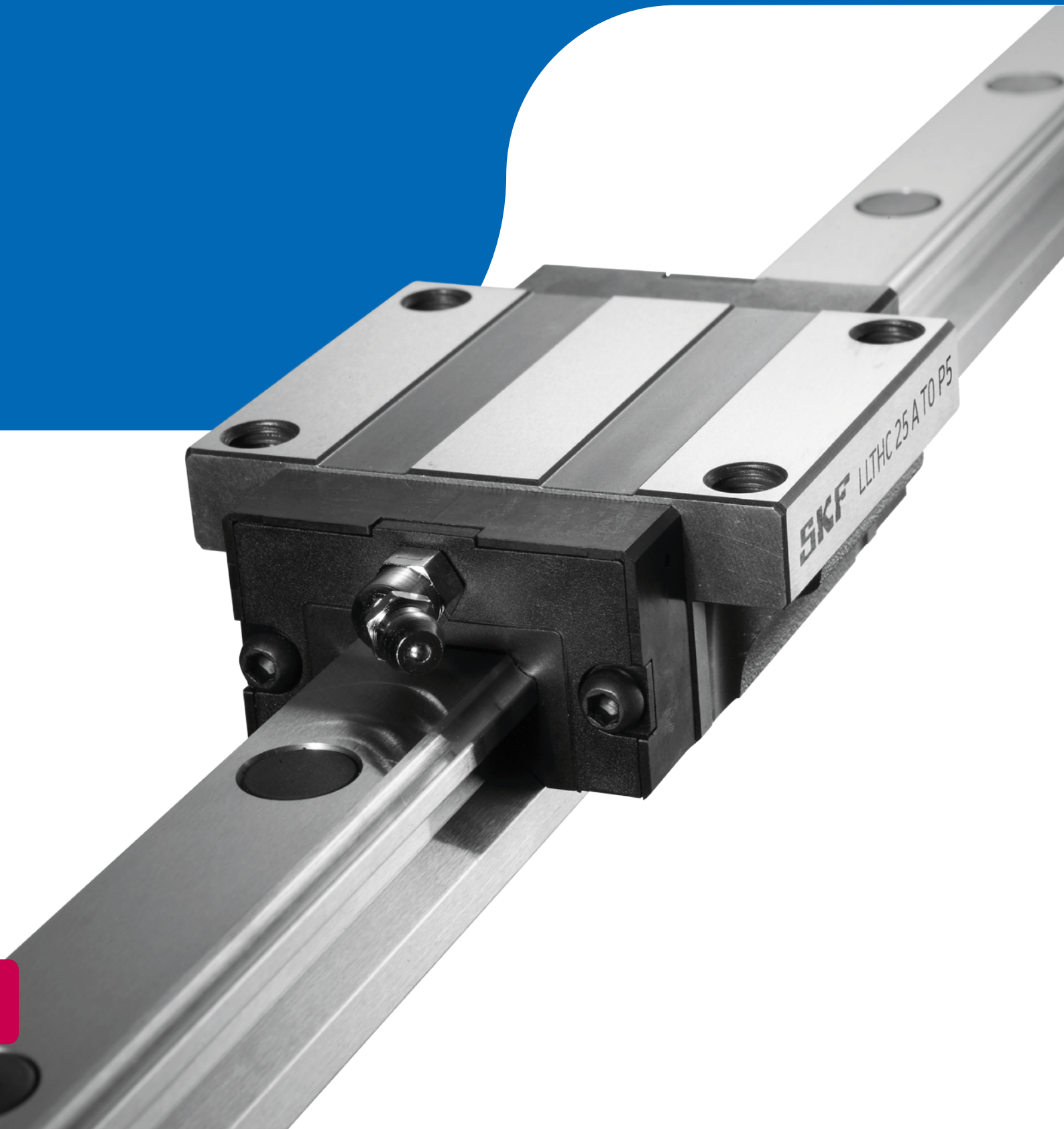
Profile rail guides
LLT



Contents

The SKF brand now stands for more than ever before, and means more to you as a valued customer.

While SKF maintains its leadership as the hallmark of quality bearings throughout the world, new dimensions in technical advances, product support and services have evolved SKF into a truly solutions-oriented supplier, creating greater value for customers.

These solutions encompass ways to bring greater productivity to customers, not only with breakthrough application-specific products, but also through leading-edge design simulation tools and consultancy services, plant asset efficiency maintenance programmes, and the industry's most advanced supply management techniques.

The SKF brand still stands for the very best in rolling bearings, but it now stands for much more.

SKF – the knowledge engineering company

A Product information

Foreword **3**
Features and benefits 4
LLT Design 5
Product overview 6
Load rating 7
Definition of the basic dynamic load rating C 7
Definition of the basic static load rating C_0 7
Definition and calculation of the basic rating life 7
Equivalent dynamic bearing load for calculating the service life 7
Equivalent bearing load 8
Equivalent dynamic bearing load . . . 8
Combined equivalent dynamic bearing load 8
Equivalent static bearing load 9
Combined equivalent static bearing load 9
Static load safety factor 9
Technical data 10
Speed 10
Temperature resistance 10
Lubrication 10
Friction 10
LLT components and material specifications 10
Standard carriage components 11
Seals 11
Preload classes 12
Relation of preload and stiffness 12
Generation of preload 12
Preload classes 12
Accuracy classes 13
Accuracy 13
Width and height accuracy 13
Parallelism 13
Combination of rails and carriages . . 13
Ordering key 14
Ordering examples 15

B Product data

Product data **16**
Carriages 16
Carriage LLTHC ... A 18
Carriage LLTHC ... LA 20
Carriage LLTHC ... R 22
Carriage LLTHC ... LR 24
Carriage LLTHC ... U 26
Carriage LLTHC ... SU 28
Rails 17
LLTHR rails 30
LLTHR ... D4 rails 32

Accessories **34**
Scraper plate 35
Additional front seal 36
Seal kit 37
Bellows 38

C Recommendations

Mounting **40**
Typical mounting examples 40
Rails 40
Carriage 40
Interface design, screw sizes and tightening torques 41
Permissible height deviation 42
Parallelism 43

Lubrication **44**
Factory pre-lubrication 44
Initial lubrication 44
Re-lubrication 44
Short stroke applications 45

Maintenance **45**

Typical application areas 46

D Additional information

Specification sheet 47

SKF – the knowledge engineering company **50**

Foreword

The productivity and economic success of a given application depends, to a large extent, on the quality of the selected linear components. Often these components determine market acceptance and thus help to secure the manufacturer a competitive edge. For this purpose, the linear components have to be as adaptable as possible to precisely meet the application's requirements, ideally with standard components.

The new SKF profile rail guide series LLT satisfies these market demands: available in a wide range of sizes, carriages and accessories as well as in various preload and accuracy classes, LLT profile rail guides facilitate the adaptation to individual application demands. In combination with their ability to operate at virtually unlimited stroke. This opens up almost any design option.

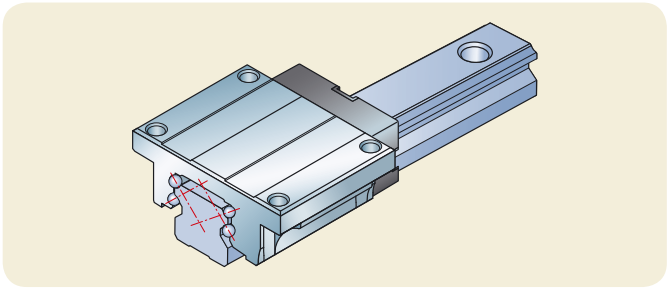
The range of possible applications includes material handling, plastic injection moulding, woodworking, printing, packaging and medical devices, to name only a few. With such applications, the design of the LLT reveals its full capabilities:

SKF manufactures these profile rail guides in an X-arrangement with a 45° contact angle between the rolling elements and raceways. This design provides an equal load carrying capacity in all four main load directions and therefore greater design flexibility since all mounting positions are possible. Moreover, deviations in parallelism and height, which usually occur in multi-axis systems, can be compensated for more efficiently, resulting in reliable and smooth operation under a variety of operating conditions.

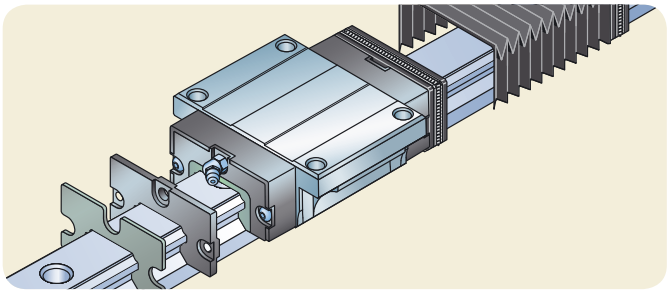
In addition, SKF offers a miniature profile rail guide series and a series of ready assembled and driven profile rail guide slides. Contact your SKF representative for additional information.



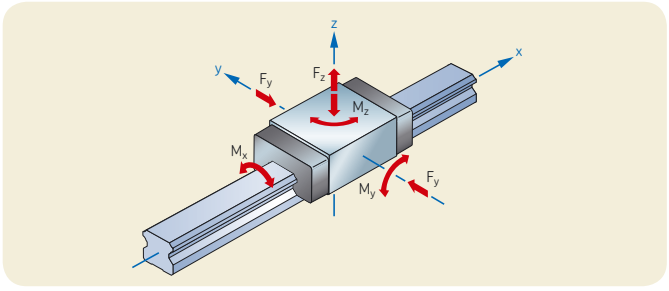
Features and benefits



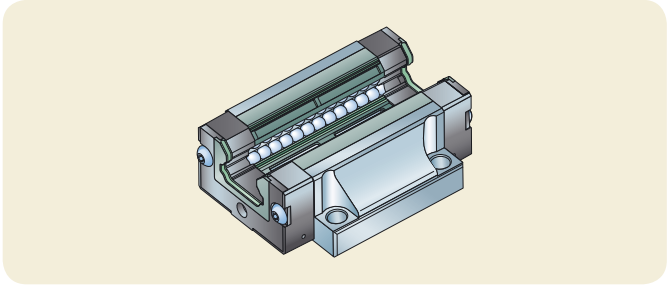
Improved repeatability and smooth running performance
The new LLT profile rail guide has four rows of balls with a 45° contact angle between the rolling elements and raceways. This X-arrangement improves the system's self-aligning capability. Mounting deviation can be absorbed even under preload, resulting in smooth running performance. Friction is kept to a minimum due to two-point ball contact. This enables reliable, stick-slip-free operation for the life of the rail guide.



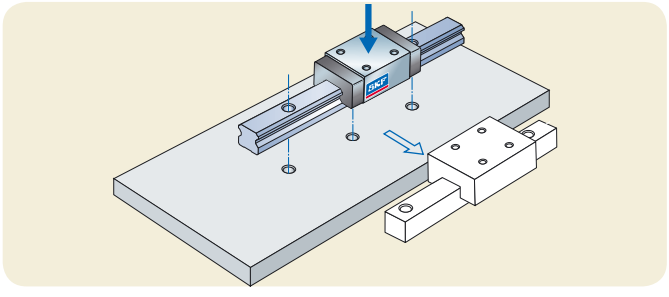
Modular concept for customized solutions
Applications have different speed, precision and environmental requirements. As a result, SKF LLT rail guides use modular components so that cost-effective solutions can be built based on the needs of the application. Various accuracy and preload classes are available to meet different precision and stiffness requirements. Furthermore, a wide range of accessories supports the adaptation to specific environmental needs.



Stiffness, strength and accuracy for improved production processes
The four-row arrangement of balls at a 45° angle optimizes load sharing in all four main load directions and is in accordance with ISO 14728. This feature provides a high degree of design flexibility. The ability to accommodate high loads and moment loads makes these rail guides ideal even for single carriage systems.



Longer service life and reduced maintenance
SKF profile rail guide carriages are factory pre-lubricated. The integrated lubricant reservoirs, located in the end plates, constantly relubricate the circulating balls. Both ends of the carriage have metal threaded lubrication ports to accommodate an automatic re-lubrication system. As standard, one grease nipple is provided with each carriage. These fully sealed carriages have double lip seals on both ends as well as side and inner seals. The seal design results in both low friction and high protection of the internal components.



Interchangeability and global availability
The main dimensions of SKF profile rail guides are in accordance with DIN 645-1. This enables full interchangeability with all DIN-compliant brands. SKF's global sales and distribution network results in availability of replacement parts and serviceability for all systems worldwide.

LLT Design

Just as in rotary bearings, the raceways of profile rail guides can be arranged in an X- or an O-configuration. The technical characteristics of these two arrangements are the same except for their behaviour when subjected to a torsional moment. Generally, they show no difference in behaviour when it comes to compressive loads, lift-off loads and side loads or under longitudinal moments.

The new profile rail guides from SKF feature an X-arrangement, based on the contact angle of the rolling elements (→ **fig. 1**).

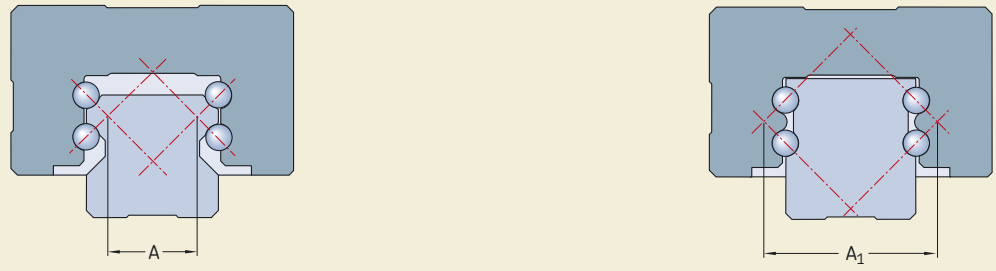
The advantage of this arrangement is that deviations in parallelism and height, which usually appear in multi-axis systems, can be accommodated more effectively (→ **fig. 2**).

Due to the design-related smaller lever arm, the X-arrangement provides better self-aligning capability.

In combination with a two-point contact of the rolling elements, running friction is kept to a minimum. This results in smooth and stick-slip-free operation of the guidance system.

Fig. 1

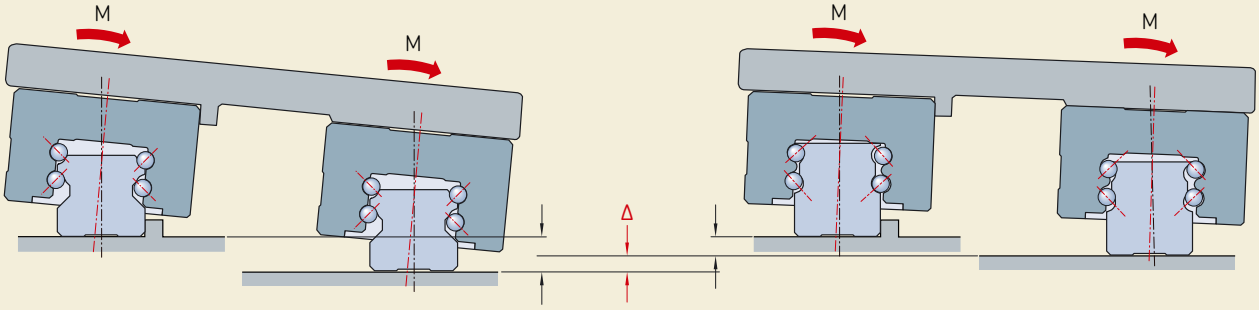
Schematic illustration of the different ball-arrangements



X-arrangement O-arrangement

Fig. 2

Self-aligning capability in comparison



X-arrangement O-arrangement

Product overview

LLTHC ... A
Flanged carriage, standard length, standard height
Further information on ***page 18***

LLTHC ... R
Slim-line carriage, standard length, extended height
Further information on ***page 22***

LLTHC ... U
Slim-line carriage, standard length, standard height
Further information on ***page 26***







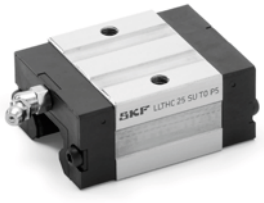
LLTHR profile rail with blind holes
Additional information on ***page 32***



LLTHR profile rail with standard holes
Additional information on ***page 30***







LLTHC ... LA
Flanged carriage, extended length, standard height
Further information on ***page 20***

LLTHC ... LR
Slim-line carriage, extended length, extended height
Further information on ***page 24***

LLTHC ... SU
Slim-line carriage, short length, standard height
Further information on ***page 28***

Load rating

Definition of the basic dynamic load rating C

The radial load, constant in magnitude and direction, which a linear rolling bearing can in theory accommodate for a basic rating life represented by a travelled distance of 100 km (according to ISO 14728 Part 1).

Definition of the basic static load rating C_0

The static load in the direction of loading which corresponds to a calculated stress at the centre of the most heavily loaded contact point between the rolling element and each of the raceways of carriage and rail.

