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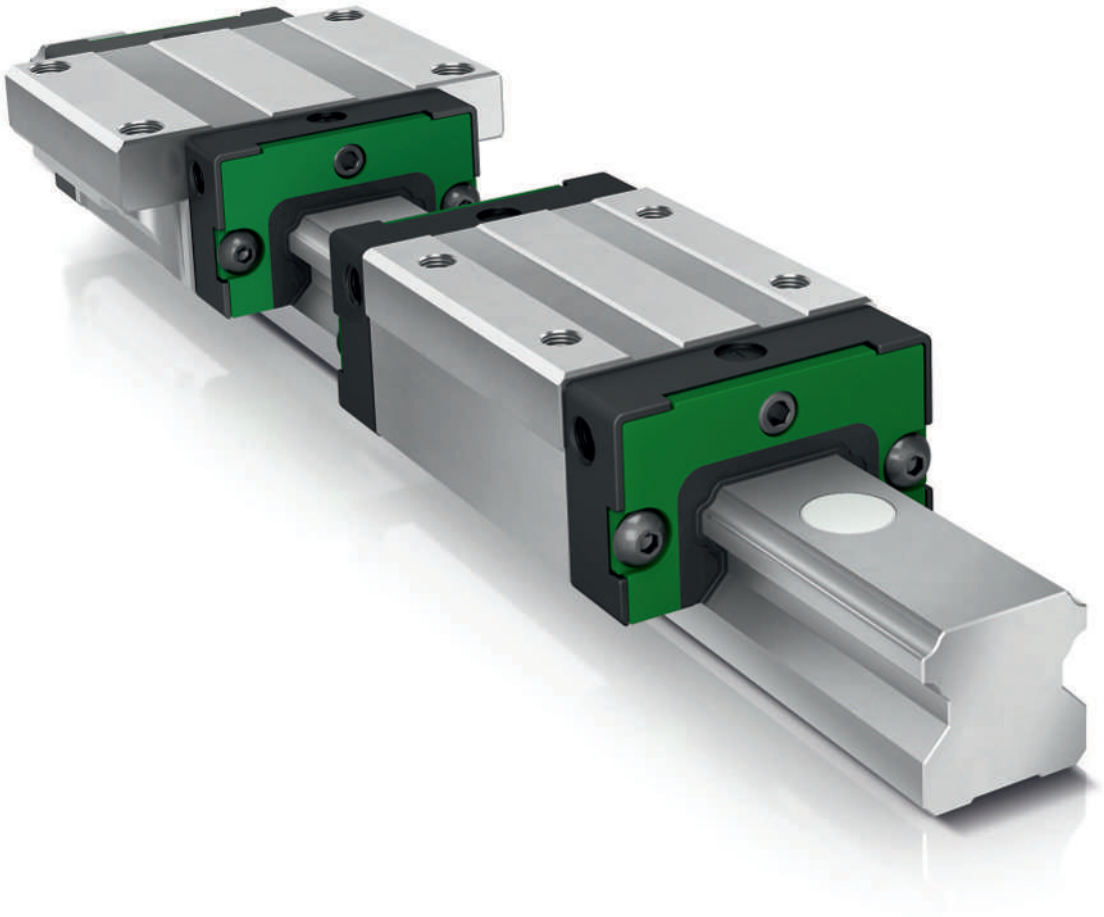


Four-row linear recirculating ball bearing and guideway assemblies in X arrangement

KLLT

Technical Product Information

Contents

1 Technical principles

1.1 Load carrying capacity and rating life

1.1.1 Load carrying capacity

The size of the guidance unit is determined by the load carrying capacity of the individual elements. The load carrying capacity is described in terms of the basic dynamic load rating C and the basic static load rating C_0.

Calculation of the basic load rating according to DIN ISO

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

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 displacement distance of only 50 km in contrast to 100 km in accordance with DIN ISO. This results in comparatively higher basic load ratings.

Conversion of basic load ratings

For linear ball bearing and guideway assemblies, the basic load ratings to DIN can be converted to basic load ratings as used in the Far East and vice versa:

*f*1

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

*f*2

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

C_{50}	N	Basic dynamic load rating according to DIN ISO 14728-1, based on 50 km
C_{100}	N	Basic dynamic load rating according to DIN ISO 14728-1, based on 100 km

1.1.2 Basic rating life

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

*f*3

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

*f*4

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

$$L_h = \frac{1666}{v_m} \cdot \left(\frac{C_{100}}{P}\right)^p \quad (5)$$

C_{100}	N	Basic dynamic load rating according to DIN ISO 14728-1, based on 100 km
L_h	h	Basic rating life in operating hours
L	km	Basic rating life as a distance
n_{osc}	min^{-1}	Number of return strokes per minute
P	N	Equivalent dynamic bearing load
p	–	Rating life exponent for guidance system with ball bearings: p = 3
v_m	m/min	Mean velocity

According to DIN ISO 14728-1:2018-10, 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 should be checked. Ideally, locating edges should be provided.

1.2 Rigidity

1.2.1 Preload

Increasing the preload increases the rigidity of the guidance system. The preload also influences the displacement force of the guidance system: the higher the preload, the larger the displacement force. Furthermore, the preload also influences the operating life of the guidance system.

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 rating life and static load safety factor may be lower than those calculated using the approximation formulae for the equivalent static and dynamic load.

Linear recirculating ball bearing and guideway assemblies are available in different preload classes.

The preload class affects the characteristics of a carriage.

1 Preload classes

Preload class	Preload setting
V0	Slight clearance to clearance-free
V1 [1)]	0,02 · C Slight preload
V2	0,08 · C Moderate preload, higher rigidity

1) Standard preload class

1.3 Friction

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

Friction is influenced by the following factors:

- load
- preload
- travel velocity
- lubricant (viscosity and quantity)
- temperature
- misalignment
- 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, but returns to a lower value after a short running-in period.

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.

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

2 Coefficient of friction for KLLT

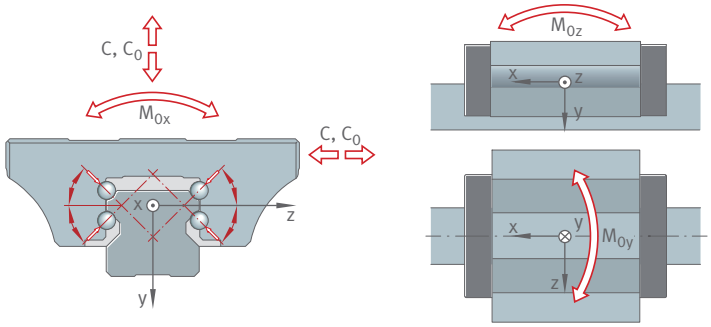
Load C/P		Coefficient of friction μ	
from	to	from	to
4,5	35,5	0,003	0,005

1.4 Load carrying capacity

The rows of balls are in an X arrangement on the raceways.

The units can support forces from all directions, apart from the direction of motion, and moments about all axes.

1 Load carrying capacity and contact angle



1.5 Acceleration and speed

Carriages KWLT permit accelerations up to 75 m/s^2 and speeds up to 5 m/s.

1.6 Temperature range

Four-row linear recirculating ball bearing and guideway assemblies are suitable as a standard for operating temperatures of –10 °C to +80 °C.

2 Four-row linear recirculating ball bearing and guideway assemblies KLLT

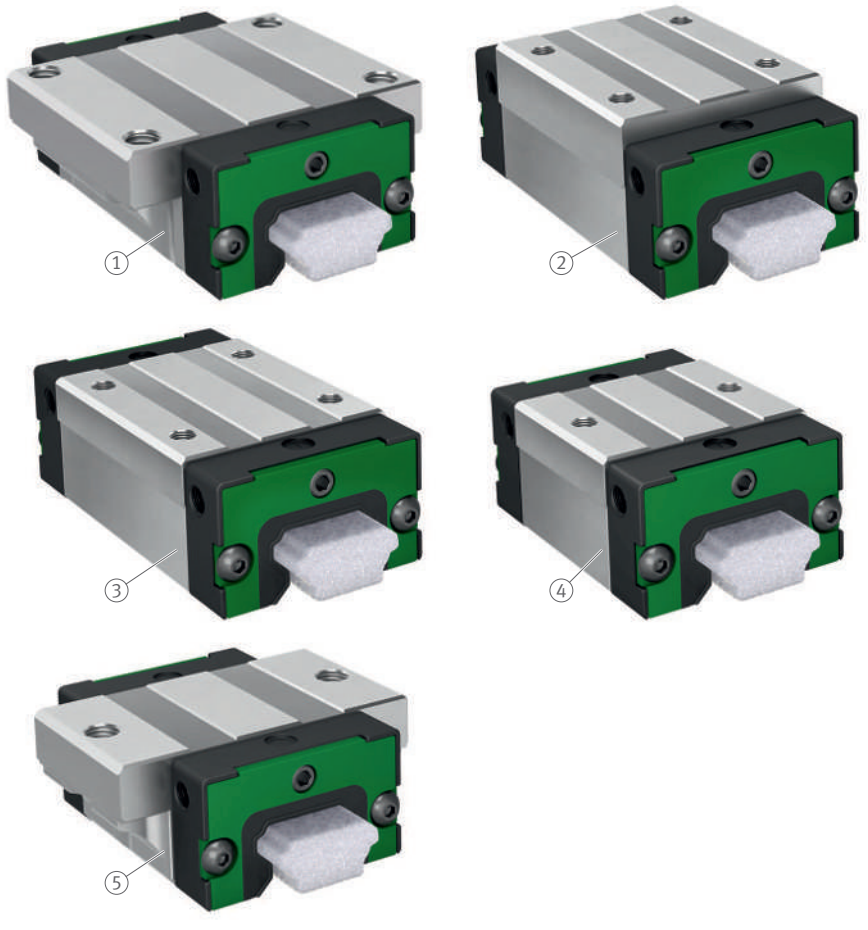
2.1 Product design

2.1.1 Carriages

Four-row linear recirculating ball bearing and guideway assemblies KLLT are available in 6 sizes (15, 20, 25, 30, 35, 45) and with carriages in 8 different designs. Carriages KWLT and guideways TKLT can also be ordered separately. The matching guideways are available in freely selectable lengths up to the maximum lengths that can be supplied (up to 10 × l_{max}). The carriages are delivered with a foam guideway.

The foam guideway remains in the carriage during mounting and dismounting to prevent the loss of rolling elements. Use the foam rail when mounting and dismounting the carriage. Keep the foam guideway in a safe place.

