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प्रारंभिक मसौदा

साइन बार — विशिष्टि

(IS 5359 *का दूसरा पुनरीक्षण*)

Preliminary Draft

Sine Bars — Specifications

(*Second Revision of* IS 5359)

ICS 77.140.60

Engineering Metrology Sectional Committee, PGD 25	Last date for receipt of comment is **XXXX**

FOREWORD

(*Formal clause will be added later on*)

A sine bar is a testing device with which angles can be set on the basis of sine function with the help of slip gauges and can be used for testing of taper objects.

These sine bars are preferably used for the range of setting angles 0º to 45º. For the range of setting over 45º to 60º, attention must be paid to angular uncertainty. The angle to be set (α) is reduced to linear measurement with the help of the sine function. The required combination of slip gauges is calculated according to the following formula:

$$E = L_1 \sin \alpha$$ (*see* Fig. 1 and Fig. 2)

This standard was originally published in 1969 and subsequently revised in 1987. This second revision has been brought out to keep pace with the latest technological developments. In this revision following major changes have been made:

a) Requirement for surface finish of the sine bar has been added, and
b) The reference clause has been updated.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 2022. 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded-off value should be the same as that of the specified value in this standard.

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SINE BARS — SPECIFICATIONS

(Second Revision)

1 SCOPE

This standard specifies the dimensions and requirements of sine bars of nominal sizes 100 mm to 500 mm. The nominal size represents the distance between the axes of rollers.

2 REFERENCE

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. In case the standards are to be referred in this clause they are to be listed as follows:

IS No	*Title*
IS 2102 (Part 1) : 1993/ ISO 2768-1 : 1989	General tolerances for dimensions and form and position: Part 1 General tolerances for linear and angular dimensions (*third revision*)
IS 2285 : 2003/ ISO 8512-1 : 1990	Engineering metrology — Measuring equipment — Cast iron surface plates — Specification (*third revision*)
IS 2984 : 2003 / ISO 3650 : 1998	Specification for slip gauges (*second revision*)
IS 7018 (Part 1):1983	Technical supply conditions for gauges: Part 1 General (*first revision*)
IS 8000 (Part 1) : 2019/ ISO 1101 : 2017	Geometrical product specifications (GPS) — Geometrical tolerancing: Part 1 Tolerances of form, orientation, location and run-out (*second revision*)
IS /ISO/IEC Guide 99:2007	International vocabulary of metrology (VIM) — Basic and general concepts and associated terms

3 NOMENCLATURE AND TERMINOLOGY

3.1 The nomenclature of sine bar shall be as shown in Fig. 1. Terminology in this standard is based on IS Guide 99.

3.2 Flatness Tolerance

See 17.3 of IS 8000 (Part 1)

3.3 Squareness Tolerance

See 17.11 of IS 8000 (Part 1)

3.4 Parallelism Tolerance

See 17.10 of IS 8000 (Part 1)

3.5 Working Surface

The upper surface of the sine bar constitutes the working surface.

4 DIMENSIONS

The dimensions of sine bar shall be as given in Fig. 1 and Table 1.

5 MATERIAL AND HARDNESS

5.1 The main body of sine bar, supporting rollers (and support, if required) shall be made from suitable gauge steel as specified in IS 7018 (Part 1).

