

JIS

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS B 7507 : 2016

(JMA/JSA)

Vernier, dial and digital callipers

ICS 17.040.30

Reference number : JIS B 7507 : 2016 (E)

Date of Establishment: 1954-03-15

Date of Revision: 2016-08-22

Date of Public Notice in Official Gazette: 2016-08-22

Investigated by: Japanese Industrial Standards Committee
Standards Board for ISO area
Technical Committee on Basic Engineering

JIS B 7507 : 2016, First English edition published in 2017-01

Translated and published by: Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

© JSA 2017

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized
in any form or by any means, electronic or mechanical, including photocopying and microfilm, without
permission in writing from the publisher.

Printed in Japan

KK/HN

Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Design specification (design characteristics)	3
4.1 General	3
4.2 Names of main parts	3
4.3 Dimensions	4
4.4 Types of indicating devices	5
4.5 Measuring face	9
4.6 Construction and function	9
4.7 Hardness	10
5 Metrological characteristics and performance	10
5.1 General	10
5.2 Effect of slider locking	10
5.3 Maximum permissible error of indication (MPE)	10
6 Marking on product documents	15
7 Proof of conformance with specifications	15
7.1 General	15
7.2 Measurement standard for calibration of metrological characteristics and performance	15
7.3 Standard reference temperature	15
8 Inspection	15
9 Marking	15
Annex A (informative) Notes on use	16
Annex B (informative) Typical data sheet for design specification (design characteristics), metrological characteristics and performance	17
Annex C (informative) Relation to the GPS matrix model	18
Annex JA (informative) Marking on product documents	20
Annex JB (informative) Comparison table between JIS and corresponding International Standard	21

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 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 7507:1993 is replaced with this Standard.

JIS B 7507: 1993 may be applied in the JIS mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until August 21, 2017.

This JIS document is protected by the Copyright Law.

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 callipers

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of ISO 13385-1 published in 2011 with some modifications of the technical contents in order to correspond to the practical manufacture 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 JB.

This Standard is one of geometrical product specifications (GPS) under the GPS Basic Standard (see ISO/TR 14638 : 1995) and related to the chain link 5 for the chain of standards on size. The details about the relation of this Standard and other GPS Standard are given in Annex C.

1 Scope

This Standard specifies callipers equipped with analogue or digital indicating devices with either a vernier scale or a circular scale.

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

ISO 13385-1 : 2011 *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 1 : Callipers; 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 conformity or nonconformity with specifications*

JIS B 0642 *Geometrical product specifications (GPS) — General concepts and re-*

quirements 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 B 7506 Gauge blocks

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)* (IDT)

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, JIS Z 8103 and the following apply.

3.1 calliper

measuring instrument which gives the evaluation of a dimensional quantity of an internal or external feature on the basis of the movement of a slider with a measuring jaw, moving relative to a measuring scale

A beam has a fixed jaw while a slider has a measuring jaw.

NOTE 1 Callipers with an additional measuring face at the end of the beam and a depth measuring rod are used for depth measurements.

NOTE 2 The indication is either analogue (vernier scale or circular scale) or digital. Regarding digital data transfer, see 4.4.3.

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

3.2.3 measuring face line contact

contact between a line, perpendicular to the length of the jaws, on the measuring face and a feature of a workpiece

NOTE : Form deviations in either the measuring face(s) or the feature are disregarded for the purposes of these definitions.

3.3 error of indication

indication of a calliper 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) and workmanship of the calliper shall be such that its metrological characteristics comply with this Standard under all operational orientations unless otherwise specified by the manufacturer (or the supplier).

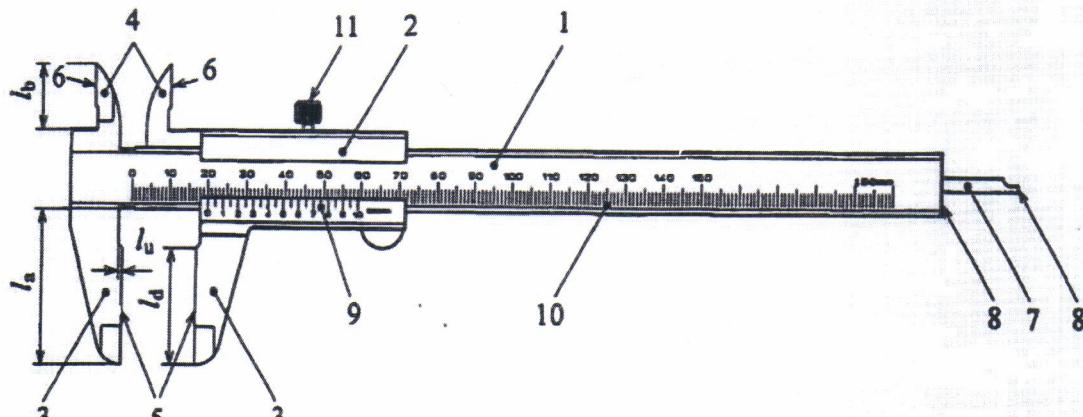
NOTE : An example of data sheet for specification marking in the case of providing the information for users is given in Annex B.

4.2 Names of main parts

The main parts of calliper shall be as shown in Figures 1 and 2, and the callipers shall be classified into M-type calliper and CM-type calliper.

