BS ISO 3548-1:2014

BSI Standards Publication

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

Part 1: Tolerances, design features and methods of test

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of ISO 3548-1:2014. It supersedes BS ISO 3548:1999 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/12, Plain bearings.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 76003 7

ICS 21.100.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2014.

Amendments issued since publication

Date	Text affected

INTERNATIONAL STANDARD

ISO 3548-1

First edition
2014-06-15

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

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

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

Partie 1: Tolérances, caractéristiques de conception et méthodes d'essai

Reference number
ISO 3548-1:2014(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 123, *Plain Bearings*, Subcommittee SC 3 *Dimensions, tolerances and constructions details.*,

This first edition of ISO 3548-1 cancels and replaces the second edition of ISO 3548:1999, 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 1:
Tolerances, design features and methods of test

1 Scope

This part of ISO 3548 specifies tolerances, design features, and test methods for thin-walled half bearings with integral flange up to an outside diameter of D_0 = 250 mm and without flange up to an outside diameter of D_0 = 500 mm. Due to the variety of design, it is, however, not possible to standardize the dimensions of the half bearings.

Half bearings according to this part of ISO 3548 are predominantly used in reciprocating machinery and consist of a steel backing and one or more bearing metal layers on the inside.

In reciprocating machinery, flanged half bearings can be used in connection with half bearings without flange.

Alternatively, to serve as a flanged half bearing, it is possible to use a half bearing without flange together with two separate half thrust washers according to ISO 6526; or a half bearing with assembled flanges.

NOTE All dimensions and tolerances are given in millimetres.

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.

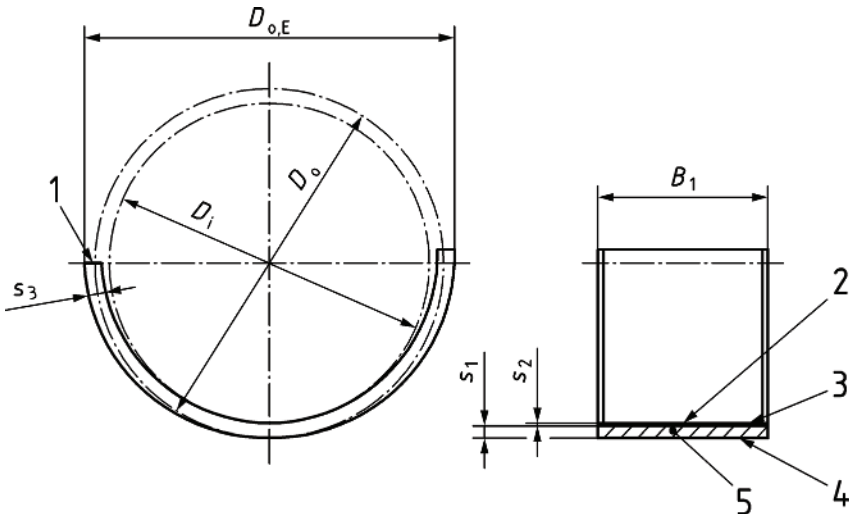
ISO 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*

ISO 6524, *Plain bearings — Thin-walled half bearings — Checking of peripheral length*

ISO 6526, *Plain bearings — Pressed bimetallic half thrust washers — Features and tolerances*

3 Symbols

See Figures 1 and 2 and Table 1.



Key

1 joint face

2 sliding surface

3 bearing metal

4 bearing back

5 steel back

Figure 1 — Half bearing without flange
(with positive free spread)

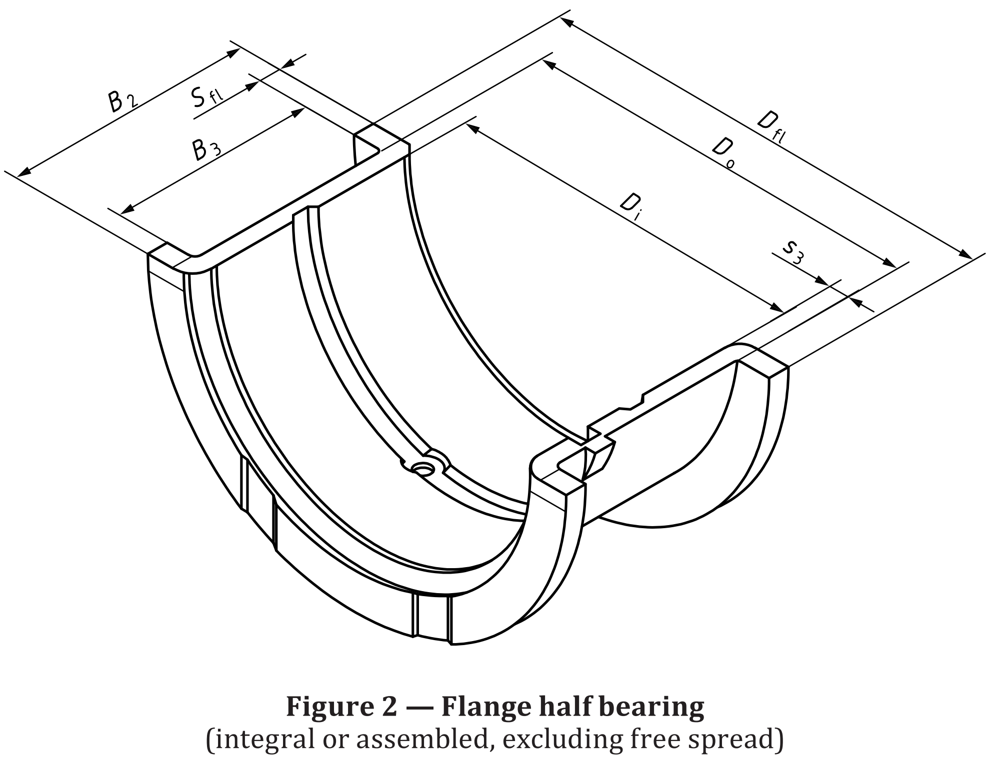


Figure 2 — Flange half bearing
(integral or assembled, excluding free spread)

