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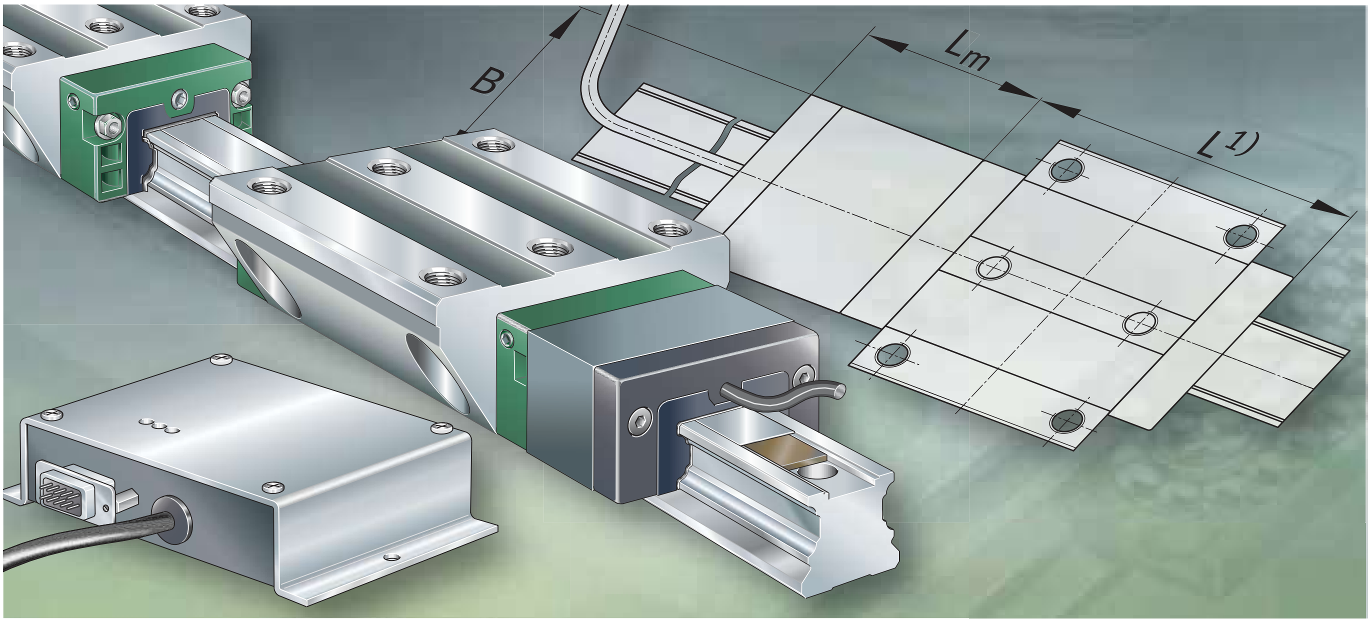


Four-row linear recirculating ball bearing and guideway assemblies

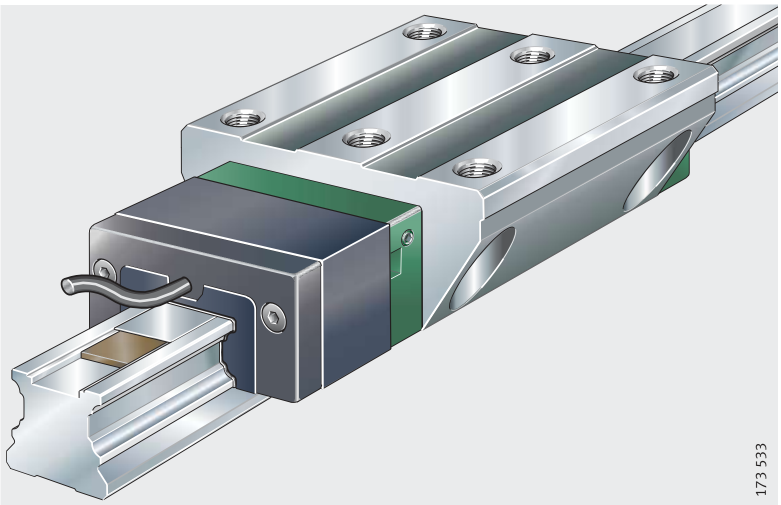
With integral measuring system

Product overview Four-row linear ball bearing and guideway assemblies with measuring system

Electronic-magnetic measuring system

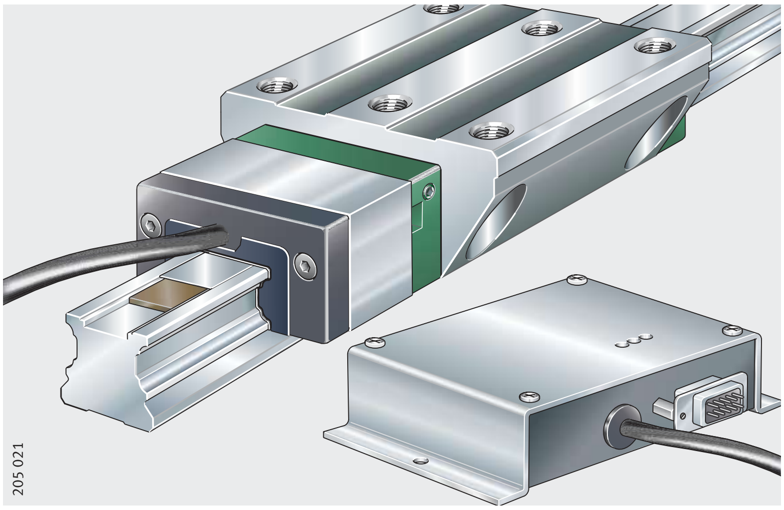
Incremental

KUVE..-B-LMST



Absolute digital

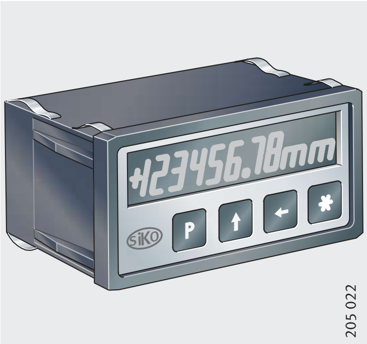
KUVE..-B-LMSD



Special accessory

Positional display

MA10/4



Four-row linear ball bearing and guideway assemblies with measuring system

Features

These linear recirculating ball bearing and guideway assemblies comprise a carriage with an adapted measuring head and a guideway for location of the magnetic strip and covering strip. Measurement is carried out by incremental or absolute digital means.

The guidance systems expand on the advantages of the proven linear recirculating ball bearing and guideway assemblies KUVE without a measuring system by the direct measurement of travel distances.

Mechanical component

The mechanical component of the monorail guidance system corresponds to linear recirculating ball bearing and guideway assemblies KUVE. These units can support forces from all directions and moments about all axes, are preloaded and have high accuracy, rigidity and load carrying capacity.

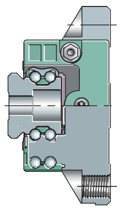
Mechanical features: see page 235.

Measuring system

The measuring system is used to measure the displacement distance. It directly measures the distance covered by means of magnetic scanning (Incremental or absolute measurement) irrespective of the quality of the drive.

The magnetic strip has a single track dimensional scale with a pole pitch of 5 mm.

The maximum travel speed of the carriage is 360 m/min,
the maximum measurement length is 90 m.



Four-row linear ball bearing and guideway assemblies with measuring system

Incremental measuring system

Linear recirculating ball bearing and guideway assemblies KUVE..-B-LMST+EP have an incremental length measuring system with a fixed reference point, KUVE..-B-LMST+MP have the same system with a multiple reference point, *Figure 1*.
The technical data are given on page 329.

The multiple reference point is a freely selectable reference point and can be defined over the whole measurement length on a 5 mm grid.

Ordering examples: see page 332 and page 333.

KUVE..-B-LMST+EP
KUVE..-B-LMST+MP

① Adapted measuring head
② Guideway with integral magnetic strip
③ Covering strip

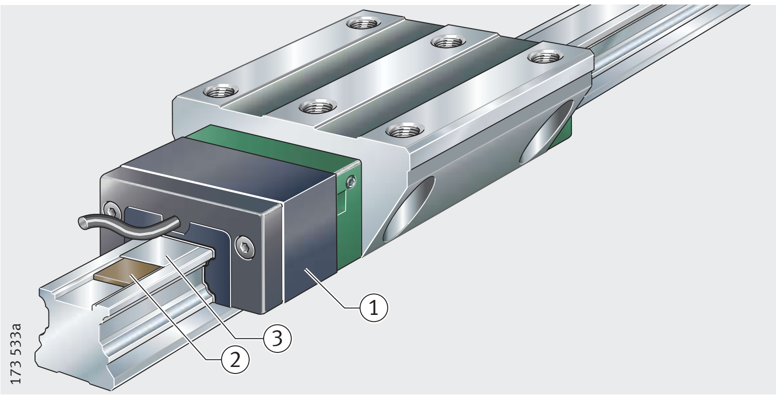


Figure 1
Incremental system

Absolute digital measuring system

Linear recirculating ball bearing and guideway assemblies KUVE..-B-LMSD have an absolute digital length measuring system. The electronic evaluation system is connected directly to the measuring head, *Figure 2*. The technical data are given on page 330.

Ordering example: see page 334.

KUVE..-B-LMSD

① Adapted measuring head
② Guideway with integral magnetic strip
③ Covering strip
④ Electronic evaluation system ASA 510

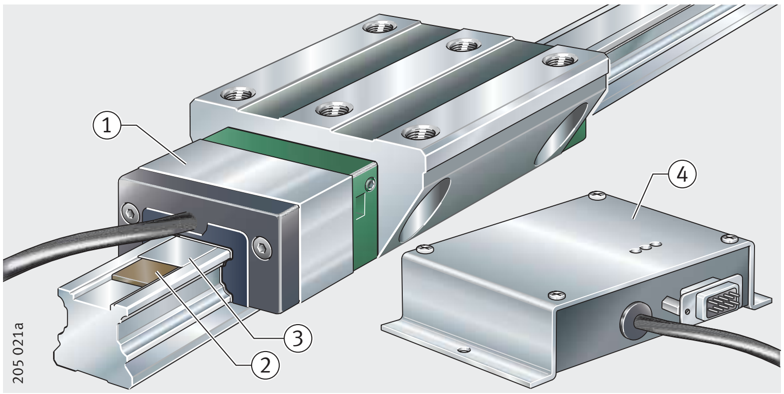


Figure 2
Absolute digital system

Design of measuring system

The designs of the measuring system are shown in the following table.

Designs

Measuring system	Guideway	Reference signal	Magnetic strip	Accuracy class (relative)[1)]
LMST+EP Length measuring system, incremental, TTL with single reference point	TKVD..-LMSD	Single point	MB500-LMST+EP	KL3
LMST+MP Length measuring system, incremental, TTL with multiple reference point	TKVD..-LMSD	Multiple point	MB500-LMSD	KL3
LMSD Length measuring system, absolute digital	TKVD..-LMSD	–	MB500-LMSD	KL3

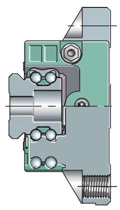
1) Accuracy class of magnetic strip:
– KL3: 0,05 mm = ±25 µm

Designs continued

Measuring system	Sensing head	Resolution[1)]	System accuracy (absolute)
LMST+EP Length measuring system, incremental, TTL with single reference point	ABTKO-LMST+EP	AU3	±(0,03 + 0,01×L) mm[2)]
LMST+MP Length measuring system, incremental, TTL with multiple reference point	ABTKO-LMST + MP	AU3	±(0,03 + 0,01×L) mm[2)]
LMSD Length measuring system, absolute digital	ABTKO LMSD	AU4	±(0,025 + 0,01×L) mm[2)]

1) Resolution class of sensing head:
– AU1: 0,001 mm = 1 µm (by agreement for LMST)
– AU3: 0,005 mm = 5 µm
– AU4: 0,01 mm = 10 µm.

2) L in m at +20 °C and per metre or part thereof.



Four-row linear ball bearing and guideway assemblies with measuring system

Available measuring system for series and size

Series	Size				
	KUVE20-B	KUVE25-B	KUVE30-B	KUVE35-B	KUVE45-B
KUVE..-B	●	●	●	●	●
KUVE..-B-L	●	●	●	●	●
KUVE..-B-H	–	●	●	●	●
KUVE..-B-HL	–	●	●	●	●
KUVE..-B-S	●	●	●	●	●
KUVE..-B-SL	●	●	●	●	●
KUVE..-B-SN	●	●	●	●	●
KUVE..-B-SNL	●	●	●	●	●
KUVE..-B-N	●	●	●	●	●
KUVE..-B-NL	●	●	●	●	●
KUVE..-B-E	●	●	●	●	●
KUVE..-B-EC	●	●	●	●	●
KUVE..-B-ES	●	●	●	●	●
KUVE..-B-ESC	●	●	●	●	●

Special accessory Positional display

The positional display MA10/4 is an individually programmable single axis device with a 12 character LCD display, high contrast and dot matrix, *Figure 3*.

The display shows the evaluated information from the magnetic sensors.

MA10/4

Figure 3
Positional display

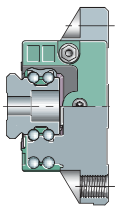
Design and safety guidelines

Attention! Note the design and safety guidelines starting from page 240.

Measuring system for incremental length measurement

Technical data

Feature	Technical data
Operating voltage	24 V DC ± 20 %, standard
Cable length	Open cable ends 2 m cable (standard), other cable lengths available by agreement
Cable sheath	PUR, oil-resistant, standard
Output switching	Line Driver (LD) standard, 5 V square wave output signal to RS422
Reference signal	Periodic index (LMST+MP) Fixed index (LMST+EP)
Resolution	0,005 mm, standard
Power consumption	max. 70 mA, to 24 V DC zero load
Output signals	A Quad B 5V TTL
Travel speed	max. 6,9 m/s (of magnetic sensor)
Distance between strip and sensor	max. 1,5 mm, over whole measurement length
System accuracy	$\pm(0,03 + 0,01 \times L)$ mm [L in m], at T_u = +20 °C; L = length per metre or part thereof
Repeat accuracy	±1 increment = ±0,005 mm
Temperature range	Working temperature –10 °C to +70 °C Storage temperature –30 °C to +80 °C
Humidity	100 % rF, dew formation permissible
Interference protection class	3, to IEC 801
Magnetic sensor type	MSK 500/1
Reference point	KUVE-LMST+EP: single reference point KUVE-LMST+MP: multiple reference point



Four-row linear ball bearing and guideway assemblies with measuring system

Measuring system for absolute length measurement

Technical data

Feature	Technical data
Operating voltage	24 V DC±20 %, standard
Cable length	2 m standard (fixed), between the measuring head and the electronic evaluation system
Measurement length	max. 83 m
Dimensional scale	1 track, pole pitch 5 mm
Positional detection	current-free, 3 V lithium battery, life approx. 7 to 10 years according to ambient temperature
Cable sheath	PUR, oil-resistant, standard
Output switching either or	 SSI, standard (to RS422 A, max. 1 MHz) RS485, ASCII protocol
Resolution	0,01 mm, internally adjustable
Power consumption	$<$ 100 mA, protection against reverse polarity
Connection type	D-SUB 9 pin
Housing for electronic evaluation system	Sheet steel, zinc electroplating
Interference protection class	3, to IEC 801
Travel speed	max. 6 m/s
Distance between strip and sensor	max. 2 mm, over whole measurement length
System accuracy	$\pm$(0,025 + 0,01$\times$L) mm [L in m], at T_u = +20 °C; L = length per metre or part thereof
Repeat accuracy	$\pm$1 digit = $\pm$0,01 mm
Temperature range	Working temperature 0 °C to +60 °C Storage temperature –30 °C to +70 °C
Humidity (electronic evaluation system)	95 % rF, dew formation permissible
Protection type (electronic evaluation system)	IP 40 to DIN VDE 0470, CE inspection symbol
Mass	approx. 550 g, electronic evaluation system with cable and measuring head

Fitting

When fitting the KUVE..-B-LMST+EP, attention must be paid to the direction of the arrows, *Figure 4*. The arrow on the magnetic strip and on the measuring head must point in the same direction.

(1) Locating face
(2) Reference point
(3) Marking arrows

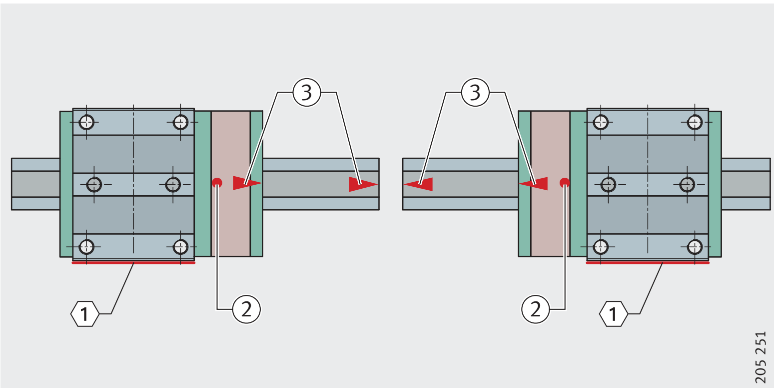


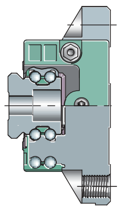
Figure 4
Marking arrows

Ordering example, ordering designation

Ordering data required

The following must be stated when ordering:

- the type of measuring system, see table Designs, page 327
  - incremental (LMST) with single or multiple reference point (EP or MP)
  - absolute digital (LMSD)
- the position of the measuring head: left (L) or right (R) with reference to the locating face, *Figure 5* and *Figure 6*
- the reference signal in the LMST version
  - single point (EP)
  - multiple point (MP)
- the position of the reference point (EP) in mm, *Figure 5*
  - EP = distance between the end face of the guideway and the centre of the carriage
  - E = distance between the end face of the guideway and the reference point (calculated by Schaeffler)
- the resolution of the sensing head
  - AU3 = 5 µm for LMST (EP and MP)
  - AU4 = 10 µm for LMSD
- the accuracy class of the magnetic strip
  - KL3 = 0,05 mm.



KUVE..-B-LMST+EP

1 Locating face
2 Reference point
3 Marking arrows

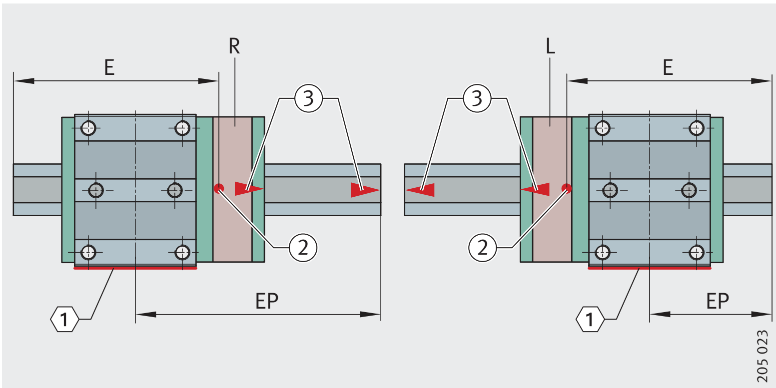


Figure 5
Position of the reference point

KUVE..-B-LMST+MP
KUVE..-B-LMSD

1 Locating face

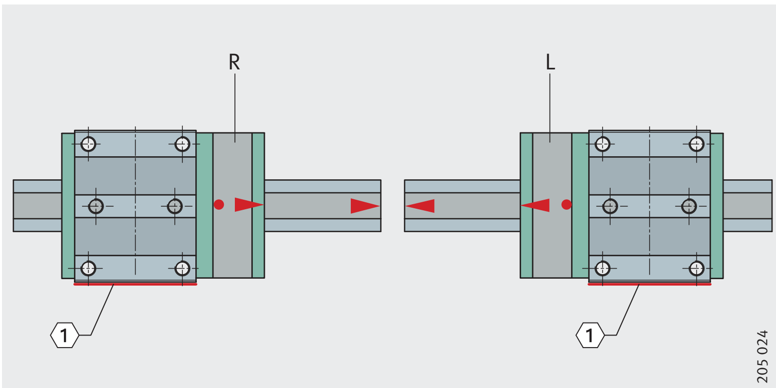


Figure 6
Position of the measuring head (R or L) with reference to the locating face

Four-row linear ball bearing and guideway assemblies with measuring system

Incremental measuring system with single reference point

Linear guidance system data

Four-row linear ball bearing and guideway assembly with electronic-magnetic measuring system	KUVE
Size	25
Carriage type	B
Number of carriages per unit[1]	W1
Accuracy class	G3
Preload class	V1
Guideway length	1 200 mm
a_L	30 mm
a_R	30 mm

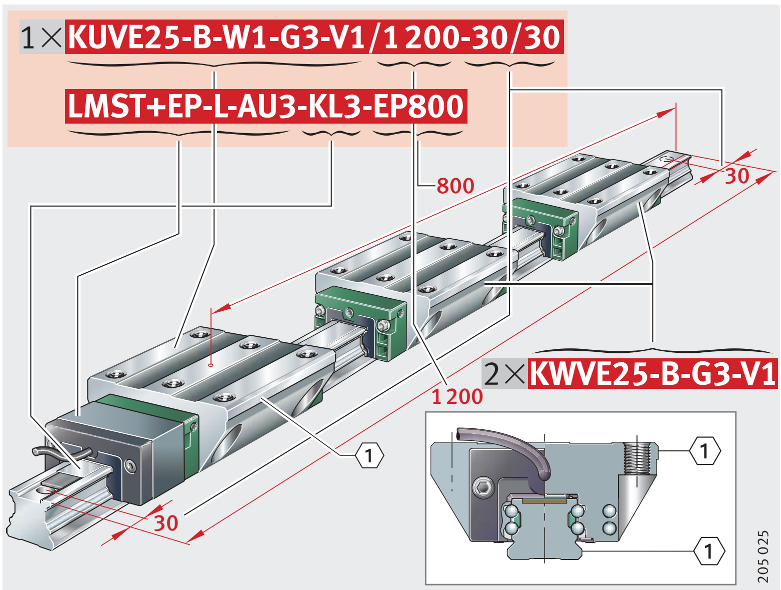
[1] Only one carriage is fitted with a measuring head, independent of the number of carriages on the guideway.
The carriages can be arranged in any sequence.
It is also possible to fit several carriages with measuring heads on one guideway and magnetic strips with several independent reference points. Please contact us in this case.

Measuring system data

Length measuring system, incremental, TTL	LMST
Reference signal: single point	+EP
Position of measuring head on left of carriage with reference to locating face	L
Resolution of sensing head	AU3
Accuracy class of magnetic strip	KL3
Position of reference signal in relation to centre of carriage	EP800

Ordering designation

1×**KUVE25-B-W1-G3-V1/1200-30/30LMST+EP-L-AU3-KL3-EP800**
2×**KWVE25-B-G3-V1**, *Figure 7*



1 Locating face

Figure 7
Ordering example, ordering designation

Incremental measuring system with multiple reference point

Linear guidance system data

Four-row linear ball bearing and guideway assembly with electronic-magnetic measuring system	KUVE
Size	25
Carriage type	B
Number of carriages per unit[1]	W1
Accuracy class	G3
Preload class	V2
Guideway length	1 200 mm
a_L	30 mm
a_R	30 mm

[1] Only one carriage is fitted with a measuring head, independent of the number of carriages on the guideway.
The carriages can be arranged in any sequence.

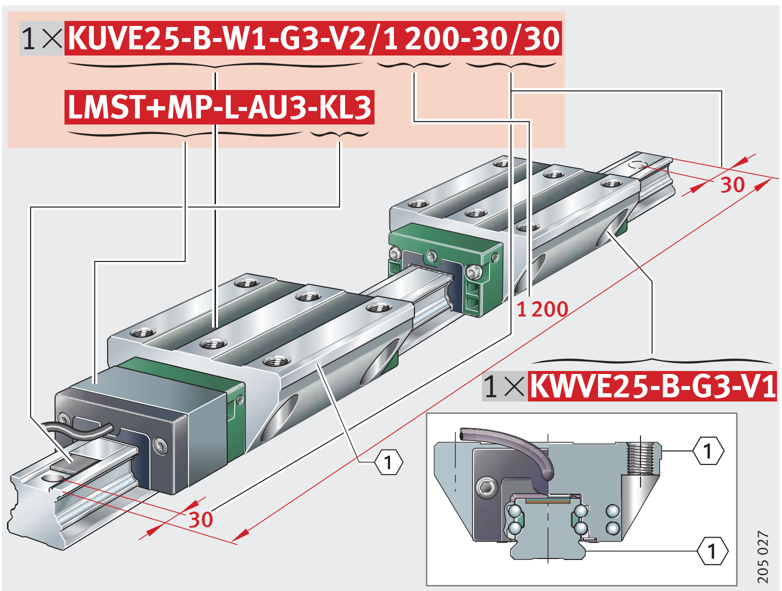
Measuring system data

Length measuring system, incremental, TTL	LMST
Reference signal: multiple point; by means of an external switch, any reference position can be defined and changed, pole pitch 5 mm	+MP
Position of measuring head on left of carriage with reference to locating face	L
Resolution of sensing head	AU3
Accuracy class of magnetic strip	KL3

Ordering designation

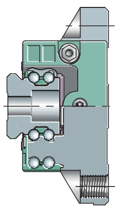
1×**KUVE25-B-W1-G3-V2/1200-30/30 LMST+MP-L-AU3-KL3**

1×**KWVE25-B-G3-V1**, *Figure 8*



1 Locating face

Figure 8
Ordering example, ordering designation



Four-row linear ball bearing and guideway assemblies with measuring system

Absolute digital measuring system

Linear guidance system data

Four-row linear ball bearing and guideway assembly with electronic-magnetic measuring system	KUVE
Size	25
Carriage type	B
Number of carriages per unit[1]	W1
Accuracy class	G3
Preload class	V1
Guideway length	900 mm
a_L	30 mm
a_R	30 mm

[1] Only one carriage is fitted with a measuring head, independent of the number of carriages on the guideway.
The carriages can be arranged in any sequence.

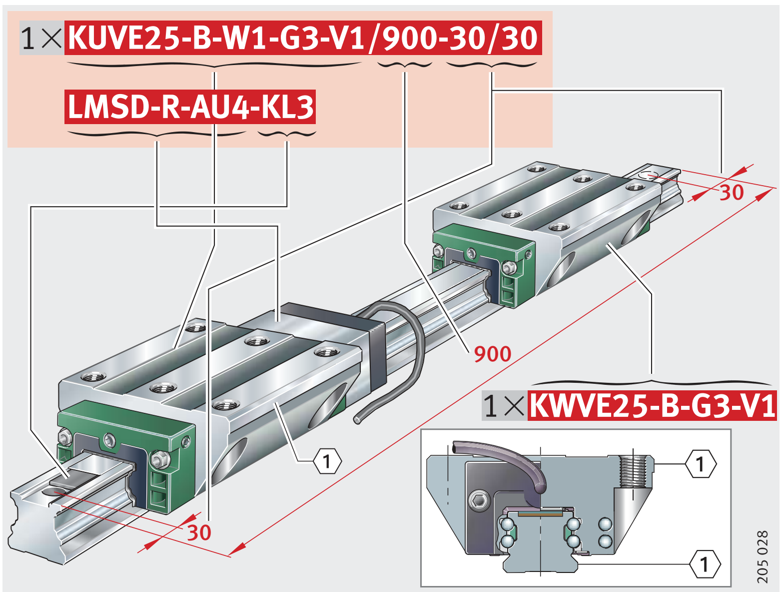
Measuring system data

Length measuring system, absolute digital	LMSD
Position of measuring head on right of carriage with reference to locating face	R
Resolution of sensing head	AU4
Accuracy class of magnetic strip	KL3

Ordering designation

1×**KUVE25-B-W1-G3-V1/900-30/30 LMSD-R-AU4-KL3**

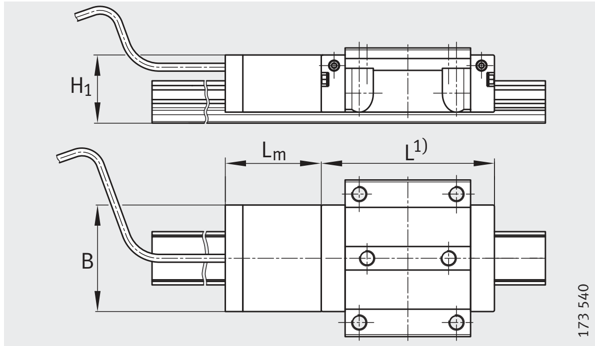
1×**KWVE25-B-G3-V1**, *Figure 9*



1 Locating face

Figure 9
Ordering example, ordering designation

Four-row linear recirculating ball bearing and guideway assemblies with integral measuring system

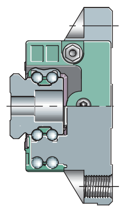


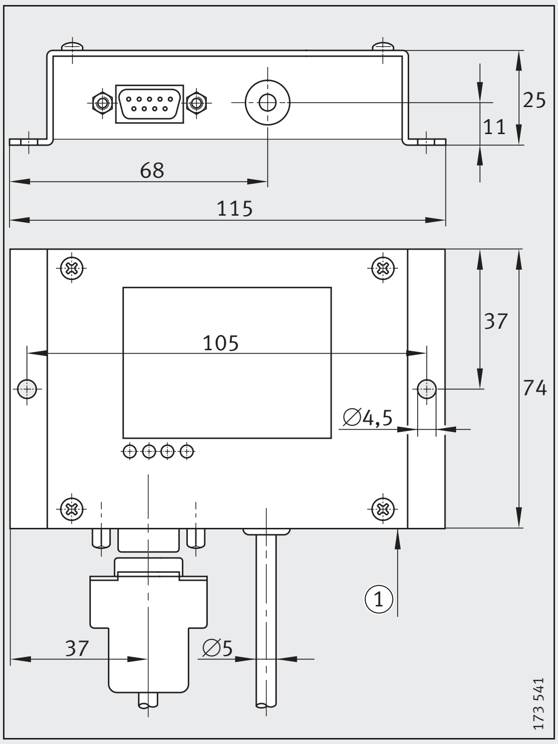
KUVE..-B-LMST, KUVE..-B-LMSD

Dimension table · Dimensions in mm

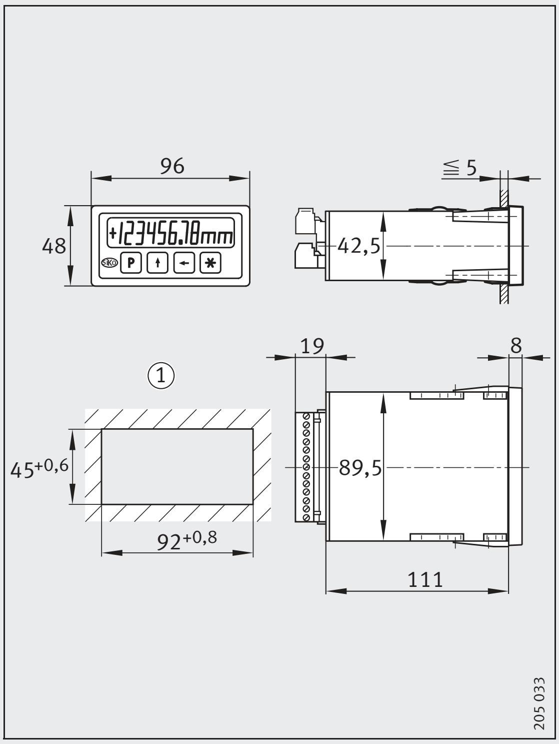
Designation		Dimensions			
		B	L_m	L	H_1
KUVE20-B..-LMST	**KUVE20-B..-LMSD**	40,6	45	1)	26,6
KUVE25-B..-LMST	**KUVE25-B..-LMSD**	46	45	1)	30,5
KUVE30-B..-LMST	**KUVE30-B..-LMSD**	58	48	1)	37,5
KUVE35-B..-LMST	**KUVE35-B..-LMSD**	68	48,6	1)	43,5
KUVE45-B..-LMST	**KUVE45-B..-LMSD**	84,6	49,7	1)	51,5

1) L = standard length of linear recirculating ball bearing and guideway assembly.

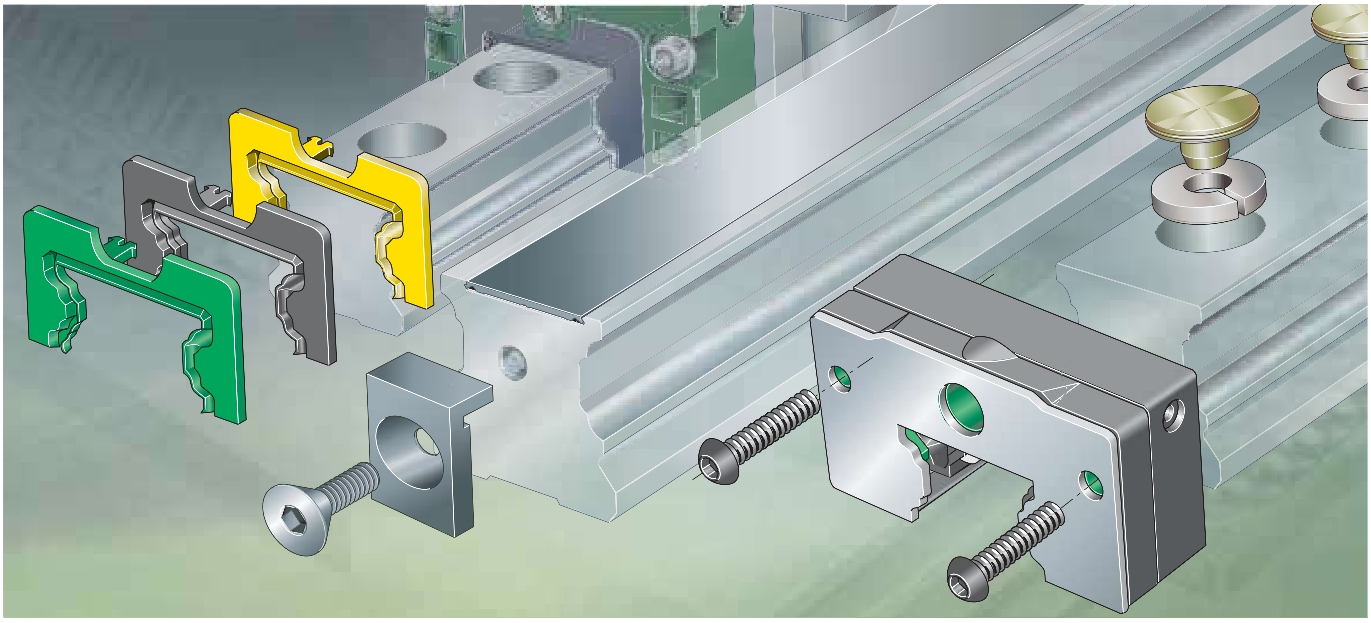




Electronic evaluation system ASA510
1 Cable length 2 m



Positional display MA10/4 (special accessory)
1 Panel outline to DIN 43 700



Accessories

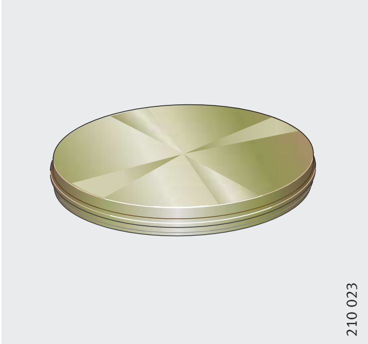
Closing plugs
Guideway covering strips
Rolling-in device for covering strip
Clamping lugs and clamping strips
Braking and clamping element
Sealing and lubrication elements – system KIT
Gearbox
Coupling
Drive shaft
Clamping joint
Lubricant dispenser

Closing plugs

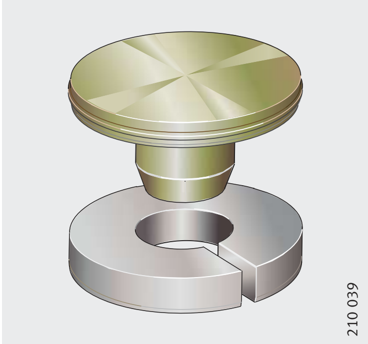
Brass closing plug

Brass closing plug with clinch ring

KA..-M



KA..-MSA

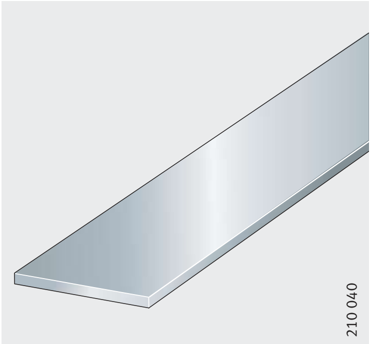


Guideway covering strips

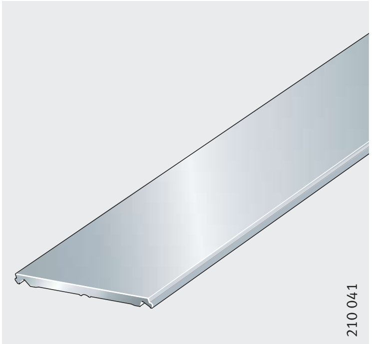
Adhesive bonded

Clip fit

ADB



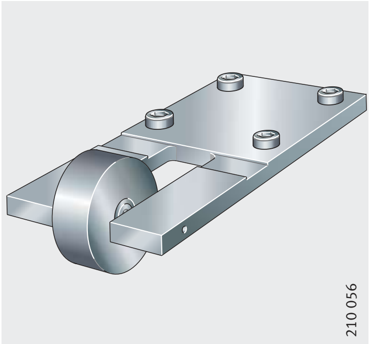
ADB..-K



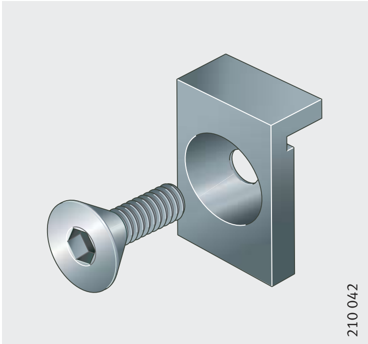
Rolling-in device and retaining plate

For covering strip

ERVV

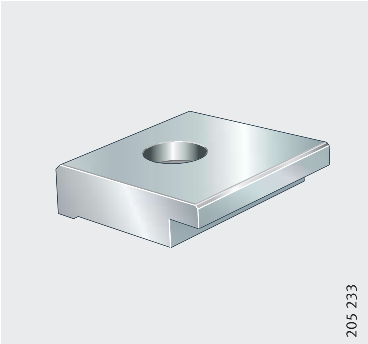


HPL.ADB

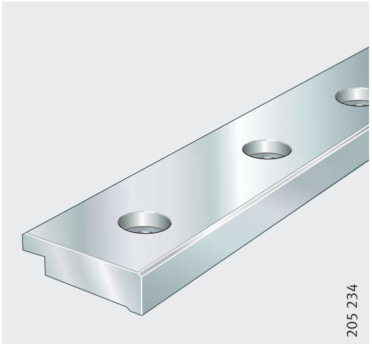


Clamping lug
Clamping strip

SPPR

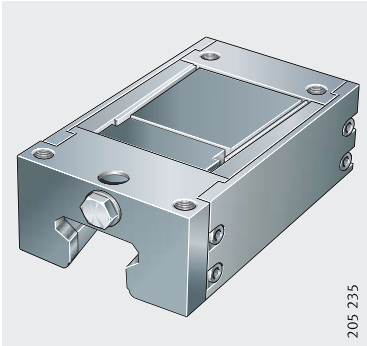


SPPL



Braking and clamping element

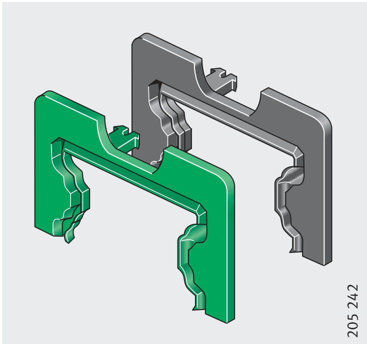
BKE.TKVD



Sealing elements – system KIT

End wiper
and smooth-running seal –
example KIT

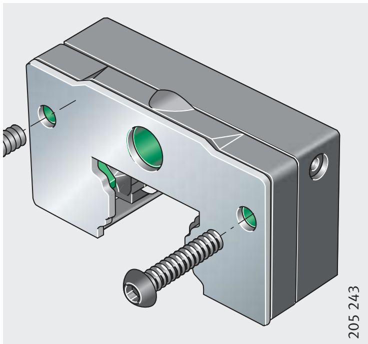
KIT

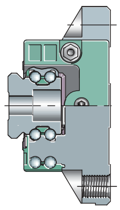


Lubrication elements – system KIT

Long term lubrication unit –
example KIT

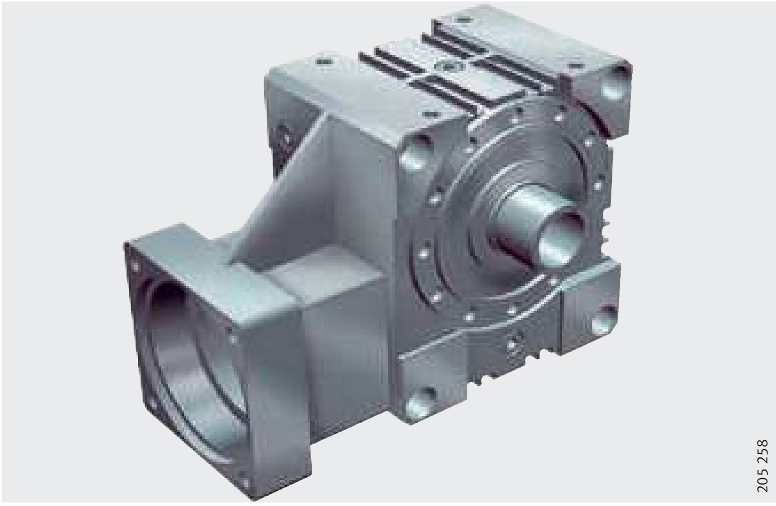
KIT





Gearbox

GTR..-SCHN..-KL



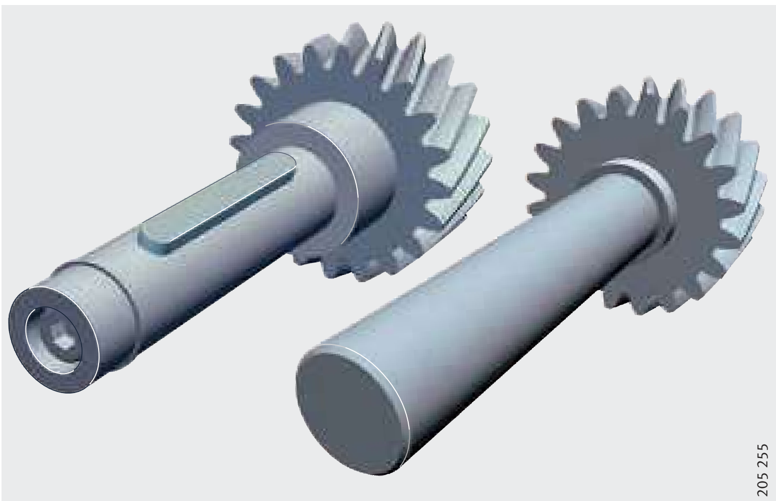
Coupling

KUP

Drive shafts

For feather key or clamping joint

RITZ..-PF, RITZ..-KL

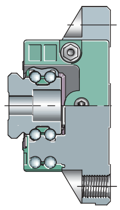


Clamping joint
Lubricant dispenser

SPE

205 257

205 256



Closing plugs

Closing plugs are used to close off the counterbores for the fixing screws in the guideways. As a result, the surface of the guideway is completely flush.

In addition to the standard plastic closing plugs, brass closing plugs and closing plugs with clinch ring are also available.

Brass closing plugs

Closing plugs KA..-M are particularly suitable for conditions involving hot swarf, aggressive media and vibrations, *Figure 1*.

KA..-M

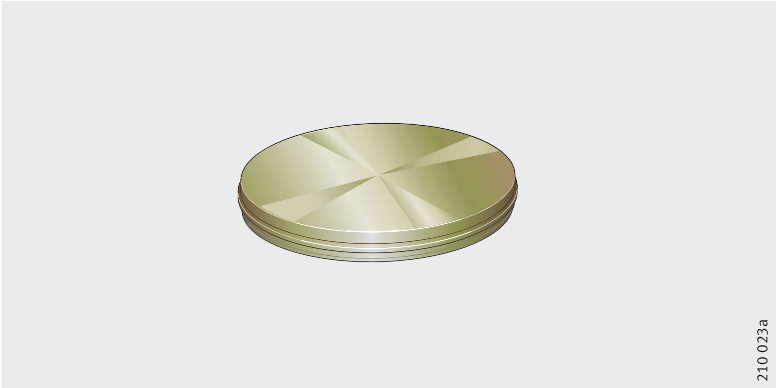


Figure 1
Brass closing plug

With clinch ring

Brass closing plugs of type KA..-MSA comprise a brass plug with a plastic clinch ring, *Figure 2*.

The clinch ring ensures secure seating of the closing plug in the counterbore.

KA..-MSA

① Brass plug
② Plastic clinch ring

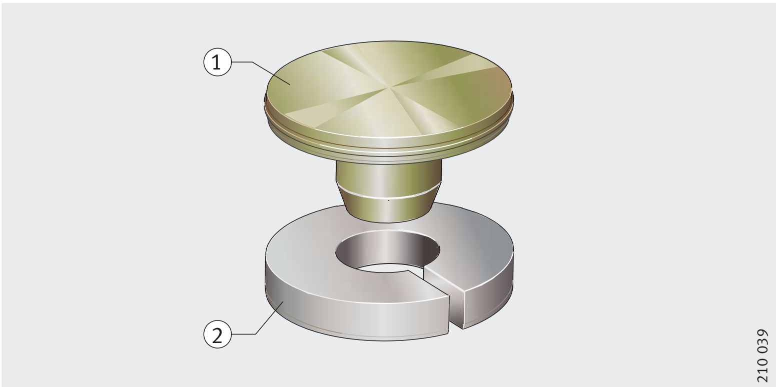


Figure 2
Closing plug with clinch ring

Guideway covering strips

Covering strips are an alternative to closing plugs. They completely cover the counterbores for the fixing holes in the guideways and close these off flush with the guideway surface.

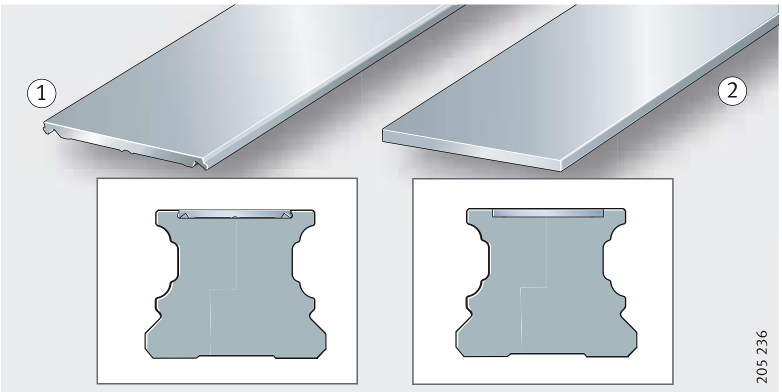
Adhesive bonded or clip fit

Covering strips are available in two designs. The covering strip ADB is adhesive bonded in the slot in the guideway, the covering strip ADB-K is clipped into the slot, *Figure 3*.

Attention! The clip fit covering strip must be fitted using the rolling-in device ERW, see page 346.

For fitting of covering strips see page 77 to page 79.

Where applications using the covering strip are planned, please contact us.



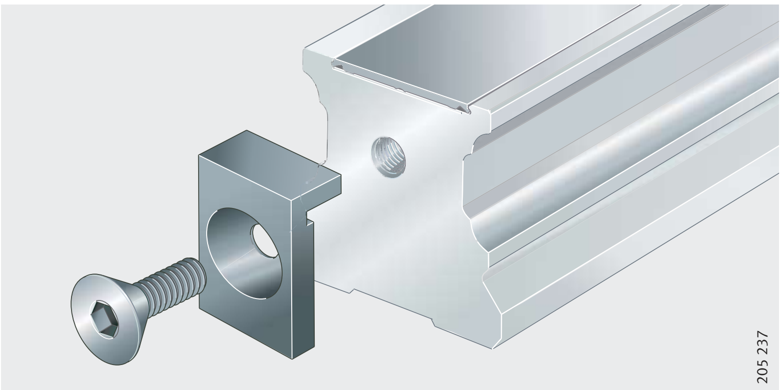
ADB-K
ADB

① Clip fit
② Adhesive bonded

Figure 3
Guideway covering strip

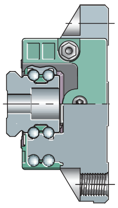
Retaining plate

The retaining plate HPL.ADB fixes the covering strip ADB-K to the end of the guideway, *Figure 4*. It is included in the delivery.



HPL.ADB

Figure 4
Retaining plate for covering strip



Rolling-in device

The clip fit covering strip ADB..-K is fitted using the fitting device ERW. As a result, it is securely located in the guideway, *Figure 5*.

The rolling-in device must be ordered separately. When ordering, the size of the linear recirculating ball bearing and guideway assembly KUVE must be stated; see Ordering example.

ERVV

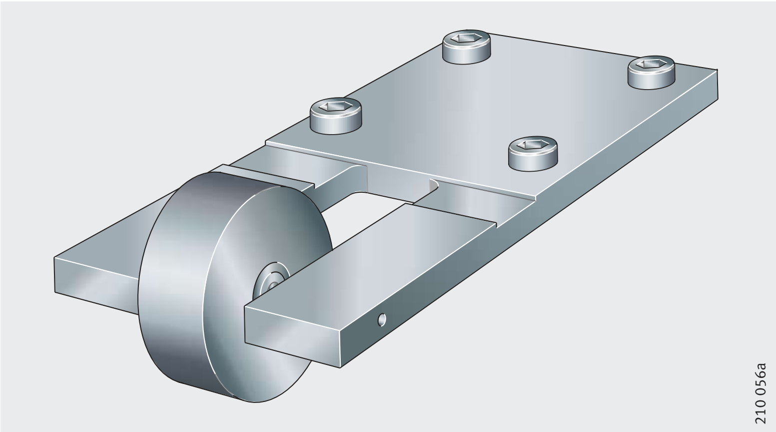


Figure 5
Rolling-in device for covering strip

Ordering example, ordering designation

A rolling-in device for the covering strip ADB18-K for KUVE35-B is to be ordered.

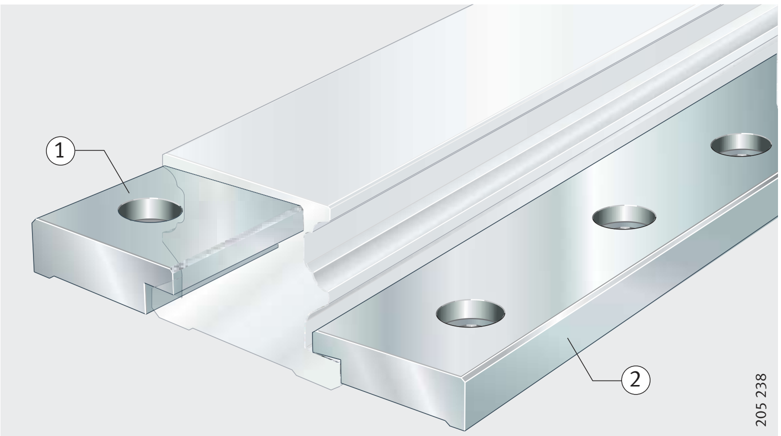
Ordering designation
1×**ERVV35**

Clamping lugs and clamping strips

Clamping lugs SPPR and clamping strips SPPL are used to clamp guideways TKVD25-K to profiled sections, *Figure 6*. The lugs and strips are made from aluminium and locate in the longitudinal slots in the base of the guideway.

Clamping lugs and clamping strips are available for the guideways of the monorail guidance system KUVE25-B-K, *Figure 6*.

SPPR
SPPL



(1) Clamping lug
(2) Clamping strip

Figure 6
Clamping lug and clamping strip

Braking and clamping element

The braking and clamping element BKE.TKVD is used, for example, as a positionally independent safety system for linear drives where the drive cannot fully provide the braking and clamping function, *Figure 7*.

The compact construction and the arrangement of the elements saves space and no special devices are required.

If particularly high braking forces are required, several braking and clamping elements can be fitted.

The system automatically compensates any clearance occurring up to the wear limit of the brake shoes, see Automatic clearance compensation, page 349. The elements are thus maintenance-free.

BKE.TKVD

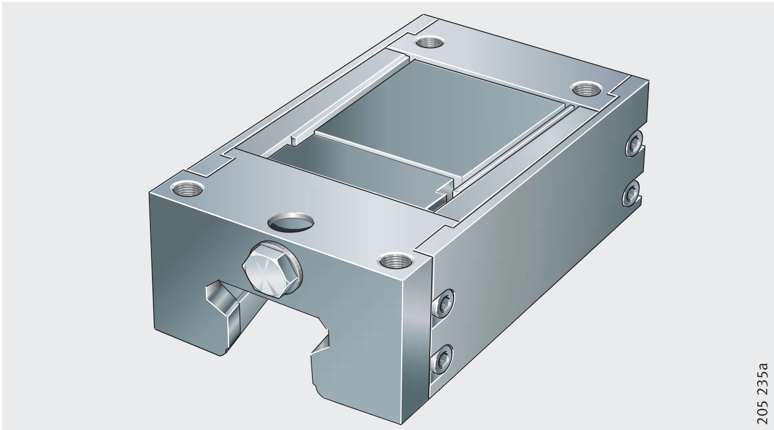
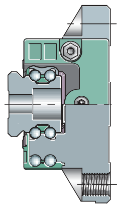


Figure 7
Braking and clamping element



Mechanical braking and clamping forces

The elements operate by purely mechanical means, they therefore function even if a power failure occurs and are reliable in any mounting position; for a description of their function, see page 348. This eliminates safety problems resulting from power failure – a possibility with electronically braked systems.

The system carries out braking only when no pressure is present. This allows safety-focussed control even in emergencies. The hydraulic brake opens under a pressure of approx. 55 bar.

If appropriate control is provided, even vertical axes can be rapidly braked to a stationary position. In a suspended arrangement, however, the entire guidance unit should be secured by a drop guard, for an example see page 67.

When the brake is locked, an axial clearance of up to 0,25 mm can occur. This must be noted if the elements are used for locating.

Short reaction time

The clearance-free adjustment of the brake shoes ensures a short, consistent reaction time (in size 35 for example <30 m/s).

In order to ensure the shortest reaction times, the Schaeffler Group has worked with a manufacturer of fluid power devices to develop a hydraulic unit with a special valve. The unit can be purchased directly from the manufacturer.

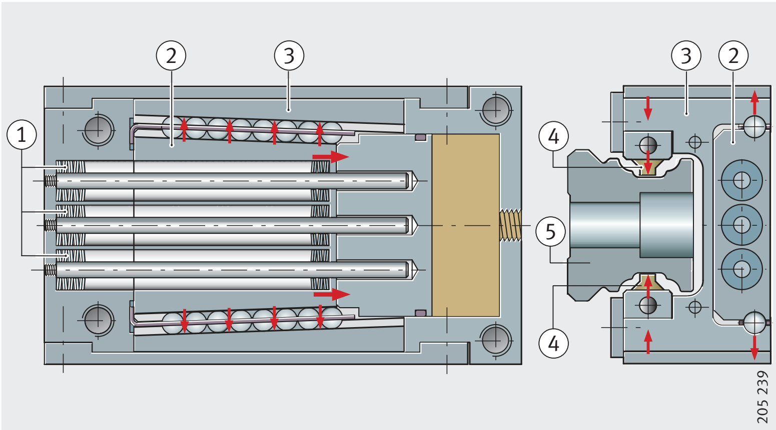
Attention! Braking and clamping elements are one part of the emergency braking system. Their reliable operation also depends on the hydraulic components and the control system.

If the system is activated frequently, contact us.

Function

Three disc spring columns generate the braking and clamping force, *Figure 8*. Thanks to this mechanical spring energy store, the system operates extremely reliably without external energy.

The force is transmitted to the brake shoes by mechanical means. If the braking or clamping function is activated, the spring columns push a wedge-shaped slider between the upper legs of the H-shaped saddle plate. This presses the upper legs outwards and the lower ones inwards. The brake shoes clamp against the guideway, but not on the raceways.



① Disc spring columns
② Wedge-shaped slider
③ H-shaped saddle plate
④ Brake shoes
⑤ Guideway

Figure 8
Functional components

Automatic clearance compensation

Wear of brake shoes

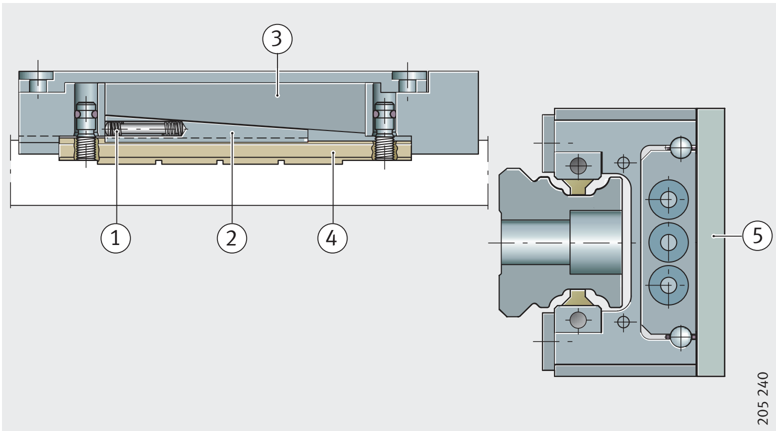
As the system clamps not only stationary guidance systems, but also moving ones, the brake shoes are subject to wear resulting from abrasion. However, clearance between the brake shoes and brake contact surfaces increases the system reaction time.

Wear compensation

In order to ensure consistent clearance-free contact of the brake shoes against the contact surfaces, wear of the linings is automatically compensated by mechanical means up to the wear limit. Compression springs slide a wedge between the brake shoes and the saddle plate, *Figure 9*. This ensures that the element always operates without clearance. The wear compensation mechanism is designed such that, in the opened condition, the brake shoes are adjacent to but not in contact with the guideway surface.
This ensures that there is no wear or displacement resistance during movement of the guidance system.

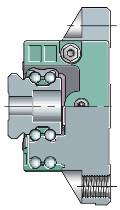
Adapter plate

For the H variant of the carriages, an adapter plate is necessary, *Figure 9*. The adapter plate is included in the delivery.



① Compression springs
② Wedge
③ Saddle plate
④ Brake shoes
⑤ Adapter plate for H variant

Figure 9
Wear compensation and adapter plate



Easy to fit

Braking and clamping elements are particularly easy to fit. They are simply slid onto the guideway and screw mounted to the adjacent construction.

Attention!

Due to the automatic wear compensation system, braking and clamping elements must be slid directly from the dummy guideway onto the guideway.

The element must never be separated from the guideway without using a dummy guideway and the dummy guideway must never be removed from the element.

Suitable for ...

The elements give high braking and clamping forces within a very small design envelope. Their dimensions are matched to the INA standard and H carriages, can be used for the RUE guideways and can be easily integrated in existing applications based on INA linear guidance systems. The dimension table for the braking and clamping element is on page 353.

The compact construction and the arrangement of the elements directly on the guideway saves space and thus allows complete constructions with a reduced number of components.

They can also be used in applications without recirculating roller systems. In this case, the guideway is used only as a braking or clamping rail.

A typical arrangement as an emergency brake in an application with a linear motor is shown in *Figure 10*.

1, 2 Guideways
3, 4, 5, 6 Carriages
7, 8 Emergency brakes
9 Table
10 Motor primary part
11 Motor secondary part

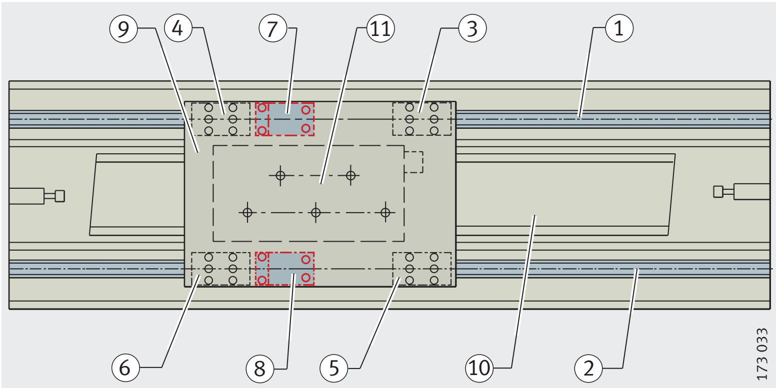


Figure 10
Typical application

Delivered condition

The elements are premounted on a separate rail and clamped in place by means of a fitting screw. The screw is used to loosen and then move the fixed element. The fitting screw is later replaced by the hydraulic connector.

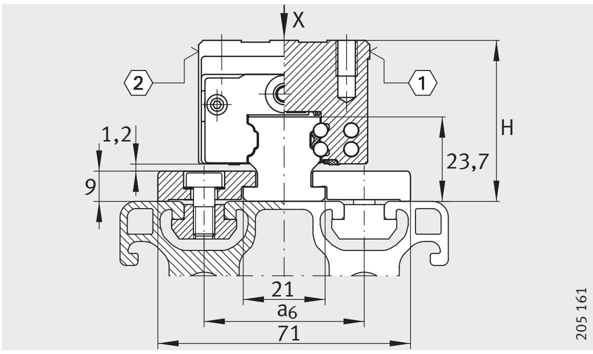
Ordering example, ordering designation

A braking and clamping element for KUVE35-B with a hydraulic connector on the end face is to be ordered.

Ordering designation

1×**BKE.TKVD35**

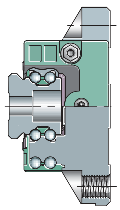
Guideway for profiled sections



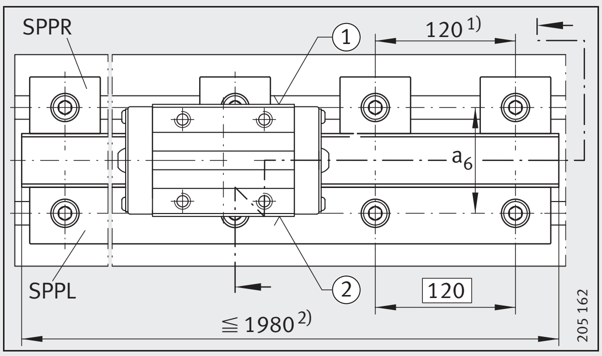
TKVD25-K with SPPR and SPPL
⟨1⟩, ⟨2⟩ 4)

Dimension table · Dimensions in mm		
Guideway		Mounting dimensions
Designation	Mass m ≈kg/m	a_6
TKVD25-K	3,2	40
		45
		50

1) Recommended distance between screws.
2) Maximum length of guideway and clamping strip;
longer guideways are supplied in several pieces and are marked accordingly.
3) The basic dynamic load rating C (page 271) is used to calculate the basic rating life.
The permissible load is dependent on the profile and the type and quantity of fasteners.
4) ⟨1⟩ Locating face
⟨2⟩ Marking

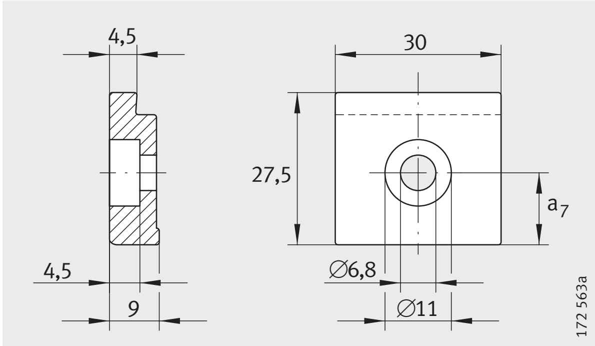


Dimension table · Dimensions in mm			
Carriage		Guideway	Dimensions
Designation	Mass m ≈kg	Designation	H
KWVE25-B-H	0,41	**TKVD25-K**	45
KWVE25-B-S	0,56	**TKVD25-K**	41
KWVE25-B-SN	0,45	**TKVD25-K**	36



KUVE25-B-K with SPPR and SPPL
⟨1⟩, ⟨2⟩ 4)

Clamping lug
Clamping strip

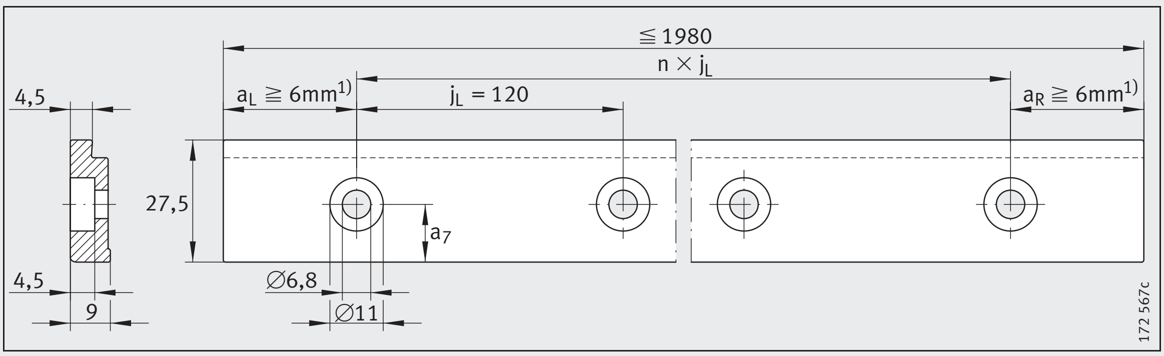


SPPR

Dimension table · Dimensions in mm

Clamping lug		Clamping strip		Dimensions
Designation	Mass m ≈g	Designation	Mass m ≈kg/m	a_7
SPPR2540	0,02	**SPPL2540**	0,6	15,5
SPPR2545	0,02	**SPPL2545**	0,6	13
SPPR2550	0,02	**SPPL2550**	0,6	10,5

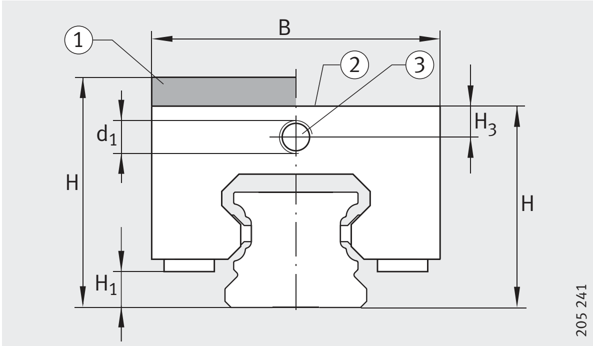
[1] a_L and a_R are dependent on the length of the strip.



SPPL

Braking and clamping element

for four-row linear recirculating ball bearing and guideway assembly

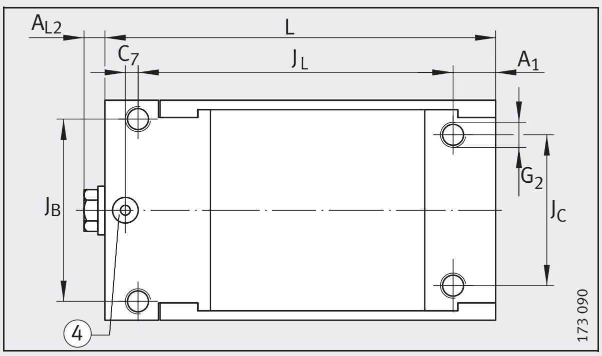


BKE.TKVD
1, 2, 3 [2)]

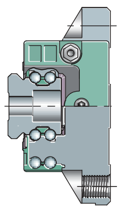
Dimension table · Dimensions in mm															
Designation	Clamping force	Dimensions													
		H		B	L	J_B	J_C	A_1	J_L	C_7	H_1	H_3	A_{L2}	d_1	G_2
		Without adapter plate	With adapter plate												
	N														
BKE.TKVD25	1 000	36	–	47	91	38	34	10	75	–	6,5	6	5	M6X1	M6
BKE.TKVD25-O										0					
BKE.TKVD25-H		–	40							–					
BKE.TKVD25-H-SO										0					
BKE.TKVD35	2 800	48	–	69	120	58	48	13,5	100	–	7,9	8,1	5	M8X1	M8
BKE.TKVD35-O										0					
BKE.TKVD35-H		–	55							–					
BKE.TKVD35-H-SO										0					
BKE.TKVD45	4 300	60	–	85	141	70	60	15	113	–	13	10	5	M8X1	M10
BKE.TKVD45-O										5					
BKE.TKVD45-H		–	70							–					
BKE.TKVD45-H-SO										5					

1) Maximum diameter of oil inlet hole = 6 mm.

2) 1 With adapter plate
2 Without adapter plate
3 Hydraulic connector
4 Hydraulic connector in top face (design O, SO)[1)]



Top view[1)]
4 [2)]



Sealing and lubrication elements – system KIT

With their comprehensive range of standard accessories, monorail guidance systems can be easily used in numerous areas. Since the guidance systems are used in an extremely wide variety of applications, however, additional requirements are often placed on the lubrication and sealing components.

Application-oriented complete package

If the standard components are not adequate for reliable operation and a long operating life, it is possible to draw on a finely graduated system of lubrication and sealing elements. These special accessories protect the rolling element system of the guidance systems against contamination and ensure lubrication appropriate to requirements with long relubrication intervals even under the most demanding operating conditions.

Structured as a KIT

The elements are configured as the system KIT and are designed for various application conditions.

Starting from the degree of contamination, the best combination in each case can be quickly and easily compiled, see Degree of contamination. Which combinations are possible and advisable is shown in the table.

The sealing elements are described on pages 355 to 357, for table see page 360.

The description of the lubrication elements is on page 358 and page 359, for table see page 364.

Attention!

Only a proportion of the KITs can retrofitted. Parts that cannot be retrofitted must be ordered together with the linear recirculating ball bearing and guideway assembly and are supplied already fitted.

Degree of contamination

Attention!

The degree of contamination will vary depending on the market sector, the application and the environmental conditions.
The definitions according to the table are therefore only an initial aid in the selection of KITs.

By agreement, we will be pleased to assemble complete packages for specific applications.

Definition of the degree of contamination

Degree of contamination			
Very slight	Slight	Moderate	Heavy
■ Clean environment	■ Coarse (large) metal swarf ■ Clean environment ■ No cooling lubricants	■ Coarse (large) metal swarf ■ Slight exposure to, for example, cooling lubricants	■ Hot swarf (metal, aluminium) of widely varying size and shape, including very small swarf from HSC machining ■ Aggressive media and dust as well as cooling lubricants

Sealing elements

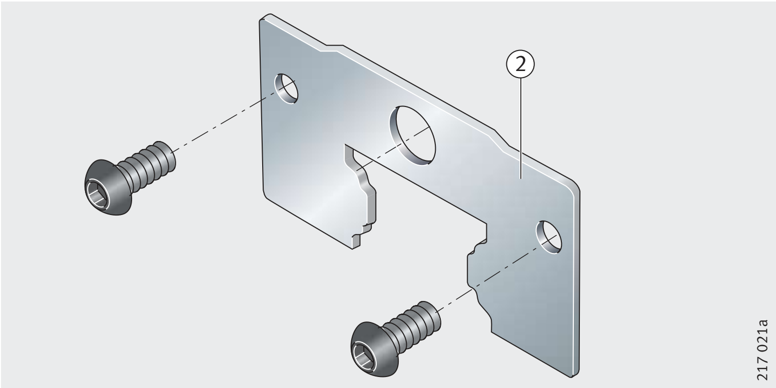
The following additional sealing components are available:

- end plates, page 355
- end wipers, page 355 and page 356
- end wipers with carrier plate, page 356
- additional wipers, page 356
- sealing strips, page 357.

End plates

End plates are corrosion-resistant, non-contact components, *Figure 1*. They protect the end wipers located behind them against, for example, coarse contaminants and hot swarf.

There is a narrow gap between the guideway and the wiper.



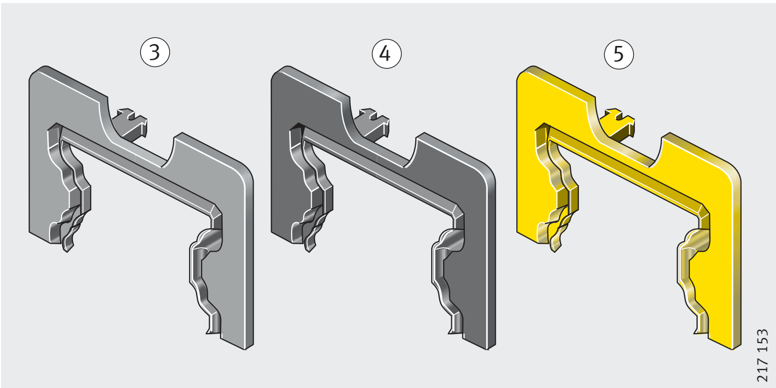
2 End plate, non-contact

Figure 1
End plate

End wipers

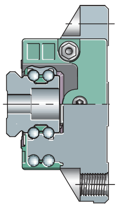
End wipers are contact seals that are fixed to the end faces of the carriage.

They are available in a single lip design made from special high performance material, *Figure 2*.



3 Gap seal, single lip, grey
4 End wiper, single lip, black
5 Smooth-running seal, single lip, yellow

Figure 2
End wipers



End wipers with carrier plate

In addition to the standard seal, other end wipers may be used behind each other (cascading arrangement). These are screw mounted with a carrier plate in front of the first wiper on the carriage, *Figure 3*.

The end wipers are of a single or double lip design and are made from special high performance seal material.

① Fixing screw
⑥ End wiper, single lip
⑦ End wiper, double lip
⑧ Carrier plate for end wiper

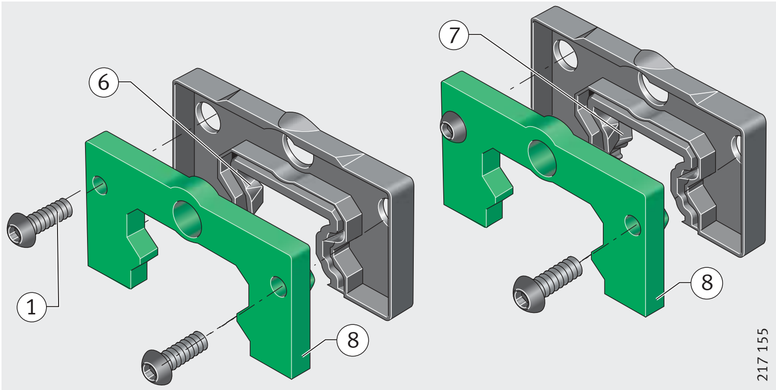


Figure 3
End wipers

Additional wiper

For protection against aggressive media (for example acids, alkalis), special additional wipers made from FPM are available, *Figure 4*.

The additional wipers are of single lip design.

① Fixing screw
⑨ Additional wiper, single lip

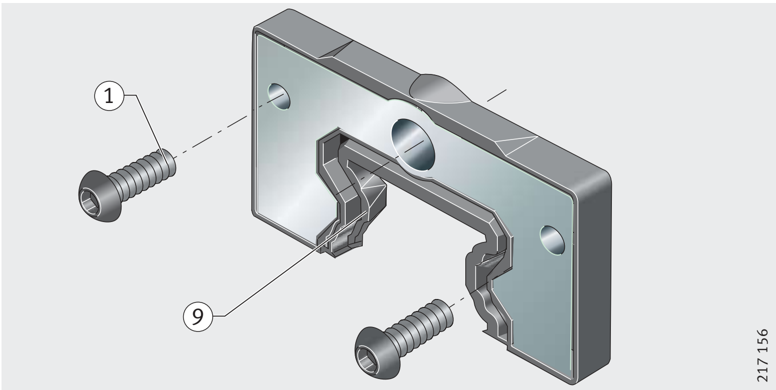


Figure 4
Additional wiper

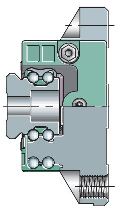
Sealing strips

Sealing strips are contact components that are fitted to the upper and lower longitudinal sides of the carriage, *Figure 5*.
They protect the rolling element system against contamination and loss of lubricant.

Attention! Upper sealing strips should be used in addition to end wipers especially in applications where lubrication is critical, such as those involving fine dust or aggressive coolants.

⑩ Lower sealing strips, single lip
⑪ Upper sealing strips, single lip

Figure 5
Sealing strips



Lubrication elements

A long term lubrication unit is available as a lubrication component.

Long term lubrication unit

Operating life of the linear guidance system

The operating life is defined as the life actually achieved by a linear guidance system. This may deviate significantly from the basic rating life.

A sufficiently long operating life is only achieved, assuming the bearing arrangement is correctly designed, through optimum lubrication and sealing.

Grease operating life and relubrication interval

If guidance systems cannot be relubricated, the grease operating life becomes the decisive factor. This indicates the length of time for which a grease can be used without its function being impaired. For calculation of the grease operating life, see page 48.

As the load increases, the grease is subjected to increasing strain. As a result, it ages more quickly. Premature destruction of the grease structure has an adverse effect on the performance characteristics of the grease. The grease operating life declines and relubrication must be carried out earlier.

If the shortened relubrication intervals are not observed, the guidance system will fail before the end of the expected operating life. With decreasing grease operating life, the operating life of the linear guidance system is thus reduced.

Longer operating life by means of a long term lubrication unit

The volume of lubricating grease in the carriage is increased by the lubrication pockets in the saddle plate.

If a long term lubrication unit KIT.KWVE..B-4 is also fitted, this gives an additional improvement in the lubricant balance, *Figure 6*, page 359. The lubricant is stored in a high capacity reservoir and continuously released to the raceways via a transfer medium. Depending on the operating and environmental conditions, long relubrication intervals or even complete freedom from maintenance are possible as a result.

The operating life of four-row monorail guidance systems KUVE with and without a long term lubrication unit is shown in *Figure 7*, page 359.

Function irrespective of position

Long term lubrication units are particularly suitable in applications where lubrication is of critical importance. They are screw mounted between the end piece and the wiper and function with equal reliability in either a horizontal or vertical mounting position.

With initial greasing and refillable

Due to their initial greasing, long term lubrication units are ready for immediate operation.

If they are ordered together with a KUVE, the monorail guidance system KUVE and long term lubrication unit are greased.
If necessary, the reservoir can be refilled through lateral holes.

Double lip end seal

Integrated double lip end seals give protection against grease loss and contamination.

1 Fixing screws
2 End plate
7 End wiper, double lip
8 Carrier plate
12 Long term lubrication unit

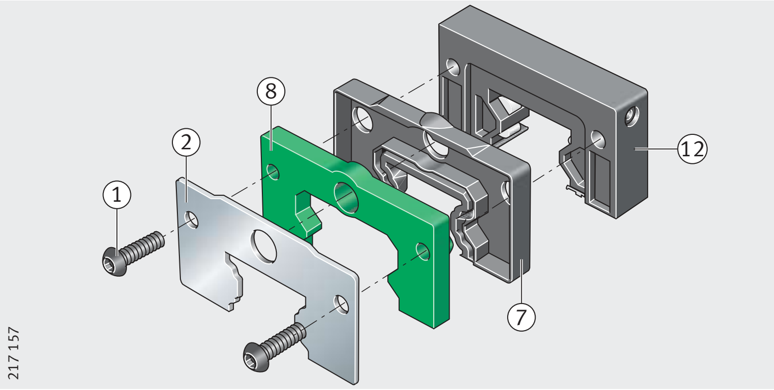


Figure 6
Long term lubrication unit

1 Displacement distance
2 KUVE with long term lubrication unit (restricted by material fatigue)
3 KUVE without long term lubrication unit (restricted by material fatigue)
4 Competitor systems

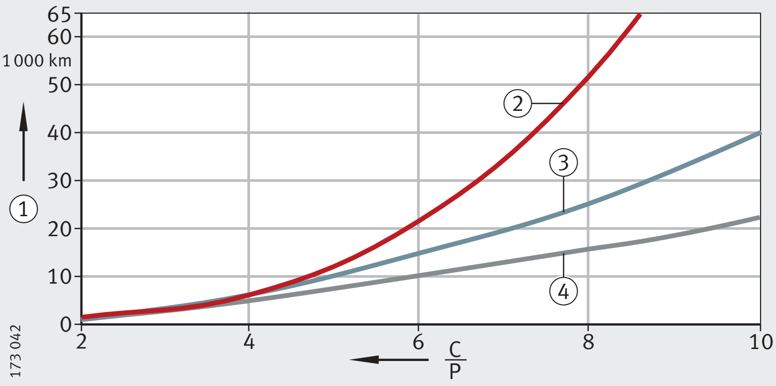
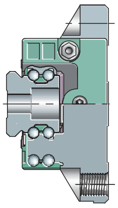
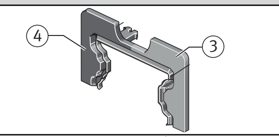
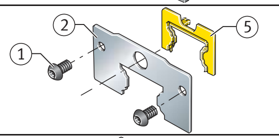
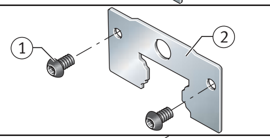
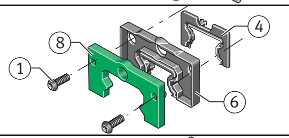
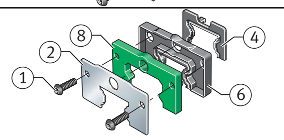


Figure 7
Operating life with and without long term lubrication unit



Accessories

Sealing elements KIT[1]
Part 1

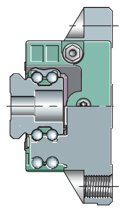
KIT	Description	Designation and KIT end number KIT.KWVE..-B[2]	① Fixing screws K_1 (2 pieces)	② End plate, non-contact
	① Fixing screws K_1 ② End plate ③ Gap seal, single lip ④ End wiper, single lip ⑤ Smooth-running seal, single lip ⑥ End wiper, single lip ⑦ End wiper, double lip ⑧ Carrier plate for end wipers ⑨ Additional wiper, single lip ⑩ Sealing strip, lower, single lip ⑪ Sealing strip, upper, single lip	100[5]	–	–
		110[6]		
		200	1	1
		210		
		220	1	1
		300	1	–
		309		
		310	1	1
		319		

Attention!
The table is only a guide.
The specific application conditions must be taken into consideration when selecting the elements.

The lubrication elements can be used in various combinations.
However, not every combination is possible or advisable.
For recommended combinations, see page 366.

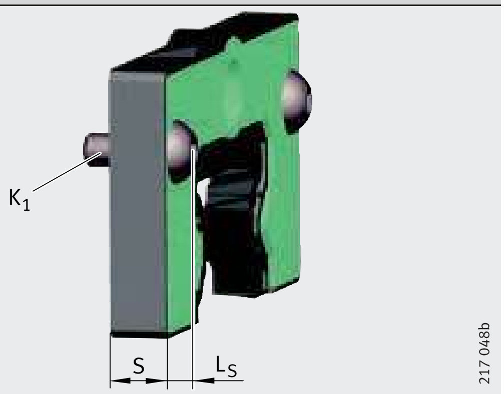
1) The KITs are available for the sizes KUVE15-B (-KT) to KUVE55-B (-KT) .
2) Ordering example for KIT100 for KUVE-35-B: KIT.KWVE35-B-100.
3) See figure bottom right.
4) For definition see page 354.
5) Standard for KUVE..-B and KUVE..-B-KT.
6) Valid for sizes 15 to 25.
7) Valid for sizes 20 to 45.

	End wipers			End wipers with carrier plate ⑧		⑨	Sealing strips		Fitting of KIT			Contamination[4)]			
							Lower	Upper							
	③	④	⑤	⑥	⑦		⑩	⑪							
	Gap seal, grey	Contact type, single lip, black	Smooth-running seal,single lip, yellow	Contact type, single lip	Contact type, double lip	Additional wiper, single lip	Single lip	Single lip	Retrofittable[2)]	Factory fit	Width S in mm[3)]	Very slight	Slight	Moderate	Heavy
	–	1	–	–	–	–	–	–	■	■	–	■	■	–	–
	1	–				–						■	–	–	
	–	1	–	–	–	–	–	–	■	■	1	–	■	■	–
		–				–						■	–	–	
	–	–	1	–	–	–	–	–	■	■	1	■	■	–	–
						–									
	–	1	–	1	–	–	–	–	■	■	5	–	–	■	■
		–				–									
	–	1	–	1	–	–	–	–	■	■	6	–	–	■	■
		–				–									

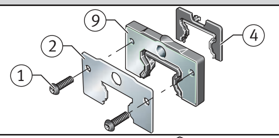
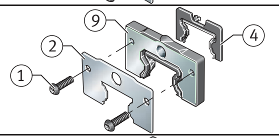
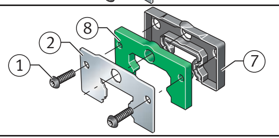
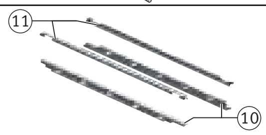


Fixing screws K_1, L_S, width S

KUVE size	KIT end number	Fixing screw K_1	
			L_S mm
15 **20**	200, 210, 220, 300, 309	M2	1,3
	310, 319, 360, 370		
25 **30, 35**	200, 210, 220, 300, 309	M3	1,65
	310, 319, 360, 370		
45 **55**	200, 210, 220, 300, 309	M4	2,2
	310, 319, 360, 370		



Accessories

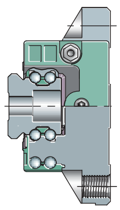
Sealing elements KIT[1] Part 2			①	②
KIT	Description	Designation and KIT end number KIT.KWVE..-B[2]	Fixing screws K_1 (2 pieces)	End plate, non-contact
 217 158	① Fixing screws K_1 ② End plate ③ Gap seal, single lip ④ End wiper, single lip ⑤ Smooth-running seal, single lip ⑥ End wiper, single lip ⑦ End wiper, double lip ⑧ Carrier plate for end wipers ⑨ Additional wiper, single lip ⑩ Sealing strip, lower, single lip ⑪ Sealing strip, upper, single lip	320[7]	1	–
		329[7]	1	–
 217 158		330[7]	1	1
		339[7]	1	1
 217 088a		360	1	1
		370		–
 217 047a		900[5]	–	–
		910		

Attention!
The table is only a guide.
The specific application conditions must be taken into consideration when selecting the elements.

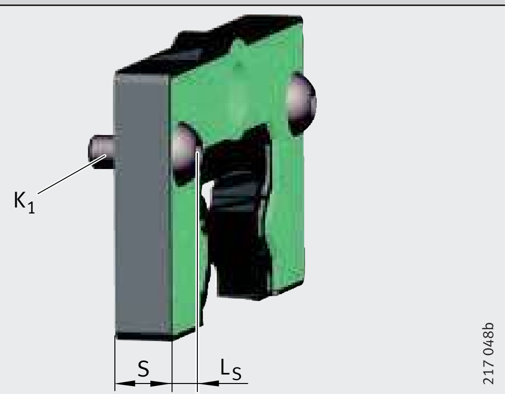
The lubrication elements can be used in various combinations.
However, not every combination is possible or advisable.
For recommended combinations, see page 366.

1) The KITs are available for the sizes KUVE15-B (-KT) to KUVE55-B (-KT) .
2) Ordering example for KIT100 for KUVE-35-B: KIT.KWVE35-B-100.
3) See figure bottom right.
4) For definition see page 354.
5) Standard for KUVE..-B and KUVE..-B-KT.
6) Valid for sizes 15 to 25.
7) Valid for sizes 20 to 45.

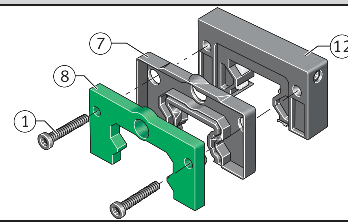
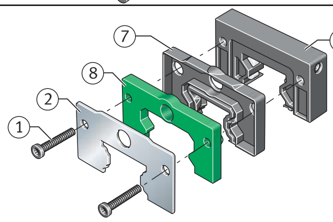
	End wipers			End wipers with carrier plate ⑧		⑨	Sealing strips		Fitting of KIT			Contamination[4)]			
							Lower	Upper							
	③	④	⑤	⑥	⑦		⑩	⑪							
	Gap seal, grey	Contact type, single lip, black	Smooth-running seal, single lip, yellow	Contact type, single lip	Contact type, double lip	Additional wiper, single lip	Single lip	Single lip	Retrofittable[2)]	Factory fit	Width S in $mm^{3)}$	Very slight	Slight	Moderate	Heavy
	–	1	–	–	–	1	–	–	■	■	5	–	–	■	■
	–	–	–	–	–	1	–	–	■	■	5	–	–	■	■
	–	1	–	–	–	1	–	–	■	■	6	–	–	■	■
	–	–	–	–	–	1	–	–	■	■	6	–	–	■	■
	–	–	–	–	1	–	–	–	■	■	6	–	–	■	■
						–					5		■	■	–
	–	–	–	–	–	–	1		■	■	–	–	■	■	–
						–		1	–				–	–	■



Fixing screws K_1, L_S, width S			
KUVE size	KIT end number	Fixing screw K_1	
			L_S mm
15 **20**	200, 210, 220, 300, 309	M2	1,3
	310, 319, 360, 370		
25 **30, 35**	200, 210, 220, 300, 309	M3	1,65
	310, 319, 360, 370		
45 **55**	200, 210, 220, 300, 309	M4	2,2
	310, 319, 360, 370		



Accessories

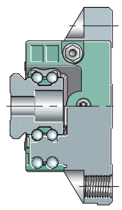
Lubrication elements KIT[1]		
KIT	Description	Designation and KIT end number KIT.KWVE..-B[2]
 217 049a	(1) Fixing screws K_1 (2) End plate (6) Additional wiper, single lip (7) Additional wiper, double lip (8) Carrier plate for end wipers (12) Long term lubrication unit	400
 217 050a		430

Attention!
The table is only a guide.
The specific application conditions must be taken into consideration when selecting the elements.

The lubrication elements can be used in various combinations.
However, not every combination is possible or advisable.
For recommended combinations, see page 366.

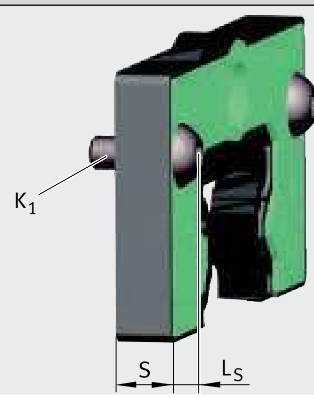
1) The KITs are available for the sizes KUVE20-B (-KT) to KUVE45-B (-KT) .
2) Ordering example for KIT400 for KUVE-35-B: KIT.KWVE35-B-400.
3) See figure bottom right.
4) For definition see page 354.
5) Valid for sizes 20 to 35.
6) Valid for size 45.

① Fixing screws K_1 (2 pieces)	② End plate, non-contact	End wipers with carrier plate ⑧: ⑥ Contact type, single lip	End wipers with carrier plate ⑧: ⑦ Contact type, double lip	⑫ Long term lubrication unit	Fitting of KIT: Retrofittable	Fitting of KIT: Factory fit	Width S in mm[3]	Contamination[4]: Very slight	Contamination[4]: Slight	Contamination[4]: Moderate	Contamination[4]: Heavy
1	–	–	1	1	■	–	14[5] 15,5[6]	–	■	■	–
1	1	–	1	1	■	–	15[5] 16,5[6]	–	–	■	■



Fixing screws K_1, L_S, width S

KUVE size	KIT end number	Fixing screw K_1	
			L_S mm
20	400, 430	M2	1,3
25, 30, 35	400, 430	M3	1,65
45	400, 430	M4	2,2



Accessories

Recommended combinations																	
Designation and KIT end numbers KIT.KWVE..-B-	100	110	200	210	220	300	309	310	319	320	329	330	339	360	370	400	430
100	●		●			●	●	●	●	●	●	●	●				
110		●															
200			●														
210				●				●	●								
220					●												
300						●	●										
309						●	●										
310								●	●								
319								●	●								
320						●	●			●	●						
329						●	●			●	●						
330								●	●			●	●				
339								●	●			●	●				
360[1)]														●			
370[1)]															●		
400[1)]														●		●	
430[1)]															●		●
900	●		●		●	●	●	●	●	●	●	●	●	●	●	●	●
910						●	●	●	●	●	●	●	●	●	●	●	●

● Recommended combinations.

[1)] Only in conjunction with KIT.KWVE-B-900.

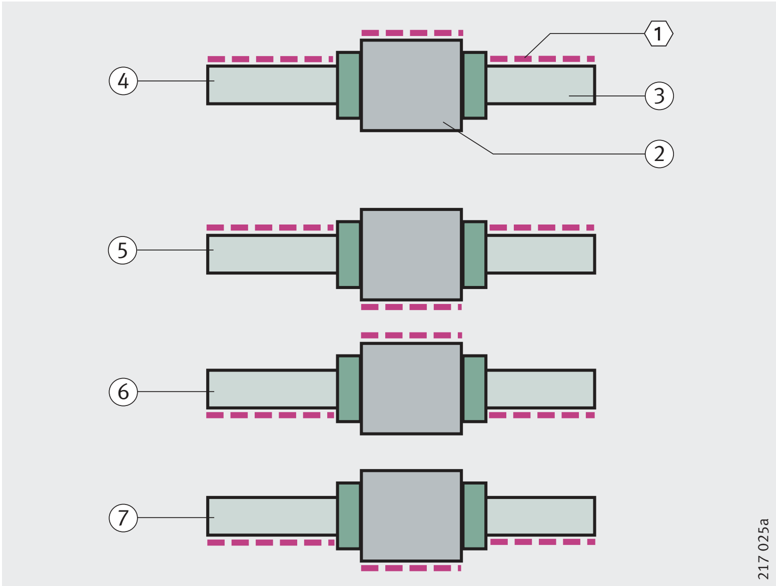
Configuration of KIT.KWVE

The description shows how an ordering designation is constructed for factory fitted KITs.

Attention! Always pay attention to the position of the locating faces of the carriage and guideway, *Figure 8*.

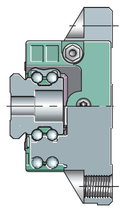
Definition of locating faces

Possible locating faces for guideways and carriages are shown in *Figure 8*. The locating faces are indicated by the broken lines.



1 Locating face
2 Carriage
3 Guideway
4 Standard KUVE..-B
5 KUVE..-B-OU
6 KUVE..-B-UO
7 KUVE..-B-UU

Figure 8
Locating faces on guideways and carriages



Definition of KIT position on the carriage

KIT components can be fitted on the left, centre or right of the carriage, *Figure 9*.

Attention!

In order to clearly define the KIT components, the carriage is always shown viewed with the locating face upwards.

1 Locating face
2 Carriage number (W) for each guideway set (W1.1, W1.n, W2.n)
W1.1 indicates:
1 = number of guideway
.1 = number of carriage
3 Guideway set (S1, S2, Sn)
4 KIT.KWVE on left of carriage
5 KIT.KWVE on centre of carriage
6 KIT.KWVE on right of carriage

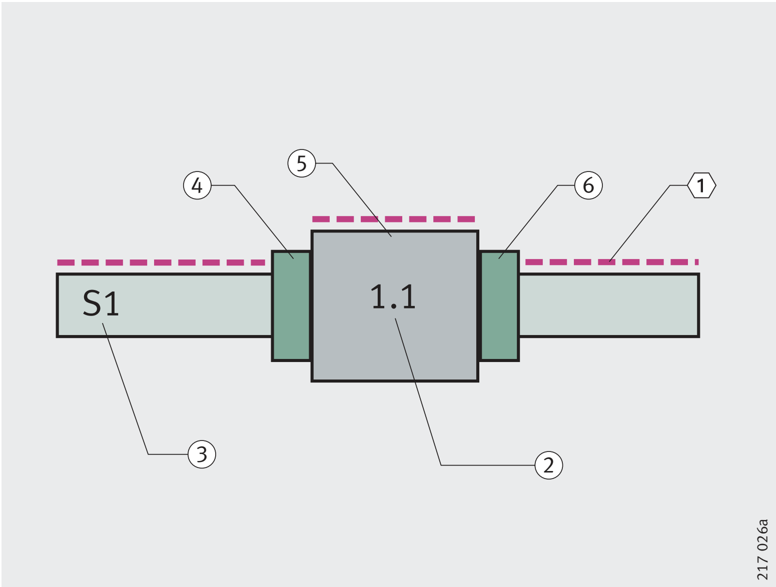


Figure 9

KIT position on carriage
Position of locating face for guideway and carriage

Ordering example, ordering designation

Unit with one guideway set

Attention!

In order to clearly define the KIT components, the carriage is always shown viewed with the locating face upwards.

The KIT structure is always described from left to right.

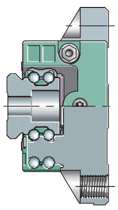
Four-row linear recirculating ball bearing and guideway assembly KUVE with KIT components

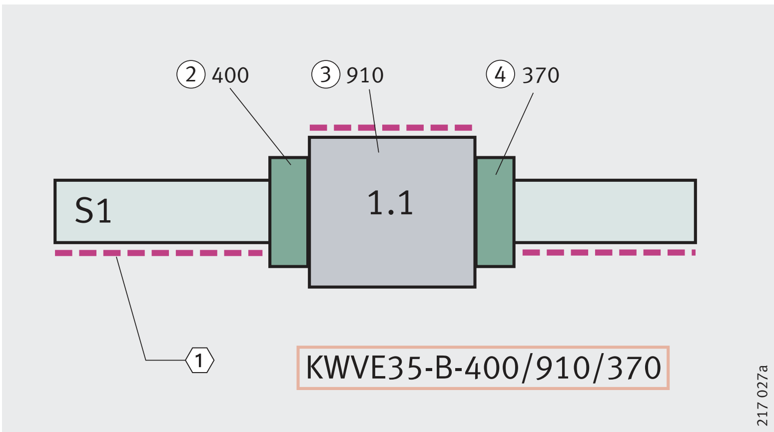
Four-row linear ball bearing and guideway assembly	KUVE
Size	35
Carriage type, full complement	B
Guideways with clip fit covering strip	ADB+K
Number of guideway sets	1
Number of carriages per unit	W1
Accuracy class	G2
Preload class	V1
Guideway length	800 mm
a_L	40 mm
a_R	40 mm
Long term lubrication unit, fitted on left	KIT.KWVE35-B-400
Sealing strips, upper and lower	KIT.KWVE35-B-910
Additional wiper, double row, fitted on right	KIT.KWVE35-B-370

Designation of KIT components: see *Figure 10*.

Ordering designation

System		**KUVE35-B**
Guideway set	S1	**KUVE35-B-ADB+K-UO-W1-G2-V1/800-40/40**
Carriage	W1.1	**KWVE35-B-400/910/370-G2-V1**





1 Locating face
2 Long term lubrication unit KIT.KWVE35-B-400
3 Sealing strips KIT.KWVE35-B-910
4 Additional wiper, double lip, KIT.KWVE35-B-370

Figure 10
Ordering example, ordering designation

Unit with two guideway sets

Attention!

In order to clearly define the KIT components, the carriage is always shown viewed with the locating face upwards.
In the example, the guideway set 2 is rotated for definition by 180°.

The KIT structure is always described from left to right.

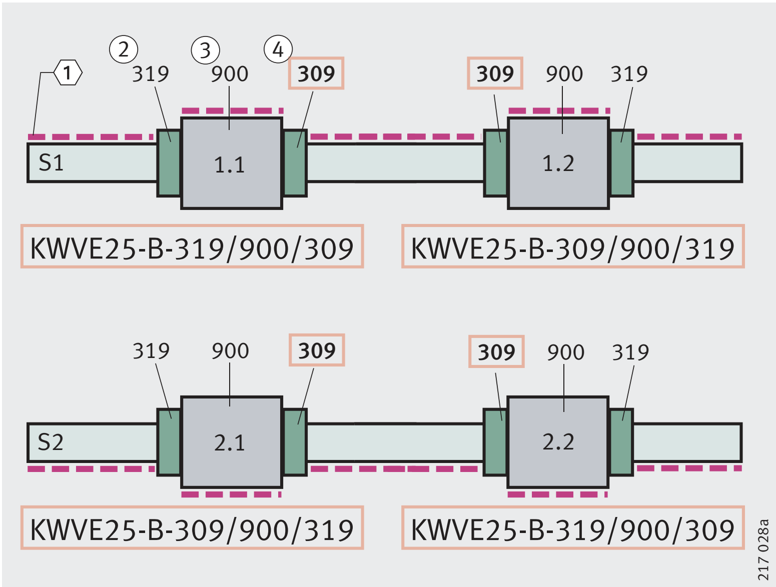
Four-row linear recirculating ball bearing and guideway assembly KUVE with KIT components

Four-row linear ball bearing and guideway assembly	KUVE
Size	25
Carriage type, full complement	B
Number of guideway sets	2
Number of carriages per unit	W2
Accuracy class	G2
Preload class	V1
Guideway length	2 500 mm
a_L	20 mm
a_R	20 mm
Additional wiper, single lip, end plate (facing outward in each case)	KIT.KWVE25-B-319
Sealing strips, lower	KIT.KWVE25-B-900
Additional wiper, single lip, (facing inward in each case)	KIT.KWVE25-B-309

Designation of KIT components: see *Figure 11*.

Ordering designation

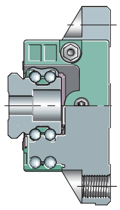
System		**KUVE25-B**
Guideway set	S1	**KUVE25-B-W2-G2-V1/2 500-20/20**
Carriage	W1.1	**KWVE25-B-319/900/309-G2-V1**
	W1.2	**KWVE25-B-309/900/319-G2-V1**
Guideway set	S2	**KUVE25-B-UU-W2-G2-V1/2 500-20/20**
Carriage	W2.1	**KWVE25-B-309/900/319-G2-V1**
	W2.2	**KWVE25-B-319/900/309-G2-V1**



1 Locating face
2 Additional wiper, double lip, and sheet steel wiper KIT.KWVE25-B-319
3 Sealing strips KIT.KWVE25-B-900
4 Additional wiper KIT.KWVE25-B-309

Figure 11

Ordering example, ordering designation



Accessories

Gearbox

The high performance worm gearboxes are specially matched to the new generation of direct current servomotors.
The light metal housings ensure optimum heat dissipation.

The gearboxes run quietly and can be used in any position.
Available ratios: see page 374.

The tooth set has low backlash (backlash $<$ 2) and can be adjusted.

Mounting position

Five machined surfaces with adequately dimensioned fixing and threaded holes ensure stress-free mounting in all positions.

If the additional forces are to be fully utilised, the gearbox should be flange mounted to the largest locating surfaces.

The most favourable mounting position for lubrication is achieved with a lateral or bottom-mounted worm shaft.

Attention! With a top-mounted worm shaft, the drive power is reduced by approx. 10%.

Flank backlash

The flank backlash ist set to the smallest possible value at the manufacturing plant. If the backlash changes after a long period of operation, it can be corrected to the specified value by means of the eccentrically supported input shaft.

Lubrication

The gearboxes are filled with synthetic lubricant.

The filling should be checked monthly and several times in the first weeks of operation.

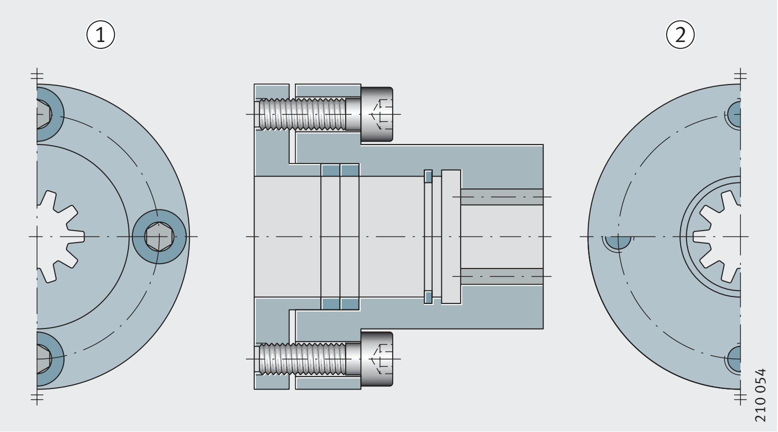
Attention! Under moderate load or with single shift operation, the lubricant should be changed between once and four times per year,
with two or three shift operation it should be changed annually.
See also the accessory “Electronically controlled lubricant dispenser” on page 388.

Coupling

The couplings are premounted. The bore on the gearbox side has a backlash-free tooth hub profile for slide fitting – similar to DIN 5 480, *Figure 1*.

The bore on the motor side has annular spring elements as a clamping joint, *Figure 1*.

Before fixing on the motor shaft, all the contact surfaces must be cleaned and protected by means of a light oil film – to prevent fretting corrosion.



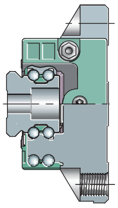
1 Gearbox side
2 Motor side

Figure 1
Coupling

Drive shaft

The drive shafts have helical teeth, 19°31′42″, have a mesh angle of 20° and are case hardened. The teeth are ground to grade 6e25 – similar to DIN 3 962, DIN 3 963 and DIN 3 967.

In order to prevent fretting corrosion, the drive shafts must be cleaned and lightly greased or oiled before fitting.



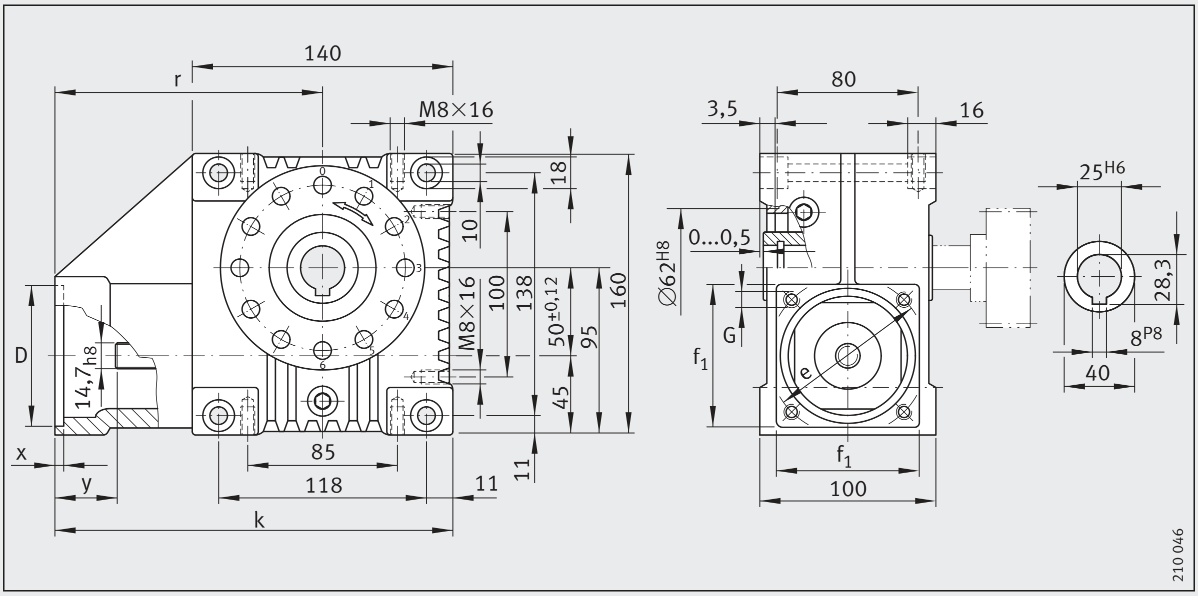
Gearbox

Axis centre distance $a_0 = 50$ mm
Drive shaft with feather key joint
or clamping joint[1)]

Dimension table · Dimensions in mm		
Designation Drive shaft with		Mass m
Clamping joint	Feather key joint	≈kg
GETR-50-SCHN-95/115-KL-i	**GETR-50-SCHN-95/115-PF-i**	7
GETR-50-SCHN-50/95-KL-i	**GETR-50-SCHN-50/95-PF-i**	7
GETR-50-SCHN-80/100-KL-i	**GETR-50-SCHN-80/100-PF-i**	7
GETR-50-SCHN-95/115-KL-i	**GETR-50-SCHN-95/115-PF-i**	7
GETR-50-SCHN-60/95-KL-i	**GETR-50-SCHN-60/95-PF-i**	7
GETR-50-SCHN-95/130-KL-i	**GETR-50-SCHN-95/130-PF-i**	8
GETR-50-SCHN-110/130-KL-i	**GETR-50-SCHN-110/130-PF-i**	8

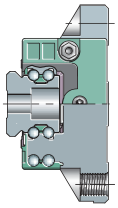
Possible ratios: i = 4,75; 6,75; 9,25; 14,5; 19,5; 29; 39; 50.

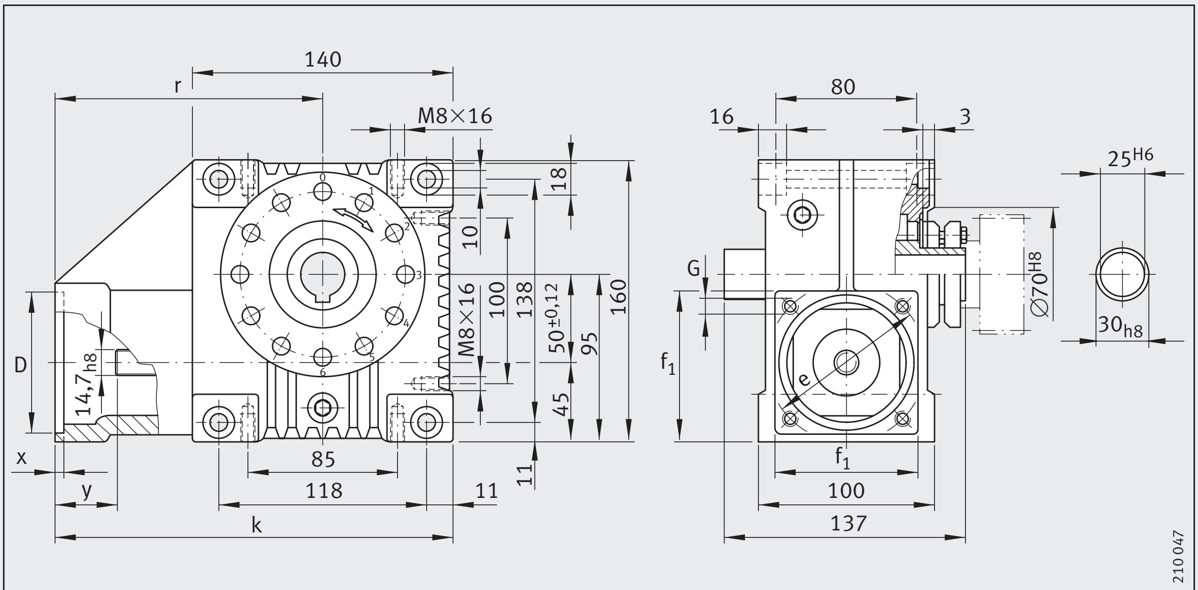
1) Gearbox coupling see page 392.



Gearbox – drive shaft with feather key joint

Dimensions							
e	G	D^{G7}	x	y	k	r	f_1
115	M8	95	5	42	222	152	100
95	M6	50	5	42	222	152	100
100	M6	80	5	42	222	152	100
115	M8	95	5	52	232	162	105
75	M5	60	4	54	234	164	100
130	M8	95	5	58	238	168	115
130	M8	110	5	58	238	168	115





Gearbox – drive shaft with clamping joint

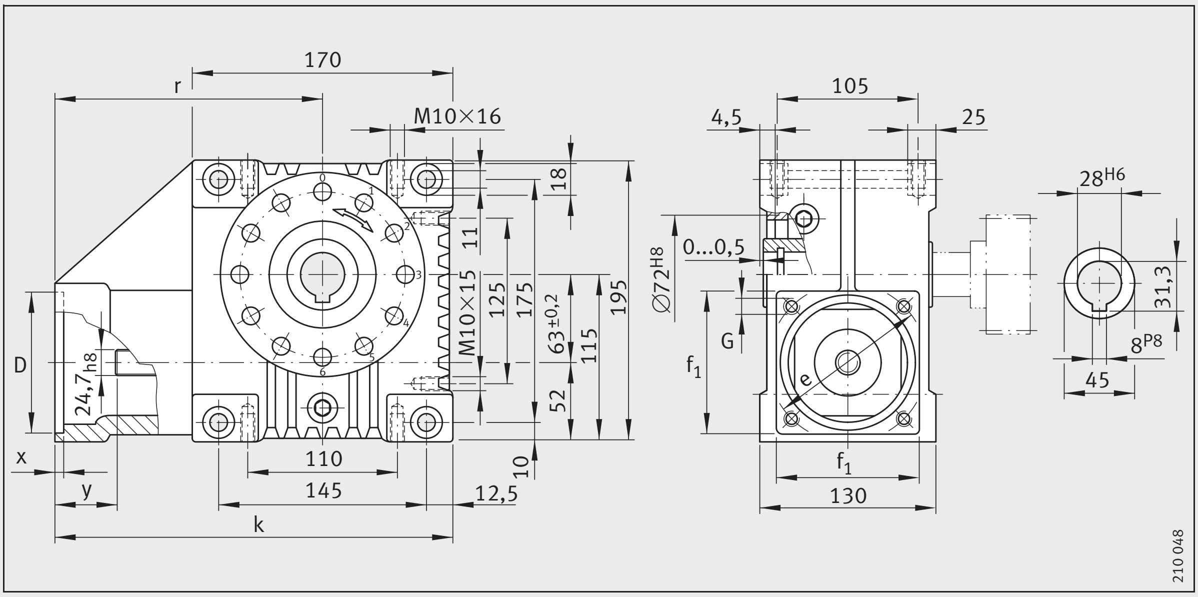
Gearbox

Axis centre distance a_0 = 63 mm
Drive shaft with feather key joint
or clamping joint[1)]

Dimension table · Dimensions in mm		
Designation Drive shaft with		Mass m
Clamping joint	Feather key joint	≈kg
GETR-63-SCHN-95/115-KL-i	**GETR-63-SCHN-95/115-PF-i**	12
GETR-63-SCHN-110/165-KL-i	**GETR-63-SCHN-110/165-PF-i**	12,5
GETR-63-SCHN-130/165-KL-i	**GETR-63-SCHN-130/165-PF-i**	12,5
GETR-63-SCHN-95/130-KL-i	**GETR-63-SCHN-95/130-PF-i**	12
GETR-63-SCHN-110/130-KL-i	**GETR-63-SCHN-110/130-PF-i**	12
GETR-63-SCHN-110/130-KL-i	**GETR-63-SCHN-110/130-PF-i**	12,5
GETR-63-SCHN-130/165-KL-i	**GETR-63-SCHN-130/165-PF-i**	12,5
GETR-63-SCHN-130/215-KL-i	**GETR-63-SCHN-130/215-PF-i**	12

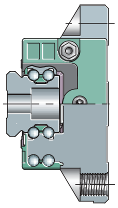
Possible ratios: i = 4,75; 6,75; 9,25; 14,5; 19,5; 29; 39; 50.

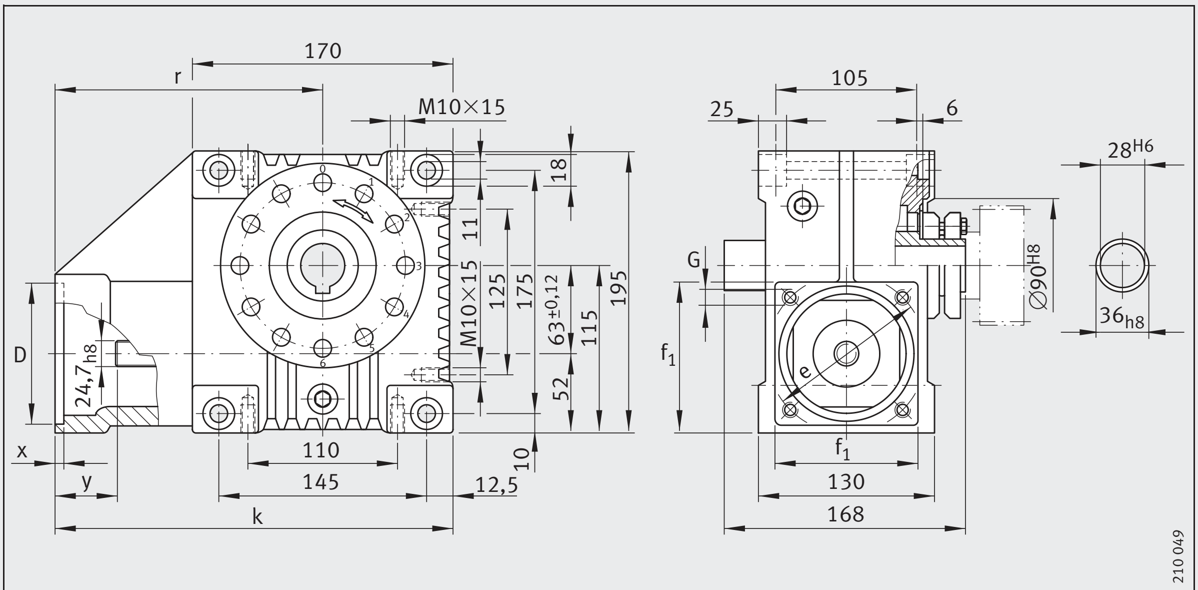
1) Gearbox coupling see page 392.



Gearbox – drive shaft with feather key joint

Dimensions							
e	G	D^{G7}	x	y	r	f_1	k
115	M8	95	5	48	180	100	265
165	M10	110	5	53	185	140	270
165	M10	130	5	53	185	140	270
130	M8	95	5	48	180	115	265
130	M8	110	5	48	180	115	265
130	M8	110	5	53	185	115	270
165	M10	130	5	73	205	140	290
215	M12	130	5	73	205	195	290





Gearbox – drive shaft with clamping joint

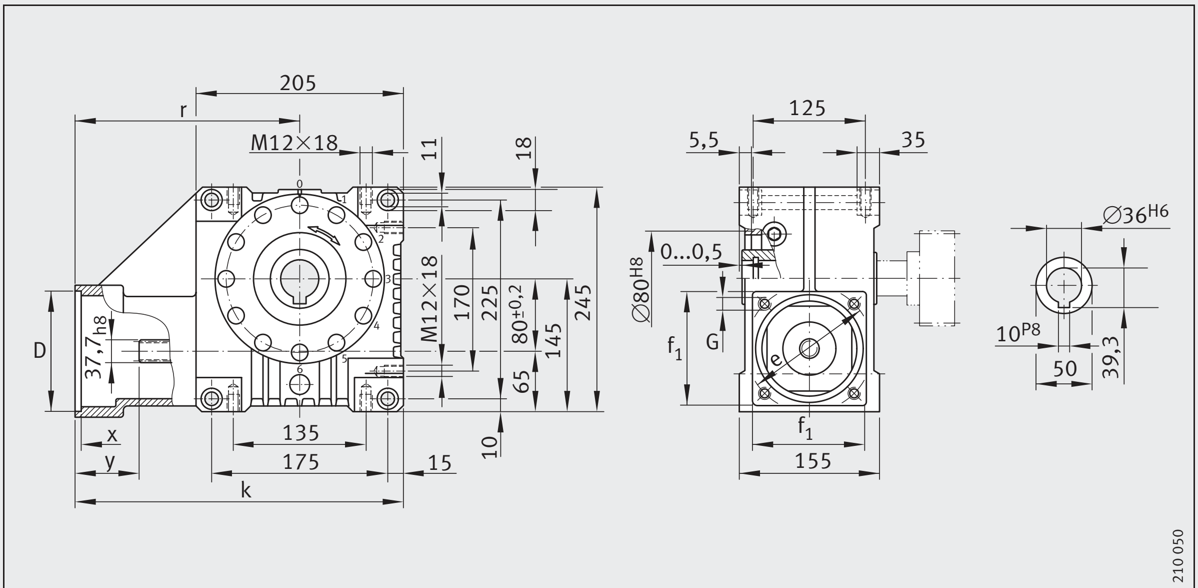
Gearbox

Axis centre distance a_0 = 80 mm
Drive shaft with feather key joint
or clamping joint[1)]

Dimension table · Dimensions in mm		
Designation Drive shaft with		Mass m
Clamping joint	Feather key joint	≈kg
GETR-80-SCHN-110/165-KL-i	**GETR-80-SCHN-110/165-PF-i**	23
GETR-80-SCHN-180/215-KL-i	**GETR-80-SCHN-180/215-PF-i**	25
GETR-80-SCHN-130/165 KL-i	**GETR-80-SCHN-130/165-PF-i**	23
GETR-80-SCHN-130/165-KL-i	**GETR-80-SCHN-130/165-PF-i**	24
GETR-80-SCHN-180/215-KL-i	**GETR-80-SCHN-180/215-PF-i**	30
GETR-80-SCHN-180/215-KL-i	**GETR-80-SCHN-180/215-PF-i**	25
GETR-80-SCHN-130/215-KL-i	**GETR-80-SCHN-130/215-PF-i**	25

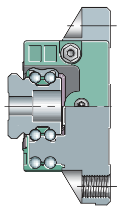
Possible ratios: i = 4,75; 6,75; 9,25; 14,5; 19,5; 29; 39; 50.

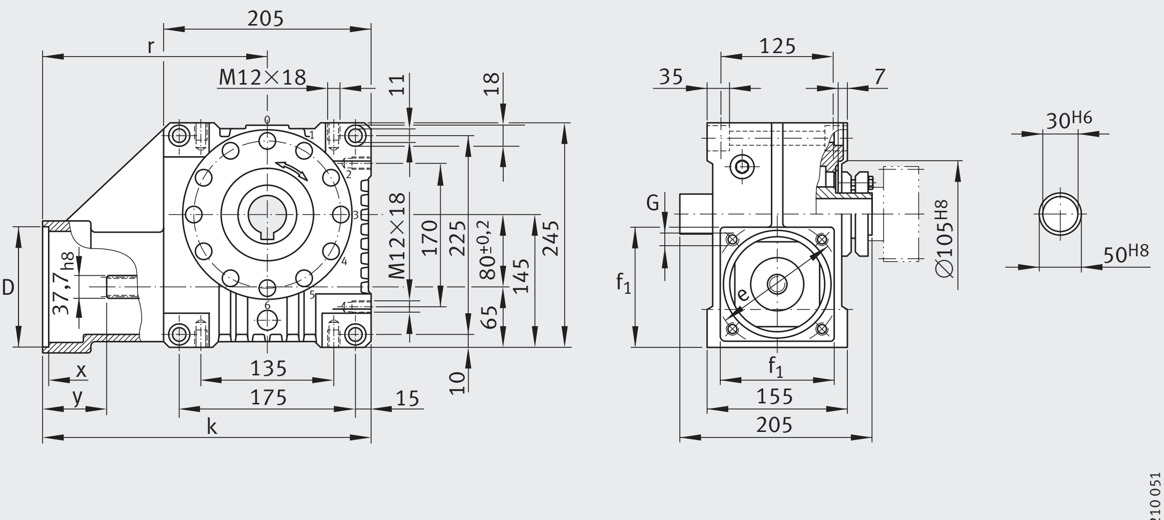
1) Gearbox coupling see page 392.



Gearbox – drive shaft with feather key joint

Dimensions							
e	G	D^{G7}	x	y	r	f_1	k
165	M10	110	5	55	230	140	332,5
215	M12	180	5	85	260	193	362,5
165	M10	130	5	55	230	140	332,5
165	M10	130	5	75	250	155	352,5
215	M12	180	6	90	265	192	367,5
215	M12	180	5	75	250	193	352,5
215	M12	130	5	75	250	193	352,5





Gearbox – drive shaft with clamping joint

Gearbox

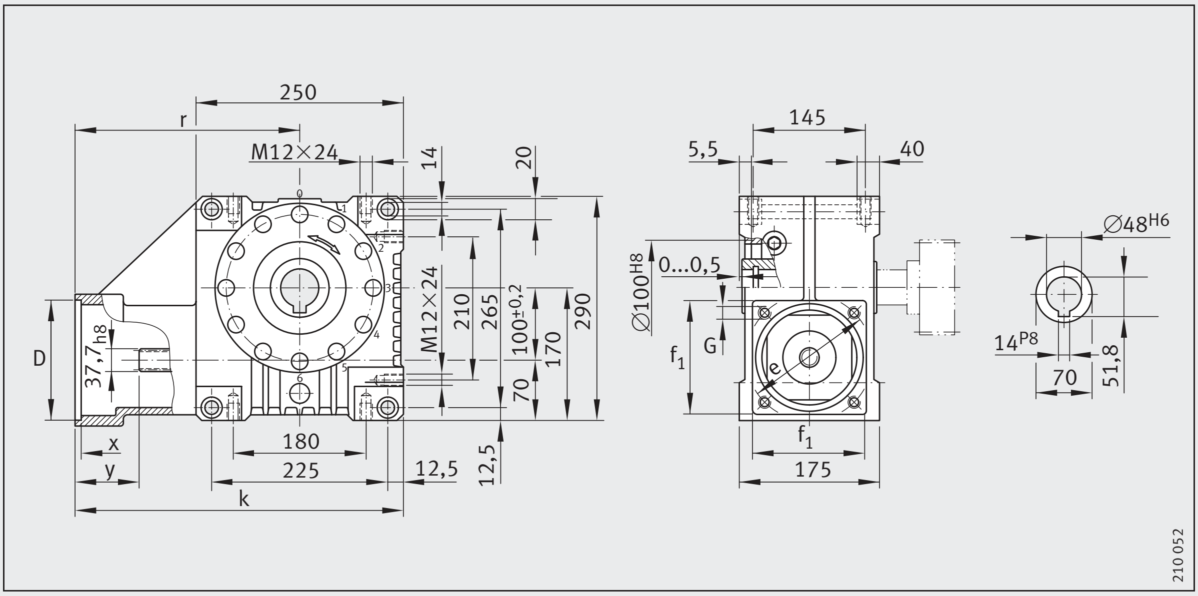
Axis centre distance a_0 = 100 mm
Drive shaft with feather key joint
or clamping joint[1)]

Dimension table · Dimensions in mm

Designation Drive shaft with		Mass m
Clamping joint	Feather key joint	≈kg
GETR-100-SCHN-110/165-KL-i	**GETR-100-SCHN-110/165-PF-i**	30
GETR-100-SCHN-130/165-KL-i	**GETR-100-SCHN-130/165-PF-i**	30
GETR-100-SCHN-130/165-KL-i	**GETR-100-SCHN-130/165-PF-i**	31
GETR-100-SCHN-180/215-KL-i	**GETR-100-SCHN-180/215-PF-i**	35
GETR-100-SCHN-180/215-KL-i	**GETR-100-SCHN-180/215-PF-i**	33
GETR-100-SCHN-130/215-KL-i	**GETR-100-SCHN-130/215-PF-i**	33

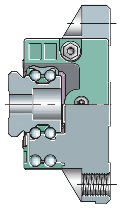
Possible ratios: i = 4,75; 6,75; 9,25; 14,5; 19,5; 29; 39; 50.

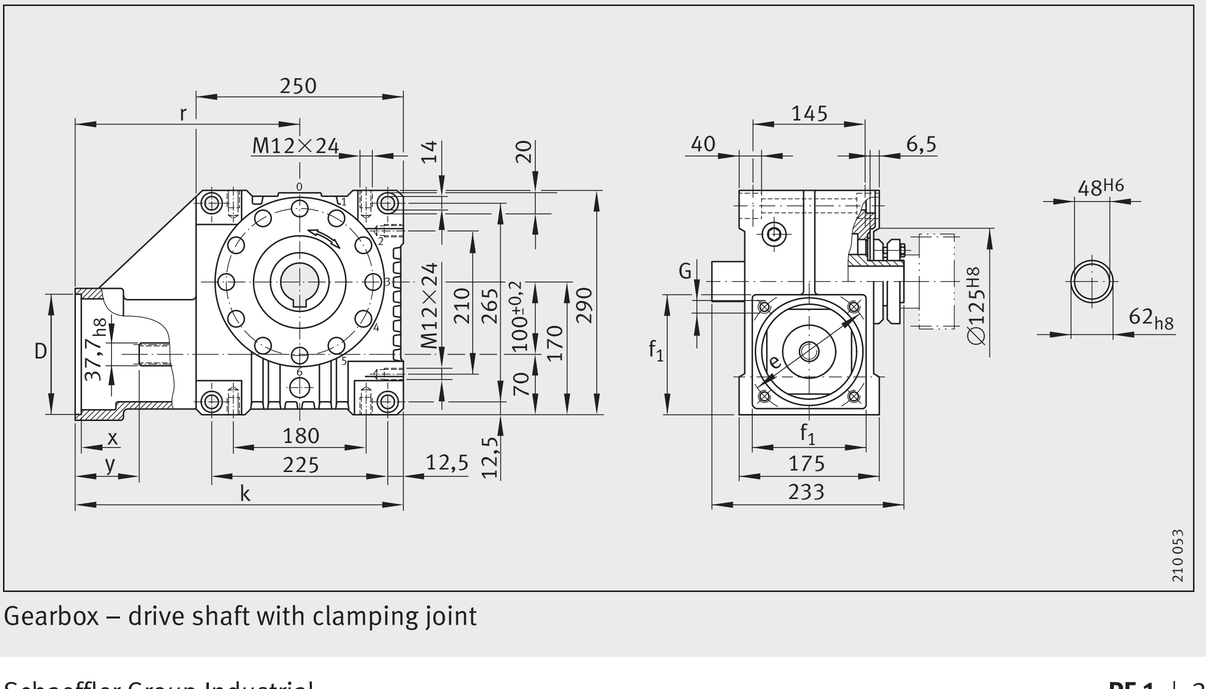
1) Gearbox coupling see page 392.



Gearbox – drive shaft with feather key joint

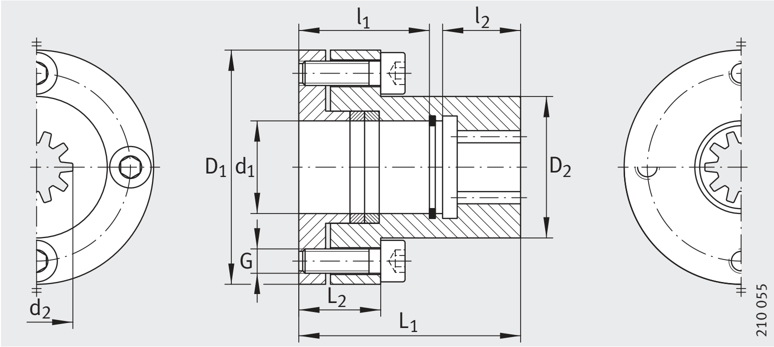
Dimensions							
e	G	D^{G7}	x	y	r	f_1	k
165	M10	110	5	55	240	140	365
165	M10	130	5	55	240	140	365
165	M10	130	5	75	260	140	385
215	M12	180	6	90	275	192	400
215	M12	180	5	75	260	190	385
215	M12	130	5	75	260	195	385





Gearbox – drive shaft with clamping joint

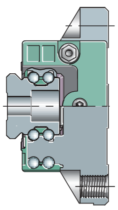
Coupling



KUP to DIN 5 480

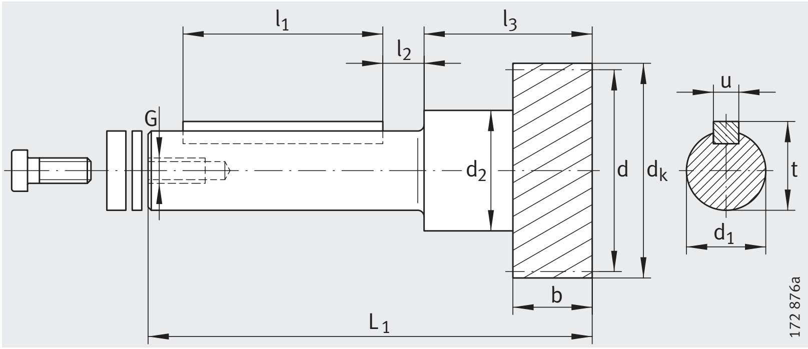
Dimension table · Dimensions in mm						
Designation	Mass	Jred	Dimensions			
	m		d_1	d_2	D_1	D_2
	≈kg	10^{-4} kg · m^2				
KUP-6543110	0,4	0,835	10	15X1,25X10	48	29
KUP-6543111	0,5	0,976	11	15X1,25X10	48	29
KUP-6543114	0,45	0,835	14	15X1,25X10	48	29
KUP-6543116	0,45	0,824	16	15X1,25X10	48	29
KUP-6543119	0,4	0,799	19	15X1,25X10	48	29
KUP-6543914	0,5	0,985	14	15X1,25X10	48	29
KUP-6543916	0,4	0,975	16	15X1,25X10	48	29
KUP-6543919	0,45	0,853	19	15X1,25X10	48	29
KUP-6543924	0,52	1,041	24	15X1,25X10	50	29
KUP-6544024	0,75	2,628	24	25X1,25X18	50	29
KUP-6544114	0,5	1,645	14	25X1,25X18	55	32
KUP-6544116	0,5	1,622	16	25X1,25X18	55	32
KUP-6544119	0,5	1,598	19	25X1,25X18	55	32
KUP-6544219	0,5	1,703	19	25X1,25X18	55	32
KUP-6544919	0,55	1,757	19	25X1,25X18	55	32
KUP-6544928	0,85	5,998	28	25X1,25X18	70	48
KUP-6544932	0,8	5,921	32	25X1,25X18	70	48
KUP-6544935	0,95	6,155	35	25X1,25X18	70	48
KUP-6546024	0,9	4,452	24	38X1,25X29	55	–
KUP-6546834	1,95	16,32	$1^3/_8$″	38X1,25X29	80	58
KUP-6546928	0,9	5,882	28	38X1,25X29	70	48
KUP-6546932	0,85	5,784	32	38X1,25X29	70	48
KUP-6546935	1,95	16,55	35	38X1,25X29	80	58
KUP-6546938	1,88	16,24	38	38X1,25X29	80	58
KUP-6547948	3,1	41,86	48	38X1,25X29	103	74

l_1	l_2	l_3	l_4	L_1	L_2	Fixing screws G Quantity and size	Tightening torque M_A Nm
22	17	–	5	44	18	4XM5	7
20,5	17	–	5	64	18	4XM5	7
24	19	–	5	50	18	4XM5	7
27	16	–	5	50	18	4XM5	7
24	16	–	5	40	18	4XM5	7
26	19	–	5	64	18	4XM5	7
27	15	–	5	64,3	18,3	4XM5	7
23	17	–	5	55	18	4XM5	7
34	22	–	6	56	40	4XM6	10
41,5	24	–	6	66,5	59,5	4XM6	10
24	23,5	–	6	64	21	4XM6	10
34	23,5	–	6	64	21	4XM6	10
33	26,5	–	6	63	21	4XM6	10
27	26,5	–	6	74	21	4XM6	10
31	26,5	–	6	78	21	4XM6	10
48	26	–	6	83	25	5XM6	10
43	23	–	6	78	25	5XM6	10
52	26	–	6	78	25	5XM6	10
38,5	31	4	6	72,5	–	5XM6	10
63	34	–	6	100	40	6XM6	10
47	34	–	6	90	25	5XM6	10
43	34	–	6	86	25	5XM6	10
65	34	–	6	100	40	6XM6	10
62	34	–	6	100	40	6XM6	10
58	31	–	8	89	42	6XM8	25



Drive shaft

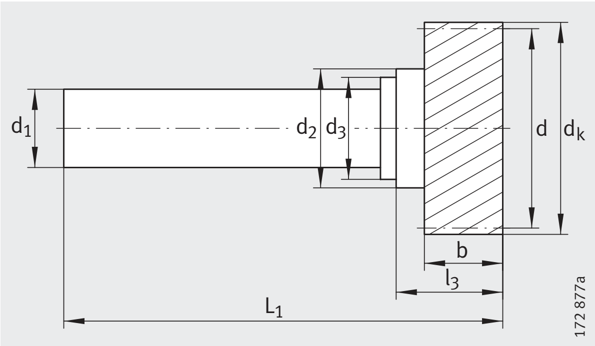
For feather key or
clamping joint
Helical teeth



RITZ..-PF
Feather key joint

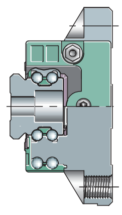
Dimension table · Dimensions in mm

Designation	Mass m ≈kg	Axis centre distance	Modulus	Number of teeth	Dimensions			
					d	d_k	b	d_1 h6
RITZ-023050-PF	1,25	50	2	30	63,66	67,7	25	25
RITZ-023050-KL								
RITZ-022050-PF	1,33		3	20		69,7	30	
RITZ-032050-KL								
RITZ-023063-PF	1,5	63	2	30	63,66	67,7	25	28
RITZ-023063-KL	1,6							
RITZ-032063-PF	1,6		3	20		69,7	30	
RITZ-032063-KL								
RITZ-041563-PF	1,85	63	4	15		71,7	40	28
RITZ-041563-KL								
RITZ-032080-PF	2,4	80	3	20	63,66	69,7	30	36
RITZ-0320 80-KL								
RITZ-041580-PF	2,5	80	4	15	63,66	71,7	40	36
RITZ-041580-KL								
RITZ-0415100-PF	3,9	100	4	15	63,66	71,7	40	48
RITZ-0415100-KL								

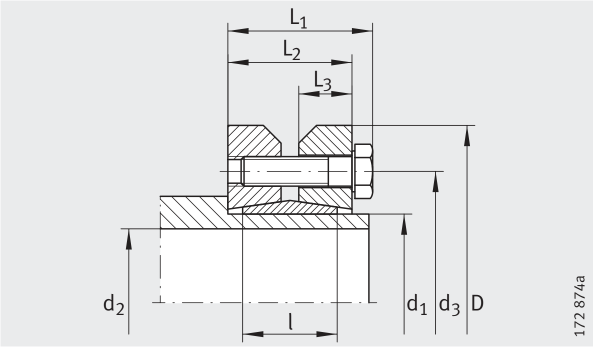


RITZ..-KL
Clamping joint

d_2	d_3	L_1	l_1	l_2	l_3	l_4	u	t	G
38	–	140	63	13	53	–	8	28	M8
	31	148	–	–	34	28,5	–	–	–
	–	142	63	13	55	–	8	28	M8
		150	–	–	36,5		–	–	–
42	–	164,5	80	14,5	57,5	–	8	31	M8
	36	180	–	–	38,5	33	–	–	–
	–	167	80	14,5	60	–	8	31	M8
	36	183	–	–	41	33,5	–	–	–
	–	172	80	14,5	65	–	8	31	M8
		188	–	–	46		–	–	–
48	–	185	100	12,5	62	–	10	39	M12
		208	–	–	37,5		–	–	–
48	–	190	100	12,5	67	–	10	39	M12
		213	–	–	42,5		–	–	–
57	–	215	125	9	72	–	14	51,5	M12
		240	–	–	43,5		–	–	–



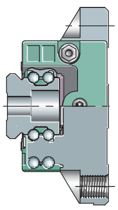
Clamping joint



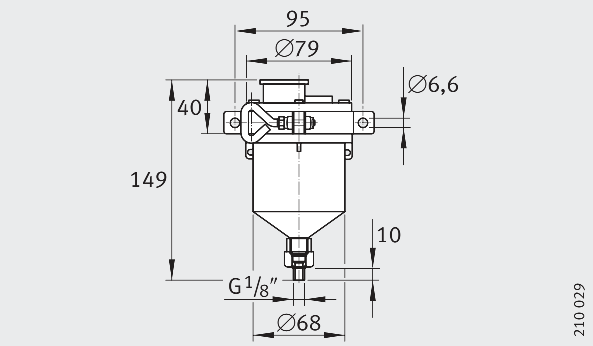
SPE

Dimension table · Dimensions in mm							
Designation	Mass m ≈kg	Axis centre distance	J_{red} 10^{-4} kg · m^2	Dimensions			
				d_1	d_2	d_3	D
SPE-8083030	0,3	50	1,756	30	25	44	60
SPE-8084036	0,4	63	4,029	36	28	52	72
SPE-8085050	0,8	80	11,322	50	36	70	90
SPE-8086062	1,3	100	27,137	62	48	86	110

L_1	L_2	L_3	l	Fixing screws G Quantity and size	Tightening torque M_A Nm
25	21,5	9	16	7XM5	4
27,5	23,5	10	18	5XM6	12
31,5	27,5	12	22	8XM6	12
34,5	30,5	13	23	10XM6	12



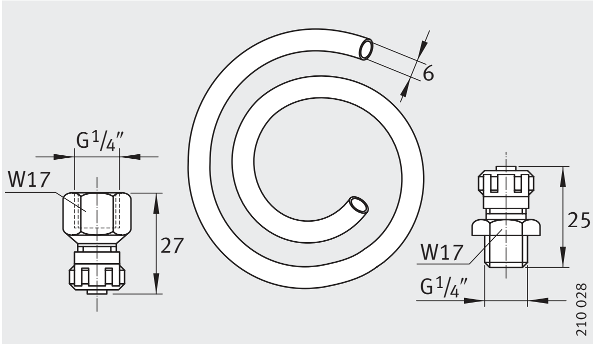
Electronically controlled lubricant dispenser



Volume 125 cm^3

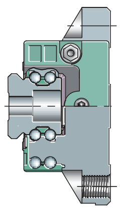
Ordering designation	
6591000	Ready-to-fit lubricant dispenser with Klüber special grease

Hose connection set

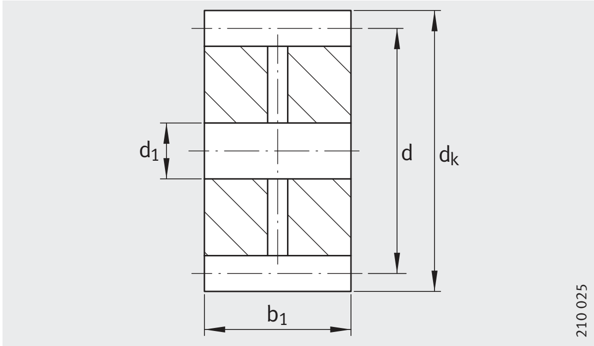


Hose connection set,
width across flats W = 17 mm

Ordering designation	
6591020	Hose connection set comprising; – 2 m plastic hose – aluminium screw connection with internal thread – aluminium screw connection with external thread



Felted gear
Locating pin

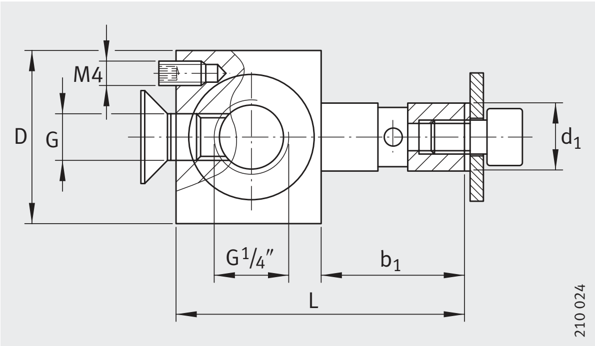


Felted gear
Helical teeth on right side

Dimension table · Dimensions in mm

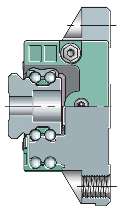
Ordering designation		Mass	Modulus	Number of teeth
Felted gear	Locating pin	m ≈g		z
RITZ-6591229	–	11	2	18
–	**RITZ-6591210**	140	2	–
RITZ-6591329	–	36	3	18
–	**RITZ-6591310**	145	3	–
RITZ-6591429	–	97	4	18
–	**RITZ-6591410**	150	4	–

Before the lubrication device is put into operation, the connecting hose between the felted gear and the lubrication device should be filled and the felted gear impregnated with grease, for example Klüber Microlub GB 0.



Locating pin

Dimensions						
d	d_k	d_1	D	b_1	L	G
38,2	42	12	–	25	–	–
–	–	12	30	25	50	M8
57,3	63	12	–	30	–	–
–	–	12	30	30	55	M8
76,5	84	12	–	40	–	–
–	–	12	30	40	65	M8



Allocation:
motor – coupling – gearbox

Gearbox with axis centre distance a_0 = 50 mm

Dimension table · Dimensions in mm

Ordering designation			Motor shaft	
Clamping joint	Feather key joint	Coupling	Diameter	Length
GETR-50-SCHN-80/100-KL-i	**GETR-50-SCHN-80/100-PF-i**	**KUP-6543110**	10	32
GETR-50-SCHN-60/75-KL-i	**GETR-50-SCHN-60/75-PF-i**	**KUP-6543111**	11	23
GETR-50-SCHN-50/95-KL-i	**GETR-50-SCHN-50/95-PF-i**	**KUP-6543114**	14	30
GETR-50-SCHN-60/75-KL-i	**GETR-50-SCHN-60/75-PF-i**	**KUP-6443914**	14	30
GETR-50-SCHN-80/100-KL-i	**GETR-50-SCHN-80/100-PF-i**	**KUP-6543114**	14	30
GETR-50-SCHN-95/115-KL-i	**GETR-50-SCHN-95/115-PF-i**	**KUP-6543114**	14	30
GETR-50-SCHN-60/75-KL-i	**GETR-50-SCHN-60/75-PF-i**	**KUP-6543116**	16	40
GETR-50-SCHN-95/115-KL-i	**GETR-50-SCHN-95/115-PF-i**	**KUP-6543116**	16	40
GETR-50-SCHN-95/115-KL-i	**GETR-50-SCHN-95/115-PF-i**	**KUP-6543119**	19	40
GETR-50-SCHN-95/115-KL-i	**GETR-50-SCHN-95/115-PF-i**	**KUP-6543119**	19	50
GETR-50-SCHN-95/130-KL-i	**GETR-50-SCHN-95/130-PF-i**	**KUP-6543919**	19	40
GETR-50-SCHN-110/130-KL-i	**GETR-50-SCHN-110/130-PF-i**	**KUP-6543919**	19	50
GETR-50-SCHN-110/130-KL-i	**GETR-50-SCHN-110/130-PF-i**	**KUP-6543924**	24	50

Possible ratios: i = 4,75; 6,75; 9,25; 14,5; 19,5; 29; 39; 50.