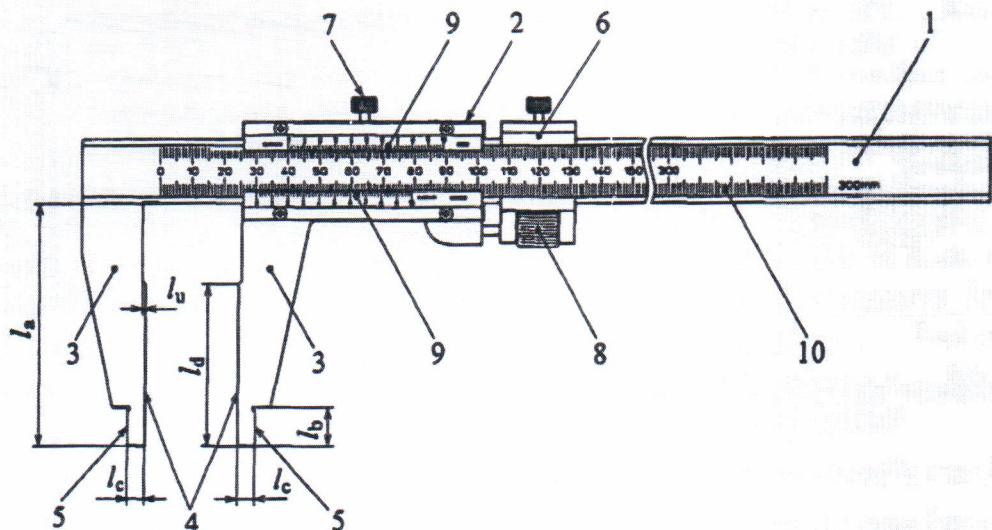
The figures are intended to indicate the names but not intended to give the design details.

- a) **M-type calliper**, having a jaw for external measurements and an independent jaw for internal measurements. Some may be equipped with a fine adjustment device. The calliper of maximum measurable dimension 300 mm or under may be equipped with a depth measuring rod.
- b) **CM-type calliper**, having a face for external measurements and that for internal measurements on the identical jaw. Some may be equipped with a fine adjustment device.



1	beam	7	depth measuring rod	l_1	length of jaw for external measurements
2	slider	8	measuring faces for depth measurement	l_2	length of jaw for internal measurements
3	jaw for external measurements	9	vernier scale	l_3	length of measuring faces for external measurements
4	jaw for internal measurements	10	main scale	l_u	undercut depth
5	measuring faces for external measurements	11	locking screw		
6	measuring faces for internal measurements				

Figure 1...M-type calliper



1 beam	6 fine adjustment clamp	l_a length of jaw
2 slider	7 locking screw	l_b length of measuring faces for internal measurements
3 jaw	8 fine adjustment device	(including undercut)
4 measuring faces for external measurements	9 vernier scale	l_c thickness of measuring faces
5 measuring faces for internal measurements	10 main scale	l_d ... length of measuring faces for external measurements
		l_e undercut depth

Figure 2. CM-type calliper

4.3 Dimensions

The dimensions shall be as follows.

- a) The dimensions of the elements which are given in Table 1 are typical dimensions.

For callipers with a fine adjustment device, the maximum measurable dimension may become smaller by the length of the device.

Table 1 Dimensions of callipers

Maximum measurable dimension	M-type calliper			CM-type calliper				Unit: mm
	l_a	l_b	l_d	l_s	l_b	l_c	l_d	
100				—	—	5	—	
150 (130) b)	40 max.	20 max.	20 min.	50 max.	10 min.	5	30 min.	
200 (180) b)	50 max.	25 max.	30 min.	60 max.	15 min.	5	40 min.	
250 (230) b)						5		
300 (280) b)	65 max.	30 max.	40 min.	75 max.	20 min.	5 or 10	50 min.	
400						5 or 10		
450						5 or 10		
500	95 max.	40 max.	50 min.	105 max.	25 min.	10	60 min.	
600						10 or 20		
1 000	130 max.	60 max.	80 min.	140 max.	30 min.	10 or 20	90 min.	
Callipers of other maximum measurable dimension shall be as agreed between the parties concerned with delivery.								
Notes a) The maximum measurable dimension is the dimension for external measurements. b) The values in parentheses in the column of maximum measurable dimension are the values of calliper with a fine adjustment device.								

- b) The undercut depth, l_a , should be typically kept as small as practicable.
- c) For CM-type calliper, the measuring face for internal measurement shall have such a shape that enables the accurate internal measurement, for example the shape of circle whose radius does not exceed the thickness of measuring faces, l_c .
- d) The cross-sectional dimension of depth measuring rod should be at least 1.2 mm × 3 mm, or at least Ø1.5 mm.
- e) The individual dimensions of indication shall be as given in 4.4.

4.4 Types of indicating devices

4.4.1 General

The types of indicating devices shall be classified into digital and analogue with either a vernier scale or a circular scale.

On callipers with an analogue indicating device, the scale interval, minimum reading value and its unit shall be labelled.

On callipers with a digital indicating device, the unit of the indication shall be labelled.