Table 1 — Symbols and units

Symbol	Term	Unit
a_1	Measuring point perpendicular to plane of joint face	mm
A_{cal}	Reduced area of cross section (calculated value) of half bearing	mm^2
b_H	Housing width	mm
B_1	Half bearing width (without flange)	mm
B_2	Flange half bearing width	mm
B_3	Distance between flanges	mm
C_1	Outside chamfer	mm
C_2	Inside chamfer	mm
d_{ch}	Diameter of the checking block bore	mm
d_H	Housing diameter	mm
D_{fl}	Outside diameter of flange	mm
D_i	Nominal Inside diameter of the half bearing (bearing bore)	mm
D_o	Nominal Outside diameter of the half bearing	mm
$D_{o,E}$	Outside diameter of the half bearing in the free state (with free spread)	mm
e_B	Amount of eccentricity	mm
F	Test force	N
F_{ax}	Axial test force for assembled flange bearings	N
h	Crush height, $h = h_1 + h_2$ (in checking method B)	mm
p	Amount of free spread	mm
s_{fl}	Flange thickness	mm
s_1	Thickness of the steel backing	mm
s_2	Bearing metal thickness	mm
s_3	Half bearing wall thickness	mm
s_4	Wall thickness at base of groove	mm
u	Amount of wall thickness reduction for eccentric bearing	mm

4 Dimensions and tolerances

4.1 Housing diameter, half bearing outside diameter and crush height

The housing diameter should be manufactured to ISO H6 limits. Thereby the half bearing outside diameter shall be selected with such an oversize that an adequate interference fit is ensured in the housing diameter.

In the case of housings made from materials having a high coefficient of expansion or where other factors such as housing dimensional stability are involved, the housing size may depart from tolerance class H6 but shall always be produced in accordance with a grade 6 tolerance.

The half bearing in a free state is flexible so that its outside diameter cannot be measured directly. Instead of this, its peripheral length is determined by means of special checking fixtures. The peripheral length results from the periphery of the checking block bore and the crush height taking into account the reduction under a given checking load per joint face (see Clause 6). For the calculation of the effective interference fit of the half bearings in the housing, see Reference [5].

The tolerances given in Table 2 for the crush height apply to half bearings with machined joint faces. Different materials and housing design require different interference fits, therefore only tolerances are given in Table 2.

4.2 Half bearing wall thickness and bearing bore

Nominal dimensions to be preferred for the wall thickness of the bearing are given in Table 2 (the particulars of the wall thickness for each application cannot be specified in general). Therefore, only tolerances can be given for the wall thickness. These tolerances and the surface roughnesses of the bearing back and the sliding surface of half bearings with or without electroplated antifriction layers are given in Table 2.

The tolerance for the half bearing wall thickness depends on the fact whether the bearing bore is subject to a final machining operation (i.e. "as machined") or whether the bearing bore is electroplated without further machining (i.e. "as-plated").

Slight surface deformations are acceptable on the outside diameter of the bearing provided that they are not numerous. However, the measurement of the wall thickness shall not be carried out in these areas.

The bearing bore in the fitted state results from the housing bore which is elastically enlarged by the press fit, reduced by twice the value of the half bearing wall thickness.[5]

NOTE In certain applications it might be necessary to use plain or flange half bearings with eccentric bores, i.e. the wall thickness of the half bearing decreases uniformly from the crown to the joint faces (see Figures 3 and 4).

The eccentricity e_B is characterized in a radial plane by the distance between the centre x_1 of the bearing outside surface and the centre x_2 of the bearing bore. e_B is not dimensioned specifically. The eccentricity is controlled by the specified reduction u which is measured at a vertical distance a_1 from the plane of the joint face. (For guidance of draughtsmen, a_1 is generally specified so that the angle α_2 is approximately 25° from the joint face). It is subject to agreement between the user and manufacturer.

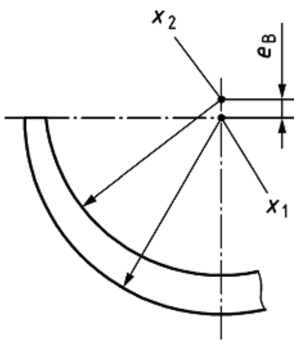
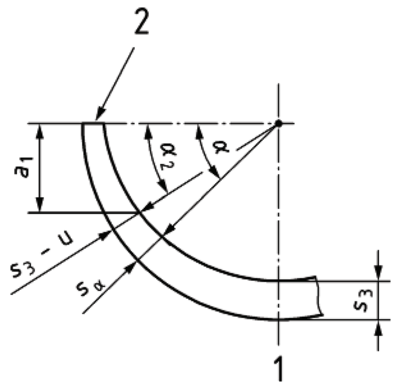


Figure 3 — Eccentric bearing bore of half bearing



Key

1 crown

2 joint face

Figure 4 — Example of the wall thickness at different angles

The tolerance limit for the behaviour of wall thickness can be calculated using Formulae 1 and 2:

$$s_{\alpha,\mathrm{BL}} = s_{3,\mathrm{act}} - \mathrm{BL}_u \times \frac{1-\sin\alpha}{1-\sin\alpha_2} \tag{1}$$

$$s_{\alpha,\mathrm{UL}} = s_{3,\mathrm{act}} - \mathrm{UL}_u \times \frac{1-\sin\alpha}{1-\sin\alpha_2} \tag{2}$$

where

BL_u is the bottom limit of u;

UL_u is the upper limit of u;

$s_{3,\mathrm{act}}$ is the actual value of s_3;

$s_{\alpha,\mathrm{BL}}$ is the bottom value of s_α;

$s_{\alpha,\mathrm{UL}}$ is the upper value of s_α.

For an example of calculations, see Annex A.

4.3 Width of half bearing, distance between flanges, outside diameter of flange and flange thickness

The nominal dimension for the half bearing width and the distance between flanges depends upon the type of application, the common ratio being $B_1(B_2)/D_\mathrm{i} \leq 0{,}5$. The tolerances for the half bearing width are given in Table 2. The flange outside diameter should be smaller than the diameter of the shoulder of the shaft and smaller than the diameter of the housing block.

In most cases the flange thickness is fixed in conformity with the half bearing wall thickness and, in general, a tolerance is fixed only for the flange thickness of the pressure loaded side in order to ensure that these flanges of the upper and lower half bearing have approximately the same thickness. In this case, the position of these flanges with respect to the locating lips is fixed.

If the upper and lower half bearings are of the same design, then generally the two flanges of one half bearing shall have the same thickness within the tolerance range fixed in Table 2. In that case, the flange thicknesses result from the bearing width and the distance between flanges. Nevertheless, another tolerance can be accepted after agreement between the user and the manufacturer (see Clause 7).

4.4 Free spread

Free spread is influenced by factors such as the lining material, its thickness and its physical properties, by the bearing backing material and its properties, and by the operating temperature of the assembly. Since these features are not specified in this part of ISO 3548, it is not possible to specify free spread. Free spread shall in all circumstances be positive. After operation in the combustion engine at normal conditions, a sufficient amount of free spread remains in the bearing to enable it to be refitted. The actual amount of free spread shall be the subject of agreement between the manufacturer and user.

