SCHAEFFLER

Linear bearings

Linear bearings, linear bearing units, precision shafts, support rails, shaft support blocks and standard housings

Catalog

Schaeffler linear guide systems
Product portfolio

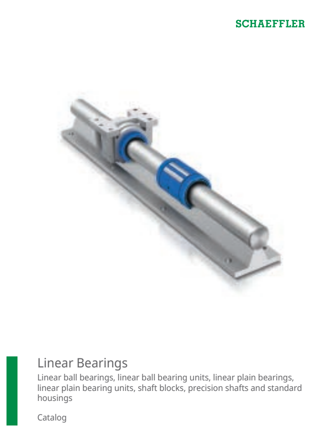
Linear guide systems are used in a variety of applications in a wide variety of industries. The guidance principle consists of three elements: linear ball bearings, bearing housings and precision shafts. Due to the wide range of diameters in combination with the different types of bearings, housings and shafts, shaft guidance systems offer maximum design freedom while simultaneously making handling and usage easy.
The catalog consists of two parts and combines the SCHAEFFLER and EWELLIX product ranges.

Range A: Shaft guidance systems

Linear bearings and linear bearing units
Ball bearings and plain bearings
Compact series
Heavy-duty series
Solid series

Range B: Linear bearings

Linear bearings and linear bearing units
Ball bearings and plain bearings
Compact series
Standard series



SCHAEFFLER

Shaft guidance systems

Linear bearings, linear bearing units, solid shafts, hollow shafts, support rails and shaft support blocks

Catalog

Contents

1 Technical principles

1.1 Load rating and rating life

The size of a linear ball bearing is determined by the requirements for its load capacity, rating life and operating reliability.

The load rating (load capacity) is described by the:

- Dynamic load rating C
- Static load rating C_0

The calculation of the dynamic and static load rating in the product tables is based on DIN 636-1:1993.

1.1.1 Basic rating life

The basic rating life L and L_h is reached or exceeded by 90 % of a sufficiently large quantity of the same bearings before the first signs of material fatigue occur.

ƒ1

$$L = \left(\frac{C}{P}\right)^3$$

ƒ2

$$L_h = \frac{833}{H \cdot n_{osc}} \cdot \left(\frac{C}{P}\right)^3$$

ƒ3

$$L_h = \frac{1666}{\bar{v}} \cdot \left(\frac{C}{P}\right)^3$$

C	N	Basic dynamic load rating
H	m	Simple stroke length of the oscillating motion
L	m	Basic rating life L in 100,000 m
L_h	h	Basic rating life in operating hours
n_{osc}	min^{-1}	Number of double strokes per minute
P	N	Equivalent dynamic load
v_m	m/min	Medium speed

1.1.2 Service life

The service life is the actual rating life achieved for a shaft guidance system. It may differ significantly from the calculated rating life.

Premature failure due to wear or fatigue can result from:

- Misalignment between the shafts or the guide elements
- Contamination
- Insufficient lubrication
- Oscillating movements with very small strokes (brinelling)
- Vibrations at a standstill (brinelling)

Due to the variety of installation conditions and operating conditions, it is not possible to determine the service life of a shaft guidance system exactly in advance. The safest way to accurately estimate the service life is to compare it with similar installation cases.

1.1.3 Static safety factor

The static safety factor S_0 indicates the security with regard to impermissible permanent deformation in the bearing and is determined using the following formula:

ƒ4

$$S_0 = \frac{C_0}{P_0}$$

C_0	N	Static load rating of the load direction
P_0	N	Static equivalent bearing load of the load direction
S_0	–	Static load safety factor

For linear ball bearings, KH must be $S_0 \geq 4$.

$S_0 \geq 2$ is considered permissible with regard to running accuracy and smooth running. For S_0 2, please contact us for advice.

1.1.4 Influence of the shaft raceway on the load rating

The load ratings in the product tables apply only if a ground (Ra 0.3) and hardened shaft (minimum 670 HV) serves as a raceway.

1.1.4.1 Deviating hardness of the raceway

If shafts with a surface hardness lower than 670 HV are used (e.g. shafts made of X46 or X90), a hardness factor must be taken into account.

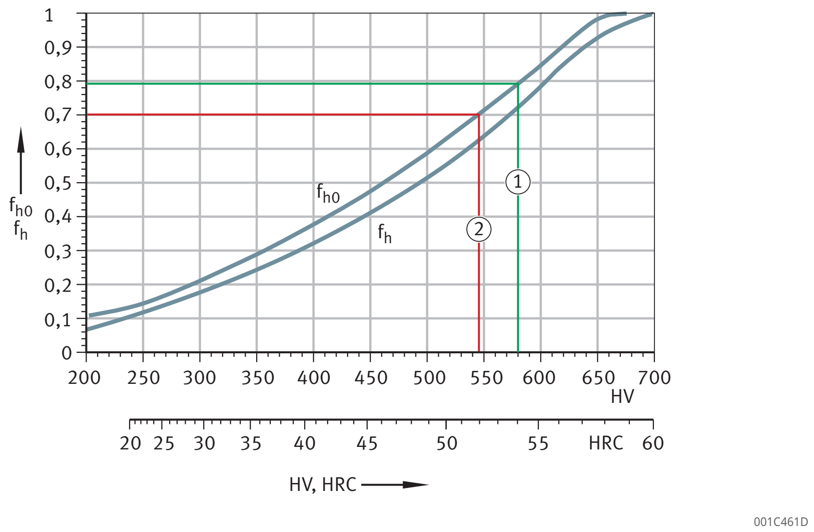
ƒ5

$$C_H = f_H \cdot C$$

ƒ6

$$C_{0H} = f_{H0} \cdot C_0$$

1 Static and dynamic hardness coefficients for reduced raceway hardness



1	X90	2	X46

C	N	Basic dynamic load rating
C_H	N	Effective dynamic load rating
C_0	N	Basic static load rating
C_{0H}	N	Effective static load rating
f_H	–	Dynamic hardness factor
f_{H0}	–	Static hardness factor
HV, HRC	–	Surface hardness

1.1.5 Load direction and orientation of the ball rows

The effective load rating of a linear ball bearing depends on the orientation of the load direction relative to the position of the ball rows:

- The lowest load ratings C_{min} and $C_{0\ min}$ occur in the apex position
- The highest load ratings C_{max} and $C_{0\ max}$ occur in the symmetry position

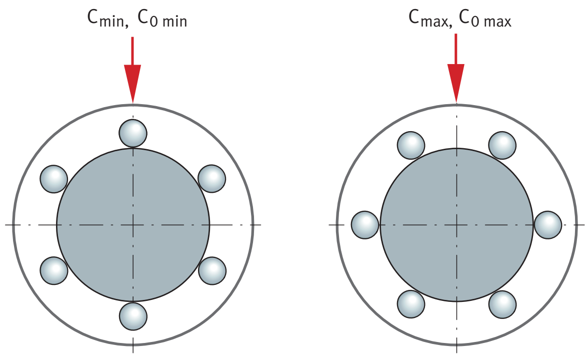
If the bearings are installed in a directional position, the maximum load rating can be used. If it is not possible to install in a directional position or if the load direction is not defined, the minimum load ratings must be assumed.

1.1.5.1 Main load direction

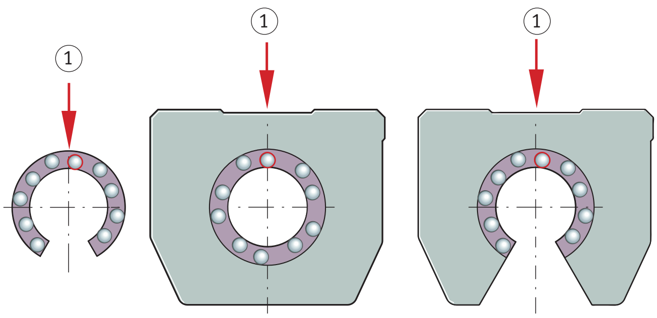
For linear ball bearings and linear ball bearing units for which the installation position of the ball rows is defined, the load ratings C and C_0 are specified in the main load direction. For different load directions, the effective load ratings can be determined using the load direction factors.

If the installation position of the ball rows is not defined, the minimum load capacities are specified.

2 Load rating, depending on the position of the ball rows



3 Main load direction for bearings and units



1	Main load direction

1.1.6 Load ratings for linear ball bearings

The load ratings in the product tables are defined as follows:

- For KH, KS, KB and KBS, the minimum and maximum load ratings apply ➤9 | 2
- For KSO and KBO, the load ratings in the main load direction apply. For different load directions, the diagrams ➤10 | 4 to ➤13 | 17 apply

1.1.7 Load ratings for linear ball bearing units

The load ratings in the product tables are defined as follows:

Compact series

For units KGHK and KTHK, the minimum load rating applies.

Heavy-duty series

For the heavy-duty series, the load rating in the main load direction applies. For different load directions, the diagrams ➤12 | 10 to ➤12 | 13 apply.

Solid series

For units KGB, KGBA, KTB, KGBS, KGBAS, the minimum load rating applies.

For the open units KGBO and KGBAO, the load rating in the main load direction applies. For different load directions, the diagrams ➤13 | 16 and ➤13 | 17 apply.

1

1.1.8 Load direction factors

The load direction factors shown in the diagrams take the following formulas into account:

ƒ7

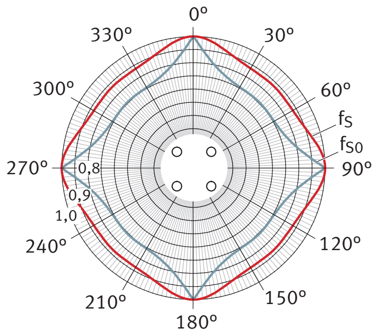
$$C_w = f_S \cdot C$$

ƒ8

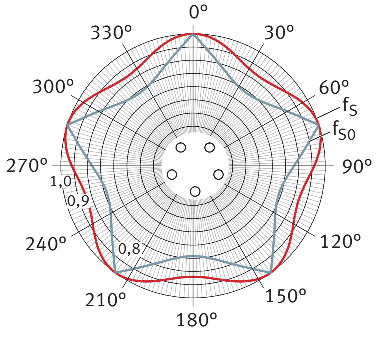
$$C_{0w} = f_{S0} \cdot C_0$$

C	N	Basic dynamic load rating
C_0	N	Basic static load rating
C_{0w}	N	Effective static load rating
C_w	N	Effective dynamic load rating
f_S	-	Dynamic load factor for load direction
f_{S0}	-	Static load factor for load direction

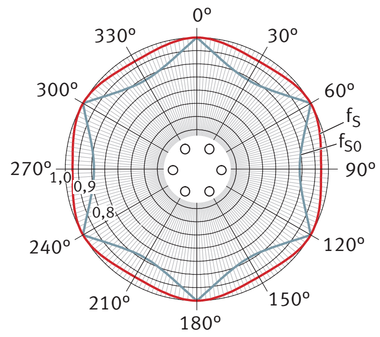
4 Compact series load direction factor for KH06, KH08, KH10



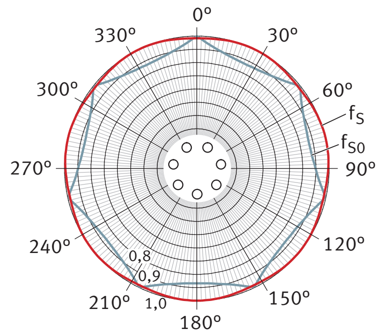
5 Compact series load direction factor for KH12, KH14, KH16



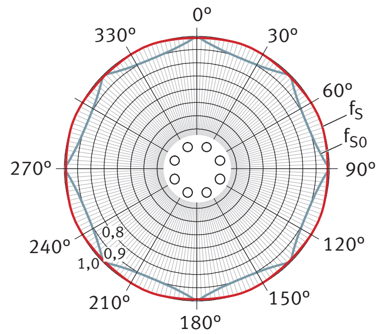
6 Compact series load direction factor for KH20, KH25



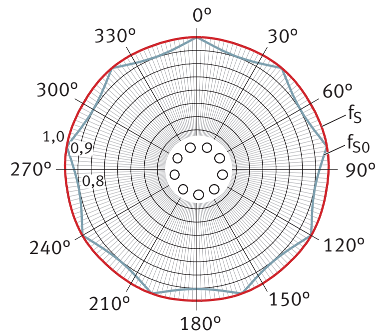
7 Compact series load direction factor for KH30



8 Compact series load direction factor for KH40



9 Compact series load direction factor for KH50



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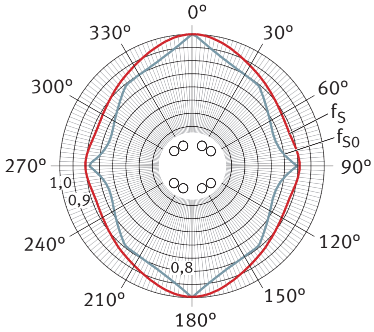
10 Heavy-duty series load direction factor for KS12, KS16, KS20, KS25, KS30, KS40, KS50



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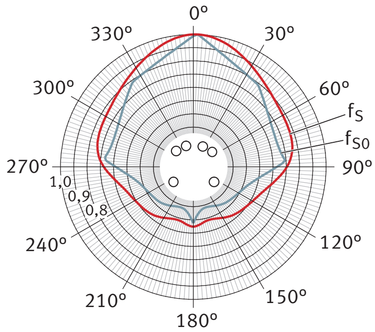
11 Heavy-duty series load direction factor for KSO12, KSO16



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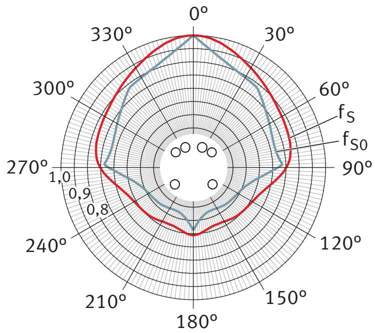
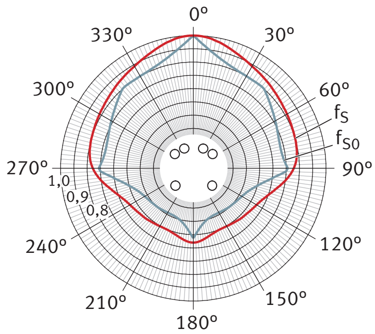
12 Heavy-duty series load direction factor for KSO20, KSO25



0001AC9D

13 Heavy-duty series load direction factor for KSO30, KSO40, KSO50



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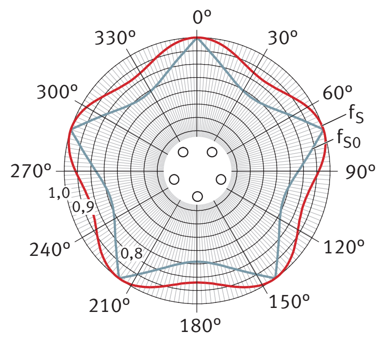
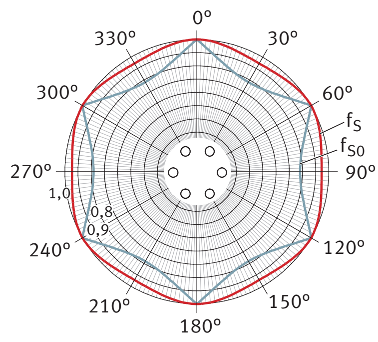
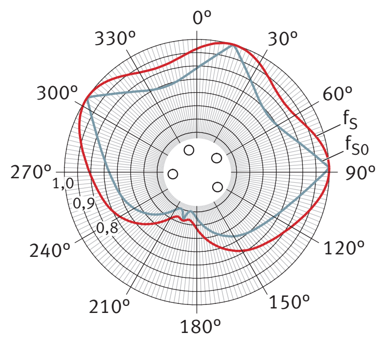
14 Solid series load direction factor for KB12, KB16



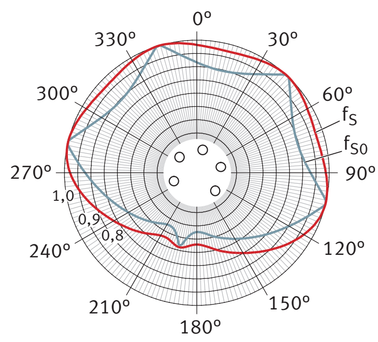
15 Solid series load direction factor for KB20, KB25, KB30, KB40, KB50



16 Solid series load direction factor for KBO12, KBO16



17 Solid series load direction factor for KBO20, KBO25, KBO30, KBO40, KBO50



1.1.9 Misalignment of the shaft

The running quality and service life of the linear ball bearings are impaired by misalignment of the shaft. For this reason, guides with one shaft should have at least 2 bearings; guides with 2 shafts should have at least 3 bearings.

1.1.9.1 Load factors for misalignment

Due to shaft deflections, misalignment cannot always be avoided. If this is the case, load factors for the misalignment must be taken into account.

9

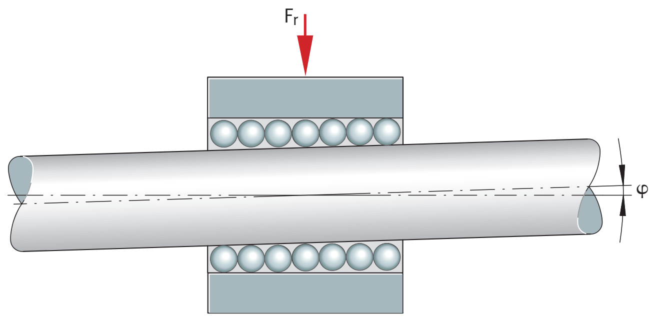
$$P = K_F \cdot F_r$$

10

$$P_0 = K_{F0} \cdot F_r$$

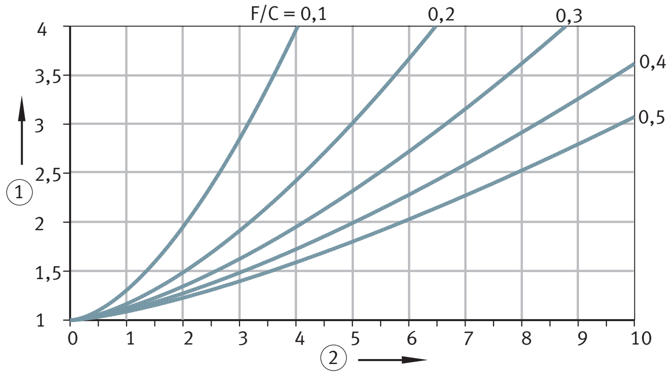
C, C_0	N	Dynamic or static load rating
F_r	N	Maximum radial bearing load
K_F, K_{F0}	-	Dynamic or static load factor for misalignment
P, P_0	N	Equivalent dynamic or static load

18 Misalignment φ of the shaft



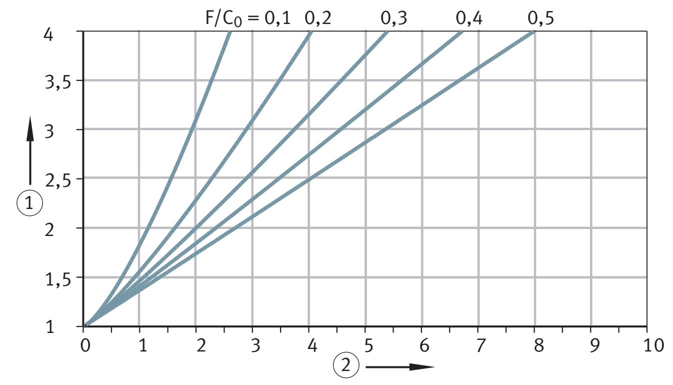
F_r	Radial load	φ	Misalignment

19 Dynamic load factor when the shaft is misaligned



1	Dynamic load factor K_F.	2	Misalignment φ in angular minutes

20 Static load factor when the shaft is misaligned



1	Static load factor K_{F0}	2	Misalignment φ in angular minutes

1.1.10 Compensation of angle errors in the heavy-duty series

Linear ball bearings KS and KSO and linear ball bearing units with these bearings are self-adjusting. They compensate for misalignments up to ±40 Winkelminute without impairing the load rating.

1.2 Friction

Linear ball bearings are often used in situations that require high positioning accuracy and efficiency. The bearings must therefore run smoothly and with only low friction.

Linear ball bearings KS, KSO, KB, KBS and KBO offer particularly low friction.

The total friction results from:

- Rolling friction and sliding friction in the contact zones (sliding friction in linear plain bearings)
- Friction in the deflection zones and returns
- Lubricant friction
- Seal friction

The factors that determine the coefficient of friction also influence each other in part, act in one direction or work against each other.

For non-sealed linear ball bearings and oil lubrication, the coefficients of friction are as follows:

1 Type series and coefficient of friction

Designation	Friction coefficient
KH	0.003 – 0.005
KS, KSO	0.001 – 0.0025
KB, KBS, KBO	0.001 – 0.0025

For linear plain bearings, the coefficient of friction is between 0.02 and 0.2.

1.3 Lubrication

Open linear ball bearings are preserved wet or dry and can be lubricated with grease or oil. The oily preservative is compatible with and can be mixed with mineral-oil-based lubricants, meaning that it is usually not necessary to wash out the bearings before installation.

Dry-preserved bearings must be greased or oiled immediately after being removed from the packaging.

1.3.1 Grease or oil lubrication

Grease lubrication is preferable to oil lubrication, as the grease remains in the bushing and thus prevents dirt from entering. This sealing effect protects the rolling elements against corrosion.

In addition, the design effort required for grease lubrication is less than for oil lubrication, as the sealing can be less complex.

Lubricating greases for linear ball bearings have the following properties:

- Lithium or lithium complex soap
- Base oil on a mineral oil basis or polyalphaolefin (PAO)
- Special wear protection additives for loads C/P 8, marked with “P” in the DIN designation KP2K–30
- Consistency as per NLGI class 2 according to DIN 51818.

Oil lubrication is preferred if heat is to be dissipated and dirt is to be removed by the lubricant.

This advantage is offset by the increased design effort (lubricant supply, sealing).

Depending on the load, we recommend the following lubricating oils:

- For low to medium loads (C/P > 15):
  - Hydraulic oils HL according to and lubricating oils CL according to DIN 51517:2018 in the viscosity range ISO VG 10 to ISO VG 22
- For high loads (C/P 8):
  - Hydraulic oils HLP according to and lubricating oils CLP according to DIN 51517:2018 in the viscosity range ISO VG 68 to ISO VG 100.

1.3.2 Initial greasing and service life

Experience has shown that the service life is achieved when using bearings in normal ambient conditions (C/P > 10), at room temperature and $v \leq 0.6 \cdot v_{max}$ with the initial greasing. If these conditions are not possible, relubrication is required.

Sealed linear ball bearings are already sufficiently greased on delivery, so that maintenance-free operation is achieved in many applications.

1.3.2.1 Performing initial greasing and relubrication of the bearing

The initial greasing and relubrication of linear ball bearings without seals and relubrication holes must be carried out via the shaft. Make sure that all rolling elements in circulation come into contact with grease. To ensure this, the bushing must be moved over at least twice the bearing length during the relubrication process.

When first greasing the bearing with the shaft fitted, add lubricant until it escapes from the bearing.

For linear ball bearings KH, KS..-PP-AS and the plain bearing PAB..-PP-AS, relubrication is possible through holes or recesses in the retaining ring or outer ring.

! Linear bearings and linear bearing housing units are to be relubricated when the shaft is assembled.

1.3.2.2 Relubrication interval

The relubrication period depends on a wide range of operating conditions such as load, temperature, speed, stroke, lubricant, environmental influences and the installation position.

! Exact lubrication intervals must be determined by testing under application conditions.

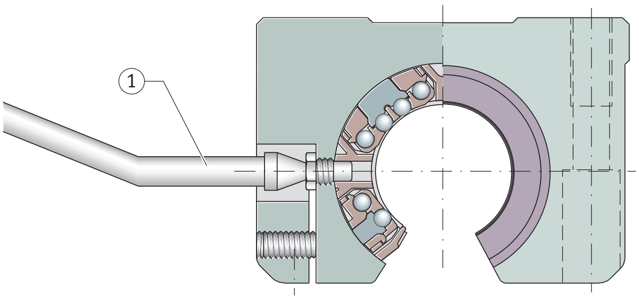
1.3.3 Relubrication of linear ball bearings in housings

If linear ball bearings are installed in a housing, special nozzle pipes may be required for relubrication. We are able to provide details of suppliers of nozzle pipes with suitable pointed mouthpieces upon request.

21 Nozzle pipe

00008E58

22 Relubrication with nozzle pipe



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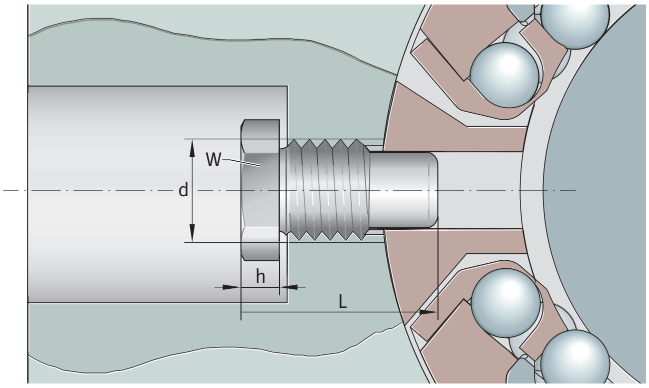
1	Nozzle pipe

1.3.4 Lubricating nipple for housing

Lubricating nipples NIP..MZ are suitable for housings in the heavy-duty series KS.

23 Lubricating nipples NIP..MZ for heavy-duty series KS

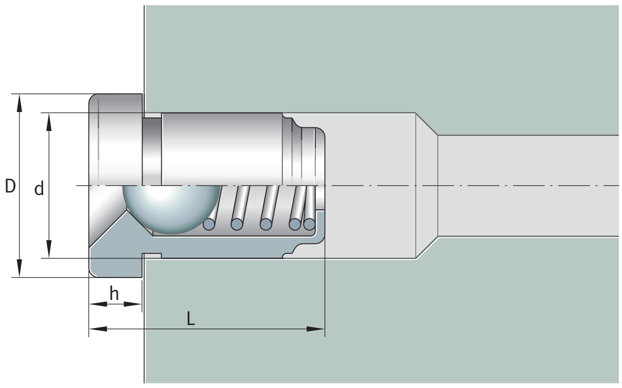


2 Lubricating nipple

Lubricating nipple	Width across flats	Dimensions		
	W	d	L	h
		–	mm	mm
NIP4MZ	5	M4	7.7	1.5
NIP5MZ	6	M5	11.1	2
NIP6MZ	7	M6	14.8	2.5

Lubricating nipples NIPA are suitable for housings of the compact series KH, solid series KB and plain bearing series PAB.

24 Lubricating nipples NIPA for compact series KH, solid series KB, plain bearing series PAB



3 Lubricating nipple

Lubricating nipple	Dimensions			
	D	d	L	h
	mm	mm	mm	mm
NIPA1	6	4	6	1.5
NIPA2	8	6	9	2

1.3.5 Use in special environments

In vacuum applications, lubricants with low evaporation rates are required to maintain the vacuum atmosphere.

In the food industry and clean rooms, special requirements are also placed on lubricants with regard to emissions and compatibility. Please contact us for advice when working in such conditions.

1.4 Bearing design

Linear bearings and linear bearing units are available as a compact series, lightweight construction series, heavy-duty series, solid series and plain bearing series. The bearings handle high loads at a relatively low weight and enable linear guides with unlimited travel distances.

Each type series has very specific properties that make it particularly suited to certain applications. Such requirements include misalignment compensation, low-friction running, high acceleration and running speeds, and a long service life.

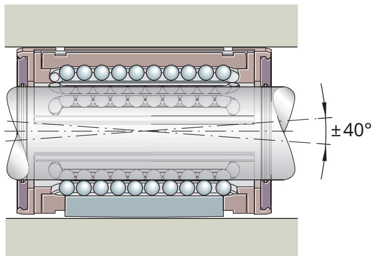
The modular and extended range provides the best technical and economic solution for bearings with shaft guidance systems for every requirement.

1.4.1 Linear bearings

Linear ball bearings and linear plain bearings can be closed or open. The open design has a segment cutout and is intended for supported shafts. With several series, the radial clearance can be set for clearance-free or preloaded guides when used together with the corresponding housing.

Misalignment can be caused by tolerance errors, mounting errors or inaccuracies in the adjacent construction. Linear ball bearings in the KS and KSO series compensate for static misalignment of up to ±40"

25 Compensation for misalignment KS



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The self-adjusting properties enable the balls to run smoothly into the loaded zone, which also makes the load distribution more even across the entire row of balls. This results in smoother running, allows higher accelerations and prevents the overloading of individual balls.

Overall, this results in higher achievable loads and a longer service life for the bearings; it may even be possible to use smaller and more cost-effective dimensioning for the adjacent construction.

! To achieve the full load ratings according to the product table, the shaft bearing surface must be hardened (670 HV + 165 HV) and ground.

1.4.2 Linear bearing units

Linear ball bearings and linear plain bearings are also supplied as complete bearing units together with INA housings. A radial fastening screw secures the bearing in the housing to prevent axial displacement.

The housings are made of a rigid and high-strength aluminum alloy, which enables the full load rating of the mounted bearings. The solid series also includes housings made of die-cast iron.

Due to their comparatively low total mass, the units are particularly suitable for weight-reduced constructions with high loads and when higher accelerations and running speeds are required.

Threaded holes or countersunk holes in the housing allow easy screw attachment to the adjacent construction (if necessary, also from below).

The housings have a stop edge for quick alignment. This prevents the linear bearings from twisting when the housings are installed.

Center holes allow quick, additional pinning of the housing to the adjacent construction.

Since they are manufactured in series production at high quantities, the price of the complete units is usually considerably more economical than customer-specific designs.

1.4.2.1 Housing versions

The housing is available in closed, segment cut-out, open, slotted and tandem versions (with and without centering collar).

The closed version enables the straightforward implementation of precision standard guides with a fixed enveloping circle.

Open versions with segment cut-out are used when the shaft must be supported for long guides and the bearing needs to be very stiff.

Closed versions and versions with segment cut-out are also supplied in a slotted version in several series. Slotted versions are suitable for clearance-free or preloaded guides. The operating clearance is adjusted using an adjusting screw.

The tandem version features two linear bearings. This gives the units high load-bearing properties.

Tandem ball bearing units are available in closed and open versions. Both variants are also supplied in the above-mentioned design with slots.

For special applications, we provide a tandem version with a centering collar for mounting holes in accordance with H7.

1.4.3 Sealing

The bearings are available in an open design and with contact seals on both sides (suffix PP). The KH and KB linear bearings have seals with two sealing lips on the front; the outer lip prevents dirt from entering, the inner lip keeps the lubricant in the bearing. The linear bearings of the type KS have contact seals with a sealing lip.

1.4.4 Lubrication

The initial lubrication with a high-quality grease and the integrated lubricant reservoir mean that linear bearings are maintenance-free for many applications. They can, however, be relubricated if necessary.

Depending on the version, linear ball bearings can be lubricated via the openings in the outer ring or radial holes arranged in the center of the bearing.

On the units, lubrication is carried out via separate lubricating nipples in the housing. The fixing of the bearing in the housing and the relubrication devices therefore are separated from each other.

Bearings and units with the suffix AS can be relubricated.

1.4.5 Operating temperature

Bearings and housings can be used at operating temperatures from –30 to +80.

1.4.6 Areas of application

The table shows the areas of application for linear bearings.

If the dependencies between bearing size and bearing design, load, operating clearance, bearing fastening and lubrication have been checked, higher values may be possible in individual cases. In this case, please contact us.

! Linear bearing units are classified according to the installed linear bearing.

4 Dynamic values of the linear bearings

Acceleration, speed		Series of linear bearings			
		KH	KB	KS	PAB
Acceleration	m/s^2	50	50	100	50
Speed	m/s	2	to 5	to 5	to 3

For linear ball bearings with a seal (suffix PP), speeds of up to 2 m/s are permissible.

1.4.7 Suffix

5 Suffix of the available versions

Suffix	Description	Design
PP	Lip seal on both sides	Standard
PPL	Longitudinal seals for bearings with segment cut-out	On request
AS	Bearing and unit can be relubricated	Standard

1.4.8 Design of the adjacent construction

Good running behavior of the shaft guidance systems is not solely dependent on the bearings. The form tolerances and positional tolerances of the adjacent construction also have a major influence on this.

The more precisely the adjacent construction is manufactured and the more precisely it has been mounted, the better the running behavior.

1.4.8.1 Fastening

Linear ball bearings KH and KH..-PP are pressed into the housing bore. They are thus fixed radially and axially. No additional measures are required.

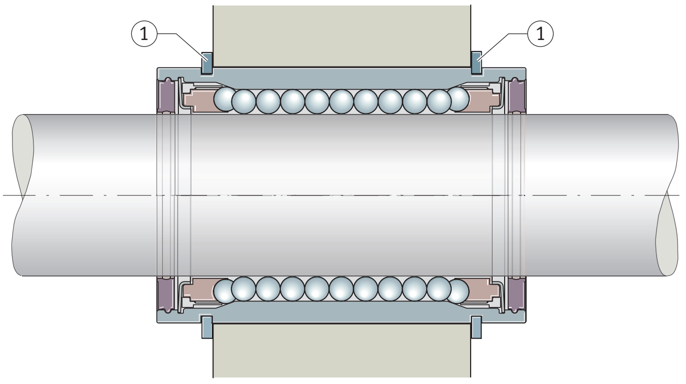
Linear ball bearings KB and KS and plain bearings PAB must be fixed axially.

Linear ball bearings KB and plain bearings PAB can be secured with snap rings or by the adjacent construction.

Linear ball bearings KS can be fixed with snap rings in the housing bore and with snap rings in the housing shoulder.

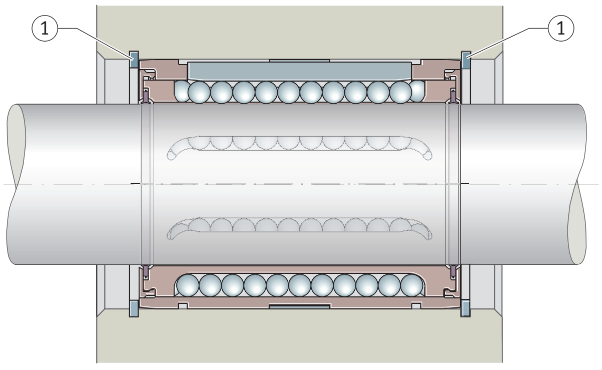
The series KS should not be secured using shaft snap rings. This can impair the function of the bearing.

26 Snap rings in the grooves of the bearing



1 Snap rings	

27 Snap rings in the housing bore



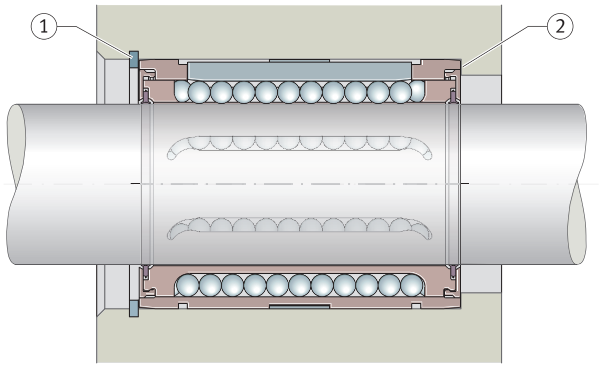
1 Snap rings	

Linear ball bearings KBO and plain bearings PABO must be secured axially and radially.

These bearings have a fixing on the outside. A screw with a pin is preferred to secure the bearing. Threaded pins are also suitable.

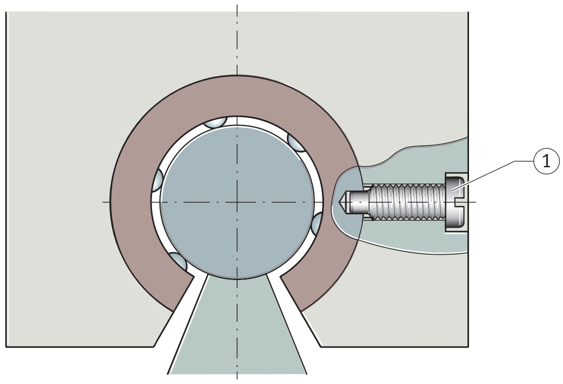
The fixing screw must not deform the bearing. The screw must be secured against loosening.

28 Snap ring and housing shoulder



1 Snap ring	2 Housing shoulder

29 Securing the bearing with a screw

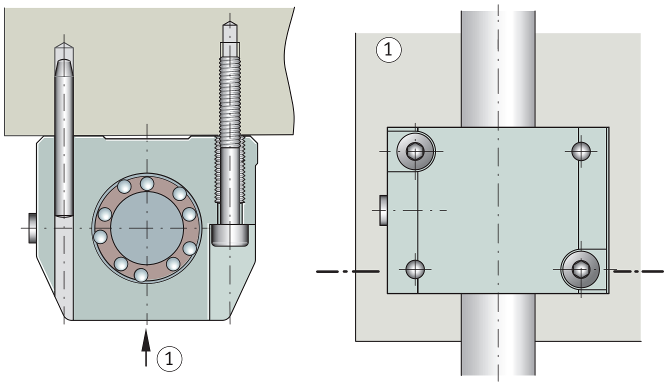


1	Locking screw with pin

Linear ball bearing units and linear plain bearing units are screwed using mounting holes.

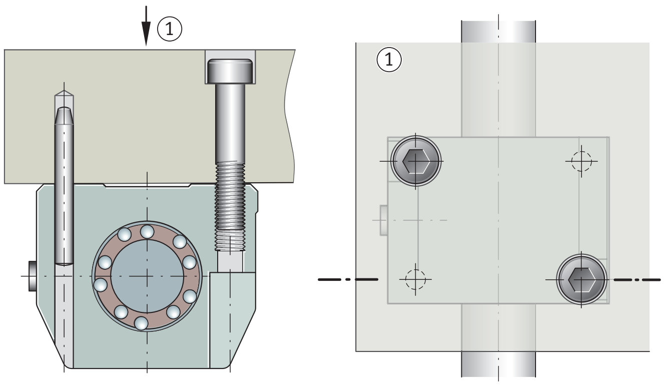
Pinning of the units is necessary only in rare cases, but is easily done by drilling out the centering holes.

30 Securing a unit from below



1	Bottom view

31 Securing a unit from above



1	Top view

1.4.8.2 Sealing

Clean raceways prevent premature shaft and bearing failure. Therefore, the bearing position should always be sealed.

1

Gap seals protect the bearings from coarse dirt. Contact seals protect against fine dirt and keep the grease in the bearing.

If the bearings and shaft are located in very aggressive environments, it is recommended that the guide is additionally protected using bellows or telescopic covers.

! If the bearings and shaft are located in very aggressive environments, it is recommended that the guide is additionally protected using bellows or telescopic covers.

6 Sealing of bearings and units

Designation [1)]	Seal		
	Open	Gap seal	Contact seal
KH	✓	–	✓
KS, KSO	–	✓	✓
KB, KBO	–	✓	✓
PAB, PABO	–	–	✓

✓ available
– not available

1) All linear bearing units have contact seals.

1.5 Installation

The bearings should not be taken out of the packaging until immediately before assembly. Dry-preserved bearings must be protected against corrosion immediately after removal.

! The assembly area and the adjacent construction must be clean. Dirt impairs accuracy and shortens the service life of the guides.

The bearings must not be tilted.

For sealed bearings with segment cut-out, it must be ensured that the ends of the sealing lips are not turned inside out (see packing slip).

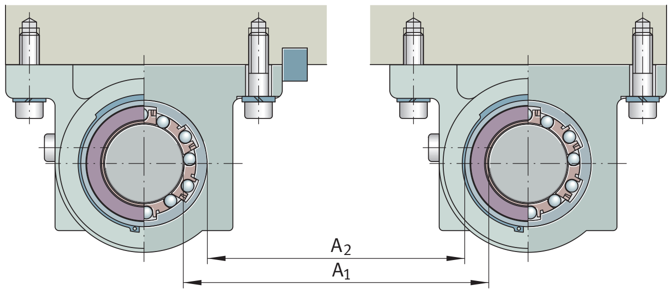
1.5.1 Aligning the bearings and shafts

Bearings arranged in succession should be aligned using a continuous shaft, set against a stop and then screwed tight.

Parallel bearings are aligned by measuring the distance between the shafts (A_1) or between the outer bearing diameters (A_2). This distance can also be defined using spacers.

Fix the first shaft (reference shaft) and screw it on. Align the second shaft by moving the slide and thus creating the required distance.

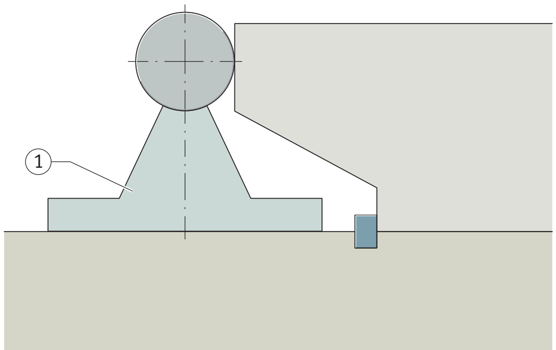
32 Alignment of parallel bearings



A_1	Distance between the shafts	A_2	Distance between the outer bearing diameters

For very long guides with a supported shaft, first align a support rail over the shaft and screw in place step by step (reference shaft).

33 Alignment of a support rail over the shaft

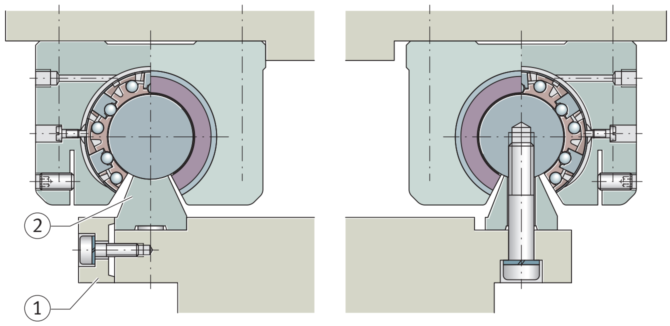


1	Support rail		

Only one row of bearings in succession should be positioned without clearance or preloaded. Parallel bearings should have a larger operating clearance.

When using parallel support rails, clamp the reference rail against a stop.

34 Clamping of the reference rail with two TSUW support rails



1	Stopper	2	Reference rail

1

1.5.2 Setting the operating clearance

The operating clearance for linear bearings is determined by the shaft tolerance and housing tolerance.

The operating clearance of linear bearing units is either determined by the shaft or adjusted using the adjusting screw on slotted housings.

! When using non-rigid housings, tests are required to adjust the operating clearance in line with the housing tolerances and shaft tolerances.

1.5.2.1 Adjusting bearings to eliminate clearance

The operating clearance can be set for KBS linear ball bearings and slotted housings. For this, the screw must be adjusted until there is noticeable torsional resistance between the shaft and the bearing.

! Do not screw the adjusted bearing any further onto the shaft.

7 Tolerance and operating clearance

Linear bearings and linear bearing units	Designation	Tolerance		Operating clearance
		Shaft	Bore	
Compact series	KH	➤26 | 8		
	KGHK, KTHK	h6	–	Normal
Heavy-duty series	KS, KSO	h6	H7	Free from clearance
	KGSNG, KTSG, KGSNO, KTSO, KGSC	h6	–	Slight preload
	KGSNS, KGSNOS, KGSCS	–	–	Adjustable with screw
Solid series	KB	➤26 | 10		
	KBS, KBO			
	KGB, KGBA, KTB, KGBO	h6	–	➤27 | 11
	KGBS, KGBAS, KGBAO	–	–	Adjustable with screw
Plain bearing series	PAB, PABO	h7	H7	Normal
	PAGBA, PAGBAO	h7	–	Normal

1.5.2.2 Installation tolerances and operating clearance

The theoretically possible operating clearance for the individual series:

8 Operating clearance for KH

Installation tolerance		Operating clearance for all sizes	
Shaft	Bore		
h6	H7, K7	Normal operating clearance	Steel/alum.
j5	H6, K6	Operating clearance less than normal	Steel/alum.

9 Operating clearance for KS, KSO

Installation tolerance		Size and operating clearance													
Shaft	Bore	12		16		20		25		30		40		50	
		U	L	U	L	U	L	U	L	U	L	U	L	U	L
		μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm
h6	H6	+36	–8	+34	–10	+37	–12	+34	–15	+29	–20	+33	–22	+30	–25
h6	H7	+44	–8	+42	–10	+46	–12	+43	–15	+38	–20	+44	–22	+41	–25
h6	JS6	+29	–14.5	+27.5	–16.5	+29	–20	+26	–23	+21	–28	+23.5	–31.5	+20.5	–34.5

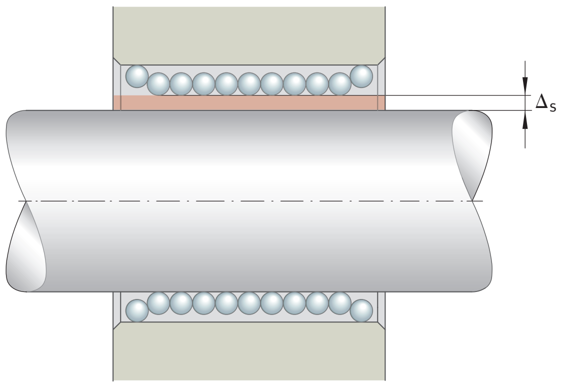
10 Operating clearance for KB

Installation tolerance		Size and operating clearance													
Shaft	Bore	12		16		20		25		30		40		50	
		U	L	U	L	U	L	U	L	U	L	U	L	U	L
		μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm
h6	H6 (H7)	+19	0	+20	–1	+22	–1	+24	–1	+24	–1	+29	–2	+29	–2

11 Operating clearance for KBS, KBO

Installation tolerance		Size and operating clearance													
Shaft	Bore	12		16		20		25		30		40		50	
		U	L	U	L	U	L	U	L	U	L	U	L	U	L
		μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm
h6	H6	+50	0	+51	–1	+60	–1	+62	–1	+62	–1	+74	–2	+74	–2
h6	H7	+58	0	+59	–1	+69	–1	+71	–1	+71	–1	+85	–2	+85	–2
h6	JS6	+43.5	–6.5	+44.5	–7.5	+52	–9	+54	–9	+54	–9	+64.5	–11.5	+64.5	–11.5

35 Operating clearance



Δ_s Operating clearance

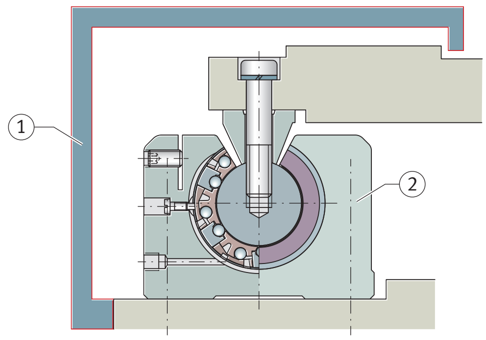
1.5.2.3 Adjust the preload

Preloaded bearings are set on a master shaft without clearance that is smaller than the running shaft by the preload dimension.

1.5.2.4 Suspended arrangement of guide system

! If the guide system is suspended, a fall arrester is recommended.

36 Suspended shaft guidance system with fall arrester



1	Fall arrester	2	Mounting position 180°

2 Linear ball bearings and linear ball bearing units of the compact series

2.1 Product design

Linear ball bearings KH and linear ball bearing units of the compact series require a small radial installation space and are particularly cost-effective. Their low radial height automatically makes them ideal for applications where only a small radial installation space is available.

The closed design makes them suitable for use with shafts.

37 Linear ball bearings KH, KH..-PP, with and without seal (PP)

00008DE3

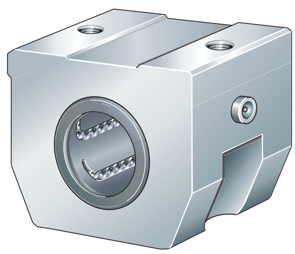
The bearings have an outer ring with opening that integrates a ball-cage assembly with a plastic cage. The outer ring is formed without cutting and hardened. The balls run back into the openings in the outer ring.

The bearings are available in an open design and with a lip seal on both sides (suffix PP). The seals on the front have two sealing lips: the outer lips prevent dirt from entering and the inner lips keep the lubricant in the bearing.

Linear ball bearing units in the compact series are available with an integrated bearing, as well as in a tandem version with two bearings that offers particularly load-bearing properties.

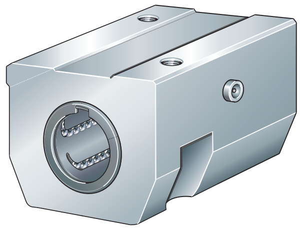
High-strength aluminum is used for the housing.

38 Closed units KGHK..-B-PP-AS



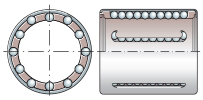
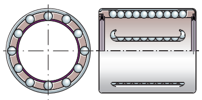
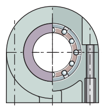
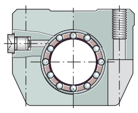
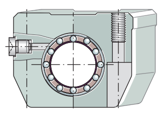
0000897C

39 Closed units KTHK..-B-PP-AS, bearings in tandem arrangement



40 Closed unit KGHA..-PP

12 Linear ball bearings and linear ball bearing units of the compact series

Model series		**Characteristic**
KH		• Linear ball bearing
KH..-PP		• Linear ball bearing • Sealed
KGHA..-PP		• Closed unit • Sealed
KGHK..-PP-AS		• Closed unit • Sealed • Can be relubricated
KTHK..PP-AS		• Closed unit • Tandem design • Sealed • Can be relubricated

Further information

- Product tables ➤31|2.2
- Shafts ➤82|6.1
- Support rails ➤101|7.1
- Shaft support blocks ➤117|8.1

2

2.2 Product tables

2.2.1 Explanations

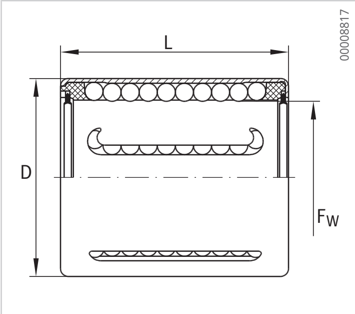
A_3	mm	Lubrication connection distance
A_5	mm	Stop side distance
B	mm	Width of the housing
B_1	mm	Width of housing flange
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
D	mm	Outside diameter
F_w	mm	Inner envelope diameter
G_2	–	Connecting thread
H	mm	Height of the housing
H_2	mm	Center distance
H_4	mm	Height of housing flange
H_5	mm	Height of stop edge
H_6	mm	Height of the mounting hole
J_B	mm	Mounting hole distance
J_L	mm	Distance between mounting holes
J_{L4}	mm	Lubrication hole distance
K_5	–	Fixing screw
K_8	–	Lubrication connection
L	mm	Length of the housing
L	mm	Length of the linear ball bearing
m	g	Mass
N_1	mm	Diameter of the mounting hole
N_2	mm	Connection dimension
N_3	mm	Diameter of the counterbore
T_5	mm	Thread depth

2

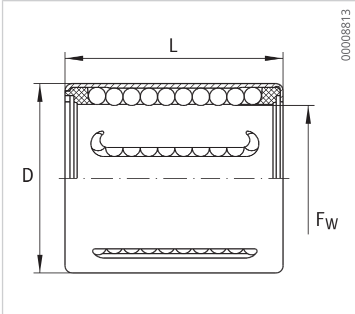
2.2.2 Linear ball bearing KH

Sealed (optional)

Can be relubricated

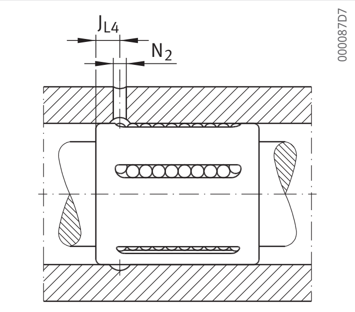


KH..-PP



KH

Designation	m	F_w	D	L	J_{L4}	N_2
–	g	mm	mm	mm	mm	mm
KH06	7	6	12	22	4	2
KH06-PP	7	6	12	22	4	2
KH08	12	8	15	24	6	2
KH08-PP	12	8	15	24	6	2
KH10	14.5	10	17	26	6	2.5
KH10-PP	14.5	10	17	26	6	2.5
KH12	18.5	12	19	28	6	2.5
KH12-PP	18.5	12	19	28	6	2.5
KH14	20.5	14	21	28	6	2.5
KH14-PP	20.5	14	21	28	6	2.5
KH16	27.5	16	24	30	7	2.5
KH16-PP	27.5	16	24	30	7	2.5
KH20	32.5	20	28	30	7	2.5
KH20-PP	32.5	20	28	30	7	2.5
KH25	66	25	35	40	8	2.5
KH25-PP	66	25	35	40	8	2.5
KH30	95	30	40	50	8	2.5
KH30-PP	95	30	40	50	8	2.5
KH40	182	40	52	60	9	2.5
KH40-PP	182	40	52	60	9	2.5
KH50	252	50	62	70	9	2.5
KH50-PP	252	50	62	70	9	2.5



Connection dimensions

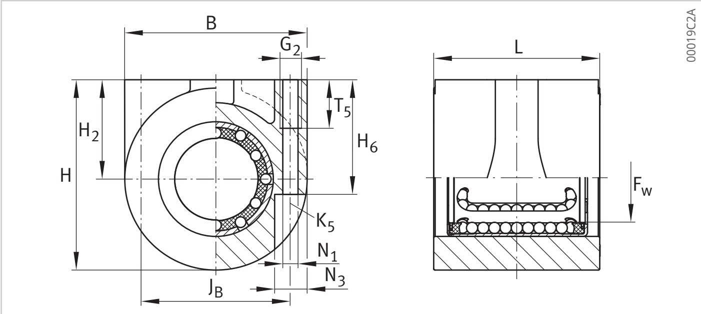
C	C_0	C	C_0
min	min	Max.	Max.
N	N	N	N
340	240	390	340
340	240	390	340
410	280	475	400
410	280	475	400
510	370	590	520
510	370	590	520
670	510	800	740
670	510	800	740
690	520	830	760
690	520	830	760
890	620	1060	910
890	620	1060	910
1110	790	1170	1010
1110	790	1170	1010
2280	1670	2420	2130
2280	1670	2420	2130
3300	2700	3300	3100
3300	2700	3300	3100
5300	4450	5300	4950
5300	4450	5300	4950
6800	6300	6800	7000
6800	6300	6800	7000

2

2.2.3 Linear ball bearing units KGHA

Sealed

Greased



KGHA..-PP

Designation	m	F_w	H_2	H	B	L
			±0.015			+0.5
–	g	mm	mm	mm	mm	mm
KGHA16-PP	228	16	20	41	42	37
KGHA20-PP	303	20	25	48.5	47	39
KGHA25-PP	496	25	30	57.5	55	49
KGHA30-PP	860	30	35	67.5	65	59
KGHA40-PP	1434	40	45	84	78	71

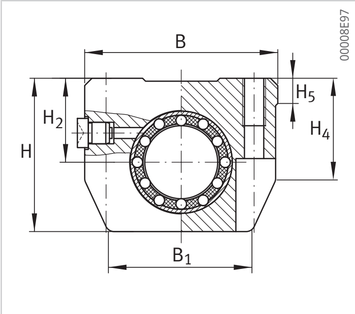
[1)] For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.

H_6	T_5	J_B	G_2	N_1	N_3	K_5 [1)]	C	C_0
		±0.1						
mm	mm	mm	–	mm	mm	–	N	N
27	15	32	M6	5.1	8.1	M4	890	620
29	15	38	M6	5.1	8.1	M4	1110	790
35	15	46	M6	5.1	8.1	M4	2280	1670
39	20	54	M8	6.7	11.1	M6	3300	2700
49	20	66	M8	6.7	11.1	M6	5300	4450

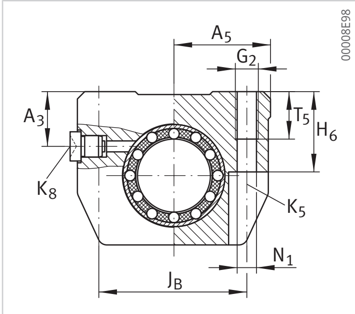
2.2.4 Linear ball bearing units KGHK

Sealed

Greased, can be relubricated



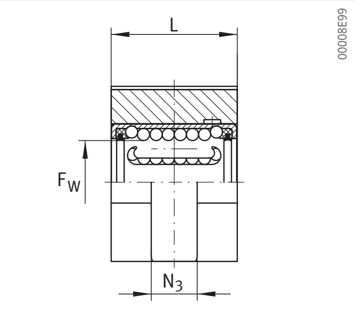
KGHK..-B-PP-AS



KGHK..-B-PP-AS

Designation	m	F_w	B	L	H	J_B ±0.15	B_1	A_5	H_2 +0.010 –0.014
–	g	mm	mm	mm	mm	mm	mm	mm	mm
KGHK06-B-PP-AS	40	6	32	22.2	27	23	25	16	13
KGHK08-B-PP-AS	50	8	32	24.2	27	23	25	16	14
KGHK12-B-PP-AS	80	12	40	28.2	33	29	32	20	17
KGHK10-B-PP-AS	70	10	40	26.2	33	29	32	20	16
KGHK16-B-PP-AS	110	16	43	30.2	36.5	34	34	21.5	19
KGHK14-B-PP-AS	100	14	43	28.2	36.5	34	34	21.5	18
KGHK20-B-PP-AS	150	20	53	30.2	42.5	40	40	26.5	23
KGHK25-B-PP-AS	270	25	60	40.2	52.5	48	44	30	27
KGHK30-B-PP-AS	400	30	67	50.2	60	53	49.6	33.5	30
KGHK40-B-PP-AS	750	40	87	60.2	73.5	69	63	43.5	39
KGHK50-B-PP-AS	1250	50	103	70.2	92	82	74	51.5	47

[1] For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.



KGHK..-B-PP-AS

H_4	H_5	T_5	H_6	A_3	G_2	N_1	N_3	K_5 [1)]	K_8	C	C_0
mm	mm	mm	mm	mm	–	mm	mm	–	–	N	N
20.6	5	9	13	9	M4	3.4	7	M3	NIPA1	340	240
20.6	5	9	13	9	M4	3.4	7	M3	NIPA1	410	280
25.1	5	11	16	11	M5	4.3	10	M4	NIPA1	670	510
25.1	5	11	16	11	M5	4.3	10	M4	NIPA1	510	370
28.1	6.9	11	18	13	M5	4.3	10	M4	NIPA1	890	620
28.1	6.9	11	18	13	M5	4.3	10	M4	NIPA1	690	520
29.8	7.4	13	22	15	M6	5.3	11	M5	NIPA2	1110	790
36.6	9.9	18	26	17.5	M8	6.6	15	M6	NIPA2	2280	1670
42.7	8	18	29	18	M8	6.6	15	M6	NIPA2	3300	2700
49.7	12.8	22	38	23	M10	8.4	18	M8	NIPA2	5300	4450
62.3	10.9	26	46	28	M12	10.5	20	M10	NIPA2	6800	6300

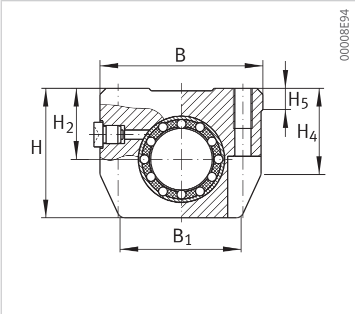
2

2.2.5 Linear ball bearing units KTHK

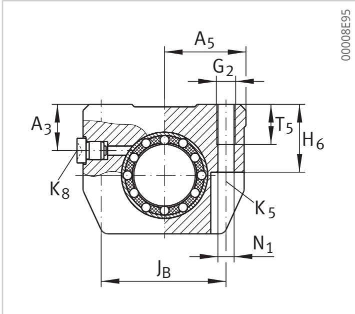
Tandem arrangement

Sealed

Greased, can be relubricated



KTHK..-B-PP-AS



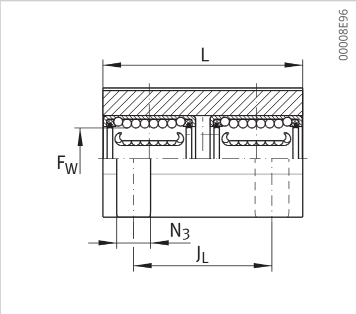
KTHK..-B-PP-AS

Designation	m	F_w	B	L	H	J_B	B_1	A_5	J_L [1]	H_2
						±0.15			±0.15	+0.010 –0.014
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm
KTHK12-B-PP-AS	170	12	40	60	33	29	32	20	35	17
KTHK16-B-PP-AS	230	16	43	65	36.5	34	34	21.5	40	19
KTHK20-B-PP-AS	320	20	53	65	42.5	40	40	26.5	45	23
KTHK25-B-PP-AS	580	25	60	85	52.5	48	44	30	55	27
KTHK30-B-PP-AS	850	30	67	105	60	53	49.6	33.5	70	30
KTHK40-B-PP-AS	1600	40	87	125	73.5	69	63	43.5	85	39
KTHK50-B-PP-AS	2700	50	103	145	92	82	74	51.5	100	47

[1] Hole position symmetrical to bearing length L.

[2] For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.

[3] The load ratings apply only to hardened (670 HV + 165 HV) and ground shaft raceways and to an even load on the two linear ball bearings.



KTHK..-B-PP-AS

2

H_4	H_5	T_5	H_6	A_3	G_2	N_1	N_3	K_5 2)	K_8	C 3)	C_0 3)
mm	mm	mm	mm	mm	–	mm	mm	–	–	N	N
25.1	5	11	16	11	M5	4.3	10	M4	NIPA1	1090	1020
28.1	6.9	11	18	13	M5	4.3	10	M4	NIPA1	1440	1240
29.8	7.4	13	22	15	M6	5.3	11	M5	NIPA2	1800	1580
36.6	9.9	18	26	17.5	M8	6.6	11	M6	NIPA2	3700	3350
42.7	8	18	29	18	M8	6.6	15	M6	NIPA2	5400	5400
49.7	12.8	22	38	23	M10	8.4	18	M8	NIPA2	8600	6900
62.3	10.9	26	46	28	M12	10.5	20	M10	NIPA2	11000	12600

3 Linear ball bearings and linear ball bearing units of the heavy-duty series

3.1 Product design

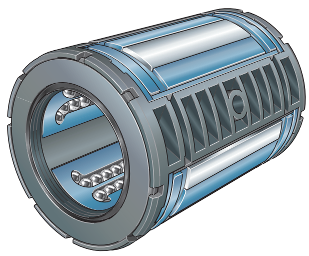
Linear ball bearings of the heavy-duty series KS and KSO and the associated ball bearing units have a particularly high load-bearing capacity and are self-aligning to compensate for misalignment. They have very good running behavior.

The bearings are available with contact seals or with gap seals. The contact seals on the front have two sealing lips: the outer lips prevent dirt from entering and the inner lips keep the lubricant in the bearing.

Linear ball bearings KS and KSO consist of a plastic cage with loosely held segments. The double-row segments with convex raceway plates can adjust in all directions and thus compensate for alignment errors. Since the entire segment adjusts, this prevents disruptions in the ball circulation, which results in even and low displacement resistance.

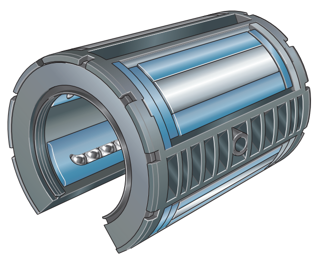
The series KS is closed and designed for use with shafts. KSO has a segment cut-out and is used in conjunction with support rails.

41 Linear ball bearings KS, KS..-PP, closed, with and without seal (PP)



00008C2B

42 Linear ball bearings KSO, KSO..-PP, with segment cut-out, with and without seal (PP)



00008C36

Linear ball bearing units in the heavy-duty series are available with an integrated bearing, as well as in a tandem version with two bearings that offers particularly load-bearing properties.

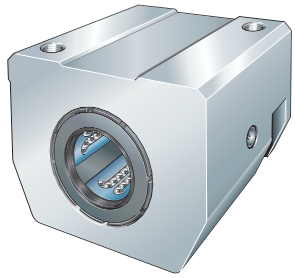
High-strength aluminum is used for the housing.

Housings are available in a closed design, with segment cut-out for supported shafts, and with or without a slot. The slotted versions enable the radial clearance to be adjusted using an adjusting screw.

All series have a stop edge and centering holes for pin holes.

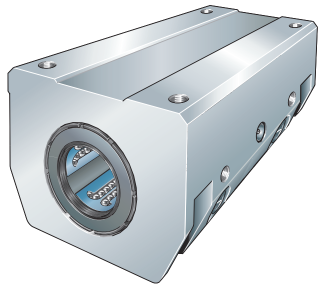
The assembled bearings are sealed on both sides, feature initial greasing and can be relubricated through lubricating nipples in the housing.

43 Closed units KGSNG..-PP-AS, KGSNS..PP-AS, housing slotted (KGSNS) or not slotted (KGSNG)



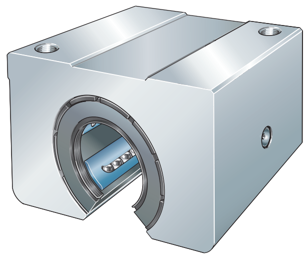
00008CED

44 Closed units KTSG..-PP-AS, bearings in tandem arrangement



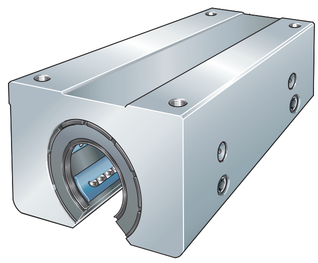
001CD0AF

45 Units with segment cut-out KGSNO..-PP-AS, KGSNOS..PP-AS, housing slotted (KGSNOS) or not slotted (KGSNO)



00008CF7

46 Units with segment cut-out KTSO..-PP-AS, bearing in tandem arrangement



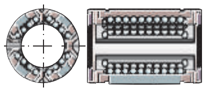
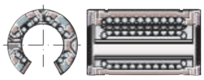
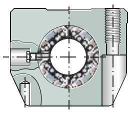
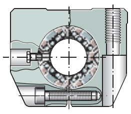
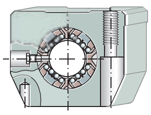
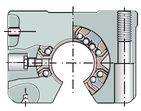
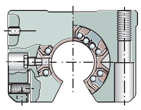
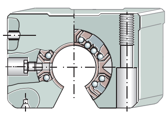
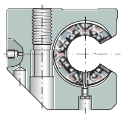
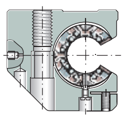
001CD0B2

3

47 Units with segment cutout KGSC..-PP-AS, KGSCS..-PP-AS, housing slotted (KGSCS) or not slotted (KGSC)

00008D04

13 Linear ball bearings and linear ball bearing units of the heavy-duty series

Model series		Characteristic
KS KS..-PP		• Linear ball bearing • Self-aligning • With or without lip seal
KSO KSO..-PP		• Linear ball bearing • With segment cut-out • Self-aligning • With or without lip seal
KGSNG..-PP-AS		• Closed • Can be relubricated
KGSNS..PP-AS		• Closed • Housing slotted • Can be relubricated
KTSG..-PP-AS		• Closed • Tandem arrangement • Can be relubricated
KGSNO..-PP-AS		• With segment cut-out • Can be relubricated
KGSNOS..PP-AS		• With segment cut-out • Housing slotted • Can be relubricated
KTSO..-PP-AS		• With segment cut-out • Tandem arrangement • Can be relubricated
KGSC..-PP-AS		• Open on the side • Can be relubricated
KGSCS..-PP-AS		• Open on the side • Housing slotted • Can be relubricated

Further information

- Product tables ➤43 | 3.2
- Shafts ➤82 | 6.1
- Support rails ➤101 | 7.1
- Shaft support blocks ➤117 | 8.1

3

3.2 Product tables

3.2.1 Explanations

(1)	–	Main load direction
A_{10}	mm	Offset of relubrication opening
A_2	mm	Mounting hole distance
A_4	mm	Pin hole distance
A_5	mm	Stop side distance
B	mm	Width of the housing
B_1	mm	Width of housing flange
B_2	mm	Segment opening
B_{L2}	mm	Width of mounting groove
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
D	mm	Outside diameter
D_N	mm	Diameter of mounting groove
F_w	mm	Inner envelope diameter
G_2	–	Connecting thread
H	mm	Height of the housing
H_2	mm	Center distance
H_4	mm	Height of housing flange
H_5	mm	Height of stop edge
H_6	mm	Height of the mounting hole
H_6	mm	Depth of mounting hole
J_B	mm	Mounting hole distance
J_L	mm	Pin hole distance
J_L	mm	Distance between mounting holes
K_5	–	Fixing screw
K_8	–	Lubrication connection
L	mm	Length of the housing
L	mm	Lower limit deviation
L_2	mm	Connection dimension
L_6	mm	Pin hole distance
m	g	Mass
n	–	Number of ball rows
N_1	mm	Diameter of the through bore
N_3	mm	Diameter of the counterbore
N_4	mm	Diameter of the pin bore
T_5	mm	Thread depth
U	mm	Upper limit deviation
α	°	Segment cut-out angle

3

3.2.2 Linear ball bearings KS, KSO

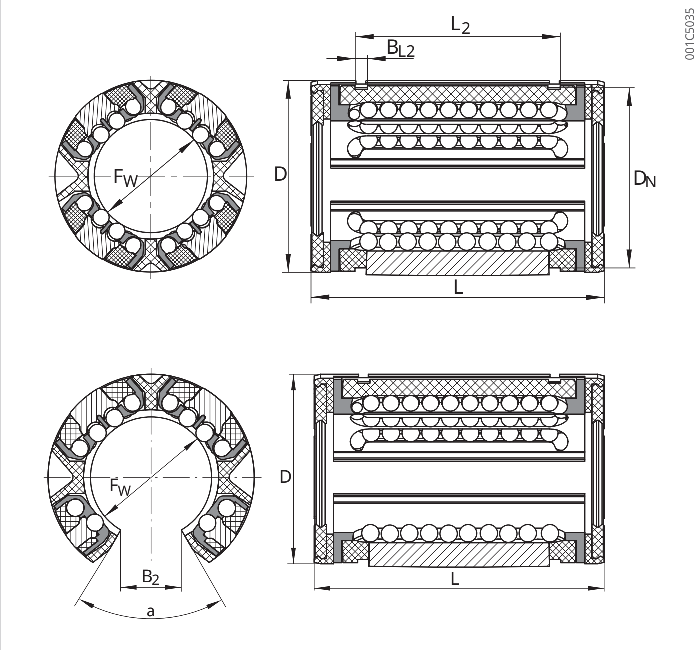
self-aligning

closed

With segment cut-out

Sealed (optional)

Can be relubricated

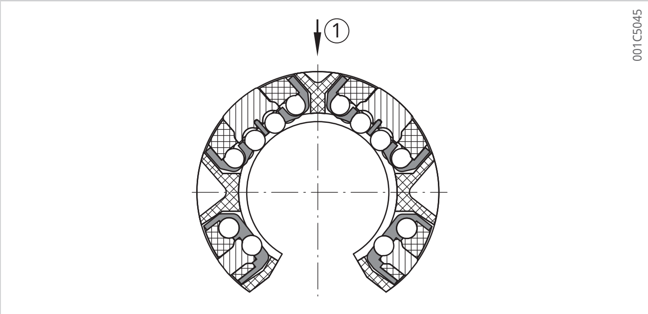


KS..-PP, KS, KSO..-PP, KSO

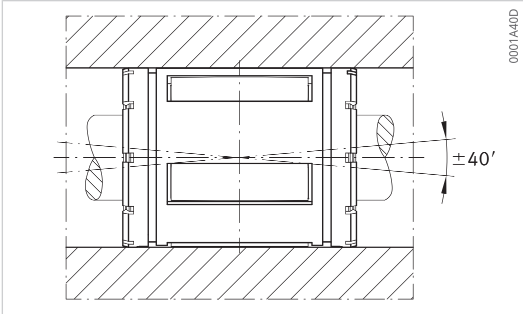
Designation	m	F_W	D	L	B_2	L_2	B_{L2}	D_N
						H13		
–	g	mm	mm	mm	mm	mm	mm	mm
KS12	18	12	22	32	–	22.6	1.3	21
KS12-PP	18	12	22	32	–	22.6	1.3	21
KSO12	13	12	22	32	7.6	–	–	–
KSO12-PP	13	12	22	32	7.6	–	–	–
KS16	28	16	26	36	–	24.6	1.3	25
KS16-PP	28	16	26	36	–	24.6	1.3	25
KSO16	19	16	26	36	10.1	–	–	–
KSO16-PP	19	16	26	36	10.1	–	–	–
KS20	51	20	32	45	–	31.2	1.6	30.7
KS20-PP	51	20	32	45	–	31.2	1.6	30.7
KSO20	38	20	32	45	10	–	–	–
KSO20-PP	38	20	32	45	10	–	–	–
KS25	102	25	40	58	–	43.7	1.85	38
KS25-PP	102	25	40	58	–	43.7	1.85	38
KSO25	75	25	40	58	12.5	–	–	–
KSO25-PP	75	25	40	58	12.5	–	–	–
KS30	172	30	47	68	–	51.7	1.85	44.7
KS30-PP	172	30	47	68	–	51.7	1.85	44.7
KSO30	135	30	47	68	14.3	–	–	–
KSO30-PP	135	30	47	68	14.3	–	–	–
KS40	335	40	62	80	–	60.3	2.15	59.4
KS40-PP	335	40	62	80	–	60.3	2.15	59.4
KSO40	259	40	62	80	18.2	–	–	–
KSO40-PP	259	40	62	80	18.2	–	–	–
KS50	589	50	75	100	–	77.3	2.65	71.4
KS50-PP	589	50	75	100	–	77.3	2.65	71.4
KSO50	454	50	75	100	22.7	–	–	–
KSO50-PP	454	50	75	100	22.7	–	–	–

1) Hole position symmetrical to bearing length L.