4.4.2 Analogue indicating devices

4.4.2.1 General

The scale interval of the main scale on the beam of a calliper with a vernier scale shall be 1 mm. The main scale shall be longer by at least one vernier scale length than the measuring range of the calliper.

In the case of callipers with circular scales, the scale interval on the beam should be 1 mm or 2 mm.

4.4.2.2 Vernier scale and main scale

The minimum reading value of the calliper with an analogue indicating device equipped with a vernier scale shall be 0.1 mm, 0.05 mm or 0.02 mm. An example is shown in Figure 3.

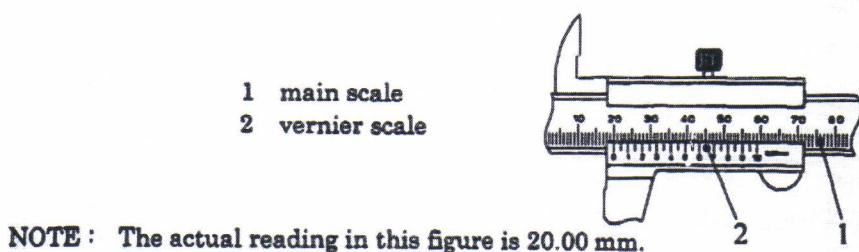


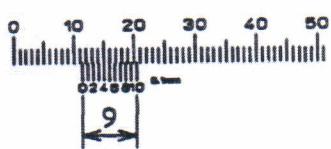
Figure 3 Example of analogue indicating device with vernier scale

4.4.2.3 Design of vernier scale

Graduating methods of vernier scales shall be as given in Table 2.

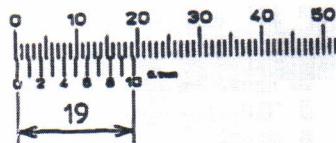
Table 2 Graduating methods of vernier scales

Main scale interval	Graduating method	Minimum reading value	Explanatory figure	Unit: mm
1	Divide 9 mm into 10 equal parts	0.1	Figure 4	
	Divide 19 mm into 10 equal parts		Figure 5	
	Divide 19 mm into 20 equal parts	0.05	Figure 6	
	Divide 39 mm into 20 equal parts		Figure 7	
	Divide 49 mm into 50 equal parts	0.02	Figure 8	



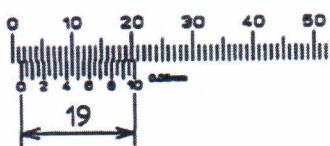
NOTE : The actual reading in this figure is 11.4 mm.

Figure 4 Divide 9 mm into 10 equal parts



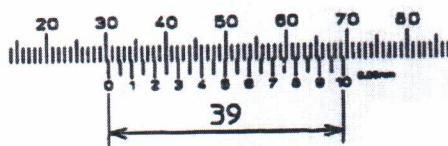
NOTE : The actual reading in this figure is 0.3 mm.

Figure 5 Divide 19 mm into 10 equal parts



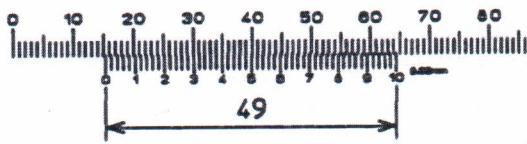
NOTE : The actual reading in this figure is 1.45 mm.

Figure 6 Divide 19 mm into 20 equal parts



NOTE : The actual reading in this figure is 30.35 mm.

Figure 7 Divide 39 mm into 20 equal parts



NOTE : The actual reading in this figure is 15.40 mm.

Figure 8 Divide 49 mm into 50 equal parts

The scale line thickness of a calliper with a vernier scale shall be as given in Table 3 unless otherwise specified.

Table 3 Scale line thickness of calliper 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 surface 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 9 and 10.

- 1 main scale
- 2 vernier scale
- 3 beam
- 4 slider

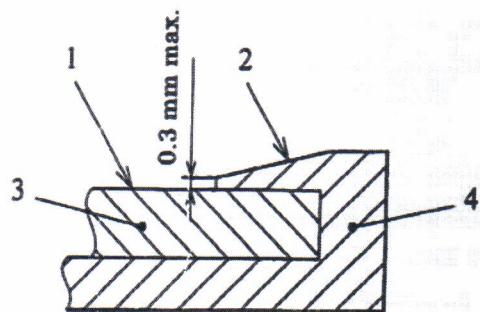


Figure 9 Slider with inclined vernier scale

- 1 main scale
- 2 vernier scale
- 3 beam
- 4 slider

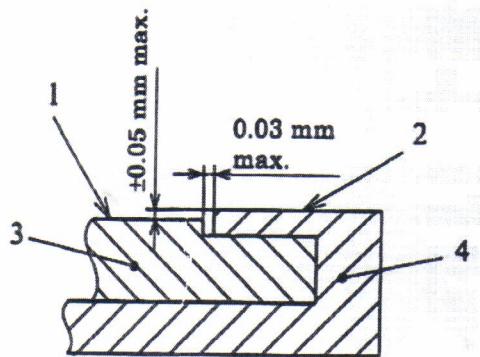
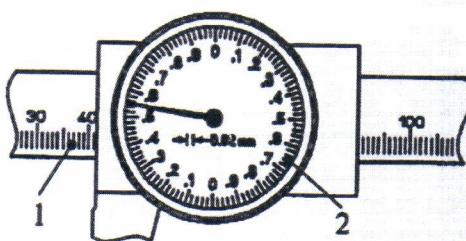


Figure 10 Slider with plane vernier scale

4.4.2.5 Main scale and circular scale

The scale interval of a calliper with an analogue indicating device equipped with a vernier scale shall be 0.1 mm, 0.05 mm, 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 11.

