INTERNATIONAL STANDARD

ISO 3548-3

First edition
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Plain bearings — Thin-walled half bearings with or without flange —

Part 3: Measurement of peripheral length

Paliers lisses — Demi-coussinets minces à collerette ou sans collerette —

Partie 3: Mesurage de la longueur développée

Reference number
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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 3548-3 was prepared by Technical Committee ISO/TC 123, *Plain Bearings*, Subcommittee SC 5, *Quality analysis and assurance*.

This first edition of ISO 3548-3 cancels and replaces ISO 6524:1992, which has been technically revised.

ISO 3548 consists of the following parts, under the general title *Plain bearings — Thin walled half bearings with or without flange*:

— *Part 1: Tolerances, design features and methods of test*

— *Part 2: Measurement of wall thickness and flange thickness*

— *Part 3: Measurement of peripheral length*

Plain bearings — Thin-walled half bearings with or without flange —

Part 3: Measurement of peripheral length

1 Scope

This part of ISO 3548 specifies, according to ISO 12301, the checking of the peripheral length of thin-walled half bearings with or without flange, and describes the necessary checking methods and measuring equipment.

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

In addition, measuring equipment different from that illustrated in this part of ISO 3548 can be used, provided the measuring accuracy of the equipment is consistent with the specifications given in Clause 17.

This part of ISO 3548 does not include measurement of the parting line taper.

This part of ISO 3548 applies to thin-walled half bearings, the specifications of which are given in ISO 3548-1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3548-1, *Plain bearings — Thin-walled half bearings with or without flange — Tolerances, design features and methods of test*

ISO 12301, *Plain bearings — Quality control techniques and inspection of geometrical and material quality characteristics*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
peripheral length
circumferential length, which runs from one parting line face to the other

3.2
crush height
a
value 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 In practice, the datum serves as a basis for measuring *a* (see Figure 1).

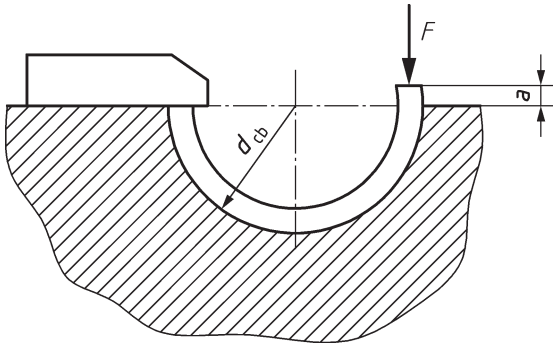


Figure 1 — Crush height, a

3.3
repeatability
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 Repeatability is assessed from the standard deviation of repeatability σ_Δ (see Annex E).

3.4
reproducibility
closeness of agreement between individual results obtained with the same method on the same test piece but under different conditions (identical or different operator, measurement equipment, checking place and times)

NOTE For the purposes of this part of ISO 3548, reproducibility is the difference between the two averages obtained from two sets of measuring equipment (see Annex E).

3.5
comparability
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 using method B, on the same plain bearing test piece in different checking blocks

NOTE Comparability is assessed from the difference between the two averages obtained from the two methods (see Annex E).

4 Symbols

For the purposes of this document, the following symbols apply.

Table 1 — Symbols and units

Symbol	Parameter	Unit
a_A or $a_{B1}+a_{B2}$	Crush height	mm
B	Width of the half bearing without flange	mm
B_1	Checking block width (construction for flanged half bearings)	mm
B_2	Checking block width	mm
B_3	Checking block width (construction for half bearings without flange)	mm
B_{ms}	Master shell width	mm
d_{cb}	Diameter of the checking block bore	mm
D_{bs}	Outside diameter of the half bearing to be checked	mm

Table 1 *(continued)*

Symbol	Parameter	Unit
D_{ms}	Outside diameter of the master shell	mm
E	Elasticity modulus	MPa
F	Friction coefficient in calculation of deflection under load	
$F = F_1 = F_2$	Checking load	N
F_{cor}	Correction factor	mm
H	Fillet radius between back and flange on flanged half bearing	mm
H_{cb}	Distance from the bottom of the checking block bore to the datum face	mm
ΔH_{cb}	Elastic deformation of the height of the checking block under load	mm
K_1	Checking block chamfer (construction for half bearings without flange)	mm
K_2	Checking block chamfer (construction for flanged half bearings)	mm
L	Peripheral length	mm
Δl	Deviation of the actual peripheral length of the checking block	mm
p_E	Elastic depression of the metering bar	mm
R_a	Surface roughness	µm
s_{cs}	Wall thickness of the comparison shell	mm
s_{ms}	Wall thickness of the master shell	mm
s_{tot}	Total wall thickness of the half bearing	mm
U	Uncertainty of measurement	
W	Width of the metering bar contact area	mm
Z	Distance between flanges of the flanged half bearing	mm
δ	Empirical correction to compensate for the difference in elastic deflections under load between method A and method B	mm
δ_x	Correction, estimated by calculation	mm
σ	Standard deviation	mm

The characteristic subscripts are given in Table 2.

