BRITISH STANDARD

BS ISO
13012-2:2009

# Rolling bearings — Accessories for sleeve type linear ball bearings

## Part 2: Boundary dimensions and tolerances for series 5

ICS 21.100.20



BSI
British Standards

# National foreword

This British Standard is the UK implementation of ISO 13012-2:2009.

The UK participation in its preparation was entrusted to Technical Committee MCE/7, Rolling bearings.

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

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2009



**ISBN 978 0 580 59015 3**

**Amendments/corrigenda issued since publication**

| Date | Comments |
|---|---|
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BS ISO 13012-2:2009

INTERNATIONAL STANDARD

**ISO 13012-2**

First edition
2009-02-01

# Rolling bearings — Accessories for sleeve type linear ball bearings —

## Part 2: Boundary dimensions and tolerances for series 5

*Roulements — Accessoires pour douilles à billes linéaires —*

*Partie 2: Dimensions d'encombrement et tolérances pour la série 5*

Reference number
ISO 13012-2:2009(E)



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Published in Switzerland

 

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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.

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

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

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

ISO 13012-2 was prepared by Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 11, *Linear motion rolling bearings*.

ISO 13012 consists of the following parts, under the general title *Rolling bearings — Accessories for sleeve type linear ball bearings*:

— *Part 1: Boundary dimensions and tolerances for series 1 and 3*

— *Part 2: Boundary dimensions and tolerances for series 5*

# Introduction

The use of sleeve type linear ball bearings can be facilitated by the selection of bearing housings, shafts, shaft support blocks and shaft support rails. These items, referred to as accessories, can aid in the application of the sleeve type linear ball bearings to achieve the desired criteria of smooth, accurate, low-friction linear motion free from chatter or stick-slip.

The appropriate selection of bearing housing type, shaft and shaft support should be established between the manufacturer and the user.

This part of ISO 13012 was developed to be used with ISO 10285.

**INTERNATIONAL STANDARD** **ISO 13012-2:2009(E)**

# Rolling bearings — Accessories for sleeve type linear ball bearings —

# Part 2: Boundary dimensions and tolerances for series 5

## 1 Scope

This part of ISO 13012 specifies the boundary dimensions, other relevant dimensions and their tolerances of accessories for sleeve type linear ball bearings which are specified in ISO 10285.

This part of ISO 13012 applies to:

housings —

closed and adjustable flangeless housings for series 5 sleeve type linear ball bearings,

open and open adjustable flangeless housings for series 5 sleeve type linear ball bearings;

shaft support rails —

standard height shaft support rails for series 5 sleeve type linear ball bearings;

shaft support blocks —

flanged shaft support blocks for series 5 sleeve type linear ball bearings;

shafts —

solid and tubular shafts for series 5 sleeve type linear ball bearings.

## 2 Normative references

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

ISO 286-2, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO 1132-1, *Rolling bearings — Tolerances — Part 1: Terms and definitions*

ISO 1302, *Geometrical Product Specifications (GPS) — Indications of surface texture in technical product documentation*

ISO 3754, *Steel — Determination of effective depth of hardening after flame or induction hardening*

ISO 5593, *Rolling bearings — Vocabulary*

ISO 10285:2007, *Rolling bearings — Sleeve type linear ball bearings — Boundary dimensions and tolerances*

ISO 15241, *Rolling bearings — Symbols for quantities*

ISO 24393, *Rolling bearings — Linear motion rolling bearings — Vocabulary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1132-1, ISO 5593, ISO 10285, and ISO 24393 apply.

**3.1**
**flangeless housing**
⟨sleeve type linear ball bearing⟩ bearing housing which has a face with bolt holes or threaded holes for attachment to a support surface nominally parallel to the bearing axis

[ISO 13012-1:2009]

**3.2**
**closed housing**
⟨sleeve type linear ball bearing⟩ bearing housing in which the bearing seating is circumferentially continuous

[ISO 13012-1:2009]

**3.3**
**adjustable housing**
⟨sleeve type linear ball bearing⟩ bearing housing with a longitudinal slit across its bearing seating which facilitates the mechanical adjustment of the bearing seating diameter

[ISO 13012-1:2009]

**3.4**
**open housing**
⟨sleeve type linear ball bearing⟩ bearing housing with a longitudinal section removed to provide clearance over a shaft and support rail unit

[ISO 13012-1:2009]

**3.5**
**open adjustable housing**
⟨sleeve type linear ball bearing⟩ bearing housing which has the features of both open and adjustable sleeve type linear ball bearing housings

[ISO 13012-1:2009]

**3.6**
**shaft support rail**
longitudinal pedestal which provides continuous support to a shaft

NOTE Shaft support rails may be used with open sleeve type linear ball bearings.

