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Vernier, dial and digital height gauges

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Foreword

This Japanese Industrial Standard has been 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 7517** : 1993 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.

Vernier, dial and digital height gauges

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 13225**:2012, Edition 1, with some modifications of the technical contents to correspond to the actual situations of manufacturing industries and application.

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 height gauges with analogue indication: vernier scale or circular scale (dial), and those with digital indication.

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

ISO 13225:2012 *Geometrical product specifications (GPS)—Dimensional measuring equipment; Height gauges—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 standards (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*

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*

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

NOTE : Corresponding International Standard: ISO 1 *Geometrical Product Specifications (GPS)—Standard reference temperature for geometrical product specification and verification*

JIS B 7503 *Mechanical dial gauges*

JIS B 7506 *Gauge blocks*

JIS B 7513 *Precision surface plates*

JIS B 7526 *Squares*

JIS B 7533 *Dial test indicators (lever type)*

JIS B 7536 *Electrical comparators*

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

NOTE : Corresponding International Standard: IEC 60529 *Degrees of protection provided by enclosures (IP Code)*

JIS Z 8103 *Glossary of terms used in measurement*

3 Terms and definitions

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

3.1 height gauge

measuring instrument in which a slider with a scriber or measuring stylus moves relative to a measuring scale on a beam and in which this motion is along a single vertical axis nominally perpendicular to a reference plane on the instrument base

NOTE 1 Height gauges are designed to be used with surface plates in which the reference plane of the height gauge is placed in contact with the surface plate.

NOTE 2 Various types of measuring scales on the beam with appropriate indication are possible, such as analogue indication, including vernier and circular scales, and digital indication.

NOTE 3 Most height gauges are capable of using various types of measuring styli, including a scriber.

NOTE 4 Height gauges are sometimes equipped with motorized motion of the slider, while on others the slider can only be moved by hand (manually).

NOTE 5 Height gauges are sometimes equipped with a device to control the measuring force.

NOTE 6 Height gauges are sometimes designed only for measuring distances parallel to the beam while others have measuring devices which allow for more complex measurements, including scanning functions and measurements perpendicular to the beam.

3.2 measuring face contact

contact between the measuring face and a feature of a workpiece

3.2.1 full measuring face contact

contact between the full area of the measuring face and a feature of a workpiece

3.2.2 partial measuring face contact

contact between a partial area of the measuring face and a feature of a workpiece

3.3 error of indication

indication of height gauge minus a true value of the corresponding input quantity

NOTE : The conventional true value is used because it is impracticable to determine a true value.

4 Design specification (design characteristics)

4.1 General

The general design specification (design characteristics) of the height gauge shall be such that its metrological characteristics comply with the requirements of this Standard under all operational orientations, unless otherwise specified by the manufacturer or supplier.

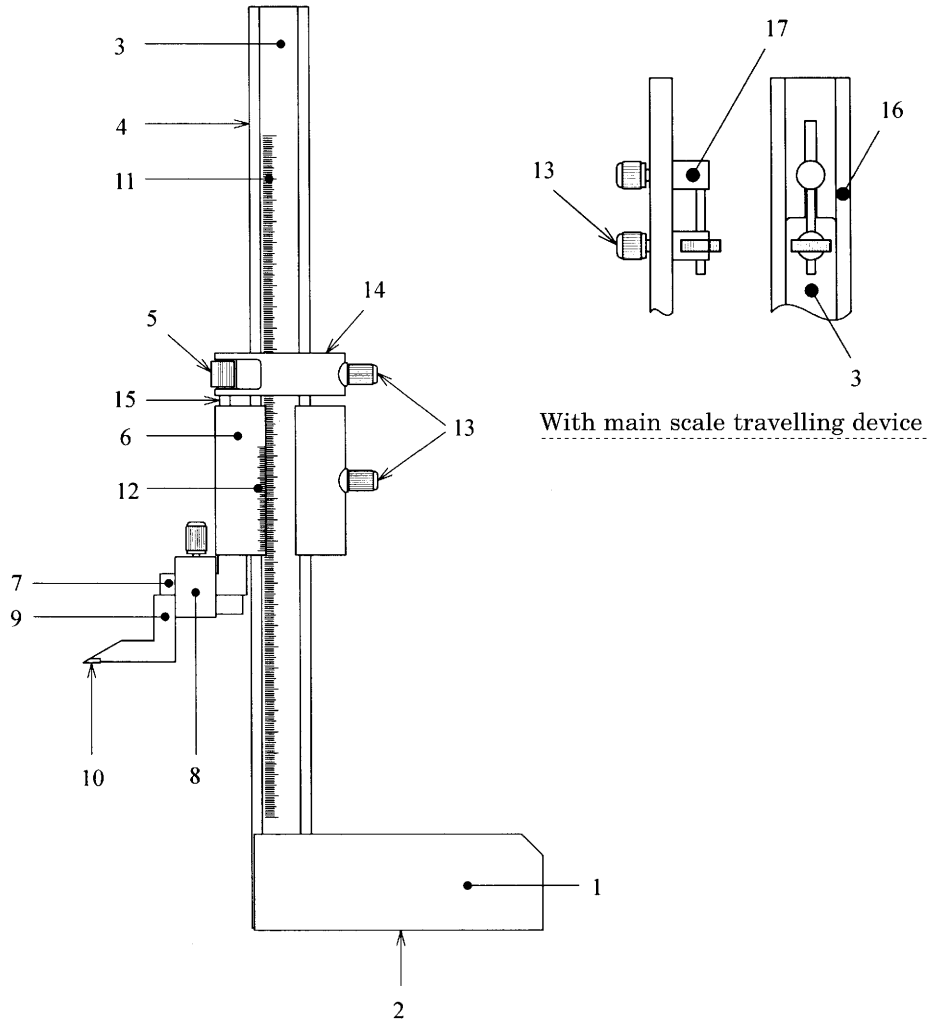
An example of data sheet for specification marking in the case of providing the information for users is given in Annex B.

4.2 Names of main parts

Two examples of height gauge having typical design characteristics: for vernier height gauge and digital height gauge are shown below.

