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Plain bearings — Terms, definitions, classification and symbols —

Part 1: Design, bearing materials and their properties

Paliers lisses — Termes, définitions, classification et symboles —

Partie 1: Conception, matériaux pour paliers et leurs propriétés

Reference number
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Foreword

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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).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 123, *Plain bearings*, Subcommittee SC 6, *Terms and common items*.

This fourth edition cancels and replaces the third edition (ISO 4378-1:2009), which has been technically revised. The following changes have been made:

— editorial revision of the document;

— addition of Figures 3, 4, 5, 6, 7, 8, 9, 18, 19, 36, 37, 40, 44 and 49 and technical revision of the other figures;

— revision of clause numbers.

A list of all the parts in the ISO 4378 series can be found on the ISO website.

Introduction

As there is a large number of multiple designations in the domain of plain bearings, there is a considerable risk of error in the interpretation of standards and technical literature. This uncertainty leads to the continuous addition of supplementary designations, which only serves to increase the misunderstanding.

This document is an attempt to establish a uniform basic system of designations of design, bearing materials and their properties.

Plain bearings — Terms, definitions, classification and symbols —

Part 1:
Design, bearing materials and their properties

1 Scope

This document specifies the most commonly used terms relating to design, bearing materials and their properties of plain bearings with their definitions and classification.

For some terms and word combinations, their short forms are given, which can be used where they are unambiguous. Self-explanatory terms are given without definitions.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1 General terms

3.1.1
bearing
mechanical component by means of which a part in relative motion is supported and/or guided with respect to other parts of a mechanism

3.1.2
plain bearing
sliding bearing
bearing (3.1.1) in which the type of relative motion is sliding

3.1.3
plain bearing unit
mechanical component of a tribological system including a *plain bearing* (3.1.2), its supporting part (e.g. a housing), a shaft and a lubricating system

3.2 Types of plain bearings and classification

3.2.1 Classification according to the type of load

3.2.1.1
statically loaded plain bearing
plain bearing (3.1.2) operating under a load constant in magnitude and direction

3.2.1.2
dynamically loaded plain bearing
plain bearing (3.1.2) operating under a load changing in magnitude and/or direction

3.2.2 Classification according to the direction of the acting load

3.2.2.1
plain journal bearing
journal bearing
plain bearing (3.1.2) in which the load acts radially to the axis of the rotating shaft

Note 1 to entry: See Figures 1 and 3.

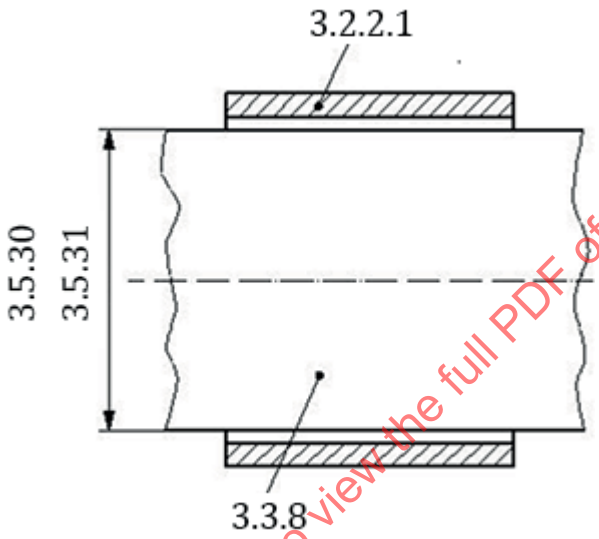


Figure 1 — Plain journal bearing

3.2.2.2
plain thrust bearing
thrust bearing
plain bearing (3.1.2) in which the load acts along the axis of the rotating shaft

Note 1 to entry: See Figure 2.

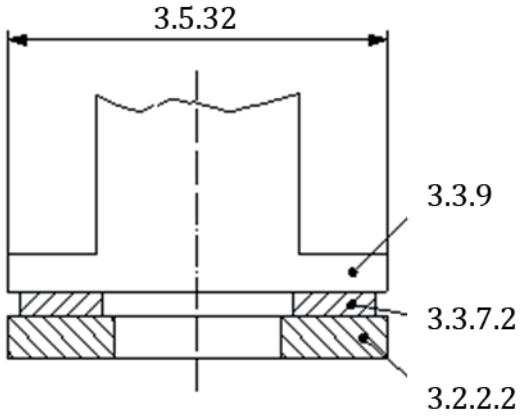


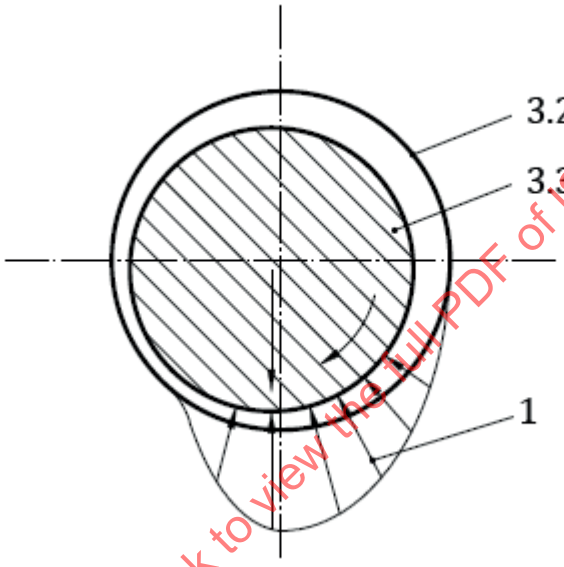
Figure 2 — Plain thrust bearing

3.2.2.3
journal thrust bearing
flanged bearing
plain bearing (3.1.2) capable of supporting a load in both the axial and radial directions

3.2.3 Classification according to the type of lubrication

3.2.3.1
hydrodynamic bearing
plain bearing (3.1.2) operating under conditions of hydrodynamic lubrication

Note 1 to entry: See Figure 3.



Key
1 oil film pressure distribution

Figure 3 — Hydrodynamic bearing

3.2.3.2
hydrostatic bearing
externally pressurized bearing
plain bearing (3.1.2) operating under conditions of hydrostatic lubrication

Note 1 to entry: See Figure 4.

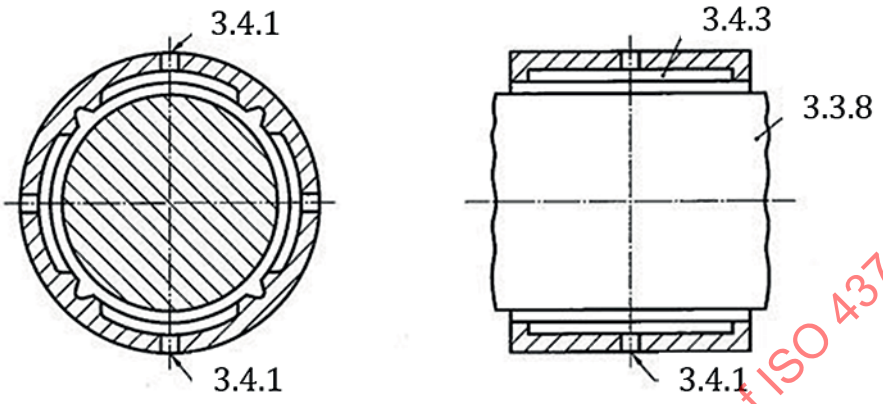


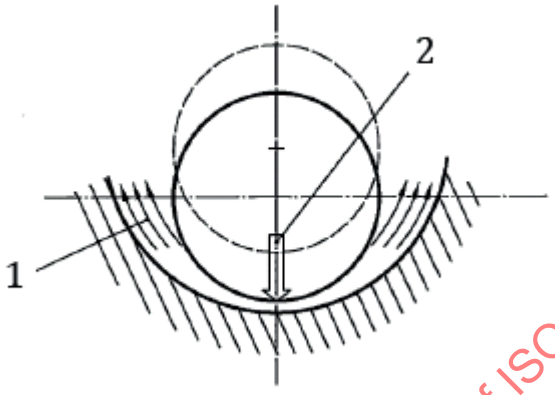
Figure 4 — Hydrostatic bearing

3.2.3.3
hydrodynamic gas bearing
hydrodynamic air bearing
plain bearing (3.1.2) operating under conditions of hydrodynamic gas/air lubrication

