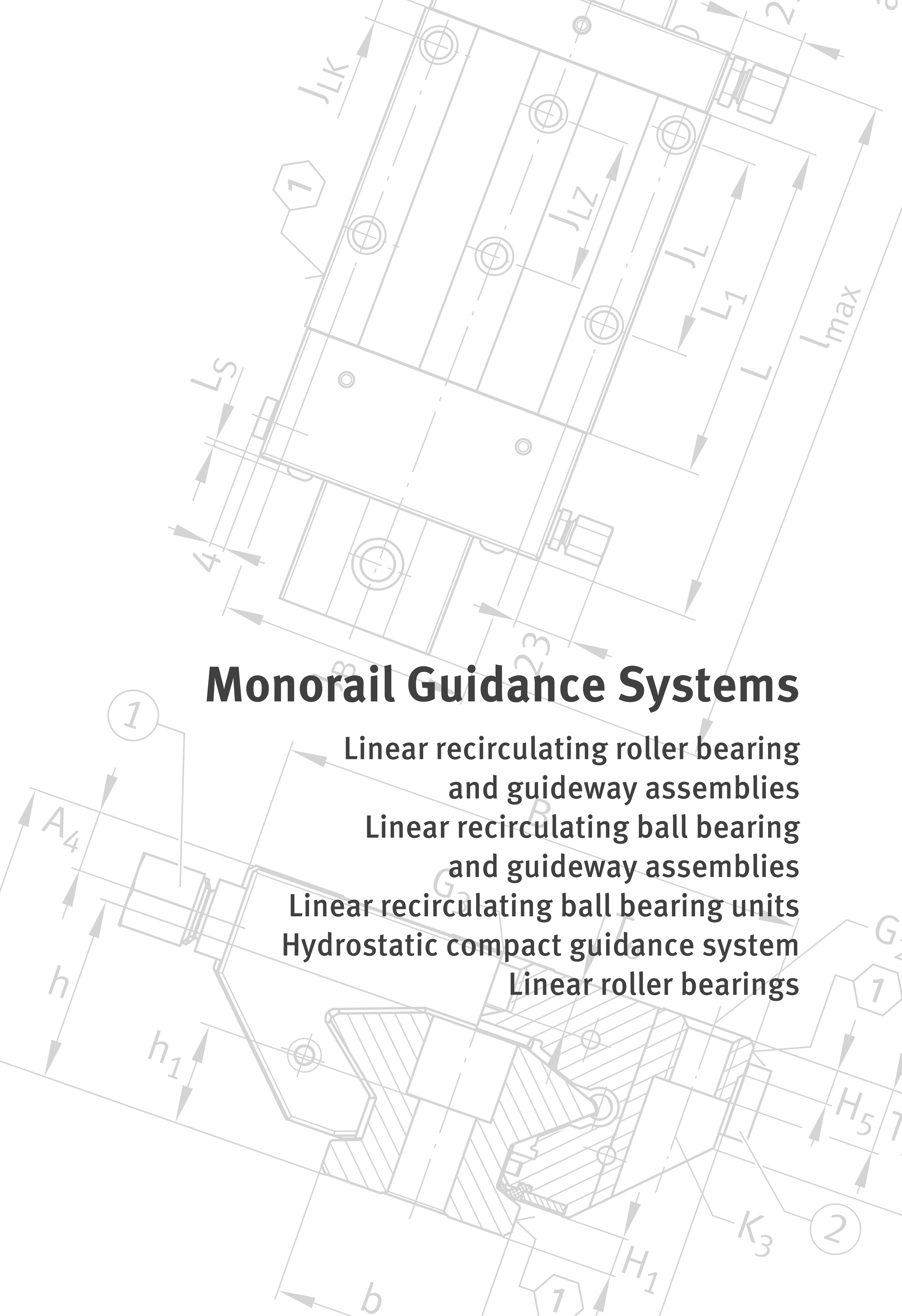
SCHAEFFLER

Monorail Guidance Systems

Linear recirculating roller bearing and guideway assemblies, Linear recirculating ball bearing and guideway assemblies, Linear recirculating ball bearing units, Hydrostatic compact guidance system, Linear roller bearings



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Linear recirculating roller bearing
and guideway assemblies
Linear recirculating ball bearing
and guideway assemblies
Linear recirculating ball bearing units
Hydrostatic compact guidance system
Linear roller bearings

Issued: 2021, February

Preface

The performance capacity and economic success of a design incorporating monorail guidance systems is essentially dependent on the components used. It is at this stage that the competitive technical superiority and subsequent acceptance in the market of the machine or installation is often decided. However, the bearing arrangement must be precisely matched to the application and achievable by the use of standard components.

High load capacity, rigid, flexible, cost-effective

INA monorail guidance systems are compact linear guidance systems that are supplied complete as standard and have high rigidity and load carrying capacity. They can support forces from all directions, apart from the direction of motion, as well as moments about all axes and can be supplied in various accuracies and preload classes. As a result, they are also suitable for applications with high guidance and positioning requirements.

In most series, the carriages and guideways can be used in any combination within the same accuracy class. This gives a high degree of design flexibility with simplified fitting and reduced stockholding costs.

In order to reduce maintenance costs, the linear recirculating ball bearing and guideway assemblies have a lubricant reservoir. As a result, they are low-maintenance for many applications.

Product range

Catalogue PF 1 gives information on:

- linear recirculating roller bearing and guideway assemblies RUE
- six-row linear recirculating ball bearing and guideway assemblies KUSE
- four-row linear recirculating ball bearing and guideway assemblies KUVE
- linear recirculating ball bearing units KUVS
- hydrostatic compact guidance system HLE
- linear roller bearings RUS, RUSV, PR.

It also describes the relevant principles of rolling bearing technology for the design and lubrication of bearing arrangements based on these guidance systems.

Accessories for any application

The comprehensive standard range can be further optimised by means of a range of accessories precisely matched to various application requirements.

Replacement for ...

This catalogue supersedes all older issues of Catalogue PF 1 from Schaeffler Technologies AG & Co. KG. The data represent the current level of technology and manufacture as of September 2018. They reflect not only progress in rolling bearing technology but also the experience gathered in practical use.

Data in earlier catalogues as well as in Product and Market Information publications that do not correspond to the data in this catalogue are therefore invalid.

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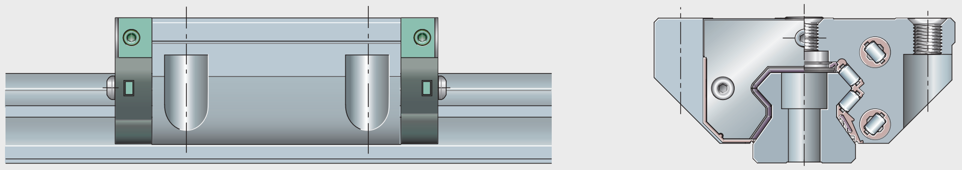

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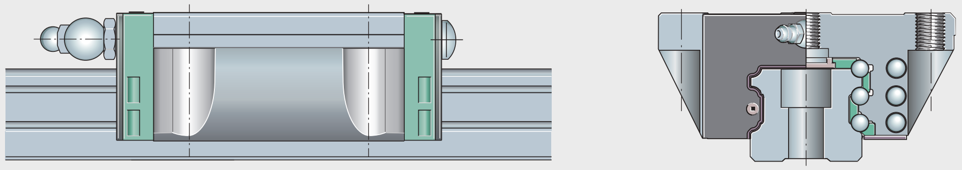

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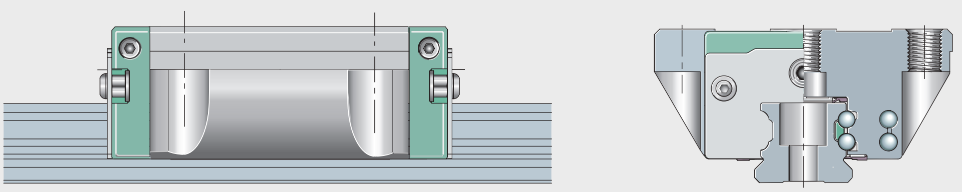

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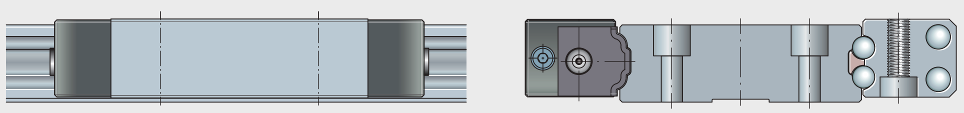

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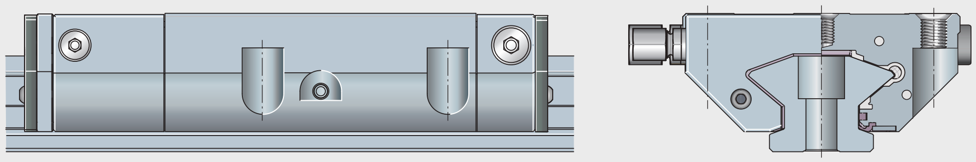

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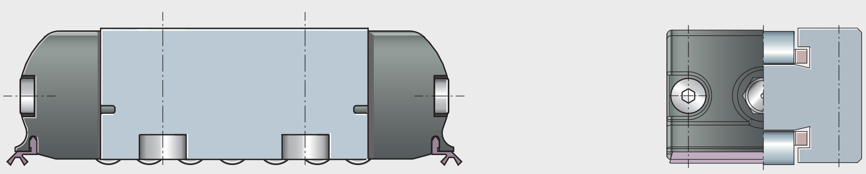

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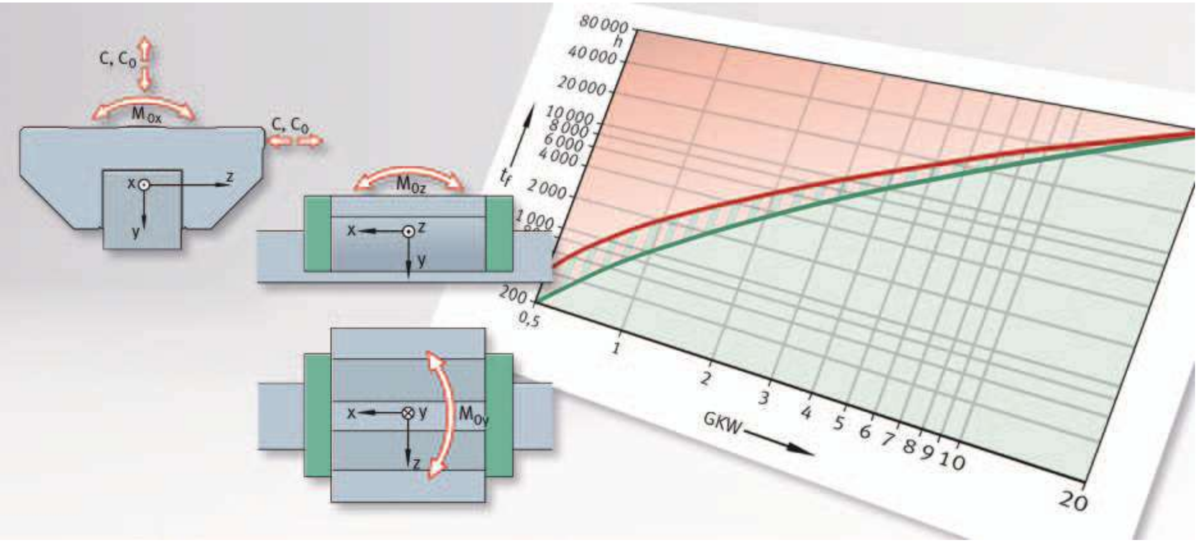

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The size of a monorail guidance system is determined by the demands made on its load carrying capacity, life and operational security.

Load carrying capacity

The load carrying capacity is described in terms of the basic dynamic load rating C, the basic static load rating C_0 and the static moment ratings M_{0x}, M_{0y} and M_{0z}, *Figure 1*.

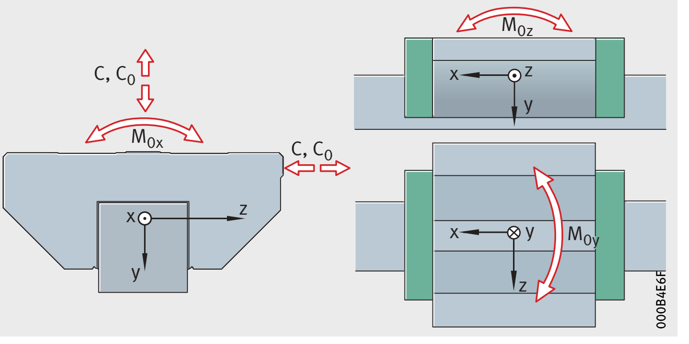


Figure 1
Load carrying capacity and load directions

Calculation of basic load ratings according to DIN ISO

The calculation of the basic dynamic and static load ratings given in the dimension tables is based on DIN ISO 14728-1 and 2.

Differences between DIN ISO and suppliers from the Far East

Suppliers from the Far East frequently calculate basic load ratings using a basic rating life based on a distance of only 50 km in contrast to 100 km according to DIN ISO. This results in comparatively higher basic load ratings.

Conversion of basic load ratings

The conversion factors are applied as follows:

Linear recirculating ball bearing and guideway assemblies

$$C_{50} = \mathbf{1,26} \cdot C_{100}$$

$$C_{100} = \mathbf{0,79} \cdot C_{50}$$

Linear recirculating roller bearing and guideway assemblies

$$C_{50} = \mathbf{1,23} \cdot C_{100}$$

$$C_{100} = \mathbf{0,81} \cdot C_{50}$$

C_{100} N
Basic dynamic load rating in accordance with DIN ISO 14728-1 (based on 100 km)

C_{50} N
Basic dynamic load rating in accordance with DIN ISO 14728-1 (based on 50 km).

Load carrying capacity and life

Dynamic load carrying capacity and life

The dynamic load carrying capacity is described in terms of the basic dynamic load rating and the basic rating life.

The basic dynamic load rating is the load in N at which the guidance system, with a survival probability of 90%, achieves a distance of 100 km (C_{100}).

! The data for the basic dynamic load rating C in the dimension tables correspond to the basic dynamic load rating C_{100} in accordance with DIN ISO 14728-1.

Basic rating life

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

$$L = \left(\frac{C_{100}}{P}\right)^p \cdot 100$$

$$L_h = \frac{833}{H \cdot n_{osc}} \cdot \left(\frac{C_{100}}{P}\right)^p$$

$$L_h = \frac{1666}{v_m} \cdot \left(\frac{C_{100}}{P}\right)^p$$

! In accordance with DIN ISO 14728-1, the equivalent dynamic load P should not exceed the value 0,5 · C. If lateral forces are present, the frictional locking of the fixing screws must be checked. Ideally, locating edges should be provided.

Equivalent load and velocity

The equations for calculating the basic rating life assume that the load P and the velocity v_m are constant. Non-constant operating conditions can be taken into consideration by means of equivalent operating values. These have the same effect as the loads occurring in practice.

Equivalent dynamic load

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

$$P = \sqrt[p]{\frac{q_1 \cdot F_1{}^p + q_2 \cdot F_2{}^p + \ldots + q_z \cdot F_z{}^p}{100}}$$

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

$$P = \sqrt[p]{\frac{q_1 \cdot v_1 \cdot F_1{}^p + q_2 \cdot v_2 \cdot F_2{}^p + \ldots + q_z \cdot v_z \cdot F_z{}^p}{q_1 \cdot v_1 + q_2 \cdot v_2 + \ldots + q_z \cdot v_z}}$$

Mean velocity

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

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

Combined load

If the direction of the load acting on an element does not coincide with one of the main load directions, an approximate value for the equivalent load is calculated as follows:

$$P = \left|F_y\right| + \left|F_z\right|$$

If an element is simultaneously subjected to a force F and a moment M, an approximate value for the equivalent dynamic load is calculated as follows:

$$P = \left|F\right| + \left|M\right| \cdot \frac{C_0}{M_0}$$

Load carrying capacity and life

Symbols, units and definitions

C_{100} N
Basic dynamic load rating in accordance with DIN ISO 14728-1 (based on 100 km)

C_0 N
Basic static load rating in the direction of the force acting on the element

F N
Force acting on the element

F_y N
Vertical component

F_z N
Horizontal component

H m
Single stroke length for oscillating motion

L, L_h km, h
Basic rating life in km or in operating hours

M Nm
Moment acting on the element

M_0 Nm
Static moment rating

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

P N
Equivalent dynamic load

p –
Life exponent:
Monorail guidance systems based on balls: $p = 3$
Monorail guidance systems based on rollers: $p = {}^{10}/_{3}$

q_z %
Duration as a proportion of the total operating time

v_z m/min
Variable velocity

v_m m/min
Mean velocity.

Operating life

The operating life is defined as the life actually achieved by monorail guidance systems. It may differ significantly from the calculated life.

The following influences can lead to premature failure through wear or fatigue:

- excess load due to misalignment as a result of temperature differences and manufacturing tolerances (elasticity of the adjacent construction)
- contamination of the guidance systems
- inadequate lubrication
- reciprocating motion with very small stroke length (false brinelling)
- vibration while stationary (false brinelling)
- overloading of the guidance system (even for short periods)
- plastic deformation.

Static load carrying capacity

The static load carrying capacity of the monorail guidance system is limited by:

- the permissible load on the monorail guidance system
- the load carrying capacity of the raceway
- the permissible load on the screw connections
- the permissible load on the adjacent construction.

For design purposes, the static load safety factor S_0 required for the application must be observed, see tables, page 26. If lateral forces are present, the frictional locking of the fixing screws must be checked. Ideally, locating edges should be provided.

Basic static load ratings and moment ratings

The basic static load ratings and static moment ratings are those loads under which the raceways and rolling elements undergo a permanent overall deformation corresponding to $^1/_{10\,000}$ of the rolling element diameter.

Static load safety factor

The static load safety factor S_0 is the security against permanent deformation at the rolling contact:

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

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

S_0 –
Static load safety factor

C_0 N
Basic static load rating in the load direction (for KUSE: C_{0I}, C_{0II}, C_{0III}), see dimension tables

P_0 N
Equivalent static bearing load in the load direction

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

M Nm
Equivalent static moment rating in the load direction.

The equivalent static bearing load is determined in approximate terms from the maximum loads:

$$P_0 = F_{max}$$

$$M = M_{max}$$

The static load safety factor S_0 for the design of linear guidance systems must be observed, see tables, page 26.

Application-oriented static load safety factor

For the design of linear guidance systems, the static load safety factor S_0 according to the following tables must be taken into consideration.

Standard arrangement

Preconditions	S_0
Critical case - High dynamic loading (such as vibrations) is present, one axis is stationary. - Severe contamination is present. - Actual load parameters are not defined. - Catalogue specifications for accuracy of adjacent construction are not observed.	8 – 12
Normal case - Not all load parameters are completely known. - Loads are estimated from the performance data of the machine.	5 – 8
- All load parameters are known.	4 – 5
- All load parameters are known and definitely correspond to reality.	3 – 4

In the field of machine tools, safety factors of $S_0 > 10$ are normal for reasons of rigidity. For the precise design of the guidance system, Schaeffler offers BEARINX-online or design by the “Schaeffler Technology Center” in conjunction with Application Engineering. In precise design, the displacement of the tool point can also be analysed.

Utilisation in general applications Overhead arrangements[1]

Preconditions	S_0
- Not all load parameters are known and fewer than 4 carriages support a coherent weight.	20
- Not all load parameters are known and at least 4 carriages support a coherent weight. - All load parameters are known and fewer than 4 carriages support a coherent weight.	8 – 12
- All load parameters are known and at least 4 carriages support a coherent weight.	5 – 8

[1] If the guidance system is in a suspended arrangement, a drop guard is recommended, see page 67.

Strength of guidance systems

If the fixing screw threads are of a sufficient size, monorail guidance systems can be subjected to loads up to the static load carrying capacity C_0 and M_0, see dimension tables.

The load must be transmitted via locating surfaces. The basic load ratings can only be achieved if the whole thread length is utilised.

Mounting variants and mounting work, see page 63.

Basic load rating life calculation is used for the preliminary selection of monorail guidance systems, see page 22. It allows an approximate calculation of the equivalent static and dynamic bearing loads.

BEARINX for precise design

In order to achieve precise design of linear guidance elements in relation to basic rating life and static load safety factor, it is necessary to calculate the bearing load in a statically indeterminate system and the internal load distribution of the linear guidance elements (Loading of individual rolling elements, *Figure 1*). This requires a complex calculation process.

For this reason, INA developed the rolling bearing analysis program BEARINX which can be used to calculate linear and guidance system elements as part of the complete system (e.g. machine tool) and thereby ensure reliable designs.

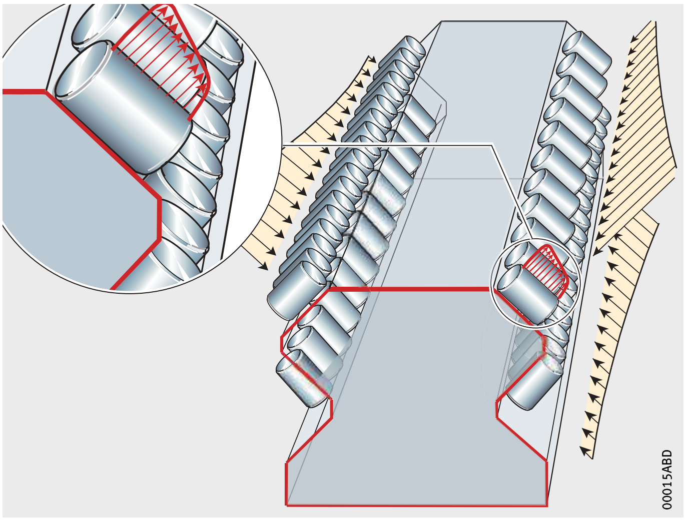


Figure 1
Internal load distribution under combined load

BEARINX linear module

The linear module of BEARINX can be used to calculate linear guidance elements in multi-axis systems under any load combination comprehensively down to the level of the rolling element contact. The integral analysis method can be used to investigate the influence of nearly all parameters relating to the complete system on relevant results.

INA calculation program

Taking account of elasticities in the system

This sophisticated calculation model takes account of all the elasticities in the system, ranging from the rigidity of the saddle plates and guideways through to the non-linear deflection behaviour of the rolling elements.

In order to determine even more precisely the pressure between the rolling elements and raceway in linear recirculating roller bearing and guideway assemblies, the end profiling of the rolling elements is also taken into consideration. The adjacent construction is assumed to be rigid in the first instance but can, if necessary, be modelled on an elastic basis by means of reduced rigidity matrices (e.g. from FE calculation).

Very precise results

This model gives significantly more precise results than calculation programs that only take account of elasticity in rolling contact. This means an increased level of security in the design.

BEARINX allows the calculation of systems with any number of: traverse axes, linear guidance elements and linear drives, load situations, loads and masses.

The results provided by BEARINX include the static load safety factor, the basic rating life and the displacements that arise from the elasticity of the bearing arrangement.

Calculation using BEARINX is available as a service.

Linear BEARINX online

The linear calculation program BEARINX-online assists in the calculation and design of the linear guidance system, *Figure 2*.
A fee will be charged for usage.

Information and registration ➤ *https://www.schaeffler.de/std/1F2D*.

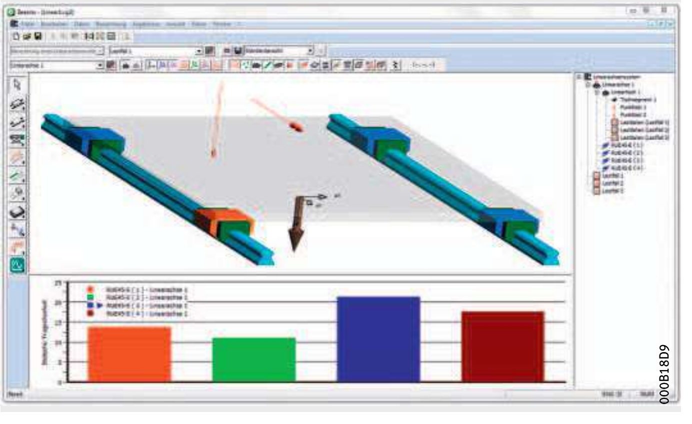


Figure 2
Example from the online program

BEARINX-online Easy Linear

For calculation of an axis, the linear calculation program BEARINX-online Easy Linear is available on the Internet and is free of charge. The user guide simplifies access to the calculation of linear axes.

➤ *https://bearinx-online-easy-linear.schaeffler.com*

Calculation program – Example of input data for a design brief

The input data for the calculation program should be compiled from the design brief (with clearly dimensioned drawings or diagrams in at least two views). Here is a step-by-step guide based on a simple example to show the dimensioning process.

Step 1 Define the components

The relevant factors for calculation, apart from the linear guidance elements and the drive system for the table, are those components that induce loads on the linear guidance elements (the inherent mass of the components or their inertia forces), *Figure 3*.

1 Motor
2 Headstock
3 Base plate
4 Linear guidance elements
5 Drive

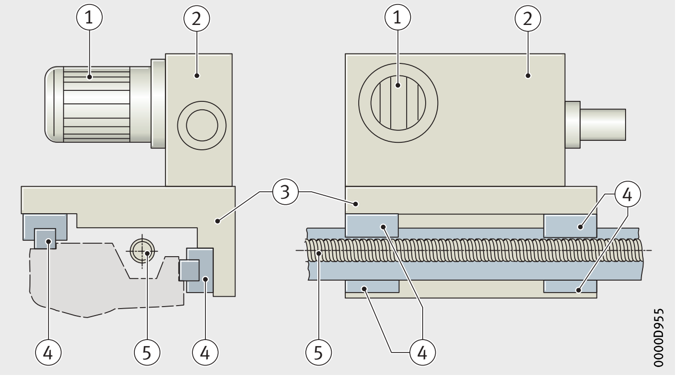


Figure 3
Defining the components

Step 2 Define the table co-ordinate system

The table co-ordinate system is a Cartesian, right hand co-ordinate system.

The directions in the table co-ordinate system are defined as follows, *Figure 4*:

- X axis: traverse direction of the table
- Y axis: main load direction on the system (direction of weight)
- Z axis: derived from the right hand rule (lateral direction).

The (translational) position of the table co-ordinate system is freely selectable. It is recommended that this should be located centrally between the carriages for the X and Y directions.

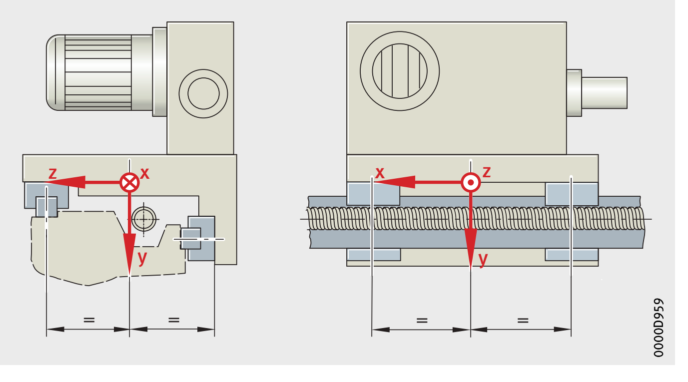


Figure 4
Defining the table co-ordinate system

Step 3
Define the position of the linear guidance elements

The translational position of the linear guidance elements is stated in relation to the table co-ordinate system. In order to determine the torsion angle of the linear guidance elements, their co-ordinate system is rotated about the X axis into the table co-ordinate system, *Figure 5*.

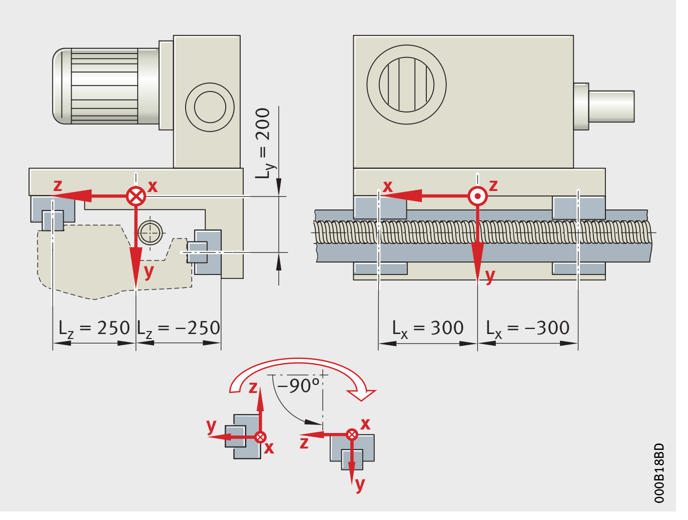


Figure 5
Defining the position of the linear guidance elements

Step 4
Define the position of the drives

The translational position of the drives (support function in the traverse direction) is stated in relation to the table co-ordinate system as Y and Z co-ordinates, *Figure 6*.

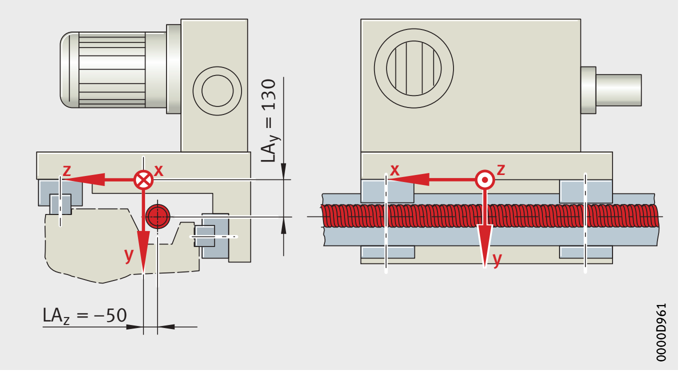
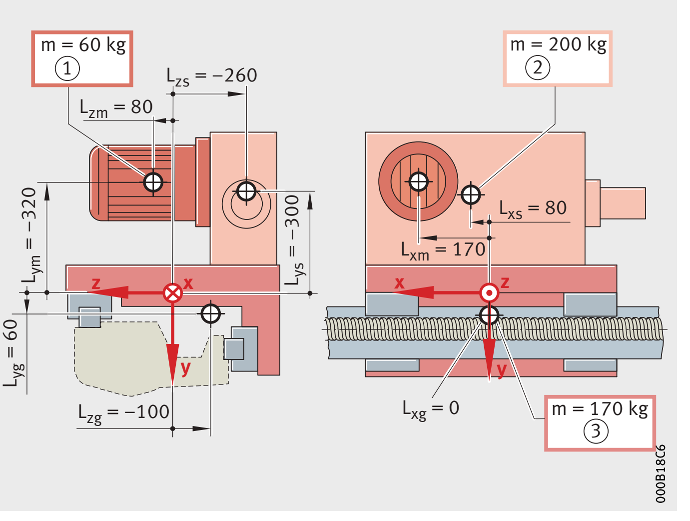


Figure 6
Defining the position of the drives

Step 5
Define the centres of gravity of the components

The mass of the components is concentrated at a mass point at its centre.

The translational position of the centres of gravity is in turn stated in relation to the table co-ordinate system, *Figure 7*.



① Mass of motor
② Mass of headstock
③ Mass of base plate

Figure 7
Defining the centres of gravity of the components

Step 6
Define the external loads

External loads, such as machining forces on the linear table, are stated in relation to the table co-ordinate system.

The following must be stated, *Figure 8*:

- in which of the defined load cases the load acts on the table co-ordinate system
- the position of its loading point
- the force and moment components.

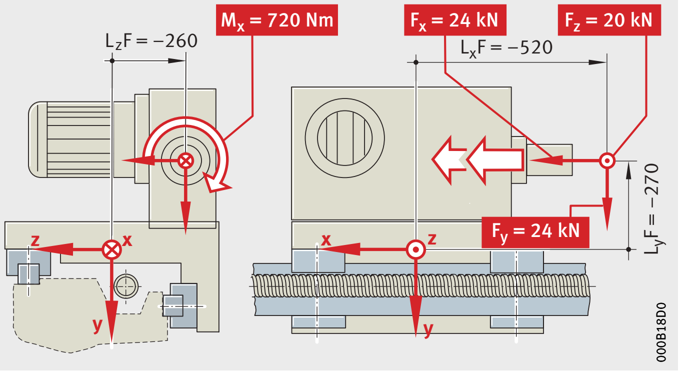


Figure 8
Defining the external loads

Step 7
Define the duty cycle

In order to depict the working cycle of the machine, a duty cycle must be described. This is composed of the motion parameters of the machine and their loading due to external loads (e.g. machining forces).

On the basis of a velocity/time diagram, the working cycle should be subdivided logically into individual load cases, *Figure 9*, ① to ⑧.

With the aid of the basic motion equations for uniform motion (v = const.) or uniform acceleration (a = const.) as appropriate, the missing values (travel, acceleration) can then be determined.

① – ⑧ = load cases

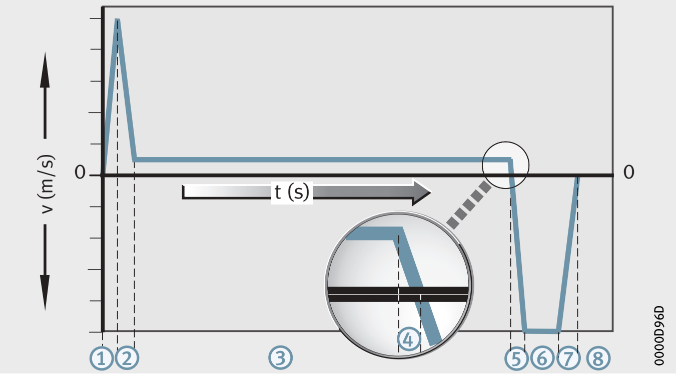


Figure 9
Defining the duty cycle

Travel

$$s(t) = s_0 + \left(\frac{v + v_0}{2} \cdot t\right)$$

Velocity

$$v(t) = v_0 + a \cdot t$$

Acceleration

$$a(t) = \frac{\Delta v}{\Delta t}$$

Example of the motion pattern of a linear table

The following simplified example describes the motion of a linear table. The analysis covers eight load cases, *Figure 9*, page 32, circled numbers 1 to 8.

Complex traverse cases can in certain circumstances be usefully reduced by combination. In such cases, please consult the Schaeffler engineering service.

Rapid traverse to machining position

Acceleration

In t_1 (0,05 s) to v_1 (0,5 m/s), *Figure 9*, page 32, 1.

$$a(t) = \frac{\Delta v}{\Delta t}$$

$$a_1 = \frac{0{,}5}{0{,}05} = 10\,\text{m/s}^2$$

$$s_1 = \frac{v_1 \cdot t_1}{2}$$

$$s_1 = \frac{0{,}5 \cdot 0{,}05}{2} = 0{,}0125\,\text{m} = 12{,}5\,\text{mm}$$

Deceleration

In t_2 (0,045 s) to v_2 (0,05 m/s), *Figure 9*, page 32, 2.

$$a_2 = \frac{v_2 - v_1}{t_2}$$

$$a_2 = \frac{0{,}05 - 0{,}5}{0{,}045} = -10\,\text{m/s}^2$$

$$s_2 = s_1 + \frac{v_2 + v_1}{2} \cdot t_2$$

$$s_2 = 0{,}0125 + \frac{0{,}05 + 0{,}5}{2} \cdot 0{,}045 = 0{,}0249\,\text{m} = 24{,}9\,\text{mm}$$

Machining
Constant velocity

v_3 (0,05 m/s) for t_3 (1,105 s); additional effect of machining force, *Figure 9*, page 32, ③.

$$a_3 = 0\,m/s^2$$

$$s_3 = s_2 + \frac{v_3 + v_2}{2} \cdot t_3$$

$$s_3 = 0{,}0249 + \frac{0{,}05 + 0{,}05}{2} \cdot 1{,}105 = 0{,}0801\,m = 80{,}1\,mm$$

Machining force

Position:
- x = –520 mm
- y = –270 mm
- z = –260 mm.

Size:
- M_x = 720 Nm
- F_x = 24 kN
- F_y = 24 kN
- F_z = 20 kN.

Deceleration

In t_4 (0,0025 s) to v_4 (0 m/s), *Figure 9*, page 32, ④.

$$a_4 = \frac{v_4 - v_3}{t_4}$$

$$a_4 = \frac{0{,}0 - 0{,}05}{0{,}0025} = -20\,m/s^2$$

$$s_4 = s_3 + \frac{v_4 + v_3}{2} \cdot t_4$$

$$s_4 = 0{,}0801 + \frac{0{,}0 + 0{,}05}{2} \cdot 0{,}0025 = 0{,}0802\,m = 80{,}2\,mm$$

Rapid traverse back to original position
Acceleration

In t_5 (0,025) to v_5 (–0,5 m/s); opposing direction, *Figure 9*, page 32, ⑤.

$$a_5 = \frac{v_5 - v_4}{t_5}$$

$$a_5 = \frac{-0{,}5 - 0{,}0}{0{,}025} = -20\,m/s^2$$

$$s_5 = s_4 + \frac{v_5 + v_4}{2} \cdot t_5$$

$$s_5 = 0{,}0802 + \frac{-0{,}5 + 0{,}0}{2} \cdot 0{,}025 = 0{,}0739\,\text{m} = 73{,}9\,\text{mm}$$

Constant velocity

v_6 (–0,5 m/s) for t_6 (0,135 s); opposing direction, *Figure 9*, page 32, 6.

$$a_6 = 0\,\text{m/s}^2$$

$$s_6 = s_5 + \frac{v_6 + v_5}{2} \cdot t_6$$

$$s_6 = 0{,}0739 + \frac{-0{,}5 + (-0{,}5)}{2} \cdot 0{,}135 = 0{,}0064\,\text{m} = 6{,}4\,\text{mm}$$

Deceleration

In t_7 (0,0257 s) to v_7 (0 m/s), *Figure 9*, page 32, 7.

$$a_7 = \frac{v_7 - v_6}{t_7}$$

$$a_7 = \frac{0 - (-0{,}5)}{0{,}0257} = 19{,}46\,\text{m/s}^2$$

$$s_7 = s_6 + \frac{v_7 + v_6}{2} \cdot t_7$$

$$s_7 = 0{,}064 + \frac{0{,}0 + (-0{,}5)}{2} \cdot 0{,}0257 \approx 0\,\text{m}$$

Standstill in original position

Duration

t_8 (1,5 s), v_8 (0 m/s), *Figure 9*, page 32, 8.

$$a_8 = 0\,\text{m/s}^2$$

$$s_8 = 0\,\text{mm}$$

t_i s
Duration of time interval i

s_i mm
Travel position at end of interval i

v_i m/s
Velocity at end of interval i

a_i m/s^2
Acceleration during interval i.

Preload

Influence of preload

Increasing the preload increases the rigidity of the guidance system. The preload influences not only the rigidity but also the displacement force of the guidance system. The higher the preload, the larger the displacement force. Furthermore, preload also influences the operating life of the guidance system.

Preload and damping

The damping of linear guidance systems based on rolling elements is not influenced by preload. A significant level of damping is only achieved by means of additional design measures, for example using the damping carriage RUDS..-D for RUE or the hydrostatic compact guidance system HLE.

The approximate calculation of the equivalent static and dynamic load is based on the standard preload.

Under low load and high preload, the values for the rating life and static load safety factor may be lower than those calculated using the approximation equations for the equivalent static and dynamic load.

The correct preload is only achieved once the guidance system is completely assembled (due to deflection of the back of the carriage).

Preload classes

Preload class	Preload setting
Linear recirculating roller bearing and guideway assemblies RUE..-E	
V1	$0,04 \cdot C$
V2	$0,08 \cdot C$
V3[1]	$0,1 \cdot C$
V4	$0,13 \cdot C$
V5	$0,15 \cdot C$
Linear recirculating ball bearing and guideway assemblies KUSE	
V0	Very small clearance to clearance-free
V1[1]	$0,04 \cdot C_{II}$[2]
V2	$0,13 \cdot C_{II}$[2]
Linear recirculating ball bearing and guideway assemblies KUVE..-B, KUVE..-W	
V0	Very small clearance to clearance-free
V1[1]	$0,04 \cdot C$
V2	$0,1 \cdot C$

[1] Standard preload class.

[2] Basic dynamic load rating C_{II} in tensile direction.

Friction

Influencing factors

Linear guidance systems have a low, uniform resistance to displacement.

The factors influencing friction are:

- load
- preload
- travel velocity
- lubricant (viscosity and quantity)
- temperature
- misalignment
- the sliding motion components of the seals.

Influence of grease on friction

During commissioning and relubrication, the coefficient of friction increases temporarily due to the fresh grease. After a short running-in period, however, the coefficient of friction returns to its original lower value.

The friction behaviour is determined significantly by the characteristics of the grease used. The consistency and base oil viscosity serve as approximate guide values.

! Systems have an increased resistance to displacement after initial greasing.

Influence of seals on friction

Contact seals increase the total friction of the linear guidance system.

The seal friction is at its highest in new guidance systems. It decreases after the running-in period.

! Additional wiper variants (accessories) increase the friction to differing extents depending on the seal design.

Lubrication in general

Oil or grease lubrication

Monorail guidance systems must be lubricated. Technical, economic and ecological factors will determine whether oil or grease should be used and which lubrication method should be applied.

A significant factor in selecting the type of lubrication is the environmental conditions, such as contamination. If extreme conditions are anticipated, it is recommended that Schaeffler External Sales is consulted in the design phase.

Accessories for lubrication:

- Lubricant quantity metering valves SMDS, see page 144
- KIT series 500 with minimal lubricant quantity metering unit, see page 142
- KIT series 400 with long term lubrication unit
  - RWU, see page 140
  - KWVE..-B, see page 370
  - KWVE..-W, see page 370
- KIT series 600 with lubrication adapter plate, see page 145
- Lubrication connectors
  - RWU, see page 164
  - KWSE, see page 254
  - KWVE..-B, see page 384
  - KWVE..-W, see page 394.

Delivered condition, suitable lubricants

RUE..-E and KUSE are protected by a preservative. The preservative is compatible with oils and greases having a mineral oil base.

The series KUVE..-B and KUVE..-W are supplied with basic greasing. Nevertheless, the series KUVE..-B and KUVE..-W must be relubricated with the minimum oil quantity or initial grease quantity before commissioning.

Initial greasing is possible by agreement, in order to supplement the basic greasing. Initial grease quantities, see tables, page 47. The basic greasing is not a substitute for initial greasing. It is only suitable for bridging the period for commissioning, until the carriages are provided with an initial greasing or are connected to a central lubrication system.

KUVE25-B..-HS (design High-Speed) and KUVS are supplied as standard with an initial greasing (greasing ready for operation).

Monorail guidance systems run exclusively under mixed friction conditions. Doped lubricants should therefore be used in preference (type P to DIN 51502).

Overview of lubricating oils

Linear guidance system	Lubricating oil to ISO VG			
	68	100	150	220
Linear recirculating roller bearing and guideway assemblies				
RUE..-E	●	●	●	●
Minimal lubricant quantity metering unit				
KIT series 500	●	●	●	●
Linear recirculating ball bearing and guideway assemblies				
KUSE	●	●	●	●
KUVE..-B KUVE..-W	●	●	●	●
KUVS	●	●	●	●

● Suitable.

Overview of lubricating greases

Linear guidance system	Grease and flowable grease									
	NLGI grade (consistency)						Base oil ISO VG			
	000	00	0	1	2	3	68	100	150	220
Linear recirculating roller bearing and guideway assemblies										
RUE..-E	●	●	●	●	●	●	–	–	●	●
Minimal lubricant quantity metering unit										
KIT series 500	●	●	–	–	–	–	–	–	●	●
Linear recirculating ball bearing and guideway assemblies										
KUSE	●	●	●	●	●	●	●	●	●	–
KUVE..-B KUVE..-W	●	●	●	●	●	●	●	●	●	–
KUVS	●	●	●	●	●	●	●	●	●	–

● Suitable.

Used lubricants

Used lubricants should be disposed of by environmentally-friendly methods. The use of lubricants is governed by national regulations for environmental protection and occupational safety as well as guidance from the lubricant manufacturers. These regulations must be observed.

Oil lubrication

The advantage of oil lubrication is the flushing effect. The rolling elements are coated with oil, excess oil flows away and any particles are flushed out of the carriage.

Preference should be given to the use of lubricating oils CLP or CGLP to DIN 51517 and HLP to DIN 51524.

At operating temperatures between +10 °C and +80 °C, the viscosity should be between ISO VG 68 and ISO VG 220, see table, page 39.

If the temperatures are outside the range stated above, oils with appropriate suitability must be used.

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

Compatibility

If it is possible to draw upon practical experience or guidelines from the oil manufacturer, oils must not be used until their behaviour in relation to plastics, elastomers and non-ferrous metals has been tested.

!

The compatibility of oils must always be checked.

This must only be checked under dynamic conditions and at operating temperature.

In case of doubt, the lubricant manufacturer must be consulted.

Miscibility

Oils with a mineral oil base of the same classification are miscible with each other. However, the viscosities should not differ by more than one ISO VG grade.

!

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.

Lubricant quantities

All the values given are guide values, see tables, page 43.

They are valid for the following conditions:

- operating duration 100%
- $C_0/P = 8$
- $v = 0,8$ m/s
- stroke 500 mm to 1 000 mm
- irrespective of mounting positions, 0° to 90°, *Figure 1*.

Precise values can only be determined in practice. Adequate provision of lubricant is indicated by a visible, unbroken oil film at the profile of the wipers.

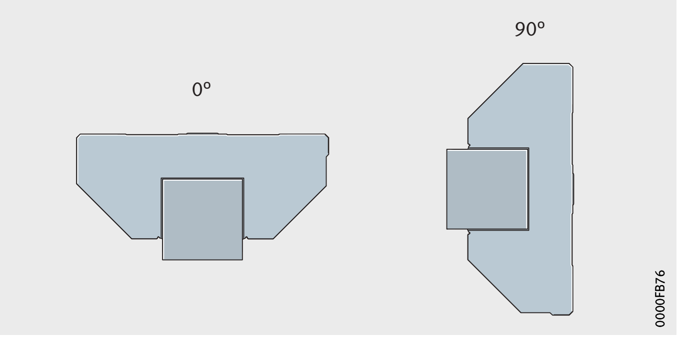


Figure 1
Mounting position

Minimum oil quantity Q_{min}

The minimum oil quantity Q_{min} is valid for commissioning or recommissioning after machine downtime of more than 8 hours, see tables, page 43.

For initial operation, it is measured such that the oil ducts, rolling elements and raceways will be adequately provided with oil.

Oil lubrication

Oil impulse quantity Q_{imp}

The oil impulse quantity Q_{imp} is valid if the linear guidance system is connected to a central lubrication system and the stroke ratio is less than 200, see tables, page 43 and *Figure 3*, page 52.

The lubricant quantities are valid for all mounting positions.

If heavy contamination is present, it may be necessary to increase the oil relubrication quantity.

The lubrication impulses must be carried out in direct succession.

Carriages with a minimal lubricant quantity metering unit have integral piston distributors. These inject 0,12 cm^3 of lubricant per impulse into the carriages. A separate piston distributor cannot be used with these guidance systems.

KIT series 500 with minimal lubricant quantity metering unit, see page 142.

The oil quantity for the damping carriage RUDS is dependent on the size of the recirculating roller guidance system RUE..-E.

Damping carriages RUDS, see page 192.

Guide values for lubricant quantities

The guide values are valid under the stated conditions, see page 41.

Oil quantities for RUE and RUDS

Designation[1]	Commissioning quantity	Relubrication quantities			
	Minimum oil quantity Q_{min} cm^3	Number of impulses	Oil impulse quantity Q_{imp} cm^3	Relubrication interval h	Consumption cm^3/h
RUE25-E (-H, -L, -HL)	0,8	1	0,2	5	0,04
RUE35-E (-H, -L, -HL)	1,3	2	0,6	12	0,1
RUE45-E (-H)	1,6	3	0,6	7	0,25
RUE45-E-L (-HL)	2,1	3	0,6	7	0,25
RUE55-E (-H)	2,8	3	0,6	9	0,2
RUE55-E-L (-HL)	3,2	3	0,6	9	0,2
RUE65-E (-H)	5,2	4	0,6	2	1,2
RUE65-E-L (-HL)	5,8	4	0,6	2	1,2
RUE100-E-L	17,6	4	0,6	1	2,4

[1] The oil quantity for the damping carriage RUDS is dependent on the size of the linear recirculating roller bearing and guideway assembly RUE.

Oil quantities for RUE..-E with minimal lubricant quantity metering unit

Designation	Number of impulses	Oil impulse quantity Q_{imp} cm^3	Relubrication interval h	Consumption cm^3/h
RUE35-E (-E-H)	1	0,12	2,4	0,05
RUE35-E (-E-L, -E-HL)	1	0,12	2,4	0,05
RUE45-E (-E-H)	1	0,12	1,5	0,08
RUE45-E-L (-E-HL)	1	0,12	1,2	0,1
RUE55-E (-E-H)	1	0,12	0,9	0,13
RUE55-E-L (-E-HL)	1	0,12	0,8	0,15
RUE65-E (-E-H)	1	0,12	0,5	0,25
RUE65-E-L (-E-HL)	1	0,12	0,4	0,28

RUE..-E systems with a minimal lubricant quantity metering unit have integral piston distributors. A separate piston distributor cannot be used with this combination.

Oil lubrication

Oil quantities for RUE..-E with lubricant quantity metering valves SMDS

Designation	Number of impulses	Oil impulse quantity Q_{imp} cm³	Relubri-cation interval h	Consump-tion cm³/h
RUE35-E-SMDS (-H)	1	0,1	1,3	0,075
RUE35-E-L-SMDS (-HL)	1	0,1	1,3	0,075
RUE45-E-SMDS (-H)	1	0,1	0,6	0,165
RUE45-E-L-SMDS (-HL)	1	0,1	0,6	0,175
RUE55-E-SMDS (-H)	1	0,2	1,2	0,165
RUE55-E-L-SMDS (-HL)	1	0,2	1,1	0,175
RUE65-E-SMDS (-H)	1	0,2	0,3	0,725
RUE65-E-L-SMDS (-HL)	1	0,2	0,3	0,74

The functionality of the lubricant quantity metering valve is already integrated in the RUE25-E. The use of a lubricant quantity metering valve is therefore unnecessary in the case of RUE25-E.

Oil quantities for KUSE

Designation	Minimum oil quantity for commissioning Q_{min} cm³	Oil impulse quantity Q_{imp} cm³/h
KUSE20 (-H)	1,2	0,03
KUSE20-L (-HL)	1,6	0,04
KUSE25 (-H)	1,2	0,03
KUSE25-L (-HL)	2	0,05
KUSE30 (-H)	1,6	0,04
KUSE30-L (-HL)	2,8	0,07
KUSE35	2,2	0,04
KUSE35-L	3,2	0,08
KUSE45	2,8	0,07
KUSE45-L	5,2	0,12

Oil quantities for KUVE

Designation	Minimum oil quantity for commissioning Q_{min} cm^3	Oil impulse quantity Q_{imp} cm^3/h
KUVE15-B (-S, -H, -E, -ES)	0,6	0,02
KUVE15-B-EC (-ESC)	0,6	0,02
KUVE15-W	0,6	0,02
KUVE20-B (-S, -H, -SN, -N, -E, -ES)	0,9	0,03
KUVE20-B-L (-SL, -SNL, -NL)	0,9	0,03
KUVE20-B-EC (-ESC)	0,6	0,02
KUVE20-W	0,9	0,03
KUVE20-WL	0,9	0,03
KUVE25-B (-S, -H, -SN, -N, -E, -ES)	0,9	0,03
KUVE25-B (-S, -H, -SN, -N, -E, -ES) -HS	0,9	0,03
KUVE25-B-L (-SL, -HL, -SNL, -NL)	1,2	0,04
KUVE25-B-EC (-ESC)	0,9	0,02
KUVE25-W	0,9	0,03
KUVE25-WL	1,2	0,04
KUVE30-B (-S, -H, -SN, -N, -E, -ES)	0,9	0,03
KUVE30-B-L (-SL, -HL, -SNL, -NL)	1,5	0,05
KUVE30-B-EC (-ESC)	0,9	0,02
KUVE30-W	0,9	0,03
KUVE35-B (-S, -H, -SN, -N, -E, -ES)	1,4	0,04
KUVE35-B-L (-SL, -HL, -SNL, -NL)	1,8	0,06
KUVE35-B-EC (-ESC)	0,9	0,02
KUVE35-WL	1,8	0,06
KUVE45-B (-S, -H, -SN, -N)	2,2	0,05
KUVE45-B-L (-SL, -HL, -SNL, -NL)	3	0,09
KUVE45-B-EC (-ESC)	1,4	0,03
KUVE55-B (-S)	3	0,09
KUVE55-B-L (-SL)	4,2	0,12

Oil quantities for KUVS

Designation	Minimum oil quantity for commissioning Q_{min} cm^3	Oil impulse quantity Q_{imp} cm^3/h
KUVS10-B	0,5 – 0,6	0,3
KUVS13-B	0,5 – 0,6	0,3
KUVS17-B	0,8 – 0,9	0,5

Grease lubrication

The advantages of grease lubrication are as follows:

- little requirement for design work;
  it may be possible to dispense with a central lubrication system
- the possibility of long term lubrication
- the use of reservoir lubrication.

Flowable grease lubrication

Due to the risk of increased lubricant egress, flowable greases of grades NLGI 00 and NLGI 000 should be used in accordance with the guide values for oil lubrication, see tables, page 43.

In the case of flowable greases of grade NLGI 0, the lubricant quantity and relubrication interval should be taken from the chapter Grease lubrication.

In clean environmental conditions, the impulse quantity can in certain circumstances be reduced to approx. 20% of the oil impulse quantity stated in the tables.

Minimal lubricant quantity metering unit

For the minimal lubricant quantity metering unit, only flowable greases of grades NLGI 00 and NLGI 000 are permissible.

Lithium soap and lithium complex soap greases with a mineral oil base and EP additives are recommended.

Base oil viscosity

The base oil viscosity is shown in the table:

Guidance system	Base oil viscosity
RUE..-E[1]	ISO VG 150 to ISO VG 220
KUSE[2] KUVE..-B[2] KUVE..-W[2]	ISO VG 68 to ISO VG 100
KUVS[2]	ISO VG 68 to ISO VG 100

[1] For initial greasing with grease KP2N–20 to DIN 51825.

[2] For initial greasing with grease KP2K–30 to DIN 51825.

Grease lubrication

Lithium soap and lithium complex soap greases with a mineral oil base are recommended.

Base oil viscosity

The base oil viscosity is shown in the table:

Guidance system	Base oil viscosity
RUE..-E	ISO VG 150 to ISO VG 220
KUSE KUVE..-B KUVE..-W	ISO VG 68 to ISO VG 150
KUVS	ISO VG 68 to ISO VG 150

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 be no more than one ISO VG grade
- they have the same consistency (NLGI grade).

In case of doubt, please contact us.

If the grease quality differs from our specifications, this can lead to negative effects.

Initial grease quantity

Carriages that are not connected to a central lubrication system must be greased before mounting with the initial grease quantity, see tables.

Linear recirculating ball bearing and guideway assemblies KUVE..-B

- Standard designs are delivered with a basic greasing, which must be supplemented before commissioning.
- KUVE25-B..-HS (design High-Speed) systems are supplied with an initial greasing.
- KUVE..-B..-UG is supplied without basic greasing, which means that it only has a preservative (the suffix for this option is -UG).

If a linear guidance system not lubricated by a central lubrication system is not given an initial greasing, there is a risk of damage.

Initial grease quantities for RUE

Designation	Initial grease quantity ≈ g
RUE25-E (-H)	2,3
RUE25-E-L (-HL)	3,5
RUE35-E (-H)	6,9
RUE35-E-L (-HL)	8,1
RUE45-E (-H)	11,5
RUE45-E-L (-HL)	16,1
RUE55-E (-H)	20,7
RUE55-E-L (-HL)	25,3
RUE65-E (-H)	23
RUE65-E-L (-HL)	28,8
RUE100-E-L	92

Grease lubrication

Initial grease quantities for KUSE

Designation	Initial grease quantity ≈ g
KUSE20-H	3,5
KUSE20-L (-HL)	4,4
KUSE25-H	4,6
KUSE25-L (-HL)	6,3
KUSE30-H	8,1
KUSE30-L (-HL)	10,4
KUSE35	12,7
KUSE35-L	17,3
KUSE45	20,7
KUSE45-L	26,5

Initial grease quantities for KUVE with basic greasing

Designation	Initial grease quantity ≈ g
KUVE15-B (-S, -H, -E, -ES)	0,6
KUVE15-B-EC (-ESC)	0,4
KUVE15-W	0,8
KUVE20-B (-S, -H, -SN, -N, -E, -ES)	0,9
KUVE20-B-L (-SL, -SNL, -NL)	1,1
KUVE20-B-EC (-ESC)	0,8
KUVE20-W	1,2
KUVE20-WL	1,4
KUVE25-B (-S, -H, -SN, -N, -E, -ES)	1,2
KUVE25-B (-S, -H, -SN, -N, -E, -ES) -HS[1]	–
KUVE25-B-L (-SL, -HL, -SNL, -NL)	1,6
KUVE25-B-EC (-ESC)	1,0
KUVE25-W	1,8
KUVE25-WL	2,1
KUVE30-B (-S, -H, -SN, -N, -E, -ES)	3,1
KUVE30-B-L (-SL, -HL, -SNL, -NL)	3,4
KUVE30-B-EC (-ESC)	2,5
KUVE30-W	4,5
KUVE35-B (-S, -H, -SN, -N, -E, -ES)	4,9
KUVE35-B-L (-SL, -HL, -SNL, -NL)	5,7
KUVE35-B-EC (-ESC)	4,2
KUVE35-WL	6,6
KUVE45-B (-S, -H, -SN, -N)	7,9
KUVE45-B-L (-SL, -HL, -SNL, -NL)	8,6
KUVE45-B-EC (-ESC)	6,4
KUVE55-B (-S)	11,4
KUVE55-B-L (-SL)	13,1

[1] KUVE25-B..-HS (design High-Speed) systems are supplied with an initial greasing.

Initial grease quantities for KUVE..-UG with preservative (without basic greasing)

Designation	Initial grease quantity ≈ g
KUVE15-B (-S, -H, -E, -ES) ..-UG	0,9
KUVE15-B-EC (-ESC) ..-UG	0,6
KUVE15-W..-UG	0,9
KUVE20-B (-S, -H, -SN, -N, -E, -ES) ..-UG	1,7
KUVE20-B-L (-SL, -SNL, -NL) ..-UG	2,2
KUVE20-B-EC (-ESC) ..-UG	1,7
KUVE20-W..-UG	1,7
KUVE20-WL..-UG	2,2
KUVE25-B (-S, -H, -SN, -N, -E, -ES) ..-UG	2,5
KUVE25-B (-S, -H, -SN, -N, -E, -ES) -HS..-UG	2,5
KUVE25-B-L (-SL, -HL, -SNL, -NL) ..-UG	3,5
KUVE25-B-EC (-ESC) ..-UG	1,7
KUVE25-W..-UG	2,5
KUVE25-WL..-UG	3,5
KUVE30-B (-S, -H, -SN, -N, -E, -ES) ..-UG	4,8
KUVE30-B-L (-SL, -HL, -SNL, -NL) ..-UG	6,1
KUVE30-B-EC (-ESC) ..-UG	3,1
KUVE30-W..-UG	4,8
KUVE35-B (-S, -H, -SN, -N, -E, -ES) ..-UG	7,7
KUVE35-B-L (-SL, -HL, -SNL, -NL) ..-UG	9,9
KUVE35-B-EC (-ESC) ..-UG	4,8
KUVE35-WL..-UG	9,9
KUVE45-B (-S, -H, -SN, -N) ..-UG	13,8
KUVE45-B-L (-SL, -HL, -SNL, -NL) ..-UG	17,0
KUVE45-B-EC (-ESC) ..-UG	9,2
KUVE55-B (-S) ..-UG	16,7
KUVE55-B-L (-SL) ..-UG	21,9

Initial grease quantities for KUVS

Designation	Initial grease quantity[1] ≈ g
KUVS10-B	0,3
KUVS13-B	0,9
KUVS17-B	2,3

[1] KUVS systems are supplied with an initial greasing.

Calculation of the lubrication interval

Grease operating life

Since it is not possible to calculate all the influencing factors, the precise grease operating life can only be determined under operating conditions. The approximation equation below, however, can be used to determine a guide value for many applications:

$$t_{fG} = t_f \cdot K_P \cdot K_W \cdot K_U$$

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

t_f h
Factor for basic lubrication interval in operating hours, *Figure 1*

K_P, K_W, K_U –
Correction factors for load, stroke length and environment, see page 52.

The grease operating life is restricted to a maximum of three years due to the ageing resistance of the grease:

- for linear recirculating roller bearing and guideway assemblies RUE-E, to 18 000 h
- for linear recirculating ball bearing and guideway assemblies KUSE, KUVE..-B, KUVE..-W, KUVS, to 26 000 h.

Basic lubrication interval

The basic lubrication interval t_f is valid under the following conditions, *Figure 1*:

- bearing temperature $<$ +80 °C
- load ratio $C_0/P = 20$
- no disruptive environmental influences
- stroke ratio between 10 and 50, *Figure 3*, page 52.

Speed parameter

The speed parameter is defined as follows:

$$GKW = \frac{60}{v_m} \cdot K_{LF}$$

GKW –
Speed parameter, *Figure 1*

v_m m/min
Mean travel velocity

K_{LF} –
Bearing factor, see table, page 51.

t_f = basic lubrication interval
GKW = speed parameter
① Relubrication possible
② Regreasing necessary

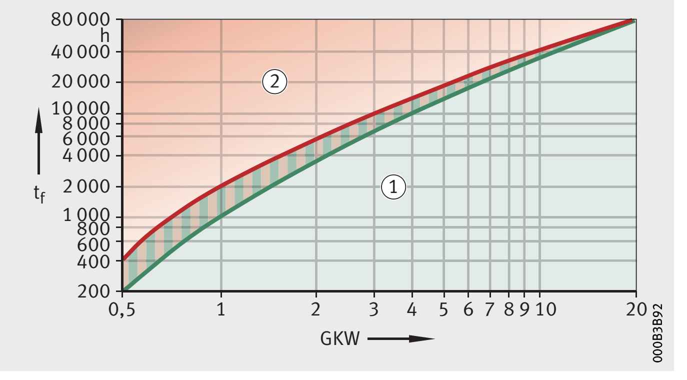


Figure 1
Determining the basic lubrication interval

The bearing factor K_{LF} takes account of the internal and external structure of the bearing, such as lubricant reservoirs, wipers and additional lubrication devices that influence the grease operating life.

Bearing factor K_{LF} for delivered condition

Linear guidance system	Bearing factor K_{LF}		
	Carriage with initial greasing and		Long term lubrication unit KIT[1] (KIT series 400)
	single lip wipers	double lip wipers	
RUE..-E	0,8	1,2	2,5
KUSE	1,5	–	–
KUVE..-B	2,5	4,5	5,5
KUVE25-B..-HS	–	2,7	–
KUVE..-W	2,5	4,5	5,5
KUVS	1,5	–	–

[1] Valid only with mounting on both sides of the long term lubrication unit KIT on the carriage.

Correction factor for load K_P

The correction factor K_P takes account of the strain on the grease at a load ratio of $C_0/P < 20$, *Figure 2*.

The factors are only valid for high quality lithium soap greases.

K_P = correction factor for load
C_0/P = load ratio

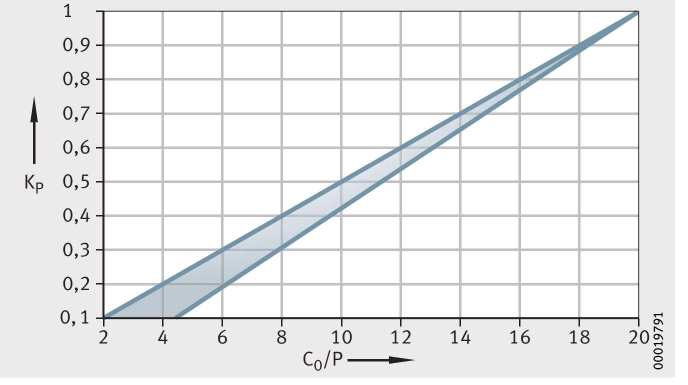


Figure 2
Correction factor for load

Correction factor for stroke K_W

The correction factor K_W takes account of the displacement distance to be lubricated, *Figure 3*. It is dependent on the stroke ratio.

K_W = correction factor for stroke length
H_v = stroke ratio

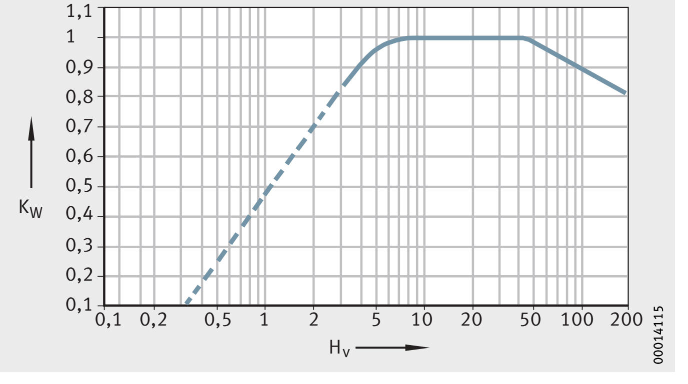


Figure 3
Correction factor for stroke length

Stroke ratio

If the stroke ratio is < 10 or > 50, the grease operating life is reduced due to the risk of fretting corrosion or the loss of grease.

The stroke ratio is calculated as follows:

$$H_v = \frac{H \cdot 10}{L_1}$$

H_v –
Stroke ratio

L_1 mm
Effective saddle plate length, see dimension tables

H mm
Stroke length.

If the stroke length is very small ($< 2 \cdot L_1$), the grease operating life may be shorter than the calculated guide value. In such cases, special greases are recommended.

Correction factor for environment K_U

The correction factor K_U takes account of shaking forces, vibrations (a cause of fretting corrosion) and shocks as well as environmental influences (contamination and operating media), see table.

These influences place an additional strain on the grease.

Cooling lubricants can wash greases out of the carriage. If cooling lubricant or moisture comes into contact with the linear system, calculation in approximate terms is possible but, for reasons of unpredictability, it must be regarded as a guide value only and requires monitoring and adjustment in practice. Where necessary, the grease operating life must be completely determined again.

Environmental influence and correction factor

Environmental influence	Correction factor K_U
light	1
moderate	0,8
heavy	0,5

Grease lubrication

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:

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

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.

Relubrication of the guidance system

Relubrication should be carried out at a stage no later than half the grease operating life.

For the relubrication of monorail guidance systems, Schaeffler offers matched lubrication connectors, depending on the wiper KIT combination, RWU, see page 164, KWSE, see page 254, KWVE..-B, see page 384, KWVE..-W, see page 394.

Lubricating grease

Relubrication should be carried out using the same grease as for initial greasing; if different greases are to be used, the miscibility and compatibility of the greases must first be checked, see page 40.

Relubrication quantity

The relubrication quantity is approx. 50% of the initial grease quantity. In the case of KUVE, the relubrication quantity is 50% of the initial grease quantity without basic greasing, see page 49. 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 procedure

Relubrication should be carried out with the carriage still warm from operation and the carriage should be moved during relubrication. The minimum stroke is four times the saddle plate length; saddle plate length (L_1), see dimension tables.

If lubrication is carried out by hand, the grease gun, lubrication connector and the environment of the lubrication connector must first be cleaned thoroughly.

If long term lubrication units are used, these must always be mounted on both sides of the carriage in order to achieve the stated bearing factors K_{LF}.

Long term lubrication units are a component of the KIT series 400.

Influence of grease on friction behaviour

During commissioning and relubrication, the coefficient of friction increases temporarily due to the fresh grease. After a short running-in period, however, the coefficient of friction returns to its original lower value.

The friction behaviour is determined significantly by the characteristics of the grease used. The consistency and base oil viscosity serve as approximate guide values.

Special coatings

In order that standard components can function for long periods, without maintenance and reliably even under extreme operating conditions, Schaeffler has developed various coatings for such requirements.

These coatings increase the corrosion resistance and/or wear resistance of the surface.

The selection of the coating is always dependent on the area of operation and the application.

! Coatings have an effect on system accuracy. Tolerances for coated parts of linear recirculating roller bearing and guideway assemblies, see page 115, for six-row linear recirculating ball bearing and guideway assemblies, see page 225, for four-row linear recirculating ball bearing and guideway assemblies, see page 306.

! Coated carriages and coated guideways must always be used in combination. If coated carriages are used with uncoated guideways, for example, this will lead to a reduction in preload.

Types of coatings

Components at risk of corrosion are protected by the:

- special coating Corrotect (RROC), see page 57
- thin dense chromium coating Protect A (KD), see page 59.

Corrotect special coating

Corrosion protection

Corrotect is a surface coating applied by electroplating, *Figure 1*. The coating gives cathodic corrosion protection and is extremely thin. Under load, it is compacted into the surface roughness profile and partially worn away.

In parts coated with Corrotect, running-in occurs in the area of the seal and an optically bright area develops as a result. Due to the remote cathodic protection mechanism, formation of rust in this area can also be prevented.

Parts with Corrotect coating have the suffix RROC.

KUVE..-B-RROC

Figure 1
Corrotect special coating – Cr(VI)-free

Advantages of RROC

The special coating Corrotect:

- is resistant to moisture, salt spray mist, contaminated water and weak alkaline or weak acidic cleaning agents
- does not impair the load carrying capacity, in contrast to the use of corrosion-resistant steels
- is extremely resistant to corrosion
- offers protection against rust on all surfaces
- gives protection against rust even on smaller bright spots due to the cathodic protection effect
- gives protection against EP additives
- has good thermal conductivity
- is free from Cr(VI) and fulfils the requirements relating to RoHS in accordance with EU Directive 2002/95/EC
- is suitable for use in the food industry.

Special coatings

Applications

Components coated with Corrotect are particularly suitable where corrosion resistance is the most important factor.

The coating can also be used to prevent adhesion of weld spray.

Available products

The following products in the field of linear motion are available with the Corrotect coating:

- linear recirculating roller bearing and guideway assemblies RUE..-E
- linear recirculating ball bearing and guideway assemblies KUSE
- linear recirculating ball bearing and guideway assemblies KUVE..-B
- linear recirculating ball bearing and guideway assemblies KUVE..-W
- linear recirculating ball bearing units KUVS.

Suffixes

Components with the Corrotect Cr(VI)-free coating have the suffix RROC, see Ordering example.

Ordering designation

The ordering designation for a linear recirculating ball bearing and guideway assembly KUVE45-B with the Corrotect Cr(VI)-free coating is, for example:

- KUVE45-B-W1-V1-G3-RROC.

Technical/physical data for Corrotect

The table shows technical/physical data for the special coating Corrotect.

Data for Corrotect

Characteristics	Data
Suffix	RROC
Colour	Colourless, blue to iridescent
Layer thickness[1]	0,5 μm – 3 μm
Number of layers	1
Composition	Zinc alloyed with iron
Layer hardness	300 HV
Corrosion protection[2]	96 h
Coating resistance	The coating has reduced corrosion resistance for pH values < 6 and pH values > 8
Wear protection	–
Maximum single-piece length	3 500 mm
Cr(VI)-free	yes

1) Thickness in functional area.

2) Salt spray test in accordance with DIN EN ISO 9227.

Protect A

Wear and corrosion protection

Protect A is a pure chromium coating with a columnar surface structure, *Figure 2*.

The coating is applied by electroplating. The parts to be coated are heated to approx. +50 °C. Since no structural changes occur, the parts retain full dimensional stability.

The matt grey chromium layer retains a certain amount of lubricant in the recess between the Cr pearls. As a result, effective wear protection is achieved even under mixed friction or slippage conditions.

Parts with Protect A coating have the suffix KD.

KUVE..-B-KD

Figure 2
Thin dense chromium coating Protect A

Special coatings

Advantages of KD

The coating:

- is resistant to various chlorides, various oils, sulphur compounds, chlorine compounds and weak acidic media
- does not influence the load carrying capacity and operating life of the coated products
- has higher wear resistance due to its high hardness
- ensures effective wear protection even under mixed friction conditions
- offers good protection against EP additives
- has good thermal conductivity
- is moderately resistant to corrosion
- prevents false brinelling under vibration while stationary
- is Cr(VI)-free and, at the time of issue of this catalogue, is compliant with the RoHS Directive 2011/65/EU.

The high hardness of the thin dense chromium coating and the special surface structure give an anti-wear effect. The columnar structure has a certain capacity for storage of lubricant. This ensures adequate lubricant in the rolling element contact zone even under extreme environmental and operating conditions.

For use in the food industry, compliance with exacting environmental and health conditions must be achieved. The coating Protect A is free from Cr(VI) and can therefore also be used in this sector.

Operating temperature

The temperature range of the guidance system is between –10 °C and +80 °C.

Applications Protect A does not contain Cr(VI). Components with this coating are therefore particularly suitable for use in the food industry, medical equipment and similar areas.

The coating is recommended for particularly short stroke lengths and vibrations while stationary.

Available products The following products in the field of linear motion are available with the Protect A coating:

- linear recirculating roller bearing and guideway assemblies RUE..-E
- linear recirculating ball bearing and guideway assemblies KUVE..-B
- linear recirculating ball bearing and guideway assemblies KUVE..-W
- linear recirculating ball bearing units KUVS.

Suffixes Components coated with Protect A have the suffix KD, see Ordering designation.

Ordering designation The ordering designation for a linear recirculating ball bearing and guideway assembly KUVE25-B with the Protect A coating is, for example:

- KUVE25-B-W2-V2-G3-KD.

Technical/physical data for Protect A The table shows technical/physical data for the special coating Protect A.

Data for Protect A

Characteristics	Data
Suffix	KD
Colour	Matt grey
Layer thickness[1)]	0,5 μm – 4 μm
Number of layers	1
Composition	Pure chromium layer with pearly surface
Layer hardness	900 HV – 1 300 HV
Corrosion protection[2)]	8 h
Wear protection	Under mixed friction
Maximum single-piece length	4 000 mm
Cr(VI)-free[3)]	yes

1) Thickness in functional area.

2) Salt spray test in accordance with DIN EN ISO 9227.

3) Parts free from Cr(VI) are suitable for the food industry.

Mounting variants

Mounting work – Influencing factors and assessment

The amount of work involved in mounting is essentially determined by:

- the arrangement of the screw mounting and locating surfaces for the guideways and carriages
- the accessibility of the fixing screws.

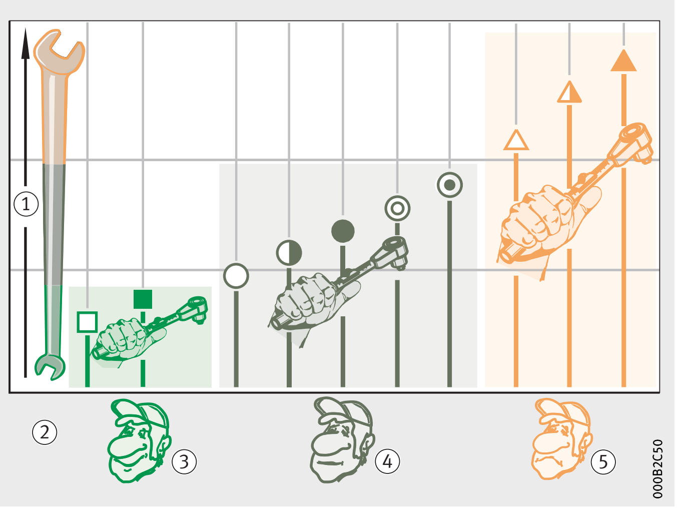
Based on these points, the mounting work can be assessed.

The structure, *Figure 1*, is ascending and describes the work according to the following criteria:

- simple mounting without fitting aids ③
- simple mounting with fitting aids ④
- demanding, time-consuming mounting with fitting aids ⑤.

For reasons of time and cost (reduced mounting work) only variants corresponding to ③ and ④ should be selected.

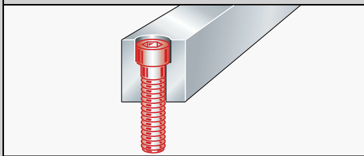
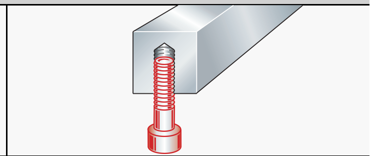
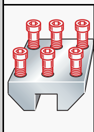
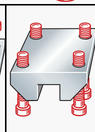
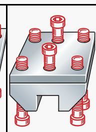
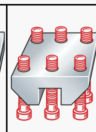
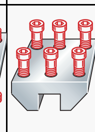
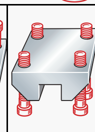
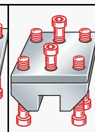
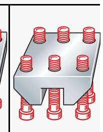
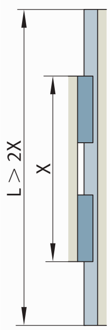
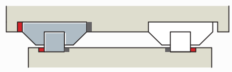
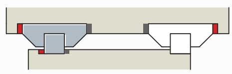
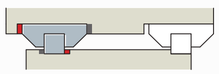
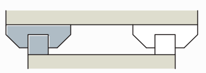
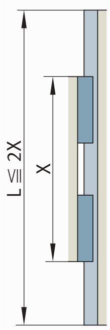
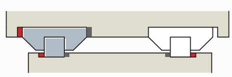
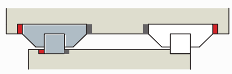
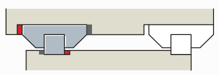
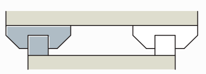
For the assessment of mounting work, see table, page 63.



① Mounting work
② Fitting variant
③ Simple mounting without aids
④ Simple mounting with aids
⑤ Demanding, time-consuming mounting with aids

Figure 1
Relationship between mounting work and mounting variant

Mounting work as a function of the adjacent construction

Ratio of table length to guideway length	Design of adjacent construction	Location of guideway and carriage							
									
									
		□	□	□	○	□	□	□	○
		□	□	□	○	□	□	□	○
		■	■	■	◎	■	■	■	◎
		◑	◑	◑	◉	◑	◑	◑	◉
		●	●	●	△	□	□	□	○
		●	●	●	△	□	□	□	○
		■	■	■	◮	■	■	■	◎
		◑	◑	◑	▲	◑	◑	◑	◉

□ ■ ○ ◑ ● ◎ ◉ △ ◮ ▲ From left to right: increasing mounting work

■ Pressure and fixing elements

■ Locating faces

Datum side

Adjustment side

Connection to the adjacent construction

The connection between the guidance elements and the adjacent construction influences the effective load carrying capacity.
The direction of the forces and moments, the position and arrangement of the locating faces as well as the load carrying capacity and the number of screws must be taken into consideration.

The better supported the guidance system is in relation to the forces occurring, the greater the extent to which the load carrying capacity can be used, *Figure 2*.

Locating faces must be provided.

F_S = lateral force

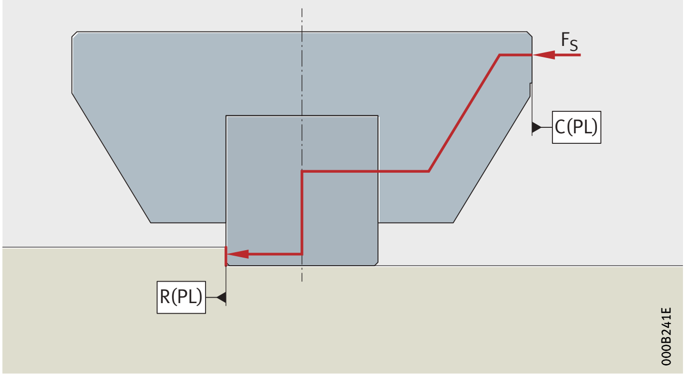


Figure 2
Favourable application of force

If no locating faces are present, the maximum lateral load that can be transmitted is dependent on the screw connection between the guideway and adjacent construction, *Figure 3*. This must be taken into consideration in the design process at the customer.

F_S = lateral force

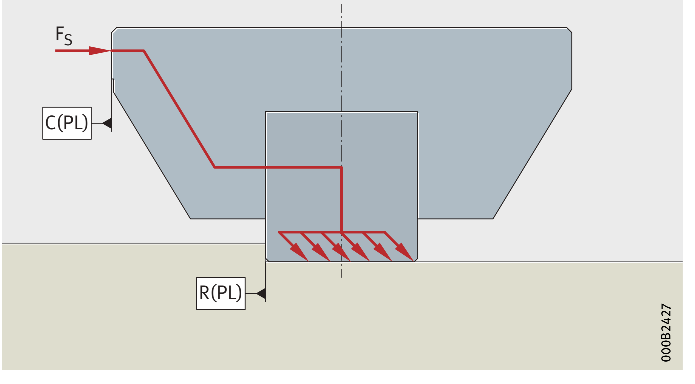
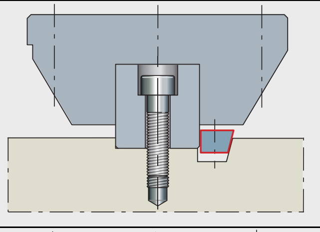
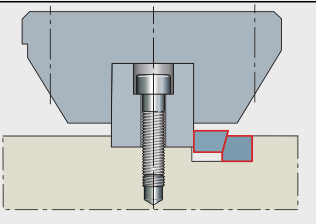
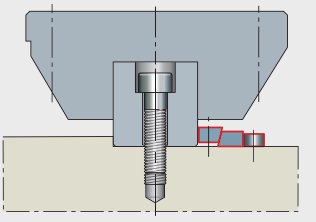
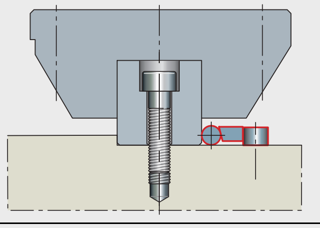
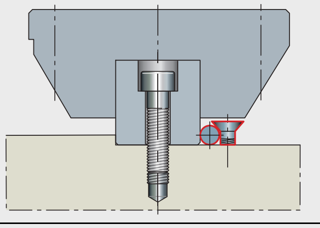
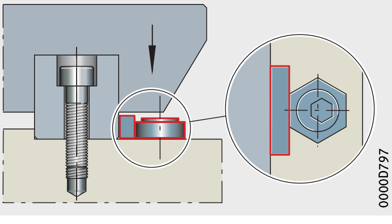


Figure 3
Unfavourable application of force

Pressure and fixing elements

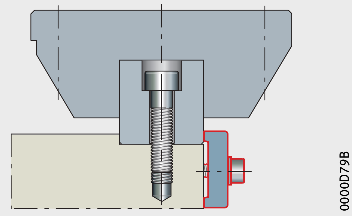
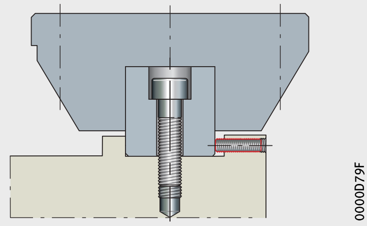
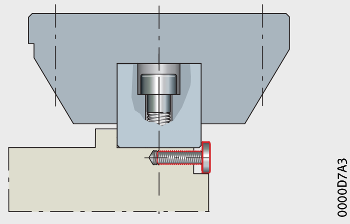
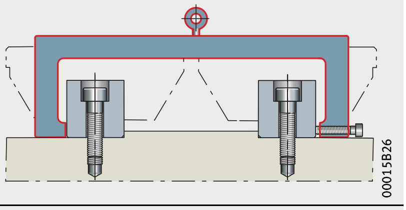
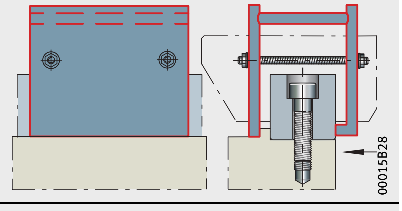
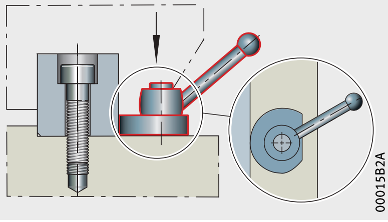
For guideways and carriages, pressure and fixing elements should be provided, see table.

Fixing method

Element	
Vee strip, integrated in a slot in the machine bed	 0000D783
Double vee strip in a slot in the machine bed	 0000D787
Double vee strip screw mounted to the machine bed	 0000D78B
Vee strip with integral shaft, screw mounted to the machine bed	 0000D78F
Shaft screw mounted to the machine bed	 0000D793
Square section rail, adjusted using eccentric screw	 0000D797

Mounting variants

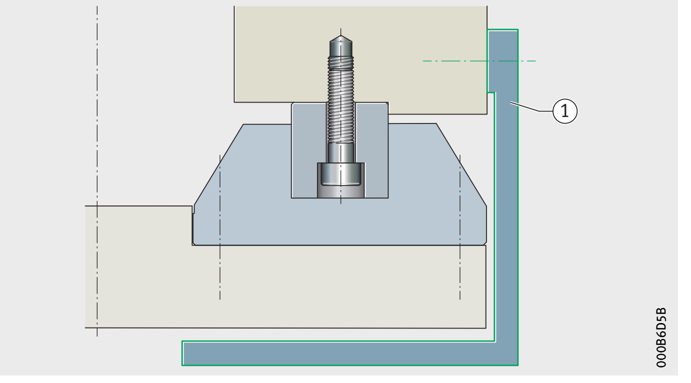
Fixing method
(continued)

Element	
Clamping strip	
Adjusting screws	
Locking screws	
Fixing bracket with adjusting screws	
Fixing bracket with threaded rod	
Eccentric hand lever	

Pressure and fixing elements are not included in the scope of delivery.

Suspended arrangement of guidance system

If the guidance system is in a suspended arrangement, a drop guard 1 is recommended, *Figure 4*.



Mounting position of the guidance system 180°

1 Drop guard

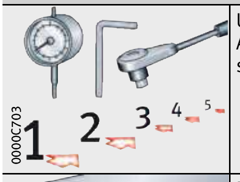
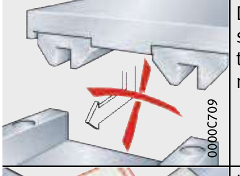
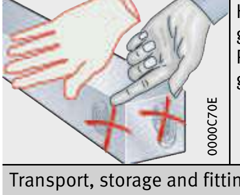
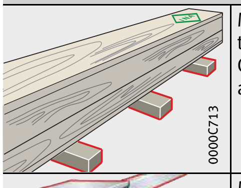
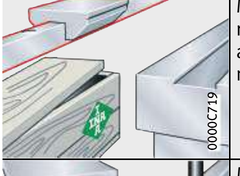
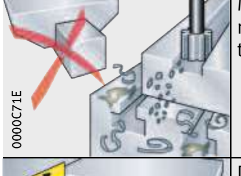
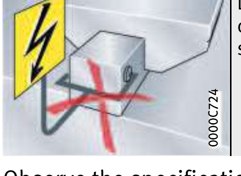
Figure 4
Suspended monorail guidance system with drop guard

Mounting guidelines

Guidelines for mounting of monorail guidance systems

The guidance systems can only achieve their function and maximum operating life if they are correctly mounted and maintained, see page 87.

Guidelines

General	
	Use only the appropriate tools and fitting aids. Always carry out the operations in the specified sequence.
	Do not carry out “prestrung mounting” – do not slide carriages already mounted on the machine table onto guideways that are also already mounted.
	Hands should be kept clean and dry, wear cotton gloves if necessary. Perspiration can lead to corrosion on monorail guidance systems with a dry preservative.
Transport, storage and fitting area	
	Monorail guidance systems should only be transported and stored in their original packaging. Guideways longer than 1,5 m must be supported at a minimum of 3 points.
	Monorail guidance systems should only be removed from their original packaging once they are at the assembly area and immediately before mounting.
	Monorail guidance systems should not be mounted in the vicinity of machines or equipment that generate swarf or dust.
	Do not transmit electrical currents, for example during welding, through the monorail guidance systems.

Observe the specifications and regulations in accordance with the table.

The mounting guidelines are structured such that they can be used as a basis for creating individual mounting manuals as easily as possible.

Mounting manuals can be called up on the Internet
➤ *https://www.schaeffler.de/std/1D51*.

Mounting manuals available from Schaeffler in the field of monorail guidance systems:

- RUE: MON 30, MON 40, MON 41, MON 42
- KUSE: MON 22
- KUVE: MON 38, MON 45, MON 46
- accessories: MON 01, MON 07, MON 21, MON 65
- HLE: MON 50.

Risk of injury. In your handling or mounting manuals, please draw attention to the sharp edges caused by the design on guideways, holes and covering strips.

Risk of injury. Draw attention in your handling or mounting manuals to the normal hazards that are generally present in the mounting of machines and when working with lifting gear and tools.

Fixing screws for carriages and guideways

Monorail guidance systems must only be located using the specified screws.

It is vital to follow the information:

- in this catalogue
- in the technical proposal letter
- in the assembly drawing – if contained therein.

The screw specifications and tightening torques must be observed.

Any deviations will influence the performance of the screw connections as well as the function and operating life of the guidance systems.

Only fixing screws of the specified grades must be used.

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

Ensure that the adjacent construction is of adequate strength.

The technical performance capability can only be achieved through the use of:

- all threaded fixing holes
- the specified screw grade
- the specified tightening torques for screws.

Mounting guidelines

Delivered condition

Monorail guidance systems are supplied with a preservative, basic greasing or initial greasing, see table.

The preservative is compatible with oils and greases having a mineral oil base.

Delivered condition

Designation	Delivered condition				
	Lubrication			Mounting	
	coated with pre-servative	with initial greasing	with basic greasing	pre-assembled as unit	guideway and carriage separate
RUE..-E	●	❍	–	●	❍
KUSE	●	❍	–	●	❍
KUVE..-B	❍	❍	●	●	❍
KUVE25-B..-HS	❍	●	–	●	❍
KUVE..-W	❍	❍	●	●	❍
KUVS	❍	●	–	–	●

● Standard.
❍ Optional.

Protection of wipers

The sharp-edged counterbores of the holes in the guideways are covered by an adhesive strip, *Figure 1*.

The adhesive strip protects the seal lips on the wipers of the carriages. The adhesive strip should not be removed until immediately before the guidance system is mounted.

The counterbores may cause injury.

RUE..-E

① Adhesive strip

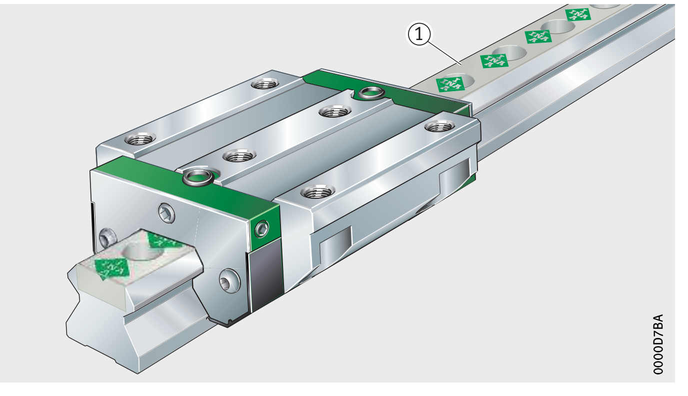
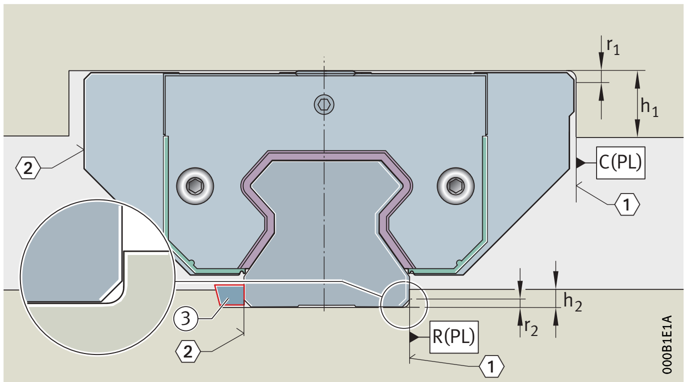


Figure 1
Holes covered by adhesive strip

Marking of locating face and marked face

The locating face is always on the opposing side to the marked face. The locating face of the guideway and the locating face of the carriage are on the same side when supplied, *Figure 2*. If the locating faces shall not be on the same side, the position of the locating faces must be indicated when ordering. If the carriage is separated from the guideway for mounting, it must be ensured that the position of the locating faces corresponds to the initial situation, when joining the carriage and the guideway.

The locating heights and corner radii in the table must be observed, see the section for the specific series.



1 Locating face
2 Marked face
3 Vee strip

Figure 2
Position of locating face and marked face

Dismounting and mounting of carriages

Observe and if necessary note the mounting position of the carriages (locating face).

Only remove carriages from the guideway if necessary.

Dismounting of carriages

Locate the dummy guideway 1 on one end face of the guideway 2 and slide the carriage 3 carefully onto the dummy guideway 1, *Figure 3*, page 72.

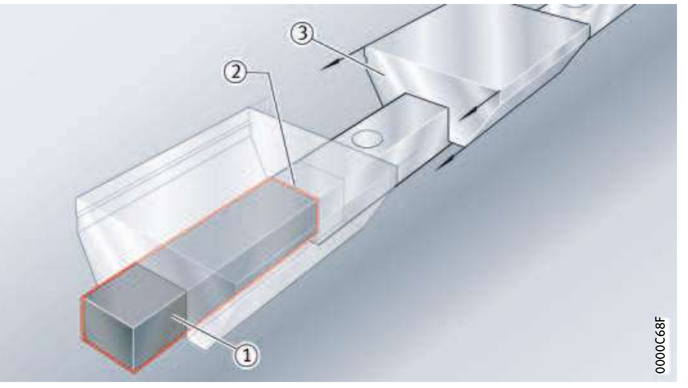
Do not move carriages over the counterbores of fixing holes that have not been closed off. Ensure that the seal lips of the wipers are protected if carriages are moved.

Do not remove the dummy guideway from the carriage.
Protect the rolling element set against contamination and damage.

Mounting of carriages

Locate the dummy guideway ① with the carriage ③ on one end face of the guideway ②, *Figure 3*.

Slide the carriage ③ carefully onto the guideway, taking care not to damage the seal lips.



① Dummy guideway
② End face of guideway
③ Carriage

Figure 3
Dismounting and mounting of carriages

Location of carriages

The tightening torques M_A in the dimension tables are valid for screws coated with preservative. If there is a possibility of settling, the fixing screws should be secured against rotation.

Observe the tightening torques M_A for the fixing screws.

If the carriages are not connected to a central lubrication system, grease the carriages using the initial grease quantity – for grease quantities, see tables, page 47.

The guideways and carriages must be protected before and during mounting against solid and fluid contaminants.

Series RUE and KUSE

Before the carriages are screw mounted to the adjacent construction, check the seat of the O rings.

Location of guideways

The sharp-edged counterbores for the fixing screws may cause injury.

The tightening torques M_A in the dimension tables are valid for screws coated with preservative.

Tightening scheme

Tighten the fixing screws in accordance with the scheme, *Figure 4*:

1. Tighten all the screws to $0{,}4 \times M_A$.
2. Tighten the screws marked in red to $0{,}7 \times M_A$.
3. Tighten the screws marked in black to $0{,}7 \times M_A$.
4. Tighten the screws marked in red to M_A.
5. Tighten the screws marked in black to M_A.

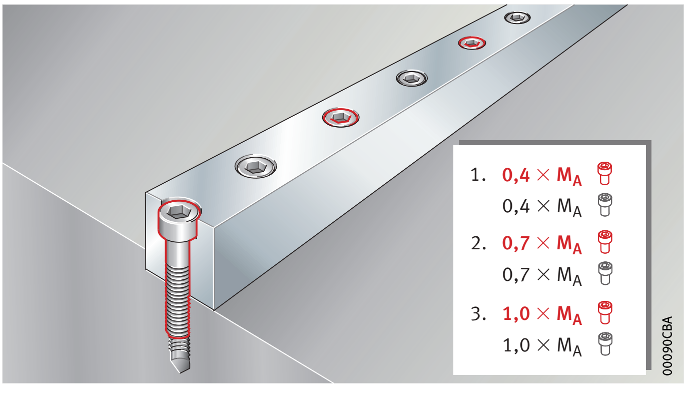


Figure 4
Tightening scheme for guideways

Multi-piece guideways

The end faces of the guideways are abutted against each other and the carriages are moved over the joint – this gives almost ideal alignment of the guideways.

In the case of multi-piece guideways, the gap at the end faces between two segments must be $< 0,05$ mm.

Screw mount the guideways in accordance with the tightening scheme, *Figure 4*. Leave the carriages located at the joint. Then check the joints again.

The guideway segments are marked with numbers and letters, *Figure 5*.

During mounting, the numbers and letters of the ends at each joint must match.

Butt joints:
1 1A – 1A
2 1B – 1B
3 2A – 2A

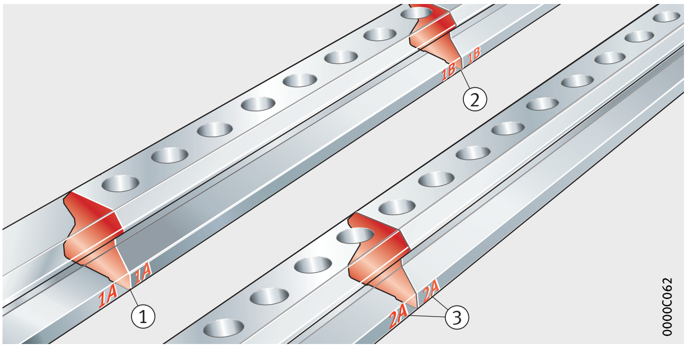


Figure 5
Butt joints on multi-piece guideways

Fitting of closing plugs

The sharp-edged counterbores for the fixing screws may cause injury.

Before mounting, guideways must be located using the tightening torque M_A, see dimension tables.

Do not move carriages over the counterbores of fixing holes that have not been closed off. Ensure that the seal lips of the wipers are protected if carriages are moved.

Depending on the environment and operating conditions, the counterbores are closed off using plastic or brass closing plugs. A fitting device for brass closing plugs is available, see page 76.

Knock in the closing plugs, *Figure 6*:

- Insert the closing plugs ① in the correct position in the counterbore.
- Place the press-in block ② vertically on the closing plugs.
- Knock in the closing plugs by means of concentric impacts.
- Remove the ring-shaped burr from the closing plugs ③.

① Closing plug
② Press-in block
③ Ring-shaped burr

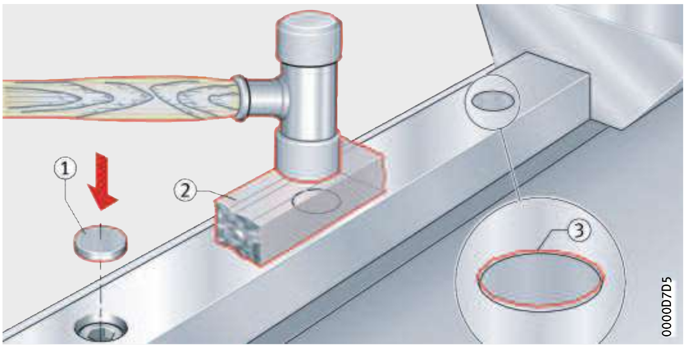


Figure 6
Knocking in of closing plugs

Carry out final fitting of the closing plugs, *Figure 7*:

- Knock the closing plugs in flush with the surface of the guideway ① by means of a second impact.
- Smooth off the top surface of brass closing plugs flat using an oilstone ②.
- Clean the guideway using a lint-free clean cloth and check that the closing plugs are fitted flush by means of a “fingertip test”.

① Press-in block
② Oilstone

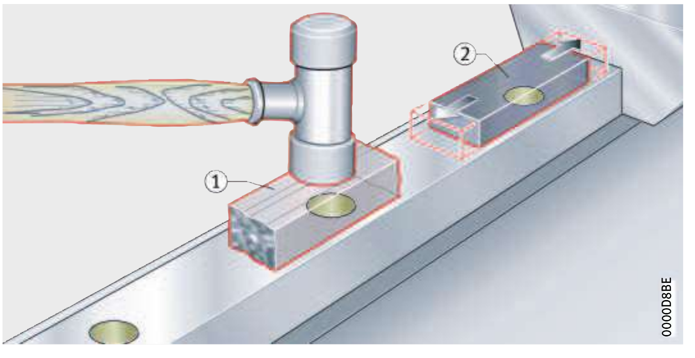


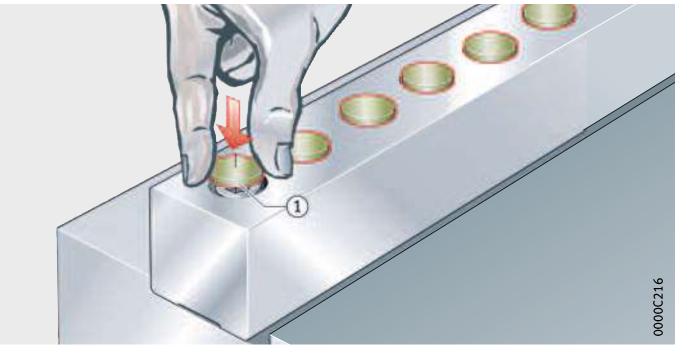
Figure 7
Final fitting of closing plugs

Fitting of brass closing plugs using fitting device

The sharp-edged counterbores for the fixing screws may cause injury.

Insert the closing plugs in the counterbore, *Figure 8*:

- Insert the closing plug ① in the correct position in the counterbore.

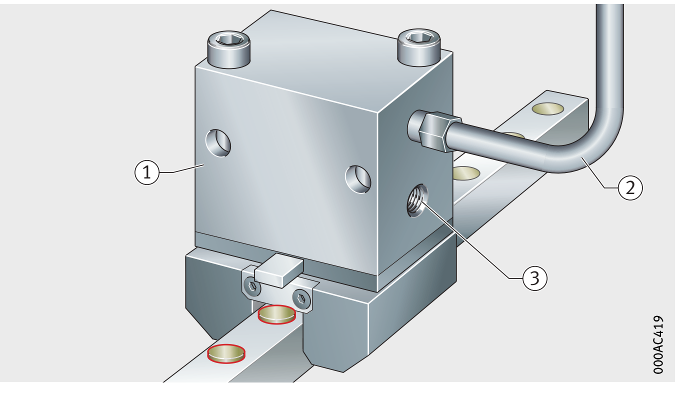


① Closing plug

Figure 8
Inserting the closing plugs in the counterbore

Fit the fitting device, *Figure 9*:

- Place the fitting device MVH ① on the guideway.
- Connect the fitting device to the hydraulic source ② and ensure that the bleed ③ is activated.



① Fitting device MVH
② Hydraulic connector
③ Bleed

Figure 9
Fitting the fitting device

Press in the closing plugs, *Figure 10*:
- Position the fitting device ① over the closing plug ② until the pawl ③ contacts the next closing plug that has not yet been pressed in; for the last closing plug, carry out this alignment visually ④.
- Press in the closing plug using a maximum of 300 bar.

① Fitting device MVH
② Closing plug
③ Pawl
④ Optical inspection

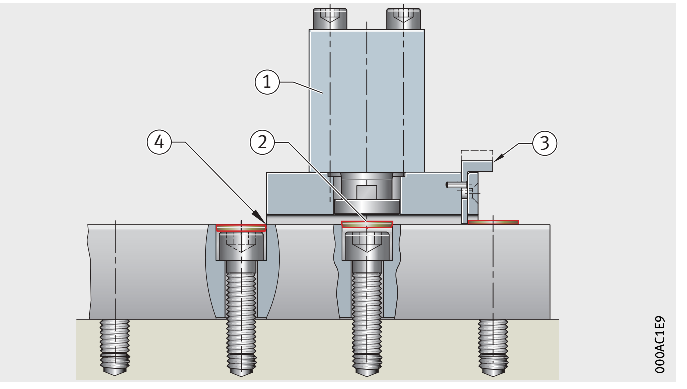


Figure 10
Pressing in the closing plugs

Smooth off the closing plugs flat, *Figure 11*:
- Smooth off the top surface of brass closing plugs flat using an oilstone ①.
- Then clean the guideway using a lint-free clean cloth.

① Oilstone

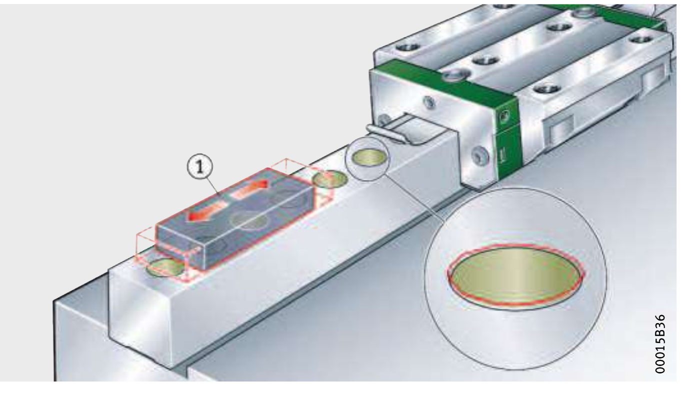


Figure 11
Smoothing off the closing plugs flat

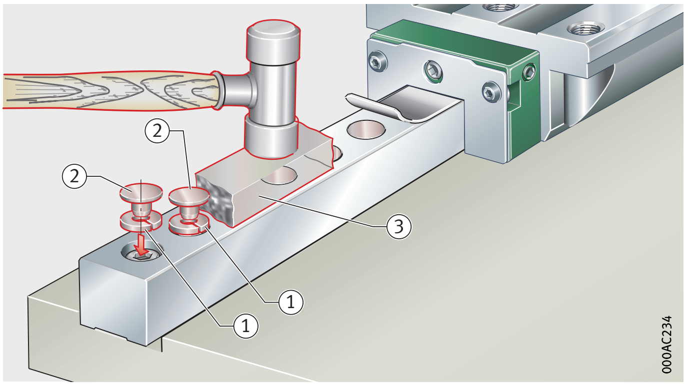
Fitting of two-piece plastic closing plugs

!

The sharp-edged counterbores for the fixing screws may cause injury.

Press in the closing plugs, *Figure 12*:

- Insert the plastic clinch rings ① in the holes.
- Press the closing plugs ② in flush using a press-in block ③.

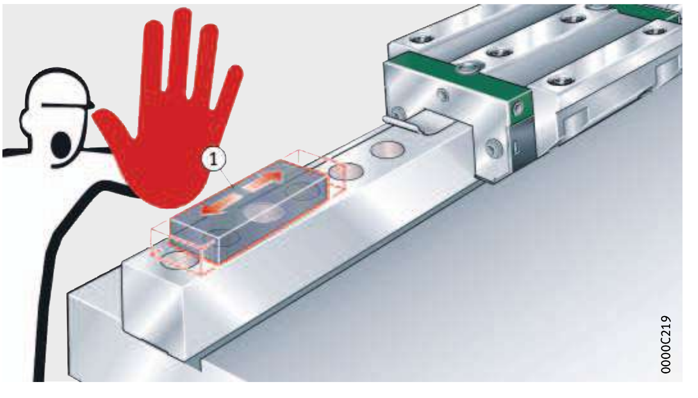


① Plastic clinch ring
② Closing plug
③ Press-in block

Figure 12
Pressing in the closing plugs

!

Do not work the plastic closing plugs using an oilstone ① or similar, *Figure 13*.



① Oilstone

Figure 13
Do not work using an oilstone

Fitting of adhesive bonded covering strip

Risk of injury due to the sharp edges of the slot and on the covering strip.

Do not use the covering strip ADB if using the damping carriage RUDS.

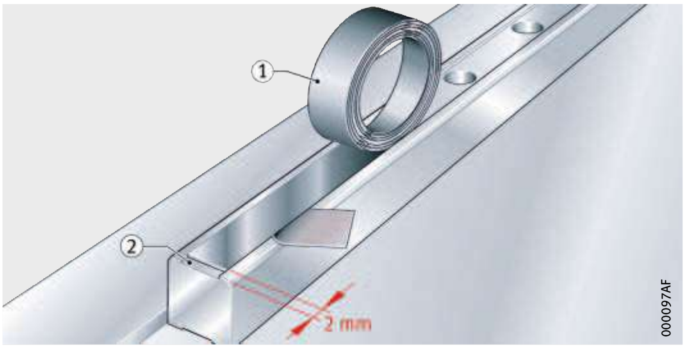
Only fit the covering strip to guideways that have been located.

The surface for adhesive bonding – the slot in the guideway – must be clean, free of grease and dry.

Avoid damaging the seal lip on the carriage.

Place the covering strip in the slot, *Figure 14*:

- Unroll a portion of the covering strip (1) and place with the adhesive film side face down in the slot (2) – the covering strip should finish approx. 2 mm from the end of the guideway.



(1) Covering strip
(2) Slot

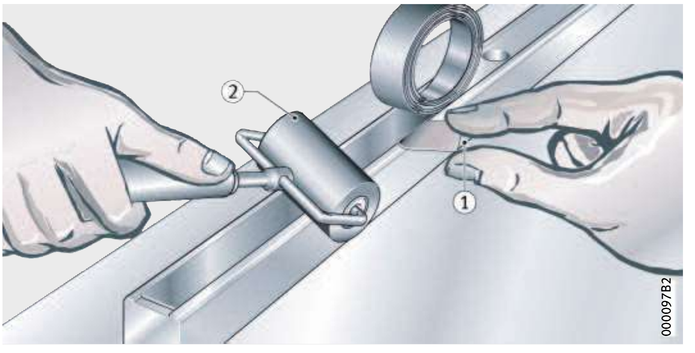
Figure 14
Placing the covering strip in the slot

Stick down the covering strip, *Figure 15*:

- Peel off the protective film ① over a length of approx. 30 mm and fold it out at an angle to one side.
- Align the covering strip in the slot and stick it down by applying pressure – for example by means of a pressure roller ②. The strength of the bond will depend on the pressure used.
- Remove the protective film ① and finish fitting the covering strip.

The final adhesive force is achieved at room temperature after approx. 72 hours.

Check the storage life of the adhesive tape, see printed information on packaging.



① Protective film
② Pressure roller

Figure 15
Sticking down the covering strip

Fitting of clip fit covering strip

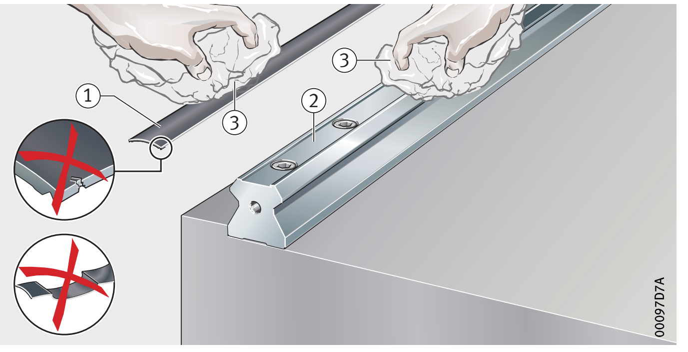
Risk of injury. The slot in the guideway and the ends of the covering strip have sharp edges.

Do not use the covering strip ADK if using the damping carriage RUDS.

Fit the covering strip only if it is free from creases and damage. Protect the covering strip and slot against contamination during fitting. Handle the covering strip with great care, avoiding alignment. Do not reuse the covering strip.

Cleaning and inspection, *Figure 16*:

- Check the covering strip ① for damage.
- Clean the covering strip ① and guideway slot ② using a lint-free cloth ③.



① Covering strip
② Slot in guideway
③ Lint-free cloth

Figure 16
Inspecting and cleaning the covering strip and guideway slot

! The covering strip may spring out of the slot if retaining plates are not used, so it must always be secured.

Insert and roll out the covering strip, *Figure 17*:

- Insert the covering strip ① with the convex side upwards in the slot ②.
- Unroll the covering strip ① by at least 200 mm. Leave the strip protruding by 10 mm to 20 mm. Bend the protruding length downwards by approx. 45° for fixing.
- Unroll the covering strip ① completely and position it in the slot ②.
- Secure the covering strip ① by means of retaining plates ③.

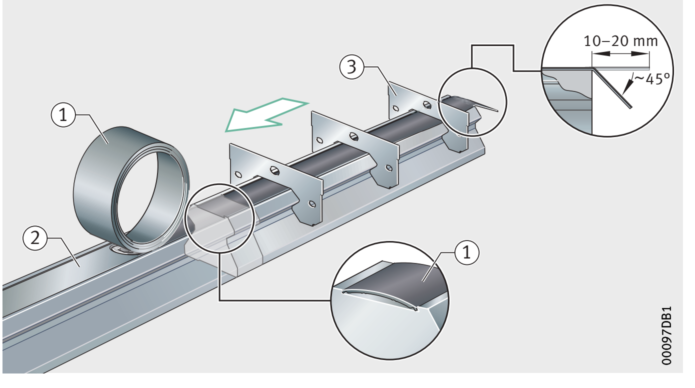


Figure 17
Placing the covering strip in the slot

! The covering strip must be completely inserted in the slot before it is rolled in.

Always observe the travel direction of the rolling-in device. Do not tilt or reverse the rolling-in device.

Fit the covering strip without interruption.

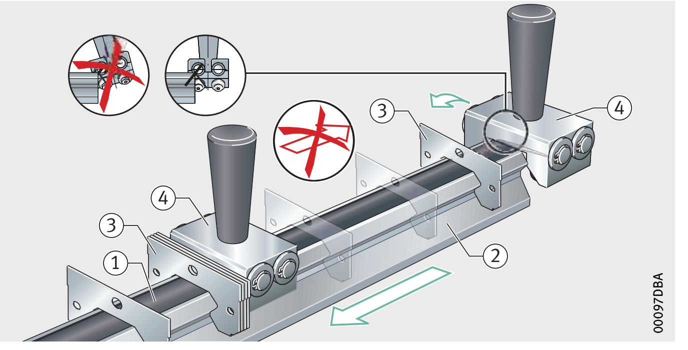
Mounting guidelines

Roll in the covering strip 1, *Figure 18*:

- Position the rolling-in device 4 tangentially with the chamfered side marked with an arrow first, avoiding tilting.
- Move the rolling-in device 4 with a uniform movement and without stopping along the covering strip 1.
- Slide the retaining plates 3 away.
- Slide the rolling-in device 4 a further two to four times along the covering strip 1.

1 Covering strip
2 Guideway
3 Retaining plate
4 Rolling-in device

Figure 18
Rolling in the covering strip

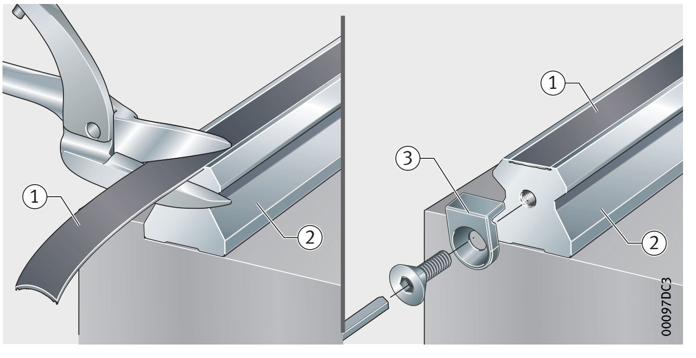


Secure the ends of the covering strip 1, *Figure 19*:

- Cut off the protruding ends of the covering strip 1 using snips.
- Fit the retaining plate 3.

1 Covering strip
2 Guideway
3 Retaining plate

Figure 19
Cutting off the protruding ends and mounting the retaining plate



Mounting and maintenance manual

- Comprehensive information, see MON 65, Covering Strip ADK for Guideway TSX, TKSD, TKVD.

Mounting with a positioned carriage

If the covering strip is to be fitted when the carriage is already on the guideway, please contact us.

Fitting of clamping element

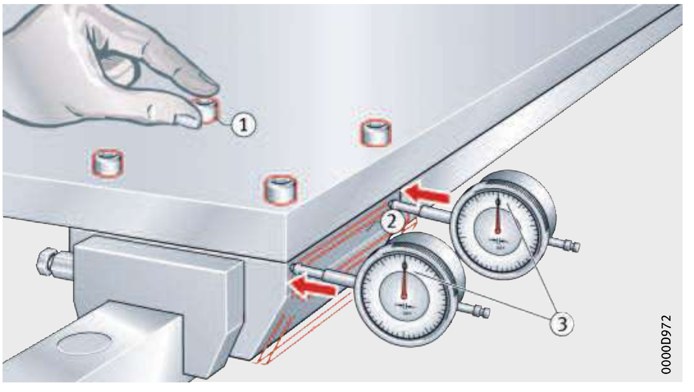
!

Fix the clamping element RUKS in place only after the guideways and carriages have been mounted.

Before fitting, close off the counterbores of the fixing holes in the guideways or fit the covering strips ADB or ADK.

Align the clamping element, *Figure 20*:

- Tighten the fixing screws ① in the clamping element finger tight. Use all the threaded holes.
- Place one dial gauge ③ at each corner of one longitudinal side ② of the clamping element.
- Press the clamping element against one longitudinal side of the guideway (in the direction of the arrows) and set the dial gauges to "0" ③.



① Fixing screws
② Longitudinal side of clamping element
③ Dial gauges, datum on machine bed

Figure 20
Aligning the clamping element

!

Do not exceed the maximum oil pressure of 350 bar.
Pay attention to pressure spikes.

Mounting guidelines

Carry out final fitting of the clamping element, *Figure 21*:

- Press the clamping element onto the opposing longitudinal side of the guideway (in the direction of the arrow).
- Read off and record the measurement values on both dial gauges ①.
- Calculate the mean value of the measurement values ③.
- Set the RUKS to half the mean value.
- Tighten the fixing screws ⑤, observing the tightening torque.
- Connect the hydraulic connector ⑥ to the clamping element.
- Increase the oil pressure slowly to the maximum operating pressure.
- Check the clamping element for seal integrity, reduce the oil pressure.

M_A = tightening torque, see dimension tables

① Dial gauges, datum on machine bed
② Measured value 1
③ Mean value of measured values
④ Measured value 2
⑤ Fixing screws
⑥ Hydraulic connector

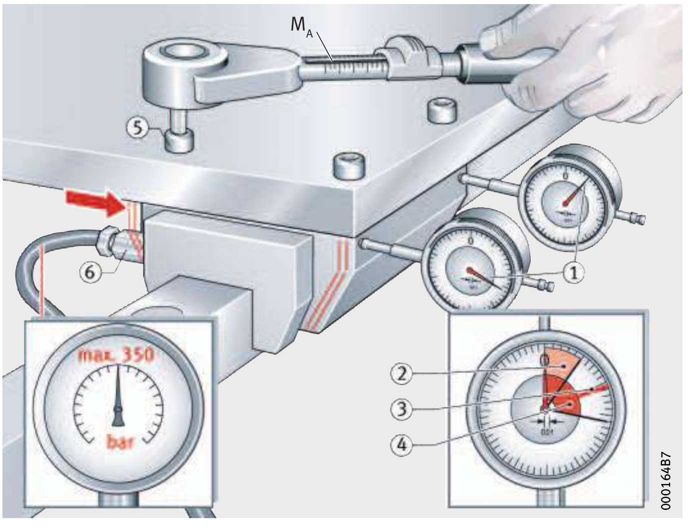


Figure 21
Final fitting
of the clamping element

Fitting of damping carriage

!

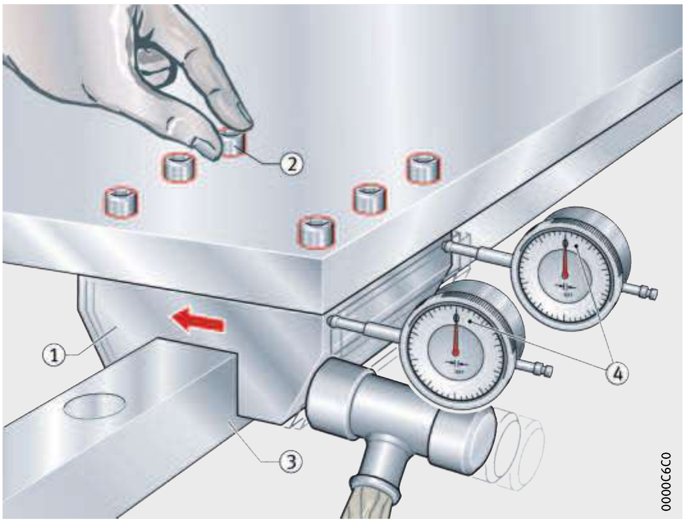
The damping carriage RUDS should only be fixed in place once the guideways and carriages have been mounted.

The counterbores of the fixing holes in the guideways must first be closed off. Only use brass closing plugs.

Keep the guideways free from oil.

Align the damping carriage, *Figure 22*:

- Insert the fixing screws ② in the damping carriage ① and tighten finger tight.
- Place one dial gauge ④ at each corner of one longitudinal side of the damping carriage.
- Press one longitudinal side of the damping carriage against the guideway (in the direction of the arrow) ③ and set the dial gauges to "0" ④.



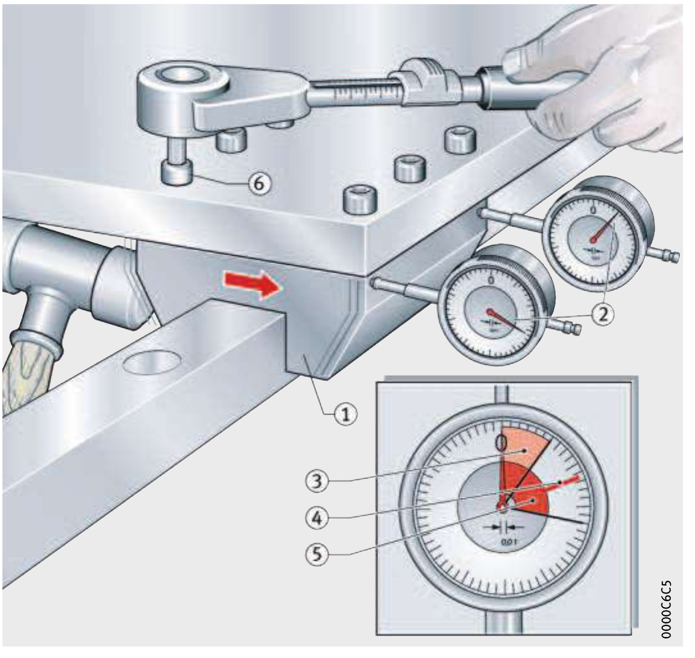
① Damping carriage
② Fixing screws
③ Longitudinal side of the guideway
④ Dial gauges, datum on machine bed

Figure 22
Aligning the damping carriage

Mounting guidelines

Carry out final fitting of the damping carriage, *Figure 23*:

- Press the damping carriage ① against the opposing side of the guideway (in the direction of the arrow).
- Read off and record the measured values on both dial gauges ②.
- Calculate the mean value ④ from the measured values.
- Set the damping carriage to half the mean value.
- Tighten the fixing screws ⑥; observe the tightening torque M_A, see dimension tables.
- Make the lubrication connection and charge the system with oil.



① Damping carriage
② Dial gauges, datum on machine bed
③ Measured value 1
④ Mean value of measured values
⑤ Measured value 2
⑥ Fixing screws

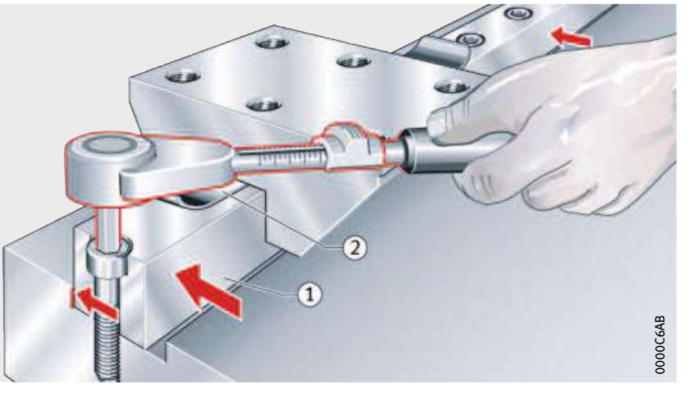
Figure 23
Final fitting
of the damping carriage

Mounting example for a linear guidance system

As an example, a mounting variant from *Figure 1*, page 62, ③, has been selected.

Screw mount the datum side, *Figure 24*:

- Press the guideway on the datum side ① against the locating face (in the direction of the arrows) and screw mount; observe the tightening torque M_A, see dimension tables.

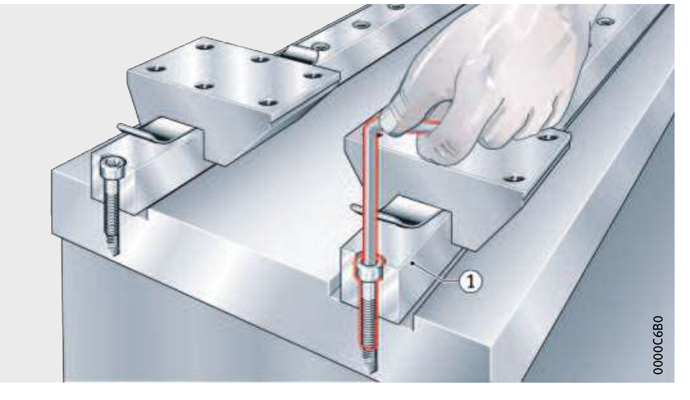


① Datum side
② Spring steel strip

Figure 24
Screw mounting of the datum side

Screw mount the adjustment side, *Figure 25*:

- Screw mount the guideway on the adjustment side ① finger tight.



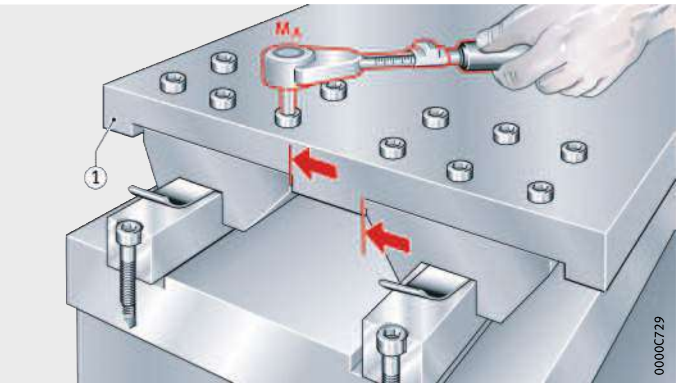
① Adjustment side

Figure 25
Screw mounting of the adjustment side

Mounting guidelines

Screw mount the table, *Figure 26*:

- Place the table 1 gently on the carriages.
- Screw mount the carriages on the datum and adjustment sides to the table; observe the tightening torque M_A, see dimension tables.

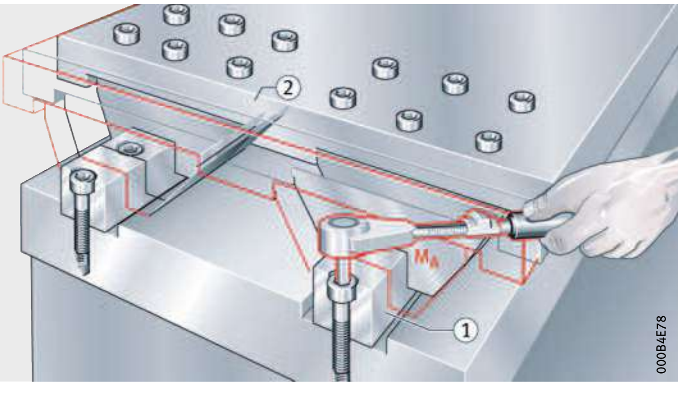


1 Table

Figure 26
Screw mounting
of the table to the carriages

Screw mount the adjustment side, *Figure 27*:

- Align the guideway on the adjustment side 1 with the table 2 and screw mount; observe the tightening torque M_A, see dimension tables.