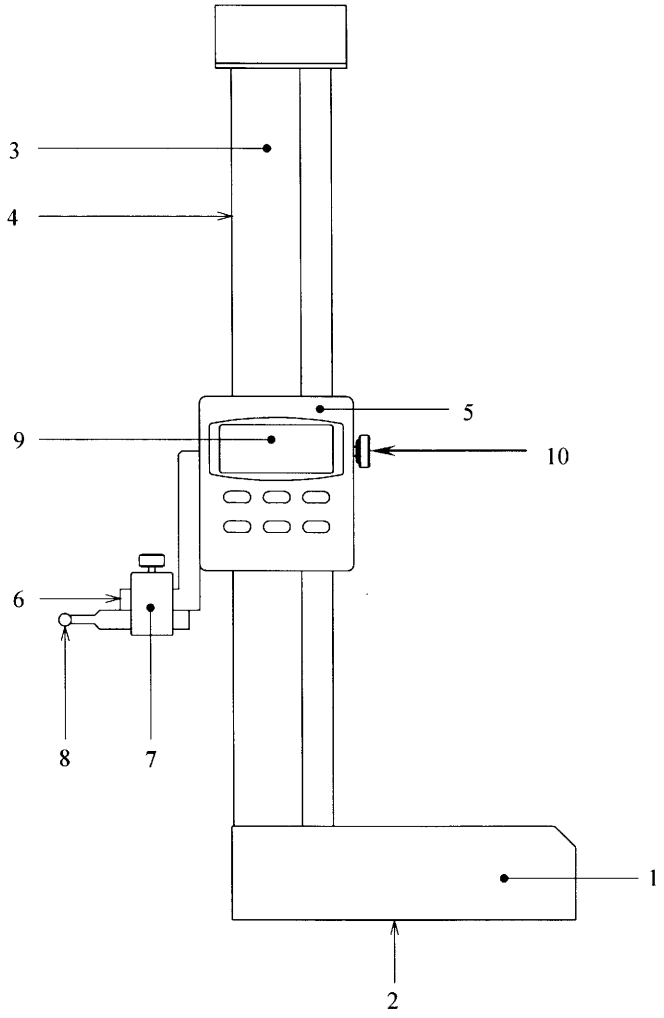
Names of main parts are as given in Figures 1 and 2.

The figures are intended to indicate the names but not intended to give the design details.



1	instrument base	7	probe extension	13	locking devices
2	instrument base reference plane	8	fixing device	14	fine adjustment
3	beam	9	scriber	15	fine adjustment screw thread
4	guiding face	10	scriber measuring face	16	pillar
5	fine adjustment wheel	11	main scale	17	main scale travelling device
6	slider	12	vernier scale		

Figure 1 Example and nomenclature of height gauge with vernier scale



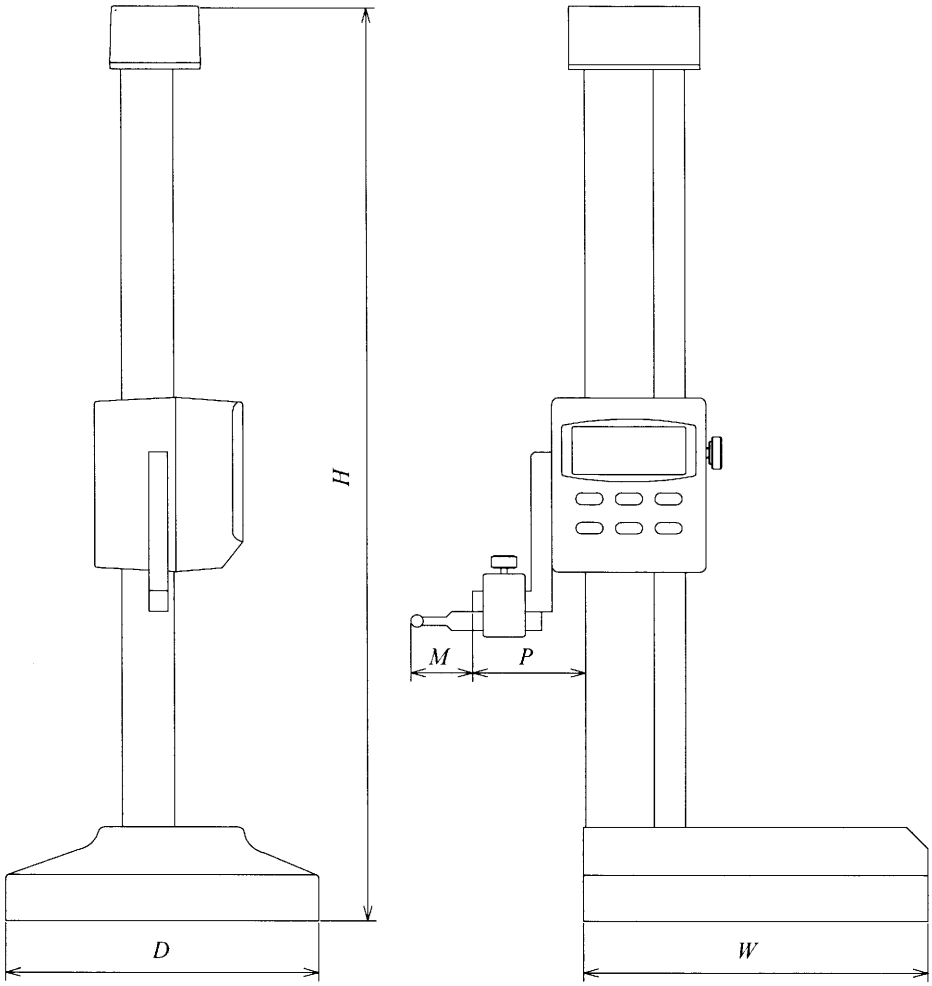
1 instrument base
2 instrument base reference plane
3 beam
4 guiding face
5 slider
6 probe extension
7 fixing device
8 stylus tip
9 digital display
10 locking device

Figure 2 Example and nomenclature of height gauge with digital indication

4.3 Dimensions

As a minimal requirement, the manufacturer shall specify the main dimensions as shown in Figure 3.

Typical data sheet in the case of giving the dimensions of height gauge to the user as product information is given in Annex B.



W width of instrument base
D depth of instrument base
H overall height
P probe extension offset
M stylus length

Figure 3 Symbols of main dimensions for height gauge

4.4 Types of indicating devices

4.4.1 General

Types of indicating devices are analogue indicating devices with a vernier scale or circular scale, or digital indicating devices with digital display.

On height gauges with analogue indicating devices, the scale interval or the minimum reading, and its unit shall be labelled.

On height gauges with digital indicating devices, the unit of the indication shall be labelled.

4.4.2 Analogue indicating devices

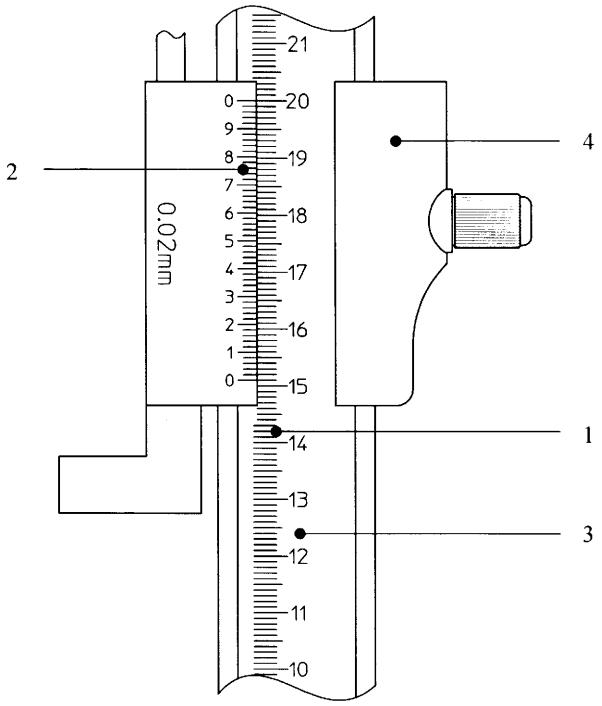
4.4.2.1 General

In the case of instruments with vernier scale, the scale interval on the beam shall be 1 mm. The main scale shall be longer, by at least one vernier scale length, than the measuring range of the instrument.

