

Plain bearings — Thin-walled half bearings — Checking of peripheral length

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- Association of Bronze and Brass Founders
- British Plastics Federation
- British Powder Metal Federation
- Copper Development Association
- Institution of Diesel and Gas Turbine Engineers
- Institution of Mechanical Engineers
- Society of Motor Manufacturers and Traders Ltd.

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National foreword

This British Standard has been prepared under the direction of the Machinery and Components Standards Policy Committee. It is identical with ISO 6524:1992 *Plain bearings — Thin-walled half bearings — Checking of peripheral length*, published by the International Organization for Standardization (ISO).

Cross-references

International Standard	Corresponding British Standard
	BS 4480 <i>Plain bearings: metric series</i>
ISO 3548:1978	Part 5:1979 <i>Dimensions, tolerances and methods of checking thin-walled half bearings</i> (Identical)
	BS 4480 <i>Plain bearings: metric series</i>
ISO 6864:1984	Part 8:1984 <i>Specification for dimensions, tolerances and methods of checking of thin-walled flanged half bearings</i> (Identical)

Textual error. When adopting the text of the International Standard, the textual error given below was discovered. It has been marked in the text and has been reported to ISO/TC 123/SC3 in a proposal to amend the text of the International Standard.

On page 2, in clause 4, Young’s modulus is in newtons per square millimetre.
A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 26, an inside back cover and a back cover.
This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This International Standard specifies methods of checking the measuring equipment and gauging tools necessary for measuring the peripheral length (or nip or crush) of thin-walled half-bearings.

Thin-walled half-bearings are flexible and, in the free condition, do not conform to a cylindrical profile. This is one reason why the peripheral length of the half-bearings can only be measured under a constraining load by use of specialized measuring equipment.

Measuring equipment different from that illustrated in this International Standard can be used, providing the measuring accuracy of the equipment is consistent with the specifications given in clause 17.

This International Standard does not include measurement of the joint face taper.

It applies to thin-walled half-bearings, the specifications of which are given in ISO 3548 and ISO 6864.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards. ISO 3548:1978, *Plain bearings — Thin-walled half bearings — Dimensions, tolerances and methods of checking*.

ISO 6864:1984, *Plain bearings — Thin-walled flanged half bearings — Dimensions, tolerances and methods of checking*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1

peripheral length

the circumferential length which runs from one joint face to the other

3.2

nip; crush

the value, α , by which a half-bearing fitted in a checking block of bore diameter d_{cb} under a predetermined checking load F exceeds the defined peripheral length of the checking block bore (see Figure 1)

NOTE 1 In practice, the datum serves as a basis for measuring α (see Figure 2).

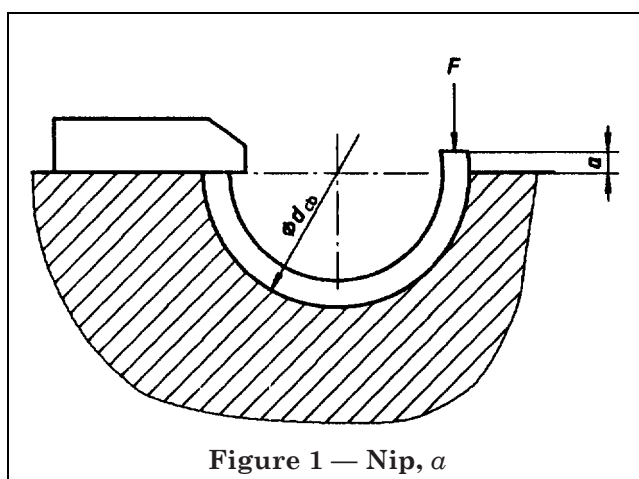


Figure 1 — Nip, α

3.3

repeatability

the closeness of agreement between successive results obtained with the same method on the same test piece, under the same conditions (same operator, same measuring equipment, same checking place and time intervals)

NOTE 2 Repeatability is assessed from the standard deviation of repeatability σ_A . See Annex E.

3.4

reproducibility

the closeness of agreement between individual results obtained with the same method on the same test piece but under different conditions (identical or different operator, measuring equipment, checking place and times)

NOTE 3 For the purposes of this International Standard, reproducibility is the difference between the two averages obtained from two sets of measuring equipment. See Annex E.

3.5

comparability

the accuracy in the case of operators working in different checking places at different periods and each of them achieving individual results, one using method A and the other method B, on the same half-bearing in different checking blocks

NOTE 4 Comparability is assessed from the difference between the two averages obtained from the two methods. See Annex E.

