
**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*



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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 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.

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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](#).

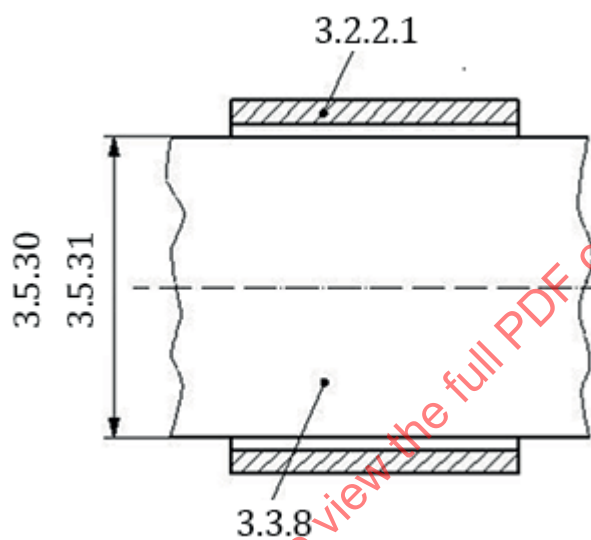


Figure 1 — Plain journal bearing

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](#).

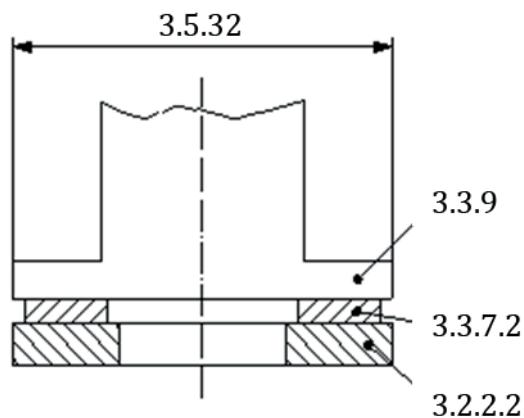


Figure 2 — Plain thrust bearing

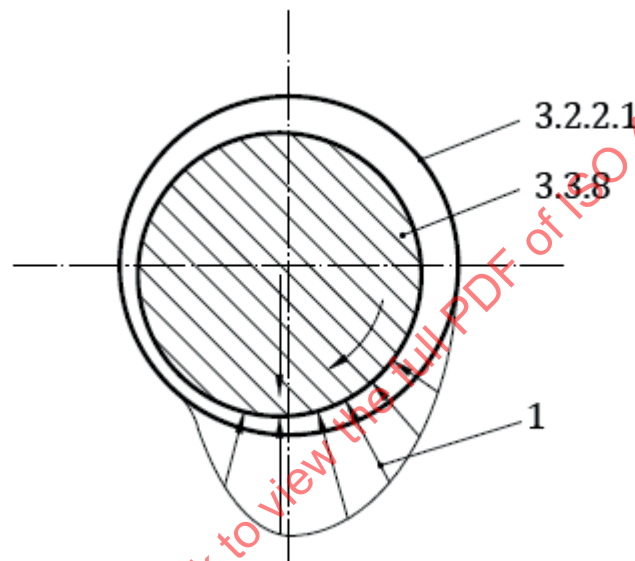
3.2.2.3**journal thrust bearing****flanged bearing**

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](#).

