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

**Part 1:
Boundary dimensions, geometrical
product specifications (GPS) and
tolerances for series 1 and 3**

Roulements — Accessoires pour douilles à billes linéaires —

*Partie 1: Dimensions d'encombrement, spécification géométrique des
produits (GPS) et tolérances pour les séries 1 et 3*



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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 of 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 www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 13012-1:2009), which has been technically revised. The main changes compared to the previous edition are as follows:

- Change of title;
- Change of scope;
- Update of normative references;
- Revision of terms, definitions, symbols and dimensional tolerance indications in figures and tables according to rules of geometrical product specification (GPS) system;
- Deletion of F_w 35 and L_1 ;
- Inclusion of [Tables 2, 4, 6, 8, 10, 12, 14, 16, 18](#);
- Inclusion of a bibliography.

A list of all the parts in the ISO 13012 series can be found on the ISO website.

This document was developed to be used in conjunction with ISO 10285.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a machine element geometry standard as defined in the geometrical product specification system (GPS system) as presented in matrix model of ISO 14638^[5].

The fundamental rules of ISO/GPS given in ISO 8015^[2] apply to this document and the default decision rules given in ISO 14253-1^[3] apply to specifications made in accordance with this document, unless otherwise indicated.

The connection between functional requirements, measuring technique and measuring uncertainty is always intended to be considered. For measurement uncertainty, it is intended that ISO 14253-2^[4] be considered.

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 and 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.

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Rolling bearings — Accessories for sleeve type linear ball bearings —

Part 1:

Boundary dimensions, geometrical product specifications (GPS) and tolerances for series 1 and 3

1 Scope

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

This document applies to:

- the following housings:
 - closed and adjustable flangeless housings for series 1 sleeve type linear ball bearings,
 - closed and adjustable flanged housings for series 3 sleeve type linear ball bearings,
 - open flanged housings for series 3 sleeve type linear ball bearings,
 - closed and adjustable flangeless housings for series 3 sleeve type linear ball bearings,
 - open and open adjustable flangeless housings for series 3 sleeve type linear ball bearings;
- the following shaft support rails:
 - standard height shaft support rails for series 3 sleeve type linear ball bearings,
 - low height shaft support rails for series 3 sleeve type linear ball bearings;
- the following shaft support blocks:
 - flanged shaft support blocks for series 1 and 3 sleeve type linear ball bearings,
 - flangeless shaft support blocks for series 1 and 3 sleeve type linear ball bearings;
- solid and tubular shafts for series 1 and 3 sleeve type linear ball bearings.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1132-1, *Rolling bearings — Tolerances — Part 1: Terms and definitions*

ISO 5593, *Rolling bearings — Vocabulary*

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

ISO 15241, *Rolling bearings — Symbols for physical quantities*

ISO 18203, *Steel — Determination of the thickness of surface-hardened layers*

3 Terms and definitions

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

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

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

3.2

flanged housing

<sleeve type linear ball bearing> bearing housing which has a mounting face with projecting lugs having bolt holes for attachment to a support surface nominally parallel to the bearing axis

3.3

closed housing

<sleeve type linear ball bearing> bearing housing in which the bearing seating is circumferentially continuous

3.4

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

3.5

open housing

<sleeve type linear ball bearing> bearing housing with a longitudinal section removed to provide clearance over a *shaft* (3.9) and support rail unit

3.6

open adjustable housing

<sleeve type linear ball bearing> bearing housing which has the features of both *open* (3.5) and *adjustable* (3.4) sleeve type linear ball bearing housings

3.7

shaft support rail

longitudinal pedestal which provides continuous support to a *shaft* (3.9)

Note 1 to entry: Shaft support rails may be used with open sleeve type linear ball bearings.

3.8

shaft support block

block which provides support to a *shaft* (3.9)

Note 1 to entry: 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.

3.9

shaft

basically cylindrical rod along which a linear ball bearing traverses

4 Symbols

4.1 General

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 10](#) and the values given in [Tables 1 to 20](#) denote nominal dimensions, unless specified otherwise.

NOTE [Figures 1 to 10](#) are drawn schematically and do not necessarily show all design details.

Tolerance values associated to a characteristic are symbolized by t followed by the symbol of characteristic, for example, t_{p1} .

In this document, the ISO default specification operator for size is according to ISO 14405-1, i.e. the two-point size is valid.

4.2 Closed and adjustable flangeless housings for series 1 sleeve type linear ball bearings

See [Tables 1 and 2](#) 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 a 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)
L	length of housing
N	diameter of bolt hole
t_{p1}	position tolerance of bore in correlation to mounting surface
t_{p2}	position tolerance of threaded holes in correlation to mounting surface and mounting reference surface
t_{p3}	position tolerance of bore in correlation to mounting surface

4.3 Closed and adjustable flanged housings for series 3 sleeve type linear ball bearings

See [Tables 3 and 4](#) and [Figure 2](#).

A	(overall) width
A_1	width of seating
D_a	seating diameter
F_w	bore diameter of ball complement of sleeve type linear ball bearing (reference)
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)
J_1	centre distance between bolt holes (width)
L	length of housing
N	diameter of bolt hole
t_{p1}	position tolerance of bore in correlation to mounting surface
t_{p2}	position tolerance of threaded holes in correlation to mounting surface and mounting reference surface
t_{p3}	position tolerance of bore in correlation to mounting surface

4.4 Open flanged housings for series 3 sleeve type linear ball bearings

See [Tables 5](#) and [6](#) and [Figure 3](#).