[ISO 13012-1:2009]

**3.7**
**shaft support block**
block which provides support to a shaft

NOTE Shaft support blocks are normally used to support the shaft at its ends and can be used with closed sleeve type, adjustable sleeve type or open sleeve type linear ball bearings.

[ISO 13012-1:2009]

**3.8**
**shaft**
basically cylindrical rod along which a linear ball bearing traverses

[ISO 13012-1:2009]

# 4 Symbols

For the purposes of this document, the symbols given in ISO 15241 and the following apply.

The symbols (except those for tolerances) shown in Figures 1 to 5, and the values given in Tables 1 to 6 denote nominal dimensions unless specified otherwise.

NOTE Figures 1 to 5 are drawn schematically and do not necessarily show all design details.

## 4.1 Closed and adjustable flangeless housings for series 5 sleeve type linear ball bearings

See Table 1 and Figure 1.

$A$ (overall) width

$D_a$ seating diameter

$F_w$ bore diameter of ball complement of sleeve type linear ball bearing (reference)

$G$ designation of screw thread of attachment hole

$H$ distance from mounting face to centreline of seating diameter

$H_1$ (overall) height

$J$ centre distance between bolt holes (length)

$J_1$ centre distance between bolt holes (width)

$L$ length of housing

$L_1$ distance from side face to centreline of seating diameter

$N$ diameter of bolt hole

## 4.2 Open and open adjustable flangeless housings for series 5 sleeve type linear ball bearings

See Table 2 and Figure 2.

$A$ (overall) width

$D_a$ seating diameter

$E$ width of sector opening (at diameter $D_a$)

$F_w$ bore diameter of ball complement of sleeve type linear ball bearing (reference)

$G$ designation of screw thread of attachment hole

$H$ distance from mounting face to centreline of seating diameter

$H_1$ (overall) height

$J$ centre distance between bolt holes (length)

$J_1$ centre distance between bolt holes (width)

$L$ length of housing

$L_1$ distance from side face to centreline of seating diameter

$\alpha$ angle of sector opening

### 4.3 Standard height shaft support rails for series 5 sleeve type linear ball bearings

See Table 3 and Figure 3.

$A$ (overall) width

$d$ outside diameter of shaft (reference)

$H$ distance from mounting face to centreline of shaft

$H_1$ height of flange

$J$ centre distance between bolt holes (length)

$J_1$ centre distance between bolt holes (width)

$M$ width of shaft support

$N$ diameter of bolt hole

$N_1$ diameter of bolt hole (shaft attachment)

$\beta$ angle of shaft support

### 4.4 Flanged shaft support blocks for series 5 sleeve type linear ball bearings

See Table 4 and Figure 4.

$A$ (overall) width

$D_a$ seating diameter

$H$ distance from mounting face to centreline of seating diameter

$H_1$ height of flange

$H_2$ (overall) height

$J$ centre distance between bolt holes (length)

$L$ length of base

$N$ diameter of bolt hole

### 4.5 Solid and tubular shafts for series 5 sleeve type linear ball bearings

See Tables 5 and 6, and Figure 5

$d$ outside diameter of shaft

$d_s$ single outside diameter of shaft

$L$ length of shaft

$L_s$ actual length of shaft

$t$ straightness of shaft

$V_{dmp}$ variation of mean outside diameter of shaft

$V_{dsp}$ variation of outside diameter of shaft in a single plane

$\Delta_{ds}$ deviation of a single outside diameter of shaft

$\Delta_{Ls}$ deviation of the actual length of shaft

# 5 Housings

## 5.1 General

To facilitate the design and assembly of sleeve type linear ball bearings, specifically designed housings are available. Included in this part of ISO 13012 are the boundary dimensions and other related dimensions of sleeve type linear ball bearings series 5 as specified in ISO 10285:2007.

The housings specified in Tables 1 and 2, and the corresponding sleeve type linear ball bearings should be supplied by the same producer. The reason for this is that the fixation of the bearings in the housings is specified by the producer and is not covered by this part of ISO 13012.