Half bearings for reciprocating machinery normally have a free spread of 0,2 mm up to 3 mm. For very large, thin-walled half bearings, the free spread may be greater but it shall not be such that the half bearing cannot be fitted into the housing.

Table 2 — Dimensions, tolerances and limit deviations for half bearings with and without flange

			Tolerance or limit deviation for[a]										Surface roughness[bc] µm	
Housing diameter		Wall thickness	Wall thickness		Flange thickness[de]	Half bearing width			Flange outside diameter	Distance between flanges[e]	Housing width	Crush height[f]	Bearing back	Sliding surface
d_H		s_3	s_3		s_{fl}	B_1	B_2		D_{fl}	B_3	b_H	h	Ra	Ra
		preferred nominal dimension	without electroplated antifriction layer	with electroplated antifriction layer[g]		without flange	Integral flange bearing	Assembled flange bearing[h]						
>	≤													
—	50	1,5 1,75 2 2,5	0,008	—[a]	0 -0,05	0 -0,3	0 -0,05	0 -0,12	±1	+0,05 0	-0,02 -0,07	0,03	0,8	0,8
50	80	1,75 2 2,5 3	0,008	0,012	0 -0,05	0 -0,3	0 -0,05	0 -0,12	±1	+0,05 0	-0,02 -0,07	0,045	1,2	0,8
80	120	2 2,5 3 3,5	0,01	0,015	0 -0,05	0 -0,3	0 -0,07	0 -0,12	±1	+0,07 0	−0,02 −0,07	0,04	0,8	0,8
120	160	3 3,5 4 5	0,015	0,022	0 -0,05	0 -0,4	0 -0,07	0 −0,2	±1,5	+0,07 0	−0,02 −0,1	0,045	1,2	0,8
160	200	3,5 4 5	0,015	0,022	0 −0,05	0 −0,4	0 -0,12	0 −0,2	±1,5	+0,07 0	−0,02 −0,1	0,05	1,2	0,8
200	250	4 5 6	0,02	0,03	0 −0,05	0 −0,4	0 −0,12	0 −0,2	±1,5	+0,07 0	−0,02 −0,1	0,055	1,2	0,8

Table 2 *(continued)*

Housing diameter		Wall thickness	Tolerance or limit deviation for[a]										Surface roughness[bc] µm	
			Wall thickness		Flange thickness[de]	Half bearing width			Flange outside diameter	Distance between flanges[e]	Housing width	Crush height[f]	Bearing back	Sliding surface
d_H		s_3	s_3		s_{fl}	B_1	B_2		D_{fl}	B_3	b_H	h	Ra	Ra
		preferred nominal dimension	without electroplated antifriction layer	with electroplated antifriction layer[g]		without flange	Integral flange bearing	Assembled flange bearing[h]						
>	≤													
250	315	5 5 8	0,02	0,03	—	0 −0,5	—	—	—	—	—	0,06	1,6	1,2
315	400	6 8 10	0,025	0,035	—	0 −0,5	—	—	—	—	—	0,07	1,6	1,2
400	500	8 10 12	0,03	0,04	—	0 −0,5	—	—	—	—	—	0,07	1,6	1,2

[a] Subject to agreement between the user and manufacturer.

[b] Surface roughness in accordance with ISO 4288.

[c] Surface roughness measurements of bearings with an electroplated antifriction layer may be unreliable due to penetration of the soft layer by the stylus of the measuring equipment.

[d] On the pressure loaded side.

[e] The limit deviations shall not be added.

[f] See Clause 6 and Figures 18 and 19. For crush height of bearings with an electroplated antifriction layer and without subsequent machining of the joint faces add 0,01 mm to the tolerance value.

[g] For larger half bearings, thicker electroplated antifriction layers are often used which require another machining operation. In such cases, the tolerances for sliding surfaces without electroplated antifriction layer apply.

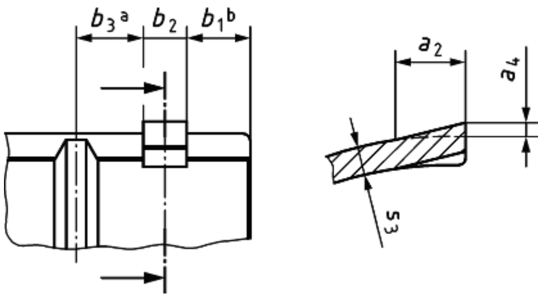
[h] Checked as shown in 7.1 and 7.2.

5 Design features

Dimensions are by agreement and tolerances shall be as given in Tables 3 and 4.

5.1 Locating lip and recess

See Figures 5, 6, and 7.



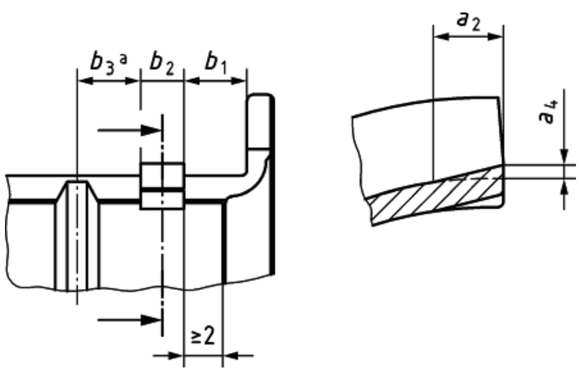
Key

$b_1 \geq 1{,}5 \times s_3$, but not less than 3 mm.

a If b_3 is less than 2 mm, this area is permitted to be free of bearing metal over a circumferential length a_2 to avoid the breaking of bearing metal when the bearing bore is machined. The locating nick can also break into the oil groove.

b The locating nick can also be designed to be produced at the end of the half bearing; in this case is $b_1 = 0$.