2) Only one lubrication hole and one fixing hole each for sizes 16 and 20.



KSO..-PP, KSO



Self-aligning up to ±40°

A_{10}	N_1 [1) 2)]	N_4 [1) 2)]	α	n	C	C_0	C	C_0
					min	min	Max.	Max.
mm	mm	mm	°	–	N	N	N	N
–	–	3	–	8	630	600	900	1100
–	–	3	–	8	630	600	900	1100
–	3	3	78	6	–	–	900	1100
–	3	3	78	6	–	–	900	1100
–	3	3	–	8	1060	950	1430	1550
–	3	3	–	8	1060	950	1430	1550
–	3	3	78	6	–	–	1430	1550
–	3	3	78	6	–	–	1430	1550
–	3	3	–	8	1780	1600	2200	2310
–	3	3	–	8	1780	1600	2200	2310
–	3	3	60	6	–	–	2200	2310
–	3	3	60	6	–	–	2200	2310
1.5	3.5	3	–	8	2700	2430	3950	4300
1.5	3.5	3	–	8	2700	2430	3950	4300
1.5	3.5	3	60	6	–	–	3950	4300
1.5	3.5	3	60	6	–	–	3950	4300
2	3.5	3	–	8	4650	3970	5900	6000
2	3.5	3	–	8	4650	3970	5900	6000
2	3.5	3	57	6	–	–	5900	6000
2	3.5	3	57	6	–	–	5900	6000
1.5	3.5	3	–	8	8800	7200	10200	9600
1.5	3.5	3	–	8	8800	7200	10200	9600
1.5	3.5	3	54	6	–	–	10200	9600
1.5	3.5	3	54	6	–	–	10200	9600
2.5	4.5	5	–	8	12300	9700	15100	13900
2.5	4.5	5	–	8	12300	9700	15100	13900
2.5	4.5	5	54	6	–	–	15100	13900
2.5	4.5	5	54	6	–	–	15100	13900

3

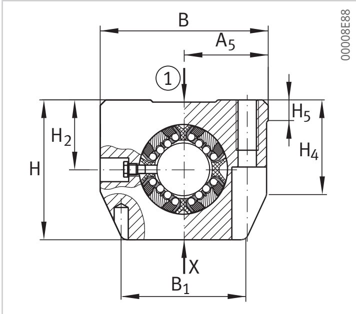
3.2.3 Linear ball bearing units KGSNG, KGSNS

closed

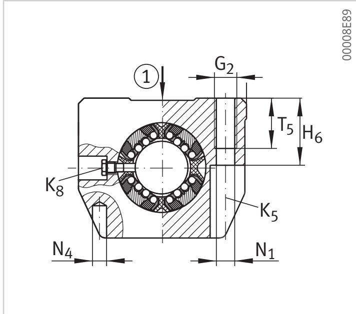
With slot (optional)

Sealed

Greased, can be relubricated



KGSNG..-PP-AS, KGSNS..-PP-AS

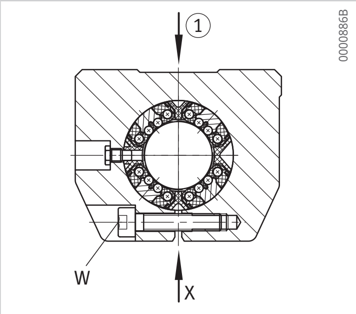


KGSNG..-PP-AS, KGSNS..-PP-AS

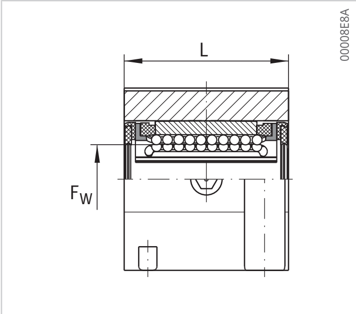
Designation	m	F_w	B	L	H	J_B	B_1	A_5	J_L	H_2
						±0.15		±0.01	±0.15	+0.008 –0.016
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm
KGSNG12-PP-AS	110	12	43	32	35	32	34	21.5	23	18
KGSNS12-PP-AS	100	12	43	32	35	32	34	21.5	23	18
KGSNG16-PP-AS	220	16	53	37	42	40	40	26.5	26	22
KGSNS16-PP-AS	200	16	53	37	42	40	40	26.5	26	22
KGSNG20-PP-AS	370	20	60	45	50	45	44	30	32	25
KGSNS20-PP-AS	360	20	60	45	50	45	44	30	32	25
KGSNG25-PP-AS	630	25	78	58	60	60	59.4	39	40	30
KGSNS25-PP-AS	550	25	78	58	60	60	59.4	39	40	30
KGSNG30-PP-AS	890	30	87	68	70	68	63	43.5	45	35
KGSNS30-PP-AS	730	30	87	68	70	68	63	43.5	45	35
KGSNG40-PP-AS	1300	40	108	80	90	86	76	54	58	45
KGSNS40-PP-AS	1350	40	108	80	90	86	76	54	58	45
KGSNG50-PP-AS	2200	50	132	100	105	108	90	66	50	50
KGSNS50-PP-AS	2250	50	132	100	105	108	90	66	50	50

[1] Centering for pin hole.

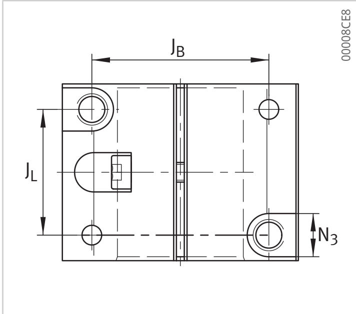
[2] Hole position symmetrical to bearing length L.



KGSNS..-PP-AS



KGSNG..-PP-AS, KGSNS..-PP-AS



KGSNS..-PP-AS

H_5	H_4	T_5	H_6	G_2	N_1	N_4 1)	N_3	K_5 2)	K_8 2)	SW	n	C	C_0
mm	mm	mm	mm	–	mm	mm	mm	–	–	–	–	N	N
5.4	26.6	11	16.5	M5	4.3	4	8	M4	NIP4MZ	–	8	900	1100
5.4	26.6	11	16.5	M5	4.3	4	8	M4	NIP4MZ	2.5	8	900	1100
6.9	29.3	13	21	M6	5.3	4	10	M5	NIP4MZ	–	8	1430	1550
6.9	29.3	13	21	M6	5.3	4	10	M5	NIP4MZ	3	8	1430	1550
7.4	34.1	18	24	M8	6.6	5	11	M6	NIP4MZ	–	8	2200	2310
7.4	34.1	18	24	M8	6.6	5	11	M6	NIP4MZ	4	8	2200	2310
8.3	41.5	22	29	M10	8.4	6	15	M8	NIP5MZ	–	8	3950	4300
8.3	41.5	22	29	M10	8.4	6	15	M8	NIP5MZ	5	8	3950	4300
9.3	46.2	22	34	M10	8.4	6	15	M8	NIP5MZ	–	8	5900	6000
9.3	46.2	22	34	M10	8.4	6	15	M8	NIP5MZ	5	8	5900	6000
11.7	57.6	26	44	M12	10.5	8	18	M10	NIP5MZ	–	8	10200	9600
11.7	57.6	26	44	M12	10.5	8	18	M10	NIP5MZ	6	8	10200	9600
10.6	62	35	49	M16	13.5	10	20	M12	NIP6MZ	–	8	15100	13900
10.6	62	35	49	M16	13.5	10	20	M12	NIP6MZ	8	8	15100	13900

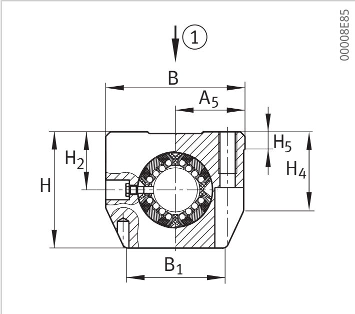
3.2.4 Linear ball bearing units KTSG

Tandem arrangement

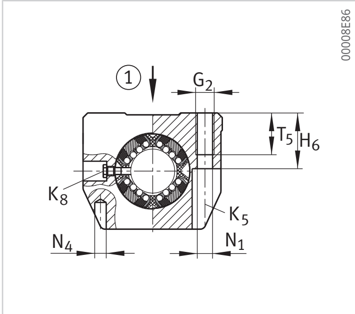
closed

Sealed

Greased, can be relubricated



KTSG..-PP-AS

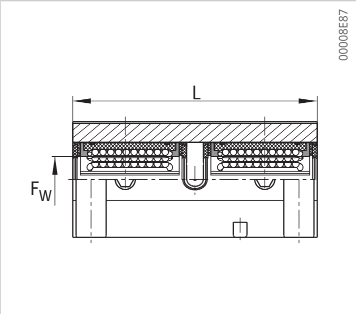


KTSG..-PP-AS

Designation	m	F_w	B	L	H	J_B ±0.15	B_1	A_5 ±0.01	J_L [1] ±0.15	L_6 [1]
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm
KTSG12-PP-AS	210	12	43	70	35	32	34	21.5	56	24
KTSG16-PP-AS	380	16	53	78	42	40	40	26.5	64	26
KTSG20-PP-AS	550	20	60	96	50	45	44	30	76	33
KTSG25-PP-AS	1130	25	78	122	60	60	59.4	39	94	44
KTSG30-PP-AS	1780	30	87	142	70	68	63	43.5	106	54

[1] Hole position symmetrical to bearing length L.

[2] Centering for pin hole.



KTSG..-PP-AS

H_2 +0.008 –0.016	H_5	H_4	T_5	H_6	G_2	N_1	N_4 [2]	N_3	K_5 [1]	K_8 [1]	n	C	C_0
mm	mm	mm	mm	mm	–	mm	mm	mm	–	–	–	N	N
18	5.4	26.6	11	16.5	M5	4.3	4	8	M4	NIP4MZ	8	1460	2100
22	6.9	29.3	13	21	M6	5.3	4	10	M5	NIP4MZ	8	2330	3100
25	7.4	34.1	18	24	M8	6.6	5	11	M6	NIP4MZ	8	3500	4600
30	8.3	41.5	22	29	M10	8.4	6	15	M8	NIP5MZ	8	6400	8600
35	9.3	46.2	22	34	M10	8.4	6	15	M8	NIP5MZ	8	9600	12000

3

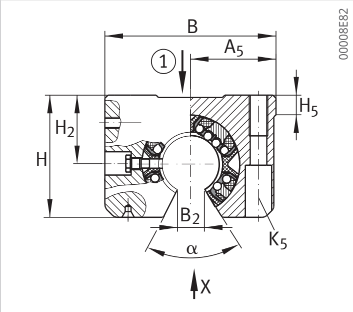
3.2.5 Linear ball bearing units KGSNO, KGSNOS

With segment cut-out

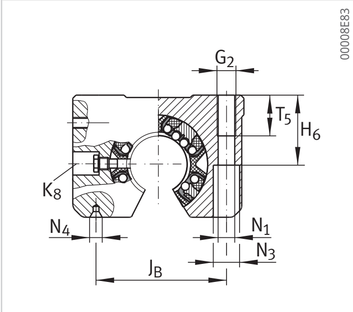
With slot (optional)

Sealed

Greased, can be relubricated



From KGSNO16-PP-AS, KGSNOS16-PP-AS

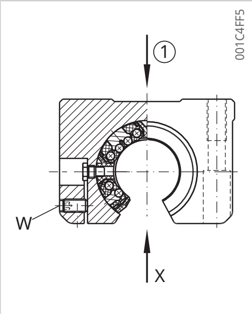


From KGSNO16-PP-AS, KGSNOS16-PP-AS

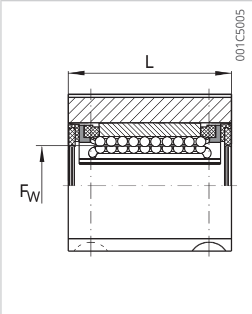
Designation	m	F_w	B	L	H	J_B ±0.15	A_5 ±0.01	B_2	J_L ±0.15	H_2 +0.008 –0.016
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm
KGSNO12-PP-AS	80	12	43	32	28	32	21.5	7.6	23	18
KGSNOS12-PP-AS	90	12	43	32	28	32	21.5	7.6	23	18
KGSNO16-PP-AS	150	16	53	37	35	40	26.5	10.1	26	22
KGSNOS16-PP-AS	150	16	53	37	35	40	26.5	10.1	26	22
KGSNO20-PP-AS	200	20	60	45	42	45	30	10	32	25
KGSNOS20-PP-AS	250	20	60	45	42	45	30	10	32	25
KGSNO25-PP-AS	410	25	78	58	51	60	39	12.5	40	30
KGSNOS25-PP-AS	520	25	78	58	51	60	39	12.5	40	30
KGSNO30-PP-AS	600	30	87	68	60	68	43.5	14.3	45	35
KGSNOS30-PP-AS	760	30	87	68	60	68	43.5	14.3	45	35
KGSNO40-PP-AS	1100	40	108	80	77	86	54	18.2	58	45
KGSNOS40-PP-AS	1400	40	108	80	77	86	54	18.2	58	45
KGSNO50-PP-AS	2870	50	132	100	88	108	66	22.7	50	50
KGSNOS50-PP-AS	2670	50	132	100	88	108	66	22.7	50	50

1) For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.

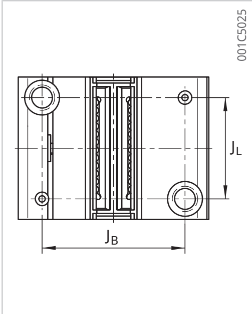
2) Hole position symmetrical to bearing length L.



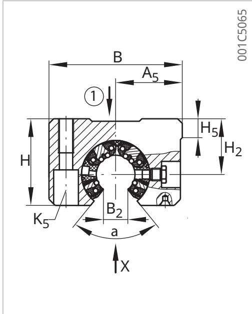
From KGSNOS16-PP-AS



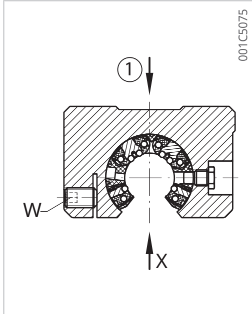
KGSNO,
KGSNOS..-PP-AS



KGSNOS..-PP-AS
View X



KGSNO12-PP-AS



KGSNO12-PP-AS

H_5	T_5	H_6	G_2	N_1	N_4 DIN 332 type A	N_3	K_5 1)	K_8 2)	SW	α	n	C	C_0
mm	mm	mm	–	mm	–	mm	–	–	–	°	–	N	N
6.1	11	16.5	M5	4.3	1.6x3.35	8	M4	NIP4MZ	–	78	6	900	1100
6.1	11	16.5	M5	4.3	1.6x3.35	8	M4	NIP4MZ	2.5	78	6	900	1100
7.5	13	21	M6	5.3	1.6x3.35	10	M5	NIP4MZ	–	68	6	1430	1550
7.5	13	21	M6	5.3	1.6x3.35	10	M5	NIP4MZ	2.5	68	6	1430	1550
8	18	24	M8	6.6	2x4.25	11	M6	NIP4MZ	–	55	6	2200	2310
8	18	24	M8	6.6	2x4.25	11	M6	NIP4MZ	2.5	55	6	2200	2310
8.8	22	29	M10	8.4	2.5x5.3	15	M8	NIP5MZ	–	57	6	3950	4300
8.8	22	29	M10	8.4	2.5x5.3	15	M8	NIP5MZ	3	57	6	3950	4300
9.7	22	34	M10	8.4	2.5x5.3	15	M8	NIP5MZ	–	57	6	5900	6000
9.7	22	34	M10	8.4	2.5x5.3	15	M8	NIP5MZ	3	57	6	5900	6000
12.4	26	44	M12	10.5	3.15x6.7	18	M10	NIP5MZ	–	56	6	10200	9600
12.4	26	44	M12	10.5	3.15x6.7	18	M10	NIP5MZ	4	56	6	10200	9600
11.1	35	49	M16	13.5	4x8.5	20	M12	NIP5MZ	–	54	6	15100	13900
11.1	35	49	M16	13.5	4x8.5	20	M12	NIP5MZ	5	54	6	15100	13900

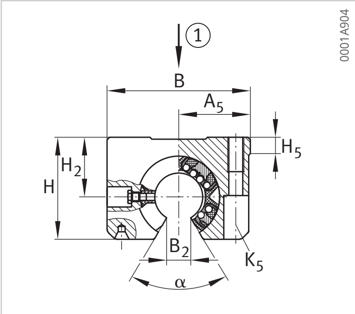
3.2.6 Linear ball bearing units KTSO

Tandem arrangement

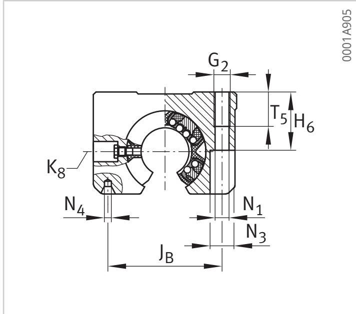
With segment cut-out

Sealed

Greased, can be relubricated



KTSO..-PP-AS

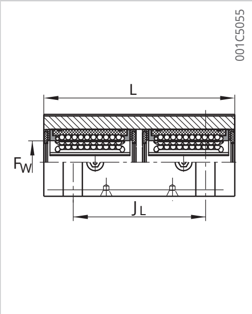


KTSO..-PP-AS

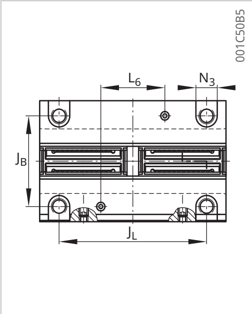
Designation	m	F_w	B	L	H	J_B	A_5	B_2	J_L 1)	L_6 1)	H_2
						±0.15	±0.01		±0.15		+0.008 –0.016
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
KTSO12-PP-AS	190	12	43	70	28	32	21.5	7.6	56	24	18
KTSO16-PP-AS	320	16	53	78	35	40	26.5	10.1	64	26	22
KTSO20-PP-AS	520	20	60	96	42	45	30	10	76	33	25
KTSO25-PP-AS	1060	25	78	122	51	60	39	12.5	94	44	30
KTSO30-PP-AS	1550	30	87	142	60	68	43.5	14.3	106	54	35

1) Hole position symmetrical to bearing length L.

2) For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.



KTSO..-PP-AS



KTSO..-PP-AS

H_5	T_5	H_6	G_2	N_1	N_4 DIN 332 type A	N_3	K_5 [2)]	K_8 [1)]	α	n	C	C_0
mm	mm	mm	–	mm	–	mm	–	–	°	–	N	N
6.1	11	16.5	M5	4.3	1.6x3.35	8	M4	NIP4MZ	66	6	1460	2100
7.5	13	21	M6	5.3	1.6x3.35	10	M5	NIP4MZ	68	6	2330	3100
8	18	24	M8	6.6	2x4.25	11	M6	NIP4MZ	55	6	3500	4600
8.8	22	29	M10	8.4	2.5x5.3	15	M8	NIP5MZ	57	6	6400	8600
9.7	22	34	M10	8.4	2.5x5.3	15	M8	NIP5MZ	57	6	9600	12000

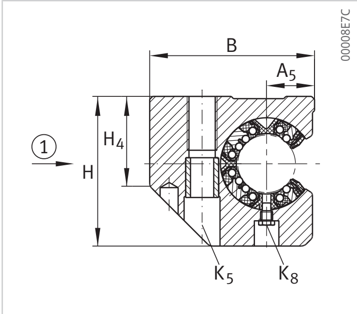
3.2.7 Linear ball bearing units KGSC, KGSCS

Side segment cut-out

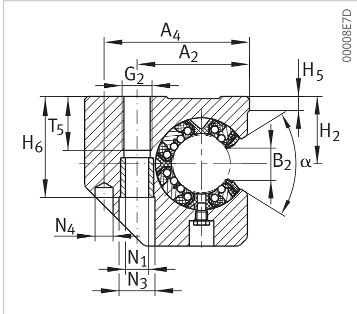
With slot (optional)

Sealed

Greased, can be relubricated



KGSC..-PP-AS, KGSCS..-PP-AS



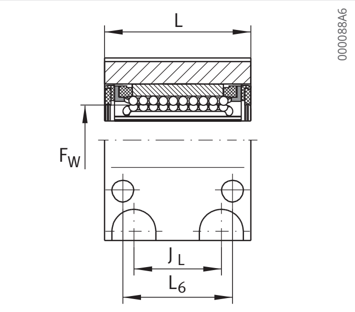
KGSC..-PP-AS, KGSCS..-PP-AS

Designation	m	F_w	B	L	H	A_2 ±0.15	A_4	A_5 ±0.01	B_2	J_L [1] ±0.15	L_6 [1]	H_2 +0.008 –0.016
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
KGSC20-PP-AS	350	20	60	47	60	39	51	17	10	30	36	30
KGSCS20-PP-AS	350	20	60	47	60	39	51	17	10	30	36	30
KGSC25-PP-AS	680	25	75	58	72	49	64	21	12.5	36	45	35
KGSCS25-PP-AS	680	25	75	58	72	49	64	21	12.5	36	45	35
KGSC30-PP-AS	1000	30	86	68	82	59	76	25	14.3	42	52	40
KGSCS30-PP-AS	1000	30	86	68	82	59	76	25	14.3	42	52	40
KGSC40-PP-AS	1800	40	110	80	100	75	97	32	18.2	48	60	45
KGSCS40-PP-AS	1800	40	110	80	100	75	97	32	18.2	48	60	45
KGSC50-PP-AS	2900	50	127	100	115	88	109	38	22.7	62	80	50
KGSCS50-PP-AS	2900	50	127	100	115	88	109	38	22.7	62	80	50

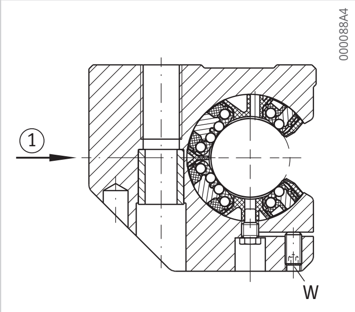
1) Hole position symmetrical to bearing length L.

2) Centering for pin hole.

3) For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.



KGSC..-PP-AS



KGSCS..-PP-AS

H_5	H_4	T_5	H_6	G_2	N_1	N_4 2)	N_3	K_5 3)	K_8 1)	SW	α	n	C	C_0
mm	mm	mm	mm	–	mm	–	mm	–	–	–	°	–	N	N
8.3	37.5	18	42.6	M10	8.4	6	15	M8	NIP4MZ	–	55	6	2200	2310
8.3	37.5	18	42.6	M10	8.4	6	15	M8	NIP4MZ	2.5	55	6	2200	2310
8.2	45	22	50.6	M12	10.5	8	18	M10	NIP5MZ	–	57	6	3950	4300
8.2	45	22	50.6	M12	10.5	8	18	M10	NIP5MZ	3	57	6	3950	4300
9	52	29	55.6	M16	13.5	10	20	M12	NIP5MZ	–	57	6	5900	6000
9	52	29	55.6	M16	13.5	10	20	M12	NIP5MZ	3	57	6	5900	6000
9.5	60	36	67.6	M20	15.5	12	24	M14	NIP5MZ	–	56	6	10200	9600
9.5	60	36	67.6	M20	15.5	12	24	M14	NIP5MZ	4	56	6	10200	9600
8.6	70	36	78.8	M20	17.5	12	26	M16	NIP6MZ	–	54	6	15100	13900
8.6	70	36	78.8	M20	17.5	12	26	M16	NIP6MZ	5	54	6	15100	13900

4 Linear ball bearings and linear ball bearing units of the solid series

4.1 Product design

Linear ball bearings of the solid series KB, KBS and KBO as well as the associated linear ball bearing units are highly precise and particularly rigid. They have excellent running behavior.

Linear ball bearings KB, KBS and KBO consist of a hardened and ground outer ring, in which a ball-cage assembly with a plastic cage is integrated.

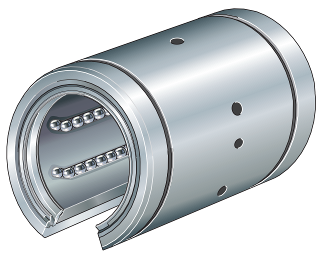
Throughout the entire deflection range, the balls are guided with high precision by a special spring washer. This ensures that the displacement resistance is low and uniform under difficult operating conditions and regardless of the installation position.

The series KB is closed and designed for use with shafts. KBO has a segment cut-out and is used in conjunction with support rails. KBS has a slot for adjusting the radial clearance.

The bearings have contact seals or gap seals.

48 Linear ball bearings KB, KB..-PP, KB..-PP-AS, KBS, KBS..-PP, KBS..-PP-AS, closed, slotted (KBS) or not slotted (KB), with or without lip seal (PP)

49 Linear ball bearings with segment cut-out KBO, KBO..-PP, KBO..-PP-AS, with or without lip seal (PP)



Linear ball bearing units in the solid series are available with an integrated bearing, as well as in a tandem version with two bearings that offers particularly load-bearing properties.

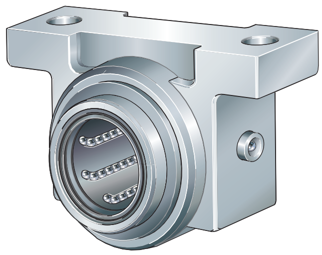
High-strength aluminum or die-cast is used for the housings.

Housings are available in a closed design, with segment cut-out for supported shafts, and with or without a slot. The slotted versions enable the radial clearance to be adjusted using an adjusting screw.

All series have a stop edge and centering holes for pin holes.

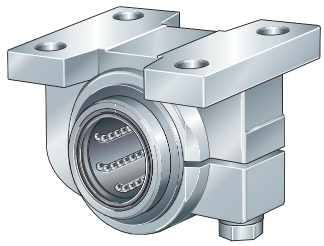
The assembled bearings are sealed on both sides, feature initial greasing and can be relubricated through lubricating nipples in the housing.

50 Closed units KGB..-PP-AS, KGBS..-PP-AS, housing slotted (KGBS) or not slotted (KGB), bearing with lip seal



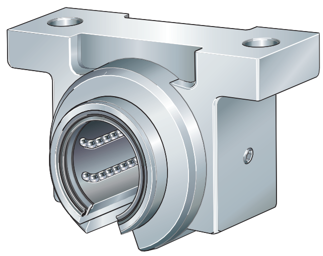
000089A5

51 Closed units KGBA..-PP-AS, KGBAS..-PP-AS, housing slotted (KGBAS) or not slotted (KGBA), bearing with lip seal



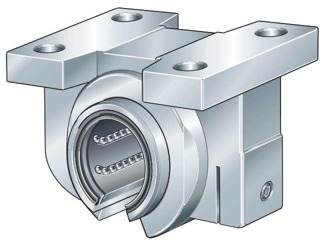
000089C4

52 Unit with segment cut-out KGBO..-PP-AS, with lip seal



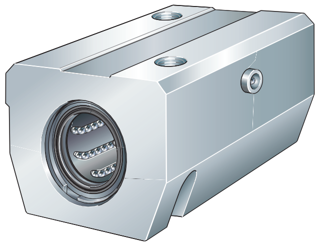
00008B01

53 Unit with segment cut-out KGBAO..-PP-AS, with lip seal

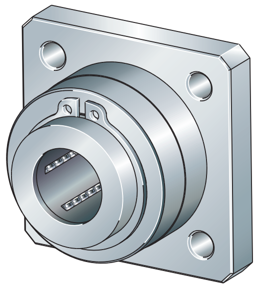


00008B09

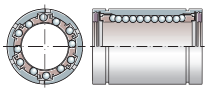
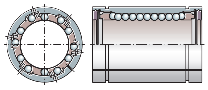
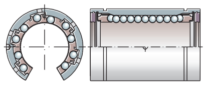
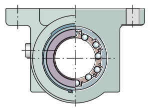
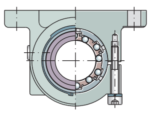
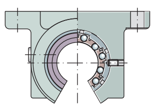
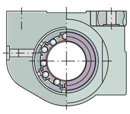
54 Closed unit KTB..-PP-AS, bearing in tandem arrangement, with lip seal

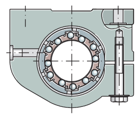
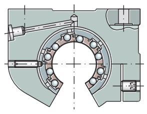
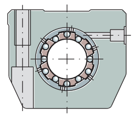
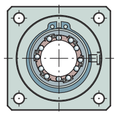


55 Closed unit KFB..-B-PP-AS, housing with flange, bearing with lip seal



14 Linear ball bearings and linear ball bearing units of the solid series

Model series		**Characteristic**
KB KB..-PP KB..-PP-AS		• Linear ball bearing • With or without lip seal, depending on the version • Can also be relubricated
KBS KBS..-PP KBS..-PP-AS		• Linear ball bearing • With or without lip seal, depending on the version • Can also be relubricated • Slotted
KBO KBO..-PP KBO..-PP-AS		• Linear ball bearing • With or without lip seal, depending on the version • Can also be relubricated • With segment cut-out
KGB..-PP-AS		• Closed • Can be relubricated
KGBS..-PP-AS		• Closed • Housing slotted • Can be relubricated
KGBO..-PP-AS		• With segment cut-out • Can be relubricated
KGBA..-PP-AS		• Closed • Can be relubricated

Model series		**Characteristic**
KGBAS..-PP-AS		• Closed • Housing slotted • Can be relubricated
KGBAO..-PP-AS		• With segment cut-out • Can be relubricated
KTB..-PP-AS		• Closed • Tandem arrangement • Can be relubricated
KFB..-B-PP-AS		• Closed • Can be relubricated

Further information

- Product tables ➤60 | 4.2
- Shafts ➤82 | 6.1
- Support rails ➤101 | 7.1
- Shaft support blocks ➤117 | 8.1

4

4.2 Product tables

4.2.1 Explanations

(1)	–	Main load direction
A_3	mm	Lubrication connection distance
A_5	mm	Stop side distance
B	mm	Width of the housing
B_1	mm	Width of housing flange
B_3	mm	Slot
B_{L2}	mm	Width of mounting groove
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
D	mm	Outside diameter
D_1	mm	Flange diameter
D_2	mm	Diameter of housing flange
D_N	mm	Diameter of mounting groove
F_w	mm	Inner envelope diameter
G_2	–	Connecting thread
G_3	–	Connecting thread
H	mm	Height of the housing
H_2	mm	Center distance
H_4	mm	Height of housing flange
H_5	mm	Height of stop edge
H_6	mm	Depth of mounting hole
J_B	mm	Mounting hole distance
J_L	mm	Distance between mounting holes
J_{L4}	mm	Lubrication hole distance
K_5	–	Fixing screw
K_8	–	Lubrication connection
L	mm	Length of the housing
L	mm	Length of the linear ball bearing
L	mm	Lower limit deviation
L_2	mm	Connection dimension
L_4	mm	Length of the housing section
L_5	mm	Housing width
L_6	mm	Pin hole distance
L_7	mm	Offset
L_B	mm	Centering diameter
m	g	Mass
n	–	Number of ball rows
N_1	mm	Diameter of the mounting hole
N_2	mm	Diameter of the lubrication hole
N_3	mm	Diameter of the counterbore
N_4	mm	Diameter of the fixing hole
U	mm	Upper limit deviation
W	mm	Width across flats
α	°	Segment cut-out angle
β	°	Position of the lubrication hole
χ	°	Position from slot to fixing hole

4

4.2.2 Linear ball bearings KB, KBS, KBO

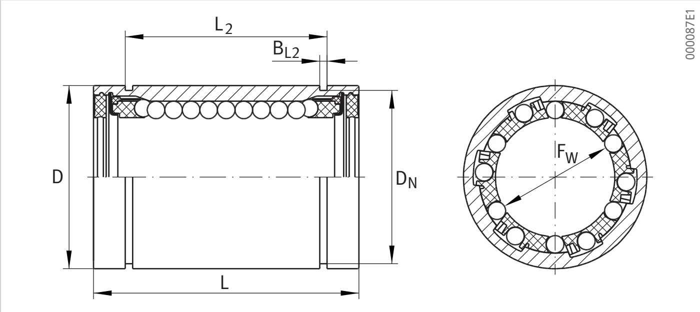
closed

With segment cut-out

With slot (optional)

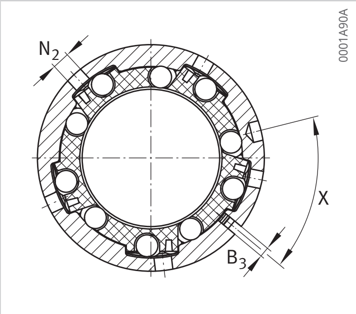
Sealed (optional)

Non-greased, greased (PP), greased and can be relubricated (PP-AS)

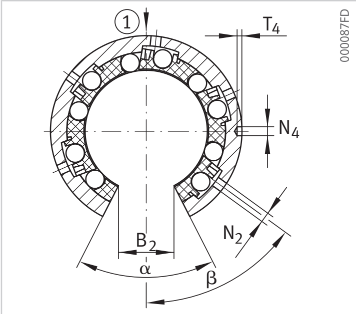


KB

Designation	m	F_w			D	L	B_2	L_2	B_{L2} 1)	B_3
		–	U	L	h5	h12		H13		
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm
KB12	40	12	+0.008	0	22	32	–	22.6	1.3	–
KB12-PP	40	12	+0.008	0	22	32	–	22.6	1.3	–
KB12-PP-AS	40	12	+0.008	0	22	32	–	22.6	1.3	–
KBS12	40	12	+0.008	0	22	32	–	22.6	1.3	1
KBS12-PP	40	12	+0.008	0	22	32	–	22.6	1.3	1
KBS12-PP-AS	40	12	+0.008	0	22	32	–	22.6	1.3	1
KBO12	30	12	+0.008	0	22	32	7.7	22.6	1.3	–
KBO12-PP	30	12	+0.008	0	22	32	7.7	22.6	1.3	–
KBO12-PP-AS	30	12	+0.008	0	22	32	7.7	22.6	1.3	–
KB16	50	16	+0.009	−0.001	26	36	–	24.6	1.3	–
KB16-PP	50	16	+0.009	−0.001	26	36	–	24.6	1.3	–
KB16-PP-AS	50	16	+0.009	−0.001	26	36	–	24.6	1.3	–
KBS16	50	16	+0.009	−0.001	26	36	–	24.6	1.3	1
KBS16-PP	50	16	+0.009	−0.001	26	36	–	24.6	1.3	1
KBS16-PP-AS	50	16	+0.009	−0.001	26	36	–	24.6	1.3	1
KBO16	40	16	+0.009	−0.001	26	36	10.1	24.6	1.3	–
KBO16-PP	40	16	+0.009	−0.001	26	36	10.1	24.6	1.3	–
KBO16-PP-AS	40	16	+0.009	−0.001	26	36	10.1	24.6	1.3	–
KB20	90	20	+0.009	−0.001	32	45	–	31.2	1.6	–
KB20-PP	90	20	+0.009	−0.001	32	45	–	31.2	1.6	–
KB20-PP-AS	90	20	+0.009	−0.001	32	45	–	31.2	1.6	–
KBS20	90	20	+0.009	−0.001	32	45	–	31.2	1.6	1
KBS20-PP	90	20	+0.009	−0.001	32	45	–	31.2	1.6	1
KBS20-PP-AS	90	20	+0.009	−0.001	32	45	–	31.2	1.6	1
KBO20	70	20	+0.009	−0.001	32	45	10	31.2	1.6	–
KBO20-PP	70	20	+0.009	−0.001	32	45	10	31.2	1.6	–
KBO20-PP-AS	70	20	+0.009	−0.001	32	45	10	31.2	1.6	–
KB25	190	25	+0.011	−0.001	40	58	–	43.7	1.85	–
KB25-PP	190	25	+0.011	−0.001	40	58	–	43.7	1.85	–
KB25-PP-AS	190	25	+0.011	−0.001	40	58	–	43.7	1.85	–
KBS25	190	25	+0.011	−0.001	40	58	–	43.7	1.85	1
KBS25-PP	190	25	+0.011	−0.001	40	58	–	43.7	1.85	1
KBS25-PP-AS	190	25	+0.011	−0.001	40	58	–	43.7	1.85	1
KBO25	150	25	+0.011	−0.001	40	58	12.5	43.7	1.85	–
KBO25-PP	150	25	+0.011	−0.001	40	58	12.5	43.7	1.85	–
KBO25-PP-AS	150	25	+0.011	−0.001	40	58	12.5	43.7	1.85	–
KB30	300	30	+0.011	−0.001	47	68	–	51.7	1.85	–
KB30-PP	300	30	+0.011	−0.001	47	68	–	51.7	1.85	–
KB30-PP-AS	300	30	+0.011	−0.001	47	68	–	51.7	1.85	–
KBS30	300	30	+0.011	−0.001	47	68	–	51.7	1.85	1



KBS..-PP-AS



KBO..-PP-AS

D_N [1)]	T_4	N_4	N_2	α	β	X	n	C	C_0	C	C_0
								–	min	Max.	Max.
mm	mm	mm	mm	°	°	°	–	N	N	N	N
21	–	–	1.5	–	–	–	5	540	385	640	570
21	–	–	1.5	–	–	–	5	540	385	640	570
21	–	–	1.5	–	–	–	5	540	385	640	570
21	–	–	1.5	–	–	55	5	540	385	640	570
21	–	–	1.5	–	–	55	5	540	385	640	570
21	–	–	1.5	–	–	55	5	540	385	640	570
21	1.2	2.2	1.5	78	64	–	4	–	–	600	445
21	1.2	2.2	1.5	78	64	–	4	–	–	600	445
21	1.2	2.2	1.5	78	64	–	4	–	–	600	445
24.9	–	–	2	–	–	–	5	710	530	840	780
24.9	–	–	2	–	–	–	5	710	530	840	780
24.9	–	–	2	–	–	–	5	710	530	840	780
24.9	–	–	2	–	–	54	5	710	530	840	780
24.9	–	–	2	–	–	54	5	710	530	840	780
24.9	–	–	2	–	–	54	5	710	530	840	780
24.9	1.2	2.2	2	78	64	–	4	–	–	800	620
24.9	1.2	2.2	2	78	64	–	4	–	–	800	620
24.9	1.2	2.2	2	78	64	–	4	–	–	800	620
30.3	–	–	2	–	–	–	6	1570	1230	1660	1570
30.3	–	–	2	–	–	–	6	1570	1230	1660	1570
30.3	–	–	2	–	–	–	6	1570	1230	1660	1570
30.3	–	–	2	–	–	62.5	6	1570	1230	1660	1570
30.3	–	–	2	–	–	62.5	6	1570	1230	1660	1570
30.3	–	–	2	–	–	62.5	6	1570	1230	1660	1570
30.3	1.2	2.2	2	60	52	–	5	–	–	1600	1280
30.3	1.2	2.2	2	60	52	–	5	–	–	1600	1280
30.3	1.2	2.2	2	60	52	–	5	–	–	1600	1280
37.5	–	–	2.5	–	–	–	6	2800	2220	2950	2850
37.5	–	–	2.5	–	–	–	6	2800	2220	2950	2850
37.5	–	–	2.5	–	–	–	6	2800	2220	2950	2850
37.5	–	–	2.5	–	–	62	6	2800	2220	2950	2850
37.5	–	–	2.5	–	–	62	6	2800	2220	2950	2850
37.5	–	–	2.5	–	–	62	6	2800	2220	2950	2850
37.5	1.5	3	2.5	60	53	–	5	–	–	2850	2300
37.5	1.5	3	2.5	60	53	–	5	–	–	2850	2300
37.5	1.5	3	2.5	60	53	–	5	–	–	2850	2300
44.5	–	–	2.5	–	–	–	6	3600	2850	3800	3600
44.5	–	–	2.5	–	–	–	6	3600	2850	3800	3600
44.5	–	–	2.5	–	–	–	6	3600	2850	3800	3600
44.5	–	–	2.5	–	–	64	6	3600	2850	3800	3600

4

4.2.2 Linear ball bearings KB, KBS, KBO

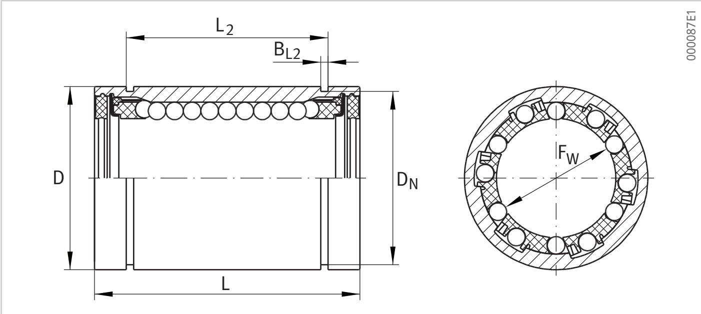
closed

With segment cut-out

With slot (optional)

Sealed (optional)

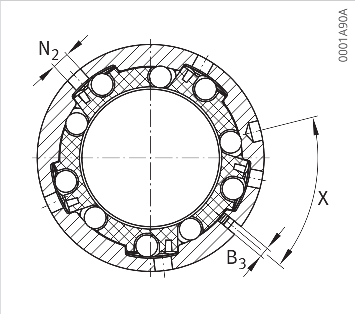
Non-greased, greased (PP), greased and can be relubricated (PP-AS)



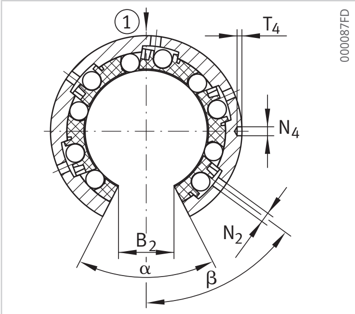
KB

Designation	m	F_W			D	L	B_2	L_2	B_{L2} 1)	B_3
		–	U	L	h5	h12		H13		
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm
KBS30-PP	300	30	+0.011	−0.001	47	68	–	51.7	1.85	1
KBS30-PP-AS	300	30	+0.011	−0.001	47	68	–	51.7	1.85	1
KBO30	240	30	+0.011	−0.001	47	68	13.6	51.7	1.85	–
KBO30-PP	240	30	+0.011	−0.001	47	68	13.6	51.7	1.85	–
KBO30-PP-AS	240	30	+0.011	−0.001	47	68	13.6	51.7	1.85	–
KB40	600	40	+0.013	−0.002	62	80	–	60.3	2.15	–
KB40-PP	600	40	+0.013	−0.002	62	80	–	60.3	2.15	–
KB40-PP-AS	600	40	+0.013	−0.002	62	80	–	60.3	2.15	–
KBS40	600	40	+0.013	−0.002	62	80	–	60.3	2.15	1
KBS40-PP	600	40	+0.013	−0.002	62	80	–	60.3	2.15	1
KBS40-PP-AS	600	40	+0.013	−0.002	62	80	–	60.3	2.15	1
KBO40	520	40	+0.013	−0.002	62	80	18.2	60.3	2.15	–
KBO40-PP	520	40	+0.013	−0.002	62	80	18.2	60.3	2.15	–
KBO40-PP-AS	520	40	+0.013	−0.002	62	80	18.2	60.3	2.15	–
KB50	1000	50	+0.013	−0.002	75	100	–	77.3	2.65	–
KB50-PP	1000	50	+0.013	−0.002	75	100	–	77.3	2.65	–
KB50-PP-AS	1000	50	+0.013	−0.002	75	100	–	77.3	2.65	–
KBS50	1000	50	+0.013	−0.002	75	100	–	77.3	2.65	1
KBS50-PP	1000	50	+0.013	−0.002	75	100	–	77.3	2.65	1
KBS50-PP-AS	1000	50	+0.013	−0.002	75	100	–	77.3	2.65	1
KBO50	850	50	+0.013	−0.002	75	100	22.7	77.3	2.65	–
KBO50-PP	850	50	+0.013	−0.002	75	100	22.7	77.3	2.65	–
KBO50-PP-AS	850	50	+0.013	−0.002	75	100	22.7	77.3	2.65	–

1) Groove dimensions suitable for snap rings according to DIN 471.



KBS..-PP-AS



KBO..-PP-AS

D_N 1)	T_4	N_4	N_2	α	β	X	n	C	C_0	C	C_0
								–	min	Max.	Max.
mm	mm	mm	mm	°	°	°	–	N	N	N	N
44.5	–	–	2.5	–	–	64	6	3600	2850	3800	3600
44.5	–	–	2.5	–	–	64	6	3600	2850	3800	3600
44.5	1.5	3	2.5	54	55	–	5	–	–	3700	3000
44.5	1.5	3	2.5	54	55	–	5	–	–	3700	3000
44.5	1.5	3	2.5	54	55	–	5	–	–	3700	3000
59	–	–	3	–	–	–	6	6000	4400	6400	5600
59	–	–	3	–	–	–	6	6000	4400	6400	5600
59	–	–	3	–	–	–	6	6000	4400	6400	5600
59	–	–	3	–	–	64	6	6000	4400	6400	5600
59	–	–	3	–	–	64	6	6000	4400	6400	5600
59	–	–	3	–	–	64	6	6000	4400	6400	5600
59	1.5	3	3	54	54	–	5	–	–	6100	4600
59	1.5	3	3	54	54	–	5	–	–	6100	4600
59	1.5	3	3	54	54	–	5	–	–	6100	4600
72	–	–	4	–	–	–	6	8700	6300	9200	8000
72	–	–	4	–	–	–	6	8700	6300	9200	8000
72	–	–	4	–	–	–	6	8700	6300	9200	8000
72	–	–	4	–	–	64	6	8700	6300	9200	8000
72	–	–	4	–	–	64	6	8700	6300	9200	8000
72	–	–	4	–	–	64	6	8700	6300	9200	8000
72	1.5	3	4	54	54	–	5	–	–	8900	6600
72	1.5	3	4	54	54	–	5	–	–	8900	6600
72	1.5	3	4	54	54	–	5	–	–	8900	6600

4.2.3 Linear ball bearing units KGB, KGBS, KGBO

closed

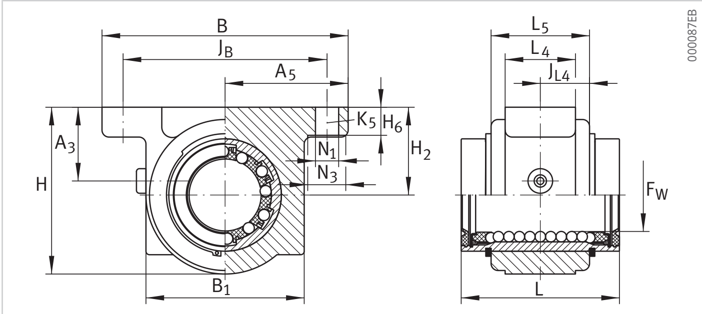
With segment cut-out

With slot (optional)

Sealed

Greased

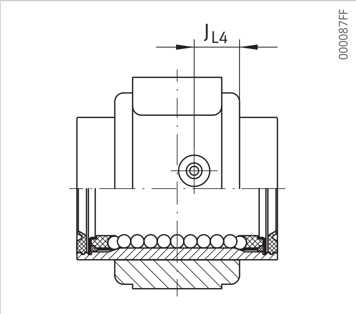
Can be relubricated



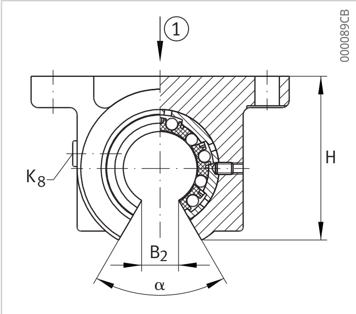
KGB..-PP-AS

Designation	m	F_w			B	L	H	J_B			B_1	A_5	B_2
		–	U	L		h12		–	U	L		±0.02	
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
KGB12-PP-AS	100	12	+0.008	0	52	32	35.8	42	+0.15	−0.15	31.6	26	–
KGBS12-PP-AS	100	12	+0.008	0	52	32	35.8	42	+0.15	−0.15	31.6	26	–
KGBO12-PP-AS	90	30	+0.008	0	52	32	32	42	+0.15	−0.15	31.6	26	7.7
KGB16-PP-AS	140	16	+0.009	−0.001	56	36	37.5	46	+0.15	−0.15	35	28	–
KGBS16-PP-AS	140	16	+0.009	−0.001	56	36	37.5	46	+0.15	−0.15	35	28	–
KGBO16-PP-AS	120	50	+0.009	−0.001	56	36	33.5	46	+0.15	−0.15	35	28	10.1
KGB20-PP-AS	300	20	+0.009	−0.001	70	45	47.5	58	+0.15	−0.15	45	35	–
KGBS20-PP-AS	300	20	+0.009	−0.001	70	45	47.5	58	+0.15	−0.15	45	35	–
KGBO20-PP-AS	250	25	+0.009	−0.001	70	45	45	58	+0.15	−0.15	45	35	10
KGB25-PP-AS	580	25	+0.011	−0.001	80	58	57.5	68	+0.15	−0.15	55	40	–
KGBS25-PP-AS	580	25	+0.011	−0.001	80	58	57.5	68	+0.15	−0.15	55	40	–
KGBO25-PP-AS	490	40	+0.011	−0.001	80	58	54.5	68	+0.15	−0.15	55	40	12.5
KGB30-PP-AS	900	30	+0.011	−0.001	88	68	66.5	76	+0.2	−0.2	63	44	–
KGBS30-PP-AS	900	30	+0.011	−0.001	88	68	66.5	76	+0.2	−0.2	63	44	–
KGBO30-PP-AS	780	20	+0.011	−0.001	88	68	63.5	76	+0.2	−0.2	63	44	13.6
KGB40-PP-AS	1430	40	+0.013	−0.002	108	80	83.5	94	+0.2	−0.2	77	54	–
KGBS40-PP-AS	1430	40	+0.013	−0.002	108	80	83.5	94	+0.2	−0.2	77	54	–
KGBO40-PP-AS	1280	12	+0.013	−0.002	108	80	79.5	94	+0.2	−0.2	77	54	18.2
KGB50-PP-AS	2780	50	+0.013	−0.002	135	100	98	116	+0.2	−0.2	96	67.5	–
KGBS50-PP-AS	2780	50	+0.013	−0.002	135	100	98	116	+0.2	−0.2	96	67.5	–
KGBO50-PP-AS	2460	16	+0.013	−0.002	135	100	93	116	+0.2	−0.2	96	67.5	22.7

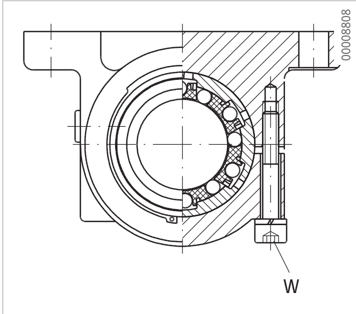
1) For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.



KGBO..-PP-AS



KGBO, KGBO..-PP-AS



KGBS..-PP-AS

L_5	L_4	J_{L4}	H_2 ±0.015	A_3	H_6	N_1	N_3	K_5 1)	α	SW	K_8	n	C	C_0
mm	mm	mm	mm	mm	mm	mm	mm	–	°	–	–	–	N	N
20	12	10	20	15	6	5.5	10	M5	–	–	NIPA1	5	540	385
20	12	10	20	15	6	5.5	10	M5	–	2	NIPA1	5	540	385
20	12	6.5	20	15	6	5.5	10	M5	78	–	NIPA1	4	600	445
22	15	11	20	15	6	5.5	10	M5	–	–	NIPA1	5	710	530
22	15	11	20	15	6	5.5	10	M5	–	2	NIPA1	5	710	530
22	15	6.5	20	15	6	5.5	10	M5	78	–	NIPA1	4	800	620
28	20	14	25	21	8	6.6	11	M6	–	–	NIPA1	6	1570	1230
28	20	14	25	21	8	6.6	11	M6	–	3	NIPA1	6	1570	1230
28	20	9.5	25	21	8	6.6	11	M6	60	–	NIPA1	5	1600	1280
40	28	20	30	23	10	6.6	11	M6	–	–	NIPA1	6	2800	2220
40	28	20	30	23	10	6.6	11	M6	–	3	NIPA1	6	2800	2200
40	28	15	30	23	10	6.6	11	M6	60	–	NIPA1	5	2850	2330
48	32	24	35	25	10	6.6	11	M6	–	–	NIPA2	6	3600	2850
48	32	24	35	25	10	6.6	11	M6	–	4	NIPA2	6	3600	2850
48	32	19	35	25	10	6.6	11	M6	54	–	NIPA2	5	3700	3000
56	40	28	45	30	12	9	15	M8	–	–	NIPA2	6	6000	4400
56	40	28	45	30	12	9	15	M8	–	4	NIPA2	6	6000	4400
56	40	23	45	30	12	9	15	M8	54	–	NIPA2	5	6100	4600
72	52	36	50	34	14	11	18	M10	–	–	NIPA2	6	8700	6300
72	52	36	50	34	14	11	18	M10	–	5	NIPA2	6	8700	6300
72	52	28	50	34	14	11	18	M10	54	–	NIPA2	5	8900	6600

4.2.4 Linear ball bearing units KGBA, KGBAS, KGBAO

closed

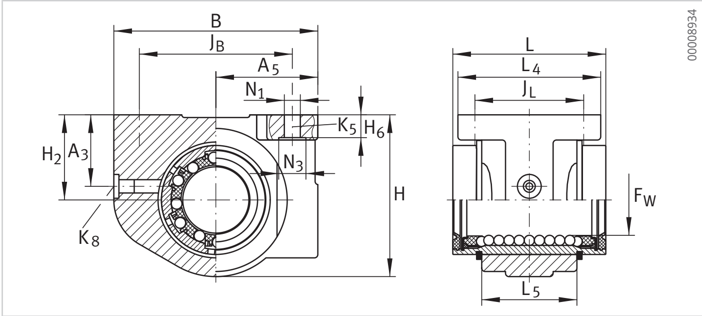
With segment cut-out

With slot (optional)

Sealed

Greased

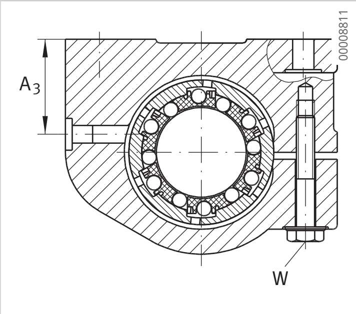
Can be relubricated



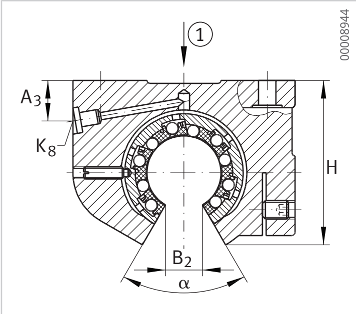
KGBA..-PP-AS

Designation	m	F_W			B	L	H	J_B			A_5	B_2	L_4	J_L		
		–	U	L		h12		–	U	L	–			–	U	L
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
KGBA12-PP-AS	80	12	+0.008	0	42	32	34	32	+0.15	–0.15	21	–	32	23	+0.15	–0.15
KGBAS12-PP-AS	80	12	+0.008	0	42	32	34	32	+0.15	–0.15	21	–	–	23	+0.15	–0.15
KGBAO12-PP-AS	70	12	+0.008	0	42	32	30.5	32	+0.15	–0.15	21	7.7	–	23	+0.15	–0.15
KGBA16-PP-AS	120	16	+0.009	–0.001	50	36	41	40	+0.15	–0.15	25	–	35	26	+0.15	–0.15
KGBAS16-PP-AS	120	16	+0.009	–0.001	50	36	41	40	+0.15	–0.15	25	–	–	26	+0.15	–0.15
KGBAO16-PP-AS	100	16	+0.009	–0.001	50	36	37	40	+0.15	–0.15	25	10.1	–	26	+0.15	–0.15
KGBA20-PP-AS	200	20	+0.009	–0.001	60	45	47.5	45	+0.15	–0.15	30	–	42	32	+0.15	–0.15
KGBAS20-PP-AS	200	20	+0.009	–0.001	60	45	47.5	45	+0.15	–0.15	30	–	–	32	+0.15	–0.15
KGBAO20-PP-AS	170	20	+0.009	–0.001	60	45	44.5	45	+0.15	–0.15	30	10	–	32	+0.15	–0.15
KGBA25-PP-AS	410	25	+0.011	–0.001	74	58	60	60	+0.2	–0.2	37	–	54	40	+0.2	–0.2
KGBAS25-PP-AS	410	25	+0.011	–0.001	74	58	60	60	+0.2	–0.2	37	–	–	40	+0.2	–0.2
KGBAO25-PP-AS	350	25	+0.011	–0.001	74	58	56	60	+0.2	–0.2	37	12.5	–	40	+0.2	–0.2
KGBA30-PP-AS	610	30	+0.011	–0.001	84	68	67	68	+0.2	–0.2	42	–	60	45	+0.2	–0.2
KGBAS30-PP-AS	610	30	+0.011	–0.001	84	68	67	68	+0.2	–0.2	42	–	–	45	+0.2	–0.2
KGBAO30-PP-AS	530	30	+0.011	–0.001	84	68	63.5	68	+0.2	–0.2	42	13.6	–	45	+0.2	–0.2
KGBA40-PP-AS	1200	40	+0.013	–0.002	108	80	87	86	+0.2	–0.2	54	–	78	58	+0.2	–0.2
KGBAS40-PP-AS	1200	40	+0.013	–0.002	108	80	87	86	+0.2	–0.2	54	–	–	58	+0.2	–0.2
KGBAO40-PP-AS	1070	40	+0.013	–0.002	108	80	82.5	86	+0.2	–0.2	54	18.2	–	58	+0.2	–0.2
KGBA50-PP-AS	1880	50	+0.013	–0.002	130	100	98	108	+0.2	–0.2	65	–	70	50	+0.2	–0.2
KGBAS50-PP-AS	1880	50	+0.013	–0.002	130	100	98	108	+0.2	–0.2	65	–	–	50	+0.2	–0.2
KGBAO50-PP-AS	1650	50	+0.013	–0.002	130	100	93	108	+0.2	–0.2	65	22.7	–	50	+0.2	–0.2

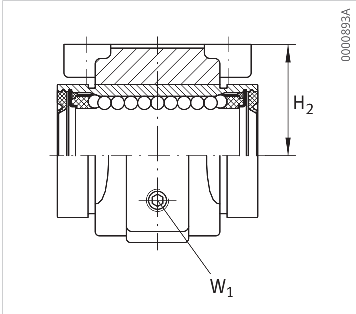
[1] For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.



KGBAS..-PP-AS



KGBAO..-PP-AS



KGBAO..-PP-AS

L_5	H_2			A_3	H_6	N_1	N_3	K_5 1)	α	SW	SW_1		K_8	n	C	C_0
	–	U	L		–0.05					–	–	M_A				
mm	mm	mm	mm	mm	mm	mm	mm	–	°	–	–	Nm	–	–	N	N
20	18	+0.01	–0.01	15	4.8	4.7	8	M4	–	–	–	–	NIPA1	5	540	385
–	18	+0.01	–0.01	15	4.8	4.7	8	M4	–	7	–	–	NIPA1	5	540	385
–	18	+0.01	–0.01	7.8	4.8	4.7	8	M4	78	–	2	1	NIPA1	4	600	445
22	22	+0.01	–0.01	15	5.4	4.7	8	M4	–	–	–	–	NIPA1	5	710	530
–	22	+0.01	–0.01	15	5.4	4.7	8	M4	–	7	–	–	NIPA1	5	710	530
–	22	+0.01	–0.01	10	5.4	4.7	8	M4	78	–	2.5	1.5	NIPA1	4	800	620
28	25	+0.01	–0.01	21	6.7	4.7	8	M4	–	–	–	–	NIPA1	6	1570	1230
–	25	+0.01	–0.01	21	6.7	4.7	8	M4	–	7	–	–	NIPA1	6	1570	1230
–	25	+0.01	–0.01	11	6.7	4.7	8	M4	60	–	2.5	1.5	NIPA1	5	1600	1280
40	30	+0.01	–0.01	23	7.8	5.7	10	M5	–	–	–	–	NIPA1	6	2800	2220
–	30	+0.01	–0.01	23	7.8	5.7	10	M5	–	8	–	–	NIPA1	6	2800	2220
–	30	+0.01	–0.01	13	7.8	5.7	10	M5	60	–	3	3	NIPA1	5	2850	2330
48	35	+0.01	–0.01	25	8.7	6.8	11	M6	–	–	–	–	NIPA2	6	3600	2850
–	35	+0.01	–0.01	25	8.7	6.8	11	M6	–	10	–	–	NIPA2	6	3600	2850
–	35	+0.01	–0.01	14	8.7	6.8	11	M6	54	–	3	4	NIPA2	5	3700	3000
56	45	+0.01	–0.01	30	11	9.2	15	M8	–	–	–	–	NIPA2	6	6000	4400
–	45	+0.01	–0.01	30	11	9.2	15	M8	–	13	–	–	NIPA2	6	6000	4400
–	45	+0.01	–0.01	18	11	9.2	15	M8	54	–	4	5	NIPA2	5	6100	4600
72	50	+0.015	–0.015	34	12.5	9.2	15	M8	–	–	–	–	NIPA2	6	8700	6300
–	50	+0.015	–0.015	34	12.5	9.2	15	M8	–	13	–	–	NIPA2	6	8700	6300
–	50	+0.015	–0.015	19	12.5	9.2	15	M8	54	–	4	7	NIPA2	5	8900	6600

4.2.5 Linear ball bearing units KTB

Tandem arrangement

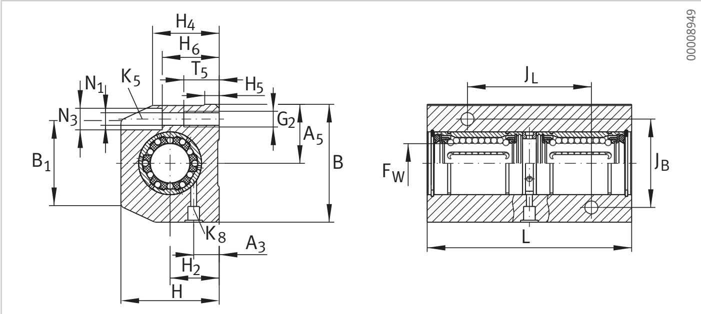
closed

Sealed

Greased

Can be relubricated

4



KTB..-PP-AS

Designation	m	F_W			B	L	H	J_B	A_5	B_1	J_L [1]	H_2
		–	U	L				±0.15			±0.015	±0.015
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
KTB12-B-PP-AS	310	12	+0.008	0	43	76	35	30	21.5	34	40	18
KTB16-B-PP-AS	460	16	+0.009	−0.001	53	84	42	36	26.5	40	45	22
KTB20-B-PP-AS	800	20	+0.009	−0.001	60	104	50	45	30	44	55	25
KTB25-B-PP-AS	1490	25	+0.011	−0.001	78	130	60	54	39	60	70	30
KTB30-B-PP-AS	2300	30	+0.011	−0.001	87	152	70	62	43.5	63	85	35
KTB40-B-PP-AS	3700	40	+0.013	−0.002	108	176	90	80	54	76	100	45
KTB50-B-PP-AS	6600	50	+0.013	−0.002	132	224	105	100	66	90	125	50

[1] Hole position symmetrical to bearing length L.

H_4	A_3	H_5	T_5	H_6	N_1	N_3	G_2	K_8	K_5	C	C_0
									–		
mm	mm	mm	mm	mm	mm	mm	–	–		N	N
25.5	10	5.4	13	28	5.3	10	M6	NIPA1	M5	880	770
20	12	6.9	13	35	5.3	10	M6	NIPA1	M5	1150	1060
33	13	7.4	18	37	6.4	11	M8	NIPA2	M6	2550	2450
40	15	8.3	22	49	8.4	15	M10	NIPA2	M8	4550	4450
44.5	16	9.3	26	52	10.5	18	M12	NIPA2	M10	5900	5700
56	20	12.4	34	64	13	20	M16	NIPA2	M12	8800	9700
60	20	11.1	34	70	13	20	M16	NIPA2	M12	12600	14100

4

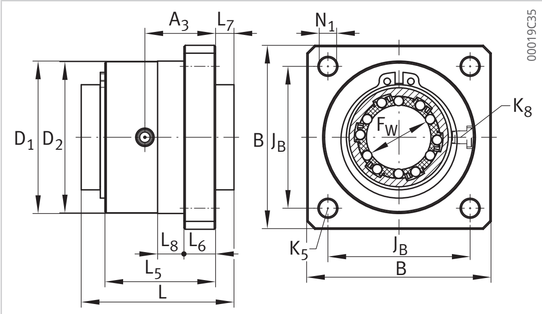
4.2.6 Linear ball bearing units KFB

With flange

Sealed

Greased

Can be relubricated



KFB..-B-PP-AS

Designation	m	F_W			B	L	L_5	L_6	L_7	A_3
		–	U	L						
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm
KFB12-B-PP-AS	80	12	+0.008	0	40	32	22	6	4.2	11.5
KFB16-B-PP-AS	120	16	+0.009	−0.001	50	36	24	8	5.2	12.5
KFB20-B-PP-AS	220	20	+0.009	−0.001	60	45	30	10	6.7	15.8
KFB25-B-PP-AS	430	25	+0.011	−0.001	70	58	42	12	7	22
KFB30-B-PP-AS	640	30	+0.011	−0.001	80	68	50	14	8	26
KFB40-B-PP-AS	1280	40	+0.013	−0.002	100	80	59	16	9.2	30.3
KFB50-B-PP-AS	2160	50	+0.013	−0.002	130	100	75	18	11.2	38.8

[1)] For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.