3.2.3.4
hydrostatic gas bearing
hydrostatic air bearing
plain bearing (3.1.2) operating under conditions of hydrostatic gas/air lubrication

3.2.3.5
squeeze film bearing
plain bearing (3.1.2) in which complete separation of sliding surfaces is caused by the pressure developed in the lubricant film as a result of their approach in the direction normal to the surface

Note 1 to entry: See Figure 5.



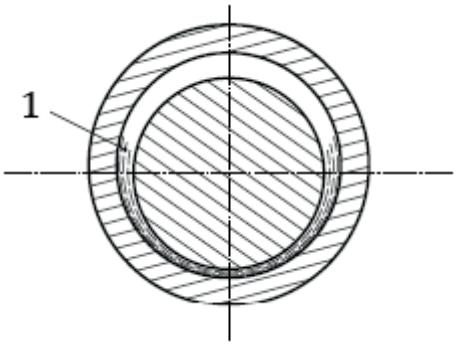
Key
1 lubricant
2 load

Figure 5 — Squeeze film bearing

3.2.3.6
hybrid bearing
plain bearing (3.1.2) operating under conditions of both hydrostatic and hydrodynamic lubrication

3.2.3.7
solid-film lubricated bearing
plain bearing (3.1.2) operating with a solid lubricant

Note 1 to entry: See Figure 6.



Key
1 solid lubricant

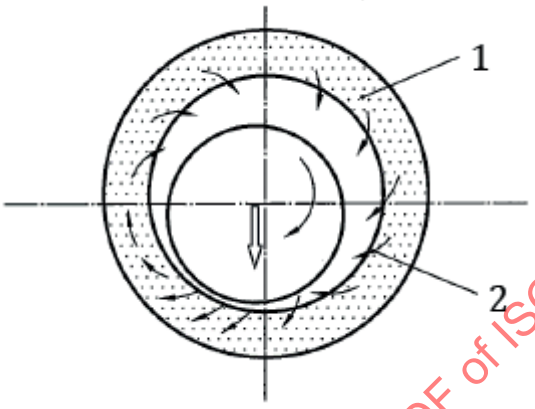
Figure 6 — Solid film lubricated bearing

3.2.3.8
unlubricated bearing
plain bearing (3.1.2) operating without a lubricant

3.2.3.9
self-lubricating bearing
plain bearing (3.1.2) lubricated by the *bearing material* (3.6.1), by the material components or by solid lubricant overlays

3.2.3.10
porous self-lubricating bearing
sintered bearing
oil-impregnated sintered bearing
bearing (3.1.1), the sliding part of which consists of material having communicating pores filled with lubricant

Note 1 to entry: See Figure 7.



Key

1 porous bearing
2 oil flow

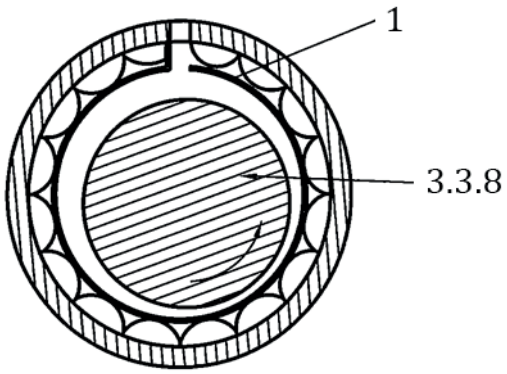
Figure 7 — Porous self-lubricating bearing

3.2.3.11
self-contained plain bearing assembly
bearing assembly with a lubricant reservoir and means of circulating the lubricant to the bearing surface

Note 1 to entry: See *plain bearing assembly* (3.2.4.9).

3.2.3.12
foil bearing
hydrodynamic bearing (3.2.3.1) consisting of a thin *solid material* (3.6.2) with low bending stiffness, which supports a load while allowing deflection of the thin solid material

Note 1 to entry: See Figure 8.

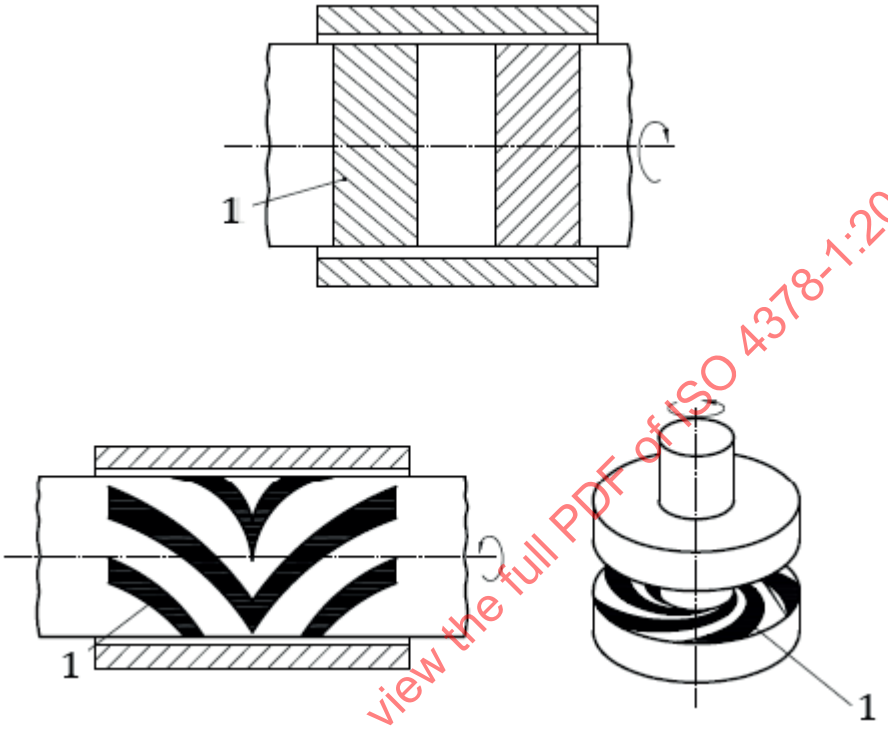


Key
1 foil

Figure 8 — Foil bearing

3.2.3.13
spiral groove bearing
hydrodynamic bearing (3.2.3.1) system with many shallow spiral grooves on the surface of the bearing or the shaft

Note 1 to entry: See Figure 9.



