INTERNATIONAL STANDARD

ISO 10285

Second edition
2007-11-01

Rolling bearings — Sleeve type linear ball bearings — Boundary dimensions and tolerances

Roulements — Roulements linéaires à recirculation de billes, type manchon — Dimensions d'encombrement et tolérances

Reference number
ISO 10285:2007(E)

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

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 10285 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 10285:1992), which has been technically revised.

Introduction

Linear motion rolling bearings provide for linear motion as opposed to rotational motion. The sleeve type linear ball bearing described in this International Standard uses balls which circulate in a number of closed loops in the cylindrical bearing that surrounds the shaft.

Linear ball bearings are typically applied to meet one or more of the following criteria:

a) smooth low-friction motion, free from stick-slip or chatter;

b) low force required to produce relative linear motion between the bearing and the shaft.

These requirements, as well as others, can be met by appropriate use of the various linear motion rolling bearing types (closed sleeve type, adjustable sleeve type and open sleeve type). The appropriate selection of bearing type and specification is to be established between the manufacturer and the user.

Rolling bearings — Sleeve type linear ball bearings — Boundary dimensions and tolerances

1 Scope

This International Standard specifies the boundary dimensions, tolerances and definitions for sleeve type linear motion ball bearings.

It is applicable to the size ranges covered by Table 1.

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 reference document (including any amendments) applies.

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

ISO 5593, *Rolling bearings — Vocabulary*

ISO 13012, *Rolling bearings — Linear motion, recirculating ball, sleeve type — Accessories*

ISO 15241, *Rolling bearings — Symbols for quantities*

3 Terms and definitions

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

3.1
sleeve type linear ball bearing
linear motion ball bearing incorporating an outer sleeve with a number of closed loops of recirculating balls, which is designed to achieve unlimited linear motion along a shaft

3.2
shaft
basically cylindrical rod along which a linear ball bearing traverses

3.3
nominal bore diameter of ball complement
diameter of the theoretical cylinder inscribed inside all of the balls

3.4
nominal outer sleeve width
distance between two theoretical end faces designated to bound the width of the linear ball bearing

3.5
radial runout
difference between the largest and the smallest of the radial distances between the outside surface of the cylindrical outer sleeve and the centreline of the bore diameter of ball complement

3.6
closed sleeve type linear ball bearing
sleeve type linear ball bearing in which the outer sleeve is continuous or virtually continuous, whereby adjustment of clearance between the bore diameter of ball complement and a shaft is achieved, in most cases, by selection of the housing fit, a shaft diameter and the bore diameter of ball complement of the bearing

3.7
adjustable sleeve type linear ball bearing
sleeve type linear ball bearing which has elastic features which permit mechanical adjustment of the clearance between the bore diameter of ball complement and a shaft

3.8
open sleeve type linear ball bearing
sleeve type linear ball bearing in which a longitudinal section is removed to provide clearance over a shaft and shaft support rail unit

4 Symbols

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

The symbols (except those for tolerances) shown in Figures 1 and 2 and the values given in Tables 1 to 9 denote nominal dimensions, unless specified otherwise.

b	snap ring groove width
C	outer sleeve width
C_s	single outer sleeve width
C_1	distance between outer faces of outer sleeve snap ring grooves
C_{1s}	single distance between outer faces of outer sleeve snap ring grooves
D	bearing outside diameter
D_1	snap ring groove diameter
d	outside diameter of shaft
E	width of sector opening at diameter F_w of open sleeve type bearing
F_w	bore diameter of ball complement
F_{ws}	single bore diameter of ball complement
$F_{ws\ min}$	smallest single bore diameter of ball complement [1)]
K_{ea}	radial runout of assembled bearing
α	angle of sector opening (included angle) of open sleeve type bearing

1) The smallest single bore diameter of ball complement is the diameter of the cylinder which, when placed in the ball complement bore, results in zero radial clearance in at least one radial direction.

Δ_{Cs} deviation of a single outer sleeve width

Δ_{C1s} deviation of a single distance between outer faces of outer sleeve snap ring grooves

Δ_{Dmp} deviation of mean bearing outside diameter in a single plane

5 Boundary dimensions

Boundary dimensions for dimension series 1, 3 and 5 are given in Table 1.