2 Carriages



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1	KWLT..-A, KWLT..-AL	2	KWLT..-H, KWLT..-HL
3	KWLT..-S, KWLT..-SL	4	KWLT..-US, KWLT..-ESC
5	KWLT..-AS		

All KWLT carriages are supplied with an initial application of grease and also contain lubricant reservoirs filled with food-grade oil.

Overview of carriage designs

- design with flange:
  KWLT..-A, KWLT..-AL, KWLT..-AS
  The wider design results in a higher moment rigidity in the direction of travel.
- designs in standard lengths:
  KWLT..-A, KWLT..-H, KWLT..-S
- narrow designs:
  KWLT..-H, KWLT..-HL, KWLT..-S, KWLT..-SL, KWLT..-ESC, KWLT..-US
- long designs:
  KWLT..-AL, KWLT..-HL, KWLT..-SL
  Through the long design, a higher basic load rating is achieved.
- high designs:
  KWLT..-H, KWLT..-HL
- shortened designs:
  KWLT..-ESC, KWLT..-US, KWLT..-AS

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

2.1.2 Guideways

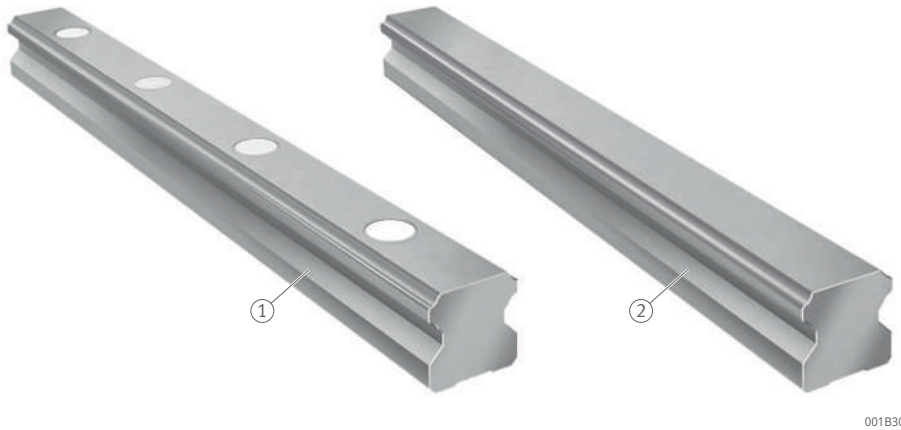
Guideways TKLT can be ordered individually.

The guideways are made from hardened steel and are ground on all faces, while the rolling element raceways are precision ground. For fixing to the adjacent construction, the guideways have fixing holes with counterbores for the screw heads. The guideways are located from above as standard.

Guideways with the suffix U should be located from below and have threaded blind holes.

If the desired guideway length exceeds the value l_{max} in the product tables, the guideway will be delivered in multiple sections.

3 Guide rails



1	Guideway TKLT with plastic closing plugs	2	Guideway TKLT-U, location from below

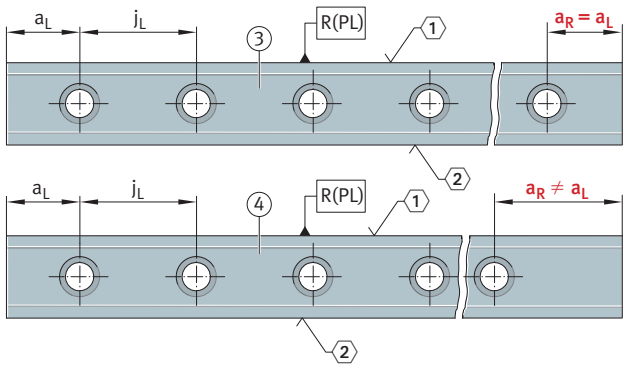
2.1.2.1 Hole patterns for guideways

Unless otherwise specified, the guideway has a symmetrical hole pattern with $a_L = a_R$.

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

The guideways have 1 locating face. When ordering a guideway with an asymmetrical hole pattern, the distance from the left is a_L and the distance from the right is a_R.

4 Hole patterns for guideways with single rows of holes



1	Locating face	2	Marking
3	Symmetrical hole pattern	4	Asymmetrical hole pattern
R(PL)	Reference face of the guideway		

2.1.2.2 Maximum number of pitches between holes

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

6

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

The distances a_L and a_R are generally determined by:

7

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

For guideways with a symmetrical hole pattern:

8

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

Number of holes:

$$x = n + 1 \quad (9)$$

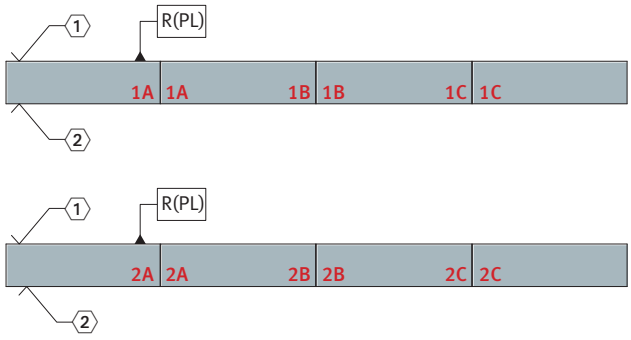
$a_{L\,min}$	mm	Minimum values for a_L
a_L	mm	Distance from start of guideway to nearest hole
$a_{R\,min}$	mm	Minimum values for a_R
a_R	mm	Distance from end of guideway to nearest hole
j_L	mm	Distance between holes
l	mm	Guideway length
n	–	Max. number of pitches
x	–	Number of holes

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

2.1.2.3 Multi-piece guideways

Guideways longer than l_{max} are made up of segments and joined together. The individual sections are matched to each other and marked. The division is always made at the midpoint between the fixing holes.

5 Marking of multi-piece guideways



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1	Locating face	2	Marking
R(PL)	Reference face of the guideway		Individual sections: 1A, 1A 1B, 1B 1C, 1C 2A, 2A 2B, 2B 2C, 2C

For multi-piece guideways, the front gap between two sections must be < 0,05 mm.

2.1.3 Design

Linear recirculating ball bearing and guideway assemblies KLLT are available in many designs.

3 Available types

Design	Description
A	Carriage with flange
AL	Long carriage with flange
AS	Short carriage with flange
S	Narrow carriage
SL	Narrow, long carriage
H	Narrow, high carriage

Design	Description
HL	Narrow, high, long carriage
US	Narrow, short carriage
ESC	Narrow, short carriage with standard height

2.1.4 X arrangement

Linear recirculating ball bearing and guideway assemblies KLLT each have 4 rows of balls with a contact angle of 45° between the rolling elements and the raceways. The X arrangement ensures uniform load distribution, load carrying capacity and rigidity in all 4 main loading directions. As a result, deviations in the adjacent construction can be compensated for, even in preloaded systems, ensuring smooth running. Friction is minimised due to the 2-point contact of the rolling elements.

2.1.5 Interchangeability

Carriages KWLT and guideways TKLT of the same size can be combined or interchanged.

If combined or interchanged within a single accuracy class, the accuracy class is also maintained for the entire system or for the combination of carriage and guideway. Carriages and guideways are delivered separately as standard. Complete systems are delivered with the carriage pre-mounted on the guideway.

4 Interchangeability of carriages and guideways

Accuracy class			Preload class			Comment
Carriage KWLT	Guideway TKLT	Unit KLLT	V0	V1	V2	
G2	G2	G2	-	o	o	As complete system only in V1 and V2
G3	G3	G3	✓	✓	o	As complete system only in V2, interchangeable in V1 and V0 (recommended combination)
G4 [1)]	G4 [1)]	G4 [1)]	✓	✓	✓	As complete system or interchangeable (recommended combination)

✓ available
o available as an option
– not available

[1)] Standard

2.2 Sealing

Double-lipped elastic end wipers are fitted to the end pieces of the carriages on both sides to retain the lubricant within the system.

Upper and lower sealing strips ensure a secure seal and protect the rolling system from contamination even in critical environmental conditions.

If the contamination level is extremely high, additional wipers can be mounted. If necessary, additional covers should be installed.

2.3 Lubrication

Linear recirculating ball bearing and guideway assemblies KLLT are suitable for grease lubrication. The systems and carriages are delivered with an initial application of grease as standard.

Properties of the grease:

- KP2N-20 in accordance with DIN 51825
- NLGI grade 00
- base oil viscosity ISO VG 150 to ISO VG 220

Lubrication is carried out via lubrication connectors in the end face or side of the end piece, or from above via the adjacent construction and the lubrication hole in the end pieces. A lubrication connector for manual lubricators is included in the delivery. Other lubrication connectors are optionally available.

The lubrication connectors can be screw mounted into the end piece on the side or end face. The relubrication holes are closed off on the end face with a grub screw and on the side and top of the end piece with a membrane seal.

Lubrication via the end face

Remove the corresponding grub screw before screwing in the lubrication connector.

Lubrication from the side

Screwing in the lubrication connector opens the membrane seal at this position.

Once opened, a side lubrication connector will not reseal when the lubrication connector is removed. An opened side lubrication connector can be closed with a DIN EN ISO 4026 grub screw.

Only use the lubrication connector included in the delivery. Otherwise, there is a risk that the membrane seal will not open correctly or that the end piece will be damaged.

5 Grub screws

Size	Grub screw
15	M3×8
20	M5×8
25	M5×8
30	M6×12
35	M6×16
45	M5×16

Lubrication from above

Before using the upper relubrication hole, pierce the membrane seal with a hot, pointed object.

Ensure that the adjacent construction completely covers the carriage (including end pieces) and that the original O-rings or adapter pieces (accessories) are correctly mounted. Otherwise, lubricant may escape through the upper lubrication hole.

Once opened, a relubrication hole does not reseal.

Protect the carriages against solid and liquid contaminants.

2.3.1 Relubrication quantity

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.

1. The lubricant should be applied in partial quantities of the total lubricant volume.
2. After applying each partial lubricant quantity, move the carriage along the guideway with a minimum stroke of 4 × the saddle plate length. The lubricant is evenly distributed inside the carriage.
3. Before the carriages are screw mounted to the adjacent construction, check the seating of the O-rings as necessary.

6 Relubrication quantities for KWLT carriages

Size	Relubrication quantity		
	Short carriage	Standard carriage	Long carriage
	≈g	≈g	≈g
15	0,5	0,6	–
20	0,7	0,8	0,8
25	0,8	0,9	1,1
30	1,7	1,8	2,0
35	1,9	2,1	2,3
45	–	2,4	2,8

2.3.2 Lubricant reservoir

Linear recirculating ball bearing and guideway assemblies KLLT are each supplied with a pre-filled lubricant reservoir as standard, which is located in the end piece. The lubricant reservoir ensures long-term and uniform distribution of the lubricant, allowing the assembly to operate over particularly long distances without the need for relubrication.