Key
1 grooves

Figure 9 — Spiral groove bearing

3.2.4 Classification according to the design

3.2.4.1
circular cylindrical bearing
plain journal bearing (3.2.2.1), every cross-section of the inside surface of which is a circle of the same diameter

Note 1 to entry: See Figure 10.

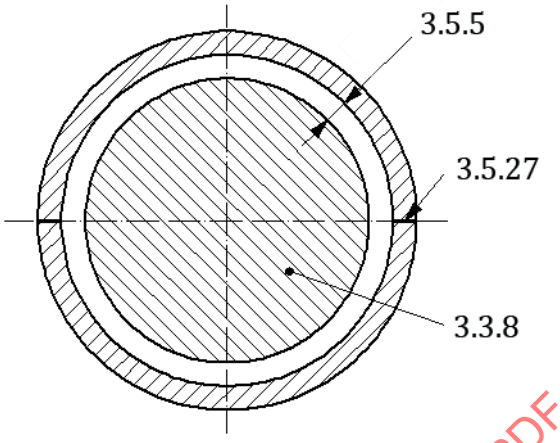


Figure 10 — Circular cylindrical bearing

3.2.4.2
profile bore bearing
plain journal bearing (3.2.2.1) in which no cross-section of the inside surface is a circle

Note 1 to entry: See Figure 11.

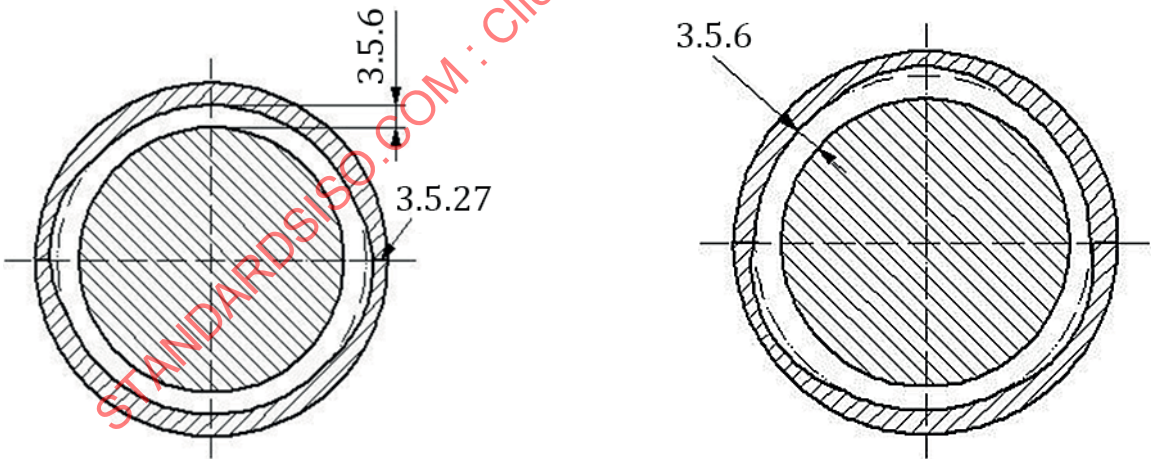


Figure 11 — Profile bore bearing

3.2.4.3
lobed bearing
plain journal bearing (3.2.2.1) having more than one cylindrical surface so arranged that two or more lubricant wedges develop around the bearing circumference

Note 1 to entry: See Figure 11.

3.2.4.4
pad thrust bearing
plain thrust bearing (3.2.2.2), the sliding surface of which consists of fixed *pads* (3.3.7)

Note 1 to entry: See Figure 12.

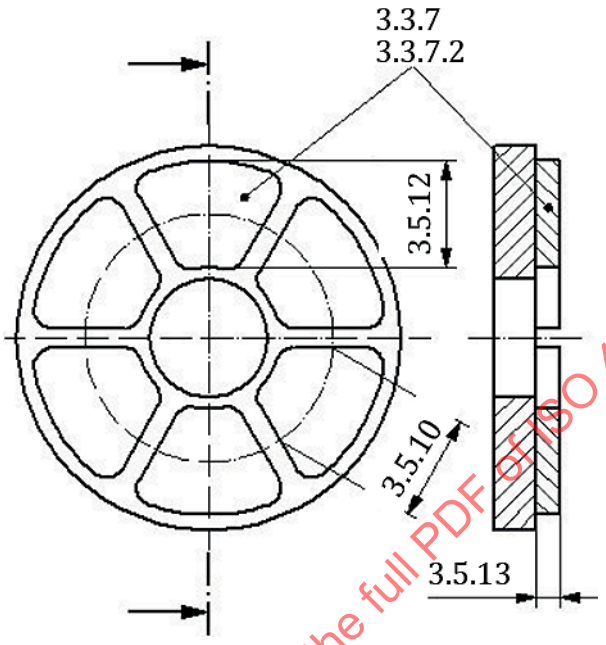


Figure 12 — Pad thrust bearing

3.2.4.5
taper-land thrust bearing
plain bearing (3.1.2) in which one side of the sliding surfaces is tapered

Note 1 to entry: See Figure 13.

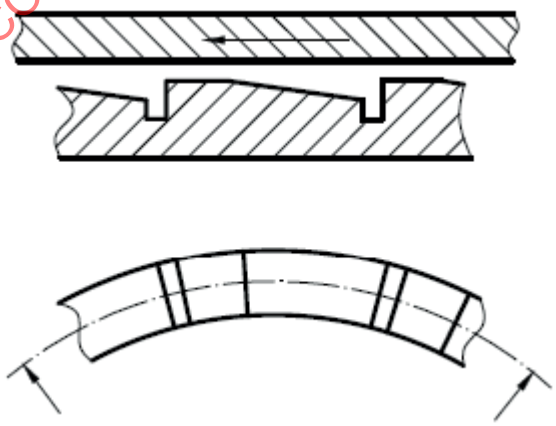


Figure 13 — Taper-land thrust bearing

3.2.4.6
tilting pad journal bearing
self-tilting *plain journal bearing* (3.2.2.1), the sliding surface of which consists of *pads* (3.3.7) free to align with respect to the journal under the hydrodynamic action of the lubricant film

Note 1 to entry: See Figure 14.

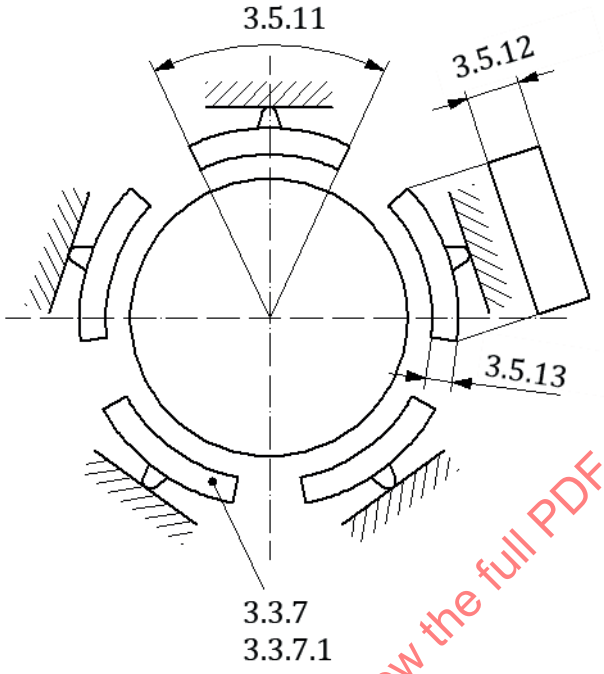


Figure 14 — Tilting pad journal bearing

3.2.4.7
tilting pad thrust bearing
self-tilting *plain thrust bearing* (3.2.2.2), the sliding surface of which consists of *pads* (3.3.7) free to tilt to make a convergent lubricant film with the thrust collar sliding surface under the hydrodynamic action of the lubricant film

Note 1 to entry: See Figure 15.