4 Symbols

NOTE 5 The characteristic subscripts are as follows:

bs: bearing to be checked
cb: checking block
cbm: master checking block
cbs: series checking block
cs: comparison shell
M: measured
ms: master shell
th: theoretical

a or $a_1 + a_2$	nip, in millimetres
B	width of the half-bearing without flange, in millimetres
B_1	checking block width (construction for flanged half-bearings), in millimetres
B_2	checking block width, in millimetres
B_3	checking block width (construction for half-bearings without flange), in millimetres
B_{ms}	master shell width, in millimetres
d_{cb}	diameter of the checking block bore, in millimetres ^a
D_{bs}	outside diameter of the half-bearing to be checked, in millimetres
D_{ms}	outside diameter of the master shell, in millimetres ^a
E	Young's modulus, in newtons per square metre ^b
f	coefficient of friction in calculation of deflection under load
$F = F_1 = F_2$	checking load, in newtons
F_{cor}	correction factor, in millimetres ^a
h	fillet radius between back and flange on flanged half-bearing, in millimetres
H_{cb}	distance from the bottom of the checking block bore to the datum plane, in millimetres ^a
ΔH_{cb}	elastic deformation of the height of the checking block under load, in millimetres
K_1	checking block chamfer (construction for half-bearings without flange), in millimetres
K_2	checking block chamfer (construction for flanged half-bearings), in millimetres
l	peripheral length, in millimetres ^a
Δl	deviation of the actual peripheral length of the checking block, in millimetres
p_E	elastic depression of the toe piece, in millimetres

R_a	surface roughness, in microns
s_{cs}	wall thickness of the comparison shell, in millimetres
s_{ms}	wall thickness of the master shell, in millimetres
s_{tot}	total wall thickness of the half-bearing, in millimetres
u	uncertainty of measurement
w	width of the toe piece contact area, in millimetres
z	distance between flanges of the flanged half-bearing, in millimetres
δ	empirical correction to compensate for the difference in elastic deflections under load between method A and method B, in millimetres
$\bar{\delta}$	correction estimated by calculation
σ	standard deviation

^a The symbol may be followed by a subscript defining the gauging tool to which the symbol is applied and/or by a subscript indicating an effective measured value or a theoretical value.

^b See national foreword for details of textual error.

5 Purpose of checking

It is necessary to keep to within the nip tolerances of ISO 3548 and ISO 6864 in order to guarantee the designated mounting compression (interference fit) for the half-bearings in the housing bore.

6 Checking methods

6.1 Method A

The checking load, F , is directly applied via the measuring head with a pivoting toe piece to one joint face of the half-bearing whilst the other joint face is in contact with a fixed stop (see Figure 2).