Table 2 — Subscripts

Subscript	
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

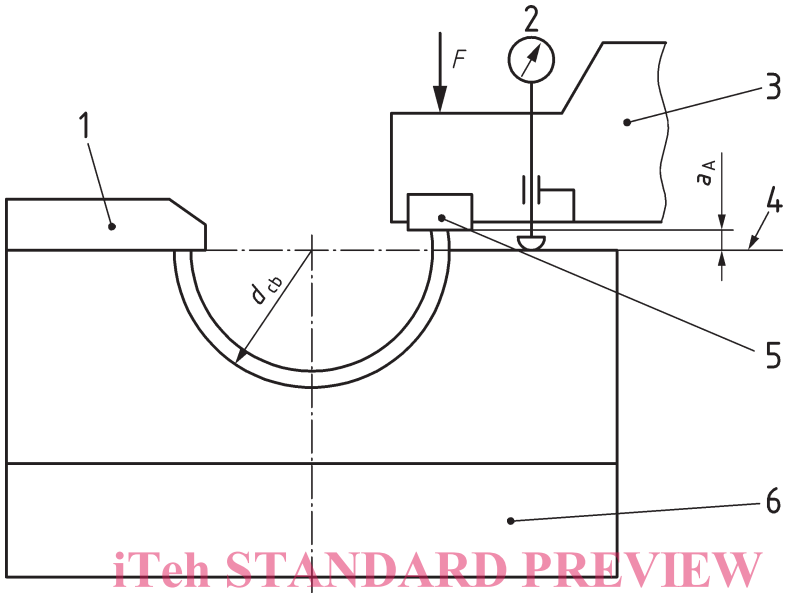
5 Purpose of checking

In order to ensure the required mounting compression (interference fit) for the half bearings in the housing bore, it is necessary to keep to the crush height tolerances as specified in ISO 3548-1 and ISO 12301.

6 Checking methods

6.1 Method A

The checking load, *F*, is directly applied via the measuring head with a pivoting metering bar to one parting line face of the half bearing while the other parting line face is in contact with a fixed stop (see Figure 2).



$$a_A = (n/p)_A \quad (1)$$

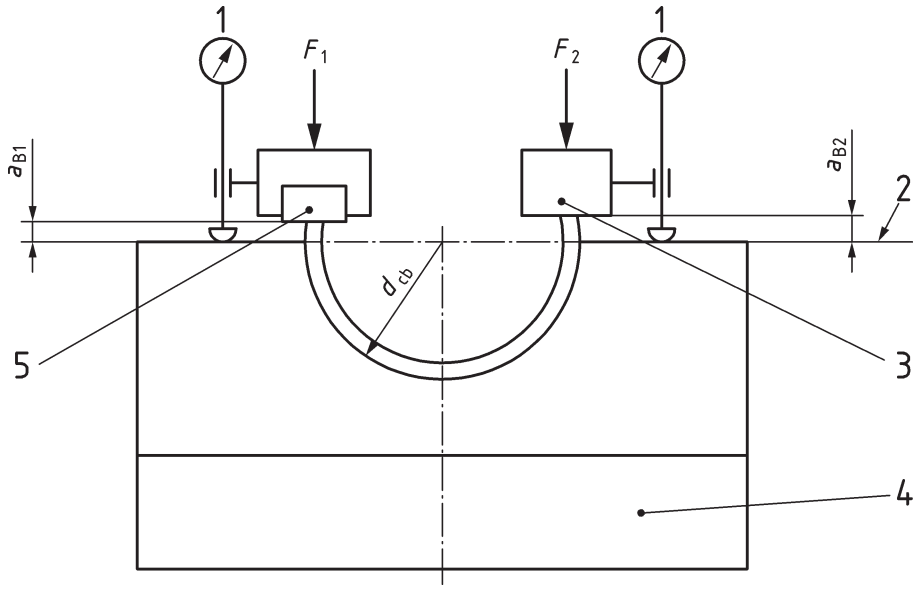
Key

1 fixed stop
2 dial gauge
3 movable measuring head
4 datum
5 metering bar
6 checking block

Figure 2 — Measuring principle of method A

6.2 Method B

The checking loads, F_1 and F_2, are applied via the measuring head and two metering bars to both parting line faces of the half bearing (see Figure 3).



$$a_B = a_{B1} + a_{B2} = a \quad (2)$$

Key

1 dial gauge
2 datum
3 rigid metering bar[a]
4 checking block
5 pivoting toe piece

[a] Bearings may also be checked using two pivoting metering bars.