In the case of instruments with digital scale, the scale interval on the beam should be 1 mm.

4.4.2.2 Vernier scale and main scale

The minimum reading of the instrument with vernier scale shall be 0.05 mm or 0.02 mm. The example is shown in Figure 4.



1 main scale
2 vernier scale
3 beam
4 slider

The reading "10" on the main scale indicates 100 mm.

NOTE : The actual reading in this Figure is 151.00 mm.

Figure 4 Analogue indication with vernier scale

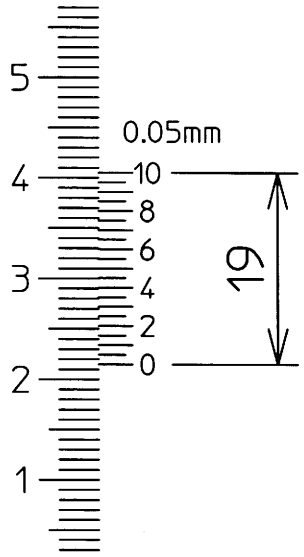
4.4.2.3 Design of vernier scale

The graduating method of verniers is shown in Table 1. Examples corresponding to the graduating method of vernier scale of Table 1 are shown in Figures 5 to 7.

Table 1 Graduating method of verniers

Unit: mm

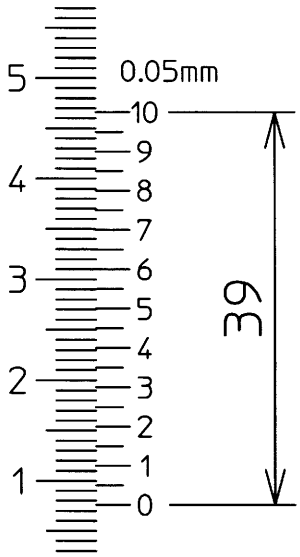
Main scale interval	Graduating method of vernier	Minimum reading	Explanatory figure
1	Divide 19 mm into 20 equal parts	0.05	Figure 5
	Divide 39 mm into 20 equal parts		Figure 6
	Divide 49 mm into 50 equal parts	0.02	Figure 7



The reading "1" on the main scale indicates 10 mm.

NOTE : The actual reading in this Figure is 21.50 mm.

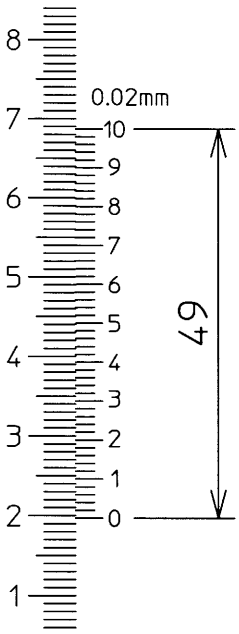
Figure 5 Minimum reading 0.05 mm (divide 19 mm into 20 equal parts)



The reading "1" on the main scale indicates 10 mm.

NOTE : The actual reading in this Figure is 7.60 mm.

Figure 6 Minimum reading 0.05 mm (divide 39 mm into 20 equal parts)



The reading "1" on the main scale indicates 10 mm.

NOTE : The actual reading in this Figure is 19.68 mm.

Figure 7 Minimum reading 0.02 mm (divide 49 mm into 50 equal parts)

The scale line thickness of the height gauge with vernier scale shall be as given in Table 2 unless otherwise specified.

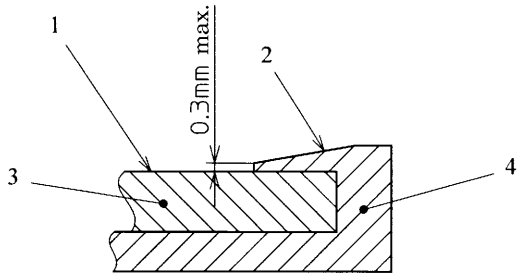
Table 2 Scale line thickness of height gauge with vernier scale

Unit: mm

Item	Thickness	Unevenness in thickness
Main scale line	0.08 to 0.20	0.03 max.
Vernier scale line		

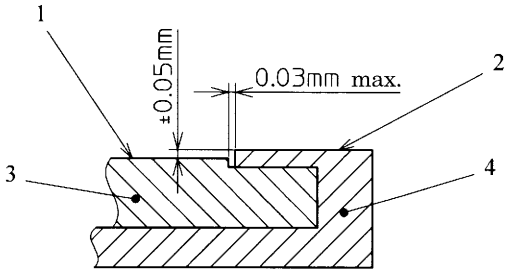
4.4.2.4 Scale surfaces of vernier scale

The dimensions of step difference and clearance between the main scale surface and vernier scale surface shall be as shown in Figures 8 and 9.



1 main scale
2 vernier scale
3 beam
4 slider

Figure 8 Slider with inclined vernier scale

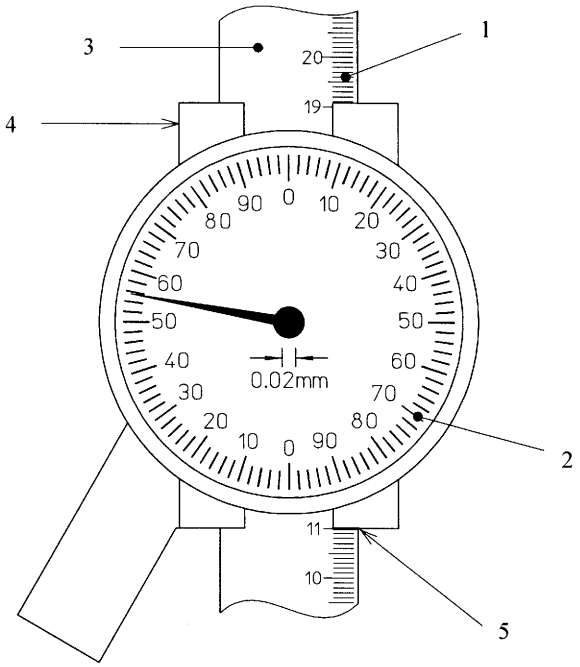


1 main scale
2 vernier scale
3 beam
4 slider

Figure 9 Slider with plane vernier scale

4.4.2.5 Circular scale and main scale

The scale interval of an analogue indicating device with a circular scale shall be 0.02 mm or 0.01 mm. The main scale is located on the beam and the circular scale is located on the slider. The scale interval and its unit shall be labelled on the circular scale. An example is shown in Figure 10.