5.2 The working surface and rollers shall be hardened to a minimum hardness of 700 HV (60 HRC) and properly stabilized.

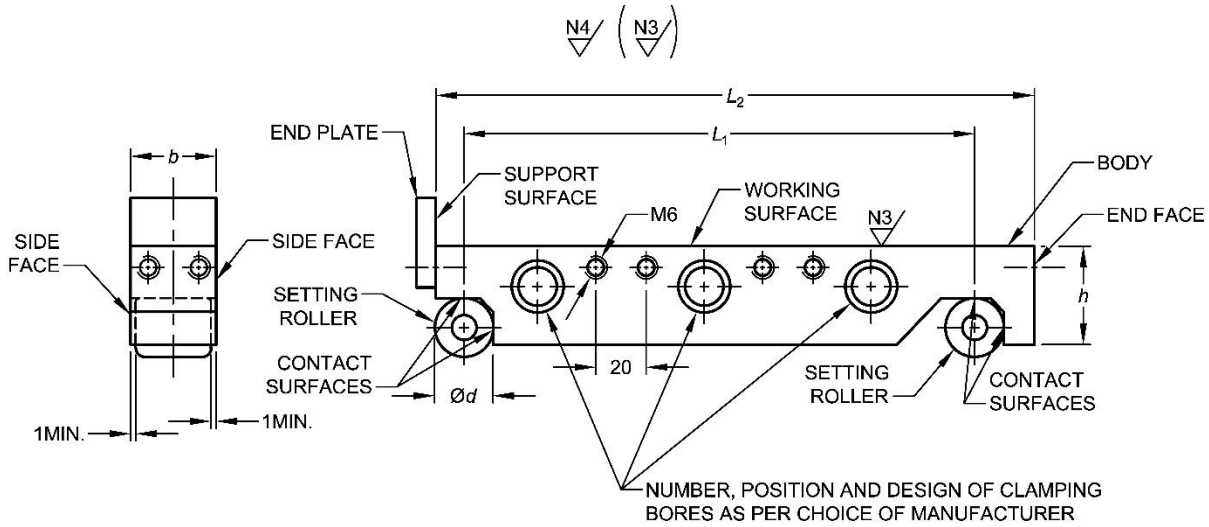
6 GENERAL REQUIREMENTS

6.1 Tolerances and Permissible Deviations

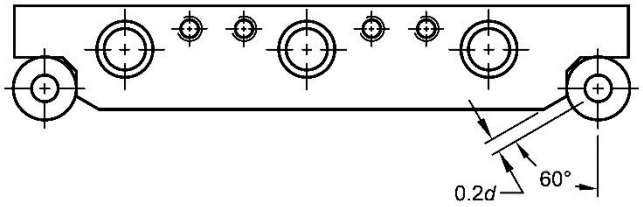
The general tolerances as specified in IS 2102 (Part 1) shall be maintained for dimensions which are not specified in Table 2. The main accuracy requirements shall be as given in Table 2. When sine bars are made according to specifications given in Table 2 and uncertainties as given in Table 3 are to be expected while using the combination of slip gauges of accuracy grade 1 as prescribed in IS 2984.

6.2 Flatness error of top surface within a zone of 0.5 mm from the chamfered edges shall be 2 µm, max.

6.3 Outer and inner edges may be chamfered to 45° x 1 mm.



1A TYPE A SINE BAR



Remaining dimensions as per Type A

2A TYPE B SINE BAR

FIG.1 NOMENCLATURE AND DIMENSIONS FOR SINE BAR

Table 1 Dimensions of Sine Bar

(*Clause* 4 and *Fig.*1)

All dimensions in millimetres

Sl No.	**Nominal size, L_1**	***b***	***L_2***		***h***	**Diameter of Roller, *d***
			Type A	**Type B**		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	100	20	130	120	40	20
ii)		30				
iii)	200	20	230	220	40	20
iv)		30				
v)	300	25	345	330	50	30
vi)		40				
vii)	400	25	445	430	50	30
viii)		40				
ix)	500	30	555	535	60	35
x)		50				

Table 2 Tolerances and Permissible Deviations

(*Clause* 6.1, and *Fig.* 1)

Sl No.	Nominal size, L_1		Parallelism of Roller Axis	Diameter of Rollers			Form Tolerance for Rollers	Parallelism Tolerance of Working Surface to Contact Surface	End Faces Parallelism Tolerance to Roller Axis	End Faces and Side Faces Perpendicularity Tolerances to each other and to Working Surface
	mm	Permissible Tolerance µm	µm	*d* mm	Permissible Tolerances µm	Permissible Variation in sizes of Rollers µm	µm			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
i)	100	±2	1	20	±2	1	1	$\frac{1\mu m}{100\ \text{mm}}$	$\frac{5\mu m}{10\ \text{mm}}$	$\frac{1\mu m}{10\ \text{mm}}$
ii)	200	±4	2	20						
iii)	300	±6	3	30						
iv)	400	±8	3	30						
v)	500	±10	3	35						

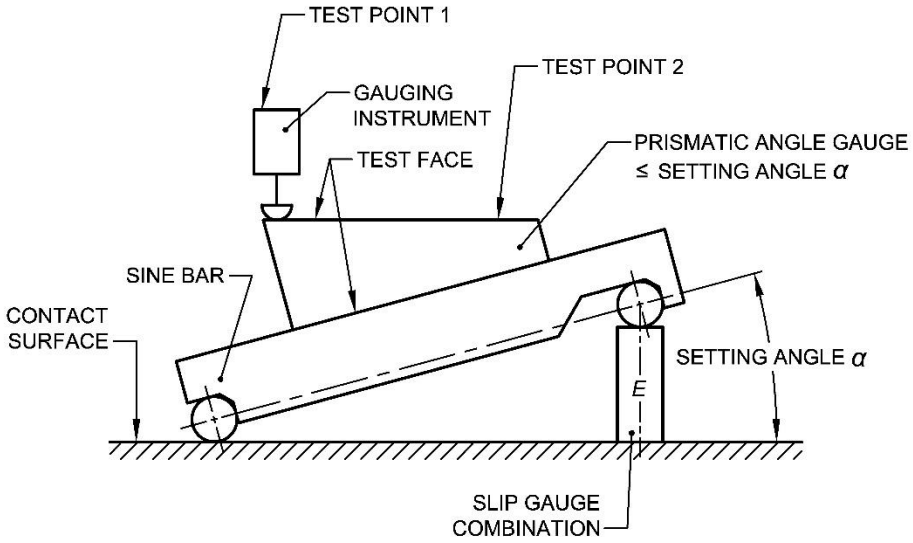


FIG. 2 TEST ASSEMBLY (SINE BAR IN THE POSITION OF OPERATION)

6.4 Construction

The rollers shall be connected rigidly to the sine bar body. Sine bars may be provided with fitting edges. The tapped holes for this are to be distributed pairwise symmetrical to the middle clamping bore on side faces and symmetrical on end faces. The fitting surfaces shall correspond to the specifications for side and end faces.