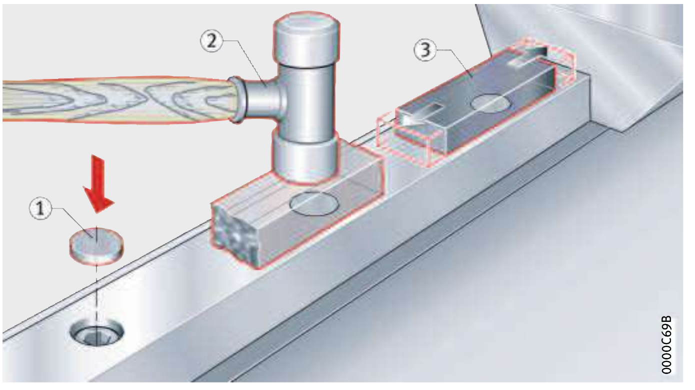


1 Adjustment side
2 Table

Figure 27
Screw mounting
of the adjustment side

Fit the closing plugs, *Figure 28*:

- Fit the closing plugs flush with the guideway surface ①, ②, see page 74.
- Clean the surface ③ (not in the case of plastic closing plugs).



① Closing plugs
② Rubber hammer
③ Oilstone

Figure 28
Fitting of the closing plugs

Commissioning the guidance system
Oil lubrication

Ensure that the guideways show a visible oil film.

Supply the guidance system with oil:

- In order to ensure cleanliness and prevent corrosion, flush and fill all lubrication point supply pipes and lubrication holes immediately after connection.
- At the time of commissioning, monorail guidance systems should be oiled with the minimum oil quantity Q_{min}, see tables, page 43, moving the carriage four times the carriage length during this process.

Damping carriage

Connect the damping carriage RUDS to the unpressurised lubricant supply system.

Grease lubrication

Ensure that the guideways show a visible grease film.

Linear recirculating ball bearing and guideway assemblies KUVE..-B have a basic greasing.

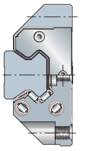
Supply the guidance system with grease:

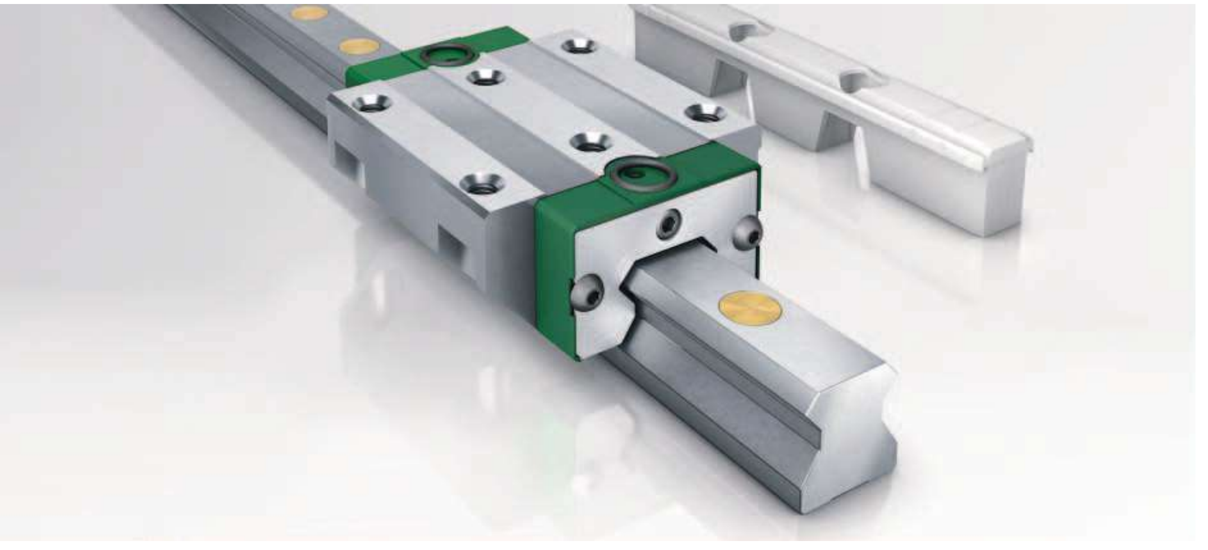
- Fill a clean grease gun or other lubrication device with fresh grease.
- Clean the lubrication connector and its immediate environment.
- Lightly grease the cleaned guideways.
- Fill the carriages with the initial grease quantity, see tables, page 47, moving the carriages four times their length during this process.

Influence of grease

During commissioning and relubrication, the coefficient of friction increases temporarily due to the fresh grease. After a short running-in period, however, the coefficient of friction returns to its original lower value.

The friction behaviour is determined significantly by the characteristics of the grease used. The consistency and base oil viscosity serve as approximate guide values.





Linear recirculating roller bearing and guideway assemblies

Carriages and guideways
Sealing and lubrication elements
Accessories

Linear recirculating roller bearing and guideway assemblies

Carriages Guideways **94**

The full complement linear recirculating roller bearing and guideway assemblies are the heavy duty designs in the range of INA monorail guidance systems.

They are used wherever linear guidance systems must support extremely heavy loads, where particularly high rigidity is required and where very precise travel is also necessary.

Sealing and lubrication elements – system KIT **132**

For optimum lubrication and sealing, there is an extensive system of sealing and lubrication elements. The elements are configured as a KIT and are designed for various application conditions.

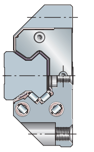
Accessories **176**

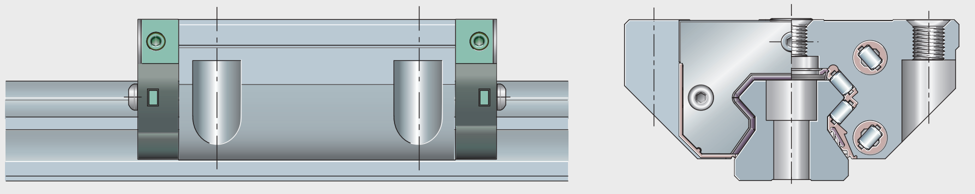
There is an extensive range of accessories for the linear recirculating roller bearing and guideway assemblies. These include closing plugs and covering strips for the guideways as well as suitable fitting tools (hydraulic fitting device and rolling-in device).

Clamping elements increase the rigidity in an axial direction while stationary and prevent micromovements under oscillating load.

The braking and clamping element is a mechanical safety system that is used, for example, where additional braking and clamping functions are required.

Where vibrations are to be damped, damping carriages placed between the carriages provide an effective solution.





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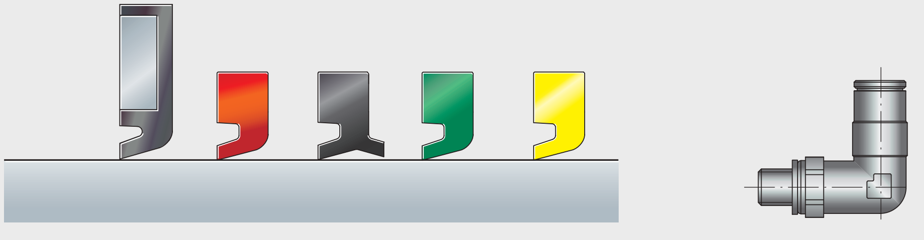

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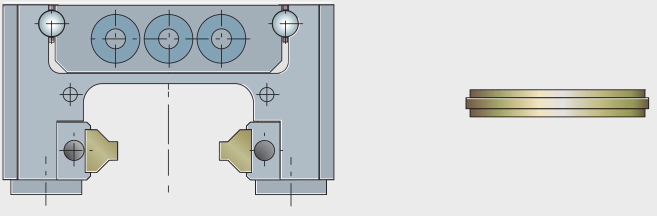

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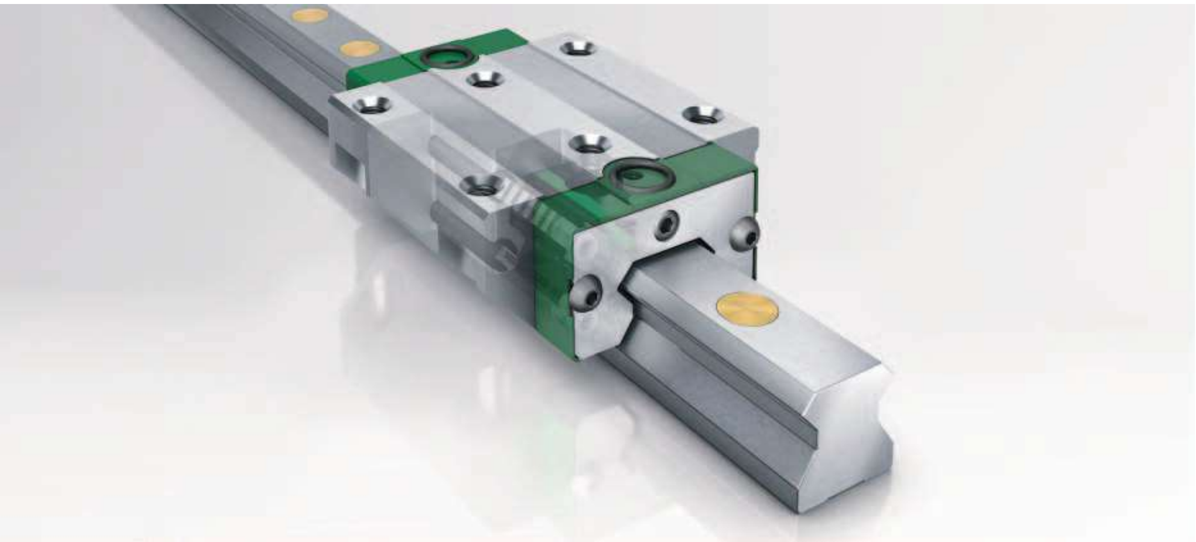
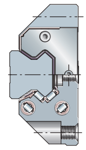


Linear recirculating roller bearing and guideway assemblies

Carriages
Guideways

Linear recirculating roller bearing and guideway assemblies



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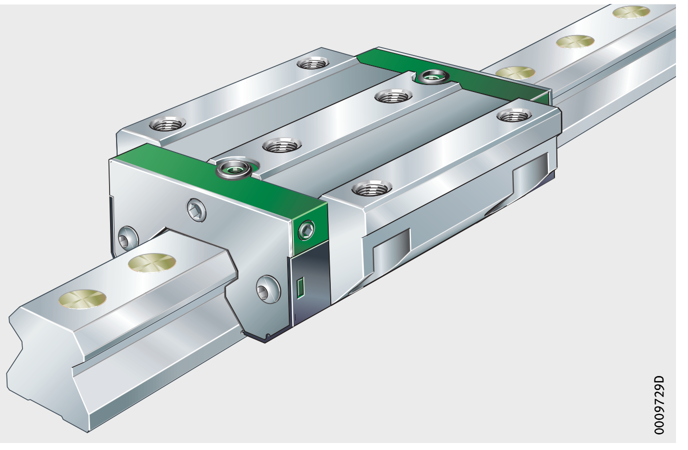
Product overview

Linear recirculating roller bearing and guideway assemblies

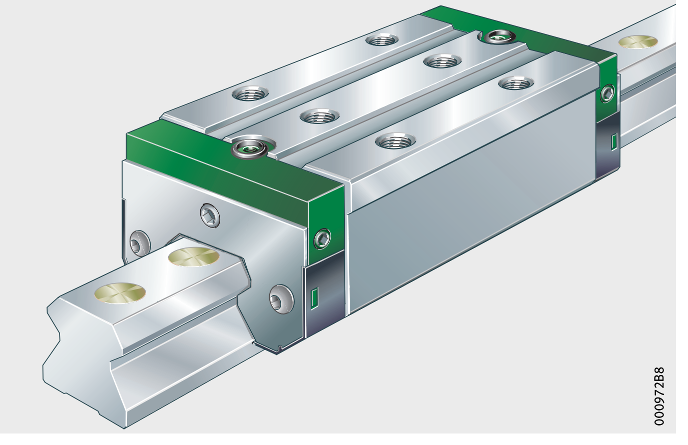
Full complement

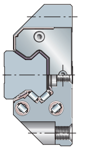
For oil and grease lubrication

RUE..-E, RUE..-E-L



RUE..-E-H, RUE..-E-HL, RUE..-E-SL

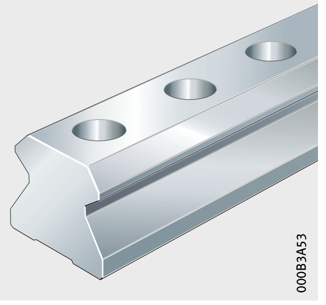




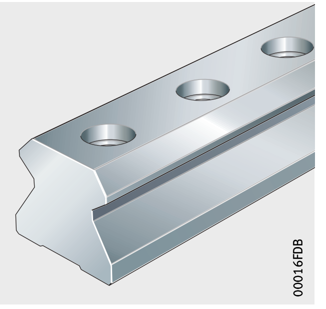
Guideways

Standard
or
for steel closing plugs

TSX..-E, TSX25-D

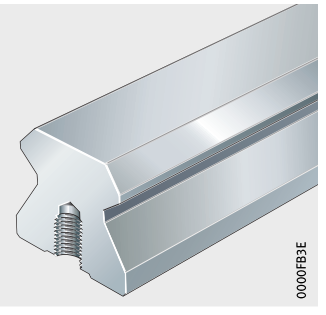


TSX..-E-KA-ST/A

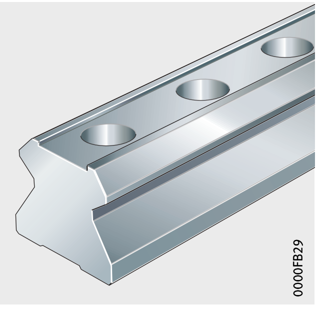


For screw mounting from below
or
with slot for covering strip

TSX..-E-U, TSX25-D-U



TSX..-E-ADB, TSX..-E-ADK, TSX25-D-ADB, TSX25-D-ADK



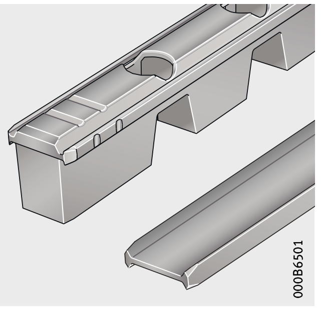
Standard accessories

Plastic closing plugs

KA..-TN

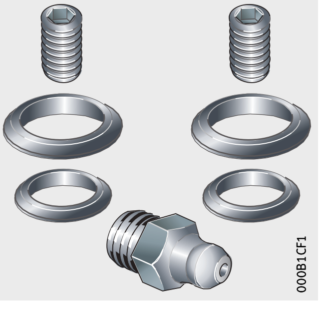
Dummy guideway

MSX..-E



Mounting set

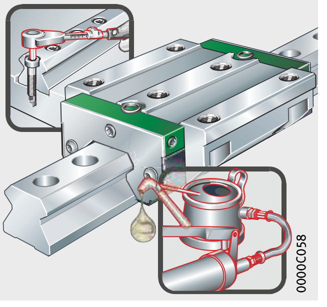
M-Satz

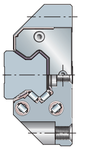


Product overview Linear recirculating roller bearing and guideway assemblies

Mounting manual

MON 30





Linear recirculating roller bearing and guideway assemblies

Features

Linear recirculating roller bearing and guideway assemblies are used in applications with very high loads and very high requirements for rigidity and precision.

These preloaded units for long, unlimited stroke lengths are particularly suitable for use in machine tools.

A guidance system comprises at least one carriage, one guideway, one dummy guideway, plastic closing plugs and one mounting set per carriage.

Full complement

Since they have the maximum possible number of rolling elements, full complement guidance systems have extremely high load carrying capacity and particularly high rigidity.

Carriages

The carriages have saddle plates made from hardened steel and the rolling element raceways are precision ground. The cylindrical rollers are recirculated in enclosed channels with plastic return elements.

Guideways

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

Location from above or below

Guideways TSX..-E (-ADB, -ADK) and TSX25-D (-ADB, -ADK) are located from above and have through holes with counterbores for the fixing screws. Guideways TSX..-E-U and TSX25-D-U are located from below and have threaded blind holes.

Slot for covering strip

Guideways TSX..-E-ADB and TSX25-D-ADB have a slot for the adhesive bonded steel covering strip ADB, while guideways TSX..-E-ADK and TSX25-D-ADK have a slot with undercut for the clip fit steel covering strip ADK, see dimension tables.

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 segments, see page 109.

Standard accessories

The scope of delivery includes various accessory parts as standard.

Dummy guideway

The dummy guideway prevents damage to the rolling element set and prevents the rolling elements from falling out while the carriage is separated from the guideway.

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

Linear recirculating roller bearing and guideway assemblies

Plastic closing plugs

The closing plugs close off the counterbores of the guideway holes flush with the surface of the guideway, see dimension tables.

Optionally, two-piece plastic plugs and closing plugs made from brass or steel are also available, see page 180.

Mounting set M-Satz

The delivery of RUE..-E includes the mounting set M-Satz. This comprises:

- one lubrication connector for grease lubrication
- O rings for sealing purposes if relubrication is carried out from above via the adjacent construction
- grub screws for closing off the relubrication hole from above.

Load carrying capacity

The cylindrical rollers are in an X arrangement on the raceways.

The units can support loads from all directions, except in the direction of motion, and moments about all axes, *Figure 1*.

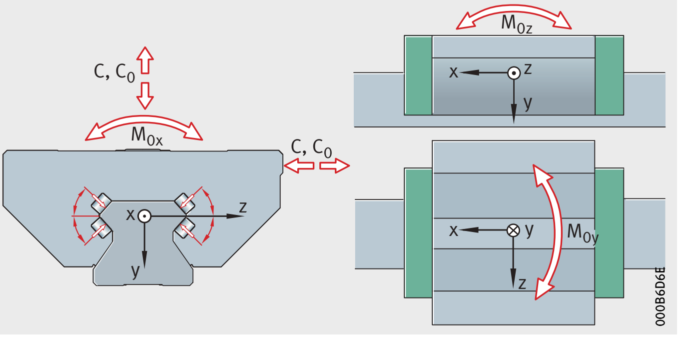


Figure 1
Load carrying capacity and contact angle

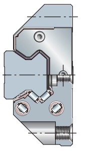
Acceleration and velocity

Linear recirculating roller bearing and guideway assemblies RUE..-E permit accelerations up to 100 m/s^2 and velocities up to 4 m/s, see table.

Operating limits

Designation	Acceleration[1)] up to m/s^2	Travel velocity[1)] up to m/s
RUE25-E	100	3
RUE35-E	100	4
RUE45-E	100	3,5
RUE55-E	100	3
RUE65-E	50	2,5
RUE100-E	5	1,5

1) The values apply, within each size, for all available carriages.



Interchangeability

The interchangeability of carriages and guideways is dependent on the accuracy class and the size, see table. Interchangeability as required is valid only for the accuracy classes G2 and G3. When ordering individual components in the accuracy classes G0 and G1 the following postscript must be added to the order: "Interchangeable as required".

Interchangeability of carriages and guideways

Designation	Carriage interchangeable[1]	Guideway interchangeable
RUE25-E	as required	as required
RUE35-E	as required	as required
RUE45-E	as required	as required
RUE55-E	as required	as required
RUE65-E[2]	restricted	restricted
RUE100-E[2]	restricted	restricted

[1] Where the carriages are interchangeable, this applies within one bearing size irrespective of the design of the carriage.

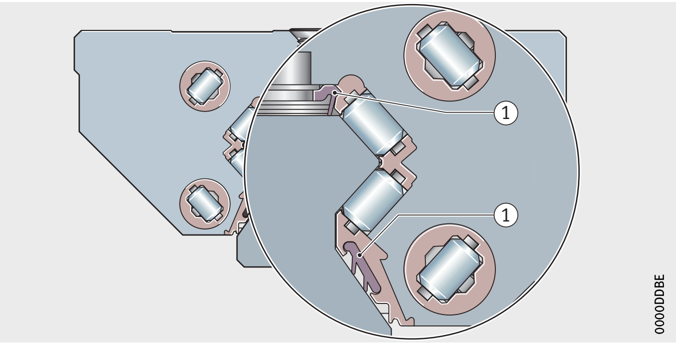
[2] If necessary, please contact us.

Sealing

The end pieces of the carriages are fitted on both sides with non-contact, corrosion-resistant end plates and elastic end wipers that retain the lubricant in the system.

Standard sealing strips ensure reliable sealing and protect the rolling element system against contamination, even in critical environmental conditions, *Figure 2*.

! Under extremely heavy contamination load, additional wipers can be fitted, see page 135. Where necessary, additional covers must be used.



① Standard sealing strips

Figure 2
Upper and lower sealing strips

Linear recirculating roller bearing and guideway assemblies

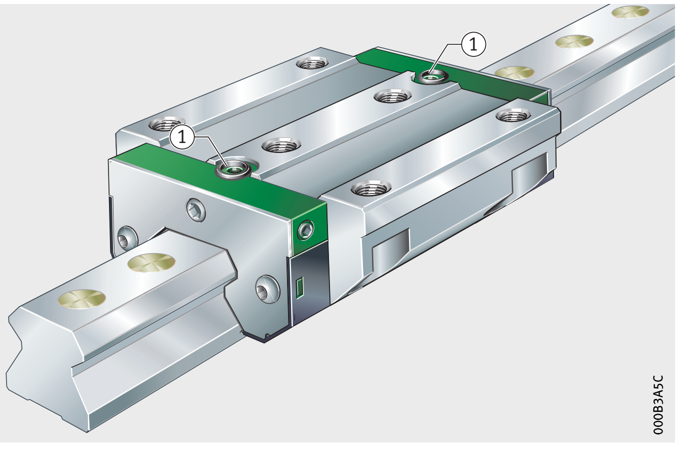
Lubrication

Linear recirculating roller bearing and guideway assemblies RUE..-E are suitable for oil and grease lubrication. A lubrication connector for grease is included in the mounting set M-Satz with the delivery. Optionally, other lubrication connectors are available, see page 164. Lubrication is optimised by accessories such as lubricant quantity metering valves (SMDS), long term lubrication units (KIT series 400) and the lubricant quantity metering unit (KIT series 500).

In the case of size 35 to 100, the lubrication connectors can be screw mounted into the end piece on the left, right or end face, while this is only possible on the end face in the case of size 25. The relubrication holes in the end faces and the sides are closed off by means of grub screws. Before the lubrication connector is screwed in, the corresponding grub screw must be removed. In the case of RUE100-E-L, an area of flash must be pierced using a hot pointed object, in accordance with the mounting manual MON 30.

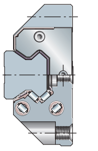
If relubrication is carried out from above, it must be ensured that the adjacent construction completely covers the carriage (including the end pieces) and the O rings for sealing off the relubrication hole from above are inserted, *Figure 3*. Otherwise, lubricant may escape through the upper lubrication hole.

If the upper relubrication holes are not used, these can be closed off using grub screws. Grub screws GSTI for closing off the upper relubrication hole are included with the mounting set M-Satz.



① Upper relubrication hole with O ring

Figure 3
Relubrication hole



If lubrication connectors are fitted on the end or side, the maximum permissible screw depth must be observed, see dimension tables. If additional sealing elements KIT are used, the screw depth is increased for the end relubrication facility. The standard lubrication connector is then no longer usable. Suitable lubrication connectors must additionally be taken into consideration when ordering, see page 164.

Operating temperature

As standard, linear recirculating roller bearing and guideway assemblies can be used at operating temperatures from –10 °C to +80 °C.

Corrosion-resistant design

Linear recirculating roller bearing and guideway assemblies RUE..-E are also available in the accuracy class G2 and preload class V3 in a corrosion-resistant design with the special coatings Corrotect and Protect A, see page 56.

Designs

Linear recirculating roller bearing and guideway assemblies are available in five designs, see table.

Available designs

Design	Description
–	Standard carriage
H	High carriage
HL	High, long carriage
L	Long carriage
SL	Narrow, long carriage

Design and safety guidelines

Preload

Linear recirculating roller bearing and guideway assemblies are available in the preload classes V1 to V5, see table.

Optimum rigidity of the elements is impaired by any deviation in the preload force. Linear recirculating roller bearing and guideway assemblies are therefore supplied as a preassembled unit; this means that the elements are sorted and matched to each other.

For interchangeability of the guideway and carriage, see page 101.

Preload class

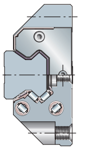
Preload class	Preload setting
V1	0,04 · C
V2	0,08 · C
V3[1]	0,1 · C
V4	0,13 · C
V5	0,15 · C

[1] Standard preload class.

Influence of preload on the linear guidance system

The preload of a linear guidance system defines the rigidity of the system. The linear recirculating roller bearing and guideway assembly RUE..-E can be obtained in the preload classes V1 to V5, where the preload class V3 is the standard preload class. This preload class can be used in numerous applications (including machine tools). If special requirements are present, the alternative preload classes may be used.

Increasing the preload increases the rigidity of the guidance system. The preload influences not only the rigidity but also the displacement force of the guidance system. The higher the preload, the larger the displacement force. Furthermore, preload also influences the operating life of the 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_{RUE}	
from	to	from	to
4	20	0,002	0,004

Rigidity

The deflection curves show the deformation of the linear recirculating roller bearing and guideway assemblies including the deformation of the screw connections to the adjacent construction, *Figure 4*, page 105, to *Figure 7*, page 107.

The rigidity curves are valid only for screw mounting in accordance with the mounting manual MON 30 and the standard preload class V3.

RUE25-E
RUE35-E
RUE45-E
RUE55-E
RUE65-E

δ = deflection
F = load

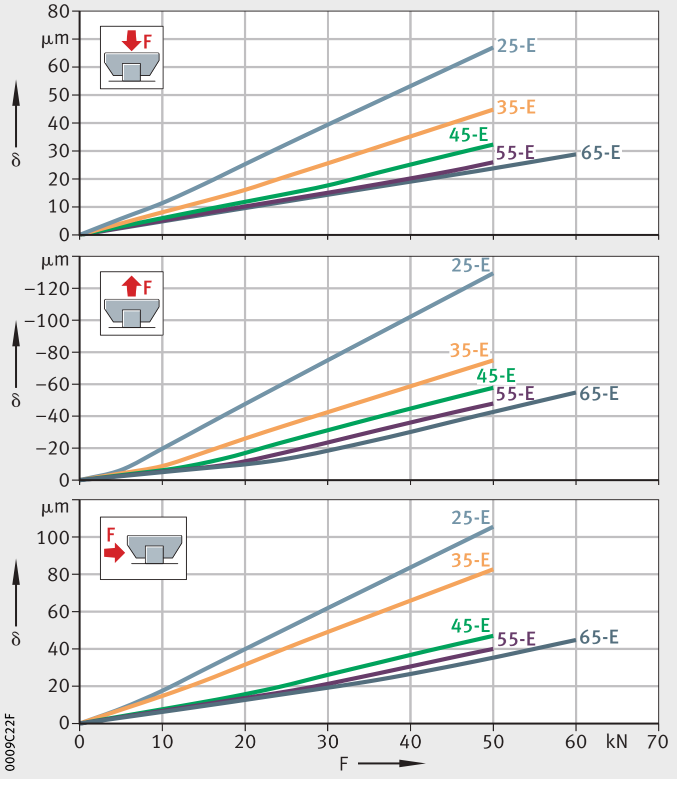


Figure 4
Deflection curves for compressive, tensile and lateral load

RUE25-E-L
RUE35-E-L
RUE45-E-L
RUE55-E-L
RUE65-E-L
RUE100-E-L

δ = deflection
F = load

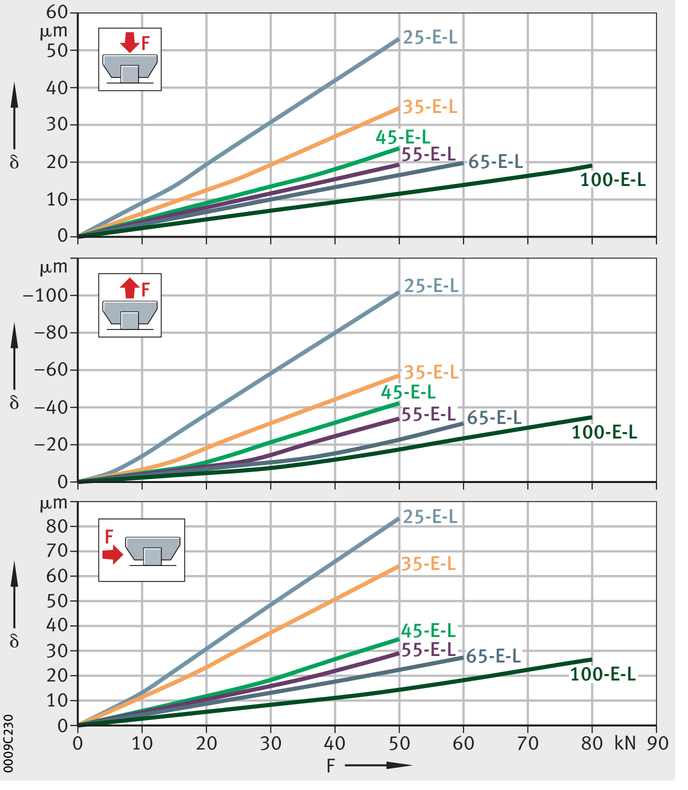


Figure 5
Deflection curves for compressive, tensile and lateral load

RUE25-E-H
RUE35-E-H
RUE45-E-H
RUE55-E-H
RUE65-E-H

δ = deflection
F = load

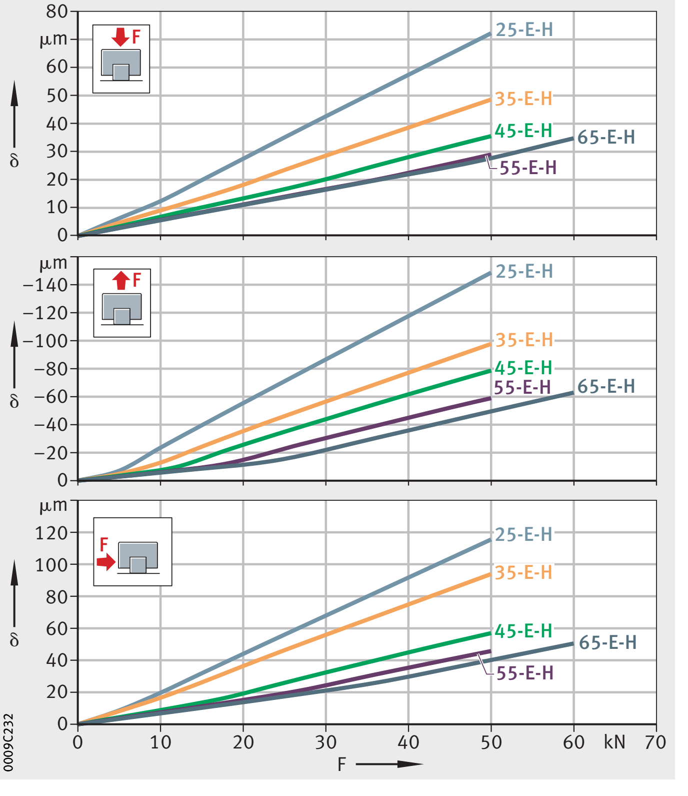
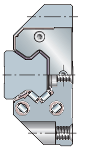


Figure 6
Deflection curves for compressive, tensile and lateral load



RUE25-E-HL
RUE35-E-HL
RUE45-E-HL
RUE55-E-HL
RUE65-E-HL
RUE65-E-SL

δ = deflection
F = load

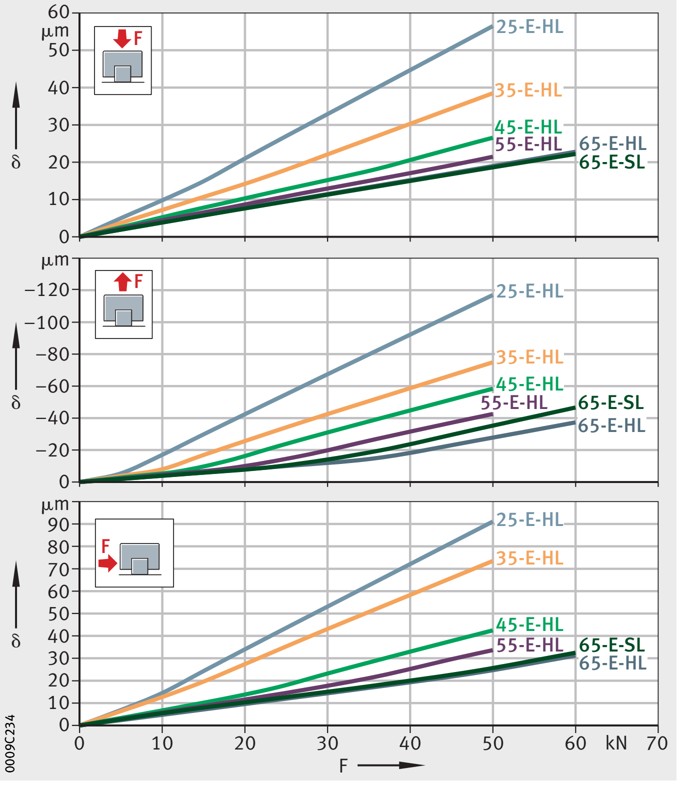


Figure 7
Deflection curves for compressive, tensile and lateral load

Linear recirculating roller bearing and guideway assemblies

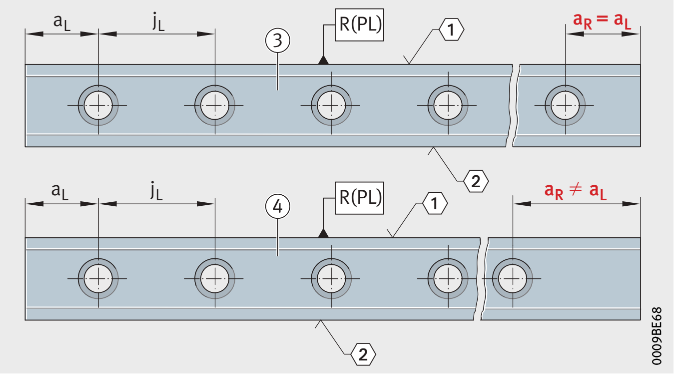
Hole patterns of guideways

Unless specified otherwise, the guideways have a symmetrical hole pattern where $a_L = a_R$, *Figure 8*.

An asymmetrical hole pattern may also be available upon request. In this case, $a_L \geqq a_{L\,min}$ and $a_R \geqq a_{R\,min}$, *Figure 8*.

!

Irrespective of the orientation of the locating face, a_L is on the left and a_R on the right, *Figure 8*. When ordering, the required orientation of the locating face (top or bottom) must be indicated.



1 Locating face
2 Marking
3 Symmetrical hole pattern
4 Asymmetrical hole pattern

Figure 8
Hole patterns of guideways with one row of holes

Maximum number of pitches between holes

The number of pitches between holes is the 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:

$$x = n + 1$$

a_L, a_R mm
Spacing between start or end of guideway and nearest hole, *Figure 8*

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

l mm
Guideway length

n –
Maximum possible number of pitches between holes

j_L mm
Spacing between holes

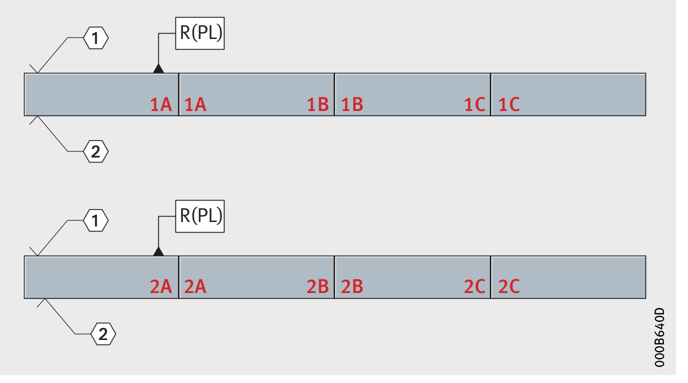
x –
Number of holes.

!

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

Multi-piece guideways

If the guideway length required is greater than l_{max}, see dimension tables, or joined guideways are required, these guideways are made up from segments that together comprise the total required length. The segments are matched to each other and marked, *Figure 9*. The pitch is always located centrally between the fixing holes.



1 Locating face
2 Marking

Guideway segments:
1A, 1A 1B, 1B 1C, 1C
2A, 2A 2B, 2B 2C, 2C

Figure 9
Marking of multi-piece guideways

In the case of multi-piece guideways, the gap at the end faces between two segments must be $<$ 0,05 mm.

Guideways suitable for joining as required

If partial guideway lengths ($l < l_{max}$) are to be combined with each other to form a guideway set as requested by the customer, the following postscript must be added to the order for the relevant guideway segment: “Guideway suitable for joining as required”.

If the guideway segment is an end segment, it is recommended that the guideway end has a chamfer, in order to make it easier to slide the carriages onto the guideway and protect the seals against damage. In this case, the position of the chamfer (left or right) and the position of the locating face (top or bottom) must be taken into consideration when ordering.

This design facilitates easier logistics.

Linear recirculating roller bearing and guideway assemblies

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 can be achieved most easily when the guideway is pressed against a locating face.

If the guideway cannot be aligned as recommended by means of locating faces or very high requirements are placed on the running accuracy, the guideway straightness must be restricted.
The following postscript must be added to the order: “Restricted guideway straightness”.

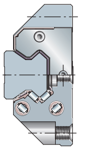
Geometrical and positional accuracy of the adjacent surfaces

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.

Tolerances of mounting surfaces and parallelism of mounted guideways must be observed, *Figure 10*, page 112, and table, page 113.

Surfaces should be ground or precision milled with the objective of achieving a mean roughness value Ramax 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 equation.

$$\Delta H = a \cdot b$$

ΔH — μm
Maximum permissible deviation from the theoretically precise position, *Figure 10*, page 112

a — –
Factor, as a function of the preload class, see table

b — mm
Centre distances between guidance elements.

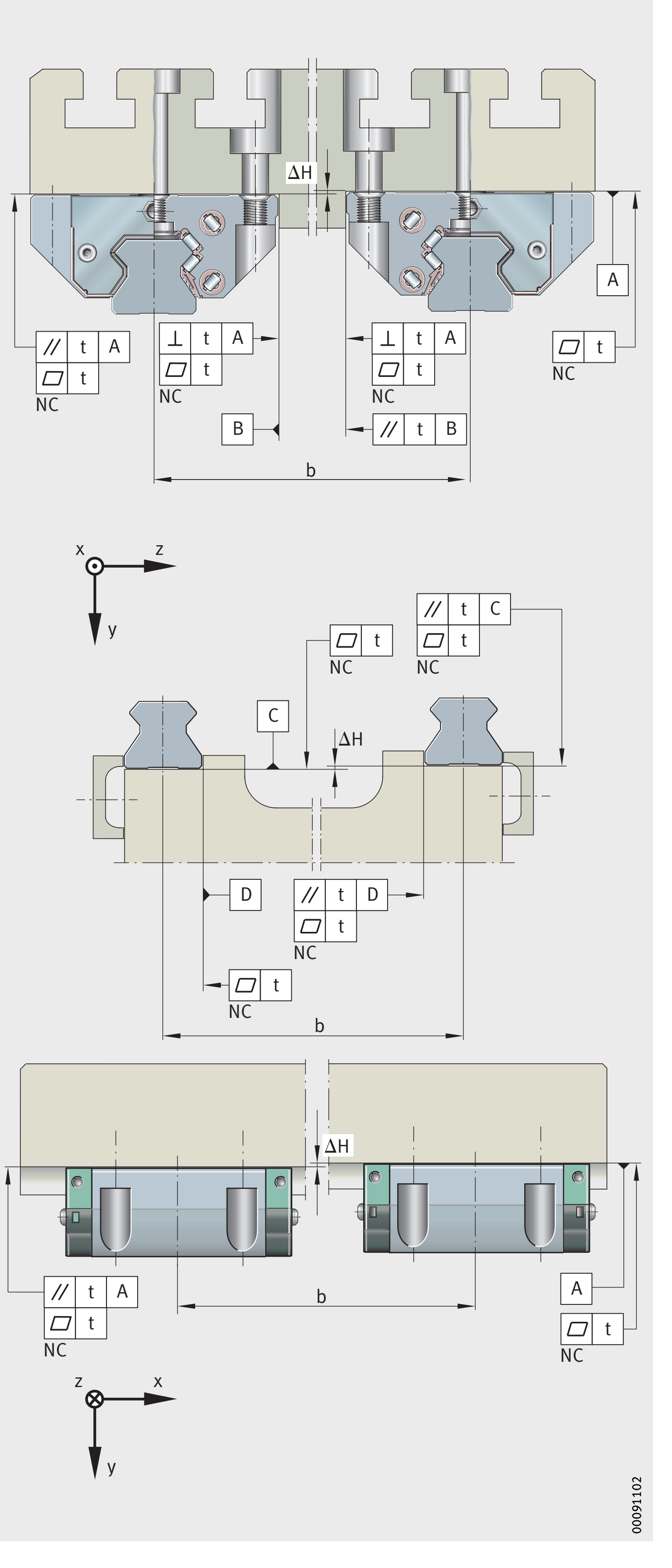
Factor a

Preload class	Factor a
V1	0,15
V2	0,09
V3[1]	0,075
V4	0,06
V5	0,06

[1] Standard preload class.

Observe the guidelines in the mounting manual MON 30 for RUE.

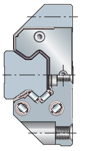
Linear recirculating roller bearing and guideway assemblies



NC = not convex

b = spacing between guidance elements
ΔH = height difference
t = parallelism, flatness and perpendicularity tolerance

Figure 10
Tolerances of mounting surfaces and parallelism of mounted guideways and carriages



Parallelism of mounted guideways

For guideways arranged in parallel, the values for t are in accordance with *Figure 10*, page 112 and the table. If the maximum values are used, this may increase the displacement resistance.

Values for geometry and position

Guideway	Preload class	
	V1, V2	V3[1], V4, V5
	Parallelism, flatness and perpendicularity t µm	
TSX25-D (-U, -ADB, -ADK)	11	7
TSX35-E (-U, -ADB, -ADK)	15	10
TSX45-E (-U, -ADB, -ADK)	17	10
TSX55-E (-U, -ADB, -ADK)	20	10
TSX65-E (-U, -ADB, -ADK)	20	10
TSX100-E	20	10

[1] Standard preload class.

Locating heights and corner radii

For the design of locating heights and corner radii, see table and *Figure 11*.

Locating heights, corner radii

Designation	Locating heights		Corner radii	
	h_1 mm	h_2 mm max.	r_1 mm max.	r_2 mm max.
RUE25-E (-L, -H, -HL)[1]	7,5	4,5	0,8	0,3
RUE35-E (-L, -H, -HL)	8	6	1	0,8
RUE45-E (-L, -H, -HL)	10	8	1	0,8
RUE55-E (-L, -H, -HL)	12	9,5	1	0,8
RUE65-E (-L, -H, -HL, -SL)	15	10,5	1	0,8
RUE100-E-L	25	13	1	0,8

[1] The linear recirculating roller bearing and guideway assembly RUE25-E is used in conjunction with the guideway TSX25-D.

(1) Locating face
(2) Marking
(3) Vee strip

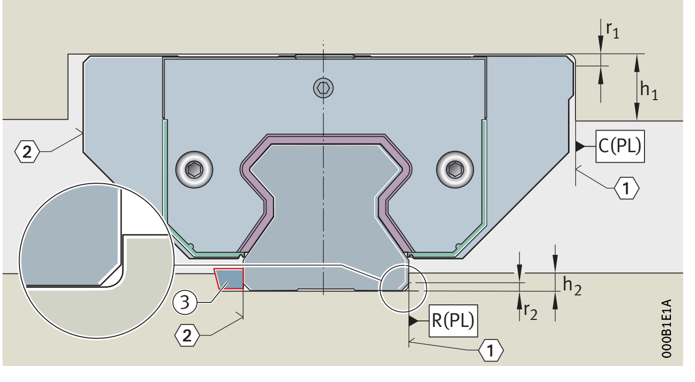


Figure 11
Locating heights and corner radii

Linear recirculating roller bearing and guideway assemblies

Accuracy

Accuracy classes

Linear recirculating roller bearing and guideway assemblies are available in the accuracy classes G0 to G3, *Figure 12*. The standard is class G2.

Parallelism of raceways to locating surfaces

The parallelism tolerance of the guideways is dependent on the accuracy class, *Figure 12*.

In coated systems, there may be deviations in tolerances compared with uncoated units.

t = parallelism tolerance
l = total guideway length

1 Locating face

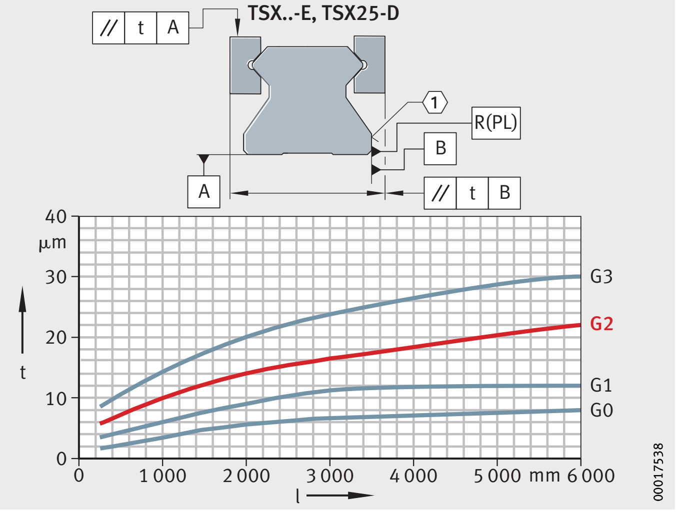


Figure 12
Accuracy classes and parallelism tolerances of guideways

Running accuracy

The running accuracy is influenced by the accuracy of the adjacent construction.

Tolerances

The tolerances are arithmetic mean values, see table and *Figure 13*, page 115. They are relative to the centre point of the screw mounting or locating faces of the carriage.

The dimensions H and A_1 should always remain within the tolerance irrespective of the position of the carriage on the guideway, see table, page 115.

Tolerances for height H and spacing A_1

Tolerance		Accuracy			
		G0	G1	G2[1]	G3
		μm	μm	μm	μm
Tolerance for height	H	±5	±10	±20	±25
Difference in height[2]	ΔH	3	5	10	15
Tolerance for spacing	A_1	±5	±10	±15	±20
Difference in spacing[2]	ΔA_1	3	7	15	22

[1] Standard accuracy class.

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

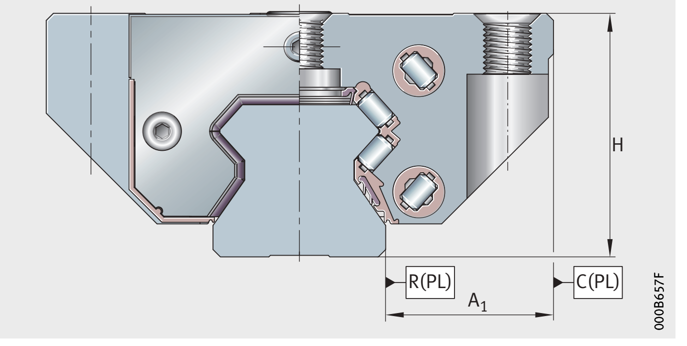


Figure 13
Datum dimensions for accuracy

Units with coating

For these units, the values for the appropriate accuracy class must be increased by the values for the coating, see table.

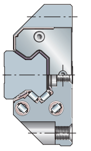
Coated systems are only available in the accuracy class G2.

Tolerances for coated parts

Tolerance[1]		Corrotect	Protect A
		RROC	KD
		μm	μm
Tolerance for height	H	+6	+6
Difference in height[2]	ΔH	+3	+3
Tolerance for spacing	A_1	+3	+3
Difference in spacing[2]	ΔA_1	+3	+3

[1] Displacement in tolerance zone (guideway and carriage with coating).

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

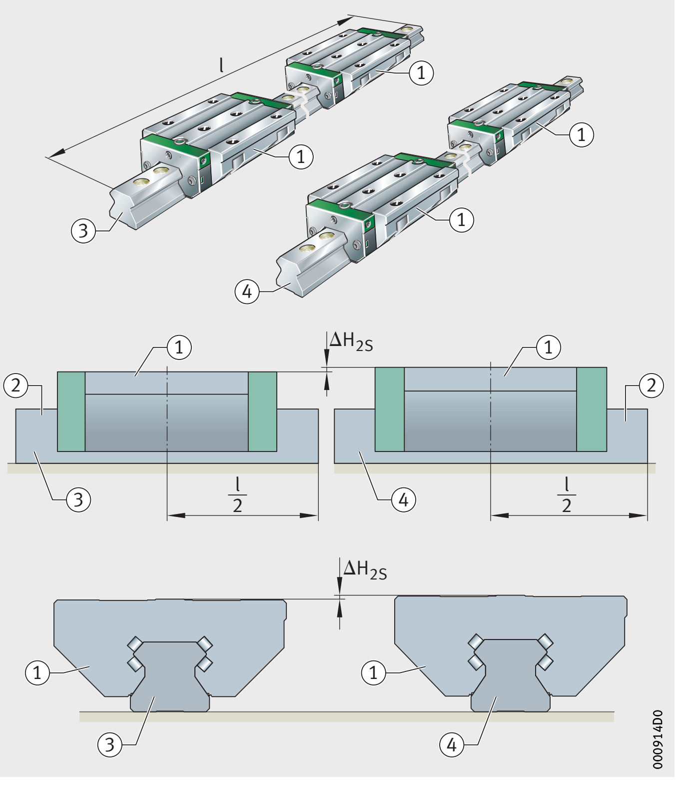


Linear recirculating roller bearing and guideway assemblies

Height sorting 2S

If there are particular requirements for the accuracy of parallel systems, it is possible to restrict the height tolerance by specific sorting.

The height difference ΔH_{2S} is measured at the centre of the guideway (l/2). At this point, the height difference between all carriages of linear recirculating roller bearing and guideway assemblies supplied as a set is max. ΔH_{2S}, *Figure 14* and table.



l = guideway length

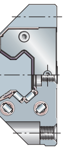
1 Any carriage
2 Guideway
3 Linear recirculating roller bearing and guideway assembly 1
4 Linear recirculating roller bearing and guideway assembly 2

Figure 14
Height sorting 2S

Height difference in 2S

Height difference	Accuracy			
	G0	G1	G2	G3
	μm	μm	μm	μm
ΔH_{2S} 1)	6	8	15	20

1) Measured at the centre of the guideway.



Positional and length tolerances of guideways

The positional tolerances are not dependent on the guideway length, *Figure 15* and tables.

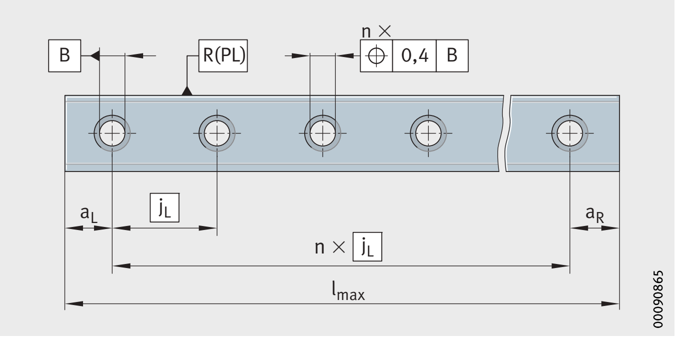


Figure 15
Positional and length tolerances of guideways

Length tolerances of guideways

Length tolerance			
Dependent on guideway length l mm			Multi-piece guideways mm
≦ 1000	1000 – 3000	> 3000	
–1	–1,5	±0,1% of guideway length	±3 over total length

If the ordering designation does not specify delivery of the guideway as a single piece, the guideway can optionally be supplied as several segments. Permissible pitch, see table.

Segments for multi-piece guideways

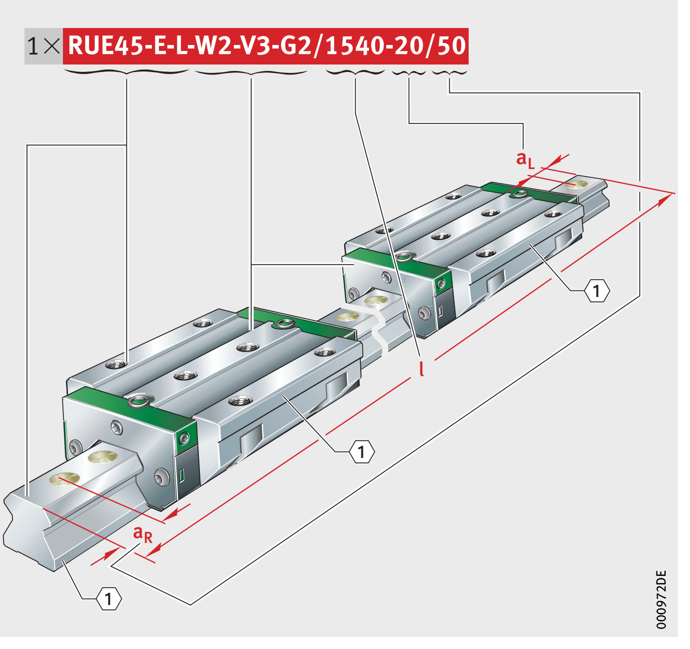
Guideway length[1)] mm	Maximum permissible number of segments
< 3 000	2
3 000– 4 000	3
4 000– 6 000	4
> 6 000	4 plus 1 segment each of 1 500 mm above 6 000 mm guideway length

1) Minimum length of one segment = 600 mm.

Ordering example, ordering designation

Unit, guideway with asymmetrical hole pattern:

Unit	Linear recirculating roller bearing and guideway assembly	RUE-E
	Size	45
	Carriage type	L
	Number of carriages per unit	W2
	Preload	V3
	Accuracy class	G2
	Length of guideway	1 540 mm
	a_L	20 mm
	a_R	50 mm
Ordering designation	1×**RUE45-E-L-W2-V3-G2/1540-20/50**, *Figure 16*	

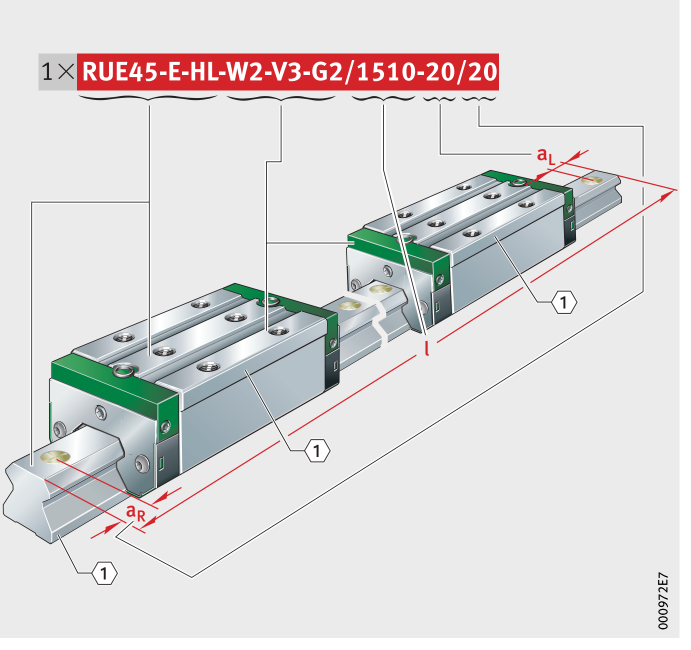


1 Locating face

Figure 16
Ordering example,
ordering designation

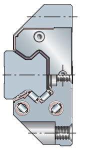
Unit, guideway with symmetrical hole pattern:

Unit	Linear recirculating roller bearing and guideway assembly	RUE-E
	Size	45
	Carriage type	HL
	Number of carriages per unit	W2
	Preload	V3
	Accuracy class	G2
	Length of guideway	1 510 mm
	a_L	20 mm
	a_R	20 mm
Ordering designation	1×**RUE45-E-HL-W2-V3-G2/1510-20/20**, *Figure 17*	



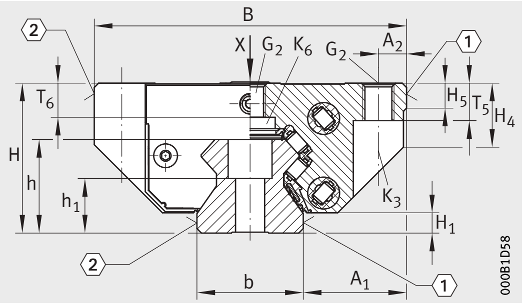
1 Locating face

Figure 17
Ordering example, ordering designation



Linear recirculating roller bearing and guideway assemblies

Full complement
Standard and L carriages



RUE..-E, RUE..-E-L

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions										
	l_{max} 2)	H	B	L 3)	A_1	J_B	b −0,005 −0,035	A_2	L_1	L_S	J_L	J_{LZ}	j_L	a_L, a_R 4) min.	max.
RUE25-E	3 930	36	70	91	23,5	57	23	6,5	65,6	2,2	45	40	30	20	23
RUE25-E-L				107					82,2						
RUE35-E	5 900	48	100	122,9	33	82	34	9	85,2	2,2	62	52	40	20	31
RUE35-E-L				148,8					111						
RUE45-E	5 888	60	120	145,9	37,5	100	45	10	104,2	2,2	80	60	52,5	20	41
RUE45-E-L				178,3					136,6						
RUE55-E	5 880	70	140	172,7	43,5	116	53	12	127	2,75	95	70	60	20	47
RUE55-E-L				210,7					165						
RUE65-E	5 865	90	170	195,5	53,5	142	63	14	141,2	2,75	110	82	75	20	61
RUE65-E-L				261,9					207,6						
RUE100-E-L	2 730	120	250	372,2	75	200	100	25	306,5	3,3	230	–	105	30	83

For further table values, see page 122 and page 123.

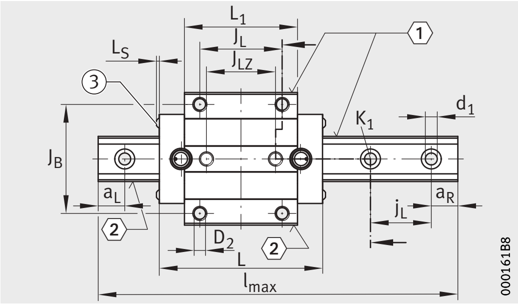
⟨1⟩ Locating face. ⟨2⟩ Marking. ③ Fixing screw.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

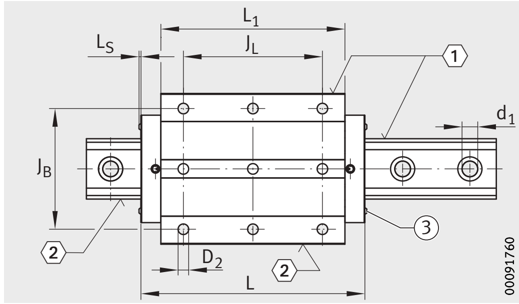
2) Maximum length of single-piece guideways. Permissible number of guideway segments, see page 117.

3) Minimum covered length for sealing the upper lubrication connectors.

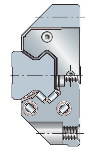
4) a_L and a_R are dependent on the guideway length.



RUE..-E, RUE..-E-L
View X rotated 90°



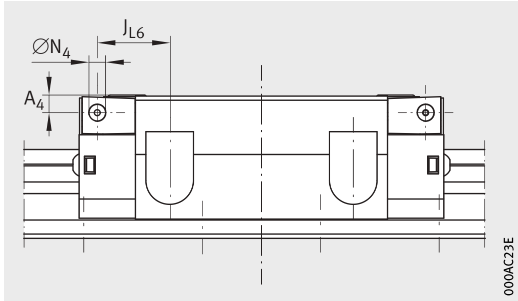
RUE100-E-L



							Fixing screws[1)]									
H_1	H_5	H_4	T_5	T_6	h	h_1	G_2		K_1		K_3		K_6		d_1	D_2
							DIN ISO 4762-12.9						DIN 7984-8.8			
						±0,5		M_A Nm		M_A Nm		M_A Nm		M_A Nm		
6,5	5,25	17,8	10	8,5	22,3	11,8	M8	24	M6	17	M6	17	M6	10	6,8	6,7
6,5	8	20,5	12	10,9	30	17,5	M10	41	M8	41	M8	41	M8	24	9	8,6
8,5	8	26	15	13,2	38	19,5	M12	83	M12	140	M10	83	M10	48	13,4	10,6
11	12	32	18	14,8	45	22,5	M14	140	M14	220	M12	140	M12	83	15,4	12,5
11,5	15	39,2	23,3	23,3	53,8	28,8	M16	220	M16	340	M14	220	M14	130	18	14,5
15	25	52,5	29	26,6	80	48	M20	470	M24	1100	M16	340	M16	220	26	17,5

Linear recirculating roller bearing and guideway assemblies

Full complement
Standard and L carriages

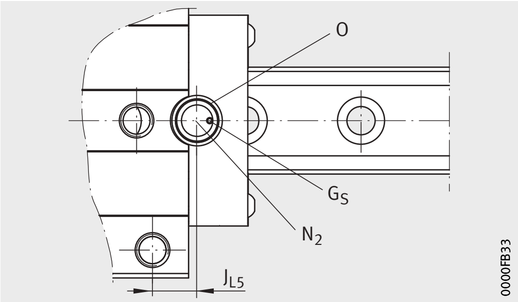


Lubrication connector on lateral face

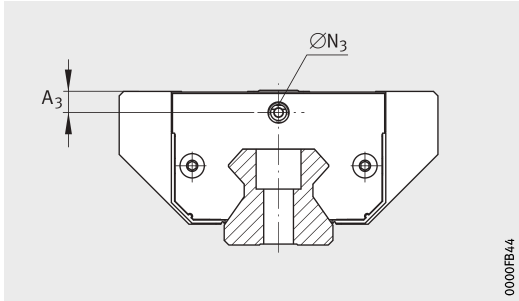
Dimension table (continued) · Dimensions in mm

Designation	Carriage		Guideway		Lubrication connectors				
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	N_3[1]	A_4	N_4[1]	J_{L6}
RUE25-E	RWU25-E	0,68	TSX25-D	2,9	7,5	M6	–	–	–
RUE25-E-L	RWU25-E-L	0,86							
RUE35-E	RWU35-E	1,75	TSX35-E	5,9	6,6	M6	5,6	M6	24,4
RUE35-E-L	RWU35-E-L	2,29							37,4
RUE45-E	RWU45-E	3,07	TSX45-E	9,4	6,6	M6	6,6	M6	27
RUE45-E-L	RWU45-E-L	4,05							43,2
RUE55-E	RWU55-E	5,24	TSX55-E	13,1	8,1	M6	8,1	M6	32,9
RUE55-E-L	RWU55-E-L	6,83							51,9
RUE65-E	RWU65-E	9,32	TSX65-E	19,5	19,6	M6	19,6	M6	34,8
RUE65-E-L	RWU65-E-L	13,8							68,1
RUE100-E-L	RWU100-E-L	35,7	TSX100-E	45,3	10,6	M6	10,6	∅5,6	65,1

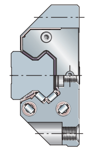
1) Maximum screw depth in end piece 6 mm.
2) Maximum diameter of lubrication hole in adjacent construction.
3) Position of lubrication hole in adjacent construction.
4) The basic load rating can only be transmitted fully if the whole thread length is used and the adjacent construction is dimensioned appropriately.
5) Supplied loose with the M-Satz.



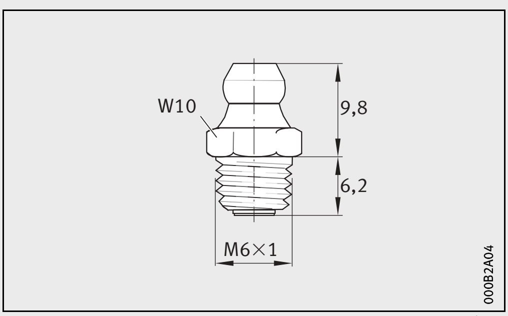
Lubrication connector on top face



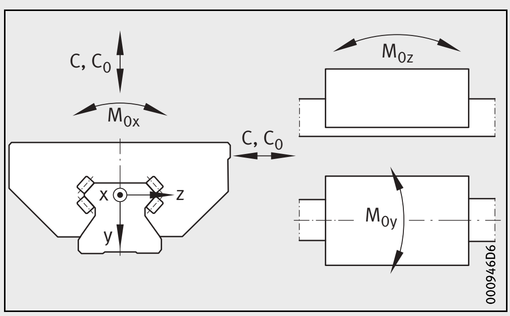
Dimensioning of lubrication connector on end face



				Load carrying capacity				
N_2[2)]	J_{L5}[3)]	G_S DIN EN ISO 4027	O DIN 3771	Basic load ratings[4)]		Moment ratings		
				dyn. C	stat. C_0	M_{0x}	M_{0y}	M_{0z}
				N	N	Nm	Nm	Nm
3	14,5	M4×4	10×1,5	28 000	65 000	350	760	680
	22,8			33 500	82 000	440	1 200	1 080
6	14,3	M4×4	10×1,5	59 000	140 000	1 200	2 150	1 950
	27,2			70 000	175 000	1 500	3 350	3 000
6	15,7	M4×4	10×1,5	92 000	215 000	1 899	4 255	3 821
	31,9			114 000	285 000	2 503	7 263	6 536
6	21,6	M4×4	10×1,5	136 000	320 000	3 287	7 404	6 667
	40,6			167 000	415 000	4 226	12 214	11 010
6	15,6	M4×4	18×1,5	200 000	435 000	5 450	12 100	10 900
	48,8			270 000	640 000	7 600	24 000	21 500
6	47,15	M4×4	10×1,5	630 000	1 490 000	33 780	80 250	72 280



Lubrication connector S25 to DIN 71412-A-M6[5)]



Load directions

Linear recirculating roller bearing and guideway assemblies

Full complement
H, HL and SL carriages

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions									
	l_{max} 2)	H	B	L 3)	A_1	J_B	b	A_2	L_1	L_S	J_L	j_L	a_L, a_R 4)	
							$^{-0,005}_{-0,035}$						min.	max.
RUE25-E-H	3 930	40	48	91	12,5	35	23	6,5	65,6	2,2	35	30	20	23
RUE25-E-HL				107					82,2		50			
RUE35-E-H	5 900	55	70	122,9	18	50	34	10	85,2	2,2	50	40	20	31
RUE35-E-HL				148,7					111		72			
RUE45-E-H	5 888	70	86	145,9	20,5	60	45	13	104,2	2,2	60	52,5	20	41
RUE45-E-HL				178,3					136,6		80			
RUE55-E-H	5 880	80	100	172,7	23,5	75	53	12,5	127	2,75	75	60	20	47
RUE55-E-HL				210,7					165		95			
RUE65-E-H	5 865	100	126	195,5	31,5	76	63	25	141,2	2,75	70	75	20	61
RUE65-E-HL				261,9					207,6		120			
RUE65-E-SL	2 730	90	126	261,9	31,5	76	63	25	207,6	2,75	120	75	20	61

For further table values, see page 126 and page 127.

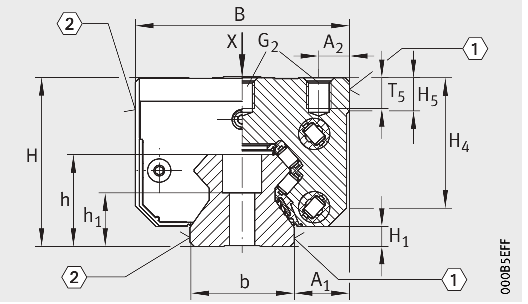
1 Locating face. 2 Marking. 3 Fixing screw.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

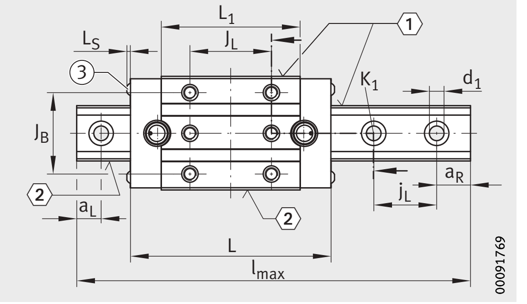
2) Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 117.

3) Minimum covered length for sealing the upper lubrication connectors.

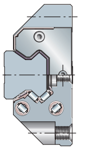
4) a_L and a_R are dependent on the guideway length.



RUE..-E-H, RUE..-E-HL, RUE..-E-SL



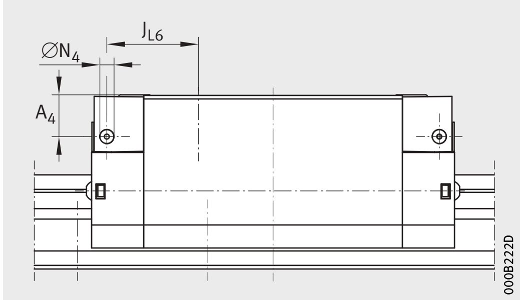
RUE..-E-H, RUE..-E-HL, RUE..-E-SL
View X rotated 90°



						Fixing screws[1)]				
H_1	H_5	H_4	T_5	h	h_1	G_2		K_1		d_1
						DIN ISO 4762-12.9				
					±0,5		M_A Nm		M_A Nm	
6,5	5,25	32,5	7,5	22,3	11,8	M6	17	M6	17	6,8
6,5	10,8	41,9	10	30	17,5	M8	41	M8	41	9
8,5	13,7	52,4	12,5	38	19,5	M10	83	M12	140	13,4
11	16	61,4	15	45	22,5	M12	140	M14	220	15,4
11,5	15	71,2	20	53,8	28,8	M14	220	M16	340	18
11,5	15	61,2	12,5	53,8	28,8	M16	340	M16	340	18

Linear recirculating roller bearing and guideway assemblies

Full complement
H, HL and SL carriages



Lubrication connector on lateral face

Dimension table (continued) · Dimensions in mm

Designation	Carriage		Guideway		Lubrication connectors				
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	N_3[1]	A_4	N_4[1]	J_{L6}
RUE25-E-H	RWU25-E-H	0,58	TSX25-D	2,9	11,5	M6	–	–	–
RUE25-E-HL	RWU25-E-HL	0,72							
RUE35-E-H	RWU35-E-H	1,67	TSX35-E	5,9	13,6	M6	12,6	M6	30,4
RUE35-E-HL	RWU35-E-HL	2,14							32,4
RUE45-E-H	RWU45-E-H	3,05	TSX45-E	9,4	16,6	M6	16,6	M6	37
RUE45-E-HL	RWU45-E-HL	3,95							43,2
RUE55-E-H	RWU55-E-H	4,94	TSX55-E	13,1	18,1	M6	18,1	M6	42,9
RUE55-E-HL	RWU55-E-HL	6,34							51,9
RUE65-E-H	RWU65-E-H	8,9	TSX65-E	19,5	29,6	M6	29,6	M6	54,8
RUE65-E-HL	RWU65-E-HL	12,89							63,1
RUE65-E-SL	RWU65-E-SL	10,8	TSX65-E	19,5	19,6	M6	19,6	M6	63,1

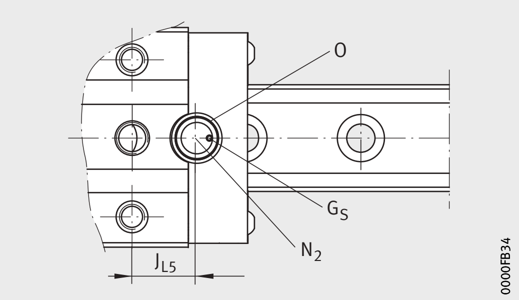
1) Maximum screw depth in end piece 6 mm.

2) Maximum diameter of lubrication hole in adjacent construction.

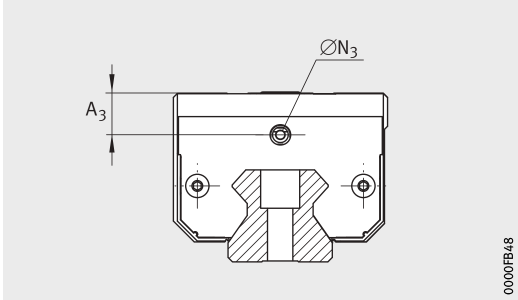
3) Position of lubrication hole in adjacent construction.

4) The basic load rating can only be transmitted fully if the whole thread length is used and the adjacent construction is dimensioned appropriately.

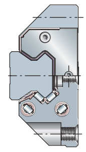
5) Supplied loose with the M-Satz.



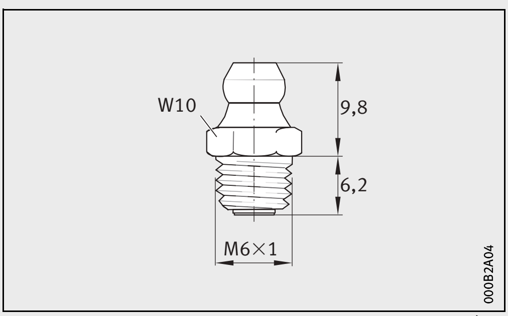
Lubrication connector on top face



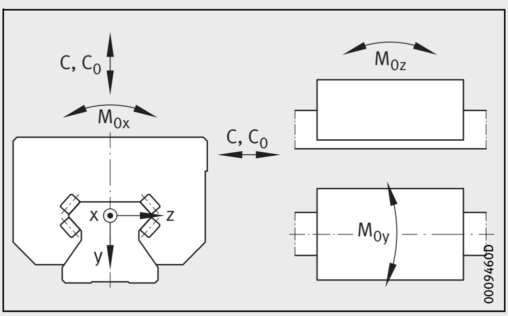
Dimensioning of lubrication connector on end face



N_2[2]	J_{L5}[3]	G_S DIN EN ISO 4027	O DIN 3771	Load carrying capacity: Basic load ratings[4] dyn. C N	stat. C_0 N	Moment ratings M_{0x} Nm	M_{0y} Nm	M_{0z} Nm
3	19,5	M4×4	10×1,5	28 000	65 000	350	760	680
	20,3			33 500	82 000	440	1 200	1 080
6	20,3	M4×4	10×1,5	59 000	140 000	1 200	2 150	1 950
	22,2			70 000	175 000	1 500	3 350	3 000
6	25,7	M4×4	10×1,5	92 000	215 000	1 899	4 255	3 821
	31,9			114 000	285 000	2 503	7 263	6 536
6	31,6	M4×4	10×1,5	136 000	320 000	3 287	7 404	6 667
	40,6			167 000	415 000	4 226	12 214	11 010
6	35,6	M4X4	18×1,5	200 000	435 000	5 450	12 100	10 900
	43,8			270 000	640 000	7 600	24 000	21 500
6	43,8	M4X4	18×1,5	270 000	640 000	7 600	24 000	21 500



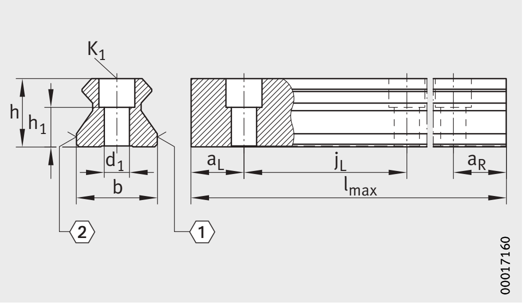
Lubrication connector S25 to DIN 71412-A-M6[5]



Load directions

Linear recirculating roller bearing and guideway assemblies

Guideways and closing methods



TSX..-D, TSX..-E

Dimension table · Dimensions in mm

Designation	For linear guidance system	Mass m ≈ kg/m	Closing plug[1)] Plastic[4)] one-piece	Plastic two-piece	Brass one-piece	Brass two-piece	Brass conical	Steel two-piece	Covering strip[2)] Adhesive bonded	Clip fit
TSX25-D			KA11-TN	KA11-TN/A	KA11-M	KA11-M/A	KA11-M-konisch		–	
TSX25-D-U	RUE25-E	2,9						–		–
TSX25-D-ADB			–	–	–	–	–		ADB13	
TSX25-D-ADK									–	ADK12
TSX35-E			KA15-TN	KA15-TN/A	KA15-M	KA15-M/A	KA15-M-konisch	–		
TSX35-E-KA+ST								KA16-ST/A	–	
TSX35-E-U	RUE35-E	5,9	–	–	–	–	–			–
TSX35-E-ADB								–	ADB18	
TSX35-E-ADK									–	ADK16
TSX45-E			KA20-TN	KA20-TN/A	KA20-M	KA20-M/A	KA20-M-konisch	–		
TSX45-E-KA+ST								KA21-ST/A	–	
TSX45-E-U	RUE45-E	9,4	–	–	–	–	–			–
TSX45-E-ADB								–	ADB23	
TSX45-E-ADK									–	ADK21

1 Locating face. 2 Marking.

1) Closing plugs, see page 180.

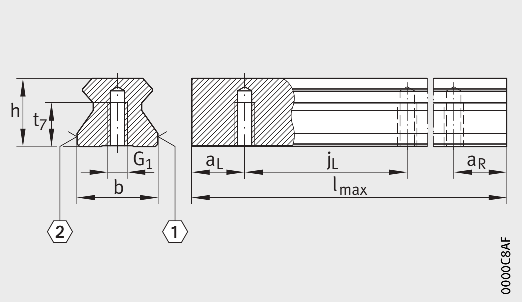
2) Covering strips, see page 183.

3) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

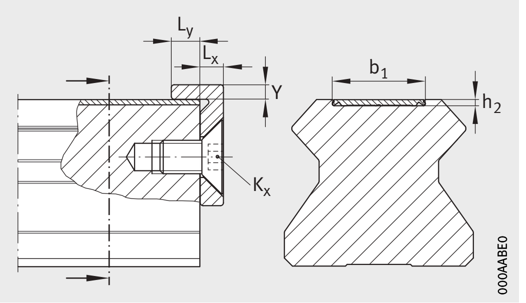
4) Standard.

5) Maximum length of single-piece guideways. Permissible number of guideway segments, see page 117.

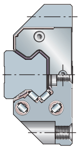
6) a_L and a_R are dependent on the guideway length.



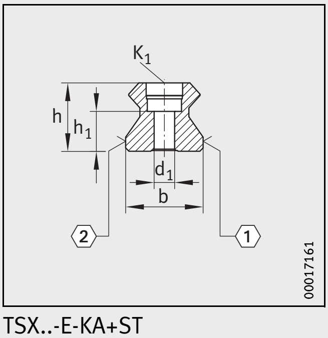
TSX..-D-U, TSX..-E-U



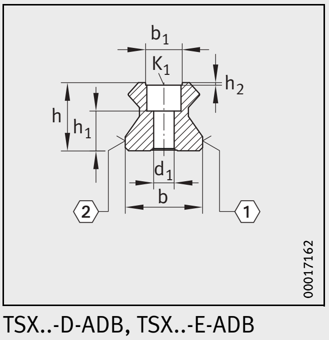
Retaining plate and covering strip



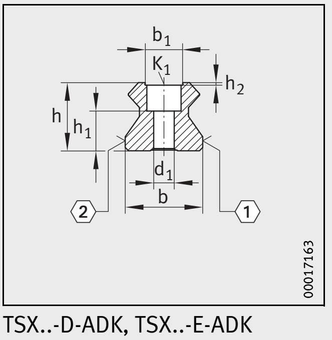
Retaining plate	Dimensions				Dimensions										Fixing screws[3)]				
	K_x	L_x	L_y	Y	l_{max}[5)]	h	b	a_L, a_R[6)]		j_L	h_1	h_2	t_7	b_1	G_1		K_1		d_1
															DIN ISO 4762-12.9				
							$^{-0,005}_{-0,035}$	min.	max.		±0,5					M_A Nm		M_A Nm	
–	–	–	–	–	3 930	22,3	23	20	23	30	11,8	–	–	–	–	–	M6	17	6,8
													12,5		M6	17	–	–	–
HPL.ADB9-B	M5	4	5	2								0,5	–	13	–	–	M6	17	6,8
												1,1		12,6					
–	–	–	–	–	5 900	30	34	20	31	40	17,5	–	15	–	–	–	M8	41	9
													–		M8	41	–	–	–
HPL.ADB17-B	M6	4	5	2,5								0,5		18	–	–	M8	41	9
												1,1		16,6					
–	–	–	–	–	5 888	38	45	20	41	52,5	19,5	–	–	–	–	–	M12	140	13,4
													20		M12	140	–	–	–
HPL.ADB17-B	M6	4	5	2,5								0,5	–	23	–	–	M12	120	13,4
												1,1		21,7					



TSX..-E-KA+ST



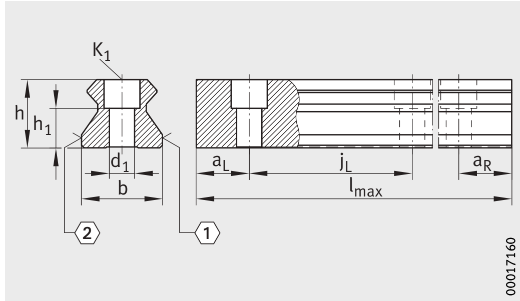
TSX..-D-ADB, TSX..-E-ADB



TSX..-D-ADK, TSX..-E-ADK

Linear recirculating roller bearing and guideway assemblies

Guideways and closing methods



TSX..-E

Dimension table (continued) · Dimensions in mm

Designation	For linear guidance system	Mass m ≈ kg/m	Closing plug[1] Plastic[4] one-piece	Closing plug[1] Plastic[4] two-piece	Closing plug[1] Brass one-piece	Closing plug[1] Brass two-piece	Closing plug[1] Brass conical	Closing plug[1] Steel two-piece	Covering strip[2] Adhesive bonded	Covering strip[2] Clip fit
TSX55-E			KA24-TN	KA24-TN/A	KA24-M	KA24-M/A	KA24-M-konisch	–		
TSX55-E-KA+ST								KA25-ST/A	–	–
TSX55-E-U	RUE55-E	13,1	–	–	–	–	–			
TSX55-E-ADB								–	ADB27	
TSX55-E-ADK									–	ADK25
TSX65-E			KA26-TN		KA26-M		KA26-M-konisch	–		
TSX65-E-KA+ST								KA27-ST/A	–	–
TSX65-E-U	RUE65-E	19,5	–	–	–	–	–			
TSX65-E-ADB								–	ADB29	
TSX65-E-ADK									–	ADK27
TSX100-E	RUE100-E-L	45,3	–	–	KA40-M	–	–	–	–	–

⟨1⟩ Locating face. ⟨2⟩ Marking.

[1] Closing plugs, see page 180.

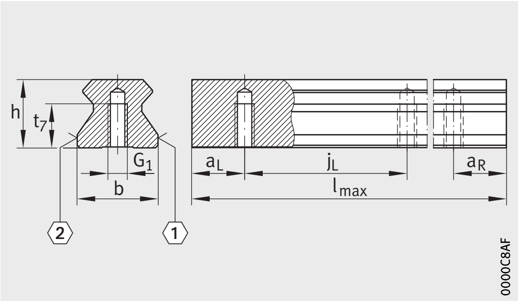
[2] Covering strips, see page 183.

[3] The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

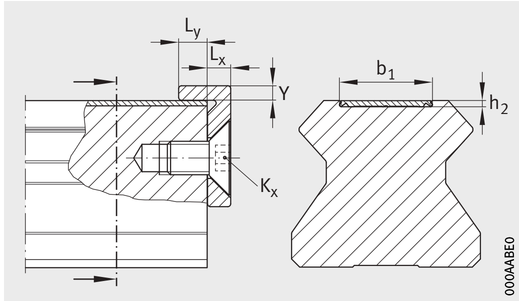
[4] Standard.

[5] Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 117.

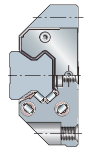
[6] a_L and a_R are dependent on the guideway length.



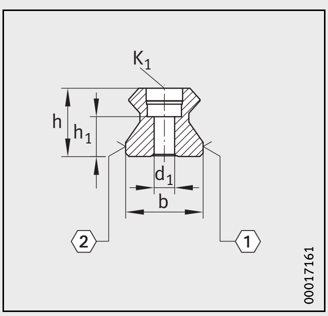
TSX..-E-U



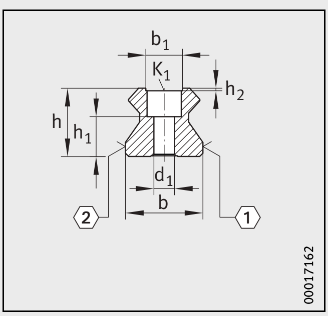
Retaining plate and covering strip



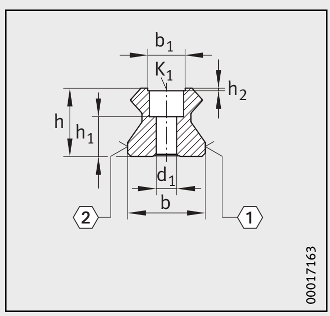
Retaining plate	Dimensions K_x	L_x	L_y	Y	Dimensions l_{max} 5)	h	b −0,005 −0,035	a_L, a_R 6) min.	max.	j_L	h_1 ±0,5	h_2	t_7	b_1	Fixing screws 3) G_1 DIN ISO 4762-12.9	M_A Nm	K_1	M_A Nm	d_1
–	–	–	–	–	5 880	45	53	20	47	60	22,5	–	–	–	–	–	M14	220	15,4
													22		M14	220	–	–	–
HPL.ADB17-B	M6	4	5	2,5								0,5	–	27	–	–	M14	220	15,4
												1,1		25,7					
–	–	–	–	–	5 865	53,8	63	20	61	75	28,8	–	–	–	–	–	M16	340	18
													25		M16	340	–	–	–
HPL.ADB17-B	M6	4	5	2,5								0,5	–	29	–	–	M16	340	18
												1,1		27,7					
–	–	–	–	–	2 730	80	100	30	83	105	48	–	–	–	–	–	M24	1 100	26



TSX..-E-KA+ST



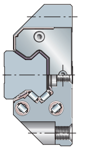
TSX..-E-ADB



TSX..-E-ADK

Sealing and lubrication elements – system KIT

Sealing and lubrication elements



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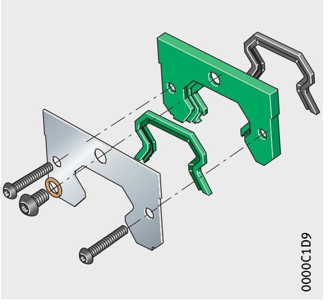
Sealing elements – system KIT

End plate with end wiper – example KIT

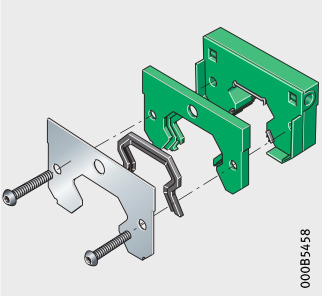
KIT



Lubrication elements – system KIT

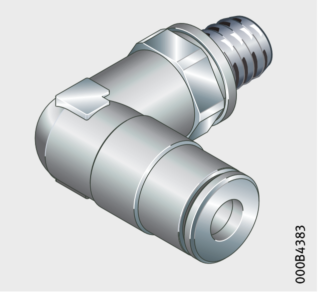
Long term lubrication unit – example KIT

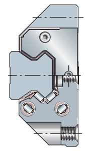
KIT



Lubrication connectors

S





Sealing and lubrication elements – system KIT

With their extensive range of standard accessories, the linear 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 sealing and lubrication 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 sealing and lubrication elements. These special accessories protect the rolling element system of the guidance systems against contamination and ensure long lubrication intervals even under the most demanding operating conditions.

KIT structure

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:

- Possible combinations, see page 162 and page 162
- Description of sealing elements, see page 136
- Overview of sealing elements, see page 148
- Description of lubrication elements, see page 140
- Overview of lubrication elements, see page 140.

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

Degree of contamination

The degree of contamination will vary depending on the market sector, the application and the environmental conditions.

The definitions at this point, see table, are therefore only an initial aid in the selection of KITs.

Definition of the degree of contamination

Degree of contamination			
Very slight	Slight	Moderate	Heavy [1]
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

[1] If this degree of contamination is present, a KIT can give only a restricted level of protection. Additional measures implemented by the customer, such as additional covers on the guidance system, will give a considerable increase in the operating life.

Sealing and lubrication elements

Sealing elements

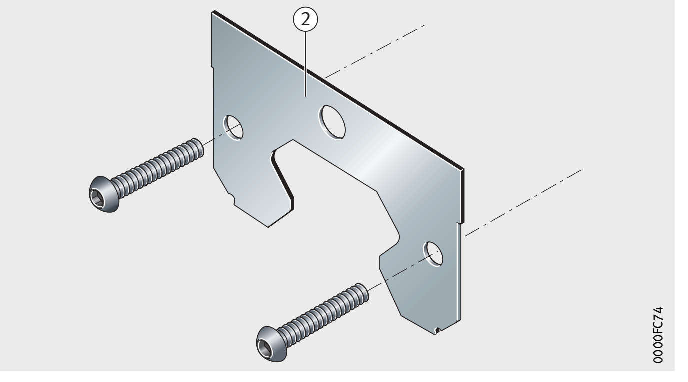
Additional sealing elements are available both for open upper lubrication holes as well as for closed upper lubrication holes:

- End plates, see page 136
- End wipers, see page 137
- Additional wipers, see page 138
- Sealing strips, see page 139.

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 seal.

A KIT.RWU..-E always contains an end plate.



② End plate, non-contact

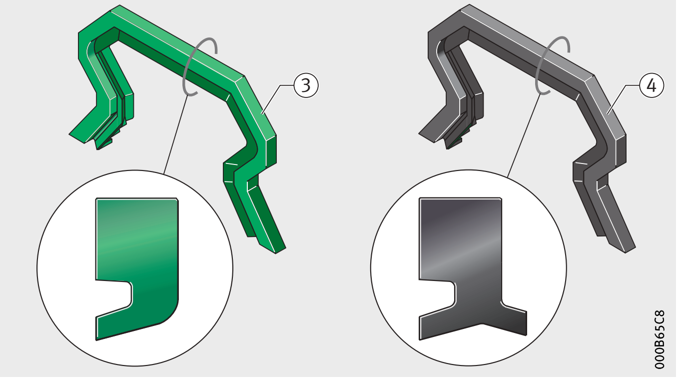
Figure 1
End plate
KIT.RWU..-210

End wipers

End wipers are contact seals that are fixed to the end faces of the carriages. End wipers protect the guidance system against the ingress of contaminant particles and can extend the relubrication intervals. The selection of the suitable sealing system is based on the application of the guidance system. End wipers are available in single lip and double lip designs (double lip as standard) and are made from special high performance materials, *Figure 2*.

Single lip end wipers have a seal lip oriented outwards that protects the carriage against the ingress of contaminant particles. In combination with oil lubrication, the single lip end wiper facilitates the rinsing out of contaminant particles (flushing effect).

Double lip end wipers have one seal lip oriented outwards and one seal lip oriented inwards. The seal lip oriented inwards prevents the escape of lubricant from the carriage, which means that an increase in the relubrication interval can be achieved. Double lip end wipers are recommended for use with grease lubrication (reservoir lubrication).



(3) End wiper, single lip, green
(4) End wiper, double lip, black

Figure 2
End wiper
Example
KIT.RWU..-100, -200

Additional wipers

Additional wipers with carrier plate

In addition to the standard seal, other additional 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 additional wipers are of a single or double lip design and are made from special high performance seal material. For protection against aggressive media (for example acids, alkalis), special end wipers made from FPM are available, *Figure 3*.

③ End wiper, single lip, green
④ End wiper, double lip, black
⑤ Carrier plate
⑮ End wiper, single lip, red (FPM)

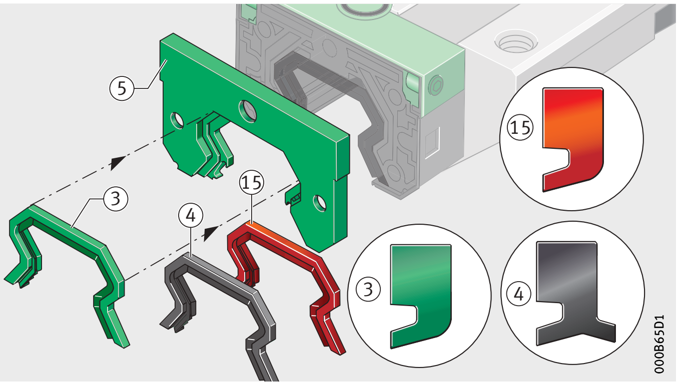


Figure 3
Additional wipers
Example
KIT.RWU..-130, -140, -350

Additional wipers with squeeze plate

Additional wipers for heavy contamination, such as dust or liquids, are used in combination with further seals and with a metallic squeeze plate.

Additional wipers are of a single lip design and are made from NBR, *Figure 4*.

⑥ Additional wiper with squeeze plate, single lip

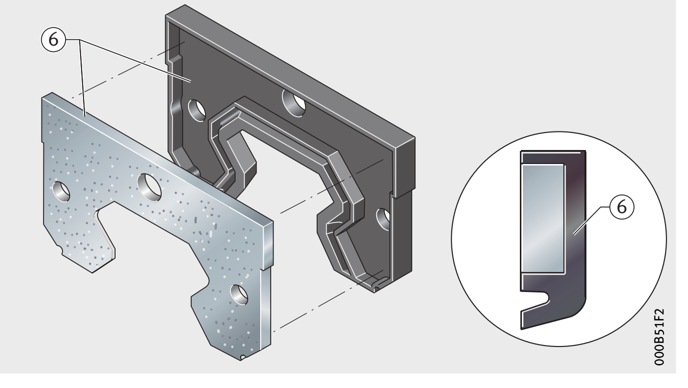


Figure 4
Additional wiper
Example
KIT.RWU..-340

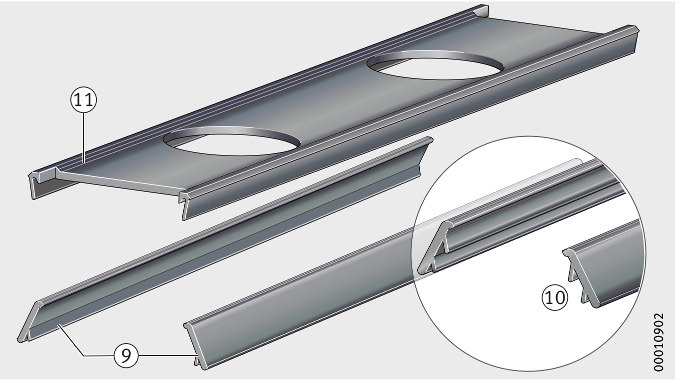
Sealing strips

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.

Single lip and double lip

Linear recirculating roller bearing and guideway assemblies are supplied with a single lip upper sealing strip as well as a double lip lower sealing strip.

Sealing strips should be used in addition to end wipers especially in applications where contamination is critical, such as those involving fine dust or aggressive coolants.



9 Lower sealing strip, single lip
10 Double lower sealing strip, double lip
11 Upper sealing strip

Figure 5
Sealing strips
KIT.RWU..-910, -920, -930

Lubrication elements

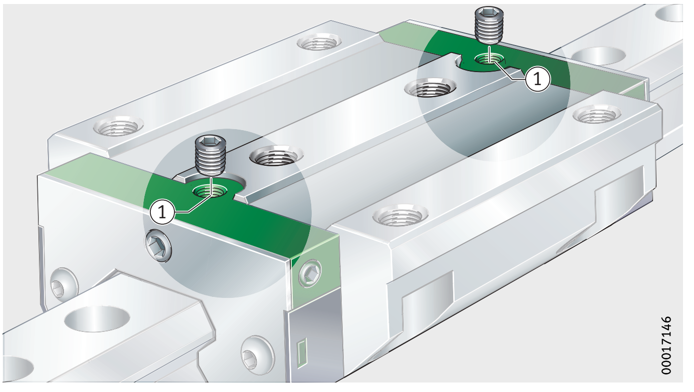
The following components are available:

- End piece with closed off upper relubrication hole, *Figure 6*
- Long term lubrication unit KIT series 400, see page 140
- Minimal lubricant quantity metering unit, KIT series 500, see page 142
- Lubricant quantity metering valves SMDS, see page 144
- Lubrication adapter plate KIT series 600, see page 145

End piece with closed upper relubrication hole

The designation of the KITs can also be used to order end pieces of the carriage with a closed upper relubrication hole (end number -..3), *Figure 6*.

KITs for minimal lubricant quantity metering units do not have an upper relubrication hole. At the time of ordering, it should be determined which KITs are required.



① Closed off upper relubrication hole in the end piece

Figure 6
End piece with closed off upper relubrication hole
KIT.RWU..-..3

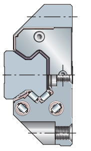
Long term lubrication unit KIT series 400

For linear recirculating roller bearing and guideway assemblies RUE..-E, KITs with a long term lubrication unit are available.

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, however, 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. This can be achieved using the long term lubrication unit, *Figure 7*, page 141.



Grease operating life and relubrication interval

If guidance systems cannot be relubricated, the grease operating life becomes the decisive factor, see page 50. This indicates the length of time for which a grease can be used without its function being impaired.

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.

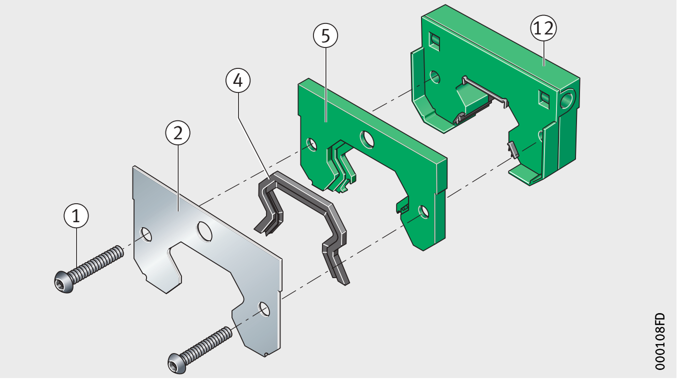
If the shortened relubrication intervals are not observed, the guidance system will fail before the end of the expected operating life. With decreasing grease operating life, the operating life of the linear guidance system is thus reduced.

Longer operating life by means of a long term lubrication unit

The volume of grease in the carriage is increased by the lubrication pockets in the saddle plate. If a long term lubrication unit of KIT series 400 is also fitted, this gives an additional improvement in the lubricant balance, *Figure 7*. 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, it is possible to achieve long relubrication intervals or even complete freedom from maintenance.

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.



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

Figure 7
Long term lubrication unit

With initial greasing

Due to their initial greasing, long term lubrication units are ready for immediate operation. If they are ordered together with an RUE, the RUE and long term lubrication unit are greased.

If the long term lubrication unit is retrofitted, it is absolutely essential that the carriage has an initial greasing.
Initial grease quantities, see page 47.

The long term lubrication unit must always be used on both sides of the carriage, in order to achieve the stated bearing factor K_{LF} and thus the maximum operating life.

Double lip end seal

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

Long term lubrication units should not be used with Corrotect-coated guideways.

Minimal lubricant quantity metering unit KIT series 500

The lubricant metering device is screw mounted to the end face of the carriage and can be connected to all conventional central lubrication systems, *Figure 8* and dimension table.

The piston distributors in the aluminium body lubricate all four raceways evenly, irrespective of position, economically and with the smallest possible quantities of precisely metered lubricant.

The lubrication is fed in from the side via one line. The pressure must be measured directly at the metering unit:

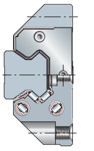
Pressure ranges for oil

- p_{min} = 6 bar
  (minimum pressure for initiation of a lubrication impulse)
- p_{max} = 38 bar.

In idle mode, the pressure level present must not exceed 0,5 bar.

Pressure ranges for flowable grease

- p_{min} = 12 bar
  (minimum pressure for initiation of a lubrication impulse)
- p_{max} = 38 bar.



Coupling piece

The coupling piece for connection to the central lubrication system has a union nut similar to DIN 3871-A, is fitted on the left or right side of the metering unit and is suitable for connecting pipes with an outside diameter of 4 mm.

!

In the case of RUE..-E-H and RUE..-E-HL, the lubrication connector protrudes laterally approx. 9 mm from the carriage.

KIT series 500

⑭ Minimal lubricant quantity metering unit

⑮ The lateral relubrication hole in the end piece must not be used

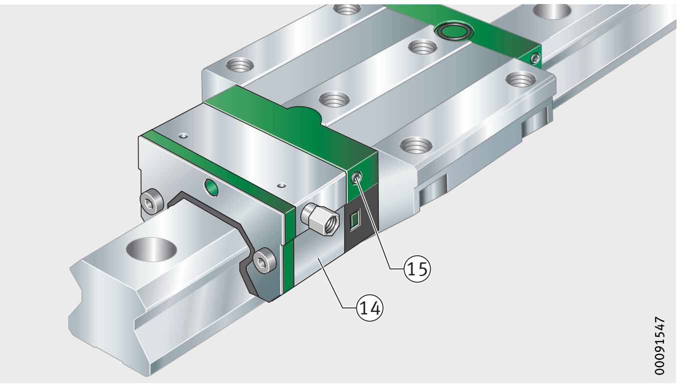


Figure 8
Minimal lubricant quantity metering unit KIT.RWU..-500

End piece

The lubrication adapter plate SMVT for the minimal lubricant quantity metering unit differs from the lubrication adapter plate for a carriage of standard design.

If the minimal lubricant quantity metering unit is to be fitted by the customer, the lubrication adapter plate included in the scope of delivery must always be replaced. The lubrication adapter plate must be replaced very carefully, taking account of the mounting manual MON 41.

Lubricant and metering quantities

The lubricant quantity is determined by the number of lubrication impulses. The metering unit is supplied with metering quantities of 0,03 cm^3 per impulse and metering unit. A metering unit contains four metering elements.

Suitable lubricants

Oils CLP to DIN 55517 and HLP to DIN 51524 should be used in preference.

At operating temperatures between 0 °C and +70 °C, the viscosity should be between ISO VG 32 and ISO VG 68.

When using oil, the permissible viscosity range is from 20 to 2 000 mm^2/s (cSt). A 25 μm oil filter is recommended.

Flowable greases of the NLGI grade 00 and 000 are used for operation of the minimal lubricant quantity metering unit.

The maximum operating temperature is +80 °C.

Lubricant quantity metering valves

Lubricant quantity metering valves for oil lubrication

The lubricant quantity metering valves SMDS are, when supplied with oil as the lubricant, an economical solution for reducing lubricant consumption while also achieving high functional security. Comparison of oil quantities for RUE..-E with SMDS, see table, page 44.

Optimum lubricant supply

The lubricant quantity metering valves replace the conventional O rings in the return guides of the rolling element return channels. The lubricant quantity metering valves exactly fit the position of the O rings and replace these while retaining the design envelope of the carriage, *Figure 9*.

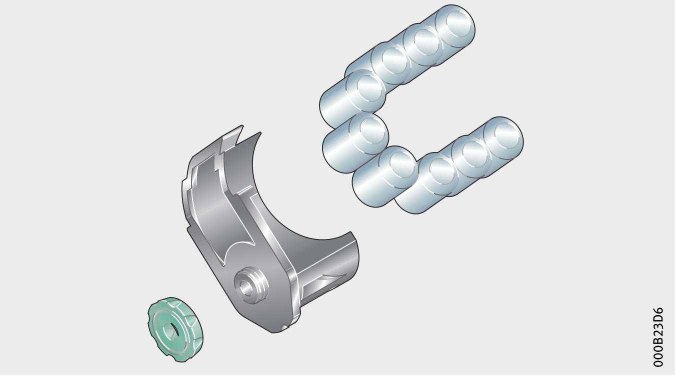


Figure 9
Lubricant quantity metering valves SMDS

The metering valves seal off the lubrication ducts and only open during the lubrication impulse. Between the lubrication impulses, the lubricant quantity metering valves prevent the lubrication ducts from running dry irrespective of position. This and the uniform opening pressure facilitate an optimum supply of lubricant.

Lubricant distribution

Where the mounting position is at an angle of 90° (wall mounting), the lubricant quantity metering valves offer an optimum supply of lubricant.

If the lubrication ducts are initially filled with oil, the lubricant quantity metering valves seal off the lubrication ducts, thus preventing the ducts from running dry, and support the optimum and uniform supply of lubricant to the rows of rolling elements. The lubricant quantity metering valves give effective prevention of damage to the raceways and rolling elements up to failure of the guidance system.

Lubricant consumption

A linear recirculating roller bearing and guideway assembly RUE35-E with a load ratio C/P = 4 and a velocity of 2 m/s can, with the aid of the lubricant quantity metering valves, save approx. 0,025 cm^3 of lubricant per hour in comparison with the standard design while using an identical design envelope.

Design

The guidance systems must be ordered for delivery with the lubricant quantity metering valves, for example RUE35-E-SMDS-L. Retrofitting by the customer is not possible. The delivery of RUE..-E includes a mounting set M-Satz. This M-Satz contains one lubrication connector. The use of SMDS does not require a further lubrication connector. One lubrication connector per carriage is sufficient. Optionally, other lubrication connectors are available, see page 140.

Lubrication adapter plate KIT series 600

The lubrication adapter plate is screwed to the end face of the carriage. It comprises an aluminium body with integrated lubrication ducts and, on each side, 2 lateral threads M6. The useful thread length is max. 8 mm for accommodating the lubrication connectors. Depending on the design, connectors for manual lubricators or central lubrication systems and screw plugs are already fitted.

Contact surface for bellows

The screw heads for locating the lubrication adapter plate and the screw plug for sealing off the end face relubrication adapter plate are arranged countersunk in the body of the lubrication adapter plate. This gives a flat contact surface on the end face of the carriage, which can be used as an interface for the location of fasteners such as bellows.

① Fixing screw
② Grub screw for closing off the relubrication hole
③ Aluminium body
④ Lubrication connector to DIN 71412-A
⑤ Central lubrication connector with sealing ring
⑥ Screw plug with sealing ring

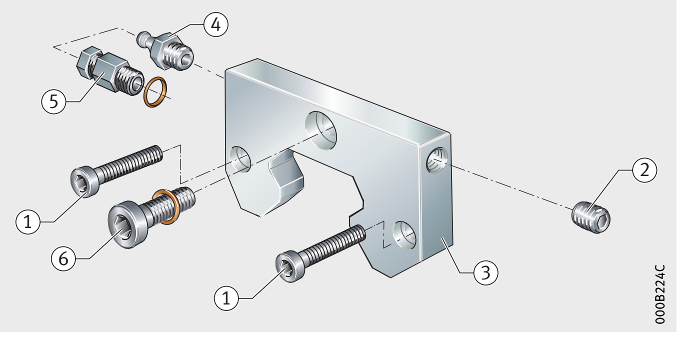


Figure 10
Lubrication adapter plate KIT series 600

Configuration of KIT.RWU

Unless indicated otherwise, the locating face is defined as being at the top. The KIT designation is given in the sequence left/centre/right. If no KIT numbers are indicated, the standard version will be supplied, see page 148.

KIT components can be fitted on the left, centre and right of the carriage, *Figure 11*.

RWU..-E-130/900/120

1 Locating face
2 KIT.RWU..-E-130
3 KIT.RWU..-E-900
4 KIT.RWU..-E-120

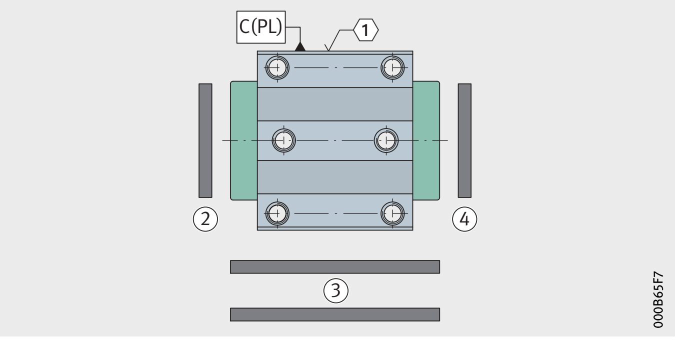


Figure 11
Example of KIT configuration

Retrofitting by the customer

The KITs available for retrofitting by the customer are indicated accordingly as retrofittable in the KIT tables, see page 148.

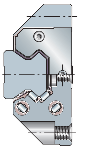
KIT left, right

The KIT components are identical for all carriage designs, with the exception of KIT series 500. The KIT end number -..3 describes the closed upper relubrication hole in the end piece, *Figure 6*, page 140.
The end piece (lubrication distributor plate) is not a KIT component, so the KIT end number -..3 is not taken into consideration in retrofitting by the customer.

KIT components for retrofitting by the customer must be ordered for all types and designs using the designation KIT.RWU..-E as well as the suffix -OS and the KIT end number -..0.

The scope of delivery includes the wear components and fixing screws required for retrofitting.

Example: **KIT.RWU35-E-OS-340**.



This procedure excludes the lubrication elements KIT series 500 and KIT series 600.

In the case of KIT series 500, there is no upper relubrication hole. The height of the carriage must be taken into consideration and the end piece must be replaced, see page 142 and dimension tables.

In the case of KIT series 600, the upper relubrication hole is not taken into consideration and the suffix -OS must be added, see dimension tables.

KIT centre

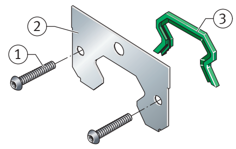
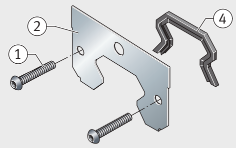
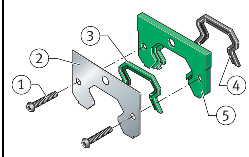
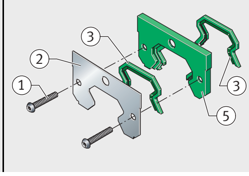
If retrofitting is to be carried out by the customer, attention must be paid to the carriage length.

KIT components for retrofitting by the customer of long carriages must be ordered using the designation KIT.RWU..-E-L.

Example: **KIT.RWU35-E-L-930**.

Sealing and lubrication elements

Sealing and lubrication elements KIT (left, right) for RUE..-E

Designation and KIT end number KIT.RWU..-E[2]		Image	Description
Upper lubrication hole open			
yes	no		
100	**103**		1 Fixing screw K_1 2 End plate, non-contact 3 End seal, single lip
120[3]	**123**		1 Fixing screw K_1 2 End plate, non-contact 4 End seal, double lip
130	**133**		1 Fixing screw K_1 2 End plate, non-contact 3 End seal, single lip 4 End seal, double lip 5 Carrier plate
140	**143**		1 Fixing screw K_1 2 End plate, non-contact 3 End seal, single lip 5 Carrier plate

1 Locating face

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

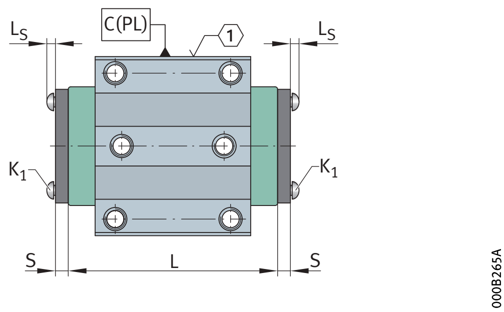
The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations of the KITs, see page 162.
Recommended lubrication connectors, see page 164.

1) Definition, see page 135.

2) In the case of retrofitting by the customer, the suffix OS must be stated. The condition of the upper relubrication hole is not taken into consideration. The KIT end number is always -..0. See Retrofitting by the customer, page 146. Ordering example: KIT.RWU35-E-OS-100.

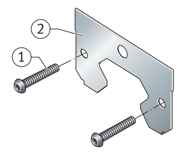
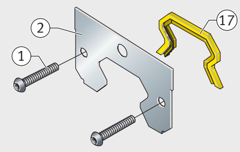
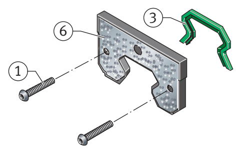
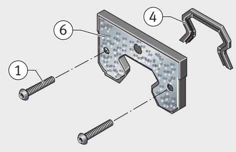
3) Standard for RUE..-E.

Degree of contamination[1)			Size	Retrofittable	Tolerances			Increase in displacement force				Designation and KIT end number KIT.RWU..-E[2)	
												Upper lubrication hole open	
Slight	Moderate	Heavy			K_1	L_S mm	S mm	None	Slight	Moderate	Heavy	yes	no
■	■	–	–	■	–	–	–	–	–	■	–	**100**	**103**
			35		M4×25	2,2	0						
			45		M4×30	2,2							
			55		M5×30	2,75							
			–		–	–	–						
			–		–	–	–						
■	■	–	25	■	M4×20	2,2	0	–	–	■	–	**120**[3)	**123**
			35		M4×25	2,2							
			45		M4×30	2,2							
			55		M5×30	2,75							
			65		M5×35	2,75							
			100		M6×40	4,5							
■	■	■	25	■	M4×20	2,2	4,2	–	–	–	■	**130**	**133**
			35		M4×30	2,2	5,8						
			45		M4×35	2,2							
			55		M5×35	2,75							
			–		–	–	–						
			–		–	–	–						
■	■	■	25	■	M4×20	2,2	0	–	–	–	■	**140**	**143**
			35		M4×30	2,2	5,8						
			45		M4×35	2,2							
			55		M5×35	2,75							
			–		–	–	–						
			–		–	–	–						



Sealing and lubrication elements

Sealing and lubrication elements KIT (left, right) for RUE..-E (continued)

Designation and KIT end number KIT.RWU..-E[2]		Image	Description
Upper lubrication hole open			
yes	no		
210	**213**		① Fixing screw K_1 ② End plate, non-contact
220	**223**		① Fixing screw K_1 ② End plate, non-contact ⑰ End seal, single lip, smooth running
300	**303**		① Fixing screw K_1 ③ End seal, single lip ⑥ End seal, single lip, NBR, with squeeze plate
340	**343**		① Fixing screw K_1 ④ End seal, double lip ⑥ End seal, single lip, NBR, with squeeze plate

⟨1⟩ Locating face

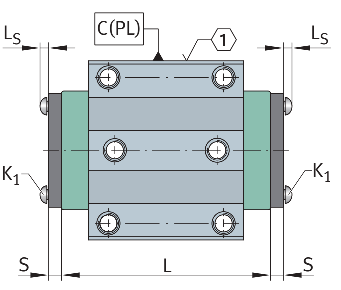
Attention!
The table is only intended as a guide.
Specific application conditions must be taken into consideration when selecting the elements.

The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations of the KITs, see page 162.
Recommended lubrication connectors, see page 164.

[1] Definition, see page 135.

[2] In the case of retrofitting by the customer, the suffix OS must be stated.
The condition of the upper relubrication hole is not taken into consideration.
The KIT end number is always -..0. See Retrofitting by the customer, page 146.
Ordering example: KIT.RWU35-E-OS-220.

Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number KIT.RWU..-E[2]	
												Upper lubrication hole open	
Slight	Moder-ate	Heavy			K_1	L_S mm	S mm	None	Slight	Moder-ate	Heavy	yes	no
■	–	–	25	■	M4×20	2,2	0	■	–	–	–	**210**	**213**
			35		M4×25	2,2							
			45		M4×30	2,2							
			55		M5×30	2,75							
			65		M5×35	2,75							
			100		M6×40	4,5							
■	■	–	–	■	–	–	–	–	■	–	–	**220**	**223**
			35		M4×25	2,2	0						
			45		M4×30	2,2							
			55		M5×30	2,75							
			–		–	–	–						
			–		–	–	–						
■	■	–	–	■	–	–	–	–	–	–	■	**300**	**303**
			35		M4×30	2,2	5,4						
			45		M4×35	2,2							
			55		M5×35	2,75							
			–		–	–	–						
			–		–	–	–						
■	■	■	25	■	M4×20	2,2	4,2	–	–	–	■	**340**	**343**
			35		M4×30	2,2	5,4						
			45		M4×35	2,2							
			55		M5×35	2,75							
			65		M5×45	2,75							
			100		M5×50	4,5							



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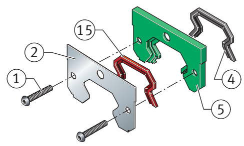
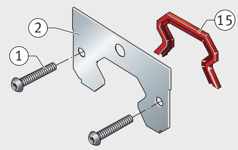
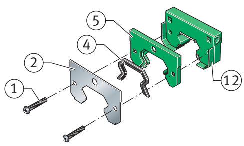
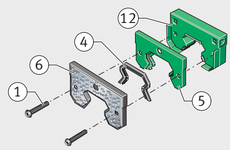
Sealing and lubrication elements KIT (left, right) for RUE..-E (continued)

Designation and KIT end number KIT.RWU..-E[2]		Image	Description
Upper lubrication hole open			
yes	no		
350	**353**		① Fixing screw K_1 ② End plate, non-contact ④ End seal, double lip ⑤ Carrier plate ⑮ End seal, single lip, FPM
380	**383**		① Fixing screw K_1 ② End plate, non-contact ⑮ End seal, single lip, FPM
410	**413**		① Fixing screw K_1 ② End plate, non-contact ④ End seal, double lip ⑤ Carrier plate ⑫ LZU housing unit
420	**423**		① Fixing screw K_1 ④ End seal, double lip ⑤ Carrier plate ⑥ End seal, single lip, NBR, with squeeze plate ⑫ LZU housing unit

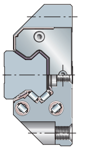
1 Locating face

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

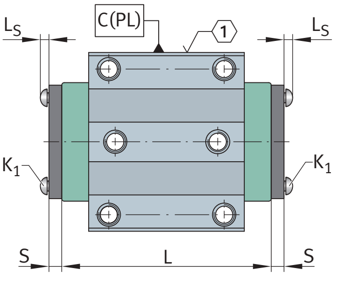
The sealing and lubrication elements KIT can be combined flexibly. Recommended and possible combinations of the KITs, see page 162. Recommended lubrication connectors, see page 164.

1) Definition, see page 135.

2) In the case of retrofitting by the customer, the suffix OS must be stated. The condition of the upper relubrication hole is not taken into consideration. The KIT end number is always -..0. See Retrofitting by the customer, page 146. Ordering example: KIT.RWU35-E-OS-350.

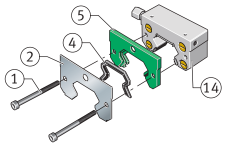
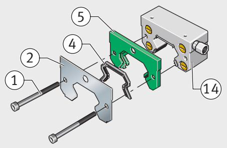
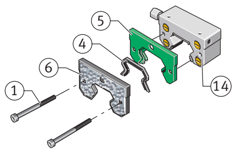
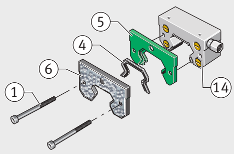
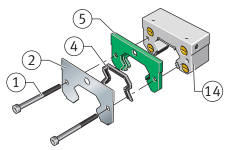


Degree of contamination[1] Slight	Moderate	Heavy	Size	Retrofittable	Tolerances K_1	L_S mm	S mm	Increase in displacement force None	Slight	Moderate	Heavy	Designation and KIT end number KIT.RWU..-E[2] Upper lubrication hole open yes	no
■	■	■	25	■	M4×20	2,2	4,2	–	–	–	■	**350**	**353**
			35		M4×30	2,2	5,8						
			45		M4×35	2,2							
			55		M5×35	2,75							
			65		M5×40	2,75							
			–		–	–	–						
■	■	–	–	■	–	–	–	–	–	■	–	**380**	**383**
			35		M4×25	2,2	0						
			45		M4×30	2,2							
			55		M5×30	2,75							
			65		M5×35	2,75							
			100		M6×40	4,5							
■	■	–	25	■	M4×30	2,2	13,2	–	–	–	■	**410**	**413**
			35		M4×45	2,2	17,5						
			45		M4×45	2,2	17,5						
			55		M5×45	2,75	18,2						
			65		M5×50	2,75	18,4						
			–		–	–	–						
■	■	■	25	■	M4×30	2,2	13,2	–	–	–	■	**420**	**423**
			35		M4×45	2,2	20,25						
			45		M4×45	2,2	20,25						
			55		M5×45	2,75	21,2						
			65		M5×50	2,75	21,4						
			–		–	–	–						



Sealing and lubrication elements

Sealing and lubrication elements KIT (left, right) for RUE..-E (continued)

Designation and KIT end number KIT.RWU..-E[2]	Image	Description
510		① Fixing screw K_1 ② End plate, non-contact ④ End seal, double lip ⑤ Carrier plate ⑭ SMDE unit, lubrication connector on right
511		① Fixing screw K_1 ② End plate, non-contact ④ End seal, double lip ⑤ Carrier plate ⑭ SMDE unit, lubrication connector on left
530		① Fixing screw K_1 ④ End seal, double lip ⑤ Carrier plate ⑥ End seal, single lip, NBR, with squeeze plate ⑭ SMDE unit, lubrication connector on right
531		① Fixing screw K_1 ④ End seal, double lip ⑤ Carrier plate ⑥ End seal, single lip, NBR, with squeeze plate ⑭ SMDE unit, lubrication connector on left
540		① Fixing screw K_1 ② End plate, non-contact ④ End seal, double lip ⑤ Carrier plate ⑭ SMDE unit, lubrication connector closed off on both sides

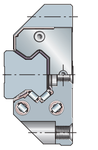
⟨1⟩ Locating face

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

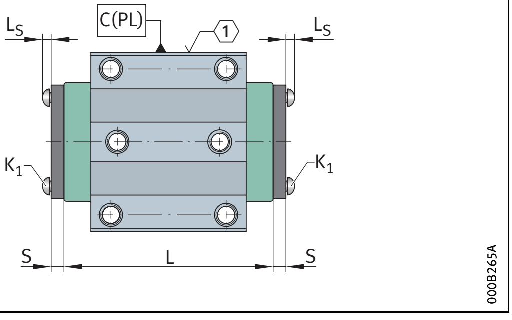
The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations of the KITs, see page 162.
Recommended lubrication connectors, see page 164.

[1] Definition, see page 135.

[2] In the KIT series 500, there is no upper relubrication hole. These KITs are supplied together with special end pieces (lubrication adapter plate), see mounting manual MON 41. The carriage can only be lubricated by means of the minimal lubricant quantity metering unit. If retrofitting is to be carried out by the customer, see page 146.

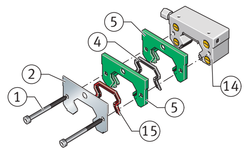
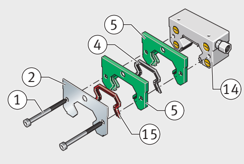
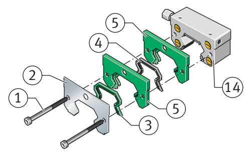
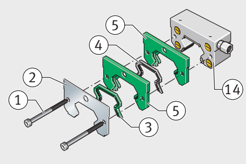


Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_1	L_S mm	S mm	None	Slight	Moder-ate	Heavy	KIT.RWU..-E[2]
■	■	–	–	■	–	–	–	–	–	■	–	**510**
			35		M4×55	4	31,8					
			45		M4×60	4						
			55		M5×60	5						
			65		M5×65	5						
			–		–	–	–					
■	■	–	–	■	–	–	–	–	–	■	–	**511**
			35		M4×55	4	31,8					
			45		M4×60	4						
			55		M5×60	5						
			65		M5×65	5						
			–		–	–	–					
■	■	■	–	■	–	–	–	–	–	–	■	**530**
			35		M4×55	4	37,2					
			45		M4×60	4						
			55		M5×60	5						
			65		M5×65	5						
			–		–	–	–					
■	■	■	–	■	–	–	–	–	–	–	■	**531**
			35		M4×55	4	37,2					
			45		M4×60	4						
			55		M5×60	5						
			65		M5×65	5						
			–		–	–	–					
■	■	–	–	■	–	–	–	–	–	■	–	**540**
			35		M4×55	4	31,8					
			45		M4×60	4						
			55		M5×60	5						
			65		M5×65	5						
			–		–	–	–					



Sealing and lubrication elements

Sealing and lubrication elements KIT (left, right) for RUE..-E (continued)

Designation and KIT end number KIT.RWU..-E[2]	Image	Description
550		1 Fixing screw K_1 2 End plate, non-contact 4 End seal, double lip 5 Carrier plate 14 SMDE unit, lubrication connector on right 15 End seal, single lip, FPM
551		1 Fixing screw K_1 2 End plate, non-contact 4 End seal, double lip 5 Carrier plate 14 SMDE unit, lubrication connector on left 15 End seal, single lip, FPM
560		1 Fixing screw K_1 2 End plate, non-contact 3 End seal, single lip 4 End seal, double lip 5 Carrier plate 14 SMDE unit, lubrication connector on right
561		1 Fixing screw K_1 2 End plate, non-contact 3 End seal, single lip 4 End seal, double lip 5 Carrier plate 14 SMDE unit, lubrication connector on left

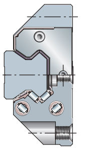
1 Locating face

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

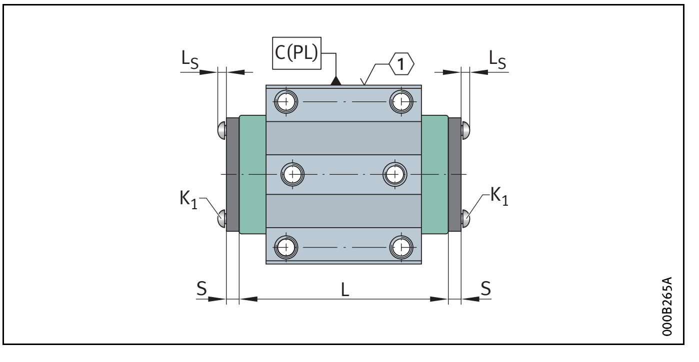
The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations of the KITs, see page 162.
Recommended lubrication connectors, see page 164.

[1] Definition, see page 135.

[2] In the KIT series 500, there is no upper relubrication hole. These KITs are supplied together with special end pieces (lubrication adapter plate), see mounting manual MON 41. The carriage can only be lubricated by means of the minimal lubricant quantity metering unit. If retrofitting is to be carried out by the customer, see page 146.