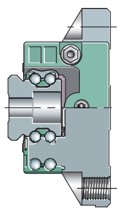
Allocation:
motor – coupling – gearbox

Gearbox with axis centre distance a_0 = 63 mm

Dimension table · Dimensions in mm

Ordering designation			Motor shaft	
Clamping joint	Feather key joint	Coupling	Diameter	Length
GETR-63-SCHN-95/115 KL-i	**GETR-63-SCHN-95/115-PF-i**	**KUP-6544114**	14	30
GETR-63-SCHN-95/165 KL-i	**GETR-63-SCHN-95/165-PF-i**	**KUP-6544114**	14	30
GETR-63-SCHN-95/115 KL-i	**GETR-63-SCHN-95/115-PF-i**	**KUP-6544116**	16	40
GETR-63-SCHN-130/165 KL-i	**GETR-63-SCHN-130/165-PF-i**	**KUP-6444219**	19	28
GETR-63-SCHN-95/115 KL-i	**GETR-63-SCHN-95/115-PF-i**	**KUP-6544119**	19	40
GETR-63-SCHN-95/130 KL-i	**GETR-63-SCHN-95/130-PF-i**	**KUP-6544119**	19	40
GETR-63-SCHN-110/130 KL-i	**GETR-63-SCHN-110/130-PF-i**	**KUP-6544119**	19	40
GETR-63-SCHN-130/215 KL-i	**GETR-63-SCHN-130/215-PF-i**	**KUP-6544919**	19	40
GETR-63-SCHN-110/130 KL-i	**GETR-63-SCHN-110/130-PF-i**	**KUP-6544024**	24	50
GETR-63-SCHN-110/165 KL-i	**GETR-63-SCHN-110/165-PF-i**	**KUP-6544024**	24	50
GETR-63-SCHN-130/165 KL-i	**GETR-63-SCHN-130/165-PF-i**	**KUP-6544024**	24	50
GETR-63-SCHN-110/130 KL-i	**GETR-63-SCHN-110/130-PF-i**	**KUP-6544028**	28	40
GETR-63-SCHN-130/165 KL-i	**GETR-63-SCHN-130/165-PF-i**	**KUP-6544932**	32	58
GETR-63-SCHN-130/215 KL-i	**GETR-63-SCHN-130/215-PF-i**	**KUP-6544932**	32	58 – 60

Possible ratios: i = 4,75; 6,75; 9,25; 14,5; 19,5; 29; 39; 50.



Allocation:
motor – coupling – gearbox

Gearbox with axis centre distance a_0 = 80 mm

Dimension table · Dimensions in mm

Ordering designation			Motor shaft	
Clamping joint	Feather key joint	Coupling	Diameter	Length
GETR-80-SCHN-110/165-KL-i	**GETR-80-SCHN-110/165-PF-i**	**KUP-6546024**	24	50
GETR-80-SCHN-130/165-KL-i	**GETR-80-SCHN-130/165-PF-i**	**KUP-6546024**	24	50
GETR-80-SCHN-180/215-KL-i	**GETR-80-SCHN-180/215-PF-i**	**KUP-6546928**	28	42
GETR-80-SCHN-180/125-KL-i	**GETR-80-SCHN-180/125-PF-i**	**KUP-6546928**	28	60
GETR-80-SCHN-130/165-KL-i	**GETR-80-SCHN-130/165-PF-i**	**KUP-6546932**	32	50
GETR-80-SCHN-130/215-KL-i	**GETR-80-SCHN-130/215-PF-i**	**KUP-6546932**	32	58 – 60
GETR-80-SCHN-180/215-KL-i	**GETR-80-SCHN-180/215-PF-i**	**KUP-6546932**	32	58 – 60
GETR-80-SCHN-180/215-KL-i	**GETR-80-SCHN-180/215-PF-i**	**KUP-6546938**	38	80 – 85
GETR-80-SCHN-180/215-KL-i	**GETR-80-SCHN-180/215-PF-i**	**KUP-6547948**	48	58

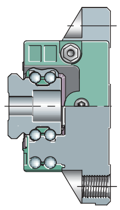
Possible ratios: i = 4,75; 6,75; 9,25; 14,5; 19,5; 29; 39; 50.

Allocation: motor – coupling – gearbox

Gearbox with axis centre distance a_0 = 100 mm

Dimension table · Dimensions in mm				
Ordering designation			Motor shaft	
Clamping joint	Feather key joint	Coupling	Diameter	Length
GETR-100-SCHN-110/165-KL-i	**GETR-100-SCHN-110/165-PF-i**	**KUP-6546024**	24	50
GETR-100-SCHN-130/165-KL-i	**GETR-100-SCHN-130/165-PF-i**	**KUP-6546024**	24	50
GETR-100-SCHN-180/215-KL-i	**GETR-100-SCHN-180/215-PF-i**	**KUP-6546928**	28	42
GETR-100-SCHN-130/165-KL-i	**GETR-100-SCHN-130/165-PF-i**	**KUP-6546928**	28	60
GETR-100-SCHN-130/165-KL-i	**GETR-100-SCHN-130/165-PF-i**	**KUP-6546932**	32	50
GETR-100-SCHN-130/165-KL-i	**GETR-100-SCHN-130/165-PF-i**	**KUP-6546932**	32	58
GETR-100-SCHN-130/215-KL-i	**GETR-100-SCHN-130/215-PF-i**	**KUP-6546932**	32	58 – 60
GETR-100-SCHN-180/215-KL-i	**GETR-100-SCHN-180/215-PF-i**	**KUP-6546932**	32	58 – 60
GETR-100-SCHN-180/215-KL-i	**GETR-100-SCHN-180/215-PF-i**	**KUP-6546938**	38	80 – 85
GETR-100-SCHN-180/215-KL-i	**GETR-100-SCHN-180/215-PF-i**	**KUP-6547948**	48	58

Possible ratios: i = 4,75; 6,75; 9,25; 14,5; 19,5; 29; 39; 50.



Gearbox load table
with allocation of gearbox ratio

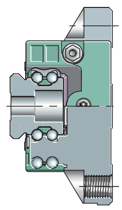
Gearbox with axis centre distance a_0 = 50 mm

Gearbox load								
Axis centre distance	Ratio	Maximum static torque against tooth fracture	Drive power P_1 and static torque T_2 against tooth fracture at a drive power of					
a_0	i	$T_{2\ max}$	500 min^{-1}		750 min^{-1}		1 000 min^{-1}	
			P_1	T_2	P_1	T_2	P_1	T_2
mm		Nm	kW	Nm	kW	Nm	kW	Nm
50	4,75	550	0,81	65	1,2	65	1,7	70
	6,75	400	0,5	56	0,77	59	1,1	63
	9,25	275	0,32	48	0,5	51	0,7	54
	14,5	350	0,26	57	0,4	60	0,57	65
	19,5	250	0,16	45	0,25	48	0,34	50
	29	300	0,14	48	0,2	52	0,29	55
	39	200	0,12	53	0,17	56	0,24	60
	50	150	0,08	42	0,12	44	0,16	47

Maximum permisible torque for toothed guideways ZHP and ZHST+SVS, see page 302				
Pinion hardened Number of teeth[1)	Modulus	Pitch circle diameter	Teeth hardened Maximum torque	
z	m		ZHP	ZHST+SVS
		mm	Nm	Nm
30	2	63,66	270	–
20	3	63,66	505	410
15	4	63,66	–	670

1) Other pinions available by agreement.

1 500 min^{-1}		3 000 min^{-1}		4 000 min^{-1}		5 000 min^{-1}		Efficiency at 1 500 min^{-1}
P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	
2,52	70	5	70	6,2	65	7,3	61	0,92
1,75	69	3,5	69	4,4	65	5,2	61	0,91
1,1	58	2,55	70	3,55	70	4,1	65	0,89
0,89	70	1,82	75	2,5	75	3,15	75	0,83
0,55	55	1,2	65	1,65	65	2,1	65	0,81
0,44	60	0,93	70	1,23	70	1,41	65	0,75
0,37	65	0,77	75	1	75	1,25	75	0,7
0,25	50	0,51	60	0,72	60	0,9	60	0,64



Gearbox load table with allocation of gearbox ratio

Gearbox with axis centre distance a_0 = 63 mm

Gearbox load

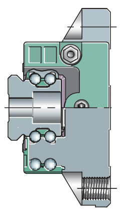
Axis centre distance a_0 mm	Ratio i	Maximum static torque against tooth fracture $T_{2\,max}$ Nm	Drive power P_1 and static torque T_2 against tooth fracture at a drive power of					
			500 min^{-1}		750 min^{-1}		1 000 min^{-1}	
			P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	P_1 kW	T_2 Nm
63	4,75	1 000	2,1	170	3,3	180	4,4	180
	6,75	750	1,5	170	2,35	180	3,1	180
	9,25	500	0,74	115	1,18	125	1,63	130
	14,5	600	0,74	165	1,19	180	1,54	180
	19,5	500	0,39	115	0,61	125	0,85	130
	29	650	0,48	175	0,75	190	1,04	205
	39	450	0,3	140	0,44	150	0,61	160
	50	300	0,16	95	0,25	105	0,35	115

Maximum permisible torque for toothed guideways ZHP and ZHST+SVS, see page 302

Pinion hardened Number of teeth[1)] z	Modulus m	Pitch circle diameter mm	Teeth hardened Maximum torque	
			ZHP Nm	ZHST+SVS Nm
30	2	63,66	270	–
20	3	63,66	505	410
15	4	63,66	–	670

1) Other pinions available by agreement.

1 500 min^{-1}		3 000 min^{-1}		4 000 min^{-1}		Efficiency at 1 500 min^{-1}
P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	
6,11	170	10,3	145	13,2	135	0,92
4,25	170	7,2	145	9,3	135	0,91
2,52	135	4,93	135	6,35	126	0,9
2,45	180	4,18	170	5,25	160	0,84
1,28	135	2,98	165	3,83	155	0,83
1,55	220	2,57	195	3,22	185	0,77
0,97	175	1,88	190	2,55	190	0,73
0,55	125	1,2	150	1,63	160	0,68



Gearbox load table with allocation of gearbox ratio

Gearbox with axis centre distance a_0 = 80 mm

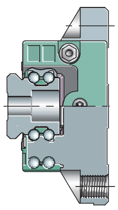
Gearbox load						
Axis centre distance	Ratio	Maximum static torque against tooth fracture	Drive power P_1 and static torque T_2 against tooth fracture at a drive power of			
a_0	i	$T_{2\ max}$	500 min^{-1}		750 min^{-1}	
			P_1	T_2	P_1	T_2
mm		Nm	kW	Nm	kW	Nm
80	4,75	2 000	5,2	420	6,9	380
	6,75	1 400	3,6	420	4,86	380
	9,25	1 100	2,38	370	3,53	370
	14,5	1 300	1,98	450	2,9	450
	19,5	1 000	1,24	370	2	400
	29	1 200	1,38	520	2,04	550
	39	850	0,87	430	1,35	460
	50	600	0,38	240	0,57	260

Maximum permisible torque for toothed guideways ZHP and ZHST+SVS, see page 302

Pinion hardened Number of teeth[1]	Modulus	Pitch circle diameter	Teeth hardened Maximum torque	
z	m		ZHP	ZHST+SVS
		mm	Nm	Nm
30	2	63,66	270	–
20	3	63,66	505	410
15	4	63,66	–	670

[1] Other pinions available by agreement.

	1 000 min^{-1}		1 500 min^{-1}		3 000 min^{-1}		Efficiency at 1 500 min^{-1}
	P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	
	8,53	360	11,6	330	19,5	280	0,94
	6,14	360	8,44	330	14,01	280	0,91
	4,53	360	6,22	330	10,3	280	0,9
	3,57	420	4,6	370	7	295	0,87
	2,6	400	3,6	380	5,73	320	0,86
	2,52	530	3,32	490	5,42	420	0,8
	1,85	490	2,51	480	4,03	410	0,77
	0,8	275	1,22	300	2,46	330	0,74



Gearbox load table with allocation of gearbox ratio

Gearbox with axis centre distance a_0 = 100 mm

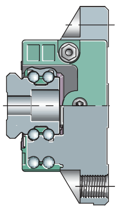
Gearbox load						
Axis centre distance	Ratio	Maximum static torque against tooth fracture	Drive power P_1 and static torque T_2 against tooth fracture at a drive power of			
			500 min^{-1}		750 min^{-1}	
a_0	i	$T_{2\,max}$	P_1	T_2	P_1	T_2
mm		Nm	kW	Nm	kW	Nm
100	4,75	3 300	10,77	880	14,22	800
	6,75	2 300	7,23	830	9,6	750
	9,25	1 900	5,34	830	7,1	750
	14,5	2 050	4,2	930	5,8	880
	19,5	1 800	3,02	900	4,27	870
	29	2 300	2,96	1 150	4,02	1 070
	39	1 650	2,07	1 080	2,88	1 030
	52	1 100	1,16	760	1,82	820

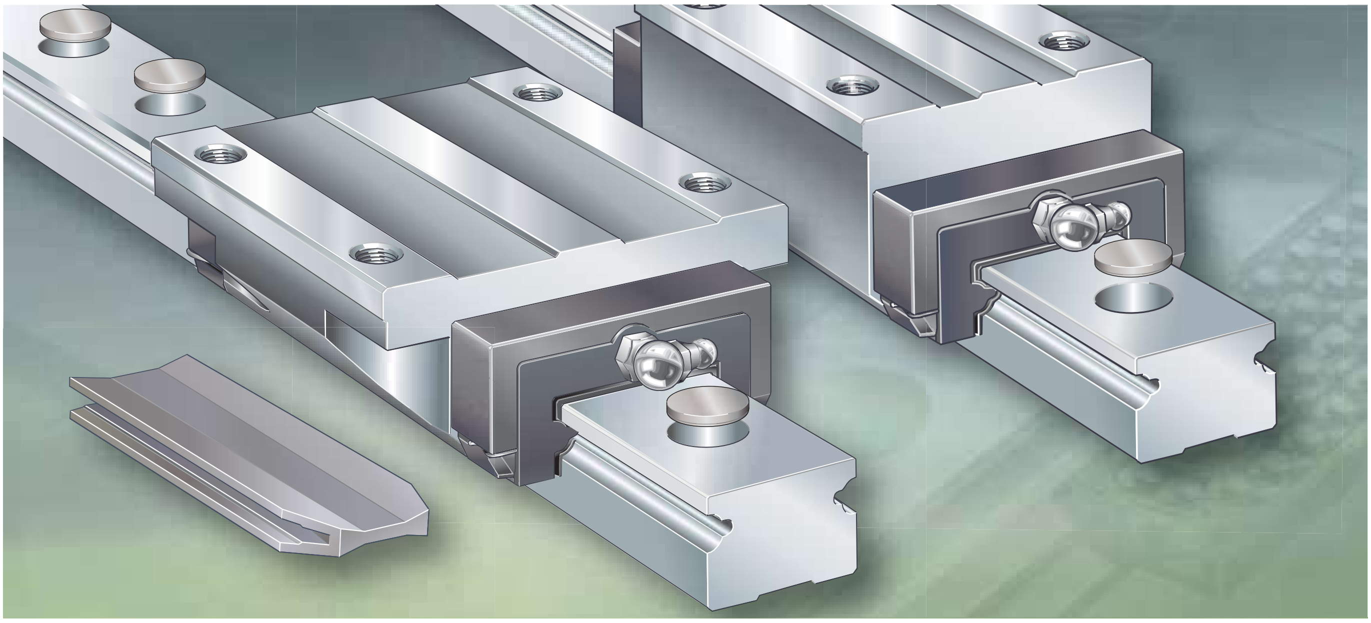
Maximum permisible torque for toothed guideways ZHP and ZHST+SVS, see page 302

Pinion hardened Number of teeth[1]	Modulus	Pitch circle diameter	Teeth hardened Maximum torque	
z	m		ZHP	ZHST+SVS
		mm	Nm	Nm
30	2	63,66	270	–
20	3	63,66	505	410
15	4	63,66	–	670

[1] Other pinions available by agreement.

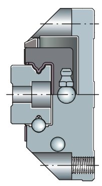
	1 000 min^{-1}		1 500 min^{-1}		3 000 min^{-1}		Efficiency at 1 500 min^{-1}
	P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	P_1 kW	T_2 Nm	
	17,77	750	24,1	685	40,37	580	0,94
	12	720	16,7	660	29	580	0,92
	9,1	720	12,3	660	21,2	580	0,91
	6,8	810	9	720	14,3	620	0,87
	5,2	810	6,67	720	11,1	620	0,87
	4,67	1 010	5,97	850	10,31	800	0,77
	3,63	1 000	4,53	900	7,48	780	0,8
	2,41	850	3,08	785	5	680	0,77

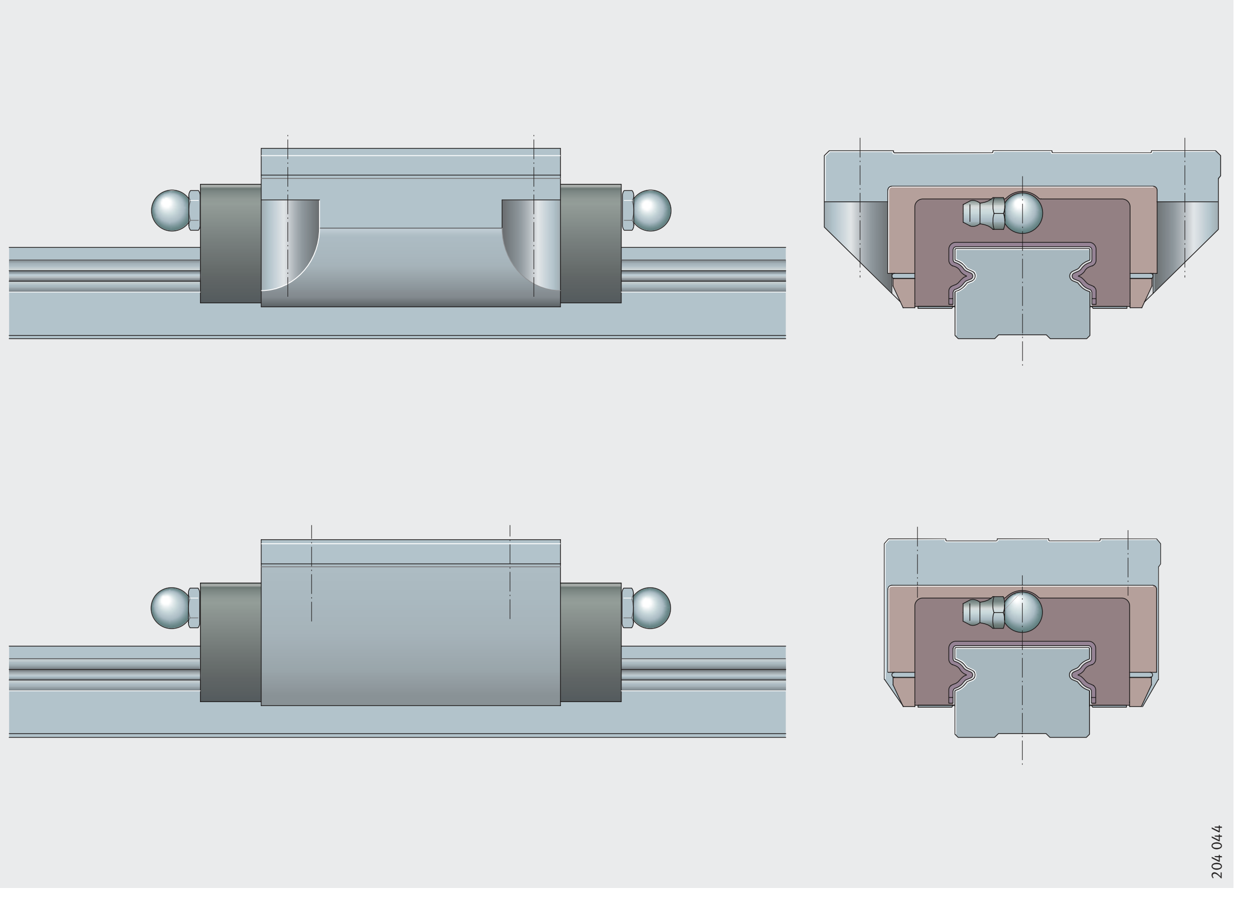




Two-row linear recirculating ball bearing and guideway assemblies

Full complement
Accessories

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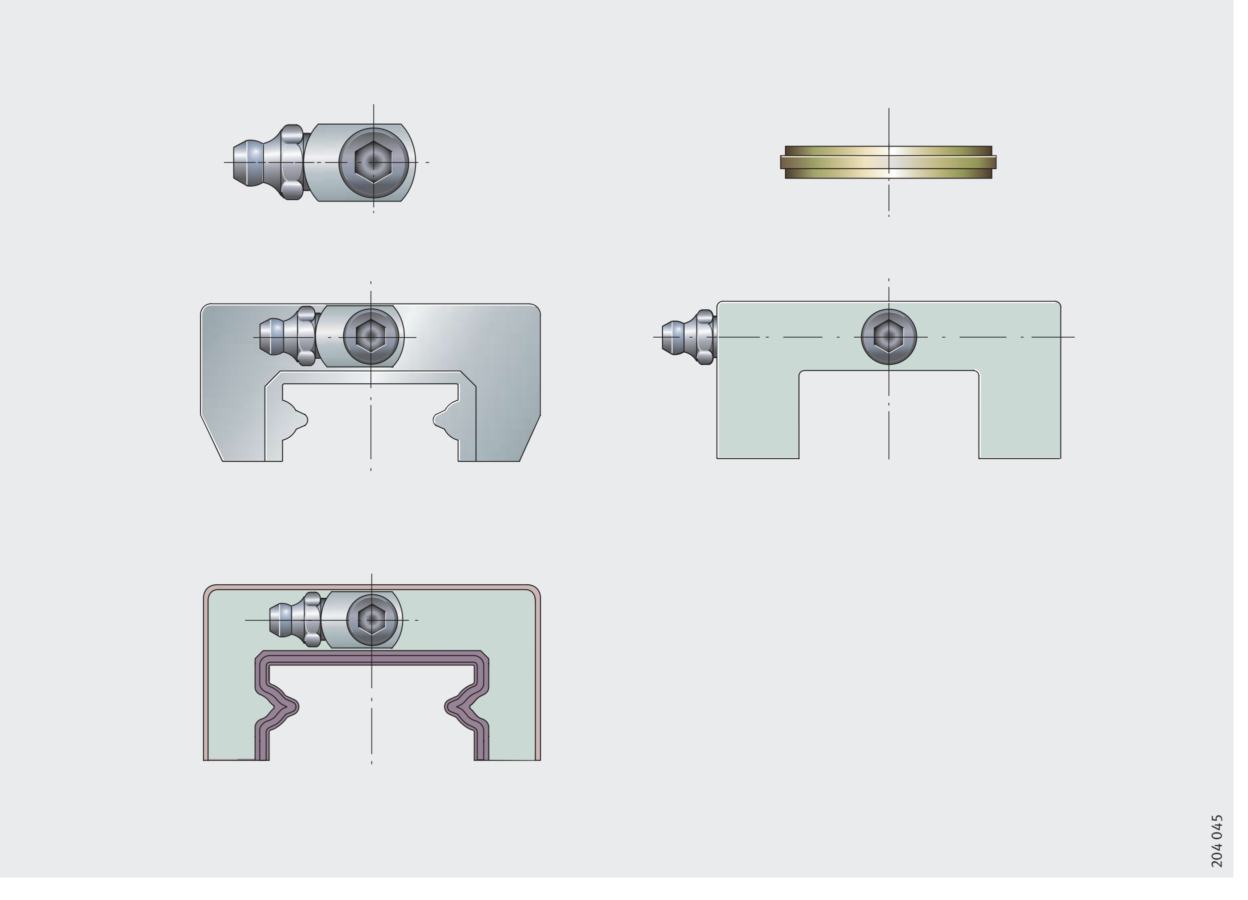
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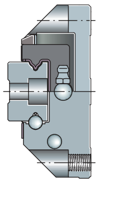
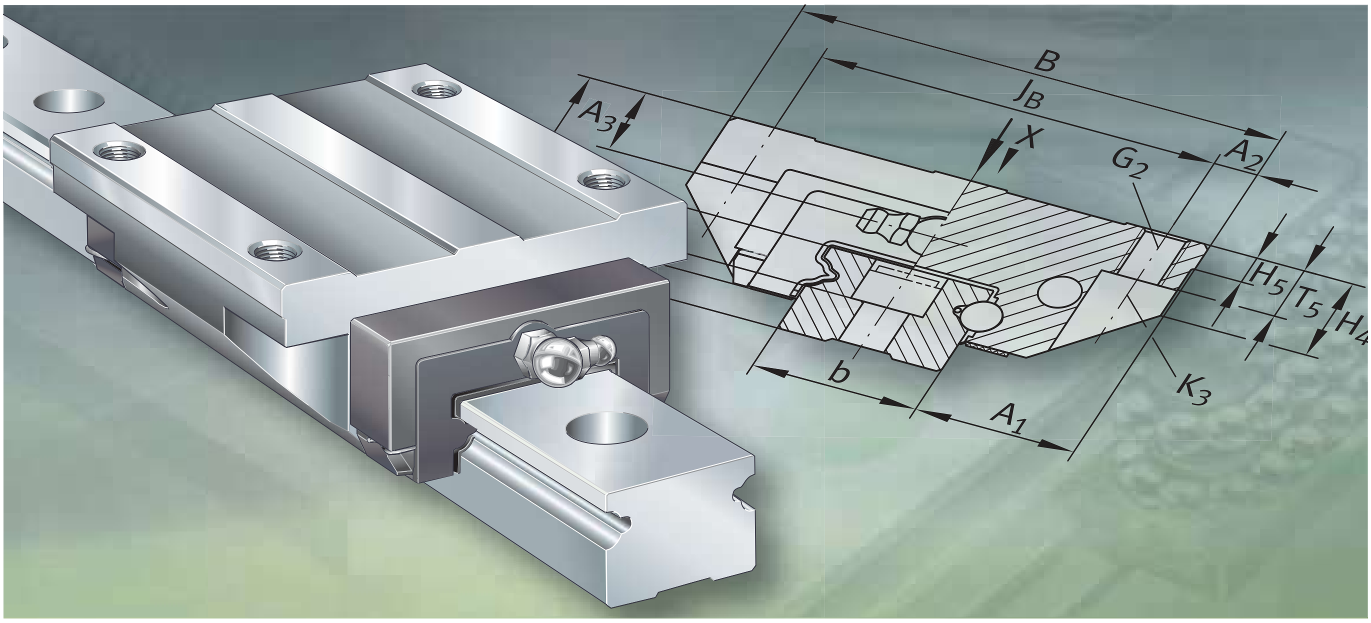
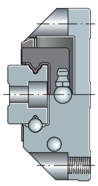




Two-row linear recirculating ball bearing and guideway assemblies

Full complement

Two-row linear recirculating ball bearing and guideway assemblies

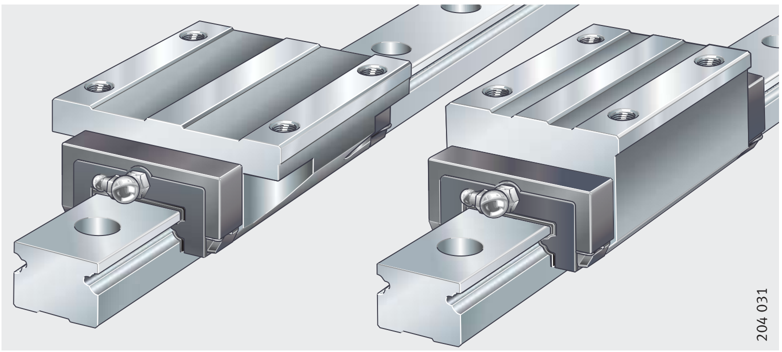


Product overview Two-row linear recirculating ball bearing and guideway assemblies

Full complement

For oil and grease lubrication

KUE, KUE..-H

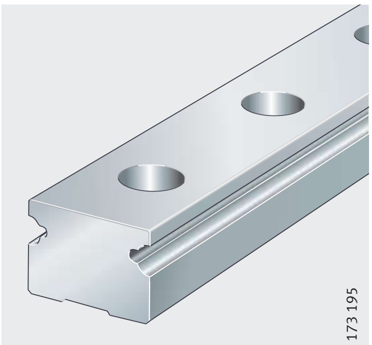


204 031

Guideway

Standard

TKD



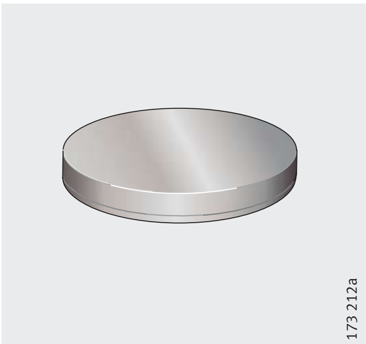
173 195

Standard accessories

Plastic closing plug

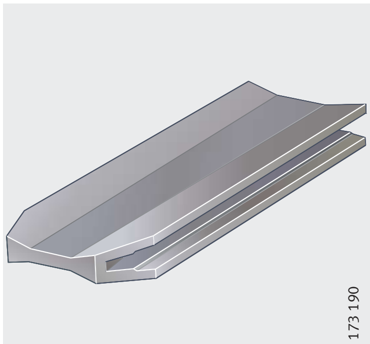
Dummy guideway

KA..-TN



173 212a

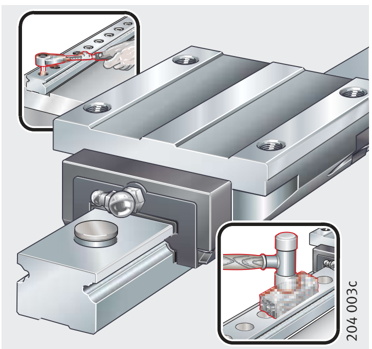
MKD



173 190

Fitting manual

MON 31



204 003c

Two-row linear recirculating ball bearing and guideway assemblies

Features

Linear recirculating ball bearing and guideway assemblies KUE are preloaded. They are used in applications with long unrestricted strokes, moderate loads, low rigidity and low friction.

A guidance system comprises at least one carriage with a full complement rolling element system, a guideway and plastic closing plugs.

The units can be ordered separately as carriage KWE and guideway TKD or as a unit KUE. In a unit, one or more carriages are mounted on each guideway.

Load carrying capacity

These linear recirculating ball bearing and guideway assemblies have two rows of balls at a contact angle of 45° to the raceways. They can support forces from all directions – apart from the direction of motion – and moments about all axes, *Figure 1*.

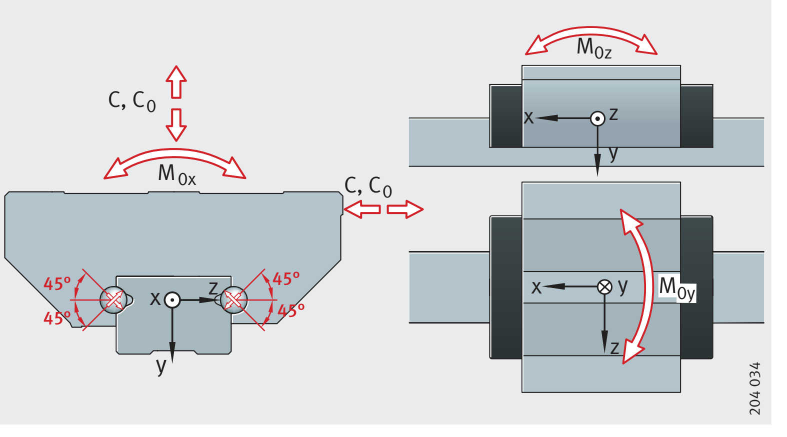


Figure 1

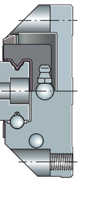
Load carrying capacity and contact angle

Acceleration and speed

Operating limits

The dynamic values are shown in the table.

Designation	Acceleration up to m/s^2	Speed up to m/s
KUE (-H)	150	180



Two-row linear recirculating ball bearing and guideway assemblies

Carriages

The carriages have saddle plates made from hardened steel and ground on all sides, the rolling element raceways are precision ground. The balls are recirculated in enclosed channels with plastic return elements.

In order to increase the grease volume, the carriages have lubricant reservoirs.

Guideways

The guideways are made from hardened steel and are ground on all faces, the rolling element raceways are precision ground.

Located from above

Guideways TKD are located from above.
The through holes have counterbores for the fixing screws.

Multi-piece guideways

If the required guideway length l_{max} is greater than the value in the dimension tables, the guideways are supplied in several pieces; see page 416.

Sealing

Standard sealing strips and elastic wipers on the end faces ensure effective sealing of the carriages, *Figure 2*. These sealing elements protect the rolling element system from contamination even under demanding environmental conditions.

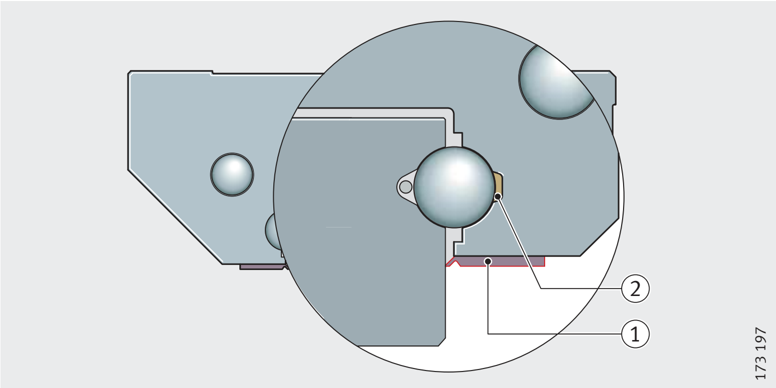
For additional sealing variants see Accessories, pages 436 to 438.

Attention! If the contamination conditions are exceptionally severe, please contact us.

Lubrication

The linear recirculating ball bearing and guideway assemblies are suitable for oil and grease lubrication. If grease lubrication is used, they are maintenance-free for most applications due to the lubricant reservoir, *Figure 2*.

Lubrication is carried out via the lubrication nipple in the end face of the end piece.



1 Standard sealing strips
2 Lubricant reservoir

Figure 2
Sealing strips and lubricant reservoir

Operating temperature

Linear recirculating ball bearing and guideway assemblies KUE can be used at operating temperatures from –10 °C to +100 °C.

Standard accessories

Plastic dummy guideway

The dummy guideway prevents damage to the rolling element set if the carriage is removed from the guideway.

Carriages are always pushed directly from the guideway onto the dummy guideway and must remain there until they are reassembled.

Plastic closing plugs

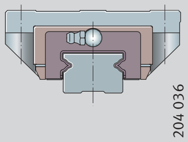
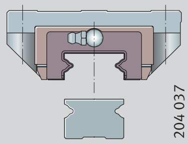
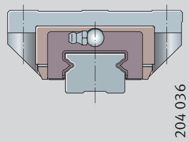
The closing plugs close off the counterbores of the guideway holes flush with the surface of the guideway.

Optionally, brass closing plugs are also available, see Accessories page 435.

Corrosion-resistant designs

Linear recirculating ball bearing and guideway assemblies KUE are also available in corrosion-resistant designs with the special coatings Corrotect®, Protect A and Protect B.

Suffixes for Corrotect®-coated parts

With Corrotect® coating	Preassembled unit Guideway only coated	Carriage and guideway separate Carriage or guideway coated	Preassembled unit Carriage and guideway coated
			
Suffix	RRFT	RRF	RRF

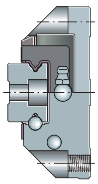
For applications with Corrotect®, please contact us.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description
–	Standard carriage
L	Long carriage
H	High carriage



Two-row linear recirculating ball bearing and guideway assemblies

Design and safety guidelines

Preload

Linear recirculating ball bearing and guideway assemblies KUE are available in preload classes V0 and V1, see table Preload classes.

Preload classes

Preload class	Preload setting	Suitable applications
V0	Very small clearance to clearance-free	Particularly smooth running Moment load
V1	Clearance-free	Moderate load High rigidity requirements Moment load

Influence of preload on the linear guidance system

Increasing the preload increases the rigidity.

However, preload also influences the displacement resistance and operating life of the linear guidance system.

Friction

The coefficient of friction is dependent on the ratio C/P, see table.

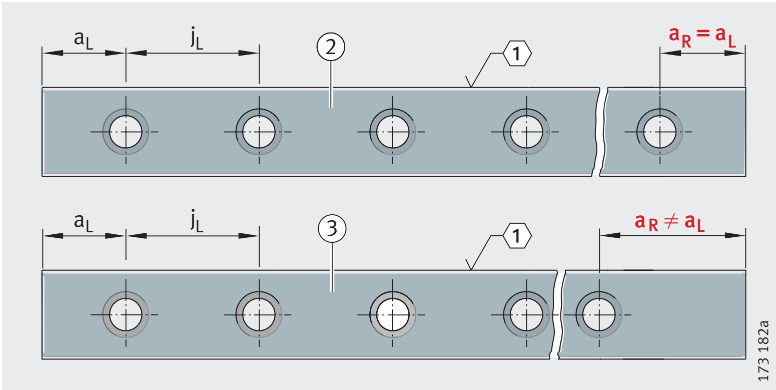
Coefficient of friction

Load C/P	Coefficient of friction μ_{KUE}
4 to 20	0,002 to 0,004

Guideway hole patterns

Unless specified otherwise, the guideways have a symmetrical hole pattern, *Figure 3*.

At customer request, an asymmetrical hole pattern is also possible. In this case, $a_L \geqq a_{L\,min}$ and $a_R \geqq a_{R\,min}$, *Figure 3*.



1 Locating face
2 Symmetrical hole pattern
3 Asymmetrical hole pattern

Figure 3
Hole patterns of guideways with one row of holes

Maximum number of pitches between holes

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

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

The distances a_L and a_R are generally determined by:

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

For guideways with a symmetrical hole pattern:

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

Number of holes:

$$x = n + 1$$

a_L, a_R mm
Distance between start or end of guideway and nearest hole

$a_{L\,min}$, $a_{R\,min}$ mm
Minimum values for a_L, a_R according to dimension tables

l mm
Guideway length

n –
Maximum possible number of hole pitches

j_L mm
Distance between holes

x –
Number of holes.

Attention!

If the minimum values for a_L und a_R are not observed, the counterbores of the holes may be intersected.

Two-row linear recirculating ball bearing and guideway assemblies

Multi-piece guideways

If the guideway length required is greater than l_{max} according to the dimension tables, these guideways are made up from individual pieces that together comprise the total required length.
The individual pieces are matched to each other and marked, *Figure 4*.

(2) Marking
Guideway pieces:
1A, 1A
1B, 1B
1C, 1C
2A, 2A
2B, 2B
2C, 2C

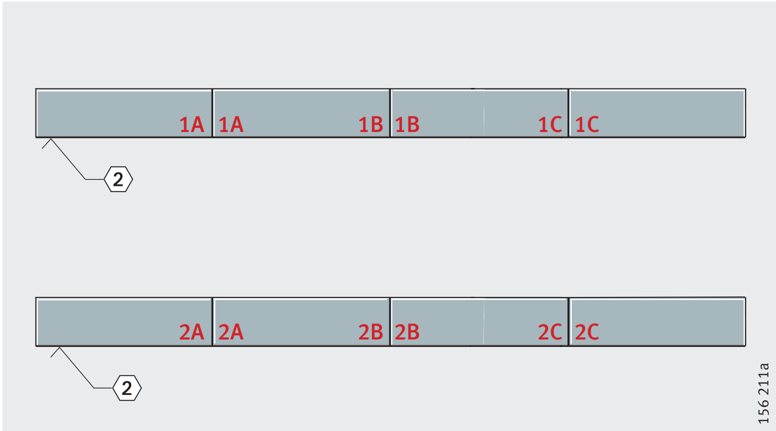


Figure 4
Marking of multi-piece guideways

Demands on the adjacent construction

The running accuracy is essentially dependent on the straightness, accuracy and rigidity of the fit and mounting surfaces.

The straightness of the system is only achieved when the guideway is pressed against the datum surface.

If high demands are to be made on the running accuracy and/or if soft substructures and/or movable guideways are used, please contact us.

Geometrical and positional accuracy of the mounting surfaces

The higher the requirements for accuracy and smooth running of the guidance system, the more attention must be paid to the geometrical and positional accuracy of the mounting surfaces.

Attention!

The tolerances according to *Figure 5*, page 417 and table Values for parallelism tolerances t, page 418 must be observed.

Surfaces should be ground or precision milled –
with the aim of achieving a mean roughness value R_a1,6.

Any deviations from the stated tolerances will impair the overall accuracy, alter the preload and reduce the operating life of the guidance system.

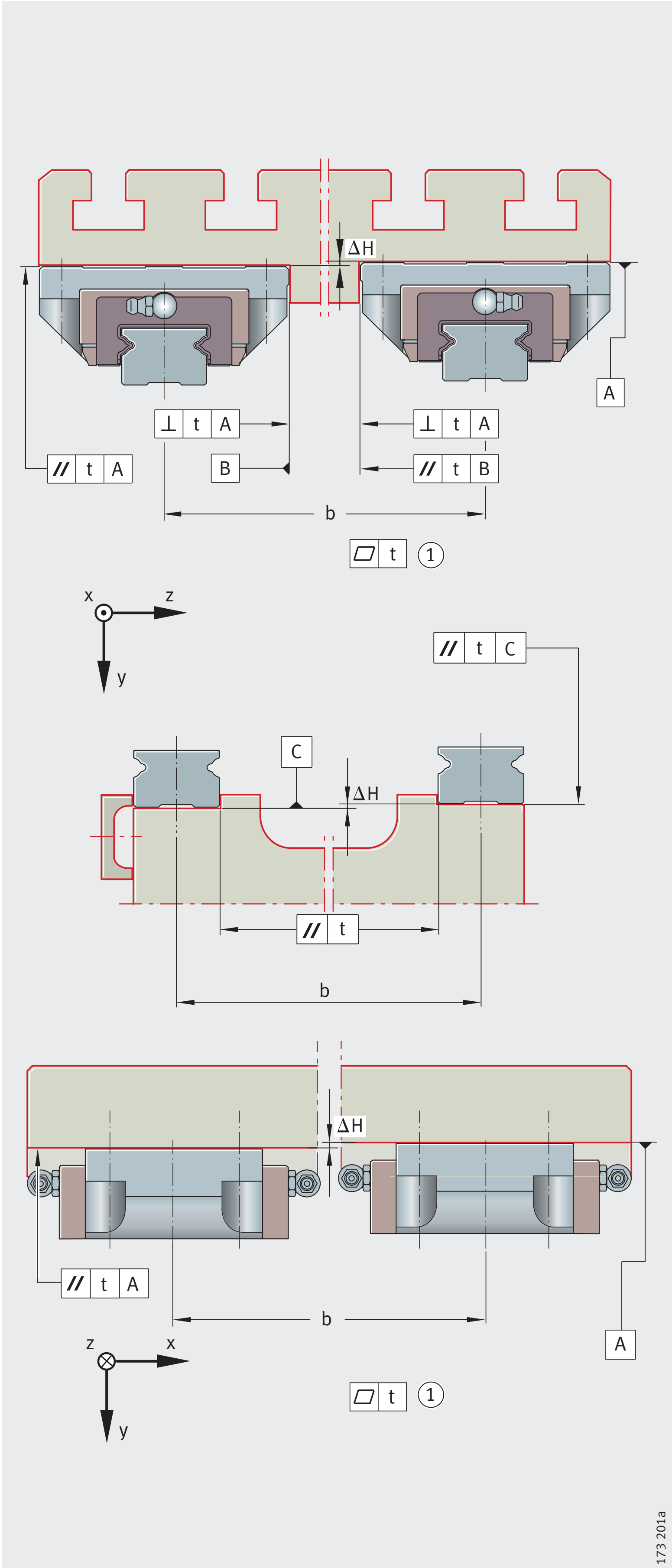
Height difference ΔH

For ΔH, permissible values are in accordance with the following formula. If larger deviations are present, please contact us.

$$\Delta_H = 0{,}2 \cdot b$$

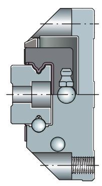
ΔH µm
Maximum permissible deviation from the theoretically precise position, *Figure 5*, page 417

b mm
Centre distance between guidance elements.



① Not convex
(for all machined surfaces)

Figure 5
Tolerances of mounting surfaces
and parallelism
of mounted guideways



Two-row linear recirculating ball bearing and guideway assemblies

Parallelism of mounted guideways

For guideways arranged in parallel, the parallelism t should be in accordance with *Figure 5*, page 417 and table. If the maximum values are used, the displacement resistance may increase.
If larger tolerances are present, please contact us.

Values for parallelism tolerances t

Guideway Designation	Preload class	
	V0	V1
	Parallelism tolerance	
	t µm	t µm
TKD15	13	10
TKD20	18	12
TKD25	22	14
TKD30	26	17
TKD35	30	20

Locating heights and corner radii

The locating heights and corner radii should be designed in accordance with table and *Figure 6*.

Locating heights, corner radii

Two-row linear recirculating ball bearing and guideway assembly Designation	h_1 mm	h_2 max. mm	r_1 max. mm	r_2 max. mm
KUE15 (-H)	4,5	3,5	1	0,5
KUE20 (-H)	5	4	1	0,5
KUE25 (-H)	5	4,5	1	0,8
KUE30 (-H)	6	5	1	0,8
KUE35 (-H)	6,5	6	1	0,8

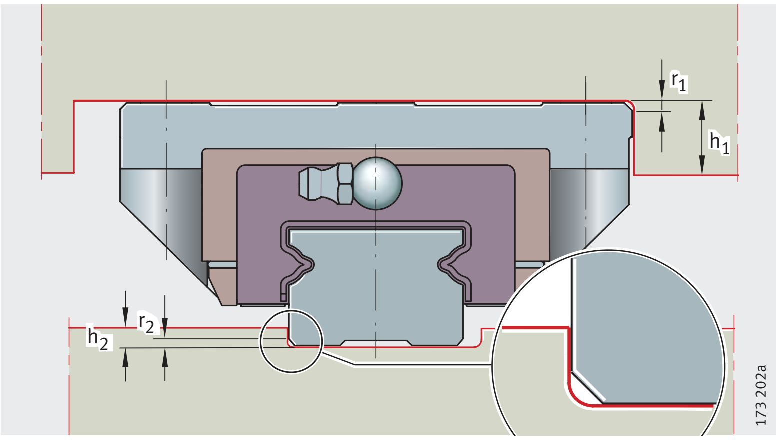
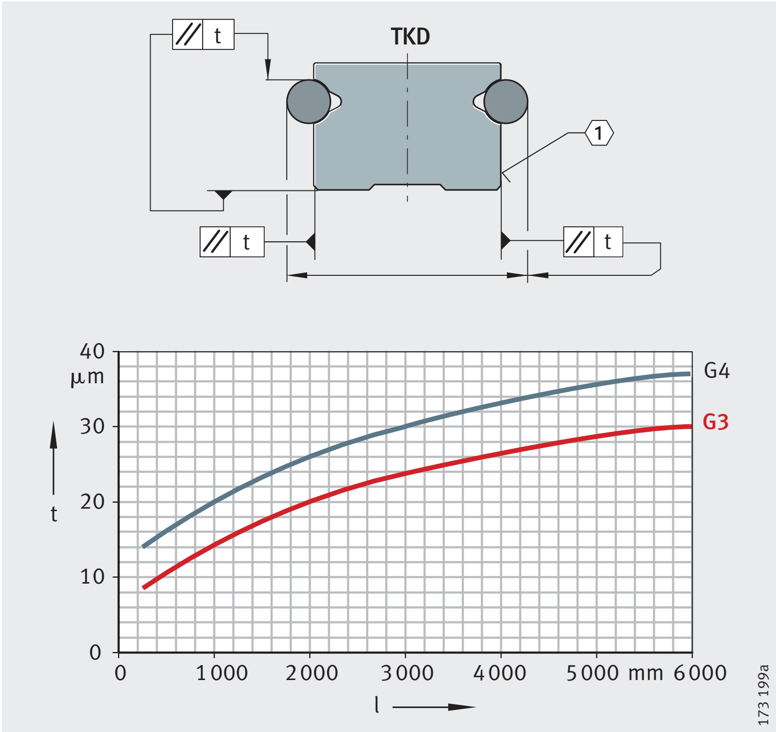


Figure 6
Locating heights and corner radii

Accuracy

Accuracy classes

Two-row linear recirculating ball bearing and guideway assemblies are available in accuracy classes G3 and G4, *Figure 7*.
The standard is class G3.



t = parallelism tolerance with differential measurement
l = total guideway length
1 Locating face

Figure 7
Accuracy classes and parallelism tolerances of guideways

Parallelism of raceways to locating surfaces

The parallelism tolerances of guideways are shown in *Figure 7*.
In systems with Corrotect® coating, there may be deviations in tolerances compared with uncoated units.

Two-row linear recirculating ball bearing and guideway assemblies

Tolerances

Tolerances: see table and *Figure 8*.

The tolerances are arithmetic mean values. They relate to the centre point of the screw mounting or locating surfaces of the carriage.

The dimensions H and A_1 (table Tolerances of accuracy classes) should always remain within the tolerance irrespective of the position of the carriage on the guideway.

Tolerances of accuracy classes

Tolerance		Accuracy	
		G3[1)] µm	G4 µm
Tolerance for height	H	±25	±80
Height difference[2)]	ΔH	15	20
Tolerance for spacing	A_1	±20	±80
Spacing difference[2)]	ΔA_1	22	30

1) Standard accuracy class.

2) Difference between several carriages on one guideway, measured at the same point on the guideway.

Units with Corrotect® coating

For these units, the values for the appropriate accuracy class must be increased by the values for RRF or RRFT; for values, see table.

Tolerances for coated parts

Tolerance		With Corrotect® coating		With Protect A coating	With Protect B coating
		RRF[1)] µm	RRFT[2)] µm	KD µm	KDC µm
Tolerance for height	H	+6	+3	+6	+6
Height difference[3)]	ΔH	+3	0	+3	+3
Tolerance for spacing	A_1	+3	+3	+3	+3
Spacing difference[3)]	ΔA_1	+3	0	+3	+3

1) Displacement in tolerance zone (guideway and carriage coated).

2) Displacement in tolerance zone (guideway only coated).

3) Difference between several carriages on one guideway, measured at the same point on the guideway.

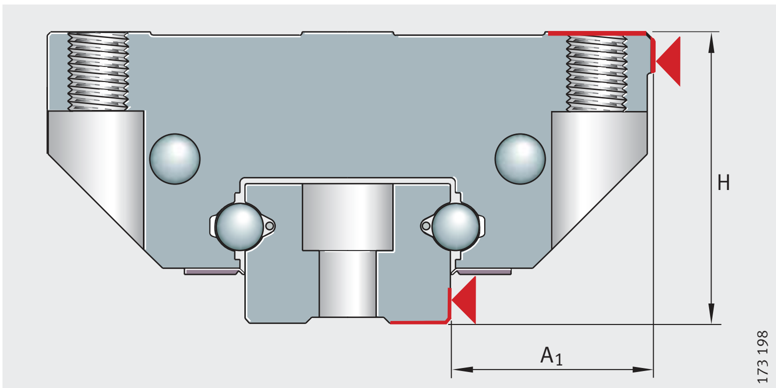


Figure 8
Datum dimensions for accuracy

Positional and length tolerances of guideways

The positional and length tolerances are shown in *Figure 9* and table Length tolerances of guideways.

The hole pattern corresponds to DIN ISO 1101.

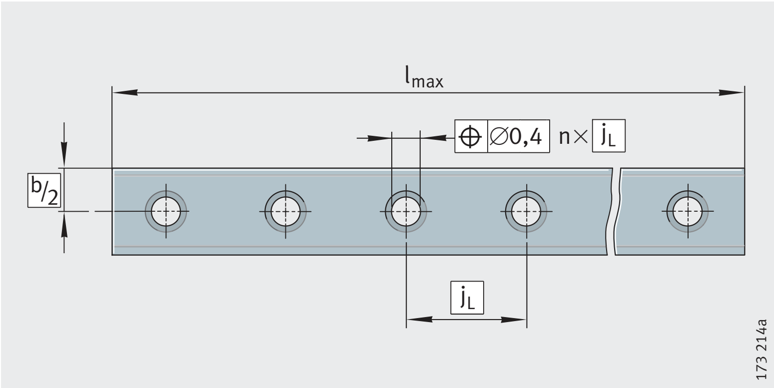


Figure 9
Positional and length tolerances of guideways

Length tolerances of guideways

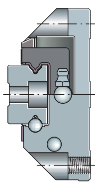
Tolerances			
of guideway, as a function of length l_{max} 1) Guideway length mm			on multi-piece guideways mm
≦1 000	>1 000 <3 000	>3 000	
−1	−1,5	±0,1% of guideway length	±3 over total length

1) Length l_{max}: see dimension tables.

Pieces of joined guideways

Guideway length 1) mm	Maximum permissible number of pieces
<3 000	2
3 000 – 4 000	3
4 000 – 6 000	4
>6 000	4 + 1 piece per 1 500 mm

1) Minimum length of one piece = 600 mm.



Two-row linear recirculating ball bearing and guideway assemblies

Ordering example, ordering designation

Carriage, guideway with symmetrical hole pattern

Carriages

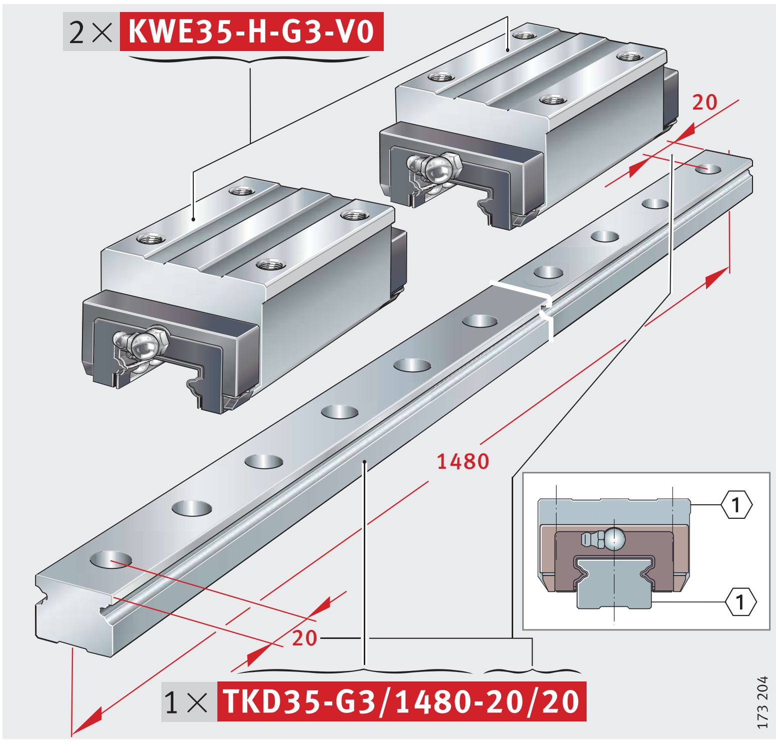
Two carriages for two-row linear ball bearing and guideway assembly	KWE
Size	35
Carriage type	H
Accuracy class	G3
Preload	V0

Ordering designation 2×**KWE35-H-G3-V0**, *Figure 10*

Guideway

One guideway for carriages	TKD
Size	35
Accuracy class	G3
Guideway length	1 480 mm
a_L	20 mm
a_R	20 mm

Ordering designation 1×**TKD35-G3/1480-20/20**, *Figure 10*



⟨1⟩ Locating face

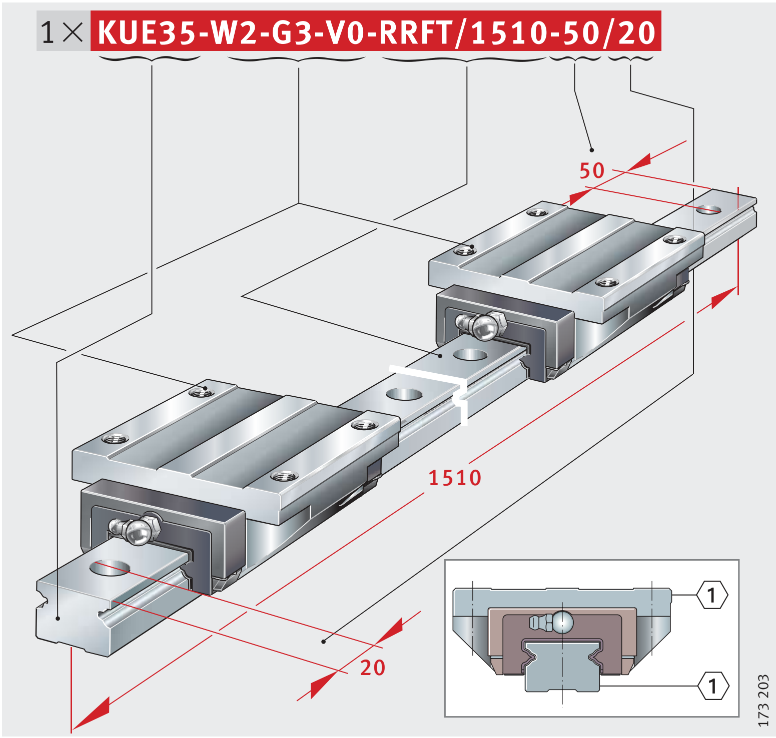
Figure 10
Ordering example, ordering designation

Guideway with asymmetrical hole pattern

One linear ball bearing and guideway assembly

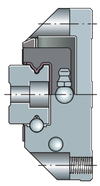
with two carriages per guideway	KUE
Size	35
Number of carriages per unit	W2
Accuracy class	G3
Preload	V0
Guideway with Corrotect® coating	RRFT
Guideway length	1 510 mm
a_L	50 mm
a_R	20 mm

Ordering designation 1×**KUE35-W2-G3-V0-RRFT/1510-50/20**, *Figure 11*



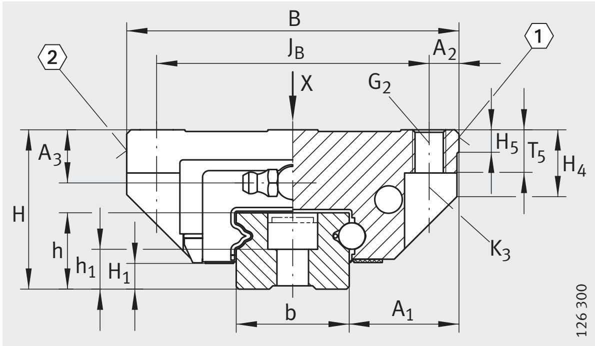
⟨1⟩ Locating face

Figure 11
Ordering example, ordering designation



Two-row linear recirculating ball bearing and guideway assemblies

Standard carriages



KUE
⟨1⟩, ⟨2⟩ 3)

Dimension table · Dimensions in mm

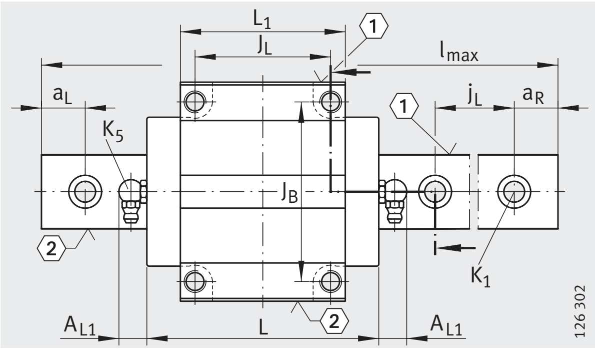
Designation	Dimensions				Mounting dimensions									
	l_{max} 1)	H	B	L	A_1	J_B	b $^{-0,004}_{-0,05}$	A_2	L_1	J_L	j_L	a_L, a_R 2) min.	max.	A_{L1}
KUE15	1 200	24	47	54,5	16	38	15	4,5	38,7	30	60	20	53	1,5
KUE20	1 980	30	63	70,4	21,5	53	20	5	49,4	40	60	20	53	14
KUE25	1 980	36	70	80,5	23,5	57	23	6,5	56,5	45	60	20	53	14
KUE30	2 000	42	90	92,9	31	72	28	9	65,7	52	80	20	71	14
KUE35	2 960	48	100	106,1	33	82	34	9	75,4	62	80	20	71	14

For further table values, see page 426 and page 427.

1) Maximum length of single-piece guideways. For permissible number of guideway pieces, see page 421.
Maximum single-piece guideway length of 6 m available by agreement.

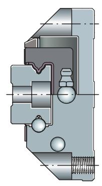
2) a_L and a_R are dependent on the guideway length.

3) ⟨1⟩ Locating face
⟨2⟩ Marking



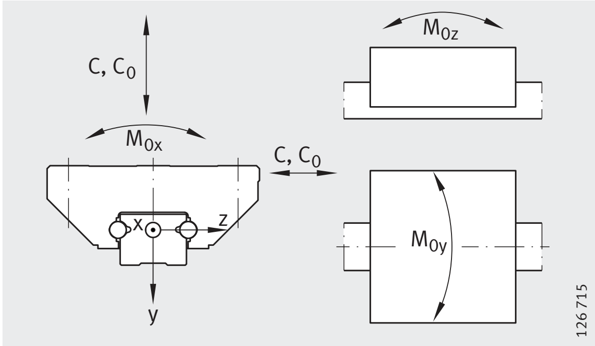
KUE · View rotated 90°
⟨1⟩, ⟨2⟩ 3)

								Fixing screws					
H_1	H_5	A_3	H_4	T_5	h	h_1	K_5	G_2 DIN ISO 4 762-12.9		K_1		K_3	
									M_A Nm		M_A Nm		M_A Nm
4,8	4,5	4	7,5	7	15	8,2	NIP-A1	M5	5,8	M4	5	M4	5
5	5	6,5	11,6	10	16,5	8,8	NIP-KE-M6	M6	10	M5	10	M5	10
6,5	5	10	11,6	10	18	9,2	NIP-KE-M6	M8	24	M6	17	M6	17
7	6	13	14,6	10	21,5	10,5	NIP-KE-M6	M10	41	M8	41	M8	41
8	6,5	16	20,1	13	23	12	NIP-KE-M6	M10	41	M8	41	M8	41



Two-row linear recirculating ball bearing and guideway assemblies

Standard carriages

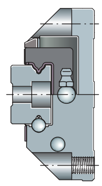


Load directions

Dimension table (continued) · Dimensions in mm

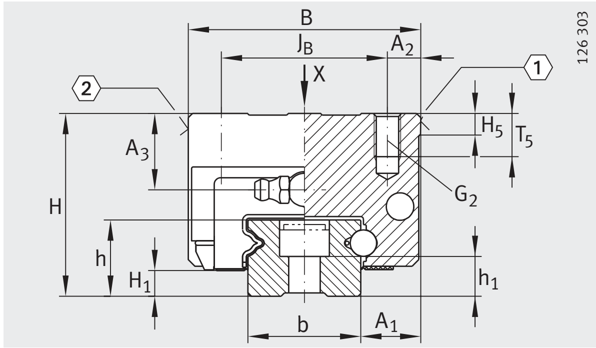
Designation	Carriage		Guideway		
	Designation	Mass m ≈kg	Designation	Mass m ≈kg/m	Closing plug
KUE15	**KWE15**	0,17	**TKD15**	1,5	**KA08-TN**
KUE20	**KWE20**	0,45	**TKD20**	2,2	**KA10-TN**
KUE25	**KWE25**	0,65	**TKD25**	2,8	**KA11-TN**
KUE30	**KWE30**	1,2	**TKD30**	4,2	**KA15-TN**
KUE35	**KWE35**	1,7	**TKD35**	5,6	**KA15-TN**

Load carrying capacity				
Basic load ratings		Moment ratings		
C	C_0	M_{0x}	M_{0y}	M_{0z}
N	N	Nm	Nm	Nm
6 500	9 200	73	56	56
13 300	18 000	190	154	154
16 200	20 900	253	185	185
22 500	29 700	437	335	335
6 500	9 200	73	56	56



Two-row linear recirculating ball bearing and guideway assemblies

H carriages



KUE..-H
⟨1⟩, ⟨2⟩ [4]

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions									
	l_{max} [1]	H	B	L	A_1	J_B	b −0,004 −0,05	A_2	L_1	J_L	j_L	a_L, a_R [2] min.	max.	A_{L1}
KUE15-H	1 200	28	34	54,5	9,5	26	15	4	38,7	26	60	20	53	1,5
KUE20-H	1 980	30	44	70,4	12	32	20	6	49,4	36	60	20	53	14
KUE25-H	1 980	40	48	80,5	12,5	35	23	6,5	56,5	35	60	20	53	14
KUE30-H	2 000	45	60	92,9	16	40	28	10	65,7	40	80	20	71	14
KUE35-H	2 960	55	70	106,1	18	50	34	10	75,4	50	80	20	71	14

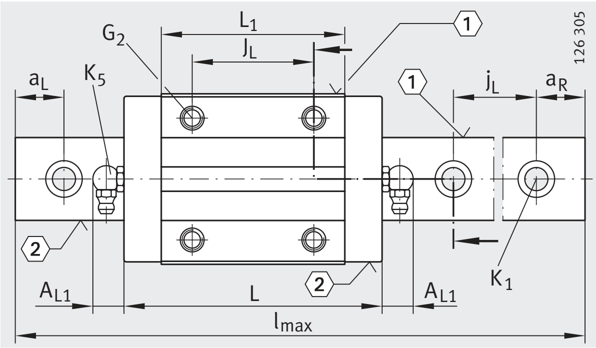
For further table values, see page 430 and page 431.

[1] Maximum length of single-piece guideways. For permissible number of guideway pieces, see page 421.
Maximum single-piece guideway length of 6 m available by agreement.

[2] a_L and a_R are dependent on the guideway length.

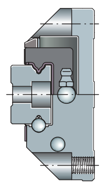
[3] Maximum screw depth.

[4] ⟨1⟩ Locating face
⟨2⟩ Marking



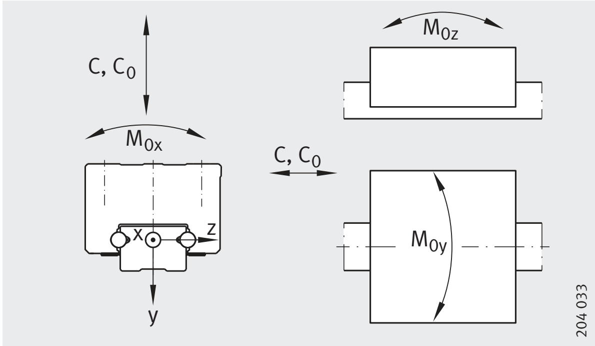
KUE..-H · View rotated 90°
⟨1⟩, ⟨2⟩ [4)]

							Fixing screws			
H_1	H_5	A_3	T_5 [3)]	h	h_1	K_5	G_2 DIN ISO 4 762-12.9		K_1	
								M_A Nm		M_A Nm
4,8	4,5	8	5	15	8,2	NIP-A1	M4	5	M4	5
5	5	6,5	5,5	16,5	8,8	NIP-KE-M6	M5	10	M5	10
6,5	5	14	8	18	9,2	NIP-KE-M6	M6	17	M6	17
7	6	16	10	21,5	10,5	NIP-KE-M6	M8	41	M8	41
8	6,5	23	12	23	12	NIP-KE-M6	M8	41	M8	41



Two-row linear recirculating ball bearing and guideway assemblies

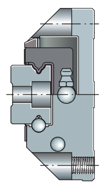
H carriages

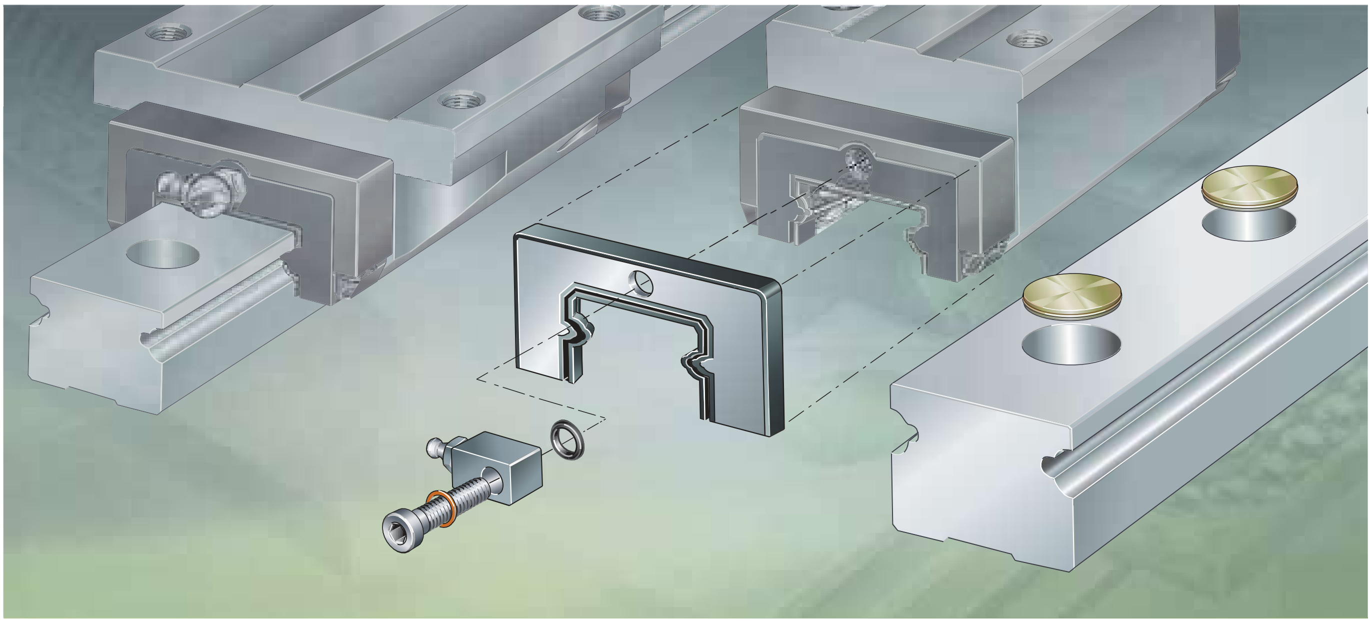


Load directions

Dimension table (continued) · Dimensions in mm					
Designation	Carriage		Guideway		
	Designation	Mass m ≈kg	Designation	Mass m ≈kg/m	Closing plug
KUE15-H	**KWE15-H**	0,17	**TKD15**	1,5	**KA08-TN**
KUE20-H	**KWE20-H**	0,35	**TKD20**	2,2	**KA10-TN**
KUE25-H	**KWE25-H**	0,55	**TKD25**	2,8	**KA11-TN**
KUE30-H	**KWE30-H**	0,9	**TKD30**	4,2	**KA15-TN**
KUE35-H	**KWE35-H**	1,46	**TKD35**	5,6	**KA15-TN**

Load carrying capacity				
Basic load ratings		Moment ratings		
C	C_0	M_{0x}	M_{0y}	M_{0z}
N	N	Nm	Nm	Nm
6 500	9 200	73	56	56
13 300	18 000	190	154	154
16 200	20 900	253	185	185
22 500	29 700	437	335	335
28 000	37 000	658	450	450





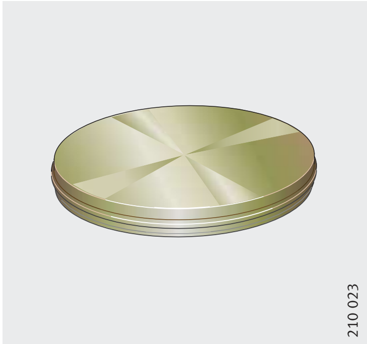
Accessories

Closing plugs
Sealing and lubrication elements

Closing plug

Brass closing plug

KA..-M

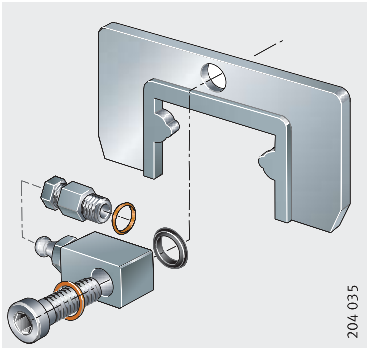


Lubrication and sealing elements

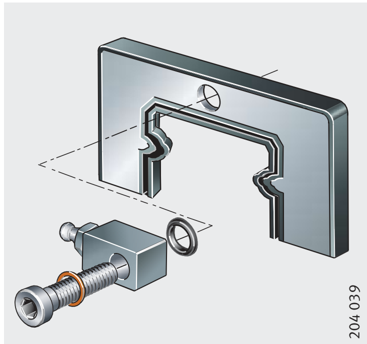
Sheet steel wipers

End wipers

APLE

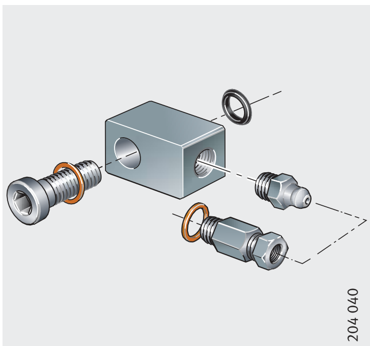


ABE



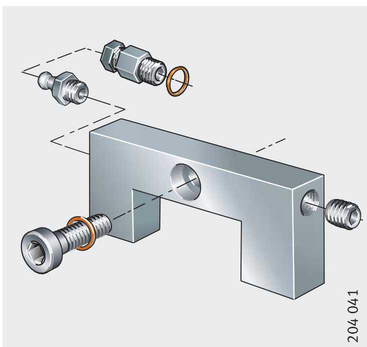
Lubrication adapters for grease and oil lubrication

SMAD.KFE, SMAD.KOE



Lubrication adapter plate

BPLE



Brass closing plugs

Closing plugs are used to close off the counterbores for the fixing screws in the guideways. As a result, the surface of the guideway is completely flush.

Brass closing plugs KA..-M are particularly suitable for conditions involving hot swarf and aggressive media, *Figure 1*.

KA..-M

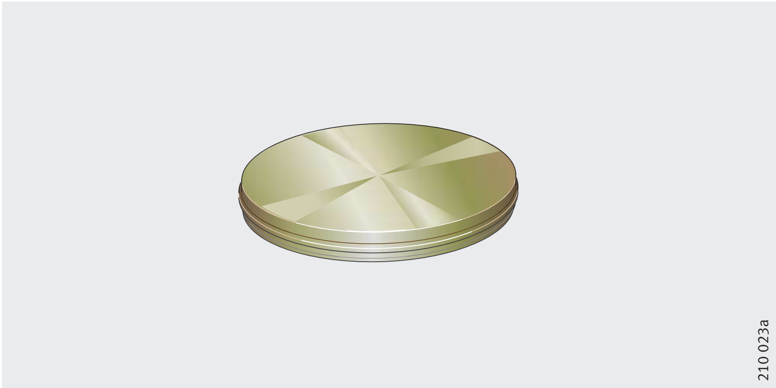
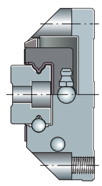


Figure 1
Brass closing plug



Sheet steel wipers

Sheet steel wipers APLE are screw mounted to the end faces of the carriage, *Figure 2*.

They protect the seal lips of the standard wipers against coarse contaminants and hot swarf. There is a narrow gap between the guideway and the wiper.

APLE

1 Sheet steel wiper
2 Lubrication adapter
3 Fixing screw
4 Lubrication nipple
5 Central lubrication connector

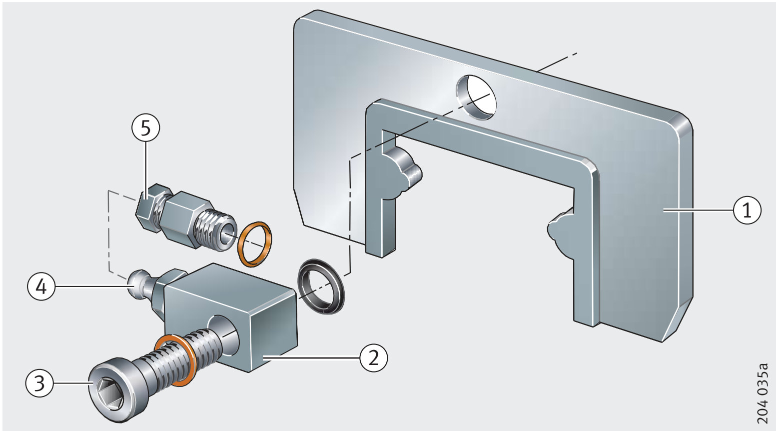


Figure 2
Sheet steel wipers

Complete fitting set

The wipers are supplied with the lubrication adapter SMAD.KFE and a fixing screw. This lubrication adapter can be replaced by the lubrication adapter SMAD.KOE; lubrication adapters: see page 443.

Instead of the lubrication nipple, the adapter can be fitted with a central lubrication connector – with a thread DIN 13 M8×1.

The sheet steel wiper APLE is not available for size KUE15.

Ordering example, ordering designation

Two sheet steel wipers for a KUE25 are required.

Ordering designation

2×**APLE25-FE**

End wipers

The end wipers are available with double and single lip seals; single lip seals: see page 438. They are screw mounted to the end faces of the carriage and protect the components behind them as well as the rolling element system, *Figure 3* and *Figure 4*. It is thus possible in many cases to dispense with costly sealing measures on the adjacent construction.

The seal carrier is an aluminium plate. The seal material is wear-resistant NBR plastic (nitrile rubber). In the single lip design, a seal lip variant with FPM (fluoro rubber) is also possible, see page 438.

Wipers with double lip seals

These wipers are particularly suitable for applications involving a high level of contamination and extend the operating life of the guidance system compared with the standard version even in heavily contaminated environments.

They are suitable for fine dusts and most cooling lubricants. Furthermore, they can also be used for the design of maintenance-free bearing arrangements even in contaminated environments, since the double lip concept minimises the loss of lubricant.

With lubrication adapter

A lubrication adapter for grease (SMAD.KFE) or oil (SMAD.KOE) is supplied in accordance with the ordering data.

① End wiper
② Double lip seal ABE..-P2-NBR
③ Lubrication adapter

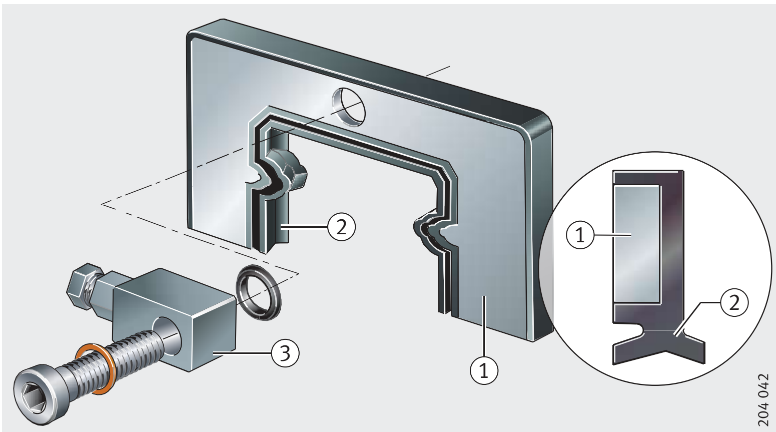


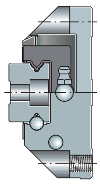
Figure 3
End wiper with double lip seal

Ordering example, ordering designation

Two end wipers with double lip seals for a KUE35 with a central lubrication connector for oil.

Ordering designation

2×**ABE.KWE35-P2-NBR-OE**



Wipers with single lip seals

These wipers are available with the seal materials NBR for fine dust and most cooling lubricants and with FPM for particularly aggressive cooling lubricants or alkalis, *Figure 4*.

They are suitable for applications involving a high level of contamination and extend the operating life of the guidance system compared with the standard version even in contaminated environments.

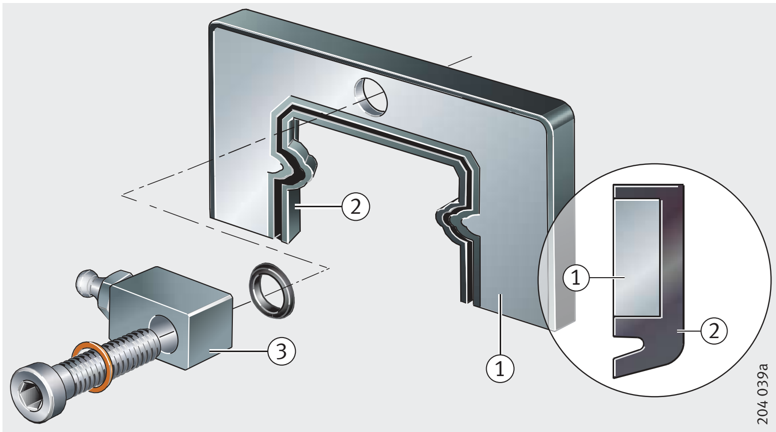
The wipers are available from size KUSE25.

With lubrication adapter

A lubrication adapter for grease (SMAD.KFE) or oil (SMAD.KOE) is supplied in accordance with the ordering data.

Attention!

If wipers are to be retrofitted, please contact us first.



① End wiper
② Single lip seal ABE..-NBR or ABE..-FPM
③ Lubrication adapter

Figure 4
End wiper with single lip seal

Ordering example, ordering designation

Two end wipers with NBR single lip seals for a KUE35 with a lubrication nipple for grease.

Ordering designation

2×**ABE.KWE35-NBR-FE**

Lubrication adapters for grease and oil lubrication

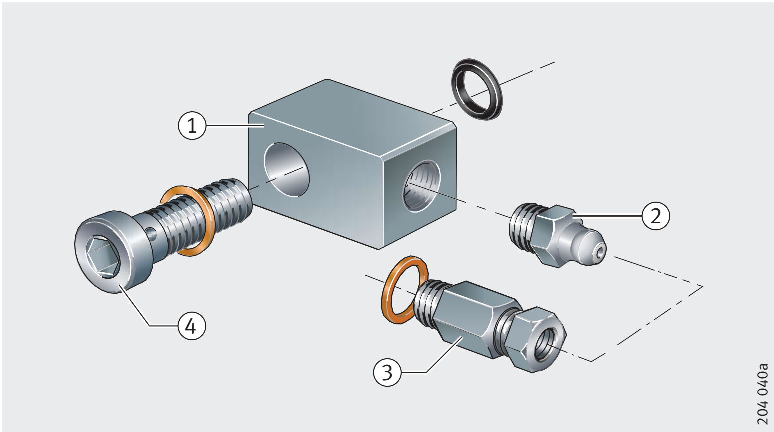
Lubrication adapters SMAD.KFE (for grease) or SMAD.KOE (for oil) are screwed into the end piece of the carriage instead of the lubrication nipple NIP-KG-M6, *Figure 5*.

The lubrication adapters are not available for series KUE15.

SMAD.KFE
SMAD.KOE

① Lubrication adapter
② Lubrication nipple
③ Central lubrication connector
④ Fixing screw

Figure 5
Lubrication adapters



Design of lubrication adapter

The design of the adapter depends on the lubrication method, see table.

Lubrication adapters

Adapter Designation	Lubrication method	Design
SMAD.KFE	Grease lubrication	With lubrication nipple
SMAD.KOE	Oil lubrication	With central lubrication connector

Fitting

Attention!

The maximum tightening torque M_A for the fixing screw is 1,5 Nm.

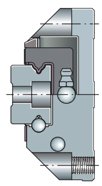
Lubrication adapters must not be subjected to moment loads.

Ordering example, ordering designation

One lubrication adapter for a KUE35 for oil lubrication.

Ordering designation

1×**SMAD.KWE35-OE**



Lubrication adapter plate

Lubrication adapter plates BPLE are screw mounted to the end piece of the carriage. They move the lubrication connector to the outer side of the carriage.

The adapter plates each comprise an aluminium body, a screw plug, a fixing screw with a sealing ring, a lubrication nipple to DIN 71 412-A M8×1 or a central lubrication connector with a sealing ring and thread to DIN 13 M8×1.

Attention! In all high carriages (-H), the lubrication nipple protrudes laterally approx. 9 mm from the carriage.

The unused hole in the adapter plate must be closed off using the screw plug.

The lubrication adapter plates are not available for series KUE15.

BPLE

1 Aluminium body
2 Screw plug
3 Fixing screw with sealing ring
4 Lubrication nipple
5 Central lubrication connector

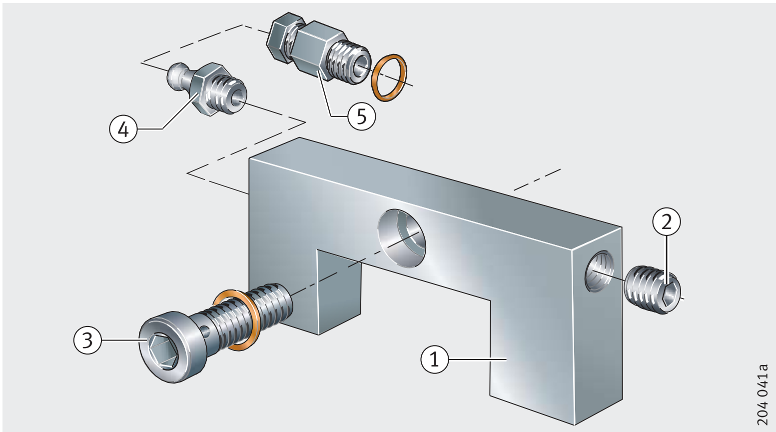


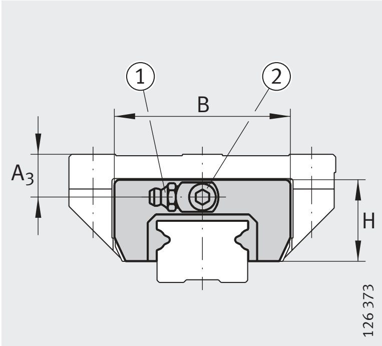
Figure 6
Lubrication adapter plate

Ordering example, ordering designation

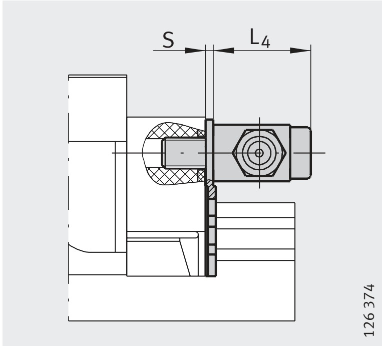
One lubrication adapter plate for a KUE35 with a central lubrication connector.

Ordering designation 1×**BPLE35-OE**

Sheet steel wipers



APLE
①, ② [2)]



APLE

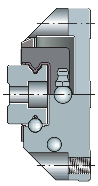
Dimension table · Dimensions in mm

Designation[1)]		Mass	Dimensions					Suitable for linear recirculating ball bearing and guideway assembly
With grease lubrication	With oil lubrication	m ≈g	B	H	L4	S	A_3	
APLE20-FE	**APLE20-OE**	35	40	24	19	1,2	6,5	KUE20
								KUE20-H
APLE25-FE	**APLE25-OE**	39	44	25,3	19	1,2	10	KUE25
							14	KUE25-H
APLE30-FE	**APLE30-OE**	43	58	28	19	1,2	13	KUE30
							16	KUE30-H
APLE35-FE	**APLE35-OE**	47	68	30,5	19	1,2	16	KUE35
							23	KUE35-H

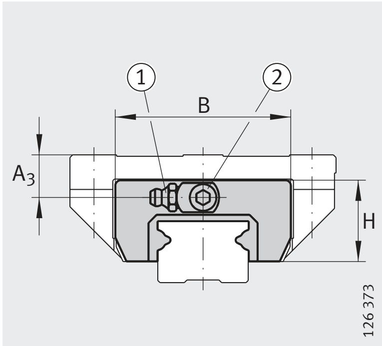
Attention!
During fitting, it must be ensured that there is a uniform gap between the guideway and the wiper.

1) APLE..-FE has a lubrication nipple.
APLE..-OE has an oil connector (similar to DIN 3871-A).

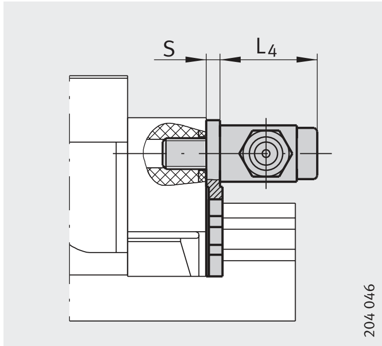
2) ① Lubrication nipple
② Tightening torque M_A of fixing screws = 1,5 Nm



Wipers



ABE.KWE
①, ② [2)]



ABE.KWE

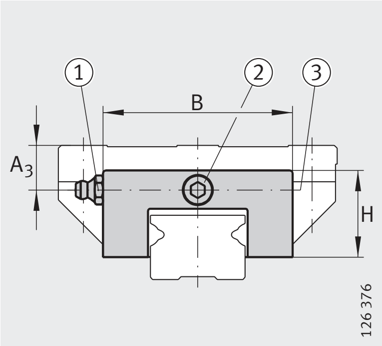
Dimension table · Dimensions in mm

Designation[1)]		Mass	Dimensions					Suitable for linear recirculating ball bearing and guideway assembly
With grease lubrication	With oil lubrication	m ≈g	B	H	S	A_3	L_4	
ABE.KWE25-FE-NBR	**ABE.KWE25-OE-NBR**	37,4	45,7	25,4	4,5	10	19	KUE25
ABE.KWE25-FE-FPM	**ABE.KWE25-OE-FPM**					14		KUE25-H
ABE.KWE30-FE-NBR	**ABE.KWE30-OE-NBR**	41	57,4	27,9	4,5	13	19	KUE30
ABE.KWE30-FE-FPM	**ABE.KWE30-OE-FPM**					16		KUE30-H
ABE.KWE35-FE-NBR	**ABE.KWE35-OE-NBR**	44,4	67,3	30,9	4,5	16	19	KUE35
ABE.KWE35-FE-FPM	**ABE.KWE35-OE-FPM**					23		KUE35-H

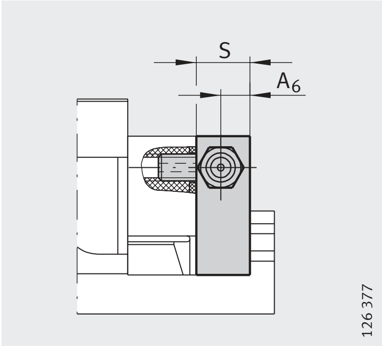
1) ABE.KWE..-FE has a lubrication nipple.
ABE.KWE..-OE has an oil connector (similar to DIN 3871-A).

2) ① Lubrication nipple
② Maximum tightening torque M_A of fixing screw = 1,5 Nm

Lubrication adapter plate



BPLE
①, ②, ③ [2)]



BPLE

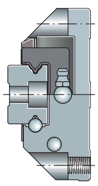
Dimension table · Dimensions in mm

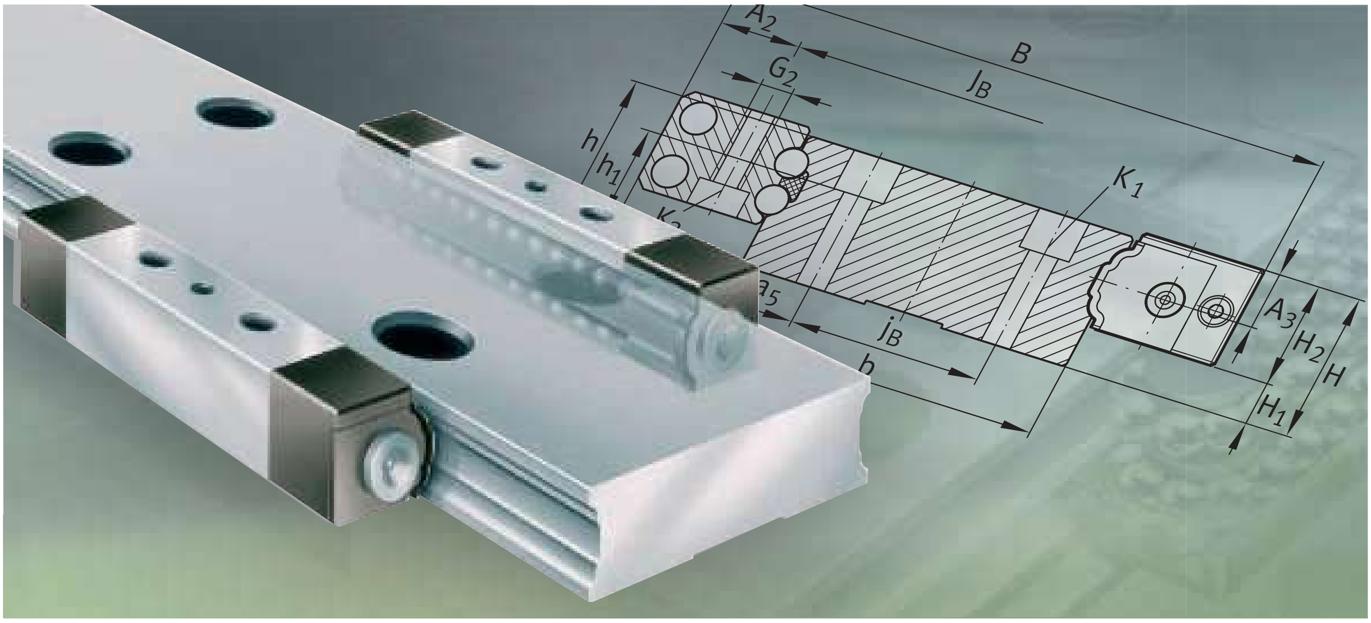
Designation[1)]		Mass	Dimensions					Suitable for linear recirculating ball bearing and guideway assembly
With grease lubrication	With oil lubrication	m ≈g	B	H	S	A_6	A_3	
BPLE20-FE	**BPLE20-OE**	25	42	23,5	12	6,5	6,5	KUE20
								KUE20-H
BPLE25-FE	**BPLE25-OE**	34	46,5	26	12	6,5	10	KUE25
							14	KUE25-H
BPLE30-FE	**BPLE30-OE**	44	58	28	12	6,5	13	KUE30
							16	KUE30-H
BPLE35-FE	**BPLE35-OE**	54	68	31	12	6,5	16	KUE35
							23	KUE35-H

Attention!
In series KUE..-H, the lubrication nipple or
the oil connector protrudes laterally approx. 9 mm from the profile of the carriage.
The lubrication nipple and screw plug can be interchanged.

1) BPLE..-FE has a lubrication nipple.
BPLE..-OE has an oil connector (similar to DIN 3871-A).

2) ① Lubrication nipple
② Tightening torque M_A of fixing screws = 1,5 Nm
③ Screw plug M8×1





Linear guidance systems with linear recirculating ball bearing units

Product overview

Linear guidance systems with linear recirculating ball bearing units

Linear guidance system

With linear recirculating ball bearing units and guideway

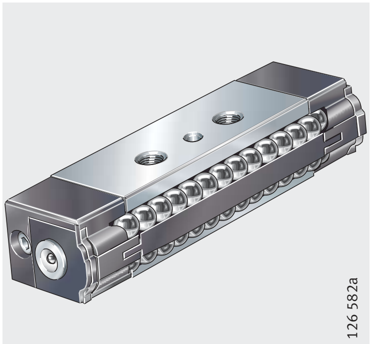
KUVS, TKVD

205 019c

Linear recirculating ball bearing unit

Carriages

KUVS



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KWVK..-AL

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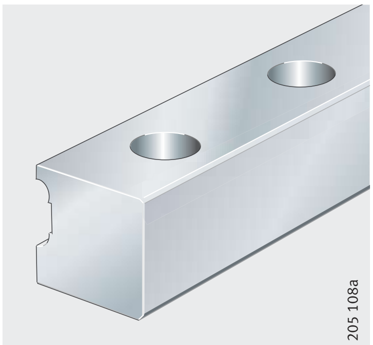
Guideways

Half guideway

Full guideway

TKVD14, TKVD19



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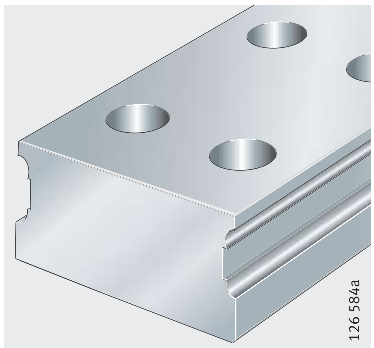
TKVD32, TKVD42, TKVD69



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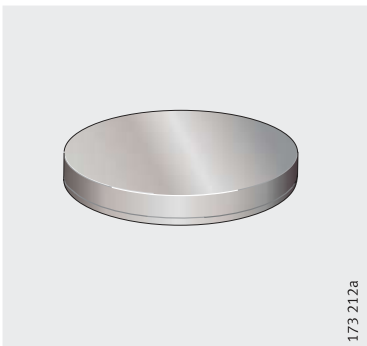
Standard accessories

Plastic closing plugs

KA..-TN



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Linear guidance systems
with linear recirculating ball bearing units

Features

These linear guidance systems are constructed using full complement linear recirculating ball bearing units KUVS and guideways TKVD. They have adjustable clearance and are suitable for long, unlimited stroke lengths.

The linear recirculating ball bearing units can be linked directly to the adjacent construction or integrated in a carriage and thus incorporated into the adjacent construction. This allows very flexible solutions with a low section height.

Since the linear recirculating bearing units are arranged to the sides of the guideway, this gives a large support distance.

Load carrying capacity

The rolling elements are in two point contact with the raceways and have a contact angle of 45°.

The guidance systems can support forces from all directions – apart from the direction of motion – and moments about all axes, *Figure 1*.

Their load carrying capacity corresponds approximately to that of the four-row linear recirculating ball bearing and guideway assemblies KUVE, while the rigidity is somewhat lower.

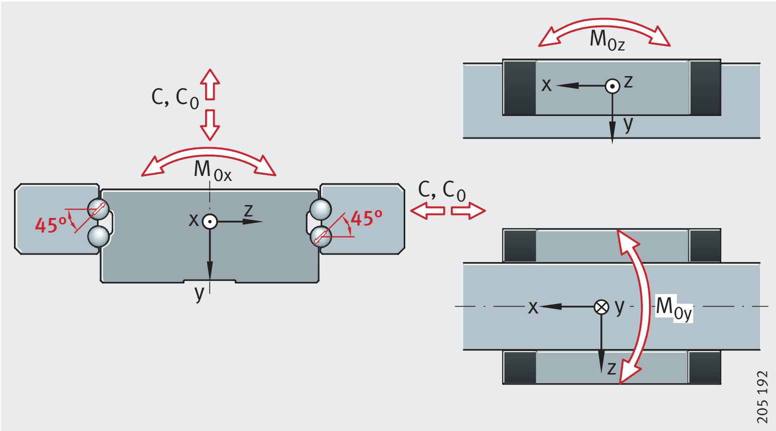


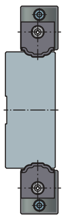
Figure 1

Load carrying capacity and contact angle

Linear recirculating ball bearing units

The main body of the linear recirculating ball bearing units is made from hardened and ground steel and has two raceways with profiled ends. It is screw mounted to the adjacent construction by means of threaded through holes.

The balls are recirculated in enclosed channels with plastic return elements. A plastic crosspiece running between the end pieces retains the balls in the main body while the linear recirculating ball bearing unit is not yet mounted.



Linear guidance systems with linear recirculating ball bearing units

Carriage

The carriage KWVK..-AL has a saddle plate made from anodised aluminium in which two linear recirculating ball bearing units KUVS are integrated.

Longer carriages with four linear recirculating ball bearing units are also available by agreement.

The screw mounting surfaces for the linear recirculating ball bearing units in the saddle plate are precision milled. The carriage can be fixed to the adjacent construction using the T-slots for conventional hexagonal nuts and T-bolts.

Clearance adjustment

The bearing clearance of the guidance systems with carriages can be adjusted by three screws on the side of the carriage. The screws press into the back of the linear recirculating ball bearing unit.

Guideway

The guideways are available with raceways on both sides (TKVD32, TKVD42 and TKVD69) or as a half guideway with the raceway on one side (TKVD14 and TKVD19).

They are made from hardened steel and are ground on all faces, the rolling element raceways are precision ground.

Multi-piece guideways

If the required guideway length l_{max} is greater than the value in the dimension tables, the guideways are supplied in several pieces; see page 452.

Sealing

The linear recirculating ball bearing unit is sealed on all sides by the wipers on the end faces and on the sealing strips which form a gap seal in conjunction with the guideway.

Lubrication

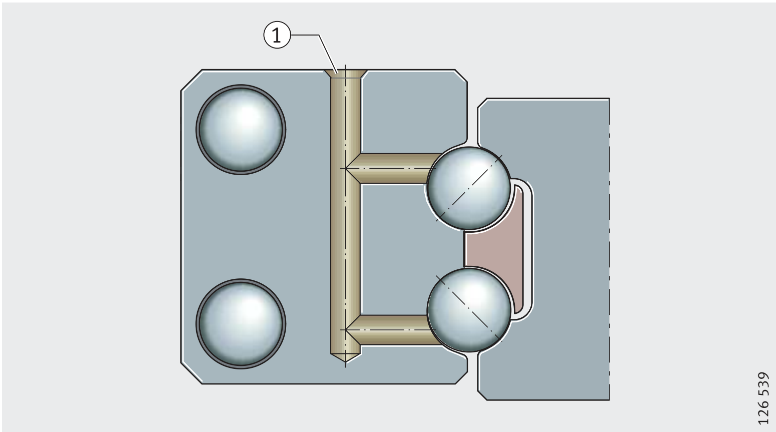
Linear recirculating ball bearing units

The linear recirculating bearing units are supplied protected by a wet preservative. They are suitable for oil and grease lubrication.

They have lubrication nipples on both end faces for lubrication. Relubrication can also be carried out from above via a hole, *Figure 2*.

Carriages

A lubrication nipple is fitted to each longitudinal side of the carriages. Lubricant is pressed into the upper hole of the linear recirculating ball bearing unit through this lubrication nipple.



1 Lubrication duct

Figure 2
Lubrication from above

Operating temperature

Linear recirculating ball bearing units can be used at operating temperatures from –10 °C to +100 °C.

Standard accessories

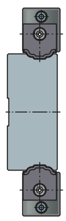
Plastic closing plugs

The closing plugs close off the counterbores of the guideway holes flush with the surface of the guideway.

Corrosion-resistant designs

Linear guidance systems with linear recirculating ball bearing units are also available in a corrosion-resistant version with the INA special coating Corrotect®.

For applications with Corrotect®, please contact us.



Linear guidance systems with linear recirculating ball bearing units

Design and safety guidelines

Sealing

The raceways must be kept clean at all times in order to prevent damage to the linear recirculating ball bearing units.

The linear recirculating ball bearing units are protected effectively against contamination by the wipers fitted as standard.

If a guideway is subjected to heavy contamination or aggressive meda, special measures must be taken.
One possibility is to cover the whole linear guidance system, for example by means of a telescopic cover or bellows.

Location

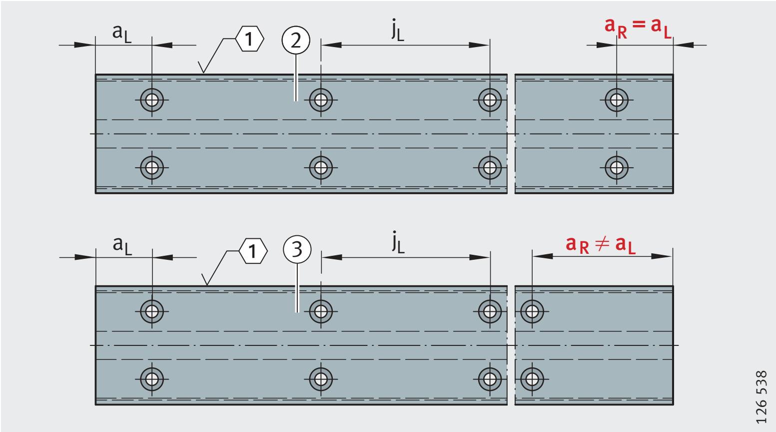
In order to achieve high rigidity and high load carrying capacity, the guidance elements should be abutted or fixed by dowels against locating faces on both sides.

In order to avoid location defects, the holes in the adjacent construction must be deburred.

Guideway hole patterns

Unless specified otherwise, the guideways have a symmetrical hole pattern, *Figure 3*.

An asymmetrical hole pattern may also be available at customer request. In this case, $a_L \geqq a_{L\,min}$ and $a_R \geqq a_{R\,min}$, *Figure 3*.



① Locating face
② Symmetrical hole pattern
③ Asymmetrical hole pattern

Figure 3
Hole patterns for guideways with two rows of holes

Maximum number of pitches between holes

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

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

The distances a_L and a_R are generally determined by:

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

For guideways with a symmetrical hole pattern:

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

Number of holes:

$$x = n + 1$$

a_L, a_R mm
Distance between start or end of guideway and nearest hole

$a_{L\,min}$, $a_{R\,min}$ mm
Minimum values for a_L, a_R according to dimension tables

l mm
Guideway length

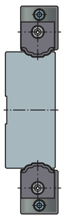
n –
Maximum possible number of hole pitches

j_L mm
Distance between holes

x –
Number of holes.

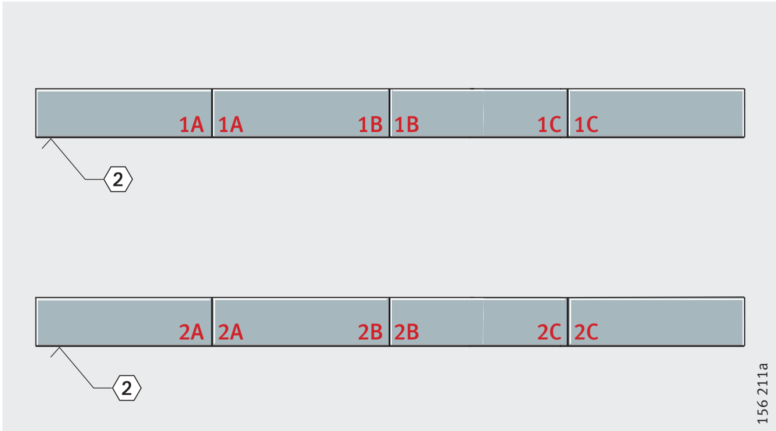
Attention!

If the minimum values for a_L und a_R are not observed, the counterbores of the holes may be intersected.



Multi-piece guideways

If the guideway length required is greater than l_{max} according to the dimension tables, these guideways are made up from individual pieces that together comprise the total required length.
The individual pieces are matched to each other and marked, *Figure 4*.



(2) Marking
Guideway pieces:
1A, 1A
1B, 1B
1C, 1C
2A, 2A
2B, 2B
2C, 2C

Figure 4
Marking of multi-piece guideways

Demands on the adjacent construction

The running accuracy is essentially dependent on the straightness, accuracy and rigidity of the fit and mounting surfaces.

The straightness of the system is only achieved when the guideway is pressed against the datum surface.

If high demands are to be made on the running accuracy and/or if soft substructures and/or movable guideways are used, please contact us.

Geometrical and positional accuracy of the mounting surfaces

The higher the requirements for accuracy and smooth running of the guidance system, the more attention must be paid to the geometrical and positional accuracy of the mounting surfaces.

Attention!

The tolerances according to *Figure 5*, page 453 and table Values for parallelism tolerances t, page 453 must be observed.

Surfaces should be ground or precision milled – with the aim of achieving a mean roughness value $R_a 1{,}6$.

Any deviations from the stated tolerances will impair the overall accuracy, alter the preload and reduce the operating life of the guidance system.

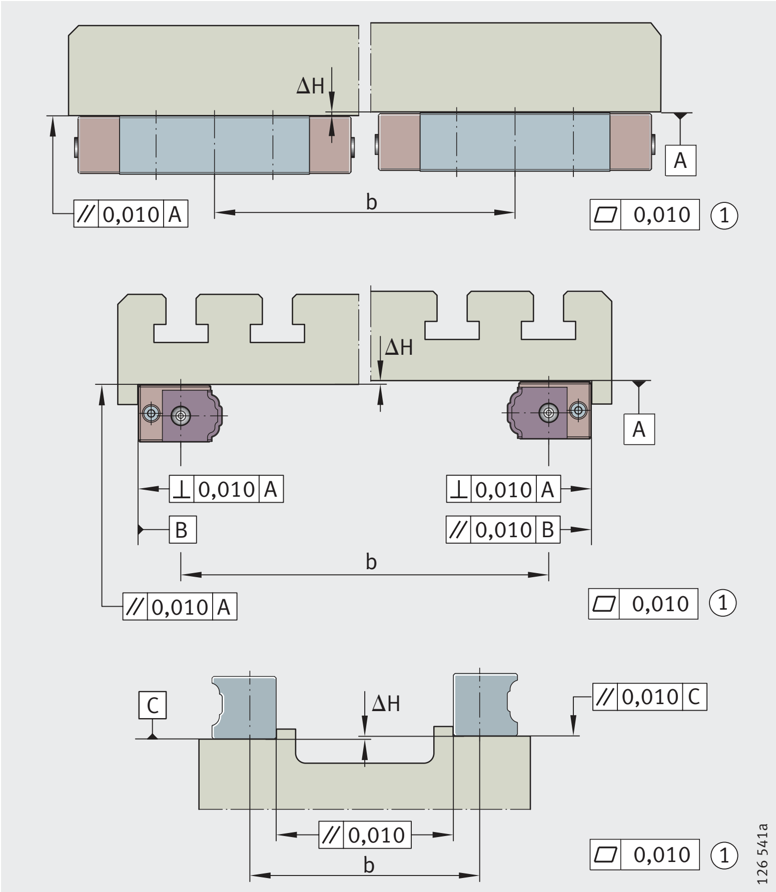
Height difference ΔH

For ΔH, permissible values are in accordance with the following formula. If larger deviations are present, please contact us.

$$\Delta_H = 0{,}2 \cdot b$$

ΔH — µm
Maximum permissible deviation from the theoretically precise position, *Figure 5*, page 453

b — mm
Centre distance between guidance elements.



1 Not convex
(for all machined surfaces)

Figure 5
Tolerances of mounting surfaces and parallelism of mounted guideways

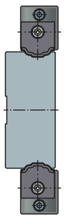
Parallelism of mounted guideways

For guideways arranged in parallel, the parallelism t should be in accordance with *Figure 5* and table. If the maximum values are used, the displacement resistance may increase.
If larger tolerances are present, please contact us.

Values for parallelism tolerances t

Guideway[1)] Designation	Parallelism tolerance t μm
TKVD14	11
TKVD19	13
TKVD32	9
TKVD42	11
TKVD69	13

1) In the case of guideways TKVD14 and TKVD19, the locating face is the longitudinal face without a raceway.



Locating heights and corner radii

The locating heights and corner ratio should be designed in accordance with table, *Figure 6* and *Figure 7*.

Locating heights, corner radii

Linear recirculating ball bearing unit, carriage Designation	Locating heights		Corner radii	
	h_1 mm	h_2 mm max.	r_1 mm max.	r_2 mm max.
KUVS32	5	5	1	1
KUVS42	5	5	1	1
KUVS69	5	5	1	1
KWVK32-AL	7	5	1	1
KWVK42-AL	7	5	1	1
KWVK69-AL	12	5	1	1

KUVS

1 Locating face
2 Machine bed
3 Machine table

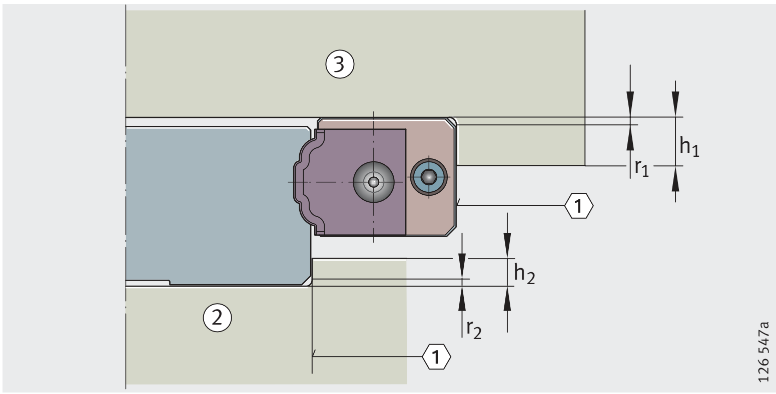


Figure 6
Locating heights and corner radii for linear recirculating ball bearing unit

KWVK..-AL

1 Locating face
2 Machine bed
3 Machine table

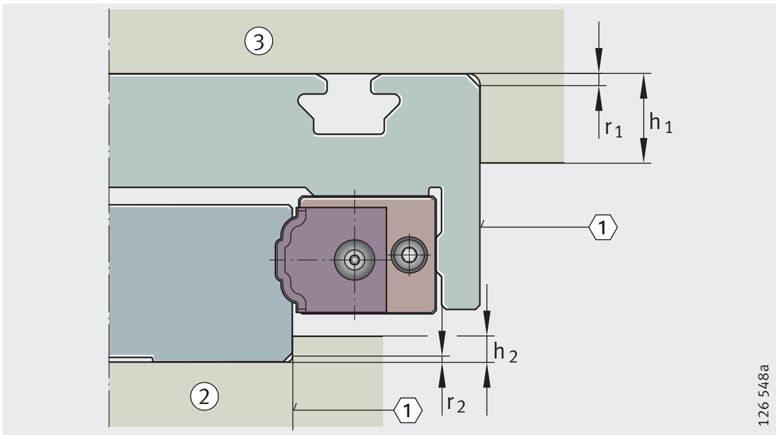
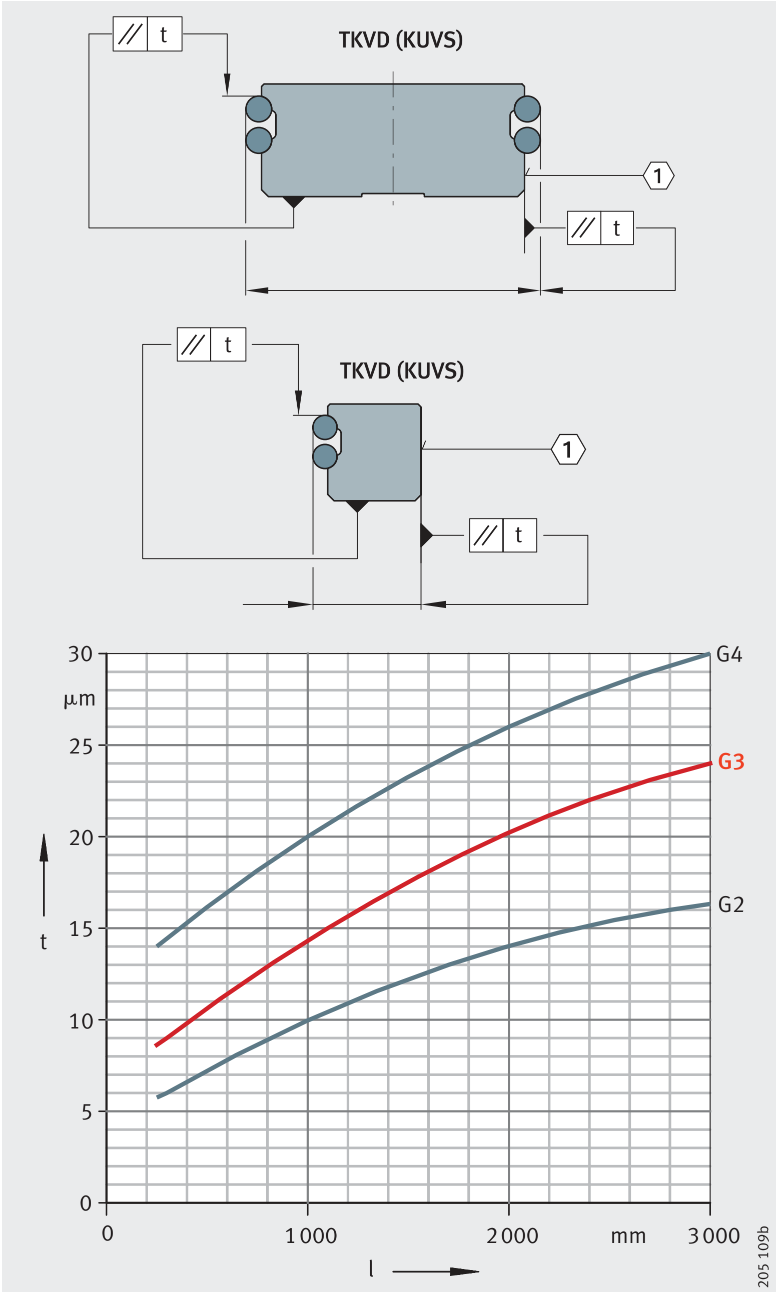


Figure 7
Locating heights and corner radii for carriage

Accuracy
Accuracy classes

Linear recirculating ball bearing and guideway assemblies are available in accuracy classes G2 to G4, *Figure 8*.
The standard is class G2.

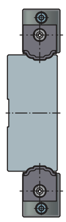


t = parallelism tolerance with differential measurement
l = total guideway length
⟨1⟩ Locating face

Figure 8
Accuracy classes and parallelism tolerances of guideways

Parallelism of raceways to locating surfaces

The parallelism tolerances of guideways are shown in *Figure 8*.



Linear guidance systems with linear recirculating ball bearing units

Tolerances

Tolerances: see table Tolerances of accuracy classes and *Figure 9*.

The tolerances are arithmetic mean values. They relate to the centre point of the screw mounting or locating surfaces of the carriage.

The dimensions H and A_1 (table Tolerances of accuracy classes) should always remain within the tolerance irrespective of the position of the carriage on the guideway.

Tolerances of accuracy classes

Tolerance		KUVS μm	KWVK..-AL μm
Tolerance for height	H	±25	±75
Height difference[1)]	ΔH	10	50
Tolerance for spacing	A_1	±25	±125
Spacing difference[1)]	ΔA_1	20	100

1) Difference between several carriages on one guideway, measured at the same point on the guideway.

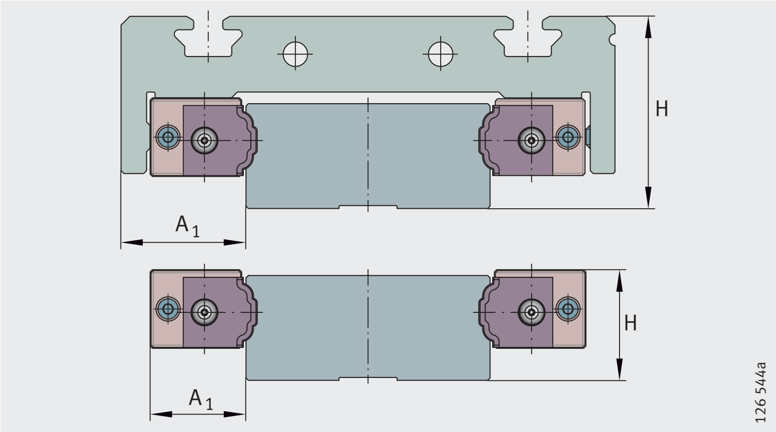


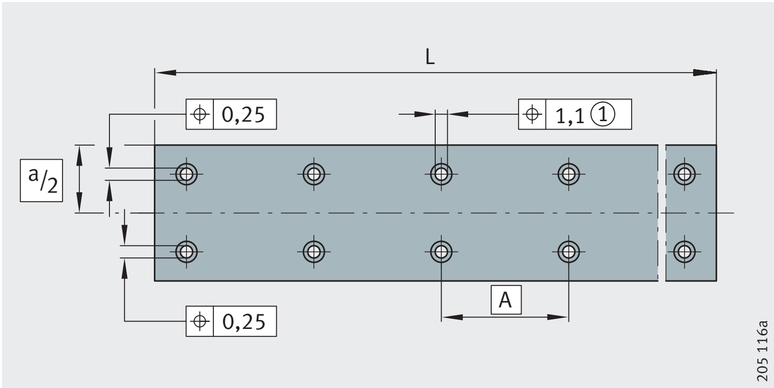
Figure 9
Datum dimensions for accuracy

Positional and length tolerances of guideways

The length tolerance of single-piece guideways is ±0,1%. Multi-piece guideways have a length tolerance of ±3 mm over the total length.

The positional tolerances are shown in *Figure 10*.

The hole pattern corresponds to DIN ISO 1101.



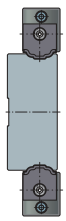
① for TKVD32 = 0,9 mm

Figure 10
Positional tolerances of guideways

Pieces of joined guideways

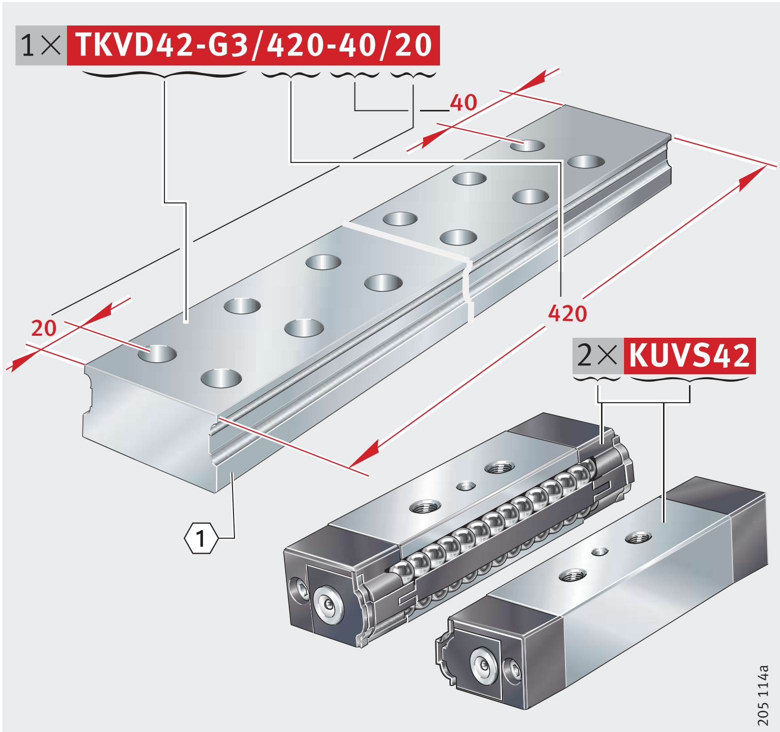
Guideway length[1] mm	Maximum permissible number of pieces
< 3 000	2
3 000 – 4 000	3
4 000 – 6 000	4
> 6 000	4 + 1 piece per 1 500 mm

[1] Minimum length of one piece = 600 mm.



Ordering example, ordering designation

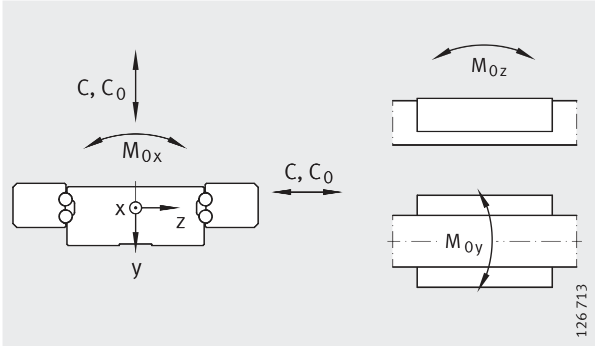
Linear recirculating ball bearing units	Two linear recirculating ball bearing units	KUVS
	Size	42
Ordering designation	2×**KUVS42**, *Figure 11*	
Guideway with asymmetrical hole pattern	Guideway for linear recirculating ball bearing units	TKVD
	Size	42
	Accuracy class	G3
	Guideway length	420 mm
	a_L	40 mm
	a_R	20 mm
Ordering designation	1×**TKVD42-G3/420-40/20**, *Figure 11*	



(1) Locating face

Figure 11
Ordering example,
ordering designation

Linear recirculating ball bearing units Guideways



Load directions

Dimension table · Dimensions in mm

Linear recirculating ball bearing unit	Guideway	Dimensions						Mounting dimensions					
		l_{max} 1)	H	B	L	h	b	A_1	A_2	J_B	B_1	j_B	a_5
KUVS32	**TKVD32**	2 000	11	51,6	47	10	31,8	9,9	5,5	40,6	–	18	6,9
KUVS42	**TKVD42**	2 000	19	75	71	18	42	16,5	10	55	–	24	9
KUVS42	**TKVD14**	1 500	15	30	71	14	13,5	16,5	10	–	16,2	6	–
KUVS69	**TKVD69**	2 000	25	114	96	24	69	22,5	13	88	–	40	14,5
KUVS69	**TKVD19**	2 000	20	42	96	19	19,5	22,5	13	–	22,2	8	–

1) Maximum length of single-piece guideways. For permissible number of guideway pieces, see page 452.
Longer guideways are supplied in several pieces and marked accordingly.

2) a_L and a_R are dependent on the guideway length.

3) If there is a possibility of settling, the fixing screws should be secured against rotation.

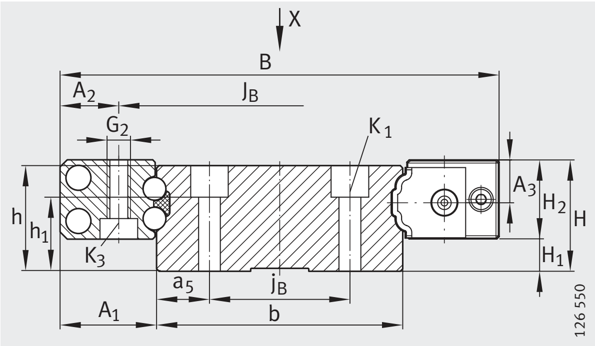
Dimension table (continued)

Linear recirculating ball bearing unit		Guideway			Load carrying capacity 4)5)				
	Mass		Mass	Closing plug	Basic load ratings		Moment ratings		
	m		m		C	C_0	M_{0x}	M_{0y}	M_{0z}
	≈kg		≈kg/m		N	N	Nm	Nm	Nm
KUVS32	0,025	**TKVD32**	2,3	KA8-TN	5 700	10 600	203	51	51
KUVS42	0,085	**TKVD42**	5,54	KA8-TN	13 500	26 000	648	211	211
KUVS42	0,085	**TKVD14**	1,45	KA8-TN	6 750	13 000	–	–	–
KUVS69	0,2	**TKVD69**	12,42	KA11-TN	26 000	46 500	1 872	492	492
KUVS69	0,2	**TKVD19**	2,66	KA11-TN	13 000	23 250	–	–	–

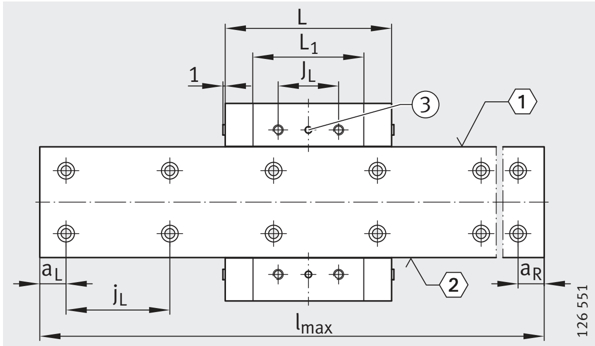
4) For two linear recirculating ball bearing units with TKVD32, TKVD42 and TKVD69,
one linear recirculating ball bearing unit with TKVD 14 and TKVD19.

5) The usable load carrying capacity is influenced by the connections between the guidance elements
and the adjacent construction.

6) 1 Locating face
2 Marking
3 Lubrication hole

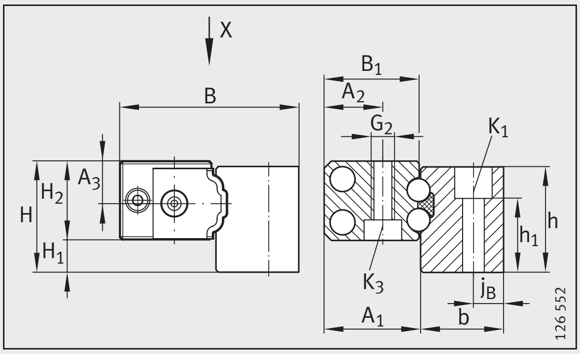


KUVS with TKVD32, TKVD42, TKVD69

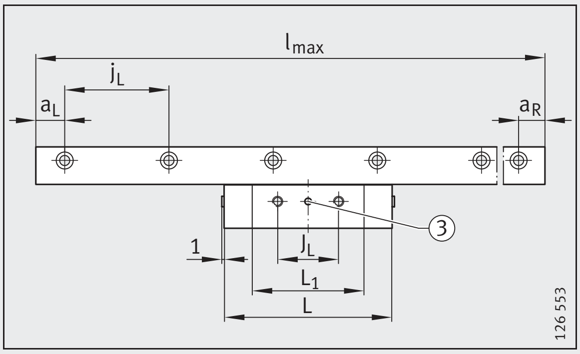


View rotated 90°
⟨1⟩, ⟨2⟩, ③ 6)

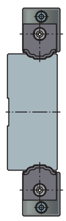
L_1	J_L	j_L	a_L, a_R 2)		H_1	H_2	A_3	h_1	Fixing screws 3) DIN ISO 4 762-12.9					
									K_1		G_2		K_3	
			min.	max.						M_A Nm		M_A Nm		M_A Nm
29,8	15	40	20	34	0,5	10,5	6	3,1	M3	2,5	M3	1,5	–	–
48,5	20	60	20	53	5,5	13,5	7,3	11,1	M3	2,5	M4	3	M3	2,5
48,5	20	60	20	53	1,5	13,5	7,3	7,1	M3	2,5	M4	3	M3	2,5
64	35	60	20	53	7,5	17,5	9,5	15,1	M5	10	M6	10	M5	10
64	35	60	20	53	2,5	17,5	9,5	10,1	M5	10	M6	10	M5	10



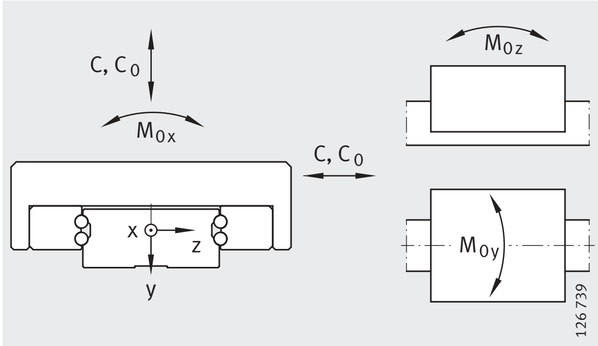
KUVS with TKVD14, TKVD19



View rotated 90°
③ 6)



Carriages
Guideways



Load directions

Dimension table · Dimensions in mm														
Carriages	Guideway	Dimensions						Mounting dimensions						
		l_{max} 1)	H	B	L	h	b	A_1	A_2	J_B	j_B	a_5	B_6	A_7
KWVK32-AL	**TKVD32**	2 000	26	62	50	10	31,8	9,9	10,7	40,6	18	6,9	51,6	–
KWVK42-AL	**TKVD42**	2 000	35	87	75	18	42	16,5	16	55	24	9	75	31
KWVK69-AL	**TKVD69**	2 000	47	130	100	24	69	22,5	21	88	40	14,5	114	42,5

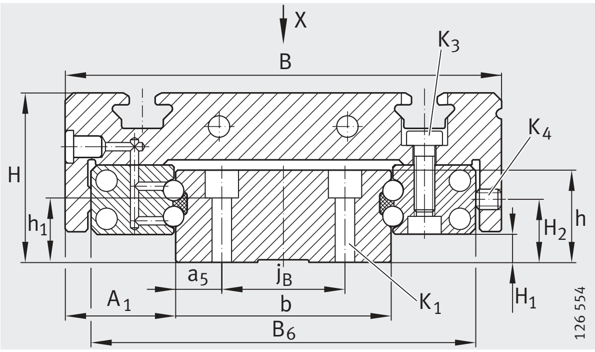
1) Maximum length of single-piece guideways. For permissible number of guideway pieces, see page 452.
Longer guideways are supplied in several pieces and marked accordingly.

2) a_L and a_R are dependent on the guideway length.

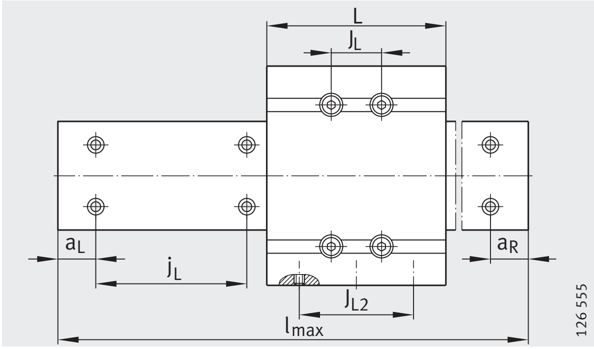
3) If there is a possibility of settling, the fixing screws should be secured against rotation.

Dimension table (continued)									
Carriage		Guideway			Load carrying capacity 4)				
	Mass		Mass	Closing plug	Basic load ratings		Moment ratings		
	m		m		C	C_0	M_{0x}	M_{0y}	M_{0z}
	≈kg		≈kg/m		N	N	Nm	Nm	Nm
KWVK32-AL	0,17	**TKVD32**	2,3	KA8-TN	5 700	10 600	203	51	51
KWVK42-AL	0,45	**TKVD42**	5,54	KA8-TN	13 500	26 000	648	211	211
KWVK69-AL	1,1	**TKVD69**	12,42	KA8-TN	26 000	46 500	1 800	490	492

4) The usable load carrying capacity is influenced by the connections between the guidance elements and the adjacent construction.

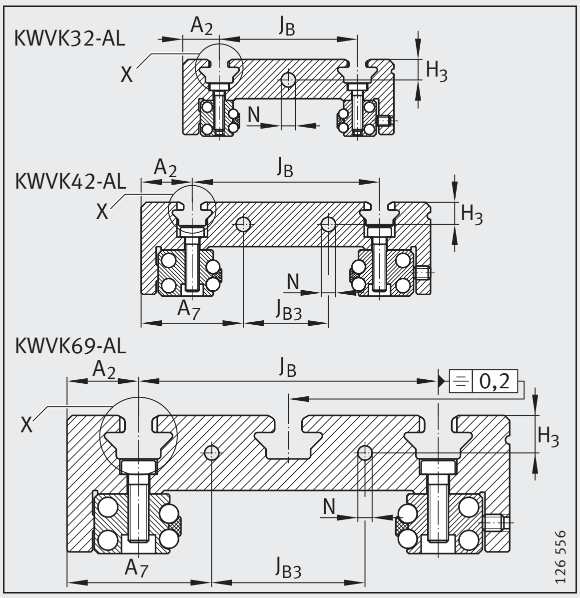


KWVK..-AL on TKVD

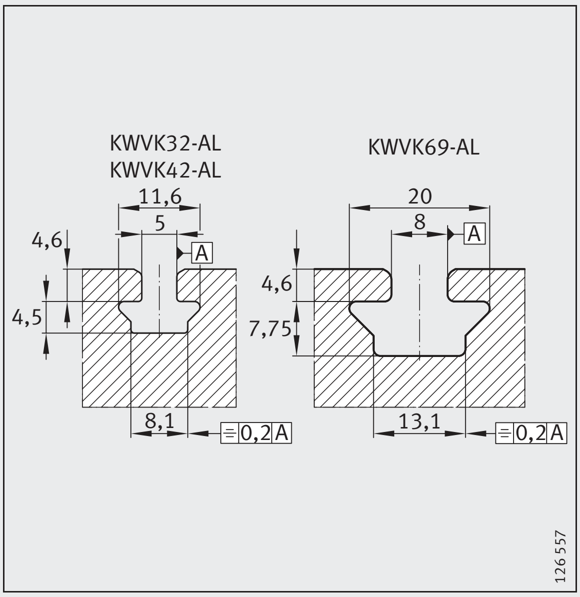


View rotated 90°

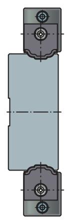
											Fixing screws[3)]				
J_{B3}	J_L	J_{L2}	j_L	a_L, a_R[2)]		N	H_1	H_2	h_1	H_3	K_1		K_3		K_4
											DIN ISO 4 762-12.9				
												M_A		M_A	
				min.	max.							Nm		Nm	
–	15	25	40	20	35	4,2	0,5	6	3,1	7,5	M3	2,5	M3	0,6	M3
25	20	40	60	20	53	4,2	5,5	12	11,1	8	M3	2,5	M4	2,1	M4
45	35	55	60	20	53	4,2	7,5	17	15,1	11	M5	10	M6	4,8	M6



Carriage KWVK..-AL



Detail X



Linear recirculating ball bearing units KUVS

Linear guidance systems with linear recirculating ball bearing units KUVS allow wide distances between support points. Furthermore, the bearing clearance can be adjusted. Linear guidance systems with linear recirculating ball bearing units are four-row systems.

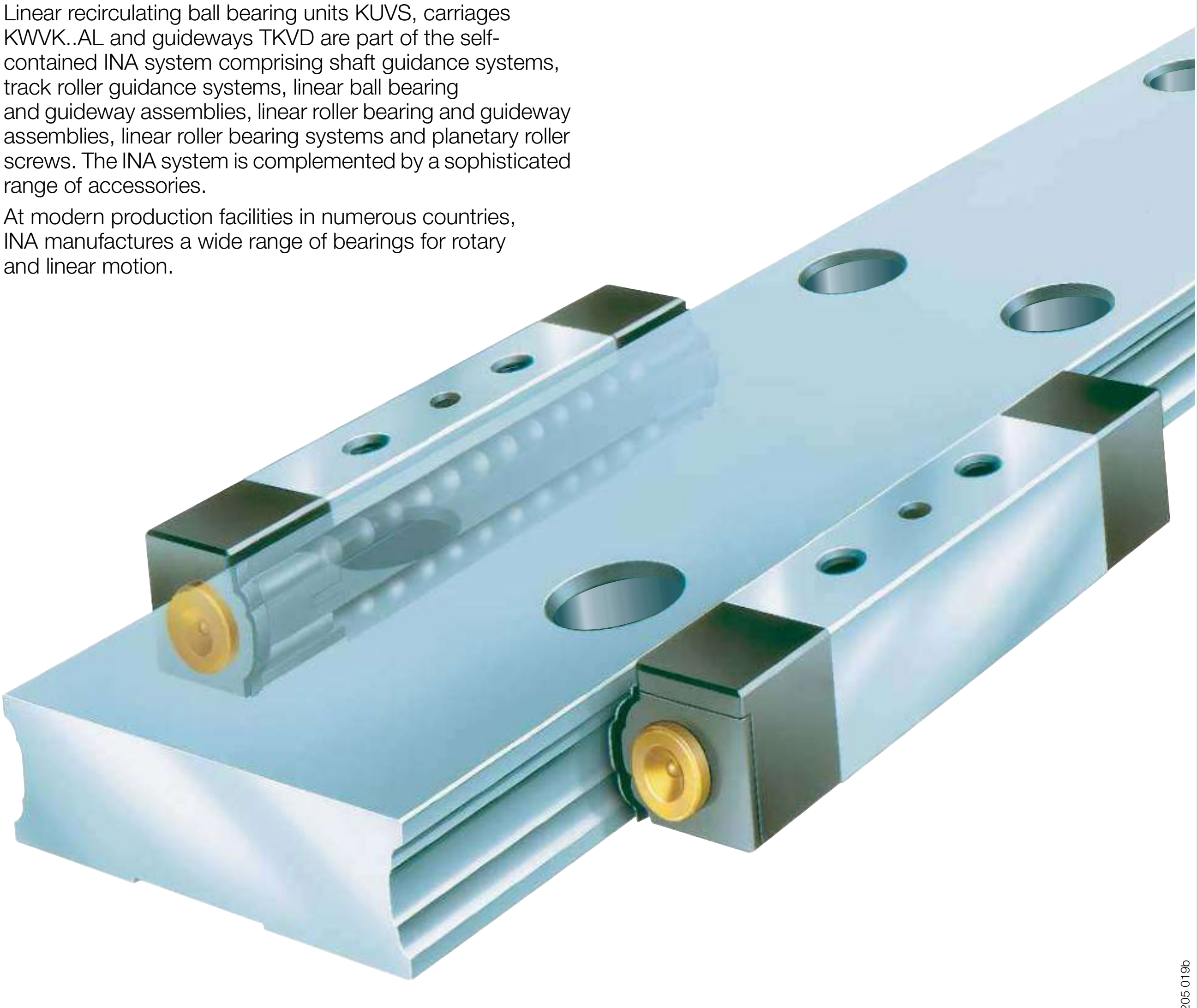
Despite their small envelope dimensions, linear recirculating ball bearing units KUVS have a high load carrying capacity. They run on guideways TKVD with raceways on one or both sides.

Carriages KWVK..AL, in which linear recirculating ball bearing units KUVS are screw mounted, are combined with guideways TKVD to form four-row linear ball bearing and guideway assemblies.

Linear recirculating ball bearing units KUVS, carriages KWVK..AL and guideways TKVD are part of the self-contained INA system comprising shaft guidance systems, track roller guidance systems, linear ball bearing and guideway assemblies, linear roller bearing and guideway assemblies, linear roller bearing systems and planetary roller screws. The INA system is complemented by a sophisticated range of accessories.

At modern production facilities in numerous countries, INA manufactures a wide range of bearings for rotary and linear motion.

The INA application engineering departments and engineering service can give expert assistance in the selection of bearings and guidance systems. Our engineers and technicians can provide comprehensive advice and prepare installation proposals based on our considerable experience, numerous investigations and the design programs derived as a result.



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Linear recirculating ball bearing units KUVS

Features

Linear guidance systems with linear recirculating ball bearing units KUVS

Linear guidance systems with linear recirculating ball bearing units KUVS consist of:

- linear recirculating ball bearing units KUVS or
- carriages KWVK..AL

and

- guidways TKVD.

The balls and raceways are in two point contact with each other. The contact angles are 45° and are in an O type arrangement.

Corrosion-resistant designs

Linear guidance systems with linear recirculating ball bearing units KUVS are also available with the anti-corrosion coating "Corrotect®".

Further information on this electroplated coating is given in *INA Technical Product Information TPI 77: "Corrotect®" coatings for linear guidance systems*.

Linear recirculating ball bearing unit

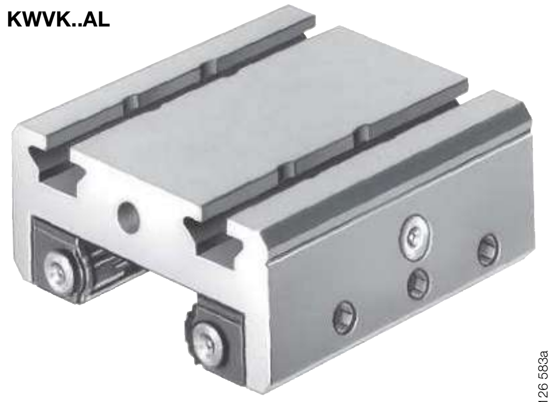
KUVS

- load-bearing part with hardened and precision ground rolling element raceways
  – balls are recirculated in enclosed channels with plastic return elements
- full complement design
- threaded holes for mounting on the adjacent construction

20

Carriage

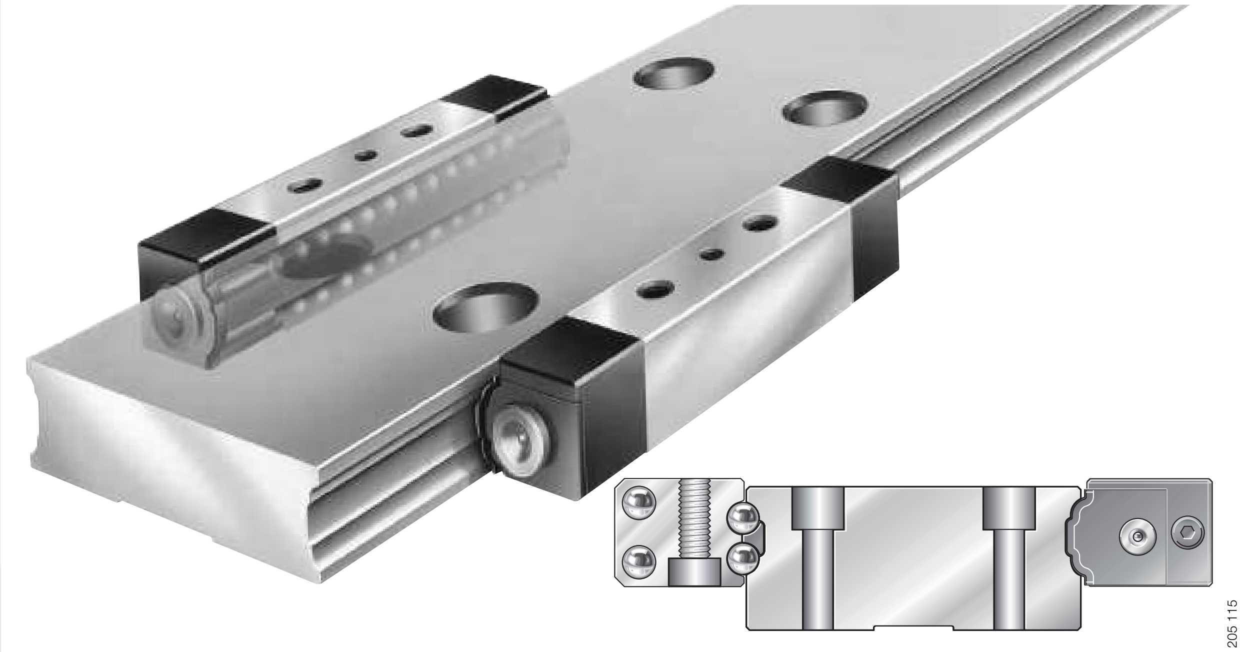
KWVK..AL



- body made from anodised aluminium
- two or four ball bearing units fitted
- adjustable bearing clearance

23

Linear recirculating ball bearing units with guideway



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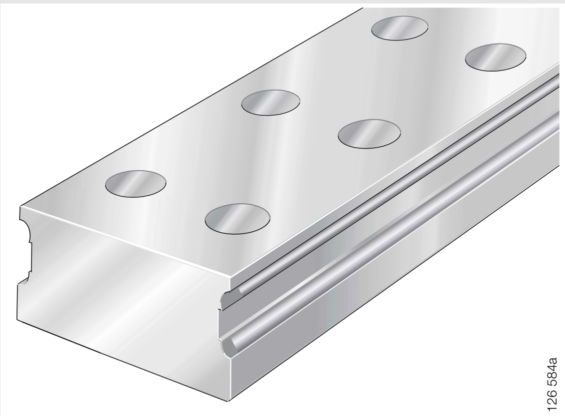
20

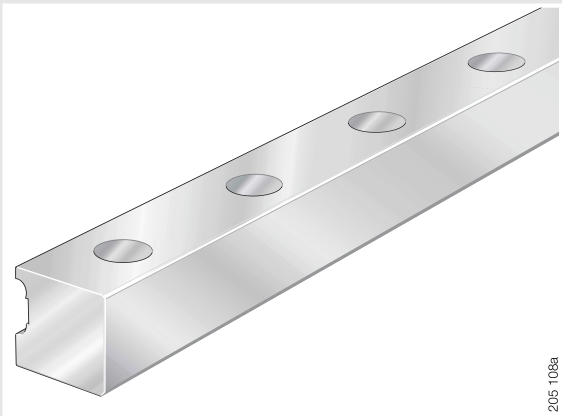
Guideways



126 584a

- guideway
  - TKVD 32
  - TKVD 42
  - TKVD 69

20



205 108a

- guideway
  - TKVD 14
  - TKVD 19

20

Linear recirculating ball bearing units KUVS

Full complement linear recirculating ball bearing units KUVS (Figure 1) have a hardened and ground load-bearing body made from steel with two raceways. The raceways have profiled ends.