Note: This stress produces a permanent total deformation of the rolling element and the raceway which corresponds to about 0,0001 times the rolling element diameter (according to ISO 14728 Part 2).

Definition and calculation of the basic rating life

The basic rating life is the calculated life achievable with 90% reliability for a single rolling bearing or a group of seemingly identical rolling bearings operating under identical conditions, given the use of materials made of current manufacturer's quality under normal operating conditions.

Basic rating life at constant speed

The basic rating life L_{10} or L_{10h} can be calculated using formulae (**1**), (**2**) and (**3**):

$$(1) \quad L_{10} = \left(\frac{C}{P}\right)^3 \times 10^5$$

$$(2) \quad L_{10h} = \frac{L_{10}}{2\ s\ n\ 60}$$

Basic rating life at changing speed

$$(3) \quad L_{10h} = \frac{L_{10}}{60\ v_m}$$

$$(4) \quad v_m = \frac{t_1\ v_1 + t_2\ v_2 + \ldots + t_n\ v_n}{100}$$

where

L_{10} = basic rating life [m]
L_{10h} = basic rating life [h]
C = basic dynamic load rating [N]
P = equivalent load [N]
s = stroke length [m]
n = stroke frequency [double strokes/min]
v_m = mean speed [m/min]
$v_1, v_2 \ldots v_n$ = travel speeds [m/min]
$t_1, t_2 \ldots t_n$ = time proportions for $v_1, v_2 \ldots v_n$ [%]

The formulae for calculating the rating life of profile rail guides apply to a stroke length of $s \geq 2$ times the carriage length. At lower values the load rating is reduced. For additional information contact the SKF engineering service.

Equivalent dynamic bearing load for calculating the service life

For a number of forces which are of constant magnitude for a given stroke, the equivalent dynamic bearing load F_m can be obtained from formula (**5**):

$$(5) \quad F_m = \sqrt[3]{\frac{F_1^3\ s_1 + F_2^3\ s_2 + \ldots + F_n^3\ s_n}{s}}$$

where

F_m = constant mean load [N]
$F_1, F_2 \ldots F_n$ = constant loads during stroke lengths $s_1, s_2, \ldots, s_n$ [N]
s = total stroke length ($s = s_1 + s_2 + \ldots + s_n$), during which loads $F_1, F_2 \ldots F_n$ have an effect [mm]

given a combined bearing load.

Note: The SKF calculation for determining dynamic load capacity and moments is based on 100 km. However, the values of other manufacturers are frequently based on only 50 km. When comparing values, multiply the C values for LLT rail guides by 1,26.

Equivalent bearing load

A linear guidance system is subjected to various loads during a travel cycle. In order to simplify calculations of life, these loads are summarized into one single load known as the equivalent bearing load.

Fig. 3

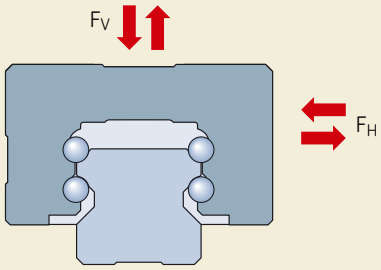
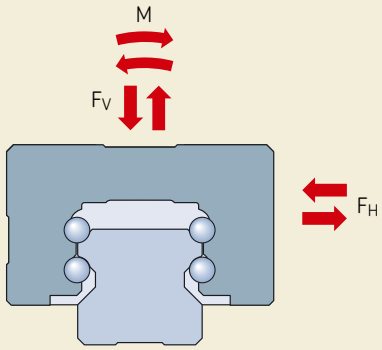


Fig. 4



Equivalent dynamic bearing load

For external loads – both vertical and horizontal (→ **fig. 3**) – the equivalent dynamic load F is calculated by means of formula (**6**). Formula (**6**) applies if a two rail system with four carriages is used.

(**6**) $F = |F_V| + |F_H|$

equivalent dynamic load [N]

where
F_V = external dynamic load, vertical [N]
F_H = external dynamic load, horizontal [N]

Note: The design of the profile rail guide permits this simplified calculation. If different load stages exist for F_v and F_H, then F_v and F_H must be calculated individually using formula (**5**). An external load applied at any angle to the carriage must be divided into the proportions F_v and F_H. The amounts are then used in formula (**6**).

Combined equivalent dynamic bearing load

For external loads – both vertical and horizontal – in combination with a torsional moment, the equivalent dynamic load F can be calculated using formula (**7**) (→ **fig. 4**):

(**7**) $F = |F_V| + |F_H| + C \frac{|M|}{M_t}$

where
F = equivalent dynamic load [N]
F_V, F_H = external dynamic loads [N]
M = dynamic torsional moment [Nm]
C = basic dynamic load rating [N]
M_t = permissible dynamic moment [Nm]

Formula (**7**) applies for the following systems:

- one rail with one carriage
- two rails with one carriage each rail
- single rail with two carriages

Note: If different load stages exist for F_V and F_H, then F_V and F_H must be calculated individually using formula (**5**). An external load applied at any angle to the carriage must be divided into the proportions F_V and F_H. The amounts are then used in formula (**7**).

Fig. 5

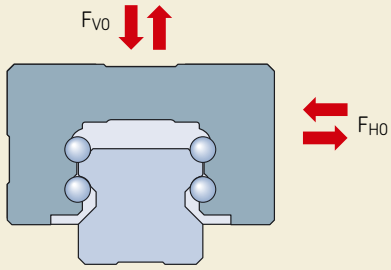
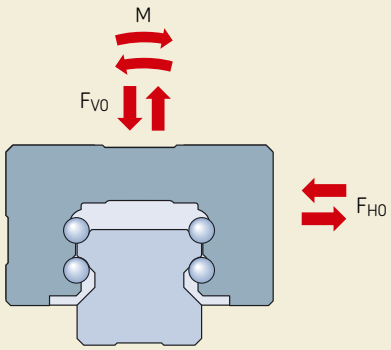


Fig. 6



Equivalent static bearing load

For external static loads – both vertical and horizontal – the equivalent static load F_0 can be calculated using formula (**8**) (→ **fig. 5**).

The equivalent static load F_0 must not exceed the static load rating C_0. Formula (**8**) applies if a two rail system with four carriages is used.

(**8**) $F_0 = |F_{V0}| + |F_{H0}|$

equivalent static load [N]

where
F_0 = equivalent static load [N]
F_{V0}, F_{H0} = external static loads [N]

Note: An external load applied at any angle to the carriage must be divided into the proportions F_{V0} and F_{H0}. The amounts are then used in formula (**8**).

Combined equivalent static bearing load

For external loads – both vertical and horizontal – in combination with a static torsional moment, the equivalent static load F_0 can be calculated using formula (**9**) (→ **fig. 6**). The equivalent static load F_0 must not exceed the static load rating C_0. Formula (**9**) applies if a single- or two-rail system with only one carriage per rail is used.

(**9**) $F_0 = |F_{V0}| + |F_{H0}| + C_0 \frac{|M_0|}{M_{t0}}$

where
F_0 = equivalent static load [N]
F_{V0}, F_{H0} = external static loads [N]
M_0 = static torsional moment [Nm]
C_0 = basic static load rating [N]
M_{t0} = permissible static moment [Nm]

Note: An external load applied at any angle to the carriage must be divided into the proportions F_{V0} and F_{H0}. The amounts are then used in formula (**9**).

Static load safety factor

The static load safety factor s_0 (**table 1**) is required in order to avoid any impermissible permanent deformations of the running tracks and rolling elements. It is the ratio of the static load carrying capacity C_0 to the maximum load occurring $F_{0\,max}$ and is always determined using the highest amplitude, even if this is only of very short duration.

(**10**) $s_0 = C_0/F_{0\,max}$

where
s_0 = static load safety factor
C_0 = static load carrying capacity [N]
$F_{0\,max}$ = maximum static load [N]

Table 1

Static safety factor s_0

Operating conditions	s_0
Normal conditions	min. 2
Small vibrations or impact loads	> 2–4
Medium vibrations or impact loads	3–5
High vibrations or impact loads	> 5

Technical data

The general technical data applies to all the profile rail guides contained in this catalogue, including the carriages and rails. Special technical data is listed separately for the individual designs.

Speed

V_{max} = 3 m/s

Temperature resistance

t_{max} = 100 °C

LLT rail guides can operate continuously at temperatures ranging from –20 to 80 °C. They can operate at temperatures up to 100 °C for brief periods only.

Lubrication

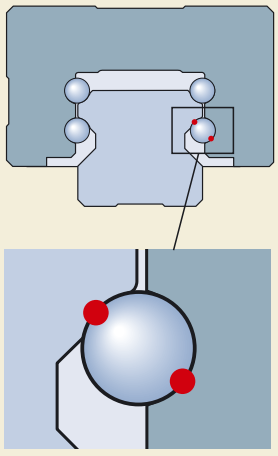
All carriages are factory pre-lubricated with SKF grease LGEP 2. For additional information, refer to chapter *Lubrication*, **page 44**.

Friction

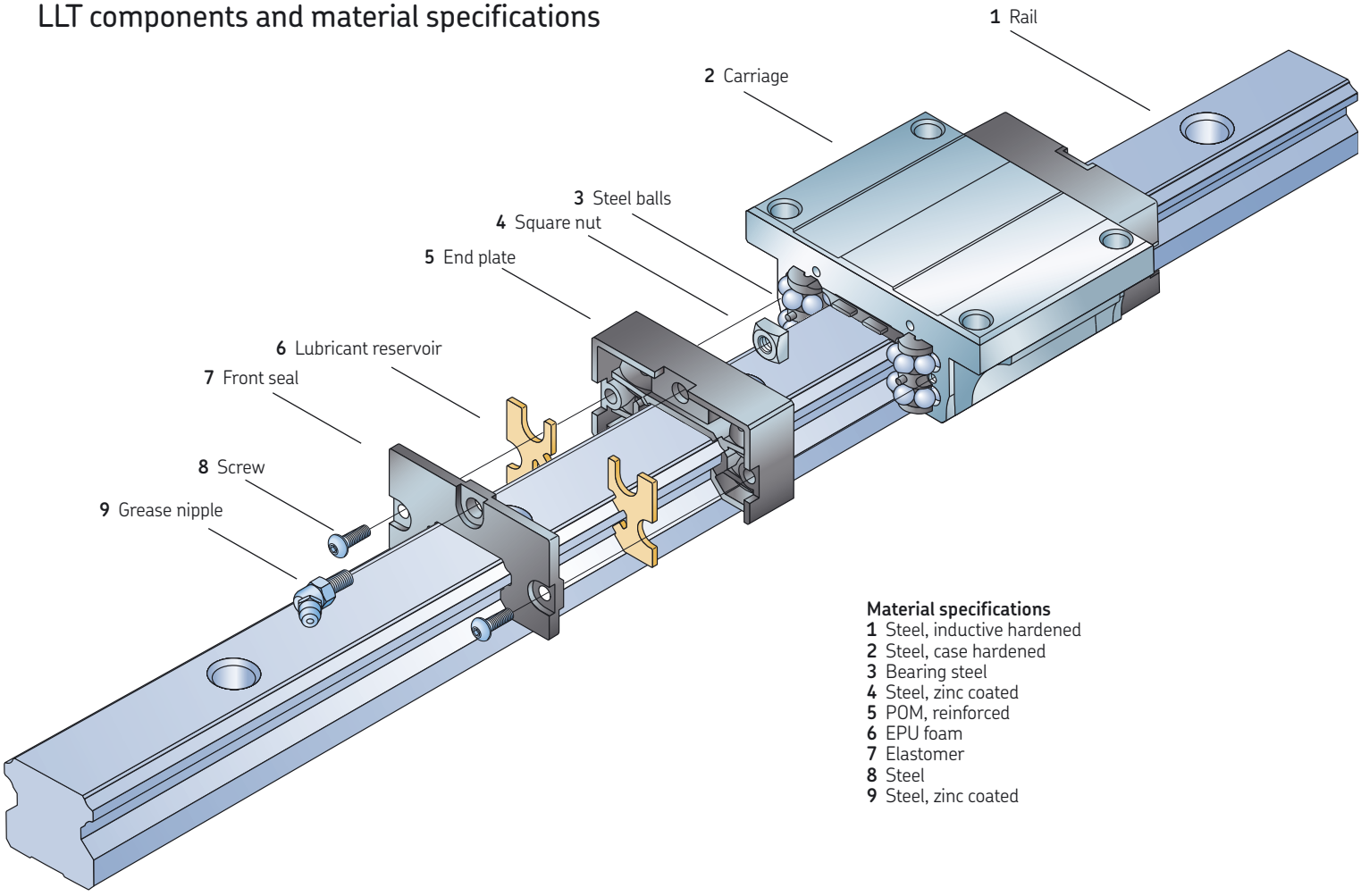
The SKF design with 4 ball rows results in a two–point contact of each rolling element, regardless of the load direction. This reduces friction to a minimum (→ **fig. 7**).

The friction coefficient for LLT rail guides, without end seals, is approximately 0,003.

Fig. 7



LLT components and material specifications

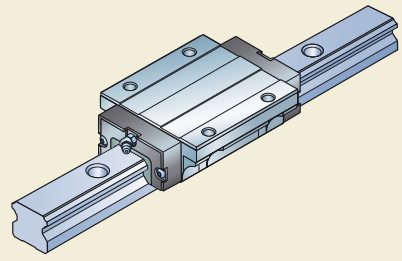


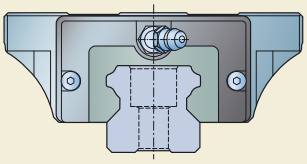
Material specifications
1 Steel, inductive hardened
2 Steel, case hardened
3 Bearing steel
4 Steel, zinc coated
5 POM, reinforced
6 EPU foam
7 Elastomer
8 Steel
9 Steel, zinc coated

Standard carriage components

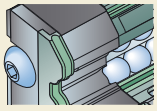
Seals

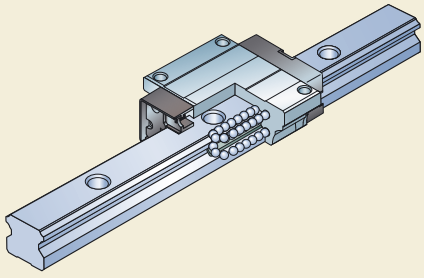
The ingress of dirt, swarf and liquids, as well as lubricant leakage can significantly reduce the service life of a profile rail guide system. SKF LLT profile rail guide carriages are therefore supplied with front, side and inner seals as standard, which results in long life expectancy.

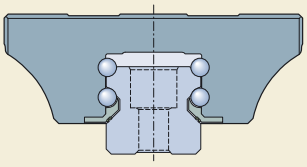




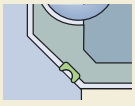
Front seal
Front seals are especially important since they provide protection for the carriage in the direction of movement. They are designed as double-lip seals in order to provide improved wiping properties.

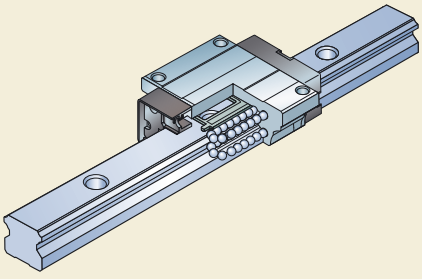


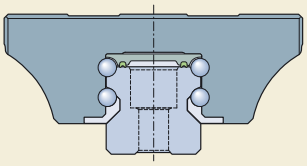




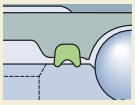
Side seal
Side seals effectively prevent contaminants from working their way into the system from below. Seal design can deviate per size.

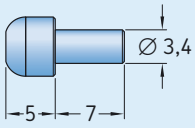




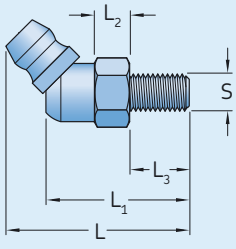


Inner seal
Inner seals are an additional means of protection against lubricant leakage. Seal design can deviate per size.





Design version for size 15



Size	Dimension				
	L	L_1	L_2	L_3	S
–	mm				
20–25	24,6	19,2	4,72	8	M5
30–45	28,3	23,2	4,72	12	M6

Grease nipple1)
Two lube ports with metal thread[2)] are located on both front sides of each carriage. As standard, one grease nipple for manual relubrication is supplied along with the carriage, while the opposite side is secured by a set screw. The metal thread also enables the easy and reliable mounting of automatic lubricators.

1) If some accessories require longer grease nipples, they will be provided.
2) Grease nipples for size 15 are without thread.

Preload classes

Relation of preload and stiffness

To adjust a profile rail guide to the specific demands of a given application, it is advisable to choose an appropriate preload. This will positively affect the operating behaviour of the entire linear guidance system. Preload increases the stiffness of linear guides and thus reduces the deviation under load.