1 main scale
2 circular scale
3 beam
4 slider
5 main scale index line

The reading "10" on the main scale indicates 100 mm.

NOTE : The actual reading in this Figure is 109.56 mm.

Figure 10 Analogue indication with circular scale

4.4.2.6 Design of circular scale

The scale line thickness of the height gauge with circular scale shall be as given in Table 3 unless otherwise specified.

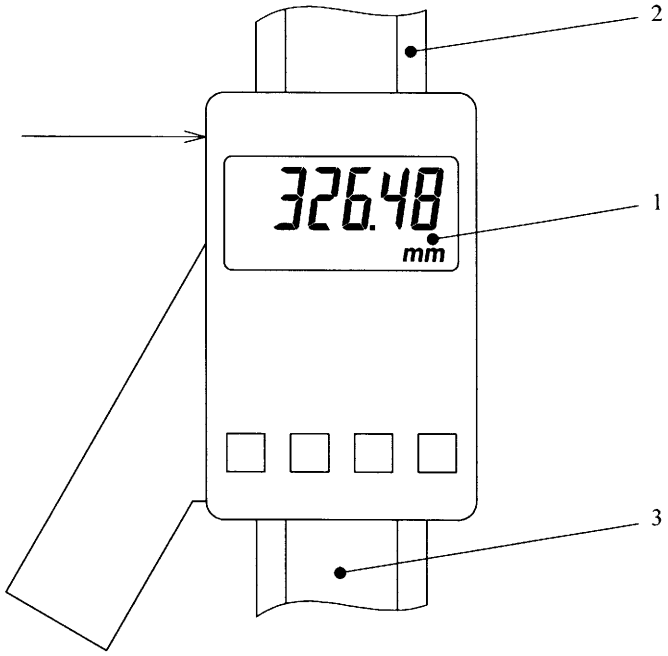
Table 3 Scale line thickness of height gauge with circular scale

Unit: mm

Item	Thickness	Unevenness in thickness
Main scale line	0.10 to 0.30	0.03 max.
Circular scale line		

4.4.3 Digital indicating devices

An example of height gauge with the electronic main scale on the beam and the digital indication on the slider is shown in Figure 11.



1 digital display
2 beam
3 electronic main scale
4 slider

Figure 11 Example of digital indication

In the case of instruments with data output function, the data output protocol (interface) shall be recorded in the product documentation such as catalogue and specification sheet (hereafter referred to as product documentation). Height gauges with digital indicating device shall include a device capable of displaying all operation and system error messages when rapid slider movement could cause the wrong indication or when power-supply voltage declines.

4.4.4 Protection of digital indication for field use

For height gauges with digital indication, manufacturers shall indicate clearly which kind of water and dust protection is provided (IP code, according to **JIS C 0920**) in the product documentation.

4.5 Measuring and scribing stylus

The measuring and scribing styli shall be interchangeable for various measurements.

The measuring face shall be wear-resistant having surface roughness of *Ra* 0.4 or less.

The scribing edge shall be sharp-edged.

4.6 Instrument base

The surface roughness of base reference plane for instruments other than air bearing system shall be *Ra* 0.4 or less. The instrument base shall be designed to move steadily on the surface plate. For air bearing system, the manufacturer or supplier shall give necessary information about air supply if required.

4.7 Construction and function

The construction and function of height gauge shall be as follows.

a) The slider shall be smooth over the entire operating range, be free from harmful play, and operate without looseness.

b) For the instrument of which main scale can be moved, the main scale shall travel smoothly and be securely fixed to the pillar with locking device when used.

c) The slider and fine adjustment shall be securely fixed to the beam or pillar with locking device.

4.8 Hardness

The hardness of base reference plane for instruments other than air bearing system shall be 500 HV or over, or 49 HRC or over. The hardness of scriber measuring surface shall be 700 HV or over, or 60 HRC or over.

5 Metrological characteristics and performance

5.1 General

The metrological characteristics and performance of height gauges are given in **5.4**; however, the manufacturer or supplier shall specify the metrological characteristics and performance according to the function of the height gauge.

The metrological characteristics and performance shall be measured by a suitable instrument and a standard with clear uncertainty, for example a gauge block specified in **JIS B 7506**. The measurement standard shall be able to evaluate the metrological characteristics and performance of a height gauge over the whole measuring range.

NOTE : Notes on use are given in Annex A for reference.

5.2 Operating conditions

The manufacturer or supplier shall give special measuring conditions, if necessary at the request of the user. The measuring conditions are, for example, measuring force, probe stylus-tip calibration (for bidirectional length measurements) and temperature compensation (if available).

5.3 Effect of slider locking

If the slider is locked, the indication shall fulfil the following:

— instruments with analogue indication: the indication shall not change;

— instruments with digital indication: the indicated value shall not change by more than one digital step.

NOTE : The digital display can change by one digital step if the slider is positioned just short of the position where the indication will change.

5.4 Maximum permissible error (MPE)

5.4.1 General

The characteristics on the errors of indication apply to any indication based on the conditions described in **5.1** and **5.2**.

NOTE : The symbols of error-of-indication characteristics and their corresponding markings are given in Annex JA.

5.4.2 Length measurement error E (limited by E_{MPE})

The length measurement error, E, is the error of indication when using the height gauge to measure lengths perpendicular to the height-gauge base reference plane and when the contact direction is in a downward direction. The length measurement error applies when either full measuring face contact or partial measuring face contact is employed.

The maximum permissible error of length measurement error of height gauge, E_{MPE}, shall be in accordance with Table 4 when the instrument is tested according to Table 5. For the permissible values in Table 4, the zero point shall be set on the surface plane.

Table 4 Maximum permissible error of length measurement error E_{MPE}

Unit: mm

Measuring length (L)	Scale interval, minimum indication and minimum reading	
	0.05	0.02 or 0.01
50 max.	± 0.05	± 0.02
Over 50 to and incl. 100	± 0.06	± 0.03
Over 100 to and incl. 200	± 0.07	
Over 200 to and incl. 300	± 0.08	± 0.04
Over 300 to and incl. 400	± 0.09	
Over 400 to and incl. 500	± 0.10	± 0.05
Over 500 to and incl. 600	± 0.11	
Over 600 to and incl. 700	± 0.12	± 0.06
Over 700 to and incl. 800	± 0.13	
Over 800 to and incl. 900	± 0.14	± 0.07
Over 900 to and incl. 1 000	± 0.15	
E_{MPE} of height gauges having other measuring length, scale interval, minimum indication or minimum reading shall be as agreed between the parties concerned with delivery.		
NOTE : E_{MPE} includes the measurement error due to the straightness, flatness and parallelism to reference plane of a measuring face.		