The balls are recirculated in enclosed channels with plastic return elements. A plastic crosspiece running between the end pieces retains the balls in the load-bearing body while the linear ball bearing unit is not mounted.

The linear recirculating ball bearing unit has two threaded through holes which are used for screw mounting on the adjacent construction.

Sealing

The linear recirculating ball bearing unit is sealed on all sides by the wipers on the end faces and on the sealing strips which form a gap seal in conjunction with the guideway.

Lubrication

Linear recirculating ball bearing units KUVS can be lubricated with grease or oil.

Lubrication nipples are pressed into both end faces of the linear ball bearing units. It is als possible to lubricate the linear ball bearing units from above via a hole (Figure 2) which need not be closed off if it is not used.

Delivered condition

Linear recirculating ball bearing units are supplied coated with an oil-based preservative.

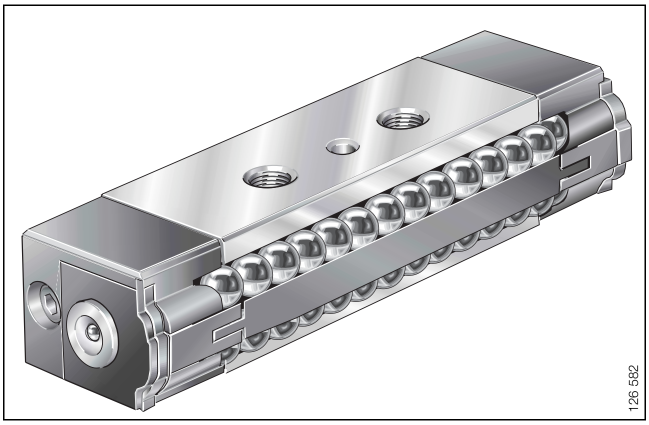


Figure 1 · Linear recirculating ball bearing unit KUVS

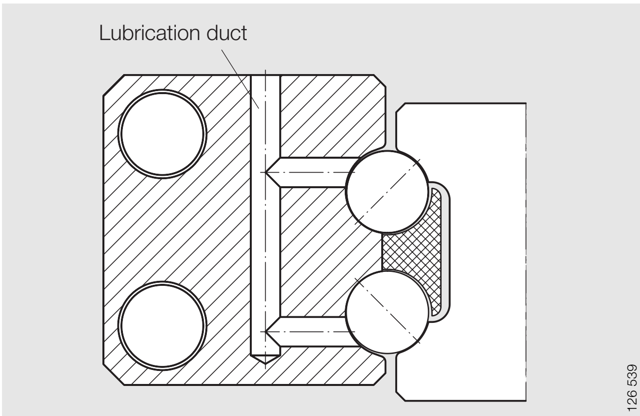


Figure 2 · Lubricant supply from above

Carriages KWVK..AL

The carriage KWVK..AL (Figure 3) has a saddle plate made from anodised aluminium and two linear recirculating ball bearing units KUVS as standard. Longer carriages with four linear recirculating ball bearing units are also available by agreement.

The screw mounting surfaces for the linear ball bearing units in the saddle plate are precision milled.

The carriage has T-slots for fixing to the adjacent construction. The slots can accommodate conventional hexagon nuts and T-nuts.

Clearance adjustment

The bearing clearance in a linear guidance system with carriages KWVK..AL can be adjusted by three screws on the side of the carriage. The screws press into the back of the linear ball bearing unit.

Sealing

See section on linear recirculating ball bearing units KUVS.

Lubrication

See section on linear recirculating ball bearing units KUVS.
A lubrication nipple is pressed into each longitudinal face of the carriage. Lubricant can be pressed into the upper hole of the linear ball bearing unit through this lubrication nipple.

Delivered condition

One linear recirculating ball bearing unit is ready mounted in the saddle plate.

The opposing linear ball bearing unit is screwed into place only finger tight. The clearance is adjusted on this side.

Linear recirculating ball bearing units are supplied coated with an oil-based preservative.

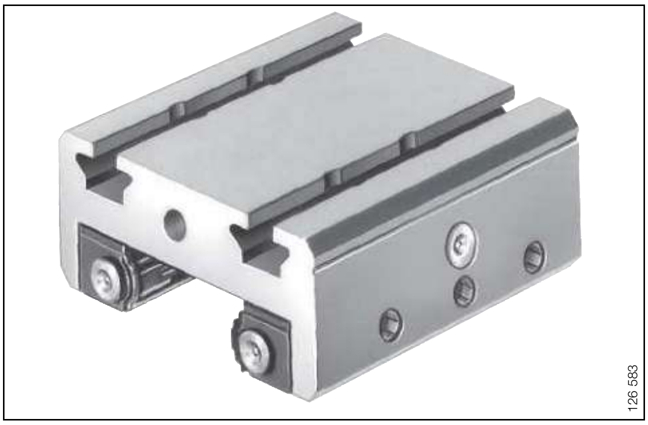


Figure 3 · Carriage KWVK..AL

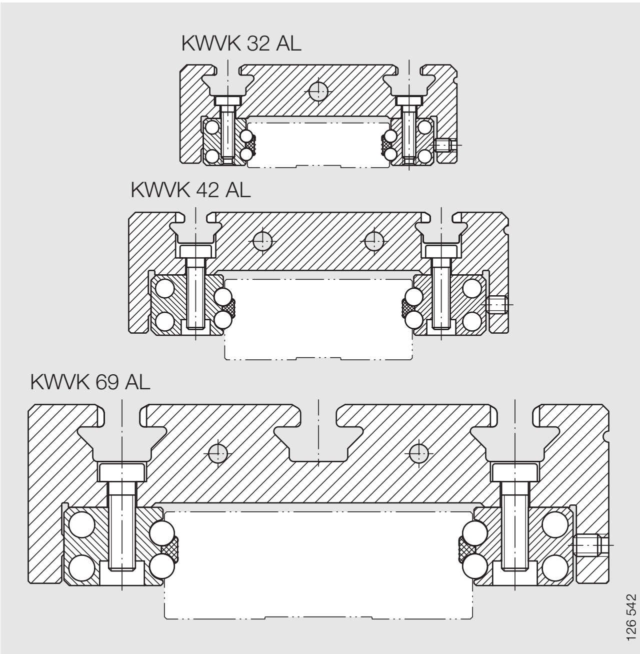


Figure 4 · Cross-sections of carriage KWVK..AL

Guideways TKVD

Guideways TKVD are available in two designs:

- with raceways on both sides, TKVD 32, TKVD 42 and TKVD 69 (Figure 5)
- with raceways on one side, TKVD 14 and TKVD 19 (half guideway, Figure 6).

The guideways are made from hardened steel and ground on all sides. The raceways have a hardness of

- 670 HV to 840 HV.

The cylindrical counterbores of the fixing holes have sharp edges in order to give a flat guideway surface when closing plugs are inserted flush with the surface.

⚠ Risk of injury!

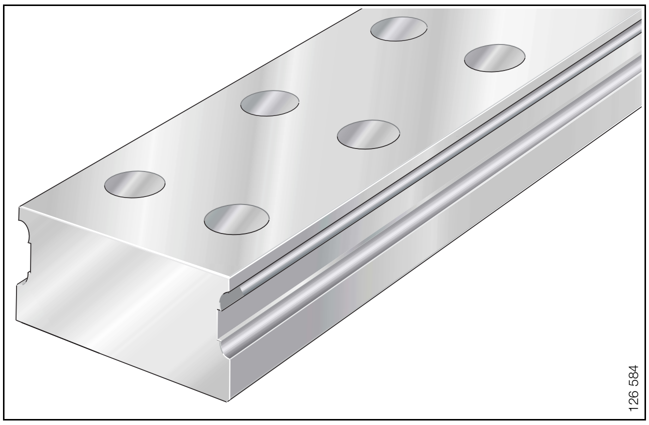


Figure 5 · Guideway TKVD 32, TKVD 42 and TKVD 69

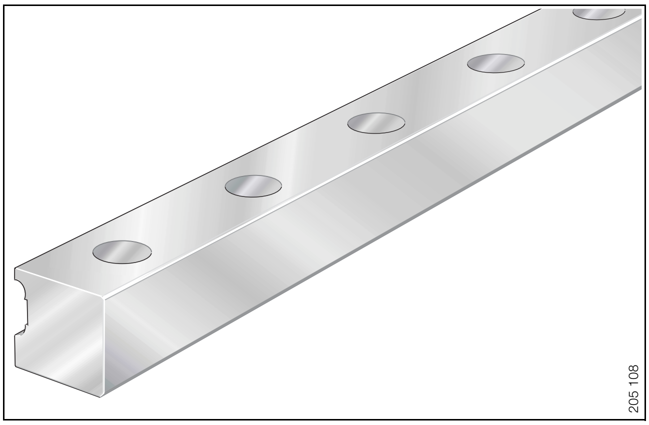


Figure 6 · Guideway TKVD 14 and TKVD 19

Multi-piece guideways

If single-piece guideways are not possible, the guideways can be assembled from sections matched to each other and marked (Figure 7).

Hole patterns (Figure 8)

Unless stated otherwise, guideways are supplied with a symmetrical hole pattern. An asymmetrical hole pattern may be available at customer request.

With a symmetrical hole pattern, $a_L = a_R$ (Figure 8 "top"), where $a_{L\,min} \leqq a_L \leqq a_{L\,max}$ and $a_{R\,min} \leqq a_R \leqq a_{R\,max}$.

With an asymmetrical hole pattern, $a_L \neq a_R$ (Figure 8 "bottom"). a_L is on the marked end of the guideway.

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

l_{max} mm
Guideway length

n –
Maximum possible number of hole pitches

j_L mm
Hole pitch (specified in *dimension tables*).

The minimum and maximum values for a_L and a_R must be observed (see *dimension table*)!

If they are not adhered to, the counterbore of a hole may be intersected.

Closing off the fixing holes

Fixing holes can be closed off using plastic closing plugs KA..TN or filled out with resin.

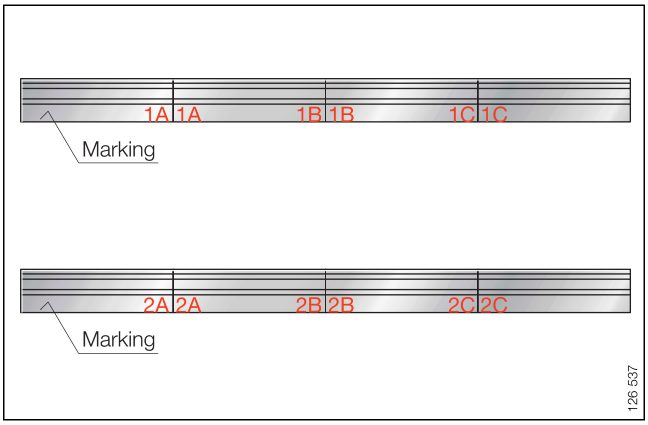


Figure 7 · Multi-piece guideways

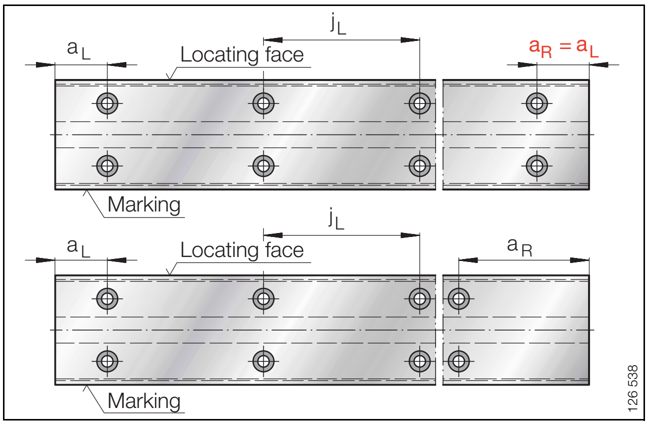
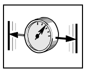


Figure 8 · Symmetrical and asymmetrical hole pattern



Accuracy

Table 1 shows the accuracy of linear recirculating ball bearing units KUVS and carriages KWVK..AL in conjunction with a guideway TKVD.

The tolerances are arithmetic mean values. They relate to the centre point of the screw mounting or locating surfaces of the linear ball bearing unit KUVS or the carriage. The dimensions ΔH and A_1 should always remain within the tolerances in Table 1, irrespective of the position of the guidance elements on the guideway.

The length tolerance of single-piece guideways is ±0,1%. Multi-piece guideways have a length tolerance of ±3 mm over the total length.

The positional tolerance limits the deviation of the hole centre point from the precise theoretical position (Figure 10).

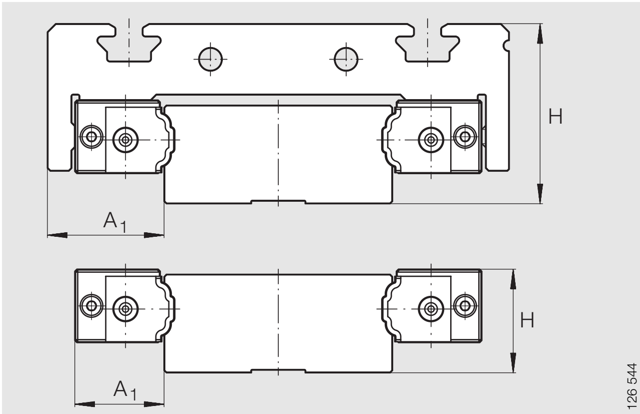


Figure 9 · Reference dimensions for accuracy

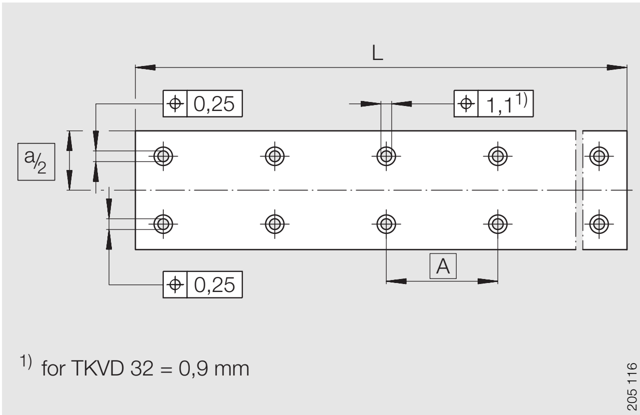


Figure 10 · Tolerance for guideways TKVD, hole pattern to DIN ISO 1101

The parallelism tolerance of the guideways is shown in Figure 11.

Table 1 · Accuracy of linear ball bearing units and carriages

Dimension		KUVS Tolerance µm	KWVK..AL Tolerance µm
Height tolerance	H	± 25	± 75
Height difference[1]	ΔH	10	50
Spacing tolerance	A_1	± 25	± 125
Spacing difference[1]	ΔA_1	20	100

[1] Dimensional difference between several carriages on one guideway, measured at the same point on the guideway.

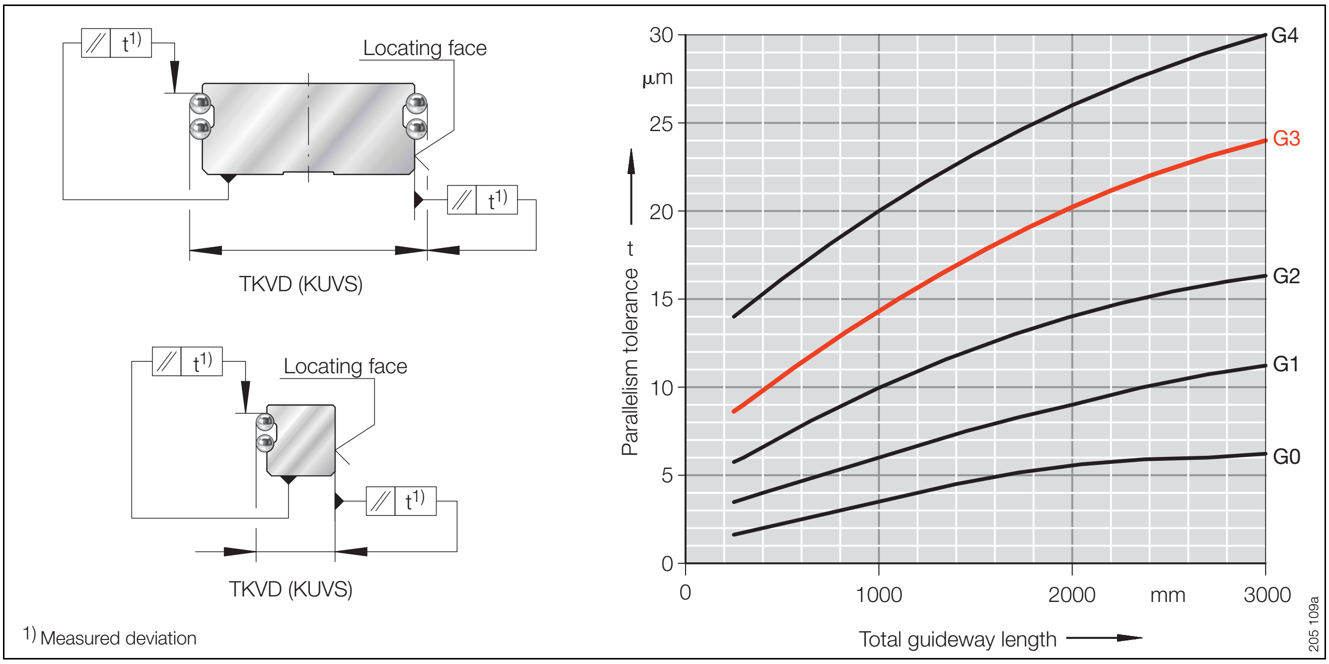


Figure 11 · Parallelism tolerance of guideways of series TKVD

Lubrication

Linear recirculating ball bearing units KUVS can be lubricated with grease or oil. Oil lubrication should be used in preference if possible.

The linear recirculating ball bearing units are supplied coated with an oil-based preservative as standard. The oil used is compatible with oils and greases having a mineral oil base. If greases with polycarbamide thickeners are used, please consult INA.

Linear recirculating ball bearing units run almost exclusively under mixed friction conditions. Doped lubricants (type P to DIN 51502) should therefore be used in preference.

Lubricant supply

This is provided as standard:

- via funnel type lubrication nipples to DIN 3405 on the end piece
- via the hole in the centre of the load-bearing body.

If a central lubrication system is used:

- via the hole in the centre of the load-bearing body.

The handling and use of lubricants is governed by national regulations for environmental protection and health and safety at work as well as information from the lubricant manufacturers. These regulations must be observed.

Lubricant oils and viscosity

Lubricant oils CLP or CGLP to DIN 51517 and HLP to DIN 51524 should be used in preference.

Viscosity

For operating temperatures between +10 °C and +70 °C, the viscosity should be between ISO VG 68 and ISO VG 220.

For low temperatures, oils with lower viscosity must be used.

For highly dynamic applications, lubricant oils to ISO VG 100 are recommended.

Compatibility

If no experience or guidelines from the oil manufacturer are available, lubricant oils must not be used until tests have been carried out to determine their behaviour in relation to:

- plastics
- elastomers
- non-ferrous and light metals.

⚠ Tests should only be carried out under dynamic conditions and at the appropriate operating temperature.

The compatibility of oils must always be checked. In case of doubt, the lubricant manufacturer must be consulted.

Initial operation

The guideway and carriages must be oiled before initial operation and protected against solid and liquid contaminants.

The carriages must be lubricated using at least the minimum oil quantity and moved back and forth during this process.

Table 2 · Minimum oil quantity and oil impulse quantity

Size	Minimum oil quantity Q_{min} cm^3	Oil impulse quantity Q_{imp} cm^3/h
KUVS 32	0,5 incl. 0,6	0,3
KUVS 42	0,5 incl. 0,6	0,3
KUVS 69	0,8 incl. 0,9	0,5

Minimum oil quantity

The minimum oil quantity is measured such that the oil ducts, rolling elements and raceways will be supplied with sufficient quantities of lubricant.

Table 2 shows the minimum oil quantity Q_{min} for initial operation. If the stroke ratio is less than 0,5, please consult INA (stroke ratio: see page 13).

Oil impulse lubrication

Table 2 shows the oil impulse quantity Q_{imp} when a linear recirculating ball bearing unit is connected to a central lubrication system.

Pneumatic oil lubrication

The linear recirculating ball bearing units are also suitable for pneumatic oil lubrication.

Pneumatic oil lubrication may allow smaller quantities of oil to be used than stated in Table 2 (oil impulse lubrication). It is not possible to state definitive quantities since these are essentially dependent on the design of the central lubrication system.

The necessary oil quantity must therefore be determined under operating conditions.

Grease lubrication

INA recommends lithium soap greases with a mineral oil base. The viscosity should be between ISO VG 68 and ISO VG 100. For high loads, greases doped with EP additives are absolutely necessary.

Miscibility

Greases may be mixed if:

- they have the same base oil type
- they have matching thickener types
- they have similar base oil viscosities
  – the difference must not be more than one ISO VG class
- they have the same consistency (NLGI class).

In case of doubt, please consult INA.

⚠ The miscibility of synthetic oils must always be checked. In case of doubt, the lubricant manufacturer must be consulted.

Compatibility with process materials (e.g. cooling lubricants) must be checked.

Storage

Experience shows that INA linear guidance systems lubricated with greases having a mineral oil base can be stored for up to 3 years.

The following preconditions apply:

- closed storage room
- storage temperature between 0 °C and +40 °C
- relative humidity <65%
- protection against chemical agents (vapours, gases, fluids).

It is the user's responsibility to follow the directions given by the lubricant manufacturer.

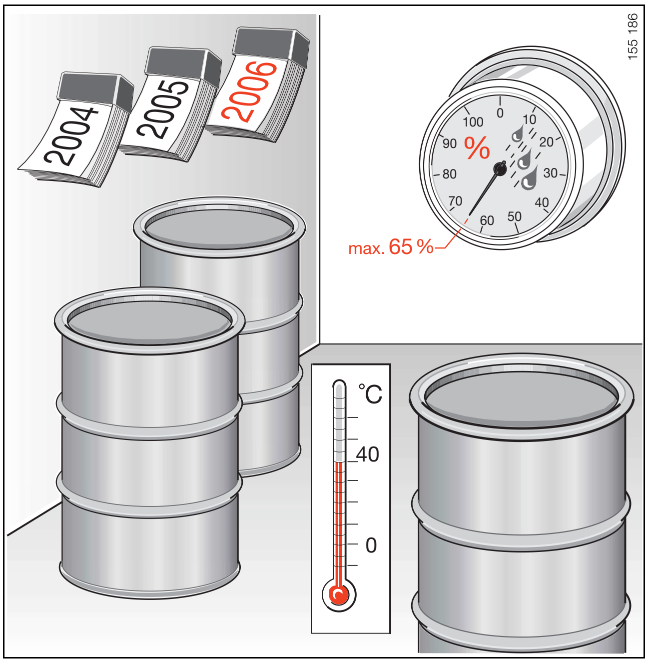


Figure 12 · Storage of greases

Initial operation

The guideways should be lightly greased before initial operation.

Before fitting, the linear recirculating ball bearing units should be filled with the initial grease quantity (Table 3). After fitting, the linear recirculating ball bearing units must be regreased via the lubrication devices connected until fresh grease emerges from the linear ball bearing units: the linear recirculating ball bearing units should be moved several times without load and regreased repeatedly.

Relubrication

The relubrication quantity is approximately 50% of the initial grease quantity. Relubrication should be carried out with several partial quantities at shorter intervals in preference to a single regreasing at the end of the relubrication interval.

The relubrication interval and quantity can only be determined precisely under operating conditions since it is not possible to calculate all the influences in advance. An observation period of adequate length must be allowed.

Relubrication interval

If the guide value for the grease operating life t_{fG} is less than the required operating duration of the linear unit, relubrication must be carried out.

Relubrication must be carried out at a time when the old grease can still be forced out of the carriage by the new grease.

A guide value for the relubrication interval for most applications is:

$$t_{fR} = 0{,}5 \cdot t_{fG} \text{ if } t_{fG} < t_{fE}$$

t_{fR} h
Guide value for relubrication interval in operating hours

t_{fG} h
Guide value for grease operating life in operating hours

t_{fE} h
Required operating duration in hours.

Table 3 · Size and initial grease quantity

Size	Initial grease quantity g
KUVS 32	0,2 incl. 0,3
KUVS 42	0,8 incl. 1
KUVS 69	2,0 incl. 2,5

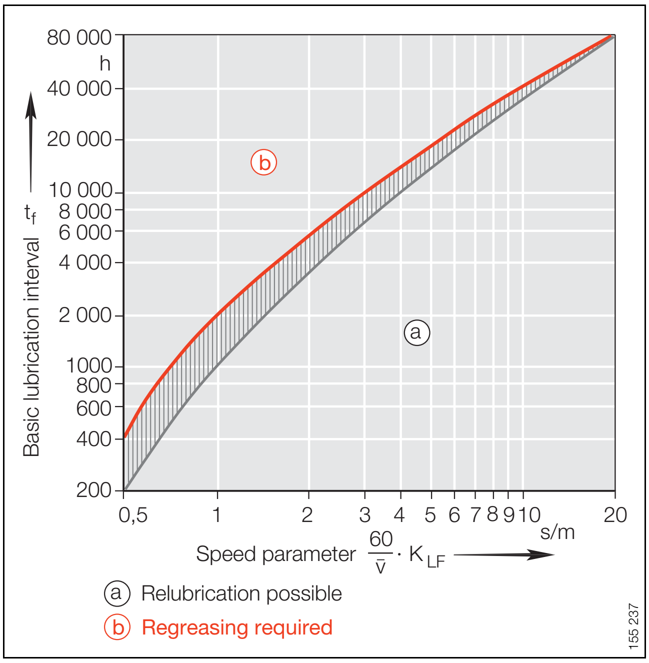


Figure 13 · Determining the basic lubrication interval

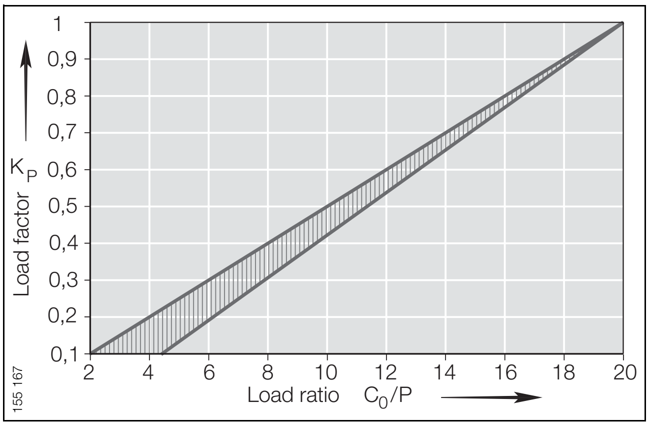


Figure 14 · Load correction factor K_P

Basic lubrication interval

The basic lubrication interval t_f is dependent on the speed parameter. It is determined using Figure 13.

The speed parameter is defined as follows:

$$\text{Speed parameter}: \frac{60}{\bar{v}} \cdot K_{LF}$$

$\bar{v}$ m/min
Mean travel velocity

K_{LF} –
Bearing factor for KUVS: $K_{LF} = 1,5$.

The basic lubrication interval is valid under the following conditions:

- bearing temperature <70 °C
- load ratio $C_0/P = 20$
- lubrication with high quality lithium soap grease
- no disruptive environmental influences
- stroke ratio between 1 and 10.

Load correction factor K_p

The correction factor K_p takes into consideration the greater strain on the lubricating grease at loads $C_0/P < 20$. The factors in Figure 14 are valid only for high quality lithium soap grease.

The preload must be taken into consideration.

Stroke ratio correction factor K_w

The correction factor K_w takes into consideration the travel distance to be lubricated. It is dependent on the stroke ratio und is determined using Figure 15. If the stroke ratio is <1 or >10, the relubrication interval must be shortened in order to reduce possible fretting corrosion.

The stroke ratio is defined as follows:

$$\text{Stroke ratio}: \frac{H \cdot 10}{L_1}$$

L_1 mm
Effective saddle plate length C_1 from *dimension table*

H mm
Stroke length.

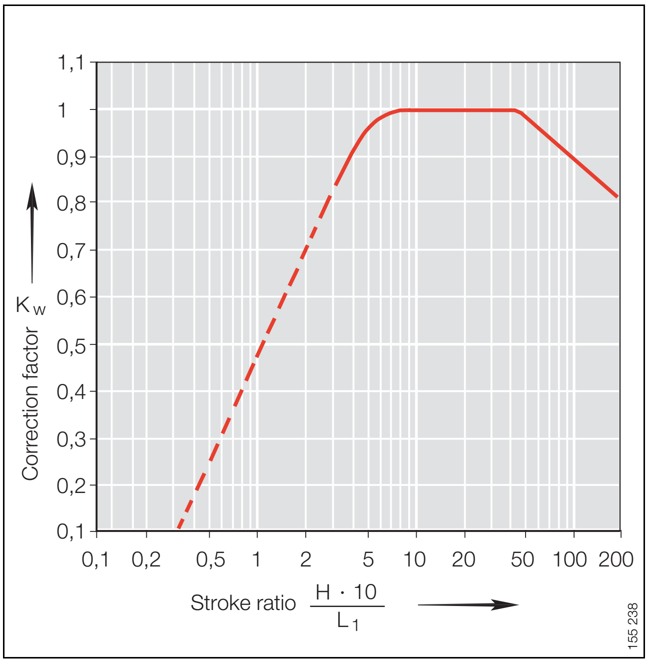


Figure 15 · Stroke ratio correction factor K_w

Environmental correction factor K_u

The correction factor K_u (Table 4) takes into consideration the effect of oscillations, vibration (leading to fretting corrosion) and shocks.

These subject the grease to additional strain.

All calculations are invalid if cooling lubricants or moisture penetrate the system.

Table 4 · Environmental correction factor K_u

Environmental influences	K_u
Slight	1,0
Moderate	0,8
Severe	0,5

The design of a bearing arrangement with linear recirculating ball bearing units KUVS or carriages KWVK..AL is essentially determined by:

- the accuracy
- the rigidity
- the load carrying capacity.

This has a direct influence on the adjacent construction and primarily concerns:

- the geometrical and positional accuracy of the mounting surfaces
- the methods used to locate the guidance elements
- the sealing of the bearing arrangement.

Geometrical and positional accuracy of the mounting surfaces

The higher the requirements for accuracy and smooth running of the guidance system, the more attention must be paid to the geometrical and positional accuracy.

The mounting surfaces, i.e. the support and locating surfaces, should be designed according to the tolerances in Figure 16.

The surfaces can, for example, be produced using grinding or precision milling. The objective should be to achieve a mean roughness of $R_a 1{,}6$.

If the tolerances are not adhered to, the overall accuracy of the guidance system will be impaired, even though linear guidance systems with linear recirculating ball bearing units KUVS or carriages KWVK..AL can partially compensate for inaccuracies.

The dimension ΔH (Figure 16) indicates the possible height offset of the support surface. For linear guidance systems with linear recirculating ball bearing units KUVS or carriages KWVK..AL, the permissible dimension ΔH is:

$$\Delta H = 0{,}2 \cdot b$$

ΔH m
Height offset

b mm
Centre distance between guidance elements.

If the height offset is larger than that calculated using the above formula, this will affect the operating life.

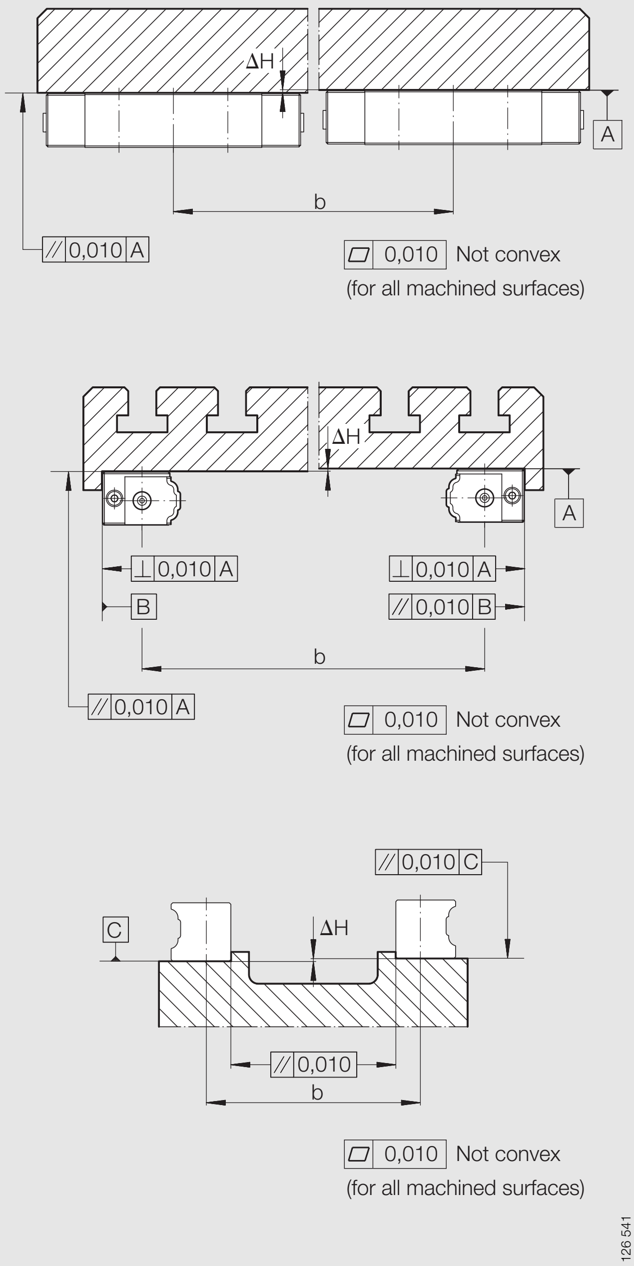


Figure 16 · Tolerances for mounting surfaces

Parallelism of mounted guideways

For two or more guideways parallel to each other, the parallelism according to Table 5 and Figure 16 must be observed.

If the maximum values (Table 5) are used, this may increase the displacement resistance.

Table 5 · Parallelism according to Figure 16 for mounted guideway

Guideway size[1)]	Parallelism t μm
TKVD 14	11
TKVD 19	13
TKVD 32	9
TKVD 42	11
TKVD 69	13

1) In the case of guideways TKVD 14 and TKVD 19, the locating face is the longitudinal face without a raceway.

Location

If high rigidity and high load carrying capacity are required, the guidance elements should be abutted or fixed by means of dowels on both sides against locating faces.

In order to avoid location defects, the holes in the adjacent construction must be carefully deburred.

The heights and corner radii of the locating faces correspond to the dimensions in Table 6 (Figures 17 and 18).

Table 6 · Locating heights and corner radii (Figures 17 and 18)

Size	r_1 max.	h_1	r_2 max.	h_2 max.
KUVS 42	1	5	1	5
KUVS 69	1	5	1	5
KWVK..AL 42	1	7	1	5
KWVK..AL 69	1	12	1	5

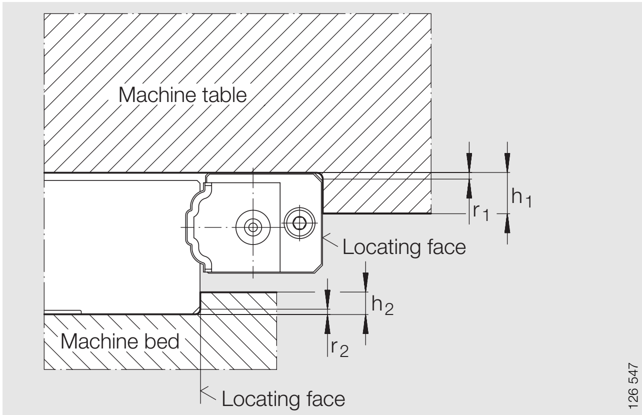


Figure 17 · Locating height and corner radii for linear recirculating ball bearing units KUVS

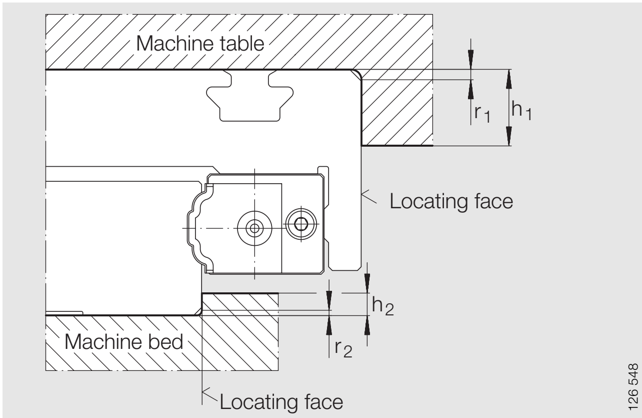


Figure 18 · Locating heights and corner radii for carriages KWVK..AL

Lubricant supply

Lubrication nipples in both end faces facilitate lubrication of the linear recirculating ball bearing unit KUVS. It is als possible to lubricate the linear ball bearing unit from above via a hole (Figure 2, page 4); which need not be closed off if it is not used.

The carriage KWVK..AL is lubricated via the lubrication nipples in the linear recirculating ball bearing units. In addition, a lubrication nipple is inserted on each longitudinal face of the carriage through which lubricant can be pressed into the uppoer hole in the linear recirculating ball bearing units (Figure 3, page 5).

Sealing

The raceways must be kept clean at all times in order to prevent damage to the linear recirculating ball bearing units.

The linear recirculating ball bearing units are protected effectively against contamination by the wipers fitted as standard.

If a guideway is subjected to severe contamination or aggressive media, special measures must be used.
One possibility is to cover the whole linear guidance system, for example by means of a telescopic cover or bellows.

Load carrying capacity and life

The load carrying capacity is described in terms of the basic dynamic load rating C, the basic static load rating C_0 and the basic static moment rating M_0. The dimension tables state the values for C and C_0 as well as M_{0x}, M_{0y} and M_{0z} (Figures 19 and 20).

Basic rating life in 100 000 m

The basic rating life is reached or exceeded by 90% of a sufficiently large group of apparently identical bearings before the first evidence of material fatigue occurs.

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

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

$$L_h = \frac{833}{\frac{\bar{v}}{2}} \cdot \left(\frac{C}{P}\right)^3$$

L m
Basic rating life in 100 000 m

L_h h
Basic rating life in operating hours

C N
Basic dynamic load rating

P N
Equivalent dynamic load

H mm
Single stroke length for reciprocating motion

n_{osc} min^{-1}
Number of return strokes per minute

$\bar{v}$ m/min
Mean travel velocity.

⚠ According to DIN 636-1, the equivalent dynamic load should not exceed P = 0,5 · C.

Basic rating life in 10 000 m

In order to calculate the basic rating life in 10 000 m, the basic load rating C must be multipled by a factor of 1,26; the calculation of life values in 10 000 m is common among Japanese rolling bearing manufacturers.

$$L_{5 \cdot 10^4} = \left(\frac{1{,}26 \cdot C}{P}\right)^3$$

Static load safety factor

The static load safety factor S_0 indicates the security with regard to permissible permanent deformation in the rolling contact without affecting guidance accuracy and smooth running:

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

$$S_0 = \frac{M_0}{M}$$

S_0 –
Static load safety factor

C_0 N
Basic static load rating

P_0 N
Equivalent static bearing load (see “Equivalent bearing load”)

M_0 Nm
Static moment rating in load direction (M_{0x}, M_{0y}, M_{0z})

M Nm
Equivalent static moment in load direction.

If high demands are placed on accuracy and smoothness of running, the static load safety factor should not be less than $S_0 = 3$.

Permissible load

The permissible load is restricted by the load carrying capacity of the raceways and the strength of the screw connections and adjacent construction.

Tensile strength

If the fixing screw threads have sufficient strength, the linear recirculating ball bearing units can be subjected to loads up to the static load carrying capacity C_0 or M_0.

Equivalent bearing load

Variable bearing load

Where the bearing load varies in steps, the equivalent dynamic load is calculated as follows:

$$P = \sqrt[3]{\frac{q_1 \cdot F_1^3 + \ldots + q_z \cdot F_z^3}{100}}$$

P N
Equivalent bearing load

q %
Duration of particular steps

F N
Load applied during the particular step.

The equivalent static bearing load is defined as:

$$P_0 = F_{max}$$

Variable speed

Where the speed varies in steps, the mean speed is calculated as follows:

$$\bar{v} = \frac{q_1 \cdot v_1 + q_2 \cdot v_2 + \ldots + q_z \cdot v_z}{100}$$

$\bar{v}$ m/min
Equivalent dynamic speed

q_i %
Duration as a proportion of the total operating time

v_i m/min
Variable speed.

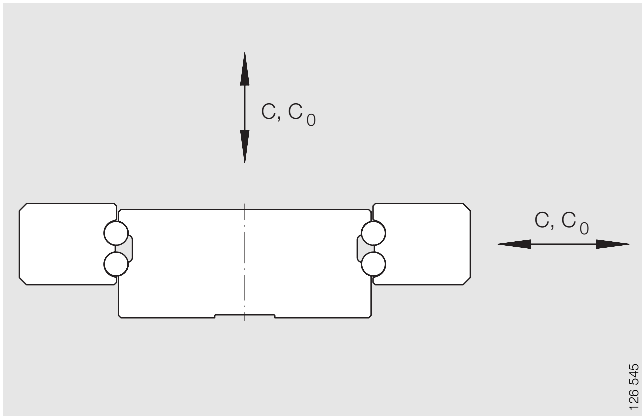


Figure 19 · Load directions

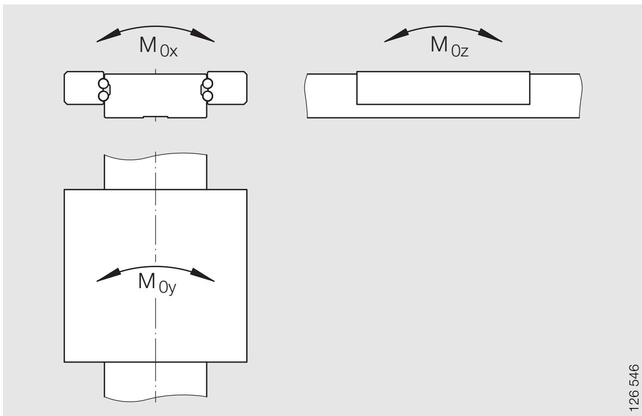


Figure 20 · Moments about x, y and z axes

Ordering example and ordering designation

Linear recirculating ball bearing units with guideway

Data on linear recirculating ball bearing units

Linear recirculating ball bearing units	KUVS
Size	42

Data on guideway with asymmetrical hole pattern

Guideway for linear recirculating ball bearing units	TKVD
Size	42
Guideway length	420 mm
Spacing a_L	20 mm
Spacing a_R	40 mm

Ordering designation:

Item 1:

2×KUVS 42.

Item 2:

1×TKVD 42/420-20/40 (Figure 21).

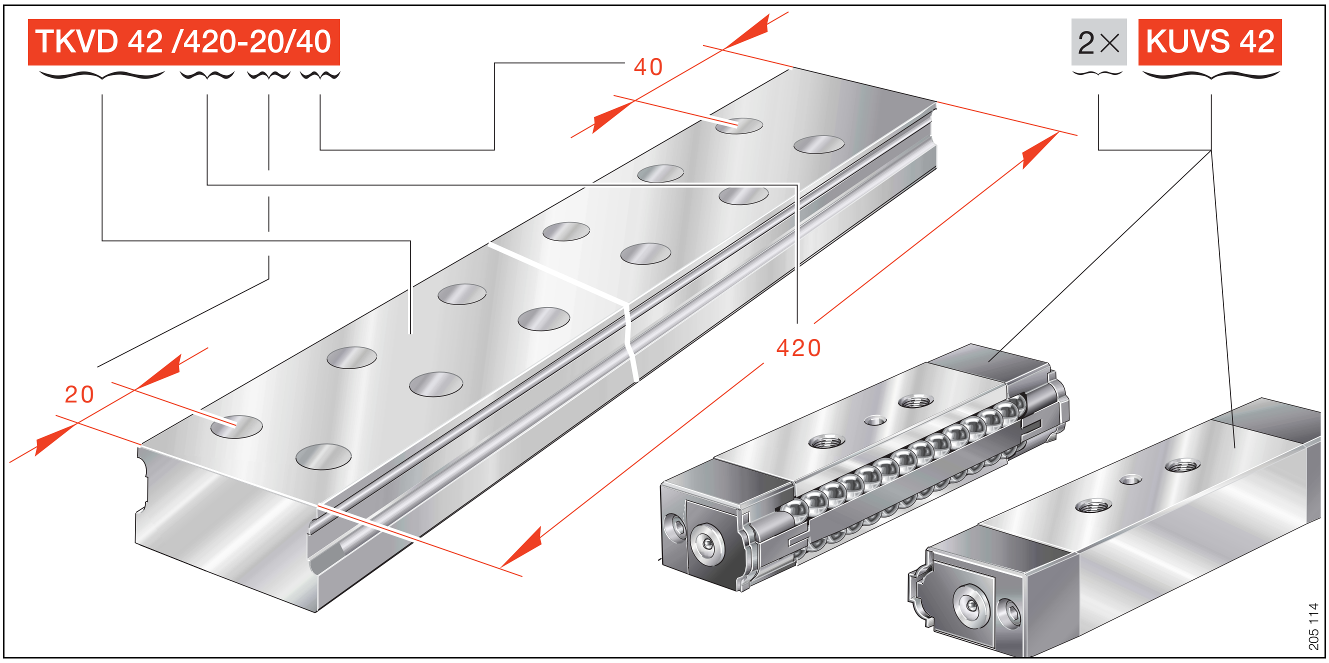


Figure 21 · Ordering example, linear recirculating ball bearing units with guideway

Linear recirculating ball bearing units

Series KUVS

Guideways

Series TKVD

Dimension table · Dimensions in mm

Linear recirculating ball bearing units		Guideway			Dimensions						Mounting dimensions				
Designation	Mass m ≈kg	Designation	Mass m ≈kg/m	Closing plug	H	B	L	h	b	l_{max}[3]	A_1	A_2	J_B	B_1	j_B
KUVS 32	0,025	**TKVD 32**	2,3	KA 8 TN	11	51,6	47	10	31,8	2 000	9,9	5,5	40,6	–	18
KUVS 42	0,085	**TKVD 42**	5,54	KA 8 TN	19	75	71	18	42	2 000	16,5	10	55	–	24
KUVS 42	0,085	**TKVD 14**	1,45	KA 8 TN	15	30	71	14	13,5	1 500	16,5	10	–	32,4	6
KUVS 69	0,2	**TKVD 69**	12,42	KA 11 TN	25	114	96	24	69	2 000	22,5	13	88	–	40
KUVS 69	0,2	**TKVD 19**	2,66	KA 11 TN	20	43	96	19	19,5	2 000	22,5	13	–	44,4	8

[1] For to two linear recirculating ball bearing units in the case of TKVD 32, TKVD 42 and TKVD 69, one linear recirculating ball bearing unit in the case of TKVD 14 and TKVD 19.

[2] The usable load carrying capacity is influenced by the connections between the guidance elements and the adjacent construction.

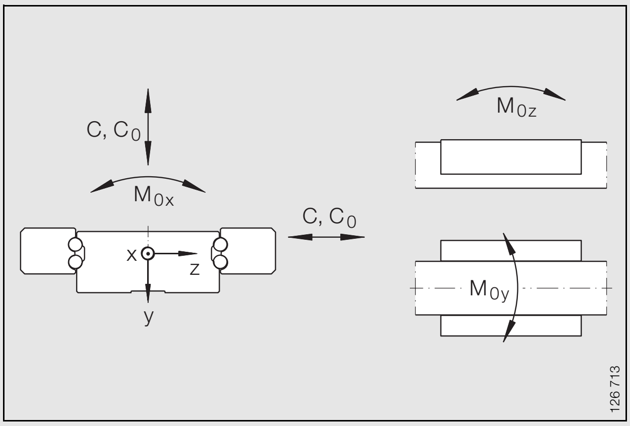
[3] Maximum length l_{max} of single-piece guideways, longer guideways are supplied in several sections and are marked accordingly.

[4] The dimensions a_L and a_R are dependent on the guideway length, for calculation see page 7.

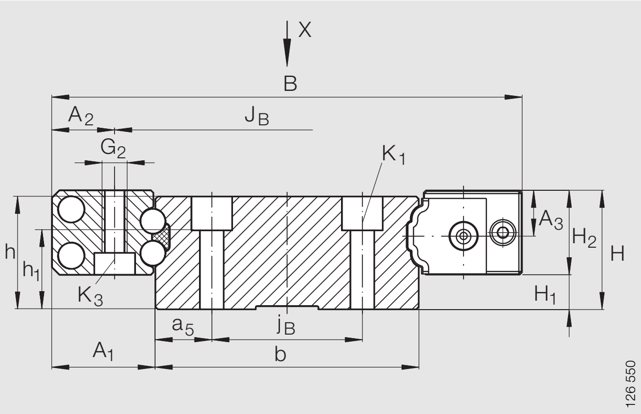
[5] If there is a possibility of settling, the fixing screws should be secured against rotation.

Thread and screw diameters and tightening torques[5]

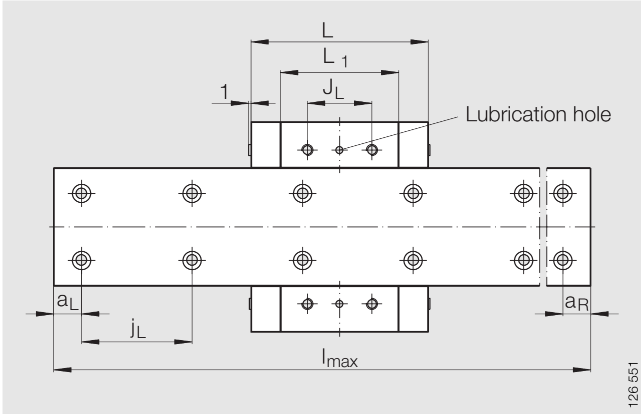
Designation	K_1 for screw to ISO 4762-12.9		G_2 for screw to ISO 4762-12.9		K_3 for screw to ISO 4762-12.9	
		Nm max.		Nm max.		Nm max.
KUVS 32	M3	2,5	M3	1,5	–	–
KUVS 42	M3	2,5	M4	3	M3	2,5
KUVS 42	M3	2,5	M4	3	M3	2,5
KUVS 69	M5	10	M6	10	M5	10
KUVS 69	M5	10	M6	10	M5	10



Load directions

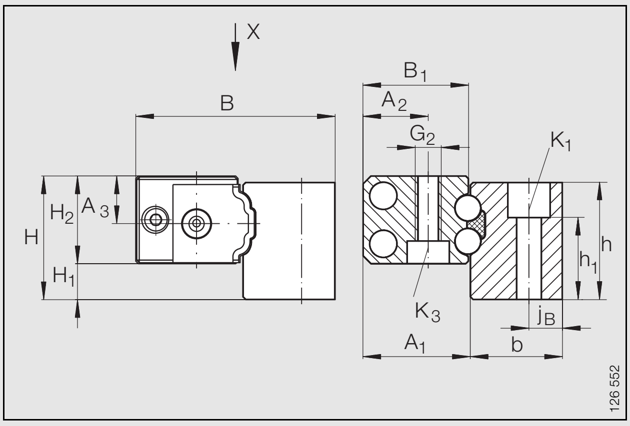


Two KUVS with TKVD 32, TKVD 42 and TKVD 69

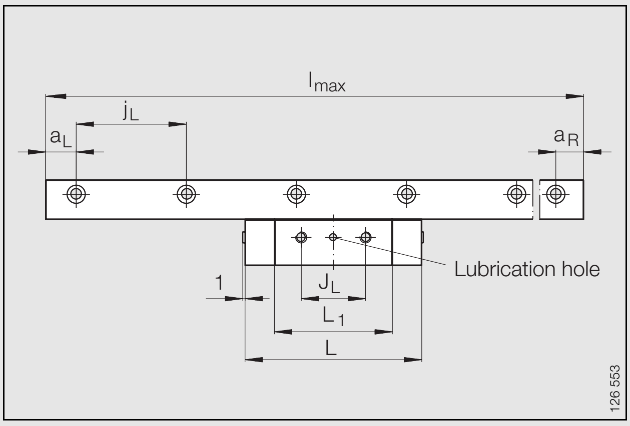


View X (rotated through 90°)

												Load carrying capacity[1)2)]				
a_5	L_1	J_L	j_L	$a_{L\,min}$[4)]	$a_{L\,max}$[4)]	$a_{R\,min}$[4)]	$a_{R\,max}$[4)]	H_1	H_2	A_3	h_1	C	C_0	M_{0x}	M_{0y}	M_{0z}
												kN	kN	Nm	Nm	Nm
6,9	29,8	15	40	5	35	5	35	0,5	10,5	6	3,1	5,7	10,6	203	51	51
9	48,5	20	60	5	55	5	55	5,5	13,5	7,3	11,1	13,5	26	648	211	211
–	48,5	20	60	5	55	5	55	1,5	13,5	7,3	7,1	6,75	13	–	–	–
14,5	64	35	60	7	53	7	53	7,5	17,5	9,5	15,1	26	46,5	1872	492	492
–	64	35	60	7	53	7	53	2,5	17,5	9,5	10,1	13	23,25	–	–	–



KUVS with TKVD 14, TKVD 19 (view and section)



View X (rotated through 90°)

Carriages

Series KWVK..AL

Guideways

Series TKVD

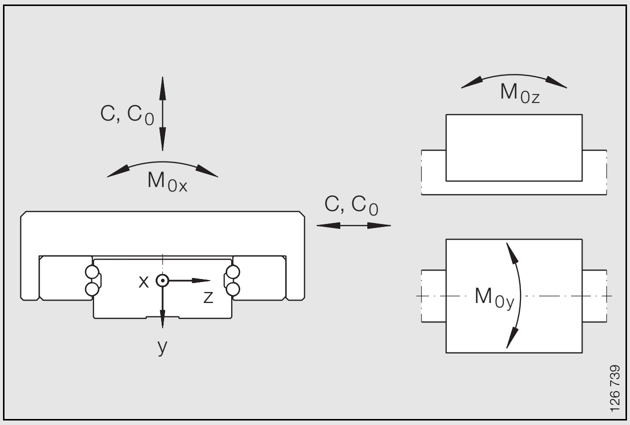
Dimension table · Dimensions in mm

Carriages		Guideway			Dimensions						Mounting dimensions					
Designation	Mass m ≈kg	Designation	Mass m ≈kg/m	Closing plug	H	B	L	h	b	l_{max}	A_1	A_2	J_B	j_B	a_5	B_6
KWVK 32 AL	0,17	**TKVD 32**	2,3	KA 8 TN	26	62	50	10	31,8	2000	15,1	10,7	40,6	18	6,9	51,6
KWVK 42 AL	0,45	**TKVD 42**	5,54	KA 8 TN	35	87	75	18	42	2000	22,5	16	55	24	9	75
KWVK 69 AL	1,1	**TKVD 69**	12,42	KA 11 TN	47	130	100	24	69	2000	30,5	21	88	40	14,5	114

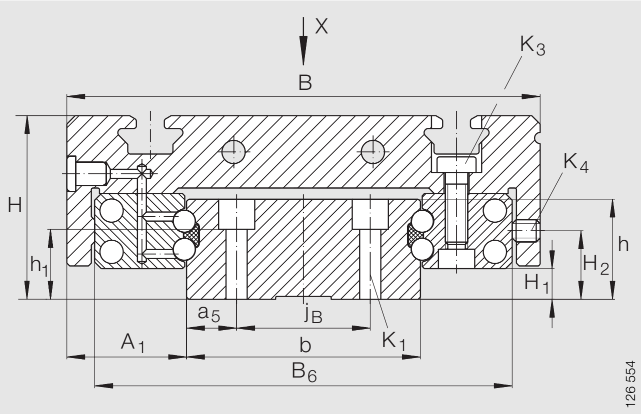
[1] The usable load carrying capacity is influenced by the connections between the guidance elements and the adjacent construction.
[2] Maximum length l_{max} of single-piece guideways, longer guideways are supplied in several sections and are marked accordingly.
[3] The dimensions a_L and a_R are dependent on the guideway length, for calculation see page 7.
[4] If there is a possibility of settling, the fixing screws should be secured against rotation.

Thread and screw diameters and tightening torques[4]

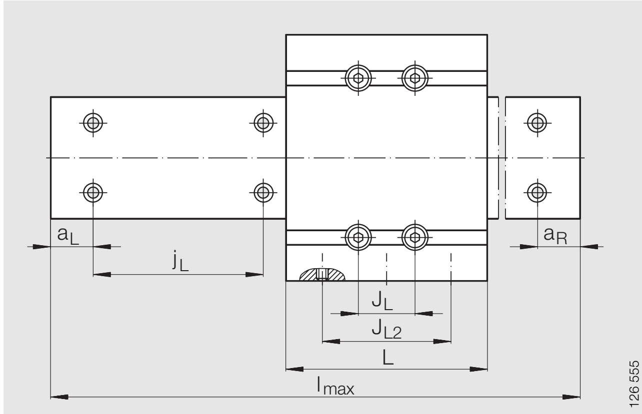
Designation	K_1 for screw to ISO 4762-12.9		K_3 for screw to ISO 4762-12.9		K_4 for screw to ISO 4762-12.9
		Nm max.		Nm max.	
KWVK 32 AL	M3	2,5	M3	0,6	M3
KWVK 42 AL	M3	2,5	M4	2,1	M4
KWVK 69 AL	M5	10	M6	4,8	M6



Load directions

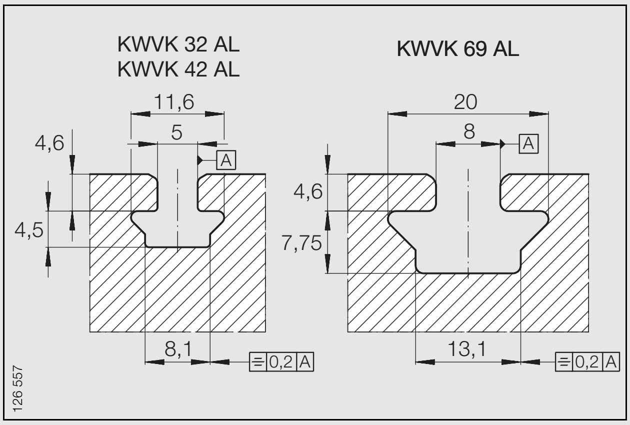


KWVK..AL on TKVD

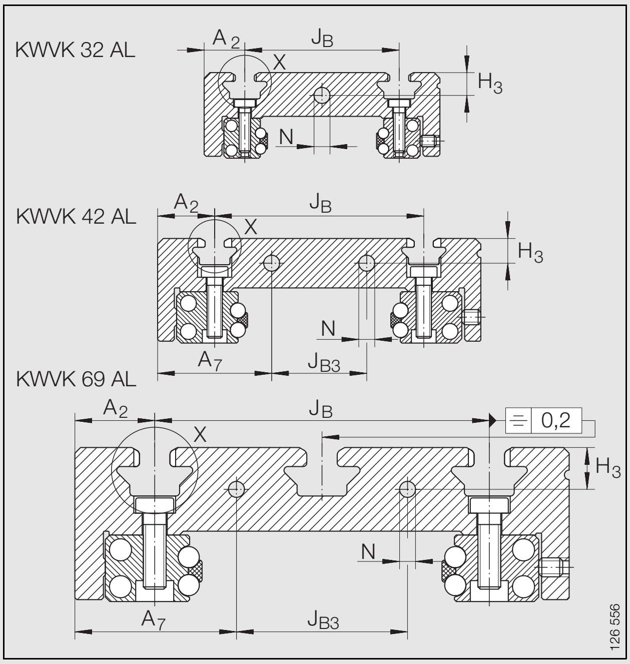


View X (rotated through 90°)

	A_7	J_{B3}	J_L	J_{L2}	j_L	$a_{L\,min}$[3]	$a_{L\,max}$[3]	$a_{R\,min}$[3]	$a_{R\,max}$[3]	N	H_1	H_2	h_1	H_3	Load carrying capacity[1] C kN	C_0 kN	M_{0x} Nm	M_{0y} Nm	M_{0z} Nm
	–	–	15	25	40	5	35	5	35	4,2	0,5	6	3,1	7,5	5,7	10,6	203	51	51
	31	25	20	40	60	5	55	5	55	4,2	5,5	12	11,1	8	13,5	26	648	211	211
	42,5	45	35	55	60	7	53	7	53	4,2	7,5	17	15,1	11	26	46,5	1872	492	492



Detail X



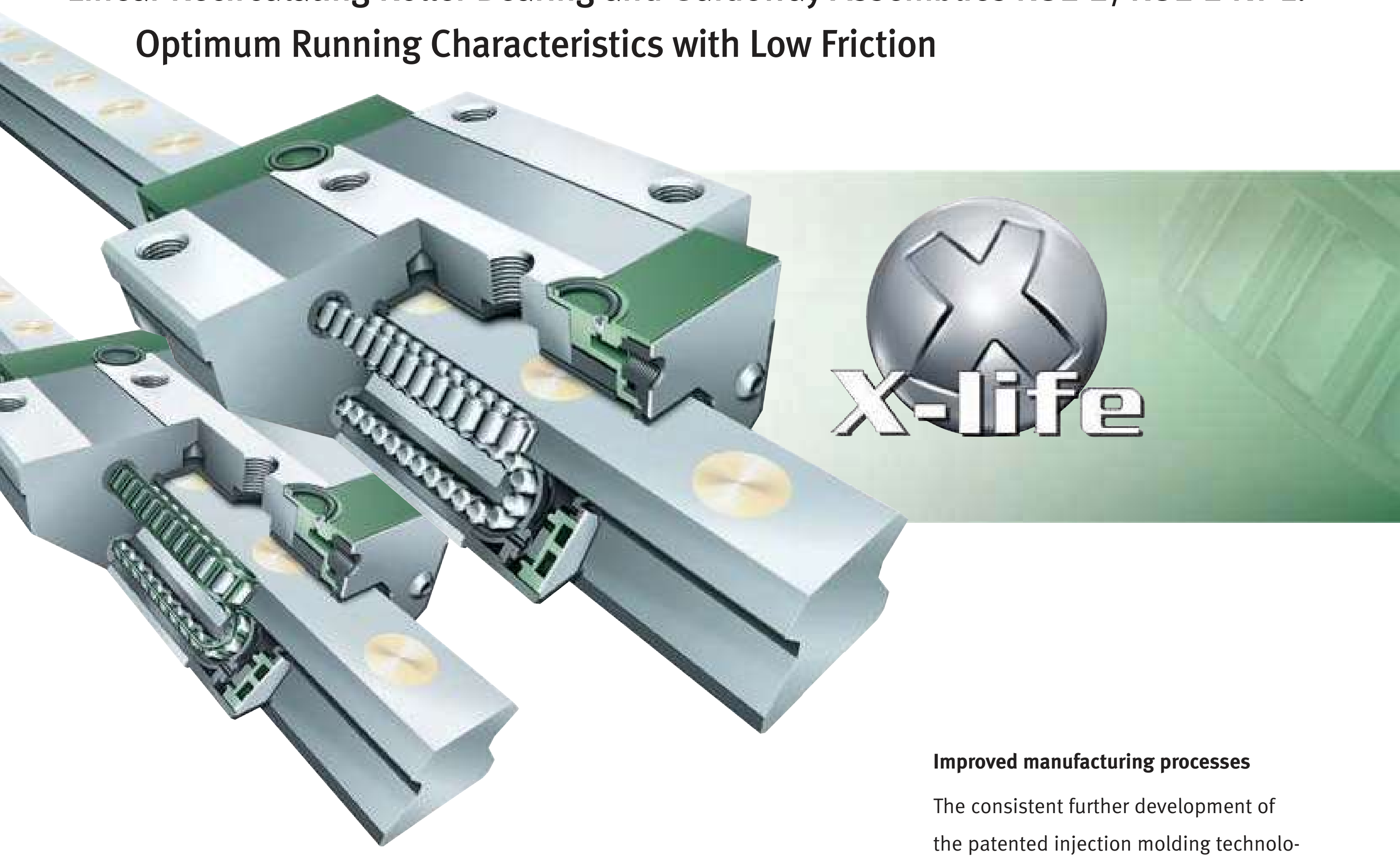
Cross-section of carriages KWVK..AL

Linear Recirculating Roller Bearing and Guideway Assemblies

Series RUE-E / RUE-E-KT-L

SCHAEFFLER GROUP
INDUSTRIAL

Linear Recirculating Roller Bearing and Guideway Assemblies RUE-E / RUE-E-KT-L: Optimum Running Characteristics with Low Friction



High load ratings, robust design, high rigidity and high precision, together with excellent sealing, are the most important conditions that must be fulfilled by linear roller bearing and guideway assemblies in production machinery. Speeds of up to 4 m/s (size 35) and accelerations up to 100 m/s^2 are further performance standards that must be achieved.

If you value products that are easy to fit and maintain as well as a precisely matched range of accessories, the Schaeffler Group and its Linear Technology Division is the ideal partner for you. This is because we offer not just products, but complete system solutions. System solutions that can often be easily configured on a modular basis and with excellent levels of cost-effectiveness.

The newest generation of linear roller bearing and guideway assemblies RUE-E / RUE-E-KT-L are robust monorail guidance systems with very high load carrying capacity and rigidity. With their smooth, uniform running characteristics, high dynamics and wide range of accessories, they are the ideal linear guidance system for moving heavy loads with precise linear travel.

In conjunction with efficient seals, the units have a long operating life even under extreme operating conditions. Type RUE-E-KT-L offers a low-noise solution with a rolling element chain.

Improved manufacturing processes

The consistent further development of the patented injection molding technology has lead to the unprecedented quality of the linear roller bearing and guideway assembly RUE-E / RUE-E-KT-L.

- Perfect rolling element guidance in the load and return zones, optimized transitions and the best possible running characteristics with very low stroke pulsation
- More robust rolling element guidance due to a reduction in the number of components
- Improved protection against contamination due to labyrinth seals on the rolling element recirculation system
- Uniform lubricant distribution due to the completely closed and sealed lubrication duct.

D e s i g n

Efficient sealing concept

- Standard seals: single lip upper seals, double lip lower sealing strips as well as double lip end wipers
- Various other sealing arrangements are available as an option

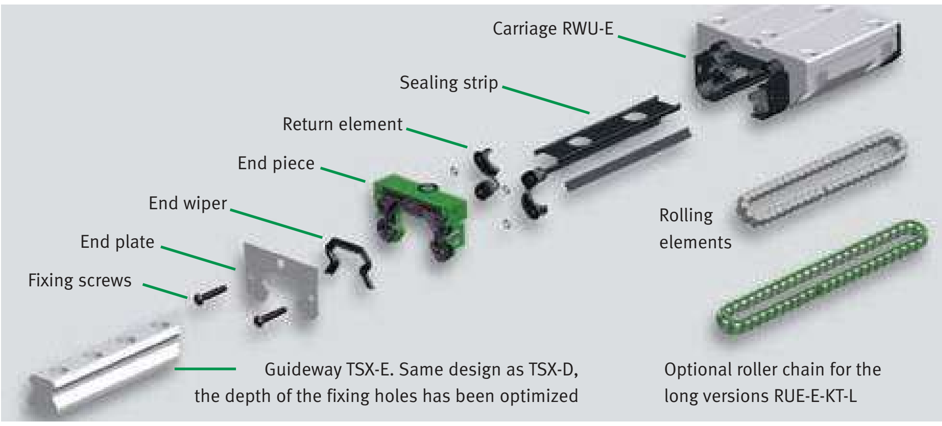
The end plates fitted as standard in front of the contact end wipers offer additional protection against coarse contaminants, which means the contact end wipers retain their full performance capability even in environments with fine, often aggressive particles.

Integrated lubricant reservoir

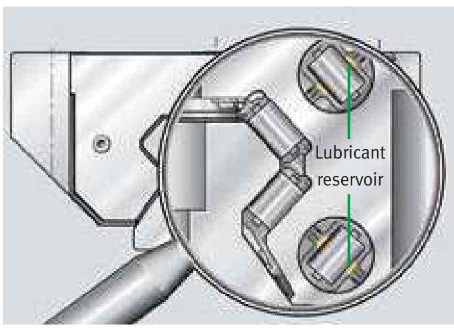
The rolling elements are always supplied with sufficient lubricant thanks to the position of the lubricant reservoir and the patented injection molding technique used in its production.

Only available from INA Linear Technology

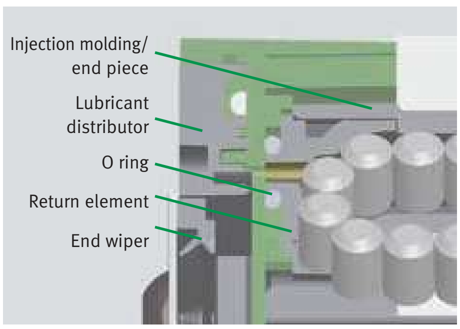
INA linear roller bearing and guideway assemblies RUE-E and RUE-E-KT-L enable a unique combination of the “full complement” principle and “chain systems” in a single guidance system concept. The low-noise rolling element chain system is only available for long carriages, since these offer the best compensation for the reduction in load carrying capacity and rigidity caused by the chain.



Design of the linear roller bearing and guideway assembly RUE-E

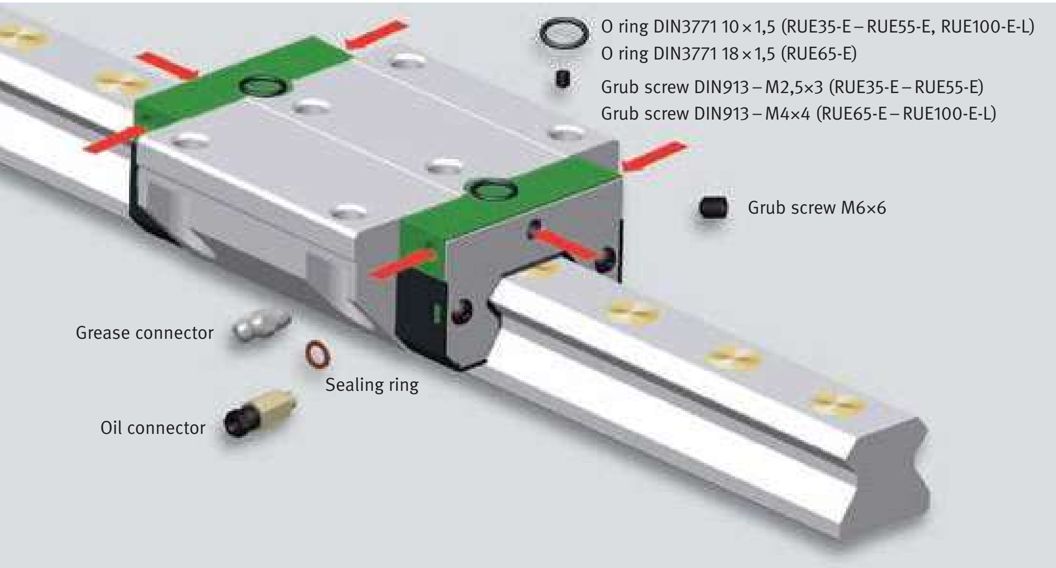


Cross-section of carriage



Longitudinal section of carriage

Permanent Lubrication



Lubricant supply

Permanent Lubrication

The design of the lubricant distribution ducts and their position in the end piece make a significant contribution to ensuring that the four rows of rolling elements are constantly supplied with fresh lubricant.

The advantages include:

- Uniform supply irrespective of position
- Defined lubricant access holes in the return element units

Lubrication set

Every linear roller bearing and guideway assembly RUE-E / RUE-E-KT-L is supplied with a lubrication fitting set. This contains all the relevant components for connection to the lubricant supply.

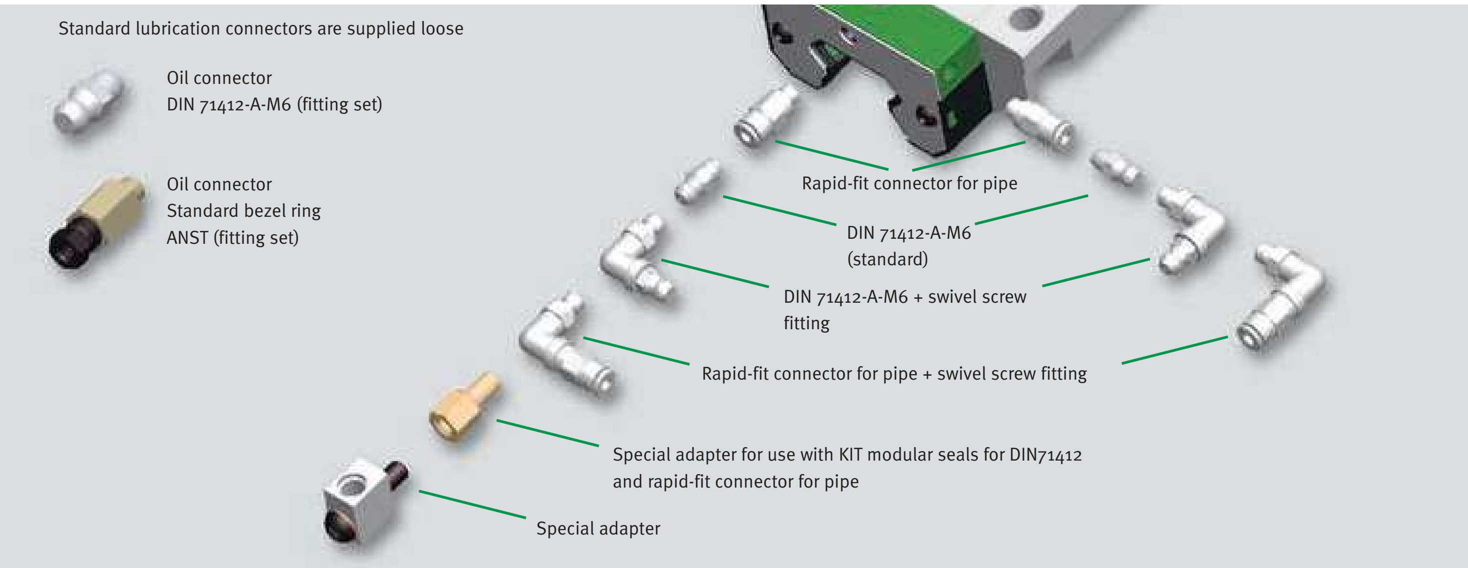
Connector positions

Linear roller bearing and guideway assemblies RUE-E / RUE-E-KT-L offer flexibility in the positioning of lubrication connectors so that they can be easily matched to the adjacent construction:

- From above through the adjacent construction directly into the end piece
- From either side of the end pieces
- From the end.

The connectors are suitable for supply systems with oil, grease and flowable grease.

Easy To Assemble



Connectors for oil or grease lubrication

Connector components

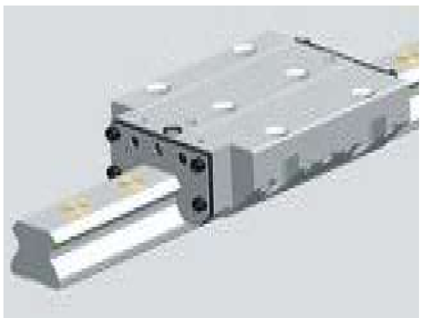
Linear roller bearing and guideway assemblies RUE-E / RUE-E-KT-L can be lubricated via a wide range of standardized connectors. These include standardized oil and grease supply connectors, adapters, etc.

Clamping element RUKS

The hydraulic clamping element is primarily used for the locking in place of machining axes. The axial clearance in the direction of travel can also be minimized. This can be retrofitted at any time to linear roller bearing and guideway assemblies RUE..-E / RUE..-E-KT-L.

The advantages include:

- High clamping force with simple fitting within the design envelope of a linear roller bearing and guideway assembly
- Optimized cutting and machining accuracy of high performance machines
- Prevention of micromovements under oscillating load
- Improvements in the axial rigidity of the clamped axis.



Clamping element RUKS

Damping carriage RUDS

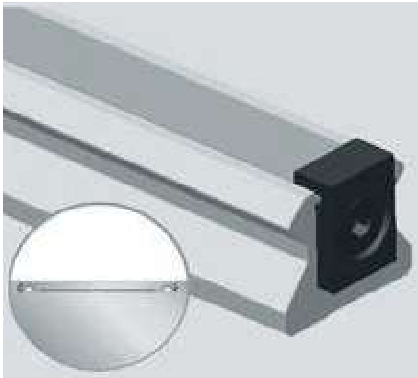
The damping carriage is highly effective in reducing vibrations on the guideway. It glides on an oil film between the damping carriage and the guideway. During fitting, the ready-to-fit carriage is simply screwed onto the adjacent construction; it is positioned in front of or behind the linear roller bearing and guideway assembly depending on the type of vibration involved.

The advantages include:

- Effective damping of the linear axes by means of the squeeze film effect
- Impulse lubrication or pressure-free oil feed
- Additional crash safety of the guidance system
- Increases in the surface quality of workpieces due to “chatter-free” machining, even at limiting loads.

Damping carriage RUDS

Reliable Operation



Guideway covering strip ADB-K

Guideway covering strip ADB-K

The strip is made of a roll-bonded composite material and is simply clamped in the groove on both sides to close off the guideway surface flush with the sides. This provides an optimum surface for wiping.

A fitting device makes fitting quick and precise, especially in the case of long axes.

The covering strips can be supplied in coils up to 300 meters long and can be customized according to requirements.

The advantages include:

- Flush connection with the surface of the guideway
- Secure retention and protection by geometrical locking
- Good sealing action against cooling lubricants.

Braking and clamping element BKE.TSX

Braking and clamping element BKE.TSX

This important safety element slows down the linear axis safely if the power drops or if the control system fails. Driven axes that do not have their own braking or clamping function are stopped instantly and reliably without any input of external energy, giving protection for personnel and machinery.

The advantages include:

- Also suitable for use as an emergency stop brake
- Reaction time less than 40 milliseconds
- Secure, powerful braking of linear axes
- Cost-effective, maintenance-free system
- Compact solution within the design envelope of the linear roller bearing and guideway assembly
- Clearance-free brake shoes with automatic wear compensation.

Hydraulic fitting device MVH-D-A

Hydraulic fitting device MVH-D-A

This portable device has been specially designed for pressing brass closing plugs easily and securely into the guideway fixing holes.

The advantages include:

- Simple fitting of the brass plug flush with the surface in a single operation
- Currently the best solution on the market in terms of technology and cost-effectiveness.

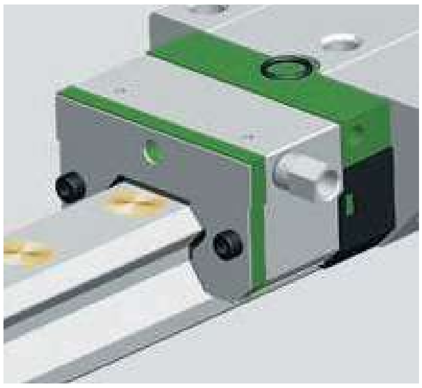
Practical Service Packages

KIT modular system
“minimal lubricant quantity metering unit”

The lubricant metering unit can be connected to all conventional central lubrication systems. The direct lubricant feed into the recirculation system ensures that the linear roller bearing and guideway assemblies RUE-E / RUE-E-KT-L are always supplied with the correct quantity of lubricant.

The advantages include:

- Economical use of lubricants due to precise metering of the smallest possible quantity
- Reliable lubrication in all mounting positions
- Easy connection to the lubrication system
- Lubricant supply can be monitored.



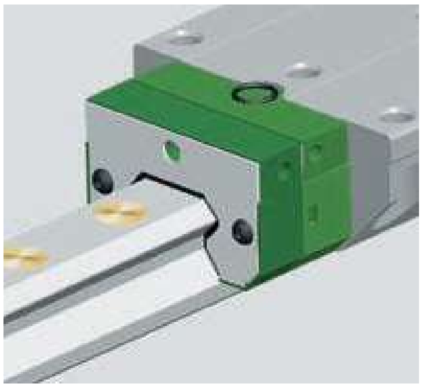
KIT modular system
“minimal lubricant quantity metering unit”

KIT modular system
“long term lubrication unit”

The operating life of linear roller bearing and guideway assemblies RUE-E / RUE-E-KT-L can be significantly extended with the large-volume “long term lubrication unit” from INA Linear Technology. Premounted “long term lubrication units” are ready for immediate use.

The advantages include:

- High capacity lubricant reservoir
- Lubricant supply irrespective of position
- Minimized lubricant discharge from the guidance system due to a double lip end wiper
- Lower operating and maintenance costs due to longer maintenance intervals
- Absolutely maintenance-free depending on environmental and operating conditions.



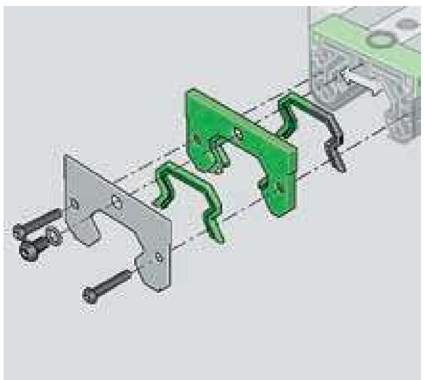
KIT modular system “long term lubrication unit”

KIT modular system “seals”

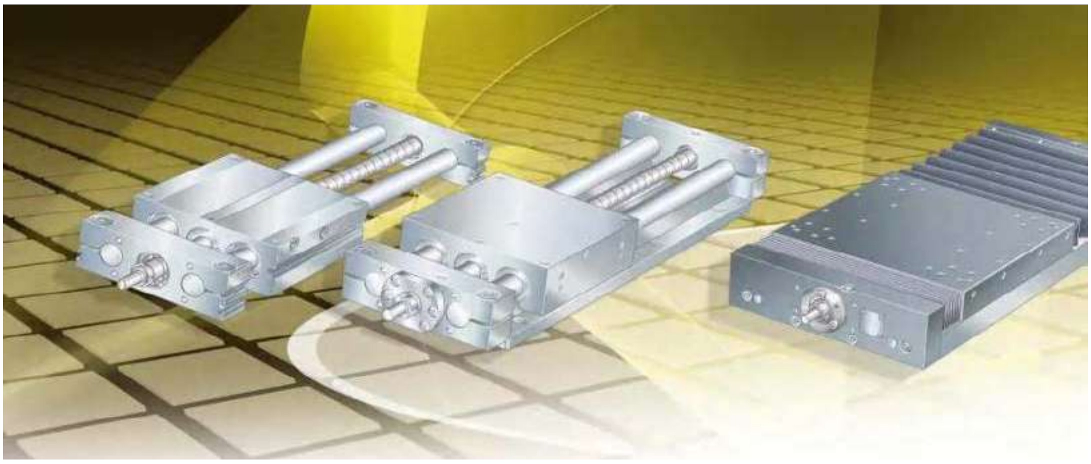
The configuration of these matched seal elements is based on practical experience. Single lip or double lip end seals and sealing strips made from proven sealing material are available.

The advantages include:

- Versatile use of various seal elements, including cascade arrangements
- Customer-specific configurations are available on request
- Little fitting work required, easy retrofitting, quick and easy to replace
- Simple, easily predictable stockholding
- Positioning freely selectable.

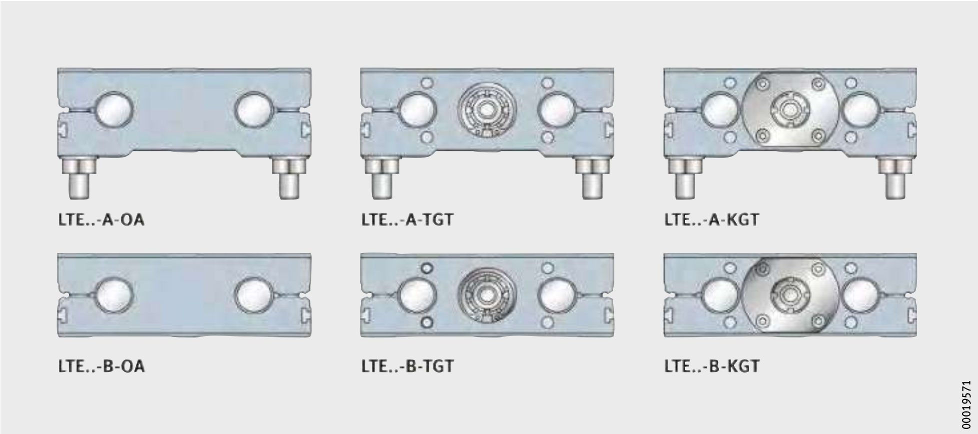


KIT modular system “seals”

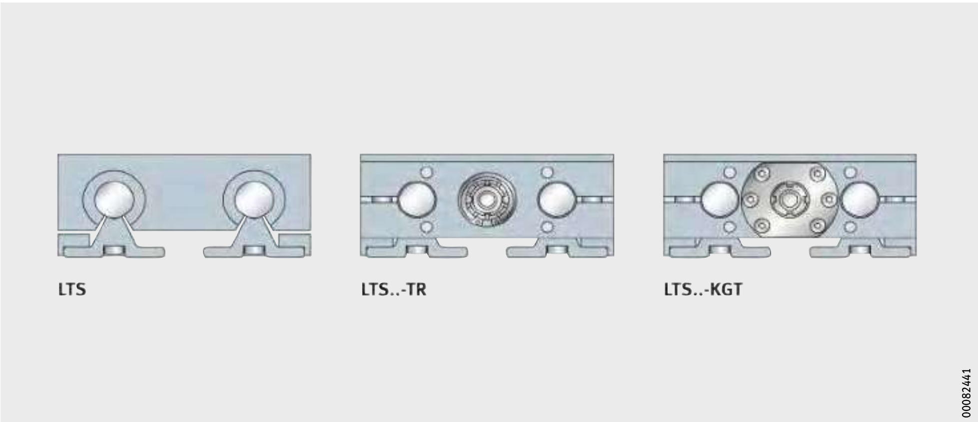


Linear tables

Closed shaft guidance system
Open shaft guidance system
High precision linear tables



LTE..-A-OA
LTE..-A-TGT
LTE..-A-KGT
LTE..-B-OA
LTE..-B-TGT
LTE..-B-KGT
00019571



LTS
LTS..-TR
LTS..-KGT
00082441

LTP
LTPG
00019573

Linear tables with closed shaft guidance system

Linear table	Characteristics					
	Size	Width B_1, B_3 mm	Height H mm	Length of carriage unit L mm	Total length[1] L_{tot} mm	Load carrying capacity
LTE Without drive	LTE08	65	24	65	1 000	From all directions
	LTE12	85	34	85	1 200	
	LTE16	100	38	100	1 400	
	LTE20	130	48	130	1 800	
	LTE25	160	58	160	2 000	
	LTE30	180	67	180	2 200	
	LTE40	230	84	230	2 500	
	LTE50	280	100	280	2 500	
LTE With trapezoidal screw drive	LTE16	100	38	100	1 400	From all directions
	LTE20	130	48	130	1 800	
	LTE25	160	58	160	2 000	
	LTE30	180	67	180	2 200	
	LTE40	230	84	230	2 500	
	LTE50	280	100	280	2 500	
LTE With ball screw drive	LTE16	100	38	100	1 400	From all directions
	LTE20	130	48	130	1 800	
	LTE25	160	58	160	2 000	
	LTE30	180	67	180	2 200	
	LTE40	230	84	230	2 500	
	LTE50	280	100	280	2 500	

[1] Appropriate maximum total length of linear tables LTE taking account of deflection.

[2] Maximum axial load $F_{a\,max}$ on spindle bearing arrangement (locating bearing).

Basic load ratings of shaft guidance system		Screw drive		Basic load ratings of nut		Maximum travel velocity	Maximum acceleration	Repeat accuracy		Operating temperature	Mounting position
dyn. C	stat. C_0	$\varnothing d_0$	P	dyn. C	stat. C_0			Single nut	Double nut, preloaded		
N	N	mm	mm	N	N	m/s	m/s^2	mm	mm	°C	
630	860	Without drive				5	50	–	–	0 to +80	Horizontal and vertical
1 420	1 540										
1 870	2 120										
4 140	4 920										
7 390	8 880										
9 500	11 400										
15 830	17 600										
22 950	25 200										
1 870	2 120	12	3	–	630 [2)]	0,075	2,5	–	±0,25	0 to +80	Horizontal and vertical
4 140	4 920	16	4		2 250 [2)]	0,1					
7 390	8 880	16	4								
9 500	11 400	20	4		2 230 [2)]						
9 500	11 400	20	8			0,2					
15 830	17 600	24	5		2 500 [2)]	0,125					
15 830	17 600	24	10			0,25					
22 950	25 200	32	6		5 530 [2)]	0,15					
1 870	2 120	12	4	4 900	6 600	0,3	20	±0,05	–	0 to +80	Horizontal and vertical
			5	4 400	6 800	0,375					
4 140	4 920	16	5	9 300	13 100	0,25	20	±0,05	±0,025	0 to +80	Horizontal and vertical
			10	15 400	26 500	0,75			–		
7 390	8 880	16	5	9 300	13 100	0,25	20	±0,05	±0,025	0 to +80	Horizontal and vertical
			10	15 400	26 000	0,75					
9 500	11 400	20	5	10 500	16 600	0,29	20	±0,05	±0,025	0 to +80	Horizontal and vertical
			10	12 700	22 100	0,5					
			20	11 600	18 400	1,16			–		
			50	13 000	24 600	2,9					
15 830	17 600	25	5	12 300	22 500	0,25	20	±0,05	±0,025	0 to +80	Horizontal and vertical
		32	10	33 400	54 500	0,5					
			20	29 700	59 800	1					
			40	14 900	32 400	2			–		
22 950	25 200	25	5	12 300	22 500	0,25	20	±0,05	±0,025	0 to +80	Horizontal and vertical
		32	10	33 400	54 500	0,5					
			20	29 700	59 800	1					
			40	14 900	32 400	2			–		

Linear tables with open shaft guidance system

Linear table	Characteristics					
	Size	Width B_1, B_3, B_4 mm	Height H mm	Length of carriage unit L mm	Total length without bellows L_{tot} mm	Load carrying capacity
LTS Without drive	LTS12	85	40	85	6 000	From all directions
	LTS16	100	48	100		
	LTS20	130	57	130		
	LTS25	160	66	160		
	LTS30	180	77	180		
	LTS40	230	95	230		
	LTS50	280	115	280		
LTS With trapezoidal screw drive	LTS16	100	48	100	2 900	From all directions
	LTS20	130	57	130		
	LTS25	160	66	160		
	LTS30	180	77	180		
	LTS40	230	95	230		
	LTS50	280	115	280		
LTS With ball screw drive	LTS16	100	48	100	2 900	From all directions
	LTS20	130	57	130	5 850	
	LTS25	160	66	160		
	LTS30	180	77	180		
	LTS40	230	95	230		
	LTS50	280	115	280		

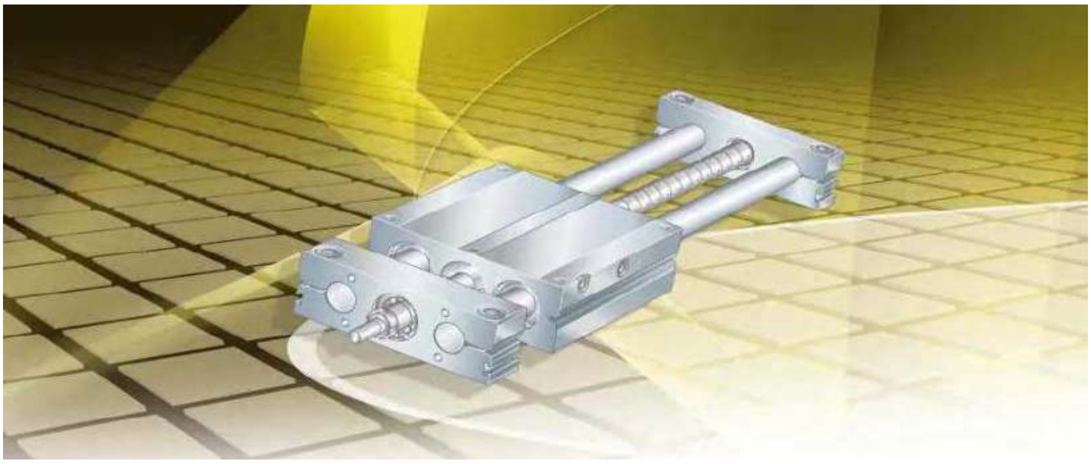
[1] Maximum axial load $F_{a\,max}$ on spindle bearing arrangement (locating bearing).

Basic load ratings of shaft guidance system		Screw drive		Basic load ratings of nut		Maximum travel velocity	Maximum acceleration	Repeat accuracy		Operating temperature	Mounting position
dyn. C	stat. C_0	$\varnothing d_0$	P	dyn. C	stat. C_0			Single nut	Double nut		
N	N	mm	mm	N	N	m/s	m/s^2	mm	mm	°C	
1 580	1 780	Without drive				5	20	–		0 to +80	Horizontal and vertical
2 110	2 480										
4 220	5 120										
7 520	9 200										
9 760	12 000										
16 100	18 400										
23 480	26 400										
2 110	2 480	12	3	–	630 1)	0,075	2,5	–	±0,25	0 to +80	Horizontal and vertical
4 220	5 120	16	4		2 250 1)	0,1					
7 520	9 200	16	4								
9 760	12 000	20	4		2 530 1)						
			8			0,2					
16 100	18 400	24	5		2 500 1)	0,125					
			10			0,25					
23 480	26 400	32	6		5 530 1)	0,15					
2 110	2 480	12	4	4 900	6 600	0,3	20	±0,05	–	0 to +80	Horizontal and vertical
			5	4 400	6 800	0,25					
4 200	5 120	16	5	9 300	13 100	0,25			±0,025		
			10	15 400	26 500	0,75			–		
7 520	9 200	16	5	9 300	13 100	0,25			±0,025		
			10	15 400	26 500	0,75					
9 760	12 000	20	5	10 500	16 600	0,29			±0,025		
			10	12 700	22 100	0,5					
			20	11 600	18 400	1,16			–		
			50	13 000	24 600	2,9					
16 100	18 400	25	5	12 300	22 500	0,25			±0,025		
		32	10	33 400	54 500	0,5					
			20	29 700	59 800	1					
			40	14 900	32 400	2			–		
23 480	26 400	25	5	12 300	22 500	0,25			±0,025		
		32	10	33 400	54 500	0,5					
			20	29 700	59 800	1					
			40	14 900	32 400	2			–		

High precision linear tables with linear recirculating ball bearing and guideway assemblies

Linear table	Characteristics					
	Size	Width B_4 mm	Height H mm	Length of carriage unit L mm	Total length L_{tot} mm	Load carrying capacity
LTP **LTPG** With ball screw drive	LTP15-185 LTPG15-185	185	75	180	3 500	From all directions
	LTP15-275 LTPG15-275	275	75	270	3 500	From all directions
	LTP25-325	325	100	320	3 500	From all directions
	LTPG25-325	325	100	320	3 500	From all directions

	Basic load ratings of monorail guidance system		Screw drive		Basic load ratings of nut		Maximum travel velocity	Maximum accel-eration	Repeat accuracy		Operating tempera-ture	Mounting position
	dyn. C	stat. C_0	∅ d_0	P	dyn. C	stat. C_0			Single nut	Double nut		
	N	N	mm	mm	N	N	m/s	m/s^2	mm	mm	°C	
	17 150	36 800	20	5	10 500	16 600	0,29	20	±0,05	±0,025	0 to +80	Horizontal and vertical
				10	12 700	22 100	0,5					
				20	11 600	18 400	1,16			–		
				50	13 000	24 600	2,9					
	17 150	36 800	20	5	10 500	16 600	0,29	20	±0,05	±0,025	0 to +80	Horizontal and vertical
				10	12 700	22 100	0,5					
				20	11 600	18 400	1,16			–		
				50	13 000	24 600	2,9					
	47 200	83 600	32	5	21 500	49 300	0,215	20	±0,05	±0,025	0 to +80	Horizontal and vertical
				10	33 400	54 500	0,43					
				20	29 700	59 800	0,86					
				40	14 900	32 400	1,73			–		
	73 900	268 000	32	5	21 500	49 300	0,215	20	±0,05	±0,025	0 to +80	Horizontal and vertical
				10	33 400	54 500	0,43					
				20	29 700	59 800	0,86					
				40	14 900	32 400	1,73			–		



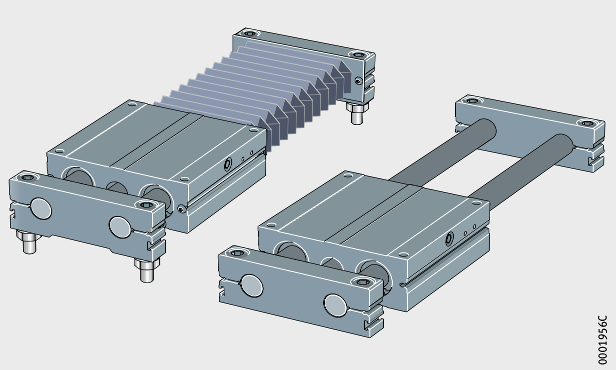
Linear tables
with closed shaft guidance system

Product overview

Linear tables with closed shaft guidance system

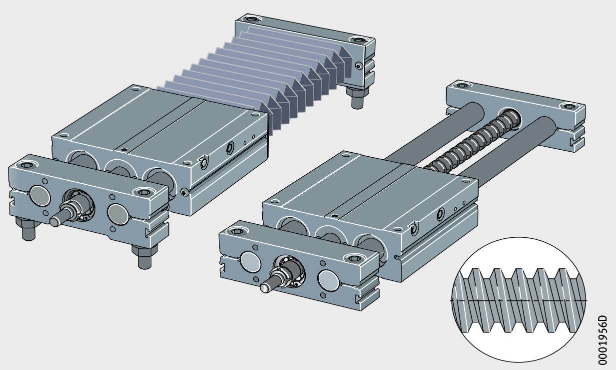
Without drive

LTE..-A-OA, LTE..-B-OA



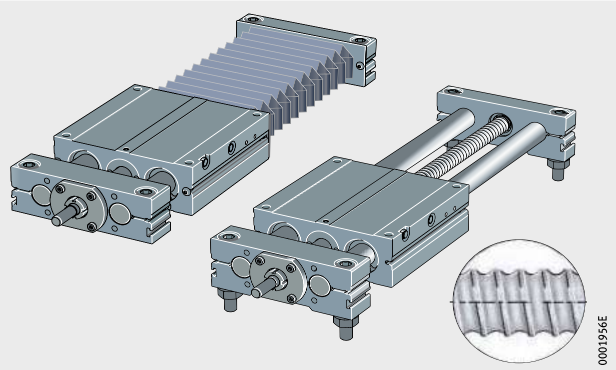
With trapezoidal screw drive

LTE..-A-TGT, LTE..-B-TGT



With ball screw drive

LTE..-A-KGT, LTE..-B-KGT



Linear tables with closed shaft guidance system

Features

Linear tables LTE are linear units for positioning, handling and machining tasks. They are suitable for moderate loads and short stroke lengths.

Basic design

The basic design of linear tables LTE has no drive and comprises:

- a carriage unit made from aluminium alloy with four linear ball bearings KB and one lubrication nipple on each side of the carriage unit
- two hardened and ground shafts made from high alloy steel
- two shaft support blocks

  design A: movable carriage unit

  design B: stationary carriage unit.

Linear tables LTE are supplied already assembled.

The linear ball bearings have an initial greasing, are sealed and can be relubricated.

With trapezoidal screw drive

Linear tables LTE with trapezoidal screw drive comprise the basic design plus the following additional components:

- a rolled trapezoidal screw spindle with a cylindrical bronze nut
- on the drive side: a locating bearing in a shaft support block; depending on the table size, the locating bearing comprises one double row angular contact ball bearing or two single row angular contact ball bearings
- on the opposite side: a non-locating bearing in a shaft support block; the non-locating bearing comprises one single row ball bearing.

The spindle support bearings are sealed and lubricated for life. The spindle nut has an initial greasing, is sealed and can be relubricated via a lubrication nipple in the carriage unit.

With ball screw drive

Linear tables LTE with ball screw drive comprise the basic design plus the following additional components:

- a rolled ball screw spindle with a cylindrical single nut M. In the case of some pitch values, preloaded double nuts MM are also possible.
- on the drive side: a locating bearing in a shaft support block; the locating bearing comprises a preloaded double row angular contact ball bearing ZKLN and a lubrication nipple.
- on the opposite side: a non-locating bearing in a shaft support block; the non-locating bearing comprises a needle roller bearing NA and a lubrication nipple.

The spindle support bearings and spindle nuts have an initial greasing, are sealed and can be relubricated. The spindle nuts can be relubricated via a lubrication nipple in the carriage unit.

Linear tables with closed shaft guidance system

With bellows

Linear tables LTE can be equipped with two sets of bellows, with the following exceptions: LTE8 and LTE12. The bellows are attached by means of Velcro tape, with the exception of LTE20: In this case, the bellows are mounted using screws.

For the same stroke length, the total length of a linear table with bellows is greater than the total length of a linear table without bellows.

Screw drive

The spindle thread has a pitch value of between 3 mm and 50 mm, see table.

As standard, single nuts with an axial clearance dependent on the pitch are used. In the case of some pitch values, the ball screw drive can be supplied with preloaded double nuts.

Screw drive variants

Screw drive variants		Trapezoidal screw drive	Ball screw drive	Suffix
Pitch	3 mm	●	–	3
	4 mm	●	●	4
	5 mm	●	●	5
	6 mm	●	–	6
	8 mm	●	–	8
	10 mm	●	●	10
	20 mm	–	●	20
	40 mm	–	●	40
	50 mm	–	●	50
Single nut (cylindrical)		●	●	M
Double nut (cylindrical)		–	●	MM
Without drive (no spindle), with bellows		–	–	OA

Drive elements

For linear tables, Schaeffler also supplies couplings, coupling housings, planetary gearboxes and servo motors, *Figure 1*.
The range is supplemented by servo controllers for effective drive and control of the motors.

Example:
LTE
① Linear table LTE20-A
② Coupling KUP
③ Coupling housing KGEH
④ Servo motor MOT

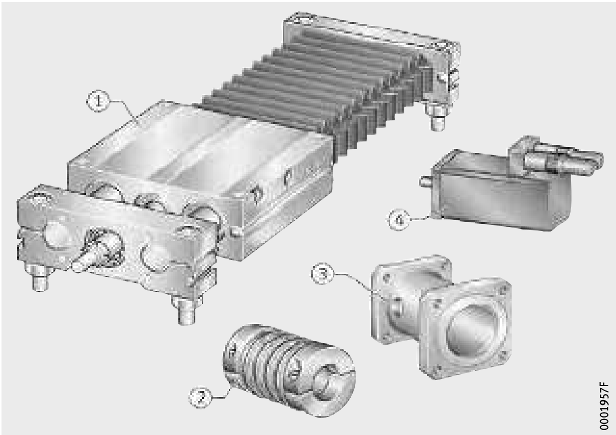


Figure 1
Linear table
with closed shaft guidance system

Proven drive combinations

The combination of the necessary drive components for vertical and horizontal applications as a function of the mass to be moved, the acceleration and the travel velocity of carriage units is shown on page 681.

For vertical mounting, motors with a holding brake must be used.

If different loading and kinematic criteria apply, calculation should be based on the least favourable operating conditions. This applies to calculation of the drive motor and design of the gearbox, coupling and servo controller.

Special designs

Special designs are available by agreement. Examples of these are linear tables LTE with

- guidance shafts and spindles with anti-corrosion protection and a Permaglide guidance system
- bellows resistant to welding beads
- a rolled ball screw spindle to accuracy class 25 μm/300 mm
- a trapezoidal screw drive with a left hand thread
- inductive limit switches
- special machining.

Linear tables with closed shaft guidance system

Design and safety guidelines

Load carrying capacity and load safety factor

The load carrying capacities and load safety factors to be observed differ as a function of the mounting position, see section Technical principles, page 12 and Product preselection matrix, page 554.

Preload and rigidity

A preloaded linear guidance system increases the rigidity of a machine system. However, preload also influences the displacement resistance and operating life of the linear guidance system.

Linear tables LTE with linear ball bearings cannot, due to their construction, be regarded as preloaded. Individually, each linear ball bearing has operating clearance on the guidance shaft. The operating clearance of the individual linear ball bearings is substantially eliminated and is no longer relevant in practical terms. This is due to the compact, rigid carriage unit and the positional tolerances of the locating bore for the linear ball bearings relative to each other.

Main load direction of linear tables with linear ball bearings

The effective load rating of a linear ball bearing is dependent on the position of the load direction in relation to the position of the ball rows.

In the case of linear tables LTE, the linear ball bearings are not fitted in a specific alignment, so the basic load rating data C and C_0 give the minimum values, see dimension tables. The corresponds to a ball row in the linear ball bearing in an apex position relative to the load direction.

C_{min}, $C_{0\ min}$ = minimum basic load rating in main load direction
C_{max}, $C_{0\ max}$ = maximum basic load rating in main load direction

① Apex position
② Symmetrical position

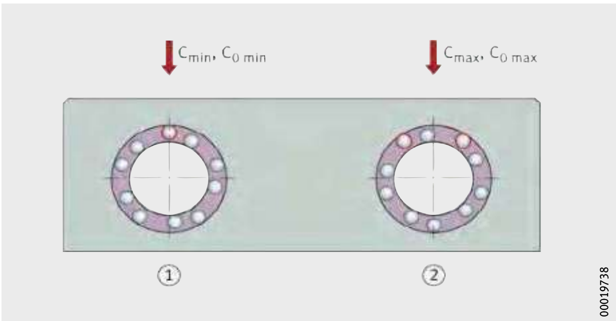


Figure 2
Load carrying capacity, dependent on the position of the ball rows

Deflection

The deflection of linear tables is essentially dependent on the support spacing, the rigidity of the shaft, the adjacent construction and the bearing arrangement. As the rigidity of these components increases, the deflection of the actuators is reduced.

The deflection restricts the effective length of a linear table with a movable carriage unit, design A, or the load carrying capacity.

Diagrams

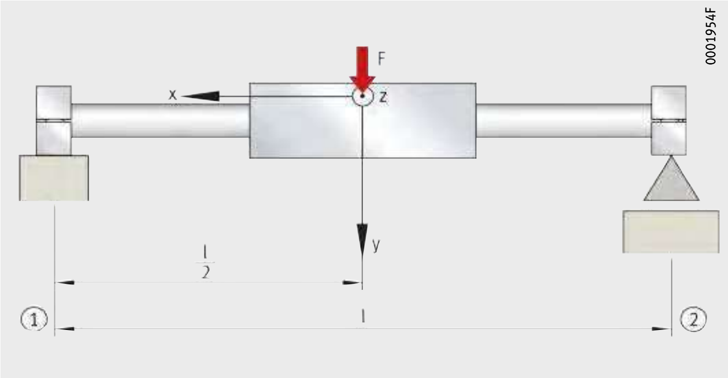
The diagram values are determined for a bearing arrangement or clamping which is in theory infinitely rigid and are subdivided into locating/non-locating and locating/locating bearing arrangements, starting *Figure 3*, page 568. The influence of spindles in driven linear tables LTE has not been taken into consideration here.

The deflection of the support rail is valid under the following conditions:

- central position of the carriage unit
- vertical load
- horizontal mounting position of the linear table.

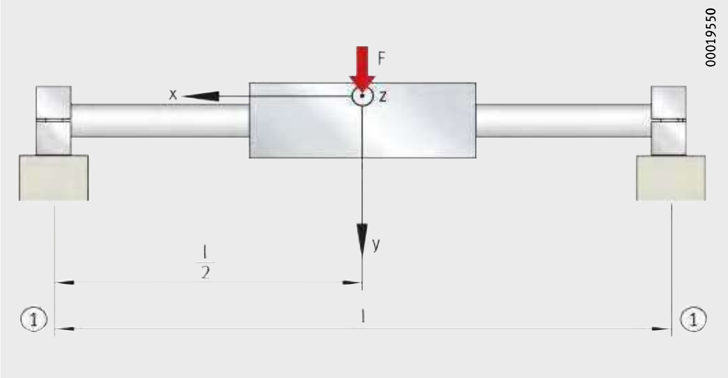
Due to shaft deflection, the rolling element rows adopt an apex position relative to the outside diameter of the machined linear ball bearing, but this should not be regarded as critical in the load ranges displayed in each case.

The running quality and operating life of the linear ball bearings are not substantially influenced by the guidance system concept "two shafts each with two linear ball bearings" of the linear tables LTE.



1 Locating bearing arrangement
2 Non-locating bearing arrangement

Figure 3
Deflection about the z axis



1 Locating bearing arrangement

Figure 4
Deflection about the z axis

LTE08

Locating/non-locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

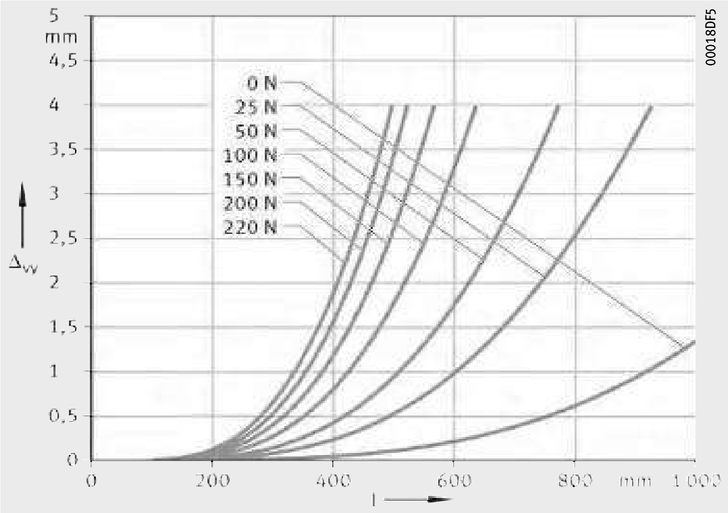


Figure 5
Deflection about the z axis

LTE08

Locating/locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

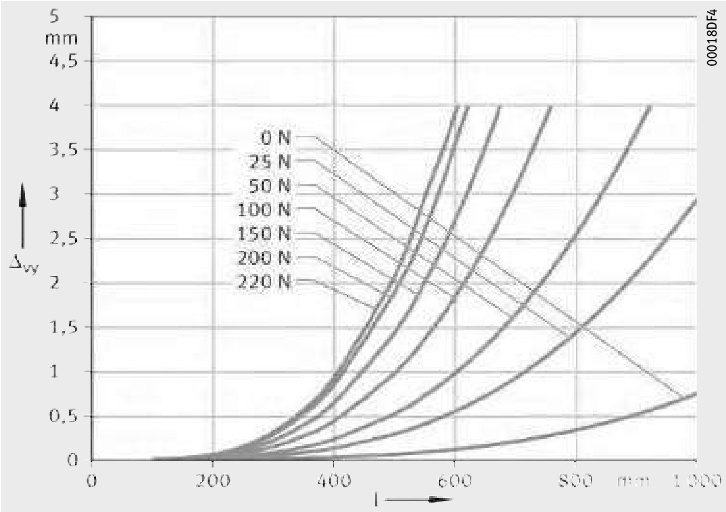


Figure 6
Deflection about the z axis

LTE12

Locating/non-locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

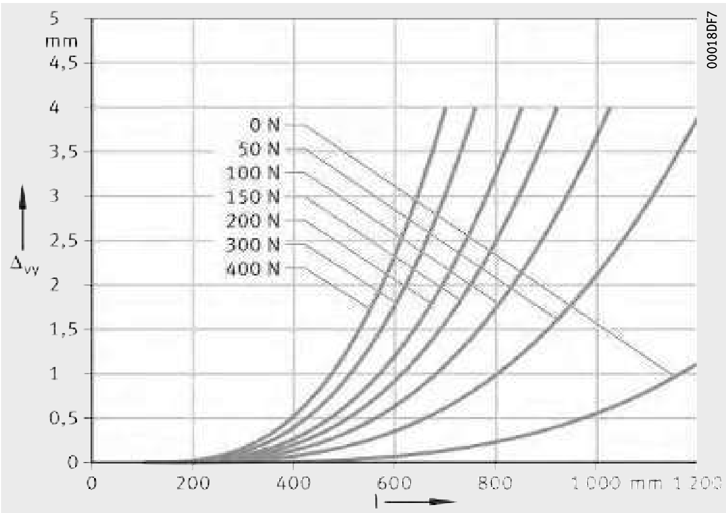
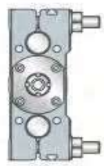


Figure 7
Deflection about the z axis



LTE12

Locating/locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

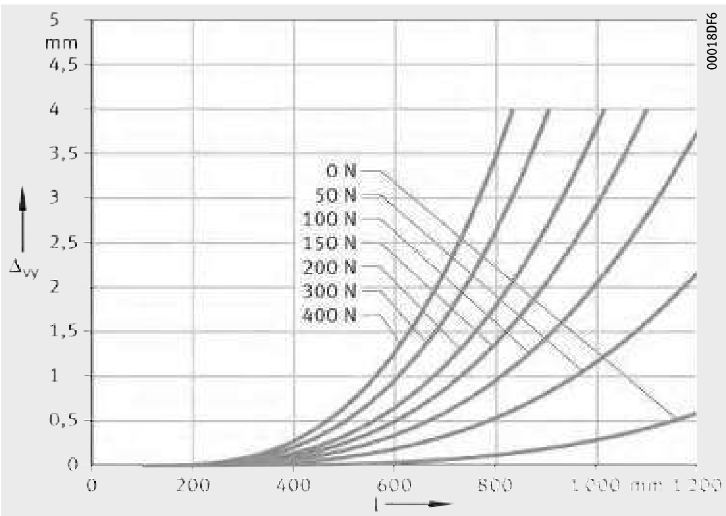


Figure 8
Deflection about the z axis

LTE16

Locating/non-locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

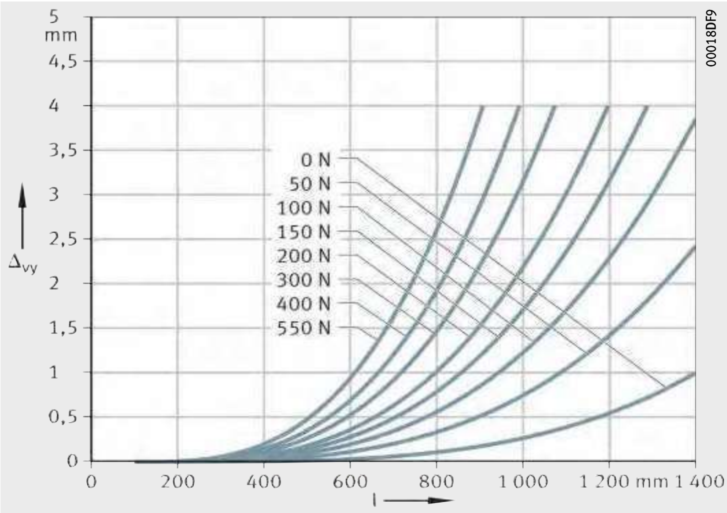


Figure 9
Deflection about the z axis

LTE16

Locating/locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

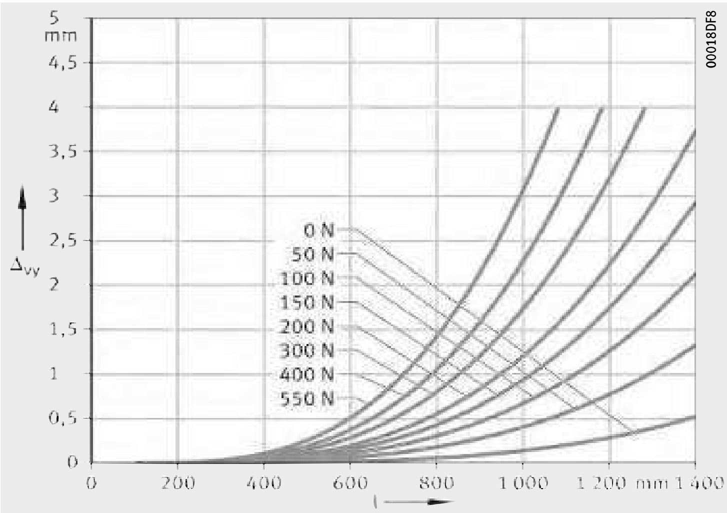


Figure 10
Deflection about the z axis

LTE20

Locating/non-locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

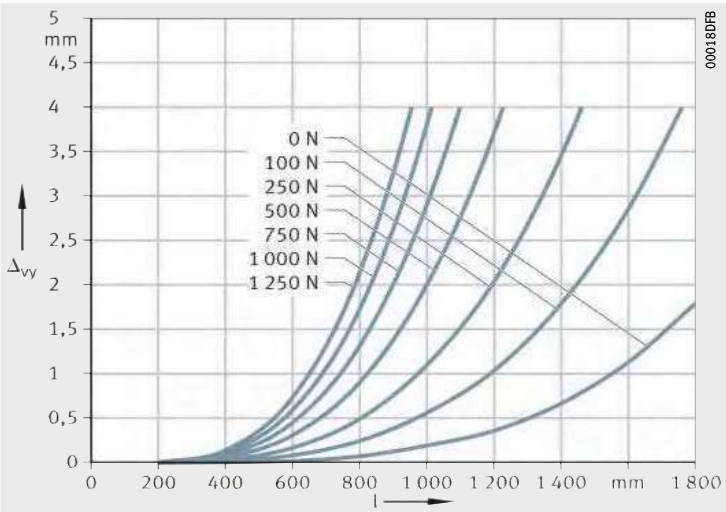
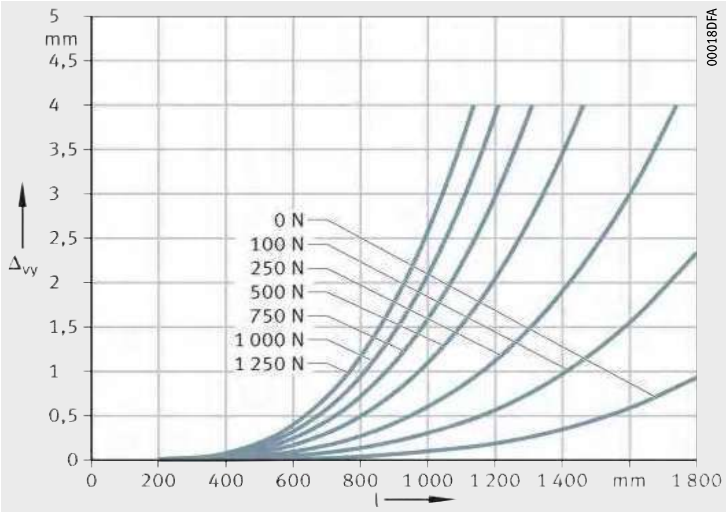


Figure 11
Deflection about the z axis

LTE20

Locating/locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

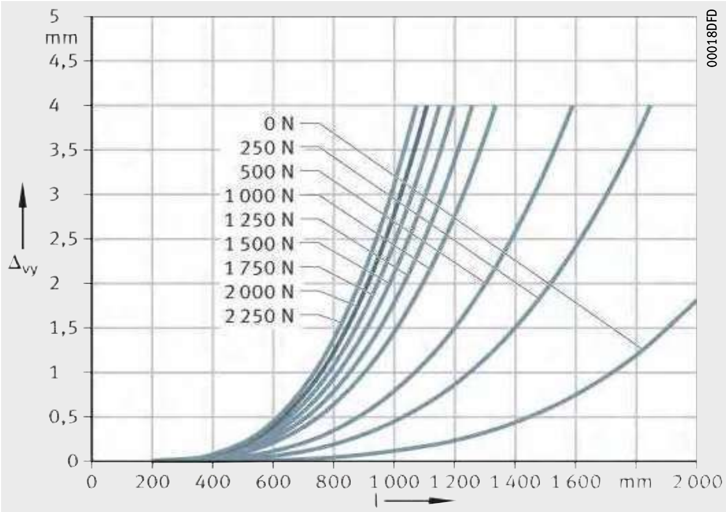
Figure 12
Deflection about the z axis

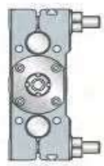


LTE25

Locating/non-locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

Figure 13
Deflection about the z axis

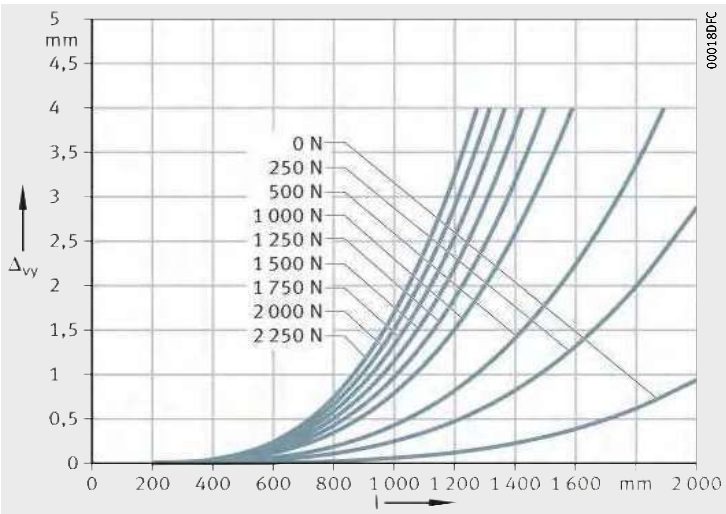




LTE25

Locating/locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

Figure 14
Deflection about the z axis



LTE30

Locating/non-locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

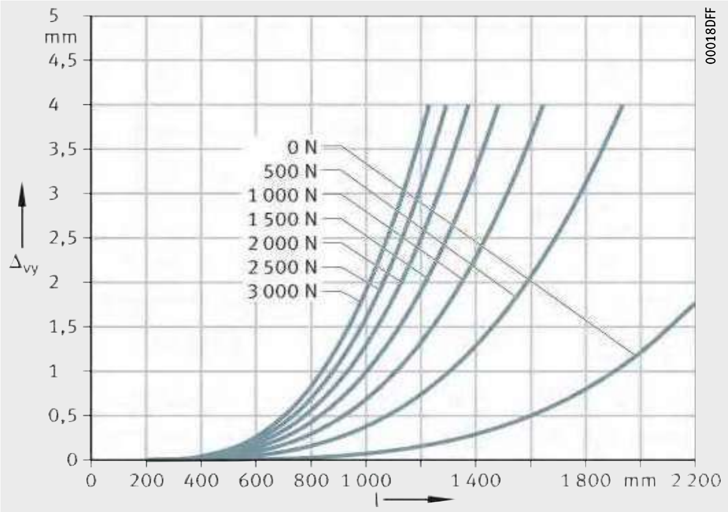


Figure 15
Deflection about the z axis

LTE30

Locating/locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

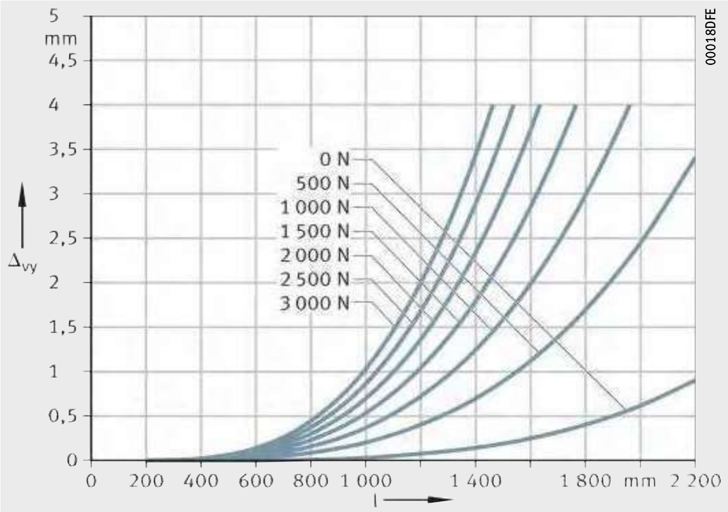


Figure 16
Deflection about the z axis

LTE40

Locating/non-locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

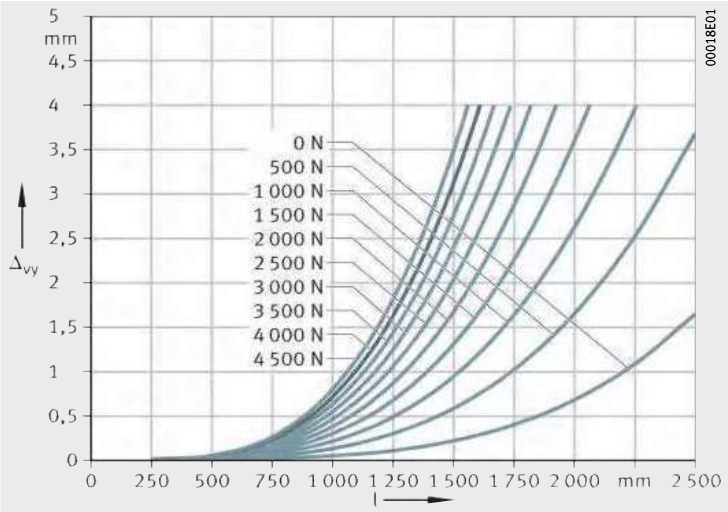


Figure 17
Deflection about the z axis

LTE40

Locating/locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

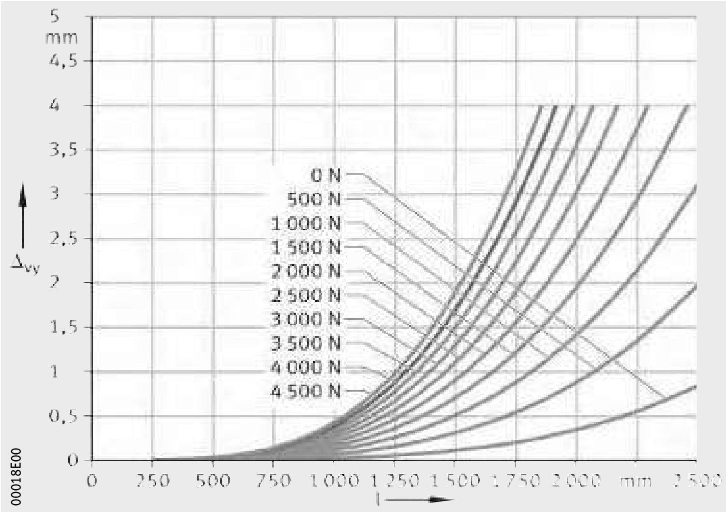


Figure 18
Deflection about the z axis

LTE50

Locating/non-locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

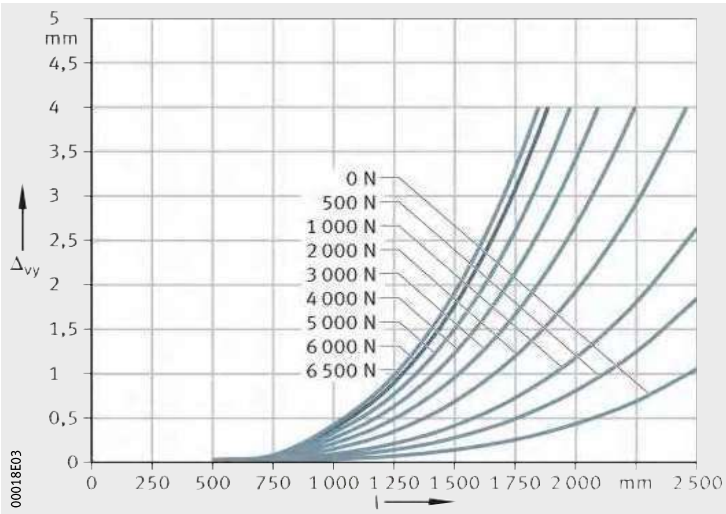


Figure 19
Deflection about the z axis

LTE50

Locating/locating bearing arrangement
Δ_{vy} = deflection
l = support spacing

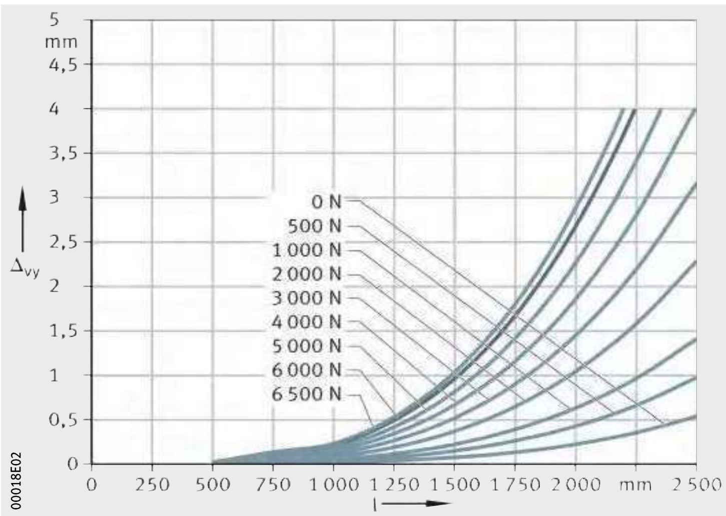


Figure 20
Deflection about the z axis

Linear tables with closed shaft guidance system

Length calculation of linear tables

The length calculation of linear tables is based on the required effective stroke length N_H. The effective stroke length N_H must be increased by the addition of safety spacing values on both sides of the travel distance. It is only if bellows are present that the effective length B_L must be added.

The total length L_{tot} of the linear table is determined from the effective stroke length N_H, the safety spacings S, the carriage unit length L and the lengths of the end plates L_3, L_4 and L_5.

Parameters for length calculation

G_H mm
Total stroke length

N_H mm
Effective stroke length

S mm
Safety spacing, see table, page 576

L mm
Length of carriage plate

L_3 mm
Length of end plates in LTE..-A-OA, LTE..-B-OA

L_4 mm
Length of end plate in LTE..-TR, LTE..-TGT, LTE..-KGT

L_5 mm
Length of end plate in LTE..-TR, LTE..-TGT, LTE..-KGT

L_{tot} mm
Total length of linear table

F_{BL} –
Effective length factor according to linear table type

B_L mm
Effective length of bellows

B_B mm
Length of bellows fastener.

Total stroke length G_H

The total stroke length G_H is determined from the required effective stroke length N_H and the safety spacings S, which must correspond to at least the spindle pitch P.

$$G_H = N_H + 2 \cdot S$$

Maximum lengths of linear tables

The maximum length of linear tables LTE is determined taking account of the deflection, see table.

Maximum lengths

Designation	L_{tot} mm	Designation	L_{tot} mm	Designation	L_{tot} mm
LTE08	1 000	–	–		–
LTE12	1 200	–	–		–
LTE16	1 400	LTE16..-TR	1 400	LTE16..-KGT	1 400
LTE20	1 800	LTE20..-TGT	1 800	LTE20..-KGT	1 800
LTE25	2 000	LTE25..-TR	2 000	LTE25..-KGT	2 000
LTE30	2 200	LTE30..-TR	2 200	LTE30..-KGT	2 200
LTE40	2 500	LTE40..-TR	2 500	LTE40..-KGT	2 500
LTE50	2 500	LTE50..-TR	2 500	LTE50..-KGT	2 500

Total length L_{tot}

The following equations are designed for one linear table.
The parameters and their position can be found in *Figure 21* and *Figure 22* as well as in the table, page 576.

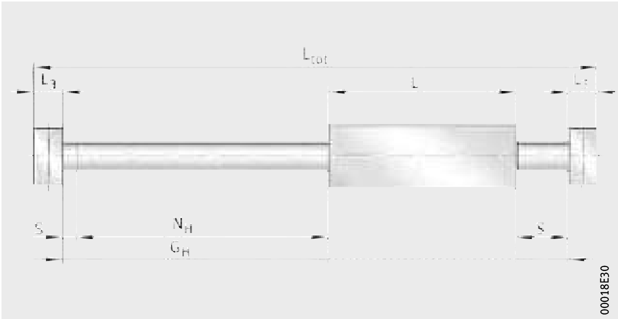


Figure 21
Length parameters
for linear tables LTE..-A and LTE..-B

Linear table without bellows, without drive
LTE..-A, LTE..-B

$$L_{tot} = G_H + L + 2 \cdot L_3$$

Linear table with bellows, without drive
LTE..-A, LTE..-B

$$L_{tot} = G_H \cdot F_{BL} + L + 2 \cdot L_3 + B_B$$

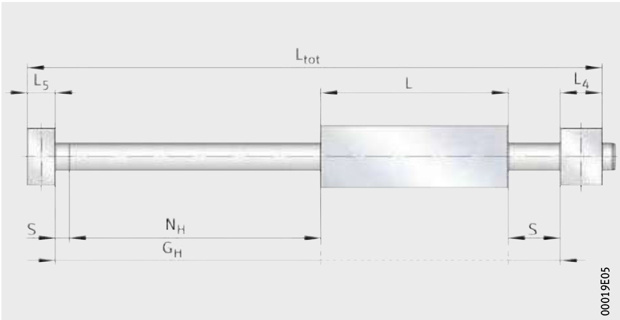


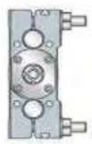
Figure 22
Length parameters
for linear tables LTE..-TR,
LTE..-TGT and LTE..-KGT

Linear table without bellows
LTE..-TR, LTE..-TGT, LTE..-KGT

$$L_{tot} = G_H + L + L_4 + L_5$$

Linear table with bellows
LTE..-TR, LTE..-TGT, LTE..-KGT

$$L_{tot} = G_H \cdot F_{BL} + L + L_4 + L_5 + B_B$$



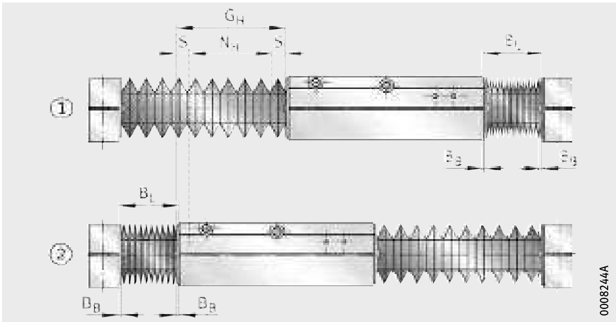
Linear tables with closed shaft guidance system

Length parameters
Valid for design A and design B

Designation	L mm	L_3 mm	L_4 mm	L_5 mm	S mm	F_{BL}	B_B
LTE08-65	65	12	–	–	Dependent on appli-cation	–	–
LTE12-85	85	14					
LTE16-100	100	18				1,5	20
LTE20-130..-OA	130	20				1,33	20
LTE25-160	160	25				1,34	21
LTE30-180	180	25				1,27	21
LTE40-230	230	30				1,28	22
LTE50-280	280	30				1,24	22
LTE16-100..-TR12×3	100	–	24	18	3	1,5	20
LTE20-130..-TGT16×4	130		29	20	4	1,33	20
LTE25-160..-TR16×4	160		33	25	4	1,34	21
LTE30-180..-TR20×4	180		38	25	4	1,27	21
LTE30-180..-TR20×8	180		38	25	8	1,27	21
LTE40-230..-TR24×5	230		39	30	5	1,28	22
LTE40-230..-TR24×10	230		39	30	10	1,28	22
LTE50-280..-TR32×6	280		42	30	6	1,24	22
LTE16-100..-1204	100		24	18	4	1,5	20
LTE16-100..-1205	100		24	18	5	1,5	20
LTE20-130..-KGT/5	130		29	20	5	1,33	20
LTE20-130..-KGT/10	130		29	20	10	1,33	20
LTE25-160..-1605	160		33	25	5	1,34	21
LTE25-160..-1610	160		33	25	10	1,34	21
LTE30-180..-2005	180		38	25	5	1,27	21
LTE30-180..-2010	180		38	25	10	1,27	21
LTE30-180..-2020	180		38	25	20	1,27	21
LTE30-180..-2050	180		38	25	50	1,27	21
LTE40-230..-2505	230		39	30	5	1,28	22
LTE40-230..-3210	230		42	30	10	1,28	22
LTE40-230..-3220	230		42	30	20	1,28	22
LTE40-230..-3240	230		42	30	40	1,28	22
LTE50-280..-2505	280		39	30	5	1,24	22
LTE50-280..-3210	280		42	30	10	1,24	22
LTE50-280..-3220	280		42	30	20	1,24	22
LTE50-280..-3240	280		42	30	40	1,24	22

Effective length of bellows

The effective length of bellows is the length occupied by the bellows in the fully compressed state. Calculation is based on the total stroke length G_H, *Figure 23*, equation and table, page 576.



① Carriage unit against the right end stop
② Carriage unit against the left end stop

Figure 23
Effective length calculation

$$B_L = \frac{G_H \cdot (F_{BL} - 1) + B_B}{2}$$

B_L mm
Effective length of bellows

G_H mm
Total stroke length

F_{BL} –
Effective length factor according to linear table type, see table, page 576

B_B mm
Length of bellows fastener.

Linear tables with closed shaft guidance system

Mass calculation

The total mass of a linear table is calculated from the mass of the table without a carriage unit and the carriage unit.

$$m_{tot} = m_{LAW} + m_{BOL}$$

Values for mass calculation, linear table without screw drive

Designation	Mass	
	Carriage unit m_{LAW} ≈kg	Actuator without carriage unit m_{BOL} ≈kg
LTE08..-A, LTE08..-B	0,24	L_{tot} · 0,000 8 + 0,35
LTE12..-A, LTE12..-B	0,63	L_{tot} · 0,001 8 + 0,86
LTE16..-A, LTE16..-B	0,9	L_{tot} · 0,003 1 + 1,3
LTE20..-A-OA, LTE20..-B-OA	1,8	L_{tot} · 0,004 9 + 2,5
LTE25..-A, LTE25..-B	3,5	L_{tot} · 0,007 7 + 4,9
LTE30..-A, LTE30..-B	5,1	L_{tot} · 0,011 0 + 6,8
LTE40..-A, LTE40..-B	10,3	L_{tot} · 0,019 6 + 13,4
LTE50..-A, LTE50..-B	16,4	L_{tot} · 0,030 6 + 20,6

Values for mass calculation, linear table with screw drive

Designation	Mass	
	Carriage unit[1)] m_{LAW} ≈kg	Actuator without carriage unit m_{BOL} ≈kg
LTE16..-A, LTE16..-B	0,86	L_{tot} · 0,003 9 + 0,4
LTE20..-A, LTE20..-B	1,82	L_{tot} · 0,006 2 + 0,8
LTE25..-A, LTE25..-B	3,49	L_{tot} · 0,009 0 + 1,4
LTE30..-A, LTE30..-B	5,04	L_{tot} · 0,013 1 + 1,9
LTE40..-A-25, LTE40..-B-25	4,3	L_{tot} · 0,022 9 + 2,8
LTE40..-A-32, LTE40..-B-32	10,6	L_{tot} · 0,025 3 + 3,4
LTE50..-A-25, LTE50..-B-25	4,3	L_{tot} · 0,033 9 + 2,8
LTE50..-A-32, LTE50..-B-32	16,5	L_{tot} · 0,036 3 + 4,7

1) Including single or preloaded double nut.

Lubrication

The guidance systems and the trapezoidal or ball screw drive in linear tables are initially greased with a high quality lithium complex soap grease KP2P-30 according to DIN 51825 and must be relubricated during operation.

Structure of suitable greases

The following greases are suitable for the linear ball bearings and the linear recirculating ball bearing and guideway assemblies as well as the screw drives:

- lithium soap or lithium complex soap grease with base oil having a mineral oil base
- special anti-wear additives for loads $C/P < 8$, indicated by “P” in the DIN designation
- base oil viscosity ISO VG 68 to ISO VG 100 in the case of linear recirculating ball bearing and guideway assemblies
- consistency in accordance with NLGI grade 2 in the case of linear ball bearings.

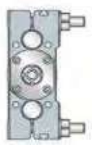
If different greases are used, their miscibility and compatibility must be checked first.

Relubrication intervals

The relubrication intervals are essentially dependent on the following factors:

- the travel velocity of the carriage unit
- the load
- the operating temperature
- the stroke length
- the environmental conditions and environmental influences
- the mounting position.

The cleaner the environment, the lower the lubricant consumption.



Linear tables with closed shaft guidance system

Calculation of the relubrication interval

The relubrication interval and relubrication quantity can only be precisely determined under actual operating conditions since it is not possible to calculate all the influencing factors.
If the relubrication quantity cannot be determined under operating conditions, the guide values in the table should be used.
The locating and non-locating bearing in the trapezoidal screw drive are lubricated for life.

Relubrication quantities per lubrication nipple

Designation	Linear ball bearing	d_0	P	Trapezoidal screw drive			Ball screw drive		
				Threaded nut	Locating bearing	Non-locating bearing	Threaded nut	Locating bearing	Non-locating bearing
	≈ g	mm	mm	≈ g			≈ g		
LTE08	0,2	–	–	–	–	–	–	–	–
LTE12	0,5								
LTE16	0,8	12	3	2	Lubricated for life		–	Lubricated for life[1]	
			4	–			0,2		
LTE20	1	16	4	3,5			–		
			5	–			0,5		
			10	–			1,3		
LTE25	2,5	16	4	3,5			–		
			5	–			0,5		
			10	–			1,3		
LTE30	3,1	20	4	6			–		
			5	–			0,6		
			10	–			3,1		
			20	–			3		
			50	–			8,6		
LTE40	5,8	24	5	10			–		
		25	5	–			0,8		
		32	10	–			3,1		
			20	–			6,8		
			40	–			9,5		
LTE50	13	25	5	–			0,8		
LTE50	13	32	6	15			–		
			10	–			3,1		
			20	–			6,8		
			40	–			9,5		

[1] If relubrication is required due to the application, please consult us.

In the case of linear tables LTE with linear ball bearings, experience shows that the initial greasing is sufficient if the following apply: normal environmental conditions, load ratio $C/P > 10$, room temperature and $v \leqq 0{,}6\ v_{max}$. If it is not possible to achieve these conditions, relubrication must be carried out.

For the trapezoidal and ball screw drive, a relubrication interval of 200 h to 300 h is sufficient under normal operating conditions. Relubrication must be carried out, irrespective of the result of this calculation, no more than 1 year after the last lubrication.

Fretting corrosion is caused by lubricant starvation and is visible as a reddish discolouration of the rolling element raceways. Lubricant starvation can lead to permanent damage to the system and therefore to its failure. It must be ensured that the lubrication intervals are reduced accordingly in order to prevent fretting corrosion.

When calculating the relubrication interval, the grease operating life must also be checked. This is restricted to a maximum of 3 years due to the ageing resistance of the grease. It is the user's responsibility to consult the lubricant manufacturer.

Relubrication procedure

Relubrication should be carried out whilst the carriage unit is moving and warm from operation over a minimum stroke length corresponding to one carriage unit length.

During lubrication, it must be ensured that the grease gun, lubrication nipple, environment of the lubrication nipple and the grease are clean.

Relubrication should be carried out wherever possible with several partial quantities at various times instead of the complete quantity at the time of the relubrication interval. Relubrication quantities, see table.

The lubrication method involves loss of lubricant. The used lubricant must be collected and disposed of by methods that help to protect the environment.

The use of lubricants is governed by national regulations for environmental protection and occupational safety as well as information from the lubricant manufacturers.
These regulations must be observed in all cases.

Lubrication nipples

Linear tables LTE (excluding size LTE20) are relubricated via drive fit lubrication nipples NIP A, while linear tables LTE20 are relubricated via funnel type lubrication nipples NIP to DIN 3405, *Figure 24*.

NIP A
NIP DIN 3405-A M6

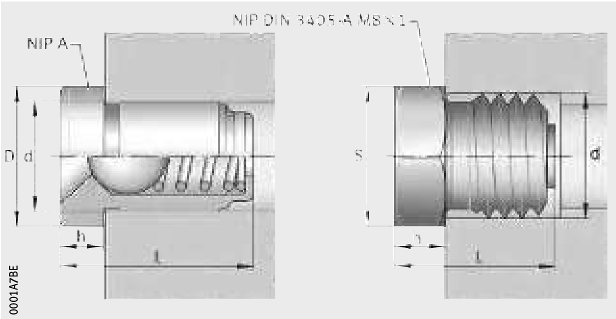


Figure 24
Drive fit lubrication nipple and funnel type lubrication nipple

Lubrication nipples for LTE and LTS excluding LTE20

Drive fit lubrication nipple	D mm	d mm	L mm	h mm
NIP A1	6	4	6	1,5
NIP A2	8	6	9	2
NIP A3	10	9	12	3

Funnel type lubrication nipple for LTE20

Funnel type lubrication nipple	S h13 mm	d mm	L mm	h j6 mm
NIP DIN 3405-A M6	7	M6	9,5	3

Linear tables
with closed shaft guidance system

Relubrication points

The linear ball bearings are greased in pairs in each case via a lateral lubrication nipple in the carriage unit. Each spindle nut is supplied with lubricant via a separate lubrication nipple. The spindle bearing arrangement of the ball screw drive in the shaft support blocks is supplied in each case from above via a lubrication nipple, *Figure 25*. Exception: In the case of the actuator LTE20, the spindle bearings fitted are sealed and lubricated for life.