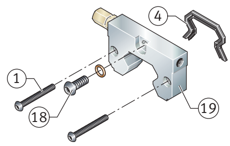
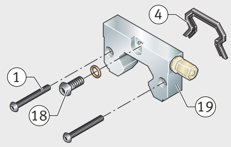
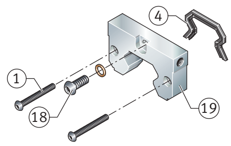
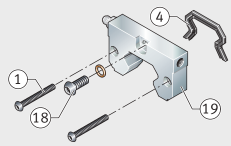
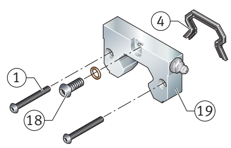


Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_1	L_S mm	S mm	None	Slight	Moder-ate	Heavy	KIT.RWU..-E[2]
■	■	■	–	■	–	–	–	–	–	–	■	**550**
			35		M4×55	4	37,2					
			45		M4×60	4						
			55		M5×60	5						
			65		M5×65	5						
			–		–	–	–					
■	■	■	–	■	–	–	–	–	–	–	■	**551**
			35		M4×55	4	37,2					
			45		M4×60	4						
			55		M5×60	5						
			65		M5×65	5						
			–		–	–	–					
■	■	■	–	■	–	–	–	–	–	■	–	**560**
			35		M4×55	4	37,2					
			45		M4×60	4						
			55		M5×60	5						
			–		–	–	–					
			–		–	–	–					
■	■	■	–	■	–	–	–	–	–	■	–	**561**
			35		M4×55	4	37,2					
			45		M4×60	4						
			55		M5×60	5						
			–		–	–	–					
			–		–	–	–					



Sealing and lubrication elements

Sealing and lubrication elements KIT (left, right) for RUE..-E (continued)

Designation and KIT end number KIT.RWU..-E[2]	Image	Description
610		1 Fixing screw K_1 4 End seal, double lip 18 Screw plug with sealing washer 19 Lubrication adapter plate, lubrication connector on right side for connection to central lubrication system
611		1 Fixing screw K_1 4 End seal, double lip 18 Screw plug with sealing washer 19 Lubrication adapter plate, lubrication connector on left side for connection to central lubrication system
614		1 Fixing screw K_1 4 End seal, double lip 18 Screw plug with sealing washer 19 Lubrication adapter plate, lubrication connectors closed off on both sides
615		1 Fixing screw K_1 4 End seal, double lip 18 Screw plug with sealing washer 19 Lubrication adapter plate, lubrication connector on right side for connection to manual lubricators
616		1 Fixing screw K_1 4 End seal, double lip 18 Screw plug with sealing washer 19 Lubrication adapter plate, lubrication connector on left side for connection to manual lubricators

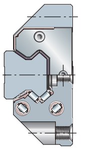
1 Locating face

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

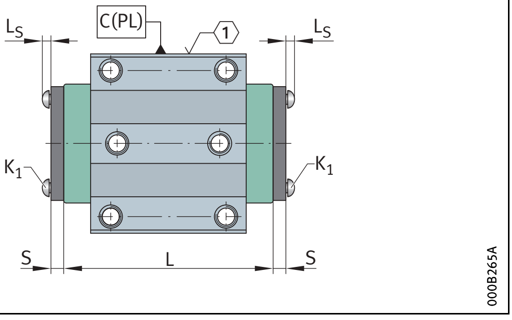
The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations of the KITs, see page 162.
Recommended lubrication connectors, see page 164.

[1] Definition, see page 135.

[2] In the case of retrofitting by the customer, the suffix OS must be stated.
The condition of the upper relubrication hole is not taken into consideration.
The KIT end number is always -..0. See Retrofitting by the customer, page 146.
Ordering example: KIT.RWU35-E-OS-616.

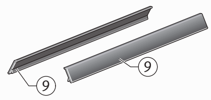
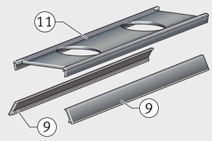
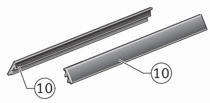
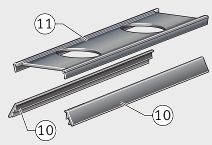


Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_1	L_S	S	None	Slight	Moder-ate	Heavy	KIT.RWU..-E[2]
			–		–	–	–					**610**
			35		M4×35		14,6					
			45		M4×40	0	15,6					
■	■	–	55	■	M5×40		14,6	–	–	■	–	
			65		M5×45		14					
			–		–	–	–					
			–		–	–	–					**611**
			35		M4×35		14,6					
			45		M4×40	0	15,6					
■	■	–	55	■	M5×40		14,6	–	–	■	–	
			65		M5×45		14					
			–		–	–	–					
			–		–	–	–					**614**
			35		M4×35		14,6					
			45		M4×40	0	15,6					
■	■	–	55	■	M5×40		14,6	–	–	■	–	
			65		M5×45		14					
			–		–	–	–					
			–		–	–	–					**615**
			35		M4×35		14,6					
			45		M4×40	0	15,6					
■	■	–	55	■	M5×40		14,6	–	–	■	–	
			65		M5×45		14					
			–		–	–	–					
			–		–	–	–					**616**
			35		M4×35		14,6					
			45		M4×40	0	15,6					
■	■	–	55	■	M5×40		14,6	–	–	■	–	
			65		M5×45		14					
			–		–	–	–					



Sealing and lubrication elements

Sealing and lubrication elements KIT (centre) for RUE..-E

Designation and KIT end number KIT.RWU..-E[4]	Image	Description
900		⑨ Lower sealing strip, single lip
910[2]		⑨ Lower sealing strip, single lip ⑪ Upper sealing strip, single lip
920		⑩ Lower sealing strip, double lip
930[3]		⑩ Lower sealing strip, double lip ⑪ Upper sealing strip, single lip

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

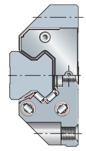
The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations of the KITs, see page 162.
Recommended lubrication connectors, see page 164.

[1] Definition, see page 135.

[2] Standard for RUE25-E.

[3] Standard for RUE35-E to RUE100-E.

[4] If retrofitting is to be carried out by the customer, attention must be paid to the carriage length.
See Retrofitting by the customer, page 146.
Ordering example: KIT.RWU35-E-L-930.



<table>
<tr><th colspan="3">Degree of contamination[1)]</th><th rowspan="2">Size</th><th rowspan="2">Retrofit-table</th><th colspan="3">Tolerances</th><th colspan="4">Increase in displacement force</th><th rowspan="2">Designation and KIT end number

KIT.RWU..-E[4)]</th></tr>
<tr><th>Slight</th><th>Moder-ate</th><th>Heavy</th><th>K_1</th><th>L_S

mm</th><th>S

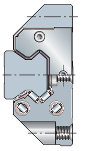
mm</th><th>None</th><th>Slight</th><th>Moder-ate</th><th>Heavy</th></tr>
<tr><td rowspan="6">■</td><td rowspan="6">–</td><td rowspan="6">–</td><td>–</td><td rowspan="6">■</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">■</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">900</td></tr>
<tr><td>35</td></tr>
<tr><td>45</td></tr>
<tr><td>55</td></tr>
<tr><td>–</td></tr>
<tr><td>–</td></tr>
<tr><td rowspan="6">■</td><td rowspan="6">■</td><td rowspan="6">–</td><td>25</td><td>–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">■</td><td rowspan="6">–</td><td rowspan="6">910[2)]</td></tr>
<tr><td>35</td><td rowspan="5">■</td></tr>
<tr><td>45</td></tr>
<tr><td>55</td></tr>
<tr><td>–</td></tr>
<tr><td>–</td></tr>
<tr><td rowspan="6">■</td><td rowspan="6">■</td><td rowspan="6">–</td><td>–</td><td rowspan="6">■</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">■</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">920</td></tr>
<tr><td>35</td></tr>
<tr><td>45</td></tr>
<tr><td>55</td></tr>
<tr><td>–</td></tr>
<tr><td>–</td></tr>
<tr><td rowspan="6">■</td><td rowspan="6">■</td><td rowspan="6">■</td><td>–</td><td rowspan="4">■</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">–</td><td rowspan="6">■</td><td rowspan="6">–</td><td rowspan="6">930[3)]</td></tr>
<tr><td>35</td></tr>
<tr><td>45</td></tr>
<tr><td>55</td></tr>
<tr><td>65</td><td>–</td></tr>
<tr><td>100</td><td>–</td></tr>
</table>

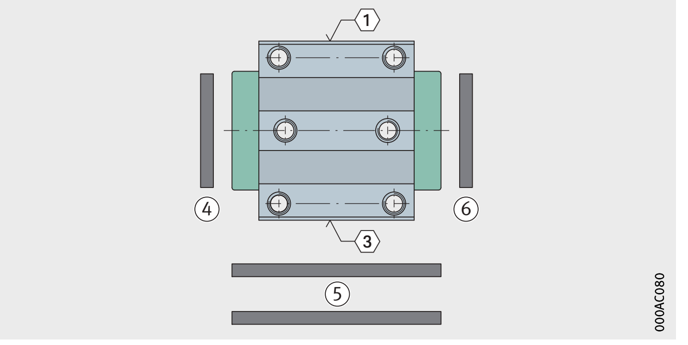
Possible combinations – KIT allocation (left) to KIT right																										
Designation and KIT end numbers KIT.RWU..-E	100, 103	120, 123	130, 133	140, 143	210, 213	220, 223	300, 303	340, 343	350, 353	380, 383	410, 413	420, 423	510	511	530	531	540	550	551	560	561	610	611	614	615	616
100, 103	●	●	●	●	–	–	●	●	–	–	–	–	–	–	–	–	–	–	–	–	–	●	●	●	●	●
120, 123	●	●	●	●	–	–	●	●	–	–	–	–	●	●	●	●	●	–	–	●	●	●	●	●	●	●
130, 133	●	●	●	●	–	–	●	●	–	–	–	–	●	●	●	●	●	–	–	●	●	●	●	●	●	●
140, 143	●	●	●	●	–	–	●	●	–	–	–	–	–	–	–	–	–	–	–	–	–	●	●	●	●	●
210, 213	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
220, 223	–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
300, 303	●	●	●	●	–	–	●	●	–	–	–	–	–	–	–	–	–	–	–	–	–	●	●	●	●	●
340, 343	●	●	●	●	–	–	●	●	–	–	–	–	●	●	●	●	●	–	–	●	●	●	●	●	●	●
350, 353	–	–	–	–	–	–	–	–	●	–	–	–	–	–	–	–	–	●	●	–	–	●	●	●	●	●
380, 383	–	–	–	–	–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
410, 413	–	–	–	–	–	–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
420, 423	–	–	–	–	–	–	–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–
510	–	●	●	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
511	–	●	●	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
530	–	●	●	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
531	–	●	●	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
540	–	●	●	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
550	–	–	–	–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
551	–	–	–	–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
560	–	●	●	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
561	–	●	●	–	–	–	–	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
610	●	●	●	●	–	–	●	●	●	–	–	–	–	–	–	–	–	–	–	–	–	●	●	●	–	–
611	●	●	●	●	–	–	●	●	●	–	–	–	–	–	–	–	–	–	–	–	–	●	●	●	–	–
614	●	●	●	●	–	–	●	●	●	–	–	–	–	–	–	–	–	–	–	–	–	●	●	●	●	●
615	●	●	●	●	–	–	●	●	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	●	●	●
616	●	●	●	●	–	–	●	●	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	●	●	●

● Possible combination.

Possible combinations – KIT allocation (left or right) to KIT centre																										
Designation and KIT end numbers KIT.RWU..-E	100, 123	120, 123	130, 133	140, 143	210, 213	220, 223	300, 303	340, 343	350, 353	380, 383	410, 413	420, 423	510	511	530	531	540	550	551	560	561	610	611	614	615	616
900	●	●	●	●	–	●	●	●	●	–	–	–	–	–	–	–	–	–	–	–	–	●	●	●	●	●
910	●	●	●	●	▲	●	●	●	●	–	❍	❍	–	–	–	–	–	–	–	–	–	●	●	●	●	●
920	●	●	●	●	–	●	●	●	●	–	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
930	●	●	●	●	▲	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

● Possible combination.
▲ For RUE25, only 910 is available, for RUE65 and RUE100 only 930 is available.
For all other sizes, these combinations are not available.
❍ Only size 25.





1 Locating face top
or
3 Locating face bottom
4 Left
5 Centre
6 Right

Figure 12
Definition of side allocation

The side allocation of the KIT (left, centre, right) is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.

Lubrication connectors

Linear recirculating roller bearing and guideway assemblies must be lubricated with grease or oil. Depending on the position of the lubrication connector and the other accessories, suitable lubrication connectors are available as special accessories.

Lubrication connectors:

- Standard lubrication connector, *Figure 13*
- Lubrication connectors for manual lubricators, *Figure 14* and table, page 165
- Lubrication connectors for central lubrication, *Figure 16*, page 166, and table, page 167.

W = hexagon

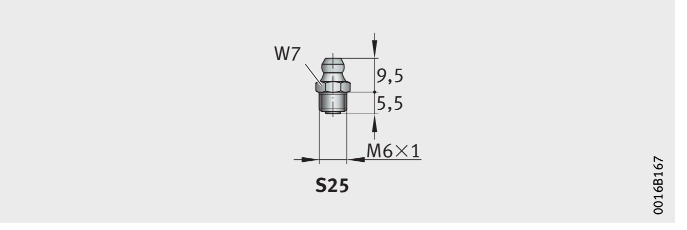


Figure 13
Standard lubrication connector

W = hexagon
S = hexagon socket

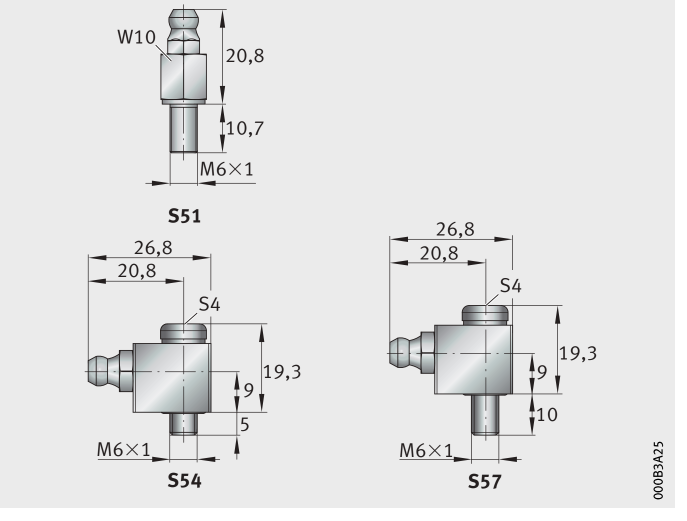
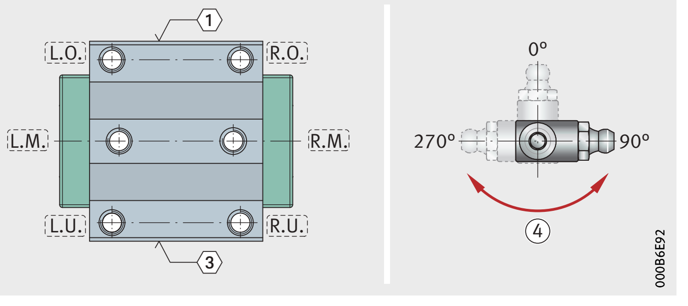


Figure 14
Lubrication connectors
for manual lubricators

Lubrication connectors for manual lubricators

Size	Thread	Positions: L.M., R.M.				Positions: L.U., L.O., R.U., R.O.	
		Straight KIT		Angled (90°) KIT		Straight KIT	
		100 103 120 123 210 213 220 223 380 383	130 133 140 143 300 303 340 343 350 353	100 103 120 123 210 213 220 223 380 383	130 133 140 143 300 303 340 343 350 353	100 103 120 123 130 133 140 143 210 213	220 223 300 303 340 343 350 353 380 383
25	M6	S25[1]	S51	S54	S57	–	–
35	M6	S25[1]	S51	S54	S57	S25[1]	S25[1]
45	M6	S25[1]	S51	S54	S57	S25[1]	S25[1]
55	M6	S25[1]	S51	S54	S57	S25[1]	S25[1]
65	M6	S25[1]	S51	S54	S57	S25[1]	S25[1]
100	M6	S25[1]	S51	S54	S57	S25[1]	S25[1]

[1] Standard.



(1) Locating face top
or
(3) Locating face bottom
(4) Alignment of the angled lubrication connectors from viewpoint of carriage

Figure 15
Definition of lubrication connectors

!

The position and alignment of the lubrication connectors is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.

W = hexagon
S = hexagon socket

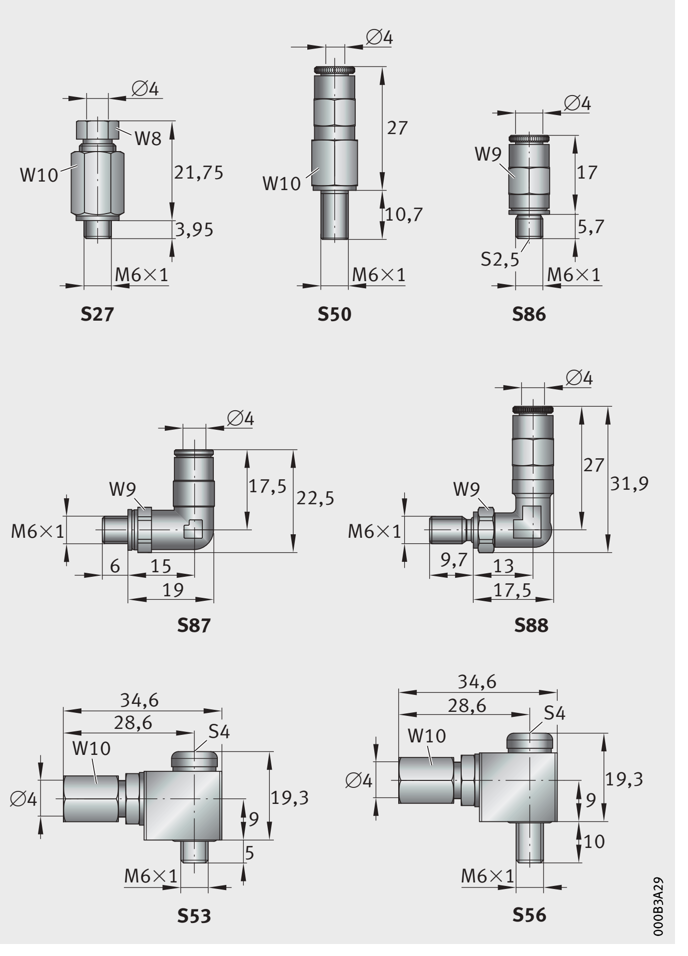
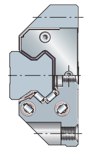
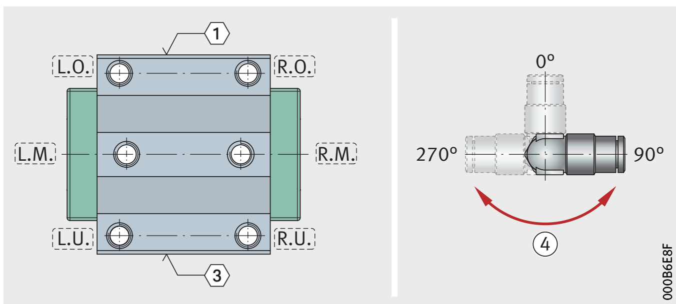


Figure 16
Lubrication connectors
for central lubrication

Lubrication connectors for central lubrication



Size	Thread	Positions: L.M., R.M.				Positions: L.U., L.O., R.U., R.O.	
		Straight KIT		Angled (90°) KIT		Straight KIT	
		100 103 120 123 210 213 220 223 380 383	130 133 140 143 300 303 340 343 350 353	100 103 120 123 210 213 220 223 380 383	130 133 140 143 300 303 340 343 350 353	100 103 120 123 130 133 140 143 210 213	220 223 300 303 340 343 350 353 380 383
25	M6	S27 S86	S50	S53 S87	S56 S88	–	–
35	M6	S27 S86	S50	S53 S87	S56 S88	S27 S86	S27 S86
45	M6	S27 S86	S50	S53 S87	S56 S88	S27 S86	S27 S86
55	M6	S27 S86	S50	S53 S87	S56 S88	S27 S86	S27 S86
65	M6	S27 S86	S50	S53 S87	S56 S88	S27 S86	S27 S86
100	M6	S27 S86	S50	S53 S87	S56 S88	S27 S86	S27 S86

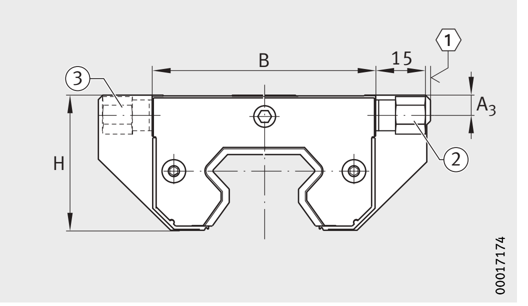


1 Locating face top
or
3 Locating face bottom
4 Alignment of the angled lubrication connectors from viewpoint of carriage

Figure 17
Definition of lubrication connectors

The position and alignment of the lubrication connectors is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.

Minimal lubricant quantity metering unit



KIT.RWU..-E for RUE..-E, RUE..-E-L

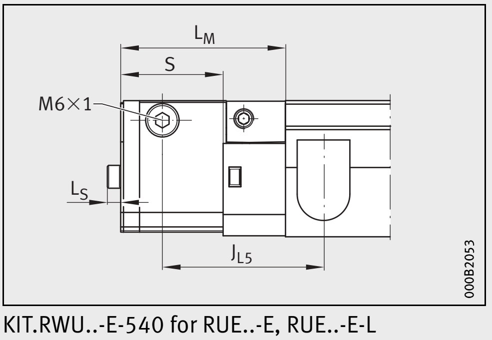
Dimension table · Dimensions in mm

Designation[1)]	Mass m ≈ g	Dimensions B	A_3	H	L_M	J_{L5}	S	L_S	For linear guidance system
KIT.RWU35-E-510 (-511)	170	66,7	6,15	41,3	49,9	48,7	30,9	4	RUE35-E
						61,7			RUE35-E-L
KIT.RWU35-E-H-510 (-511)			13,15			54,7			RUE35-E-H
						56,7			RUE35-E-HL
KIT.RWU35-E-530 (-531)	170	66,7	6,15	41,3	54,6	48,7	35,6	4	RUE35-E
						61,7			RUE35-E-L
KIT.RWU35-E-H-530 (-531)			13,15			54,7			RUE35-E-H
						56,7			RUE35-E-HL
KIT.RWU35-E-540[2)]	170	66,7	6,15	41,3	49,9	48,7	30,9	4	RUE35-E
						61,7			RUE35-E-L
KIT.RWU35-E-H-540[2)]			13,15			54,7			RUE35-E-H
						56,7			RUE35-E-HL
KIT.RWU35-E-550 (-551)	170	66,7	6,15	41,3	54,9	48,7	35,9	4	RUE35-E
						61,7			RUE35-E-L
KIT.RWU35-E-H-550 (-551)			13,15			54,7			RUE35-E-H
						56,7			RUE35-E-HL
KIT.RWU35-E-560 (-561)	170	66,7	6,15	41,3	54,9	48,7	35,9	4	RUE35-E
						61,7			RUE35-E-L
KIT.RWU35-E-H-560 (-561)			13,15			54,7			RUE35-E-H
						56,7			RUE35-E-HL

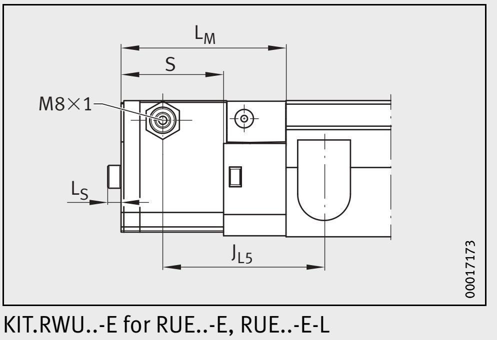
1 Locating face. 2 Lubrication connector, KIT end number 1. 3 Lubrication connector, KIT end number 0.

1) In the case of retrofitting by the customer, the designation corresponds to the ordering designation, see page 146.

2) The lubrication connectors are closed off using screws. The screw heads protrude by 5 mm.

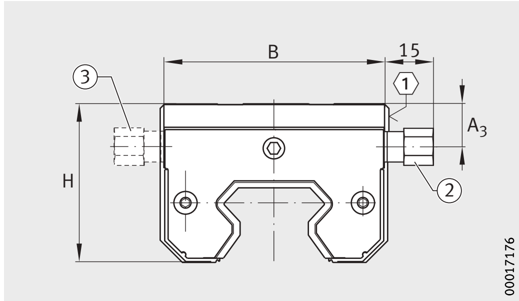


KIT.RWU..-E-540 for RUE..-E, RUE..-E-L

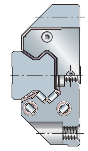


KIT.RWU..-E for RUE..-E, RUE..-E-L

Minimal lubricant quantity metering unit



KIT.RWU..-E-H for RUE..-E-H, RUE..-E-HL



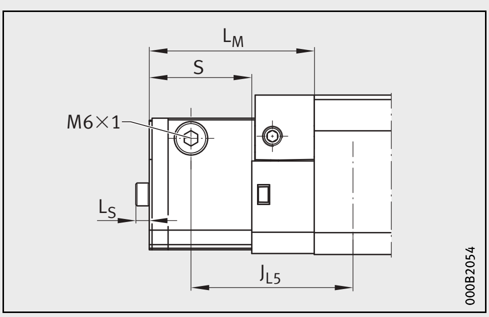
Dimension table (continued) · Dimensions in mm

Designation[1]	Mass m ≈ g	Dimensions B	A_3	H	L_M	J_{L5}	S	L_S	For linear guidance system
KIT.RWU45-E-510 (-511)	200	83	6,15	51,3	51,9	51,3	30,9	4	RUE45-E
						67,5			RUE45-E-L
KIT.RWU45-E-H-510 (-511)			16,15			61,3			RUE45-E-H
						67,5			RUE45-E-HL
KIT.RWU45-E-530 (-531)	200	83	6,15	51,3	56,6	51,3	35,6	4	RUE45-E
						67,5			RUE45-E-L
KIT.RWU45-E-H-530 (-531)			16,15			61,3			RUE45-E-H
						67,5			RUE45-E-HL
KIT.RWU45-E-540[2]	200	83	6,15	51,3	51,9	51,3	30,9	4	RUE45-E
						67,5			RUE45-E-L
KIT.RWU45-E-H-540[2]			16,15			61,3			RUE45-E-H
						67,5			RUE45-E-HL
KIT.RWU45-E-550 (-551)	200	83	6,15	51,3	56,9	51,3	35,9	4	RUE45-E
						67,5			RUE45-E-L
KIT.RWU45-E-H-550 (-551)			16,15			61,3			RUE45-E-H
						67,5			RUE45-E-HL
KIT.RWU45-E-560 (-561)	200	83	6,15	51,3	56,9	51,3	35,9	4	RUE45-E
						67,5			RUE45-E-L
KIT.RWU45-E-H-560 (-561)			16,15			61,3			RUE45-E-H
						67,5			RUE45-E-HL

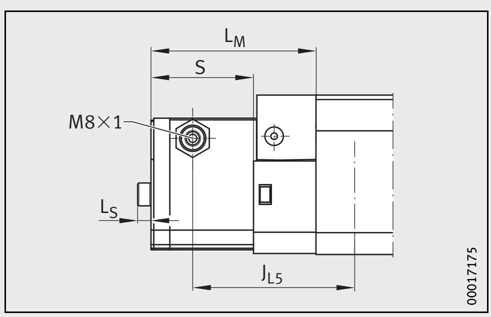
1 Locating face. 2 Lubrication connector, KIT end number 1. 3 Lubrication connector, KIT end number 0.

1) In the case of retrofitting by the customer, the designation corresponds to the ordering designation, see page 146.

2) The lubrication connectors are closed off using screws. The screw heads protrude by 5 mm.

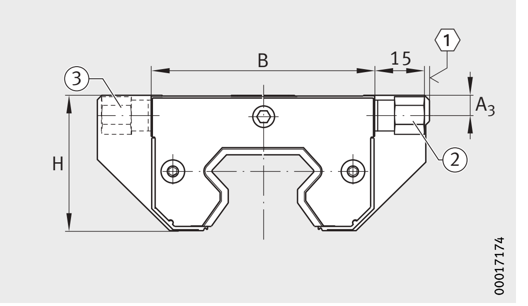


KIT.RWU..-E-H-540 for RUE..-E-H, RUE..-E-HL



KIT.RWU..-E-H for RUE..-E-H, RUE..-E-HL

Minimal lubricant quantity metering unit



KIT.RWU..-E for RUE..-E, RUE..-E-L

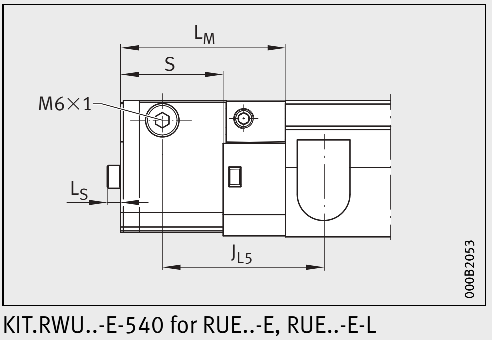
Dimension table (continued) · Dimensions in mm

Designation[1]	Mass m ≈ g	Dimensions B	A_3	H	L_M	J_{L5}	S	L_S	For linear guidance system
KIT.RWU55-E-510 (-511)	240	97	7,9	58,8	53,9	56,4	30,9	5	RUE55-E
						75,4			RUE55-E-L
KIT.RWU55-E-H-510 (-511)			17,9			66,4			RUE55-E-H
						75,4			RUE55-E-HL
KIT.RWU55-E-530 (-531)	240	97	7,9	58,8	58,6	56,4	35,6	5	RUE55-E
						75,4			RUE55-E-L
KIT.RWU55-E-H-530 (-531)			17,9			66,4			RUE55-E-H
						75,4			RUE55-E-HL
KIT.RWU55-E-540[2]	240	97	7,9	58,8	53,9	56,4	30,9	5	RUE55-E
						75,4			RUE55-E-L
KIT.RWU55-E-H-540[2]			17,9			66,4			RUE55-E-H
						75,4			RUE55-E-HL
KIT.RWU55-E-550 (-551)	240	97	7,9	58,8	58,9	56,4	35,9	5	RUE55-E
						75,4			RUE55-E-L
KIT.RWU55-E-H-550 (-551)			17,9			66,4			RUE55-E-H
						75,4			RUE55-E-HL
KIT.RWU55-E-560 (-561)	240	97	7,9	58,8	58,9	56,4	35,9	5	RUE55-E
						75,4			RUE55-E-L
KIT.RWU55-E-H-560 (-561)			17,9			66,4			RUE55-E-H
						75,4			RUE55-E-HL

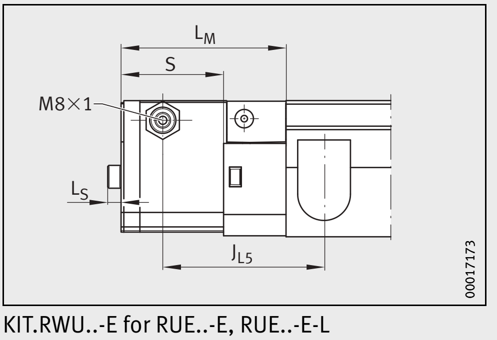
1 Locating face. 2 Lubrication connector, KIT end number 1. 3 Lubrication connector, KIT end number 0.

[1] In the case of retrofitting by the customer, the designation corresponds to the ordering designation, see page 146.

[2] The lubrication connectors are closed off using screws. The screw heads protrude by 5 mm.

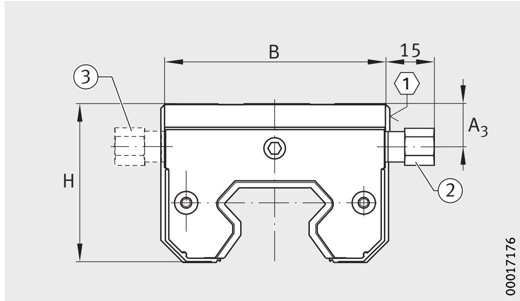


KIT.RWU..-E-540 for RUE..-E, RUE..-E-L

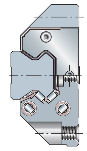


KIT.RWU..-E for RUE..-E, RUE..-E-L

Minimal lubricant quantity metering unit



KIT.RWU..-E-H for RUE..-E-H, RUE..-E-HL

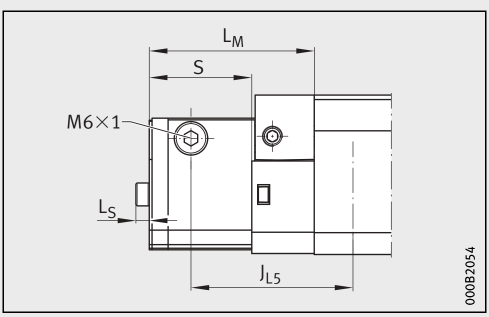


Dimension table (continued) · Dimensions in mm

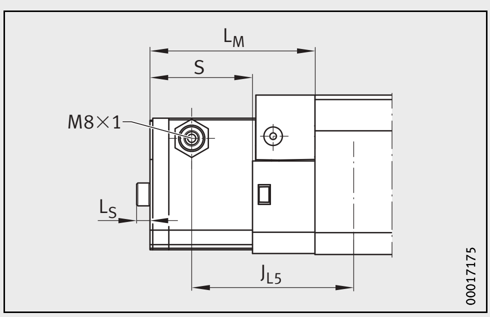
Designation[1]	Mass m ≈g	Dimensions B	A_3	H	L_M	J_{L5}	S	L_S	For linear guidance system
KIT.RWU65-E-510 (-511)	500	125	7,9	78,3	58,1	60	30,8	5	RUE65-E
						93,2			RUE65-E-L
KIT.RWU65-E-H-510 (-511)			17,9			80			RUE65-E-H
						88,2			RUE65-E-HL (-SL)
KIT.RWU65-E-530 (-531)	500	125	7,9	78,3	62,8	60	35,5	5	RUE65-E
						93,2			RUE65-E-L
KIT.RWU65-E-H-530 (-531)			17,9			80			RUE65-E-H
						88,2			RUE65-E-HL (-SL)
KIT.RWU65-E-540[2]	500	125	7,9	78,3	58,1	60	30,8	5	RUE65-E
						93,2			RUE65-E-L
KIT.RWU65-E-H-540[2]			17,9			80			RUE65-E-H
						88,2			RUE65-E-HL (-SL)
KIT.RWU65-E-550 (-551)	500	125	7,9	78,3	62,9	60	35,6	5	RUE65-E
						93,2			RUE65-E-L
KIT.RWU65-E-H-550 (-551)			17,9			80			RUE65-E-H
						88,2			RUE65-E-HL (-SL)
KIT.RWU65-E-560 (-561)	500	125	7,9	78,3	62,9	60	35,6	5	RUE65-E
						93,2			RUE65-E-L
KIT.RWU65-E-H-560 (-561)			17,9			80			RUE65-E-H
						88,2			RUE65-E-HL (-SL)

1 Locating face. 2 Lubrication connector, KIT end number 1. 3 Lubrication connector, KIT end number 0.

[1] In the case of retrofitting by the customer, the designation corresponds to the ordering designation, see page 146.
[2] The lubrication connectors are closed off using screws. The screw heads protrude by 5 mm.

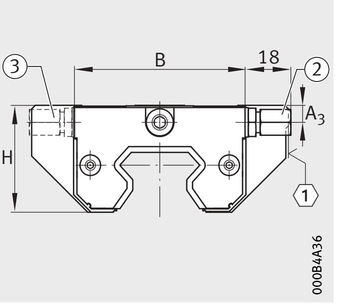


KIT.RWU..-E-H-540 for RUE..-E-H, RUE..-E-HL

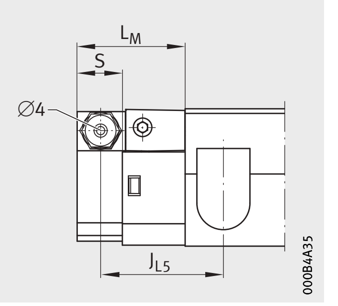


KIT.RWU..-E-H for RUE..-E-H, RUE..-E-HL

Lubrication adapter plate



KIT.RWU..-E-610(-611)
for RUE..-E, RUE..-E-L



KIT.RWU..-E-610(-611)
for RUE..-E, RUE..-E-L

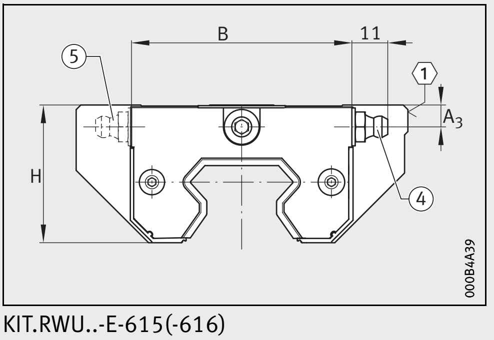
Dimension table · Dimensions in mm

Designation[1]	Mass m ≈ g	Dimensions B	A_3	H	L_M	J_{L5}	S	L_S	For linear guidance system
KIT.RWU35-E-610 (-611)	122	66,3	6,6	39,6	32,6	37,1	14,75	0	RUE35-E
						50,1			RUE35-E-L
			13,6			43,1			RUE35-E-H
						45,1			RUE35-E-HL
KIT.RWU35-E-614[2]	122	66,3	6,6	39,6	32,6	37,1	14,75	0	RUE35-E
						50,1			RUE35-E-L
			13,6			43,1			RUE35-E-H
						45,1			RUE35-E-HL
KIT.RWU35-E-615 (-616)	122	66,3	6,6	39,6	32,6	37,1	14,75	0	RUE35-E
						50,1			RUE35-E-L
			13,6			43,1			RUE35-E-H
						45,1			RUE35-E-HL

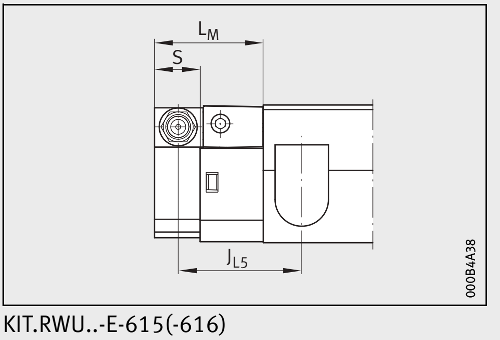
1 Locating face. 2 Lubrication connector for central lubrication, KIT end number 1. 3 Lubrication connector for central lubrication, KIT end number 0. 4 Lubrication connector for manual lubricators, KIT end number 6. 5 Lubrication connector for manual lubricators, KIT end number 5.

[1] In the case of retrofitting by the customer, the suffix OS must be stated.
The condition of the upper relubrication hole is not taken into consideration.
See Retrofitting by the customer, page 146. Ordering example: KIT.RWU35-E-OS-616.

[2] Lubrication connectors closed off flush on both sides by grub screws.

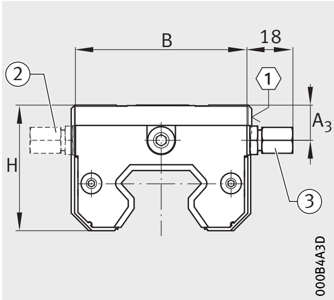


KIT.RWU..-E-615(-616)
for RUE..-E, RUE..-E-L

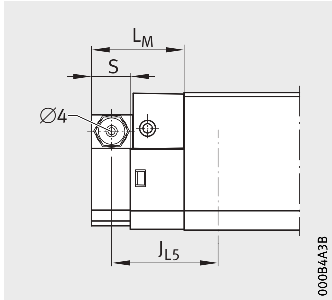


KIT.RWU..-E-615(-616)
for RUE..-E, RUE..-E-L

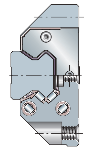
Lubrication adapter plate



KIT.RWU..-E-610(-611)
for RUE..-E-H, RUE..-E-HL



KIT.RWU..-E-610(-611)
for RUE..-E-H, RUE..-E-HL



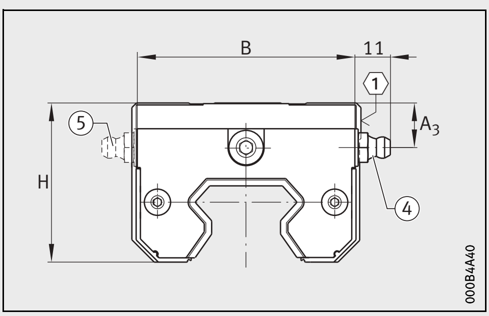
Dimension table (continued) · Dimensions in mm

Designation[1]	Mass m ≈ g	Dimensions B	A_3	H	L_M	J_{L5}	S	L_S	For linear guidance system
KIT.RWU45-E-610 (-611)	168	83	6,6	35,6	32,6	39,7	14,75	0	RUE45-E
						55,9			RUE45-E-L
			16,6			49,7			RUE45-E-H
						55,9			RUE45-E-HL
KIT.RWU45-E-614[2]	168	83	6,6	35,6	32,6	39,7	14,75	0	RUE45-E
						55,9			RUE45-E-L
			16,6			49,7			RUE45-E-H
						55,9			RUE45-E-HL
KIT.RWU45-E-615 (-616)	168	83	6,6	35,6	32,6	39,7	14,75	0	RUE45-E
						55,9			RUE45-E-L
			16,6			49,7			RUE45-E-H
						55,9			RUE45-E-HL

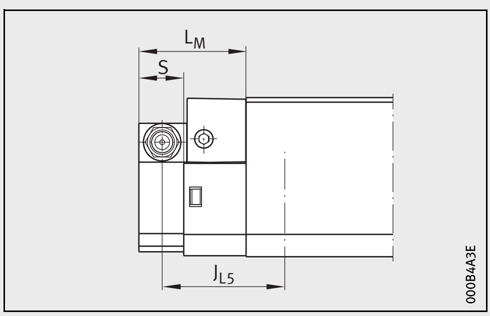
1 Locating face. 2 Lubrication connector for central lubrication, KIT end number 1. 3 Lubrication connector for central lubrication, KIT end number 0. 4 Lubrication connector for manual lubricators, KIT end number 6. 5 Lubrication connector for manual lubricators, KIT end number 5.

[1] In the case of retrofitting by the customer, the suffix OS must be stated.
The condition of the upper relubrication hole is not taken into consideration.
See Retrofitting by the customer, page 146. Ordering example: KIT.RWU45-E-OS-616.

[2] Lubrication connectors closed off flush on both sides by grub screws.

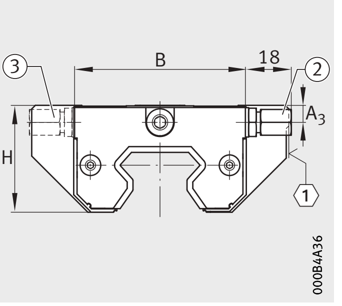


KIT.RWU..-E-615(-616)
for RUE..-E-H, RUE..-E-HL

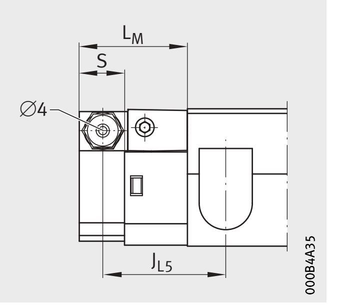


KIT.RWU..-E-615(-616)
for RUE..-E-H, RUE..-E-HL

Lubrication adapter plate



KIT.RWU..-E-610(-611)
for RUE..-E, RUE..-E-L



KIT.RWU..-E-610(-611)
for RUE..-E, RUE..-E-L

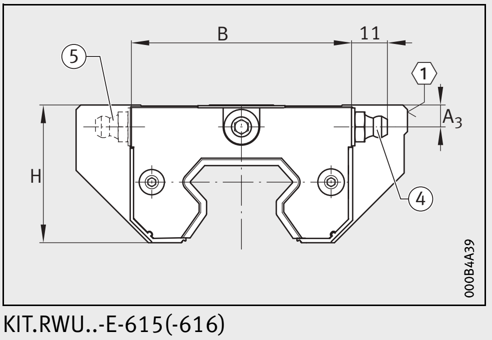
Dimension table (continued) · Dimensions in mm

Designation[1]	Mass m ≈ g	Dimensions							For linear guidance system
		B	A_3	H	L_M	J_{L5}	S	L_S	
KIT.RWU55-E-610 (-611)	217	97	8,1	36,6	32,6	44,6	14,75	0	RUE55-E
						63,6			RUE55-E-L
			18,1			54,6			RUE55-E-H
						63,6			RUE55-E-HL
KIT.RWU55-E-614[2]	217	97	8,1	36,6	32,6	44,6	14,75	0	RUE55-E
						63,6			RUE55-E-L
			18,1			54,6			RUE55-E-H
						63,6			RUE55-E-HL
KIT.RWU55-E-615 (-616)	217	97	8,1	36,6	32,6	44,6	14,75	0	RUE55-E
						63,6			RUE55-E-L
			18,1			54,6			RUE55-E-H
						63,6			RUE55-E-HL

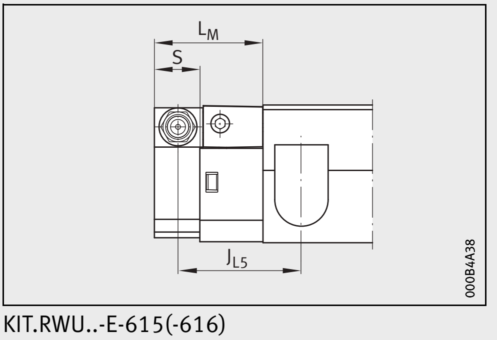
1 Locating face. 2 Lubrication connector for central lubrication, KIT end number 1. 3 Lubrication connector for central lubrication, KIT end number 0. 4 Lubrication connector for manual lubricators, KIT end number 6. 5 Lubrication connector for manual lubricators, KIT end number 5.

1) In the case of retrofitting by the customer, the suffix OS must be stated.
The condition of the upper relubrication hole is not taken into consideration.
See Retrofitting by the customer, page 146. Ordering example: KIT.RWU55-E-OS-616.

2) Lubrication connectors closed off flush on both sides by grub screws.

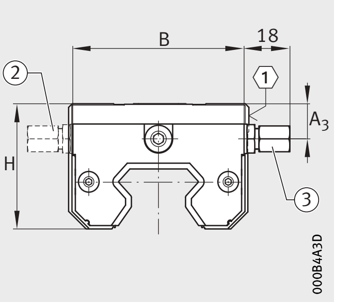


KIT.RWU..-E-615(-616)
for RUE..-E, RUE..-E-L

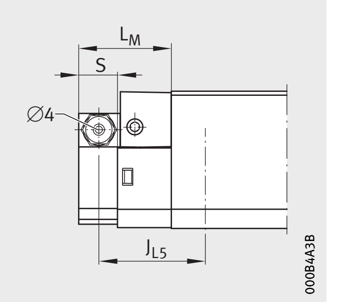


KIT.RWU..-E-615(-616)
for RUE..-E, RUE..-E-L

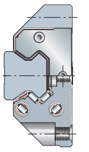
Lubrication adapter plate



KIT.RWU..-E-610(-611)
for RUE..-E-H, RUE..-E-HL



KIT.RWU..-E-610(-611)
for RUE..-E-H, RUE..-E-HL



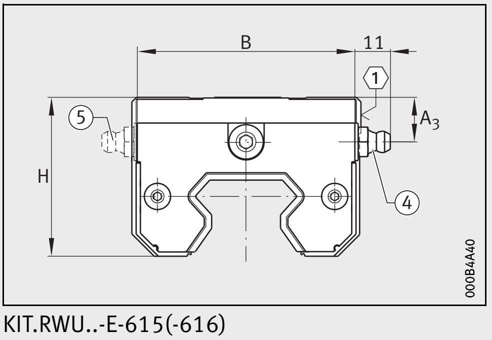
Dimension table (continued) · Dimensions in mm

Designation[1]	Mass	Dimensions							For linear guidance system
	m ≈ g	B	A_3	H	L_M	J_{L5}	S	L_S	
KIT.RWU65-E-610 (-611)	362	125	19,6	40,2	32,6	48,1	14,75	0	RUE65-E
						81,4			RUE65-E-L
			29,6			68,1			RUE65-E-H
						76,4			RUE65-E-HL (-SL)
KIT.RWU65-E-614[2]	362	125	19,6	40,2	32,6	48,1	14,75	0	RUE65-E
						81,4			RUE65-E-L
			29,6			68,1			RUE65-E-H
						76,4			RUE65-E-HL (-SL)
KIT.RWU65-E-615 (-616)	362	125	19,6	40,2	32,6	48,1	14,75	0	RUE65-E
						81,4			RUE65-E-L
			29,6			68,1			RUE65-E-H
						76,4			RUE65-E-HL (-SL)

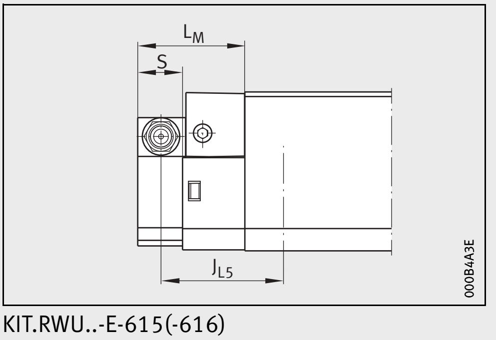
1 Locating face. 2 Lubrication connector for central lubrication, KIT end number 1. 3 Lubrication connector for central lubrication, KIT end number 0. 4 Lubrication connector for manual lubricators, KIT end number 6. 5 Lubrication connector for manual lubricators, KIT end number 5.

1) In the case of retrofitting by the customer, the suffix OS must be stated.
The condition of the upper relubrication hole is not taken into consideration.
See Retrofitting by the customer, page 146. Ordering example: KIT.RWU65-E-OS-616.

2) Lubrication connectors closed off flush on both sides by grub screws.



KIT.RWU..-E-615(-616)
for RUE..-E-H, RUE..-E-HL

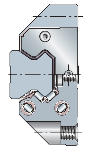


KIT.RWU..-E-615(-616)
for RUE..-E-H, RUE..-E-HL

Accessories

Closing plugs
Hydraulic fitting device
Guideway covering strips
Rolling-in device for covering strip
Clamping element
Braking and clamping element
Damping carriage

Accessories



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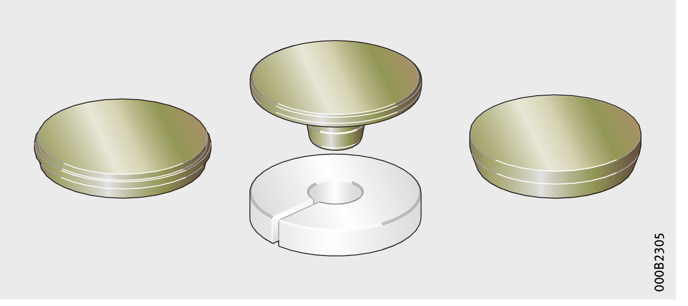
Closing plugs

Brass

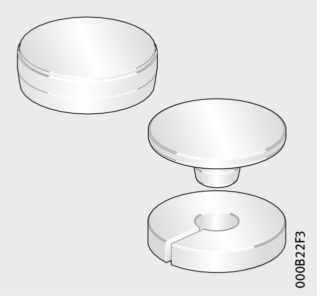
KA..-M, KA..-M/A, KA..-M-konisch



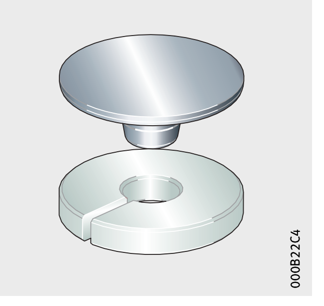
Plastic

Steel

KA..-TN, KA..-TN/A



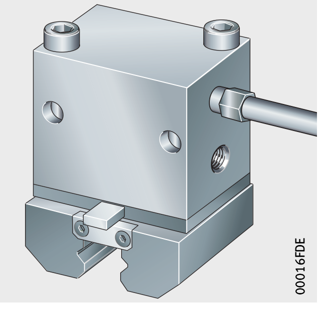
KA..-ST/A



Hydraulic fitting device

For brass closing plugs

MVH.TSX..-D-A

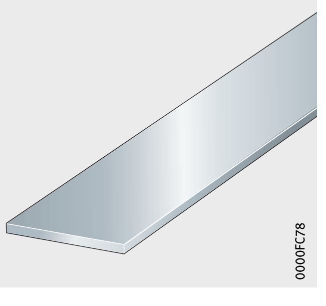


Guideway covering strips

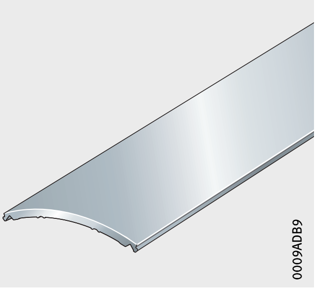
Adhesive bonded

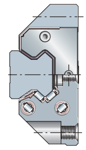
Clip fit

ADB



ADK

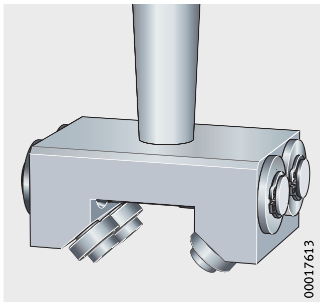




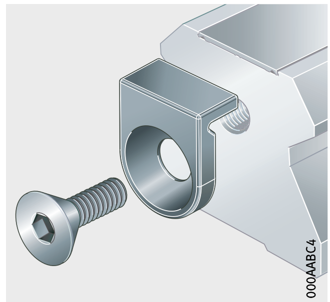
Rolling-in device and retaining plate

For covering strips

ERVU..-B

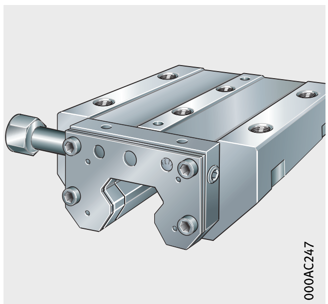


HPL.ADB..-B

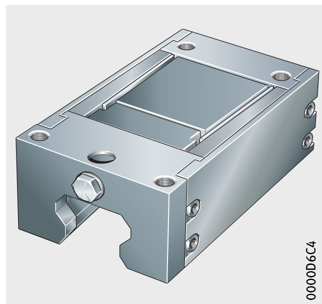


Clamping element
Braking and clamping element

RUKS..-D-A

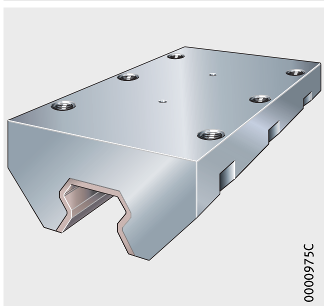


BKE.TSX..-D



Damping carriage

RUDS..-D



Closing plugs

The closing plugs close off the counterbores for the fixing screws in the guideway holes flush with the surface of the guideway.

The closing plugs are available in a one-piece or two-piece design and are made from various materials. In addition to the plastic closing plugs, closing plugs made from brass and steel are also available.

If closing plugs are used in coated guideways, only plastic closing plugs or two-piece brass or steel closing plugs with a clinch ring can be used.

When fitting the closing plugs, observe the guidelines in the Technical principles, see page 74.

Plastic closing plugs

Plastic closing plugs are an economical solution and are suitable for most applications, *Figure 1*.

Plastic closing plugs, one-piece

The one-piece closing plugs KA..-TN can be easily fitted with the aid of a hammer and press-in block. The interference between the plug and hole creates a burr that must be removed during fitting. After fitting, a minimal ring gap remains.

Plastic closing plugs with clinch ring

The two-piece closing plugs KA..-TN/A comprise a plastic plug and a plastic clinch ring. The clinch ring ensures secure seating of the closing plug in the counterbore. These closing plugs can also be easily fitted with the aid of a hammer and press-in block. After fitting, a small ring gap remains.

KA..-TN
Standard for RUE25-E to RUE65-E
KA..-TN/A

1 Plastic closing plug
2 Plastic plug
3 Plastic clinch ring

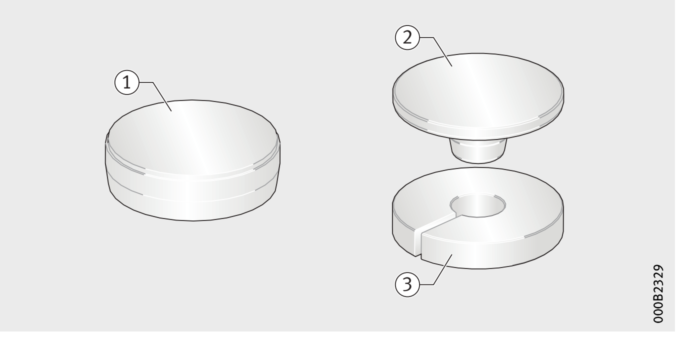


Figure 1
Plastic closing plugs

Brass closing plugs

Brass closing plugs are particularly suitable for conditions involving hot swarf, aggressive media and vibrations. As a result, they are recommended in particular for use in machine tools, *Figure 2*.

Brass closing plugs with shear ring

The brass closing plugs KA..-M with a shear ring can be fitted with the aid of a hammer and press-in block.

It is recommended that brass closing plugs should be fitted using the hydraulic fitting device MVH.

During fitting, the shear ring is sheared off, leaving a ring-shaped burr that must be removed. A minimal ring gap remains.

After fitting, the top surfaces of the plugs must be smoothed off using an oilstone.

Brass closing plugs, conical

The brass conical closing plugs KA..-M-konisch offer very high retaining force and must be fitted using the hydraulic fitting device MVH. They close off the surface tightly and flush, leaving no ring gap.

After fitting, the top surfaces of the plugs must be smoothed off using an oilstone.

Brass closing plugs with clinch ring

The two-piece closing plugs KA..-M/A comprise a brass plug and a plastic clinch ring. The clinch ring ensures secure seating of the closing plug in the counterbore.

The closing plugs can be easily fitted with the aid of a hammer and press-in block. After fitting, a small ring gap remains.
The top surfaces of the plugs do not require further processing.

KA..-M
Standard for RUE100-E-L
KA..-M/A
KA..-M-konisch

1 Brass closing plug with shear ring
2 Brass plug
3 Plastic clinch ring
4 Brass closing plug, conical

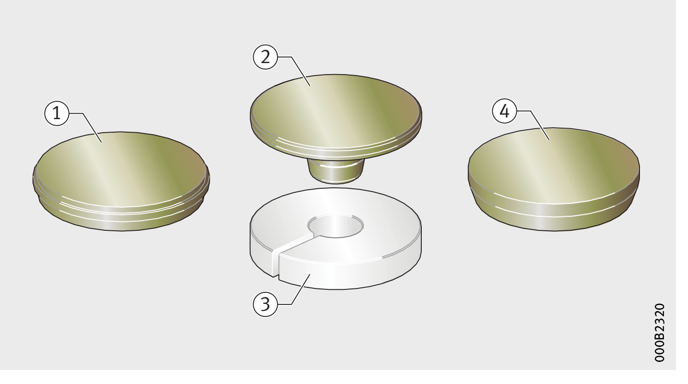
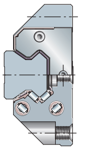


Figure 2
Brass closing plugs



Steel closing plugs

Steel closing plugs are suitable, due to their robustness, for applications that involve special requirements in terms of the environmental conditions, *Figure 3*.

Steel closing plugs with clinch ring

The two-piece closing plugs KA..-ST/A comprise a steel plug and an aluminium clinch ring. The clinch ring ensures secure seating of the closing plug in the counterbore. The closing plugs must be fitted using the hydraulic fitting device MVH. After fitting, a minimal ring gap remains.

The top surfaces of the plugs must be smoothed off using an oilstone.

!

In order to achieve a perfect seat, the holes in the guideways are reamed. For the steel closing plugs, special guideways are therefore necessary. This must be taken into consideration when ordering.

KA..-ST/A

① Steel plug
② Aluminium clinch ring

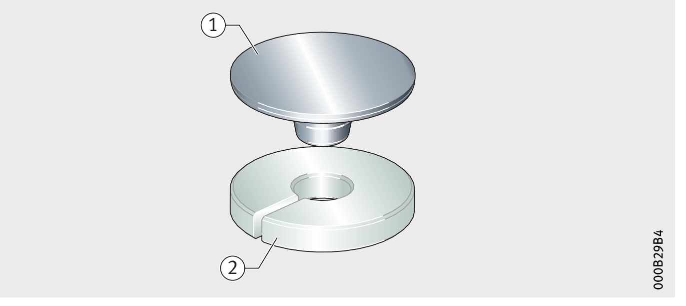


Figure 3
Steel closing plug

Hydraulic fitting device

With the hydraulic fitting device MVH..-D-A, the closing plugs are pressed in flush with the surface of the guideway, *Figure 4* and page 76.

The device is available for all RUE series.

MVH.TSX..-D-A

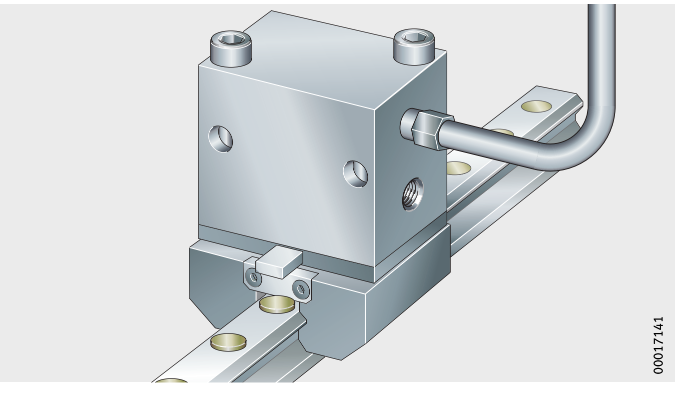
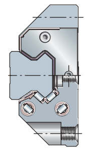


Figure 4
Hydraulic fitting device



Observe the guidelines in the mounting manual MON 30.

Ordering example, ordering designation

A hydraulic fitting device for the fitting of closing plugs KA..-M, KA..-ST/A or KA..-M-konisch for the linear recirculating roller bearing and guideway assembly RUE35-E is to be ordered.

Ordering designation: 1×**MVH.TSX35-D-A**

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, while the covering strip ADK is clipped into the slot, *Figure 5*.

The clip fit covering strip ADK must be fitted using the rolling-in device ERVU..-B, see page 184.

The covering strip ADK is recommended particularly for use under aggressive environmental conditions.

Adhesive bonded covering strips ADB are supplied with linear recirculating roller bearing and guideway assemblies RUE..-E-ADB, clip fit covering strips ADK are supplied with linear recirculating roller bearing and guideway assemblies RUE..E-ADK, see dimension table.

Principles for fitting of the strips, see page 79.

ADK
ADB

① Clip fit
② Adhesive bonded

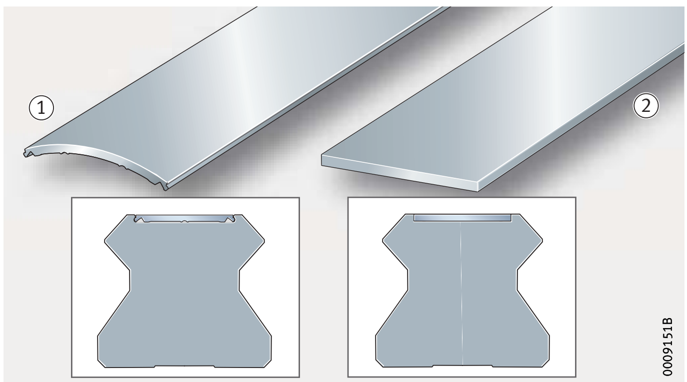


Figure 5
Guideway covering strip

Accessories

Retaining plate

The retaining plate HPL.ADB..-B fixes the covering strips ADB and ADK to the end of the guideway, *Figure 6*. It is included in the scope of delivery.

! Comprehensive information can be found on the covering strip ADB in the mounting manual MON 07 and on the covering strip ADK in the mounting manual MON 65.
Principles for fitting of the retaining plates, see page 79.

HPL.ADB..-B

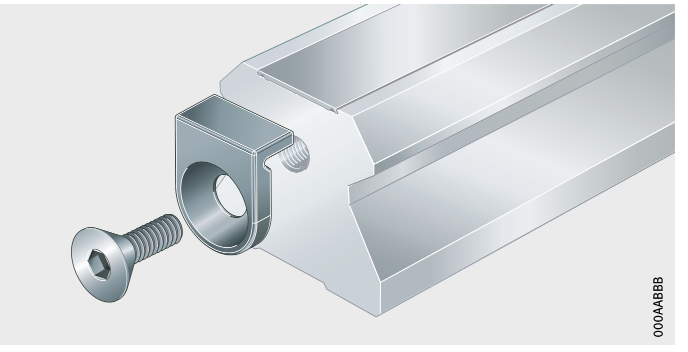


Figure 6
Retaining plate
for covering strip

Rolling-in device

The clip fit covering strip ADK is fitted using the rolling-in device ERVU..-B, *Figure 7*. As a result, it is securely located in the guideway.

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

Elements are available for the series RUE..-E, see dimension table.

ERVU..-B

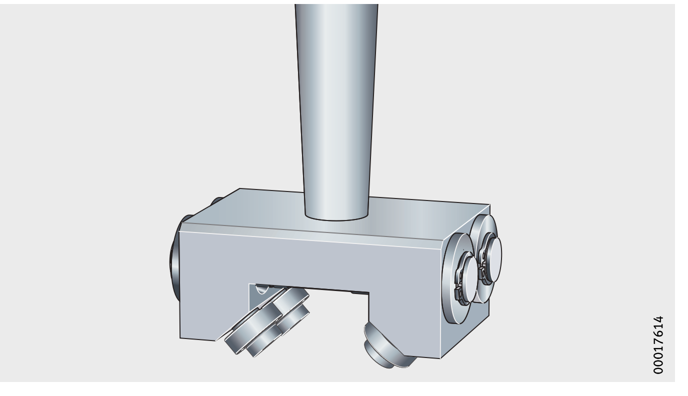


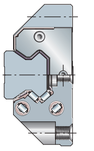
Figure 7
Rolling-in device
for covering strip

! Observe the guidelines in the mounting manual MON 65.

Ordering example, ordering designation

Rolling-in device for the covering strip ADK16 for RUE35-E.

Ordering designation: 1×**ERVU35-B**



Clamping element

The clamping element RUKS..-D-A operates by hydraulic means and prevents micromovements under oscillating load, *Figure 8*.

It is screw mounted to the adjacent construction and increases the rigidity, particularly in the direction of travel. This gives a significant improvement in the machining result, for example in machine tools.

Wipers and sealing strips protect the contact surfaces between the guideway and clamping element against contamination.

The elements are available for series RUE..-E in the standard design and in the high design, see dimension table.

RUKS..-D-A-SR

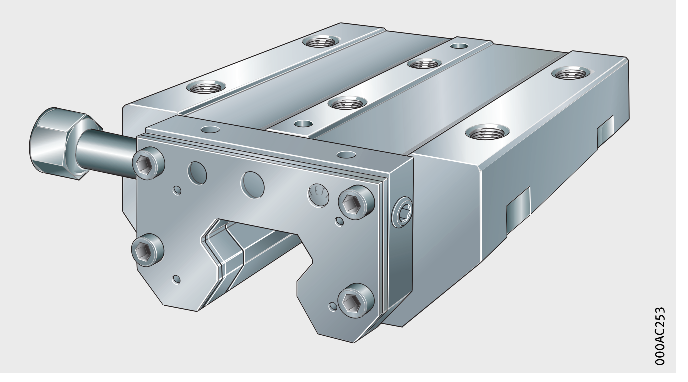


Figure 8
Clamping element

Breakaway force

The breakaway forces are dependent on the size, *Figure 9*.

Clamping forces may vary depending on the condition of the guideway (lubricant quantity). The clamping forces in the diagram are measured with a lightly oiled guideway.

F_L = breakaway force
p_{max} = pressure

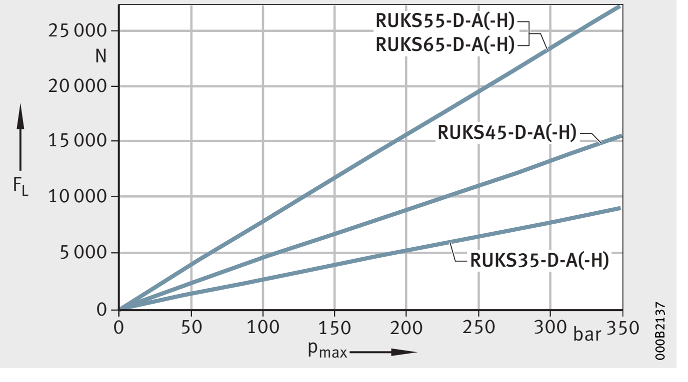


Figure 9
Breakaway forces

Mounting

The clamping element must be aligned to the guideway.
Principles for fitting of the clamping elements, see page 83.

Clamping elements do not have locating surfaces. The elements should never be laterally abutted.

The maximum pressure is 350 bar. Pay attention to pressure spikes.

Hydraulic oil feed from the side

In the case of the clamping elements RUKS..-D-A-SR and RUKS..-D-A-H-SR, the hydraulic oil is fed from the side. Diminishing pipes with a thread M12×1,5 for Ermeto connectors are included in the scope of delivery.

Hydraulic oil feed from above

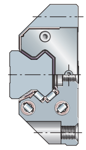
In the case of the clamping elements RUKS..-D-A-SO and RUKS..-D-A-H-SO, the hydraulic oil is fed from above via the adjacent construction.

Ordering example, ordering designation

A clamping element for RUE35-E is to be ordered.

Hydraulic oil is to be fed from above via the adjacent construction.

Ordering designation 1×**RUKS35-D-A-SO**



Braking and clamping element

The braking and clamping element BKE.TSX..-D is used, for example, as a positionally independent security system for linear drives where the drive cannot fully provide the braking and clamping function, *Figure 10*.

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 page 189. The elements are thus maintenance-free.

BKE.TSX..-D

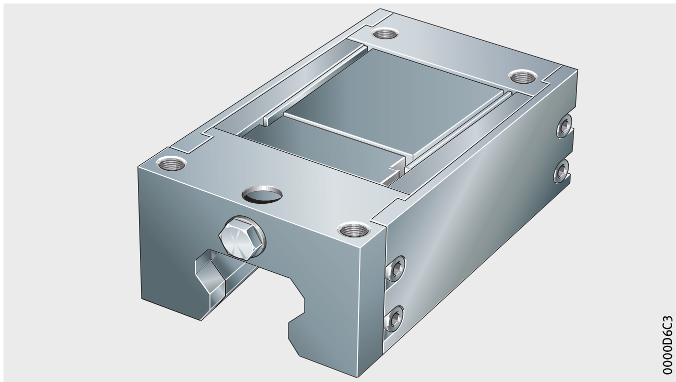


Figure 10
Braking and clamping element

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. The brake shoes are opened by hydraulic means. If the pressure drops or the power fails, the brake shoes are closed again. This eliminates safety problems resulting from power failure, which is a possibility with electronically braked systems.

The system carries out braking if 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, see page 67.

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

Short reaction time

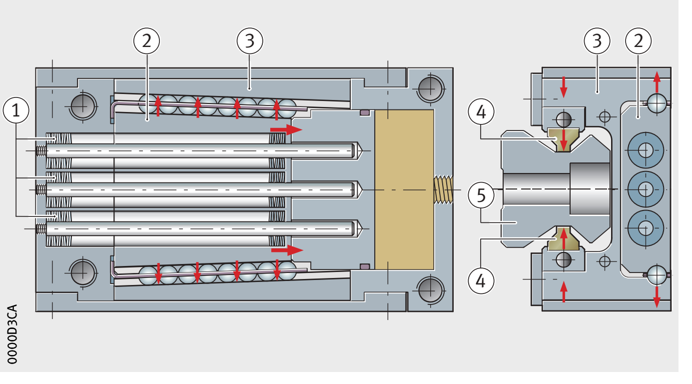
The clearance-free adjustment of the brake shoes ensures a short, consistent reaction time (in the case of size 35, for example, of <30 ms).

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.

Function

Three disc spring columns generate the braking and clamping force, *Figure 11*. 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 11
Functional components

Operating pressure of braking and clamping elements

Operating pressure	
min.	max.
> 55 bar	90 bar

Pressure spikes of more than 90 bar must be avoided in all cases. Comprehensive information can be found in the mounting manual MON 01, Braking and Clamping Elements.

Wear of brake shoes

Since the system performs not only a clamping function on stationary guidance systems but also a braking function on moving guidance systems, wear of the brake shoes occurs. However, clearance between the brake shoes and brake contact surfaces increases the system reaction time.

Automatic clearance compensation

For reliable functioning of the system, the brake shoes must always be in clearance-free contact. 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. Disc spring assemblies slide a wedge between the brake shoes and the saddle plate, *Figure 12*. 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 travel.

Adapter plate

For the H variant of the carriages, an adapter plate is necessary, *Figure 12*. The adapter plate is included in the scope of delivery.

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

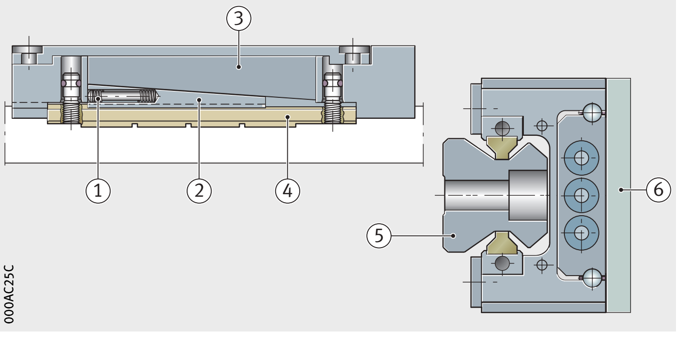


Figure 12
Wear compensation and adapter plate

Ease of mounting

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

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 but have only a very small design envelope. They are matched in their dimensions to the INA standard and H design carriages. The elements are available for the monorail guidance systems RUE-E, KUSE and KUVE-B and can be integrated without any problems in existing applications with INA linear guidance systems, see dimension table.

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 rolling element systems. In this case, the guideway is used as a braking or clamping rail.

Typically, the braking and clamping element is arranged between two carriages on the table and acts as an emergency brake, *Figure 13*.

(1) Guideways
(2) Carriages
(3) Emergency brakes
(4) Table
(5) Motor primary part
(6) Motor secondary part

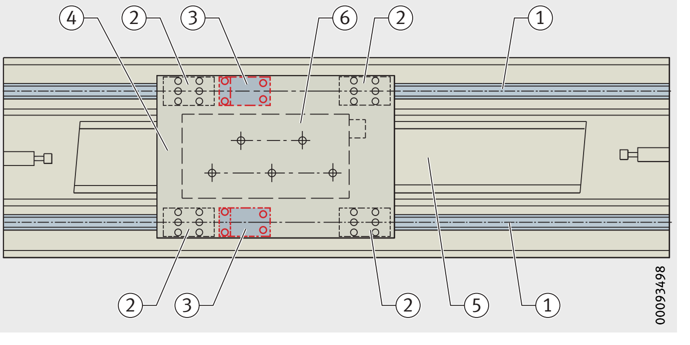
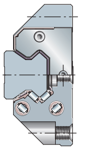


Figure 13
Typical application



Delivered condition

The elements are premounted on a separate support rail and clamped in place by means of a fitting screw, *Figure 14*. The screw is used to loosen and then move the fixed element. The fitting screw is later replaced by the hydraulic connector.

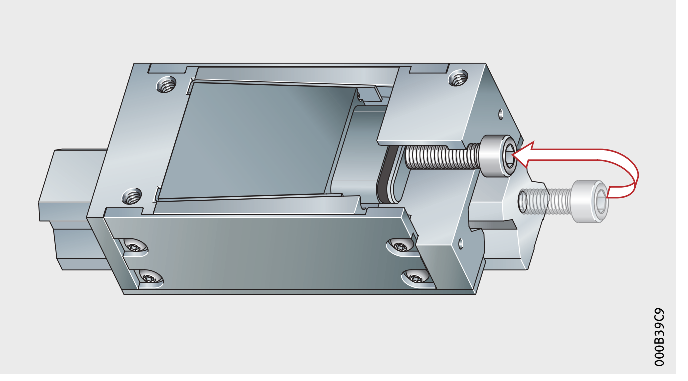


Figure 14
Braking and clamping element on support rail

Ordering example, ordering designation

A braking and clamping element for RUE35-E with a hydraulic connector on the end face is to be ordered.

Ordering designation

1×**BKE.TSX35-D**

Damping carriages

Damping carriages RUDS..-D reduce vibrations acting on the guidance system. They improve operating results, extend the service life of the tools under vibration and increase the crash safety of the guidance system.

The damping carriage is arranged on the guideway in addition to the carriages and is screw mounted to the adjacent construction, *Figure 15* and *Figure 16*.

The additional damping element does not influence the special characteristics of the rolling element guidance system, such as low displacement resistance and high running accuracy.

The damping carriage is available for RUE..-E. It must always be ordered together with a monorail guidance system, see dimension table.

In addition to the damping carriage RUDS, Schaeffler also offers a fully hydrostatic guidance system HLE45, see page 438.

RUDS..-D

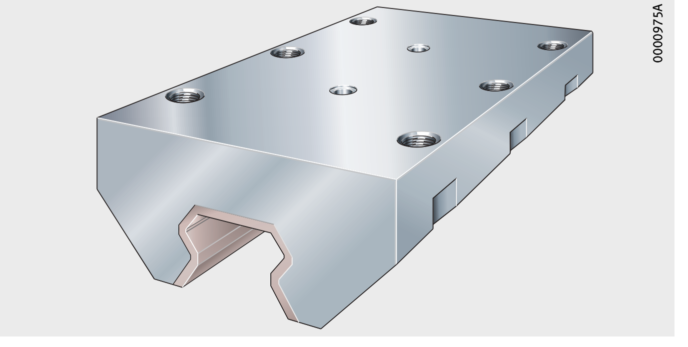
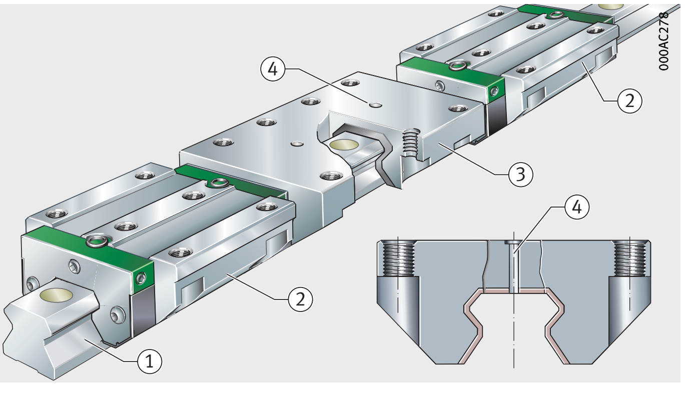
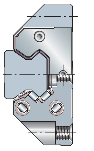


Figure 15
Damping carriage



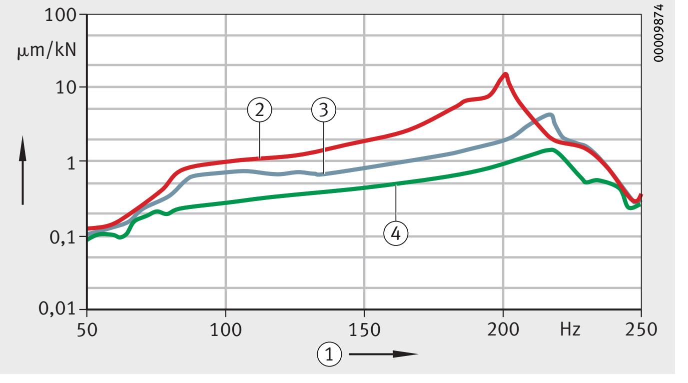
① Guideway TSX..-E
② Carriage RWU..-E
③ Damping carriage RUDS..-D
④ Hole for oil feed

Figure 16
Linear recirculating roller bearing and guideway assembly with damping carriage



Damping by oil film

The carriage damps vibrations acting on the guidance system by means of an oil film (squeeze film effect) between the damping carriage and the guideway, *Figure 17*. The damping effect increases with the size of the damping surface and the width of the gap. During operation, the guideway and damping carriage are not in contact with each other. The supply of oil by the oil drop method must be ensured. The oil reaches the damping surface via lubrication holes in the back of the element, necessary grease quantity, see page 43.



① Frequency in Hz
② 6×ball guidance system
③ 6×roller guidance system
④ 4×roller guidance system with RUDS

Figure 17
Frequency – with and without damping carriage

Damping carriages do not have locating faces. The elements should never be laterally abutted.

The damping carriage must be centred on the guideway during mounting, in order that the gap between the guideway and damping carriage is of uniform size on all sides.

Counterbores in the guideways should only be closed off using brass closing plugs KA..-M. The covering strips ADB and ADK must not be used.

Observe the principles for mounting, see page 85.

Ordering example, ordering designation

A damping carriage is required for a RUE35-E. The length of the carriage is 150 mm.

Ordering designation

1×**RUDS35-D-150**

Option for damping carriage

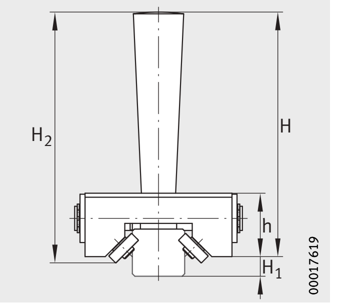
If the option of fitting a damping carriage is to be maintained, a damping carriage with a length of 0 mm should be ordered, see Ordering example. The guideway is then supplied with a narrower height tolerance.

Ordering designation

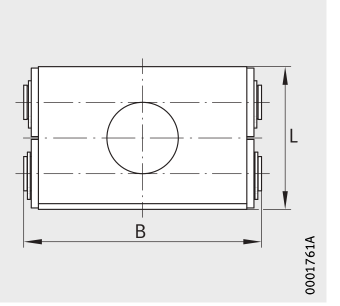
1×**RUDS35-D-0**
(option for use of damping carriage)

If the feature RUDS is ordered, all guideway sets in a system are prepared accordingly for RUDS.

Rolling-in device



ERVU..-B
Front view

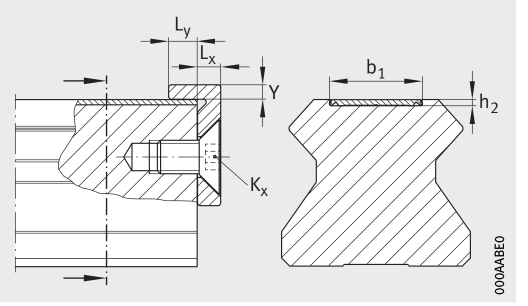


ERVU..-B
Top view

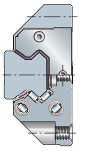
Dimension table · Dimensions in mm

Designation	Mass m ≈ kg	Dimensions						For linear guidance system
		H	H_1	H_2	h	B	L	
ERVU25-B	0,45	120,5	9,6	121,9	30,5	83,3	49,5	RUE25-E
ERVU35-B	0,45	121,5	16,3	128,3	31,5	83,3	49,5	RUE35-E
ERVU45-B	0,48	125	20,8	129,5	35	89,3	49,5	RUE45-E
ERVU55-B	0,51	127	25,9	131,7	37	95,3	49,5	RUE55-E
ERVU65-B	0,53	128	33,6	133,5	38	101,3	49,5	RUE65-E

Retaining plate for covering strip



Retaining plate



Dimension table · Dimensions in mm										
Designation	Mass	For linear guidance system	Dimensions						For covering strip	
	m		h_2	b_1	K_x	L_x	L_y	Y		
	≈ kg/m									
HPL.ADB9-B	0,05	RUE25-E	0,5	13	M5	4	5	2	ADB13	ADK12
HPL.ADB17-B	0,07	RUE35-E	0,5	18	M6	4	5	2,5	ADB18	ADK16
HPL.ADB17-B	0,09	RUE45-E	0,5	23	M6	4	5	2,5	ADB23	ADK21
HPL.ADB17-B	0,1	RUE55-E	0,5	27	M6	4	5	2,5	ADB27	ADK25
HPL.ADB17-B	0,11	RUE65-E	0,5	29	M6	4	5	2,5	ADB29	ADK27

Clamping element

Dimension table · Dimensions in mm

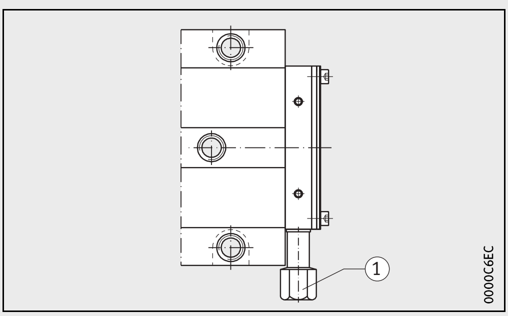
Designation	Mass	Dimensions			Mounting dimensions					
	m	B	H	L	J_B	A_3	L_1	J_{L1}	J_{L2}	J_{L5}
	≈ kg									
RUKS35-D-A-SR[2)]	2,5	98	48	134,3	82	24,5	113	62	52	32
RUKS35-D-A-SO[3)]						–				
RUKS35-D-A-H-SR[2)]	2,3	68	55		50	39,5		50	–	38
RUKS35-D-A-H-SO[3)]						–				
RUKS45-D-A-SR[2)]	4,5	118	60	156,6	100	22	134	80	60	33,5
RUKS45-D-A-SO[3)]						–				
RUKS45-D-A-H-SR[2)]		84	70		60	39		60	–	43,5
RUKS45-D-A-H-SO[3)]						–				
RUKS55-D-A-SR[2)]	7,3	138	70	186,3	116	18,5	163	95	70	40,5
RUKS55-D-A-SO[3)]						–				
RUKS55-D-A-H-SR[2)]	6,8	98	80		75	38,5		75	–	50,5
RUKS55-D-A-H-SO[3)]						–				
RUKS65-D-A-SR[2)]	13,5	169	90	201	142	17,25	170,1	110	82	40,05
RUKS65-D-A-H-SR[2)]	11,7	124	78		76	40,5		70	–	60,05

1 Oil connector on side, diminishing pipe M12×1,5, 12 deep, included in scope of delivery. 2 Oil feed from above.

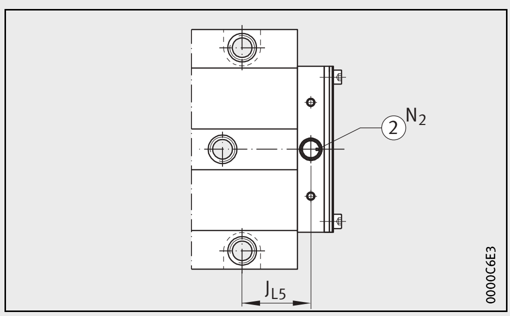
1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

2) Oil connector on side: suffix SR.

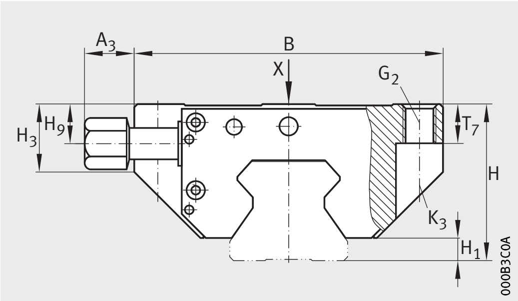
3) Oil feed from above: suffix SO.



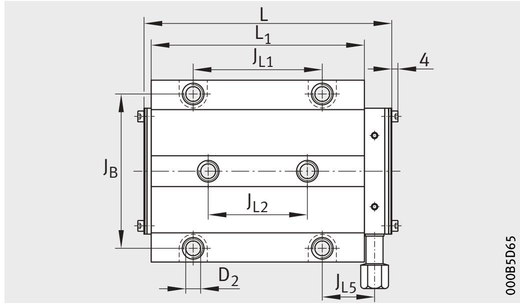
RUKS..-D-A-SR



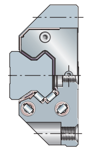
RUKS..-D-A-SO



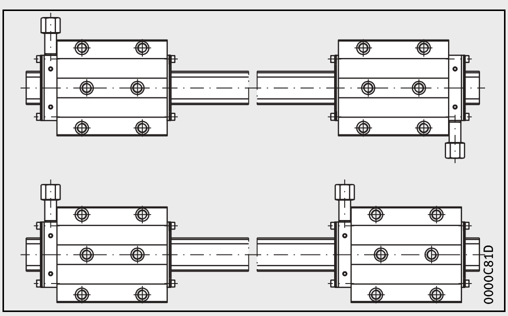
RUKS..-D-A



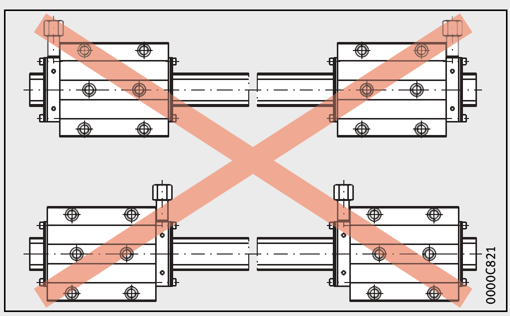
RUKS..-D-A
View X rotated 90°



					Fixing screws[1)]					For guideway
N_2	H_1	H_3	T_7	H_9	G_2		K_3		D_2	
					DIN ISO 4762-12.9					
max.						M_A Nm		M_A Nm		
6	6,8	21	12	13,4 / –	M10	41	M8	41	8,6	TSX35-E
		42	10	20,4 / –	M8		–	–	–	
6	8,7	27	15	15,8 / –	M12	83	M10	83	10,6	TSX45-E
		58,3	12,5	25,8 / –	M10		–	–	–	
6	11	32	18	19 / –	M14	140	M12	140	12,5	TSX55-E
		62	15	29 / –	M12		–	–	–	
–	11,5	60	23,25	28,1	M16	220	M14	220	14,5	TSX65-E
		–	–	38,1			–	–	–	



Position of pressure oil connector, possible combinations



Position of pressure oil connector, impossible combinations

Braking and clamping element

Dimension table · Dimensions in mm

Designation	Clamping force[1]	Dimensions						
		H		B	L	J_B	J_C	A_1
		Adapter plate						
	N	without	with					
BKE.TSX25-D	1 000	36	–	47	91	38	34	10
BKE.TSX25-D-SO								
BKE.TSX25-D-H		–	40					
BKE.TSX25-D-H-SO								
BKE.TSX35-D	2 800	48	–	69	120	58	48	13,5
BKE.TSX35-D-SO								
BKE.TSX35-D-H		–	55					
BKE.TSX35-D-H-SO								
BKE.TSX45-D	4 300	60	–	85	141	70	60	15
BKE.TSX45-D-SO								
BKE.TSX45-D-H		–	70					
BKE.TSX45-D-H-SO								
BKE.TSX55-D	5 100	70	–	99	170	80	72	18
BKE.TSX55-D-SO								
BKE.TSX55-D-H		–	80					
BKE.TSX55-D-H-SO								
BKE.TSX65-D	11 000	90	–	125	186	96	96	22
BKE.TSX65-D-SO								
BKE.TSX65-D-H		–	100					
BKE.TSX65-D-H-SO								

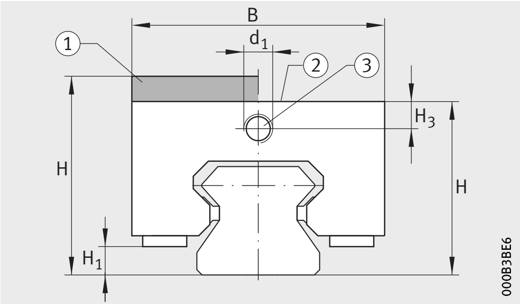
① With adapter plate. ② Without adapter plate. ③ Hydraulic connector. ④ Hydraulic connection from above (suffix SO)[3].

[1] Valid for lightly oiled guideway. Increased contamination of the oil will lead to a reduction in the holding force or an increase in the braking travel.

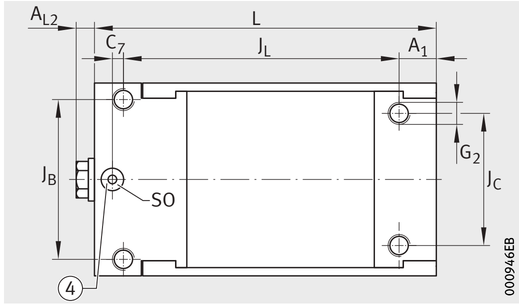
[2] The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

[3] O ring.

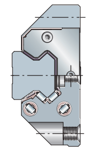
[4] The maximum diameter of the oil feed hole is: for sizes 25 to 55 = 6 mm, for size 65 = 15 mm.



BKE.TSX..-D



Top view[4)]



J_L	C_7	H_1	H_3	A_{L2}	d_1	SO[3) 4)]	Fixing screws[2)] G_2 DIN ISO 4762-12.9	M_A Nm
75	–	6,2	6	5	M6×1	–	M6	17,4
	0					7×1,5		
	–					–		
	0					7×1,5		
100	–	6,6	8,1	5	M8×1	–	M8	42,2
	0					7×1,5		
	–					–		
	0					7×1,5		
113	–	11,8	10	5	M8×1	–	M10	83
	5					7×1,5		
	–					–		
	5					7×1,5		
138	–	17	11,75	6	M10×1	–	M12	144
	6					7×1,5		
	–					–		
	6					7×1,5		
150	–	18,2	17,5	7,5	M16×1,5	–	M14	229
	0					16×2		
	–					–		
	0					16×2		

Damping carriage

Dimension table · Dimensions in mm

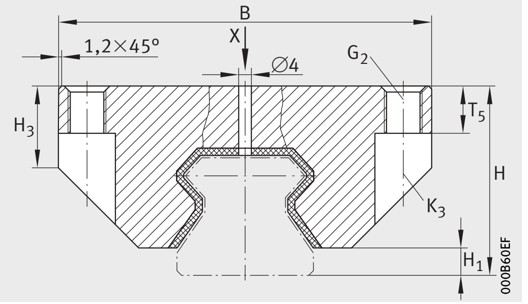
Designation	Mass	Dimensions[1)]		Mounting dimensions					
	m	B	H	H_1	T_5	H_3	J_B	A_1	A_2, J_L
	≈ kg/100 mm								
RUDS25-D	1,1	68	36	7,2	10	18	57	37,5	75
RUDS25-D-H	1	47	40	7,2	9	29,5	35		
RUDS35-D	2,3	98	48	6,8	12	20	82	37,5	75
RUDS35-D-H	2	68	55	8,8	12	41	50		
RUDS45-D	3,3	118	60	8,7	15	26	100	37,5	75
RUDS45-D-H	3,2	84	70	10,7	12	53	60		
RUDS55-D	4,4	138	70	11	18	31	116	37,5	75
RUDS55-D-H	4	98	80	13	18	61	75		
RUDS65-D	7	168	90	11,5	23	39	142	37,5	75
RUDS65-D-H	6,6	124	100	11,5	23	71	76		

1) Standard lengths:
L_1 = 150 mm, not for RUDS65-D (-H)
L_2 = 225 mm, not for RUDS65-D (-H)
L_3 = 300 mm, not for RUDS25-D (-H) and RUDS35-D (-H).

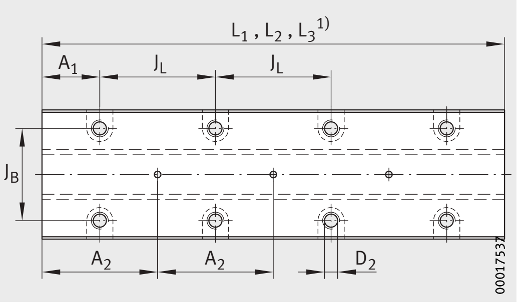
2) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

3) For screws to DIN ISO 4762-12.9.
Thread length for RUDS..D-H at least 1,25 · G_2.

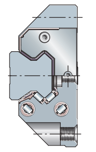
4) G_2 as through hole for screws to DIN ISO 4762-12.9.



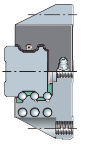
RUDS..-D



RUDS..-D
View X rotated 90°



Fixing screws[2]					For linear guidance system	
G_2[3]		K_3[4]		D_2		
DIN ISO 4762-12.9						
	M_A Nm		M_A Nm			
M8	42,2	M6	17,4	6,7	RUE25-E	RUE25-E-L
M6	17,4	–	–	–	RUE25-E-H	RUE25-E-HL
M10	83	M8	42,2	8,6	RUE35-E	RUE35-E-L
M8	42,2	–	–	–	RUE35-E-H	RUE35-E-HL
M12	144	M10	83	10,6	RUE45-E	RUE45-E-L
M10	83	–	–	–	RUE45-E-H	RUE45-E-HL
M14	229	M12	144	12,5	RUE55-E	RUE55-E-L
M12	144	–	–	–	RUE55-E-H	RUE55-E-HL
M16	354	M14	229	14,5	RUE65-E	RUE65-E-L
M14	229	–	–	–	RUE65-E-H	RUE65-E-HL



Six-row linear recirculating ball bearing and guideway assemblies

Carriages and guideways
Sealing and lubrication elements
Accessories

Six-row linear recirculating ball bearing and guideway assemblies

X-life
Carriages
Guideways **206**

These linear recirculating ball bearing and guideway assemblies are, with their six rows of balls, the INA monorail guidance system based on balls with the highest load carrying capacity and highest rigidity.

The rolling elements are in two point contact with the raceways. The four outer rows of balls support compressive loads while the two inner rows of balls support tensile loads.

The guidance systems are preloaded in order to increase their rigidity.

Due to the modular concept, the guideways can be combined with all carriage types within one size.

Sealing and lubrication elements – system KIT **240**

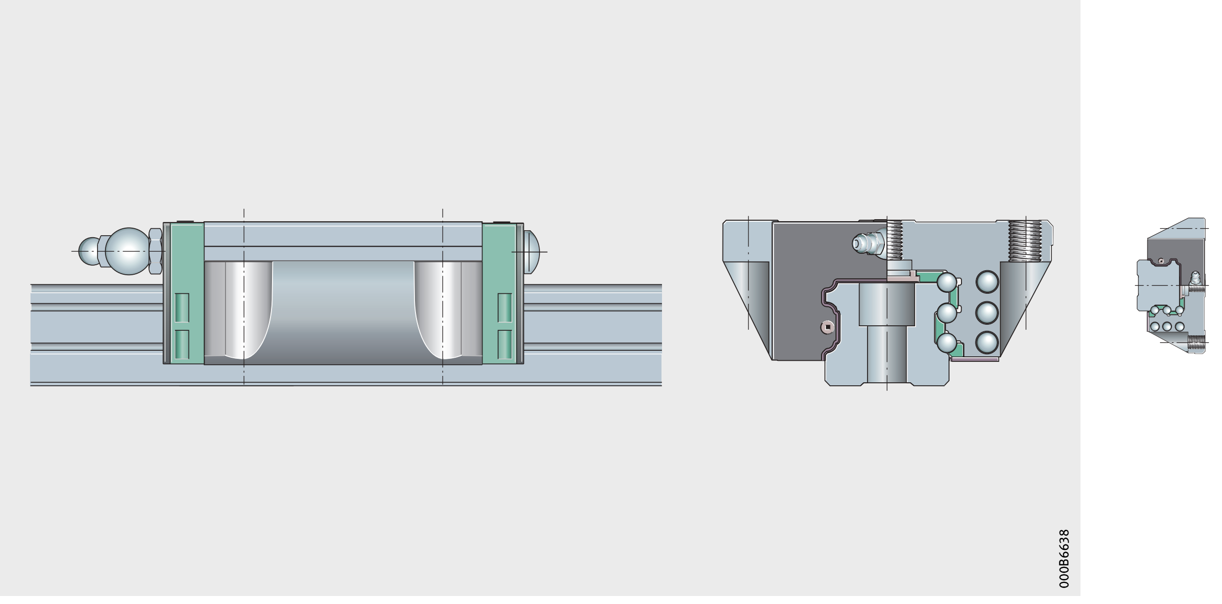
For optimum lubrication and sealing, there is an extensive system of sealing and lubrication elements. The elements are configured as a KIT and are designed for various application conditions.

Accessories **258**

There is an extensive range of accessories for the six-row linear recirculating ball bearing and guideway assemblies.

These include closing plugs and covering strips for the guideways as well as a suitable fitting tool for rolling in the clip fit covering strip ADK (rolling-in device).

The braking and clamping element is a mechanical retaining system that is used, for example, where additional braking and clamping functions are required.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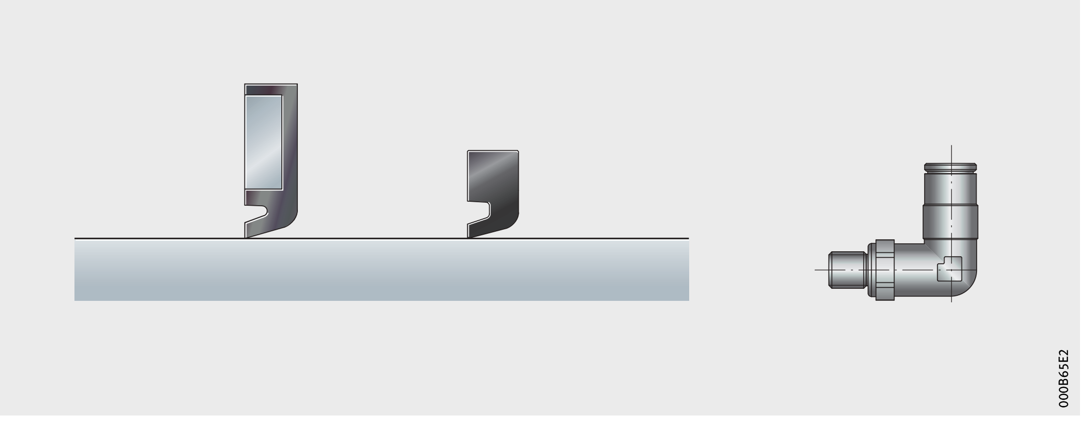
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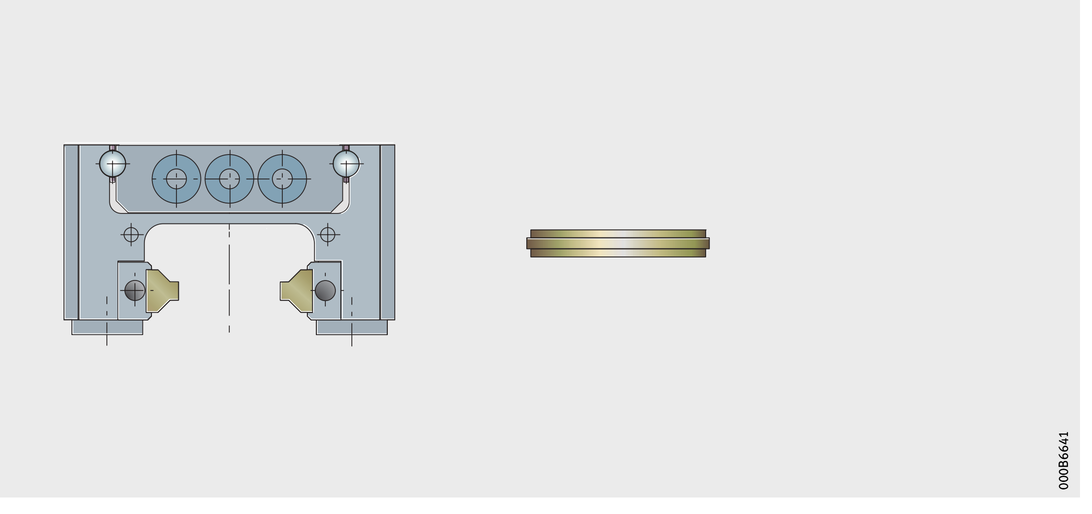
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Six-row linear recirculating ball bearing and guideway assemblies

Carriages
Guideways

Six-row linear recirculating ball bearing and guideway assemblies

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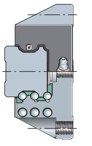
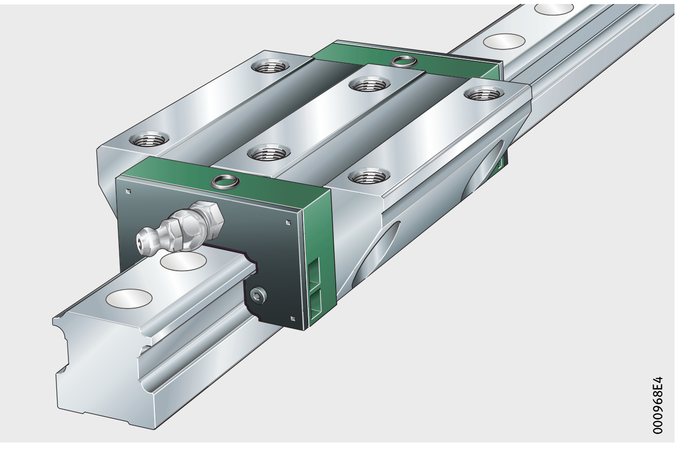


Product overview Six-row linear recirculating ball bearing and guideway assemblies

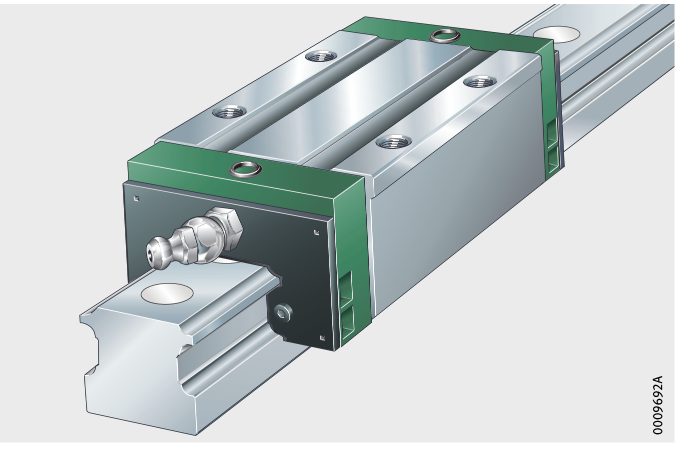
Full complement

For oil and grease lubrication

KUSE, KUSE..-L



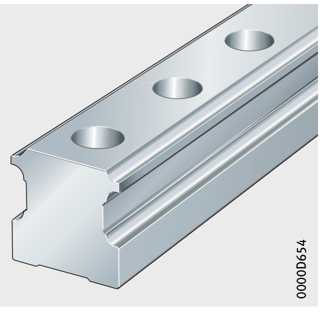
KUSE..-H, KUSE..-HL



Guideways

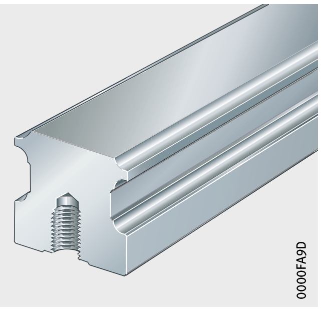
Standard

TKSD

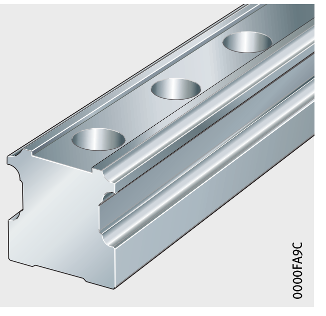


For screw mounting from below or with slot for covering strip

TKSD..-U



TKSD..-ADB, TKSD..-ADK



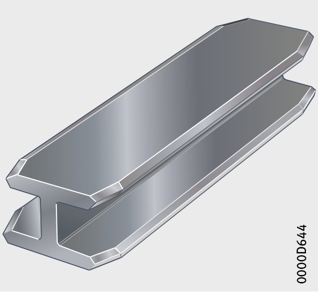
Standard accessories

Plastic closing plugs

Dummy guideway

KA..-TN

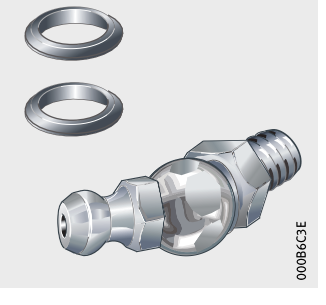
MKSD

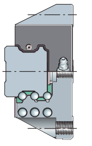


Lubrication connector

O rings

S



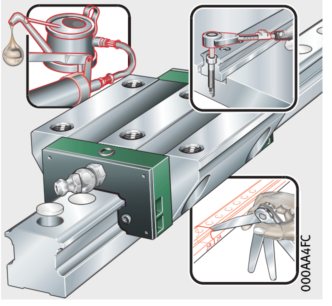


Product overview

Six-row linear recirculating ball bearing and guideway assemblies

Mounting manual

MON 22

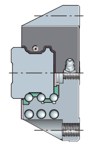


Six-row linear recirculating ball bearing and guideway assemblies

Features

Linear recirculating ball bearing and guideway assemblies KUSE are full complement, preloaded units that are used in applications with long unrestricted strokes, very high loads and very high rigidity.

A guidance system comprises at least one carriage supplied fitted with a lubrication connector, one guideway, one dummy guideway, plastic closing plugs and O rings for sealing off the upper relubrication holes.



X-life

In linear recirculating ball guidance systems, the entry zones – the area in which the rolling elements enter the saddle plate up to full load – are considered as areas determining the rating life. They ensure that the load is applied to the rolling element not abruptly but steadily, which gives a more uniform load distribution.

Through optimisation of the entry zone geometry, the six-row linear recirculating ball bearing and guideway assembly KUSE has not only smaller stroke pulsation but also achieves a significant increase in the basic load ratings according to its size and series in comparison with the conventional design.

Full complement

Since they have the maximum possible number of rolling elements, full complement guidance systems have extremely high load carrying capacity and particularly high rigidity.

Carriages

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

Favourably positioned lubrication pockets in the carriage provide a generous grease reservoir and advantageous lubrication, see page 213.

Guideways

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

Location from above or below

Guideways TKSD.. (-ADB, -ADK) are located from above and have through holes with counterbores for the fixing screws. Guideways TKSD..-U are located from below and have threaded blind holes.

Slot for covering strip

Guideways TKSD..-ADB have a slot for the adhesive bonded steel covering strip ADB. Guideways TKSD..-ADK have a slot with undercut for the clip fit steel covering strip ADK, see dimension table.

Multi-piece guideways

If the required guideway length l_{max} is greater than the value in the dimension tables, the guideways are supplied as several segments, see page 220.

Six-row linear recirculating ball bearing and guideway assemblies

Standard accessories

As standard, the scope of delivery includes various accessory parts.

Dummy guideway

The dummy guideway prevents damage to the rolling element set and prevents the rolling elements from falling out while the carriage is separated from the guideway.

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

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 dimension table.

Lubrication connector and O rings

A lubrication connector for relubrication from the end is included already fitted.

O rings for sealing purposes if relubrication is carried out from above via the adjacent construction are included in the delivery.

Load carrying capacity

The linear recirculating ball bearing and guideway assemblies have six rows of balls. The four outer rows have a contact angle of 45° and the two inner rows have a contact angle of 60° to the raceways, *Figure 1*.

Four rows of balls support compressive loads while two rows of balls support tensile loads and all six rows support lateral loads.

The units can support loads from all directions, except in the direction of motion, and moments about all axes, *Figure 1*.

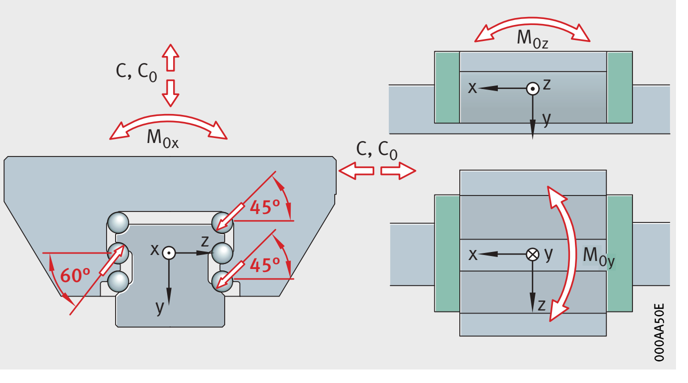


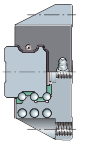
Figure 1
Load carrying capacity and contact angle

Acceleration and velocity

Six-row linear recirculating ball bearing and guideway assemblies KUSE permit accelerations up to 150 m/s^2 and velocities up to 5 m/s, see table.

Operating limits

Designation	Acceleration up to m/s^2	Velocity up to m/s
KUSE	150	5



Interchangeability

Carriages KWSE and guideways TKSD are interchangeable in any combination within one size, preload class and accuracy class.

Sealing

Elastic end wipers are fitted to the end pieces of the carriages on both sides to retain the lubricant within the system. Size 45 is fitted on both sides with non-contact, corrosion-resistant end plates.

Standard sealing strips ensure reliable sealing and protect the rolling element system against contamination, even in critical environmental conditions, *Figure 2*, page 214.

Under extremely heavy contamination load, additional wipers can be fitted, see page 244. Where necessary, additional covers must be used.

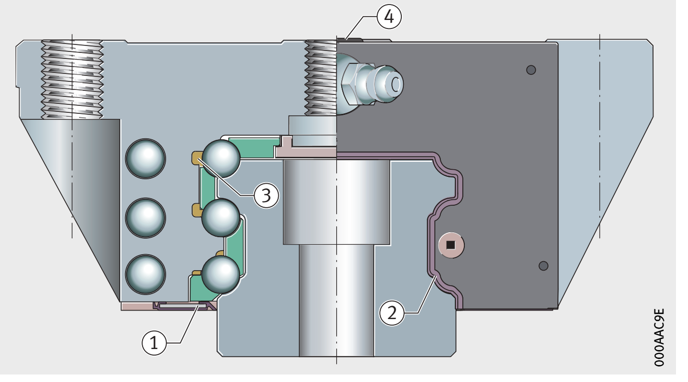
Lubrication

Six-row linear recirculating ball bearing and guideway assemblies KUSE are suitable for oil and grease lubrication. A lubrication connector for grease lubrication from the end is included already fitted. Optionally, other lubrication connectors are available, see page 254.

Lubrication is carried out via lubrication connectors in the end face of the end piece or from above via the adjacent construction and the lubrication holes in the end pieces. Observe the mounting manual MON 22.

Six-row linear recirculating ball bearing and guideway assemblies

It must be ensured that the adjacent construction completely covers the carriage (including the end pieces) and the O rings for sealing off the relubrication hole from above are inserted, *Figure 2*. Otherwise, lubricant may escape through the upper lubrication hole.



1 Standard sealing strips
2 Elastic wipers
3 Lubricant pockets and grease reservoir
4 O ring

Figure 2
Sealing strips, wipers, lubricant reservoir

If lubrication connectors are fitted, the maximum permissible screw depth must be observed, see dimension tables. If additional sealing elements KIT, the screw depth is increased. The standard lubrication connector is then no longer usable. Suitable lubrication connectors must additionally be taken into consideration when ordering, see page 254.

Operating temperature

As standard, six-row linear recirculating ball bearing and guideway assemblies KUSE can be used at operating temperatures from –10 °C to +80 °C.

Corrosion-resistant design

Six-row linear recirculating ball bearing and guideway assemblies KUSE are available in the accuracy class G3 and preload class V1 or V2 and also in a corrosion-resistant design with the special coating Corrotect, see page 57.

Designs

Six-row linear recirculating ball bearing and guideway assemblies KUSE are available in four designs, see table.

Available designs

Design	Description
–	Standard carriage
H	High carriage
HL	High, long carriage
L	Long carriage

Design and safety guidelines

Preload

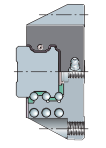
Linear recirculating ball bearing and guideway assemblies KUSE are available in the preload classes V0, V1 and V2, see table.

Preload classes

Preload class	Preload setting
V0	Very small clearance to clearance-free
V1[1]	$0{,}04 \cdot C_{II}$[2]
V2	$0{,}13 \cdot C_{II}$[2]

1) Standard preload class.

2) Basic dynamic load rating of the central rows of balls.



Influence of preload on the linear guidance system

The preload of a linear guidance system defines the rigidity of the system. The six-row linear recirculating bearing and guideway assembly KUSE can be obtained in the preload classes V0 to V2, where the preload class V1 is the standard preload class.
If special requirements are present, the alternative preload classes may be used.

Increasing the preload increases the rigidity of the guidance system. The preload influences not only the rigidity but also the displacement force of the guidance system. The higher the preload, the larger the displacement force. Furthermore, preload also influences the operating life of the 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_{KUSE}	
from	to	from	to
4	20	0,001	0,002

Rigidity

The deflection curves show the deformation of the linear recirculating ball bearing and guideway assemblies KUSE, including the deformation of the screw connections to the adjacent construction, *Figure 3*, page 216, to *Figure 6*, page 217.

! The rigidity curves are valid only for screw mounting in accordance with the mounting manual MON 22 and the standard preload class V1.

Six-row linear recirculating ball bearing and guideway assemblies

KUSE20
KUSE25
KUSE30
KUSE35
KUSE45

δ = deflection
F = load

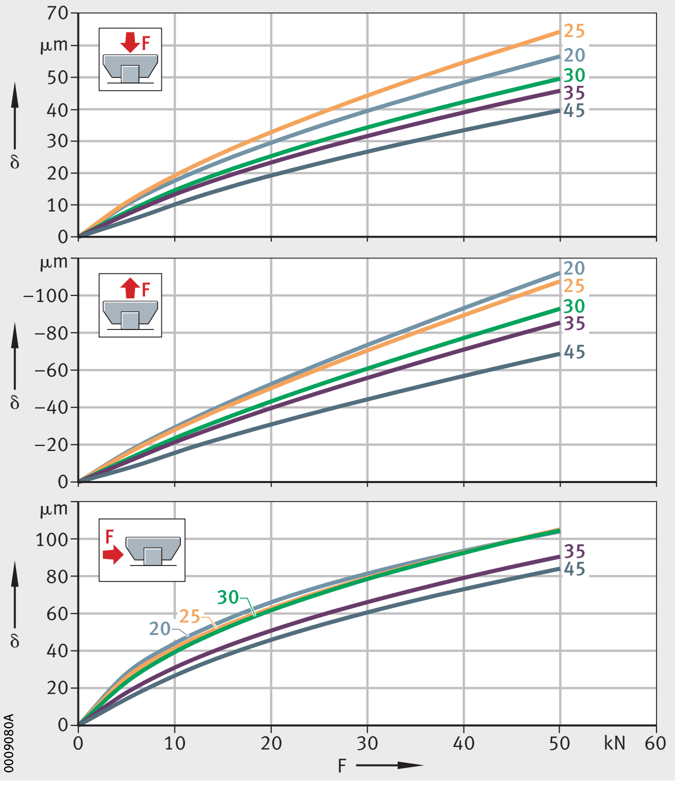


Figure 3
Deflection curves for compressive, tensile and lateral load

KUSE20-L
KUSE25-L
KUSE30-L
KUSE35-L
KUSE45-L

δ = deflection
F = load

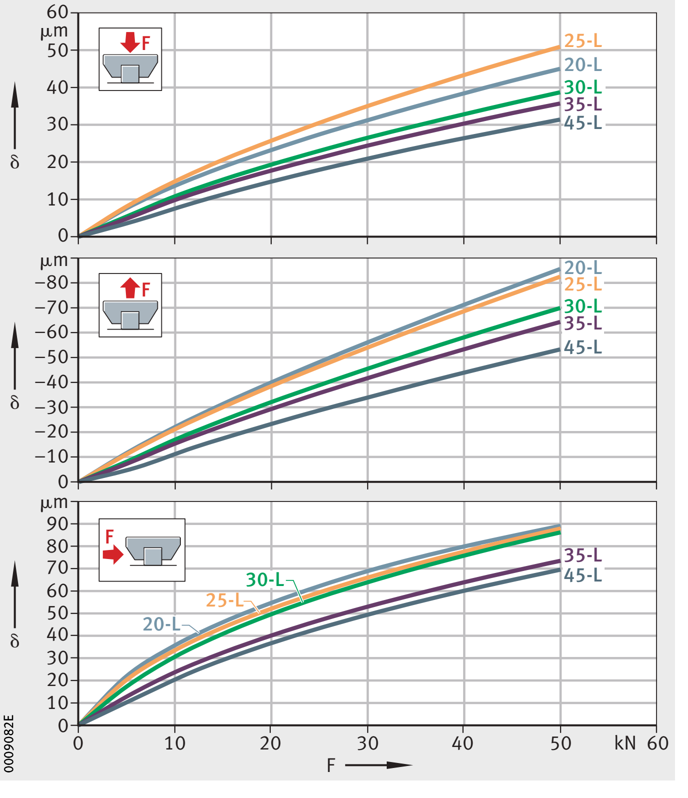
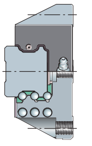


Figure 4
Deflection curves for compressive, tensile and lateral load



KUSE20-H
KUSE25-H
KUSE30-H

δ = deflection
F = load

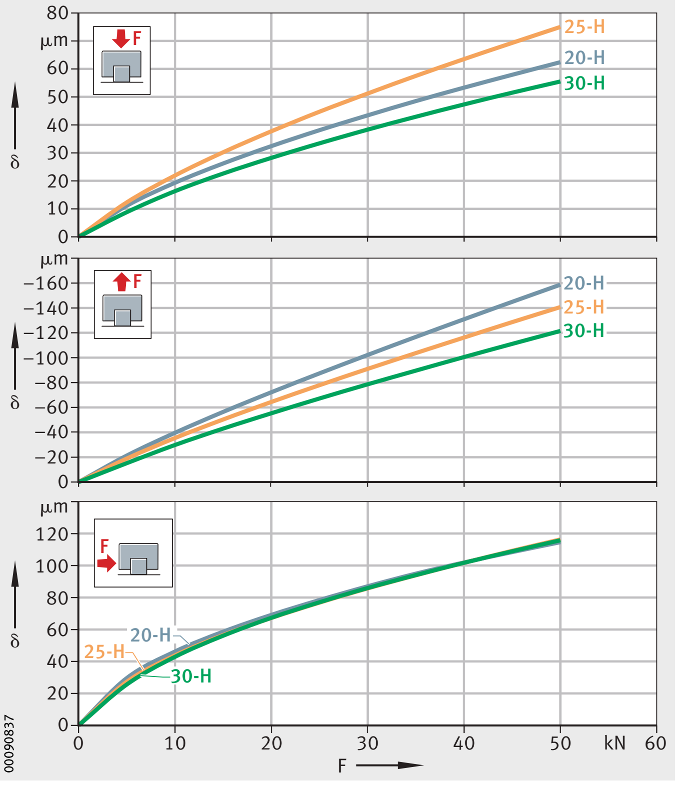


Figure 5
Deflection curves for compressive, tensile and lateral load

KUSE20-HL
KUSE25-HL
KUSE30-HL

δ = deflection
F = load

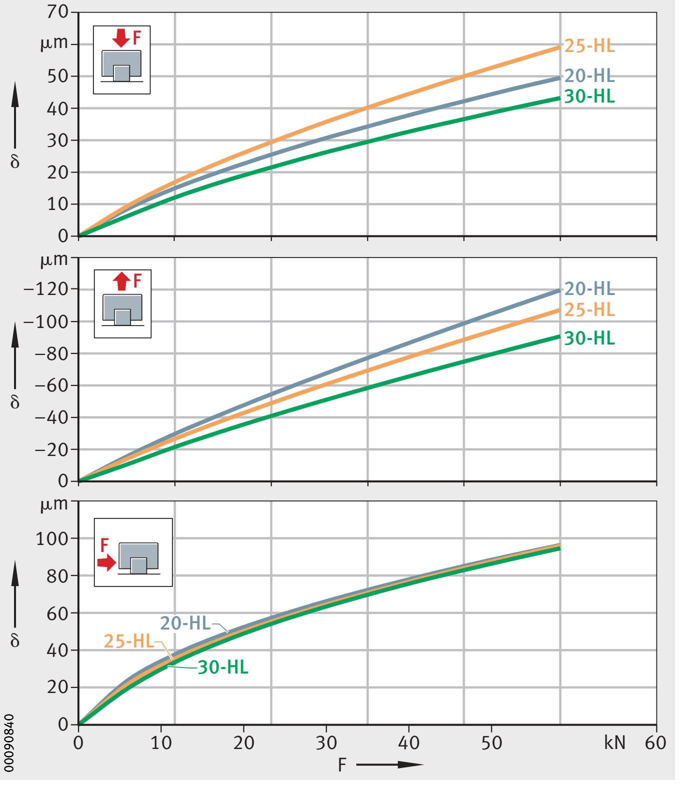


Figure 6
Deflection curves for compressive, tensile and lateral load

Six-row linear recirculating ball bearing and guideway assemblies

Hole patterns of guideways

Unless specified otherwise, the guideways have a symmetrical hole pattern, where $a_L = a_R$, *Figure 7*.

An asymmetrical hole pattern may also be available upon request. In this case, $a_L \geqq a_{L\,min}$ and $a_R \geqq a_{R\,min}$, *Figure 7*.

Irrespective of the orientation of the locating face, a_L is on the left and a_R on the right, *Figure 7*. When ordering, the required orientation of the locating face (top or bottom) must be indicated.

1 Locating face
2 Marking
3 Symmetrical hole pattern
4 Asymmetrical hole pattern

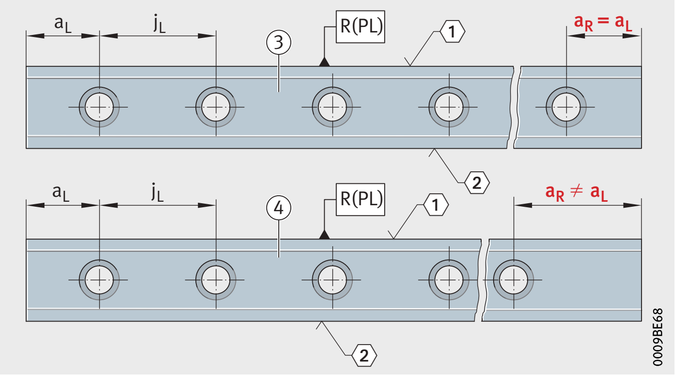


Figure 7
Hole patterns of guideways with one row of holes

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 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:

$$x = n + 1$$

a_L, a_R mm
Spacing between the start and the end of the guideway and the nearest hole, *Figure 7*, page 218

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

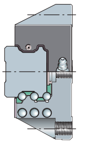
l mm
Guideway length

n –
Maximum possible number of pitches between holes

j_L mm
Spacing between holes

x –
Number of holes.

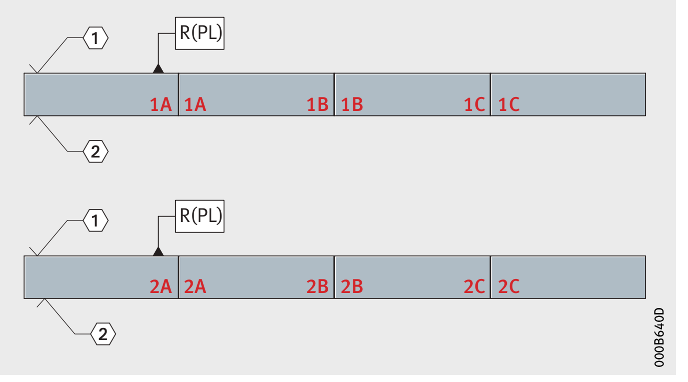
If the minimum values for a_L and a_R are not observed, the counterbores of the holes may be intersected. Risk of injury.