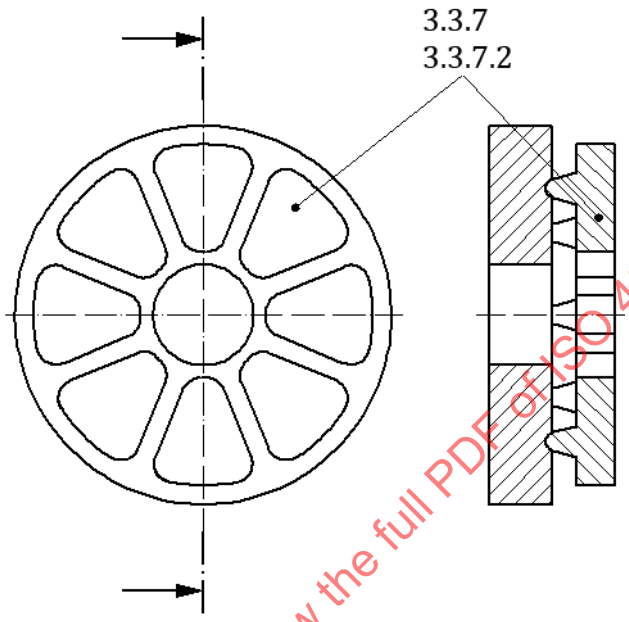


Figure 15 — Tilting pad thrust bearing

3.2.4.8
floating bush bearing
plain bearing (3.1.2) designed as a *bush* (3.3.2), being able to slide and rotate on the shaft and in the housing bore

Note 1 to entry: See Figure 16.

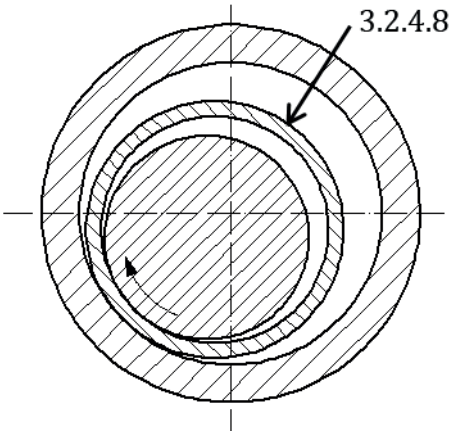


Figure 16 — Floating bush bearing

3.2.4.9
plain bearing assembly
bearing assembly consisting of a plain bearing fitted in a pedestal or flanged housing

Note 1 to entry: See *self-contained plain bearing assembly* (3.2.3.11).

Note 2 to entry: See Figure 17.

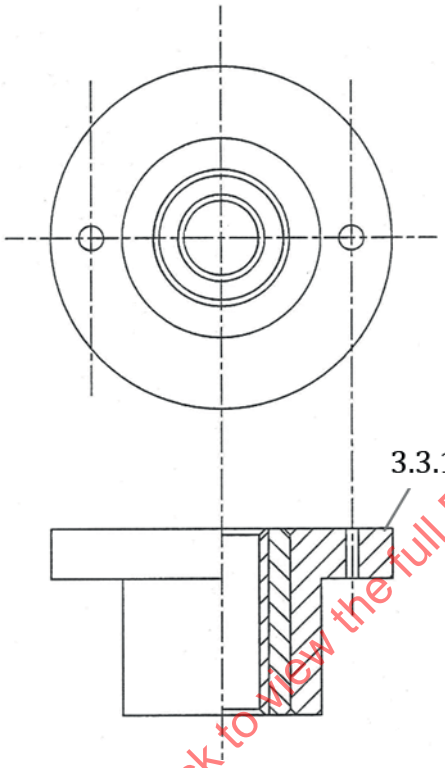


Figure 17 — Plain bearing assembly

3.2.4.9.1
pedestal plain bearing assembly
pillow block bearing assembly
plain bearing assembly (3.2.4.9) secured by fixing elements perpendicular or parallel to the shaft axis

3.2.4.9.2
flanged plain bearing assembly
plain bearing assembly (3.2.4.9) secured by fixing elements parallel and/or perpendicular to the shaft axis

Note 1 to entry: See Figure 17.

3.2.4.10
self-aligning bearing
plain bearing (3.1.2) designed with the ability to self-align, with respect to the opposing surface

Note 1 to entry: See Figure 18.

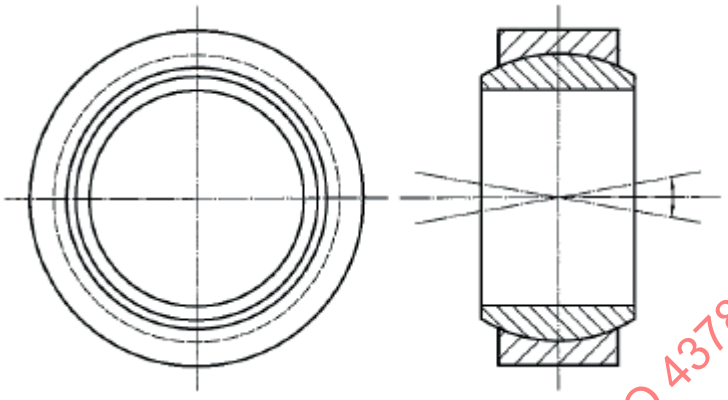


Figure 18 — Self-aligning bearing

3.2.4.11
offset bearing
pair of *plain bearings* (3.1.2) assembled by shifting radially by a certain distance smaller than the radius clearance

Note 1 to entry: See Figure 19.

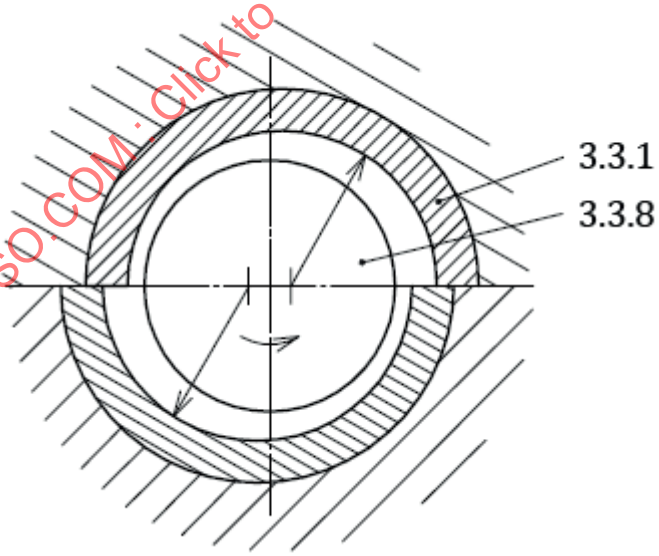


Figure 19 — Offset bearing

3.3 Structural elements of plain bearing assembly

3.3.1
half-bearing
plain journal bearing (3.2.2.1) with a sliding surface of 180° of the shaft circumference

Note 1 to entry: See Figure 20.