The length measurement error can be tested by measuring measurement standards, e.g. gauge blocks, at different positions within the measuring range of the height gauge (see Figure 12).

NOTE 1 The length measurement error, E, depends on the usage of the height gauge, e.g. the measuring position within the measuring range and the length and configuration of the measuring stylus.

NOTE 2 Form deviations of the surface plate can influence the measurement results.

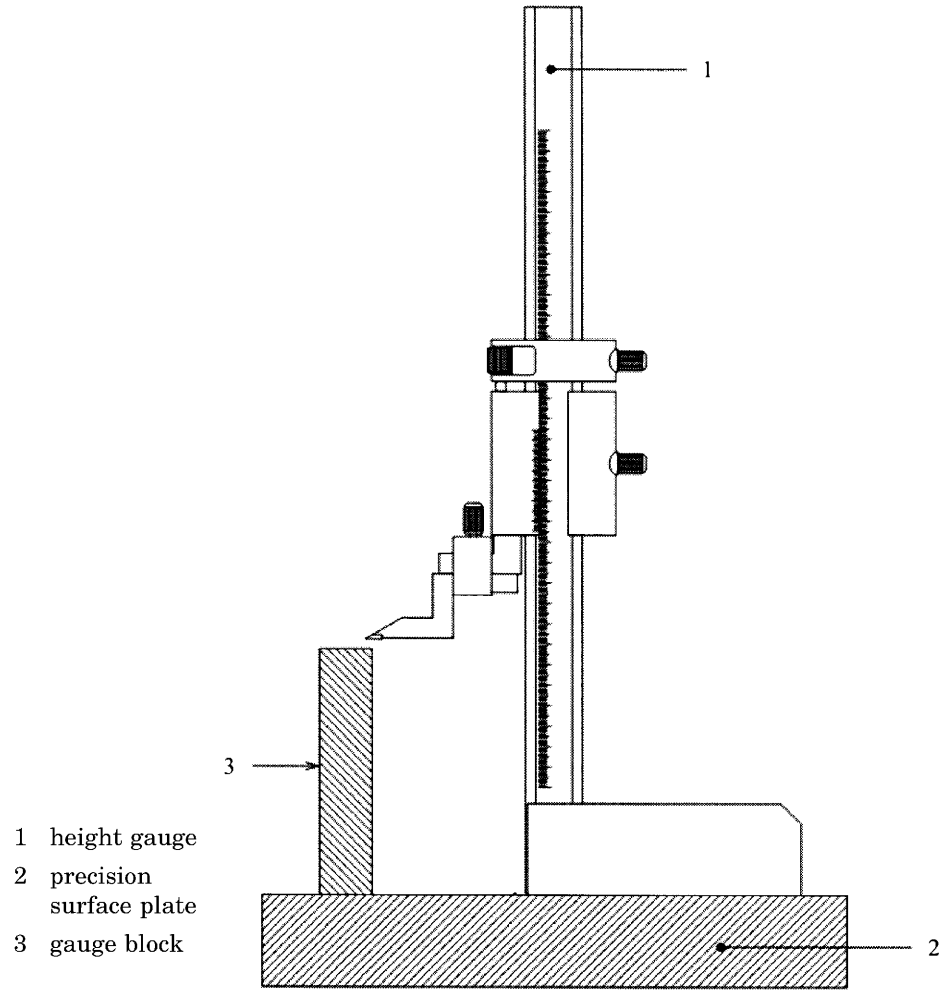
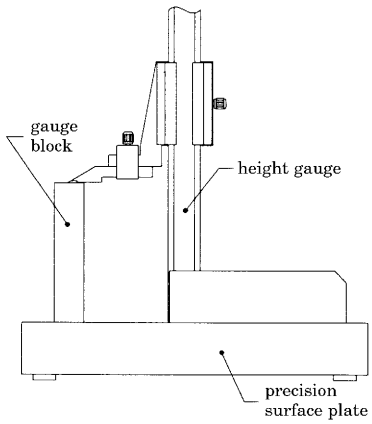


Figure 12 Test arrangement for length measurement error

The measuring method of length measurement error shall be as given in Table 5.

Table 5 Measuring method for length measurement error of height gauge

Item	Measuring method	Figure	Measurement tool
Length measurement error	a) Measure by placing the gauge block or other gauge on the precision surface plate and applying the measuring stylus of scriber to the block, b) Obtain the measurement error by subtracting the dimension of gauge from the reading of height gauge.		• Gauge block of grade 2 specified in **JIS B 7506** or other gauge at least equal to this • Precision surface plate of grade 1 specified in **JIS B 7513**

5.4.3 Repeatability of length measurement error R (limited by R_{MPE})

The repeatability of length measurement error, R, is the closeness of agreement between the results of successive measurements of the same length measurement carried out at any position on the slider under the same conditions of measurement.

The repeatability of the length measurement error may be tested by taking multiple measurements of a measurement standard, e.g. gauge blocks, at any one position of scriber or measuring face of stylus within the measuring range of the height gauge.

NOTE : The manufacturer or supplier may give the details of repeatability of length measurement error at the request of the user.

5.4.4 Bidirectional length measurement error B (limited by B_{MPE})

The bidirectional length measurement error, B, is the error of indication when using the height gauge to measure lengths perpendicular to the height-gauge base reference plane and when the measured surfaces are in opposing directions.

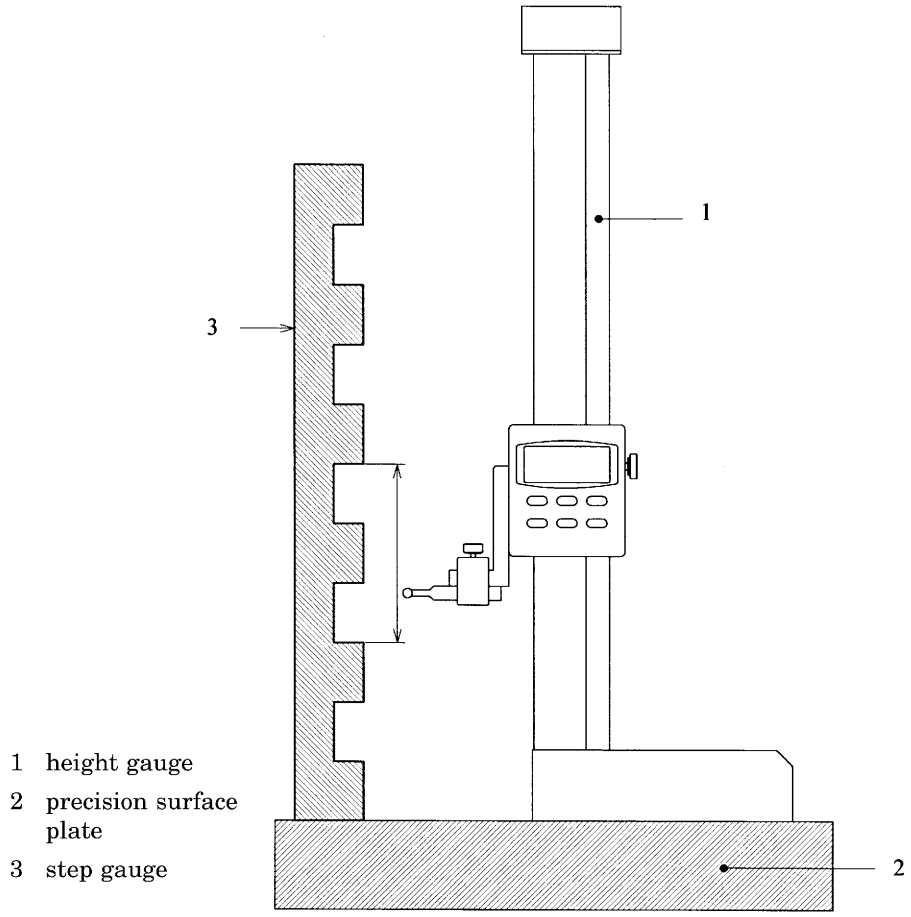
The bidirectional length measurement error may be tested by measuring bidirectional measurement standards, e.g. step gauges and ring gauges, which allow measuring in opposing directions (see Figure 13).