4

N_1	K_5 [1]	D_1	D_2	J_B	L_8	K_8	n	C	C_0
		+0.2	g7						
mm	–	mm	mm	mm	mm	–	–	N	N
5.5	M5	31.5	32	30	10	NIPD3	5	540	385
5.5	M5	37.5	38	35	10	NIPD3	5	710	530
6.6	M6	45.5	46	42	10	NIPD3	6	1570	1230
6.6	M6	57.5	58	54	10	NIPA1	6	2800	2200
9	M8	65.5	66	60	10	NIPA1	6	3600	2850
11	M10	89.5	90	78	10	NIPA1	6	6000	4400
11	M10	97.5	98	98	10	NIPA2	6	8700	6300

5 Linear plain bearings and linear plain bearing units of the plain bearing series

5

5.1 Product design

Linear plain bearings PAB and PABO and the associated plain bearing units PAGBA and PAGBAO are very heavy duty, extremely robust and are particularly quiet. Their emergency running properties are excellent.

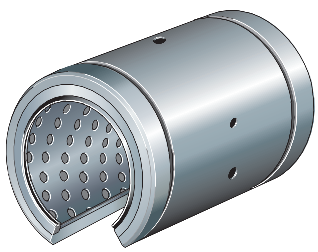
Linear plain bearings PAB and PABO consist of an outer ring made of high-strength aluminum, into which plain bearing bushes EGB..-E50 are glued.

The series PAB is closed and designed for use with shafts. PABO has a segment cut-out and is used in conjunction with support rails.

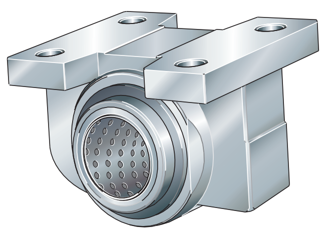
! Plain bushes must not be used in conjunction with the special Corrotect coating. This can lead to crevice corrosion, which impairs the function of the bearing.

56 Linear plain bearings PAB..-PP-AS, closed, sealed

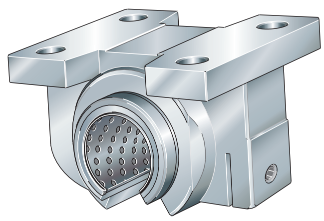
57 Linear plain bearings PABO..-PP-AS, with segment cut-out, sealed



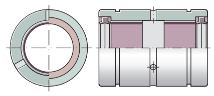
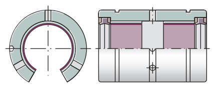
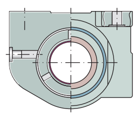
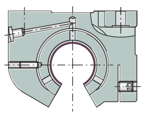
58 Linear plain bearing units PAGBA..-PP-AS, closed



59 Linear plain bearing units PAGBAO..-PP-AS, with segment cut-out



15 Linear plain bearings and linear plain bearing units of the plain bearing series

Model series		Characteristic
PAB..-PP-AS		• Closed • Lip seal on both sides • Can be relubricated
PABO..-PP-AS		• With segment cut-out • Lip seal on both sides • Can be relubricated
PAGBA..-PP-AS		• Closed • Can be relubricated
PAGBAO..-PP-AS		• With segment cut-out • Housing slotted • Can be relubricated

Further information

- Product tables
- Shafts ➤82 | 6.1
- Support rails ➤101 | 7.1
- Shaft support blocks ➤117 | 8.1

5.2 Product tables

5.2.1 Explanations

A_3	mm	Lubrication connection distance
A_5	mm	Stop side distance
B	mm	Width of the housing
B_2	mm	Segment opening
B_{L2}	mm	Width of mounting groove
C_0	N	Basic static load rating
D	mm	Outside diameter
D_N	mm	Diameter of mounting groove
F_W	mm	Inner envelope diameter
H	mm	Height of the housing
H_2	mm	Center distance
H_6	mm	Depth of mounting hole
J_B	mm	Mounting hole distance
J_L	mm	Distance between mounting holes
K_5	–	Fixing screw
K_8	–	Lubrication connection
L	mm	Length of the housing
L	mm	Length of the linear ball bearing
L	mm	Lower limit deviation
L_2	mm	Connection dimension
L_4	mm	Length of the housing section
L_5	mm	Housing width
m	g	Mass
N_1	mm	Diameter of the mounting hole
N_3	mm	Diameter of the counterbore
N_4	mm	Diameter of the fixing hole
N_L	mm	Diameter of the lubrication hole
U	mm	Upper limit deviation
α	°	Segment cut-out angle

5.2.2 Linear plain bearings PAB, PABO

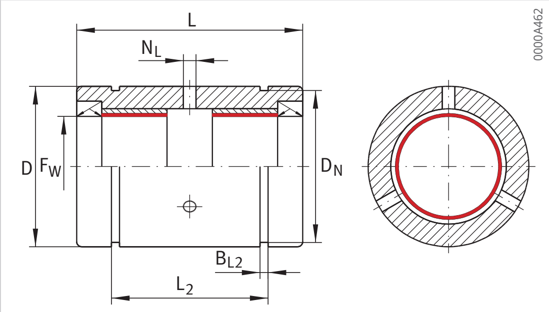
closed

With segment cut-out

Sealed

Greased

Can be relubricated



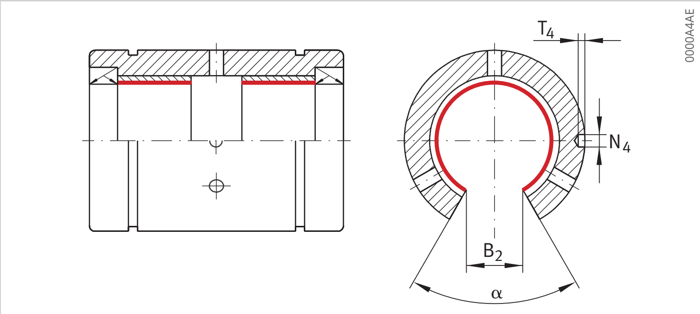
PAB..-PP-AS

Designation	m	F_w	D	L	L_2 1)	B_{L2} 2)
			h7	h12	H13	H13
–	g	mm	mm	mm	mm	mm
PAB12-PP-AS	26	12	22	32	22.6	1.3
PABO12-PP-AS	21	12	22	32	22.6	1.3
PAB16-PP-AS	34	16	26	36	24.6	1.3
PABO16-PP-AS	28	16	26	36	24.6	1.3
PAB20-PP-AS	68	20	32	45	31.2	1.6
PABO20-PP-AS	58	20	32	45	31.2	1.6
PAB25-PP-AS	132	25	40	58	43.7	1.85
PABO25-PP-AS	113	25	40	58	43.7	1.85
PAB30-PP-AS	169	30	47	68	51.7	1.85
PABO30-PP-AS	143	30	47	68	51.7	1.85
PAB40-PP-AS	426	40	62	80	60.3	2.15
PABO40-PP-AS	362	40	62	80	60.3	2.15
PAB50-PP-AS	773	50	75	100	77.3	2.65
PABO50-PP-AS	657	50	75	100	77.3	2.65

1) Hole position symmetrical to bearing length L.

2) Groove dimensions suitable for snap rings according to DIN 471.

3) The static load ratings are not valid when the above bearings are installed in housings, as shown on the following pages.



PABO..-PP-AS

D_N	B_2	T_4	N_4	N_L H13	α	C_0 [3)]
mm	mm	mm	mm	mm	°	N
21	–	–	–	2.5	–	60000
21	7.6	1.2	2.2	2.5	78	60000
24.9	–	–	–	2.5	–	96000
24.9	10.1	1.2	2.2	2.5	78	96000
30.3	–	–	–	2.5	–	150000
30.3	10	1.2	2.2	2.5	60	150000
37.5	–	–	–	2.5	–	250000
37.5	12.5	1.5	3	2.5	60	250000
44.5	–	–	–	3	–	375000
44.5	13.6	1.5	3	3	54	375000
59	–	–	–	3	–	600000
59	18.2	1.5	3	3	54	600000
72	–	–	–	4	–	1000000
72	22.7	1.5	3	4	54	1000000

5.2.3 Linear plain bearing units PAGBA, PAGBAO

closed

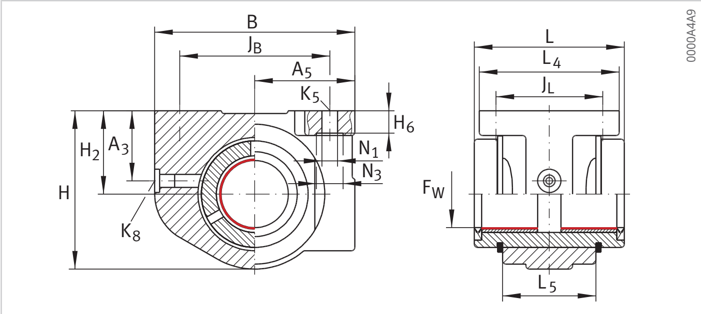
With segment cut-out

Sealed

Greased

Can be relubricated

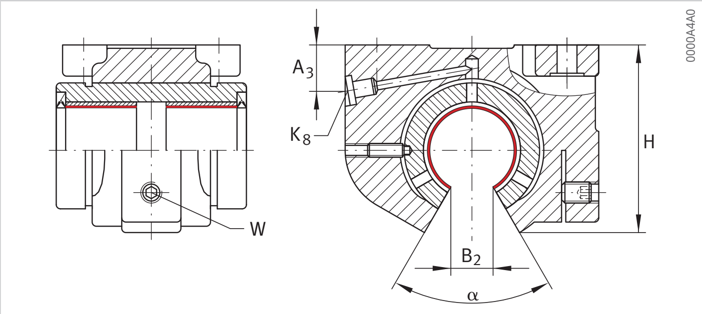
5



PAGBA..-PP-AS

Designation	m	F_w	B	L	H	J_B			A_5			B_2	L_4
				h12		–	U	L	–	U	L		
–	g	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
PAGBA12-PP-AS	70	12	42	32	34	32	+0.15	−0.15	21	+0.01	−0.01	–	32
PAGBAO12-PP-AS	60	12	42	32	30.5	32	+0.15	−0.15	21	+0.01	−0.01	7.6	32
PAGBA16-PP-AS	110	16	50	36	41	40	+0.15	−0.15	25	+0.01	−0.01	–	35
PAGBAO16-PP-AS	90	16	50	36	36.8	40	+0.15	−0.15	25	+0.01	−0.01	10.1	35
PAGBA20-PP-AS	180	20	60	45	47.5	45	+0.15	−0.15	30	+0.01	−0.01	–	42
PAGBAO20-PP-AS	160	20	60	45	44.5	45	+0.15	−0.15	30	+0.01	−0.01	10	42
PAGBA25-PP-AS	350	25	74	58	60	60	+0.2	−0.2	37	+0.01	−0.01	–	54
PAGBAO25-PP-AS	310	25	74	58	56	60	+0.2	−0.2	37	+0.01	−0.01	12.5	54
PAGBA30-PP-AS	480	30	84	68	67	68	+0.2	−0.2	42	+0.01	−0.01	–	60
PAGBAO30-PP-AS	430	30	84	68	63.5	68	+0.2	−0.2	42	+0.01	−0.01	13.6	60
PAGBA40-PP-AS	1070	40	108	80	87	86	+0.2	−0.2	54	+0.015	−0.015	–	78
PAGBAO40-PP-AS	910	40	108	80	82.4	86	+0.2	−0.2	54	+0.015	−0.015	18.2	78
PAGBA50-PP-AS	1650	50	130	100	98	108	+0.2	−0.2	65	+0.015	−0.015	–	70
PAGBAO50-PP-AS	1460	50	130	100	92.8	108	+0.2	−0.2	65	+0.015	−0.015	22.7	70

1) For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.



PAGBAO..-PP-AS

J_L			L_5	H_2			A_3	H_6	N_1 [1)]	N_3 [1)]	K_5	SW		α	K_8
mm	U	L		–	U	L		–0.5				–	M_A		
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	–	–	Nm	°	–
23	+0.15	–0.15	20	18	+0.01	–0.01	15	4.8	4.7	8	M4	–	–	–	NIPA1
23	+0.15	–0.15	20	18	+0.01	–0.01	7.8	4.8	4.7	8	M4	2	1	78	NIPA1
26	+0.15	–0.15	22	22	+0.01	–0.01	15	5.4	4.7	8	M4	–	–	–	NIPA1
26	+0.15	–0.15	22	22	+0.01	–0.01	10	5.4	4.7	8	M4	2.5	1.5	78	NIPA1
32	+0.15	–0.15	28	25	+0.01	–0.01	21	6.7	4.7	8	M4	–	–	–	NIPA1
32	+0.15	–0.15	28	25	+0.01	–0.01	11	6.7	4.7	8	M4	2.5	1.5	60	NIPA1
40	+0.2	–0.2	40	30	+0.01	–0.01	23	7.8	5.7	10	M5	–	–	–	NIPA1
40	+0.2	–0.2	40	30	+0.01	–0.01	13	7.8	5.7	10	M5	3	3	60	NIPA1
45	+0.2	–0.2	48	35	+0.01	–0.01	25	8.7	6.8	11	M6	–	–	–	NIPA2
45	+0.2	–0.2	48	35	+0.01	–0.01	14	8.7	6.8	11	M6	3	4	54	NIPA2
58	+0.2	–0.2	56	45	+0.01	–0.01	30	11	9.2	15	M8	–	–	–	NIPA2
58	+0.2	–0.2	56	45	+0.01	–0.01	18	11	9.2	15	M8	4	5	54	NIPA2
50	+0.2	–0.2	72	50	+0.015	–0.015	34	12.5	9.2	15	M8	–	–	–	NIPA2
50	+0.2	–0.2	72	50	+0.015	–0.015	19	12.5	9.2	15	M8	4	7	54	NIPA2

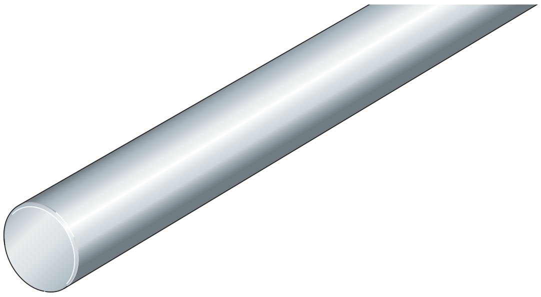
6 Solid shafts and hollow shafts

6.1 Product design

Solid shafts and hollow shafts are precision shafts made of tempered steel in rolling bearing quality and are supplied in metric dimensions.

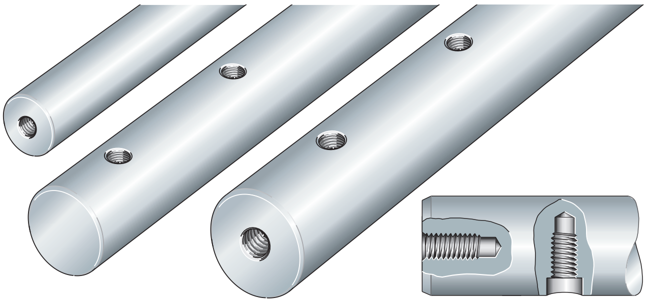
Hollow shafts are particularly suitable for weight-reduced constructions. Solid shafts can be fitted with radial and axial threaded holes for mounting or, on request, can be manufactured completely according to customer drawings ➤86|6.1.5 to ➤91|77.

60 Solid shafts without threaded holes



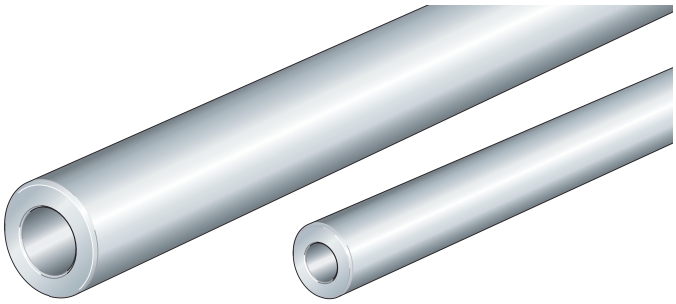
00008C1C

61 Solid shafts with axial and radial threaded holes



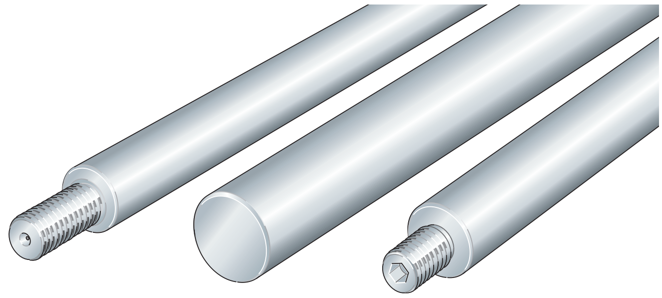
00008CE0

62 Hollow shafts



00006771

63 Shafts according to customer requirements



6.1.1 Precision raceway for economical linear guides

The material quality of the shafts ensures high dimensional accuracy and form accuracy (roundness, parallelism). Due to the high surface hardness and surface quality, the shafts are therefore very well suited as a precision raceway for linear ball bearings.

Precision shafts are suitable for a wide range of applications:

- Guide rods for jig and fixture construction, and automatic machine construction
- Counter-running surfaces for plain bushings
- Stretch and straightening rollers
- Precision raceway for precision ball bearings

When used in conjunction with linear ball bearings, support rollers and cam rollers, track rollers and profile rollers, this results in durable, rigid, accurate, ready-to-install and economical linear guides with a long rating life.

6.1.2 Steels, hardness, surface, tolerances, lengths

Shafts made of Cf53 (material number 1.1213) are inductively hardened and ground; the hardness of the surface is 670 HV + 165 HV (59 HRC + 6 HRC).

Hollow shafts are available only in tempered steel.

As an alternative to tempered steel, solid shafts are also available in corrosion-resistant steels to ISO 683-17 and EN 10880, for example as X46Cr13 (1.4034) or X90CrMoV18 (1.4112). The hardness of the surface at X46 is 520 HV + 115 HV (52 HRC + 4 HRC). The hardness of the surface at X90 is 580 HV + 85 HV (54 HRC + 4 HRC). The suffix is X46 or X90.

These steels are particularly suitable for use in the food industry, medical technology and semiconductor technology.

! Due to the hardness profile, the corrosion resistance of shafts made from materials X46Cr13 and X90CrMoV18 is limited at the front sides. This also applies to any soft-annealed areas.

An even hardening depth ensures a steady transition from the hardened edge layer to the tough, normalized core, which can absorb bending stresses.

The standard surface is Ra 0.3.

Solid shafts have the normal tolerance h6; hollow shafts have h7.

Precision shafts are available in single-piece lengths of up to 6000 mm. Longer shafts are available on request and assembled (with mortice and tenon joints).

6.1.3 Coatings

Coatings and hard chromium coating provide optimum wear protection and corrosion protection for the shafts and are available as an option.

The hard chromium coating is suitable for applications in which high wear protection is required. The chromium coating also offers good corrosion resistance.

Chromium-coated shafts have the tolerance h7. The thickness of the chromium coating is 5 µm to 15 µm, with the hardness 800 HV to 1050 HV. The suffix is CR.

Corrosion-resistant shafts are coated with the special Corrotect coating and, for production reasons, have centering or threaded holes in the end faces.

The inside diameter of hollow shafts is not coated.

Corrotect is a surface coating applied by electroplating. The coating gives cathodic corrosion protection and is extremely thin. Under load, it is compacted into the surface roughness profile and partially worn away. In parts coated with Corrotect, running-in occurs in the area of the seal and an optically bright area develops as a result. The remote cathodic protection mechanism can also prevent the formation of rust in this area. Corrotect-coated parts have the suffix RROC.

! Corrotect reduces the adhesion of weld spatter. Corrotect can be worn away by contact seals. The Corrotect coating is not approved for direct contact with food and is not suitable in abrasive ambient media.

For use in the food industry Schaeffler Group offers the special coating Corrotect Cr(VI)-free. This meets the requirements of the RoHS Directive EU-Richtlinie 2002/95/EG. All other benefits are identical to the standard Corrotect coating. The suffix is RROC.

- Resistance to moisture, salt spray, dirty water, and weakly alkaline and weakly acidic media
- Does not impair the load carrying capacity, in contrast to the use of corrosion-resistant steels
- Extremely resistant to corrosion
- Protection against rust on all surfaces
- Protection against rust on smaller bright spots due to the cathodic protection effect
- Protection against EP additives
- Good thermal conductivity
- Compliant with RoHS Directive 2011/95/EU

Components coated with Corrotect are particularly suitable when corrosion resistance is paramount. The coating can also be used to prevent weld spatter from adhering.

16 Coatings

Characteristic		Coating	
		Corrotect	Hard chromium
		CR(VI)-free	
Suffix	–	RROC	CR
Color	–	Colorless, blue to iri-descent	Chromium
Coating thickness	μm	0.5 … 5.0	5.0 … 15.0
Formulation		Zinc alloyed with iron	Chromium
Coating hardness	HV	300	800 … 1050
Corrosion protection [1]	h	96	[2]
Anti-wear protection	–	no	Yes
Maximum shaft length	mm	3500	3900 (at Ø 6 mm … 8 mm) 5900 (at Ø ≥ 10 mm)
Cr(VI)-free	–	Yes	Yes

[1] Salt spray test to DIN EN ISO 9227

[2] Please consult with Application Technology

! Machined surfaces, front sides and bore holes can be uncoated.

6.1.4 Available materials, coatings, tolerances

17 Available materials, coatings, tolerances

Shaft diameter	Solid shafts					Hollow shafts
	Material					
	Heat-treated steel			X46Cr13	X90CrMoV18	Heat-treated steel
	Tolerance [1]	CR	RRF, RROC			Tolerance
mm	h6	h7	h6	h6	h6	h7
4	● [2]	–	■	–	●	–
5	●	–	■	–	–	–
6	●	●	■	●	●	–
8	●	●	■	●	●	–
10	●	●	■	●	●	–
12	●	●	■	●	●	●
14	●	●	■	●	●	–
15	●	●	■	●	●	–
16	●	●	■	●	●	●
20	●	●	■	●	●	●
25	●	●	■	●	●	●
30	●	●	■	●	●	●
40	●	●	■	●	●	●
50	●	●	■	●	●	●
60	●	●	■	–	–	●
80	●	●	■	–	–	●

[1] Other tolerances on request.

[2] ■ On request.

● Available design.

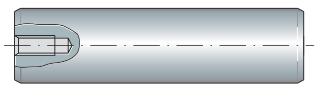
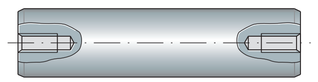
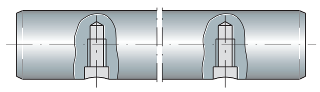
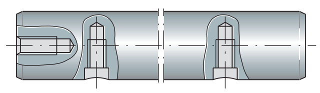
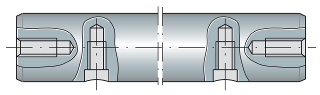
6.1.5 Solid shafts with threaded holes

If shafts are to be supported or connected to other elements, mounting holes are required.

Hole patterns B01 to B05 are available to provide standard threaded holes for solid shafts ➤86|▦18.

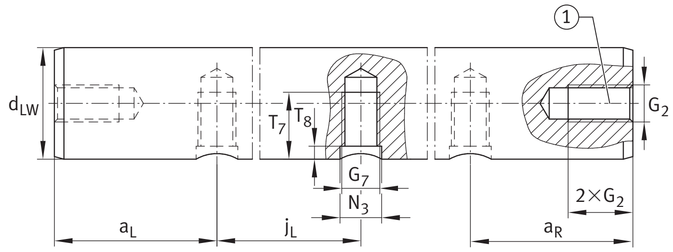
In addition, holes with or without thread are possible according to customer drawings ➤88|65 to ➤91|77.

▦18 Codes for hole patterns

Code		Execution of the holes
B01		Axial thread on one side
B02		Axial thread on both sides
B03		Radial thread
B04		Radial thread and axial thread on one side
B05		Radial thread and axial thread on both sides

Depending on the hole diameter, the outside shaft diameter in the axial bore area may increase, which may cause deviations in the tolerances to occur in this area.

64 Axial and radial threaded holes



1 Depending on the hole diameter

6

19 Recommended threaded holes for solid shafts W

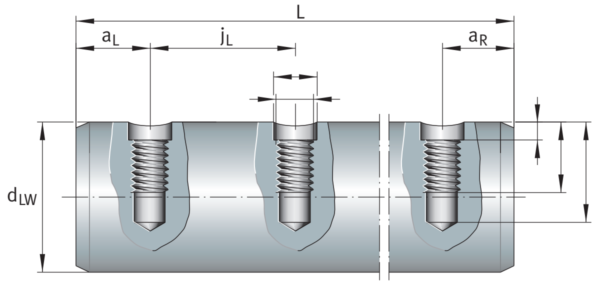
Desig-nation	d_{LW}	G_2	G_7	j_L			a_L min. Hole pattern B03	a_R min. Hole patterns B04, B05	T_7	T_8	N_3
–	mm	–	–	mm	mm	mm	mm	mm	mm	mm	mm
W08	8	M3	–	–	–	–	–	$3 \cdot G_2 + G_7$	–	–	–
W10	10	M3, M4	–	–	–	–	–	$3 \cdot G_2 + G_7$	–	–	–
W12	12	M4, M5	M4	75	–	120	10	$3 \cdot G_2 + G_7$	7	2	5
W14	14	M4, M5, M6	–	–	–	–	–	$3 \cdot G_2 + G_7$	–	–	–
W15	15	M5, M6, M8	–	–	–	–	–	$3 \cdot G_2 + G_7$	–	–	–
W16	16	M5, M6, M8	M5	75	100	150	15	$3 \cdot G_2 + G_7$	9	2.5	6
W20	20	–	M5	–	–	150	15	$3 \cdot G_2 + G_7$	9	2.5	6
W20	20	M6, M8, M10	M6	75	100	150	15	$3 \cdot G_2 + G_7$	11	3	7
W25	25	–	M6	–	–	150	15	$3 \cdot G_2 + G_7$	11	3	7
W25	25	M8, M10, M12	M8		120	200	15	$3 \cdot G_2 + G_7$	15	3	9
W30	30	–	M6	–	–	150	15	$3 \cdot G_2 + G_7$	11	3	7
W30	30	M10, M12, M16	M10	100	150	200	20	$3 \cdot G_2 + G_7$	17	3.5	11
W40	40	M10, M12, M16	M10	150	200	300	20	$3 \cdot G_2 + G_7$	19	4	11
W40	40	M10, M12, M16	M12	100	–	–	20	$3 \cdot G_2 + G_7$	21	4	13
W40	40	–	M10	–	–	150	20	$3 \cdot G_2 + G_7$	19	4	11
W50	50	M12, M16, M20	M12	–	200	300	20	$3 \cdot G_2 + G_7$	21	4	13
W50	50	M12, M16, M20	M14	100	–	–	20	$3 \cdot G_2 + G_7$	25	4	15
W60	60	M16, M20, M24	–	–	–	–	–	$3 \cdot G_2 + G_7$	–	–	–
W60	60	M16, M20, M24	–	–	–	–	–	$3 \cdot G_2 + G_7$	–	–	–

a_L	mm	Radial hole, edge distance left
a_R	mm	Radial hole, edge distance right
d_{LW}	mm	Shaft diameter
j_L	mm	Distance between holes
L	mm	Length
N_3	mm	Countersink diameter
T_7	mm	Thread length
T_8	mm	Bore depth
W	mm	Width across flats

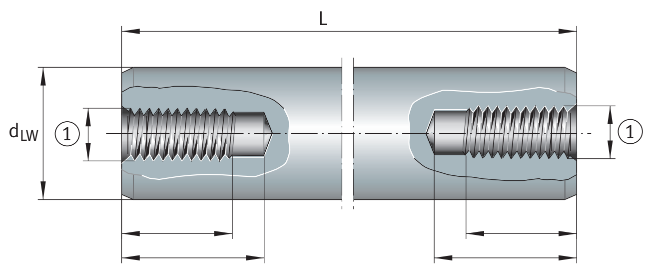
6.1.6 Shafts according to customer requirements

To request special shafts, please supply your own drawing or copy our templates and complete the required values.

65 Radial holes with and without thread

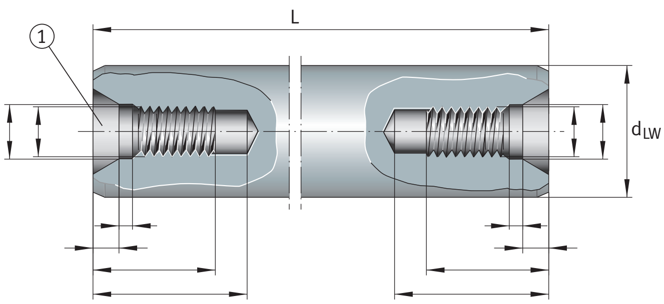


66 Internal thread, one-sided or two-sided



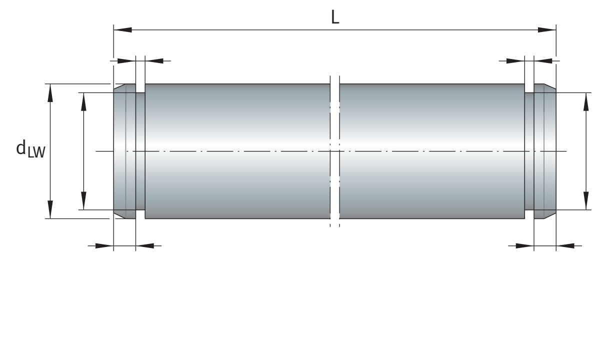
1 Diameter according to DIN 336 or DIN 13

67 Internal thread with centering hole

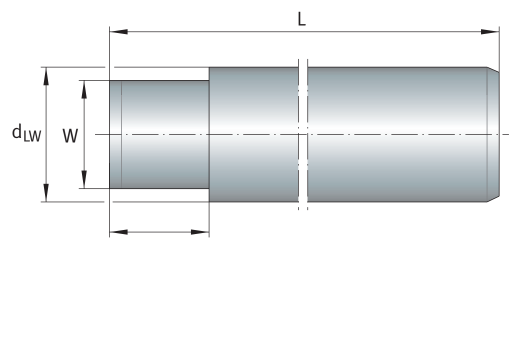


1 Recommended for threads with centering hole DIN 332-D

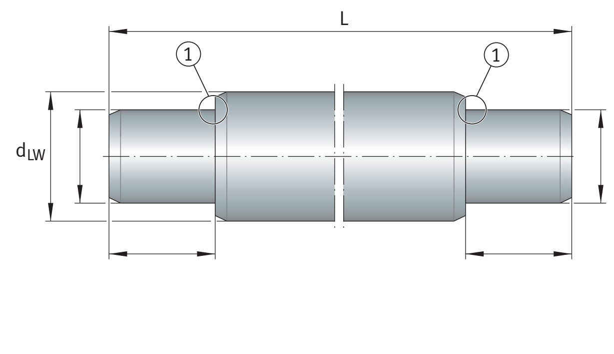
68 Groove for snap ring



69 Width across flats W

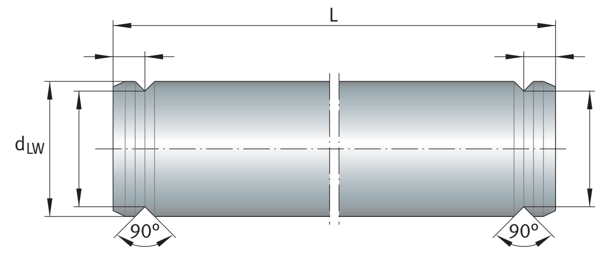


70 Pin

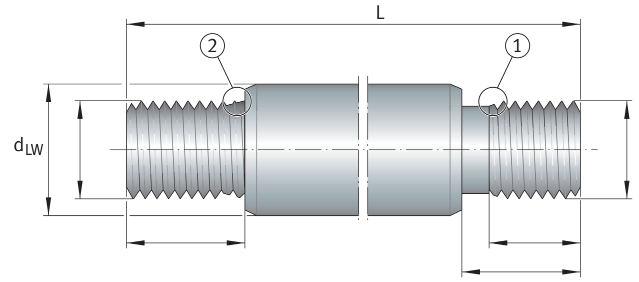


1 Undercut type F DIN 509:2022 (both sides)

71 90-groove

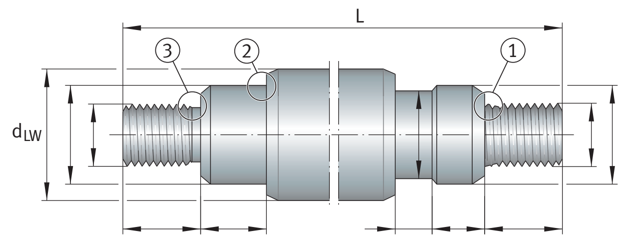


72 Threaded pin



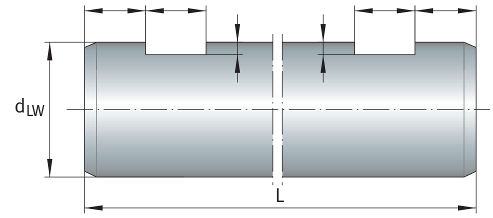
1	Thread run-out according to DIN 76-1A; in case of undercut, to DIN 76-A	2	DIN 76-A recommended for undercut

73 Pin and threaded pin



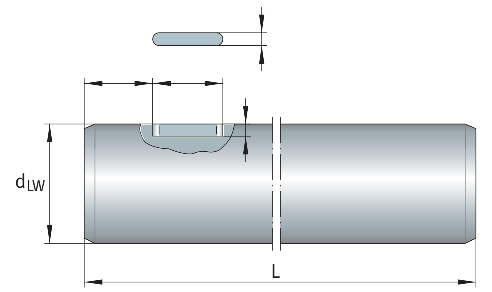
1	DIN 76-A recommended for undercut	2	DIN 509:2022 Recommended for undercut type F
3	Thread run-out according to DIN 76-1A		

74 Slot



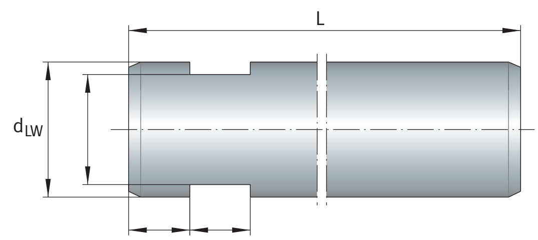
00008DC4

75 Keyway



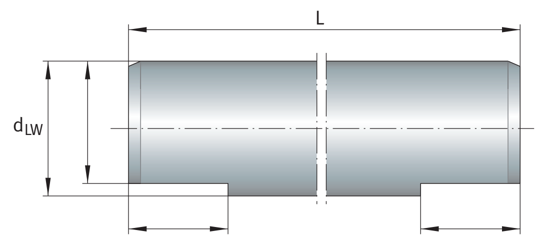
00008DC6

76 Width across flats



00008DC9

77 Area



00008DCC

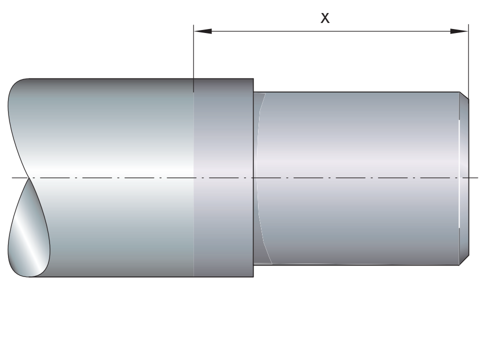
6.1.7 Shaft machining, shaft specification

6.1.7.1 Soft-annealed shafts

Additional machining (such as journals, flattened areas, external threads) may require soft annealing of the corresponding areas. In this case, slight changes may occur in the dimensional and geometrical tolerances as well as the surface quality of the soft annealed area. Material discoloration may occur in the annealed area and there may be residual hardness in the transitional zone.

! For corrosion-resistant steels, the X materials, only limited corrosion protection is provided here.

78 Soft-annealed shaft



x Soft-annealed area

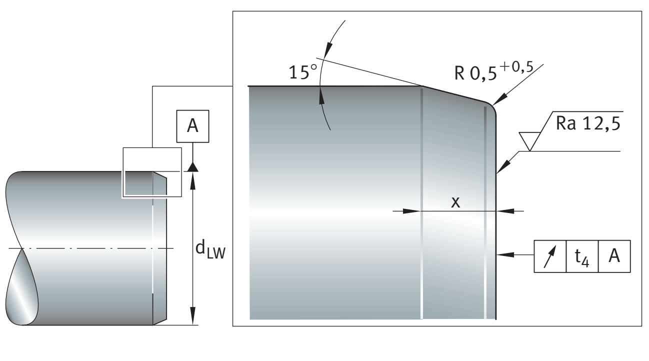
6.1.7.2 Standard chamfer

After cutting to length, the shaft ends are chamfered on both sides. They can also be supplied without chamfers as a parting cut ➤93 | 80.

20 Chamfer x, depending on shaft diameter d_{LW}

Shaft diameter		Chamfer		Axial run-out
d_{LW}		x	U	t_4
over	to			
mm	mm	mm	mm	mm
–	8	0.5 × 45°	–	0.2
8	10	1	+1	0.2
10	30	1.5	+1	0.3
30	80	2.5	+1	0.5

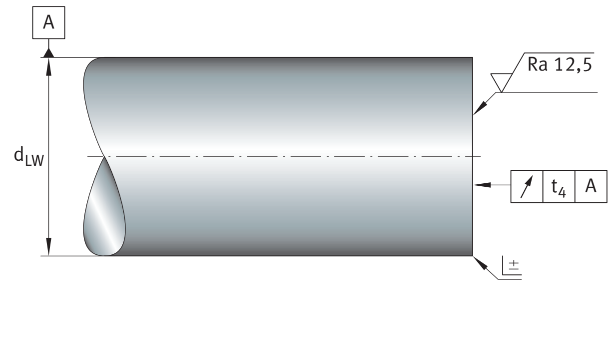
79 Standard chamfer



6.1.7.3 Parting cut

In the case of a parting cut, the shaft is only cut to length. There is no additional machining of the end faces. This can result in a burr. The suffix is T.

80 Parting cut

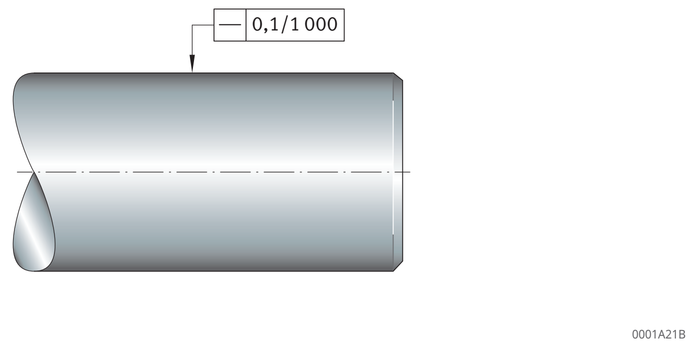


t_4 Axial run-out tolerance

6.1.7.4 Straightness

The standard straightness is shown.

81 Straightness

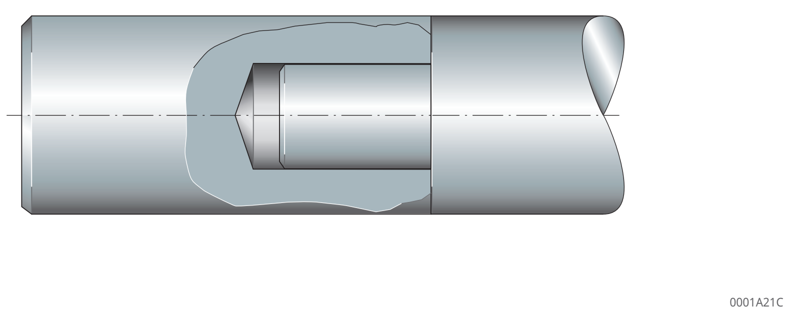


6.1.7.5 Shaft with mortice and tenon joint

If the shaft length is in excess of the stock length, the shafts are joined together.

The individual sections of shafts are joined by means of mortice and tenon joints. The joints are marked accordingly. Shafts that are screwed together are available on request.

82 Shaft with mortice and tenon joint



6

6.1.7.6 Length tolerance

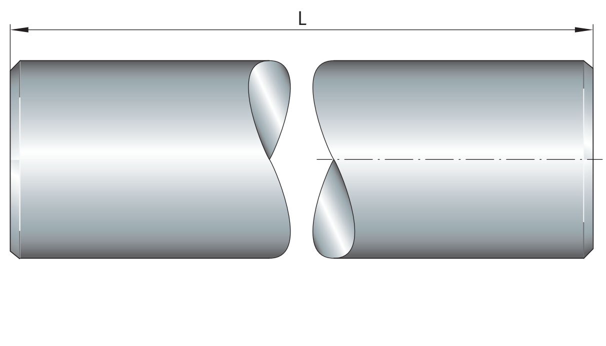
Length tolerances U and L depend on the shaft length L.

Special tolerances are possible on request.

21 Tolerances, depending on shaft length

L		U	L
over	to	Max.	Max.
mm	mm	mm	mm
–	400	0.5	–0.5
400	1000	0.8	–0.8
1000	2000	1.2	–1.2
2000	4000	2	–2
4000	6000	3	–3

83 Length tolerance

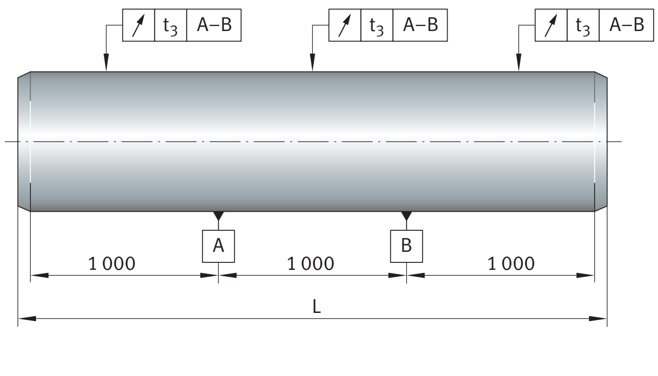


6.1.7.7 Straightness value

According to ISO 13012, the measurement points are at a distance of 1000 mm. Shafts with length 1000 mm have a maximum of two measurement points.

The straightness tolerance is half of the dial gauge value with a shaft revolution of 360.

84 Straightness measurement

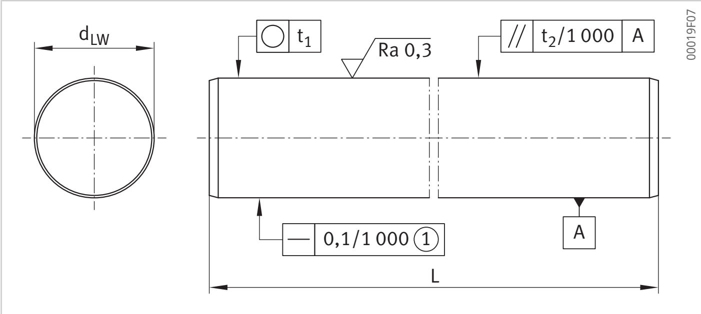


6.2 Product tables

6.2.1 Explanations

d	mm	Inside diameter
d_{LW}	mm	Shaft diameter
L	mm	Length
m	g/m	Mass
SHD	mm	Surface hardening depth
t_1	μm	Roundness tolerance
t_2	μm	Parallelism tolerance according to DIN ISO 13012
t_3	μm	Straightness tolerance

6.2.2 Solid shafts W



W
(1) Length 400 mm: maximum straightness tolerance 0.04 mm

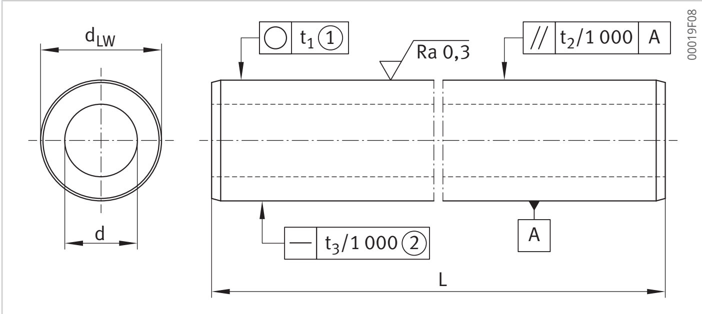
Designation	m [1]	d_{LW}		L	t_1	t_2 [2]	SHD [3]
		–					
				max.			min
–	kg/m	mm	–	mm	µm	µm	mm
W05	0.15	5	h6	4000	4	5	0.4
W06-H6	0.22	6	h6	4000	4	5	0.4
W08	0.39	8	h6	4000	4	6	0.4
W10	0.62	10	h6	6000	4	6	0.4
W12	0.89	12	h6	6000	5	8	0.6
W14	1.21	14	h6	6000	5	6	0.6
W15	1.39	15	h6	6000	5	8	0.6
W16	1.58	16	h6	6000	5	8	0.6
W20	2.47	20	h6	6000	6	9	0.9
W25	3.85	25	h6	6000	6	9	0.9
W30	5.55	30	h6	6000	6	9	0.9
W40	9.87	40	h6	6000	7	11	1.5
W50	15.41	50	h6	6000	7	11	1.5
W60	22.2	60	h6	6000	8	13	2.2
W80	39.45	80	h6	6000	8	13	2.2
W04	0.1	4	h6	2500	4	5	0.4

[1] Weight for W04 is in kg.

[2] Diameter difference measurement.

[3] According to DIN ISO 13012.

6.2.3 Hollow shafts WH



WH
(1) Roundness corresponds to a maximum of half the diameter tolerance
(2) Length 500 mm, maximum straightness tolerance of 0.1 mm

6

Designation	m	d_{LW}	L	d [1]			t_2	t_3	SHD [2]
		h7 [3]	max.	–	U	L			min.
–	kg/m	mm	mm	mm	µm	µm	µm	µm	mm
WH12	0.79	12	5700	4	0.45	−0.45	7	0.3	0.8
WH16	1.26	16	5700	7	0.15	−0.15	7	0.3	0.8
WH20	1.28	20	5700	14	0.15	−0.15	9	0.2	1.2
WH25	2.4	25	5700	15.4	0.15	−0.15	9	0.2	1.2
WH30	3.55	30	5700	18	0.15	−0.15	9	0.2	1.5
WH40	5.7	40	7300	26	0.15	−0.15	11	0.1	1.5
WH50	10.58	50	6700	28	0.25	−0.25	11	0.1	1.5
WH60	14.2	60	5700	36	0.3	−0.3	13	0.1	1.5
WH80	20.8	80	5700	57.4	0.35	−0.35	13	0.1	2.2

1) Wall thickness difference of basic material ±5%.

2) According to DIN ISO 13012.

3) Diameter tolerance h6 on request.

6.3 Order example, ordering designation

If the standard designations are not sufficient to describe the shaft, please enclose a drawing with your request.

6.3.1 Solid shaft, without machining

- Type: W
- Shaft diameter d_{LW}: 20 mm
- Tolerance: h6
- Material: Cf53
- Coating: –
- Length: 1200 mm
- Parting cut: –
- Standard chamfer: No suffix

Ordering designation:

- **W20/h6-Cf53-1200**

6.3.2 Hollow shaft, without machining

- Type: WH
- Shaft diameter d_{LW}: 20 mm
- Tolerance: h7
- Material: C60
- Coating: –
- Length: 1500 mm
- Parting cut: T
- Standard chamfer: No suffix

Ordering designation:

- **WH20/h7-C60-1500-T**

6.3.3 Solid shaft, with machining

- Type: W
- Shaft diameter d_{LW}: 30 mm
- Tolerance: h7
- Material: Cf53
- Coating: Cr
- Hole pattern: B05
- Axial thread: M12
- Radial thread: M10
- Bore distance of radial thread: 100
- Length: 1110 mm
- Parting cut: T
- Standard chamfer: –
- Distance a_L: 60 mm
- Distance a_R: 50 mm

Ordering designation:

- **W30/h7-Cf53-Cr-B05/M12-M10×100-1110-T-60-50**

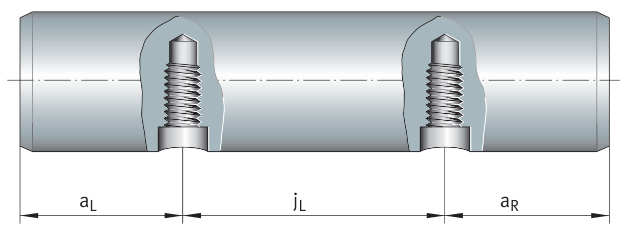
6.3.4 Possible order for standard shafts with machining

- Type: W, WH
- Shaft diameter d_{LW}: 10 mm ... 80 mm
- Tolerance [1]: h6, h7
- Material [2]: Cf53, X46, X90
- Coating: Cr, PROC
- Hole pattern: B01, B02, B03, B04, B05
- Axial thread [1]: M3 ... M24
- Radial thread [1]: M4 ... M14
- Bore distance for radial thread j_L: measured from the center of the hole, ➤99 | 85
- Length [1]: single piece to 6000 mm
- Parting cut: T
- Standard chamfer: No suffix
- Distance a_L: ➤99 | 85
- Distance a_R: ➤99 | 85

1) Depending on diameter and .

2) Hollow shafts are available only in Cf53 and C60.

85 Hole spacing of the radial threads j_L



6.3.5 Order examples

Elements of shaft guidance systems (linear ball bearings, solid and hollow shafts) must be ordered separately.

The ordering designation of an element consists of the code and specification; see the ordering designation for a shaft with axial thread and linear ball bearing.

The codes are specified in the product tables. Specification details describe the unit in more detail.

Shaft guide, shaft with axial thread

- Corrosion-resistant shaft: W20/h6-X90
- Code for hole pattern: B02
- Axial thread: M8
- Shaft length: 3500 mm

Ordering designation:

- **W20/h6-X90-B02/M8-3500**

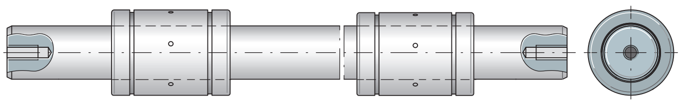
Shaft guide, linear ball bearing

- Linear ball bearing: KB
- Size code: 20
- Contact seal on both front sides: PP
- Corrotect-coating: RR
- Can be relubricated: AS

Ordering designation:

- 2 × **KB20-PP-RR-AS**

86 Shaft with axial thread, two linear ball bearings



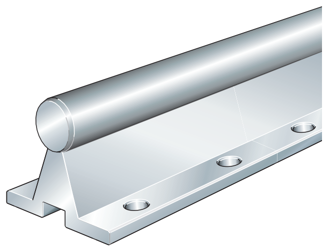
7 Support rails

7.1 Product design

Support rails TS..W are composite rails, consisting of an aluminum support and a track shaft that is screwed onto the support body. The shaft protrudes approximately 2 mm 3 mm beyond the support at both ends.

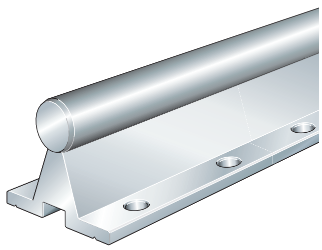
The drive shaft is made of heat-treated steel ➤82|6. Corrosion-resistant design on request.

87 TSNW



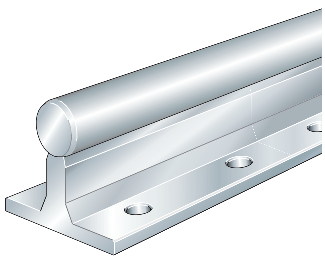
00008DFD

88 TSWW



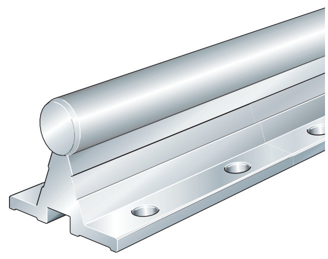
00008DDD

89 TSWWA

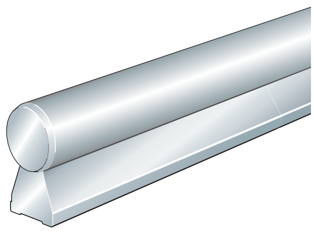


00008DFE

90 TSNW..-G4, TSNW..-G5



91 TSUW



7.1.1 Multi-part support rails

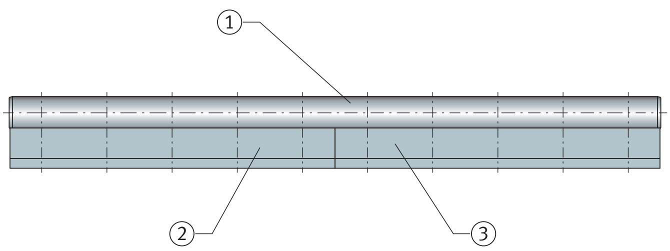
Depending on their length, support rails are made up of several sections.

If guides are of sufficient length to preclude the use of support rails TS..W with single-piece shafts, the shafts and support bodies are supplied in several parts. The joint locations on the shaft sections have mortice and tenon joints and are polished.

The joint locations on the shafts and support rails are offset from each other.

The maximum length of single-piece support rails is 6000 mm.

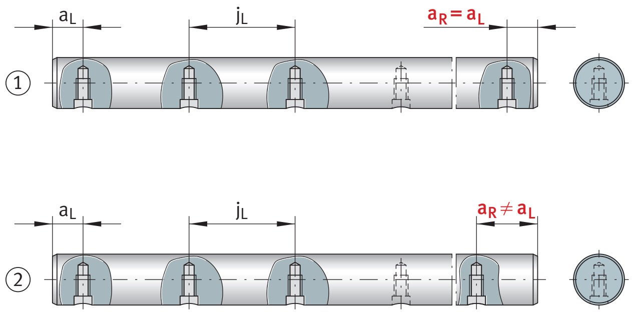
92 Shaft and support rail unit with multiple support rail sections



1	Shaft	2	Support rail 1
3	Support rail 2		

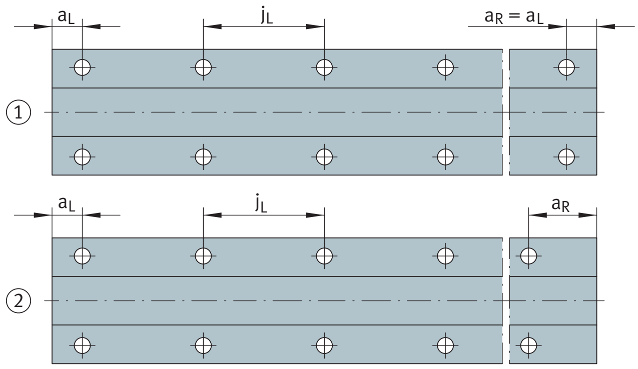
Unless stated otherwise, raceway shafts and shaft and support rail units are supplied with a symmetrical hole pattern.

93 Hole patterns for shafts with one row of holes



1	Symmetrical hole pattern	2	Unsymmetrical hole pattern

94 Hole patterns for support rails with two rows of holes



1	Symmetrical hole pattern	2	Unsymmetrical hole pattern

An asymmetrical hole pattern is also possible on request. $a_{L\ max} \geq a_L \geq a_{L\ min}$ and $a_{R\ max} \geq a_R \geq a_{R\ min.}$ must apply.

The number of pitches between holes is the rounded whole number equivalent to:

11

$$n = \frac{l - 2 \cdot a_{L\ min}}{j_L}$$

For distances a_L and a_R, the following generally applies:

12

$$a_L + a_R = l - n \cdot j_L$$

For raceway shafts and shaft and support rail units with a symmetrical hole pattern:

13

$$a_L = a_R = \frac{1}{2} \cdot \left(l - n \cdot j_L\right)$$

Number of holes:

ƒ14

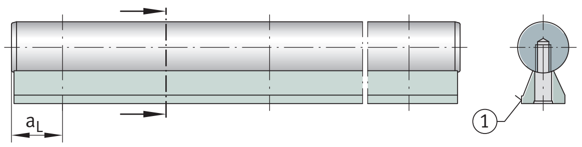
$$x = n + 1$$

a_L	mm	Radial hole, edge distance left
a_R	mm	Radial hole, edge distance right
j_L	mm	Distance between holes
l	mm	Rail length
n	–	Maximum possible number of pitches
x	-	Number of holes, for rails with T-grooves: Number of screws

7

! If the minimum and maximum values for a_L and a_R are not observed, the counterbores of the holes may be intersected. The position a_L for the support rail TSUW is shown ➤104 | 95.

95 Hole patterns for support rail TSUW



1	Saddle plate

7.1.2 Length tolerances for support rails

22 Length tolerances of the single-piece and multi-part support rails

L			
–		**U**	**L**
mm		**mm**	**mm**
over	**to**		
–	400	0.5	–0.5
400	1000	0.8	–0.8
1000	2000	1.2	–1.2
2000	4000	2	–2
4000	6000	3	–3

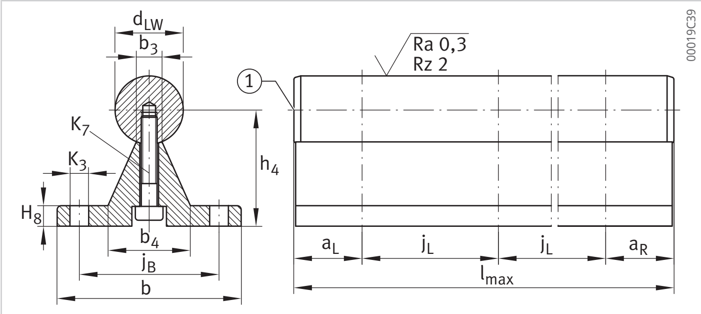
7.2 Product tables

7.2.1 Explanations

(1)	–	Protrusion of the shaft per side approx. 2 mm
Δ	mm	Deviation
a_2	mm	Distance of stop side
a_L	mm	Distance from the start of the rail to the next hole
a_R	mm	Distance from the end of the rail to the next hole
b	mm	Width of the support rail base
b_1	mm	Width of the support rail base
b_3	mm	Profile cross-section
B_3	mm	Profile cross-section
b_4	mm	Profile cross-section
d_{LW}	mm	Shaft diameter
G_1	–	Connecting thread
G_2	mm	Through bore
G_{kl}	–	Accuracy class
h_4	mm	Center distance
H_5	mm	Height of the support rail base
h_7	mm	Screw-in depth of the mounting hole
H_8	mm	Thickness of the support rail base
j_B	mm	Distance between holes
J_B	mm	Mounting hole distance
j_L	mm	Distance between holes
J_L	mm	Distance between mounting holes
K_3	mm	Diameter of the mounting hole
K_6	mm	Through bore
K_7	–	Connecting screw
l	mm	Rail length
L	mm	Lower limit deviation
m	g/m	Mass
U	mm	Upper limit deviation

7

7.2.2 Support rails TSNW



TSNW

7

Designation	m	d_{LW}	b	h_4 1)	l_{max} 2)	b_3	b_4
		h6		±0.02	±3		
–	kg/m	mm	mm	mm	mm	mm	mm
TSNW12	1.67	12	40	22	6000	5	17
TSNW16	2.95	16	45	26	6000	6.8	22.4
TSNW20	3.95	20	52	32	6000	7.5	26.3
TSNW25	5.6	25	57	36	6000	9.8	30
TSNW30	7.88	30	69	42	6000	11	33.4
TSNW40	12.83	40	73	50	6000	14.5	39.4
TSNW50	19.38	50	84	60	6000	18.5	45.2

1) Based on the nominal shaft diameter, measured in mounted condition.

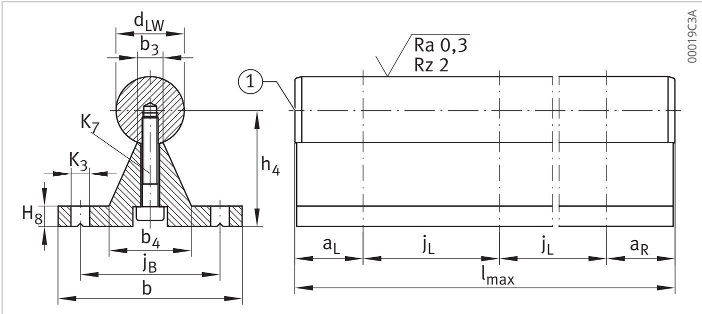
2) Maximum length of single-piece support rails; longer support rails, ➤102 | 92. Depending on the length of the support rail, the support body is made up of several sections.

3) Dimensions a_L and a_R depend on the length of the support rail.

4) For mounting screws DIN 7984. Secure the screws, especially if preload losses can occur.

j_B	j_L	a_L 3)		a_R 3)		H_8	K_3 4)	K_7
		min.	max.	min.	max.			ISO 4762
mm	mm	mm	mm	mm	mm	mm	mm	–
29	75	20	69	20	69	5	4.5	M4×18
33	100	20	93	20	93	5	5.5	M5×22
37	100	20	92	20	92	6	6.6	M6×25
42	120	20	110	20	110	6	6.6	M8×30
51	150	20	139	20	139	7	9	M10×35
55	200	20	189	20	189	8	9	M10×35
63	200	20	188	20	188	9	11	M12×40

7.2.3 Support rails TSWW



TSWW

7

Designation	m	d_{LW}	b	h_4 1)	l_{max} 2)	b_3	b_4
		h6		±0.02	±3		
–	kg/m	mm	mm	mm	mm	mm	mm
TSWW12	1.67	12	40	22	6000	5	17
TSWW16	3.15	16	54	32	6000	6.8	24.7
TSWW20	4.03	20	54	34.02	6000	7.8	24.7
TSWW25	5.9	25	65	39.66	6000	9.3	30.3
TSWW30	7.58	30	65	42.19	6000	9.3	30.3
TSWW40	14.25	40	85	60	6000	16.3	46
TSWW50	19.75	50	85	65.06	6000	16.3	46

1) Based on the nominal shaft diameter, measured in mounted condition.

2) Maximum length of single-piece support rails; longer support rails, ➤102 | 92. Depending on the length of the support rail, the support body is made up of several sections.

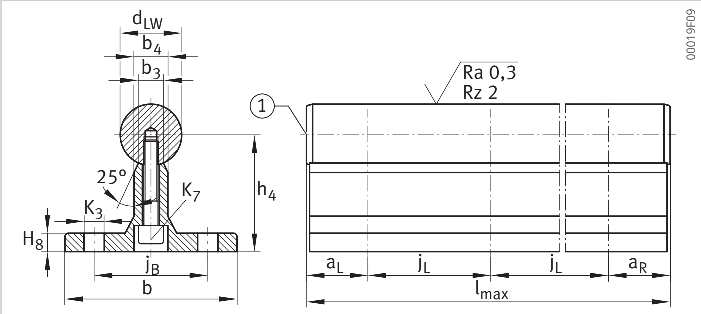
3) Dimensions a_L and a_R depend on the length of the support rail.

4) For mounting screws ISO 4762 or ISO 4017 (TSWW12, DIN 7984). Secure the screws, especially if preload losses can occur.

7

j_B	j_L	a_L 3)		a_R 3)		H_8	K_3 4)	K_7
		min.	max.	min.	max.			ISO 4762
mm	mm	mm	mm	mm	mm	mm	mm	–
29	120	20	114	20	114	5	4.5	M4×18
41	150	20	143	20	143	6	5.5	M5×25
41	150	20	143	20	143	6	5.5	M5×25
51	150	20	142	20	142	6	6.6	M6×30
51	150	20	142	20	142	6	6.6	M6×30
65	150	20	139	20	139	10	9	M10×45
65	150	20	139	20	139	10	9	M10×45

7.2.4 Support rails TSWWA



TSWWA

Designation	m	d_{LW}	b	h_4 1)	l_{max} 2)	b_3	b_4
		h6		±0.02	±3		
–	kg/m	mm	mm	mm	mm	mm	mm
TSWWA12	1.93	12	43	28	6000	5.4	9
TSWWA16	2.8	16	48	30	6000	7	10
TSWWA20	4.12	20	56	38	6000	8.2	11
TSWWA25	5.83	25	60	42	6000	10.4	14
TSWWA30	8.5	30	74	53	6000	11	14

1) Based on the nominal shaft diameter, measured in mounted condition.

2) Maximum length of single-piece support rails; longer support rails, ➤102 | 92. Depending on the length of the support rail, the support body is made up of several sections.

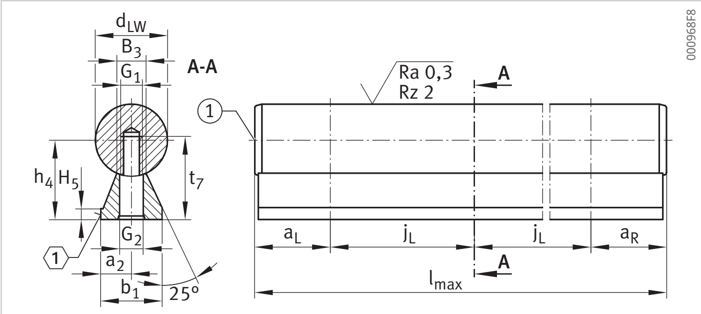
3) Dimensions a_L and a_R depend on the length of the support rail.

4) For mounting screws ISO 4762 or ISO 4017. Secure the screws, especially if preload losses can occur.

5) For TSWWA12: DIN 7984 screws.

j_B	j_L	a_L [3]		a_R [3]		H_8	K_3 [4]	K_7 [5]
		min.	**max.**	**min.**	**max.**			**ISO 4762**
mm	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**–**
29	75	20	69	20	69	5	4.5	M4×25
33	100	20	93	20	93	5	5.5	M5×25
37	100	20	92	20	92	6	6.6	M6×30
42	120	20	110	20	110	6	6.6	M8×30
51	150	20	139	20	139	8	9	M10×40

7.2.5 Support rails TSUW



TSUW

Designation	m	d_{LW}	b_1	h_4 1)	l_{max} 2)	a_2	B_3
		h6		±0.02	±3		
–	kg/m	mm	mm	mm	mm	mm	mm
TSUW12	1.1	12	11	14.5	6000	5.5	5
TSUW16	1.88	16	14	18	6000	7	6.8
TSUW20	2.92	20	17	22	6000	8.5	7.8
TSUW25	4.42	25	21	26	6000	10.5	9.8
TSUW30	6.22	30	23	30	6000	11.5	11
TSUW40	11.03	40	30	39	6000	15	14.5
TSUW50	16.98	50	35	46	6000	17.5	18.5

1) Based on the nominal shaft diameter, measured in mounted condition.

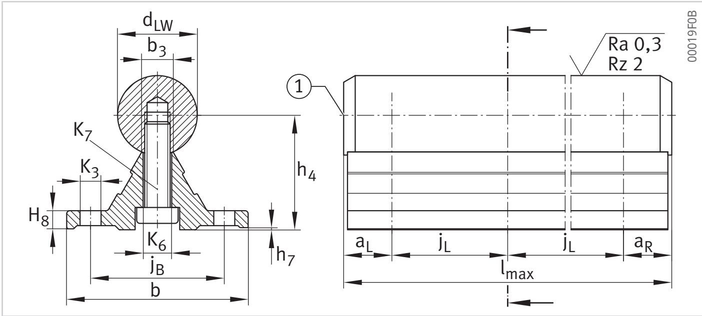
2) Maximum length of single-piece support rails; longer support rails, ➤102|92. Depending on the length of the support rail, the support body is made up of several sections.

3) Dimensions a_L and a_R depend on the length of the support rail.

7

j_L	a_L [3]		a_R [3]		H_5	G_1	G_2	t_7
	min.	max.	min.	max.				
mm	mm	mm	mm	mm	mm	–	mm	mm
75	20	70	20	70	3	M4	4.5	15.5
75	20	70	20	70	3	M5	5.5	19
75	20	69	20	69	3	M6	6.6	23
75	20	68	20	68	3	M8	9	28.5
100	20	92	20	92	3	M10	11	31.5
100	20	91	20	91	4	M12	13.5	39.5
100	20	90	20	90	5	M14	15.5	46

7.2.6 Support rails TSNW..-G4



TSNW..-G4

Designation	m	d_{LW}	b	h_4 1)			l_{max} 2)	b_3	j_B	j_L
		h6		–	U	L	±2			
–	kg/m	mm	mm	mm	mm	mm	mm	mm	mm	mm
TSNW12-G4	1.6	12	40	22	0.1	−0.1	4000	5	29	75
TSNW16-G4	2.5	16	45	26	0.1	−0.1	4000	6.8	33	100
TSNW20-G4	3.8	20	52	32	0.1	−0.1	4000	7.8	37	100
TSNW25-G4	5.3	25	57	36	0.1	−0.1	4000	9.8	42	120
TSNW30-G5	7.5	30	69	42	0.15	−0.15	4000	11	51	150
TSNW40-G5	12.4	40	73	50	0.15	−0.15	4000	14.5	55	200

1) Based on the nominal shaft diameter, measured in mounted condition.

2) Maximum length of single-piece support rails; longer support rails, ➤102|92. Depending on the length of the support rail, the support body is made up of several sections.

3) Dimensions a_L and a_R depend on the length of the support rail.