Six-row linear recirculating ball bearing and guideway assemblies

Multi-piece guideways

If the guideway length required is greater than l_{max}, see dimension tables, or joined guideways are required, these guideways are made up from segments that together comprise the total required length. The segments are matched to each other and marked, *Figure 8*. The pitch is always located centrally between the fixing holes.



1 Locating face
2 Marking

Guideway segments:
1A, 1A 1B, 1B 1C, 1C
2A, 2A 2B, 2B 2C, 2C

Figure 8
Marking of multi-piece guideways

!

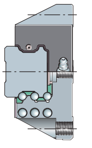
In the case of multi-piece guideways, the gap at the end faces between two segments must be $< 0{,}05$ mm.

Guideways suitable for joining as required

If partial guideway lengths ($l < l_{max}$) are to be combined with each other to form a guideway set as requested by the customer, the following postscript must be added to the order for the relevant guideway segment: “Guideway suitable for joining as required”.

If the guideway segment is an end segment, it is recommended that the guideway end has a chamfer, in order to make it easier to slide the carriages onto the guideway and protect the seals against damage. In this case, the position of the chamfer (left or right) and the position of the locating face (top or bottom) must be taken into consideration when ordering.

This design facilitates easier logistics.



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 can be achieved most easily when the guideway is pressed against a locating face.

If the guideway cannot be aligned as recommended by means of locating faces or very high requirements are placed on the running accuracy, the guideway straightness must be restricted.
The following postscript must be added to the order: “Restricted guideway straightness”.

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.

!

Observe the tolerances for the mounting surfaces and parallelism of mounted guideways, *Figure 9*, page 222, and table, page 223.

Surfaces should be ground or precision milled with the objective of achieving a mean roughness value Ramax 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 equation:

$$\Delta H = a \cdot b$$

ΔH — µm
Maximum permissible deviation from the theoretically precise position, *Figure 9*, page 222

a — –
Factor, dependent on the preload class, see table

b — mm
Centre distances between guidance elements.

Factor a

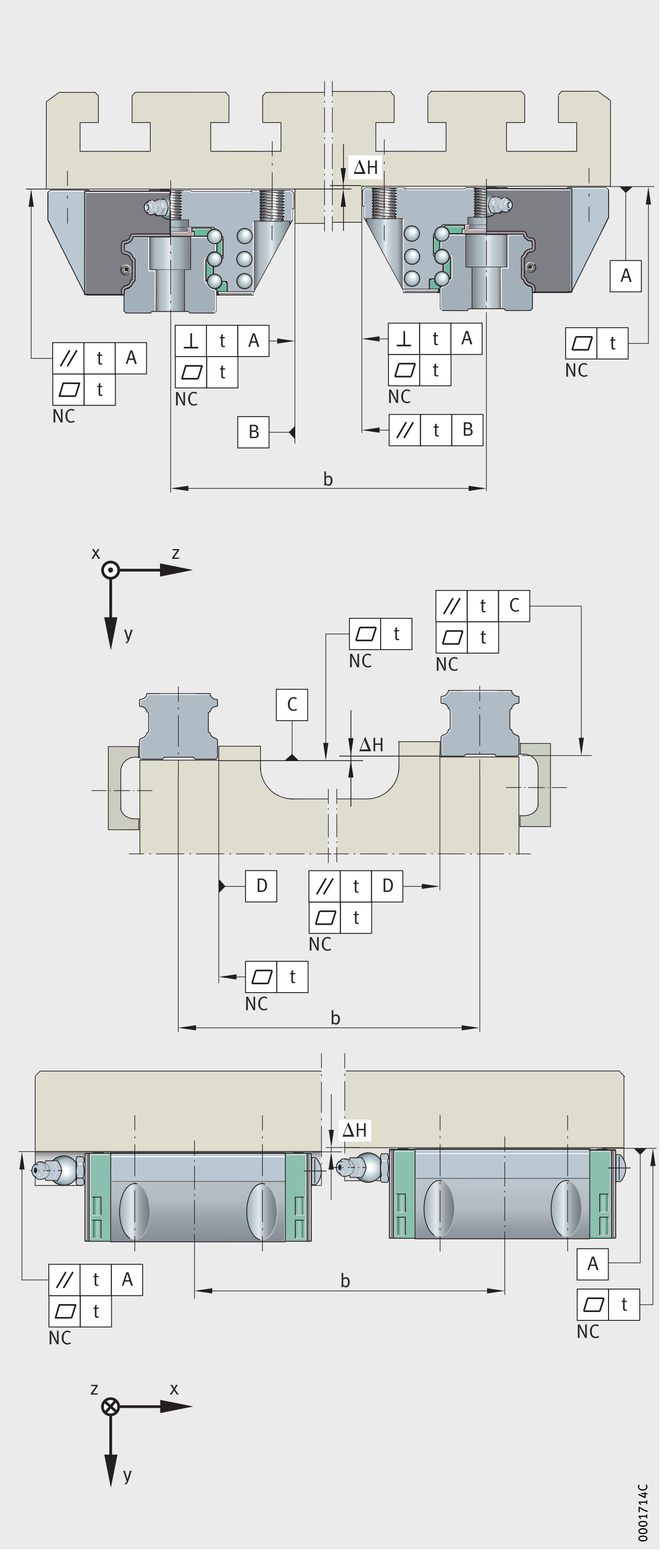
Preload class	Factor a
V0	0,2
V1[1]	0,2
V2	0,1

[1] Standard preload class.

!

Observe the guidelines in the mounting manual MON 22 for KUSE.

Six-row linear recirculating ball bearing and guideway assemblies



NC = not convex

b = spacing between guidance elements
ΔH = height difference
t = parallelism, flatness and perpendicularity tolerance

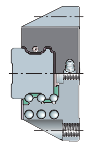
Figure 9
Tolerances of mounting surfaces and parallelism of mounted guideways and carriages

Parallelism of mounted guideways

For guideways arranged in parallel, the values for t are in accordance with *Figure 9*, page 222, and the table. If the maximum values are used, this may increase the displacement resistance.

Values for geometry and position

Guideway	Preload class	
	V0, V1	V2
	Parallelism, flatness and perpendicularity t μm	
TKSD20 (-U, -ADB, -ADK)	9	6
TKSD25 (-U, -ADB, -ADK)	11	7
TKSD30 (-ADB, -ADK)	13	8
TKSD35 (-ADB, -ADK)	15	10
TKSD45 (-ADB, -ADK)	17	12

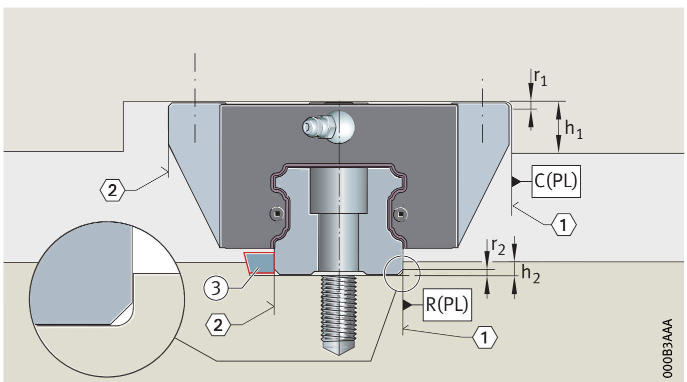


Locating heights and corner radii

For the design of the locating heights and corner radii, see table and *Figure 10*.

Locating heights, corner radii

Designation	Locating heights		Corner radii	
	h_1 mm	h_2 mm max.	r_1 mm max.	r_2 mm max.
KUSE20 (-L, -H, -HL)	5	4	1	0,5
KUSE25 (-L, -H, -HL)	5	4,5	1	0,8
KUSE30 (-L, -H, -HL)	6	5	1	0,8
KUSE35 (-L)	6,5	6	1	0,8
KUSE45 (-L)	9	8	1	1



1 Locating face
2 Marking
3 Vee strip

Figure 10
Locating heights and corner radii

Six-row linear recirculating ball bearing and guideway assemblies

Accuracy

Accuracy classes

Six-row linear recirculating ball bearing and guideway assemblies are available in accuracy classes G1 to G3, *Figure 11*. The standard is class G3.

Parallelism of raceways to locating surfaces

The parallelism tolerance of the guideways is dependent on the accuracy classes, *Figure 11*.

In systems with Corrotect coating, there may be deviations in tolerances compared with uncoated units.

t = parallelism tolerance
l = total guideway length

(1) Locating face

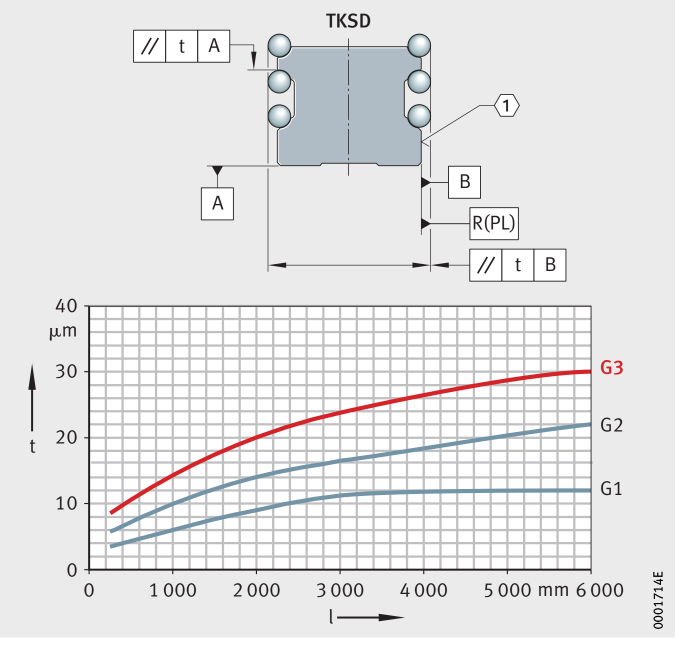


Figure 11
Accuracy classes and parallelism tolerances of guideways

Tolerances

The tolerances are arithmetic mean values, see table and *Figure 12*, page 225. They are relative to the centre point of the screw mounting or locating surfaces of the carriage.

The dimensions H and A_1 should always remain within the tolerance irrespective of the position of the carriage on the guideway, see table, page 225.

Tolerances for height H and spacing A1

Tolerance		Accuracy		
		G1 µm	G2 µm	G3[1] µm
Tolerance for height	H	±10	±20	±25
Difference in height[2]	ΔH	5	10	15
Tolerance for spacing	A_1	±10	±15	±20
Difference in spacing[2]	ΔA_1	7	15	22

[1] Standard accuracy class.

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

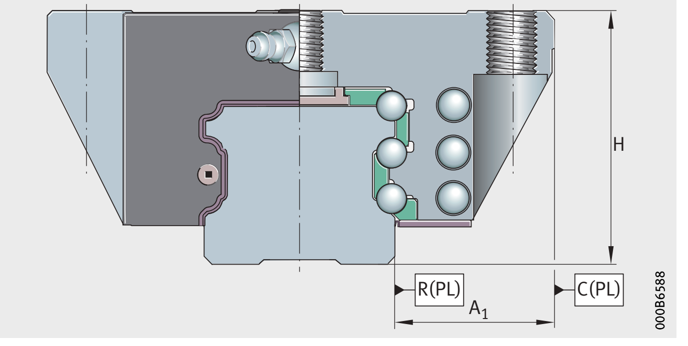


Figure 12
Datum dimensions for accuracy

Units with Corrotect coating

For these units, the values for the appropriate accuracy class must be increased by the values for the coating, see table.

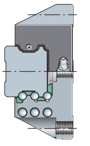
Coated systems are only available in the accuracy class G3.

Tolerances for coated parts

Tolerance[1]		Corrotect RROC µm
Tolerance for height	H	+6
Difference in height[2]	ΔH	+3
Tolerance for spacing	A_1	+3
Difference in spacing[2]	ΔA_1	+3

[1] Displacement in tolerance zone (guideway and carriage with coating).

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

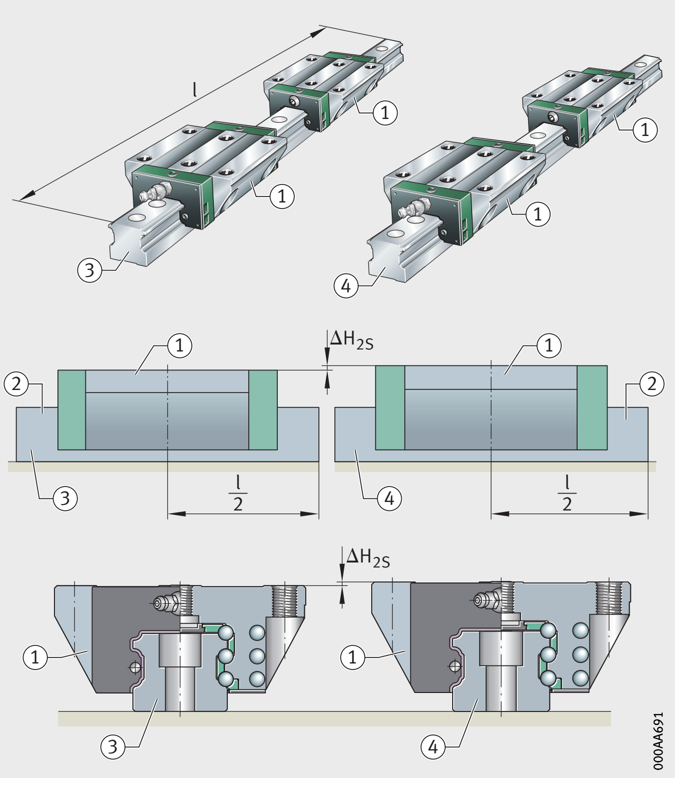


Six-row linear recirculating ball bearing and guideway assemblies

Height sorting 2S

If there are particular requirements for the accuracy of parallel systems, it is possible to restrict the height tolerance by specific sorting.

The height difference ΔH_{2S} is measured at the centre of the guideway (l/2). At this point, the height difference between all carriages of linear recirculating ball bearing and guideway assemblies supplied as a set is max. ΔH_{2S}, *Figure 13* and table.



l = guideway length

1 Any carriage
2 Guideway
3 Linear recirculating ball bearing and guideway assembly 1
4 Linear recirculating ball bearing and guideway assembly 2

Figure 13
Height sorting 2S

Height difference in 2S

Height difference	Accuracy		
	G1	G2	G3
	µm	µm	µm
ΔH_{2S} 1)	10	20	25

1) Measured at the centre of the guideway.

Positional and length tolerances of guideways

The positional tolerances are not dependent on the guideway length, *Figure 14* and tables.

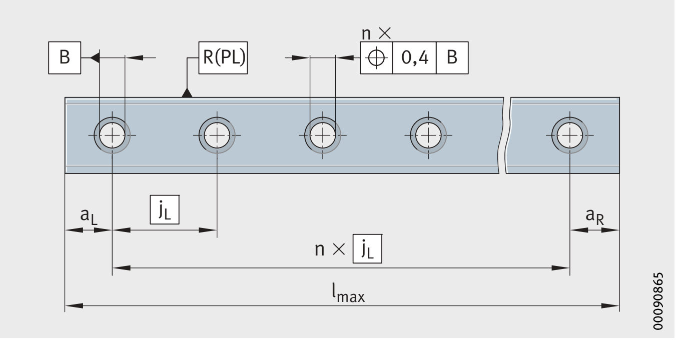


Figure 14
Positional and length tolerances of guideways

Length tolerances of guideways

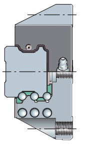
Length tolerance			
Dependent on guideway length l mm			Multi-piece guideways mm
≦ 1000	1000 – 3000	> 3000	
–1	–1,5	±0,1% of guideway length	±3 over total length

If the ordering designation does not specify delivery of the guideway as a single piece, the guideway can optionally be supplied as several segments. Permissible pitch, see table.

Segments for multi-piece guideways

Guideway length[1)] mm	Maximum permissible number of segments
< 3 000	2
3 000– 4 000	3
4 000– 6 000	4
> 6 000	4 plus 1 segment of 1 500 mm above 6 000 mm guideway length

1) Minimum length of one segment = 600 mm.

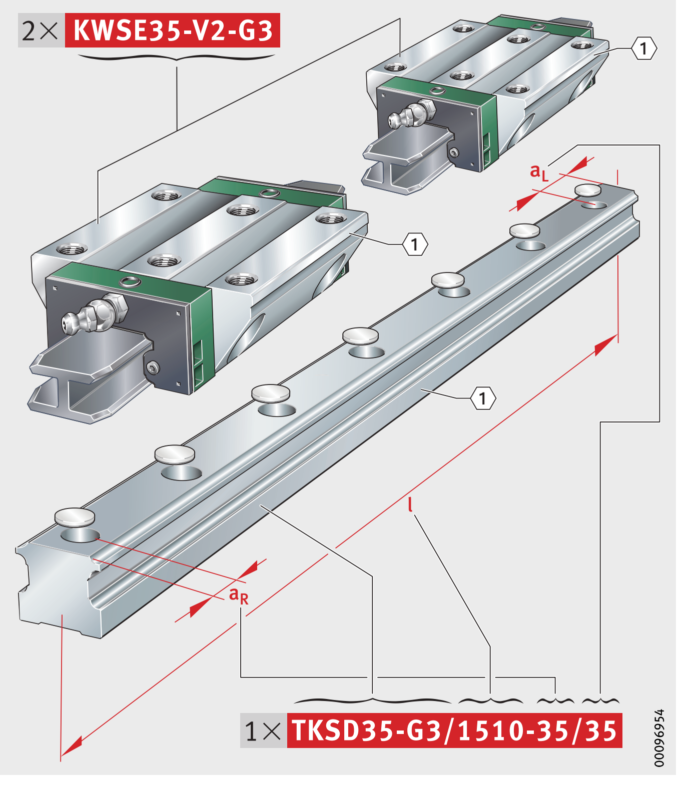


Six-row linear recirculating ball bearing and guideway assemblies

Ordering example, ordering designation

Carriage and guideway separate, guideway with symmetrical hole pattern:

Carriages	Two carriages for six-row linear recirculating ball bearing and guideway assembly	KWSE
	Size	35
	Carriage preload	V2
	Accuracy class	G3
Ordering designation	2×**KWSE35-V2-G3**, *Figure 15*	
Guideway	Guideway for carriage	TKSD
	Size	35
	Accuracy class	G3
	Length of guideway	1 510 mm
	a_L	35 mm
	a_R	35 mm
Ordering designation	1×**TKSD35-G3/1510-35/35**, *Figure 15*	

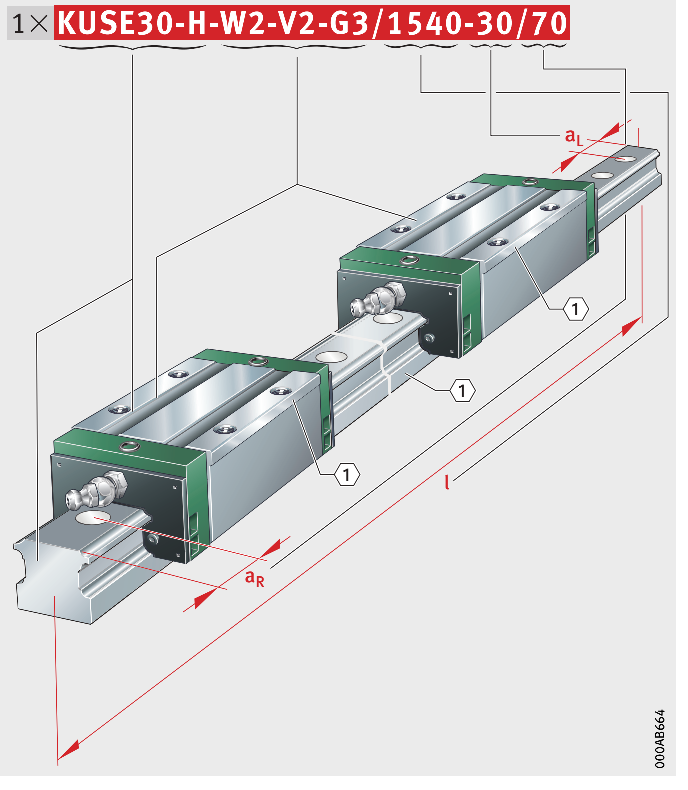


1 Locating face

Figure 15
Ordering example, ordering designation

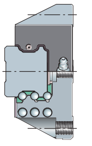
Unit, guideway with asymmetrical hole pattern:

Unit	Linear recirculating ball bearing and guideway assembly with two carriages per guideway	KUSE
	Size	30
	Carriage type	H
	Number of carriages per unit	W2
	Preload class	V2
	Accuracy class	G3
	Length of guideway	1540 mm
	a_L	30 mm
	a_R	70 mm
Ordering designation	1×**KUSE30-H-W2-V2-G3/1540-30/70**, *Figure 16*	



(1) Locating face

Figure 16
Ordering example, ordering designation



Six-row linear recirculating ball bearing and guideway assemblies

Standard and L carriages

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions									
	l_{max} 2)	H	B	L 3)	A_1	J_B	b	A_2	L_1	J_L	J_{LZ}	j_L	a_L, a_R 4)	
							$^{-0,005}_{-0,03}$						min.	max.
KUSE20	3 900	30	63	71,4	21,5	53	20	5	52,4	40	35	60	20	53
KUSE20-L				91,9					72,9					
KUSE25	5 880	36	70	81,8	23,5	57	23	6,5	60,9	45	40	60	20	53
KUSE25-L				104,3					83,4					
KUSE30	5 860	42	90	91,6	31	72	28	9	67,6	52	44	80	20	71
KUSE30-L				119,3					95,3					
KUSE35	5 860	48	100	107,2	33	82	34	9	78,3	62	52	80	20	71
KUSE35-L				138,9					109,9					
KUSE45	5 835	60	120	138,7	37,5	100	45	10	103,1	80	60	105	20	94
KUSE45-L				174,3					138,7					

For further table values, see page 232 and page 233.

⟨1⟩ Locating face. ⟨2⟩ Marking.

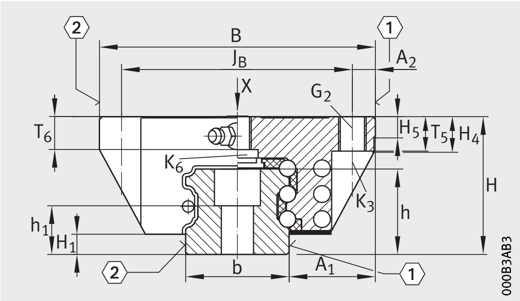
1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

2) Maximum length of single-piece guideways. Permissible number of guideway segments, see page 227.

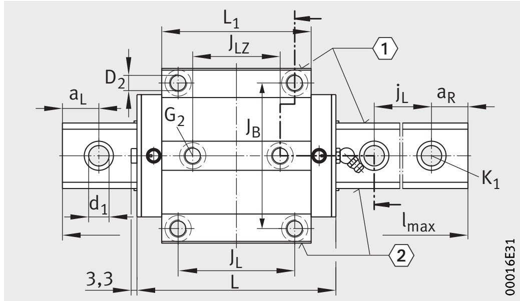
3) Minimum covered length for sealing the upper lubrication connectors N_2.

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

5) For location from above: the maximum screw depth for two central threaded holes is T_6 + 3 mm.



KUSE, KUSE..-L

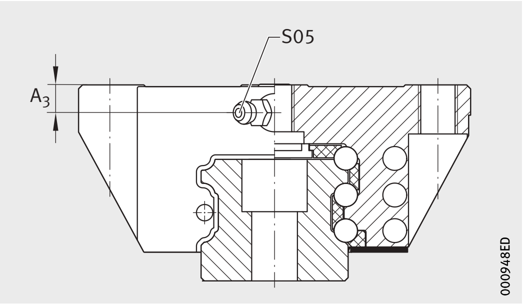


KUSE, KUSE..-L
View X rotated 90°

H_1	H_5	H_4	T_5	T_6 [5)]	h	h_1	Fixing screws[1)]								d_1	D_2
							G_2		K_1		K_3		K_6			
							DIN ISO 4762-12.9						DIN 7984-8.8			
								M_A Nm		M_A Nm		M_A Nm		M_A Nm		
4,6	5	10,6	10	7,2	18	9,8	M6	10	M5	10	M5	10	M5	5,8	5,8	5,5
5,2	5	9,8	10	9,5	21,7	12,4	M8	24	M6	17	M6	17	M6	10	6,8	6,7
5,4	6	13,2	12	10	25	13,5	M10	41	M8	41	M8	41	M8	24	9	8,6
6,6	6,5	13,3	13	12	29,7	18,2	M10	41	M8	41	M8	41	M8	24	9	8,6
8,6	9	17,7	15	15	37,2	21,7	M12	83	M12	140	M10	83	M10	48	13,4	10,6

Six-row linear recirculating ball bearing and guideway assemblies

Standard and L carriages



Lubrication connector on end face

Dimension table (continued) · Dimensions in mm

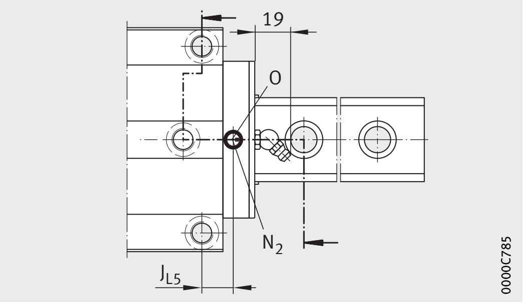
Designation	Carriage		Guideway		Lubrication connectors			
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	N_2 2) max.	J_{L5} 3)	A_3 4)	O DIN 3771
KUSE20	KWSE20	0,43	TKSD20	2,3	3	9,95	5,8	3×1,5
KUSE20-L	KWSE20-L	0,6				20,19		
KUSE25	KWSE25	0,6	TKSD25	3,1	3	12,94	6	3×1,5
KUSE25-L	KWSE25-L	0,82				24,19		
KUSE30	KWSE30	1,2	TKSD30	4,4	4,5	12,80	6,5	4,5×1,5
KUSE30-L	KWSE30-L	1,6				26,65		
KUSE35	KWSE35	1,5	TKSD35	6,5	4,5	11,93	7,2	4,5×1,5
KUSE35-L	KWSE35-L	2,1				27,75		
KUSE45	KWSE45	3,15	TKSD45	11,3	6	15,65	8,5	7×1,5
KUSE45-L	KWSE45-L	4,2				33,45		

1) The basic load rating can only be transmitted fully if the whole thread length is used and the adjacent construction is dimensioned appropriately.

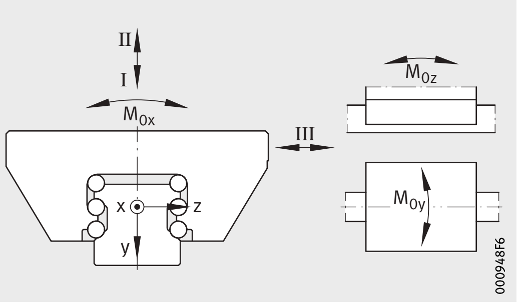
2) Maximum diameter of lubrication hole in adjacent construction.

3) Position of lubrication hole in adjacent construction.

4) Maximum screw depth in end piece 7 mm.

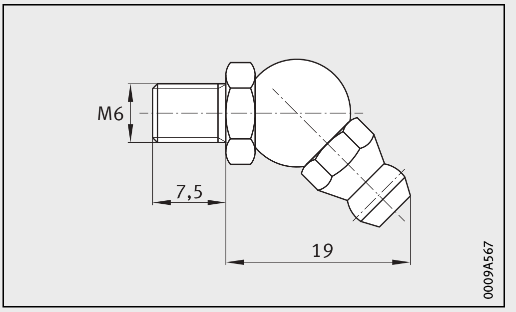


Lubrication connector on top face



Load directions

Basic load ratings[1)]						Moment ratings		
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	M_{0x} Nm	M_{0y} Nm	M_{0z} Nm
25 500	61 000	21 300	35 300	21 000	35 000	530	350	305
35 000	83 000	25 000	47 000	26 000	48 000	730	640	570
38 000	81 000	26 000	45 000	28 000	47 000	840	510	450
47 000	112 000	33 000	62 000	35 000	65 000	1 160	930	830
54 000	108 000	37 800	60 000	40 000	62 000	1 350	800	710
68 000	152 000	48 000	85 000	50 000	88 000	1 920	1 540	1 360
76 100	150 000	53 300	82 400	56 600	89 150	2 300	1 300	1 140
96 000	214 000	67 500	119 000	71 000	125 000	3 300	2 480	2 190
103 000	212 000	72 300	117 400	76 900	121 800	4 500	2 280	2 050
128 000	291 500	89 000	159 000	93 400	168 000	6 200	4 050	3 650



Lubrication connector S05

Six-row linear recirculating ball bearing and guideway assemblies

H and HL carriages

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions						
	l_{max}[2]	H	B	L[3]	A_1	J_B	b $^{-0,005}_{-0,03}$	A_2	L_1	J_L	j_L
KUSE20-H	3 900	30	44	71,4	12	32	20	6	52,4	36	60
KUSE20-HL				91,9					72,9	50	
KUSE25-H	5 880	40	48	81,8	12,5	35	23	6,5	60,9	35	60
KUSE25-HL				104,3					83,4	50	
KUSE30-H	5 860	45	60	91,6	16	40	28	10	67,6	40	80
KUSE30-HL				119,3					95,3	60	

For further table values, see page 236 and page 237.

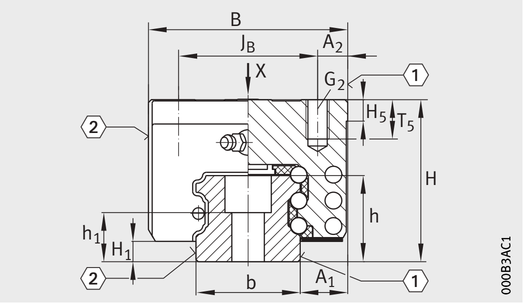
⟨1⟩ Locating face. ⟨2⟩ Marking.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

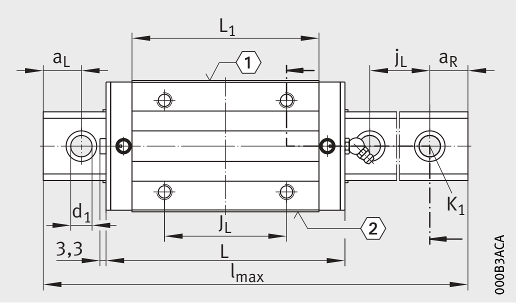
2) Maximum length of single-piece guideways. Permissible number of guideway segments, see page 219.

3) Minimum covered length for sealing the upper lubrication connectors N_2.

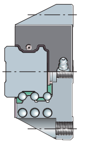
4) a_L and a_R are dependent on the guideway length.



KUSE..-H, KUSE..-HL



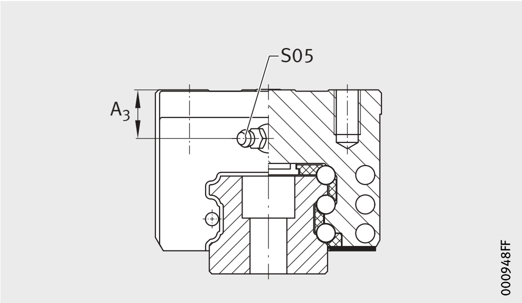
KUSE..-H, KUSE..-HL
View X rotated 90°



a_L, a_R 4)		H_1	H_5	T_5	h	h_1	Fixing screws 1) G_2 DIN ISO 4762-12.9		K_1		d_1
min.	max.							M_A Nm		M_A Nm	
20	53	4,6	5	6	18	9,8	M5	10	M5	10	5,8
20	53	5,2	5	10	21,7	12,4	M6	17	M6	17	6,8
20	71	5,4	6	11	25	13,5	M8	41	M8	41	9

Six-row linear recirculating ball bearing and guideway assemblies

H and HL carriages



Lubrication connector on end face

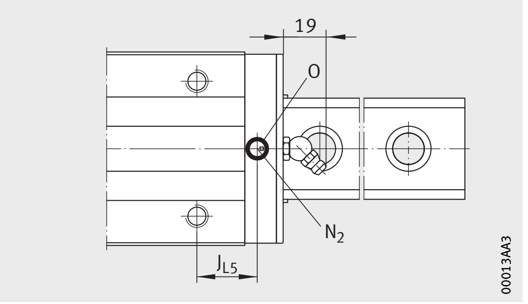
Dimension table (continued) · Dimensions in mm								
Designation	Carriage		Guideway		Lubrication connectors			
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	N_2[2)] max.	J_{L5}[3)]	A_3[4)]	O DIN 3771
KUSE20-H	KWSE20-H	0,32	TKSD20	2,3	3	11,95	5,8	3×1,5
KUSE20-HL	KWSE20-HL	0,44				15,19		
KUSE25-H	KWSE25-H	0,5	TKSD25	3,1	3	17,94	10	3×1,5
KUSE25-HL	KWSE25-HL	0,7				21,69		
KUSE30-H	KWSE30-H	0,9	TKSD30	4,4	4,5	18,80	9,5	4,5×1,5
KUSE30-HL	KWSE30-HL	1,2				22,65		

1) The basic load rating can only be transmitted fully if the whole thread length is used and the adjacent construction is dimensioned appropriately.

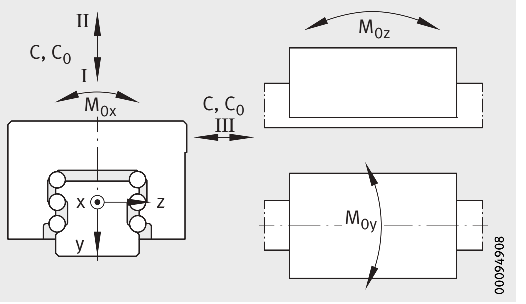
2) Maximum diameter of lubrication hole in adjacent construction.

3) Position of lubrication hole in adjacent construction.

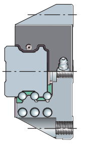
4) Maximum screw depth in end piece 7 mm.



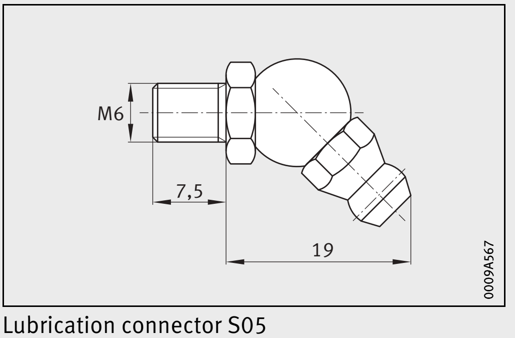
Lubrication connector on top face



Load directions



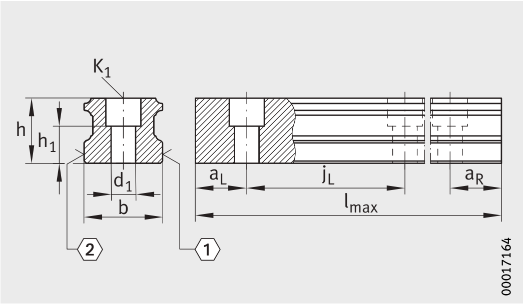
Basic load ratings[1)]						Moment ratings		
Load direction I Compressive load		Load direction II Tensile load		Load direction III Lateral load				
dyn. C N	stat. C_0 N	dyn. C N	stat. C_0 N	dyn. C N	stat. C_0 N	M_{0x} Nm	M_{0y} Nm	M_{0z} Nm
25 500	61 000	21 300	35 300	21 000	35 000	530	350	305
35 000	83 000	25 000	47 000	26 000	48 000	730	640	570
38 000	81 000	26 000	45 000	28 000	47 000	840	510	450
47 000	112 000	33 000	62 000	35 000	65 000	1 160	930	830
54 000	108 000	37 800	60 000	40 000	62 000	1 350	800	710
68 000	152 000	48 000	85 000	50 000	88 000	1 920	1 540	1 360



Lubrication connector S05

Six-row linear recirculating ball bearing and guideway assemblies

Guideways and closing methods



TKSD

Dimension table · Dimensions in mm							
Designation	For linear guidance system	Mass	Closing plug[1]		Covering strip[2]		
		m	Plastic[4] one-piece	Brass one-piece	Adhesive bonded	Clip fit	Retaining plate
		≈ kg/m					
TKSD20	KUSE20	2,3	KA10-TN	KA10-M	–	–	–
TKSD20-U			–	–			
TKSD20-ADB			–	–	ADB13	–	HPL.ADB9-B
TKSD20-ADK					–	ADK12	
TKSD25	KUSE25	3,1	KA11-TN	KA11-M	–	–	–
TKSD25-U			–	–			
TKSD25-ADB			–	–	ADB13	–	HPL.ADB9-B
TKSD25-ADK					–	ADK12	
TKSD30	KUSE30	4,4	KA15-TN	KA15-M	–	–	–
TKSD30-ADB			–	–	ADB18	–	HPL.ADB17-B
TKSD30-ADK					–	ADK16	
TKSD35	KUSE35	6,5	KA15-TN	KA15-M	–	–	–
TKSD35-ADB			–	–	ADB18	–	HPL.ADB17-B
TKSD35-ADK					–	ADK16	
TKSD45	KUSE45	11,3	KA20-TN	KA20-M	–	–	–
TKSD45-ADB			–	–	ADB23	–	HPL.ADB17-B
TKSD45-ADK					–	ADK21	

⟨1⟩ Locating face. ⟨2⟩ Marking.

1) Closing plugs, see page 261.

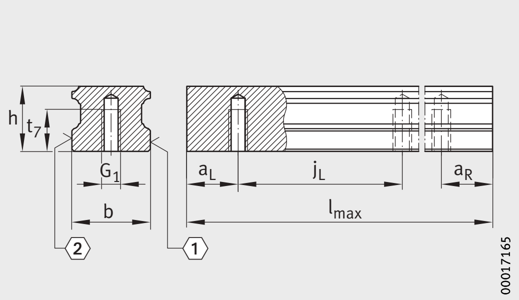
2) Covering strips, see page 262.

3) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

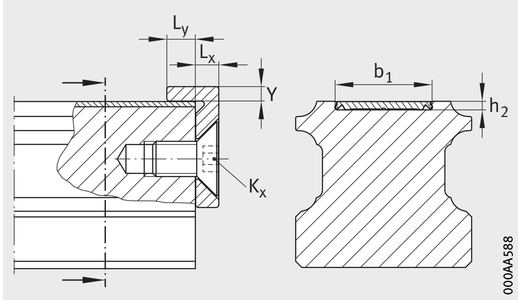
4) Standard.

5) Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 227.

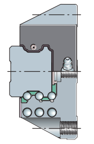
6) a_L and a_R are dependent on the guideway length.



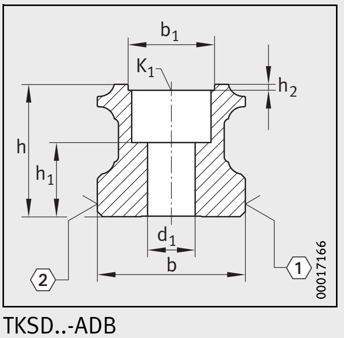
TKSD..-U



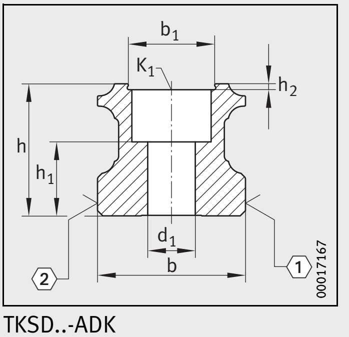
Retaining plate and covering strip



Dimensions														Fixing screws[3]				
K_x	L_x	L_y	Y	l_{max}[5]	h	b	a_L, a_R[6]		j_L	h_1	h_2	t_7	b_1	G_1		K_1		d_1
														DIN ISO 4762-12.9				
						$^{-0,005}_{-0,035}$	min.	max.							M_A Nm		M_A Nm	
–	–	–	–	3 900	18	20	20	53	60	9,8	–	–	–	–	–	M5	10	5,8
												10		M6	17	–	–	–
M5	4	5	2								0,5	–	13	–	–	M5	10	5,8
											1,1		12,6					
–	–	–	–	5 880	21,7	23	20	53	60	12,4	–	–	–	–	–	M6	17	6,8
												12		M6	17	–	–	–
M5	4	5	2								0,5	–	13	–	–	M6	17	6,8
											1,1		12,6					
–	–	–	–	5 860	25	28	20	71	80	13,5	–	–	–	–	–	M8	41	9
M6	4	5	2,5								0,5		18					
											1,1		16,6					
–	–	–	–	5 860	29,7	34	20	71	80	18,2	–	–	–	–	–	M8	41	9
M6	4	5	2,5								0,5		18					
											1,1		16,6					
–	–	–	–	5 835	37,2	45	20	94	105	21,7	–	–	–	–	–	M12	140	13,4
M6	4	5	2,5								0,5		23					
											1,1		21,7					



TKSD..-ADB



TKSD..-ADK

Sealing and lubrication elements – system KIT

Sealing and lubrication elements

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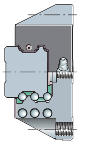
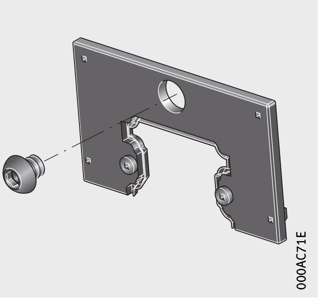


Sealing elements – system KIT

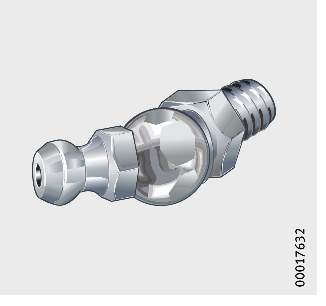
End wiper – example KIT

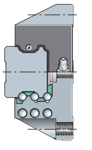
KIT



Lubrication connectors

S





Sealing and lubrication elements – system KIT

With their extensive range of standard accessories, the linear 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 sealing and lubrication 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 sealing and lubrication elements. These special accessories protect the rolling element system of the guidance systems against contamination and ensure long lubrication intervals even under the most demanding operating conditions.

KIT structure

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:

- Possible combinations, see page 252
- Description of sealing elements, see page 244
- Overview of sealing elements, see page 248
- Description of lubrication elements, see page 246.

Only a proportion of the KITs can be 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

The degree of contamination will vary depending on the market sector, the application and the environmental conditions.

The definitions at this point, see table, are therefore only an initial aid in the selection of KITs.

Definition of the degree of contamination

Degree of contamination			
Very slight	Slight	Moderate	Heavy[1]
- 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

[1] If this degree of contamination is present, a KIT can give only a restricted level of protection. Additional measures implemented by the customer, such as additional covers on the guidance system, will give a considerable increase in the operating life.

Sealing and lubrication elements

Sealing elements

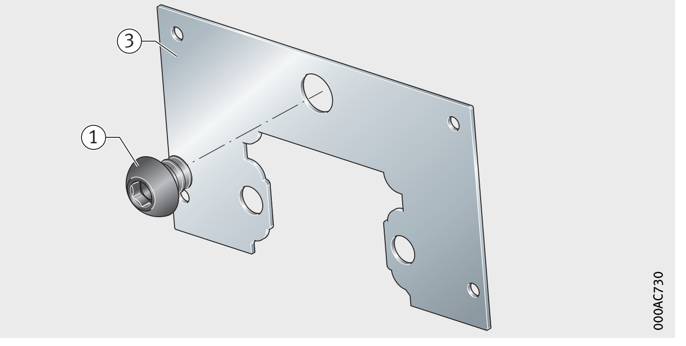
The following additional sealing components are available:

- End plates, see page 244
- End wipers, see page 244
- Additional wipers, see page 245
- Sealing strips, see page 245.

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.



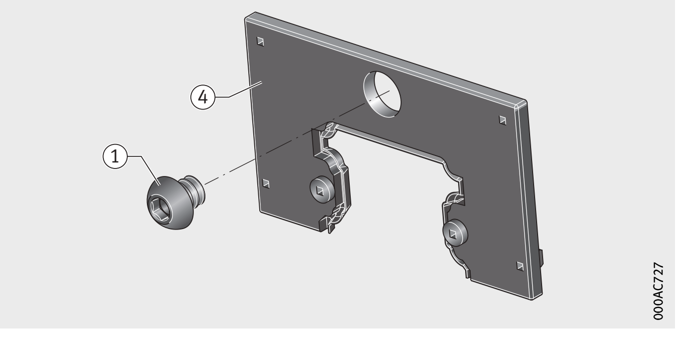
① Fixing screw
③ End plate, non-contact

Figure 1
End plate

End wipers

End wipers are contact seals that are fixed to the end faces of the carriage. End wipers protect the guidance system against the ingress of contaminant particles and can extend the relubrication intervals. The selection of the suitable sealing system is based on the application of the guidance system. End wipers are available in a single lip design (as standard) and are made from special high performance materials, *Figure 2*.

Single lip end wipers have a seal lip oriented outwards that protects the carriage against the ingress of contaminant particles. In combination with oil lubrication, the single lip end wiper facilitates the rinsing out of contaminant particles (flushing effect).



① Fixing screw
④ End wiper, single lip, black

Figure 2
End wiper
KIT.KWSE..-100

Additional wipers

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

The additional wipers are of a single lip design and are made from a special high performance material.

① , ② Fixing screws
④ End wiper, single lip
⑤ Additional wiper, single lip

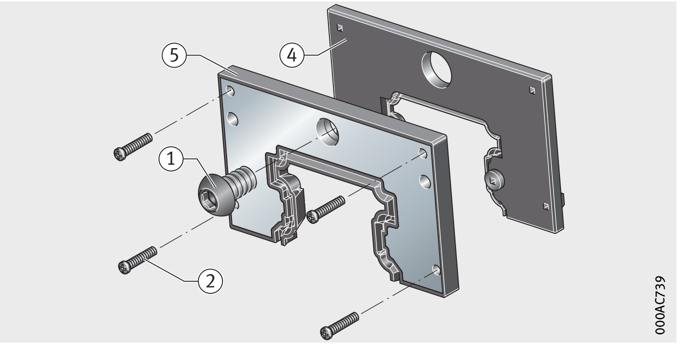


Figure 3
Additional wiper
KIT.KWSE..-300

Sealing strips

Sealing strips are contact components that are fitted to the lower longitudinal sides of the carriage, *Figure 4*. They protect the rolling element system against contamination and loss of lubricant.

⑥ Lower sealing strips, single lip
⑦ Grooved drive stud

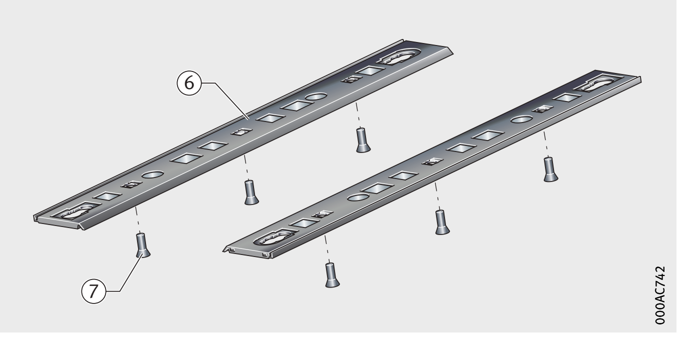
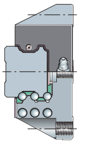


Figure 4
Sealing strips
KIT.KWSE..-900



Lubrication elements

End piece without upper relubrication hole

The designation of the KITs can also be used to order end pieces of the carriage without an upper relubrication hole (end number -..3), *Figure 5*.

At the time of ordering, it should be determined which KITs are required.

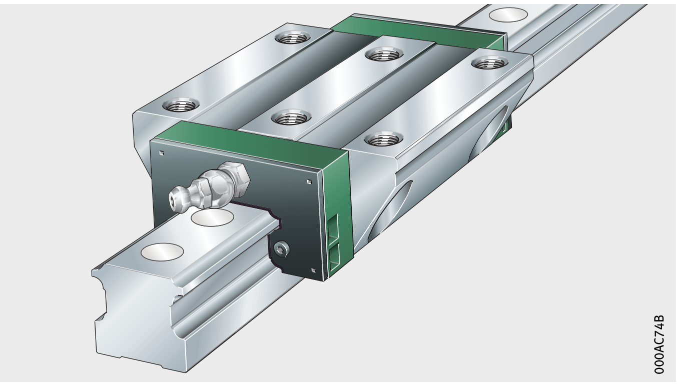


Figure 5
End pieces without upper relubrication hole KIT.KWSE..-..3

Configuration of KIT.KWSE

Unless indicated otherwise, the locating face is defined as being at the top. The KIT designation is given in the sequence left/centre/right. If no KIT numbers are indicated, the standard version will be supplied, see page 248.

KIT components can be fitted on the left, centre and right of the carriage, *Figure 6*.

KWSE..-100/900/200

1 Locating face
2 KIT.KWSE..-100
3 KIT.KWSE..-900
4 KIT.KWSE..-200

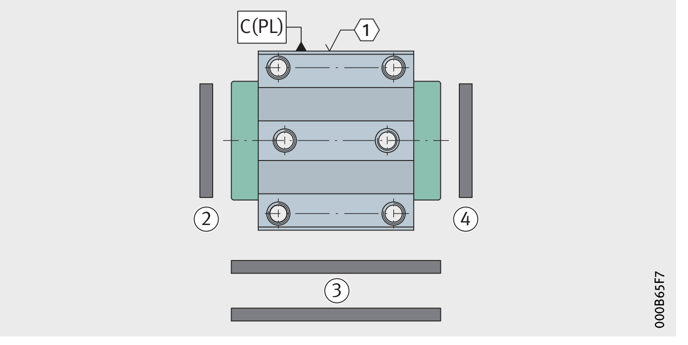
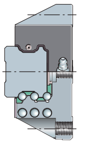


Figure 6
Example of KIT configuration



Retrofitting by the customer

The KITs available for retrofitting by the customer are indicated accordingly as retrofittable in the KIT tables, see page 248.

KIT left, right

The KIT components are identical for all carriage designs. The KIT end number -..3 describes the end piece without upper relubrication holes, *Figure 5*, page 246. The end piece (lubrication distributor plate) is not a KIT component, so the KIT end number -..3 is not taken into consideration in retrofitting by the customer.

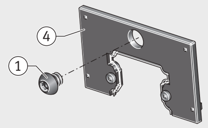
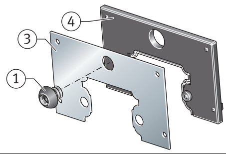
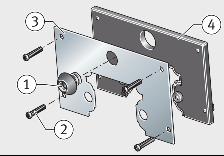
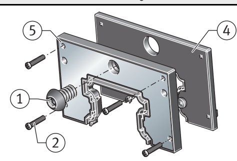
KIT components for retrofitting by the customer must be ordered for all types and designs using the designation KIT.KWSE.. as well as the suffix -OS and the KIT end number -..0.

The scope of delivery includes the wear components and fixing screws required for retrofitting.

Example: **KIT.KWSE35-OS-300**.

Sealing and lubrication elements

Sealing and lubrication elements KIT (left, right) for KUSE

Designation and KIT end number KIT.KWSE[2] Upper lubrication hole open: yes	no	Image	Description
000	**003**	–	No KIT at corresponding position.
100[3]	**103**		① Fixing screw K_1 ④ End wiper, single lip
200	**203**		① Fixing screw K_1 ③ End plate, non-contact ④ End wiper, single lip
230[4]	**233**		① Fixing screw K_1 ② Fixing screw K_2 ③ End plate, non-contact ④ End wiper, single lip
300	**303**		① Fixing screw K_1 ② Fixing screw K_2 ④ End wiper, single lip ⑤ Additional wiper, single lip

⟨1⟩ Locating face

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

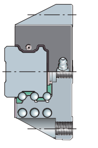
The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations, see page 252.
Recommended lubrication connectors, see page 254.

[1] Definition, see page 243.

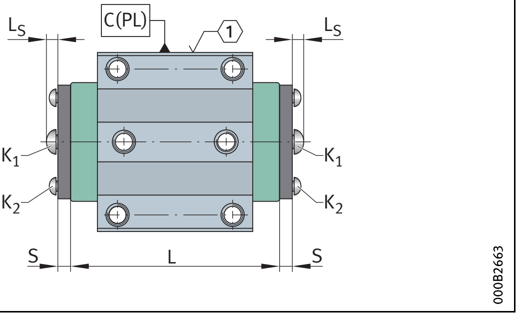
[2] In the case of retrofitting by the customer, the suffix OS must be stated. The condition of the upper relubrication hole is not taken into consideration. The KIT end number is always -..0. See Retrofitting by the customer, page 247. Ordering example: KIT.KWSE35-OS-200.

[3] Standard for KUSE except size 45.

[4] Standard for KUSE45.

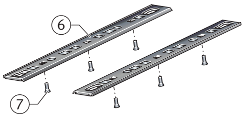


Degree of contamination[1]			Size	Retrofittable	Tolerances			Increase in displacement force				Designation and KIT end number KIT.KWSE[2] Upper lubrication hole open	
Slight	Moderate	Heavy			K_2	L_S mm	S mm	None	Slight	Moderate	Heavy	yes	no
■	–	–	20	■	–	–	–	■	–	–	–	**000**	**003**
			25										
			30										
			35										
			–										
■	■	–	20	■	–	3,3	0	–	–	■	–	**100**[3]	**103**
			25										
			30										
			35										
			–			–							
■	■	–	20	■	–	3,3	0,8		–	■	–	**200**	**203**
			25										
			30										
			35										
			–			–	–						
■	■	–	20	■	ES 1,5×5	3,3	0,8	–	–	■	–	**230**[4]	**233**
			25		ES 1,5×5								
			30		ES 1,5×5								
			35		ES 2,2×6								
			45		ES 2,2×6		0						
■	■	■	20	■	ES 1,8×8	3,3	4,5	–	–	–	■	**300**	**303**
			25		ES 1,8×8								
			30		ES 1,8×8								
			35		ES 2,2×10		4,9						
			45		ES 2,2×12		4,7						



Sealing and lubrication elements

Sealing and lubrication elements KIT (centre) for KUSE

Designation and KIT end number KIT.KWSE	Image	Description
900[2]		⑥ Lower sealing strip, single lip ⑦ Grooved drive stud

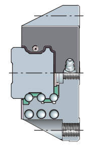
Attention!
The table is only intended as a guide.
Specific application conditions must be taken into consideration when selecting the elements.

The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations, see page 252.
Recommended lubrication connectors, see page 254.

[1] Definition, see page 243.

[2] Standard for KUSE.

Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_2	L_S	S	None	Slight	Moder-ate	Heavy	
						mm	mm					KIT.KWSE
■	■	–	20	–	–	–	–	–	■	–	–	**900**[2]
			25									
			30									
			35									
			45									



Possible combinations – KIT allocation (left) to KIT right										
Designation and KIT end numbers KIT.KWSE	000	003	100	103	200	203	230	233	300	303
000	●	–	–	–	–	–	–	–	–	–
003	–	●	–	–	–	–	–	–	–	–
100	–	–	●	–	●	–	–	–	●	–
103	–	–	–	●	–	●	–	–	–	●
200	–	–	●	–	●	–	–	–	●	–
203	–	–	–	●	–	●	–	–	–	●
230	–	–	–	–	–	–	●	–	●	–
233	–	–	–	–	–	–	–	●	–	●
300	–	–	●	–	●	–	●	–	●	–
303	–	–	–	●	–	●	–	●	–	●

● Possible combination.

Possible combinations – KIT allocation (left or right) to KIT centre										
Designation and KIT end numbers KIT.KWSE	000	003	100	103	200	203	230	233	300	303
900	●	●	●	●	●	●	●	●	●	●

● Possible combination.

1 Locating face top
or
3 Locating face bottom
4 Left
5 Centre
6 Right

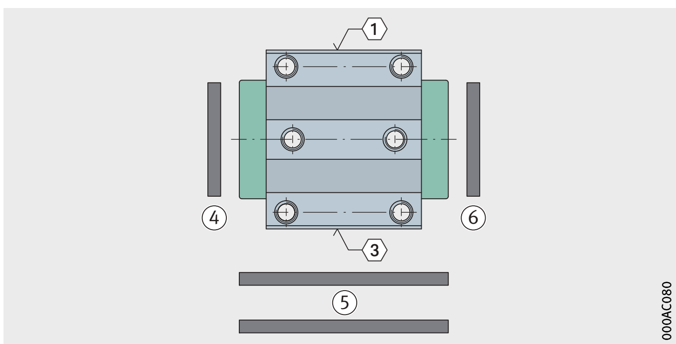
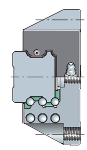


Figure 7
Definition of side allocation

The side allocation of the KIT (left, centre, right) is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.



Lubrication connectors

Linear recirculating ball bearing and guideway assemblies must be lubricated with grease or oil. Depending on the position of the lubrication connector and the other accessories, suitable lubrication connectors are available as special accessories.

Lubrication connectors:

- Standard lubrication connector, *Figure 8*
- Lubrication connectors for manual lubricators, *Figure 9* and table, page 255
- Lubrication connectors for central lubrication, *Figure 11*, page 256, and table, page 257.

W = hexagon

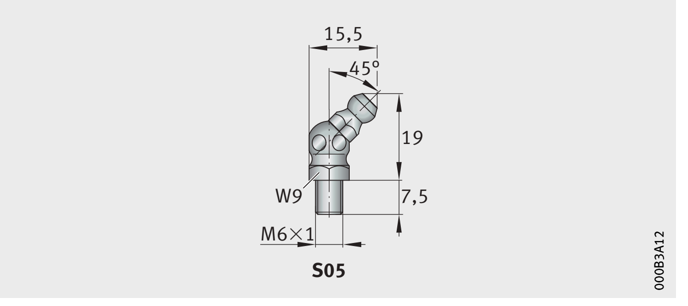


Figure 8
Standard lubrication connector

W = hexagon
S = hexagon socket

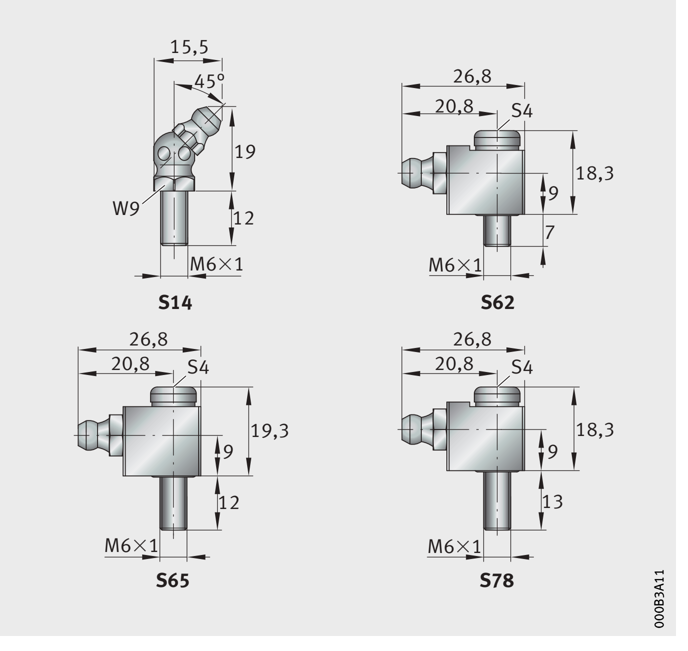
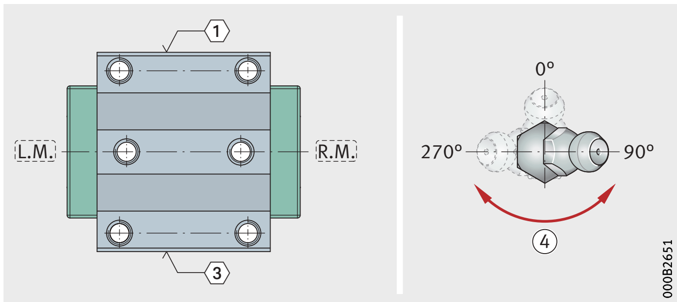


Figure 9
Lubrication connectors for manual lubricators

Lubrication connectors for manual lubricators

Size	Thread	Positions: L.M., R.M.					
		Angled (45°) KIT			Angled (90°) KIT		
		000 003 100 103	230 233	300 303	000 003 100 103	200 203 230 233	300 303
20	M6	S05[1]	S05[1]	S14	S62	S62	S65
25	M6	S05[1]	S05[1]	S14	S62	S62	S65
30	M6	S05[1]	S05[1]	S14	S62	S62	S78
35	M6	S05[1]	S05[1]	S14	S62	S62	S78
45	M6	–	S05[1]	S14	–	S62	S78

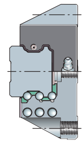
[1] Standard.

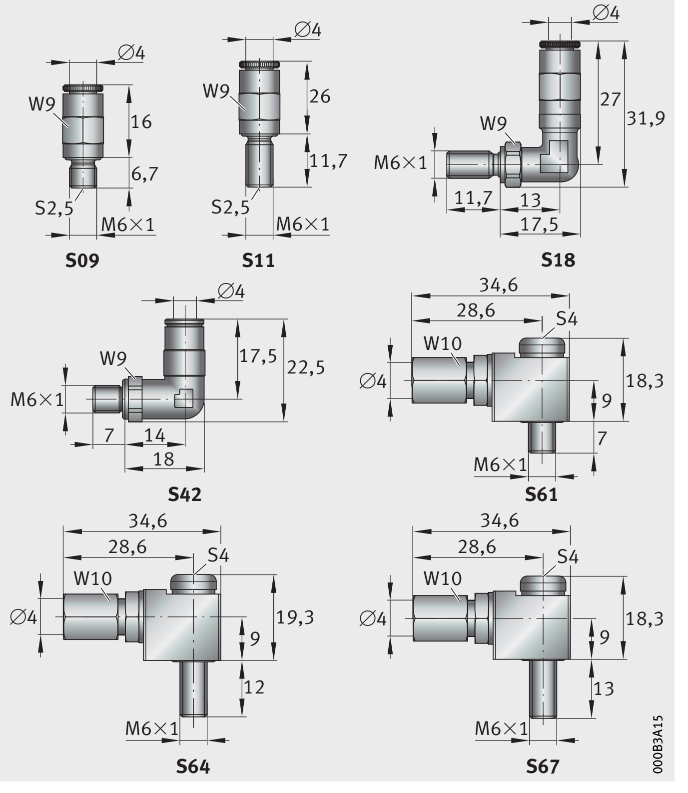


(1) Locating face top
or
(3) Locating face bottom
(4) Alignment of the angled lubrication connectors from viewpoint of carriage

Figure 10
Definition of lubrication connectors

The position and alignment of the lubrication connectors is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.



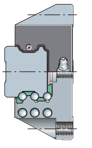


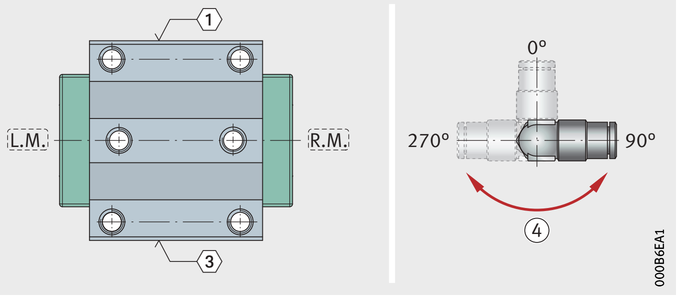
W = hexagon
S = hexagon socket

Figure 11
Lubrication connectors
for central lubrication

Lubrication connectors for central lubrication

Size	Thread	Positions: L.M., R.M.					
		Straight KIT			Angled (90°) KIT		
		000 003 100 103	200 203 230 233	300 303	000 003 100 103	200 203 230 233	300 303
20	M6	S09	S09	–	S61 S42	S18 S61 S42	S18 S64
25	M6	S09	S09	S11	S61 S42	S18 S61 S42	S18 S64
30	M6	S09	S09	S11	S61 S42	S18 S61 S42	S18 S67
35	M6	S09	S09	S11	S61 S42	S18 S61 S42	S18 S67
45	M6	–	S09	S11	–	S18 S61 S42	S18 S67





(1) Locating face top
or
(3) Locating face bottom
(4) Alignment of the angled lubrication connectors from viewpoint of carriage

Figure 12
Definition of lubrication connectors

The position and alignment of the lubrication connectors is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.

Accessories

Closing plugs
Guideway covering strips
Rolling-in device for covering strip
Braking and clamping element

Accessories

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	Brass closing plugs	262
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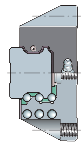


Product overview Accessories

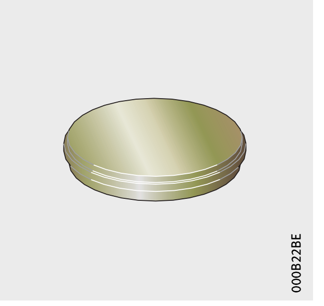
Closing plugs

Plastic

Brass

KA..-TN

KA..-M

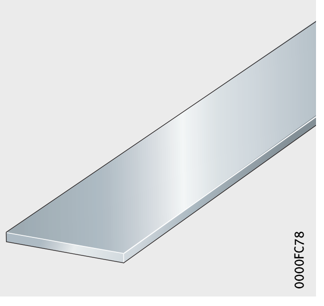


Guideway covering strips

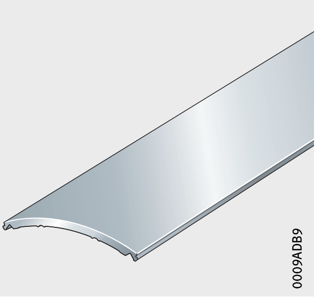
Adhesive bonded

Clip fit

ADB



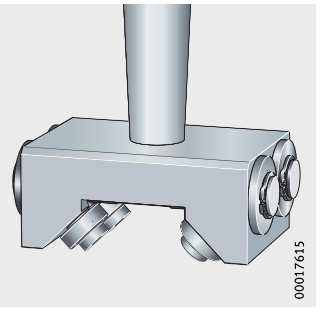
ADK



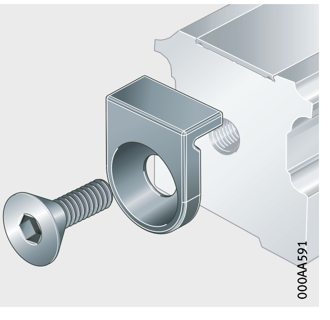
Rolling-in device and retaining plate

For covering strips

ERVS..-B

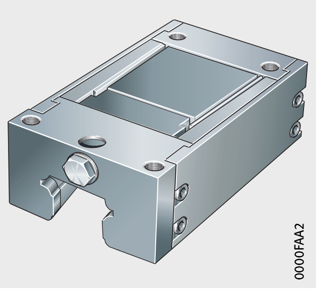


HPL.ADB..-B



Braking and clamping element

BKE.TKSD



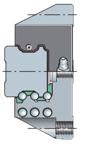
Closing plugs

The closing plugs close off the counterbores for the fixing screws in the guideway holes flush with the surface of the guideway.

In addition to plastic closing plugs, brass closing plugs are also available.

If closing plugs are used in coated guideways, only plastic closing plugs can be used.

When fitting the closing plugs, observe the guidelines in the Technical principles, see page 74.



Plastic closing plugs

Plastic closing plugs are an economical solution and are suitable for most applications, *Figure 1*.

Plastic closing plugs, one-piece

The one-piece closing plugs KA..-TN can be easily fitted with the aid of a hammer and press-in block. The interference between the plug and hole creates a burr that must be removed during fitting. After fitting, a minimal ring gap remains.

KA..-TN
Standard

Figure 1
Plastic closing plug

Brass closing plugs

Brass closing plugs are particularly suitable for conditions involving hot swarf, aggressive media and vibrations. As a result, they are recommended in particular for use in machine tools, *Figure 2*.

Brass closing plugs with shear ring

The brass closing plugs KA..-M with a shear ring can be fitted with the aid of a hammer and press-in block.

During fitting, the shear ring is sheared off, leaving a ring-shaped burr that must be removed. A minimal ring gap remains.

After fitting, the top surfaces of the plugs must be smoothed off using an oilstone.

KA..-M

Figure 2
Brass closing plug with shear 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

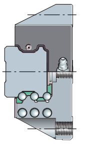
Covering strips are available in two designs. The covering strip ADB is adhesive bonded in the slot in the guideway, while the covering strip ADK is clipped into the slot, *Figure 3*, page 263.

The clip fit covering strip must be fitted using the rolling-in device ERVS..-B, see page 264.

The covering strip ADK is recommended particularly for use under aggressive environmental conditions.

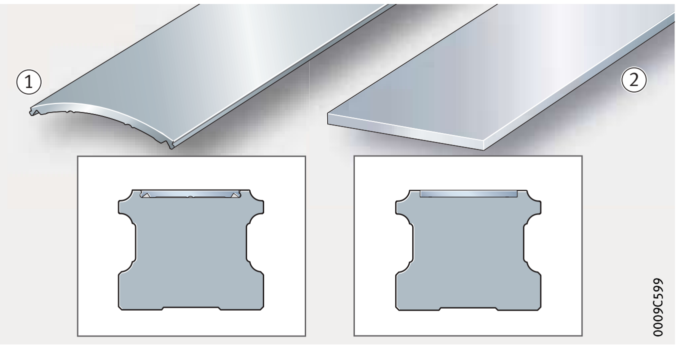
Adhesive bonded covering strips ADB are supplied with linear recirculating ball bearing and guideway assemblies KUSE..-ADB, clip fit covering strips ADK are supplied with linear recirculating ball bearing and guideway assemblies KUSE..-ADK, see page 238.

Principles for fitting of the strips, see page 79.



ADK

ADB



① Clip fit

② Adhesive bonded

Figure 3
Guideway covering strip

Retaining plate

The retaining plate HPL.ADB..-B fixes the covering strips ADB and ADK to the end of the guideway, *Figure 4*. It is included in the scope of delivery.

! Comprehensive information can be found on the covering strip ADB in the mounting manual MON 07 and on the covering strip ADK in the mounting manual MON 65.
Principles for fitting of the retaining plates, see page 79.

HPL.ADB..-B

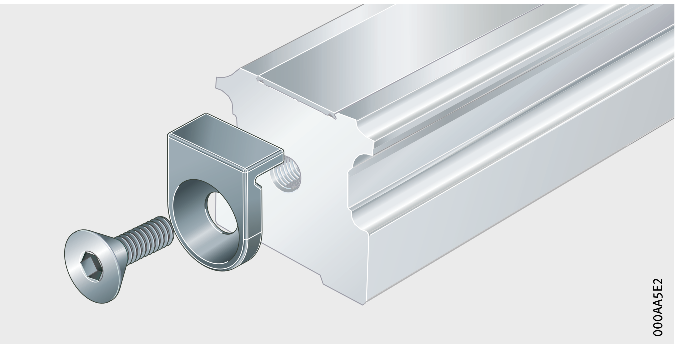


Figure 4
Retaining plate
for covering strip

Rolling-in device

The clip fit covering strip ADK is fitted using the rolling-in device ERVS..-B so that it is securely fixed 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 must be stated, see Ordering example.

The rolling-in device is available in the sizes according to the dimension table, page 270.

ERVS..-B

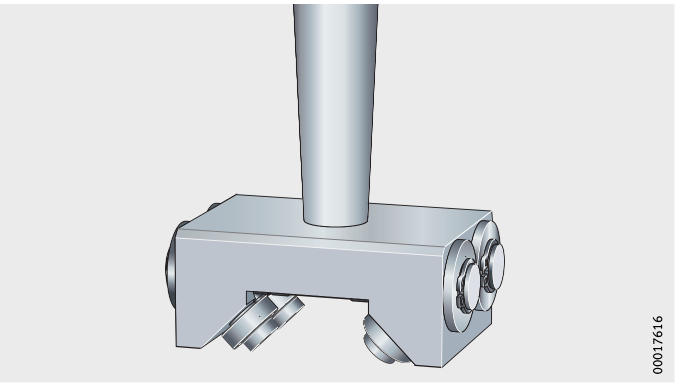


Figure 5
Rolling-in device for covering strip

Observe the guidelines in the mounting manual MON 65.

Ordering example, ordering designation

Rolling-in device for the covering strip ADK16 for KUSE35.

Ordering designation

1×**ERVS35-B**

Braking and clamping element

The braking and clamping element BKE.TKSD is used, for example, as a positionally independent security system for linear drives where the drive cannot fully provide the braking and clamping function, *Figure 6*.

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 page 267. The elements are thus maintenance-free.

BKE.TKSD

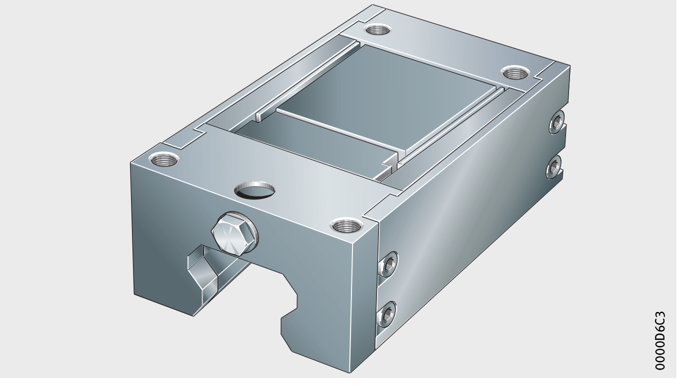
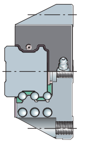


Figure 6
Braking and clamping element



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. The brake shoes are opened by hydraulic means. If the pressure drops or the power fails, the brake shoes are closed again. This eliminates safety problems resulting from power failure, which is a possibility with electronically braked systems.

The system carries out braking 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, see page 67.

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

Short reaction time

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

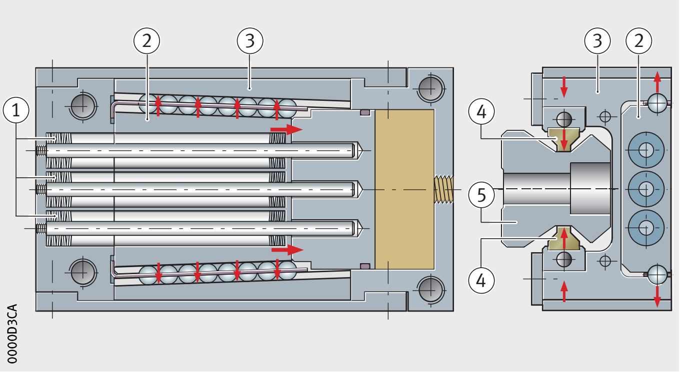
!

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.

Function

Three disc spring columns generate the braking and clamping force, *Figure 7*. 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 7
Functional components

Operating pressure of braking and clamping elements

Operating pressure	
min.	max.
> 55 bar	90 bar

!

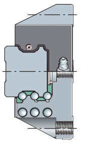
Pressure spikes of more than 90 bar must be avoided in all cases. Comprehensive information can be found in the mounting manual MON 01, Braking and Clamping Elements.

Wear of brake shoes

Since the system performs not only a clamping function on stationary guidance systems but also a braking function on moving guidance systems, wear of the brake shoes occurs. However, clearance between the brake shoes and brake contact surfaces increases the system reaction time.

Automatic clearance compensation

For reliable functioning of the system, the brake shoes must always be in clearance-free contact. 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. Disc spring assemblies slide a wedge between the brake shoes and the saddle plate, *Figure 8*. 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 travel.



Adapter plate

For the H variant of the carriages, an adapter plate is necessary, *Figure 8*. The adapter plate is included in the scope of delivery.

(1) Disc spring columns
(2) Wedge-shaped slider
(3) H-shaped saddle plate
(4) Brake shoes
(5) Guideway
(6) Adapter plate for H variant

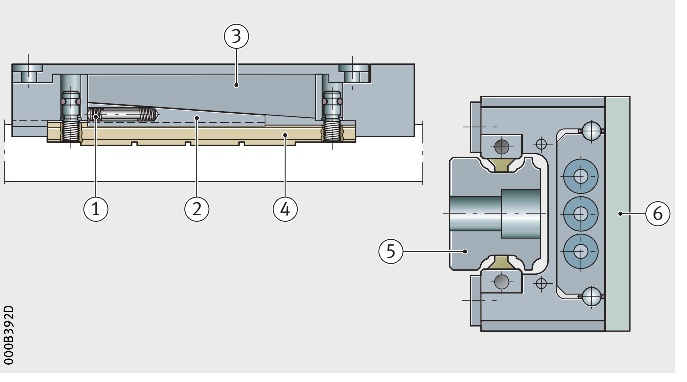


Figure 8
Wear compensation and adapter plate

Ease of mounting

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

! 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 but have only a very small design envelope. They are matched in their dimensions to the INA standard and H design carriages. The elements are available for the monorail guidance systems RUE-E, KUSE and KUVE-B and can be integrated without any problems in existing applications with INA linear guidance systems, see dimension table.

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 rolling element systems. In this case, the guideway is used as a braking or clamping rail.

Typically, the braking and clamping element is arranged between two carriages on the table and acts as an emergency brake, *Figure 9*.

1 Guideways
2 Carriages
3 Emergency brakes
4 Table
5 Motor primary part
6 Motor secondary part

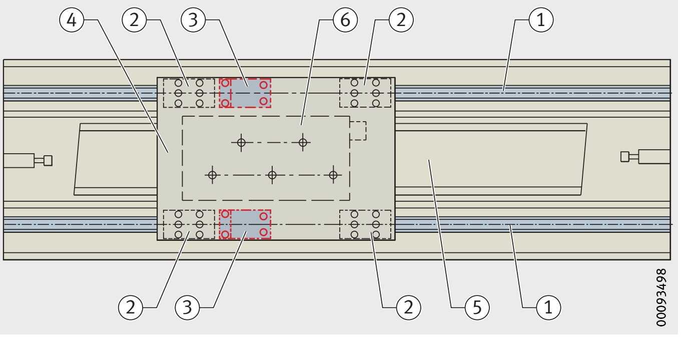


Figure 9
Typical application

Delivered condition

The elements are premounted on a separate support rail and clamped in place by means of a fitting screw, *Figure 10*. The screw is used to loosen and then move the fixed element. The fitting screw is later replaced by the hydraulic connector.

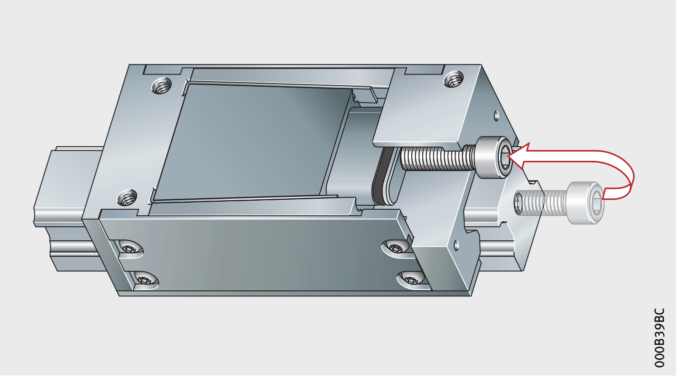
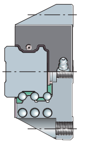


Figure 10
Braking and clamping element on support rail



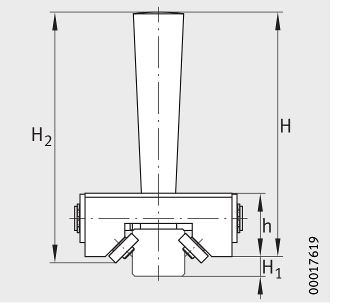
Ordering example, ordering designation

A braking and clamping element for KUSE35 with a hydraulic connector on the end face is to be ordered.

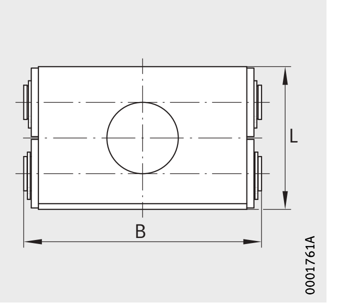
Ordering designation

1×**BKE.TKSD35**

Rolling-in device



ERVS..-B
Front view

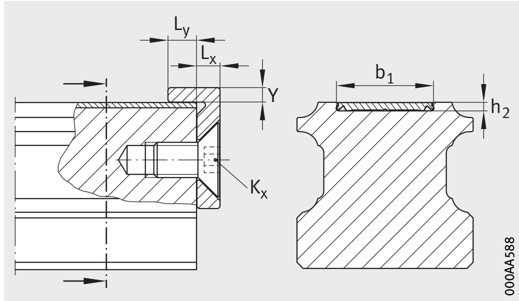


ERVS..-B
Top view

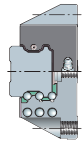
Dimension table · Dimensions in mm

Designation	Mass	Dimensions						For linear guidance system
	m	H	H_1	H_2	h	B	L	
	≈ kg							
ERVS20-B	0,6	120	5,7	120,2	30	70,3	50	KUSE20
ERVS25-B	0,6	120	9,5	121,6	30	70,3	50	KUSE25
ERVS30-B	0,7	121,5	11,3	125,3	31,5	83,3	50	KUSE30
ERVS35-B	0,7	121,5	15,9	127	31,5	83,3	50	KUSE35
ERVS45-B	0,7	121,5	23,4	128,3	31,5	89,3	50	KUSE45

Retaining plate for covering strip



Retaining plate



Dimension table · Dimensions in mm

Designation	Mass m ≈ kg/m	For linear guidance system	Dimensions						For covering strip	
			h_2	b_1	K_x	L_x	L_y	Y		
HPL.ADB9-B	0,05	KUSE20	0,5	13	M5	4	5	2	ADB13	ADK12
HPL.ADB9-B	0,05	KUSE25	0,5	13	M5	4	5	2	ADB13	ADK12
HPL.ADB17-B	0,09	KUSE30	0,5	23	M6	4	5	2,5	ADB18	ADK16
HPL.ADB17-B	0,1	KUSE35	0,5	27	M6	4	5	2,5	ADB18	ADK16
HPL.ADB17-B	0,11	KUSE45	0,5	29	M6	4	5	2,5	ADB23	ADK21

Braking and clamping element

Dimension table · Dimensions in mm								
Designation	Clamping force[1)] N	Dimensions						
		H Adapter plate		B	L	J_B	J_C	A_1
		without	with					
BKE.TKSD25	1 000	36	–	47	91	38	34	10
BKE.TKSD25-SO								
BKE.TKSD25-H		–	40					
BKE.TKSD25-H-SO								
BKE.TKSD35	2 800	48	–	69	120	58	48	13,5
BKE.TKSD35-SO								
BKE.TKSD45	4 300	60	–	85	141	70	60	15
BKE.TKSD45-SO								

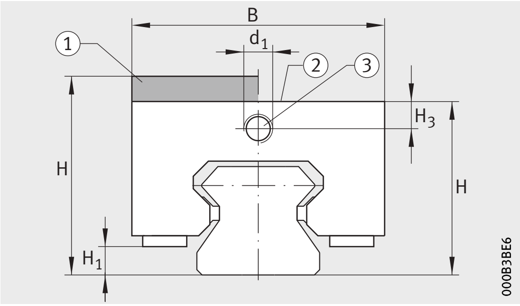
① With adapter plate. ② Without adapter plate. ③ Hydraulic connector. ④ Hydraulic connection from above (suffix SO)[4)].

1) Valid for lightly oiled guideway. Increased contamination of the oil or grease leads to a reduction in the holding force or an increase in the braking travel.

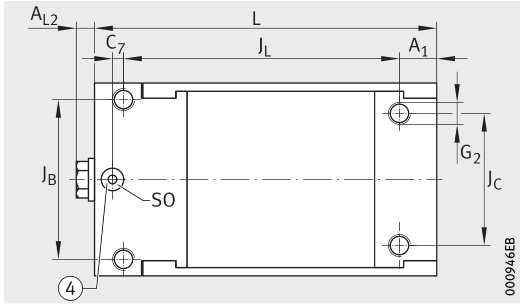
2) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

3) O ring.

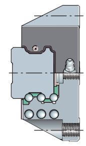
4) The maximum diameter of the oil feed hole is 6 mm.



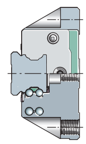
BKE.TKSD



Top view[4)]



J_L	C_7	H_1	H_3	A_{L2}	d_1	SO[3) 4)]	Fixing screws[2)] G_2 DIN ISO 4762-12.9	M_A Nm
75	–	6,2	6	5	M6×1	–	M6	17,4
	0					7×1,5		
	–					–		
	0					7×1,5		
100	–	6,6	8,1	5	M8×1	–	M8	42,2
	0					7×1,5		
113	–	11,8	10	5	M8×1	–	M10	83
	5					7×1,5		



Four-row linear recirculating ball bearing and guideway assemblies

Carriages and guideways
High-Speed
Sealing and lubrication elements
Accessories

Four-row linear recirculating ball bearing and guideway assemblies

Carriages Guideways **278**

Four-row linear recirculating ball bearing and guideway assemblies KUVE are of a full complement design and therefore have a high load carrying capacity.

They are used where the emphasis is on dynamic characteristics as well as maximum load carrying capacity and rigidity.

X-life **High-Speed** **278**

Full complement linear recirculating ball bearing and guideway assemblies KUVE..-B-HS are designed for highly dynamic operation. In this case, the end pieces and ball return systems were redesigned in comparison with linear recirculating ball bearing and guideway assemblies KUVE..-B. The design envelope corresponds to DIN 645-1.

Sealing and lubrication elements – system KIT **362**

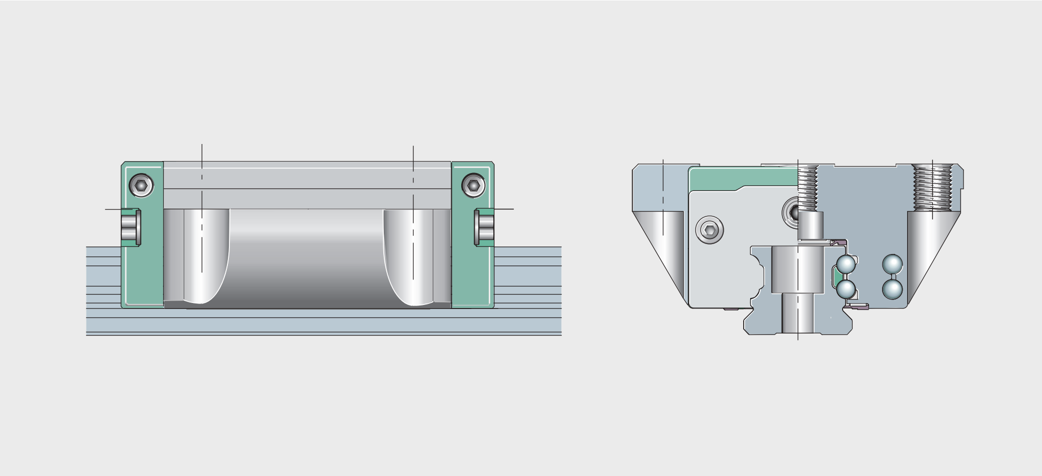
For optimum lubrication and sealing, there is an extensive system of sealing and lubrication elements. The elements are configured as a KIT and are designed for various application conditions.

Accessories **398**

There is an extensive range of accessories for the four-row linear recirculating ball bearing and guideway assemblies.

These include closing plugs and covering strips for the guideways as well as suitable fitting tools (hydraulic fitting device and rolling-in device).

The braking and clamping element is a mechanical retaining system that is used, for example, where additional braking and clamping functions are required.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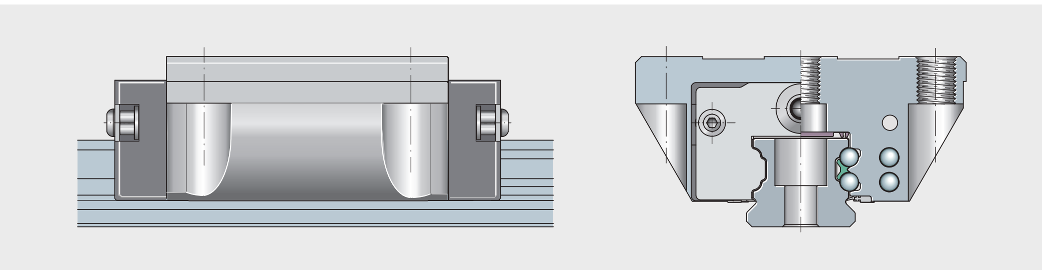
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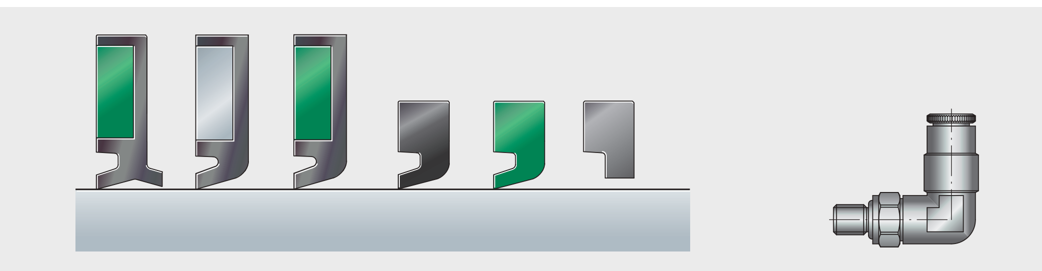
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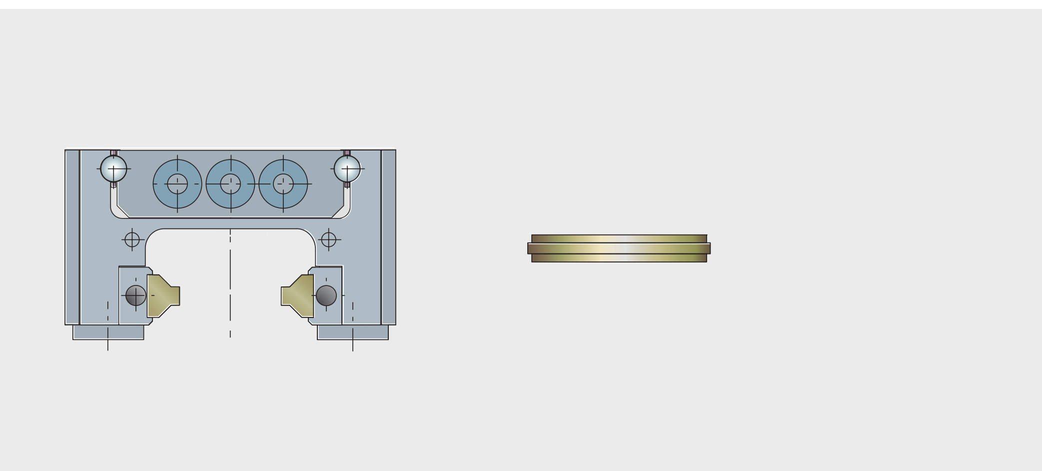
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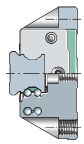

Four-row linear recirculating ball bearing and guideway assemblies

Carriages
Guideways

Four-row linear recirculating ball bearing and guideway assemblies

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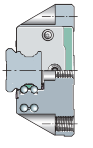

Four-row linear recirculating ball bearing and guideway assemblies

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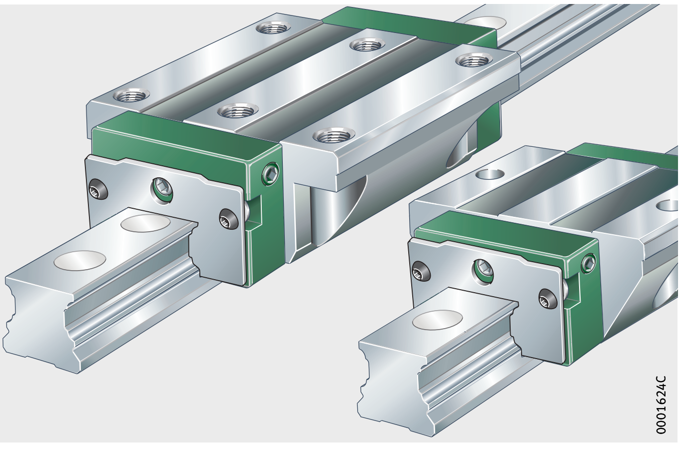
Four-row linear recirculating ball bearing and guideway assemblies

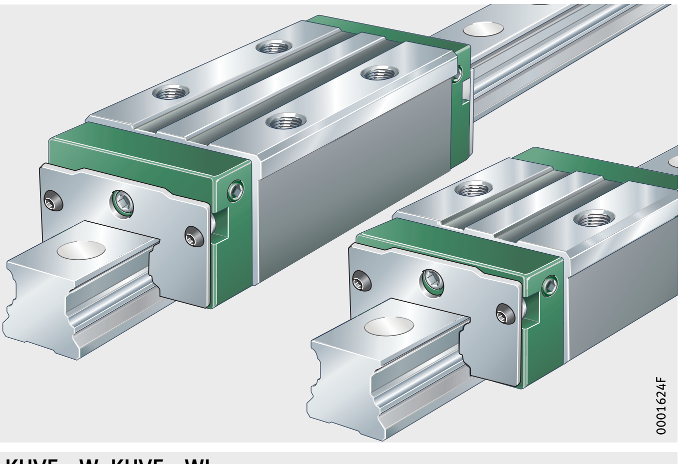
Full complement

For oil or grease lubrication

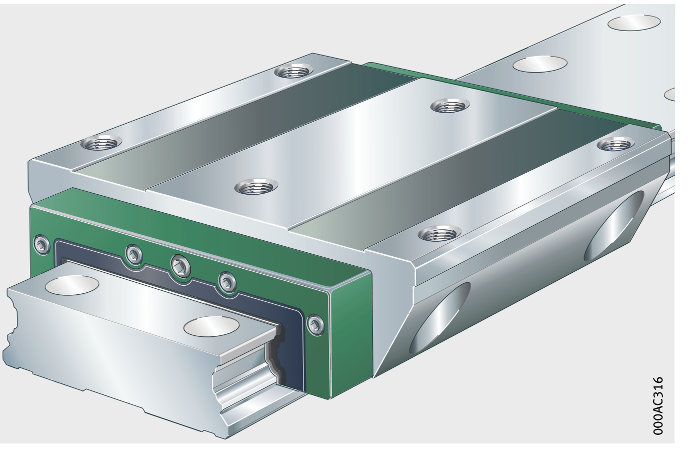
KUVE..-B, KUVE..-B-E, KUVE..-B-EC, KUVE..-B-L, KUVE..-B-HS, KUVE..-B-E-HS, KUVE..-B-N-HS, KUVE..-B-N, KUVE..-B-NL



KUVE..-B-ES, KUVE..-B-ESC, KUVE..-B-H, KUVE..-B-HL, KUVE..-B-S, KUVE..-B-SL, KUVE..-B-SN, KUVE..-B-SNL, KUVE..-B-H-HS, KUVE..-B-S-HS, KUVE..-B-SN-HS, KUVE..-B-ES-HS



KUVE..-W, KUVE..-WL

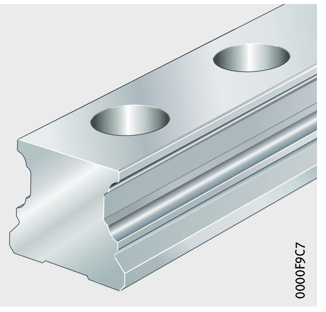


Product overview Four-row linear recirculating ball bearing and guideway assemblies

Guideways

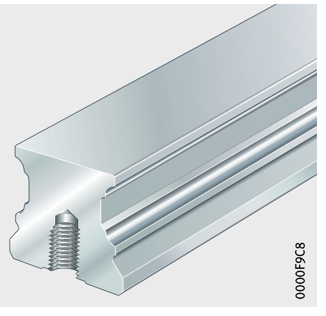
Standard

TKVD

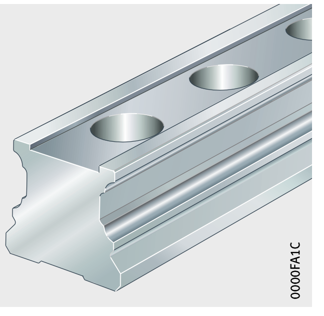


For screw mounting from below
or
with slot for covering strip

TKVD..-U

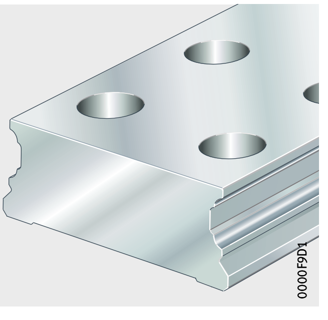


TKVD..-ADB, TKVD..-ADK

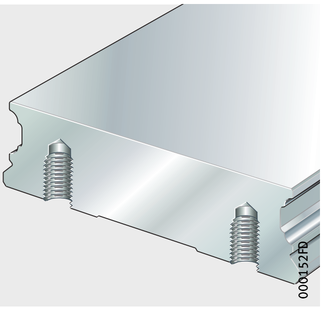


Wide guideway

TKVD..-W



TKVD..-W-U

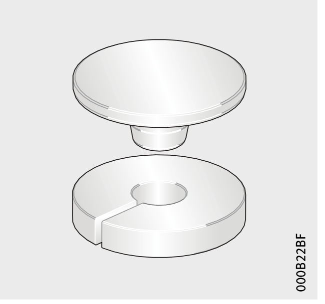


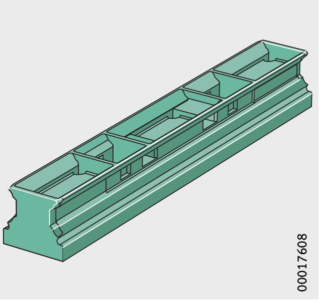
Standard accessories

Plastic closing plugs

Dummy guideway

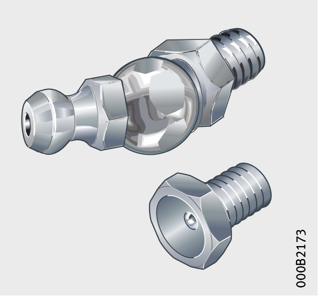
KA..-TN/A	MKVD

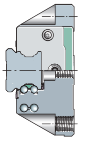




Lubrication connector

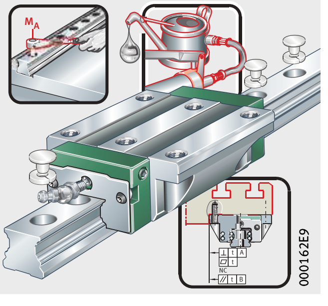
S





Mounting manual

MON 38



Four-row linear recirculating ball bearing and guideway assemblies

Features

Four-row linear recirculating ball bearing and guideway assemblies are the most extensive and complex group within the range of monorail guidance systems. They are used where heavy loads must be moved with high running and positional accuracy as well as low friction. The guidance systems are of a full complement design, preloaded and are suitable for long, unlimited stroke lengths.

A guidance system comprises at least one carriage, one guideway, one dummy guideway, two-piece plastic closing plugs and one lubrication connector included in the delivery.

The four-row linear recirculating ball bearing and guideway assemblies are supplied with basic greasing as standard.

X-life

Linear recirculating ball bearing and guideway assemblies of the design High-Speed are supplied in X-life quality. These bearings are characterised by optimised technological characteristics, increased robustness and a longer operating life at significantly higher velocities.

High-Speed

The four-row linear recirculating ball bearing and guideway assembly KUVE25-B-HS is the design High-Speed and represents an expansion of the existing extensive KUVE range in the field of highly dynamic applications.

Systems KUVE25-B..-HS are supplied as standard with an initial greasing (greasing ready for operation). In highly dynamic applications in particular, an adequate supply of lubricant is indispensable as early as the commissioning stage.

This variant is extremely robust and is currently the fastest four-row linear recirculating ball bearing and guideway assembly with steel balls on the market. In order to achieve 10 m/s, the end pieces and ball return systems were optimised for highly dynamic requirements. As a result, the total length of the carriage is slightly longer compared to the standard version. The design envelope corresponds, as before, to DIN 645-1. The loads are supported by standard steel rolling elements.

The design High-Speed is only available in size 25. In accordance with the modular concept, it is interchangeable with the other KUVE25-B units.

The unit KUVE High-Speed is used where there are very high dynamic requirements. Since hybrid technology is not used, the full performance capacity of the rolling contact can be implemented, with the associated advantages in terms of load carrying capacity, rigidity, robustness and crash safety.

Full complement

Since they have the maximum possible number of rolling elements, full complement guidance systems have extremely high load carrying capacity and particularly high rigidity.

Carriages

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

A generous grease reservoir and beneficial lubrication is provided by means of favourably positioned lubricant pockets in the carriage, see page 287.

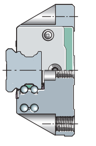
Guideways

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

Location from above or below

Guideways TKVD (-ADB, -ADK) and TKVD..W are located from above and have through holes with counterbores for the fixing screws.

Guideways TKVD..-U and TKVD..-W-U are located from below and have threaded blind holes.



Slot for covering strip

Guideways TKVD..-ADB have a slot for the adhesive bonded steel covering strip ADB. Guideways TKVD..-ADK have a slot with undercut for the clip fit steel covering strip ADK, see dimension tables.

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 segments, see page 300.

Standard accessories

The scope of delivery includes various accessory parts as standard.

Dummy guideway

The dummy guideway prevents damage to the rolling element set and prevents the rolling elements from falling out while the carriage is separated from the guideway.

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

Plastic closing plugs

The closing plugs close off the counterbores of the guideway holes flush with the surface of the guideway, see dimension tables.

Optionally, brass closing plugs are also available, see page 402.

Lubrication connector

A lubrication connector for relubrication from the end is included in the scope of delivery.

Four-row linear recirculating ball bearing and guideway assemblies

Load carrying capacity

The rows of balls are in an O arrangement with two point contact on the raceways.

The units can support loads from all directions, except in the direction of motion, and moments about all axes, *Figure 1*.

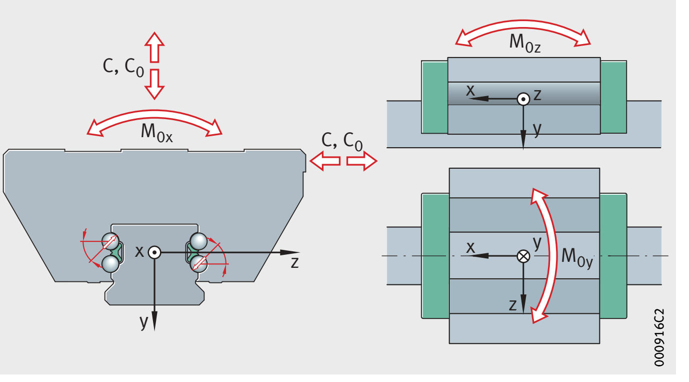


Figure 1
Load carrying capacity

Acceleration and velocity

Four-row linear recirculating ball bearing and guideway assemblies KUVE permit accelerations up to 150 m/s^2 and velocities up to 6 m/s, see table. The design High-Speed permits velocities up to 10 m/s, depending on the operating conditions.

Operating limits

Designation	Acceleration up to m/s^2	Velocity up to m/s
KUVE	150	6

Interchangeability

Carriages KWVE and guideways TKVD are interchangeable in any combination within one size, preload class and accuracy class.

Sealing

The end pieces of the carriages are fitted on both sides with non-contact, corrosion-resistant end plates and elastic end wipers that retain the lubricant in the system. Carriages of the W design are only fitted with elastic end wipers on both sides.

Standard sealing strips ensure reliable sealing and protect the rolling element system against contamination, even in critical environmental conditions, *Figure 2*, page 287.

!

Under extremely heavy contamination load, additional wipers can be fitted, see page 362. Where necessary, additional covers must be used.

Lubrication

Linear recirculating ball bearing and guideway assemblies KUVE..-B and KUVE..-W are suitable for oil and grease lubrication. The systems are supplied with a basic greasing. A lubrication connector for relubrication from the end is included in the scope of delivery. Optionally, other lubrication connectors are available, see page 384 and page 394.

The lubrication connectors can be screw mounted into the end piece on the left, right or end face in the design KUVE..-B, while this is only permissible on the end face in the designs KUVE High-Speed and KUVE..-W. All relubrication holes are closed off by means of grub screws. Before the lubrication connector is screwed in, the corresponding grub screw must be removed. Observe the mounting manual MON 38.

1 Integrated lubrication pockets with grease reservoir
2 Standard sealing strip
3 Optional sealing strip
4 Elastic wipers on end faces

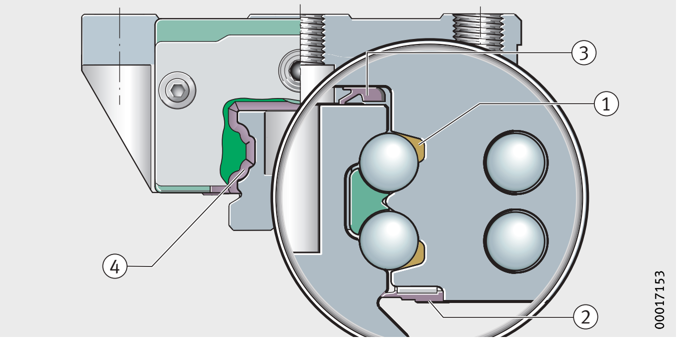
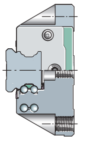


Figure 2
Lubricant reservoir KUVE..-B and sealing

If lubrication connectors are fitted on the end or side, the maximum permissible screw depth must be observed, see dimension tables. If additional sealing elements KIT are used, the screw depth is increased for the end relubrication facility. The standard lubrication connector is then no longer usable. Suitable lubrication connectors must additionally be taken into consideration when ordering, see page 384 and page 394.

In order to ensure optimum lubricant distribution, we recommend that carriages of design High-Speed should be moved several times at low speed before commissioning and after maintenance and lubrication intervals.



Four-row linear recirculating ball bearing and guideway assemblies

Operating temperature

As standard, four-row linear recirculating ball bearing and guideway assemblies can be used at operating temperatures from –10 °C to +80 °C.

Corrosion-resistant design

Four-row linear recirculating ball bearing and guideway assemblies KUVE..-B are available in the accuracy class G3 and also in a corrosion-resistant design with the special coatings Corrotect (with the preload class V1 or V2) and Protect A (with the preload class V2), see page 56.

Designs

Linear recirculating ball bearing and guideway assemblies KUVE..-B are available in numerous designs, see table.

Available designs

Design	Description
–	Standard carriage
E	Expanded design (carriage without screw threads)
EC	Expanded design, short carriage (carriage without screw threads)
ES	Expanded design, narrow carriage
ESC	Expanded design, short, narrow carriage
H	High carriage
HL	High, long carriage
HS	High-Speed
E-HS	High-Speed, expanded design
ES-HS	High-Speed, expanded design, narrow carriage
H-HS	High-Speed, high carriage
N-HS	High-Speed, low carriage
S-HS	High-Speed, narrow carriage
SN-HS	High-Speed, narrow, low carriage
L	Long carriage
N	Low carriage
NL	Low, long carriage
S	Narrow carriage
SL	Narrow, long carriage
SN	Narrow, low carriage
SNL	Narrow, low, long carriage

Wide linear recirculating ball bearing and guideway assemblies are available in two designs, see table.

Available designs

Design	Description
W	Wide carriage and wide guideway
WL	Wide, long carriage and wide guideway

Design and safety guidelines

Preload

Linear recirculating ball bearing and guideway assemblies KUVE are available in the preload classes V0, V1 and V2, see table.

Preload classes

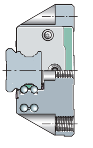
Preload class	Preload setting
V0	Very small clearance to clearance-free
V1[1]	$0{,}04 \cdot C$
V2[2]	$0{,}1 \cdot C$

[1] Standard preload class.

[2] Not for design High-Speed.

Influence of preload on the linear guidance system

The preload of a linear guidance system defines the rigidity of the system. The four-row linear recirculating ball bearing and guideway assembly KUVE can be obtained in the preload classes V0 to V2, where the preload class V1 is the standard preload class. If special requirements are present, the alternative preload classes may be used.



Increasing the preload increases the rigidity of the guidance system. The preload influences not only the rigidity but also the displacement force of the guidance system. The higher the preload, the larger the displacement force. Furthermore, preload also influences the operating life of the 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_{KUVE}	
from	to	from	to
4	20	0,0007	0,0015

Rigidity

The deflection curves show the deformation of the linear recirculating ball bearing and guideway assembly KUVE, including the deformation of the screw connections to the adjacent construction, *Figure 3*, page 290 to *Figure 18*, page 297.

The rigidity curves are valid only for screw mounting in accordance with the mounting manual MON 38 and the standard preload class V1.

Four-row linear recirculating ball bearing and guideway assemblies

KUVE15-B
KUVE20-B
KUVE25-B
KUVE25-B-HS
KUVE30-B
KUVE35-B
KUVE45-B
KUVE55-B

δ = deflection
F = load

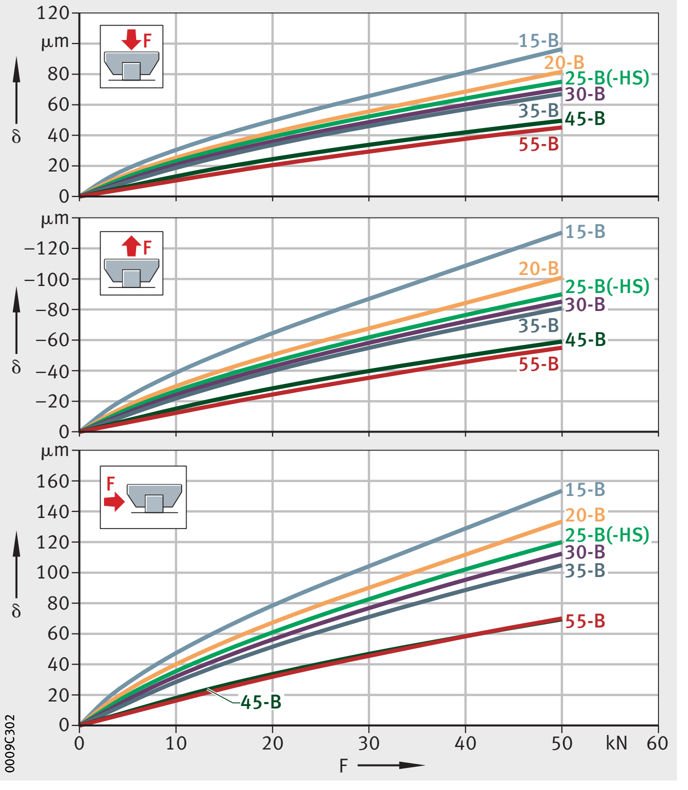


Figure 3
Deflection curves for compressive, tensile and lateral load

KUVE20-B-L
KUVE25-B-L
KUVE30-B-L
KUVE35-B-L
KUVE45-B-L
KUVE55-B-L

δ = deflection
F = load

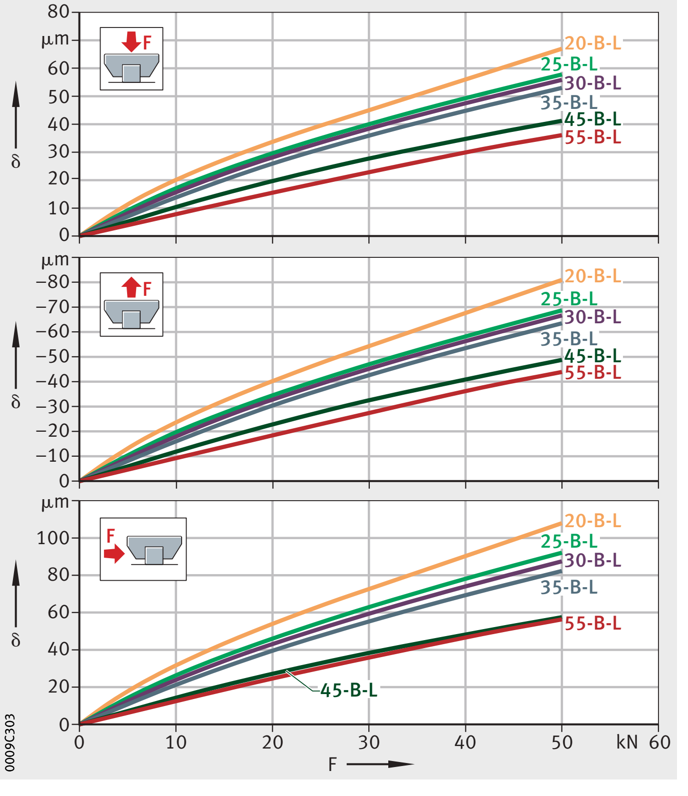


Figure 4
Deflection curves for compressive, tensile and lateral load

KUVE20-B-N
KUVE25-B-N
KUVE25-B-N-HS
KUVE30-B-N
KUVE35-B-N
KUVE45-B-N

δ = deflection
F = load

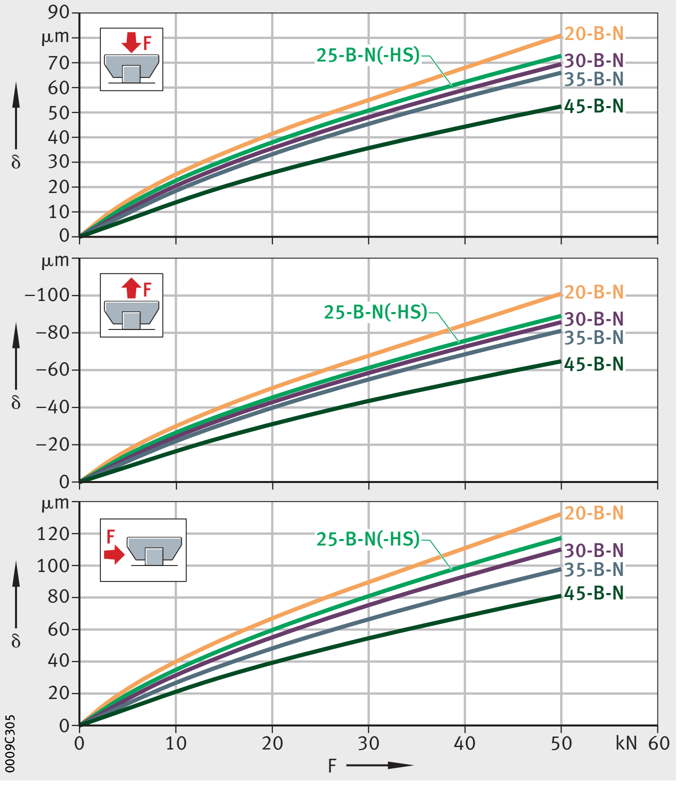


Figure 5
Deflection curves for compressive, tensile and lateral load

KUVE20-B-NL
KUVE25-B-NL
KUVE30-B-NL
KUVE35-B-NL
KUVE45-B-NL

δ = deflection
F = load

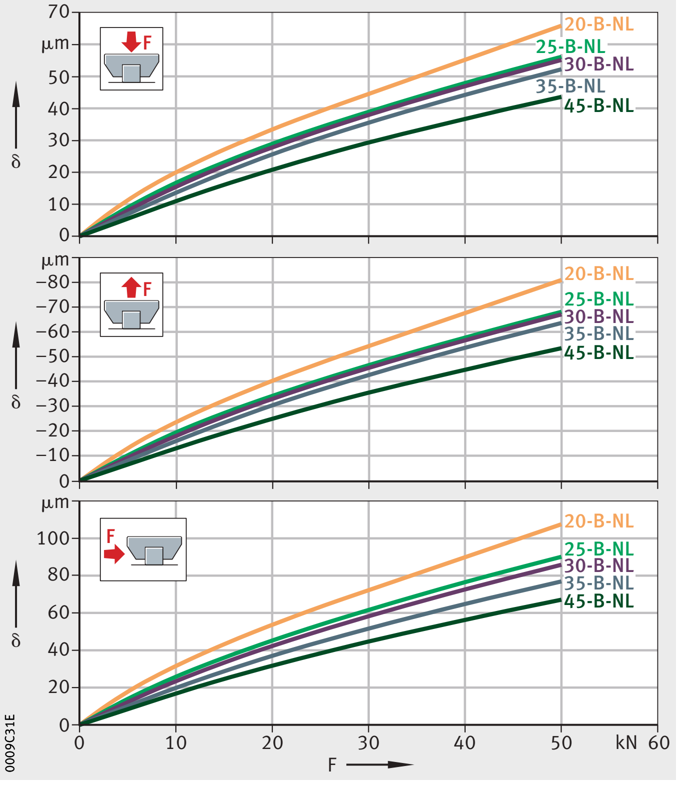
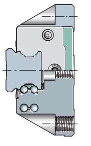


Figure 6
Deflection curves for compressive, tensile and lateral load



KUVE15-B-H
KUVE25-B-H
KUVE25-B-H-HS
KUVE30-B-H
KUVE35-B-H
KUVE45-B-H

δ = deflection
F = load

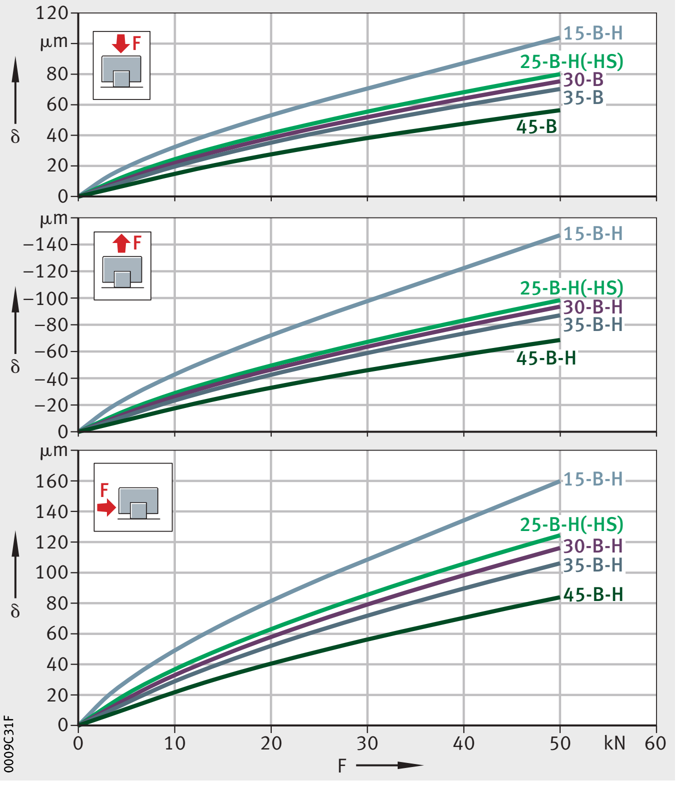


Figure 7
Deflection curves for compressive, tensile and lateral load

KUVE15-B-S
KUVE20-B-S
KUVE25-B-S
KUVE25-B-S-HS
KUVE30-B-S
KUVE35-B-S
KUVE45-B-S
KUVE55-B-S

δ = deflection
F = load

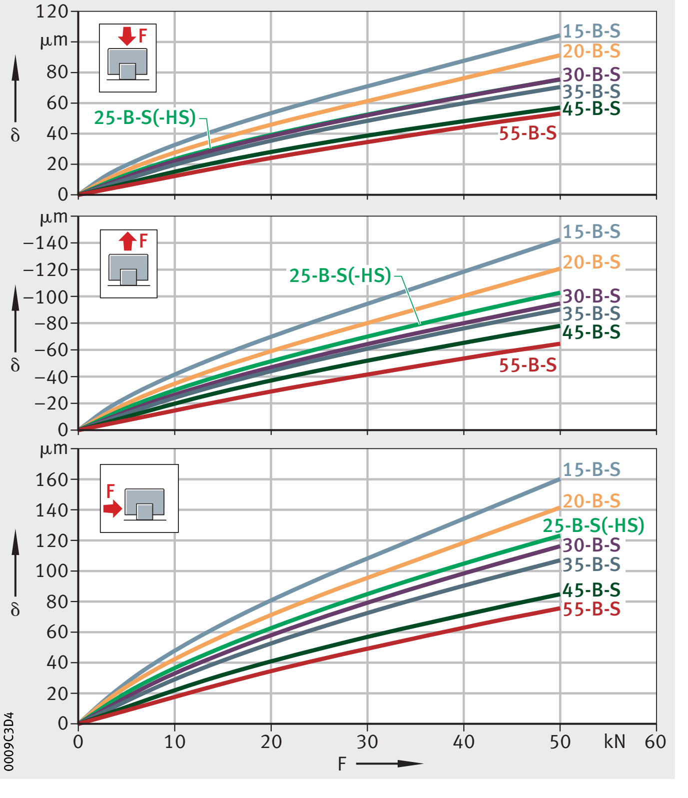


Figure 8
Deflection curves for compressive, tensile and lateral load

KUVE20-B-SN
KUVE25-B-SN
KUVE25-B-SN-HS
KUVE30-B-SN
KUVE35-B-SN
KUVE45-B-SN

δ = deflection
F = load

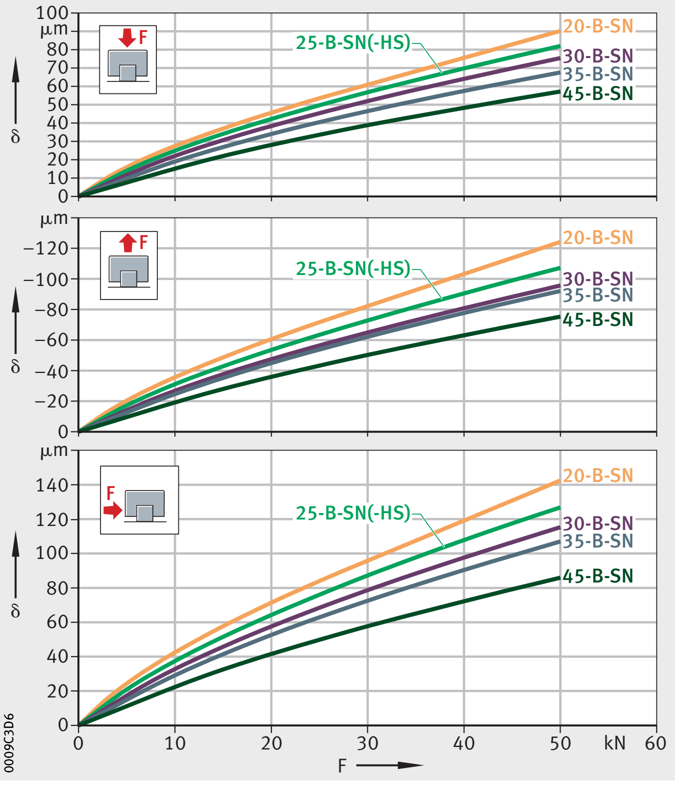
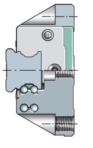


Figure 9
Deflection curves for compressive, tensile and lateral load



KUVE25-B-HL
KUVE30-B-HL
KUVE35-B-HL
KUVE45-B-HL

δ = deflection
F = load

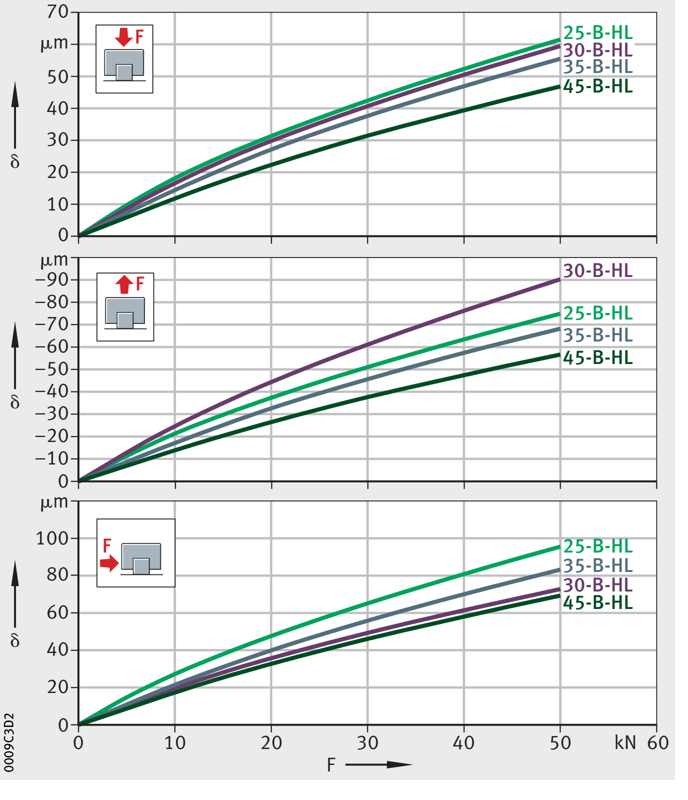


Figure 10
Deflection curves for compressive, tensile and lateral load

KUVE20-B-SL
KUVE25-B-SL
KUVE30-B-SL
KUVE35-B-SL
KUVE45-B-SL
KUVE55-B-SL

δ = deflection
F = load

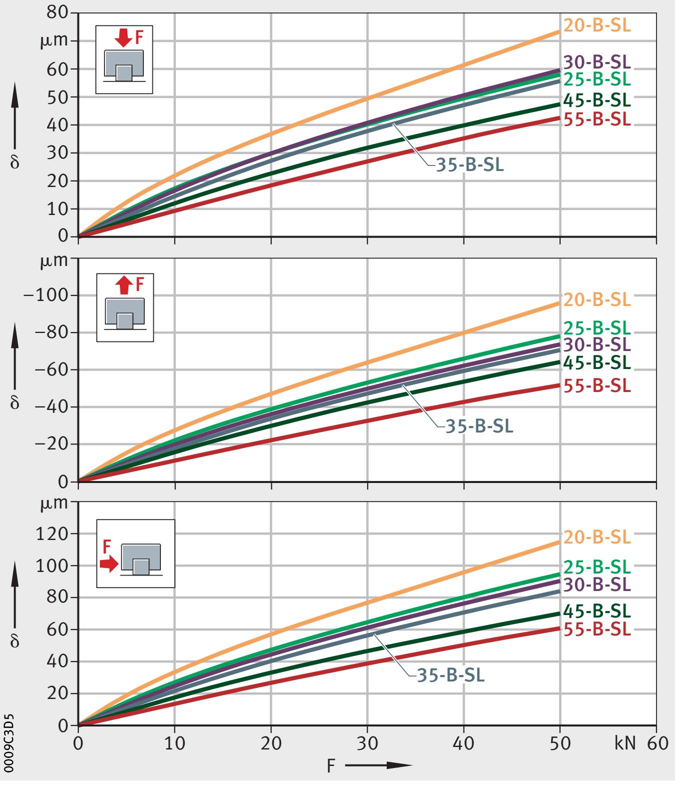


Figure 11
Deflection curves for compressive, tensile and lateral load

KUVE20-B-SNL
KUVE25-B-SNL
KUVE30-B-SNL
KUVE35-B-SNL
KUVE45-B-SNL

δ = deflection
F = load

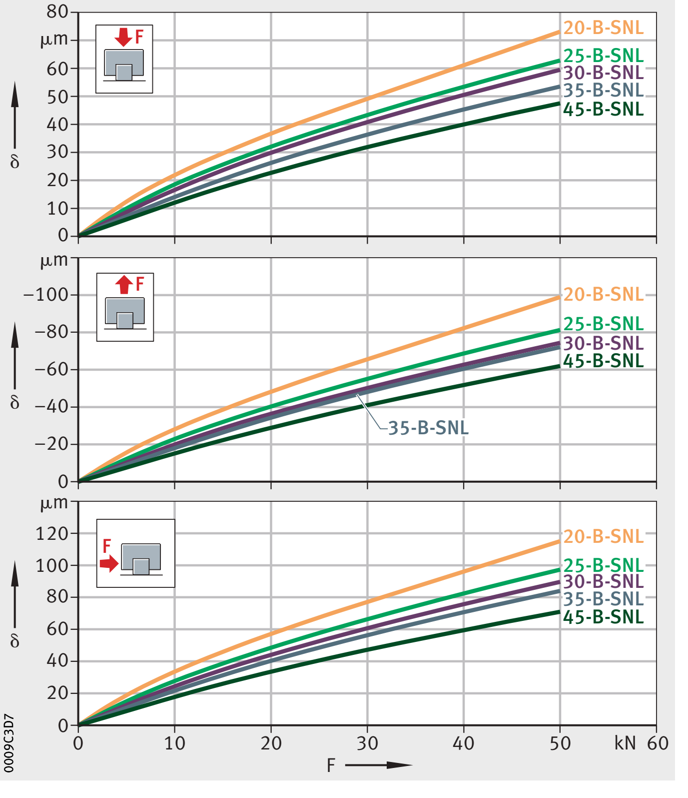


Figure 12
Deflection curves for compressive, tensile and lateral load

KUVE15-B-E
KUVE20-B-E
KUVE25-B-E
KUVE25-B-E-HS
KUVE30-B-E
KUVE35-B-E

δ = deflection
F = load

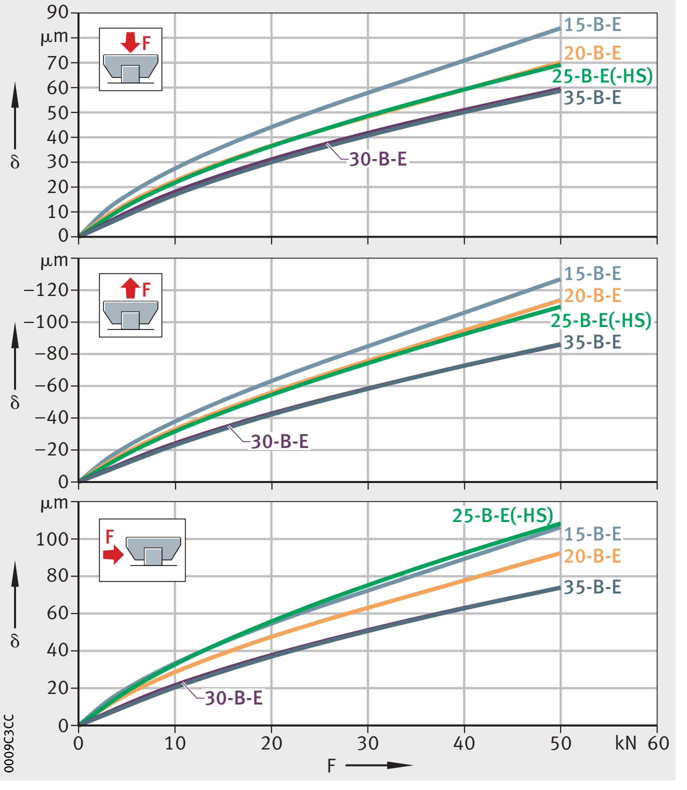


Figure 13
Deflection curves for compressive, tensile and lateral load

KUVE15-B-ES
KUVE20-B-ES
KUVE25-B-ES
KUVE25-B-ES-HS
KUVE30-B-ES
KUVE35-B-ES

δ = deflection
F = load

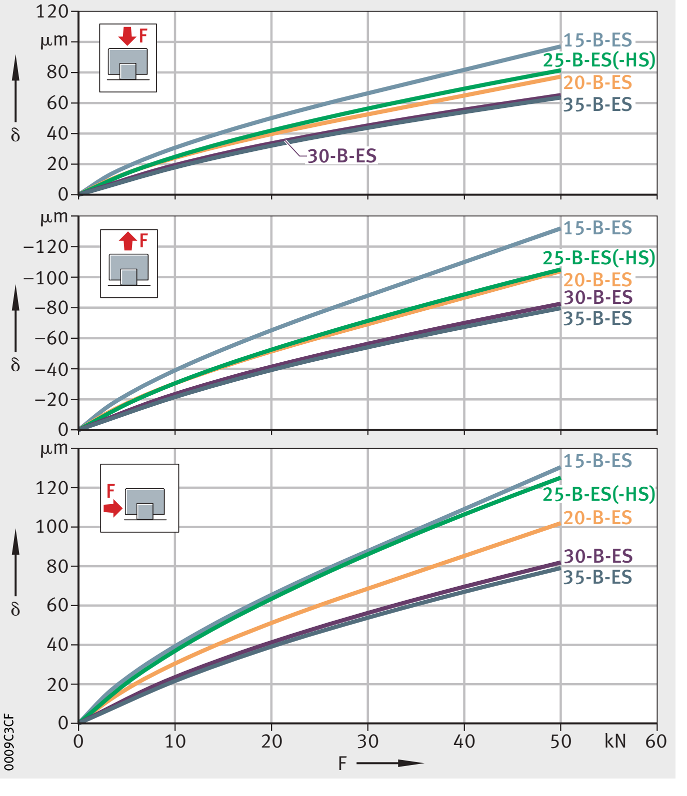
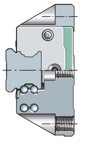


Figure 14
Deflection curves for compressive, tensile and lateral load



KUVE15-B-EC
KUVE20-B-EC
KUVE25-B-EC
KUVE30-B-EC
KUVE35-B-EC
KUVE45-B-EC

δ = deflection
F = load

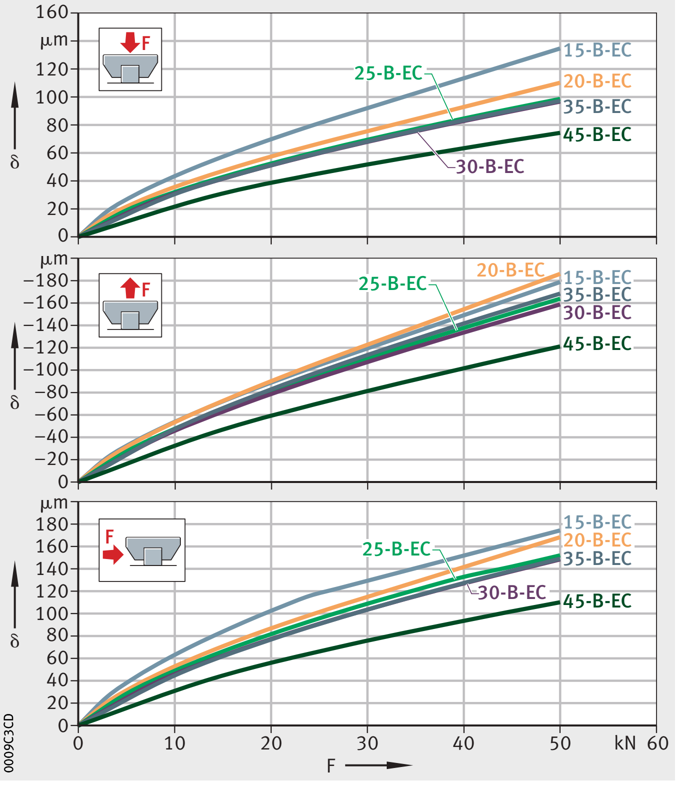


Figure 15
Deflection curves for compressive, tensile and lateral load

KUVE15-B-ESC
KUVE20-B-ESC
KUVE25-B-ESC
KUVE30-B-ESC
KUVE35-B-ESC
KUVE45-B-ESC

δ = deflection
F = load

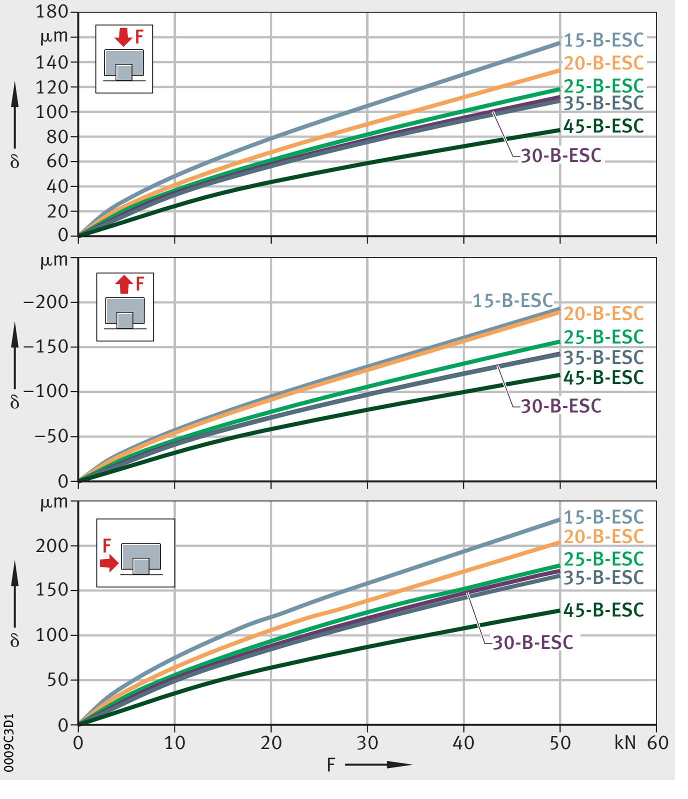


Figure 16
Deflection curves for compressive, tensile and lateral load

KUVE15-W
KUVE20-W
KUVE25-W
KUVE30-W

δ = deflection
F = load

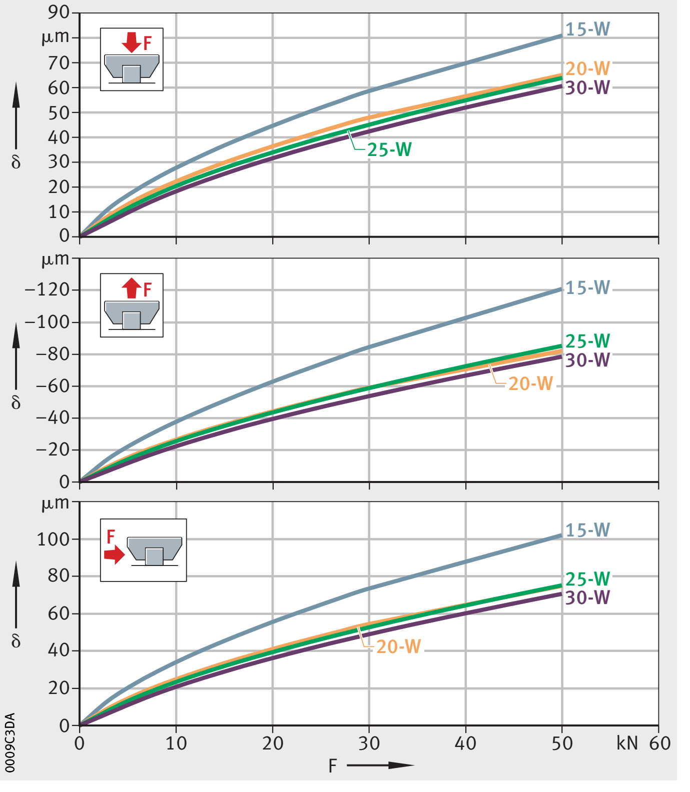


Figure 17
Deflection curves for compressive, tensile and lateral load

KUVE20-WL
KUVE25-WL
KUVE35-WL

δ = deflection
F = load

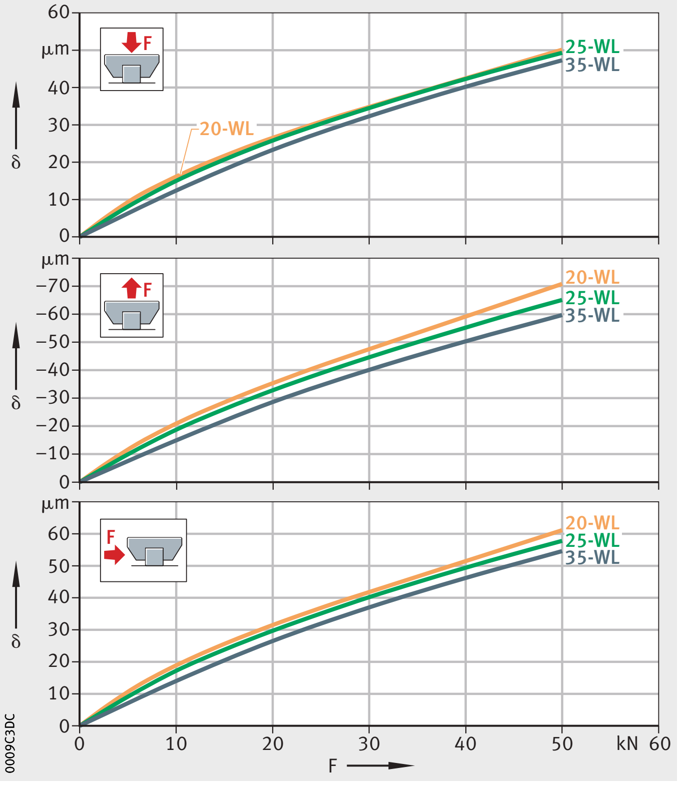
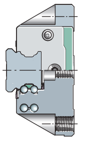


Figure 18
Deflection curves for compressive, tensile and lateral load

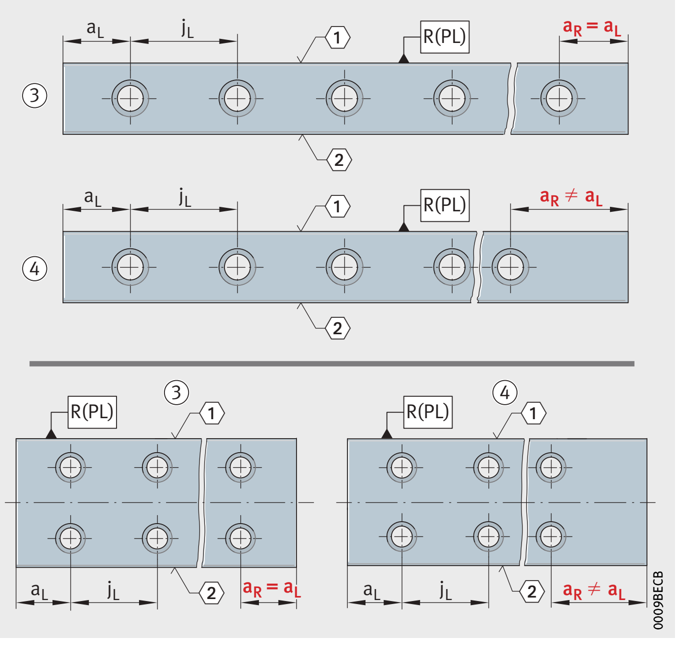


Hole patterns of guideways

Unless specified otherwise, the guideways have a symmetrical hole pattern where $a_L = a_R$, *Figure 19*.