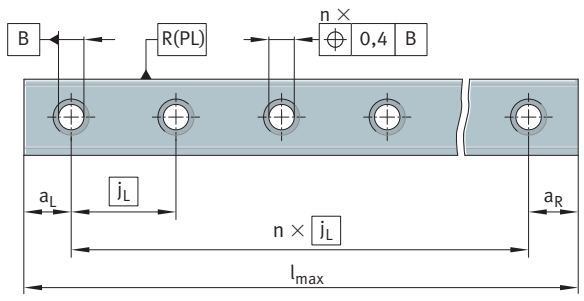
The lubricant reservoir is supplied pre-filled with food-grade oil.

2.4 Tolerances of guideways

2.4.1 Positional and length tolerances of guideways

The positional tolerances are independent of the guideway length.

6 Positional and length tolerances of guideways



R(PL)	Reference face of the guideway	l	Length of guideway

7 Length tolerances of guideways

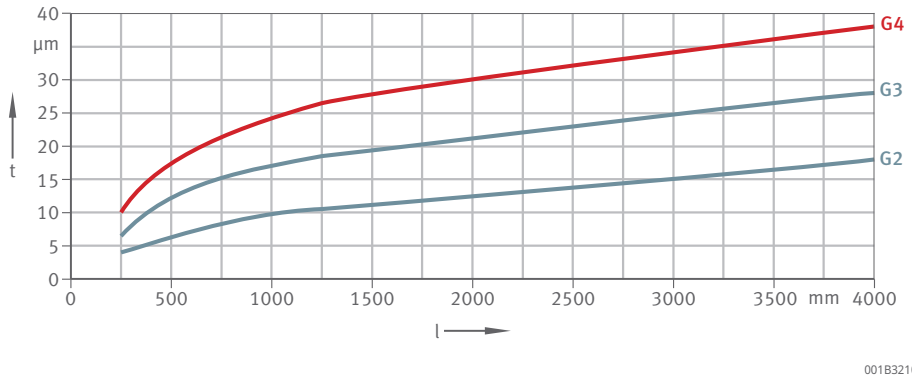
Guideway Designation	Length tolerances	
	L	U
	mm	mm
TKLT	−1,5	+1,5

L	mm	Lower limit deviation
U	mm	Upper limit deviation

2.4.2 Accuracy classes

Four-row linear recirculating ball bearing and guideway assemblies KLLT are available in accuracy classes G2, G3 and G4.

7 Accuracy classes and parallelism tolerances



t	Parallelism tolerance	l	Total guideway length

2.4.3 Tolerances

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

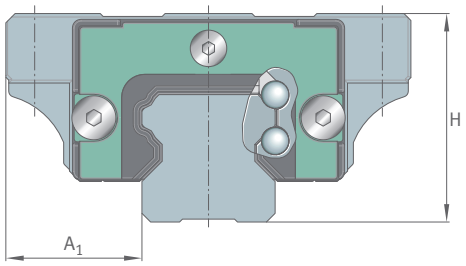
8 Tolerances for height H and spacing A_1

Tolerance		Accuracy		
		G2	G3	G4 [1]
		µm	µm	µm
Tolerance for height	H	±20	±25	±80
Difference in height [2]	ΔH	10	15	20
Tolerance for spacing	A_1	±15	±20	±80
Difference in spacing [2]	$ΔA_1$	15	22	30

1) Standard

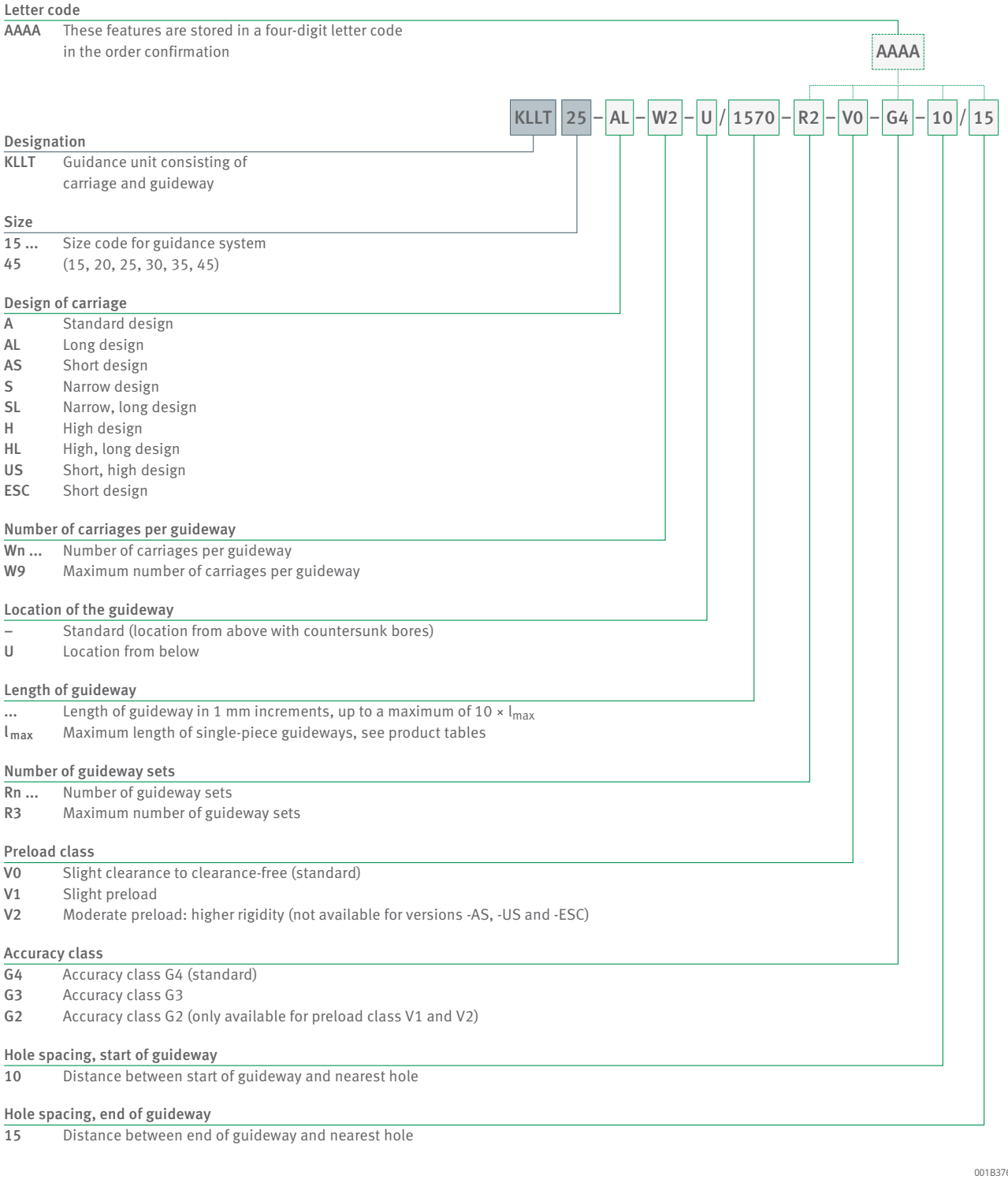
2) Dimensional difference between several carriages on one guideway, measured at the same point on the guideway

8 Datum dimensions for parallelism of raceways to locating faces



2.5 Structure of the ordering designation

9 Ordering designation structure, guidance unit



Letter code

AAAA These features are stored in a four-digit letter code in the order confirmation

Designation

KLLT Guidance unit consisting of carriage and guideway

Size

15 ... Size code for guidance system
45 (15, 20, 25, 30, 35, 45)

Design of carriage

A Standard design
AL Long design
AS Short design
S Narrow design
SL Narrow, long design
H High design
HL High, long design
US Short, high design
ESC Short design

Number of carriages per guideway

Wn ... Number of carriages per guideway
W9 Maximum number of carriages per guideway

Location of the guideway

– Standard (location from above with countersunk bores)
U Location from below

Length of guideway

... Length of guideway in 1 mm increments, up to a maximum of 10 × l_{max}
l_{max} Maximum length of single-piece guideways, see product tables

Number of guideway sets

Rn ... Number of guideway sets
R3 Maximum number of guideway sets

Preload class

V0 Slight clearance to clearance-free (standard)
V1 Slight preload
V2 Moderate preload: higher rigidity (not available for versions -AS, -US and -ESC)

Accuracy class

G4 Accuracy class G4 (standard)
G3 Accuracy class G3
G2 Accuracy class G2 (only available for preload class V1 and V2)

Hole spacing, start of guideway

10 Distance between start of guideway and nearest hole

Hole spacing, end of guideway

15 Distance between end of guideway and nearest hole

001B3764

10 Ordering designation structure, carriage

Designation

KWLT	Four-row carriage in an X arrangement

Size

15 ...	Size code for carriage
45	(15, 20, 25, 30, 35, 45)

Design

A	Standard design
AL	Long design
AS	Short design
S	Narrow design
SL	Narrow, long design
H	High design
HL	High, long design
US	Short, high design
ESC	Short design

Preload class

V0	Slight clearance to clearance-free (standard)
V1	Slight preload

Accuracy class

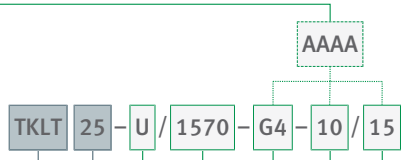
G4	Accuracy class G4 (standard)
G3	Accuracy class G3

001B3774

11 Ordering designation structure, guideway

Letter code

AAAA	These features are stored in a four-digit letter code in the order confirmation



Designation

TKLT	Guideway for carriage KWLT

Size

15 ...	Size code for guideway
45	(15, 20, 25, 30, 35, 45)

Location of the guideway

–	Standard (location from above with countersunk bores)
U	Location from below

Length of guideway

...	Length of guideway in 1 mm increments, up to a maximum of 10 × l_{max}
l_{max}	Maximum length of single-piece guideways, see product tables.

Accuracy class

G4	Accuracy class G4 (standard)
G3	Accuracy class G3

Hole spacing, start of guideway

10	Distance between start of guideway and nearest hole

Hole spacing, end of guideway

15	Distance between end of guideway and nearest hole

001B3784

Linear recirculating ball bearing and guideway assemblies KLLT with carriage and guideway in accuracy class G2 as guidance unit

An order is to be placed for one KWLT25-AL carriage with accuracy class G2 and a matching guideway. As accuracy class G2 is required, carriage KWLT25-AL and guideway TKLT must be ordered together.

