figure JC.1 Example diagram of errors of indication obtained by the fixed zero method

Figure JC.1 shows a diagram of errors of indication obtained by the fixed zero method, where point A is the maximum error of indication and point B is the minimum of error of indication.

NOTE : For the sake of simplicity, only the forward direction curve is shown.

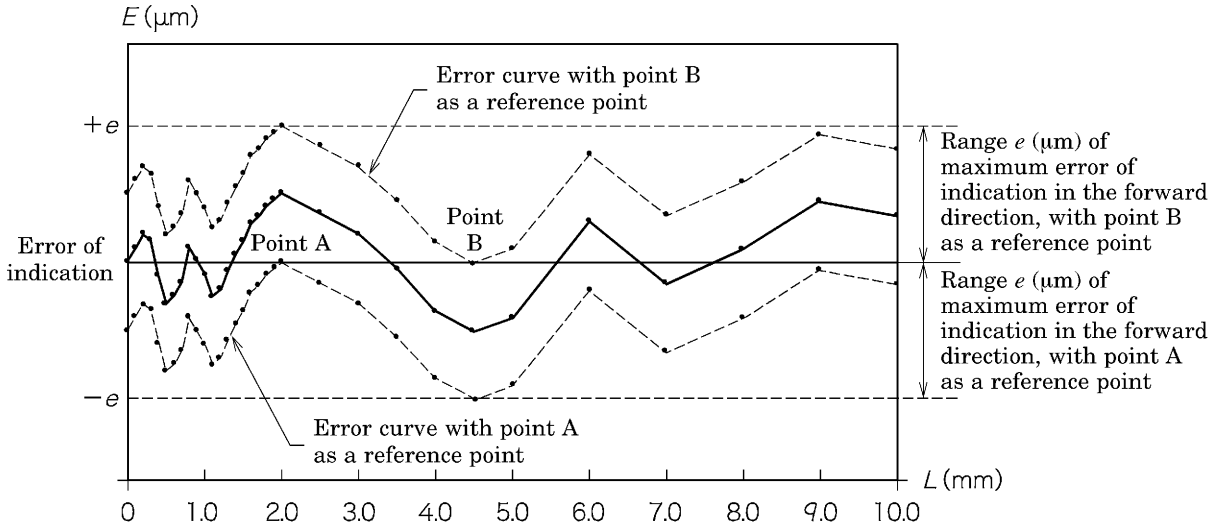


Figure JC.2 Example diagram of errors of indication obtained by moving the reference point to point A and point B

Figure JC.2 shows the diagram of errors of indication obtained by moving the reference point of the diagram shown in Figure JC.1 to point A and point B. This diagram shows that dispersion of errors, as the result of moving the reference point to an arbitrary point, is within the range e (μm), and therefore the error of indication over the whole measuring range is e (μm).

