11. Inspection

The inspection for the micrometer shall be carried out on the measuring range, performances, scale figures, shape and dimensions, appearance and functions, and materials and hardnesses, and the results shall meet the requirements of 4., 5., 6., 7., 8. and 9. However, for that using cemented carbide alloy on the measuring faces of the anvil and spindle, measurement of hardness may be omitted.

12. Designation

The micrometer shall be designated by the number of standard or title of standard and measuring range.

Example: JIS B 7520 0 to 25

Indicating micrometer 75 to 100

13. Marking

The micrometer shall be marked with the following information:

(1) Scale interval of indicator part

(2) Measuring range

(3) Manufacturing number

(4) Manufacturer's name or its abbreviation

Depth micrometers

1. Scope This Japanese Industrial Standard specifies those of 300 mm or under in the maximum measuring length, among the depth micrometers (1) (hereafter referred to as "micrometers") for general purpose of 0.01 mm in scale interval or 0.001 mm in the minimum indication, and of 0.5 mm in the pitch of screw threads of the spindle.

Furthermore, as to the exchanging spindles (2), these are specified in the Annex.

Notes (1) The micrometers annexed with mechanical or electronic digital indication are also included.

(2) The exchanging spindles may also be called "rods".

Remarks: The standards cited in this Standard are given in the following:

JIS B 7430	Optical flats
JIS B 7431	Optical parallels
JIS B 7506	Gauge blocks
JIS B 7513	Precision surface plates
JIS G 4051	Carbon steels for machine structural use
JIS G 4303	Stainless steel bars
JIS G 4401	Carbon tool steels
JIS G 4404	Alloy tool steels
JIS H 5501	Cemented carbide alloy of tip
JIS Z 8103	Glossary of terms used in instrumentation

2. Definitions For the main terms used in this Standard, the definitions in JIS Z 8103 apply, and the rest of the terms are as follows:

(1) depth micrometer The measuring instrument capable of reading the distance between the reference plane of a base and the measuring plane corresponding to the depth or height of an article to be measured, being equipped with the base having a flat plane which serves as the reference of measurement, and the spindle which travels in axial direction perpendicular to the reference plane; and the sleeve and thimble having graduations indicating the movement of the spindle.

As to those having digital indications, there are the mechanical types and electronic types.

(2) instrumental error The value subtracted the true value from the reading of the micrometer.

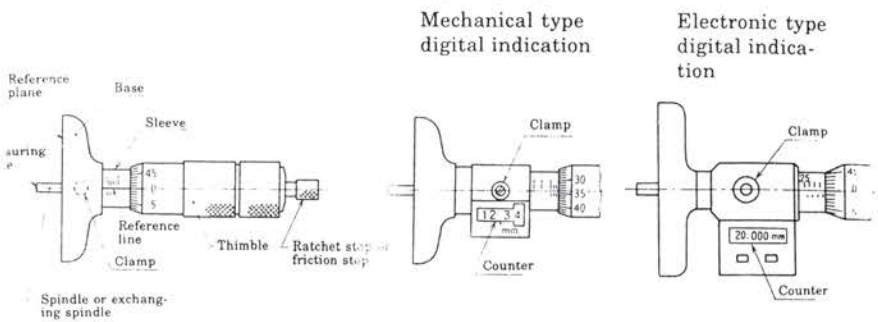
(3) feed error of spi... — he difference between the maximum value and the minimum value a... differences between the readings of the micrometer within the ... range of the spindle, taking the minimum measuring length ... rdinal point and the final measuring length as the terminal point, ... true value.

(4) mechanical type dig... ation — The numerical indication to be expressed by a wheel of rota... s, magnifying the travelling amount of the spindle mechanically ... or the like.

(5) electronic type digita... n — The numerical indication to be expressed, detecting the trav... ount of the spindle electrically and counting this by an electronic c...

3. Names — The names o... incipal parts of the micrometers shall be in accordance with Fig. 1.

Fig. 1. ...mes of principal parts



Remarks: These figures are those for indicating the names only, and are not those for indicating the details of design.

4. Measuring ranges — The measuring ranges and the number of exchanging spindles of the micrometers shall be in accordance with Table 1.

Table 1. Measuring ranges and number of exchanging spindles

Measuring range mm	Number of exchanging spindles
0 to 25	1 (3)
0 to 50	2
0 to 75	3
0 to 100	4
0 to 150	6
0 to 200	8
0 to 300	12

Note (3) Among the micrometers of 0 mm to 25 mm in measuring range, there are those having no exchanging spindle, but integrated with the threaded part of the spindle.