## 5.2 Housings for series 5 sleeve type linear ball bearings

This part of ISO 13012 includes the following housing designs for series 5 linear ball bearings:

— closed and adjustable flangeless housings for series 5 sleeve type linear ball bearings (Table 1);

— open and open adjustable flangeless housings for series 5 sleeve type linear ball bearings (Table 2).

# 6 Shaft support rails

This part of ISO 13012 includes the following shaft support rails for sleeve type linear ball bearings:

— standard height shaft support rails for series 5 sleeve type linear ball bearings (Table 3).

# 7 Shaft support blocks

This part of ISO 13012 includes the following shaft support blocks for sleeve type linear ball bearings:

— flanged shaft support blocks for series 5 sleeve type linear ball bearings (Table 4).

# 8 Shafts

## 8.1 Material

Shafts covered by this part of ISO 13012 are precision hardened and ground steel shafts in both solid and tubular section. They are manufactured from high quality carbon steel or high quality carbon chrome steel and are either surface hardened or through hardened.

## 8.2 Heat treatment

### 8.2.1 Surface hardened shafts

The cylindrical surface of the shafts is heat treated to provide a basically uniform effective depth of hardening and a surface hardness of not less than 653 HV (58 HRC) over the entire operating length. The effective depth of hardening shall be determined in accordance with ISO 3754. This effective depth of hardening is the distance from the outside surface of the shaft to a material layer at which the hardness is approximately 80 % of the specified minimum surface hardness. End faces of shafts may remain unhardened.

#### 8.2.2 Through hardened shafts

The shafts shall be heat treated to give a surface hardness of no less than 653 HV (58 HRC) over the entire operating length.

### 8.3 Geometrical tolerances

#### 8.3.1 Tolerance class

The precision hardened and ground solid and tubular shafts are specified in one diameter tolerance class to match the sleeve type linear ball bearing and housing series 5.

#### 8.3.2 Geometric form

The geometric form of the tolerance class is controlled by the following features:

a) circularity (roundness): variation of shaft outside diameter in a single plane;

b) cylindricity (taper, concavity, convexity): variation of mean shaft outside diameter;

c) straightness (per metre).

These tolerances for the class are shown in Table 5. A method for measuring straightness is illustrated in Figure 5 and defined in Table 5.

#### 8.3.3 Shaft length tolerances

These tolerances are given in Table 6.

#### 8.3.4 Chamfers

The shaft ends are provided with chamfers to facilitate entry of the shaft into the sleeve type linear ball bearing. The ends of shafts with machined end faces are usually provided with chamfers that are shallow in the radial direction and long in the axial direction. The length of the chamfer is shown in Table 5. Shafts for use with sealed sleeve type linear ball bearings shall have a chamfer angle less than 30°.