4) Maximum deviation from dimension h4, measured on a support rail for a length of 1000 mm.

a_L [3)]		a_R [3)]		H_8	h_7	K_3	K_6	K_7	Deviation of h_4 [4)]	
min.	max.	min.	max.					ISO 4762	G_{kl}	Δ
mm	mm	mm	mm	mm	mm	mm	mm	–	–	mm
20	69	20	69	5	0.2	4.5	4.5	M4×18	G4	0.03
20	93	20	93	5	0.2	5.5	5.5	M5×22	G4	0.03
20	92	20	92	6	0.2	6.6	6.6	M6×25	G4	0.03
20	110	20	110	6	0.3	6.6	9	M8×30	G4	0.03
20	139	20	139	7	0.3	9	11	M10×30	G5	0.04
20	189	20	189	8	0.3	9	11	M10×35	G5	0.04

7.3 Order example, ordering designation

7.3.1 Possible ordering designation for standard support rails

- Type: TSWW, TSNW, TSUW, TSWWA
- Shaft diameter d_{LW}: 12 mm … 50 mm
- Length: 1200 mm
- Distance a_L: Distance between the first hole and the start of the shaft
- Distance a_R: Distance between the last hole and the end of the shaft
- Corrosion-resistant design: on request

7.3.2 Support rail

- Type: TSNW
- Shaft diameter d_{LW}: 25 mm
- Length: 1253 mm
- Distance a_L: 26 mm
- Distance a_R: 27 mm
- Corrosion-resistant design: on request

Ordering designation:

- TSNW25-1253-26-27

8 Shaft support blocks

8.1 Product design

Depending on the type series, the shaft support blocks have through-holes or threaded holes.

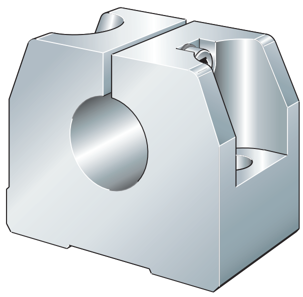
An aluminum alloy or die-cast zinc is used as the material.

The series GWA..-B is identical to the series GW, but suitable for larger mounting screws.

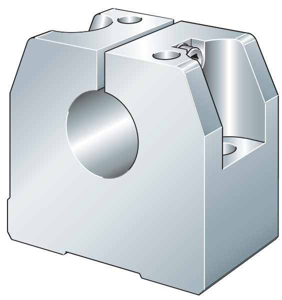
They are suitable for all solid shafts and hollow shafts in this catalog.

Shaft support blocks support shafts and fix them to the shaft ends.

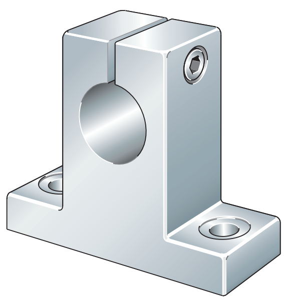
96 GWH..-B



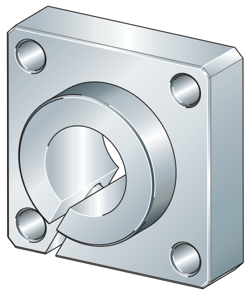
97 GWN..-B



98 GW, GWA..-B



99 FW..-B

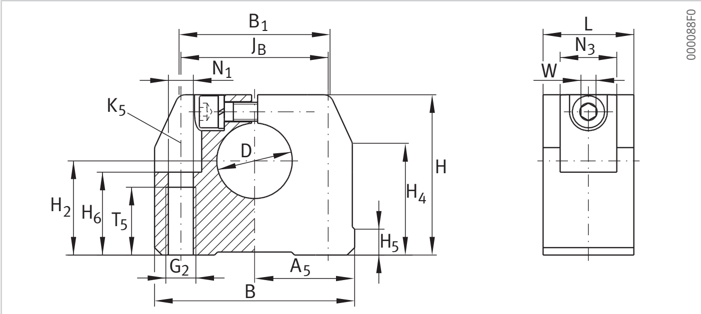


8.2 Product tables

8.2.1 Explanations

A_5	mm	Stop side distance
B	mm	Width of the housing
B_1	mm	Width of housing flange
D	mm	Bore diameter
D_1	mm	Flange diameter
G_2	–	Connecting thread
H	mm	Height of the housing
H_2	mm	Center distance
H_4	mm	Height of housing flange
H_5	mm	Height of stop edge
H_6	mm	Height of the mounting hole
H_8	mm	Height of the mounting hole
J_B	mm	Mounting hole distance
J_{B1}	mm	Pin hole distance
J_L	mm	Pin hole distance
K_5	–	Fixing screw
L	mm	Length of the housing
L	mm	Lower limit deviation
L_1	mm	Connection dimension
m	g	Mass
N_1	mm	Diameter of the through bore
N_3	mm	Diameter of the counterbore
N_4	mm	Diameter of the pin bore
T_5	mm	Thread depth
U	mm	Upper limit deviation
W	mm	Width across flats

8.2.2 Shaft support blocks GWH..-B



GWH..-B

8

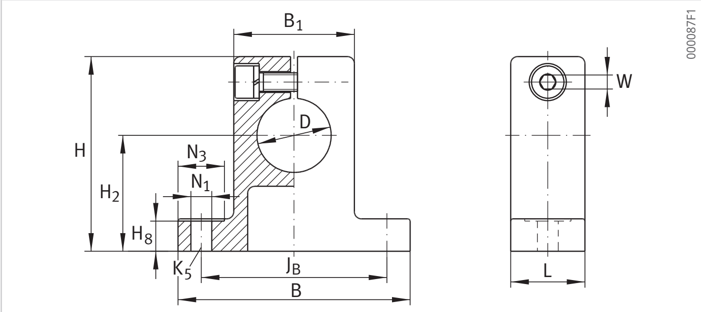
Designation	m	D	B	L	H	J_B	A_5	B_1
		H8				±0.15		
–	kg	mm	mm	mm	mm	mm	mm	mm
GWH06-B	30	6	32	16	27	22	16	25
GWH08-B	30	8	32	16	27	22	16	25
GWH10-B	50	10	40	18	33	27	20	32
GWH12-B	50	12	40	18	33	27	20	32
GWH14-B	70	14	43	20	36.5	32	21.5	34
GWH16-B	70	16	43	20	36.5	32	21.5	34
GWH20-B	120	20	53	24	42.5	39	26.5	40
GWH25-B	170	25	60	28	52.5	44	30	44
GWH30-B	220	30	67	30	60	49	33.5	49.5
GWH40-B	480	40	87	40	73.5	66	43.5	63
GWH50-B	820	50	103	50	92	80	51.5	74

[1] For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.

8

H_2 ±0.01	H_4	H_5	T_5	H_6	G_2	N_1	N_3	K_5 [1)]	W
mm	mm	mm	mm	mm	–	mm	mm	–	mm
15	20.6	5	11	13	M5	4.3	10	M4	2.5
16	20.6	5	11	13	M5	4.3	10	M4	2.5
18	25.1	5	13	16	M6	5.3	11	M5	3
19	25.1	5	13	16	M6	5.3	11	M5	3
20	28.1	6.9	13	18	M6	5.3	11	M5	3
22	28.1	6.9	13	22	M6	5.3	11	M5	3
25	29.8	7.4	18	22	M8	6.6	15	M6	4
31	36.6	9.9	22	26	M10	8.4	18	M8	5
34	42.7	8	22	29	M10	8.4	18	M8	5
42	49.7	12.8	26	38	M12	10.5	20	M10	6
50	62.3	10.9	34	46	M16	13.5	24	M12	8

8.2.3 Shaft support blocks GW



GW, GWA..-B

8

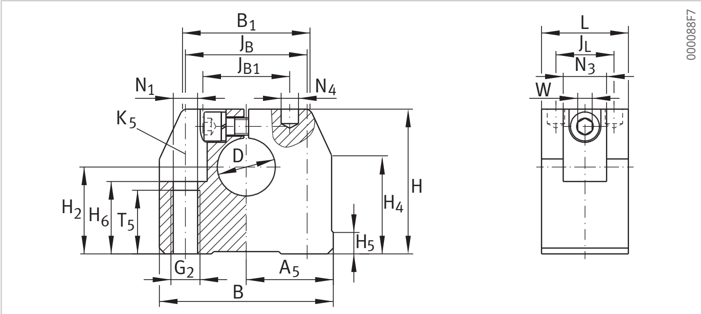
Designation	m	D	B	L	H	J_B	
						–	U/L
–	kg	mm	mm	mm	mm	mm	mm
GW10	30	10	37	11	30	28	±0.15
GW12	40	12	42	12	35	32	±0.15
GW14	60	14	46	14	38	36	±0.15
GW16	80	16	50	16	42	40	±0.15
GW20	150	20	60	20	50	45	±0.15
GW25	260	25	74	25	58	60	±0.15
GW30	380	30	84	28	68	68	±0.2
GW40	670	40	108	32	86	86	±0.2
GW50	1380	50	130	40	100	108	±0.2

1) For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.

8

B_1	H_2	H_8	N_1	N_3	K_5 [1)]	W
	±0.15					
mm	mm	mm	mm	mm	–	mm
18	17	5	3.4	8	M3	2.5
20	20	5.5	4.5	10	M4	3
23	22	6	4.5	10	M4	3
26	25	6.5	4.5	10	M4	3
32	30	7.5	4.5	10	M4	3
38	35	8.5	5.5	11	M5	4
45	40	9.5	6.6	13	M6	5
56	50	12	9.1	18	M8	6
80	60	14	9	18	M8	6

8.2.4 Shaft support blocks GWN..-B



GWN..-B

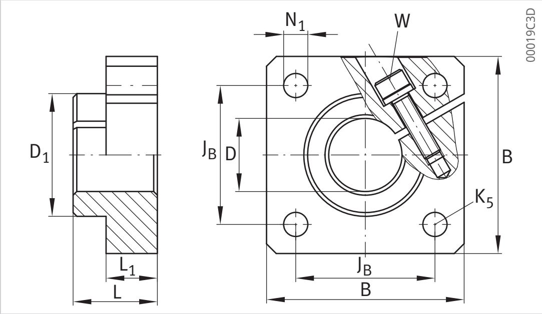
Designation	m	D	B	L	H	JB		JB1	B1	A5
		H8				–	U/L			±0.01
–	kg	mm	mm	mm	mm	mm	mm	mm	mm	mm
GWN12-B	0.06	12	43	20	35	30	±0.15	20	34	21.5
GWN16-B	0.105	16	53	24	42	38	±0.15	26	40	26.5
GWN20-B	0.17	20	60	30	50	42	±0.15	30	44	30
GWN25-B	0.33	25	78	38	60	56	±0.15	40	60	39
GWN30-B	0.45	30	87	40	70	64	±0.15	45	63	43.5
GWN40-B	0.82	40	108	48	90	82	±0.15	65	76	54
GWN50-B	1.36	50	132	58	105	100	±0.2	70	90	66

1) Centering for pin hole.

2) For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.

J_L	H_2	H_4	H_5	T_5	H_6	G_2	N_1	N_4 1)	N_3	K_5 2)	W
	±0.01										
mm	mm	mm	mm	mm	mm	–	mm	mm	mm	–	mm
13	20	26.6	5.4	13	16.5	M6	5.3	4	10	M5	3
16	25	26.6	5.4	18	21	M8	6.6	5	11	M6	4
20	30	34.1	7.4	22	25	M10	8.4	6	15	M8	5
25	35	41.5	8.3	26	30	M12	10.5	8	18	M10	6
26	40	46.2	9.3	26	4	M12	10.5	8	18	M10	6
32	50	57.6	11.7	34	44	M16	13.5	10	20	M12	8
36	60	62	10.6	43	49	M20	17.5	12	26	M16	10

8.2.5 Shaft support blocks with flange FW..-B

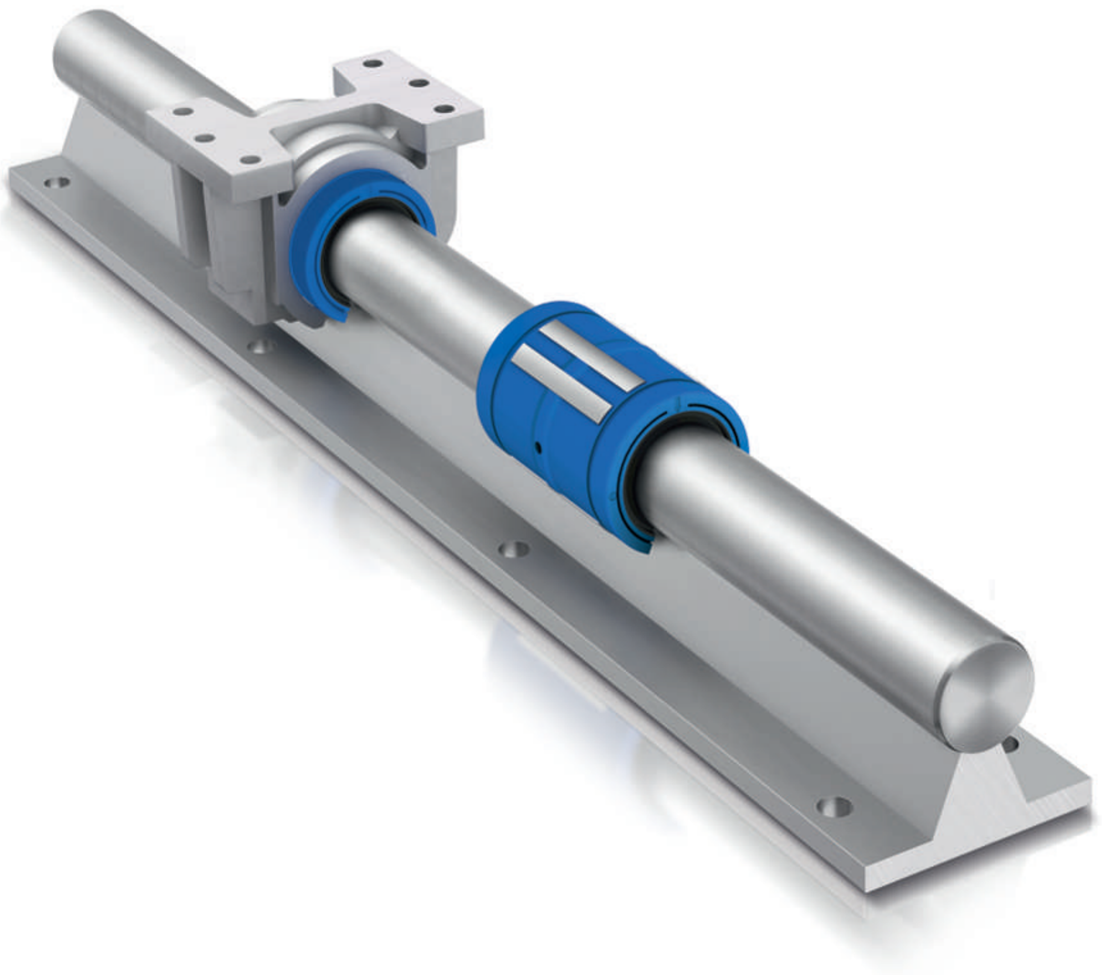


FW..-B

Designation	m	D	B	L	L_1	D_1	N_1	K_5 [1]	J_B	W
		H8					H13			
–	kg	mm	mm	mm	mm	mm	mm	–	mm	mm
FW12-B	50	12	40	20	12	23.5	5.5	M5	30	3
FW16-B	80	16	50	20	12	27.5	5.5	M5	35	3
FW20-B	100	20	50	23	14	33.5	6.6	M6	38	4
FW25-B	160	25	60	25	16	42	6.6	M6	42	5
FW30-B	260	30	70	30	19	49.5	9	M8	54	6
FW40-B	700	40	100	40	26	65	11	M10	68	8
FW50-B	900	50	100	50	36	75	11	M10	75	8

[1] For mounting screws ISO 4762-8.8. Secure the screws, especially if preload losses can occur.

SCHAEFFLER



Linear Bearings

Linear ball bearings, linear ball bearing units, linear plain bearings, linear plain bearing units, shaft blocks, precision shafts and standard housings

Catalog

Foreword

Linear bearings

Linear ball bearings support high radial loads at low weight and enable linear guidance with unlimited travel distances. The bearings are available in closed design or in open design with a segment cutout for use with supported shafts. In certain series, the radial clearance can be adjusted, allowing for either clearance-free or preloaded guides. Depending on the application, the linear bearings are supplied either without seals or with contact seals on both sides.

Linear ball bearings convert rolling motion into linear motion. Similar to conventional ball bearings, the rolling elements enable virtually friction-free operation even under load. To achieve this, linear ball bearings feature a precision steel shaft (inner ring), multiple ball recirculations, and raceways that transmit the load into the housing. The ball recirculation system allows the linear bearing to travel along the precision shaft with an effectively unlimited stroke. To ensure reliable function over a long service life, all components of the linear guide must exhibit a high level of accuracy and be manufactured from hardened steel. A linear slide typically consists of 4 linear ball bearings or linear ball bearing units, 2 shafts, and 4 shaft blocks.

For applications where linear ball bearings are not suitable, interchangeable linear plain bearings are available for most sizes.

Linear bearing units

In linear bearing units, the bearing is integrated into a rigid, high-strength housing. The housings are available in closed, open, slotted, tandem, and flanged designs. Thanks to their low overall mass, these units are particularly suitable for lightweight constructions that must withstand high loads, as well as for applications requiring high accelerations and running speeds. As they are manufactured in large quantities using series production, the complete units are generally much more economical than custom in-house designs.

Economical modular system

Bearings and units are available in both compact and standard ranges. With the wide range of bearing sizes, linear bearing units, shafts, and shaft blocks, almost any application requirement can be met. The extensive combination possibilities within the product range make it easy to select the right linear guide solution to boost productivity. The highly standardized product range also ensures rapid implementation, as most components are available directly from stock.

Contents

1

1 Technical principles

1.1 Load rating and rating life

To determine which size of linear guide is best suited for a given application, the following calculation methods must be applied:

- calculation of the basic rating life
- calculation of the static safety factor

In both calculation methods, all loads and forces acting on the linear guide system must be taken into account. As a result, representative load values are used to describe the whole load case. These represent a combination of all forces, lever arms, and torque loads, which may vary in terms of duration or stroke length.

The rating life of a linear guide with rolling elements is defined as the travel distance the guide can achieve before the first signs of material fatigue appear on one of the raceways or rolling elements. When selecting a linear guide based on the calculation of the basic rating life, the dynamic load rating C is used. This value indicates the load at which a basic rating life of 100 km of travel distance is achieved.

1.1.1 Calculation concept for static safety factor

When selecting a linear guide, the static safety factor must be calculated if any of the following conditions apply:

- The linear guide is operated under load at very low speeds.
- The linear guide works under normal operating conditions but must withstand high shock loads.
- The linear guide remains under load when at a standstill for extended periods.
- The linear guide is subjected to a load P > 50 % of the dynamic load rating C, such that the theoretical basis for calculating the basic rating life is no longer valid.

In all of these cases, the permissible load is determined not by material fatigue, but by the need to prevent plastic deformation of the rolling elements or raceways. Loads occurring at standstill or at very low operating speeds, as well as high shock-loads, can cause flattening of the rolling elements and subsequent damage to the shaft or linear ball bearing. Such damage may vary in depth or appear along the raceway at intervals corresponding to the pitch of the rolling elements. Permanent deformation leads to vibration within the linear bearing, increased running noise, and higher friction. It may also result in a reduction of preload and, in more advanced stages, an increase in bearing clearance. If operation continues under these conditions, the resulting peak loads caused by the permanent deformation can serve as initiation points for fatigue damage. The extent of damage depends on the specific application.

1.1.2 Calculation method for static safety factor

When designing a linear guide based on the static load rating, the static safety factor s_0, expressed as the ratio of the static load rating C_0 to the maximum static bearing load P_0, must be taken into account. The static safety factor s_0 indicates the degree of safety against permanent plastic deformation of the rolling elements and raceways. The static load rating C_0 s defined as the static load that produces a total permanent deformation equal to 0.0001 times the rolling element diameter. Depending on the contact conditions, a maximum Hertzian pressure of 5300 MPa at the most heavily loaded contact point is permissible in accordance with ISO 14728-2, without impairing running behavior.

1.1.3 Calculation of the static safety factor

For a selected linear guide and a defined load case, the static safety factor s_0 can be calculated as follows.

When the maximum load occurs at standstill:

1

$$s_0 = \frac{C_{0,\ eff\ slide}}{P_0}$$

When the maximum load occurs during operation:

2

$$s_0 = \frac{C_{0,\ eff\ slide}}{F_{res\ max}}$$

C_0	N	Basic static load rating
P_0	N	Equivalent static bearing load
P_{max}	N	maximum equivalent load
s_0	–	static safety factor

Depending on the operating conditions, the following reference values are recommended for the static safety factor s_0.

1 Static safety factor s_0

Ambient conditions	s_0
Normal conditions	> 1 ... 2
Smooth, vibration-free operation	> 2 ... 4
Moderate vibration	> 3 ... 5
High vibration or shock loads	> 5

For overhead installations, the general technical regulations and standards applicable to the respective industry must be taken into account. If an application involves a high risk of injury, the user must implement appropriate design measures and safety precautions to prevent components from becoming detached (e.g., due to rolling elements falling out or faulty screw connections).

If the linear guide system is exposed to external vibrations, such as those transmitted by nearby machinery, higher safety factors should be taken into account. Particular attention must also be paid to the load transmission paths between the guide and the adjacent construction when designing the system.

! Check all screw connections for adequate safety. For overhead installations of linear guides, use higher values for the safety factor.

! Always observe the general technical regulations and standards applicable to the respective industry.

1.1.4 Required static load rating

For specific operating conditions with a corresponding recommended safety factor value and a defined load case, the required static load rating C_0 can be calculated using the following formulas.

When the maximum load occurs at standstill:

ƒ3

$$C_{0,\ \mathrm{eff\ slide}} = s_0 \cdot P_0$$

When the maximum load occurs during operation:

ƒ4

$$C_0 = s_0 \cdot P_{max}$$

C_0	N	Basic static load rating
P_0	N	Equivalent static bearing load
P_{max}	N	maximum equivalent load
s_0	–	static safety factor

1.1.5 Basic rating life

Both under laboratory conditions and in practice, it has been observed that the basic rating life of bearings that appear identical and run under completely identical operating conditions can vary from one bearing to another. For this reason, calculation of the required bearing size necessitates a precise definition of the term rating life.

All specifications for the dynamic load rating of linear bearings are based, in accordance with ISO 14728-1, on a basic rating life that 90 % of a sufficiently large number of apparently identical bearings can achieve or exceed. The majority of bearings achieve a longer rating life, and half of all bearings reach at least 5 times the basic rating life.

1.1.6 Calculation of the basic rating life

The basic rating life L_{ns} of a linear guide, given in km, can be calculated using the following formula:

ƒ5

$$L_{ns} = 100 \cdot \left(\frac{C}{P}\right)^p$$

If the travel distance and stroke frequency remain constant, it is often more practical to calculate the basic rating life L_{nh} in operating hours. This value can be determined using the following formula:

ƒ6

$$L_{nh} = \frac{5 \cdot 10^7}{S_{sin} \cdot n \cdot 60} \cdot \left(\frac{C}{P}\right)^p$$

! The concept for calculating the basic rating life is only applicable if the equivalent dynamic load P does not exceed 50 % of the dynamic load rating C.

! The more accurately the expected loads and operating conditions are known or can be determined, the more precise and reliable the calculated rating life of the linear guides will be.

! The rating life calculation is related to the physical effect of material fatigue. Fatigue is the result of cyclic shear stresses occurring directly beneath the load-bearing surface. Over time, these stresses can cause cracks that gradually propagate toward the surface. When the rolling elements pass over these cracks, spalling or flaking of the material may occur. These surface defects then intensify progressively and ultimately lead to bearing failure.

Various characteristics of the components used also influence the rating life of linear ball bearings. To take account of these effects, the equation for calculating bearing rating life is extended by 7 coefficients ➤17 | 1.1.9.

ƒ7

$$L_{ns} = 100 \cdot c_1 \cdot c_2 \cdot f_s \cdot \left(\frac{f_i \cdot f_h \cdot f_l \cdot f_m \cdot C}{F} \right)^3$$

C	N	Basic dynamic load rating
C_0	N	Basic static load rating
c_1	–	Coefficient for reliability
c_2	–	Coefficient for operating conditions
F	N	Bearing load
f_h	–	Coefficient for shaft hardness
f_i	–	Coefficient for the number of loaded bearings per shaft
f_l	–	Coefficient for load direction
f_m	–	Coefficient for misalignment
f_s	–	Coefficient for stroke length
L_{nh}	h	Basic rating life
L_{ns}	km	Basic rating life
n	min^{-1}	Stroke frequency
P	N	Equivalent dynamic load
p	–	Life exponent • Roller bearing p = 10/3 • Ball bearing p = 3
S_{sin}	mm	Single stroke length

Some parameters are determined once during the design of a linear guide. The corresponding coefficients therefore remain constant throughout the calculation. These are:

- number of bearings (coefficient f_i) ➤20 | 1.1.9.3
- shaft hardness (coefficient f_h) ➤22 | 1.1.9.5
- reliability (coefficient c_1) ➤17 | 1.1.9.1
- operating conditions (coefficient c_2) ➤18 | 1.1.9.2

Other characteristics may vary from one load phase to another:

- the applied load
- stroke length (coefficient f_s) ➤22 | 1.1.9.4
- load direction (coefficient f_l) ➤24 | 1.1.9.7
- misalignment between shaft and linear bearing (coefficient f_m) ➤23 | 1.1.9.6

1

1.1.7 Service life

In addition to the term rating life, the term service life is also used. This refers to the period during which a linear guide remains functional in a specific application.

The service life of a bearing therefore does not necessarily depend on fatigue alone, but also on the following factors:

- wear
- corrosion
- seal failure
- lubrication interval (grease life)
- vibrations at standstill

The service life can generally only be determined through practical testing or by comparison with similar applications.

1.1.8 Determining the bearing load

The load can be inserted directly into the rating life equations and into the equation for calculating the static load rating if the load F acting on the linear bearing is constant in magnitude, position, and direction, and acts perpendicular to the center of the raceway. In all other cases, the maximum resulting load P_{max} and the equivalent dynamic mean load P_m must first be calculated. These representative loads are defined as those that have the same effect on the rating life and on the static safety factor s_0 as the combined influence of all actual load cases.

1.1.8.1 Equivalent dynamic mean load

The formulas used to calculate the basic rating life are based on the assumption that both load and running speed remain constant. Under real operating conditions, however, the external loads, travel positions, and running speeds generally vary. The working cycle should therefore be divided into load phases with constant or nearly constant conditions during the individual strokes. Taken together, these individual load phases, depending on their respective stroke lengths, determine the equivalent dynamic mean load P_m.

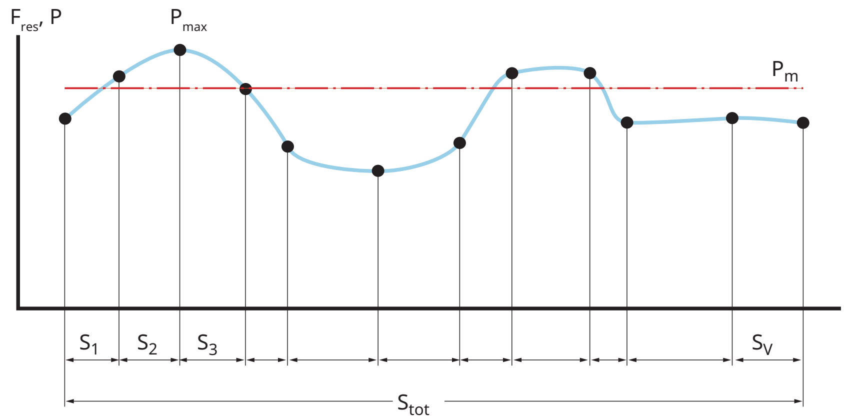
ƒ8

$$P_m = \sqrt[p]{\frac{\sum_{j=1}^{v} \left|P_j^p\right| \cdot S_j}{S_{tot}}}$$

ƒ9

$$S_{tot} = S_1 + S_2 + S_3 + \ldots + S_j + \ldots + S_v$$

1 Variable load of a linear bearing



The equivalent dynamic load P is calculated from the combined bearing load, adjusted by the coefficients for load direction and misalignment.

10

$$P_j = \frac{F_{comb,j}}{f_{l,j} \cdot f_{m,j}}$$

$F_{comb,j}$	N	Combined bearing load during a specific load phase
$f_{l,j}$	–	Coefficient for load direction during a specific load phase
$f_{m,j}$	–	Coefficient for misalignment during a specific load phase
j	–	Index for load phases
P_j	N	Equivalent dynamic load during a specific load phase
P_m	N	Equivalent dynamic mean load
p	–	Life exponent • Roller bearing p = 10/3 • Ball bearing p = 3
S_j	mm	Individual stroke length of a specific load phase
S_{tot}	mm	Total stroke length
V	–	Number of load phases

1.1.8.2 Maximum equivalent load

If the maximum load occurs during the movement of the linear guide, the maximum value of P must be used for calculating the static safety factor s_0. To determine this, all loads must first be calculated for the individual stroke lengths. These values can then be used to determine the maximum equivalent load P_{max}.

The maximum static load P_0, which occurs when the linear guide is at a standstill, is calculated using the same formula. The maximum values P_0 and P_{max} are then inserted into the equation for calculating the static safety factor s_0.

11

$$P_{max} = \frac{1}{f_{h,0}} \cdot \max_{j=1 \to V} \left| \frac{F_{comb,j}}{f_{l,0,j} \cdot f_{m,j}} \right|$$

$F_{comb,j}$	N	Combined bearing load during a specific load phase
$f_{h,0}$	–	Static coefficient for shaft hardness
$f_{l,0,j}$	–	Static coefficient for load direction during a specific load phase
$f_{m,j}$	–	Coefficient for misalignment during a specific load phase
j	–	Index for load phases
P_{max}	N	maximum equivalent load
P_0	N	Maximum static load
V	–	Number of load phases

1.1.8.3 Combined bearing load

For linear ball bearings, the combined bearing load is composed of the load vectors at bearing point F_y and F_z. The absolute value of the combined bearing load is calculated from F_y and F_z.

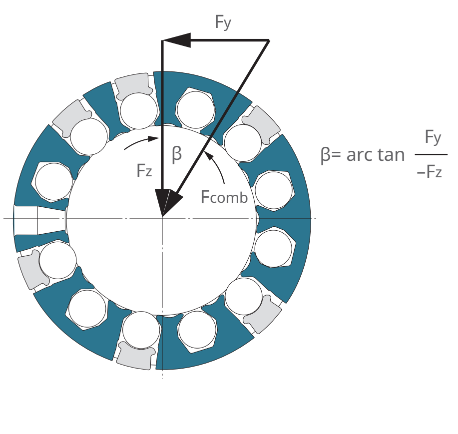
12

$$F_{comb} = \sqrt{F_y^2 + F_z^2}$$

The direction of the combined bearing load, expressed as the angle β relative to the z-axis of the coordinate system, can be determined using the inverse tangent function.

F_{comb}	N	Combined bearing load
F_y	N	Bearing load in y-direction
F_z	N	Bearing load in z-direction

2 Angle β

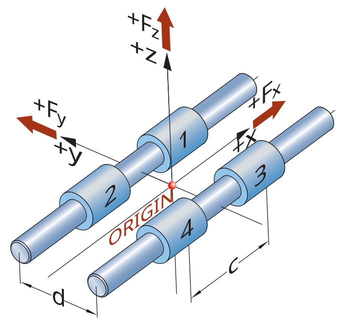


1.1.8.4 Conversion of external forces into loads at the bearing point

Various formulas can be used to determine the loads acting on the linear bearings.

System with 2 shafts and 4 linear bearings:

3 Loads in a system with 2 shafts and 4 linear bearings



1	Bearing 1	2	Bearing 2
3	Bearing 3	4	Bearing 4

Load at the bearing point: force in y-direction

13

$$F_{y1} = F_{y3} = \frac{\sum_{i=1}^{U} F_{y,1}}{4} - \frac{\sum_{i=1}^{U}\left(F_{x,i} \cdot y_i\right) - \sum_{i=1}^{U}\left(F_{y,i} \cdot x_i\right)}{2 \cdot c}$$

14

$$F_{y2} = F_{y4} = \frac{\sum_{i=1}^{U} F_{y,1}}{4} + \frac{\sum_{i=1}^{U}\left(F_{x,i} \cdot y_i\right) - \sum_{i=1}^{U}\left(F_{y,i} \cdot x_i\right)}{2 \cdot c}$$

Load at the bearing point: force in z-direction

15

$$F_{z1} = \frac{\sum_{i=1}^{U} F_{z,i}}{4} - \frac{\sum_{i=1}^{U}\left(F_{x,i} \cdot z_i\right) - \sum_{i=1}^{U}\left(F_{z,i} \cdot x_i\right)}{2 \cdot c} - \frac{\sum_{i=1}^{U}\left(F_{y,i} \cdot z_i\right) - \sum_{i=1}^{U}\left(F_{z,i} \cdot y_i\right)}{2 \cdot d}$$

16

$$F_{z2} = \frac{\sum_{i=1}^{U} F_{z,i}}{4} + \frac{\sum_{i=1}^{U}\left(F_{x,i} \cdot z_i\right) - \sum_{i=1}^{U}\left(F_{z,i} \cdot x_i\right)}{2 \cdot c} - \frac{\sum_{i=1}^{U}\left(F_{y,i} \cdot z_i\right) - \sum_{i=1}^{U}\left(F_{z,i} \cdot y_i\right)}{2 \cdot d}$$

17

$$F_{z3} = \frac{\sum_{i=1}^{U} F_{z,i}}{4} - \frac{\sum_{i=1}^{U}\left(F_{x,i} \cdot z_i\right) - \sum_{i=1}^{U}\left(F_{z,i} \cdot x_i\right)}{2 \cdot c} + \frac{\sum_{i=1}^{U}\left(F_{y,i} \cdot z_i\right) - \sum_{i=1}^{U}\left(F_{z,i} \cdot y_i\right)}{2 \cdot d}$$

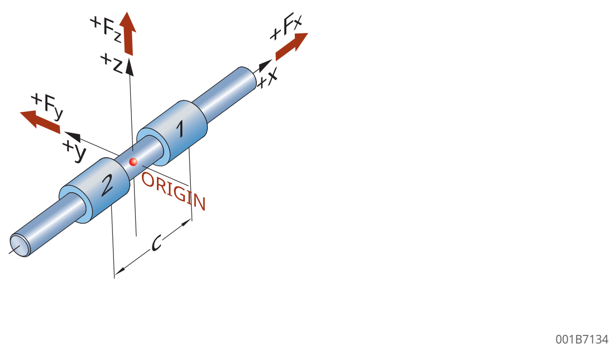
f18

$$F_{z4} = \frac{\sum_{i=1}^{U} F_{z,i}}{4} + \frac{\sum_{i=1}^{U} (F_{x,i} \cdot z_i) - \sum_{i=1}^{U} (F_{z,i} \cdot x_i)}{2 \cdot c} + \frac{\sum_{i=1}^{U} (F_{y,i} \cdot z_i) - \sum_{i=1}^{U} (F_{z,i} \cdot y_i)}{2 \cdot d}$$

$F_{x,i}$, $F_{y,i}$, $F_{z,i}$	N	External loads in x-direction, y-direction, z-direction
F_{yn}	N	Bearing load in y-direction at bearing n
F_{zn}	N	Bearing load in z-direction at bearing n
i	–	Index for external loads
U	–	Number of simultaneously acting loads
x_i, y_i, z_i	mm	Lever arms for external loads

System with 1 shaft and 2 linear bearings:

4 Loads in a system with 1 shaft and 2 linear bearings



1	Bearing 1	2	Bearing 2

Load at the bearing point: force in y-direction

f19

$$F_{y1} = \frac{\sum_{i=1}^{U} F_{y,i}}{2} + \frac{\sum_{i=1}^{U} (F_{x,i} \cdot y_i) - \sum_{i=1}^{U} (F_{y,i} \cdot x_i)}{c}$$

f20

$$F_{y2} = \frac{\sum_{i=1}^{U} F_{y,i}}{2} + \frac{\sum_{i=1}^{U} (F_{x,i} \cdot y_i) - \sum_{i=1}^{U} (F_{y,i} \cdot x_i)}{c}$$

Load at the bearing point: force in z-direction

f21

$$F_{z1} = \frac{\sum_{i=1}^{U} F_{z,i}}{2} - \frac{\sum_{i=1}^{U} (F_{x,i} \cdot z_i) - \sum_{i=1}^{U} (F_{z,i} \cdot x_i)}{c}$$

22

$$F_{z2} = \frac{\sum_{i=1}^{U} F_{z,i}}{2} + \frac{\sum_{i=1}^{U}\left(F_{x,i} \cdot z_i\right) - \sum_{i=1}^{U}\left(F_{z,i} \cdot x_i\right)}{c}$$

Load at the bearing point: Moment about the x-axis

23

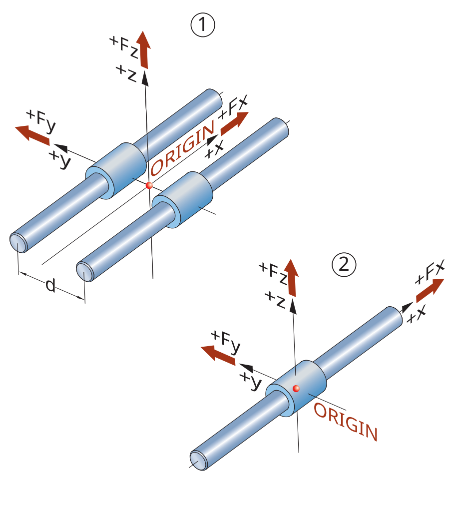
$$M_{x1} = M_{x2} = \frac{-\sum_{i=1}^{U}\left(F_{y,i} \cdot z_i\right) + \sum_{i=1}^{U}\left(F_{z,i} \cdot y_i\right)}{2}$$

$F_{x,i}$, $F_{y,i}$, $F_{z,i}$	N	External loads in x-direction, y-direction, z-direction
F_{yn}	N	Bearing load in y-direction at bearing n
F_{zn}	N	Bearing load in z-direction at bearing n
i	–	Index for external loads
M_{xn}	Nmm	Torque load about the x-axis at bearing n
U	–	Number of simultaneously acting loads
x_i, y_i, z_i	mm	Lever arms for external loads

! Since linear ball bearings cannot support loads about the x-axis, a system with 1 shaft and 2 bearings can only be realized if $M_x = 0$, either as a result of the external loads themselves or through additional measures.

! Linear ball bearings are sensitive to edge stresses and therefore cannot support torque loads M_y and M_z.

5 Less suitable systems (2 shafts and 2 bearings, 1 shaft and 1 bearing)



1	2 shafts and 2 bearings	2	1 shaft and 1 bearing

1.1.9 Influencing factors

1.1.9.1 Reliability, coefficient c_1

The coefficient c_1 is used in rating life calculations in cases where the intended prediction of reliability has to exceed 90 %.

1

2 Coefficient c_1 for reliability

Reliability %	L	c_1
90	L_{10s}	1
95	L_{5s}	0.62
96	L_{4s}	0.53
97	L_{3s}	0.44
98	L_{2s}	0.33
99	L_{1s}	0.21

1.1.9.2 Operating conditions, coefficient c_2

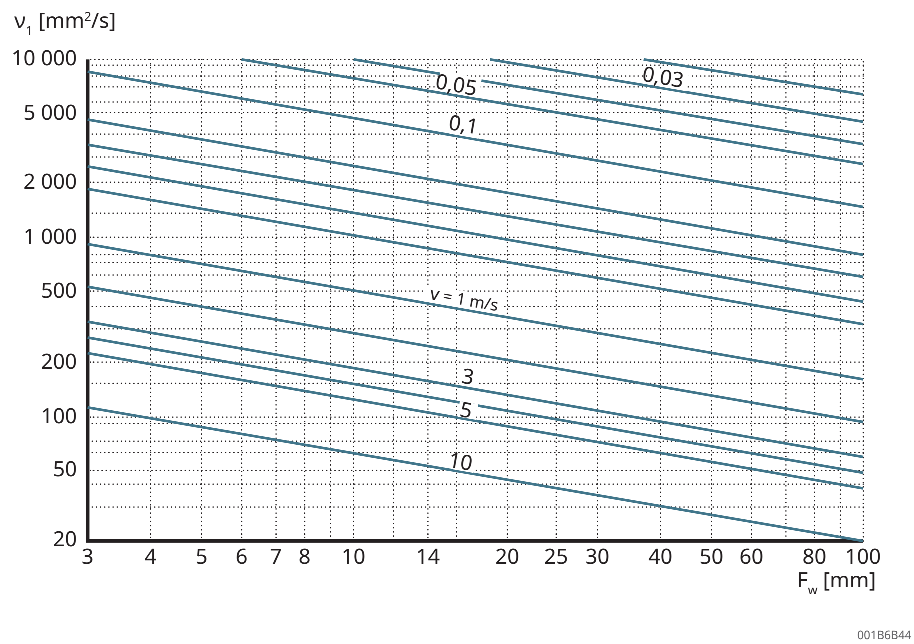
The effectiveness of lubrication largely depends on the degree of surface separation at the contact points between the rolling elements and the raceways. The viscosity ratio κ serves as a measure of the quality of lubricant film formation. Assuming normal cleanliness of the shaft guide and effective sealing, the coefficient c_2 depends solely on the viscosity ratio κ.

24 Viscosity ratio

$$\kappa = \frac{\nu}{\nu_1}$$

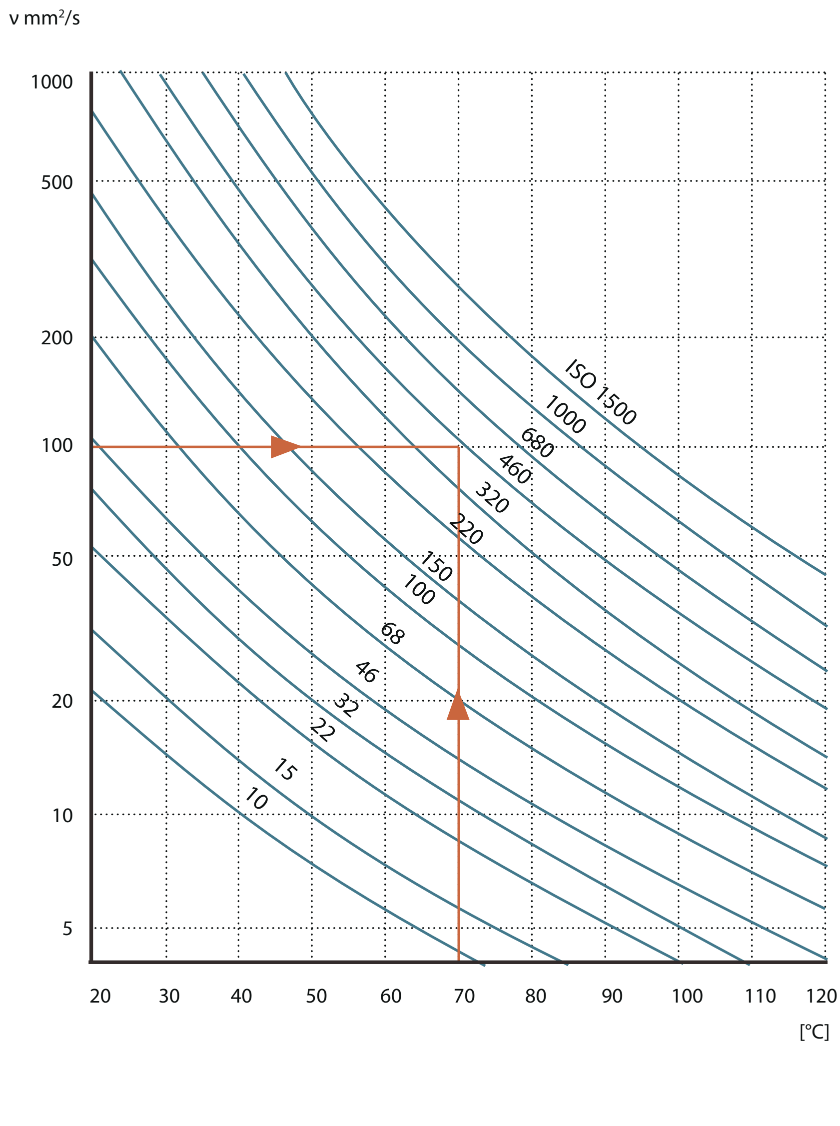
κ	–	Viscosity ratio
ν	mm^2/s	Kinematic viscosity of the lubricant at operating temperature
ν_1	mm^2/s	Requisite viscosity of the lubricant at operating temperature

6 Determining the requisite viscosity ν_1 at operating temperature



The requisite viscosity ν_1 is determined using the shaft diameter F_W and the mean speed v. The diagram is valid for additive-free mineral oils and lubricating greases with mineral base oils and shows the requisite viscosity of the base oil at operating temperature.

7 Lubricant viscosity ν as a function of temperature

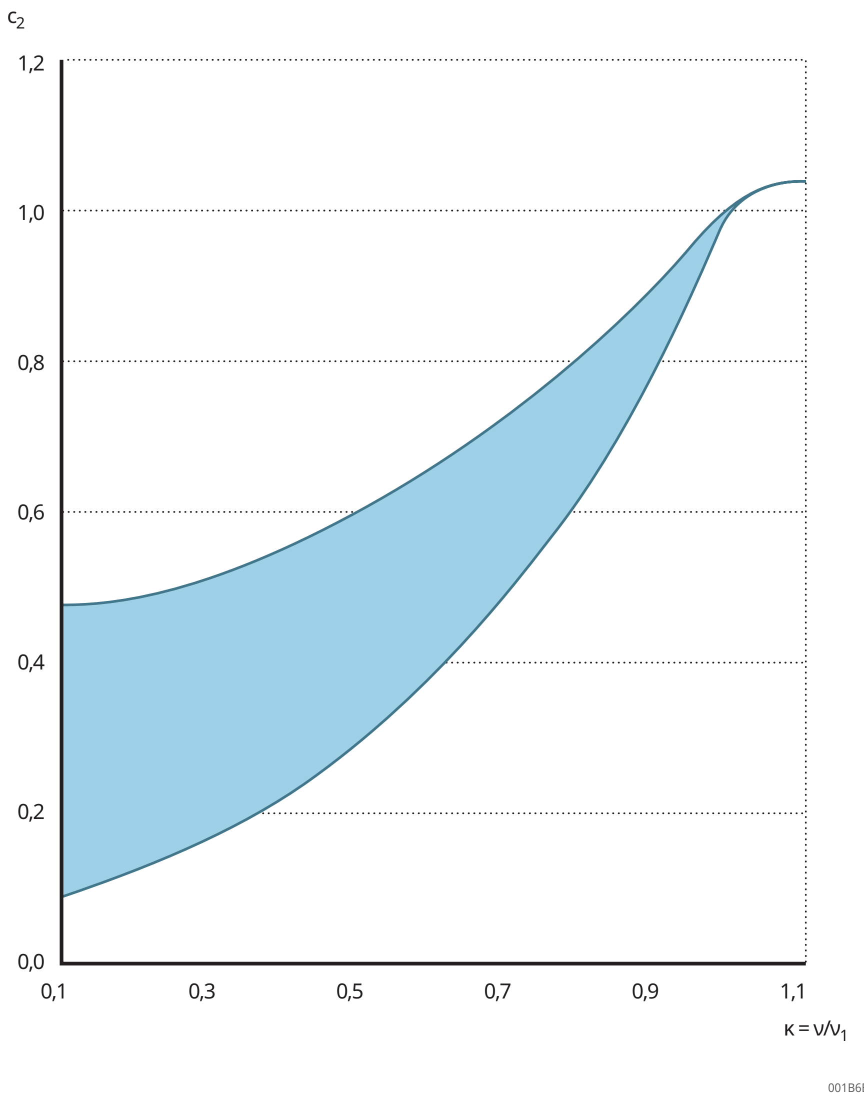


The diagram can be used to convert a kinematic viscosity at operating temperature to the corresponding viscosity at the international standard temperature of 40 °C. Each individual curve represents a lubricant with a specific kinematic viscosity at 40 °C.

For example, if the requisite viscosity is 100 mm^2/s and the operating temperature is 70 °C, the corresponding kinematic viscosity at a temperature of 40 °C is 460 mm^2/s. The red arrows in the diagram illustrate this example.

1

8 Coefficient c_2 for the operating conditions



After determining the viscosity ratio κ, the value for c_2 can be taken from the diagram. If κ is less than 1, it is recommended that a lubricant containing EP-additives (EP=Extreme Pressure) is used. If κ is less than 0.4, the use of EP-additives is essential. When a lubricant with EP-additives is used, the higher value for c_2 from the diagram may be used for the calculation. Linear ball bearings are prelubricated with a grease containing EP-additives at the factory.

! If a lubricant other than the standard grease is used, it must be ensured that this grease, and in particular the EP-additives it contains, is compatible with the materials used in the linear guide.

1.1.9.3 Number of loaded bearings per shaft, coefficient f_i

In most linear ball bearing configurations, 2 or more bearings are mounted on one shaft.

The load distribution across the bearings is strongly influenced by the:

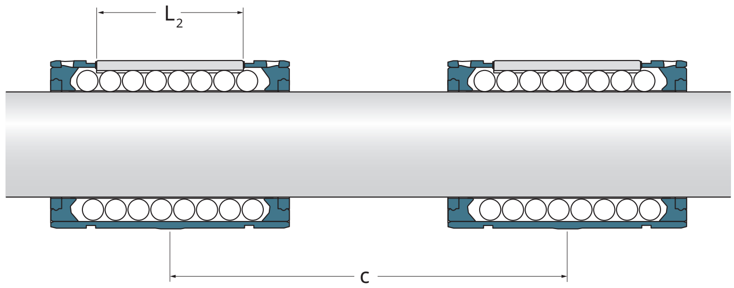
- distance between the bearings
- mounting accuracy
- manufacturing quality of the adjacent construction

1

The coefficient f_i accounts for these influences on bearing load, based on the number of bearings per shaft, their spacing, and the raceway length L_2 of the linear ball bearings.

! This coefficient has no effect if the mounting bore for the bearings is produced with the same accuracy as that of an original Schaeffler housing.

9 Coefficient f_i for the number of loaded bearings per shaft



3 Coefficient f_i as a function of the number of bearings per shaft and the distance

Number of bearings	f_i	
	$c \geq 1.5\ L_2$	$c < 1.5\ L_2$
1	1	1
2	1	0.81
3	1	0.72

4 Raceway lengths L_2 of the various linear ball bearings

Designation		L_2
Compact range	Standard range	mm
LBBR 3	–	4.1
LBBR 4	–	5.4
LBBR 5	–	7.1
–	LBCR 5	11.3
LBBR 6	–	12
LBBR 8		12.7
–	LBCR 8	12.5
LBBR 10	–	12.7
LBBR 12	–	15.4
–	LBCR 12, LBCT 12, LBCD 12, LBCF 12	18.4
LBBR 14	–	15.4
LBBR 16	–	15.4
–	LBCR 16, LBCT 16, LBCD 16, LBCF 16	21.2
LBBR 20	–	15.4
–	LBCR 20, LBCT 20, LBCD 20, LBCF 20	27.6
LBBR 25	–	22.4
–	LBCR 25, LBCT 25, LBCD 25, LBCF 25	37.2
LBBR 30	–	32
–	LBCR 30, LBCT 30, LBCD 30, LBCF 30	45.4
LBBR 40	–	38.6
–	LBCR 40, LBCD 40	50.8
–	LBCT 40, LBCF 40	54
LBBR 50	–	47.8

Designation		L_2
Compact range	Standard range	mm
–	LBCR 50, LBCT 50, LBCD 50, LBCF 50	68.5
–	LBCR 60, LBCT 60	92
–	LBCR 80, LBCT 80	122

1.1.9.4 Influence of stroke length, coefficient f_s

Strokes that are shorter than the raceway length of the linear ball bearing have a negative effect on the achievable rating life of a guide system. Starting from the ratio of the single stroke length S, or, in cases with several load phases in the same direction of motion, the sub stroke length S_S to the raceway length L_2, the coefficient f_s is determined.

ƒ25

$$S_s = \sum_{j=A}^{B} S_j$$

A	–	Starting point of movement in one direction
B	–	Next reversal point
j	–	Index for load phases
S_j	mm	Individual stroke length of a specific load phase
S_s	mm	Sub stroke length

5 Coefficient f_s as a function of the ratio of single stroke length S or sub stroke length S_s and L_2

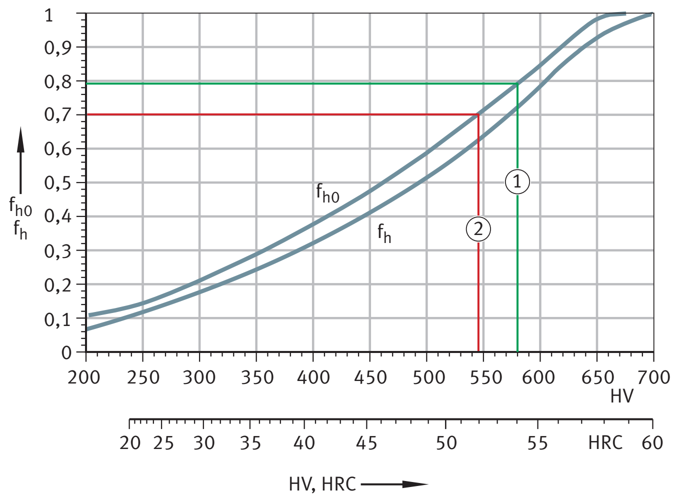
S/L_2 S_s/L_2	f_s
1.0	1.00
0.9	0.91
0.8	0.82
0.7	0.73
0.6	0.63
0.5	0.54
0.4	0.44
0.3	0.34
0.2	0.23

1.1.9.5 Influence of shaft hardness, coefficients f_h and $f_{h,0}$

The full load rating of a linear ball bearing is achieved in conjunction with a shaft hardness of ≥ 58 HRC. For shafts with lower hardness, for example shafts made from corrosion-resistant steel, the coefficient $f_{h,0}$ reduces the static load rating C_0, and the coefficient f_h reduces the dynamic load rating C.

The load ratings of the linear ball bearings specified in the product tables apply to bearings made from both rolling bearing steel and corrosion-resistant steel. However, when corrosion-resistant shafts are used, the ratings must be reduced as described. If shafts with a hardness of < 44 HRC (430 HV) are to be used, please consult Schaeffler.

10 Static and dynamic hardness coefficients for reduced raceway hardness



1	X90	2	X46

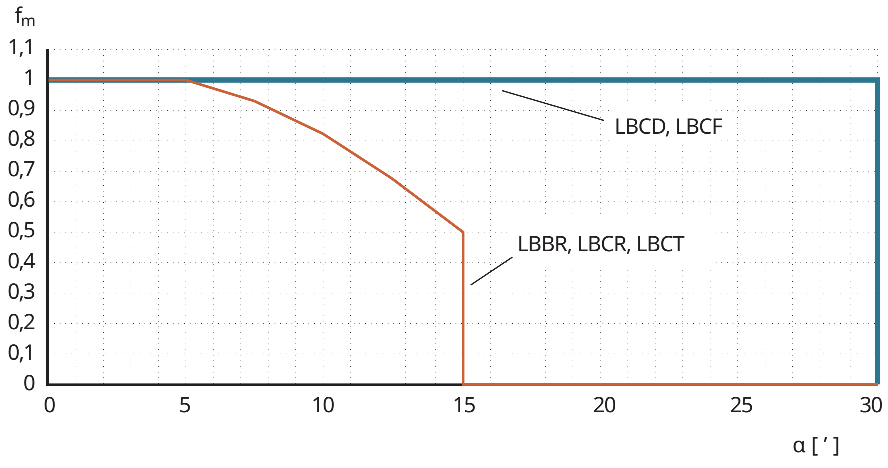
1.1.9.6 Influence of misalignment, coefficient f_m

Loads acting on unsupported shafts cause deflection, which in turn results in misalignment between the shaft and the linear ball bearing under load ➤29|1.2.3. The effects of misalignment on the calculations for the static safety factor and rating life, as a function of the bearing type and degree of misalignment, are shown in the following table. The degree of misalignment is given in angular minutes. Since the loads vary across individual load phases, the coefficient f_m is phase-dependent and is therefore applied in the denominator of the equations for calculating the static safety factor and rating life.

6 Coefficient f_m as a function of misalignment α

Designation	**α** '	f_m	**Static safety factor and rating life**
Non-self-aligning bearings:			
LBBR, LBCR, LBCT	α ≤ ±5	1	Full static safety factor and rating life
	α ≤ ±15	1.04 + α · (0.006 − 0.0028 · α)	Reduced static safety factor and rating life
	±15 < α	0	Invalid value
Self-aligning bearings:			
LBCD, LBCF	α ≤ ±30	1	Full static safety factor and rating life
	±30 < α	0	Invalid value

11 Coefficient for misalignment

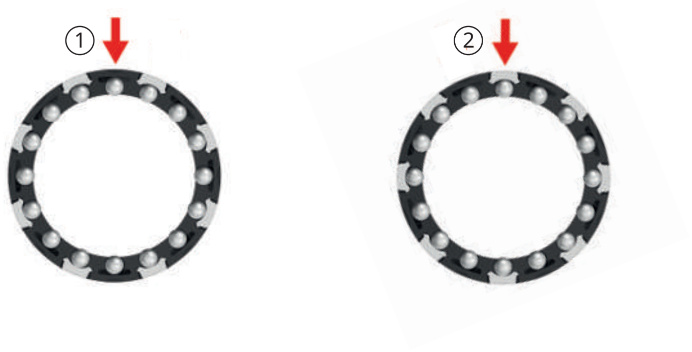


1.1.9.7 Influence of load direction, coefficients f_l, $f_{l,0}$

The static and dynamic load ratings vary around the central axis of a linear ball bearing.

Bearings of the compact range exhibit relatively small deviations between $C_{0,min}$ and $C_{0,max}$, or C_{min} and C_{max}. The minimum and maximum values are distributed according to the arrangement of the raceway plates. Normally, the load direction for maximum load rating $C_{0,max}$ and C_{max} is between the raceway plates. In contrast, for sizes 25, 30, and 40, the direction of the maximum dynamic load ratings is on the raceway plates.

12 Load direction for max. load rating of bearings from the compact range



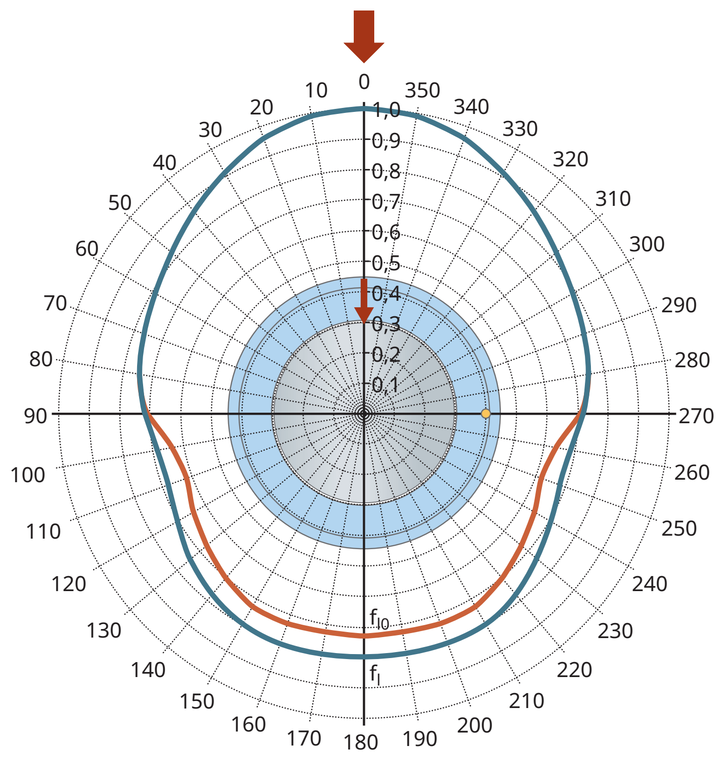
1 Between the raceway plates	2 On the raceway plates

7 Load direction for max. load rating of bearings from the compact range

Load direction	**C_0 stat. max**	**C dyn. max**
Between the raceway plates	All sizes	Sizes 3 to 20 and 50
On the raceway plates	–	Sizes 25, 30, 40

Bearings of the standard range feature a concentration of raceway plates and therefore have a specific load direction for maximum load rating which is indicated by an arrow (D-design) or hatching (A-design) on the end face of the linear ball bearing. The difference between $C_{0,min}$ and $C_{0,max}$, and between C_{min} and C_{max}, is considerable. The influence of load angle on load rating, expressed by the coefficients f_l and f_{l0}, is shown in the diagrams ➤25 | 13 to ➤27 | 16.

13 Coefficients for LBCR and LBCD, D-design



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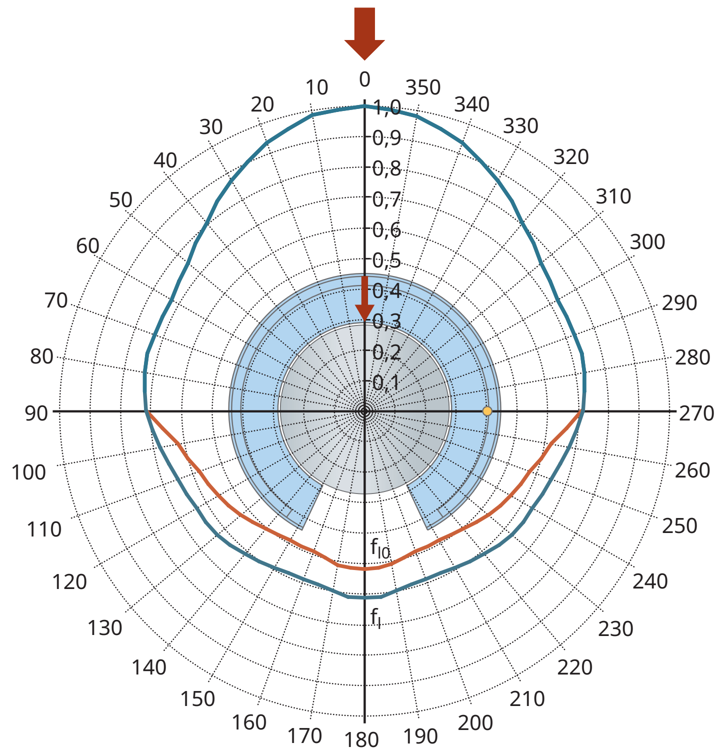
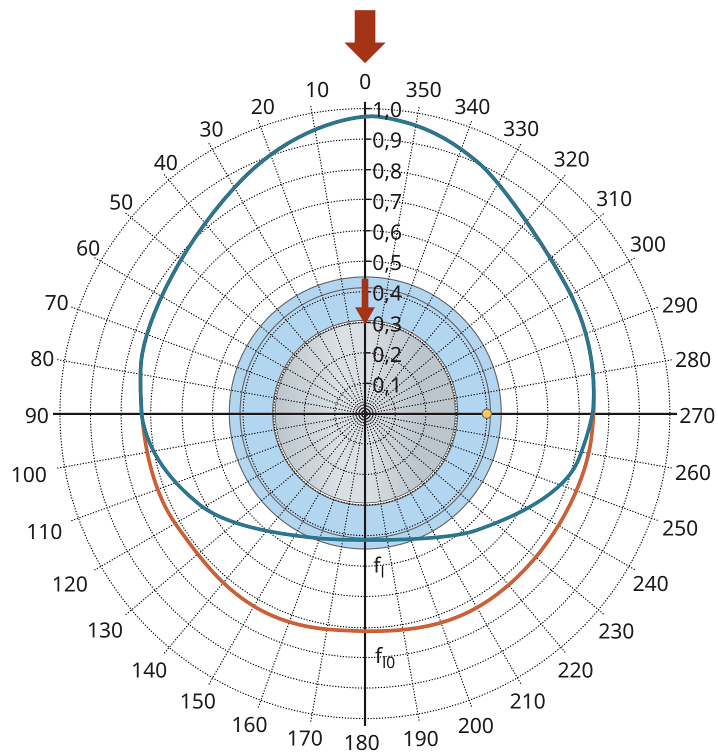
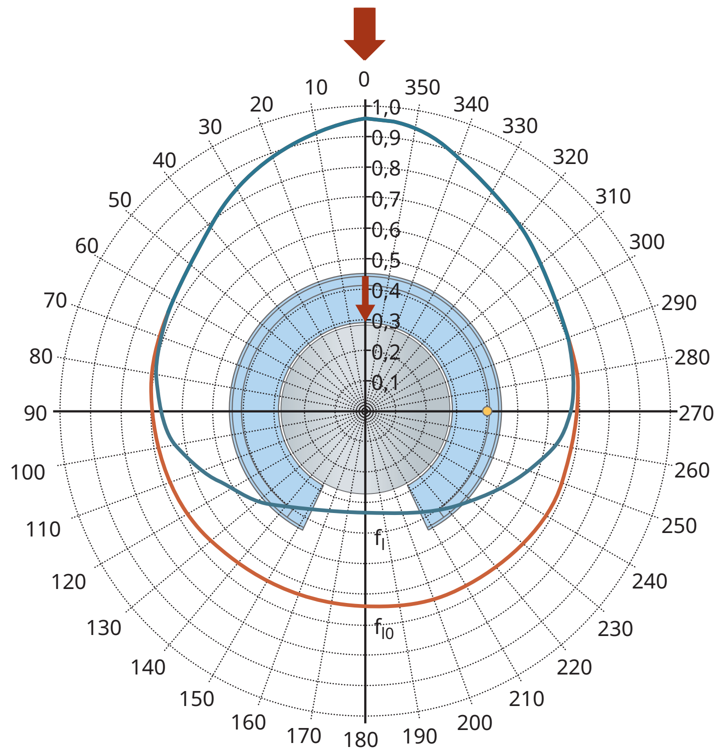
14 Coefficients for LBCT and LBCF, D-design



15 Coefficients for LBCR and LBCD, A-design



16 Coefficients for LBCT and LBCF, A-design



The varying load ratings of linear ball bearings around their central axis must be taken into account when designing and selecting linear guides.

To assist in the decision-making process, the various orientation options for linear ball bearings are illustrated.

Defined orientation

Advantage:

- enables alignment of main load direction and maximum load ratings
- allows full load rating of the linear ball bearing to be utilized

Compromise:

- slightly more effort required during series assembly

Random orientation

Advantage:

- slightly less effort required during series assembly

Compromise:

- only the values $C_{0,min}$ and C_{min} can be used in bearing design calculations, as there is no way of guaranteeing that the direction of maximum load rating coincides with the main load direction
- only the minimum load rating can be assumed in practical application

1

1.2 Rigidity

1.2.1 Rigidity of linear ball bearing guides

In addition to its load rating, the deflection of a linear guide system is a key criteria when selecting a suitable system. Rigidity is defined as the ratio of the load acting on the linear guide to the resulting deflection at the loading point and in the load direction. The deflection of the individual elements generally contributes to the total deflection of the system, whereby consideration must be given to whether these individual elements are arranged in parallel or in series.

The convex–convex contact between the shaft and the balls results in the linear ball bearing guide having the lowest rigidity of all linear guide types.

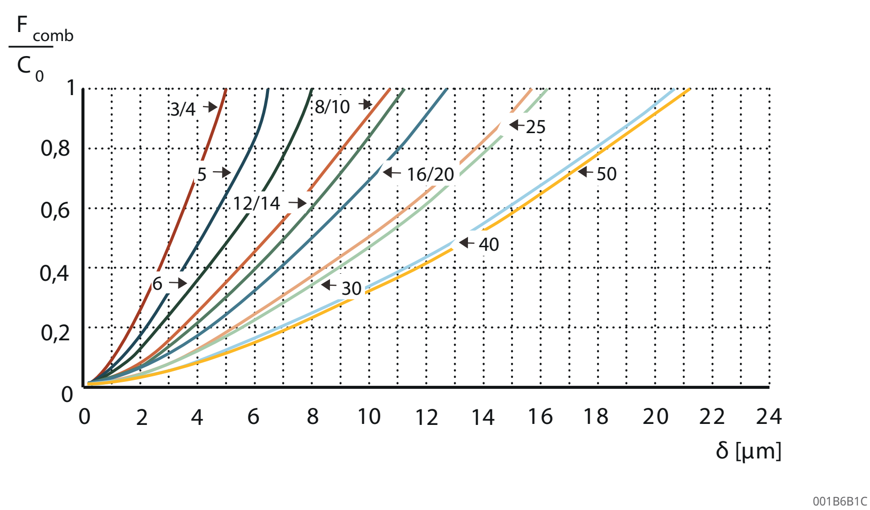
Furthermore, in unsupported guides, the rigidity of the system is significantly reduced due to shaft deflection under load ➤29 | 1.2.3.

1.2.2 Elastic deformation of clearance-free linear ball bearings in the contact zone

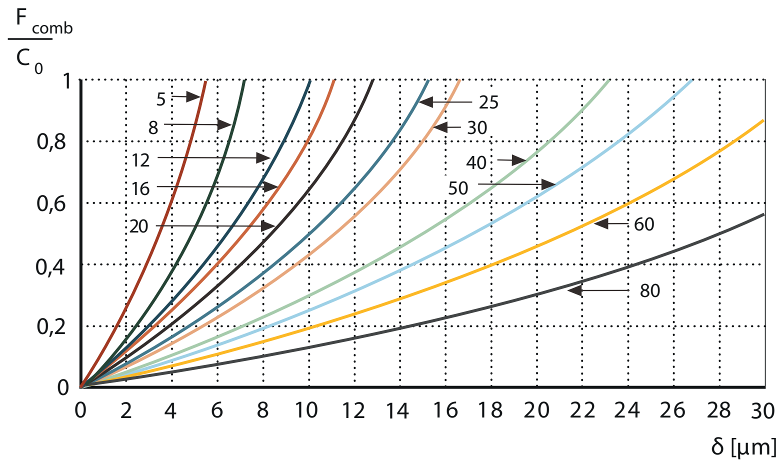
Starting from a clearance-free linear guide, the diagrams show the elastic deformation of various linear ball bearings as a function of the load. In the diagrams, the load is expressed as a fraction with the static load rating C_0 as the denominator. For preloaded guides, the elastic deformation is smaller, meaning that the rigidity is higher than indicated in the diagrams.