5. Performances — The performances of the micrometers shall be in accordance with Table 2.

Table 2. Performances of micrometers

Measuring range mm	Flatness of measuring plane μm	Flatness of reference plane μm	Parallelism of measuring plane in respect to reference plane μm	Instrumental error μm	Feed error of spindle μm	Measuring force N	Dispersion of measuring force N
25 or under	0.6	2	5	± 4	4	5 to 15	3
Over 25 up to and incl. 50				± 5			
Over 50 up to and incl. 100			6	± 6			
Over 100 up to and incl. 150			7	± 7			
Over 150 up to and incl. 200			8	± 8			
Over 200 up to and incl. 250			9	± 9			
Over 250 up to and incl. 300			10	±10			

Remarks 1. The values in this Table are those at 20°C.

2. For those of the electronic type digital indication, the errors due to the uncertainty per one figure at the end place indicated are not included in the instrumental errors and the feed errors of spindles.

6. Graduations

6.1 Graduation figures — The graduation figures of the sleeve and thimble, unless otherwise specified, shall be in accordance with the examples of Table 3.

Table 3. Examples for inscription of graduation figures

No.	Item	Graduation figures to be inscribed
1	Graduation figure of sleeve	25 20 15 10 5 0
2	Graduation figure of thimble	0 45 40 35 30 25 20 15 10 5

Remarks: For those of the electronic type digital indications, these are exempt from application.

6.2 Graduation types The graduation types of the sleeve and thimble, unless particularly specified, shall be in accordance with the examples of Table 4.

Table 4. Examples of graduation types

No.	Item	Remarks
1	Sleeve	Fig. 2
2	Thimble	Fig. 3

Fig. 2. Sleeve (example of 0 mm to 25 mm in measuring range)

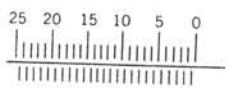
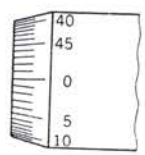


Fig. 3. Thimble



Remarks: For those of the electronic type digital indications, these are exempt from application.

6.3 Thicknesses of reference line and graduation line The thicknesses of the reference line of a sleeve and graduation line of a thimble, unless particularly specified, shall be in accordance with Table 5.

Table 5. Thicknesses of reference and graduation lines

Unit: mm

No.	Item	Thickness	Unevenness in thickness
1	Reference line of sleeve	0.08 to 0.20	0.03 max.
2	Graduation line of thimble		

6.4 Scale spacing of thimble The interval between the neighboring graduation lines of the thimble shall be 0.8 mm or over.

6.5 Letters of electronic type digital indications The heights of the letters for the electronic type digital indications of the micrometers shall be 4 mm or over.

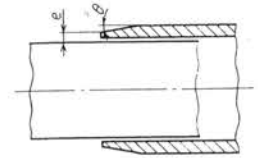
7. Shapes and dimensions The shapes and dimensions of principal parts of the micrometers shall be in accordance with the following:

(1) The angle of inclination of the thimble end shall be 20° or under (see Fig. 4).

(2) The distance from the graduation face end of the thimble to the graduation face of the sleeve shall be 0.4 mm (see Fig. 4).

(3) The dimensions of the base and the spindle shall be in accordance with Fig. 5.

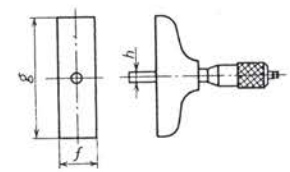
Fig. 4. The angle of inclination of thimble end and the distance from the graduation face end of thimble to the graduation face of sleeve



Angle of inclination
$\theta = 20°$ max.

Distance
$e = 0.4$ mm max.

Fig. 5. The dimensions of the base and spindle



Width of base
$f = 14$ mm to 20 mm

Length of base
$g = 50$ mm to 60 mm or 100 mm to 105 mm

Diameter of spindle
$h = 4$ mm to 4.5 mm

8. Construction and functions The construction and functions of the micrometer shall be in accordance with the following:

(1) The fit of the threaded parts shall be excellent, and shall be smooth over the whole working range and work without slackness.

(2) The fit of the threaded parts of the micrometer, when worn, shall be capable of being adjusted easily and securely.

(3) The spindle shall be capable of being fixed securely with the clamp.

The change of the reading of the micrometer, when clamped, shall be 2 μm or under.

(4) The ratchet stop or friction stop shall rotate smoothly.

(5) The graduation of the sleeve shall coincide with the end part of the thimble to such a degree as not impedimental in reading.

(6) The cardinal point of the scale of the micrometer shall be capable of being adjusted securely.

(7) The exchanging spindle shall be replaced easily, and shall be capable of being fixed securely without difficulty.