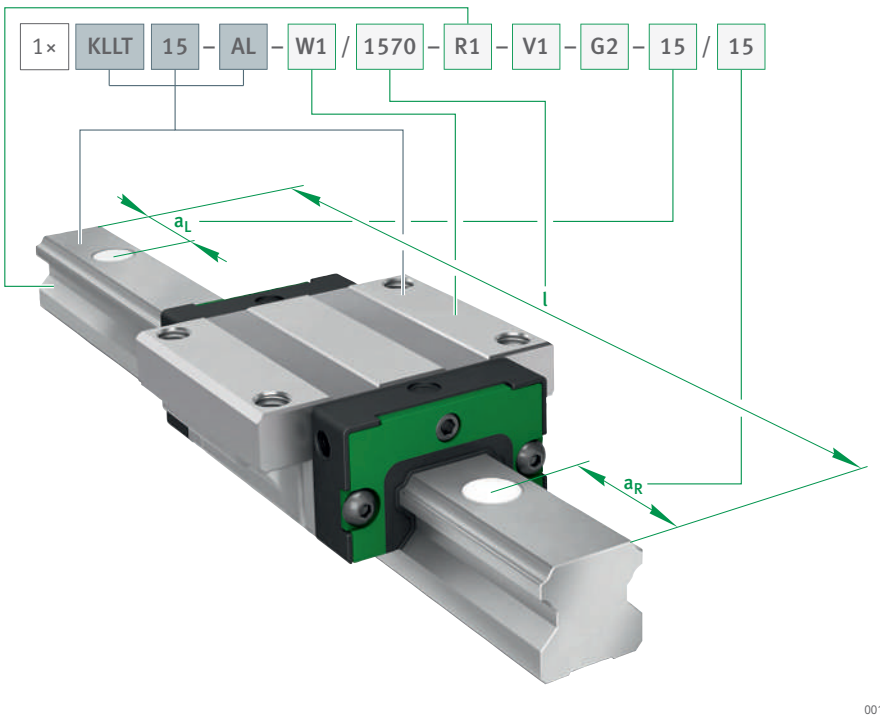
An order is placed for one linear recirculating ball bearing and guideway assembly KLLT:

- 1 carriage: KWLT..-AL
- size: 25
- preload: V1
- accuracy class: G2
- with end wipers
- with lubricant reservoir
- matching guideway: TKLT
- size: 25
- accuracy class G4
- length: 1570 mm
- a_L: 15 mm
- a_R: 15 mm

Ordering designation provided by the customer and in the order confirmation (with sample letter code):

- 1×KLLT25-AL-W1/1570/AAAA

12 Structure of the ordering designation



Carriage

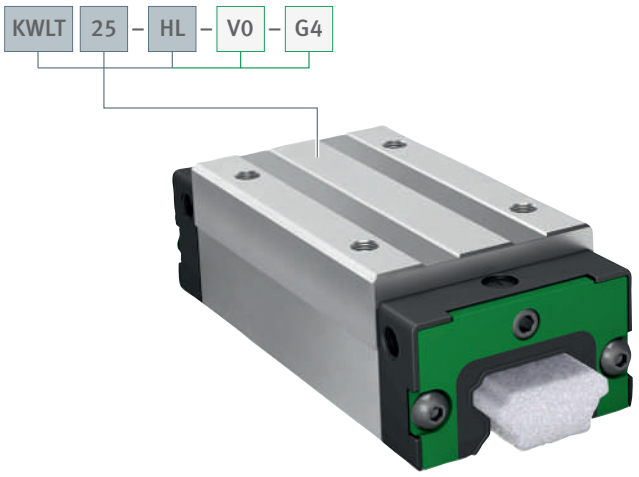
Single carriages can be ordered as follows:

- carriage: KWLT..-HL
- size: 25
- preload: V0
- accuracy class: G4
- with end wipers
- with lubricant reservoir

Ordering designation provided by the customer and in the order confirmation (with sample letter code):

- KWLT25-AL-V0-G4

13 Structure of the ordering designation



Guideway

The displacement distance needs to be extended. As a result, a longer guideway is required.

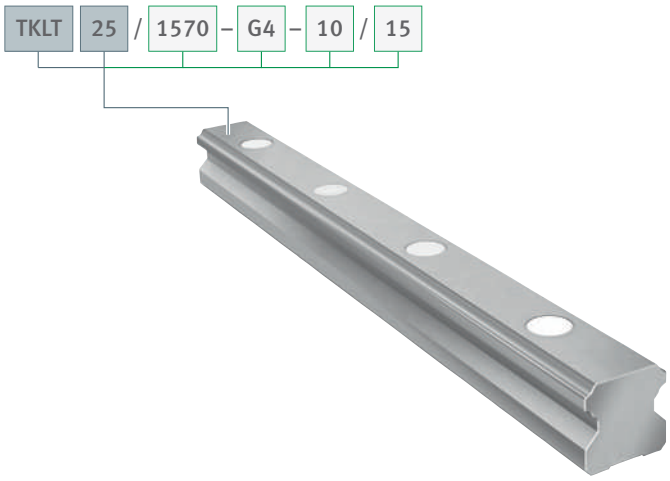
The guideway can be ordered as follows:

- guideway that can be combined with the existing carriage of identical size and belonging to accuracy class G4: TKLT
- size: 25
- length: 1570 mm
- accuracy class: G4

Ordering designation provided by the customer and in the order confirmation (with sample letter code):

- TKLT25/1570-G4

14 Structure of the ordering designation



2.6 Design of the bearing arrangement

2.6.1 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.

Tolerances of mounting surfaces and parallelism of mounted guideways must be observed.

Surfaces should be ground or precision milled: aim to achieve a mean roughness value Ra_{max} 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.

2.6.2 Height differences S1 and S2

The height difference in transverse direction S1 is dependent on the preload class and the guideway spacing b and is permissible in accordance with the following formulae.

f10

$$S1 = b \cdot Y$$

f11

$$S1 < 2 \cdot H$$

$$S1 < \Delta H \quad (12)$$

b	mm	Centre distances between guidance elements
H	µm	System height tolerance
S1	µm	Maximum permissible deviation from the theoretically precise position
Y	–	Side factor
ΔH	µm	Height deviation

9 System height tolerance H as a function of the accuracy class

Accuracy class	H
	µm
G4	+80 / –80
G3	+25 / –25
G2	+20 / –20

10 Height deviation ΔH as a function of the accuracy class

Accuracy class	ΔH
	µm
G4	15
G3	10
G2	7

11 Side factor Y for carriage as a function of the preload class

Designation	Y		
	Preload class		
	V0	V1	V2
KWLT..-A (-S, -H, -AL, -SL, -HL)	0,00052	0,00034	0,0002
KWLT..-AS (-US, -ESC)	0,00062	0,00041	–

The height deviation in longitudinal direction S2 with more than one carriage on the same guideway is permissible in accordance with the following formulae.

$$S2 = c \cdot X \quad (13)$$

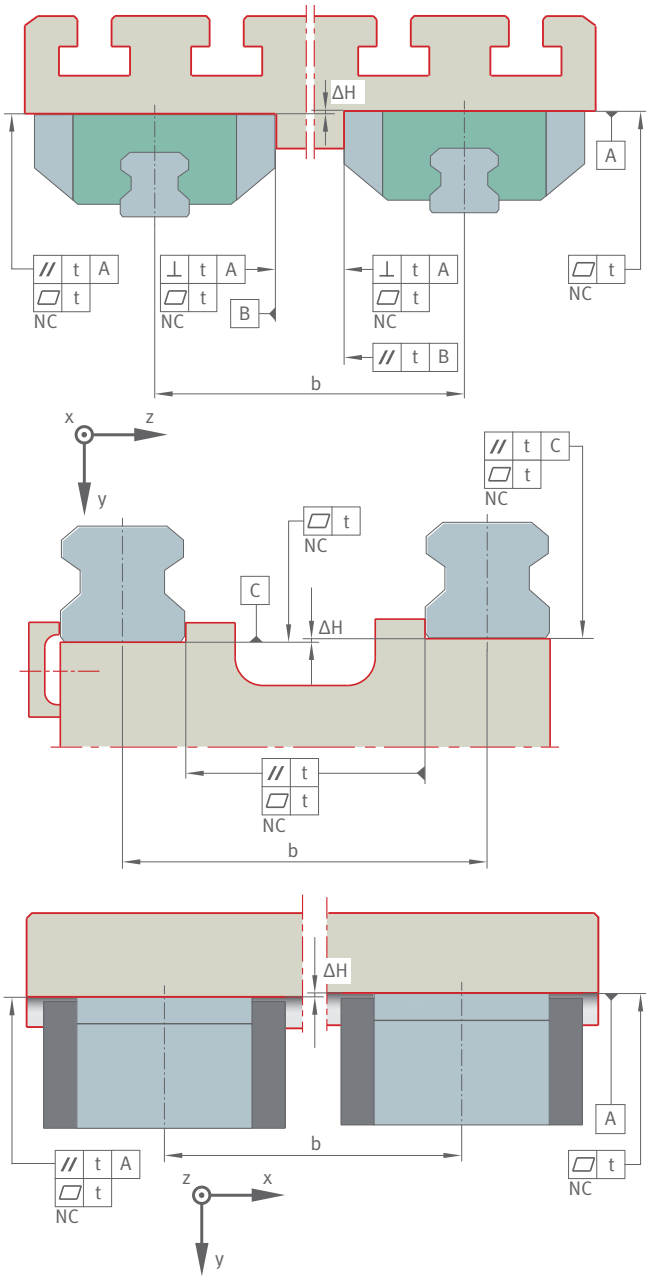
$$S2 < 2 \cdot \Delta H \quad (14)$$

c	mm	Centre distance between guidance elements
S2	µm	Maximum permissible deviation from the theoretically precise position
X	–	Longitudinal factor
ΔH	µm	Height deviation

12 Longitudinal factor X for carriages

Designation	X
KWLT..-A (-S, -H)	0,000047
KWLT..-AL (-SL, -HL)	0,000033
KWLT..-AS (-US, -ESC)	0,000066

15 Tolerances of mounting surfaces and parallelism of mounted guideways and carriages



NC	Not convex	b	Spacing between guidance elements
ΔH	Height difference	t	Parallelism, flatness and perpendicularity tolerance

2.6.3 Parallelism of mounted guideways

For guideways arranged in parallel, a parallelism t is required. If the maximum values are used, this may increase the displacement resistance. If larger tolerances are present, please contact Schaeffler.