The maximum permissible error of bidirectional length measurement error, B_{MPE} shall be given according to the design characteristics of each product by the manufacturer or supplier at the request of the user.

NOTE 1 The bidirectional length measurement error, B, depends on the usage of the height gauge, e.g. the measuring position within the measuring range and the length and configuration of the measuring stylus.

NOTE 2 Parallelism and form deviation of the measuring face of the stylus, as well as scale errors, are included.

NOTE 3 Form deviations of the surface plate can influence the measurement results.



1 height gauge
2 precision surface plate
3 step gauge

Figure 13 Test arrangement for bidirectional length measurement error

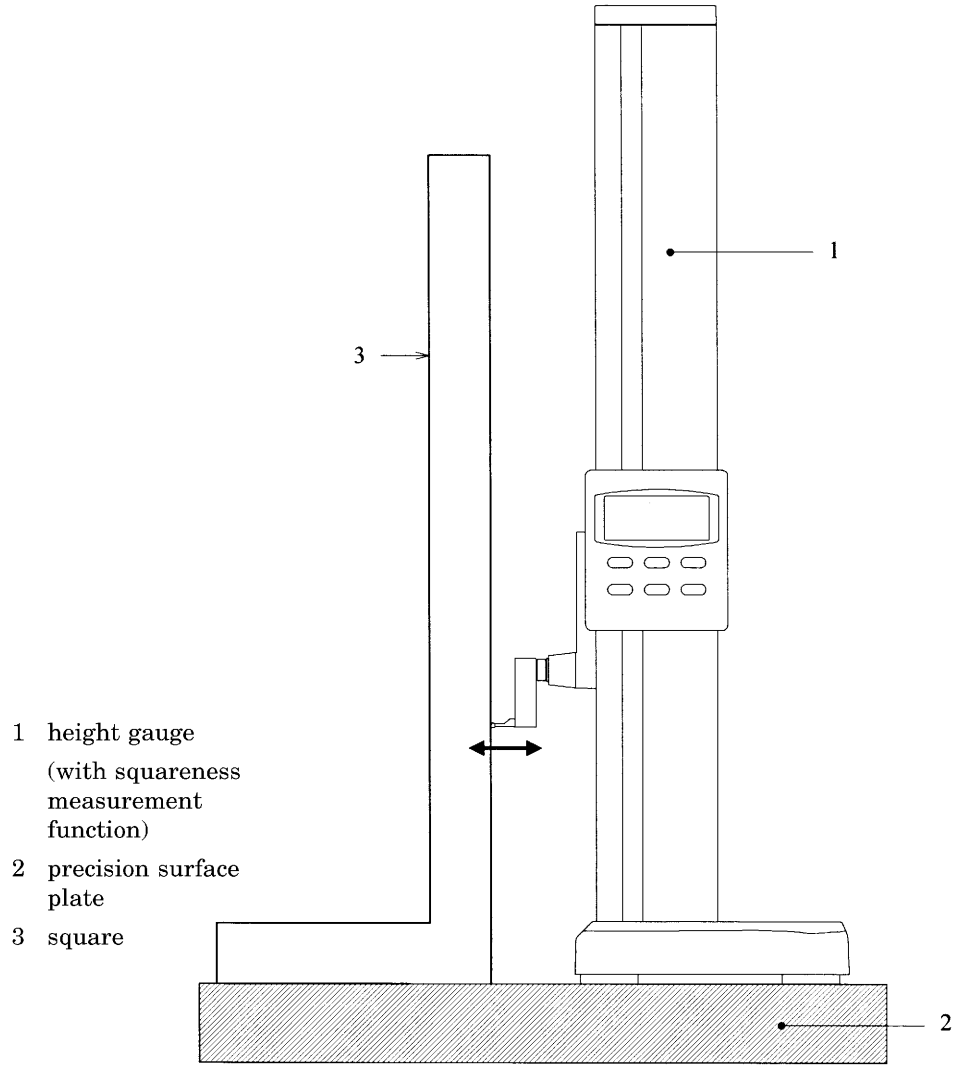
5.4.5 Squareness error *S* (limited by S_{MPE})

The squareness error, *S*, is the error of indication when using the height gauge with squareness measurement function to measure perpendicular to the guiding face of beam.

Since the maximum permissible error, S_{MPE} of squareness measurement error is affected by the design characteristics of each product and by additional accessories, it shall be given by the manufacturer or supplier at the request of the user.

The square error shall be measured by using a square such as cylindrical square (see Figure 14).

NOTE : Form deviations of the surface plate can influence the measurement results.



1 height gauge
(with squareness measurement function)
2 precision surface plate
3 square

Figure 14 Test arrangement for squareness measurement error

5.5 Performance

5.5.1 Performance of height gauge

a) **Flatness of base reference plane** The flatness of the base reference plane of a height gauge other than air bearing system, shall be 0.005 mm or less, when measured in accordance with **5.5.2**.

b) **Squareness of the guiding face of beam or pillar relative to base reference plane** The squareness, in mm, of the guiding face of a beam or a pillar relative to the base reference plane of height gauge shall not exceed the value calculated by the following formula, when measured in accordance with **5.5.2**.