6.5 Angular Uncertainty

The angular uncertainty of sine bar shall be as given in Table 3.

Table 3 Angular Uncertainty
(*Clauses* 6.1 *and* 6.5)

Sl No.	Nominal size, L_1 (mm)	Angular Uncertainty for Setting Angles (seconds)			
		15º	30º	45º	60º
(1)	(2)	(3)	(4)	(5)	(6)
i)	100	±4	±5	±7	±11
ii)	200	±3	±4	±6	±10
iii)	300	±3	±4	±6	±9
iv)	400	±2	±3	±5	±9
v)	500	±2	±3	±5	±9

NOTE — The values of angular uncertainty are valid for unstressed sine bars.

6.6 Methods of testing the sine bars are given in Annex A.

6.7 The surface finish of sine bar shall be as specified in Table 4:

Table 4 Surface Finish of Sine Bar
(*Clause* 6.7)

Sl No.	Roughness Grade Number	Roughness Value, R_a (µm)	Roughness Symbol
(1)	(2)	(3)	(4)
i)	N12	50	~
ii) iii)	N11 N10	25 12.5	∇
iv) v) vi)	N9 N8 N7	6.3 3.2 1.6	∇∇
vii) viii) ix)	N6 N5 N4	0.8 0.4 0.2	∇∇∇
x) xi) xii)	N3 N2 N1	0.1 0.05 0.025	∇∇∇∇

7 DESIGNATION

The sine bars shall be designated by the type size and the number of this standard.

Example:

Sine Bar A 200 IS 5359

8 PRESERVATIVE TREATMENT

8.1 All surfaces of the sine bar shall be well protected by covering with suitable corrosion preventives during storage and transit.

8.2 Each sine bar shall be supplied in a suitable case, strongly constructed and designed to protect the working surfaces and prevent ingress of dust.

9 MARKING

9.1 Each sine bar shall be legibly and permanently marked with the following particulars:

a) Nominal size,
b) Identification number, and
c) Manufacturer’s name or trade-mark.

9.2 The markings shall not interfere with the accuracy of the working surfaces and as such there shall be no markings on the working surfaces.

9.3 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

ANNEX A
(*Clause* 6.6)

METHODS OF TESTING

A-l PARALLELISM OF UPPER SURFACE TO THE CONTACT SURFACE

The test of parallelism includes the test of flatness. The contact surface should correspond to the measuring plate (surface plate) with accuracy grade 0 as given in IS 2285. The upper surface is checked with an instrument for gauging lengths with scale 0.2 µm, with a permissible deviation of display 1 scale unit that is in accordance with inductive measuring method. The flatness of the upper surface can also be checked interferentially.

A-2 SETTING ANGLE

Preferably, the angles 15º, 30º and 45º are tested. The contact surface should correspond to a surface plate with accuracy grade 0 as specified in IS 2285 with most suitable slip gauge combinations (maximum five slip gauges) which corresponds to at least Grade 1 in accordance with IS 2984 when the angle is set. A prismatic angle gauge is put on the upper surface of the sine bar according to the test assembly, only prismatic angle gauge (no combination) shall be used for testing. The angle of the prismatic gauge block should be equal to the theoretical value of the set angle and must not cross the permissible deviations of ±2.

A-2.1 The upper surface of the prismatic angle block is checked with an instrument for measuring gauging length with a scale of least count $\leq$ 0.2 µm with a permissible deviation of the display 1 scale unit between two testing points which are as far as possible from each other. An edge zone of 0.5 mm width is not taken into consideration during testing.

A-2.2 The difference in display between both the points shall not exceed the values given in Table 4.

Table 4 Permissible Difference in Reading at Test Points 1 and 2
(*Clause* A-2.2 and *Fig.* 2)

Sl No.	Nominal Size, L_1 (in mm)	Permissible Difference for Setting Angle (Theoretical Value) (µm)		
		15°	30°	45°
(1)	(2)	(3)	(4)	(5)
i)	100	0.8	1.0	1.3
ii)	200	0.7	0.9	1.2
iii)	300	0.6	0.8	1.2
iv)	400	0.6	0.8	1.1
v)	500	0.5	0.7	1.1

NOTE — The values in the table refer to a distance of 40 mm between test points 1 and 2. If any other distance is chosen, then the values in the table must be proportionately recalculated.