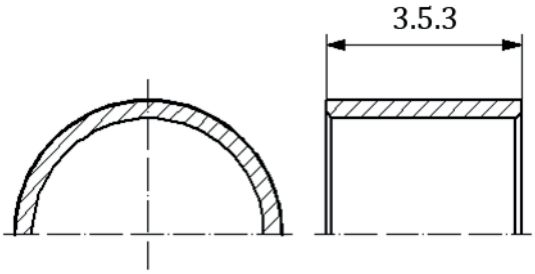


Figure 20 — Half-bearing

3.3.1.1
thin wall half-bearing
half-bearing (3.3.1) of sufficiently small wall thickness that the bearing geometry will be influenced by housing bore geometrical imperfections

Note 1 to entry: See Figure 46.

3.3.1.2
thick wall half-bearing
half-bearing (3.3.1) of sufficiently large wall thickness that the bearing geometry will not be influenced by housing bore geometrical imperfections

3.3.1.3
bearing back
surface of *bearing backing* (3.3.1.4) opposite the slide surface

Note 1 to entry: See Figure 24.

3.3.1.4
bearing backing
backing
part of a multilayer bearing applied for giving a bearing the required strength and/or stiffness

Note 1 to entry: See Figure 24.

3.3.2
plain bearing bush
bearing bush
bush
replaceable tubular bearing element, the inner and/or outer surface of which is the sliding surface of a *plain bearing* (3.1.2)

Note 1 to entry: See Figure 21.

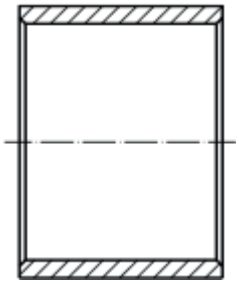


Figure 21 — Plain bearing bush

3.3.2.1
plain bearing wrapped bush
bearing wrapped bush
wrapped bush
bush (3.3.2) made from a wrapped strip of a single-layer or multilayer *bearing material* (3.6.1)

Note 1 to entry: See Figure 22.

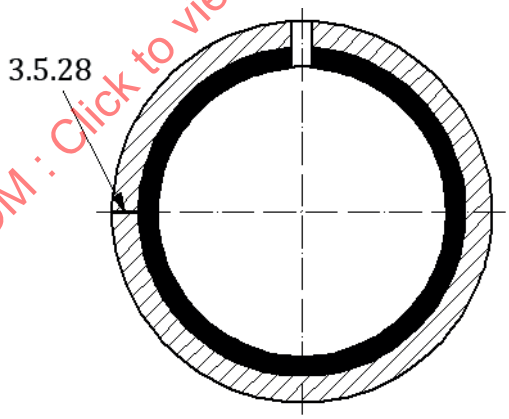


Figure 22 — Plain bearing wrapped bush

3.3.3
flanged half-bearing
flanged bush
half-bearing (3.3.1)/*bush* (3.3.2) with a flange at one or both ends

Note 1 to entry: See Figure 23.

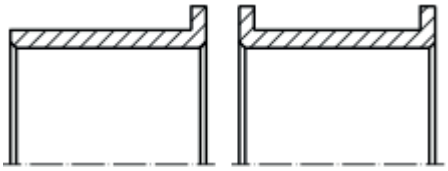


Figure 23 — Flanged half-bearing

3.3.4
solid half-bearing
solid bush
half-bearing (3.3.1)/*bush* (3.3.2) made of a single material

3.3.5
multilayer half-bearing
multilayer bush
half-bearing (3.3.1)/*bush* (3.3.2) made of layers of different materials

Note 1 to entry: See Figure 24.

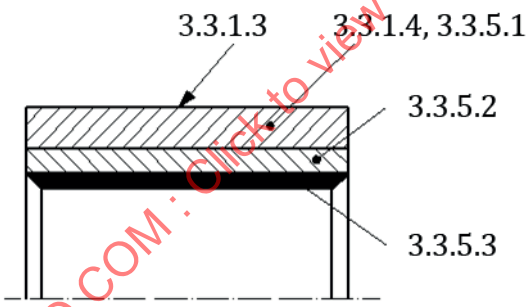


Figure 24 — Multilayer half-bearing

3.3.5.1
half-bearing backing
bush backing
backing
part of a *multilayer half-bearing/bush* (3.3.5) which gives the required strength and/or stiffness to the *bearing* (3.1.1)

Note 1 to entry: See Figure 24.

3.3.5.2
bearing material layer
bearing layer
lining
layer of a *bearing material* (3.6.1) as part of a *multilayer half-bearing* (3.3.5)

Note 1 to entry: The layer thickness is usually greater than 0,2 mm.

Note 2 to entry: See Figure 24.

3.3.5.3
plain bearing running-in layer
running-in layer
overlay
additional layer of material applied to the *bearing material* (3.6.1) to improve *running-in ability* (3.6.11), *conformability* (3.6.10), *embeddability* (3.6.12) and, in some cases, *corrosion resistance* (3.6.16)

Note 1 to entry: The layer thickness is usually from 0,01 mm to 0,05 mm.

Note 2 to entry: See Figure 24.

3.3.5.4
interlayer
bonding layer
nickel dam
thin layer between the *overlay* (3.3.5.3) and the *lining* (3.3.5.2) to strengthen the bond and reduce diffusion

Note 1 to entry: The layer thickness is usually between 0,001 mm and 0,002 mm.

3.3.5.5
protective layer
flash
very thin layer on bearing surface or backing to provide corrosion protection in storage

Note 1 to entry: The layer thickness is usually between 0,000 5 mm and 0,001 mm.

3.3.6
thrust washer
annular plate used to support an axial load in conjunction with a *plain journal bearing* (3.2.2.1)

Note 1 to entry: See Figure 25.

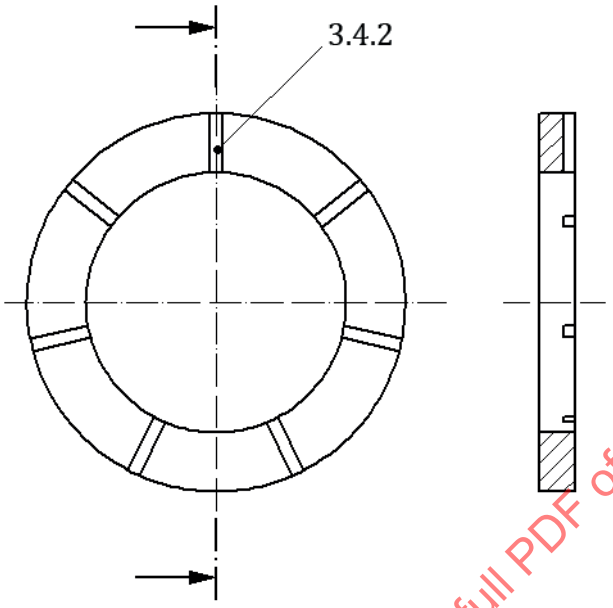


Figure 25 — Thrust washer

3.3.6.1
thrust half-washer
part of an annular plate which, on its own, or combined with another similar part, forms a *thrust bearing* (3.2.2.2)

Note 1 to entry: See Figure 26.