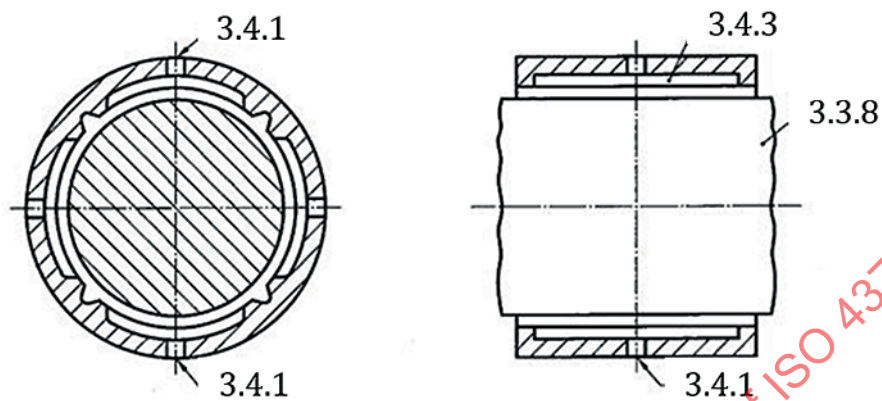


Figure 4 — Hydrostatic bearing

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

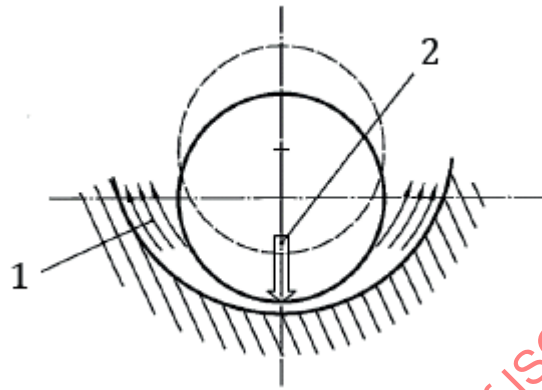
hydrostatic air bearing

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**

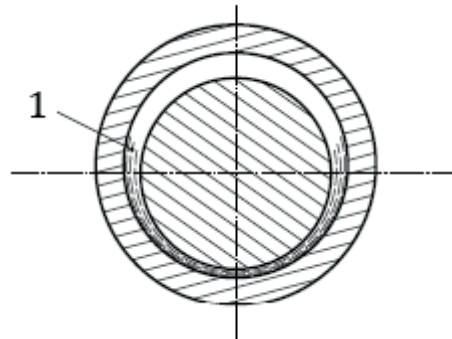
plain bearing (3.1.2) operating under conditions of both hydrostatic and hydrodynamic lubrication

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

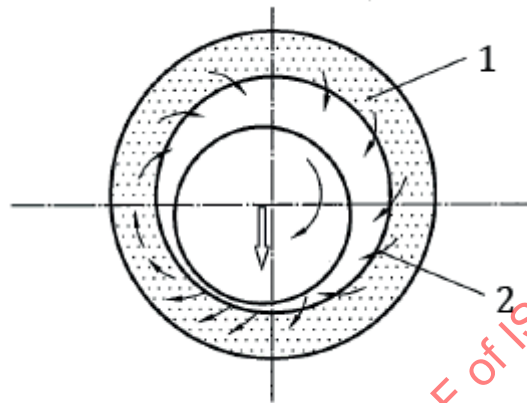
self-lubricating bearing

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

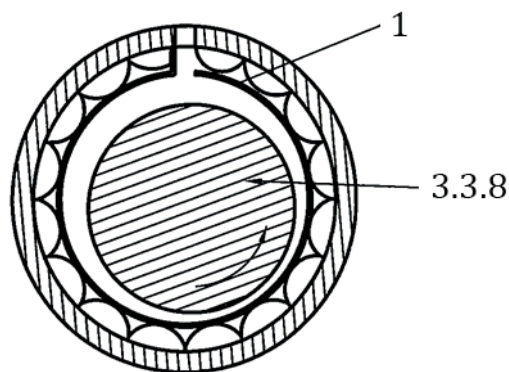
Note 1 to entry: See *plain bearing assembly* ([3.2.4.9](#)).

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

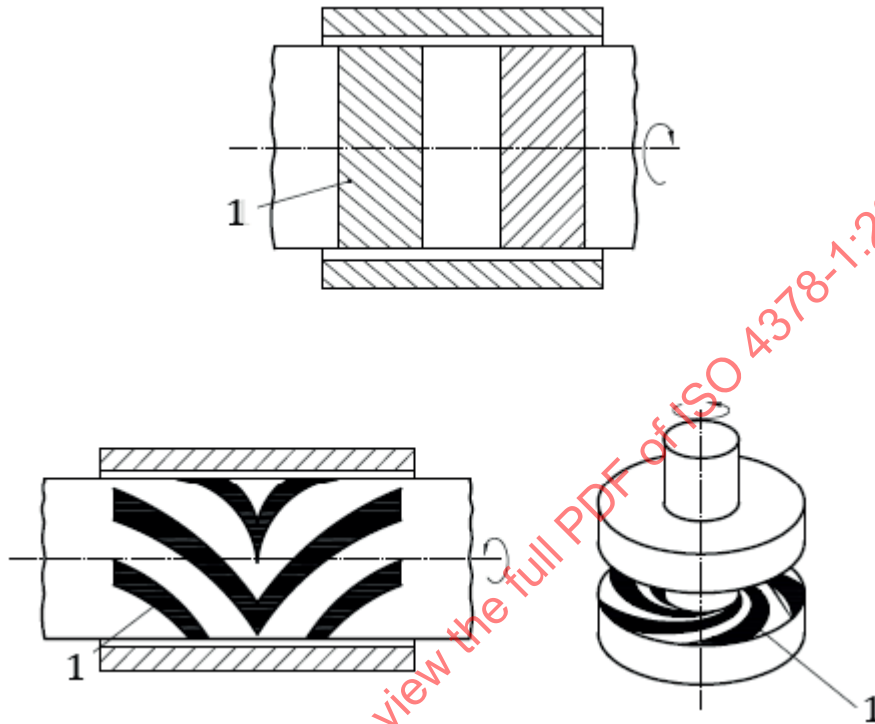
1 foil

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](#).

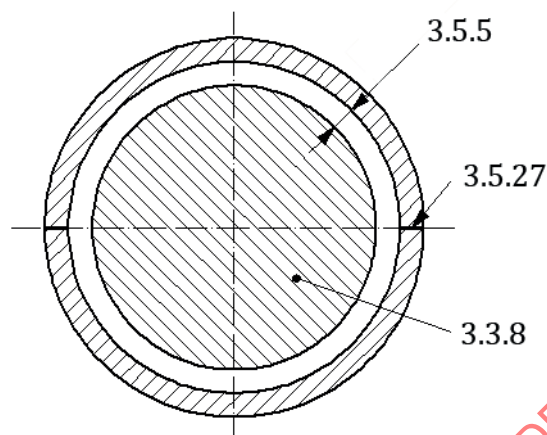


Figure 10 — Circular cylindrical bearing

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](#).