LTE

① Relubrication point for non-locating bearing
② Relubrication point for locating bearing
③ Relubrication points for linear ball bearings
④ Relubrication point for spindle nut

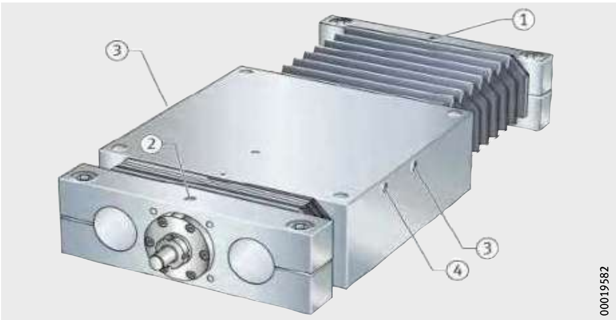


Figure 25
Lubrication points on linear table

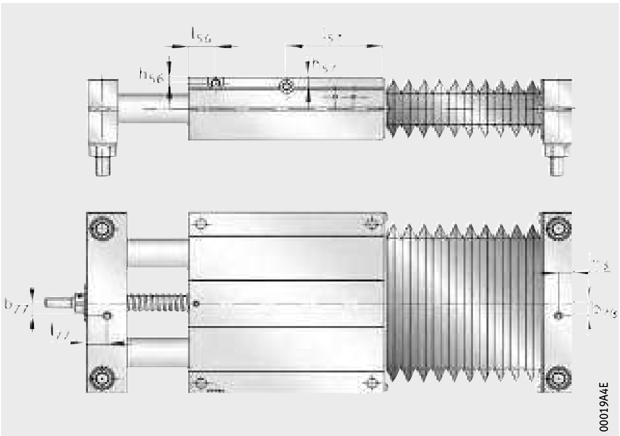


Figure 26
Position of relubrication points, linear tables LTE

Position of relubrication points

Designation	Mounting dimensions										
	Type NIP	Without drive		With screw drive							
		2×for linear ball bearings		1×for spindle nut		2×for linear ball bearings		Locating bearing		Non-locating bearing	
		h_{56}	l_{56}	h_{56}	l_{56}	h_{57}	l_{57}	b_{77}	l_{77}	b_{78}	l_{78}
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
LTE08	A1	5	32,5	–							
LTE12		6	42,5								
LTE16		6	50	18	30	6	50	9,5	10,5	9	9
LTE20	DIN[1]	8	65	4,5	22	8	65	0	0	0	0
LTE25	A2	8	80	5	53,15	8	80	10	16	0	12,5
LTE30	A2	9	90	5	56,4[2]	9	90	14	14,5	0	12,5
LTE40	A2	9	115	5	56,4[3]	9	115	13[4]	17[5]	0	15
LTE50	A3	11	140	6	56,4[3]	11	140	0	17[5]	0	15

[1] Lubrication nipple DIN 3405-A M6.

[2] In the case of a spindle 2020 and 2050, l_{56} = 52 mm.

[3] In the case of a spindle 3210 and 3220, l_{56} = 86 mm.
In the case of a spindle 3240, l_{56} = 69 mm.

[4] In the case of a spindle size 25, b_{77} = 0 mm.

[5] In the case of a spindle size 25, l_{77} = 15,5 mm.

Environments with special requirements

In vacuum applications, lubricants with low vapourisation rates are required in order to maintain the vacuum atmosphere.

In the foodstuffs sector and in clean rooms, special requirements are also placed on lubricants in relation to emissions and compatibility.

For such environmental conditions, please consult the grease manufacturer.

Linear tables with closed shaft guidance system

T-slots

The shaft support blocks of size LTE20 are designed for thin hexagon nuts in accordance with DIN EN ISO 4035, *Figure 27*.

LTE

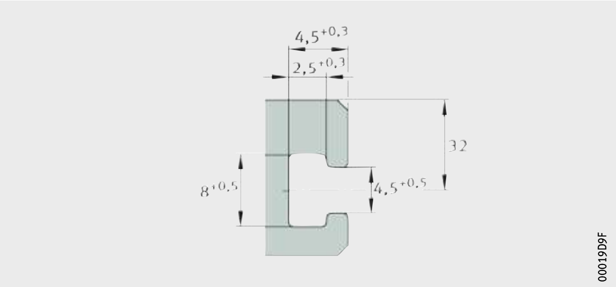


Figure 27
T-slot size in shaft support block

Filling openings

The thin hexagon nuts are pushed into the T-slot on the end faces of the shaft support blocks.

Connectors for switching tags

Switching tags can be screw mounted to the linear table in order to activate switches in the adjacent construction. The position and size are dependent on the size, *Figure 28* and table.

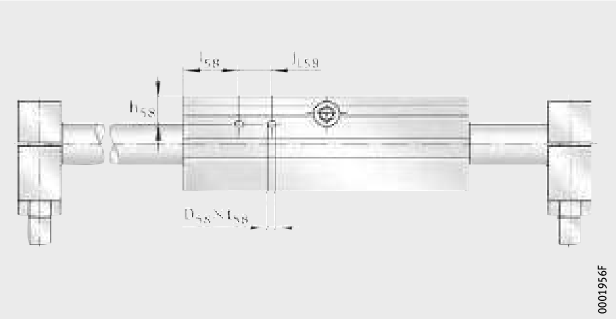


Figure 28
Connectors for switching tags on actuator LTE20-A-OA

Mounting dimensions for switching tags on actuator LTE20-A-OA

Series Actuator	Mounting dimensions				
	J_{L58} mm	l_{58} mm	h_{58} mm	∅ P9 D_{58} mm	Depth t_{58} mm
LTE20-A-OA	15	25	13	3,5	12

Maximum permissible spindle speed

Screw drives must not be allowed to run in the critical speed range.

The critical speed is essentially dependent on the following factors:

- spindle length
- spindle diameter
- spindle bearing arrangement
- mounting method.

The carriage unit velocity v is determined from the spindle speed n and the spindle pitch P. The limit values for velocities must be observed, see page 555.

For calculation of the carriage unit velocity, the following applies:

$$v = \frac{n \cdot P}{60 \cdot 1000}$$

v m/s
Carriage unit velocity
n min^{-1}
Spindle speed
P mm
Spindle pitch.

Diagram

The diagram shows the relationship for individual series and sizes between the critical speed and the spindle length, *Figure 29*.
The diagram takes account of the effective length B_L of the bellows cover.

LTE16
LTE20
LTE25
LTE30
LTE40
LTE50

n_{max} for pitch 5 mm
n = spindle speed
L_{tot} = support shaft length

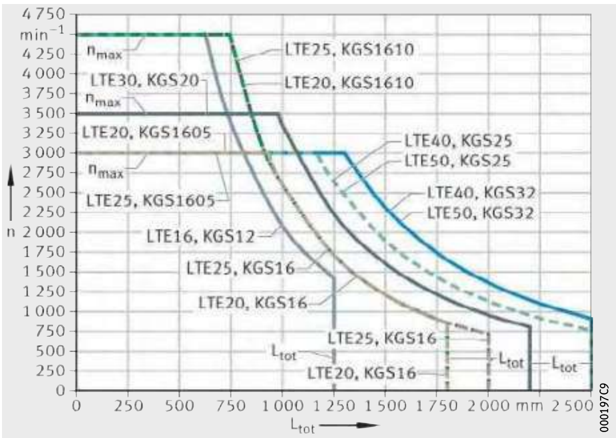


Figure 29
Maximum permissible spindle speed

Influences of the adjacent construction

The running accuracy is essentially dependent on the straightness and accuracy of the fit and mounting surfaces.

The higher the requirements for accuracy and smooth running of the guidance system, the more attention must be paid to the geometrical and positional accuracy of the mounting surfaces.

Linear tables
with closed shaft guidance system

Mounting position and mounting arrangement

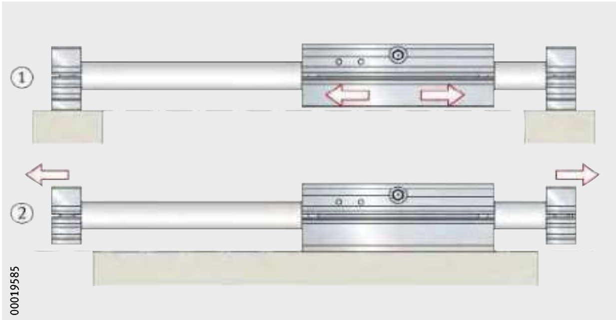
Linear tables are suitable for numerous mounting positions and mounting arrangements.

The guidance system can be fitted with a movable or stationary linear table, *Figure 30*, page 587. The linear tables can be used in the common horizontal mounting position and also in a vertical mounting position, *Figure 31*, page 587.

Mounting of linear tables with a carriage unit to one side or suspended overhead is possible, *Figure 32*, page 587.
In such cases, please consult the Schaeffler engineering service.

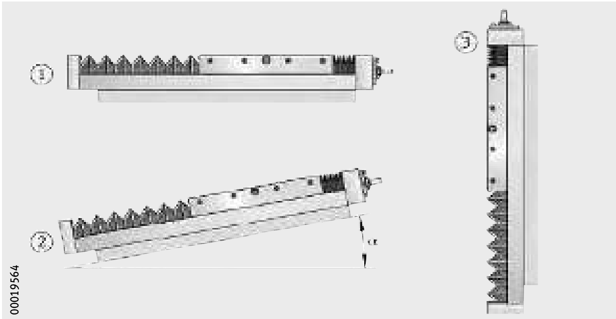
! The ball screw drives fitted in these linear tables are not self-locking. The carriage unit and load must be secured against autonomous travel or dropping if the linear tables are used in a vertical or tilted mounting position. This can be achieved, for example, by means of a brake or counterweight. The drop guard must function in manual operation as well as in motor operation, especially if the motor has no current.

Safety guidelines (especially in relation to personal protection) must be observed.



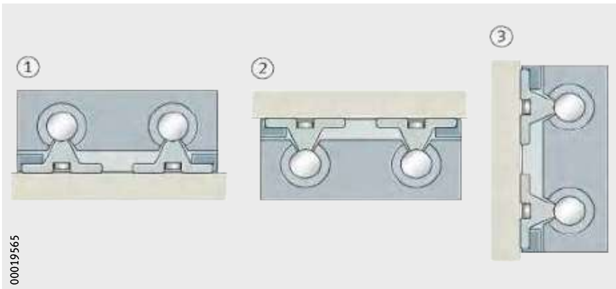
① Design A: movable carriage unit
② Design B: stationary carriage unit

Figure 30
Movable or stationary carriage unit



① Horizontal
② Tilted
③ Vertical

Figure 31
Mounting positions



① Mounting position 0°
② Mounting position 180°
③ Mounting position 90°

Figure 32
Mounting positions

Linear tables
with closed shaft guidance system

Kinematic operating limits

Maximum velocities are determined as a function of the critical spindle speed, see tables. The limiting speed of the bearings can also restrict the spindle speed and thus the velocity.

Kinematic operating limits with trapezoidal screw drive

Series and size	Spindle		Maximum acceleration	Maximum velocity	Maximum spindle speed
	d_0	P	a	v	n
	mm	mm	m/s^2	m/s	min^{-1}
LTE16	12	3	2,5	0,075	1 500
LTE20	16	4	2,5	0,1	1 500
LTE25	16	4	2,5	0,1	1 500
LTE30	20	4	2,5	0,1	1 500
		8			
LTE40	24	5	2,5	0,125	1 500
		10			
LTE50	32	6	2,5	0,125	1 500

Kinematic operating limits with ball screw drive

Series and size	Spindle		Spindle nut design		Maximum acceleration		Maximum velocity	Maximum spindle speed
	d_0	P			a		v	n
	mm	mm			m/s^2	m/s^2	m/s	min^{-1}
LTE16	12	4	M	–	20	–	0,25	4 500
LTE20	16	5	M	MM	20	10	0,25	3 000
		10	M	–		–	0,75	4 500
LTE25	16	5	M	MM	20	10	0,25	3 000
		10	M	MM		10	0,75	4 500
LTE30	20	5	M	MM	20	10	0,29	3 500[1)]
		10	M	MM		10	0,75	3 000
		20	M	–		–	1,16	3 500[1)]
		50	M	–		–	0,29	3 500[1)]
LTE40	25	5	M	MM	20	10	0,25	3 000
	32	10	M	MM	20	10	0,5	3 000[1)]
		20	M	MM		10	1	
		40	M	–		–	2	
LTE50	25	5	M	MM	20	10	0,25	3 000
	32	10	M	MM	20	10	0,5	3 000[1)]
		20	M	MM		10	1	
		40	M	–		–	2	

1) Restricted by the limiting speed of the bearing with grease lubrication.

Mounting

In most applications, a linear table is mounted in two steps:

- location of the support rail or base plate on the adjacent construction
- mounting of the components to be moved on the carriage unit.

The support rail or base plate is screw mounted to the stationary adjacent construction using conventional fixing screws and washers. Location of the components that are to be moved with the carriage unit can be carried out using conventional fixing screws.

Interchange of linear table components

For the fitting and assembly of linear table components, a fitting and maintenance manual is available. Please consult the Schaeffler engineering service.

Maintenance

Failure to carry out maintenance, incorrect maintenance, assembly errors and lubrication errors as well as inadequate protection against contamination can lead to premature failure of linear tables.

Maintenance work is restricted in general to relubrication, cleaning and regular visual inspection for damage.

Maintenance intervals, especially the intervals between relubrication, are influenced by the following factors:

- the travel velocity
- the load
- the temperature
- the stroke length
- the environmental conditions and influences.

! Guidance parts relevant to function must be greased and supplied with lubricant via appropriate lubrication points.

Cleaning

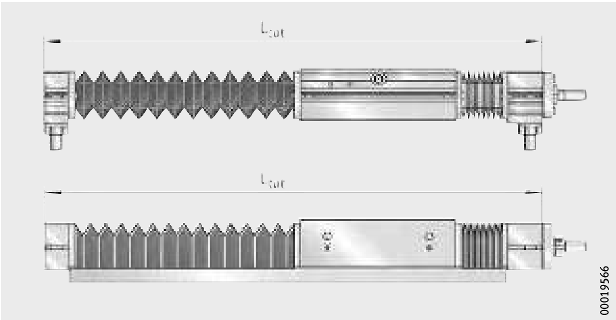
If heavy contamination is present, linear tables must be cleaned in order to ensure reliable function. Suitable cleaning tools include paintbrushes, soft brushes and soft cloths.

! Abrasives, petroleum ether and oils must not be used.

Accuracy

Length tolerances

The length tolerances for linear tables can be taken from *Figure 33* and the table.



L_{tot} = total length

Figure 33
Length tolerances

Length tolerances for all linear tables

Total length L_{tot} of linear tables LTE mm	Tolerance mm
$L_{tot} < 400$	±0,5
$400 \leqq L_{tot} < 1\,000$	±0,8
$1\,000 \leqq L_{tot} < 2\,000$	±1,2
$2\,000 \leqq L_{tot} < 4\,000$	±2
$4\,000 \leqq L_{tot} < 6\,000$	±3

Accuracy of the screw drive

Linear tables with trapezoidal screw drive are only available with a single nut with clearance, see table, page 591.
The pitch accuracy is dependent on the size, see table, page 591.

Linear tables with ball screw drive are only available with a single nut with clearance, see table, page 591. Where higher accuracy requirements are present, preloaded (clearance-free) double nuts are possible for many pitch values, see table, page 591.

! In the case of standard linear tables with ball screw drive, the nut unit (double nut) can only be preloaded clearance-free if the spindle pitch P is less than the nominal diameter d_0 of the spindle.

Trapezoidal screw drive

Designation	Spindle			Spindle nut	
	Nominal diameter	Pitch		Single nut	
	d_0	P	Accuracy	Suffix	Axial clearance
	mm	mm	µm each 300 mm		mm
LTE16	12	3	300	M	0,4 to 0,5
LTE20	16	4	50		
LTE25	16	4	50		
LTE30	20	4	50		
		8	200		
LTE40	24	5	50		
		10	200		
LTE50	32	6	50		

Ball screw drive

Desig-nation	Spindle			Spindle nut			
	Nominal diameter	Pitch		Single nut		Double nut	
	d_0	P	Accuracy	Suffix	Axial clearance	Suffix	Axial clearance
	mm	mm	µm each 300 mm		mm		
LTE16	12	4	50	M	0,05	–	–
LTE20	16	5	50	M	0,05	MM	Preloaded
		10		M	0,05	–	–
LTE25	16	5	50	M	0,05	MM	Preloaded
		10		M	0,05	MM	Preloaded
LTE30	20	5	50	M	0,05	MM	Preloaded
		10		M	0,05	MM	Preloaded
		20		M	0,05	–	–
		50					
LTE40	25	5	50	M	0,05	MM	Preloaded
	32	10		M	0,05	MM	Preloaded
		20		M	0,05	MM	Preloaded
		40		M	0,05	–	–
LTE50	25	5	50	M	0,05	MM	Preloaded
	32	10		M	0,05	MM	Preloaded
		20		M	0,05	MM	Preloaded
		40		M	0,05	–	–

Linear tables
with closed shaft guidance system

Ordering example, ordering designation

Available designs

Available designs of linear tables LTE, see table.

Design	Linear table with closed linear ball bearing guidance system		
Size	Size code		
Carriage unit length	Length	L	mm
Shaft support block types	Design A	A	
	Design B	B	
No drive type	Without drive	● / OA	
Drive type with	Trapezoidal screw drive	TR / TGT	
Spindle dimensions	Trapezoidal screw diameter	d_0	mm
	Spindle pitch	P	mm
Nut design	Single nut	●	
Drive type with	Ball screw drive	● / KGT	
Spindle dimensions	Ball screw diameter	d_0	mm
	Spindle pitch	P	mm
Nut design	Single nut	M	
	Double nut	MM	
Cover optional	Without bellows	0	
	With bellows	1	
Lengths	Total length	L_{tot}	mm
	Total stroke length	G_H	mm

● Standard scope of delivery.

■ Design not available.

Designation and suffixes																			
LTE																			
08	12	16		20		25		30				40				50			
65	85	100		130		160		180				230				280			
A	A	A		A		A		A				A				A			
B	B	B		B		B		B				B				B			
●	●	●		OA		●		●				●				●			
■	■	TR		TGT		TR		TR				TR				TR			
■	■	12		16		16		20				24				32			
■	■	3		4		4		4		8		5		10		6			
■	■	●		●		●		●		●		●		●		●			
■	■	●		KGT		●		●				●				●			
■	■	12		16		16		20				25	32			25	32		
■	■	04	05	05	10	05	10	05	10	20	50	05	10	20	40	05	10	20	40
■	■	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
■	■	■	■	MM	■	MM	MM	MM	MM	■	■	MM	MM	MM	■	MM	MM	MM	■
●	●	0		0		0		0				0				0			
■	■	1		1		1		1				1				1			
to be calculated from total stroke length, see page 574																			
to be calculated from effective stroke length, see page 574																			

Linear tables with closed shaft guidance system

Closed shaft guidance system, without drive

Linear table with closed linear ball bearing guidance system	LTE
Size code	20
Carriage plate length L	130 mm
Shaft support blocks, design (A or B)	B
Without drive	OA
Bellows (with = 1, without = 0)	0
Total length L_{tot}	570 mm
Total stroke length G_H	400 mm

Ordering designation **LTE20-130-B-OA-0/570-400**, *Figure 34*

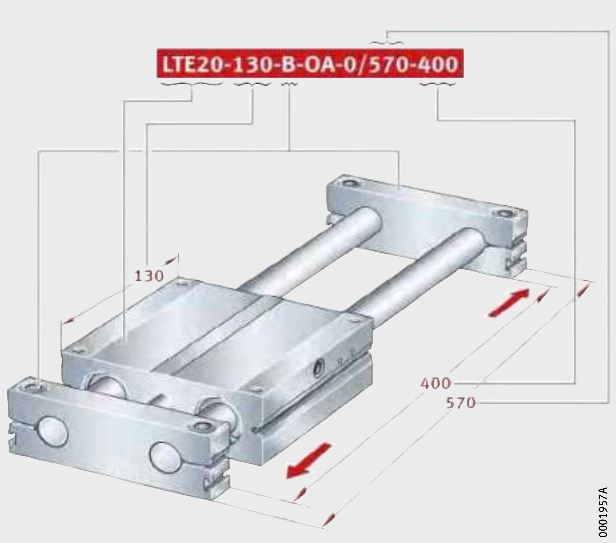


Figure 34
Ordering designation

Closed shaft guidance system, with trapezoidal screw drive

Linear table with closed linear ball bearing guidance system	LTE
Size code	20
Carriage plate length L	130 mm
Shaft support blocks, design (A or B)	A
Trapezoidal screw drive, d_0 = 16 mm pitch P = 4 mm	TGT 16X4
Bellows (with = 1, without = 0)	1
Total length L_{tot}	731 mm
Total stroke length G_H	400 mm

Ordering designation **LTE20-130-A-TGT 16X4-1/731-400**, *Figure 35*

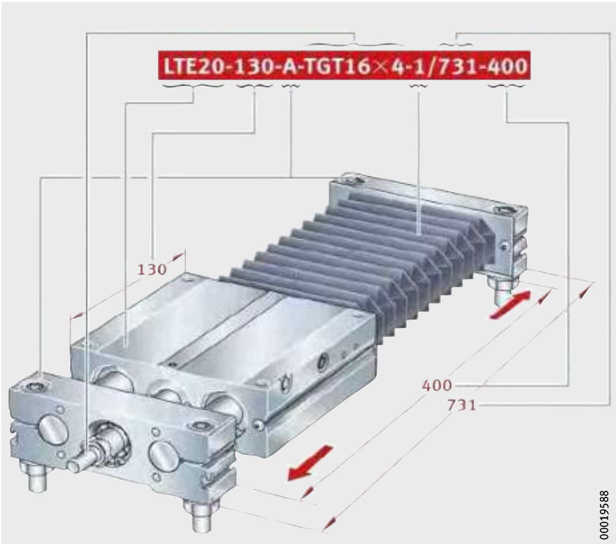


Figure 35
Ordering designation

Linear tables
with closed shaft guidance system

Closed shaft guidance system, with ball screw drive

Linear table with closed linear ball bearing guidance system	LTE
Size code	20
Carriage plate length L	130 mm
Shaft support blocks, design (A or B)	A
Ball screw drive, d_0 = 16 mm pitch P = 5 mm	KGT1605
Nut (cylindrical, single nut)	M
Bellows (with = 1, without = 0)	1
Total length L_{tot}	731 mm
Total stroke length G_H	400 mm

Ordering designation **LTE20-130-A-KGT 1605-M-1/731-400**, *Figure 36*

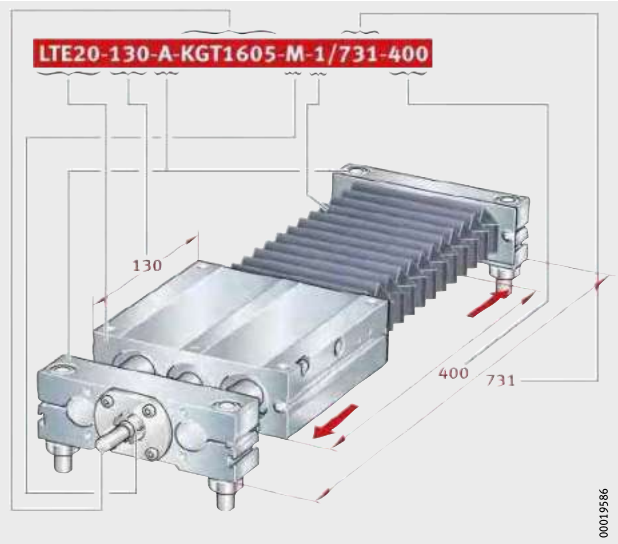
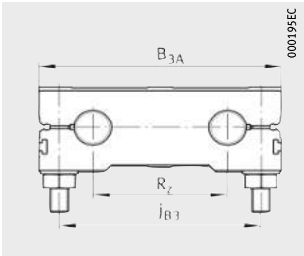


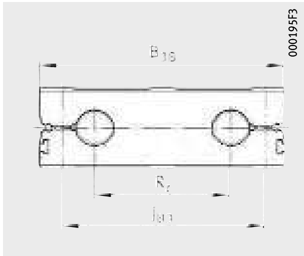
Figure 36
Ordering designation

Linear tables

Closed linear ball bearing guidance system
Without drive



LTE..-A



LTE..-B

Dimension table · Dimensions in mm

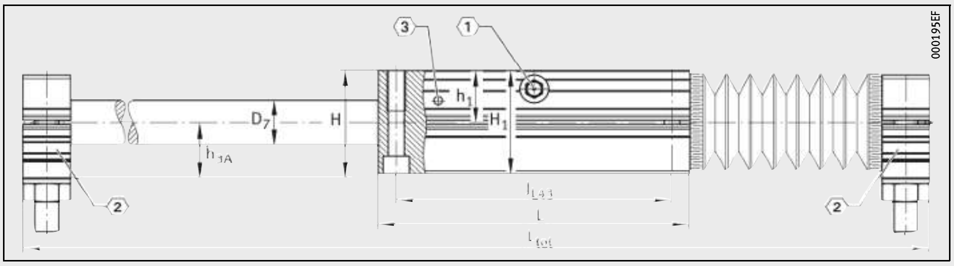
Designation		Dimensions			
Design A	Design B	B_1, B_{3A}, B_{3B}	H	H_1, H_{3A}	L
LTE08-65-A[1]	**LTE08-65-B**[1]	65	24	23	65
LTE12-85-A[1]	**LTE12-85-B**[1]	85	34	32	85
LTE16-100-A	**LTE16-100-B**	100	38	36	100
LTE20-130-A-OA	**LTE20-130-B-OA**	130	48	46	130
LTE25-160-A	**LTE25-160-B**	160	58	56	160
LTE30-180-A	**LTE30-180-B**	180	67	64	180
LTE40-230-A	**LTE40-230-B**	230	84	80	230
LTE50-280-A	**LTE50-280-B**	280	100	96	280

For further table values, see page 610 and page 611.

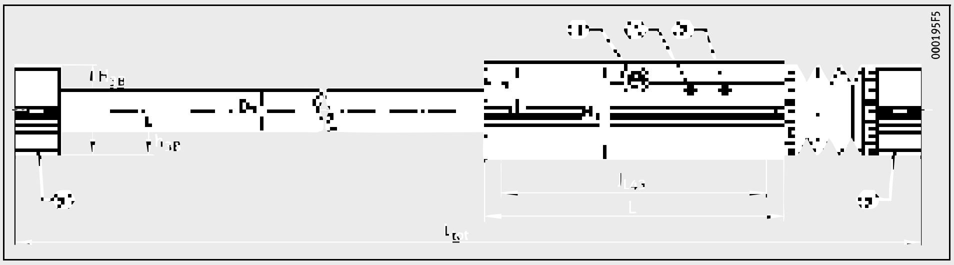
Calculation of length L_{tot}, see page 574.

1) Not available with bellows.

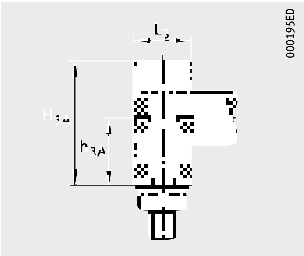
2) ⟨1⟩ Lubrication nipple DIN 3405-A M6, see page 581.
⟨2⟩ Filling openings, see page 584.
⟨3⟩ Switching tag connectors on carriage unit, see page 584.



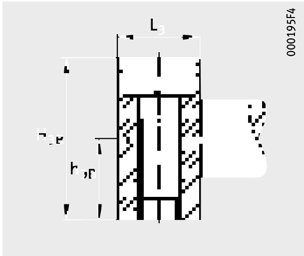
LTE..-A
⟨1⟩, ⟨2⟩, ⟨3⟩ 2)



LTE..-B
⟨1⟩, ⟨2⟩, ⟨3⟩ 2)

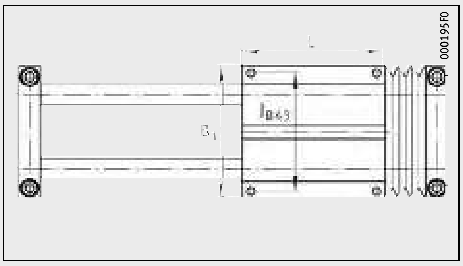


LTE..-A



LTE..-B

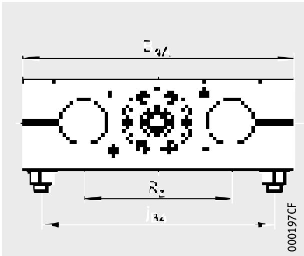
Mounting dimensions								
∅ D_7 h7	h_1	h_{3A}	h_{3B}	H_{3B}	j_{B3}	J_{B43}, J_{L43}	L_3	R_z
8	11,5	12,5	11	22	52	55	12	32
12	16	18	14	28	70	73	14	42
16	18	20	16	32	82	88	18	54
20	23	25	21	42	108	115	20	72
25	28	30	26	52	132	140	25	88
30	32	35	29	58	150	158	25	96
40	40	44	36	72	190	202	30	122
50	48	52	44	88	240	250	30	152



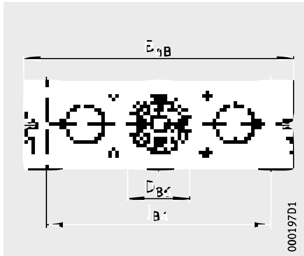
LTE · Top view

Linear tables

Closed linear ball bearing guidance system
With trapezoidal screw drive



LTE40..-A-TR and LTE50..-A-TR



LTE16..-B-TR, LTE20..-B-TGT, LTE25..-B-TR, LTE30..-B-TR

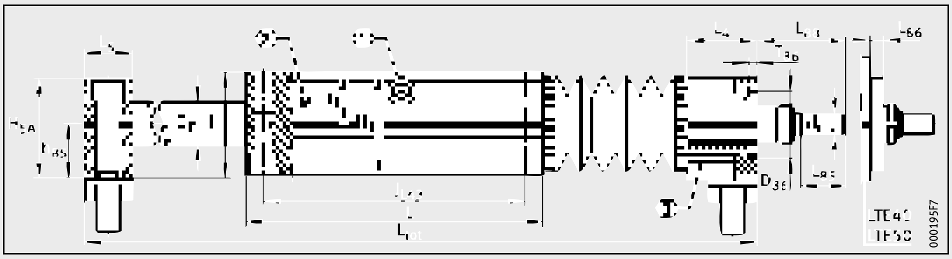
Dimension table · Dimensions in mm

Designation		Dimensions				Mounting dimensions				
Design A	Design B	B_1, B_{4A}, B_{4B}	H	H_1, H_{4A}, H_{5A}	L	b_{87} $\pm 0{,}2$	$\varnothing\, d_{85}$ h7	$\varnothing\, d_{86}$ g7	$\varnothing\, D_7$ h7	D_{86} H7
LTE16-100-A-TR	**LTE16-100-B-TR**	100	38	36	100	44	5	–	16	17
LTE20-130-A-TGT	**LTE20-130-B-TGT**	130	48	46	130	62	9[1)]	–	20	30
LTE25-160-A-TR	**LTE25-160-B-TR**	160	58	56	160	64	9[1)]	–	25	30
LTE30-180-A-TR	**LTE30-180-B-TR**	180	67	64	180	68	10	–	30	32
LTE40-230-A-TR	**LTE40-230-B-TR**	230	84	80	230	68	16[1)]	66	40	–
LTE50-280-A-TR	**LTE50-280-B-TR**	280	100	96	280	62	16	72	50	–

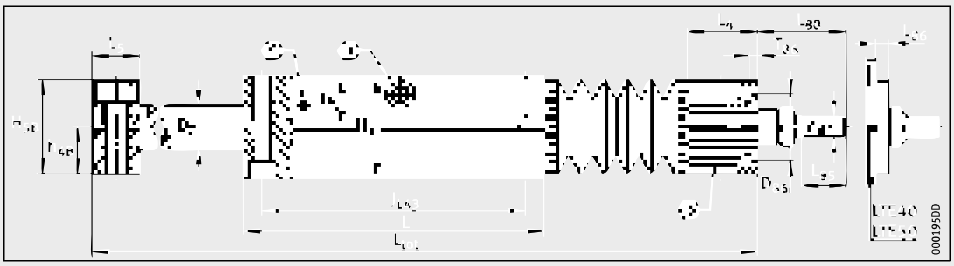
For further table values, see page 610 and page 611.
Calculation of length L_{tot}, see page 574.

1) Thread witness marks may be present on the pin.

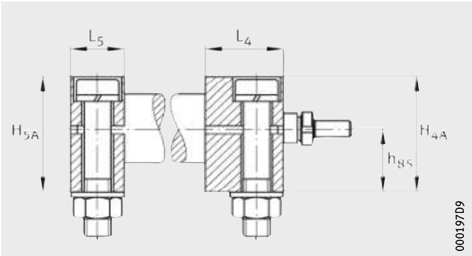
2) (1) Lubrication nipple DIN 3405-A M6, see page 581.
(2) Filling openings, see page 584.
(3) Switching tag connectors on carriage unit, see page 584.



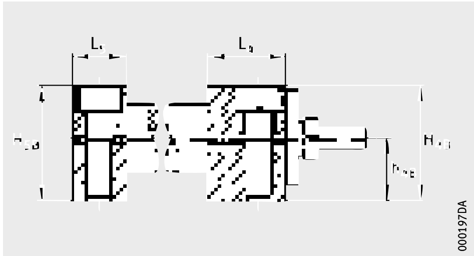
LTE20..-A-TGT
(1), (2), (3) 2)



LTE20..-B-TGT
(1), (2), (3) 2)

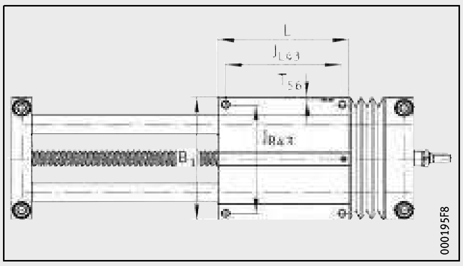


LTE..-A-TR, LTE..-A-TGT · Detail

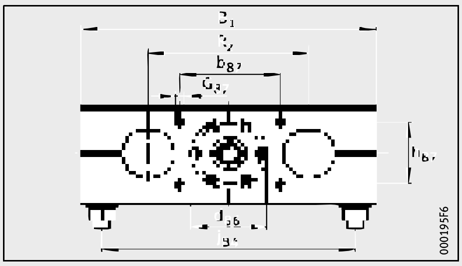


LTE..-B-TR, LTE..-B-TGT · Detail

G_{87} M×Depth	h_1	h_{4B}, h_{5B}	h_{85}	h_{87} ±0,2	H_{4B}, H_{5B}	j_{B4}	j_{B43}, j_{L43}	L_4	L_5	L_{85}	L_{86}	L_{88}	R_z	T_{56}	T_{86}
M5×12	18	16	20	22	32	82	88	24	18	12	–	28,5	54	–	3
M6×15	23	21	25	30	42	108	115	29	20	18	–	37	72	3,75	2,8
M6×15	28	26	30	38	52	132	140	33	25	18	–	34,5	88	–	3,3
M6×15	32	29	35	44	58	150	158	38	25	18	–	36,5	96	–	2,8
M8×18	40	36	44	56	72	190	202	39	30	23	9	46	122	–	–
M8×18	48	44	52	62	88	240	250	42	30	23	9	46	152	–	–



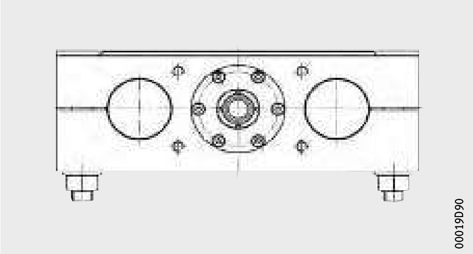
LTE · Top view



LTE40..-A-TR, LTE50..-A-TR (with centring cover) · Drive flange, drive shaft

Linear tables

Closed linear ball bearing guidance system
With trapezoidal screw drive
Drive
Performance data



LTE

Performance data						
Designation		Drive				
Design A	Design B	Spindle			Spindle nut	
		Diameter d_0	Pitch P	Mass moment of inertia	Design	Basic static load rating C_0[1)]
		mm	mm	$kg \cdot cm^2$		N
LTE16-100-A-TR	**LTE16-100-B-TR**	12	3	0,09	Single nut	630
LTE20-130-A-TGT	**LTE20-130-B-TGT**	16	4	0,3	Single nut	2 250
LTE25-160-A-TR	**LTE25-160-B-TR**	16	4	0,3	Single nut	2 250
LTE30-180-A-TR	**LTE30-180-B-TR**	20	4 8	0,81	Single nut	2 550
LTE40-230-A-TR	**LTE40-230-B-TR**	24	5 10	1,65	Single nut	2 500
LTE50-280-A-TR	**LTE50-280-B-TR**	32	6	5,45	Single nut	5 530

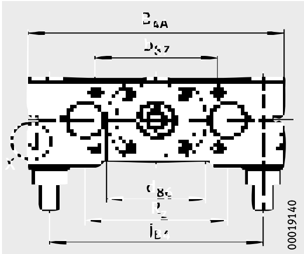
For further table values, see page 600 and page 601.

1) In the case of linear tables with trapezoidal screw drive,
the maximum axial load is restricted by the spindle bearing arrangement.
Please consult us regarding the loading of the trapezoidal screw drive.

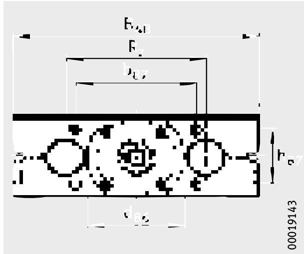
Spindle bearing arrangement (locating bearing)		Drive torque on drive stud max.
Bearing	Basic static axial load rating C_{0a}	
	N	Nm
30/6-2RSR	630	1,5
2×7200-2RS	2 250	3
2×7200-2RS	2 250	3
2×7201-2RS	2 550	10
3303-2RS	2 500	5
3304-2RS	5 530	5

Linear tables

Closed linear ball bearing guidance system
With ball screw drive



LTE..-A, LTE20..-A-KGT



LTE..-B, LTE20..-B-KGT

Dimension table · Dimensions in mm

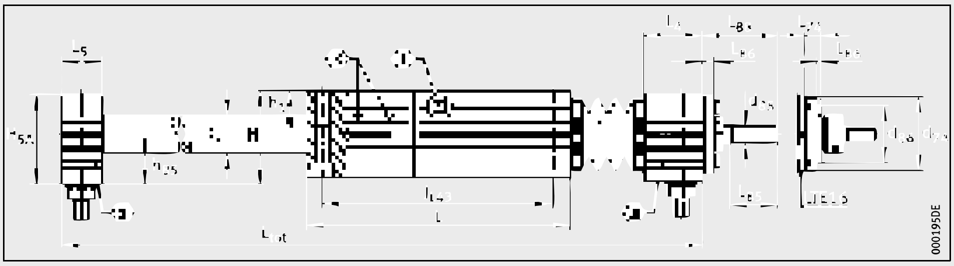
Designation		Dimensions				Mounting dimensions				
Design A	Design B	B_1, B_{4A}, B_{4B}	H	H_1, H_{4A}, H_{5A}	L	b_{87} $\pm 0{,}2$	$\varnothing\, d_{74}$	$\varnothing\, d_{85}$ h7	$\varnothing\, d_{86}$ g7	$\varnothing\, D_7$ h7
LTE16-100-A-12	**LTE16-100-B-12**	100	38	36	100	44	38	5	24	16
LTE20-130-A-KGT	**LTE20-130-B-KGT**	130	48	46	130	62	–	9¹⁾	50	20
LTE25-160-A-16	**LTE25-160-B-16**	160	58	56	160	64	–	9¹⁾	52	25
LTE30-180-A-20	**LTE30-180-B-20**	180	67	64	180	68	–	10	60	30
LTE40-230-A-25	**LTE40-230-B-25**	230	84	80	230	68	–	16¹⁾	66	40
LTE40-230-A-32	**LTE40-230-B-32**							16	72	
LTE50-280-A-25	**LTE50-280-B-25**	280	100	96	280	62	–	16¹⁾	66	50
LTE50-280-A-32	**LTE50-280-B-32**							16	72	

For further table values on connection, see page 610 and page 611.

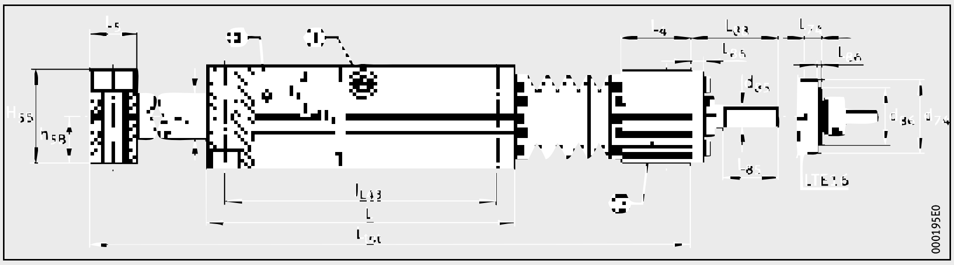
Calculation of length L_{tot}, see page 574.

1) Thread witness marks may be present on the pin.

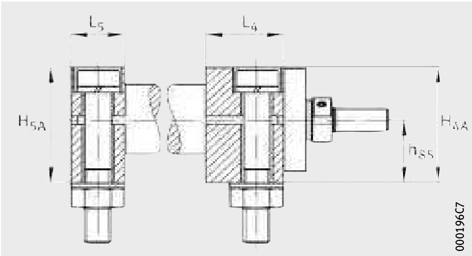
2) ⟨1⟩ Lubrication nipple DIN 3405-A M6, see page 581.
⟨2⟩ Filling openings, see page 584.
⟨3⟩ Switching tag connectors on carriage unit, see page 584.



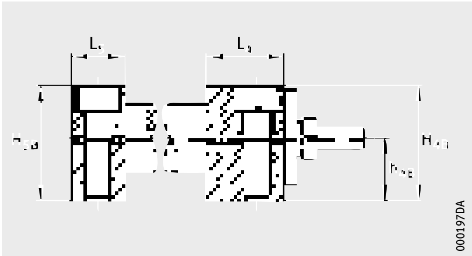
LTE..-A
⟨1⟩, ⟨2⟩, ⟨3⟩ 2)



LTE..-B
⟨1⟩, ⟨2⟩, ⟨3⟩ 2)

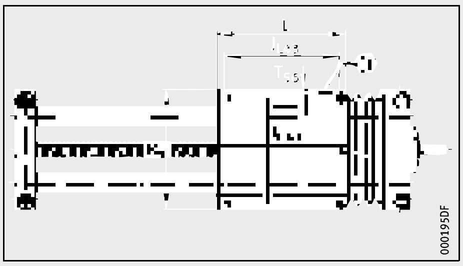


LTE..-A, LTE20..-A-KGT · Detail

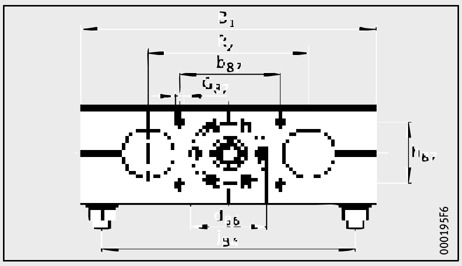


LTE..-B, LTE20..-B-KGT · Detail

G_{87} M×depth	h_1	h_{4B}, h_{5B}	h_{85}	h_{87} ±0,2	H_{4B}, H_{5B}	j_{B4}	j_{B43}, j_{L43}	L_4	L_5	L_{74}	L_{85}	L_{86}	L_{88}	R_z	T_{56}
M5×12	18	16	20	22	32	82	88	24	18	6,5	12	1,5	28,5	54	–
M6×15	23	21	25	30	42	108	115	29	20	–	23	8	37	72	3,75
M6×15	28	26	30	38	52	132	140	33	25	–	18	7	34,5	88	–
M6×15	32	29	35	44	58	150	158	38	25	–	18	9	36,5	96	–
M8×18	40	36	44	56	72	190	202	39 42	30	–	23	9	46	122	–
M8×18	48	44	52	62	88	240	250	39 42	30	–	23	9	46	152	–



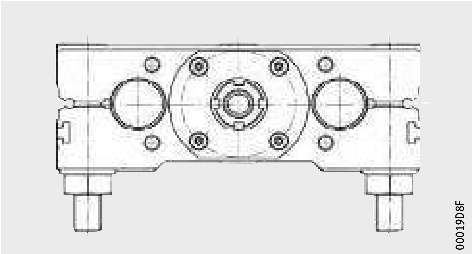
LTE · Top view
1 2)



LTE..-A · Drive flange, drive shaft

Linear tables

Closed linear ball bearing guidance system
With ball screw drive
Drive
Performance data



LTE

Performance data							
Designation		Drive					
Design A	Design B	Spindle			Spindle nut		
		Diameter d_0 mm	Pitch P mm	Mass moment of inertia kg · cm²	Design	Basic dynamic load rating C_a [1] N	Basic static load rating C_0 [1] N
LTE16-100-A-12	**LTE16-100-B-12**	12	4	0,11	Single nut	4 900	6 600
			5			4 400	6 800
LTE20-130-A-KGT	**LTE20-130-B-KGT**	16	5	0,313	Single nut, double nut	9 300	13 100
			10	0,321	Single nut	15 400	26 500
LTE25-160-A-16	**LTE25-160-B-16**	16	5	0,313	Single nut, double nut	9 300	13 100
			10	0,321		15 400	26 500
LTE30-180-A-20	**LTE30-180-B-20**	20	5	0,846	Single nut, double nut	10 500	16 600
			10	0,846		12 700	22 100
			20	0,883	Single nut	11 600	18 400
			50	0,845		13 000	24 600
LTE40-230-A-25	**LTE40-230-B-25**	25	5	2,25	Single nut, double nut	12 300	22 500
LTE40-230-A-32	**LTE40-230-B-32**	32	10	6,43		33 400	54 500
			20			29 700	59 800
			40		Single nut	14 900	32 400
LTE50-280-A-25	**LTE50-280-B-25**	25	5	2,25	Single nut, double nut	12 300	22 500
LTE50-280-A-32	**LTE50-280-B-32**	32	10	6,43		33 400	54 500
			20			29 700	59 800
			40		Single nut	14 900	32 400

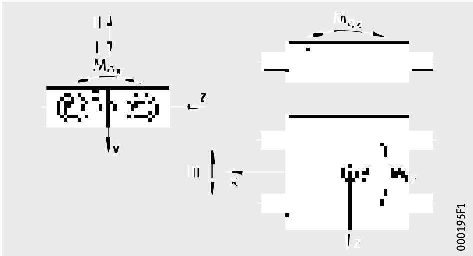
For further table values, see page 604 and page 605.

[1] Basic load ratings in accordance with DIN 69051. Due to the modified calculation algorithms in DIN 69051, the basic load ratings C_a and C_0 may differ in comparison with older data.

Spindle bearing arrangement (locating bearing)			Drive torque on drive stud max.
Bearing	Basic dynamic axial load rating C_a N	Basic static axial load rating C_{0a} N	Nm
ZKLN0624-2RS-PE	6 900	8 500	1,5
ZKLN1034-2RS-PE	13 400	18 800	6
ZKLN1034-2RS-PE	13 400	18 800	6
ZKLN1545-2RS-PE	17 900	28 000	17
ZKLN1747-2RS-PE	18 800	31 000	12
ZKLN2052-2RS-PE	26 000	47 000	50
ZKLN1747-2RS-PE	18 800	31 000	12
ZKLN2052-2RS-PE	26 000	47 000	50

Linear tables

Closed linear ball bearing guidance system
Performance data



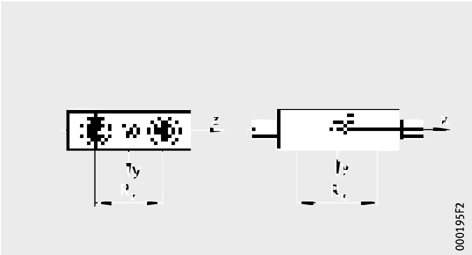
Load directions

Performance data

Designation		Carriage unit guidance system (for each carriage unit)1)						
Design A	Design B	Linear ball bearing	Basic load ratings (per carriage unit)					
			Load direction I Minimum compressive load		Load direction II Minimum tensile load		Load direction III Minimum lateral load	
			dyn. C N	stat. C_0 N	dyn. C N	stat. C_0 N	dyn. C N	stat. C_0 N
LTE08-65-A	**LTE08-65-B**	KB08-P	630	860	630	860	630	860
LTE12-85-A	**LTE12-85-B**	KB12-P	1 420	1 540	1 420	1 540	1 420	1 540
LTE16-100-A	**LTE16-100-B**	KB16-P	1 870	2 120	1 870	2 120	1 870	2 120
LTE16-100-A-TR	**LTE16-100-B-TR**							
LTE16-100-A-12	**LTE16-100-B-12**							
LTE20-130-A-OA	**LTE20-130-B-OA**	KB20-P	4 140	4 920	4 140	4 920	4 140	4 920
LTE20-130-A-TGT	**LTE20-130-B-TGT**							
LTE20-130-A-KGT	**LTE20-130-B-KGT**							
LTE25-160-A	**LTE25-160-B**	KB25-P	7 390	8 880	7 390	8 880	7 390	8 880
LTE25-160-A-TR	**LTE25-160-B-TR**							
LTE25-160-A-16	**LTE25-160-B-16**							
LTE30-180-A	**LTE30-180-B**	KB30-P	9 500	11 400	9 500	11 400	9 500	11 400
LTE30-180-A-TR	**LTE30-180-B-TR**							
LTE30-180-A-20	**LTE30-180-B-20**							
LTE40-230-A	**LTE40-230-B**	KB40-P	15 830	17 600	15 830	17 600	15 830	17 600
LTE40-230-A-TR	**LTE40-230-B-TR**							
LTE40-230-A-25	**LTE40-230-B-25**							
LTE40-230-A-32	**LTE40-230-B-32**							
LTE50-280-A	**LTE50-280-B**	KB50-P	22 950	25 200	22 950	25 200	22 950	25 200
LTE50-280-A-TR	**LTE50-280-B-TR**							
LTE50-280-A-25	**LTE50-280-B-25**							
LTE50-280-A-32	**LTE50-280-B-32**							

1) The deflection of the shafts must be taken into consideration.
Design of linear ball bearing guidance systems: see Catalogue WF1.

2) These values apply if load is evenly distributed over all four linear ball bearings.
Values indicate single loads. These must be reduced for combined loads.
For design criteria of the linear guidance system, see Catalogue WF1.

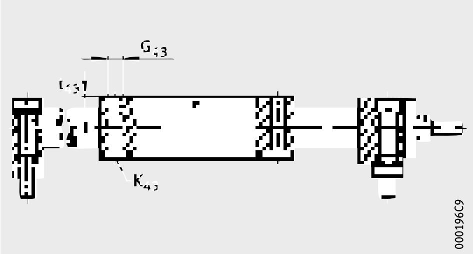


Mounting geometry of linear ball bearings

Permissible static moment ratings (per carriage unit)[2]			Mounting geometry Spacings between linear ball bearings	
$M_{0x\ per}$ Nm	$M_{0y\ per}$ Nm	$M_{0z\ per}$ Nm	R_x mm	R_z mm
14	15	15	34	32
41	37,5	35	46	42
57	48	45	55,6	54
178	155	138	74,6	72
390	340	280	88,6	88
540	503	393	98,6	96
1 080	970	876	134	122
1 904	1 736	1 510	163	152

Linear tables

Closed linear ball bearing guidance system
Location of carriage unit and
shaft support blocks

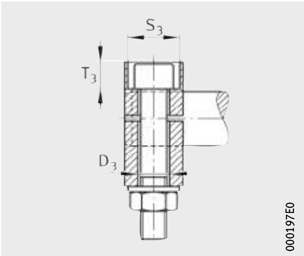


LTE..-A-TGT, LTE..-A-KGT
Carriage unit · Fixing screws

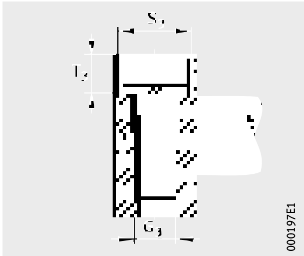
Dimension table

Designation		Fixing screws			
Design A	Design B	Shaft support block A			
		D_3	S_3	T_3	j_{L3}
LTE08-65-A[1]	**LTE08-65-B**[1]	5,5	10	7,3	–
LTE12-85-A[1]	**LTE12-85-B**[1]	6,6	11	8,4	–
LTE16-100-A	**LTE16-100-B**	9	15	8	9
LTE16-100-A-TR	**LTE16-100-B-TR**				
LTE16-100-A-12	**LTE16-100-B-12**				
LTE20-130-A-OA	**LTE20-130-B-OA**	11	18	10	10
LTE20-130-A-TGT	**LTE20-130-B-TGT**				
LTE20-130-A-KGT	**LTE20-130-B-KGT**				
LTE25-160-A	**LTE25-160-B**	13,5	20	15,5	12,5
LTE25-160-A-TR	**LTE25-160-B-TR**				
LTE25-160-A-16	**LTE25-160-B-16**				
LTE30-180-A	**LTE30-180-B**	13,5	20	15,5	12,5
LTE30-180-A-TR	**LTE30-180-B-TR**				
LTE30-180-A-20	**LTE30-180-B-20**				
LTE40-230-A	**LTE40-230-B**	17,5	26	14,5	15
LTE40-230-A-TR	**LTE40-230-B-TR**				
LTE40-230-A-25	**LTE40-230-B-25**				
LTE40-230-A-32	**LTE40-230-B-32**				
LTE50-280-A	**LTE50-280-B**	17,5	26	21	15
LTE50-280-A-TR	**LTE50-280-B-TR**				
LTE50-280-A-25	**LTE50-280-B-25**				
LTE50-280-A-32	**LTE50-280-B-32**				

[1] Not available with bellows.

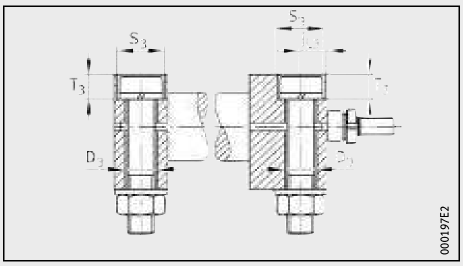


LTE..-A · Location of shaft support block

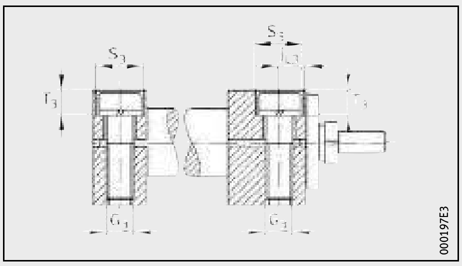


LTE..-B · Location of shaft support block

Shaft support block B	For screws to DIN ISO 4762		
G_3	K_{43}	G_{43}	t_{43}
M5	M4	M5	11
M6	M5	M6	13
M8	M5	M6	13
M10	M6	M8	18
M12	M8	M10	22
M12	M10	M12	26
M16	M12	M16	34
M16	M12	M16	34



LTE..-A-TR, LTE..-A-TGT, LTE..-A-KGT



LTE..-B-TR, LTE..-B-TGT, LTE..-B-KGT

Linear tables
with open shaft guidance system

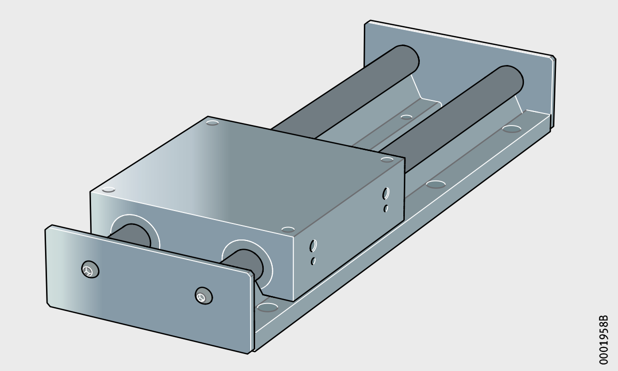
Product overview

Linear tables with open shaft guidance system

Basic design

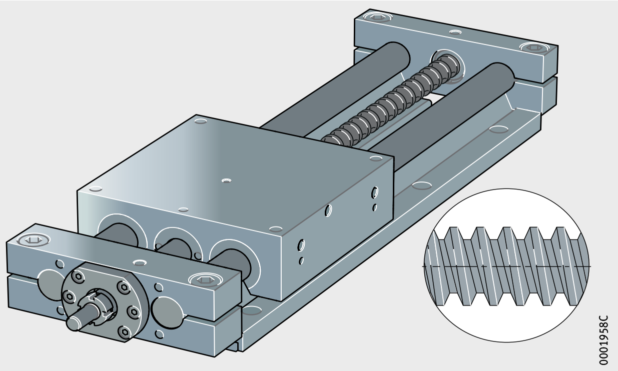
Open shaft guidance system
Without drive

LTS



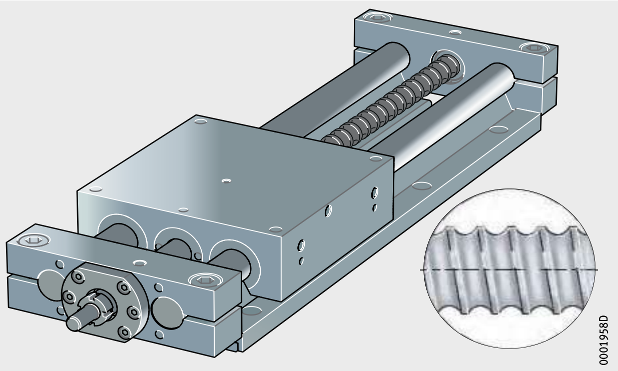
Open shaft guidance system
With trapezoidal screw drive

LTS..-TR



Open shaft guidance system
With ball screw drive

LTS..-KGT



Linear tables
with open shaft guidance system

Features

Linear tables LTS are suitable for moderate loads and long stroke lengths.

Linear tables LTS have higher load capacity in the compressive direction, due to the supported guidance shafts, than for example linear tables LTE with open shaft guidance system.

Basic design

The basic design of linear tables LTS has no drive and comprises:

- a carriage unit made from aluminium alloy with four linear ball bearings KBO lubricated via two lubrication nipples on each side of the carriage unit
- two shaft and support rail units. The shaft and support rail units are composite units comprising an aluminium support rail and a shaft made from quenched and tempered steel to rolling bearing quality. The shafts are hardened and ground
- bellows fitted as optional.

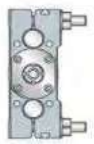
The linear ball bearings have an initial greasing, are sealed and can be relubricated.

With trapezoidal screw drive

Linear tables LTS with trapezoidal screw drive comprise the basic design plus the following additional components:

- a rolled trapezoidal screw spindle with a cylindrical bronze nut
- on the drive side: a locating bearing in a shaft support block; depending on the table size, the locating bearing comprises one double row angular contact ball bearing or two single row angular contact ball bearings
- on the opposite side: a non-locating bearing in a shaft support block; the non-locating bearing comprises one single row ball bearing.

The spindle support bearings are sealed and lubricated for life. The spindle nut has an initial greasing, is sealed and can be relubricated via a lubrication nipple in the carriage unit.



Linear tables
with open shaft guidance system

With ball screw drive

Linear tables LTS with ball screw drive comprise the basic design plus the following additional components:

- a rolled ball screw spindle with a cylindrical single nut M. In the case of some pitch values, preloaded double nuts MM are also possible
- on the drive side: a locating bearing in a shaft support block; the locating bearing comprises a preloaded double row angular contact ball bearing ZKLN and a lubrication nipple
- on the opposite side: a non-locating bearing in a shaft support block; the non-locating bearing comprises a needle roller bearing NA and a lubrication nipple.

The spindle support bearings and spindle nuts have an initial greasing, are sealed and can be relubricated. The spindle nuts can be relubricated via a lubrication nipple in the carriage unit.

With bellows

Linear tables LTS can be equipped with two sets of bellows, excluding LTS12.

The bellows are attached by means of Velcro tape.

For the same stroke length, the total length of a linear table with bellows is greater than the total length of a linear table without bellows.

Screw drive

The spindle thread has a pitch value of between 3 mm and 50 mm, see table. As standard, single nuts with an axial clearance dependent on the pitch are used. In the case of some pitch values, the ball screw drive can be supplied with preloaded double nuts.

Screw drive variants

Screw drive variants		Trapezoidal screw drive	Ball screw drive	Suffix
Pitch	3 mm	●	–	3
	4 mm	●	●	4
	5 mm	●	●	5
	6 mm	●	–	6
	8 mm	●	–	8
	10 mm	●	●	10
	20 mm	–	●	20
	40 mm	–	●	40
	50 mm	–	●	50
Single nut (cylindrical)		●	●	M
Double nut (cylindrical)		–	●	MM
Without drive (no spindle), with bellows		–	–	OA

Drive elements

For linear tables, Schaeffler also supplies components such as couplings, coupling housings, servo motors and servo controllers, *Figure 1*. The range is supplemented by servo controllers for effective drive and control of the motors.

Example:
LTS
① Carriage unit
② Coupling KUP
③ Coupling housing KGEH
④ Servo motor MOT

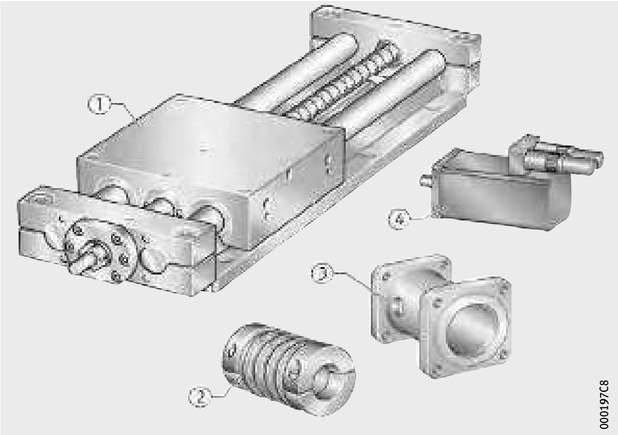


Figure 1
Linear table
with open shaft guidance system

Proven drive combinations

The combination of the necessary drive components for vertical and horizontal applications as a function of the mass to be moved, the acceleration and the travel velocity of carriage units is shown on page 681.

The bearing load in the linear tables must be checked; it is not taken into consideration in dimensioning of the motor.
For vertical mounting, motors with a holding brake must be used.

If different loading and kinematic criteria apply, the least favourable operating conditions should be used for calculation of the drive motor and design of the gearbox, coupling and servo controller.

Special designs

Special designs are available by agreement. Examples of these are linear tables LTS with

- guidance shafts and spindles with anti-corrosion protection
- bellows resistant to welding beads
- a rolled ball screw spindle to accuracy class 25 μm per 300 mm
- a trapezoidal screw drive with a left hand thread
- special table designs according to customer requirements.

Linear tables with open shaft guidance system

Design and safety guidelines

The information on design and safety guidelines for linear tables LTS substantially matches the information on design and safety guidelines for linear tables LTE, see page 566. The following pages describe exclusively the differences between the linear tables LTS and the linear tables LTE.

Main load direction of linear tables with linear ball bearings

The effective load rating of a linear ball bearing is dependent on the position of the load direction in relation to the position of the ball rows.

In the case of linear tables LTS, the linear ball bearings are fitted in a specific alignment. As a result, the basic load rating relating to the mounting position of the linear ball bearing is specifically defined, *Figure 2*.

LTS

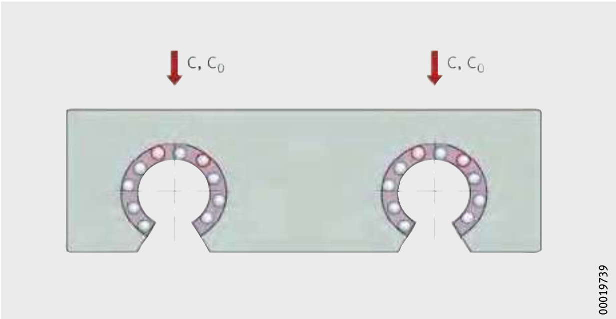


Figure 2
Main load direction

Deflection

The deflection of linear tables LTS is essentially dependent on the adjacent construction. It is not therefore possible to provide data or diagrams for the deflection.

Length calculation of linear tables

The length calculation of linear tables is based on the required effective stroke length N_H. The effective stroke length N_H must be increased by the addition of safety spacing values on both sides of the travel distance. It is only if bellows are present that the effective length B_L must be added.

The total length L_{tot} of the linear table is determined from the effective stroke length N_H, the safety spacings S, the carriage unit length L and the lengths of the end plates L_4 and L_5.

Parameters required for length calculation

G_H	mm	Total stroke length
N_H	mm	Effective stroke length
S	mm	Safety spacing, see table, page 622
L	mm	Length of carriage plate
L_{tot}	mm	Total length of linear table
L_4	mm	Length of end plate
L_5	mm	Length of end plate
L_{20}	mm	Screw head of end plate
L_{21}	mm	Thickness of end plate
F_{BL}	–	Effective length factor according to linear table type
B_L	mm	Effective length of bellows
B_B	mm	Length of bellows fastener.

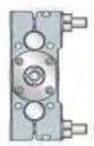
Total stroke length G_H

The total stroke length G_H is determined from the required effective stroke length effective stroke length N_H and the safety spacings S, which must correspond to at least the spindle pitch P.

$$G_H = N_H + 2 \cdot S$$

Maximum lengths of linear tables

The maximum length of linear tables LTS without bellows is dependent on the size, the drive type and the maximum length of the bellows, see table, page 620.



In the case of a total length $L_{tot} < 2 \cdot L + 30$, not all fixing holes in the support rail will be accessible, so please consult us.

Linear tables with open shaft guidance system

Maximum lengths without bellows

Designation	L_{tot} mm	Designation	L_{tot} mm	Designation	L_{tot} mm
LTS12	6 000	–	–	–	–
LTS16	6 000	LTS16..-TR	2 900	LTS16..-KGT	2 900
LTS20	6 000	LTS20..-TR	2 900	LTS20..-KGT	5 850
LTS25	6 000	LTS25..-TR	2 900	LTS25..-KGT	5 850
LTS30	6 000	LTS30..-TR	2 900	LTS30..-KGT	5 850
LTS40	6 000	LTS40..-TR	2 900	LTS40..-KGT	5 850
LTS50	6 000	LTS50..-TR	2 900	LTS50..-KGT	5 850

Maximum lengths with bellows

Designation	L_{tot} mm	Designation	L_{tot} mm	Designation	L_{tot} mm
LTS12	–	–	–	–	–
LTS16	3 000	LTS16..-TR	2 900	LTS16..-KGT	2 900
LTS20	3 800	LTS20..-TR	2 900	LTS20..-KGT	3 800
LTS25	4 400	LTS25..-TR	2 900	LTS25..-KGT	4 400
LTS30	5 400	LTS30..-TR	2 900	LTS30..-KGT	5 400
LTS40	6 000	LTS40..-TR	2 900	LTS40..-KGT	5 600
LTS50	6 000	LTS50..-TR	2 900	LTS50..-KGT	5 600

Total length L_{tot}

The following equations are designed for one linear table.
The parameters and their position can be found in *Figure 3* and *Figure 4* as well as in the table, page 622.

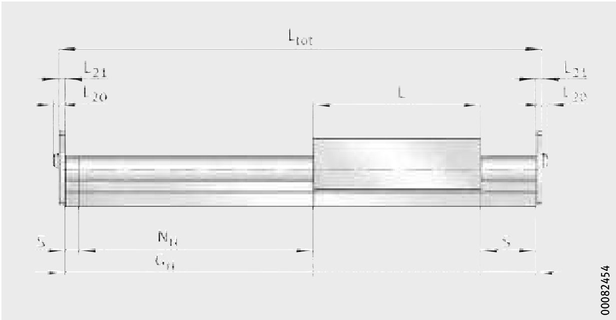


Figure 3
Length parameters for linear tables without drive

Linear table without bellows
LTS..-OA

$$L_{tot} = G_H + L + 2 \cdot L_{21}$$

Linear table with bellows
LTS..-OA

$$L_{tot} = G_H + F_{BL} + L + 2 \cdot L_{21} + B_B$$

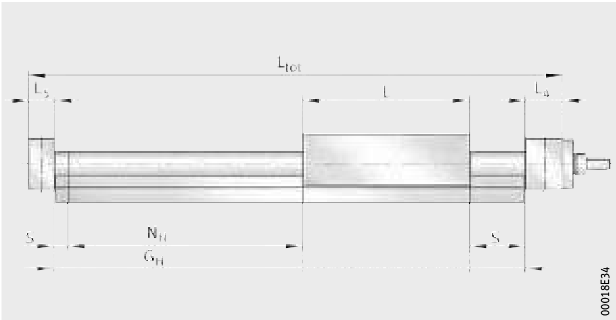


Figure 4
Length parameters for linear tables with trapezoidal or ball screw drive

Linear table without bellows
LTS..-TR, LTS..-KGT

$$L_{tot} = G_H + L + L_4 + L_5$$

Linear table with bellows
LTS..-TR, LTS..-KGT

$$L_{tot} = G_H + F_{BL} + L + L_4 + L_5 + B_B$$

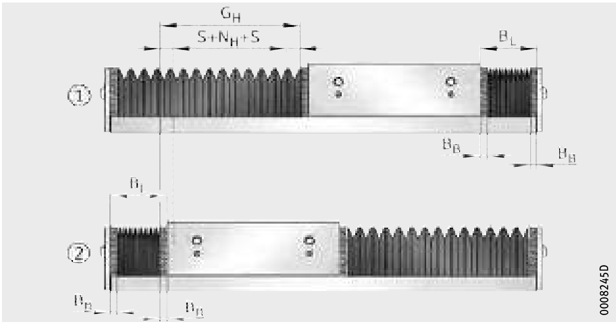
Linear tables with open shaft guidance system

Length parameters

Designation	L mm	L_4 mm	L_{20} mm	L_{21} mm	L_5 mm	S mm	F_{BL}	B_B mm
LTS12-85	85	–	–	–	–	Dependent on application	–	–
LTS16-100	100		3,3	4			1,58	29
LTS20-130	130						1,43	29
LTS25-160	160						1,34	29
LTS30-180	180						1,26	29
LTS40-230	230						1,27	30
LTS50-280	280						1,22	30
LTS16-100-TR12×3	100	24	–	–	18	3	1,58	21
LTS20-130-TR16×4	130	29			20	4	1,43	21
LTS25-160-TR16×4	160	33			25	4	1,34	21
LTS30-180-TR20×4	180	38			25	4	1,26	21
LTS30-180-TR20×8	180	38			25	8	1,26	21
LTS40-230-TR24×5	230	39			30	5	1,27	22
LTS40-230-TR24×10	230	39			30	10	1,27	22
LTS50-280-TR32×6	280	42			30	6	1,22	22
LTS16-100-1204	100	24			18	4	1,58	21
LTS16-100-1205	100	24			18	5	1,58	21
LTS20-130-1605	130	29			20	5	1,43	21
LTS20-130-1610	130	29			20	10	1,43	21
LTS25-160-1605	160	33			25	5	1,34	21
LTS25-160-1610	160	33			25	10	1,34	21
LTS30-180-2005	180	38			25	5	1,26	21
LTS30-180-2010	180	38			25	10	1,26	21
LTS30-180-2020	180	38			25	20	1,26	21
LTS30-180-2050	180	38			25	50	1,26	21
LTS40-230-2505	230	39			30	5	1,27	22
LTS40-230-3210	230	42			30	10	1,27	22
LTS40-230-3220	230	42			30	20	1,27	22
LTS40-230-3240	230	42			30	40	1,27	22
LTS50-280-2505	280	39			30	05	1,22	22
LTS50-280-3210	280	42			30	10	1,22	22
LTS50-280-3220	280	42			30	20	1,22	22
LTS50-280-3240	280	42			30	40	1,22	22

Effective length of bellows

The effective length of bellows is the length occupied by the bellows in the fully compressed state. Calculation is based on the total stroke length G_H, *Figure 5*, equation and table, page 622.



① Carriage unit against the right end stop
② Carriage unit against the left end stop

Figure 5
Effective length calculation

$$B_L = \frac{G_H \cdot (F_{BL} - 1) + B_B}{2}$$

B_L mm
Effective length of bellows

G_H mm
Total stroke length

F_{BL} –
Effective length factor according to linear table type, see table, page 622

B_B mm
Length of bellows fastener.

Linear tables
with open shaft guidance system

Calculation of hole pattern of shaft and support rail units

Shaft and support rail units are supplied as standard with a symmetrical hole pattern. If a symmetrical hole pattern is present: $a_R = a_L$. In the following calculation, the values must not be less than the value $a_{R\,min}$ ($a_{L\,min}$).

Parameters for hole pattern calculation

a_R, a_L mm
Spacing on right and left between end of shaft and nearest hole centre point, *Figure 6* and *Figure 7*
$a_{R\,min} = a_{L\,min}$ = 20 mm for linear tables without bellows
$a_{R\,min} = a_{L\,min}$ = 24 mm for linear tables with bellows

j_{L8} mm
Hole spacing, see dimension table

L_{tot} mm
Total length of table

n –
Number of hole pitches.

Hole pattern, without drive

The number of hole pitches n is the whole number equivalent to:

$$n = \frac{L_{tot} - 2 \cdot a_{R\,min}}{j_{L8}}$$

The spacing a_L between the end of the shaft and support rail units and the nearest hole centre point is calculated as follows:

$$a_R, a_L = 0{,}5 \cdot (L_{tot} - n \cdot j_{L8})$$

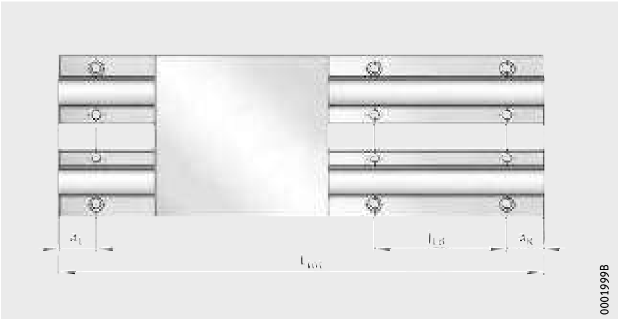


Figure 6
Spacings a_R and a_L on shaft and support rail units

Hole pattern, with drive

The number of hole pitches n is the whole number equivalent to:

$$n = \frac{L_{tot} - L_4 - L_5 - 2 \cdot a_{R\,min}}{j_{LS}}$$

The spacing a_R and a_L between the end piece and the nearest hole centre point is calculated as follows:

$$a_R, a_L = 0{,}5 \cdot \left(L_{tot} - L_4 - L_5 - n \cdot j_{LS}\right)$$

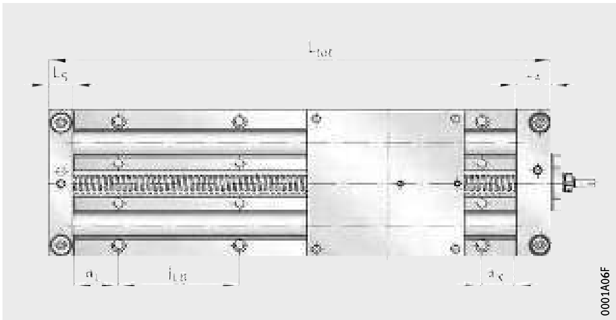


Figure 7
Spacings a_R and a_L
on shaft and support rail units

! In the case of a total length $L_2 < 2 \cdot L + 30$, not all fixing holes in the support rail will be accessible, so please consult us.

Linear tables with open shaft guidance system

Mass calculation

The total mass of a linear table is calculated from the mass of the table without a carriage unit and the carriage unit.

$$m_{tot} = m_{LAW} + m_{BOL}$$

Values for mass calculation, linear table without drive

Designation	Mass	
	Carriage unit m_{LAW} ≈kg	Table without carriage unit m_{BOL} ≈kg
LTS12	0,5	$L_{tot} \cdot 0{,}003\,2 + 0{,}5$
LTS16	0,8	$L_{tot} \cdot 0{,}005\,0 + 0{,}1$
LTS20	1,6	$L_{tot} \cdot 0{,}007\,6 + 0{,}14$
LTS25	3	$L_{tot} \cdot 0{,}010\,6 + 0{,}21$
LTS30	4,4	$L_{tot} \cdot 0{,}015\,0 + 0{,}27$
LTS40	9,1	$L_{tot} \cdot 0{,}024\,8 + 0{,}42$
LTS50	16,1	$L_{tot} \cdot 0{,}037\,8 + 0{,}62$

Values for mass calculation, linear table with screw drive

Designation	Mass	
	Carriage unit[1] m_{LAW} ≈kg	Table without carriage unit m_{BOL} ≈kg
LTS16..-12	0,8	$L_{tot} \cdot 0{,}005\,8 + 0{,}46$
LTS20..-16	1,6	$L_{tot} \cdot 0{,}008\,9 + 0{,}94$
LTS25..-16	2,9	$L_{tot} \cdot 0{,}011\,9 + 1{,}54$
LTS30..-20	4,3	$L_{tot} \cdot 0{,}017\,1 + 2{,}07$
LTS40..-25	8,8	$L_{tot} \cdot 0{,}028\,1 + 3{,}46$
LTS40..-32	9,2	$L_{tot} \cdot 0{,}030\,5 + 3{,}64$
LTS50..-25	15,8	$L_{tot} \cdot 0{,}041\,1 + 4{,}94$
LTS50..-32	16,3	$L_{tot} \cdot 0{,}043\,5 + 5{,}16$

[1] Including single or preloaded double nut.

Lubrication

The information on the lubrication of LTS matches the information on the lubrication of LTE, see page 579. The only differences are in the relubrication quantities and relubrication points.

Relubrication

Relubrication should be carried out wherever possible with several partial quantities at various times instead of the complete quantity at the time of the relubrication interval. Relubrication quantities, see table. The locating and non-locating bearing in the trapezoidal screw drive are lubricated for life.

Relubrication quantities per lubrication nipple

Designation	Linear ball bearing	d_0	P	Trapezoidal screw drive			Ball screw drive		
				Threaded nut	Locating bearing	Non-locating bearing	Threaded nut	Locating bearing	Non-locating bearing
	≈g	mm	mm	≈g			≈g		
LTS12	0,2	–	–	–	–	–	–	–	–
LTS16	0,3	12	3	–			–		
			4	–			0,2		
LTS20	0,4	16	4	3,5			–		
			5	–			0,5		
			10	–			1,3		
LTS25	1,1	16	4	3,5			–		
			5	–			0,5		
			10	–			1,3		
LTS30	1,3	20	4	6			–		
			5	–			0,6		
			10	–			3,1		
			20	–	Lubricated for life		3	Lubricated for life[1]	
			50	–			8,6		
LTS40	2,5	24	5	10			–		
		25	5	–			0,8		
		32	10	–			3,1		
			20	–			6,8		
			40	–			9,5		
LTS50	5,5	25	5	–			0,8		
		32	6	15			–		
			10	–			3,1		
			20	–			6,8		
			40	–			9,5		

[1] If relubrication is required due to the application, please consult us.

Linear tables with open shaft guidance system

Relubrication points

The linear ball bearings are greased in pairs in each case via a lateral lubrication nipple in the carriage unit. The spindle nuts are supplied with lubricant via a separate lubrication nipple. The spindle bearing arrangement of the ball screw drive in the shaft support blocks is supplied in each case from above via a lubrication nipple, see *Figure 8*, table, *Figure 9*, page 629, and *Figure 10*, page 629.

LTS

① Relubrication point for locating bearing
② Relubrication point for non-locating bearing
③ Lubrication points for linear ball bearings
④ Relubrication point for spindle nut

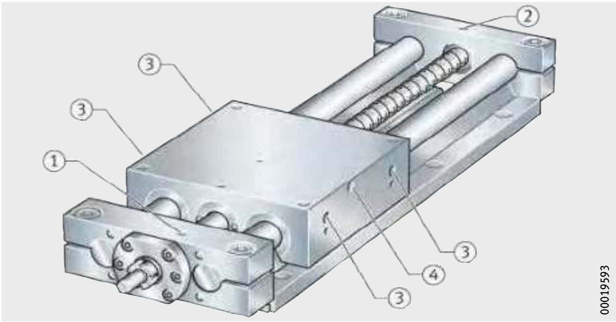


Figure 8
Lubrication points on linear table

!

During lubrication of actuators, all lubrication points on one longitudinal side of a carriage unit must always be provided with lubricant.

Position of relubrication points

Designation	Mounting dimensions										
	Type NIP	Without drive		With screw drive							
		2×for linear ball bearings		1×for spindle nut		2×for linear ball bearings		Locating bearing		Non-locating bearing	
		h_{56} mm	l_{56} mm	h_{56} mm	l_{56} mm	h_{57} mm	l_{57} mm	b_{77} mm	l_{77} mm	b_{78} mm	l_{78} mm
LTS12	A1	10	16	–							
LTS16		14	18	5,5	40	14	18	9,5	10,5	9	9
LTS20		15	22,5	5	53,15	15	22,5	12	10	–	10
LTS25	A2	15	29	6	53,15	20	29	10	16	–	12,5
LTS30		20	34	6	56,4[2)]	20	34	14	14,5	–	12,5
LTS40		30	40	8	56,4[3)]	30	40	13[4)]	17[5)]	–	15
LTS50	A3	40	50	10	56,4[3)]	40	50	–	17[5)]	–	15

1) In the case of a spindle 2020 and 2050, l_{56} = 52 mm.
2) In the case of a spindle 3210 and 3220, l_{56} = 86 mm.
In the case of a spindle 3240, l_{56} = 69 mm.
3) In the case of a spindle size 25, b_{77} = 0 mm.
4) In the case of a spindle size 25, l_{77} = 15,5 mm.

LTS
without drive

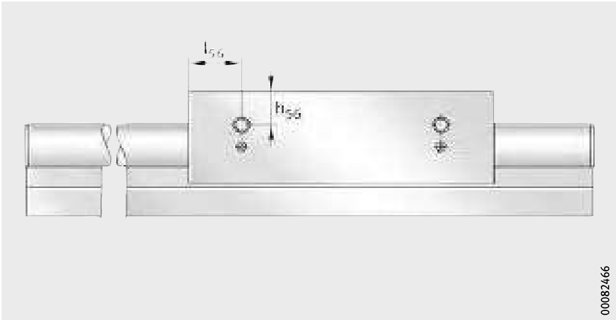


Figure 9
Lubrication points

LTS
with drive

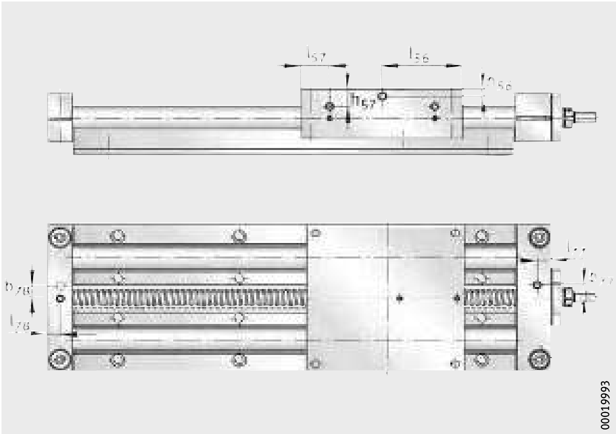


Figure 10
Position of relubrication points

Linear tables
with open shaft guidance system

Maximum permissible spindle speed

Screw drives must not be allowed to run in the critical speed range.

The critical speed is essentially dependent on the following factors:

- spindle length
- spindle diameter
- spindle bearing arrangement
- mounting method.

The carriage unit travel velocity is calculated as follows:

$$v = \frac{n \cdot P}{60 \cdot 1000}$$

v Carriage unit velocity	m/s
n Spindle speed	min^{-1}
P Spindle pitch.	mm

The carriage unit velocity v is determined from the spindle speed n and the spindle pitch P. Note the factors influencing the carriage unit velocity, such as maximum values, see page 557.

Diagram

The diagram shows the relationship for individual series and sizes between the critical speed and the spindle length, *Figure 11*.
The diagram takes account of the effective length B_L of the bellows cover. Definition of the effective length, see page 623.

LTS16
LTS20
LTS25
LTS30
LTS40
LTS50

n_{max} = maximum speed
n = spindle speed
L_2 = length of shaft and support rail unit

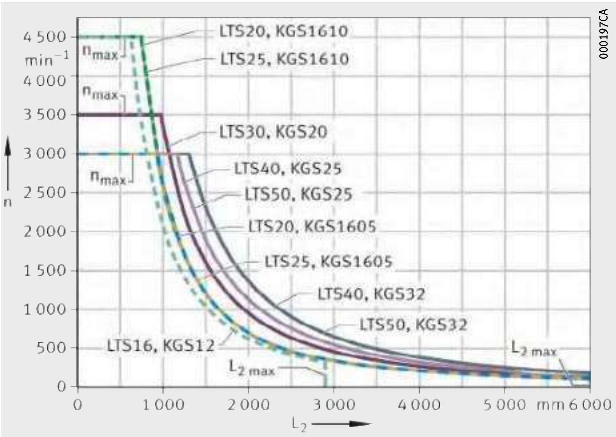


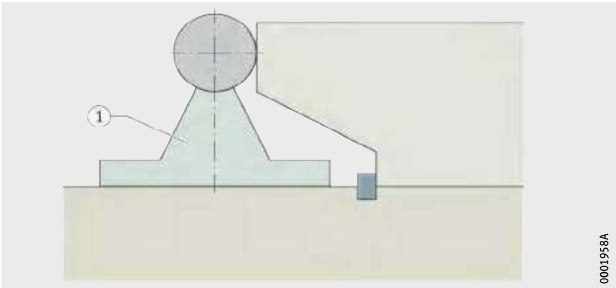
Figure 11
Maximum permissible spindle speed without spindle supports

Mounting requirements

The information on the influences of the adjacent construction of LTS matches the information on the influences of the adjacent construction of LTE, see page 585. The information on the mounting position and mounting arrangement of LTS matches the information on the mounting position and mounting arrangement of LTE, see page 586. At this point, only deviating or additional information will be covered.

Overlong tables

In the case of very long linear tables LTS, one support rail must first be aligned by means of the shaft and screw mounted in stages. The support rail arranged in parallel is aligned by moving the carriage, thus ensuring the centre spacing of the support rail.
In the case of parallel support rails, the linear table must be located by an additional form fit on the adjacent construction.
The datum support rail should be clamped against a stop, *Figure 12*.



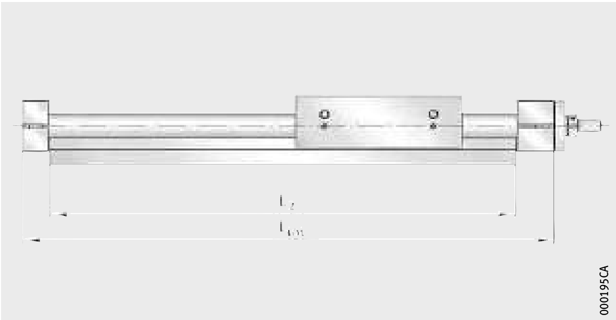
① Shaft and support rail unit

Figure 12
Alignment
of a shaft and support rail unit
by means of the shaft

Linear tables
with open shaft guidance system

Accuracy
Length tolerances

The length tolerances for linear tables can be taken from *Figure 13* and the table.



L_2 = length of shaft and support rail unit
L_{tot} = total length

Figure 13
Length tolerances

Tolerances

Total length L_{tot} of linear tables LTS mm	Tolerance mm
$L_{tot} < 400$	$\pm 0{,}5$
$400 \leq L_{tot} < 1\,000$	$\pm 0{,}8$
$1\,000 \leq L_{tot} < 2\,000$	$\pm 1{,}2$
$2\,000 \leq L_{tot} < 4\,000$	± 2
$4\,000 \leq L_{tot} < 5\,850$	± 3

Accuracy of the screw drive

Linear tables with trapezoidal screw drive are only available with a single nut with clearance, see table. The pitch accuracy is dependent on the size, see table.

Linear tables with ball screw drive are available with a single nut with clearance, see table, page 633. Where higher accuracy requirements are present, preloaded (clearance-free) double nuts are possible for many pitch values, see table, page 633.

In the case of standard linear tables with ball screw drive, the nut unit (double nut) can only be preloaded clearance-free if the spindle pitch P is less than the nominal diameter d_0 of the spindle.

Trapezoidal screw drive

<table>
<tr><th rowspan="3">Designation</th><th colspan="3">Spindle</th><th colspan="2">Spindle nut</th></tr>
<tr><th rowspan="2">Nominal diameter
d_0
mm</th><th colspan="2">Pitch</th><th colspan="2">Single nut</th></tr>
<tr><th>P
mm</th><th>Accuracy
µm each 300 mm</th><th>Suffix</th><th>Axial clearance
mm</th></tr>
<tr><td>LTS16</td><td>12</td><td>3</td><td>300</td><td rowspan="8">M</td><td rowspan="8">0,4 to 0,5</td></tr>
<tr><td>LTS20</td><td>16</td><td>4</td><td>50</td></tr>
<tr><td>LTS25</td><td>16</td><td>4</td><td>50</td></tr>
<tr><td rowspan="2">LTS30</td><td rowspan="2">20</td><td>4</td><td>50</td></tr>
<tr><td>8</td><td>200</td></tr>
<tr><td rowspan="2">LTS40</td><td rowspan="2">24</td><td>5</td><td>50</td></tr>
<tr><td>10</td><td>200</td></tr>
<tr><td>LTS50</td><td>32</td><td>6</td><td>50</td></tr>
</table>

Ball screw drive

<table>
<tr><th rowspan="3">Desig-
nation</th><th colspan="3">Spindle</th><th colspan="4">Spindle nut</th></tr>
<tr><th rowspan="2">∅ d_0
mm</th><th rowspan="2">P
mm</th><th rowspan="2">Pitch accuracy
µm each 300 mm</th><th colspan="2">Single nut</th><th colspan="2">Double nut</th></tr>
<tr><th>Suffix</th><th>Axial clearance
mm</th><th>Suffix</th><th>Axial clearance</th></tr>
<tr><td>LTS16</td><td>12</td><td>4</td><td>50</td><td>M</td><td>0,05</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">LTS20</td><td rowspan="2">16</td><td>5</td><td rowspan="2">50</td><td rowspan="2">M</td><td rowspan="2">0,05</td><td>MM</td><td>Preloaded</td></tr>
<tr><td>10</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">LTS25</td><td rowspan="2">16</td><td>5</td><td rowspan="2">50</td><td rowspan="2">M</td><td rowspan="2">0,05</td><td rowspan="2">MM</td><td rowspan="2">Preloaded</td></tr>
<tr><td>10</td></tr>
<tr><td rowspan="4">LTS30</td><td rowspan="4">20</td><td>5</td><td rowspan="4">50</td><td rowspan="4">M</td><td rowspan="4">0,05</td><td rowspan="2">MM</td><td rowspan="2">Preloaded</td></tr>
<tr><td>10</td></tr>
<tr><td>20</td><td rowspan="2">–</td><td rowspan="2">–</td></tr>
<tr><td>50</td></tr>
<tr><td rowspan="4">LTS40</td><td>25</td><td>5</td><td rowspan="4">50</td><td rowspan="4">M</td><td rowspan="4">0,05</td><td rowspan="3">MM</td><td rowspan="3">Preloaded</td></tr>
<tr><td rowspan="3">32</td><td>10</td></tr>
<tr><td>20</td></tr>
<tr><td>50</td><td>–</td><td>–</td></tr>
<tr><td rowspan="4">LTS50</td><td>25</td><td>5</td><td rowspan="4">50</td><td rowspan="4">M</td><td rowspan="4">0,05</td><td rowspan="3">MM</td><td rowspan="3">Preloaded</td></tr>
<tr><td rowspan="3">32</td><td>10</td></tr>
<tr><td>20</td></tr>
<tr><td>50</td><td>–</td><td>–</td></tr>
</table>

Linear tables with open shaft guidance system

Ordering example, ordering designation

Available designs of linear tables LTS, see table.

Available designs

Design	Linear table with open linear ball bearing guidance system		
Size	Size code		
Carriage unit length	Length	L	mm
No drive type	Without drive	●	
Type of drive	Trapezoidal screw drive	TR	
Spindle dimensions	Trapezoidal screw diameter	d_0	mm
	Spindle pitch	P	mm
Nut design	Single nut	●	
Type of drive	Ball screw drive	●	
Spindle dimensions	Ball screw diameter	d_0	mm
	Spindle pitch	P	mm
Nut design	Single nut	M	
	Double nut	MM	
Cover optional	Without bellows	0	
	With bellows	1	
Lengths	Total length	L_{tot}	mm
	Total stroke length	G_H	mm

● Standard scope of delivery.

■ Design not available.

Designation and suffixes																		
LTS																		
12	16		20		25		30				40				50			
85	100		130		160		180				230				280			
●	●		●		●		●				●				●			
■	TR		TR		TR		TR				TR				TR			
■	12		16		16		20				24				32			
■	3		4		4		4		8		5		10		6			
■	●		●		●		●		●		●		●		●		●	
■	●		●		●		●				●				●			
■	12		16		16		20				25	32			25	32		
■	04	05	05	10	05	10	05	10	20	50	05	10	20	40	05	10	20	40
■	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
■	■	■	MM	■	MM	MM	MM	MM	■	■	MM	MM	MM	■	MM	MM	MM	■
●	0		0		0		0				0				0			
■	1		1		1		1				1				1			
to be calculated from total stroke length, see page 619																		
to be calculated from effective stroke length, see page 619																		

Linear tables
with open shaft guidance system

Open shaft guidance system, without drive

Linear table	
with open linear ball bearing guidance system	LTS
Size code	20
Carriage plate length L	130 mm
Without drive	–
Bellows (with = 1, without = 0)	0
Total length L_{tot}	530 mm
Total stroke length G_H	400 mm

Ordering designation **LTS20-130-0/530-400**, *Figure 14*

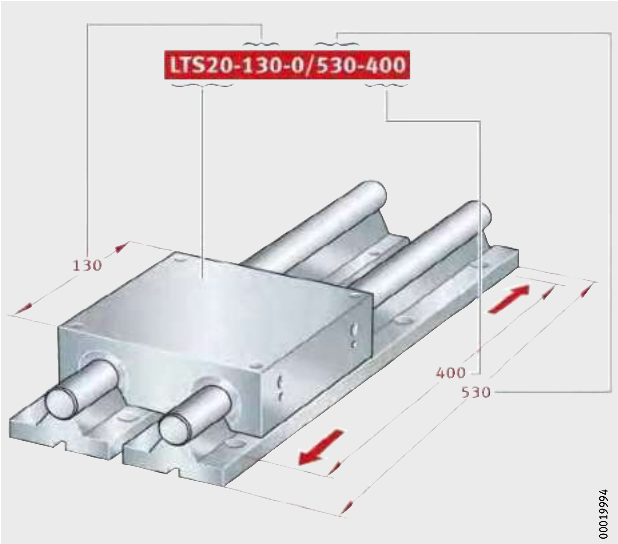


Figure 14
Ordering designation

Open shaft guidance system, with trapezoidal screw drive

Linear table with open linear ball bearing guidance system	LTS
Size code	40
Carriage plate length L	230 mm
Trapezoidal screw drive, d_0 = 24 mm, pitch P = 5 mm	TR24×5
Bellows (with = 1, without = 0)	1
Total length L_{tot}	842 mm
Total stroke length G_H	400 mm

Ordering designation **LTS40-230-TR24×5-1/842-400**, *Figure 15*

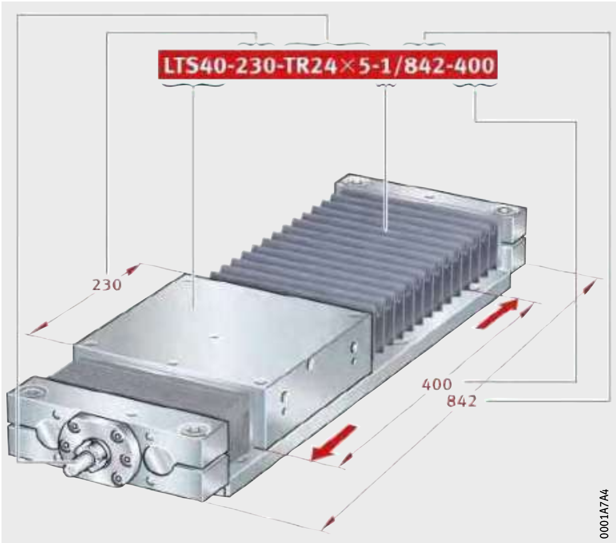


Figure 15
Ordering designation

Linear tables with open shaft guidance system

Open shaft guidance system, with ball screw drive

Linear table	
with open linear ball bearing guidance system	LTS
Size code	30
Carriage plate length L	180 mm
Ball screw drive, d_0 = 20 mm, pitch P = 5 mm	2005
Nut (cylindrical, single nut)	M
Bellows (with = 1, without = 0)	1
Total length L_{tot}	780 mm
Total stroke length G_H	400 mm

Ordering designation **LTS30-180-2005-M-1/780-400**, *Figure 16*

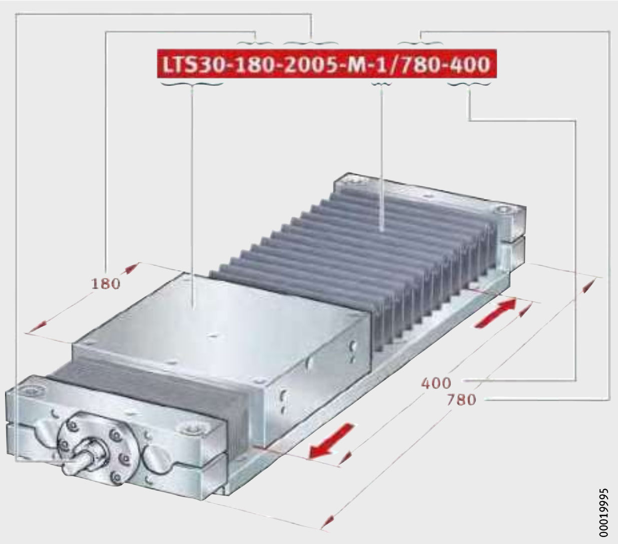
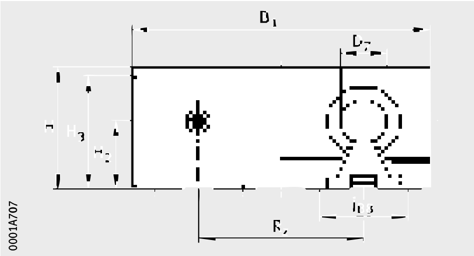


Figure 16
Ordering designation

Linear tables

Open linear ball bearing guidance system
Without drive

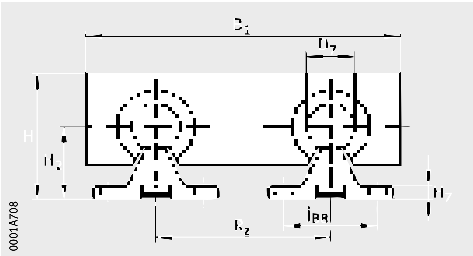


LTS · With bellows

Dimension table · Dimensions in mm							
Designation	Dimensions			Mounting dimensions			
	B_1	H	L	∅ D_7 h7	h_1	H_1	H_2
LTS12-85[1]	85	40	85	12	18	30	22
LTS16-100	100	48	100	16	22	35,5	26
LTS20-130	130	57	130	20	25	42	32
LTS25-160	160	66	160	25	30	51	36
LTS30-180	180	77	180	30	35	60	42
LTS40-230	230	95	230	40	45	77	50
LTS50-280	280	115	280	50	55	93	60

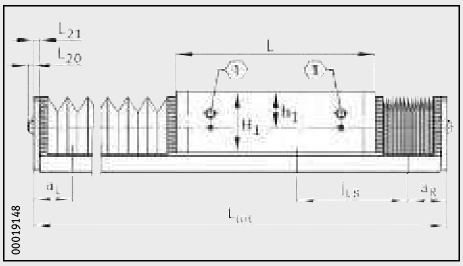
For further table values, see page 652.
Calculation of length L_{tot}, see page 619.
Calculation of effective length B_L of bellows, see page 623.

1) Not available with bellows.
2) Only valid for standard bellows.
3) Location of shaft and support rail units:
Shaft and support rail units are supplied as standard with a symmetrical hole pattern.
With a symmetrical hole pattern, $a_L = a_R$.
Calculation of hole pattern, see page 624.
4) ⟨1⟩ Lubrication nipple NIP, see page 627.

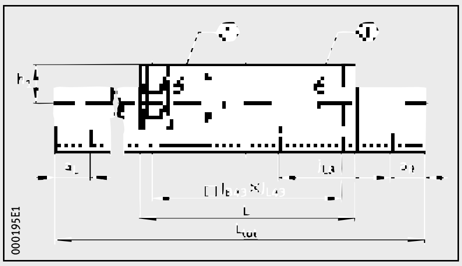


LTS · Without bellows

H_3 2)	H_7	j_{B8}	j_{L8} 3)	J_{B43}, J_{L43}	L_{20}	L_{21}	R_z
–	5	29	75	73	–	4	42
42	5	33	100	88	3,3	4	54
53	6	37	100	115	3,3	4	72
62	6	42	120	140	3,3	4	88
71	7	51	150	158	4,4	4	96
86	8	55	200	202	4,4	4	122
104	9	63	200	250	4,4	4	152



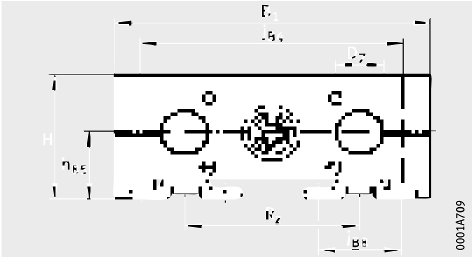
LTS · With bellows
1 4)



LTS · Without bellows
1 4)

Linear tables

Open linear ball bearing guidance system
With trapezoidal screw drive



LTS16 to LTS30 · With bellows

Dimension table · Dimensions in mm

Designation	Dimensions			Mounting dimensions								
	B_1	H	L	b_{87} ±0,2	∅ d_{85} h7	∅ d_{86} g7	∅ D_7 h7	∅ D_{86} H7	G_4, G_5	G_{87}×t_{87} M×depth	h_1	h_5
LTS16-100-TR	100	48	100	44	5	–	16	17	M8	M5×12	22	16
LTS20-130-TR	130	57	130	62	9[1]	–	20	30	M10	M6×15	25	21
LTS25-160-TR	160	66	160	64	9[1]	–	25	30	M12	M6×15	30	26
LTS30-180-TR	180	77	180	68	10	–	30	32	M12	M6×15	35	29
LTS40-230-TR	230	95	230	68	16[1]	66	40	–	M16	M8×18	45	36
LTS50-280-TR	280	115	280	62	16	72	50	–	M16	M8×18	55	44

For further table values, see page 652.

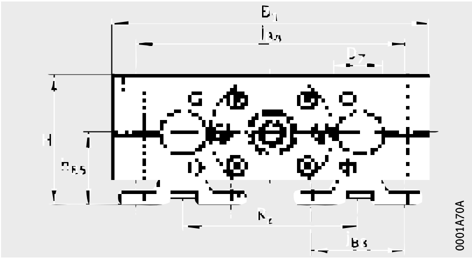
Calculation of length L_{tot}, see page 619.

Calculation of effective length B_L of bellows, see page 623.

1) Thread witness marks may be present on the pin.

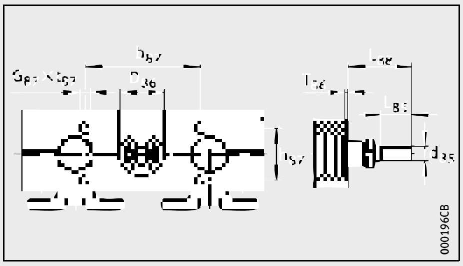
2) Location of shaft and support rail units:
Shaft and support rail units are supplied as standard with a symmetrical hole pattern.
With a symmetrical hole pattern, $a_L = a_R$.
Calculation of hole pattern, see page 624.

3) ⟨1⟩ Lubrication nipple NIP, see page 627.

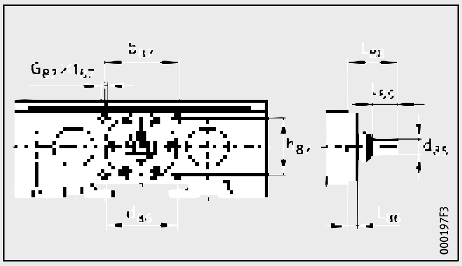


LTS40 and LTS50 · Without bellows

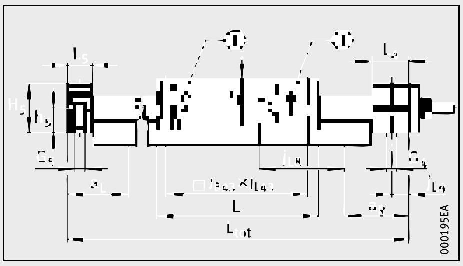
h_{85}	h_{87} ±0,2	H_1	H_5	j_{B4}	j_{B8}	j_{L4}	j_{L8} 2)	J_{B43}, J_{L43}	L_4	L_5	L_{85}	L_{86}	L_{88}	R_z	T_{86}
26	22	35,5	32	82	33	9	100	88	24	18	12	–	28,5	54	3
32	30	42	42	108	37	10	100	115	29	20	18	–	37	72	2,8
36	38	51	52	132	42	12,5	120	140	33	25	18	–	34,5	88	3,3
42	44	60	58	150	51	12,5	150	158	38	25	18	–	36,5	96	2,8
50	56	77	72	190	55	15	200	202	39	30	23	9,4	46	122	–
60	62	93	88	240	63	15	200	250	42	30	23	9,4	46	152	–



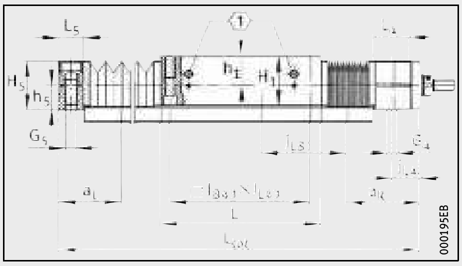
LTS16 to LTS30 · Without bellows
Drive flange, drive shaft



LTS40 and LTS50 · Without bellows
Drive flange, drive shaft



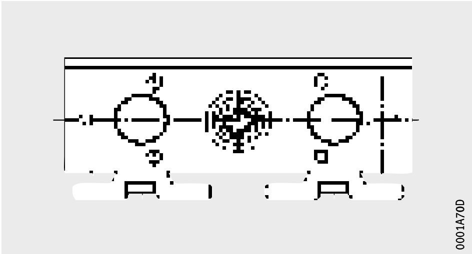
LTS · Without bellows
1 3)



LTS · With bellows
1 3)

Linear tables

Open linear ball bearing guidance system
With trapezoidal screw drive
Drive
Performance data



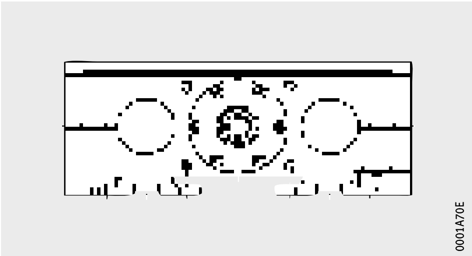
LTS16 to LTS30 · Without bellows

Performance data

Designation	Drive				
	Spindle			Spindle nut	
	Diameter d_0 mm	Pitch P mm	Mass moment of inertia kg · cm^2	Design	Basic static load rating C_0[1)] N
LTS16-100-TR	12	3	0,094	Single nut	630
LTS20-130-TR	16	4	0,3	Single nut	2 250
LTS25-160-TR	16	4	0,3	Single nut	2 250
LTS30-180-TR	20	4	0,81	Single nut	2 550
		8			
LTS40-230-TR	24	5	1,65	Single nut	2 500
		10			
LTS50-280-TR	32	6	5,45	Single nut	5 530

For further table values, see page 642 and page 643.

1) In the case of linear tables with trapezoidal screw drive,
the maximum axial load is restricted by the spindle bearing arrangement.
Please consult us regarding the loading of the trapezoidal screw drive.

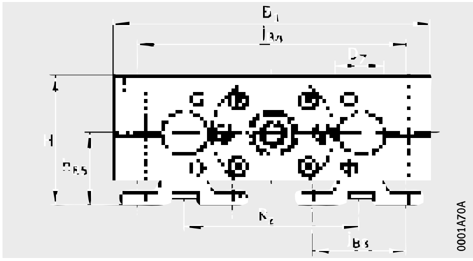


LTS40 and LTS50 · With bellows

Spindle bearing arrangement (locating bearing)		Drive torque on drive stud max.
Bearing	Basic static axial load rating C_{0a}	
	N	Nm
30/6-2RS	630	1,5
2×7200-2RS	2 250	3
2×7200-2RS	2 250	3
2×7201-2RS	2 550	10
3303-2RS	2 500	5
3304-2RS	5 530	5

Linear tables

Open linear ball bearing guidance system
With ball screw drive



LTS · Without bellows

Dimension table · Dimensions in mm

Designation	Dimensions			Mounting dimensions								
	B_1	H	L	b_{87} $\pm 0{,}2$	$\varnothing\, d_{74}$	$\varnothing\, d_{85}$ h7	$\varnothing\, d_{86}$ g7	$\varnothing\, D_7$ h7	G_4, G_5	$G_{87} \times t_{87}$ M×depth	h_1	h_5
LTS16-100-12	100	48	100	44	38	5	24	16	M8	M5×12	22	16
LTS20-130-16	130	57	130	62	–	9[1)]	50	20	M10	M6×15	25	21
LTS25-160-16	160	66	160	64	–	9[1)]	52	25	M12	M6×15	30	26
LTS30-180-20	180	77	180	68	–	10	60	30	M12	M6×15	35	29
LTS40-230-25	230	95	230	68	–	16[1)]	66	40	M16	M8×18	45	36
LTS40-230-32						16	72					
LTS50-280-25	280	115	280	62	–	16[1)]	66	50	M16	M8×18	55	44
LTS50-280-32						16	72					

For further table values, see page 652.

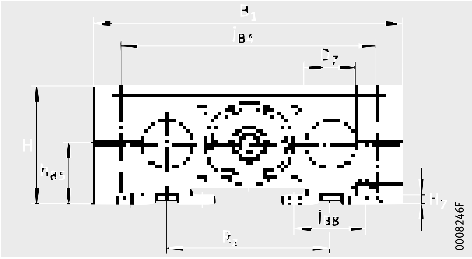
Calculation of length L_{tot}, see page 619.

Calculation of effective length B_L of bellows, see page 623.

1) Thread witness marks may be present on the pin.

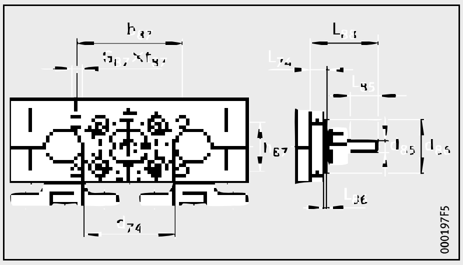
2) Location of shaft and support rail units:
Shaft and support rail units are supplied as standard with a symmetrical hole pattern.
With a symmetrical hole pattern, $a_L = a_R$.
Calculation of hole pattern, see page 624.

3) ⟨1⟩ Lubrication nipple NIP, see page 627.

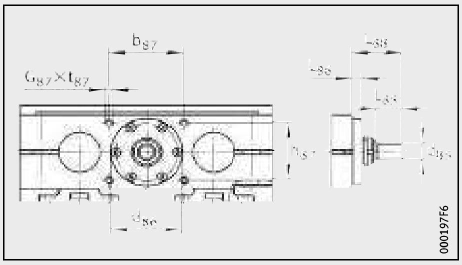


LTS · With bellows

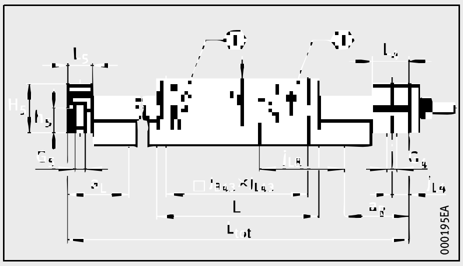
h_{85}	h_{87} $\pm 0{,}2$	H_1	H_5	j_{B4}	j_{B8}	j_{L4}	j_{L8} 2)	J_{B43}, J_{L43}	L_4	L_5	L_{74}	L_{85}	L_{86}	L_{88}	R_z
26	22	35,5	32	82	33	9	100	88	24	18	6,5	28,5	1,5	28,5	54
32	30	42	42	108	37	10	100	115	29	20	–	37	8	37	72
36	38	51	52	132	42	12,5	120	140	33	25	–	34,5	7	34,5	88
42	44	60	58	150	51	12,5	150	158	38	25	–	36,5	9,4	36,5	96
50	56	77	72	190	55	15	200	202	39 42	30	–	46	9,4	46	122
60	62	93	88	240	63	15	200	250	39 42	30	–	46	9,4	46	152



LTS20 · Without bellows
Drive flange, drive shaft



LTS20 to LTS50 · With bellows
Drive flange, drive shaft



LTS · Without bellows
⟨1⟩ 3)

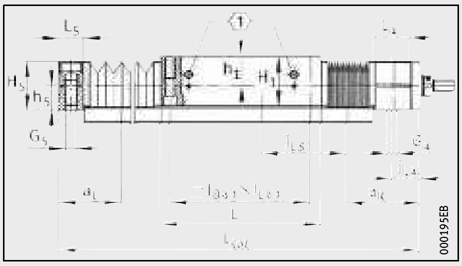
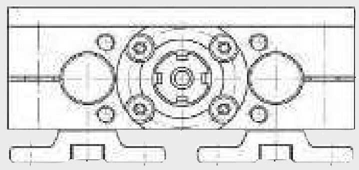


Table with bellows
⟨1⟩ 3)

Linear tables

Open linear ball bearing guidance system
With ball screw drive
Drive
Performance data



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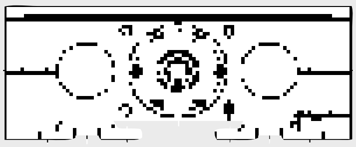
LTS16 · Without bellows

Performance data

Designation	Drive					
	Spindle			Basic load ratings of spindle nut		
	Diameter d_0 mm	Pitch P mm	Mass moment of inertia kg · cm^2	Design	Basic dynamic load rating C_a 1) N	Basic static load rating C_0 1) N
LTS16-100-12	12	4	0,11	Single nut	4 900	6 600
		5			4 400	6 800
LTS20-130-16	16	5	0,313	Single nut, double nut	9 300	13 100
		10	0,321	Single nut	15 400	26 500
LTS25-160-16	16	5	0,313	Single nut, double nut	9 300	13 100
		10	0,321		15 400	26 500
LTS30-180-20	20	5	0,846	Single nut, double nut	10 500	16 600
		10	0,846		12 700	22 100
		20	0,883	Single nut	11 600	18 400
		50	0,845		13 000	24 600
LTS40-230-25	25	5	2,25	Single nut, double nut	12 300	22 500
LTS40-230-32	32	10	6,43		33 400	54 500
		20			29 700	59 800
		40		Single nut	14 900	32 400
LTS50-280-25	25	5	2,25	Single nut, double nut	12 300	22 500
LTS50-280-32	32	10	6,43		33 400	54 500
		20			29 700	59 800
		40		Single nut	14 900	32 400

For further table values, see page 646 and page 647.

1) Basic load ratings in accordance with DIN 69051. Due to the modified calculation algorithms in DIN 69051, the basic load ratings C_a and C_0 may differ in comparison with older data.



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LTS20 to LTS50 · With bellows

Spindle bearing arrangement (locating bearing)			Drive torque on drive stud max.
Bearing	Basic dynamic axial load rating C_a N	Basic static axial load rating C_{0a} N	Nm
ZKLN0624.2RS-PE	6 900	8 500	1,5
ZKLN1034.2RS-PE	13 400	18 800	6
ZKLN1034.2RS-PE	13 400	18 800	6
ZKLN1545.2RS-PE	17 900	28 000	17
ZKLN1747.2RS-PE	18 800	31 000	12
ZKLN2052.2RS-PE	26 000	47 000	50
ZKLN1747.2RS-PE	18 800	31 000	12
ZKLN2052.2RS-PE	26 000	47 000	50

Linear tables

Open linear ball bearing guidance system
Performance data

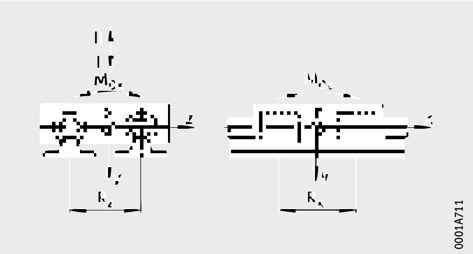
Load directions

Performance data

Designation	Carriage unit guidance system (for each carriage unit)[1]						
	Linear ball bearing	Basic load ratings (per carriage unit)					
		Load direction I Compressive load		Load direction II Tensile load		Load direction III Lateral load	
		dyn. C N	stat. C_0 N	dyn. C N	stat. C_0 N	dyn. C N	stat. C_0 N
LTS12-85	KBO12-PP-AS	1 580	1 780	680	840	1 715	2 320
LTS16-100	KBO16-PP-AS	2 110	2 480	880	1 140	2 240	2 900
LTS16-100-TR							
LTS16-100-12							
LTS20-130	KBO20-PP-AS	4 220	5 120	2 500	3 280	3 880	4 600
LTS20-130-TR							
LTS20-130-16							
LTS25-160	KBO25-PP-AS	7 520	9 200	4 550	6 000	6 930	8 200
LTS25-160-TR							
LTS25-160-16							
LTS30-180	KBO30-PP-AS	9 760	12 000	5 930	7 600	8 970	10 700
LTS30-180-TR							
LTS30-180-20							
LTS40-230	KBO40-PP-AS	16 100	18 400	9 760	12 500	14 910	16 800
LTS40-230-TR							
LTS40-230-25							
LTS40-230-32							
LTS50-280	KBO50-PP-AS	23 480	26 400	14 200	16 800	30 320	22 600
LTS50-280-TR							
LTS50-280-25							
LTS50-280-32							

1) Design of linear ball bearing guidance systems: see Catalogue WF1, Shaft Guidance Systems.

2) These values apply if load is evenly distributed over all four linear ball bearings.
The values are single loads and apply when the shaft and support rail units are fully supported.
These must be reduced for combined loads. For design criteria of the linear guidance system, see Catalogue WF1, Shaft Guidance Systems.

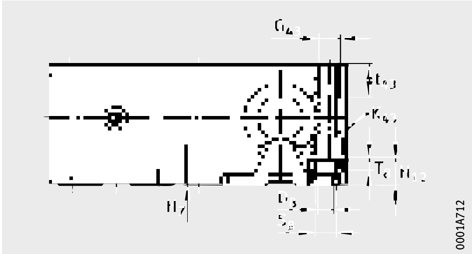


Mounting geometry of linear ball bearings

	Permissible static moment ratings (per carriage unit)[2]			Mounting geometry Spacings between linear ball bearings	
	$M_{0x\ per}$ Nm	$M_{0y\ per}$ Nm	$M_{0z\ per}$ Nm	R_x mm	R_z mm
	23	32	21	46	42
	29	50	32	55,6	54
	109	130	100	74,6	72
	240	312	240	88,6	88
	340	450	345	98,6	96
	670	960	730	134	122
	1 180	1 580	1 250	163	152

Linear tables

Open linear ball bearing guidance system
Mounting of table and shaft and support rail unit



LTS · With bellows, detail of fixing screws

Dimension table · Dimensions in mm

Designation	Fixing screws						Mounting dimensions	
	Shaft and support rail units according to DIN 6912-8.8			Carriage unit according to DIN ISO 4762-8.8				
	D_8	S_8	T_8	K_{43}	G_{43}	t_{43}	H_7	H_{12}
LTS12-85	4,5	–	–	M5	M6	13	5	–
LTS16-100	5,5	10	5,6	M5	M6	13	5	11,5
LTS16-100-TR								
LTS16-100-12								
LTS20-130	6,6	11	6,1	M6	M8	18	6	13
LTS20-130-TR								
LTS20-130-16								
LTS25-160	6,6	11	6,1	M8	M10	22	6	14
LTS25-160-TR								
LTS25-160-16								
LTS30-180	9	15	7,5	M10	M12	26	7	16
LTS30-180-TR								
LTS30-180-20								
LTS40-230	9	15	7,5	M12	M16	34	8	17
LTS40-230-TR								
LTS40-230-25								
LTS40-230-32								
LTS50-280	11	17	9,5	M12	M16	34	9	21
LTS50-280-TR								
LTS50-280-25								
LTS50-280-32								

High precision linear tables

With linear recirculating ball bearing and guideway assemblies

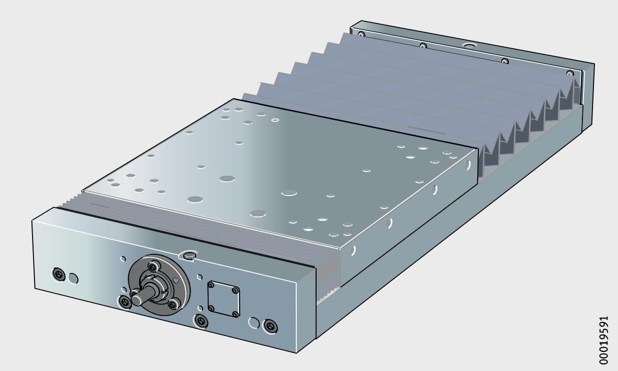
Product overview High precision linear tables

Aluminium design

With linear recirculating ball bearing and guideway assemblies

With ball screw drive

LTP

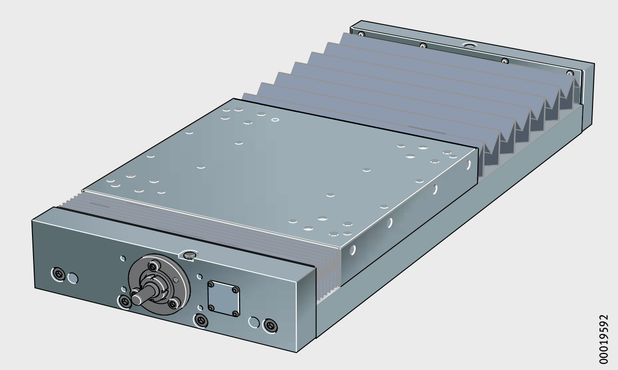


Cast iron design

With linear recirculating ball bearing and guideway assemblies

With ball screw drive

LTPG



High precision linear tables

Features

High precision linear tables LTP and LTPG are particularly suitable, due to their construction and high guidance accuracy, for the precise positioning of moderate and high loads. These tables are supplied assembled.

Aluminium design

High precision linear tables LTP

High precision linear tables LTP comprise:

- a base plate made from aluminium
- two high precision two-row linear recirculating ball bearing and guideway assemblies KUE or, by agreement, two four-row linear recirculating ball bearing and guideway assemblies KUVE in the case of LTP15 or two six-row linear recirculating ball bearing and guideway assemblies KUSE in the case of LTP25 with two carriages per side. The linear recirculating ball bearing and guideway assemblies are preloaded clearance-free and run without stick-slip
- a carriage unit made from aluminium with a central lubrication system for relubricating the carriages of the linear recirculating ball bearing and guideway assemblies and the spindle nuts
- a rolled ball screw spindle with a single flanged nut F. In the case of some pitch values, double flanged nuts FM are possible. A double nut FM comprises a single flanged nut paired with a cylindrical single nut. Double nuts are preloaded
- a locating bearing housing made from aluminium alloy with a preloaded double row angular contact ball bearing ZKLF and a lubrication nipple
- a non-locating bearing housing made from aluminium alloy with a needle roller bearing NA and a lubrication nipple.

The spindle support bearings, carriages and spindle nuts have an initial greasing, are sealed and can be relubricated.

Cast iron design

High precision linear tables LTPG

High precision linear tables LTPG comprise a base plate, a carriage unit and a bearing housing made from cast iron. They are suitable for applications requiring increased accuracy and have good vibration behaviour. High precision linear tables LTPG differ from linear tables LTP in that they have:

- a base plate made from cast iron with ground seating and locating surfaces for the guideways
- two high precision six-row linear ball bearing and guideway assemblies KUSE with two carriages per side
- a carriage unit made from cast iron with a ground surface and seating surfaces for the carriages
- a locating bearing housing made from cast iron
- a non-locating bearing housing made from cast iron.

With bellows

High precision linear tables LTP and LTPG can be equipped with two sets of bellows.

The bellows are attached by means of screws.

For the same stroke length, the total length of a linear table with bellows is greater than the total length of a linear table without bellows.

High precision linear tables

Screw drive

The spindle thread has a pitch value of between 5 mm and 50 mm, see table. As standard, single flanged nuts with an axial clearance dependent on the pitch are used. In the case of some pitch values, the ball screw drive can be supplied with preloaded double nuts.

Screw drive variants

Screw drive variants		Suffix
Pitch	5 mm	5
	10 mm	10
	20 mm	20
	40 mm	40
	50 mm	50

Drive elements

The information on drive elements in high precision linear tables LTP and LTPG matches the information on drive elements in linear tables LTE, see page 565.

Special designs

Special designs of high precision linear tables, including the following, are available by agreement:

- with a rolled or ground ball screw spindle with an accuracy of 25 μm/300 mm
- with anti-corrosion coating of the spindle and/or linear recirculating ball bearing and guideway assemblies
- with special bellows, for example in a version resistant to welding beads
- with a trapezoidal screw drive
- with special hole patterns on the carriage unit and base plate in accordance with customer requirements.

Design and safety guidelines

The design and safety guidelines for high precision linear tables LTP and LTPG essentially match the design and safety guidelines for linear tables LTE, see page 566. The following pages describe exclusively the differences between the high precision linear tables LTP and LTPG and the linear tables LTE.

Deflection

High precision linear tables LTP and LTPG are essentially dependent on the adjacent construction. It is not therefore possible to provide data or diagrams for the deflection.

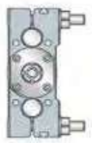
Length calculation of linear tables

The length calculation of linear tables is based on the required effective stroke length N_H. The effective stroke length N_H must be increased by the addition of safety spacing values on both sides of the travel distance. It is only if bellows are present that the effective length B_L must be added.

The total length L_{tot} of the linear table is determined from the total stroke length G_H, the lengths of the end plates L_4 and L_5 on both sides and the carriage plate length L.

Parameters for length calculation

G_H Total stroke length	mm
N_H Effective stroke length	mm
S Safety spacing, see table, page 660	mm
L Total length of carriage unit	mm
L_2 Length of base plate	mm
L_4 Length of end plate	mm
L_5 Length of end plate	mm
L_{tot} Total length of linear table	mm
B_B Length of bellows fastener	mm
B_L Effective length of bellows	mm
F_{BL} Effective length factor according to linear table type.	–



Total stroke length G_H

The total stroke length G_H is determined from the required effective stroke length N_H and the safety spacings S, which must correspond to at least the spindle pitch P.

$$G_H = N_H + 2 \cdot S$$

Maximum length of linear tables

The maximum length L_{tot} of high precision linear tables LTP and LTPG is 3 500 mm.

In the case of a total length $L_{tot} < 2 \cdot L + L_4 + L_5 + 30$, not all fixing holes in the support rail will be accessible, so please consult us.

High precision linear tables

Total length L_{tot}

The following equations are designed for one linear table.
The parameters and their position can be found in *Figure 1* and the table, page 660.

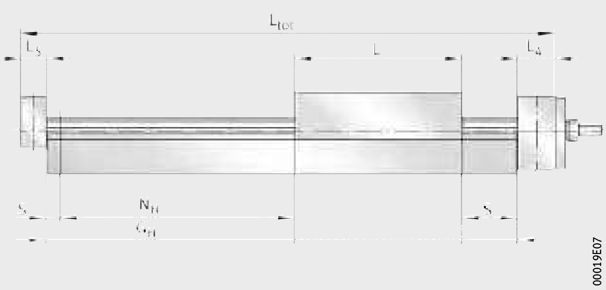


Figure 1
Length parameters
for one high precision linear table

Linear table LTP without bellows

$$L_{tot} = G_H + L + L_4 + L_5$$

Linear table LTP with bellows

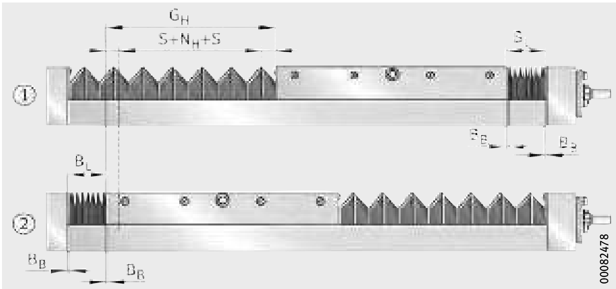
$$L_{tot} = G_H \cdot F_{BL} + L + L_4 + L_5 + B_B$$

Length parameters

Designation	Spindle pitch P mm	L mm	L_4 mm	L_5 mm	S mm	F_{BL}	B_B mm
LTP15-185 LTPG15-185	5	185	35	25	5	1,35	28
	10				10		
	20				20		
	50				50		
LTP15-275 LTPG15-275	5	275	35	25	5	1,35	20
	10				10		
	20				20		
	50				50		
LTP25-325 LTPG25-325	5	325	35	30	5	1,27	20
	10				10		
	20				20		
	40				40		

Effective length of bellows

The effective length of bellows is the length occupied by the bellows in the fully compressed state. Calculation is based on the total stroke length G_H, *Figure 2*, equation and table, page 660.



① Carriage unit against the right end stop
② Carriage unit against the left end stop

Figure 2
Effective length calculation

$$B_L = \frac{G_H \cdot (F_{BL} - 1) + B_B}{2}$$

B_L mm
Effective length of bellows

G_H mm
Total stroke length

F_{BL} –
Effective length factor according to linear table type, see table, page 660

B_B mm
Length of bellows fastener.

High precision linear tables

Calculation of hole pattern of base plates

Base plates are supplied as standard with a symmetrical hole pattern. If a symmetrical hole pattern is present: $a_R = a_L$.
In the following calculation, the values must not be less than the value $a_{R\,min}$ ($a_{L\,min}$).

Parameters for hole pattern calculation

a_R, a_L mm
Left and right spacing between the end of the base plate and the nearest hole centre point, *Figure 3* and *Figure 4*, page 663
$a_{R\,min} = a_{L\,min} = 20$ mm

j_{L8} mm
Hole spacing, see dimension table

L mm
Total length of carriage plate

L_2 mm
Total length of base plate

L_4, L_5 mm
Lengths of bearings

L_{tot} mm
Total length of linear table

J_{B8} mm
Hole spacing of inner row of holes

J_{B9} mm
Hole spacing of outer row of holes.

The number of hole pitches n is the whole number equivalent to:

$$n = \frac{L_2 - 2 \cdot a_{R\,min}}{j_{L8}}$$

The spacing a_L between the end of the base plate and the nearest hole centre point is calculated as follows:

$$a_R, a_L = 0,5 \cdot \left(L_2 - n \cdot j_{L8}\right)$$

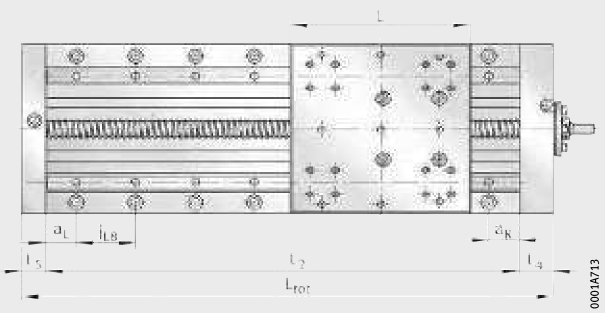
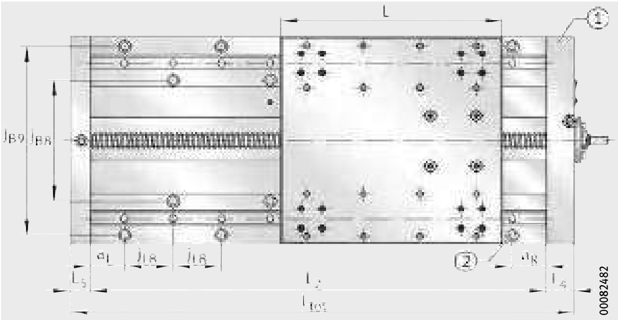


Figure 3
Spacings a_R and a_L on the base plate



① Locating bearing side
② First hole in outer rows

Figure 4
Spacings a_R and a_L on the base plate in double rows of fixing holes

In the case of a total length $L_{tot} < 2 \cdot L + L_4 + L_5 + 30$, not all fixing holes in the base plate will be accessible, so please consult us.

In the case of double rows of fixing holes, the first fixing hole is always in the outer row on the locating bearing side, *Figure 4*.

Mass calculation

The total mass of a linear table is calculated from the mass of the table without a carriage unit and the carriage unit.

$$m_{tot} = m_{LAW} + m_{BOL}$$

Values for mass calculation, aluminium design

Designation	Mass	
	Carriage unit[1)] m_{LAW} ≈kg	Table without carriage unit m_{BOL} ≈kg
LTP15-185	3,5	$(L_{tot} - 60) \cdot 0{,}018\,1 + 2{,}6$
LTP15-275	6,4	$(L_{tot} - 60) \cdot 0{,}025\,8 + 3{,}6$
LTP25-325	12,3	$(L_{tot} - 65) \cdot 0{,}043\,3 + 6{,}2$

Values for mass calculation, cast iron design

Designation	Mass	
	Carriage unit[1)] m_{LAW} ≈kg	Table without carriage unit m_{BOL} ≈kg
LTPG15-185	6,4	$(L_{tot} - 60) \cdot 0{,}041\,9 + 5{,}5$
LTPG15-275	13,8	$(L_{tot} - 60) \cdot 0{,}052\,8 + 8{,}1$
LTPG25-325	26,5	$(L_{tot} - 65) \cdot 0{,}084\,4 + 13{,}9$

1) Including single or preloaded double nut.

High precision linear tables

Lubrication

The information on the lubrication of LTP and LTPG substantially matches the information on the lubrication of LTE, see page 579. The only differences are in the relubrication quantities and relubrication points.

Relubrication

Relubrication should be carried out wherever possible with several partial quantities at various times instead of the complete quantity at the time of the relubrication interval. Relubrication quantities, see table.

Relubrication quantity per lubrication nipple

Series	Carriage unit, carriage and ball screw drive and nut			Ball screw drive	
	d_0 mm	P mm	≈ g	Locating bearing	Non-locating bearing
LTP15-185 and LTPG15-185	20	5	2,6	Lubricated for life[1]	Lubricated for life[1]
		10	3,1		
		20	5		
		50	10,6		
LTP15-275 and LTPG15-275	20	5	2,6		
		10	3,1		
		20	5		
		50	10,6		
LTP25-325	32	5	5,4		
		10	7,1		
		20	10,8		
		40	13,5		
LTPG25-325	32	5	9,4		
		10	11,1		
		20	14,8		
		40	17,5		

[1] If relubrication is required due to the application, please consult us.

Relubrication points

Relubrication can be carried out via a funnel type lubrication nipple in accordance with DIN 3405-A M8×1 on the side of the carriage unit, *Figure 5*. The thread of the lubrication nipple hole can also be used for connection to a central lubrication system. The carriage and the spindle nuts are supplied centrally with grease via this one lubrication nipple.

LTP
LTPG

① Relubrication point for locating bearing
② Relubrication point for non-locating bearing
③ Relubrication point for carriage unit

Figure 5
Lubrication points on linear table

Position of relubrication points

Designation	Mounting dimensions											
	Carriage unit				Locating bearing				Non-locating bearing			
	h_{56} mm	l_{56} mm	∅ S_{56}[1)] mm	T_{56}[1)] mm	b_{77} mm	l_{77} mm	∅ S_{77}[1)] mm	T_{77}[1)] mm	b_{78} mm	l_{78} mm	∅ S_{78}[1)] mm	T_{78}[1)] mm
LTP15-185	11	74,5			26				10	14		
LTP15-275	9,5	135	15	5		6,5	15	3,5	–		15	3,5
LTP25-325	10	150			26,5					17		

1) Countersink for lubrication nipple.

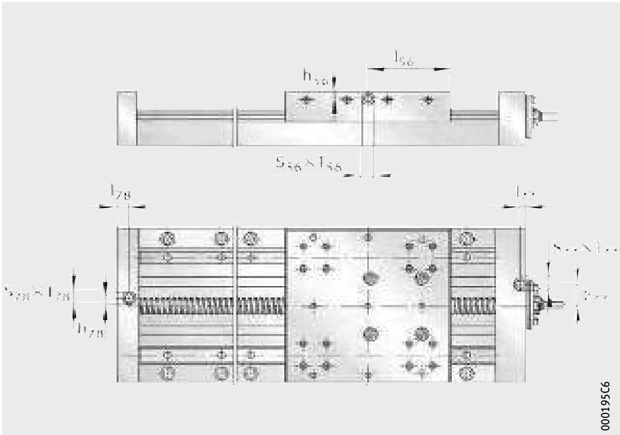


Figure 6
Lubrication points

Lubrication nipples

High precision linear tables are lubricated via funnel type lubrication nipples NIP according to DIN 3405, *Figure 7*.

NIP DIN 3405-A M8×1

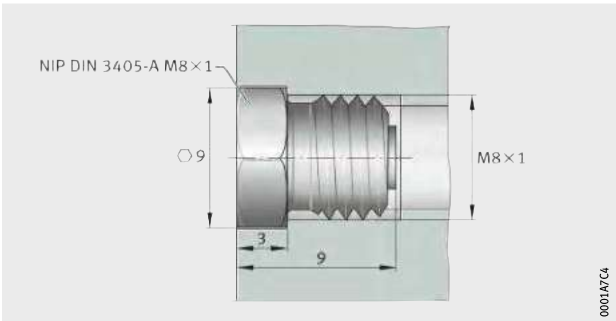


Figure 7
Funnel type lubrication nipple

High precision linear tables

Maximum permissible spindle speed

Screw drives must not be allowed to run in the critical speed range.

The critical speed is essentially dependent on the following factors:

- spindle length
- spindle diameter
- spindle bearing arrangement
- mounting method.

The carriage unit velocity v is determined from the spindle speed n and the spindle pitch P. The limit values for velocities must be observed, see page 559.

For calculation of the carriage unit velocity, the following applies:

$$v = \frac{n \cdot P}{60 \cdot 1000}$$

v Carriage unit velocity	m/s
n Spindle speed	min^{-1}
P Spindle pitch.	mm

Diagram

The diagram shows the relationship for individual series and sizes between the critical speed and the spindle length, *Figure 8*.
The diagram takes account of the effective length B_L of the bellows cover.

LTP15
LTPG15
LTP25
LTPG25

n_{max} for pitch 5 mm
n = spindle speed
L_{tot} = support shaft length

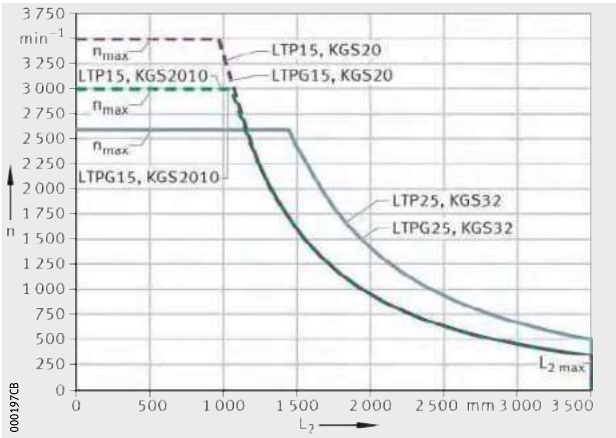


Figure 8
Maximum permissible spindle speed without spindle supports

Kinematic operating limits

Maximum velocities are determined as a function of the critical spindle speed, see table. The limiting speed of the bearings can also restrict the spindle speed and thus the velocity.

Kinematic operating limits

Series and size	Spindle		Spindle nut design		Maximum acceleration	Maximum velocity	Maximum spindle speed
	d_0 mm	P mm			a m/s^2	v m/s	n min^{-1}
LTP15-185	20	5	F	FM	20	0,29	3 500[1]
LTPG15-185		10	F	FM		0,5	3 000
LTP15-275		20	F	–		1,16	3 500[1]
LTPG15-275		50	F	–		2,9	3 500[1]
LTP25-325	32	5	F	FM	20	0,215	2 600[1]
LTPG25-325		10	F	FM		0,43	2 600[1]
		20	F	FM		0,86	2 600[1]
		40	F	–		1,73	2 600[1]

[1] Restricted by the limiting speed of the bearing with grease lubrication.

Mounting requirements

The information on the influences of the adjacent construction of LTP matches the information on the influences of the adjacent construction of LTE, see page 585. The information on the mounting position and mounting arrangement of LTP matches the information on the mounting position and mounting arrangement of LTE, see page 586.
The only information covered here is that which is additional to or different from the information given previously.

Location

If the geometrical characteristics of high precision linear tables LTP and LTPG are to be fully utilised, mounting on completely flat supporting surfaces with low roughness values is necessary.
Linear tables LTP and LTPG are located on the adjacent construction via the base plate by means of conventional screws.
The components to be moved are also located on the carriage unit by means of conventional screws.

For location of the linear tables, all the fixing holes should be used.

If the total length is small, not all the fixing holes in the base plate may be accessible. In such cases, please consult the Schaeffler engineering service.

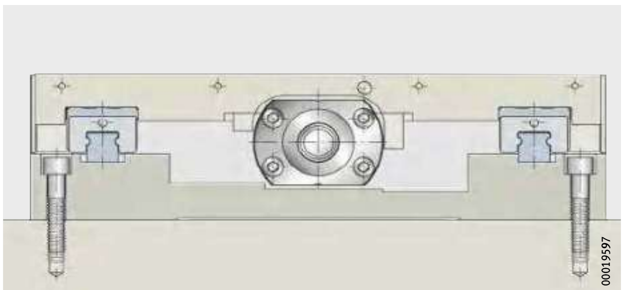


Figure 9
Location
of the high precision linear table

High precision linear tables

Accuracy
Length tolerances

Length tolerances of high precision linear tables LTP and LTPG, *Figure 10* and table.

LTP(G)

L_{tot} = total length

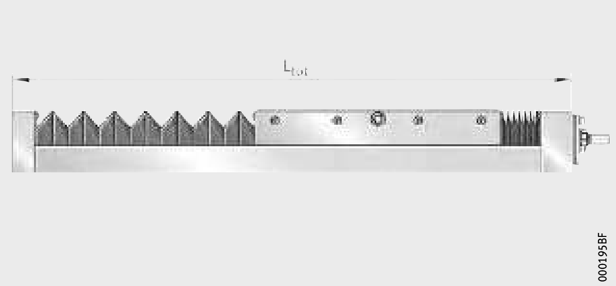


Figure 10
Length tolerances

Tolerances

Total length L_{tot} of linear tables LTP and LTPG mm	Tolerance mm
$L_{tot} \leqq$ 3 500	–1

Pitch accuracy of spindle

High precision linear tables with ball screw drive are available with a single flanged nut with clearance, see table, page 669. Where higher accuracy requirements are present, preloaded (clearance-free) double nuts are possible for many pitch values, see table, page 669.

In the case of high precision linear tables, the nut unit (double nut) can only be preloaded clearance-free if the spindle pitch P is less than the nominal diameter d_0 of the spindle.

Ball screw drive						
Series and size	Spindle			Spindle nut		
	$\varnothing$ d_0 mm	P mm	Pitch accuracy P µm each 300 mm	Single or double nut	Suffix	Axial clearance max. mm
LTP15-185 LTPG15-185	20	5	50	Single	F	0,05
				Double	FM	Preloaded
		10		Single	F	0,05
				Double	FM	Preloaded
		20		Single	F	0,05
		50				
LTP15-275 LTPG15-275		5		Single	F	0,05
				Double	FM	Preloaded
		10		Single	F	0,05
				Double	FM	Preloaded
		20		Single	F	0,05
		50				
LTP25-325 LTPG25-325	32	5		Single	F	0,05
				Double	FM	Preloaded
		10		Single	F	0,05
				Double	FM	Preloaded
		20		Single	F	0,05
				Double	FM	Preloaded
		40		Single	F	0,05

Parallelism values

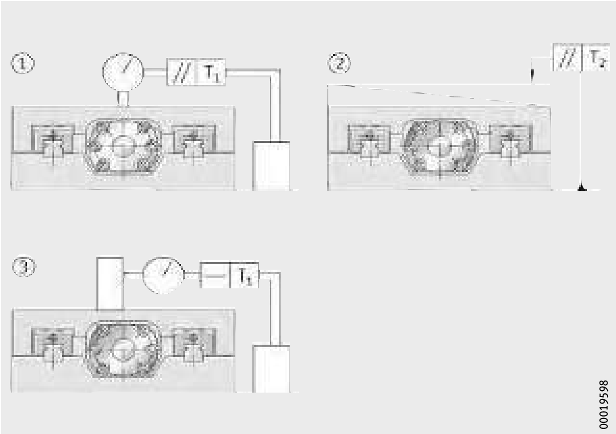
The parallelism values T_1 and T_2 are based on an ideally flat locating surface. Geometrical deviations of the locating surface are not taken into consideration.

The values in the diagrams are standard accuracies, *Figure 12* and *Figure 13*, page 670.

During measurement of the values, the following conditions apply:

- T_1 and T_2 measured with a clamped base plate, where all fixing holes must be used
- parallelism in a longitudinal direction measured at the centre of the carriage unit.

High precision linear tables



① Parallelism in longitudinal direction
② Parallelism in transverse direction
③ Straightness in longitudinal direction

Figure 11
Parallelism and straightness

LTP

① Accuracy

l = length

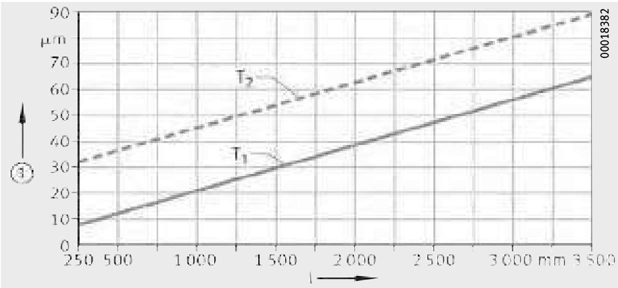


Figure 12
Accuracy values

LTPG

① Accuracy

l = length

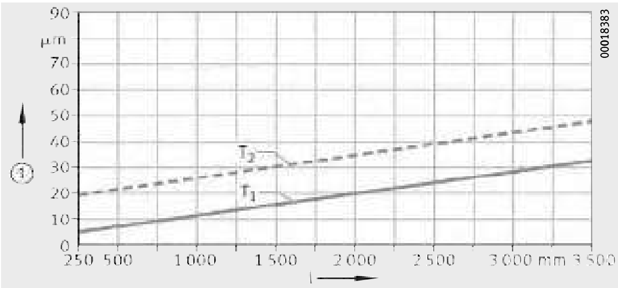


Figure 13
Accuracy values

High precision linear tables

Ordering example, ordering designation

Available designs

Available designs of high precision linear tables LTP and LTPG, see table.