Generation of preload

Preload in the carriage is determined by the diameter of the balls. The use of balls with a defined larger diameter generates a preload in the carriage. The chosen oversized ball determines the degree of preload.

The final preload will adjust after mounting the carriage onto the rail.

Preload classes

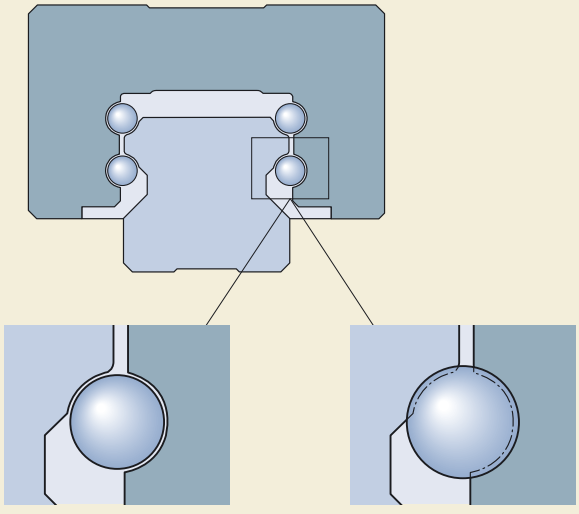
SKF LLT profile rail guides are manufactured in three different preload classes. For additional information refer to **table 2**.

Table 2

Preload classes

T0 – Zero preload (zero to light preload) For extremely smooth-running rail guide systems with low friction and low external influences. This preload class is only available in P5 and P3 accuracy classes.
T1 – Light preload (2% of dynamic preload C) For precise rail guide systems with low external load and high requirements for overall stiffness.
T2 – Medium preload (8% of dynamic preload C) For precise rail guide systems with high external load and high requirements for overall stiffness, also recommended for single-rail systems. Above-average moment loads are absorbed without any significant elastic deformation. At only medium moment loads the overall stiffness is further improved.

Generation of preload



System without preload

Preloaded system with oversized balls

The preload should not amount to more than 1/3 of the bearing load F to avoid negative effects on the guide's service life.

Please refer to the chapter *Typical application areas*, **page 46** to find suitable preload suggestions for different fields of application.

Note: The basic load in the carriage resulting from the preload must be taken into consideration for the value C when calculating the service life:

$C_{eff} = C_{dyn}$ – preload

Example for a carriage of type 25 A with preload class T1:

C_{eff} = 18 800 N – 0,02 C
C_{eff} = 18 424 N

Accuracy classes

Accuracy

SKF manufactures its LLT profile rail guides in three accuracy classes. These accuracy classes define the maximum permissible tolerance range of a rail system in terms of height, width and parallelism. This choice determines the positioning accuracy of the system within the application. Please refer to **table 3** and the chapter *Typical application areas*, **page 46**, for further information.

Width and height accuracy

The width accuracy N determines the maximum lateral deviation of the carriage and the reference side of the rail in longitudinal direction. Both sides of the rail and the ground side of the carriage can be used as reference side.

The height accuracy H is measured between the mounting surface of the carriage and the ground bottom face of the rail. H and N are arithmetic mean values and refer to the centre of the carriage. They are measured at either the same position on the rail for Δ_H or Δ_N.

Parallelism

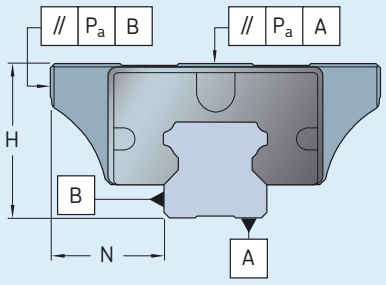
This refers to the parallelism tolerance between the two reference planes of rail and carriage when the carriage is moved along the entire rail length, the rail being screwed to the reference plane. Please refer to **diagram 1** for detailed information.

Combination of rails and carriages

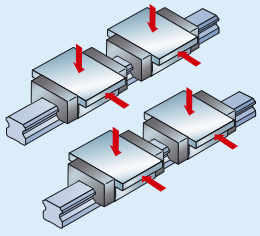
All carriages and rails of the same size and accuracy class (P5/P3) can be combined with each other while maintaining the initial accuracy class. They are fully interchangeable at any time. Mixed accuracy classes are possible.

Note: Accuracy class P1 can only be delivered as a complete system.

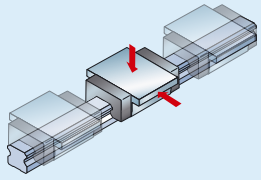
Table 3



Accuracy class[1]	Tolerances[2]		Differences in dimension H and N on one rail	
	H	N	Δ_H max.	Δ_N max.
–	µm		µm	
P5	±100	±40	30	30
P3	±40	±20	15	15
P1	±20	±10	7	7



For any combination of carriages and rails

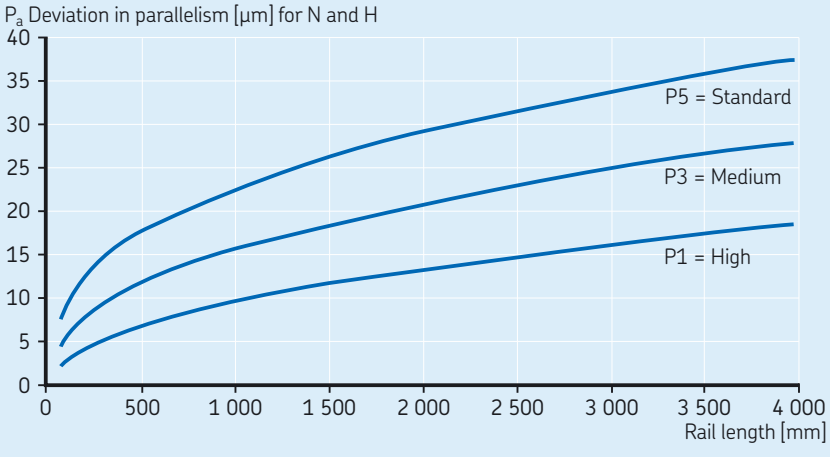


For different carriages on the same rail position

[1] Measured at the centre of the carriage.
[2] Values for one meter rail length.

Diagram 1

Parallelism



Ordering key

Designations

LLTH S 25 A 2 T0 – 1000 P5 A B D4 M S1 /E=0

Type code
C Carriage (carriage only)[1)]
R Rail (rail only)[1)]
S System[2)]
Z Accessories (if ordered separately)[1)]

Carriage size
15, 20, 25, 30, 35, 45

Carriage type
A Flanged carriage, standard length, standard height
LA Flanged carriage, extended length, standard height
SU Slim-line carriage, short length, standard height
U Slim-line carriage, standard length, standard height
R Slim-line carriage, standard length, extended height
LR Slim-line carriage, extended length, extended height

Number of carriages per rail
1, 2 ,4 , 6, ...

Preload class
T0 Zero preload
T1 Light preload, 2% C
T2 Medium preload, 8% C

Rail length
80–4 000 mm (1 mm steps)

Precision class
P5 Standard
P3 Medium
P1 High[3)]

Joined rail track (if not selected – no code)
A Yes

Bellows (if not selected – no code)
B System complete with bellows[1)]
B2 Kit, type 2 (carriage to the end of the rail)[4)]
B4 Kit, type 4 (between two carriages)[4)]

Rail
D Rail, if customized according to drawing number
D4 Rail with blind holes

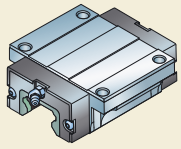
System (Carriage mounted on rail, if not selected – no code)
M Yes[4)]

Sealing
S1 Scraper plate
S3 Seal kit, additional front seal with scraper plate
S7 Additional front seal

Distance between end face and first mounting hole of the rail
E = 0 If no “E” specified, the holes at both rail ends will be positioned equidistantly from either end of the rail
E = xx “E” dimension to be specified, for calculation and minimum “E” dimension, see **page 31**

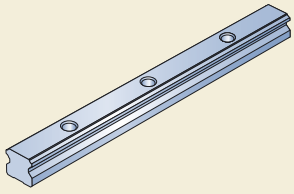
[1)] When ordered separately (not in a system).
[2)] System can consist of one rail, one or more carriages and accessories.
[3)] P1 only available as system.
[4)] If selected, accessories have to be ordered seperately and will not be mounted. Refer to **page 34** to get more information about the accessories.

Ordering examples



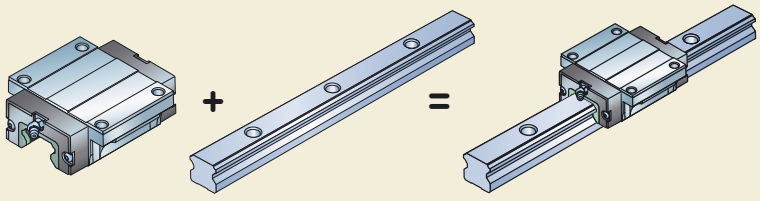
LLTHC 25 A T0 P5

- **Carriage**
- size 25
- flanged carriage, standard length, standard height
- preload class T0
- accuracy class P5



LLTHR 25-200 P5 /E=0

- **Rail**
- size 25
- 200 mm length
- accuracy class P5
- standard “E” dimension (equidistantly)



LLTHS 25 A 1 T0-200 P5 /E=0

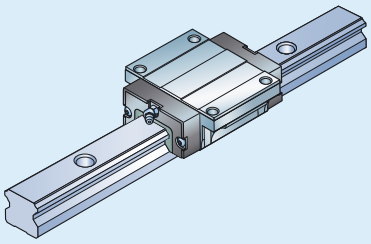
- **System**
- size 25
- with one flanged carriage, standard length, standard height
- preload class T0
- rail length 200 mm
- accuracy class P5
- standard “E” dimension (equidistantly)

Product data

Carriages

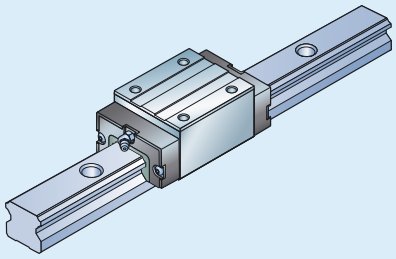
Pages 18–29

LLTHC ... A
Flanged carriage, standard length, standard height



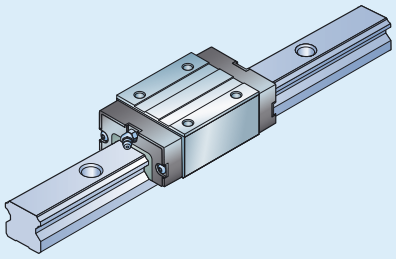
Size [1]	Load ratings C	C_0
–	N	
15	8 400	15 400
20	12 400	24 550
25	18 800	30 700
30	26 100	41 900
35	34 700	54 650
45	59 200	91 100

LLTHC ... R
Slim-line carriage, standard length, extended height



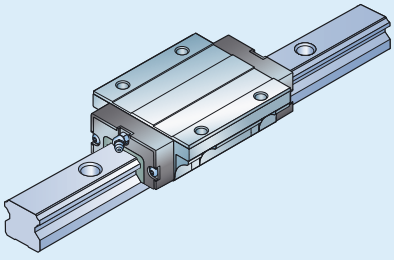
Size [1]	Load ratings C	C_0
–	N	
15	8 400	15 400
20	–	–
25	18 800	30 700
30	26 100	41 900
35	34 700	54 650
45	59 200	91 100

LLTHC ... U
Slim-line carriage, standard length, standard height



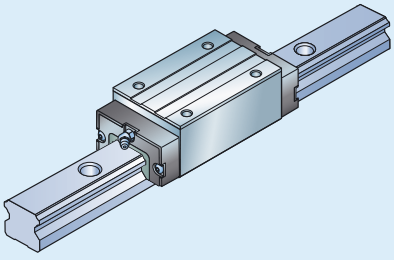
Size [1]	Load ratings C	C_0
–	N	
15	8 400	15 400
20	12 400	24 550
25	18 800	30 700
30	26 100	41 900
35	34 700	54 650
45	59 200	91 100

LLTHC ... LA
Flanged carriage, extended length, standard height



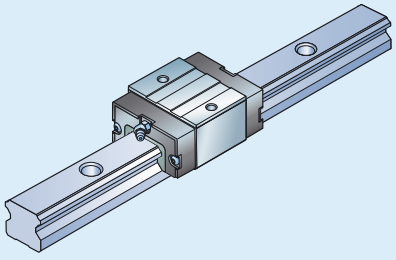
Size [1]	Load ratings C	C_0
–	N	
15	–	–
20	24 400	35 200
25	30 400	45 500
30	40 000	57 800
35	55 600	81 000
45	90 400	128 500

LLTHC ... LR
Slim-line carriage, extended length, extended height



Size [1]	Load ratings C	C_0
–	N	
15	–	–
20	24 400	35 200
25	30 400	45 500
30	40 000	57 800
35	55 600	81 000
45	90 400	128 500

LLTHC ... SU
Slim-line carriage, short length, standard height



Size [1]	Load ratings C	C_0
–	N	
15	5 800	9 000
20	9 240	14 400
25	13 500	19 600
30	19 200	26 600
35	25 500	34 800
45	–	–

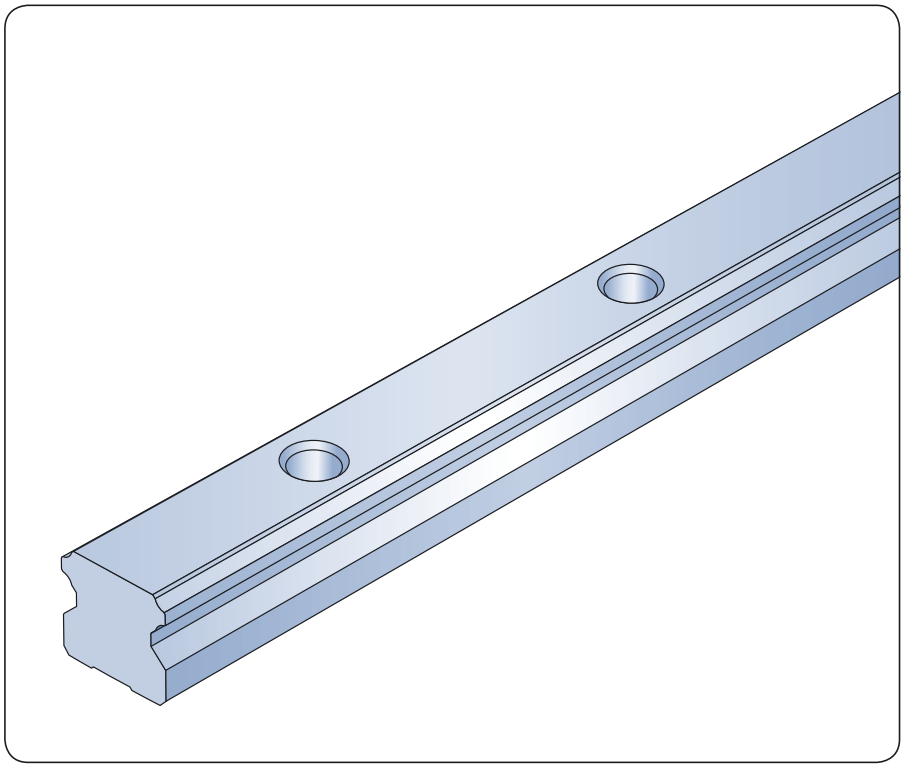
[1] Front seal appearance can slightly deviate per size.

Rails

Pages 30–33

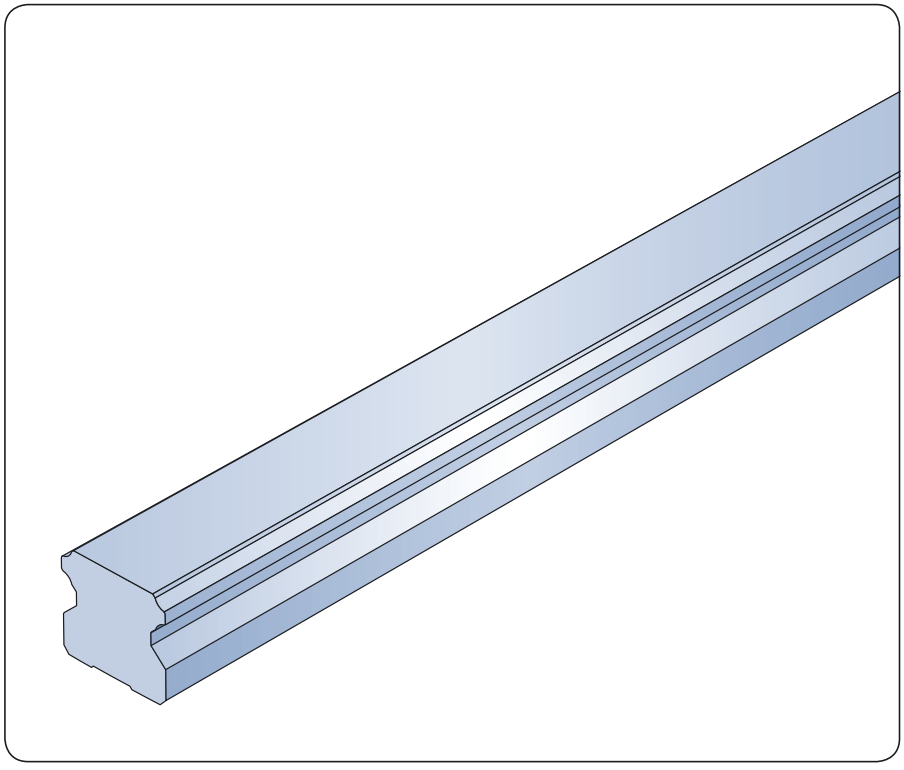
LLTHR rails

For mounting from above, supplied with protective plastic caps as standard.