13 Values for the parallelism tolerances of four-row units

Designation	Parallelism tolerance t		
	Preload class		
	V0 [1]	V1	V2
	µm	µm	µm
KWLT15	8	8	5
KWLT20	9	9	6
KWLT25	11	11	7
KWLT30	13	13	8
KWLT35	15	15	10
KWLT45	17	17	12

1) Standard preload class

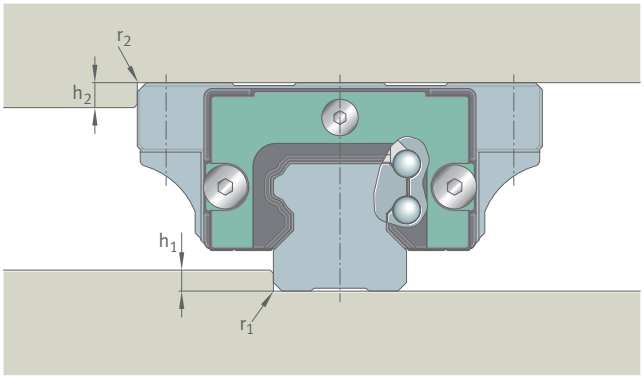
2.6.4 Locating heights and corner radii

The locating heights and corner radii can be designed using these specifications.

14 Locating heights, corner radii

Designation	Locating heights		Corner radii	
	h_1	h_2	r_1	r_2
	mm	mm	mm	mm
	max.	–	max.	max.
KLLT15	3,5	4	0,4	0,6
KLLT20	4	5	0,6	0,6
KLLT25	5	5	0,8	0,8
KLLT30	5	6	0,8	0,8
KLLT35	6	6	0,8	0,8
KLLT45	8	8	0,8	0,8

16 Locating heights and corner radii



3 Sealing and lubrication components

3.1 Sealing components and lubrication components – KIT system

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, additional requirements are often placed on the sealing and lubrication components.

3.2 Seals

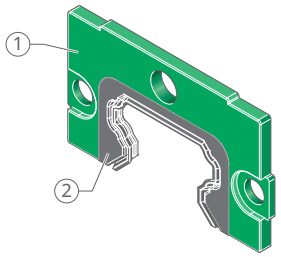
The linear recirculating ball bearing and guideway assemblies are equipped as standard with end wipers and sealing strips to prevent the ingress of contaminants, swarf and liquids, as well as the escape of lubricant, thereby increasing the rating life. The selection of a suitable sealing system is dependent on the specific application of the guidance system.

3.3 End wipers

End wipers are double-lipped contact seals that are attached to the end faces of the carriages. End wipers have both outward-facing and inward-facing seal lips. The outward-facing seal lip prevents the ingress of dirt particles, while the inward-facing seal lip prevents lubricant egress from the carriage. Depending on the application, this can extend the relubrication interval.

The guideways and systems are equipped with double-lipped seals as standard.

17 End wiper KIT.KWLT..-OS-100



001B5914

1	End wiper	2	Seal lip

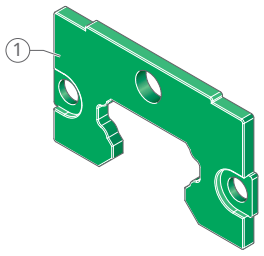
3.4 Gap wipers

Gap wipers are non-contact wipers that are fixed to the end faces of the carriages. Gap wipers provide protection against coarse contamination. A small gap remains between the guideway and the gap wiper.

The gap wiper replaces the standard end wiper and affects the guidance system by reducing friction and, depending on the application, extending relubrication intervals.

Non-contact wipers are suitable for applications with low levels of contamination where a low displacement force is required.

18 Gap wiper KIT.KWLT..-OS-110



1	Gap wipers		

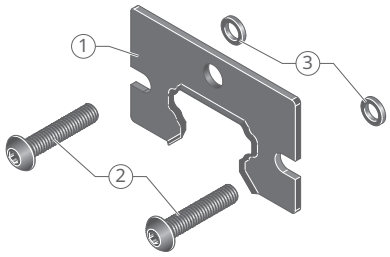
3.5 Additional wipers

In addition to the standard seal, other additional wipers can be used behind each other in a cascading arrangement.

Depending on the design, additional wipers provide protection against heavy contamination, such as coarse swarf and liquids. Additional carrier plates or cascaded additional wipers enhance the sealing function.

KIT.KWLT..-OS-220 is a vulcanised, non-contact wiper plate that protects the front wiper from coarse contamination.

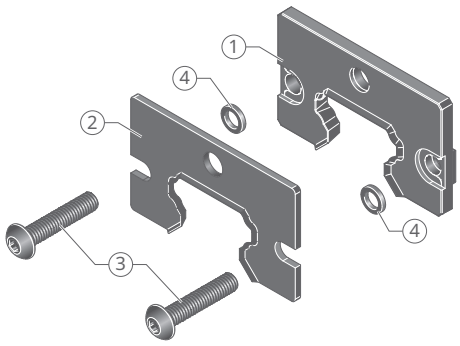
19 Additional wiper KIT.KWLT..-OS-220



1	Wiper plate	2	Fixing screws
3	Sealing rings		

KIT.KWLT..-OS-360 is a contact-type NBR wiper with an additional vulcanised, non-contact wiper plate to provide wiper protection.

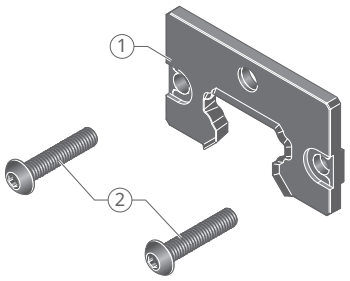
20 Additional wiper KIT.KWLT..-OS-360



1	NBR wiper	2	Wiper plate
3	Fixing screws	4	Sealing rings

KIT.KWLT..-OS-370 is a contact-type NBR wiper.

21 Additional wiper KIT.KWLT..-OS-370



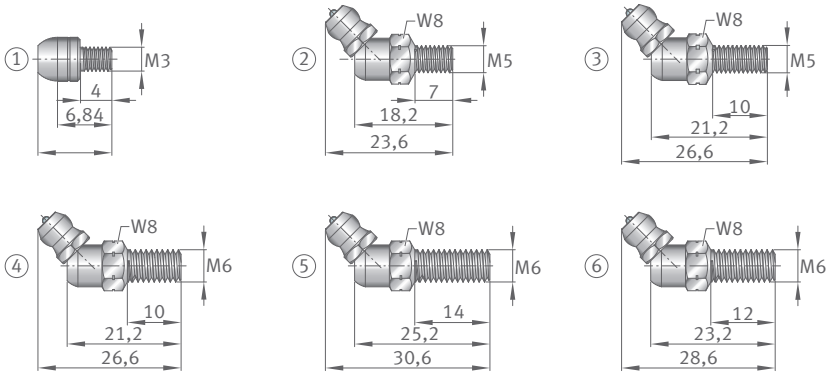
001BABB0

1	NBR wiper	2	Fixing screws

3.6 Lubrication fitting

A lubrication connector that allows relubrication via the end face using a manual lubricator is included loose in the delivery.

22 Standard lubrication connectors KLLT



001B3623

1	Standard lubrication connector, size 15	2	Standard lubrication connector, size 20
3	Standard lubrication connector, size 25	4	Standard lubrication connector, size 30
5	Standard lubrication connector, size 35	6	Standard lubrication connector, size 45

3.7 Closing plugs

3.7.1 1-piece plastic closing plug with clinch ring KA..-TN/B

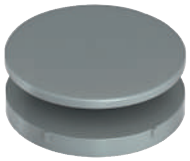
1-piece plastic closing plugs with clinch ring KA..-TN/B are included in the delivery. The closing plugs close off the counterbores of the guideway holes flush with the surface of the guideway.

The 1-piece plastic closing plug with clinch ring KA..-TN/B comprises a closing plug and a clinch ring connected to it. The clinch ring guides the closing plug and ensures ideal alignment with the guideway surface. Retaining lugs on the circumference of the clinch ring ensure a firm and secure hold in the fixing hole. This allows the closing plug to be easily mounted in all spatial directions. The 1-piece plastic closing plug with clinch ring KA..-TN/B is very easy to use, particularly in overhead and wall mounting or where long guideways are used.

The closing plug can be securely fitted with minimal effort with the aid of a hammer and press-in block. After fitting, a minimal visible ring gap remains.

The closing plugs are included in the delivery.

23 1-piece plastic closing plug with clinch ring KA..-TN/B



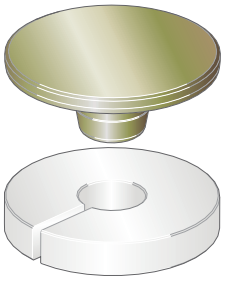
001B1492

3.7.2 2-piece brass closing plugs with clinch ring KA..- M/A

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

The closing plugs can be easily mounted with the aid of a hammer and a press-in block. After fitting, a small annular gap remains. The cap heads do not require any further machining.

24 Brass closing plug KA..-M/A



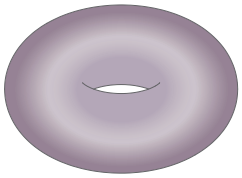
001BAD8A

3.8 Accessories

Additional accessories are required if relubrication is to be performed from above through the adjacent construction. The listed parts must be ordered separately.

For carriages with standard height, MSATZ.KWLT..-0200 enables lubrication from above.

25 O-ring MSATZ.KWLT..-0200



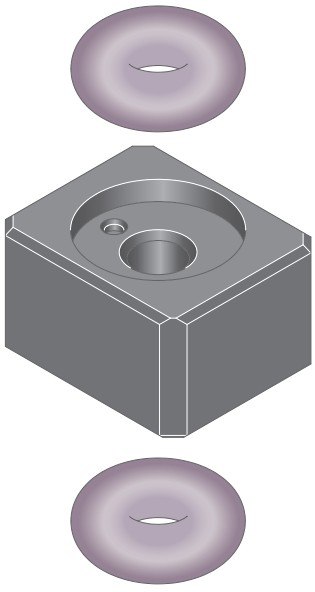
001B9C0B

15 O-ring MSATZ.KWLT..-0200

Size	Designation
15	MSATZ.KWLT15-0200
20	MSATZ.KWLT15-0200
25	MSATZ.KWLT25-0200
30	MSATZ.KWLT25-0200
35	MSATZ.KWLT25-0200
45	MSATZ.KWLT25-0200

For carriages with increased height, MSATZ.KWLT..-0100 enables lubrication from above.