Design	Linear table with linear recirculating ball bearing and guideway assemblies and ball screw drive		
Size	Size code		
Carriage plate length	Length	L	mm
Drive type with	Ball screw drive	●	
Spindle dimensions	Ball screw diameter	d_0	mm
	Spindle pitch	P	mm
Nut design	Single nut	F	
	Double nut	FM	
Cover optional	Without bellows	0	
	With bellows	1	
Lengths	Total length	L_{tot}	mm
	Total stroke length	G_H	mm

● Standard scope of delivery.

■ Design not available.

Designation and suffixes LTP and LTPG											
15				15				25			
185				275				325			
●				●				●			
20				20				32			
05	10	20	50	05	10	20	50	05	10	20	40
F	F	F	F	F	F	F	F	F	F	F	F
FM	FM	■	■	FM	FM	■	■	FM	FM	FM	■
0				0				0			
1				1				1			
to be calculated from total stroke length, see page 660											
to be calculated from effective stroke length, see page 660											

High precision linear tables

High precision linear table with ball screw drive

High precision linear table with linear recirculating ball bearing and guideway assemblies and ball screw drive (aluminium design)	LTP
Size code	25
Carriage plate length L	325
Ball screw drive, d_0 = 32 mm, pitch P = 10 mm	3210
Nut (preloaded, double nut)	FM
Bellows (with = 1, without = 0)	1
Total length L_{tot}	918 mm
Total stroke length G_H	400 mm

Ordering designation **LTP25-325-3210-FM-1/918-400**, *Figure 14*

Figure 14
Ordering designation

High precision linear table with ball screw drive

High precision linear table with linear recirculating ball bearing and guideway assemblies and ball screw drive (cast iron design)	LTPG
Size code	25
Carriage plate length L	325
Ball screw drive, d_0 = 32 mm, pitch P = 10 mm	3210
Nut (preloaded, double nut)	FM
Bellows (with = 1, without = 0)	1
Total length L_{tot}	918 mm
Total stroke length G_H	400 mm

Ordering designation **LTPG25-325-3210-FM-1/918-400**, *Figure 15*

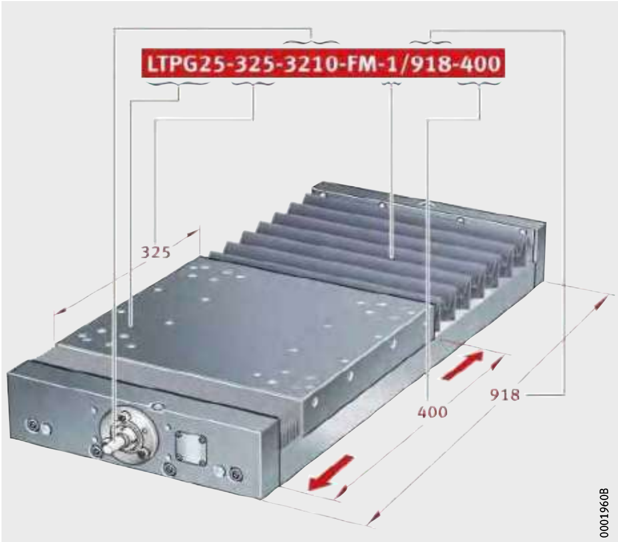
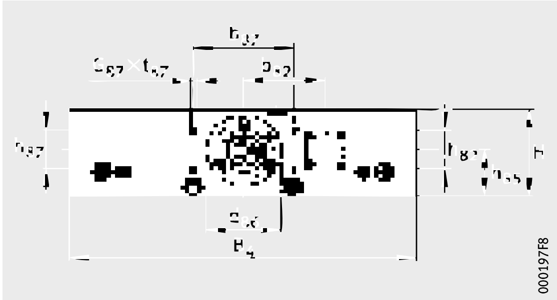


Figure 15
Ordering designation

High precision linear tables

Linear recirculating ball bearing and guideway assemblies with ball screw drive
Aluminium design (LTP)
Cast iron design (LTPG)



LTP, LTPG

Dimension table · Dimensions in mm

Designation		Dimensions			Mounting dimensions						
Aluminium	Cast iron	B_4	H	L	b_{82}	b_{87} ±0,2	∅ d_{85} h6	∅ d_{86} −0,01	$G_{87} \times t_{87}$ M×depth	h_{82}	h_{85}
LTP15-185	**LTPG15-185**	185	75	185	–	80	11	60	M6×15	–	40
LTP15-275	**LTPG15-275**	275		275	65					31	
LTP25-325	**LTPG25-325**	325	100	325	75	96	19	75	M8×20	31	52

Calculation of length L_{tot}, see page 659.
Calculation of effective length B_L of bellows, see page 661.

1) Location of high precision linear tables:
High precision linear tables are supplied as standard with a symmetrical hole pattern.
With a symmetrical hole pattern, $a_L = a_R$.
Calculation of the hole pattern, see page 662.

2) ⟨1⟩ Lubrication nipples, see page 665.

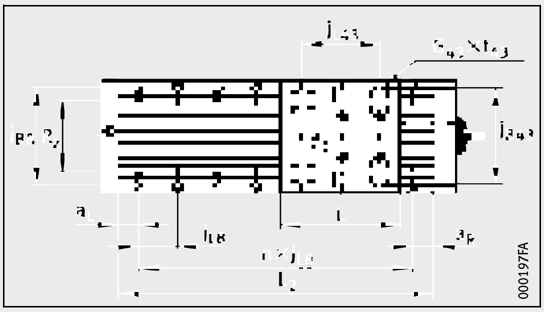
Dimension table (continued) · Dimensions in mm

Designation		Fixing screws				
Aluminium	Cast iron	Table base plate			Carriage unit	
		D_8	S_8	T_8	G_{43}	t_{43}
LTP15-185	**LTPG15-185**	9	15	11	9 × M8	16
LTP15-275	**LTPG15-275**				16 × M8	
LTP25-325	**LTPG25-325**	11	18	13,5	25 × M8	16

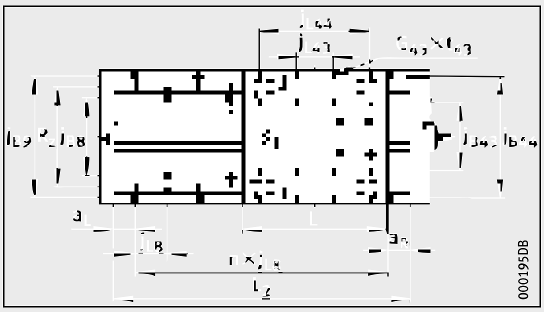
LTP, LTPG · With bellows
⟨1⟩ 2)

LTP, LTPG · Without bellows
⟨1⟩ 2)

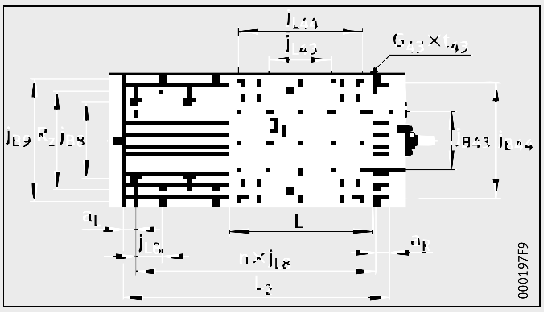
	h_{87} ±0,2	H_1	H_2	H_4, H_5	j_{B8}	j_{B9}	j_{B43}	j_{B44}	j_{L8} 1)	j_{L43}	j_{L44}	L_4	L_5	L_{85}	L_{86}	L_{88}	R_z
	33	40,5	34	74,5	160	–	164	–	60	120	–	35	25	23	8	42	116
					160	250	140	252		70	210						206
	44	55,5	44	99,5	185	298	140	280	60	140	280	35	30	40	9	65	240



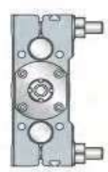
LTP15-185, LTPG15-185 · Without bellows



LTP15-275, LTPG15-275 · Without bellows

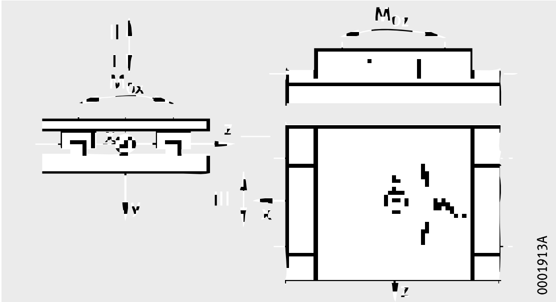


LTP25-325, LTPG25-325 · Without bellows



High precision linear tables

Linear recirculating ball bearing and
guideway assemblies with ball screw drive
Performance data



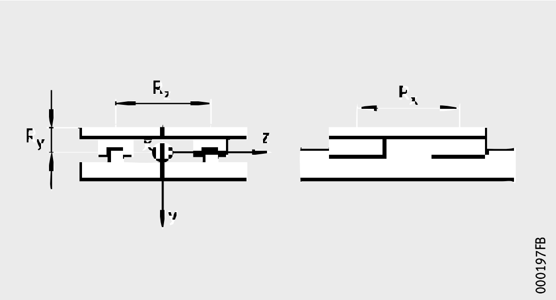
Load directions

Performance data

Designation	Carriage guidance system												
	Carriages	Basic load ratings						Permissible static moment ratings[1]			Mounting geometry Spacings between carriages		
		Load direction I Compressive load		Load direction II Tensile load		Load direction III Lateral load							
		dyn. C	stat. C_0	dyn. C	stat. C_0	dyn. C	stat. C_0	M_{0x} per	M_{0y} per	M_{0z} per	R_x	R_y	R_z
		N	N	N	N	N	N	Nm	Nm	Nm	mm	mm	mm
LTP(G)15-185	4× KWE15-H	17 150	36 800	17 150	36 800	17 150	36 800	1 830	1 480	1 480	118	34,5	116
LTP(G)15-275	4× KWE15-H	17 150	36 800	17 150	36 800	17 150	36 800	3 400	3 000	3 000	198	34,5	206
LTP25-325	4× KWE25-H	47 200	83 600	47 200	83 600	47 200	83 600	16 600	8 800	8 800	220	48	240
LTPG25-325	4× KWSE25-H	73 900	268 000	60 400	172 000	56 200	184 000	18 000	10 400	10 400	220	45,3	240

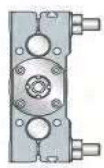
[1] The values are single loads and apply when the underside of the table is fully supported. These must be reduced for combined loads. For design criteria of the linear guidance system, see Catalogue PF1, Monorail Guidance Systems.

[2] Basic load ratings in accordance with DIN 69051. Due to the modified calculation algorithms in DIN 69051, the basic load ratings C_a and C_0 may differ in comparison with older data.



Mounting geometry of carriages

Drive									
Spindle			Spindle nut			Spindle bearing arrangement (locating bearing)			
Diameter d_0	Pitch P	Mass moment of inertia	Design	Basic dynamic load rating C_a[2)]	Basic static load rating C_0[2)]	Bearing	dyn. C_a	stat. C_{0a}	Drive torque on drive stud max.
mm	mm	$kg \cdot cm^2$		N	N		N	N	Nm
20	5	0,85	Single nut, double nut	10 500	16 600	ZKLF1560.2RS	17 900	28 000	15
	10			12 700	22 100				
	20		Single nut	11 600	18 400				
	50			13 000	24 600				
20	5	0,85	Single nut, double nut	10 500	16 600	ZKLF1560.2RS	17 900	28 000	15
	10			12 700	22 100				
	20		Single nut	11 600	18 400				
	50			13 000	24 600				
32	5	6,43	Single nut, double nut	21 500	49 300	ZKLF2575.2RS	27 500	55 000	50
	10			33 400	54 500				
	20			29 700	59 800				
	40		Single nut	14 900	32 400				
32	5	6,43	Single nut, double nut	21 500	49 300	ZKLF2575.2RS	27 500	55 000	50
	10			33 400	54 500				
	20			29 700	59 800				
	40		Single nut	14 900	32 400				



Multi-axis Positioning Systems

From standard linear systems to individual complete solutions

SCHAEFFLER GROUP
INDUSTRIAL

From standard to individual: New Schaeffler portfolio for positioning systems

Example of a positioning system according to customer requirements

The designers of handling systems place a high value on individual complete solutions, since these can save them a great deal of valuable time.

We have therefore developed a completely new concept for positioning systems: proven INA linear systems + smart ideas from our experienced machine system developers + flexible production capacities for short delivery times.

Schaeffler is thus in a position to offer you an economical, all-round service package – from the planning phase, through design and layout, to assembly and initial operation at your company.

The product spectrum extends from ready-to-fit, single-axis units through to completely integrated multi-axis positioning systems. All matched to customer requirements.

The advantages for you at a glance:

- Components perfectly matched to each other
- Assembly and initial operation service
- Worldwide service network
- Time savings in planning, design and purchasing.

An economical solution:
Driven linear units constructed from standard components

Through the combination of perfectly matched driven linear units with appropriate accessories and drive and control elements, we can tailor the multi-axis positioning systems exactly to customer requirements.

The product portfolio of INA Linear Technology Division is one of the most comprehensive in the world. This means we can serve the widest variety of market sectors: assembly and handling, automation equipment, packaging machinery, electronic component manufacture and many others. The spectrum extends from miniature guidance systems for clean room applications to heavy duty actuators for extreme loads, such as in steel plants and rolling mills. As a systems supplier, we offer ready-to-fit complete solutions.

Each series has its particular advantages. Selection of the “right” linear system is guided by your requirements for

- dynamic characteristics
- load
- moving masses
- positioning and repeat accuracy
- environmental influences.

In the appropriate size for your application, you can choose between ...

- **guidance systems** (track roller and shaft guidance systems, linear recirculating ball bearing and guideway assemblies)
- **types of drive** (toothed belt and ball screw or trapezoidal lead screw drives, linear motor drives)
- linear actuators with special functions (telescopic actuators, quill type actuators, actuators with opposing carriages)
- a wide **range of accessories** (fasteners and connectors, couplings, coupling housings, ...)
- **drive and control elements** (motors, gearboxes, sensors, controllers, ...)

For applications with small to moderate stroke lengths and speeds where increased accuracy is required, **INA linear tables** of various designs are available.

How to save on design work: Standard multi-axis positioning systems

With the proven standard multi-axis positioning systems, many applications can be realised without additional design work. This allows you to complete projects rapidly using components that are already matched to each other. You have considerably less design and planning work and within a very short time you receive a proposal from us for a positioning system with your required axis travel distances.

The standard 3 axis positioning systems are available in two classes: up to 5 kg and up to 15 kg moving mass.

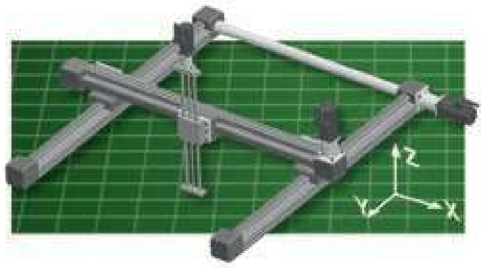
Arrangement: Gantry portal for freely selectable, three-dimensional movements

Function: Parts handling, assembly, etc.

Build status: Preconfigured ready for operation, including drive and connection equipment such as AC servomotors, controllers, cables, flexible cable carriers, etc.

MPS301/5 (up to 5 kg moving mass)

Axis	Series	Stroke $h_{max.}$ [mm]	Acceleration a [m/s²]	Speed v [m/s]	Repeat accuracy [mm]
X	MLF52-130 ZR	7500	4	1	± 0,1
Y	MLF52-145 ZR	1000	4	1	± 0,1
Z	LTE20-B-KGT	200	1,2	0,3	± 0,05



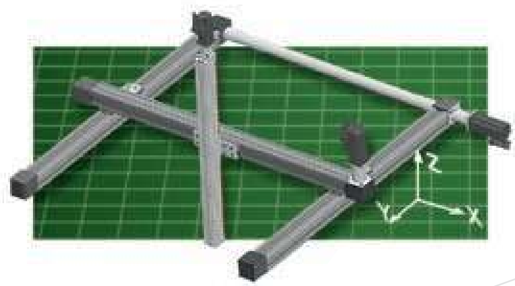
The axes of the multi-axis positioning system comprise:

X and Y axis: Actuator with track roller guidance system and toothed belt drive of series MLF52-ZR

Z axis: Linear table with linear ball bearing guidance system and ball screw drive of series LTE20-B-KGT

MPS301/15 (up to 15 kg moving mass)

Axis	Series	Stroke $h_{max.}$ [mm]	Acceleration a [m/s²]	Speed v [m/s]	Repeat accuracy [mm]
X	MKUVE20-B-ZR	7500	4	1	± 0,1
Y	MKUVE20-B-ZR	1000	4	1	± 0,1
Z	MKUVE15-KGT	200	1,2	0,3	± 0,05

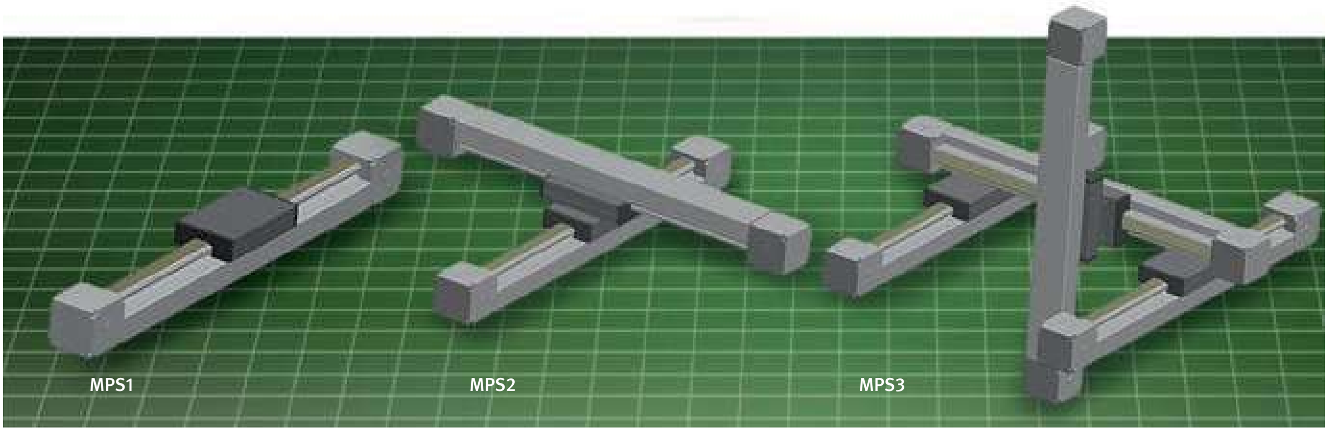


The axes of the multi-axis positioning system comprise:

X and Y axis: Actuator with linear recirculating ball bearing and guideway assembly and toothed belt drive of series MKUVE20-B-ZR

Z axis: Actuator with linear recirculating ball bearing and guideway assembly and toothed belt drive of series MKUVE15-KGT

Tailor-made for you:
Individual multi-axis systems of versatile design



Examples of possible axis configuration

You have a brief to fulfil, in which you are not making progress with a standard linear system or a standard multi-axis positioning system? Then just ask us! As a systems supplier, we can realise the requirements completely to the wishes and requirements of our customers.

An extensive modular concept of fasteners and connectors allows a large number of assembly configurations with driven linear units. You can use this to fulfil practically any requirement – for example:

- number of axes from 1 to ...
- position and positioning of linear units (assembly arrangement)
- location method
- function.

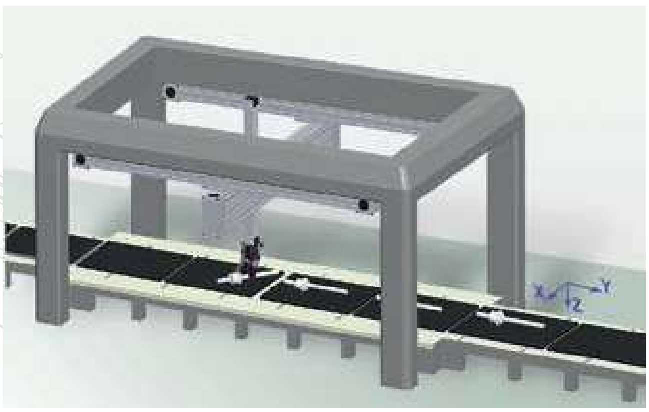
The following performance data are achievable:

- travel distance (stroke) up to 30 m
- travel speed up to 10 m/s
- moving mass up to 500 kg

Application example: Sorting station

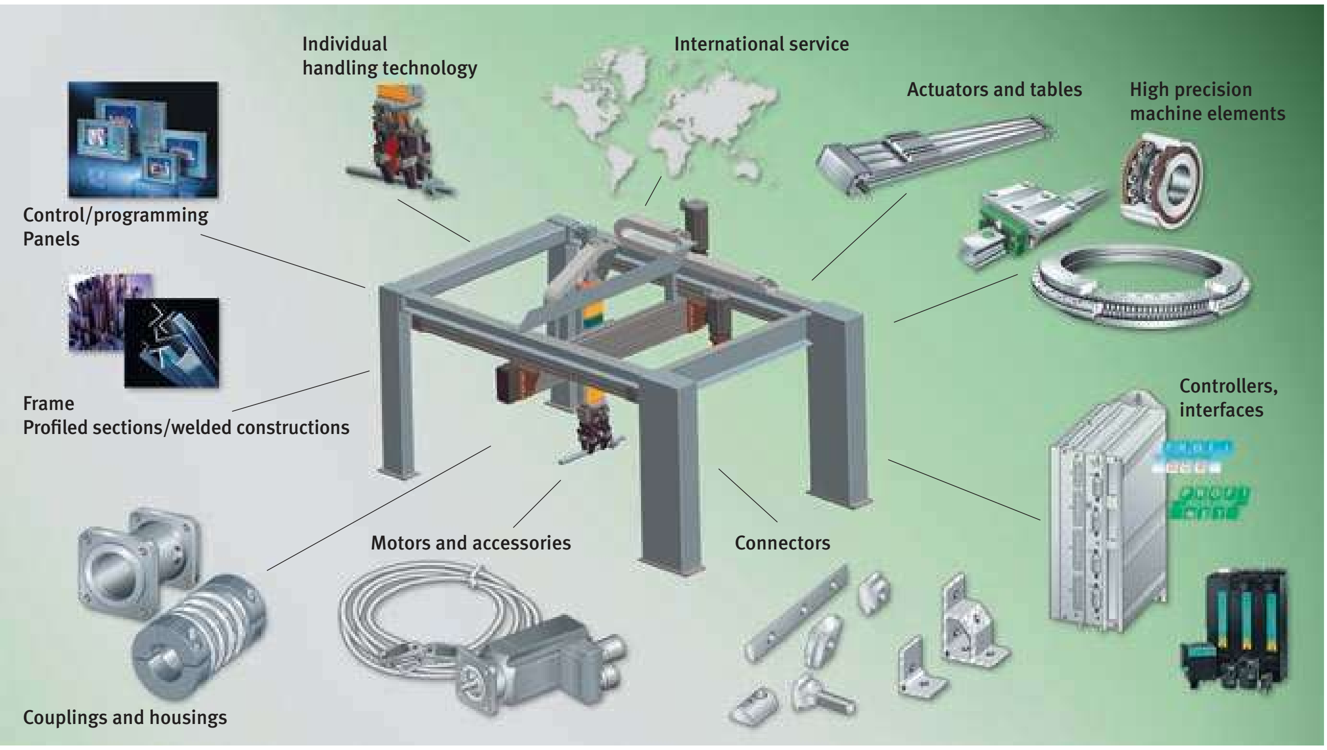
Performance data for customer application
“Defined-position sorting of workpieces”
Workpiece mass: 20 kg

	X	Y	Z
Total stroke [mm]	1000	1400	400
Speed [m/s]	4,3	2,7	1,25
Acceleration [m/s²]	19	11,5	20



Sorting station (customer application)

Supplied to you “turnkey ready”: Ready-to-fit complete solutions



Upon request, you will receive your individual positioning system supplied by us, completely assembled and ready for operation. Our portfolio of services includes all necessary operations and preparations such as:

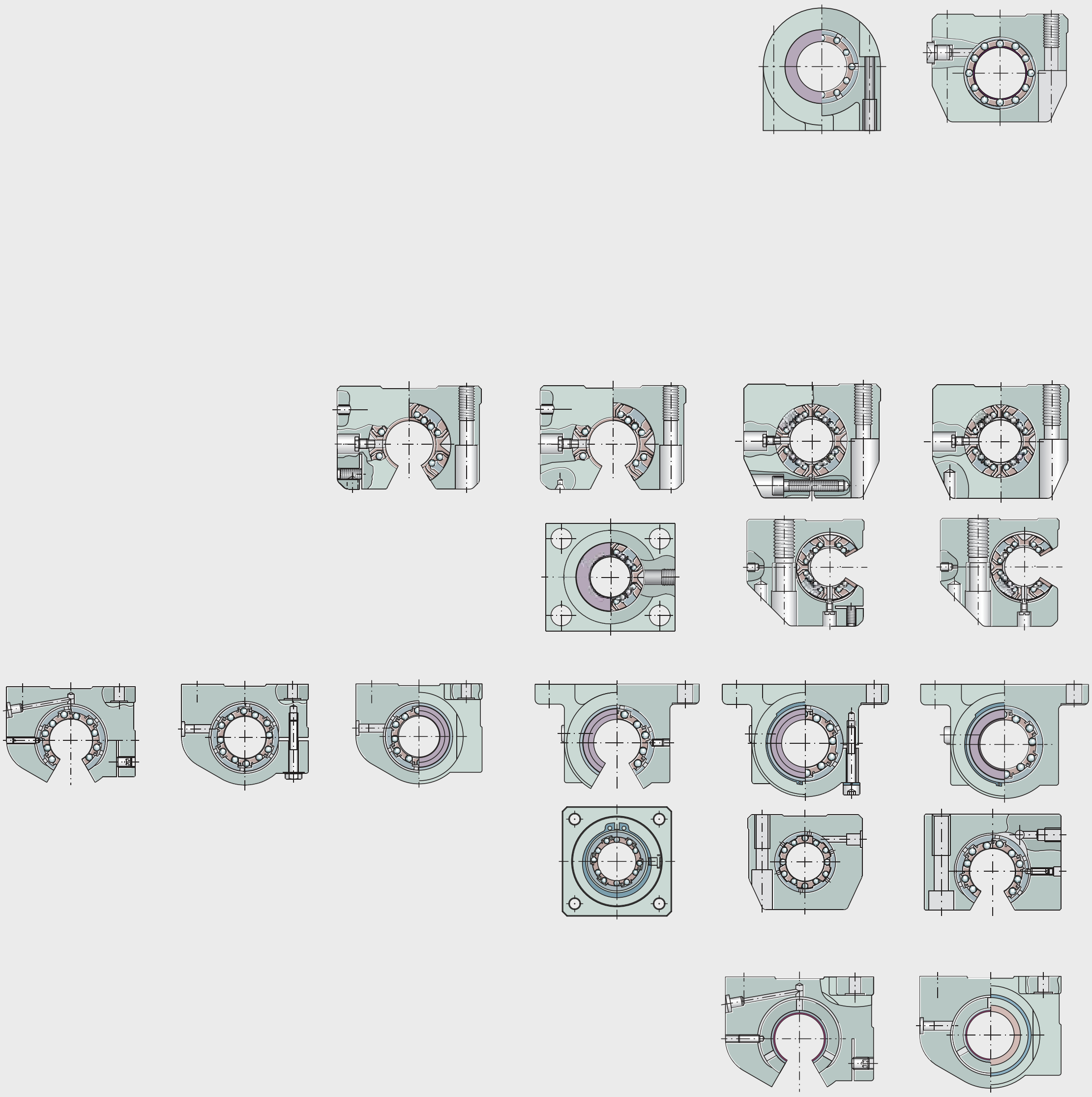
- project management and layout
- overall and detailed design
- preliminary and final assembly of components
- safety and control devices
- control and programming
- transport and final assembly of the positioning system
- initial operation and service
- maintenance (including remote maintenance)

All the services listed above are of course offered worldwide.

Examples of automation equipment: Triple axis positioning system

Shaft Guidance Systems

Linear bearings, linear bearing and housing units
Solid shafts, hollow shafts
Shaft and support rail units
Shaft support blocks



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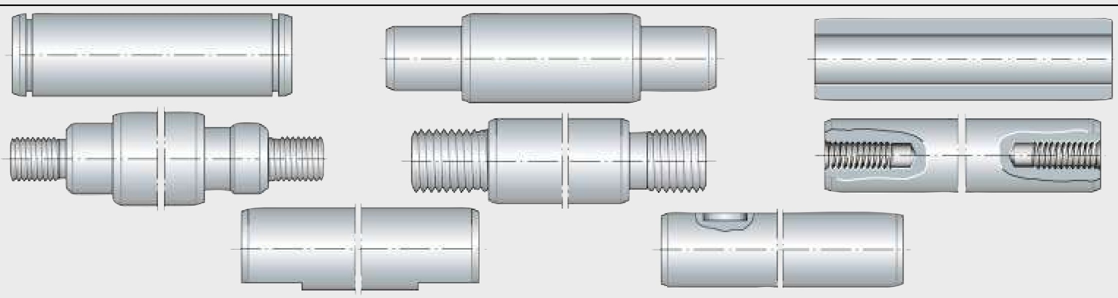

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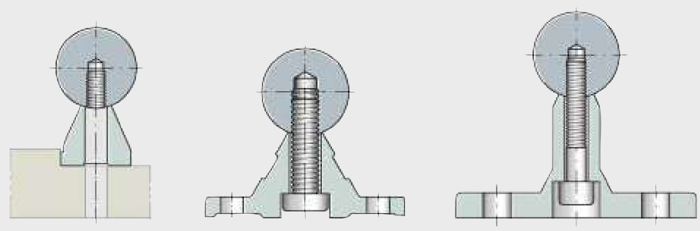

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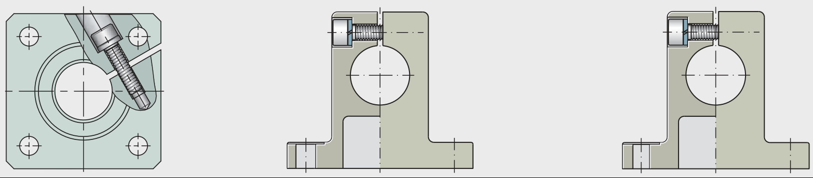

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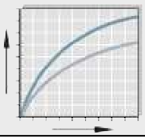

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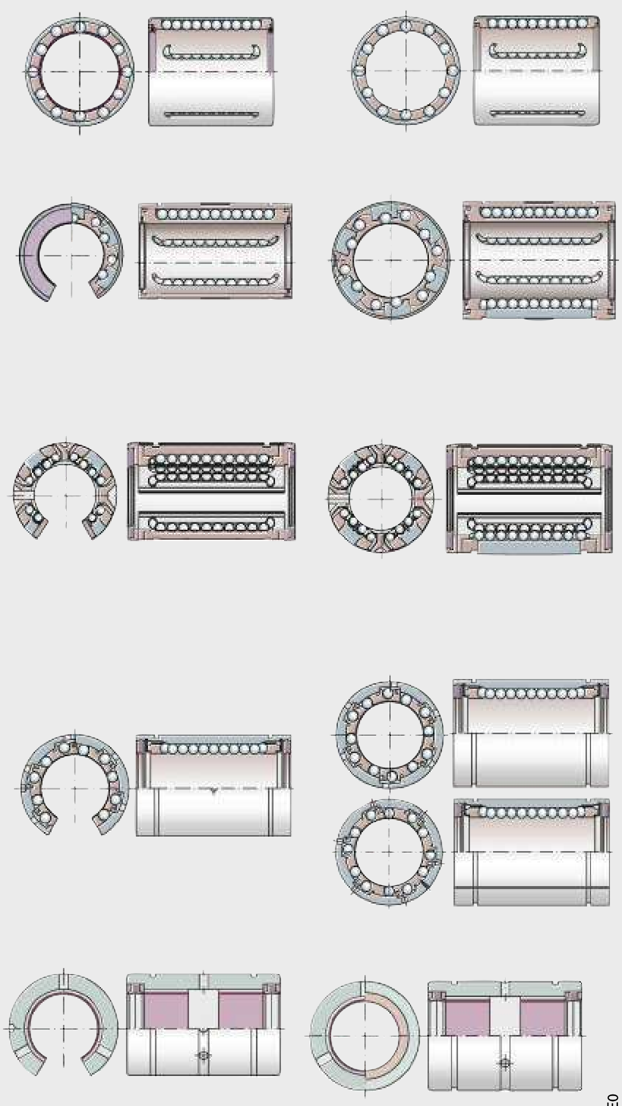
Technical principles



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Linear bearings, linear bearing and housing units

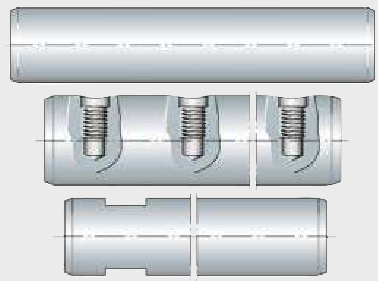
Compact range

Light range

Heavy duty range

Machined range

Plain bearing range



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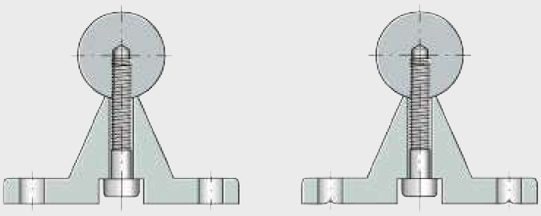
Solid shafts
Hollow shafts



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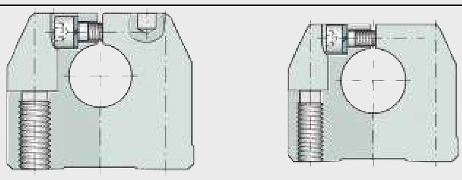
Shaft and support rail units



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Shaft support blocks

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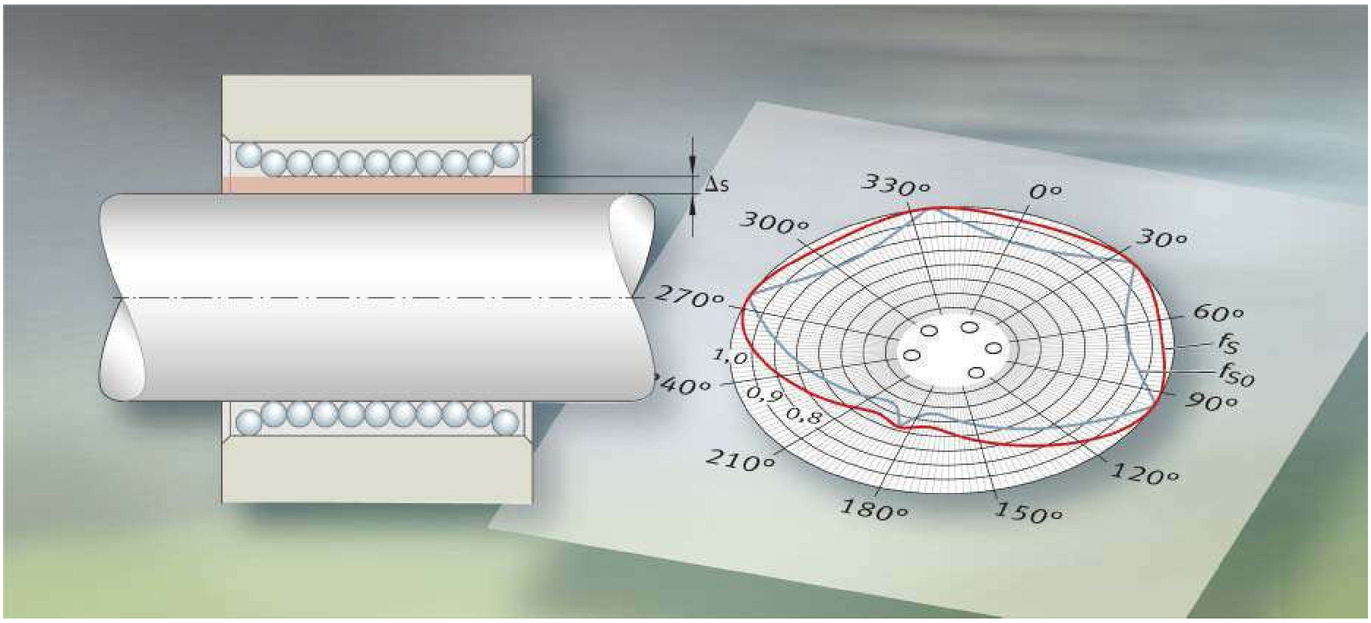
Appendix



Technical principles

Load carrying capacity and life
Friction
Lubrication
Design of bearing arrangements
Operating clearance
Fitting

Load carrying capacity and life

The size of a linear ball bearing is determined by the demands made in terms of load carrying capacity, rating life and operational security.

The load carrying capacity is described in terms of:

- the basic dynamic load rating C
- the basic static load rating C_0.

The calculation of the basic dynamic and static load ratings given in the dimension tables is based on DIN 636-1.

Basic rating life

The basic rating life L is reached or exceeded by 90 % of a sufficiently large group of apparently identical bearings before the first evidence of material fatigue occurs.

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

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

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

L m
Basic rating life L in 100 000 m

C N
Basic dynamic load rating

P N
Equivalent dynamic bearing load

L_h h
Basic rating life in operating hours

H m
Single stroke length

n_{osc} min^{-1}
Number of return strokes per minute

$\bar{v}$ m/min
Mean travel velocity.

Load carrying capacity and life

Operating life

The operating life is defined as the life actually achieved by a shaft guidance system. It may differ significantly from the calculated life.

The following influences can lead to premature failure through wear or fatigue:

- misalignment between the guideways and guidance elements
- contamination
- inadequate lubrication
- reciprocating motion with very small stroke length (false brinelling)
- vibration during stoppage (false brinelling).

Due to the wide variety of mounting and operating conditions, it is not possible to precisely predetermine the operating life of a shaft guidance system. The safest way to arrive at an appropriate estimate of the operating life is comparison with similar applications.

Static load safety factor

The static load safety factor S_0 indicates the security against impermissible permanent deformations in the bearing and is determined by means of the following equation.

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

S_0 –
Static load safety factor

C_0 N
Basic static load rating

P_0 N
Equivalent static load.

For linear ball bearings KH and KN..-B, the value must be $S_0 \geqq 4$.

In relation to guidance accuracy and smooth running, a value of $S_0 \geqq 2$ is regarded as permissible. If $S_0 < 2$, please contact us.

Influence of the shaft raceway on the basic load ratings

The basic load ratings in the dimension tables are only valid if a ground (Ra 0,3) and hardened shaft (at least 670 HV) is provided as a raceway.

Differences in raceway hardness

If shafts with a surface hardness lower than 670 HV are used (for example, shafts made from X46 or X90), a hardness factor must be applied, see equations and *Figure 1*.

$$C_H = f_H \cdot C$$

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

C_H	N	Effective dynamic load rating
f_H	–	Dynamic hardness factor, *Figure 1*
C	N	Basic dynamic load rating
C_{0H}	N	Effective static load rating
f_{H0}	–	Static hardness factor, *Figure 1*
C_0	N	Basic static load rating.

f_{H0} = static hardness factor
f_H = dynamic hardness factor
HV, HRC = surface hardness

① X90
② X46

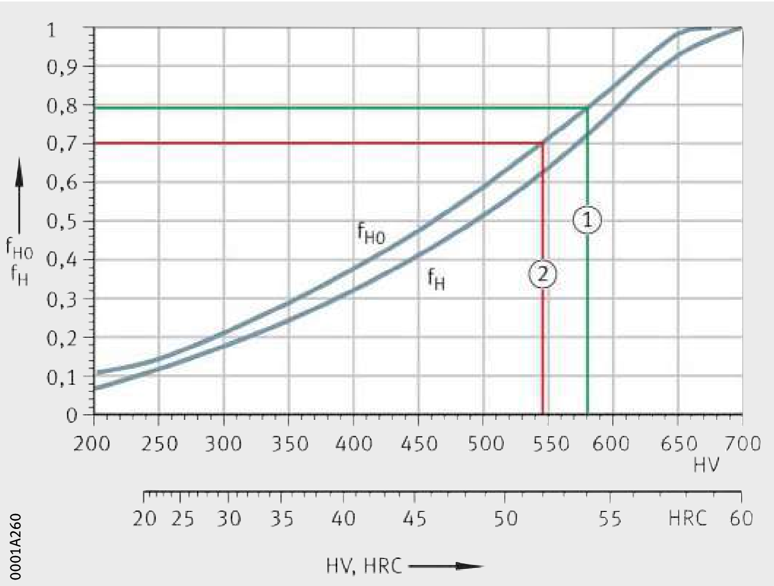


Figure 1
Static and dynamic hardness factors for lower hardness of raceways

Load direction and orientation of the ball rows

The effective load rating of a linear ball bearing is dependent on the position of the load direction in relation to the position of the ball rows:

- The lowest load rating C_{min} and $C_{0\ min}$ occurs at the zenith position, *Figure 2*.
- The highest load rating C_{max} and $C_{0\ max}$ occurs at the symmetrical position, *Figure 2*.

If the bearings are mounted in correct alignment, the maximum load rating can be used. If aligned mounting is not possible or the direction of loading is not defined, the minimum load ratings must be assumed.

Main load direction

For linear ball bearings and linear ball bearing and housing units where the mounting position of the ball rows is defined, the basic load ratings C and C_0 in the main load direction are given, *Figure 3*. For other load directions, the effective load ratings can be determined using the load direction factors in *Figure 4*, page 20, to *Figure 21*, page 24.

If the mounting position of the ball rows is not defined, the minimum basic load ratings are stated.

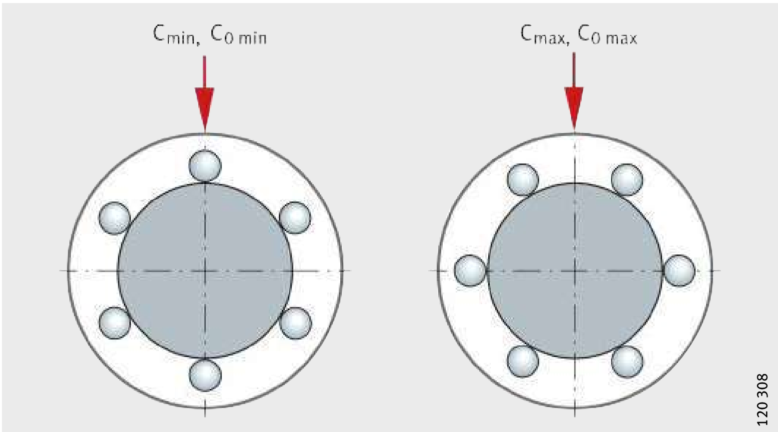
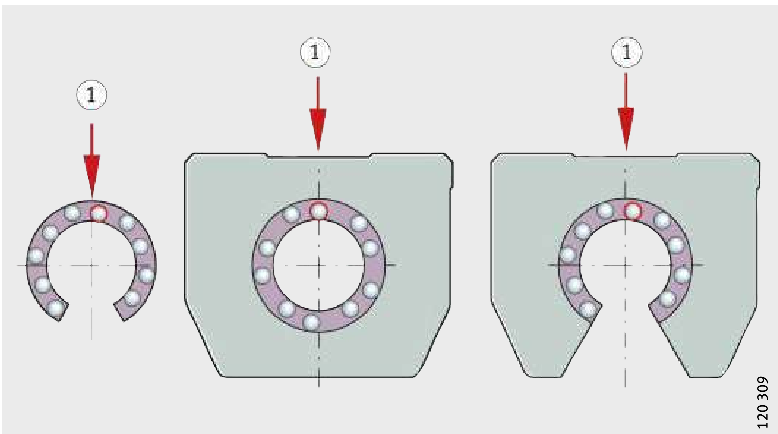


Figure 2
Load carrying capacity, dependent on the position of the ball rows



(1) Main load direction

Figure 3
Main load direction for bearings and housing units

Linear ball bearings

The basic load ratings given in the dimension tables are defined as follows:

- For KH, KN..-B, KS, KB and KBS, the minimum and maximum load ratings apply, *Figure 2*, page 18.
- For KNO..-B, KSO and KBO, the basic load ratings apply in the main load direction. In the case of other load directions, see *Figure 4*, page 20, to *Figure 13*, page 22.

Linear ball bearing and housing units

The basic load ratings given in the dimension tables are defined as follows:

Compact range

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

Heavy duty range

For the heavy duty range, the basic load rating applies in the main load direction. In the case of other load directions, see *Figure 14* to *Figure 17*, page 23.

Machined range

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

For the open units KGBO, KGBAO, the basic load rating applies in the main load direction. In the case of other load directions, see *Figure 20* to *Figure 21*, page 24.

Load direction factors

The factors in *Figure 4*, page 20, to *Figure 13*, page 22, are applied as follows:

$$C_w = f_S \cdot C$$

C_w N
Effective dynamic load carrying capacity

f_S –
Dynamic load factor for load direction

C N
Basic dynamic load rating.

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

C_{0w} N
Effective static load carrying capacity

f_{S0} –
Static load factor for load direction

C_0 N
Basic static load rating.

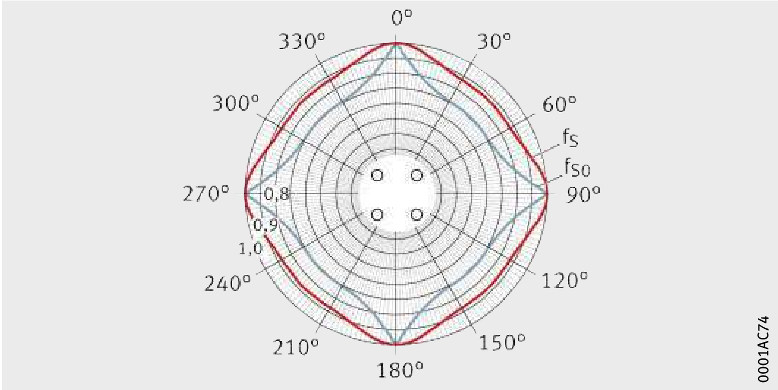


Figure 4
Compact range
Load direction factor
for KH06, KH08, KH10

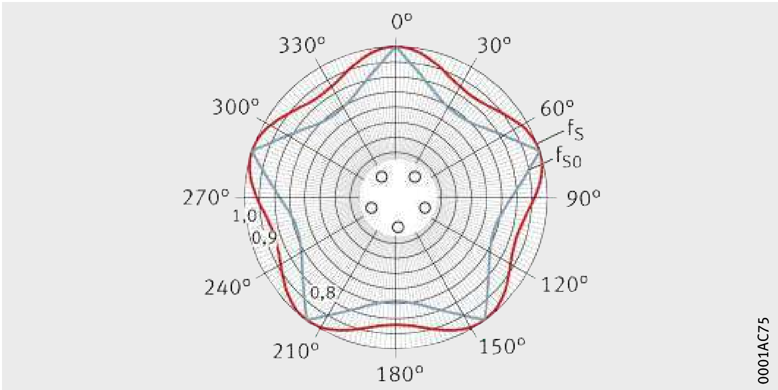


Figure 5
Compact range
Load direction factor
for KH12, KH14, KH16

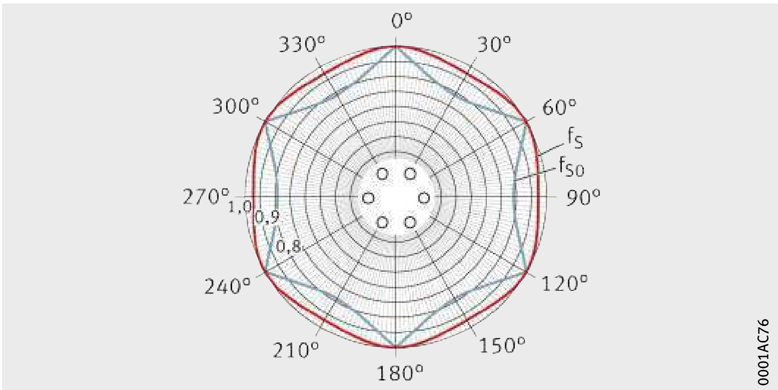


Figure 6
Compact range
Load direction factor
for KH20, KH25

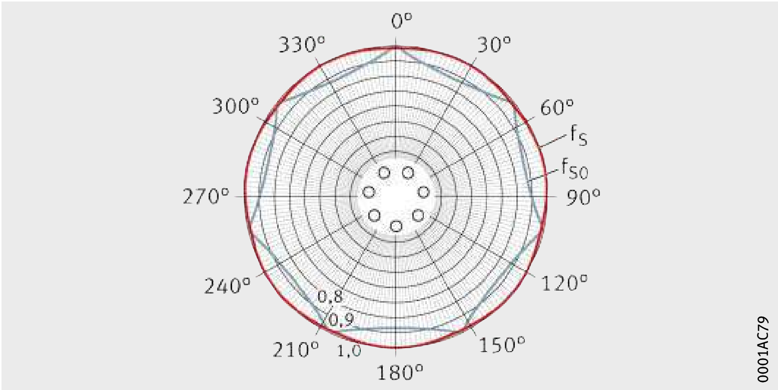


Figure 7
Compact range
Load direction factor
for KH30

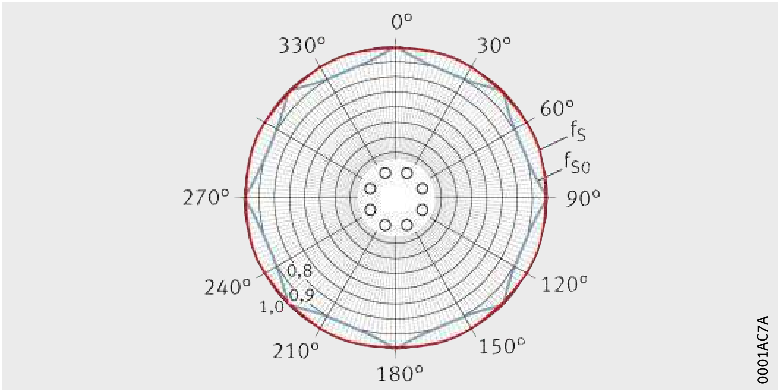


Figure 8
Compact range
Load direction factor
for KH40

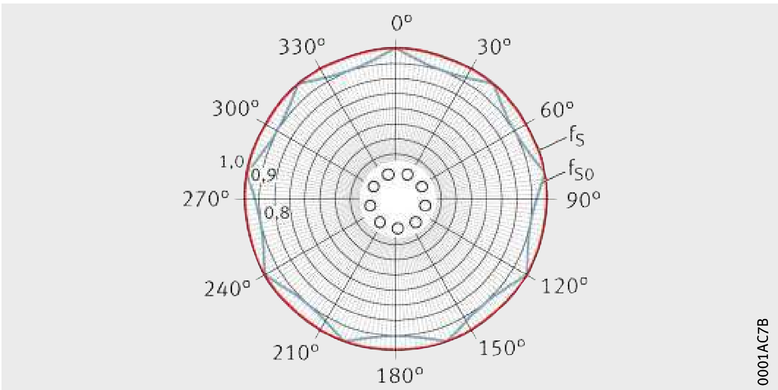


Figure 9
Compact range
Load direction factor
for KH50

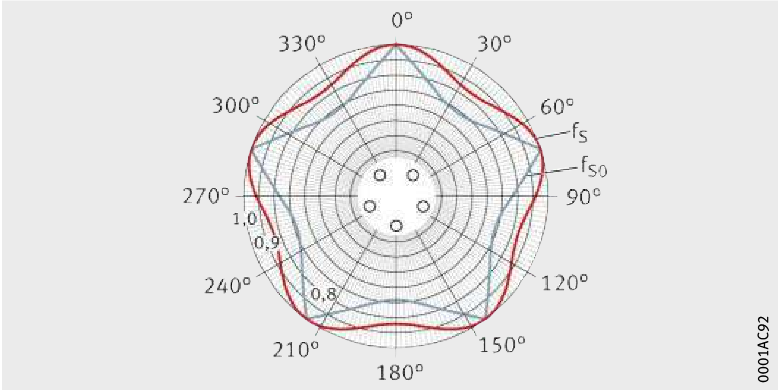


Figure 10
Light range
Load direction factor
for KN12-B, KN16-B

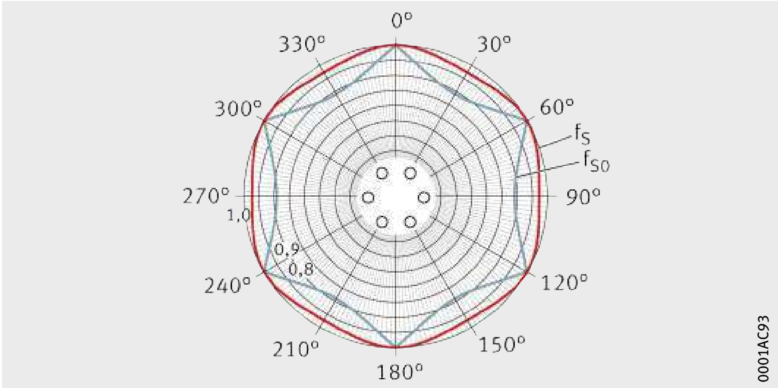


Figure 11
Light range
Load direction factor
for KN20-B, KN25-B,
KN30-B, KN40-B, KN50-B

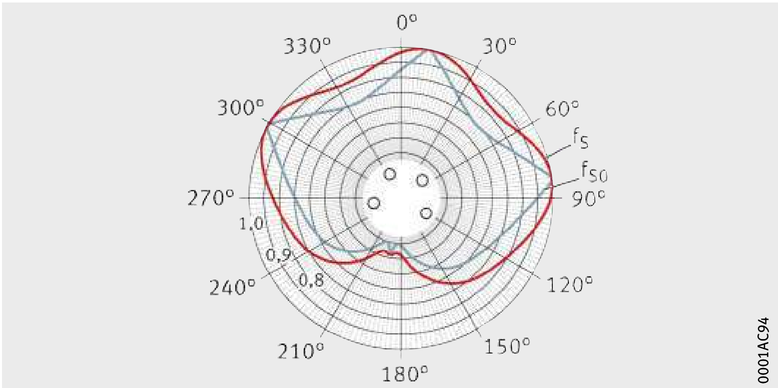


Figure 12
Light range
Load direction factor
for KNO12-B, KNO16-B

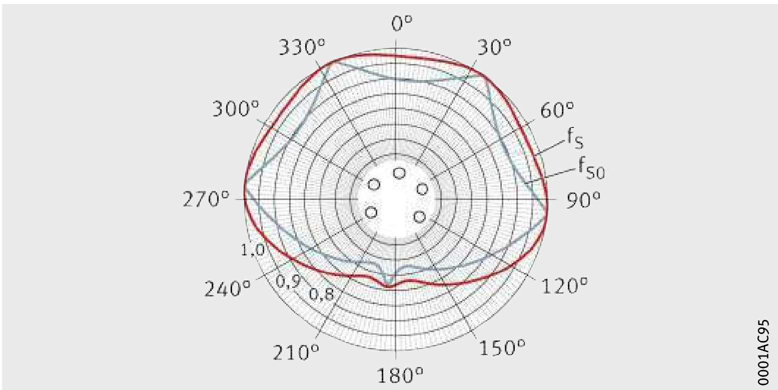
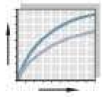


Figure 13
Light range
Load direction factor
for KNO20-B, KNO25-B,
KNO30-B, KNO40-B, KNO50-B



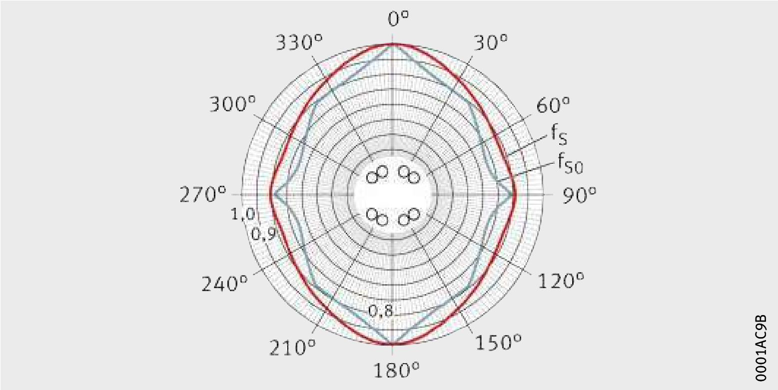


Figure 14
Heavy duty range
Load direction factor
for KS12, KS16, KS20, KS25, KS30, KS40, KS50

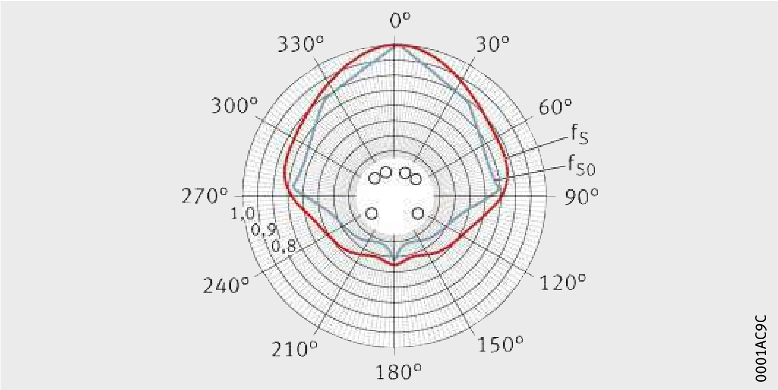


Figure 15
Heavy duty range
Load direction factor
for KSO12, KSO16

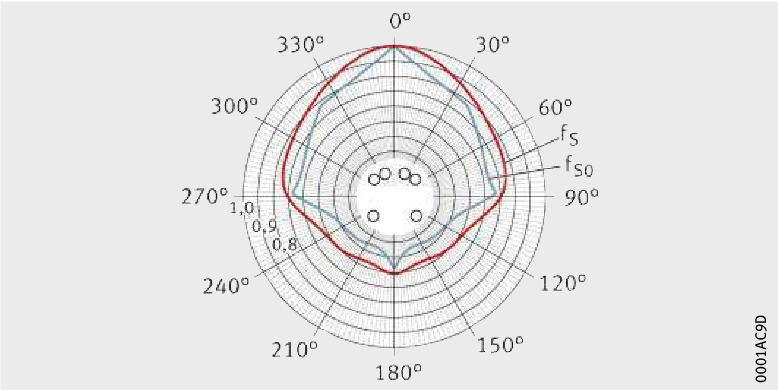


Figure 16
Heavy duty range
Load direction factor
for KSO20, KSO25

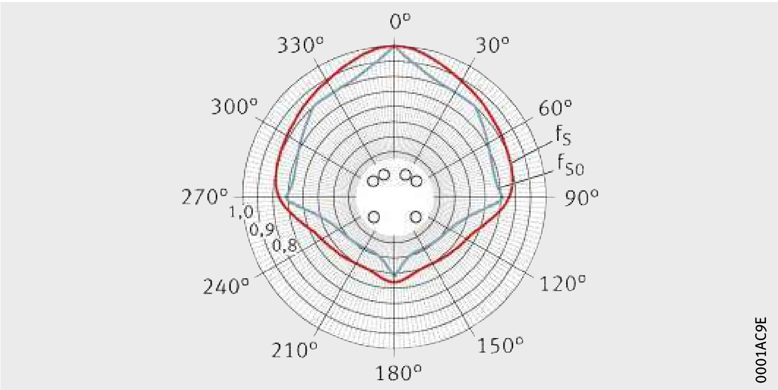


Figure 17
Heavy duty range
Load direction factor
for KSO30, KSO40, KSO50

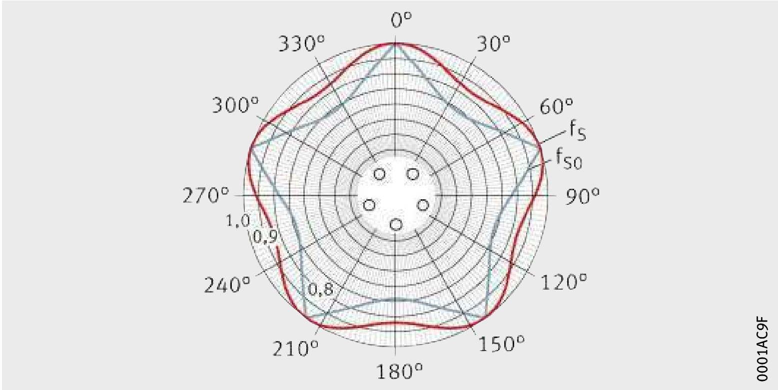


Figure 18
Machined range
Load direction factor for KB12, KB16

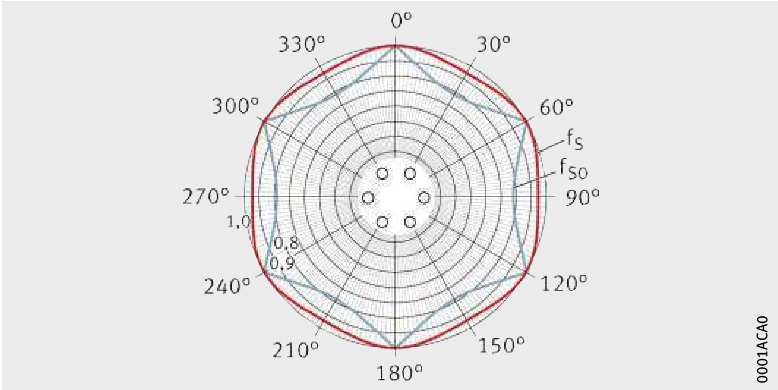


Figure 19
Machined range
Load direction factor for KB20, KB25, KB30, KB40, KB50

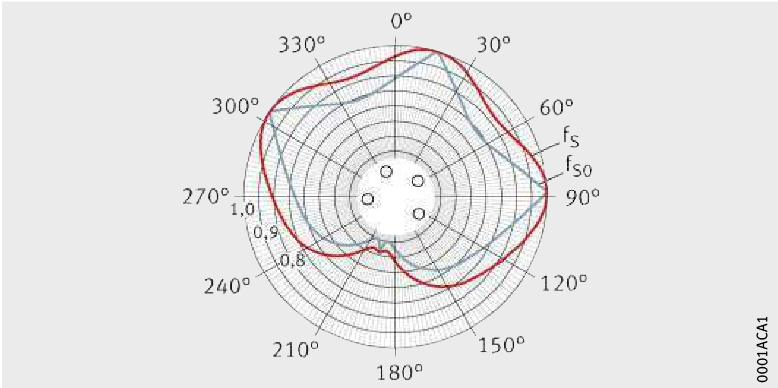


Figure 20
Machined range
Load direction factor for KBO12, KBO16

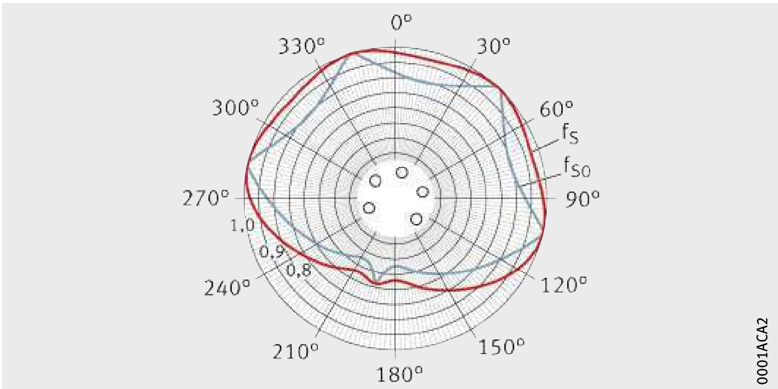


Figure 21
Machined range
Load direction factor for KBO20, KBO25, KBO30, KBO40, KBO50

Misalignment of the shaft

Misalignment of the shaft impairs the running quality and operating life of linear ball bearings. Guidance systems with one shaft should therefore have at least two bearings, while guidance systems with two shafts should have at least three bearings.

Load factors in misalignment

Due to shaft flexing, it is not always possible to avoid misalignment, *Figure 22*. If it is present, load factors for misalignment should be applied, *Figure 23* and *Figure 24*, page 26.

$$P = K_F \cdot F_r$$

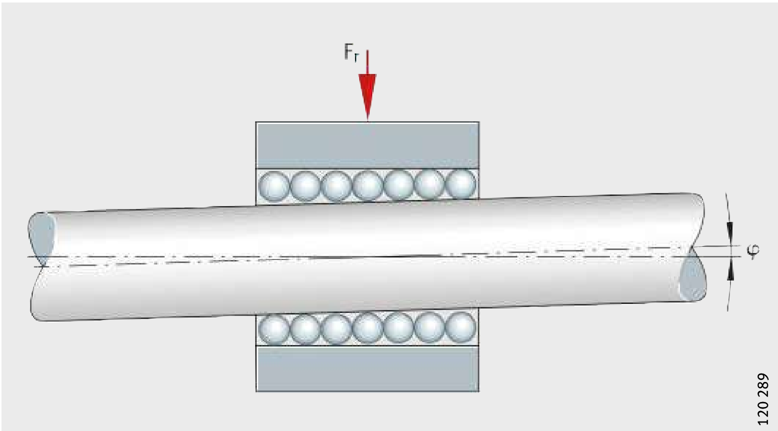
$$P_0 = K_{F0} \cdot F_r$$

P, P_0 N
Equivalent dynamic or static load

K_F, K_{F0} –
Dynamic or static load factor for misalignment, *Figure 23* or *Figure 24*, page 26

F_r N
Maximum radial bearing load

C, C_0 N
Basic radial dynamic or static load rating, *Figure 23* or *Figure 24*, page 26.



F_r = radial load
φ = misalignment

Figure 22
Misalignment φ of the shaft

Load carrying capacity and life

① Dynamic load factor K_F
② Misalignment φ in angular minutes

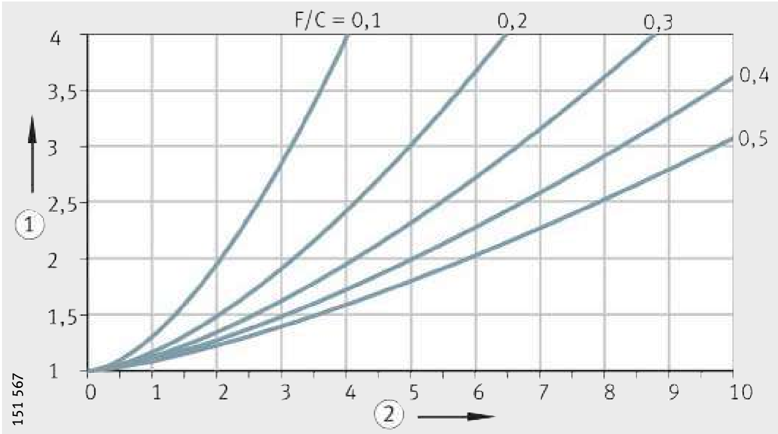


Figure 23
Dynamic load factor for shaft misalignment

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

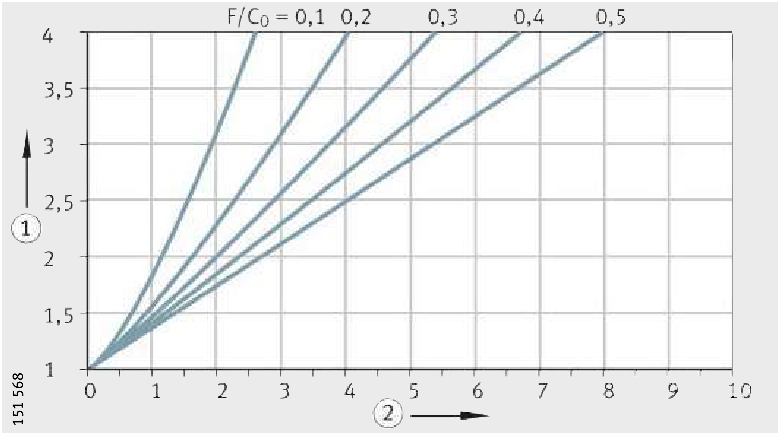


Figure 24
Static load factor for shaft misalignment

Compensation of misalignments in the light and heavy duty range

Linear ball bearings KN..-B, KNO..-B, KS and KSO and linear ball bearing and housing units containing these bearings are self-aligning. They can compensate misalignments of up to ±30 angular minutes (KN..-B and KNO..-B) or ±40 angular minutes (KS and KSO) without detrimental effect on the load carrying capacity.

Friction

Linear ball bearings are frequently used where high positional accuracy and high efficiency are a priority. The bearings must therefore run without stick-slip and with only low friction.

The linear ball bearings KN..-B, KNO..-B, KS, KSO, KB, KBS, KBO have particularly low friction.

Coefficient of friction

The total friction consists of:

- rolling and sliding friction at the rolling contacts (sliding friction in linear plain bearings)
- friction in the return zones and recirculation guides
- lubricant friction
- seal friction.

The factors on which the coefficient of friction depends may act in a reciprocal manner, may act in a single direction or may counteract each other.

Coefficient of friction in unsealed bearings

The coefficients of friction for unsealed linear bearings with oil lubrication are given in the table.

In the case of linear plain bearings, the coefficient of friction is between 0,02 and 0,2.

Series and coefficient of friction

Series	Coefficient of friction
KH	0,003 – 0,005
KN..-B, KNO..-B	0,001 – 0,0025
KS, KSO	0,001 – 0,0025
KB, KBS, KBO	0,001 – 0,0025

Lubrication

Open linear ball bearings are supplied with a wet or dry preservative and can be lubricated using either grease or oil. The oil-based preservative is compatible and miscible with lubricants with a mineral oil base, which means that it is not generally necessary to wash out the bearings before mounting.

Bearings with a dry preservative must be greased or oiled immediately after they are removed from the packaging.

Grease lubrication

Grease lubrication should be used in preference to oil lubrication, since the grease adheres to the inside of the bearing and thus prevents the ingress of contamination. This sealing effect protects the rolling elements against corrosion.

In addition, the design work involved in providing grease lubrication is less than that for providing oil, since design of the sealing arrangement is less demanding.

Composition of suitable greases

The greases for linear ball bearings have the following composition:

- lithium or lithium complex soap
- base oil: mineral oil or poly-alpha-olefin (PAO)
- special anti-wear additives for loads $C/P < 8$, indicated by “P” in the DIN designation KP2K–30
- consistency to NLGI grade 2 in accordance with DIN 51818.

Initial greasing and operating life

Based on experience, the operating life is achieved when bearings are operated with grease lubrication in normal environmental conditions ($C/P > 10$), at room temperature and at $v \leqq 0,6 \cdot v_{max}$. If it is not possible to achieve these conditions, the bearings must be relubricated.

Sealed linear ball bearings are already adequately greased when delivered and are therefore maintenance-free in many applications.

Initial greasing and relubrication of bearings

The initial greasing and relubrication of linear ball bearings without seals and relubrication holes must be carried out via the shaft. It must be ensured that all rolling elements come into contact with grease during recirculation. The bearing must be moved over at least twice its length during relubrication.

During initial greasing, the bearing fitted on the shaft should be fed with lubricant until this begins to emerge from the bearing.

In the case of the linear ball bearings KH, KN..-B-PP-AS, KS..-PP-AS and PAB..-PP-AS, relubrication can be carried out via holes or openings in the retaining ring or outer ring.

Relubrication interval

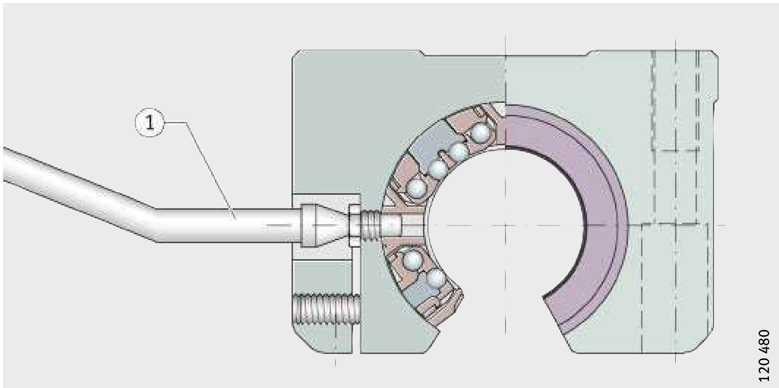
The relubrication interval is dependent on many operating conditions such as load, temperature, speed, stroke length, lubricant, environmental conditions and the mounting position.

Precise lubrication intervals should be determined by tests conducted under application conditions.

Relubrication of linear ball bearings in housings

If linear ball bearings are mounted in a housing, special nozzle tubes may be required for relubrication, *Figure 1* and *Figure 2*.
Sources for nozzle tubes with suitable needle point heads can be requested from us.

Figure 1
Nozzle tube



(1) Nozzle tube

Figure 2
Relubrication using nozzle tube

Lubrication nipples for housings

Lubrication nipples for housings with KS are shown in *Figure 3*, suitable DIN lubrication nipples for housings with KN..-B are shown in *Figure 4* and *Figure 5*, page 31, for other housings, see *Figure 6*, page 31. The dimensions are given in the tables.

NIP..MZ

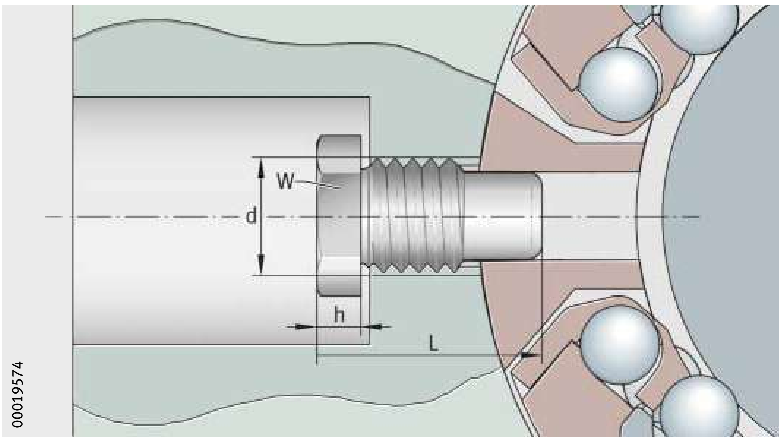


Figure 3
Lubrication nipple
for heavy duty range KS

Lubrication nipples

Lubrication nipple	Width across flats	Dimensions		
	W	d mm	L mm	h mm
NIP4MZ	5	M4	7,7	1,5
NIP5MZ	6	M5	11,1	2
NIP6MZ	7	M6	14,8	2,5

NIP DIN 71412

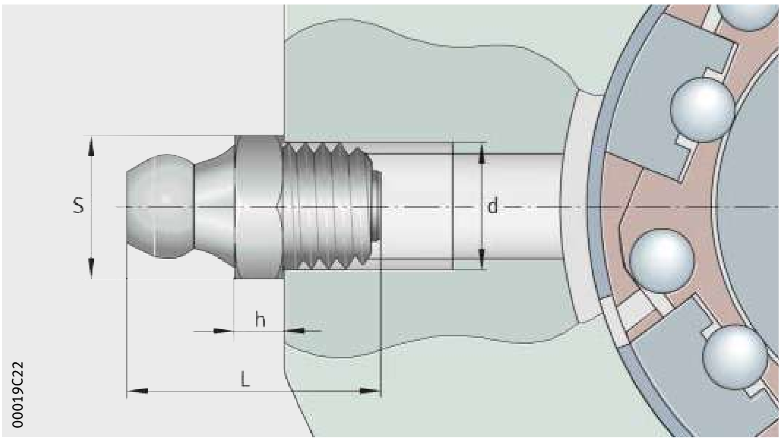


Figure 4
Lubrication nipple DIN 71412 type A
for light range KN..-B

Taper type lubrication nipples

Taper type lubrication nipple	Dimensions			
	S h13 mm	d mm	L mm	h j16 mm
NIP DIN 71412-AM6	7	M6	16	3
NIP DIN 71412-AM8×1	9	M8×1	16	3

NIP DIN 3405

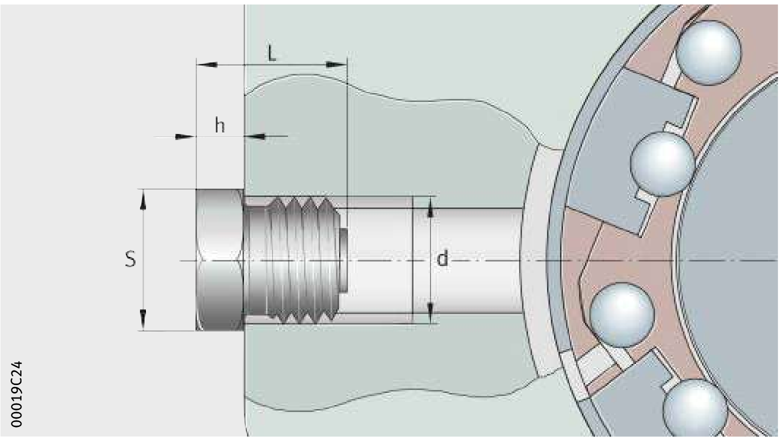


Figure 5
Alternative lubrication nipple DIN 3405 type A for light range KN..-B

Funnel type lubrication nipples

Funnel type lubrication nipple	Dimensions			
	S h13 mm	d mm	L mm	h j16 mm
NIP DIN 3405-AM6	7	M6	9,5	3
NIP DIN 3405-AM8×1	9	M8×1	9,5	3

NIPA

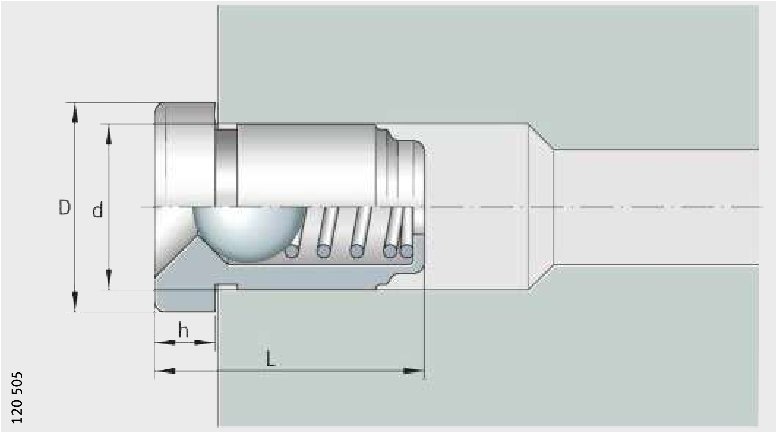


Figure 6
Lubrication nipple for compact range KH, machined range KB, plain bearing range PAB

Lubrication nipples

Lubrication nipple	Dimensions			
	D mm	d mm	L mm	h mm
NIPA1	6	4	6	1,5
NIPA2	8	6	9	2

Lubrication

Application in special environments

In vacuum applications, lubricants with low vapourisation rates are required in order to maintain the vacuum atmosphere.

In the foodstuffs sector and clean rooms, special requirements are also placed on lubricants in relation to emissions and compatibility. For such environmental conditions, please consult us.

Oil lubrication

Oil lubrication should be used in preference if heat is to be dissipated and contaminants are to be carried out of the bearing by the lubricant.

This advantage should be set against the increased design work required (lubricant feed, sealing).

Suitable oils

As a function of the load case, we recommend the following oils:

- for low to moderate loads ($C/P > 15$):
  - hydraulic oils HL to DIN 51524 and oils CL to DIN 51517 in the viscosity range ISO-VG 10 to ISO-VG 22
- for high loads ($C/P < 8$):
  - hydraulic oils HLP to DIN 51524 and oils CLP to DIN 51517 in the viscosity range ISO-VG 68 to ISO-VG 100.

The good running characteristics of shaft guidance systems are dependent not only on the bearings. The geometrical and positional tolerances of the adjacent construction also play a significant role.

The higher the accuracy to which the adjacent construction is produced and assembled, the better the running characteristics.

Location

Linear ball bearings KH

Linear ball bearings KH and KH..-PP are pressed into the housing bore. This provides axial and radial location. No additional means of location are required.

Linear ball bearings KN..-B, KB, KS and plain bearings PAB

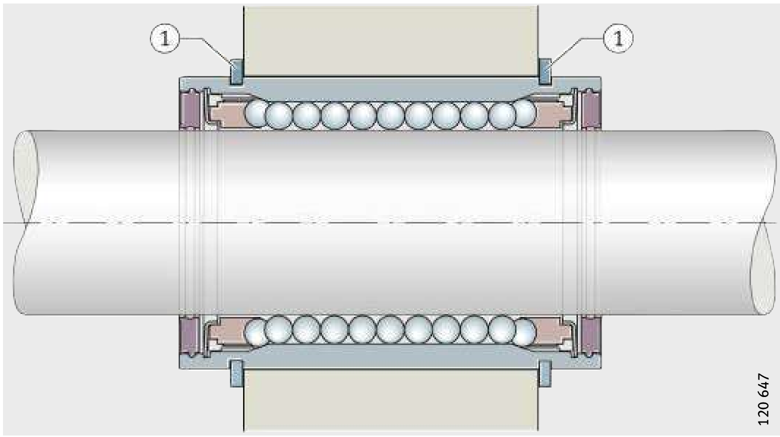
Linear ball bearings KN..-B, KB, KS and plain bearings PAB require axial location.

Linear ball bearings KB and plain bearings PAB can be located by means of retaining rings or by the adjacent construction, *Figure 1* to *Figure 3*, page 34.

Linear ball bearings KN..-B and KS can be located in accordance with *Figure 2* and *Figure 3*, page 34.

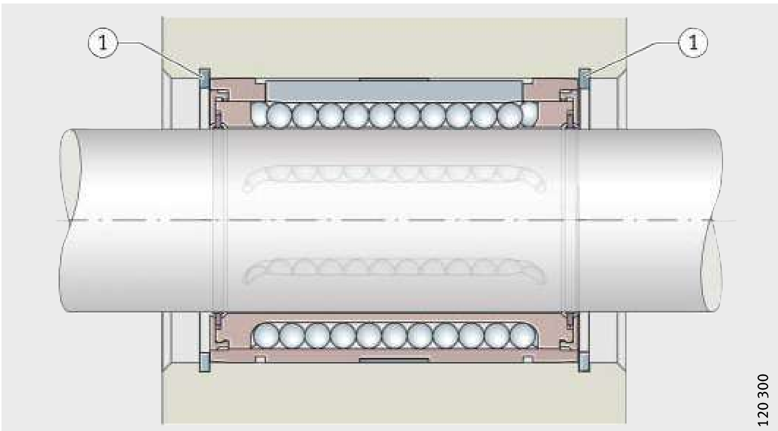
Linear ball bearings KN..-B can also be located by means of a screw, *Figure 4*, page 34.

! The series KN..-B and KS should not be located by means of shaft retaining rings according to *Figure 1*. This could impair the function of the bearing.



① Retaining rings

Figure 1
Retaining rings in the bearing slots



① Retaining rings

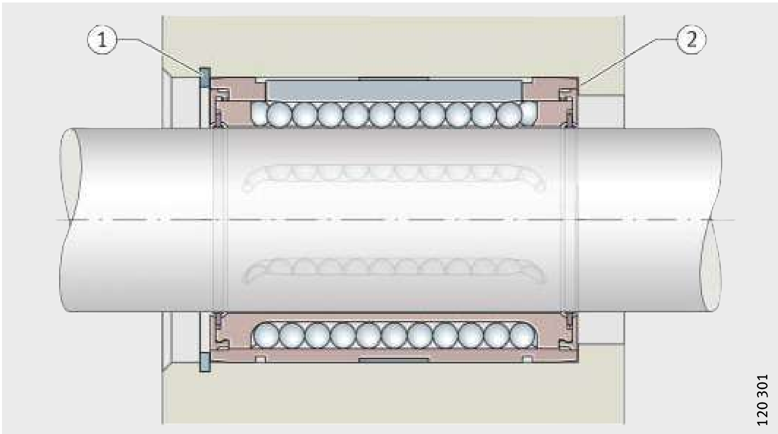
Figure 2
Retaining rings in the housing bore

Linear ball bearings KNO..-B, KBO and plain bearings PABO

Linear ball bearings KNO..-B, KBO and plain bearings PABO must be axially located.

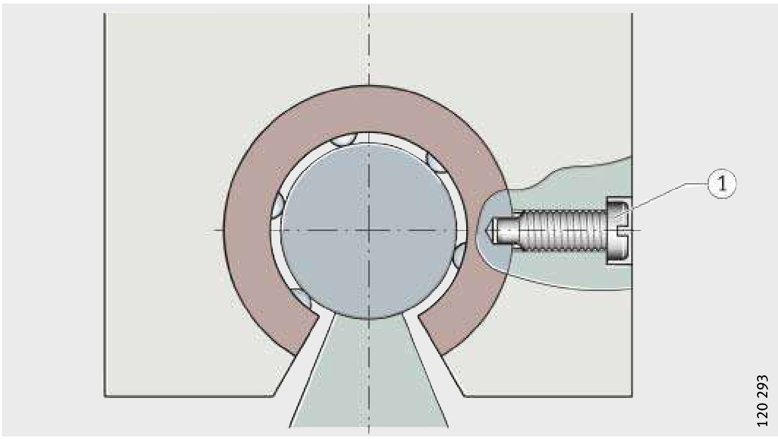
These bearings are located by external means. A dog point screw should preferably be used for location, *Figure 4*. Grub screws are also suitable.

The locating screw must not be allowed to deform the bearing. The screw must be secured against loosening.



① Retaining ring
② Housing rib

Figure 3
Retaining ring and housing rib



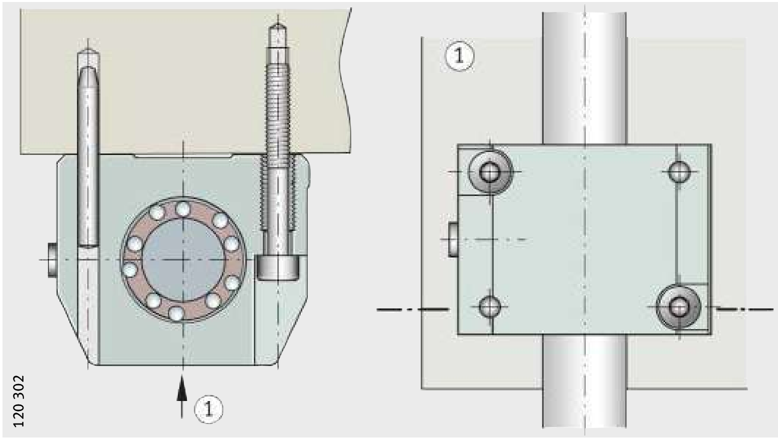
① Dog point retaining screw

Figure 4
Location of the bearing using a screw

Linear ball bearing and housing units

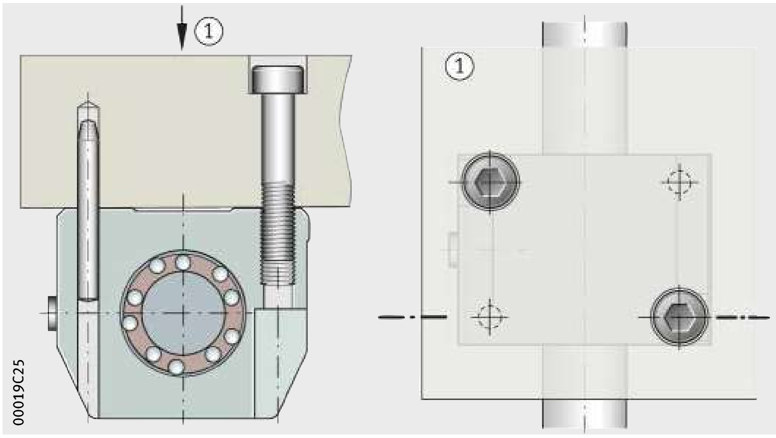
Linear ball bearing and housing units and linear plain bearing units are screw mounted into or through the fixing holes, *Figure 5* and *Figure 6*.

Location of the units by means of dowels is only necessary in rare cases, but can be achieved easily by drilling out the centring holes.



① Bottom view

Figure 5
Location of a unit from below



① Top view

Figure 6
Location of a unit from above

Sealing

Clean raceways are necessary in order to prevent premature failure of the shaft and bearing. The bearing position should therefore always be sealed.

Gap seals or contact seals

The seals for the bearing series are shown in the table.

Gap seals protect the bearings against coarse contaminants. Contact seals give protection against fine contaminants and also retain the grease in the bearing.

Linear ball bearings and linear plain bearings with contact seals have the PP, example KH..-PP.

!

If the bearing and shaft are in a highly aggressive environment, it is recommended that the guidance system should be provided with additional protection by means of bellows or telescopic covers.

Seals for bearings and units

Series[1)]	Seal		
	Open design	Gap seals	Contact seals
KH	●	–	●
KN..-B, KNO..-B	–	●	●
KS, KSO	–	●	●
KB, KBO	–	●	●
PAB, PABO	–	–	●

● Available design.

1) All linear bearing units have contact seals.

Operating clearance

Tolerance and operating clearance

The operating clearance of linear bearings is defined by the selection of shaft and housing tolerance, see tables, page 38.

The operating clearance of linear bearing units is defined either by the shaft or, in the case of slotted housings, is set by means of the adjustment screw.

In the case of non-rigid housings, tests must be carried out in order to achieve the required operating clearance by means of the housing and shaft tolerances.

For adjustment of the operating clearance see page 43.

Tolerance and operating clearance

Linear bearings, linear bearing and housing units	Designation	Tolerance		Operating clearance
		Shaft	Bore	
Compact range	KH	See table, page 38		
	KGHK, KTHK	h6	–	Standard
Light range	KN..-B, KNO..-B	h6	H7	Clearance-free
Heavy duty range	KS, KSO	h6	H7	Clearance-free
	KGSNG, KTSG, KGSNO, KTSO, KGSC, KTFS	h6	–	Slight preload
	KGSNS, KTSS, KGSNOS, KTSOS, KGSCS	–	–	Adjustable by means of screw
Machined range	KB	See table, page 38		
	KBS, KBO			
	KGB, KGBA, KTB, KGBO, KTBO	h6	–	See table, page 38
	KGBS, KGBAS, KGBAO	–	–	Adjustable by means of screw
Plain bearing range	PAB, PABO	h7	H7	Standard
	PAGBA, PAGBAO	h7	–	Standard

Operating clearance

Mounting tolerances and operating clearance

The theoretically possible operating clearance for the individual series is shown in the following tables and *Figure 1*.

Operating clearance for KH, KN..-B, KNO..-B

Mounting tolerance		Operating clearance All sizes	
Shaft	Bore		
h6	H7, K7	Normal operating clearance	Steel/ aluminium
j5	H6, K6	Operating clearance smaller than normal	Steel/ aluminium

Operating clearance for KS, KSO

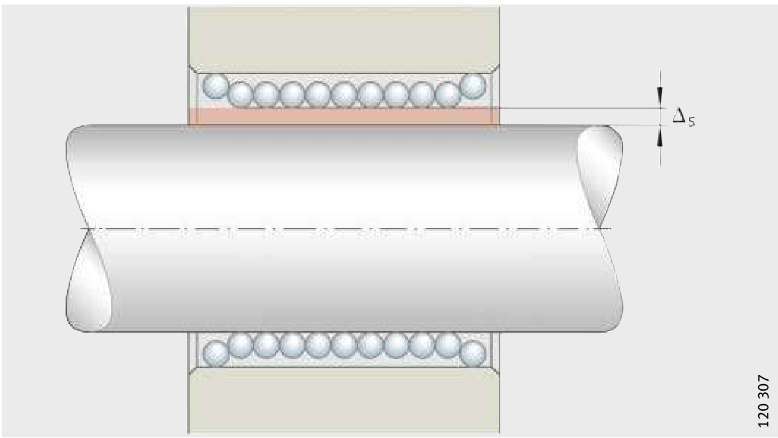
Mounting tolerance		Size and operating clearance						
Shaft	Bore	12 µm	16 µm	20 µm	25 µm	30 µm	40 µm	50 µm
h6	H6	+36 −8	+34 −10	+37 −12	+34 −15	+29 −20	+33 −22	+30 −25
h6	H7	+44 −8	+42 −10	+46 −12	+43 −15	+38 −20	+44 −22	+41 −25
h6	JS6	+29 −14,5	+27,5 −16,5	+29 −20	+26 −23	+21 −28	+23,5 −31,5	+20,5 −34,5

Operating clearance for KB

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

Operating clearance for KBS, KBO

Mounting tolerance		Size and operating clearance						
Shaft	Bore	12 µm	16 µm	20 µm	25 µm	30 µm	40 µm	50 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



Δ_s = operating clearance

Figure 1
Operating clearance

Mounting

The bearings should only be removed from their packaging immediately before mounting. Bearings with dry preservative should be protected against corrosion immediately after removal from the packaging.

The mounting area and the adjacent construction must be clean. Contamination impairs the accuracy and operating life of the guidance systems.

The bearings must not be tilted.

In the case of sealed bearings with a segment cutout, it must be ensured at all costs that the ends of the seal lips are not turned inside out (pay attention to the packing slip).

Mounting of bearings

Linear ball bearings KH

Linear ball bearings KH are pressed into the housing bore using a pressing mandrel, *Figure 1*. The mandrel dimensions must be in accordance with *Figure 1*.

The marked end face of the linear ball bearing should be in contact with the flange of the mandrel.

Linear ball bearings can be mounted more easily if the outside surface is greased.

d_{LW} = shaft diameter
D_G = housing bore

① Detail

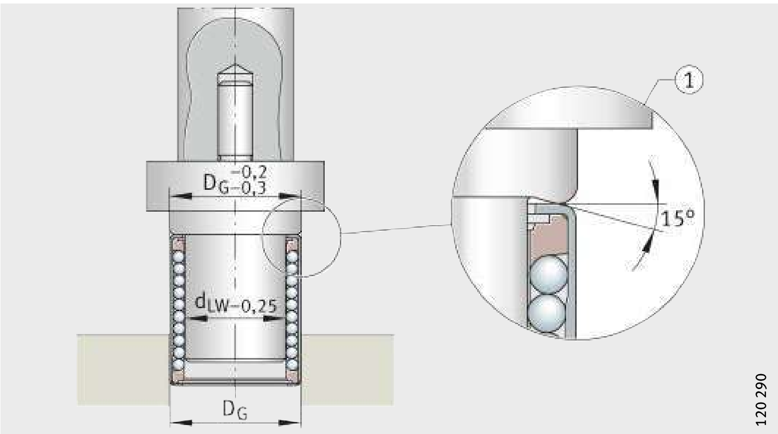


Figure 1
Pressing in
of linear ball bearings KH

Linear ball bearings KN..-B,KNO..-B, KB, KBS, KBO, KS, KSO and linear plain bearings PAB, PABO

Smaller bearings of these series can be slid into the housing bore by hand. For larger bearings, it is advisable to use a mounting mandrel, *Figure 2*.

The bearings are then located by means of retaining rings or a screw, *Figure 3*.

In the case of all bearings located by means of a screw, it must be ensured that the screw does not deform the bearing and the screw is secured against loosening.

d_{LW} = shaft diameter

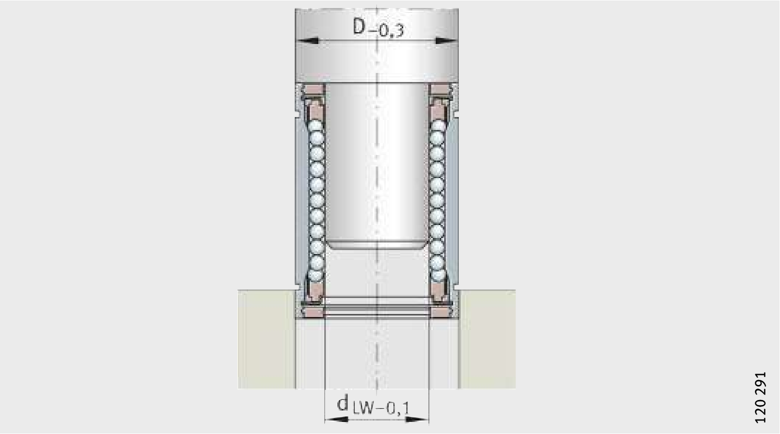


Figure 2
Mounting of linear ball bearings using fitting mandrel

(1) Dog point retaining screw

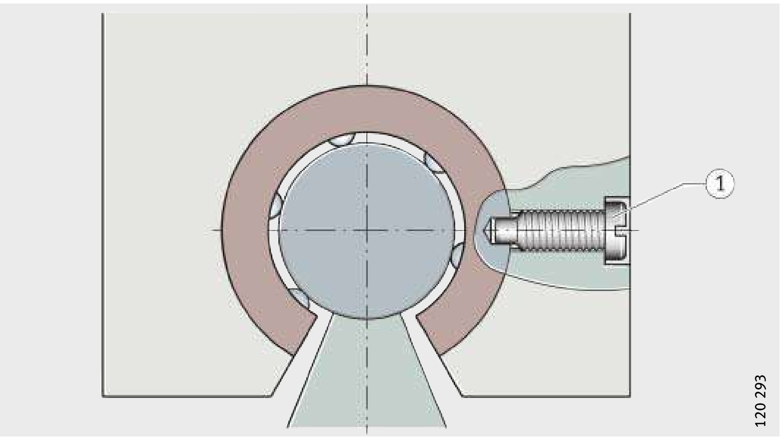


Figure 3
Location of the bearing using a screw

Alignment of bearings and shafts

Bearings arranged in series

Bearings arranged in series should be aligned with a continuous shaft, positioned against a stop and then screw mounted firmly in place.

Bearings arranged in parallel

Bearings arranged in parallel are aligned by measuring the spacing between the shafts (A_1) or between the bearing outside diameters (A_2), *Figure 4*. This spacing can also be defined by means of spacers.

The first shaft is set (datum shaft) and screw mounted. The second shaft is aligned by moving the table to achieve the required spacing.

A_1 = spacing between the shafts

A_2 = spacing between the bearing outside diameters

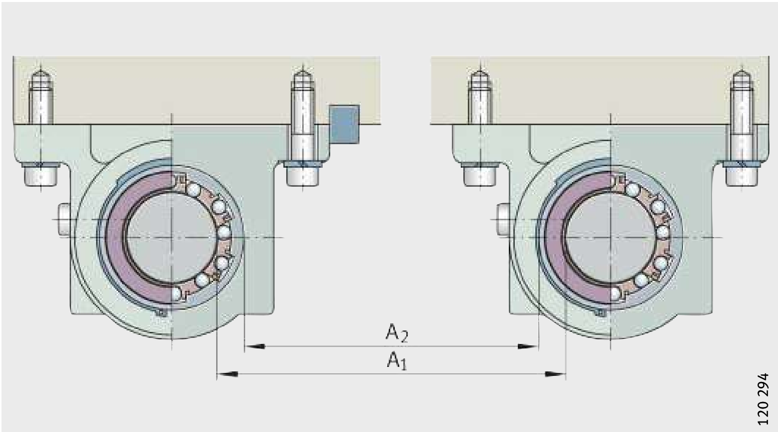


Figure 4
Alignment of bearings arranged in parallel

Very long guidance systems with supported shaft

In very long guidance systems with supported shaft, one shaft and support rail unit is first aligned by means of the shaft and screw mounted firmly in place in stages (datum shaft), *Figure 5*.

The procedure described in section Bearings arranged in parallel is then carried out.

① Shaft and support rail unit

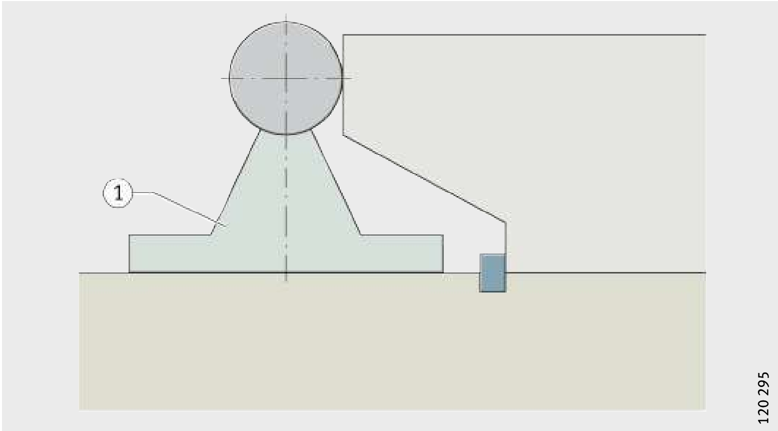


Figure 5
Alignment of a shaft and support rail unit by means of the shaft

Guidance systems with clearance-free or preloaded bearings

Only one row of bearings arranged in series should be set clearance-free or preloaded. The bearings parallel thereto should have a substantial operating clearance.

Parallel shaft and support rail units

Clamp the datum support rail against a stop, *Figure 6*.

① Stop
② Datum support rail

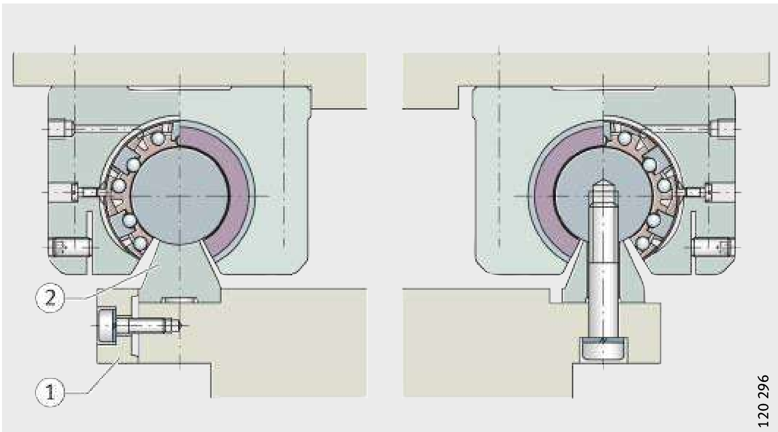


Figure 6
Clamping of the support rail when using two shaft and support rail units TSUW

Setting the operating clearance

Setting bearings clearance-free

In the case of linear ball bearings KBS and slotted housings, the operating clearance can be adjusted. The screw must be adjusted until resistance to further rotation can be felt between the shaft and bearing.

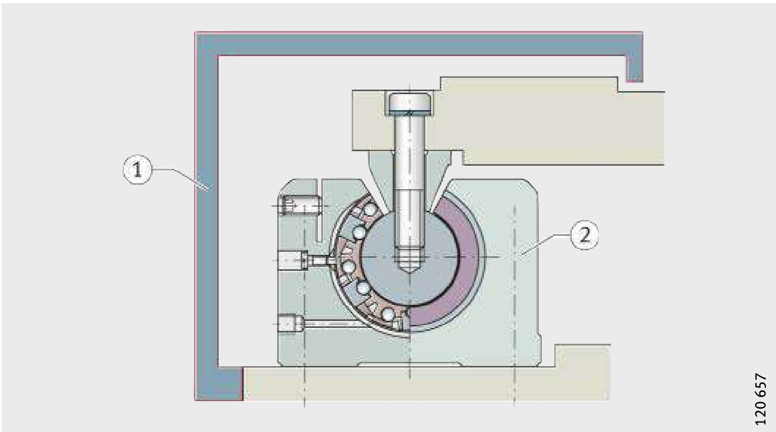
! The adjusted bearing should not be rotated any further on the shaft.

Setting the preload

Preloaded bearings are set clearance-free on a master shaft that is smaller than the actual shaft in the application by the amount of the preload dimension.

Suspended arrangement of guidance system

! If the guidance system is in a suspended arrangement, a drop guard ① is recommended, *Figure 7*.



① Drop guard
② Mounting position 180°

Figure 7
Suspended shaft guidance system with drop guard

Linear bearings and linear bearing and housing units

Compact range
Light range
Heavy duty range
Machined range
Plain bearing range

Matrix for preselection of linear bearings and linear bearing and housing units

Linear bearings and linear bearing and housing units	For shaft diameter d_{LW} in mm					
	06	08	10	12	14	16
Compact range						
KH, KH..-PP	●	●	●	●	●	●
KGHK..-PP-AS	●	●	●	●	●	●
KTHK..-PP-AS	–	–	–	●	–	●
KGHA..-PP	–	–	–	–	–	●
Light range						
KN..-B KN..-B-PP KNO..-B KNO..-B-PP	–	–	–	●	–	●
Heavy duty range						
KS, KS..-PP	–	–	–	●	–	●
KSO, KSO..-PP	–	–	–	●	–	●
KGSNG..-PP-AS	–	–	–	●	–	●
KGSNS..-PP-AS	–	–	–	●	–	●
KTSG..-PP-AS	–	–	–	●	–	●
KTSS..-PP-AS	–	–	–	●	–	●
KGSNO..-PP-AS	–	–	–	●	–	●
KGSNOS..-PP-AS	–	–	–	●	–	●
KTSO..-PP-AS	–	–	–	●	–	●
KTSOS..-PP-AS	–	–	–	●	–	●
KGSC..-PP-AS	–	–	–	●	–	●
KGSCS..-PP-AS	–	–	–	●	–	●
KTFS..-PP-AS	–	–	–	●	–	●
Machined range						
KB, KBS, KBO KB..-PP, KBS..-PP KBO..-PP KB..-PP-AS KBS..-PP-AS KBO..-PP-AS KGB..-PP-AS KGBS..-PP-AS KGBO..-PP-AS KGBA..-PP-AS KGBAS..-PP-AS KGBAO..-PP-AS KFB..-B-PP-AS KTB..-PP-AS KTBO..-PP-AS	–	–	–	●	–	●
Plain bearing range						
PAB..-PP-AS PABO..-PP-AS PAGBA..-PP-AS PAGBAO..-PP-AS	–	–	–	●	–	●

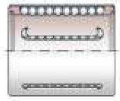
Definition of symbols

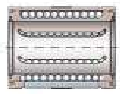
+++ Very good
++ Good
+ Satisfactory
● Available for shaft diameter

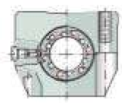
Linear bearings KH, KN..-B, KNO..-B, KS, KSO with the suffix PP are sealed on both sides.

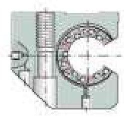
Linear bearings with the suffix PP-AS are sealed on both sides and can be relubricated.

						Design		Characteristics					
	20	25	30	40	50	Closed	Segment cutout	Feature	Load carrying capacity	Precision	Self-alignment ′	Adjustable	Description, page
	●	●	●	●	●	KH	–	Low section height	+	+	–	–	53, 56
	●	●	●	●	●								
	●	●	●	●	●								
	●	●	●	●	–								
	●	●	●	●	●	KN..-B	KNO..-B	Robust design	+	+	up to ±30	all	53, 58
	●	●	●	●	●	KS	KSO	High load capacity	++	++	up to ±40	all	53, 60
	●	●	●	●	●								
	●	●	●	●	●								
	●	●	●	●	●								
	●	●	●	–	–								
	●	●	●	–	–								
	●	●	●	●	●								
	●	●	●	●	●								
	●	●	●	–	–								
	●	●	●	–	–								
	●	●	●	●	●								
	●	●	●	●	●								
	●	●	●	–	–								
	●	●	●	●	●	KB	KBO	High precision	+	+++	–	KBS	53, 62
	●	●	●	●	●	PAB	PABO	Plain bearings	+++	++	–	–	53, 64









Product overview

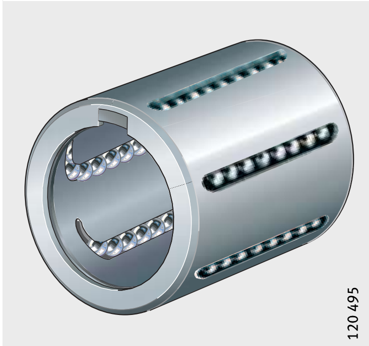
Linear bearings and linear bearing and housing units

Compact range

Linear ball bearings
With and without seals

Features, see page 56

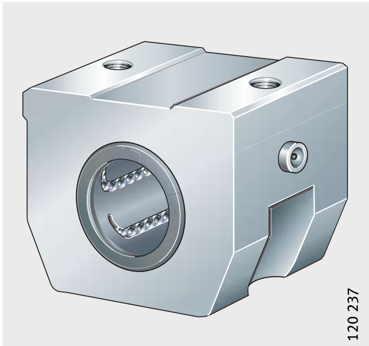
KH, KH..-PP



120 495

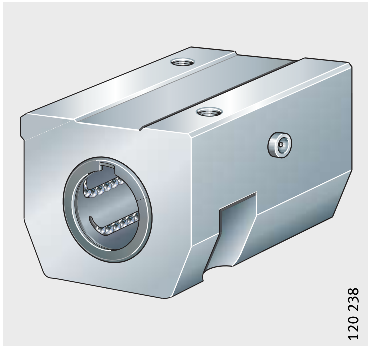
Closed units
Bearings in single or tandem arrangement

KGHK..-B-PP-AS



120 237

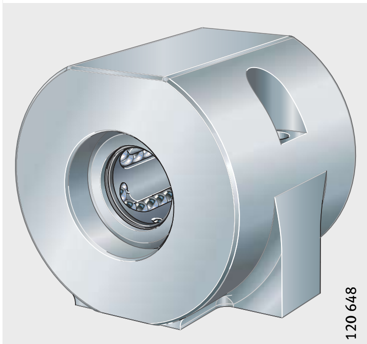
KTHK..-B-PP-AS



120 238

Closed unit

KGHA..-PP



120 648

Light range

Linear ball bearings
Closed or with segment cutout
With and without seals

Features, see page 58

KN..-B, KN..-B-PP

202 039

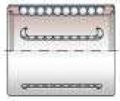
KNO..-B, KNO..-B-PP

202 040

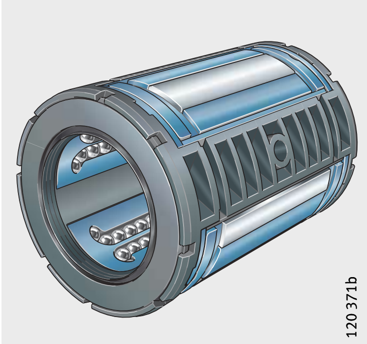
Heavy duty range

Linear ball bearings
Closed or with segment cutout
With and without seals

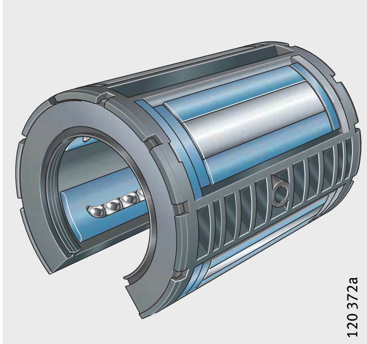
Features, see page 60

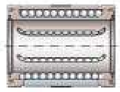


KS, KS..-PP

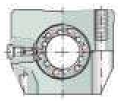


KSO, KSO..-PP

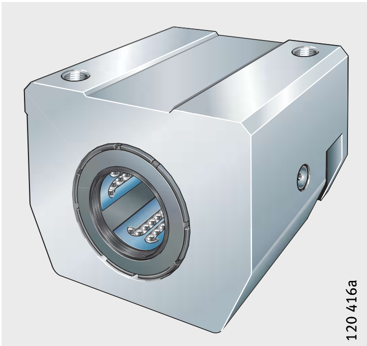




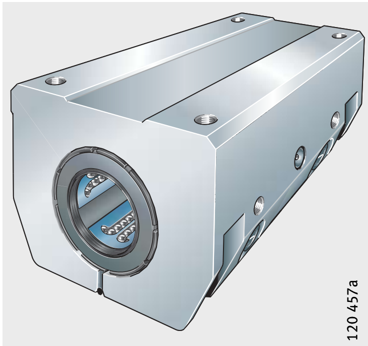
Closed units
Housing closed or slotted
Bearings in single or tandem arrangement



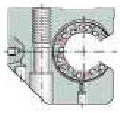
KGSNG..-PP-AS, KGSNS..-PP-AS



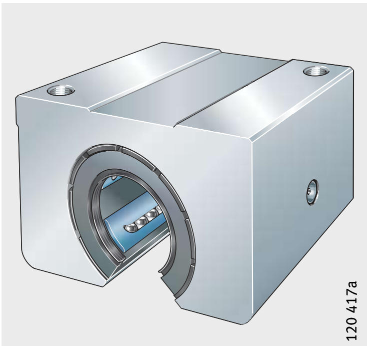
KTSG..-PP-AS, KTSS..-PP-AS



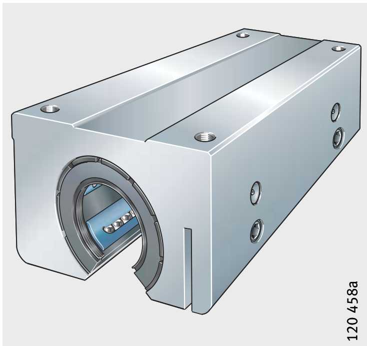
Units with segment cutout
Housing not slotted or slotted
Bearings in single or tandem arrangement



KGSNO..-PP-AS, KGSNOS..-PP-AS



KTSO..-PP-AS, KTSOS..-PP-AS



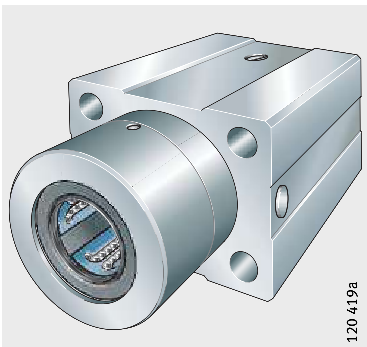
Bearings in single or tandem arrangement

Housing not slotted or slotted

Unit with centring collar

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

KTFS



Product overview Linear bearings and linear bearing and housing units

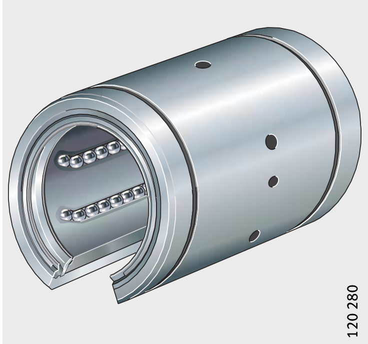
Machined range

Linear ball bearings
Closed or with slot
With segment cutout
With and without seals

Features, see page 62

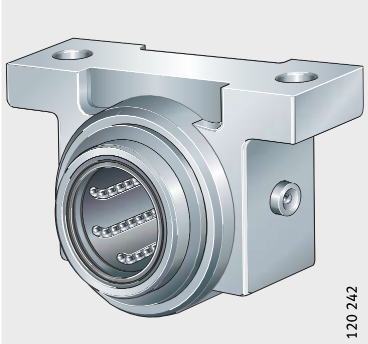
KB, KB..-PP, KB..-PP-AS,
KBS, KBS..-PP, KBS..-PP-AS

KBO, KBO..-PP, KBO..-PP-AS

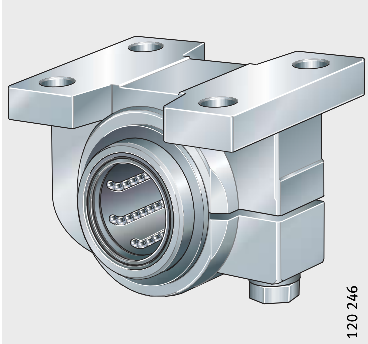


Closed units
Housing closed or slotted

KGB..-PP-AS,
KGBS..-PP-AS

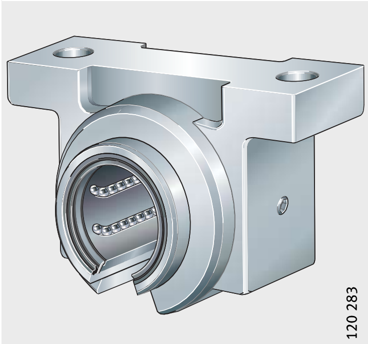


KGBA..-PP-AS,
KGBAS..-PP-AS

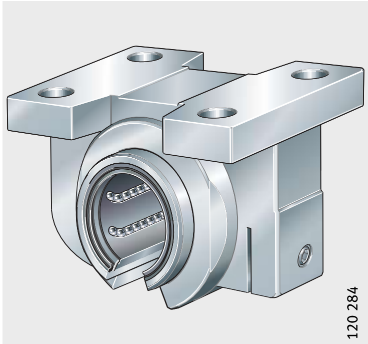


Units with segment cutout
Housing not slotted or slotted

KGBO..-PP-AS

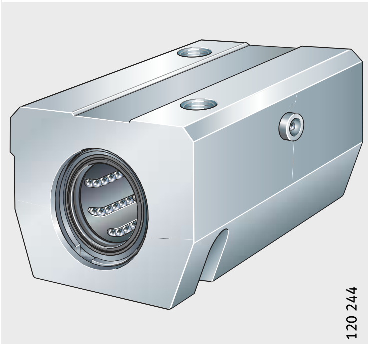


KGBAO..-PP-AS

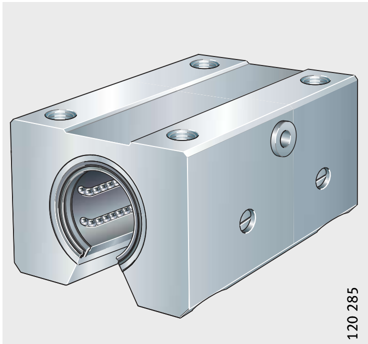


Closed units or units with segment output
Bearings in tandem arrangement

KTB..-PP-AS

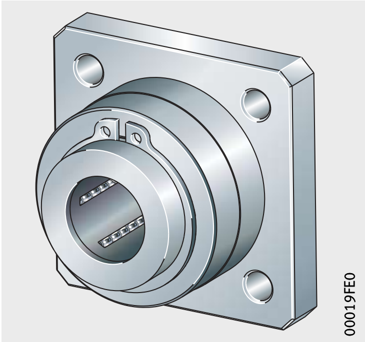


KTBO..-PP-AS



Closed unit
Housing with flange

KFB..-B-PP-AS



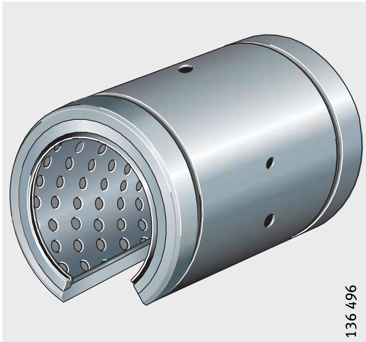
Plain bearing range

Linear plain bearings
Closed or with segment cutout
Sealed

Features, see page 64

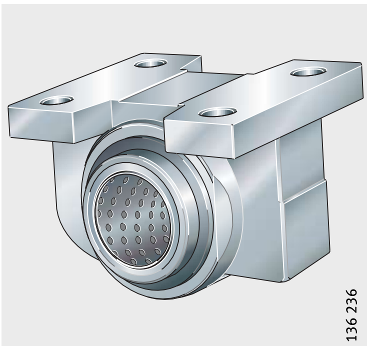
PAB..-PP-AS

PABO..-PP-AS

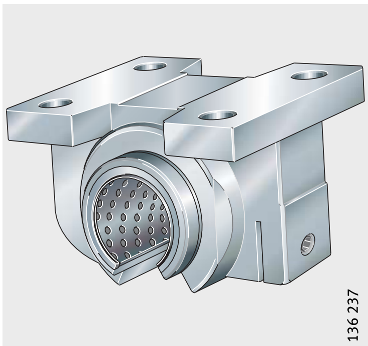


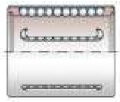
Linear plain bearing and housing units
Closed or with segment cutout

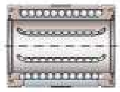
PAGBA..-PP-AS

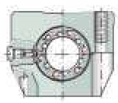


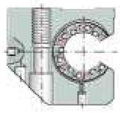
PAGBAO..-PP-AS











Linear bearings and linear bearing and housing units

Features

Linear bearings and linear bearing and housing units are available in the compact, light, heavy duty, machined and plain bearing range. The bearings can support high loads while having a relatively low mass and allow the construction of linear guidance systems with unlimited travel.

Each series has highly specific characteristics that precisely define it as suitable for particular applications. These may include, for example, requirements for compensation of misalignments, low-friction running, high accelerations and travel velocities or long operating life.

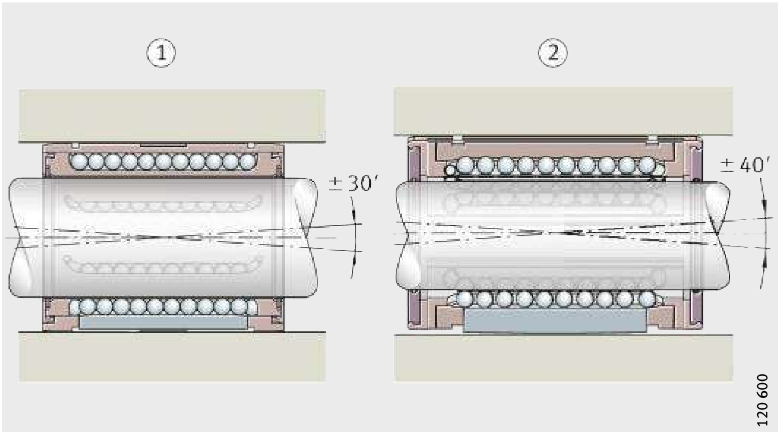
The range, which has been constructed and expanded in accordance with a modular concept, provides the best technical and economic solution, in relation to each application, for bearing arrangements with shaft guidance systems.

Linear bearings

Linear ball bearings and linear plain bearings are available in open or closed designs. The open design has a segment cut out and is intended for supported shafts. Several series allow, in conjunction with the corresponding housings, adjustment of the radial clearance in order to achieve clearance-free or preloaded guidance systems.

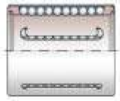
Compensation of misalignment

Misalignment can be caused by tolerance defects, mounting errors or inaccuracies in the adjacent construction. Linear ball bearings of the series KN..-B and KNO..-B can compensate static misalignment of up to ±30′, linear ball bearings of the series KS and KSO can compensate static misalignment of up to ±40′, *Figure 1*.



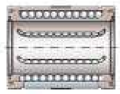
1 KN..-B
2 KS

Figure 1
Compensation of misalignment by KN..-B and KS



Due to the self-alignment function, the balls run without difficulty into the load zone. At the same time, the load distribution over the whole ball row is more uniform. This leads to smoother running, allows higher accelerations and prevents overloading of the individual balls.

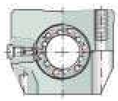
Overall, this means that the bearings can achieve higher loads and a longer operating life; if necessary, the adjacent construction can be designed to be smaller and more economical.



In order to fully utilise the basic load ratings given in the dimension table, the shaft raceway must be hardened (670 HV + 165 HV) and ground. The indications in section Design of bearing arrangements must be observed, page 33.

Linear bearing and housing units

Linear ball bearings and plain bearings are also available in conjunction with INA housings as complete bearing units. The linear bearing is located in the housing by means of a radial fixing screw to prevent axial displacement.

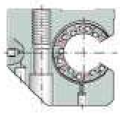


The housings are made from a high rigidity, high strength aluminium alloy that allows the full load carrying capacity of the bearings fitted to be utilised. In the machined series, pressure diecast housings are also available.

Due to the comparatively low total mass, the units are particularly suitable for reduced mass designs with high loads and where higher accelerations and travel velocities are required.

Simple location

Threaded or counterbored holes in the housing allow straightforward screw mounting on the adjacent construction, if necessary from below.



For rapid alignment, the housings have a locating edge. This also prevents distortion of the linear bearings when the housings are being mounted.

Centring holes allow rapid additional location of the housings by dowels on the adjacent construction.

Linear bearings and linear bearing and housing units

Housing designs The housings are available in closed design, with a segment cutout and in open, slotted and tandem versions (with and without a centring collar).

Closed design In this variant, the bearings and housings are closed. As a result, high precision standard guidance systems with a fixed enveloping circle can be easily achieved.

With segment cutout Open designs with a segment cutout are used where, in the case of long guidance systems, the shaft must be supported and the bearing arrangement must be highly rigid.

Slotted design Closed designs and designs with a segment cutout are also available in several series with a slot. Slotted variants are suitable for clearance-free or preloaded guidance systems. The operating clearance is set by means of an adjusting screw.

Tandem design The tandem version contains two linear bearings. As a result, the units have particularly high load carrying capacity.

Tandem ball bearing and housing units are available in open and closed designs. Both variants are also available in the named design with a slot.

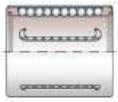
With centring collar For special applications, there is also a tandem version with a centring collar for locating bores to H7.

Highly cost-effective As a result of volume production in large quantities, the complete units are normally considerably more economical than customers' own designs.

Sealing

The bearings are available in an open version and with contact seals on both sides (suffix PP). The linear bearings of type KH, KN..-B and KB have seals with two seal lips on their end faces; the outer lip prevents the ingress of contamination, the inner lip retains the lubricant in the bearing. The linear bearings of type KS have contact seals with one seal lip.

Lubrication

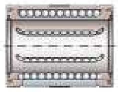


Due to the initial greasing with a high quality grease and the integral lubricant reservoir, the linear bearings are maintenance-free for many applications; if necessary, however, they can be relubricated.

Linear ball bearings can be lubricated, depending on the design, via the openings in the outer ring or radial holes arranged in the centre of the bearing.

In the units, lubrication is carried out via a separate lubrication nipple in the housing; location of the bearing in the housing and the relubrication devices are thus separate from each other.

Operating temperature

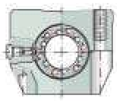


The bearings and housings can be used at operating temperatures from –30 °C to +80 °C.

Operating limits

The table shows the operating limits for linear bearings.

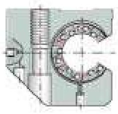
Once the interrelationships of bearing size and design, load, operating clearance, location of bearings and lubrication have been checked, it may be possible in individual cases to use higher values. In this case, please contact us.



Linear bearing and housing units should be allocated in accordance with the linear bearing fitted.

Dynamic values for linear bearings

Acceleration, velocity	Linear bearing series				
	KH	KN..-B	KB	KS	PAB
Acceleration in m/s^2	50	50	50	100	50
Velocity in m/s	2	up to 5	up to 5	up to 5	up to 3



In the case of linear ball bearings with seals, suffix PP, velocities up to 2 m/s are permissible.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
PP	Lip seals on both sides	Standard
PPL	Sealing strips on bearings with segment cutout	Available by agreement
AS	Bearing and unit with relubrication facility	Standard

Linear bearings and linear bearing and housing units

Compact range

Linear ball bearings KH and linear ball bearing and housing units of the compact range have a small radial design envelope and are particularly economical. Their low section height automatically makes them attractive for applications in which only a small amount of radial space is available.

Due to the closed design, they are suitable for use on shafts.

Linear ball bearings

The bearings have an outer ring with openings. This contains a ball and cage assembly with a plastic cage. The outer ring is formed and hardened. The balls undergo return travel along the openings in the outer ring.

Seals

The bearings are available in an open version and with lip seals on both sides (suffix PP). The end face seals have two seal lips; the outer lip prevents the ingress of contamination, the inner lip retains the lubricant in the bearing.

Linear ball bearing and housing units

Linear ball bearing and housing units of the compact range are available with one integral bearing and, in the tandem version with particularly high load carrying capacity, with two bearings.

The housings are made from high strength aluminium.

Anti-corrosion protection

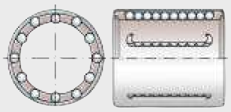
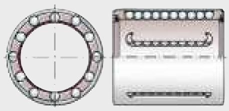
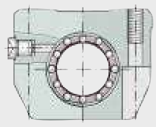
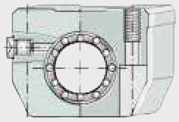
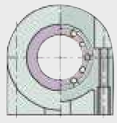
The housings are two-piece components made from sheet steel with a Corrotect® coating. The bearings and housing parts are packed separately. The bearing is firmly seated once it is mounted in the housing.

Further information

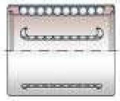
Further information is given on the following pages:

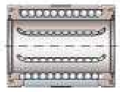
- dimension tables, see page 67
- shafts, see page 104
- shaft and support rail units, see page 128
- accessories, see page 144.

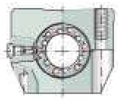
Linear ball bearings and linear ball bearing and housing units, compact range

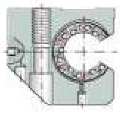
Series[1)]		Feature
KH		Linear ball bearings Not sealed
KH..-PP		Linear ball bearings Lip seals on both sides
KGHK..-PP-AS		Closed design Relubrication facility
KTHK..PP-AS		Closed design Tandem design Relubrication facility
KGHA..-PP		Unit Closed design

1) Bearings with the suffix PP have lip seals on both sides.









Linear bearings and linear bearing and housing units

Light range

The light range is available as linear ball bearings KN..-B of a closed design and as linear ball bearings KNO..-B with a segment cutout.

In order to compensate misalignments arising from manufacturing tolerances, mounting errors and shaft deflection, the linear bearings of series KN..-B are self-aligning up to $\pm 30'$.

Their robust construction allows operation even under aggressive operating conditions.

The series KN..-B is of a closed construction and is designed for use on shafts. KNO..-B has a segment cutout and is used with shaft and support rail units.

Linear ball bearings

Linear ball bearings KN..-B and KNO..-B comprise a plastic cage with inserted raceway plates. The plates are supported in the housing bore by means of a retaining ring. Due to the retaining ring, the plates can “rock” and thus compensate for static misalignments.

Seals

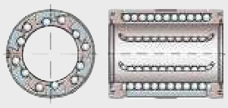
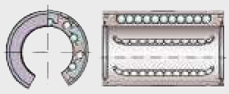
The bearings are available in an open version and with lip seals on both sides (suffix PP). The end face seals have two seal lips; the outer lip prevents the ingress of contamination, the inner lip retains the lubricant in the bearing.

Further information

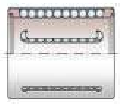
Further information is given on the following pages:

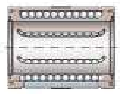
- dimension tables, see page 74
- shafts, see page 104
- shaft and support rail units, see page 128
- accessories, see page 144.

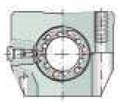
Linear ball bearings, light range

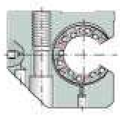
Series[1]	Feature
KN..-B KN..-B-PP 	Linear ball bearings Closed design Self-aligning With or without lip seals
KNO..-B KNO..-B-PP 	Linear ball bearings With segment cutout Self-aligning With or without lip seals

[1] Bearings with the suffix PP have lip seals on both sides.









Linear bearings and linear bearing and housing units

Heavy duty range

Linear ball bearings of the heavy duty range KS and KSO and the corresponding ball bearing and housing units have particularly high load carrying capacity and have an angular adjustment facility for compensation of misalignments. They have very good running characteristics.

Linear ball bearings

Linear ball bearings KS and KSO comprise a plastic cage with loosely retained segments. The double row segments with crowned raceway plates can realign themselves in all directions and thus compensate misalignments. Since the complete segment undergoes realignment, there is no disruption to the recirculation of the balls. This results in uniformly low displacement resistance.

The series KS is of a closed construction and is designed for use on shafts. KSO has a segment cutout and is used in conjunction with shaft and support rail units.

Seals

The bearings are available with contact seals or gap seals. The contact seals on the end faces have two seal lips; the outer lip prevents the ingress of contamination, the inner lip retains the lubricant in the bearing.

Linear ball bearing and housing units

Linear ball bearing and housing units of the heavy duty range are available with one integral bearing and, in the tandem version with particularly high load carrying capacity, with two bearings.

The housings are made from high strength aluminium.

The housings are available in a closed design, with a segment cutout for supported shafts and with or without a slot. In designs with a slot, the radial clearance can be adjusted by means of an adjusting screw.

All series have a locating edge and centring holes for dowel holes.

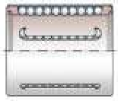
The bearings are sealed on both sides, they have an initial greasing and can be relubricated via a lubrication nipple in the housing.

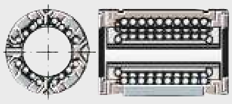
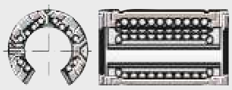
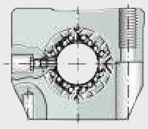
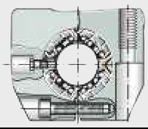
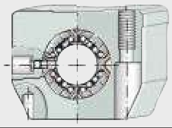
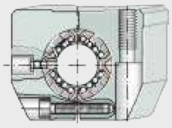
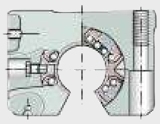
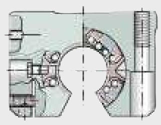
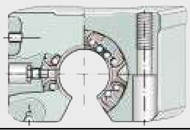
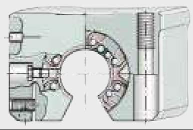
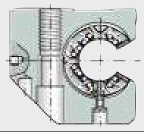
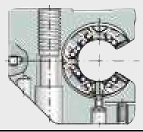
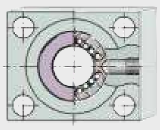
Further information

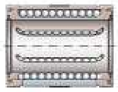
Further information is given on the following pages:

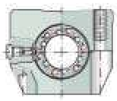
- dimension tables, see page 76
- shafts, see page 104
- shaft and support rail units, see page 128
- accessories, see page 144.

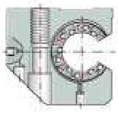
Linear ball bearings and linear ball bearing and housing units, heavy duty range



Series[1]		Feature
KS KS..-PP		Linear ball bearings Self-aligning With or without lip seals
KSO KSO..-PP		Linear ball bearings With segment cutout Self-aligning With or without lip seals
KGSNG..-PP-AS		Closed design Relubrication facility
KGSNS..PP-AS		Closed design Slotted housing Relubrication facility
KTSG..-PP-AS		Closed design Tandem arrangement Relubrication facility
KTSS..-PP-AS		Closed design Tandem arrangement Slotted housing Relubrication facility
KGSNO..-PP-AS		With segment cutout Relubrication facility
KGSNOS..PP-AS		With segment cutout Slotted housing Relubrication facility
KTSO..-PP-AS		With segment cutout Tandem arrangement Relubrication facility
KTSOS..-PP-AS		With segment cutout Tandem arrangement Slotted housing Relubrication facility
KGSC..-PP-AS		Open at side Relubrication facility
KGSCS..-PP-AS		Open at side Slotted housing Relubrication facility
KTFS..-PP-AS		With centring collar Tandem arrangement Relubrication facility







[1] Bearings with the suffix PP have lip seals on both sides.

Linear bearings and linear bearing and housing units

Machined range

Linear ball bearings of the machined range KB, KBS and KBO and the corresponding linear ball bearing and housing units are high precision and particularly rigid. They have excellent running characteristics.

Linear ball bearings

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

The balls are guided with high precision throughout the return area by a special spring washer. This ensures that the displacement resistance remains uniformly low even under difficult operating conditions and irrespective of the mounting position.

The series KB is of a closed construction and is designed for use on shafts. KBO has a segment cutout and is used in conjunction with shaft and support rail units. KBS has a slot for adjustment of the radial clearance.

Seals

The bearings have contact seals or gap seals.

Linear ball bearing and housing units

Linear ball bearing and housing units of the machined range are available with one integral bearing and, in the tandem version with particularly high load carrying capacity, with two bearings.

The housings are made from high strength aluminium or are pressure diecast.

The housings are available in a closed design, with a segment cutout for supported shafts and with or without a slot. In designs with a slot, the radial clearance can be adjusted by means of an adjusting screw.

All series have a locating edge and centring holes for dowel holes.

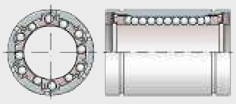
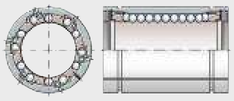
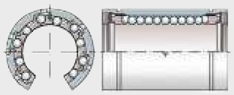
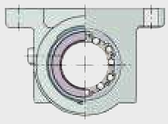
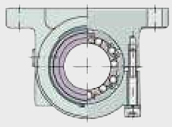
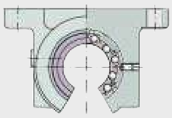
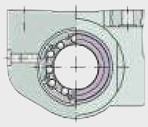
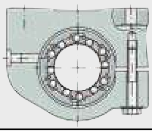
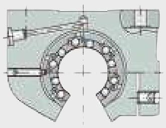
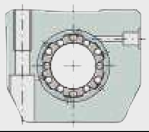
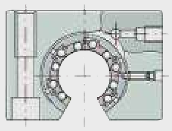
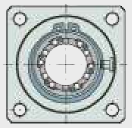
The bearings are sealed on both sides, they have an initial greasing and can be relubricated via a lubrication nipple in the housing.

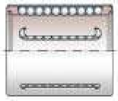
Further information

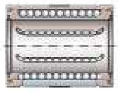
Further information is given on the following pages:

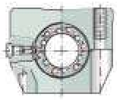
- dimension tables, see page 90
- shafts, see page 104
- shaft and support rail units, see page 128
- accessories, see page 144.

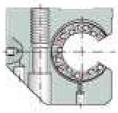
Linear ball bearings and linear ball bearing and housing units, machined range

Series[1)2)]		Feature
KB KB..-PP KB..-PP-AS		☐ Linear ball bearings ☐ With or without lip seals depending on the design ☐ Relubrication facility
KBS KBS..-PP KBS..-PP-AS		☐ Linear ball bearings ☐ With or without lip seals depending on the design ☐ Relubrication facility ☐ Slotted design
KBO KBO..-PP KBO..-PP-AS		☐ Linear ball bearings ☐ With or without lip seals depending on the design ☐ Relubrication facility ☐ With segment cutout
KGB..-PP-AS		☐ Closed design ☐ Relubrication facility
KGBS..-PP-AS		☐ Closed design ☐ Slotted housing ☐ Relubrication facility
KGBO..-PP-AS		☐ With segment cutout ☐ Relubrication facility
KGBA..-PP-AS		☐ Closed design ☐ Relubrication facility
KGBAS..-PP-AS		☐ Closed design ☐ Slotted housing ☐ Relubrication facility
KGBAO..-PP-AS		☐ With segment cutout ☐ Relubrication facility
KTB..-PP-AS		☐ Closed design ☐ Tandem arrangement ☐ Relubrication facility
KTBO..-PP-AS		☐ With segment cutout ☐ Tandem arrangement ☐ Relubrication facility
KFB..-B-PP-AS		☐ Closed design ☐ Relubrication facility









1) Bearings with the suffix PP have lip seals on both sides.

2) Bearings and units with the suffix AS can be relubricated.

Linear bearings and linear bearing and housing units

Plain bearing range

Linear plain bearings PAB and PABO and the corresponding plain bearing and housing units have very high load carrying capacity, are extremely robust and have particularly low running noise. They have excellent emergency running characteristics.

Linear plain bearings

Linear plain bearings PAB and PABO comprise an outer ring made from high strength aluminium into which plain bearing bushes PAP..-P20 are fixed by adhesive.

The series PAB is of a closed construction and is designed for use on shafts. PABO has a segment cutout and is used in conjunction with shaft and support rail units.

!

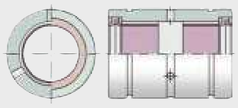
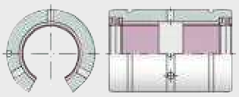
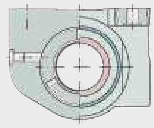
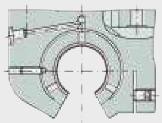
Plain bushes must not be used in conjunction with the special coating Corrotect®. Crevice corrosion may occur that would impair the function of the bearing.

Further information

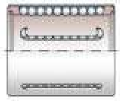
Further information is given on the following pages:

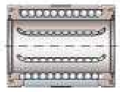
- dimension tables, see page 100
- shafts, see page 104
- shaft and support rail units, see page 128
- accessories, see page 144.

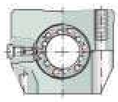
Linear plain bearings and linear plain bearing and housing units, plain bearing range

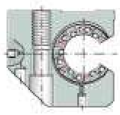
Series[1]		Feature
PAB..-PP-AS		Closed design Lip seals on both sides Relubrication facility
PABO..-PP-AS		With segment cutout Lip seals on both sides Relubrication facility
PAGBA..-PP-AS		Closed design Relubrication facility
PAGBAO..-PP-AS		With segment cutout Slotted housing Relubrication facility

[1] Bearings with the suffix PP have lip seals on both sides.





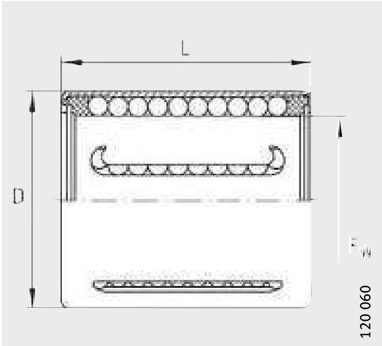




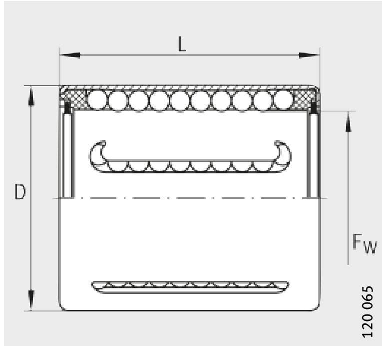
Compact range

Linear ball bearings

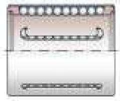
Open or sealed
Relubrication facility

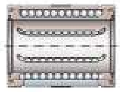


KH



KH..-PP

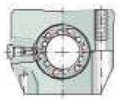


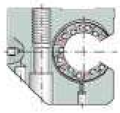


Dimension table · Dimensions in mm

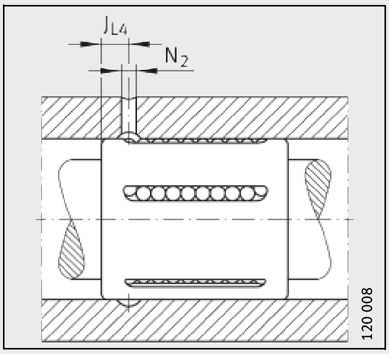
Designation		Mass	Dimensions			Mounting dimensions		Basic load ratings[1]			
[2]	[3]	m	F_W	D	L	J_{L4}	N_2	dyn. C_{min}	stat. $C_{0\,min}$	dyn. C_{max}	stat. $C_{0\,max}$
		g						N	N	N	N
KH06	**KH06-PP**	7	**6**	12	22	4	2	340	240	390	340
KH08	**KH08-PP**	12	**8**	15	24	6	2	410	280	475	400
KH10	**KH10-PP**	14,5	**10**	17	26	6	2,5	510	370	590	520
KH12	**KH12-PP**	18,5	**12**	19	28	6	2,5	670	510	800	740
KH14	**KH14-PP**	20,5	**14**	21	28	6	2,5	690	520	830	760
KH16	**KH16-PP**	27,5	**16**	24	30	7	2,5	890	620	1 060	910
KH20	**KH20-PP**	32,5	**20**	28	30	7	2,5	1 110	790	1 170	1 010
KH25	**KH25-PP**	66	**25**	35	40	8	2,5	2 280	1 670	2 420	2 130
KH30	**KH30-PP**	95	**30**	40	50	8	2,5	3 300	2 700	3 300	3 100
KH40	**KH40-PP**	182	**40**	52	60	9	2,5	5 300	4 450	5 300	4 950
KH50	**KH50-PP**	252	**50**	62	70	9	2,5	6 800	6 300	6 800	7 000

Corrosion-resistant designs have the suffix -RROC.
This must be stated when ordering.





[1] The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
[2] With preservative.
[3] With initial greasing, sealed on both sides.

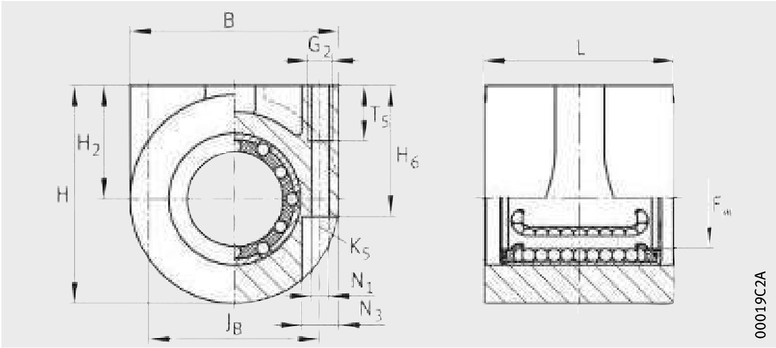


Mounting dimensions

Compact range

Linear ball bearing and housing units

Sealed
Greased



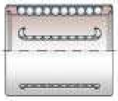
KGHA..-PP

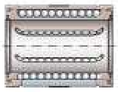
Dimension table · Dimensions in mm						
Designation	Mass	Dimensions				
	m	F_W	H_2	H	B	L
	≈g		±0,015			+0,5
KGHA16-PP	228	**16**	20	41	42	37
KGHA20-PP	303	**20**	25	48,5	47	39
KGHA25-PP	496	**25**	30	57,5	55	49
KGHA30-PP	860	**30**	35	67,5	65	59
KGHA40-PP	1 434	**40**	45	84	78	71

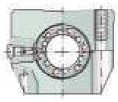
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.

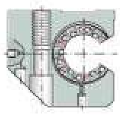
2) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.

