

# LICENCE

for

JIS B7541 : 2001 : EN : COMBINED PDF

Licensee: RnD Sentral Sistem Calibration Lab

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JAPANESE  
INDUSTRIAL  
STANDARD

Translated and Published by  
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# JIS B 7541 : 2001

(JOMA/JSA)

## Standard scales

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ICS 17.040.30

**Descriptors** : instrument scales

**Reference number** : JIS B 7541 : 2001 (E)

## 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 the Japan Optical Measuring Instruments Manufacturers' Association (JOMA)/the Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law. Consequently **JIS B 7541 : 1973** is replaced with this Standard.

Date of Establishment: 1973-01-01

Date of Revision: 2001-03-20

Date of Public Notice in Official Gazette: 2001-03-21

Investigated by: Japanese Industrial Standards Committee  
Divisional Council on Precision Machinery

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JIS B 7541 : 2001, First English edition published in 2001-10

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Printed in Japan

## Standard scales

**1 Scope** This Japanese Industrial Standard specifies the glass standard scales used for the calibration of measuring instruments and for the transfer of length unit to low grade line standards.

**2 Normative references** The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0601 *Surface roughness—Definitions and designation*

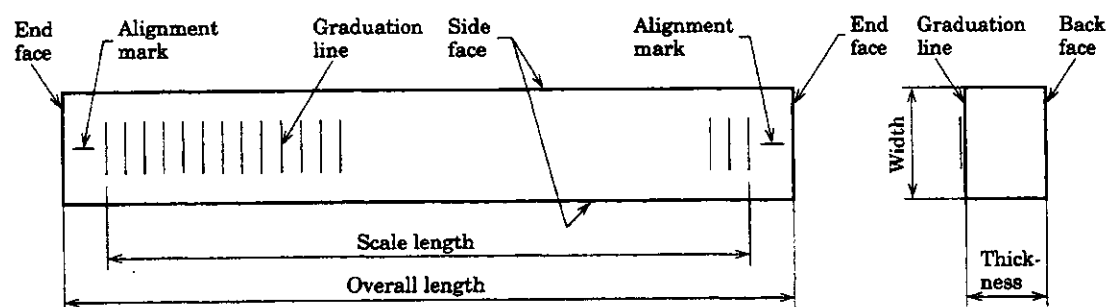
JIS B 7513 *Precision surface plates*

JIS Z 8103 *Glossary of terms used in measurement*

**3 Definitions** For the purposes of this Standard the definitions given in JIS Z 8103 and the following definitions apply.

- a) **measuring axis** The line made by the crossing of the graduated face and the face perpendicular thereto including the alignment marks.
- b) **length of standard scale** The length between the centers of two optional graduated lines along the measuring axis.

**4 Name of each part as given in Fig. 1.**



**Fig. 1 Name of each part**

**5 Grades** The standard scales are divided into three grades of Grade 0, Grade 1 and Grade 3 according to performance.

**6 Material** The material used for standard scale shall show clear information about the coefficient of linear expansion of glass material.

**Remarks :** The coefficient of linear expansion shall be determined within a range of temperature 15 °C to 30 °C.

**7 Cross sectional form and dimensions** The cross sectional form of the standard scales shall be rectangular or square and the dimensions suitable for satisfying the tolerance on length of the standard scale according to the scale length shall be secured.

The sectional dimensions shall be expressed with width  $\times$  thickness and the values shall be as given in Table 1.

**Table 1 Sectional dimensions**

Unit : mm					
Width	20		30		
Thickness	10	20	15	20	30

## 8 Graduation

**8.1 Scale length** The scale length of standard scale is as given in Table 2.

**Table 2 Scale length**

Unit : mm												
Scale length	50	100	150	200	250	300	400	500	600	750	800	1 000
Overall length (informative)	70	120	170	220	280	330	430	530	640	790	840	1 040