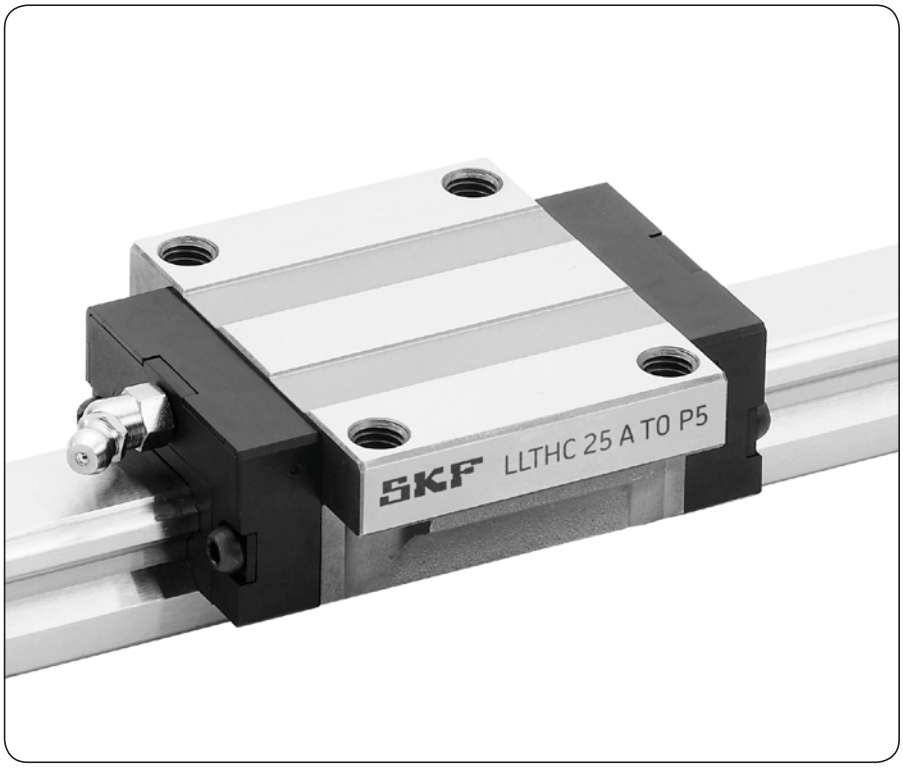
LLTHR ... D4 rails

With blind holes for mounting from below.



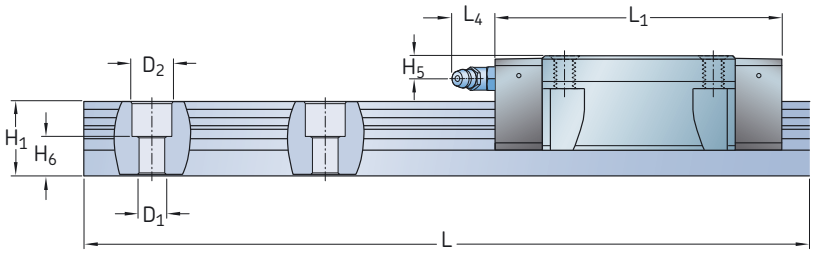
Carriage LLTHC ... A

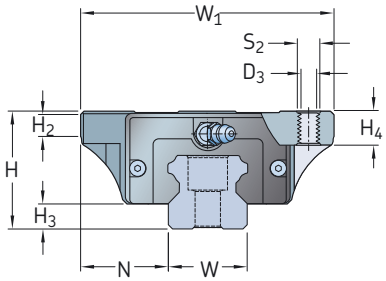
Flanged carriage, standard length, standard height

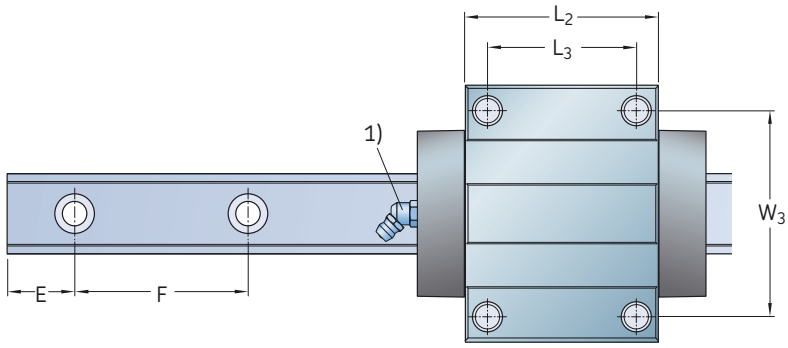


Size[1]	Accuracy class[2]	Designation[3] Preload class T0	T1	T2
–		–		
15	P5	LLTHC 15 A T0 P5	LLTHC 15 A T1 P5	LLTHC 15 A T2 P5
	P3	LLTHC 15 A T0 P3	LLTHC 15 A T1 P3	LLTHC 15 A T2 P3
	▶ P1		LLTHC 15 A T1 P1	LLTHC 15 A T2 P1
20	P5	LLTHC 20 A T0 P5	LLTHC 20 A T1 P5	LLTHC 20 A T2 P5
	P3	LLTHC 20 A T0 P3	LLTHC 20 A T1 P3	LLTHC 20 A T2 P3
	▶ P1		LLTHC 20 A T1 P1	LLTHC 20 A T2 P1
25	P5	LLTHC 25 A T0 P5	LLTHC 25 A T1 P5	LLTHC 25 A T2 P5
	P3	LLTHC 25 A T0 P3	LLTHC 25 A T1 P3	LLTHC 25 A T2 P3
	▶ P1		LLTHC 25 A T1 P1	LLTHC 25 A T2 P1
30	P5	LLTHC 30 A T0 P5	LLTHC 30 A T1 P5	LLTHC 30 A T2 P5
	P3	LLTHC 30 A T0 P3	LLTHC 30 A T1 P3	LLTHC 30 A T2 P3
	▶ P1		LLTHC 30 A T1 P1	LLTHC 30 A T2 P1
35	P5	LLTHC 35 A T0 P5	LLTHC 35 A T1 P5	LLTHC 35 A T2 P5
	P3	LLTHC 35 A T0 P3	LLTHC 35 A T1 P3	LLTHC 35 A T2 P3
	▶ P1		LLTHC 35 A T1 P1	LLTHC 35 A T2 P1
45	P5	LLTHC 45 A T0 P5	LLTHC 45 A T1 P5	LLTHC 45 A T2 P5
	P3	LLTHC 45 A T0 P3	LLTHC 45 A T1 P3	LLTHC 45 A T2 P3
	▶ P1		LLTHC 45 A T1 P1	LLTHC 45 A T2 P1

[1] Front seal appearance can slightly deviate per size.
[2] ▶ P1 only available as system.
[3] ■ **Preferred range.** For system designation please refer to designation system on **page 14**.







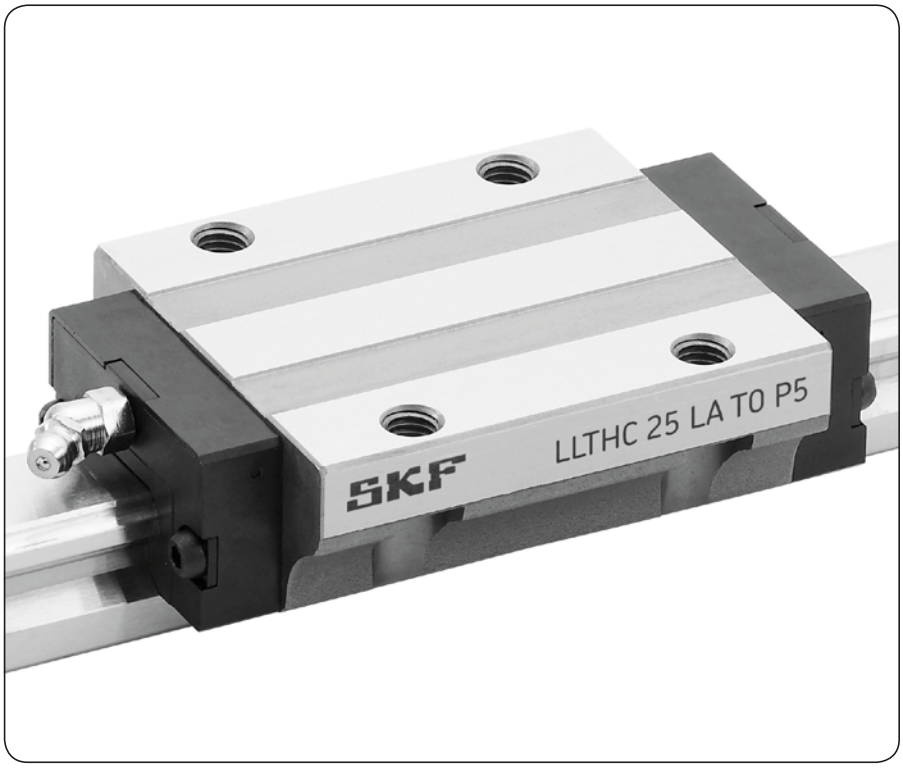
Size	Assembly dimensions					Carriage dimensions								
	W_1	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	D_3	S_2
–	mm													–
15	47	16	24	5,9	4,6	62	40	30	4,3	38	8	4,3	4,3	M5
20	63	21,5	30	6,9	5	72	50	40	15	53	9	5,7	5,2	M6
25	70	23,5	36	11	7	82	57	45	16,6	57	12	6,5	6,7	M8
30	90	31	42	9	9	100,4	67,4	52	14,6	72	11,5	8	8,5	M10
35	100	33	48	12,3	9,5	114	77	62	14,6	82	13	8	8,5	M10
45	120	37,5	60	12,3	14	135	96	80	14,6	100	15	8,5	10,4	M12

Size	Rail dimensions									Weight		Load ratings		Moments			
										carriage	rail			dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} –0,75	E_{max} –0,75	L_{max} –1,5			C	C_0	M_C	M_{Co}	$M_{A/B}$	$M_{Ao/Bo}$
–	mm									kg	kg/m	N		Nm			
15	15	14	8,5	60	4,5	7,5	10	50	3 920	0,21	1,4	8 400	15 400	56	103	49	90
20	20	18	9,3	60	6	9,5	10	50	3 920	0,4	2,3	12 400	24 550	112	221	90	179
25	23	22	12,3	60	7	11	10	50	3 920	0,57	3,3	18 800	30 700	194	316	155	254
30	28	26	13,8	80	9	14	12	70	3 944	1,1	4,8	26 100	41 900	329	528	256	410
35	34	29	17	80	9	14	12	70	3 944	1,6	6,6	34 700	54 650	535	842	388	611
45	45	38	20,8	105	14	20	16	90	3 917	2,7	11,3	59 200	91 100	1215	1869	825	1270

[1] For detailed informations on grease nipples please refer to **page 11**.
[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 7** for further details.

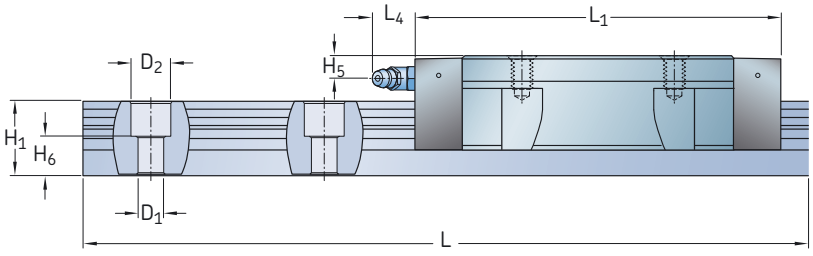
Carriage LLTHC ... LA

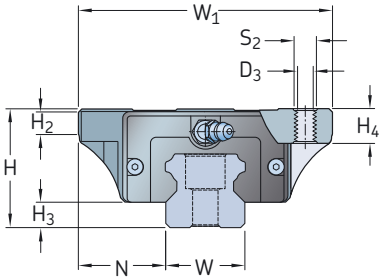
Flanged carriage, extended length, standard height

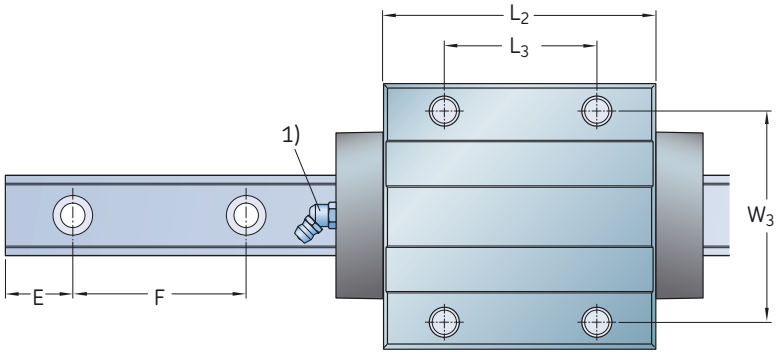


Size[1]	Accuracy class[2]	Designation[3] Preload class T0	T1	T2
–		–		
20	P5	LLTHC 20 LA T0 P5	LLTHC 20 LA T1 P5	LLTHC 20 LA T2 P5
	P3	LLTHC 20 LA T0 P3	LLTHC 20 LA T1 P3	LLTHC 20 LA T2 P3
	▶ P1		LLTHC 20 LA T1 P1	LLTHC 20 LA T2 P1
25	P5	LLTHC 25 LA T0 P5	LLTHC 25 LA T1 P5	LLTHC 25 LA T2 P5
	P3	LLTHC 25 LA T0 P3	LLTHC 25 LA T1 P3	LLTHC 25 LA T2 P3
	▶ P1		LLTHC 25 LA T1 P1	LLTHC 25 LA T2 P1
30	P5	LLTHC 30 LA T0 P5	LLTHC 30 LA T1 P5	LLTHC 30 LA T2 P5
	P3	LLTHC 30 LA T0 P3	LLTHC 30 LA T1 P3	LLTHC 30 LA T2 P3
	▶ P1		LLTHC 30 LA T1 P1	LLTHC 30 LA T2 P1
35	P5	LLTHC 35 LA T0 P5	LLTHC 35 LA T1 P5	LLTHC 35 LA T2 P5
	P3	LLTHC 35 LA T0 P3	LLTHC 35 LA T1 P3	LLTHC 35 LA T2 P3
	▶ P1		LLTHC 35 LA T1 P1	LLTHC 35 LA T2 P1
45	P5	LLTHC 45 LA T0 P5	LLTHC 45 LA T1 P5	LLTHC 45 LA T2 P5
	P3	LLTHC 45 LA T0 P3	LLTHC 45 LA T1 P3	LLTHC 45 LA T2 P3
	▶ P1		LLTHC 45 LA T1 P1	LLTHC 45 LA T2 P1

[1] Front seal appearance can slightly deviate per size.
[2] ▶ P1 only available as system.
[3] ■ **Preferred range.** For system designation please refer to designation system on **page 14**.