26 Adapter with 2 O-rings MSATZ.KWLT..-0100



001B9C0E

16 Adapter with 2 O-rings MSATZ.KWLT..-0100

Size	Designation
15	MSATZ.KWLT15-0100
20	–
25	MSATZ.KWLT25-0100
30	MSATZ.KWLT30-0100
35	MSATZ.KWLT35-0100
45	MSATZ.KWLT45-0100

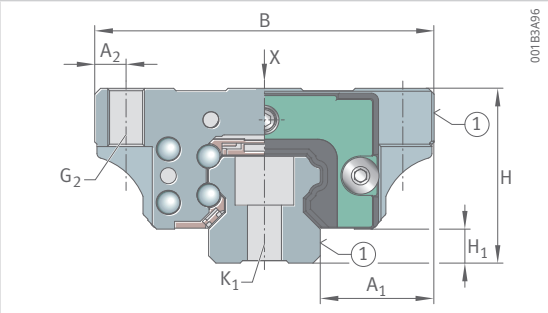
4 Product tables

4.1 Explanations

(1)	–	Locating face
A_1	mm	Distance from locating edge of the carriage to locating edge of the guideway
A_2	mm	Distance between locating edge and hole
A_3	mm	Position of lubrication connector
a_L	mm	Distance from start of guideway to nearest hole
a_R	mm	Distance from end of guideway to nearest hole
b	mm	Width of guideway
B	mm	Width
C	N	Basic dynamic load rating
C_0	N	Basic static load rating
d_1	mm	Through hole in guideway
G_1	–	Thread, DIN ISO 4762-12.9
G_2	–	Thread, DIN ISO 4762-12.9
h	mm	Height of guideway
H	mm	Height
h_1	mm	Height of through hole
H_1	mm	Guideway clearance
j_B	mm	Distance between holes
J_B	mm	Distance between fixing threads in carriage
j_L	mm	Distance between holes
J_L	mm	Distance between fixing threads in carriage
K_1	–	Thread size, DIN ISO 4762-12.9
L	mm	Length of carriage
L_1	mm	Effective saddle plate length
l_{max}	mm	Max. length of guideway
L_S	mm	Screw head length
M_A	Nm	Tightening torque
m_c	kg	Mass of carriage
m_r	kg/m	Mass of guideway
$M_{x\ dyn}$	Nm	Dynamic moment rating about x-axis
$M_{x\ stat}$	Nm	Static moment rating about x-axis
$M_{yz\ dyn}$	Nm	Dynamic moment rating about y-axis and z-axis
$M_{yz\ stat}$	Nm	Static moment rating about y-axis and z-axis
T_5	mm	Thread depth
t_7	mm	Thread length

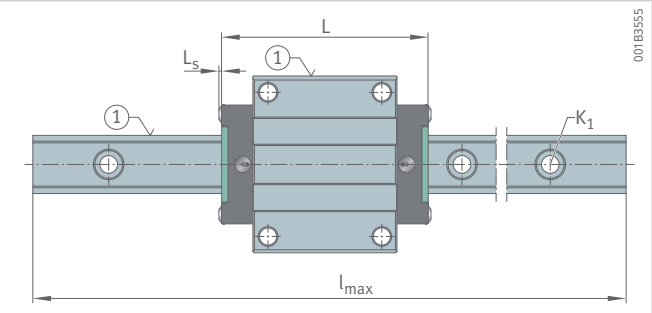
4.2 KLLT..-A, KLLT..-AL System

Four-row system in X arrangement

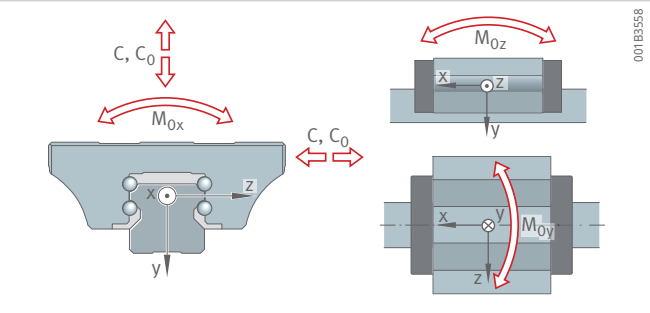


KLLT

System Designation	l_{max}	H	B	L	L_S	A_1	A_2	H_1
–	mm	mm	mm	mm	mm	mm	mm	mm
KLLT15-A	3900	24	47	62	0,5	16	4,5	4,6
KLLT20-A	3900	30	63	71,8	0,5	21,5	5	5
KLLT20-AL	3900	30	63	88	0,5	21,5	5	5
KLLT25-A	3900	36	70	81,8	1	23,5	6,5	7
KLLT25-AL	3900	36	70	103,9	1	23,5	6,5	7
KLLT30-A	3840	42	90	100,4	−0,5	31	9	9
KLLT30-AL	3840	42	90	125,4	−0,5	31	9	9
KLLT35-A	3840	48	100	114	0,1	33	9	9,5
KLLT35-AL	3840	48	100	142,5	0,1	33	9	9,5
KLLT45-A	3885	60	120	135	0,6	37,5	10	14
KLLT45-AL	3885	60	120	167	0,6	37,5	10	14



KLLT, view rotated by 90°

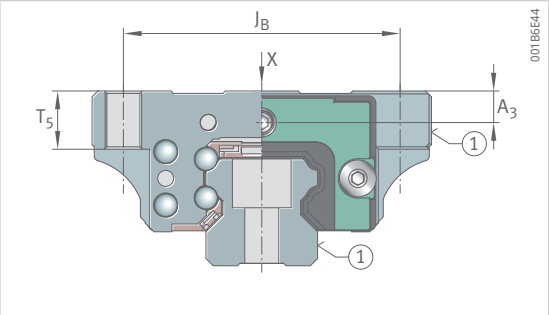


Moments and load direction

G_2		K_1		C	C_0	$M_{x\ dyn}$	$M_{x\ stat}$	$M_{y\ dyn}$, $M_{z\ dyn}$	$M_{y\ stat}$, $M_{z\ stat}$
mm	M_A	–	M_A						
–	Nm	–	Nm	N	N	Nm	Nm	Nm	Nm
M5×12	9,7	M4×12	4,95	8400	16200	140	65	85	99
M6×12	16,5	M5×16	9,7	12300	22400	244	122	154	173
M6×12	16,5	M5×16	9,7	15100	30000	325	148	251	300
M8×16	40	M6×20	16,5	19900	36500	480	240	305	340
M8×16	40	M6×20	16,5	24300	48500	640	287	490	590
M10×20	81	M8×20	40	27500	49500	790	406	493	540
M10×20	81	M8×20	40	34000	66000	1060	495	810	940
M10×20	81	M8×25	40	36500	65000	1270	664	746	800
M10×20	81	M8×25	40	45000	86000	1680	807	1224	1390
M12×30	140	M12×30	140	59000	101000	2700	1442	1505	1520
M12×30	140	M12×30	140	72000	135000	3600	1735	2440	2600

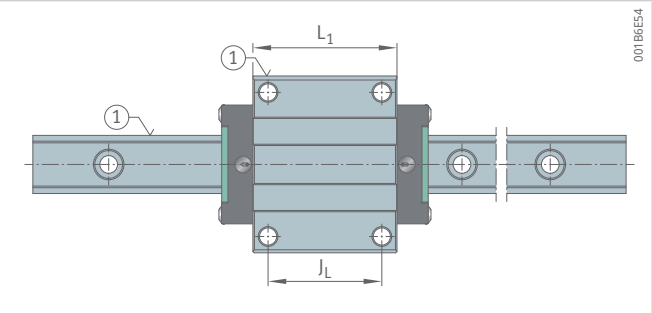
4.3 KLLT..-A, KLLT..-AL Carriage

Four-row system in X arrangement



KLLT

Designation	m_c	J_B
–	kg	mm
KWLT15-A	0,21	38
KWLT20-A	0,40	53
KWLT20-AL	0,52	53
KWLT25-A	0,57	57
KWLT25-AL	0,72	57
KWLT30-A	1,10	72
KWLT30-AL	1,40	72
KWLT35-A	1,60	82
KWLT35-AL	2,00	82
KWLT45-A	2,70	100
KWLT45-AL	3,60	100

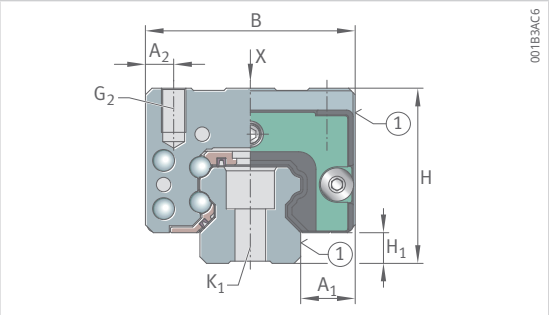


KLLT, view rotated by 90°

L_1	J_L	T_5	A_3
mm	mm	mm	mm
40	30	8	4,3
50	40	9	5,7
66,2	40	9	5,7
57	45	12	6,5
79,1	45	12	6,5
67,4	52	11,5	8
92,4	52	11,5	8
77	62	13	8
105,5	62	13	8
96	80	15	8,5
128	80	15	8,5

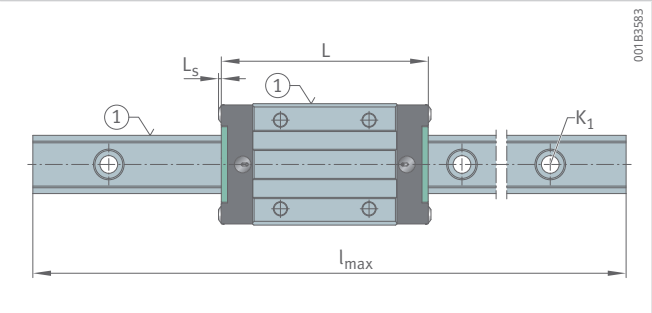
4.4 KLLT..-H, KLLT..-HL, KLLT..-S, KLLT..-SL System