Figure 5 — Locating nick in a half bearing without flange

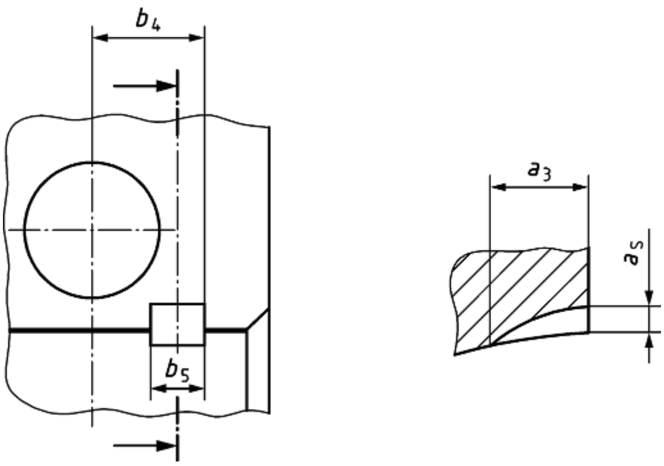


Key

$b_1 \geq 1{,}5 \times s_3$, but not less than 3 mm.

a If b_3 is less than 2 mm, this area is permitted to be free of bearing metal over a circumferential length a_2 to avoid the breaking of bearing metal when the bearing bore is machined. The locating nick can also break into the oil groove.

Figure 6 — Locating nick in a flanged half bearing



Key

$$b_4 \approx \frac{(B_1 \text{ or } B_3)}{2} - b_1 \text{ }^{a}$$

a See Figure 5 or Figure 6.

Figure 7 — Locating lip recess in the housing

5.2 Reliefs and chamfers

Joint face bore reliefs are normally provided at both sides of the half bearing (with or without flange) on the whole width. For guidance, it is suggested that the dimension a_6 be approximately 1/10 of the inside diameter D_i, but the actual value of this dimension will be dependent on the application and is subject to agreement between the user and manufacturer (see Figure 8).

Chamfers are provided at both ends of a half bearing without flange (see Figure 9).

Flange reliefs are provided at all joint faces (see Figure 10, section A–A) as well as at the edges of the flange sliding surfaces (see Figure 10, detail X).

For dimensions and limit deviations, see Table 3.

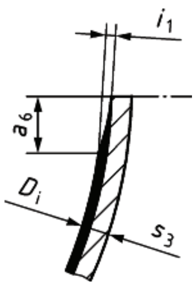


Figure 8 — Bearing bore relief

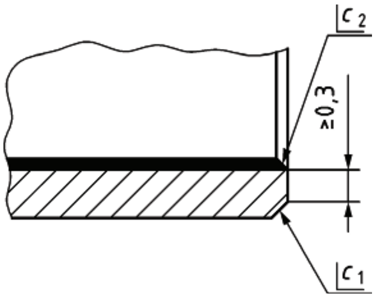
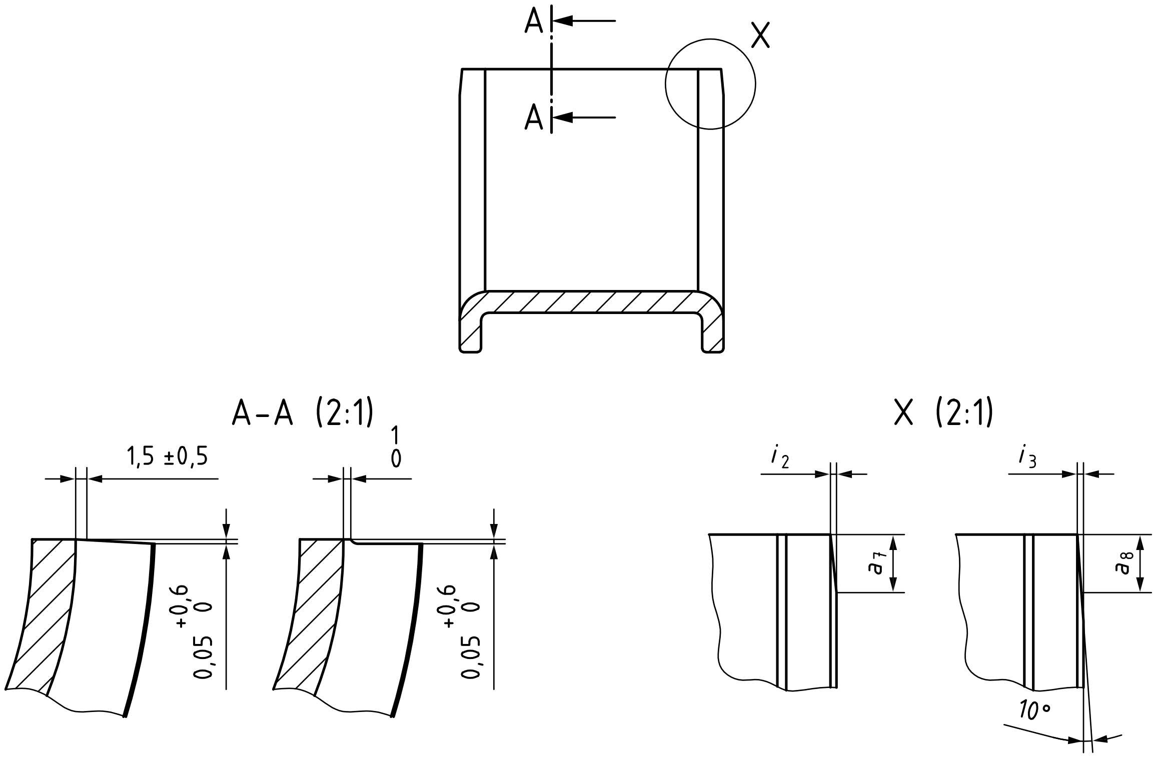


Figure 9 — Chamfers



a) b)

Sliding surface relief for assembled flange bearing to be in accordance with ISO 6526.

a) Joint face relief

b) Sliding surface relief for flange bearing

Figure 10 — Flange reliefs
(design at the option of the manufacturer)

5.3 Transition between radial part and flange

Figure 11 shows typical examples of the transition region, the actual form used being dependent upon the manufacturing method, and the ratio between wall thickness and flange thickness.

The transition between the radial part and flange shall comply with dimension a_9 in order to avoid cracking.

The transition geometry shall be adapted to the form of the shaft in order to avoid fouling of the fillet radius and of the housing inside diameter.

Figure 12 shows an example of the transition region between half bearing and the flange of an assembled flange bearing.

For assembled flange bearings, the preferred dimensions of transition to maximize material for flange attachment are indicated in Figure 12.