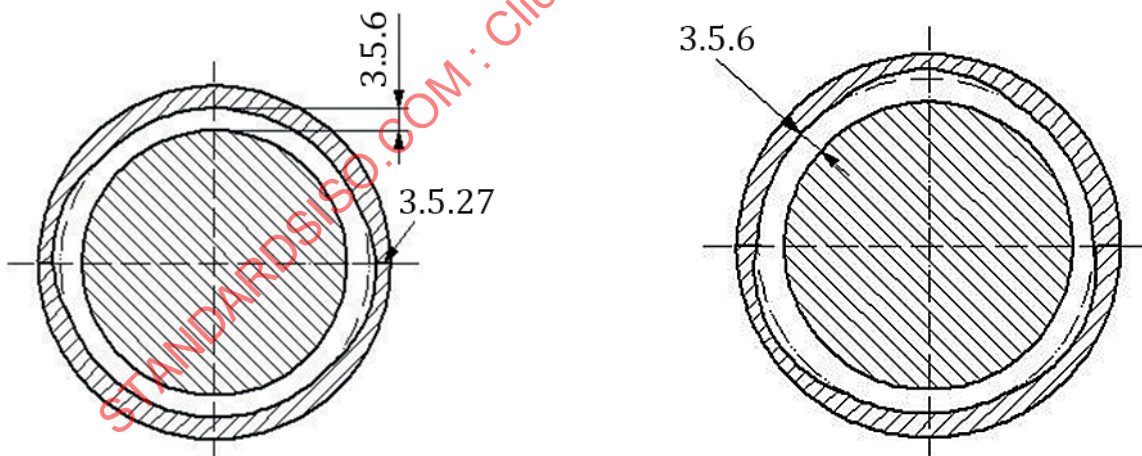


Figure 11 — Profile bore bearing

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](#).

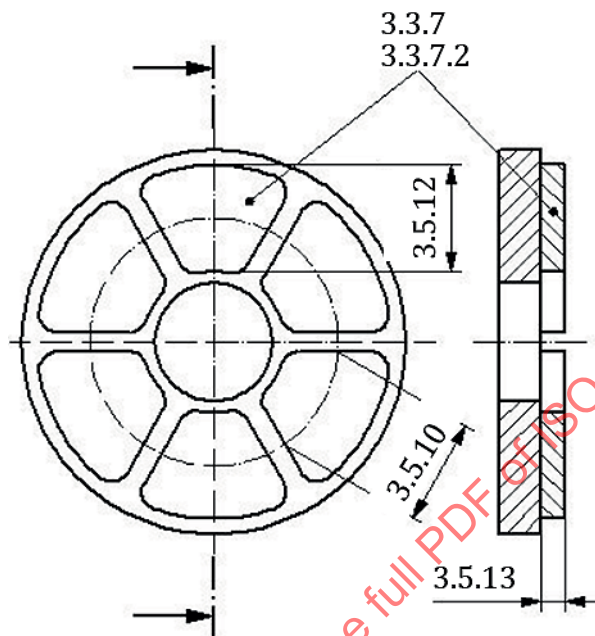


Figure 12 — Pad thrust bearing

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](#).

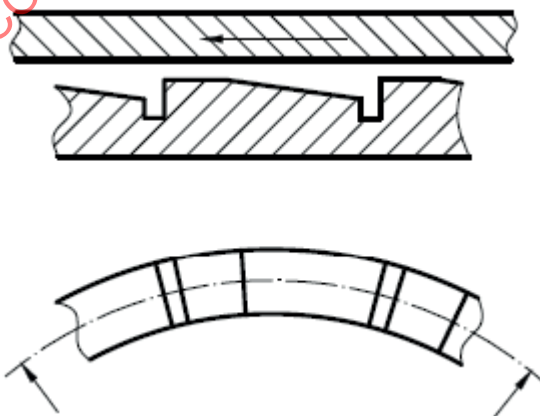


Figure 13 — Taper-land thrust bearing

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](#).

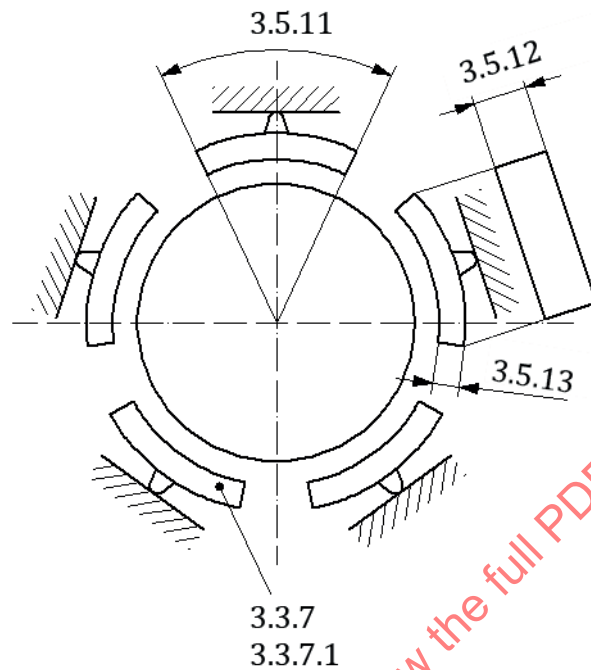


Figure 14 — Tilting pad journal bearing

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](#).