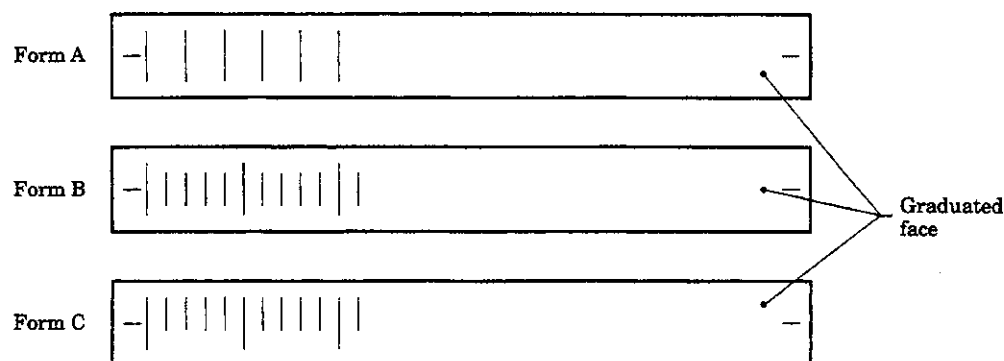
**8.2 Thickness and perpendicularity of graduation lines** The thickness of graduation lines of the standard scales is as given in Table 3.

**Table 3 Thickness of graduation lines**

Unit : $\mu\text{m}$	
Grade	Thickness of graduation line
Grade 0, Grade 1	3 to 10
Grade 2	10 to 20

The uniformity in thickness of one graduation line shall be at the most 10 % in the vicinity of the measuring axis within a range of the length of 100 times the thickness of the graduation line. The perpendicularity of the graduation line to the measuring axis shall be at the most 1' in the vicinity of the measuring axis within a range of the length of 100 times the thickness of the graduation line.

**8.3 Presentation of graduation line** The graduation lines of the standard scales are presented in the forms shown in Fig. 2 and the alignment marks are given in longitudinal direction of the scale for indicating the measuring axis.



**Fig. 2 Presentation of graduation lines**

## 9 Performance

### 9.1 Precision in shape

- Surface roughness of graduated face** The surface roughness of graduated face is expressed with the maximum height  $R_y$  specified in **JIS B 0601** and is at most  $0.05 \mu\text{m}$ .
- Straightness of graduated face** The straightness of graduated face is not allowed to exceed the values given in Table 4 when placed directly on a precision surface plate specified in **JIS B 7513** or placed with a support at a fulcrum, if instructed, with the graduated face upward.

**Table 4 Straightness of graduated face**

Unit :  $\mu\text{m}$

Grade	Straightness
Grade 0, Grade 1	20
Grade 2	40

**9.2 Tolerance on length** The tolerance on the length of standard scale is expressed with the absolute value at the temperature of  $20^\circ\text{C}$  and its value shall not exceed the values given in Table 5.

**Table 5 Tolerance on length**

Unit :  $\mu\text{m}$

Length (mm)	Grade		
	Grade 0	Grade 1	Grade 2
100 or under	1.1	2.2	4.4
Over 100 up to and incl. 200	1.2	2.4	4.8
Over 200 up to and incl. 300	1.3	2.6	5.2
Over 300 up to and incl. 400	1.4	2.8	5.6
Over 400 up to and incl. 500	1.5	3.0	6.0
Over 500 up to and incl. 600	1.6	3.2	6.4
Over 600 up to and incl. 800	1.8	3.6	7.2
Over 800 up to and incl. 1 000	2.0	4.0	8.0

**Remarks :** The values in Table 5 were calculated by the following formulae and rounded off.  $L$  (mm) in the formulae is the length of the standard scale.