A	(overall) width
A_1	width of seating
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)
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)
J_1	centre distance between bolt holes (width)
L	length of housing
N	diameter of bolt hole
t_{p1}	position tolerance of bore in correlation to mounting surface
t_{p2}	position tolerance of threaded holes in correlation to mounting surface and mounting reference surface
t_{p3}	position tolerance of bore in correlation to mounting surface
α	angle of sector opening

4.5 Closed and adjustable flangeless housings for series 3 sleeve type linear ball bearings

See [Tables 7](#) and [8](#) and [Figure 4](#).

A	(overall) width
D_a	seating diameter
F_w	bore diameter of ball complement of sleeve type linear ball bearing (reference)
G	designation of a 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
N	diameter of bolt hole
t_{p1}	position tolerance of bore in correlation to mounting surface
t_{p2}	position tolerance of threaded holes in correlation to mounting surface and mounting reference surface
t_{p3}	position tolerance of bore in correlation to mounting surface

4.6 Open and open adjustable flangeless housings for series 3 sleeve type linear ball bearings

See [Tables 9](#) and [10](#) and [Figure 5](#).

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 a 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
N	diameter of bolt hole
t_{p1}	position tolerance of bore in correlation to mounting surface

- t_{p2} position tolerance of threaded holes in correlation to mounting surface and mounting reference surface
- t_{p3} position tolerance of bore in correlation to mounting surface
- α angle of sector opening

4.7 Standard height shaft support rails for series 3 sleeve type linear ball bearings

See [Tables 11](#) and [12](#) and [Figure 6](#).

- 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)
- t_{p1} position tolerance of centreline of shaft in correlation to mounting surface
- t_{p2} position tolerance of centreline of shaft in correlation to mounting reference surface
- t_{p3} position tolerance of mounting holes in correlation to mounting surface and mounting reference surface

4.8 Low height shaft support rails for series 3 sleeve type linear ball bearings

See [Tables 13](#) and [14](#) and [Figure 7](#).

- A (overall) width
- d outside diameter of shaft (reference)
- H distance from mounting face to centreline of shaft
- H_1 height of flange
- H_2 distance from mounting face to top of attachment screw head
- 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)

t_{p1}	position tolerance of centreline of shaft in correlation to mounting surface
t_{p2}	position tolerance of centreline of shaft in correlation to mounting reference surface
t_{p3}	position tolerance of mounting holes in correlation to mounting surface and mounting reference surface
β	angle of shaft support

4.9 Flanged shaft support blocks for series 1 and 3 sleeve type linear ball bearings

See [Tables 15](#) and [16](#) and [Figure 8](#).

A	(overall) width
D_a	seating diameter
F_w	bore diameter of ball complement of sleeve type linear ball bearing (reference)
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
t_{p1}	position tolerance of bore in correlation to mounting surface
t_{p2}	position tolerance of bore in correlation to mounting reference surface
t_{p3}	position tolerance of mounting holes in correlation to mounting surface and mounting reference surface

4.10 Flangeless shaft support blocks for series 1 and 3 sleeve type linear ball bearings

See [Tables 17](#) and [18](#) and [Figure 9](#).

A	(overall) width
D_a	seating diameter
G	designation of a 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)
L	length of base
N	diameter of bolt hole

- t_{p1} position tolerance of bore in correlation to mounting surface
- t_{p2} position tolerance of bore in correlation to mounting reference surface
- t_{p3} position tolerance of threaded holes in correlation to mounting surface and mounting reference surface

4.11 Solid and tubular shafts for series 1 and 3 sleeve type linear ball bearings

See [Tables 19](#) and [20](#), and [Figure 10](#).

- d outside diameter of shaft
- d_s single outside diameter of shaft
- k run-out
- k_{adj} adjusted run-out derived from discrete shaft length
- k_1 total indicator reading (TIR) at shaft position 1
- k_2 total indicator reading (TIR) at shaft position 2
- k_3 total indicator reading (TIR) at shaft position 3
- L length of shaft
- L_s actual length of shaft
- l_{ch} length of chamfer in axial direction
- V_{Dmp} variation of mean outside diameter of shaft
- V_{Dsp} variation of outside diameter of shaft in a single plane
- Δ_{ds} deviation of a single outside diameter of shaft
- Δ_{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 document are the boundary dimensions and other related dimensions of sleeve type linear ball bearings series 1 and 3 as specified in ISO 10285.

The housings specified in [Tables 1](#) to [10](#) 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 document.

5.2 Housings for series 1 sleeve type linear ball bearings

This document includes the following housing design for series 1 sleeve type linear ball bearings:

- closed and adjustable flangeless housings ([Tables 1](#) and [2](#)).

5.3 Housings for series 3 sleeve type linear ball bearings

This document includes the following housing designs for series 3 sleeve type linear ball bearings:

- closed and adjustable flanged housings ([Tables 3](#) and [4](#));
- open flanged housings ([Tables 5](#) and [6](#));
- closed and adjustable flangeless housings ([Tables 7](#) and [8](#));
- open and open adjustable flangeless housings ([Tables 9](#) and [10](#)).

6 Shaft support rails

This document includes the following shaft support rails for sleeve type linear ball bearings:

- standard height shaft support rails for series 3 sleeve type linear ball bearings ([Tables 11](#) and [12](#));
- low height shaft support rails for series 3 sleeve type linear ball bearings ([Tables 13](#) and [14](#)).