- 1 main scale
- 2 circular scale



NOTE : The actual reading in this figure is 41.55 mm.

Figure 11 Example of analogue indicating device with circular scale

4.4.2.6 Design of circular scale

The scale line thickness of a calliper with a circular scale shall be as given in Table 4 unless otherwise specified.

Table 4 Scale line thickness of calliper with circular scale

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

4.4.3 Digital indicating devices

The minimum digital step of digital indicating devices shall be 0.01 mm. An example is shown in Figure 12.

1 electronic main scale
2 digital display

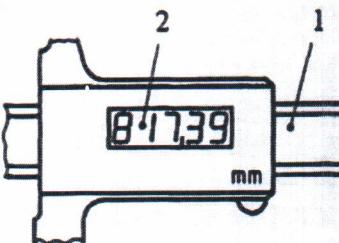


Figure 12 Example of digital indicating device with digital display

Callipers with a digital display may also be capable of data transfer. In this case, the manufacturer shall describe the data output protocol (interface) in sufficient detail. Calliper with digital indicating device shall include a device capable of displaying all operation and system error messages when rapid spindle rotation could cause the wrong indication or when power-supply voltage declines.

4.4.4 Protection of digital indication for filed use

When calliper with digital indication guarantees fluid and dust protection, the manufacturers shall indicate clearly which kind of fluid and dust protection (IP code, according to JIS C 0920) in the body or in catalogues.

4.5 Measuring faces

The measuring face shall consist of wear-resistant material of suitable surface finish. They shall not be sharp-edged. The surface roughness of measuring face shall be R_a 0.4 or over.

4.6 Construction and function

The step difference on the plane surface between a jaw for external measurements

on the beam and a jaw for external measurements on the slider shall not be detrimental to use. The slider shall be smooth over the entire operating range, be free from harmful play, and operate without looseness.

4.7 Hardness

The hardnesses of calliper's measuring face shall be not less than 550 HV or 52 HRC if it is made of stainless steel, and not less than 700 HV or 60 HRC if it is made of other materials.

The measuring position shall be either on the measuring faces or on the point within 2 mm from the measuring faces.

5 Metrological characteristics and performance

5.1 General

Callipers with a vernier scale have a fixed zero point. Adjustable callipers with a digital display shall be able to be set to zero in any position within the measuring range. Adjustable callipers with a circular scale shall be able to be set to zero within the range of the scale.

The metrological characteristics and performance of a calliper specified in this Standard shall apply only when the faces for external measurements are pressed against each other for zero setting. The metrological characteristics and performance of a calliper can be measured by a suitable instrument and a standard with clear uncertainty, for example a gauge block, step block or ring gauge specified in JIS B 7506. The measurement standard shall be able to evaluate the metrological characteristics and performance of a calliper over the whole measuring range.

NOTE 1 Requirements for straightness, flatness and parallelism of the measuring faces are not given separately but are included in the error of indication.

NOTE 2 Notes on use are given in Annex A.

NOTE 3 An example of data sheet for specification marking in the case of providing the information for users is given in Annex B.

5.2 Effect of slider locking

If the slider is clamped (i.e. the slider is equipped with a locking screw or a clamping device), the indication shall fulfil the following conditions.

- Callipers with analogue indication : the indication shall not change.
- Callipers with digital indication : the indicated value shall not change by more than the last significant digit of the indication.

5.3 Maximum permissible error of indication (MPE)

5.3.1 General

The error of indication characteristics apply to any indications based on the zero setting stated in 5.1.

Tolerances on the error of indication shall be limited by maximum permissible error (MPE).

This applies to partial surface contact error (5.3.2) and scale shift error (5.3.4) without exception, but other items apply only when required by the manufacturer (or the supplier) based on the design specification (design characteristics).

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

5.3.2 Partial surface contact error E (maximum permissible error $EMPE$)

The partial surface contact error shall be the error of indication in the case of partial measuring face contact (3.2.2), applicable to external measurements.

The maximum permissible error of indication by partial measuring face contact, $EMPE$, shall be as given in Table 5.

Table 5 Maximum permissible error of indication by partial measuring face contact $EMPE$

Unit: mm

Measuring length	Scale interval, minimum digital step or minimum reading value	
	0.1 or 0.05	0.02 or 0.01
50 or under	±0.05	±0.02
over 50 up to and incl. 100	±0.06	±0.03
over 100 up to and incl. 200	±0.07	
over 200 up to and incl. 300	±0.08	±0.04
over 300 up to and incl. 400	±0.09	
over 400 up to and incl. 500	±0.10	±0.05
over 500 up to and incl. 600	±0.11	
over 600 up to and incl. 700	±0.12	±0.06
over 700 up to and incl. 800	±0.13	
over 800 up to and incl. 900	±0.14	±0.07
over 900 up to and incl. 1 000	±0.15	

$EMPE$ of callipers having other measuring length shall be as agreed between the parties concerned with delivery.