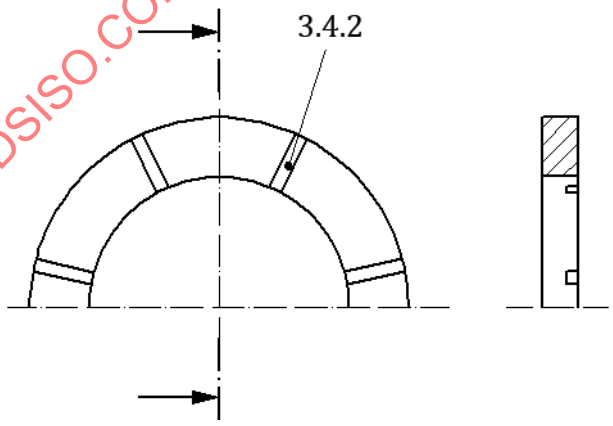


Figure 26 — Thrust half-washer

3.3.7
pad
part of a pad bearing that carries the load

Note 1 to entry: See Figures 12, 14 and 15.

3.3.7.1
journal pad
part of a plain journal pad bearing

Note 1 to entry: See Figure 14.

3.3.7.2
thrust pad
part of a plain thrust pad bearing

Note 1 to entry: See Figures 2, 4 and 15.

3.3.8
journal
part of a shaft or of an axle supported by a *plain journal bearing* (3.2.2.1)

Note 1 to entry: See Figures 1, 3, 4, 8 and 10.

3.3.9
thrust collar
annular part of a shaft supported by a *plain thrust bearing* (3.2.2.2)

Note 1 to entry: See Figure 2.

3.3.10
oil ring (loose)
oil disc (secured)
annular element loosely supported by, or secured to, the shaft to transfer lubricant to the *bearing* (3.1.1)

Note 1 to entry: See Figure 27.

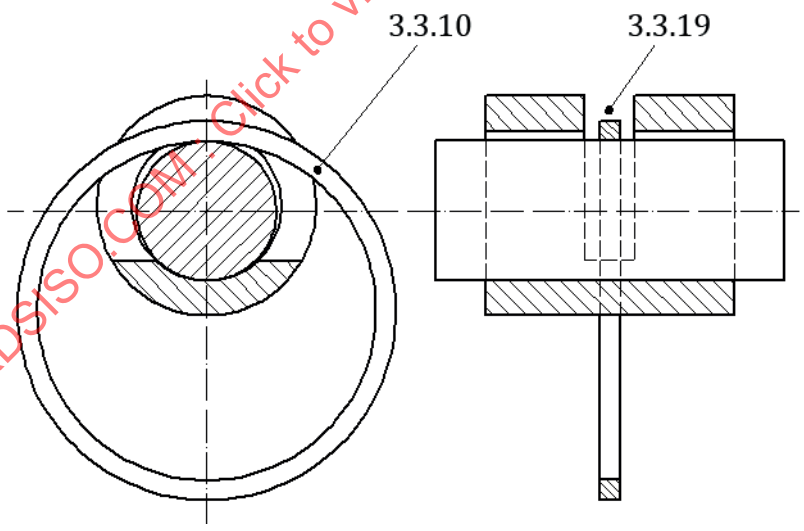


Figure 27 — Oil ring

3.3.11
plain bearing housing
housing into which a *plain bearing* (3.1.2) is fitted

3.3.12
plain bearing housing block
bearing block
pillow block
part of the housing that supports the *bearing* (3.1.1)

Note 1 to entry: See Figure 28.

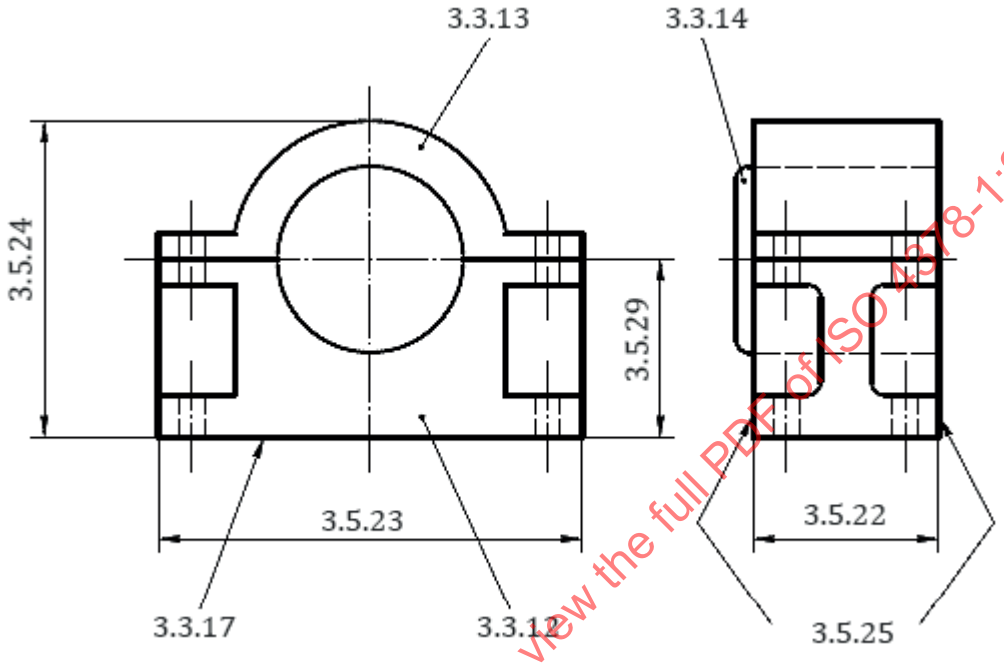


Figure 28 — Plain bearing housing block

3.3.13
plain bearing housing cap
bearing cap
part of the housing that retains the bearing in the block

Note 1 to entry: See Figure 28.

3.3.14
plain bearing housing cover plate
cover plate
plate for closing the *housing face* (3.5.25) in axial direction

Note 1 to entry: See Figure 28.

3.3.15
plain bearing assembly gasket
bearing gasket
element used for sealing the bearing housing against lubricant leakage and ingress of dirt

3.3.16
bearing housing flange
part of the flanged bearing housing for connection to the machine in an axial direction and/or perpendicular to the axis

Note 1 to entry: See Figure 17.

3.3.17
bearing housing base
part of the pedestal bearing housing for perpendicular or parallel connection to the machine casing or machine foundation

Note 1 to entry: See Figure 28.

3.3.18
bearing insulation
electrical insulation between *plain bearing* (3.1.2) and housing or between housing and housing support

Note 1 to entry: This is sometimes used to prevent the *bearing* (3.1.1) from electroerosive wear.

3.3.19
oil ring slot
recess in the *plain bearing* (3.1.2) for location of an oil ring

Note 1 to entry: See Figure 27.

3.3.20
oil filler hole
lubricant filler hole
lubricant supply hole
capped hole for charging the bearing housing with oil

3.3.21
oil drain hole
lubricant drain hole
plugged hole for draining the lubricant charge from the bearing housing

3.3.22
plain bearing housing bore
cylindrical bore of the housing for fixing the *bearing bush* (3.3.2) or a pair of *half-bearings* (3.3.1), which is a spherical bore in the case of the spherical plain bearing

3.4 Structural elements of plain bearing

3.4.1
oil hole
lubrication hole
hole through backing and sliding surface of a *plain bearing* (3.1.2) to supply and distribute lubricant

Note 1 to entry: See Figures 4, 29 and 30.