7 Shaft support blocks

This document includes the following shaft support blocks for sleeve type linear ball bearings:

- flanged shaft support blocks for series 1 and 3 sleeve type linear ball bearings ([Tables 15](#) and [16](#));
- flangeless shaft support blocks for series 1 and 3 sleeve type linear ball bearings ([Tables 17](#) and [18](#)).

8 Shafts

8.1 Material

Shafts covered by this document 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 18203. 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 670 HV (58 HRC) over the entire operating length.

8.3 Geometrical tolerances

8.3.1 Tolerance classes

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

8.3.2 Geometric form

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

- a) V_{Dsp} : variation of shaft outside diameter in a single plane;
- b) V_{Dmp} : variation of mean shaft outside diameter;
- c) run-out (per metre).

These tolerances for both classes are shown in [Table 19](#). A method for measuring run-out is illustrated in [Figure 10](#) and defined in [Table 19](#).

8.3.3 Shaft length tolerances

These tolerances are given in [Table 20](#).

8.3.4 Chamfers

The shaft ends are provided with chamfers to facilitate the 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 19](#). Shafts for use with sealed sleeve type linear ball bearings shall have a chamfer angle less than 30°.

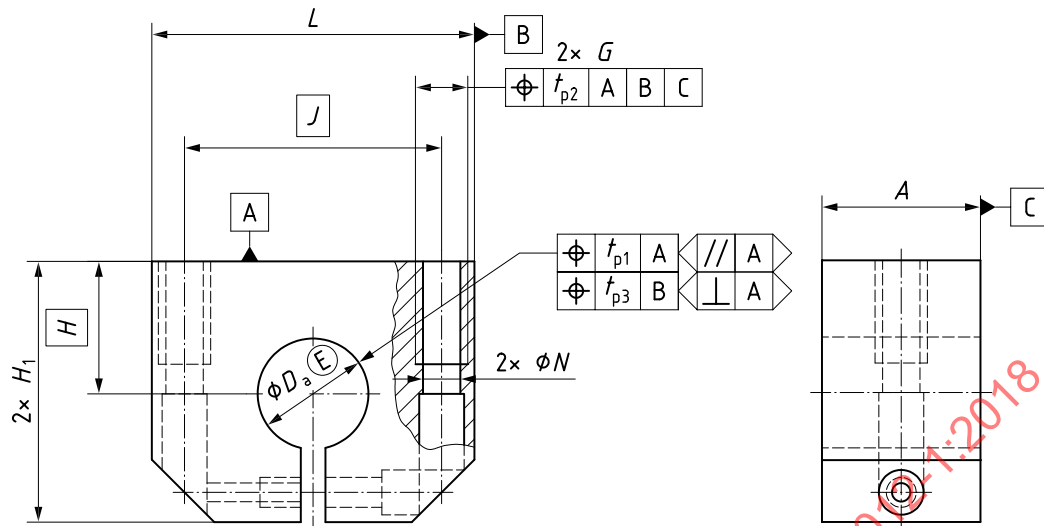
8.3.5 Surface roughness

The roughness of the cylindrical surface of the steel shaft is given in [Table 19](#) in accordance with ISO 1302.

9 Boundary dimensions and tolerances

9.1 Housings

Boundary dimensions and tolerances for housings are given in [Tables 1](#) to [10](#).



NOTE 1 This figure shows an adjustable type housing.

NOTE 2 D_a (E) needs to be measured before the housing is split.

NOTE 3 Identification of reference side face is at the discretion of the manufacturer.

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

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

Dimensions in millimetres

F_w Ref.	D_a K7 ^a or H7 ^b	H^c	H_1 max.	L max.	A max.	J	N	G
3	7	10	18	26	11	16	2,7	M3
4	8	11	20	27	13	17	2,7	M3
5	10	12	22	28	16	18	2,7	M3
6	12	14	26	32	20	22	3,4	M4
8	15	15	29	35	25	25	3,4	M4
10	17	16	32	39	27	27	4,3	M5
12	19	17	34	41	29	29	4,3	M5
14	21	18	39	46	29	34	4,3	M5
16	24	19	39	46	31	34	4,3	M5
20	28	23	46	54	31	40	5,3	M6
25	35	27	55	63	41	48	6,6	M8
30	40	30	61	68	51	53	6,6	M8
40	52	39	77	88	61	69	8,4	M10
50	62	47	93	104	71	82	10,5	M12
60	75	57	113	122	86	100	10,5	M12

^a Seating diameter tolerance for aluminium housings for closed type bearings (see ISO 286-2).

^b Seating diameter tolerance for steel or aluminium housings for adjustable type bearings and for steel housings for closed type bearings (see ISO 286-2).