NOTE : $EMPE$ includes the measurement error due to the straightness, flatness and parallelism of a measuring face.

The partial surface contact error shall be tested by measuring a measurement standard with small faces, e.g. gauge blocks, at different positions along the jaws, at any position within the measuring range (see Figure 13).

NOTE 1 The partial surface contact error depends on the usage of the calliper, e.g. the measuring position of jaws for external measurement, the measuring range (deflection of the beam), the clearance between the slider and the beam, and the length of the jaws.

NOTE 2 Parallelism and form deviation of the measuring surface of the jaws as well as scale errors are included.

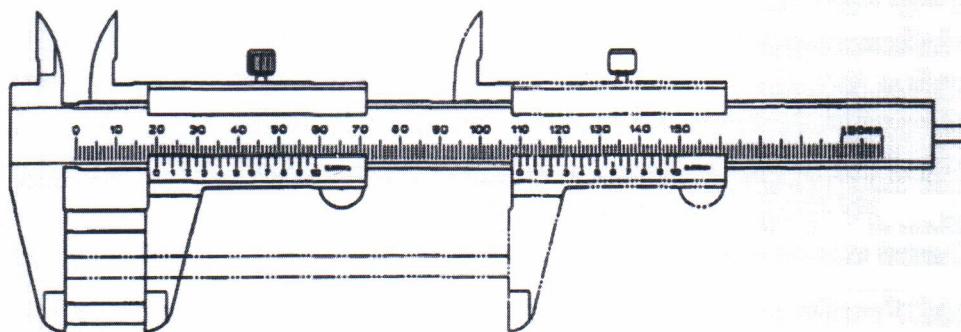
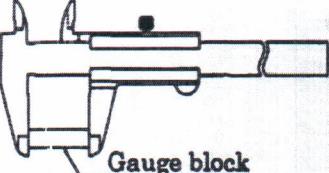


Figure 13 Measurement of partial surface contact error

The partial surface contact error shall be measured as given in Table 6.

Table 6 Measurement of partial surface contact error

Item	Measurement	Figure
Partial surface contact error	Place the specified gauge block or at least equivalent gauges between the measuring faces for external measurements, measure at the tip side of the faces, and subtract the dimension of the gauge from the indication of the calliper.	

5.3.3 Repeatability of partial surface contact error R (maximum permissible error MPE)

This is the closeness of agreement between the results of successive measurements of the same measurand carried out at any position on the jaws under the same conditions of measurement.

The repeatability of partial surface contact error shall be tested by measuring a measurement standard, e.g. gauge blocks, at any positions of measuring faces on the jaws to any dimension within the measuring range.

NOTE: The manufacturer sometimes provides the details of repeatability upon request from the user.

5.3.4 Scale shift error S (maximum permissible error $SMPE$)

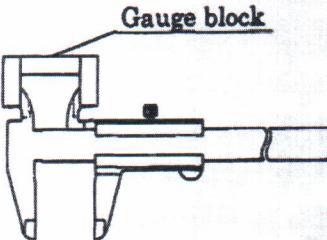
This is the error of indication when using measuring faces other than the measuring faces for external measurement, such as internal measurements and depth measurements, provided that a full contact of the measuring faces (3.2.1) is given.

The maximum permissible error of indication shall be as follows.

- The maximum permissible error of indication for internal measurements shall be identical with the value given in Table 5.
- The maximum permissible error of indication for depth measurements shall be the value given in Table 5 plus 0.02 mm.

The error of indication for internal measurements shall be tested by measuring a measurement standard, e.g. gauge blocks, at any positions within the measuring range. The error of indication for internal measurements shall be measured as given in Table 7.

Table 7 Measurement of error of indication for internal measurements of calliper

Item	Measurement	Figure
Error of indication for internal measurements	Using the gauge block and its accessories or equal or superior equipment, measure the internal dimension at the measuring faces for internal measurement, and subtract the dimension of the gauge block or the reading of the equipment from the indication of the calliper.	

The error of indication of depth measurement may be measured by the deviation of a zero point. In this case, the deviation shall be not more than 0.02 mm.

5.3.5 Line contact error L (maximum permissible error $LMPE$)

This is the error of indication when a measuring face line contact (3.2.3) is employed, to be applied for external measurement.

The line contact error may be tested at the clearance between measuring faces for external measurements. In this case, the tolerance should be 5 μm or under, i.e. the degree that the interference colour due to light diffraction is observed when the clearance is inspected while it is held in front of a proper light source.

The line contact error shall be tested by measuring a cylindrical measurement standard, e.g. cylindrical measuring pins, of a small diameter (approximately 10 mm), at different positions along the jaws, perpendicular to the plane of jaws (see Figure 14).

NOTE 1 Line contact error is especially important for long-used callipers.

NOTE 2 The test of the line contact error is important for the detection of worn measuring faces of long-used callipers.

NOTE 3 It is not necessary to test the line contact error at more than one position within the measuring range.