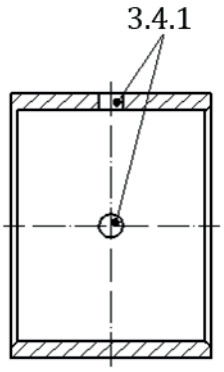


Figure 29 — Oil hole

3.4.2
oil groove
lubrication groove
groove on the sliding surface to supply and distribute lubricant on the sliding surface

Note 1 to entry: See Figures 26, 27, 31 and 32.

3.4.2.1
outer oil groove
outer lubrication groove
groove on the *bearing back* (3.3.1.3) to supply lubricant to the *oil hole* (3.4.1)

Note 1 to entry: See Figure 30.

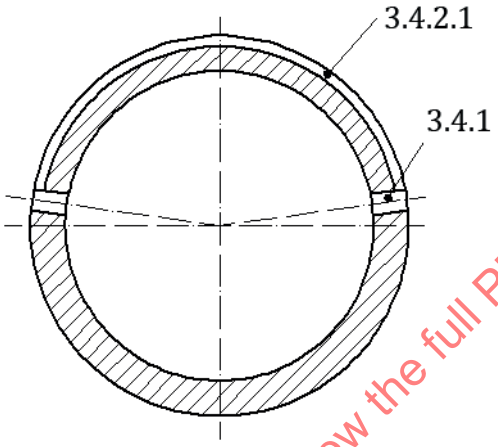


Figure 30 — Outer oil groove

3.4.2.2
longitudinal groove
axial groove
lubrication groove (3.4.2) parallel to the axis in a *plain journal bearing* (3.2.2.1)

Note 1 to entry: See Figure 31.

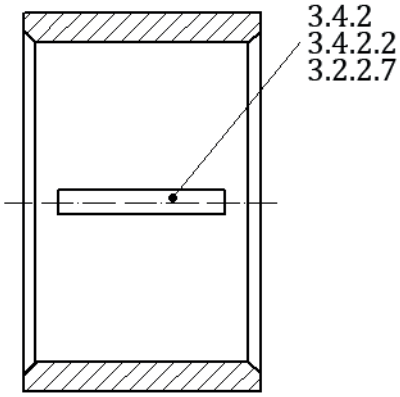


Figure 31 — Longitudinal groove

3.4.2.3
circumferential groove
lubrication groove (3.4.2) in annular or partially annular form

Note 1 to entry: See Figure 32.

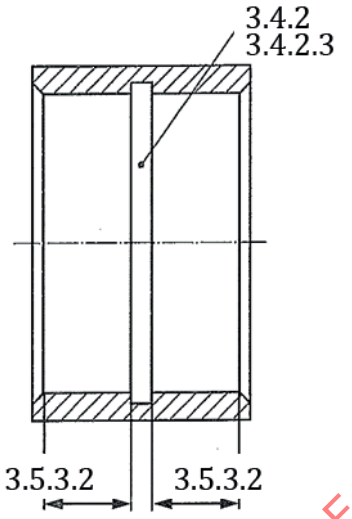


Figure 32 — Circumferential groove

3.4.2.4
partially circumferential groove
partially circumferential *lubrication groove* (3.4.2) provided on a part of a *plain journal bearing* (3.2.2.1)

3.4.2.5
helical groove
spiral groove
helically cut *lubrication groove* (3.4.2)

Note 1 to entry: See Figure 33.

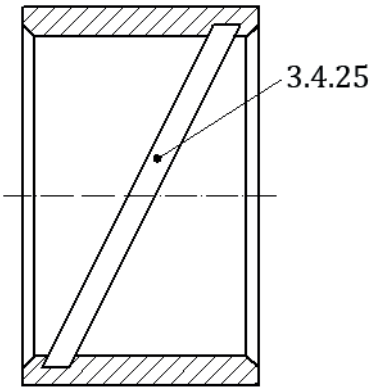


Figure 33 — Helical groove

3.4.2.6
open groove
axial *lubrication groove* (3.4.2) extending over the full bearing width

Note 1 to entry: See Figure 34.

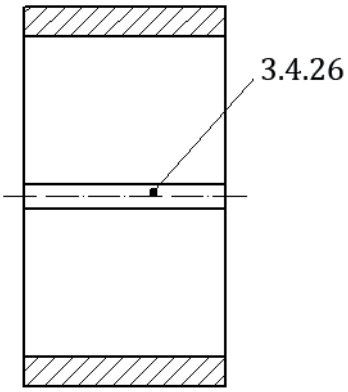


Figure 34 — Open groove

3.4.2.7
stopped-off groove
oil groove (3.4.2) that does not reach the bearing end face or faces

Note 1 to entry: See Figure 31.

3.4.2.8
gutterway
axial *oil groove* (3.4.2) adjacent to or spanning an axial joint in a *bearing* (3.1.1)

Note 1 to entry: See Figure 35.

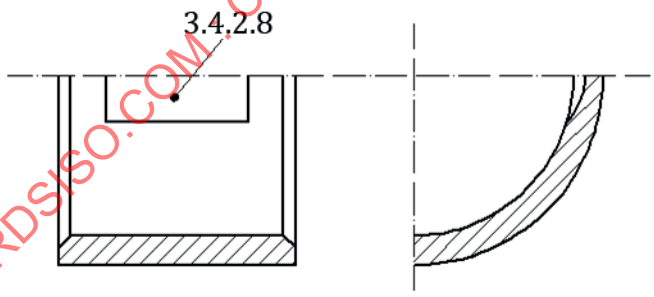


Figure 35 — Gutterway

3.4.2.9
chevron groove
oil groove (3.4.2) that has a line or pattern in the shape of a V

Note 1 to entry: See Figure 36.

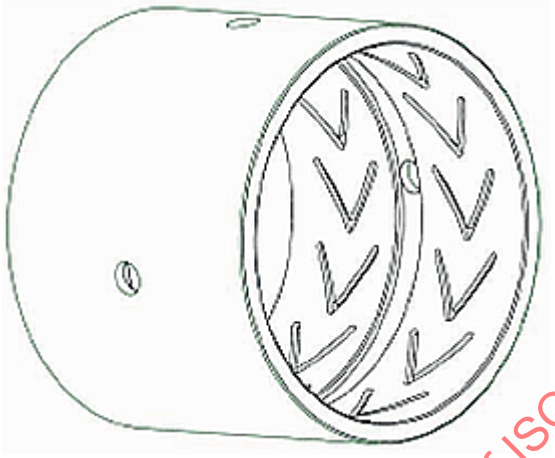


Figure 36 — Chevron groove

3.4.2.10
herringbone groove
oil grooves (3.4.2) having twist angles in opposite directions from both ends of the bearing surface

Note 1 to entry: See Figure 37.