(8) The indicating values of the mechanical and electronic digital types shall be capable of being adjusted securely.

(9) Those of the electronic digital indication shall have functions to clarify that the values are not correct, when the thimble has been rotated at the speed exceeding the permissible value or any incorrect value has been indicated due to voltage drop.

9. Materials and hardnesses The materials and hardnesses of the principal parts of the micrometers shall be in accordance with Table 6. However, as to the materials, when equal to or superior to in mechanical properties, these shall be exempt from application.

Table 6. Materials and hardnesses

No.	Item	Material	Hardness	Measuring place of hardness
1	Measuring plane	Class D No.2 of JIS H 5501 SK2 to 5 of JIS G 4401 SKS3 of JIS G 4404	700 HV or over	On the cylindrical surface about 1 mm apart from the measuring plane
2	Reference plane of base	SK2 to 5 of JIS G 4401 SKS3 of JIS G 4404	600 HV or over	On the side face about 1 mm apart from the reference plane
3	Threaded part of spindle	SKS3 of JIS G 4404	700 HV or over	The threaded part or on the cylindrical surface of proximity to this
		SUS420J2 of JIS G 4303	530 HV or over	
4	Threaded part of spindle fitted with external thread	S25C to S45C of JIS G 4051	—	—

10. Measuring methods of performances The measuring methods of the performances of the micrometer shall be in accordance with Table 7. If it is possible to measure the performances at the measuring accuracies equal to or superior to these, these shall be exempt from application.

Table 7. Measuring methods of performances

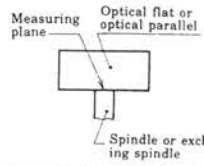
No.	Performance	Measuring method	Diagram	Measuring instruments	Remarks
1	Flatness of measuring plane	Allow the optical flat or optical parallel to contact closely to the measuring plane and read out the number of red interference fringes by white light.		Optical flat of grade 1 or grade 2 specified in JIS B 7430, or optical parallel of grade 1 specified in JIS B 7431	

Table 7. (continued)

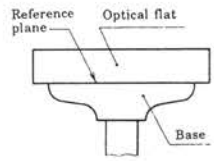
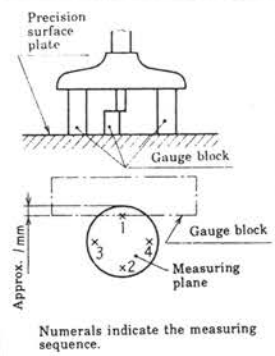
No.	Performance	Measuring method	Diagram	Measuring instruments	Remarks
2	Flatness of reference plane	Allow the optical flat to contact closely to the reference plane, and read out the number of red interference fringes by white light.		Optical flat of grade 1 or grade 2 specified in JIS B 7430	Assume one stick of red interference fringe as 0.3 μm.
3	Parallelism of reference plane in respect to measuring plane	Fix a pair of gauge blocks of equal length on a precision surface plate, and allow the reference plane of a micrometer to contact closely to these. Next insert a gauge block between the precision surface plate and 4 corners of the measuring plane of the micrometer in turn, rotate the ratchet of the micrometer to read the respective readings, and obtain its maximum difference.		Gauge blocks of grade 0 or grade 1 specified in JIS B 7506 or the gauges of equal to or superior to these, and precision surface plate of grade 0 or grade 1 specified in JIS B 7513 or the surface plate equal to or superior to this	

Table 7. (continued)

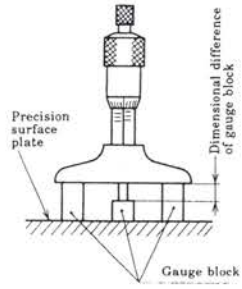
No.	Performance	Measuring method	Diagram	Measuring instruments	Remarks
4	Instrumental error	After the error at the minimum measuring length has been adjusted to zero, place a pair of gauge blocks (equal length) of longer than the maximum measuring length on a precision surface plate, and allow the reference plane of the micrometer to contact closely to this. Next, place another gauge block between the micrometer and the precision surface plate, rotate the ratchet of the micrometer, and obtain the difference between the reading of the micrometer and the dimension of the gauge block, when the measuring plane is allowed to contact.		Gauge blocks of grade 0 or grade 1 specified in JIS B 7506 or the gauge equal to or superior to these, and precision surface plate of grade 0 or grade 1 specified in JIS B 7513 or the one equal to or superior to this	

Table 7. (continued)