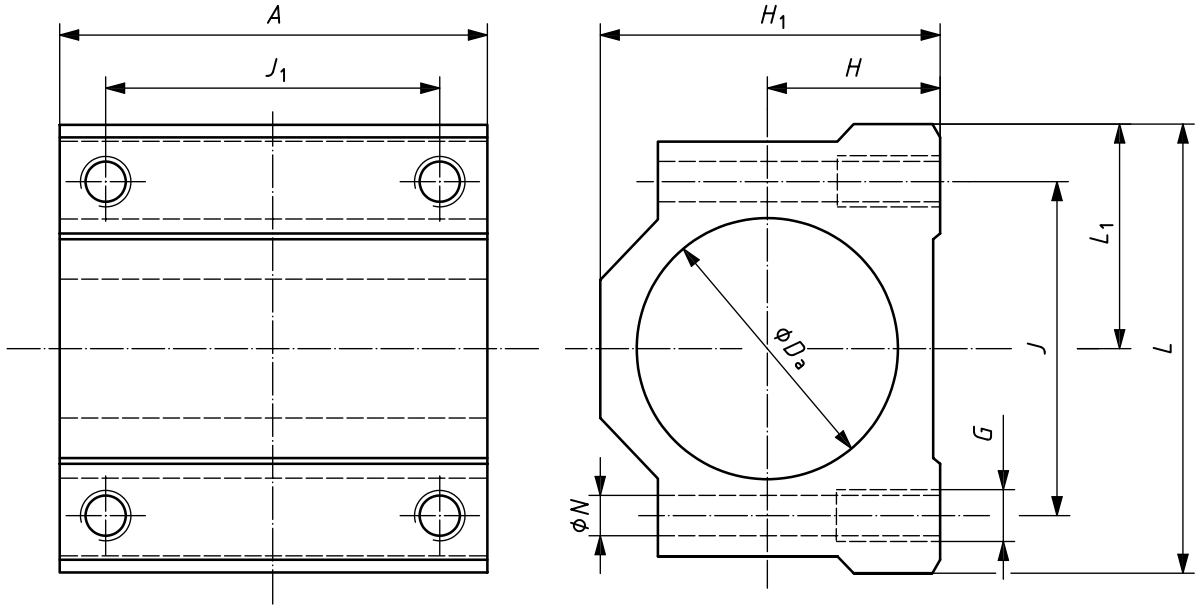
#### 8.3.5 Surface roughness

The roughness of the cylindrical surface of the steel shaft is given in Table 5 in accordance with ISO 1302.

## 9 Boundary dimensions and tolerances

### 9.1 Housings

Boundary dimensions and tolerances for housings are given in Tables 1 and 2.




NOTE This figure shows a closed type housing.