Mounting dimensions							Basic load ratings[1]	
H_6	T_5	J_B	G_2	N_1	N_3	K_5[2]	dyn. C	stat. C_0
		±0,1					N	N
27	15	32	M6	5,1	8,1	M4	890	620
29	15	38	M6	5,1	8,1	M4	1 110	790
35	15	46	M6	5,1	8,1	M4	2 280	1 670
39	20	54	M8	6,7	11,1	M6	3 300	2 700
49	20	66	M8	6,7	11,1	M6	5 300	4 450



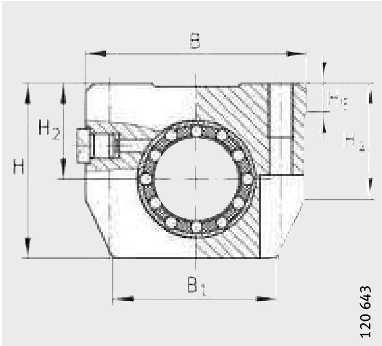




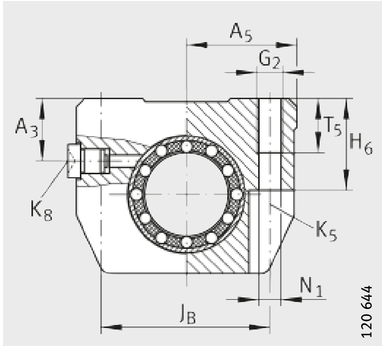


Compact range

Linear ball bearing and housing units
Sealed
Greased,
with relubrication facility



KGHK..-B-PP-AS



KGHK..-B-PP-AS

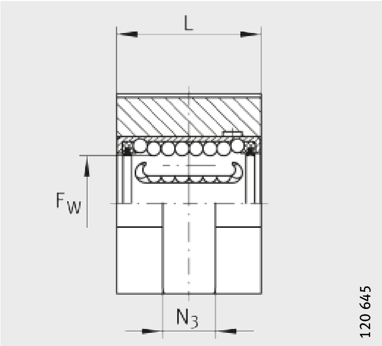
Dimension table · Dimensions in mm

Designation	Mass	Dimensions				Mounting dimensions		
	m ≈g	F_W	B	L	H	J_B ±0,15	B_1	A_5
KGHK06-B-PP-AS	40	**6**	32	22,2	27	23	25	16
KGHK08-B-PP-AS	50	**8**	32	24,2	27	23	25	16
KGHK10-B-PP-AS	70	**10**	40	26,2	33	29	32	20
KGHK12-B-PP-AS	80	**12**	40	28,2	33	29	32	20
KGHK14-B-PP-AS	100	**14**	43	28,2	36,5	34	34	21,5
KGHK16-B-PP-AS	110	**16**	43	30,2	36,5	34	34	21,5
KGHK20-B-PP-AS	150	**20**	53	30,2	42,5	40	40	26,5
KGHK25-B-PP-AS	270	**25**	60	40,2	52,5	48	44	30
KGHK30-B-PP-AS	400	**30**	67	50,2	60	53	49,6	33,5
KGHK40-B-PP-AS	750	**40**	87	60,2	73,5	69	63	43,5
KGHK50-B-PP-AS	1 250	**50**	103	70,2	92	82	74	51,5

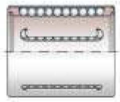
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.

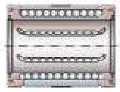
2) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.

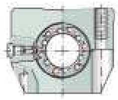
3) Lubrication nipple, see page 31.

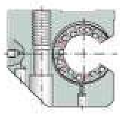


KGHK..-B-PP-AS





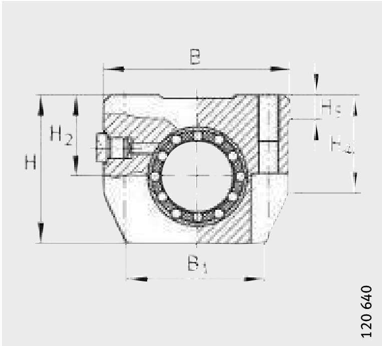




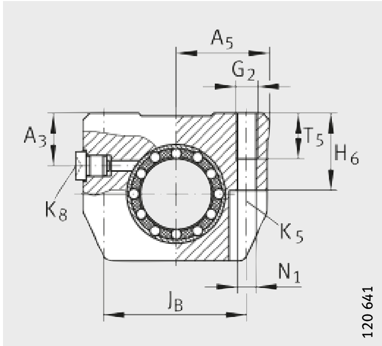
											Basic load ratings[1]	
H_2 $^{+0,010}_{-0,014}$	H_4	H_5	T_5	H_6	A_3	G_2	N_1	N_3	K_5[2]	K_8[3]	dyn. C N	stat. C_0 N
13	20,6	5	9	13	9	M4	3,4	7	M3	NIPA1	340	240
14	20,6	5	9	13	9	M4	3,4	7	M3	NIPA1	410	280
16	25,1	5	11	16	11	M5	4,3	10	M4	NIPA1	510	370
17	25,1	5	11	16	11	M5	4,3	10	M4	NIPA1	670	510
18	28,1	6,9	11	18	13	M5	4,3	10	M4	NIPA1	690	520
19	28,1	6,9	11	18	13	M5	4,3	10	M4	NIPA1	890	620
23	29,8	7,4	13	22	15	M6	5,3	11	M5	NIPA2	1 110	790
27	36,6	9,9	18	26	17,5	M8	6,6	15	M6	NIPA2	2 280	1 670
30	42,7	8	18	29	18	M8	6,6	15	M6	NIPA2	3 300	2 700
39	49,7	12,8	22	38	23	M10	8,4	18	M8	NIPA2	5 300	4 450
47	62,3	10,9	26	46	28	M12	10,5	20	M10	NIPA2	6 800	6 300

Compact range

Linear ball bearing and housing units
Tandem arrangement
Sealed
Greased,
with relubrication facility



KTHK..-B-PP-AS



KTHK..-B-PP-AS

Dimension table · Dimensions in mm

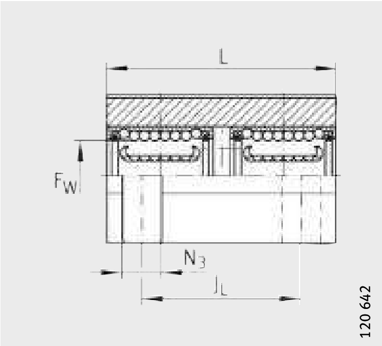
Designation	Mass	Dimensions				Mounting dimensions			
	m	F_W	B	L	H	J_B	B_1	A_5	J_L 2)
	≈g					±0,15			±0,15
KTHK12-B-PP-AS	170	**12**	40	60	33	29	32	20	35
KTHK16-B-PP-AS	230	**16**	43	65	36,5	34	34	21,5	40
KTHK20-B-PP-AS	320	**20**	53	65	42,5	40	40	26,5	45
KTHK25-B-PP-AS	580	**25**	60	85	52,5	48	44	30	55
KTHK30-B-PP-AS	850	**30**	67	105	60	53	49,6	33,5	70
KTHK40-B-PP-AS	1 600	**40**	87	125	73,5	69	63	43,5	85
KTHK50-B-PP-AS	2 700	**50**	103	145	92	82	74	51,5	100

1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways and where the two linear ball bearings are subjected to equal loading.

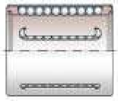
2) Dimension J_L and lubrication hole symmetrical to the bearing length L.

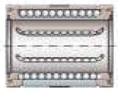
3) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.

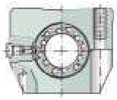
4) Lubrication nipple, see page 31.

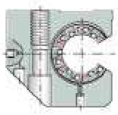


KTHK..-B-PP-AS







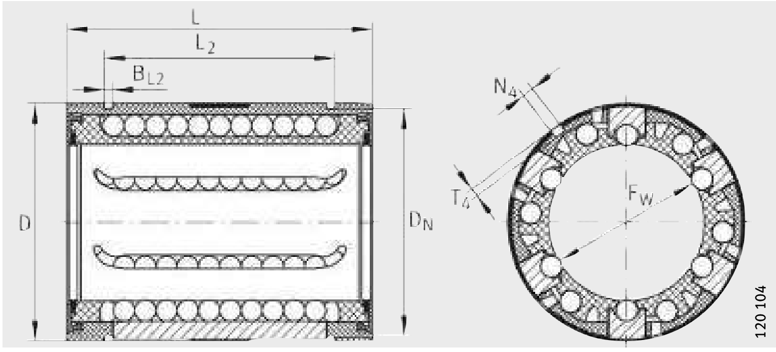


											Basic load ratings[1]	
H_2 +0,010 −0,014	H_4	H_5	T_5	H_6	A_3	G_2	N_1	N_3	K_5[3]	K_8[4]	dyn. C N	stat. C_0 N
17	25,1	5	11	16	11	M5	4,3	10	M4	NIPA1	1 090	1 020
19	28,1	6,9	11	18	13	M5	4,3	10	M4	NIPA1	1 440	1 240
23	29,8	7,4	13	22	15	M6	5,3	11	M5	NIPA2	1 800	1 580
27	36,6	9,9	18	26	17,5	M8	6,6	11	M6	NIPA2	3 700	3 350
30	42,7	8	18	29	18	M8	6,6	15	M6	NIPA2	5 400	5 400
39	49,7	12,8	22	38	23	M10	8,4	18	M8	NIPA2	8 600	6 900
47	62,3	10,9	26	46	28	M12	10,5	20	M10	NIPA2	11 000	12 600

Light range

Linear ball bearings

Self-aligning
Closed or with segment cutout
Open or sealed
Relubrication facility

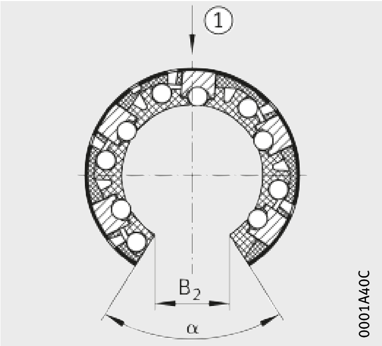


KN..-B-PP, KN..-B

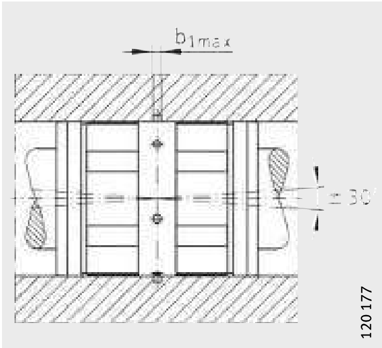
Dimension table · Dimensions in mm

Designation				Mass	Dimensions			Mounting dimensions	
				m	F_W	D	L	B_2 [2)]	L_2
				≈g					H13
KN12-B-PP	**KN12-B**	**–**	**–**	20	**12**	22	32	–	22,6
–	**–**	**KNO12-B-PP**	**KNO12-B**					6,5	–
KN16-B-PP	**KN16-B**	**–**	**–**	30	**16**	26	36	–	24,6
–	**–**	**KNO16-B-PP**	**KNO16-B**	20				9	–
KN20-B-PP	**KN20-B**	**–**	**–**	60	**20**	32	45	–	31,2
–	**–**	**KNO20-B-PP**	**KNO20-B**	50				9	–
KN25-B-PP	**KN25-B**	**–**	**–**	130	**25**	40	58	–	43,7
–	**–**	**KNO25-B-PP**	**KNO25-B**	110				11,5	–
KN30-B-PP	**KN30-B**	**–**	**–**	190	**30**	47	68	–	51,7
–	**–**	**KNO30-B-PP**	**KNO30-B**	160				14	–
KN40-B-PP	**KN40-B**	**–**	**–**	350	**40**	62	80	–	60,3
–	**–**	**KNO40-B-PP**	**KNO40-B**	300				19	–
KN50-B-PP	**KN50-B**	**–**	**–**	670	**50**	75	100	–	77,3
–	**–**	**KNO50-B-PP**	**KNO50-B**	570				22,5	–

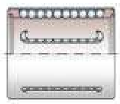
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
2) Dimension B_2 on diameter F_W.
3) Hole position symmetrical to bearing length L.
4) Basic load rating in main load direction.
5) ① Main load direction

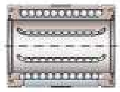


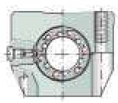
KNO..-B-PP, KNO..-B
① [5]

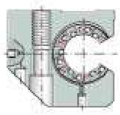


Self-aligning up to ±30′

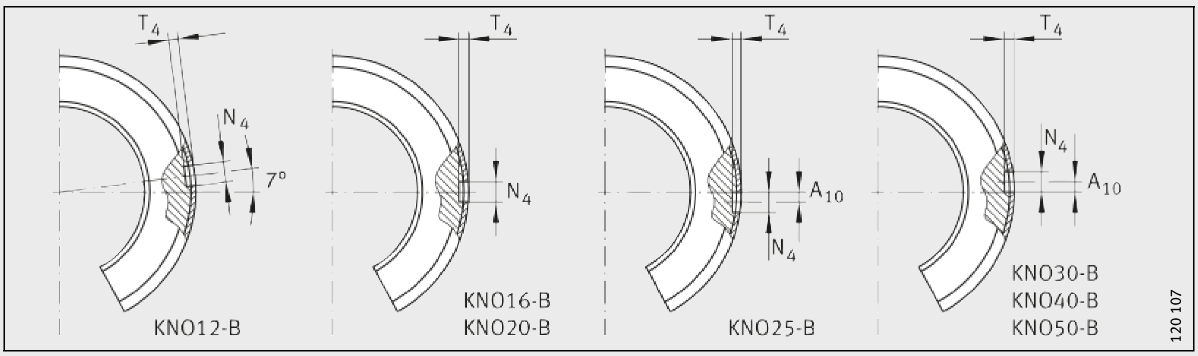








						Ball rows		Basic load ratings[1]			
B_{L2}	D_N	T_4	A_{10}	N_4[3]	α °	$b_{1\ max}$	Quantity	dyn. C_{min} N	stat. $C_{0\ min}$ N	dyn. C_{max} N	stat. $C_{0\ max}$ N
1,3	21	0,7	–	3	–	1,5	5	730	510	870	740
–	–				66		4	–	–	840[4]	640[4]
1,3	25	0,7	–	3	–	1,5	5	870	620	1 040	910
–	–				68		4	–	–	1 000[4]	750[4]
1,6	30,7	0,9	–	3	–	2,5	6	1 730	1 230	1 830	1 570
–	–				55		5	–	–	1 740[4]	1 240[4]
1,85	38,5	1,4	–	3	–	2,5	6	3 100	2 220	3 250	2 850
–	–		1,5		57		5	–	–	3 100[4]	2 260[4]
1,85	44,7	2,2	–	3	–	2,5	6	3 750	2 850	3 950	3 650
–	–		2		57		5	–	–	3 750[4]	2 850[4]
2,15	59,4	2,2	–	3	–	3	6	6 300	4 350	6 700	5 600
–	–		1,5		56		5	–	–	6 300[4]	4 350[4]
2,65	71,4	2,3	–	5	–	3	6	9 300	6 500	9 800	8 300
–	–		2,5		54		5	–	–	9 300[4]	6 500[4]

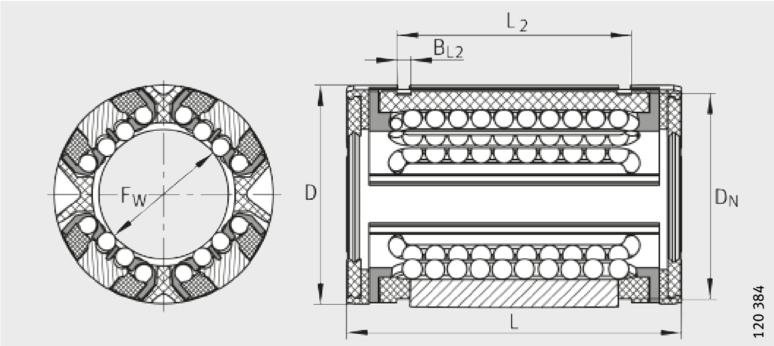


Fixing holes

Heavy duty range

Linear ball bearings

Self-aligning
Closed or with segment cutout
Open or sealed
Relubrication facility

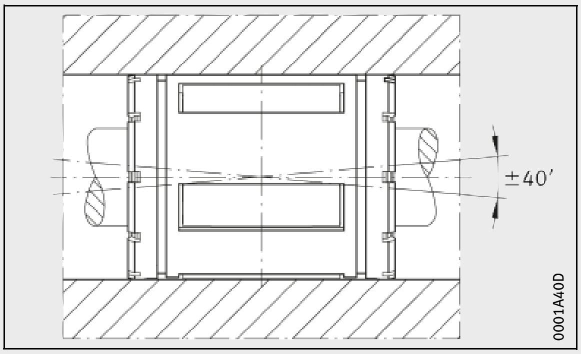


KS, KS..-PP

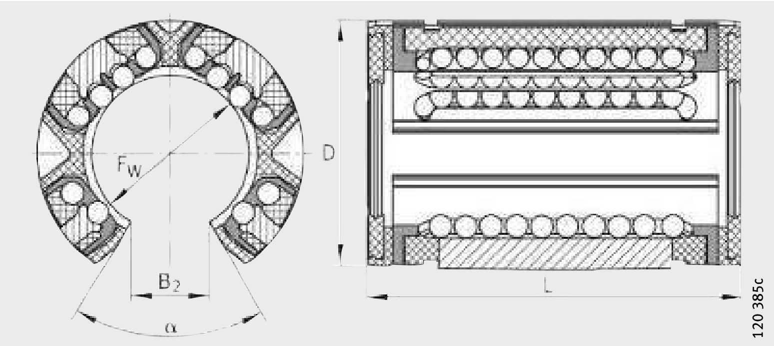
Dimension table · Dimensions in mm

Designation				Mass	Dimensions			Mounting dimensions		
3)	4)	3)	4)	m ≈g	F_W	D	L	B_2 5)	L_2 H13	B_{L2}
KS12	**KS12-PP**	–	–	18	**12**	22	32	–	22,6	1,3
–	–	**KSO12**	**KSO12-PP**	13				7,6	–	–
KS16	**KS16-PP**	–	–	28	**16**	26	36	–	24,6	1,3
–	–	**KSO16**	**KSO16-PP**	19				10,1	–	–
KS20	**KS20-PP**	–	–	51	**20**	32	45	–	31,2	1,6
–	–	**KSO20**	**KSO20-PP**	38				10	–	–
KS25	**KS25-PP**	–	–	102	**25**	40	58	–	43,7	1,85
–	–	**KSO25**	**KSO25-PP**	75				12,5	–	–
KS30	**KS30-PP**	–	–	172	**30**	47	68	–	51,7	1,85
–	–	**KSO30**	**KSO30-PP**	135				14,3	–	–
KS40	**KS40-PP**	–	–	335	**40**	62	80	–	60,3	2,15
–	–	**KSO40**	**KSO40-PP**	259				18,2	–	–
KS50	**KS50-PP**	–	–	589	**50**	75	100	–	77,3	2,65
–	–	**KSO50**	**KSO50-PP**	454				22,7	–	–

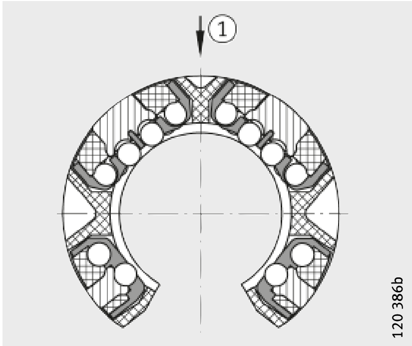
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
2) Basic load rating in main load direction.
3) With preservative, gap seals on both sides.
4) With initial greasing, contact seals on both sides.
5) Dimension B_2 on diameter F_W.
6) Hole position symmetrical to bearing length L.
7) Only one lubrication and fixing hole each in size 16 and 20.
8) 1 Main load direction



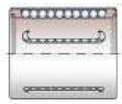
Self-aligning up to ±40′

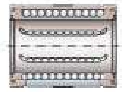


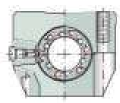
KSO, KSO..-PP

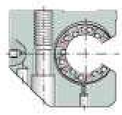


KSO, KSO..-PP
1 [8)]

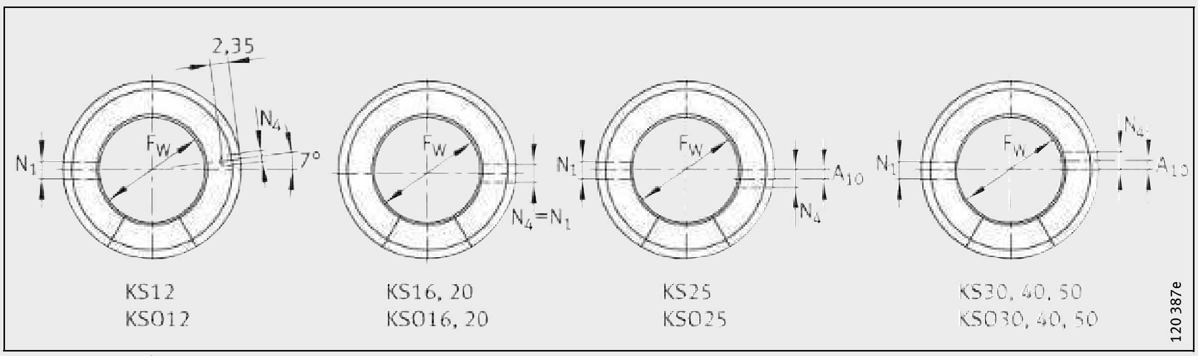








D_N	A_{10}	N_1[6)]	N_4[6)]	α	Ball rows	Basic load ratings[1)]			
				°	Quantity	dyn. C_{min} N	stat. $C_{0\,min}$ N	dyn. C_{max} N	stat. $C_{0\,max}$ N
21	–	–	3	–	8	630	600	900	1 100
–		3		78	6	–	–	900[2)]	1 100[2)]
25	–	3[7)]	3[7)]	–	8	1 060	950	1 430	1 550
–				78	6	–	–	1 430[2)]	1 550[2)]
30,7	–	3[7)]	3[7)]	–	8	1 780	1 600	2 200	2 310
–				60	6	–	–	2 200[2)]	2 310[2)]
38	1,5	3,5	3	–	8	2 700	2 430	3 950	4 300
–				60	6	–	–	3 950[2)]	4 300[2)]
44,7	2	3,5	3	–	8	4 650	3 970	5 900	6 000
–				57	6	–	–	5 900[2)]	6 000[2)]
59,4	1,5	3,5	3	–	8	8 800	7 200	10 200	9 600
–				54	6	–	–	10 200[2)]	9 600[2)]
71,4	2,5	4,5	5	–	8	12 300	9 700	15 100	13 900
–				54	6	–	–	15 100[2)]	13 900[2)]

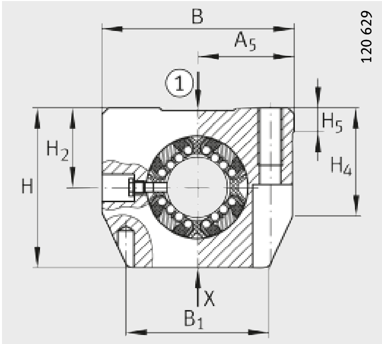


Fixing holes[7)]

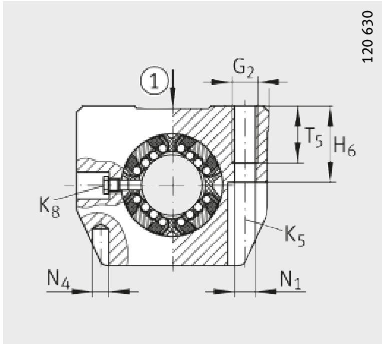
Heavy duty range

Linear ball bearing and housing units

Closed or with slot
Sealed
Greased,
with relubrication facility



KGSNG..-PP-AS, KGSNS..-PP-AS
1 [7]

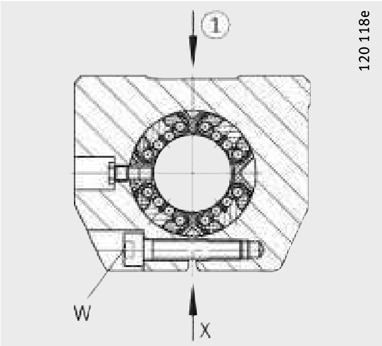


KGSNG..-PP-AS, KGSNS..-PP-AS
1 [7]

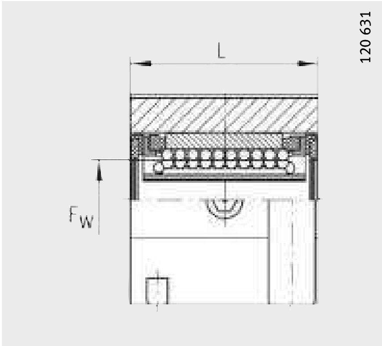
Dimension table · Dimensions in mm

Designation		Mass	Dimensions				Mounting dimensions			
		m	F_W	B	L	H	J_B	B_1	A_5	J_L[3]
		≈g					±0,15		±0,01	±0,15
KGSNG12-PP-AS	–	110	**12**	43	32	35	32	34	21,5	23
–	**KGSNS12-PP-AS**	100								
KGSNG16-PP-AS	–	220	**16**	53	37	42	40	40	26,5	26
–	**KGSNS16-PP-AS**	200								
KGSNG20-PP-AS	–	370	**20**	60	45	50	45	44	30	32
–	**KGSNS20-PP-AS**	360								
KGSNG25-PP-AS	–	630	**25**	78	58	60	60	59,4	39	40
–	**KGSNS25-PP-AS**	550								
KGSNG30-PP-AS	–	890	**30**	87	68	70	68	63	43,5	45
–	**KGSNS30-PP-AS**	730								
KGSNG40-PP-AS	–	1 300	**40**	108	80	90	86	76	54	58
–	**KGSNS40-PP-AS**	1 350								
KGSNG50-PP-AS	–	2 200	**50**	132	100	105	108	90	66	50
–	**KGSNS50-PP-AS**	2 250								

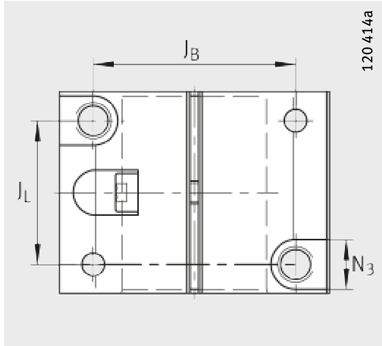
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
2) Basic load rating in main load direction.
3) Dimension J_L and lubrication hole symmetrical to the bearing length L.
4) Centring for dowel hole.
5) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.
6) Lubrication nipple. Designs and dimensions, see page 30.
7) 1 Main load direction



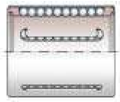
KGSNS..-PP-AS
1 7)

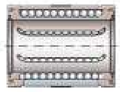


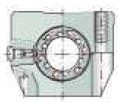
KGSNG..-PP-AS,KGSNS..-PP-AS

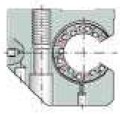


KGSNS..-PP-AS





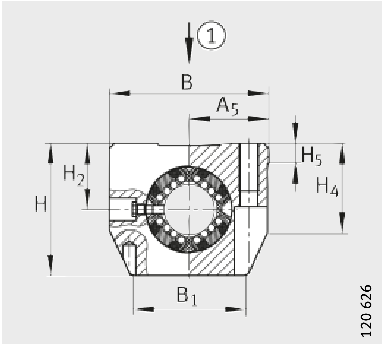




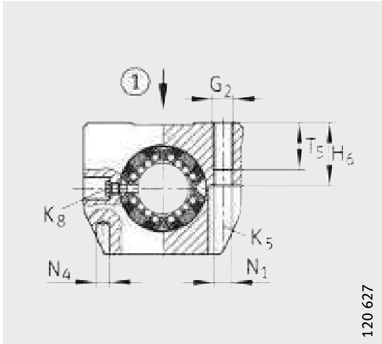
H_2 +0,008 −0,016	H_5	H_4	T_5	H_6	G_2	N_1	N_4[4]	N_3	K_5[5]	K_8[3) 6)]	Width across flats W	Ball rows Quantity	Basic load ratings[1) 2)] dyn. C_{max} N	stat. $C_{0\ max}$ N
18	5,4	26,6	11	16,5	M5	4,3	4	8	M4	NIP4MZ	– / 2,5	8	900	1 100
22	6,9	29,3	13	21	M6	5,3	4	10	M5	NIP4MZ	– / 3	8	1 430	1 550
25	7,4	34,1	18	24	M8	6,6	5	11	M6	NIP4MZ	– / 4	8	2 200	2 310
30	8,3	41,5	22	29	M10	8,4	6	15	M8	NIP5MZ	– / 5	8	3 950	4 300
35	9,3	46,2	22	34	M10	8,4	6	15	M8	NIP5MZ	– / 5	8	5 900	6 000
45	11,7	57,6	26	44	M12	10,5	8	18	M10	NIP5MZ	– / 6	8	10 200	9 600
50	10,6	62	35	49	M16	13,5	10	20	M12	NIP6MZ	– / 8	8	15 100	13 900

Heavy duty range

Linear ball bearing and housing units
Tandem arrangement
Closed or with slot
Sealed
Greased,
with relubrication facility



KTSG..-PP-AS, KTSS..-PP-AS
① [7]

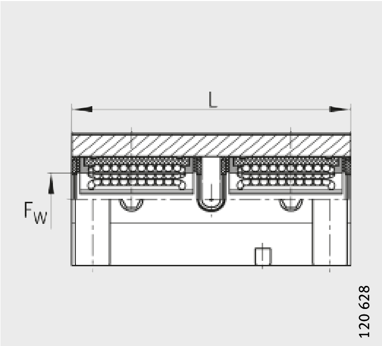


KTSG..-PP-AS, KTSS..-PP-AS
① [7]

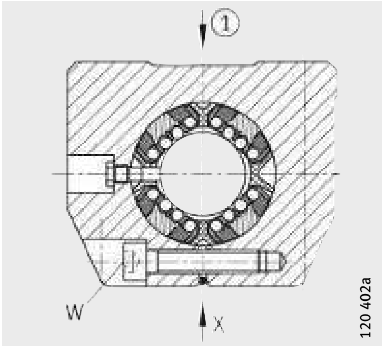
Dimension table · Dimensions in mm

Designation		Mass	Dimensions				Mounting dimensions				
		m	F_W	B	L	H	J_B	B_1	A_5	J_L[3]	L_6[3]
		≈g					±0,15		±0,01	±0,15	
KTSG12-PP-AS	–	210	**12**	43	70	35	32	34	21,5	56	24
–	**KTSS12-PP-AS**										
KTSG16-PP-AS	–	380	**16**	53	78	42	40	40	26,5	64	26
–	**KTSS16-PP-AS**										
KTSG20-PP-AS	–	550	**20**	60	96	50	45	44	30	76	33
–	**KTSS20-PP-AS**										
KTSG25-PP-AS	–	1 130	**25**	78	122	60	60	59,4	39	94	44
–	**KTSS25-PP-AS**										
KTSG30-PP-AS	–	1 780	**30**	87	142	70	68	63	43,5	106	54
–	**KTSS30-PP-AS**										

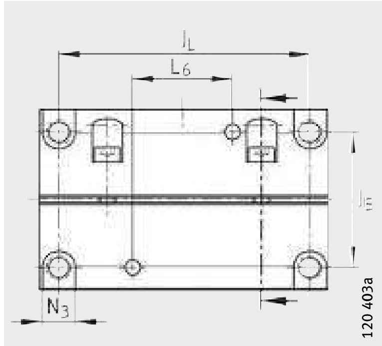
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
2) Basic load rating in main load direction.
3) Dimensions J_L, L_6 and lubrication hole symmetrical to the bearing length L.
4) Centring for dowel hole.
5) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.
6) Lubrication nipple. Designs and dimensions, see page 30.
7) ① Main load direction



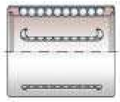
KTSG..-PP-AS, KTSS..-PP-AS

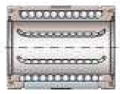


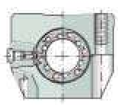
KTSS..-PP-AS
① 7)

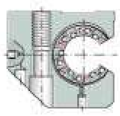


KTSS..-PP-AS







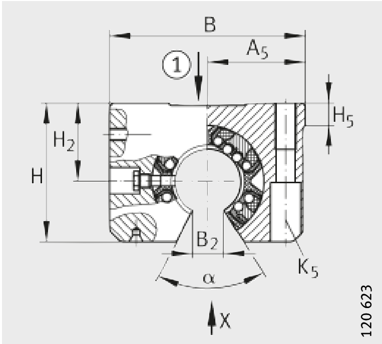


											Ball rows	Basic load ratings[1) 2)]	
H_2 $^{+0,008}_{-0,016}$	H_5	H_4	T_5	H_6	G_2	N_1	N_4[4)]	N_3	K_5[5)]	K_8[3) 6)]	Width across flats W	Quantity	dyn. C_{max} N	stat. $C_{0\ max}$ N
18	5,4	26,6	11	16,5	M5	4,3	4	8	M4	NIP4MZ	– 2,5	8	1 460	2 100
22	6,9	29,3	13	21	M6	5,3	4	10	M5	NIP4MZ	– 3	8	2 330	3 100
25	7,4	34,1	18	24	M8	6,6	5	11	M6	NIP4MZ	– 4	8	3 500	4 600
30	8,3	41,5	22	29	M10	8,4	6	15	M8	NIP5MZ	– 5	8	6 400	8 600
35	9,3	46,2	22	34	M10	8,4	6	15	M8	NIP5MZ	– 5	8	9 600	12 000

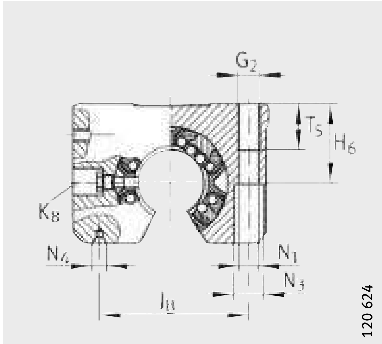
Heavy duty range

Linear ball bearing and housing units

With segment cutout
With or without slot
Sealed
Greased,
with relubrication facility



Starting KGSNO16-PP-AS,
KGSNOS16-PP-AS
1 [8]

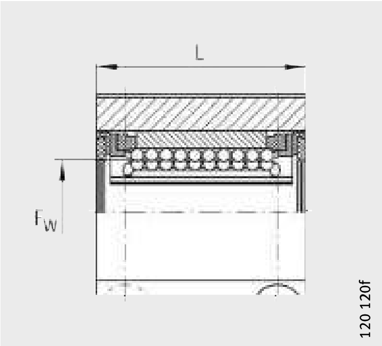


Starting KGSNO16-PP-AS,
KGSNOS16-PP-AS

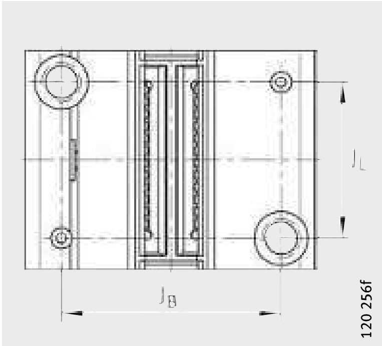
Dimension table · Dimensions in mm

Designation		Mass	Dimensions				Mounting dimensions			
		m	F_W	B	L	H	J_B	A_5	B_2 [3]	J_L [4]
		≈g					±0,15	±0,01		±0,15
KGSNO12-PP-AS	–	80	**12**	43	32	28	32	21,5	7,6	23
–	**KGSNOS12-PP-AS**	90								
KGSNO16-PP-AS	–	150	**16**	53	37	35	40	26,5	10,1	26
–	**KGSNOS16-PP-AS**	150								
KGSNO20-PP-AS	–	200	**20**	60	45	42	45	30	10	32
–	**KGSNOS20-PP-AS**	250								
KGSNO25-PP-AS	–	410	**25**	78	58	51	60	39	12,5	40
–	**KGSNOS25-PP-AS**	520								
KGSNO30-PP-AS	–	600	**30**	87	68	60	68	43,5	14,3	45
–	**KGSNOS30-PP-AS**	760								
KGSNO40-PP-AS	–	1 100	**40**	108	80	77	86	54	18,2	58
–	**KGSNOS40-PP-AS**	1 400								
KGSNO50-PP-AS	–	2 870	**50**	132	100	88	108	66	22,7	50
–	**KGSNOS50-PP-AS**	2 670								

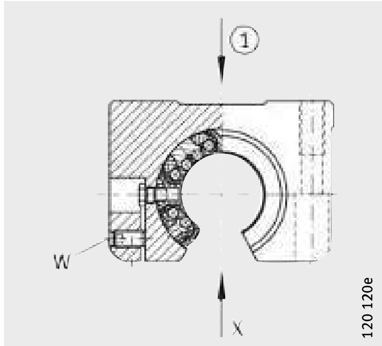
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
2) Basic load rating in main load direction.
3) Dimension B_2 on diameter F_W.
4) Dimension J_L and lubrication hole symmetrical to the bearing length L.
5) Centring hole DIN 332 type A.
6) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.
7) Lubrication nipple. Designs and dimensions, see page 30.
8) 1 Main load direction



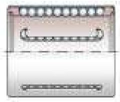
KGSNO..-PP-AS, KGSNOS..-PP-AS

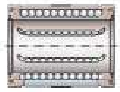


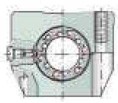
KGSNOS..-PP-AS
View X

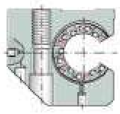


Starting KGSNOS16-PP-AS
① 8)

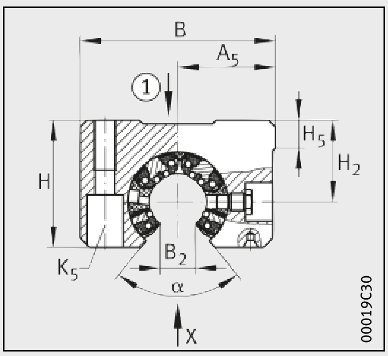




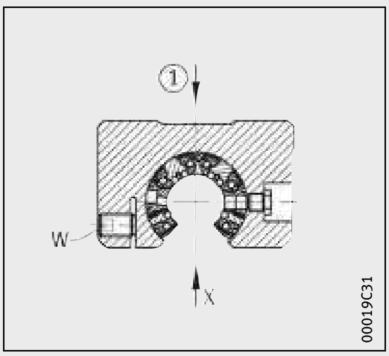




H_2	H_5	T_5	H_6	G_2	N_1	N_4 5)	N_3	K_5 6)	K_8 4) 7)	Width across flats W	α	Ball rows	Basic load ratings 1) 2) dyn. C_{max}	stat. $C_{0\ max}$
+0,008 −0,016											°	Quantity	N	N
18	6,1	11	16,5	M5	4,3	1,6×3,35	8	M4	NIP4MZ	– 2,5	78	6	900	1 100
22	7,5	13	21	M6	5,3	1,6×3,35	10	M5	NIP4MZ	– 2,5	68	6	1 430	1 550
25	8	18	24	M8	6,6	2×4,25	11	M6	NIP4MZ	– 2,5	55	6	2 200	2 310
30	8,8	22	29	M10	8,4	2,5×5,3	15	M8	NIP5MZ	– 3	57	6	3 950	4 300
35	9,7	22	34	M10	8,4	2,5×5,3	15	M8	NIP5MZ	– 3	57	6	5 900	6 000
45	12,4	26	44	M12	10,5	3,15×6,7	18	M10	NIP5MZ	– 4	56	6	10 200	9 600
50	11,1	35	49	M16	13,5	4×8,5	20	M12	NIP5MZ	– 5	54	6	15 100	13 900



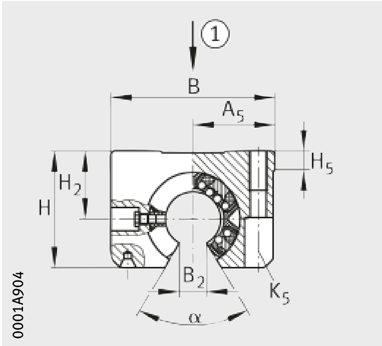
KGSNO12-PP-AS,
KGSNOS12-PP-AS



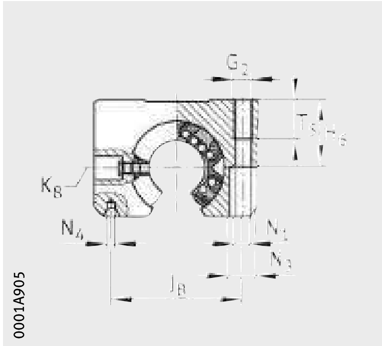
KGSNOS12-PP-AS

Heavy duty range

Linear ball bearing and housing units
Tandem arrangement
With segment cutout
With or without slot
Sealed
Greased,
with relubrication facility



KTSO..-PP-AS
1 [8]

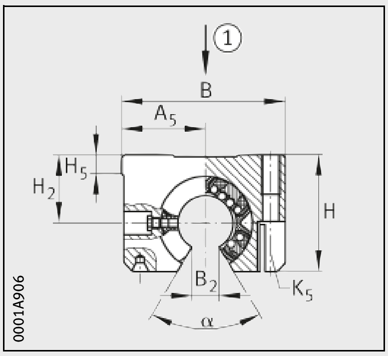


KTSO..-PP-AS

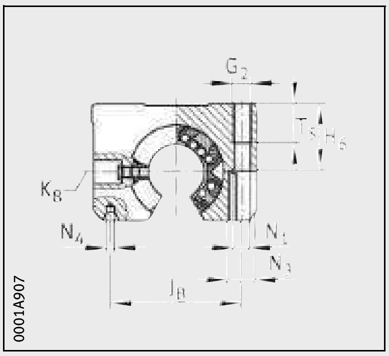
Dimension table · Dimensions in mm

Designation		Mass	Dimensions				Mounting dimensions			
		m ≈g	F_W	B	L	H	J_B ±0,15	A_5 ±0,01	B_2 [3]	J_L [4] ±0,15
KTSO12-PP-AS	–	190	**12**	43	70	28	32	21,5	7,6	56
–	**KTSOS12-PP-AS**									
KTSO16-PP-AS	–	320	**16**	53	78	35	40	26,5	10,1	64
–	**KTSOS16-PP-AS**									
KTSO20-PP-AS	–	520	**20**	60	96	42	45	30	10	76
–	**KTSOS20-PP-AS**									
KTSO25-PP-AS	–	1 060	**25**	78	122	51	60	39	12,5	94
–	**KTSOS25-PP-AS**									
KTSO30-PP-AS	–	1 550	**30**	87	142	60	68	43,5	14,3	106
–	**KTSOS30-PP-AS**									

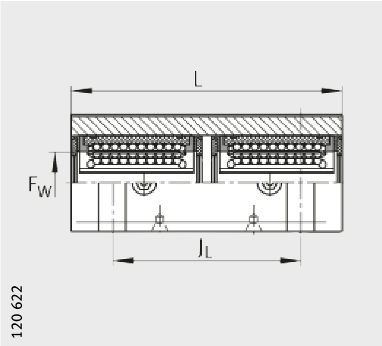
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
2) Basic load rating in main load direction.
3) Dimension B_2 on diameter F_W.
4) Dimensions J_L, L_6 and lubrication hole symmetrical to the bearing length L.
5) Centring hole DIN 332 type A.
6) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.
7) Lubrication nipple. Designs and dimensions, see page 30.
8) 1 Main load direction



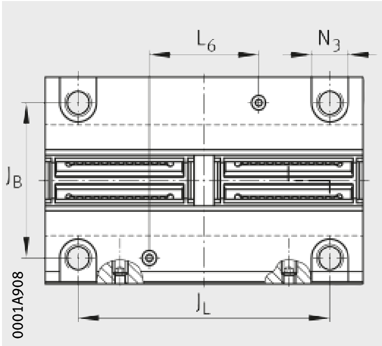
KTSOS..-PP-AS
1 [8]



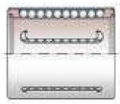
KTSOS..-PP-AS

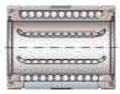


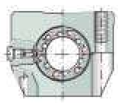
KTSO..-PP-AS, KTSOS..-PP-AS

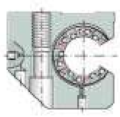


KTSO..-PP-AS
View X

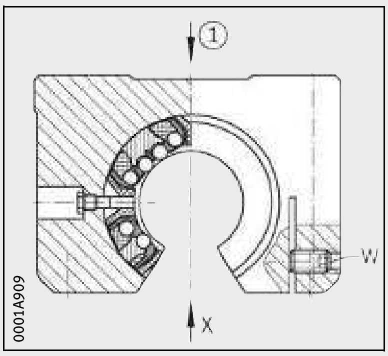








													Ball rows	Basic load ratings[1] [2]	
L_6[4]	H_2 +0,008 −0,016	H_5	T_5	H_6	G_2	N_1	N_4[5]	N_3	K_5[6]	K_8[4] [7]	Width across flats W	α °	Quantity	dyn. C_{max} N	stat. $C_{0\ max}$ N
24	18	6,1	11	16,5	M5	4,3	1,6×3,35	8	M4	NIP4MZ	– 2,5	66	6	1 460	2 100
26	22	7,5	13	21	M6	5,3	1,6×3,35	10	M5	NIP4MZ	– 2,5	68	6	2 330	3 100
33	25	8	18	24	M8	6,6	2×4,25	11	M6	NIP4MZ	– 2,5	55	6	3 500	4 600
44	30	8,8	22	29	M10	8,4	2,5×5,3	15	M8	NIP5MZ	– 3	57	6	6 400	8 600
54	35	9,7	22	34	M10	8,4	2,5×5,3	15	M8	NIP5MZ	– 3	57	6	9 600	12 000

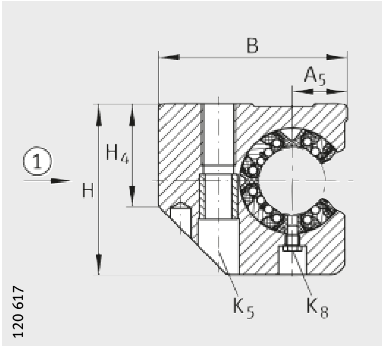


KTSOS..-PP-AS
1 [8]

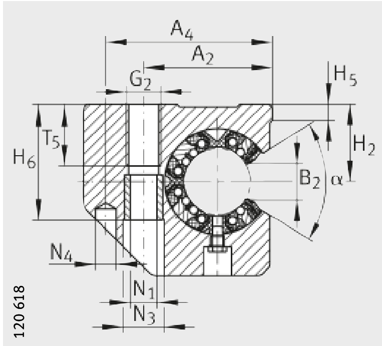
Heavy duty range

Linear ball bearing and housing units

Lateral segment cutout
With or without slot
Sealed
Greased,
with relubrication facility



KGSC..-PP-AS, KGSCS..-PP-AS
1 [8)]



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

Dimension table · Dimensions in mm

Designation		Mass	Dimensions				Mounting dimensions					
		m	F_W	B	L	H	A_2	A_4	A_5	B_2 [3)]	J_L [4)]	L_6 [4)]
		≈g					±0,15		±0,01		±0,15	
KGSC20-PP-AS	–	350	**20**	60	47	60	39	51	17	10	30	36
–	**KGSCS20-PP-AS**											
KGSC25-PP-AS	–	680	**25**	75	58	72	49	64	21	12,5	36	45
–	**KGSCS25-PP-AS**											
KGSC30-PP-AS	–	1 000	**30**	86	68	82	59	76	25	14,3	42	52
–	**KGSCS30-PP-AS**											
KGSC40-PP-AS	–	1 800	**40**	110	80	100	75	97	32	18,2	48	60
–	**KGSCS40-PP-AS**											
KGSC50-PP-AS	–	2 900	**50**	127	100	115	88	109	38	22,7	62	80
–	**KGSCS50-PP-AS**											

1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.

2) Basic load rating in main load direction.

3) Dimension B_2 on diameter F_W.

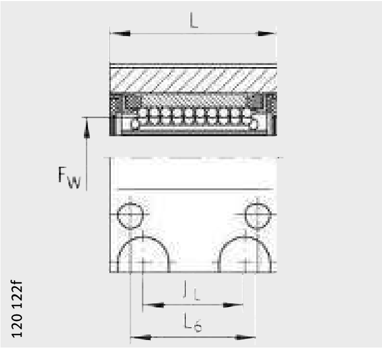
4) Dimensions J_L, L_6 and lubrication hole symmetrical to the bearing length L.

5) Centring for dowel hole.

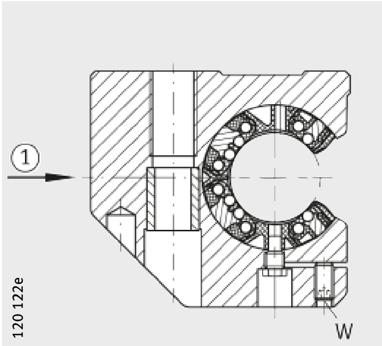
6) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.

7) Lubrication nipple. Designs and dimensions, see page 30.

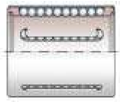
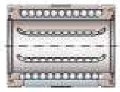
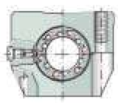
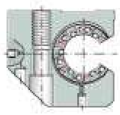
8) 1 Main load direction



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



KGSCS..-PP-AS
1 [8)]

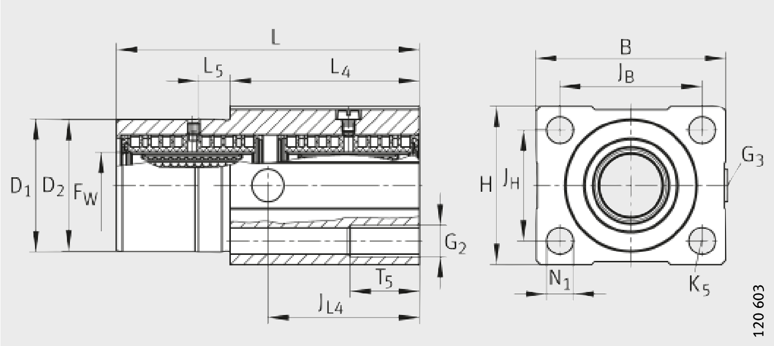





													Ball rows	Basic load ratings[1) 2)]	
H_2 +0,008 −0,016	H_5	H_4	T_5	H_6	G_2	N_1	N_4[5)]	N_3	K_5[6)]	K_8[4) 7)]	Width across flats W	α °	Quantity	dyn. C_{max} N	stat. $C_{0\,max}$ N
30	8,3	37,5	18	42,6	M10	8,4	6	15	M8	NIP4MZ	– 2,5	55	6	2 200	2 310
35	8,2	45	22	50,6	M12	10,5	8	18	M10	NIP5MZ	– 3	57	6	3 950	4 300
40	9	52	29	55,6	M16	13,5	10	20	M12	NIP5MZ	– 3	57	6	5 900	6 000
45	9,5	60	36	67,6	M20	15,5	12	24	M14	NIP5MZ	– 4	56	6	10 200	9 600
50	8,6	70	36	78,8	M20	17,5	12	26	M16	NIP6MZ	– 5	54	6	15 100	13 900

Heavy duty range

Linear ball bearing and housing units

Centring collar
Tandem arrangement
Sealed
Greased,
with relubrication facility



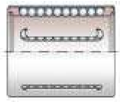
KTFS..-PP-AS

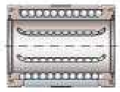
Dimension table · Dimensions in mm

Designation	Mass	Dimensions				Mounting dimensions		
	m ≈g	F_W	B	L	H	J_B ±0,15	L_4	L_5
KTFS12-PP-AS	180	**12**	42	70	34	32	46	10
KTFS16-PP-AS	260	**16**	50	78	40	38	50	10
KTFS20-PP-AS	550	**20**	60	96	50	45	60	10
KTFS25-PP-AS	700	**25**	74	122	60	56	73	10
KTFS30-PP-AS	1 100	**30**	84	142	70	64	82	10

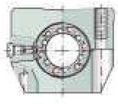
[1] The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.

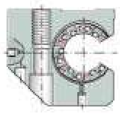
[2] Recommended locating bore for D_1 = H7.





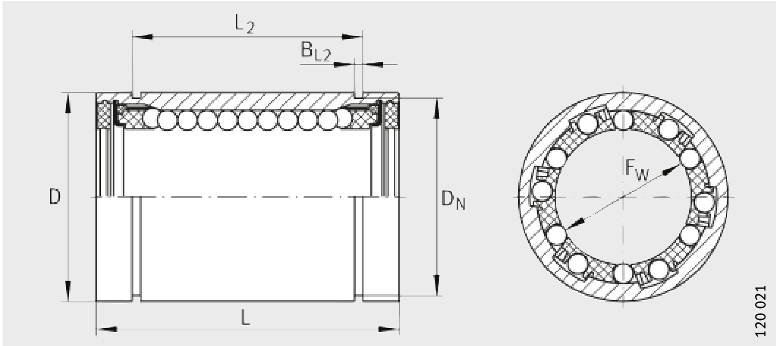
									Ball rows	Basic load ratings[1]	
J_{L4}	D_1[2] g7	D_2 $^{-0,1}_{-0,3}$	J_H $\pm 0{,}15$	T_5	G_2	N_1	K_5	G_3	Quantity	dyn. C_{min} N	stat. $C_{0\,min}$ N
35	30	30	24	13	M6	5,3	M5	M8×1	8	1 020	1 200
39	35	35	28	18	M8	6,6	M6	M8×1	8	1 790	1 900
48	42	42	35	22	M10	8,4	M8	M8×1	8	3 100	3 200
61	52	52	42	26	M12	10,5	M10	M8×1	8	4 400	4 850
71	61	61	50	35	M16	13,5	M12	M8×1	8	7 550	7 900





Machined range

Linear ball bearings
Closed, slotted or
with segment cutout
Open or sealed
Not greased, greased,
with relubrication facility

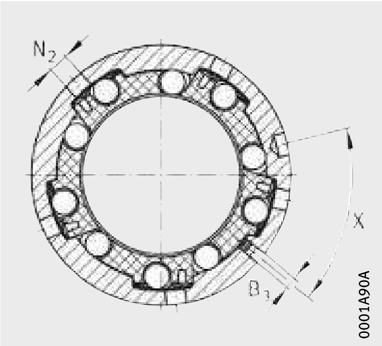


KB

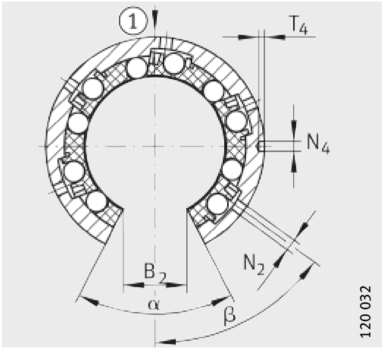
Dimension table · Dimensions in mm

Designation			Mass	Dimensions				Mounting dimensions		
3)	4)	5)	m	F_w		D 6)	L	B_2 7)	L_2	B_{L2} 8)
			≈g		Tolerances 6)	h5	h12		H13	
KB12	**KB12-PP**	**KB12-PP-AS**	40					–		
KBS12	**KBS12-PP**	**KBS12-PP-AS**		**12**	+0,008 / 0	22	32		22,6	1,3
KBO12	**KBO12-PP**	**KBO12-PP-AS**	30					7,7		
KB16	**KB16-PP**	**KB16-PP-AS**	50					–		
KBS16	**KBS16-PP**	**KBS16-PP-AS**		**16**	+0,009 / −0,001	26	36		24,6	1,3
KBO16	**KBO16-PP**	**KBO16-PP-AS**	40					10,1		
KB20	**KB20-PP**	**KB20-PP-AS**	90					–		
KBS20	**KBS20-PP**	**KBS20-PP-AS**		**20**	+0,009 / −0,001	32	45		31,2	1,6
KBO20	**KBO20-PP**	**KBO20-PP-AS**	70					10		
KB25	**KB25-PP**	**KB25-PP-AS**	190					–		
KBS25	**KBS25-PP**	**KBS25-PP-AS**		**25**	+0,011 / −0,001	40	58		43,7	1,85
KBO25	**KBO25-PP**	**KBO25-PP-AS**	150					12,5		
KB30	**KB30-PP**	**KB30-PP-AS**	300					–		
KBS30	**KBS30-PP**	**KBS30-PP-AS**		**30**	+0,011 / −0,001	47	68		51,7	1,85
KBO30	**KBO30-PP**	**KBO30-PP-AS**	240					13,6		
KB40	**KB40-PP**	**KB40-PP-AS**	600					–		
KBS40	**KBS40-PP**	**KBS40-PP-AS**		**40**	+0,013 / −0,002	62	80		60,3	2,15
KBO40	**KBO40-PP**	**KBO40-PP-AS**	520					18,2		
KB50	**KB50-PP**	**KB50-PP-AS**	1 000					–		
KBS50	**KBS50-PP**	**KBS50-PP-AS**		**50**	+0,013 / −0,002	75	100		77,3	2,65
KBO50	**KBO50-PP**	**KBO50-PP-AS**	850					22,7		

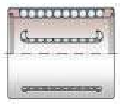
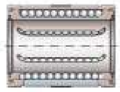
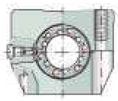
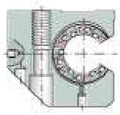
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
2) Basic load rating in main load direction.
3) With preservative.
4) With initial greasing, sealed on both sides.
5) With initial greasing, sealed on both sides, with relubrication facility.
6) The tolerances are only valid for KB.
7) Dimension B_2 on diameter F_W.
8) Slot dimensions suitable for retaining rings to DIN 471.
9) Hole position symmetrical to bearing length L.
10) ① Main load direction



KBS..-PP-AS



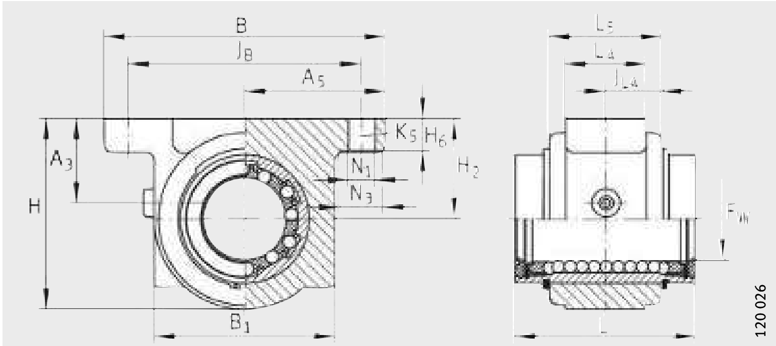
KBO..-PP-AS
1 [10]

B_3	D_N[8]	T_4	N_4[9]	N_2	α °	β °	X °	Ball rows Quantity	Basic load ratings[1] dyn. C_{min} N	 stat. $C_{0\ min}$ N	 dyn. C_{max} N	 stat. $C_{0\ max}$ N
–	21	–	–	1,5	–	–	–	5	540	385	640	570
1							55					
–		1,2	2,2		78	64	–	4	–	–	600 [2]	445 [2]
–	24,9	–	–	2	–	–	–	5	710	530	840	780
1							54					
–		1,2	2,2		78	64	–	4	–	–	800 [2]	620 [2]
–	30,3	–	–	2	–	–	–	6	1 570	1 230	1 660	1 570
1							62,5					
–		1,2	2,2		60	52	–	5	–	–	1 600 [2]	1 280 [2]
–	37,5	–	–	2,5	–	–	–	6	2 800	2 220	2 950	2 850
1							62					
–		1,5	3		60	53	–	5	–	–	2 850 [2]	2 300 [2]
–	44,5	–	–	2,5	–	–	–	6	3 600	2 850	3 800	3 600
1							64					
–		1,5	3		54	55	–	5	–	–	3 700 [2]	3 000 [2]
–	59	–	–	3	–	–	–	6	6 000	4 400	6 400	5 600
1							64					
–		1,5	3		54	54	–	5	–	–	6 100 [2]	4 600 [2]
–	72	–	–	4	–	–	–	6	8 700	6 300	9 200	8 000
1							64					
–		1,5	3		54	54	–	5	–	–	8 900 [2]	6 600 [2]

Machined range

Linear ball bearing and housing units
Closed, slotted or
with segment cutout
Sealed
Greased,
with relubrication facility

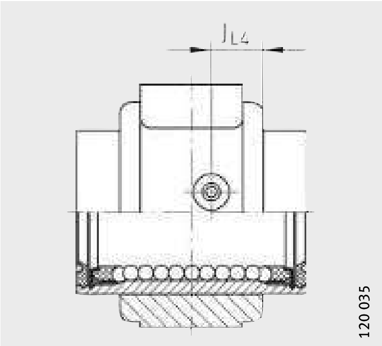


KGB..-PP-AS

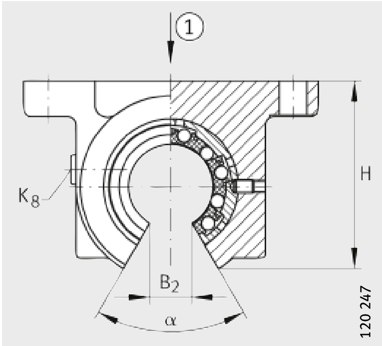
Dimension table · Dimensions in mm

Designation			Mass m ≈g	Dimensions F_W	Tolerances[6]	B	L h12	H	Mounting dimensions J_B	B_1	A_5	B_2[4]
KGB12-PP-AS	–	–	100	**12**	$^{+0,008}_{0}$	52	32	35,8	42 ±0,15	31,6	26±0,02	–
–	**KGBS12-PP-AS**	–										
–	–	**KGBO12-PP-AS**	90					32				7,7
KGB16-PP-AS	–	–	140	**16**	$^{+0,009}_{-0,001}$	56	36	37,5	46 ±0,15	35	28±0,02	–
–	**KGBS16-PP-AS**	–										
–	–	**KGBO16-PP-AS**	120					33,5				10,1
KGB20-PP-AS	–	–	300	**20**	$^{+0,009}_{-0,001}$	70	45	47,5	58 ±0,15	45	35±0,02	–
–	**KGBS20-PP-AS**	–										
–	–	**KGBO20-PP-AS**	250					45				10
KGB25-PP-AS	–	–	580	**25**	$^{+0,011}_{-0,001}$	80	58	57,5	68 ±0,15	55	40±0,02	–
–	**KGBS25-PP-AS**	–										
–	–	**KGBO25-PP-AS**	490					54,5				12,5
KGB30-PP-AS	–	–	900	**30**	$^{+0,011}_{-0,001}$	88	68	66,5	76 ±0,2	63	44±0,02	–
–	**KGBS30-PP-AS**	–										
–	–	**KGBO30-PP-AS**	780					63,5				13,6
KGB40-PP-AS	–	–	1 430	**40**	$^{+0,013}_{-0,002}$	108	80	83,5	94 ±0,2	77	54±0,02	–
–	**KGBS40-PP-AS**	–										
–	–	**KGBO40-PP-AS**	1 280					79,5				18,2
KGB50-PP-AS	–	–	2 780	**50**	$^{+0,013}_{-0,002}$	135	100	98	116 ±0,2	96	67,5±0,02	–
–	**KGBS50-PP-AS**	–										
–	–	**KGBO50-PP-AS**	2 460					93				22,7

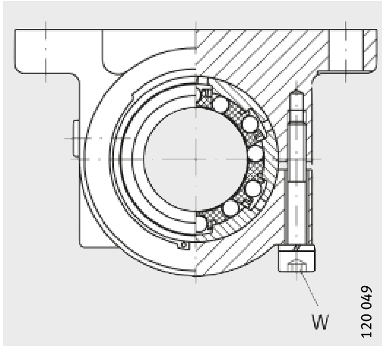
1) Designs and dimensions, see page 31.
2) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
3) Basic load rating in main load direction.
4) Dimension B_2 on diameter F_W.
5) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.
6) The tolerances are valid for KGB..-PP-AS.
7) ① Main load direction



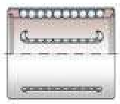
KGBO..-PP-AS

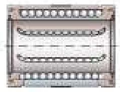


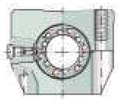
KGBO, KGBO..-PP-AS
1 [7)]

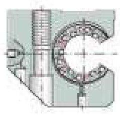


KGBS..-PP-AS







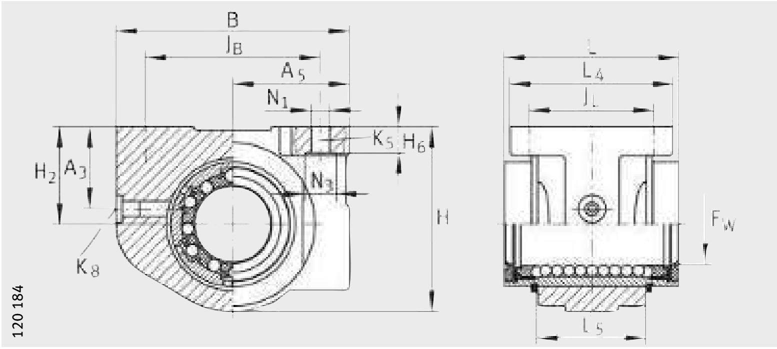


L_5	L_4	J_{L4}	H_2 ±0,015	A_3	H_6	N_1	N_3	K_5 [5)]	α °	Width across flats W	Lubrication nipple[1)] K_8	Ball rows Quantity	Basic load ratings[2)] dyn. C N	stat. C_0 N
20	12	10	20	15	6	5,5	10	M5	–	–	NIPA1	5	540	385
										2				
		6,5							78	–		4	600 [3)]	445 [3)]
22	15	11	20	15	6	5,5	10	M5	–	–	NIPA1	5	710	530
										2				
		6,5							78	–		4	800 [3)]	620 [3)]
28	20	14	25	21	8	6,6	11	M6	–	–	NIPA1	6	1 570	1 230
										3				
		9,5							60	–		5	1 600 [3)]	1 280 [3)]
40	28	20	30	23	10	6,6	11	M6	–	–	NIPA1	6	2 800	2 220
										3				
		15							60	–		5	2 850 [3)]	2 330 [3)]
48	32	24	35	25	10	6,6	11	M6	–	–	NIPA2	6	3 600	2 850
										4				
		19							54	–		5	3 700 [3)]	3 000 [3)]
56	40	28	45	30	12	9	15	M8	–	–	NIPA2	6	6 000	4 400
										4				
		23							54	–		5	6 100 [3)]	4 600 [3)]
72	52	36	50	34	14	11	18	M10	–	–	NIPA2	6	8 700	6 300
										5				
		28							54	–		5	8 900 [3)]	6 600 [3)]

Machined range

Linear ball bearing and housing units

Closed, slotted or
with segment cutout
Sealed
Greased,
with relubrication facility

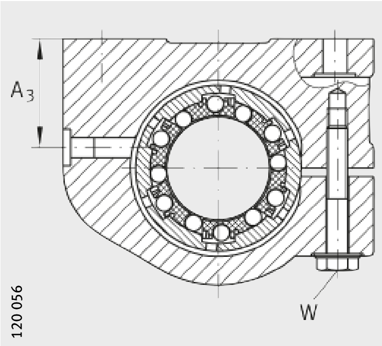


KGBA..-PP-AS

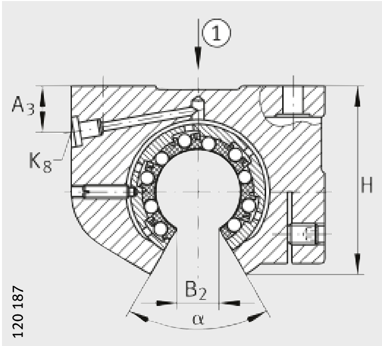
Dimension table · Dimensions in mm

Designation			Mass	Dimensions				Mounting dimensions				
			m	F_W		B	L	H	J_B	A_5	B_2[4)]	L_4
			≈g		Toler-ances[7)]		h12					
KGBA12-PP-AS	–	–	80	**12**	+0,008/0	42	32	34	32±0,15	21±0,01	–	32
–	**KGBAS12-PP-AS**	–										
–	–	**KGBAO12-PP-AS**	70					30,5			7,7	
KGBA16-PP-AS	–	–	120	**16**	+0,009/−0,001	50	36	41	40±0,15	25±0,01	–	35
–	**KGBAS16-PP-AS**	–										
–	–	**KGBAO16-PP-AS**	100					37			10,1	
KGBA20-PP-AS	–	–	200	**20**	+0,009/−0,001	60	45	47,5	45±0,15	30±0,01	–	42
–	**KGBAS20-PP-AS**	–										
–	–	**KGBAO20-PP-AS**	170					44,5			10	
KGBA25-PP-AS	–	–	410	**25**	+0,011/−0,001	74	58	60	60±0,2	37±0,01	–	54
–	**KGBAS25-PP-AS**	–										
–	–	**KGBAO25-PP-AS**	350					56			12,5	
KGBA30-PP-AS	–	–	610	**30**	+0,011/−0,001	84	68	67	68±0,2	42±0,01	–	60
–	**KGBAS30-PP-AS**	–										
–	–	**KGBAO30-PP-AS**	530					63,5			13,6	
KGBA40-PP-AS	–	–	1 200	**40**	+0,013/−0,002	108	80	87	86±0,2	54±0,015	–	78
–	**KGBAS40-PP-AS**	–										
–	–	**KGBAO40-PP-AS**	1 070					82,5			18,2	
KGBA50-PP-AS	–	–	1 880	**50**	+0,013/−0,002	130	100	98	108±0,2	65±0,015	–	70
–	**KGBAS50-PP-AS**	–										
–	–	**KGBAO50-PP-AS**	1 650					93			22,7	

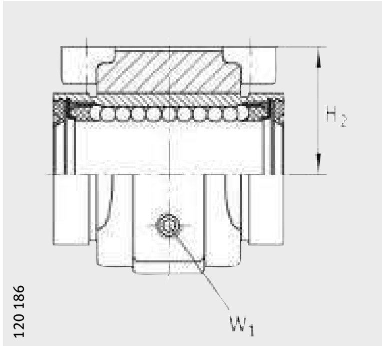
1) Designs and dimensions, see page 31.
2) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.
3) Basic load rating in main load direction.
4) Dimension B_2 on diameter F_W.
5) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.
6) Note maximum tightening torques.
7) The tolerances are valid for KGBA..-PP-AS.
8) ① Main load direction



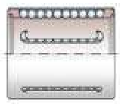
KGBAS..-PP-AS

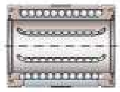


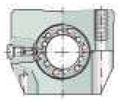
KGBAO..-PP-AS
1 8)

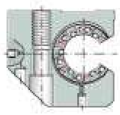


KGBAO..-PP-AS







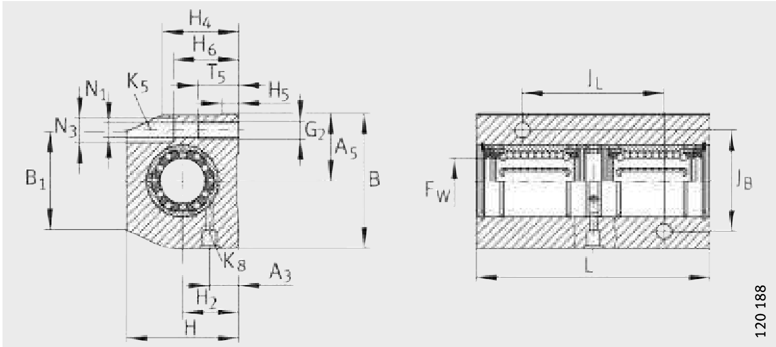


J_L	L_5	H_2	A_3	H_6	N_1	N_3	K_5 5)	α	Width across flats W	Width across flats W_1 6)	W_1 max. Nm	Lubrication nipple 1) K_8	Ball rows	Basic load ratings 2) dyn. C	Basic load ratings 2) stat. C_0
				−0,5				°					Quantity	N	N
23±0,15	20	18±0,01	15	4,8	4,7	8	M4	–	– 7	–	–	NIPA1	5	540	385
			7,8					78	–	2	1		4	600 3)	445 3)
26±0,15	22	22±0,01	15	5,4	4,7	8	M4	–	– 7	–	–	NIPA1	5	710	530
			10					78	–	2,5	1,5		4	800 3)	620 3)
32±0,15	28	25±0,01	21	6,7	4,7	8	M4	–	– 7	–	–	NIPA1	6	1 570	1 230
			11					60	–	2,5	1,5		5	1 600 3)	1 280 3)
40±0,2	40	30±0,01	23	7,8	5,7	10	M5	–	– 8	–	–	NIPA1	6	2 800	2 220
			13					60	–	3	3		5	2 850 3)	2 330 3)
45±0,2	48	35±0,01	25	8,7	6,8	11	M6	–	– 10	–	–	NIPA2	6	3 600	2 850
			14					54	–	3	4		5	3 700 3)	3 000 3)
58±0,2	56	45±0,01	30	11	9,2	15	M8	–	– 13	–	–	NIPA2	6	6 000	4 400
			18					54	–	4	5		5	6 100 3)	4 600 3)
50±0,2	72	50±0,015	34	12,5	9,2	15	M8	–	– 13	–	–	NIPA2	6	8 700	6 300
			19					54	–	4	7		5	8 900 3)	6 600 3)

Machined range

Linear ball bearing and housing units

Tandem arrangement
Closed or with segment cutout
Sealed
Greased,
with relubrication facility



KTB..-PP-AS

Dimension table · Dimensions in mm

Designation		Mass m ≈g	Dimensions F_W	Tolerances[6]	B	L	H	Mounting dimensions J_B ±0,15	A_5	B_1	B_2[3]	J_L[4] ±0,15	H_2 ±0,015
KTB12-PP-AS	–	310	**12**	+0,008 / 0	43	76	35	30	21,5	34	–	40	18
–	**KTBO12-PP-AS**	260			42		30		–	–	7,7		
KTB16-PP-AS	–	460	**16**	+0,009 / −0,001	53	84	42	36	26,5	40	–	45	22
–	**KTBO16-PP-AS**	360			50		35		–	–	10,1		
KTB20-PP-AS	–	800	**20**	+0,009 / −0,001	60	104	50	45	30	44	–	55	25
–	**KTBO20-PP-AS**	620					42		–	–	10		
KTB25-PP-AS	–	1 490	**25**	+0,011 / −0,001	78	130	60	54	39	60	–	70	30
–	**KTBO25-PP-AS**	1 180			74		51		–	–	12,5		
KTB30-PP-AS	–	2 300	**30**	+0,011 / −0,001	87	152	70	62	43,5	63	–	85	35
–	**KTBO30-PP-AS**	1 840			84		60		–	–	13,6		
KTB40-PP-AS	–	3 700	**40**	+0,013 / −0,002	108	176	90	80	54	76	–	100	45
–	**KTBO40-PP-AS**	3 000					77		–	–	18,2		
KTB50-PP-AS	–	6 600	**50**	+0,013 / −0,002	132	224	105	100	66	90	–	125	50
–	**KTBO50-PP-AS**	5 100			130		88		–	–	22,7		

[1] The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways and where the two linear ball bearings are subjected to equal loading.

[2] Basic load rating in main load direction.

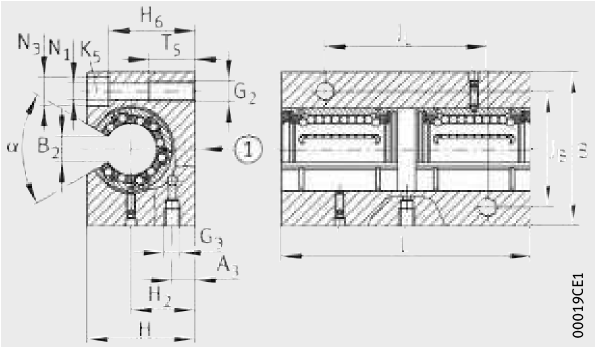
[3] Dimension B_2 on diameter F_W.

[4] Dimension J_L and lubrication hole symmetrical to the bearing length L.

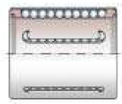
[5] Lubrication nipple. Designs and dimensions, see page 31.

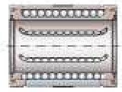
[6] The tolerances are valid for KTB..-PP-AS.

[7] 1 Main load direction

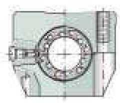


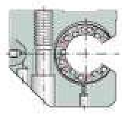
KTBO..-PP-AS
① 7)





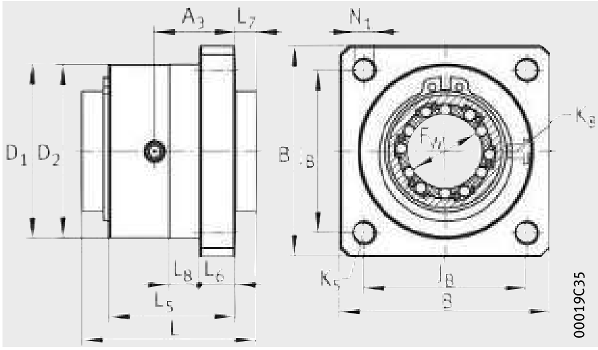
H4	A3	H5	T5	H6	N1	N3	G2	G3	K8[5]	α	Fixing screws K5		Basic load ratings[1]	
										°	ISO 4762	DIN 6912	dyn. C N	stat. C0 N
25,5	10	5,4	13	28	5,3	10	M6	–	NIPA1	–	M5	–	880	770
–	6	–		25				M6	–	78	–	M5	980 [2]	890 [2]
20	12	6,9	13	35	5,3	10	M6	–	NIPA1	–	M5	–	1 150	1 060
–	8	–		29,5				M6	–	78	–	M5	1 290 [2]	1 240 [2]
33	13	7,4	18	37	6,4	11	M8	–	NIPA2	–	M6	–	2 550	2 450
–	9	–		35,5				M6	–	60	–	M6	2 600 [2]	2 550 [2]
40	15	8,3	22	49	8,4	15	M10	–	NIPA2	–	M8	–	4 550	4 450
–	9	–		43				M8×1	–	60	–	M8	4 650 [2]	4 650 [2]
44,5	16	9,3	26	52	10,5	18	M12	–	NIPA2	–	M10	–	5 900	5 700
–	11	–		50,5				M8×1	–	54	–	M10	6 000 [2]	6 000 [2]
56	20	12,4	34	64	13	20	M16	–	NIPA2	–	M12	–	8 800	9 700
–	14	–		66				M8×1	–	54	–	M12	9 200 [2]	9 900 [2]
60	20	11,1	34	70	13	20	M16	–	NIPA2	–	M12	–	12 600	14 100
–	14	–		77				M8×1	–	54	–	M12	13 200 [2]	14 500 [2]





Machined range

Linear ball bearing and housing unit
With flange
Sealed
Greased, with relubrication facility



KFB..-B-PP-AS

Dimension table · Dimensions in mm

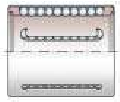
Designation	Mass m ≈g	Dimensions F_W	Tolerances	B	L	Mounting dimensions L_5	L_6	L_7	A_3
KFB12-B-PP-AS	80	**12**	+0,008 / 0	40	32	22	6	4,2	11,5
KFB16-B-PP-AS	120	**16**	+0,009 / −0,001	50	36	24	8	5,2	12,5
KFB20-B-PP-AS	220	**20**	+0,009 / −0,001	60	45	30	10	6,7	15,8
KFB25-B-PP-AS	430	**25**	+0,011 / −0,001	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	1 280	**40**	+0,013 / −0,002	100	80	59	16	9,2	30,3
KFB50-B-PP-AS	2 160	**50**	+0,013 / −0,002	130	100	75	18	11,2	38,8

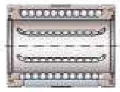
1) The basic load ratings are only valid for hardened (670 HV + 165 HV) and ground shaft raceways.

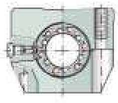
2) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.

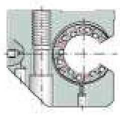
3) Lubrication nipple. Designs and dimensions, see page 31.

N_1	K_5 [2]	D_1 +0,2	D_2 g7	J_B	L_8	K_8 [3]	Ball rows Quantity	Basic load ratings[1] dyn. C N	stat. C_0 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	1 570	1 230
6,6	M6	57,5	58	54	10	NIPA1	6	2 800	2 220
9	M8	65,5	66	60	10	NIPA1	6	3 600	2 850
11	M10	89,5	90	78	10	NIPA1	6	6 000	4 400
11	M10	97,5	98	98	10	NIPA2	6	8 700	6 300





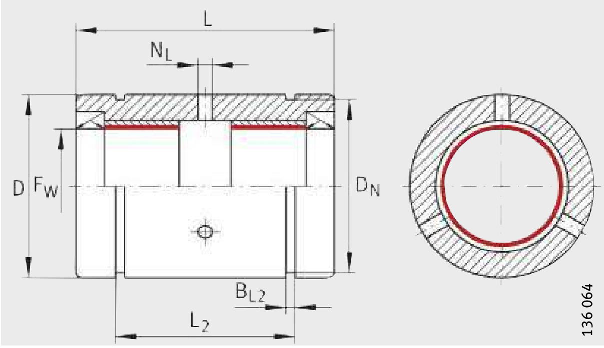




Plain bearing range

Linear plain bearings

Closed or with segment cutout
Sealed
Greased, with relubrication facility



PAB..-PP-AS, PABO..-PP-AS

Dimension table · Dimensions in mm

Designation		Mass	Dimensions			Mounting dimensions	
		m	F_W	D	L	L_2[3]	B_{L2}[4]
		≈g		h7[2]	h12	H13	H13
PAB12-PP-AS	–	26	**12**	22	32	22,6	1,3
–	**PABO12-PP-AS**	21					
PAB16-PP-AS	–	34	**16**	26	36	24,6	1,3
–	**PABO16-PP-AS**	28					
PAB20-PP-AS	–	68	**20**	32	45	31,2	1,6
–	**PABO20-PP-AS**	58					
PAB25-PP-AS	–	132	**25**	40	58	43,7	1,85
–	**PABO25-PP-AS**	113					
PAB30-PP-AS	–	169	**30**	47	68	51,7	1,85
–	**PABO30-PP-AS**	143					
PAB40-PP-AS	–	426	**40**	62	80	60,3	2,15
–	**PABO40-PP-AS**	362					
PAB50-PP-AS	–	773	**50**	75	100	77,3	2,65
–	**PABO50-PP-AS**	657					

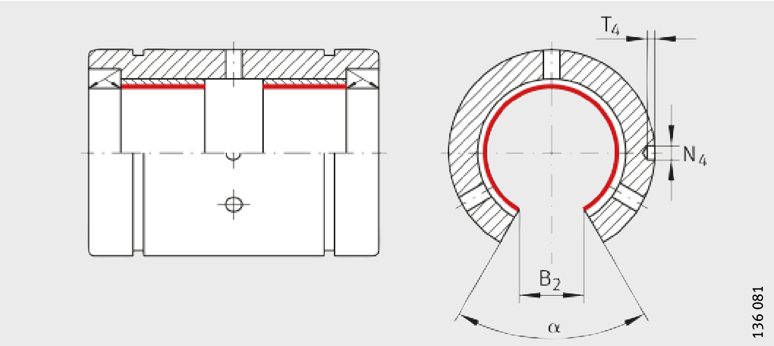
1) The basic static load ratings are not valid if the bearings above are fitted – as shown on the following pages – in housings.

2) The tolerance is only valid for PAB..-PP-AS.

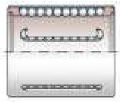
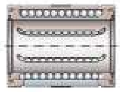
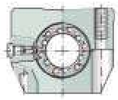
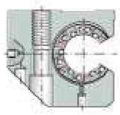
3) Holes symmetrical to bearing length L.

4) Slot dimensions suitable for retaining rings to DIN 471.

5) Dimension B_2 on diameter F_W.



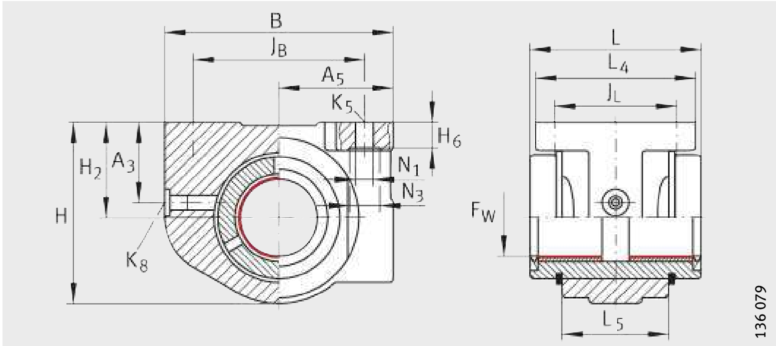
PABO..PP-AS
Segment cutout and fixing hole

D_N	B_2 5)	T_4	N_4	N_L H13	α °	Basic load ratings 1) stat. C_0 N
21	–	–	–	2,5	–	60 000
	7,6	1,2	2,2		78	
24,9	–	–	–	2,5	–	96 000
	10,1	1,2	2,2		78	
30,3	–	–	–	2,5	–	150 000
	10	1,2	2,2		60	
37,5	–	–	–	2,5	–	250 000
	12,5	1,5	3		60	
44,5	–	–	–	3	–	375 000
	13,6	1,5	3		54	
59	–	–	–	3	–	600 000
	18,2	1,5	3		54	
72	–	–	–	4	–	1 000 000
	22,7	1,5	3		54	

Plain bearing range

Linear plain bearing units
Closed or with segment cutout
Sealed
Greased,
with relubrication facility

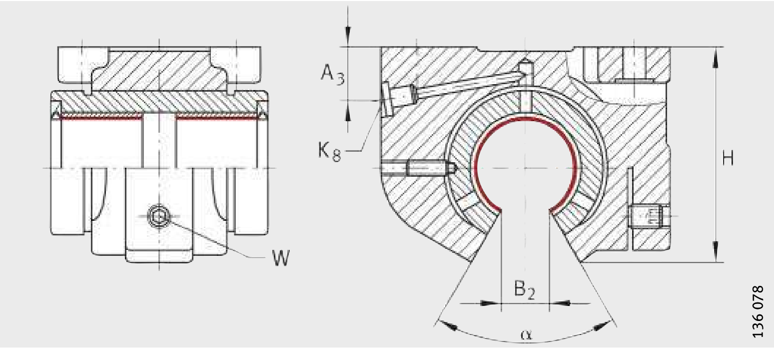


PAGBA..-PP-AS, PAGBA..-PP-AS

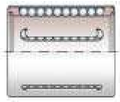
Dimension table · Dimensions in mm

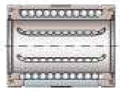
Designation		Mass	Dimensions			Mounting dimensions				
		m ≈g	F_W	B	L h12	H	J_B	A_5	B_2 [2)]	L_4
PAGBA12-PP-AS	–	70	**12**	42	32	34	32 ±0,15	21±0,01	–	32
–	**PAGBAO12-PP-AS**	60				30,5		21	7,6	
PAGBA16-PP-AS	–	110	**16**	50	36	41	40 ±0,15	25±0,01	–	35
–	**PAGBAO16-PP-AS**	90				36,8		25	10,1	
PAGBA20-PP-AS	–	180	**20**	60	45	47,5	45 ±0,15	30±0,01	–	42
–	**PAGBAO20-PP-AS**	160				44,5		30	10	
PAGBA25-PP-AS	–	350	**25**	74	58	60	60 ±0,2	37±0,01	–	54
–	**PAGBAO25-PP-AS**	310				56		37	12,5	
PAGBA30-PP-AS	–	480	**30**	84	68	67	68 ±0,2	42±0,01	–	60
–	**PAGBAO30-PP-AS**	430				63,5		42	13,6	
PAGBA40-PP-AS	–	1 070	**40**	108	80	87	86 ±0,2	54±0,015	–	78
–	**PAGBAO40-PP-AS**	910				82,4		54	18,2	
PAGBA50-PP-AS	–	1 650	**50**	130	100	98	108 ±0,2	65±0,015	–	70
–	**PAGBAO50-PP-AS**	1 460				92,8		65	22,7	

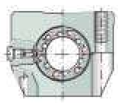
1) Designs and dimensions, see page 31.
2) Dimension B_2 on diameter F_W.
3) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.
4) Note maximum tightening torques.

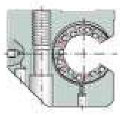


PAGBAO..-PP-AS
Segment cutout

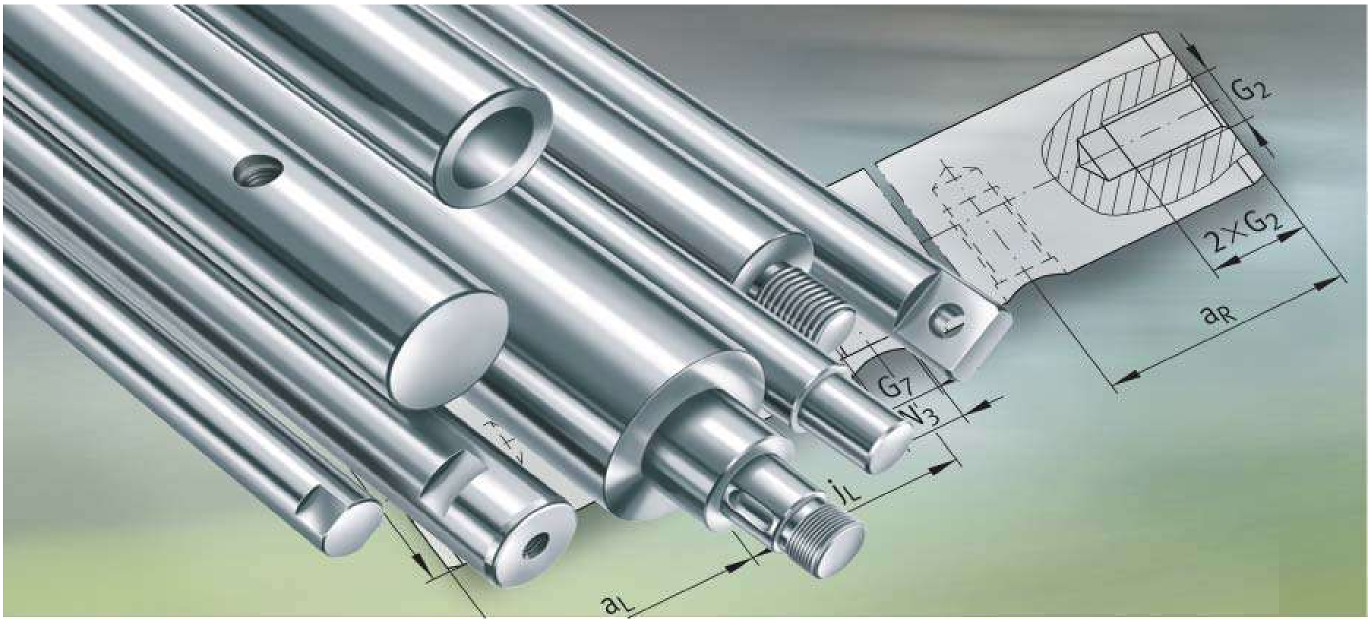






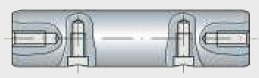
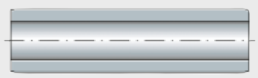
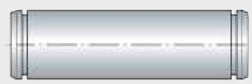
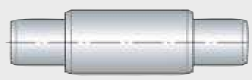


											Lubrication nipple[1]
J_L	L_5	H_2	A_3	H_6	N_1[3]	N_3[3]	K_5	Width across flats W[4]		α	K_8
				−0,5					max. Nm	°	
23±0,15	20	18±0,01	15	4,8	4,7	8	M4	–	–	–	NIPA1
		18	7,8					2	1	78	
26±0,15	22	22±0,01	15	5,4	4,7	8	M4	–	–	–	NIPA1
		22	10					2,5	1,5	78	
32±0,15	28	25±0,01	21	6,7	4,7	8	M4	–	–	–	NIPA1
		25	11					2,5	1,5	60	
40±0,2	40	30±0,01	23	7,8	5,7	10	M5	–	–	–	NIPA1
		30	13					3	3	60	
45±0,2	48	35±0,01	25	8,7	6,8	11	M6	–	–	–	NIPA2
		35	14					3	4	54	
58±0,2	56	45±0,01	30	11	9,2	15	M8	–	–	–	NIPA2
		45	18					4	5	54	
50±0,2	72	50±0,015	34	12,5	9,2	15	M8	–	–	–	NIPA2
		50	19					4	7	54	



Solid shafts
Hollow shafts

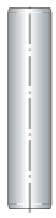
Matrix for preselection of solid and hollow shafts

Solid shafts and hollow shafts			Shaft diameter d_{LW} mm from ... to	Standard tolerance for shaft
Solid shafts Without threaded holes	**W**		4 – 80	h6
Solid shafts With threaded holes	**W**		10 – 80	h6
Hollow shafts	**WH**		12 – 80	h7
Shafts According to customer requirements	**W**	 	10 – 80	h6, h7

Definition:
■ Available by agreement
● Available

1) Not available for all diameters.
2) For WH, Cf53 or C60.

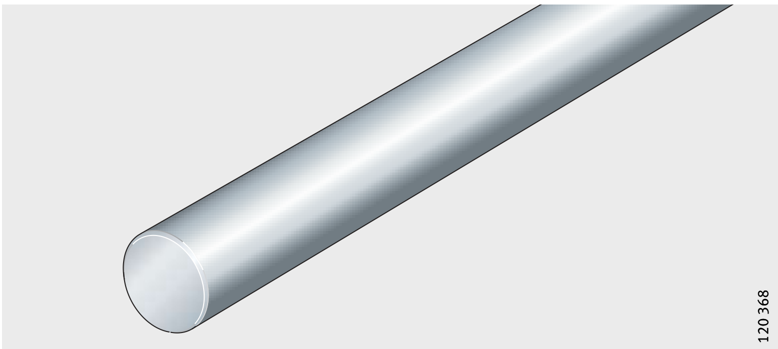
Special tolerances, only for shafts made from quenched and tempered steel		Steel			Coating[1]		Description
		Quenched and tempered steel[2]	Corrosion-resistant steel[1]		Hard chromium	Corrotect®	
		Cf53	X46Cr13	X90CrMoV18			Page
j5	f7	●	■	■	■	■	109
j5	f7	●	■	■	■	■	113
h7	–	●	–	–	■	■	109
j5	f7	●	■	■	■	■	114



Solid shafts

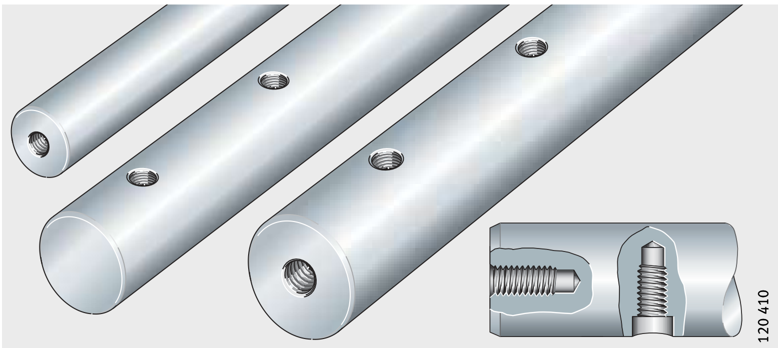
Without threaded holes

W



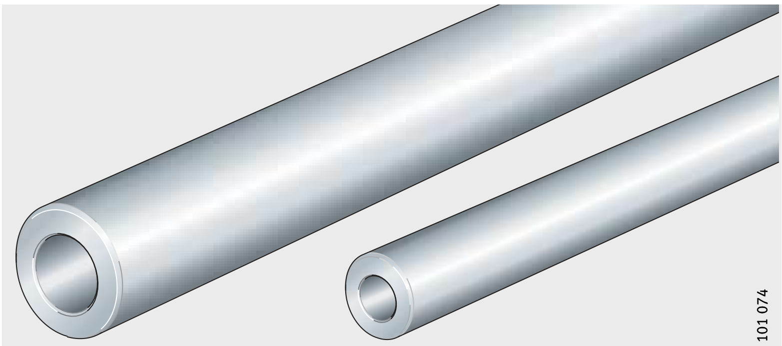
Axial and radial threaded holes

W



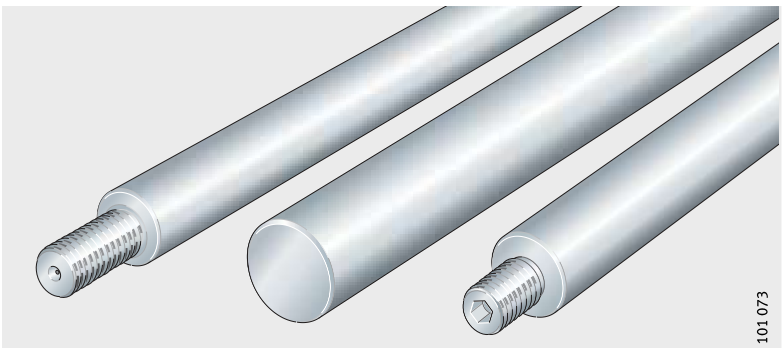
Hollow shafts

WH



Shafts according to customer requirements

W



Solid shafts, hollow shafts

Features

Solid and hollow shafts are high precision shafts made from quenched and tempered steel to rolling bearing quality and are supplied in metric sizes.

Hollow shafts are particularly suitable for reduced-mass designs. For location, solid shafts can be provided with radial and axial threaded holes or can, by agreement, be produced completely in accordance with a customer drawing, see page 113 to page 117.

High precision raceway for economical linear guidance systems

The material quality of the shafts guarantees high dimensional and geometrical accuracy (roundness, parallelism). Due to their high surface hardness and surface quality, the shafts are highly suitable as precision raceways for linear ball bearings.

High precision shafts are also suitable as guide rods for plain bushes, as stretch and levelling rollers and in the construction of equipment and automatic machinery.

They can be combined with linear ball bearings, yoke type, stud type, ball bearing and profiled track rollers to give linear guidance systems that are rigid, precise, economical and ready to fit, with high load carrying capacity and a long operating life.

Steels, hardness, surface, tolerances, lengths

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

Hollow shafts are only available made from quenched and tempered steel.

Shafts made from corrosion-resistant steel to ISO 683-17 and EN 10880

As an alternative to quenched and tempered steel, solid shafts are also available in corrosion-resistant steels, for example X46Cr13 (material number 1.4034) or X90CrMoV18 (material number 1.4112). The surface hardness in the case of X46 is 520 HV + 115 HV (52 HRC + 4 HRC). The surface hardness in the case of X90 is 580 HV + 85 HV (54 HRC + 4 HRC).

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

The suffix is X46 or X90.

Due to the hardness curve, shafts made from the materials X46Cr13 and X90CrMoV18 have only limited corrosion resistance on the end faces. This also applies to any soft-annealed areas.

Solid shafts, hollow shafts

Hardness, surface, tolerances, lengths

A uniform hardening depth will ensure a smooth transition from the hardened surface layer to the tough, normally annealed core, which can support bending stresses.

The standard surface is Ra 0,3.

Solid shafts have the normal tolerance h6, while hollow shafts have h7.

High precision shafts are available in single piece lengths up to 6 000 mm. Longer shafts are available by agreement and are assembled (with mortice and tenon joints).

Available steels and tolerances, see page 112.

Coatings

Coatings and hard chromium coating provide optimum anti-wear and anti-corrosion protection for shafts and are optional.
The characteristics of the coatings are also shown in the table Coatings, page 111.

Hard chromium coating – Anti-wear protection

Hard chromium coating is suitable for applications in which a high degree of anti-wear protection is required. The chromium coating also offers good corrosion resistance.

Chromium coated shafts are to tolerance h7.
The thickness of the chromium coating is at least 5 μm, the hardness is 800 HV to 1 050 HV.

The suffix is CR.

Corrotect® – Anti-corrosion protection

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

The inside diameter of hollow shafts is not coated.

Corrotect® is resistant to neutral, organic fluids such as oil, brake fluid and petrol. For applications where aqueous salt solutions in the pH range from 5 to 10 are present, Corrotect® is also suitable due to its good resistance.

The suffix is RRF.

!

Corrotect® reduces the adhesion of weld spatter.

Corrotect® can be worn away by contact seals.

The coating is not permitted for direct contact with foodstuffs and is not suitable in abrasive ambient media.

For application in the food industry, the Schaeffler Group also offers the special coating Corrotect® Cr(VI)-free.

It thus complies with the requirements for RoHS in accordance with EU Directive 2002/95/EC. All other advantages are identical with the standard Corrotect® coating.

The suffix is RROC.

Coatings

Feature	Coating		
	Corrotect®		**Hard chromium**
	Cr(VI)-containing[1]	CR(VI)-free	
Suffix	RRF	RROC	–
Colour	Black	Colourless, blue to iridescent	Chromium
Coating thickness in µm	0,5 – 5,0	0,5 – 5,0	5,0 – 15,0
Composition	Zinc alloyed with iron and cobalt	Zinc alloyed with iron	Chromium
Coating hardness in HV	300	300	800 – 1 050
Anti-corrosion protection[2] in h	96	96	120
Anti-wear protection	–	–	yes
Maximum shaft length in mm	3 500	3 500	∅ 6 – 8 = 3 900 ∅ ≧ 10 = 5 900
Cr(VI)-free	no	yes	no

[1] Cr(VI)-containing parts are not suitable for the food industry.

[2] Salt spray test to DIN 50021.

! Machined surfaces, end faces and bores may be uncoated.

Available materials, coatings, tolerances
Solid and hollow shafts

Shaft diameter	Solid shafts					Hollow shafts
	Material					
	Quenched and tempered steel			X46Cr13	X90CrMoV18	Quenched and tempered steel
	Tolerance[3)]	CR[1)]	RRF RROC[2)]			Tolerance
mm	h6	h7	h6	h6	h6	h7
4	●	–	■	–	●	–
5	●	–	■	–	–	–
6	●	●	■	●	●	–
8	●	●	■	●	●	–
10	●	●	■	●	●	–
12	●	●	■	●	●	●
14	●	●	■	●	●	–
15	●	●	■	●	●	–
16	●	●	■	●	●	●
20	●	●	■	●	●	●
25	●	●	■	●	●	●
30	●	●	■	●	●	●
40	●	●	■	●	●	●
50	●	●	■	●	●	●
60	●	●	■	–	–	●
80	●	●	■	–	–	●

■ Available by agreement.
● Available design.

1) Hard chromium coating, see page 110.
2) Corrotect® coating, see page 110.
3) Other tolerances available by agreement.

Solid shafts with threaded holes

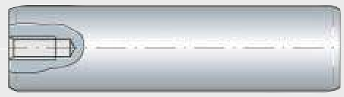
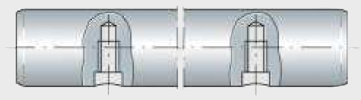
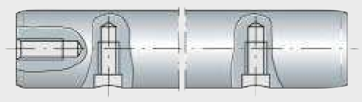
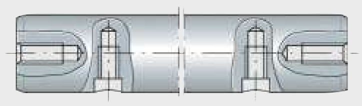
Where shafts are to be supported or connected to other elements, fixing holes are required.

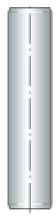
The standard threaded holes for solid shafts are defined as hole patterns B01 to B05 in accordance with the table.

In addition, holes may be made in accordance with a customer drawing with or without threads, *Figure 1*, page 114 to *Figure 13*, page 117.

Ordering examples, see page 121.

Codes for hole patterns

Code		Design of holes
B01		Axial threaded hole on one side
B02		Axial threaded holes on both sides
B03		Radial threaded holes
B04		Radial threaded holes and axial threaded hole on one side
B05		Radial threaded holes and axial threaded holes on both sides



Shafts according to customer requirements

In order to place enquiries for special shafts, please use your own drawing or copy our templates and complete using the required values, *Figure 1* to *Figure 13*, page 117.

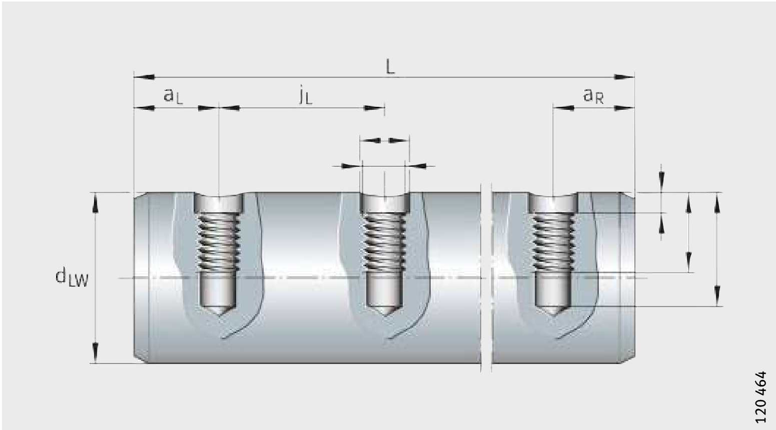
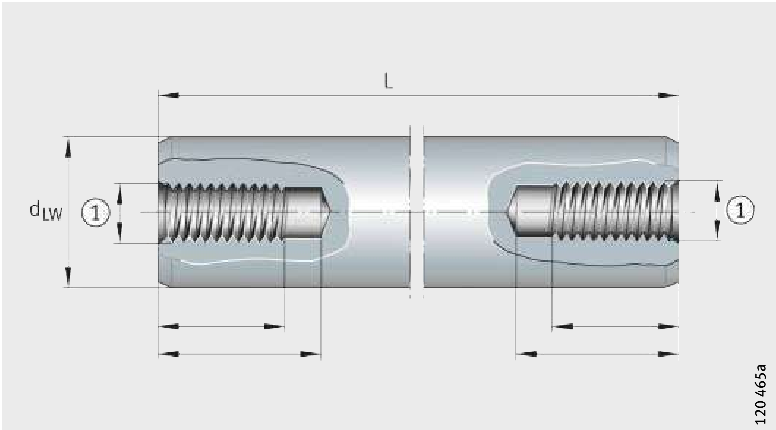
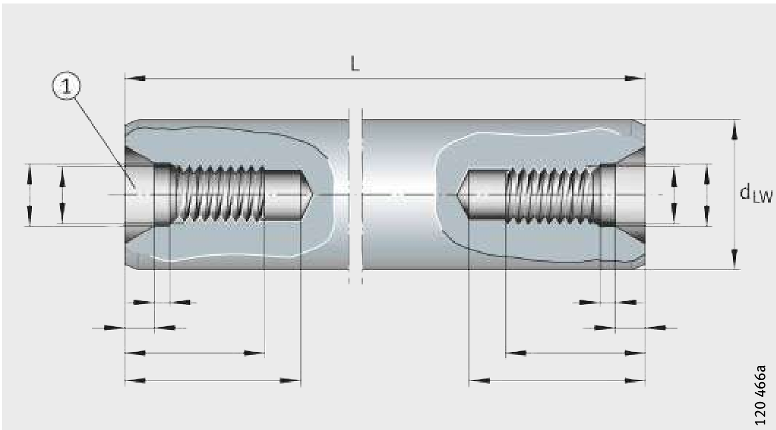


Figure 1
Radial holes
with and without threads



1 Diameter to DIN 336 or DIN 13

Figure 2
Internal threaded hole,
on one or both sides



1 For threaded hole with centring hole DIN 332-D recommended

Figure 3
Internal threaded hole
with centring hole

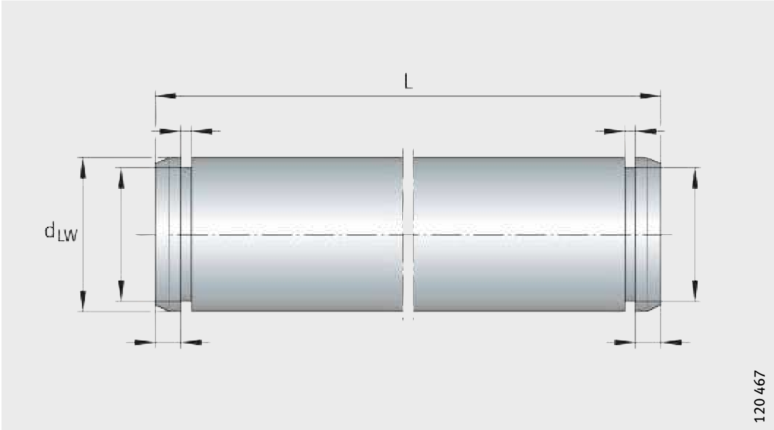


Figure 4
Undercut for retaining ring

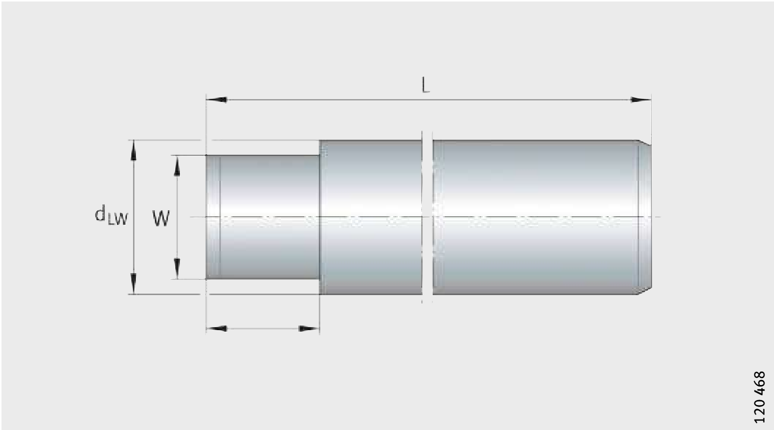
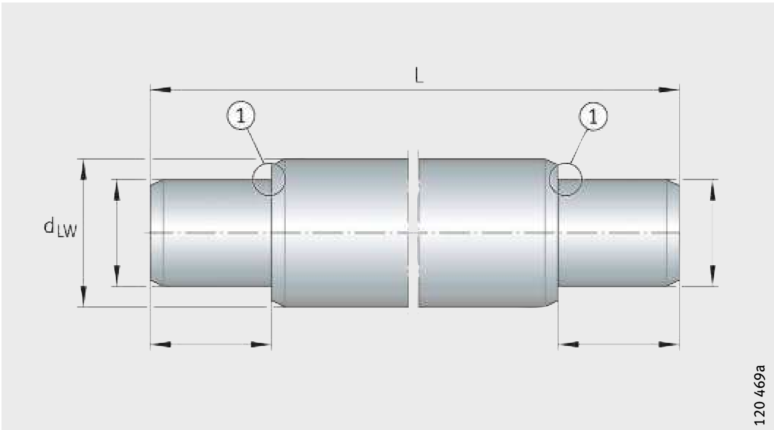


Figure 5
Width across flats W



① Undercut type F DIN 509 (both sides)

Figure 6
Journal

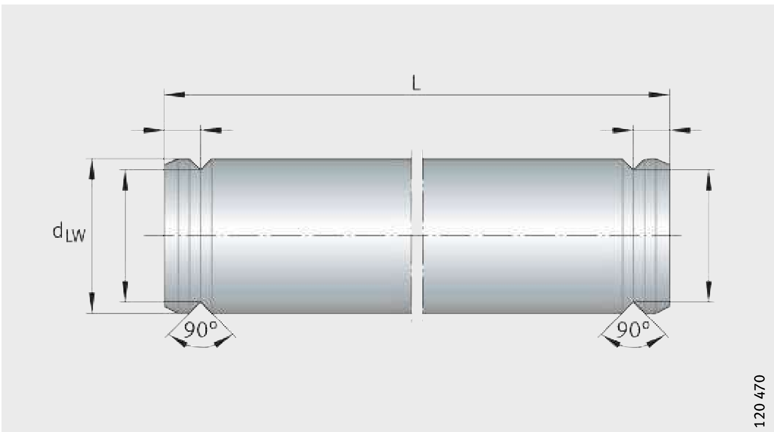
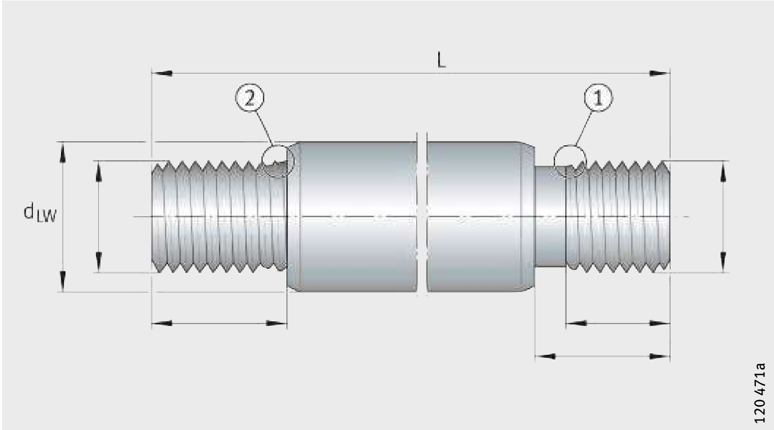
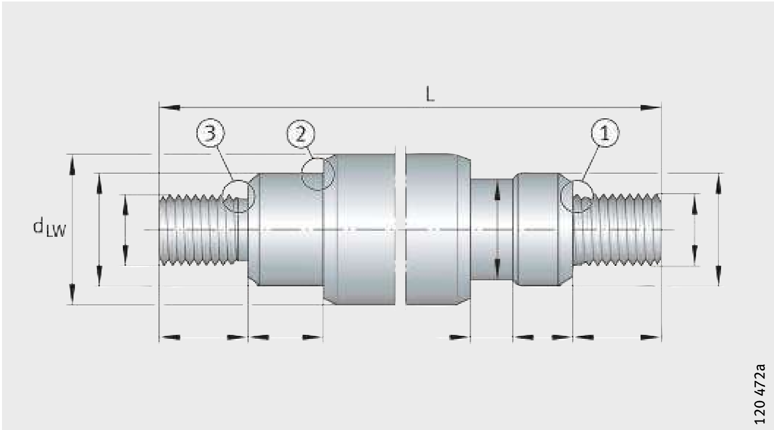


Figure 7
90° undercut



① Thread runout to DIN 76-1A, with undercut to DIN 76-A
② With undercut, DIN 76-A recommended

Figure 8
Threaded journal



① With undercut, DIN 76-A recommended
② With undercut type F, DIN 509 recommended
③ Thread runout to DIN 76-1A

Figure 9
Journal and threaded journal

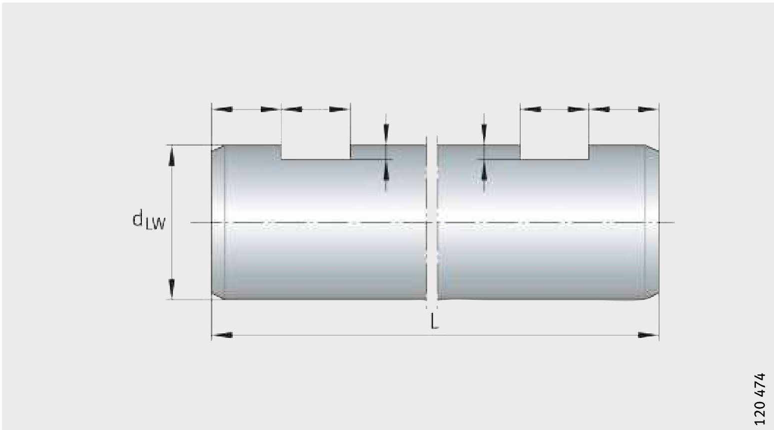


Figure 10
Slot

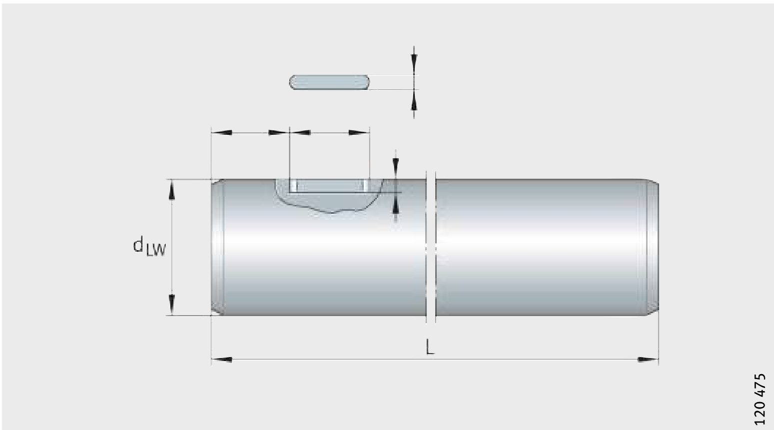


Figure 11
Keyway

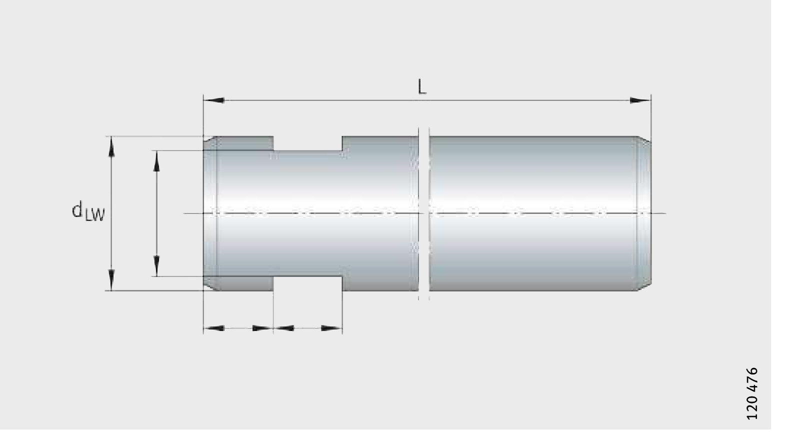


Figure 12
Width across flats

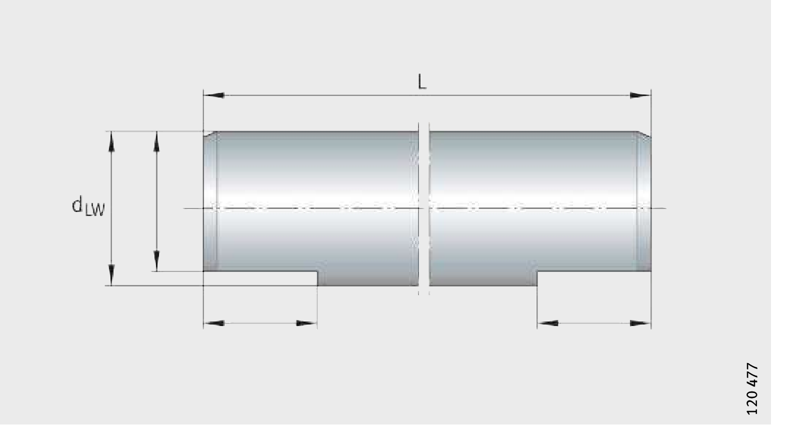


Figure 13
Flattened area

Shaft machining, shaft specification

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, *Figure 14*. Material discolouration may occur in the annealed area and there may be residual hardness in the transitional zone.

In the case of corrosion-resistant steels, the X class materials, the anti-corrosion protection is restricted here.

x = soft annealed area

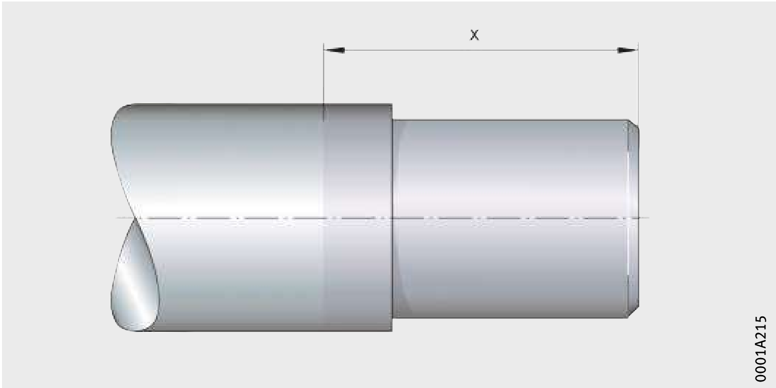


Figure 14
Soft annealed shaft

Standard chamfer

After cutting to length, both ends of the shaft are chamfered, *Figure 15* and table. However, they can also be supplied without chamfers as a parting cut, *Figure 16*, page 119.

Chamfer, as a function of shaft diameter

Shaft diameter d_{LW} mm	Chamfer x mm	Axial runout t_4 mm
$d_{LW} \leqq 8$	$0{,}5 \times 45°$	0,2
$8 < d_{LW} \leqq 10$	1^{+1}	0,2
$10 < d_{LW} \leqq 30$	$1{,}5^{+1}$	0,3
$30 < d_{LW} \leqq 80$	$2{,}5^{+1}$	0,5

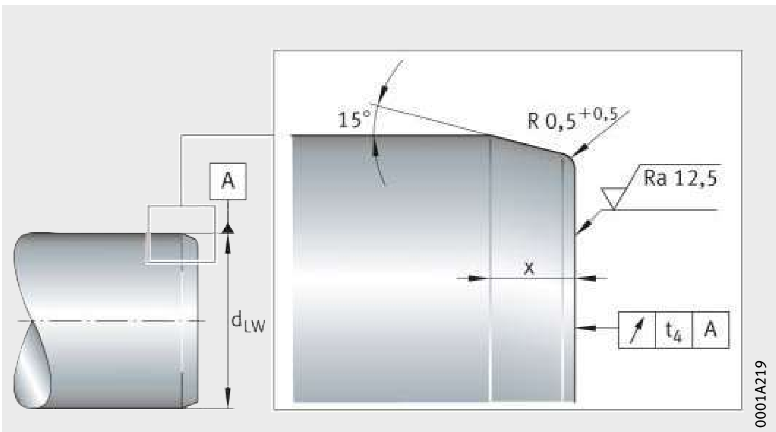


Figure 15
Standard chamfer

Parting cut

In the case of a parting cut, the shaft is only cut to length, *Figure 16*. There is no additional machining of the end faces. A burr may be present. The suffix is T.

t_4 = axial runout tolerance, table, page 118

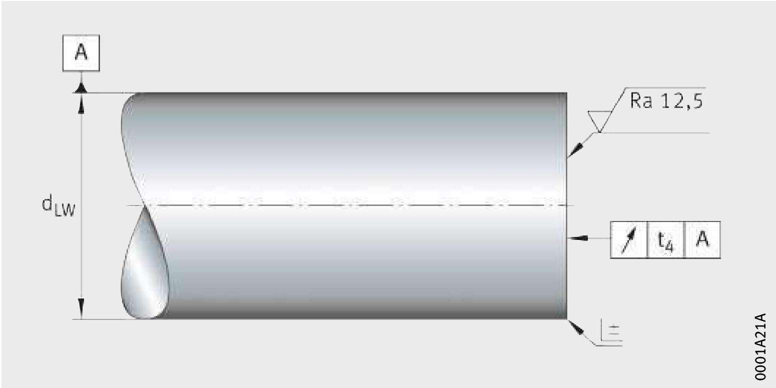


Figure 16
Parting cut

Straightness

The standard straightness is shown in *Figure 17*.

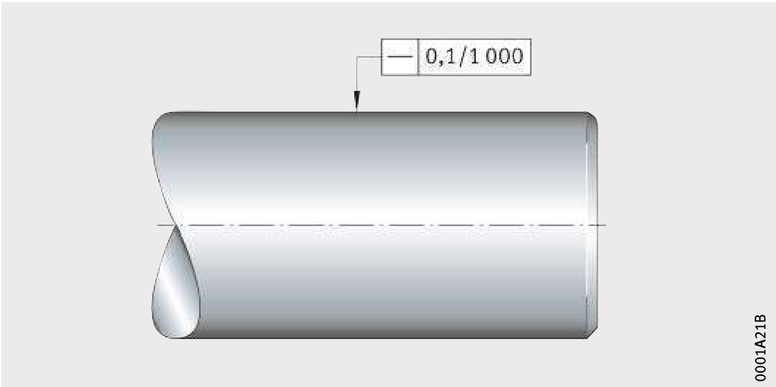


Figure 17
Straightness

Shafts 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, *Figure 18*. The joints are marked accordingly. Shafts screwed together are available by agreement.

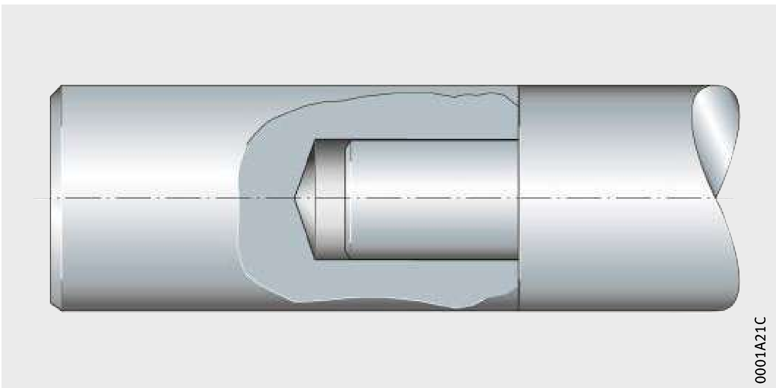


Figure 18
Shaft with mortice and tenon joint

Solid shafts, hollow shafts

Accuracy

Length tolerance

Length tolerances are dependent on the shaft length, see table and *Figure 19*.

Special tolerances are available by agreement.

Tolerance

Shaft length L mm		Tolerance mm
over	incl.	max.
–	400	±0,5
400	1 000	±0,8
1 000	2 000	±1,2
2 000	4 000	±2
4 000	6 000	±3

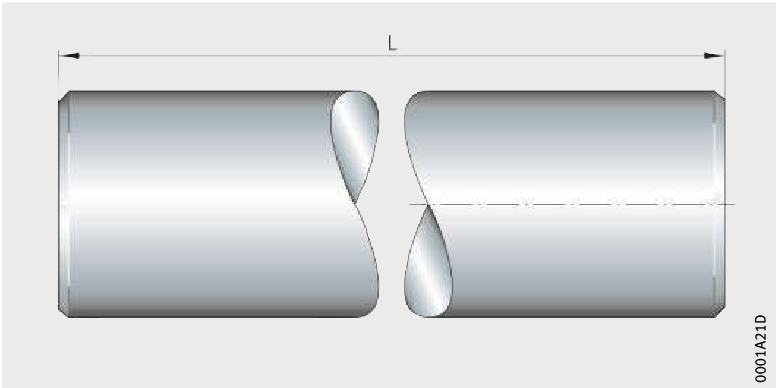


Figure 19
Length tolerance

Straightness value to ISO 13012

The measurement points are separated by a distance of 1 000 mm. Shafts < 1 000 mm have a maximum of two measurement points, *Figure 20*.

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

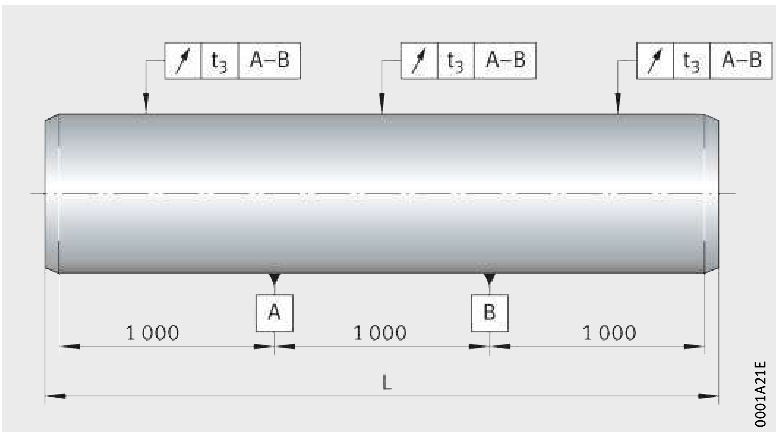


Figure 20
Straightness measurement

Ordering example, ordering designation

Solid shaft, without machining

Type	W
Shaft diameter d_{LW}	20
Tolerance	h6
Material	Cf53
Coating	–
Length	1 200
Parting cut	–
Standard chamfer	No suffix

Ordering designation **W20/h6-Cf53-1200**

Hollow shaft, without machining

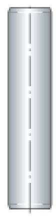
Type	WH
Shaft diameter d_{LW}	20
Tolerance	h7
Material	C60
Coating	–
Length	1 500
Parting cut	T
Standard chamfer	–

Ordering designation **WH20/h7-C60-1 500-T**

Solid shaft, with machining

Type	W
Shaft diameter d_{LW}	30
Tolerance	h7
Material	Cf53
Coating	Cr
Hole pattern	B05
Axial threaded hole	M12
Radial threaded hole	M10
Hole pitch, radial threaded hole	100
Length	1 110
Parting cut	T
Standard chamfer	–
Distance a_L	60
Distance a_R	50

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



Solid shaft, according to customer requirements

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

Possible ordering designation for standard shafts

Type	W, WH
Shaft diameter d_{LW}	10 to 80
Tolerance[1)]	h6, h7
Material[2)]	Cf53, X46, X90
Coating	Cr, RROC
Hole pattern	B01, B02, B03, B04, B05
Axial threaded hole[3)]	M3 to M24
Radial threaded hole[3)]	M4 to M14
Hole pitch, radial threaded hole j_L	Measured from centre point of hole, *Figure 21*
Length[3)]	Single piece up to 6 000
Parting cut	T
Standard chamfer	No suffix
Distance a_L	Start of shaft – first hole, *Figure 21*
Distance a_R	Last hole – end of shaft, *Figure 21*

1) Available tolerances are dependent on diameter, see dimension table page 124 and page 126.

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

3) Dependent on diameter, see dimension table page 124 to page 126.

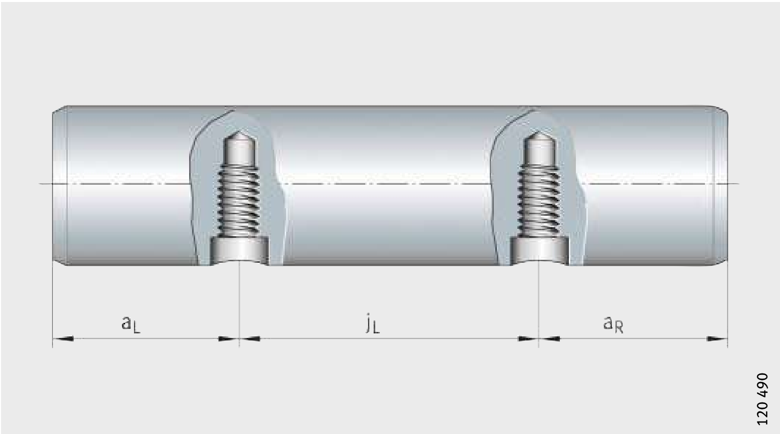


Figure 21
Hole pitch of radial threaded hole j_L

Shaft guidance system

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

The ordering designation of an element comprises the designation and additional specific data – where necessary, see ordering designation for shaft with axial threaded hole, linear ball bearing and *Figure 22*.

The designations are given in the dimension tables.
The unit is described in greater detail by means of the additional data.

Required

A shaft guidance system in a corrosion-resistant design with two sealed and corrosion-resistant linear ball bearings.

Shaft with axial threaded holes

Shaft with axial threaded holes	Corrosion-resistant shaft	W20/h6-X90
	Code for hole pattern	B02
	Axial threaded hole	M8
	Shaft length	3 500

Ordering designation: 1×**W20/h6-X90-B02/M8-3500**

Linear ball bearing	Linear ball bearing	KB
	Size code	20
	Contact seals on both end faces	PP
	Corrotect® coating	RR
	Relubrication facility	AS

Ordering designation: 2×**KB20-PP-RR-AS**

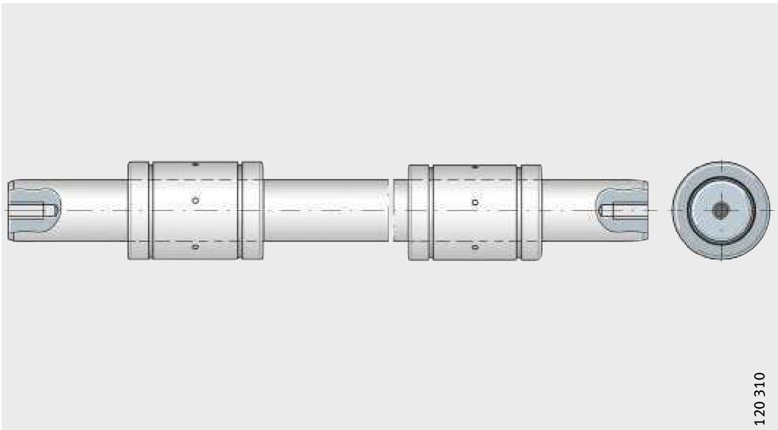
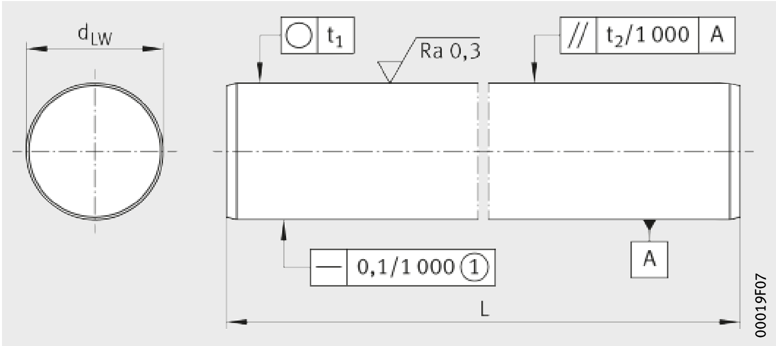


Figure 22
Shaft with axial threaded holes, two linear ball bearings

Solid shafts



W

① 3)

Dimension table · Dimensions in mm

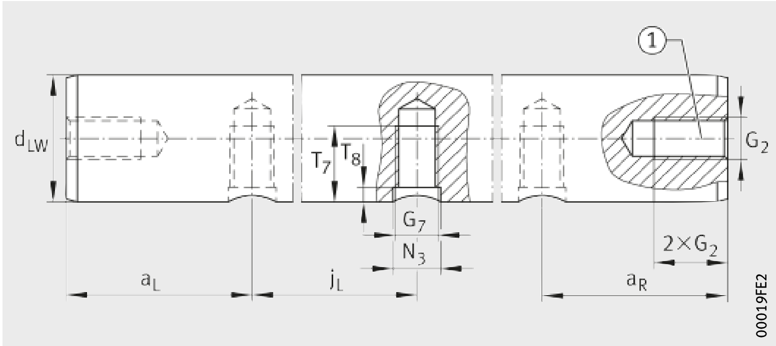
Designation	Mass	Dimensions		Tolerance	Roundness	Parallelism	Surface hardening depth
	m	d_{LW}	L	h6	t_1	t_2 [1]	SHD [2]
	≈kg/m			µm	µm	µm	min.
W04	0,1	**4**	2 500	$^{0}_{-8}$	4	5	0,4
W05	0,15	**5**	4 000	$^{0}_{-8}$	4	5	0,4
W06	0,22	**6**	4 000	$^{0}_{-8}$	4	5	0,4
W08	0,39	**8**	4 000	$^{0}_{-9}$	4	6	0,4
W10	0,62	**10**	6 000	$^{0}_{-9}$	4	6	0,4
W12	0,89	**12**	6 000	$^{0}_{-11}$	5	8	0,6
W14	1,21	**14**	6 000	$^{0}_{-11}$	5	8	0,6
W15	1,39	**15**	6 000	$^{0}_{-11}$	5	8	0,6
W16	1,58	**16**	6 000	$^{0}_{-11}$	5	8	0,6
W20	2,47	**20**	6 000	$^{0}_{-13}$	6	9	0,9
W25	3,85	**25**	6 000	$^{0}_{-13}$	6	9	0,9
W30	5,55	**30**	6 000	$^{0}_{-13}$	6	9	0,9
W40	9,87	**40**	6 000	$^{0}_{-16}$	7	11	1,5
W50	15,41	**50**	6 000	$^{0}_{-16}$	7	11	1,5
W60	22,2	**60**	6 000	$^{0}_{-19}$	8	13	2,2
W80	39,45	**80**	6 000	$^{0}_{-19}$	8	13	2,2

1) Differential diameter measurement.

2) To DIN ISO 13012.

3) ① For shaft length < 400 mm, max. straightness tolerance of 0,04 mm.

Recommended threaded holes for solid shafts

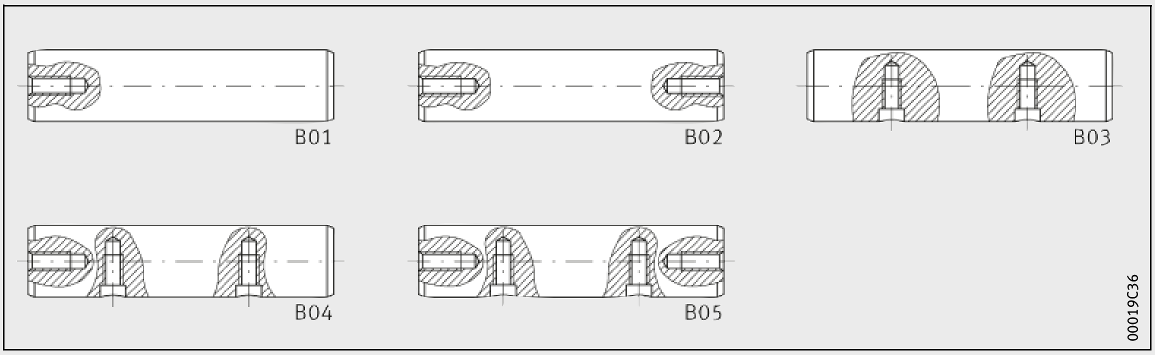


Axial and radial threaded holes
1 2)

Dimension table · Dimensions in mm																			
Designation d_{LW}	Axial threaded hole G_2									Radial threaded hole j_L			$a_{L\,min}$ 1) Hole pattern B03	$a_{R\,min}$ 1) Hole pattern B04–B05	T_7	T_8	N_3	G_7
W08	M3	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–
W10	M3	M4	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–
W12	–	M4	M5	–	–	–	–	–	–	–	75	–	120	10		7	2	5	M4
W14	–	M4	M5	M6	–	–	–	–	–	–	–	–	–	–		–	–	–	–
W15	–	–	M5	M6	M8	–	–	–	–	–	–	–	–	–		–	–	–	–
W16	–	–	M5	M6	M8	–	–	–	–	–	75	100	150	15		9	2,5	6	M5
W20	–	–	–	–	–	–	–	–	–	–	–	–	150	15		9	2,5	6	M5
W20	–	–	–	M6	M8	M10	–	–	–	–	75	100	150	15		11	3	7	M6
W25	–	–	–	–	–	–	–	–	–	–	–	–	150	15		11	3	7	M6
W25	–	–	–	–	M8	M10	M12	–	–	–	75	120	200	15	$3 \cdot G_2 + G_7$	15	3	9	M8
W30	–	–	–	–	–	–	–	–	–	–	–	–	150	15		11	3	7	M6
W30	–	–	–	–	–	M10	M12	M16	–	–	100	150	200	20		17	3,5	11	M10
W40	–	–	–	–	–	M10	M12	M16	–	–	150	200	300	20		19	4	11	M10
W40	–	–	–	–	–	M10	M12	M16	–	–	100	–	–	20		21	4	13	M12
W40	–	–	–	–	–	–	–	–	–	–	–	–	150	20		19	4	11	M10
W50	–	–	–	–	–	–	M12	M16	M20	–	–	200	300	20		21	4	13	M12
W50	–	–	–	–	–	–	M12	M16	M20	–	100	–	–	20		25	4	15	M14
W60	–	–	–	–	–	–	–	M16	M20	M24	–	–	–	–		–	–	–	–
W80	–	–	–	–	–	–	–	M16	M20	M24	–	–	–	–		–	–	–	–

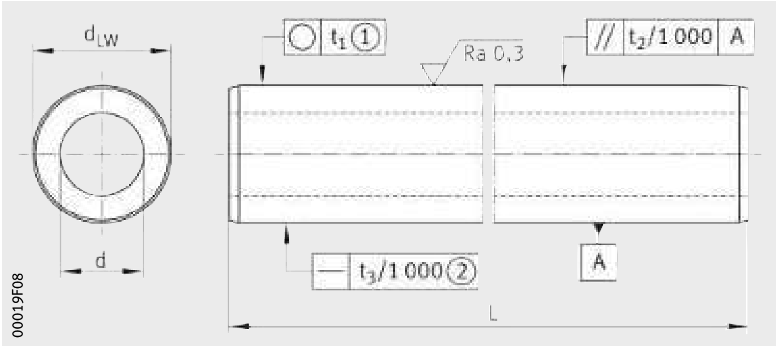
1) a_L, a_R are dependent on the length of the shaft.
Calculation, see page 134.
In the case of variants in accordance with codes B04 and B05, the axial threaded holes must be taken into consideration.

2) 1 Depending on the hole diameter, the shaft diameter may be larger in the region of the axial hole, as a result of which there may be a deviation from the tolerances.



Codes B01 to B05 for hole patterns

Hollow shafts



WH
①, ② 4)

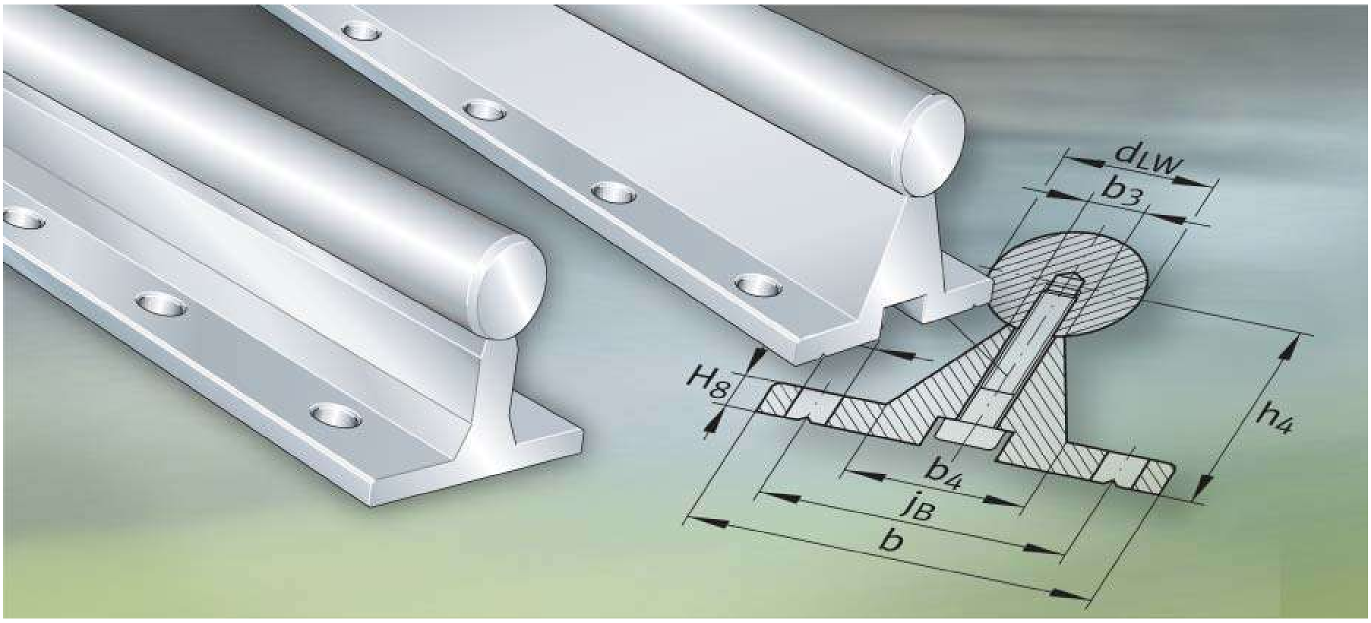
Dimension table · Dimensions in mm								
Designation	Mass	Dimensions		Inside diameter	Tolerance	Parallelism	Straightness tolerance	Surface hardening depth
	m	d_{LW}	L	d[1]	d_{LW} h7[3]	t_2	t_3	SHD[2]
	≈kg/m		max.		µm	µm	µm	min.
WH12	0,79	**12**	5 700	4 ±0,45	$^{0}_{-18}$	7	0,3	0,8
WH16	1,26	**16**	5 700	7 ±0,15	$^{0}_{-18}$	7	0,3	0,8
WH20	1,28	**20**	6 000	14 ±0,15	$^{0}_{-21}$	9	0,2	1,2
WH25	2,4	**25**	7 100	15,4 ±0,15	$^{0}_{-21}$	9	0,2	1,2
WH30	3,55	**30**	7 100	18 ±0,15	$^{0}_{-21}$	9	0,2	1,5
WH40	5,7	**40**	7 100	26 ±0,15	$^{0}_{-25}$	11	0,1	1,5
WH50	10,58	**50**	6 500	28 ±0,25	$^{0}_{-25}$	11	0,1	1,5
WH60	14,2	**60**	7 300	36 ±0,3	$^{0}_{-30}$	13	0,1	1,5
WH80	20,8	**80**	7 300	57,4 ±0,35	$^{0}_{-30}$	13	0,1	2,2

1) Difference in the wall thickness relative to the original material ±5%.

2) To DIN ISO 13012.

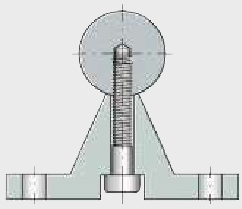
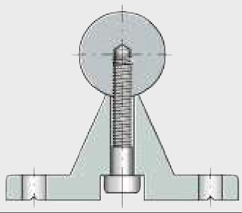
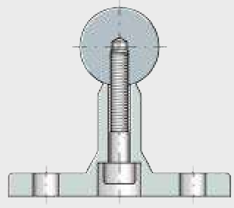
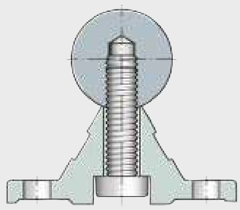
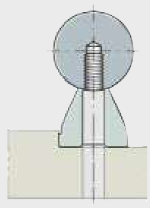
3) Diameter tolerance h6 available by agreement.

4) ① The roundness corresponds to no more than half the diameter tolerance.
② For shaft length < 500 mm, max. straightness tolerance of 0,1 mm.



Shaft and support rail units

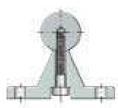
Matrix for preselection of shaft and support rail units

Shaft and support rail units	Precision
TSNW 	+++
TSWW 	+++
TSWWA 	+++
TSNW..-G4 **TSNW..-G5** 	++
TSUW 	+++

Definition:
+++ Very good
++ Good
● Available

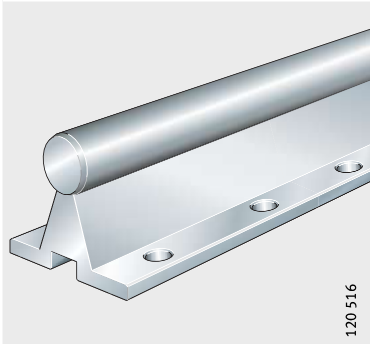
1) Location by screw mounting from below; threaded hole in the shaft.