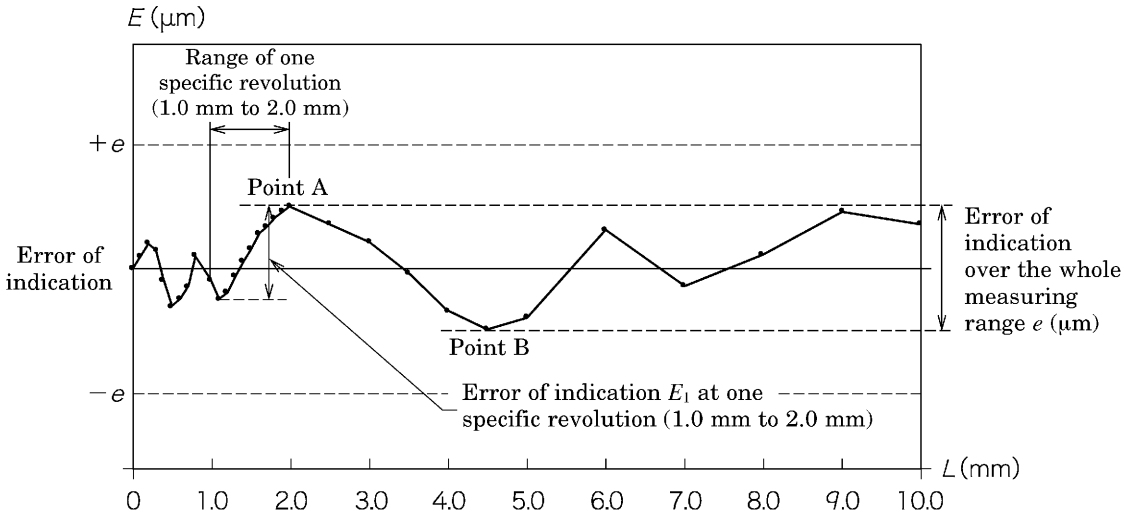


Figure JC.3 Example of diagram for determining errors of indication obtained from the diagram by fixed zero method by transferring zero method

For determining the indication error over the whole measuring range by the transferring zero method from the diagram by the fixed zero method shown in Figure JC.1, the difference between the maximum error at point A and minimum error at point B in Figure JC.3 can be determined, which is equal to the value e (μm) shown on the diagram in Figure JC.2 obtained by moving the reference point to an arbitrary point. Other

errors of indication can be also determined within a specific range in a similar manner [E_1 indicates an error of indication over a specific range (at second revolution), with respect to the measuring length of one revolution (1 mm)].

Annex JD (informative)

Example data sheet for design and performance specifications of mechanical dial gauges

The following is an example of data sheet provided by a manufacturer in a catalogue or a brochure, etc. to communicate the product information to the users. The information shown in the following is most typically shown on a dimensional drawing or in a list.

Name of equipment: .....

Product outline: .....
(scale layout, type of contact element, accessories, etc.)

☐ Design specification (design characteristics)

Type: .....

Overall dimensions:

width (*W*) ..... mm

thickness (*T*) ..... mm

height (*H*) ..... mm

Other dimensions are in accordance with **JIS B 7503**.

Measuring range: ..... mm

Scale interval: ..... mm

Plunger lifting device (lifter): Yes/No

Back plate: With lug/Without lug

Protection against: Fluid ( ) · Dust ( ) · None

Shock protection: Shock proof Yes/No

☐ Performance (metrological characteristics) specification

Hysteresis of indication (MPE_H): ..... μm Repeatability of indication (MPE_R): ..... μm

Errors of indication (MPE) over a range of:

the whole measuring range ..... μm

1/10 revolution ..... μm

1/2 revolution ..... μm

one revolution ..... μm

Measuring force (MPL):

maximum ..... N minimum ..... N hysteresis ..... N

Company .....

Date or edition .....

Bibliography

JIS C 0920 *Degrees of protection provided by enclosures (IP Code)*

TS Z 0033 : 2012 *Guide to the expression of uncertainty in measurement*

ISO/TR 14253-6 : 2012 *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*

Annex JE (informative)
Comparison table between JIS and corresponding International Standard

JIS B 7503:2017 *Mechanical dial gauges*	**ISO 463**:2006 *Geometrical Product Specifications (GPS)—Dimensional measuring equipment—Design and metrological characteristics of mechanical dial gauges*