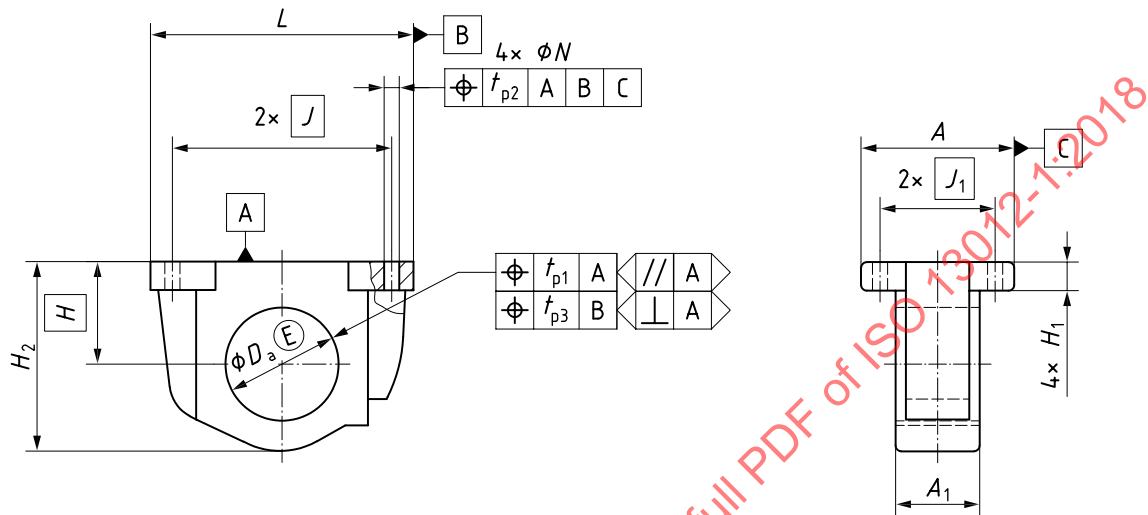
^c H shall be measured with the nominal seating bore diameter. For adjustable type housings, the tolerance for D_a shall apply before the housing is split.

Table 2 — Tolerances for closed and adjustable flangeless housings for series 1 sleeve type linear ball bearings

Dimensions in millimetres

F_w	t_{p1}	t_{p2}^a	t_{p3}^a
All sizes	0,04	(0,04)	(0,04)

^a The given values can be used as a guideline for specific agreement between supplier and manufacturer to define t_{p2} and t_{p3} .



- NOTE 1 This figure shows a closed type housing.
- NOTE 2 $D_a \text{ (E)}$ needs to be measured before the housing is split.
- NOTE 3 Identification of reference side face is at the discretion of the manufacturer.

Figure 2 — Closed and adjustable flanged housings for series 3 sleeve type linear ball bearings

Table 3 — Closed and adjustable flanged housings for series 3 sleeve type linear ball bearings

Dimensions in millimetres

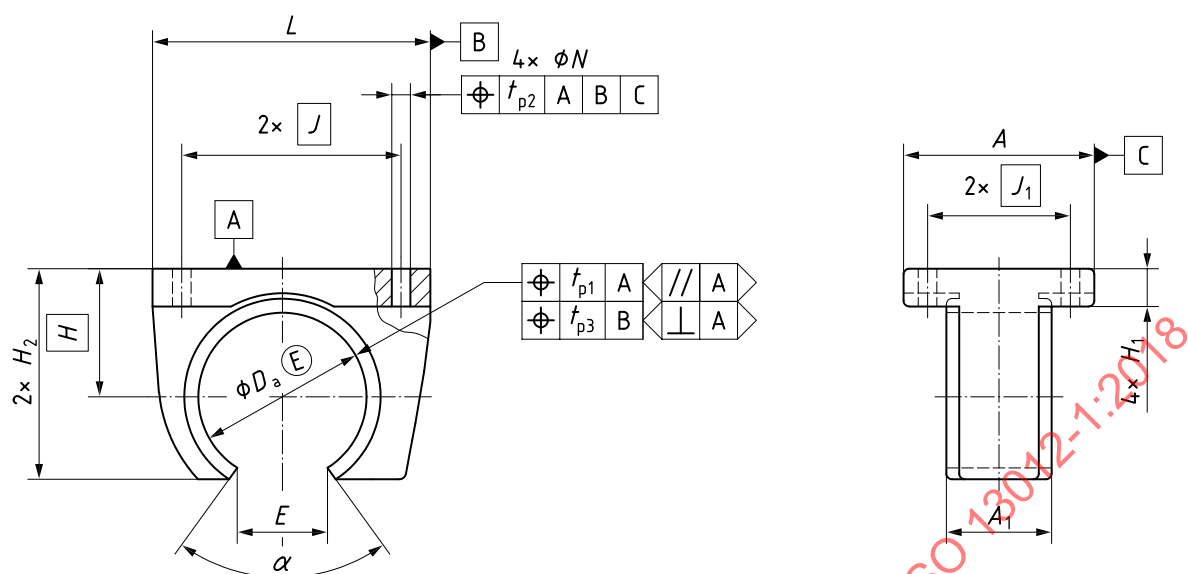
F_w Ref.	D_a H7 ^a	H^b	H_1 max.	H_2 max.	L max.	A max.	A_1		J	J_1	N
							max.	min.			
5	12	11	4	22	33	25	12,1	11,7	24	16	3,4
6	13	12	5	24	34	26	12,1	11,7	25	18	3,4
8	16	15	6	29	46	29	14,1	13,7	25	20	3,4
10	19	17	6	30	50	30	20,1	19,7	34	21	4,5
12	22	18	7	36	54	33	20,1	19,7	32	23	4,5
16	26	22	8	43	58	36	22,1	21,7	40	26	4,5
20	32	25	9	51	72	43	28,1	27,7	45	32	4,5
25	40	30	10	62	82	56	40,1	39,6	60	40	5,5
30	47	35	11	72	90	62	48,1	47,5	68	45	6,6
40	62	45	13	92	110	80	56,1	55,5	86	58	9
50	75	50	15	107	137	72	72,1	71,5	108	50	9
60	90	60	18	131	162	94	95,1	94,5	132	65	11
80	120	80	23	176	207	124	125,1	124,5	170	90	13,5
100	150	100	30	210	250	135	135,1	134,5	210	100	17,5

^a Seating diameter tolerance (see ISO 286-2).^b 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.**Table 4 — Tolerances for closed and adjustable flanged housings for series 3 sleeve type linear ball bearings**

Dimensions in millimetres

F_w	t_{p1}	t_{p2}^a	t_{p3}^a
All sizes	0,04	(0,04)	(0,04)

^a The given values can be used as a guideline for specific agreement between supplier and manufacturer to define t_{p2} and t_{p3} .