An asymmetrical hole pattern may also be available upon request. In this case, $a_L \geqq a_{L\,min}$ and $a_R \geqq a_{R\,min}$, *Figure 19*.

Irrespective of the orientation of the locating face, a_L is on the left and a_R on the right, *Figure 19*. When ordering, the required orientation of the locating face (top or bottom) must be indicated.



1 Locating face
2 Marking
3 Symmetrical hole pattern
4 Asymmetrical hole pattern

Figure 19
Hole patterns of guideways with one or two rows of holes

Maximum number of pitches between holes

The number of pitches between holes is the 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:

$$x = n + 1$$

a_L, a_R mm
Spacing between the start and the end of the guideway and the nearest hole, *Figure 19*, page 298

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

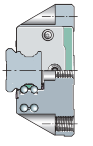
l mm
Guideway length

n –
Maximum possible number of pitches between holes

j_L mm
Spacing between holes

x –
Number of holes.

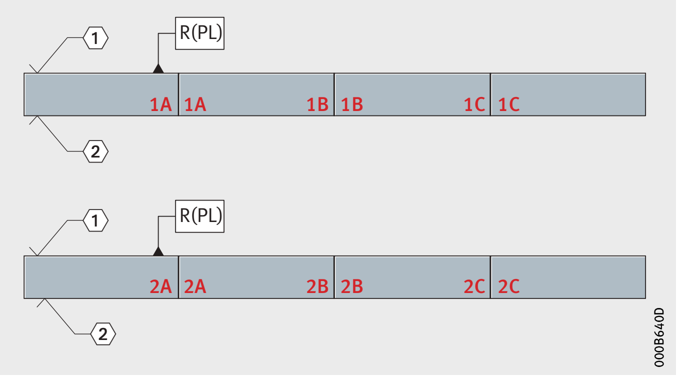
If the minimum values for a_L and a_R are not observed, the counterbores of the holes may be intersected.
Risk of injury.



Four-row linear recirculating ball bearing and guideway assemblies

Multi-piece guideways

If the guideway length required is greater than l_{max}, see dimension tables, or joined guideways are required, these guideways are made up from segments that together comprise the total required length. The segments are matched to each other and marked, *Figure 20*. The pitch is always located centrally between the fixing holes.



1 Locating face
2 Marking

Guideway segments:
1A, 1A 1B, 1B 1C, 1C
2A, 2A 2B, 2B 2C, 2C

Figure 20
Marking of multi-piece guideways

!

In the case of multi-piece guideways, the gap at the end faces between two segments must be < 0,05 mm.

Guideways suitable for joining as required

If partial guideway lengths ($l < l_{max}$) are to be combined with each other to form a guideway set as requested by the customer, the following postscript must be added to the order for the relevant guideway segment: “Guideway suitable for joining as required”.

If the guideway segment is an end segment, it is recommended that the guideway end has a chamfer, in order to make it easier to slide the carriages onto the guideway and protect the seals against damage. In this case, the position of the chamfer (left or right) and the position of the locating face (top or bottom) must be taken into consideration when ordering.

This design facilitates easier logistics.

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 can be achieved most easily when the guideway is pressed against a locating face.

If the guideway cannot be aligned as recommended by means of locating faces or very high requirements are placed on the running accuracy, the guideway straightness must be restricted.
The following postscript must be added to the order: “Restricted guideway straightness”.

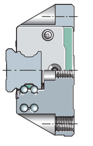
Geometrical and positional accuracy of the adjacent surfaces

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.

! Observe the tolerances for the mounting surface and parallelism of the mounted guideways, *Figure 21*, page 302, and table, page 303.

Surfaces should be ground or precision milled with the objective of achieving a mean roughness value Ramax 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 equation:

$$\Delta H = a \cdot b$$

ΔH — μm
Maximum permissible deviation from the theoretically precise position, *Figure 21*, page 302

a — –
Factor, dependent on the preload class, see table

b — mm
Centre distances between guidance elements.

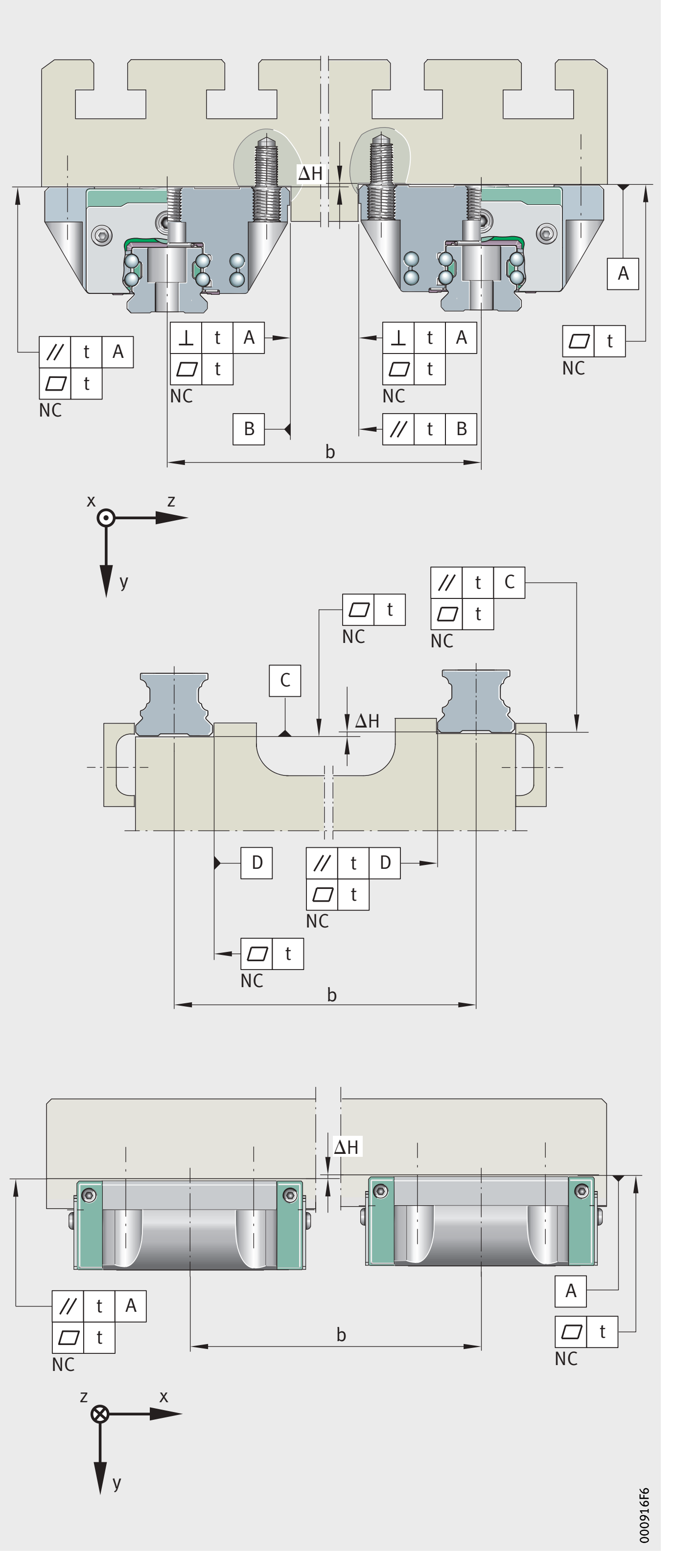
Factor a

Preload class	Factor a
V0	0,2
V1[1]	0,2
V2	0,1

[1] Standard preload class.

! Observe the guidelines in the mounting manual MON 38 for KUVE.

Four-row linear recirculating ball bearing and guideway assemblies



NC = not convex

b = spacing between guidance elements
ΔH = height difference
t = parallelism, flatness and perpendicularity tolerance

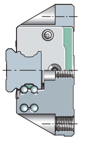
Figure 21
Tolerances of mounting surfaces and parallelism of mounted guideways and carriages

Parallelism of mounted guideways

For guideways arranged in parallel, the values for t are in accordance with *Figure 21*, page 302, and the table. If the maximum values are used, this may increase the displacement resistance.

Values for geometry and position

Guideway	Preload class	
	V0, V1	V2
	Parallelism, flatness and perpendicularity t μm	
TKVD15-B (-U)	8	5
TKVD15-W (-U)		
TKVD20 (-U, -ADB, -ADK)	9	6
TKVD20-W (-U)		
TKVD25 (-U, -ADB, -ADK)	11	7
TKVD25-W (-U)		
TKVD30 (-U, -ADB, -ADK)	13	8
TKVD30-W (-U)		
TKVD35 (-U, -ADB, -ADK)	15	10
TKVD35-W (-U)		
TKVD45 (-U, -ADB, -ADK)	17	12
TKVD55-B (-U, -ADB, -ADK)	20	14



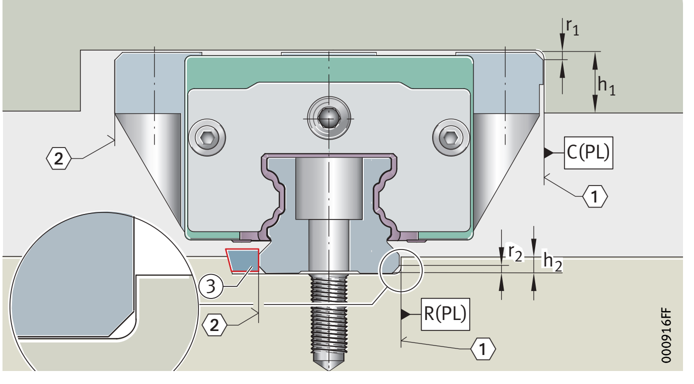
Four-row linear recirculating ball bearing and guideway assemblies

Locating heights and corner radii

For the design of the locating heights and corner radii, see table and *Figure 22*.

Locating heights, corner radii

Designation	Locating heights		Corner radii	
	h_1 mm	h_2 mm max.	r_1 mm max.	r_2 mm max.
KUVE15-B (-H, -S, -E, -EC, -ES, -ESC)	4,5	3,5	1	0,3
KUVE15-W	4,5	1,6	1	0,5
KUVE20-B (-L, -H, -HL, -S, -SL, -SN, -SNL, -N, -NL, -E, -EC, -ES, -ESC)	5	4	1	0,5
KUVE20-W (-WL)	5	4	1	0,5
KUVE25-B (-L, -H, -HL, -S, -SL, -SN, -SNL, -N, -NL, -E, -EC, -ES, -ESC)	5	4,5	1	0,8
KUVE25-B (-E, -ES, -H, -S, -SN, -N) -HS	5	4,5	1	0,8
KUVE25-W (-WL)	5	4,5	1	0,8
KUVE30-B (-L, -H, -HL, -S, -SL, -SN, -SNL, -N, -NL, -E, -EC, -ES, -ESC)	6	5	1	0,8
KUVE30-W	6	5	1	0,8
KUVE35-B (-L, -H, -HL, -S, -SL, -SN, -SNL, -N, -NL, -E, -EC, -ES, -ESC)	6,5	6	1	0,8
KUVE35-WL	6,5	6	1	0,8
KUVE45-B (-L, -H, -HL, -S, -SL, -SN, -SNL, -N, -NL, -EC, -ESC)	9	8	1	1
KUVE55-B (-L, -S, -SL)	12	10	1	1,5



1 Locating face
2 Marking
3 Vee strip

Figure 22
Locating heights and corner radii

Accuracy

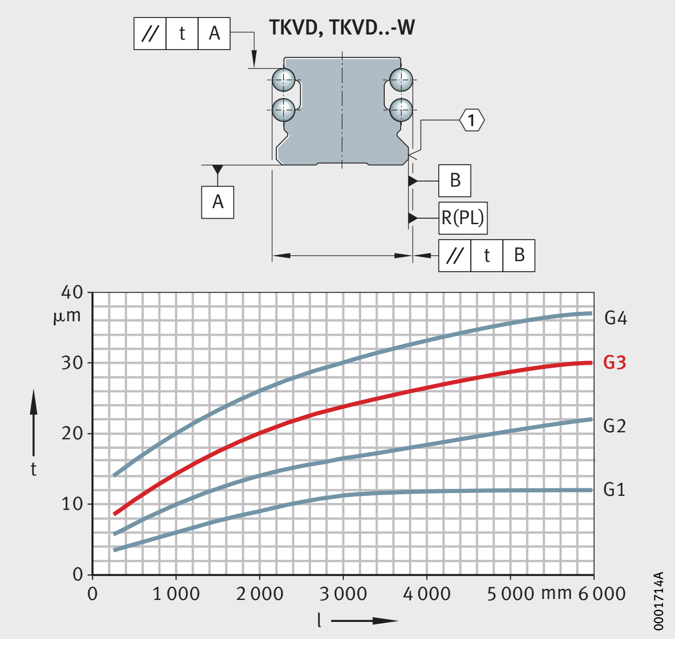
Accuracy classes

Four-row linear recirculating ball bearing and guideway assemblies are available in the accuracy classes G1 to G4, *Figure 23* and table, page 306. The standard is class G3.

Parallelism of raceways to locating surfaces

The parallelism tolerances of the guideways are dependent on the accuracy class, *Figure 23*.

In coated systems, there may be deviations in tolerances compared with uncoated units.



t = parallelism tolerance
l = total guideway length

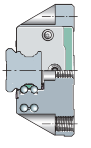
1 Locating face

Figure 23
Accuracy classes and parallelism tolerances of guideways

Tolerances

The tolerances are arithmetic mean values, see table and *Figure 24*, page 306. They are relative to the centre point of the screw mounting or locating surfaces of the carriage.

The dimensions H and A_1 should always remain within the tolerance irrespective of the position of the carriage on the guideway, see table, page 306.



Four-row linear recirculating ball bearing and guideway assemblies

Tolerances for height H and spacing A_1

Tolerance		Accuracy			
		G1	G2	G3[1]	G4
		µm	µm	µm	µm
Tolerance for height	H	±10	±20	±25	±80
Difference in height[2]	ΔH	5	10	15	20
Tolerance for spacing	A_1	±10	±15	±20	±80
Difference in spacing[2]	ΔA_1	7	15	22	30

1) Standard accuracy class.

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

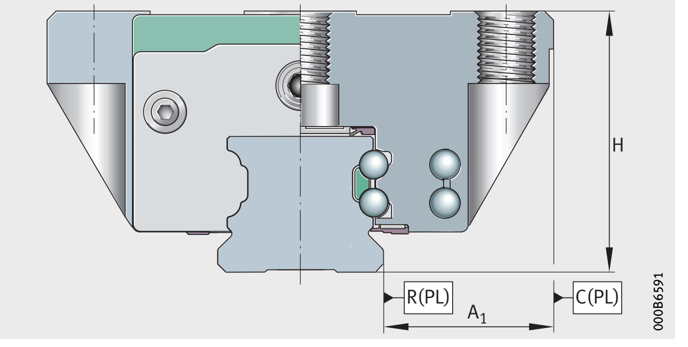


Figure 24
Datum dimensions for accuracy

Units with coating

For these units, the values for the appropriate accuracy class must be increased by the values for the coating, see table.

Coated systems are only available in the accuracy class G3.

Tolerances for coated parts

Tolerance[1]		Corrotect	Protect A
		RROC	KD
		µm	µm
Tolerance for height	H	+6	+6
Difference in height[2]	ΔH	+3	+3
Tolerance for spacing	A_1	+3	+3
Difference in spacing[2]	ΔA_1	+3	+3

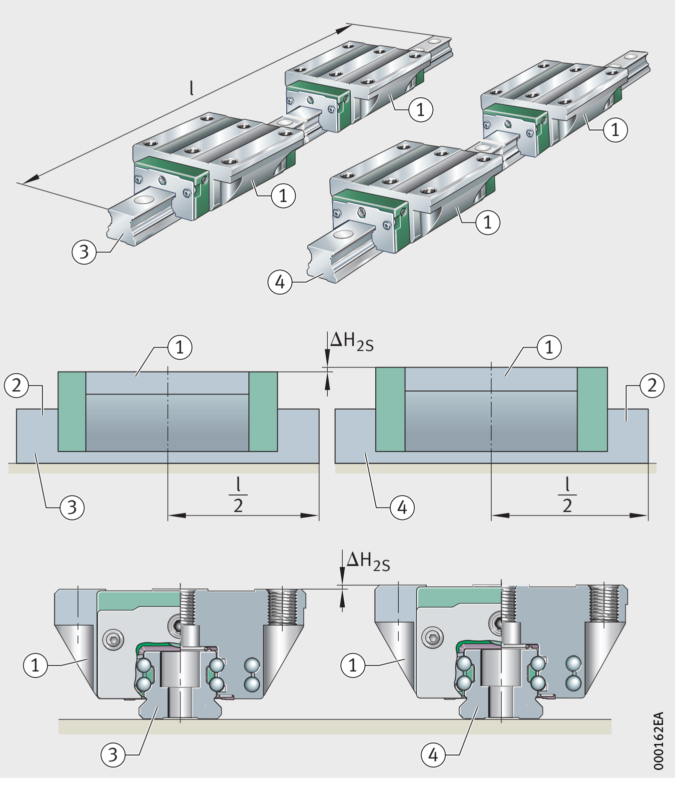
1) Displacement in tolerance zone (guideway and carriage with coating).

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

Height sorting 2S

If there are particular requirements for the accuracy of parallel systems, it is possible to restrict the height tolerance by specific sorting.

The height difference ΔH_{2S} is measured at the centre of the guideway (l/2). At this point, the height difference between all carriages of linear recirculating ball bearing and guideway assemblies supplied as a set is max. ΔH_{2S}, *Figure 25* and table.



l = guideway length

(1) Any carriage
(2) Guideway
(3) Linear recirculating ball bearing and guideway assembly 1
(4) Linear recirculating ball bearing and guideway assembly 2

Figure 25
Height sorting 2S

Height difference in 2S

Height difference	Accuracy		
	G1	G2	G3
	µm	µm	µm
ΔH_{2S}[1)]	10	20	25

1) Measured at the centre of the guideway.

Four-row linear recirculating ball bearing and guideway assemblies

Positional and length tolerances of guideways

The positional tolerances are not dependent on the guideway length, *Figure 26*, *Figure 27* and tables, page 309.

The hole pattern corresponds to DIN EN ISO 1101.

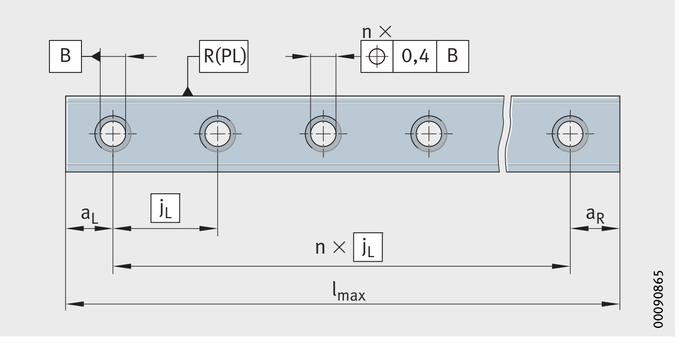


Figure 26
Positional and length tolerances of guideways TKVD with one row of holes

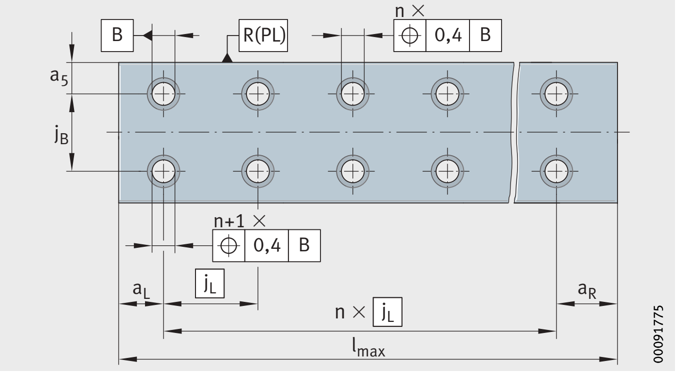


Figure 27
Positional and length tolerances of guideways TKVD..-W with two rows of holes

Length tolerances of guideways

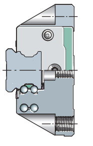
Length tolerance			
Dependent on guideway length l mm			Multi-piece guideways mm
≦ 1000	1000 – 3000	> 3000	
−1	−1,5	±0,1% of guideway length	±3 over total length

If the ordering designation does not specify delivery of the guideway as a single piece, the guideway can optionally be supplied as several segments. Permissible pitch, see table.

Segments for multi-piece guideways

Guideway length[1)] mm	Maximum permissible number of segments
< 3 000	2
3 000– 4 000	3
4 000– 6 000	4
> 6 000	4 plus 1 segment each of 1 500 mm above 6 000 mm guideway length

1) Minimum length of one segment = 600 mm.



Four-row linear recirculating ball bearing and guideway assemblies

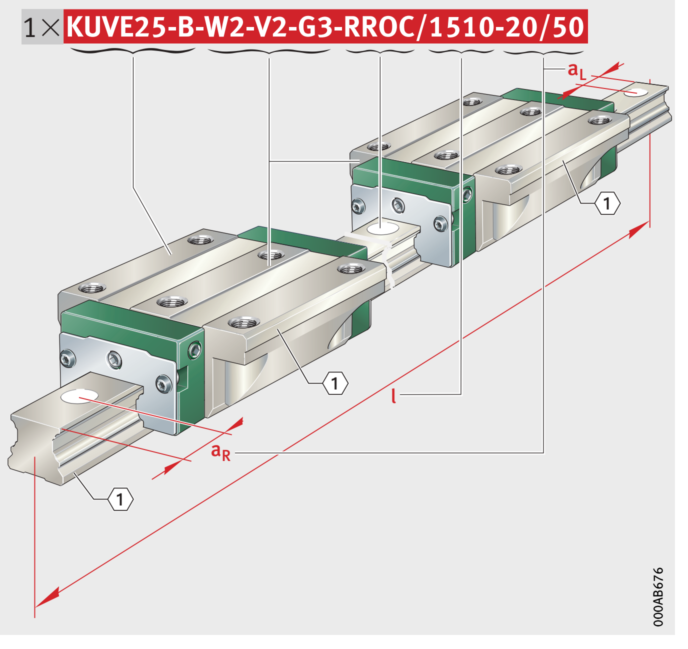
Ordering example, ordering designation

Unit, guideway with asymmetrical hole pattern:

Unit

Linear recirculating ball bearing and guideway assembly with two carriages per guideway	KUVE
Size	25
Carriage type, full complement	B
Number of carriages per unit	W2
Preload class	V2
Accuracy class	G3
With Corrotect coating	RROC
Length of guideway	1 510 mm
a_L	20 mm
a_R	50 mm

Ordering designation: 1×**KUVE25-B-W2-V2-G3-RROC/1510-20/50**, *Figure 28*



(1) Locating face

Figure 28
Ordering example, ordering designation

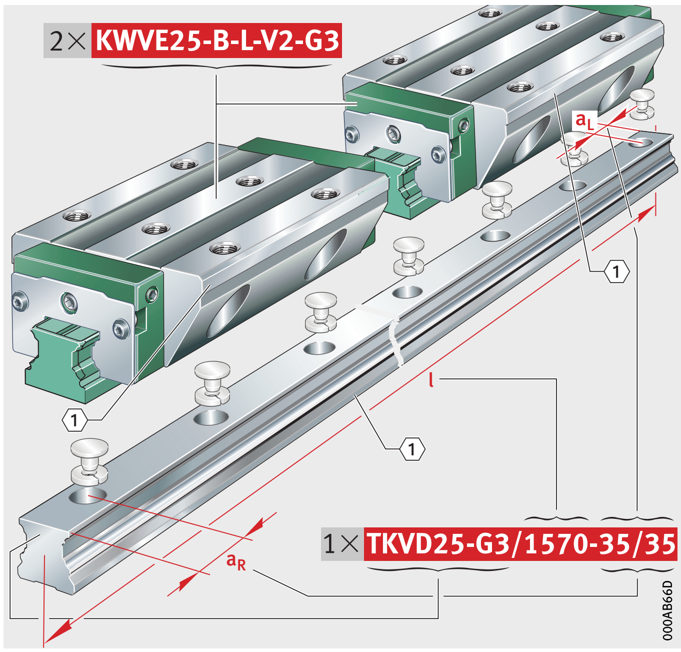
Carriage and guideway separate, guideway with symmetrical hole pattern:

Carriages	Carriage for four-row linear ball bearing and guideway assembly	KWVE
	Size	25
	Carriage type, full complement	B
	Long carriage	L
	Preload class	V2
	Accuracy class	G3

Ordering designation 2×**KWVE25-B-L-V2-G3**, *Figure 29*

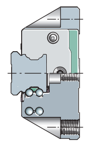
Guideway	Guideway for carriage	TKVD
	Size	25
	Accuracy class	G3
	Length of guideway	1 570 mm
	a_L	35 mm
	a_R	35 mm

Ordering designation 1×**TKVD25-G3/1570-35/35**, *Figure 29*



(1) Locating face

Figure 29
Ordering example, ordering designation



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
Standard, L, N and NL carriages

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions										
	l_{max} 2)	H	B	L	A_1	J_B	b $^{-0,005}_{-0,03}$	A_2	L_1	L_s	J_L	J_{LZ}	j_L	a_L, a_R 3) min.	a_L, a_R 3) max.
KUVE15-B	2 880	24	47	61,2	16	38	15	4,5	39,8	1,3	30	26	60	20	53
KUVE20-B	5 880	30	63	71,4	21,5	53	20	5	50,4	1,3	40	35	60	20	53
KUVE20-B-L				88,9					67,9						
KUVE20-B-N		27		71,4					50,4						
KUVE20-B-NL				88,9					67,9						
KUVE25-B	5 880	36	70	83,3	23,5	57	23	6,5	60,7	1,65	45	40	60	20	53
KUVE25-B-L				109,1					86,5						
KUVE25-B-N		31		83,3					60,7						
KUVE25-B-NL				109,1					86,5						
KUVE30-B	5 860	42	90	99	31	72	28	9	72	1,65	52	44	80	20	71
KUVE30-B-L				127					100						
KUVE30-B-N		38		99					72						
KUVE30-B-NL				127					100						
KUVE35-B	5 860	48	100	112	33	82	34	9	80	1,65	62	52	80	20	71
KUVE35-B-L				145					113						
KUVE35-B-N		44		112					80						
KUVE35-B-NL				145					113						
KUVE45-B	5 835	60	120	140,6	37,5	100	45	10	102,5	2,2	80	60	105	20	94
KUVE45-B-L				172,7					134,6						
KUVE45-B-N		52		140,6					102,5						
KUVE45-B-NL				172,7					134,6						
KUVE55-B	5 820	70	140	173,6	43,5	116	53	12	132	2,2	95	70	120	20	107
KUVE55-B-L				211,6					170						

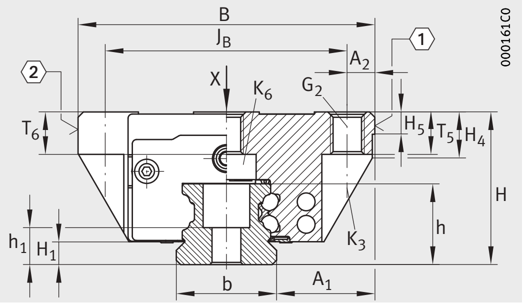
For further table values, see page 314 and page 315.

⟨1⟩ Locating face. ⟨2⟩ Marking.

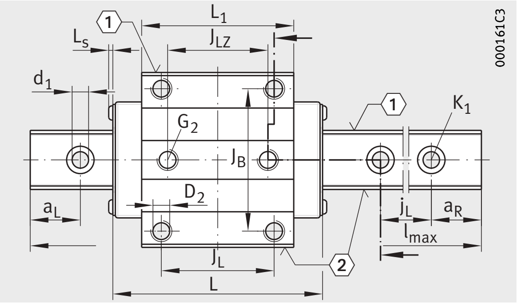
1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

2) Maximum length of single-piece guideways. Permissible number of guideway segments, see page 309.

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

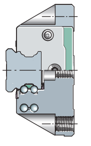


KUVE..-B, KUVE..-B-L, KUVE..-B-N, KUVE..B-NL



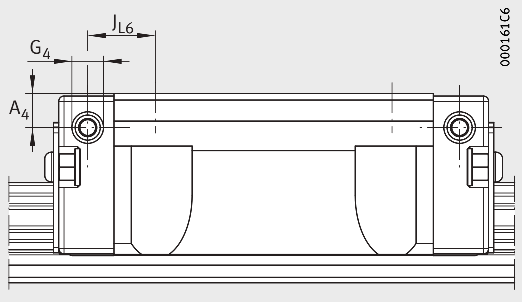
KUVE..-B, KUVE..-B-L, KUVE..-B-N, KUVE..-B-NL
View X rotated 90°

							Fixing screws[1)]											
H_1	H_4	H_5	T_5	T_6	h	h_1	G_2		K_1		K_3		K_6		K_6		d_1	D_2
							DIN ISO 4762-12.9								DIN 7984-8.8			
								M_A Nm		M_A Nm		M_A Nm		M_A Nm		M_A Nm		
4,3	7,6	4,75	7	5,8	15	7,6	M5	5,8	M4	5	M4	5	–	–	M4	2	4,6	4,5
4,5	11	5,25	10	7,5	17	8,6	M6	10	M5	10	M5	10	M5	10	–	–	5,8	5,5
	8,6		8	6							M5	10	–	–	M5	4		
5,1	10,9	5,25	10	10	18,7	8,2	M8	24	M6	17	M6	17	M6	17	–	–	6,8	6,7
	9,3			8									–	–	M6	8		
5,9	13,8	6,25	12	11,5	23,5	11	M10	41	M8	41	M8	41	M8	41	–	–	9	8,6
	9,8			9									–	–	M8	12		
6,7	14,3	6,75	13	12,3	27	14,5	M10	41	M8	41	M8	41	M8	41	–	–	9	8,6
	10,3			8,3									–	–	M8	12		
9,7	19,9	9,25	15	15	34,2	15,7	M12	83	M12	140	M10	83	M10	83	–	–	13,4	10,6
	17,2			11									–	–	M10	35		
13,5	22,7	11,25	21	18	41,5	19	M14	140	M14	220	M12	140	M12	140	–	–	15,4	12,5



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
Standard, L, N and NL carriages



Lubrication connector on lateral face

Dimension table (continued) · Dimensions in mm

Designation	Carriage		Guideway		Lubrication connectors		
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	G_3	2)
KUVE15-B	KWVE15-B	0,2	TKVD15-B[3)]	1,44	4,3	M3	5,5
KUVE20-B	KWVE20-B	0,44	TKVD20	2,2	7,7	M5	7
KUVE20-B-L	KWVE20-B-L	0,59					
KUVE20-B-N	KWVE20-B-N	0,37			4,7		
KUVE20-B-NL	KWVE20-B-NL	0,51					
KUVE25-B	KWVE25-B	0,68	TKVD25	2,7	11	M6	7
KUVE25-B-L	KWVE25-B-L	1					
KUVE25-B-N	KWVE25-B-N	0,56			6		
KUVE25-B-NL	KWVE25-B-NL	0,82					
KUVE30-B	KWVE30-B	1,2	TKVD30	4,3	11,5	M6	7
KUVE30-B-L	KWVE30-B-L	1,7					
KUVE30-B-N	KWVE30-B-N	1			7,5		
KUVE30-B-NL	KWVE30-B-NL	1,5					
KUVE35-B	KWVE35-B	1,75	TKVD35	5,7	12,3	M6	7
KUVE35-B-L	KWVE35-B-L	2,52					
KUVE35-B-N	KWVE35-B-N	1,56			8,3		
KUVE35-B-NL	KWVE35-B-NL	2,23					
KUVE45-B	KWVE45-B	3,3	TKVD45	9,2	16,5	M6	7
KUVE45-B-L	KWVE45-B-L	4,3					
KUVE45-B-N	KWVE45-B-N	2,72			8,5		
KUVE45-B-NL	KWVE45-B-NL	3,38					
KUVE55-B	KWVE55-B	5,5	TKVD55-B	14	15	M6	7
KUVE55-B-L	KWVE55-B-L	6,6					

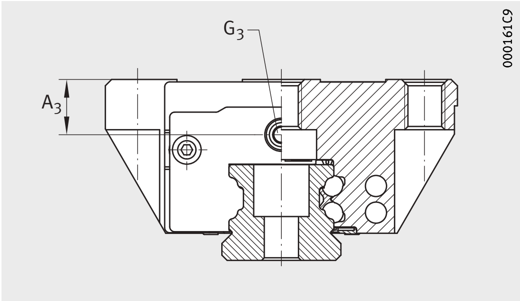
1) Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the whole thread length is used
and the adjacent construction is dimensioned appropriately.

2) Maximum permissible screw depth for lubrication connectors.

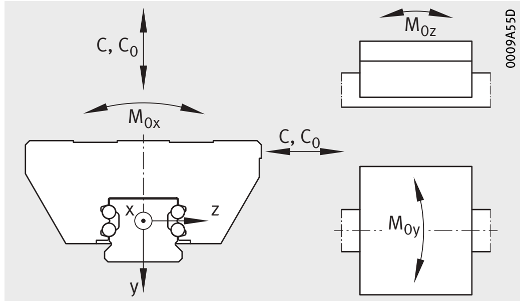
3) The new carriages cannot be used on the previous guideways TKVD15 or TKVD15-U.

4) Lubrication connectors are included loose:

- S04 with KUVE20-B
- S05 with KUVE25-B to KUVE55-B
- S16 with KUVE15-B.

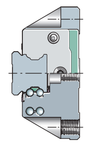


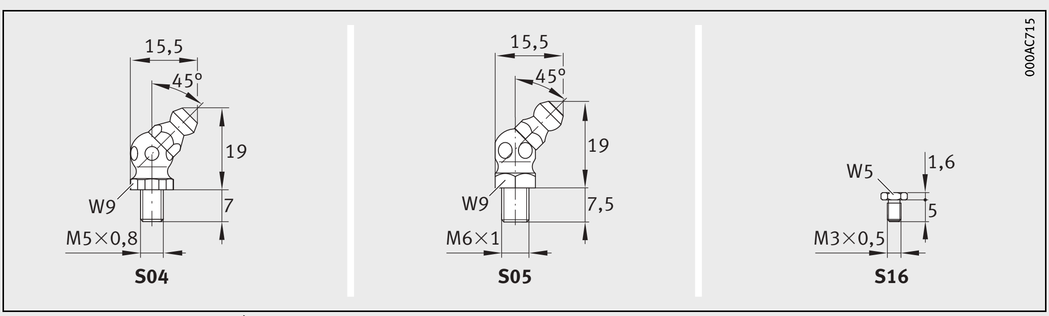
Lubrication connector on end face



Load directions

A_4	G_4		J_{L6}	Load carrying capacity				
				Basic load ratings[1]		Moment ratings		
		2)		dyn. C	stat. C_0	M_{0x}	M_{0y}	M_{0z}
				N	N	Nm	Nm	Nm
3,2	M3	5,5	9,1	7 200	14 500	150	100	100
4,6	M5	5,5	9,4	13 100	27 000	332	240	240
			18,9	16 200	36 500	452	430	430
3,3	M3		9,4	13 100	27 000	332	240	240
			18,9	16 200	36 500	452	430	430
6,5	M6	7	12,85	17 900	37 000	510	395	395
			25,75	23 400	54 000	745	825	825
4	M3	6	12,05	17 900	37 000	510	395	395
			24,95	23 400	54 000	745	825	825
7	M6	7	15,5	27 500	55 000	970	700	700
			29,5	34 500	74 000	1 310	1 240	1 240
4,95	M5		15,1	27 500	55 000	970	700	700
			29,1	34 500	74 000	1 310	1 240	1 240
11	M6	7	16	38 000	72 000	1 465	1 020	1 020
			32,5	47 500	100 000	2 625	1 890	1 890
7			16	38 000	72 000	1 465	1 020	1 020
			32,5	47 500	100 000	2 625	1 890	1 890
16,5	M6	7	19,25	69 000	141 000	3 610	2 485	2 485
			35,3	82 000	181 000	4 635	4 000	4 000
8,5			19,25	69 000	141 000	3 610	2 485	2 485
			35,5	82 000	181 000	4 635	4 000	4 000
15	M6	7	30,5	104 000	213 000	5 600	2 730	2 730
			49,5	127 000	285 000	7 500	4 725	4 800





Lubrication connectors[4]

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
H, S and SN carriages

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions						
	l_{max} 2)	H	B	L	A_1	J_B	b $^{-0,005}_{-0,03}$	A_2	L_1	L_s	J_L
KUVE15-B-H	2 880	28	34	61,2	9,5	26	15	4	39,8	1,3	26
KUVE15-B-S		24									
KUVE20-B-H 4)	5 880	30	44	71,4	12	32	20	6	50,4	1,3	36
KUVE20-B-S 4)		30									
KUVE20-B-SN		27									
KUVE25-B-H	5 880	40	48	83,3	12,5	35	23	6,5	60,7	1,65	35
KUVE25-B-S		36									
KUVE25-B-SN		31									
KUVE30-B-H	5 860	45	60	99	16	40	28	10	72	1,65	40
KUVE30-B-S		42									
KUVE30-B-SN		38									
KUVE35-B-H	5 860	55	70	112	18	50	34	10	80	1,65	50
KUVE35-B-S		48									
KUVE35-B-SN		44									
KUVE45-B-H	5 835	70	86	140,6	20,5	60	45	13	102,5	2,2	60
KUVE45-B-S		60									
KUVE45-B-SN		52									
KUVE55-B-S	5 820	70	100	173,6	23,5	75	53	12,5	132	2,2	75

For further table values, see page 318 and page 319.

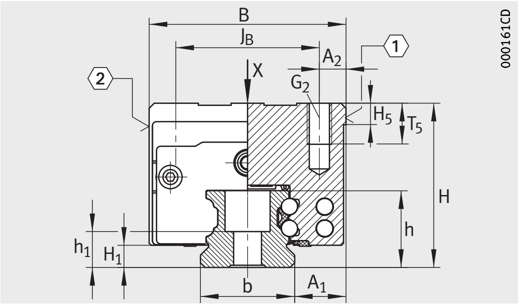
1 Locating face. 2 Marking.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

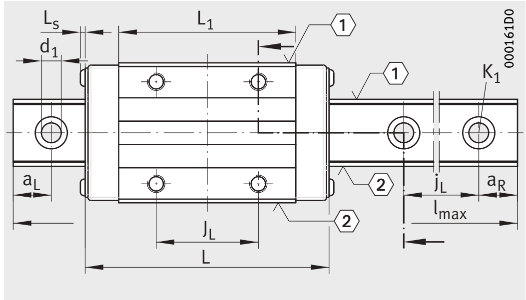
2) Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 309.

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

4) KUVE20-B-H and KUVE20-B-S are 100% identical in dimensions and performance.
If a KUVE20-B-H is ordered, the order confirmation will contain the designation KUVE20-B-S.

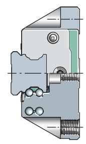


KUVE..-B-H, KUVE..-B-S, KUVE..-B-SN



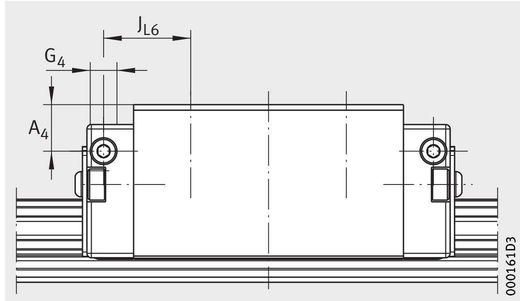
KUVE..-B-H, KUVE..-B-S, KUVE..-B-SN
View X rotated 90°

j_L	a_L, a_R [3)]		H_1	H_5	T_5	h	h_1	Fixing screws[1)]				d_1
								G_2		K_1		
								DIN ISO 4762-12.9				
	min.	max.							M_A Nm		M_A Nm	
60	20	53	4,3	4,75	6	15	7,6	M4	5	M4	5	4,6
60	20	53	4,5	5,25	7,5	17	8,6	M5	10	M5	10	5,8
60	20	53	5,1	5,25	10 7,5	18,7	8,2	M6	17	M6	17	6,8
80	20	71	5,9	6,25	13,5 11	23,5	11	M8	41	M8	41	9
80	20	71	6,7	6,75	13,5	27	14,5	M8	41	M8	41	9
105	20	94	9,7	9,25	17 16,5	34,2	15,7	M10	83	M12	140	13,4
120	20	107	13,5	11,25	15	41,5	19	M12	140	M14	220	15,4



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
H, S and SN carriages



Lubrication connector on lateral face

Dimension table (continued) · Dimensions in mm

Designation	Carriage		Guideway		Lubrication connectors		
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	G_3	[2]
KUVE15-B-H	KWVE15-B-H	0,2	TKVD15-B[3]	1,44	8,3	M3	5,5
KUVE15-B-S	KWVE15-B-S	0,16			4,3		
KUVE20-B-H[4]	KWVE20-B-H	0,34			7,7		
KUVE20-B-S[4]	KWVE20-B-S	0,34	TKVD20	2,2	7,7	M5	7
KUVE20-B-SN	KWVE20-B-SN	0,29			4,7		
KUVE25-B-H	KWVE25-B-H	0,65			15		
KUVE25-B-S	KWVE25-B-S	0,56	TKVD25	2,7	11	M6	7
KUVE25-B-SN	KWVE25-B-SN	0,45			6		
KUVE30-B-H	KWVE30-B-H	1,04			14,5		
KUVE30-B-S	KWVE30-B-S	0,94	TKVD30	4,3	11,5	M6	7
KUVE30-B-SN	KWVE30-B-SN	0,8			7,5		
KUVE35-B-H	KWVE35-B-H	1,71			19,3		
KUVE35-B-S	KWVE35-B-S	1,3	TKVD35	5,7	12,3	M6	7
KUVE35-B-SN	KWVE35-B-SN	1,24			8,3		
KUVE45-B-H	KWVE45-B-H	3,36			26,5		
KUVE45-B-S	KWVE45-B-S	2,67	TKVD45	9,2	16,5	M6	7
KUVE45-B-SN	KWVE45-B-SN	2,12			8,5		
KUVE55-B-S	KWVE55-B-S	4,35	TKVD55-B	14	15	M6	7

1) Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the whole thread length is used
and the adjacent construction is dimensioned appropriately.

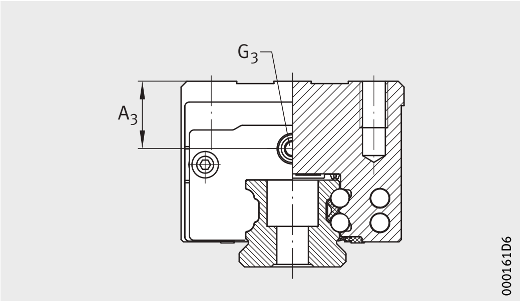
2) Maximum permissible screw depth for lubrication connectors.

3) The new carriages cannot be used on the previous guideways TKVD15 or TKVD15-U.

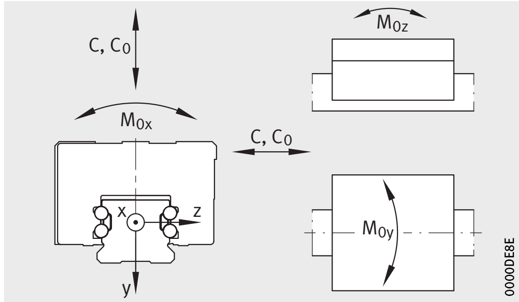
4) KUVE20-B-H and KUVE20-B-S are 100% identical in dimensions and performance.
If a KUVE20-B-H is ordered, the order confirmation will contain the designation KUVE20-B-S.

5) Lubrication connectors are included loose:

- S04 with KUVE20-B
- S05 with KUVE25-B to KUVE55-B
- S16 with KUVE15-B.

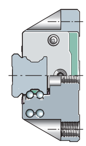


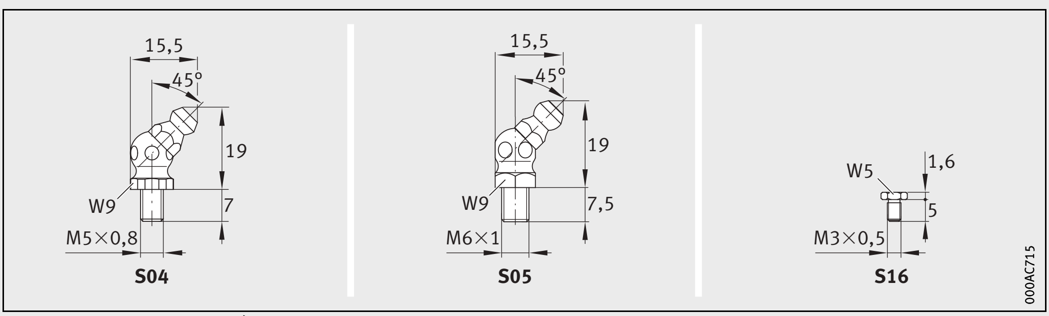
Lubrication connector on end face



Load directions

				Load carrying capacity				
A_4	G_4		J_{L6}	Basic load ratings[1]		Moment ratings		
		2)		dyn. C N	stat. C_0 N	M_{0x} Nm	M_{0y} Nm	M_{0z} Nm
7,2	M3	5,5	11,1	7 200	14 500	150	100	100
3,2								
4,6	M5	5,5	11,4	13 100	27 000	332	240	240
4,6								
3,3	M3							
10,5	M6	7	17,9	17 900	37 000	510	395	395
6,5								
4	M3	6						
10	M6	7	21,5	27 500	55 000	970	700	700
7								
4,95	M5							
18	M6	7	22	38 000	72 000	1 465	1 020	1 020
11								
7								
26,5	M6	7	29,3	69 000	141 000	3 610	2 485	2 485
16,5								
8,5								
15	M6	7	40,5	104 000	213 000	5 600	2 730	2 730





Lubrication connectors[5]

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
HL, SL and SNL carriages

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions						
	l_{max} 2)	H	B	L	A_1	J_B	b $^{-0,005}_{-0,03}$	A_2	L_1	L_s	J_L
KUVE20-B-SL	5 880	30	44	88,9	12	32	20	6	67,9	1,3	50
KUVE20-B-SNL		27									
KUVE25-B-HL	5 880	40	48	109,1	12,5	35	23	6,5	86,5	1,65	50
KUVE25-B-SL		36									
KUVE25-B-SNL		31									
KUVE30-B-HL	5 860	45	60	127	16	40	28	10	100	1,65	60
KUVE30-B-SL		42									
KUVE30-B-SNL		38									
KUVE35-B-HL	5 860	55	70	145	18	50	34	10	113	1,65	72
KUVE35-B-SL		48									
KUVE35-B-SNL		44									
KUVE45-B-HL	5 835	70	86	172,7	20,5	60	45	13	134,6	2,2	80
KUVE45-B-SL		60									
KUVE45-B-SNL		52									
KUVE55-B-SL	5 820	70	100	211,6	23,5	75	53	12,5	170	2,2	95

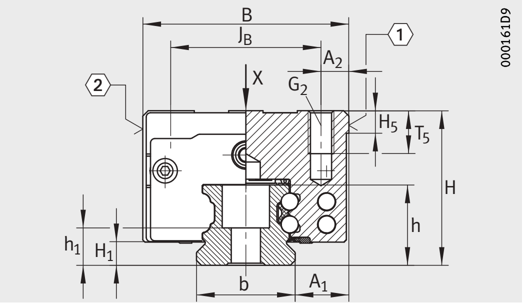
For further table values, see page 322 and page 323.

⟨1⟩ Locating face. ⟨2⟩ Marking.

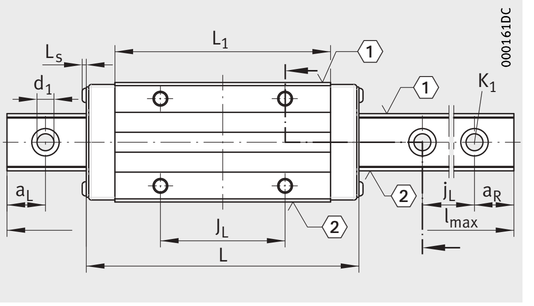
1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

2) Maximum length of single-piece guideways. Permissible number of guideway segments, see page 309.

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

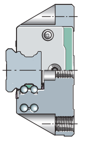


KUVE..-B-HL, KUVE..-B-SL, KUVE..-B-SNL



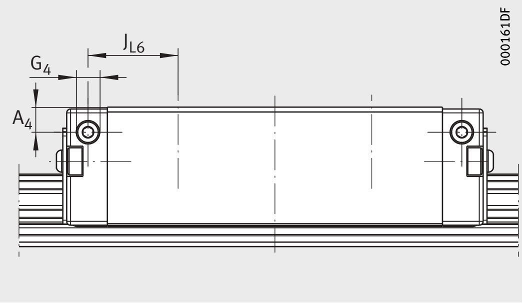
KUVE..-B-HL, KUVE..-B-SL, KUVE..-B-SNL
View X rotated 90°

j_L	a_L, a_R 3)		H_1	H_5	T_5	h	h_1	Fixing screws 1)				d_1
								G_2		K_1		
								DIN ISO 4762-12.9				
	min.	max.							M_A Nm		M_A Nm	
60	20	53	4,5	5,25	7,5	17	8,6	M5	10	M5	10	5,8
60	20	53	5,1	5,25	10 7,5	18,7	8,2	M6	17	M6	17	6,8
80	20	71	5,9	6,25	13,5 11	23,5	11	M8	41	M8	41	9
80	20	71	6,7	6,75	13,5	27	14,5	M8	41	M8	41	9
105	20	94	9,7	9,25	17 16,5	34,2	15,7	M10	83	M12	140	13,4
120	20	107	13,5	11,25	15	41,5	19	M12	140	M14	220	15,4



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
HL, SL and SNL carriages



Lubrication connector on lateral face

Dimension table (continued) · Dimensions in mm

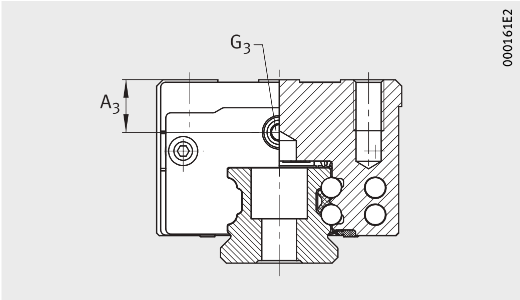
Designation	Carriage		Guideway		Lubrication connectors		
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	G_3	2)
KUVE20-B-SL	KWVE20-B-SL	0,46	TKVD20	2,2	7,7	M5	7
KUVE20-B-SNL	KWVE20-B-SNL	0,38			4,7		
KUVE25-B-HL	KWVE25-B-HL	1			15		
KUVE25-B-SL	KWVE25-B-SL	1	TKVD25	2,7	11	M6	7
KUVE25-B-SNL	KWVE25-B-SNL	0,62			6		
KUVE30-B-HL	KWVE30-B-HL	1,43			14,5		
KUVE30-B-SL	KWVE30-B-SL	1,7	TKVD30	4,3	11,5	M6	7
KUVE30-B-SNL	KWVE30-B-SNL	1,1			7,5		
KUVE35-B-HL	KWVE35-B-HL	2,4			19,3		
KUVE35-B-SL	KWVE35-B-SL	1,81	TKVD35	5,7	12,3	M6	7
KUVE35-B-SNL	KWVE35-B-SNL	1,72			8,3		
KUVE45-B-HL	KWVE45-B-HL	4,27			26,5		
KUVE45-B-SL	KWVE45-B-SL	3,38	TKVD45	9,2	16,5	M6	7
KUVE45-B-SNL	KWVE45-B-SNL	2,68			8,5		
KUVE55-B-SL	KWVE55-B-SL	6,3	TKVD55-B	14	15	M6	7

1) Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the whole thread length is used
and the adjacent construction is dimensioned appropriately.

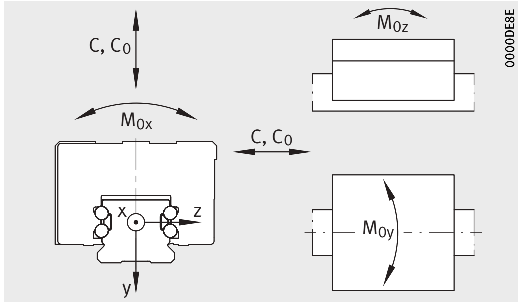
2) Maximum permissible screw depth for lubrication connectors.

3) Lubrication connectors are included loose:

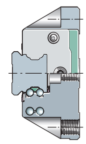
- S04 with KUVE20-B
- S05 with KUVE25-B to KUVE55-B
- S16 with KUVE15-B.



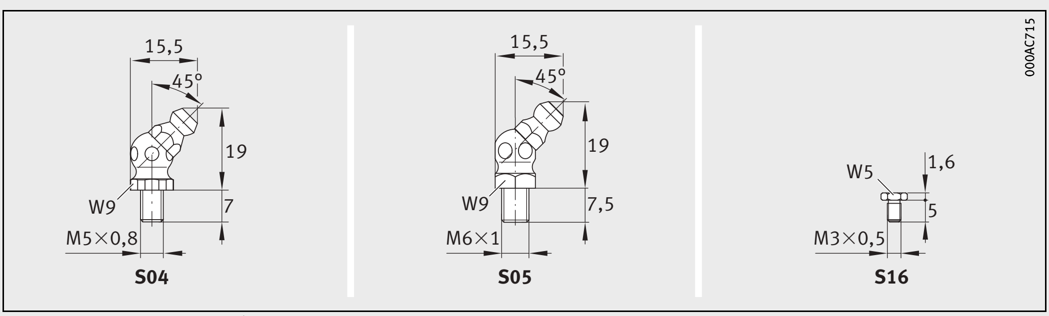
Lubrication connector on end face



Load directions



				Load carrying capacity				
A_4	G_4		J_{L6}	Basic load ratings[1)]		Moment ratings		
		2)		dyn. C	stat. C_0	M_{0x}	M_{0y}	M_{0z}
				N	N	Nm	Nm	Nm
4,6	M5	5,5	13,2	16 200	36 500	452	430	430
3,3	M3							
10,5	M6	7	23,3	23 400	54 000	745	825	825
6,5								
4	M3	6	22,5					
10	M6	7	25,5	34 500	74 000	1 310	1 240	1 240
7								
4,95	M5		25,1					
18	M6	7	27,5	47 500	100 000	2 625	1 890	1 890
11								
7								
26,5	M6	7	35,3	82 000	181 000	4 635	4 000	4 000
16,5								
8,5								
15	M6	7	49,5	127 000	285 000	7 500	4 725	4 800



Lubrication connectors[3)]

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
E carriages
Without screw threads

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions						
	l_{max} [2]	H	B	L	A_1	J_B	b $^{-0,005}_{-0,03}$	A_2	L_1	L_S	J_L
KUVE15-B-E	2 880	24	52	61,2	18,5	41	15	5,5	39,8	1,3	26
KUVE20-B-E	5 880	28	59	71,4	19,5	49	20	5	50,4	1,3	32
KUVE25-B-E	5 880	33	73	83,3	25	60	23	6,5	60,7	1,65	35
KUVE30-B-E	5 860	42	90	99	31	72	28	9	72	1,65	40
KUVE35-B-E	5 860	48	100	112	33	82	34	9	80	1,65	50

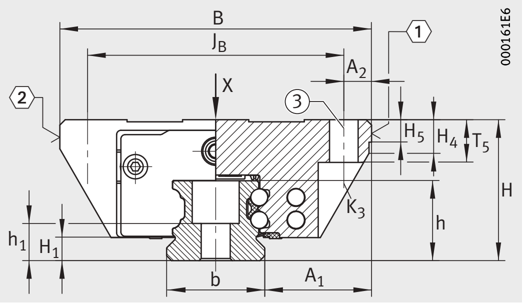
For further table values, see page 326 and page 327.

1 Locating face. 2 Marking. 3 No thread.

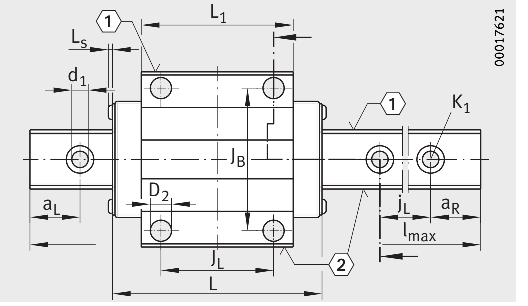
1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

2) Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 309.

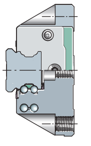
3) a_L and a_R are dependent on the guideway length.



KUVE..-B-E



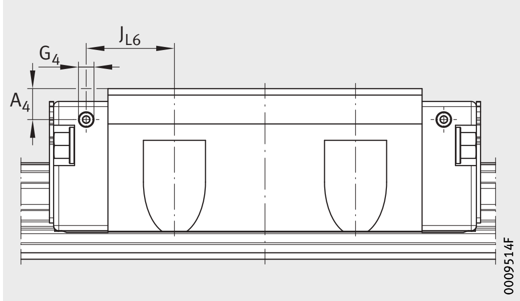
KUVE..-B-E
View X rotated 90°



j_L	a_L, a_R 3)		H_1	H_4	H_5	T_5	h	h_1	Fixing screws 1) K_1		K_3		d_1	D_2
									DIN ISO 4762-12.9					
	min.	max.								M_A Nm		M_A Nm		
60	20	53	4,3	6,1	4,75	7	15	8,15	M4	5	M4	5	4,6	4,5
60	20	53	4,5	11,2	5,25	9	17	9,1	M5	10	M5	10	5,8	5,5
60	20	53	5,1	7,85	5,25	10	18,7	8,7	M6	17	M6	17	6,8	6,7
80	20	71	5,9	13,8	6,25	12	23,5	11,5	M8	41	M8	41	9	8,6
80	20	71	6,7	14,3	6,75	13	27	15	M8	41	M8	41	9	8,6

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
E carriages
Without screw threads



Lubrication connector on lateral face

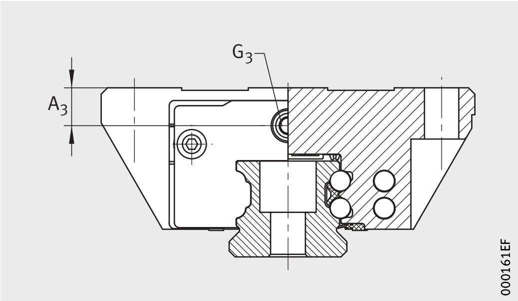
Dimension table (continued) · Dimensions in mm

Designation	Carriage		Guideway		Lubrication connectors		
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	G_3	2)
KUVE15-B-E	KWVE15-B-E	0,2	TKVD15-B	1,44	4,3	M3	5,5
KUVE20-B-E	KWVE20-B-E	0,36	TKVD20	2,2	6	M5	7
KUVE25-B-E	KWVE25-B-E	0,68	TKVD25	2,7	8	M6	7
KUVE30-B-E	KWVE30-B-E	1,2	TKVD30	4,3	11,5	M6	7
KUVE35-B-E	KWVE35-B-E	1,75	TKVD35	5,7	12,3	M6	7

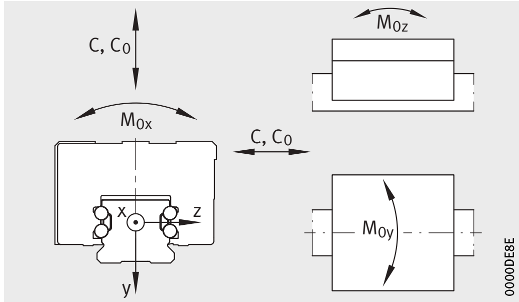
1) Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the whole thread length is used
and the adjacent construction is dimensioned appropriately.

2) Maximum permissible screw depth for lubrication connectors.

3) Lubrication connectors are included loose:
- S04 with KUVE20-B
- S05 with KUVE25-B to KUVE55-B
- S16 with KUVE15-B.

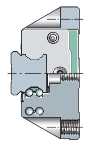


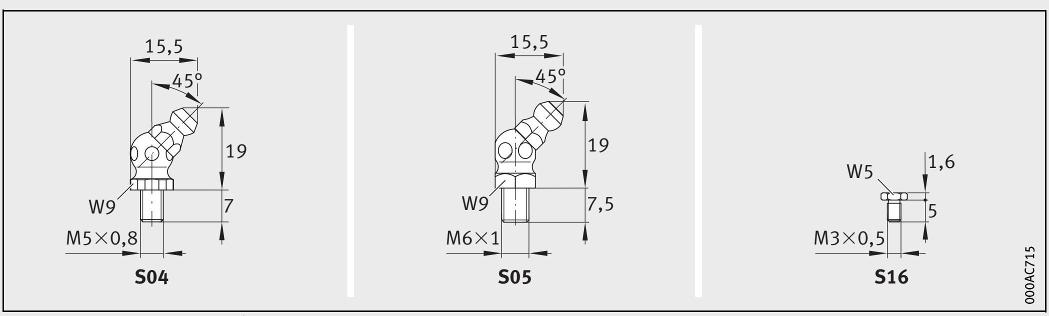
Lubrication connector on end face



Load directions

				Load carrying capacity				
A_4	G_4		J_{L6}	Basic load ratings[1]		Moment ratings		
		[2]		dyn. C	stat. C_0	M_{0x}	M_{0y}	M_{0z}
				N	N	Nm	Nm	Nm
3,2	M3	5,5	11,1	7 200	14 500	150	100	100
4,3	M3	5,5	13,4	13 100	27 000	332	240	240
6	M3	7	17,05	17 900	37 000	510	395	395
7	M6	7	21,1	27 500	55 000	970	700	700
11	M6	7	22	38 000	72 500	1 465	1 020	1 020





Lubrication connectors[3]

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
ES carriages

Dimension table · Dimensions in mm

Designation[2)]	Dimensions				Mounting dimensions					
	l_{max}[3)]	H	B	L	A_1	J_B	b $^{-0,06}_{-0,03}$	A_2	L_1	L_S
KUVE15-B-ES	2 880	24	34	61,2	9,5	26	15	4	39,8	1,3
KUVE20-B-ES	5 880	28	42	71,4	11	32	20	5	50,4	1,3
KUVE25-B-ES	5 880	33	48	83,3	12,5	35	23	6,5	60,7	1,65
KUVE30-B-ES	5 860	42	60	99	16	40	28	10	72	1,65
KUVE35-B-ES	5 860	48	70	112	18	50	34	10	80	1,65

For further table values, see page 330 and page 331.

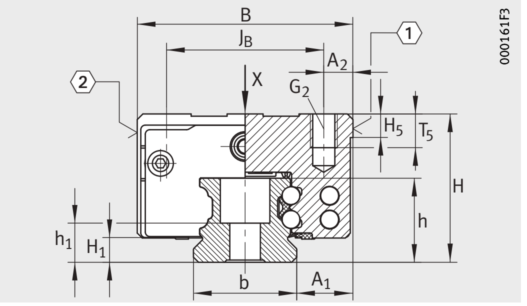
⟨1⟩ Locating face. ⟨2⟩ Marking.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

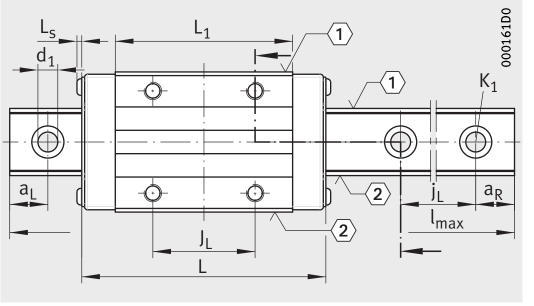
2) KUVE15-B-ES and KUVE15-B-S, KUVE30-B-ES and KUVE30-B-S as well as KUVE35-B-ES and KUVE35-B-S are in each case 100% identical in dimensions and performance.
If a KUVE15-B-ES, KUVE30-B-ES or KUVE35-B-ES is ordered, the confirmation of the quotation will contain the designation KUVE15-B-S, KUVE30-B-S or KUVE35-B-S.

3) Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 309.

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

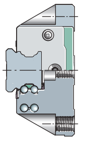


KUVE..-B-ES



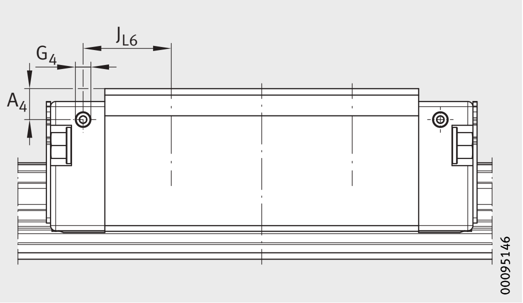
KUVE..-B-ES
View X rotated 90°

									Fixing screws[1)]				
J_L	j_L	a_L, a_R[4)]		H_1	H_5	T_5	h	h_1	G_2		K_1		d_1
									DIN ISO 4762-12.9				
										M_A		M_A	
		min.	max.							Nm		Nm	
26	60	20	53	4,3	4,75	6	15	7,6	M4	5	M4	5	4,6
32	60	20	53	4,5	5,25	7,5	17	8,6	M5	10	M5	10	5,8
35	60	20	53	5,2	5,25	10	18,7	8,2	M6	17	M6	17	6,8
40	80	20	71	5,9	6,25	13,5	23,5	11	M8	41	M8	41	9
50	80	20	71	6,7	6,75	13,5	27	14,5	M8	41	M8	41	9



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
ES carriages



Lubrication connector on lateral face

Dimension table (continued) · Dimensions in mm

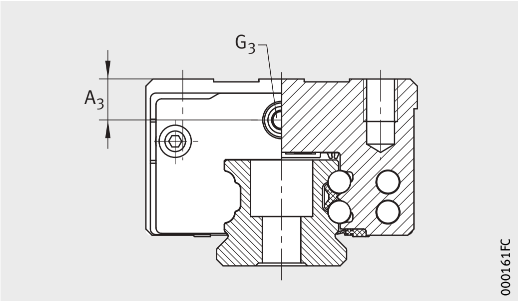
Designation	Carriage		Guideway		Lubrication connectors		
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	G_3	2)
KUVE15-B-ES	KWVE15-B-ES	0,16	TKVD15-B3)	1,44	4,3	M3	5,5
KUVE20-B-ES	KWVE20-B-ES	0,31	TKVD20	2,2	8	M5	7
KUVE25-B-ES	KWVE25-B-ES	0,56	TKVD25	2,7	11	M6	7
KUVE30-B-ES	KWVE30-B-ES	0,94	TKVD30	4,3	11,5	M6	7
KUVE35-B-ES	KWVE35-B-ES	1,3	TKVD35	5,7	12,3	M6	7

1) Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the whole thread length is used
and the adjacent construction is dimensioned appropriately.

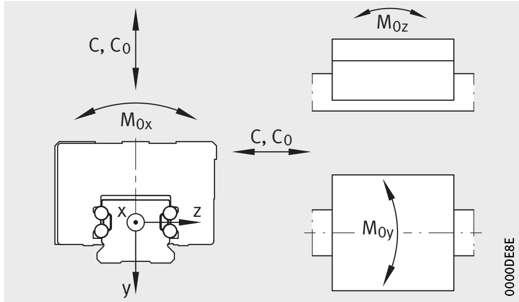
2) Maximum permissible screw depth for lubrication connectors.

3) The new carriages cannot be used on the existing guideways TKVD15 or TKVD15-U.

4) Lubrication connectors are included loose:
- S04 with KUVE20-B
- S05 with KUVE25-B to KUVE55-B
- S16 with KUVE15-B.

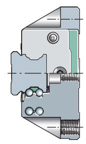


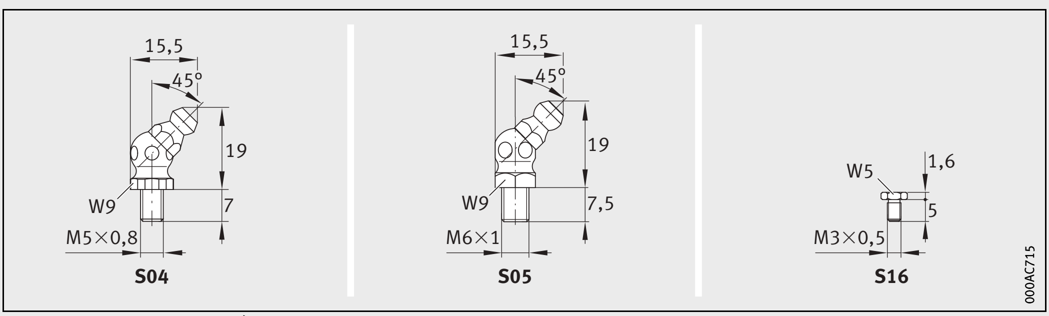
Lubrication connector on end face



Load directions

A_4	G_4		J_{L6}	Load carrying capacity				
				Basic load ratings[1]		Moment ratings		
		2)		dyn. C N	stat. C_0 N	M_{0x} Nm	M_{0y} Nm	M_{0z} Nm
3,2	M3	5,5	9,1	7 200	14 500	150	100	100
4,6	M3	5,5	9,4	13 100	27 000	332	240	240
6,5	M3	7	12,85	17 900	37 000	510	395	395
7	M6	7	15,5	27 500	55 000	970	700	700
11	M6	7	16	38 000	72 500	1 465	1 020	1 020





Lubrication connectors[4]

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
EC carriages
Without screw threads

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions					
	l_{max}[2]	H	B	L	A_1	J_B	b $^{-0,005}_{-0,03}$	A_2	L_1	L_s
KUVE15-B-EC	2 880	24	52	44,5	18,5	41	15	5,5	23,1	1,3
KUVE20-B-EC	5 880	28	59	50,4	19,5	49	20	5	29,4	1,65
KUVE25-B-EC	5 880	33	73	58,2	25	60	23	6,5	35,6	1,65
KUVE30-B-EC	5 860	42	90	69	31	72	28	9	42	1,65
KUVE35-B-EC	5 860	48	100	76,2	33	82	34	9	44,2	1,65
KUVE45-B-EC	5 835	60	120	97,8	37,5	100	45	10	59,7	2,2

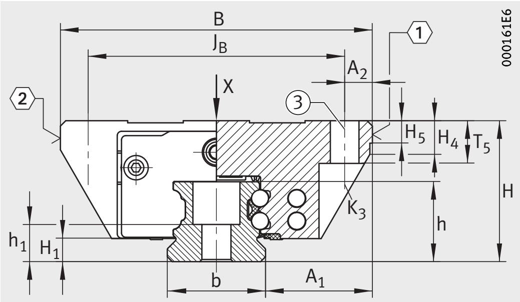
For further table values, see page 334 and page 335.

⟨1⟩ Locating face. ⟨2⟩ Marking. ③ No thread.

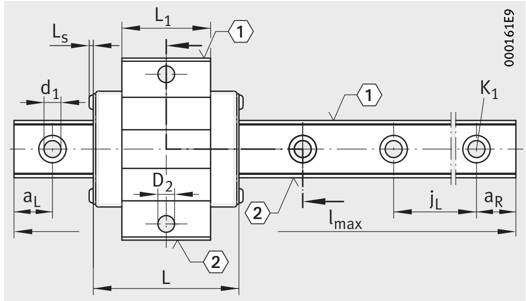
1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

2) Maximum length of single-piece guideways. Permissible number of guideway segments, see page 309.

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

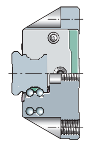


KUVE..-B-EC



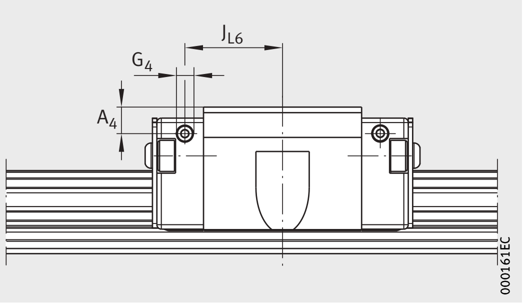
KUVE..-B-EC
View X rotated 90°

j_L	a_L, a_R 3)		H_1	H_4	H_5	T_5	h	h_1	Fixing screws 1)				d_1	D_2
									K_1		K_3			
									DIN ISO 4 762-12.9					
	min.	max.								M_A Nm		M_A Nm		
60	20	53	4,3	6,1	4,75	7	15	7,6	M4	5	M4	5	4,6	4,5
60	20	53	4,5	11,2	5,25	9	17	8,6	M5	10	M5	10	5,8	5,5
60	20	53	5,1	7,85	5,25	10	18,7	8,2	M6	17	M6	17	6,8	6,7
80	20	71	5,9	13,8	6,25	12	23,5	11	M8	41	M8	41	9	8,6
80	20	71	6,7	14,3	6,75	13,5	27	14,5	M8	41	M8	41	9	8,6
105	20	94	9,7	19,9	9,25	15	34,2	15,7	M12	140	M10	83	13,4	10,6



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
EC carriages
Without screw threads



Lubrication connector on lateral face

Dimension table (continued) · Dimensions in mm

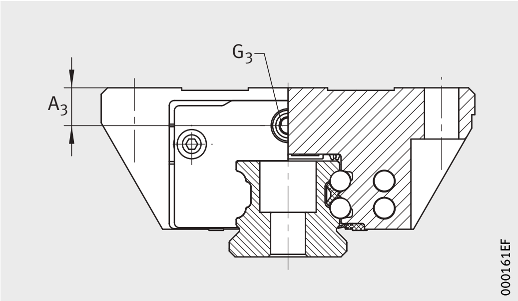
Designation	Carriage		Guideway		Lubrication connectors		
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	G_3	2)
KUVE15-B-EC	KWVE15-B-EC	0,13	TKVD15-B3)	1,44	4,3	M3	5,5
KUVE20-B-EC	KWVE20-B-EC	0,23	TKVD20	2,2	6	M5	7
KUVE25-B-EC	KWVE25-B-EC	0,4	TKVD25	2,7	8	M6	7
KUVE30-B-EC	KWVE30-B-EC	0,75	TKVD30	4,3	11,5	M6	7
KUVE35-B-EC	KWVE35-B-EC	1,04	TKVD35	5,7	12,3	M6	7
KUVE45-B-EC	KWVE45-B-EC	2,07	TKVD45	9,2	16,5	M6	7

1) Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the whole thread length is used
and the adjacent construction is dimensioned appropriately.

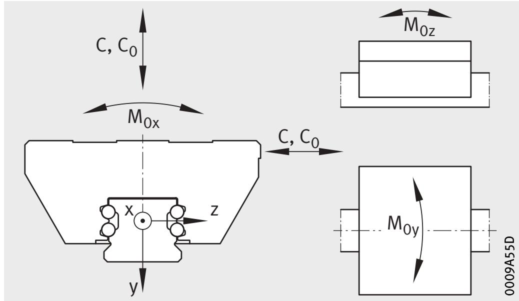
2) Maximum permissible screw depth for lubrication connectors.

3) The new carriages cannot be used on the previous guideways TKVD15 or TKVD15-U.

4) Lubrication connectors are included loose:
- S04 with KUVE20-B
- S05 with KUVE25-B to KUVE55-B
- S16 with KUVE15-B.

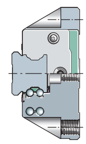


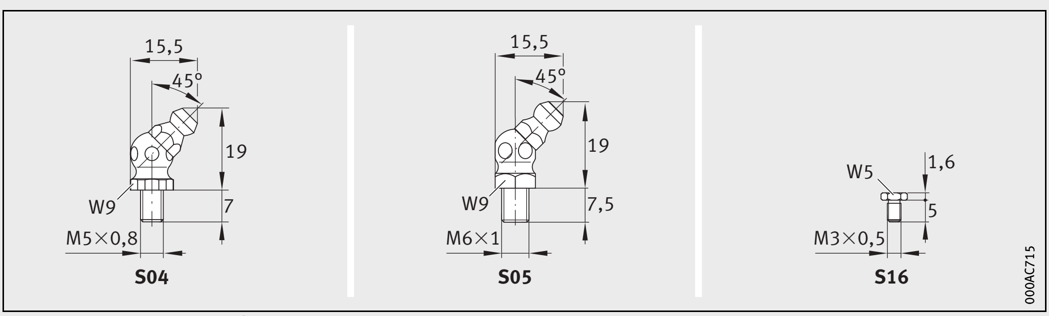
Lubrication connector on end face



Load directions

A_4	G_4		J_{L6}	Load carrying capacity				
				Basic load ratings[1]		Moment ratings		
		2)		dyn. C	stat. C_0	M_{0x}	M_{0y}	M_{0z}
				N	N	Nm	Nm	Nm
3,2	M3	5,5	15,8	4 900	8 300	86	35	35
4,3	M3	5,5	18,9	8 900	15 400	190	85	85
6	M3	6	22	12 500	22 200	305	155	155
7	M6	7	26,5	18 700	31 500	554	248	248
11	M6	7	29,1	24 600	39 000	790	330	330
16,5	M6	7	37,9	46 500	80 000	2 060	883	883





Lubrication connectors[4]

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
ESC carriages

Dimension table · Dimensions in mm										
Designation	Dimensions				Mounting dimensions					
	l_{max} 2)	H	B	L	A_1	J_B	b $^{-0,005}_{-0,03}$	A_2	L_1	L_s
KUVE15-B-ESC	2 880	24	34	44,5	9,5	26	15	4	23,1	1,3
KUVE20-B-ESC	5 880	28	42	50,4	11	32	20	5	29,4	1,65
KUVE25-B-ESC	5 880	33	48	58,2	12,5	35	23	6,5	35,6	1,65
KUVE30-B-ESC	5 860	42	60	69	16	40	28	10	42	1,65
KUVE35-B-ESC	5 860	48	70	76,2	18	50	34	10	44,2	1,65
KUVE45-B-ESC	5 835	60	86	97,8	20,5	60	45	13	59,7	2,2

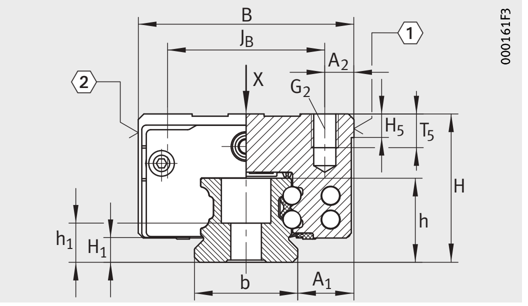
For further table values, see page 338 and page 339.

⟨1⟩ Locating face. ⟨2⟩ Marking.

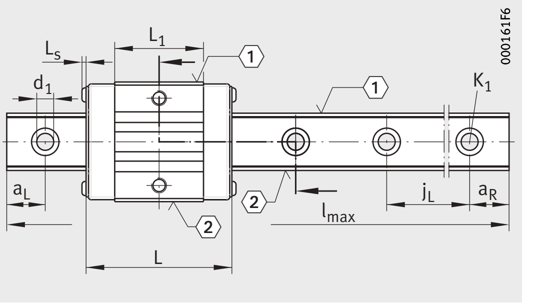
1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

2) Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 309.

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

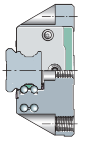


KUVE..-B-ESC



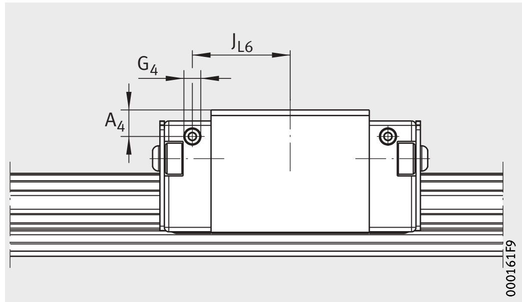
KUVE..-B-ESC
View X rotated 90°

j_L	a_L, a_R 3)		H_1	H_5	T_5	h	h_1	Fixing screws 1)				d_1
								G_2		K_1		
								DIN ISO 4762-12.9				
	min.	max.							M_A Nm		M_A Nm	
60	20	53	4,3	4,75	6	15	7,6	M4	5	M4	5	4,6
60	20	53	4,5	5,25	7,5	17	8,6	M5	10	M5	10	5,8
60	20	53	5,1	5,25	10	18,7	8,2	M6	17	M6	17	6,8
80	20	71	5,9	6,25	13,5	23,5	11	M8	41	M8	41	9
80	20	71	6,7	6,75	13,5	27	14,5	M8	41	M8	41	9
105	20	94	9,7	9,25	17	34,2	15,7	M10	83	M12	140	13,4



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
ESC carriages



Lubrication connector on lateral face

Dimension table (continued) · Dimensions in mm

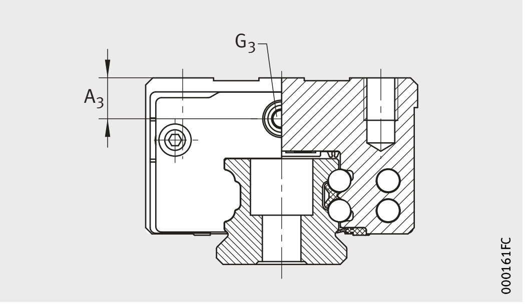
Designation	Carriage		Guideway		Lubrication connectors		
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	G_3	2)
KUVE15-B-ESC	KWVE15-B-ESC	0,12	TKVD15-B[3)]	1,44	4,3	M3	5,5
KUVE20-B-ESC	KWVE20-B-ESC	0,18	TKVD20	2,2	6	M5	7
KUVE25-B-ESC	KWVE25-B-ESC	0,3	TKVD25	2,7	8	M6	7
KUVE30-B-ESC	KWVE30-B-ESC	0,57	TKVD30	4,3	11,5	M6	7
KUVE35-B-ESC	KWVE35-B-ESC	1,04	TKVD35	5,7	12,3	M6	7
KUVE45-B-ESC	KWVE45-B-ESC	1,8	TKVD45	9,2	16,5	M6	7

1) Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the whole thread length is used
and the adjacent construction is dimensioned appropriately.

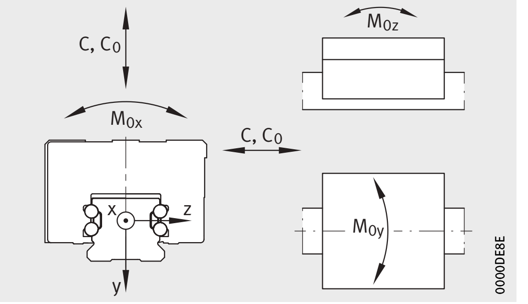
2) Maximum permissible screw depth for lubrication connectors.

3) The new carriages cannot be used on the previous guideways TKVD15 or TKVD15-U.

4) Lubrication connectors are included loose:
- S04 with KUVE20-B
- S05 with KUVE25-B to KUVE55-B
- S16 with KUVE15-B.

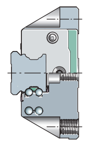


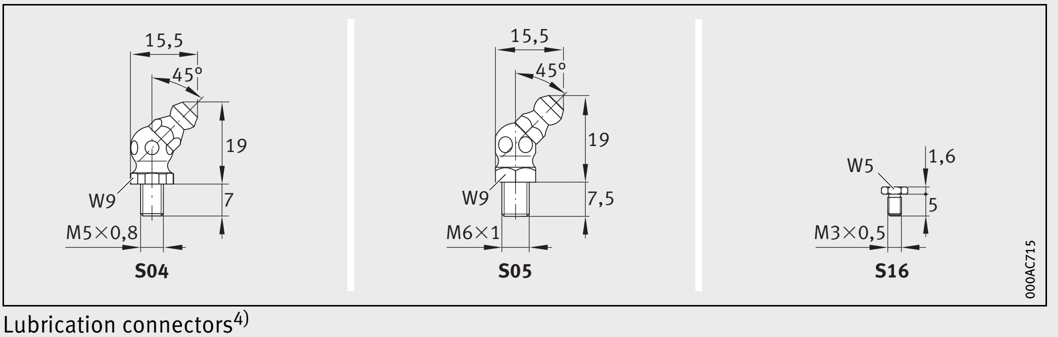
Lubrication connector on end face



Load directions

A_4	G_4		J_{L6}	Load carrying capacity				
				Basic load ratings[1]		Moment ratings		
		2)		dyn. C	stat. C_0	M_{0x}	M_{0y}	M_{0z}
				N	N	Nm	Nm	Nm
3,2	M3	5,5	15,8	4 900	8 300	86	35	35
4,3	M3	5,5	18,9	8 900	15 400	190	85	85
6	M3	6	22	12 500	22 200	305	155	155
7	M6	7	26,5	18 700	31 500	554	248	248
11	M6	7	29,1	24 600	39 000	790	330	330
16,5	M6	7	37,9	46 500	80 000	2 060	883	883





Lubrication connectors[4]

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
Wide guideway
W and WL carriages

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions										
	l_{max} [2]	H	B	L	A_1	J_B	j_B	a_5	b	A_2	L_1	J_L	j_L	a_L, a_R [3] min.	a_L, a_R [3] max.
KUVE15-W	2 890	21	68	55,6	15,5	60	22	7,5	37	4	39,8	29	50	20	44
KUVE20-W	2 880	27	80	69,8	19	70	24	9	42	5	50,4	40	60	20	53
KUVE20-WL				87,3							67,9				
KUVE25-W	5 860	35	120	81,7	25,5	107	40	14,5	69	6,5	60,7	45	80	20	71
KUVE25-WL				107,5							86,5	60			
KUVE30-W	5 860	42	142	97,5	31	124	50	15	80	9	72	52	80	20	71
KUVE35-WL	5 860	50	162	140,2	36	144	60	15	90	9	109,8	80	80	20	71

Further table values, see page 342 and page 343.

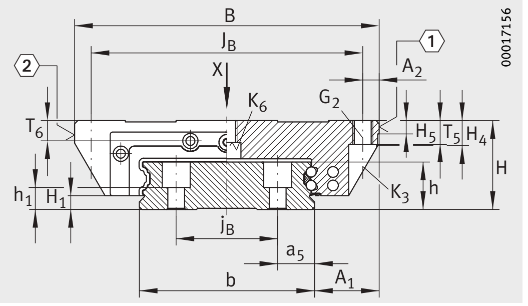
⟨1⟩ Locating face. ⟨2⟩ Marking.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

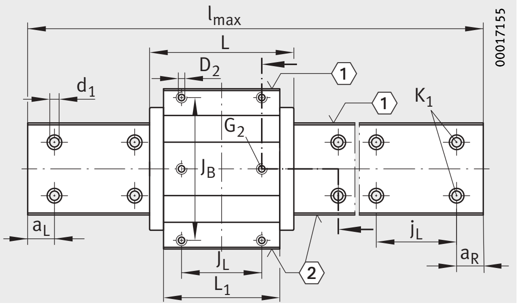
2) Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 309.

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

4) For location from above:
The maximum screw depth for the two central threaded holes is T_6 + 2,5 mm.

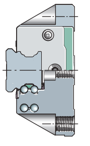


KUVE..-W, KUVE..-WL



KUVE..-W, KUVE..-WL
View X rotated 90°

							Fixing screws[1]											
H_1	H_5	H_4	T_5	T_6[4]	h	h_1	G_2		K_1		K_3		K_6		K_6		d_1	D_2
							DIN ISO 4762-12.9								DIN 7984-8.8			
								M_A Nm		M_A Nm		M_A Nm		M_A Nm		M_A Nm		
2,1	4,5	7,7	7	4,8	12,9	6	M5	5,8	M4	5	M4	5	–	–	M4	2	4,6	4,5
4,6	5	10,6	10	6	17	10	M6	10	M4	5	M5	10	–	–	M5	4	4,6	5,5
				6									M6	17	–	–		
5,2	5	9,9	10	8,5	18,7	8,2	M8	41	M6	17	M6	17	–	–	M6	8	6,8	6,7
				10									M6	17	–	–		
6	6	13,8	12	12	23,5	11	M10	41	M8	41	M8	41	–	–	M8	12	9	8,6
6,8	6,5	16,3	13	13	27	14,5	M10	41	M8	41	M8	41	M8	41	–	–	9	8,6



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
Wide guideway
W and WL carriages

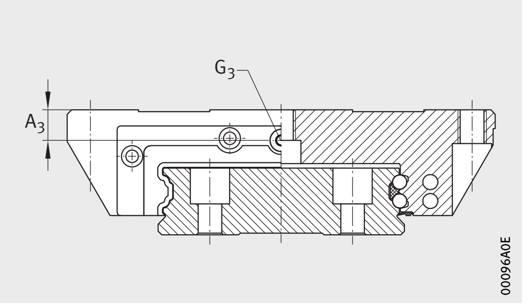
Dimension table (continued) · Dimensions in mm

Designation	Carriage		Guideway	
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m
KUVE15-W	KWVE15-W	0,27	TKVD15-W	3,6
KUVE20-W	KWVE20-W	0,5	TKVD20-W	5
KUVE20-WL	KWVE20-WL	0,7		
KUVE25-W	KWVE25-W	1,1	TKVD25-W	9,4
KUVE25-WL	KWVE25-WL	1,46		
KUVE30-W	KWVE30-W	1,95	TKVD30-W	13,6
KUVE35-WL	KWVE35-WL	4,11	TKVD35-W	17,4

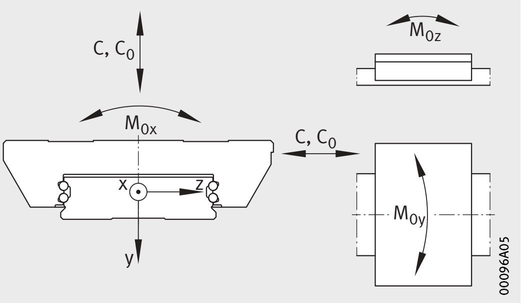
1) Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the full thread length is used and the adjacent construction is dimensioned accordingly.

2) Maximum permissible screw depth for lubrication connectors.

3) Lubrication connectors are included loose:
- S04 with KUVE20-W
- S05 with KUVE25-W to KUVE35-WL
- S16 with KUVE15-W.

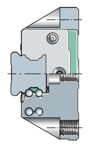


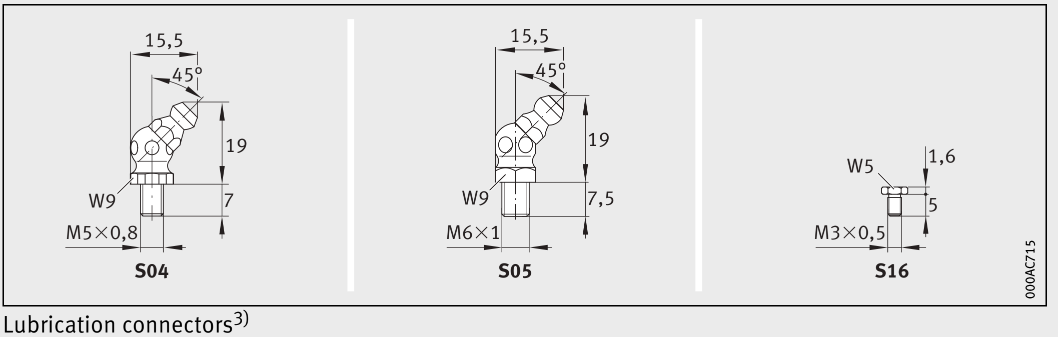
Lubrication connector on end face



Load directions

Lubrication connectors			Load carrying capacity				
			Basic load ratings[1]		Moment ratings		
A_3	G_3		dyn.	stat.	M_{0x}	M_{0y}	M_{0z}
		[2]	C	C_0			
			N	N	Nm	Nm	Nm
3,6	M3	4	7 200	14 500	332	100	100
5	M5	5	13 100	27 000	687	240	240
			16 200	36 500	920	400	400
10	M6	6	17 900	37 000	1 470	395	395
			23 400	54 000	2 225	825	825
11,25	M6	6	27 500	55 000	2 660	700	700
14,3	M6	6	47 500	100 000	5 550	1 890	1 890





Lubrication connectors[3]

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
High-Speed
HS, E-HS and N-HS carriages

X-life

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions										
	l_{max} 2)	H	B	L	A_1	J_B	b	A_2	L_1	L_s	J_L	J_{LZ}	j_L	a_L, a_R 3)	
							−0,005 −0,03							min.	max.
KUVE25-B-HS	5 880	36	70	98,3	23,5	57	23	6,5	60,7	1,65	45	40	60	20	53
KUVE25-B-E-HS	5 880	33	73	98,3	25	60	23	6,5	60,7	1,65	35	4)	60	20	53
KUVE25-B-N-HS	5 880	31	70	98,3	23,5	57	23	6,5	60,7	1,65	45	40	60	20	53

For further table values, see page 346 and page 347.

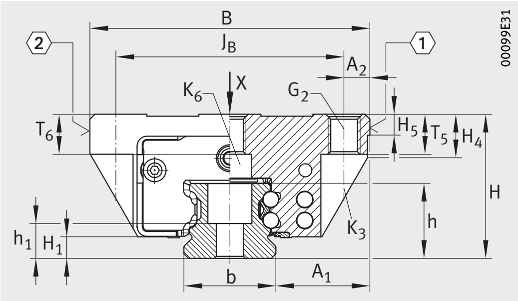
⟨1⟩ Locating face. ⟨2⟩ Marking.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

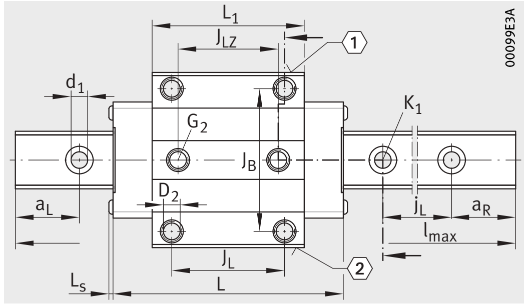
2) Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 309.

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

4) The central holes are not present in the case of KUVE25-B-E-HS. The outer holes do not have the thread G_2.

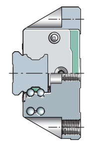


KUVE25-B-HS, KUVE25-B-E-HS, KUVE25-B-N-HS



KUVE25-B-HS, KUVE25-B-E-HS, KUVE25-B-N-HS
View X rotated 90°

							Fixing screws[1]											
H_1	H_4	H_5	T_5	T_6	h	h_1	G_2		K_1		K_3		K_6		K_6		d_1	D_2
							DIN ISO 4762-12.9								DIN 7984-8.8			
								M_A Nm		M_A Nm		M_A Nm		M_A Nm		M_A Nm		
5,1	10,9	5	10	10	18,7	8,7	M8	24	M6	17	M6	17	M6	17	–	–	6,8	6,7
5,1	7,85	5,25	10	[4]	18,7	8,7	[4]	[4]	M6	17	M6	17	[4]	[4]	[4]	[4]	6,8	–
5,1	9,3	5	10	8	18,7	8,7	M8	24	M6	17	M6	17	–	–	M6	8	6,8	6,7



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
High-Speed
HS, E-HS and N-HS carriages

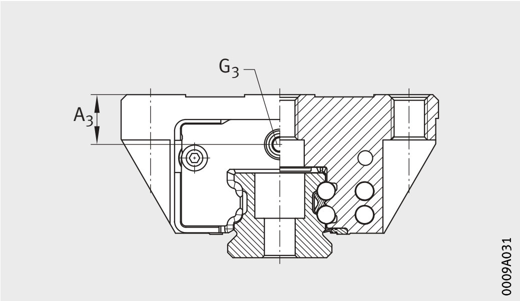
Dimension table (continued) · Dimensions in mm

Designation	Carriage		Guideway		Lubrication connectors		
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	G_3	[2]
KUVE25-B-HS	KWVE25-B-HS	0,71	TKVD25	2,7	11	M6	7
KUVE25-B-E-HS	KWVE25-B-E-HS	0,68	TKVD25	2,7	8	M6	7
KUVE25-B-N-HS	KWVE25-B-N-HS	0,57	TKVD25	2,7	6	M6	7

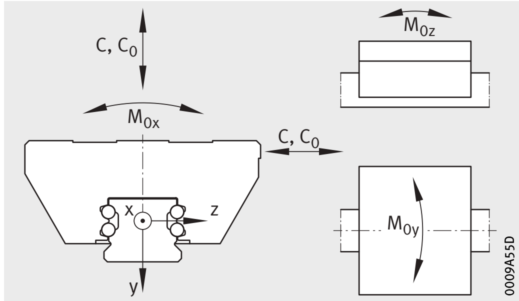
1) Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the whole thread length is used
and the adjacent construction is dimensioned appropriately.

2) Maximum permissible screw depth for lubrication connectors.

3) Lubrication connector S62 is included loose.

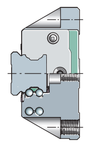


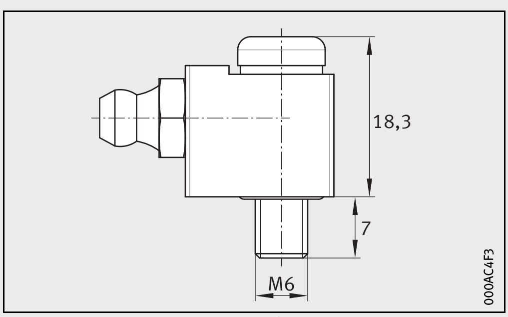
Lubrication connector on end face



Load directions

Load carrying capacity				
Basic load ratings[1)]		Moment ratings		
dyn. C N	stat. C_0 N	M_{0x} Nm	M_{0y} Nm	M_{0z} Nm
15 000	37 000	510	395	395
15 000	37 000	510	395	395
15 000	37 000	510	395	395





Lubrication connector S62[3)]

Four-row linear recirculating ball bearing and guideway assemblies

Full complement
High-Speed
ES-HS, H-HS, S-HS and SN-HS carriages

X-life

Dimension table · Dimensions in mm

Designation	Dimensions				Mounting dimensions					
	l_{max}[2)]	H	B	L	A_1	J_B	b $^{-0,005}_{-0,03}$	A_2	L_1	L_s
KUVE25-B-ES-HS	5 880	33	48	98,3	12,5	35	23	6,5	60,7	1,65
KUVE25-B-H-HS	5 880	40	48	98,3	12,5	35	23	6,5	60,7	1,65
KUVE25-B-S-HS	5 880	36	48	98,3	12,5	35	23	6,5	60,7	1,65
KUVE25-B-SN-HS	5 880	31	48	98,3	12,5	35	23	6,5	60,7	1,65

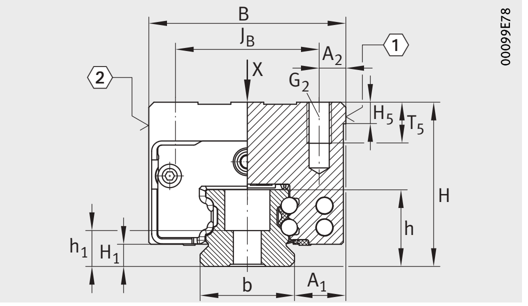
For further table values, see page 350 and page 351.

⟨1⟩ Locating face. ⟨2⟩ Marking.

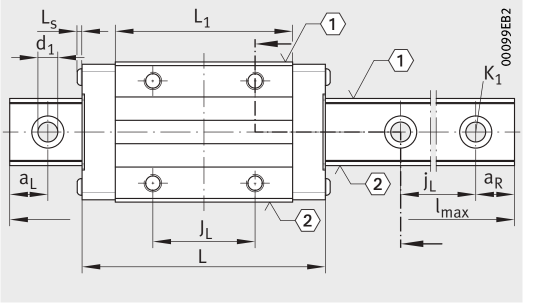
1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

2) Maximum length of single-piece guideways.
Permissible number of guideway segments, see page 309.
Maximum single-piece guideway length of 6 m available by agreement.

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

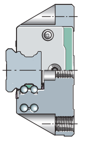


KUVE25-B-ES-HS, KUVE25-B-H-HS, KUVE25-B-S-HS, KUVE25-B-SN-HS



KUVE25-B-ES-HS, KUVE25-B-H-HS, KUVE25-B-S-HS, KUVE25-B-SN-HS
View X rotated 90°

J_L	j_L	a_L, a_R [3]		H_1	H_5	T_5	h	h_1	Fixing screws[1] G_2		K_1		d_1
									DIN ISO 4762-12.9				
		min.	max.							M_A Nm		M_A Nm	
35	60	20	53	5,2	5,25	10	18,7	8,2	M6	17	M6	17	6,8
35	60	20	53	5,1	5	10	18,7	8,7	M6	10	M6	17	6,8
35	60	20	53	5,1	5	10	18,7	8,7	M6	10	M6	17	6,8
35	60	20	53	5,1	5	7,5	18,7	8,7	M6	10	M6	17	6,8



Four-row linear recirculating ball bearing and guideway assemblies

Full complement
High-Speed
ES-HS, H-HS, S-HS and SN-HS carriages

X-life

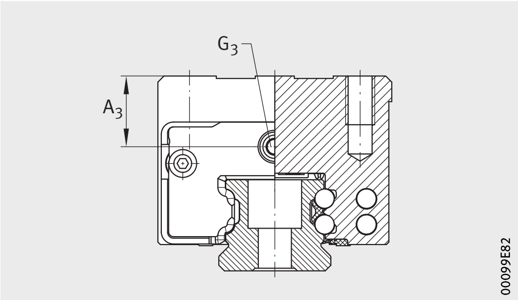
Dimension table (continued) · Dimensions in mm

Designation	Carriage		Guideway		Lubrication connectors		
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg/m	A_3	G_3	[2]
KUVE25-B-ES-HS	KWVE25-B-ES-HS	0,56	TKVD25	2,7	11	M6	7
KUVE25-B-H-HS	KWVE25-B-H-HS	0,65	TKVD25	2,7	15	M6	7
KUVE25-B-S-HS	KWVE25-B-S-HS	0,56	TKVD25	2,7	11	M6	7
KUVE25-B-SN-HS	KWVE25-B-SN-HS	0,45	TKVD25	2,7	6	M6	7

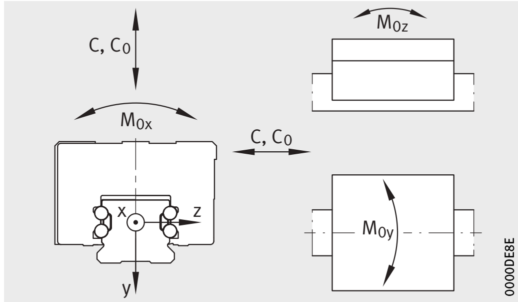
[1] Calculation of basic load ratings in accordance with DIN ISO 14728-1.
Based on practical experience, it may be possible to increase the basic dynamic load rating.
The basic load rating can only be transmitted fully if the whole thread length is used
and the adjacent construction is dimensioned appropriately.

[2] Maximum permissible screw depth for lubrication connectors.

[3] Lubrication connector S62 is included loose.

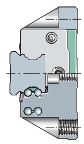


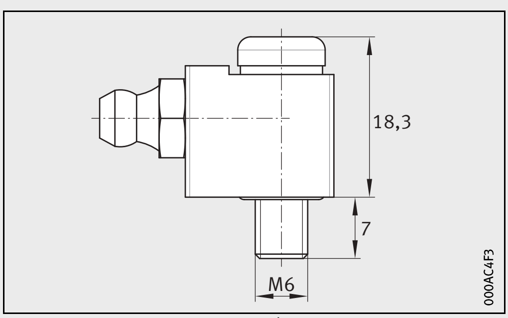
Lubrication connector on end face



Load directions

Load carrying capacity				
Basic load ratings[1)]		Moment ratings		
dyn. C N	stat. C_0 N	M_{0x} Nm	M_{0y} Nm	M_{0z} Nm
15 000	37 000	510	395	395
15 000	37 000	510	395	395
15 000	37 000	510	395	395
15 000	37 000	510	395	395

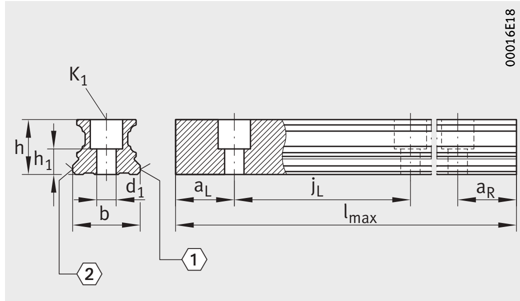




Lubrication connector S62[3)]

Four-row linear recirculating ball bearing and guideway assemblies

Guideways and closing methods for
KUVE..-B
KUVE..-W



TKVD

Dimension table · Dimensions in mm

Designation	For linear guidance system	Mass m ≈ kg/m	Closing plug[1] Plastic one-piece	Closing plug[1] Plastic two-piece[6]	Closing plug[1] Brass one-piece	Closing plug[1] Brass two-piece	Covering strip[2] Adhesive bonded	Covering strip[2] Clip fit Convex	Covering strip[2] Retaining plate
TKVD15-B	KUVE15-B	1,44	KA07-A-TN	KA07-A-TN/A	–	KA07-M/A	–	–	–
TKVD15-B-U			–	–		–			
TKVD15-W	KUVE15-W	3,6	KA08-TN	KA08-TN/A	–	–	–	–	–
TKVD15-W-U			–	–					
TKVD20	KUVE20-B	2,2	KA10-TN	KA10-TN/A	KA10-M	KA10-M/A	–	–	–
TKVD20-U			–	–	–	–			
TKVD20-ADB			–	–	–	–	ADB13	–	HPL.ADB9-B
TKVD20-ADK							–	ADK12	
TKVD20-W	KUVE20-W	5	KA08-TN	KA08-TN/A	–	–	–	–	–
TKVD20-W-U			–	–					

(1) Locating face. (2) Marking.

[1] Closing plugs, see page 401.

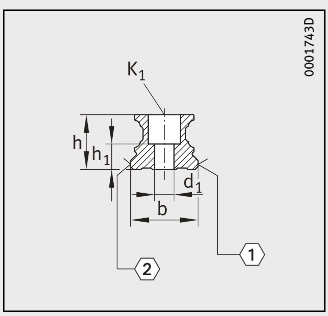
[2] Covering strips, see page 402.

[3] The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

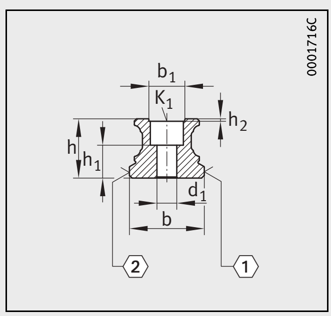
[4] Maximum length of single-piece guideways.
Longer guideways are supplied as several segments and are marked accordingly.
Permissible number of guideway segments, see page 309.

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

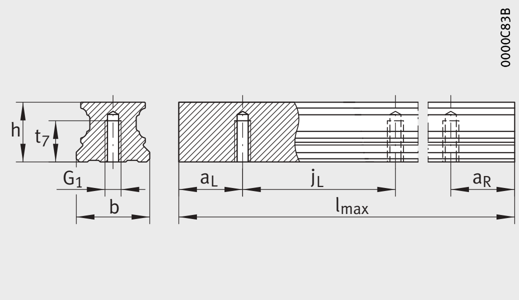
[6] Standard.



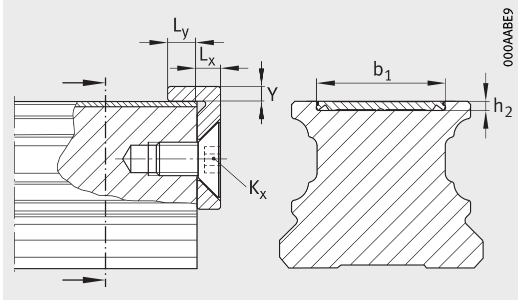
TKVD



TKVD..-ADB

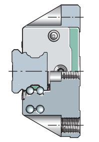


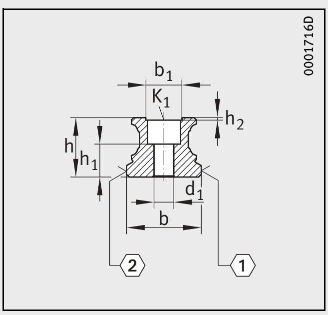
TKVD..-U



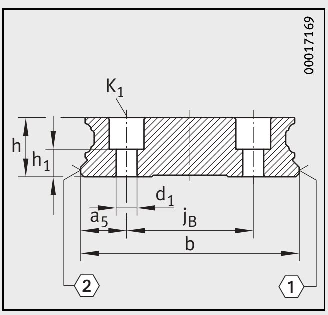
Retaining plate and covering strip

Dimensions																Fixing screws[3)]				
K_x	L_x	L_y	Y	l_{max}[4)]	h	b	a_L, a_R[5)]		j_L	j_B	a_5	h_1	h_2	t_7	b_1	G_1		K_1		d_1
																DIN ISO 4762-12.9				
						$-0{,}005$ $-0{,}035$	min.	max.				$\pm 0{,}5$					M_A Nm		M_A Nm	
–	–	–	–	2 880	15	15	20	53	60	–	–	7,7	–	–	–	–	–	M4	5	4,6
														8		M5	10	–	–	–
–	–	–	–	2 890	12,9	37	10	44	50	22	7,5	6	–	–	–	–	–	M4	5	4,6
														7		M5	10	–	–	–
–	–	–	–	5 880	17	20	20	53	60	–	–	8,6	–	–	–	–	–	M5	10	5,8
														10		M6	17	–	–	–
M5	4	5	2	5 880	17	20	20	53	60	–	–	8,6	0,5	–	13	–	–	M5	10	5,8
													1,1		12,6					
–	–	–	–	2 880	17	42	20	53	60	24	9	10	–	–	–	–	–	M4	5	4,6
														10		M6	17	–	–	–

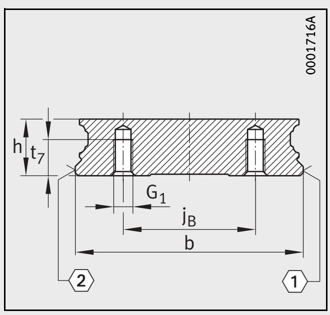




TKVD..-ADK



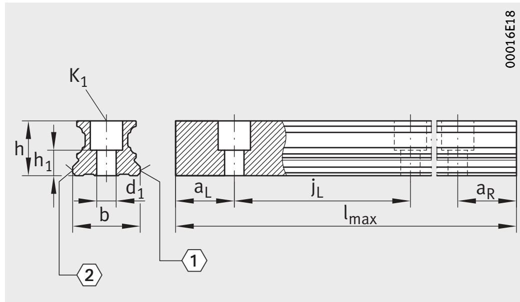
TKVD..-W



TKVD..-W-U

Four-row linear recirculating ball bearing and guideway assemblies

Guideways and closing methods for
KUVE..-B
KUVE..-W



TKVD

Dimension table (continued) · Dimensions in mm

Designation	For linear guidance system	Mass m ≈ kg/m	Closing plug[1] Plastic one-piece	Plastic two-piece[6]	Brass one-piece	Brass two-piece	Covering strip[2] Adhesive bonded	Clip fit Convex	Retaining plate
TKVD25	KUVE25-B	2,7	KA11-TN	KA11-TN/A	KA11-M	KA11-M/A	–	–	–
TKVD25-U			–	–	–	–			
TKVD25-ADB		2,7	–	–	–	–	ADB13	–	HPL.ADB9-B
TKVD25-ADK							–	ADK12	
TKVD25-W	KUVE25-W	9,4	KA11-TN	KA11-TN/A	–	–	–	–	–
TKVD25-W-U			–	–					

⟨1⟩ Locating face. ⟨2⟩ Marking.

1) Closing plugs, see page 401.

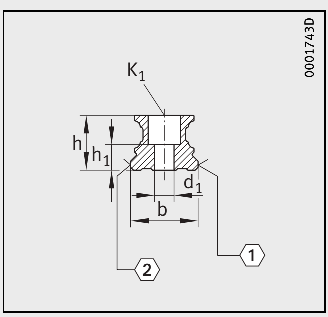
2) Covering strips, see page 402.

3) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

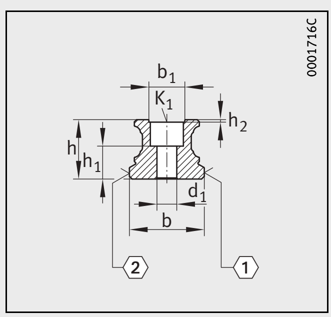
4) Maximum length of single-piece guideways.
Longer guideways are supplied as several segments and are marked accordingly.
Permissible number of guideway segments, see page 309.