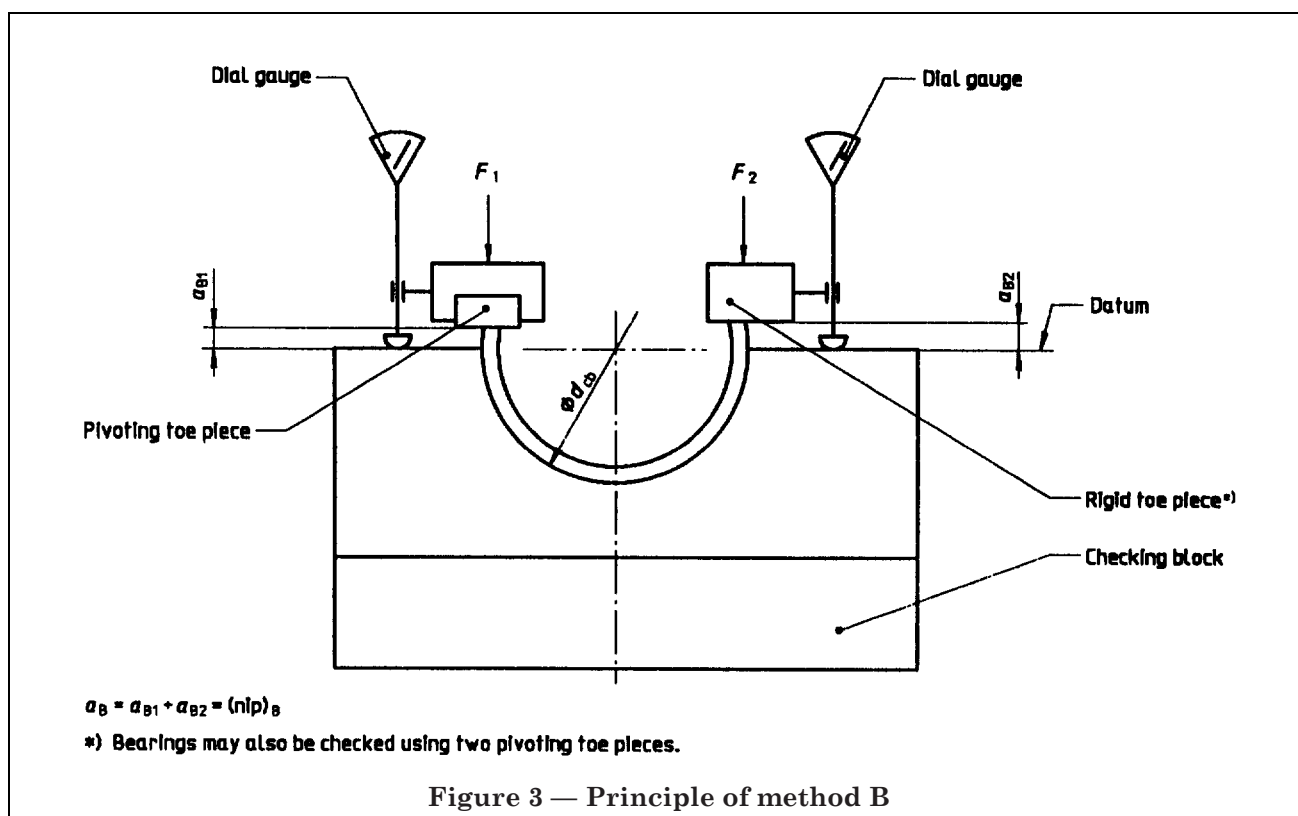
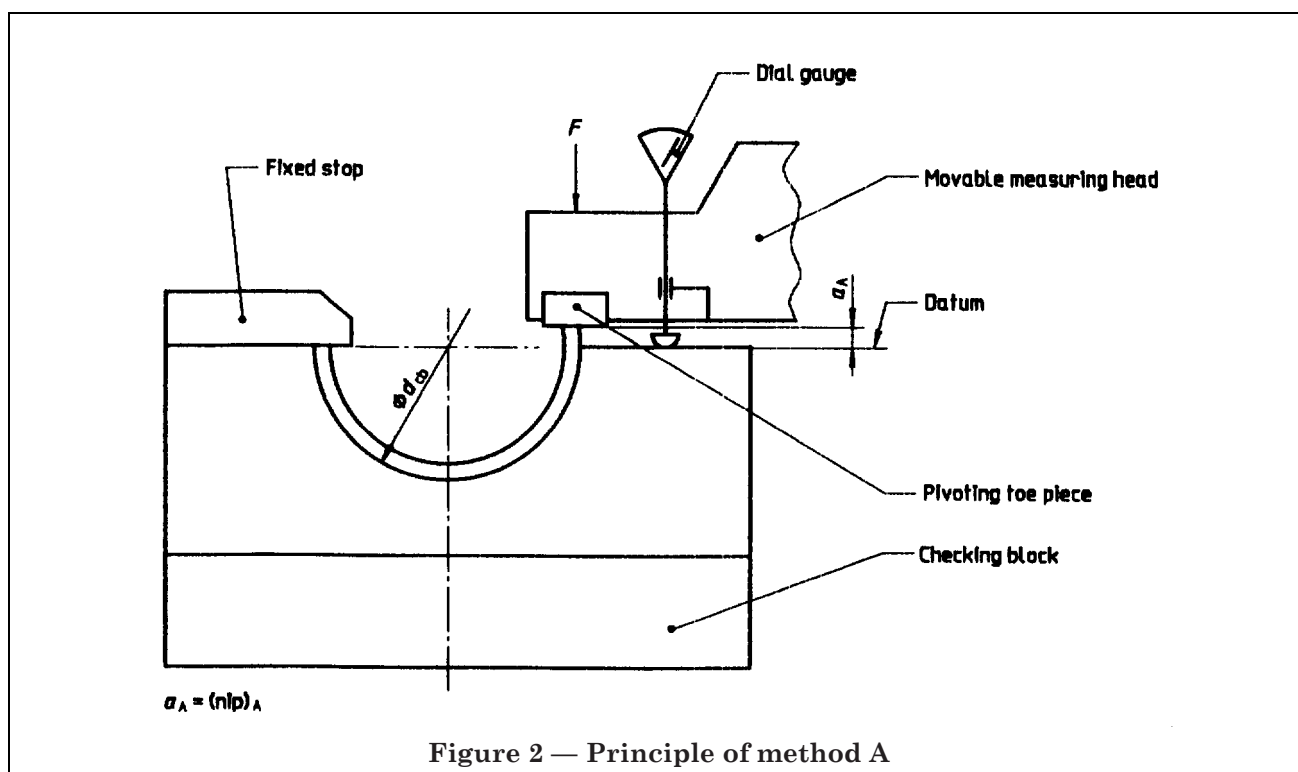
6.2 Method B