**Figure 1 — Closed and adjustable flangeless housings for series 5 sleeve type linear ball bearings**

**Table 1 — Closed and adjustable flangeless housings for series 5 sleeve type linear ball bearings**

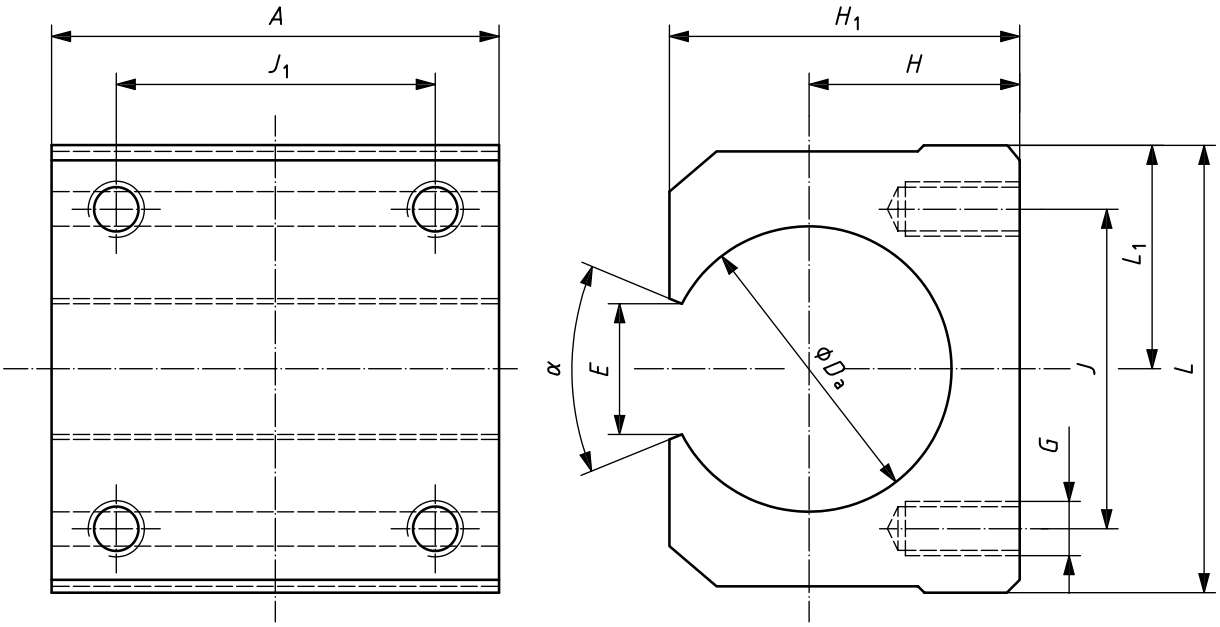
Dimensions in millimetres

| | | | | | | | Type 1 | | Type 2 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $F_w$ Ref. | $D_a$ H7 [a] | $H$ [b] ± 0,02 | $H_1$ max. | $L$ max. | $L_1$ ± 0,02 | $J$ | $A$ max. | $J_1$ | $A$ max. | $J_1$ | $N$ | $G$ |
| 6 | 12 | 9 | 18,5 | 30 | 15 | 20 | 25 | 15 | 48 | 36 | 3,4 | M4 |
| 8 | 15 | 11 | 22,5 | 34 | 17 | 24 | 30 | 18 | 58 | 42 | 3,4 | M4 |
| 10 | 19 | 13 | 26,5 | 40 | 20 | 28 | 35 | 21 | 68 | 46 | 4,3 | M5 |
| 12 | 21 | 15 | 29 | 42 | 21 | 30,5 | 36 | 26 | 70 | 50 | 4,3 | M5 |
| 13 | 23 | 15 | 30,5 | 44 | 22 | 33 | 39 | 26 | 75 | 50 | 4,3 | M5 |
| 16 | 28 | 19 | 39 | 50 | 25 | 36 | 44 | 34 | 85 | 60 | 4,3 | M5 |
| 20 | 32 | 21 | 42 | 54 | 27 | 40 | 50 | 40 | 96 | 70 | 5,2 | M6 |
| 25 | 40 | 26 | 52 | 76 | 38 | 54 | 67 | 50 | 130 | 100 | 7 | M8 |
| 30 | 45 | 30 | 60 | 78 | 39 | 58 | 72 | 58 | 140 | 110 | 7 | M8 |
| 35 | 52 | 34 | 68,5 | 90 | 45 | 70 | 80 | 60 | 155 | 120 | 7 | M8 |
| 40 | 60 | 40 | 78,5 | 102 | 51 | 80 | 90 | 60 | 175 | 140 | 8,7 | M10 |
| 50 | 80 | 52 | 102,5 | 122 | 61 | 100 | 110 | 80 | 215 | 160 | 8,7 | M10 |
| 60 | 90 | 58 | 114,5 | 132 | 66 | 108 | 122 | 90 | 240 | 180 | 10,7 | M12 |

NOTE Type 1 housings are designed to be combined with one linear bearing and Type 2 housings are designed to be combined with two linear bearings.

[a] Seating diameter tolerance (see ISO 286-2).

[b] The dimension $H$ shall be measured with the nominal seating bore diameter. For adjustable type housings the tolerance for $D_a$ shall apply before the housing is split.




NOTE This figure shows an open type housing.

**Figure 2 — Open and open adjustable flangeless housings for series 5 sleeve type linear ball bearings**

**Table 2 — Open and open adjustable flangeless housings for series 5 sleeve type linear ball bearings**

Dimensions in millimetres and angles in degrees

| $F_w$ Ref. | $D_a$ [a] JS7 [b] | $H$ [c] ± 0,02 | $H_1$ max. | $L$ | $L_1$ ± 0,02 | $A$ max. | $J$ | $J_1$ | $G$ | $\alpha$ min. | $E$ min. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 23 | 17 | 28 | 40 | 20 | 39 | 28 | 26 | M5 | 80 | 14,8 |
| 16 | 28 | 20 | 34 | 45 | 22,5 | 45 | 32 | 30 | M5 | 80 | 17,7 |
| 20 | 32 | 23 | 39 | 48 | 24 | 50 | 35 | 35 | M6 | 60 | 16 |
| 25 | 40 | 28 | 48 | 60 | 30 | 65 | 40 | 40 | M6 | 50 | 16,9 |
| 30 | 45 | 33 | 56 | 70 | 35 | 70 | 50 | 50 | M8 | 50 | 19 |
| 35 | 52 | 37 | 63 | 80 | 40 | 80 | 55 | 55 | M8 | 50 | 22 |
| 40 | 60 | 42 | 72 | 90 | 45 | 90 | 65 | 65 | M10 | 50 | 25,4 |
| 50 | 80 | 53 | 92 | 120 | 60 | 110 | 94 | 80 | M10 | 50 | 33,8 |

[a] Diameter $D_a$ can only be measured when housing is fastened to a plane surface.

[b] Seating diameter tolerance (see ISO 286-2).

[c] The dimension $H$ shall be measured with the nominal seating bore diameter.

## 9.2 Shaft support rails

Boundary dimensions are given in Table 3.