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

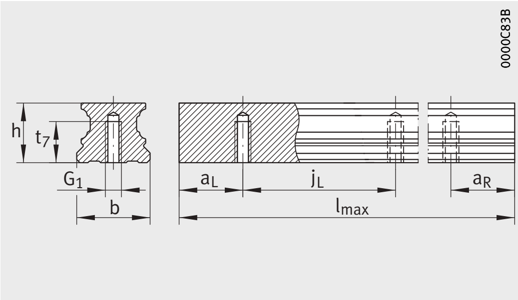
6) Standard.



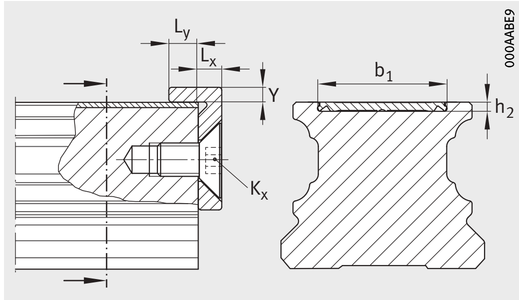
TKVD



TKVD..-ADB

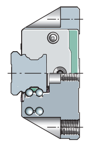


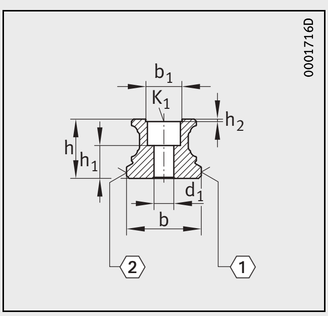
TKVD..-U



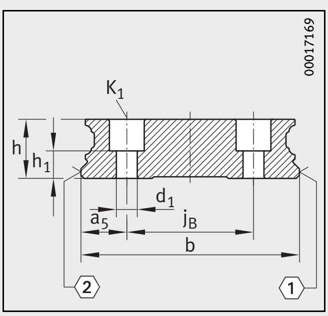
Retaining plate and covering strip

Dimensions																Fixing screws[3)]				
K_x	L_x	L_y	Y	l_{max}[4)]	h	b	a_L, a_R[5)]		j_L	j_B	a_5	h_1	h_2	t_7	b_1	G_1		K_1		d_1
																DIN ISO 4762-12.9				
																	M_A		M_A	
						−0,005 −0,035	min.	max.				±0,5					Nm		Nm	
–	–	–	–	5 880	18,7	23	20	53	60	–	–	8,2	–	–	–	–	–	M6	17	6,8
														12		M6	17	–	–	–
M5	4	5	2	5 880	18,7	23	20	53	60	–	–	8,2	0,5	–	13	–	–	M6	17	6,8
													1,1		12,6					
–	–	–	–	5 860	18,7	69	20	71	80	40	14,5	8,2	–	–	–	–	–	M6	17	6,8
														12		M6	17	–	–	–

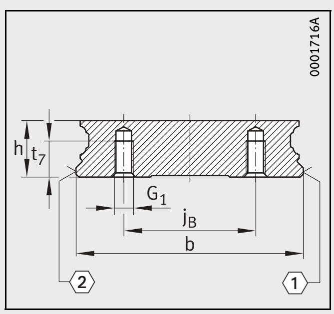




TKVD..-ADK



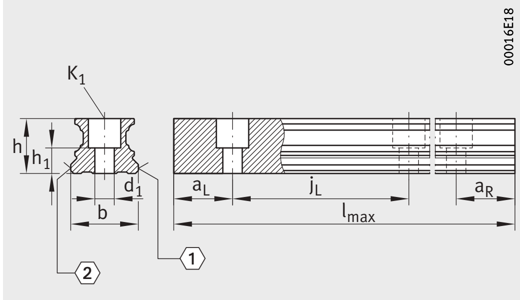
TKVD..-W



TKVD..-W-U

Four-row linear recirculating ball bearing and guideway assemblies

Guideways and closing methods for
KUVE..-B
KUVE..-W



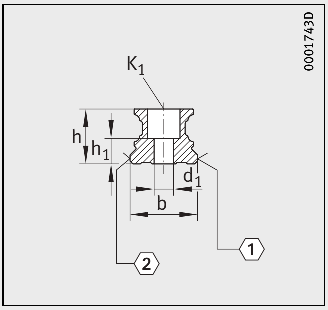
TKVD

Dimension table (continued) · Dimensions in mm

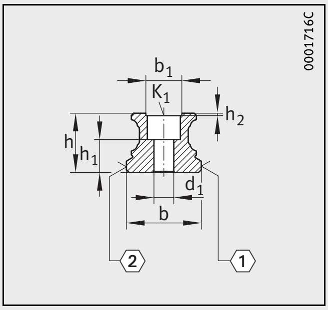
Designation	For linear guidance system	Mass	Closing plug[1]				Covering strip[2]		
		m	Plastic		Brass		Adhesive bonded	Clip fit Convex	Retaining plate
		≈ kg/m	one-piece	two-piece[6]	one-piece	two-piece			
TKVD30	KUVE30-B	4,3	KA15-TN	KA15-TN/A	KA15-M	KA15-M/A	–	–	–
TKVD30-U			–	–	–	–			
TKVD30-ADB		4,3	–	–	–	–	ADB18	–	HPL.ADB17-B
TKVD30-ADK							–	ADK16	
TKVD30-W	KUVE30-W	13,6	KA15TN	KA15TN/A	–	–	–	–	–
TKVD30-W-U			–	–					

⟨1⟩ Locating face. ⟨2⟩ Marking.

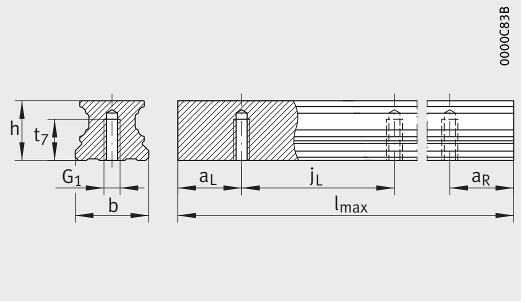
1) Closing plugs, see page 401.
2) Covering strips, see page 402.
3) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.
4) Maximum length of single-piece guideways. Longer guideways are supplied as several segments and are marked accordingly. Permissible number of guideway segments, see page 309.
5) a_L and a_R are dependent on the guideway length.
6) Standard.



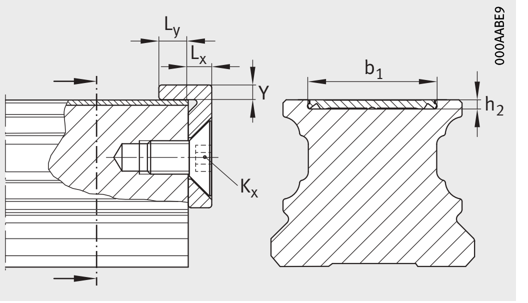
TKVD



TKVD..-ADB

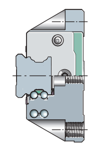


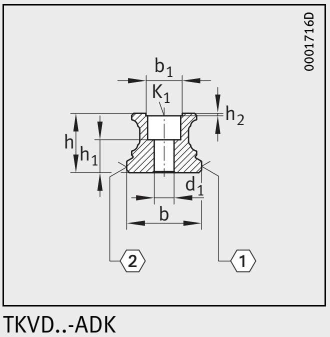
TKVD..-U



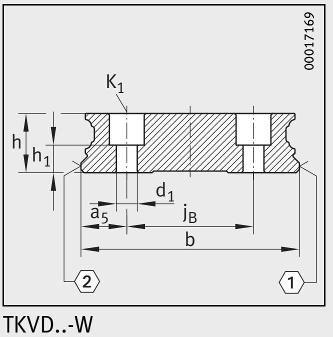
Retaining plate and covering strip

Dimensions																Fixing screws[3)]				
K_x	L_x	L_y	Y	l_{max}[4)]	h	b	a_L, a_R[5)]		j_L	j_B	a_5	h_1	h_2	t_7	b_1	G_1		K_1		d_1
																DIN ISO 4762-12.9				
																	M_A		M_A	
						−0,005 −0,035	min.	min.				±0,5					Nm		Nm	
–	–	–	–	5 860	23,5	28	20	71	80	–	–	11	–	–	–	–	–	M8	41	9
														15		M8	41	–	–	–
M6	4	5	3	5 860	23,5	28	20	71	80	–	–	11	0,5	–	18	–	–	M8	41	9
													1,1		16,6					
–	–	–	–	5 860	23,5	80	20	71	80	50	15	11	–	–	–	–	–	M8	41	9
														15		M8	41	–	–	–

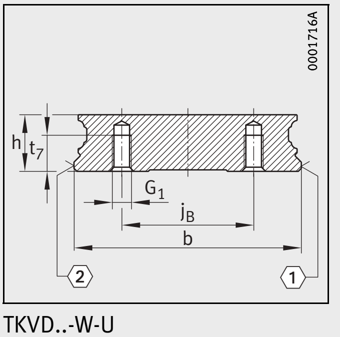




TKVD..-ADK



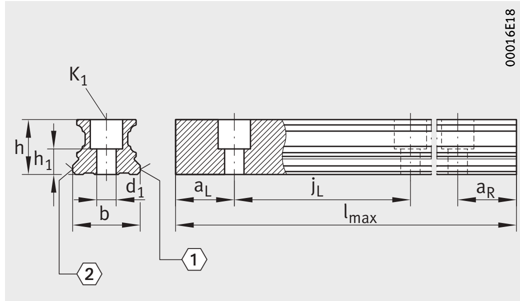
TKVD..-W



TKVD..-W-U

Four-row linear recirculating ball bearing and guideway assemblies

Guideways and closing methods for
KUVE..-B
KUVE..-W



TKVD

Dimension table (continued) · Dimensions in mm									
Designation	For linear guidance system	Mass	Closing plug[1]				Covering strip[2]		
		m	Plastic		Brass		Adhesive bonded	Clip fit Convex	Retaining plate
		≈ kg/m	one-piece	two-piece[6]	one-piece	two-piece			
TKVD35	KUVE35-B	5,7	KA15-TN	KA15-TN/A	KA15-M	KA15-M/A	–	–	–
TKVD35-U			–	–	–	–			
TKVD35-ADB		5,7	–	–	–	–	ADB18	–	HPL.ADB17-B
TKVD35-ADK							–	ADK16	
TKVD35-W	KUVE35-W	17,4	KA15-TN	KA15-TN/A	–	–	–	–	–
TKVD35-W-U			–	–					

⟨1⟩ Locating face. ⟨2⟩ Marking.

1) Closing plugs, see page 401.

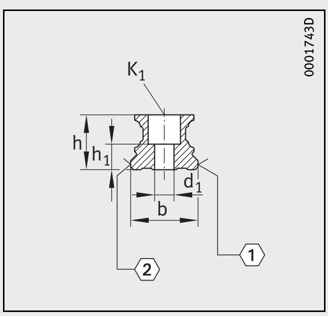
2) Covering strips, see page 402.

3) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

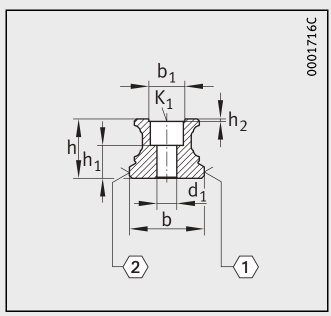
4) Maximum length of single-piece guideways.
Longer guideways are supplied as several segments and are marked accordingly.
Permissible number of guideway segments, see page 309.

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

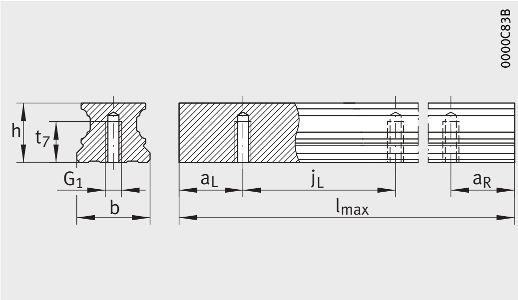
6) Standard.



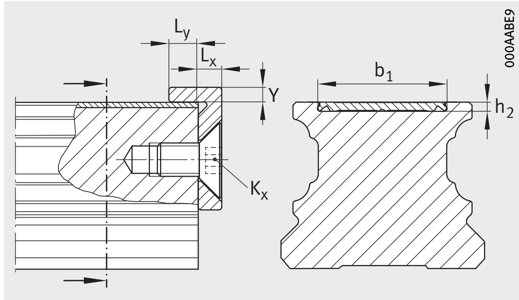
TKVD



TKVD..-ADB

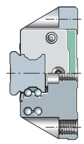


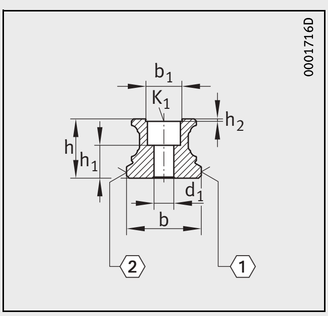
TKVD..-U



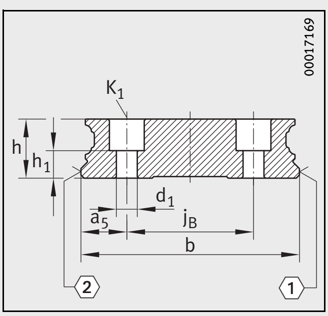
Retaining plate and covering strip

Dimensions																Fixing screws[3)]				
K_x	L_x	L_y	Y	l_{max}[4)]	h	b	a_L, a_R[5)]		j_L	j_B	a_5	h_1	h_2	t_7	b_1	G_1		K_1		d_1
																DIN ISO 4762-12.9				
						−0,005 −0,035	min.	max.				±0,5					M_A Nm		M_A Nm	
–	–	–	–	5 860	27	34	20	71	80	–	–	14,5	–	–	–	–	–	M8	41	9
														15		M8	41	–	–	–
M6	4	5	3	5 860	27	34	20	71	80	–	–	14,5	0,5	–	18	–	–	M8	41	9
													1,1		16,6	M5	10			
–	–	–	–	5 860	27	90	20	71	80	60	15	14,5	–	–	–	–	–	M8	41	9
														15		M8	41	–	–	–

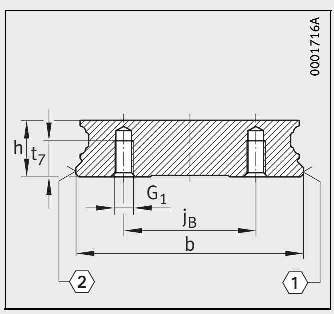




TKVD..-ADK



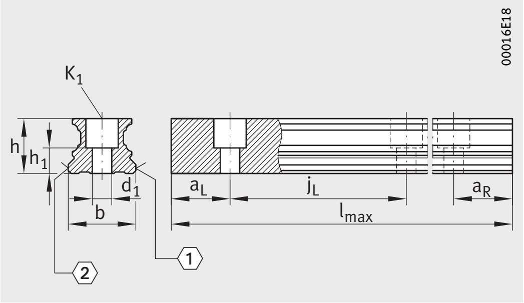
TKVD..-W



TKVD..-W-U

Four-row linear recirculating ball bearing and guideway assemblies

Guideways and closing methods for KUVE..-B



TKVD

Dimension table (continued) · Dimensions in mm

Designation	For linear guidance system	Mass m ≈ kg/m	Closing plug[1] Plastic one-piece	Closing plug[1] Plastic two-piece[6]	Closing plug[1] Brass one-piece	Closing plug[1] Brass two-piece	Covering strip[2] Adhesive bonded	Covering strip[2] Clip fit Convex	Covering strip[2] Retaining plate
TKVD45	KUVE45-B	9,2	KA20-TN	KA20-TN/A	KA20-M	KA20-M/A	–	–	–
TKVD45-U			–	–	–	–			
TKVD45-ADB		9,2	–	–	–	–	ADB23	–	HPL.ADB17-B
TKVD45-ADK							–	ADK21	
TKVD55-B	KUVE55-B	14	KA24-TN	KA24-TN/A	KA24-M	KA24-M/A	–	–	–
TKVD55-B-U			–	–	–	–			
TKVD55-ADB		14	–	–	–	–	ADB27	–	HPL.ADB17-B
TKVD55-ADK							–	ADK25	

1 Locating face. 2 Marking.

1) Closing plugs, see page 401.

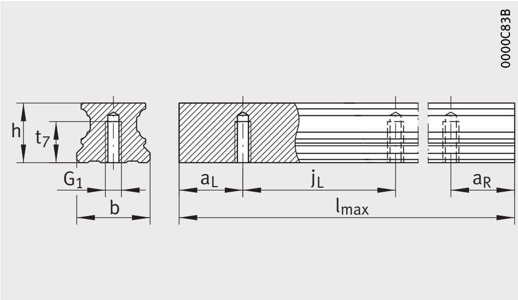
2) Covering strips, see page 402.

3) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

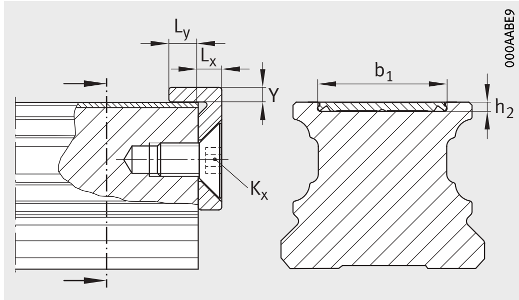
4) Maximum length of single-piece guideways. Longer guideways are supplied as several segments and are marked accordingly. Permissible number of guideway segments, see page 309.

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

6) Standard.

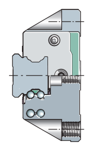


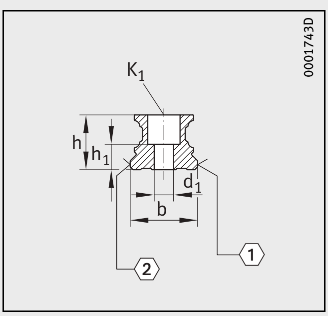
TKVD..-U



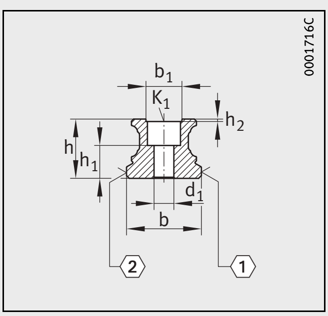
Retaining plate and covering strip

Dimensions																Fixing screws[3)]				
K_x	L_x	L_y	Y	l_{max}[4)]	h	b	a_L, a_R[5)]		j_L	j_B	a_5	h_1	h_2	t_7	b_1	G_1		K_1		d_1
																DIN ISO 4762-12.9				
						−0,005 −0,035	min.	max.				±0,5					M_A Nm		M_A Nm	
–	–	–	–	5 835	34,2	45	20	94	105	–	–	15,7	–	–	–	–	–	M12	140	13,4
														20		M12	140	–	–	–
M5	4	5	2	5 835	34,2	45	20	94	105	–	–	15,7	0,5	–	23	–	–	M12	140	13,4
													1,1		21,7					
–	–	–	–	5 820	41,5	53	20	107	120	–	–	19	–	–	–	–	–	M14	220	15,4
														22		M14	220	–	–	–
M5	4	5	2	5 820	41,5	53	20	107	120	–	–	19	0,5	–	27	–	–	M14	220	15,4
													1,1		25,7					

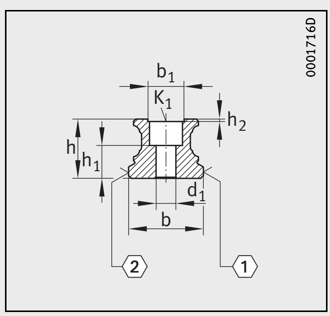




TKVD



TKVD..-ADB



TKVD..-ADK

Sealing and lubrication elements – system KIT

Sealing and lubrication elements

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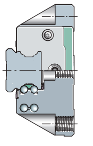
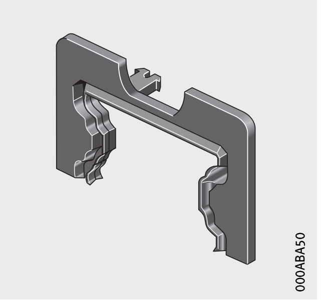


Sealing elements – system KIT

End wiper – example KIT

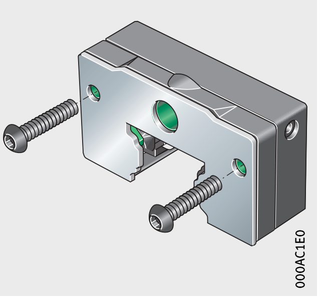
KIT



Lubrication elements – system KIT

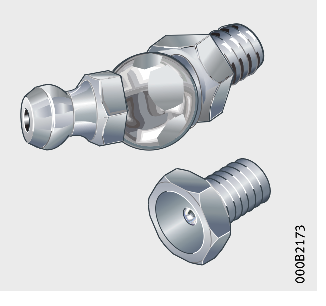
Long term lubrication unit – example KIT

KIT



Lubrication connectors

S



Sealing and lubrication elements – system KIT

With their extensive range of standard accessories, the linear 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

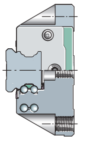
If the standard components are not adequate for reliable operation and a long operating life, it is possible to draw on a finely graduated system of sealing and lubrication elements. These special accessories protect the rolling element system of the guidance systems against contamination and ensure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

KIT structure

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:

- Possible combinations, see page 382 and page 392
- Description of sealing elements, see page 366
- Overview of sealing elements, see page 374 and page 388
- Description of lubrication elements, see page 370
- Overview of lubrication elements, see page 382 and page 392.



Only a proportion of the KITs can be 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

The degree of contamination will vary depending on the market sector, the application and the environmental conditions.

The definitions at this point, see table, are therefore only an initial aid in the selection of KITs.

Definition of the degree of contamination

Degree of contamination			
Very slight	Slight	Moderate	Heavy[1]
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

[1] If this degree of contamination is present, a KIT can give only a restricted level of protection. Additional measures implemented by the customer, such as additional covers on the guidance system, will give a considerable increase in the operating life.

Sealing and lubrication elements

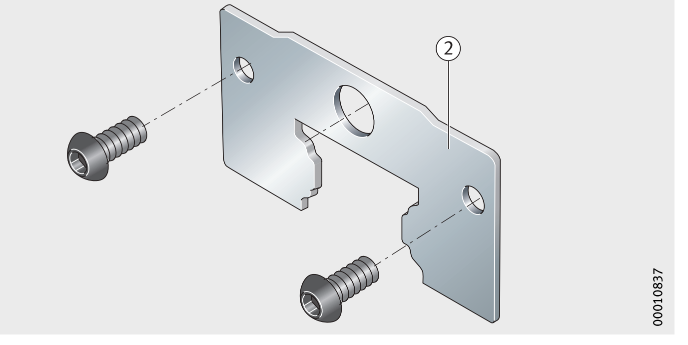
Sealing elements

Additional sealing elements are available both for open upper lubrication holes as well as for close upper lubrication holes:

- End plates, see page 366
- End wipers, see page 367
- Additional wipers, see page 368
- Sealing strips, see page 369.

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 seal.



2 End plate, non-contact

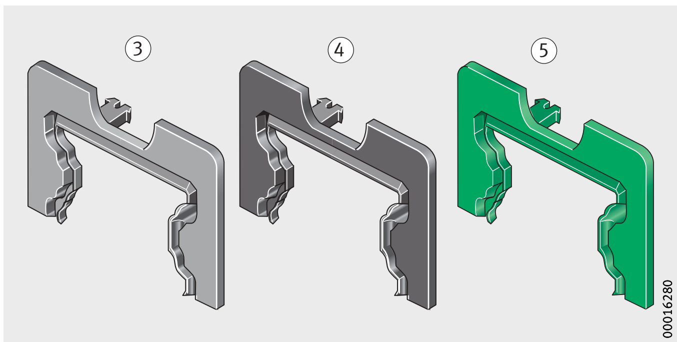
Figure 1
End plate
KIT.KWVE..-210

End wipers

End wipers are contact seals that are fixed to the end faces of the carriages. End wipers protect the guidance system against the ingress of contaminant particles and can extend the relubrication intervals. The selection of the suitable sealing system is based on the application of the guidance system. End wipers are available as a gap seal (grey), single lip smooth-running end wiper (green) and a single lip end wiper (black) with increased sealing action, *Figure 2*.

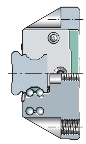
Single lip end wipers (green, black) have a seal lip oriented outwards that protects the carriage against the ingress of contaminant particles. In combination with oil lubrication, the single lip end wiper facilitates the rinsing out of contaminant particles (flushing effect).

Gap seals are non-contact seals. They have a small gap around the contour of the guideway. There is no increase in displacement force. The gap seal should only be used in a clean environment.



③ Gap seal, grey
④ End wiper, single lip, black
⑤ Standard: Smooth-running end wiper, single lip, green

Figure 2
End wipers
Example
KIT.KWVE..-110, -100,
KIT.KWVE..-220 (with end plate)



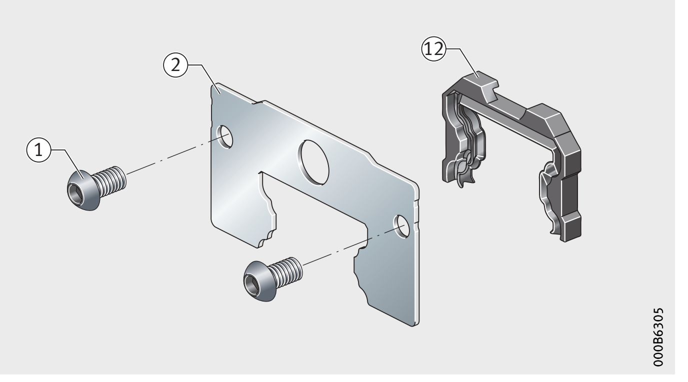
Sealing and lubrication elements

High-Speed

Linear recirculating ball bearing and guideway assemblies of the series High-Speed are only available in a standard KIT combination (120/900/120). It is not necessary to indicate this when ordering.

① Fixing screws
② End plate, non-contact
⑫ End wiper, double lip (black)

Figure 3
End wiper KIT.KWVE25B-120



Since the series High-Speed has an optimised end piece, KIT.KWVE25-B-120 can only be used for this version.
Other KIT combinations are not available.

Additional wipers

Additional wipers with squeeze plate

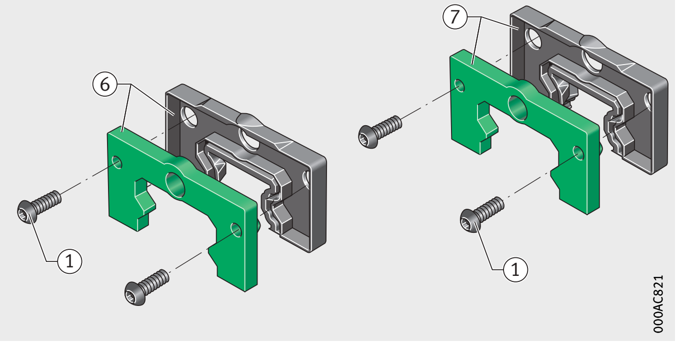
In addition to the standard seal, other additional wipers may be used behind each other (cascading arrangement). These are screw mounted with a squeeze plate in front of the first wiper on the carriage, *Figure 4*.

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

Double lip additional wipers with a squeeze plate have one seal lip oriented outwards and one seal lip oriented inwards. The seal lip oriented inwards prevents the escape of lubricant from the carriage, which means that an increase in the relubrication interval can be achieved. Double lip end wipers are recommended for use with grease lubrication (reservoir lubrication).

① Fixing screw
⑥ Additional wiper, single lip, with squeeze plate
⑦ Additional wiper, double lip, with squeeze plate

Figure 4
Additional wipers
Example
KIT.KWVE..-300, -370



Additional wipers

Additional wipers for heavy contamination, such as dust or liquids, are used in combination with further wipers.

Additional wipers are of a single lip design and are made from FPM, *Figure 5*.

① Fixing screw
⑨ Additional wiper, single lip

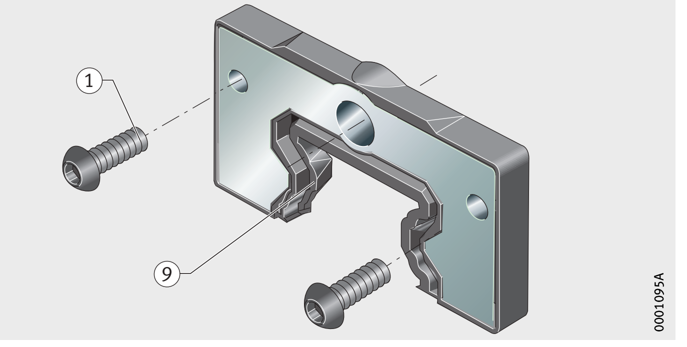
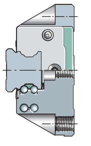


Figure 5
Additional wiper
Example
KIT.KWVE..-320



Sealing strips

Sealing strips are contact components that are fitted to the upper and lower longitudinal sides of the carriage, *Figure 6*. They protect the rolling element system against contamination and loss of lubricant.

Single lip

Linear recirculating ball bearing and guideway assemblies are available with a single lip upper sealing strip as well as a single lip lower sealing strip.

!

Upper sealing strips should be used in addition to end wipers and lower sealing strips 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 6
Sealing strips
KIT.KWVE..-900, -910

Lubrication elements

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

Long term lubrication unit KIT series 400

For linear recirculating ball bearing and guideway assemblies KUVE, KITs with a long term lubrication unit are available.

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. This can be achieved using the long term lubrication unit, *Figure 7*, page 371.

Grease operating life and relubrication interval

If guidance systems cannot be relubricated, the grease operating life becomes the decisive factor, see page 50. This indicates the length of time for which a grease can be used without its function being impaired.

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 of KIT series 400 is also fitted, this gives an additional improvement in the lubricant balance, *Figure 7*, page 371. 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, it is possible to achieve long relubrication intervals or even complete freedom from maintenance.

The operating life of four-row linear recirculating ball bearing and guideway assemblies KUVE..-B with and without a long term lubrication unit is shown in *Figure 8*, page 371.

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.

1 Fixing screws
7 Additional wiper, double lip, with squeeze plate
9 Long term lubrication unit

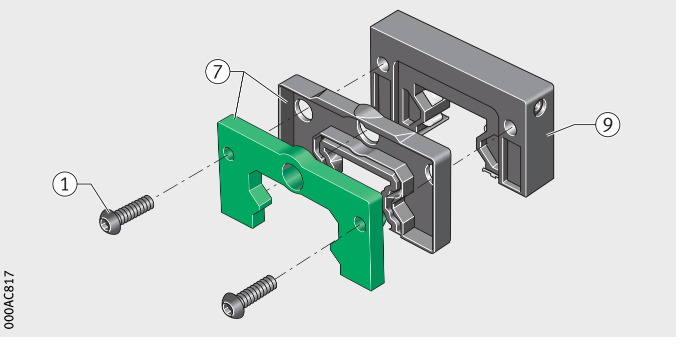
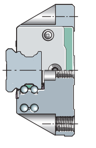


Figure 7
Long term lubrication unit



With initial greasing

Due to their initial greasing, long term lubrication units are ready for immediate operation. If they are ordered together with a KUVE, both the linear recirculating ball bearing and guideway assembly KUVE and the long term lubrication unit have an initial greasing.

!

If the long term lubrication unit is retrofitted, it is absolutely essential that the carriage is given an initial greasing.
Initial grease quantities, see page 47.

The long term lubrication unit must always be used on both sides of the carriage, in order to achieve the stated bearing factor K_{LF} and thus the maximum operating life.

Double lip end seal

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

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

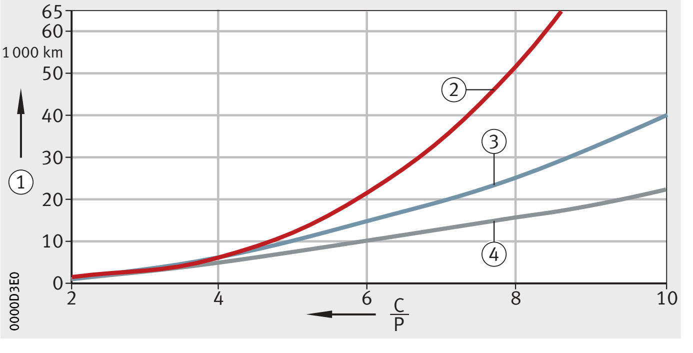


Figure 8
Operating life with and without long term lubrication unit

!

Long term lubrication units should not be used with Corrotect-coated guideways.

Configuration of KIT.KWVE

Unless indicated otherwise, the locating edge is defined as being at the top. The KIT designation is given in the sequence left/centre/right. If no KIT numbers are indicated, the standard version will be supplied, see tables Sealing and lubrication elements KIT for KUVE...-B, page 374, and for KUVE..-W, page 388.

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

KWVE..-100/900/200

1 Locating face
2 KIT.KWVE..-B-100
3 KIT.KWVE..-B-900
4 KIT.KWVE..-B-200

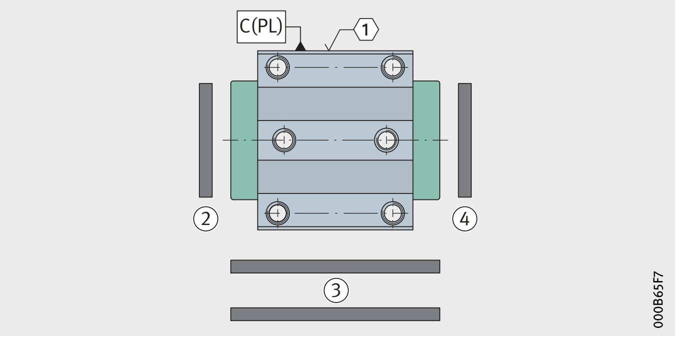


Figure 9
Example of KIT configuration

Retrofitting by the customer

The KITs available for retrofitting by the customer are indicated accordingly as retrofittable in the KIT tables, see page 374 and page 388.

KIT left, right

The KIT components are identical for all carriage designs.

KIT components for retrofitting by the customer of the linear recirculating ball bearing and guideway assembly KUVE-..B must be ordered for all types and designs using the designation KIT.KWVE..-B.

KIT components for retrofitting by the customer of the linear recirculating ball bearing and guideway assembly KUVE-..W must be ordered for all types and designs using the designation KIT.KWVE..-W.

The scope of delivery includes the wear components and fixing screws required for retrofitting.

Example: **KIT.KWVE20-B-330**.

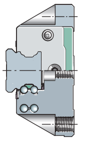
KIT centre

If retrofitting is to be carried out by the customer, attention must be paid to the carriage length.

KIT components for retrofitting by the customer of long carriages must be ordered using the designation KIT.KWVE..-B-L-900.

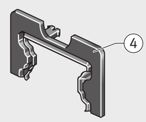
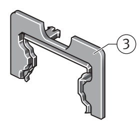
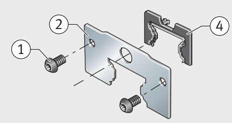
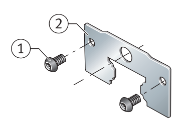
KIT components for retrofitting by the customer of short carriages must be ordered using the designation KIT.KWVE..-B-C-900.

Example: **KIT.KWVE20-B-L-900**.



Sealing and lubrication elements

Sealing and lubrication elements KIT (left, right) for KUVE..-B

Designation and KIT end number KIT.KWVE..-B	Image	Description
000	–	No KIT at corresponding position.
100		4 End wiper contact type, single lip
110		3 Gap seal
200		1 Fixing screw K_1 2 Sheet metal wiper non-contact 4 End wiper contact type, single lip
210		1 Fixing screw K_1 2 Sheet metal wiper non-contact

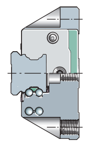
1 Locating face

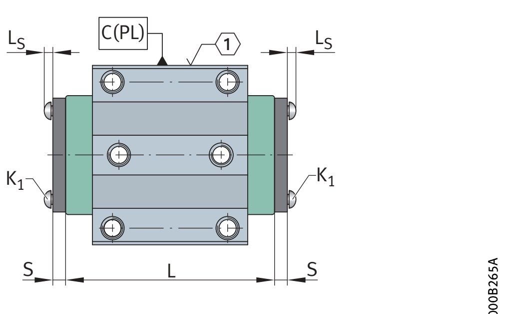
Attention!
The table is only intended as a guide.
Specific application conditions must be taken into consideration when selecting the elements.

The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations, see page 382.
Recommended lubrication connectors, see page 384.

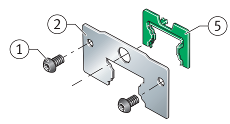
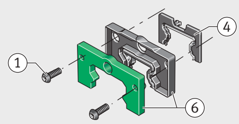
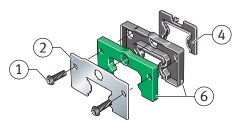
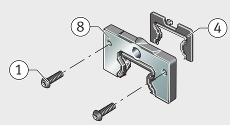
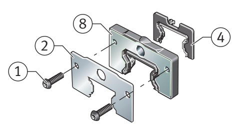
[1] Definition, see page 365.

Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_1	L_S mm	S mm	None	Slight	Moder-ate	Heavy	KIT.KWVE..-B
			15									**000**
			20									
			25									
■	–	–	30	■	–	–	–0,8	■	–	–	–	
			35									
			45									
			55									
			15									**100**
			20									
			25									
■	■	–	30	■	–	–	–0,8	–	–	■	–	
			35									
			45									
			55									
			15									**110**
			20									
			25									
■	–	–	–	■	–	–	–0,8	■	–	–	–	
			–									
			–									
			–									
			15		M2×4	1,3						**200**
			20		M2×4	1,3						
			25		M3×5	1,65						
■	■	–	30	■	M3×5	1,65	0	–	–	■	–	
			35		M3×5	1,65						
			45		M4×6	2,2						
			55		M4×6	2,2						
			15		M2×4	1,3						**210**
			20		M2×4	1,3						
			25		M3×5	1,65						
■	–	–	30	■	M3×5	1,65	0	■	–	–	–	
			35		M3×5	1,65						
			45		M4×6	2,2						
			55		M4×6	2,2						





Sealing and lubrication elements KIT (left, right) for KUVE..-B (continued)

Designation and KIT end number KIT.KWVE..-B	Image	Description
220[2]		① Fixing screw K_1 ② Sheet metal wiper, non-contact ⑤ Smooth-running end wiper contact type, single lip
300		① Fixing screw K_1 ④ End wiper, contact type, single lip ⑥ Additional wiper, single lip (PU), with squeeze plate
310		① Fixing screw K_1 ② Sheet metal wiper, non-contact ④ End wiper, contact type, single lip ⑥ Additional wiper, single lip (PU), with squeeze plate
320		① Fixing screw K_1 ④ End wiper, contact type, single lip ⑧ Additional wiper, single lip (FPM)
330		① Fixing screw K_1 ② Sheet metal wiper, non-contact ④ End wiper, contact type, single lip ⑧ Additional wiper, single lip (FPM)

1 Locating face

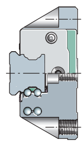
Attention!
The table is only intended as a guide.
Specific application conditions must be taken into consideration when selecting the elements.

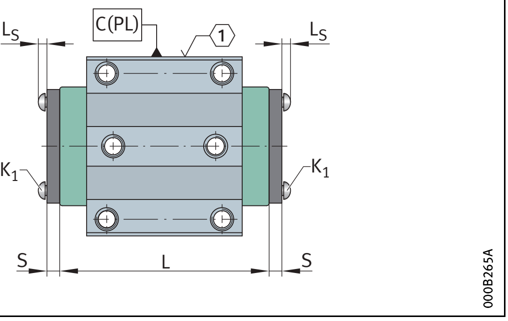
The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations, see page 382.
Recommended lubrication connectors, see page 384.

1) Definition, see page 365.

2) Standard for KUVE..-B.

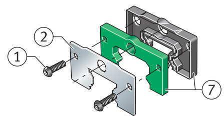
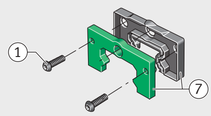
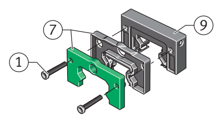
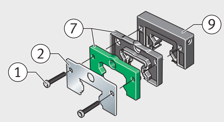
Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_1	L_S	S	None	Slight	Moder-ate	Heavy	
						mm	mm					KIT.KWVE..-B
			15		M2×4	1,3						**220**[2]
			20		M2×4	1,3						
			25		M3×5	1,65						
■	–	–	30	■	M3×5	1,65	0	–	■	–	–	
			35		M3×5	1,65						
			45		M4×6	2,2						
			55		M4×6	2,2						
			15		M2×8	1,3						**300**
			20		M2×8	1,3						
			25		M3×8	1,65						
■	■	■	30	■	M3×8	1,65	4,2	–	–	–	■	
			35		M3×8	1,65						
			45		M4×10	2,2						
			55		M4×10	2,2						
			15		M2×9	1,3						**310**
			20		M2×9	1,3						
			25		M3×10	1,65						
■	■	■	30	■	M3×10	1,65	5,0	–	–	–	■	
			35		M3×10	1,65						
			45		M4×10	2,2						
			55		M4×10	2,2						
			–		–	–	–					**320**
			20		M2×8	1,3						
			25		M3×8	1,65						
■	■	■	30	■	M3×8	1,65	3,7	–	–	–	■	
			35		M3×8	1,65						
			45		M4×10	2,2						
			–		–	–	–					
			–		–	–	–					**330**
			20		M2×8	1,3						
			25		M3×8	1,65						
■	■	■	30	■	M3×8	1,65	4,5	–	–	–	■	
			35		M3×8	1,65						
			45		M4×10	2,2						
			–		–	–	–					





Sealing and lubrication elements

Sealing and lubrication elements KIT (left, right) for KUVE..-B (continued)

Designation and KIT end number KIT.KWVE..-B	Image	Description
360		① Fixing screw K_1 ② Sheet metal wiper, non-contact ⑦ Additional wiper, double lip (PU), with squeeze plate
370		① Fixing screw K_1 ⑦ Additional wiper, double lip (PU), with squeeze plate
400		① Fixing screw K_1 ⑦ Additional wiper, double lip (PU), with squeeze plate ⑨ Long term lubrication unit
430		① Fixing screw K_1 ② Sheet metal wiper, non-contact ⑦ Additional wiper, double lip (PU), with squeeze plate ⑨ Long term lubrication unit

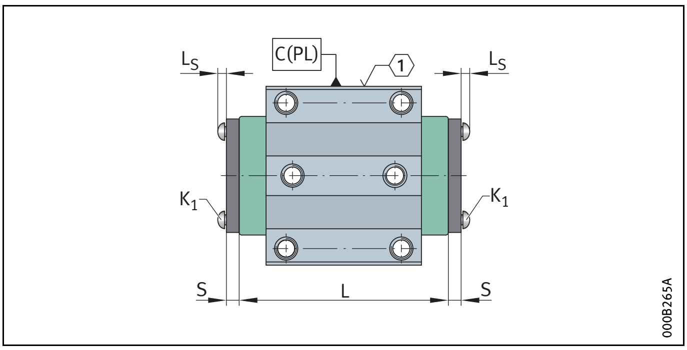
⟨1⟩ Locating face

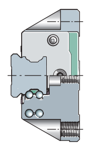
Attention!
The table is only intended as a guide.
Specific application conditions must be taken into consideration when selecting the elements.

The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations, see page 382.
Recommended lubrication connectors, see page 384.

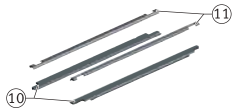
[1] Definition, see page 365.

Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_1	L_S mm	S mm	None	Slight	Moder-ate	Heavy	KIT.KWVE..-B
			15		M2×9	1,3						**360**
			20		M2×9	1,3						
			25		M3×10	1,65						
■	■	■	30	■	M3×10	1,65	5	–	–	–	■	
			35		M3×10	1,65						
			45		M4×10	2,2						
			55		M4×10	2,2						
			15		M2×8	1,3						**370**
			20		M2×8	1,3						
			25		M3×8	1,65						
■	■	–	30	■	M3×8	1,65	4,2	–	–	–	■	
			35		M3×8	1,65						
			45		M4×10	2,2						
			55		M4×10	2,2						
			15		M2×17	1,3	14,1					**400**
			20		M2×17	1,3	13,2					
			25		M3×18	1,65	13,2					
■	■	–	30	■	M3×18	1,65	13,2	–	–	–	■	
			35		M3×18	1,65	13,2					
			45		M4×20	2,2	14,7					
			–		–	–	–					
			15		M2×18	1,3	14,9					**430**
			20		M2×18	1,3	14					
			25		M3×19	1,65	14					
■	■	■	30	■	M3×19	1,65	14	–	–	–	■	
			35		M3×19	1,65	14					
			45		M4×22	2,2	15,5					
			–		–	–	–					





Sealing and lubrication element KIT (centre) for KUVE..-B

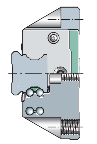
Designation and KIT end number KIT.KWVE..-B[2]	Image	Description
000	–	No KIT at corresponding position.
900[3]		⑩ Lower sealing strip, single lip
910		⑩ Lower sealing strip, single lip ⑪ Upper sealing strip, single lip

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

The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations, see page 382.
Recommended lubrication connectors, see page 384.

1) Definition, see page 365.
2) If retrofitting is to be carried out by the customer, attention must be paid to the carriage length. See Retrofitting by the customer, page 372.
3) Standard for KUVE..-B.

Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_1	L_S mm	S mm	None	Slight	Moder-ate	Heavy	KIT.KWVE..-B
			15									**000**
			20									
			25									
■	–	–	30	■	–	–	–	■	–	–	–	
			35									
			45									
			55									
			15									**900**[3]
			20									
			25									
■	■	–	30	■	–	–	–	–	■	–	–	
			35									
			45									
			55									
			15									**910**
			20									
			25									
■	■	■	30	–	–	–	–	–	–	■	–	
			35									
			45									
			55									



Sealing and lubrication elements

Possible combinations – KIT allocation (left) to KIT right														
Designation and KIT end numbers KIT.KWVE..-B	000	100	110	200	210	220	300	310	320	330	360	370	400	430
000	●	–	●	–	●	–	–	–	–	–	–	–	–	–
100	–	●	–	●	–	●	●	●	●	●	●	●	–	–
110	●	–	●	–	●	–	–	–	–	–	–	–	–	–
200	–	●	–	●	–	●	●	●	●	●	●	●	–	–
210	●	–	●	–	●	–	–	–	–	–	–	–	–	–
220	–	●	–	●	–	●	●	●	●	●	●	●	–	–
300	–	●	–	●	–	●	●	●	–	–	–	–	–	–
310	–	●	–	●	–	●	●	●	–	–	–	–	–	–
320	–	●	–	●	–	●	–	–	●	●	–	–	–	–
330	–	●	–	●	–	●	–	–	●	●	–	–	–	–
360	–	●	–	●	–	●	–	–	–	–	●	●	–	–
370	–	●	–	●	–	●	–	–	–	–	●	●	–	–
400	–	–	–	–	–	–	–	–	–	–	–	–	●	●
430	–	–	–	–	–	–	–	–	–	–	–	–	●	●

● Possible combination.

Possible combinations – KIT allocation (left or right) to KIT centre														
Designation and KIT end numbers KIT.KWVE..-B	000	100	110	200	210	220	300	310	320	330	360	370	400	430
000	●	–	●	–	●	–	–	–	–	–	–	–	–	–
900	–	●	–	●	–	●	●	●	●	●	●	●	●	●
910	–	●	–	●	–	●	●	●	●	●	●	●	●	●

● Possible combination.

1 Locating face top
or
3 Locating face bottom
4 Left
5 Centre
6 Right

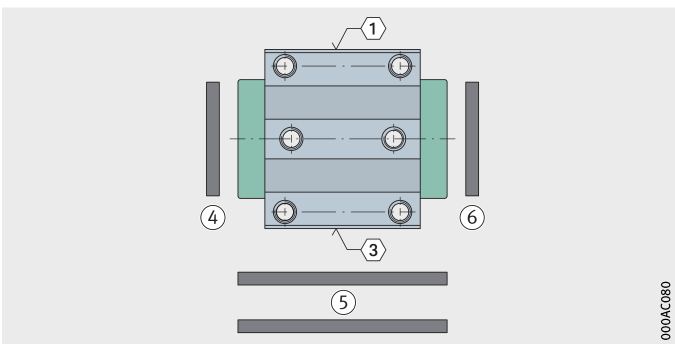
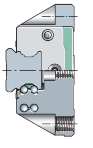


Figure 10
Definition of side allocation

!

The side allocation of the KIT (left, centre, right) is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.



Lubrication connectors for KUVE..-B

Linear recirculating ball bearing and guideway assemblies must be lubricated with grease or oil. Depending on the position of the lubrication connector and the other accessories, suitable lubrication connectors are available as special accessories.

Lubrication connectors:

- Standard lubrication connectors, *Figure 11*
- Lubrication connectors for manual lubricators, *Figure 12* and table, page 385
- Lubrication connectors for central lubrication, *Figure 14*, page 386, and table, page 387.

S04: KUVE20-B
S05: KUVE25-B to KUVE55-B
S16: KUVE15-B

W = hexagon

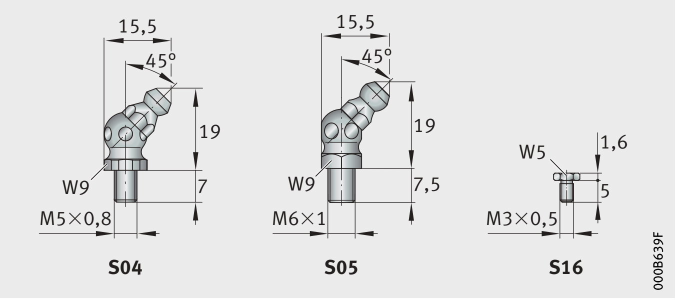


Figure 11
Standard lubrication connectors

W = hexagon

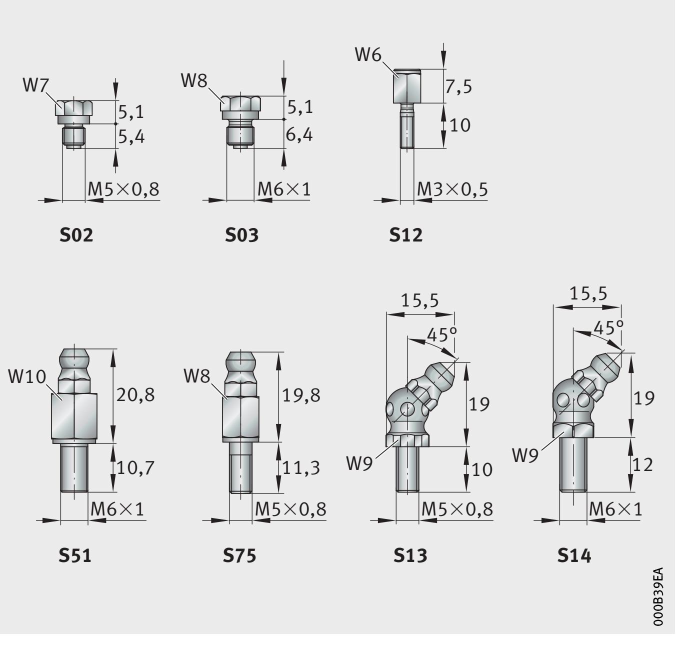
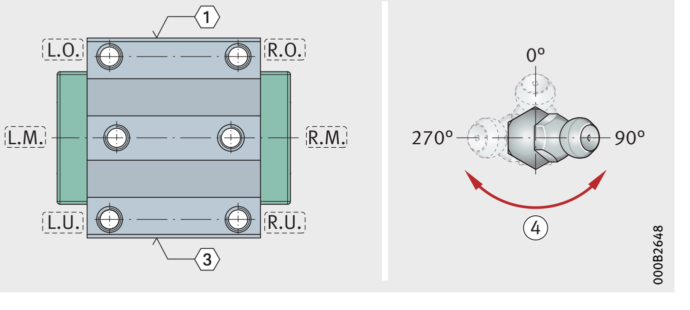


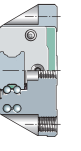
Figure 12
Lubrication connectors for manual lubricators

Lubrication connectors for manual lubricators

Size	Designation KUVE..-B	Positions: L.M., R.M. Thread	Straight KIT 000 100 110 200 210 220	Straight KIT 300 310 320 330 360 370	Angled (45°) KIT 000 100 110 200 210 220	Angled (45°) KIT 300 310 320 330 360 370	Positions: L.U., L.O., R.U., R.O. Thread	Straight KIT 000 100 110 200 210 220	Straight KIT 300 310 320 330 360 370
15	All	M3	S16[1]	S12	–	–	M3	S16	S16
20	-E, -EC, -N, -NL, -ES, -ESC, -SN, -SNL	M5	S02	S75	S04[1]	S13	M3	S16	S16
	-B, -L, -H, -HL, -S, -SL						M5	S02	S02
25	-E, -EC, -N, -NL, -ES, -ESC, -SN, -SNL	M6	S03	–	S05[1]	S14	M3	S16	S16
	-B, -L, -H, -HL, -S, -SL						M6	S03	S03
30	-N, -NL, -SN, -SNL	M6	S03	S51	S05[1]	S14	M5	S02	S02
	-B, -L, -E, -EC, -H, -HL, -S, -SL, -ES, -ESC						M6	S03	S03
35	All	M6	S03	S51	S05[1]	S14	M6	S03	S03
45	All	M6	S03	S51	S05[1]	S14	M6	S03	S03
55	All	M6	S03	S51	S05[1]	S14	M6	S03	S03

[1] Standard.



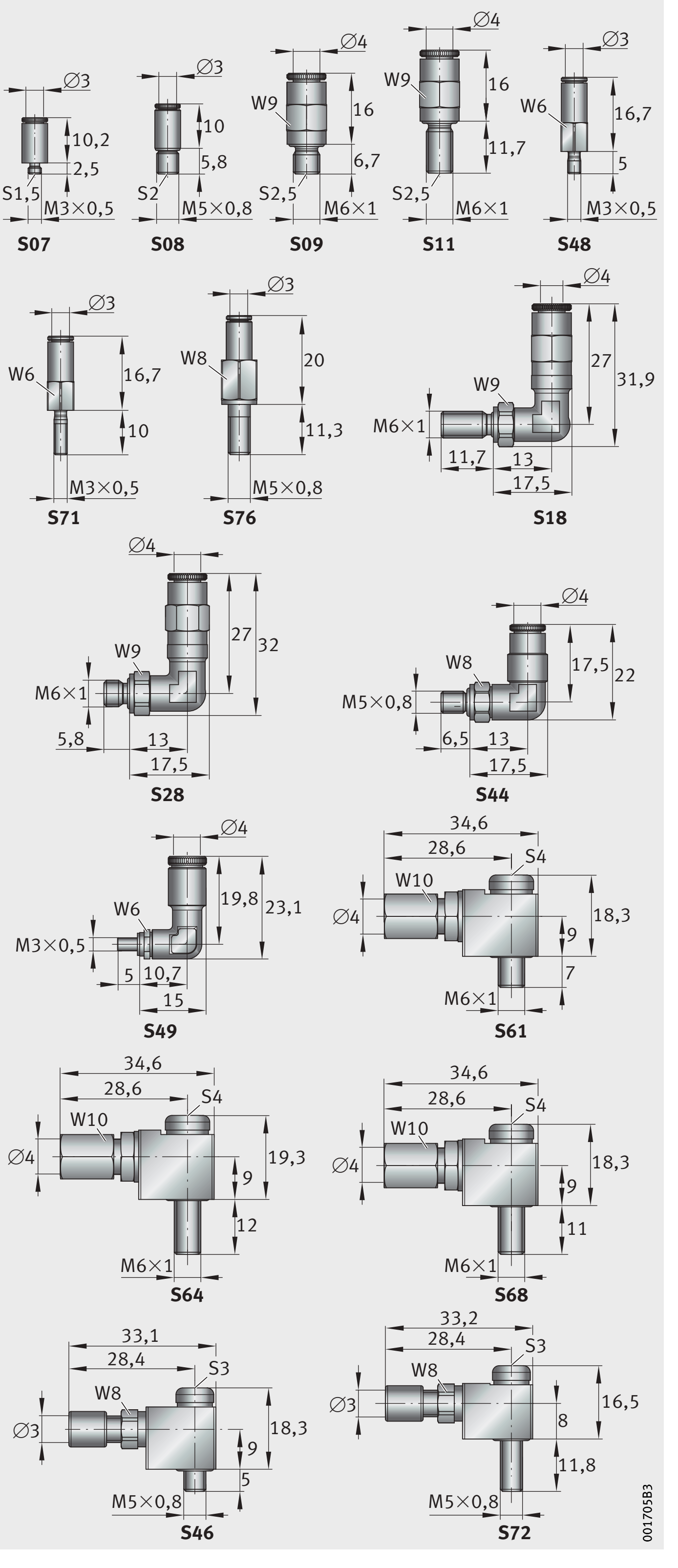


(1) Locating face top
or
(3) Locating face bottom
(4) Alignment of the angled lubrication connectors from viewpoint of carriage

Figure 13
Definition of lubrication connectors

The position and alignment of the lubrication connectors is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.

Sealing and lubrication elements



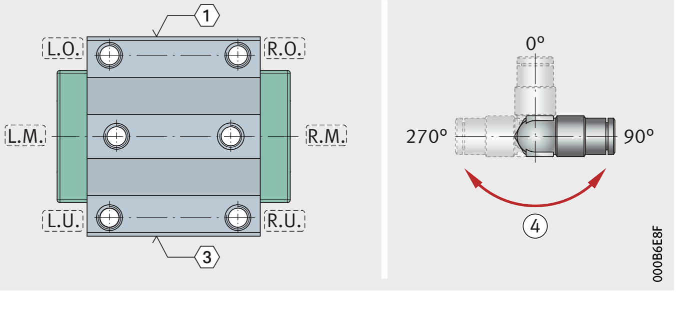
W = hexagon
S = hexagon socket

Figure 14
Lubrication connectors
for central lubrication

Lubrication connectors for central lubrication

Size	Designation KUVE..-B	Positions: L.M., R.M. Thread	Straight KIT 000 100 110	Straight KIT 200 210 220	Straight KIT 300 310 320 330 360 370	Angled (90°) KIT 000 100 110	Angled (90°) KIT 200 210 220	Angled (90°) KIT 300	Angled (90°) KIT 310 320 330 360	Angled (90°) KIT 370	Positions: L.U., L.O., R.U., R.O. Thread	Straight KIT 000 100 110 200 210 220	Straight KIT 300 310 320 330 360 370
15	All	M3	S07	S48	S71	S49	S49	–	–	–	M3	S07	S07
20	-E, -EC, -N, -NL, -ES, -ESC, -SN, -SNL	M5	S08	S08	S76	S44	S46	–	S72 1)	–	M3	S07	S07
	-B, -L, -H, -HL, -S, -SL										M5	S08	S08
25	-E, -EC, -N, -NL, -ES, -ESC, -SN, -SNL	M6	S09	S09	S11	S28	S61	S18	S18	S18 S68	M3	S07	S07
	-B, -L, -H, -HL, -S, -SL										M6	S09	S09
30	-N, -NL, -SN, -SNL	M6	S09	S09	S11	S28	S61	S18 S64	S18	S18 S68	M5	S08	S08
	-B, -L, -E, -EC, -H, -HL, -S, -SL, -ES, -ESC										M6	S09	S09
35	All	M6	S09	S09	S11	S28	S61	S18 S64	S18	S18 S64	M6	S09	S09
45	All	M6	S09	S09	S11	S28	S61	S18 S64	S18	S18 S64	M6	S09	S09
55	All	M6	S09	S09	S11	S28	S61	S18 S64	S18	–	M6	S09	S09

1) Not permissible for KIT320.



1 Locating face top
or
3 Locating face bottom
4 Alignment of the angled lubrication connectors from viewpoint of carriage

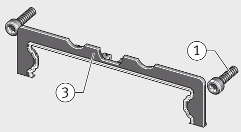
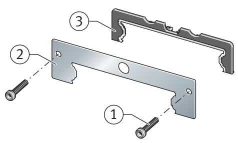
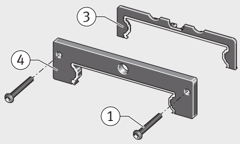
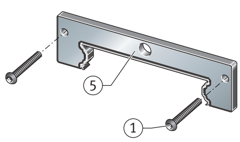
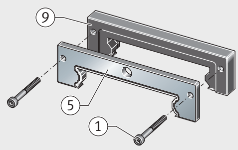
Figure 15
Definition of lubrication connectors

!

The position and alignment of the lubrication connectors is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.

Sealing and lubrication elements

Sealing and lubrication elements KIT (left, right) for KUVE..-W

Designation and KIT end number KIT.KWVE..-W	Image	Description
000	–	No KIT at corresponding position.
100[2]		1 Fixing screw K_1 3 End wiper contact type, single lip
200		1 Fixing screw K_1 2 Sheet metal wiper non-contact 3 End wiper contact type, single lip
300		1 Fixing screw K_1 3 End wiper contact type, single lip 4 Additional wiper single lip (NBR)
370		1 Fixing screw K_1 5 Additional wiper double lip (NBR)
400		1 Fixing screw K_1 5 Additional wiper double lip (NBR) 9 Long term lubrication unit

1 Locating face

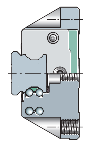
Attention!
The table is only intended as a guide.
Specific application conditions must be taken into consideration when selecting the elements.

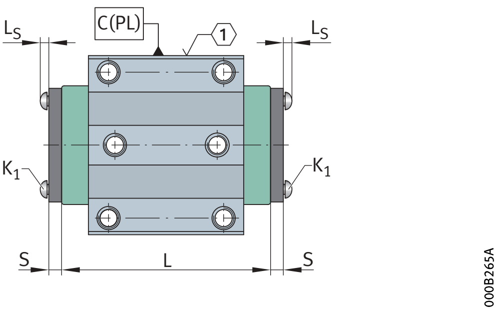
The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations, see page 392.
Recommended lubrication connectors, see page 394.

[1] Definition, see page 365.

[2] Standard for KUVE..-W.

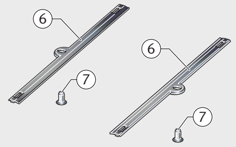
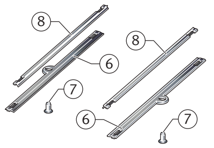
Degree of contamination[1)]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_1	L_S mm	S mm	None	Slight	Moder-ate	Heavy	KIT.KWVE..-W
■	–	–	15	■	–	–	–	■	–	–	–	**000**
			20									
			25									
			30									
			35									
■	■	–	15	■	–	–	0	–	–	■	–	**100**[2)]
			20									
			25									
			30									
			35									
■	■	–	15	■	M2×12	2	0,8	–	–	■	–	**200**
			20		M2,5×16	2,5						
			25		M3×16	3						
			30		M3×20	3						
			35		M4×22	4						
■	■	■	–	■	–	–	–	–	–	–	■	**300**
			20		M2,5×18	1,5	4,5					
			25		M3×18	1,65						
			30		M3×22	1,65						
			35		M4×25	2,2						
■	■	–	–	■	–	–	–	–	–	–	■	**370**
			20		M2,5×18	1,5	4,5					
			25		M3×18	1,65						
			30		M3×22	1,65						
			35		M4×25	2,2						
■	■	■	15	■	M2×25	1,3	13	–	–	–	■	**400**
			20		M2,5×28	1,5	13					
			25		M3×28	1,65	14					
			30		M3×30	1,57	14					
			35		M4×35	2,2	15					





Sealing and lubrication elements

Sealing and lubrication elements KIT (centre) for KUVE..-W

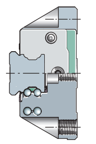
Designation and KIT end number KIT.KWVE..-W	Image	Description
000	–	No KIT at corresponding position.
900[2]		⑥ Lower sealing strip, single lip ⑦ Grooved drive stud (not for size 15)
910		⑥ Lower sealing strip, single lip ⑦ Grooved drive stud (not for size 15) ⑧ Upper sealing strip, single lip

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

The sealing and lubrication elements KIT can be combined flexibly.
Recommended and possible combinations, see page 392.
Recommended lubrication connectors, see page 394.

1) Definition, see page 365.
2) Standard for KUVE..-W.

Degree of contamination[1]			Size	Retrofit-table	Tolerances			Increase in displacement force				Designation and KIT end number
Slight	Moder-ate	Heavy			K_1	L_S	S	None	Slight	Moder-ate	Heavy	
						mm	mm					KIT.KWVE..-W
■	–	–	15 20 25 30 35	■	–	–	–	■	–	–	–	**000**
■	■	–	15 20 25 30 35	–	–	–	–	–	■	–	–	**900**[2]
■	■	■	15 20 25 30 35	–	–	–	–	–	–	■	–	**910**



Possible combinations – KIT allocation (left) to KIT right						
Designation and KIT end numbers KIT.KWVE..-W	000	100	200	300	370	400
000	●	–	–	–	–	–
100	–	●	●	●	●	–
200	–	●	●	●	●	–
300	–	●	●	●	–	–
370	–	●	●	–	●	–
400	–	–	–	–	–	●

● Possible combination.

Possible combinations – KIT allocation (left or right) to KIT centre						
Designation and KIT end numbers KIT.KWVE..-W	000	100	200	300	370	400
000	●	–	–	–	–	–
900	–	●	●	●	●	●
910	–	●	●	●	●	●

● Possible combination.

1 Locating face top
or
3 Locating face bottom
4 Left
5 Centre
6 Right

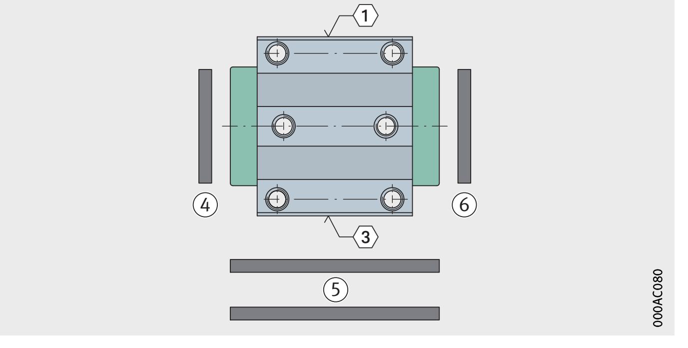
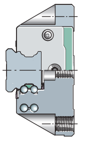


Figure 16
Definition of side allocation

The side allocation of the KIT (left, centre, right) is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.



Lubrication connectors for KUVE..-W

Linear recirculating ball bearing and guideway assemblies must be lubricated with grease or oil. Depending on the position of the lubrication connector and the other accessories, suitable lubrication connectors are available as special accessories.

Lubrication connectors:

- Standard lubrication connectors, *Figure 17*
- Lubrication connectors for manual lubricators, *Figure 18* and table, page 395
- Lubrication connectors for central lubrication, *Figure 20*, page 396, and table, page 397.

S04: KUVE20-W
S05: KUVE25-W to KUVE35-W
S16: KUVE15-W

W = hexagon

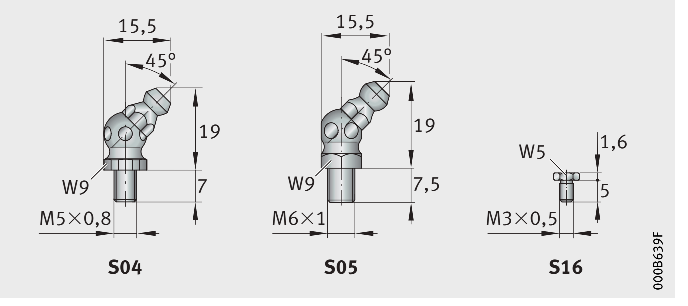


Figure 17
Standard lubrication connectors

W = hexagon
S = hexagon socket

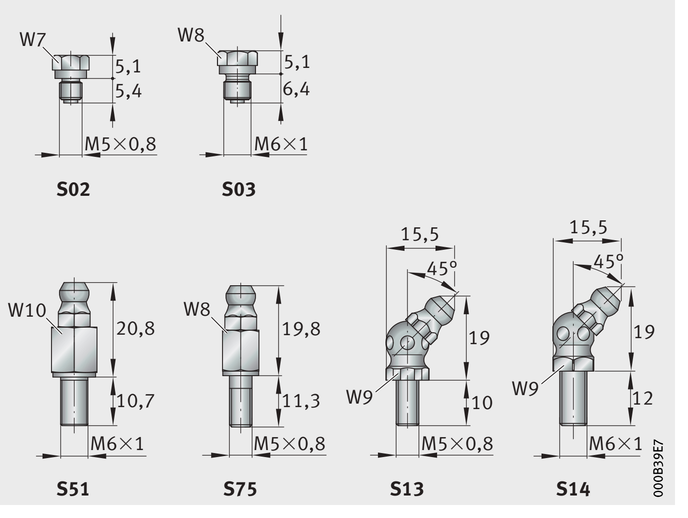
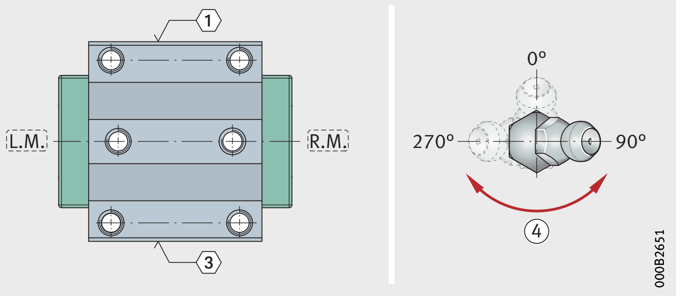


Figure 18
Lubrication connectors for manual lubricators

Lubrication connectors for manual lubricators

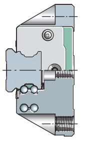
Size	Thread	Positions: L.M., R.M.			
		Straight KIT		Angled (45°) KIT	
		000 100 200	300 370	000 100 200	300 370
15	M3	S16[1]	–	–	–
20	M5	S02	S75	S04[1]	S13
25	M6	S03	S51	S05[1]	S14
30	M6	S03	S51	S05[1]	S14
35	M6	S03	S51	S05[1]	S14

[1] Standard.



1 Locating face top or 3 Locating face bottom
4 Alignment of the angled lubrication connectors from viewpoint of carriage

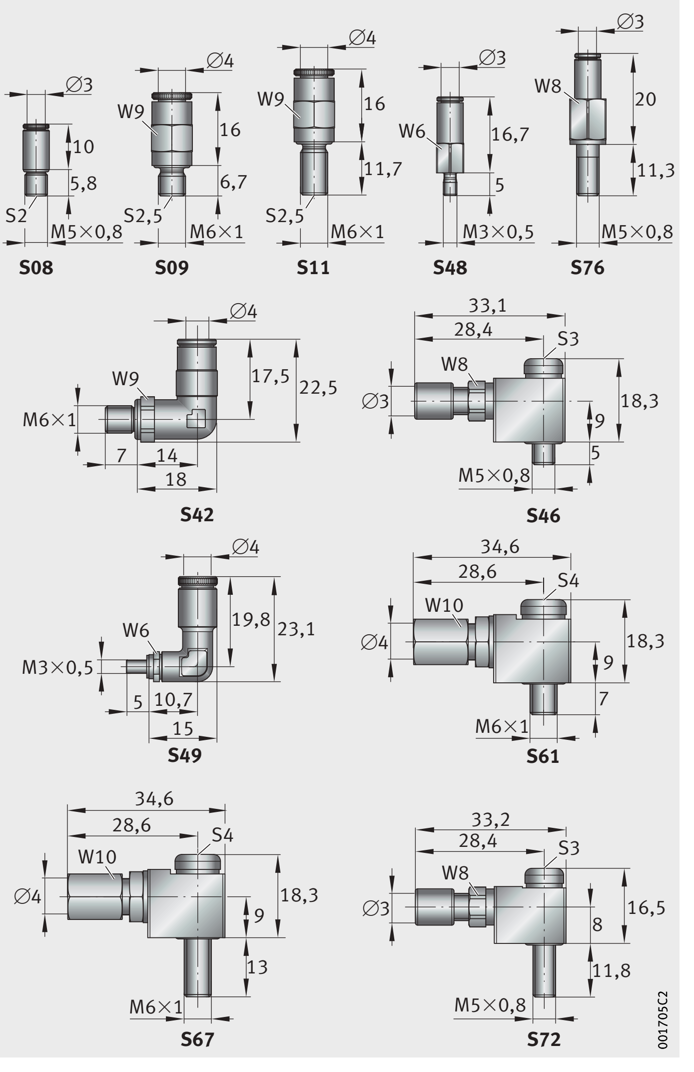
Figure 19
Definition of lubrication connectors



!

The position and alignment of the lubrication connectors is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.

Sealing and lubrication elements

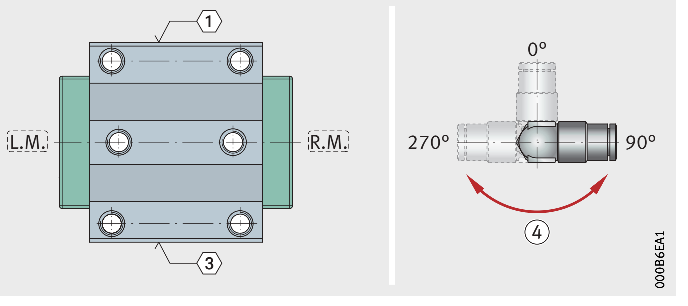


W = hexagon
S = hexagon socket

Figure 20
Lubrication connectors
for central lubrication

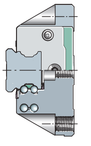
Lubrication connectors for central lubrication

Size	Thread	Positions: L.M., R.M.			
		Straight KIT		Angled (90°) KIT	
		000 100 200	300 370	000 100 200	300 370
15	M3	S48	–	S49	–
20	M5	S08	S76	S46	S72
25	M6	S09	S11	S42 S61	S67
30	M6	S09	S11	S42 S61	S67
35	M6	S09	S11	S42 S61	S67



(1) Locating face top or (3) Locating face bottom
(4) Alignment of the angled lubrication connectors from viewpoint of carriage

Figure 21
Definition of lubrication connectors



The position and alignment of the lubrication connectors is independent of the orientation of the locating face. When ordering, the required orientation of the locating face (top or bottom) must be indicated.

Accessories

Closing plugs
Guideway covering strips
Rolling-in device for covering strip
Braking and clamping element

Accessories

		Page
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	Brass closing plugs	402
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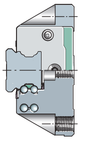
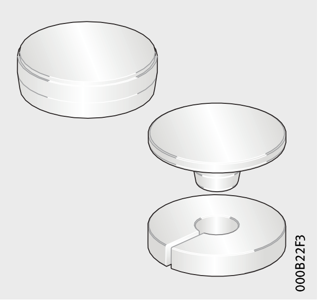


Closing plugs

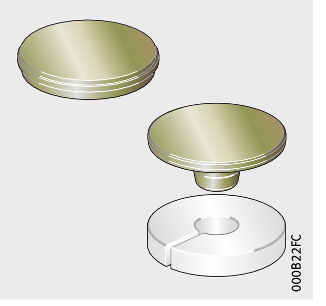
Plastic

Brass

KA..-TN, KA..-TN/A



KA..-M, KA..-M/A

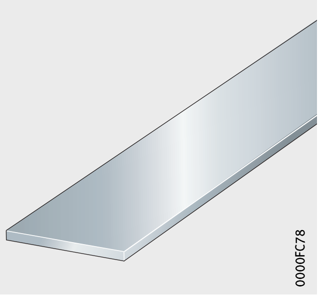


Guideway covering strips

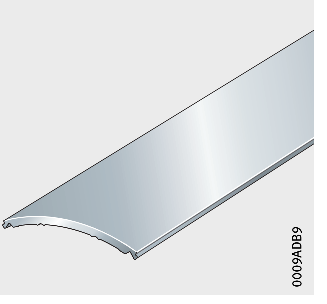
Adhesive bonded

Clip fit

ADB



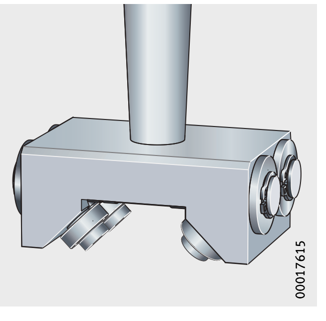
ADK



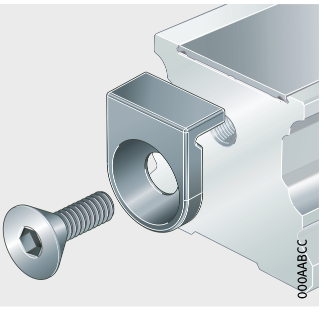
Rolling-in device and retaining plate

For covering strip

ERVV..-B

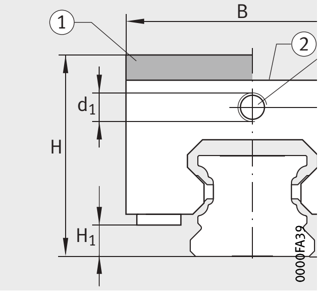


HPL.ADB..-B



Braking and clamping element

BKE.TKVD



Accessories

Closing plugs

The closing plugs close off the counterbores for the fixing screws in the guideway holes flush with the surface of the guideway.

The closing plugs are available in a one-piece or two-piece design and are made from various materials. In addition to plastic closing plugs, brass closing plugs are also available.

! If closing plugs are used in coated guideways, only plastic closing plugs can be used.

! When fitting the closing plugs, observe the guidelines in the Technical principles, see page 76.

Plastic closing plugs

Plastic closing plugs are an economical solution and are suitable for most applications, *Figure 1*.

Plastic closing plugs, one-piece

The one-piece closing plugs KA..-TN can be easily fitted with the aid of a hammer and press-in block. The interference between the plug and hole creates a burr that must be removed during fitting. After fitting, a minimal ring gap remains.

Plastic closing plugs with clinch ring

The two-piece closing plugs KA..-TN/A comprise a plastic plug and a plastic clinch ring. The clinch ring ensures secure seating of the closing plug in the counterbore. These closing plugs can also be easily fitted with the aid of a hammer and press-in block. After fitting, a small ring gap remains.

KA..-TN
KA..-TN/A
Standard

① Plastic closing plug
② Plastic plug
③ Plastic clinch ring

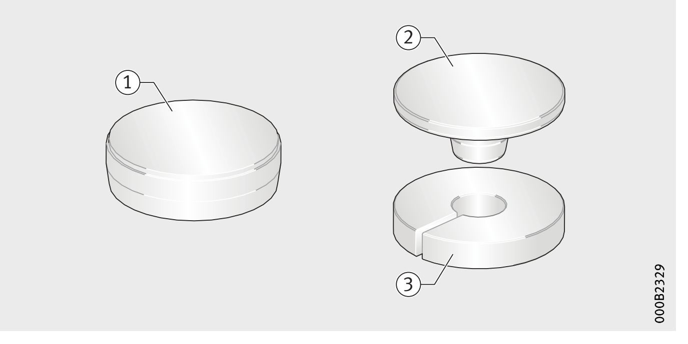


Figure 1
Plastic closing plugs

Brass closing plugs

Brass closing plugs are particularly suitable for conditions involving hot swarf, aggressive media and vibrations. As a result, they are recommended in particular for use in machine tools, *Figure 2*.

Brass closing plugs with shear ring

The brass closing plugs KA..-M with shear ring can be fitted with the aid of a hammer and press-in block.

During fitting, the shear ring is sheared off, leaving a ring-shaped burr that must be removed. A minimal ring gap remains.

After fitting, the top surfaces of the plugs must be smoothed off using an oilstone.

Brass closing plugs with clinch ring

The two-piece closing plugs KA..-M/A comprise a brass plug and a plastic clinch ring. The clinch ring ensures secure seating of the closing plug in the counterbore.

The closing plugs can be easily fitted with the aid of a hammer and press-in block. After fitting, a small ring gap remains.
The top surfaces of the plugs do not require further processing.

KA..-M
KA..-M/A

1 Brass closing plug with shear ring
2 Brass plug
3 Plastic clinch ring

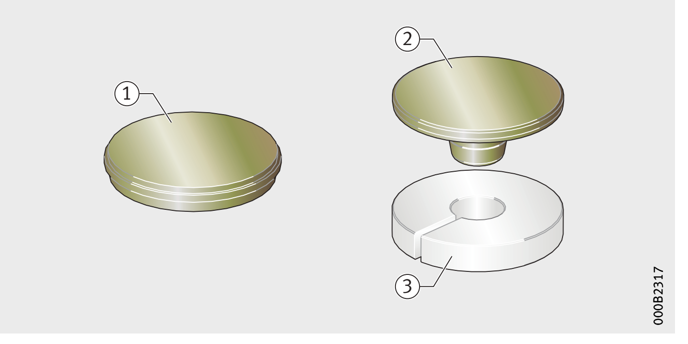


Figure 2
Brass closing plugs

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, while the covering strip ADK is clipped into the slot, *Figure 3*, page 403.

! The clip fit covering strip must be fitted using the rolling-in device ERVV..-B, see page 404.

The covering strip ADK is recommended particularly for use under aggressive environmental conditions.

Adhesive bonded covering strips ADB are supplied with linear recirculating ball bearing and guideway assemblies KUVE..-B-ADB, clip fit covering strips ADK are supplied with linear recirculating ball bearing and guideway assemblies KUVE..B-ADK, see dimension table.

When ordering individual carriages for guideways with a clip fit covering strip (ADK) in the sizes 20, 25 and 30, the postscript ADK must be added, for example: KWVE25-B-ADK.

Principles for fitting of the strips, see page 79.

ADK
ADB

① Clip fit
② Adhesive bonded

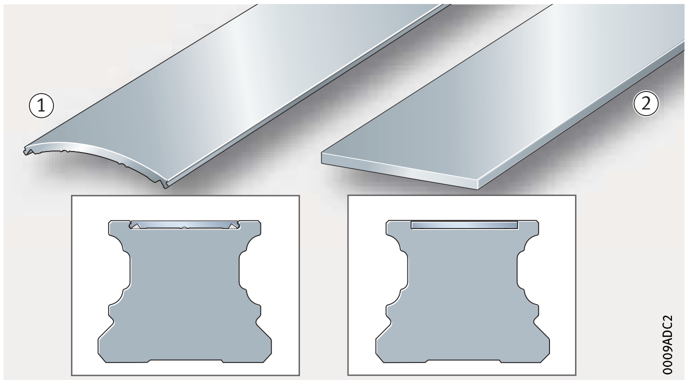
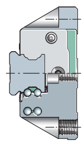


Figure 3
Guideway covering strip



Retaining plate

The retaining plate HPL.ADB..-B fixes the covering strips ADB and ADK to the end of the guideway, *Figure 4*. It is included in the scope of delivery.

Comprehensive information can be found on the covering strip ADB in the mounting manual MON 07 and on the covering strip ADK in the mounting manual MON 65.
Principles for fitting of the retaining plates, see page 79.

HPL.ADB..-B

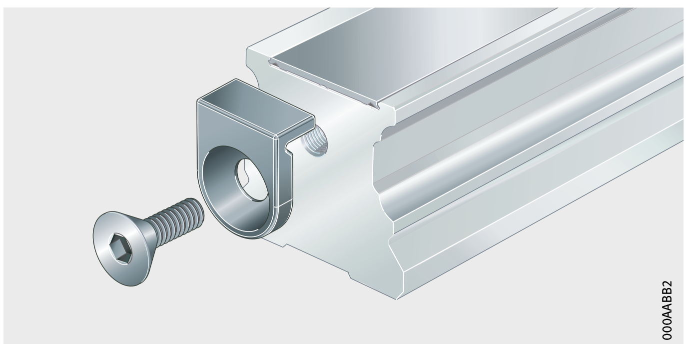


Figure 4
Retaining plate
for covering strip

Rolling-in device

The clip fit covering strip ADK is fitted using the rolling-in device ERVV..-B. 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..-B must be stated, see Ordering example.

The elements are available for the series KUVE..-B. For the dimension table for the rolling-in device, see page 410.

ERVV..-B

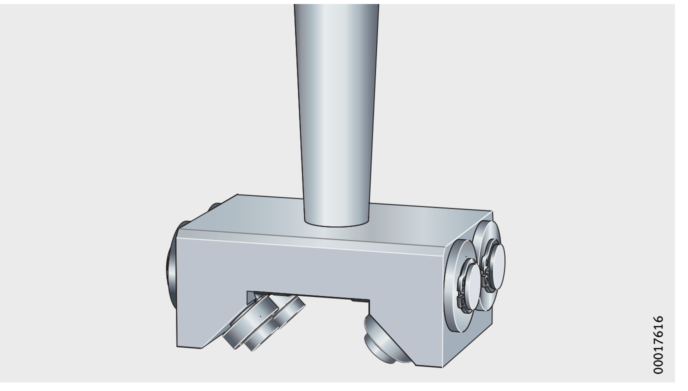


Figure 5
Rolling-in device
for covering strip

Observe the guidelines in the mounting manual MON 65.

Ordering example, ordering designation

A rolling-in device for the covering strip ADK16, for KUVE35-B is to be ordered.

Ordering designation

1×**ERVV35-B**

Braking and clamping element

The braking and clamping element BKE.TKVD is used, for example, as a positionally independent security system for linear drives where the drive cannot fully provide the braking and clamping function, *Figure 6*.

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 page 407. The elements are thus maintenance-free.

BKE.TKVD

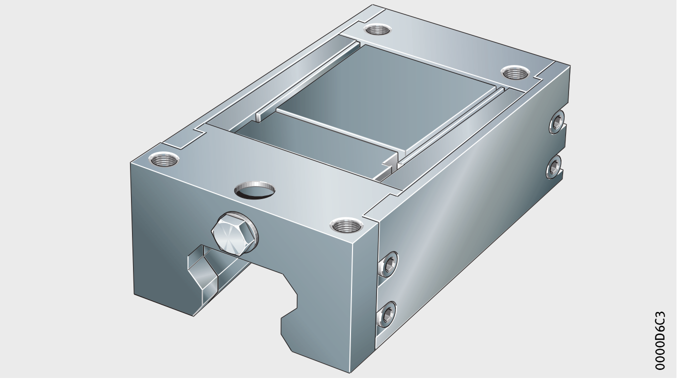
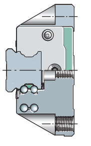


Figure 6
Braking and clamping element



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. The brake shoes are opened by hydraulic means. If the pressure drops or the power fails, the brake shoes are closed again. This eliminates safety problems resulting from power failure, which is a possibility with electronically braked systems.

The system carries out braking if 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, see page 67.

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

Short reaction time

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

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.

Function

Three disc spring columns generate the braking and clamping force, *Figure 7*. 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

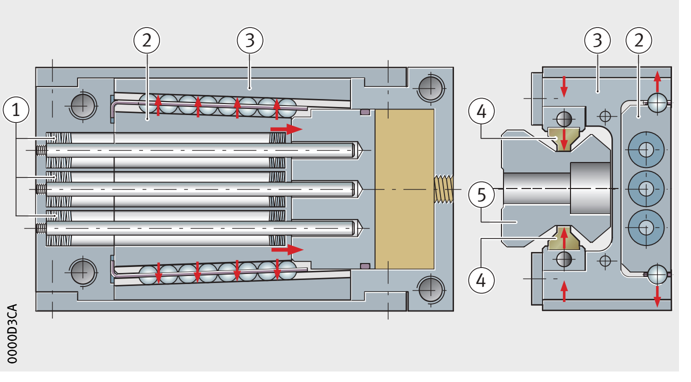


Figure 7
Functional components

Operating pressure of braking and clamping elements

Operating pressure	
min.	max.
> 55 bar	90 bar

Pressure spikes of more than 90 bar must be avoided in all cases. Comprehensive information can be found in the mounting manual MON 01, Braking and Clamping Elements.

Wear of brake shoes

Since the system performs not only a clamping function on stationary guidance systems but also a braking function on moving guidance systems, wear of the brake shoes occurs. However, clearance between the brake shoes and brake contact surfaces increases the system reaction time.

Automatic clearance compensation

For reliable functioning of the system, the brake shoes must always be in clearance-free contact. 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 8*. 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 travel.

Adapter plate

For the H variant of the carriages, an adapter plate is necessary, *Figure 8*. The adapter plate is included in the scope of delivery.

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

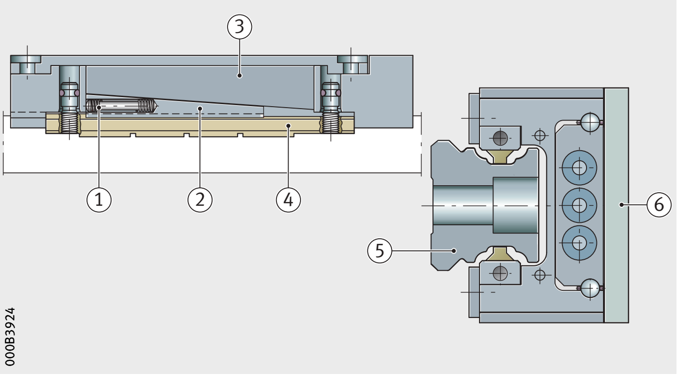
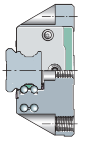


Figure 8
Wear compensation and adapter plate



Ease of mounting

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

!

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 but have only a very small design envelope. They are matched in their dimensions to the INA standard and H design carriages. The elements are available for the monorail guidance systems RUE-E, KUSE and KUVE-B and can be integrated without any problems in existing applications with INA linear guidance systems, see dimension table.

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 rolling element systems. In this case, the guideway is used as a braking or clamping rail.

Typically, the braking and clamping element is arranged between two carriages on the table and acts as an emergency brake, *Figure 9*.

① Guideways
② Carriages
③ Emergency brakes
④ Table
⑤ Motor primary part
⑥ Motor secondary part

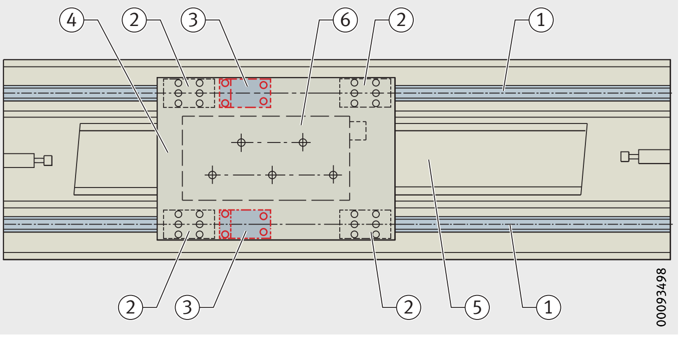


Figure 9
Typical application

Delivered condition

The elements are premounted on a separate rail and clamped in place by means of a fitting screw, *Figure 10*. The screw is used to loosen and then move the fixed element. The fitting screw is later replaced by the hydraulic connector.

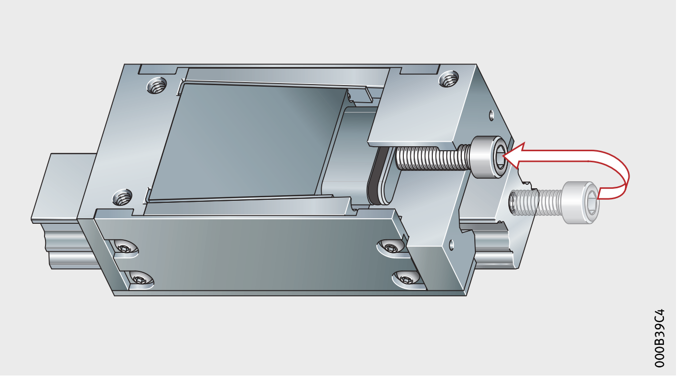


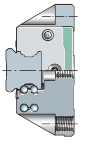
Figure 10
Braking and clamping element on support rail

Ordering example, ordering designation

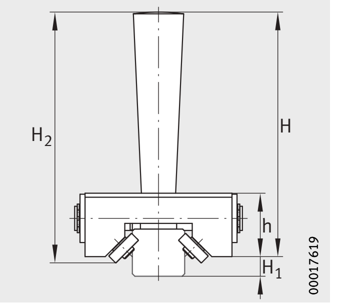
A braking and clamping element for KUVE35-B with a hydraulic connector on the end face is to be ordered.

Ordering designation

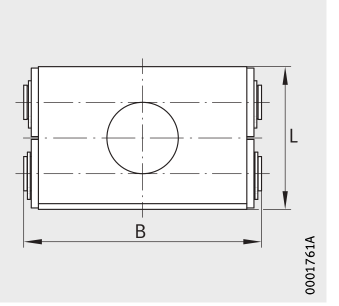
1×**BKE.TKVD35**



Rolling-in device



ERVV..-B

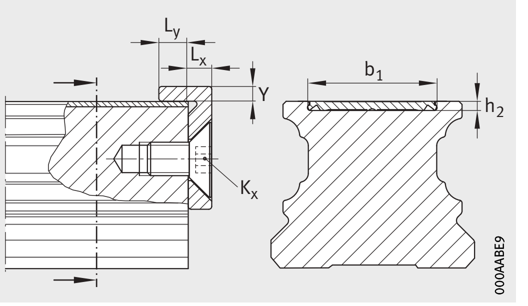


ERVV..-B · Top view

Dimension table · Dimensions in mm

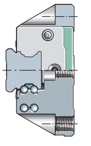
Designation	Mass	Dimensions						For linear guidance system
	m	H	H_1	H_2	h	B	L	
	≈ kg							
ERVV20-B	0,4	120	4,7	119,6	30	70,3	50	KUVE20-B
ERVV25-B	0,4	120	6,4	120,1	30	70,3	50	KUVE25-B
ERVV30-B	0,5	121,5	9,8	124,6	31,5	83,3	50	KUVE30-B
ERVV35-B	0,5	121,5	13,3	126	31,5	83,3	50	KUVE35-B
ERVV45-B	0,5	121,5	20,4	126	31,5	89,3	50	KUVE45-B
ERVV55-B	0,5	121,5	27,8	126	31,5	95,3	50	KUVE55-B

Retaining plate for covering strip



Retaining plate

Dimension table · Dimensions in mm										
Designation	Mass m ≈ kg/m	for linear guidance system	Dimensions						for covering strip	
			h_2	b_1	K_x	L_x	L_y	Y		
HPL.ADB9-B	0,05	KUVE20-B	0,5	13	M5	4	5	2	ADB13	ADK12
HPL.ADB9-B	0,05	KUVE25-B	0,5	13	M5	4	5	2	ADB13	ADK12
HPL.ADB17-B	0,07	KUVE30-B	0,5	18	M6	4	5	2,5	ADB18	ADK16
HPL.ADB17-B	0,09	KUVE35-B	0,5	23	M6	4	5	2,5	ADB18	ADK16
HPL.ADB17-B	0,1	KUVE45-B	0,5	27	M6	4	5	2,5	ADB23	ADK21
HPL.ADB17-B	0,11	KUVE55-B	0,5	29	M6	4	5	2,5	ADB27	ADK25



Braking and clamping element

Dimension table · Dimensions in mm

Designation	Clamping force[1]	Dimensions						
		H		B	L	J_B	J_C	A_1
		Adapter plate						
	N	with	without					
BKE.TKVD25	1 000	36	–	47	91	38	34	10
BKE.TKVD25-SO								
BKE.TKVD25-H		–	40					
BKE.TKVD25-H-SO								
BKE.TKVD35	2 800	48	–	69	120	58	48	13,5
BKE.TKVD35-SO								
BKE.TKVD35-H		–	55					
BKE.TKVD35-H-SO								
BKE.TKVD45	4 300	60	–	85	141	70	60	15
BKE.TKVD45-SO								
BKE.TKVD45-H		–	70					
BKE.TKVD45-H-SO								

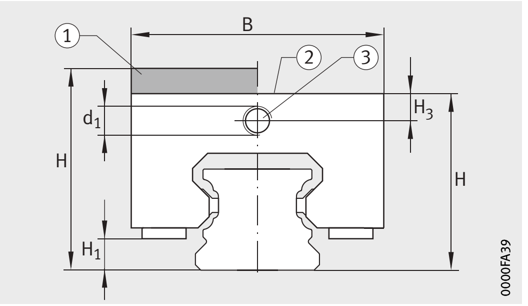
① With adapter plate. ② Without adapter plate. ③ Hydraulic connector. ④ Hydraulic connection from above (suffix SO).[4]

1) Valid for lightly oiled guideway. Increased contamination of the oil will lead to a reduction in the holding force or an increase in the braking travel.

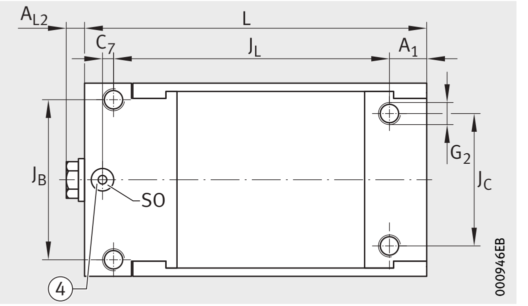
2) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

3) O ring.

4) The maximum diameter of the oil inlet hole is 6 mm.

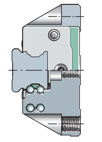


BKE.TKVD



Top view[4]

							Fixing screws[2]	
J_L	C_7	H_1	H_3	A_{L2}	d_1	SO[3][4]	G_2 DIN ISO 4762-12.9	M_A Nm
75	–	6,5	6	5	M6×1	–	M6	17,4
	0					7×1,5		
	–					–		
	0					7×1,5		
100	–	7,9	8,1	5	M8×1	–	M8	42,2
	0					7×1,5		
	–					–		
	0					7×1,5		
113	–	13	10	5	M8×1	–	M10	83
	5					7×1,5		
	–					–		
	5					7×1,5		



Linear recirculating ball bearing units

Linear recirculating ball bearing units

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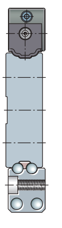
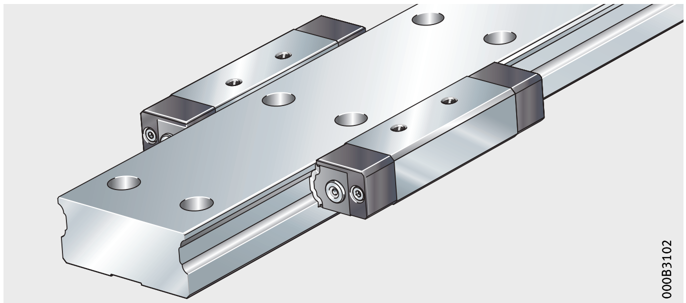


Linear guidance system

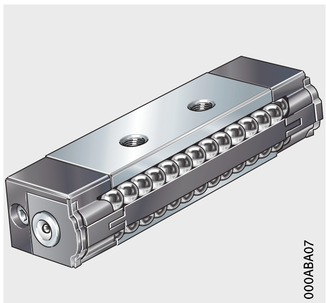
Full complement
For oil and grease lubrication

KUVS..-B + TKVD



Linear recirculating ball bearing unit

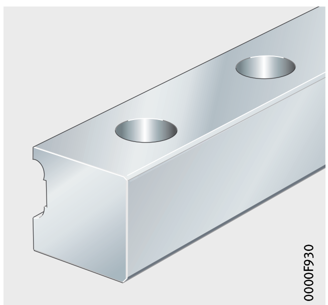
KUVS..-B



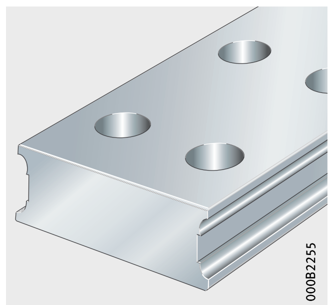
Guideways

Half guideway
Full guideway

TKVD14



TKVD32, TKVD42, TKVD71

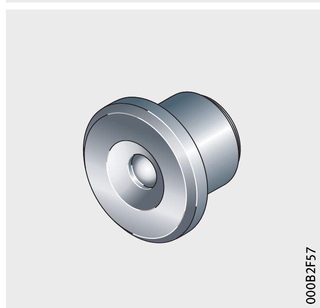


Standard accessories

Plastic closing plugs
Lubrication connectors

KA..-TN

S



Linear recirculating ball bearing units

Features

These linear guidance systems are constructed using full complement linear recirculating ball bearing units KUVS..-B 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 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. If the half guideway TKVD14 is used, this gives increased design flexibility.

A guidance system comprises at least two linear recirculating ball bearing units with lubrication connectors supplied fitted, a full guideway or two half guideways and plastic closing plugs.

Full complement

Since they have the maximum possible number of rolling elements, full complement guidance systems have extremely high load carrying capacity and particularly high rigidity.

Linear recirculating ball bearing units

The linear recirculating ball bearing units have saddle plates made from hardened steel and the rolling element raceways are precision ground.

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

Guideways

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

The guideways are available with raceways on both sides (TKVD32, TKVD42 and TKVD71) or as a half guideway with raceways on one side only (TKVD14).

Location from above

Guideways TKVD are located from above and have through holes with 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 as several segments, see page 423.

Standard accessories

The standard accessories include plastic closing plugs.

Plastic closing plugs

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

Lubrication connector

Lubrication connectors similar to DIN 3405 for relubrication from the ends are fitted on both end faces.

Load carrying capacity

The rows of balls are in an O arrangement with two point contact on the raceways, *Figure 1*.

The guidance systems can support loads from all directions, except in 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.

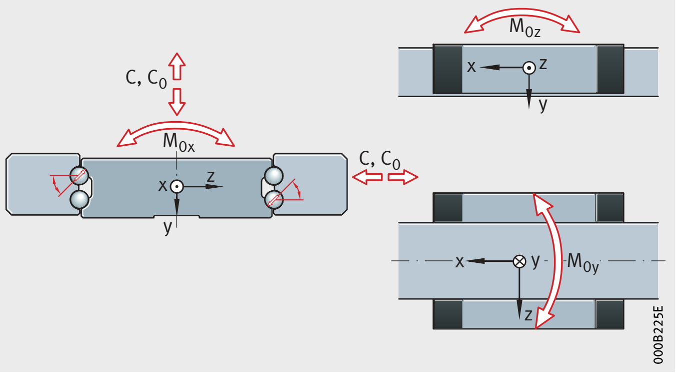


Figure 1
Load carrying capacity and contact angle

Acceleration and velocity

Linear guidance systems with linear recirculating ball bearing units KUVS permit accelerations up to 100 m/s^2 and velocities up to 3 m/s, see table.

Operating limits

Designation	Acceleration up to m/s^2	Velocity up to m/s
KUVS	100	3

Interchangeability

Linear recirculating ball bearing units KUVS and guideways TKVD are interchangeable in any combination within one size and accuracy class.

Sealing

End wipers are fitted on both sides to the end pieces of the linear recirculating ball bearing units to retain the lubricant within the system and seal the end faces of the linear recirculating ball bearing unit.

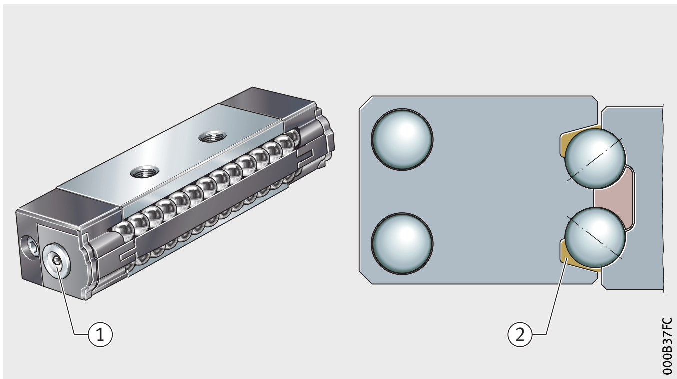
In order to prevent damage to the linear recirculating ball bearing units, the raceways on the guideways must be kept clean.

Under extremely heavy contamination load, additional covers must be used.

Lubrication

Linear recirculating ball bearing units KUVS are suitable for oil and grease lubrication. The systems are supplied with an initial greasing.

Lubrication connectors similar to DIN 3405 for relubrication from the ends are fitted on both end faces, *Figure 2*.



1 Lubrication connector
2 Lubricant reservoir

Figure 2
Lubrication connector and lubricant reservoir

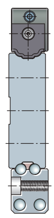
Operating temperature

As standard, linear recirculating ball bearing units can be used at operating temperatures from –10 °C to +80 °C.

Other temperature ranges are possible by means of special greases.

Corrosion-resistant design

Linear recirculating ball bearing units KUVS are also available in a corrosion-resistant design by means of the special coating Corrotect, see page 57.



Design and safety guidelines

Preload

In the operation of systems with linear recirculating ball bearing units, setting of the preload must be ensured.

Setting the preload

The preload can be set, for example, by means of pressure screws that can be secured. These are supported in the adjacent construction and act on the back of the linear recirculating ball bearing unit facing the rolling elements. The force ideally acts at the symmetry point of this surface. Application of the preload force is intended to provide clearance-free guidance of the rolling elements in the ball bearing units on the guideways.

Influence of preload on the linear guidance system

The preload of a linear guidance system defines the rigidity of the system.

Increasing the preload increases the rigidity of the guidance system. The preload influences not only the rigidity but also the displacement force of the guidance system. The higher the preload, the larger the displacement force. Furthermore, preload also influences the operating life of the guidance system.

Rigidity

The rigidity is dependent on the preload set.

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.

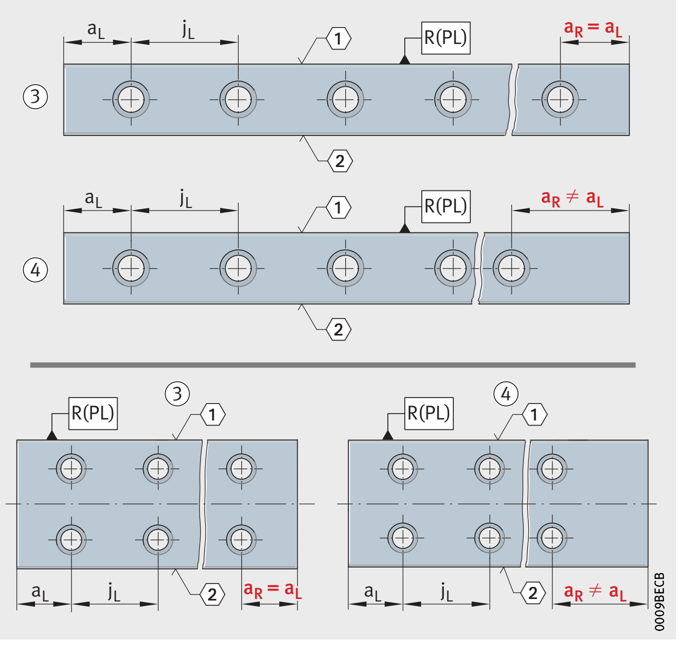
In order to avoid location defects, the holes in the adjacent construction must be deburred.

Hole patterns of guideways

Unless specified otherwise, the guideways have a symmetrical hole pattern where $a_L = a_R$, *Figure 3*.

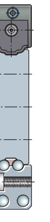
An asymmetrical hole pattern may also be available upon request. In this case, $a_L \geqq a_{L\,min}$ and $a_R \geqq a_{R\,min}$, *Figure 3*.

Irrespective of the orientation of the locating face, a_L is on the left and a_R on the right, *Figure 3*. When ordering, the required orientation of the locating face (top or bottom) must be indicated.



1 Locating face
2 Marking
3 Symmetrical hole pattern
4 Asymmetrical hole pattern

Figure 3
Hole patterns of guideways with one or two rows of holes



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:

$$x = n + 1$$

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

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

l mm
Guideway length

n –
Maximum possible number of pitches between holes

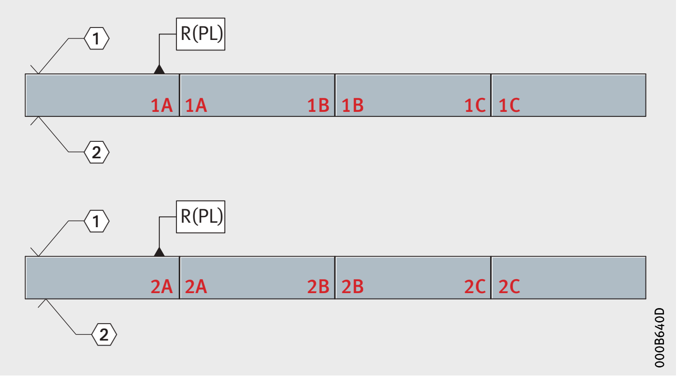
j_L mm
Spacing between holes

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. Risk of injury.

Multi-piece guideways

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



(1) Locating face
(2) Marking

Guideway segments:
1A, 1A 1B, 1B 1C, 1C
2A, 2A 2B, 2B 2C, 2C

Figure 4
Marking of multi-piece guideways

!

In the case of multi-piece guideways, the gap at the end faces between two segments must be $< 0{,}05$ mm.

Guideways suitable for joining as required

If partial guideway lengths ($l < l_{max}$) are to be combined with each other to form a guideway set as requested by the customer, the following postscript must be added to the order for the relevant guideway segment: “Guideway suitable for joining as required”.

If the guideway segment is an end segment, it is recommended that the guideway end has a chamfer, in order to make it easier to slide the carriages onto the guideway and protect the seals against damage. In this case, the position of the chamfer (left or right) and the position of the locating face (top or bottom) must be taken into consideration when ordering.

The design facilitates easier logistics.

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 can be achieved most easily when the guideway is pressed against a locating face.

Geometrical and positional accuracy of the adjacent 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.

Observe the tolerances for the mounting surfaces and parallelism of mounted guideways, *Figure 5*, page 425 and table, page 426.

Surfaces should be ground or precision milled with the objective of achieving a mean roughness value Ramax 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 equation:

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

ΔH μm
Maximum permissible deviation from the theoretically precise position, *Figure 5*, page 425

b mm
Centre distances between guidance elements.

NC = not convex

b = spacing between guidance elements
ΔH = height difference
t = parallelism, flatness and perpendicularity tolerance

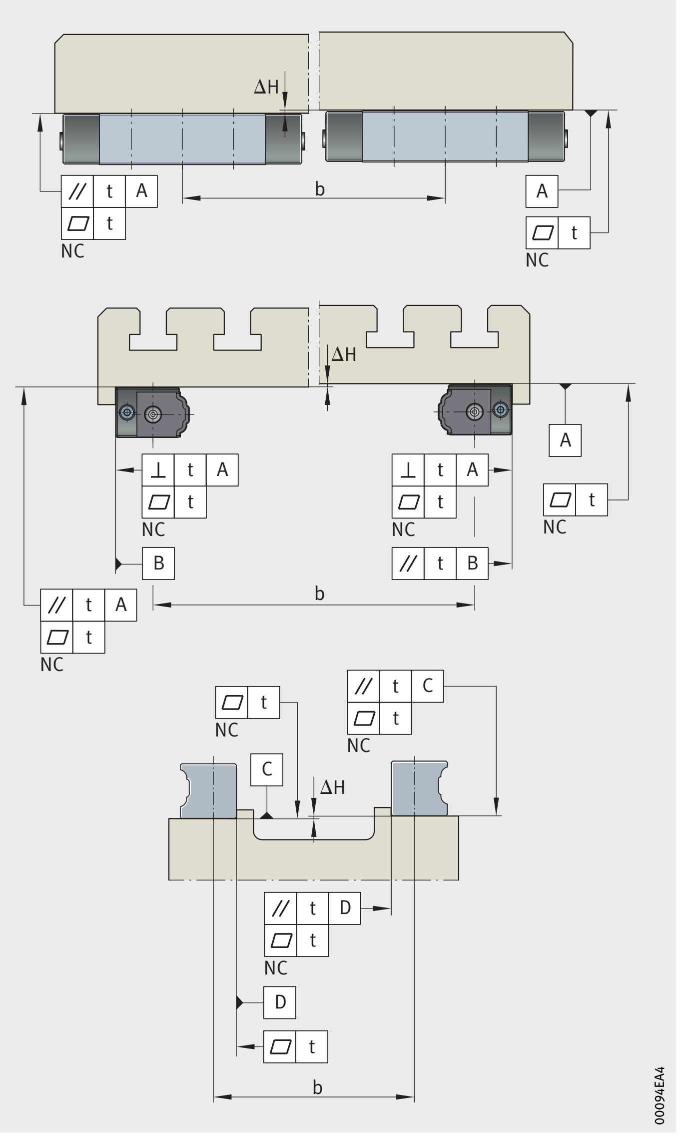


Figure 5
Tolerances of mounting surfaces and parallelism of mounted guideways and linear recirculating ball bearing units

Parallelism of mounted guideways

For guideways arranged in parallel, the values for t are in accordance with *Figure 5*, page 425 and the table. If the maximum values are used, this may increase the displacement resistance.

Values for geometry and position

Guideway[1)]	Parallelism, flatness and perpendicularity t μm
TKVD14	11
TKVD32	9
TKVD42	11
TKVD71	13

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

Locating heights and corner radii

For the design of the locating heights and corner radii, see table and *Figure 6*.

Locating heights, corner radii

Designation	Locating heights		Corner radii	
	h_1 mm	h_2 mm max.	r_1 mm max.	r_2 mm max.
KUVS10-B	5	5	1	1
KUVS13-B	5	5	1	1
KUVS17-B	5	5	1	1

KUVS..-B

1 Locating face
2 Machine bed
3 Machine table

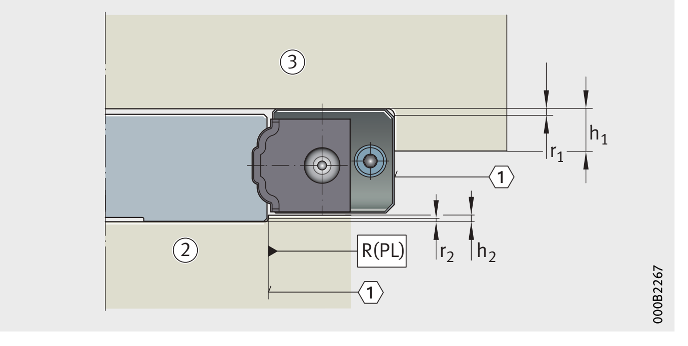


Figure 6
Locating heights and corner radii for linear recirculating ball bearing unit

Accuracy

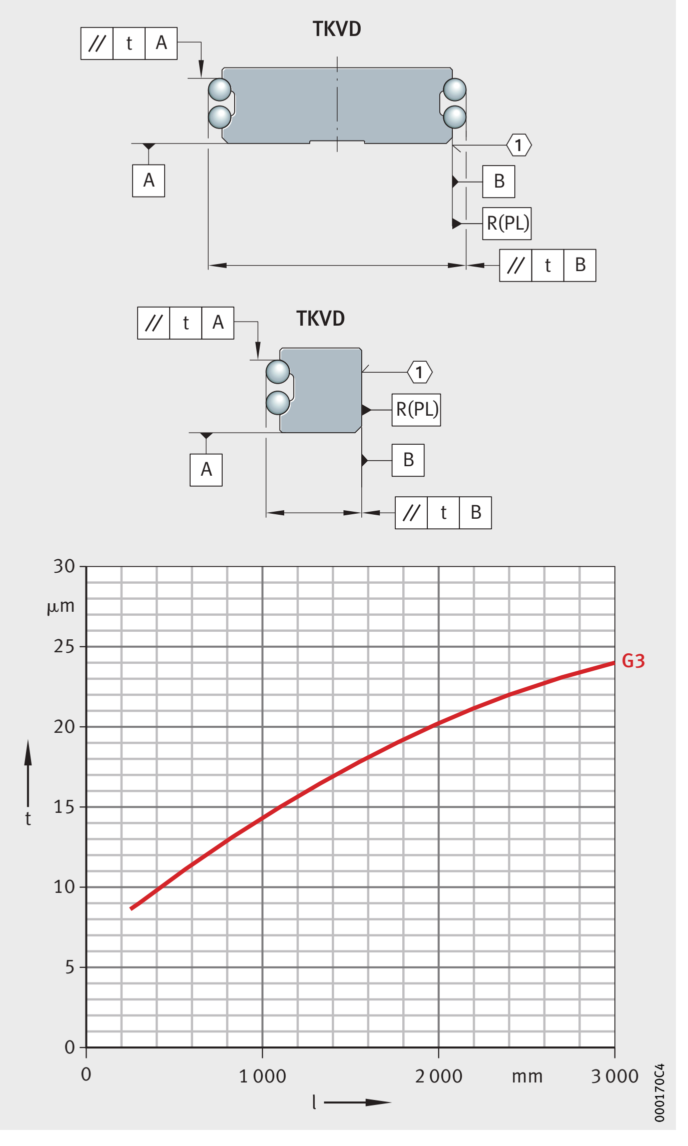
Accuracy classes

Guidance systems with linear recirculating ball bearing units are available in the accuracy class G3.

Parallelism of raceways to locating surfaces

The parallelism tolerance of the guideways is dependent on the accuracy class, *Figure 7*.

In coated systems, there may be deviations in tolerances compared with uncoated guidance systems.



t = parallelism tolerance
l = total guideway length
1 Locating face

Figure 7
Accuracy class and parallelism tolerance of guideways

Tolerances

The tolerances are arithmetic mean values, see table and *Figure 8*. They are relative to the centre point of the screw mounting or locating surfaces of the carriage.

The dimensions H and A_1 should always remain within the tolerance irrespective of the position of the carriage on the guideway, see table.

Tolerances for height H and spacing A_1

Tolerance		KUVS..-B µm
Tolerance for height	H	±25
Difference in height[1]	ΔH	10
Tolerance for spacing	A_1	±25
Difference in spacing[1]	ΔA_1	20

[1] Difference between several bearing units on one guideway, measured at the same point on the guideway.

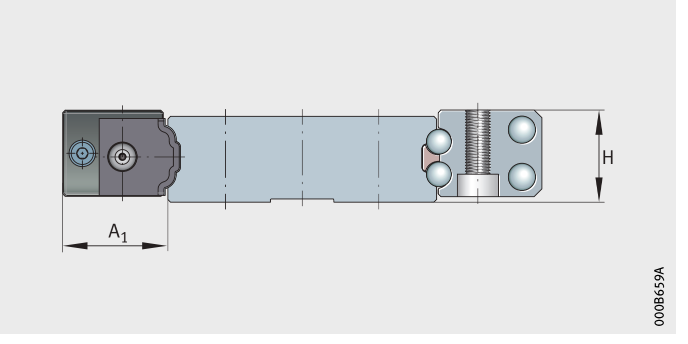


Figure 8
Datum dimensions for accuracy

Units with coating

In the case of these units, the values for the corresponding accuracy class must be increased by the values for the coating, see table.

Tolerances for coated parts

Tolerance[1]		Corrotect RROC µm
Tolerance for height	H	+6
Difference in height[2]	ΔH	+3
Tolerance for spacing	A_1	+3
Difference in spacing[2]	ΔA_1	+3

[1] Displacement in tolerance zone (guideway and bearing units coated).

[2] Difference between several bearing units on one guideway, measured at the same point on the guideway.

Positional and length tolerances of guideways

The positional tolerances are not dependent on the guideway length, *Figure 9*, *Figure 10* and tables.

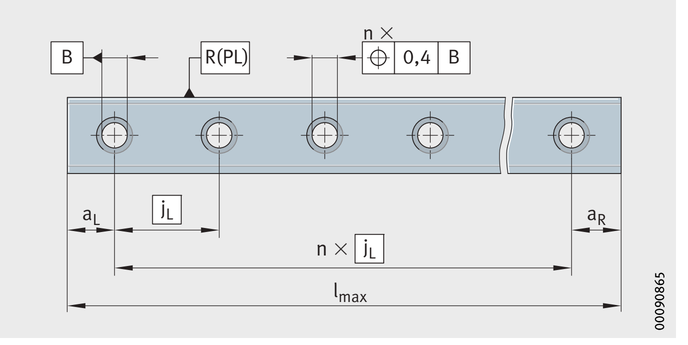


Figure 9
Positional and length tolerances of guideway TKVD14 with one row of holes

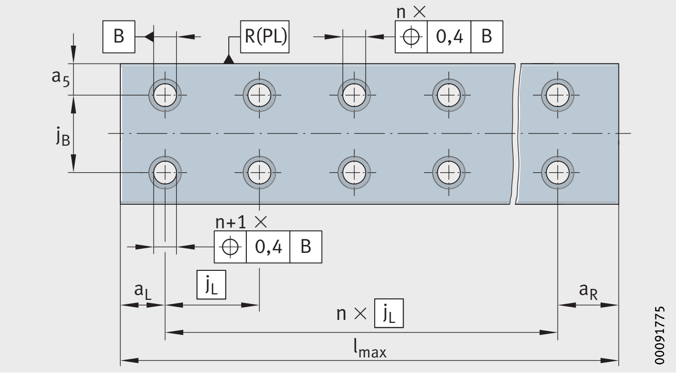


Figure 10
Positional and length tolerances of guideways TKVD32, TKVD42 and TKVD71 with two rows of holes

Length tolerances of guideways

Length tolerance			
Dependent on guideway length l mm			Multi-piece guideways mm
≦ 1 000	1 000 – 3 000	> 3 000	
–1	–1,5	±0,1% of guideway length	±3 over total length

!

If delivery of the guideway as a single piece is not specified in the order, the guideway can optionally be supplied as several segments. Permissible pitch, see table.

Segments for multi-piece guideways

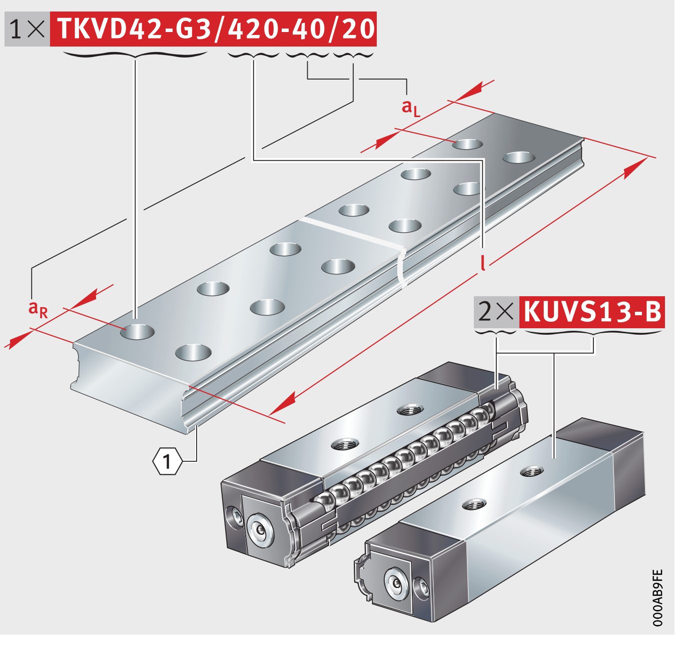
Guideway length[1)] mm	Maximum permissible number of segments
< 3 000	2
3 000– 4 000	3
4 000– 6 000	4
> 6 000	4 plus 1 segment each of 1 500 mm above 6 000 mm guideway length

1) Minimum length of one segment = 600 mm.

Ordering example, ordering designation

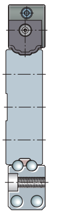
An ordering example is given below for two linear recirculating ball bearing units with one guideway.

Linear recirculating ball bearing units	Two linear recirculating ball bearing units	KUVS..-B
	Size	13
Ordering designation	2×**KUVS13-B**, *Figure 11*	
Guideway with asymmetrical hole pattern	Guideway for linear recirculating ball bearing units	TKVD
	Size	42
	Accuracy class	G3
	Length of guideway	420 mm
	a_L	40 mm
	a_R	20 mm
Ordering designation	1×**TKVD42-G3/420-40/20**, *Figure 11*	

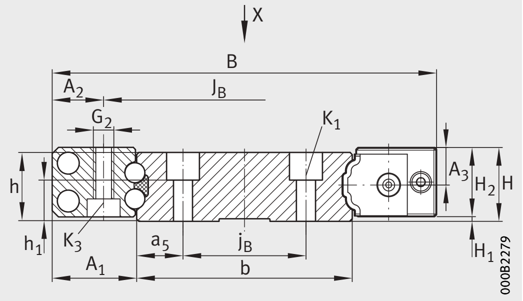


1 Locating face

Figure 11
Ordering example, ordering designation



Linear recirculating ball bearing units Guideways



KUVS..-B with TKVD32, TKVD42, TKVD71

Dimension table · Dimensions in mm

Linear recirculating ball bearing unit	Guideway	Dimensions						Mounting dimensions					
Designation	Designation	l_{max} 2)	H	B	L	h	b	A_1	A_2	J_B	B_1	j_B	a_5
KUVS10-B	**TKVD32**	1 960	11	51,6	47	10	31,8	9,9	5,5	40,6	–	18	6,9
KUVS13-B	**TKVD42**	2 940	19	75	71	18	42	16,5	10	55	–	24	9
KUVS13-B	**TKVD14**	1 940	15	30	71	14	13,5	16,5	10	–	16,2	–	6
KUVS17-B	**TKVD71**	2 940	18	116	96	17	71	22,5	13	90	–	50	10,5

(1) Locating face. (2) Marking.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

2) Maximum length of single-piece guideways.
Permissible number of segments, see page 423.
Longer guideways are supplied as several segments and are marked accordingly.

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

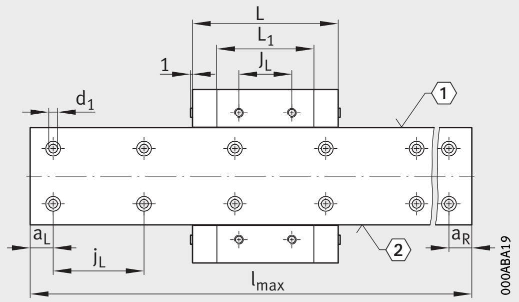
4) In relation to two linear recirculating ball bearing units with TKVD32, TKVD42 and TKVD71, in relation to one linear recirculating ball bearing unit with TKVD14.

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

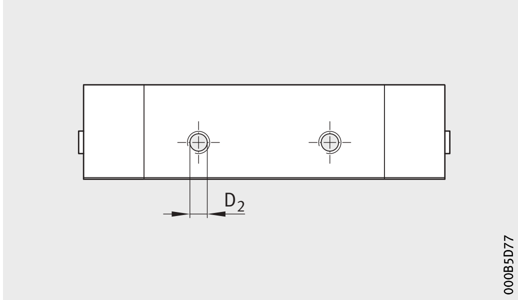
6) The basic load rating can only be transmitted fully if the whole thread length is used and the adjacent construction is dimensioned appropriately.