! If radial clearance is present, a higher elastic deformation must be expected. With an alternating load direction, it may be necessary to include the radial clearance as reverse clearance in the calculation.

17 Elastic deformation for linear ball bearings of the compact range



18 Elastic deformation for linear ball bearings of the standard range



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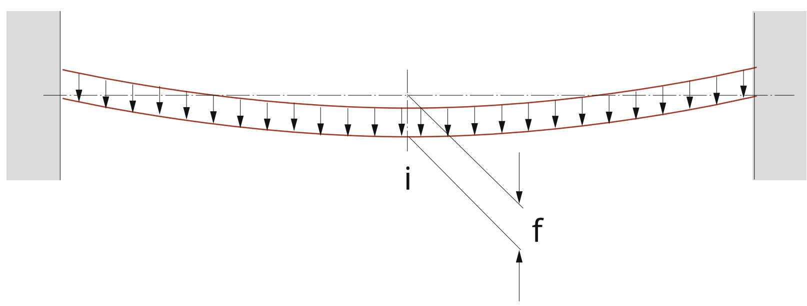
C_0	N	Basic static load rating
F_{comb}	N	Combined bearing load

1.2.3 Shaft deflection and misalignment

For an approximate determination of shaft deflection and misalignment relative to the symmetry axis (longitudinal direction) of the linear bearing, the formulas should be used ➤31 | ƒ26 to ➤31 | ƒ32. These formulas are based on the general theory of strength of materials. They assume the most unfavorable loading conditions, with the linear bearing unit positioned midway between the two shaft blocks. The deflection of the shaft caused by its own weight must also be taken into account. It is assumed that the shaft is either clamped or freely supported at both ends. This approach provides the maximum value for expected deflection.

The formulas apply to E = 206000 N/mm² and G = 77000 N/m³.

19 Shaft deflection



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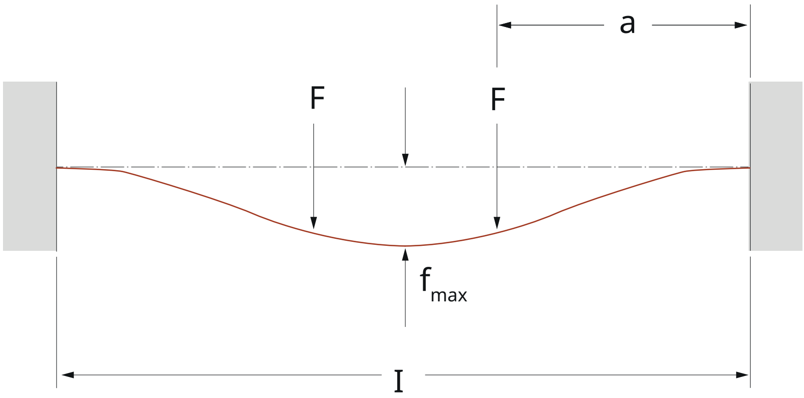
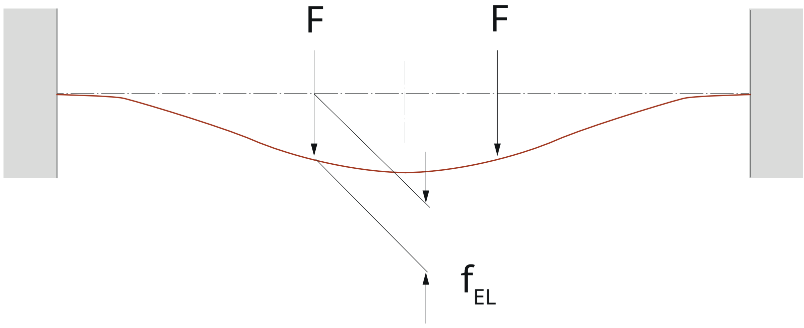
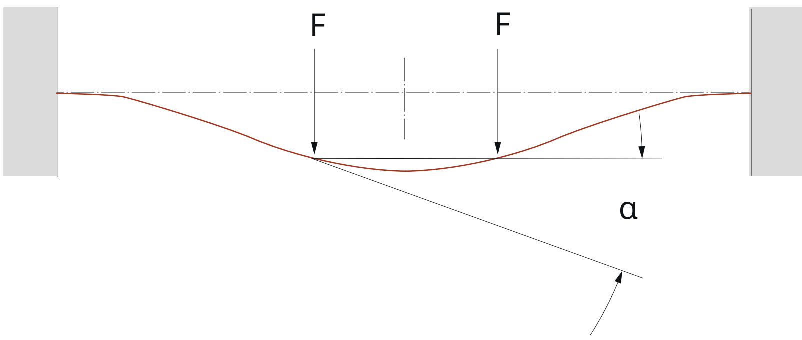
20 Maximum shaft deflection



21 Shaft deflection at the loading point



22 Misalignment



a	mm	Distance between clamping points and loading point
d	mm	Shaft diameter
d_1	mm	Inside diameter of hollow shaft
f	mm	Shaft deflection
f_{max}	mm	max. shaft deflection
F	N	Bearing load
l	mm	Shaft length
α	'	Misalignment

Clamped shaft

under own weight:

ƒ26

$$f_{EG} = \frac{2.49 \cdot 10^{-7} \cdot \left[a \cdot (l - a)\right]^2}{\left(d^2 + d_1^2\right)}$$

ƒ27

$$f_{max,EG} = \frac{1.56 \cdot 10^{-8} \cdot l^4}{\left(d^2 + d_1^2\right)}$$

ƒ28

$$\alpha_{EG} = \frac{1.71 \cdot 10^{-6} \cdot a \cdot \left(l^2 + 2a^2 - 3al\right)}{\left(d^2 + d_1^2\right)}$$

with 2 symmetrically applied loads F:

ƒ29

$$f_{EL} = \frac{0.0165 \cdot F \cdot a^3 \cdot \left(\frac{2 - 3a}{l}\right)}{\left(d^4 - d_1^4\right)}$$

ƒ30

$$f_{max,EL} = \frac{0.00412 \cdot F \cdot a^2 \cdot (3l - 4a)}{\left(d^4 - d_1^4\right)}$$

ƒ31

$$\alpha_{EL} = \frac{0.17 \cdot F \cdot a^2 \cdot \left(\frac{1 - 2a}{l}\right)}{\left(d^4 - d_1^4\right)}$$

total:

ƒ32

$$\alpha_{tot} = \alpha_{EG} + \alpha_{EL}$$

1

Freely supported shaft

under own weight:

ƒ33

$$f_{FG} = \frac{2.49 \cdot 10^{-7} \cdot a \cdot (l - a) \cdot \left(l^2 - a^2 + a \cdot l\right)}{\left(d^2 + d_1^2\right)}$$

ƒ34

$$f_{max,FG} = \frac{7.78 \cdot 10^{-8} \cdot l^4}{\left(d^2 + d_1^2\right)} = 5 \cdot f_{max,EG}$$

ƒ35

$$\alpha_{FG} = \frac{8.57 \cdot 10^{-7} \cdot \left(l^3 + 4a^3 - 6a^2 l\right)}{\left(d^2 + d_1^2\right)}$$

with 2 symmetrically applied loads F:

ƒ36

$$f_{FL} = \frac{0.0165 \cdot F \cdot a^2 \cdot (3l - 4 \cdot a)}{\left(d^4 - d_1^4\right)}$$

ƒ37

$$f_{max,FL} = \frac{0.00412 \cdot F \cdot a \cdot \left(3l^2 - 4a^2\right)}{\left(d^4 - d_1^4\right)}$$

ƒ38

$$\alpha_{FL} = \frac{0.17 \cdot F \cdot a \cdot (l - 2a)}{\left(d^4 - d_1^4\right)}$$

total:

ƒ39

$$\alpha_{tot} = \alpha_{FG} + \alpha_{FL}$$

Indices for results at loading points with distance a

EG	–	Clamped shaft under own weight
EL	–	Clamped shaft under 2 symmetrical individual loads F
FG	–	Freely supported shaft under own weight
FL	–	Freely supported shaft under 2 symmetrical individual loads F

1.3 Preload

1.3.1 Operating clearance

With slotted housings, the operating clearance of an installed linear ball bearing can be adjusted to suit the requirements of the application, ranging from slight clearance to preload. This is possible with slotted bearing units such as LUCS, LUCE, LUNS, and LUNE as well as with all single bearing units in an open design. For linear ball bearings in housings with a fixed diameter, the operating clearance of the mounted linear ball bearing results from the interaction of the following factors:

- housing bore tolerance ➤43 | 1.10.2
- radial internal clearance of the linear ball bearing in the unmounted condition ➤40 | 1.9
- tolerance of the shaft diameter ➤177 | 14.1.3

The expected operating clearance for the various bearing designs can be found in the tables for shaft tolerances h6 and h7 and the 6 housing bore tolerance variants. While the first line indicates the theoretically possible limit values for the operating clearance after installation, the second line shows the limit values achieved with a confidence level of more than 99 %, assuming a Gaussian normal distribution of the individual tolerances.

! For housings with relatively rough bores and during running in, the operating clearance may increase due to smoothing effects.

! At operating temperature, the operating clearance is also influenced by the ambient temperature and the temperature of the shaft, bearing, and housing.

8 Operating clearance of the compact range

Designation	Operating clearance											
	h6						h7					
	H6		J6		K6		H7		J7		K7	
	U	L	U	L	U	L	U	L	U	L	U	L
	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm
LBBR 3	27	0	23	-4	20	-7	37	0	30	-7	27	-10
	22	5	18	1	15	-2	29	8	22	1	19	-2
LBBR 4	32	0	28	-4	25	-7	42	0	35	-7	32	-10
	26	6	22	2	19	-1	33	9	26	2	23	-1
LBBR 5	32	0	28	-4	25	-7	42	0	35	-7	32	-10
	26	6	22	2	19	-1	33	9	26	2	23	-1
LBBR 6	34	0	29	-5	25	-9	45	0	37	-8	33	-12
	27	7	22	2	18	-2	36	9	28	1	24	-3
LBBR 8	38	0	33	-5	29	-9	51	0	43	-8	39	-12
	30	8	25	3	21	-1	40	11	32	3	28	-1
LBBR 10	38	0	33	-5	29	-9	51	0	43	-8	39	-12
	30	8	25	3	21	-1	40	11	32	3	28	-1
LBBR 12	45	0	40	-5	34	-11	60	0	51	-9	45	-15
	36	9	31	4	25	-2	47	13	38	4	32	-2
LBBR 14	45	0	40	-5	34	-11	60	0	51	-9	45	-15
	36	9	31	4	25	-2	47	13	38	4	32	-2
LBBR 16	45	0	40	-5	34	-11	60	0	51	-9	45	-15
	36	9	31	4	25	-2	47	13	38	4	32	-2
LBBR 20	52	0	47	-5	41	-11	68	0	59	-9	53	-15
	42	10	37	5	31	-1	54	14	45	5	39	-1
LBBR 25	55	0	49	-6	42	-13	72	0	61	-11	54	-18
	44	11	38	5	31	-2	57	15	46	4	39	-3

1

Desig-nation	Operating clearance											
	h6						h7					
	H6		J6		K6		H7		J7		K7	
	U	L	U	L	U	L	U	L	U	L	U	L
	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm
LBBR 30	55	0	49	-6	42	-13	72	0	61	-11	54	-18
	44	11	38	5	31	-2	57	15	46	4	39	-3
LBBR 40	66	0	60	-6	51	-15	86	0	74	-12	65	-21
	53	13	47	7	38	-2	68	18	56	6	47	-3
LBBR 50	66	0	60	-6	51	-15	86	0	74	-12	65	-21
	53	13	47	7	38	-2	68	18	56	6	47	-3

9 Operating clearance of the standard range

Desig-nation	Operating clearance											
	h6						h7					
	H6		J6		K6		H7		J7		K7	
	U	L	U	L	U	L	U	L	U	L	U	L
	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm
LBCR 5	31	0	26	-5	22	-9	42	0	34	-8	30	-12
	25	6	20	1	16	-3	33	9	25	1	21	-3
LBCR 8	36	0	31	-5	27	-9	49	0	41	-8	37	-12
	29	7	24	2	20	-2	39	10	31	2	27	-2
LBCR 12, LBCT 12, LBCD 12, LBCF 12	41	0	36	-5	30	-11	56	0	47	-9	41	-15
	33	8	28	3	22	-3	44	12	35	3	29	-3
LBCR 16, LBCT 16, LBCD 16, LBCF 16	41	0	36	-5	30	-11	56	0	47	-9	41	-15
	33	8	28	3	22	-3	44	12	35	3	29	-3
LBCR 20, LBCT 20, LBCD 20, LBCF 20	48	0	42	-6	35	-13	65	0	54	-11	47	-18
	38	10	32	4	25	-3	51	14	40	3	33	-4
LBCR 25, LBCT 25, LBCD 25, LBCF 25	48	0	42	-6	35	-13	65	0	54	-11	47	-18
	38	10	32	4	25	-3	51	14	40	3	33	-4
LBCR 30, LBCT 30, LBCD 30, LBCF 30	48	0	42	-6	35	-13	65	0	54	-11	47	-18
	38	10	32	4	25	-3	51	14	40	3	33	-4
LBCR 40, LBCD 40	56	0	50	-6	41	-15	76	0	64	-12	55	-21
	44	12	38	6	29	-3	60	16	48	4	39	-5
LBCT 40, LBCF 40	60	0	54	-6	45	-15	80	0	68	-12	59	-21
	48	12	42	6	33	-3	63	17	51	5	42	-4
LBCR 50, LBCT 50, LBCD 50, LBCF 50	60	0	54	-6	45	-15	80	0	68	-12	59	-21
	48	12	42	6	33	-3	63	17	51	4	42	-4
LBCR 60, LBCT 60	71	0	65	-6	53	-18	95	0	82	-13	70	-25
	56	15	50	9	38	-3	75	20	62	7	50	-5
LBCR 80, LBCT 80	71	0	65	-6	53	-18	95	0	82	-13	70	-25
	56	15	50	9	38	-3	75	20	62	7	50	-5

1

1.4 Friction

The friction in a linear guide system is influenced not only by the load but also by a number of additional factors, particularly the type and size of the bearing, the running speed, and the quality and quantity of the lubricant used. The cumulative running resistance of a linear ball bearing is determined by several factors:

- rolling and sliding friction of the rolling elements in the loaded zone
- sliding friction between the rolling elements and the cage during recirculation
- friction within the lubricant
- sliding friction of the contact seals

The coefficient of friction for lubricated linear ball bearings without seals is between 0.0015 for heavy loads and 0.005 for light loads.

When bearings with contact double lip seals are used, the values for friction and starting friction of the seals must be added to the friction calculated using the coefficients of friction listed above. The values in the table therefore apply to unloaded linear ball bearings, prelubricated at the factory, with seals on both ends.

In lightly loaded linear ball bearings, the lubricant has a significant influence on frictional behavior. When a grease with the minimum viscosity specified in our recommendations is used, the basic friction of the linear ball bearing is correspondingly higher than when a grease with lower viscosity is used. However, this effect diminishes over time as the grease distributes evenly within the linear ball bearing and excess lubricant is expelled from the ball recirculations (running-in effect).

10 Friction and starting friction of linear ball bearings

Designation		**Friction**	**Starting friction**
Compact range	**Standard range**	**N**	**N**
LBBR 3	–	0.4	1
LBBR 4	–	0.5	1.3
LBBR 5	–	0.6	1.7
–	LBCR 5	0.8	2
LBBR 6	–	0.7	2
LBBR 8	–	0.8	2.5
–	LBCR 8	1.5	4
LBBR 10	–	1	3.5
LBBR 12	–	1.5	5
–	LBCR 12, LBCT 12, LBCD 12, LBCF 12	2.5	5
LBBR 14	–	1.8	6
LBBR 16	–	2	7
–	LBCR 16, LBCT 16, LBCD 16, LBCF 16	3	7
LBBR 20	–	2.5	8
–	LBCR 20, LBCT 20, LBCD 20, LBCF 20	4	8
–	–	4	12
LBBR 25	–	4	12
–	LBCR 25, LBCT 25, LBCD 25, LBCF 25	5	11
–	–	5	14
LBBR 30	–	5.5	16
–	LBCR 30, LBCT 30, LBCD 30, LBCF 30	7	14
–	–	6	18

Designation		Friction	Starting friction
Compact range	Standard range	N	N
LBBR 40	–	6.5	20
–	LBCR 40, LBCD 40	8	19
–	LBCT 40, LBCF 40	8	24
LBBR 50	–	8	24
–	LBCR 50, LBCT 50, LBCD 50, LBCF 50	10	30
–	LBCR 60, LBCT 60	12	36
–	LBCR 80, LBCT 80	15	45

1.5 Load carrying capacity

1.5.1 Required minimum load

To ensure slip-free operation of a linear ball bearing, a general guideline is that a load of $P \geq 0.02 \cdot C$ should act on the bearing.

The minimum load is particularly important for linear guides operating at high running speeds or high accelerations. In such cases, the inertia forces of the balls and the frictional components of the lubricant can adversely affect rolling conditions in the bearing and lead to harmful sliding movements of the rolling elements on the raceway.

1.5.2 Permissible maximum load

According to ISO 14728-1, the equivalent dynamic mean load P_m of a linear bearing must not exceed 50 % of the dynamic load rating C when calculating the bearing rating life. Higher loads in operation result in uneven load distribution and can significantly reduce the rating life of the bearing. In accordance with ISO 14728-2, the maximum load should also not exceed 50 % of the static load rating C_0.

1.6 Acceleration and speed

Linear ball bearings can be operated up to the following limits:

- maximum speed: $v_{max} = 5$ m/s
- maximum acceleration: $a_{max} = 100$ m/s²

Higher running speeds and acceleration values may be possible depending on the bearing type, bearing size, applied load, lubricant, or preload. Please conctact Schaeffler in such cases.

1.7 Lubrication

The correct type and quantity of lubricant play a decisive role in ensuring that linear bearings fulfill their function to optimum effect. The lubricant reduces direct metallic contact between the rolling elements and the raceway plates, thereby minimizing wear. In addition, the lubricant protects both the linear bearing and the shaft against corrosion. In the majority of linear bearing applications, grease lubrication is used.

1.7.1 Grease lubrication

Under normal operating conditions, linear bearings must be lubricated with grease. Compared with lubricating oil, grease offers the advantage of being more easily retained within the bearing, which is especially important for inclined or vertical axes of travel. In addition, grease contributes to sealing the bearing point against liquid contaminants or moisture.

1.7.1.1 Base oil viscosity

The viscosity of the base oil in a lubricating grease is decisive for the formation of a separating hydrodynamic film between the rolling elements and the raceway plates.

In general, the viscosity of lubricating oils is specified at 40 °C. This also applies to the mineral base oils contained in lubricating greases.

The base oils of commercially available rolling bearing greases typically have viscosities of 15 mm^2/s to 500 mm^2/s (at 40 °C). Greases with higher base oil viscosity often release oil only very slowly, which may result in insufficient lubrication of the bearing points.

1.7.1.2 Consistency classes

Metal soap greases of NLGI consistency classes 2 and 3 in accordance with DIN 51818 and DIN 51825, are particularly suitable for the lubrication of linear bearings. The consistency of the lubricating grease should not change excessively under varying temperatures within the operating temperature range or under differing load conditions. Greases that become soft at higher temperatures may escape from the bearing point, while greases that become too stiff at lower temperatures may hinder the movement of the linear guide.

In certain application areas, special requirements apply to the purity, composition, and compatibility of the lubricating grease, for example in the food industry or in medical technology. In such cases, additional criteria must be defined for the lubricant, in addition to viscosity and consistency class.

1.7.1.3 Temperature range

The operating temperature range of a lubricant is primarily determined by the type of base oil, the thickener, and the additives used.

The lower temperature limit, i.e., the lowest temperature at which the linear bearing can still function reliably, depends mainly on the type and viscosity of the base oil. The upper temperature limit is determined by the type of thickener and its dropping point. The dropping point is the temperature at which the lubricating grease changes its consistency and transitions to a liquid state.

! At higher operating temperatures, the aging process of a lubricating grease accelerates. The resulting reaction products have a negative effect on the lubricating properties and on the conditions in the rolling contact.

Unlike mineral oil-based lubricants, greases with synthetic base oils can be used both at higher and at lower temperatures.

1.7.1.4 Corrosion protection in lubricants

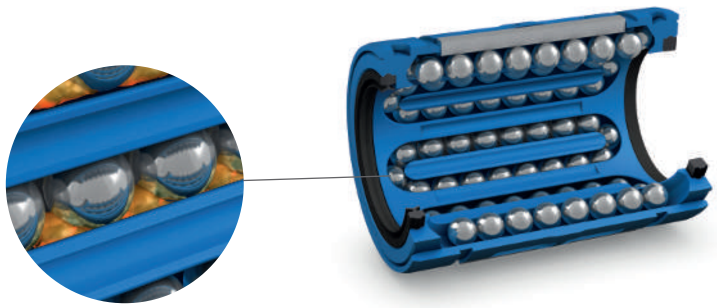
Lubricants are generally blended with additives that improve corrosion protection. In addition, the type of thickener used also plays a decisive role.

Lithium greases and calcium soap greases exhibit excellent corrosion protection properties and are also resistant to washout by any penetrating water. For applications in which corrosion protection is an important operating parameter, Schaeffler recommends the use of corrosion-resistant linear bearings and shafts made of corrosion-resistant steel, or chrome-plated shafts.

1.7.2 Delivery condition from the factory

Linear ball bearings and linear ball bearing units with a shaft diameter of 8 mm or larger are greased at the factory. This reduces both assembly time and maintenance effort for the user. The linear ball bearings are lubricated with a high-performance grease suitable for a wide range of industrial and automotive applications. This lithium soap- and mineral oil-based grease contains EP-additives (Extreme Pressure), which ensure excellent wear protection and corrosion protection.

23 Factory pre-lubrication



Special greases for use in food industry or cleanroom environments are available on request. If required, linear ball bearings can also be supplied without a factory pre-lubrication; this must be specified when ordering. Linear bearings supplied without a factory pre-lubrication must then be lubricated appropriately prior to installation. When using alternative lubricants, it must be ensured that they possess the necessary properties and are compatible with the bearing materials and the preservative used.

Linear ball bearings are generally protected for transport and storage with a corrosion-inhibiting preservative. This preservative is compatible with the lubricating grease but not suitable for food contact.

! As standard, linear ball bearings LBBR 6 and LBCR 5 are prelubricated with lubricating oil at the factory. LBBR 3, LBBR 4, and LBBR5 are supplied without lubricant as standard, but like other bearings, are protected with a preservative for transport and storage.

Properties of the lubricating grease:

- thickener: lithium soap
- base oil: mineral oil
- operating temperature during continuous operation of −20 to +110 °C
- kinematic viscosity of the base oil of 200 mm²/s
- consistency class NLGI 2
- EP-additives for long service life

1.7.3 Initial grease application

Unless otherwise specified, linear ball bearings are pre-lubricated at the factory and supplied ready for installation. An initial grease application is not required. If, for any reason, the ball bearing has not yet been lubricated, it must receive an initial application of grease before mounting, ensuring that the grease is distributed across all ball rows and ball recirculation elements.

The initial grease application must be carried out 3 times as follows:

1. Grease the linear bearing with the calculated lubricant quantity G_p ➤39 | ƒ40.
2. Move the linear bearing back and forth several times, ensuring that the travel distance is longer than the bearing length.
3. Repeat steps 1 and 2 2 more times.
4. Check the lubricant film on the shaft.

1.7.4 Relubrication

The required grease quantity for relubrication can be calculated using the following formula:

ƒ40

$$G_p = F_w \cdot C \cdot n_r \cdot const_1$$

C	mm	Length of the linear ball bearing
$const_1$	–	Constant 1
F_w	mm	Inscribed diameter of the ball set
G_p	g	Lubricant quantity
n_r	–	Number of ball rows

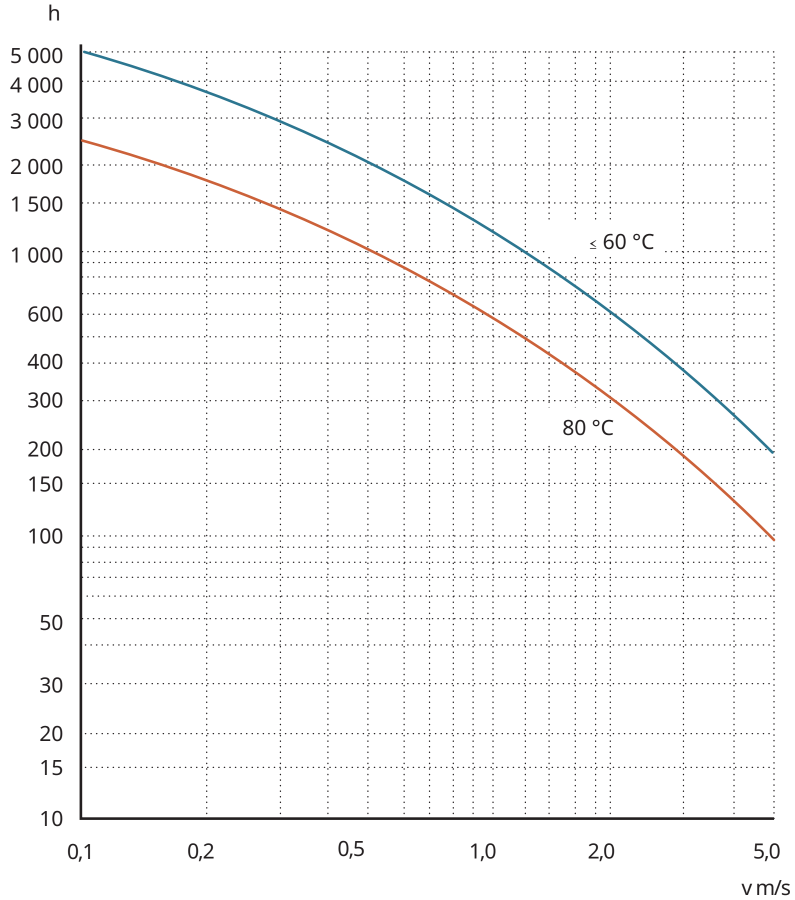
11 Constant 1

Designation	Size	$const_1$
LBBR	8 ... 50	0.00003
LBCR, LBCD	8 ... 40	0.00003
	50 ... 80	0.00009
LBCT, LBCF	12 ... 40	0.000025
	50 ... 80	0.000075

Relubrication should always be performed while the lubrication conditions in the bearing are still satisfactory. The relubrication intervals for linear ball bearings depend on a range of different factors. The main factors influencing the relubrication interval are the average running speed, load, operating temperature, shaft length, and grease quality. The appropriate relubrication interval for a given application must be determined by testing under actual operating conditions.

The reference values provided apply to bearings in stationary machines operating under normal load.

24 Relubrication interval as a function of running speed and operating temperature



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1.8 Temperature range

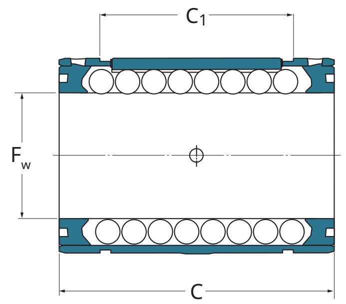
The permissible temperature range for the continuous operation of linear ball bearings is between –20 °C and +80 °C, and is determined by the materials used for the cage and the seals. Lower or higher temperatures can also be tolerated for short periods of time.

1.9 Tolerances

The main dimensions of linear ball bearings from the compact range and standard range comply with the standard ISO 10285. Linear ball bearings are manufactured to the specified tolerances. The respective values affect the operating clearance or preload of a linear guide.

! On request, linear ball bearings can also be supplied with customer-specific tolerance values for the inscribed diameter of the ball set, allowing both the position and width of the tolerance field to be modified.

25 Tolerances for the inscribed diameter of the ball set



C	mm	Length
C_1	mm	Distance of grooves
F_w	mm	Inscribed diameter of the ball set
L	–	Lower limit dimension
U	–	Upper limit dimension

12 Tolerances for the inscribed diameter of the ball set for linear ball bearings of the compact range

Designation	Tolerance	
	F_w	
	U	L
	μm	μm
LBBR 3	+12	0
LBBR 4	+15	0
LBBR 5	+15	0
LBBR 6	+15	0
LBBR 8	+18	0
LBBR 10	+18	0
LBBR 12	+21	0
LBBR 14	+21	0
LBBR 16	+21	0
LBBR 20	+26	0
LBBR 25	+26	0
LBBR 30	+26	0
LBBR 40	+31	0
LBBR 50	+31	0

13 Tolerances for the inscribed diameter of the ball set for linear ball bearings of the standard range

Designation	Tolerance	
	F_w	
	U	L
	μm	μm
LBCR 5	+12	0
LBCR 8	+16	0
LBCR 12, LBCT 12, LBCD 12, LBCF 12	+17	0
LBCR 16, LBCT 16, LBCD 16, LBCF 16	+17	0
LBCR 20, LBCT 20, LBCD 20, LBCF 20	+19	0
LBCR 25, LBCT 25, LBCD 25, LBCF 25	+19	0
LBCR 30, LBCT 30, LBCD 30, LBCF 30	+19	0
LBCR 40, LBCD 40,	+21	0
LBCT 40, LBCF 40	+25	0

Designation	Tolerance	
	F_w	
	U	L
	μm	μm
LBCR 50, LBCT 50, LBCD 50, LBCF 50	+25	0
LBCR 60, LBCT 60	+30	0
LBCR 80, LBCT 80	+30	0

14 Length tolerances for linear ball bearings of the compact range

Designation	Length tolerance	
	C	
	U	L
	mm	mm
LBBR 3	+0.18	−0.18
LBBR 4	+0.215	−0.215
LBBR 5	+0.215	−0.215
LBBR 6	+0.26	−0.26
LBBR 8	+0.26	−0.26
LBBR 10	+0.26	−0.26
LBBR 12	+0.26	−0.26
LBBR 14	+0.26	−0.26
LBBR 16	+0.26	−0.26
LBBR 20	+0.26	−0.26
LBBR 25	+0.31	−0.31
LBBR 30	+0.31	−0.31
LBBR 40	+0.37	−0.37
LBBR 50	+0.37	−0.37

15 Length tolerances for linear ball bearings of the standard range

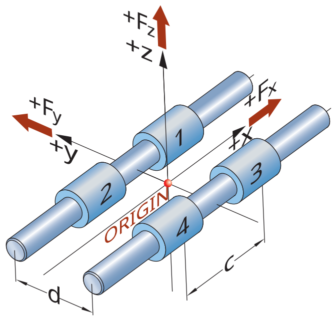
Designation	Length tolerance			
	C		C_1	
	U	L	U	L
	mm	mm	mm	mm
LBCR 5	0	−0.52	+0.27	0
LBCR 8	0	−0.52	+0.27	0
LBCR 12, LBCT 12, LBCD 12, LBCF 12	0	−0.62	+0.33	0
LBCR 16, LBCT 16, LBCD 16, LBCF 16	0	−0.62	+0.33	0
LBCR 20, LBCT 20, LBCD 20, LBCF 20	0	−0.62	+0.39	0
LBCR 25, LBCT 25, LBCD 25, LBCF 25	0	−0.74	+0.39	0
LBCR 30, LBCT 30, LBCD 30, LBCF 30	0	−0.74	+0.46	0
LBCR 40, LBCT 40, LBCD 40, LBCF 40	0	−0.74	+0.46	0
LBCR 50, LBCT 50, LBCD 50, LBCF 50	0	−0.87	+0.6	0
LBCR 60, LBCT 60	0	−1	+0.8	0
LBCR 80, LBCT 80	0	−1	+1	0

1.10 Design of bearing arrangements

1.10.1 Use of linear bearings

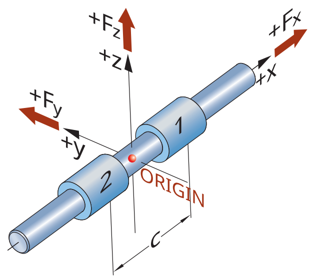
A typical linear slide consists of 4 linear bearings mounted in housings and 2 shafts.

26 Design variant: 4 linear bearings mounted in housings and 2 shafts



Another design variant involves the use of a single shaft with 2 linear bearings. For the configuration with 1 shaft and 2 bearings, it is important to prevent the linear bearing from rotating around the shaft. This can be achieved by suitable measures, such as using an anti-rotation lock. Schaeffler generally recommends using 2 linear bearings per shaft. The second linear bearing may be omitted only in exceptional cases, such as when no torque loads occur or when the load involved is very low (configuration with 1 shaft and 1 bearing or 2 shafts and 2 bearings).

27 Design variant: 1 shaft with 2 linear bearings



Linear bearings and linear bearing units in a closed design offer excellent sealing properties and are easy to install. They are typically used in applications with shorter shafts, where the influence of shaft deflection is limited ➤23 | 1.1.9.6. For longer shaft guidance systems, particularly those subjected to high loads, the use of linear ball bearings in open design is recommended. This allows the use of shaft supports which prevent any shaft deflection.

1.10.2 Housing design

A linear ball bearing requires a housing that provides sufficient support for the raceway plates. The diameter tolerance, cylindricity, and roughness of the bearing seat surfaces are critical factors for the performance of a linear ball bearing system.

To ensure the self-holding functionality of linear bearings in the compact range, the housing bore must exhibit a diameter tolerance of J6 or J7. For the standard range, the dimensional tolerance should correspond to a minimum of quality grade H6 or H7.

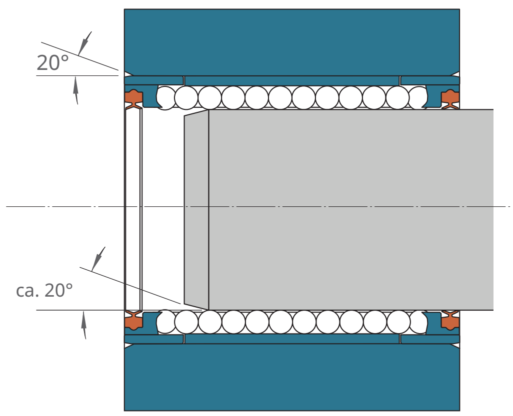
In general, the housing bore tolerances, in combination with the bearing type tolerances and the shaft tolerances, determine the operating clearance of the linear guide system ➤33 | 1.3. This means that the operating clearance can be reduced by selecting a housing bore tolerance of J or K.

The cylindricity tolerance according to DIN EN ISO 1101 should be 1 to 2 IT grades better than the dimensional tolerance.

The following apply as guideline values for the roughness of the bearing seat surfaces Ra in the housing bore:

- diameter tolerance IT7: Ra = 1.6 μm
- diameter tolerance IT6: Ra = 0.8 μm

28 Chamfers on the housing bore and shaft



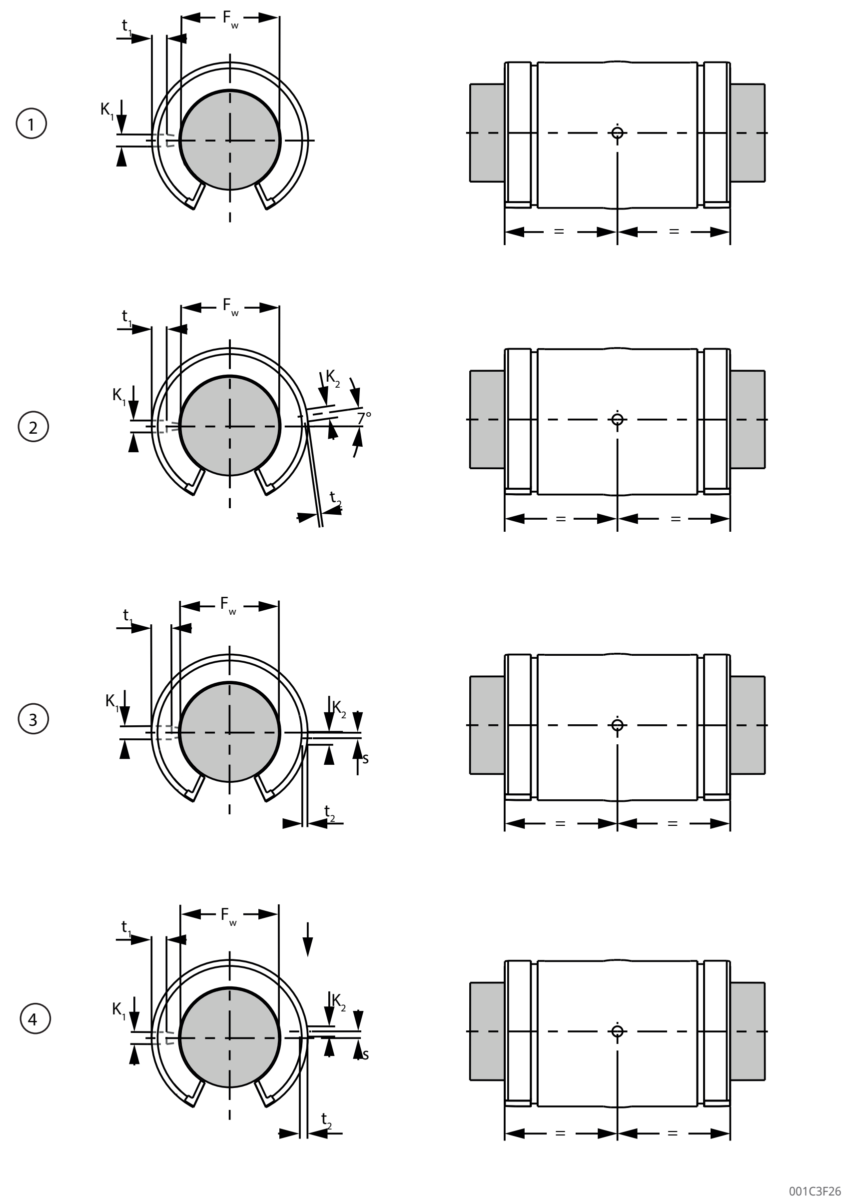
To facilitate assembly, the housing bore should have a chamfer of approximately 20°. This facilitates the insertion of the linear ball bearing into the housing.

1.10.3 Bearing fixation

Linear ball bearings of the compact range LBBR have 2 plastic end rings with an outer diameter which is slightly larger than the nominal diameter of the linear ball bearing. This oversize, in combination with a housing bore tolerance of J7 or J6, ensures the self-holding functionality of the bearing. Additional axial fixation of the linear ball bearing is not required if the housing covers the full bearing length and normal ambient and operating conditions exist.

All linear bearings of the standard range must be fixed in the housing. This is achieved by bores in the outside surface of the bearing, which accommodate pins used to secure the linear ball bearing axially and against rotation. The position of the lubrication port is marked on the end face of the bearing with a small circle (D-design). The position and diameter of the bores in the outside diameter of the bearing are given in the table below, with value K_1 applying to the relubrication and fixation of linear bearings in Schaeffler housings and value K_2 referring to the alternative bore for housings from other manufacturers.

29 Lubrication ports in linear bearings of the standard range



16 Lubrication ports for linear ball bearings

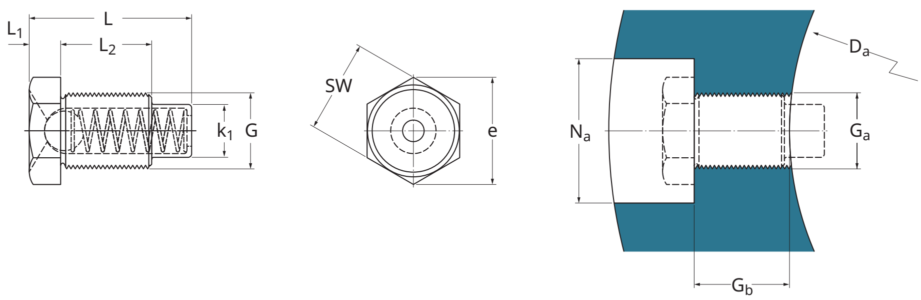
Designation	Dimensions					Matching grease fitting	Grub screw	Straight pin or grooved pin	Slotted pin	No.
	K_1	t_1	K_2	t_2	s	–	–	Ø	Ø	
	mm	mm	mm	mm	mm			mm	mm	➤45 | 29
LBCT 12, LBCF 12	3.0	2.6	3.0	1.0	–	VN-LHC 20	M4	3.0	3.0	2
LBCR 12, LBCD 12	3.0	2.6	–	–	–	VN-LHC 20	M4	3.0	3.0	1
LBCR 16, LBCT 16, LBCD 16, LBCF 16	3.0	2.6	–	–	–	VN-LHC 20	M4	3.0	3.0	1
LBCR 20, LBCT 20, LBCD 20, LBCF 20	3.0	2.6	–	–	–	VN-LHC 20	M4	3.0	3.0	1

1

Designation	Dimensions					Matching grease fitting	Grub screw	Straight pin or grooved pin	Slotted pin	No.
	K_1	t_1	K_2	t_2	s	–	–	Ø	Ø	
	mm	mm	mm	mm	mm			mm	mm	➤45 | 29
LBCR 25, LBCT 25, LBCD 25, LBCF 25	3.5	4.5	3.0	1.4	1.5	VN-LHC 40	M5	3.0	3.5	3
LBCR 30, LBCT 30, LBCD 30, LBCF 30	3.5	4.5	3.0	2.3	2.0	VN-LHC 40	M5	3.0	3.5	4
LBCR 40, LBCD 40	3.5	4.5	3.0	2.7	1.5	VN-LHC 40	M5	3.0	3.5	4
LBCT 40, LBCF 40	3.5	–	3.0	–	1.5	VN-LHC 40	M5	3.0	3.5	4
LBCR 50, LBCT 50, LBCD 50, LBCF 50	4.5	–	5.0	–	2.5	VN-LHC 50	M6	4.0	4.5	4
LBCR 60, LBCT 60, LBCD 60, LBCF 60	6.0	–	5.0	–	2.5	VN-LHC 80	M8	6.0	6.0	4
LBCR 80, LBCT 80, LBCD 80, LBCF 80	8.0	–	5.0	–	2.5	VN-LHC 80	M8	8.0	8.0	4

These bores also serve as lubrication ports. When VN-LHC grease fittings are used, both functions – relubrication and fixation of the linear ball bearing in the housing – can be utilized. The grease fitting is designed according to DIN 3405 as a funnel-type grease fitting and is suitable for grease guns with a needle nozzle or pointed nozzle.

30 Grease fitting VN-LHC



17 Grease fitting VN-LHC

Designation	Dimensions							Mounting dimensions			
	G	L	L_1	L_2	k_1	e	SW	G_a	G_b	N_a	Tightening torque
	–	mm	mm	mm	mm	mm	mm	–	mm	mm	Nm
VN-LHC 20	M4	7.7	1.5	3.5	3.0	5.5	5	M4	3.8	3.0	1.0
VN-LHC 40	M5	11.1	2.0	5.0	3.5	6.6	6	M5	5.2	3.0	2.2
VN-LHC 50	M6	14.8	2.5	7.0	4.5	7.8	7	M6	7.2	4.0	3.7
VN-LHC 80	M8	20.5	3.5	10.5	6.0	11.1	10	M8	11.2	8.0	9.3

For a defined orientation, care must be taken to ensure that the main load direction of the bearing and the bore for bearing fixation are positioned at 90° to each other, and that the housing design, particularly the bore for locating the bearing, is consistent with the factor for load direction used in the rating life calculation.

In addition to grease fittings, the following components can also be used for anti-rotation purposes:

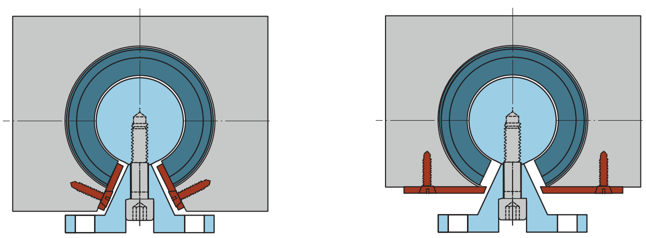
- grub screws in accordance with DIN EN 27435 or DIN EN ISO 4028
- straight pins in accordance with DIN EN ISO 2338
- grooved pins in accordance with DIN EN ISO 8739 or DIN EN ISO 8744
- slotted pins in accordance with DIN EN ISO 8752

If the screw or pin used extends deeper into the bearing than the value t_1, the linear ball bearing may become severely damaged.

Linear ball bearings LBCR 5 and LBCR 8 have no lubrication port, but are self-retaining when the temperature is limited to a maximum of 60 °C and the ball bearings are installed in housings at least one bearing length long. For shorter housings, retaining rings are required. Linear plain bearings LPAR 5 and LPAR 8 are manufactured without lubrication ports.

If none of the aforementioned anti-rotation options can be used for design reasons, open linear ball bearings can alternatively be secured with plates that are screwed to the housing.

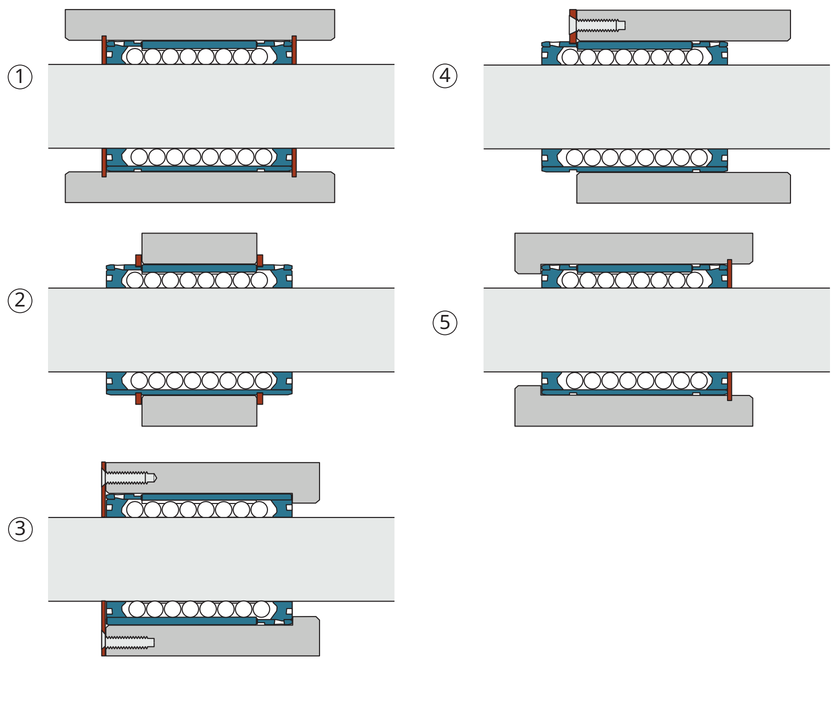
31 Alternative fixation of open linear ball bearings



1.10.4 Axial fixation

For bearing fixation, Schaeffler recommends the use of grease fittings VN-LHC. Most linear bearing applications require the bearing to be fixed both axially and against rotation, for example with open linear ball bearings, or when a closed linear ball bearing must be installed in a defined orientation. In some applications, however, it is sufficient to provide axial location only. The most important axial fixation methods are described below.

32 Axial fixation



1	Retaining rings	2	Retaining rings in accordance with DIN 471
3	End plates and covers	4	Retaining plates
5	Mounting against a housing shoulder		

Axial fixation using retaining rings is particularly space-saving, allows fast installation and removal, and simplifies machining of the mating components. Linear ball bearings and linear plain bearings of the standard range are equipped with 2 grooves on the outside diameter to accommodate the retaining rings.

When fixing bearings axially with retaining rings in accordance with DIN 471, it should be noted that the clamping force of the retaining ring applies a slight preload to the balls via the raceway plates, which are loosely held in the cage, and onto the shaft. However, the radial clearance between the outside surfaces of the raceway plates and the housing bore remains unchanged.

Instead of retaining rings, axial fixation can also be achieved using end plates, covers, or retaining plates that are screwed to the housing.

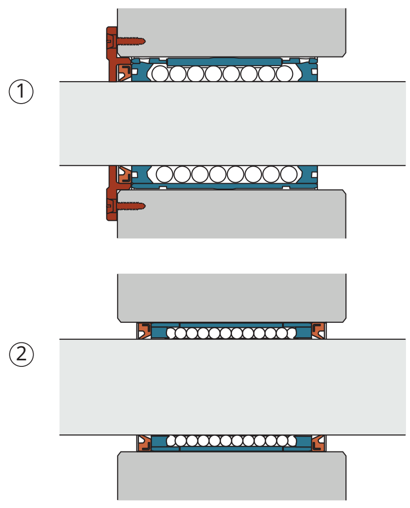
Another option is to locate the linear bearing against a housing shoulder. In this instance, the outer radius of the linear bearing and the corner radius R in the housing must be observed.

! In all cases, care must be taken to ensure that a residual axial clearance remains between the screw-mounting surfaces and the bearing.

1.10.5 Sealing

All linear ball bearings are available with double lip seals. The seals serve primarily to prevent the ingress of solid contaminants and moisture, and to retain the lubricant inside the bearing, thereby ensuring the full performance capability of the linear ball bearing.

33 Sealing with shaft seals



1	Shaft seals in the housing cover	2	Shaft seals in the housing bore

Linear bearings used under harsh operating conditions may require additional protection. In such cases, shaft seals are typically used. Housings fitted with such additional shaft seals must be twice the width of the shaft seal longer. Shaft seals can be either integrated into the housing cover or inserted directly into the housing bore.

Since ambient conditions can vary widely, each application must be assessed individually, and the appropriate sealing arrangement selected. A number of factors must be considered, including the design features, the available installation space, the type and degree of contamination, as well as cost considerations and the maximum permissible friction. For self-aligning linear ball bearings, care must be taken to ensure that the seal always remains in contact with the shaft.

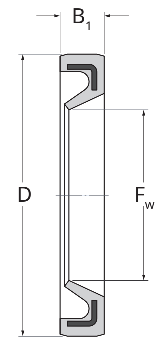
1.10.5.1 External shaft seals

Linear bearings of the compact range that operate under very harsh environmental conditions can be fitted with additional external shaft seals from Schaeffler to ensure a longer service life. Shaft seals SP consist of a steel insert covered with rubber material. These shaft seals are also self-retaining in a suitable housing, which must be designed with a correspondingly larger length. The high contact pressure of the seal lip on the shaft surface provides excellent protection against contamination where frictional forces are of secondary importance. The designation of the shaft seal in the catalog may differ slightly from that marked on the seal itself, e.g., SP-10×17×3 (catalog) and SP-10 17 3-4 (seal).

Characteristics and designs of shaft seals:

- sizes from 6 mm to 50 mm
- self-retaining in a suitable housing
- longer housing required
- suitable for highly contaminated environments
- maximum running speed 3 m/s

34 Shaft seals SP



18 Shaft seals SP

Designation	Mass	Dimensions		
	m	F_w	D	B_1
	kg	mm	mm	mm
SP-06×12×02/SEAL	0.0004	6	12	2
SP-08×15×03/SEAL	0.0007	8	15	3
SP-10×17×03/SEAL	0.0009	10	17	3
SP-12×19×03/SEAL	0.001	12	19	3
SP-14×21×03/SEAL	0.0011	14	21	3
SP-16×24×03/SEAL	0.0013	16	24	3
SP-20×28×04/SEAL	0.0021	20	28	4
SP-25×35×04/SEAL	0.0026	25	35	4
SP-30×40×04/SEAL	0.0036	30	40	4
SP-40×52×05/SEAL	0.0048	40	52	5
SP-50×62×05/SEAL	0.0105	50	62	5

1.10.6 Requirements for precision shafts

Shafts play a crucial role in a linear guide system. Their hardness and hardness depth have a direct influence on the rating life. The shaft diameter tolerance affects the operating clearance. For this reason, h6 or h7 tolerances are generally recommended. The dimensional and geometric accuracy of precision shafts are of decisive importance for the accuracy of a linear guide system. The key characteristics are defined in standard ISO 13012:

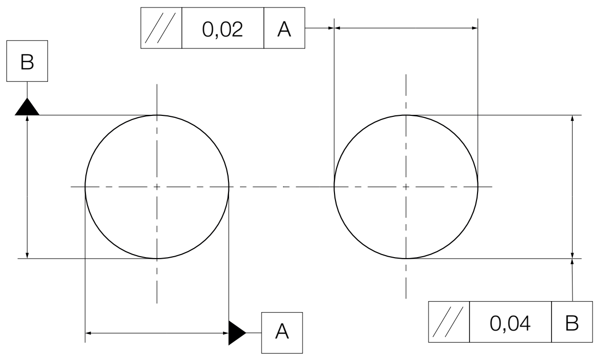
- roundness:
  - Excessive deviations from roundness can cause uneven load distribution in the linear ball bearing, which in turn can lead to overloading of individual ball rows.
- cylindricity:
  - Cylindricity is particularly important for the guiding accuracy of linear ball bearings, as it captures short-wave geometric deviations along the shaft contour.
- straightness:
  - The straightness of shafts in the unmounted condition is of secondary importance, since shaft deflection in unsupported guides and clamping conditions in supported guides have more impact.

In general, the shaft ends should be provided with a chamfer of approximately 20°. This allows the shafts to be inserted into the linear ball bearing more easily and without damage to the balls or seals.

1.10.7 Mounting surfaces and shaft alignment

To ensure smooth running of the linear bearing slide and to prevent additional loads that could shorten the rating life, the two shafts should exhibit the highest possible degree of parallelism.

35 Maximum tolerable deviations



This value applies to both supported and unsupported shafts. It also serves as a reference when defining the mounting surfaces for shaft supports or shaft blocks. Shafts with axial threads enable quick installation and easy alignment.

1.11 Installation

Expert knowledge and cleanliness are essential when installing linear bearings to ensure that the bearings function correctly and do not fail prematurely. As precision products, linear ball bearings must be handled with corresponding care. In particular, this involves selecting the proper installation procedures and using the appropriate tools.

1.11.1 Preparations

Carry out installation in a dust-free, dry environment. Before installing the bearings, prepare all necessary parts, tools, and auxiliary equipment.

Thoroughly clean all components of the linear guide (housing, shafts, etc.), remove any burrs, and check dimensional and geometric accuracy. The bearings will only run correctly if the required tolerances are maintained.

Do not remove the bearings from their original packaging until immediately before installation to avoid contamination.

The corrosion-inhibiting preservative applied to factory-new bearings generally does not need to be removed. Only for linear ball bearings of the compact range with self-holding functionality the corrosion-inhibiting preservative should be removed from the outer surface.

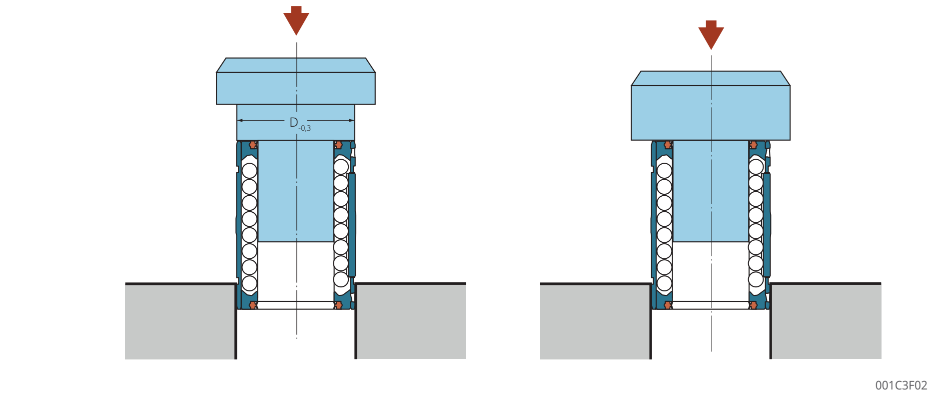
When using special greases that are not compatible with the corrosion-inhibiting preservative, the bearings must be carefully washed and dried before installation to ensure that the lubricating properties of the grease are not impaired.

1.11.2 Installing linear ball bearings

Installing a linear ball bearing into a chamfered housing bore is straightforward and requires no special force. Linear ball bearings with small to medium diameters can be inserted by hand. If greater force is required for installation, the use of a mechanical press is recommended. When installing linear ball bearings of the standard range that are secured against rotation by means of a grease fitting, for example, care must be taken to ensure that the lubrication port in the bearing, which also serves as fixation bore, aligns with the corresponding retaining bore in the housing.

It is advisable to place a mandrel between the press and the linear ball bearing. The mandrel, preferably made of plastic, should be designed to guide the bearing accurately and support it fully at the end face, as otherwise the seals may become damaged. Avoid striking the linear ball bearing with a hammer, as this can damage the seals and cage.

36 Mandrel used in non-flush and flush installation of the bearing



Carefully insert the shafts into the lubricated bearings. Ensure that neither the linear bearing nor the seals are damaged and that the shafts maintain the required parallelism. To facilitate alignment, most linear bearing units and shaft blocks feature a reference side with tight tolerances.

Screw connections must comply with state-of-the-art engineering standards. Dimensioning is carried out by the customer. Lateral displacement of components must be prevented, for example through the use of a locating edge or retaining strip.

1.11.3 Adjusting the operating clearance

The operating clearance of all linear units in slotted or open designs is adjusted by means of an adjustment screw in the housing. To achieve zero clearance, tighten the adjustment screw until a slight resistance can be felt when the shaft or unit is rotated by hand. Preload of linear bearings can be applied in the same way, using a calibrating shaft whose diameter is reduced by the desired preload amount. Clearance-free or preloaded linear bearings must not be rotated on the shaft after installation, as this may lead to marks or scratches. Secure the adjustment screw using a threadlocker, for example.

When adjusting the clearance, the linear unit must always be mounted on a shaft and must not be subjected to external loads.

1.12 Transport and storage

Linear ball bearings must be stored in a cool and dry in-door area and inside its original packing, which should be kept closed until the bearing is needed for use. The storage temperature must not exceed 30 °C and must remain above 0 °C. It must also be ensured that the relative humidity at the storage location does not exceed 60 %. Linear ball bearings must not be stored in the immediate vicinity of a heat source and must be protected from direct sunlight.

Under normal conditions, the linear bearings are coated with a corrosion-inhibiting preservative before packaging and can be stored in their unopened original packaging for up to 4 a (years). Extended storage periods may result in a deterioration of the grease's lubricating properties inside the bearing. In such cases, the old grease must be replaced with the required quantity of fresh grease before use. Bearings with seals, when stored for longer periods, may be found to have a higher initial starting friction than new bearings.

! If linear ball bearings remain stationary for an extended period while exposed to external vibrations, micro-movements in the contact zone between the rolling elements and raceways can cause surface damage. This, in turn, leads to a significant increase in running noise and may result in premature failure due to material fatigue. Such damage must therefore be avoided, for example by isolating the bearings from external vibrations and taking suitable precautions during transport.

1.13 Maintenance

1.13.1 Preventive maintenance

To prevent contaminants from adhering to the shafts, the shafts must be cleaned regularly with a cleaning stroke. Schaeffler recommends performing a cleaning stroke 2 times a day, or at least every 8 h, over the entire travel length. This removes contaminant particles and applies a fresh lubricating film to the shafts, providing continuous protection against corrosion.

2

2 Technical principles for linear plain bearings and units

2.1 Load rating and rating life

For linear plain bearings, the static load rating C_0 applies at standstill or during occasional adjustment movements. In addition, the static load rating C_0 must also be taken into account if a dynamically loaded linear plain bearing is subjected to high shock loads. The static load rating C_0 indicates the load that a linear plain bearing can support without exceeding a defined deformation of the sliding layer, assuming that the surrounding components exhibit sufficient rigidity.

! The screw connections must be checked for adequate safety. When installing linear guides overhead, higher safety factors should be applied.

! Load ratings always depend on the underlying definition, which means that dynamic load ratings specified by different manufacturers are not directly comparable.

2.1.1 Service life

In practice, the service life of a linear plain bearing depends on the following factors:

- surface pressure
- positive or negative effects due to increasing surface adaptation during operation in the mixed friction or dry friction range
- bearing clearance
- increase in bearing friction caused by:
  - progressive wear of the sliding surfaces
  - plastic deformation
  - material fatigue at the sliding surface

Additional influencing factors include contamination, corrosion, high-frequency loads or load cycles, and shock loads. Depending on the application and the sliding contact surface used, varying degrees of wear or increase in friction may be permissible.

2.1.2 Selecting linear plain bearings using the pv-diagram

A suitable method for checking bearing size is the use of the pv-diagram. The value p represents the specific bearing load, and v represents the mean sliding speed. It can generally be assumed that the rating life of a plain bearing is sufficient if the combination of the calculated p and v values lies below the red line.

ƒ41

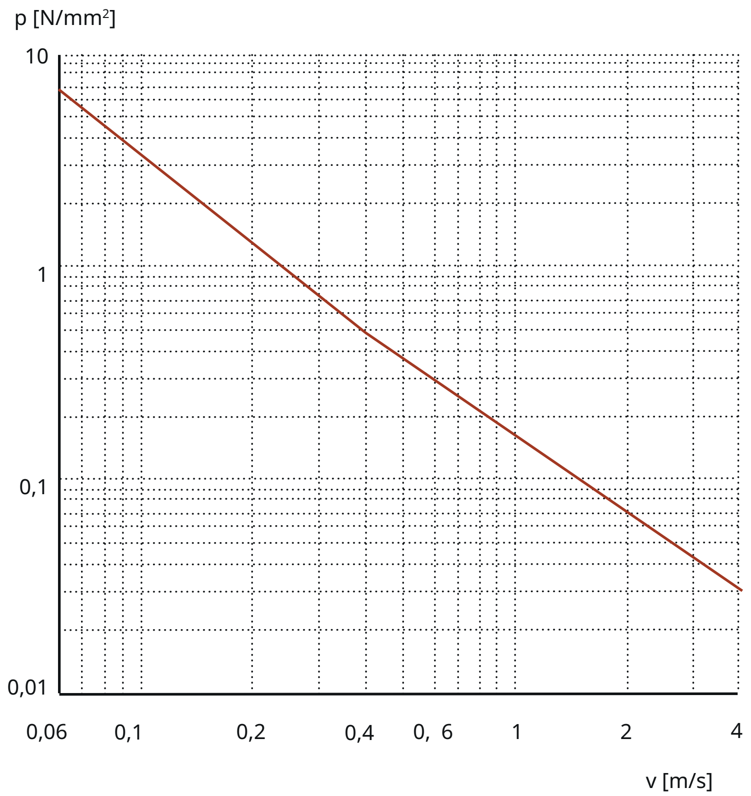
$$p = \frac{P}{2 \cdot F_w \cdot C_4}$$

ƒ42

$$v = \frac{S_{sin} \cdot n}{30000}$$

C_4	mm	Width of the sliding surfaces (2 per bearing)
F_W	mm	Bore diameter of the linear plain bearing
n	min^{-1}	Stroke frequency
P	Nmm	Equivalent dynamic bearing load
p	N/mm^2	specific bearing load
S_{sin}	mm	Single stroke length
v	m/s	mean sliding speed
$2 \cdot F_W \cdot C_4$	–	Load index

37 pv-diagram for linear plain bearings



2.2 Influence of shaft hardness

As a rule, shafts for plain bearings are made from soft carbon steels with a ground surface finish. The surface roughness Ra should be around 0.4 µm. For applications with higher requirements, hardened sliding surfaces with a surface hardness of at least 50 HRC, or surfaces coated with materials such as hard chromium, can be advantageous. In such cases, the Ra value should be around 0.3 µm. A higher surface quality also improves running behavior, while lower quality leads to increased wear.

2.3 Friction

The friction behavior of linear plain bearings primarily depends on the bearing load, sliding speed, and lubrication conditions. In addition, the surface quality of the mating sliding surface and the operating temperature are important factors. For linear plain bearings operating under dry conditions, the coefficient of friction typically lies between 0.17 and 0.21. The lowest friction values are generally obtained at high specific bearing loads and low sliding speeds. Under particularly unfavorable conditions or at low loads, the specified upper limits may even be exceeded. The sliding material is characterized by a static coefficient of friction that is only slightly higher than the dynamic coefficient of friction, meaning stick-slip effects are avoided. Linear plain bearings fitted with additional external shaft seals exhibit higher friction values.

2.4 Lubrication

Linear plain bearings can be operated either dry or with lubrication. In many applications, it is advisable to fill the bearings with grease to provide corrosion protection and improve sealing performance. Particularly suitable are corrosion-inhibiting, water-repellent lithium soap greases of normal consistency. Under no circumstances should greases containing molybdenum disulfide or other solid lubricants be used. The quantity of grease and the relubrication intervals depend on the specific application.

2.5 Temperature range

The recommended temperature range for continuous operation of linear plain bearings is between –40 °C and +80 °C; temperatures of up to 120 °C are permissible for short periods. However, it must be noted that the mechanical strength of the plastic is temperature-dependent, decreasing from 100 % at room temperature to approximately 30 % at 100 °C.

2.6 Tolerances

To ensure full interchangeability with linear ball bearings, the external dimensions and tolerances of linear plain bearings correspond to those of the equivalent linear ball bearings. Only the radial clearance is significantly larger than that of linear ball bearings, which is in line with recommendations for plain bearings. The values in the table apply to shaft tolerance h7 and housing tolerance H7.

Increased wear may occur during the running in of linear plain bearings, resulting in a further increase in radial clearance.

19 Radial clearance for linear plain bearings LPBR

Designation	Radial clearance		Load index
	U	L	
	μm	μm	mm²
LPBR 12	+175	+100	240
LPBR 14	+195	+120	336
LPBR 16	+205	+130	384
LPBR 20	+210	+135	520
LPBR 25	+210	+135	850
LPBR 30	+260	+185	1200
LPBR 40	+330	+225	1920
LPBR 50	+380	+275	2700

20 Radial clearance for linear plain bearings LPAR

Designation	Radial clearance		Load index
	U	L	
	μm	μm	mm²
LPAR 5	+110	+55	80
LPAR 8	+110	+55	144
LPAR 12	+160	+110	264

Designation	Radial clearance		Load index
	U	L	
	μm	μm	mm²
LPAR 16	+160	+110	416
LPAR 20	+165	+110	680
LPAR 25	+165	+110	1100
LPAR 30	+165	+110	1500
LPAR 40	+165	+110	2160
LPAR 50	+165	+110	3200
LPAR 60	+220	+160	4800
LPAR 80	+220	+160	8320

21 Radial clearance for linear plain bearings LPAT

Designation	Radial clearance		Load rating index
	U	L	
	μm	μm	mm²
LPAT 12	+205	+130	264
LPAT 16	+205	+130	416
LPAT 20	+210	+135	680
LPAT 25	+210	+135	1100
LPAT 30	+205	+135	1500
LPAT 40	+215	+140	2160
LPAT 50	+215	+140	3200
LPAT 60	+275	+190	4800
LPAT 80	+275	+190	8320

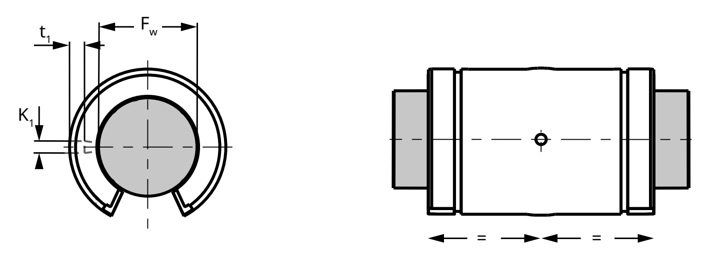
2.7 Design of bearing arrangements

Information on the design of bearing arrangements can be found under linear ball bearings ➤42|1.10.1. Information on housing tolerances is also provided under linear ball bearings ➤43|1.10.2.

2.7.1 Bearing fixation

For linear plain bearings of the compact range, no additional axial retention is required when they are installed in a housing with bore diameter D_h and tolerance J7 or J6. Linear plain bearings of the standard range must be axially retained, preferably using retaining rings and a grease fitting. The position and diameter of the bores in the outside diameter of the bearing are specified in the table below. Further options for axial location are analogous to those used for linear ball bearings ➤47|1.10.4.

38 Lubrication ports of linear plain bearings



22 Lubrication ports for linear plain bearings

Designation	Dimension	Matching grease fitting	Grub screw	Straight pin or grooved pin	Slotted pin
	K_1	–	–	Ø	Ø
	mm			mm	mm
LPAR 12, LPAT 12	3.0	VN-LHC 20	M4	3.0	3.0
LPAR 16, LPAT 16	3.0	VN-LHC 20	M4	3.0	3.0
LPAR 20, LPAT 20	3.0	VN-LHC 20	M4	3.0	3.0
LPAR 25, LPAT 25	3.5	VN-LHC 40	M5	3.0	3.5
LPAR 30, LPAT 30	3.5	VN-LHC 40	M5	3.0	3.5
LPAR 40, LPAT 40	3.5	VN-LHC 40	M5	3.0	3.5
LPAR 50, LPAT 50	4.5	VN-LHC 50	M6	4.0	4.5
LPAR 60, LPAT 60	6.0	VN-LHC 80	M8	6.0	6.0
LPAR 80, LPAT 80	8.0	VN-LHC 80	M8	8.0	8.0

2.8 Installation

2.8.1 Installation of linear plain bearings

To facilitate installation, the shaft ends and the housing bore should have a chamfer at an angle of approximately 20°. It must be ensured that the shaft has no sharp edges or burrs that could damage the sliding surfaces of the bearing. As with linear ball bearings, the use of a mandrel is recommended for installing linear plain bearings, whether manually or using a mechanical press.

Even in applications where continuous lubrication is not envisaged, it is advisable to carry out lubrication during installation and running in. This reduces the coefficient of friction during the running-in process and increases the rating life of the bearing.