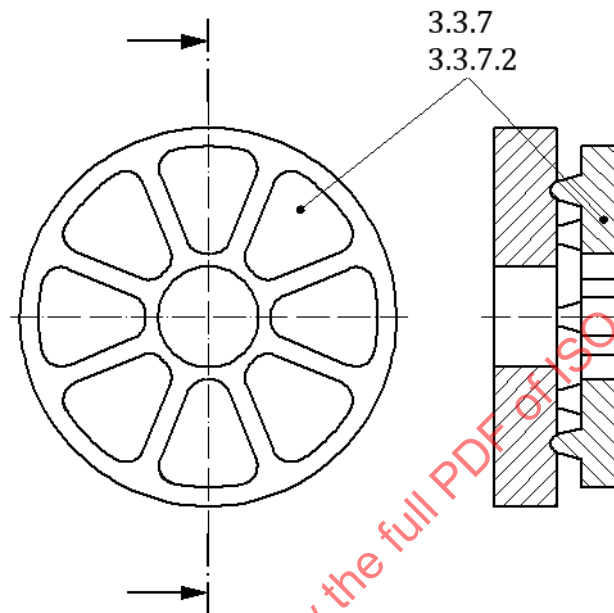


Figure 15 — Tilting pad thrust bearing

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](#).

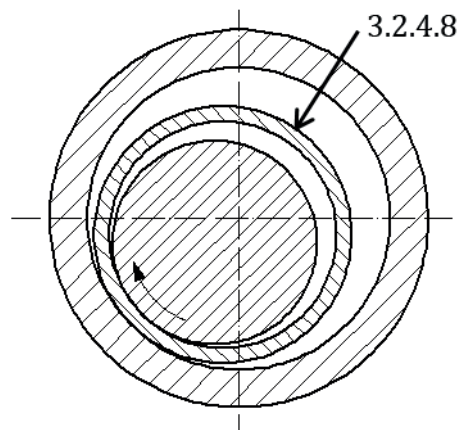


Figure 16 — Floating bush bearing

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](#).

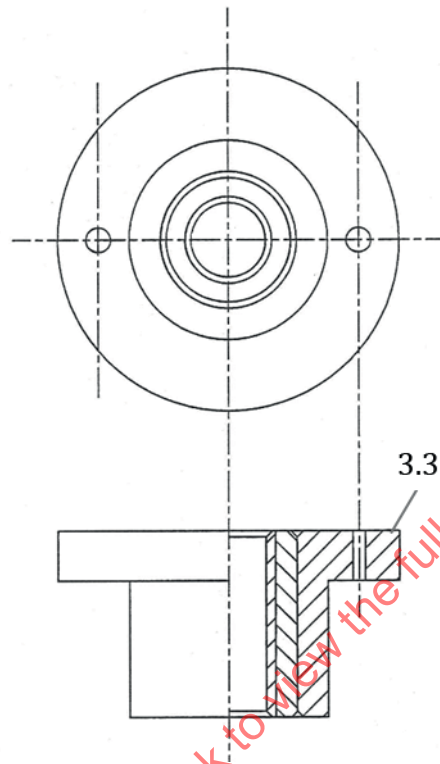


Figure 17 — Plain bearing assembly

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](#).

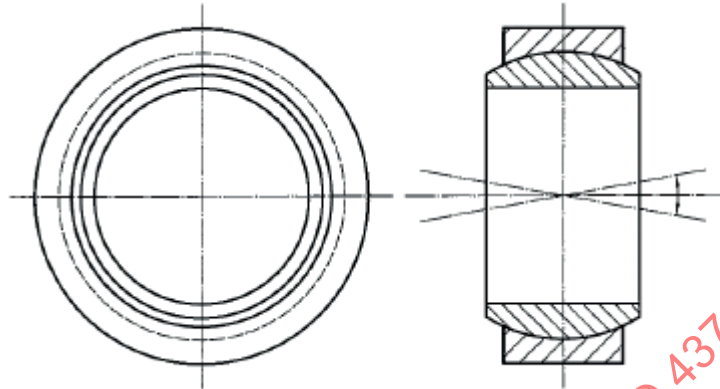


Figure 18 — Self-aligning bearing

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](#).