NOTE 1 D_a (E) needs to be measured before the housing is split.

NOTE 2 Identification of reference side face is at the discretion of the manufacturer.

Figure 3 — Open flanged housings for series 3 sleeve type linear ball bearings

Table 5 — Open flanged housings for series 3 sleeve type linear ball bearings

Dimensions in millimetres and angles in degrees

F_w Ref.	D_a^a JS7 ^b	H^c	H_1 max.	H_2 max.	L max.	A max.	A_1 max. min.	J	J_1	N	α min.	E min.
10	19	17	6	27	50	30	20,1 19,7	32	21	4,5	65	11
12	22	18	7	29	54	33	20,1 19,7	32	23	4,5	65	12
16	26	22	8	36	58	36	22,1 21,7	40	26	4,5	50	13,5
20	32	25	9	43	72	43	28,1 27,7	45	32	4,5	50	14,5
25	40	30	10	52,5	82	56	40,1 39,6	60	40	5,5	50	17,5
30	47	35	11	61,5	90	62	48,1 47,5	68	45	6,6	50	20
40	62	45	13	78,5	110	80	56,1 55,5	86	58	9	50	26
50	75	50	15	89,5	137	72	72,1 71,5	108	50	9	50	32
60	90	60	18	106,5	162	94	95,1 94,5	132	65	11	50	39
80	120	80	23	141,5	207	124	125,1 124,5	170	90	13,5	50	53
100	150	100	30	177	250	135	135,1 134,5	210	100	17,5	50	66

^a D_a can only be measured when the housing is fastened to a plane surface.

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

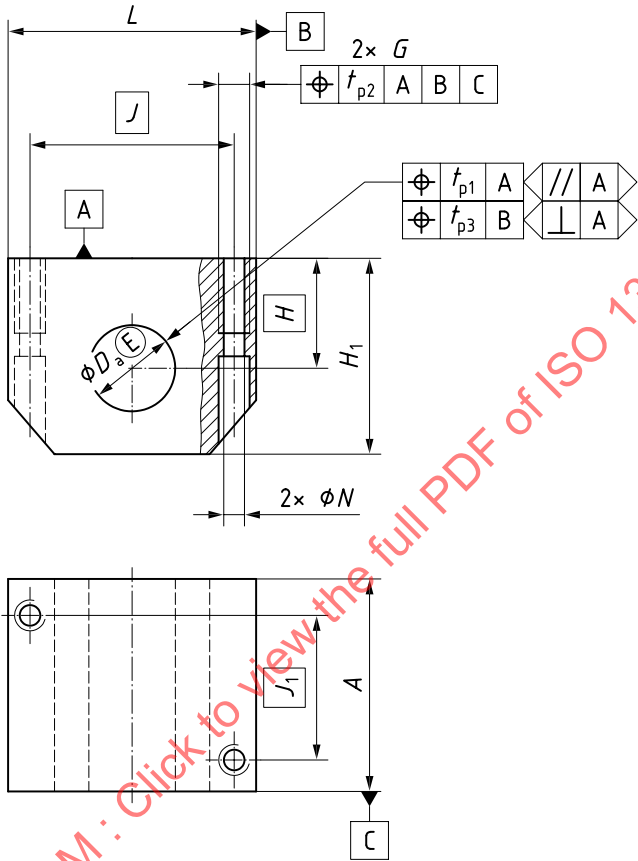
^c H shall be measured with the nominal seating bore diameter.

Table 6 — Tolerances for open flanged housings for series 3 sleeve type linear ball bearings

Dimensions in millimetres

F_w	t_{p1}	t_{p2}^a	t_{p3}^a
All sizes	0,04	(0,04)	(0,04)

^a The given values can be used as a guideline for specific agreement between supplier and manufacturer to define t_{p2} and t_{p3} .



- NOTE 1 Alternatively, there can be four attachment holes.
- NOTE 2 This figure shows a closed type housing.
- NOTE 3 Identification of reference side face is at the discretion of the manufacturer.
- NOTE 4 D_a (E) needs to be measured before the housing is split.

Figure 4 — Closed and adjustable flangeless housings for series 3 sleeve type linear ball bearings

Table 7 — Closed and adjustable flangeless housings for series 3 sleeve type linear ball bearings

Dimensions in millimetres

F_w Ref.	D_a^a H7 ^b	H^c	H_1 max.	L max.	A max.	J	J_1	N	G
10	19	16	32	40	37	29	20	4,3	M5
12	22	18	36	43	40	32	23	4,3	M5
16	26	22	43	53	44	40	26	5,3	M6
20	32	25	51	60	56	45	32	6,6	M8
25	40	30	62	78	69	60	40	8,4	M10
30	47	35	72	87	81	68	45	8,4	M10
40	62	45	92	108	93	86	58	10,5	M12
50	75	50	107	132	115	108	50	13,5	M16

^a For adjustable type housings, D_a can only be measured when the housing is fastened to a plane surface.