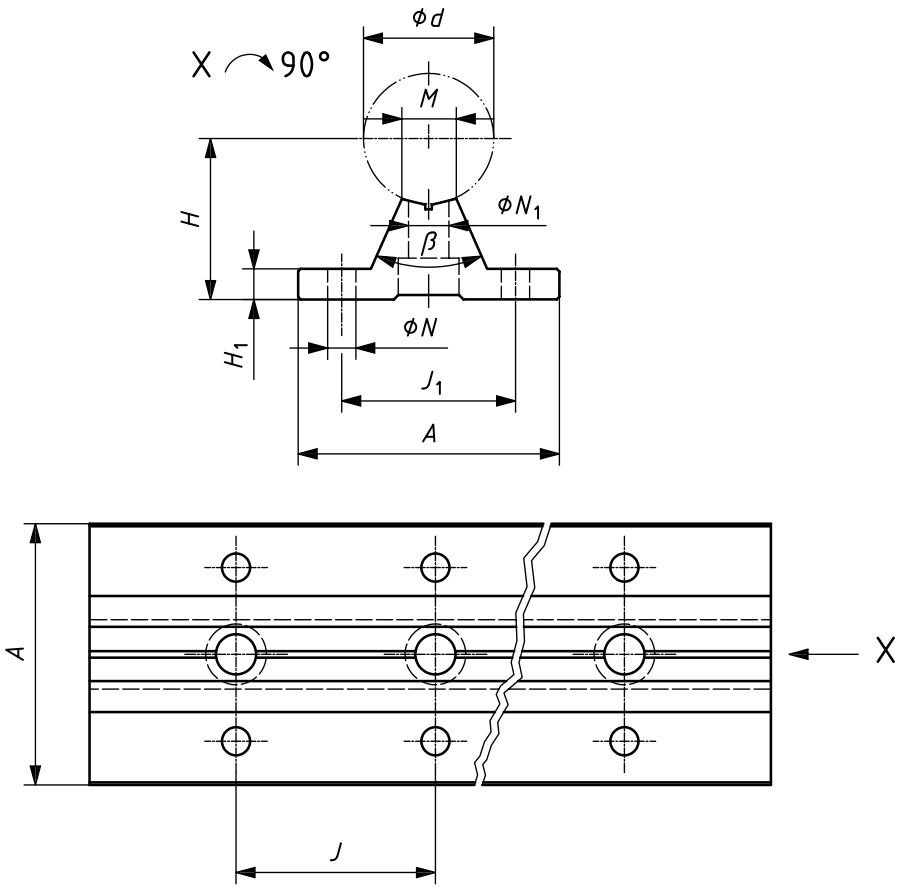



**Figure 3 — Standard height shaft support rails for series 5 sleeve type linear ball bearings**

**Table 3 — Standard height shaft support rails for series 5 sleeve type linear ball bearings**

Dimensions in millimetres and angles in degrees

| $d$ Ref. | $H$ [a] ± 0,02 | $A$ max. | $H_1$ ± 0,5 | $J_1$ | $J$ | $M$ max. | $N$ | $N_1$ | $\beta$ max. |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 18 | 32 | 4 | 22 | 100 | 4,7 | 4,5 | 4,5 | 80 |
| 13 | 21 | 34 | 4,5 | 25 | 100 | 6,5 | 4,5 | 4,5 | 80 |
| 16 | 25 | 40 | 5 | 30 | 100 | 8 | 5,5 | 5,5 | 80 |
| 20 | 27 | 45 | 5 | 30 | 100 | 8,5 | 5,5 | 6,6 | 50 |
| 25 | 32 | 55 | 6 | 35 | 120 | 10,6 | 6,6 | 6,6 | 50 |
| 30 | 37 | 60 | 7 | 40 | 150 | 12,7 | 6,6 | 9 | 50 |
| 35 | 43 | 65 | 8 | 45 | 200 | 14,8 | 9 | 9 | 50 |
| 40 | 48 | 75 | 9 | 55 | 300 | 16,9 | 9 | 9 | 50 |
| 50 | 62 | 95 | 11 | 70 | 300 | 20 | 11 | 11 | 50 |

[a] The dimension $H$ shall be measured with the nominal shaft diameter under mounting condition.

## 9.3 Shaft support blocks

Boundary dimensions are given in Table 4.