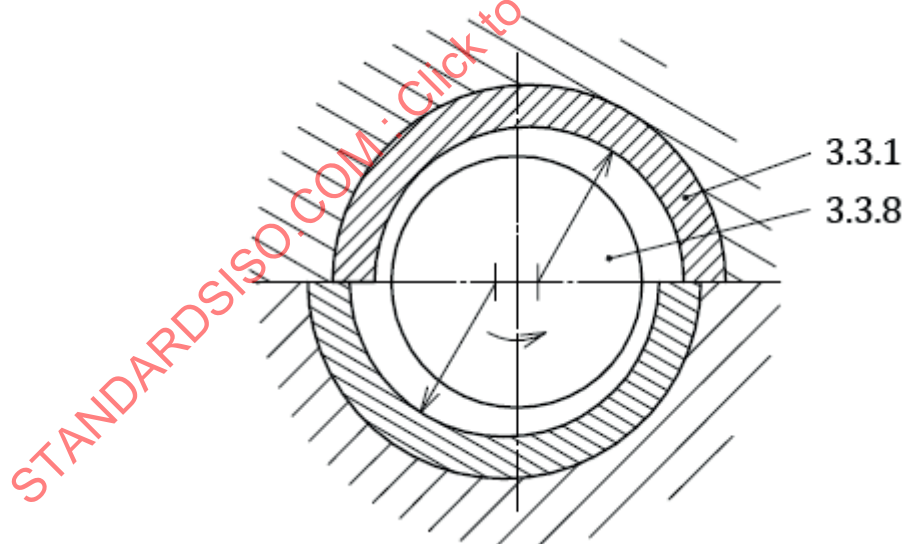


Figure 19 — Offset bearing

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](#).

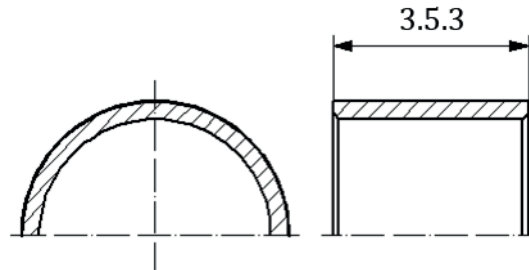


Figure 20 — Half-bearing

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](#).

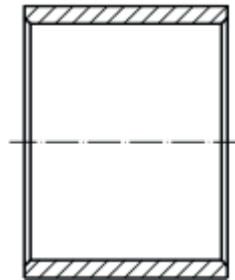


Figure 21 — Plain bearing bush

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](#).

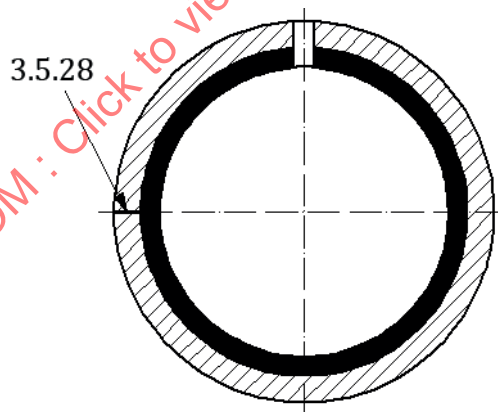


Figure 22 — Plain bearing wrapped bush

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](#).

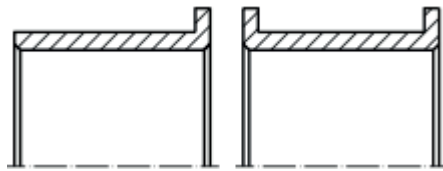


Figure 23 — Flanged half-bearing

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](#).

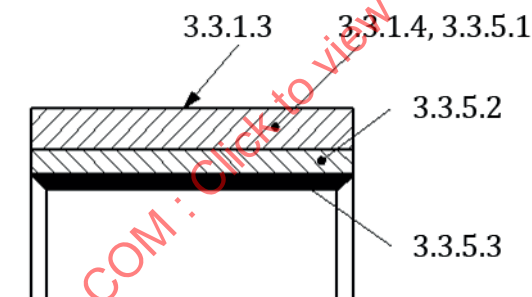


Figure 24 — Multilayer half-bearing

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](#).

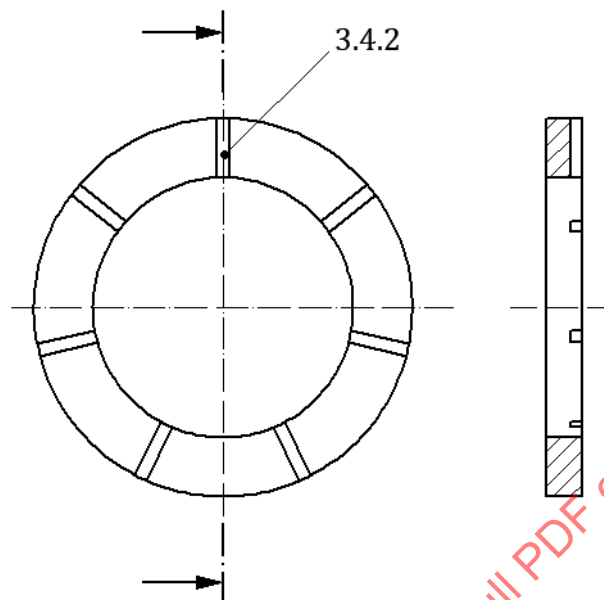


Figure 25 — Thrust washer

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](#).