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

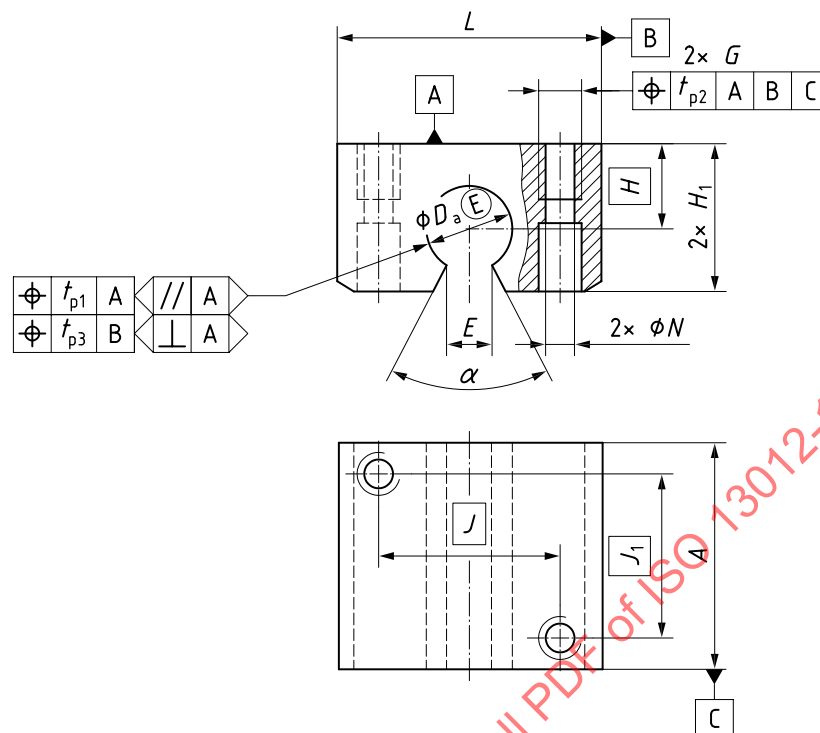
^c H shall be measured with the nominal seating bore diameter. For adjustable type housings, the tolerance for D_a shall apply before the housing is split.

Table 8 — Tolerances for closed and adjustable flangeless housings for series 3 sleeve type linear ball bearings

Dimensions in millimetres

F_w	t_{p1}	t_{p2}^a	t_{p3}^a
All sizes	0,04	(0,04)	(0,04)

^a The given values can be used as a guideline for specific agreement between supplier and manufacturer to define t_{p2} and t_{p3} .



NOTE 1 Alternatively, there can be four attachment holes.

NOTE 2 This figure shows an open type housing.

NOTE 3 Identification of reference side face is at the discretion of the manufacturer.

NOTE 4 D_a (E) needs to be measured before the housing is split.

Figure 5 — Open and open adjustable flangeless housings for series 3 sleeve type linear ball bearings

Table 9 — Open and open adjustable flangeless housings for series 3 sleeve type linear ball bearings

Dimensions in millimetres and angles in degrees

F_w Ref.	D_a^a IS7 ^b	H^c	H_1 max.	L max.	A max.	J	J_1	N	G	α min.	E min.
12	22	18	29	43	40	32	23	4,3	M5	65	12
16	26	22	36	53	44	40	26	5,3	M6	50	13,5
20	32	25	43	60	56	45	32	6,6	M8	50	14,5
25	40	30	52,5	78	69	60	40	8,4	M10	50	17,5
30	47	35	61,5	87	81	68	45	8,4	M10	50	20
40	62	45	78,5	108	93	86	58	10,5	M12	50	26
50	75	50	89,5	132	115	108	50	13,5	M16	50	32

^a D_a can only be measured when the housing is fastened to a plane surface.

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

^c H shall be measured with the nominal seating bore diameter.

Table 10 — Tolerances for open and open adjustable flangeless housings for series 3 sleeve type linear ball bearings