3 Linear ball bearings of the compact range

3.1 Product design

With their small external dimensions, linear ball bearings of the compact range are particularly suitable for applications with limited installation space and for integration into customer-specific housings. They consist of a plastic cage with hardened steel raceway plates to guide the ball sets. The raceway plates of linear ball bearings LBBR are designed to utilize the full length of the load zone. This results in a very high load rating and a long rating life. All ball recirculations are designed to ensure low-friction and quiet operation.

Sealed linear ball bearings with integrated double lip seals retain the lubricant inside the linear ball bearing and provide optimal protection against external contamination. Sealed designs are lubricated for life and virtually maintenance free under normal ambient and operating conditions.

In applications requiring particularly low-friction linear guides, the linear ball bearings are protected against coarse contaminant particles by non-contact shields.

Additional axial fixation of linear ball bearings LBBR is not required, as the cage ensures the self-holding functionality of the bearings in a suitable housing and under normal conditions. Linear ball bearings LBBR are supplied with a factory pre-lubrication as standard, with the option of relubrication when installed in a suitable housing. For applications in corrosive or particularly harsh environments, the linear bearings are available with balls and raceway plates made of corrosion-resistant steel. In such cases, the suffix HV6 must be specified when ordering. The bearing dimensions correspond to dimension series 1 in accordance with ISO 10285.

39 Linear ball bearings of the compact range LBBR with double lip seal

001B6F3B

Characteristics and designs of linear ball bearings LBBR:

- sizes from 3 mm to 50 mm
- with factory pre-lubrication
- lubricated for life under normal operating conditions
- designs available with 2 double lip seals, 2 shields, or 1 double lip seal and 1 shield
- designs available in rolling bearing steel (standard) or corrosion-resistant steel
- self-holding in housing bores with tolerance J7 or J6
- bearing clearance or preload depends on the shaft and housing bore tolerances

3.2 Product tables

3.2.1 Explanations

(1)	–	Load direction for maximum static load ratings for all sizes and maximum dynamic load ratings for sizes 3 to 20 and 50
(2)	–	Load direction for maximum dynamic load ratings for sizes 25, 30, and 40. For these sizes, the load directions of the maximum static and maximum dynamic load ratings differ.
C	mm	Length
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
D	mm	Outside diameter
F_w	mm	Inscribed diameter of the ball set
m	kg	Mass
n_r	–	Number of ball rows

3.2.2 Linear ball bearings LBBR

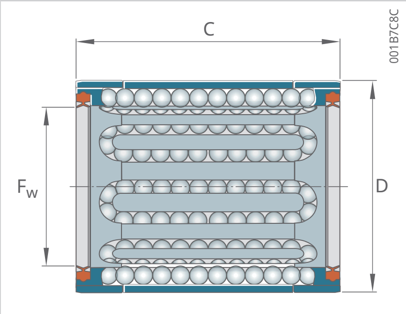
3

Designation [1) 2)]	m	F_w	D	C [3)]
–	kg	mm	mm	mm
LBBR 3	0.0007	3	7	10
LBBR 3-2LS	0.0007	3	7	10
LBBR 4	0.0010	4	8	12
LBBR 4-2LS	0.0010	4	8	12
LBBR 5	0.0020	5	10	15
LBBR 5-2LS	0.0020	5	10	15
LBBR 6 A	0.0060	6	12	22
LBBR 6 A-2LS	0.0060	6	12	22
LBBR 8	0.0070	8	15	24
LBBR 8-2LS	0.0070	8	15	24
LBBR 10	0.0110	10	17	26
LBBR 10-2LS	0.0110	10	17	26
LBBR 12	0.0120	12	19	28
LBBR 12-2LS	0.0120	12	19	28
LBBR 14	0.0130	14	21	28
LBBR 14-2LS	0.0130	14	21	28
LBBR 16	0.0180	16	24	30
LBBR 16-2LS	0.0180	16	24	30
LBBR 20	0.0210	20	28	30
LBBR 20-2LS	0.0210	20	28	30
LBBR 25	0.0470	25	35	40
LBBR 25-2LS	0.0470	25	35	40
LBBR 30	0.0700	30	40	50
LBBR 30-2LS	0.0700	30	40	50
LBBR 40	0.1300	40	52	60
LBBR 40-2LS	0.1300	40	52	60
LBBR 50	0.1800	50	62	70
LBBR 50-2LS	0.1800	50	62	70

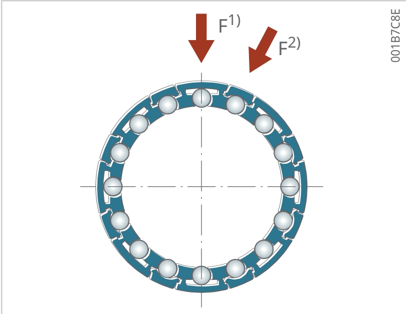
1) For LBBR 3, LBBR 4, LBBR 5: supplied with preservative and in packaging units composed of 4 bearings (suffix C004). Lubricate before installation.

2) For LBBR 6: lubricated with oil at the factory.

3) For LBBR 6: width 22 mm does not correspond to dimension series 1 in accordance with ISO 10285



LBBR with 2 double lip seals



LBBR with 2 double lip seals

3

n_r	C min.	C max.	C_0 min.	C_0 max.
–	N	N	N	N
4	60	67	44	63
4	60	67	44	63
4	75	85	60	85
4	75	85	60	85
4	170	193	129	183
4	170	193	129	183
4	335	390	270	380
4	335	390	270	380
4	490	560	355	500
4	490	560	355	500
5	585	695	415	600
5	585	695	415	600
5	695	815	510	750
5	695	815	510	750
5	710	850	530	765
5	710	850	530	765
5	930	1100	630	915
5	930	1100	630	915
6	1160	1220	800	1020
6	1160	1220	800	1020
7	2080	2120	1560	1800
7	2080	2120	1560	1800
8	3100	3150	2700	3050
8	3100	3150	2700	3050
8	5400	5500	4500	5000
8	5400	5500	4500	5000
9	6950	7100	6300	6950
9	6950	7100	6300	6950

4

4 Linear ball bearing units of the compact range

4.1 Product design

A combination of a linear bearing and a housing is referred to as a linear bearing unit. The housing defines the bearing clearance and is crucial to the linear functionality. Schaeffler offers various types of linear bearing units to meet the demand for flexible slide designs in terms of width and length through modular standard products.

Linear bearing units of the compact range consist of a linear bearing and an aluminum housing. These units are extremely compact, cost-effective, and lightweight. All linear bearing units are prelubricated at the factory and ready for operation. The combination of a factory pre-lubrication and integrated double lip seals allows the linear bearing units to operate under normal conditions without relubrication. For this reason, these compact units are not equipped with grease fittings for relubrication. If your application requires relubrication, please contact Schaeffler.

For corrosive or humid environments, Schaeffler offers various linear units fitted with linear ball bearings LBBR made from corrosion-resistant steel. These linear ball bearings are identified by the suffix HV6.

To complete the linear guide system, precision shafts and shaft blocks are also required ➤162|13 ➤176|14.

Characteristics and designs of linear bearing units:

- sizes from 12 mm to 50 mm, for flexible slide design
- units greased at the factory, lubricated for life under normal operating conditions
- available with double lip seal or shield for low friction
- linear ball bearings available in standard or corrosion-resistant design
- suitable for screw mounting from above or below
- optimized for mounting with hexagon socket head cap screws in accordance with ISO 4762

LUHR

- aluminum housing extending over the full bearing length

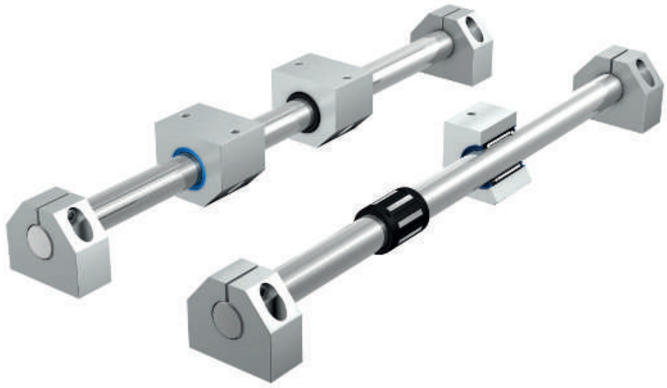
LUJR

- with 2 external shaft seals for harsh ambient conditions
- integrated bearing available in sealed design or with shield
- max. running speed 3 m/s

LTBR

- tandem aluminum housing with 2 integrated bearings

40 Linear bearing units of the compact range



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4.1.1 Linear ball bearing units of the compact range

Linear bearing units of the compact range LUHR and LUJR consist of a closed aluminum housing and an LBBR linear ball bearing with or without seals. Linear bearing units LUJR are identical in design to LUHR, but are fitted with 2 additional external shaft seals for applications with increased contamination exposure and therefore feature a longer housing.

41 Linear bearing units of the compact range LUHR

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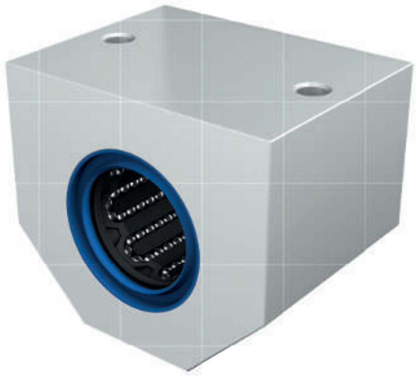
42 Linear bearing units of the compact range LUJR



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Linear bearing units LUHR and LUJR are suitable for constructing a wide range of flexible designs or compact linear slide configurations.

4.1.2 Tandem linear bearing units of the compact range

43 Tandem linear bearing units of the compact range LTBR

001B6F7E

Tandem linear bearing units of the compact range LTBR consist of 2 LBBR linear ball bearings mounted in an aluminum housing. Tandem linear bearing units with the suffix 2LS have double lip seals facing outward from the housing.

Units LTBR are particularly suitable for table or slide constructions of any width and can be mounted from above or below.

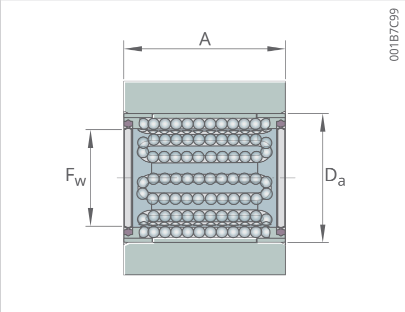
4.2 Product tables

4.2.1 Explanations

(1)	–	Load direction for max. load ratings
A	mm	Length
C	N	Basic dynamic load rating
C	mm	Length
C_0	N	Basic static load rating
D_a	mm	Bore diameter
F_w	mm	Inscribed diameter of the ball set
H	mm	Center height
H_1	mm	Height
H_2	mm	Height
H_3	mm	Height
J	mm	Distance
J_1	mm	Distance
L	mm	Width
m	kg	Mass
N	mm	Bore diameter
N_1	-	Thread size

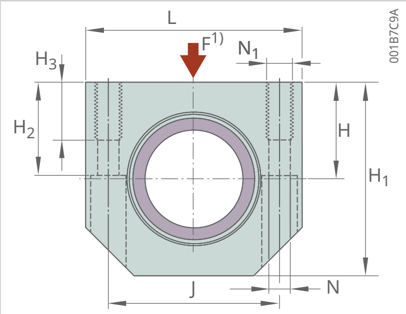
4.2.2 Linear bearing units LUHR

with linear ball bearings LBBR

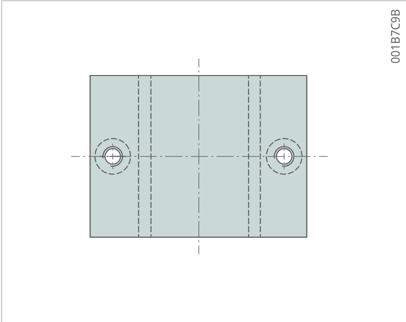


LUHR with double lip seals

Designation	m	F_w	A	D_a	H ±0.01	H_1	H_2	H_3
–	kg	mm	mm	mm	mm	mm	mm	mm
LUHR 12	0.08	12	28	19	17	33	16	11
LUHR 12-2LS	0.08	12	28	19	17	33	16	11
LUHR 16	0.10	16	30	24	19	38	18	11
LUHR 16-2LS	0.10	16	30	24	19	38	18	11
LUHR 20	0.14	20	30	28	23	45	22	13
LUHR 20-2LS	0.14	20	30	28	23	45	22	13
LUHR 25	0.25	25	40	35	27	54	26	18
LUHR 25-2LS	0.25	25	40	35	27	54	26	18
LUHR 30	0.37	30	50	40	30	60	29	18
LUHR 30-2LS	0.37	30	50	40	30	60	29	18
LUHR 40	0.74	40	60	52	39	76	38	22
LUHR 40-2LS	0.74	40	60	52	39	76	38	22
LUHR 50	1.19	50	70	62	47	92	46	26
LUHR 50-2LS	1.19	50	70	62	47	92	46	26



LUHR with double lip seals

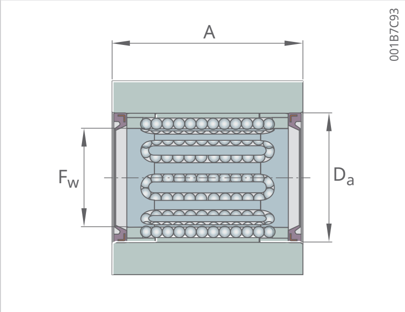


LUHR with double lip seals

L	J	N	N_1	C min.	C max.	C_0 min.	C_0 max.
mm	mm	mm	–	N	N	N	N
40	29	4.3	M5	695	815	510	750
40	29	4.3	M5	695	815	510	750
45	34	4.3	M5	930	1100	630	915
45	34	4.3	M5	930	1100	630	915
53	40	5.3	M6	1160	1220	800	1020
53	40	5.3	M6	1160	1220	800	1020
62	48	6.6	M8	2120	2080	1560	1800
62	48	6.6	M8	2120	2080	1560	1800
67	53	6.6	M8	3150	3100	2700	3050
67	53	6.6	M8	3150	3100	2700	3050
87	69	8.4	M10	5500	5400	4500	5000
87	69	8.4	M10	5500	5400	4500	5000
103	82	10.5	M12	6950	7100	6300	6950
103	82	10.5	M12	6950	7100	6300	6950

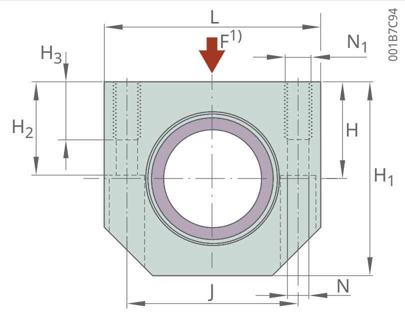
4.2.3 Linear bearing units LUJR

with linear ball bearings LBBR
with external shaft seals

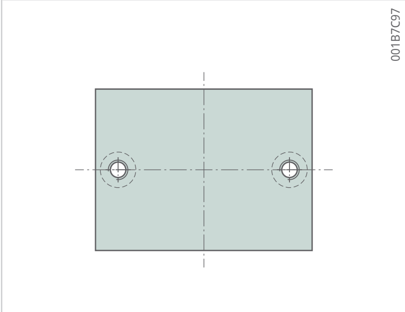


LUJR with shaft seals

Designation	m	F_w	A	D_a	H ±0.01	H_1	H_2	H_3
–	kg	mm	mm	mm	mm	mm	mm	mm
LUJR 12	0.1	12	35	19	17	33	16	11
LUJR 12-2LS	0.1	12	35	19	17	33	16	11
LUJR 16	0.12	16	37	24	19	38	18	11
LUJR 16-2LS	0.12	16	37	24	19	38	18	11
LUJR 20	0.18	20	39	28	23	45	22	13
LUJR 20-2LS	0.18	20	39	28	23	45	22	13
LUJR 25	0.3	25	49	35	27	54	26	18
LUJR 25-2LS	0.3	25	49	35	27	54	26	18
LUJR 30	0.44	30	59	40	30	60	29	18
LUJR 30-2LS	0.44	30	59	40	30	60	29	18
LUJR 40	0.86	40	71	52	39	76	38	22
LUJR 40-2LS	0.86	40	71	52	39	76	38	22
LUJR 50	1.37	50	81	62	47	92	46	26
LUJR 50-2LS	1.37	50	81	62	47	92	46	26



LUJR with shaft seals



LUJR with shaft seals

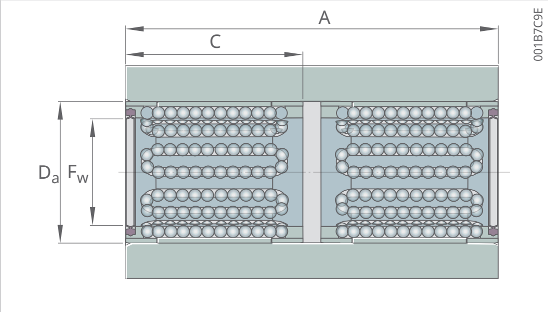
4

L	J	N	N_1	C	C	C_0	C_0
				min.	max.	min.	max.
mm	mm	mm	–	N	N	N	N
40	29	4.3	M5	695	815	510	750
40	29	4.3	M5	695	815	510	750
45	34	4.3	M5	930	1100	630	915
45	34	4.3	M5	930	1100	630	915
53	40	5.3	M6	1160	1220	800	1020
53	40	5.3	M6	1160	1220	800	1020
62	48	6.6	M8	2120	2080	1560	1800
62	48	6.6	M8	2120	2080	1560	1800
67	53	6.6	M8	3150	3100	2700	3050
67	53	6.6	M8	3150	3100	2700	3050
87	69	8.4	M10	5500	5400	4500	5000
87	69	8.4	M10	5500	5400	4500	5000
103	82	10.5	M12	6950	7100	6300	6950
103	82	10.5	M12	6950	7100	6300	6950

4.2.4 Tandem units LTBR

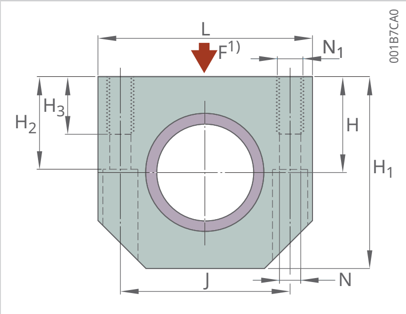
with linear ball bearings LBBR

4

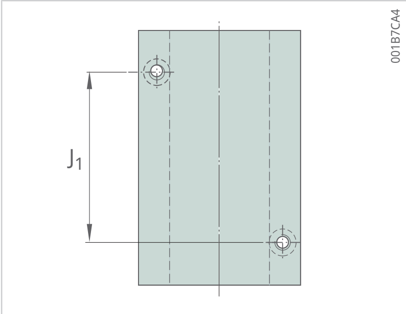


LTBR with 2 double lip seals

Designation	m	F_w	A	C	D_a	H ±0.01	H_1	H_2	H_3
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LTBR 12	0.17	12	60	28	19	17	33	16	11
LTBR 12-2LS	0.17	12	60	28	19	17	33	16	11
LTBR 16	0.22	16	65	30	24	19	38	18	11
LTBR 16-2LS	0.22	16	65	30	24	19	38	18	11
LTBR 20	0.31	20	65	30	28	23	45	22	13
LTBR 20-2LS	0.31	20	65	30	28	23	45	22	13
LTBR 25	0.54	25	85	40	35	27	54	26	18
LTBR 25-2LS	0.54	25	85	40	35	27	54	26	18
LTBR 30	0.8	30	105	50	40	30	60	29	18
LTBR 30-2LS	0.8	30	105	50	40	30	60	29	18
LTBR 40	1.57	40	125	60	52	39	76	38	22
LTBR 40-2LS	1.57	40	125	60	52	39	76	38	22
LTBR 50	2.51	50	145	70	62	47	92	46	26
LTBR 50-2LS	2.51	50	145	70	62	47	92	46	26



LTBR



LTBR

4

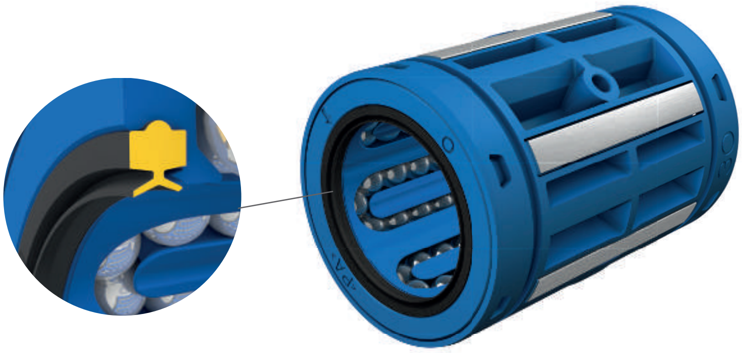
J	J_1	L	N	N_1	C	C	C_0	C_0
					min	max	min	max
mm	mm	mm	mm	–	N	N	N	N
29	35	40	4.3	M5	1140	1340	1020	1500
29	35	40	4.3	M5	1140	1340	1020	1500
34	40	45	4.3	M5	1530	1800	1270	1830
34	40	45	4.3	M5	1530	1800	1270	1830
40	45	53	5.3	M6	1900	2000	1600	2040
40	45	53	5.3	M6	1900	2000	1600	2040
48	55	62	6.6	M8	3450	3400	3150	3600
48	55	62	6.6	M8	3450	3400	3150	3600
53	70	67	6.6	M8	5200	5100	5400	6100
53	70	67	6.6	M8	5200	5100	5400	6100
69	85	87	8.4	M10	9000	8800	9000	10000
69	85	87	8.4	M10	9000	8800	9000	10000
82	100	103	10.5	M12	11400	11600	12700	14000
82	100	103	10.5	M12	11400	11600	12700	14000

5 Linear ball bearings of the standard range

5.1 Product design

5.1.1 Linear ball bearings of the standard range in closed design

44 Linear ball bearings of the standard range LBCR in D-design with double lip seal



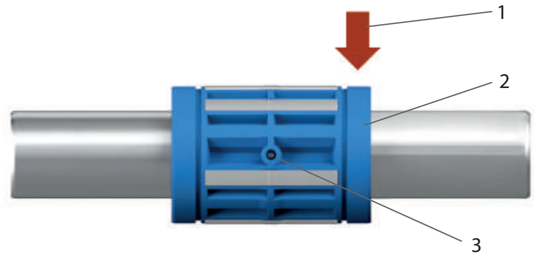
001B6FAB

45 Linear ball bearings of the standard range LBCR in A-design with double lip seal

001C3F09

Linear ball bearings of the standard range LBCR are designed for high loads, featuring optimized raceway length and precise osculation. The straight raceway plates make these bearings ideal for linear bearing applications requiring high rigidity. Bearings LBCR consist of a plastic cage with hardened steel raceway plates, balls, and seals. The cage design and ball recirculation elements are optimized for low-friction and quiet operation, and are virtually maintenance free. Within the diameter range from 5 mm to 80 mm, Schaeffler offers the bearings in either the A-design (black) or the D-design (blue). For harsh environments, each bearing in the standard range is also available in a corrosion-resistant steel design. This is indicated by the suffix HV6 in the bearing designation. The linear bearings are prelubricated at the factory, and sizes 12 mm to 80 mm feature a lubrication port for direct relubrication into the bearing interior. All LBCR bearings correspond to the dimensions of dimension series 3 in accordance with ISO 10285. The operating clearance is determined by the housing and the shaft tolerance. When installed in a slotted housing, the clearance can be adjusted to meet the machine's requirements. Linear ball bearings LBCR must be axially fixed either using grease fittings or retaining rings in accordance with DIN 471. All LBCR bearings are available with double lip seals or non-contact shields. Bearings with the suffix LS are equipped with one shield and one seal on the right-hand side.

46 Position of the double lip seal on linear ball bearings LBCR..-LS



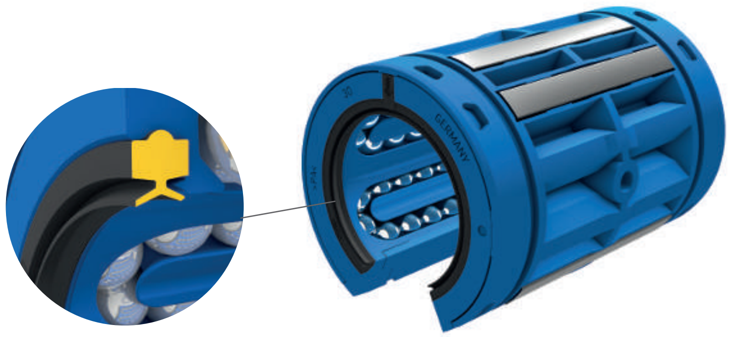
1	Main load direction	2	Right-hand side
3	Lubrication port		

Characteristics and designs of linear ball bearings of the standard range LBCR in closed design:

- sizes from 5 mm to 80 mm
- straight raceway plates to accommodate high loads
- designs available with 2 double lip seals, 2 shields, or 1 double lip seal and 1 shield
- designs available in rolling bearing steel (standard) or corrosion-resistant steel
- with factory pre-lubrication
- ready for operation
- bearing clearance or preload depends on the shaft and housing bore tolerances; adjustable when slotted housings are used
- suitable grease fittings for axial fixation ➤44 | 1.10.3

5.1.2 Linear ball bearings of the standard range in open design

47 Linear ball bearings of the standard range LBCT in D-design with double lip seal



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48 Linear ball bearings of the standard range LBCT in A-design with double lip seal

001C3F0B

Linear ball bearings of the standard range LBCT are open designs used in constructions with supported shafts. They are particularly suitable for applications involving long linear travel distances, where closed designs reach their limits due to shaft deflection. The straight raceway plates provide high rigidity. The bearings feature a longitudinal gap seal to prevent the ingress of contaminants.

When installed in suitable housings, the bearing clearance can be adjusted. Open linear ball bearings LBCT must be fixed to prevent axial and radial movement within the housing.

Characteristics and designs of linear ball bearings of the standard range LBCT in open design:

- sizes from 12 mm to 80 mm
- open design for long travel distances combined with supported shafts
- straight raceway plates to accommodate high loads
- designs available with 2 double lip seals, 2 shields, or 1 double lip seal and 1 shield
- designs available in rolling bearing steel (standard) or corrosion-resistant steel

- with factory pre-lubrication
- ready for operation
- bearing clearance or preload depends on the shaft and housing bore tolerances; adjustable
- suitable grease fittings for axial fixation ➤44 | 1.10.3

5.2 Product tables

5.2.1 Explanations

(1)	–	Load direction for max. load ratings
b	mm	Groove width
C	mm	Length
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
C_1	mm	Distance of grooves
D	mm	Outside diameter
E	mm	Width of cutout
F_w	mm	Inscribed diameter of the ball set
m	kg	Mass
n_r	–	Number of ball rows
α	°	Opening angle

5.2.2 Linear ball bearings

LBCR

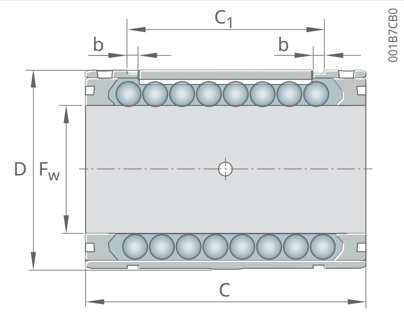
closed

5

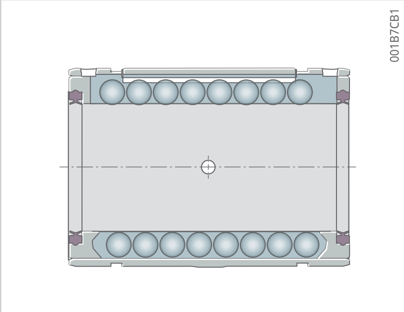
Designation [1) 2)]	m	F_w	D	C	C_1
–	kg	mm	mm	mm	mm
LBCR 5	0.005	5	12	22	14.2
LBCR 5-2LS	0.005	5	12	22	14.2
LBCR 8	0.009	8	16	25	16.2
LBCR 8-2LS	0.009	8	16	25	16.2
LBCR 12 D	0.020	12	22	32	22.6
LBCR 12 D-2LS	0.020	12	22	32	22.6
LBCR 16 D	0.026	16	26	36	24.6
LBCR 16 D-2LS	0.026	16	26	36	24.6
LBCR 20 D	0.056	20	32	45	31.2
LBCR 20 D-2LS	0.056	20	32	45	31.2
LBCR 25 D	0.108	25	40	58	43.7
LBCR 25 D-2LS	0.108	25	40	58	43.7
LBCR 30 D	0.168	30	47	68	51.7
LBCR 30 D-2LS	0.168	30	47	68	51.7
LBCR 40 D	0.323	40	62	80	60.3
LBCR 40 D-2LS	0.323	40	62	80	60.3
LBCR 50 A	0.460	50	75	100	78.5
LBCR 50 A-2LS	0.460	50	75	100	78.5
LBCR 60 A	0.820	60	90	125	102.1
LBCR 60 A-2LS	0.820	60	90	125	102.1
LBCR 80 A	1.900	80	120	165	133
LBCR 80 A-2LS	1.900	80	120	165	133

1) For LBCR 5: lubricated with oil at the factory

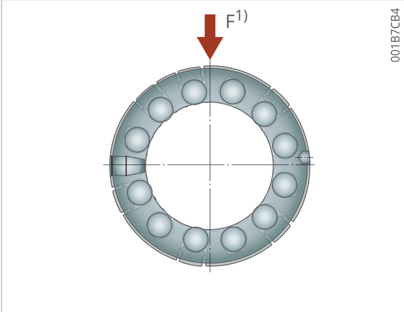
2) For LBCR 5, LBCR 8: no fixing bore or lubrication port



LBCR D with shields



LBCR D with 2 double lip seals



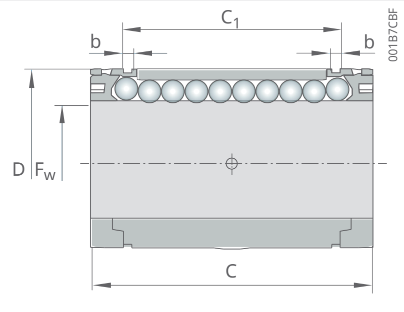
LBCR D

b	n_r	C	C	C_0	C_0
min.		min.	max.	min.	max.
mm	–	N	N	N	N
1.1	4	280	320	210	300
1.1	4	280	320	210	300
1.1	4	490	570	355	500
1.1	4	490	570	355	500
1.3	5	930	1370	695	1120
1.3	5	930	1370	695	1120
1.3	5	1080	1600	800	1290
1.3	5	1080	1600	800	1290
1.6	6	2200	3250	1630	2650
1.6	6	2200	3250	1630	2650
1.85	6	3100	4550	2360	3800
1.85	6	3100	4550	2360	3800
1.85	6	4800	7100	3550	5700
1.85	6	4800	7100	3550	5700
2.15	6	7650	11200	5100	8300
2.15	6	7650	11200	5100	8300
2.65	7	9650	13400	7200	12200
2.65	7	9650	13400	7200	12200
3.15	7	14600	20400	11200	18000
3.15	7	14600	20400	11200	18000
4.15	7	26500	37500	19600	32000
4.15	7	26500	37500	19600	32000

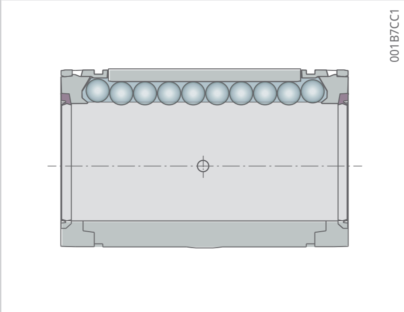
5.2.3 Linear ball bearings
LBCT
open design

5

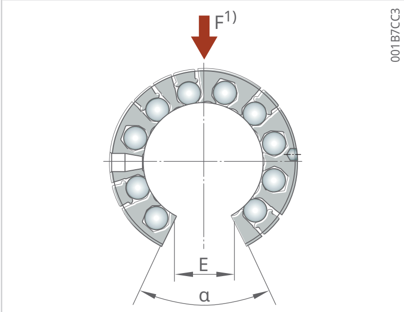
Designation	m	F_w	D	C	C_1	b
						min.
–	kg	mm	mm	mm	mm	mm
LBCT 12 D	0.016	12	22	32	22.6	1.3
LBCT 12 D-2LS	0.016	12	22	32	22.6	1.3
LBCT 16 D	0.020	16	26	36	24.6	1.3
LBCT 16 D-2LS	0.020	16	26	36	24.6	1.3
LBCT 20 D	0.046	20	32	45	31.2	1.6
LBCT 20 D-2LS	0.046	20	32	45	31.2	1.6
LBCT 25 D	0.090	25	40	58	43.7	1.85
LBCT 25 D-2LS	0.090	25	40	58	43.7	1.85
LBCT 30 D	0.142	30	47	68	51.7	1.85
LBCT 30 D-2LS	0.142	30	47	68	51.7	1.85
LBCT 40 A	0.230	40	62	80	60.3	2.15
LBCT 40 A-2LS	0.230	40	62	80	60.3	2.15
LBCT 50 A	0.390	50	75	100	78.5	2.65
LBCT 50 A-2LS	0.390	50	75	100	78.5	2.65
LBCT 60 A	0.720	60	90	125	102.1	3.15
LBCT 60 A-2LS	0.720	60	90	125	102.1	3.15
LBCT 80 A	1.670	80	120	165	133	4.15
LBCT 80 A-2LS	1.670	80	120	165	133	4.15



LBCT D with shields



LBCT D with 2 double lip seals



LBCT D

5

E	α	n_r	C	C	C_0	C_0
			min.	max.	min.	max.
mm	°	–	N	N	N	N
7.6	78	4	695	1220	510	1020
7.6	78	4	695	1220	510	1020
10.4	78	4	765	1500	585	1370
10.4	78	4	765	1500	585	1370
10.8	60	5	1860	3200	1340	2700
10.8	60	5	1860	3200	1340	2700
13.2	60	5	2700	4650	2000	4000
13.2	60	5	2700	4650	2000	4000
14.2	50	5	4150	7200	3000	6000
14.2	50	5	4150	7200	3000	6000
18.7	50	6	3900	9000	3550	8150
18.7	50	6	3900	9000	3550	8150
23.6	50	6	5850	13400	5300	12200
23.6	50	6	5850	13400	5300	12200
29.6	54	6	8650	20400	8000	18000
29.6	54	6	8650	20400	8000	18000
38.4	54	6	16000	37500	14000	32000
38.4	54	6	16000	37500	14000	32000

6 Linear ball bearing units of the standard range

6.1 Product design

A comprehensive range of linear bearing units fitted with linear ball bearings from the standard range is available for the flexible design of slide assemblies. These units are the ideal choice for applications requiring flexibility in shaft spacing and slide length. A simpler slide structure can be achieved using tandem units with 2 bearings. A flanged bearing unit is also available, providing additional mounting options.

6

All open and closed units, with the exception of the flanged bearing units, are made of aluminum. These high precision units have been structurally optimized to ensure high strength and rigidity. Linear bearing units LUCR, LUCS, and LUCT made of die-cast material have a very low weight, minimizing acceleration forces and inertia forces. For applications that require preload, slotted designs are available. In open linear ball bearing units with single bearings, the preload can be adjusted.

All linear bearing units are lubricated at the factory and ready for operation. To provide maximum design flexibility, all linear bearing units can be fitted with linear ball bearings made of bearing steel or corrosion-resistant steel, and are available with either seals or shields. Depending on the diameter, the closed and open units are fitted with linear ball bearings of either the A-design or the D-design.

To complete the linear guide system, precision shafts and shaft blocks are also required ➤162|13 ➤176|14.

Characteristics and designs of linear bearing units:

- lightweight housing made of die-cast aluminum (LUCR, LUCS, LUCT)
- straight raceway plates to accommodate high loads
- available with 2 double lip seals or 2 shields
- available in bearing steel (standard) or corrosion-resistant steel
- with factory pre-lubrication
- ready for operation
- with grease fitting
- suitable for screw mounting from above or below
- optimized for mounting with hexagon socket head cap screws in accordance with ISO 4762

LUCR

- closed design

LUCS

- slotted design for adjusting the bearing clearance

LVCR

- flanged housing with flexible screw mounting facility from the front of the flange or the rear
- high rigidity due to cast-iron housing

LTCR

- tandem unit
- aluminum housing with 2 bearings mounted in series

LUCT

- open design, adjustable operating clearance

6.1.1 Linear ball bearing units of the standard range in closed design

Linear ball bearing units of the standard range LUCR provide flexible design options for the construction of linear slides. With their very low weight, they are ideal for applications involving low mass inertia and high accelerations. Linear ball bearing units LUCR are available for shaft diameters from 8 mm to 80 mm and are fitted with non-self-aligning linear ball bearings LBCR. The units are lubricated at the factory and can be relubricated via the grease fitting if required. The grease fitting also serves to secure the bearing in the housing. An exception applies to the 8 mm linear bearing unit, where the bearings are axially retained using retaining rings.

49 Linear bearing units LUCR

6.1.2 Linear ball bearing units of the standard range with slotted housing

Linear bearing units of the standard range LUCS are structurally identical to the LUCR bearing units. In these units, the operating clearance or preload can be adjusted via the slotted housing. However, this adjustment must be carried out with the utmost care, as it can affect the service life.

Linear bearing units LUCS for shaft diameters from 8 mm to 80 mm are fitted with non-self-aligning linear ball bearings LBCR.

The units are lubricated at the factory and can be relubricated via the grease fitting if required. The grease fitting also serves to secure the bearing in the housing. An exception applies to the 8 mm linear bearing unit, where the bearings are axially retained using retaining rings.

50 Linear bearing units LUCS with slotted housing

001B701E

6.1.3 Linear ball bearing units of the standard range with closed flanged housing

Linear bearing units with flanged housing LVCR provide flexible mounting options. The closed flanged housing of these bearing units is made of cast iron. Flanged units LVCR are available for shaft diameters from 12 mm to 80 mm and are fitted with non-self-aligning linear bearings LBCR.

Each linear ball bearing is axially fixed in the housing by a pin. The flange is machined on both sides, allowing the linear bearing unit to be mounted from either the front or rear face. Linear bearing units with flanged housings are lubricated at the factory and cannot be relubricated.

51 Linear bearing units with closed flanged housing LVCR

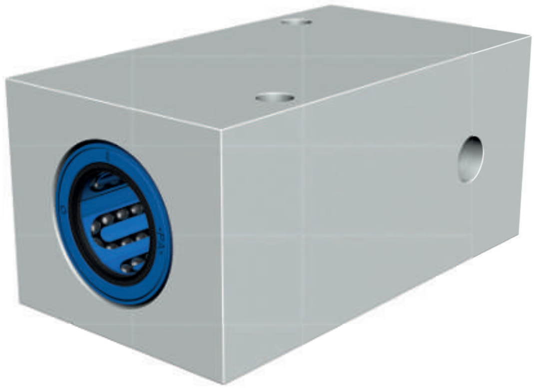
001B707B

6.1.4 Tandem linear bearing units of the standard range

Closed tandem linear bearing units LTCR consist of a solid aluminum housing with 2 linear ball bearings of the standard range LBCR mounted in series. Tandem linear bearing units are ideal for linear guide systems of any required width. The units' mounting surface can be bolted from top or bottom side using suitable screws, and are available for shaft diameters from 12 mm to

50 mm. Tandem units are lubricated at the factory and can be relubricated via the grease fitting if required, which also serves to secure the bearing axially and against rotation. Tandem linear bearing units with the suffix 2LS have double lip seals facing outward from the housing.

52 Tandem linear bearing units LTCR



001B7095

6.1.5 Linear ball bearing units of the standard range in open design

Linear bearing units of the standard range LUCT are open designs and are intended for applications with supported shafts operating under high loads and with long travel distances. Linear bearing units LUCT are available for shaft diameters from 12 mm to 80 mm and are fitted with non-self-aligning linear ball bearings LBCT. The units are lubricated at the factory and can be relubricated via the grease fitting if required. The grease fitting also serves to secure the bearing in the housing. In addition, the bearing clearance can be adjusted via the hexagon socket screw located near the housing opening.

53 Linear bearing units LUCT in open design

001B702A

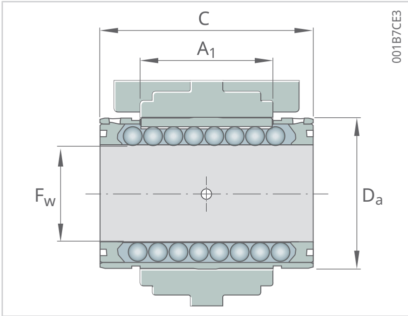
6.2 Product tables

6.2.1 Explanations

(1)	–	Load direction for max. load ratings
A	mm	Length
A_1	mm	Length
C	mm	Length
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
D_2	mm	Diameter of centering collar
D_a	mm	Bore diameter
E	mm	Width of cutout
F_w	mm	Inscribed diameter of the ball set
H	mm	Center height
H_1	mm	Height
H_2	mm	Height
H_3	mm	Height
J	mm	Distance
J_1	mm	Distance
J_2	mm	Distance
L	mm	Width
m	kg	Mass
N	mm	Bore diameter
N_1	-	Thread size
N_2	mm	Bore diameter
α	°	Opening angle

6.2.2 Linear bearing units LUCR

with linear ball bearings LBCR



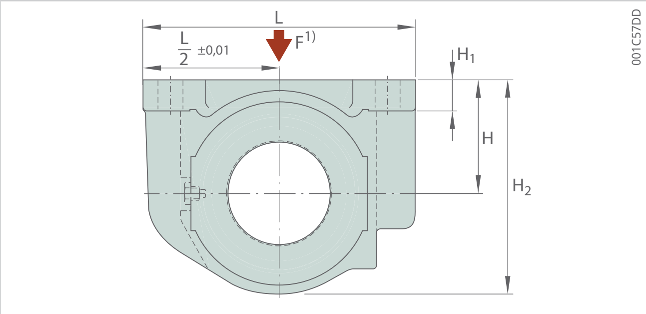
LUCR

6

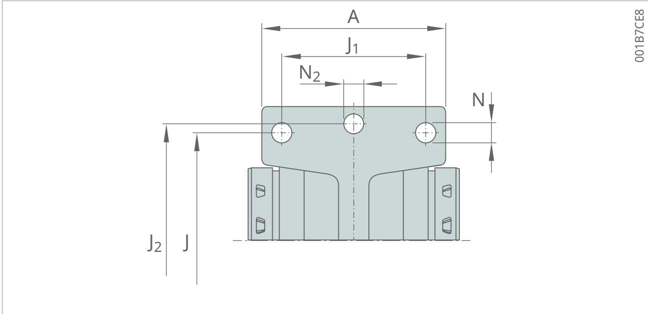
Designation [1]	m	F_w	A	A_1	C	D_a	H ±0.01	H_1	H_2
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LUCR 8	0.027	8	27.0	14	25	16	15	6	28
LUCR 8-2LS	0.027	8	27.0	14	25	16	15	6	28
LUCR 12 D	0.058	12	31.0	20	32	22	18	6	35
LUCR 12 D-2LS	0.058	12	31.0	20	32	22	18	6	35
LUCR 16 D	0.076	16	34.5	22	36	26	22	7	41
LUCR 16 D-2LS	0.076	16	34.5	22	36	26	22	7	41
LUCR 20 D	0.157	20	41.0	28	45	32	25	8	48
LUCR 20 D-2LS	0.157	20	41.0	28	45	32	25	8	48
LUCR 25 D	0.308	25	52.0	40	58	40	30	10	58
LUCR 25 D-2LS	0.308	25	52.0	40	58	40	30	10	58
LUCR 30 D	0.450	30	59.0	48	68	47	35	10	67
LUCR 30 D-2LS	0.450	30	59.0	48	68	47	35	10	67
LUCR 40 D	0.799	40	74.0	56	80	62	45	12	85
LUCR 40 D-2LS	0.799	40	74.0	56	80	62	45	12	85
LUCR 50	1.215	50	66.0	72	100	75	50	14	99
LUCR 50-2LS	1.215	50	66.0	72	100	75	50	14	99
LUCR 60	2.160	60	84.0	95	125	90	60	18	118
LUCR 60-2LS	2.160	60	84.0	95	125	90	60	18	118
LUCR 80	5.155	80	113.0	125	165	120	80	22	158
LUCR 80-2LS	5.155	80	113.0	125	165	120	80	22	158

1) For size 8: fixation by means of retaining rings in accordance with DIN 471, no lubrication port

2) For sizes 50 to 80: tolerance L/2 ± 0.02



LUCR

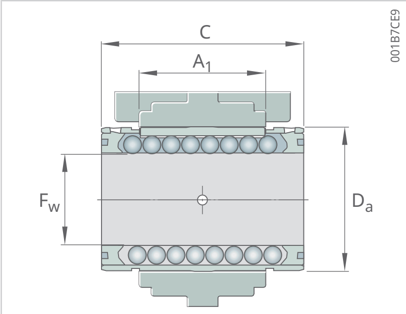


LUCR

J	J_1	J_2	L 2)	N	N_2	C	C	C_0	C_0
						min.	max.	min.	max.
mm	mm	mm	mm	mm	mm	N	N	N	N
25	20	35	45	3.2	5.3	490	570	355	500
25	20	35	45	3.2	5.3	490	570	355	500
32	23	42	52	4.3	5.3	930	1370	695	1120
32	23	42	52	4.3	5.3	930	1370	695	1120
40	26	46	56	4.3	5.3	1080	1600	800	1290
40	26	46	56	4.3	5.3	1080	1600	800	1290
45	32	58	70	4.3	6.4	2200	3250	1630	2650
45	32	58	70	4.3	6.4	2200	3250	1630	2650
60	40	68	80	5.3	6.4	3100	4550	2360	3800
60	40	68	80	5.3	6.4	3100	4550	2360	3800
68	45	76	88	6.4	6.4	4800	7100	3550	5700
68	45	76	88	6.4	6.4	4800	7100	3550	5700
86	58	94	108	8.4	8.4	7650	11200	5100	8300
86	58	94	108	8.4	8.4	7650	11200	5100	8300
108	50	116	135	8.4	10.5	9650	13400	7200	12200
108	50	116	135	8.4	10.5	9650	13400	7200	12200
132	65	138	160	10.5	13.0	14600	20400	11200	18000
132	65	138	160	10.5	13.0	14600	20400	11200	18000
170	90	180	205	13.0	13.0	26500	37500	19600	32000
170	90	180	205	13.0	13.0	26500	37500	19600	32000

6.2.3 Linear bearing units LUCS

with linear ball bearings LBCR
Adjustable operating clearance



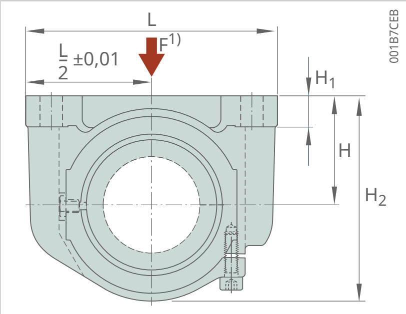
LUCS

6

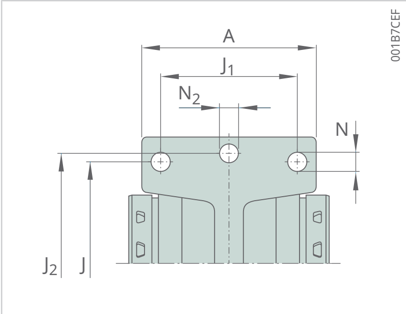
Designation [1]	m	F_w	A	A_1	C	D_a	H	H_1	H_2
							±0.01		
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LUCS 8	0.028	8	27	14	25	16	15	6	28
LUCS 8-2LS	0.028	8	27	14	25	16	15	6	28
LUCS 12 D	0.058	12	31	20	32	22	18	6	35
LUCS 12 D-2LS	0.058	12	31	20	32	22	18	6	35
LUCS 16 D	0.077	16	35	22	36	26	22	7	41
LUCS 16 D-2LS	0.077	16	35	22	36	26	22	7	41
LUCS 20 D	0.160	20	41	28	45	32	25	8	48
LUCS 20 D-2LS	0.160	20	41	28	45	32	25	8	48
LUCS 25 D	0.310	25	52	40	58	40	30	10	58
LUCS 25 D-2LS	0.310	25	52	40	58	40	30	10	58
LUCS 30 D	0.452	30	59	48	68	47	35	10	67
LUCS 30 D-2LS	0.452	30	59	48	68	47	35	10	67
LUCS 40 D	0.795	40	74	56	80	62	45	12	85
LUCS 40 D-2LS	0.795	40	74	56	80	62	45	12	85
LUCS 50	1.217	50	66	72	100	75	50	14	99
LUCS 50-2LS	1.217	50	66	72	100	75	50	14	99
LUCS 60	2.191	60	84	95	125	90	60	18	118
LUCS 60-2LS	2.191	60	84	95	125	90	60	18	118
LUCS 80	5.110	80	113	125	165	120	80	22	158
LUCS 80-2LS	5.110	80	113	125	165	120	80	22	158

1) For size 8: fixation by means of retaining rings in accordance with DIN 471, no lubrication port

2) For sizes 50 to 80: tolerance L/2 ± 0.02



LUCS



LUCS

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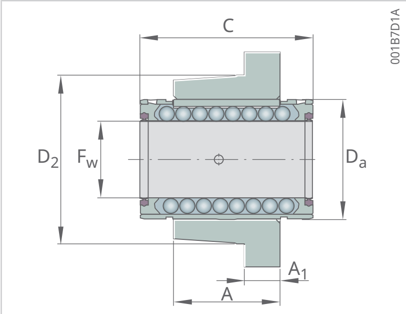
J	J_1	J_2	L 2)	N	N_2	C	C	C_0	C_0
						min.	max.	min.	max.
mm	mm	mm	mm	mm	mm	N	N	N	N
25	20	35	45	3.2	5.3	490	570	355	500
25	20	35	45	3.2	5.3	490	570	355	500
32	23	42	52	4.3	5.3	930	1370	695	1120
32	23	42	52	4.3	5.3	930	1370	695	1120
40	26	46	56	4.3	5.3	1080	1600	800	1290
40	26	46	56	4.3	5.3	1080	1600	800	1290
45	32	58	70	4.3	6.4	2200	3250	1630	2650
45	32	58	70	4.3	6.4	2200	3250	1630	2650
60	40	68	80	5.3	6.4	3100	4550	2360	3800
60	40	68	80	5.3	6.4	3100	4550	2360	3800
68	45	76	88	6.4	6.4	4800	7100	3550	5700
68	45	76	88	6.4	6.4	4800	7100	3550	5700
86	58	94	108	8.4	8.4	7650	11200	5100	8300
86	58	94	108	8.4	8.4	7650	11200	5100	8300
108	50	116	135	8.4	10.5	9650	13400	7200	12200
108	50	116	135	8.4	10.5	9650	13400	7200	12200
132	65	138	160	10.5	13.0	14600	20400	11200	18000
132	65	138	160	10.5	13.0	14600	20400	11200	18000
170	90	180	205	13.0	13.0	26500	37500	19600	32000
170	90	180	205	13.0	13.0	26500	37500	19600	32000

6

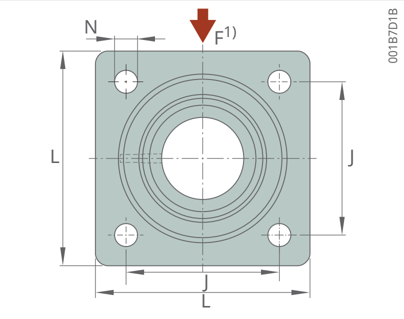
6.2.4 Flanged units LVCR

with linear ball bearings LBCR



LVCR with 2 double lip seals

Designation	m	F_w	A	A_1	C	D_a	D_2 0 -0.5
–	kg	mm	mm	mm	mm	mm	mm
LVCR 12	0.117	12	20	8	32	22	32
LVCR 12 D-2LS	0.117	12	20	8	32	22	32
LVCR 16 D	0.171	16	22	8	36	26	38
LVCR 16 D-2LS	0.171	16	22	8	36	26	38
LVCR 20 D	0.326	20	28	10	45	32	46
LVCR 20 D-2LS	0.326	20	28	10	45	32	46
LVCR 25 D	0.676	25	40	12	58	40	58
LVCR 25 D-2LS	0.676	25	40	12	58	40	58
LVCR 30 D	1.032	30	48	14	68	47	66
LVCR 30 D-2LS	1.032	30	48	14	68	47	66
LVCR 40 D	1.973	40	56	16	80	62	90
LVCR 40 D-2LS	1.973	40	56	16	80	62	90
LVCR 50	3.294	50	72	18	100	75	110
LVCR 50-2LS	3.294	50	72	18	100	75	110
LVCR 60	5.920	60	95	22	125	90	135
LVCR 60-2LS	5.920	60	95	22	125	90	135
LVCR 80	13.300	80	125	25	165	120	180
LVCR 80-2LS	13.300	80	125	25	165	120	180



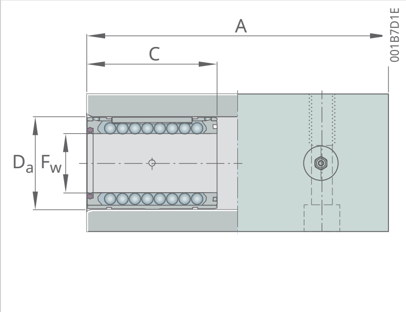
LVCR with 2 double lip seals

6

J	L	N	C	C	C_0	C_0
			min.	max.	min.	max.
mm	mm	mm	N	N	N	N
30	42	5.5	930	1370	695	1120
30	42	5.5	930	1370	695	1120
35	50	5.5	1080	1600	800	1290
35	50	5.5	1080	1600	800	1290
42	60	6.6	2200	3250	1630	2650
42	60	6.6	2200	3250	1630	2650
54	74	6.6	3100	4550	2360	3800
54	74	6.6	3100	4550	2360	3800
60	84	9.0	4800	7100	3550	5700
60	84	9.0	4800	7100	3550	5700
78	108	11.0	7650	11200	5100	8300
78	108	11.0	7650	11200	5100	8300
98	130	11.0	9650	13400	7200	12200
98	130	11.0	9650	13400	7200	12200
120	160	13.5	14600	20400	11200	18000
120	160	13.5	14600	20400	11200	18000
155	200	13.5	26500	37500	19600	32000
155	200	13.5	26500	37500	19600	32000

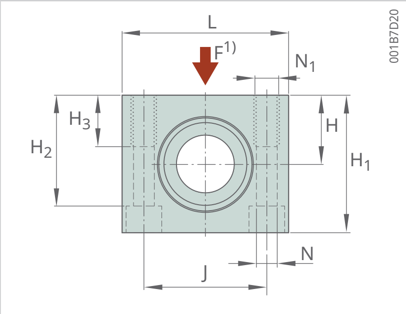
6.2.5 Tandem units LTCR

with linear ball bearings LBCR

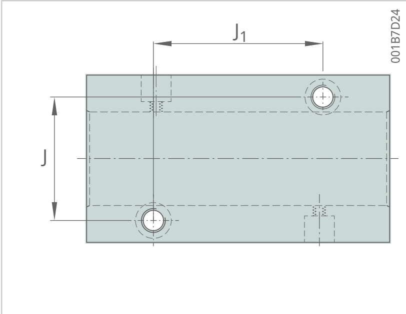


LTCR with 2 double lip seals

Designation	m	F_w	A	C	D_a	H ±0.01	H_1	H_2	H_3
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LTCR 12 D	0.248	12	76	32	22	18	35.0	27.0	13
LTCR 12 D-2LS	0.248	12	76	32	22	18	35.0	27.0	13
LTCR 16 D	0.387	16	84	36	26	22	41.5	33.0	13
LTCR 16 D-2LS	0.387	16	84	36	26	22	41.5	33.0	13
LTCR 20 D	0.696	20	104	45	32	25	49.5	39.5	18
LTCR 20 D-2LS	0.696	20	104	45	32	25	49.5	39.5	18
LTCR 25 D	1.282	25	130	58	40	30	59.5	47.0	22
LTCR 25 D-2LS	1.282	25	130	58	40	30	59.5	47.0	22
LTCR 30 D	1.942	30	152	68	47	35	69.5	55.0	26
LTCR 30 D-2LS	1.942	30	152	68	47	35	69.5	55.0	26
LTCR 40 D	3.683	40	176	80	62	45	89.5	71.0	34
LTCR 40 D-2LS	3.683	40	176	80	62	45	89.5	71.0	34
LTCR 50	5.970	50	224	100	75	50	99.5	81.0	34
LTCR 50-2LS	5.970	50	224	100	75	50	99.5	81.0	34



LTCR



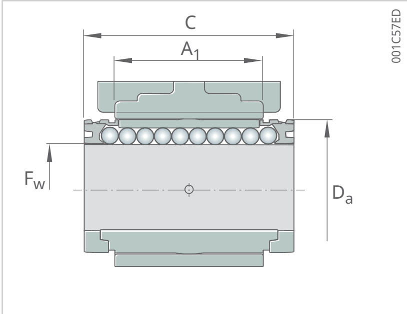
LTCR

6

J	J1	L	N	N1	C	C	C0	C0
					min.	max.	min.	max.
mm	mm	mm	mm	–	N	N	N	N
30	40	42	5.3	M6	1500	2240	1400	2240
30	40	42	5.3	M6	1500	2240	1400	2240
36	45	50	5.3	M6	1760	2600	1600	2600
36	45	50	5.3	M6	1760	2600	1600	2600
45	55	60	6.4	M8	3550	5300	3250	5300
45	55	60	6.4	M8	3550	5300	3250	5300
54	70	74	8.4	M10	5000	7350	4750	7650
54	70	74	8.4	M10	5000	7350	4750	7650
62	85	84	10.5	M12	7800	11600	7100	11400
62	85	84	10.5	M12	7800	11600	7100	11400
80	100	108	13.0	M16	12500	18300	10200	16600
80	100	108	13.0	M16	12500	18300	10200	16600
100	125	130	13.0	M16	15600	21600	14300	24500
100	125	130	13.0	M16	15600	21600	14300	24500

6.2.6 Linear bearing units LUCT

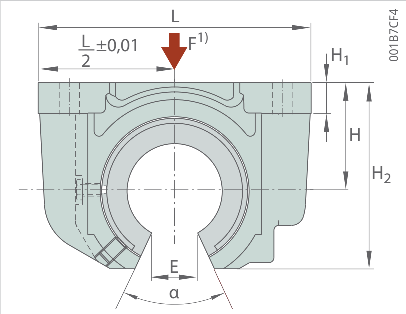
with linear ball bearings LBCT
open design



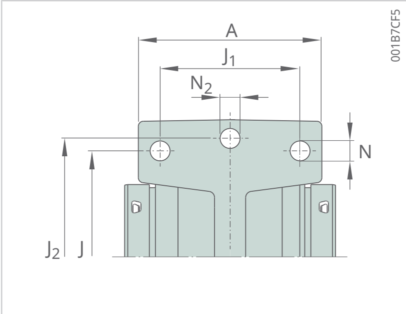
LUCT

Designation	m	F_w	A	A_1	C	D_a	H	H_1	H_2
							±0.01		
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LUCT 12 D	0.050	12	31	20	32	22	18	6	28
LUCT 12 D-2LS	0.050	12	31	20	32	22	18	6	28
LUCT 16 D	0.065	16	35	22	36	26	22	7	35
LUCT 16 D-2LS	0.065	16	35	22	36	26	22	7	35
LUCT 20 D	0.138	20	41	28	45	32	25	8	42
LUCT 20 D-2LS	0.138	20	41	28	45	32	25	8	42
LUCT 25 D	0.269	25	52	40	58	40	30	10	51
LUCT 25 D-2LS	0.269	25	52	40	58	40	30	10	51
LUCT 30 D	0.396	30	59	48	68	47	35	10	60
LUCT 30 D-2LS	0.396	30	59	48	68	47	35	10	60
LUCT 40	0.639	40	74	56	80	62	45	12	77
LUCT 40-2LS	0.639	40	74	56	80	62	45	12	77
LUCT 50	1.055	50	66	72	100	75	50	14	88
LUCT 50-2LS	1.055	50	66	72	100	75	50	14	88
LUCT 60	1.903	60	84	95	125	90	60	18	105
LUCT 60-2LS	1.903	60	84	95	125	90	60	18	105
LUCT 80	4.531	80	113	125	165	120	80	22	140
LUCT 80-2LS	4.531	80	113	125	165	120	80	22	140

[1] For sizes 50 to 80: tolerance L/2 ± 0.02



LUCT



LUCT

J	J_1	J_2	L [1]	N	N_2	E	α	C	C	C_0	C_0
								min.	max.	min.	max.
mm	mm	mm	mm	mm	mm	mm	°	N	N	N	N
32	23	42	52	4.3	5.3	7.6	78	695	1220	510	1020
32	23	42	52	4.3	5.3	7.6	78	695	1220	510	1020
40	26	46	56	4.3	5.3	10.4	78	765	1500	585	1370
40	26	46	56	4.3	5.3	10.4	78	765	1500	585	1370
45	32	58	70	4.3	6.4	10.8	60	1860	3200	1340	2700
45	32	58	70	4.3	6.4	10.8	60	1860	3200	1340	2700
60	40	68	80	5.3	6.4	13.2	60	2700	4650	2000	4000
60	40	68	80	5.3	6.4	13.2	60	2700	4650	2000	4000
68	45	76	88	6.4	6.4	14.2	50	4150	7200	3000	6000
68	45	76	88	6.4	6.4	14.2	50	4150	7200	3000	6000
86	58	94	108	8.4	8.4	18.7	50	3900	9000	3550	8150
86	58	94	108	8.4	8.4	18.7	50	3900	9000	3550	8150
108	50	116	135	8.4	10.5	23.6	50	5850	13400	5300	12200
108	50	116	135	8.4	10.5	23.6	50	5850	13400	5300	12200
132	65	138	160	10.5	13.0	29.6	54	8650	20400	8000	18000
132	65	138	160	10.5	13.0	29.6	54	8650	20400	8000	18000
170	90	180	205	13.0	13.0	38.4	54	16000	37500	14000	32000
170	90	180	205	13.0	13.0	38.4	54	16000	37500	14000	32000

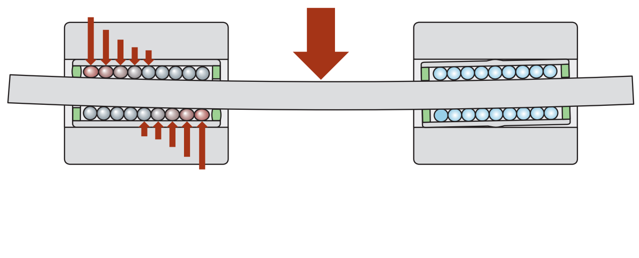
7 Linear ball bearings of the standard range, self-aligning

7.1 Product design

Both open and closed designs are available as self-aligning linear ball bearings. Improperly machined mounting surfaces, misaligned shafts, or shaft deflection under high loads can cause internal stresses when the linear bearing system is screwed into place. In such cases, the use of self-aligning linear ball bearings of series LBCD and LBCF is recommended.

7

54 Self-aligning linear bearings



These bearings feature raceway plates with a special profile on the outside. A ground spherical elevation in the center of the raceway plate allows the bearing to tilt by up to ±30'. Self-aligning bearings can significantly reduce both the load conditions and noise generation in many applications. This minimizes peak loads and ultimately extends the rating life of the bearing while lowering maintenance costs.

To ensure effective sealing of the linear bearing, the outside diameter of the cage is slightly reduced. This allows the bearing, including its seals, to follow the tilt concentrically around the shaft. Self-aligning bearings have already proven their effective sealing performance and low-friction operation in numerous applications.

7.1.1 Linear ball bearings of the standard range in closed design

Linear ball bearings of the standard range LBCD are the self-aligning design of the closed linear ball bearing in the standard range LBCR. The self-aligning raceway plate compensates for misalignments of up to ±30', while the bearing seal maintains optimum contact with the shaft.

Linear ball bearings LBCD are suitable for applications requiring quiet linear motion and smooth running.

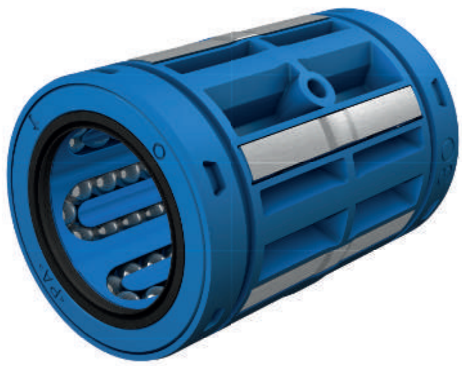
As with linear ball bearings LBCR, the operating clearance is determined by the housing and the shaft tolerance, while in slotted housings it can be adjusted to meet the specific machine requirements. Linear ball bearings LBCD must be axially fixed either using grease fittings or retaining rings in accordance with DIN 471.

Characteristics and designs of linear ball bearings LBCD:

- sizes from 12 mm to 50 mm
- tilting angle of ±30' (self-aligning)
- designs available with 2 double lip seals, 2 shields, or 1 seal and 1 shield

- designs available in rolling bearing steel (standard) or corrosion-resistant steel
- with factory pre-lubrication
- ready for operation
- bearing clearance or preload depends on the shaft and housing bore tolerances; adjustable when slotted housings are used
- suitable grease fittings for axial fixation ➤44 | 1.10.3

55 Linear ball bearings of the standard range LBCD in D-design, self-aligning, with double lip seal



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56 Linear ball bearings of the standard range LBCD, in A-design, self-aligning, with double lip seal

001C3F07

7.1.2 Linear ball bearings of the standard range in open design

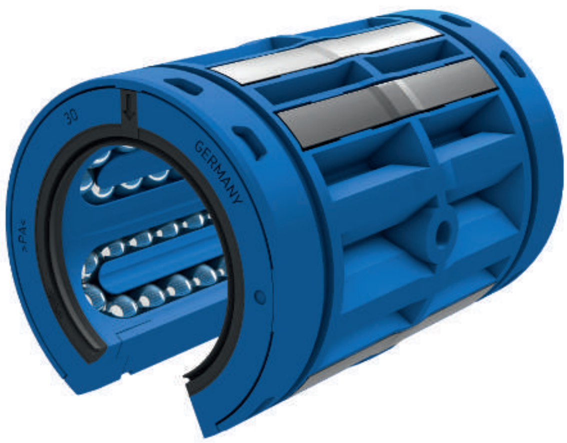
Linear ball bearings of the standard range LBCF are the self-aligning version of linear ball bearing LBCT in open design. Capable of compensating misalignments of up to ±30' they are ideal for applications requiring quiet linear motion and smooth running. When used with supported shafts, the linear slides can achieve an almost unlimited stroke. Design LBCF is available in sizes from 12 mm to 50 mm.

When installed in suitable housings, the bearing clearance can be adjusted. Open linear ball bearings of the type LBCF must be fixed to prevent axial and radial movement within the housing. This can be achieved using grease fittings.