6 Tolerances

6.1 Classes

The degrees of precision to which linear ball bearings are manufactured are defined as tolerance classes L9, L7, L7A, L6, L6A, L6J and L6JA. The tolerance values are tabulated in Tables 2 to 8. For an overview of the basis for the tolerance values, see Annex A.

Tables 2 to 8 have been established on the basis of listing all the linear ball bearing tolerances for a given nominal bore diameter of ball complement (F_w).

6.2 Applicability

— Tolerance class L9 shall be applicable to series 1, closed and adjustable sleeve type bearings.

— Tolerance classes L7 and L6 shall be applicable to series 1 and 3, closed sleeve type bearings.

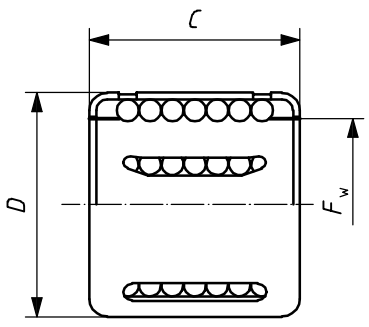
— Tolerance classes L7A and L6A shall be applicable to series 3, open and adjustable sleeve type bearings.

— Tolerance class L6J shall be applicable to series 5, closed sleeve type bearings.

— Tolerance class L6JA shall be applicable to series 5, open and adjustable sleeve type bearings.

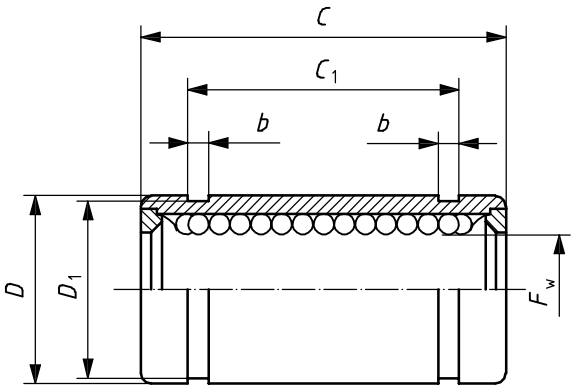
6.3 Shaft tolerances

For the proper functioning and performance of sleeve type linear ball bearings, it is essential that they are matched with shafts having dimensional and geometrical tolerances that are matched to the size and series of the sleeve type linear ball bearing being used. Full details for the shafts suitable for use with the sleeve type linear ball bearings in this International Standard are specified in ISO 13012.

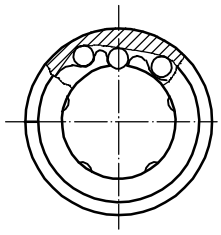


NOTE The figure shows an example of the design.

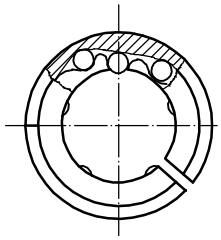
Figure 1 — Bearing without snap ring grooves (for series 1)



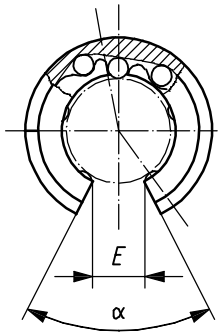
a) Bearing (side view)



b) Closed sleeve type



c) Adjustable sleeve type



d) Open sleeve type

NOTE The figure shows examples of the designs.

Figure 2 — Bearings with snap ring grooves (for series 3 and 5)