Shaft diameter d_{LW} in mm							Features	Location		Description
								Thread	Through hole	
12	16	20	25	30	40	50				Page
●	●	●	●	●	●	●	For location from above	–	yes	133
●	●	●	●	●	●	●	For location from above High position of shaft	–	yes	133
●	●	●	●	●	–	–	For location from above Narrow crosspiece	–	yes	133
●	●	●	●	●	●	–	For location from above Accuracy class (G4, G5) dependent on shaft diameter Economical	–	yes	133
●	●	●	●	●	●	●	Threaded holes from below	1)	–	133

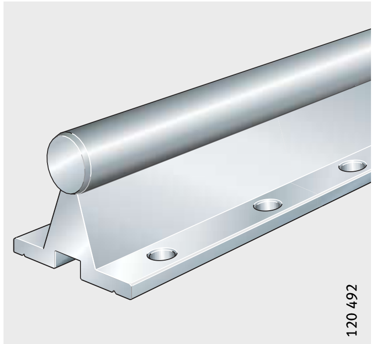


Shaft and support rail units

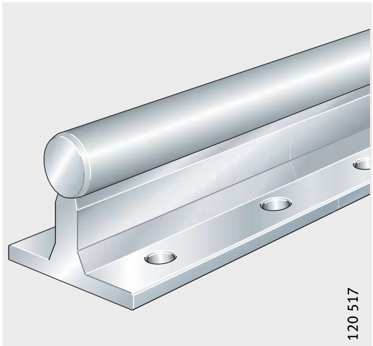
TSNW



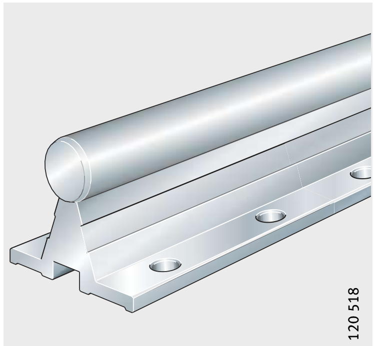
TSWW



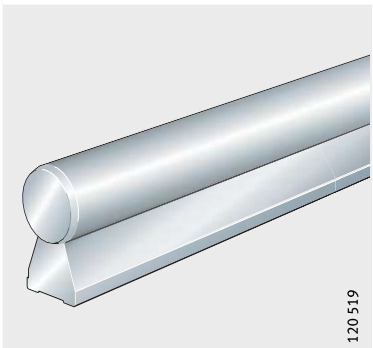
TSWWA



TSNW..-G4, TSNW..-G5



TSUW



Shaft and support rail units

Features

Shaft and support rail units TS..W are composite units comprising a raceway shaft screw mounted to an aluminium support rail. The shaft protrudes approx. 2 mm to 3 mm beyond the end of the support rail at both ends.

The raceway shaft is made from quenched and tempered steel, see page 109. Corrosion-resistant design available by agreement.

Shaft and support rail units are composed of several individual sections depending on their length.

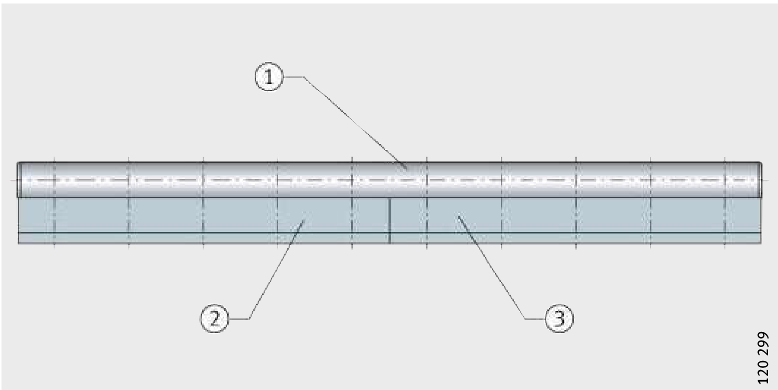
Shafts made from special materials such as those with coatings are available by agreement.

Multi-piece raceway shafts and shaft and support rail units

If the guidance systems are of such a length that shaft and support rail units TS..W cannot be achieved using single-piece shafts, shafts and support rails are supplied as multi-piece units, *Figure 1*. The joint locations on the shaft sections have mortice and tenon joints and are polished.

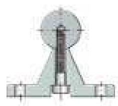
The joint locations on the shafts and support rails are offset from each other.

The maximum length of single-piece shaft and support rail units is 6 000 mm.



① Shaft
② Support rail 1
③ Support rail 2

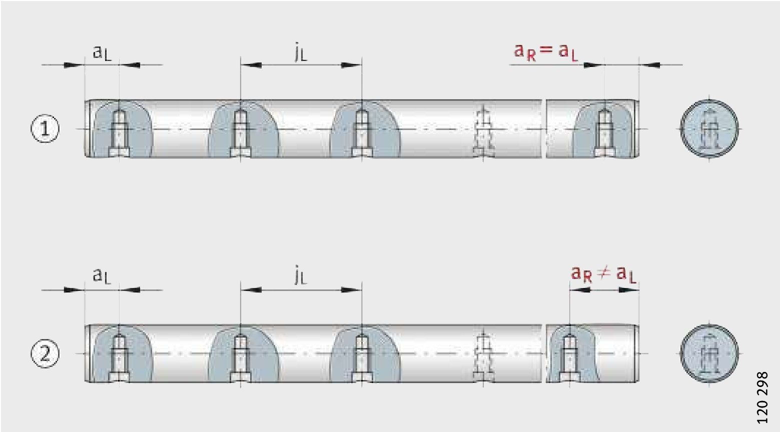
Figure 1
Shaft and support rail unit with multiple support rail sections



Design and safety guidelines
Hole patterns for shaft and support rail units

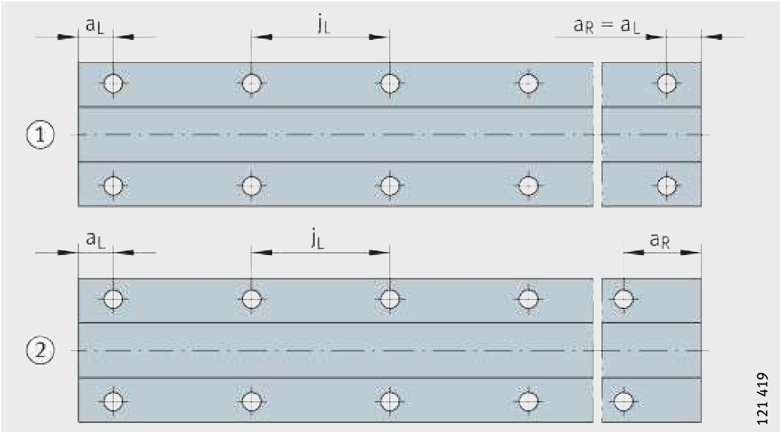
Unless stated otherwise, raceway shafts and shaft and support rail units are supplied with a symmetrical hole pattern, *Figure 2* to *Figure 4*.

An asymmetrical hole pattern may be available at customer request. In this case, $a_{L\,max} \geqq a_L \geqq a_{L\,min}$ and $a_{R\,max} \geqq a_R \geqq a_{R\,min}$.



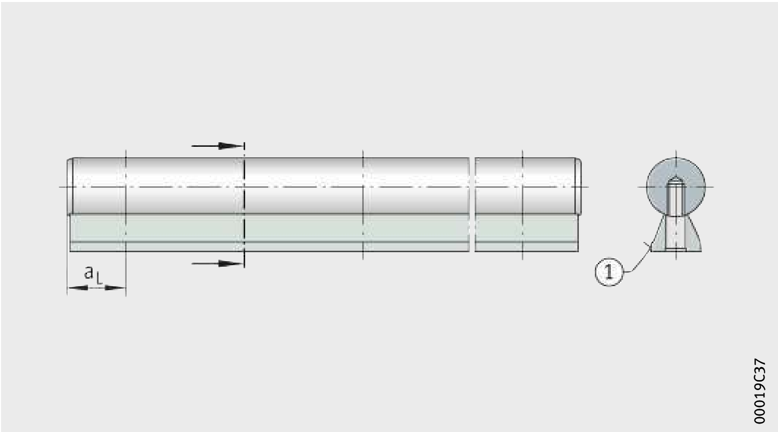
① Symmetrical hole pattern
② Asymmetrical hole pattern

Figure 2
Hole patterns for shafts with one row of holes



① Symmetrical hole pattern
② Asymmetrical hole pattern

Figure 3
Hole patterns for support rails with two rows of holes



① Support rail

Figure 4
Hole patterns for shaft and support rail unit TSUW

Maximum number of pitches between holes

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

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

The distances a_L and a_R are generally determined by:

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

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

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

Number of holes:

$$x = n + 1$$

n mm
Maximum possible number of pitches or recommended distance between screws on shaft and support rail units with T-slots

l mm
Length of shaft and support rail unit

a_L, a_R mm
Distance between start or end of shaft and support rail unit and nearest hole

$a_{L\,min}$, $a_{R\,min}$ mm
Minimum values for a_L, a_R according to dimension tables

$a_{L\,max}$, $a_{R\,max}$ mm
Maximum values for a_L, a_R according to dimension tables

j_L mm
Distance between holes

x mm
Number of holes on shaft and support rail units with T-slots: number of screws.

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 shaft and support rail unit TSUW is shown in *Figure 4*, page 134.

Accuracy
Length tolerances for shafts and shaft and support rail units

The length tolerances are shown in the table.

Tolerances

Length of shaft or shaft and support rail unit L mm	Length tolerance mm
Single-piece and multi-piece raceway shaft and support rail units	±0,1% of total length
L ≦ 400	±0,5
400 < L ≦ 1 000	±0,8
1 000 < L ≦ 2 000	±1,2
2 000 < L ≦ 4 000	±2
4 000 < L ≦ 6 000	±3

Ordering example, ordering designation

Shaft and support rail unit

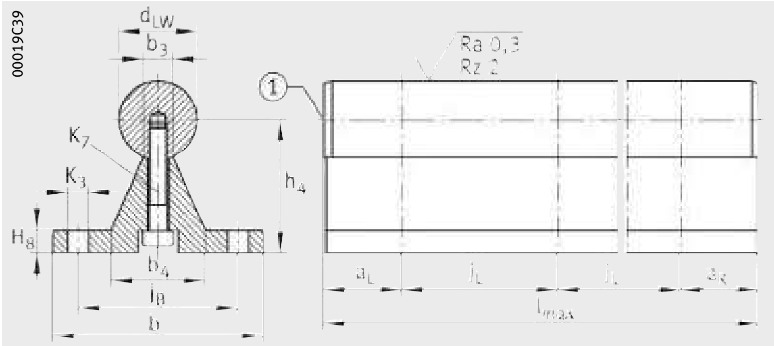
Type	TSNW
Shaft diameter d_{LW}	25
Length	1 253
Distance a_L	26
Distance a_R	27
Corrosion-resistant design	Available by agreement

Ordering designation **TSNW25-1253-26-27**

Possible ordering designation for standard shaft and support rail units

Type	TSWW, TSNW, TSUW, TSWWA
Shaft diameter d_{LW}	12 to 50
Length	1 200
Distance a_L	Start of shaft – first hole
Distance a_R	Last hole – end of shaft
Corrosion-resistant design	Available by agreement

Shaft and support rail units



TSNW
① 5)

Dimension table · Dimensions in mm

Designation	Mass	Dimensions				Mounting dimensions								
	m	d_{LW}	b	h_4 1)	l_{max} 2)	b_3	b_4	j_B	j_L	a_L/a_R 3)		H_8	K_3 4)	K_7
	≈g/m	h6		±0,02	±3					min.	max.			ISO 4762
TSNW12	1 670	**12**	40	22	6 000	5	17	29	75	20	69	5	4,5	M4×18
TSNW16	2 950	**16**	45	26	6 000	6,8	22,4	33	100	20	93	5	5,5	M5×22
TSNW20	3 950	**20**	52	32	6 000	7,5	26,3	37	100	20	92	6	6,6	M6×25
TSNW25	5 600	**25**	57	36	6 000	9,8	30	42	120	20	110	6	6,6	M8×30
TSNW30	7 880	**30**	69	42	6 000	11	33,4	51	150	20	139	7	9	M10×35
TSNW40	12 830	**40**	73	50	6 000	14,5	39,4	55	200	20	189	8	9	M10×35
TSNW50	19 380	**50**	84	60	6 000	18,5	45,2	63	200	20	188	9	11	M12×40

1) In relation to the nominal shaft diameter, measured whilst clamped.

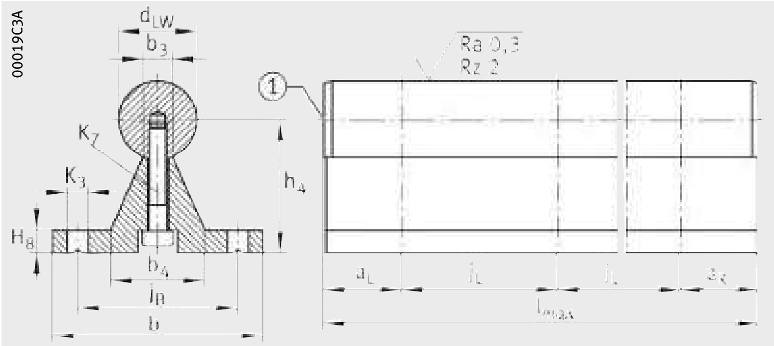
2) Maximum length of single-piece shaft and support rail units; longer shaft and support rail units, see page 133.
Depending on the length of the shaft and support rail unit, the support rail is composed of several individual sections.

3) Dimensions a_L/a_R are dependent on the length of the shaft and support rail unit.
Calculation, see page 135.

4) For fixing screws DIN 7984.
If there is a possibility of settling, the screws should be secured against rotation.

5) ① The shaft may if necessary protrude on both sides beyond the support rail by approx. 3 mm.

Shaft and support rail units



TSWW
① 5)

Dimension table · Dimensions in mm														
Designation	Mass	Dimensions				Mounting dimensions								
	m	d_{LW}	b	h_4 1)	l_{max} 2)	b_3	b_4	j_B	j_L	a_L/a_R 3)		H_8	K_3 4)	K_7
	≈g/m	h6		±0,02	±3					min.	max.			ISO 4762
TSWW12	1 670	**12**	40	22	6 000	5	17	29	120	20	114	5	4,5	M4×18
TSWW16	3 150	**16**	54	32	6 000	6,8	24,7	41	150	20	143	6	5,5	M5×25
TSWW20	4 030	**20**	54	34,02	6 000	7,8	24,7	41	150	20	143	6	5,5	M5×25
TSWW25	5 900	**25**	65	39,66	6 000	9,3	30,3	51	150	20	142	6	6,6	M6×30
TSWW30	7 580	**30**	65	42,19	6 000	9,3	30,3	51	150	20	142	6	6,6	M6×30
TSWW40	14 250	**40**	85	60	6 000	16,3	46	65	150	20	139	10	9	M10×45
TSWW50	19 750	**50**	85	65,06	6 000	16,3	46	65	150	20	139	10	9	M10×45

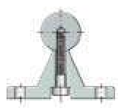
1) In relation to the nominal shaft diameter, measured whilst clamped.

2) Maximum length of single-piece shaft and support rail units; longer shaft and support rail units, see page 133.
Depending on the length of the shaft and support rail unit, the support rail is composed of several individual sections.

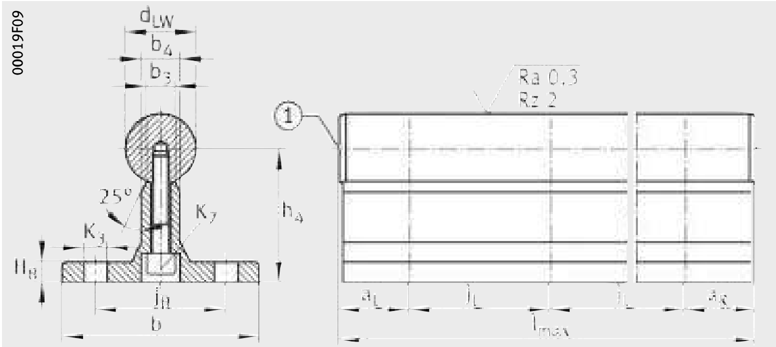
3) Dimensions a_L/a_R are dependent on the length of the shaft and support rail unit.
Calculation, see page 135.

4) For fixing screws ISO 4762 or ISO 4017 (TSWW12, DIN 7984).
If there is a possibility of settling, the screws should be secured against rotation.

5) ① The shaft may if necessary protrude on both sides beyond the support rail by approx. 3 mm.



Shaft and support rail units



TSWWA
① [6)]

Dimension table · Dimensions in mm

Designation	Mass	Dimensions				Mounting dimensions								
	m	d_{LW}	b	h_4 [1)]	l_{max} [2)]	b_3	b_4	j_B	j_L	a_L/a_R [3)]		H_8	K_3 [4)]	K_7
	≈g/m	h6		±0,02	±3					min.	max.			ISO 4762
TSWWA12	1 930	**12**	43	28	6 000	5,4	9	29	75	20	69	5	4,5	M4×25 [5)]
TSWWA16	2 800	**16**	48	30	6 000	7	10	33	100	20	93	5	5,5	M5×25
TSWWA20	4 120	**20**	56	38	6 000	8,2	11	37	100	20	92	6	6,6	M6×30
TSWWA25	5 830	**25**	60	42	6 000	10,4	14	42	120	20	110	6	6,6	M8×30
TSWWA30	8 500	**30**	74	53	6 000	11	14	51	150	20	139	8	9	M10×40

[1)] In relation to the nominal shaft diameter, measured whilst clamped.

[2)] Maximum length of single-piece shaft and support rail units; longer shaft and support rail units, see page 133.
Depending on the length of the shaft and support rail unit, the support rail is composed of several individual sections.

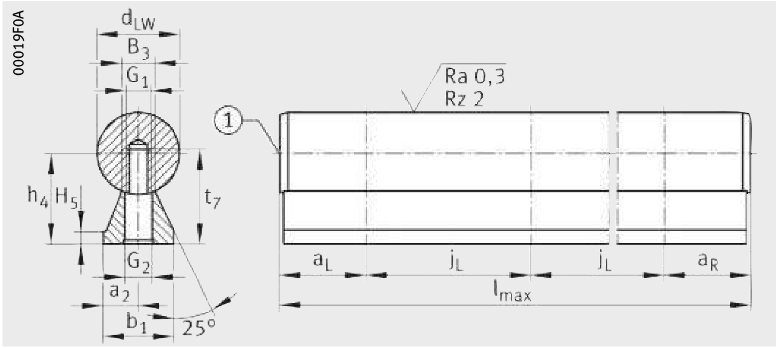
[3)] Dimensions a_L/a_R are dependent on the length of the shaft and support rail unit.
Calculation, see page 135.

[4)] For fixing screws ISO 4762 or ISO 4017.
If there is a possibility of settling, the fixing screws should be secured against rotation.

[5)] Screws DIN 7984.

[6)] ① The shaft protrudes on both sides beyond the support rail by approx. 2 mm.

Shaft and support rail units



TSUW
① 4)

Dimension table · Dimensions in mm

Designation	Mass	Dimensions				Mounting dimensions								
	m	d_{LW}	b_1	h_4 1)	l_{max} 2)	a_2	B_3	j_L	a_L/a_R 3)		H_5	G_1	G_2	t_7
	≈g/m	h6		±0,02	±3				min.	max.				
TSUW12	1 100	**12**	11	14,5	6 000	5,5	5	75	20	70	3	M4	4,5	15,5
TSUW16	1 880	**16**	14	18	6 000	7	6,8	75	20	70	3	M5	5,5	19
TSUW20	2 920	**20**	17	22	6 000	8,5	7,8	75	20	69	3	M6	6,6	23
TSUW25	4 420	**25**	21	26	6 000	10,5	9,8	75	20	68	3	M8	9	28,5
TSUW30	6 220	**30**	23	30	6 000	11,5	11	100	20	92	3	M10	11	31,5
TSUW40	11 030	**40**	30	39	6 000	15	14,5	100	20	91	4	M12	13,5	39,5
TSUW50	16 980	**50**	35	46	6 000	17,5	18,5	100	20	90	5	M14	15,5	46

Attention!
The shaft and support rail are supplied unassembled.

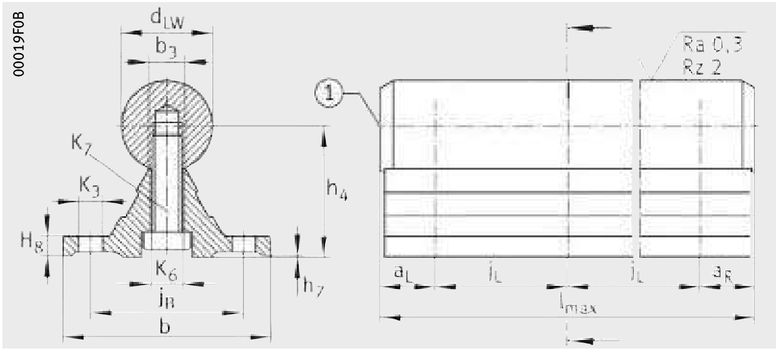
1) In relation to the nominal shaft diameter, measured whilst clamped.

2) Maximum length of single-piece shaft and support rail units; longer shaft and support rail units, see page 133.
Depending on the length of the shaft and support rail unit, the support rail is composed of several individual sections.

3) Dimensions a_L/a_R are dependent on the length of the shaft and support rail unit.
Calculation, see page 135.

4) ① The shaft protrudes on both sides beyond the support rail by approx. 2 mm.

Shaft and support rail units

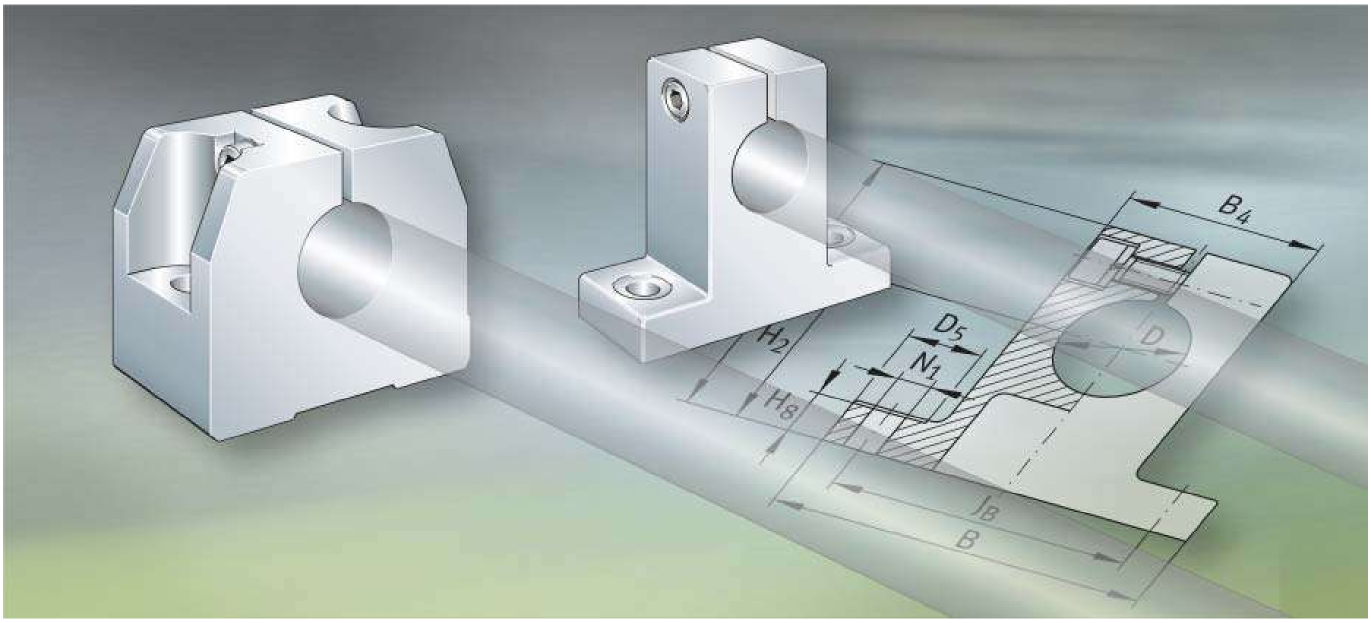


TSNW..-G4, TSNW..-G5
① 6)

Dimension table · Dimensions in mm								
Designation	Mass	Dimensions				Mounting dimensions		
	m	d_{LW}	b	h_4 1)	l_{max} 2)	b_3	j_B	j_L
	≈g/m	h6			±2			
TSNW12-G4	1 600	**12**	40	22±0,1	4 000	5	29	75
TSNW16-G4	2 500	**16**	45	26±0,1	4 000	6,8	33	100
TSNW20-G4	3 800	**20**	52	32±0,1	4 000	7,8	37	100
TSNW25-G4	5 300	**25**	57	36±0,1	4 000	9,8	42	120
TSNW30-G5	7 500	**30**	69	42±0,15	4 000	11	51	150
TSNW40-G5	12 400	**40**	73	50±0,15	4 000	14,5	55	200

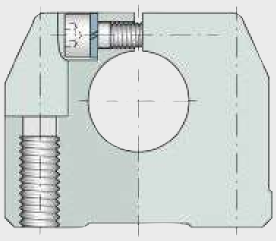
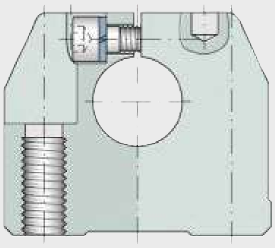
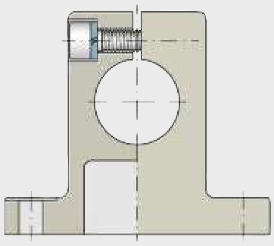
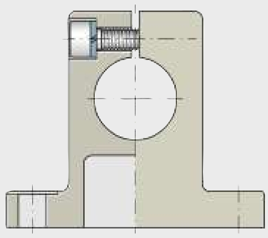
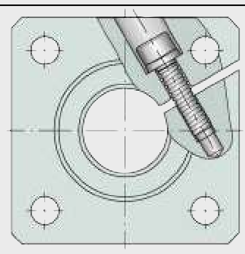
1) In relation to the nominal shaft diameter, measured whilst clamped.
2) Maximum length of single-piece shaft and support rail units.
3) Dimensions a_L/a_R are dependent on the length of the shaft and support rail unit. Calculation, see page 135.
4) For fixing screws DIN 7964. If there is a possibility of settling, the screws should be secured against rotation.
5) Maximum variation of dimension h_4, measured on the same shaft and support rail unit over a length of 1 000 mm.
6) ① The shaft protrudes on both sides beyond the support rail by approx. 2 mm.

a_L/a_R[3]		H_8	h_7	K_3[4]	K_6	K_7	Variation of h_4[5]	
							Accuracy class	Variation
min.	max.					ISO 4762		mm
20	69	5	0,2	4,5	4,5	M4×18	G4	0,03
20	93	5	0,2	5,5	5,5	M5×22	G4	0,03
20	92	6	0,2	6,6	6,6	M6×25	G4	0,03
20	110	6	0,3	6,6	9	M8×30	G4	0,03
20	139	7	0,3	9	11	M10×30	G5	0,04
20	189	8	0,3	9	11	M10×35	G5	0,04



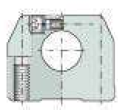
Shaft support blocks

Matrix for preselection of shaft support blocks

Shaft support blocks		Material
GWH..-B		Aluminium
GWN..-B		Aluminium
GW		Diecast zinc
GWA..-B		Diecast zinc
FW..-B		Aluminium

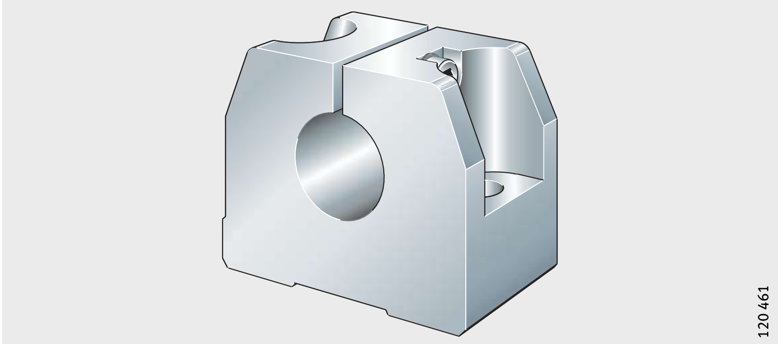
Definition:
- ● Available for stated shaft diameter d_{LW}

	For shaft diameter d_{LW} in mm											Features	Location		Description
													Thread	Through hole	
	06	08	10	12	14	16	20	25	30	40	50				Page
	●	●	●	●	●	●	●	●	●	●	●	Low position of shaft	yes	yes	149
	–	–	–	●	–	●	●	●	●	●	●	Suitable for dowelling	yes	yes	149
	–	–	●	●	●	●	●	●	●	●	●	Space-saving design	–	yes	149
	–	–	●	●	–	●	●	●	●	●	●	For larger fixing screws Space-saving design	–	yes	149
	–	–	–	●	–	●	●	●	●	●	●	Suitable for dowelling	yes	yes	149

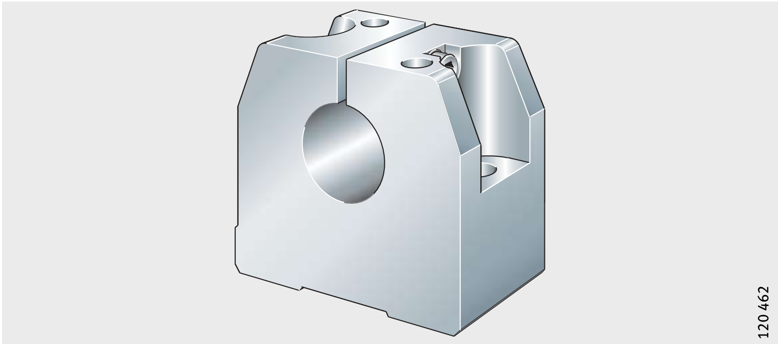


Shaft support blocks

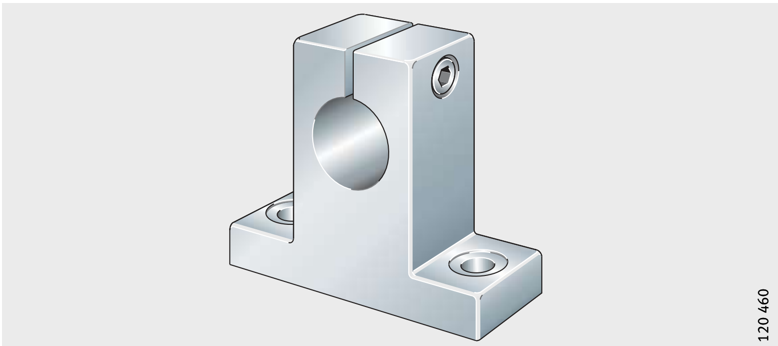
GWH..-B



GWN..-B

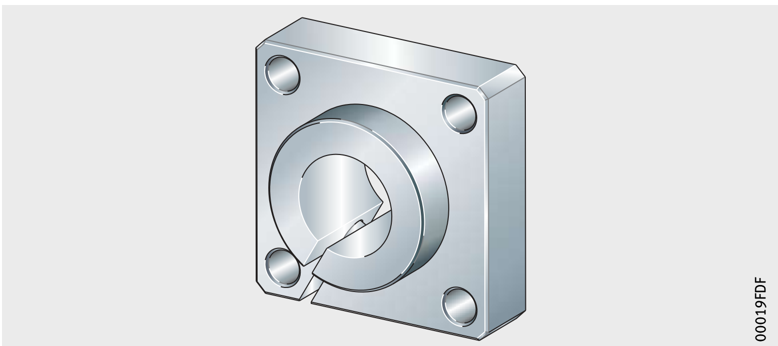


GW, GWA..-B



Shaft support block with flange

FW..-B



Shaft support blocks

Features

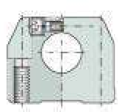
Shaft support blocks are used to support shafts and locate the ends of the shaft.

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

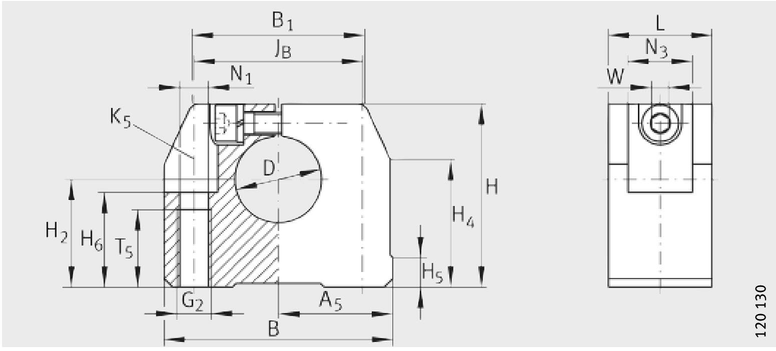
They are made from either an aluminium alloy or pressure diecast zinc.

Series GWA..-B is identical in design to series GW but is suitable for larger fixing screws.

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



Shaft support blocks



GWH..-B

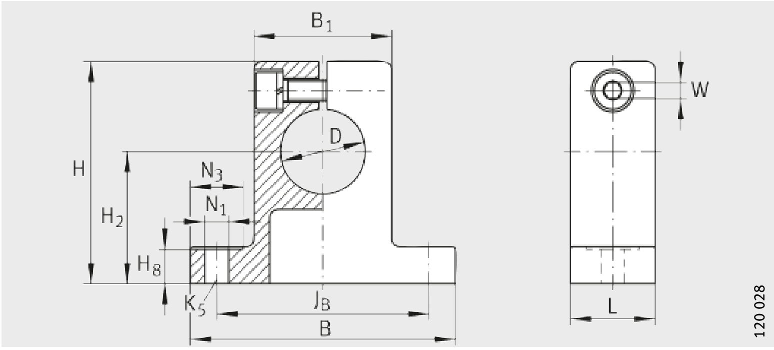
Dimension table · Dimensions in mm

Designation	Mass	Dimensions				Mounting dimensions												
	m	D	B	L	H	J_B	A_5	B_1	H_2	H_4	H_5	T_5	H_6	G_2	N_1	N_3	K_5[1]	W[2]
	≈g	H8				±0,15			±0,01									
GWH06-B	30	**6**	32	16	27	22	16	25	15	20,6	5	11	13	M5	4,3	10	M4	2,5
GWH08-B	30	**8**	32	16	27	22	16	25	16	20,6	5	11	13	M5	4,3	10	M4	2,5
GWH10-B	50	**10**	40	18	33	27	20	32	18	25,1	5	13	16	M6	5,3	11	M5	3
GWH12-B	50	**12**	40	18	33	27	20	32	19	25,1	5	13	16	M6	5,3	11	M5	3
GWH14-B	70	**14**	43	20	36,5	32	21,5	34	20	28,1	6,9	13	18	M6	5,3	11	M5	3
GWH16-B	70	**16**	43	20	36,5	32	21,5	34	22	28,1	6,9	13	22	M6	5,3	11	M5	3
GWH20-B	120	**20**	53	24	42,5	39	26,5	40	25	29,8	7,4	18	22	M8	6,6	15	M6	4
GWH25-B	170	**25**	60	28	52,5	44	30	44	31	36,6	9,9	22	26	M10	8,4	18	M8	5
GWH30-B	220	**30**	67	30	60	49	33,5	49,5	34	42,7	8	22	29	M10	8,4	18	M8	5
GWH40-B	480	**40**	87	40	73,5	66	43,5	63	42	49,7	12,8	26	38	M12	10,5	20	M10	6
GWH50-B	820	**50**	103	50	92	80	51,5	74	50	62,3	10,9	34	46	M16	13,5	24	M12	8

[1] For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.

[2] Width across flats.

Shaft support blocks

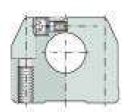


GW, GWA..-B

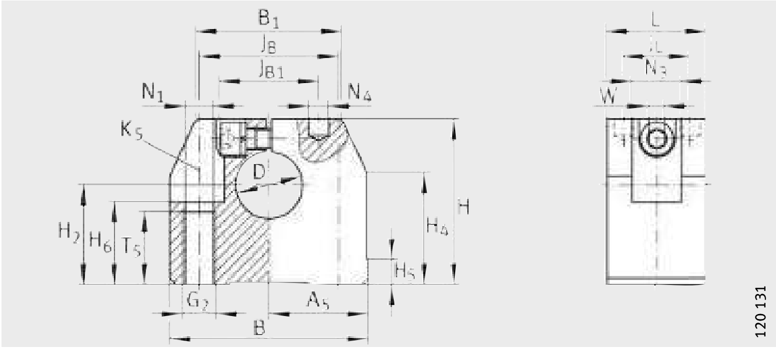
Dimension table · Dimensions in mm

Designation	Mass	Dimensions				Mounting dimensions							
	m	D	B	L	H	J_B	B_1	H_2	H_8	N_1[1]	N_3	K_5	Width across flats W
	≈g							±0,15					
GW10	30	**10**	37	11	30	28 ±0,15	18	17	5	3,4	8	M3	2,5
GWA10-B										4,5	9	M4	
GW12	40	**12**	42	12	35	32 ±0,15	20	20	5,5	4,5	10	M4	3
GWA12-B										5,5	11	M5	
GW14	60	**14**	46	14	38	36 ±0,15	23	22	6	4,5	10	M4	3
GWA14-B										5,5	11	M5	
GW16	80	**16**	50	16	42	40 ±0,15	26	25	6,5	4,5	10	M4	3
GWA16-B										5,5	11	M5	
GW20	150	**20**	60	20	50	45 ±0,15	32	30	7,5	4,5	10	M4	3
GWA20-B										5,5	11	M5	
GW25	260	**25**	74	25	58	60 ±0,15	38	35	8,5	5,5	11	M5	4
GWA25-B										6,6	13	M6	
GW30	380	**30**	84	28	68	68 ±0,2	45	40	9,5	6,6	13	M6	5
GWA30-B										9	18	M8	
GW40	670	**40**	108	32	86	86 ±0,2	56	50	12	9,1	18	M8	6
GWA40-B										11,1	22	M10	
GW50	1 380	**50**	130	40	100	108 ±0,2	80	60	14	9	18	M8	6
GWA50-B										11	22	M10	

[1] For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.



Shaft support blocks



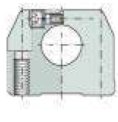
GWN..-B

Dimension table · Dimensions in mm										
Designation	Mass	Dimensions				Mounting dimensions				
	m	D	B	L	H	J_B	J_{B1}	B_1	A_5	J_L
	≈g	H8							±0,01	
GWN12-B	60	**12**	43	20	35	30±0,15	20	34	21,5	13
GWN16-B	100	**16**	53	24	42	38±0,15	26	40	26,5	16
GWN20-B	170	**20**	60	30	50	42±0,15	30	44	30	20
GWN25-B	330	**25**	78	38	60	56±0,15	40	60	39	25
GWN30-B	450	**30**	87	40	70	64±0,15	45	63	43,5	26
GWN40-B	850	**40**	108	48	90	82±0,15	65	76	54	32
GWN50-B	1 400	**50**	132	58	105	100±0,2	70	90	66	36

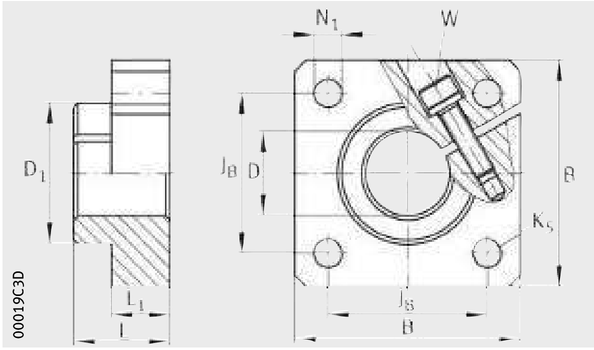
1) Centring for dowel hole.

2) For fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.

H_2 ±0,01	H_4	H_5	T_5	H_6	G_2	N_1	N_4[1]	N_3	K_5[2]	Width across flats W
20	26,6	5,4	13	16,5	M6	5,3	4	10	M5	3
25	26,6	5,4	18	21	M8	6,6	5	11	M6	4
30	34,1	7,4	22	25	M10	8,4	6	15	M8	5
35	41,5	8,3	26	30	M12	10,5	8	18	M10	6
40	46,2	9,3	26	34	M12	10,5	8	18	M10	6
50	57,6	11,7	34	44	M16	13,5	10	20	M12	8
60	62	10,6	43	49	M20	17,5	12	26	M16	10



Shaft support block with flange



FW-B

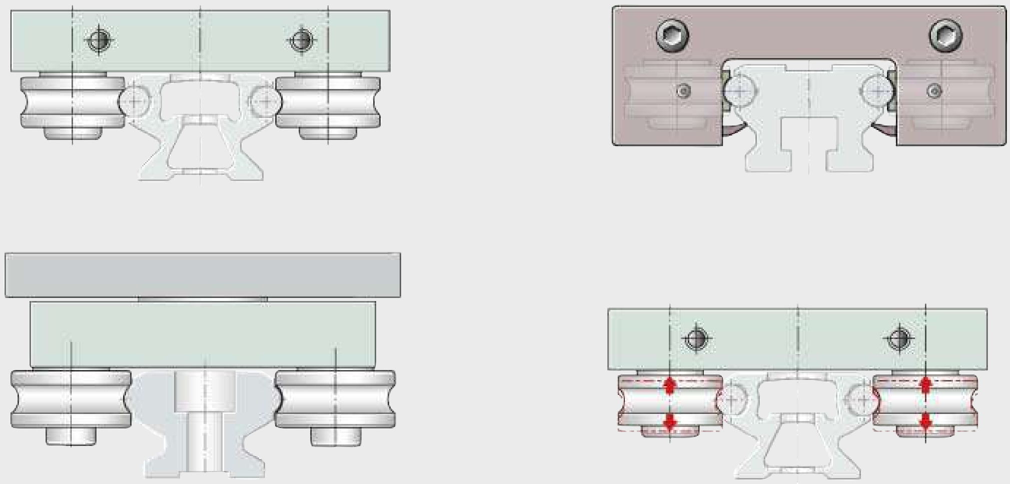
Dimension table · Dimensions in mm

Designation	Mass	Dimensions			Mounting dimensions					
	m ≈g	D H8	B	L	L_1	D_1	N_1 H13	K_5 1)	J_B	Width across flats W
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 fixing screws ISO 4762-8.8.
If there is a possibility of settling, the screws should be secured against rotation.

Track Roller Guidance Systems

Track roller guidance systems
Track rollers, bolts, guideways
Accessories



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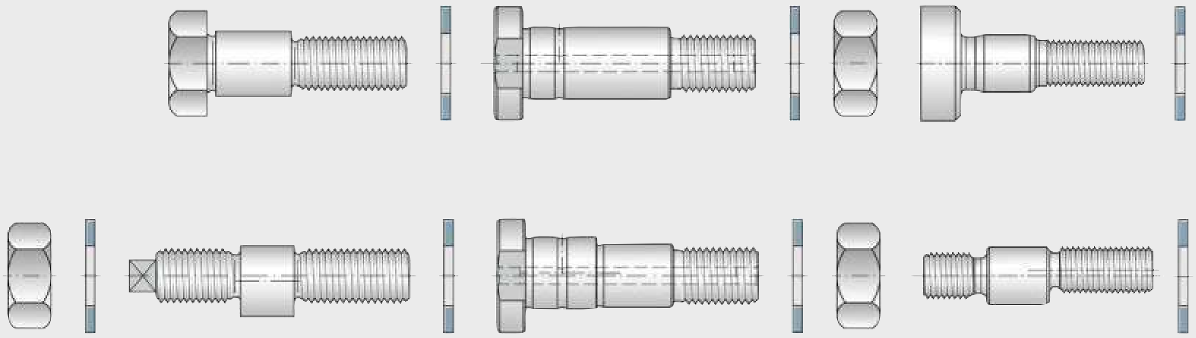

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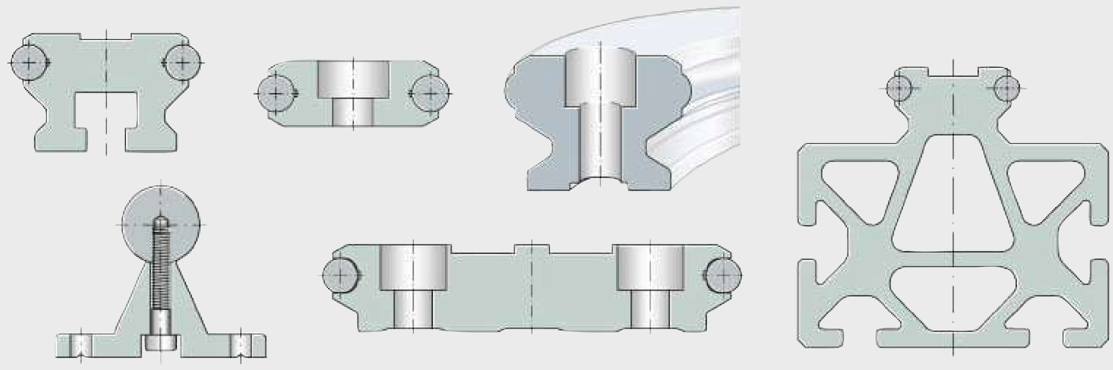

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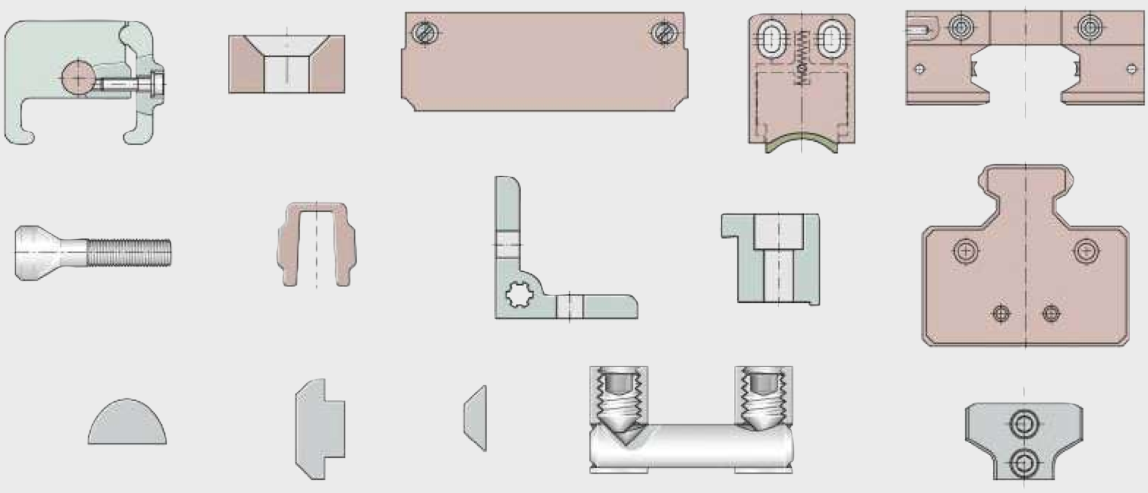

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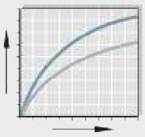

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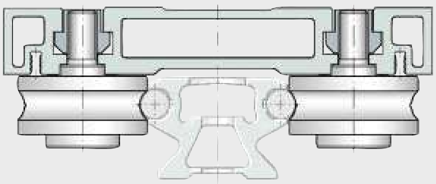
Technical principles



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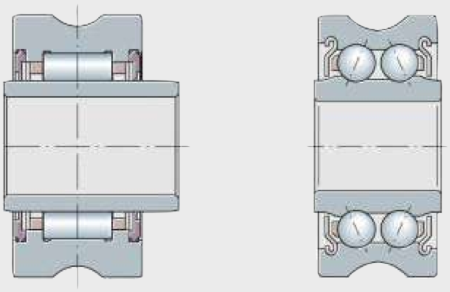
Track roller guidance systems

- With hollow section carriage
- With compact carriage
- With open carriage
- With non-locating bearing carriage
- With bogie carriage



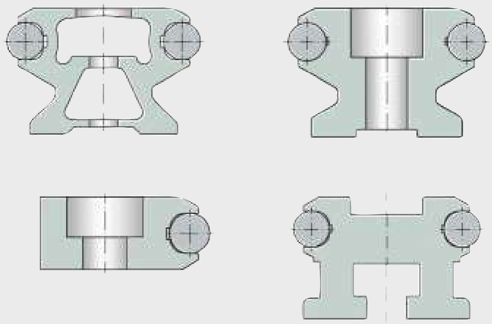
121 670

Track rollers

- Locating bearing track roller
- Non-locating bearing track roller

Bolts

- Concentric
- Eccentric



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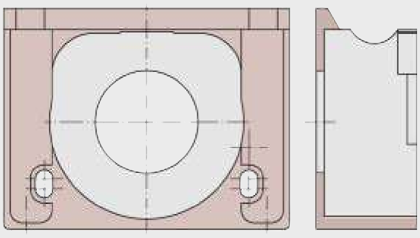
Guideways

- With solid or hollow section profile
- Flat design
- With support rail
- With slots
- Half guideway
- Curved guideway element



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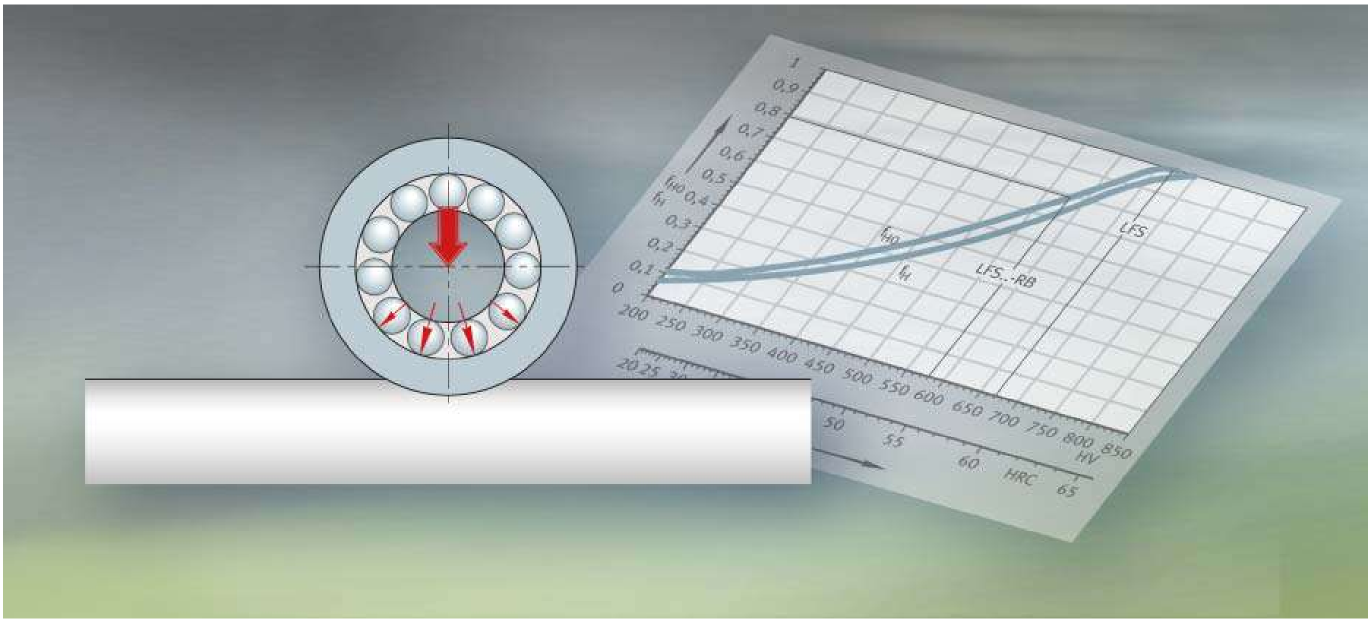
Accessories

0001A281

Addresses



Technical principles

Load carrying capacity and rating life
Lubrication
Design of bearing arrangements
Mounting
Accuracy
Ordering designations
Operating limits

Permissible radial loads

The thick-walled outer rings of the track rollers can support high radial loads. If these track rollers are used against a shaft as a raceway, the outer rings undergo elastic deformation, *Figure 1*.

Compared to rolling bearings supported in a housing bore, track rollers have the following characteristics:

- modified load distribution in the bearing. This is taken into consideration by means of the basic load ratings $C_{r\,w}$ and $C_{0r\,w}$ used in the calculation of the rating life
- bending stress in the outer ring. This is taken into consideration by means of the permissible radial loads $F_{r\,per}$ and $F_{0r\,per}$. The bending stresses must not exceed the permissible strength values of the material (due to the risk of fracture).

Permissible radial load under dynamic loading

For rotating bearings under dynamic load, the effective dynamic load rating $C_{r\,w}$ is used. $C_{r\,w}$ is used to calculate the basic rating life.

The permissible dynamic radial load $F_{r\,per}$ must not be exceeded.

If the basic static load rating $C_{0r\,w}$ is lower than the basic dynamic load rating $C_{r\,w}$, $C_{0r\,w}$ is used.

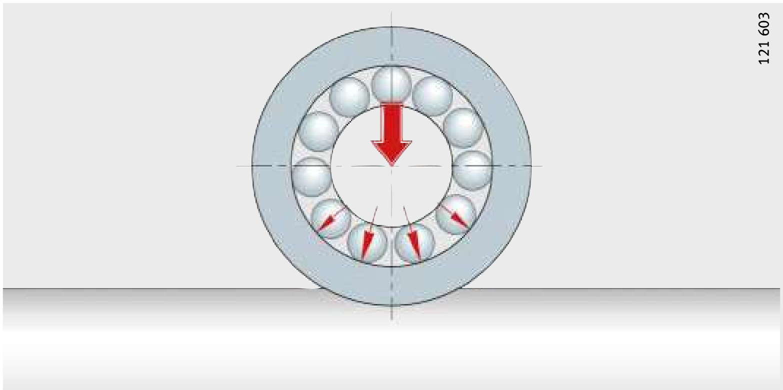


Figure 1
Deformation of the outer ring when used against a flat raceway

Permissible radial load under static loading

For bearings under static load, when stationary or with only infrequent motion, the effective static load rating $C_{0r\,w}$ is used. $C_{0r\,w}$ is used to calculate the static load safety factor S_0.

At the same time, the permissible static radial load $F_{0r\,per}$ must not be exceeded.

In addition to the permissible radial load of the bearing, the permissible radial load of the mating track must also be taken into consideration.

The basic load ratings stated are valid only in conjunction with a shaft as a mating track that is hardened (at least 670 HV) and ground (Ra 0,3).

Fatigue limit load

The fatigue limit load $C_{ur\,w}$ is defined as the load below which – under laboratory conditions – no fatigue occurs in the material.

Calculation of the rating life

The general methods for calculating the rating life are:

- the basic rating life in accordance with DIN ISO 281
- the adjusted rating life in accordance with DIN ISO 281
- the expanded calculation of the adjusted reference rating life in accordance with DIN ISO 281-4.

These methods are described in Catalogue HR 1, Rolling Bearings, in the chapter Load carrying capacity and rating life.

Load carrying capacity and rating life

Rating life of track rollers

In comparison with Catalogue HR 1, Rolling Bearings, the following values must be exchanged:

- $C_r = C_{rw}$
- $C_{0r} = C_{0r\,w}$
- $C_{ur} = C_{ur\,w}$.

The carriages LFCL, LFL..-SF, LFLL, LFKL..-SF and bogie carriage LFDL contain four track rollers LFR.

The equivalent principle applies here. The corresponding parameters are taken into consideration in the basic load ratings C_y, C_{0y}, C_z, C_{0z} and the permissible moment ratings M_{0x}, M_{0y} and M_{0z}.

C_y N
Basic dynamic load rating in y direction

C_{0y} N
Basic static load rating in y direction

C_z N
Basic dynamic load rating in z direction

C_{0z} N
Basic static load rating in z direction

M_{0x} Nm
Static moment rating about x axis

M_{0y} Nm
Static moment rating about y axis

M_{0z} Nm
Static moment rating about z axis.

In the case of track rollers with a profiled outer ring, calculation is carried out exclusively by means of the basic rating life to DIN ISO 281.

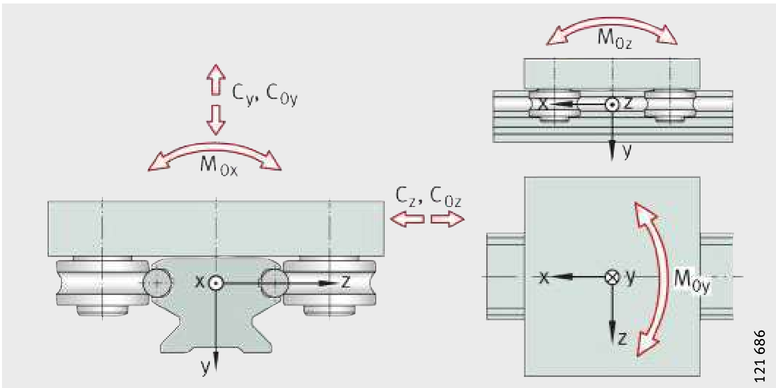


Figure 2
Load carrying capacity and load directions

Other formulae for calculating the basic rating life

$$L_s = 0{,}0314 \cdot D_a \cdot \left(\frac{C_{r\,w}}{P_r}\right)^p$$

$$L_h = 26{,}18 \cdot \frac{D_a}{H \cdot n_{osc}} \cdot \left(\frac{C_{r\,w}}{P_r}\right)^p$$

$$L_h = 52{,}36 \cdot \frac{D_a}{\bar{v}} \cdot \left(\frac{C_{r\,w}}{P_r}\right)^p$$

Rating life for carriages with four track rollers

$$L_s = \left(\frac{C_y, C_z}{P}\right)^p$$

$$L_h = \frac{833}{H \cdot n_{osc}} \cdot \left(\frac{C_y, C_z}{P}\right)^p$$

$$L_h = \frac{1\,666}{\bar{v}} \cdot \left(\frac{C_y, C_z}{P}\right)^p$$

L_s — 10^5 m
Basic rating life in metres

D_a — mm
Rolling contact diameter of track roller, see dimension tables

$C_{r\,w}$, C_y, C_z — N
Effective dynamic load rating

P_r — N
Equivalent dynamic load (radial load)

p — –
Ball: p = 3;
needle roller (non-locating bearing track roller or carriage): p = 10/3

L_h — h
Basic rating life in operating hours

H — m
Single stroke length for reciprocating motion

n_{osc} — min^{-1}
Number of return strokes per minute

$\bar{v}$ — m/min
Mean travel velocity

P — N.
Equivalent dynamic load in the corresponding load direction
(for applications with combined loads, please contact us).

Load carrying capacity and rating life

Operating life

The operating life is the life actually achieved by a rolling bearing. It may differ significantly from the calculated rating life.

This may be due to wear or fatigue as a result of:

- deviations in the operating data
- insufficient or excessive operating clearance (track roller, guideway)
- contamination
- inadequate lubrication
- operating temperature too high or too low
- reciprocating motion with very small stroke length, which can lead to false brinelling
- high vibration load, leading to false brinelling
- very high shock loads (static overloading)
- prior damage during mounting.

Due to the variety of mounting and operating conditions, the operating life cannot be precisely calculated in advance. The most reliable way of arriving at a close estimate is by comparison with similar applications.

Static load safety factor

The indicator of static loading is the static load safety factor S_0.

This indicates the security against impermissible permanent deformations in the bearing and is determined by means of the following equation:

$$S_0 = \frac{C_{0r\,w}}{F_{0r}}$$

Static load safety factor for carriages with four track rollers

$$S_0 = \frac{C_0}{F_0}$$

$$S_0 = \frac{M_0}{M}$$

S_0 –
Static load safety factor

$C_{0r\,w}$ N
Effective static load rating of track roller, see dimension tables

F_{0r} N
Static force acting in radial direction

C_0 N
Basic static load rating of carriage, see dimension tables

F_0 N
Static force acting in y and z direction

M_0 Nm
Permissible static moment in x, y, z direction

M Nm
Moment acting in load direction (M_x, M_y, M_z).

Track rollers are regarded as heavily loaded at a static load safety factor of $S_0 < 4$.

For applications with normal operating conditions, a value $S_0 > 4$ is required.

When using individual track rollers, for example in conjunction with guideways, the decisive factor where required is the permissible load of the guideway.

Static load safety factors $S_0 < 1$ cause plastic deformation of the rolling elements and the raceway, which can impair smooth running. This is only permissible for bearings with small rotary motions or in secondary applications.

Minimum load

In order to ensure that the outer ring is driven, that no slippage occurs and that the track roller does not lift from the mating track, the track rollers must be subjected to a minimum load in dynamic operation.

In general, the minimum load is calculated using the ratio $C_{0r\,w}/F_r < 60$.

Differences in raceway hardness

If shafts with a lower surface hardness are used (such as X46, X90), a hardness factor must be applied, see equations and *Figure 3*.

$$C_H = f_H \cdot C$$

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

C_H N
Effective dynamic load rating

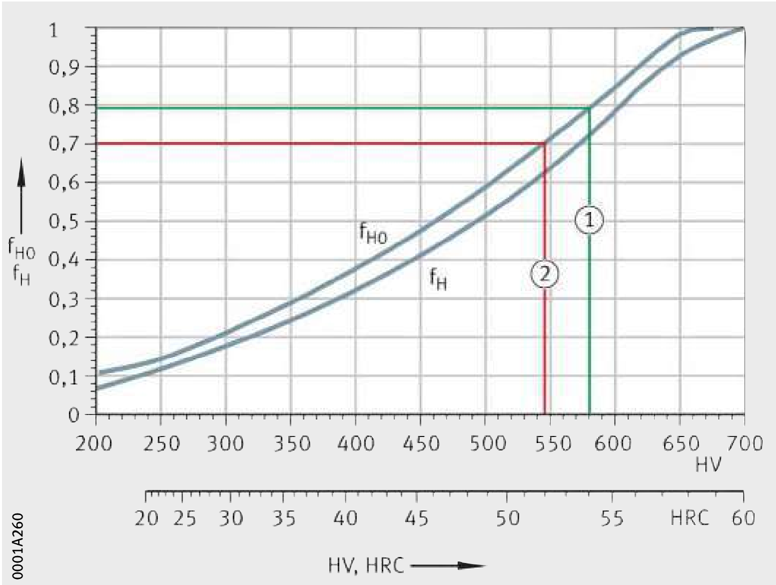
f_H –
Dynamic hardness factor

C N
Basic dynamic load rating

C_{0H} N
Effective static load rating

f_{H0} –
Static hardness factor

C_0 N
Basic static load rating.



f_{H0}, f_H = hardness factor
HV, HRC = surface hardness

① LFS..-RB, W..-X90
② W..-X46

Figure 3
Static and dynamic hardness factors for lower hardness of raceways

Lubrication of guideway raceways

The guideway raceways must be lubricated (even before first use). Lubrication can be carried out by means of lubrication and wiper units.

These units are already integrated in the compact carriage LFKL..-SF. For carriages LFL..-SF and LFCL, the lubrication and wiper unit AB, see page 109, is available as an accessory.

The guideway raceway is lubricated by an oil-soaked felt insert. Oil can be fed to the felt inserts via lubrication nipples in the end faces. At delivery, the felt inserts are already soaked with oil (H1 approval for the food industry), where relubrication is to be carried out an oil of viscosity $\nu = 460\ \text{mm}^2/\text{s}$ is recommended.

Lubrication intervals

The lubrication intervals for guideway raceways are dependent on the environmental influences. The cleaner the environment, the smaller the quantity of lubricant required. The time and quantity can only be determined precisely under operating conditions since it is not possible to determine all the influences by calculation. An observation period of adequate length must be allowed.

! Fretting corrosion is a consequence of inadequate lubrication and is visible as a reddish discolouration of the mating track or outer ring. Inadequate lubrication can lead to permanent system damage and therefore to failure. It must be ensured that the lubrication intervals are reduced accordingly in order to prevent fretting corrosion.

In general, a thin film of oil should always be present on the shaft.

Lubrication of track rollers

At delivery, track rollers LFR have an initial greasing of a high quality lithium soap grease.

From LFR5204-16, the inner ring has a relubrication hole. Track rollers of smaller diameters are lubricated for life.

Further information on lubrication

Further information can be found in Catalogue HR 1, Rolling Bearings, in the chapter Lubrication.

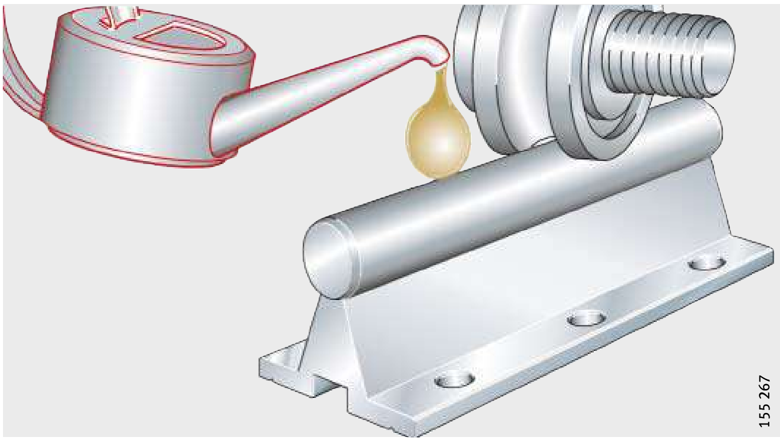


Figure 1
Lubrication of guideway raceways

Requirements for the adjacent construction

The running accuracy of the linear guidance system is essentially dependent on the straightness, accuracy and rigidity of the mounting surfaces.

The higher the requirements for accuracy and smooth running of a track roller guidance system, the more attention must be paid to the geometrical and positional accuracy of the adjacent construction. The adjacent surfaces should be flat and have parallel faces.

For two guideways, we recommend a parallelism according to *Figure 1*.

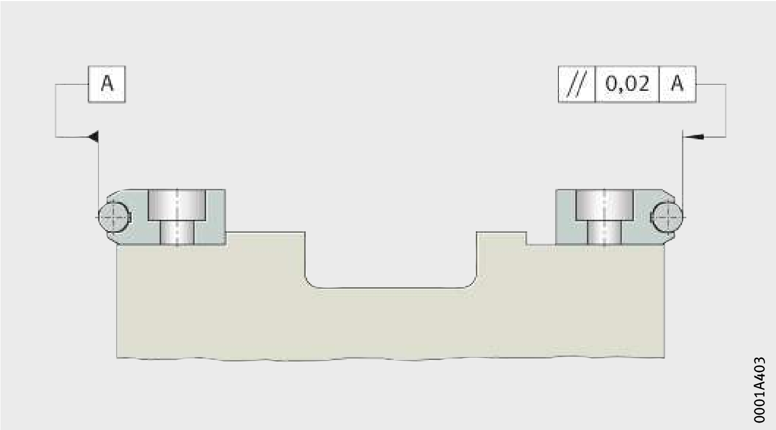


Figure 1
Parallelism of guideways

Shaft creep

Under unfavourable conditions, shaft creep of a few millimetres may occur in isolated cases. This creep may occur mainly in applications with high accelerations in conjunction with high alternating loads and guideways that are not completely supported. It may also be caused by an adjacent construction that is too soft.

In such cases, shaft creep can be prevented by the use of end plates ANS.LFS, see dimension table page 115. They can be supplied already mounted.

Displacement force

The displacement force is dependent on the preload, the lubrication and the particular application. It is therefore not possible to make generally valid statements.

Location of carriages and guideways

If lateral loads are present, it is recommended that the guideways and carriages should be located against locating surfaces. In the case of guideways comprising multiple sections joined together, it is recommended that the guideways should be aligned by means of the shaft. If necessary, the shafts should be located on the adjacent construction by means of dowels.

If two guideways are arranged in parallel, the first guideway should be clamped against a stop, *Figure 1*, page 21. The second guideway should then be aligned accordingly. Any gaps between the guideway and the adjacent construction should be filled with synthetic resin.

Track roller guidance systems in accordance with customer specifications

The INA track roller guidance systems with curved guideway elements can be used to achieve an extremely wide variety of applications, *Figure 2* and *Figure 3*, page 23.

If the arrangement required cannot be represented using the standard ordering designation, a customer drawing must be submitted with the enquiry.

For arrangements with curved guideway elements, it is recommended that the guideway connectors VBS should be used at the joints, see page 114. This gives considerably easier mounting.

!

Standard oval tracks are always supplied with guideway connectors VBS, see page 102.

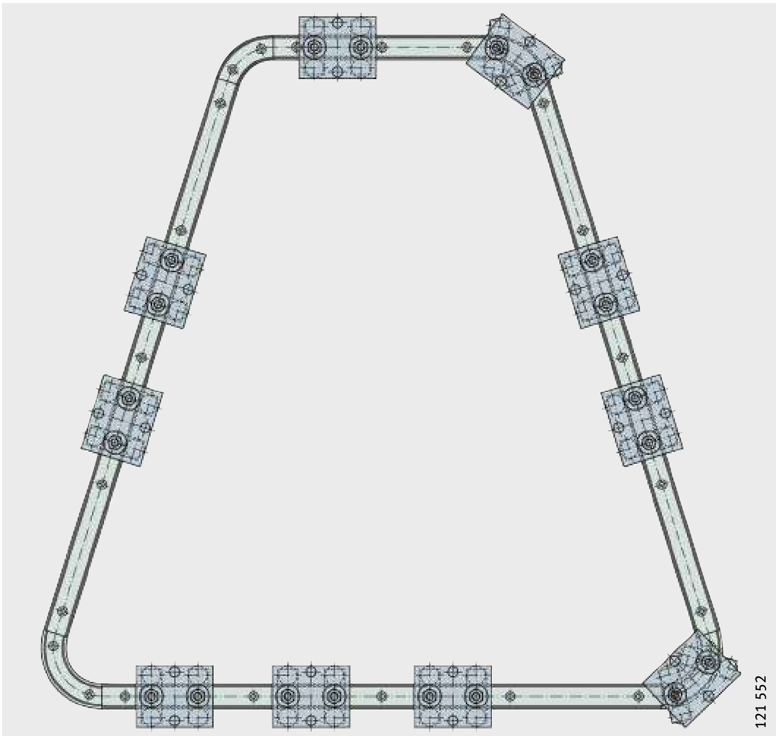


Figure 2
Arrangement according to customer requirements

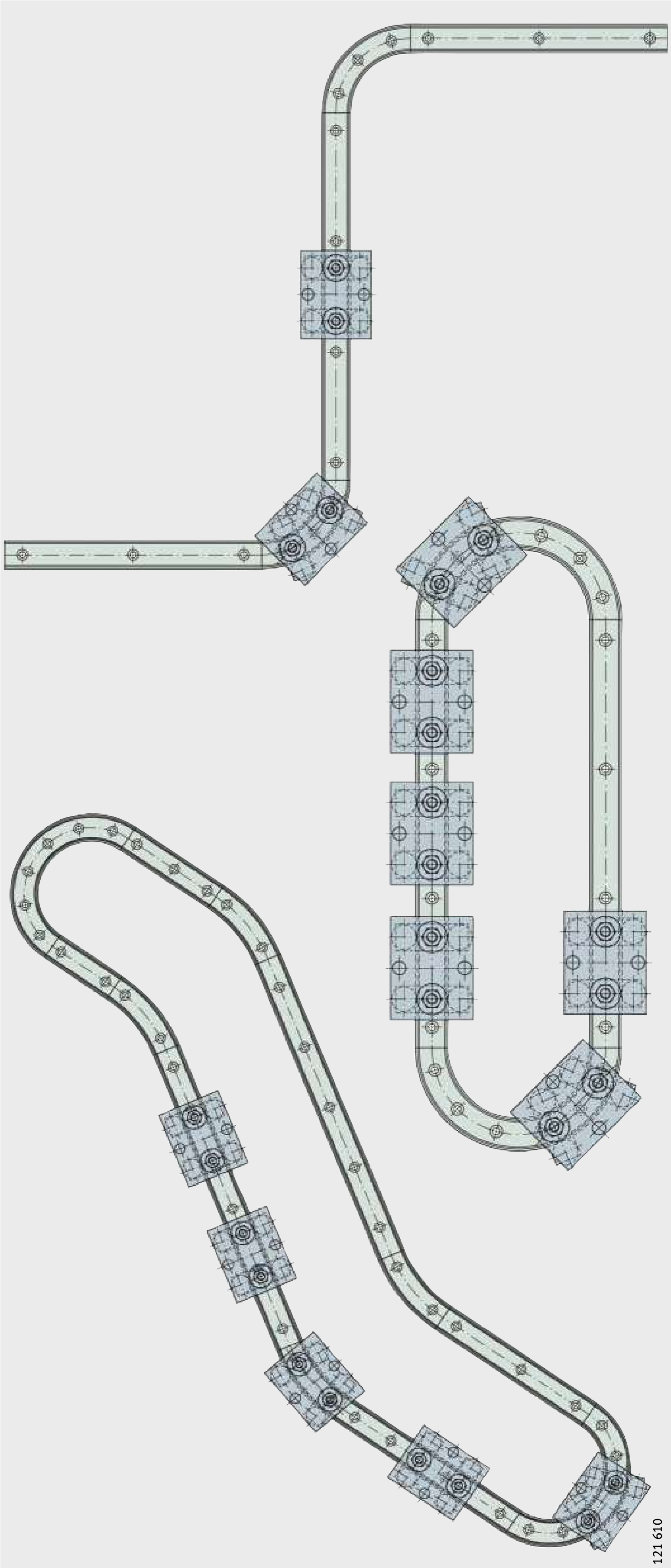
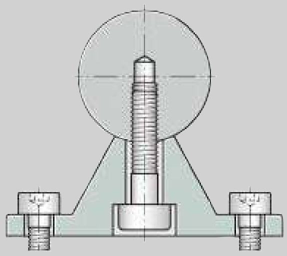


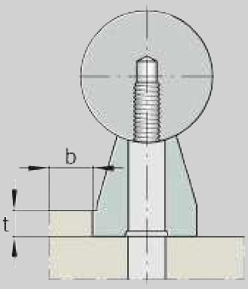
Figure 3
Closed and open applications with guidance systems including curved guideway elements

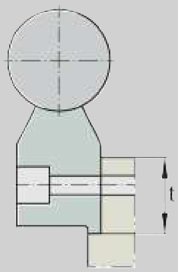
Possible combinations of profiled track rollers with guideways

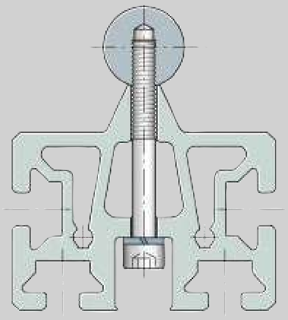
Shaft diameter mm	Guideways			
				
	TSNW, TSNW..-G4 (-G5)			
	Fixing screw	Load case, *Figure 4*		
		I	II	III
12	DIN ISO 4762	■	–	–
	DIN 7984	■	■	■
16	DIN ISO 4762	■	–	–
	DIN 7984	■	–	–
20	DIN ISO 4762	■	–	–
	DIN 7984	■	–	–
25	DIN ISO 4762	■	■	■
	DIN 7984	■	■	■
30	DIN ISO 4762	■	–	–
	DIN 7984	■	■	■
40	DIN ISO 4762	■	■	■
	DIN 7984	■	■	■
50	DIN ISO 4762	■	■	■
	DIN 7984	■	■	■

■ combination possible if the rail is located using the stated screw
● combination possible
❍ combination possible if $t \leqq t_{max}$ and $b \leqq b_{max}$
– please contact us

[1] With AB.W: $t_{max} = 2,5$.







	TSUW					TSSW				TSMW		
	t_{max}	b_{max}	Load case, *Figure 4*			t_{max}	Load case, *Figure 4*			Load case, *Figure 4*		
			I	II	III		I	II	III	I	II	III
	mm	mm				mm[1)]						
	5	5	●		○[1)]	–	–	–	–	–	–	–
	–	–	●	–	–	–	–	–	–	–	–	–
	–	–	●	–	–	–	●	–	–	●	–	–
	10	12	●	●	○	36	●	●	●	●	●	●
	12	16	●	●	○	42	●	●	●	●	●	●
	10	–	●	●	○	50	●	●	●	–	–	–
	13	–	●	●	○	70	●	●	●	–	–	–

!

For the combination, take account of:

- the static load safety factor S_0, see page 17
- the load cases, *Figure 4*
- a shaft hardness of 670 HV.

$S_0 = C_{0w}/P_0$

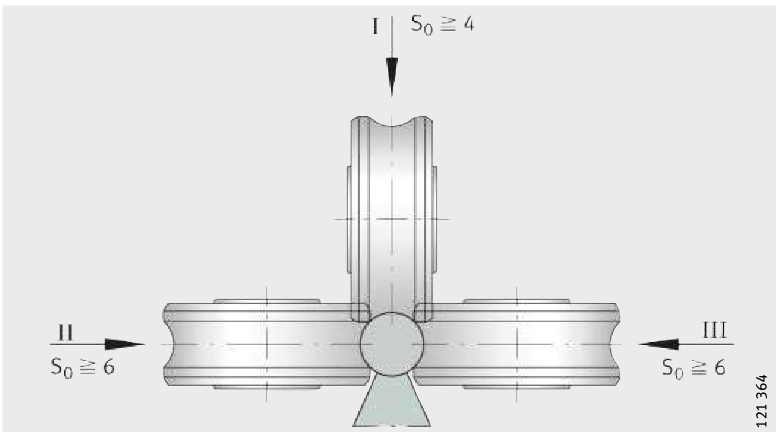


Figure 4
Load cases I, II and III

Mounting

Delivered condition

Carriages are delivered with the track rollers fitted. All the bolts are tightened to the required tightening torque.

Carriages

For carriages, this gives:

- hollow section carriage LFCL;
  clearance-free, with mounting of accessories as necessary
- compact carriage LFKL..-SF;
  clearance-free, with mounting of lubrication and wiper unit as necessary
- non-locating bearing carriage LFLL..-SF;
  clearance-free, with mounting of accessories as necessary
- open carriage LFL..-SF;
  clearance-free, with mounting of accessories as necessary
- bogie carriage LFDL..-SF (-B);
  LFDL..-SF clearance-free, with mounting of accessories as necessary. In the case of LFDL..-B, the clearance must be set by means of eccentrics.

Mounting of guidance system with one guideway

Mounting of guidance system with one guideway:

- Place the guideway on the adjacent construction and screw mount finger tight.
- Align the guideway; if necessary, clamp the shaft against the locating edge and screw mount firmly, observing the tightening torques.
- Clearance-free carriages: slide the carriage onto the guideway.
- Carriages with adjustable clearance: if lateral load is present, ensure that the principal load is supported by the concentric bolts.
- Position and screw mount the adjacent construction.

Mounting of guidance system with two guideways

Mounting of guidance system with two guideways:

- Position the first guideway, clamp it against the locating edge and tighten the screws.
- Position the second guideway and screw mount finger tight.
- Slide the carriage onto the guideway, set the clearance as necessary, *Figure 2*, page 28.
- Position the adjacent construction, align the carriage and screw mount firmly; observe the tightening torques M_A, see table, page 29.
- Align the second guideway with the aid of the table, move the table several times during this operation.
- Tighten the fixing screws in the guideway; tightening torques M_A, see table, page 29.

Where necessary, form fit can be achieved between the guideways and adjacent construction by means of synthetic resin or strips.

Mounting of curved guideway elements and oval tracks

Mounting of curved guideway elements and oval tracks:

- Assemble the curved guideway elements or oval tracks.
- Position the assembled elements precisely on the adjacent construction and fix in place by means of clamps.
- Transfer the hole pattern for the fixing holes to the adjacent construction.
- Remove the elements and make the fixing holes in the adjacent construction.
- Position the elements on the adjacent construction again and tighten the fixing screws; observe the tightening torques M_A, see table, page 29.

Mounting of bogie carriage

Slide the clearance-free carriage LFDL..-SF onto the guideway. No setting of clearance is required, *Figure 1*, page 28.

The bogie carriage LFDL..-SF cannot be mounted on closed ring systems, in this case use the clearance-free bogie carriage LFDL..-B.

Carriages with adjustable clearance

Slide the carriage LFDL..-B onto the guideway and set in position without load. Rotate the eccentric bolts using an open-end wrench or ring wrench so that the track rollers are set against the raceway, observing the direction of rotation, *Figure 2*, page 28.

Tighten the hexagon nuts to the tightening torque M_A; tightening torques, see table, page 29.

The track rollers must be easily movable and clearance-free. If they are set in place too firmly, this will generate preload that reduces the life of the guidance system.

Inspection

Check the adjustment. The guidance system is correctly adjusted if, when the carriages are moved, all the track rollers rotate and the carriages can be moved easily.

The concentric bolts are tightened to the necessary tightening torque, the eccentric bolts are tightened finger tight. When setting the preload, these must be tightened to the tightening torque M_A, see table Tightening torques for track roller bolts, page 29.

Figure 1
Clearance-free carriage LFDL..-SF

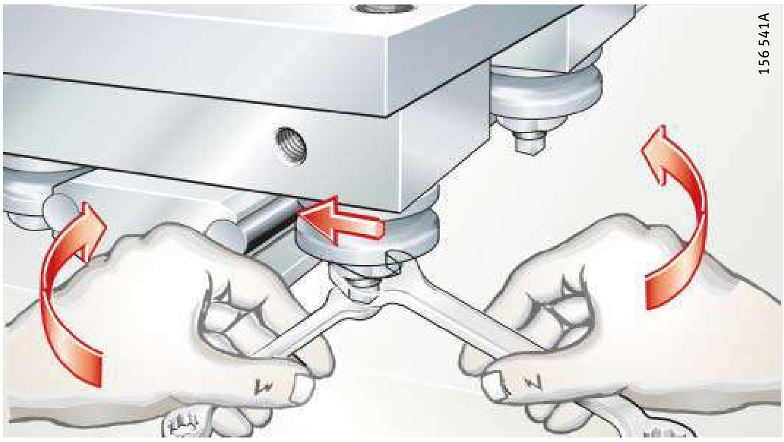


Figure 2
Carriage with adjustable clearance LFDL..-B

Tightening torques for track roller bolts

Track roller, profiled track roller	Bolt	Tightening torque M_A	
		Standard (-2Z) Nm	RB (-2RSR) Nm
LFR50/5-4	M4	2,5	2,5
LFR50/5-6	M4	2,5	2,5
LFR50/8-6	M8	15	12
LFR5201-10	M10	40	23
LFR5301-10	M10	40	23
LFR5302-10	M12	70	39
LFR5201-12	M10	40	23
LFR5204-16	M16×1,5	100	75
LFR5206-20	M20×1,5	200	100
LFR5206-25	M20×1,5	200	100
LFR5207-30	M24×1,5	300	150
LFR5208-40	M30×1,5	600	310
LFR5308-50	M30×1,5	800	410

Tightening torques for screws in carriage according to DIN ISO 4762-8.8

Screw	Tightening torque M_A Nm
M5	5,8
M6	9,9
M8	24
M10	48
M12	83

Tightening torques for screws in guideways LFS according to DIN ISO 4762-8.8 or DIN 7984-8.8

Screw	Tightening torque M_A Nm
M5	5,8
M6	9,9
M8	24
M10	48
M12	83

Accuracy of guideways LFS

Data on the straightness, parallelism (differential measurement), length and positional tolerances of guideways are given in the following tables and figures, *Figure 1* to *Figure 5*, page 32.

The guideways are precision straightened and the tolerances are better than DIN EN 12020.

Length tolerance

Length L mm		Tolerance mm
Single-piece guideways	L < 1 000	±2
	1 000 ≦ L < 2 000	±3
	2 000 ≦ L < 4 000	±4
	4 000 ≦ L	±5
Multi-piece guideways	Total length L	±0,1%

Straightness tolerance for guideways

Length of guideway	Tolerance	
	t_1 (contact face) mm	t_2 (lateral) mm
L < 1 000	0,5	0,2
1 000 ≦ L < 2 000	1	0,3
2 000 ≦ L < 3 000	1,5	0,4
3 000 ≦ L < 4 000	2	0,5
4 000 ≦ L < 5 000	2,5	0,6
5 000 ≦ L < 6 000	3	0,7
6 000 ≦ L < 7 000	3,5	0,8
7 000 ≦ L < 8 000	4	0,9

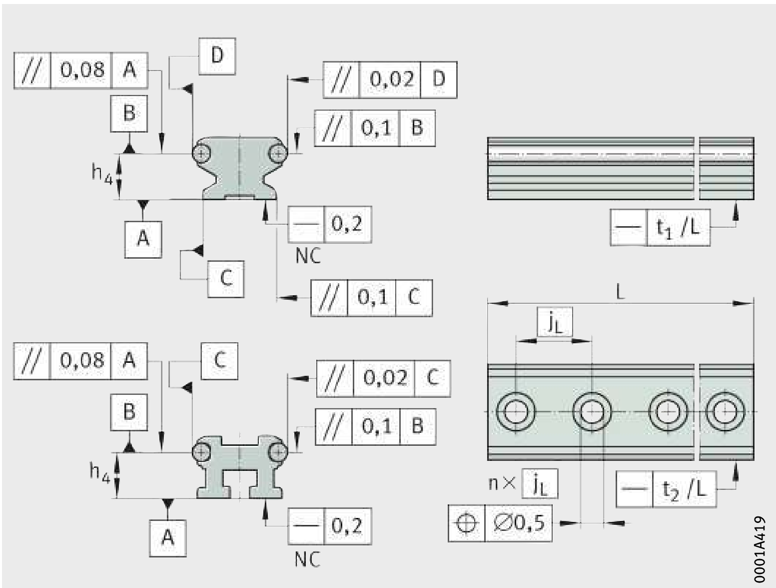
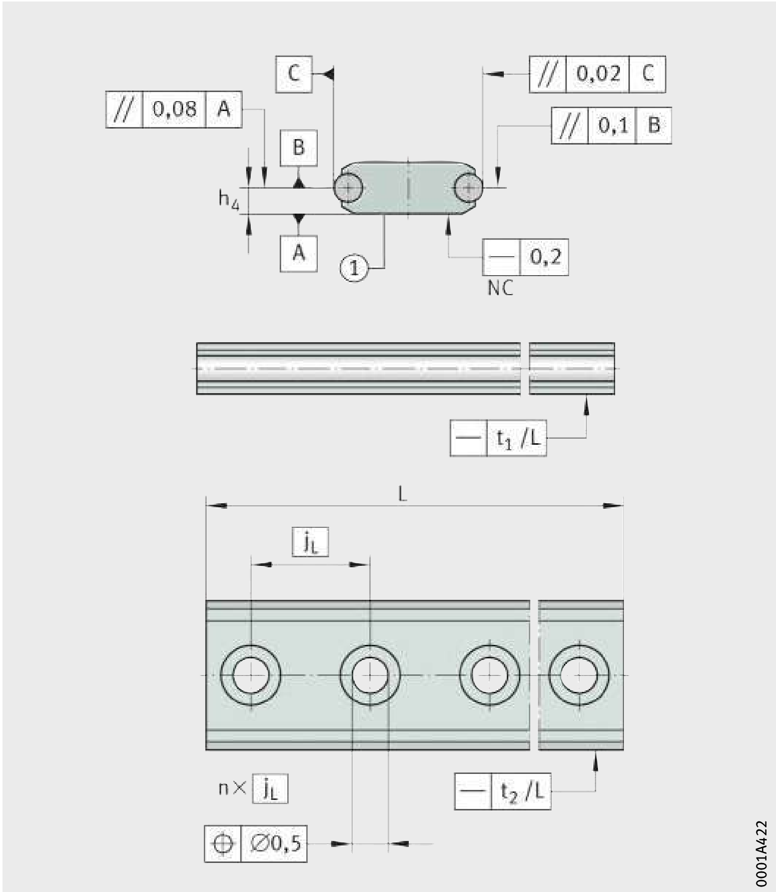
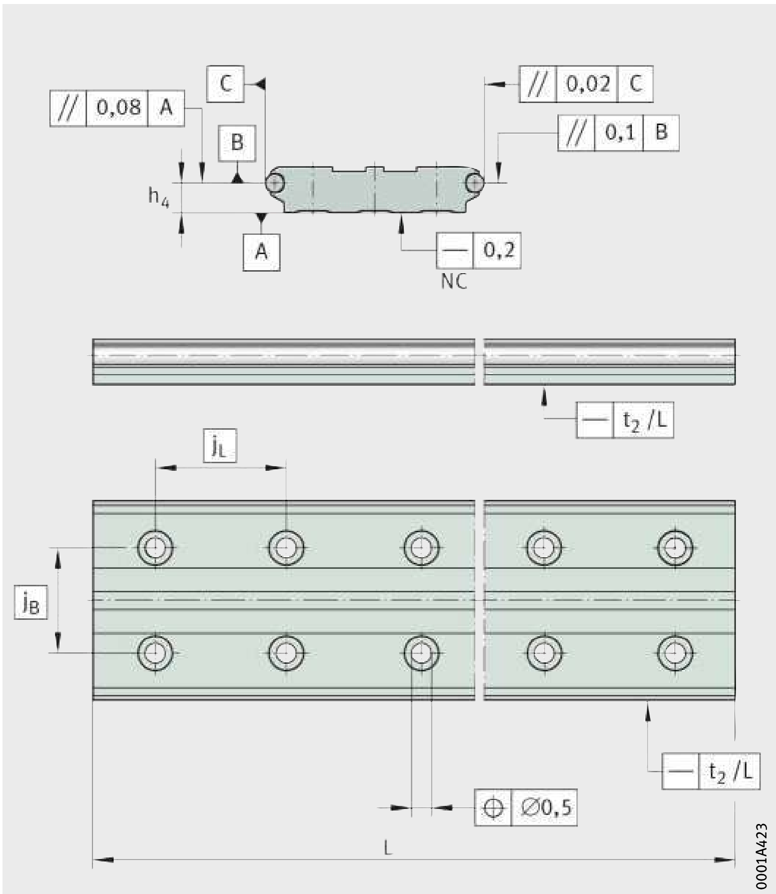


Figure 1
Tolerances for guideways
LFS, LFS..-C, LFS..-NZZ, LFSR..-ST



① Contact face indicated by slot

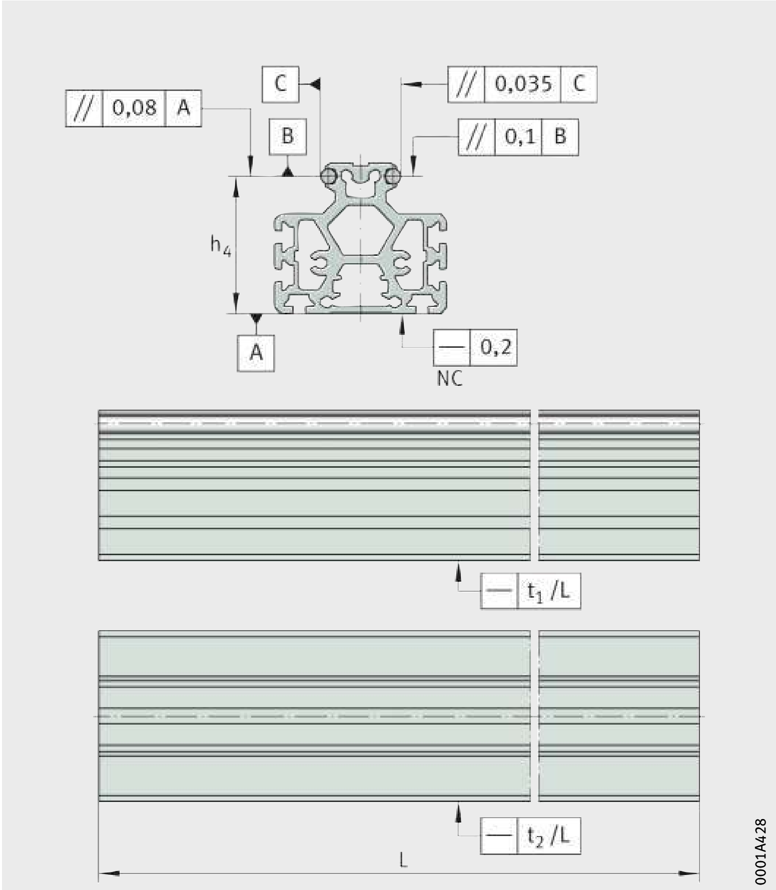
Figure 2
Guideway LFS..-F



Parallelism determined
by differential measurement

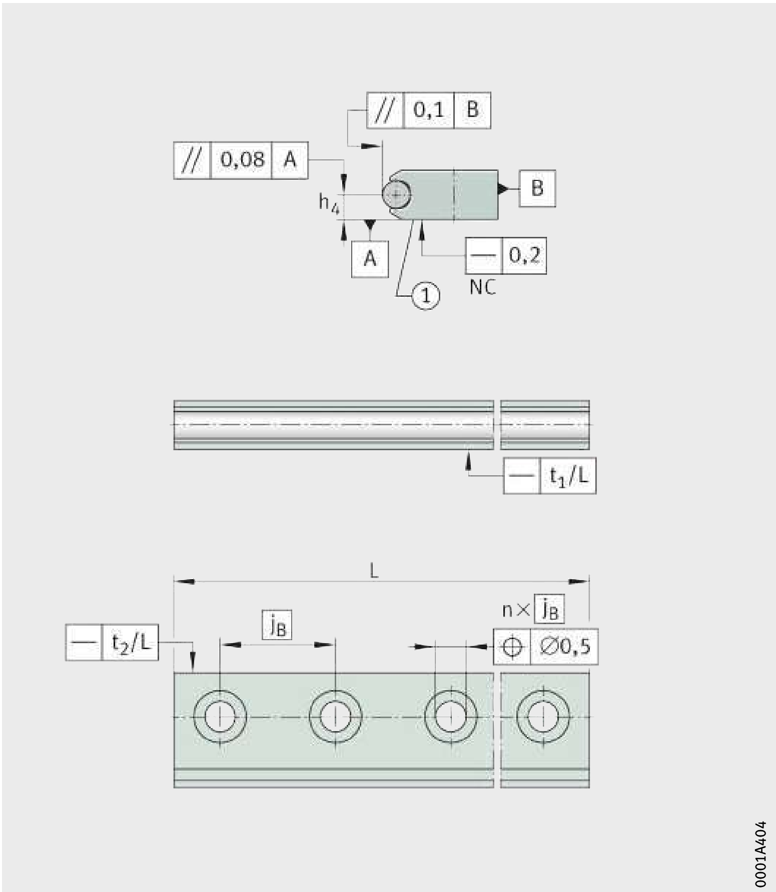
Figure 3
Guideway LFS120

Accuracy



Parallelism determined
by differential measurement

Figure 4
Guideway LFS..-M



1 Contact face indicated by slot

Figure 5
Guideway LFS..-FH

Tolerances for H_2 and h_4, see table, *Figure 6* and *Figure 7*.

Tolerances for H_2 and h_4

Guideway	Tolerance for	
	H_2 mm	h_4 mm
LFS20		−0,1
LFS25		−0,1
LFS25-M		±0,25
LFS32		+0,2
LFS32-C		+0,2
LFS32-N		+0,2
LFS32-F		+0,1
LFS32-M		±0,25
LFS32-FH		+0,1
LFS42-C	+0,3	+0,2
LFS42-F		+0,1
LFS52		+0,2
LFS52-C		+0,2
LFS52-NZZ		+0,2
LFS52-F		+0,1
LFS52-M		+0,5
LFS52-FH		+0,1
LFS86-C		+0,25
LFS120		+0,2

Tolerance for H_2 = +0,3 mm

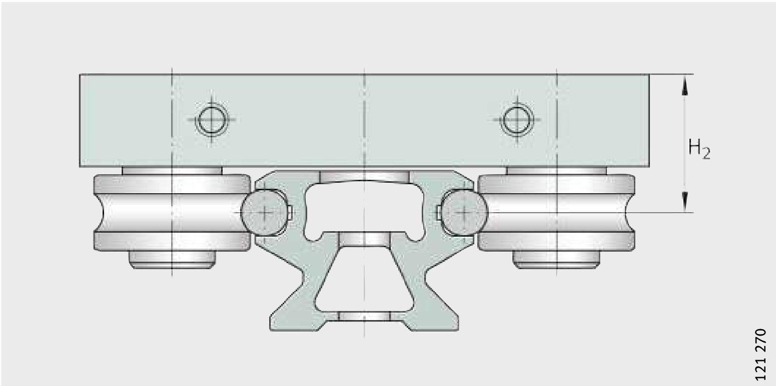


Figure 6
Reference dimension for accuracy, dimension H_2

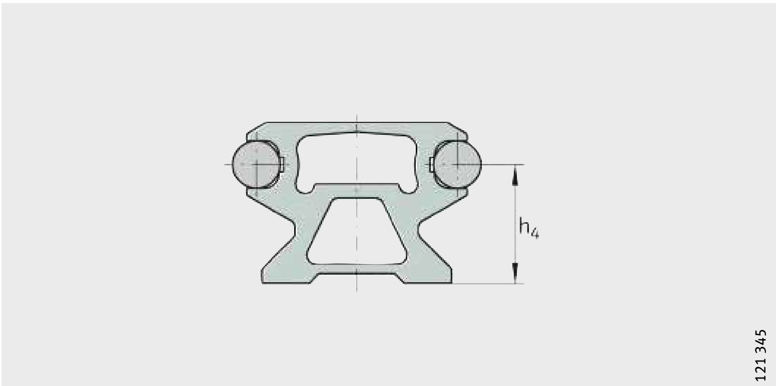


Figure 7
Reference dimension for accuracy, dimension h_4

Ordering example, ordering designation

Ready-to-fit systems

The elements of the track roller guidance systems (such as the carriage, guideway) must be ordered separately.

Carriages should be regarded as a unit, including the track rollers and bolts.

Carriages and guideways can be used in any combination and can be ordered independently of each other.

Ordering example

Track roller guidance system of corrosion-resistant design with open carriage LFL52-E-SF, *Figure 1* and *Figure 2*.

Carriage

Carriage	LFL
Size	52-E
Clearance-free	SF
Corrosion-resistant	RB

Ordering designation **LFL52-E-SF-RB**

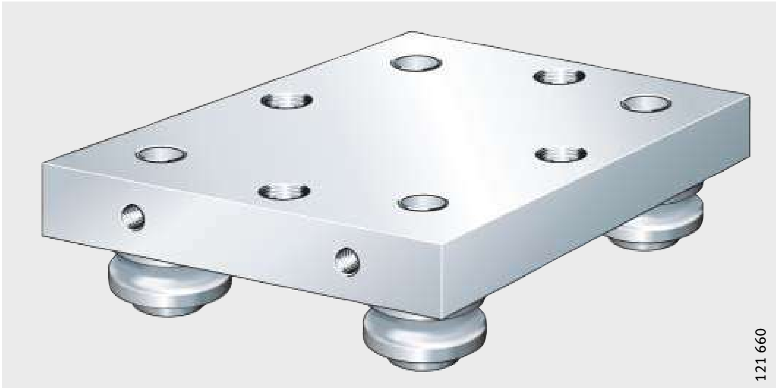


Figure 1
Open carriage LFL52-E-SF

Guideway

Hollow section guideway LFS52-CE, length 1 500 mm, a_L = 50 mm, a_R = 75 mm, corrosion-resistant design, *Figure 2*:

Guideways	LFS
Width of guideway	52 mm
Length of guideway l	1 500 mm
Design	CE
Corrosion-resistant	RB
Spacing a_L	50 mm
Spacing a_R	75 mm

Ordering designation **LFS52×1500-CE-RB-50/75**

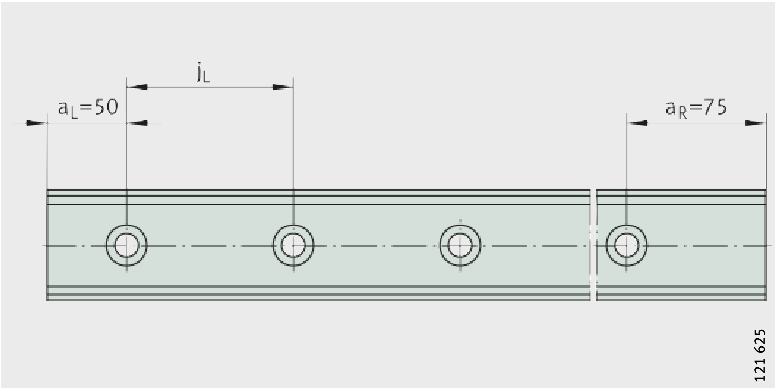


Figure 2
Guideway LFS52-CE

Ordering example, ordering designation

Closed oval tracks

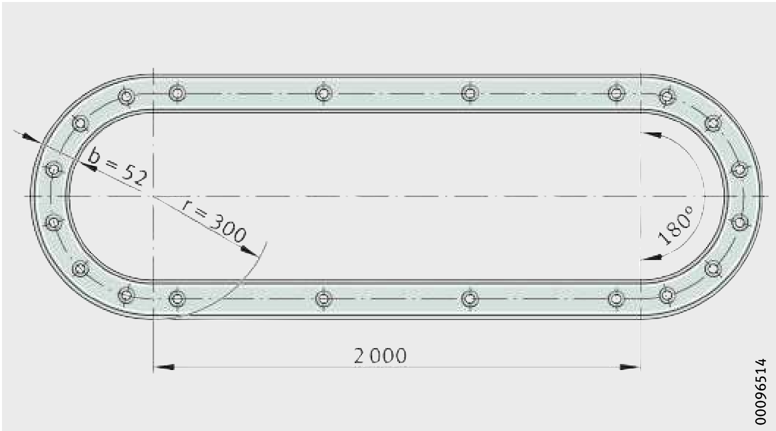
Oval track with two 180° arcs

Guideways	LFS
Width of guideways b	52 mm
Length of straight guideways	2 000 mm
Closed oval track	OV
Radius of arc r	300 mm

Ordering designation

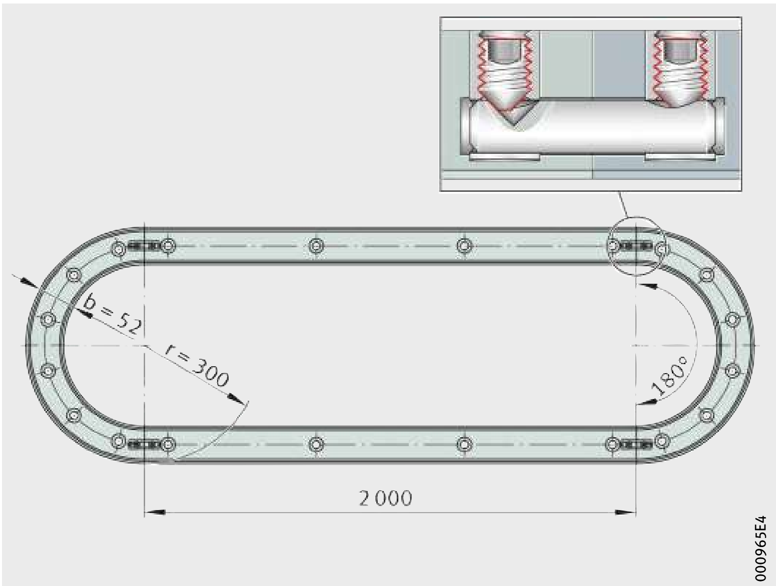
Without guideway connectors VBS, *Figure 3*
1×LFS52×2000-OV-300

With guideway connectors VBS, *Figure 4*
1×LFS52×2000-OV-300-VBS



b = width of guideways
r = radius of arc

Figure 3
Closed oval track with 180° arcs
LFS52×2000-OV-300



b = width of guideways
r = radius of arc

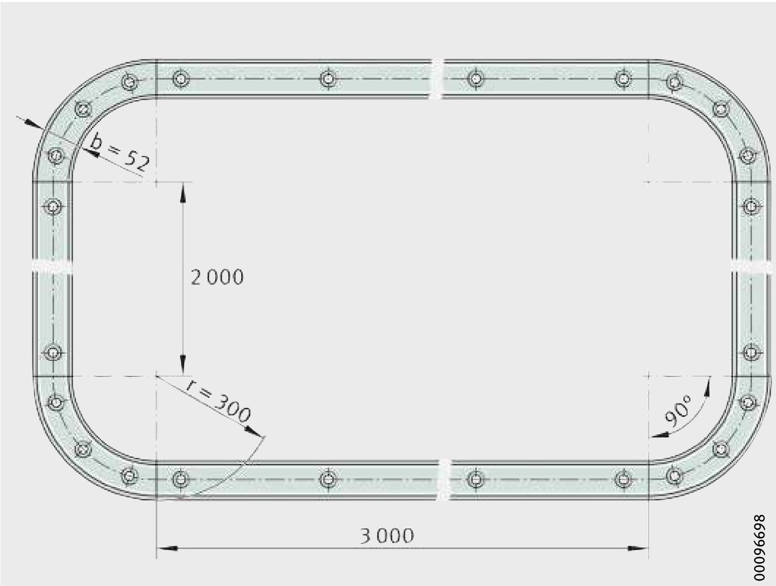
Figure 4
Closed oval track with 180° arcs and guideway connectors VBS
LFS52×2000-OV-300-VBS

Oval track with four 90° arcs	Guideways	LFS
	Width of guideways b	52 mm
	Length of straight guideways	
	1st straight guideway	2 000 mm
	2nd straight guideway	3 000 mm
	Closed oval track	OV
	Radius of arc r	300 mm

Ordering designation

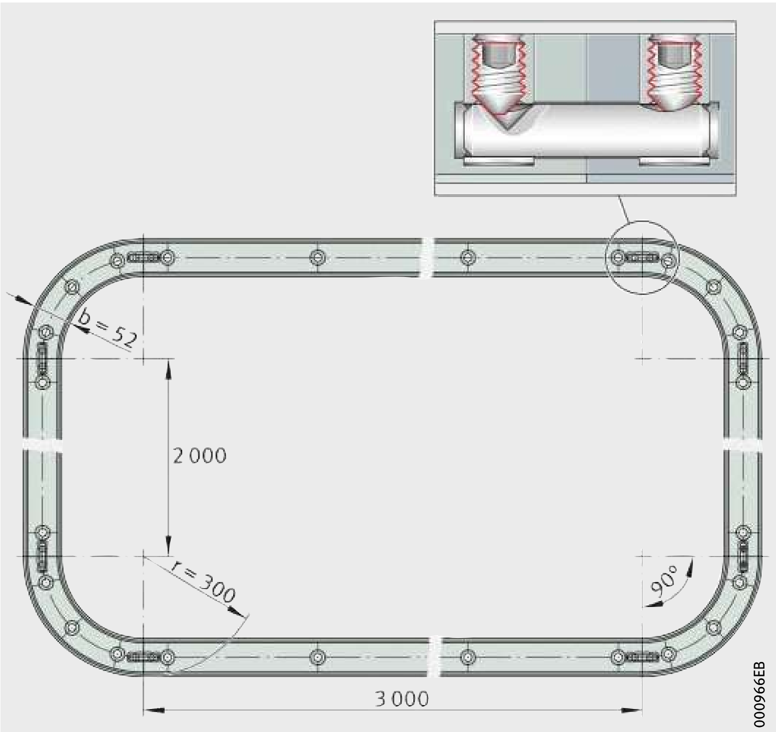
Without guideway connectors VBS, *Figure 5*
1×LFS52×2000×3000-OV-300

With guideway connectors VBS, *Figure 6*
1×LFS52×2000×3000-OV-300-VBS



b = width of guideways
r = radius of arc

Figure 5
Closed oval track with 90° arcs
LFS52×2000×3000-OV-300



b = width of guideways
r = radius of arc

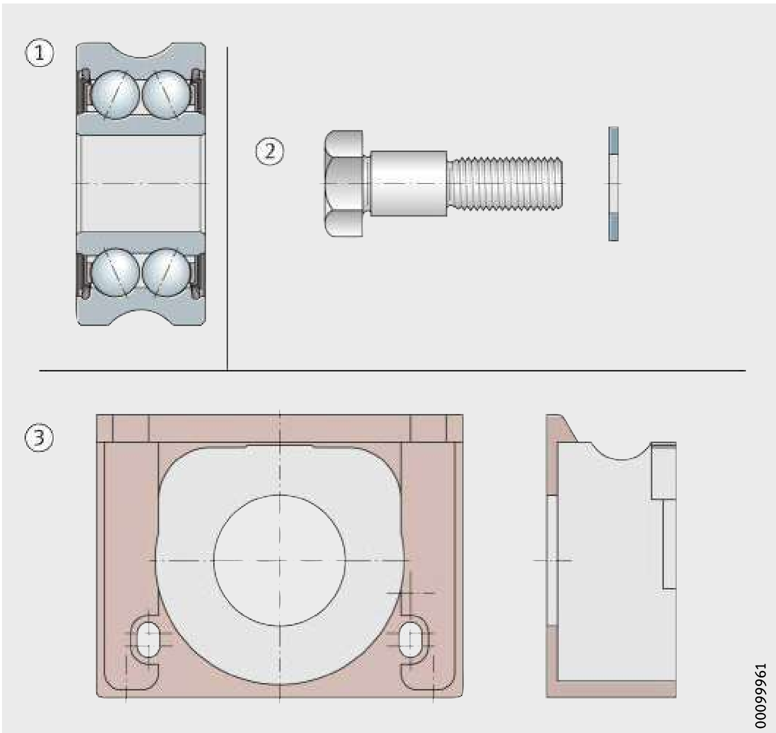
Figure 6
Closed oval track with 90° arcs and guideway connectors VBS
LFS52×2000×3000-OV-300-VBS

Ordering example, ordering designation

Individual components

In order to achieve versatile user designs, it is also possible to order individual components of the ready-to-fit systems; example, *Figure 7*.

Track roller	Series	LFR
	Size	50/8-6
	Sealing	2RS
	Corrosion-resistant	RB, *Figure 7*
Ordering designation	**LFR50/8-6-2RS-RB**	
Bolt	Series	LF
	Concentric	Z
	Size	8
	Corrosion-resistant	RB, *Figure 7*
Ordering designation	**LFZ8-RB**	
Cap wiper	Series	AB.LFR
	Size	50/8, *Figure 7*
Ordering designation	**AB.LFR50/8**	



1 Track roller
2 Bolt, concentric
3 Cap wiper

Figure 7
Track roller, bolt, wiper

Operating limits

Operating temperature

Track roller guidance systems can be used at a temperature from −20 °C to +80 °C. For applications below −20 °C and above +80 °C, please contact us.

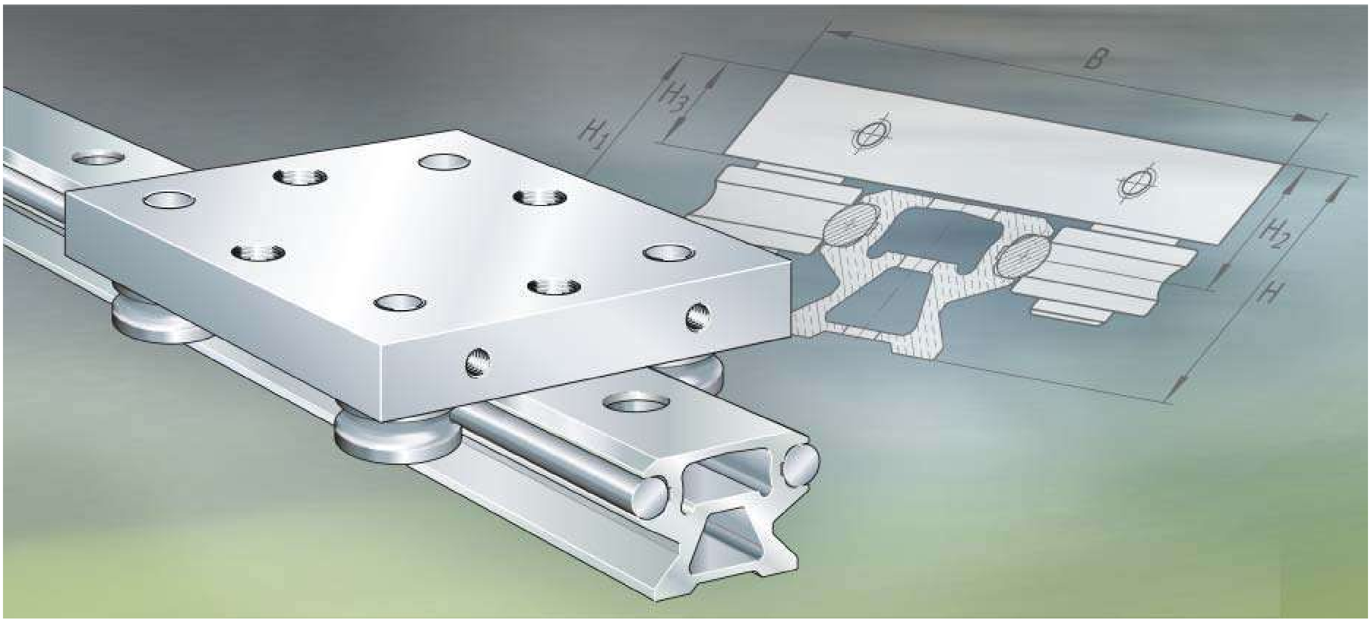
The area of application is restricted by the lubricant, the plastics used and the composite materials.

Velocities

The maximum possible speed of track roller guidance systems is 10 m/s. Higher speeds may be possible by agreement.

Acceleration

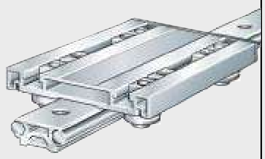
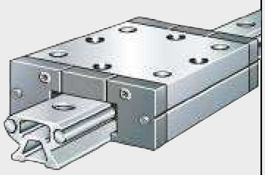
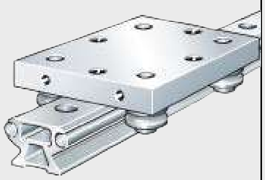
When using track roller guidance systems, accelerations of up to 50 m/s^2 can be achieved.



Track roller guidance systems

With hollow section carriage
With compact carriage
With open carriage
With non-locating bearing carriage
With bogie carriage

Matrix for preselection of track roller guidance systems

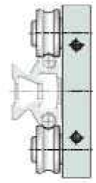
Track roller guidance systems with	Width of guideways						Corrosion-resistant
	20	25	32	42	52	86	
Hollow section carriage LFCL 	–	●	–	●	–	●	■
Compact carriage LFKL..-SF 	●	●	●	–	●	–	■
Open carriage LFL..-SF 	●	–	●	–	●	–	■
Non-locating bearing carriage LFLL..-SF 	–	–	●	–	●	–	■
Bogie carriage LFDL..-SF LFDL..-B 	–	–	●	–	●	–	■

● available sizes

■ possible

1) The guideway LFS..-M can only be combined with carriages with adjustable clearance. If carriages LFCL and LFKL..-SF are to be used, please contact us in advance.

Special features of guidance systems	Sizes	Basic dimensions of guidance systems, dimensions, *Figure 1*									Description
		LFS (-C, -CE, -CEE, -E, -EE, -NZZ, -OV), LFSR..-ST			LFS..-F (-FE)			LFS..-M[1]			
		H	B	L	H	B	L	H	B	L	see page
▫ economical ▫ low mass ▫ high moment load carrying capacity M_X	25 42 86	32,1 39 59	80 116 190	110 150 235	– 33,9 –	80 116 190	110 150 235	63,1 – –	80 116 190	110 150 235	46
▫ closed series ▫ protected track rollers ▫ integrated lubrication unit	20 25 32 52 52-E 52-EE	22 25 35,5 54,3 60,4 60,4	56 65 86 13 145 155	69 85 112 136 186 205	– – 25,5 38,2 44,3 44,3	56 65 86 130 145 155	69 85 112 136 186 205	– 56 – 118,9 125 125	56 65 86 130 145 155	69 85 112 136 186 205	48
▫ very robust ▫ simple construction	20 32 52 52-E	22 35,5 54,3 60,4	55 80 120 135	50 90 100 150	– 25,5 38,2 44,3	55 80 120 135	50 90 100 150	– 81,5 118,9 125	55 80 120 135	50 90 100 150	50
▫ locating and non-locating bearing arrangement ▫ compensation of skewing in the adjacent construction up to ±1 mm	32 52	35,5 54,3	80 120	90 100	25,5 38,2	80 120	90 100	81,5 118,9	80 120	90 100	52
▫ oval track guidance systems for unlimited stroke length	32-B 32-SF 52-B 52-SF	44,2 44,2 66,1 60,1	80 80 120 120	100 100 150 150	34,2 34,2 50 50	80 80 120 120	100 100 150 150	90,2 90,2 130,7 130,7	80 80 120 120	100 100 150 150	54



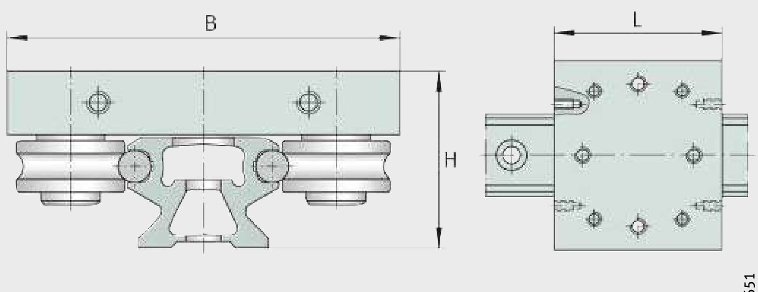
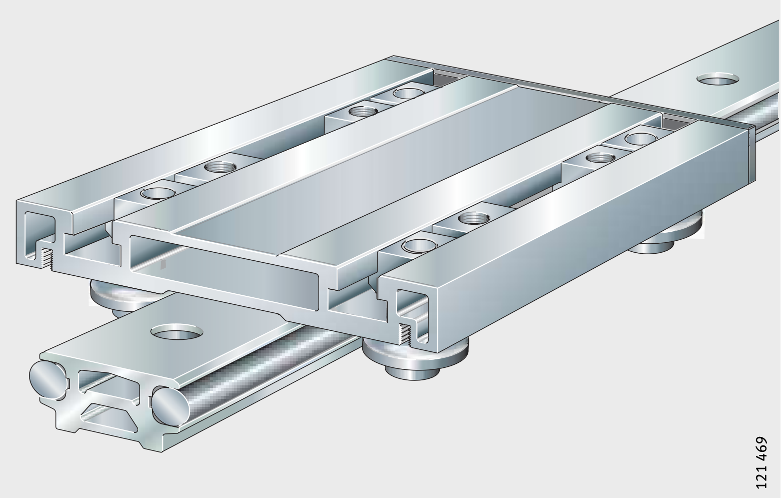


Figure 1
Dimensions H, B, L

With hollow section carriage

Clearance-free

LFCL

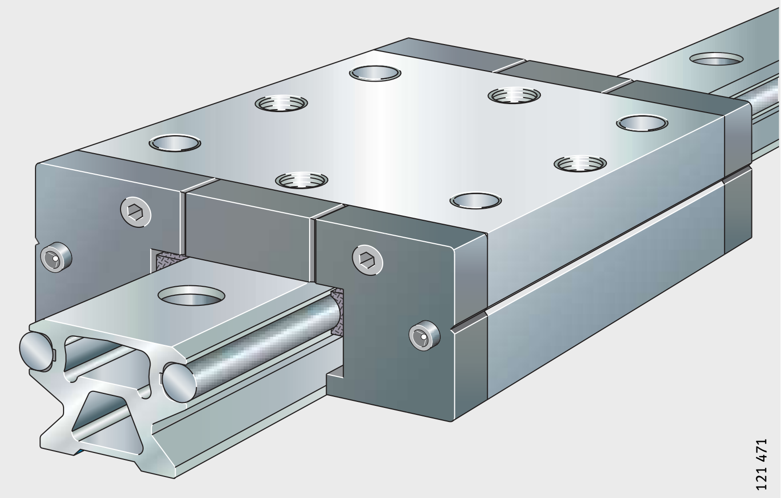


121 469

With compact carriage

Clearance-free

LFKL..-SF

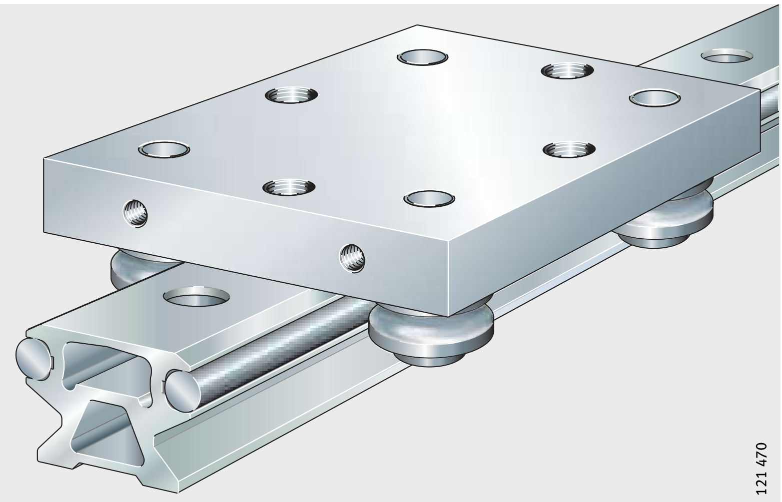


121 471

With open carriage

Clearance-free

LFL..-SF

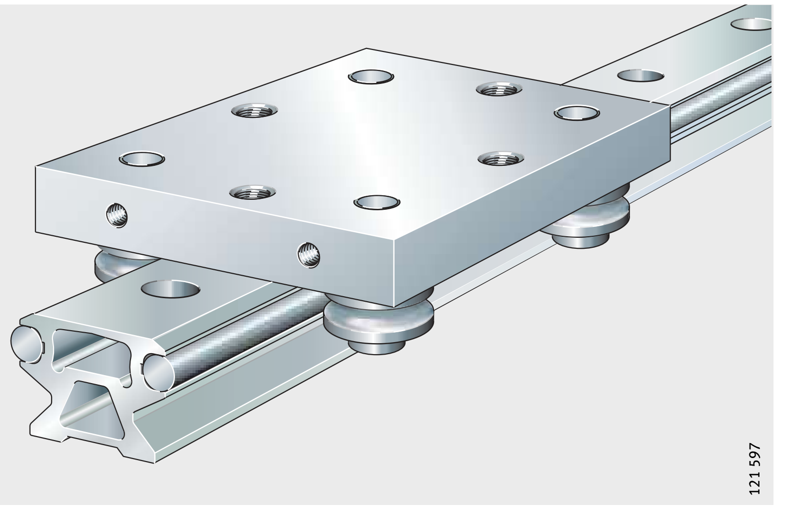


121 470

With non-locating bearing carriage

Clearance-free

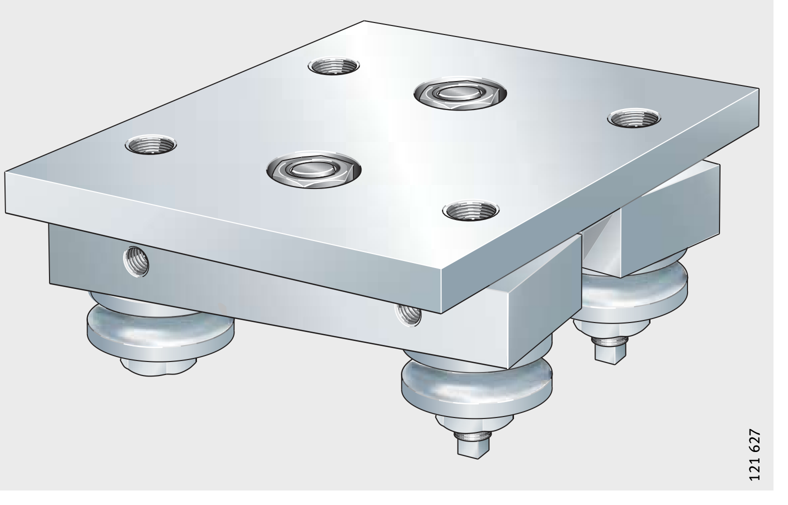
LFLL..-SF


121 597

With bogie carriage

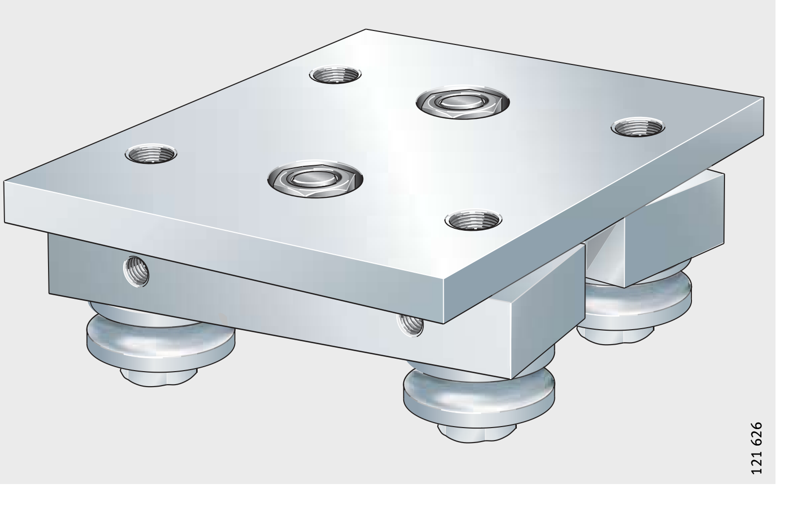
Concentric and eccentric bolts, adjustable clearance

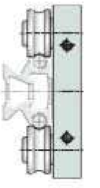
LFDL..-B


121 627

Concentric bolts clearance-free

LFDL..-SF


121 626



Track roller guidance systems

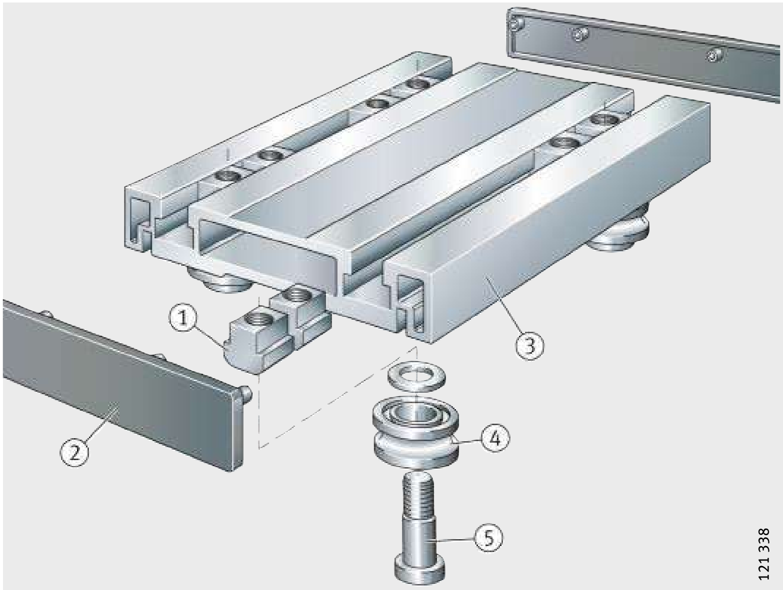
Features

Track roller guidance systems are available with a hollow section carriage, compact carriage, open carriage, non-locating bearing carriage or bogie carriage.

Track roller guidance system with hollow section carriage

The economical series LFCL is characterised in particular by its low mass and its high moment load carrying capacity M_x. In addition, more individual design of the adjacent construction is possible by means of four T-bolts that can be moved in a longitudinal direction.

A carriage comprises a carriage plate made from anodised aluminium, four concentric bolts, four track rollers, two end covers for the hollow sections and four T-nuts that can be used for the adjacent construction, *Figure 1*. The track rollers and end covers are already fitted.

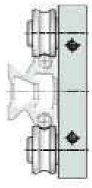


1 T-nut
2 End cover
3 Carriage plate
4 Track roller
5 Concentric bolt

Figure 1
Hollow section carriage

Preload and clearance

The carriages run clearance-free on all INA guideways, see page 42, and can be combined with all guideways of the relevant size, but not with the curved guideway elements LFSR. Due to the highly accurate guideways, it is not necessary to set the clearance.



Sealing and lubrication

The track rollers have gap seals on both sides, are greased for life and are therefore maintenance-free.

The raceways can be lubricated using cap wipers AB.LFR. Their fixing screws pass into the screw mounting channels of the carriage plate.

Corrosion-resistant design

All steel parts, the inner and outer rings of the track rollers and the bolts, washers and nuts are made from corrosion-resistant steel. The rolling elements are protected against corrosion by the grease.

Corrosion-resistant designs have the suffix RB.

Further information

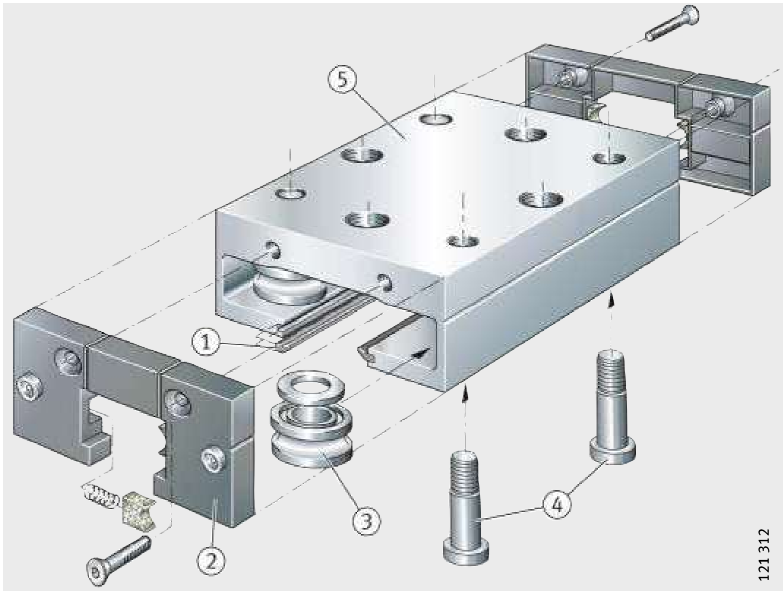
Further information is given on the following pages:

- dimension table, see page 56
- track rollers, see page 68
- guideways, see page 76
- accessories, see page 106.

Track roller guidance system with compact carriage

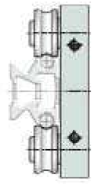
The closed compact carriage LFKL..-SF gives a simple means of achieving track roller guidance systems for operation in contaminated environments. The track rollers are protected against contamination by the closed design. It has two integrated lubrication units for lubrication of the raceways.

A carriage comprises a saddle plate made from anodised, profiled aluminium, four concentric bolts, four track rollers, two sealing strips and two lubrication and wiper units, *Figure 2*. The track rollers are already fitted, the sealing strips as well as the lubrication and wiper units are included loose in the delivery.



① Sealing strip
② Lubrication and wiper unit
③ Track roller
④ Concentric bolt
⑤ Saddle plate

Figure 2
Compact carriage



Preload and clearance

The carriages run clearance-free on all INA guideways, see page 42, and can be combined with all guideways of the relevant size, but not with the curved guideway elements LFSR. Due to the highly accurate guideways, it is not necessary to set the clearance.

Sealing and lubrication

The track rollers have gap seals on both sides, are greased for life and are therefore maintenance-free.

For lubrication of the raceways, the lubrication and wiper units have oil-soaked felt inserts that can be replenished with oil via lubrication nipples. In combination with the sealing strips (gap seals), these units protect the compact carriage on all sides against contamination.

Corrosion-resistant design

All steel parts, the inner and outer rings of the track rollers and the bolts, washers and nuts are made from corrosion-resistant steel. The rolling elements are protected against corrosion by the grease.

Corrosion-resistant designs have the suffix RB.

Further information

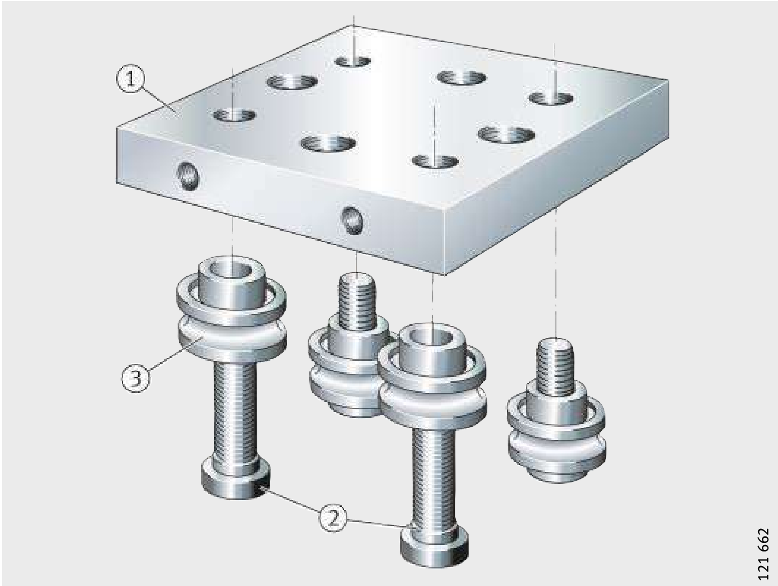
Further information is given on the following pages:

- dimension table, see page 58
- track rollers, see page 68
- guideways, see page 76
- accessories, see page 106.

Track roller guidance system with open carriage

The robust, open carriage LFL..-SF is suitable where high performance linear guidance systems of a simple construction are required.

A carriage comprises a carriage plate made from anodised aluminium, four screws and four track rollers, *Figure 3*. The track rollers are already fitted.

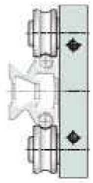


1 Carriage plate
2 Screws
3 Track roller

Figure 3
Open carriage

Preload and clearance

The carriages run clearance-free on all INA guideways, see page 42, and can be combined with all guideways of the relevant size, but not with the curved guideway elements LFSR. Due to the highly accurate guideways, it is not necessary to set the clearance.



Sealing and lubrication

The track rollers have gap seals on both sides, are greased for life and are therefore maintenance-free.

The raceways can be lubricated by means of lubrication and wiper units AB, see page 106. Their oil-soaked felt inserts can be replenished with oil via lubrication nipples. In combination with side plates ABAL, these units seal the end faces and longitudinal sides of the open carriage, see page 107.

Corrosion-resistant design

All steel parts, the inner and outer rings of the track rollers and the screws, washers and nuts are made from corrosion-resistant steel. The rolling elements are protected against corrosion by the grease.

Corrosion-resistant designs have the suffix RB.

Further information

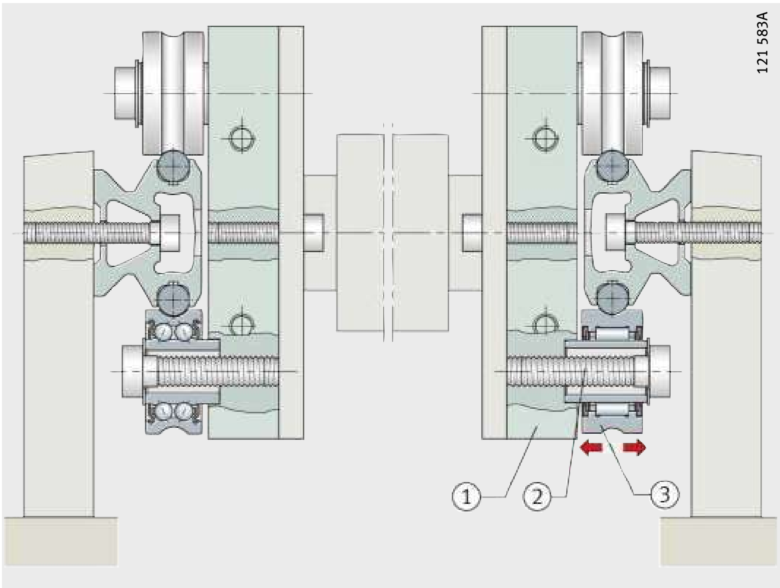
Further information is given on the following pages:

- dimension table, see page 60
- track rollers, see page 68
- guideways, see page 76
- accessories, see page 106.

Track roller guidance system with non-locating bearing carriage

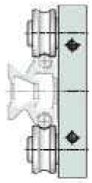
Non-locating bearing carriages LFLL..-SF are robust, ready-to-fit linear guidance systems that are used exclusively in locating or non-locating bearing applications with two parallel guideway systems. The track rollers can be axially displaced. In this way, it is possible to compensate inaccuracies of ±1 mm in relation to the spacing of the guideways.

A carriage comprises a carriage plate made from anodised aluminium, four screws and four non-locating bearing track rollers, *Figure 4*. The track rollers are already fitted.



① Carriage plate
② Screw
③ Non-locating bearing track roller

Figure 4
Non-locating bearing carriage



Preload and clearance

The carriages run clearance-free on all INA guideways, see page 42, and can be combined with all guideways of the relevant size, but not with the curved guideway elements LFSR. Due to the highly accurate guideways, it is not necessary to set the clearance.

Sealing and lubrication

The track rollers have gap seals on both sides, are greased for life and are therefore maintenance-free.

The contact zone between the raceways and track rollers must be lubricated via the shaft.

Corrosion-resistant design

All steel parts, the inner and outer rings of the track rollers and the screws, washers and nuts are made from corrosion-resistant steel.

The rolling elements are protected against corrosion by the grease.

Corrosion-resistant designs have the suffix RB (available by agreement only).

Non-locating bearing carriages must never be used on their own but only ever in combination with locating bearing carriages.

The track rollers can support loads in a radial direction only.

Further information

Further information is given on the following pages:

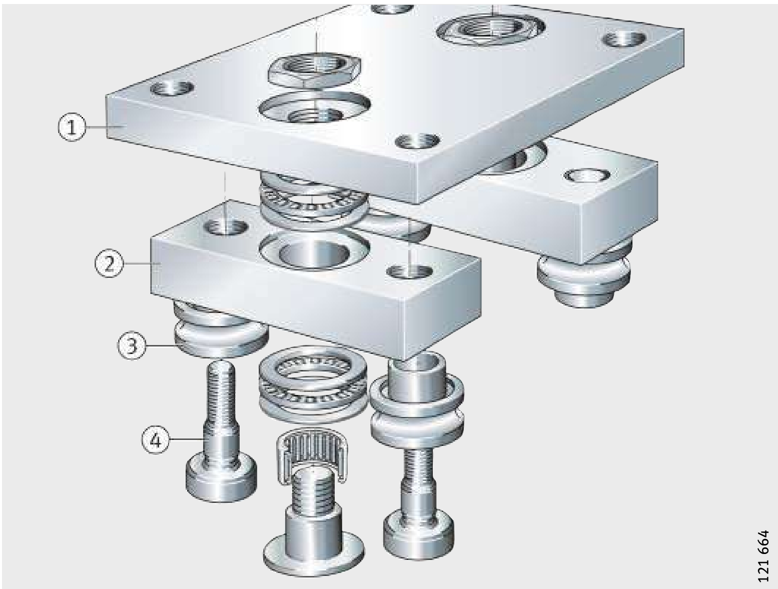
- dimension table, see page 62
- track rollers, see page 68
- guideways, see page 76
- accessories, see page 106.

Track roller guidance system with bogie carriage

Bogie carriages LFDL..-B and LFDL..-SF can be used in combination with curved guideway elements LFSR..-ST to achieve almost any variant of oval and circular track guidance systems. The straight guideway elements are precisely matched to the arc.

The carriages LFDL..-B and LFDL..-SF comprise a steel carriage plate, two aluminium swivel brackets (supported axially and radially by rolling bearings). In the case of LFDL..-B, the preload of the four profiled track rollers can be set by means of two concentric and two eccentric bolts. In the case of LFDL..-SF, the preload is already preset to the optimum value by means of four concentric bolts, *Figure 5*.

LFDL..-SF cannot be mounted on closed curved guideway systems.



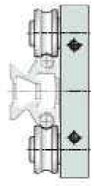
1 Carriage plate
2 Bracket
3 Track roller
4 Concentric bolt

Figure 5
Bogie carriage

Sealing and lubrication

The track rollers have gap seals on both sides, are greased for life and are therefore maintenance-free.

The contact zone between the raceways and track rollers must be lubricated via the shaft.



Corrosion-resistant design

All steel parts, the inner and outer rings of the track rollers and the bolts, washers and nuts are made from corrosion-resistant steel. The rolling elements are protected against corrosion by the grease.

Corrosion-resistant designs have the suffix RB (available by agreement only).

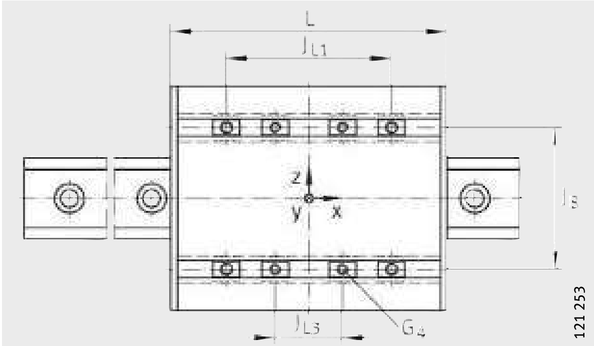
! The adjustable carriage LFDL..-B must be used in combination with a 360° guideway.

Further information

Further information is given on the following pages:

- dimension table, see page 64
- track rollers, see page 68
- guideways, see page 76
- accessories, see page 106.

Track roller guidance system with hollow section carriage



LFCL with LFS (-C, -CE, -CEE, -E, -EE, -NZZ, -M, -F)
View rotated 90°

Dimension table · Dimensions in mm

Carriage[1]	Mass	Track roller[2]	For shaft diameter	Dimensions			Mounting dimensions		
	m			H_1	B	L	J_B	J_{B1}	J_{B2}
	≈ kg								
LFCL25	0,44	**LFR50/8-6-2Z**	**6**	30,5	80	110	47	47	69
LFCL42	1	**LFR5201-10-2Z**	**10**	38,1	116	150	73	73	98,5
LFCL86[4]	2,2	**LFR5301-10-2Z**	**10**	48,4	190	235	124	124	151,5

Ordering designations
Corrosion-resistant design: LFCL..-RB, LFS..-RB with LFR..-2RSR-RB.
Guideways without holes: LFS..-OL.

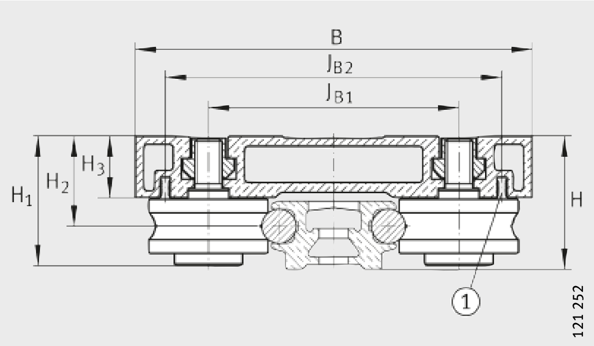
① Threaded slot for screws M3.

1) The design of the hollow sections is dependent on the size.
2) For ordering of replacement parts, please contact us.
3) The guideway LFS..-M can only be combined with carriages with adjustable clearance. If SF and LFCL carriages are to be used, please contact us in advance.
4) Additional T-slot in the centre of the carriage.

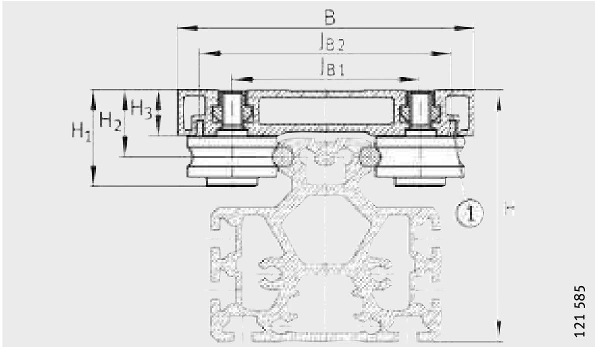
Basic load ratings[1]

Carriage	Guideway	Track roller[2]	Basic load ratings						
			C_y	C_{0y}	C_z	C_{0z}	M_{0x}	M_{0y}	M_{0z}
			N	N	N	N	Nm	Nm	Nm
LFCL25	**LFS25**	**LFR50/8-6-2Z**	4 600	2 400	7 320	4 500	25	120	65
LFCL42	**LFS42**	**LFR5201-10-2Z**	10 200	5 480	16 900	10 000	85	425	230
LFCL86	**LFS86**	**LFR5301-10-2Z**	17 800	8 850	28 400	15 500	335	1 190	680

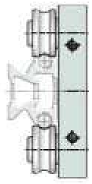
1) Basic load ratings in combination with LFS..-RB: see page 18.
2) For ordering of replacement parts, please contact us.