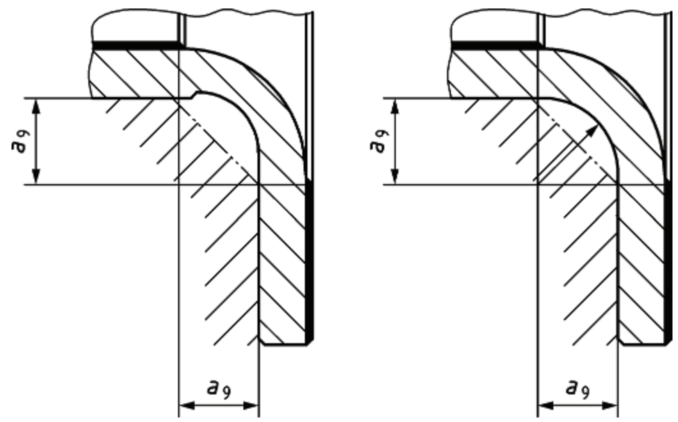
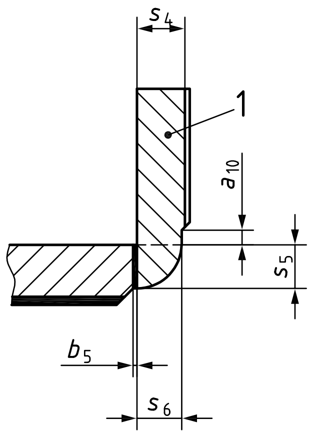


Figure 11 — Types of transition between radial parts of the flange



Key

1 flange

s_5 ≥ No less than 66 % of half bearing wall thickness

s_6 ≥ No less than 50 % of flange thickness but <s_4;

corner profile should always overlap flange and half bearing thickness as follows:

a_{10} = 0,5 mm min.

b_5 = 0,25 mm min.

Oil groove depth shall be clear of half bearing maximum profile.

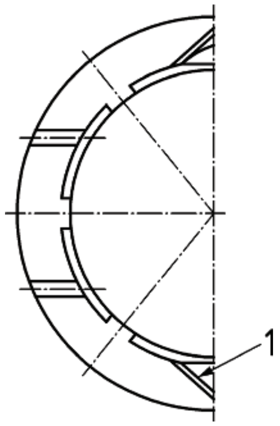
Figure 12 — Type of transition between half bearing and flange of a assembled flange bearing

Table 3 — Minimum height (and width) of transition and relief of the flanges

Housing diameter d_H		a_7	a_8	a_9	i_2	i_3
>	≤	±2	±0,5	min.	$^{+0,2}_{0}$	$^{+0,3}_{0}$
—	120	5,5	3	2	0,1	0,3
120	250	8	3	3	0,2	0,3

5.4 Assembled flange scalloped toes

This feature is used to improve material utilization and should be shown optional, see Figure 13.



Key

1 thrust washer

NOTE Scalloped toe optional at joints to facilitate maximum material utilization in accordance with ISO 6526.

Figure 13 — Assembled flange scalloped toes

5.5 Oil grooves and holes

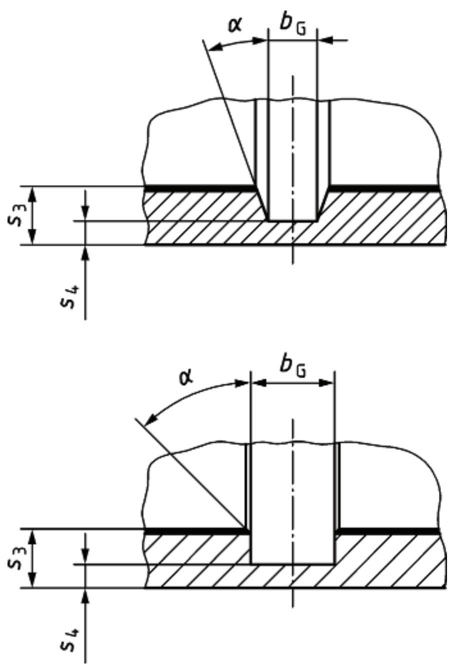
See Figures 14, 15, 16, and 17.

The sizes of oil grooves, pockets, and holes are determined by functional requirements and are not specified in this part of ISO 3548.

For preferred groove forms in the radial part, see Figure 14.

Oil grooves and oil pockets on the flange faces are preferably cut up to the steel backing in the bearing metal and are normally provided up to D_{fl} = 160 mm flange outside diameter. Above this size other shapes of grooves or pockets can be provided.

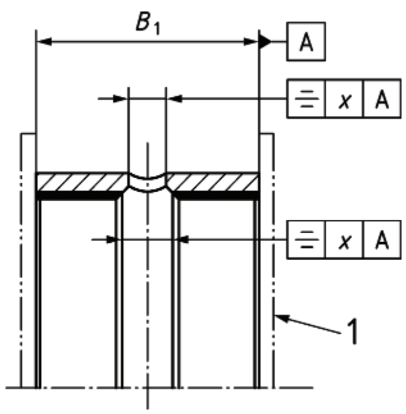
Oil holes can be drilled or punched. In both cases the sharp edges of the oil holes shall be free of burrs, except at the transition to the oil groove. If a chamfer is provided, its form is at the option of the manufacturer. A chamfer is necessary on the sliding surface.



α = 30° or 45° are usual.

$s_{4\approx}$approximately 0,35 x s_3, but ≥0,7 mm.

Figure 14 — Types of oil groove



Key

1 profile of flange bearing

NOTE For tolerance *x*, see Table 4.