Dimension table (continued) · Dimensions in mm

Linear recirculating ball bearing unit		Guideway			Load carrying capacity 4) 5)				
Designation	Mass	Designation	Mass	Closing plug	Basic load ratings 6)		Moment ratings		
	m		m		dyn. C	stat. C_0	M_{0x}	M_{0y}	M_{0z}
	≈ kg		≈ kg/m		N	N	Nm	Nm	Nm
KUVS10-B	0,025	**TKVD32**	2,3	KA8-TN	5 700	10 600	203	51	51
KUVS13-B	0,085	**TKVD42**	5,64	KA8-TN	13 500	26 000	648	211	211
KUVS13-B	0,085	**TKVD14**	1,36	KA8-TN	6 750	13 000	–	–	–
KUVS17-B	0,2	**TKVD71**	9,5	KA10-TN	26 000	46 500	1 872	492	492

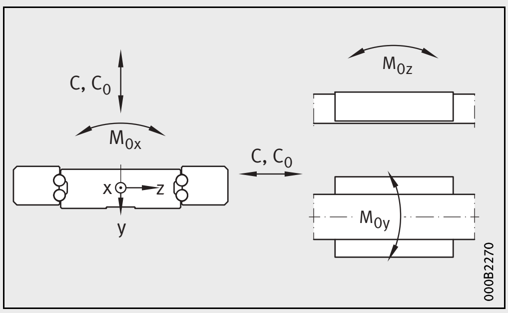


KUVS..-B with TKVD32, TKVD42, TKVD71
View X rotated 90°

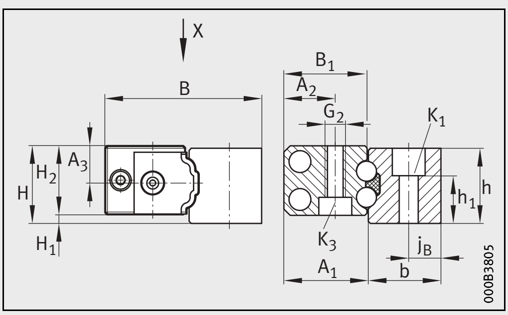


KUVS..-B

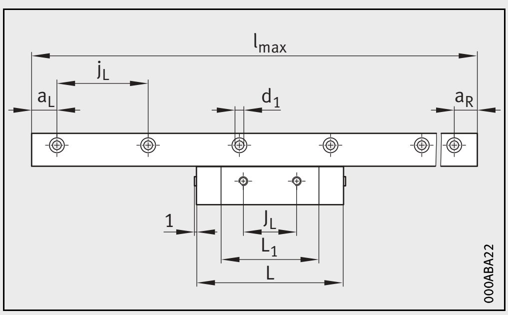
L_1	J_L	j_L	a_L, a_R[3)]		H_1	H_2	A_3	h_1	Fixing screws[1)]						d_1	D_2
									K_1		G_2		K_3			
									DIN ISO 4762-12.9							
			min.	max.						M_A Nm		M_A Nm		M_A Nm		
29,8	15	40	20	34	0,5	10,5	6	3,4	M3	2,5	M3	1,5	–	–	3,8	–
48,5	20	60	20	53	5,5	13,5	7,3	11,4	M3	2,5	M4	3	M3	2,5	3,8	3,3
48,5	20	60	20	53	1,5	13,5	7,3	7,4	M3	2,5	M4	3	M3	2,5	3,8	3,3
64	35	60	20	53	0,5	17,5	9,5	8,3	M5	10	M6	10	M4	3	6	4,9



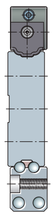
Load directions



KUVS..-B with TKVD14

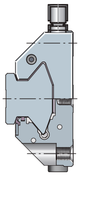


KUVS..-B with TKVD14
View X rotated 90°



Hydrostatic compact guidance system

Carriages and guideways
Accessories



Hydrostatic compact guidance system

X-life
Carriages
Guideways

.... **438**

The hydrostatic compact guidance system HLE is a complete unit that can damp vibrations directly at the bearing seat, without additional components and irrespective of position.

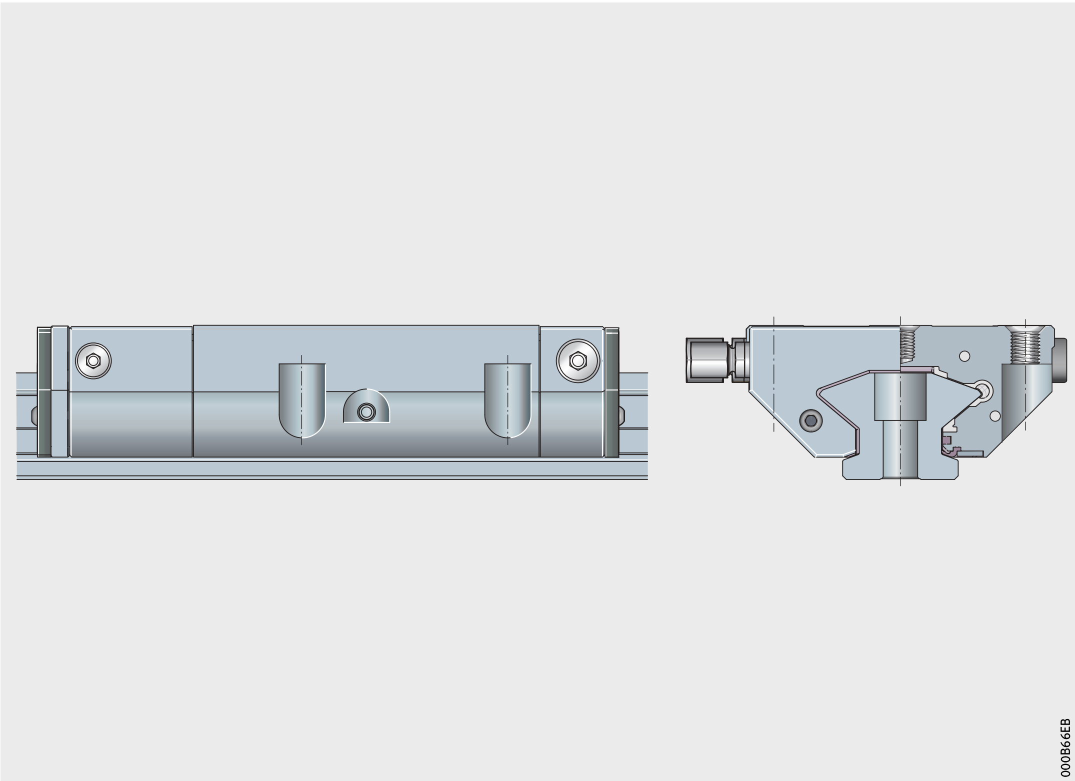
Since there are no rolling elements present, no wear under rolling contact occurs in the guidance system, so the operating life can be exceeded many times over in comparison with conventional monorail guidance systems.

Accessories

.... **468**

These include closing plugs for the guideways as well as a suitable fitting tool for pressing in the closing plugs (hydraulic fitting device).

The fitting carriage is a mechanical element that facilitates the alignment of guideways in mounting.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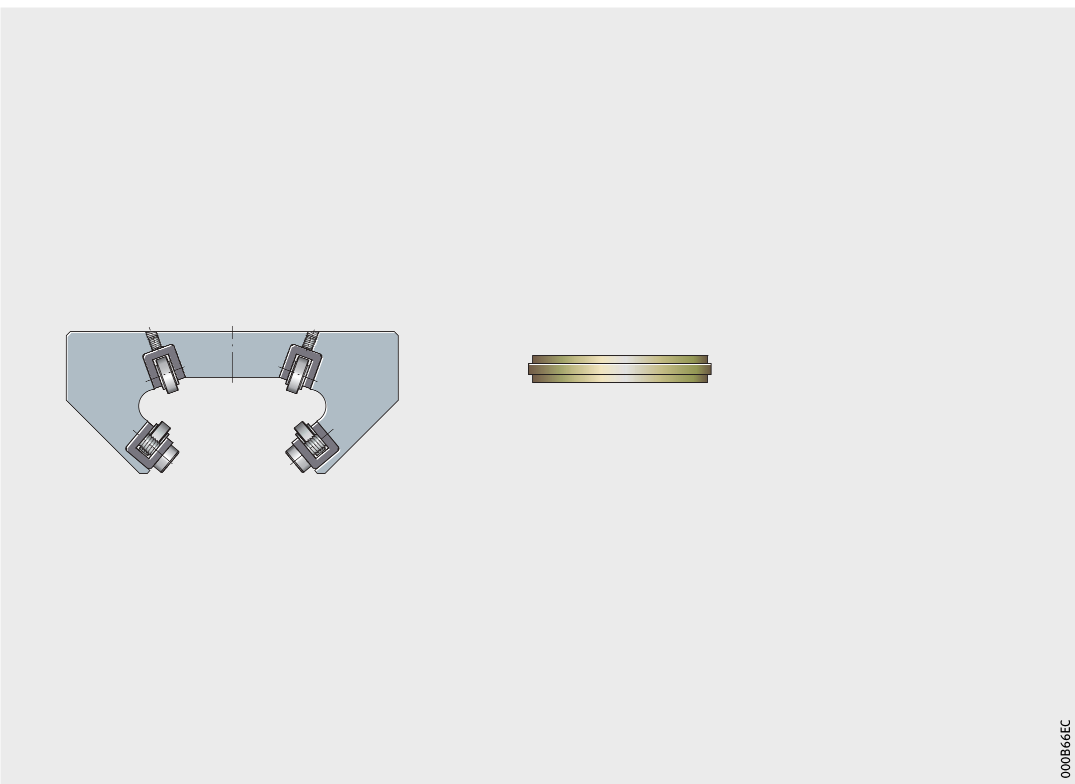
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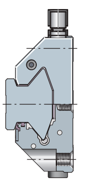

Hydrostatic compact guidance system

Carriages
Guideways

Hydrostatic compact guidance system

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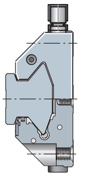


Matching the design envelope of a monorail guidance system

HLE45-A-XL

Carriages

Guideways

HLW45-A..-XL

TSH45-XL

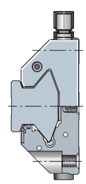
Standard accessories

Brass closing plug

KA20-M

Mounting manual

MON 50



Hydrostatic compact guidance system

Features

The carriages in monorail guidance systems based on rolling contact cannot accommodate vibration damping. In order to allow appropriate damping of vibrations from the adjacent construction, additional elements such as the passive damping carriage RUDS-D for the linear recirculating roller bearing and guideway assemblies RUE-E are necessary, which is positioned between the carriages. In order to have the greatest effect when bending vibrations occur, however, the damping element must be positioned at the point of largest deflection. For this reason, knowledge of the vibration modes is absolutely necessary.

X-life

Hydrostatic compact guidance systems HLE45-A-XL are supplied in X-life quality.

Since there are no rolling elements present, the guidance system is not subject to wear under rolling contact, so the operating life can be exceeded many times over in comparison with conventional monorail guidance systems.

Hydrostatic vibration damping within the design envelope of a monorail guidance system

For applications with very high demands on damping, dynamic rigidity, very good running characteristics and load carrying capacity, there is now a hydrostatic compact guidance system based on our proven linear recirculating roller bearing and guideway assemblies RUE..-E for size 45.

This sealed and preloaded guidance system is a complete unit. Through use of the hydrostatic compact guidance system, vibration can be damped irrespective of position, directly at the bearing seat and there is no longer any requirement for retrofitting with damping-specific components.

The guidance systems combine damping values of more than 470 000 kg/s with levels of tensile/compressive rigidity that are almost as high as the rigidity of the corresponding rolling element guidance systems. When used in machine tools, this gives higher cutting output, better surface quality and longer tool life.

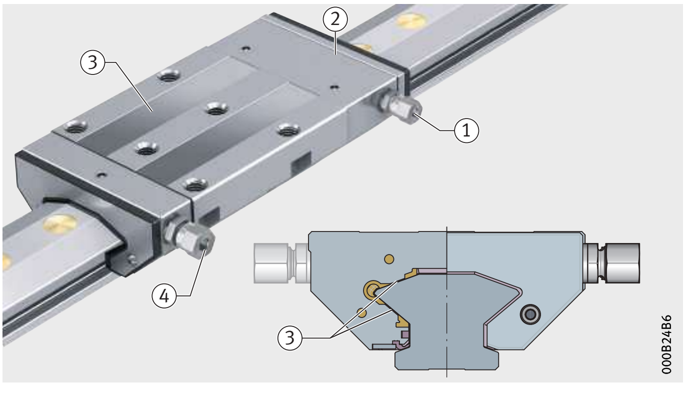
A special bronze coating in the pressure pockets of the saddle plate gives excellent emergency running characteristics, which means that the guidance system is not damaged immediately even when overloaded or during operation without hydraulic pressure.

Functional principle

A carriage has one pressure pocket per raceway that is subjected to the pressure of hydraulic oil, *Figure 1*. The oil is fed to the pressure side under a continuous pressure of 100 bar. The end piece on the pressure side contains flow control valves. These are supplied already set to optimum values and control the oil flow rate for all pressure pockets, so setting by the customer is not necessary. This ensures that the maximum forces can be supported. Product data, see dimension table, page 466.

After the oil has left the pressure pocket, the hydraulic oil is approximately unpressurised, is extracted from the compact guidance system on the suction side and can be fed back to the oil circuit.

The carriage has an inner seal on all faces that retains the oil in the carriage. As a result, leakage is reduced to a minimum. It is not necessary to collect the oil as in the case of conventional hydrostatic guidance systems. For sealing, see page 445.



1 Pressure side
2 Integrated flow control valves
3 Pressure pockets
4 Extraction side (unpressurised area)

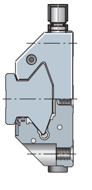
Figure 1
Functional parts

Advantages of this solution

Due to the integral hydraulic control mechanism, the hydrostatic guidance system is ready to fit and can be integrated into the standard design envelope of a linear recirculating roller bearing and guideway assembly.

The demanding adjustment in the mounting of conventional hydrostatic guidance systems is completely eliminated in the case of the hydrostatic compact guidance system HLE45. Furthermore, the hydrostatic compact guidance system does not require complex machining processes on the surfaces in order to achieve optimum gap dimensions, since these are already defined by the system.

Since a carriage can support forces in all directions, except in the direction of motion, its design integration is significantly easier because a counterstay is not required.



Hydrostatic compact guidance system

Only one machine concept required

As a result of compliance with the DIN design envelope, the DIN mounting dimensions for monorail guidance systems (identical geometrical mounting dimensions and identical outline profile) and the excellent damping characteristics of the hydrostatic compact guidance system, several performance classes are possible with a single machine concept. As a result, just one concept can be used to cover various requirements in relation to machining.

Depending on the priority, the following examples are possible:

- excellent surface quality and accuracy in normal machining
- increased cutting rate and cutting depth with high machining quality and accuracy in high performance machining.

Carriages

The saddle plate of the carriages is made from steel, while the pressure pockets in the saddle plate have a special bronze coating. End pieces are mounted on both sides of the saddle plate which ensure the entry and exit of oil.

Guideways

The guideways are made from hardened steel and ground on all sides. The raceways that form the oil gap together with the saddle plate are ground to extremely high precision.

Location from above

Guideways TSH are located from above and have through holes with 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 as several segments, see page 450.

Standard accessories

Brass closing plugs

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

Load carrying capacity

The units can support loads from all directions, except in the direction of motion. In order to facilitate the support of additional moments about all axes, the arrangement must have at least two guideways and four carriages.

A costly counterstay system, as known from conventional hydrostatic guidance systems, is not necessary.

Acceleration and velocity

The hydrostatic compact guidance system is suitable for accelerations up to 100 m/s^2 and velocities up to 2 m/s, see table.

Operating limits

Designation	Acceleration up to m/s^2	Velocity up to m/s
HLE	100	2

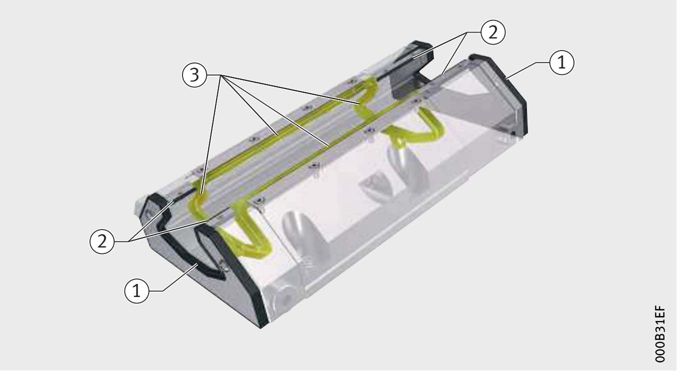
Interchangeability

The carriages and guideways are interchangeable and can therefore be freely combined with other guideways and carriages.

Sealing

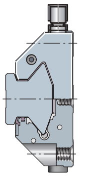
Elastic seals on the end faces and sealing strips on the undersides of the carriages protect the system against contamination.
The carriage has an inner seal on all faces that retains the oil in the carriage. As a result, leakage is reduced to a minimum. A single lip seal made from high performance material fitted to both sides of the carriage additionally protects the interior of the carriage against wear and the ingress of contamination, *Figure 2*.

Where heavy contamination load or aggressive media are present, additional covers should be used to protect the guidance system.



1 End wiper with carrier plate
2 Sealing strip giving protection against contamination
3 All-round seal for retention of the hydraulic oil

Figure 2
Standard sealing concept



Hydrostatic compact guidance system

Operating conditions

For operation of a hydrostatic compact guidance system, a hydraulic oil HLP 46 corresponding to classification in accordance with DIN 51524-2 is required. The oil corresponds to the viscosity grade ISO VG 46 and must be filtered to a particle size of 10 μm.

The operation of a carriage requires 1,3 l/min of hydraulic oil HLP 46. If the hydrostatic compact guidance system is to be operated using a hydraulic oil of a different viscosity grade, this will have effects on the rigidity, load carrying capacity and flow rates.

Furthermore, a hydraulic unit including extraction (optionally an extraction module), see page 454, and a cooling system is necessary.

Operating temperature

The compact guidance system is designed for a hydraulic oil HLP 46 in the temperature range from +20 °C to +34 °C. In this range, the rigidity, load carrying capacity and flow rate are approximately constant.

Corrosion-resistant design

There is no corrosion-resistant design of the hydrostatic compact guidance system.

Designs

The hydrostatic compact guidance system HLE is available in one design.

Available designs

A hydrostatic system comprises at least two guideways TSH45-XL each with two carriages (1×HLW45-A-SR-XL and 1×HLW45-A-SL-XL) and brass closing plugs KA20-M to close off the fixing holes in the guideways. As an option, Schaeffler offers a conical closing plug KA20-M-konisch made from brass, which ensures even lower oil discharge, see page 471.

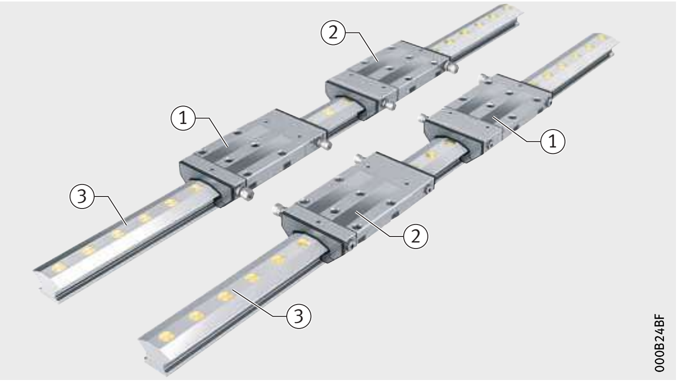
The guideways are supplied as a single piece up to a maximum length of 2 800 mm; guideways comprising joined segments are permissible.

Design and safety guidelines

The flow control valves in the carriage are preset to the relevant flow rate.

!

A system with hydrostatic compact guidance systems always comprises at least two guideways each with two carriages, *Figure 3*. It is not possible to design a system with only one guideway or one carriage.



① Carriage HLW45-A-SL-XL
② Carriage HLW45-A-SR-XL
③ Guideway TSH45-XL

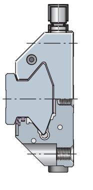
Figure 3
Hydrostatic guidance system

Preload

At an input pressure of 100 bar, the guidance unit HLE45-A-XL in a load-free state is preloaded to a pressure of approx. 50 bar per raceway (pressure pocket).

Friction

The friction in the hydrostatic compact guidance system results almost exclusively from the friction of the integrated seals. Due to the absence of rolling element recirculation, the displacement resistance of the HLE is very constant and, with correct extraction from the carriage, is approx. 20 N per carriage. If the dynamic pressure on the carriage is greater than 0,2 bar, this will lead to an increase in friction and possibly to leakage, see page 454. The friction is independent of load until the load limit is reached (positioning of the carriage on the guideway).



Rigidity

The rigidity per carriage is as follows:

- in a compressive direction = 1 200 N/μm
- in a tensile direction = 900 N/μm
- in a lateral direction = 500 N/μm.

The values were determined under an input pressure of 100 bar. They include the deformation of the hydrostatic guidance unit HLE , including the screw connections to the adjacent construction.

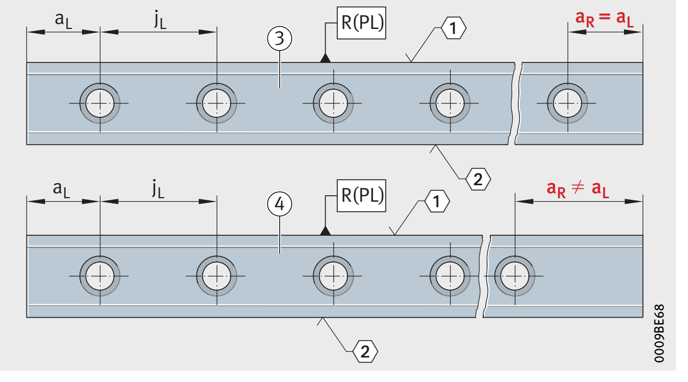
The rigidity curves are valid only for mounting using six screws and an appropriate oil supply, see page 454.

Hole patterns of guideways

Unless specified otherwise, the guideways have a symmetrical hole pattern where $a_L = a_R$, *Figure 4*.

An asymmetrical hole pattern may also be available upon request. In this case, $a_L \geqq a_{L\,min}$ and $a_R \geqq a_{R\,min}$, *Figure 4*.

If the locating face is on the top, a_L is on the left and a_R on the right, *Figure 4*.



1 Locating face
2 Marking
3 Symmetrical hole pattern
4 Asymmetrical hole pattern

Figure 4
Hole patterns of guideways with one row of holes

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:

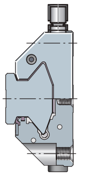
$$a_L = a_R = \frac{1}{2} \cdot \left(l - n \cdot j_L\right)$$

Number of holes:

$$x = n + 1$$

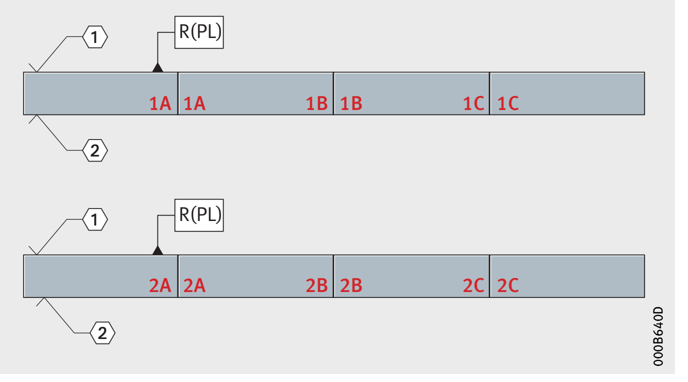
n	–
Maximum possible number of pitches between holes	
l	mm
Guideway length	
$a_{L\,min}$, $a_{R\,min}$	mm
Minimum values for a_L, a_R, see dimension table	
j_L	mm
Spacing between holes	
a_L, a_R	mm
Spacing between start or end of guideway and nearest hole	
x	–
Number of holes.	

! If the minimum values for a_L and a_R are not observed, the counterbores of the holes may be intersected. Risk of injury.



Multi-piece guideways

If the guideway length required is greater than l_{max}, see dimension table, or joined guideways are required, these guideways are assembled from segments that together comprise the total length. The segments are matched to each other and marked, *Figure 5*. The pitch is always located centrally between the fixing holes.



⟨1⟩ Locating face
⟨2⟩ Marking
Guideway segments:
1A, 1A 1B, 1B 1C, 1C
2A, 2A 2B, 2B 2C, 2C

Figure 5
Marking of multi-piece guideways

In order to achieve the necessary integrity, the guideway segments must be bonded to each other by adhesive. Observe the guidelines in the mounting manual MON 50.

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 can be achieved most easily when the guideway is pressed against a locating face.

Geometrical and positional accuracy of the adjacent 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.

Observe the tolerances according to *Figure 6*, page 452.

Surfaces should be ground or precision milled with the objective of achieving a mean roughness value Ramax 1,6.

Any deviations from the stated tolerances will reduce the overall accuracy and impair the function.

Height difference ΔH

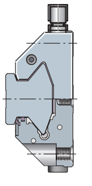
For ΔH, permissible values are in accordance with the following equation. If larger deviations are present, please contact us.

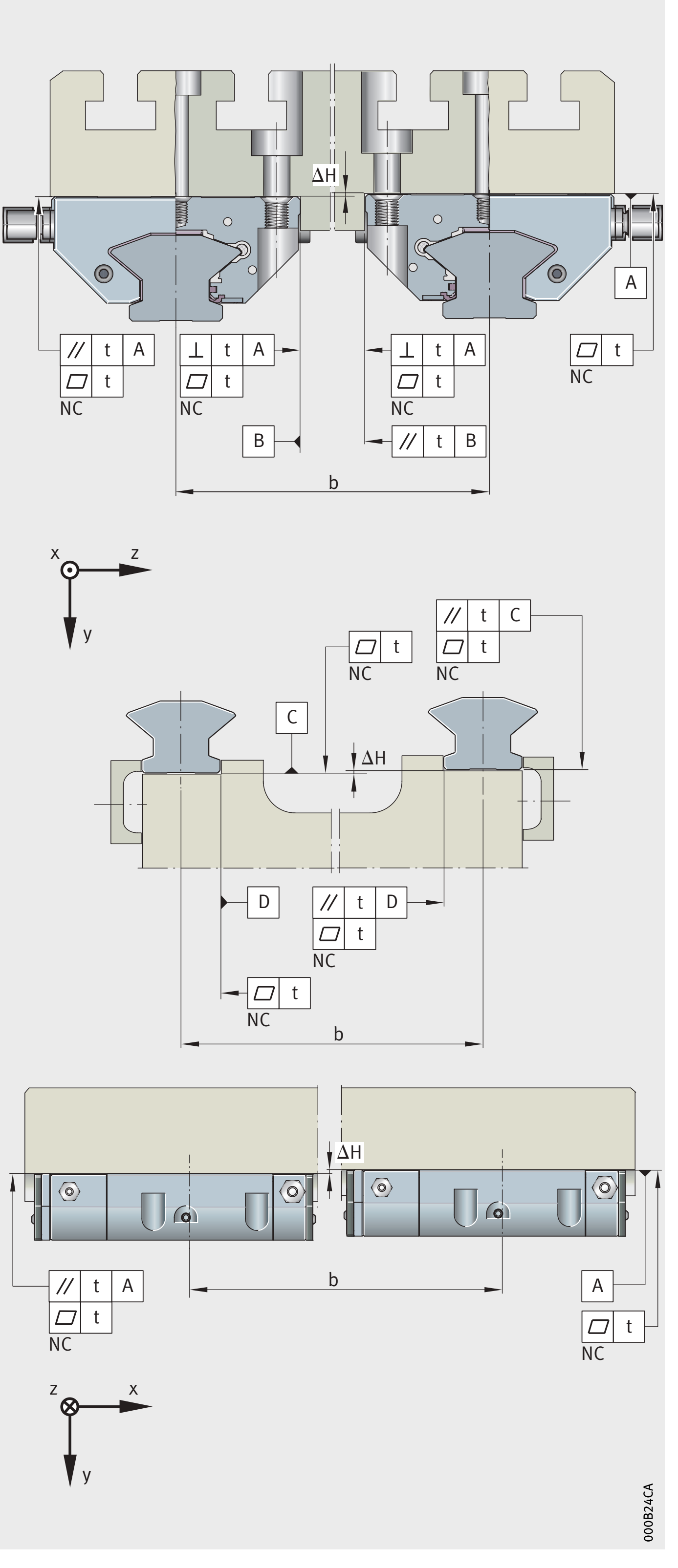
$$\Delta H = a \cdot b$$

ΔH µm
Maximum permissible deviation from the theoretically precise position, *Figure 6*, page 452

a –
Factor dependent on preload class, in this case: 0,075

b mm
Centre distances between guidance elements.





NC = not convex

b = spacing between guidance elements
ΔH = height difference
t = parallelism, flatness and perpendicularity tolerance

Figure 6
Tolerances of mounting surfaces and parallelism of mounted guideways and carriages

Parallelism of mounted guideways

For guideways arranged in parallel, the parallelism tolerance t should be in accordance with *Figure 6*, page 452, and table.

Parallelism tolerance t of guideways

Designation	Parallelism, flatness and perpendicularity t μm
TSH45-XL	< 10

!

If the maximum values are used, this may increase the displacement resistance.

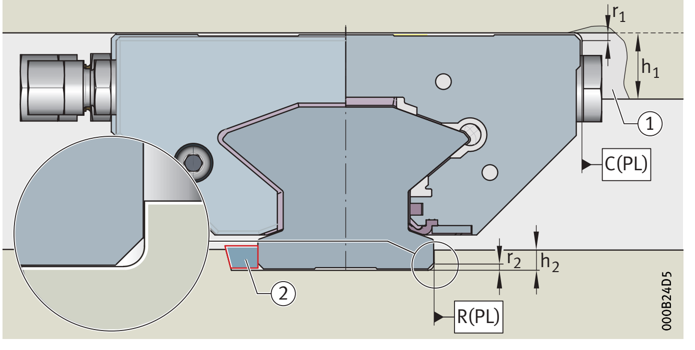
Locating heights and corner radii

The locating heights and corner radii must be matched to the compact guidance system, see table and *Figure 7*.

The adjacent construction must include a recess for the closing plugs and the pipe screw connectors, *Figure 7*.

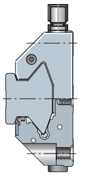
Locating heights, corner radii

Designation	h_1 mm	h_2 max. mm	r_1 max. mm	r_2 max. mm
HLE45-A-XL	10	8	1	0,8



① Recess in the adjacent construction
② Vee strip

Figure 7
Locating heights and corner radii



Mounting of the compact guidance system

Never slide the carriage onto the guideway without oil. Otherwise, the seals may be damaged.

Before the carriages are slid into place, the guideways must be aligned, firmly screwed down and the holes must be closed off using brass plugs. Otherwise, the seals may be damaged.

When using the hydrostatic guidance system, both guideways and one side of the carriages should have a fixed stop.

Before mounting the guideways and carriages, the mounting steps and warning messages in the mounting manual MON 50 must always be observed.

Mounting

Carry out mounting as described in the following steps:

- Slide the oiled carriage onto the guideway and move it to the mounting position without load.
- Make the hydraulic connection to the carriage (the positions of the pipe screw connectors for the oil connection lines and the closing plugs can be transposed to the other side if required).
- Apply the operating pressure to the system.
- Locate the mating part on the carriages.
- Screw in the carriage screw from the rear face of the carriage (from above).

The guidance system is thus ready for operation.

Hydraulic unit

Each carriage must have a volume flow of 1,3 l/min.

Inlet and outlet lines for the hydraulic system

The largest possible line diameters must always be selected.

Inlet line

In order to minimise the pressure losses due to pipe resistance, the pipe cross-section should only be reduced immediately before the connector to the carriage to an inside diameter of 4 mm. The pressure connector fitted to the carriage conforms to L6 (M12×1,5) in accordance with DIN EN ISO 8434-1 (the screw thread in the carriage is M10×1).

A shut-off valve should be fitted in the inlet pipe that will stop pressure being applied to the carriage if the pressure in the extraction pipe is too high (1 bar). This prevents damage to the system. The safety circuit is shown in the fluid diagram, *Figure 12*, page 460.

Outlet line

In the outlet pipe, the pipe resistance as far as the extraction pump for all connected carriages must be identical and as low as possible, in order to ensure uniform suction from all carriages. The pipe cross-section should be as large as possible and should only be reduced immediately before the connector to the carriage to an inside diameter of 6 mm.

The extraction connector fitted to the carriage conforms to L8 (M14×1,5) in accordance with DIN EN ISO 8434-1(the screw thread in the carriage is M12×1,5).

After exit from the carriage, the extraction pipe should be expanded after a maximum of 300 mm to an inside diameter of 16 mm in order to minimise the line resistance.

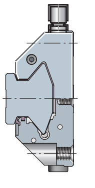
When using longer outlet pipes (> 2 m), the oil should be sucked out by the extraction module directly on the guidance axis. Through the use of the extraction module, the pipe cross-sections towards the unit can be reduced.

The dynamic pressure on the extraction side of the carriage must be less than 0,2 bar, in order to minimise leakage and friction of the guidance system. Where there are higher requirements relating to leakage and friction, there should be an underpressure on the extraction side of the carriage (up to –0,5 bar).

Pipe cross-sections should be designed in accordance with the volume flows. The pipe resistances of the extraction and pressure pipe must always be calculated; please consult us as necessary.

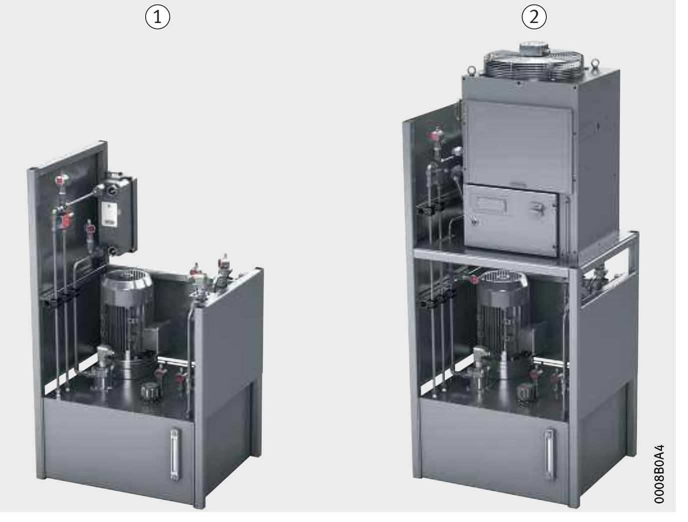
A pressure switch must be provided in the hydraulic unit that authorises motion of the hydrostatic axis in the controller only when sufficient pressure is present.

Movement and operation of the guidance system should only be carried out (despite the excellent emergency running characteristics) when the hydraulic system is active.



**Example:
Hydraulic unit and
extraction module from HYDAC
for guidance systems HLE45-A-XL**

The following examples are concepts only, which must be adapted to the corresponding requirements of the application. In partnership with the company HYDAC, a hydraulic unit and extraction module were configured as examples. The hydraulic unit was designed with 3 power levels for guidance systems with 4, 8 and 12 carriages.
In order to provide the necessary cooling performance for the guidance system, the unit can be combined with a suitable compressor cooling system, *Figure 8*.



① Hydraulic unit for HLE45-A-XL
② Hydraulic unit for HLE45-A-XL with compressor cooling system

Figure 8
Hydraulic units

Features

The hydraulic unit configured with the company HYDAC has the following features:

- power level matched to 4, 8 or 12 carriages
- electronic monitoring of:
  - contamination indicator on pressure side
  - contamination indicator on extraction side
  - oil level
  - oil temperature
  - pressure on pressure side
  - pressure on extraction side
  - pressure in the cooling loop
- filtration of oil on pressure side and return side
- in the case of ambient temperatures deviating from the specified range, see table, page 457, special tempering carried out as necessary.

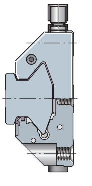
Where there are long return distances to the hydraulic unit or when using energy chains, an additional extraction module is recommended in order to assist the return movement of oil.

The technical data for the hydraulic unit are indicated for guidance systems with different numbers of carriages, see table.

Technical data for hydraulic unit (HYDAC)

Characteristics			Design		
			Number of carriages		
			4	8	12
Motor					
Rated frequency		Hz	50		
Rated speed		min^{-1}	1 420		
Connection voltage (threephase current)		V	400		
Rated power		kW	2,2	4	5
Pump					
Volume flow		l/min	5,2	10,4	15,6
Volume flow with extraction module		l/min	6,7	13,4	20,1
Controller					
Pressure setting		bar	115		
Duty cycle					
Continuous operation		bar	Suitable		
Tank					
Fill volume		l	80	100	120
Mounting position		–	Horizontal		
Ambient temperature					
	min.	°C	–10		
	max.	°C	+30		
Cooling system					
Power of compressor chiller		kW	1,5	3,3	5,8
Heat exchanger		–	HYDAC HEX S610		
Pressure fluid					
Mineral oil HL/HLP to		–	HLP 46, DIN 51524-2		
Oil temperature[1]	min.	°C	+20		
	max.	°C	+34		

[1] The values are based on the recommended operating conditions of the hydrostatic compact guidance system. If other temperature requirements are present, please consult us.



Dimensions

The external dimensions of the hydraulic units with and without a compressor cooling system differ only in the height, *Figure 9* and *Figure 10*.

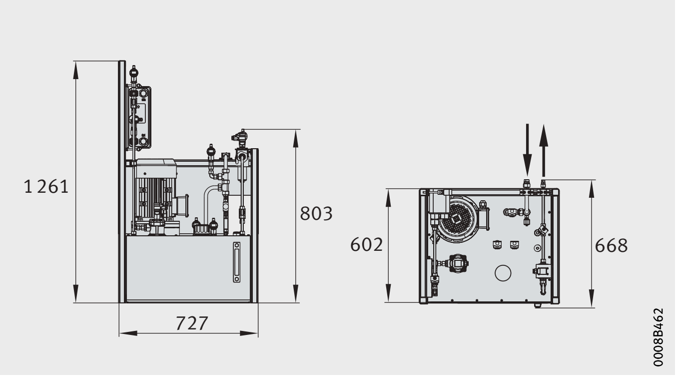


Figure 9
Hydraulic unit for HLE45-A-XL
without compressor cooling system

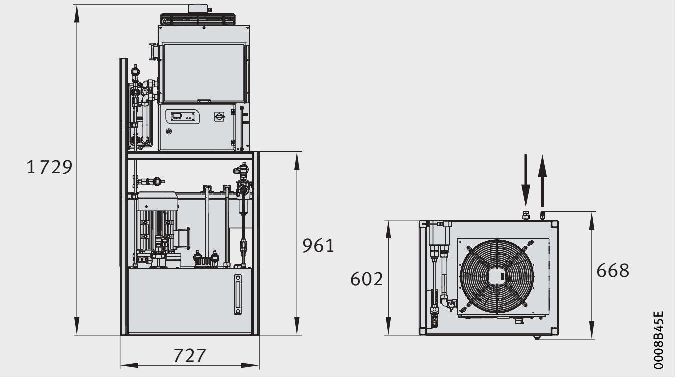


Figure 10
Hydraulic unit for HLE45-A-XL
with compressor cooling system

The dimensioning of the hydraulic pipe connectors is dependent on the number of carriages for which the unit is designed, see table.

Hydraulic pipe connectors

Number of carriages	Hydraulic pipe connector	
HLW45-A	Outlet	Inlet
4	10L	15L
8	12L	18L
12	15L	22L

Extraction module (HYDAC)

The use of an extraction module, for example from HYDAC, gives significant advantages in oil extraction:

- Where there are long return distances to the hydraulic unit or when using energy chains, an additional extraction module is recommended in order to assist the return movement of oil. In order that the pressure on the extraction side of the carriage is as low as possible, the extraction module should be positioned as close as possible to the carriages. The extraction module is resistant to dynamic pressures in the outlet pipes and can compensate these dynamic pressures to a value of 2,5 bar.
- The use of an extraction module allows the use of significantly smaller hose diameters. This means that less space is required in the energy chain.

One extraction module can be used to extract from up to 4 carriages HLW45-A. Each extraction module requires an additional volume flow of 1,5 l/min.

Dimensions and hydraulic connections of the extraction module, *Figure 11* and table, page 459.

Hydraulic connectors:
1 Motor IN
2 Pump IN
3 OUT

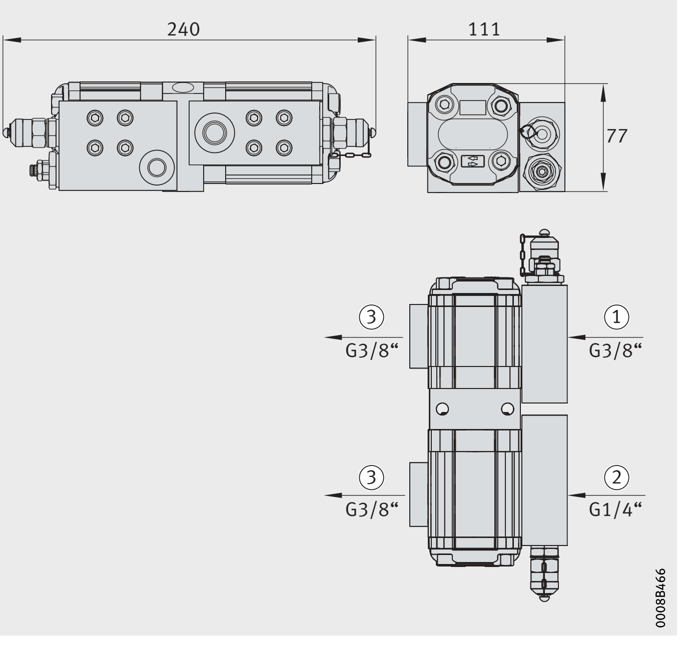
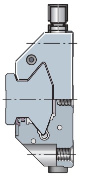


Figure 11
Extraction module

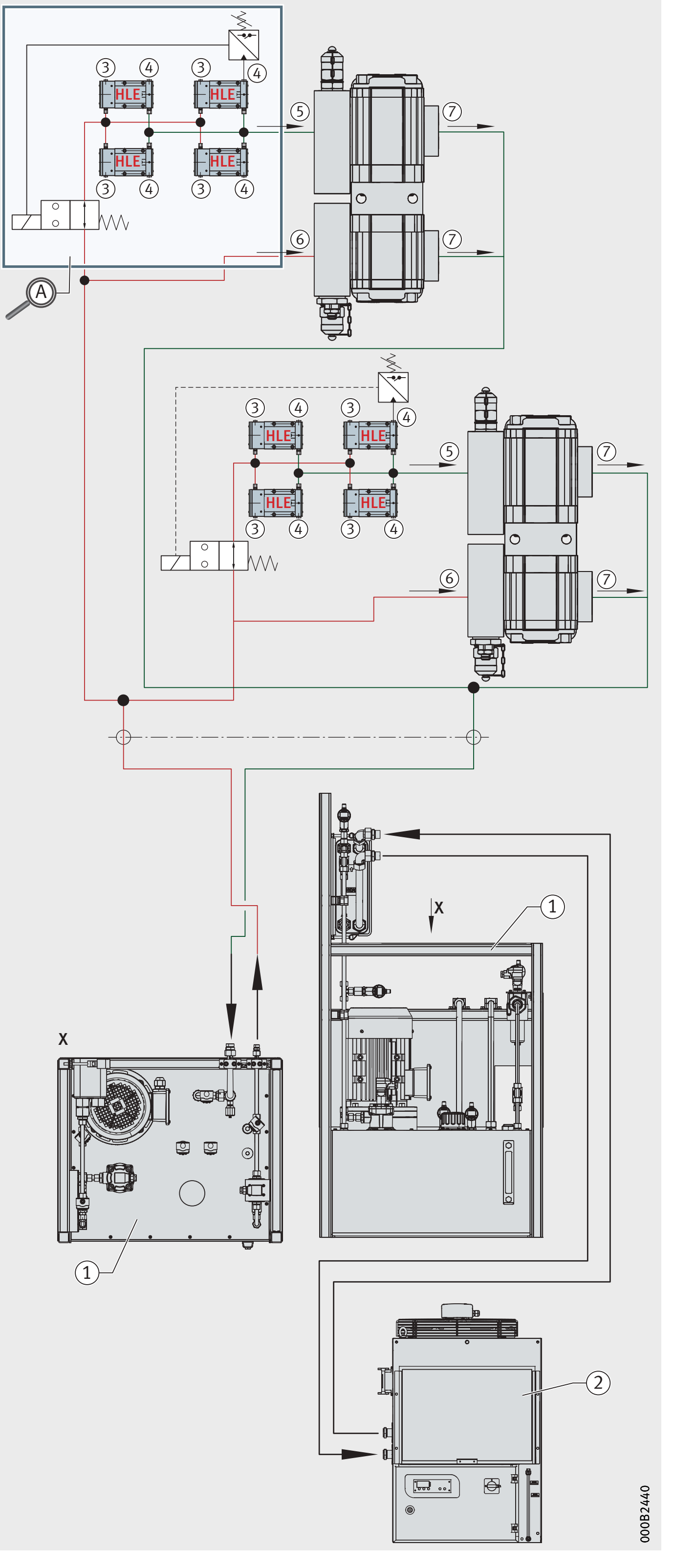


Hydraulic connections of the extraction module

Connector	Function	Recommended inside diameter of pipe mm
Pump IN	Connector for the combined outlet pipes of the carriages	8
Motor IN	Supply of hydraulic oil to pump in extraction module directly from hydraulic unit, operating pressure 100 bar	4
OUT	Connector for unpressurised outlet pipe to hydraulic tank. Configuration possible as pipe or preferably as hose	16

Hydrostatic compact guidance system

Fluid diagram



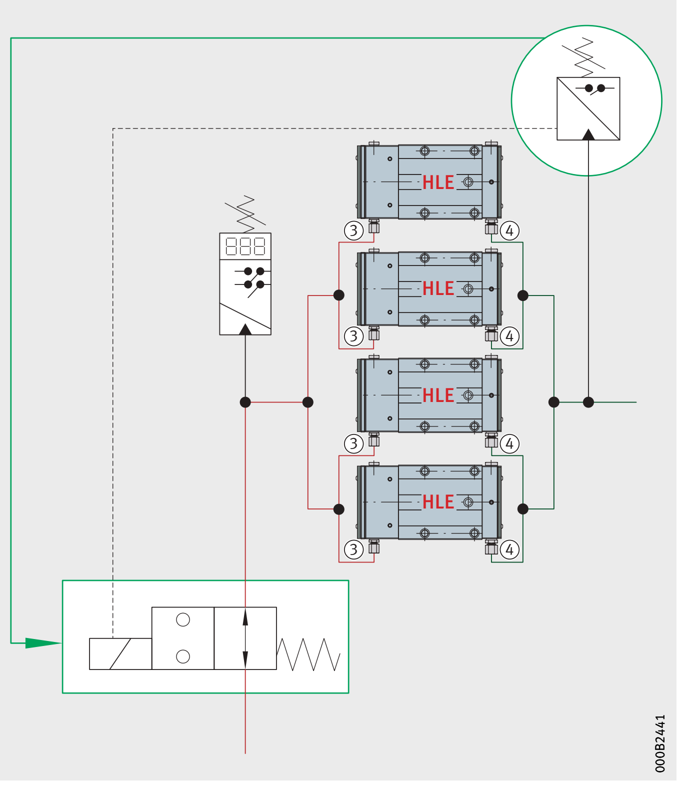
① Hydraulic unit
② Cooling device
③ Pressure side
④ Extraction side
⑤ Pump IN
⑥ Motor IN
⑦ Outlet pipe to tank OUT

Figure 12
Example unit
with extraction module
for demanding pipework systems

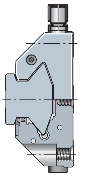
Detail A

③ Pressure side
④ Extraction side

Figure 13
Example of safety circuit
for protection against overpressure
in outlet pipe



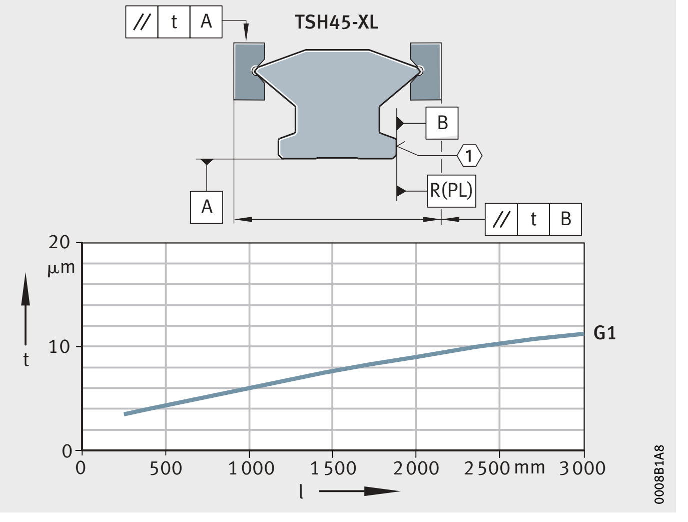
Pipe cross-sections should be designed in accordance with the volume flows.



Accuracy

Accuracy classes

The hydrostatic compact guidance system HLE45-A-XL is available in the accuracy class G1, *Figure 14*.



t = parallelism tolerance
l = total guideway length

1 Locating face

Figure 14
Parallelism tolerances of guideways

Parallelism of raceways to locating surfaces

The parallelism tolerance of the guideways is indicated for the accuracy class G1, *Figure 14*, page 462.

Tolerances

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 should always remain within the tolerance irrespective of the position of the carriage on the guideway, see table.

Datum dimensions H and A_1, *Figure 15*.

Running accuracy

The running accuracy is influenced by the accuracy of the adjacent construction.

Tolerances of accuracy class

Tolerance		Accuracy G1 µm
Tolerance for height	H[1]	±10
Difference in height[2]	ΔH	5
Tolerance for spacing	A_1[1]	±10
Difference in spacing[2]	ΔA_1	7

[1] Theoretical value used in production.

[2] Difference between several carriages on one guideway, measured on a calibration rail at the same point on the guideway.

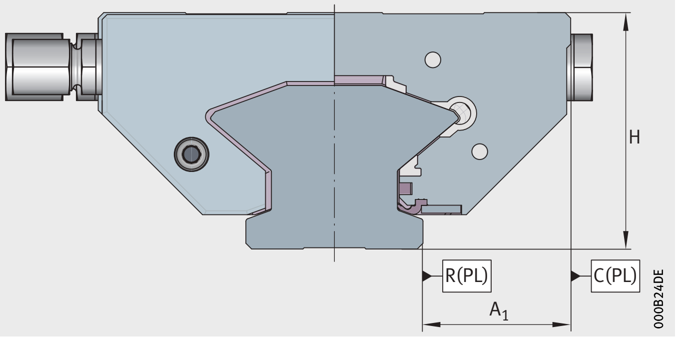
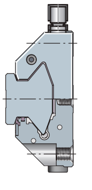


Figure 15
Datum dimensions for accuracy



Positional and length tolerances of guideways

Positional and length tolerances of guideways, *Figure 16* and table.

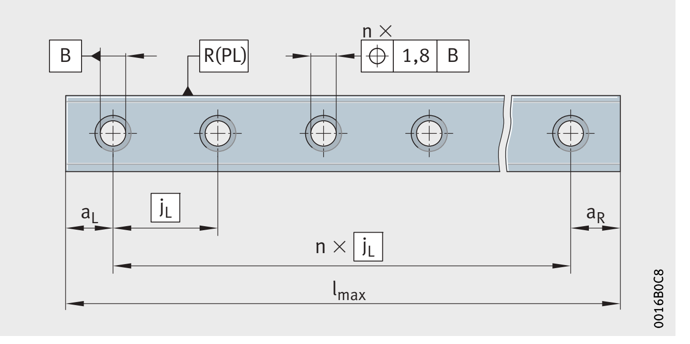


Figure 16
Positional and length tolerances of guideways

Length tolerances of guideways

Designation	Tolerances of guideways, as a function of length l_{max} 1)	
	≦1 000 mm	>1 000 mm <2 800 mm
TSH45-XL	–1 mm	–1,5 mm

1) Length l_{max}, see dimension table.

Ordering example, ordering designation

Symmetrical hole pattern

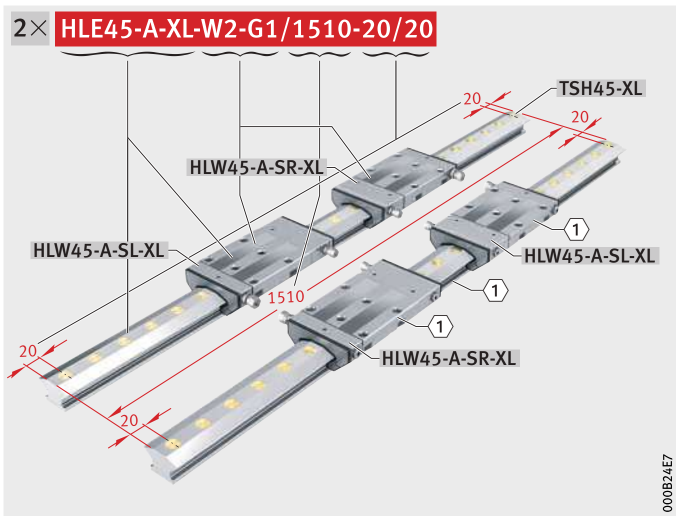
System design:

Hydrostatic compact guidance system	HLE..-A-XL
Size	45
Number of carriages per unit	W2
Accuracy class	G1
Length of guideway	1 510 mm
a_L	20 mm
a_R	20 mm

Ordering designation 2×**HLE45-A-XL-W2-G1**, *Figure 17*

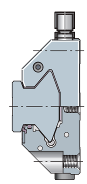
Composition:

- 2×TSH45-XL-G1/1510-20/20
- 2×HLW45-A-SR-XL
- 2×HLW45-A-SL-XL.

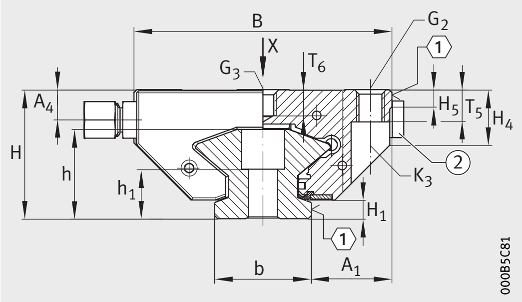


1 Locating face

Figure 17
Ordering example,
ordering designation



Hydrostatic compact guidance system



HLE45-A-XL

Dimension table · Dimensions in mm

Designation	Carriage		Guideway			Dimensions				Mounting dimensions				
	Designation	Mass m ≈ kg	Designation	Mass m ≈ kg	Closing plug	l_{max}	H	B	L	A_1	J_B	b $^{-0,005}_{-0,035}$	L_1	L_S
HLE45-A-XL	HLW45-A-SR-XL[3] HLW45-A-SL-XL[4]	6	TSH45-XL	12,4	KA20-M	2 800	60	120	226,5	37,5	100	45	134,2	2,2

① Locating face. ② Closing plugs. ③ Pressure connector (pipe screw connector) L6 (M12×1,5) in accordance with DIN EN ISO 8434-1. ④ Extraction connector (pipe screw connector) L8 (M14×1,5) in accordance with DIN EN ISO 8434-1. The positions of the pipe screw connectors (as standard on the opposing side to the locating face) and closing plugs can be transposed if necessary.

1) The basic load rating can only be transmitted fully if the whole thread length is used and the adjacent construction is dimensioned appropriately.

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

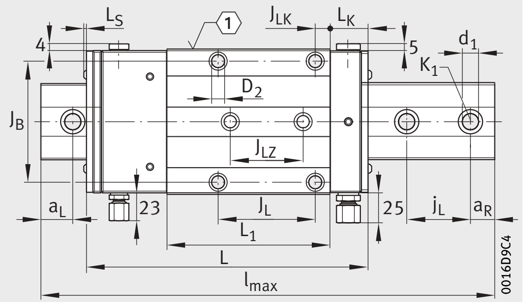
3) Position of screw connection on right.

4) Position of screw connection on left.

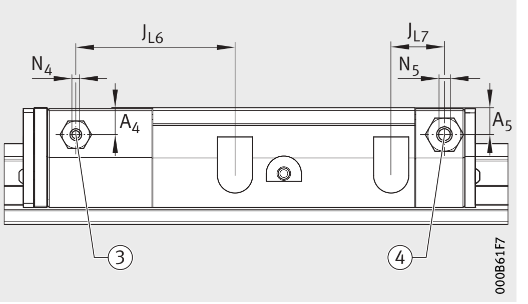
5) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 69 and page 26.

Dimension table (continued) · Dimensions in mm

Designation	Fixing screws[5]										Pipe screw connection					
	G_2		G_3		K_1		K_3		d_1	D_2	A_4	N_4	J_{L6}	A_5	N_5	J_{L7}
	DIN ISO 4762-12.9															
		M_A Nm		M_A Nm		M_A Nm		M_A Nm								
HLE45-A-XL	M12	83	M12	83	M12	140	M10	83	14	10,1	13,8	4	81,6	13,8	6	27,3

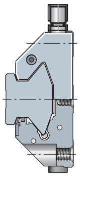


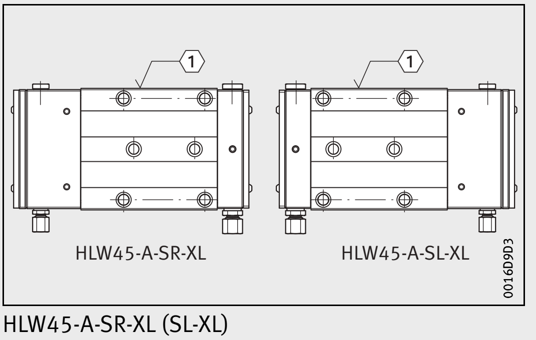
HLE45-A-XL
View X rotated 90°



Pressure oil connector on side

L_K	J_L	J_{LK}	J_{LZ}	j_L	a_L, a_R[2)]		H_1	H_5	H_4	T_5	T_6	h	h_1	Load carrying capacity at 100 bar in[1)] Compressive direction	Tensile direction	Lateral direction
					min.	max.							±0,5	N	N	N
31	80	12,1	60	52,5	20	41	8,7	8	25,8	15	10	41,5	23	22 000	17 400	10 000





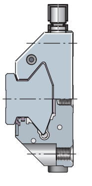
HLW45-A-SR-XL (SL-XL)

Accessories

Closing plugs
Hydraulic fitting device
Fitting carriage

Accessories

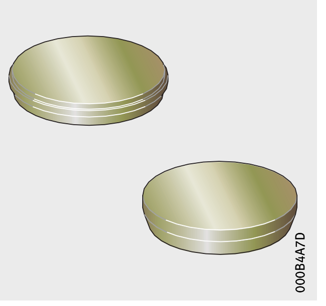
		Page
Product overview	Accessories	470
Closing plugs	Brass closing plugs	471
Hydraulic fitting device		472
	Ordering example, ordering designation	472
Fitting carriage		473



Closing plugs

Brass

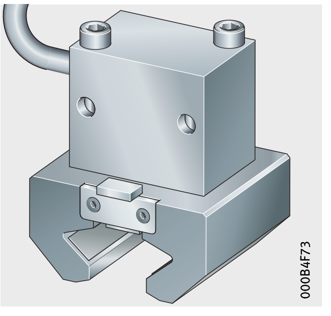
KA20-M, KA20-M-konisch



Hydraulic fitting device

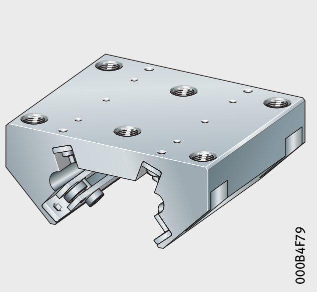
For brass closing plugs

MVH.TSH45



Fitting carriage

MWTSH45



Accessories

Closing plugs

The brass closing plugs KA20-M close off the counterbores for the fixing screws in the guideway holes flush with the surface of the guideway. As an option, Schaeffler offers a conical closing plug KA20-M-konisch made from brass, which ensures even lower oil discharge, *Figure 1*.

When fitting the closing plugs, observe the guidelines in the Technical principles, see page 74.

Brass closing plugs

Brass closing plugs with shear ring

The brass closing plugs KA20-M with a shear ring can be fitted with the aid of a hammer and press-in block.

It is recommended that brass closing plugs should be fitted using the hydraulic fitting device MVH.

During fitting, the shear ring is sheared off, leaving a ring-shaped burr that must be removed. A minimal ring gap remains.

In order to prevent increased leakage as a result of damaged seals, the top surfaces of the plugs must be smoothed off using an oilstone after fitting.

Brass closing plugs, conical

The brass conical closing plugs KA20-M-konisch offer very high retaining force and must be fitted using the hydraulic fitting device MVH. They close off the surface tightly and flush, leaving no ring gap.

In order to prevent increased leakage as a result of damaged seals, the top surfaces of the plugs must be smoothed off using an oilstone after fitting.

KA20-M
Standard
KA20-M-konisch

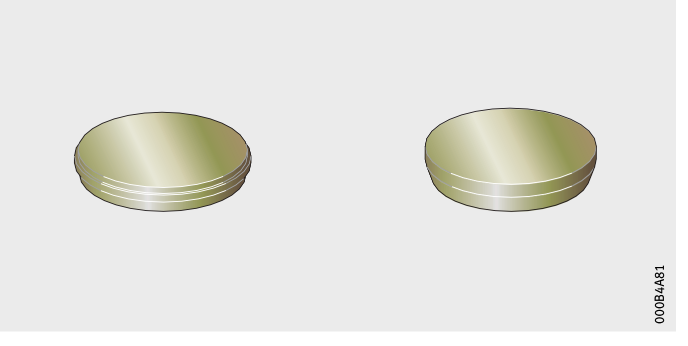
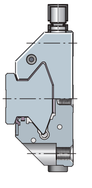


Figure 1
Brass closing plugs



Hydraulic fitting device

With the hydraulic fitting device MVH.TSH45, the closing plugs are pressed in flush with the surface of the guideway, *Figure 2* and page 76.

MVH.TSH45

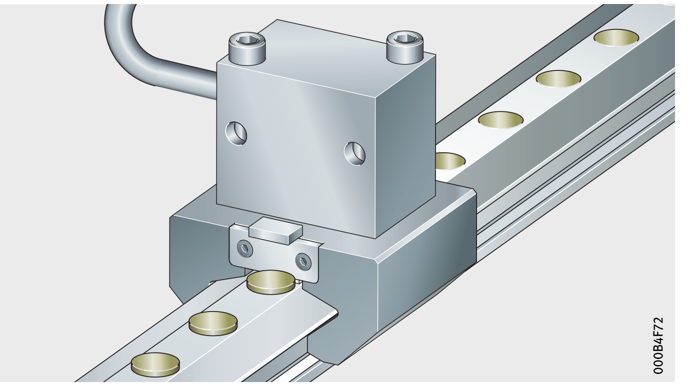


Figure 2
Hydraulic fitting device

Observe the guidelines in the mounting manual MON 50.

Ordering example, ordering designation

A hydraulic fitting device for fitting the closing plugs KA20-M or KA20-M-konisch for the hydrostatic compact unit is to be ordered.

Ordering designation

1×**MVH.TSH45**

Fitting carriage

The fitting carriage MWTSH45 assists in the mounting of guideways. The fitting carriage MWTSH45 contains a track roller set that allows easy and uniform travel on the guideway TSH45-XL and thus facilitates alignment of the guideways during mounting, *Figure 3*. In order to achieve a clearance-free measurement result, the grub screws in the back of the carriage must be adjusted to set the preload of the track roller set.

MWTSH45

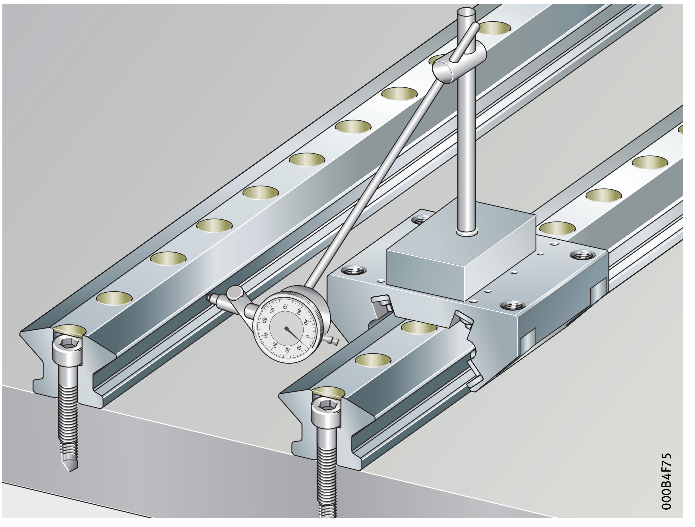
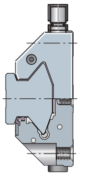
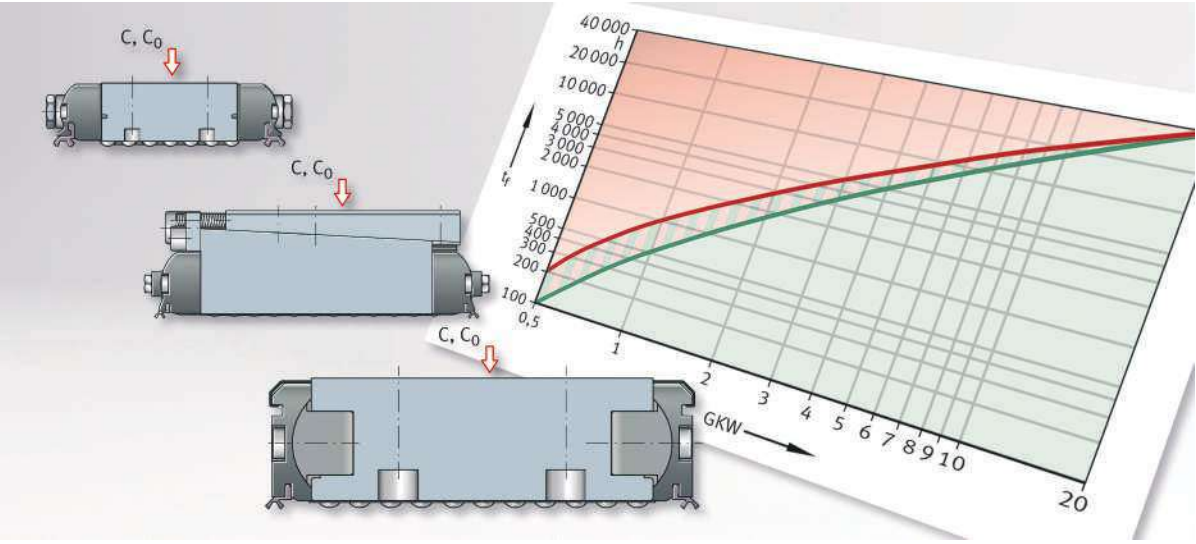


Figure 3
Fitting carriage

Observe the guidelines in the mounting manual MON 50.





Technical principles for linear roller bearings

Load carrying capacity and life
Preload
Friction
Rigidity
Lubrication
Design of bearing arrangements
Mounting guidelines

Technical principles

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Load carrying capacity and life

The size of a linear recirculating roller guidance system is determined by the demands made on its load carrying capacity, life and operational security.

Load carrying capacity

The load carrying capacity of the guidance system is described in terms of the basic dynamic load rating C_{100} and the basic static load rating C_0.

Calculation of basic load ratings according to DIN ISO

The calculation of the basic dynamic and static load ratings given in the dimension tables is based on DIN ISO 14728-1 and 2.

Differences between DIN ISO and suppliers from the Far East

Suppliers from the Far East frequently calculate basic load ratings based on a displacement distance of only 50 km in contrast to 100 km in accordance with DIN ISO. This results in comparatively larger basic load ratings.

Conversion of basic load ratings

The conversion factors are as follows:

$$C_{50} = \mathbf{1{,}23} \cdot C_{100}$$

$$C_{100} = \mathbf{0{,}81} \cdot C_{50}$$

C_{100} N
Basic dynamic load rating in accordance with DIN ISO 14728-1 (based on 100 km)

C_{50} N
Basic dynamic load rating in accordance with DIN ISO 14728-1 (based on 50 km).

Dynamic load carrying capacity and life

The dynamic load carrying capacity is described in terms of the basic dynamic load rating and the basic rating life.

The basic dynamic load rating is the load in N at which the guidance system achieves, with a survival probability of 90%, a displacement distance of 100 km (C_{100}).

The data for the basic dynamic load rating C in the dimension tables correspond to the basic dynamic load rating C_{100} in accordance with DIN ISO 14728-1.

Load carrying capacity and life

Basic rating life

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

$$L = \left(\frac{C_{100}}{P}\right)^p \cdot 100$$

$$L_h = \frac{833}{H \cdot n_{osc}} \cdot \left(\frac{C_{100}}{P}\right)^p$$

$$L_h = \frac{1666}{v_m} \cdot \left(\frac{C_{100}}{P}\right)^p$$

L, L_h km, h
Basic rating life in km or in operating hours

C_{100} N
Basic dynamic load rating.
Effective dynamic load rating for reduced hardness of raceway, see page 482

P N
Equivalent dynamic load.
For determining P under angular misalignments, see page 483

p –
Life exponent:
Linear recirculating roller guidance systems: $p = 10/3$

H m
Single stroke length for oscillating motion

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

v_m m/min
Mean velocity.

In accordance with DIN ISO 14728-1, the equivalent dynamic load P must not exceed 0,5 · C. If lateral forces are present, the frictional locking of the fixing screws must be checked. Ideally, locating edges should be provided.

The equations for calculating the rating life are based on the assumption that the guidance elements are positioned correctly. If angular misalignments are present, a correction factor must be used to determine the equivalent dynamic load P, see page 483.

Equivalent load and velocity

The equations for calculating the basic rating life are based on the assumption that the load P and the velocity v_m are constant. Non-constant operating conditions can be taken into consideration by means of equivalent operating values. These have the same effect as the loads occurring in practice.

Equivalent dynamic load

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

$$P = \sqrt[p]{\frac{q_1 \cdot F_1{}^p + q_2 \cdot F_2{}^p + \ldots + q_z \cdot F_z{}^p}{100}}$$

If the load varies in steps and the velocity varies in steps, the equivalent dynamic load is calculated as follows:

$$P = \sqrt[p]{\frac{q_1 \cdot v_1 \cdot F_1{}^p + q_2 \cdot v_2 \cdot F_2{}^p + \ldots + q_z \cdot v_z \cdot F_z{}^p}{q_1 \cdot v_1 + q_2 \cdot v_2 + \ldots + q_z \cdot v_z}}$$

Mean velocity

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

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

F N
Load on guidance system

P N
Equivalent dynamic load

p –
Life exponent:
Linear recirculating roller guidance systems: p = 10/3

q_z %
Duration as a proportion of the total operating time

v_z m/min
Variable velocity

v_m m/min
Mean velocity.

Operating life

The operating life is defined as the life actually achieved by linear recirculating roller guidance systems. It may differ significantly from the calculated life.

The following factors can lead to premature failure through wear or fatigue:

- misalignment between the guideways
- contamination of the guidance systems
- inadequate lubrication
- oscillating motion with very small stroke length (false brinelling)
- vibration while stationary (false brinelling)
- overloading of the guidance system (even for short periods)
- plastic deformation.

Due to the wide range of possible installation and operating conditions, it is not possible to calculate the operating life of a linear recirculating roller guidance system precisely in advance. The most reliable method of achieving a good estimate of the operating life is by comparison with similar applications.

Static load carrying capacity

The static load carrying capacity of the guidance system is restricted by:

- the permissible load on the linear recirculating roller guidance system
- the load carrying capacity of the raceway (if the guideways are not sourced from Schaeffler)
- the permissible load on the screw connections
- the permissible load on the adjacent construction.

! For design purposes, the static load safety factor S_0 required for the application must be observed. If lateral forces are present, the frictional locking of the fixing screws must be checked. Ideally, locating edges should be provided.

Basic static load ratings

The basic static load ratings are those loads at which the raceways and rolling elements undergo a permanent overall deformation that corresponds to $^1/_{10\,000}$ of the rolling element diameter.

Static load safety factor

The static load safety factor S_0 is the security against permanent deformation at the rolling contact:

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

S_0 –
Static load safety factor

C_0 N
Basic static load rating.
Effective static load rating for reduced hardness of raceway, see page 482

P_0 N
Maximum equivalent static load.

! If high demands are placed on the accuracy and smoothness of running, the static load safety factor should be $S_0 > 3$.

If $S_0 < 3$ for tensile and moment loading, the screw connection must be checked.

Factors influencing the load carrying capacity

The basic load ratings given in the dimension tables are only valid under certain conditions. If a different raceway hardness and angular misalignments are present, correction factors must be applied.

Correction factors for reduced hardness of raceways

The basic load ratings in the dimension tables are defined for a raceway hardness of ≧ 670 HV (58 HRC), with the fine structure characteristic of rolling bearing parts. If linear roller bearings are used on raceways with a lower surface hardness, the load rating is reduced to the value $C_{H\,100}$ or $C_{H\,0}$. In calculation, the basic load ratings are multiplied by the hardness factor f_H or $f_{H\,0}$, see equations and *Figure 1*.

The hardness factors are only valid for rolling bearing steels or similar alloy steels with corresponding purity and structure. These correction factors must not be used for other materials such as cast and non-ferrous metals.

Effective dynamic load rating

The dynamic load rating for reduced hardness is calculated as follows:

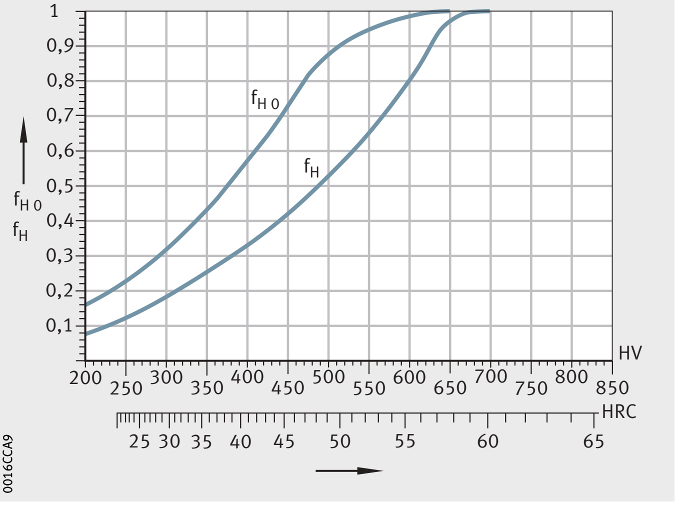
$$C_{H\,100} = f_H \cdot C_{100}$$

Effective static load rating

The static load rating for reduced hardness is calculated as follows:

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

C_{100}, C_0 N
Basic dynamic or static load rating
$C_{H\,100}$, $C_{H\,0}$ N
Effective dynamic or static load rating
f_H, $f_{H\,0}$ –
Dynamic or static hardness factor, *Figure 1*.



f_H = dynamic hardness factor
$f_{H\,0}$ = static hardness factor
HRC = surface hardness, converted in accordance with DIN 50150
HV = surface hardness

Figure 1
Hardness factors for reduced hardness of raceway

Reduction in life due to angular misalignments

The equations for calculating the rating life on page 478 are based on the assumption that the guidance elements are positioned correctly. If angular misalignment occurs, for example due to elastic deformation of the counterstay, the rolling elements are subjected to non-uniform load along the contact line.

A correction factor can be used to determine the equivalent dynamic load, see equation and *Figure 2*.

Equivalent dynamic load

$$P = k_F \cdot F$$

P	N
Equivalent dynamic load	
k_F	–
Correction factor for load under angular misalignment	
F	N
Load on the guidance system.	

k_F = load factor
F = load on guidance system
P = equivalent dynamic load
F/C_0 = relative load
C_0 = basic static load rating
β = angle at which the force acts on the rolling elements

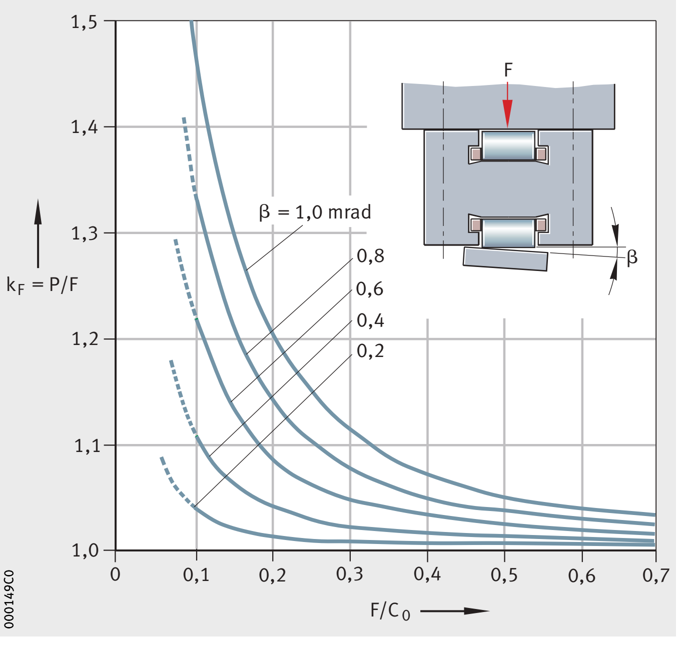


Figure 2
Correction factor for load P under angular misalignments

Preload

Increasing the preload increases the rigidity of the guidance system. The preload influences not only the rigidity but also the displacement force of the guidance system. The higher the preload, the larger the displacement force. If moment load is present, the load distribution is more favourable. This prevents clearance in the guidance system and reduces the slippage of the cylindrical rollers. Furthermore, preload influences the operating life of the guidance system.

Influence of preload on displacement resistance

Influence of preload on displacement resistance:

$$F_{RV} = \mu \cdot \Sigma F_V$$

F_{RV} N
Displacement resistance of table

μ –
Coefficient of friction, see table, page 489

F_V N
Preload force.

The influences of the lubrication and sealing as well as the mass of the table are not taken into consideration in this equation.

Preload value

As a guide value, the preload force may be taken as approx. 10% of the basic dynamic load rating C_{100} according to the dimension table of the linear roller bearing used. The guidance system must be set clearance-free.

If the preload is too low, the rigidity of the system will be reduced and the guidance system may lift under load.

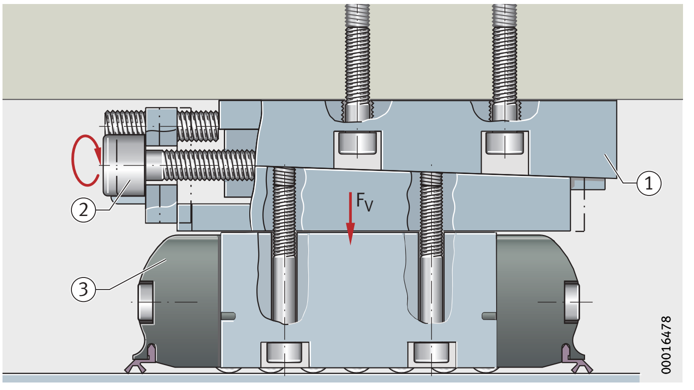
If the preload is too high, the life is reduced and the friction is increased.

Setting the preload

The preload can be set using adjusting gibs, linear roller bearings with integrated adjusting gib, shims or pressure screws.

Adjusting gibs VUS and VUSZ

Adjusting gibs can be used to set the preload easily and precisely to the required preload dimension, *Figure 1*. The gibs transmit the preload uniformly over the whole length of the linear roller bearing.

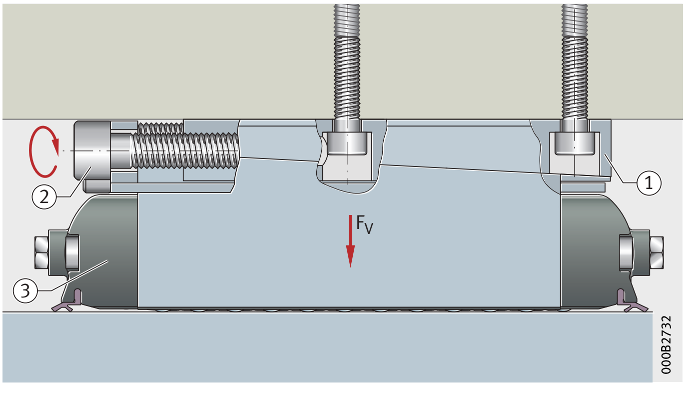


① Adjusting gib
② Adjustment screw
③ Linear roller bearing
F_V = preload

Figure 1
Preloading the guidance system using an adjusting gib

Linear roller bearings with integrated adjusting gib RUSV

In the case of linear roller bearings with integrated adjusting gib, the preload can be set easily and precisely to the required preload dimension, *Figure 2*. The gibs transmit the preload uniformly over the whole length of the linear roller bearing.



① Integrated adjusting gib
② Adjustment screw
③ Linear roller bearing (with integrated adjusting gib)
F_V = preload

Figure 2
Preloading of linear roller bearings with integrated adjusting gib RUSV

!

Setting of the preload by means of a gib is recommended.

Preload

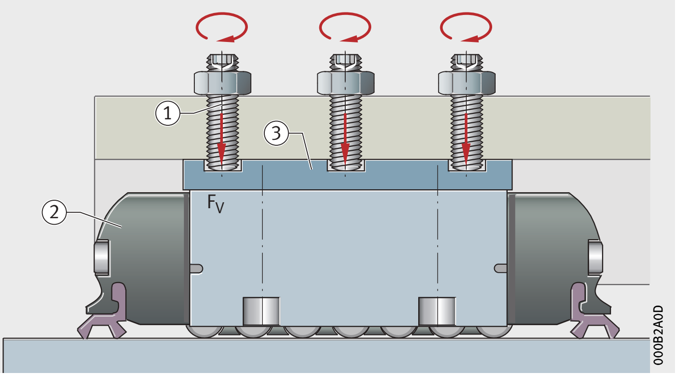
Pressure screws

The guidance systems can be preloaded using pressure screws, *Figure 3*.

In order to achieve good transmission of forces, a pressure plate of adequate rigidity and hardness must be fitted between the linear roller bearing and the pressure screws.

The pressure screws should have a flat surface and be arranged centrally between the fixing screws, in order to prevent angular misalignments. In order to allow transmission of the required preload force, the screws must be of sufficiently high strength.

Screws must be secured against loosening and linear roller bearings against slipping.



① Pressure screw
② Linear roller bearing
③ Pressure plate
F_V = preload

Figure 3
Preloading the guidance system using pressure screws

Shims

Shims are preground design elements. Once the values required have been determined (see Setting the preload using shims), they are finish ground with an appropriate oversize and fitted between the adjacent construction and the linear roller bearing.

Determining and setting the preload

The most exact method of setting the preload is achieved by means of the setting device EUS. As a result, influences such as deviations in friction values and tightening torques can be eliminated.
When the setting device EUS is used, the deformation of the adjacent construction (preload dimension) under the preload force F_V is measured.

The setting block of the device has the same dimensions as the linear roller bearing to be fitted. It is fitted in place of the linear roller bearing and connected via the distributor block to a conventional grease gun.

Determining the deformation (preload dimension)

- Fit the setting device EUS ① instead of the linear roller bearing, *Figure 4*.
- Connect the grease gun ⑤ and the high pressure hose ④ to the distributor block with manometer ③.
- Position the dial gauge ⑥ at a suitable measurement point.
- By means of the grease gun ⑤, increase the pressure continuously until the required pressure is reached on the manometer ③.
- Read off and record the deformation distance on the dial gauge ⑥.

Required pressure

$$p = \frac{F_V}{10 \cdot A_K}$$

p bar
Required pressure

F_V N
Calculated preload (approx. 10% of C_{100})

A_K cm^2
Total piston area of setting device.

① Setting device
② Adjusting gib
③ Distributor with manometer
④ High-pressure rubber hose
⑤ Grease gun
⑥ Dial gauge
⑦ Linear roller bearing

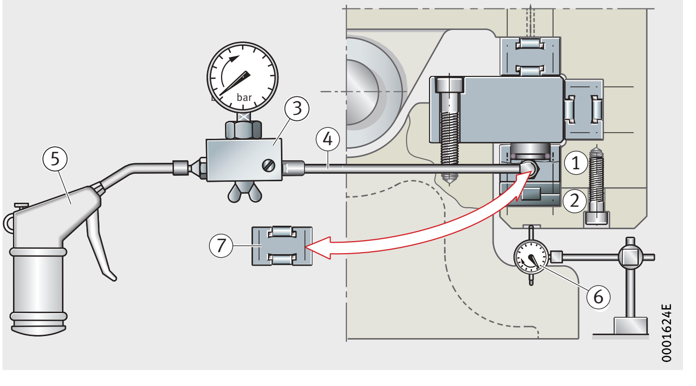


Figure 4
Measuring the preload dimension using the setting device

Preload

Once the deformation of the adjacent construction (preload dimension) under the preload force has been determined, it is recommended for the purposes of maintenance that the measurement value and measurement point is permanently marked at a suitable point on the adjacent construction or in the machine documentation.

Setting the preload

In order to achieve optimum and defined preload of the guidance system, the deformation of the adjacent construction must be known.

Setting the preload using a gib

- Determine the deformation of the adjacent construction (preload dimension).
- Remove the setting device EUS and fit the linear roller bearing with the adjusting gib.
- Position the dial gauge at the measurement point.
- Set the preload dimension determined using the adjusting screw.
- Secure the setting by means of locking screws.

Setting the preload using pressure screws

- Determine the deformation of the adjacent construction (preload dimension).
- Remove the setting device EUS and fit the linear roller bearing with the pressure plate.
- Position the dial gauge at the measurement point.
- Set the preload dimension determined using the pressure screws in a uniform manner.
- Secure the setting through locking by means of nuts.

Setting the preload using shims

- Determine and record the gap dimension between the adjacent construction and the screw mounting face of the RUS.
- Determine the deformation distance of the adjacent construction.
- Determine the deflection of the linear roller bearing under the preload force F_V, *Figure 7* and *Figure 8*, page 494.
- Add the gap dimension, deformation distance and deflection of the linear roller bearing (= total height of the shim).
- Finish grind the shim to the required height dimension. Remove the setting device EUS and fit the linear roller bearing with the shim.

! Setting of the preload by means of a gib is recommended.

Friction

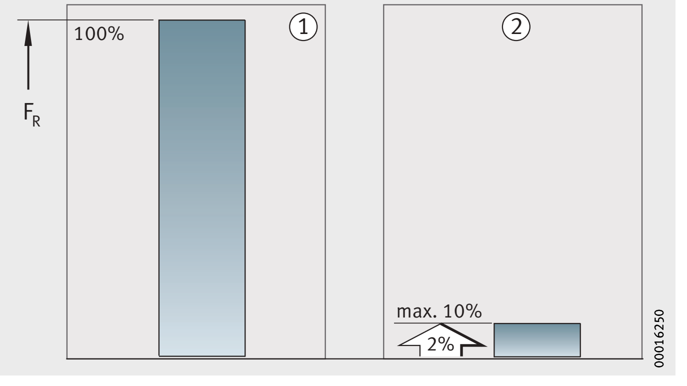
Linear recirculating roller guidance systems have a consistently low coefficient of friction throughout their operating life and free from stick-slip in comparison with plain guidance systems. The displacement force of linear recirculating roller guidance systems is only approx. 2% up to a maximum of 10% of the displacement force of plain guidance systems, *Figure 1*.

Due to the low displacement resistance, linear recirculating roller guidance systems require less drive power, the deformation of the elastic machine parts is lower and their positional accuracy is higher.

The friction is temporarily increased by fresh grease at commissioning and during regreasing. After a short running-in period, however, the coefficient of friction returns to its original lower value.

In linear recirculating roller guidance systems with wipers, the seal friction is at its highest with new guidance systems.

During the running-in phase, the geometry of the seal lips adapts to the profile of the guideway. As a result, the seal friction decreases again.



① Plain guidance system
② Linear recirculating roller guidance system
F_R = displacement force

Figure 1
Displacement forces

Displacement resistance

The displacement resistance is determined approximately using the following equation:

$$F_R = \mu \cdot F$$

F_R N
Displacement resistance

μ –
Coefficient of friction, see table

F N
Load on the linear roller bearing.

Coefficient of friction

Load C/P		Coefficient of friction μ	
from	to	from	to
4	20	0,0025	0,0045

The values given in the table are only valid if the required accuracy is achieved and if the lubrication is appropriate to the application.

Rigidity

Rigidity of the linear roller bearing

If a linear roller bearing is subjected to the load F, it undergoes elastic deformation of a magnitude δ, *Figure 1*. Measurement of the deformations gives the deflection curves of the linear roller bearing, *Figure 7* and *Figure 8*, page 494.

The rigidity of a linear roller bearing is determined by the ratio between the load and the elastic deformation.

$$c_S = \frac{F}{\delta}$$

c_S N/μm
Rigidity of the linear roller bearing

F N
Load on the linear roller bearing

δ μm
Elastic deformation.

The equation does not take into consideration the elastic deformation of the adjacent construction and screw connections, settling and similar effects. Since the adjacent construction is not completely rigid, the deformation of the complete structure can be higher in practice.

F = load
δ = elastic deformation
F_B = operating load
δ_B = deflection

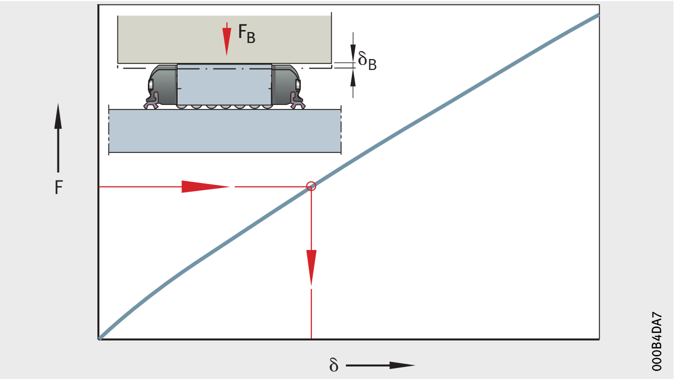


Figure 1
Deflection curve of a linear roller bearing

Linear roller bearings without preload

Where two linear roller bearings set clearance-free without preload act in opposition to each other, only one linear roller bearing is subjected to load and elastically deformed. The linear roller bearing without load has clearance corresponding to the deflection of the bearing under load. The deflection curve is shown in *Figure 2*.

F = load
δ = elastic deformation
δ_1 = elastic deformation R_1
δ_2 = clearance R_2
R_1, R_2 = linear roller bearings

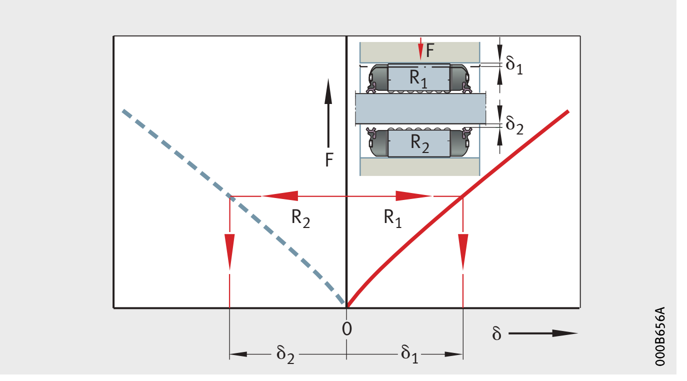


Figure 2
Deflection curve of linear roller bearings without preload

Linear roller bearings with preload

If two linear roller bearings act in opposition to each other and are subjected to a preload force F_V of magnitude δ_V, this gives the preload diagram, *Figure 3*.

If the system is subjected to an operating load F_B, it undergoes deformation of a magnitude δ_B. In this case, the linear roller bearing R_1 is deformed by a magnitude of δ_1 and the linear roller bearing R_2 by a magnitude of δ_2. The system remains clearance-free up to the maximum operating load $F_{B\,max}$. In this range, the rigidity is approximately twice that of the individual linear roller bearing.

F = load
F_B = operating load
$F_{B\,max}$ = maximum operating load
F_V = preload
δ, δ_B, δ_1, δ_2, δ_V = elastic deformation
R_1, R_2 = linear roller bearings

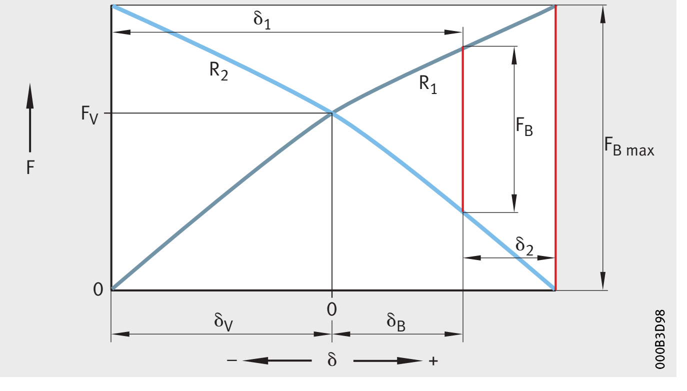
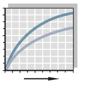


Figure 3
Preload diagram of linear roller bearings with preload



Influence of the rigidity of the adjacent construction

Since the counterstay and the screw connections are elastic, the deflection curve becomes shallower in the opposing direction.

The deflection characteristics of the counterstay can be determined by measuring its elastic deformation, for example using the setting device, see page 487.

The deflection curve (red line) for the counterstay is derived from adding together the elastic deformation of the linear roller bearing R_2 and the counterstay, *Figure 4*.

F = load
F_B = operating load
F_V = preload force
F_1, F_2 = resultant forces on linear roller bearings
F_I, F_{II} = external forces on linear roller bearings (resulting from moment)
δ, δ_B, δ_V = elastic deformation
R_1, R_2 = linear roller bearings
V = adjusting gib
U = counterstay

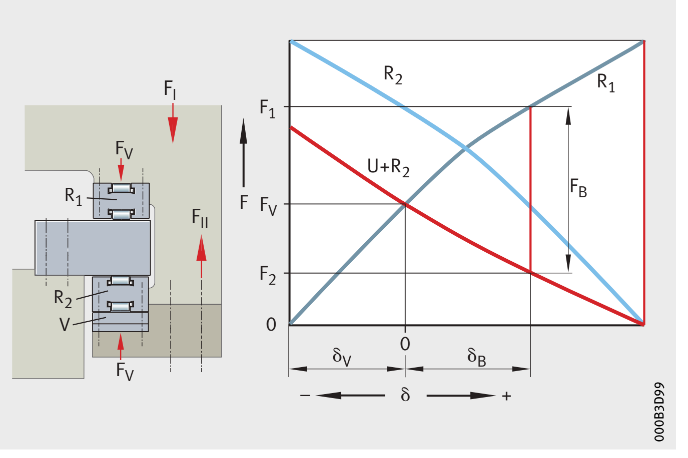


Figure 4
Preloaded linear roller bearing with counterstay

With operating loads in the opposite direction (F_{BII}), for example as a result of moment load, clearance of the linear roller bearing R_1 is possible under even relatively small loads ($F_{BII} > F_{BII\,max}$). This clearance can be prevented by increased preload or higher rigidity of the counterstay, *Figure 5*.

If the rigidity is to be fully utilised, the adjacent construction must be of sufficient rigidity and geometrical accuracy, see page 505.

F = load
F_{BI}, F_{BII} = operating load
$F_{BI\,max}$, $F_{BII\,max}$ = maximum operating load
F_V = preload force
δ, δ_V = elastic deformation
R_1, R_2 = linear roller bearings
U = counterstay
(1) Clearance

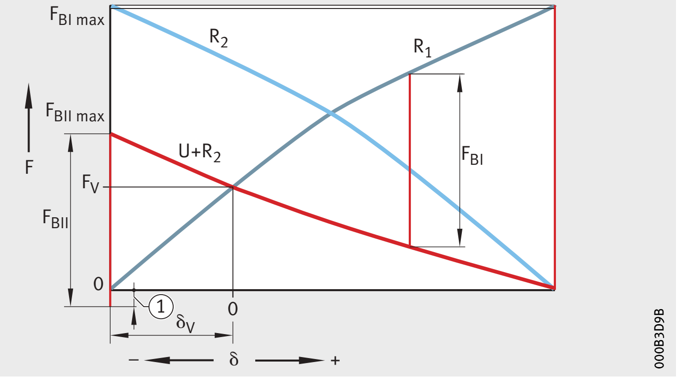


Figure 5
Rigidity of a system with counterstay under reversal of the load direction

Calculation example

Linear roller bearing	RUS	26102
Operating load at the most heavily loaded point	F_B	15 000 N
Preload force	F_V	8 000 N
Elastic deformation under operating load, *Figure 6*	δ_B	10 μm

Required

Rigidity of the guidance system	c_s

Rigidity

$$c_S = \frac{F_B}{\delta_B}$$

$$c_S = \frac{15000\,N}{10\,\mu m} = 1500\,N/\mu m$$

Guidelines for preload diagram

The deflection curve for the linear roller bearing intersects the curve for the counterstay at the point for the preload F_V, *Figure 6*. The operating load F_B between the deflection curves is deducted.

The elastic deformation δ_B is derived from the distance between the intersection of the deflection curves for the linear roller bearings and the counterstay and the points at which the operating load F_B is in contact with the deflection curves.

F = load
F_V = preload force
F_B = operating load
δ = elastic deformation
δ_B = elastic deformation under operating load
R_1, R_2 = linear roller bearings
U = counterstay

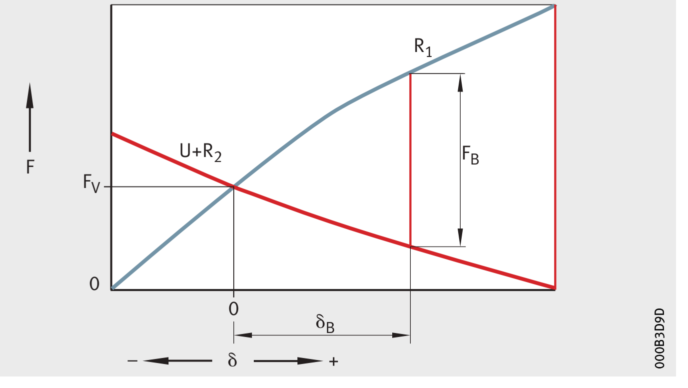
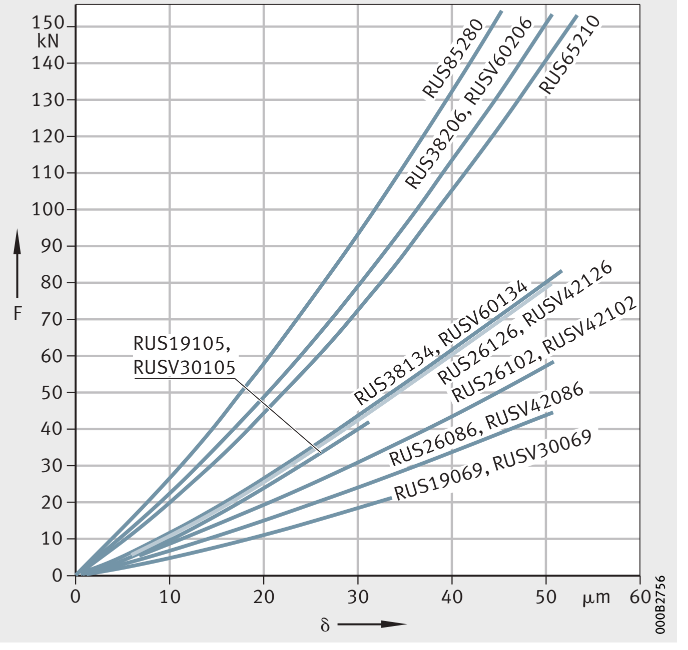


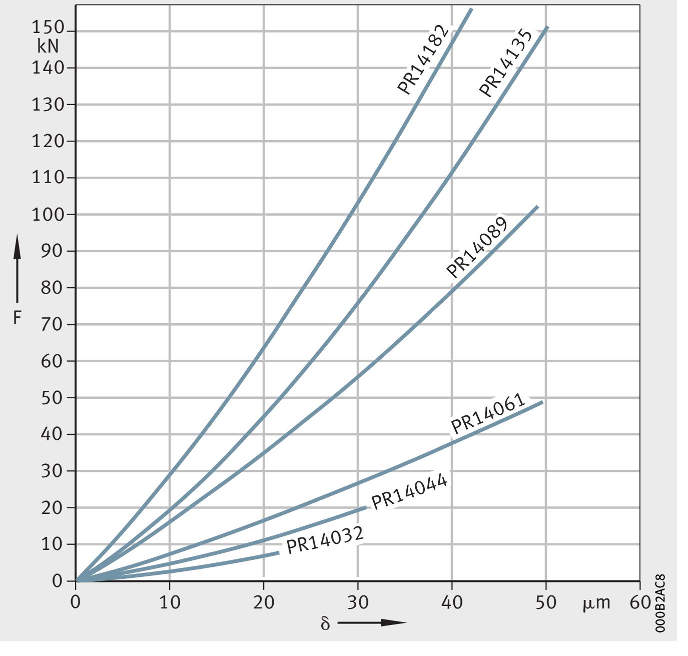
Figure 6
Preload diagram for counterstay guidance system

Measured deflection curves



F = load
δ = elastic deformation

Figure 7
Deflection curves
for linear roller bearings
RUS and RUSV



F = load
δ = elastic deformation

Figure 8
Deflection curves
for linear roller bearings
PR

Lubrication in general

Oil or grease lubrication

Linear roller bearings are coated with a preservative and must be lubricated. The preservative is compatible with oils and greases having a mineral oil base. Technical, economic and ecological factors will determine whether oil or grease should be used and which lubrication method should be applied.

Functions of the lubricant

Lubricants, both grease and oil, have an extensive range of functions and effects.

Lubricants:

- reduce friction
- minimise wear
- prevent corrosion
- give protection against contamination
- increase the operating life of guidance systems.

Delivered condition, suitable lubricants

Linear roller bearings are supplied coated with a preservative. The preservative is compatible with oils and greases having a mineral oil base. Linear roller bearings operate almost exclusively under mixed friction conditions, especially at low speeds. Preference should therefore be given to doped oils and greases (type P to DIN 51 052).

Drilling oils or other coolant emulsions must not be used for lubrication. These have the effect of thinning the lubricants and can lead to corrosion in certain circumstances. Lubricants with solid additives must not be used either.

Used lubricant

Used lubricant should be disposed of by environmentally-friendly methods. The handling and use of lubricants is governed by national regulations for environmental protection and occupational safety as well as information from the lubricant manufacturers. The regulations must be observed in all cases.

Oil lubrication

Oil used as for lubrication facilitates heat dissipation and offers good lubricant distribution.

In relubrication, the lubricant is almost completely replaced. Contaminant particles are washed out.

Furthermore, oil lubrication is advisable where the adjacent machine elements are already supplied with oil.

Preferred oils and lubrication methods

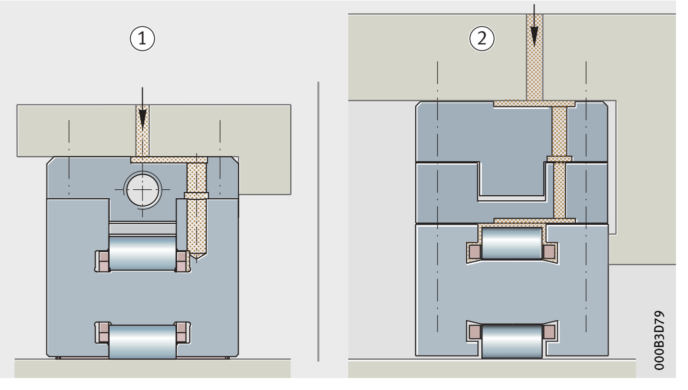
Preference should be given to oils CLP in accordance with DIN 51517 and HLP in accordance with DIN 51524.

At operating temperatures from 0 °C to +70 °C, the viscosity should be between ISO VG 32 and ISO VG 68. For low temperature operation, oils to ISO VG 10 or ISO VG 22 should be used. Slideway oils CGLP up to ISO VG 220 can be used.

!

The feed mechanism for the lubricant oil must be selected with reference to the mounting position such that all the rows of rolling elements are provided with lubricant, for example:

- via the return zone of the linear roller bearings, *Figure 1*
- via an oil pipe directly into the end piece of the linear roller bearing (instead of the lubrication connector), *Figure 2*, page 496.



1 RUSV with integrated adjusting gib
2 RUS with adjusting gib VUS or VUSZ

Figure 1
Oil feed through the adjusting gib

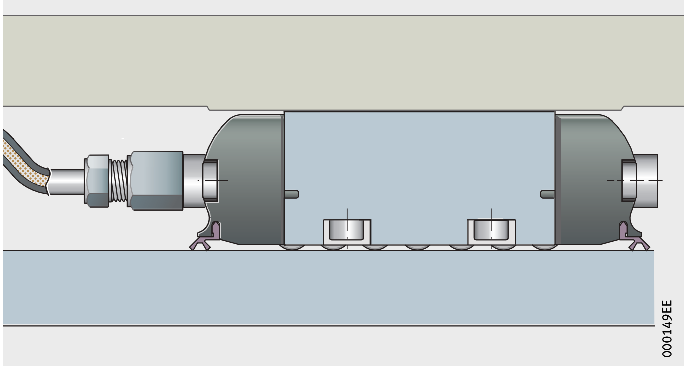


Figure 2
Oil feed through the end piece

Compatibility

If it is not possible to draw upon practical experience or guidelines from the oil manufacturer, oils must not be used until their behaviour in relation to plastics, elastomers and non-ferrous metals has been tested.

!

The compatibility of oils must always be checked.

This must always be checked under dynamic conditions and at operating temperature.

In case of doubt, the lubricant manufacturer must be consulted.

Miscibility

Oils with a mineral oil base of the same classification are miscible with each other. However, the viscosities should differ by no more than one ISO VG grade.

The miscibility of synthetic oils must always be checked.

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

In case of doubt, the lubricant manufacturer must be consulted.

Oil lubrication

Lubricant quantities

Linear roller bearings and guideway systems must be protected against solid and liquid contaminants.

Linear roller bearings and guideways should be oiled before commissioning. During this process, linear roller bearings should be moved several times consecutively without load by at least four times the length of the bearing.

The minimum oil quantities for linear roller bearings are shown in the table. The values apply under the following standardised conditions:

- 100% operating duration
- $C_0/P = 8$
- v = 0,8 m/s
- 500 mm to 1000 mm stroke length.

The values in the table are guide values. Precise values can only be determined under operating conditions.

Minimum oil quantity Q_{min}

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

Oil impulse quantity Q_{imp}

The oil impulse quantity applies when the recirculating lubrication system is connected to a central lubrication system.
It is recommended that the stated quantity should be spread over several impulses.

Minimum oil quantities – guide values

Linear roller bearing Designation	Minimum oil quantity for commissioning Q_{min} cm^3	Oil impulse quantity Q_{imp} cm^3/h
RUS19069(-KS), RUSV30069-KS	0,35 – 0,5	0,25
RUS19105(-KS), RUSV30105-KS	0,35 – 0,5	0,25
RUS26086(-KS), RUSV42086-KS	0,35 – 0,5	0,25
RUS26102(-KS), RUSV42102-KS	0,35 – 0,5	0,25
RUS26126(-KS), RUSV42126-KS	0,6 – 0,8	0,5
RUS38134(-KS), RUSV60134-KS	0,6 – 0,8	0,5
RUS38206(-KS), RUSV60206-KS	1,5 – 2	1
RUS65210	0,8 – 1,2	1
RUS85280	2,8 – 3	2
PR14032(-PP)	0,25 – 0,4	0,25
PR14044(-PP)	0,25 – 0,4	0,25
PR14061(-PP)	0,25 – 0,4	0,25
PR14089(-PP)	0,6 – 0,8	0,5
PR14135(-PP)	0,8 – 1,2	1
PR14182(-PP)	2,5 – 2,8	2

Grease lubrication

For relubrication devices, very little design work is involved if a central lubrication system is not required.

The relubrication intervals can be up to one year.

Due to the thickener in the grease, this type of lubrication exhibits very good emergency running characteristics.

In addition, grease lubrication provides good support to the sealing arrangement.

Preferred greases and lubrication methods

Lithium soap greases with a mineral oil base are recommended. A base oil viscosity of ISO VG 150 to ISO VG 220 should be selected.

Under heavy loads ($S_0 < 8$), greases with EP additives and a base oil viscosity in the region of ISO VG 220 are necessary.

For initial greasing, a grease KP2N–20 according to DIN 51825 is recommended.

Lubricants containing solid additives must not be used.

Linear roller bearings can be relubricated via the rolling element return zone or via lubrication connectors, *Figure 1*, page 500.

During relubrication, linear roller bearings should be moved several times without load by at least four times the length of the bearings.

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.

Grease lubrication

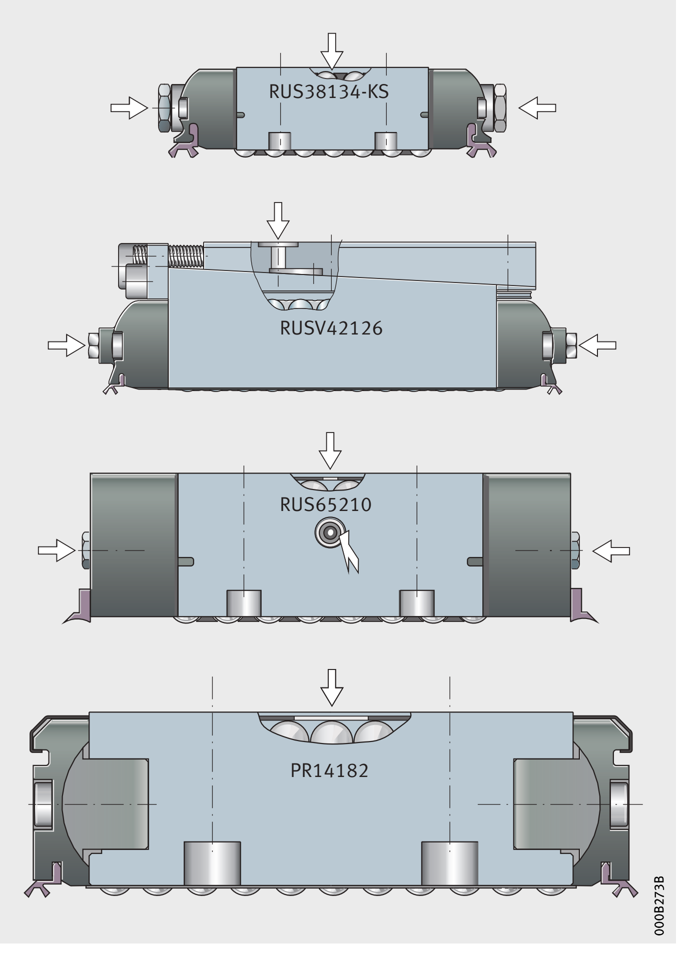


Figure 1
Lubrication points

Initial grease and relubrication quantity, see table, page 501.

Miscibility

Greases may be mixed if:

- they have the same base oil
- they have matching thickener types
- they have similar base oil viscosities, which means that the difference is no more than one ISO VG grade
- they have the same consistency (NLGI grade).

If the quality of the grease differs from our specifications, this can have negative effects.

In case of doubt, please contact us.

Initial grease quantity

Linear roller bearings and guideway systems must be protected against solid and liquid contaminants.

Linear roller bearings and guideways should be greased before commissioning. During this process, the linear roller bearings should be moved several times consecutively without load by at least four times their length, in order to ensure uniform distribution of the grease in the bearing. Regreasing should be carried out several times.

On very long guidance systems, the guideways should be coated with lubricant before commissioning so that the grease reservoir from initial greasing is not used up prematurely.

If the guidance system is not connected to a central lubrication system, the linear roller bearings should be charged with the initial grease quantity before fitting. Initial grease quantities, see table.

Central lubrication systems

Linear roller bearings should be charged with the initial grease quantity and the feed pipes filled with grease.

Initial grease and relubrication quantities – guide values

Linear roller bearing Designation	Initial grease quantity g	Relubrication quantity g
RUS19069(-KS), RUSV30069-KS	2,5	0,75
RUS19105(-KS), RUSV30105-KS	3,5	1,05
RUS26086(-KS), RUSV42086-KS	7	2
RUS26102(-KS), RUSV42102-KS	7,5	2,2
RUS26126(-KS), RUSV42126-KS	8	2,4
RUS38134(-KS), RUSV60134-KS	18	5,4
RUS38206(-KS), RUSV60206-KS	25	7,5
RUS65210	26	8,6
RUS85280	27	9
PR14032(-PP)	1	0,3
PR14044(-PP)	2	0,6
PR14061(-PP)	7	2,1
PR14089(-PP)	15	4,5
PR14135(-PP)	16	5,2
PR14182(-PP)	25	8,3

Calculation of the lubrication interval

Grease operating life

If a guidance system cannot be relubricated, the operating life of the lubricating grease is then the decisive factor.

For most applications, the guide value can be calculated as follows:

$$t_{fG} = 2 \cdot t_{fR}$$

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

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

Basic lubrication interval

The basic lubrication interval t_f is valid under the following conditions, *Figure 2*:

- bearing temperature $t < +70\ °C$
- load ratio $C_0/P = 20$
- lubrication with high quality lithium soap grease
- no disruptive environmental influences
- stroke ratio between 1 and 10, see page 504.

Speed parameter

The speed parameter is defined as follows:

$$GKW = \frac{60}{v_m} \cdot K_{LF}$$

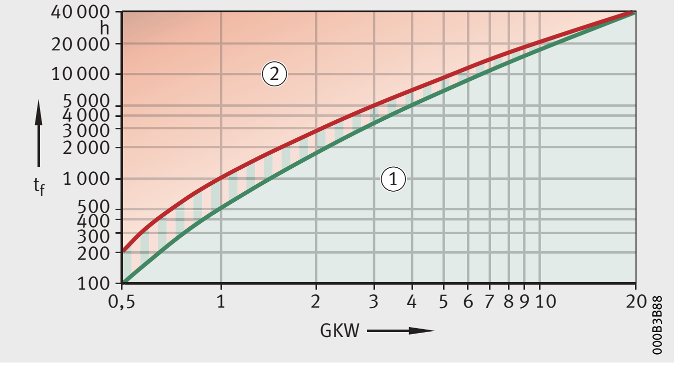
GKW –
Speed parameter, *Figure 2*

v_m m/min
Mean travel velocity

K_{LF} –
Bearing factor, see table.

Bearing factor

Linear recirculating roller guidance system Series	Bearing factor K_{LF}
RUS..(-KS), RUSV..-KS	1,5
PR..(-PP)	1



t_f = basic lubrication interval
GKW = speed parameter
① Relubrication possible
② Regreasing necessary

Figure 2
Determining the basic lubrication interval

Relubrication interval

Linear recirculating roller guidance systems must be relubricated at appropriate intervals.

The length of the interval is essentially dependent on the velocity, load, temperature, stroke length and environmental conditions.

The shorter the lubrication intervals, the easier it is to justify substantial expenditure on lubrication devices on economic grounds. Where the intervals are long, lubrication by hand or using semi-automatic devices can be advantageous.

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.

The relubrication interval t_{fR} should be no more than one year even if the equation gives a longer interval:

$$t_{fR} = t_f \cdot K_P \cdot K_W \cdot K_U$$

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

t_f h
Basic lubrication interval in operating hours, see page 502

K_P –
Correction factor for load, *Figure 3*

K_W –
Correction factor for stroke, *Figure 4*, page 504

K_U –
Correction factor for environment, see page 504.

Correction factor for load

The correction factor K_P takes account of the strain on the grease at a load ratio of $C_0/P < 20$, *Figure 3*.

The factors are only valid for high quality lithium soap grease.

The preload must be taken into consideration.

K_P = correction factor for load
C_0/P = load ratio

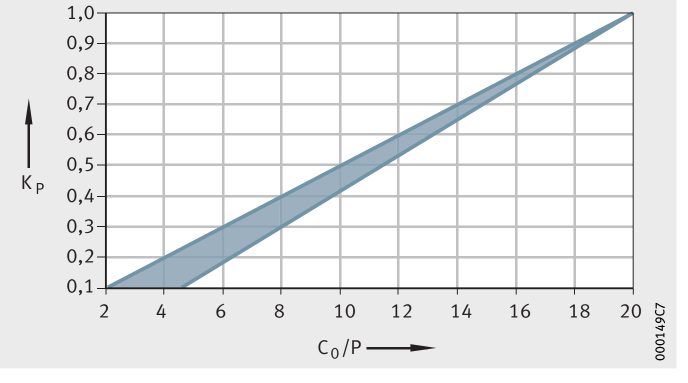


Figure 3
Correction factor for load

Correction factor for stroke

The correction factor K_W takes account of the displacement distance to be lubricated, *Figure 4*. It is dependent on the stroke ratio.

K_W = correction factor for stroke
L_1/H = stroke ratio

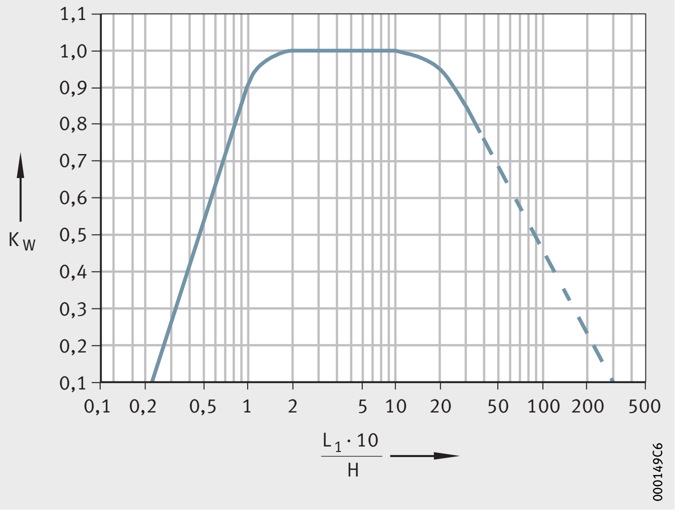


Figure 4
Correction factor for stroke

Stroke ratio

The stroke ratio is defined as follows:

$$H_v = \frac{L_1 \cdot 10}{H}$$

H_v –
Stroke ratio
L_1 mm
Effective saddle plate length, see dimension tables
H mm
Stroke length.

If the stroke length is very short or very long, the grease operating life may be shorter than the calculated guide value. In such cases, special greases are recommended. In such cases, please consult Schaeffler.

Correction factor for environment

The correction factor K_U takes account of shaking forces, vibrations (a cause of fretting corrosion) and shocks as well as environmental influences (contamination and operating media), see table.

These influences place an additional strain on the grease.

Cooling lubricants can wash greases out of the carriage. If cooling lubricant or moisture comes into contact with the linear system, calculation in approximate terms is possible but, for reasons of unpredictability, it must be regarded as a guide value only and requires monitoring and adjustment in practice. Where necessary, the grease operating life must be completely determined again.

Environmental influence and correction factor

Environmental influence	Correction factor K_U
Slight	1
Moderate	0,8
Heavy	0,5

Design of bearing arrangements

The adjacent construction has a significant influence on the load carrying capacity, rigidity, accuracy, smooth running and operating life of a guidance system with linear roller bearings.

When designing the adjacent construction, particular attention must therefore be paid to:

- the design of the raceways
- the geometrical and positional accuracy of the mounting surfaces
- the location of the guidance elements
- the sealing of the bearing arrangement.

Design of raceway

Linear roller bearings require hardened and ground guideways for use as raceways.

INA guideways are matched to the requirements of the linear roller bearings, see page 569 and dimension tables. They can be used to achieve high precision, rigid linear recirculating guidance systems with high load carrying capacity and low friction.

If these guideways cannot be used, machine parts of a suitable configuration can be used if they fulfil the required values in relation to hardening depth, hardness and roughness, see table.

In order to ensure that the high load carrying capacity and rigidity of the linear roller bearings can be used to the full, the raceways must correspond to the accuracies of the guideways.

Machine parts as raceway

Linear roller bearing Designation	Raceway				
	Hardening depth	Hardness min.		Roughness max.	
	mm	HV	HRC	Ra	Rz
RUS16069(-KS) to RUS38206(-KS) RUSV30069-KS to RUSV60206-KS PR14032(-PP) to PR14089(-PP)	≧0,6	670	58	0,6	2,5
RUS65210 RUS85280 PR14135(-PP) PR14182(-PP)	≧2	670	58	0,8	4

Demands on the adjacent construction

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

Geometrical and positional accuracy of the adjacent surfaces

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

!

Observe the tolerances for the adjacent surfaces, *Figure 1* and *Figure 2*, page 507.

Surfaces should be ground or precision milled, with the objective of achieving a mean roughness value Ramax 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.

Permissible height differential

The differentials ΔH_Q and ΔH_L indicate the maximum permissible deviation from the theoretically precise position of the seating surfaces in the longitudinal and transverse axes.

For linear recirculating roller guidance systems, permissible values are in accordance with the following equations:

$$\Delta H_L = a_L \cdot b$$

$$\Delta H_Q = a_Q \cdot b$$

ΔH_L µm
Maximum permissible deviation in a longitudinal axis from the theoretically precise position, *Figure 1*, page 506

ΔH_Q µm
Maximum permissible deviation in a transverse axis from the theoretically precise position, *Figure 2*, page 507

a_L, a_Q –
Factor, as a function of series, see table

b mm
Centre distances between guidance elements, *Figure 1* and *Figure 2*, page 507.

Series factor

Linear roller bearing Designation	Factor	
	a_L	a_Q
RUS..(-KS), RUSV..-KS, PR..(-PP)	0,1	0,15

NC = not convex

b = spacing between guidance elements
ΔH_L, ΔH_Q = height difference

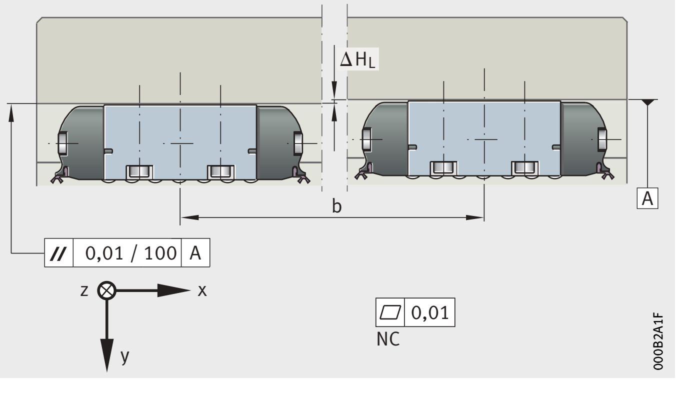


Figure 1
Geometrical and positional accuracy of the adjacent surfaces in the longitudinal direction

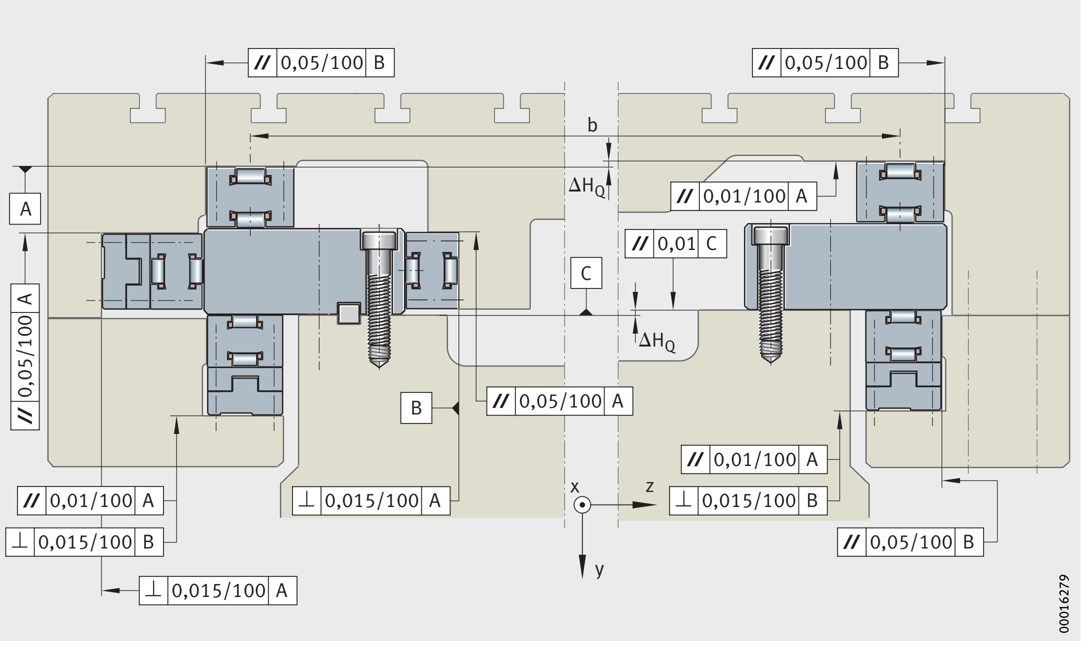


Figure 2
Geometrical
and positional accuracy
of the adjacent surfaces
in the transverse direction

Connection to the adjacent construction

The connection between the guidance elements and the adjacent construction influences the effective load carrying capacity of the guidance system.

When designing the adjacent construction, particular attention must therefore be paid to:

- the direction of the forces and moments
- the position of the locating faces
- the size of the locating faces
- the load carrying capacity and number of fixing screws.

The better supported a guidance system in relation to the forces occurring, the greater the extent to which the load carrying capacity can be used.

Support of lateral forces

Lateral guidance forces in one direction

If the friction lock of the screw connections cannot support the lateral guidance forces, the guideways must be laterally supported against a locating edge, *Figure 3*.

UG

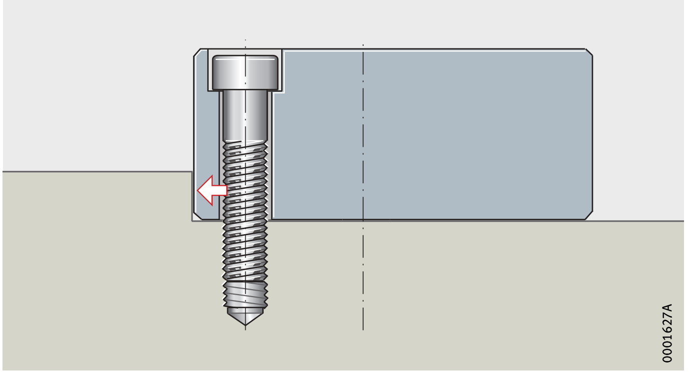
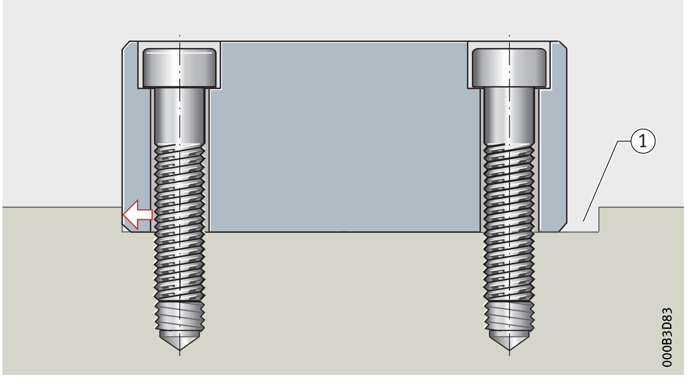


Figure 3
Lateral locating face

Lateral guidance forces in two directions

If high lateral forces occur in both directions, the guideways UZ and UG can be screw mounted in a slot, *Figure 4*.

After fitting, the gap at the side must be filled by means of a form fit connection (such as castable resin, vee strip).