The checking loads F_1 and F_2 are applied via the measuring head and two toe pieces to both joint faces of the half-bearing (see Figure 3).

NOTE 6 In the case of method A, the fixed stop exerts the required counter-force which, in the case of method B, is applied directly by the measuring equipment via two toe pieces.

EXAMPLE

Method A	$F = 6\,000\text{ N}$
Method B	$\begin{cases} F_1 = 6\,000\text{ N} \\ F_2 = 6\,000\text{ N} \end{cases}$



7 Choice and designation of checking method

7.1 Choice of checking method

Recommendations for choosing either method A or method B, based on the dimensions of the half-bearings to be checked, are given in Table 1.

However, any size of bearing may be tested by either method by agreement between the manufacturer and user. In that case, a correction δ should be applied to compensate for the difference in deflections at joint face(s) under load between method A and method B, and be such that

$$\alpha_A = \alpha_{B1} + \alpha_{B2} + \delta$$

The value of δ shall be determined empirically by actual measurements obtained on the two different types of equipment used. Since the detailed design of the checking feature will vary between different manufacturers, the value of δ established by one manufacturer cannot be transferred to another, who shall determine it separately. See example in Annex E.

For general guidance, the value of δ may be derived from the formula used in the mathematical analysis of belt friction, which gives

$$\delta = \frac{d_{cb,M} F}{s_{ms} B_{ms}} \times \frac{1}{2f} (1 + e^{-f\pi} - 2e^{-f\pi/2})$$

With a value of the friction coefficient $f = 0,15$, the formula becomes

$$\tilde{\delta} = 7 \times 10^{-7} \times \frac{d_{cb,M} F}{s_{ms} B_{ms}}$$

(See also 16.5.)

Table 1

D_{bs} mm	Recommended checking method
$D_{bs} \leq 200$	A, B
$200 < D_{bs} \leq 500$	B

7.2 Designation of checking method

Example of the designation of method B for checking thin-walled half-bearings with an outside diameter, D_{bs} , of 340 mm:

Method ISO 6524-B-340

8 Measuring equipment

Figure 4 and Figure 5 show typical measuring equipment for measuring the nip (crush) by method A and by method B, respectively.

NOTE 7 Figure 4 and Figure 5 show hydraulically operated equipment. Pneumatically or mechanically operated equipment may also be used.

9 Measuring equipment requirements

The most important factors affecting the accuracy of the measuring equipment (and hence the measured nip value) are given below.

9.1 Tolerance on checking load setting

The permissible tolerances are given in Table 2.

Table 2

F N	Tolerance on F %
$F \leq 2\,000$	$\pm 1,25$
$2\,000 < F \leq 5\,000$	± 1
$5\,000 < F \leq 10\,000$	$\pm 0,75$
$10\,000 < F \leq 50\,000$	$\pm 0,5$
$50\,000 < F$	$\pm 0,25$

9.2 Speed of approach of measuring head

The checking load, F , shall be applied to the joint face(s) of the half-bearing so that shock load will not occur. The speed of approach shall be $10 \text{ mm/s} \pm 2 \text{ mm/s}$.

For devices in which the speed of approach cannot be altered, the load shall be applied, released and applied a second time before the measurement is made.

9.3 Construction of measuring head

The measuring head shall be so constructed that it is accurately guided and moves normal to the datum of the checking block. The deviation from parallelism between the toe piece(s) in the measuring head and the supporting plane of the checking block shall not exceed $0,04 \text{ mm}$ per 100 mm in a radial direction.

9.4 Accuracy of the measuring plane of the toe pieces

Specifications on the accuracy of the measuring plane of the toe pieces are given in Table 3.