Table 1 — Boundary dimensions

Dimensions in millimetres and angles in degrees

F_w	Series 1		Series 3							Series 5						
	D	C	D	C	C_1	b	D_1	E	α	D	C	C_1	b	D_1	E	α
						min.	max.	min.	min.				min.	max.	min.	min.
3	7	10	—	—	—	—	—	—	—	7	10	—	—	—	—	—
4	8	12	—	—	—	—	—	—	—	8	12	—	—	—	—	—
5	10	15	12	22	14,2	1,1	11,5	—	—	10	15	10,2	1,1	9,6	—	—
6	12	22	13	22	14,2	1,1	12,4	—	—	12	19	13,5	1,1	11,5	—	—
8	15	24	16	25	16,2	1,1	15,2	—	—	15	24	17,5	1,1	14,3	—	—
10	17	26	19	29	21,6	1,3	18	—	—	19	29	22	1,3	18	6	65
12	19	28	22	32	22,6	1,3	21	6,5	65	21	30	23	1,3	20	6,5	65
13	—	—	—	—	—	—	—	—	—	23	32	23	1,3	22	6,7	60
14	21	28	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	24	30	26	36	24,6	1,3	24,9	9	50	28	37	26,5	1,6	27	8	60
20	28	30	32	45	31,2	1,6	30,5	9	50	32	42	30,5	1,6	30,5	8,6	50
25	35	40	40	58	43,7	1,85	38,5	11	50	40	59	41	1,85	38	10,6	50
30	40	50	47	68	51,7	1,85	44,5	12,5	50	45	64	44,5	1,85	43	12,7	50
35	—	—	—	—	—	—	—	—	—	52	70	49,5	2,1	49	14,8	50
40	52	60	62	80	60,3	2,15	59	16,5	50	60	80	60,5	2,1	57	16,9	50
50	62	70	75	100	77,3	2,65	72	21	50	80	100	74	2,6	76,5	21,1	50
60	75	85	90	125	101,3	3,15	86,5	26	50	90	110	85	3,15	86,5	25,4	50
80	—	—	120	165	133,3	4,15	116	36	50	120	140	105,5	4,15	116	33,8	50
100	—	—	150	175	143,3	4,15	145	45	50	150	175	125,5	4,15	145	42,7	50

NOTE For the open and adjustable sleeve type bearings in series 3 and series 5, the D and D_1 dimensions apply after the bearing is split and fitted into a thick-section ring gauge of diameter D with zero deviation.

Table 2 — Tolerance class L9 for use with series 1, closed and adjustable sleeve type bearings

Tolerance values in micrometres

F_w mm		Tolerances for $F_{ws\ min}$ [a]		Δ_{Cs}	
>	⩽	high	low	high	low
—	3	+12,5	−12,5	+180	−180
3	5	+15	−15	+215	−215
5	6	+15	−15	+260	−260
6	10	+18	−18	+260	−260
10	18	+21,5	−21,5	+260	−260
18	20	+26	−26	+260	−260
20	30	+26	−26	+310	−310
30	50	+31	−31	+370	−370
50	80	+37	−37	+435	−435

[a] The values give the limits of the difference between $F_{ws\ min}$ and F_w when the bearing is fitted into a thick-section ring gauge of diameter D with zero deviation.

Table 3 — Tolerance class L7 for use with series 1 and 3, closed sleeve type bearings

Tolerance values in micrometres

F_w mm		Tolerances for $F_{ws\ min}$ [a]		Δ_{Dmp} [b]				Δ_{Cs}				Δ_{C1s} [c]	
				Series 1		Series 3		Series 1		Series 3		Series 3	
>	⩽	high	low	high	low	high	low	high	low	high	low	high	low
—	3	+10	0	0	−9	—	—	0	−360	—	—	—	—
3	4	+12	0	0	−9	—	—	0	−430	—	—	—	—
4	5	+12	0	0	−9	0	−11	0	−430	0	−520	+270	0
5	6	+12	0	0	−11	0	−11	0	−520	0	−520	+270	0
6	8	+15	0	0	−11	0	−11	0	−520	0	−520	+270	0
8	10	+15	0	0	−11	0	−13	0	−520	0	−520	+330	0
10	18	+18	0	0	−13	0	−13	0	−520	0	−620	+330	0
18	20	+21	0	0	−13	0	−16	0	−520	0	−620	+390	0
20	25	+21	0	0	−16	0	−16	0	−620	0	−740	+390	0
25	30	+21	0	0	−16	0	−16	0	−620	0	−740	+460	0
30	40	+25	0	0	−19	0	−19	0	−740	0	−740	+460	0
40	50	+25	0	0	−19	0	−19	0	−740	0	−870	+460	0
50	60	+30	0	0	−19	0	−22	0	−870	0	−1 000	+540	0
60	80	+30	0	—	—	0	−22	—	—	0	−1 000	+630	0
80	120	+35	0	—	—	0	−25	—	—	0	−1 000	+630	0

[a] For series 1, the values give the limits of the difference between $F_{ws\ min}$ and F_w when the bearing is fitted into a thick-section ring gauge of diameter D with zero deviation.

[b] Not applicable to linear ball bearings having a drawn cup or a moulded plastic body.

[c] For the series 3 linear ball bearing with the nominal bore diameter of ball complement F_w = 35 mm, the tolerance values for Δ_{C1s} are + 390 µm (high) and 0 µm (low).