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		No. of clause	Content	Classification by clause	Detail of technical deviation	
2 Normative references							
3 Terms and definitions			3	Mechanical dial gauges	Addition	Add the reference to the terminology standard, **JIS Z 8103**, and new terms and definitions in **3.2** to **3.21**.	The definitions of the terms used in this Standard, like “error of indication”, are specified for clarity. This causes no technical deviation. The term “floating zero” is changed to “transferring zero”, since the former term is not appropriate in the context of measurement terminology. The word “any” before 1/10, 1/2, and one rotation in reference to respective errors of indication is deleted because the evaluation is to be made in the specified range.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		No. of clause	Content	Classification by clause	Detail of technical deviation	
4 Design specification (design characteristics)	4		4	Design characteristics	Alteration	Replace with design specification.	The term “design characteristics” is replaced with a more commonly used term.
	4.1 General		4.1	The design of the dial gauge need not consider any specific orientation of the dial gauge unless it is specified by the manufacturer.	Alteration	Add the expression “at any orientation” to the design specification of the dial gauge.	The expression is altered for establishing consistency with **JIS B 7533**:2015 [Dial test indicators (lever type)].
	4.2 Type Figure 2		4.2	Dimensions Almost identical with **JIS**.	Alteration	This causes no technical deviation.	The dimensional specification is separated from the configuration specification for users’ convenience.
	4.3 Nomenclature Figure 3		4.2	Dimensions	Alteration	Add back plate (with a lug), cap and clamping arm to Figure 3.	The dimensional specification is separated from the nomenclature for users’ convenience. This causes no technical deviation.
	4.4 Fixing of mechanical dial gauge		4.1	General Almost identical with **JIS**.	Alteration	This causes no technical deviation.	The specification regarding fixing of the dial gauge is separated from the general requirements for users’ convenience.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		No. of clause	Content	Classification by clause	Detail of technical deviation	
4 Design specification (design characteristics) (continued)	4.5 Dimensions Figure 4		4.2	Dimensions Almost identical with **JIS**.	Alteration	• Add explanation for L_2, that it is the length with the plunger pressed in. • Add back plate (with lug) to Figure 4. • Plunger axis-lug hole centre distance 20 mm (informative) • Lug hole diameter 6.5 mm (informative) • Lug thickness 5 mm (informative)	Requirements necessary for ensuring interchangeability are added.
	4.6 Scale Figure 5		4.3	Dial and pointer Almost identical with **JIS**.	Alteration	No technical deviation.	Specifications for dial and pointer are provided separately for convenience.
	4.7 Pointer		4.3	Dial and pointer	Addition	Add the following NOTES. NOTE 1 The width of pointer tip and that of the graduation line should be equal. NOTE 2 The width of the pointer tip should be 20 % or smaller of the width of one scale division, so that reading between the graduation lines is not impaired. This causes no technical deviation.	Specifications for dial and pointer are provided separately for convenience. The NOTES are added to minimize error in reading.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		No. of clause	Content	Classification by clause	Detail of technical deviation	
4 Design specification (design characteristics) (concluded)	4.8 Revolution counting device		4.4	Revolution counting device Almost identical with **JIS**.	Addition	Add the tolerance, "within ±25 % between graduation lines".	The tolerance is added for increasing usability of this Standard.
	4.10 Zero adjustment		4.6	Zero adjustment	Alteration	Add the description "the construction of the bezel shall be such that adjustment can be easily made". This causes no technical deviation.	The description ensures that the zero adjustment can be easily made, for increasing usability of this Standard.
	4.11 Pre-span and post-span Figure 6		4.3	Dial and pointer	Alteration	This causes no technical deviation.	Specifications for dial and pointer are provided separately for convenience.
5 Performance (metrological characteristics)	5.1 Maximum permissible error (MPE) and maximum permissible limit (MPL) Tables 3, 4 and 5		5.1	MPE and MPL for metrological characteristics	Alteration	Add specific figures (MPE and MPL) corresponding to scale interval and measuring range in a table.	Specification values are added for increasing usability of this Standard.
	—		5.2	Contact element	Deletion	Delete the requirement which, in **JIS** performance specification, is considered unnecessary.	The deletion causes no technical deviation.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		No. of clause	Content	Classification by clause	Detail of technical deviation	
6 Proving conformance with specification	6.1 General Methods and criterion for proving conformance/non-conformance with specification.		6.1	For proving conformance/non-conformance with specification, **ISO 14253-1** applies.	Addition	Add the definition of the acceptance criterion as "an internationally accepted criterion where the specification zone equals the acceptance zone applies", and a note further identifying the "internationally accepted criterion" to be **ISO/TR 14253-6**:2012.	The description is added to allow for selection of a suitable acceptance criteria and to thereby increase usability of this Standard.