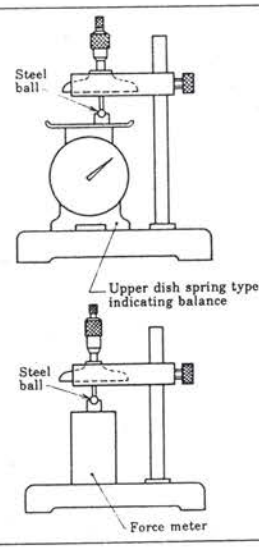
No.	Performance	Measuring method	Diagram	Measuring instruments	Remarks
5	Feed error of spindle	Obtain the difference between the maximum value and the minimum value at each measuring length which has been obtained by the procedure of No. 4.			In the case where the spindle is an exchangeable one, obtain the feed error of the spindle from the maximum difference of the instrumental errors, when measured using an exchanging spindle form 0 mm to 25 mm.
6	Measuring force	Put a steel ball between the loading point of the balance or force meter and the centre of measuring plane of the spindle, and both of them have been adjusted so that the axis of spindle becomes vertical and the reading of the balance or force meter becomes zero, rotate the ratchet stop or friction stop and read out the maximum value of the readings of the balance or force meter. Repeat this procedure 5 times, and obtain the mean value thereof.		Upper dish spring type indicating balance of scale interval 20 g or under, and force meter of 0.2 N or under in sensitivity or the measuring machine of equal to or superior to in accuracy	

Table 7. (continued)

No.	Performance	Measuring method	Diagram	Measuring instruments	Remarks
7	Dispersion of measuring forces	Consider the difference between the maximum value and the minimum value of the measured forces obtained in accordance with the procedure of No. 6 to be the measured value.			

Remarks: The dimensions of the gauge blocks to be used in the measurements of the instrumental error and feed error of spindle should preferably be selected such ones which are capable of obtaining the errors not only at the positions of integer rotation of the spindle but also at the intermediate positions.

For example, it may be well to use by setting the gauge blocks so that the dimensional differences of the gauge blocks become 2.5 mm, 5.1 mm, 7.7 mm, 10.3 mm, 12.9 mm, 15 mm, 17.6 mm, 20.2 mm, 22.8 mm and 25 mm.

11. Inspection The inspection of the micrometer shall be carried out on the measuring range, performances, graduations, shape, dimensions, construction and functions, and materials and hardnesses, and the results shall conform to the requirements of 4., 5., 6., 7., 8. and 9. However, that has used cemented carbide alloy for the measuring plane, the measurement of its hardness may be omitted.

12. Designation The micrometer shall be designated by the Standard number or the title of the Standard, measuring range, and the presence of mechanical type or electronic type digital indication.

Examples:	JIS B 7544	0 mm to 25 mm	
	Depth micrometer	0 mm to 150 mm	
	Depth micrometer	0 mm to 150 mm	Electronic type digital indication

13. Marking The micrometer shall be marked with the following information:

(1) Measuring range [4]

(2) Scale interval or minimum indication

(3) Manufacturer's name or abbreviation

Note [4] The measuring range shall be marked on the container box.

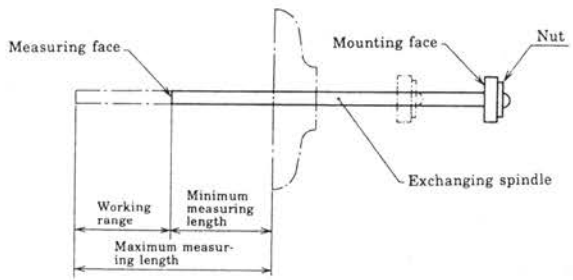
14. Matters to be attended on handling That of the electronic type digital indication is liable to be influenced the functions of its electronic portions by magnetic field, electric field, humidity, noise, etc., so that particular attention shall be paid on its working environment.

Annex Exchanging spindle for depth micrometer

1. Scope This Annex specifies the exchanging spindle for the depth micrometers.

2. Names The names of the exchanging spindle shall be in accordance with Annex Fig. 1.

Annex Fig. 1. Names of principal parts



3. Types of nominal dimensions The nominal dimensions of the exchanging spindles shall be expressed by the maximum measuring lengths, when the exchanging spindles are used, and the types thereof shall be in accordance with Annex Table 1.

Annex Table 1. Types of nominal dimensions

Unit: mm

25	125	225
50	150	250
75	175	275
100	200	300

4. Shape and dimensions The shape and dimensions of the exchanging spindle shall be in accordance with the following:

(1) The shape of the measuring plane shall be a flat plane.

(2) The diameter of the exchanging spindle shall be 4 mm to 4.5 mm.

5. Discrepancy of zero point when exchanging spindle is replaced The permissible value of the discrepancy of the zero point of the micrometer, when the exchanging spindle is replaced, shall be in accordance with Annex Table 2.

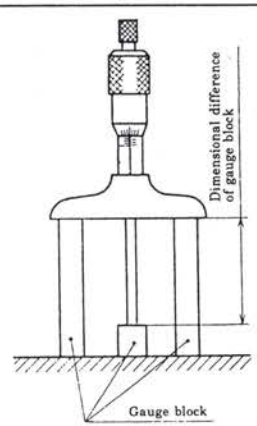
Annex Table 2. Permissible value of discrepancy of zero point

Nominal dimension of exchanging spindle mm	Permissible value μm
25	± 3
Over 25 up to and incl. 75	± 4
Over 75 up to and incl. 150	± 5
Over 150 up to and incl. 225	± 6
Over 225 up to and incl. 300	± 7

6. Material The material of the exchanging spindle shall be in accordance with Table 6 of the text of the Standard.

7. Measuring method of discrepancy of zero point when exchanging spindle is replaced The measuring method of the discrepancy of the zero point of the micrometer, when the exchanging spindle is replaced, shall be in accordance with Annex Table 3.

Annex Table 3. Measuring method of discrepancy of zero point

Item	Measuring method	Diagram	Measuring instruments
Discrepancy of zero point of micrometer	Confirm that the error at the zero point, when an exchanging spindle for 0 mm to 25 mm is attached, has been adjusted to zero. Next, replace the exchanging spindle, and after the dimensional difference of the gauge blocks on the surface plate has been so adjusted as to correspond to the minimum measuring length capable of measuring by this exchanging spindle, obtain the reading of the micrometer, when measured by applying measuring force.		Gauge blocks of grade 0 or grade 1 specified in JIS B 7506, or the gauges equal to or superior to these, and precision surface plate of grade 0 or grade 1 specified in JIS B 7513, or the surface plate equal to or superior to this

Informative reference Overall errors of depth micrometers

This Informative reference describes the overall errors of the depth micrometers, and does not constitute a part of the prescriptions.

The overall errors, when measured the articles of metal or equal to this in properties under the standard conditions or the similar environment to these, using the depth micrometers conforming to the performances of Table 2 of the text of the Standard, are in accordance with Informative reference Table 1.

Informative reference Table 1. Overall errors of depth micrometers

Maximum measuring length mm	Overall error μm
25 or under	± 7
Over 25 up to and incl. 50	± 8
Over 50 up to and incl. 100	± 9
Over 100 up to and incl. 150	± 10
Over 150 up to and incl. 200	± 11
Over 200 up to and incl. 225	± 12
Over 225 up to and incl. 250	± 13
Over 250 up to and incl. 275	± 14
Over 275 up to and incl. 300	± 15

Remarks: For those of the electronic type digital indication, the errors due to the uncertainty per one figure at the end place indicated are not included in the overall errors.

Vernier, dial and digital callipers

1. Scope This Japanese Industrial Standard specifies vernier callipers of 1000 mm or under in maximum measuring length, among those for general use which measure the external dimensions and internal dimensions to 0.1 mm, 0.05 mm, 0.02 mm or 0.01 mm in scale intervals, minimum indicating quantities or minimum reading values (hereafter, referred to as "vernier callipers".).

Remarks 1. The standards cited in this Standard are as given in the following:

JIS B 7506	Gauge blocks
JIS G 4303	Stainless steel bars
JIS G 4401	Carbon tool steels
JIS Z 8103	Glossary of terms used in instrumentation

2. The International standards corresponding to this Standard are as given in the following:

ISO 3599	Vernier callipers reading to 0.1 and 0.05 mm
ISO 6906	Vernier callipers reading to 0.02 mm

2. Definitions For the purposes of this Standard, main definitions are in accordance with JIS Z 8103, and others are in accordance with the following:

(1) vernier callipers A measuring instrument capable of reading a distance between each measuring faces with the beam scale and vernier scale or dial scale, by sliding a slider which has jaws with measuring faces parallel to those on the beam along the beam, which provides jaws with measuring faces for external measurement and internal measurement at one end, or with electronics type digital indication.

(2) vernier scale A scale for reading the further subdivided beam scale, which is obtained by dividing the scale of $(n-1)$ of the beam scale into equal parts of n or $\frac{n}{2}$. This is also called sub-scale.

(3) dial scale A circular plate scale for reading by a rotary pointer, magnifying the travelling amount of the slider mechanically by gears or the like.

(4) electronics type digital indication A numerical indication being expressed, by detecting the travelling amount of the slider on the basis of the beam and counting this by an electronics circuit.

(5) instrumental error A value subtracted the true value to be indicated from the reading of the vernier calliper.