Figure 3 — Measuring principle of method B

NOTE In the case of method A, the fixed stop exerts the required counterforce, which, in the case of method B, is applied directly by the measuring equipment via two metering bars.

EXAMPLE

Method A F = 6 000 N

Method B F_1 = 6 000 N

F_2 = 6 000 N

7 Choice and designation of checking method

7.1 Choice of checking method

Recommendations for choosing either method A or method B, based on dimensions of the half bearings to be checked, are given in Table 3.

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 parting line face(s) under load between method A and method B, and be such that:

$$a_A = a_{B1} + a_{B2} + \delta \tag{3}$$

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 shall be varied 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:

$$\delta = \frac{d_{cb,m} \cdot F}{s_{ms} \cdot B_{ms}} \cdot \frac{1}{2Ef}\left(1 + e^{-f\pi} - 2e^{-f\pi/2}\right) \tag{4}$$

With a value of the friction coefficient $f = 0{,}15$, Formula (4) becomes:

$$\delta_x = 7 \cdot 10^{-7} \cdot \frac{d_{cb,m} \cdot F}{s_{ms} \cdot B_{ms}} \tag{5}$$

(See also 16.5.)

Table 3 — Selection of checking method

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

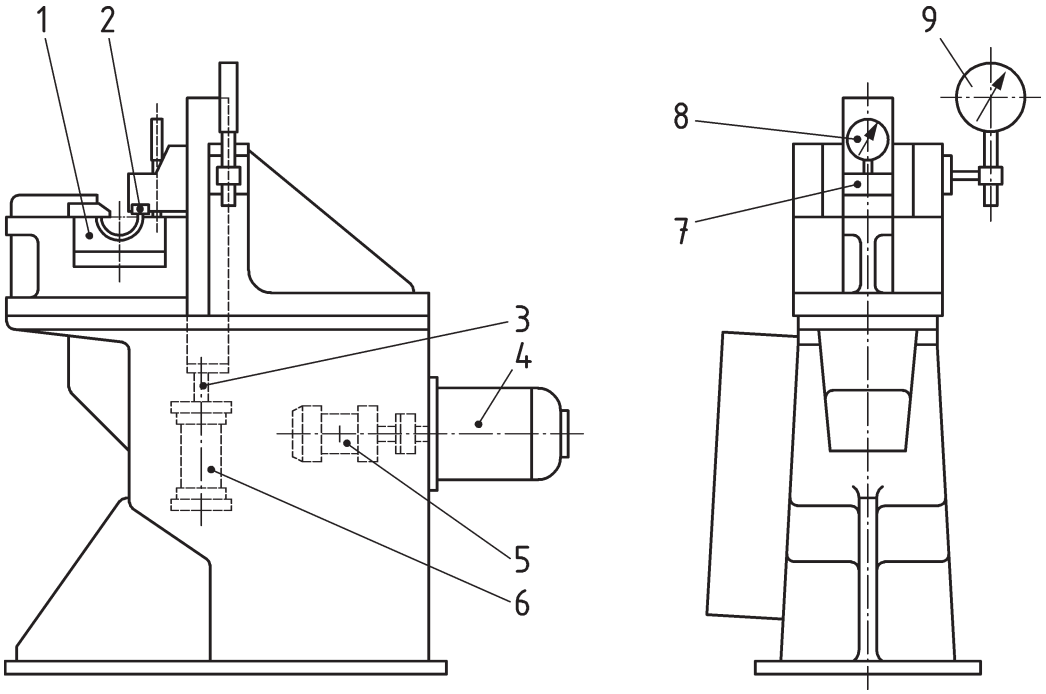
7.2 Designation of checking method

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

Method ISO 3548-3-B-340

8 Measuring equipment

Figures 4 and 5 show typical measuring equipment for the measurement of the crush height by method A and by method B, respectively.



Key

1 checking block
2 pivoting metering bar
3 pressure adjustment valve
4 drive motor
5 oil pump
6 pressure cylinder
7 movable measuring head
8 dial gauge
9 pressure gauge

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

NOTE Figures 4 and 5 show hydraulically operated equipment. Pneumatically or mechanically operated equipment can also be used.