$$\text{Grade 0} \quad \left(1 + \frac{L}{1\,000}\right) \mu\text{m}$$

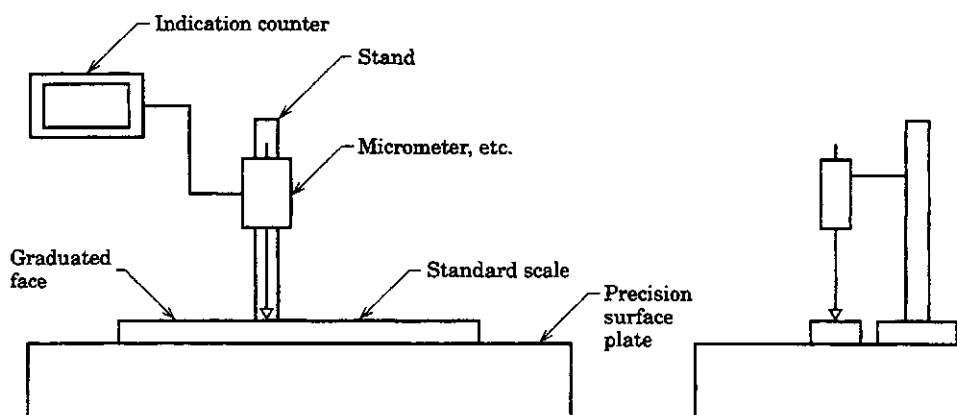
$$\text{Grade 1} \quad \left(2 + \frac{2L}{1\,000}\right) \mu\text{m}$$

$$\text{Grade 2} \quad \left(4 + \frac{4L}{1\,000}\right) \mu\text{m}$$

**9.3 Stability of length** The stability of the length of standard scale is expressed with the change of length by aged deterioration and it shall not exceed  $\frac{1}{1\,000\,000}$  of the length in a year in the case of Grade 0.

## 10 Measuring method of performance

**10.1 Measurement of straightness of graduated face** Make the graduated face of the standard scale upward, place it directly on the precision surface plate specified in **JIS B 7513** or support, if instructed, on a fulcrum and read the indicated value using a micrometer, vernier caliper, etc. (See Fig. 3.)



**Fig. 3 Measuring method of straightness**

**10.2 Measurement of tolerance on length** The measuring method is to use a laser interference length meter or to compare with a standard scale so calibrated as to be a reference or with those equivalent thereto.

#### 10.2.1 Measuring condition

- Place the standard scale directly on a moving table with the graduated face or side face upward, or with a support at a fulcrum if instructed.
- The measurement of standard scale is carried out at the standard temperature 20 °C after the standard scale and the measuring equipment adjust to that temperature.

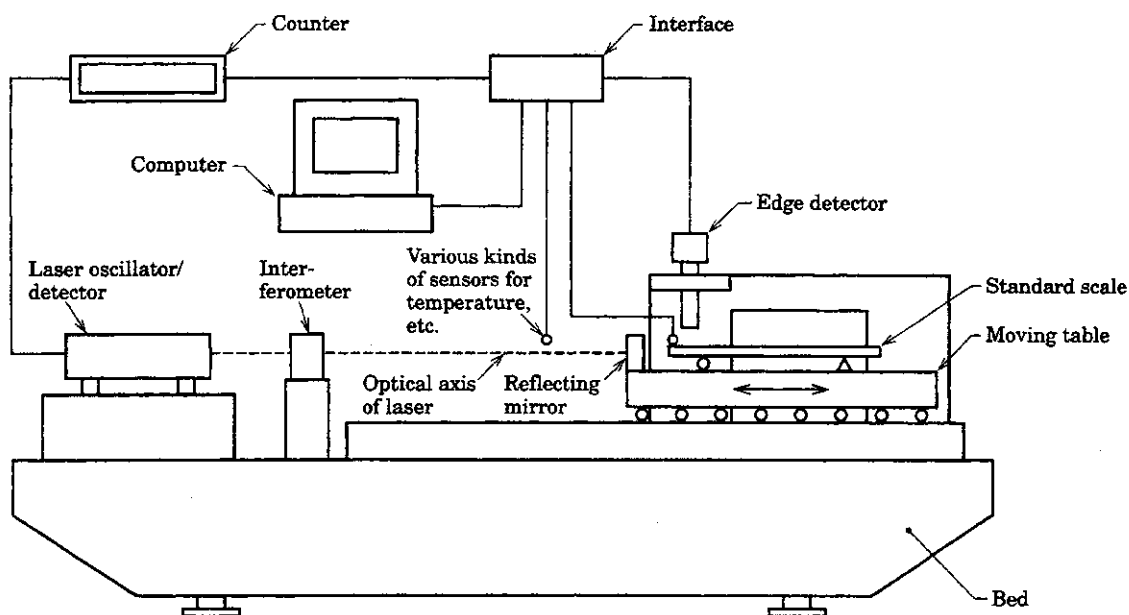
**Remarks :** When measuring at a different temperature, the amount of thermal expansion needs correction.