Characteristics and designs of linear ball bearings LBCF:

- sizes from 12 mm to 80 mm
- open design for long travel distances combined with supported shafts
- straight raceway plates to accommodate high loads
- designs available with 2 double lip seals, 2 shields, or 1 double lip seal and 1 shield
- designs available in rolling bearing steel (standard) or corrosion-resistant steel
- with factory pre-lubrication
- ready for operation
- bearing clearance or preload depends on the shaft and housing bore tolerances; adjustable
- suitable grease fittings for axial fixation ➤44|1.10.3

57 Linear ball bearings of the standard range LBCF in D-design, self-aligning, with double lip seal



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58 Linear ball bearings of the standard range LBCF, in A-design, self-aligning, with double lip seal

001C3F08

7.2 Product tables

7.2.1 Explanations

(1)	–	Load direction for max. load ratings
b	mm	Groove width
C	mm	Length
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
C_1	mm	Distance of grooves
D	mm	Outside diameter
E	mm	Width of cutout
F_w	mm	Inscribed diameter of the ball set
m	kg	Mass
n_r	–	Number of ball rows
α	°	Opening angle

7.2.2 Linear ball bearings

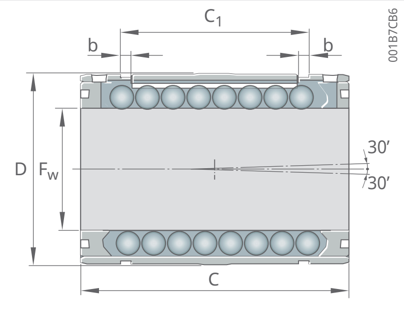
LBCD

self-aligning

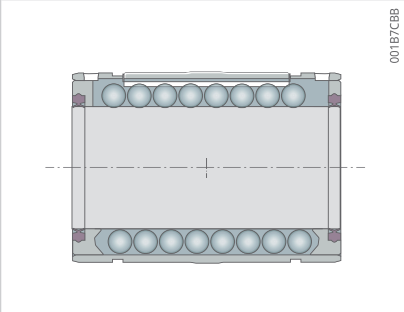
closed

7

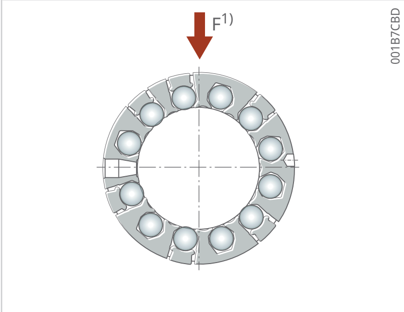
Designation	m	F_w	D	C	C_1
–	kg	mm	mm	mm	mm
LBCD 12 D	0.020	12	22	32	22.6
LBCD 12 D-2LS	0.020	12	22	32	22.6
LBCD 16 D	0.025	16	26	36	24.6
LBCD 16 D-2LS	0.025	16	26	36	24.6
LBCD 20 D	0.055	20	32	45	31.2
LBCD 20 D-2LS	0.055	20	32	45	31.2
LBCD 25 D	0.106	25	40	58	43.7
LBCD 25 D-2LS	0.106	25	40	58	43.7
LBCD 30 D	0.166	30	47	68	51.7
LBCD 30 D-2LS	0.166	30	47	68	51.7
LBCD 40 D	0.316	40	62	80	60.3
LBCD 40 D-2LS	0.316	40	62	80	60.3
LBCD 50 A	0.440	50	75	100	78.5
LBCD 50 A-2LS	0.440	50	75	100	78.5



LBCD D with shields



LBCD D with 2 double lip seals



LBCD D

b	n_r	C	C	C_0	C_0
min.		min.	max.	min.	max.
mm	–	N	N	N	N
1.3	5	800	1220	570	930
1.3	5	800	1220	570	930
1.3	5	950	1400	655	1060
1.3	5	950	1400	655	1060
1.6	6	1730	2550	1120	1800
1.6	6	1730	2550	1120	1800
1.85	6	2600	3800	1430	2320
1.85	6	2600	3800	1430	2320
1.85	6	3800	5600	2320	3750
1.85	6	3800	5600	2320	3750
2.15	6	6550	9650	3350	5700
2.15	6	6550	9650	3350	5700
2.65	7	8000	11200	4150	6950
2.65	7	8000	11200	4150	6950

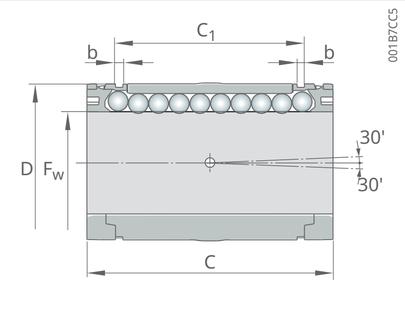
7.2.3 Linear ball bearings LBCF

self-aligning

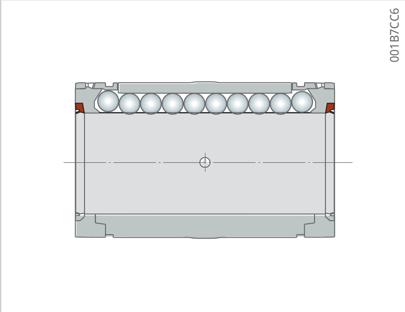
open design

7

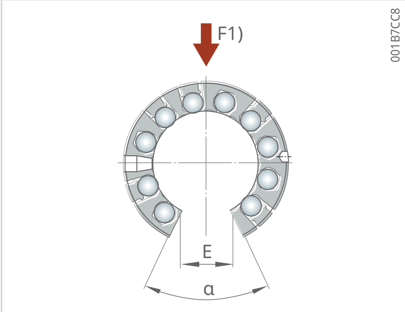
Designation	m	F_w	D	C	C_1	b
						min.
–	kg	mm	mm	mm	mm	mm
LBCF 12 D	0.016	12	22	32	22.6	1.3
LBCF 12 D-2LS	0.016	12	22	32	22.6	1.3
LBCF 16 D	0.020	16	26	36	24.6	1.3
LBCF 16 D-2LS	0.020	16	26	36	24.6	1.3
LBCF 20 D	0.045	20	32	45	31.2	1.6
LBCF 20 D-2LS	0.045	20	32	45	31.2	1.6
LBCF 25 D	0.088	25	40	58	43.7	1.85
LBCF 25 D-2LS	0.088	25	40	58	43.7	1.85
LBCF 30 D	0.140	30	47	68	51.7	1.85
LBCF 30 D-2LS	0.140	30	47	68	51.7	1.85
LBCF 40 A	0.220	40	62	80	60.3	2.15
LBCF 40 A-2LS	0.220	40	62	80	60.3	2.15
LBCF 50 A	0.370	50	75	100	78.5	2.65
LBCF 50 A-2LS	0.370	50	75	100	78.5	2.65



LBCF D with shields



LBCF D with 2 double lip seals



LBCF D

E	α	n_r	C	C	C_0	C_0
			min.	max.	min.	max.
mm	°	–	N	N	N	N
7.6	78	4	600	1080	415	850
7.6	78	4	600	1080	415	850
10.4	78	4	670	1320	480	1120
10.4	78	4	670	1320	480	1120
10.8	60	5	1460	2500	915	1830
10.8	60	5	1460	2500	915	1830
13.2	60	5	2280	3900	1220	2450
13.2	60	5	2280	3900	1220	2450
14.2	50	5	3250	5700	1960	3900
14.2	50	5	3250	5700	1960	3900
18.7	50	6	3380	7800	2280	5200
18.7	50	6	3380	7800	2280	5200
23.6	50	6	4900	11200	3000	6950
23.6	50	6	4900	11200	3000	6950

8 Linear ball bearing units of the standard range, self-aligning

8.1 Product design

A comprehensive range of linear bearing units fitted with self-aligning linear ball bearings from the standard range is available for the flexible design of slide assemblies. These units are the ideal choice for applications requiring flexibility in shaft spacing and slide length. A simpler slide structure can be achieved using tandem units with 2 bearings. A flanged bearing unit is also available, providing additional mounting options.

8

All open and closed units, with the exception of the flanged bearing units, are made of aluminum. These high precision units have been structurally optimized to ensure high strength and rigidity. Linear bearing units LUCD, LUCE, and LUCF made of die-cast material have a very low weight, minimizing acceleration forces and inertia forces. For applications that require preload, slotted designs are available. In open linear ball bearing units with single bearings, the preload can be adjusted.

All linear bearing units are lubricated at the factory and ready for operation. To provide maximum design flexibility, all linear bearing units can be fitted with linear ball bearings made of bearing steel or corrosion-resistant steel, and are available with either seals or shields. Depending on the diameter, the closed and open units are fitted with linear ball bearings of either the A-design or the D-design.

To complete the linear guide system, precision shafts and shaft blocks are also required ➤162|13 ➤176|14.

Characteristics and designs of linear bearing units:

- lightweight housing made of die-cast aluminum (LUCD, LUCE, LUCF)
- versions with aluminum housings available (LUND, LUNE, LUNF)
- tilting angle of ±30' (self-aligning)
- available with 2 double lip seals or 2 shields
- available in rolling bearing steel (standard) or corrosion-resistant steel
- with factory pre-lubrication
- ready for operation
- with grease fitting
- suitable for screw mounting from above or below
- optimized for mounting with hexagon socket head cap screws in accordance with ISO 4762

LUCD, LUND

- closed design

LUCE, LUNE

- slotted design for adjusting the bearing clearance

LVCD

- flanged housing with flexible screw mounting from the front of the flange or the rear
- high rigidity due to cast iron housing

LTCD

- Tandem unit
- aluminum housing with 2 bearings mounted in series

LUCF, LUNF

- open design, adjustable bearing clearance

LTCF

- Tandem unit in open design
- aluminum housing with 2 bearings mounted in series

8.1.1 Linear ball bearing units of the standard range in closed design

8

Linear bearing units of the standard range LUCD provide flexible design options for the construction of linear slides. With their very low weight, they are ideal for applications involving low mass inertia and high accelerations.

Linear bearing units LUCD for shaft diameters from 8 mm to 50 mm are fitted with self-aligning linear ball bearings LBCD.

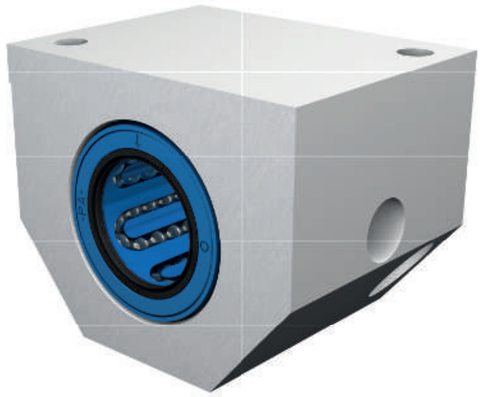
The units are lubricated at the factory and can be relubricated via the grease fitting if required. The grease fitting also serves to fix the bearing in the housing.

59 Linear bearing units LUCD

001B7014

In contrast to linear bearing units of the standard range LUCD with die-cast housings, linear bearing units LUND feature an aluminum housing that encloses the linear bearing along its entire length. Linear bearing units LUND are available for shaft diameters from 12 mm to 50 mm and are fitted with self-aligning linear ball bearings LBCD. To facilitate alignment, both linear bearing units feature a reference side with tight tolerances.

60 Linear bearing units with aluminum housing LUND



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8.1.2 Linear ball bearing units of the standard range with slotted housing

Linear bearing units of the standard range LUCE are structurally identical to the LUCD bearing units. In these units, the operating clearance or preload can be adjusted via the slotted housing. However, this adjustment must be carried out with the utmost care, as it can affect the service life.

Linear bearing units LUCE for shaft diameters from 12 mm to 50 mm are fitted with self-aligning linear ball bearings LBCD.

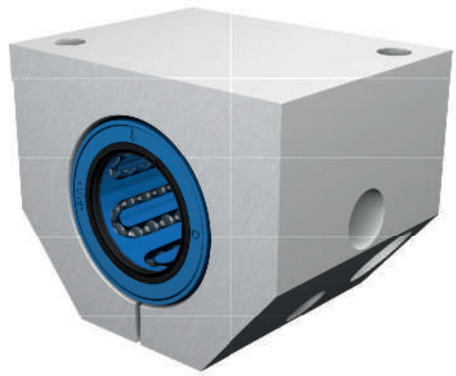
The units are lubricated at the factory and can be relubricated via the grease fitting if required. The grease fitting also serves to fix the bearing in the housing.

61 Linear bearing units LUCE with slotted housing

001B701E

In contrast to linear bearing units of the standard range LUCE with die-cast housings, linear bearing units LUNE feature an aluminum housing that encloses the linear bearing along its entire length. Linear bearing units LUNE are available for shaft diameters from 12 mm to 50 mm and are fitted with self-aligning linear ball bearings LBCD. To facilitate alignment, both linear bearing units feature a reference side with tight tolerances.

62 Linear bearing units with aluminum housing LUNE, slotted



001B704F

8.1.3 Linear ball bearing units of the standard range with closed flanged housing

Linear bearing units with flanged housing LVCD provide flexible mounting options. The closed flanged housing of these bearing units is made of cast iron. Flanged units LVCD are available for shaft diameters from 12 mm to 50 mm and are fitted with self-aligning linear ball bearings LBCD.

Each linear ball bearing is axially fixed in the housing by a pin. The flange is machined on both sides, allowing the linear bearing unit to be mounted from either the front or rear face. Linear bearing units with flanged housings are lubricated at the factory and cannot be relubricated.

63 Linear bearing units with closed flanged housing LVCD

001B707B

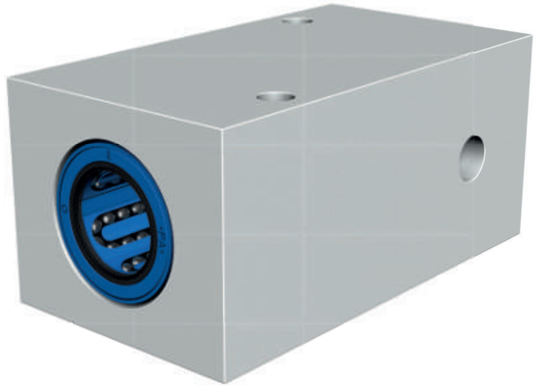
8.1.4 Tandem linear bearing units of the standard range

Tandem linear bearing units LTCD consist of a solid aluminum housing with 2 self-aligning linear ball bearings of the standard range LBCD. Tandem linear units are ideal for linear guide systems of any required width. The units' mounting surface can be bolted from top or bottom side using suitable screws, and are available for shaft diameters from 12 mm to 50 mm.

Tandem linear bearing units are lubricated at the factory and can be relubricated via the grease fitting if required, which also serves to secure the bearing axially and against rotation.

Tandem linear bearing units with the suffix 2LS have double lip seals facing outward from the housing.

64 Tandem linear bearing units LTCD



001B7095

8.1.5 Linear ball bearing units of the standard range in open design

Linear bearing units of the standard range LUCF and LUNF are open designs and are intended for applications with supported shafts operating under high loads and with long travel distances.

Linear bearing units LUCF are available for shaft diameters from 12 mm to 50 mm and are fitted with self-aligning linear ball bearings LBCF.

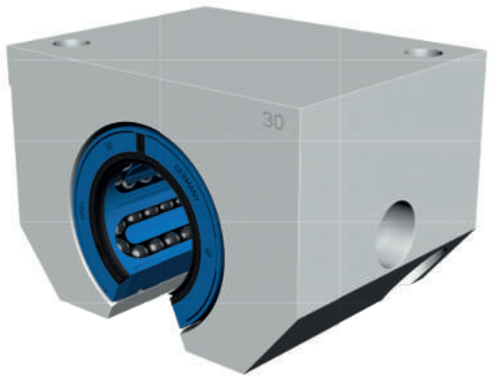
The units are lubricated at the factory and can be relubricated via the grease fitting if required. The grease fitting also serves to fix the bearing in the housing. In addition, the bearing clearance can be adjusted via the hexagon socket screw located near the segment cutout.

65 Linear bearing units LUCF in open design

001B702A

In contrast to linear bearing units of the standard range LUCF with die-cast housings, linear bearing units LUNF feature an aluminum housing that encloses the linear bearing along its entire length. Linear bearing units LUNF are available for shaft diameters from 12 mm to 50 mm and are fitted with self-aligning linear ball bearings LBCF. To facilitate alignment, both linear bearing units feature a reference side with tight tolerances.

66 Linear bearing units with aluminum housing LUNF in open design



001B706B

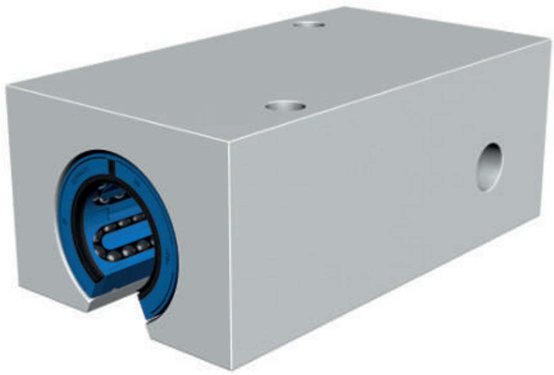
8.1.6 Tandem linear bearing units of the standard range in open design

Open tandem linear bearing units LTCF consist of a solid aluminum housing and 2 self-aligning linear ball bearings of the standard range LBCF. Tandem linear units are ideal for linear guide systems of any required width. The units' mounting surface can be bolted from top or bottom side using suitable screws, and are available for shaft diameters from 12 mm to 50 mm.

Tandem linear bearing units are lubricated at the factory and can be relubricated via the grease fitting if required, which also serves to secure the bearing axially and against rotation.

Tandem linear bearing units with the suffix 2LS have double lip seals facing outward from the housing.

67 Tandem linear bearing units LTCF



001B70A0

8

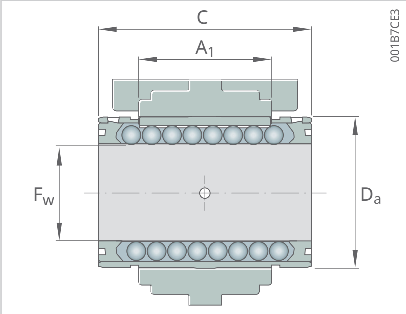
8.2 Product tables

8.2.1 Explanations

(1)	–	Load direction for max. load ratings
A	mm	Length
A_1	mm	Length
C	mm	Length
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
D_2	mm	Diameter of centering collar
D_a	mm	Bore diameter
E	mm	Width of cutout
F_w	mm	Inscribed diameter of the ball set
H	mm	Center height
H_1	mm	Height
H_2	mm	Height
H_3	mm	Height
H_4	mm	Height of locating edge
J	mm	Distance
J_1	mm	Distance
J_2	mm	Distance
L	mm	Width
m	kg	Mass
N	mm	Bore diameter
N_1	-	Thread size
N_2	mm	Bore diameter
α	°	Opening angle

8.2.2 Linear bearing units LUCD

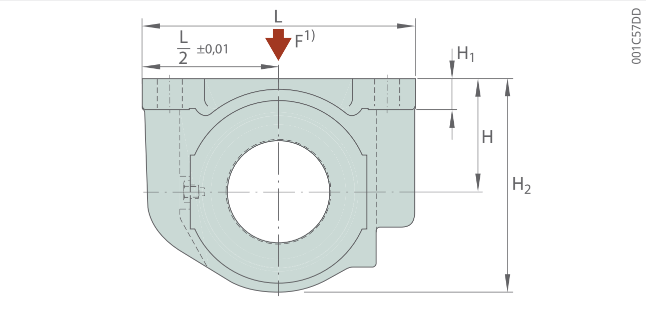
with self-aligning linear ball bearings LBCD



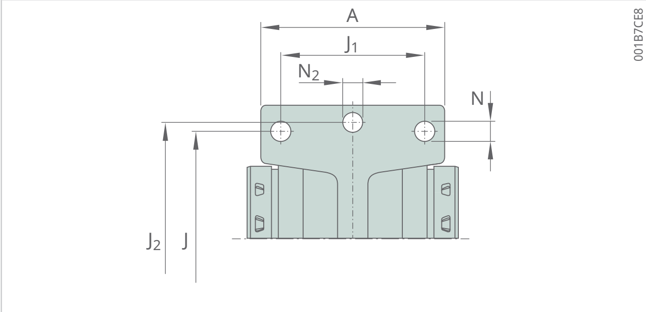
LUCD

Designation	m	F_w	A	A_1	C	D_a	H ±0.01	H_1	H_2
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LUCD 12 D	0.058	12	31.0	20	32	22	18	6	35
LUCD 12 D-2LS	0.058	12	31.0	20	32	22	18	6	35
LUCD 16 D	0.075	16	34.5	22	36	26	22	7	41
LUCD 16 D-2LS	0.075	16	34.5	22	36	26	22	7	41
LUCD 20 D	0.156	20	41.0	28	45	32	25	8	48
LUCD 20 D-2LS	0.156	20	41.0	28	45	32	25	8	48
LUCD 25 D	0.306	25	52.0	40	58	40	30	10	58
LUCD 25 D-2LS	0.306	25	52.0	40	58	40	30	10	58
LUCD 30 D	0.448	30	59.0	48	68	47	35	10	67
LUCD 30 D-2LS	0.448	30	59.0	48	68	47	35	10	67
LUCD 40 D	0.792	40	74.0	56	80	62	45	12	85
LUCD 40 D-2LS	0.792	40	74.0	56	80	62	45	12	85
LUCD 50	1.195	50	66.0	72	100	75	50	14	99
LUCD 50-2LS	1.195	50	66.0	72	100	75	50	14	99

[1] For sizes 50 to 80: tolerance L/2 ± 0.02



LUCD



LUCD

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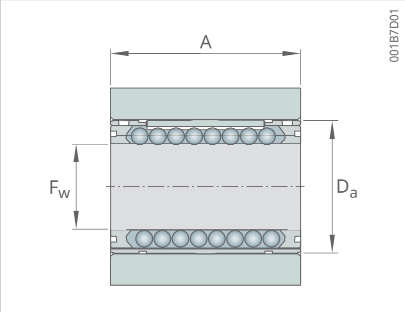
J	J_1	J_2	L [1]	N	N_2	C	C	C_0	C_0
						min.	max.	min.	max.
mm	mm	mm	mm	mm	mm	N	N	N	N
32	23	42	52	4.3	5.3	800	1220	570	930
32	23	42	52	4.3	5.3	800	1220	570	930
40	26	46	56	4.3	5.3	950	1400	655	1060
40	26	46	56	4.3	5.3	950	1400	655	1060
45	32	58	70	4.3	6.4	1730	2550	1120	1800
45	32	58	70	4.3	6.4	1730	2550	1120	1800
60	40	68	80	5.3	6.4	2600	3800	1430	2320
60	40	68	80	5.3	6.4	2600	3800	1430	2320
68	45	76	88	6.4	6.4	3800	5600	2320	3750
68	45	76	88	6.4	6.4	3800	5600	2320	3750
86	58	94	108	8.4	8.4	6550	9650	3350	5700
86	58	94	108	8.4	8.4	6550	9650	3350	5700
108	50	116	135	8.4	10.5	8000	11200	4150	6950
108	50	116	135	8.4	10.5	8000	11200	4150	6950

8.2.3 Linear bearing units LUND

with self-aligning linear ball bearings LBCD



LUND

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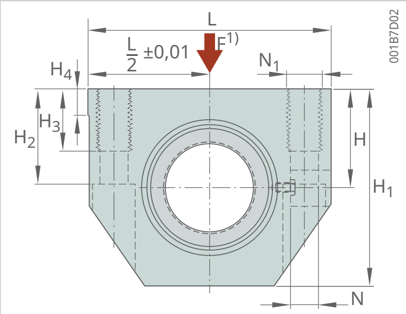
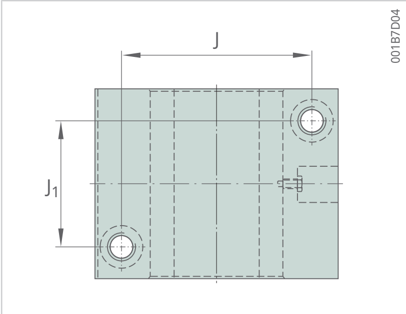
Designation	m	F_w	A	D_a	H	H_1	H_2	H_3	H_4
					±0.01				
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LUND 12 D	0.100	12	32	22	18	35	16.5	11	6.0
LUND 12 D-2LS	0.100	12	32	22	18	35	16.5	11	6.0
LUND 16 D	0.169	16	37	26	22	42	21.0	13	7.0
LUND 16 D-2LS	0.169	16	37	26	22	42	21.0	13	7.0
LUND 20 D	0.272	20	45	32	25	50	24.0	18	7.5
LUND 20 D-2LS	0.272	20	45	32	25	50	24.0	18	7.5
LUND 25 D	0.552	25	58	40	30	61	29.0	22	8.5
LUND 25 D-2LS	0.552	25	58	40	30	61	29.0	22	8.5
LUND 30 D	0.825	30	68	47	35	70	34.0	22	9.5
LUND 30 D-2LS	0.825	30	68	47	35	70	34.0	22	9.5
LUND 40 D	1.494	40	80	62	45	90	44.0	26	11.0
LUND 40 D-2LS	1.494	40	80	62	45	90	44.0	26	11.0
LUND 50	2.478	50	100	75	50	105	49.0	35	11.0
LUND 50-2LS	2.478	50	100	75	50	105	49.0	35	11.0



LUND



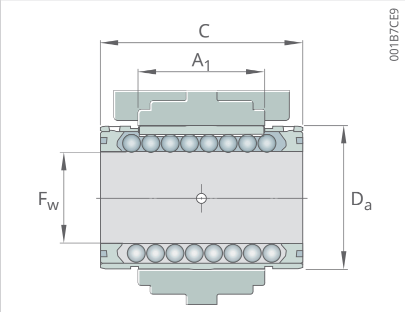
LUND

J	J1	L	N	N1	C	C	C0	C0
					min.	max.	min.	max.
mm	mm	mm	mm	–	N	N	N	N
32	23	43	4.3	M5	800	1220	570	930
32	23	43	4.3	M5	800	1220	570	930
40	26	53	5.3	M6	950	1400	655	1060
40	26	53	5.3	M6	950	1400	655	1060
45	32	60	6.6	M8	1730	2550	1120	1800
45	32	60	6.6	M8	1730	2550	1120	1800
60	40	78	8.4	M10	2600	3800	1430	2320
60	40	78	8.4	M10	2600	3800	1430	2320
68	45	87	8.4	M10	3800	5600	2320	3750
68	45	87	8.4	M10	3800	5600	2320	3750
86	58	108	10.5	M12	6550	9650	3350	5700
86	58	108	10.5	M12	6550	9650	3350	5700
108	50	132	13.5	M16	8000	11200	4150	6950
108	50	132	13.5	M16	8000	11200	4150	6950

8.2.4 Linear bearing units LUCE

with self-aligning linear ball bearings LBCD

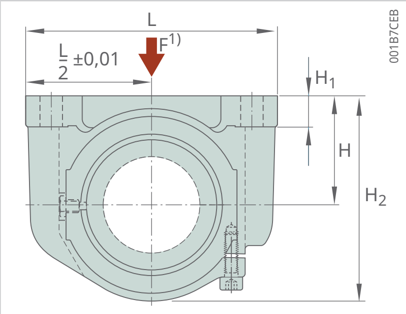
Adjustable operating clearance



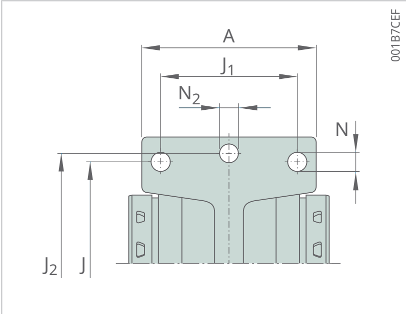
LUCE

Designation	m	F_w	A	A_1	C	D_a	H	H_1	H_2
							±0.01		
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LUCE 12 D	0.058	12	31	20	32	22	18	6	35
LUCE 12 D-2LS	0.058	12	31	20	32	22	18	6	35
LUCE 16 D	0.076	16	35	22	36	26	22	7	41
LUCE 16 D-2LS	0.076	16	35	22	36	26	22	7	41
LUCE 20 D	0.159	20	41	28	45	32	25	8	48
LUCE 20 D-2LS	0.159	20	41	28	45	32	25	8	48
LUCE 25 D	0.308	25	52	40	58	40	30	10	58
LUCE 25 D-2LS	0.308	25	52	40	58	40	30	10	58
LUCE 30 D	0.450	30	59	48	68	47	35	10	67
LUCE 30 D-2LS	0.450	30	59	48	68	47	35	10	67
LUCE 40 D	0.788	40	74	56	80	62	45	12	85
LUCE 40 D-2LS	0.788	40	74	56	80	62	45	12	85
LUCE 50	1.197	50	66	72	100	75	50	14	99
LUCE 50-2LS	1.197	50	66	72	100	75	50	14	99

1) For sizes 50 to 80: tolerance L/2 ± 0.02



LUCE



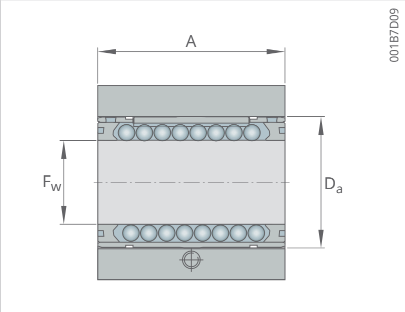
LUCE

J	J_1	J_2	L [1]	N	N_2	C	C	C_0	C_0
						min.	max.	min.	max.
mm	mm	mm	mm	mm	mm	N	N	N	N
32	23	42	52	4.3	5.3	800	1220	570	930
32	23	42	52	4.3	5.3	800	1220	570	930
40	26	46	56	4.3	5.3	950	1400	655	1060
40	26	46	56	4.3	5.3	950	1400	655	1060
45	32	58	70	4.3	6.4	1730	2550	1120	1800
45	32	58	70	4.3	6.4	1730	2550	1120	1800
60	40	68	80	5.3	6.4	2600	3800	1430	2320
60	40	68	80	5.3	6.4	2600	3800	1430	2320
68	45	76	88	6.4	6.4	3800	5600	2320	3750
68	45	76	88	6.4	6.4	3800	5600	2320	3750
86	58	94	108	8.4	8.4	6550	9650	3350	5700
86	58	94	108	8.4	8.4	6550	9650	3350	5700
108	50	116	135	8.4	10.5	8000	11200	4150	6950
108	50	116	135	8.4	10.5	8000	11200	4150	6950

8.2.5 Linear bearing units LUNE

with self-aligning linear ball bearings LBCD

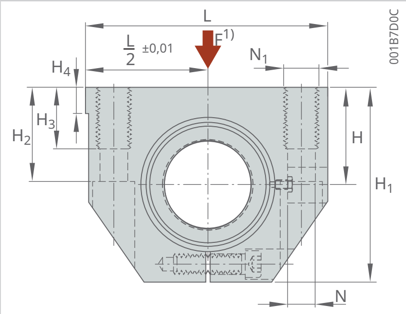
Adjustable operating clearance



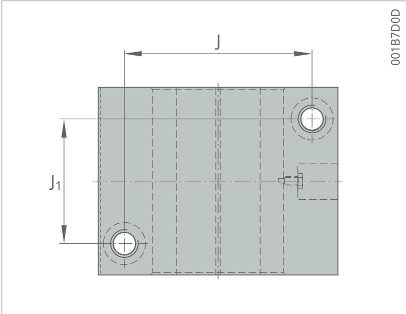
LUNE

8

Designation	m	F_w	A	D_a	H ±0.01	H_1	H_2	H_3	H_4
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LUNE 12 D	0.100	12	32	22	18	35	16.5	11	6.0
LUNE 12 D-2LS	0.100	12	32	22	18	35	16.5	11	6.0
LUNE 16 D	0.169	16	37	26	22	42	21.0	13	7.0
LUNE 16 D-2LS	0.169	16	37	26	22	42	21.0	13	7.0
LUNE 20 D	0.272	20	45	32	25	50	24.0	18	7.5
LUNE 20 D-2LS	0.272	20	45	32	25	50	24.0	18	7.5
LUNE 25 D	0.552	25	58	40	30	61	29.0	22	8.5
LUNE 25 D-2LS	0.552	25	58	40	30	61	29.0	22	8.5
LUNE 30 D	0.825	30	68	47	35	70	34.0	22	9.5
LUNE 30 D-2LS	0.825	30	68	47	35	70	34.0	22	9.5
LUNE 40 D	1.494	40	80	62	45	90	44.0	26	11.0
LUNE 40 D-2LS	1.494	40	80	62	45	90	44.0	26	11.0
LUNE 50	2.478	50	100	75	50	105	49.0	35	11.0
LUNE 50-2LS	2.478	50	100	75	50	105	49.0	35	11.0



LUNE



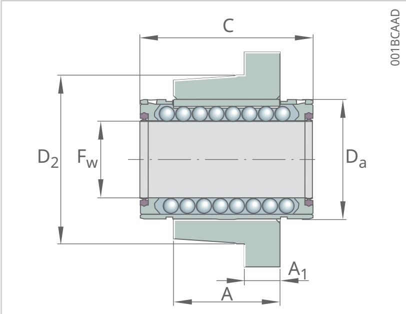
LUNE

8

J	J_1	L	N	N_1	C	C	C_0	C_0
					min.	max.	min.	max.
mm	mm	mm	mm	–	N	N	N	N
32	23	43	4.3	M5	930	1370	695	1120
32	23	43	4.3	M5	930	1370	695	1120
40	26	53	5.3	M6	1080	1600	800	1290
40	26	53	5.3	M6	1080	1600	800	1290
45	32	60	6.6	M8	2200	3250	1630	2650
45	32	60	6.6	M8	2200	3250	1630	2650
60	40	78	8.4	M10	3100	4550	2360	3800
60	40	78	8.4	M10	3100	4550	2360	3800
68	45	87	8.4	M10	4800	7100	3550	5700
68	45	87	8.4	M10	4800	7100	3550	5700
86	58	108	10.5	M12	7650	11200	5100	8300
86	58	108	10.5	M12	7650	11200	5100	8300
108	50	132	13.5	M16	9650	13400	7200	12200
108	50	132	13.5	M16	9650	13400	7200	12200

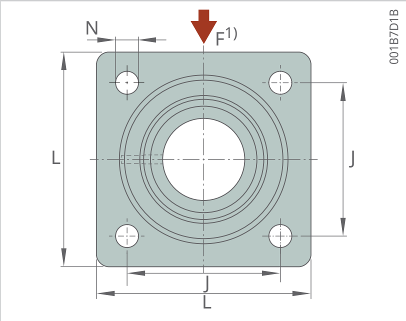
8.2.6 Flanged units LVCD

with self-aligning linear ball bearings LBCD



LVCD with 2 double lip seals

Designation	m	F_w	A	A_1	C	D_a	D_2 0 -0.5
–	kg	mm	mm	mm	mm	mm	mm
LVCD 12 D	0.117	12	20	8	32	22	32
LVCD 12 D-2LS	0.117	12	20	8	32	22	32
LVCD 16 D	0.170	16	22	8	36	26	38
LVCD 16 D-2LS	0.170	16	22	8	36	26	38
LVCD 20 D	0.325	20	28	10	45	32	46
LVCD 20 D-2LS	0.325	20	28	10	45	32	46
LVCD 25 D	0.674	25	40	12	58	40	58
LVCD 25 D-2LS	0.674	25	40	12	58	40	58
LVCD 30 D	1.030	30	48	14	68	47	66
LVCD 30 D-2LS	1.030	30	48	14	68	47	66
LVCD 40 D	1.966	40	56	16	80	62	90
LVCD 40 D-2LS	1.966	40	56	16	80	62	90
LVCD 50	3.274	50	72	18	100	75	110
LVCD 50-2LS	3.274	50	72	18	100	75	110



LVCD

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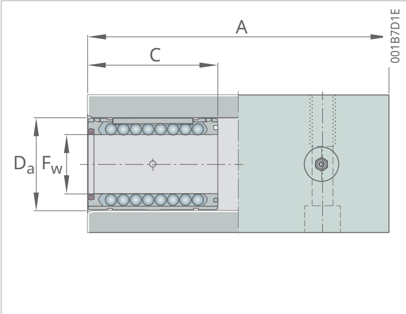
J	L	N	C	C	C0	C0
			min.	max.	min.	max.
mm	mm	mm	N	N	N	N
30	42	5.5	800	1220	570	930
30	42	5.5	800	1220	570	930
35	50	5.5	950	1400	655	1060
35	50	5.5	950	1400	655	1060
42	60	6.6	1730	2550	1120	1800
42	60	6.6	1730	2550	1120	1800
54	74	6.6	2600	3800	1430	2320
54	74	6.6	2600	3800	1430	2320
60	84	9.0	3800	5600	2320	3750
60	84	9.0	3800	5600	2320	3750
78	108	11.0	6550	9650	3350	5700
78	108	11.0	6550	9650	3350	5700
98	130	11.0	8000	11200	4150	6950
98	130	11.0	8000	11200	4150	6950

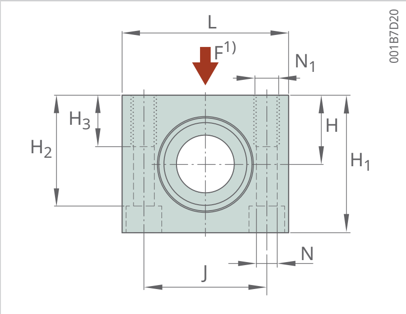
8.2.7 Tandem units LTCD

with self-aligning linear ball bearings LBCD

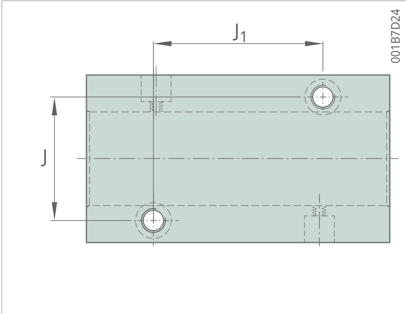


LTCD with 2 double lip seals

Designation	m	F_w	A	C	D_a	H ±0.01	H_1	H_2	H_3
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LTCD 12 D	0.248	12	76	32	22	18	+0.01	−0.01	35.0
LTCD 12 D-2LS	0.248	12	76	32	22	18	+0.01	−0.01	35.0
LTCD 16 D	0.385	16	84	36	26	22	+0.01	−0.01	41.5
LTCD 16 D-2LS	0.385	16	84	36	26	22	+0.01	−0.01	41.5
LTCD 20 D	0.694	20	104	45	32	25	+0.01	−0.01	49.5
LTCD 20 D-2LS	0.694	20	104	45	32	25	+0.01	−0.01	49.5
LTCD 25 D	1.278	25	130	58	40	30	+0.01	−0.01	59.5
LTCD 25 D-2LS	1.278	25	130	58	40	30	+0.01	−0.01	59.5
LTCD 30 D	1.938	30	152	68	47	35	+0.01	−0.01	69.5
LTCD 30 D-2LS	1.938	30	152	68	47	35	+0.01	−0.01	69.5
LTCD 40 D	3.669	40	176	80	62	45	+0.01	−0.01	89.5
LTCD 40 D-2LS	3.669	40	176	80	62	45	+0.01	−0.01	89.5
LTCD 50	5.930	50	224	100	75	50	+0.01	−0.01	99.5
LTCD 50-2LS	5.930	50	224	100	75	50	+0.01	−0.01	99.5



LTCD



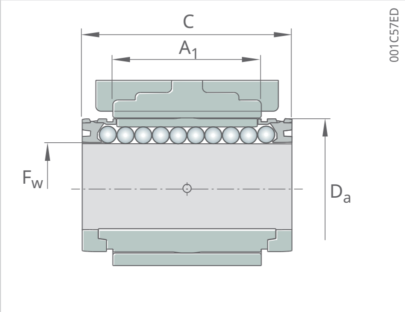
LTCD

J	J_1	L	N	N_1	C	C	C_0	C_0
					min.	max.	min.	max.
mm	mm	mm	mm	–	N	N	N	N
27.0	13	30	40	42	5.3	M6	1290	2000
27.0	13	30	40	42	5.3	M6	1290	2000
33.0	13	36	45	50	5.3	M6	1530	2280
33.0	13	36	45	50	5.3	M6	1530	2280
39.5	18	45	55	60	6.4	M8	2800	4150
39.5	18	45	55	60	6.4	M8	2800	4150
47.0	22	54	70	74	8.4	M10	4250	6200
47.0	22	54	70	74	8.4	M10	4250	6200
55.0	26	62	85	84	10.5	M12	6200	9150
55.0	26	62	85	84	10.5	M12	6200	9150
71.0	34	80	100	108	13.0	M16	10600	15600
71.0	34	80	100	108	13.0	M16	10600	15600
81.0	34	100	125	130	13.0	M16	12900	18300
81.0	34	100	125	130	13.0	M16	12900	18300

8.2.8 Linear bearing units LUCF

with self-aligning linear ball bearings LBCF

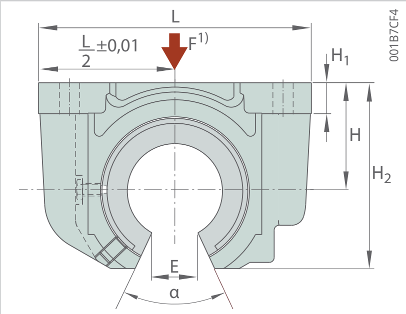
open design



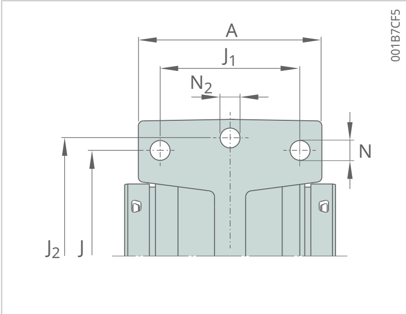
LUCF

Designation	m	F_w	A	A_1	C	D_a	H ±0.01	H_1
–	kg	mm	mm	mm	mm	mm	mm	mm
LUCF 12 D	0.050	12	31	20	32	22	18	6
LUCF 12 D-2LS	0.050	12	31	20	32	22	18	6
LUCF 16 D	0.065	16	35	22	36	26	22	7
LUCF 16 D-2LS	0.065	16	35	22	36	26	22	7
LUCF 20 D	0.137	20	41	28	45	32	25	8
LUCF 20 D-2LS	0.137	20	41	28	45	32	25	8
LUCF 25 D	0.267	25	52	40	58	40	30	10
LUCF 25 D-2LS	0.267	25	52	40	58	40	30	10
LUCF 30 D	0.394	30	59	48	68	47	35	10
LUCF 30 D-2LS	0.394	30	59	48	68	47	35	10
LUCF 40	0.629	40	74	56	80	62	45	12
LUCF 40-2LS	0.629	40	74	56	80	62	45	12
LUCF 50	1.035	50	66	72	100	75	50	14
LUCF 50-2LS	1.035	50	66	72	100	75	50	14

[1] For sizes 50 to 80: tolerance L/2 ± 0.02



LUCF



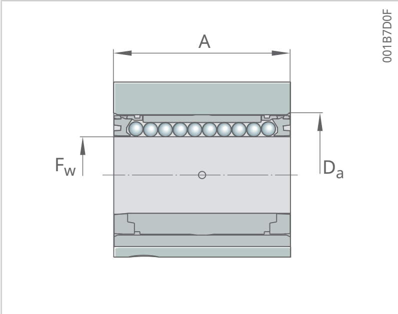
LUCF

H_2	J	J_1	J_2	L [1]	N	N_2	E	α	C	C	C_0	C_0
									min.	max.	min.	max.
mm	mm	mm	mm	mm	mm	mm	mm	°	N	N	N	N
28	32	23	42	52	4.3	5.3	7.6	78	600	1080	415	850
28	32	23	42	52	4.3	5.3	7.6	78	600	1080	415	850
35	40	26	46	56	4.3	5.3	10.4	78	670	1320	480	1120
35	40	26	46	56	4.3	5.3	10.4	78	670	1320	480	1120
42	45	32	58	70	4.3	6.4	10.8	60	1460	2500	915	1830
42	45	32	58	70	4.3	6.4	10.8	60	1460	2500	915	1830
51	60	40	68	80	5.3	6.4	13.2	60	2280	3900	1220	2450
51	60	40	68	80	5.3	6.4	13.2	60	2280	3900	1220	2450
60	68	45	76	88	6.4	6.4	14.2	50	3250	5700	1960	3900
60	68	45	76	88	6.4	6.4	14.2	50	3250	5700	1960	3900
77	86	58	94	108	8.4	8.4	18.7	50	3380	7800	2280	5200
77	86	58	94	108	8.4	8.4	18.7	50	3380	7800	2280	5200
88	108	50	116	135	8.4	10.5	23.6	50	4900	11200	3000	6950
88	108	50	116	135	8.4	10.5	23.6	50	4900	11200	3000	6950

8.2.9 Linear bearing units LUNF

with self-aligning linear ball bearings LBCF

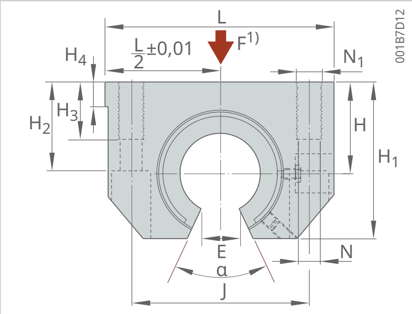
open design



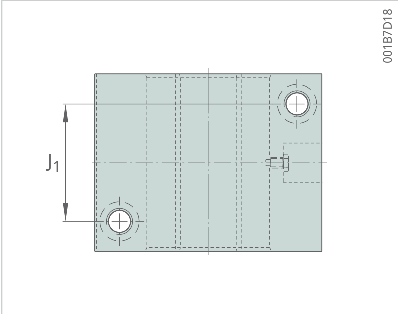
LUNF

8

Designation	m	F_w	A	D_a	H	H_1	H_2	H_3	H_4
					±0.01				
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LUNF 12 D	0.080	12	32	22	18	28	16.5	11	6.0
LUNF 12 D-2LS	0.080	12	32	22	18	28	16.5	11	6.0
LUNF 16 D	0.138	16	37	26	22	35	21.0	13	7.0
LUNF 16 D-2LS	0.138	16	37	26	22	35	21.0	13	7.0
LUNF 20 D	0.224	20	45	32	25	42	24.0	18	7.5
LUNF 20 D-2LS	0.224	20	45	32	25	42	24.0	18	7.5
LUNF 25 D	0.460	25	58	40	30	51	29.0	22	8.5
LUNF 25 D-2LS	0.460	25	58	40	30	51	29.0	22	8.5
LUNF 30 D	0.694	30	68	47	35	60	34.0	22	9.5
LUNF 30 D-2LS	0.694	30	68	47	35	60	34.0	22	9.5
LUNF 40	1.208	40	80	62	45	77	44.0	26	11.0
LUNF 40-2LS	1.208	40	80	62	45	77	44.0	26	11.0
LUNF 50	2.021	50	100	75	50	88	49.0	35	11.0
LUNF 50-2LS	2.021	50	100	75	50	88	49.0	35	11.0



LUNF



LUNF

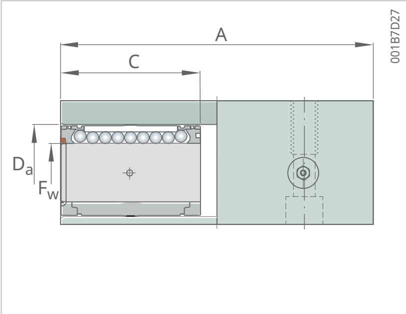
8

J	J_1	L	N	N_1	E	α	C	C	C_0	C_0
							min.	max.	min.	max.
mm	mm	mm	mm	–	mm	°	N	N	N	N
32	23	43	4.3	M5	7.6	78	600	1080	415	850
32	23	43	4.3	M5	7.6	78	600	1080	415	850
40	26	53	5.3	M6	10.4	78	670	1320	480	1120
40	26	53	5.3	M6	10.4	78	670	1320	480	1120
45	32	60	6.6	M8	10.8	60	1460	2500	915	1830
45	32	60	6.6	M8	10.8	60	1460	2500	915	1830
60	40	78	8.4	M10	13.2	60	2280	3900	1220	2450
60	40	78	8.4	M10	13.2	60	2280	3900	1220	2450
68	45	87	8.4	M10	14.2	50	3250	5700	1960	3900
68	45	87	8.4	M10	14.2	50	3250	5700	1960	3900
86	58	108	10.5	M12	18.7	50	3380	7800	2280	5200
86	58	108	10.5	M12	18.7	50	3380	7800	2280	5200
108	50	132	13.5	M16	23.6	50	4900	11200	3000	6950
108	50	132	13.5	M16	23.6	50	4900	11200	3000	6950

8.2.10 Tandem units LTCF

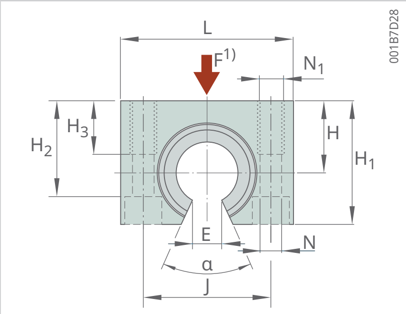
with self-aligning linear ball bearings LBCF

open design

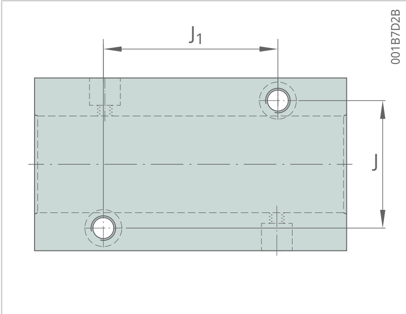


LTCF with 2 double lip seals

Designation	m	F_w	A	C	D_a	H	H_1	H_2	H_3
						±0.01			
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LTCF 12 D	0.189	12	76	32	22	18	29	23.5	13
LTCF 12 D-2LS	0.189	12	76	32	22	18	29	23.5	13
LTCF 16 D	0.296	16	84	36	26	22	35	28.0	13
LTCF 16 D-2LS	0.296	16	84	36	26	22	35	28.0	13
LTCF 20 D	0.541	20	104	45	32	25	42	33.5	18
LTCF 20 D-2LS	0.541	20	104	45	32	25	42	33.5	18
LTCF 25 D	1.000	25	130	58	40	30	51	40.0	22
LTCF 25 D-2LS	1.000	25	130	58	40	30	51	40.0	22
LTCF 30 D	1.544	30	152	68	47	35	60	46.5	26
LTCF 30 D-2LS	1.544	30	152	68	47	35	60	46.5	26
LTCF 40	2.814	40	176	80	62	45	77	61.0	34
LTCF 40-2LS	2.814	40	176	80	62	45	77	61.0	34
LTCF 50	4.840	50	224	100	75	50	88	72.0	34
LTCF 50-2LS	4.840	50	224	100	75	50	88	72.0	34



LTCF



LTCF

8

J	J1	L	N	N1	E	α	C	C	C_0	C_0
							min.	max.	min.	max.
mm	mm	mm	mm	–	mm	°	N	N	N	N
30	40	42	5.3	M6	7.6	78	980	1760	830	1700
30	40	42	5.3	M6	7.6	78	980	1760	830	1700
36	45	50	5.3	M6	10.4	78	1080	2160	965	2240
36	45	50	5.3	M6	10.4	78	1080	2160	965	2240
45	55	60	6.4	M8	10.8	60	2360	4050	1830	3660
45	55	60	6.4	M8	10.8	60	2360	4050	1830	3660
54	70	74	8.4	M10	13.2	60	3750	6300	2450	4900
54	70	74	8.4	M10	13.2	60	3750	6300	2450	4900
62	85	84	10.5	M12	14.2	50	5300	9300	3900	7800
62	85	84	10.5	M12	14.2	50	5300	9300	3900	7800
80	100	108	13.0	M16	18.7	50	5500	12700	4550	10400
80	100	108	13.0	M16	18.7	50	5500	12700	4550	10400
100	125	130	13.0	M16	23.6	50	8000	18300	6000	14000
100	125	130	13.0	M16	23.6	50	8000	18300	6000	14000

9 Linear plain bearings of the compact range

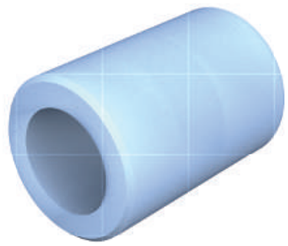
9.1 Product design

Linear plain bearings are particularly suitable for applications involving high shock loads, vibrations, or shock load at limited travel speeds. They are made of copolymer polyoxymethylene with specific polyethylene additives, ensuring smooth, stick-slip-free operation. The maximum permissible surface pressure is 14 N/mm^2. Under normal operating conditions, linear plain bearings are self-lubricating and virtually maintenance free. To improve the running-in behavior, Schaeffler recommends lightly greasing the bearings during installation. Linear plain bearings have the same dimensions as linear ball bearings and, like the compact range of linear ball bearings, are self-retaining in a suitable housing.

Characteristics and designs of linear plain bearings:

- sizes from 12 to 50 mm
- self-retaining in a suitable housing
- no additional axial fixation of the linear plain bearing is required when installed in a housing with bore diameter D_h and tolerance J7 or J6
- self-lubricating
- dimensionally interchangeable with linear ball bearings LBBR

68 Linear plain bearing LPBR



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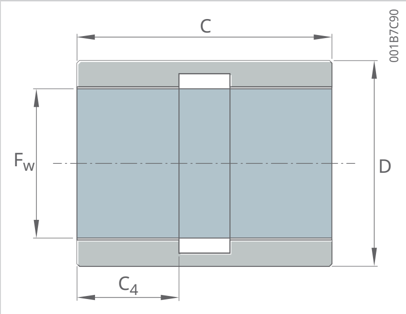
9.2 Product tables

9.2.1 Explanations

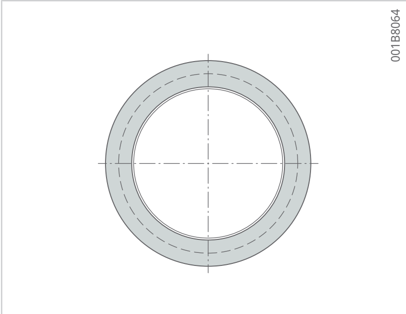
C	mm	Length
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
C_4	mm	Width of sliding surface
D	mm	Outside diameter
D_h	mm	Bore diameter
F_w	mm	Inscribed diameter of the ball set
m	kg	Mass

9.2.2 Linear plain bearing LPBR

Designation	m	F_w	D	D_h
–	kg	mm	mm	mm
LPBR 12	0.006	12	19.19	19
LPBR 14	0.007	14	21.21	21
LPBR 16	0.009	16	24.23	24
LPBR 20	0.011	20	28.24	28
LPBR 25	0.024	25	35.25	35
LPBR 30	0.033	30	40.27	40
LPBR 40	0.064	40	52.32	52
LPBR 50	0.089	50	62.35	62



LPBR



LPBR

9

C	C_4	C		C_0
		at 0.1 m/s	at 4 m/s	
mm	mm	N	N	N
28	10	965	24	3350
28	12	1340	34	4750
30	12	1530	38	5400
30	13	2080	52	7350
40	17	3400	85	12000
50	20	4800	120	17000
60	24	7650	193	27000
70	27	10800	270	38000

10 Linear plain bearing units of the compact range

10.1 Product design

Linear plain bearing units of the compact range consist of a linear plain bearing and an aluminum housing. These units are extremely compact, cost-effective, and lightweight. Schaeffler offers various types of linear bearing units to meet the demand for flexible slide designs in terms of width and length through modular standard products. Under normal operating conditions, the plain bearing units are self-lubricating and virtually maintenance free. To complete the linear guide system, precision shafts and shaft blocks are also required ➤176|14, ➤162|13.

Characteristics and designs of linear plain bearing units:

- sizes from 12 to 50
- self-lubricating
- suitable for screw mounting from above or below

! The specified maximum static load rating applies only when the load acts on the housing exclusively in the direction of the red arrow.

LUHR PB

- aluminum housing extending over the full bearing length

LUJR PB

- with 2 external shaft seals for harsh ambient conditions
- maximum running speed 3 m/s

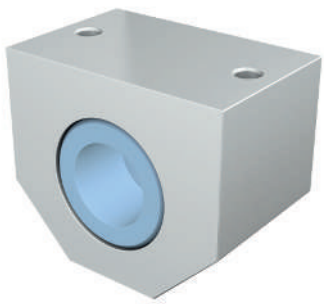
LTBR PB

- tandem aluminum housing with 2 integrated bearings

10.1.1 Linear plain bearing units of the compact range

Linear plain bearing units of the compact range LUHR PB and LUJR PB consist of a closed aluminum housing and a linear plain bearing LPBR. Linear plain bearing units LUJR PB are identical in design to LUHR PB, but are fitted with 2 additional external shaft seals for applications with increased contamination exposure and therefore feature a longer housing.

69 Linear plain bearing units of the compact range LUHR PB



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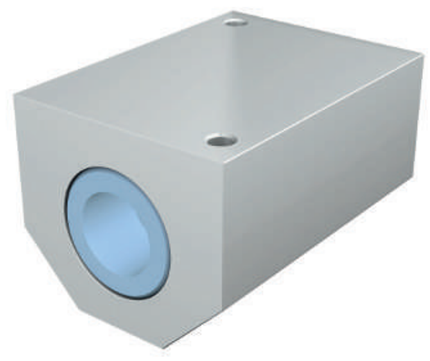
Linear plain bearing units LUHR PB and LUJR PB are suitable for constructing a wide range of flexible designs or compact linear slide configurations.

10.1.2 Tandem plain bearing units of the compact range

Tandem plain bearing units of the compact range LTBR PB consist of 2 LPBR plain bearings mounted in an aluminum housing. The units LTBR PB are particularly suitable for table or slide constructions of any width and can be mounted from above or below.

70 Tandem plain bearing units of the compact range LTBR PB



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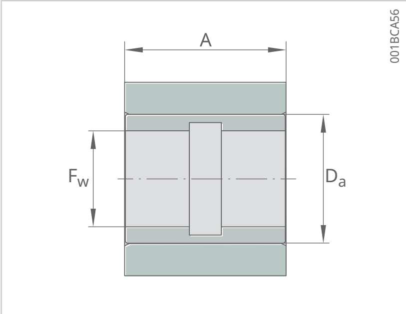
10.2 Product tables

10.2.1 Explanations

(1)	–	Load direction for max. load ratings
A	mm	Length
C	N	Basic dynamic load rating
C	mm	Length
C_0	N	Basic static load rating
D_a	mm	Bore diameter
F_w	mm	Inscribed diameter of the ball set
H	mm	Center height
H_1	mm	Height
H_2	mm	Height
H_3	mm	Height
J	mm	Distance
J_1	mm	Distance
L	mm	Width
m	kg	Mass
N	mm	Bore diameter
N_1	-	Thread size

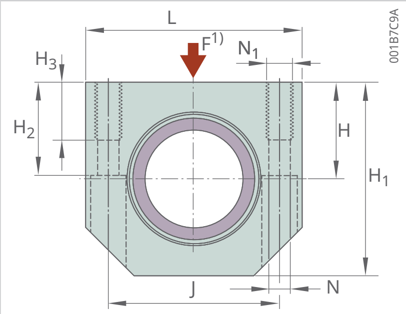
10.2.2 Plain bearing units LUHR PB

with linear plain bearings LPBR

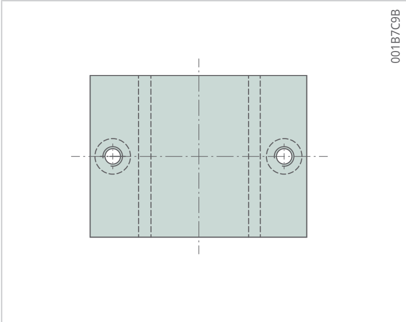


LUHR PB

Designation	m	F_w	A	D_a	H	H_1	H_2	H_3
					±0.01			
–	kg	mm	mm	mm	mm	mm	mm	mm
LUHR 12 PB	0.074	12	28	19	17	33	16	11
LUHR 16 PB	0.091	16	30	24	19	38	18	11
LUHR 20 PB	0.130	20	30	28	23	45	22	13
LUHR 25 PB	0.227	25	40	35	27	54	26	18
LUHR 30 PB	0.333	30	50	40	30	60	29	18
LUHR 40 PB	0.674	40	60	52	39	76	38	22
LUHR 50 PB	1.099	50	70	62	47	92	46	26



LUHR PB



LUHR PB

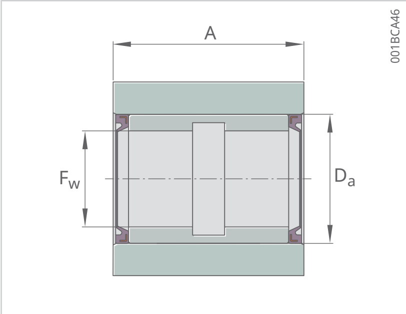
L	J	N	N_1	C		C_0
				at 0.1 m/s	at 4 m/s	
mm	mm	mm	–	N	N	N
40	29	4.3	M5	965	24	3350
45	34	4.3	M5	1530	38	5400
53	40	5.3	M6	2080	52	7350
62	48	6.6	M8	3400	85	12000
67	53	6.6	M8	4800	120	17000
87	69	8.4	M10	7650	193	27000
103	82	10.5	M12	10800	270	38000

10

10.2.3 Plain bearing units LUJR PB

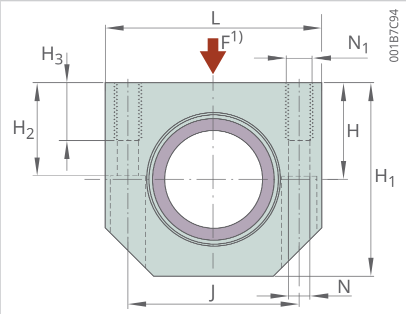
with linear plain bearings LPBR

with external shaft seals

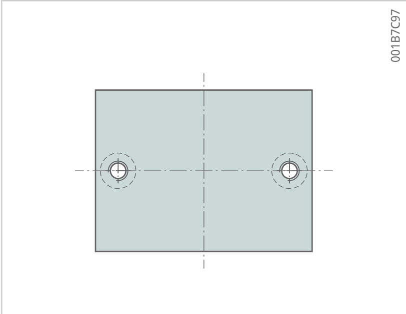


LUJR PB

Designation	m	F_w	A	D_a	H	H_1	H_2
					±0.01		
–	kg	mm	mm	mm	mm	mm	mm
LUJR 12 PB	0.09	12	35	19	17	33	16
LUJR 16 PB	0.11	16	37	24	19	38	18
LUJR 20 PB	0.17	20	39	28	23	45	22
LUJR 25 PB	0.28	25	49	35	27	54	26
LUJR 30 PB	0.40	30	59	40	30	60	29
LUJR 40 PB	0.79	40	71	52	39	76	38
LUJR 50 PB	1.28	50	81	62	47	92	46



LUJR PB

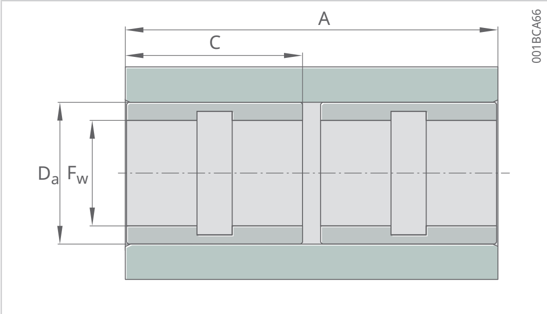


LUJR PB

H_3	L	J	N	N_1	C		C_0
					at 0.1 m/s	at 4 m/s	
mm	mm	mm	mm	–	N	N	N
11	40	29	4.3	M5	965	24	3350
11	45	34	4.3	M5	1530	38	5400
13	53	40	5.3	M6	2080	52	7350
18	62	48	6.6	M8	3400	85	12000
18	67	53	6.6	M8	4800	120	17000
22	87	69	8.4	M10	7650	193	27000
26	103	82	10.5	M12	10800	270	38000

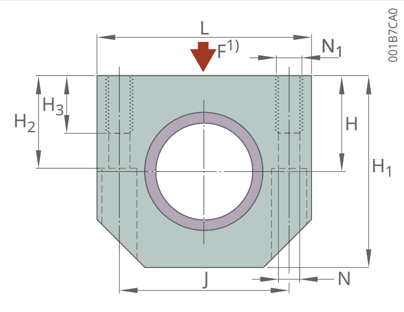
10.2.4 Tandem plain bearing units LTBR PB

with linear plain bearings LPBR

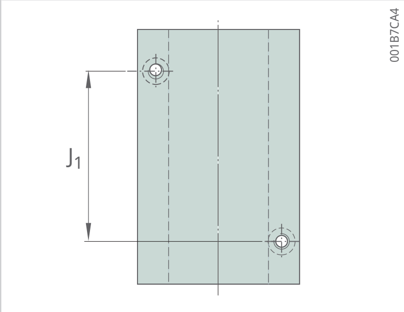


LTBR PB

Designation	m	F_w	A	C	D_a	H	H_1	H_2	H_3
						±0.01			
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LTBR 12 PB	0.16	12	60	28	19	17	33	16	11
LTBR 16 PB	0.21	16	65	30	24	19	38	18	11
LTBR 20 PB	0.29	20	65	30	28	23	45	22	13
LTBR 25 PB	0.52	25	85	40	35	27	54	26	18
LTBR 30 PB	0.75	30	105	50	40	30	60	29	18
LTBR 40 PB	1.50	40	125	60	52	39	76	38	22
LTBR 50 PB	2.38	50	145	70	62	47	92	46	26



LTBR PB



LTBR PB

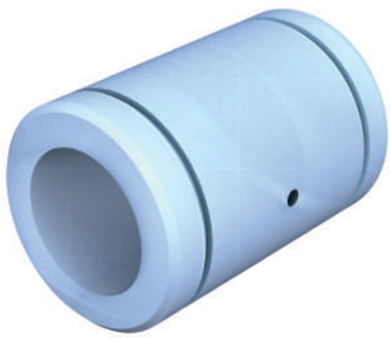
J	J_1	L	N	N_1	C		C_0
					at 0.1 m/s	at 4 m/s	
mm	mm	mm	mm	–	N	N	N
29	35	40	4.3	M5	1930	48	6700
34	40	45	4.3	M5	3060	76	10800
40	45	53	5.3	M6	4160	104	14700
48	55	62	6.6	M8	6800	170	24000
53	70	67	6.6	M8	9600	240	34000
69	85	87	8.4	M10	15300	386	54000
82	100	103	10.5	M12	21600	540	76000

10

11 Linear plain bearings of the standard range

11.1 Product design

71 Linear plain bearing LPAR



Linear plain bearings are particularly suitable for applications involving high shock loads, vibrations, or shock load at limited travel speeds. They are made of copolymer polyoxymethylene with specific polyethylene additives, ensuring smooth, stick-slip-free operation. The maximum permissible surface pressure is 14 N/mm^2. Under normal operating conditions, linear plain bearings are self-lubricating and virtually maintenance free. To improve the running-in behavior, Schaeffler recommends lightly greasing the bearings during installation. Linear plain bearings have the same dimensions as linear ball bearings

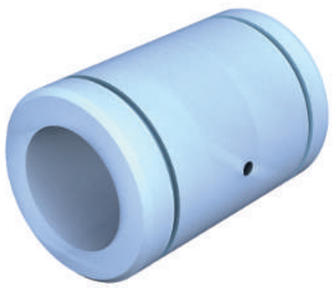
Characteristics and designs of linear plain bearings LPAR and LPAT, closed and open design:

- self-lubricating material
- interchangeable with linear ball bearings of the standard range due to identical external dimensions
- equipped with lubrication port
- compatible with grease fitting VN-LHC for axial fixation ➤44|1.10.3

11.1.1 Linear plain bearings in closed design

Linear plain bearings of the standard range LPAR are available for shaft diameters from 5 mm to 80 mm.

72 Linear plain bearings in closed design LPAR



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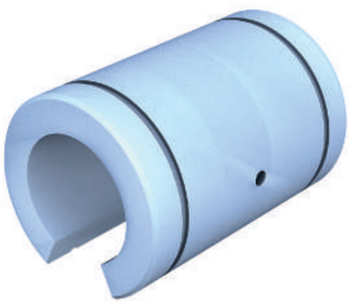
11.1.2 Linear plain bearings in open design

Linear plain bearings of the standard range LPAT are available for shaft diameters from 12 mm to 80 mm.

73 Linear plain bearings in open design LPAT



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11.2 Product tables

11.2.1 Explanations

(1)	–	Load direction for max. load ratings
b	mm	Groove width
C	mm	Length
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
C_1	mm	Distance of grooves
C_4	mm	Width of sliding surface
D	mm	Outside diameter
E	mm	Width of cutout
F_w	mm	Inscribed diameter of the ball set
m	kg	Mass
α	°	Opening angle

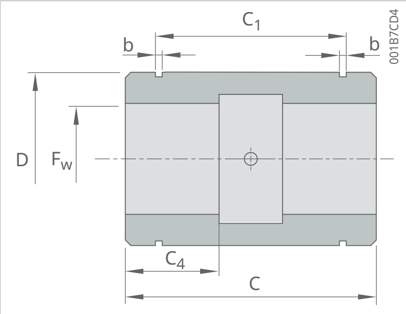
11.2.2 Linear plain bearing

LPAR

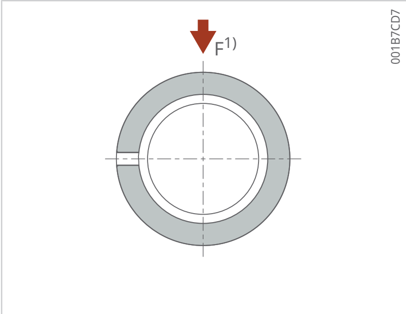
closed

Designation [1)]	m	F_w	D	C	C_1
–	kg	mm	mm	mm	mm
LPAR 5	0.003	5	12	22	14.2
LPAR 8	0.005	8	16	25	16.2
LPAR 12	0.010	12	22	32	22.6
LPAR 16	0.015	16	26	36	24.6
LPAR 20	0.028	20	32	45	31.2
LPAR 25	0.055	25	40	58	43.7
LPAR 30	0.086	30	47	68	51.7
LPAR 40	0.180	40	62	80	60.3
LPAR 50	0.310	50	75	100	77.3
LPAR 60	0.560	60	90	125	101.3
LPAR 80	1.320	80	120	165	133.3

1) For LPAR 5, LPAR 8: no fixing bore or lubrication port



LPAR, closed design

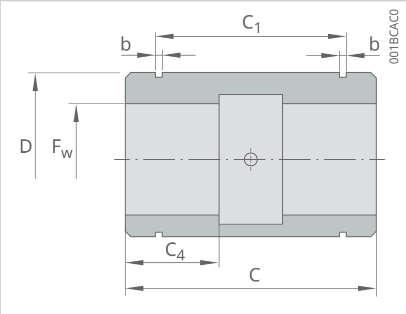


LPAR, closed design

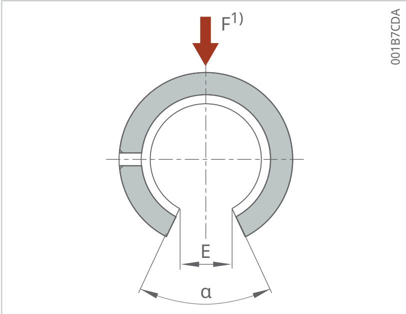
b	C		C_0
min.	at 0.1 m/s	at 4 m/s	
mm	N	N	N
1.1	320	8	1120
1.1	570	14	2000
1.3	1060	26	3650
1.3	1680	43	5850
1.6	2700	68	9500
1.85	4400	110	15300
1.85	6000	150	20800
2.15	8650	216	30000
2.65	12700	320	45000
3.15	19300	480	67000
4.15	33500	830	116000

11.2.3 Linear plain bearing
LPAT
open design

Designation	m	F_w	D	C	C_1
–	kg	mm	mm	mm	mm
LPAT 12	0.008	12	22	32	22.6
LPAT 16	0.012	16	26	36	24.6
LPAT 20	0.023	20	32	45	31.2
LPAT 25	0.046	25	40	58	43.7
LPAT 30	0.074	30	47	68	51.7
LPAT 40	0.155	40	62	80	60.3
LPAT 50	0.270	50	75	100	77.3
LPAT 60	0.480	60	90	125	101.3
LPAT 80	1.120	80	120	165	133.3



LPAT, open design



LPAT, open design

b	E	α	C		C_0
min.			at 0.1 m/s	at 4 m/s	
mm	mm	°	N	N	N
1.3	11	7.6	1060	26	3650
1.3	13	10.4	1680	43	5850
1.6	17	10.8	2700	68	9500
1.85	22	13.2	4400	110	15300
1.85	25	14.2	6000	150	20800
2.15	27	18.7	8650	216	30000
2.65	32	23.6	12700	320	45000
3.15	40	29.6	19300	480	67000
4.15	52	38.4	33500	830	116000

12 Linear plain bearing units of the standard range

12.1 Product design

A comprehensive range of linear bearing units fitted with linear plain bearings from the standard range is available for the flexible design of slide assemblies. These units are the ideal choice for applications requiring flexibility in shaft spacing and slide length. A simpler slide structure can be achieved using tandem units with 2 bearings. A flanged bearing unit is also available, providing additional mounting options.