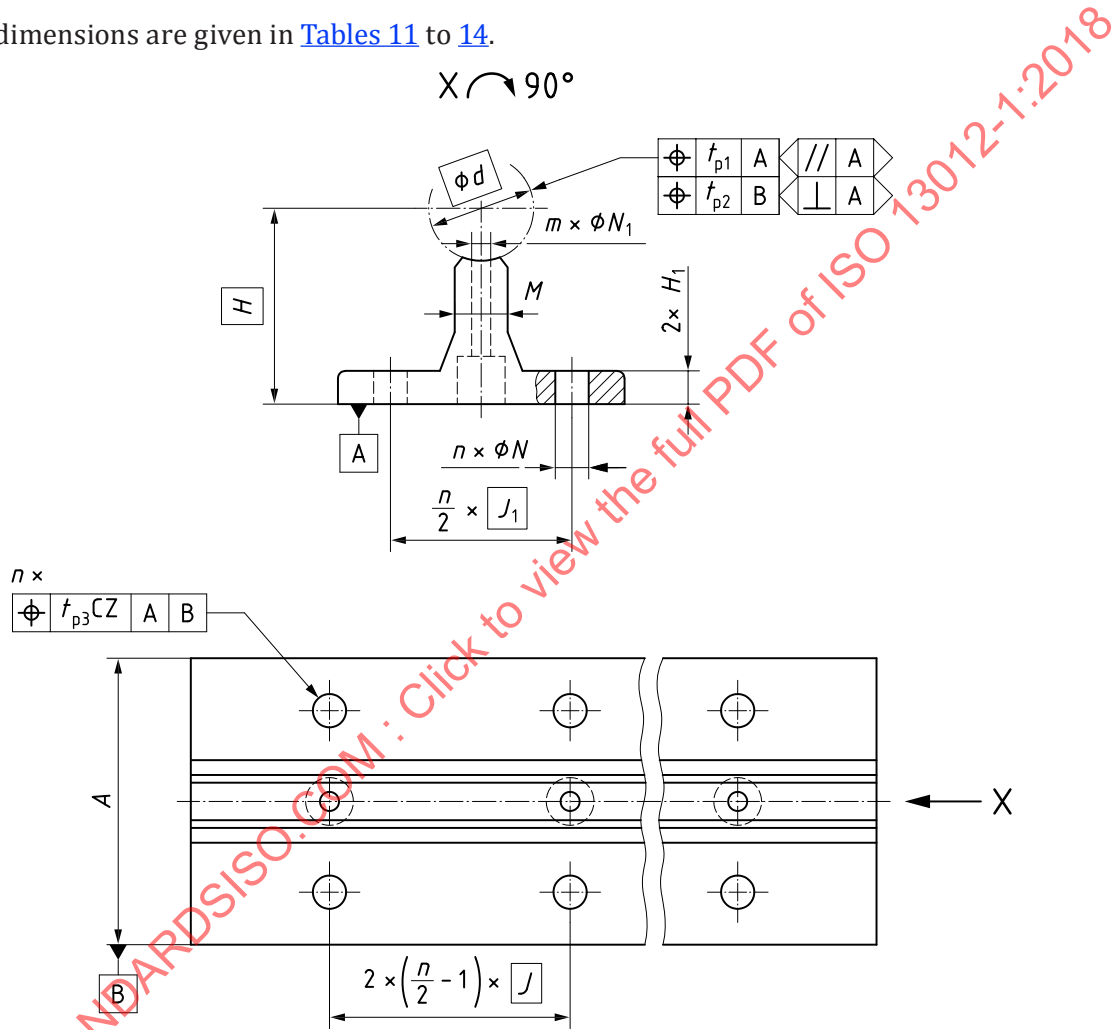
Dimensions in millimetres

F_w	t_{p1}	t_{p2}^a	t_{p3}^a
All sizes	0,04	(0,04)	(0,04)

^a The given values can be used as a guideline for specific agreement between supplier and manufacturer to define t_{p2} and t_{p3} .

9.2 Shaft support rails

Boundary dimensions are given in Tables 11 to 14.



Key

- m number of mounting holes for shaft (half of n)
- n (total) number of holes for mounting shaft support rail

NOTE Identification of reference side face is at the discretion of the manufacturer.

Figure 6 — Standard height shaft support rails for series 3 sleeve type linear ball bearings

Table 11 — Standard height shaft support rails for series 3 sleeve type linear ball bearings

Dimensions in millimetres

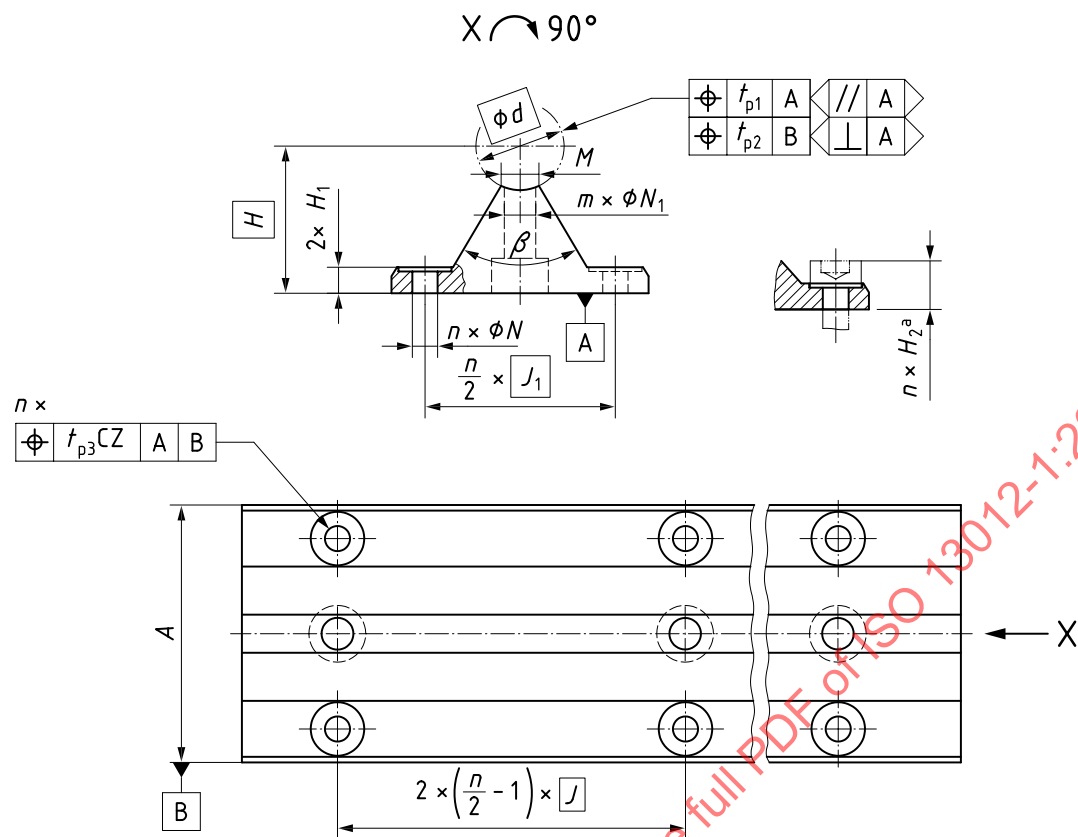
<i>d</i> Ref.	<i>H</i>^a	<i>J</i>₁	<i>J</i>	<i>N</i>	<i>N</i>₁	<i>A</i>	<i>H</i>₁	<i>M</i>
10	25	27	75	3,4	4,5	40	5	8
12	28	29	75	4,5	4,5	43	5	9
16	30	33	100	5,5	5,5	48	5	10
20	38	37	100	6,6	6,6	56	6	11
25	42	42	120	6,6	9	60	6	14
30	53	51	150	9	11	74	8	14
40	60	55	200	9	11	78	8	18
50	75	63	200	11	13,5	90	10	22
60	80	72	300	11	15,5	100	12	30
80	100	92	300	13,5	17,5	125	14	42
100	120	112	300	17,5	22	160	16	55