#### 10.2.2 Procedure

- In the method using a laser interference length meter, fix the reflecting mirror of the laser interference length meter so that the measuring axis of the standard scale on the moving table of the measuring equipment and the optical axis of laser are on one line or are in parallel, start the moving table and obtain the value indicated on the laser interference length meter corresponding to the length of the standard scale to be measured, or the value as a result of subtracting the nominal length of the standard scale to be measured from the indicated value (see Fig. 4).

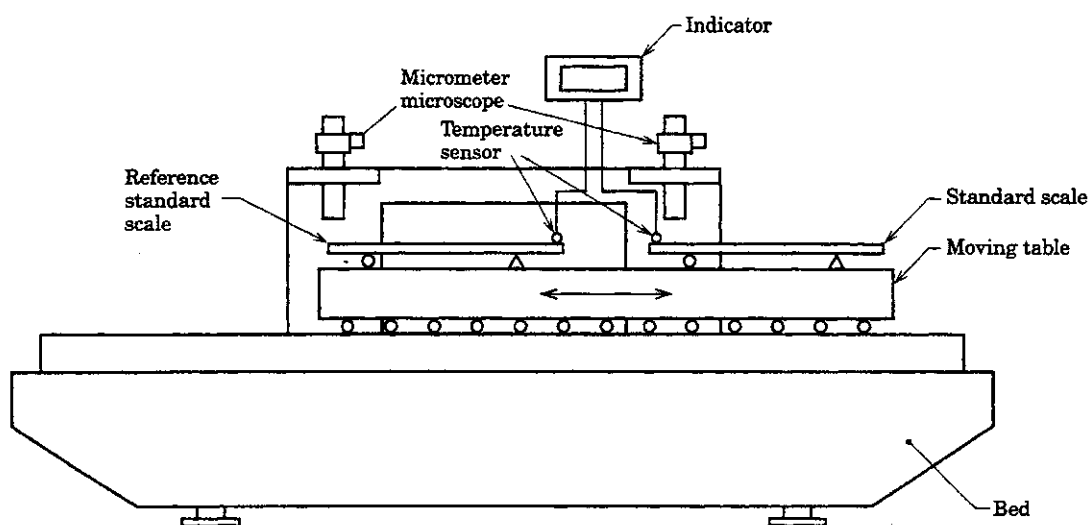
**Remarks :** Correction of refractive index of air because the indication value of the laser interference length meter depends on the environmental conditions.





**Fig. 4 Measuring method using laser interference length meter**

- b) In the method to compare with the calibrated reference standard scale or those equivalent thereto, fix the standard scale to be measured so that the measuring axis of it and the measuring axis of the reference standard scale are on one line or are in parallel on the moving table, start the moving table and obtain the value of the length of the reference standard scale corresponding to the standard scale to be measured or the value as a result of subtracting the nominal length of the standard scale to be measured from the value of that length (see Fig. 5).



**Fig. 5 Measuring method by comparing with reference standard scale**

**10.2.3 Measuring position** The measurement is carried out at least 10 positions on the measuring axis in the scale length. The intervals between the measuring positions shall be a pitch not more than  $\frac{1}{10}$  of the scale length.

**11 Designation** The standard scales are designated by title of standard, grade, dimensions of section and scale length.

Example : Standard scale    Grade 0     $30 \times 15$     500 mm

**12 Marking** The following information shall be marked on the standard scale and on the inspection form/report.

**12.1 Standard scale**

- a) Manufacturer's name or abbreviation
- b) Number of manufacture

**12.2 Inspection form/report**

- a) Grade
- b) Scale length
- c) Manufacturer's name or abbreviation
- d) Number of manufacture
- e) Year and month of inspection
- f) Coefficient of linear expansion of material
- g) Measured value

A calibration table including the uncertainty of the measurement is appended where appropriate.

Errata for JIS (English edition) are printed in *Standardization Journal*, published monthly by the Japanese Standards Association, and also provided to subscribers of JIS (English edition) in *Monthly Information*.

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