All open and closed units, with the exception of the flanged bearing units, are made of aluminum. Linear bearing units LUCR PA and LUCT PA made of die-cast material have a very low weight, minimizing acceleration forces and inertia forces. These high precision units have been structurally optimized to ensure high strength and rigidity. To complete the linear guide system, precision shafts and shaft blocks are also required ➤176|14, ➤162|13.

Characteristics and designs of linear bearing units:

- lightweight housing made of die-cast aluminum (LUCR PA, LUCT PA)
- suitable for screw mounting from above or below
- optimized for mounting with hexagon socket head cap screws in accordance with DIN ISO 4762
- self-lubricating material
- with grease fitting
- ready for operation

! The specified maximum static load rating applies only when the load acts on the housing exclusively in the direction of the red arrow.

LUCR PA

- closed design

LVCR PA

- flanged housing with flexible screw mounting facility from the front of the flange or the rear
- high rigidity due to cast-iron housing

LTCR PA

- tandem unit
- aluminum housing with 2 bearings mounted in series

LUCT PA

- open design

12.1.1 Linear plain bearing units of the standard range in closed design

Linear plain bearing units of the standard range LUCR PA offer flexible design options for the construction of linear slides. With their very low weight, they are ideal for applications involving low mass inertia. Linear plain bearing units LUCR PA are available for shaft diameters from 8 mm to 80 mm and are fitted with linear plain bearings LPAR. The plain bearings are made of self-lubricating material and can be relubricated via the grease fitting if required. The bearings are secured in the housing with a grease fitting and retaining rings.

74 Linear plain bearing units LUCR PA

001C3F15

12.1.2 Linear plain bearing units of the standard range with closed flanged housing

Linear plain bearing units with flanged housing LVCR PA provide flexible mounting options. The closed flanged housing of these bearing units is made of gray cast iron. Flanged units LVCR PA are available for shaft diameters from 12 mm to 80 mm and are fitted with linear bearings LPAR. Each linear plain bearing is axially retained in the housing by a pin and retaining rings. The flange is machined on both sides, allowing the linear bearing unit to be mounted from either the front or rear face. Linear plain bearing units with flanged housing can be relubricated via the shaft.

75 Linear plain bearing units with closed flanged housing LVCR PA

001C3F20

12.1.3 Tandem plain bearing units of the standard range

Closed tandem plain bearing units LTCR PA consist of a solid aluminum housing with 2 LPAR linear plain bearings of the standard range mounted in series. Tandem linear bearing units are ideal for linear guide systems of any required width. The units' mounting surface can be bolted from top or bottom side using suitable screws, and are available for shaft diameters from 12 mm to 50 mm. Tandem units can be relubricated via the grease fitting if required, which also serves to secure the bearing axially and against rotation.

12

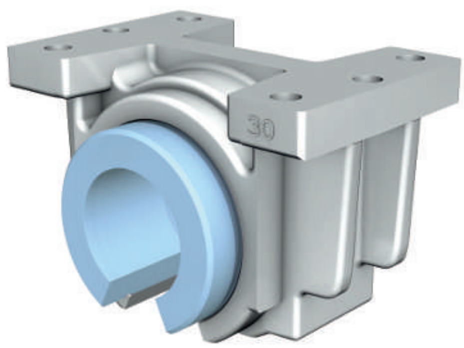
76 Tandem plain bearing units LTCR PA

001C3F14

12.1.4 Linear plain bearing units of the standard range in open design

Linear bearing units of the standard range LUCT PA are open designs and are intended for applications with supported shafts operating under high loads and with long travel distances. Linear plain bearing units LUCT PA are available for shaft diameters from 12 mm to 80 mm and are fitted with linear plain bearings LPAT. The units can be relubricated via the grease fitting if required. The bearings are secured in the housing with a grease fitting and opposing grooved pin.

77 Linear plain bearing units LUCT PA in open design



001C3F17

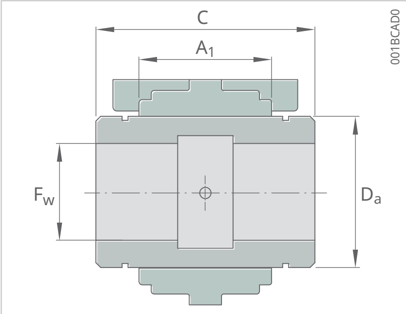
12.2 Product tables

12.2.1 Explanations

(1)	–	Load direction for max. load ratings
A	mm	Length
A_1	mm	Length
C	mm	Length
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
D_2	mm	Diameter of centering collar
D_a	mm	Bore diameter
E	mm	Width of cutout
F_w	mm	Inscribed diameter of the ball set
H	mm	Center height
H_1	mm	Height
H_2	mm	Height
H_3	mm	Height
J	mm	Distance
J_1	mm	Distance
J_2	mm	Distance
L	mm	Width
m	kg	Mass
N	mm	Bore diameter
N_1	-	Thread size
N_2	mm	Bore diameter
α	°	Opening angle

12.2.2 Plain bearing units LUCR PA

with linear plain bearings LPAR



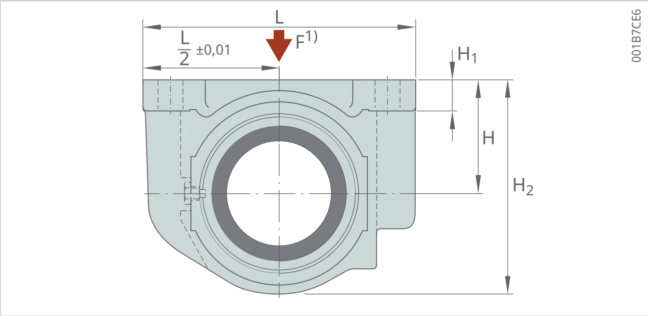
LUCR PA

Designation [1]	m	F_w	A	A_1	C	D_a	H ±0.01	H_1	H_2
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LUCR 8 PA	0.023	8	27.0	14	25	16	15	6	28
LUCR 12 PA	0.048	12	31.0	20	32	22	18	6	35
LUCR 16 PA	0.065	16	34.5	22	36	26	22	7	41
LUCR 20 PA	0.129	20	41.0	28	45	32	25	8	48
LUCR 25 PA	0.255	25	52.0	40	58	40	30	10	58
LUCR 30 PA	0.368	30	59.0	48	68	47	35	10	67
LUCR 40 PA	0.656	40	74.0	56	80	62	45	12	85
LUCR 50 PA	1.065	50	66.0	72	100	75	50	14	99
LUCR 60 PA	1.900	60	84.0	95	125	90	60	18	118
LUCR 80 PA	4.575	80	113.0	125	165	120	80	22	158

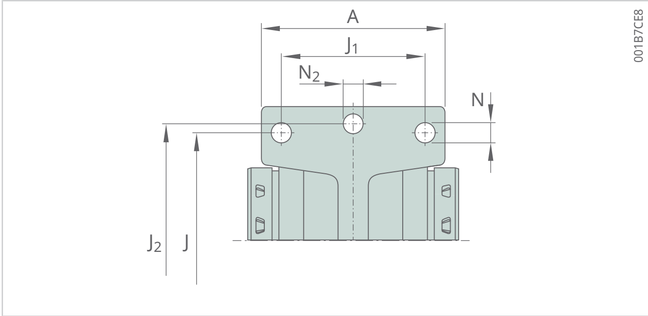
1) For size 8: fixation by means of retaining rings in accordance with DIN 471, no lubrication port

2) For sizes 50 to 80: tolerance L/2 ± 0.02

12



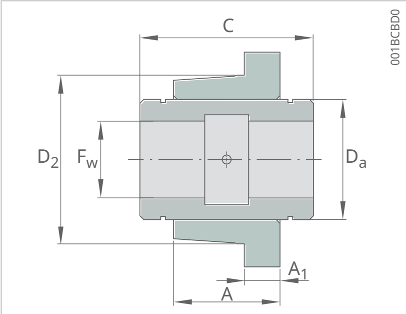
LUCR PA



LUCR PA

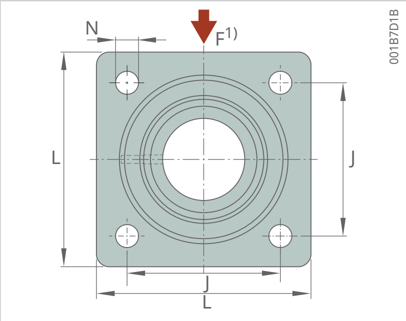
J	J_1	J_2	L 2)	N	N_2	C	C	C_0
						at 0.1 m/s	at 4 m/s	
mm	mm	mm	mm	mm	mm	N	N	N
25	20	35	45	3.2	5.3	570	14	2000
32	23	42	52	4.3	5.3	1060	26	3650
40	26	46	56	4.3	5.3	1680	43	5850
45	32	58	70	4.3	6.4	2700	68	9500
60	40	68	80	5.3	6.4	4400	110	15300
68	45	76	88	6.4	6.4	6000	150	20800
86	58	94	108	8.4	8.4	8650	216	30000
108	50	116	135	8.4	10.5	12700	320	45000
132	65	138	160	10.5	13.0	19300	480	67000
170	90	180	205	13.0	13.0	33500	830	116000

12.2.3 Flanged units LVCR PA
with linear plain bearings LPAR



LVCR PA

Designation	m	F_w	A	A_1	C	D_a	D_2
–	kg	mm	mm	mm	mm	mm	mm
LVCR 12 PA	0.107	12	20	8	32	22	32
LVCR 16 PA	0.160	16	22	8	36	26	38
LVCR 20 PA	0.298	20	28	10	45	32	46
LVCR 25 PA	0.623	25	40	12	58	40	58
LVCR 30 PA	0.950	30	48	14	68	47	66
LVCR 40 PA	1.830	40	56	16	80	62	90
LVCR 50 PA	3.144	50	72	18	100	75	110
LVCR 60 PA	5.660	60	95	22	125	90	135
LVCR 80 PA	12.720	80	125	25	165	120	180

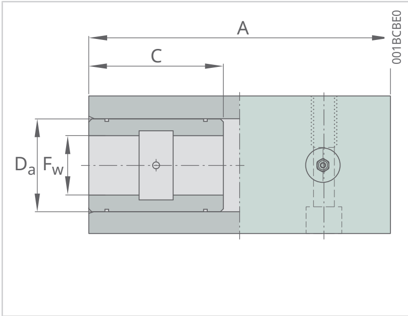


LVCR PA

J	L	N	C	C	C_0
			at 0.1 m/s	at 4 m/s	
mm	mm	mm	N	N	N
30	42	5.5	1060	26	3650
35	50	5.5	1680	43	5850
42	60	6.6	2700	68	9500
54	74	6.6	4400	110	15300
60	84	9.0	6000	150	20800
78	108	11.0	8650	216	30000
98	130	11.0	12700	320	45000
120	160	13.5	19300	480	67000
155	200	13.5	33500	830	116000

12.2.4 Tandem plain bearing units LTCR PA

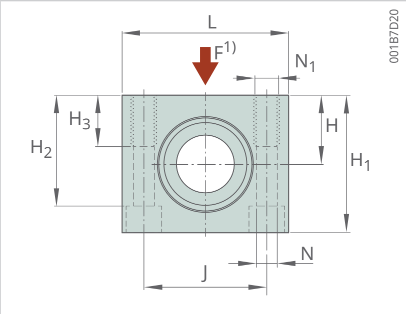
with linear plain bearings LPAR



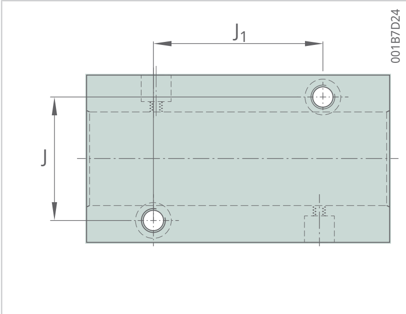
LTCR PA

Designation	m	F_w	A	C	D_a	H	H_1	H_2	H_3
						±0.01			
–	kg	mm	mm	mm	mm	mm	mm	mm	mm
LTCR 12 PA	0.228	12	76	32	22	18	35.0	27.0	13
LTCR 16 PA	0.365	16	84	36	26	22	41.5	33.0	13
LTCR 20 PA	0.640	20	104	45	32	25	49.5	39.5	18
LTCR 25 PA	1.176	25	130	58	40	30	59.5	47.0	22
LTCR 30 PA	1.778	30	152	68	47	35	69.5	55.0	26
LTCR 40 PA	3.397	40	176	80	62	45	89.5	71.0	34
LTCR 50 PA	5.670	50	224	100	75	50	99.5	81.0	34

12



LTCR PA



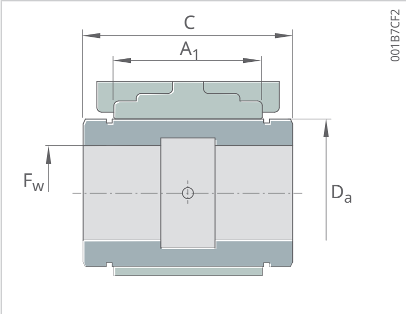
LTCR PA

J	J_1	L	N	N_1	C	C	C_0
					at 0.1 m/s	at 4 m/s	
mm	mm	mm	mm	–	N	N	N
30	40	42	5.3	M6	2120	52	7300
36	45	50	5.3	M6	3360	86	11700
45	55	60	6.4	M8	5400	136	19000
54	70	74	8.4	M10	8800	220	30600
62	85	84	10.5	M12	12000	300	41600
80	100	108	13.0	M16	17300	432	60000
100	125	130	13.0	M16	25400	640	90000

12

12.2.5 Plain bearing units LUCT PA

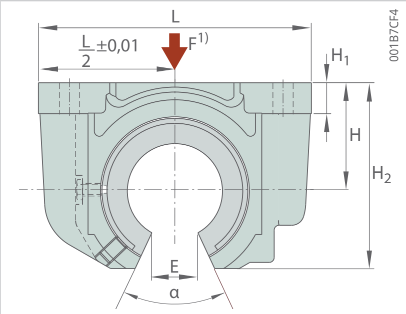
with linear plain bearings LPAT open design



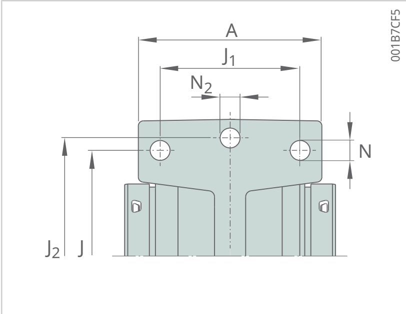
LUCT PA

Designation	m	F_w	A	A_1	C	D_a	H	H_1	H_2	J
							±0.01			
–	kg	mm	mm	mm	mm	mm	mm	mm	mm	mm
LUCT 12 PA	0.042	12	31	20	32	22	18	6	28	32
LUCT 16 PA	0.057	16	35	22	36	26	22	7	35	40
LUCT 20 PA	0.115	20	41	28	45	32	25	8	42	45
LUCT 25 PA	0.225	25	52	40	58	40	30	10	51	60
LUCT 30 PA	0.328	30	59	48	68	47	35	10	60	68
LUCT 40 PA	0.564	40	74	56	80	62	45	12	77	86
LUCT 50 PA	0.935	50	66	72	100	75	50	14	88	108
LUCT 60 PA	1.663	60	84	95	125	90	60	18	105	132
LUCT 80 PA	3.981	80	113	125	165	120	80	22	140	170

1) For sizes 50 to 80: tolerance L/2 ± 0.02



LUCT PA



LUCT PA

J_1	J_2	L [1]	N	N_2	E	α	C at 0.1 m/s	C at 4 m/s	C_0
mm	mm	mm	mm	mm	mm	°	N	N	N
23	42	52	4.3	5.3	7.6	78	1060	26	3650
26	46	56	4.3	5.3	10.4	78	1680	43	5850
32	58	70	4.3	6.4	10.8	60	2700	68	9500
40	68	80	5.3	6.4	13.2	60	4400	110	15300
45	76	88	6.4	6.4	14.2	50	6000	150	20800
58	94	108	8.4	8.4	18.7	50	8650	216	30000
50	116	135	8.4	10.5	23.6	50	12700	320	45000
65	138	160	10.5	13.0	29.6	54	19300	480	67000
90	180	205	13.0	13.0	38.4	54	33500	830	116000

12

13 Shaft blocks and shaft supports

Shaft blocks and shaft supports are standard components used for the simple construction of linear slides. Single shaft blocks are supposed to be used for linear bearing units in closed design with flexible shaft distance and length. In standard applications, they fix the end of the shaft to the surface. Shaft supports are used with linear units in the open design and applied along the entire shaft length to prevent shaft deflection.

13.1 Product design

13.1.1 Shaft blocks made of die-cast aluminum

The lightweight shaft blocks LSCS are suitable for all bearing units and enable secure location of the shaft position. The shaft blocks can be mounted from above or below and include a reference side for linear alignment.

Characteristics and designs of shaft blocks LSCS:

- sizes from 8 mm to 80 mm
- lightweight housing made of die-cast aluminum
- shaft clamping screw inserted from above
- suitable for screw mounting from above or below
- optimized for mounting with hexagon socket head cap screws in accordance with DIN ISO 4762
- 2 different hole patterns for mounting purposes
- reference side for linear alignment
- precise and secure shaft location
- LSCS 80A and LSCS 8 are not die-cast and have no forming slopes

13

78 Shaft blocks LSCS

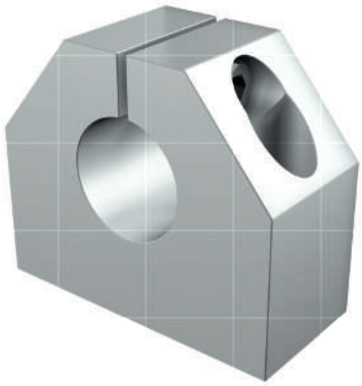
13.1.2 Shaft blocks made of aluminum

Aluminum shaft blocks LSHS and LSNS enable secure fixation of the shaft position. Shaft blocks LSHS are designed for use with linear bearing units of the compact range, while shaft blocks LSNS are matched to the design of linear bearing units of the standard range. The shaft blocks can be screwed to the mounting surface from both sides.

Characteristics and designs of shaft blocks LSHS and LSNS:

- sizes from 12 mm to 50 mm
- shaft clamping screw inserted from the side
- suitable for screw mounting from above or below
- optimized for mounting with hexagon socket head cap screws in accordance with DIN ISO 4762
- reference side for linear alignment
- precise and secure shaft location

79 Shaft blocks LSHS and LSNS



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13.1.3 Shaft support

80 Shaft supports LRCB and LRCC

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Shaft supports LRCB and LRCC are suitable for use with linear bearing units of the standard range in open design, where the shaft support prevents shaft deflection under high loads. Aluminum shaft supports can be used for partial sections, however, use over the entire shaft length is recommended. Shaft supports LRCB feature a pre-drilled hole pattern for mounting and direct screw fastening to standard shafts with the standard ESSC 6 hole pattern, while shaft supports LRCC feature finish-machined tolerances for customer-specific mounting holes.

Characteristics and designs of shaft supports LRCB and LRCC:

- LRCB with mounting holes, optimized for mounting with hexagon socket head cap screws in accordance with DIN ISO 4762
- LRCC for customer-specific mounting holes
- for all linear bearings and linear bearing units in open design
- for complete or partial shaft support
- suitable for screw mounting from above or below

13.2 Product tables

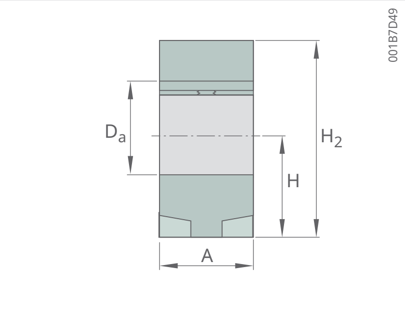
13.2.1 Explanations

A	mm	Width of shaft support
A	mm	Length
d	mm	Shaft diameter
D_a	mm	Bore diameter
H	mm	Center height
H_1	mm	Height
H_2	mm	Height
H_3	mm	Height
H_4	mm	Height
J	mm	Distance
J_1	mm	Distance
J_2	mm	Distance
J_3	mm	Distance
L	mm	Width
L_1	mm	Width
m	kg	Mass
M	mm	Width
N	mm	Bore diameter
N_1	-	Thread size
N_1	mm	Bore diameter
N_2	mm	Bore diameter
β	°	Angle

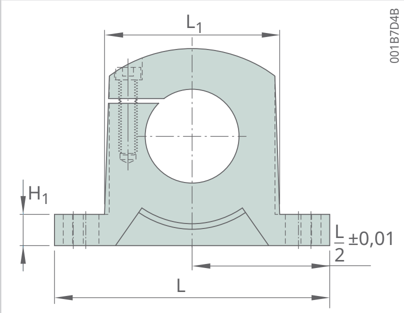
13.2.2 Shaft blocks LSCS

Designation	m	D_a	A	H	H_1	H_2
				±0.01		
–	kg	mm	mm	mm	mm	mm
LSCS 8	0.012	8	10	15	5.5	25
LSCS 12	0.023	12	12	20	6	32.5
LSCS 16	0.034	16	15	20	7	35.5
LSCS 20	0.065	20	20	25	8	43.5
LSCS 25	0.140	25	28	30	10	53
LSCS 30	0.200	30	30	35	10	63
LSCS 40	0.470	40	36	45	12	81
LSCS 50	0.680	50	49	50	14	92.5
LSCS 60	1.290	60	62	60	18	112
LSCS 80 A	3.150	80	85	80	22	147.5

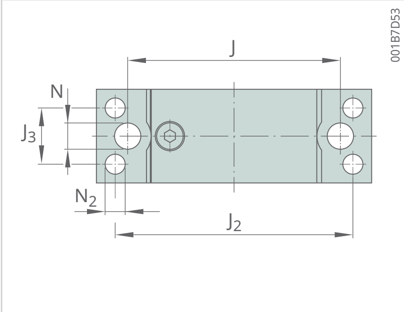
[1] For sizes 50 to 80: tolerance L/2 ± 0.02



LSCS



LSCS

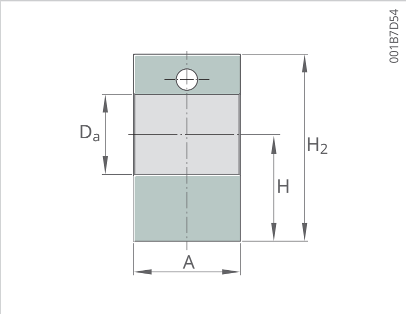


LSCS

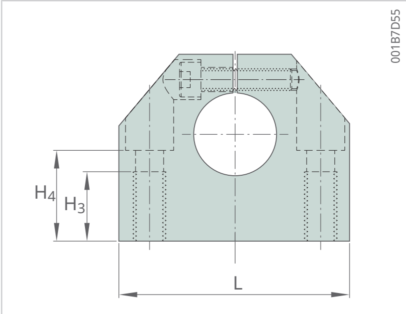
J	J2	J3	L [1)]	L1	N	N2
mm	mm	mm	mm	mm	mm	mm
25	35	5	45	19	4.3	2.7
32	42	6	52	25	5.3	3.2
40	46	7.5	56	31.8	5.3	4.3
45	58	10	70	37	5.3	5.3
60	68	16	80	48	6.4	6.4
68	76	18	88	56	8.4	6.4
86	94	22	108	71	10.5	8.4
108	116	30	135	86	10.5	10.5
132	138	40	160	105	13	13
170	180	60	205	136	17	15

13.2.3 Shaft blocks LSHS of the compact range

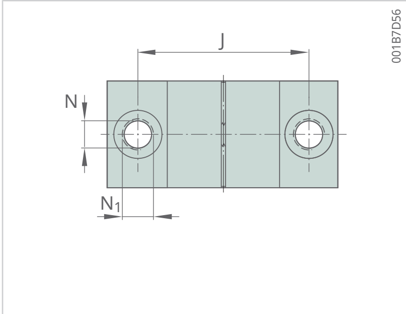
Designation	m	ISO series	D_a	A	H	H_2
					±0.01	
–	kg	–	mm	mm	mm	mm
LSHS 12	0.05	1	12	18	19	33
LSHS 16	0.07	1	16	20	22	38
LSHS 20	0.11	1	20	24	25	45
LSHS 25	0.17	1	25	28	31	54
LSHS 30	0.22	1	30	30	34	60
LSHS 40	0.47	1	40	40	42	76
LSHS 50	0.82	1	50	50	50	92



LSHS



LSHS

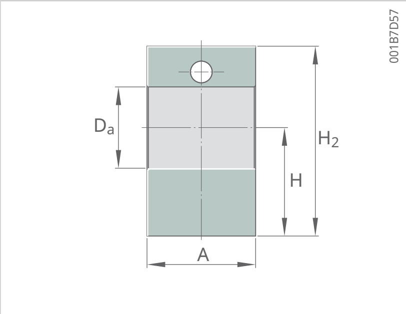


LSHS

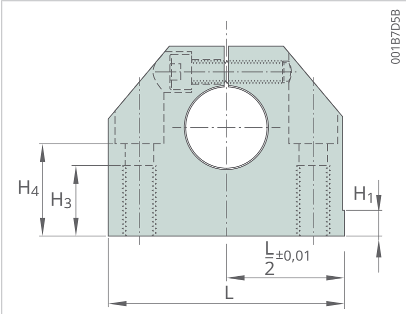
H_3	H_4	J	L	N	N_1
mm	mm	mm	mm	mm	–
13	16.5	27	40	5.3	M6
13	18	32	45	5.3	M6
18	21	39	53	6.6	M8
22	25	44	62	8.4	M10
22	29	49	67	8.4	M10
26	37	66	87	10.5	M12
34	44	80	103	13.5	M16

13.2.4 Shaft blocks LSNS

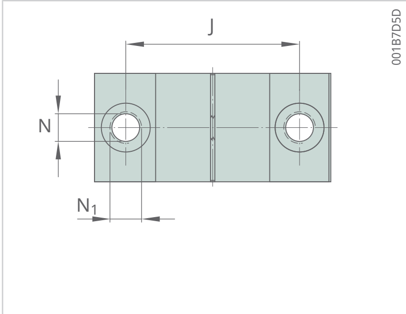
Designation	m	ISO series	D_a	A	H	H_1
					±0.01	
–	kg	–	mm	mm	mm	mm
LSNS 12	0.06	3	12	20	20	6
LSNS 16	0.11	3	16	24	25	7
LSNS 20	0.17	3	20	30	30	7.5
LSNS 25	0.34	3	25	38	35	8.5
LSNS 30	0.46	3	30	40	40	9.5
LSNS 40	0.90	3	40	48	50	11
LSNS 50	1.45	3	50	58	60	11



LSNS



LSNS



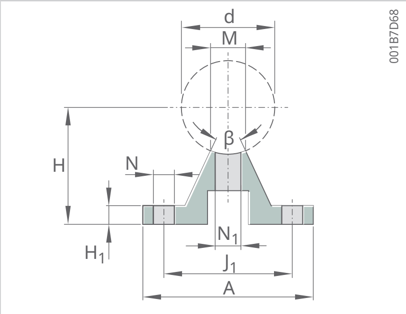
LSNS

H_2	H_3	H_4	J	L	N	N_1
mm	mm	mm	mm	mm	mm	–
35	13	16.5	30	43	5.3	M6
42	18	21	38	53	6.6	M8
50	22	25	42	60	8.4	M10
61	26	30	56	78	10.5	M12
70	26	34	64	87	10.5	M12
90	34	44	82	108	13.5	M16
105	43	49	100	132	17.5	M20

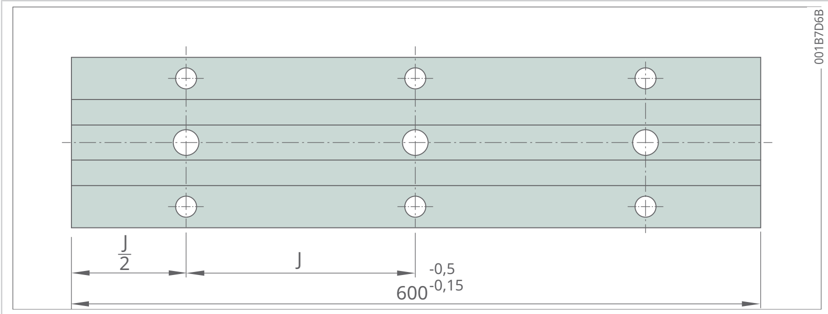
13.2.5 Shaft supports LRCB

with mounting holes

Designation	m	d	A	H	H_1
				±0.01	
–	kg	mm	mm	mm	mm
LRCB 12	0.44	12	40	22	5
LRCB 16	0.55	16	45	26	5
LRCB 20	0.80	20	52	32	6
LRCB 25	0.90	25	57	36	6
LRCB 30	1.13	30	69	42	7
LRCB 40	1.60	40	73	50	8
LRCB 50	2.10	50	84	60	9
LRCB 60	2.37	60	94	68	10
LRCB 80	4.90	80	116	86	12



LRCB



LRCB

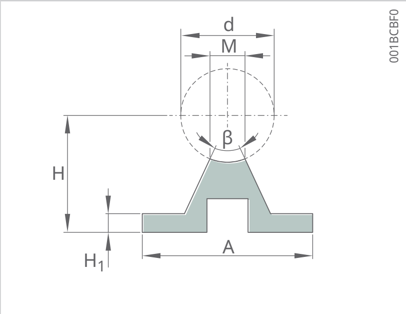
J	J_1	M	N	N_1	β	Shaft locating screw
mm	mm	mm	mm	mm	°	–
75	29	5.8	4.5	4.5	50	M4×16
100	33	7	5.5	5.5	50	M5×20
100	37	8.3	6.6	6.6	50	M6×25
120	42	10.8	6.6	9	50	M8×25
150	51	11	9	11	50	M10×30
200	55	15	9	11	50	M10×35
200	63	19	11	13	46	M12×40
300	72	25	11	15.5	46	M14×45
300	92	34	13	17.5	46	M16×55

13

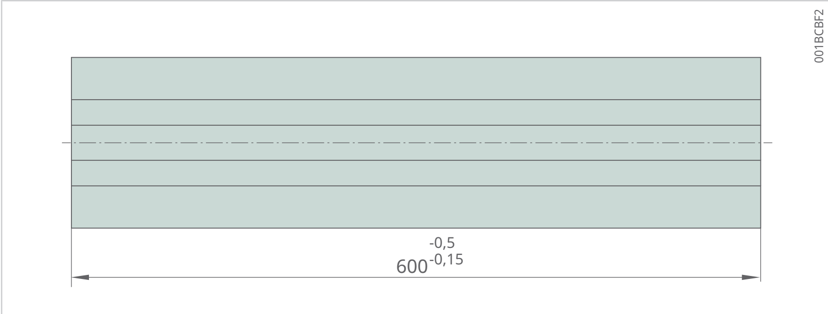
13.2.6 Shaft supports LRCC

without mounting holes

Designation	m	d	A	H
				±0.01
–	kg	mm	mm	mm
LRCC 12	0.46	12	40	22
LRCC 16	0.56	16	45	26
LRCC 20	0.81	20	52	32
LRCC 25	0.92	25	57	36
LRCC 30	1.18	30	69	42
LRCC 40	1.62	40	73	50
LRCC 50	2.16	50	84	60
LRCC 60	2.41	60	94	68
LRCC 80	4.99	80	116	86



LRCC



LRCC

H_1	M	N_1	β
mm	mm	mm	°
5	5.8	4.5	50
5	7	5.5	50
6	8.3	6.6	50
6	10.8	9	50
7	11	11	50
8	15	11	50
9	19	13	46
10	25	15.5	46
12	34	17.5	46

13

14 Precision steel shafts

Precision steel shafts are high-quality linear guide components designed for use with linear ball bearings. They offer exceptional dimensional stability and a long service life.

The shafts are induction-hardened, ground round steel bars dimensionally matched to the linear ball bearings. The tolerances of the precision steel shafts have a direct influence on the operating clearance of a linear bearing system, while the shaft hardness plays a key role in the rating life calculation. Since the shaft effectively serves as the inner ring of the linear bearing, its quality is critical to the reliability and service life of machines and systems.

The precision steel shaft range includes a suitable product for almost every linear ball bearing application in terms of material, dimensions, and design. To ensure the best possible service and high availability, shafts are pre-manufactured in long lengths. Standard shaft machining options have been defined under the designation ESSC (Standard Shaft Configurations) to ensure straightforward product selection and order processing.

14.1 Product design

23 Product design

Designation	Type	Material	Steel designation [1]	Steel designation	Hardness
			EN	AISI	HRC
LJM	Solid shaft	High grade steel	1.1213	1055	62 ± 2
LJMR	Solid shaft	High-alloy, corrosion-resistant stainless steel	1.4112	440B	54 ± 2
LJMS	Solid shaft	Corrosion-resistant stainless steel	1.4034	420	53 ± 2
LJMH	Solid shaft	High grade steel, hard-chromium-plated, approx. 10 μm	1.1213	1055	62 ± 2
LJT	Hollow shaft	High grade steel	1.0601	1060	62 ± 2

1) or equivalent

14.1.1 Shaft hardness and hardness depth

All precision steel shafts are induction hardened. Their hardness depends primarily on the respective material, while the hardness depth is determined by shaft size. Minimum hardness depths have been defined for the individual shaft sizes.

24 Hardness depth

Shaft diameter	Min. hardness depth
mm	mm
3 ... 10	0.4
12 ... 16	0.6
20 ... 30	0.9
40 ... 50	1.5
60 ... 80	2.2

The hardness depth may be larger than the values specified in the table, which affects the machinability of the shafts and should therefore be taken into account. The ends of uncut shafts in production lengths may exhibit deviations in hardness and dimensional accuracy.

14.1.2 Corrosion resistance of shafts and corrosion protection

Most linear ball bearings are available in a corrosion-resistant steel design identified by the suffix HV 6. The shaft range also includes various material options that provide protection against corrosion.

Shafts LJMR are made from high-alloy stainless steel offering high hardness and excellent wear resistance. This material is resistant to moderately aggressive media and ensures long-term corrosion protection combined with a long rating life.

Shafts LJMS are also made from stainless steel, but have lower hardness compared with LJMR. This material provides effective corrosion protection and media resistance at an economical cost.

Hard-chromium-plated shafts LJMH have a high surface hardness as a result of the chromium layer. Only the outside diameter is chromium-plated; no chromium layer is applied to the cut ends of the shaft. This material offers moderate corrosion resistance.

Corrosion protection and packaging

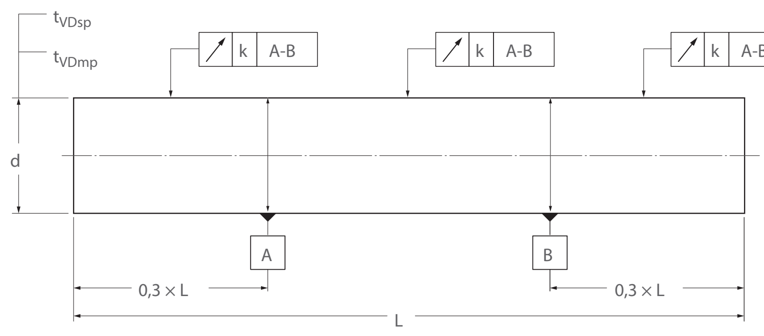
Precision steel shafts are treated with a corrosion-inhibiting preservative, which must be removed before installation. Depending on their size and quantity, the shafts are shipped in cardboard or wooden boxes that provide optimal protection during transport. Please contact us if special shipping conditions apply, for example in the case of overseas transport.

14.1.3 Tolerances of precision steel shafts

The outside diameters of the precision steel shafts are manufactured to tolerance h6 as standard. Only hard-chromium-plated shafts LJMH are available exclusively in h7 tolerance. The surface roughness Ra of the shafts is 0.3 μm. The dimensional and geometric accuracy values are listed in the respective product tables ➤182 | 14.2.2. The r values given in the tables are minimum values. For soft-annealed and machined shaft sections, slight deviations from the dimensional and geometric accuracy values specified in the tables may occur.

The shaft tolerances are defined in accordance with ISO 13012-1.

81 Tolerances



14.1.4 Machined precision steel shafts

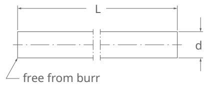
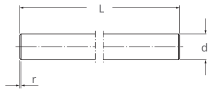
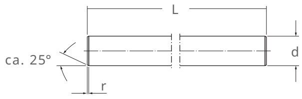
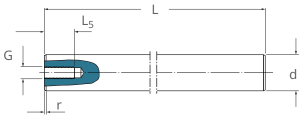
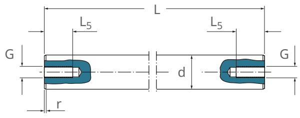
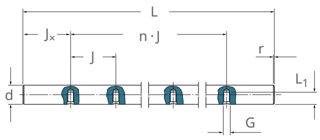
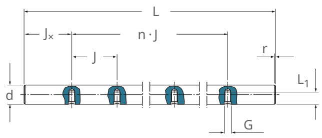
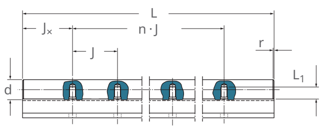
Standard shaft configurations (ESSC)

For machined shafts, standard configurations have been defined that are widely used in applications with linear ball bearings. These configurations primarily specify the design of the two shaft ends and any radial holes. The relevant standard configuration must be indicated in the shaft order code. For example, the designation for a shaft with a diameter of 20 mm, a length of 1.5 m, and chamfers on both ends is: LJM 20x1500 ESSC 2. For shafts produced to a customer drawing, the suffix ESSC 10 is used in the order code.

Precision steel shafts with radial thread

For open linear ball bearings, shafts with radial threads are required which are mounted on shaft supports. To simplify documentation and define the connection of shafts and shaft supports, a design standard has been established for the radial thread and spacing. Radial threads can be provided either to match the shaft supports (suffix ESSC 6) or according to customer specifications (suffix ESSC 7). When designing your own shafts, use the thread size and thread depth values specified in the adjacent tables. Shafts with radial threads are not annealed at the drilled locations. The thread is introduced into the hardened and ground shaft to prevent any adverse changes in the shaft's hardness and dimensional accuracy.

25 Standard shaft configurations (ESSC)

ESSC		Characteristics
1		Shaft cut to length and deburred Length tolerance ±1.5 mm
2		Shaft cut to length with chamfer Chamfer with value r of at least 1 mm Length tolerance ±1.5 mm
3		Shaft cut to length with approx. 25° chamfer Machined 90° end faces Length tolerance ±0.1 mm up to 3 m length Chamfer with value r
4		Shaft cut to length with chamfer Machined 90° end faces Length tolerance ±0.1 mm up to 3 m length Chamfer with value r 1 Axial thread in accordance with table
5		Shaft cut to length with chamfer Machined 90° end faces Length tolerance ±0,1 mm up to 3 m length Chamfer with value r 2 Axial thread
6		Shaft cut to length with chamfer Chamfer with value r of at least 1 mm Length tolerance ±1.5 mm Shaft with radial threads for LRCB shaft supports First radial thread at Jx = J/2
7		Shaft cut to length with chamfer Chamfer with value r of at least 1mm Length tolerance ±1.5 mm Shaft with radial threads Dimensions J and JX according to customer drawing
8		Shaft cut to length with chamfer Chamfer with value r of at least 1 mm Length tolerance ±1.5 mm Shaft with radial threads for LRCB shaft supports First radial thread at Jx = J/2 Shaft mounted on an LRCB shaft support

14

26 Dimensions of end-face threads ESSC 4 and ESSC 5

d	G	L_5
mm	–	mm
8	M4	10
10	M4	10
12	M5	12.5
14	M5	12.5
16	M6	15
20	M8	20
25	M10	25
30	M10	25
40	M12	30
50	M16	40
60	M20	50
80	M24	60

27 Dimensions of radial threads for ESSC 6, ESSC 7, and ESSC 8

d	G	L_1	J	J_x
mm	–	mm	mm	mm
8	–	–	–	–
10	–	–	–	–
12	M4	8	75	37.5
14	–	–	–	–
16	M5	9.5	100	50
20	M6	13	100	50
25	M8	14	120	60
30	M10	18	150	75
40	M10	20	200	100
50	M12	23	200	100
60	M14	28	300	150
80	M16	33	300	150

14.1.5 Jointed precision shafts

If shafts longer than 6 m are required, jointed precision shafts can be supplied on request. For unsupported shafts, screw connections are recommended, whereas plug connections are used for supported shafts. Schaeffler ensures the highest machining accuracy at the shaft ends, including precise centering, which is essential for a smooth transition at the shaft joint. For jointed precision shafts, a customer drawing with details and a defined joint design must always be submitted for order processing. The suffix for a customer-specific shaft is ESSC 10.

14.2 Product tables

14.2.1 Explanations

A	mm^2	Cross-sectional area
d	mm	Outside diameter
d_1	mm	Inside diameter
k	μm/m	Radial runout
L	–	Lower limit dimension
L	mm	Length
L_{max}	mm	Maximum length
m	kg/m	Mass
M_{OI}	cm^4	Mass moment of inertia
r	mm	Chamfer
t_{VDmp}	μm	Variation of the mean outside diameter over the entire length of a single shaft
t_{VDsp}	μm	Variation of the mean outside diameter within one cross-sectional plane
$t_{\Delta ds}$	μm	ISO tolerance field for the shaft outside diameter
U	μm	Upper limit deviation

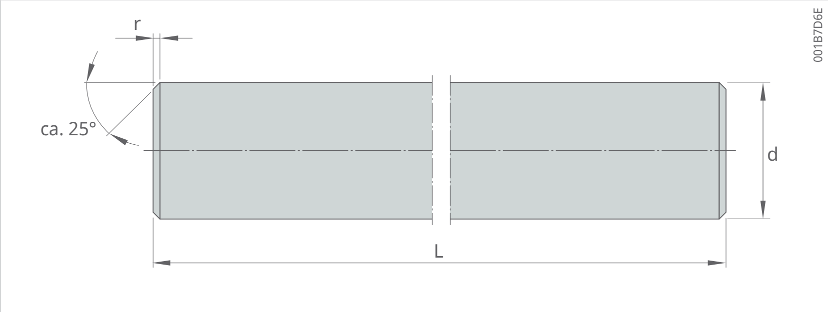
14.2.2 Precision steel shafts

LJM

Solid shafts

High grade steel

Designation	m	d	r	L_{max}	M_{OI}
				±1.5	
–	kg/m	mm	mm	mm	cm^4
LJM 3	0.06	3	0.4	1000	0.0004
LJM 4	0.1	4	0.4	3000	0.0013
LJM 5	0.15	5	0.8	3000	0.0031
LJM 6	0.22	6	0.8	3000	0.0064
LJM 8	0.39	8	0.8	3000	0.02
LJM 10	0.62	10	0.8	3000	0.049
LJM 12	0.89	12	1	6000	0.102
LJM 14	1.21	14	1	6000	0.189
LJM 16	1.58	16	1	6000	0.322
LJM 20	2.47	20	1.5	6000	0.785
LJM 25	3.86	25	1.5	6000	1.92
LJM 30	5.55	30	1.5	6000	3.98
LJM 40	9.86	40	2	6000	12.6
LJM 50	15.4	50	2	6000	30.7
LJM 60	22.2	60	2.5	6000	63.6
LJM 80	39.5	80	2.5	6000	201



Solid shaft in accordance with ESSC3

A	$t_{\Delta ds}$ h6		t_{VDsp} h6	t_{VDmp} h6	k h6
	U	L			
mm²	µm	µm	µm	µm	µm/m
7.1	0	–6	3	4	150
12.6	0	–8	4	5	150
19.6	0	–8	4	5	150
28.3	0	–8	4	5	150
50.3	0	–9	4	6	120
78.5	0	–9	4	6	120
113	0	–11	5	8	100
154	0	–11	5	8	120
201	0	–11	5	8	100
314	0	–13	6	9	100
491	0	–13	6	9	100
707	0	–13	6	9	100
1260	0	–16	7	11	100
1960	0	–16	7	11	100
2830	0	–19	8	13	100
5030	0	–19	8	13	100

14

14.2.3 Precision steel shafts

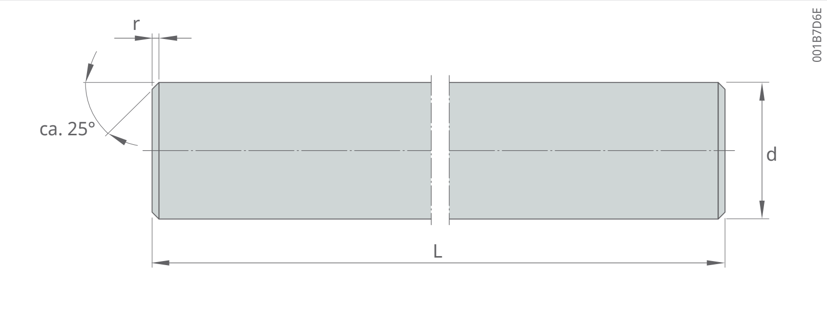
LJMR

Solid shafts

High-alloy, corrosion-resistant stainless steel

14

Designation	m	d	r	L_{max}	M_{OI}
				±1.5	
–	kg/m	mm	mm	mm	cm^4
LJMR 3	0.06	3	0.4	300	0.0004
LJMR 4	0.1	4	0.4	3000	0.0013
LJMR 5	0.15	5	0.8	3000	0.0031
LJMR 6	0.22	6	0.8	3000	0.0064
LJMR 8	0.39	8	0.8	3000	0.02
LJMR 10	0.62	10	0.8	3000	0.049
LJMR 12	0.89	12	1	6000	0.102
LJMR 14	1.21	14	1	6000	0.189
LJMR 16	1.58	16	1	6000	0.322
LJMR 20	2.47	20	1.5	6000	0.785
LJMR 25	3.86	25	1.5	6000	1.92
LJMR 30	5.55	30	1.5	6000	3.98
LJMR 40	9.86	40	2	6000	12.6
LJMR 50	15.4	50	2	6000	30.7
LJMR 60	22.2	60	2.5	6000	63.6



Solid shaft in accordance with ESSC3

A	$t_{\Delta ds}$ h6		t_{VDsp} h6	t_{VDmp} h6	k h6
	U	L			
mm^2	µm	µm	µm	µm	µm/m
7.1	0	–6	3	4	150
12.6	0	–8	4	5	150
19.6	0	–8	4	5	150
28.3	0	–8	4	5	150
50.3	0	–9	4	6	120
78.5	0	–9	4	6	120
113	0	–11	5	8	100
154	0	–11	5	8	120
201	0	–11	5	8	100
314	0	–13	6	9	100
491	0	–13	6	9	100
707	0	–13	6	9	100
1260	0	–16	7	11	100
1960	0	–16	7	11	100
2830	0	–19	8	13	100

14

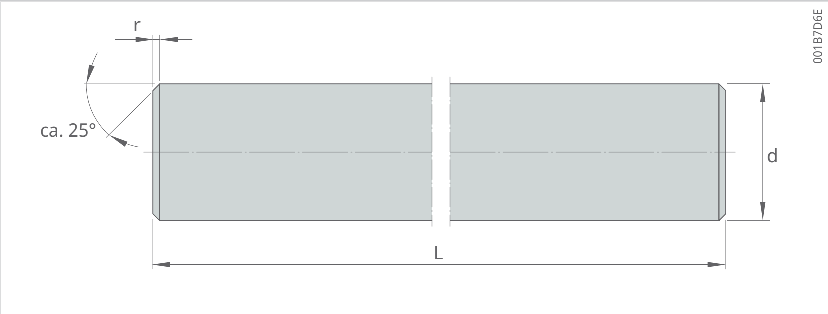
14.2.4 Precision steel shafts

LJMS

Solid shafts

Corrosion-resistant stainless steel

Designation	m	d	r	L_{max}	M_{OI}
				±1.5	
–	kg/m	mm	mm	mm	cm^4
LJMS 6	0.22	6	0.8	3000	0.0064
LJMS 8	0.39	8	0.8	3000	0.02
LJMS 10	0.62	10	0.8	3000	0.049
LJMS 12	0.89	12	1	6000	0.102
LJMS 14	1.21	14	1	6000	0.189
LJMS 16	1.58	16	1	6000	0.322
LJMS 20	2.47	20	1.5	6000	0.785
LJMS 25	3.86	25	1.5	6000	1.92
LJMS 30	5.55	30	1.5	6000	3.98
LJMS 40	9.86	40	2	6000	12.6
LJMS 50	15.4	50	2	6000	30.7
LJMS 60	22.2	60	2.5	6000	63.6



Solid shaft in accordance with ESSC3

A	$t_{\Delta ds}$ h6		t_{VDsp} h6	t_{VDmp} h6	k h6
	U	L			
mm^2	μm	μm	μm	μm	μm/m
28.3	0	–8	4	5	150
50.3	0	–9	4	6	120
78.5	0	–9	4	6	120
113	0	–11	5	8	100
154	0	–11	5	8	120
201	0	–11	5	8	100
314	0	–13	6	9	100
491	0	–13	6	9	100
707	0	–13	6	9	100
1260	0	–16	7	11	100
1960	0	–16	7	11	100
2830	0	–19	8	13	100

14

14.2.5 Precision steel shafts

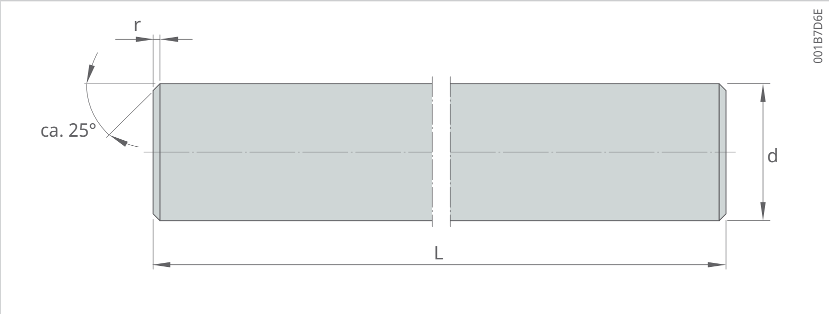
LJMH

Solid shafts

High grade steel, hard-chromium-plated

14

Designation	m	d	r	L_{max}	M_{OI}
				±1.5	
–	kg/m	mm	mm	mm	cm^4
LJMH 5	0.15	5	0.8	3000	0.0031
LJMH 6	0.22	6	0.8	3000	0.0064
LJMH 8	0.39	8	0.8	3000	0.02
LJMH 10	0.62	10	0.8	3000	0.049
LJMH 12	0.89	12	1	6000	0.102
LJMH 14	1.21	14	1	6000	0.189
LJMH 16	1.58	16	1	6000	0.322
LJMH 20	2.47	20	1.5	6000	0.785
LJMH 25	3.86	25	1.5	6000	1.92
LJMH 30	5.55	30	1.5	6000	3.98
LJMH 40	9.86	40	2	6000	12.6
LJMH 50	15.4	50	2	6000	30.7
LJMH 60	22.2	60	2.5	6000	63.6
LJMH 80	39.5	80	2.5	6000	201



Solid shaft in accordance with ESSC3

A	$t_{\Delta ds}$ h7		t_{VDsp} h7	t_{VDmp} h7	k h7
	U	L			
mm²	µm	µm	µm	µm	µm/m
19.6	0	–12	5	8	150
28.3	0	–12	5	8	150
50.3	0	–15	6	9	120
78.5	0	–15	6	9	120
113	0	–18	8	11	100
154	0	–18	8	11	120
201	0	–18	8	11	100
314	0	–21	9	13	100
491	0	–21	9	13	100
707	0	–21	9	13	100
1260	0	–25	11	16	100
1960	0	–25	11	16	100
2830	0	–30	13	19	100
5030	0	–30	13	19	100

14

14.2.6 Precision steel shafts

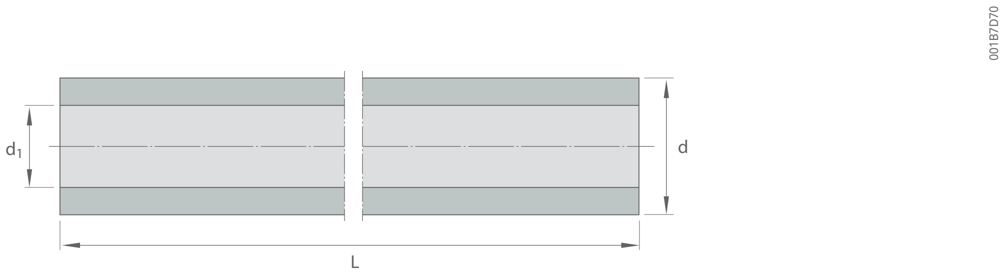
LJT

Hollow shafts

High grade steel

Designation	m	d	d_1 [1)]	r	L_{max}	M_{OI}
					±1.5	
–	kg/m	mm	mm	mm	mm	cm^4
LJT 12	0.79	12	4	1	6000	0.1
LJT 16	1.28	16	7	1	6000	0.31
LJT 20	1.25	20	14	1.5	6000	0.597
LJT 25	2.35	25	16	1.5	6000	1.64
LJT 30	3.5	30	18	1.5	6000	3.46
LJT 40	4.99	40	28	2	6000	9.96
LJT 50	9.91	50	30	2	6000	27.7
LJT 60	14.2	60	36	2.5	6000	57.1
LJT 80	19.43	80	57	2.5	6000	153

1) For sizes 25, 30, 40: d_1 may deviate from the specified value. Contact Schaeffler if necessary.



Hollow shaft LJT in accordance with ESSC1

A	$t_{\Delta ds}$ h6		t_{VDsp} h6	t_{VDmp} h6	k h6
	U	L			
mm²	µm	µm	µm	µm	µm/m
101	0	–11	5	8	100
163	0	–11	5	8	100
160	0	–13	6	9	100
305	0	–13	6	9	100
453	0	–13	6	9	100
685	0	–16	7	11	100
1350	0	–16	7	11	100
1920	0	–19	8	13	100
2565	0	–19	8	13	100

15 Standard housings

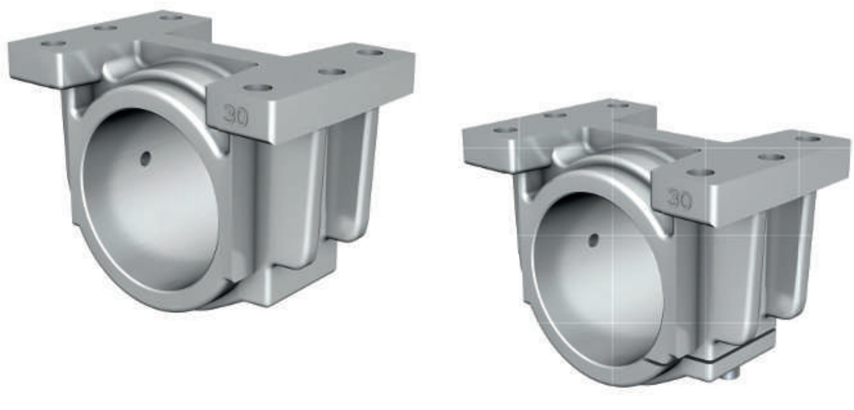
15.1 Product design

Linear ball bearings must be mounted in housings for proper operation. The individual lightweight aluminum housings are finish-machined and can be fitted with bearings of the standard range. The high-quality design provides a defined reference side for linear alignment. The housing bore Da for accommodating the linear bearing is manufactured to tolerance J6. Depending on the application, various flexible mounting and fastening options are available, with the housings optimized for mounting with hexagon socket head cap screws in accordance with DIN ISO 4762. Axial and radial bearing fixation corresponds to ISO standard bearings. Each housing is supplied with a grease fitting for bearing fixation. Three housing variants are available.

15.1.1 Closed housings

Linear bearing housings LHCR in closed design are available for standard bearings in sizes from 8 mm to 80 mm. They allow simple mounting from above or below and feature a reference side for linear alignment. The bearing is fixed via the grease fitting, which also serves for relubrication, except for size 8 mm.

82 Housings LHCR, LHCS



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15.1.2 Slotted housings

Linear bearing housings LHCS in slotted design for adjusting the operating clearance are available for standard bearings in sizes 8 mm to 80 mm. They allow simple mounting from above or below and feature a reference side for linear alignment. The bearing is fixed via the grease fitting, which also serves for relubrication, except for size 8 mm.

15.1.3 Open housings

Linear bearing housings LHCT in open design are available for standard bearings in sizes from 12 mm to 80 mm. They allow simple mounting from above or below and feature a reference side for linear alignment. The bearing is fixed via the grease fitting, which also serves for relubrication.

When using Schaeffler linear ball bearings LBCT or LBCF, the operating clearance can be adjusted.

83 Housings LHCT

15.2 Product tables

15.2.1 Explanations

A	mm	Length
A_1	mm	Length
D_a	mm	Bore diameter
H	mm	Center height
H_1	mm	Height
H_2	mm	Height
J	mm	Distance
J_1	mm	Distance
J_2	mm	Distance
L	mm	Width
N	mm	Fixing hole
N_2	mm	Bore diameter
α	°	Opening angle
β	°	Angle

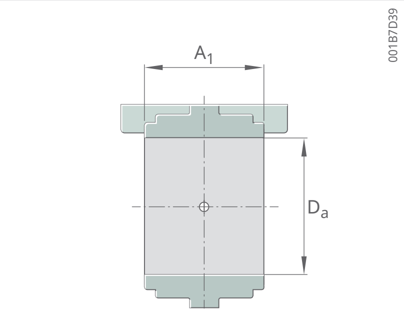
15

15.2.2 Linear bearing housings LHCR

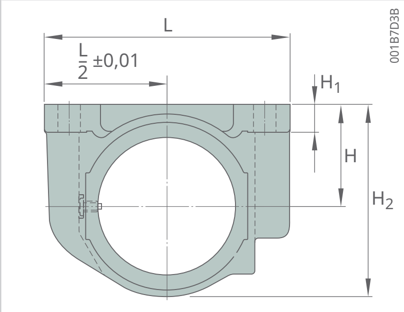
Designation	m	D_a	A	A1	H	H_1	H_2
					±0.01		
–	kg	mm	mm	mm	mm	mm	mm
LHCR 8	0.02	16	27	14	15	5.5	28
LHCR 12	0.04	22	31	20	18	6	34.5
LHCR 16	0.05	26	34.5	22	22	7	40.5
LHCR 20	0.10	32	41	28	25	8	48
LHCR 25	0.20	40	52	40	30	10	58
LHCR 30	0.28	47	59	48	35	10	67
LHCR 40	0.47	62	74	56	45	12	85
LHCR 50	0.76	75	66	72	50	14	99
LHCR 60	1.35	90	84	95	60	18	118
LHCR 80	3.25	120	113	125	80	22	158

[1) For sizes 50 to 80: tolerance L/2 ± 0.02

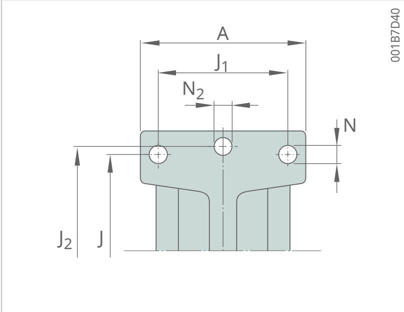
15



LHCR



LHCR



LHCR

J	J_1	J_2	L 1)	N	N_2	Grease fitting
mm	mm	mm	mm	mm	mm	–
25	20	35	45	3.2	5.3	–
32	23	42	52	4.3	5.3	VN-LHC 20
40	26	46	56	4.3	5.3	VN-LHC 20
45	32	58	70	4.3	6.4	VN-LHC 20
60	40	68	80	5.3	6.4	VN-LHC 40
68	45	76	88	6.4	6.4	VN-LHC 40
86	58	94	108	8.4	8.4	VN-LHC 40
108	50	116	135	8.4	10.5	VN-LHC 50
132	65	138	160	10.5	13	VN-LHC 80
170	90	180	205	13	13	VN-LHC 80

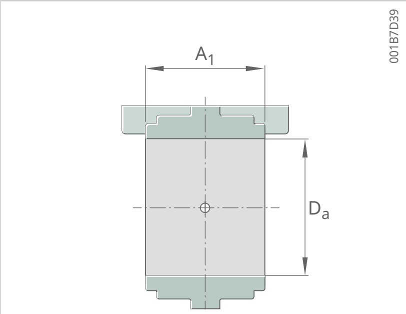
15

15.2.3 Linear bearing housings LHCS

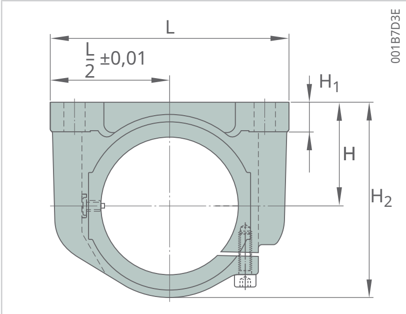
Adjustable operating clearance

Designation	m	D_a	A	A1	H	H_1	H_2
					±0.01		
–	kg	mm	mm	mm	mm	mm	mm
LHCS 8	0.02	16	27	14	15	5.5	28
LHCS 12	0.04	22	31	20	18	6	34.5
LHCS 16	0.05	26	34.5	22	22	7	40.5
LHCS 20	0.10	32	41	28	25	8	48
LHCS 25	0.20	40	52	40	30	10	58
LHCS 30	0.28	47	59	48	35	10	67
LHCS 40	0.47	62	74	56	45	12	85
LHCS 50	0.76	75	66	72	50	14	99
LHCS 60	1.35	90	84	95	60	18	118
LHCS 80	3.25	120	113	125	80	22	158

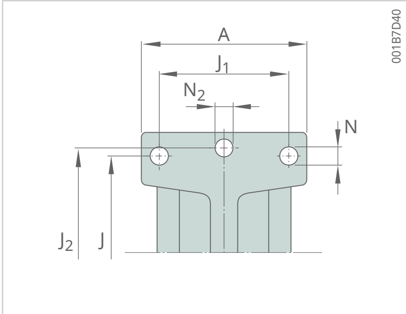
1) For sizes 50 to 80: tolerance L/2 ± 0.02



LHCS



LHCS



LHCS

J	J_1	J_2	L [1]	N	N_2	Adjustment screw	Grease fitting
mm	mm	mm	mm	mm	mm	–	–
25	20	35	45	3.2	5.3	M3	–
32	23	42	52	4.3	5.3	M3	VN-LHC 20
40	26	46	56	4.3	5.3	M3	VN-LHC 20
45	32	58	70	4.3	6.4	M4	VN-LHC 20
60	40	68	80	5.3	6.4	M5	VN-LHC 40
68	45	76	88	6.4	6.4	M6	VN-LHC 40
86	58	94	108	8.4	8.4	M6	VN-LHC 40
108	50	116	135	8.4	10.5	M8	VN-LHC 50
132	65	138	160	10.5	13	M10	VN-LHC 80
170	90	180	205	13	13	M12	VN-LHC 80

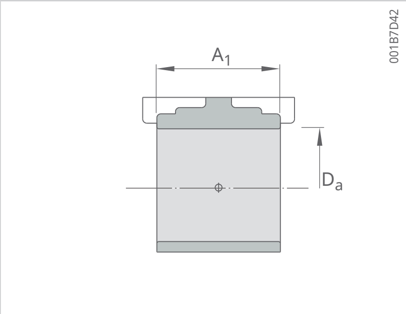
15

15.2.4 Linear bearing housings LHCT

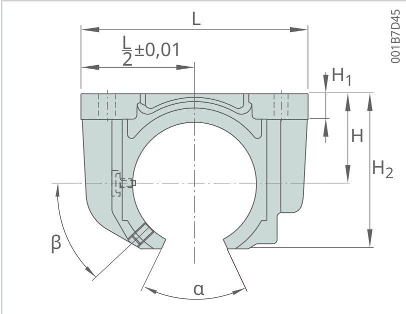
open design

Designation	m	D_a	A	A1	H	H_1	H_2
					±0.01		
–	kg	mm	mm	mm	mm	mm	mm
LHCT 12 D	0.03	22	31	20	18	6	28
LHCT 16 D	0.05	26	34.5	22	22	7	35
LHCT 20 D	0.09	32	41	28	25	8	42
LHCT 25 D	0.18	40	52	40	30	10	51
LHCT 30 D	0.25	47	59	48	35	10	60
LHCT 40	0.41	62	74	56	45	12	77
LHCT 50	0.67	75	66	72	50	14	88
LHCT 60	1.18	90	84	95	60	18	105
LHCT 80	2.86	120	113	125	80	22	140

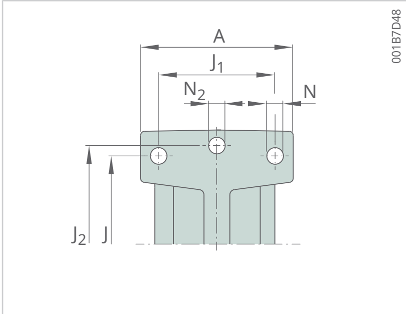
[1] For sizes 50 to 80: tolerance L/2 ± 0.02



LHCT



LHCT



LHCT

J	J_1	J_2	L [1)]	N	N_2	α	β	Grub screw	Grease fitting
mm	mm	mm	mm	mm	mm	°	°	–	–
32	23	42	52	4.3	5.3	78	29	M3	VN-LHC 20
40	26	46	56	4.3	5.3	78	27.6	M3	VN-LHC 20
45	32	58	70	4.3	6.4	60	42	M5	VN-LHC 20
60	40	68	80	5.3	6.4	60	43	M5	VN-LHC 40
68	45	76	88	6.4	6.4	50	43.6	M5	VN-LHC 40
86	58	94	108	8.4	8.4	50	30	M5	VN-LHC 40
108	50	116	135	8.4	10.5	50	30	M6	VN-LHC 50
132	65	138	160	10.5	13	54	30	M8	VN-LHC 80
170	90	180	205	13	13	54	30	M8	VN-LHC 80

16 Structure of the ordering key

84 Structure of the ordering key for linear bearings

L B C T 20 D – 2LS/HV6

L	Linear bearings
B	Linear ball bearings
P	Linear plain bearings
A	Standard range
B	Compact range
C	Standard range
D	Closed design, self-aligning
F	Open design, self-aligning
R	Closed design
T	Open design
25	Size 12 ... 50 mm
A	Design A
D	Design D
Suffix	
2LS	Double lip seal, sealed on both sides
/HV6	Design made of corrosion-resistant steel

001D0A8F

16

85 Structure of the ordering key for linear bearing units of the compact range

L U H R 25 – 2LS/HV6

L	Linear bearing unit
T	Tandem unit with 2 bearings
U	Single bearing unit
B	Compact range
H	Single bearing unit, compact range
J	Single bearing unit with external shaft rings, compact range
R	Closed design
25	Size 12 ... 50 mm
Suffix	
2LS	Double lip seal, sealed on both sides
/HV6	Design made of corrosion-resistant steel

001D0A9F

86 Structure of the ordering key for linear bearing units of the standard range

L U C R 30 D – 2LS/HV6

L	Linear bearing unit
T	Tandem unit with 2 bearings
U	Single bearing unit
V	Flanged bearing unit
C	Standard range
N	Single bearing unit, standard range
D	Closed design, self-aligning
E	Slotted design, self-aligning
F	Open design, self-aligning
R	Closed design
S	Slotted design
T	Open design
30	Size 3 ... 80 mm
-	Design A
D	Design D

Suffix

2LS	Double lip seal, sealed on both sides
/HV6	Design made of corrosion-resistant steel

001D0AAF

16

87 Structure of the ordering key for precision steel shafts

LJ M S 30 x 2500 – ESSC – 2

LJ	Precision steel shaft
Shaft design	
M	Solid shaft
T	Hollow shaft
Standard material	
H	Standard material, chromium-plated
R	High-alloy stainless steel
S	Stainless steel
Size	
30	Size 3 ... 80 mm
Length in mm	
2500	Length in mm
Configuration	
ESSC	Standard shaft configurations
Definition	
2	ESSC definition

001D0A7F

88 Structure of the ordering key for accessories

L S N S 16

L	Linear bearing accessories
H	Bearing housing
R	Shaft support
S	Shaft block
C	Standard housing, compact shaft block, or standard shaft block
H	Single bearing unit, standard range
N	Single bearing unit, standard range
B	Shaft support with mounting holes
C	Shaft support, customer-specific
R	Closed design
S	Slotted design
T	Open design
16	Size, 8 ... 80 mm

001D09B6

28 Suffixes

Designation	Shields	2 double lip seals (sealed on both sides)	1 double lip seal (sealed on one side)	Corrosion-resistant
Linear ball bearings	–	2LS	LS	HV6
Linear bearing units	–	2LS	–	HV6

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