$$\text{Squareness} = \left(0.01 + \frac{L}{1\,000}\right)$$

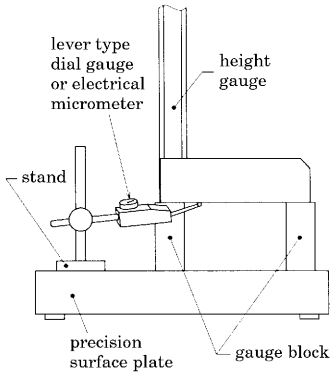
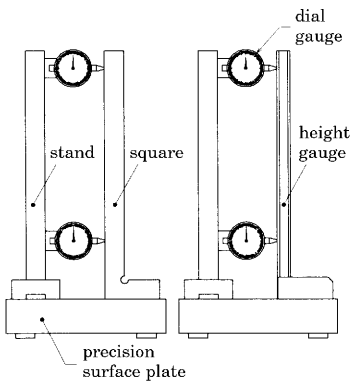
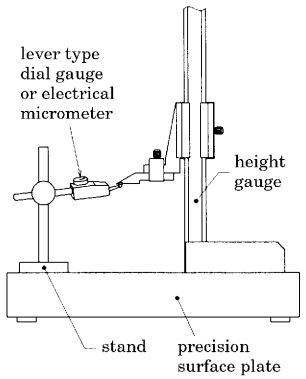
where, L : numerical value indicating the measuring length (mm)

c) **Parallelism between the base reference plane and the scriber measuring face** The parallelism between the base reference plane and the scriber measuring face of height gauge shall not exceed 0.01 mm, when measured in accordance with **5.5.2**.

5.5.2 Measuring method of performance

The measuring method of performance of height gauge shall be as given in Table 6.

Table 6 Measuring method for performance of height gauge

Item	Measuring method	Figure	Measurement tool
Flatness of base reference plane	a) Place the height gauge on two gauge blocks or other gauges equal in nominal dimensions which has been fixed to the precision surface plate. b) Measure by applying the measuring stylus of lever type dial gauge or electrical micrometer which has been mounted to the stand to the base reference plane. Obtain the difference between the maximum value and minimum value.		• Gauge block of grade 2 specified in **JIS B 7506** or other gauge at least equal to this • Precision surface plate of grade 1 specified in **JIS B 7513** • Lever type dial gauge of 0.002 mm scale interval specified in **JIS B 7533** • Electrical micrometer specified in **JIS B 7536** • Stand
Perpendicularity of base reference plane to beam or guiding face of pillar	a) Attach two dial gauges of 0.01 mm scale interval to the rigid stand so that the gauges come into contact with the upper and lower ends of pillar or beam of height gauge. b) Perform measurement on the precision surface plate with square after setting to zero.		• Precision surface plate of grade 1 specified in **JIS B 7513** • I-section square of grade 1, flat section square or beam square specified in **JIS B 7526** • Dial gauge of 0.01 mm scale interval specified in **JIS B 7503** • Stand
Parallelism of base reference plane to measuring face of scriber	a) Attach firmly the base reference plane of height gauge to the precision surface plate. b) Measure by applying the measuring stylus of lever type dial gauge or electrical micrometer which has been mounted to the stand to the measuring face of scriber. c) Obtain the difference between the maximum value and minimum value.		• Precision surface plate of grade 1 specified in **JIS B 7513** • Lever type dial gauge of 0.002 mm scale interval specified in **JIS B 7533** • Electrical micrometer specified in **JIS B 7536** • Stand

6 Marking in product documentation

The marking of symbols for maximum permissible error in the product documentation is given in Annex JA for reference.

7 Proving conformance with specifications

7.1 General

For proving of conformance and non-conformance with specifications, international acceptance criterion where the specification zone equals the acceptance zone (simple acceptance) is used.

NOTE : The international acceptance criterion refers to **ISO/TR 14253-6**:2012. For proving conformance and non-conformance with specification for high-performance products, **JIS B 0641-1** should apply.

7.2 Measurement standards for the calibration of metrological characteristics and performance

Measurement standards shall be traceable to national standards or the International System of Units (SI).

7.3 Standard reference temperature

The specifications for performances given in this Standard shall be the values at the standard reference temperature of 20 °C as specified in **JIS B 0680**.

8 Inspections

Height gauges shall be inspected for dimensions, type of indicating device, measuring face and scriber, instruction base, construction, function, hardness, metrological characteristics and performance, and shall conform to the requirements **4.3** to **4.8** and clause **5**.

9 Marking

Any marking shall be easily readable and permanent and shall be placed on the surface of the height gauge at a place that will not impair the metrological quality of the equipment. The marking shall indicate the following data:

a) scale interval or minimum reading, and its unit (for analogue indication);
unit of indication (for digital indication);

b) maximum measurable length;

c) manufacturer's name (or supplier's name) or its abbreviation;

d) serial number (serialized alpha-numeral).

Annex A (informative)
Notes on use

A.1 For the height gauges which do not have regulator, an appropriate and uniform measuring force shall be used for measurement. Attention should be paid to the fact that measurement at the stylus tip causes a relatively large error because the height gauge does not adhere to the conditions prescribed in the Abbe's Principle.

A.2 Temperature and deformation factors have a length-oriented influence. As a result, the smallest possible uncertainty of measurement is larger than the scale interval, the minimum digital step or the minimum reading value of height gauge. This shall be taken into consideration when evaluating the measured result. For details on uncertainty, see **ISO 14253-2**.

A.3 In the case of digital indications, pay attention to environmental factors which could affect the functioning of the electronic components of the height gauge.

Annex B (informative)
Typical data sheet for design specification (design characteristics), metrological characteristics and performance

The following data sheet shows an example of product information in catalogues, brochures, etc., provided for the user by the manufacturer (or the supplier). In many cases, these items of information are shown by the forms of dimensional drawings and reference charts.

Name of equipment:

Product profile:

Design specification (design characteristics)

Type:

Type of indicating devices:

Minimum reading value, scale interval or minimum digital step: mm

Measuring range: mm

Dimensions

Width of instrument base (W): mm

Depth of instrument base (D): mm

Overall height (H): mm

Measuring length (L): mm

Probe extension offset (P): mm

Metrological characteristics and performance

Maximum permissible error of indication MPE

Maximum permissible error of indication for length measurement E_{MPE}: mm

Maximum permissible error of repeatability of length measurement error R_{MPE} (if necessary): mm

Maximum permissible error of indication for bidirectional length measurement B_{MPE} (if necessary): mm

Squareness error, S_{MPE} (if necessary): mm

Company name:

Date, number of edition, etc.:

Annex JA (informative)
Marking in product documentation

The symbols given in Table JA.1 may be used in the product documentation and figure to indicate conspicuously and clearly by reducing the number of subscript.