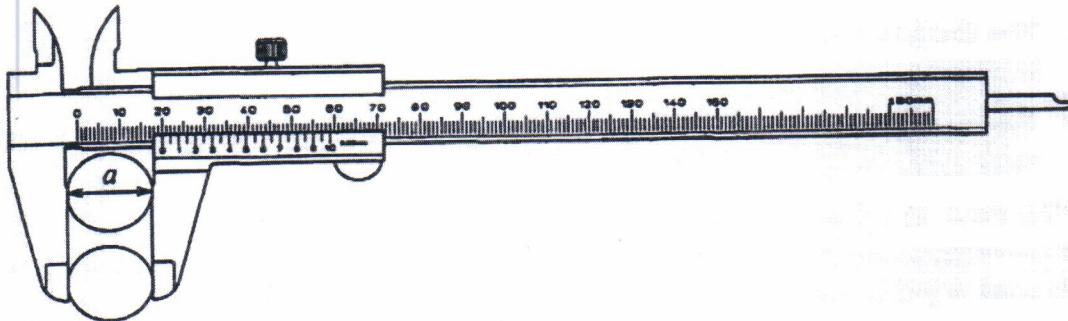


Figure 14 Measurement of line contact error

5.3.6 Full surface contact error J (maximum permissible error J_{MPE})

This is the error of indication when a full measuring face contact (3.2.1) is employed.

The full contact error shall be tested by measuring a measurement standard, e.g. gauge blocks, which covers the whole measuring surface of the jaws.

NOTE : It is not necessary to test the full contact error at more than one point within the measuring range.

5.3.7 Error due to crossed knife-edge distance of M-type jaws for internal measurements K (maximum permissible error K_{MPE})

This is the error of indication when the measurement is performed by using the M-type jaw for internal measurements perpendicular to the length of jaws in a small cylindrical hole of the M-type calliper.

The error due to crossed knife-edge distance of M-type jaws for internal measurements shall be measured using a ring gauge not greater than 5 mm (the manufacturer or the supplier shall state the size used in the test). The error depends on the clearance between the jaws for internal measurements and on the thickness of the measuring faces for internal measurements (see Figure 15).

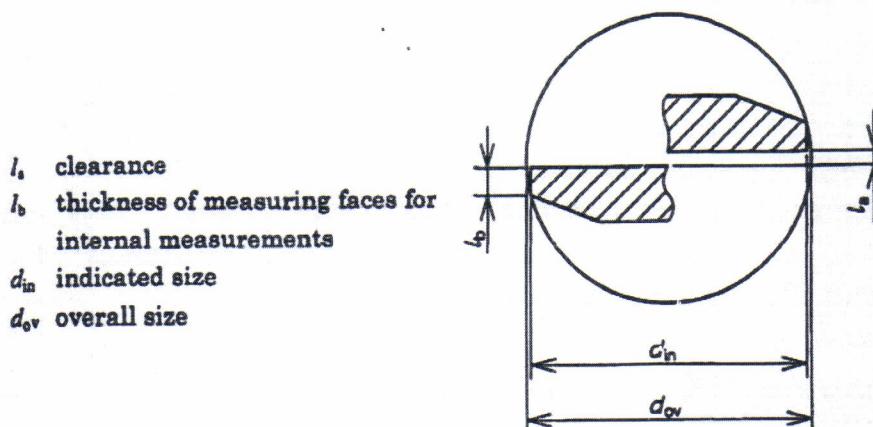


Figure 15 Error due to crossed knife-edge distance of M-type jaws for internal measurements in small holes

6 Marking on product documents

For reference, the examples of marking the maximum permissible error in product documents or figures are given in Annex JA.

7 Proof of conformance with specifications

7.1 General

For the proof of conformance and non-conformance with specifications, the 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.

7.2 Measurement standard for calibration of metrological characteristics and performance

A measurement standard shall be properly selected and used according to JIS. When such measurement standard is not available, a measurement standard traceable to national standards shall be used.

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 Inspection

Dimensions, type of indicating device, measuring face, construction, function, hardness, metrological characteristics and performance of calliper shall be inspected, and they shall conform to 4.3 to 4.7 and clause 5.

9 Marking

On a conspicuous position of a calliper, the following items shall be marked indelibly by the method which will not impair the metrological quality.

- a) Analogue indication (if used) : scale interval, minimum reading value or minimum digital step
Digital indication (if used) : unit of the indication
- b) Maximum measurable dimension
- c) Name of the manufacturer (supplier) or its abbreviation
- d) Manufacturing number (alphanumeric)
- e) CM-type callipers (if used) : mark the minimum measurable internal dimension on the jaws. For callipers with 2-step scales, mark the distinction of external or internal use, each on a conspicuous position.

Annex A (informative)

Notes on use

A.1 Since the callipers do not have measuring-force limiting device, an appropriate and uniform measuring force shall be used for measurement. Attention should be paid to the tendency that measurement at the end of jaw causes a relatively large error because the calliper 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 calliper. 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 calliper.