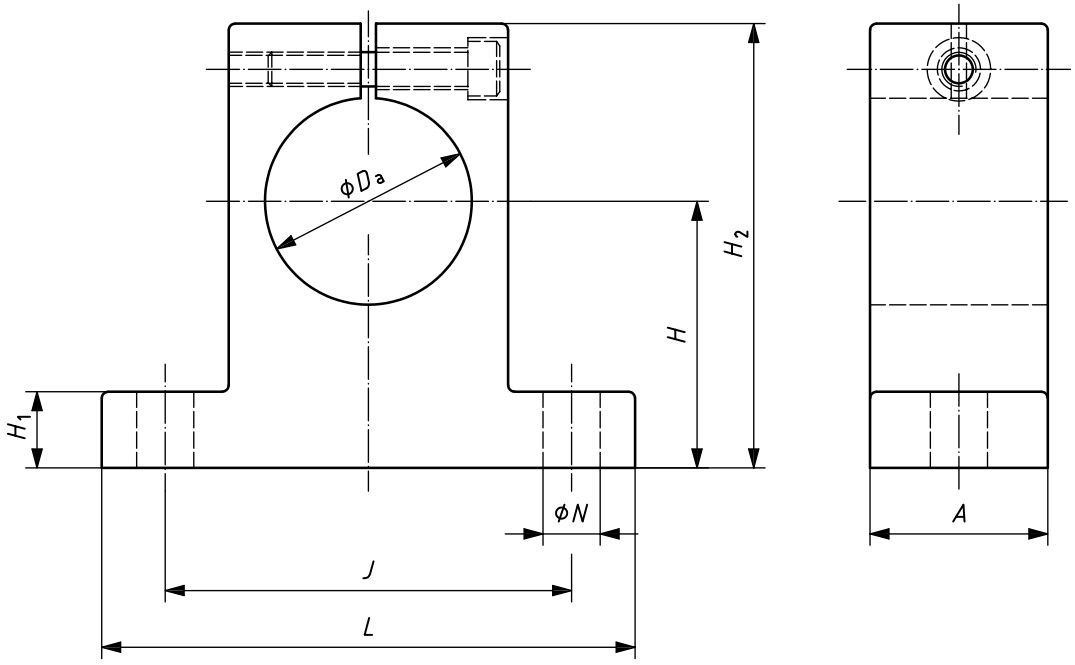



**Figure 4 — Flanged shaft support blocks for series 5 sleeve type linear ball bearings**

**Table 4 — Flanged shaft support blocks for series 5 sleeve type linear ball bearings**

Dimensions in millimetres

| $D_a$ H8 [a] | $H$ [b] ± 0,02 | $A$ max. | $J$ | $N$ | $L$ max. | $H_1$ max. | $H_2$ max. |
|---|---|---|---|---|---|---|---|
| 10 | 20 | 14,5 | 32 | 5,5 | 42,5 | 6,5 | 33 |
| 12 | 23 | 14,5 | 32 | 5,5 | 42,5 | 6,5 | 38 |
| 13 | 23 | 14,5 | 32 | 5,5 | 42,5 | 6,5 | 38 |
| 16 | 27 | 16,5 | 38 | 5,5 | 48,5 | 8,5 | 44,5 |
| 20 | 31 | 20,5 | 45 | 6,6 | 60,5 | 10,5 | 51,5 |
| 25 | 35 | 24,5 | 56 | 6,6 | 70,5 | 12,5 | 60,5 |
| 30 | 42 | 28,5 | 64 | 9 | 84,5 | 12,5 | 70,5 |
| 35 | 50 | 33 | 74 | 11 | 100 | 15,5 | 87 |
| 40 | 60 | 37 | 90 | 11 | 120 | 18 | 104 |
| 50 | 70 | 40 | 100 | 13,5 | 140 | 20 | 122 |
| 60 | 80 | 46 | 120 | 13,5 | 165 | 21 | 140 |

[a] Seating diameter tolerance (see ISO 286-2). The tolerance shall apply before the support block is split.

[b] The dimension $H$ shall be measured with the nominal shaft seating bore diameter.

## 9.4 Shafts

Boundary dimensions and tolerances are given in Tables 5 and 6.