^a *H* shall be measured with the nominal shaft diameter under mounting condition.**Table 12 — Tolerances for standard height shaft support rails for series 3 sleeve type linear ball bearings**

Dimensions in millimetres

<i>F</i>_w	<i>t</i>_{p1}	<i>t</i>_{p2}^a	<i>t</i>_{p3}^a
All sizes	0,04	(0,04)	(0,04)

^a The given values can be used as a guideline for specific agreement between supplier and manufacturer to define *t*_{p2} and *t*_{p3}.



Key

m number of mounting holes for shaft (half of n)

n total number of holes for mounting shaft support rail

^a As an option, use shallow head hexagonal socket head cap screws or counterbore the attachment holes in flange to comply with H_2 max.

NOTE Identification of reference side face is at the discretion of the manufacturer.

Figure 7 — Low height shaft support rails for series 3 sleeve type linear ball bearings

Table 13 — Low height shaft support rails for series 3 sleeve type linear ball bearings

Dimensions in millimetres and angles in degrees

<i>d</i> Ref.	<i>H</i> ^a	<i>A</i> max.	<i>H</i> ₁ ±0,5	<i>H</i> ₂ max.	<i>J</i> ₁	<i>J</i>	<i>M</i> max.	<i>N</i>	<i>N</i> ₁	<i>β</i> max.
10	20	35	4	8	25	75	4,7	4,5	4,5	50
12	22	40	5	10	29	75	5,8	4,5	4,5	50
16	26	45	5	11	33	100	7	5,5	5,5	50
20	32	52	6	13	37	100	8,3	6,6	6,6	50
25	36	57	6	13	42	120	10,8	6,6	9	50
30	42	69	7	15	51	150	11	9	11	50
40	50	73	8	16	55	200	15	9	11	50
50	60	84	9	20	63	200	19	11	13,5	46
60	68	94	10	21	72	300	25	11	15,5	46
80	86	116	12	24	92	300	34	13,5	17,5	46
100	110	146	15	31	126	300	45	17,5	22	46

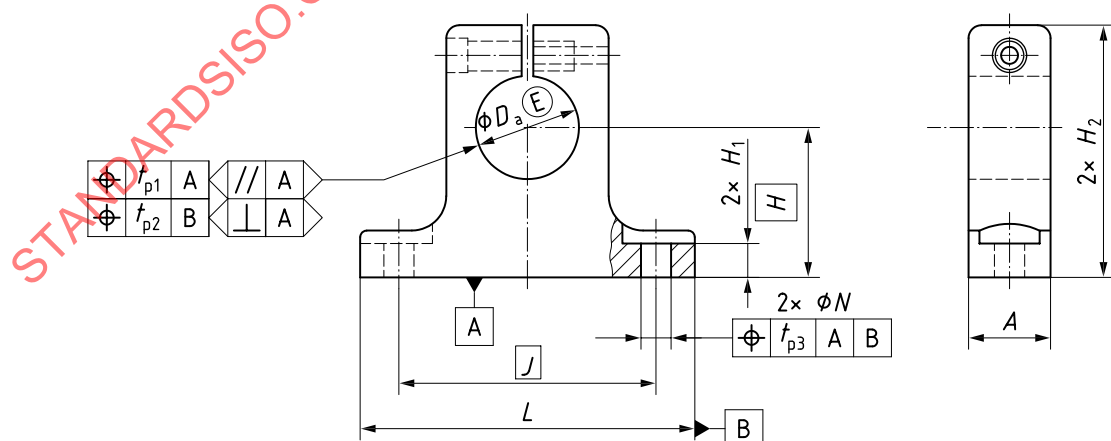
^a *H* shall be measured with the nominal shaft diameter under mounting condition.**Table 14 — Tolerances for low height shaft support rails for series 3 sleeve type linear ball bearings**

Dimensions in millimetres

<i>F_w</i>	<i>t_{p1}</i>	<i>t_{p2}</i> ^a	<i>t_{p3}</i> ^a
All sizes	0,04	(0,04)	(0,04)

^a The given values can be used as a guideline for specific agreement between supplier and manufacturer to define *t_{p2}* and *t_{p3}*.

9.3 Shaft support blocks

Boundary dimensions are given in [Tables 15 to 18](#).NOTE 1 $D_a \text{ (E)}$ needs to be measured before the splitting of the support block.

NOTE 2 Identification of reference side face is at the discretion of the manufacturer.

Figure 8 — Flanged shaft support blocks for series 1 and 3 sleeve type linear ball bearings