UZ

① Gap

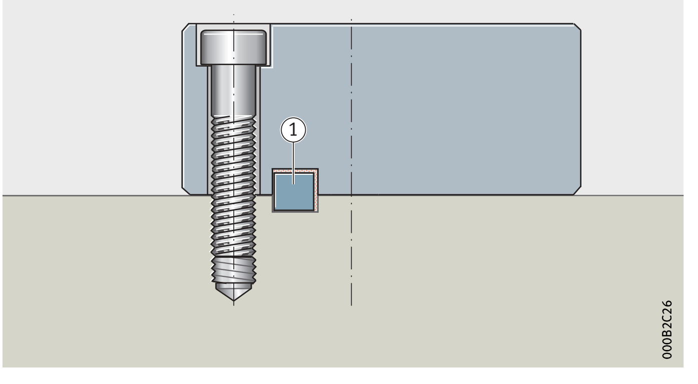
Figure 4
Guideways located in slot

Guideways with longitudinal slot

The guideways UGN and UZN have a continuous slot, *Figure 5*.

The guideways are joined to the adjacent construction by means of square steel bars in accordance with DIN EN 10278, which transmit the lateral forces to the machine part.

After fitting, the lateral gaps must be filled with castable resin.



UGN

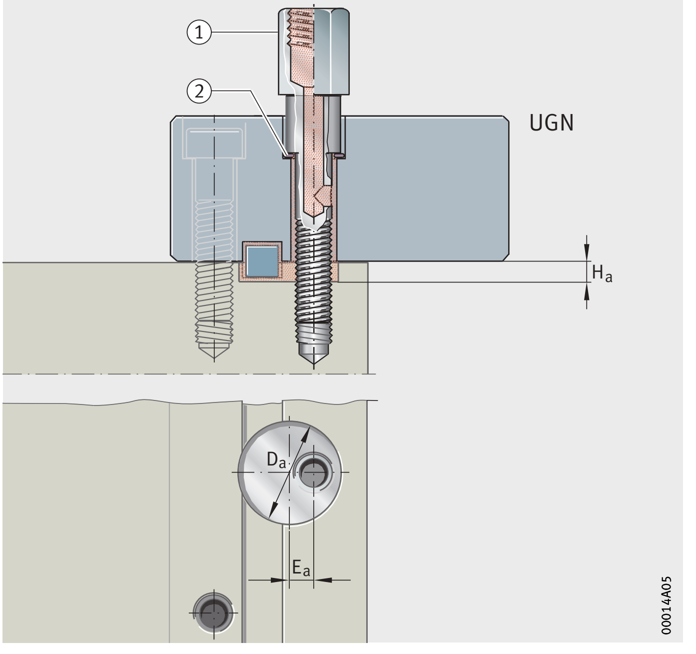
① Square steel bar

Figure 5
Guideway
with longitudinal slot
and square steel bar

Hollow filling screws

Hollow filling screws can be used to fill the remaining spaces. For this purpose, recesses should be milled 500 mm apart in the adjacent construction.

In order that the castable resin can reach these recesses, holes must be made in the adjacent construction. Due to the combination of the recess and hole, the castable resin flows into the gap between the square steel bar and the adjacent construction.



① Hollow filling screw
② Sealing washer

Figure 6
Hollow filling screws for guideways UGN and UZN

Design of recesses for hollow filling screws

Guideway Designation	Dimensions		
	D_a mm	E_a mm	H_a mm
UGN6628, UZN6628	18	4	3,5
UGN9741, UZN9741	25	6	6
UGN12553, UZN12553	30	8	7
UGN16260, UZN16260	30	7	8

! Hollow filling screws are not included in the scope of delivery and must be provided by the customer, *Figure 6*.

Location of guideways

Guideways are located by means of:

- through holes with cylindrical counterbores for screws in accordance with DIN ISO 4762
  – series UG, UGN, UZ, UZN, UFB
- high precision steel strip
  – series UFK.

The adjacent construction must be of adequate strength. VDI Guideline 2230 must be observed.

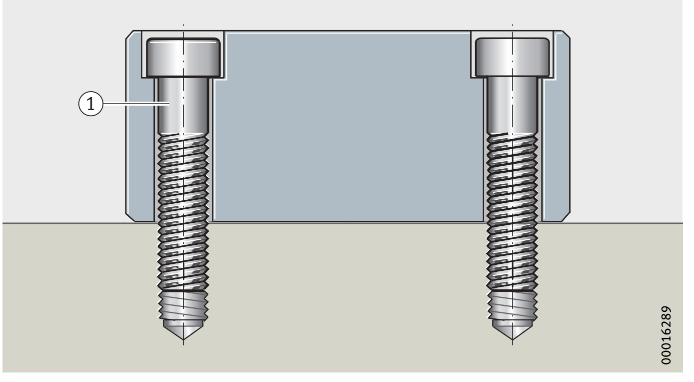
Guideways with through holes

The guideways UG, UGN, UZ, UZN and UFB are located from the guideway side, *Figure 7*.

Risk of injury due to the sharp edges of the cylindrical counterbores.

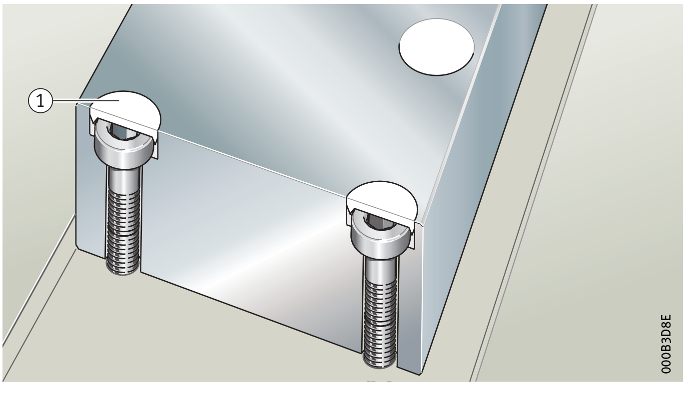
If the counterbores are closed off flush using closing plugs or castable resin, this gives a smooth guideway surface, *Figure 8*. This protects the wipers against damage. It also prevents contamination, coolants or similar from collecting in the counterbores.

UZ



1 Fixing screw

Figure 7
Location from the guideway side



1 Closing plug

Figure 8
Closing off the counterbores

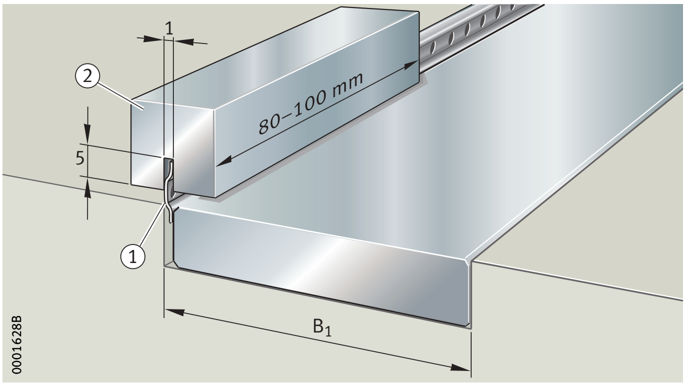
Guideways with high precision steel strip

Guideways UFK are retained in the slot by means of a high precision steel strip, *Figure 9*. The strip can be fitted using a fitting aid.

Slot widths for the guideways are shown in the table and *Figure 9*.

Slot widths for guideways

Guideway Designation	Slot width B1 +0,15 mm
UFK3210	32,65
UFK4710	47,65
UFK6412	64,65
UFK8815	88,65
UFK11518	115,65



1 High precision steel strip
2 Fitting aid
B_1 = slot width

Figure 9
Slot width, example of high precision steel strip and fitting aid

The strip and fitting aid are not included in the scope of delivery and must be provided by the customer.

Hole patterns of guideways

Unless specified otherwise, the guideways have a symmetrical hole pattern where $a_L = a_R$, *Figure 10*, page 513 and *Figure 11*, page 514.

An asymmetrical hole pattern may also be available upon request. In this case, $a_L \geqq a_{L\,min}$ and $a_R \geqq a_{R\,min}$, *Figure 10*, page 513 and *Figure 11*, page 514.

Observe the definition and position of the spacing a_L, *Figure 12*, page 514.

In the case of guideways UG and UGN, the holes are in an offset arrangement, *Figure 12*, page 514. The position of the holes depends on the length of the guideway, see dimension tables.

Maximum number of pitches between holes

The number of pitches between holes is the 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:

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

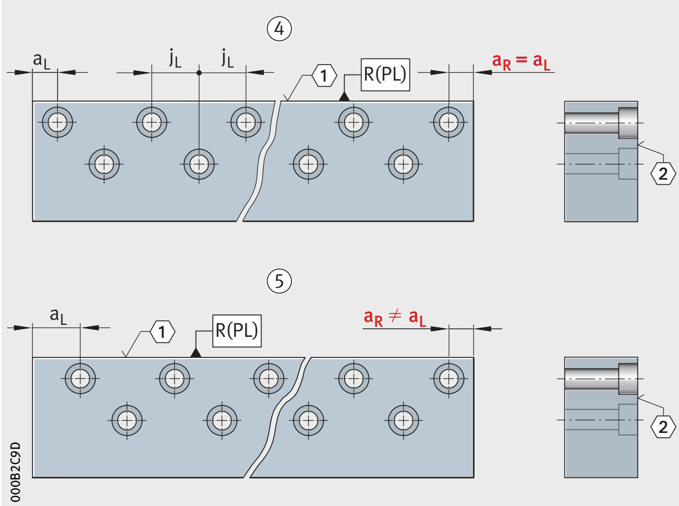
Guideways with symmetrical hole pattern:

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

Number of holes:

$$x = n + 1$$

n	–	Maximum possible number of pitches between holes
l	mm	Guideway length
a_L, a_R	mm	Spacing between start or end of guideway and nearest hole
j_L	mm	Spacing between holes
x	–	Number of holes.



1 Locating face
2 Marking
4 Symmetrical hole pattern
5 Asymmetrical hole pattern

Figure 10
Hole patterns of guideways with offset rows of holes

1 Locating face
2 Marking
4 Symmetrical hole pattern
5 Asymmetrical hole pattern

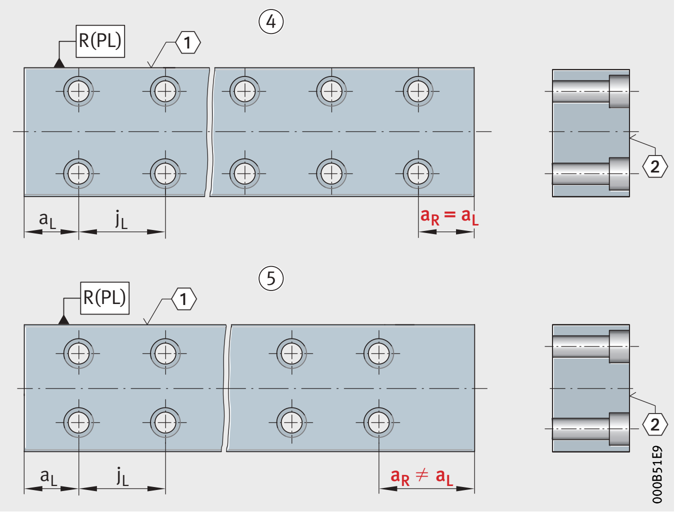


Figure 11
Hole patterns of guideways with parallel rows of holes

1 Locating face
3 Seating surface
4 Hole pattern on left side BL
5 Hole pattern, symmetrical
6 Hole pattern on right side BR

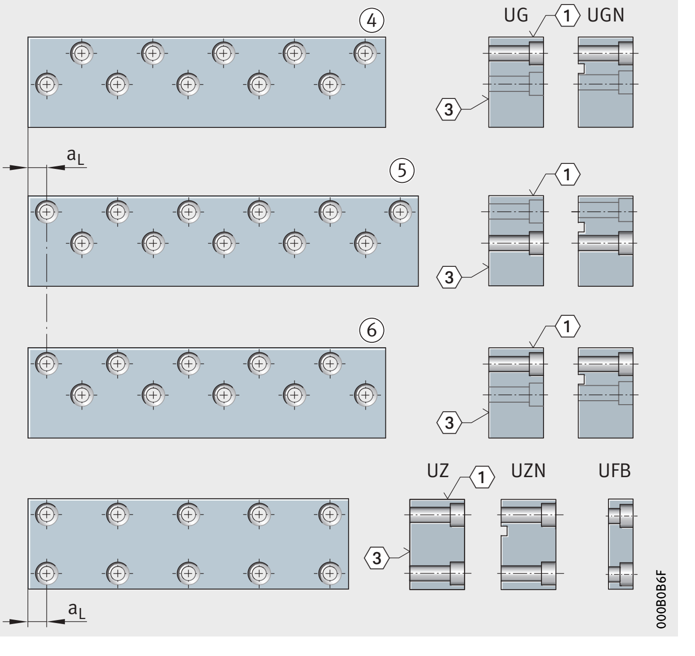


Figure 12
Position of spacing between the first hole and the start of the guideway a_L

Hole patterns

Explanations of the hole patterns:

- Hole pattern on left side BL:
  - The first hole faces away from the locating face ⟨1⟩.
  - The last hole faces toward the locating face ⟨1⟩.
- Hole pattern on right side BR:
  - The first hole faces toward the locating face ⟨1⟩.
  - The last hole faces away from the locating face ⟨1⟩.

⟨1⟩ Locating face
④ Hole pattern on left side BL
⑤ Hole pattern on right side BR
⑥ Hole pattern, symmetrical

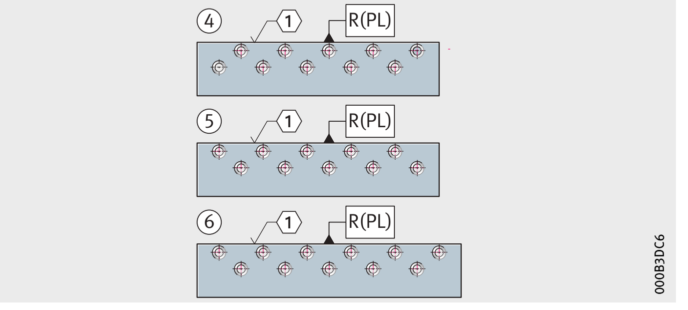


Figure 13
Hole patterns

Multi-piece guideways

If the guideway length required is greater than l_{max}, see dimension tables, or joined guideways are required, these guideways are made up from segments that together comprise the total required length. The guideways are matched to each other and form a set.
All the parts of a set have the same set number. In addition, the joints are marked consecutively by means of letters.

!

Parts with the same set number must be fitted in the same guidance system. The guideways should be assembled such that the ends with the same set numbers and letters are adjacent to each other.

⟨1⟩ Locating face

Guideway segments:
1A, 1A 1B, 1B 1C, 1C
1D, 1D 1E, 1E 1F, 1F

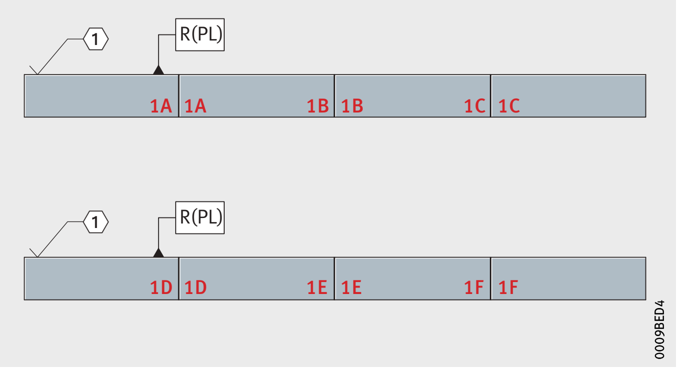


Figure 14
Marking of multi-piece guideways

!

In the case of multi-piece guideways, the gap at the end faces between two segments must be $< 0{,}05$ mm.

Location of linear roller bearings

Linear roller bearings are located on the machine part by means of hexagonal socket head screws in accordance with DIN ISO 4762. Dimensions of screws, see dimension tables. Location is possible from either the linear roller bearing or the machine part.

!

The adjacent construction must be of adequate strength. VDI Guideline 2230 must be observed.

Location from the linear roller bearing side

For this type of location, the machine part has threaded holes. The linear roller bearings are aligned to the machine part and screw mounted on the machine part from the bearing side using fixing screws, *Figure 15*.

This method can be used for locating linear roller bearings of series RUS and PR.

① Fixing screw
② Machine part

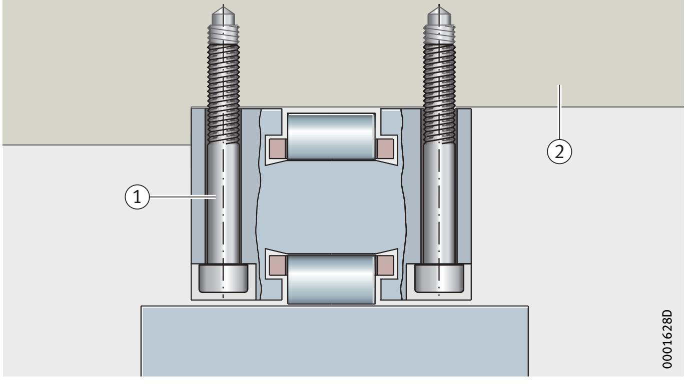


Figure 15
Location from the linear roller bearing side

Location from the machine part side

For this type of location, the machine part has through holes and counterbores for the screw heads.

The linear roller bearings are aligned to the machine part and screw mounted on the machine part from the adjacent construction side using fixing screws, *Figure 16*.

This method can be used for locating linear roller bearings of series RUS and PR.

① Fixing screw
② Machine part

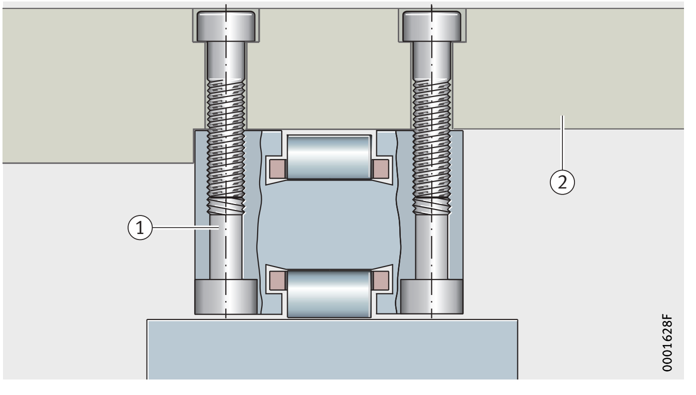
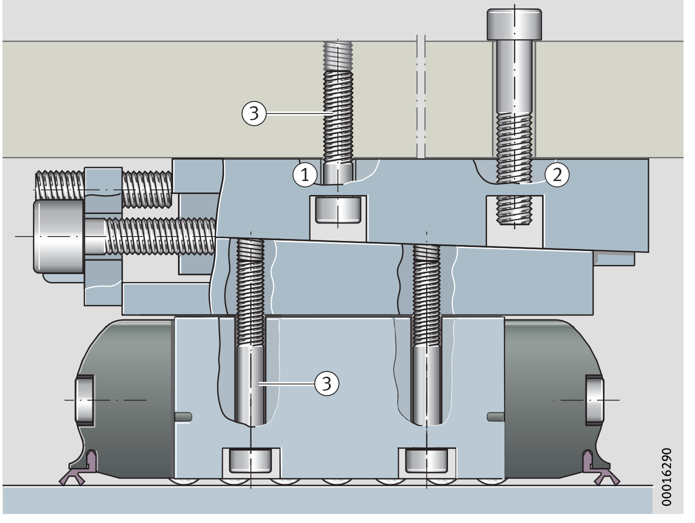


Figure 16
Location from the adjacent construction side

Location of linear roller bearing with adjusting gib assembly

The adjusting gib VUS can be located by means of the gib or the adjacent construction, *Figure 17*. The adjusting gib VUSZ can only be located by means of the gib.

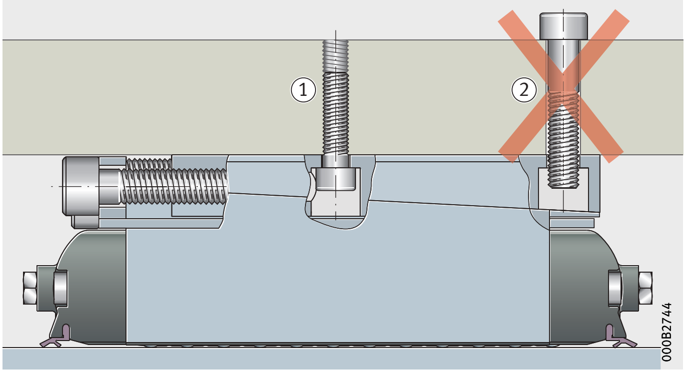


① Location by the gib
② Location by the adjacent construction
③ Fixing screws

Figure 17
Location of linear roller bearing with adjusting gib assembly

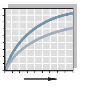
Location of linear roller bearing with integrated adjusting gib assembly

The integrated adjusting gib in RUSV can only be located by means of the gib, *Figure 18*.



① Location by the gib
② Location by the adjacent construction not possible

Figure 18
Location of linear roller bearing with integrated adjusting gib assembly



Sealing

Elastic wipers on the end pieces of the linear roller bearings give effective protection of the guidance systems against contamination.

In order to prevent damage to the wiper lips, the counterbores of the fixing screw holes must be closed off.

The function and effectiveness of the wipers also depends on correct mounting of the linear roller bearings, see page 530.

! In order to prevent damage to the running system of the linear roller bearings, the raceways must be kept clean.

If guidance systems are exposed to severe contamination or aggressive media, for example to protect the running system, additional seals must be provided, *Figure 19*.

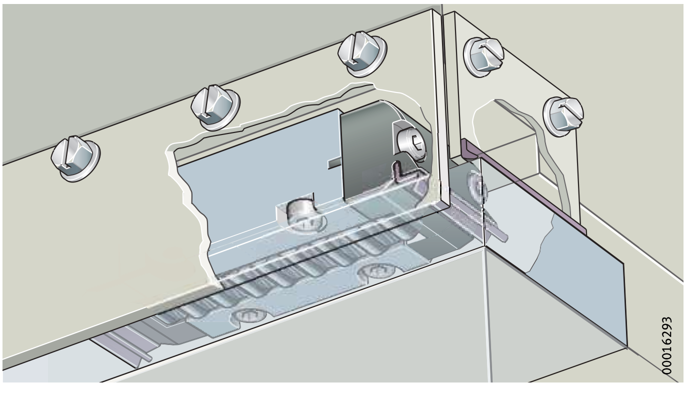


Figure 19
Sealing of the bearing arrangement, example

Design examples

Guideways are supplied in various designs, see page 569.
With these guideways, open and closed arrangements are possible.

Typical designs with guideways and linear roller bearings are shown in *Figure 20* and *Figure 21*, page 520.

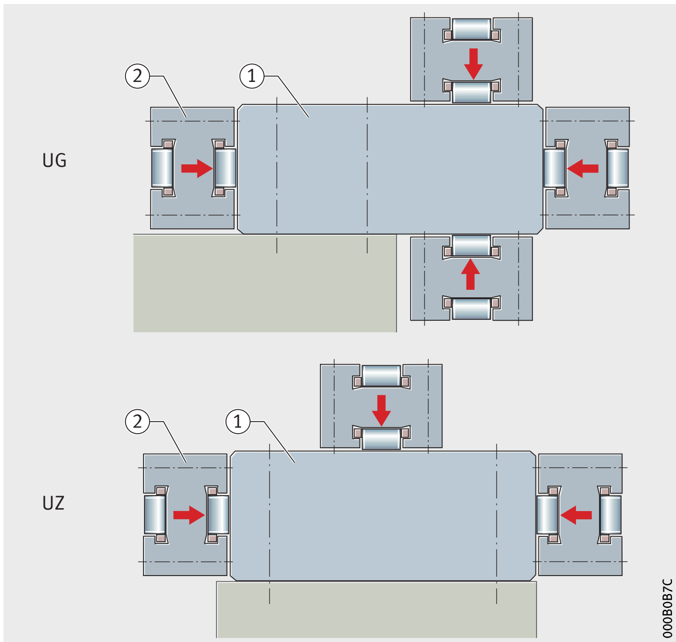
Guideways with four or three raceways

Four raceways

Guideways with four raceways (UG, UGN) can support forces in the main load direction and opposing direction with a counterstay as well as lateral forces in two directions.

Three raceways

Guideways with three raceways (UZ, UZN) can support forces in the main load direction and lateral forces in two directions.



UG, UZ

1 Guideways
2 Linear roller bearings

Figure 20
Guideways, linear roller bearings, load directions

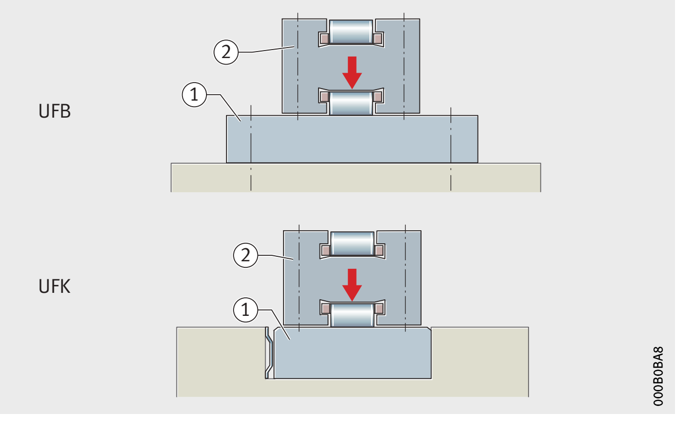
Guideways with one raceway

Guideways with one raceway (UFB, UFK) can support forces in the main load direction only.

UFB, UFK

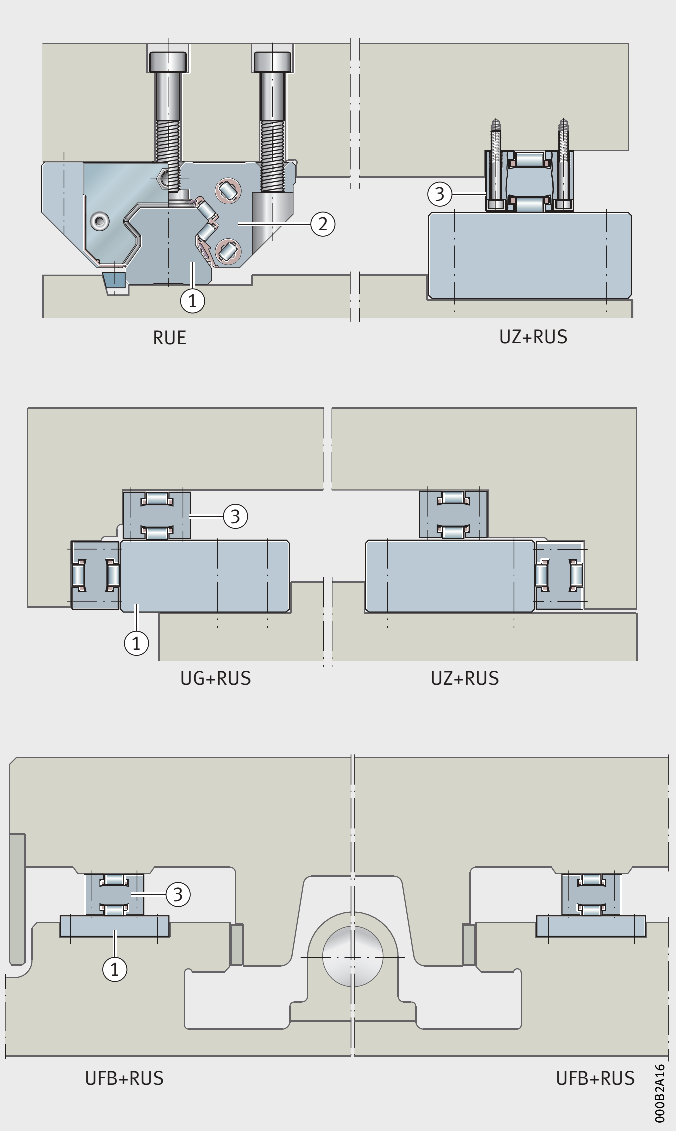
① Guideways
② Linear roller bearings

Figure 21
Guideways, linear roller bearings, load directions



Open arrangement

The open arrangement has one locating bearing side and one or more non-locating bearing sides, but does not have a counterstay. This is mainly used for applications with loads acting concentrically and vertical to the guidance plane and allows a large guidance base, *Figure 22*.



RUE, UZ, UG, UFB

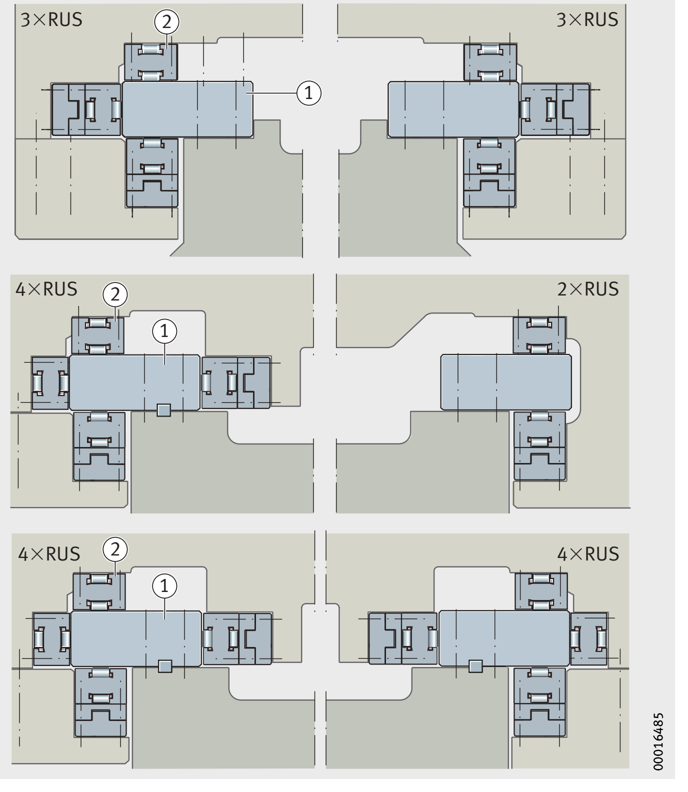
1 Guideways
2 Carriage
3 Linear roller bearings

Figure 22
Examples of open arrangements

Closed arrangement

The closed arrangement has one or two locating bearing sides and a counterstay on both sides. It is mainly used for applications with all types of load directions and for moment loads.

Preload increases the rigidity and the accuracy of the guidance system, *Figure 23*.



RUS

1 Guideways
2 Linear roller bearings

Figure 23
Examples of closed arrangements

Mounting guidelines

Linear roller bearings and guideways are high precision machine elements. These products must be handled very carefully before and during mounting. Their trouble-free operation depends largely on the care taken during mounting.

Delivered condition

Linear roller bearings and guideways

Linear roller bearings and guideways are supplied coated with a preservative. The preservative is compatible with oils and greases having a mineral oil base.

Guidelines for mounting of linear roller bearings and guideways

Linear roller bearings and guideways should only be stored in their original packaging.

Unpacking of guidance elements

Perspiration leads to corrosion. Hands must be kept clean and dry. Wear safety gloves as appropriate.

Linear roller bearings and guideways should only be removed from their packaging immediately before mounting.

If mounting is very demanding, for example due to complex mounting operations or where mounting is interrupted, bearings should be protected against contamination by appropriate measures.

Parts should be held covered in a clean, dry area.

Linear roller bearings and guideways should be lightly oiled in order to prevent corrosion during mounting. The preservative present on the parts when supplied need not be removed.

Design of the mounting area

Work surfaces must be bright, clean, free from fibres and made, for example, from plastic, and lighting conditions must be good, *Figure 1*.

Contaminants affect the operation and operating life of the guidance elements:

- Machines or equipment that produce swarf or generate dust must not be used in the immediate vicinity of the bearings.
- The guidance systems must be protected against dust, contamination, swarf, moisture, adhesives, etc.
- Wire wool or lint-forming cloths must not be used.

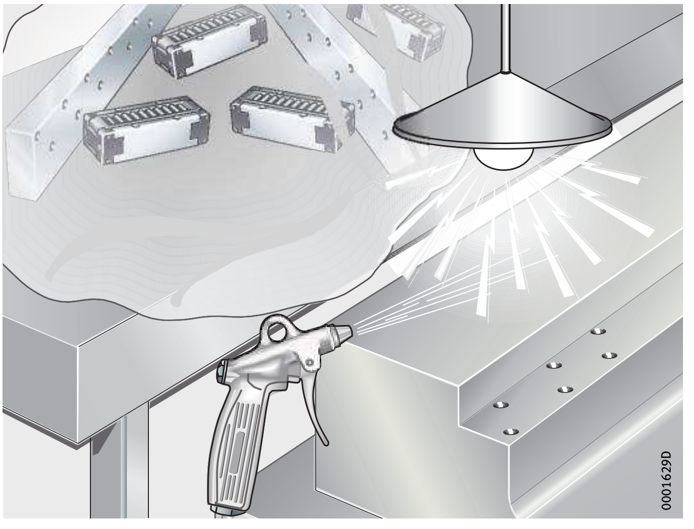


Figure 1
Design of mounting area

Cleaning the adjacent construction

In order to prevent mounting defects, the holes and edges of the adjacent components must be free from burrs.

The mounting surfaces for the guideways and the locating faces for the linear roller bearings must be clean.

Suitable cleaning agents include conventional grease solvents (isopropanol, petroleum, diesel oil).

! The appropriate legal regulations relating to the use of cleaning agents must be fulfilled. The manufacturer's instructions as well as regulations covering occupational safety and environmental protection must be observed.

Cleaning agents must be disposed of correctly after use.

Cleaning

Apply cleaning agents using a brush or suitable cloth, then clean and dry the surfaces, *Figure 2*.

! It must be ensured that the adjacent components and lubrication holes are free from cleaning agents, solvents and washing emulsions. The fit surfaces can rust or the raceway system can become contaminated.

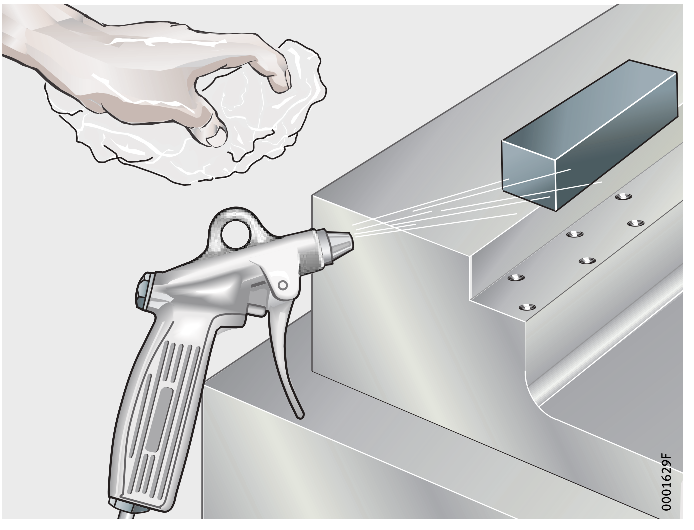


Figure 2
Cleaning
the adjacent construction

Checking the tolerances of the adjacent construction

The method used for checking dimensional, geometrical and positional tolerances is dependent on:

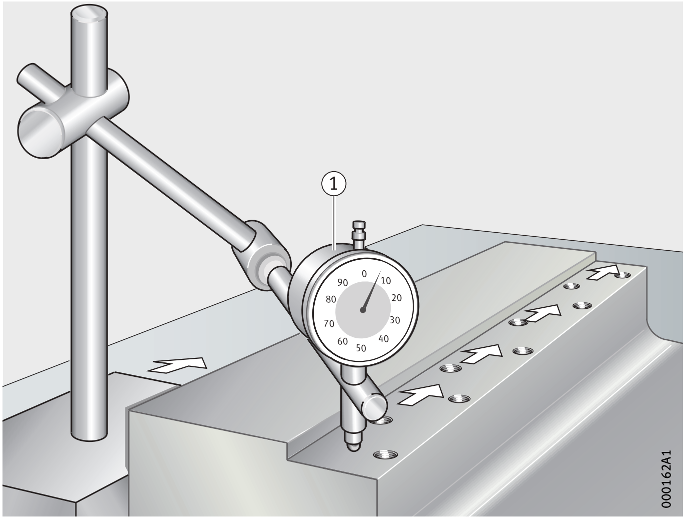
- the measuring equipment used
- the geometry of the adjacent components
- the requirements for running accuracy
  - If high running accuracy is required, the adjacent construction must be checked as appropriate using a measuring machine, *Figure 3*.

Checking the seating surfaces

!

The accuracy should not be checked if the adjacent components have been refrigerated or heated.

The seating surfaces of the adjacent construction must not exceed the permissible geometrical tolerances, see page 506.



1 Dial gauge

Figure 3
Checking the adjacent construction using a dial gauge

Fasteners for bearings and guideways

Screws, square steel bar

INA linear roller bearings and guideways must only be located using the specified screws. The information given in this catalogue must be taken as definitive.

For the guideways UGN and UZN, a square steel bar in accordance with DIN EN 10278 is required, see dimension table.

! The specifications relating to the fasteners must be observed in all cases. Any deviations will affect the security of the screw connections as well as the accuracy, load carrying capacity, rigidity and operating life of the guidance systems.

It must be ensured that the adjacent construction is of adequate strength in accordance with VDI Guideline 2230.

Fixing screws are not included in the scope of delivery.

Mounting of guideways

Aligning and screw mounting guideways with holes

Guideways of series UG, UGN, UZ, UZN and UFB have through holes and counterbores.

In the case of guideways UGN and UZN, it is also necessary to fit a square steel bar.

! In order that the load carrying capacity, rigidity, accuracy and smooth running of the linear recirculating roller guidance systems can be used to the full, the guideways must be precisely aligned.

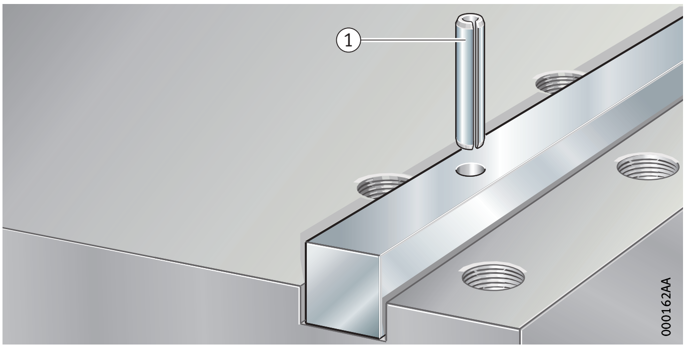
All the fixing screw holes must be used. If a smaller number of fixing screws is used, this will reduce the load carrying capacity of the screw connections and the rigidity of the guidance system.

The cylindrical counterbores of the fixing holes have sharp edges. Risk of injury.

Fitting the square steel bar

Guideways UGN and UZN:

- Position the square steel bar in the centre of the slot in the adjacent construction and locate it using at least two dowel pins (1) or screws, *Figure 4*.



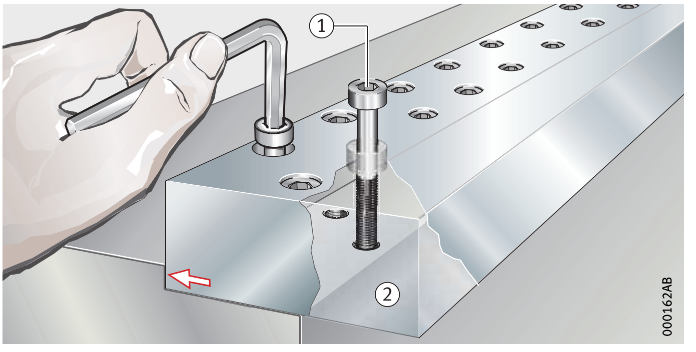
(1) Dowel pin

Figure 4
Fitting the square steel bar

Positioning the guideway

Align the guideway:

- Lightly oil the mounting and locating faces for the guideways on the adjacent construction. This prevents fretting corrosion.
- Insert the fixing screws ① in the holes in the guideways and tighten finger tight, *Figure 5*.
- Position the guideways ②, *Figure 5*. Press the guideways as appropriate against the lateral locating faces (arrow) and locate them by means of suitable devices (screw clamps or clamping fixtures).



① Fixing screw
② Guideway

Figure 5
Positioning the guideways

Tightening scheme

Tighten the screws using a torque wrench:

- Tighten the fixing screws in three stages to the specified tightening torque M_A, *Figure 6*:

  Stage 1 0,4 × M_A
  Stage 2 0,7 × M_A
  Stage 3 1,0 × M_A.

Guideways should ideally be screw mounted in both directions working from the centre, but at the very least the screws should be located consistently from one side in the direction of the other side, *Figure 6*.

Check the alignment of the guideways after each stage.

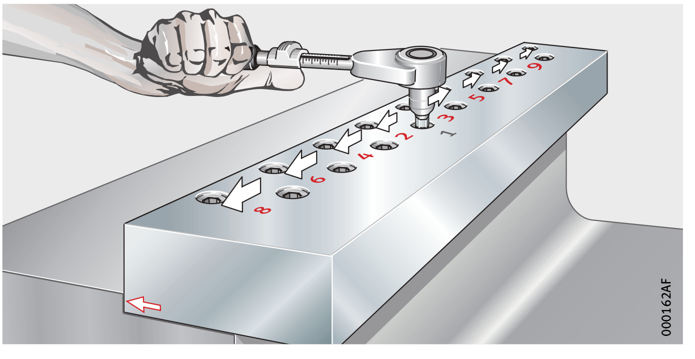
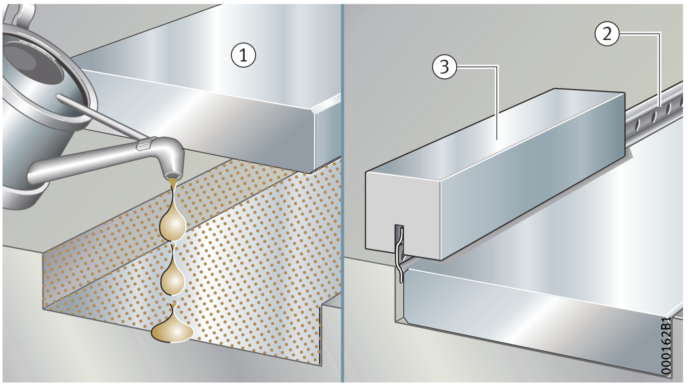


Figure 6
Locating guideways
to the tightening torque M_A

Locating guideways using a high precision steel strip

Clamp the guideways:

- Lightly oil the mounting surfaces for the guideways on the adjacent construction. This prevents fretting corrosion.
- Position the guideways ① in the slot in the adjacent construction, *Figure 7*.
  - The high precision steel strip must be used over the whole length of the guideway.
- Press in the high precision steel strip ② using a fitting aid ③.



① Guideway
② High precision steel strip
③ Fitting aid

Figure 7
Clamping of guideways

Mounting of linear roller bearings

!

Direct blows and shocks to the linear roller bearings must always be avoided. Mounting forces must never be directed through the rolling elements.

Linear roller bearings must never be fitted by force, for example by direct blows, in preloaded guidance systems. It must be ensured that the seal lips on the wipers are not damaged.

Premounting of linear roller bearings

Align the linear roller bearings:

- Lightly oil the locating faces for the linear roller bearings on the adjacent construction. This prevents fretting corrosion.
- Insert the fixing screws ① in the holes, tighten them finger tight and align the linear roller bearings, *Figure 8*.
- Press the datum side ② of the linear roller bearings against the locating face of the adjacent construction, *Figure 8*.
  The datum side is the unmarked side. This is on the opposite side to the marked side.

① Fixing screw
② Datum side

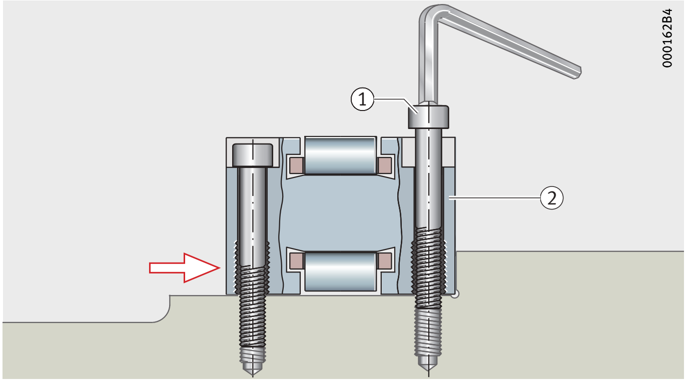


Figure 8
Premounting of linear roller bearings

Checking the parallelism

- Check the lateral alignment to the locating face and rework the adjacent construction if necessary, *Figure 9*.

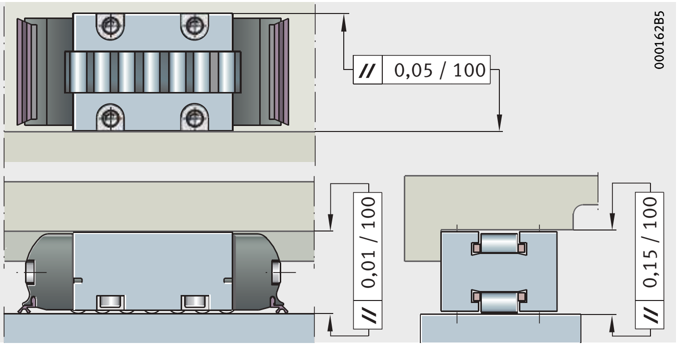


Figure 9
Lateral alignment

Tightening scheme

Tighten the screws using a torque wrench:

- Tighten the fixing screws in crosswise sequence in two stages to the specified tightening torque M_A, *Figure 10*:

  Stage 1 $0{,}5 \times M_A$
  Stage 2 $1{,}0 \times M_A$.

In order to prevent the occurrence of unacceptable stresses, the location sequence must always be observed.

Check the alignment of the linear roller bearings after each stage.

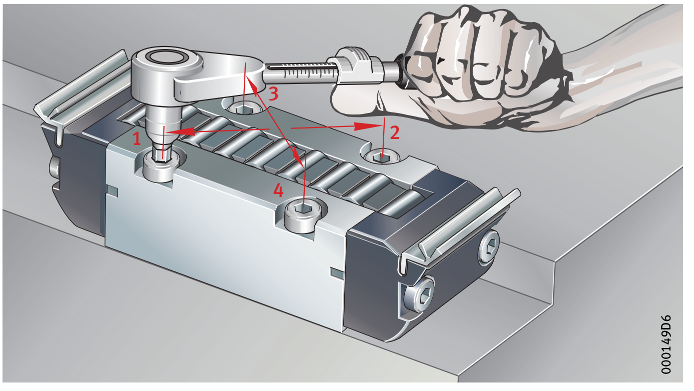


Figure 10
Tightening of linear roller bearings to the tightening torque M_A

Mounting of adjusting gibs

When units comprising a linear roller bearing and adjusting gib are mounted, the linear roller bearing is aligned against the locating face (not against the adjusting gib).

Observe the mounting guidelines for the linear roller bearings, see page 530.

Mounting the lower gib half on the linear roller bearing

In order to facilitate alignment of the linear roller bearings in the case of assemblies, the adjusting gibs are somewhat narrower compared to the associated linear roller bearings.

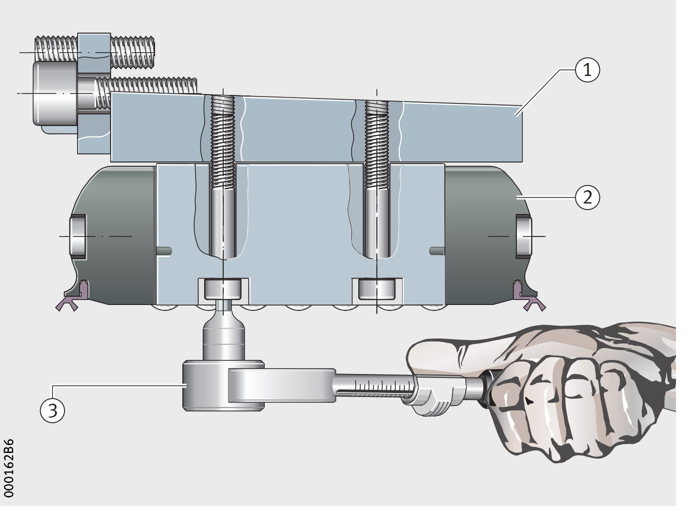
Mounting:

- Separate the gib halves.
- Screw the lower gib half ① to the linear roller bearing ② and tighten the screws finger tight, *Figure 11*.
- Align the gib half to the linear roller bearing.
- Tighten the fixing screws using a torque wrench ③ in crosswise sequence in two stages to the specified tightening torque M_A, *Figure 11*:

  Stage 1 $0,5 \times M_A$
  Stage 2 $1,0 \times M_A$.

In order to prevent the occurrence of unacceptable stresses, the location sequence must always be observed.

Check the alignment of the linear roller bearings after each stage.



① Lower gib half
② Linear roller bearing
③ Torque wrench

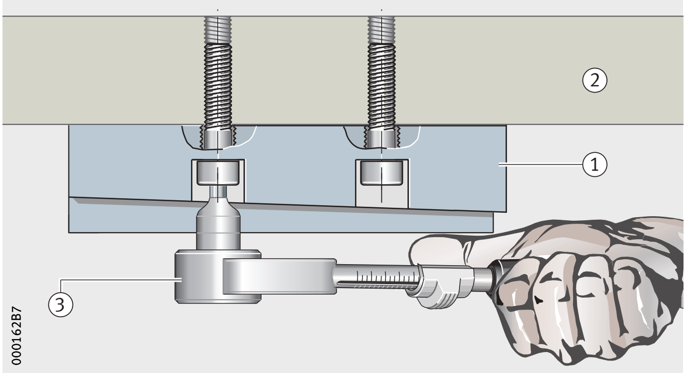
Figure 11
Mounting the lower gib half on the linear roller bearing

Mounting the upper gib half on the adjacent construction

Mounting:

- Screw the upper gib half 1 to the adjacent construction 2 finger tight, *Figure 12*.
- Align the gib half to the adjacent construction.
- Tighten the fixing screws using a torque wrench 3 in two stages to the specified tightening torque M_A, *Figure 12*:

  Stage 1: $0,5 \times M_A$
  Stage 2: $1,0 \times M_A$.
- Assemble the two gib halves carefully.



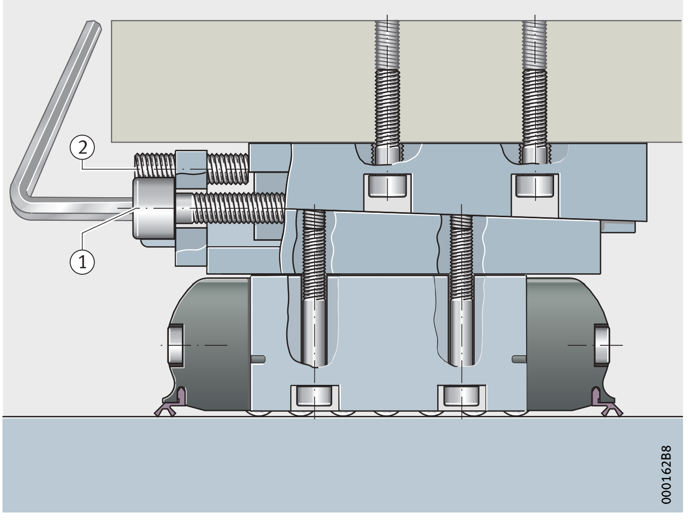
1 Upper gib half
2 Adjacent construction
3 Torque wrench

Figure 12
Mounting the upper gib half on the adjacent construction

Setting the preload

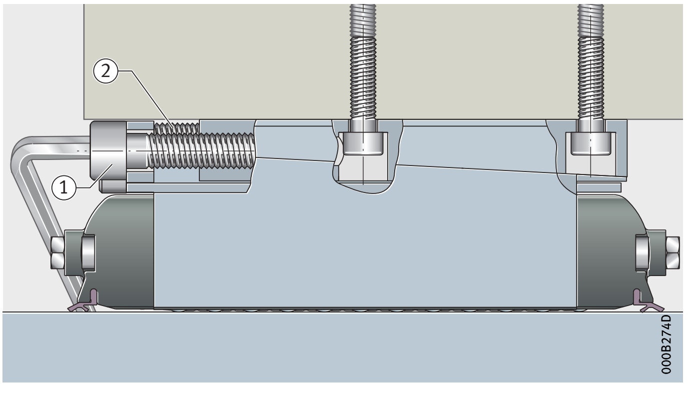
Setting operation:

- Determine the preload dimension, see page 487.
- Set the preload dimension determined using the adjusting screw ①, *Figure 13*.
- Secure the setting by means of a locking screw ②.



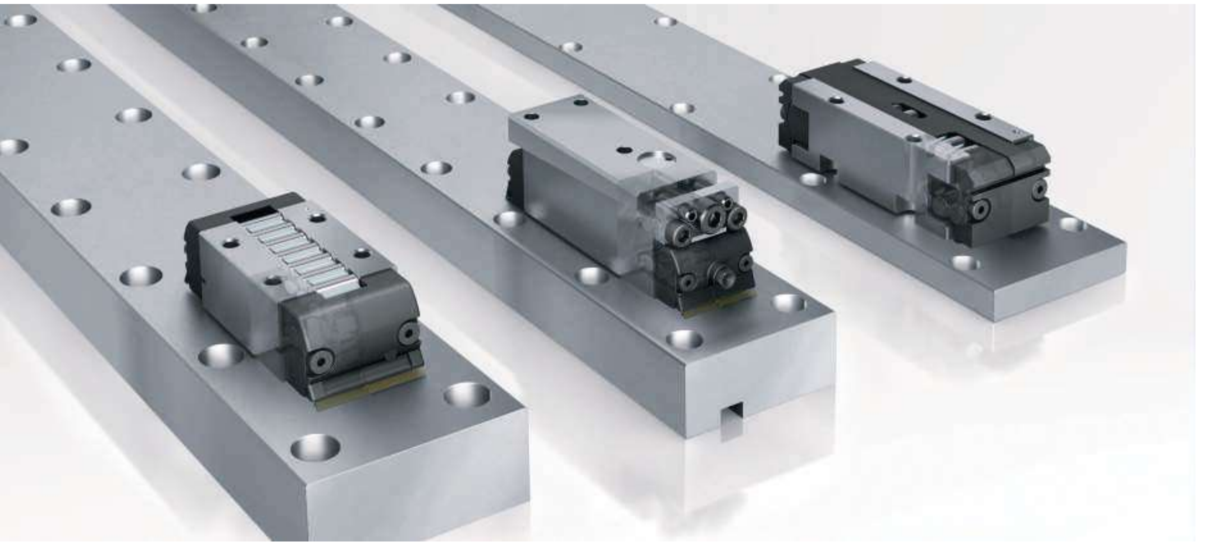
① Adjusting screw
② Locking screw

Figure 13
Setting and securing the preload



① Adjusting screw
② Locking screw

Figure 14
Setting and securing the preload on RUSV



Linear roller bearings

With spacer elements
Full complement
Accessories
Guideways

Linear roller bearings

With spacer elements **538**

Linear roller bearings with spacer elements are suitable for numerous applications in general mechanical engineering, especially where high guidance and positional accuracy is required over long displacement distances.

They are characterised by a very high load carrying capacity with low, uniform friction.

Full complement **538**

The full complement linear roller bearings are the heavy duty designs in the range of INA linear recirculating roller guidance systems.

With the same characteristics as the series with spacer elements, full complement linear roller bearings have inch size mounting dimensions.

They are used when particularly high temperatures are present or high velocities and accelerations must be achieved.

Accessories **554**

There is an extensive range of accessories for linear recirculating roller guidance systems.

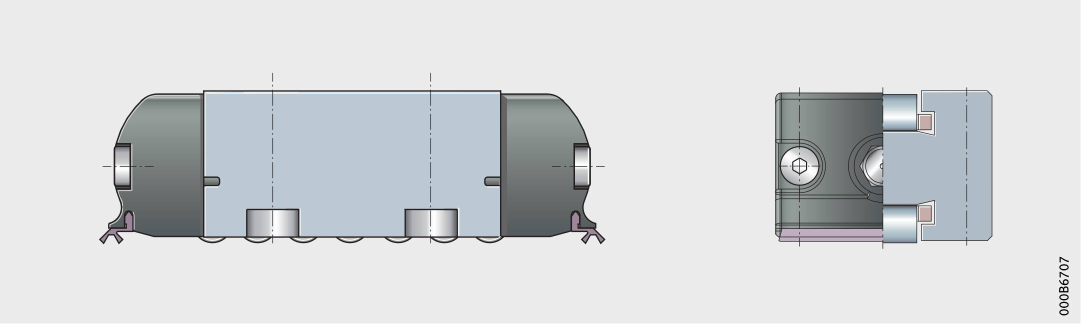
They include adjusting gibs for linear roller bearings for the simple, uniform setting of preload, in both metric and inch size designs.

A setting device is necessary for determining the preload force.

The closing plugs close off the counterbores for the fixing screws in the guideways flush with the surface of the guideway.

Guideways **566**

Guideways for linear roller bearings are available with four raceways and an offset hole pattern, with three raceways and a parallel hole pattern, or one raceway, either with a parallel hole pattern or without holes for clamping.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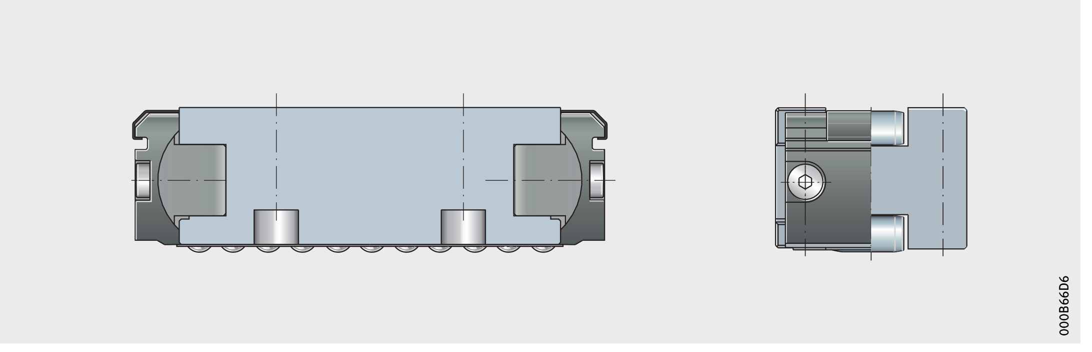
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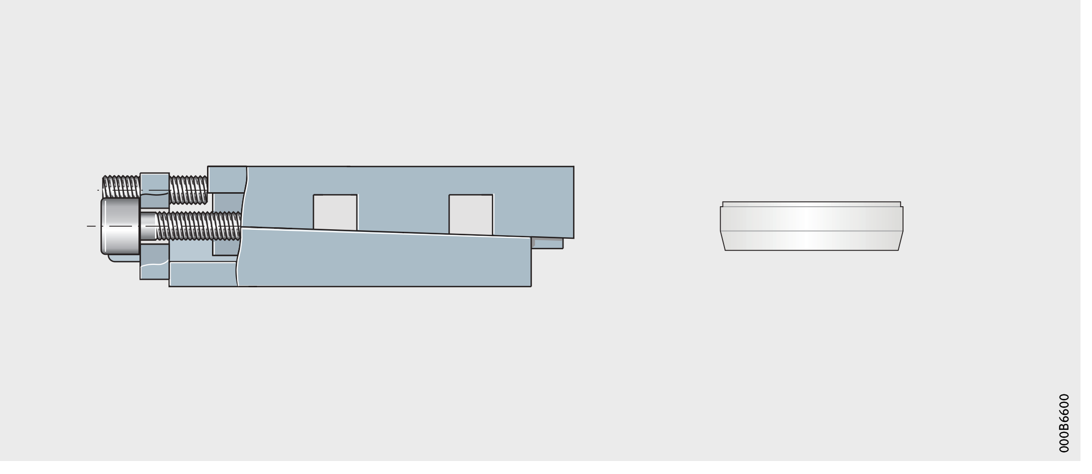
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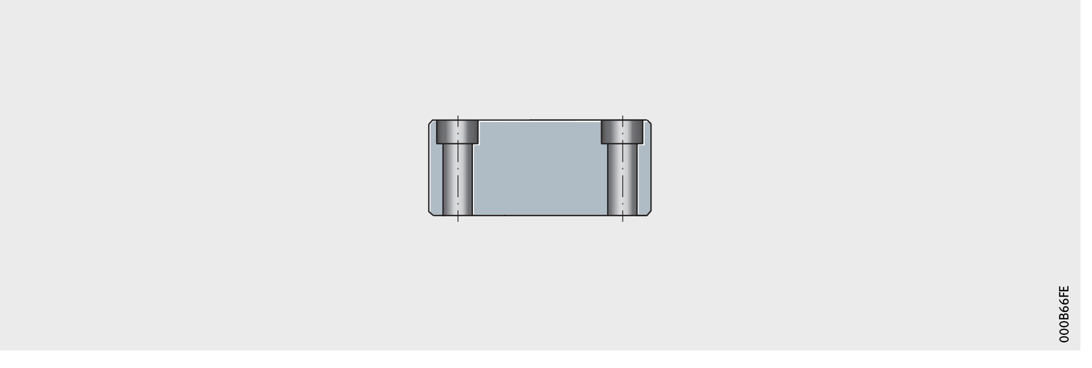
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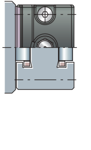

Linear roller bearings

With spacer elements
Full complement

Linear roller bearings

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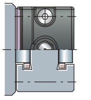
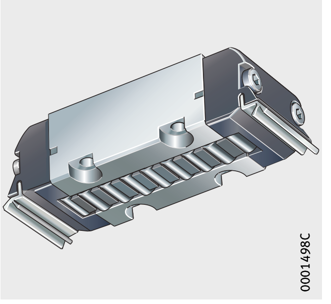


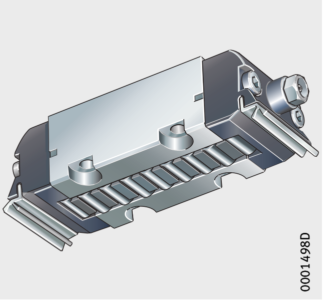
Product overview Linear roller bearings

With spacer elements

RUS

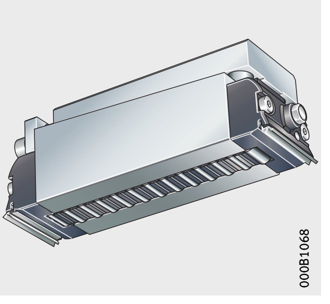


RUS..-KS



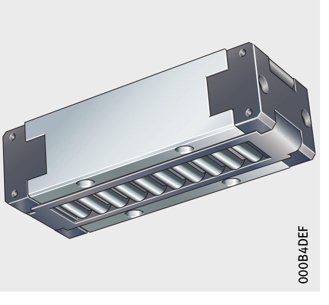
With integrated adjusting gib

RUSV..-KS



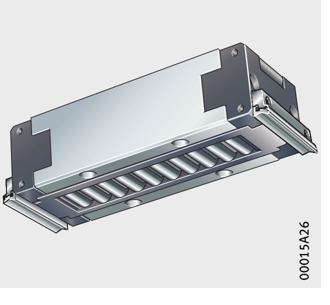
Full complement

PR



With end face wipers

PR..-PP



Linear roller bearings

Features

Linear recirculating roller guidance systems comprise linear roller bearings and guideways. The guidance systems in a closed arrangement can support loads from all directions, except in the direction of motion, and moments about all axes. They are suitable for locating/locating and locating/non-locating bearing arrangements.

They require only a small design envelope, have high load carrying capacity and are characterised by low, uniform friction and high accuracy throughout their operating life.

In a preloaded design, the guidance systems can achieve extremely high rigidity. Setting of preload can be easily carried out using adjusting gibs. The gibs give particularly uniform distribution of the preload over the whole length of the linear roller bearing.

The guidance systems can be lubricated with oil or grease.

Linear roller bearings with spacer elements

The linear roller bearings RUS, RUS..-KS and RUSV..-KS are sealed on both sides and run particularly smoothly and quietly. The cylindrical roller are guided between the ribs of the saddle plate, while their spacing and location on the raceways is maintained by the spacer elements.

They have metric mounting dimensions.

Linear roller bearings, full complement

Linear roller bearings PR and PR..-PP are made completely from metal and are suitable for high temperatures, velocities and accelerations.

The cylindrical roller are guided between the ribs of the saddle plate, while they are retained on the raceways by means of return plates.

They have inch size mounting dimensions.

Standard accessories

The linear recirculating roller guidance systems are supplemented by a range of functional accessories, see page 554.

These include adjusting gibs in metric and inch size designs for the precise setting of preload of a guidance system as well as a setting device that can be used to measure the deformation of the adjacent construction. The closing plugs close off the counter-bores for the fixing screws in the guideways flush with the surface of the guideway.

Load carrying capacity

The load carrying capacity of linear roller bearings is restricted by the required rating life L and L_h as well as by the required static load safety factor S_0.

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

Acceleration and velocity

Operating limits

Linear roller bearings permit accelerations up to 160 m/s^2 and velocities up to 2 m/s, see table.

Acceleration

Linear roller bearing Series	Acceleration a_{max} m/s^2
PR..(-PP)	160
RUS..(-KS), RUSV..-KS	110

Velocity

Linear roller bearing Series	Velocity v_{max} m/s
PR..(-PP)	2
RUS19..(-KS), RUSV30..-KS	1,6
RUS26..(-KS), RUSV42..-KS	1,3
RUS38..(-KS), RUSV60..-KS	1
RUS65..(-KS)	0,8

Sealing

The type of sealing or shielding is a decisive factor for problem-free operation and a long operating life of linear roller bearings.

Wipers

Linear roller bearings with spacer elements (series RUS) and full complement linear roller bearings PR..-PP have elastic, double lip wipers on the end pieces that can be replaced.

The wipers ensure that no contaminants enter the bearing and that no lubricants escape the bearing.

In most applications, linear roller bearings are protected reliably against contamination by the wipers and the narrow gap between the saddle plate and raceway. In special cases, additional measures may be taken to cover the raceway.

! If full complement linear roller bearings PR are used or are exposed to severe contamination (e.g. swarf, grinding dust, etc.) or aggressive media, separate raceway wipers should be fitted.

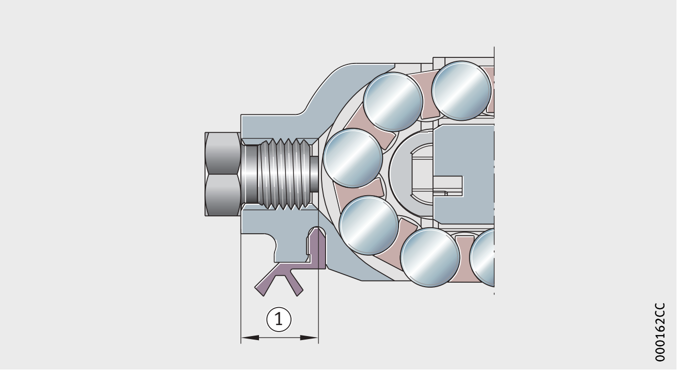
Lubrication

Linear roller bearings can be relubricated via the rolling element return zone or via lubrication connectors, see page 474.

Relubrication from the end via the end piece:

- If the lubrication connectors in accordance with DIN 3405-AM6 and DIN 3405-AM8×1 are replaced by pipe or hose connectors, the maximum screw depth cannot be more than 6 mm.

  If a lubrication pipe connection will not be made, the hole must be closed off using the lubrication connector in accordance with DIN 3405, *Figure 1*.



(1) Maximum screw depth 6 mm

Figure 1
Maximum screw depth of pipe or hose connector

Relubrication via lateral lubrication holes in the saddle plate for the linear roller bearing RUS65210 and RUS85280:

- Additional holes on both sides of the saddle plate allow lateral relubrication by means of a lubrication connector to DIN 3405 NIP A2, *Figure 2*.

  The lubrication connectors to DIN 3405 are included loose in the delivery.

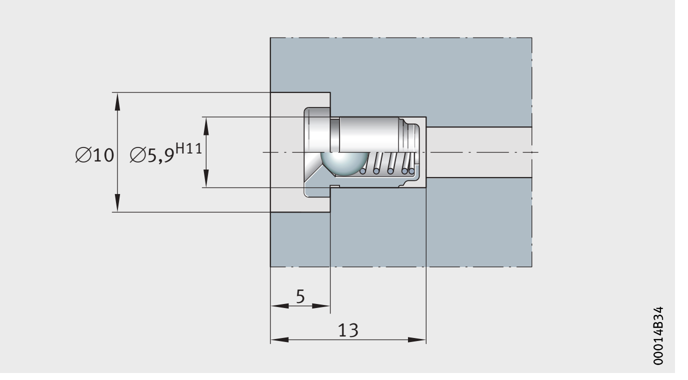


Figure 2
Closing off the hole using the lubrication connector

Operating temperature

Linear roller bearings RUS..(-KS), RUSV..-KS and PR..-PP are suitable for temperatures from –30 °C to +100 °C.

Linear roller bearings PR are suitable for temperatures from –40 °C to +120 °C.

Available designs

Suffix	Description
PP	Linear roller bearings PR with end face wiper
KS	Linear roller bearings RUS and RUSV with end face lubrication connectors

Design and safety guidelines

Mounting guidelines

In order to achieve high guidance and positional accuracy as well as constant displacement resistance, the mounting guidelines must be observed, see page 474.

Accuracy

Tolerance classes

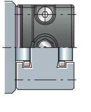
For linear roller bearings and adjusting gibs, see tables.

Tolerances for linear roller bearings

Linear roller bearing Designation		Tolerance			
		Height µm		Width µm	Parallelism and flatness µm
from	to	from	to		
PR14032(-PP)	PR14089(-PP)	0	−5	−100	2
PR14135(-PP)	PR14182(-PP)	0	−10	−100	4
RUS19069(-KS)	RUS38206(-KS)	−10	−15	−100	2
RUS65210(-KS)	RUS85280(-KS)	−10	−20	−100	4
RUSV30069-KS	RUSV60206-KS	–	–	−100	–

Tolerances for adjusting gibs

Adjusting gib Designation		Tolerance Parallelism and flatness
from	to	µm
VUS19069 VUSZ12044	VUS38134 VUSZ24084	3
VUS65210 VUSZ14135	VUS85280 VUSZ14182	8



Ordering example, ordering designation

Linear roller bearings with spacer elements	Linear roller bearing	RUS26102 RUS38134-KS
Ordering designation	8×**RUS26102** 8×**RUS38134-KS**, *Figure 3*	

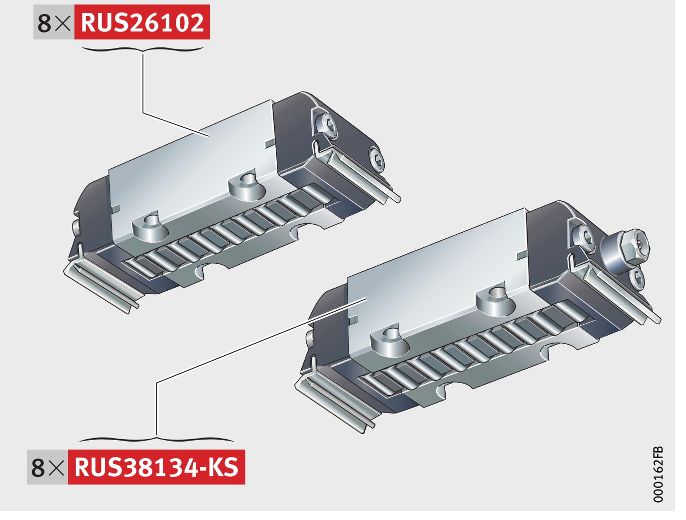


Figure 3
Ordering example, ordering designation

Linear roller bearings, full complement — Linear roller bearing — PR14061, PR14135-PP

Ordering designation — 8×**PR14061**
8×**PR14135-PP**, *Figure 4*

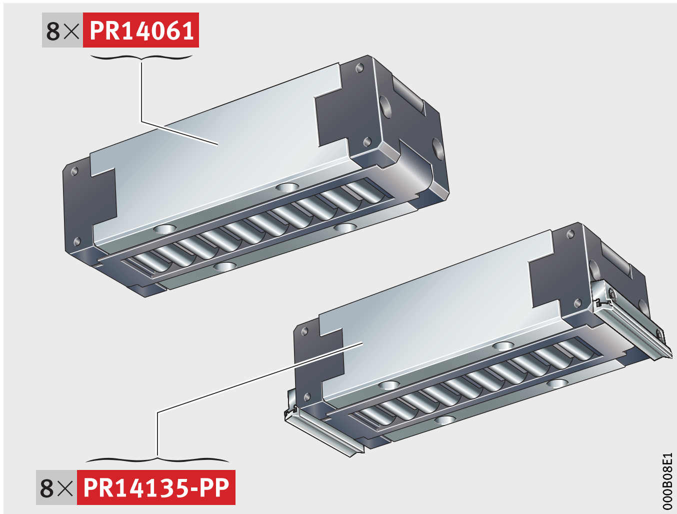
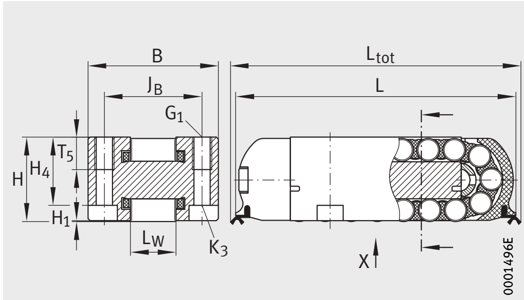


Figure 4
Ordering example, ordering designation

Linear roller bearings

With spacer elements



RUS19069 – RUS38206

Dimension table · Dimensions in mm

Designation		Mass m ≈ kg	Dimensions L	L_{tot}	H	B	Mounting dimensions L_1	J_B ±0,1	J_L ±0,1	H_1	L_4[4]	L_w	A_3	H_4	T_5
RUS19069	–	0,19	70,4	74	19	27	43,8	20,6	25,5	0,2	50	10	–	15,2	6,2
–	**RUS19069-KS**	0,21	–	82											
RUS19105	–	0,32	105,5	109			79		50		85				
–	**RUS19105-KS**	0,33	–	117,1											
RUS26086	–	0,51	86,4	90	26	40	52,8	30	28	0,2	63	14	–	21	10,2
–	**RUS26086-KS**	0,53	–	98											
RUS26102	–	0,62	102,4	106			68,9		44		79				
–	**RUS26102-KS**	0,64	–	114											
RUS26126	–	0,8	126,5	130			93		68		103				
–	**RUS26126-KS**	0,82	–	138,1											
RUS38134	–	1,29	132,7	132	38	52	84,7	41	51	0,2	100	20	–	31	14,2
–	**RUS38134-KS**	1,57	–	142,05											
RUS38206	–	2,37	206,7	206			158,8		102		172				
–	**RUS38206-KS**	2,59	–	216,1											
RUS65210	–	6,9	211,4	232	65	76	133,5	62	76	0,5	–	30	26	55,4	22,2
RUS85280[5]	–	16,8	280,1	301	85	104	184,6	82,5	101,5	0,5	–	40	33	73,3	30,2

1 Maximum screw depth 6 mm, see page 543.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 26, page 69, page 481 and page 527.

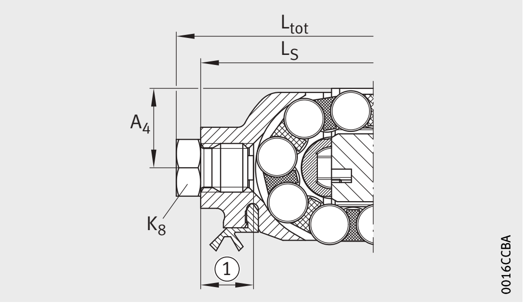
2) Adjusting gibs, see page 560 and page 562.

3) Guideways, see page 576, page 578 and page 580.

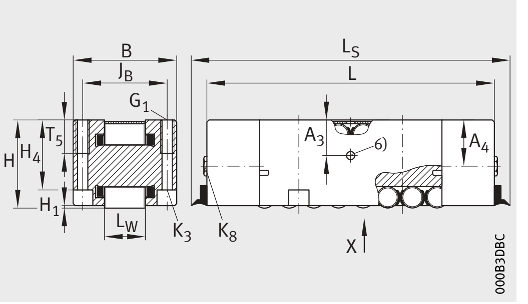
4) Minimum support length.

5) Available by agreement.

6) Relubrication from side, see page 543.

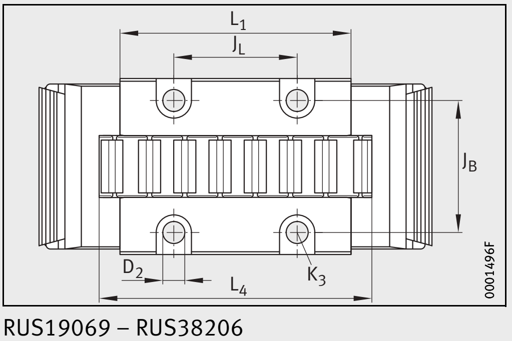


RUS19069-KS – RUS38206-KS

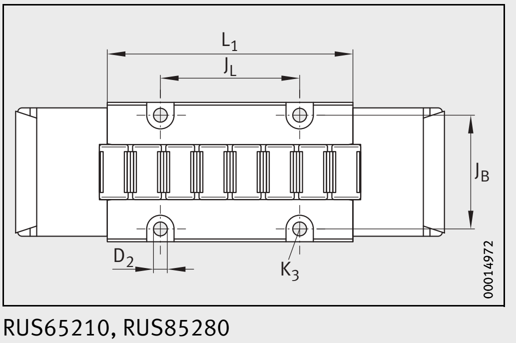


RUS65210, RUS85280

Fixing screws[1)]					Lubrication connectors		Lubrication connector to DIN 3405-A	Basic load ratings		Adjusting gib[2)]	Guideway[3)]	
G_1		K_3		D_2	L_S	A_4	K_8	dyn. C	stat. C_0			
DIN ISO 4762-12.9												
	M_A Nm		M_A Nm					N	N			
M4	5	M3	1,8	3,5	–	–	–	42 000	66 000	VUS19069-A	UG6628 UGN6628 UZ6628 UZN6628	UFK3210 UFB4710
					76	9,8	M6					
					–	–	–	68 000	123 000	VUS19105-A		
					111,5	9,8	M6					
M6	17	M4	5	4,9	–	–	–	76 000	113 000	VUS26086-A	UG9741 UGN9741-A UZ9741 UZN9741-A	UFK4710 UFB6412
					92	13,5	M6					
					–	–	–	95 000	151 000	VUS26102-A		
					108	13,5	M6					
					–	–	–	122 000	209 000	VUS26126-A		
					132,1	13,2	M6					
M8	41	M6	17	6,9	–	–	–	179 000	275 000	VUS38134-A	UG12553 UGN12553-A UZ12553 UZN12553-A	UFK6412 UFB7812
					136,1	19,3	M6					
					–	–	–	305 000	550 000	VUS38206-A		
					210,1	19,3	M6					
M10	83	M8	41	9	234	34	M8×1	465 000	732 000	VUS65210	UG16260 UGN16260-A UZ16260 UZN16260-A	UFK8815 UFB10615
M14	229	M10	83	11,8	303	45	M8×1	840 000	1 324 000	VUS85280	UFK11518 UFB140185	UFK11518 UFB140185



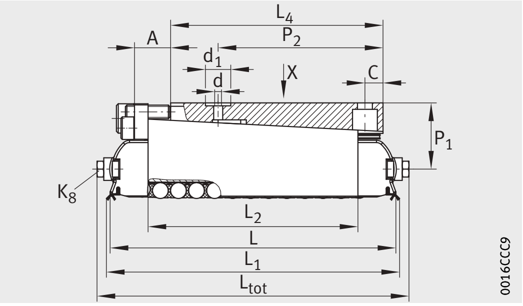
RUS19069 – RUS38206
View X



RUS65210, RUS85280
View X

Linear roller bearings

With spacer elements
With integrated adjusting gib



RUSV

Dimension table · Dimensions in mm

Designation	Mass	Dimen-sions			Mounting dimensions														
	m ≈ kg	L_{tot}	H	B	L	L_1	L_2	L_4	a	L_w	C	E	F	i	P_1	d_1	P_2	P_3	d
RUSV30069-KS	0,32	82	30	27	69	75	43,5	45	0,3	10	5	25	19	4	21	12	33	9	2,5
RUSV30105-KS	0,46	117			105	111	78,5	79				45					53		
RUSV42086-KS	0,81	98	42	40	86	92	52,4	54	0,3	14	8	23	26	6	29,5	16	38	14,5	3
RUSV42102-KS	0,99	114			102	108	68,4	70				38					53		
RUSV42126-KS	1,26	138			126	132	92,4	94				58					73		
RUSV60134-KS	2,25	143	60	52	134	133	85	86	0,3	20	10	45	35	8	41,5	22	65	18	4
RUSV60206-KS	3,47	216			206	206	158	159				115					145		

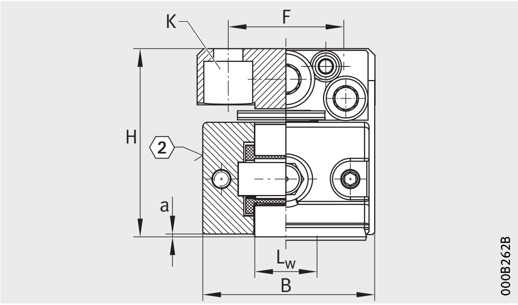
(1) Oil feed. (2) Marking.

1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 26, page 69, page 481 and page 527.

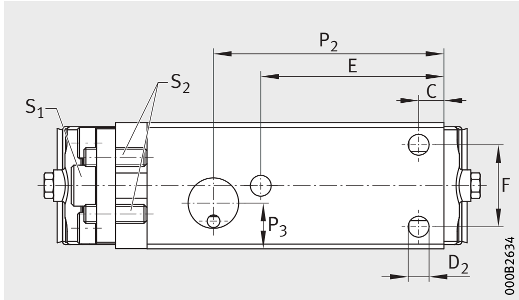
2) If the lubrication connector to DIN 3405 is replaced by a tube or hose connector, the permissible thread length is max. 6 mm.

3) Guideways, see page 576, page 578 and page 580.

4) S = hexagon socket.

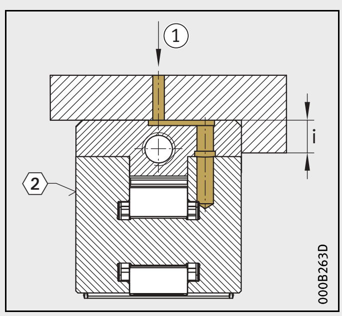


RUSV



RUSV
View X

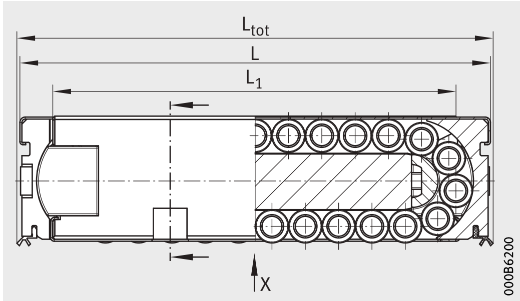
	Adjustment screw S_1 [4]	Locking and extraction screw S_2 [4]	Fixing screws[1] K DIN ISO 4762-12.9	Fixing screws[1] M_A Nm	Fixing screws[1] D_2	Adjustment A max.	Adjustment Δh max.	Adjustment per screw revolution	Lubrication connector to DIN 3405-A[2] K_8	Basic load ratings dyn. C N	Basic load ratings stat. C_0 N	Guideway[3]	
	3	2	M4	5	4,5	7	0,37	0,035	M6	42 000	66 000	UG6628 UGN6628 UZ6628 UZN6628	UFK3210 UFB4710
								0,023		68 000	123 000		
	6	3	M6	17	6,6	10	0,52	0,05	M6	76 000	113 000	UG9741 UGN9741-A UZ9741 UZN9741-A	UFK4710 UFB6412
								0,05		95 000	151 000		
								0,05		122 000	209 000		
	8	4	M8	41	8,6	15	0,78	0,062	M6	179 000	275 000	UG12553 UGN12553-A UZ12553 UZN12553-A	UFK6412 UFB7812
								0,05		305 000	550 000		



Oil feed

Linear roller bearings

Full complement



PR, PR..-PP

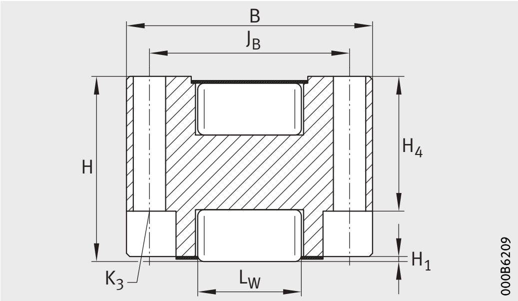
Dimension table · Dimensions in mm

Designation		Mass	Dimensions				Mounting dimensions						
		m	L	L_{tot}	H	B	L_1	J_B	J_L	H_1	L_2	L_w	H_4
		≈ kg						±0,1	±0,1				
PR14032	–	0,1	51	–	14,3	22,2	37,8	17,1	19,1	0,1	31	9	10,3
–	**PR14032-PP**		–	61,8									
PR14044	–	0,21	68,5	–	19,1	25,4	54,6	20,6	25,5	0,1	42	10	14,8
–	**PR14044-PP**		–	78,8									
PR14061	–	0,65	96,4	–	28,6	38,1	77,5	31	38	0,1	58,5	16	20,8
–	**PR14061-PP**		–	98,1									
PR14089	–	1,75	142	–	38,1	50,8	121,5	41	51	0,1	90	20	27,7
–	**PR14089-PP**		–	143,0									
PR14135	–	5,74	198	–	57,2	76,2	158	62	76,2	0,1	126	30	42
–	**PR14135-PP**			217,9									
PR14182	–	13,4	264	–	76,2	101,6	211	82,5	101,6	0,1	167	40	56,3
–	**PR14182-PP**		–	281,9									

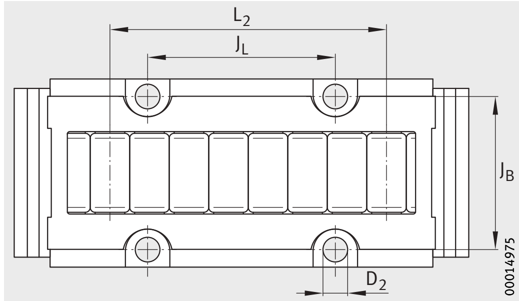
1) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 26, page 69, page 481 and page 527.

2) Adjusting gibs, see page 560 and page 562.

3) Guideways, see page 576, page 578 and page 580.

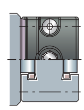


PR, PR..-PP



PR, PR..-PP
View X

Fixing screws[1]			Basic load ratings		Adjusting gib[2]	Guideway[3]	
K_3 DIN ISO 4762-12.9		D_2	dyn. C	stat. C_0			
	M_A Nm		N	N			
M2,5	1	3	21 700	19 900	–	UG6628 UGN6628 UZ6628 UZN6628	UFK3210
M3	1,8	3,65	44 000	76 000	VUSZ12044-A	UG6628 UGN6628 UZ6628 UZN6628	UFK3210 UFB4710
M4	5	5	107 000	175 000	VUSZ18059-A	UG9741 UGN9741-A UZ9741 UZN9741-A	UFK4710 UFB6412
M5	10	6	205 000	354 000	VUSZ24084-A	UG12553 UGN12553-A UZ12553 UZN12553-A	UFK6412 UFB7812
M6	17	7	435 000	735 000	–	UG16260 UGN16260-A UZ16260 UZN16260-A	UFK8815 UFB10615
M8	41	9	790 000	1 325 000	–	–	UFK11518 UFB14018



Accessories

Adjusting gibs
Setting device
Closing plugs

Accessories

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	Ordering example, ordering designation	557
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	Ordering example, ordering designation	558
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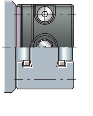
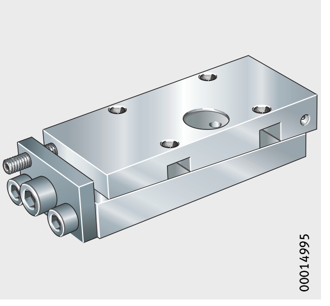


Adjusting gib

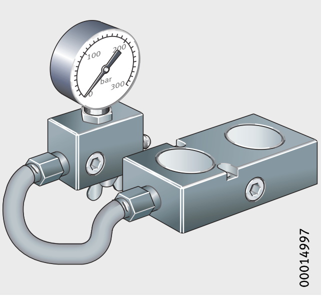
Metric or inch size

VUS, VUSZ



Setting device

EUS



Closing plugs

Plastic

Brass

KVK

KA..-M

Accessories

Adjusting gibs

Adjusting gibs are used to precisely define the preload of the guidance system by a simple method. The gibs transmit the preload with high uniformity over the whole length of the linear roller bearing, thus increasing the rigidity of the linear recirculating roller guidance system.

The adjusting gibs, which are easy to mount and maintain, comprise two ground gib halves and a central fitting strip that guides the gib halves against each other. A support plate on the end face supports the adjusting and locking screws.

The adjusting gibs are available in metric and inch sizes.

Mounting

The adjusting gibs are screw mounted to the linear roller bearings and the adjacent construction. The preload is set by means of an adjusting screw and secured by means of a locking screw, see page 474.

Lubrication

The ducts integrated in the adjusting gib feed the lubricant into the return zone of the linear roller bearings, see page 474.

The sliding surfaces should be treated with oil or grease, in order to reduce friction.

Ordering example, ordering designation

Adjusting gib for linear roller bearings, metric dimensions. RUS26102

Ordering designation

1×**VUS26102**, *Figure 1*

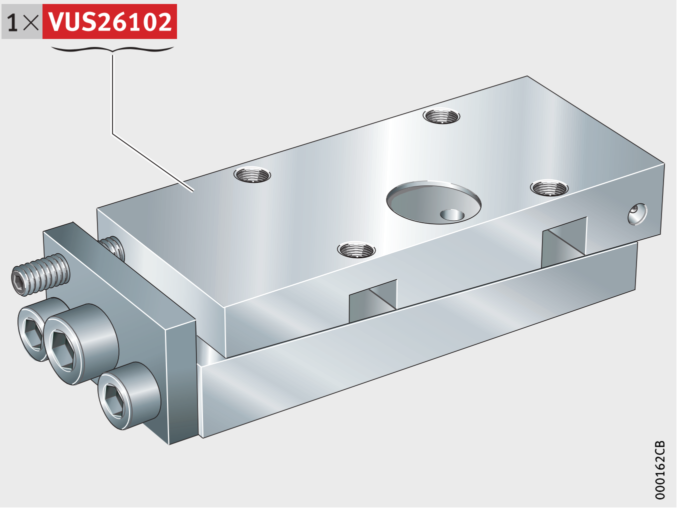


Figure 1
Ordering example, ordering designation

Setting device

The device is used in order to measure the deformation of the adjacent construction under preload forces. The deformation measured, when added to the deflection of the linear roller bearing under the preload force gives the required preload dimension, see page 474.

The setting device comprises a setting block with two hydraulic pistons, a distributor block with a manometer and a high-pressure rubber hose connecting both components. The setting block has the same dimensions as the linear roller bearing to be fitted.

Application

The setting block is fitted in place of the linear roller bearing. It is connected via the distributor block to a conventional grease gun, see page 487.

After measurement of deformation, the setting block is replaced by the linear roller bearing and the preload dimension determined is set by means of adjusting gibs or shims, see page 474.

Ordering example, ordering designation

The following components are required:

one setting block for linear roller bearing	RUS26102
one setting block for linear roller bearing	RUS19069
one distributor with manometer	VBM01
two high pressure rubber hoses	HDS01/250

Ordering designation

1×**EUS26**

1×**EUS19**

1×**VBM01**

2×**HDS01/250**, *Figure 2*

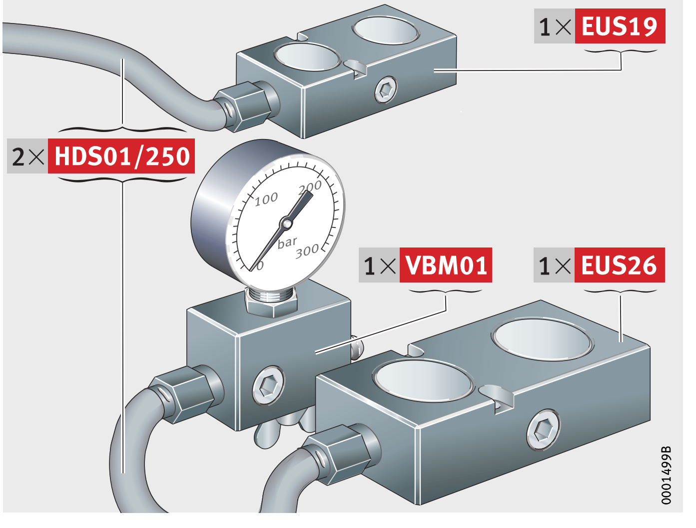


Figure 2
Ordering example, ordering designation

Closing plugs

The closing plugs close off the counterbores for the fixing screws in the guideway holes flush with the surface of the guideway. Depending on the guideway size, one-piece plastic closing plugs and two-piece brass closing plugs with a shear ring are available.

Plastic closing plugs, one-piece

The one-piece closing plugs KVK can be easily fitted with the aid of a hammer and press-in block. The interference between the plug and hole creates a burr that must be removed during fitting.

After fitting, a minimal ring gap remains.

Figure 3
KVK

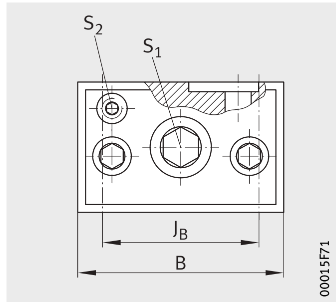
Brass closing plug with shear ring

The brass closing plugs KA..-M with a shear ring can be fitted with the aid of a hammer and press-in block. During fitting, the shear ring is sheared off, leaving a ring-shaped burr that must be removed. A minimal ring gap remains.

After fitting, the top surfaces of the plugs must be smoothed off using an oilstone.

Figure 4
KA..-M

Adjusting gibs



VUS, VUS..-A

Dimension table · Dimensions in mm														
Designation	Mass	Dimensions			Mounting dimensions									
		L	H	B	L_1	L_2	J_B	J_L	J_{L2}	J_{L5}	Q_1	A_3	A_4	N_3[4)]
	≈ kg	max.	min.			max.	±0,1	±0,1			max.			
VUS19069-A	0,24	78	16	26,6	62	73	20,6	25,5	16,5	16,5	7	14,9	–	3,5
VUS19105-A	0,32	123	16	26,6	100	119	20,6	50	25	29	15	14,9	–	3,5
VUS26086-A	0,6	97	25	39,5	75	89	30	28	20,5	19,5	8	20,5	–	5
VUS26102-A	0,71	113	25	39,5	91	105	30	44	20,5	27,5	8	20,5	–	5
VUS26126-A	0,9	137	25	39,5	115	129	30	68	20,5	39,5	8	20,5	–	5
VUS38134-A	1,47	141	30	51,5	115	131	41	51	28	30,5	8	28,25	–	5
VUS38206-A	2,1	250	25	51,5	200	240	41	102	49	61	30	28,25	–	5
VUS65210[6)]	4,7	234	38	75	200	220	62	76	62	40,5	10	30,9	21,6	8
VUS85280[6)]	8,8	314	38	100	280	300	82,5	101,5	89	53,5	10	41,25	25	8

1) Depending on the size, socket head screws to DIN ISO 4762 or grub screws to DIN ISO 4026 are used.

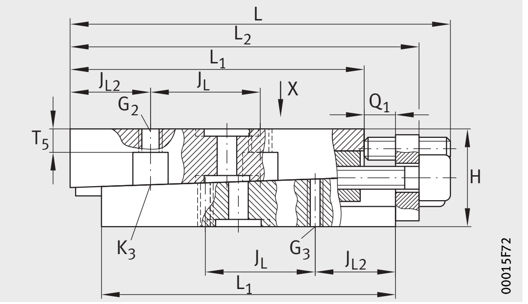
2) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 26, page 69, page 481 and page 527.

3) Linear roller bearings, see page 548 and 552.

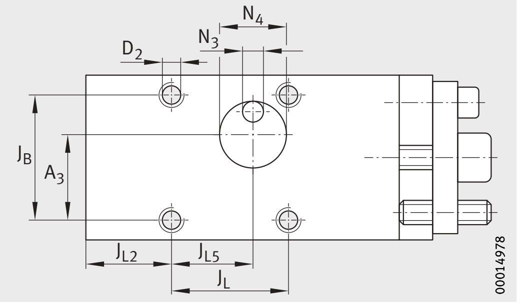
4) Through lubrication hole, use of sealing rings not necessary.

5) S = hexagon socket.

6) Available by agreement.

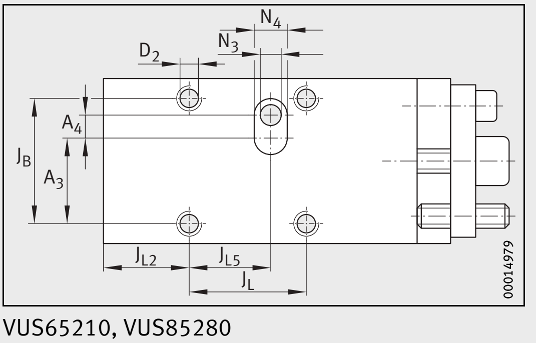


VUS, VUS..-A

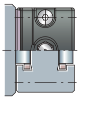


VUS..-A
View X

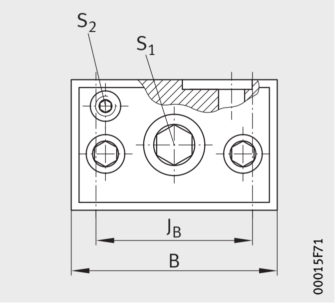
		Adjustment screw	Locking and extraction screw[1)]	Fixing screws[2)]					Adjustment		For linear roller bearing[3)]
N_4	T_5	S_1[5)]	S_2[5)]	G_2		K_3, G_3		D_2	Δh	per screw revolution	
				DIN ISO 4762-12.9							
					M_A Nm		M_A Nm		max.		
12	4	3	2	M4	5	M3	1,8	3,5	0,35	0,035	RUS19069
12	3,5	3	2,5	M4	5	M3	1,8	3,5	0,5	0,023	RUS19105
16	6	6	3	M6	17	M4	5	4,9	0,4	0,05	RUS26086
16	6	6	3	M6	17	M4	5	4,9	0,4	0,05	RUS26102
16	6	6	3	M6	17	M4	5	4,9	0,4	0,05	RUS26126
22	7	8	4	M8	41	M6	17	6,9	0,4	0,062	RUS38134
22	5	8	5	–	–	M6	17	6,9	1	0,05	RUS38206
8	7	12	5	M10	83	M8	41	9	0,5	0,075	RUS65210
10	6	12	4	M14	220	M10	83	12,5	0,5	0,075	RUS85280



VUS65210, VUS85280
View X



Adjusting gibs



VUSZ..-A

Dimension table · Dimensions in mm												
Designation	Mass	Dimensions			Mounting dimensions							
		L	H	B	L_1	L_2	J_B	J_L	J_{L2}	J_{L5}	Q_1	A_3
	≈ kg	max.	min.			max.	±0,1	±0,1			max.	
VUSZ12044-A	0,19	78	16	25	62	73	19	25,5	16,5	16,5	7	14,2
VUSZ18059-A	0,63	107	25	37,6	85	99	31	38	20,5	20	8	22,3
VUSZ24084-A	1,38	141	30	50	115	131	41	51	28	30,5	8	28,5

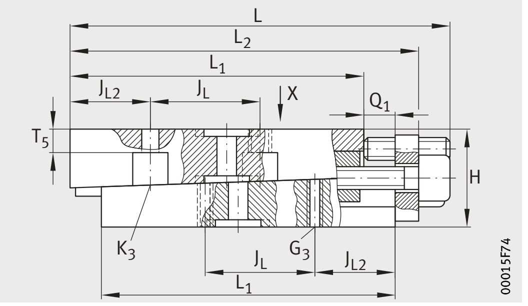
1) Depending on the size, socket head screws to DIN ISO 4762 or grub screws to DIN ISO 4026 are used.

2) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 26, page 69, page 481 and page 527.

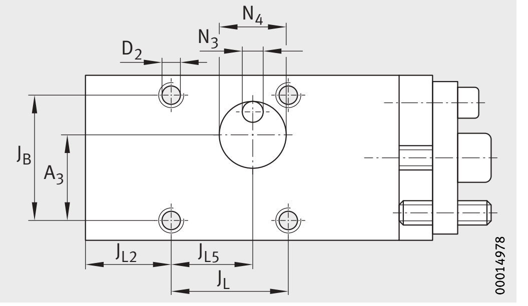
3) Linear roller bearings, see page 548 and 552.

4) Through lubrication hole, use of sealing rings not necessary.

5) S = hexagon socket.

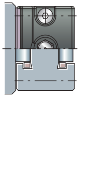


VUSZ..-A

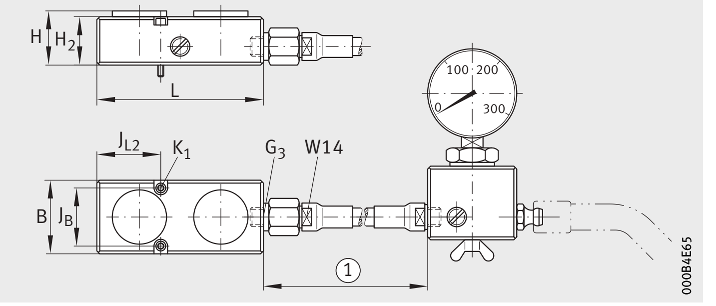


VUSZ..-A
View X

			Adjustment screw	Locking and extraction screw[1]	Fixing screws[2]			Adjustment		For linear roller bearing[3]
N_3[4]	N_4	T_5	S_1[5]	S_2[5]	K_3, G_3 DIN ISO 4762-12.9		D_2	Δh	per screw revolution	
						M_A Nm		max.		
3,5	12	4	3	2	M3	1,8	3,6	0,35	0,035	PR14044
5	16	6	6	3	M4	5	5	0,4	0,05	PR14061
5	22	7	8	4	M5	10	6	0,4	0,062	PR14089



Setting device



EUS

Dimension table · Dimensions in mm												
Designation	For linear roller bearing	Dimensions			Mounting dimensions						High pressure rubber hose HDS	Distributor with manometer VBM
		A_K cm^2	H max.	B	L	J_B	J_{L2}	H_2	K_1	G_3	01/....	
EUS19	RUS19069 RUS19105 PR14044	5	19,5	25,4	72	20,6	28	18	M3×20	R$^1/_8$″		
EUS26	RUS26086 RUS26102	10	28	38	86	30	33	25	M4×20	R$^1/_8$″	l = 250 01/250	
EUS14061	PR14061	10	30	38	85	31	33	27,5	M4×30	R$^1/_8$″	l = 400 01/400	
EUS26126	RUS26126	15	28	38	115	30	33	25	M4×30	R$^1/_8$″		01
EUS38	RUS38134 PR14089	20	40	50,8	115	41	44	36	M6×40	R$^1/_8$″	l = 1000 01/1000	
EUS38206	RUS38206	30	40	50,8	200	41	59	36	M×40	R$^1/_8$″		
EUS65	RUS65210	60	70	75	200	62	37	60	M8×70	R$^1/_8$″		
EUS85	RUS85280	100	90	100	250	82,5	89	80	M10×90	R$^1/_8$″		

Guideways

Guideways

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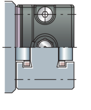
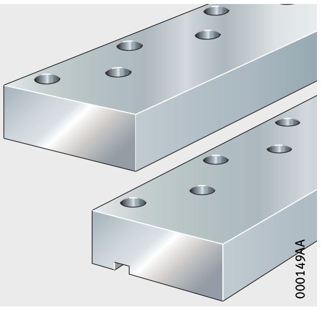


Product overview Guideways

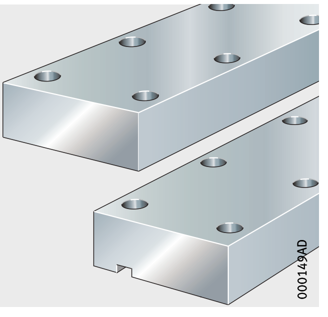
With four raceways

UG, UGN



With three raceways

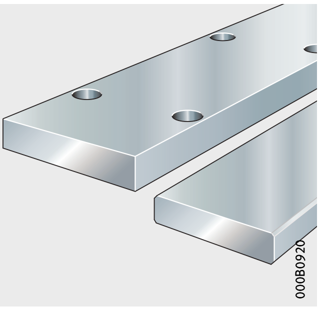
UZ, UZN



With one raceway

For screw mounting or clamping

UFB, UFK



Guideways

Features

Due to their precision, these guideways can be combined with INA linear roller bearings to give high precision linear recirculating guidance systems

They are made from through hardened tool steel (min. 670 HV) and have precision ground raceways of roughness Ramax 0,4 (Rzmax 2).

The guideways are of a single piece design up to the maximum length in the dimension tables, while longer guideways are assembled from segments that are matched to each other and marked.

Guideways with four raceways

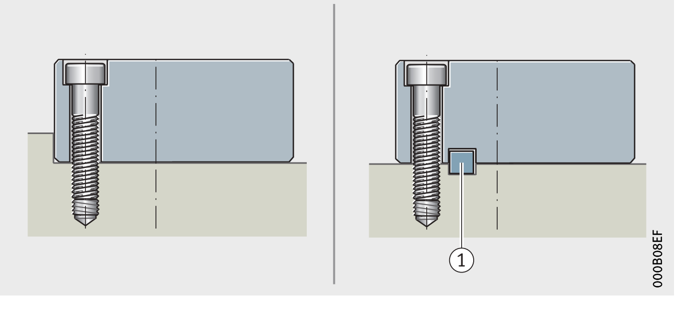
Guideways UG and UGN have a rectangular cross-section, an offset hole pattern and four raceways for linear roller bearings.

They can support forces in the main load direction, together with forces in the opposing direction if a counterstay is fitted, as well as lateral forces in two directions.

The through holes have cylindrical counterbores for fixing screws in accordance with DIN ISO 4762, *Figure 1*.

For high lateral forces

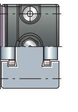
The design UGN with a continuous slot for a square steel bar in accordance with DIN EN 10278 is particularly suitable for supporting high lateral forces in two directions, *Figure 1*.



UG
UGN

1 Square steel bar

Figure 1
Location methods



Guideways with three raceways

Guideways UZ and UZN have a rectangular cross-section, a parallel hole pattern and three raceways for linear roller bearings. The upper raceway is arranged between the holes for the fixing screws.

They can support forces in the main load direction and lateral forces in two directions.

The through holes have cylindrical counterbores for fixing screws in accordance with DIN ISO 4762, *Figure 2*.

For high lateral forces

The design UZN with a continuous slot for a square steel bar in accordance with DIN EN 10278 is particularly suitable for supporting high lateral forces in two directions, *Figure 2*.

UZ
UZN

1 Square steel bar

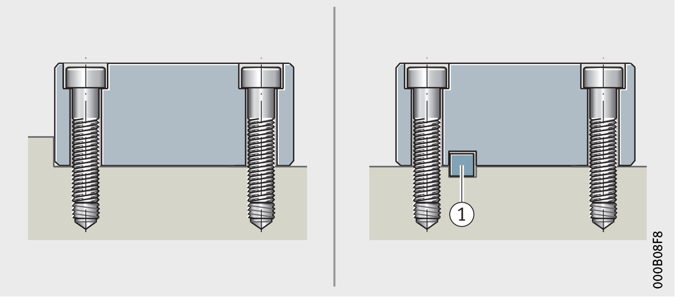


Figure 2
Location methods

Guideways with one raceway

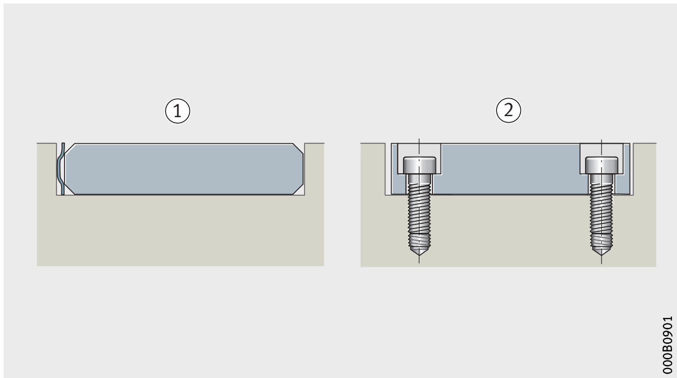
Guideways UFB and UFK have only one raceway and, due to their small section height, are particularly suitable for low guidance system heights.

They can support forces in the main load direction.

Mounting by clamping or screws

For simple location, the guideways UFK are suitable for clamping. Clamping is carried out in the slot using the high precision steel strip, *Figure 3*.

The design UFB has through holes and cylindrical counterbores for fixing screws in accordance with DIN ISO 4762.



1 UFK guideway, clamped
2 UFB guideway, screw mounted

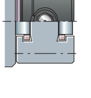
Figure 3
Location methods

Available designs

In addition to the standard designs, coated guideways and guideways according to customer drawing are also available by agreement.

Design and safety guidelines

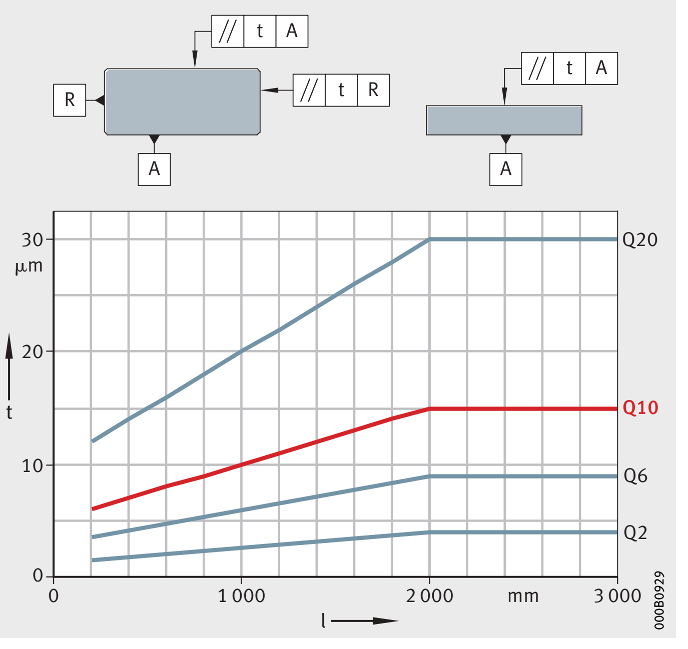
In order to achieve high running accuracy and constant displacement resistance, the mounting guidelines must be observed, see page 474.



Accuracy
Quality grades

The guideways are available in the quality grades Q2, Q6, Q10 and Q20, *Figure 4*. The standard grade is Q10:

- Q2 is used for the highest requirements in high precision machinery. This grade should only be used if the adjacent construction can be produced to equally high accuracy.
- Q6 corresponds to the requirements of precision table guidance systems in machine tool construction and is used as standard in arrangements with a counterstay.
- Q10 is the standard quality grade and is suitable for all requirements in general mechanical engineering.
- Q20 corresponds to the requirements in the handling sector.



t = parallelism tolerance
l = guideway length

Figure 4
Quality grades and parallelism tolerances of guideways

Sorted guideways S

Guideways are sorted together if two or more guideways of the same profile are mounted in the same plane adjacent to each other or in series.

The sorting affects the positional accuracy of the raceways in relation to the mounting surfaces. The guideways are, within the respective quality grade, sorted and marked according to their height.

Sorting of the guideways is indicated by the suffix S and the number of sorted guideways.

Example
2 pieces **UG9741×2000-Q6-2S**

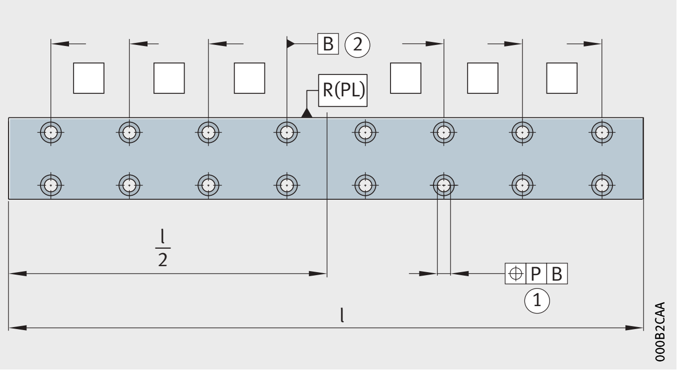
Positional and length tolerances of guideways

In the adjacent construction, a positional tolerance of ∅ 0,2 mm must be observed, in order that guideways up to the maximum guideway length, see table, can be mounted on a predrilled hole pattern. This also applies to multi-piece guideways if the individual partial length does not exceed the maximum guideway length, in accordance with the table.

The positional tolerances and maximum lengths of the guideways are shown in the table and *Figure 5*.

Positional tolerances of fixing holes

Guideway Designation	Positional tolerance P mm	Guideway length l_{max} mm
UG6628, UGN6628 UZ6628, UZN6628	1,8	2 500
UG9741, UGN9741 UZ9741, UZN9741	2,3	3 000
UG12553, UGN12553 UZ12553, UZN12553	1,8	2 000
UG16260, UGN16260 UZ16260, UZN16260	2,3	2 000
UFB4710	1,1	1 800
UFB6412	1,1	1 600
UFB7812	1,1	1 600
UFB10615	1,2	1 700
UFB14018	1,8	2 800



① Positional tolerance of all holes
② Datum B is the hole that is closest to the centre of the guideway (based on DIN 644)

Figure 5
Positional tolerances of the hole pattern

Single guideways of a different guideway length have the positional tolerance l · 0,0008 + 0,2 mm.

Length tolerances of guideways

Length tolerance	
Single-piece guideways mm	Multi-piece guideways mm
l ± (0,2 + 0,0008 · l)	l_{tot} ± 2 mm

Ordering example, ordering designation

Guideways for six machines

Twelve guideways, sorted in pairs for six machines:

Guideway	UG
For linear roller bearings	RUS26126
Profile size	UG9741
Hole pattern of guideways – symmetrical	–
Length of guideways	1000 mm
Quality grade of guideways	Q6

Ordering designation: 12×**UG9741**×**1000-Q6-2S**, *Figure 6*

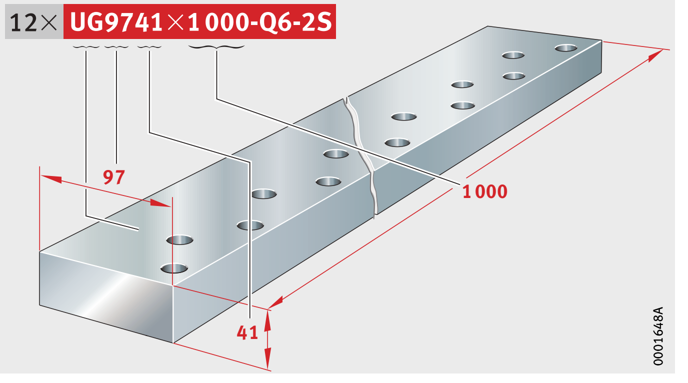
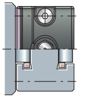
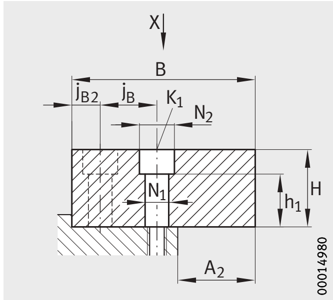


Figure 6
Ordering example, ordering designation

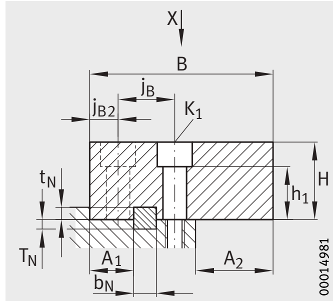


Guideways

With four raceways



UG



UGN

Dimension table · Dimensions in mm

Designation	Mass	Dimensions			Mounting dimensions							
	m	l_{max}[6]	H	B	j_B	j_{B2}	j_L	a_R, a_L[7]		h_1	A_2	N_2
	≈ kg/m		−0,1	−0,1				min.	max.		max.	
UG6628	13,8	2 000	28	66	18	12	40	15	35	16,5	28	15
UGN6628	13,6											
UG9741	29,8	3 000	41	97	30	15	40	15	35	27,5	41	18,5
UGN9741-A	28,2											
UG12553	49,9	3 000	53	125	35	18	40	15	35	37,5	53	20
UGN12553-A	49,0											
UG16260	72,0	3 000	60	162	44	20	40	20	40	35,5	77	26,5
UGN16260-A	70,6											

① Hole pattern on left side (BL). ② Hole pattern on right side (BR). ③ Hole pattern, symmetrical.

1) The remaining gap is filled with castable resin after fitting.

2) Square steel bar in accordance with DIN EN 10278 is not included in the scope of delivery.

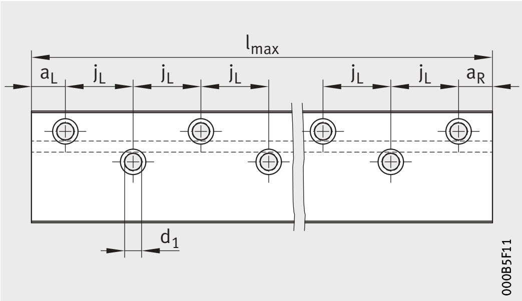
3) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications ($S_0 = 1$). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 26, page 69, page 481 and page 527.

4) Closing plugs must be ordered separately.

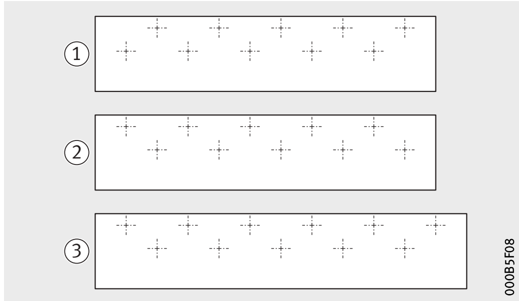
5) Linear roller bearings, see page 548, page 550 and page 552.

6) Maximum length of single-piece guideways; longer guideways are supplied as several segments.

7) Indicate hole pattern and end spacings a_R, a_L when ordering.

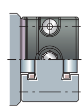


UG, UGN
View X rotated 90°



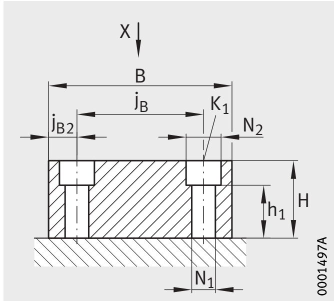
Hole patterns[7)]

Slot[1)]				Square steel bar[2)]	Fixing screws[3)]			Closing plug[4)]	For linear roller bearing[5)]		
A_1	b_N	T_N	t_N	DIN EN 10278	K_1 DIN ISO 4762-12.9	M_A Nm	d_1				
–	–	–	–	–	M8	41	10	KVK15	RUS19069 RUS19105	RUSV30069-KS RUSV30105-KS	PR14032 PR14044
17,75	6,5	2,5	3,5	5×5							
–	–	–	–	–	M10	83	12,5	KVK18,5	RUS26086 RUS26102 RUS26126	RUSV42086-KS RUSV42102-KS RUSV42126-KS	PR14061
23,25	12	5	6,5	10×10							
–	–	–	–	–	M12	140	14	KVK20	RUS38134 RUS38206	RUSV60134-KS RUSV60206-KS	PR14089
27	14	6	7,5	12×12							
–	–	–	–	–	M16	350	18,5	KA26,5-M	RUS65210	–	PR14135
31,25	18	8	9,5	16×16							

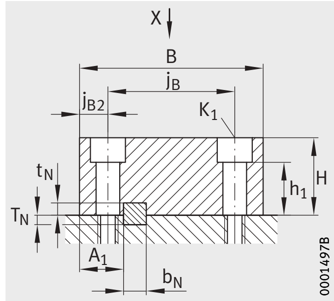


Guideways

With three raceways



UZ



UZN

Dimension table · Dimensions in mm

Designation	Mass	Dimensions			Mounting dimensions						
	m	l_{max} 6)	H	B	j_B	j_{B2}	j_L	a_R, a_L		h_1	N_2
	≈ kg/m		−0,1	−0,1				min.	max.		
UZ6628	13,8	2 000	28	66	44	11	80	15	55	16,5	15
UZN6628	13,6										
UZ9741	29,8	3 000	41	97	67	15	80	15	55	27,5	18,5
UZN9741-A	28,2										
UZ12553	49,9	3 000	53	125	89	18	80	15	55	37,5	20
UZN12553-A	49,0										
UZ16260	72,0	3 000	60	162	110	26	80	20	60	35,5	26,5
UZN16260-A	70,6										

1) The remaining gap is filled with castable resin after fitting.

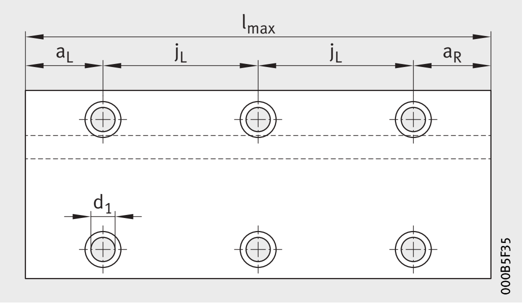
2) Square steel bar in accordance with DIN EN 10278 is not included in the scope of delivery.

3) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 26, page 69, page 481 and page 527.

4) Closing plugs must be ordered separately.

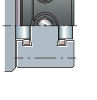
5) Linear roller bearings, see page 548, page 550 and page 552.

6) Maximum length of single-piece guideways; longer guideways are supplied as several segments.



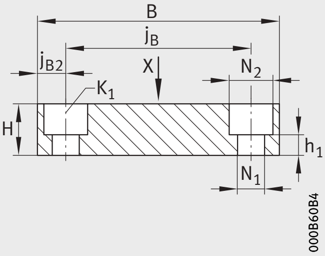
UZ, UZN
View X rotated 90°

Slot[1]				Square steel bar[2]	Fixing screws[3]			Closing plug[4]	For linear roller bearing[5]		
A_1	b_N	T_N	t_N	DIN EN 10278	K_1 DIN ISO 4762-12.9	M_A Nm	d_1				
–	–	–	–	–	M8	41	10	KVK15	RUS19069 RUS19105	RUSV30069-KS RUSV30105-KS	PR14032 PR14044
17,75	6,5	2,5	3,5	5×5							
–	–	–	–	–	M10	83	12,5	KVK18,5	RUS26086 RUS26102 RUS26126	RUSV42086-KS RUSV42102-KS RUSV42126-KS	PR14061
23,25	12	5	6,5	10×10							
–	–	–	–	–	M12	140	14	KVK20	RUS38134 RUS38206	RUSV60134-KS RUSV60206-KS	PR14089
27	14	6	7,5	12×12							
–	–	–	–	–	M16	350	18,5	KA26,5-M	RUS65210	–	PR14135
37,25	18	8	9,5	16×16							

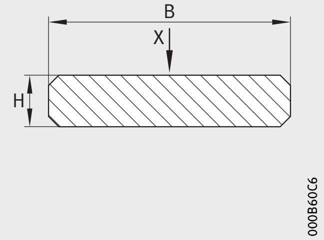


Guideways

With one raceway



UFB, for screw mounting



UFK, for clamping

Dimension table · Dimensions in mm

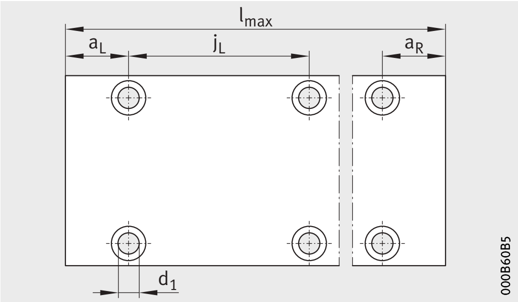
Designation[1]	Mass	Dimensions			Mounting dimensions				
	m	l_{max}[4]	H	B	j_B	j_{B2}	j_L	a_R, a_L	
	≈ kg/m		–0,1	–0,1				min.	max.
UFK3210	2,4	2 000	10	32	–	–	–	–	–
UFB4710	3,6	2 000	10	47	36	5,5	80	10	50
UFK4710	3,6	2 000	10	47	–	–	–	–	–
UFB6412	6,0	2 000	12	64	52	6	80	10	50
UFK6412	6,0	2 000	12	64	–	–	–	–	–
UFB7812	7,1	2 000	12	78	64	7	80	10	50
UFK8815	10,3	3 000	15	88	–	–	–	–	–
UFB10615	12,2	3 000	15	106	90	8	80	10	50
UFK11518	16,2	3 000	18	115	–	–	–	–	–
UFB14018	19,2	3 000	18	140	118	11	80	15	55

1) A conventional high precision steel strip for location of guideways UFK must be provided by the customer.

2) The stated torques represent maximum values for the secure transmission of forces in vibration-free, quasistatic applications (S_0 = 1). We recommend that the tightening torques for the screw connection of the adjacent construction should be determined at the customer under the conditions specific to the application and operation, observing the information in VDI Guideline 2230 Part 1 (2015) and the information in this description, see page 26, page 69, page 481 and page 527.

3) Linear roller bearings, see page 548, page 550 and page 552.

4) Maximum length of single-piece guideways; longer guideways are supplied as several segments.



UFB
View X rotated 90°

UFK
View X rotated 90°

		Fixing screws[2]		For linear roller bearing[3]			
h_1	N_2	K_1 DIN ISO 4762-8.8	d_1				
–	–	–	–	RUS19069	–	RUSV30069-KS	PR14032 PR14044
3,5	8,5	M4	5,3	RUS19069 RUS19105	RUS26086 RUS26102 RUS26126	RUSV30069-KS RUSV30105-KS RUSV42086-KS RUSV42102-KS RUSV42126-KS	PR14044 PR14061
–	–	–	–	RUS19069 RUS19105	RUS26086 RUS26102 RUS26126	RUSV30069-KS RUSV30105-KS RUSV42086-KS RUSV42102-KS RUSV42126-KS	PR14044 PR14061
4,5	10,5	M5	6,3	RUS26086 RUS26102 RUS26126	RUS38134 RUS38206	RUSV42086-KS RUSV42102-KS RUSV42126-KS RUSV60134-KS RUSV60206-KS	PR14061 PR14089
–	–	–	–	RUS26086 RUS26102 RUS26126	RUS38134 RUS38206	RUSV42086-KS RUSV42102-KS RUSV42126-KS RUSV60134-KS RUSV60206-KS	PR14061 PR14089
4,5	10,5	M5	6,3	RUS38134 RUS38206	–	RUSV60134-KS RUSV60206-KS	PR14089
–	–	–	–	RUS65210	–	–	PR14135
6,5	11,5	M6	7,5	RUS65210	–	–	PR14135
–	–	–	–	RUS85280	–	–	PR14182
6,5	15	M8	10	RUS85280	–	–	PR14182

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