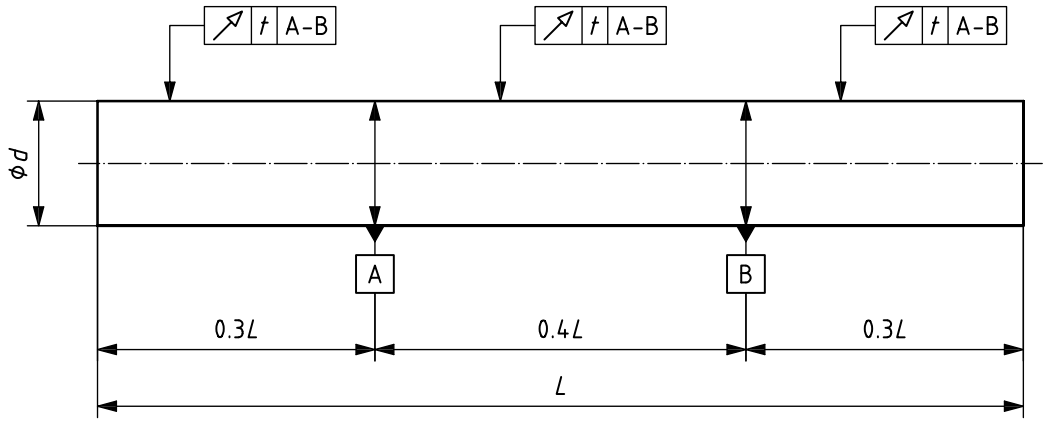



**Figure 5 — Solid and tubular shafts for series 5 sleeve type linear ball bearings**

**Table 5 — Solid and tubular shafts for series 5 sleeve type linear ball bearings**

| $d$ | $\Delta_{ds}$ | | $V_{dsp}$ | $V_{dmp}$ | $t$ **Straightness** [a] | **Surface roughness** $Ra$ | **Effective depth of hardening** [b] | **Length of chamfer** |
|---|---|---|---|---|---|---|---|---|
| mm | μm | | μm | μm | μm/m | μm | mm | mm |
| | high | low | max. | max. | max. | max. | min. | min. |
| 3 | −8 | −14 | 3 | 4 | 150 | 0,32 | 0,4 | 0,8 |
| 4 | −8 | −16 | 4 | 5 | 150 | 0,32 | 0,4 | 0,8 |
| 5 | −8 | −16 | 4 | 5 | 150 | 0,32 | 0,4 | 1 |
| 6 | −9 | −17 | 4 | 5 | 150 | 0,32 | 0,4 | 1 |
| 8 | −9 | −18 | 4 | 6 | 120 | 0,32 | 0,4 | 1 |
| 10 | −9 | −18 | 4 | 6 | 120 | 0,32 | 0,4 | 1 |
| 12 | −9 | −20 | 5 | 8 | 100 | 0,32 | 0,6 | 1,5 |
| 13 | −9 | −20 | 5 | 8 | 100 | 0,32 | 0,6 | 1,5 |
| 16 | −9 | −20 | 5 | 8 | 100 | 0,32 | 0,6 | 1,5 |
| 20 | −10 | −23 | 6 | 9 | 100 | 0,32 | 0,9 | 1,5 |
| 25 | −10 | −23 | 6 | 9 | 100 | 0,32 | 0,9 | 1,5 |
| 30 | −10 | −23 | 6 | 9 | 100 | 0,32 | 0,9 | 1,5 |
| 35 | −12 | −28 | 7 | 11 | 100 | 0,32 | 1,5 | 2,5 |
| 40 | −12 | −28 | 7 | 11 | 100 | 0,32 | 1,5 | 2,5 |
| 50 | −12 | −28 | 7 | 11 | 100 | 0,32 | 1,5 | 2,5 |
| 60 | −15 | −34 | 8 | 13 | 100 | 0,32 | 2,2 | 2,5 |
| 80 | −15 | −34 | 8 | 13 | 100 | 0,32 | 2,2 | 2,5 |
| 100 | −20 | −42 | 10 | 15 | 100 | 0,32 | 3,2 | 3,5 |

NOTE These shafts are only suitable for use in combination with sleeve type linear ball bearings of series 5 as specified in ISO 10285:2007.

[a] Straightness specifications measured as in Figure 5. Measurements are taken at points equidistant between support points and overhanging end of the shaft. A shaft, when supported as shown and rotated through 360° shall not cause a total indicator reading (TIR) in excess of the straightness tolerance stated above. The TIR values given by this measurement method are double the real shaft straightness tolerance values.

[b] For surface hardened shafts.

**Table 6 — Shaft length tolerances for series 5**

Dimensions and tolerance values in millimetres

| $L$ | | $\Delta_{Ls}$ | |
|---|---|---|---|
| > | ⩽ | high | low |
| 30 | 120 | +0,3 | –0,3 |
| 120 | 400 | +0,5 | –0,5 |
| 400 | 1 000 | +0,8 | –0,8 |
| 1 000 | 2 000 | +1,2 | –1,2 |
| 2 000 | 4 000 | +2 | –2 |
| 4 000 | 8 000 | +3 | –3 |

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