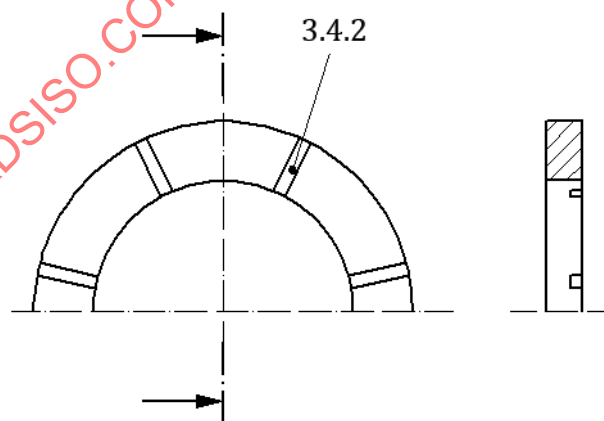


Figure 26 — Thrust half-washer

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](#).

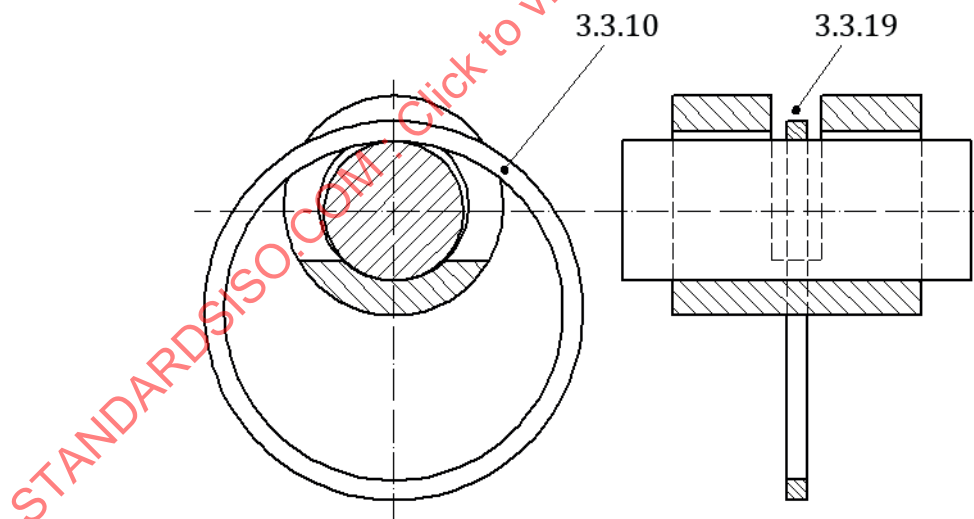


Figure 27 — Oil ring

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](#).

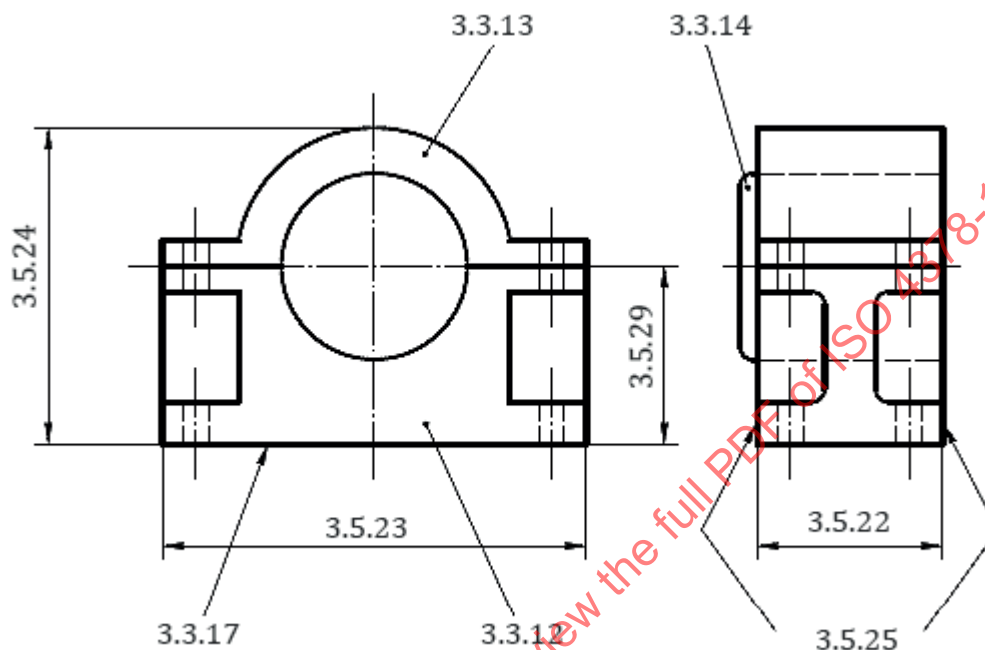


Figure 28 — Plain bearing housing block

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](#).

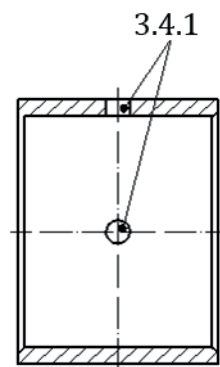


Figure 29 — Oil hole

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](#).