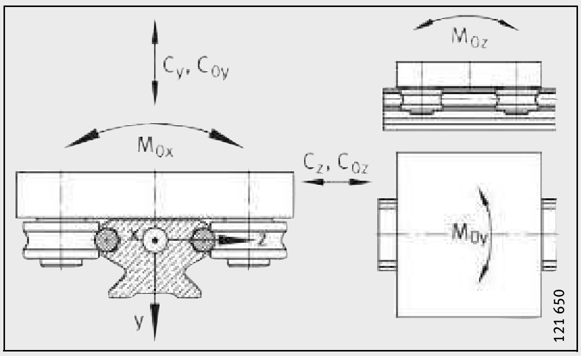
LFCL with LFS (-C, -CE, -CEE, -E, -EE, -N, -NZZ)



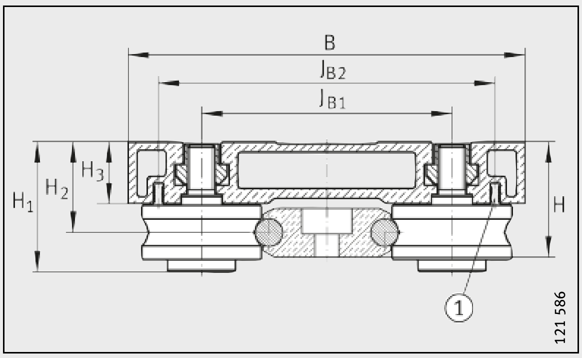
LFCL with LFS..-M[3)]



J_{L1}	J_{L3}		H_2	H_3	G_4	Maximum screw depth for G_4	Total height H of carriage and guideway		
	min.	max.	+0,3				LFS (-C, -CE, -CEE, -E, -EE, -N, -NZZ)	LFS-F	LFS..-M[3)]
58	13	32	21,5	15,4	M6	10	32,1	–	63,1
85	15	55	26,4	18	M8	12	39	33,9	–
155	18	119	33,9	23,4	M10	14	59	–	–

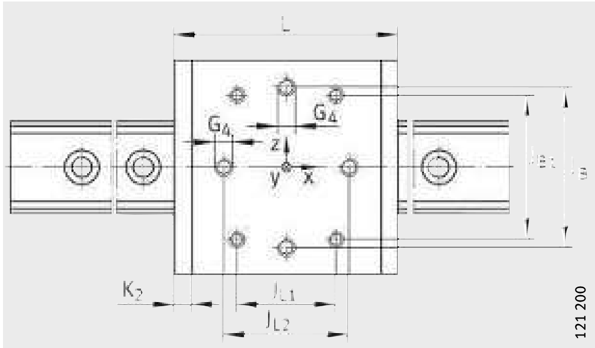


Load directions



LFCL with LFS..-F

Track roller guidance system with compact carriage



LFKL-SF with LFS (-C, -CE, -CEE, -E, -EE, -NZZ, -M, -F, -FE)
View rotated 90°

Dimension table · Dimensions in mm

Carriage	Mass	Track roller[1]	For shaft diameter	Dimensions			Mounting dimensions		
	m			H_1	B	L	J_B	J_{B1}	K_2
	≈ kg						±0,2		
LFKL20-SF	0,2	**LFR50/5-4-2Z**	**4**	20,5	56	69	39	34	5
LFKL25-SF	0,3	**LFR50/5-6-2Z**	**6**	23,5	65	85	50	40	5
LFKL32-SF	0,7	**LFR50/8-6-2Z**	**6**	32	86	112	59	54	7
LFKL52-SF	1,5	**LFR5201-10-2Z**	**10**	46,1	130	136	90	83	10
LFKL52-E-SF	2,9	**LFR5301-10-2Z**	**10**	53,8	145	186	105	90	10
LFKL52-EE-SF	4,3	**LFR5302-10-2Z**	**10**	55	155	205	115	95,2	10

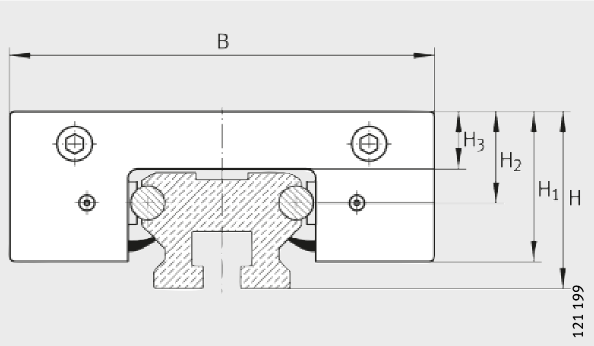
Ordering designation
Corrosion-resistant design: LFKL..-SF-RB, LFS..-RB with LFR..-2RSR-RB.
Guideways without holes: LFS..-OL.

1) For ordering of replacement parts, please contact us.
2) Tightening torque for track roller bolts, concentric bolts are supplied tightened to M_A.
3) The guideway LFS..-M can only be combined with carriages with adjustable clearance. If these are to be used, please contact us in advance.

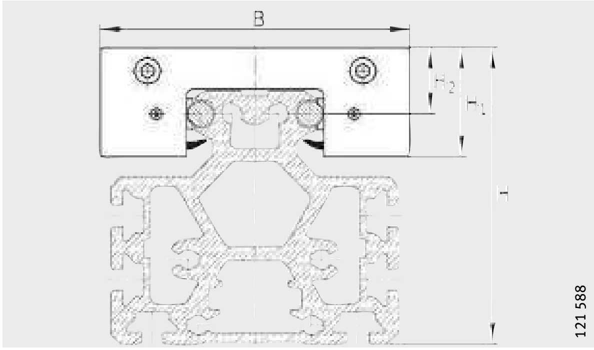
Basic load ratings[1]

Carriage	Guideway	Track roller[2]	Basic load ratings						
			C_y	C_{0y}	C_z	C_{0z}	M_{0x}	M_{0y}	M_{0z}
			N	N	N	N	Nm	Nm	Nm
LFKL20-SF	**LFS20**	**LFR50/5-4-2Z**	1 350	870	2 400	1 700	7	28	15
LFKL25-SF	**LFS25**	**LFR50/5-6-2Z**	1 280	820	2 580	1 800	8	40	18
LFKL32-SF	**LFS32**	**LFR50/8-6-2Z**	4 100	2 400	6 600	4 200	30	130	70
LFKL52-SF	**LFS52**	**LFR5201-10-2Z**	10 000	5 200	16 800	10 000	110	290	150
LFKL52-E-SF	**LFS52-E**	**LFR5301-10-2Z**	17 800	8 900	28 400	15 500	180	800	460
LFKL52-EE-SF	**LFS52-EE**	**LFR5302-10-2Z**	20 000	10 000	32 400	18 200	215	1 100	620

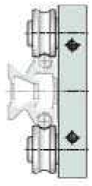
1) Basic load ratings in combination with LFS..-RB: see page 18.
2) For ordering of replacement parts, please contact us.



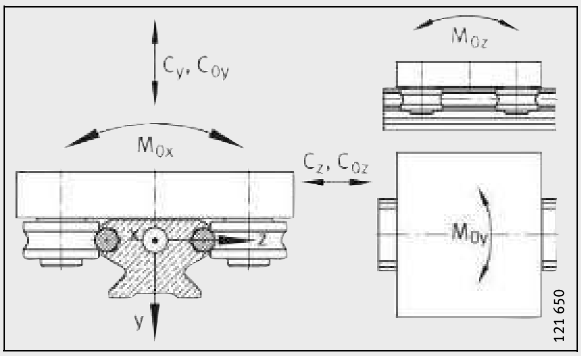
LFKL-SF with LFS (-C, -CE, -CEE, -E, -EE, -NZZ)



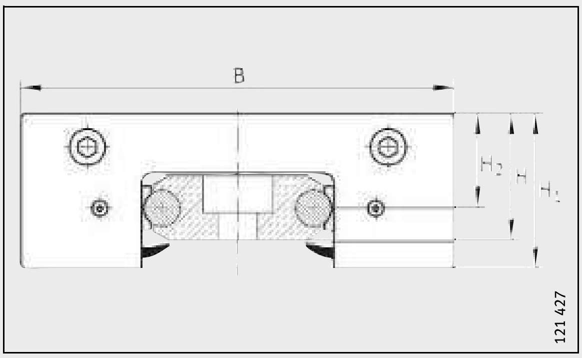
LFKL with LFS..-M[3)]



							Total height H of carriage and guideway		
J_{L1}	J_{L2}	H_2	H_3	G_4	M_A[2)]		LFS (-C, -CE, -CEE, -E, -EE, -NZZ)	LFS-F (-FE)	LFS-M[3)]
					Standard	Corrosion-resistant			
	±0,2	+0,3			Nm	Nm			
34	49	13	8,7	M5	2,5	2,5	22	–	–
45	60	14,4	9	M5	2,5	2,5	25	–	56
60	70	20,5	14	M8	15	12	35,5	25,5	81,5
60	70	29,2	19,4	M10	40	23	54,3	38,2	118,9
105	110	35,3	24	M10	40	23	60,4	44,3	125
120	140	35,3	24	M12	70	39	60,4	44,3	125

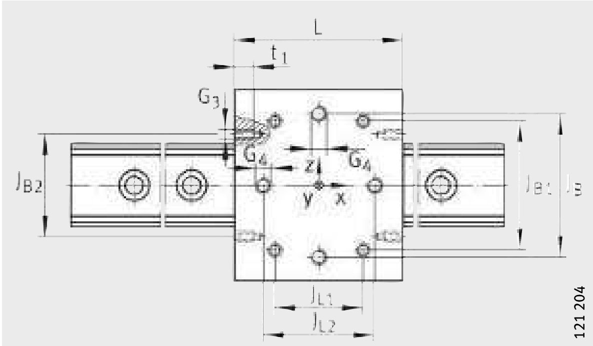


Load directions



LFKL-SF with LFS..-F (-FE)

Track roller guidance system with open carriage



LFL-SF with LFS (-C, -CE, -CEE, -E, -EE, -NZZ, -M, -F, -FE)
View rotated 90°

Dimension table · Dimensions in mm

Carriage	Mass	Track roller[1]	For shaft diameter	Dimensions			Mounting dimensions				
	m			H_1	B	L	J_B	J_{B1}	J_{B2}	J_{L1}	J_{L2}
	≈ kg						±0,2				±0,2
LFL20-SF	0,16	**LFR50/5-4-2Z**	**4**	20,5	55	50	40	34	–	24	38
LFL32-SF	0,4	**LFRI50/8-6-2Z**	**6**	30	80	90	59	54	56	60	70
LFL52-SF	1	**LFRI5201-10-2Z**	**10**	43,2	120	100	90	83,2	65	60	70
LFL52-E-SF	1,9	**LFR5301-10-2Z**	**10**	53,8	135	150	105	90	65	105	110

Ordering designation
Corrosion-resistant design: LFL..-SF-RB, LFS..-RB with LFR..-2RSR-RB.
Guideways without holes: LFS..-OL.

Corrosion-resistant design available by agreement.

1) For ordering of replacement parts, please contact us.

2) Tightening torque for track roller bolts, concentric bolts are supplied tightened to M_A.

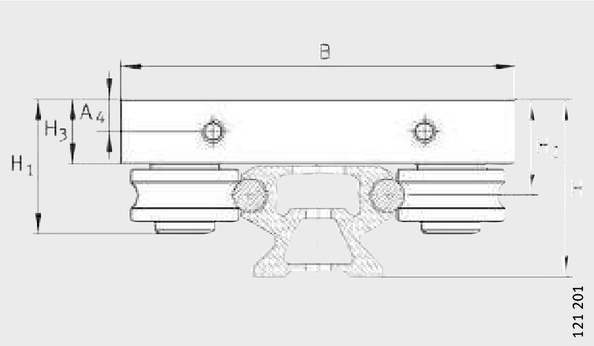
3) The guideway LFS..-M can only be combined with carriages with adjustable clearance.
If SF and LFCL carriages are to be used, please contact us in advance.

Basic load ratings[1]

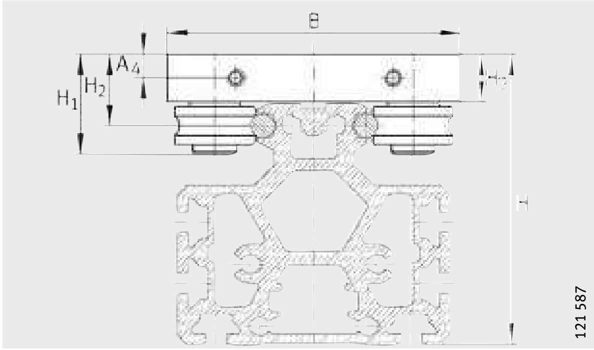
Carriage	Guideway	Track roller[2]	Basic load ratings						
			C_y	C_{0y}	C_z	C_{0z}	M_{0x}	M_{0y}	M_{0z}
			N	N	N	N	Nm	Nm	Nm
LFL20-SF	**LFS20**	**LFR50/5-4-2Z**	1 350	870	2 400	1 700	7	20	10
LFL32-SF	**LFS32**	**LFR50/8-6-2Z**	4 100	2 400	6 600	4 200	30	130	70
LFL52-SF	**LFS52**	**LFR5201-10-2Z**	10 000	5 200	16 800	10 000	110	290	150
LFL52-E-SF	**LFS52-E**	**LFR5301-10-2Z**	17 800	8 900	28 400	15 500	180	800	460

1) Basic load ratings in combination with LFS..-RB: see page 18.

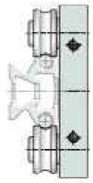
2) For ordering of replacement parts, please contact us.



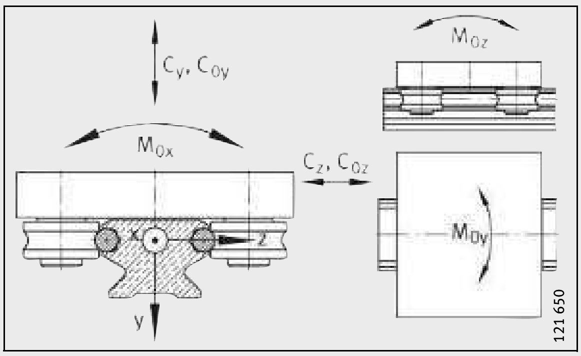
LFL-SF with LFS (-C, -CE, -CEE, -E, -EE, -NZZ)



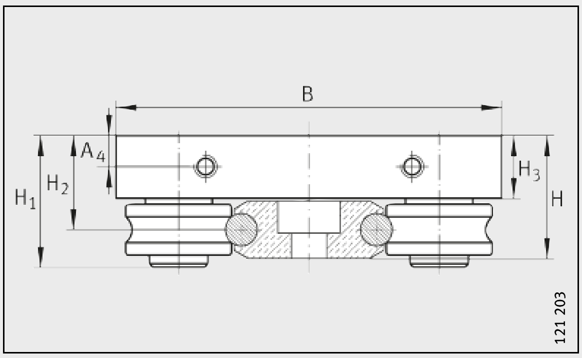
LFL with LFS..-M[3)]



								Total height H of carriage and guideway		
t_1	H_2	H_3	A_4	G_3	G_4	M_A[2)]		LFS (-C, -CE, -CEE, -E, -EE, -NZZ)	LFS-F (-FE)	LFS-M[3)]
	+0,3					Standard Nm	Corrosion-resistant Nm			
–	13	9	–	–	M5	2,5	2,5	22	–	–
7	20,5	14	7	M6	M8	15	12	35,5	25,5	81,5
12	29,2	19,5	9,75	M6	M10	40	23	54,3	38,2	118,9
12	35,3	24	12	M6	M10	40	23	60,4	44,3	125

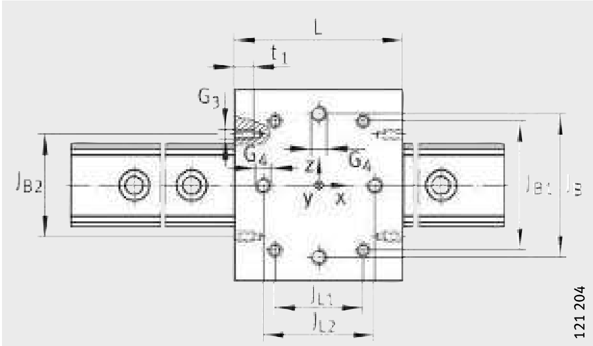


Load directions



LFL-SF with LFS..-F (-FE)

Track roller guidance system with non-locating bearing carriage



LFLL with LFS (-C, -CE, -CEE, -E, -EE, -NZZ, -M, -F, -FE)
View rotated 90°

Dimension table · Dimensions in mm

Carriage	Mass	For shaft diameter	Dimensions			Mounting dimensions			
	m		H_1	B	L	J_B	J_{B1}	J_{B2}	J_{L1}
	≈ kg					±0,2			
LFLL32-SF	0,4	**6**	32,5	80	90	59	54	56	60
LFLL52-SF	1	**10**	45	120	100	90	83	65	60

Ordering designation
Guideways without holes: LFS..-OL.

Corrosion-resistant design available by agreement.

1) LFLL32-SF: ±0,5 axial displacement capacity.

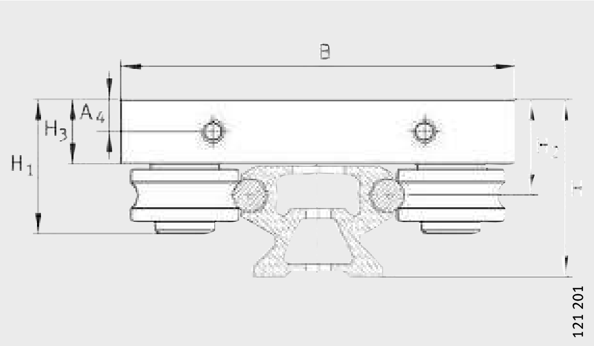
2) LFLL52-SF: ±1 axial displacement capacity.

Basic load ratings[1]

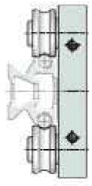
Carriage	Guideway	Track roller[2]	Basic load ratings		
			C_z	C_{0z}	M_{0y}
			N	N	Nm
LFLL32-SF	**LFS32**	**LFR22/8-6-2RSR-RNA + IR.LFLL32**	9 000	8 000	250
LFLL52-SF	**LFS52**	**LFR2202-10-2RSR-RNA + IR.LFLL52**	17 000	19 000	550

1) Basic load ratings in combination with LFS..-RB: see page 18.

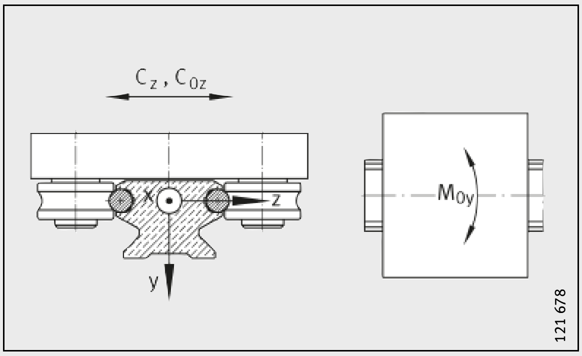
2) For ordering of replacement parts, please contact us.



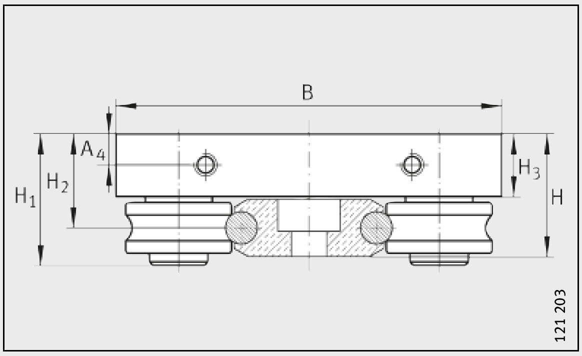
LFLL with LFS (-C, -CE, -CEE, -E, -EE, -NZZ)



							Total height H of carriage and guideway	
J_{L2} ±0,2	t_1	H_2	H_3	A_4	G_3	G_4	LFS (-C, -CE, -CEE, -E, -EE, -NZZ)	LFS-F (-FE)
70	7	20,5[1)]	13,75	7	M6	M8	35,5[1)]	25,5[1)]
70	12	29,2[2)]	19,5	9,75	M6	M10	54,3[2)]	38,2[2)]

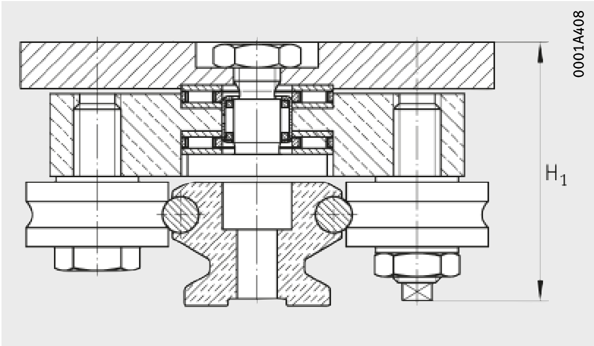


Load directions



LFLL with LFS..-F (-FE)

Track roller guidance system with bogie carriage



LFDL..-B with LFS (-C, -CE, -CEE, -E, -EE, -NZZ)

Dimension table · Dimensions in mm

Carriage[1)]	Mass	Track roller[2)]	For shaft diameter	Dimensions			Mounting dimensions	
	m			H_1	B	L	J_B	J_{B1}
	≈ kg							
LFDL32-B	1	**LFR50/8-6-2Z**	**6**	43	80	100	60	54
LFDL32-SF				37				
LFDL52-B	2,5	**LFR5201-10-2Z**	**10**	65,1	120	150	90	83
LFDL52-SF				55				

Corrosion-resistant design available by agreement.

1) In order to protect the raceways, the carriages can also be fitted with the lubrication and wiper unit AB (special accessory). Please contact us.

2) For ordering of replacement parts, please contact us.

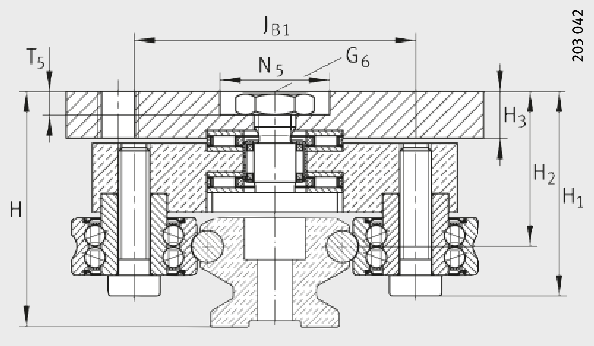
3) Tightening torque for track roller bolts, concentric bolts are supplied tightened to M_A.

Basic load ratings[1)]

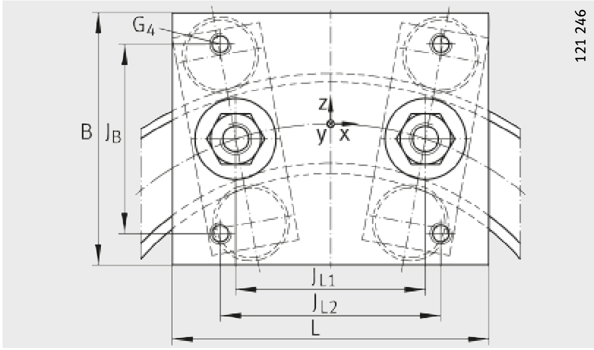
Carriage	Guideway	Track roller[2)]	Basic load ratings						
			C_y	C_{0y}	C_z	C_{0z}	M_{0x}	M_{0y}	M_{0z}
			N	N	N	N	Nm	Nm	Nm
LFDL32-B	**LFS32**	**LFR50/8-6-2Z**	4 100	2 400	6 600	4 200	30	130	70
LFDL32-SF	**LFS32**	**LFR50/8-6-2Z**							
LFDL52-B	**LFS52**	**LFR5201-10-2Z**	10 000	5 200	16 800	10 000	110	380	200
LFDL52-B-SF	**LFS52**	**LFR5201-10-2Z**							

1) Basic load ratings in combination with LFS..-RB: see page 18.

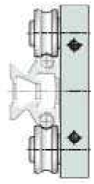
2) For ordering of replacement parts, please contact us.



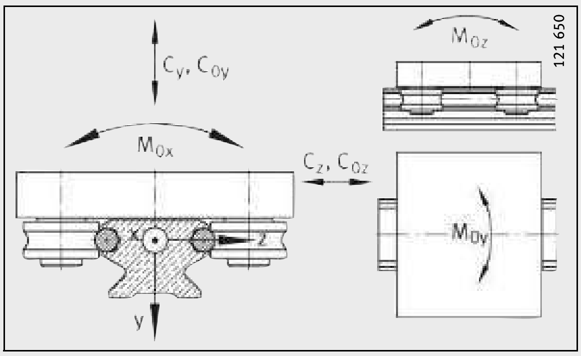
LFDL-SF with LFS (-C, -CE, -CEE, -E, -EE, -NZZ)



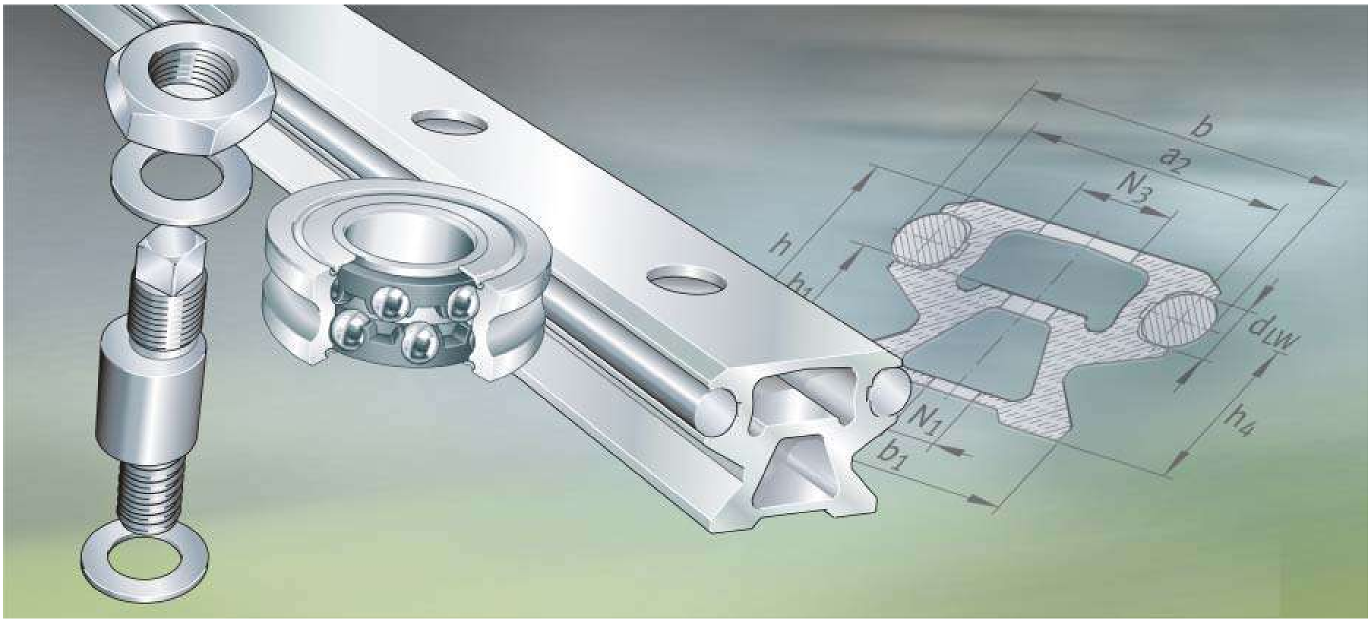
Top view



									Total height H of carriage and guideway
J_{L1}	J_{L2}	H_2 +0,3	H_3	T_5	G_4	N_5	G_6	M_A 3) Standard Nm	LFS (-C, -CE, -CEE, -E, -EE, -NZZ)
60	70	29,2	9	5	M8	21	M8	15	44,2
76	90	41	11	6	M10	26	M10	40	66,1



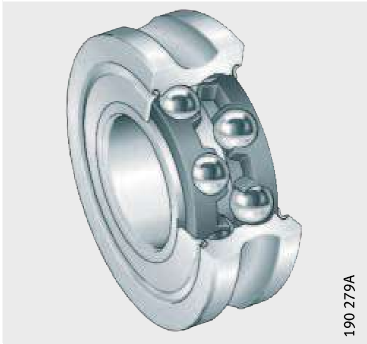
Load directions



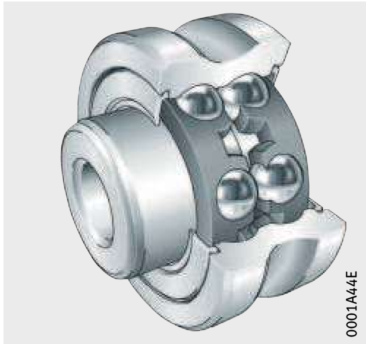
Track rollers
Bolts
Guideways

Locating bearing track roller

LFR

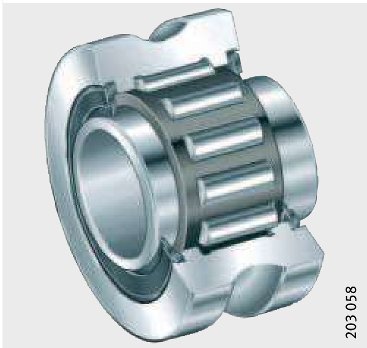


LFRI

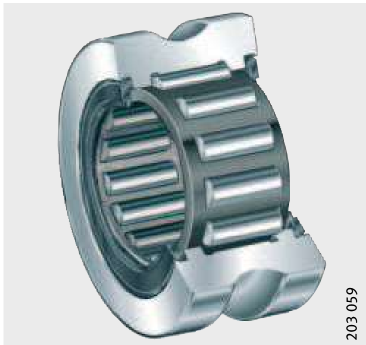


Non-locating bearing track roller

LFR..-2RSR-NA



LFR..-2RSR-RNA



Track rollers

Features

Track rollers LFR are double row angular contact ball bearings comprising an outer ring with a gothic arch profile, an inner ring and two ball and cage assemblies with plastic cages. The inner ring and outer ring are made from rolling bearing steel 100Cr6.

The special outer ring gives two point contact in the contact zone with the raceway, *Figure 1*. The contact angle α is a maximum of 30°.

The bearings can support axial forces from both directions as well as radial forces.

$\alpha = 30°$

1 Gothic arch raceway groove

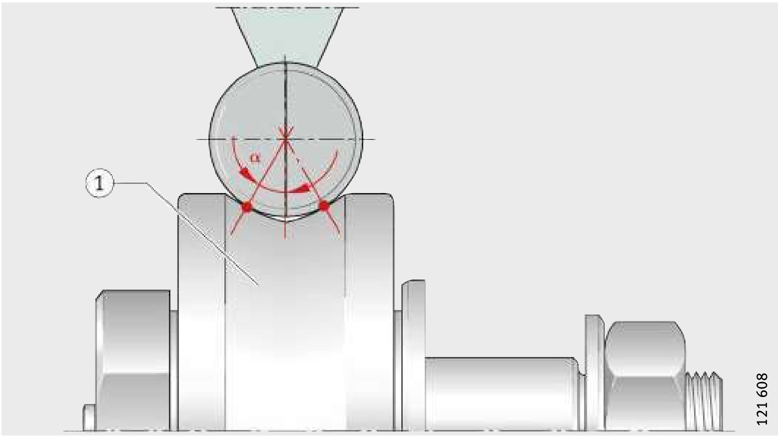
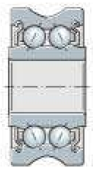
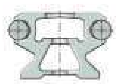


Figure 1
Gothic arch, two point contact, contact angle



Track roller with extended inner ring

Track rollers LFRI are double row angular contact ball bearings. They differ from track rollers LFR in that they have an extended inner ring. This allows exact positioning in the adjacent construction. The inner ring is mounted by means of a standard screw (for example ISO 4762) in a fit hole (preferably grade F6). The fixing screw is not included in the scope of delivery. The operating clearance of track rollers with an extended inner ring cannot be set by means of eccentric bolts.



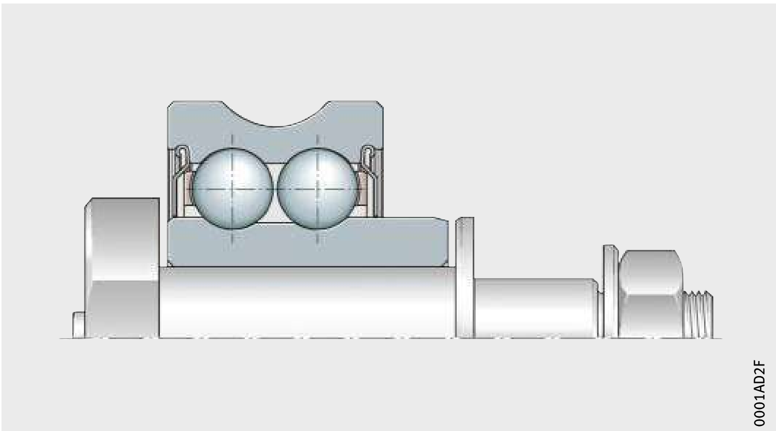


Figure 2
Track roller LFRI with fixing screw

Sealing and lubrication

Gap seals on both sides protect the rolling element system against contamination. Bearings with this seal type have the suffix 2Z.

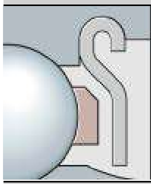
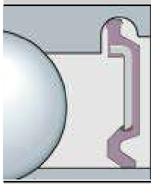
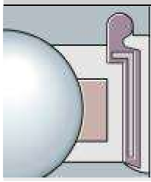
The track rollers are also available on request with contact seals on both sides, suffix 2RS and 2RSR.

The track rollers are greased for life and are therefore maintenance-free. From outside diameter ≧ 52 mm, the inner ring has a lubrication bore.

Seal types

Seal types and their specific features: see table.

Specific features

2Z seal	
	Gap seal: ■ not radially preloaded ■ low friction ■ to be used with low levels of contamination
2RSR seal	
	Contact seal: ■ radially preloaded ■ to be used with higher requirements for sealing action and under heavy contamination
2RS seal	
	Contact seal: ■ axially preloaded ■ to be used with higher requirements for sealing action and under heavy contamination

Corrosion-resistant design

The inner ring and outer ring are made from corrosion-resistant steel. The rolling elements are protected against corrosion by the grease.

Corrosion-resistant designs have contact seals and the suffix 2RS-RB or 2RSR-RB.

Accuracy and internal clearance

The dimensional and geometrical accuracies correspond to tolerance class PN to DIN 620.

The radial internal bearing clearance corresponds approximately to internal clearance group Group N in accordance with ISO 5753-1; internal clearance classes: see Catalogue HR 1, Rolling Bearings.

Further information

Further information is given on the following pages:

- dimension tables, see page 90 and page 91
- bolts, see page 73
- guideways, see page 76
- accessories, see page 106.

Possible combinations of track rollers and guideways

The tables show the possible combinations of track rollers with the guideways LFS and shaft and support rail unit TS.

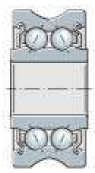
Combinations with guideways LFS

Width and shaft diameter[1]		Track roller LFR					
LFS	d_{Lw}	50/5-4	50/5-6	50/8-6	5201-10	5301-10	5302-10
20	4	●	–	–	–	–	–
25	6	–	●	●	–	–	–
32	6	–	–	●	–	–	–
42	10	–	–	–	●	●	●
52	10	–	–	–	●	●	●
86	10	–	–	–	●	●	●
120	10	–	–	–	●	●	●

● available size

[1] Width b and shaft diameter d_{Lw}: see dimension tables for guideways.

Combinations with guideways LFS (continued)

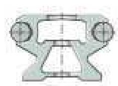


Width and shaft diameter[1]		Track roller LFRI	
LFS	d_{Lw}	50/8-6	5201
20	4	–	–
25	6	●	–
32	6	●	–
42	10	–	●
52	10	–	●
86	10	–	●
120	10	–	●

● available size

[1] Width b and shaft diameter d_{Lw}: see dimension tables for guideways.

Combinations with shaft and support rail units TS[1]



Shaft diameter	Track roller LFR						
d_{Lw}[1]	5201-12	5204-16	5206-20	5206-25	5207-30	5208-40	5308-50
12	●	–	–	–	–	–	–
16	–	●	–	–	–	–	–
20	–	–	●	–	–	–	–
25	–	–	–	●	–	–	–
30	–	–	–	–	●	–	–
40	–	–	–	–	–	●	–
50	–	–	–	–	–	–	●

● available size

[1] Shaft and support rail units TS and shaft diameter d_{Lw}: see Catalogue WF 1, Shaft Guidance Systems.

Design and safety guidelines

Adjacent construction for non-locating bearing track rollers

For non-locating bearing track rollers without an inner ring, the rolling element raceway on the shaft must be hardened and ground. The surface hardness must be 670 HV + 170 HV. The hardening depth CHD or SHD must be sufficiently large.

Design of the shaft: see table.

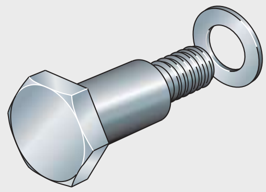
Tolerances and surface data for the shaft raceway

Diameter tolerance of shafts		Roughness	Roundness	Parallelism
without inner ring	with inner ring	max.	max.	max.
k5	g6 (under point load)	Ra 0,4 (Rz 2)	25% of diameter tolerance	50% of diameter tolerance

Product overview Bolts

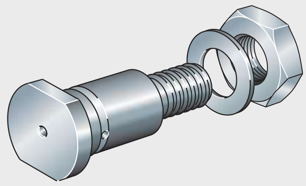
Concentric

LFZ



121 628

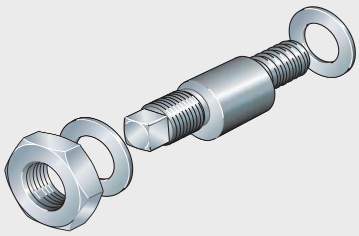
LFZ..-A1



121 630

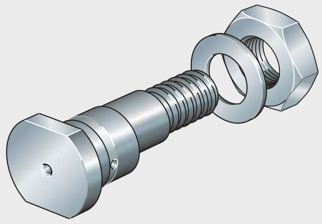
Eccentric

LFE

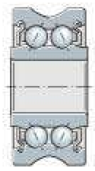


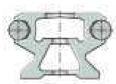
121 629

LFE..-A1



121 631





Bolts

Features

The bolts, which are made from high strength screw steel, are available with a concentric and eccentric collar; designation LFZ or LFE. Depending on their intended purpose, they are supplied with a washer, nut, drive fit lubrication nipple and sealing cap, see table.

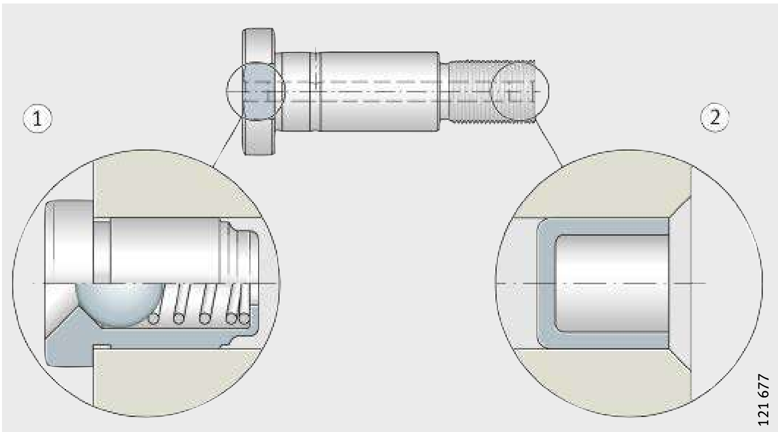
The eccentric designs LFE and LFE..-A1 allow the track roller guidance systems to be set clearance-free.

Delivered condition

Designation and suffix	Scope of delivery	Design
LFZ	Concentric bolt with washer	Standard
LFE	Eccentric bolt with washer and nut	Standard
LFZ..-A1 LFE..-A1	Concentric or eccentric bolt with washer and nut, drive fit lubrication nipple and sealing cap	Standard
NIP-A2	Drive fit lubrication nipple	Accessory
VD2	Sealing cap	Accessory

Lubrication

Bolts LFZ..-A1 and LFE..-A1 (from size 20) have a lubrication hole. Track rollers of outside diameter ≧ 52 mm can be lubricated via this hole. A lubrication nipple NIP-A2 can be pressed into the hole, *Figure 1*. If the hole will not be used for relubrication, it must be closed off using the sealing cap VD2.



① Drive fit lubrication nipple NIP-A2
② Sealing cap VD2

Figure 1
Drive fit lubrication nipple and sealing cap

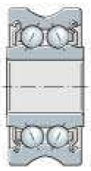
Corrosion-resistant design

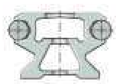
In this case, the bolts, washers and nuts are made from corrosion-resistant steel. These designs have the suffix RB.

Further information

Further information is given on the following pages:

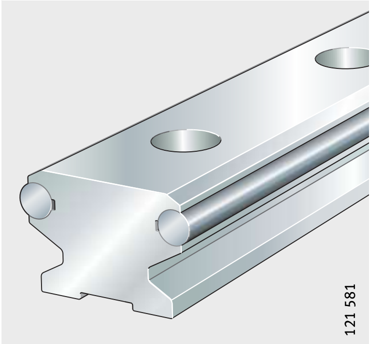
- dimension tables, see page 84
- track rollers, see page 68
- guideways, see page 76
- accessories, see page 106.



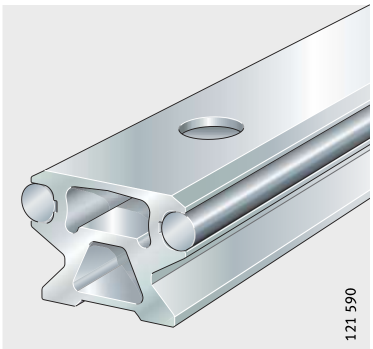


Solid profile
Hollow section profile

LFS



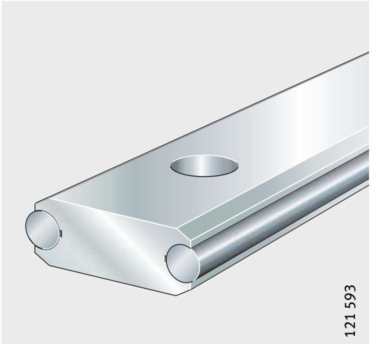
LFS..-C



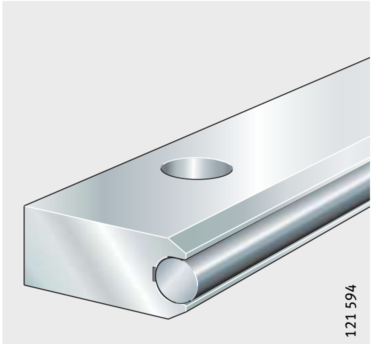
Flat design

Two raceways or one raceway

LFS..-F

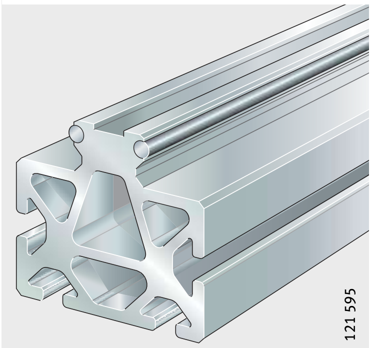


LFS..-FH



Profiled section support rail

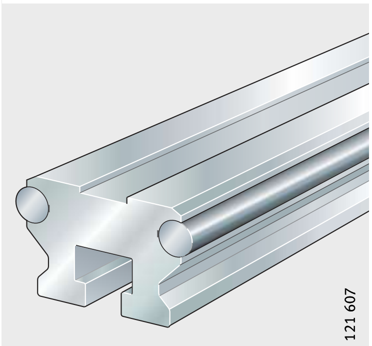
LFS..-M



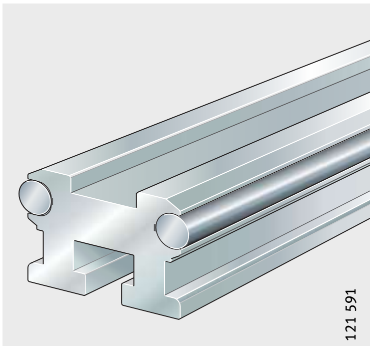
With slots

For toothed racks or toothed belts

LFS..-N



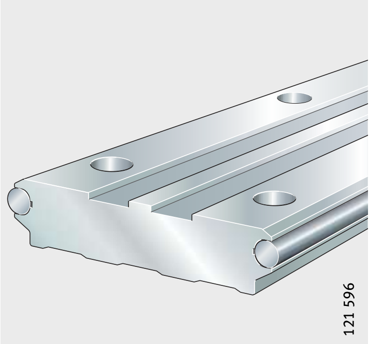
LFS..-NZZ



Wide, flat design

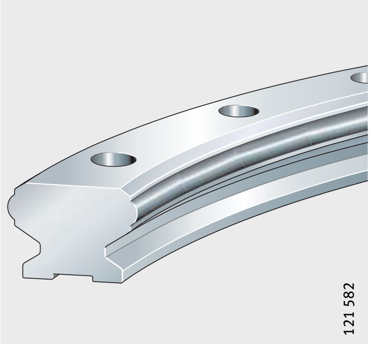
For toothed racks or toothed belts

LFS120



Curved guideway element

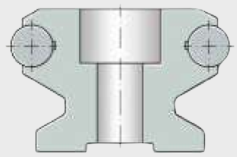
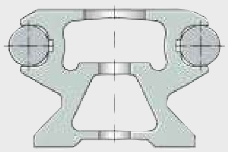
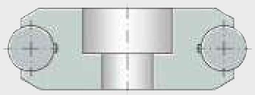
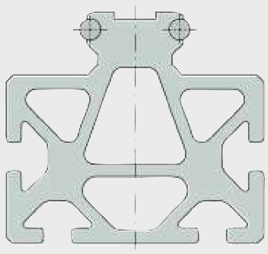
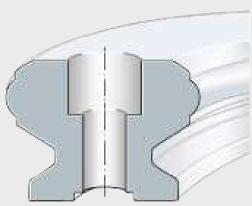
LFSR



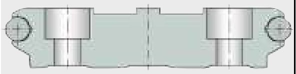
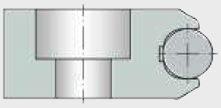
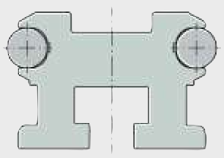
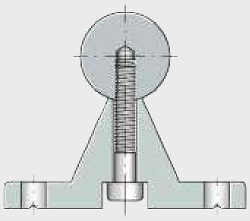
Guideways

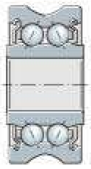
Features Guideway designs: see table.

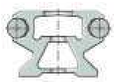
Designs

Guideway	Design
LFS 	With solid profile for location from above through holes
LFS..-C 	With hollow section profile (low mass) Location from above through holes The end faces of the hollow sections are closed off using plastic end covers
LFS..-F 	Flat guideway Preferably for applications with stationary carriage and moving guideway Location from above through holes
LFS..-M 	With support rail giving high bending rigidity The guideway can be incorporated in modular constructions by means of slots. The slots are designed for nuts to DIN EN ISO 4032 and T-nuts to DIN 508 The hollow sections are closed off using plastic end covers. Special plastic end covers are available for the slot closing strips
LFSR 	Curved guideway element made from steel Location from above through holes Combinations of curved guideway elements or of curved guideway elements and straight guideways should be treated in the same way as multi-piece guideways and must **always be ordered together**

Designs
continued

<table>
<tr><th>Guideway</th><th>Design</th></tr>
<tr><td>LFS120
</td><td>- Wide, low guideway
- With recesses for toothed racks or toothed belts
- Location from above through holes</td></tr>
<tr><td>LFS..-FH
</td><td>- Flat guideway with only one shaft as raceway
- Mainly for applications with increased support spacing
- Location from above through holes</td></tr>
<tr><td>LFS32-N, LFS..-NZZ
</td><td>- With T-slot for location from below
- The upper slot in the guideways and the lateral slots are suitable for toothed racks or toothed belts
- Supplied with special support washers for the fixing screws; the quantity is based on the length of the guideway</td></tr>
<tr><td>TSN
</td><td>- Composite guideway, aluminium support rail with screw mounted raceway shaft
- Location from above
- See Catalogue WF 1, Shaft Guidance Systems</td></tr>
</table>





Guideways without fixing holes

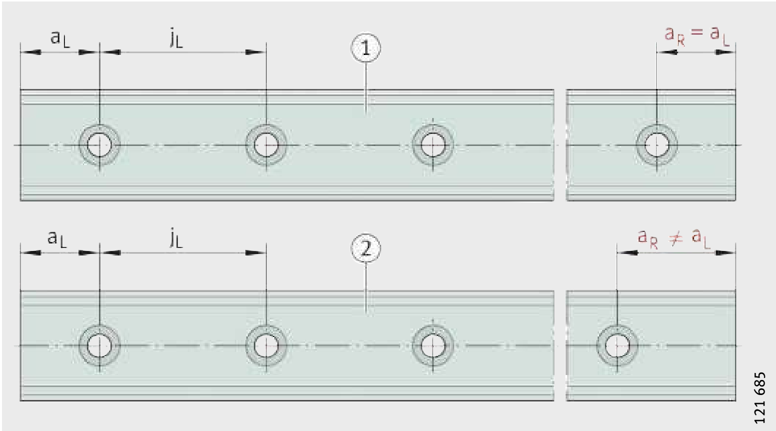
All LFS guidances with the exception of LFSR are also available without fixing holes; suffix OL.

Design and safety guidelines

Guideway hole patterns

Unless specified otherwise, guideways have a symmetrical hole pattern, *Figure 1*.

Upon request, an asymmetrical hole pattern may be available. In this case, $a_L \geqq a_{L\ min}$ and $a_R \geqq a_{R\ min}$.



① Symmetrical hole pattern
② Asymmetrical hole pattern

Figure 1
Hole patterns of guideways with one row of holes

Hole pitch values

The hole pitch values j_L are stated in the dimension tables. For high loads, guideways are available with reduced hole pitch values j_L, *Figure 2*.

These guideways have the suffix E or EE; examples: LFS..-E, LFS..-EE.

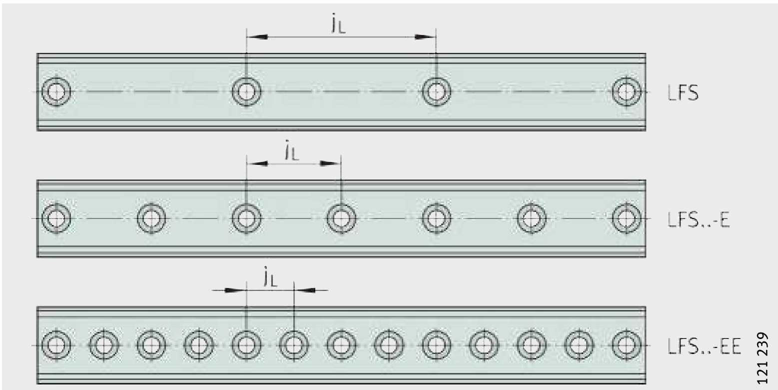


Figure 2
Hole spacings j_L

Maximum number of pitches between holes

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

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

The spacings a_L and a_R are generally determined as follows:

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

For guideways with a symmetrical hole pattern:

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

Number of holes:

$$x = n + 1$$

n –
Maximum possible number of pitches between holes

l mm
Guideway length

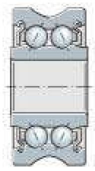
$a_{L\,min}$, $a_{R\,min}$ mm
Minimum values for a_L, a_R, see dimension tables

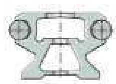
j_L mm
Spacing between holes

a_L, a_R mm
Spacing between start or end of guideway and nearest hole

x –
Number of holes.

If the minimum values for a_L and a_R are not observed, the counterbores of the holes may be intersected.





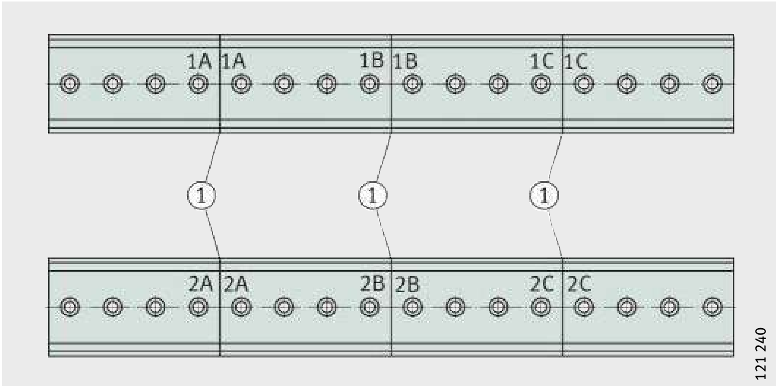
Guideways

Guideways without holes

All guideways LFS are also available without holes, with the exception of LFSR. These guideways have the suffix OL, for example LFS..-OL.

Multi-piece guideways

If the guideway length required is greater than l_{max}, the guideways are assembled from two or more sections matched to each other and marked accordingly. The sections may be of different lengths.
The guideway joint is always arranged centrally between the fixing holes, *Figure 3*.



1 Marked joints

Figure 3
Multi-piece guideways

Accuracy of joint position

In order to achieve accuracy of the joint position, additional fixing is recommended for guideways from size 32 if the spacing C7 is larger than the stated limit value, see table and *Figure 4*, page 83.

In these cases, the guideways are supplied with the additional fixing hole already made.

Spacings for additional hole

Guideway	Spacing between hole and end of guideway	
	C7 Limit value mm	C8 Limit value mm
LFS32 (-C, -F)	30	11
LFS42-C	50	17
LFS52 (-C, -F)	50	17
LFS86-C	50	17
LFS120	50	17

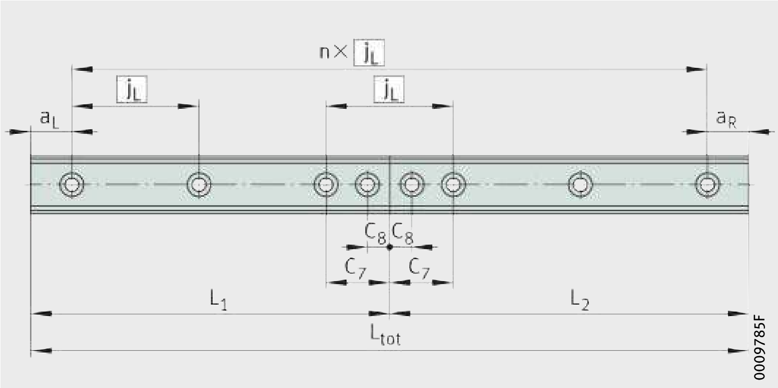


Figure 4
Additional hole

Two guideways LFS can have a deviation relative to each other at the joint position of:

- $\Delta b = \pm 0{,}01$ mm
- $\Delta h_4 = \pm 0{,}05$ mm, *Figure 5*.

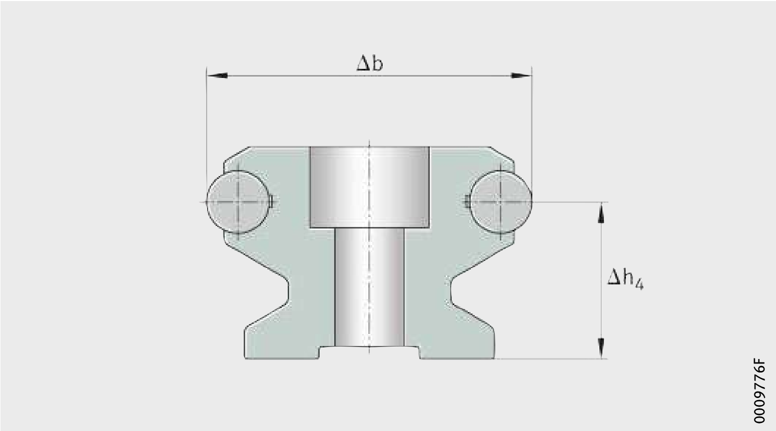
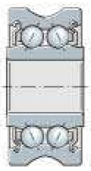
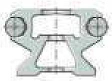
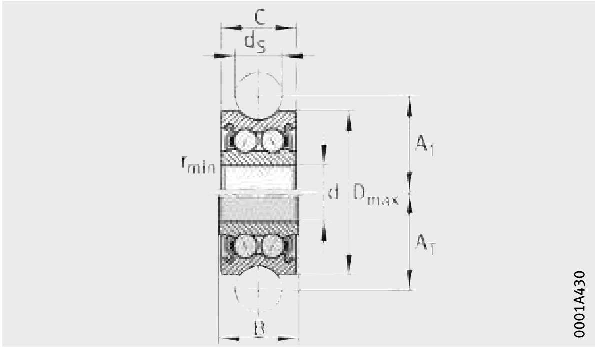


Figure 5
Deviation at the joint position on guideways assembled from sections





Locating bearing track rollers



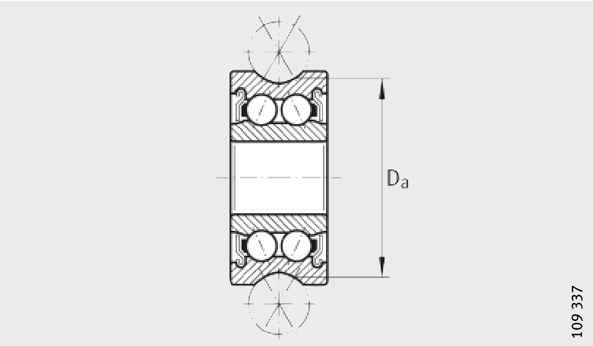
LFR..-2Z

Dimension table · Dimensions in mm

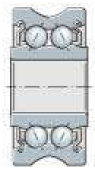
Designation	Mass	Dimensions				
	m	d	D_{max}	B	A_T	C
	≈ kg					
LFR50/5-4-2Z-HLC[8] **LFR50/5-4-2RS-RB-HLC**[8]	0,01	5	16	8	9	7
LFR50/5-6-2Z-HLC[8] **LFR50/5-6-2RS-RB-HLC**[8]	0,01	5	17	8	10,5	7
LFR50/8-6-2Z[8] **LFR50/8-6-2RS-RB**[8]	0,02	8	24	11	14	11
LFR5201-10-2Z[8] **LFR5201-10-2RS-RB**[8]	0,08	12	35	15,9	20,63	15,9
LFR5301-10-2Z[8] **LFR5301-10-2RS-RB**[8]	0,1	12	42	19	24	19
LFR5302-10-2Z[8] **LFR5302-10-2RS-RB**[8]	0,17	15	47	19	26,63	19
LFR5201-12-2Z[8] **LFR5201-12-2RS-RB**[8]	0,08	12	35	15,9	21,75	15,9
LFR5204-16-2Z[9] **LFR5204-16-2RS-RB**[9]	0,23	20	52	22,6	31,5	20,6
LFR5206-20-2Z[9] **LFR5206-20-2RS-RB**[7][9]	0,43	25	72	25,8	41	23,8
LFR5206-25-2Z[9] **LFR5206-25-2RS-RB**[9]	0,43	25	72	25,8	43,5	23,8
LFR5207-30-2Z[9] **LFR5207-30-2RS-RB**[7][9]	0,66	30	80	29	51	27
LFR5208-40-2Z[9] **LFR5208-40-2RS-RB**[7][9]	1,36	40	98	38	62,5	36
LFR5308-50-2Z[9] **LFR5308-50-2Z-RB**[7][9]	1,4	40	110	46	72,5	44

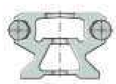
Corrosion-resistant design with suffix ..-RB.

1) Rolling contact diameter.
2) Effective dynamic load rating as track roller (radial).
3) Effective static load rating as track roller (radial).
4) Fatigue limit load.
5) Permissible dynamic limit load.
6) Permissible static limit load.
7) Corrosion-resistant design available by agreement.
8) Lubricated for life, see page 19.
9) Relubrication facility via inner ring, see page 19.



LFR..-2Z

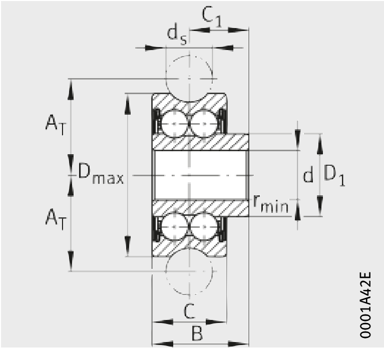




d_s	D_a[1)]	r_{min}	Load carrying capacity $C_{r\,w}$[2)] N	$C_{0r\,w}$[3)] N	C_{ur}[4)] N	$F_{r\,per}$[5)] N	$F_{0r\,per}$[6)] N
4	14,54	0,2	1 560	850	43	1 700	1 700
6	15,8	0,2	1 630	900	44,5	2 270	1 800
6	22,8	0,3	4 100	2 300	115	2 550	4 600
10	32,25	0,6	8 400	5 000	250	4 750	10 000
10	38,95	0,6	13 200	7 700	370	6 400	15 400
			13 900	8 200	390	19 600	16 400
10	44,25	1	14 500	9 100	455	9 400	18 200
12	33,1	0,6	8 300	5 000	250	4 650	10 000
16	49,14	1	15 300	10 100	520	10 500	20 200
20	64,68	1	23 100	16 400	870	21 100	33 000
25	65,35	1	22 700	16 100	850	18 800	32 000
30	76,02	1	23 100	16 400	1 100	18 500	41 500
40	90,36	1,1	38 500	29 000	1 480	51 000	58 000
50	101,7	1,1	54 000	40 500	2 000	69 000	81 000

Track rollers

With extended inner ring
Locating bearing track roller

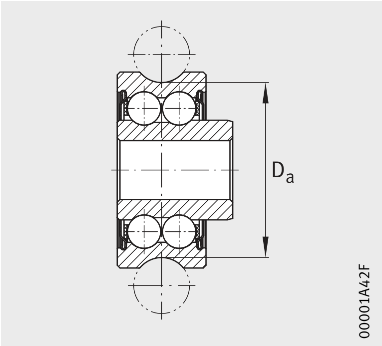


LFRI

Dimension table · Dimensions in mm							
Designation	Mass	Dimensions					
	m	d	D_{max}	B	A_T	C	C_1
	≈ kg						
LFRI50/8-6-2Z	0,025	6,1	24	15,1	14	11	9,6
LFRI5201-10-2Z	0,09	10,5	35	20,7	20,63	15,9	12,75

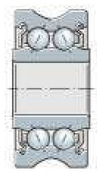
Corrosion-resistant design available by agreement.

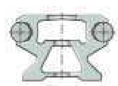
[1] Rolling contact diameter.
[2] Effective dynamic load rating as track roller (radial).
[3] Effective static load rating as track roller (radial).
[4] Fatigue limit load.
[5] Permissible dynamic limit load.
[6] Permissible static limit load.



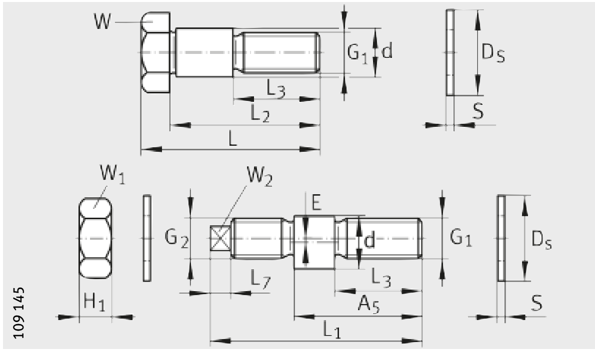
LFRI

				Load carrying capacity				
D_1 j6	d_s	D_a 1)	r_{min}	$C_{r\,w}$ 2) N	$C_{0r\,w}$ 3) N	C_{ur} 4) N	$F_{r\,per}$ 5) N	$F_{0r\,per}$ 6) N
12,6	6	22,8	0,5	4 100	2 300	115	2 550	4 600
17,8	10	32,25	0,5	8 300	5 000	250	4 550	8 300





Bolts



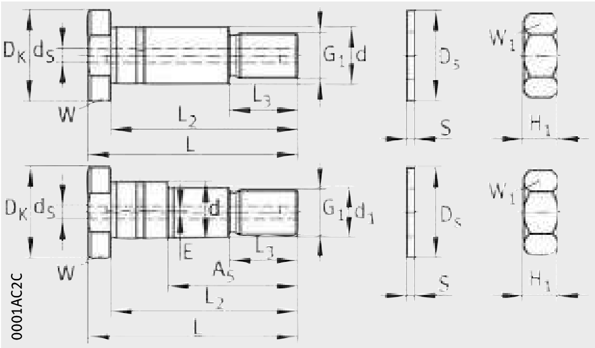
LFZ, LFE

Dimension table · Dimensions in mm									
Designation	Mass	Dimensions							
	m ≈ kg	d	G_1	G_2	L	L_2	L_3	L_1	A_5
LFZ05	0,01	5	M4	–	19,5	16	9,5	–	–
LFE05-0,5				M4	–	–	9	20	15
LFZ08	0,02	8	M8	–	28,3	24,3	15	–	–
LFE08-1				M8×0,75	–	–	13	32,5	21,6
LFZ12	0,04	12	M10	–	43	36	22	–	–
LFE12-1				M10	–	–	19,5	50	33,5
LFZ12/M12	0,06		M12	–	50,8	43,8	24	–	–
LFE12-1/M12				M12	–	–		57	41
LFZ15	0,06	15	M12	–	50,8	43,8	23,8	–	–
LFE15-1				M12	–	–	24	57	41
LFZ12×45-A1[2]	0,04	12	M10×1,5	–	50	45	16	–	–
LFE12×45-A1[2]									30
LFZ20×67-A1	0,2	20	M16×1,5	–	75	67	23	–	–
LFE20×67-A1									45
LFZ25×82-A1	0,4	25	M20×1,5	–	92	82	30	–	–
LFE25×82-A1									57
LFZ30×95-A1	0,62	30	M24×1,5	–	107	95	32	–	–
LFE30×95-A1									67
LFZ40×107-A1	1,1	40	M30×1,5	–	117	107	42	–	–
LFE40×107-A1									72
LFZ40×115-A1	1,2				125	115			–
LFE40×115-A1									72

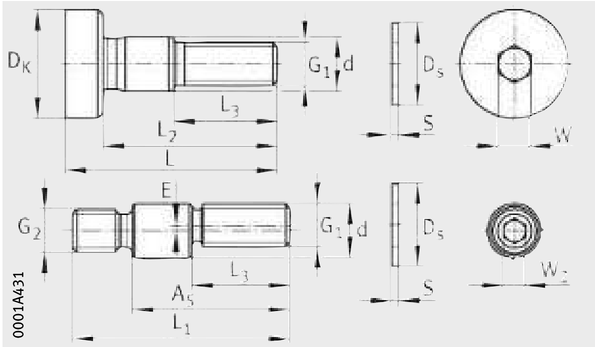
Corrosion-resistant design available by agreement.

1) No washer required.

2) Without lubrication hole.

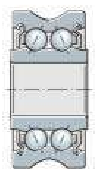


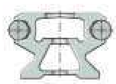
LFZ..-A1, LFE..-A1



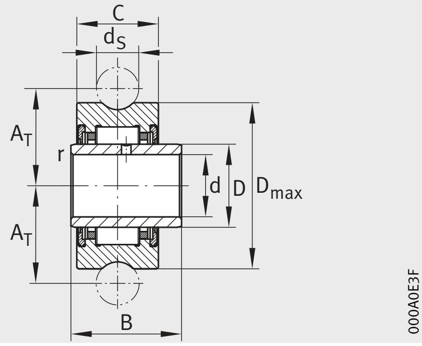
LFZ05 and LFE05-0,5

L_7	D_s	E	H_1	S	D_K	d_s	d_1	Width across flats		
								W	W_1	W_2
–	10	–	–	–1)	10	–	–	3	–	–
		0,5	2,9		–			–	7	2
–	14	–	–	1	–	–	–	13	–	–
3		1	4					–	13	5
–	21	–	–	1,8	–	–	–	17	–	–
5		1	8,4					–	17	6
–	19	–	–					17	–	–
5		1	6,5					–	17	6
–	21	–	–	2	–	–	–	19	–	–
4		1	6,5					–	19	6
–	21	–	8	2	20	–	–	17	17	–
		0,75					10			
–	30	–	13	3	30	5,9	–	27	24	–
		1					17			
–	37	–	16	3	40	5,9	–	36	30	–
		1					22			
–	44	–	19	4	45	5,9	–	41	36	–
		1					27			
–	56	–	24	4	55	5,9	–	46	46	–
		1					36			
		–					–			
		1					36			





Non-locating bearing track rollers



LFR..-2RSR-NA

Dimension table · Dimensions in mm													
Designation	Inner ring[1]	Mass	Dimensions								Load carrying capacity		
		m	d	D_{max}	B $^{0}_{-0,12}$	A_T	C	D	d_S	r_{min}	$C_{r\,w}$[2]	$C_{0r\,w}$[3]	$C_{ur\,w}$[4]
		≈ kg									N	N	N
LFR22/8-6-2RSR-NA	**IR8×12×14**	0,032	8	24	14	14	11,8	12	6	0,3	4 000	4 300	630
LFR2202-10-2RSR-NA	**IR15×20×16**	0,079	15	35	16	20,63	13,8	20	10	0,3	6 500	9 300	1 310
LFR2204-10-2RSR-NA	**IR20×25×20**	0,17	20	47	20	26,64	17,8	25	10	0,3	13 700	18 600	2 550

Non-locating bearing track rollers are also available without an inner ring: LFR..-2RSR-RNA.

Observe the guidelines relating to the adjacent construction, see page 72.

Corrosion-resistant design available by agreement.

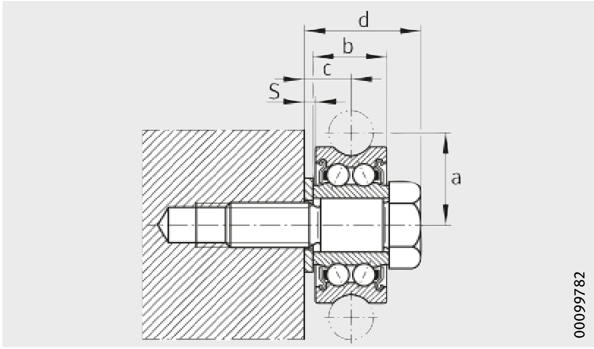
1) Lubrication hole in inner ring (diameter) 2 mm.

2) Effective dynamic load rating as track roller (radial).

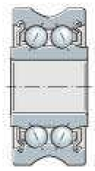
3) Effective static load rating as track roller (radial).

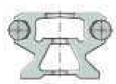
4) Fatigue limit load.

Possible combinations of track rollers and bolts



Mounting situation





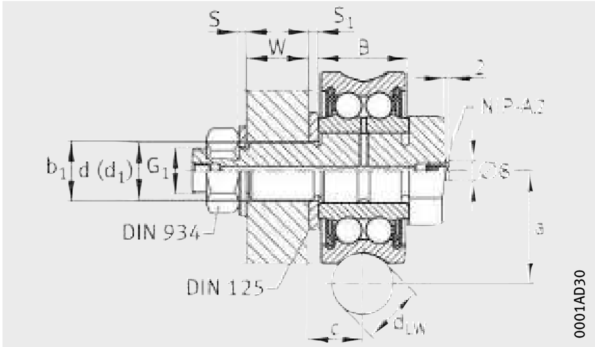
Dimension table · Dimensions in mm

Designation		Dimensions				
Locating bearing track roller	Bolt	a[1]	b	S	c	d
LFR50/5-4-2Z[2]	**LFZ05**	9	8	–	4	11,5
	LFE05-0,5					
LFR50/5-6-2Z	**LFZ05**	10,5	8	1	5	11,5
	LFE05-0,5					
LFR50/8-6-2Z	**LFZ08**	14	12	1	6,5	16
	LFE08-1					20,5
LFR5201-10-2Z	**LFZ12**	20,65	17,7	1,8	9,7	24,7
	LFE12-1					32,3
LFR5301-10-2Z	**LFZ12/M12**	24	20,8	1,8	11,3	27,8
	LFE12-1/M12					34,8
LFR5302-10-2Z	**LFZ15**	26,65	21	2	11,5	28
	LFE15-1					35
LFR5201-12-2Z	**LFZ12×45-A1**	21,75	17,9	2	9,9	22,9
	LFE12×45-A1					
LFR5204-16-2Z	**LFZ20×67-A1**	31,5	25,6	3	14,3	33,6
	LFE20×67-A1					
LFR5206-20-2Z	**LFZ25×82-A1**	41	28,8	3	15,9	38,8
	LFE25×82-A1					
LFR5206-25-2Z	**LFZ25×82-A1**	43,5	28,8	3	15,9	38,8
	LFE25×82-A1					
LFR5207-30-2Z	**LFZ30×95-A1**	51	33	4	18,5	45
	LFE30×95-A1					
LFR5208-40-2Z	**LFZ40×107-A1**	62,5	42	4	23	52
	LFE40×107-A1					
LFR5308-50-2Z	**LFZ40×115-A1**	72,5	50	4	27	60
	LFE40×115-A1					

[1] With eccentric bolts, the dimension a varies by ±E in accordance with the table, page 89.
[2] No washer required.

Possible combinations of track rollers and bolts

Flying bearing arrangement with bolt ..-A1



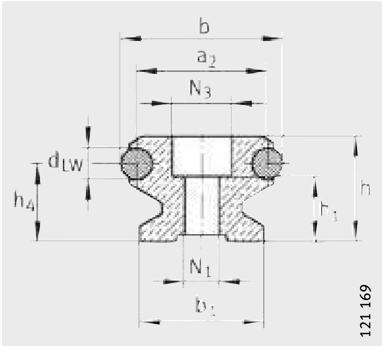
Bolt ..-A1

Dimension table · Dimensions in mm

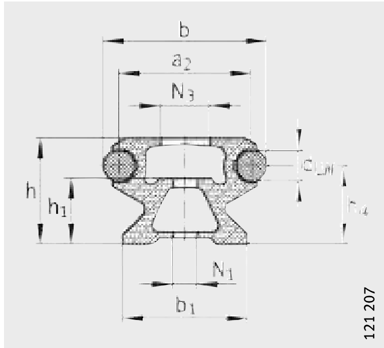
Designation		Dimensions										
Locating bearing track roller	Bolt	a	c	d	d_1	G_1[1]	S[2]	W[3]	S_1 (Washer DIN 125-A)	b_1 (Washer DIN 125-A)	d_{LW}	B
LFR5201-12-2Z	**LFZ12×45-A1**	21,75	9,75	12	–	M10×1,5	2	12	2,5	13	12	15,9
	LFE12×45-A1			–	10				2	10,5		
LFR5204-16-2Z	**LFZ20×67-A1**	31,5	11,3	20	–	M16×1,5	3	20	3	21	20	22,6
	LFE20×67-A1			–	17				3	17		
LFR5206-20-2Z	**LFZ25×82-A1**	41	12,9	25	–	M20×1,5	3	25	4	27	20	25,8
	LFE25×82-A1			–	22				3	23		
LFR5206-25-2Z	**LFZ25×82-A1**	43,5	12,9	25	–	M20×1,5	3	25	4	27	25	25,8
	LFE25×82-A1			–	22				3	23		
LFR5207-30-2Z	**LFZ30×95-A1**	51	14,5	30	–	M24×1,5	4	32	4	31	30	29
	LFE30×95-A1			–	27				4	28		
LFR5208-40-2Z	**LFZ40×107-A1**	62,5	19	40	–	M30×1,5	4	40	6	41	40	38
	LFE40×107-A1			–	36				5	37		
LFR5308-50-2Z	**LFZ40×115-A1**	72,5	23	40	–	M30×1,5	4	40	6	41	40	46
	LFE40×115-A1			–	36				5	37		

1) For nuts in accordance with DIN 934, included in the scope of delivery.
2) For washers in accordance with DIN 125, included in the scope of delivery.
3) Recommended minimum wall thickness.

Guideways



LFS



LFS..-C

<table>
<tr><th colspan="12">Dimension table · Dimensions in mm</th></tr>
<tr><th rowspan="3">Designation</th><th>Mass</th><th colspan="3">Dimensions</th><th colspan="7">Mounting dimensions</th></tr>
<tr><th>m</th><th>b</th><th>h</th><th>l_{max}[1]</th><th>b_1</th><th>a_2</th><th>j_L</th><th colspan="2">a_L[2]</th><th colspan="2">a_R[2]</th></tr>
<tr><th>≈ kg</th><th></th><th></th><th></th><th></th><th></th><th></th><th>min.</th><th>max.</th><th>min.</th><th>max.</th></tr>
<tr><td>LFS20</td><td>0,6</td><td>20</td><td>12,2</td><td>2 400</td><td>17</td><td>16</td><td>62,5</td><td>9</td><td>54</td><td>9</td><td>54</td></tr>
<tr><td>LFS25</td><td>1,1</td><td>25</td><td>15</td><td>2 400</td><td>21</td><td>19</td><td>62,5</td><td>10</td><td>54</td><td>10</td><td>54</td></tr>
<tr><td>LFS32</td><td rowspan="2">1,6</td><td rowspan="5">32</td><td rowspan="4">20</td><td rowspan="4">6 000</td><td rowspan="4">24</td><td rowspan="5">26</td><td>125</td><td rowspan="5">11</td><td>116</td><td rowspan="5">11</td><td>116</td></tr>
<tr><td>LFS32-E</td><td>62,5</td><td>52</td><td>52</td></tr>
<tr><td>LFS32-C[4]</td><td rowspan="2">1,1</td><td>125</td><td>116</td><td>116</td></tr>
<tr><td>LFS32-CE[4]</td><td>62,5</td><td>52</td><td>52</td></tr>
<tr><td>LFS32-F</td><td>1</td><td>10</td><td>4 000</td><td>–</td><td>125</td><td>116</td><td>116</td></tr>
<tr><td>LFS42-C[4]</td><td rowspan="3">2,2</td><td rowspan="3">42</td><td rowspan="2">20</td><td rowspan="2">6 000</td><td rowspan="2">28</td><td rowspan="3">32</td><td>125</td><td rowspan="2">20</td><td>113</td><td rowspan="2">20</td><td>113</td></tr>
<tr><td>LFS42-CE[4]</td><td>62,5</td><td rowspan="2">51</td><td rowspan="2">51</td></tr>
<tr><td>LFS42-F</td><td>15</td><td>4 000</td><td></td><td>125</td><td>17</td><td>17</td></tr>
<tr><td>LFS52</td><td rowspan="3">4,4</td><td rowspan="8">52</td><td rowspan="6">34</td><td rowspan="8">6 000</td><td rowspan="6">40</td><td rowspan="8">42</td><td>250</td><td rowspan="8">17</td><td>235</td><td rowspan="8">17</td><td>235</td></tr>
<tr><td>LFS52-E</td><td>125</td><td>110</td><td>110</td></tr>
<tr><td>LFS52-EE</td><td>62,5</td><td>49</td><td>49</td></tr>
<tr><td>LFS52-C[4]</td><td rowspan="5">3</td><td>250</td><td>235</td><td>235</td></tr>
<tr><td>LFS52-CE[4]</td><td>125</td><td>110</td><td>110</td></tr>
<tr><td>LFS52-CEE[4]</td><td>62,5</td><td>49</td><td>49</td></tr>
<tr><td>LFS52-F</td><td rowspan="2">18</td><td rowspan="2">–</td><td>250</td><td>235</td><td>235</td></tr>
<tr><td>LFS52-FE</td><td>125</td><td>110</td><td>110</td></tr>
<tr><td>LFS86-C[4]</td><td rowspan="2">4,4</td><td rowspan="2">86</td><td rowspan="2">34</td><td rowspan="2">6 000</td><td rowspan="2">71</td><td rowspan="2">76</td><td>250</td><td rowspan="2">17</td><td>235</td><td rowspan="2">17</td><td>235</td></tr>
<tr><td>LFS86-CE[4]</td><td>125</td><td>110</td><td>110</td></tr>
<tr><td>LFS120</td><td rowspan="2">7,9</td><td rowspan="2">120</td><td rowspan="2">25</td><td rowspan="2">8 000</td><td rowspan="2">100</td><td rowspan="2">110</td><td>250</td><td rowspan="2">17</td><td>235</td><td>17</td><td>235</td></tr>
<tr><td>LFS120-E</td><td>125</td><td>110</td><td>17</td><td>110</td></tr>
</table>

Guideways of corrosion-resistant design: LFS..-RB, observe note on page 18.

Modulus of elasticity for LFS..-C (-CE, -CEE, -E, -EE, -F, -FE): 72 000 N/mm^2.

Guideways LFS, LFS..-C and LFS..-F available without holes: LFS..-OL (-C-OL, -F-OL).

① Underside marked

1) Maximum length of single-piece guideways; longer guideways are supplied in several sections and are marked accordingly. Observe the length tolerances, see page 30.

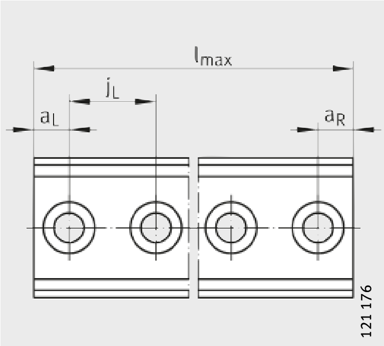
2) a_L and a_R are dependent on the guideway length l_{max}, calculation: see page 80.

3) Under maximum load F_z and F_{0z}, support washers to DIN 433 and the maximum tightening torque according to the table, page 29, are required.

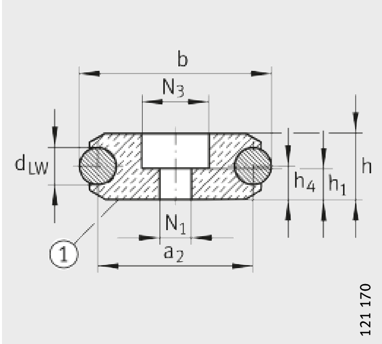
4) The design of the hollow sections is dependent on the size.

5) Counterbore depth for screws to DIN 7984.

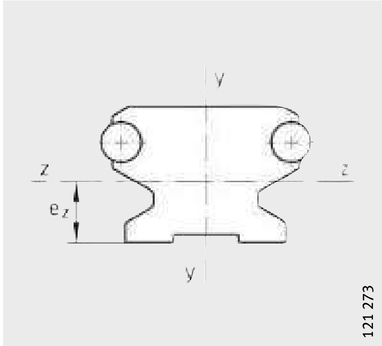
6) If support washers to DIN 433 are used, screws to DIN 7984 are recommended.



LFS, LFS..-C (-F)
View rotated 90°

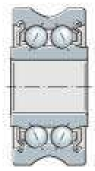


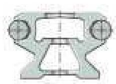
LFS..-F

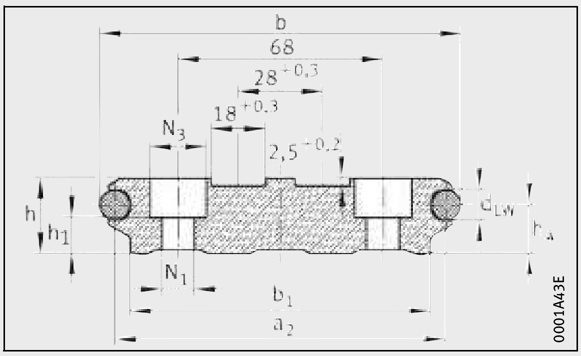


Bending axes

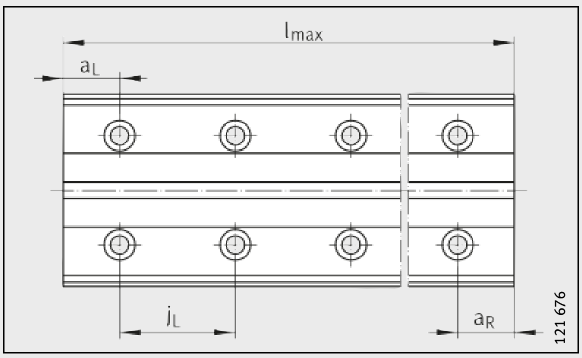
d_{LW}	h_4	h_1	N_1	N_3 [3)]	Surface data Cross-sectional area mm^2	y-y I_y mm^4	 W_y mm^3	z-z e_z mm	 I_z mm^4	 W_z mm^3
4	9	7,6	4,5	8	165	3 065	362	6,4	2 053	324
6	10,6	8,5	5,5	10	237	6 390	608	7,5	4 510	600
6	15	12	6,5	12	440	20 100	1 440	10,4	14 100	1 360
					261	18 305	1 165	10,1	10 072	995
	5	3,5 [5)]			230	11 300	810	5	2 190	438
10	12,6	12 [6)]	9	15	358	33 929	1 858	10,1	14 052	1 391
	7,5	8 [5)]			370	29 280	1 864	7,5	16 200	2 160
10	25,1	21	11	19	1 170	138 624	5 878	17,8	113 037	6 350
					649	113 821	4 896	17,1	74 878	4 378
	9	8 [5)]			670	84 000	3 610	9	19 900	2 211
10	25,1	21 [6)]	13	21	1 185	613 720	16 587	17,5	155 160	8 866
10	16,1	12	11	19	2 468	2 330 980	40 751	12,5	9 365	117 074





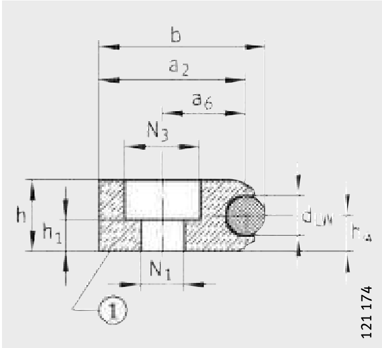


LFS120



LFS120

Guideways



LFS..-FH

Dimension table · Dimensions in mm

Designation	Mass	Dimensions			Mounting dimensions						
	m	b	h	l_{max} 1)	a_2	a_6	j_L	a_L 2)		a_R 2)	
	≈ kg							min.	max.	min.	max.
LFS32-FH	0,8	26	10	4 000	23	13	125	11	116	6	116
LFS32-FHE							62,5		52		52
LFS52-FH	2,3	42	18	6 000	37	21	250	17	235	10	235
LFS52-FHE							125		110		110
LFS52-FHEE							62,5		49		49

Guideways of corrosion-resistant design: LFS..-RB, observe note on page 18.

Guideways LFS..-FH available without holes: LFS..-FH-OL.

Modulus of elasticity for LFS..-FH (-FHE, -FHEE): 72 000 N/mm².

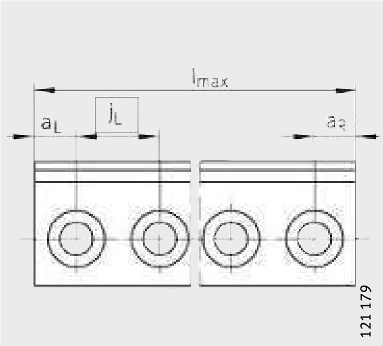
1 Underside marked

1) Maximum length of single-piece guideways; longer guideways are supplied in several sections and are marked accordingly. Observe the length tolerances, see page 30.

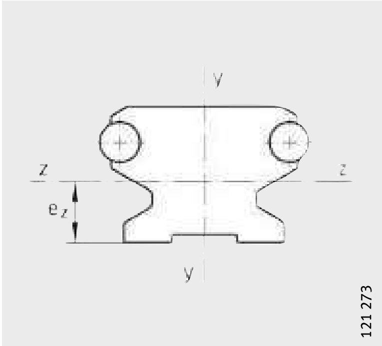
2) a_L and a_R are dependent on the guideway length l_{max}, calculation: see page 80.

3) For screw to DIN 912-8.8 (DIN EN ISO 4762), under maximum load support washers to DIN 433 (DIN EN ISO 7092) are required.

4) Counterbore depth for screws to DIN 7984.

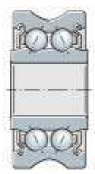


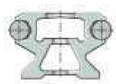
LFS..-FH
View rotated 90°



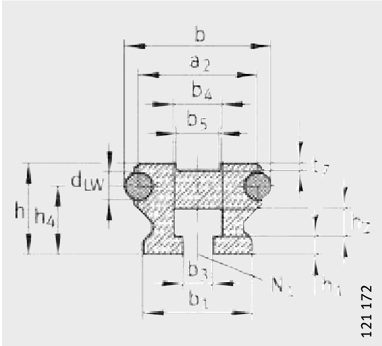
Bending axes

					Surface data					
d_{LW}	h_1	h_4	N_1 3)	N_3	Cross-sectional area	y-y		z-z		
						I_y	W_y	e_z	I_z	W_z
					mm^2	mm^4	mm^3	mm	mm^4	mm^3
6	3,5	5	6,5	12	216	8 681	790	5	1 897	379
10	8 4)	9	11	19	629	66 642	3 765	9	17 798	1 977

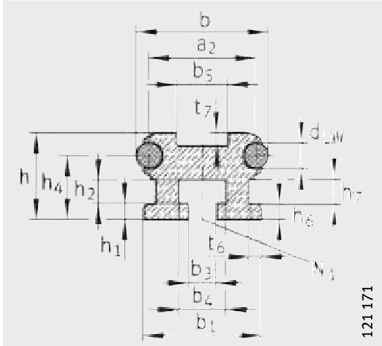




Guideways



LFS32-N



LFS52-NZZ

Dimension table · Dimensions in mm

Desig-nation	Mass	Dimensions			Mounting dimensions												
	m ≈ kg/m	b	h	l_{max} 1)	b_1	a_2	b_3 2)	b_4	b_5	t_6	a_7	j_L 3)	d_{LW}	h_1	h_2	h_5	h_4
LFS25-M5)	3,5	25	46	4 000	56	19	–	–	5,2	30	–	–	6	–	22	–	41,6
LFS32-M5)	6,4	32	66,5	8 000	75	26	–	–	10,2	43	–	–	6	–	25	–	61
LFS32-N	1,4		20	4 000	24		6,5	10,5	10,5	–		125		4	6		15
LFS52-M5)	11,2	52	98,6	8 000	112	42	18	44	10,2	80	52	–	10	–	25	50	89,7
LFS52-NZZ	3,9		34		46,5		11	18,5	18,5	4,7	–	250		6,4	9	–	25,1

Guideways of corrosion-resistant design: LFS..-RB, observe note on page 18.

Modulus of elasticity for LFS..-M (-N, -NZZ, -ZZ): 72 000 N/mm².

① For LFS52-M and LFS32-M; ② For LFS25-M; ③ Detail of slot

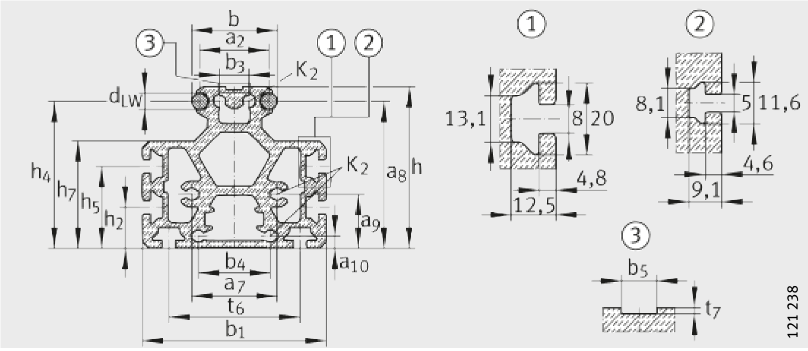
1) Maximum length of single-piece guideways; longer guideways are supplied in several sections and are marked accordingly. Observe the length tolerances, see page 30.

2) For screw to DIN 931 (DIN EN ISO 4014), DIN 933-8.8 (DIN EN ISO 4017), special support washers included in scope of delivery for guideways LFS52-NZZ.

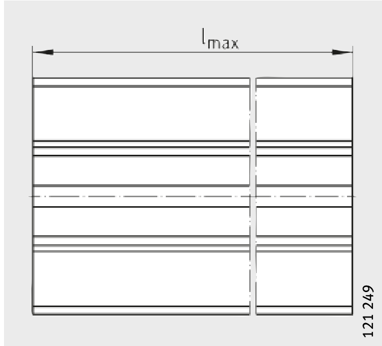
3) Recommended screw pitch (hole spacing), see page 80.

4) One core hole for non-cutting thread drill or self-tapping screws to DIN 7513.

5) The guideway LFS..-M can only be combined with carriages with adjustable clearance. If SF and LFCL carriages are to be used, please contact us in advance.

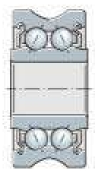


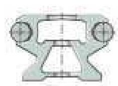
LFS..-M

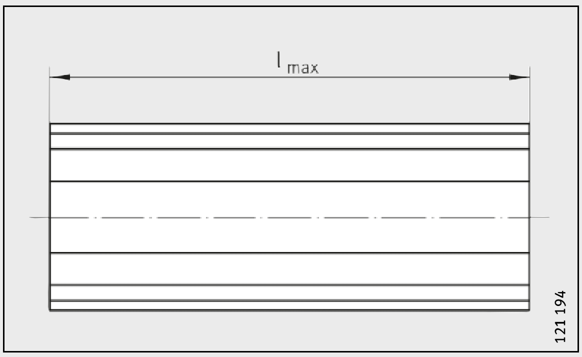


LFS..-M
View rotated 90°

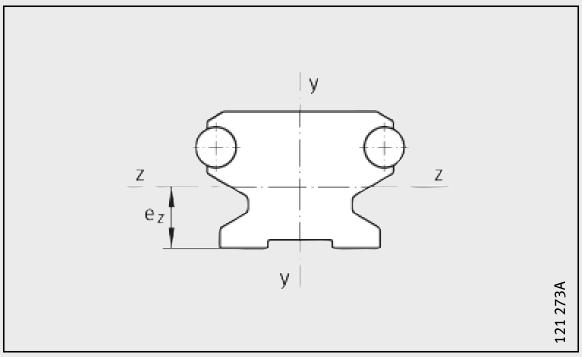
								Surface data					
									y-y		z-z		
h_7	h_6	t_7	a_{10}	a_9	a_8	N_1	K_2 ⌀4)	Cross-sectional area mm²	I_y mm⁴	W_y mm³	e_z mm	I_z mm⁴	W_z mm³
31,5	–	1,6	–	–	–	–	4,65	1 156	314 429	11 230	19,4	186 693	9 623
47	–	1,6	–	–	–	–	–	2 206	1 000 234	26 672	36,8	762 105	20 707
–						M6		360	19 600	1 400	11,1	12 600	1 135
65,4	–	1,8	7,5	33	89,7	–	7,45	3 691	3 717 250	66 380	42,6	3 014 470	55 462
10	6	5	–	–	–	M10	–	994	170 350	7 327	16,8	82 786	4 927





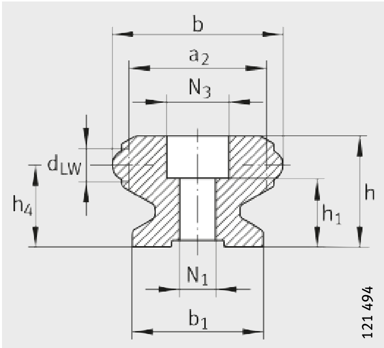


LSF52-NZZ
View rotated 90°

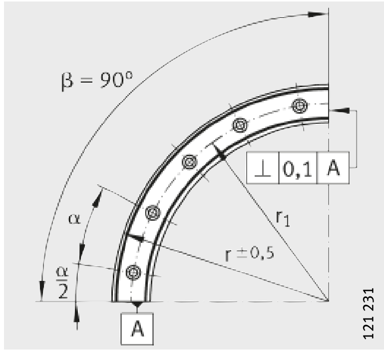


Bending axes

Guideways



LFSR..-ST



LFSR../90-ST

Dimension table · Dimensions in mm

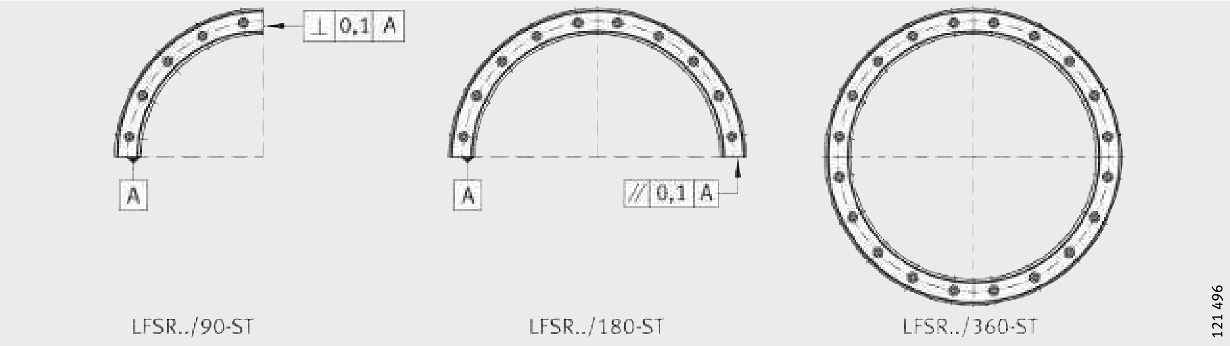
Designation	Mass m ≈ kg	Dimensions b	h	r	β °	b_1	a_2
LFSR32-100/90-ST	0,5				90		
LFSR32-100/180-ST	1			100	180		
LFSR32-100/360-ST	2				360		
LFSR32-150/90-ST	0,8				90		
LFSR32-150/180-ST	1,6			150	180		
LFSR32-150/360-ST	3,2				360		
LFSR32-300/90-ST	1,7	32	20		90	24	26
LFSR32-300/180-ST	3,4			300	180		
LFSR32-300/360-ST	6,8				360		
LFSR32-500/90-ST	2,9				90		
LFSR32-500/180-ST	5,8			500	180		
LFSR32-500/360-ST	11,6				360		
LFSR52-150/90-ST	2				90		
LFSR52-150/180-ST	4			150	180		
LFSR52-150/360-ST	8				360		
LFSR52-300/90-ST	4,5				90		
LFSR52-300/180-ST	9	52	34	300	180	40	42
LFSR52-300/360-ST	18				360		
LFSR52-500/90-ST	7,8				90		
LFSR52-500/180-ST	15,6			500	180		
LFSR52-500/360-ST	31,2				360		

Attention!
If curved guideway elements are required in combination with straight guideway sections, these must always be ordered together as a unit.
Note the guidelines relating to mounting of curved guideway elements, see page 27.

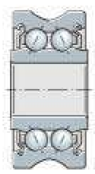
Corrosion-resistant design available by agreement.

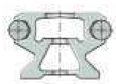
1) For screw to DIN ISO 4762-8.8.

2) Number of holes on the pitch circle r_1.



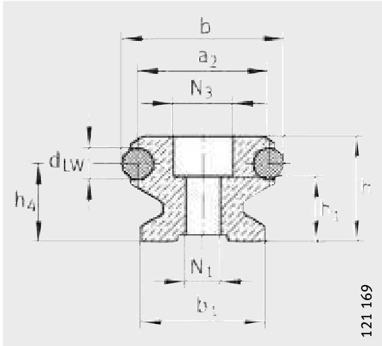
LFSR..-ST





d_{LW}	h_1	h_4	N_1 [1)]	N_3	x [2)]	r_1	α °	α/2 °
6	13,5	15	6,5	12	3	84	30	15
					6			
					12			
					3	134	30	15
					6			
					12			
					4	284	22,5	11,25
					8			
					16			
					5	484	18	9
					10			
					20			
10	21	25,1	11	19	3	124	30	15
					6			
					12			
					4	274	22,5	11,25
					8			
					16			
					5	474	18	9
					10			
					20			

Closed oval tracks
with guideway connectors VBS



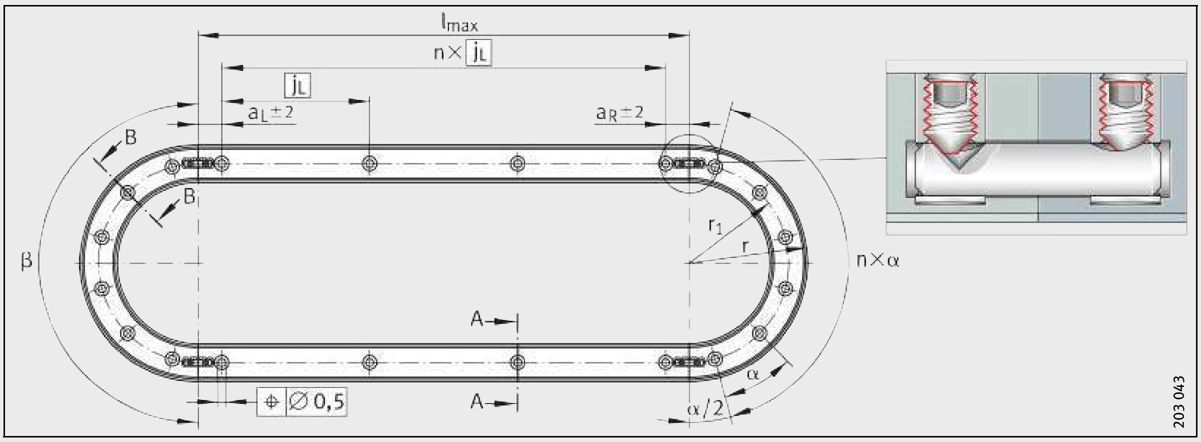
LFS (section A–A)

Dimension table · Dimensions in mm

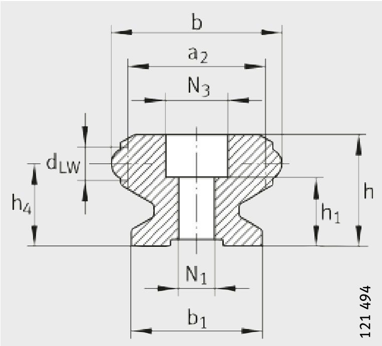
Closed oval tracks Designation		Dimensions				Mounting dimensions	
with two 180° arcs	with four 90° arcs	b	h	β °	l_{max} [1]	b_1	a_2
–	**LFS32×..×..-OV-100-VBS**	32	20	90	6 000	24	26
LFS32×..-OV-100-VBS	–			180			
–	**LFS32×..×..-OV-150-VBS**			90			
LFS32×..-OV-150-VBS	–			180			
–	**LFS32×..×..-OV-300-VBS**			90			
LFS32×..-OV-300-VBS	–			180			
–	**LFS32×..×..-OV-500-VBS**			90			
LFS32×..-OV-500-VBS	–			180			
–	**LFS52×..×..-OV-150-VBS**	52	34	90	6 000	40	42
LFS52×..-OV-150-VBS	–			180			
–	**LFS52×..×..-OV-300-VBS**			90			
LFS52×..-OV-300-VBS	–			180			
–	**LFS52×..×..-OV-500-VBS**			90			
LFS52×..-OV-500-VBS	–			180			

Attention!
If curved guideway elements are required in combination with straight guideway sections, these must always be ordered together as a unit.
Closed oval tracks can only be ordered as a single unit.
A unit consists of two curved guideway elements LFSR with an arc dimension 180° and two straight guideways LFS or a unit of four curved guideways LFSR with an arc dimension 90° and four straight guideways LFS.
Note the guidelines relating to mounting of curved guideway elements, see page 27.

1) Maximum length of single-piece guideways.
2) For screw to DIN ISO 4762-8.8.
3) Number of holes on the pitch circle r_1.

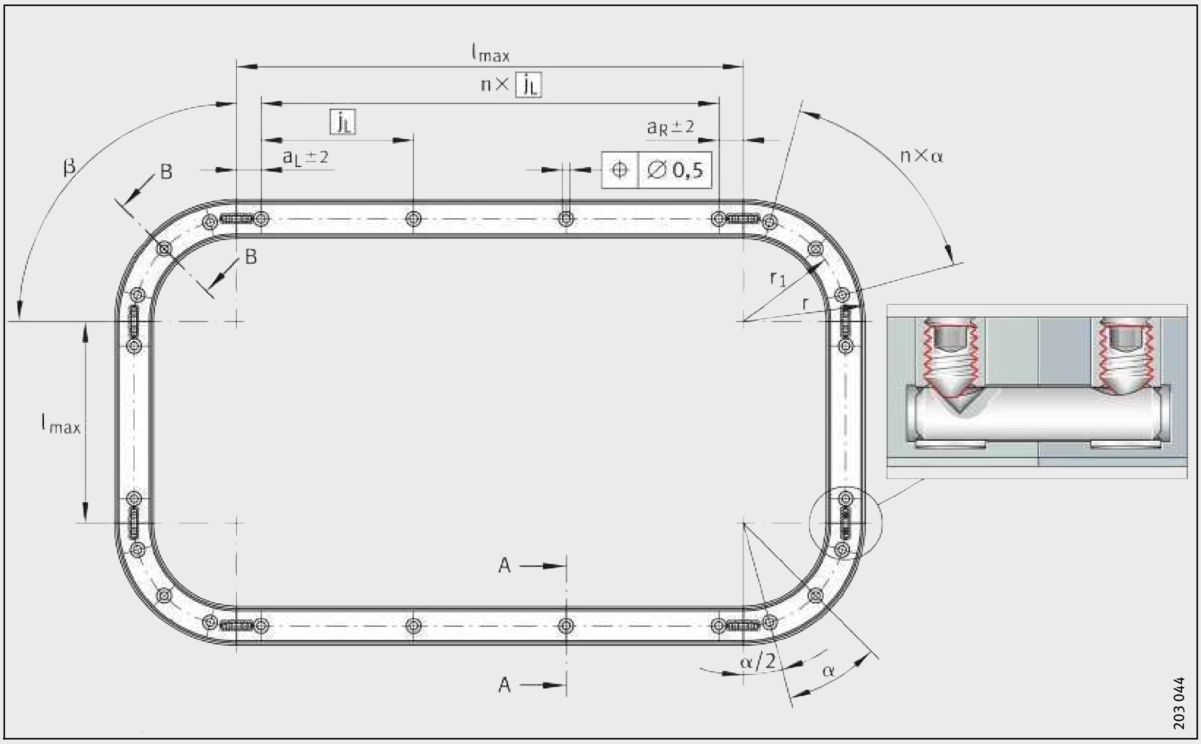


Closed oval track with two 180° arcs

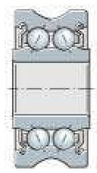


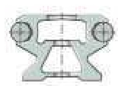
LFSR (section B–B)

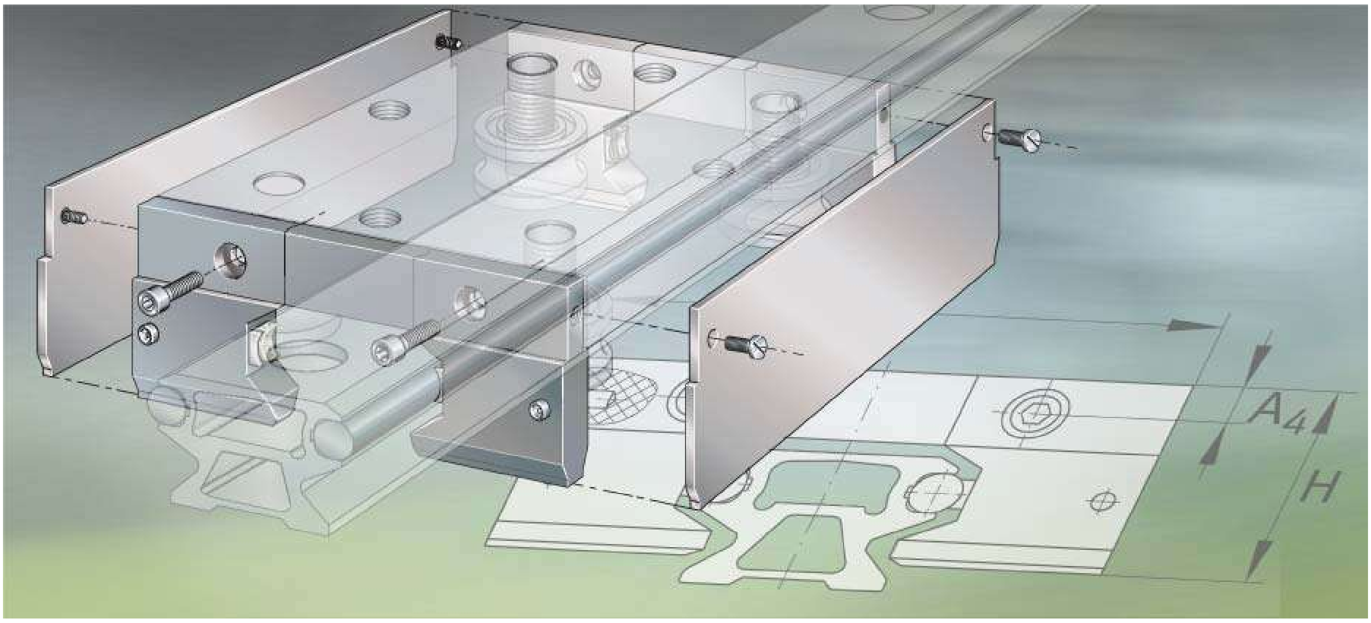
j_L	a_L, a_R		d_{LW}	h_1	h_4	N_1 2)	N_3	x 3)	r	r_1	α
	min.	max.									°
125	36	116	6	12	15	6,5	12	3	100	84	30
								6			
	30							3	150	134	
								6			
								4	300	284	22,5
								8			
								5	500	484	18
								10			
250	49	235	10	21	25	11	19	3	150	124	30
								6			
	41							4	300	274	22,5
								8			
								5	500	474	18
								10			



Closed oval track with four 90° arcs



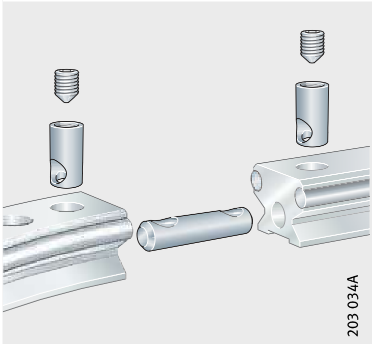




Accessories

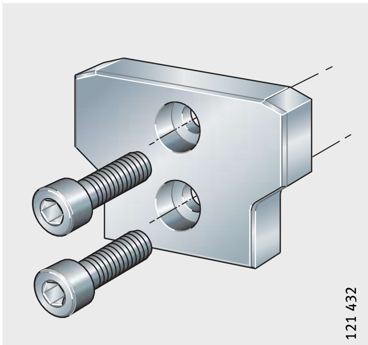
Guideway connector for guideways

VBS



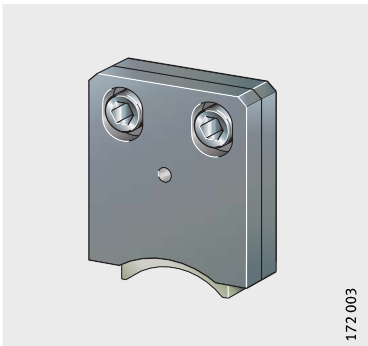
End plate

ANS.LFS

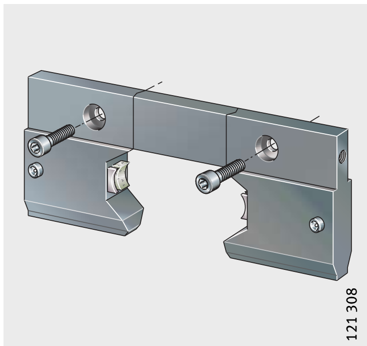


Lubrication and wiper units

AB.W

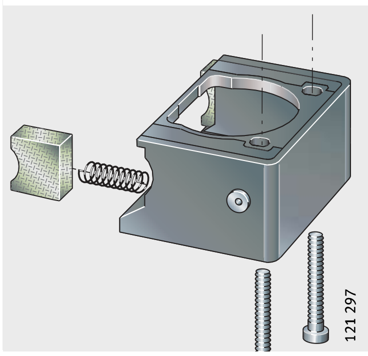


AB



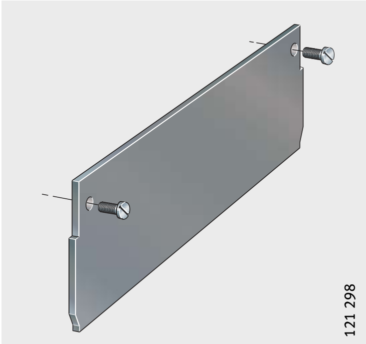
Cap wipers

AB.LFR



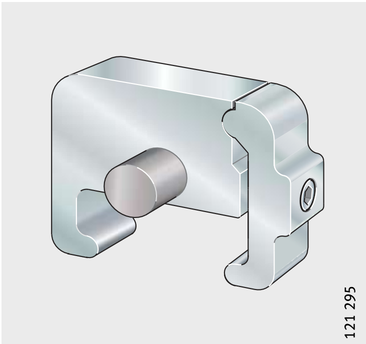
Side plate

ABAL

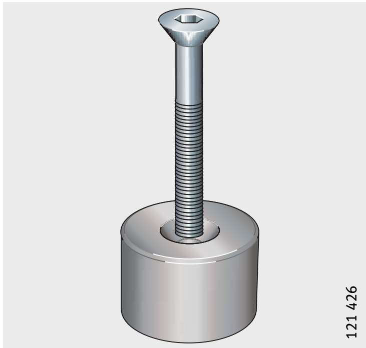


Stops

PAH

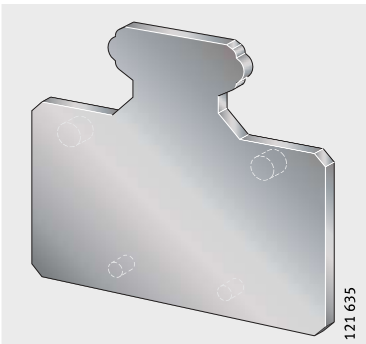


PASTP

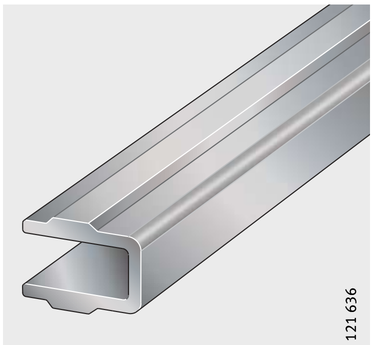


End cover
Slot closing strip

KA.LFS



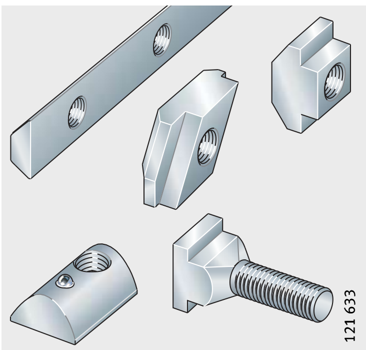
NAD



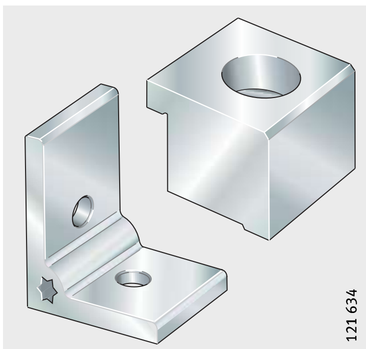
Fasteners

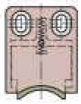
Fixing screw
T-nuts
T-bolt
T-strip
Fixing bracket
Fixing lug

MU, SHR, LEIS-M



WKL, SPPR





Features

Guideway connector for guideways

Guideway connectors VBS are accessories for curved and straight LFS guideways.

They comprise:

- pins
- bushes
- grub screws.

The guideway connectors are suitable for all LF guideways. Joined curved guideways are supplied as standard with the guideway connector. Joined straight guideways are available as an option with the guideway connector.

The VBS reduces running noise at the joint, ensures an increased operating life for the guidance system and improves the operational reliability.

End plate

End plates ANS.LFS (also for use with hollow section guideways) are made from steel. They secure the rolled-in raceway shafts by means of form fit. In the case of solid section guideways, holes must be made in the end faces (by the customer) for screw mounting of the end plates.

The end plates prevent the shaft creep that can occur under unfavourable conditions on all guideways that comprise an aluminium support rail into which a steel shaft is rolled or pressed.

! These can be supplied already fitted, but this must be indicated when ordering.

Lubrication and wiper units

Design AB.W

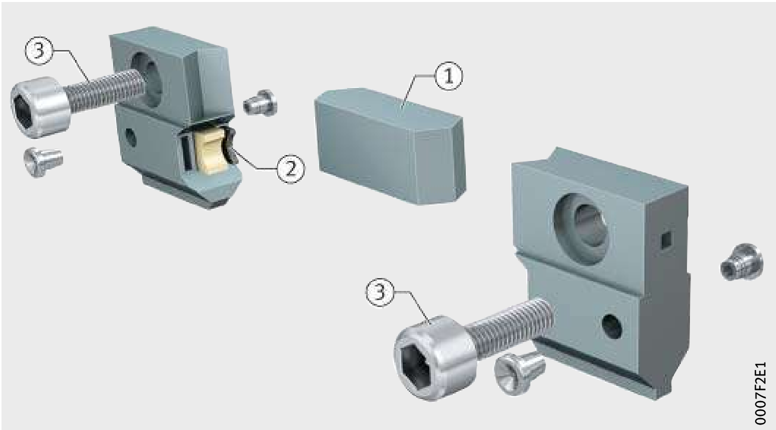
The lubrication and wiper unit AB.W comprises a plastic housing and is fixed to the adjacent construction. It contains a felt lubrication insert. This is supplied soaked with oil that has H1 approval and can be replenished with oil via a hole in the housing if necessary.

Lubrication and wiper units AB.W are supplied with fixing screws.

Design AB

The lubrication and wiper unit AB comprises a plastic housing and is screw mounted to the end of the carriage LFL-SF or LFDL. It contains felt lubrication inserts on both sides. These are supplied soaked with oil that has H1 approval and can be replenished with oil via lubrication nipples if necessary. The lubrication and wiper units AB can be fixed to carriages using two screws.

If the lubrication and wiper unit AB is used together with a stop PAH or PASTP, the central section must be removed, see *Figure 1*.



1 Central section, supplied loose
2 Felt lubrication inserts
3 Fixing screws, supplied loose

Figure 1
Lubrication and wiper unit AB

Cap wipers

The cap wipers comprise a plastic housing and are slid over the track roller from below. They contains felt lubrication inserts on both sides. These are supplied soaked with oil that has H1 approval and can be replenished with oil via lubrication nipples if necessary.

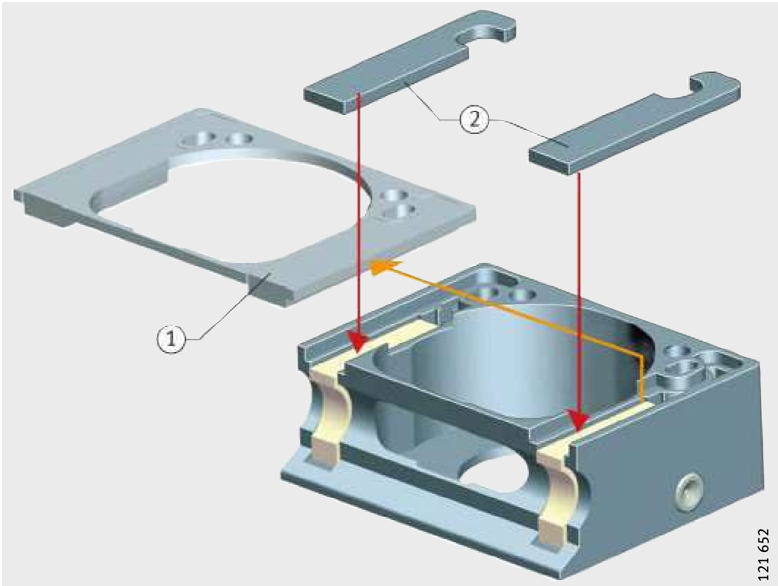
The cap wipers can be fixed using two screws to the screw mounting channels in the carriage LFCL and thus seal the track rollers from below at the screw head. When bolts LFZ and LFE are used in an application design, this gives a gap.

Cap wipers are supplied with fixing screws.

Design AB.LFR

If two or more AB.LFR are used per side, the displacement resistance can be reduced by removing the felt insert on the inner side.

AB.LFR are suitable for mounting on the carriage LFCL42 as well as customer designs. For mounting on the carriage LFCL42, the upper cover must be replaced by the two covers supplied, *Figure 2*.



① For mounting on the customer design
② For mounting on LFCL42

Figure 2
Mounting on carriage LFCL

Design AB.LFR5302

An exception is the cap wiper AB.LFR5302. This comprises an end cover and a relubrication and wiper unit AB.W10 that can be screw mounted to either the right or left of the end cover. Its function and location correspond to those of the other sizes.

Side plate

The side plate ABAL is made from plastic and can be screw mounted to the sides of carriages LFL..-SF. The side plates are used to supplement the lubrication and wiper units AB. The carriage can be sealed on all sides, with the exception of the underside, by means of two side plates and two lubrication and wiper units.

The side plate is supplied with fixing screws.

It can only be mounted in conjunction with the lubrication and wiper unit AB.

Stops

Design PAH

The stop PAH comprises anodised aluminium and a buffer made from shock-absorbent plastic. The stop can be placed at any position on guideways. It is then clamped in place by means of a screw.

The stop is used as an end stop or restricts the travel of the carriage.

The central section of lubrication and wiper units must be removed if the carriage is to run up against a stop PAH, see page 109.

Design PASTP

The stop PASTP is made from plastic. It can be screw mounted in a threaded hole (to be made by the customer) in guideways. This hole can be drilled at any position on guideways LFS. The stop is used as an end stop or restricts the travel of the carriage.

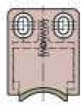
The central section of lubrication and wiper units must be removed if the carriage is to run up against a stop PASTP, see page 109.

End cover

End covers KA are made from plastic. The end covers close off the end faces of the hollow sections in guideways LFS..-C and LFS..-M as well as in the hollow section carriage LFCL.

Slot closing strip

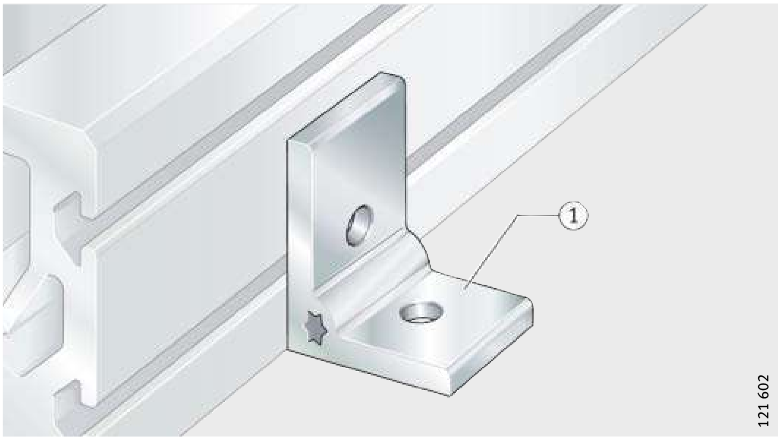
Slot closing strips NAD are made from plastic. They close off the slots in the guideway LFS..-M. For information on NAD, see publication AL 1, Driven Linear Units.



Fasteners

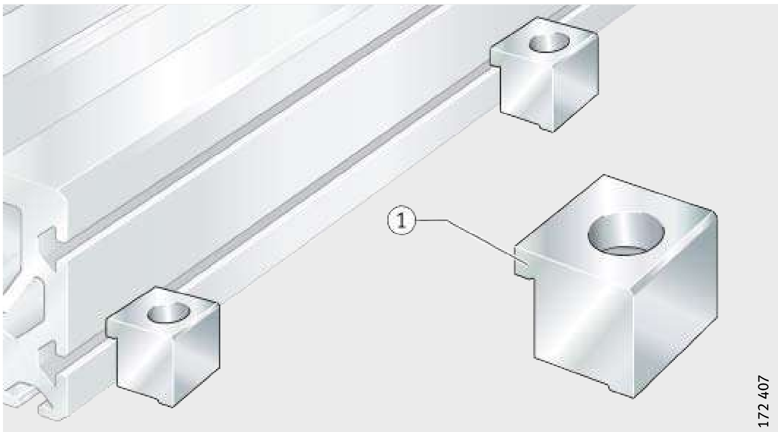
Fixing brackets, fixing lugs

For location of LFS-M with the integral profiled aluminium support rail, fixing brackets and fixing lugs are available, *Figure 3*, *Figure 4*, *Figure 5* and table, page 113.



① WKL

Figure 3
Fixing brackets



① SPPR

Figure 4
Fixing lug

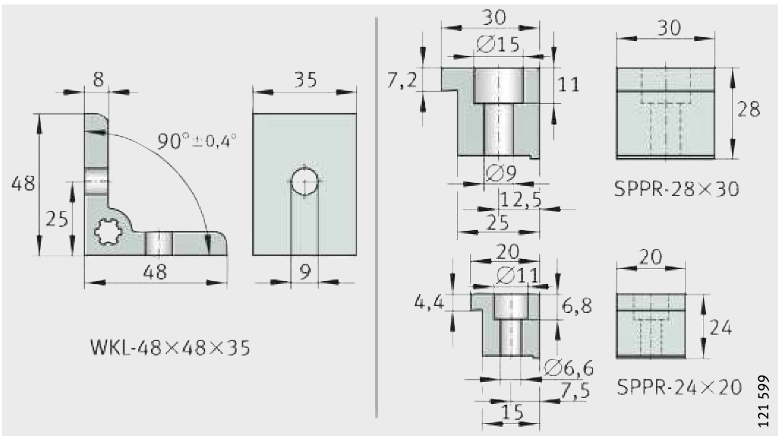
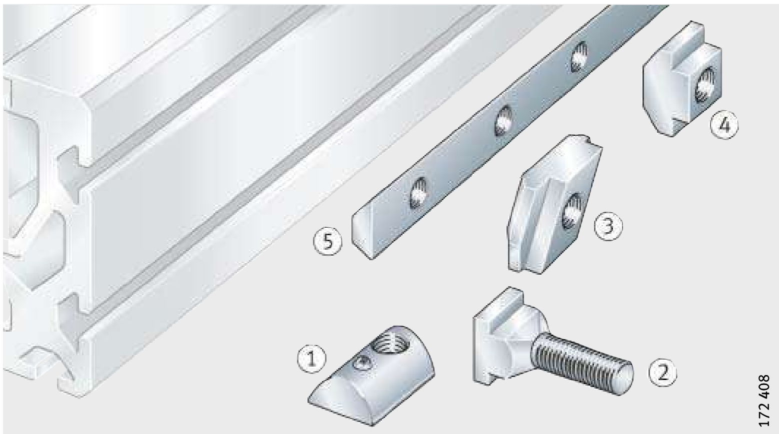


Figure 5
Fixing brackets and fixing lugs

T-strip, T-nuts, T-bolts

For integration in existing systems or for extension, T-strips, T-nuts and corresponding T-bolts are available, *Figure 6* and table.



① MU..-POS
② SHR-DIN787-M8×8×32
③ MU-M
④ MU-DIN508
⑤ LEIS-M, T-slot

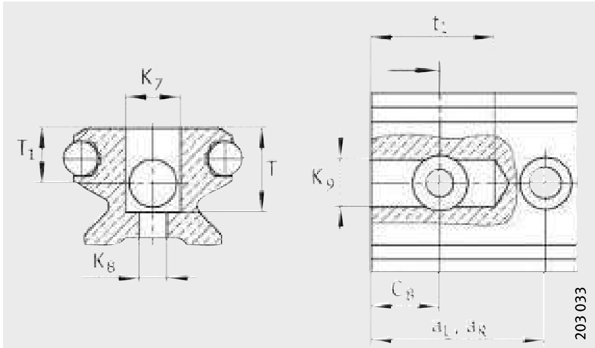
Figure 6
Fixing screws and T-nuts

Fasteners and designations

Fastener	Designation
Fixing bracket	WKL-48×48×35
For slot width 8 mm (LFS32-M, LFS52-M)	
Clamping lug	SPPR-28×30
T-nut	MU-DIN508-M4×8 MU-DIN508-M6×8
Rotatable T-nut	MU-M4×8-Rhombus MU-M6×8-Rhombus
Positionable T-nut	MU-M6×8-POS MU-M8×8-POS
T-bolt	SHR-DIN787-M8×8×32
T-strip (steel) Hole spacing 50 mm	LEIS-M6/8-T-Nut (state length)[1)] LEIS-M8/8-T-Nut (state length)[1)]
For slot width 5 mm (LFS25-M)	
Clamping lug	SPPR-24×20
T-nut	MU-DIN508-M4×5
Positionable T-nut	MU-M5×5-POS

1) Maximum single-piece length: 2 000 mm.

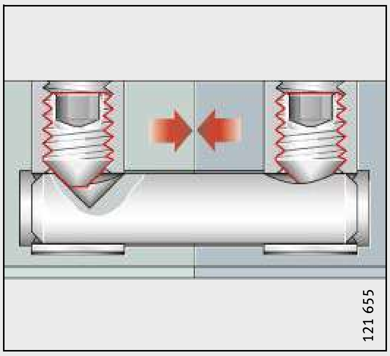
Guideway connectors for guideways LFS



VBS

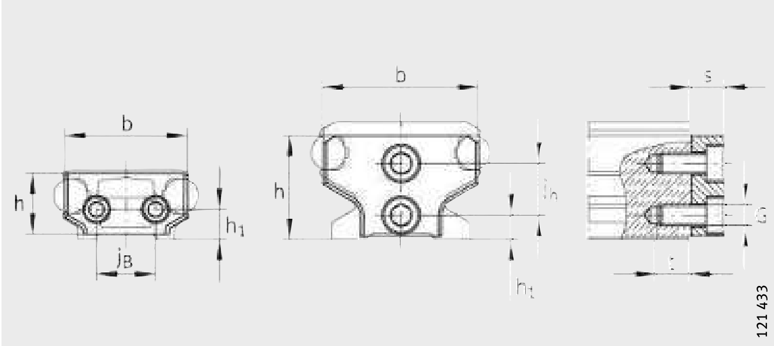
Dimension table · Dimensions in mm										
Designation	Dimensions									For guideway
	T	T_1 ±0,1	t_1 +0,5	a_L min.	a_R min.	C_8 ±0,1	K_7 +0,2	K_8	K_9 +0,5	
VBS32	16,5	10	25	30	30	15	12	6,5	9	LFS32, LFS32-E
VBS32-R100			17	22		9				LFS32, LFS32-E
VBS42	16,5	10	25	30	30	15	12	6,5	9	LFS42-C, LFS42-CE
VBS52	30	22	30	40	40	20	16	8	13	LFS52, LFS52-E, LFS52-EE, LFS52-C, LFS52-CE, LFS52-CEE
VBS52-R150			23	33		14				LFS52, LFS52-E, LFS52-EE, LFS52-C, LFS52-CE, LFS52-CEE

Attention!
If these are to be used with curved guideways LFSR or with straight guideways not included in the table, please contact us.



Guideway connector VBS

End plate

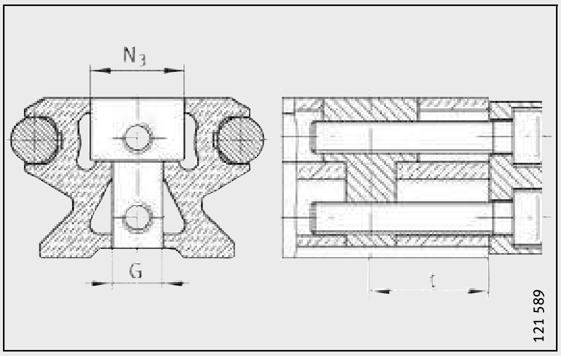


ANS.LFS, ANS.LFS42-C, ANS.LFS86-C, ANS.LFS..-NZZ

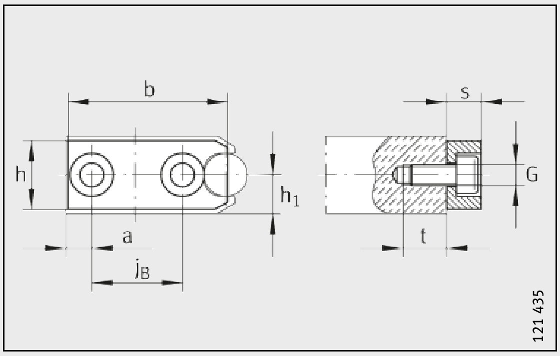
Dimension table · Dimensions in mm

<table>
<tr><th rowspan="2">Designation</th><th colspan="10">Dimensions</th><th rowspan="2">For guideway</th></tr>
<tr><th>b</th><th>j_B</th><th>a</th><th>s</th><th>t</th><th>N_3 ∅</th><th>h</th><th>h_1</th><th>j_h</th><th>G</th></tr>
<tr><td>**ANS.LFS20**</td><td>15,4</td><td>–</td><td>–</td><td>6</td><td>12</td><td>–</td><td>11</td><td>6,2</td><td>–</td><td>M5</td><td>LFS20</td></tr>
<tr><td>**ANS.LFS25**</td><td>20</td><td>–</td><td>–</td><td>5</td><td>7</td><td>–</td><td>14</td><td>4</td><td>7</td><td>M3</td><td>LFS25</td></tr>
<tr><td>**ANS.LFS32**</td><td rowspan="2">30</td><td rowspan="2">–</td><td rowspan="3">–</td><td rowspan="2">8</td><td>7</td><td>–</td><td>19</td><td>5</td><td>10</td><td>M4</td><td>LFS32</td></tr>
<tr><td>**ANS.LFS32-C**</td><td>15</td><td>12H13</td><td>–</td><td>–</td><td rowspan="4">–</td><td>∅6,5H13</td><td>LFS32-C</td></tr>
<tr><td>**ANS.LFS32-F**</td><td>26</td><td>11</td><td rowspan="3">6</td><td>–</td><td rowspan="3">–</td><td rowspan="3">9</td><td rowspan="2">5</td><td>M4</td><td>LFS32-F</td></tr>
<tr><td>**ANS.LFS32-FH**</td><td>22</td><td>9</td><td>9</td><td>7</td><td>M3</td><td>LFS32-FH</td></tr>
<tr><td>**ANS.LFS32-N**</td><td>26</td><td>11</td><td>–</td><td>–</td><td>15</td><td>M4</td><td>LFS32-N</td></tr>
<tr><td>**ANS.LFS42-C**</td><td>35,5</td><td>17</td><td>–</td><td>8</td><td>7</td><td>–</td><td>18</td><td>8</td><td>–</td><td>M4</td><td>LFS42-C</td></tr>
<tr><td>**ANS.LFS52**</td><td rowspan="2">45</td><td rowspan="2">–</td><td rowspan="3">–</td><td rowspan="2">10</td><td>10</td><td>–</td><td>30</td><td>7</td><td>15</td><td>M6</td><td>LFS52</td></tr>
<tr><td>**ANS.LFS52-C**</td><td>20</td><td>19H13</td><td>30</td><td>–</td><td rowspan="4">–</td><td>∅11H13</td><td>LFS52-C</td></tr>
<tr><td>**ANS.LFS52-F**</td><td>42</td><td>21</td><td rowspan="3">8</td><td rowspan="3">10</td><td rowspan="3">–</td><td rowspan="3">16</td><td rowspan="2">9</td><td rowspan="3">M5</td><td>LFS52-F</td></tr>
<tr><td>**ANS.LFS52-FH**</td><td>37</td><td>20</td><td>6,5</td><td>LFS52-FH</td></tr>
<tr><td>**ANS.LFS52-NZZ**</td><td>42</td><td>21</td><td>–</td><td>24</td><td>LFS52-NZZ</td></tr>
<tr><td>**ANS.LFS86-C**</td><td>80</td><td>54,1</td><td>–</td><td>9</td><td>20</td><td>–</td><td>30</td><td>17,5</td><td>–</td><td>M6</td><td>LFS86-C</td></tr>
<tr><td>**ANS.LFS120**</td><td>114</td><td>80</td><td>–</td><td>5</td><td>10</td><td>–</td><td>16</td><td>8</td><td>–</td><td>M6</td><td>LFS120</td></tr>
</table>

ANS cannot be mounted on:
LFS32-C: a_L, a_R < 28 mm
LFS52-C: a_L, a_R < 40 mm.

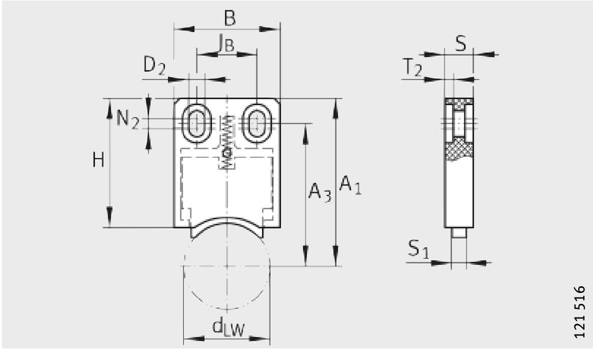


ANS.LFS32-C, ANS.LFS-52-C (hollow section)



ANS.LFS..-F (-FH)

Lubrication and wiper units

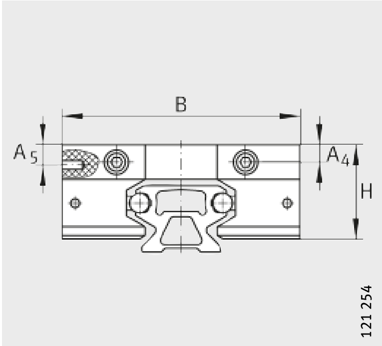


AB.W

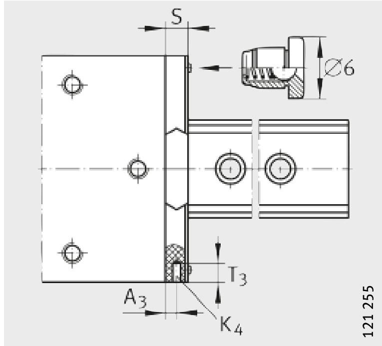
Dimension table · Dimensions in mm

Designation	Mass	Dimensions											For track roller
	m ≈ kg	d_{LW}	B	S	H	J_B ±0,1	D_2	T_2	S_1	A_1	N_2	A_3	
AB.W10	0,03	10	22,5	10	45	10	4,5	3	5	49	4	40,3	LFR5201, LFR5301, LFR5302
AB.W12	0,03	12	22,5	10	45	10	4,5	3	5	51	4	42,3	LFR5201-12
AB.W16	0,03	16	22,5	10	45	10	4,5	3	5	52	4	43,3	LFR5204-16
AB.W20	0,03	20	22,5	10	45	10	4,5	3	5	54	4	45,3	LFR5206-20
AB.W25	0,03	25	37	10	45	21	5,5	3	5	54	3,5	45,3	LFR5206-25
AB.W30	0,03	30	37	10	45	21	5,5	3	5	59	3,5	50,3	LFR5207-30
AB.W40	0,03	45	37	10	45	21	5,5	3	5	71	3,5	62,3	LFR5208-40
AB.W50	0,03	50	37	10	45	21	5,5	3	5	76	3,5	67,3	LFR5308-50

Lubrication and wiper units



AB



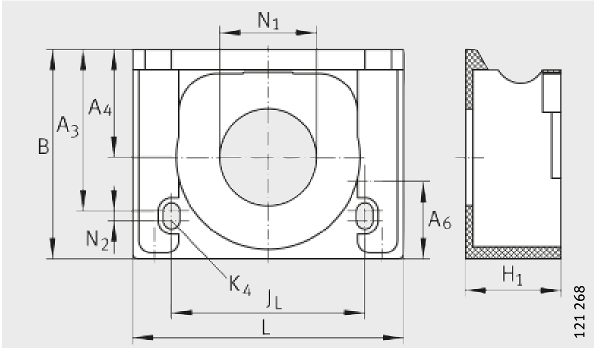
AB
View rotated 90°

Dimension table · Dimensions in mm

Designation	Mass	Dimensions								For carriage
	m ≈ kg	B	T_3	S	A_3	H	A_4	A_5	K_4 For screws to DIN 7972	
AB32	0,03	80	6	11	5	32	7	7	ST2,9	LFL32-SF, LFL52-SF, LFL52-E-SF, LFDL32-SF, LFDL32-B[1)]
AB52	0,1	120	20	18	8,5	45,5	9,7	15	ST4,8	LFL32-SF, LFL52-SF, LFL52-E-SF, LFDL32-SF, LFDL32-B
AB52-E	0,13	135	20	18	8,5	55	12	20,6	ST4,8	LFL32-SF, LFL52-SF, LFL52-E-SF
AB.LFLL32	0,03	80	6	11	5	32	7	7	ST2,9	LFLL32-SF[1)]
AB.LFLL52	0,1	120	20	18	8,5	45,5	9,7	15	ST4,8	LFLL52-SF

1) Please contact us.

Cap wipers

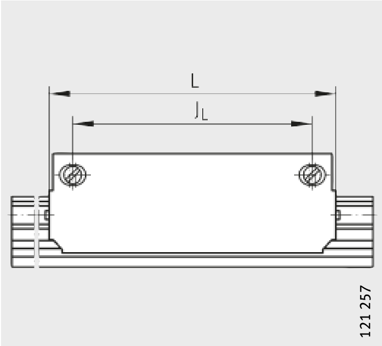


AB.LFR

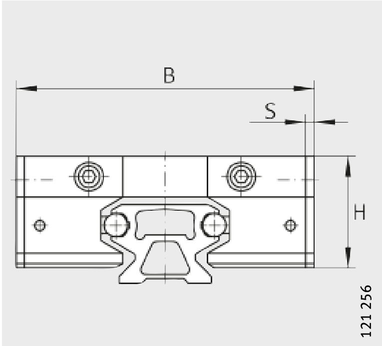
Dimension table · Dimensions in mm												
Designation	Mass	Dimensions									For	
	m ≈ kg	B	A_3	A_4	N_2	A_6	L ±0,1	J_L	H_1	K_4	N_1 +0,1	track roller	carriage
AB.LFR50/8	0,02	31,6	25,9	15,6	2	6,4	51	28,5	15	M3	15	LFR50/8	LFCL25
AB.LFR5201	0,02	43,3	33,4	22,3	2	16	56	40	21,3	M3	20	LFR5201	LFCL42
AB.LFR5301	0,03	50	38,7	26	2	10,4	76	46	25	M3	20	LFR5301	LFCL86
AB.LFR5302[1)]	–	57	46	–	1,5	15,5	58	48	31	M3	–	LFR5302	–

1) Observe the note on page 110.

Side plate



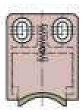
ABAL



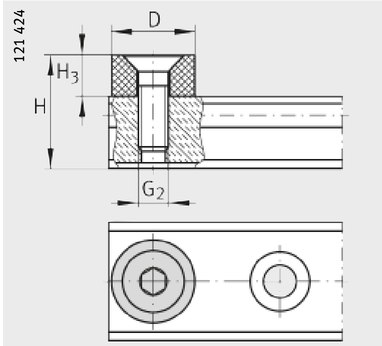
ABAL

Dimension table · Dimensions in mm

Designation	Mass m ≈ kg	Dimensions					For carriage
		B	S	L	J_L	H	
ABAL32	0,03	86	3	112	100	32	LFL32-SF
ABAL52	0,04	130	5	136	117	49,5	LFL52-SF
ABAL52-E	0,05	145	5	186	167	55	LFL52-E-SF



Stops

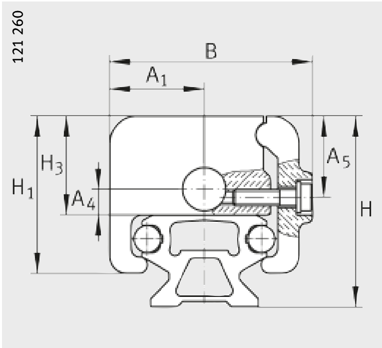


PASTP

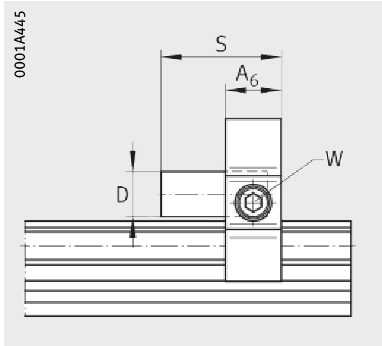
Dimension table · Dimensions in mm

Designation	Mass	Dimensions				For guideway
	m	D	H_3	G_2	H	
	≈ kg					
PASTP20	0,008	14	7	M5	22,2	LFS20
PASTP25	0,008	14	7	M5	25	LFS25
PASTP32	0,01	16	11	M6	31	LFS32
PASTP42	0,01	16	11	M6	31	LFS42-C
PASTP52	0,01	20	11	M8	45	LFS52
PASTP86	0,01	20	11	M8	45	LFS86-C

Stops



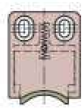
PAH



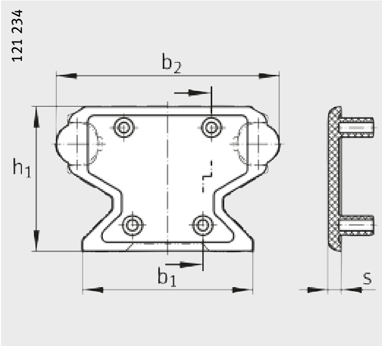
PAH
View rotated 90°

Dimension table · Dimensions in mm

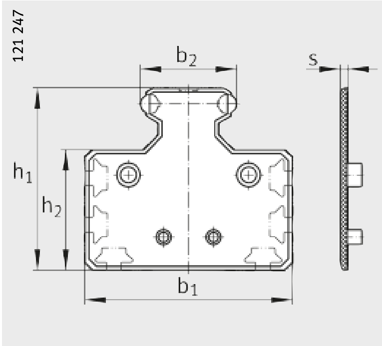
Designation	Mass	Dimensions											For guideway
	m ≈ kg	B	A_1	S	A_6	D	H	H_1	H_3	A_4	A_5	Width across flats W	
PAH32	0,05	46	21	30	15	10	39	32	19	7	14	5	LFS32-C
PAH52	0,17	75	35	43	20	16	70,5	58	36,5	9,5	30	6	LFS52-C (-NZZ)



End cover



KA.LFS..-C

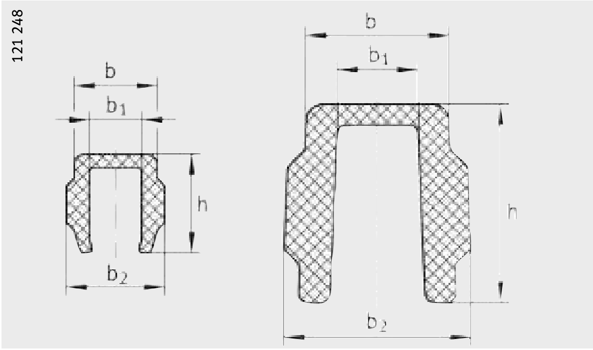


KA.LFS..-M

Dimension table · Dimensions in mm

Designation	Mass	Dimensions					For guideway
	m ≈ kg	b_2	b_1	S	h_1	h_2	
KA.LFS25-M	0,01	24,4	55,4	3	45,4	30,9	LFS25-M
KA.LFS32-C	0,01	31,4	23,4	3	19,4	–	LFS32-C
KA.LFS32-M	0,012	31,4	75,4	3	59,9	46,4	LFS32-M
KA.LFS42-C	0,012	41,4	27,4	3	19,4	–	LFS42-C
KA.LFS52-C	0,013	51,6	39,5	3	33,4	–	LFS52-C
KA.LFS52-M	0,015	51,6	111,4	4	98	64,8	LFS52-M
KA.LFS86-C	0,015	85,6	70,4	3	33,4	–	LFS86-C

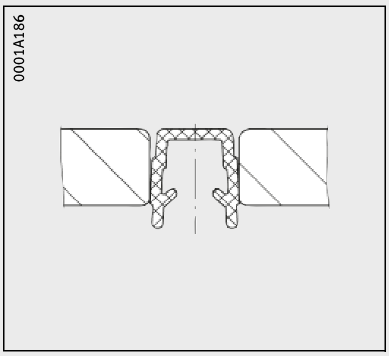
Slot closing strip



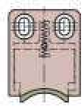
NAD

Dimension table · Dimensions in mm

Designation	Mass	Dimensions				For guideway
	m	b	b_1	b_2	h	
	≈ kg					
NAD5×5,7	0,012	4,8	3	5,7	5,7	LFS25-M
NAD8×11,5	0,027	8,2	5,5	9,2	11,5	LFS32-M, LFS52-M



NAD5×5,7



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