Table 4 — Tolerance class L7A for use with series 3, open and adjustable sleeve type bearings

Tolerance values in micrometres

F_w mm		Tolerances for $F_{ws\ min}$ [a]		Δ_{Cs}		Δ_{C1s} [b]	
>	⩽	high	low	high	low	high	low
4	6	+18	0	0	−520	+270	0
6	8	+22	0	0	−520	+270	0
8	10	+22	0	0	−520	+330	0
10	18	+27	0	0	−620	+330	0
18	20	+33	0	0	−620	+390	0
20	25	+33	0	0	−740	+390	0
25	30	+33	0	0	−740	+460	0
30	40	+39	0	0	−740	+460	0
40	50	+39	0	0	−870	+460	0
50	70	+46	0	0	−1 000	+540	0
70	80	+46	0	0	−1 000	+630	0
80	120	+54	0	0	−1 000	+630	0

[a] The values give the limits of the difference between $F_{ws\ min}$ and F_w when the bearing is fitted into a thick-section ring gauge of diameter D with zero deviation.

[b] For the series 3 linear ball bearing with the nominal bore diameter of ball complement F_w = 35 mm, the tolerance values for Δ_{C1s} are + 390 µm (high) and 0 µm (low).

Table 5 — Tolerance class L6 for use with series 1 and 3, closed sleeve type bearings

Tolerance values in micrometres

F_w mm		Tolerances for $F_{ws\ min}$ [a]		Δ_{Dmp} [b]				Δ_{Cs}				Δ_{C1s} [c]		K_{ea}	
				Series 1		Series 3		Series 1		Series 3		Series 3		Series 1	Series 3
>	⩽	high	low	high	low	high	low	high	low	high	low	high	low	max.	
—	3	+6	0	0	−6	—	—	0	−360	—	—	—	—	15	—
3	4	+8	0	0	−6	—	—	0	−430	—	—	—	—	15	—
4	5	+8	0	0	−6	0	−8	0	−430	0	−520	+270	0	15	18
5	6	+8	0	0	−8	0	−8	0	−520	0	−520	+270	0	18	18
6	8	+9	0	0	−8	0	−8	0	−520	0	−520	+270	0	18	18
8	10	+9	0	0	−8	0	−9	0	−520	0	−520	+330	0	18	21
10	18	+11	0	0	−9	0	−9	0	−520	0	−620	+330	0	21	21
18	20	+13	0	0	−9	0	−11	0	−520	0	−620	+390	0	21	25
20	25	+13	0	0	−11	0	−11	0	−620	0	−740	+390	0	25	25
25	30	+13	0	0	−11	0	−11	0	−620	0	−740	+460	0	25	25
30	40	+16	0	0	−13	0	−13	0	−740	0	−740	+460	0	30	30
40	50	+16	0	0	−13	0	−13	0	−740	0	−870	+460	0	30	30
50	60	+19	0	0	−13	0	−15	0	−870	0	−1 000	+540	0	30	35
60	80	+19	0	—	—	0	−15	—	—	0	−1 000	+630	0	—	35
80	120	+22	0	—	—	0	−18	—	—	0	−1 000	+630	0	—	40

[a] For series 1, the values give the limits of the difference between $F_{ws\ min}$ and F_w when the bearing is fitted into a thick-section ring gauge of diameter D with zero deviation.

[b] Not applicable to linear ball bearings having a drawn cup or a moulded plastic body.

[c] For the series 3 linear ball bearing with the nominal bore diameter of ball complement F_w = 35 mm, the tolerance values for Δ_{C1s} are + 390 µm (high) and 0 µm (low).

Table 6 — Tolerance class L6A for use with series 3, open and adjustable sleeve type bearings

Tolerance values in micrometres

F_w mm		Tolerances for $F_{ws\ min}$ [a]		Δ_{Cs}		Δ_{C1s} [b]	
>	⩽	high	low	high	low	high	low
4	6	+12	0	0	–520	+270	0
6	8	+15	0	0	–520	+270	0
8	10	+15	0	0	–520	+330	0
10	18	+18	0	0	–620	+330	0
18	20	+21	0	0	–620	+390	0
20	25	+21	0	0	–740	+390	0
25	30	+21	0	0	–740	+460	0
30	40	+25	0	0	–740	+460	0
40	50	+25	0	0	–870	+460	0
50	70	+30	0	0	–1 000	+540	0
70	80	+30	0	0	–1 000	+630	0
80	120	+35	0	0	–1 000	+630	0

[a] The values give the limits of the difference between $F_{ws\ min}$ and F_w when the bearing is fitted into a thick-section ring gauge of diameter D with zero deviation.