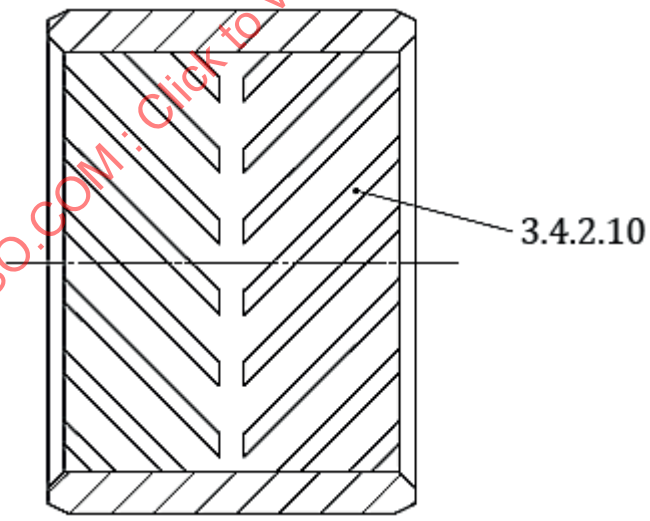


Figure 37 — Herringbone groove

3.4.3
oil pocket
lubrication indentation
recess on the sliding surface to accumulate and to distribute lubricant

Note 1 to entry: See Figures 4 and 38.

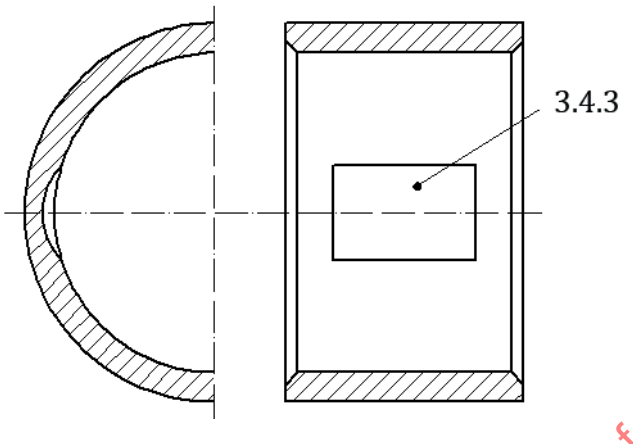


Figure 38 — Oil pocket

3.4.4
locating feature
notch, nick, recess, groove, lug or hole to locate a *bearing* (3.1.1) in a housing

Note 1 to entry: See Figure 39.

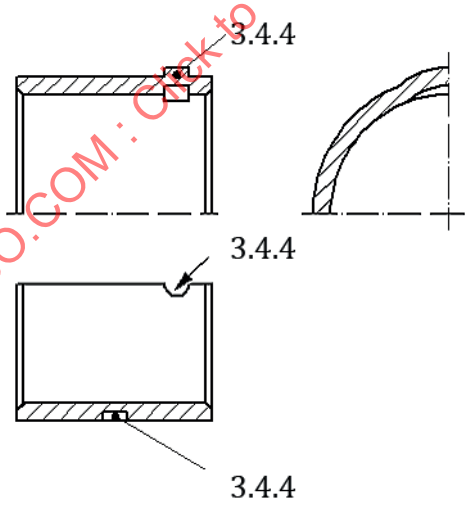


Figure 39 — Locating feature

Note 2 to entry: See ISO 12301:2007, Figures 21 to 26.

3.4.5
clinch
shapes of *joint faces* (3.5.27) in order to close the split of *wrapped bushes* (3.3.2.1) by engaging mutually

Note 1 to entry: See Figure 40.

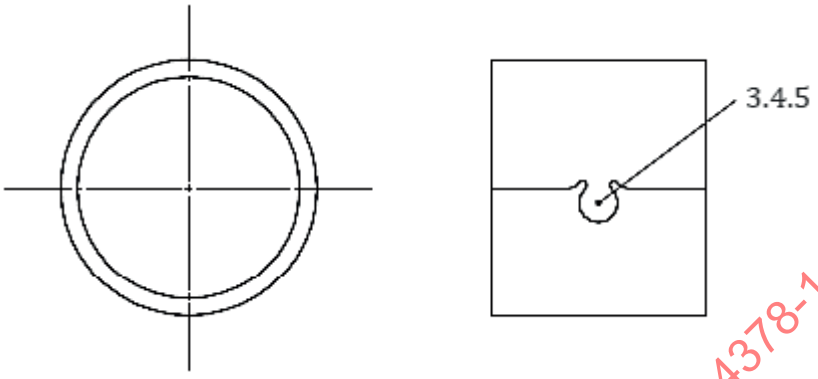


Figure 40 — Clinch

3.5 Dimensional characteristics of plain bearing

3.5.1
journal bearing bore diameter
bore
inside bearing diameter
ID
internal diameter of the section perpendicular to the axis of a circular cylindrical journal bearing

Note 1 to entry: See Figure 41.

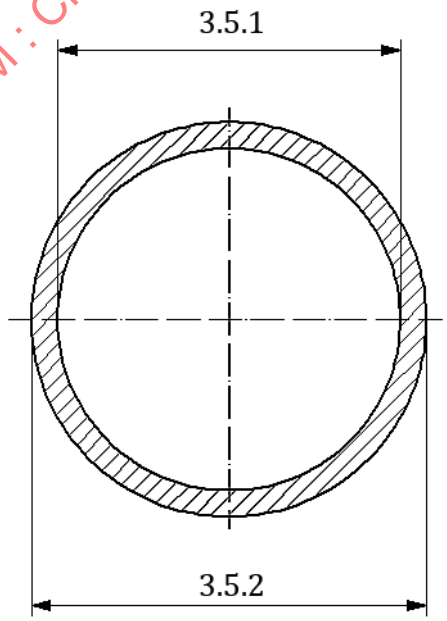


Figure 41 — Journal bearing diameter

3.5.2
plain journal bearing outside diameter
outside bearing diameter
OD
diameter of the back of the *bearing* (3.1.1)

Note 1 to entry: See Figure 41.

3.5.3
bearing width
dimension of a *plain bearing* (3.1.2) measured perpendicular to the direction of the sliding motion

Note 1 to entry: See Figures 20 and 42.

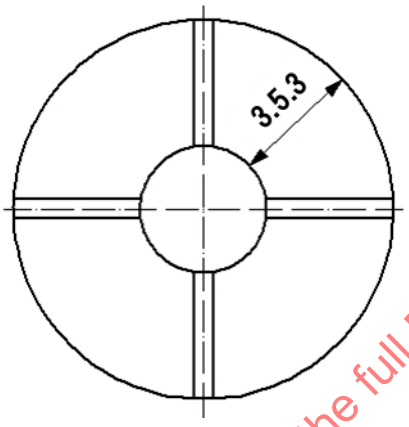


Figure 42 — Bearing width

3.5.3.1
effective bearing width
bearing (3.1.1) or *bush* (3.3.2) width excluding the central groove and chamfers

3.5.3.2
bearing land width
dimension of a circumferentially grooved journal bearing from the edge of the groove to the edge of the *bearing* (3.1.1) in the axial direction, excluding chamfers

Note 1 to entry: See Figure 32.

3.5.3.3
land
effective sliding surface in a *plain bearing* (3.1.2)

3.5.4
diametral clearance of a plain journal bearing
journal bearing clearance
bearing clearance
difference between the diameter of the bearing bore and the diameter of the journal

3.5.5
radial clearance of a circular cylindrical bearing
difference between the radius of the bearing bore and the radius of the journal

Note 1 to entry: See Figure 10.