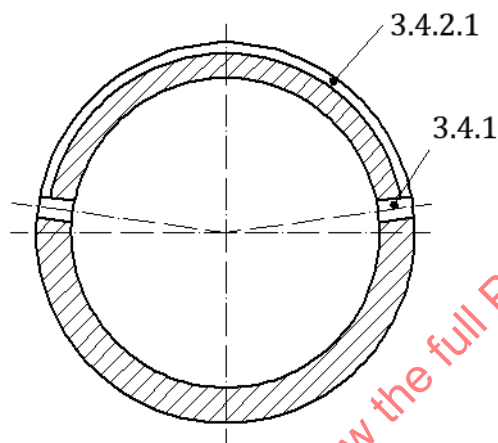


Figure 30 — Outer oil groove

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](#).

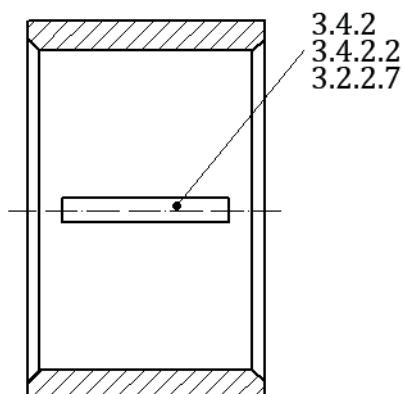


Figure 31 — Longitudinal groove

3.4.2.3**circumferential groove**

lubrication groove (3.4.2) in annular or partially annular form

Note 1 to entry: See [Figure 32](#).

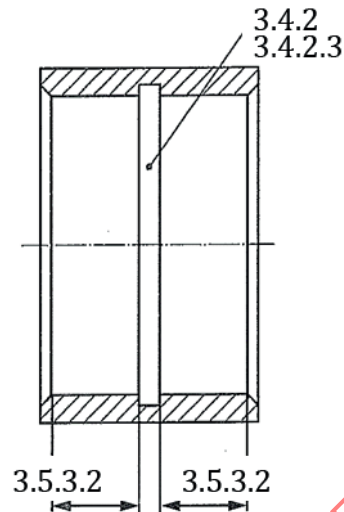


Figure 32 — Circumferential groove

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](#).

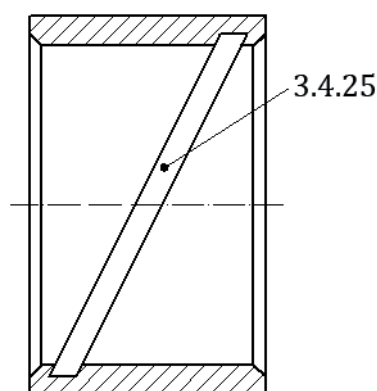


Figure 33 — Helical groove

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](#).

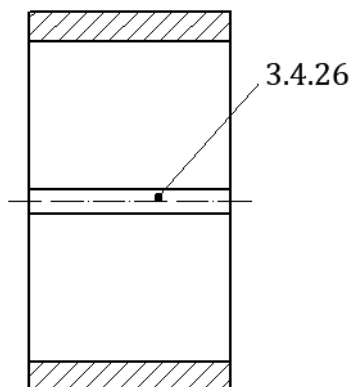


Figure 34 — Open groove

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](#).

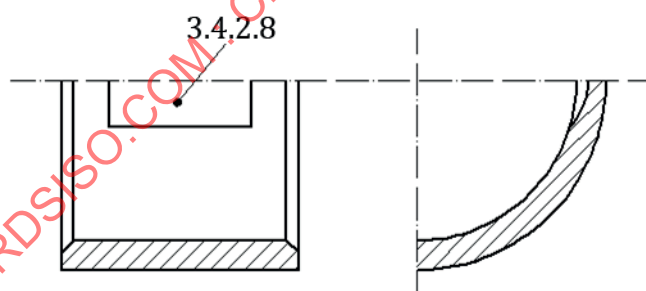


Figure 35 — Gutterway

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](#).

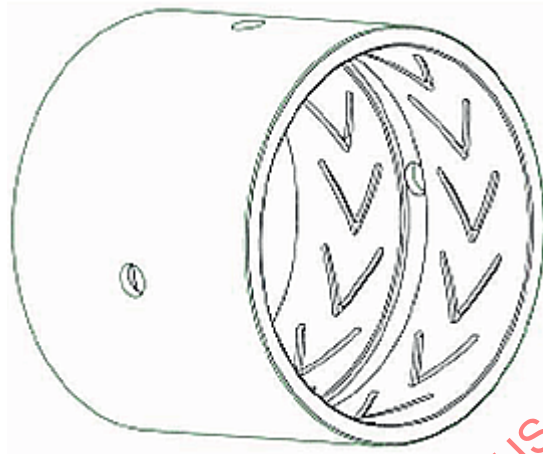


Figure 36 — Chevron groove

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](#).