Figure 15 — Position of the oil groove and oil hole

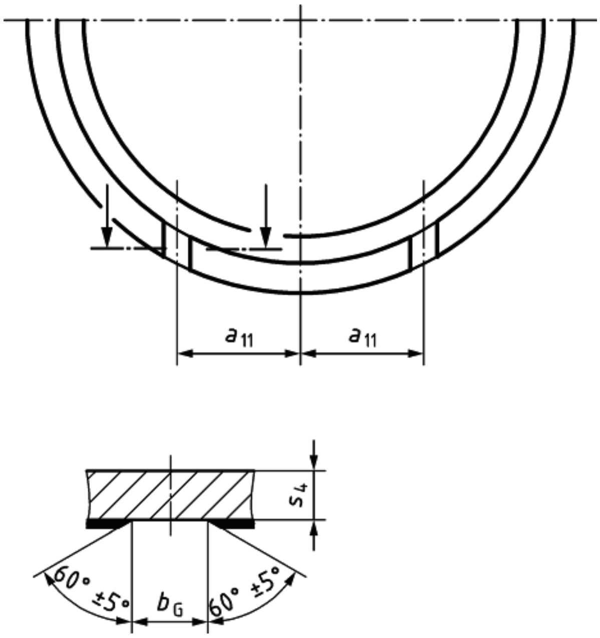
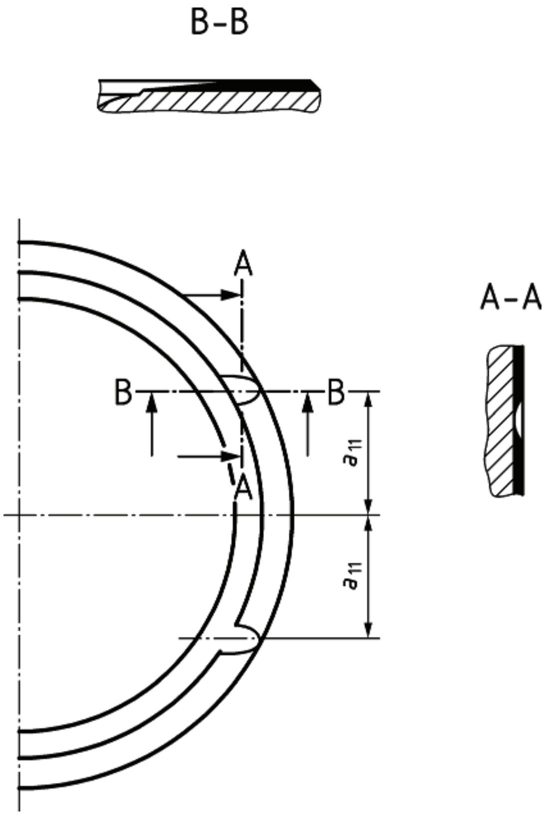


Figure 16 — Groove form on the flange face



NOTE Pocket may be closed or opened to the outer flange diameter.

Figure 17 — Pocket form on the flange face

Table 4 — Tolerances and limit deviations for design features[a]

Housing diameter d_H		Tolerance and limit deviation for												
>	≤	a_2	a_3	a_4	a_5	a_6	a_{11}	b_2	b_5	b_G	C_1, C_2	i_1	s_4	x
—	50	0 −1,5	+1,5 0	0 −0,3	+0,25 0	0 −3	±1,5	0 −0,15	+0,15 0	±0,25	−0,1 −0,6	0 −0,015	+0,3 0	0,6
50	80	0 −2	+1,5 0	0 −0,4	+0,4 0	0 −3	±1,5	0 −0,15	+0,15 0	±0,25	−0,1 −0,6	0 −0,020	+0,3 0	
80	120	0 −2	+2 0	0 −0,4	+0,6 0	0 −4	±2,5	0 −0,15	+0,15 0	±0,25	−0,1 −0,6	0 −0,020	+0,4 0	
120	160	0 −2	+3 0	0 −0,4	+0,75 0	0 −4	±2,5	0 −0,15	+0,15 0	±0,25	−0,4 −1,2	0 −0,020	+0,4 0	
160	200	0 −2,5	+3,5 0	0 −0,5	+1 0	0 −5	±2,5	0 −0,15	+0,15 0	±0,25	−0,4 −1,2	0 −0,020	+0,4 0	
200	250	0 −2,5	+5 0	0 −0,5	+1,2 0	0 −6	±2,5	0 −0,15	+0,15 0	±0,25	−0,4 −1,2	0 −0,025	+0,4 0	
250	315	0 −2,5	+5 0	0 −0,5	+1,2 0	0 −6	±2,5	0 −0,15	+0,15 0	±0,25	−1 −2	0 −0,025	+0,5 0	0,8
315	400	0 −3	+5 0	0 −0,5	+1,5 0	0 −8	±2,5	0 −0,2	+0,2 0	±0,25	−1 −2	0 −0,030	+0,5 0	
400	500	0 −3	+5 0	0 −0,6	+1,5 0	0 −8	±2,5	0 −0,25	+0,25 0	±0,25	−1,5 −2,5	0 −0,035	+0,6 0	1

[a] Closer tolerances are subject to agreement between the user and the manufacturer.

6 Test data for determining the peripheral length

6.1 Calculation of test force F

For half bearings with steel backing, the test force, F, in Newtons, per joint face for determining the crush height, h, in a checking block with an inside diameter, d_{ch} (normally equal to the maximum housing diameter) is calculated using Formula (3):

$$F = 100 \times A_{cal} \tag{3}$$

(rounded to the nearest 500 N, but limited to a maximum of 100 000 N)

The reduced cross-sectional area, A_{cal} (calculated value) of the half bearing, in square millimetres, is calculated using Formulae (4), (5) and (6):

for steel/lead alloy, steel/tin alloy:

$$A_{cal} = (B_1 \text{ or } B_2) \times s_1 \tag{4}$$

for steel/copper alloy:

$$A_{cal} = (B_1 \text{ or } B_2) \times \left(s_1 + \frac{s_2}{2} \right) \tag{5}$$

for steel/aluminium alloy:

$$A_{cal} = (B_1 \text{ or } B_2) \times \left(s_1 + \frac{s_2}{3} \right) \tag{6}$$

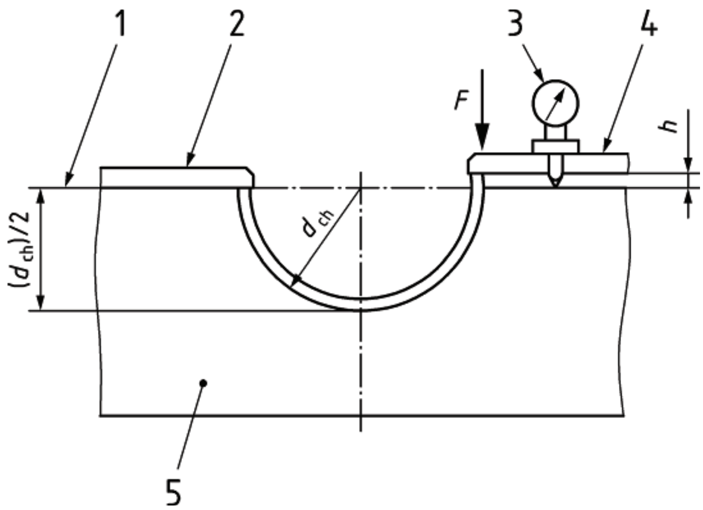
Depending on form, position, and type of manufacture, oil grooves can diminish the reduced cross-sectional area A_{cal}. If the proportion is above 10 %, this is to be taken into account in the calculation.

Depending on the size of the half bearing outside diameter, it is recommended to use either checking method A (see Figure 18) or checking method B (see Figure 19) as specified in ISO 6524.

When checking method B is used, a test force F is to be applied to each joint face (see Figure 19). The total force to be applied is 2 x F.