Table JA.1 Symbols in product documentation and figure, and corresponding marking

Symbol in this Standard	Corresponding marking
E_{MPE}	MPE_E
R_{MPE}	MPE_R
B_{MPE}	MPE_B
S_{MPE}	MPE_S

Bibliography

[1] ISO 8015 *Geometrical product specifications (GPS)—Fundamentals—Concepts, principles and rules*

[2] 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*

[3] 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*

[4] ISO/TR 14638 : 1995 *Geometrical product specification (GPS)—Masterplan*

[5] ISO/TR 16015 : 2003 *Geometrical product specifications (GPS)—Systematic errors and contributions to measurement uncertainty of length measurement due to thermal influences*

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

JIS B 7517:2018 *Vernier, dial and digital height gauges*	**ISO 13225**:2012 *Geometrical product specifications (GPS)—Dimensional measuring equipment; Height gauges—Design and metrological characteristics*

(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	
3 Terms and definitions			3	Almost identical with **JIS**.	Addition	Add the term, error of indication.	Addition of the term causes no practical deviation.
4 Design specification (design characteristics)	4.1 General 4.2 Names of main parts		4.1	Almost identical with **JIS**.	Alteration	Two examples showing the typical design are given. State that the names are not intended to give the design details.	Names generally used in Japan are given. No technical deviation.
	4.3 Dimensions		4.2	Almost identical with **JIS**.	Addition	Add the reference to Annex B.	In the previous edition, there was no description about dimensions, but this edition adds Annex B.
	4.4.2.2 Vernier scale and main scale		4.3.2.2	Almost identical with **JIS**.	Addition	Add the specification of minimum reading.	In order to include minimum reading in this Standard.
	4.4.2.3 Design of vernier scale		4.3.2.3	Almost identical with **JIS**.	Addition Deletion	Add the figures indicating the graduating method. Add the size of scale line thickness. Delete the minimum reading of 0.1 mm.	In order to keep quality levels unchanged following the previous edition. No technical deviation. Delete following the previous edition.

(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)	4.4.2.4 Scale surface of vernier scale		4.3.2.4	Almost identical with **JIS**.	Addition	Add the dimensions of step difference and clearance.	In order to keep quality levels unchanged following the previous edition.
	4.4.2.5 Circular scale and main scale		4.3.3	Almost identical with **JIS**.	Addition	Add the specification of scale interval.	In order to specify the scale interval following the previous edition.
	4.4.2.6 Design of circular scale		—	—	Addition	Add the size of scale line thickness.	In order to keep quality levels unchanged following the previous edition.
	4.4.3 Digital indicating devices		4.3.4	Almost identical with **JIS**.	Addition	Add the specification of error message.	In order to check the instrument for errors visually. Add following the previous edition.
	4.4.4 Protection of digital indication for field use		4.4	Almost identical with **JIS**.	Alteration	Limit the marking of protection degree (IP code) to the height gauge with digital indication which guarantees dust and water protection.	Limit to the relevant type because it is impracticable to impose the marking requirement on every type of height gauge.
					Deletion	Delete the description of electromagnetic protection.	Delete because it is impracticable.
	4.5 Measuring and scribing stylus		4.5	—	Addition	Add the allowable value of surface roughness.	In order to keep quality levels unchanged following the previous edition.
	4.6 Instrument base		4.6	Almost identical with **JIS**.	Addition	Add the allowable value of surface roughness.	In order to keep quality levels unchanged following the previous edition.

(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)	4.7 Construction and function		4.7	—	Addition	Add the specification of slider operation. For the instrument of which main scale can be moved, add the specification of travelling and fixing the main scale.	In order to keep quality levels unchanged following the previous edition.
	4.8 Hardness		4.7	—	Addition	Add the allowable values of hardness of base reference plane and scriber measuring face.	In order to keep quality levels unchanged following the previous edition.
5 Metrological characteristics and performance	—		5 Annex A	Almost identical with **JIS**.	Alteration	Equalize the numbering system.	Move the testing methods to the main body because they are important for **JIS** certification.
	5.4.2 Length measurement error *E*		5.4.2 A.2.2	Almost identical with **JIS**.	Addition	Add the table of the maximum permissible error. Add the details of testing methods.	In order to keep quality levels unchanged following the previous edition. Keep the plus-minus sign to correspond to **ISO** and previous edition. Add the general testing methods in Japan to correspond to the previous edition.
	5.4.4 Bidirectional length measurement error *B*		5.4.4 A.2.4	Almost identical with **JIS**.	Alteration	Limit to the relevant type of height gauge.	Limit the application because the bidirectional length measurement error depends on the design characteristics.

(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	
5 Metrological characteristics and performance (concluded)	5.4.5 Squareness error *S*		5.4.5 A.2.5	Almost identical with **JIS**.	Alteration	Limit to the relevant type of height gauge.	Limit the application because the squareness error depends on the design characteristics.
	5.5 Performance		—	—	Addition	Add the descriptions of flatness of base reference plane, squareness of beam or guiding face of pillar and parallelism of scriber measuring face.	In order to keep quality levels unchanged following the previous edition.
	5.5.1 a) Flatness of base reference plane		—	—	Addition	Add the allowable value of flatness.	In order to keep quality levels unchanged following the previous edition.
	5.5.1 b) Squareness of base reference plane to beam or guiding face of pillar		—	—	Addition	Add the allowable value of squareness.	In order to keep quality levels unchanged following the previous edition.
	5.5.1 c) Parallelism of base reference plane to measuring face of scriber		—	—	Addition	Add the allowable value of parallelism.	In order to keep quality levels unchanged following the previous edition.
	5.5.2 Measuring method of performance		—	—	Addition	Add the details of testing methods.	Add the general testing methods in Japan to correspond to the previous edition.

(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 Marking in product documentation			—	Marking in product documentation	Addition	The marking in the product documentation is described in details in Annex JA as a special case. Delete the example of data sheet.	Basically, the marking in the main text is adopted.
7 Proving conformance with specification	7.1 General		6.1	Almost identical with **JIS**.	Alteration	Alter the reference for proving of conformance and non-conformance with specifications to **ISO/TR 14253-6** : 2012. Delete the description of uncertainty evaluation.	The practicable acceptance criteria are adopted.
	7.2 Measurement standards for the calibration of metrological characteristics and performance		6.2	Almost identical with **JIS**.	Addition	State clearly that the measurement standard not specified in the relevant **JIS** is to be traceable to national standards.	Add the description of conformance to national standards.
	7.3 Standard temperature		—	—	Addition	State that the dimensions and indication error are the values at standard temperature.	For convenience, add the details.
8 Inspections			—	—	Addition	For inspection, the items to be satisfied are given.	Add in consideration of **JIS** certification.
9 Marking			7	Almost identical with **JIS**.	Addition	Add the specification of maximum measurable length.	The item (serial number) is adopted to correspond to **ISO**.

(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 C		Deletion	Delete the clause regarding calibration.	Delete to make the standard contents clear.
Annex JA (informative)	—		—	—	Addition	Marking in product documentation	Basically, the marking in the main text is adopted, but other symbols are given for reference.

Overall degree of correspondence between **JIS** and International Standard (**ISO 13225**:2012): 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.

Errata for JIS (English edition), if any, can be downloaded in PDF format at Webdesk (purchase information page) of our website (http://www.jsa.or.jp/).

In addition, printed errata are available in our journal of *Standardization and Quality Control*, and also in *Monthly Information* that is distributed to the subscribers of JIS (English edition).

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