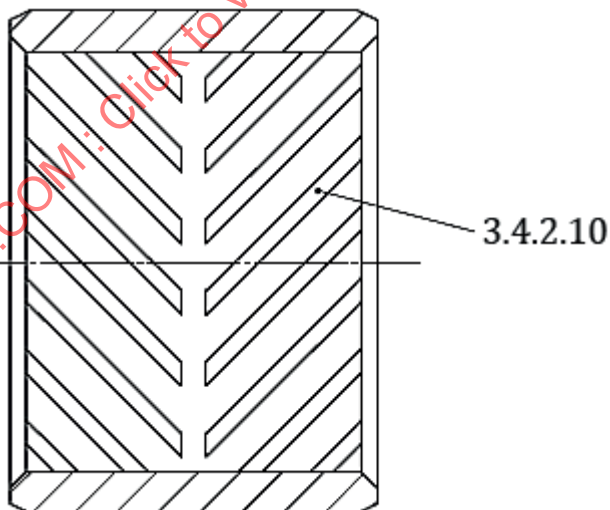


Figure 37 — Herringbone groove

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](#).

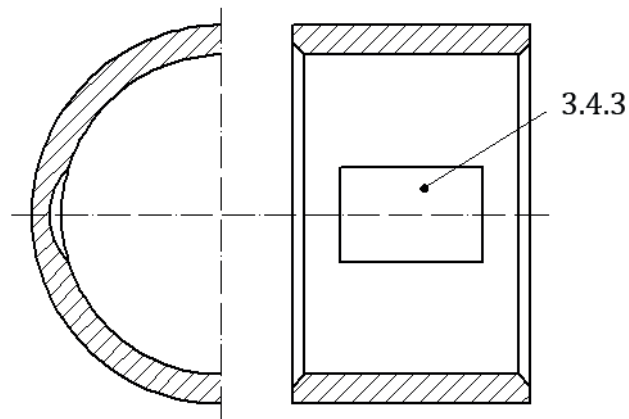


Figure 38 — Oil pocket

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](#).

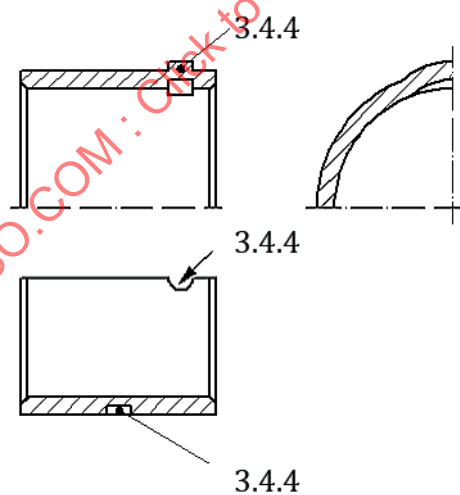


Figure 39 — Locating feature

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](#).

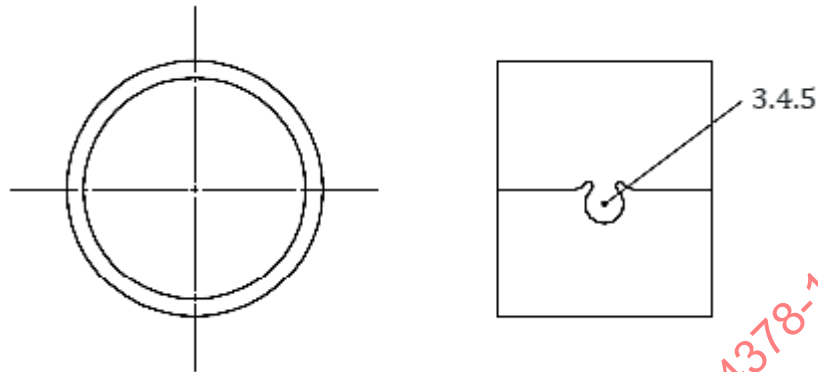


Figure 40 — Clinch

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](#).

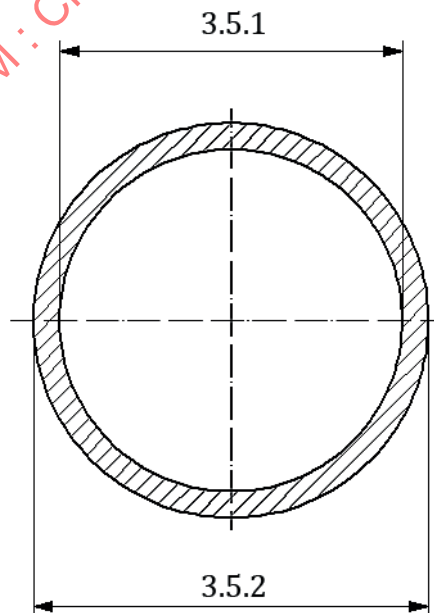


Figure 41 — Journal bearing diameter

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](#).

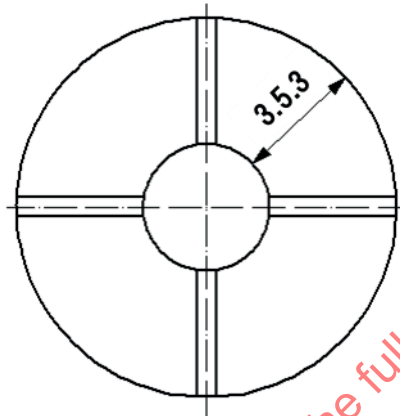


Figure 42 — Bearing width

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](#).