6.2 Checking method A

When using checking method A, the following shall be indicated in the drawing in accordance with ISO 6524.



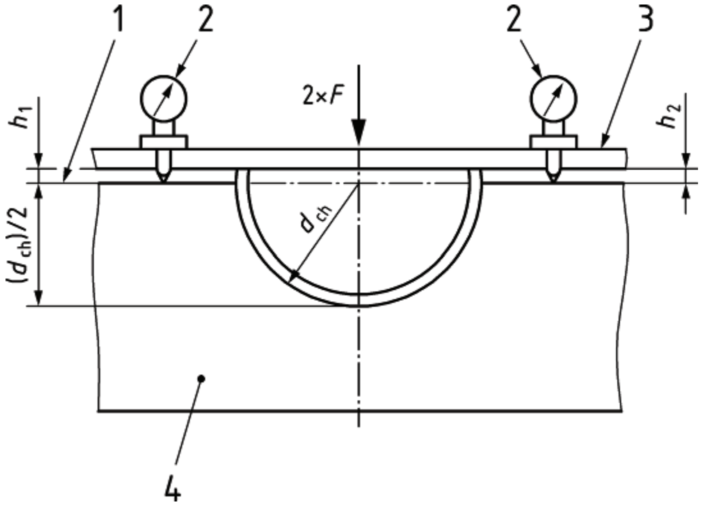
Key

1 date
2 fixed stop
3 dial gauge
4 pressure plate
5 checking block

Figure 18 — Example of checking method A for test force F = 6 000 N

6.3 Checking method B

When using checking method B, the following shall be indicated in the drawing in accordance with ISO 6524.



Key

1 date

2 dial gauge

3 pressure plate

4 checking block

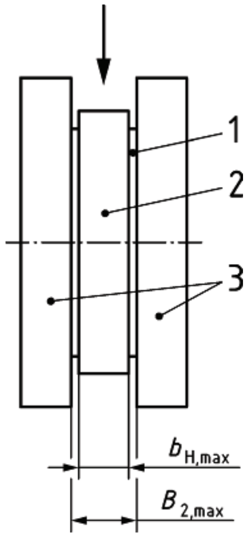
Figure 19 — Example of checking method B for test force *F* = 6 000 N (total force 2x*F* = 12 000 N)

7 Test data for determining axial width, B_2, of flange bearings

The method of checking and test force (if relevant) shall be agreed between the manufacturer and user.

7.1 Go between two parallel plates

With a gauge block inserted between the flanges of an integral or assembled flange bearing the bearing shall pass freely between two static plates; see Figure 20.



Key

1 integral or assembled flange bearing

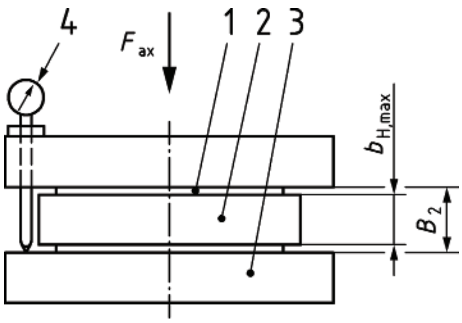
2 gauge block

3 static plate

Figure 20 — Freestate reference check for integral or assembled flange bearings

7.2 Axial width B_2 checked under force

With a gauge block inserted between the flanges of an assembled flange bearing the bearing axial length is checked under an axial force, F_{ax}; see Figure 21.



Key

1 assembled flange bearing

2 gauge block

3 fixed plate of the equipment test

4 dial gauge

NOTE F_{ax} = face area of flange × 1 N/mm^2.

Figure 21 — Example of test equipment

8 Function and characteristics of assembled flange bearings

This clause specifies precisely the assembled flange bearing.

The assembled flange bearings are usually composed of two thrust washers and one half bearing, which are connected by two to three pairs of retaining recesses and projections. The projection on the thrust washer is connected with the recess on the half bearing in a flexible manner, not in a fixed manner, and local deformation including caulking is performed if necessary, allowing movement of the thrust washer in the axial direction of the half bearing (see Figure 22). The assembled flange bearings will be classified into three types (see 8.2), based on the necessity and importance for the function.