[b] For the series 3 linear ball bearing with the nominal bore diameter of ball complement F_w = 35 mm, the tolerance values for Δ_{C1s} are + 390 µm (high) and 0 µm (low).

Table 7 — Tolerance class L6J for use with series 5, closed sleeve type bearings

Tolerance values in micrometres

F_w mm		Tolerances for $F_{ws\ min}$ [a]		Δ_{Dmp} [b]		Δ_{Cs}		Δ_{C1s}		K_{ea}
>	⩽	high	low	high	low	high	low	high	low	max.
—	4	0	–8	0	–10	0	–200	—	—	15
4	5	0	–8	0	–10	0	–200	+240	–240	15
5	8	0	–9	0	–11	0	–200	+240	–240	18
8	10	0	–9	0	–13	0	–200	+300	–300	21
10	18	0	–9	0	–13	0	–200	+300	–300	21
18	20	0	–10	0	–16	0	–200	+300	–300	25
20	30	0	–10	0	–16	0	–300	+300	–300	25
30	40	0	–12	0	–19	0	–300	+300	–300	30
40	50	0	–12	0	–22	0	–300	+300	–300	30
50	60	0	–15	0	–22	0	–300	+300	–300	35
60	80	0	–15	0	–22	0	–400	+400	–400	35
80	100	0	–20	0	–25	0	–400	+400	–400	40

[a] The values give the limits of the difference between $F_{ws\ min}$ and F_w when the bearing is fitted into a thick-section ring gauge of diameter D with zero deviation.

[b] Not applicable to linear ball bearings having a moulded plastic body.

Table 8 — Tolerance class L6JA for use with series 5, open and adjustable sleeve type bearings

Tolerance values in micrometres

F_w mm		**Tolerances for** $F_{ws\ min}$ [a]		Δ_{Cs}		Δ_{C1s}	
>	⩽	high	low	high	low	high	low
5	6	+4	–9	0	–200	+240	–240
6	8	+6	–9	0	–200	+240	–240
8	10	+6	–9	0	–200	+300	–300
10	18	+9	–9	0	–200	+300	–300
18	20	+11	–10	0	–200	+300	–300
20	30	+11	–10	0	–300	+300	–300
30	40	+13	–12	0	–300	+300	–300
40	50	+13	–12	0	–300	+300	–300
50	60	+15	–15	0	–300	+300	–300
60	80	+15	–15	0	–400	+400	–400
80	100	+15	–20	0	–400	+400	–400

[a] The values give the limits of the difference between $F_{ws\ min}$ and F_w when the bearing is fitted into a thick-section ring gauge of diameter D with zero deviation.

Annex A
(informative)

Basis of tolerances for sleeve type linear ball bearings

Table A.1 gives an overview of the basis for the tolerance values in each of the Tables 2 to 8. The symbols for the tolerance grades and IT values given in the plan in Table A.1 conform to the ISO system of limits and fits as specified in ISO 286-1 and ISO 286-2.

Table A.1 — Tolerance classes

Symbol	L9	L7	L7A	L6	L6A	L6J	L6JA
$F_{\text{ws min}}$	JS9	H7	H8	H6	H7	d	e
Δ_{Dmp}	a	h6 [b]	a	h5 [b]	a	≈ h6 [b]	a
Δ_{Cs}	js14	h14	h14	h14	h14	≈ h12	≈ h12
Δ_{C1s}	a	H13	H13	H13	H13	≈ JS14	≈ JS14
K_{ea}	a	a	a	IT7 [c]	a	IT7 [c]	a

a Tolerance not defined.
b Not applicable to linear ball bearings having a drawn cup or a moulded plastic body.
c Based on D dimension.
d Special tolerance class with the upper deviation “zero” and the lower deviation “zero minus IT6”.
e Special tolerance class with the upper deviation “zero” and the lower deviation “zero minus IT7”.

Bibliography

[1] ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits*

[2] ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ICS 21.100.20

Price based on 11 pages