Table 3

Dimensions and tolerances in millimetres
Surface roughness in microns

D_{bs}	Surface roughness R_a	Tolerance on flatness
$D_{bs} \leq 160$	0,2	0,001 5
$160 < D_{bs} \leq 340$	0,4	0,003
$340 < D_{bs} \leq 500$		0,004

9.5 Accuracy of the dial gauge

Uncertainty of measurement $u \leq 1,2 \mu\text{m}$ ($\pm 2\sigma$) with $\sigma = 0,3 \mu\text{m}$

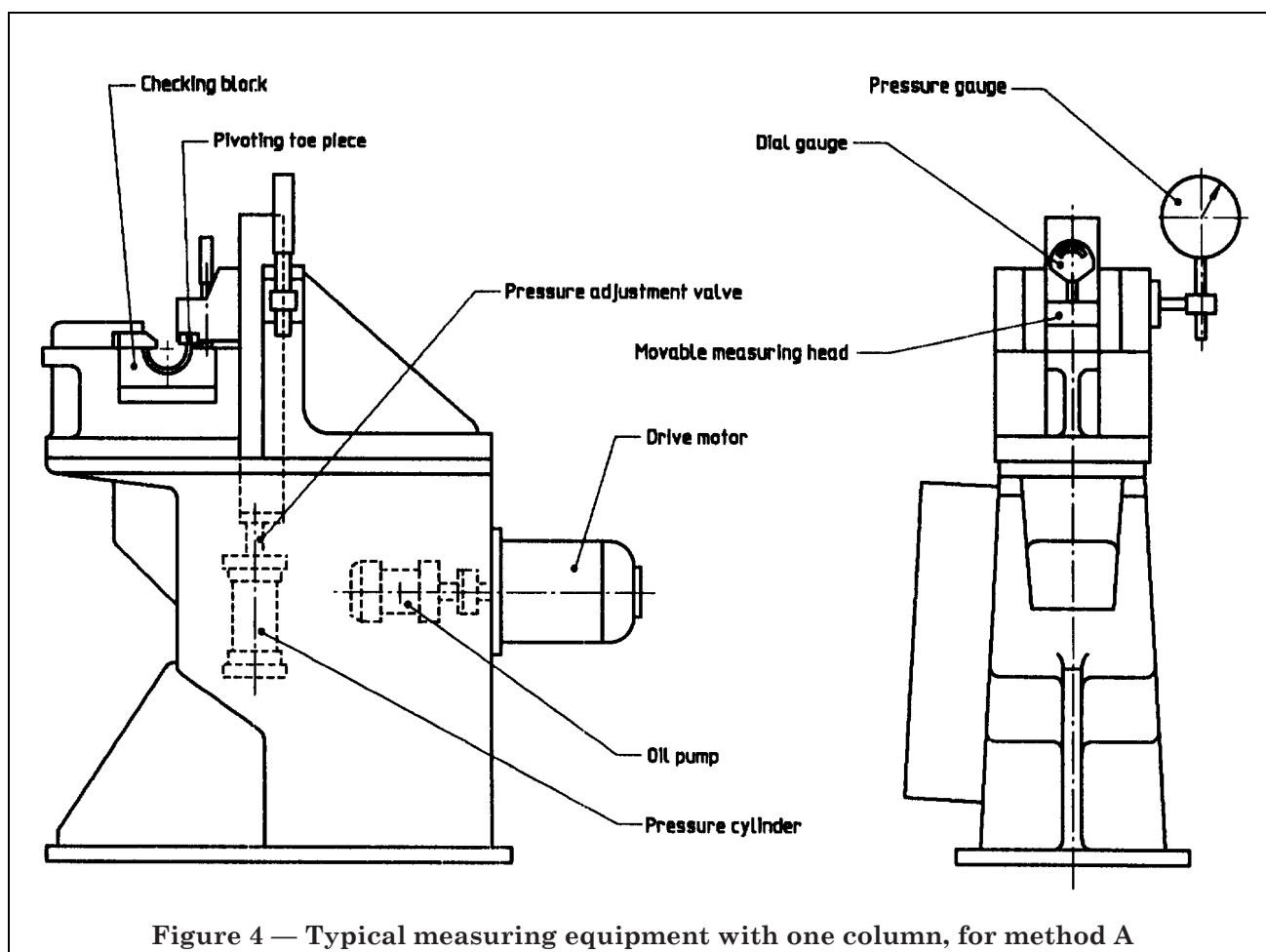


Figure 4 — Typical measuring equipment with one column, for method A