Annex B (informative)

Typical of 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	:
<input type="checkbox"/> Design specification (design characteristics)		
Type	:
Type of indicating devices	:
Minimum reading value, scale interval or minimum digital step :	mm mm
Measuring range	: mm
Dimensions		
Length of jaw for external measurements (l_x)	: mm
Length of jaw for internal measurements (l_b)	: mm
Thickness of measuring face (l_c)	: mm
Length of measuring faces for external measurements (l_d)	: mm
<input type="checkbox"/> Metrological characteristics and performance		
Maximum permissible error of indication MPE		
Maximum permissible error of indication by partial measuring face contact $EMPE$: mm
Maximum permissible error of indication by scale shift $SMPE$:	mm mm
Maximum permissible error of indication by line contact $LMPE$ (if necessary)	: mm
Maximum permissible error of indication by full measuring face contact $JMPE$ (if necessary)	: mm
Maximum permissible error of repeatability of partial measuring face contact error $RMPE$ (if necessary) :	mm mm
Maximum permissible error of indication by crossed knife-edge distance of M-type jaws for internal measurements $KMPE$ (if necessary) :	mm mm
Diameter of ring gauge used for measurement	: mm
Company name	:
Date, number of edition etc.	:

Annex C (informative)

Relation to the GPS matrix model

C.1 General

For details about the GPS matrix model, see ISO/TR 14638.

NOTE 1 ... The latest edition of ISO/TR 14638 is ISO 14638 : 2015.

NOTE 2 ... The chain link 5 corresponds to the chain link F specified in ISO 14638 : 2015.

C.2 Information about this Standard and its use

This Standard provides the most important design specification (design characteristics), metrological characteristics, and performance of callipers equipped with analogue or digital indicating devices with either a vernier scale or a circular scale.

C.3 Position in the GPS matrix model

This Standard is a general GPS standard that influences chain link 5 of the chains of standards on size and distance in the general GPS matrix, as shown in Figure C.1.

	Global GPS standards					
	General GPS standards					
Chain link number ^{a)}	1	2	3	4	5	6
Size					x	
Distance					x	
Radius						
Angle						
Form of a line independent of datum						
Form of a line dependent of datum						
Form of a surface independent of datum						
Form of a surface dependent of datum						
Orientation						
Location						
Circular run-out						
Total run-out						
Datums						
Roughness profile						
Waviness profile						
Primary profile						
Surface imperfections						
Edges						

Note ^{a)} The representation of chain link number is as follows.

Chain link 1 : symbols and indications Chain link 4 : measurement

Chain link 2 : feature requirements Chain link 5 : measurement equipment

Chain link 3 : feature properties Chain link 6 : calibration

Figure C.1 GPS matrix model

C.4 Related Standards

The related standards are included in the chain of standards in Figure C.1.

Annex JA (informative)

Marking on product documents

For better visibility and understanding, the symbols given in this Standard can be replaced by the corresponding symbols given in Table JA.1, which have fewer subscripts.

Table JA.1 Symbols in this Standard and corresponding symbols used for product documents or figures

Symbols in this Standard	Corresponding symbols
E_{MPE}	MPE_E
R_{MPE}	MPE_R
S_{MPE}	MPE_S
L_{MPE}	MPE_L
J_{MPE}	MPE_J
K_{MPE}	MPE_K

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

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 : 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*

ISO 14638 : 2015 *Geometrical product specifications (GPS) — Matrix model*

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

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 7507 : 2016 Vernier, dial and digital callipers		ISO 13385-1 : 2011 Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 1 : Callipers; 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
2 Normative references				
3 Terms and definitions		3	Almost identical with JIS.	Add the description of the error of indication. Addition of term, and no substantive deviation.
4 Design specification (design characteristics)	4.1 General 4.2 Names of main parts	4.1	Almost identical with JIS.	Divide the subclause into two. Add the explanations for M-type and CM-type callipers. Replace the calliper used in the figure with CM-type calliper. Mention that the figures indicate names but not the design details. For clear distinction of callipers, add the explanation of the previous edition and give CM-type calliper which is commonly used in Japan. No technical deviation.

(I) Requirements in JIS		(II) Internation 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)	4.3 Dimensions	4.2	Almost identical with JIS.	Alternation	<p>Change the dimensions and measuring position.</p> <p>Prescribe only the dimensions of callipers having the maximum measurable dimension of 1 000 mm or less, and specify that callipers having the maximum measurable dimension over 1 000 mm shall be as agreed between the parties concerned with delivery.</p>	<p>Add the description of the previous edition in order for practical values and measuring positions.</p> <p>Add the maximum measurable dimensions of the previous edition in order to specify practical dimensions.</p>
				Addition	<p>Add the specification for measuring length of calliper with a fine adjustment device.</p> <p>Add the length of measuring faces for external measurements, cross sectional dimension of depth measuring rod, the shape of measuring faces for internal measurement of CM-type calliper.</p>	<p>Add the description of the previous edition to clarify the contents of the standard and to maintain a constant quality of measurement.</p>

(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)	4.4.2.2 Vernier scale and main scale	4.3.2.2	Almost identical with JIS.	Addition	Add the specification for minimum reading value.	Add the description of the previous edition to standardize the minimum reading values.
	4.4.2.3 Design of vernier scale	4.3.2.3	Almost identical with JIS.	Addition	Add the figure of graduating method. Add the scale line thickness.	Add the description in the previous edition to maintain a constant quality of measurement. No technical deviation.
	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 between the main scale surface and vernier scale surface.	Add the description in the previous edition to maintain a constant quality of measurement.
	4.4.2.5 Main scale and circular scale	4.3.2.6	Almost identical with JIS.	Addition	Add the specification for scale interval.	Add the description in the previous edition to standardize the scale interval.
	4.4.2.6 Design of circular scale	—	—	Addition	Add the scale line thickness.	Add the description in the previous edition to maintain a constant quality of measurement.