Four-row system in X arrangement

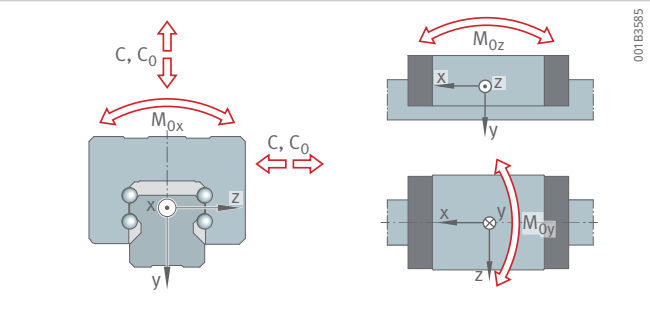


KLLT

System Designation	l_{max}	H	B	L	L_S	A_1	A_2	H_1
–	mm	mm	mm	mm	mm	mm	mm	mm
KLLT15-H	3900	28	34	62	0,5	9,5	4	4,6
KLLT15-S	3900	24	34	62	0,5	9,5	4	4,6
KLLT20-SL	3900	30	44	88	0,5	12	6	5
KLLT20-S	3900	30	44	71,8	0,5	12	6	5
KLLT25-H	3900	40	48	81,8	1	12,5	6,5	7
KLLT25-HL	3900	40	48	99,7	1	12,5	6,5	7
KLLT25-S	3900	36	48	81,8	1	12,5	6,5	7
KLLT25-SL	3900	36	48	99,7	1	12,5	6,5	7
KLLT30-H	3840	45	60	100,4	−0,5	16	10	9
KLLT30-HL	3840	45	60	125,4	−0,5	16	10	9
KLLT30-S	3840	42	60	100,4	−0,5	16	10	9
KLLT30-SL	3840	42	60	125,4	−0,5	16	10	9
KLLT35-H	3840	55	70	114	0,1	18	10	9,5
KLLT35-HL	3840	55	70	142,5	0,1	18	10	9,5
KLLT35-S	3840	48	70	114	0,1	18	10	9,5
KLLT35-SL	3840	48	70	142,5	0,1	18	10	9,5
KLLT45-H	3885	70	86	135	0,6	20,5	13	14
KLLT45-HL	3885	70	86	167	0,6	20,5	13	14
KLLT45-S	3885	60	86	135	0,6	20,5	13	14
KLLT45-SL	3885	60	86	167	0,6	20,5	13	14



KLLT, view rotated by 90°

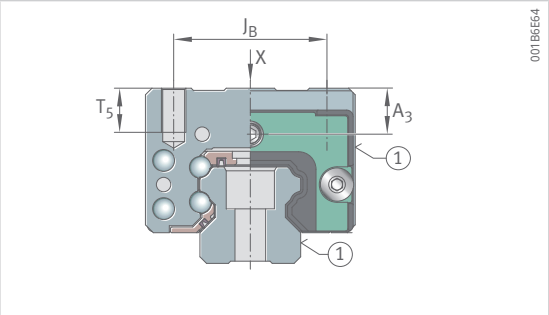


Moments and load direction

G_2		K_1		C	C_0	$M_{x\ dyn}$	$M_{x\ stat}$	$M_{y\ dyn}$, $M_{z\ dyn}$	$M_{y\ stat}$, $M_{z\ stat}$
mm	M_A	–	M_A						
–	Nm	–	Nm	N	N	Nm	Nm	Nm	Nm
M4×12	4,95	M4×12	4,95	8400	16200	140	65	85	99
M4×12	4,95	M4×12	4,95	8400	16200	140	65	85	99
M5×12	9,7	M5×16	9,7	15100	30000	325	148	251	300
M5×12	9,7	M5×16	9,7	12300	22400	244	122	154	173
M6×16	16,5	M6×20	16,5	19900	36500	480	240	305	340
M6×16	16,5	M6×20	16,5	24300	48500	640	287	490	590
M6×16	16,5	M6×20	16,5	19900	36500	480	240	305	340
M6×16	16,5	M6×20	16,5	24300	48500	640	287	490	590
M8×20	40	M8×20	40	27500	49500	790	406	493	540
M8×20	40	M8×20	40	34000	66000	1060	495	810	940
M8×20	40	M8×20	40	27500	49500	790	406	493	540
M8×20	40	M8×20	40	34000	66000	1060	495	810	940
M8×20	40	M8×25	40	36500	65000	1270	664	746	800
M8×20	40	M8×25	40	45000	86000	1680	807	1224	1390
M8×20	40	M8×25	40	36500	65000	1270	664	746	800
M8×20	40	M8×25	40	45000	86000	1680	807	1224	1390
M10×30	81	M12×30	140	59000	101000	2700	1422	1505	1520
M10×30	81	M12×30	140	72000	135000	3600	1735	2440	2600
M10×30	81	M12×30	140	59000	101000	2700	1442	1505	1520
M10×30	81	M12×30	140	72000	135000	3600	1735	2440	2600

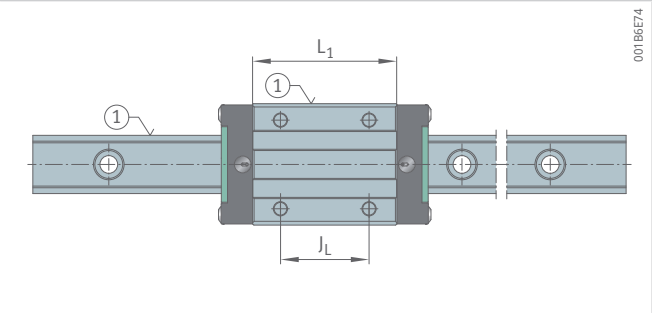
4.5 KLLT..-H, KLLT..-HL, KLLT..-S, KLLT..-SL Carriage

Four-row system in X arrangement



KLLT

Designation	m_c	J_B
–	kg	mm
KWLT15-H	0,19	26
KWLT15-S	0,17	26
KWLT20-SL	0,47	32
KWLT20-S	0,26	32
KWLT25-H	0,45	35
KWLT25-HL	0,56	35
KWLT25-S	0,38	35
KWLT25-SL	0,47	35
KWLT30-H	0,91	40
KWLT30-HL	1,2	40
KWLT30-S	0,81	40
KWLT30-SL	0,82	40
KWLT35-H	1,5	50
KWLT35-HL	1,9	50
KWLT35-S	1,2	50
KWLT35-SL	1,26	50
KWLT45-H	2,3	60
KWLT45-HL	2,8	60
KWLT45-S	2,1	60
KWLT45-SL	2,11	60

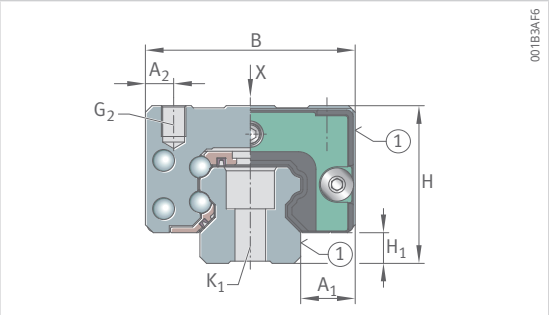


KLLT, view rotated by 90°

L_1	J_L	T_5	A_3
mm	mm	mm	mm
40	26	7,5	8,3
40	26	4	4,3
66,2	50	6,5	5,7
50	36	6,5	5,7
57	35	10	10,5
79,1	50	10	10,5
57	35	6,5	6,5
79,1	50	6,5	6,5
67,4	40	11	11
92,4	60	11	11
67,4	40	8,5	8
92,4	60	8,5	8
77	50	17	15
105,5	72	17	15
77	50	10	8
105,5	72	10	8
96	60	20,5	18,5
128	80	20,5	18,5
96	60	12	8,5
128	80	12	8,5

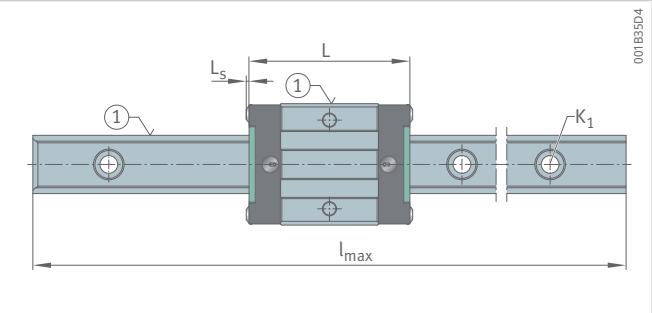
4.6 KLLT..-ESC, KLLT..-US System

Four-row system in X arrangement

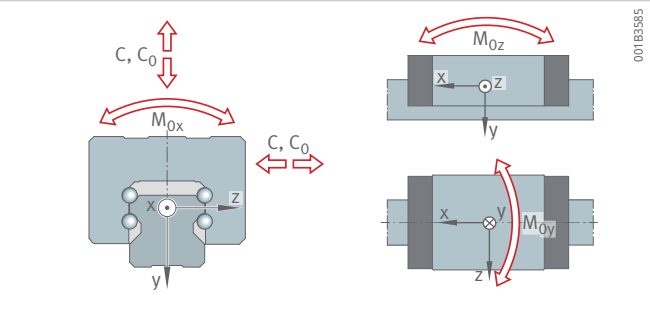


KLLT

System Designation	l_{max}	H	B	L	L_S	A_1	A_2	H_1
–	mm	mm	mm	mm	mm	mm	mm	mm
KLLT15-ESC	3900	24	34	47,6	0,5	9,5	4	4,6
KLLT20-US	3900	30	44	53,9	0,5	12	6	5
KLLT25-US	3900	36	48	63,6	1	12,5	6,5	7
KLLT30-ESC	3840	42	60	78	−0,5	16	10	9
KLLT35-ESC	3840	48	70	88,4	0,1	18	10	9,5



KLLT, view rotated by 90°

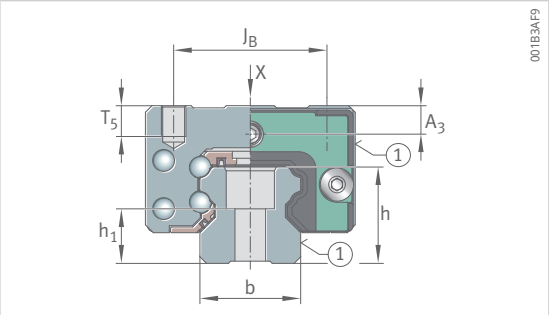


Moments and load direction

G_2		K_1		C	C_0	$M_{x\ dyn}$	$M_{x\ stat}$	$M_{y\ dyn}$, $M_{z\ dyn}$	$M_{y\ stat}$, $M_{z\ stat}$
mm	M_A	–	M_A						
–	Nm	–	Nm	N	N	Nm	Nm	Nm	Nm
M4×12	4,95	M4×12	4,95	6300	10800	95	50	43	47
M5×12	9,7	M5×16	9,7	9300	15000	163	95	78	83
M6×16	16,5	M6×20	16,5	14900	24300	320	183	153	163
M8×20	40	M8×20	40	20700	33000	530	312	249	260
M8×20	40	M8×25	40	27500	43000	940	507	378	385