	Evaluation of uncertainty			Uncertainty evaluation shall be performed according to **ISO 14253-2** and **ISO/IEC Guide 98-3**.	Alteration	Change the expression to "should be performed according to **ISO 14253-2** and **ISO/IEC Guide 98-3**" to make it a recommendation.	The changed expression allows for an option of leaving the uncertainty evaluation to the discretion of experts or performing it based on accumulated knowledge, and therefore increases the usability of this Standard.
	6.2 Measurement and performance evaluation Annex JA		—		Addition	Add detailed procedures for measurement and performance evaluation in Annex JA, and an example diagram of errors of indication in Annex JB.	Detailed specification is added to increase usability of this Standard.
	6.3 Data processing by transferring zero method Annex JC		—		Addition	Add the description regarding data processing by the transferring zero method in Annex JC.	Detailed specification is added to increase usability of this Standard.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		No. of clause	Content	Classification by clause	Detail of technical deviation	
6 Proving conformance with specification (concluded)	6.4 Standard temperature **JIS B 0680** Standard temperature 20 °C		—		Addition	Add the statement that performance values in this Standard are to be assumed as values at the standard temperature 20 °C.	Detailed specification is added to increase usability of this Standard.
7 Marking			7	Almost identical with **JIS**.	Addition	Add the name of manufacturer to the marking items. This causes no technical deviation.	The specific requirement is provided to increase usability of this Standard.
Annex	Annexes JA to JD			Annexes A to C	Alteration	Add detailed description of performance measurement and evaluation, example diagram of errors of indication, and data processing methods in separate annexes.	The whole procedure from measurement to data processing is explained orderly for users' understanding of this Standard.
Annex JA (normative)	Measurement and performance evaluation		Annex C	Measuring points are dependent on the scale interval and the measuring range. No specification regarding evaluation method.	Alteration	Add detailed specification of measuring points and measurement method. Define the error of indication over one revolution as follows: The maximum value of difference between the largest and smallest errors of indication read at every one revolution within the measuring range from the starting point to 10th revolution, in both forward and retrace directions.	Detailed specification is added to increase usability of this Standard.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		No. of clause	Content	Classification by clause	Detail of technical deviation	
Annex JB (informative)	Example diagram of errors of indication		Annex A	No specific description.	Alteration	Add evaluation ranges and specific values of indication errors to the example diagram.	An example diagram for an instrument with 0.01 mm scale interval and measuring range of 10 mm is laid out for the sake of users' convenience.
Annex JC (informative)	Transferring zero method (performance evaluation method by data processing)		Annex C	Principles of instrument calibration with fixed zero and floating zero are explained, using reference to **ISO 14978**.	Alteration	Add detailed explanation of the transferring zero method along with a diagram.	An example diagram for an instrument with 0.01 mm scale interval and measuring range of 10 mm is laid out for illustration of the transferring zero method and to increase usability of this Standard.
Annex JD (informative)	Example data sheet for design and performance specifications of mechanical dial gauges		Annex B	The data sheet example includes design and performance specifications and also sales information.	Alteration	Present the design and performance specifications to be included in the data sheet, and add the statement that the data sheet shown is an example of layout used by the manufacturer or supplier to provide product information to users.	The alteration is to reflect the norm that product specifications are most typically provided by the manufacturer or supplier in the form of a drawing or a list included in catalogues.
—	—		Annex D	GPS matrix	Deletion	—	—

Overall degree of correspondence between **JIS** and International Standard (**ISO 463**:2006): MOD
NOTE 1 Symbols in sub-columns of classification by clause in the above table indicate as follows: — Deletion: Deletes the specification item(s) or content(s) of International Standard. — Addition: Adds the specification item(s) or content(s) which are not included in International Standard. — Alteration: Alters the specification content(s) which are included in International Standard. NOTE 2 Symbol in column of overall degree of correspondence between **JIS** and International Standard in the above table indicates as follows: — MOD: Modifies International Standard.

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Errata will be provided upon request, please contact:

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