(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	No. of clause	Classification by clause		Detail of technical deviation		
4 Design specification (design characteristics) (concluded)	4.4.3 Digital indicating devices	4.3.3	Almost identical with JIS.	Addition	Add the specification for minimum digital step. Add the specification for error messages.		Add the description in the previous edition to standardize the minimum digital step. Add the description in the previous edition to examine visually for abnormalities.		
	4.4.4 Protection of digital indication for field use	4.3.4	Almost identical with JIS.	Alternation	Limit the marking of protection code to digital indication with guaranteed fluid and dust protection.		Limit the targets because it is not practical to require that all models be marked with production code. Delete the description because it is impractical.		
				Deletion	Delete the description on electromagnetic field protection.		Add the tolerances on surface roughness.		
	4.5 Measuring faces	4.4	Almost identical with JIS.	Addition			Add the description in the previous edition to maintain a constant quality of measurement.		
	4.6 Construction and function	-		Addition	Add the specification for step difference on the plane surface and the operation of slider.		Add the description in the previous edition to maintain a constant quality of measurement.		
	4.7 Hardness	-		Addition	Add the tolerances on calliper hardness.		Add the description in the previous edition to maintain a constant quality of measurement.		

(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 Metrological characteristics and performance	—	6	Almost identical Annex A with JIS.	Alternation	Integrate the contents of clause 6 and Annex A in ISO.	Relocate the contents of Annex A to the body because the measurement methods are important for the JIS certification.		
		5.3.1	Almost identical with JIS.	Addition	Limit the application of inspection basically to two types :E and S.	Limited because it is impractical to require that all items be inspected for all types of callipers.		
	5.3.1 General	5.3.2	Almost identical with JIS. A.2.2	Addition	Add the list of the maximum permissible error. Add the detail on the measurement method.	Add the description in the previous edition to maintain a constant quality of measurement. Maintain \pm symbols, according to ISO and the previous edition.		
	5.3.2 Partial surface contact error E					Add the measurement method in the previous edition that is commonly used in Japan.		

(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)	5.3.4 Scale shift error S	5.3.4 A.2.4	Almost identical with JIS.	Alternation	Add the specification for the maximum permissible error. Replace the measurement by the difference between indication of gauge block and that of ring gage, with the measurement only by the error of indication of block gauge.	Add the description in the previous edition to maintain a constant quality of measurement. Change to the description in the previous edition to specify the measurement method commonly used in Japan.			
	5.3.5 Line contact error L	5.3.5	Almost identical with JIS.	Addition	Specify that the line contact error can be also inspected by the clearance between measuring faces for external measurements.	Add the practical inspection method of the previous edition.			
	—	5.4		Deletion	Delete the items about MPE and MPL of metrological characteristics.	Delete the items for clarification.			
6 Marking on product documents	6 Marking on product documents	6	Marking on product documents	Alternation	Describe the details in Annex JA, except for the indication of maximum permissible errors in product documents, figures, etc. Delete the example of data sheet.	The maximum permissible error is basically as specified in the body.			

(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				
7 Proof of conformance with specifications	7.1 General	7.1	As specified in ISO 14253-1.	Alternation	Change the conformance or nonconformance according to ISO/TR 14253-6 : 2012. Delete the evaluation of uncertainty.		Replace with the practical conformance or nonconformance.		
	7.2 Measurement standard for calibration of metrological characteristics and performance	7.2	Almost identical with JIS.	Addition	State the necessity to use the standard traceable to national standards when it does not correspond to the Japanese Industrial Standards.		Add the specification to link the standard with national standards.		
	7.3 Standard reference temperature	—		Addition	Specify the dimensions, error of indication etc. are at the standard reference temperature.		Add the concrete specification considering the convenience for users.		
8	Inspection	—		Addition	Specify the necessity of conformance in the inspection.		Added for the JIS certification.		
9 Marking		8	Almost identical with JIS.	Alternation	Add the specification for scale interval, minimum reading value or minimum digital step, maximum measurable dimension, manufacturer's name, and 2-step scales.		Add the marking in the previous edition that is commonly used in Japan. Impracticable to make the manufacturing numbers sequential.		
							Delete the specification of sequential manufacturing numbers.		

(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 item of example of different types of calliper.	Deleted for clarity.	
-		Annex D		Deletion	Delete the types of measurement.	Deleted for clarity.	
-		Annex F		Deletion	Delete the item of calibration	Deleted for clarity.	
Annex JA (informative)		-		Addition	Add the marking on product document.	Marking is as specified in the body, but this Annex is added for reference.	

Overall degree of correspondence between JIS and International Standard (ISO 13385-1 : 2011): 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) are printed in *Standardization and Quality Control*, published monthly by the Japanese Standards Association, and also provided to subscribers of JIS (English edition) in *Monthly Information*.

Errata will be provided upon request, please contact:
Publishing Group, Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN
TEL. 03-4231-8550 FAX. 03-4231-8665