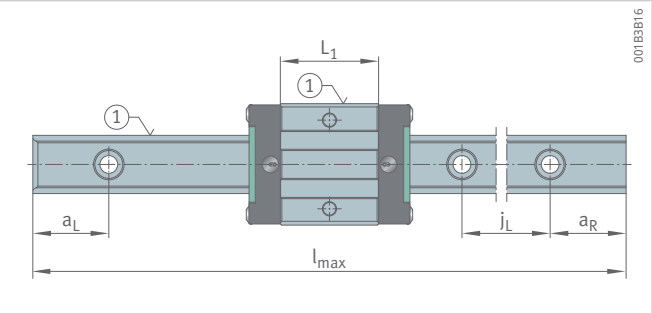
4.7 KLLT..-ESC, KLLT..-US Carriage

Four-row system in X arrangement



KLLT

Designation	m_c	J_B
–	kg	mm
KWLT15-ESC	0,10	26
KWLT20-US	0,17	32
KWLT25-US	0,21	35
KWLT30-ESC	0,48	40
KWLT35-ESC	0,80	50

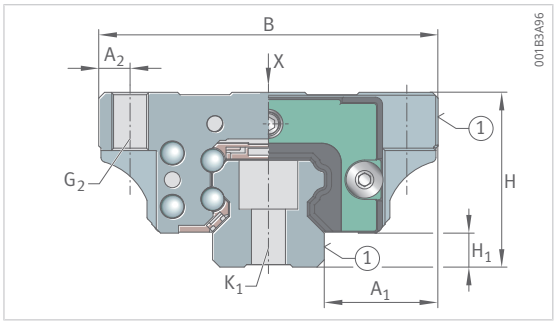


KLLT, view rotated by 90°

L_1	J_L	T_5	A_3
mm	mm	mm	mm
25,6	–	4	4,3
32,1	–	6,5	5,7
38,8	–	6,5	6,5
45	–	8,5	8
51,4	–	10	8

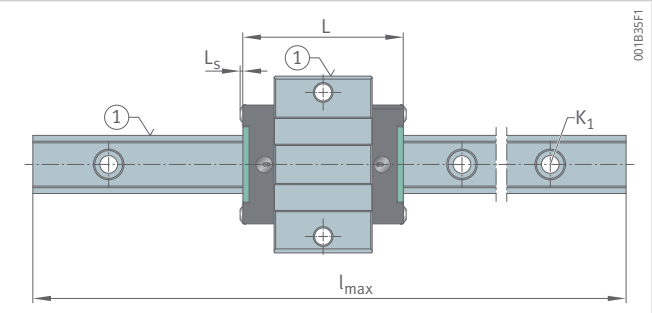
4.8 KLLT..-AS System

Four-row system in X arrangement

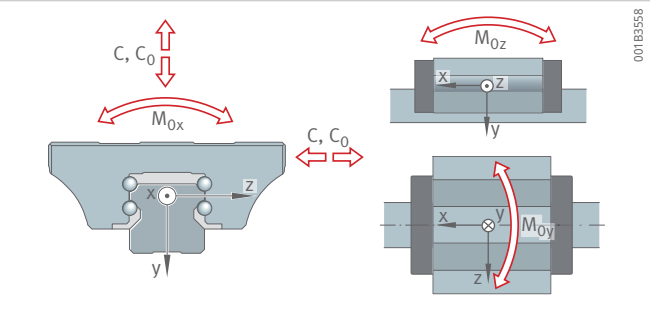


KLLT

System Designation	l_{max}	H	B	L	L_S	A_1	A_2	H_1
–	mm	mm	mm	mm	mm	mm	mm	mm
KLLT15-AS	3900	24	47	47,6	0,5	16	4,5	4,6
KLLT20-AS	3900	30	63	53,9	0,5	21,5	5	5
KLLT25-AS	3900	36	70	63,6	1	23,5	6,5	7
KLLT30-AS	3840	42	90	78	0,5	31	9	9
KLLT35-AS	3840	48	100	88,4	0,1	33	9	9,5



KLLT, view rotated by 90°

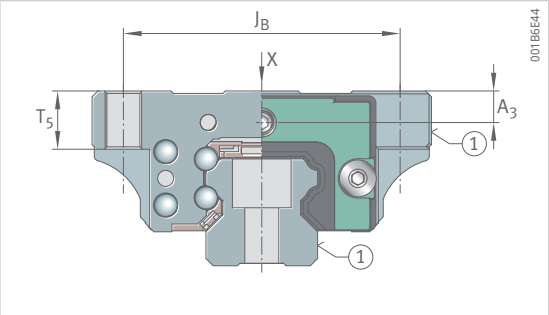


Moments and load direction

G_2		K_1		C	C_0	$M_{x\ dyn}$	$M_{x\ stat}$	$M_{y\ dyn}$, $M_{z\ dyn}$	$M_{y\ stat}$, $M_{z\ stat}$
mm	M_A	–	M_A						
–	Nm	–	Nm	N	N	Nm	Nm	Nm	Nm
M5×12	9,7	M4×12	4,95	6300	10800	95	50	43	47
M6×12	16,5	M5×16	9,7	9300	15000	163	95	78	83
M8×16	40	M6×20	16,5	14900	24300	320	183	153	163
M10×20	81	M8×20	40	20700	33000	530	312	249	260
M10×20	81	M8×25	40	27500	43000	940	507	378	385

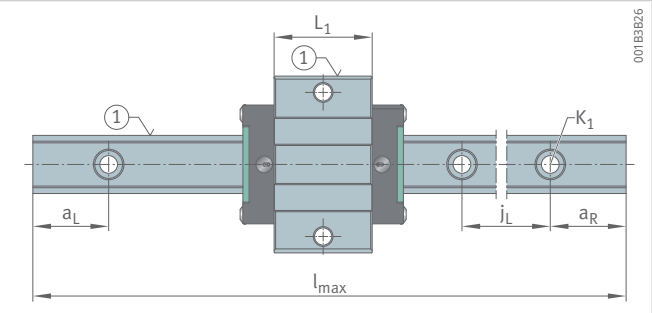
4.9 KLLT..-AS Carriage

Four-row system in X arrangement



KLLT

Designation	m_c	J_B
–	kg	mm
KWLT15-AS	0,12	38
KWLT20-AS	0,25	53
KWLT25-AS	0,38	57
KWLT30-AS	0,56	72
KWLT35-AS	0,83	82

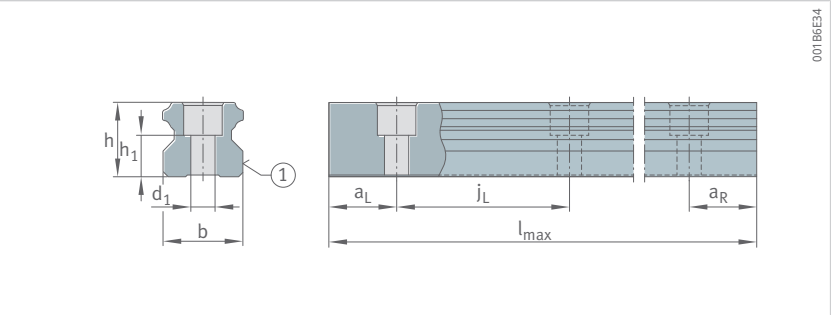


KLLT, view rotated by 90°

L_1	J_L	T_5	A_3
mm	mm	mm	mm
25,6	–	8	4,3
32,1	–	9	5,7
38,8	–	12	6,5
45	–	11,5	8
51,4	–	13	8

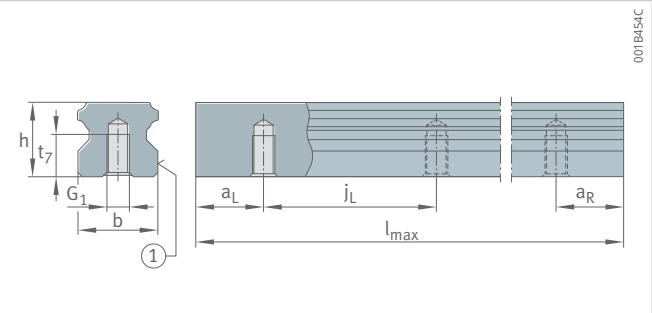
4.10 TKLT
Guideway

Four-row system in X arrangement



TKLT

Designation	m_r	l_{max}	h	b	G_1		t_7
					–	M_A	
–	kg/m	mm	mm	mm	–	Nm	mm
TKLT15	1,4	3900	14	15	–	–	–
TKLT15-U	1,4	3900	14	15	M5×0,8	10	8
TKLT20	2,3	3900	18	20	–	–	–
TKLT20-U	2,3	3900	18	20	M6×1,0	17	10
TKLT25	3,3	3900	22	23	–	–	–
TKLT25-U	3,3	3900	22	23	M6×1,0	17	12
TKLT30	4,8	3840	26	28	–	–	–
TKLT30-U	4,8	3840	26	28	M8×1,25	41	15
TKLT35	6,6	3840	29	34	–	–	–
TKLT35-U	6,6	3840	29	34	M8×1,25	41	15
TKLT45	11,3	3885	38	45	–	–	–
TKLT45-U	11,3	3885	38	45	M12×1,75	140	20



TKLT..-U

d_1	h_1	j_L	a_L		a_R		Closing plugs	
			min	max	min	max	Plastic	Brass
mm	mm	mm	mm	mm	mm	mm	–	–
4,6	8,5	60	10	50	10	50	KA07-TN/B	KA07-M/A
–	8,5	60	10	50	10	50	KA07-TN/B	KA07-M/A
5,8	9,3	60	10	50	10	50	KA10-TN/B	KA10-M/A
–	9,3	60	10	50	10	50	KA10-TN/B	KA10-M/A
6,8	12,3	60	10	50	10	50	KA11-TN/B	KA11-M/A
–	12,3	60	10	50	10	50	KA11-TN/B	KA11-M/A
9	13,8	80	12	70	12	70	KA15-TN/B	KA15-M/A
–	13,8	80	12	70	12	70	KA15-TN/B	KA15-M/A
9	17	80	12	70	12	70	KA15-TN/B	KA15-M/A
–	17	80	12	70	12	70	KA15-TN/B	KA15-M/A
13,4	20,8	105	16	90	16	90	KA20-TN/B	KA20-M/A
–	20,8	105	16	90	16	90	KA20-TN/B	KA20-M/A

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