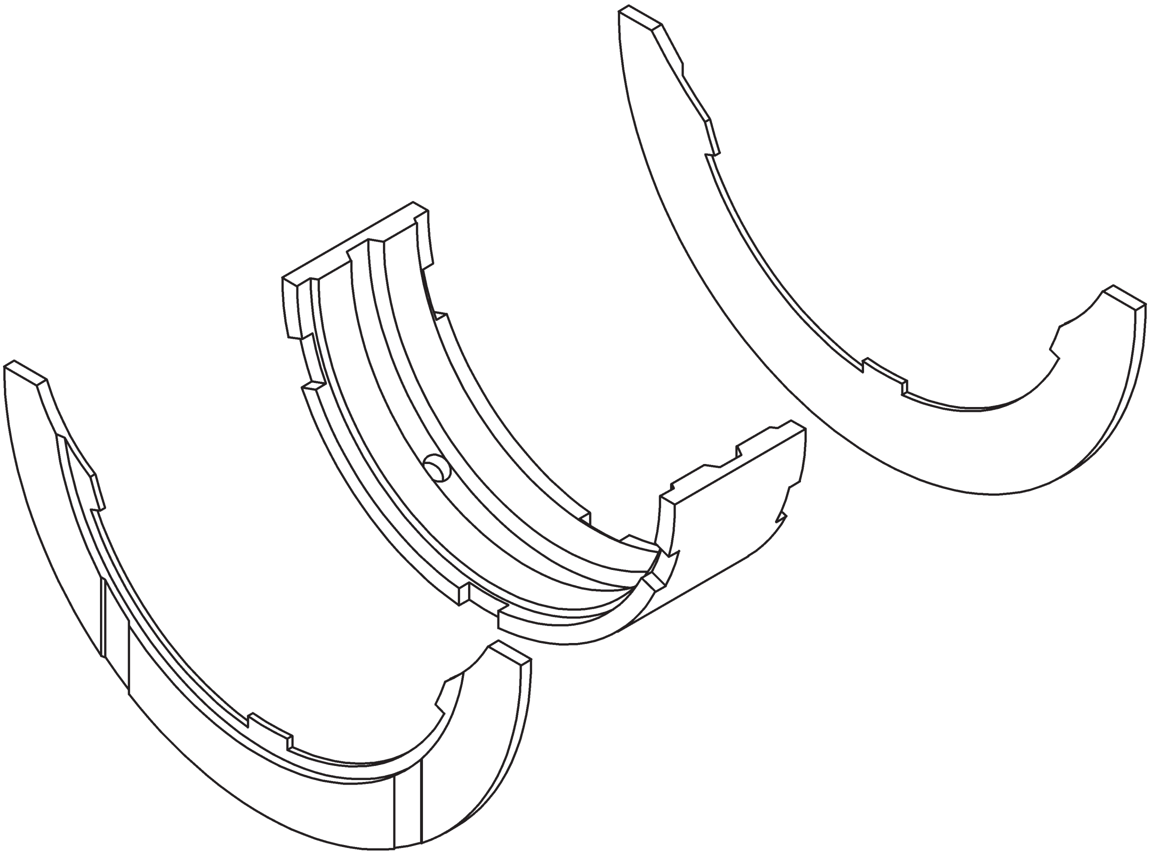


Figure 22 — Structure of assembled flange bearings

8.1 Characteristics

a) The assembled flange bearings, as well as the integral flange bearings, have a function of a flange bearing, which is capable of supporting radial load and thrust load at the same time.

b) Unlike separated type bearings in which a thrust washer and a half bearing are mounted on an engine separately, the assembled flange bearings are bearing units composed of thrust washers and a half bearing. There is no problem of dropping off of the thrust washer while mounting the bearing on an engine, contributing to workability in the assembly process. In addition, they are suitable for automatic assembly of bearings, using automatic machines, etc.

c) The thrust washer in the assembled flange bearings can move relative to the half bearing, unlike the integral flange bearings, and the thrust washer moves in the axial direction of the bearing and contacts uniformly to the side face of the housing when a thrust load is applied. This enables proper contact between the thrust bearing sliding surface and the mating thrust surface of the crankshaft, achieving a stable thrust load capability equivalent to that of an independent thrust washer of the separated type bearing.

d) Unlike the integral flange bearings, the assembled flange bearings can utilize different bearing materials for the half bearing and the thrust washer as appropriate depending on the load condition.

f) Dimensions and shapes of the integral flange bearings are often limited by production capability of forming machines that also carry out a plastic deformation process. Unlike the integral flange bearings, the assembled flange bearings" allow more flexible outer dimensions of thrust washers in terms of production. They also allow more flexible design of oil grooves on thrust washers.

g) Because the assembled flange bearings are bearing units in which the thrust washer is assembled with the half bearing, the rotation-proof mechanism for the thrust washer and spot facing on the side face of the housing, which are needed in the separated type bearing, can be eliminated.

8.2 Classification

The following points are important for the assembled flange bearings to fulfil the function. The types to be used are selected based on the necessity and importance for the function.

a) The thrust washer should not drop off the half bearing.

To prevent this risk, projections on the thrust washer are hooked in recesses on the half bearing, utilizing the free spread tension of the half bearing. In some types, local deformation is generated partly on the projections and the recesses for prevention of drop-off in others by caulking and/or other methods.

b) The thrust washer moves freely in the axial direction.

When the unit is mounted on an engine, the thrust washer moves in the axial direction and uniformly contacts the side face of the housing when a thrust load is applied.

c) The thrust washer does not interfere with the housing inside diameter or the fillet radius of the crankshaft within the free movement range of the thrust washer in the axial direction.

To prevent this risk, round chamfer machining is applied on the inner surface of the transition between half bearing and flange of an assembled flange bearing in some types. And also undercutting is applied on the back of the assembled area, after assembling the thrust washer on the half bearing.

As explained above, the assembled flange bearings can be broadly classified into the following three types.

-	Type A	Type B	Type C
Machining work after assembly	None	None	Applied
Caulking after assembly	None	Applied	Applied

8.3 Checklist of items for ensuring the function of assembled flange bearings

a) Workability in mounting into housing

When fitting to a checking block of the maximum housing width, the distance between flanges should be larger than the maximum housing width, allowing smooth mounting to a housing.

b) Total width including thrust washers

With a checking block of the maximum housing width, which an assembled flange bearing is fitted to, the bearing axial width should be checked under a force in the axial direction applied. The measured value should be confirmed to be within the maximum width specified in the drawing in order to ensure an appropriate side clearance from the crankshaft. In respect to the measurement method, make reference to Figure 21.

c) Free movement of thrust washer in the axial direction on housing

With a checking block of the minimum housing width, which an assembled flange bearing is fitted to, the thrust washer should be movable and contact uniformly on the side of the checking block under a force in the axial direction applied.

Annex A
(normative)

Example of calculation

Drawing details:

BL_u = 0,012 mm, UL_u = 0,004 mm

α = 45°, α_2 = 25°, $s_{3,\,act}$ = 2,260 mm

Upper and lower limits of the wall thickness shall be calculated for α = 45°

$$s_{\alpha,\mathrm{BL}} = s_{3,\mathrm{act}} - \mathrm{BL}_u \times \frac{1-\sin\alpha}{1-\sin\alpha_2} = 2{,}260 - 0{,}012 \times \frac{0{,}292\ 89}{0{,}577\ 38} = 2{,}253\ 92 \tag{A.1}$$

$$s_{\alpha,\mathrm{BL}} = 2{,}254 \text{ mm (rounded)} \tag{A.2}$$

$$s_{\alpha,\mathrm{UL}} = s_{3,\mathrm{act}} - \mathrm{UL}_u \times \frac{1-\sin\alpha}{1-\sin\alpha_2} = 2{,}260 - 0{,}004 \times \frac{0{,}292\ 89}{0{,}577\ 38} = 2{,}257\ 97 \tag{A.3}$$

$$s_{\alpha,\mathrm{UL}} = 2{,}258 \text{ mm (rounded)} \tag{A.4}$$

Bibliography

[1] ISO 4383, *Plain bearings — Multilayer materials for thin-walled plain bearings*

[2] ISO 4384-1, *Plain bearings — Hardness testing of bearing metals — Part 1: Multilayer bearings materials*

[3] ISO 4384-2, *Plain bearings — Hardness testing of bearing metals — Part 2: Solid materials*

[4] ISO 6282, *Plain bearings — Metallic thin-walled half bearings — Determination of the sigma 0,01*-limit*

[5] Beuth-Kommentare Gleitlager, & Konstruktion Auslegung Prüfung mit Hilfe von DIN-Normen, TEPPER, H., SCHOPF, E.; Beuth Verlag, Burggrafenstraße 6, 10787 Berlin; ISBN 3-410-11849-7

ICS 21.100.10

Price based on 22 pages

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK