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Steel tape measures

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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 Measuring Instruments Federation (JMIF) 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 7512:2016** is replaced with this Standard.

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Steel tape measures

1 Scope

This Japanese Industrial Standard specifies requirements for the steel tape measures of 0.5 m to 200 m in nominal length (hereafter referred to as tape measures).

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 7516 *Metal rules*

JIS G 4305 *Cold-rolled stainless steel plate, sheet and strip*

JIS G 4401 *Carbon tool steels*

JIS Q 17025 *General requirements for the competence of testing and calibration laboratories*

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 Z 8103, and the following apply.

Names of parts of a tape measure are shown in Figure 1.

3.1

zero point

centreline of scale mark or end face which serves as the starting point for measurement (see Figure 1)

3.2

effective measuring range

range on the scale of the tape measure, defined by the zero point and the scale mark assigned to the nominal length value

The specified length tolerances apply to this range.

3.3

extended scale

scale extended beyond the effective measuring range

The specified length tolerances do not apply to this range.

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3.4

margin

marginal portions of the tape measure outside the effective measuring range

The margin followed by the scale mark of the zero point is called “top margin”, and the margin preceded by the scale mark of the nominal length, “end margin” (see Figure 1).

3.5

scale spacing

distance between two adjacent scale marks measured centre-to-centre of their thicknesses

3.6

scale interval ¹⁾

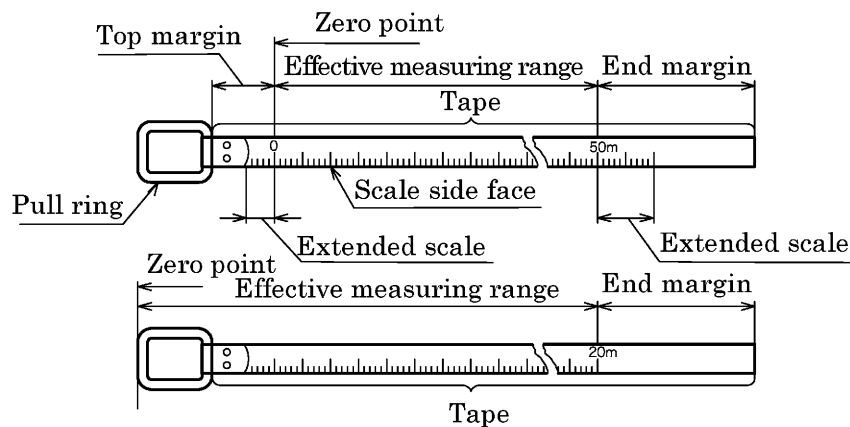
magnitude of measured quantity corresponding to the scale spacing

Note ¹⁾ The scale interval mentioned here is an abstract concept.

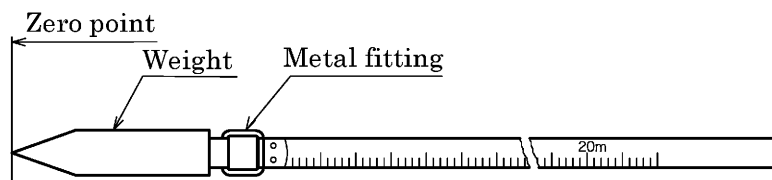
3.7

pull ring

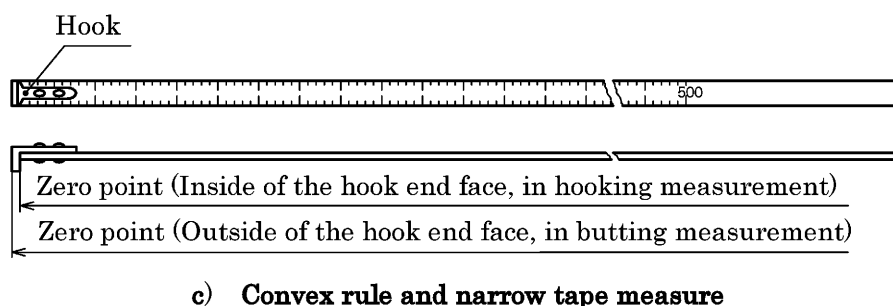
ring attached to the end of the tape



a) Wide tape measure and narrow tape measure



b) Tank tape measure



NOTE The above drawings are provided only for indicating designations of different types of products but not for specifying shapes and constructions.

Figure 1 Names of parts

4 Types and classes

Tape measures shall be classified as given in Table 1 principally according to construction and use, and divided into Class 1 and Class 2 according to the length tolerance.

5 Nominal length

Nominal lengths shall be expressed by the maximum scale value of the effective measuring range according to the type, as given in Table 1.

Table 1 Types and nominal lengths

Type	Nominal length		Construction and use
Tank tape measure	Integral multiple of 5 m (5 m to 200 m)		Tape measure provided with a weight at its end, used for measurement of the depth of a liquid in a tank and of an excavated hole
Wide tape measure			Tape measure to be used for general survey and measurement
Narrow tape measure	Integral multiple of	0.5 m to 5 m	Pocket-sized tape measure using a tape with a smaller width
Convex rule	0.5 m	0.5 m to 30 m	Tape measure with curvature provided in their tape cross-section, which allows the tape to stand upright in measurement

6 Performance

6.1 Tolerance on length

The distance from the zero point and the distance between any two consecutive scale marks, when measured in accordance with **a)** in Table 9, shall satisfy the length tolerance expressed by the following formula. For tape measures whose zero point is its end face, the following tolerance shall be increased by 0.2 for the distance from the zero point.

— For Class 1 tape measures : $\pm (0.2 + 0.1 L)$ mm

— For Class 2 tape measures : $\pm (0.25 + 0.15 L)$ mm

where, L is a value of length measured in metres, rounded up to an integer and expressed without units. For Class 2 tape measures, the result of above calculation shall be rounded up to one decimal place.

6.2 Uprightness

For convex rules 13 mm or over in tape width, the tape extended over a length at least 50 times its width according to the method shown in **b)** in Table 9 shall not bend under its own weight.

6.3 Straightness of scale side face

The straightness of the scale side face in the horizontal direction, when measured in accordance with the method shown in **c)** in Table 9, shall satisfy Table 2.

Table 2 Straightness

Nominal length	Straightness	
	Steel	Stainless steel
3 m or under	Not exceeding 1/500 of the nominal length	Not exceeding 1/500 of the nominal length
Over 3 m up to and incl. 5 m	Not exceeding 6 mm	
Over 5 m	Over any 5 m, not exceeding 6 mm	Over any 5 m, not exceeding 10 mm

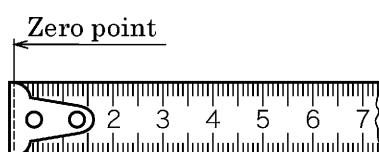
7 Scale

The scale marks of tape measures shall be as follows.

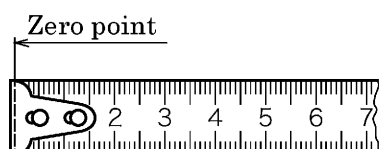
- Scale marks shall not be disposed in such a way that one of its ends is 0.5 mm or over apart from the scale side face.
- The zero point shall be a scale mark or the end face. For convex rules and narrow tape measures whose zero point is the end face, type of hook, measuring method and position of zero point shall be as given in Table 3. For convex rules of which both tape surfaces (convex and concave) bear scale marks, the zero point and the nominal length shall be as given in Table 4.

Table 3 Zero points of convex rules and narrow tape measures whose zero point is the end face

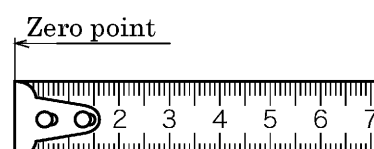
Type of hook	Measuring method	Zero point
Hook fixed securely to the tape (fixed hook)	Measurement by hooking the inside of the hook end face over the edge of a measured object (hooking measurement)	Inside of the hook end face [Figure 2 a)]
Hook fitted in such a way that it can slide (movable hook)	Measurement by hooking the inside of the hook end face over the edge of a measured object (hooking measurement)	Inside of the hook end face [Figure 2 b) and Figure 2 d)]
	Measurement by butting the outside of the hook end face against the measured object (butting measurement)	If the movable distance of the hook is equal to the thickness of the hook, the outside of the hook end face [Figure 2 c)]
		If the movable distance of the hook is equal to the thickness of the hook, the end face of the tape [Figure 2 e)]



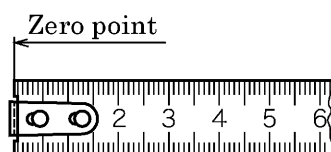
a) Fixed hook, for hooking measurement



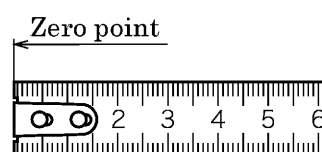
b) Movable hook, for hooking measurement



c) Movable hook, for butting measurement



d) Movable hook, for hooking measurement



e) Movable hook, for butting measurement

NOTE The above drawings are provided only for illustrating the positions of the zero point of different types of tape measures but not for specifying the appearance, shapes and constructions.

Figure 2 Zero points of convex rules and narrow tape measures whose zero point is the end face

Table 4 Zero point and nominal length of double-faced convex rule

Zero point	Concave face	End face of the tape (see Figure 3)
	Convex face	Either a) or b) in the following (see Figure 3) : a) End face of the tape b) Scale mark at a distance (top margin) of L cm, L being an integer, from the end face of the tape. This scale mark shall be in alignment with the scale mark on the concave face at a distance of L cm with a maximum displacement of ± 0.4 mm.
Nominal length	The two faces shall have the same nominal length. Inscriptions including that of nominal length may be omitted on one face.	

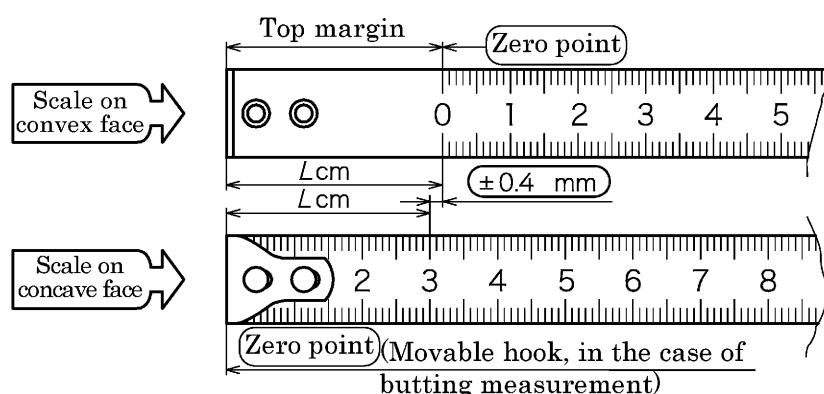


Figure 3 Scales on convex/concave sides of double-faced convex rule and their zero points, where $L = 3$

- c) The scale interval shall be 1 mm, 2 mm, 5 mm, 10 mm, 20 mm, 50 mm or 100 mm. Two or more of these intervals may be provided in combination on the same tape measure, provided that no other scale intervals than specified above are used.
- d) For scale marks of the same scale interval, maximum permissible error for the scale spacing and maximum permissible difference between the lengths of two consecutive scale spacings shall be as given in Table 5. The permissible values below do not apply to the scale spacing from the end face zero point.

Table 5 Maximum permissible error for the scale spacing and maximum permissible difference between the lengths of two consecutive scale spacings

Unit: mm		
Scale interval i	$i = 1$	$1 < i \leq 100$
Maximum permissible error for the scale spacing and maximum permissible difference between the lengths of two consecutive scale spacings	± 0.2	± 0.3

- e) The thickness of scale marks shall be 0.1 mm to 0.5 mm, and may be different according to the type of scale mark (1 mm scale marks, 5 mm scale marks, 10 mm

scale marks, etc.). For the scale marks with the same nominal thickness, the minimum value of the actual thickness shall be at least 70 % of the maximum value.

- f) Where extended scales are provided, their total length, including both the lengths at the top and at the end, shall not exceed 1 000 mm.
- g) The scale marks shall be clear, and free from any defects liable to interfere with the reading such as distortions or discontinuities.
- h) The principal scale marks shall be marked with the length from the zero point or its numerical value.

8 Appearance and construction

The appearance and construction of the tape measure shall be as follows.

- a) Indices and other markings shall be clear, indelible, and free from defects liable to interfere with the reading such as omissions and errors.
- b) Tape measures whose zero point is a scale mark shall be provided with a top margin having a length in conformance with Table 6 according to the type.

Table 6 Length of top margin

Unit: mm	
Type	Length
Wide tape measure	150 min.
Convex rule and narrow tape measure	10 min.

- c) For tape measures contained in a case, the end margin measured from the opening of the case shall be in conformance with Table 7 according to the type.

Table 7 Length of end margin

Type	Nominal length	Length
Wide tape measure and tank tape measure	5 m	50 mm min.
	Over 5 m	200 mm min.
Convex rule and narrow tape measure	—	30 mm min.

- d) The thickness of coating film on the tape shall be at most 0.5 mm on one side.
- e) The pull ring, hook, weight and their metal fittings shall be corrosion-resistant and shall have been attached properly.
- f) The weight for tank tape measures shall be 200 g to 2 kg in mass, and marked with its mass. If separable, the weight shall additionally bear a matching number traceable to the tape measure.

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- g) The case shall allow smooth extraction and retraction of the tape, and shall be durable.

9 Material

The material of the tape measure shall be as follows.

- a) **Material and hardness** For normal service conditions and applications, the material and hardness of the tape measure shall satisfy the requirements in Clause 6, and either of the following.
- 1) SK95 or SK85 specified in **JIS G 4401**, or any steel material equivalent to these in composition and of 400 HV to 600 HV in hardness
 - 2) SUS301 or SUS420J2 specified in **JIS G 4305**, or any steel material equivalent to these in composition and of 360 HV or over in hardness
- b) **Dimensions** The dimensional ranges of width and thickness of the material shall be as shown in Table 8 according to the type of tape measures.

Table 8 Dimensional ranges for material

Unit: mm		
Type	Width ^{a)}	Thickness ^{b)}
Tank tape measure	10 to 15	0.10 to 0.40
Wide tape measure		
Narrow tape measure	4 to 8	0.08 to 0.12
Convex rule	4 to 50	0.08 to 0.40
Notes ^{a)} The tolerance on width shall be ± 0.2 mm.		
^{b)} The tolerance on thickness shall be ± 20 %.		

10 Measurement method

The following measurement method shall be used.

- a) For performance measurement methods and measuring instruments, Table 9 shall apply. Other measuring instruments may be used provided that they have an accuracy at least equal to that of the specified instrument.

Table 9 Performance measurement methods

Measurement item	Measurement method	Measuring instruments
a) Tolerance on length	— With the tape measure stretched out horizontally on the inspection table under a tension, applied in its axial direction, equal to $\pm 10\%$ the tension inscribed on the tape measure (under no tension if it is a convex rule or narrow tape measure), measure the length to be inspected using a length standard scale ^{a)} and a micrometer microscope (see Figure 4).	Length standard scale ^{a)} Micrometer microscope (with 0.1 mm or smaller scale interval)
b) Uprightness	— For convex rules with a tape width 13 mm or over, extract the tape slowly with the concave side up until the length protruding beyond the inspection table is D mm as shown in Figure 5, and observe if the tape bends under its weight. — Length D shall be 50 times the tape width or more.	
c) Straightness of scale side face	— With the tape measure placed against the straightness standard ^{b)} so that it is in contact with the straightness standard at two ends of the tape length to be inspected (for tape measures with a nominal length over 5 m, at any 5 m scale marks), apply a tension equal to the tension inscribed on the tape measure (no tension is applied if it is a convex rule or narrow tape measure). — Measure the largest gap between the scale side face of the tape measure and the straightness standard by using a metal rule (see Figure 6).	Straightness standard ^{b)} Metal rule (JIS B 7516)

NOTE Figures 4 to 6 are only given to show examples.

Notes ^{a)} A length standard scale is a length scale provided with a calibration certificate which includes a statement of the uncertainty, and which has been issued by a calibration laboratory accredited or registered in accordance with **JIS Q 17025** or an equivalent International Standard.

^{b)} A straightness standard is an instrument provided with a calibration certificate for straightness issued by a calibration laboratory, or an instrument calibrated against this standard.

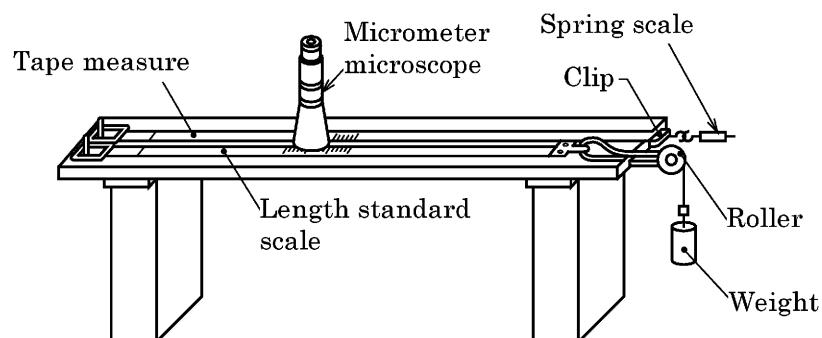


Figure 4 Measurement method (Tolerance on length)

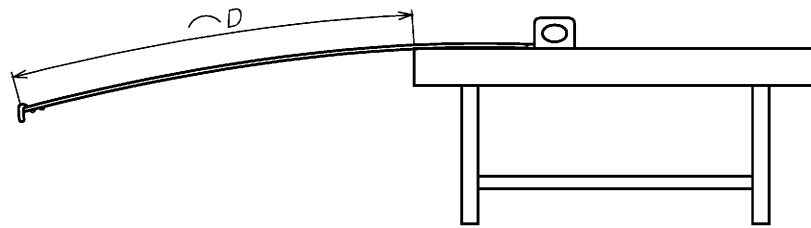


Figure 5 Measurement method (Uprightness)

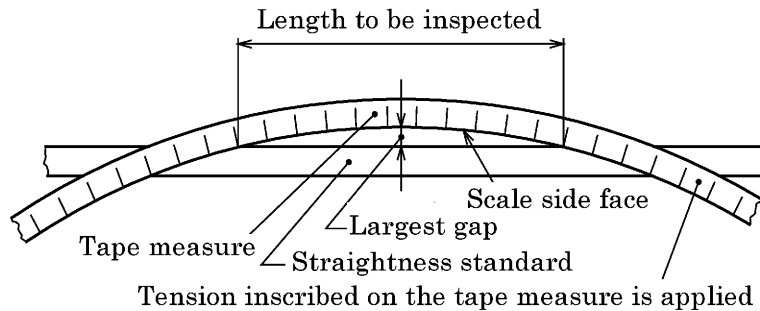


Figure 6 Measurement method (Straightness of scale side face)

- b) The ambient temperature for measurement of length tolerance shall be $(20 \pm 2) ^\circ\text{C}$. A higher temperature may be used if instrumental errors are calculated according to Formulae (1) and (2). Heat expansion coefficient of the length standard scale, (α) , and that of the tape measure under test, (β) , required for thermal correction are given in Table 10.

$$E = L - (Q - e) + c \dots\dots\dots(1)$$

where, E : instrumental error of the tape measure under test
 L : indicated value of the tape measure under test
 Q : indicated value of the length standard scale
 e : corrected value of the length standard scale
 c : thermal correction value

$$c = L (\alpha - \beta) (20 - t) \dots\dots\dots(2)$$

where, α : heat expansion coefficient of the length standard scale
 β : heat expansion coefficient of the tape measure under test
 t : ambient temperature for measurement ($^\circ\text{C}$)

NOTE If the materials of the length standard scale and the measured object are the same, the thermal correction value is zero as their heat expansion coefficients are identical.

Table 10 Heat expansion coefficients of length standard scale and tape measure under test that are required for thermal correction

Unit: 1/°C

Material of length standard scale or tape measure		Heat expansion coefficient of the length standard scale (α), and heat expansion coefficient of the tape measure under test (β)
Steel, cast steel		$(11.5 \text{ to } 11.8) \times 10^{-6}$
Stainless steel	SUS301	$(14.0 \text{ to } 16.9) \times 10^{-6}$
	SUS420J2	$(10.0 \text{ to } 11.0) \times 10^{-6}$

11 Inspection

For type inspection, the tape measures shall be tested for performance, scale marks, appearance, construction and material, and shall be accepted if found in conformance with the respective requirements in Clauses 6 to 9.

For product inspection, the tape measures shall be tested for the items agreed between the interested parties, using a reasonable sampling plan.

12 Designation of product

The tape measures shall be designated by the number or title of this Standard, type, class and nominal length.

Example 1 JIS B 7512 Class 1 convex rule 5 m

Example 2 Steel tape measure Class 1 convex rule 5 m

13 Marking

The tape measures satisfying all the requirements of this Standard shall be marked with the following information.

- Class
- Nominal length
- Manufacturer's name or its abbreviation
- That the material used is stainless steel, if applicable
- Tension ²⁾ (not applicable to convex rules and narrow tape measures)

Note ²⁾ The unit used for tension shall be accordance with International System of Units (SI).

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