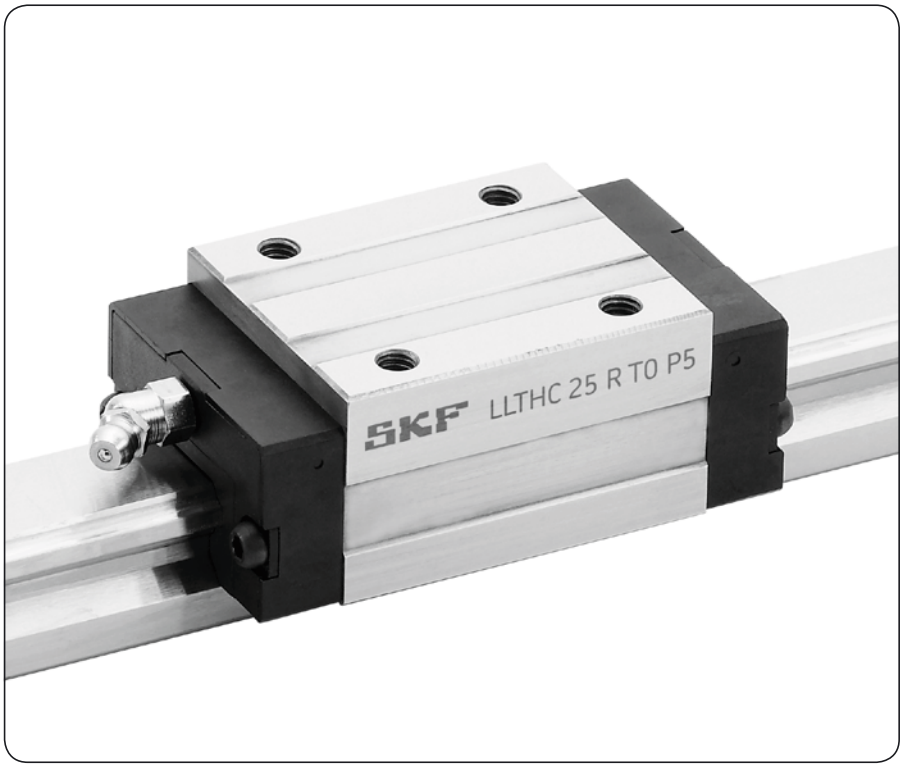
Size	Assembly dimensions					Carriage dimensions								
	W_1	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	D_3	S_2
–	mm													–
20	63	21,5	30	6,9	5	88,2	66,2	40	15	53	9	5,7	5,2	M6
25	70	23,5	36	11	7	104,1	79,1	45	16,6	57	12	6,5	6,7	M8
30	90	31	42	9	9	125,4	92,4	52	14,6	72	11,5	8	8,5	M10
35	100	33	48	12,3	9,5	142,5	105,5	62	14,6	82	13	8	8,5	M10
45	120	37,5	60	12,3	14	167	128	80	14,6	100	15	8,5	10,4	M12

Size	Rail dimensions									Weight		Load ratings		Moments			
										carriage	rail			dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} –0,75	E_{max} –0,75	L_{max} –1,5			C	C_0	M_C	M_{Co}	$M_{A/B}$	$M_{Ao/Bo}$
–	mm									kg	kg/m	N		Nm			
20	20	18	9,3	60	6	9,5	10	50	3 920	0,52	2,3	15 200	32 700	137	295	150	322
25	23	22	12,3	60	7	11	10	50	3 920	0,72	3,3	24 400	44 600	252	460	287	525
30	28	26	13,8	80	9	14	12	70	3 944	1,4	4,8	33 900	60 800	428	767	466	836
35	34	29	17	80	9	14	12	70	3 944	2	6,6	45 000	79 400	694	1 224	706	1 246
45	45	38	20,8	105	14	20	16	90	3 917	3,6	11,3	72 400	121 400	1 485	2 491	1 376	2 308

[1] For detailed informations on grease nipples please refer to **page 11**.
[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 7** for further details.

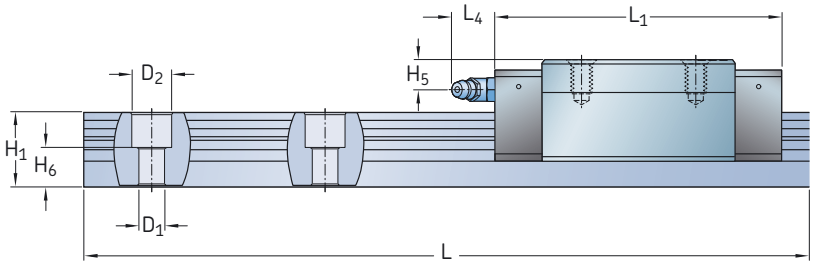
Carriage LLTHC ... R

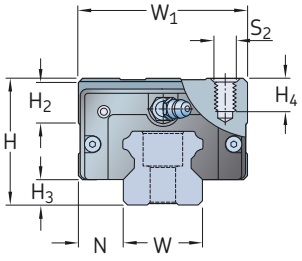
Slim-line carriage, standard length, extended height

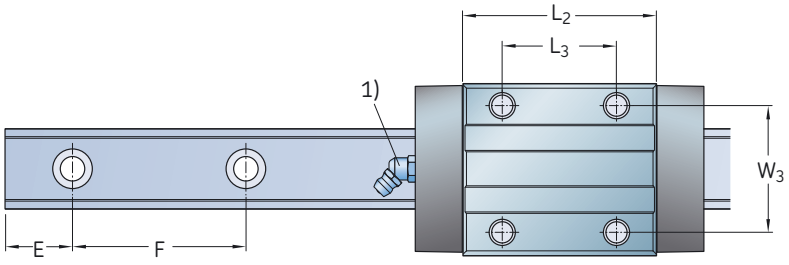


Size[1]	Accuracy class[2]	Designation[3] Preload class T0	T1	T2
–		–		
15	P5	LLTHC 15 R T0 P5	LLTHC 15 R T1 P5	LLTHC 15 R T2 P5
	P3	LLTHC 15 R T0 P3	LLTHC 15 R T1 P3	LLTHC 15 R T2 P3
	▶ P1		LLTHC 15 R T1 P1	LLTHC 15 R T2 P1
25	P5	LLTHC 25 R T0 P5	LLTHC 25 R T1 P5	LLTHC 25 R T2 P5
	P3	LLTHC 25 R T0 P3	LLTHC 25 R T1 P3	LLTHC 25 R T2 P3
	▶ P1		LLTHC 25 R T1 P1	LLTHC 25 R T2 P1
30	P5	LLTHC 30 R T0 P5	LLTHC 30 R T1 P5	LLTHC 30 R T2 P5
	P3	LLTHC 30 R T0 P3	LLTHC 30 R T1 P3	LLTHC 30 R T2 P3
	▶ P1		LLTHC 30 R T1 P1	LLTHC 30 R T2 P1
35	P5	LLTHC 35 R T0 P5	LLTHC 35 R T1 P5	LLTHC 35 R T2 P5
	P3	LLTHC 35 R T0 P3	LLTHC 35 R T1 P3	LLTHC 35 R T2 P3
	▶ P1		LLTHC 35 R T1 P1	LLTHC 35 R T2 P1
45	P5	LLTHC 45 R T0 P5	LLTHC 45 R T1 P5	LLTHC 45 R T2 P5
	P3	LLTHC 45 R T0 P3	LLTHC 45 R T1 P3	LLTHC 45 R T2 P3
	▶ P1		LLTHC 45 R T1 P1	LLTHC 45 R T2 P1

[1] Front seal appearance can slightly deviate per size.
[2] ▶ P1 only available as system.
[3] ■ **Preferred range.** For system designation please refer to designation system on **page 14**.







Size	Assembly dimensions					Carriage dimensions							
	W_1	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	S_2
–	mm												–
15	34	9,5	28	7,8	4,6	62	40	26	15	26	7,5	8,3	M4
25	48	12,5	40	12,2	7	82	57	35	16,6	35	10	11,2	M6
30	60	16	45	14,3	9	100,4	67,4	40	14,6	40	11,2	11	M8
35	70	18	55	18	9,5	114	77	50	14,6	50	17	15	M8
45	86	20,5	70	20,9	14	135	96	60	14,6	60	20,5	18,5	M10

Size	Rail dimensions									Weight		Load ratings		Moments			
										carriage	rail			dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} –0,75	E_{max} –0,75	L_{max} –1,5			C	C_0	M_C	M_{Co}	$M_{A/B}$	$M_{Ao/Bo}$
–	mm						mm			kg	kg/m	N		Nm			
15	15	14	8,5	60	4,5	7,5	10	50	3 920	0,19	1,4	8 400	15 400	56	103	49	90
25	23	22	12,3	60	7	11	10	50	3 920	0,45	3,3	18 800	30 700	194	316	155	254
30	28	26	13,8	80	9	14	12	70	3 944	0,91	4,8	26 100	41 900	329	528	256	410
35	34	29	17	80	9	14	12	70	3 944	1,5	6,6	34 700	54 650	535	842	388	611
45	45	38	20,8	105	14	20	16	90	3 917	2,3	11,3	59 200	91 100	1 215	1 869	825	1 270

[1] For detailed informations on grease nipples please refer to **page 11**.
[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 7** for further details.

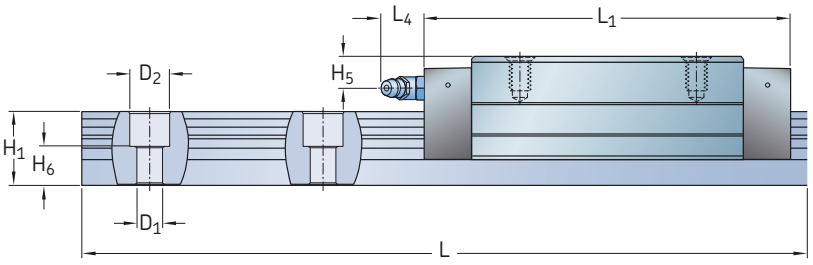
Carriage LLTHC ... LR

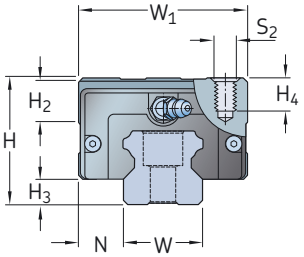
Slim-line carriage, extended length, extended height

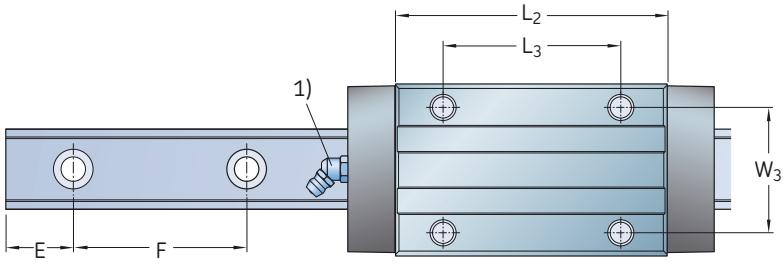


Size[1]	Accuracy class[2]	Designation[3] Preload class T0	T1	T2
–		–		
20	P5	LLTHC 20 LR T0 P5	LLTHC 20 LR T1 P5	LLTHC 20 LR T2 P5
	P3	LLTHC 20 LR T0 P3	LLTHC 20 LR T1 P3	LLTHC 20 LR T2 P3
	▶ P1		LLTHC 20 LR T1 P1	LLTHC 20 LR T2 P1
25	P5	LLTHC 25 LR T0 P5	LLTHC 25 LR T1 P5	LLTHC 25 LR T2 P5
	P3	LLTHC 25 LR T0 P3	LLTHC 25 LR T1 P3	LLTHC 25 LR T2 P3
	▶ P1		LLTHC 25 LR T1 P1	LLTHC 25 LR T2 P1
30	P5	LLTHC 30 LR T0 P5	LLTHC 30 LR T1 P5	LLTHC 30 LR T2 P5
	P3	LLTHC 30 LR T0 P3	LLTHC 30 LR T1 P3	LLTHC 30 LR T2 P3
	▶ P1		LLTHC 30 LR T1 P1	LLTHC 30 LR T2 P1
35	P5	LLTHC 35 LR T0 P5	LLTHC 35 LR T1 P5	LLTHC 35 LR T2 P5
	P3	LLTHC 35 LR T0 P3	LLTHC 35 LR T1 P3	LLTHC 35 LR T2 P3
	▶ P1		LLTHC 35 LR T1 P1	LLTHC 35 LR T2 P1
45	P5	LLTHC 45 LR T0 P5	LLTHC 45 LR T1 P5	LLTHC 45 LR T2 P5
	P3	LLTHC 45 LR T0 P3	LLTHC 45 LR T1 P3	LLTHC 45 LR T2 P3
	▶ P1		LLTHC 45 LR T1 P1	LLTHC 45 LR T2 P1

[1] Front seal appearance can slightly deviate per size.
[2] ▶ P1 only available as system.
[3] ■ **Preferred range.** For system designation please refer to designation system on **page 14**.







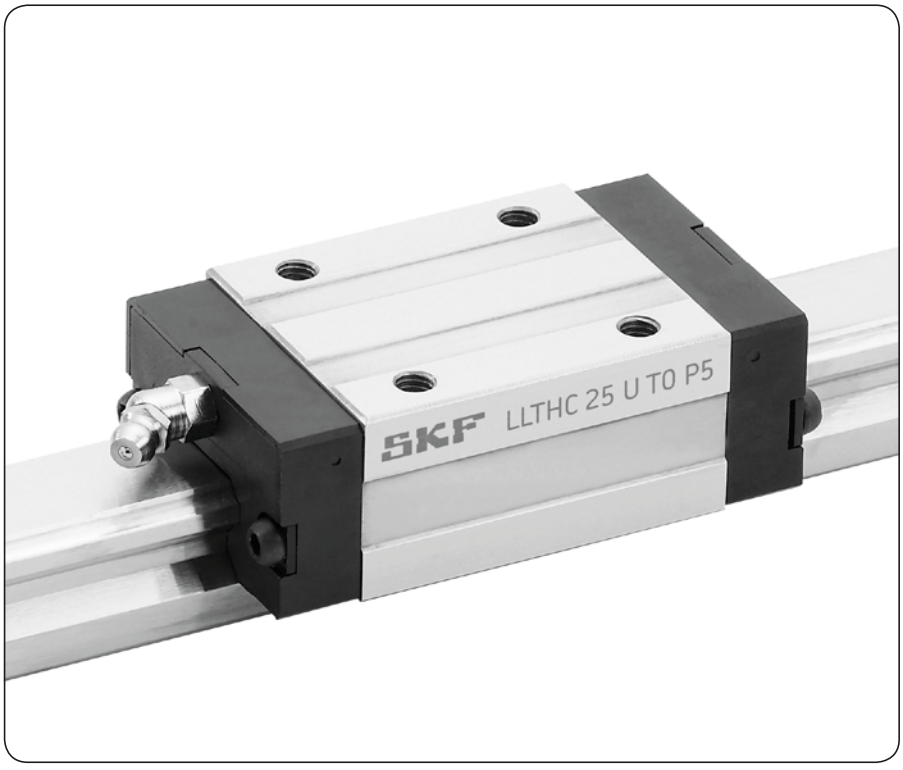
Size	Assembly dimensions					Carriage dimensions							
	W_1	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	S_2
–	mm												–
20	44	12	30	8,3	5	88,2	66,2	50	15	32	6,5	5,7	M5
25	48	12,5	40	12,2	7	104,1	79,1	50	16,6	35	10	10,5	M6
30	60	16	45	14,3	9	125,4	92,4	60	14,6	40	11,2	12	M8
35	70	18	55	18	9,5	142,5	105,5	72	14,6	50	17	19	M8
45	86	20,5	70	20,9	14	167	128	80	14,6	60	20,5	24,5	M10

Size	Rail dimensions									Weight		Load ratings		Moments			
										carriage	rail			dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} –0,75	E_{max} –0,75	L_{max} –1,5			C	C_0	M_C	M_{Co}	$M_{A/B}$	$M_{Ao/Bo}$
–	mm									kg	kg/m	N		Nm			
20	20	18	9,3	60	6	9,5	10	50	3 920	0,47	2,3	15 200	32 700	137	295	150	322
25	23	22	12,3	60	7	11	10	50	3 920	0,56	3,3	24 400	44 600	252	460	287	525
30	28	26	13,8	80	9	14	12	70	3 944	1,2	4,8	33 900	60 800	428	767	466	836
35	34	29	17	80	9	14	12	70	3 944	1,9	6,6	45 000	79 400	694	1 224	706	1 246
45	45	38	20,8	105	14	20	16	90	3 917	2,8	11,3	72 400	121 400	1 485	2 491	1 376	2 308

[1] For detailed informations on grease nipples please refer to **page 11**.
[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 7** for further details.

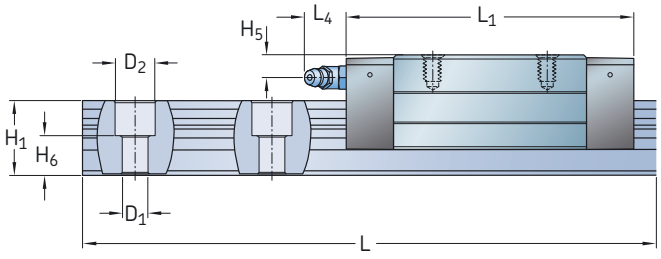
Carriage LLTHC ... U

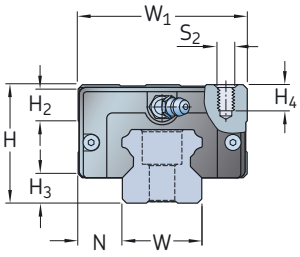
Slim-line carriage, standard length, standard height

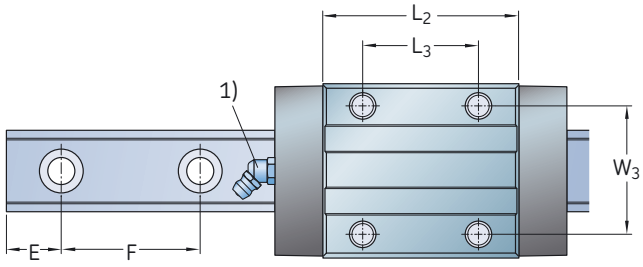


Size[1]	Accuracy class[2]	Designation[3] preload class T0	T1	T2
–		–		
15	P5	LLTHC 15 U T0 P5	LLTHC 15 U T1 P5	LLTHC 15 U T2 P5
	P3	LLTHC 15 U T0 P3	LLTHC 15 U T1 P3	LLTHC 15 U T2 P3
	▶ P1		LLTHC 15 U T1 P1	LLTHC 15 U T2 P1
20	P5	LLTHC 20 U T0 P5	LLTHC 20 U T1 P5	LLTHC 20 U T2 P5
	P3	LLTHC 20 U T0 P3	LLTHC 20 U T1 P3	LLTHC 20 U T2 P3
	▶ P1		LLTHC 20 U T1 P1	LLTHC 20 U T2 P1
25	P5	LLTHC 25 U T0 P5	LLTHC 25 U T1 P5	LLTHC 25 U T2 P5
	P3	LLTHC 25 U T0 P3	LLTHC 25 U T1 P3	LLTHC 25 U T2 P3
	▶ P1		LLTHC 25 U T1 P1	LLTHC 25 U T2 P1
30	P5	LLTHC 30 U T0 P5	LLTHC 30 U T1 P5	LLTHC 30 U T2 P5
	P3	LLTHC 30 U T0 P3	LLTHC 30 U T1 P3	LLTHC 30 U T2 P3
	▶ P1		LLTHC 30 U T1 P1	LLTHC 30 U T2 P1
35	P5	LLTHC 35 U T0 P5	LLTHC 35 U T1 P5	LLTHC 35 U T2 P5
	P3	LLTHC 35 U T0 P3	LLTHC 35 U T1 P3	LLTHC 35 U T2 P3
	▶ P1		LLTHC 35 U T1 P1	LLTHC 35 U T2 P1
45	P5	LLTHC 45 U T0 P5	LLTHC 45 U T1 P5	LLTHC 45 U T2 P5
	P3	LLTHC 45 U T0 P3	LLTHC 45 U T1 P3	LLTHC 45 U T2 P3
	▶ P1		LLTHC 45 U T1 P1	LLTHC 45 U T2 P1

[1] Front seal appearance can slightly deviate per size.
[2] ▶ P1 only available as system.
[3] ■ **Preferred range.** For system designation please refer to designation system on **page 14**.







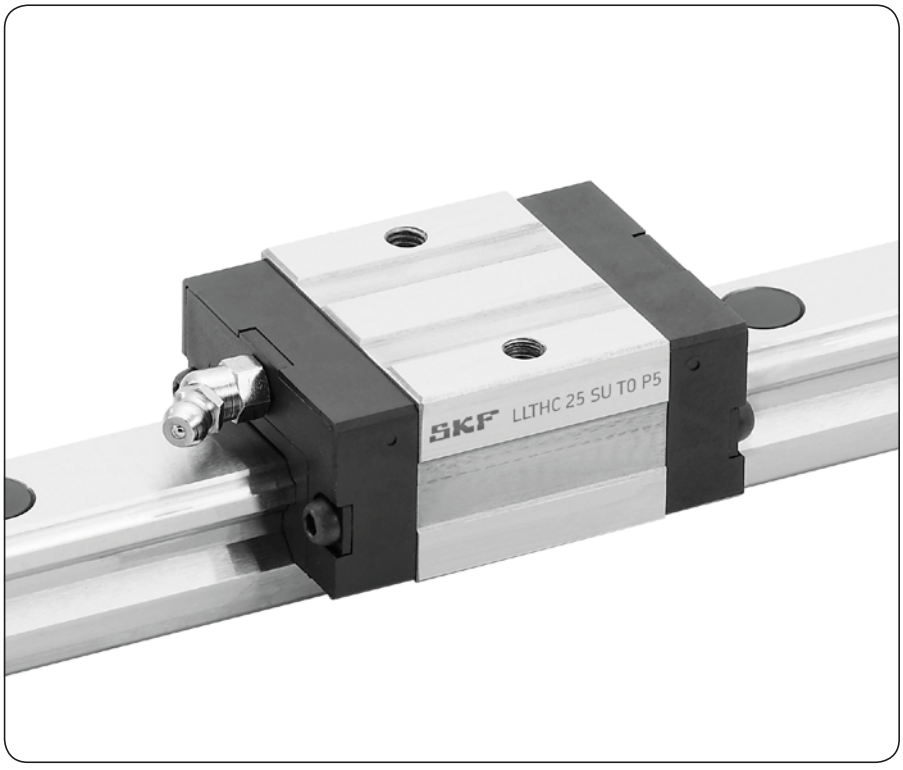
Size	Assembly dimensions					Carriage dimensions							
	W_1	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	S_2
–	mm												–
15	34	9,5	24	4,2	4,6	62	40	26	4,3	26	3,8	4,3	M4
20	44	12	30	8,3	5	72	50	36	15	32	6,5	5,7	M5
25	48	12,5	36	8,2	7	82	57	35	16,6	35	6,5	6,5	M6
30	60	16	42	11,3	9	100,4	67,4	40	14,6	40	8,5	8	M8
35	70	18	48	11	9,5	114	77	50	14,6	50	10	8	M8
45	86	20,5	60	10,9	14	135	96	60	14,6	60	12	8,5	M10

Size	Rail dimensions									Weight		Load ratings		Moments			
										carriage	rail			dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} –0,75	E_{max} –0,75	L_{max} –1,5			C	C_0	M_C	M_{Co}	$M_{A/B}$	$M_{Ao/Bo}$
–	mm				Ø		mm			kg	kg/m	N		Nm			
15	15	14	8,5	60	4,5	7,5	10	50	3 920	0,17	1,4	8 400	15 400	56	103	49	90
20	20	18	9,3	60	6	9,5	10	50	3 920	0,26	2,3	12 400	24 550	112	221	90	179
25	23	22	12,3	60	7	11	10	50	3 920	0,38	3,3	18 800	30 700	194	316	155	254
30	28	26	13,8	80	9	14	12	70	3 944	0,81	4,8	26 100	41 900	329	528	256	410
35	34	29	17	80	9	14	12	70	3 944	1,2	6,6	34 700	54 650	535	842	388	611
45	45	38	20,8	105	14	20	16	90	3 917	2,1	11,3	59 200	91 100	1 215	1 869	825	1 270

[1] For detailed informations on grease nipples please refer to **page 11**.
[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 7** for further details.

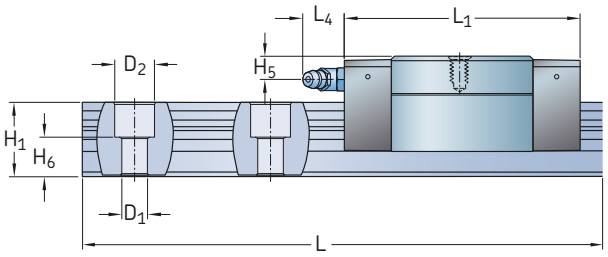
Carriage LLTHC ... SU

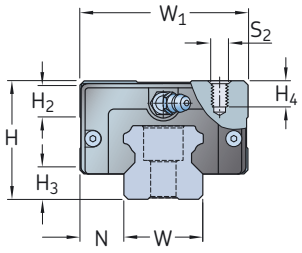
Slim-line carriage, short length, standard height

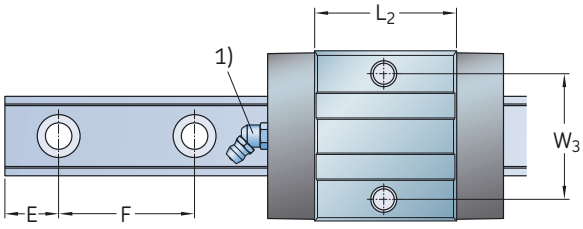


Size[1]	Accuracy class[2]	Designation[3] preload class T0	T1
–		–	
15	P5	LLTHC 15 SU T0 P5	LLTHC 15 SU T1 P5
	P3	LLTHC 15 SU T0 P3	LLTHC 15 SU T1 P3
	▶ P1		LLTHC 15 SU T1 P1
20	P5	LLTHC 20 SU T0 P5	LLTHC 20 SU T1 P5
	P3	LLTHC 20 SU T0 P3	LLTHC 20 SU T1 P3
	▶ P1		LLTHC 20 SU T1 P1
25	P5	LLTHC 25 SU T0 P5	LLTHC 25 SU T1 P5
	P3	LLTHC 25 SU T0 P3	LLTHC 25 SU T1 P3
	▶ P1		LLTHC 25 SU T1 P1
30	P5	LLTHC 30 SU T0 P5	LLTHC 30 SU T1 P5
	P3	LLTHC 30 SU T0 P3	LLTHC 30 SU T1 P3
	▶ P1		LLTHC 30 SU T1 P1
35	P5	LLTHC 35 SU T0 P5	LLTHC 35 SU T1 P5
	P3	LLTHC 35 SU T0 P3	LLTHC 35 SU T1 P3
	▶ P1		LLTHC 35 SU T1 P1

[1] Front seal appearance can slightly deviate per size.
[2] ▶ P1 only available as system.
[3] ■ **Preferred range.** For system designation please refer to designation system on **page 14**.







Size	Assembly dimensions					Carriage dimensions						
	W_1	N	H	H_2	H_3	L_1	L_2	L_4	W_3	H_4	H_5	S_2
–	mm											–
15	34	9,5	24	4,2	4,6	47,6	25,6	4,3	26	3,8	4,3	M4
20	44	12	30	8,3	5	54,1	32,1	15	32	6,5	5,7	M5
25	48	12,5	36	8,2	7	63,8	38,8	16,6	35	6,5	6,5	M6
30	60	16	42	11,3	9	78	45	14,6	40	8,5	8	M8
35	70	18	48	11	9,5	88,4	51,4	14,6	50	10	8	M8

Size	Rail dimensions									Weight		Load ratings		Moments			
										carriage	rail			dynamic	static	dynamic	static
	W	H_1	F	D_1	D_2	H_6	E_{min} –0,75	E_{max} –0,75	L_{max} –1,5			C	C_0	M_C	M_{Co}	$M_{A/B}$	$M_{Ao/Bo}$
–	mm									kg	kg/m	N		Nm			
15	15	14	60	4,5	7,5	8,5	10	50	3 920	0,1	1,4	5 800	9 000	39	60	21	32
20	20	18	60	6	9,5	9,3	10	50	3 920	0,17	2,3	9 240	14 400	83	130	41	64
25	23	22	60	7	11	12,3	10	50	3 920	0,21	3,3	13 500	19 600	139	202	73	106
30	28	26	80	9	14	13,8	12	70	3 944	0,48	4,8	19 200	26 600	242	335	120	166
35	34	29	80	9	14	17	12	70	3 944	0,8	6,6	25 500	34 800	393	536	182	248

[1] For detailed informations on grease nipples please refer to **page 11**.
[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 7** for further details.

LLTHR rails

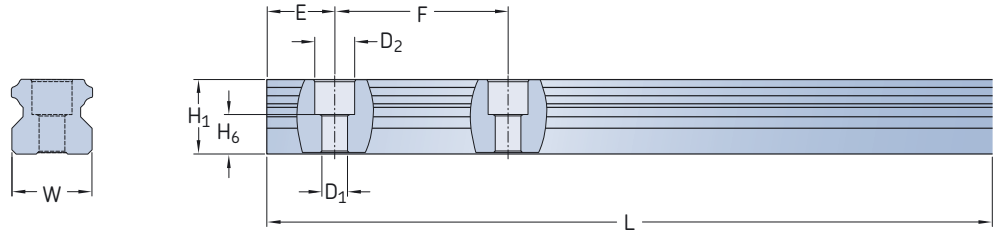
For mounting from above, supplied with protective plastic caps as standard.

Note: If a rail length is required that exceeds the maximum length available, joined rails can be ordered. These rails are manufactured to match seamlessly to each other.



Standard rail size		Accuracy class[1]	Designations[2] One-piece rail	Multi–piece rail	Pitch F
–		–	–		mm
15		P5	LLTHR 15 - ... P5	LLTHR 15 - ... P5 A	60
		P3	LLTHR 15 - ... P3	LLTHR 15 - ... P3 A	
	▶	P1	**LLTHR 15 - ... P1**	**LLTHR 15 - ... P1 A**	
20		P5	LLTHR 20 - ... P5	LLTHR 20 - ... P5 A	60
		P3	LLTHR 20 - ... P3	LLTHR 20 - ... P3 A	
	▶	P1	**LLTHR 20 - ... P1**	**LLTHR 20 - ... P1 A**	
25		P5	LLTHR 25 - ... P5	LLTHR 25 - ... P5 A	60
		P3	LLTHR 25 - ... P3	LLTHR 25 - ... P3 A	
	▶	P1	**LLTHR 25 - ... P1**	**LLTHR 25 - ... P1 A**	
30		P5	LLTHR 30 - ... P5	LLTHR 30 - ... P5 A	80
		P3	LLTHR 30 - ... P3	LLTHR 30 - ... P3 A	
	▶	P1	**LLTHR 30 - ... P1**	**LLTHR 30 - ... P1 A**	
35		P5	LLTHR 35 - ... P5	LLTHR 35 - ... P5 A	80
		P3	LLTHR 35 - ... P3	LLTHR 35 - ... P3 A	
	▶	P1	**LLTHR 35 - ... P1**	**LLTHR 35 - ... P1 A**	
45		P5	LLTHR 45 - ... P5	LLTHR 45 - ... P5 A	105
		P3	LLTHR 45 - ... P3	LLTHR 45 - ... P3 A	
	▶	P1	**LLTHR 45 - ... P1**	**LLTHR 45 - ... P1 A**	

[1] ▶ P1 only available as system.
[2] ■ **Preferred range**, replace "..." by rail length in mm, e. g. LLTHR 15 - 1000 P5



Size	Dimensions									Weight
	W	H_1	H_6	D_1	D_2	E_{min} –0,75	E_{max} –0,75	F	L_{max} –1,5	
–	mm									kg/m
15	15	14	8,5	4,5	7,5	10	50	60	3 920	1,4
20	20	18	9,3	6	9,5	10	50	60	3 920	2,3
25	23	22	12,3	7	11	10	50	60	3 920	3,3
30	28	26	13,8	9	14	12	70	80	3 944	4,8
35	34	29	17	9	14	12	70	80	3 944	6,6
45	45	38	20,8	14	20	16	90	105	3 917	11,3

The "E" dimension designates the distance from the rail end to centre of the first attachment hole. If no customer-specific "E" dimension is provided with the order, the rails are produced according to the following formulae:

$$z^* = \frac{L}{F}$$

$$E = \frac{L - zF}{2}$$

where
E = Rail end dimension
F = Distance of attachment holes
L = Rail length
z = Number of attachment holes

The distance of the first and last attachment holes is produced equidistantly.

***** round result down to next integer

LLTHR ... D4 rails

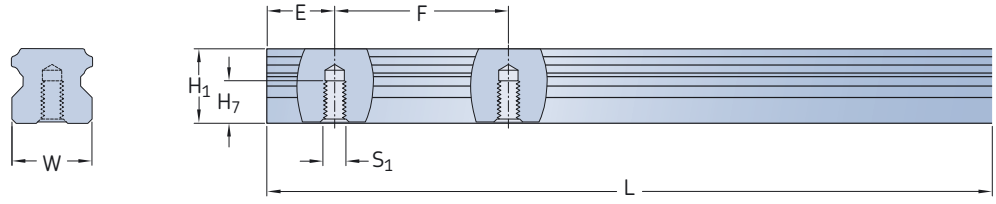
For mounting from below.

Note: If a rail length is required that exceeds the maximum length available, joined rails can be ordered. These rails are manufactured to match seamlessly to each other.



Standard rail size	Accuracy class[1]	Designations[2] One-piece rail	Multi–piece rail	Pitch F
–	–	–		mm
15	P5 D4	LLTHR 15 - ... P5 D4	LLTHR 15 - ... P5 A D4	60
	P3 D4	LLTHR 15 - ... P3 D4	LLTHR 15 - ... P3 A D4	
	▶ P1 D4	**LLTHR 15 - ... P1 D4**	**LLTHR 15 - ... P1 A D4**	
20	P5 D4	LLTHR 20 - ... P5 D4	LLTHR 20 - ... P5 A D4	60
	P3 D4	LLTHR 20 - ... P3 D4	LLTHR 20 - ... P3 A D4	
	▶ P1 D4	**LLTHR 20 - ... P1 D4**	**LLTHR 20 - ... P1 A D4**	
25	P5 D4	LLTHR 25 - ... P5 D4	LLTHR 25 - ... P5 A D4	60
	P3 D4	LLTHR 25 - ... P3 D4	LLTHR 25 - ... P3 A D4	
	▶ P1 D4	**LLTHR 25 - ... P1 D4**	**LLTHR 25 - ... P1 A D4**	
30	P5 D4	LLTHR 30 - ... P5 D4	LLTHR 30 - ... P5 A D4	80
	P3 D4	LLTHR 30 - ... P3 D4	LLTHR 30 - ... P3 A D4	
	▶ P1 D4	**LLTHR 30 - ... P1 D4**	**LLTHR 30 - ... P1 A D4**	
35	P5 D4	LLTHR 35 - ... P5 D4	LLTHR 35 - ... P5 A D4	80
	P3 D4	LLTHR 35 - ... P3 D4	LLTHR 35 - ... P3 A D4	
	▶ P1 D4	**LLTHR 35 - ... P1 D4**	**LLTHR 35 - ... P1 A D4**	
45	P5 D4	LLTHR 45 - ... P5 D4	LLTHR 45 - ... P5 A D4	105
	P3 D4	LLTHR 45 - ... P3 D4	LLTHR 45 - ... P3 A D4	
	▶ P1 D4	**LLTHR 45 - ... P1 D4**	**LLTHR 45 - ... P1 A D4**	

[1] ▶ P1 only available as system.
[2] ■ **Preferred range**, replace "..." by rail length



Size	Dimensions								Weight
	W	H_1	H_7	S_1	E_{min} –0,75	E_{max} –0,75	F	L_{max} –1,5	
–	mm								kg/m
15	15	14	8	M5	10	50	60	3 920	1,4
20	20	18	10	M6	10	50	60	3 920	2,4
25	23	22	12	M6	10	50	60	3 920	3,4
30	28	26	15	M8	12	70	80	3 944	5,0
35	34	29	17	M8	12	70	80	3 944	6,8
45	45	38	24	M12	16	90	105	3 917	11,8

The "E" dimension designates the distance from the rail end to centre of the first attachment hole. If no customer-specific "E" dimension is provided with the order, the rails are produced according to the following formulae:

$$z^* = \frac{L}{F}$$

$$E = \frac{L - zF}{2}$$

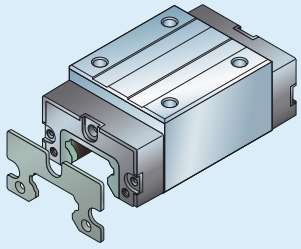
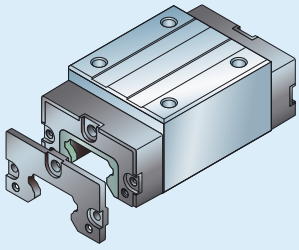
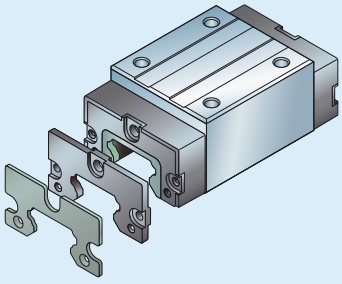
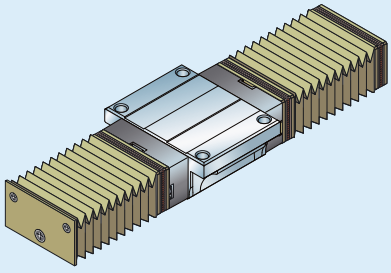
where
E = Rail end dimension
F = Distance of attachment holes
L = Rail length
z = Number of attachment holes

The distance of the first and last attachment holes is produced equidistantly.

* round result down to next integer

Accessories

Accessories

Item name	Illustration[1)]	Purpose
Scraper plate		Scraper plates are spring-steel, non-contact components. They protect the front seal from, for example, coarse contaminants or hot metal chips.
Additional front seal		Additional front seals are contact seals that can be attached to the carriage end faces. They are single-lip seals consisting of special heavy-duty material and offer additional protection against liquids and smaller contaminants.
Seal kit		The seal kit consists of a metal scraper and an additional front seal. It is intended for applications involving exposure to coarse and fine dirt as well as liquids.
Bellows		Bellows protect the entire system against solid and liquid contaminants from above. They are suitable for highly contaminated environments like machining centres in the woodworking and metals industries.

[1)] Illustrations show size 35. Appearance can vary slightly depending on the size.

Scraper plate

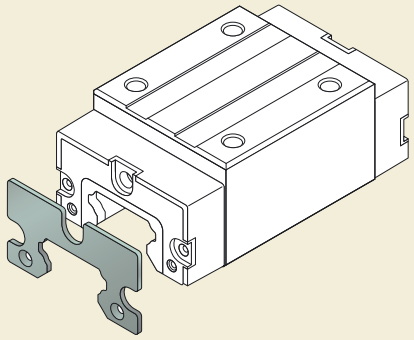
- Material: spring steel according to DIN EN 10088
- Appearance: black
- Designed with a specified maximum gap of 0,2 to 0,3 mm

Mounting

Mounting screws are supplied as standard. When mounting, be sure there is an even space between the rail and scraper plate.

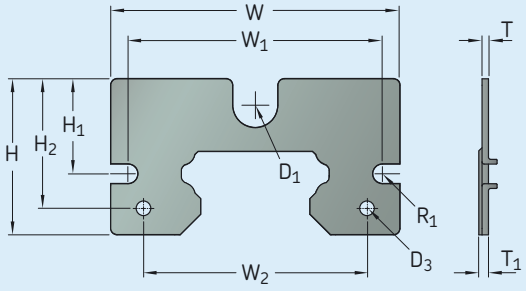
Note: Can be ordered in combination with an additional front seal as a kit, using the designation LLTHZ ... S3.

Scraper plate



Illustrations show size 35. Appearance can vary slightly depending on the size.

Scraper plate



Size	Part designation	Dimensions										
		D_1	D_3[1]	R_1	W	W_1	W_2	H	H_1	H_2	T	T_1 max
–	–	mm										
15	**LLTHZ 15 S1**	6	–	1,75	31,6	25,8	–	18,5	12	–	1,5	1,8
20	**LLTHZ 20 S1**	10	–	1,75	42,6	35	–	24,2	14,8	–	1,5	1,8
25	**LLTHZ 25 S1**	10	–	2,25	46,6	39,6	–	27,7	16,8	–	1,5	1,8
30	**LLTHZ 30 S1**	10,4	–	1,75	57	50	–	30,4	19,3	–	1,5	1,8
35	**LLTHZ 35 S1**	10,4	3,4	2,25	67,3	59,2	52	36,3	22,1	30,1	1,5	1,8
45	**LLTHZ 45 S1**	12	3,4	2,75	83,3	72	67	44,2	27,5	38,3	1,5	1,8

[1] If longer grease nipple and screws are needed, they are included.

Additional front seal

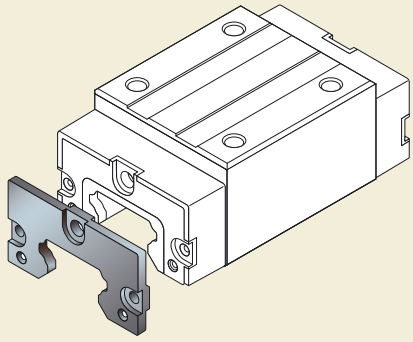
- Material: Elastomer
- Design: single-lip seal

Mounting

Mounting screws are supplied as standard.

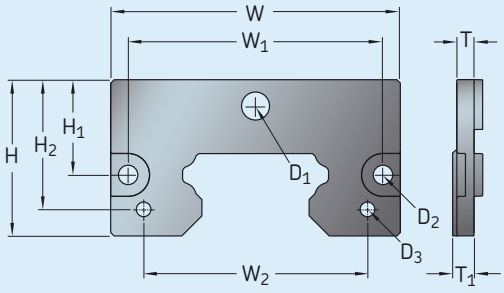
Note: Can be ordered in combination with a scraper plate as a kit, using the designation LLTHZ ... S3.

Front seal



Illustrations show size 35. Appearance can vary slightly depending on the size.

Additional front seal



Size	Part designation	Dimensions										
		D_1	D_2	D_3[1]	W	W_1	W_2	H	H_1	H_2	T	T_1
–	–	mm										
15	**LLTHZ 15 S7**	3,6	3,4	–	31,6	25,8	–	18,5	12	–	3	4
20	**LLTHZ 20 S7**	5,5	3,4	–	42,6	35	–	24,2	14,8	–	3	4
25	**LLTHZ 25 S7**	5,5	4,5	–	46,6	39,6	–	27,7	16,8	–	3	4
30	**LLTHZ 30 S7**	6,5	3,4	–	57,9	50	–	31,6	19.3	–	4	5
35	**LLTHZ 35 S7**	6,5	4,5	3,4	67,3	59,2	52	36,3	22,1	30,1	4	5
45	**LLTHZ 45 S7**	6,5	5,5	3,4	83,3	72	67	44,2	27,5	38,3	4	5

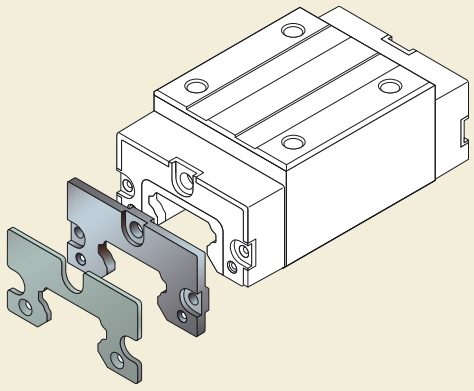
[1] If longer grease nipple and screws are needed, they are included.

Seal kit

The seal kit consists of the following components:

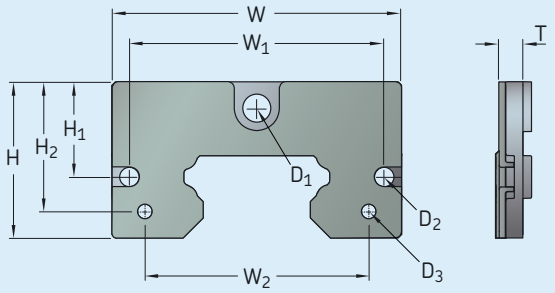
- Scraper plate
- Additional front seal

Seal kit



Illustrations show size 35. Appearance can vary slightly depending on the size.

Seal kit



Size	Part designation	Dimensions									
		D_1	D_2	D_3[1]	W	W_1	W_2	H	H_1	H_2	T
–	–	mm									
15	**LLTHZ 15 S3**	3,6	3,4	–	31,6	25,8	–	18,5	12	–	4
20	**LLTHZ 20 S3**	5,5	3,4	–	42,6	35	–	24,2	14,8	–	4
25	**LLTHZ 25 S3**	5,5	4,5	–	46,6	39,6	–	27,7	16,8	–	4
30	**LLTHZ 30 S3**	6,5	3,4	–	57,9	50	–	31,5	19,3	–	5
35	**LLTHZ 35 S3**	6,5	4,5	3,4	67,3	59,2	52	36,3	22,1	30,1	5
45	**LLTHZ 45 S3**	6,5	5,5	3,4	83,3	72	67	44,2	27,5	38,3	5

[1] If longer grease nipple and screws are needed, they are included.

Bellows

Temperature resistance

t_{max} = 90 °C.
During continuous operation the allowed temperature range is from –20 to 80 °C. Special materials for higher temperature resistance are available on request.

Material

Bellows are made of polyester fabric with a polyurethane coating. Adapter plates are made of aluminium.

Bellows kit contents (→ fig. 1)

1 Adapter plate
2 Grease nipple
3 Sealing ring
4 Set screw
5 Mounting screws
6 Hook-and-loop fastener
7 Bellows with all plates pre-assembled.

Note: rail ends need to be prepared with threaded holes.

Fig. 1

Delivery scope

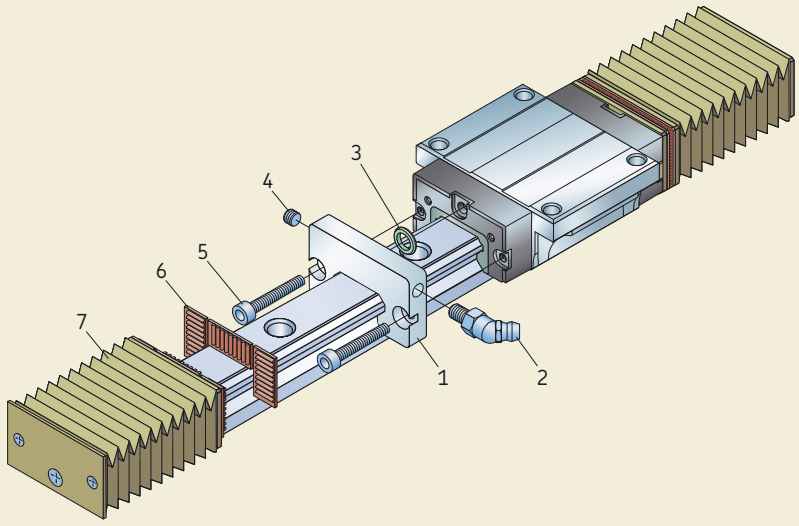


Table 1

Bellows designations[1)]

Size	 **Type 2** with fastening plate for the carriage and end plate for the rail	 **Type 4** with two fastening plates for the carriages	 **Type 9** loose bellows (spare part)
–	–		
15	LLTHB 15 B2 ..	LLTHB 15 B4 ..	LLTHB 15 ..
20	LLTHB 20 B2 ..	LLTHB 20 B4 ..	LLTHB 20 ..
25	LLTHB 25 B2 ..	LLTHB 25 B4 ..	LLTHB 25 ..
30	LLTHB 30 B2 ..	LLTHB 30 B4 ..	LLTHB 30 ..
35	LLTHB 35 B2 ..	LLTHB 35 B4 ..	LLTHB 35 ..
45	LLTHB 45 B2 ..	LLTHB 45 B4 ..	LLTHB 45 ..

[1)] Replace ".." by number of folds per bellow.

Mounting

The bellows are partly pre-assembled. The mounting screws are supplied.

Note: Prior to mounting, the grease nipples on the carriage must be removed.

For bellow arrangement type 2 (→ **table 1**) the end faces of the rails have to be equipped with threaded fixation holes.

Calculation of the bellows type 2

$$n = \frac{L - L_A}{W_{4\,min} + W_{4\,max}} + 2$$

Calculation of the rail length

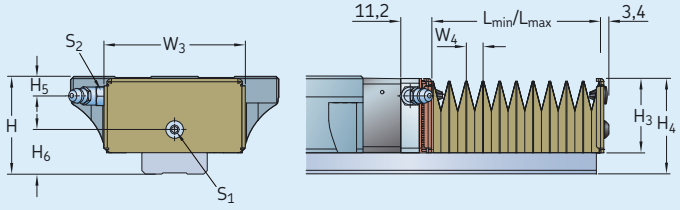
L = $(n - 2)\,(W_{4\,min} + W_{4\,max}) + L_A$

L_{min} = $n\,W_{4\,min}$
L_{max} = $n\,W_{4\,max}$
Stroke = $n\,S_F$

where
L_A = Carriage length L_1 (please refer to the dimension tables of the carriages) plus 2 · 11,2 mm for the adapter plates.
L = Rail length [mm]
L_{max} = Bellows stretched
L_{min} = Bellow pushed together
n = total number of folds per carriage side
W_4 = maximum and minimum extension per fold
Stroke = Stroke [mm]
S_F = Stroke per fold (→ **table 2**)

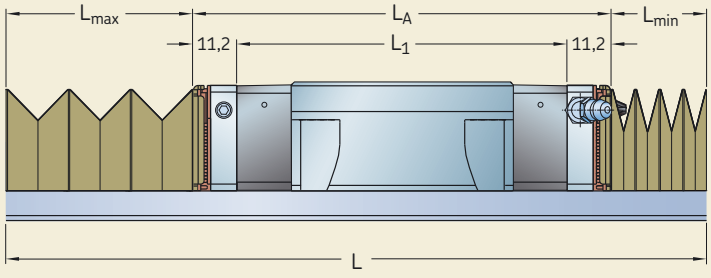
Table 2

Dimensions of the bellows



Size	Dimensions											
	W_3	$H^{1)}$	$H^{2)}$	H_3	H_4	H_5	H_6	S_1	S_2	$W_{4\,min}$	$W_{4\,max}$	S_F
–	mm											–
15	32	24	28	18,9	23,5	3,8	8,8	M4	M5	2,5	9,6	7,1
20	43	30	30	24,5	29,5	5,2	12	M4	M5	2,5	12	9,5
25	47	36	40	28	35	5,5	15,5	M4	M5	2,5	12	9,5
30	58	42	45	32	41	7	19	M4	M6	2,5	16,9	14,4
35	68	48	55	37	47	6,5	21,5	M4	M6	2,5	21	18,5
45	84	60	70	45	59	7,5	28,5	M4	M6	2,5	25,2	22,7

1) For carraiges of type A, LA, U, SU
2) For carraiges of type R, LR



1) calculation for maximum possible stroke
2) calculation of bellow type 4 on request, specifications on stroke length required

Mounting

General instructions

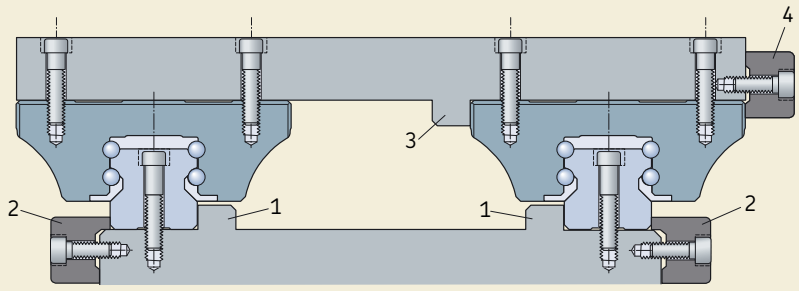
The following mounting instructions[1)] are applicable to all carriage types.

To maintain the high precision of SKF LLT profile rail guides, the carriages must be carefully handled during transport and subsequent assembly.

To provide protection during transport, storage and assembly, LLT rails and carriages are supplied with a corrosion inhibitor. This inhibitor does not need to be removed if the recommended lubricants are used.

Fig. 1

Mounting with laterally fixed rails and carriages



Typical mounting examples

Rails

Each rail has ground reference edges on both sides.

Options for securing the rails laterally (→ fig. 1)

1 Stop edges
2 Retaining strips

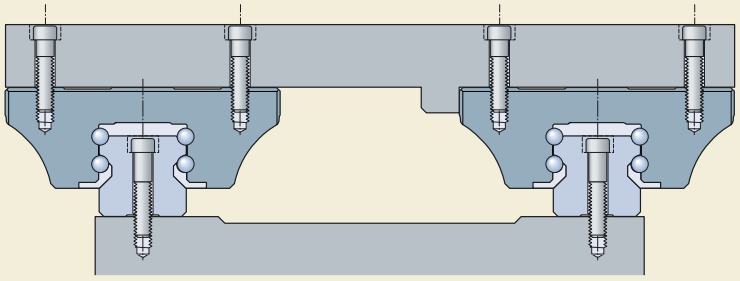
Note: Rail ends must be chamfered to prevent seal damage during installation. If two rails are to be joined, do not chamfer either of the mating ends.

Rails that are not laterally fixed must be installed straight and parallel. SKF recommends using a support strip to maintain the rail's position during installation.

Guideline values for the permissible lateral loads for unfixed rails are listed in **table 3** on **page 41**.

Fig. 2

Mounting without lateral rail fixation



Carriage

Each carriage has one ground reference side (please refer to dimension H_2 in the drawings of the carriages (**→ pages 18 ff.**).

Options for securing the carriages laterally (→ fig. 1)

3 Stop edges
4 Retaining strips

Note: If mounted correctly, the carriage should move easily on the rail when pushed.

During assembly, secure the carriage to prevent it from falling.

[1)] For detailed mounting instructions please contact your SKF representative.

Interface design, screw sizes and tightening torques

- The flange-type carriages can be fastened from above (→ **fig. 3**) and below (→ **fig. 4**)
- The slim-type carriages can be fastened from above (→ **fig. 5**)
- Rails can be fastened from both above (→ **fig. 4** and **5**) and below (→ **fig. 3**, rail type **LLTHR ... D4**).

Fig. 3

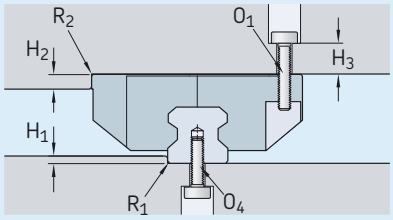


Fig. 4

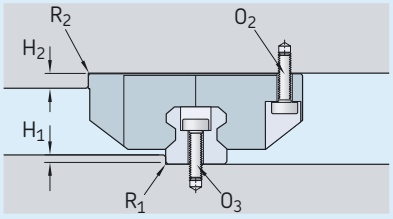
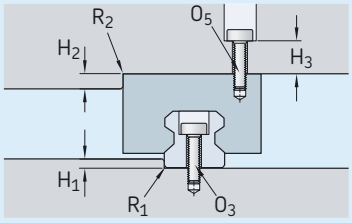


Fig. 5



C

Table 1

Stop edges, corner radii and screw sizes

Size	Dimensions H_1 min	H_1 max	R_1 max	H_2	R_2 max	H_3[1]	Screw O_1 ISO 4762	O_2	O_3[1]	O_4[1]	O_5[2]
–	mm						4 Piece		Rail		
15	2,5	3,5	0,4	4	0,6	6	M5 x 12	M4 × 12	M4 × 20	M5 × 12	M4 × 12
20	2,5	4,0	0,6	5	0,6	9	M6 x 16	M5 × 16	M5 × 25	M6 × 16	M5 × 16
25	3,0	5,0	0,8	5	0,8	10	M8 x 20	M6 × 18	M6 × 30	M6 × 20	M6 × 18
30	3,0	5,0	0,8	6	0,8	10	M10 x 20	M8 × 20	M8 × 30	M8 × 20	M8 × 20
35	3,5	6,0	0,8	6	0,8	13	M10 x 25	M8 × 25	M8 × 35	M8 × 25	M8 × 25
45	4,5	8,0	0,8	8	0,8	14	M12 x 30	M10 ×30	M12 × 45	M12 × 30	M10 × 30

[1] The stated values are only recommendations
[2] For carriage type SU two screws are sufficient to withstand the maximum load.

Table 2

Tightening torques of mounting screws

Screw strength class	Screw M4	M5	M6	M8	M10	M12
–	Nm					
for counterparts made out of steel or cast iron						
8.8	2,9	5,75	9,9	24	48	83
12.9	4,95	9,7	16,5	40	81	140
for counterparts made out of aluminium						
8.8	1,93	3,83	6,6	16	32	55
12.9	3,3	6,47	11	27	54	93

Table 3

Dimensions and guide values for permissible lateral forces without additional lateral support (→ fig. 2)

Carriages	Screw strength class	Carriages O_1	O_2	O_5	Rails O_3	O_4
A, U, R	8.8	23% C	11% C	11% C	6% C	6% C
	12.9	35% C	18% C	18% C	10% C	10% C
LA, LR	8.8	18% C	8% C	8% C	4% C	4% C
	12.9	26% C	14% C	14% C	7% C	7% C
SU	8.8	12% C	8% C	8% C	9% C	9% C
	12.9	21% C	13% C	13% C	15% C	15% C

Permissible height deviation

The values for height deviation are applicable for all carriage types.

If the values for height deviation S_1 (→ **table 4**) and S_2 (→ **table 5**) are within the specified range, the service life of the rail guide system will not be influenced.

Permissible height deviation in lateral direction (→ table 4)

$S_1 = a\ Y$

where
S_1 = Permissible height deviation [mm]
a = Distance between the rails [mm]
Y = Calculation factor lateral direction

Note: The height tolerance H for the carriages has to be taken into consideration (please refer to **table 3** on **page 13** for detailed information). Subtract H from S_1 to determine final permissible height deviation. If the result for $S_1 < 0$ new product selection is necessary related to preload and/or precision class.

Permissible height deviation in longitudinal direction (→ table 5)

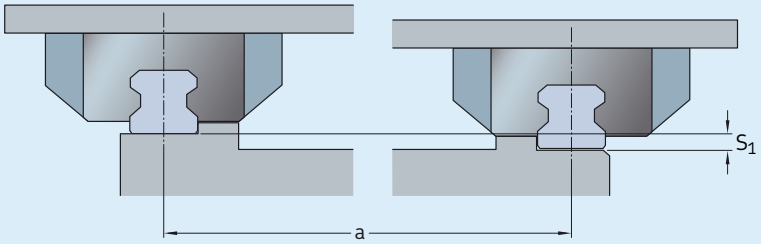
$S_2 = b\ X$

where
S_2 = Permissible height deviation [mm]
b = Distance between the carriages [mm]
X = Calculation factor longitudinal direction

Note: The maximum difference Δ_H for the carriages has to be taken into consideration (please refer to **page 13** for detailed information). Subtract Δ_H from S_2 to determine final permissible height deviation. If the result for $S_2 < 0$ new product selection is necessary related to preload and/or precision class.

Table 4

Permissible height deviation in lateral direction

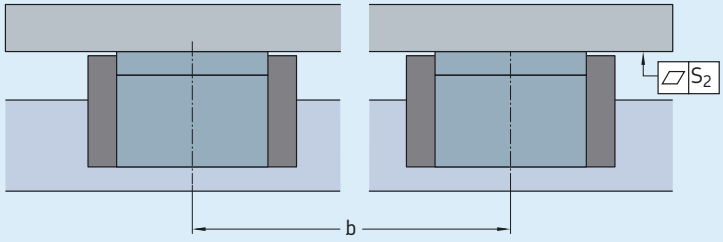


Calculation factor Y for carriages

Calculation factor	Preload T0	T1 Preload (2% C)	T2 Preload (8% C)
Y	$4{,}3 \times 10^{-4}$	$2{,}8 \times 10^{-4}$	$1{,}7 \times 10^{-4}$
Y (carriage type SU)	$5{,}2 \times 10^{-4}$	$3{,}4 \times 10^{-4}$	–

Table 5

Permissible height deviation in longitudinal direction



Calculation factor X for carriages

Calculation factor	Carriage length short	normal	long
X	$6{,}0 \times 10^{-5}$	$4{,}3 \times 10^{-5}$	$3{,}0 \times 10^{-5}$

Parallelism

The parallelism of mounted rails is measured on the rails and the carriages.

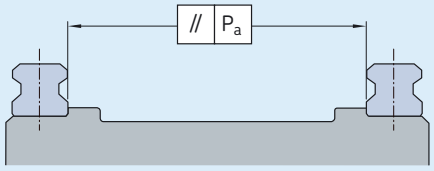
The values for the deviation in parallelism P_a are applicable to all carriage types.

Deviation in parallelism P_a slightly increases the preload. If the values are within the specified range in **table 6**, the service life of the rail guide system will not be influenced.

Precision mounting requires a stiff, high-precision adjacent construction. For standard mounting, the adjacent construction is resilient and the tolerances for deviation in parallelism can be doubled.

Table 6

Deviation in parallelism P_a



Size	Tolerance class T0	T1 (2% C)	T2 (8% C)
–	–	–	–
15	0,015	0,009	0,005
20	0,018	0,011	0,006
25	0,019	0,012	0,007
30	0,021	0,014	0,009
35	0,023	0,015	0,010
45	0,028	0,019	0,012
Carriage type SU			
15	0,018	0,011	–
20	0,022	0,013	–
25	0,023	0,014	–
30	0,025	0,017	–
35	0,028	0,018	–

C

Lubrication

To enable optimum operation and long service life, LLT profile rail guides must be sufficiently lubricated to prevent metal-to-metal contact between the rolling elements and the raceways.

Lubrication reduces wear and, at the same time, provides protection against corrosion.

Caution: To prevent damage to the LLT carriages, do not use grease with any solid lubricant such as graphite.

Note: LLT profile rail guides should never operate without basic lubrication.

Factory pre-lubrication

LLT carriages are factory pre-lubricated with SKF LGEP 2. This grease has a consistency of 2 on the NLGI scale, which is in accordance with *DIN 51 825*.

To provide protection during transport, storage and assembly, LLT rails and carriages are coated with a corrosion inhibitor. This inhibitor does not need to be removed if the recommended lubricants are used.

Initial lubrication

An initial lubrication is not required, as SKF profile rail guides are factory pre-lubricated and ready to mount. In cases where a different type of grease is required, the carriages should be thoroughly cleaned and re-greased prior to mounting. Please refer to **table 1** for appropriate grease quantity and apply it three times.

This initial lubrication has to be applied according to the steps below:

1. Grease each carriage according to the quantities listed in **table 1**.
2. Move the carriage three times backwards and forwards with stroke = carriage length.
3. Repeat steps **1** and **2** again, twice.
4. Check if a lubricating film is visible on the rail.

Re-lubrication

The lubrication intervals for profile rail guides depend primarily on the average running speed, operating temperature and grease quality.

The intervals recommended for fixed operating conditions are listed in **table 2**. For appropriate grease quantity refer to **table 1**. Where contamination, use of coolants, vibration, shock loads etc. form part of the environmental conditions, it is advisable to reduce relubrication intervals accordingly.

Table 1

Size	**Grease quantity** Carriage type A, R, U	LA, LR	SU
–	cm^3		
15	0,4	–	0,3
20	0,7	0,9	0,6
25	1,4	1,8	1,1
30	2,2	2,9	1,8
35	2,2	2,9	1,8
45	4,7	6,1	–

Table 2

Size	**Lubrication intervals**[1)] Under normal operating conditions, v ≤ 1 m/s Travel under load ≤ 0,15 C	≤ 0,3 C
–	km	–
15	5 000	1 200
20	5 000	1 200
25	10 000	2 400
30	10 000	2 400
35	10 000	2 400
45	10 000	2 400

[1)] NLGI 00 grease reduces the relubrication intervals to 75% of the stated values

Maintenance

Short stroke applications

If the stroke is less than twice the carriage length, both lube ports must be used, each filled equally with the grease quantity stated for initial lubrication or relubrication.

Example

- Short stroke application
- Carriage type A
- Size 25

Apply 3 × 1,4 cm^3 into the left and
3 × 1,4 cm^3 into the right grease nipple.

Caution: To avoid serious damage it is important to consider the miscibility of greases when changing from one lubricant to another.

Moreover, you must also consider the possibility of reduced relubrication intervals, performance at short stroke operation and reduced load carrying capacity as well as possible chemical interaction with synthetic materials, lubricants and preservatives.

Please refer to the grease manufacturer's instructions. In case of incompatibility between lubricants employed, the carriages should be thoroughly cleaned before regreasing.

For automatic relubrication systems from SKF, please contact your local SKF representative.

To avoid dirt from adhering to and embedding into the rails, the rails should be cleaned regularly with a "cleaning stroke". SKF recommends a cleaning stroke over the entire length of the rails twice a day or at least every eight hours.

Perform a cleaning stroke each time when switching on or off the machine.

Typical application areas

Typical application areas

Applications	Accuracy classes			Preload classes			Special requirements on	
	P5	P3	P1	T0	T1	T2	Speed	Sealing
Handling								
Linear robotics	+	+		+	+		+	
Linear tables	+	+	+	+	+	+	+	
Modules and axis	+	+		+	+			
Pneumatic automation	+	+		+	+		+	
Plastic injection moulding								
Clamping / injecting	+	+		+	+		+	
Machine hood	+			+				
Woodworking								
Portal and gantry	+	+	+	+	+		+	+
Machine hood	+			+				
Printing								
Cutting and transport systems	+			+	+			+
Packaging								
Labelling	+	+		+				
Stacking/palletizing	+	+		+	+		+	
Medical								
X-ray	+	+		+	+			
Patient tables	+	+		+	+			
Laboratory automation	+	+		+	+			
Machine tool								
Cutting	+	+	+	+	+		+	+
Sawing	+	+		+	+		+	

Symbols: + Suitable

Please complete form and send to your SKF representative or authorized distributor.

Specification sheet

Selection of profile rail guide slides

Date

1a Customer

Company	
Address 1	
Address 2	
City	Post code
Country	
Phone	Fax

2 SKF contact

Company	
Address 1	
Address 2	
City	Post code
Country	
Phone	Fax

1b Contact

Name	telephone	mobile
Job title / Department	e-mail	
Name	telephone	mobile
Job title / Department	e-mail	
Name	telephone	mobile
Job title / Department	e-mail	

3 Reason for request

Currently used product		
☐ Replacement	☐ New design	☐ Other:

4 Application

			Please specify other application
☐ Factory automation	☐ Woodworking	☐ Printing	
☐ Medical	☐ Packaging	☐ Other:	

5 Application description

6 Number of carriages per rail

Please specify other

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ Other:

7 Number of rails used in parallel

Please specify other

☐ 1 ☐ 2 ☐ Other:

8 Stroke

mm

9 Rail length

mm

10 Distance between carriages

mm

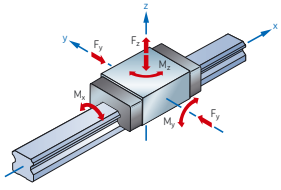
11 Distance between rails

mm

12 Loads per axis

Additional moving load: kg

Additional force: N



	X	Y	Z
Force N			
Moment Nm			
Eccentricity mm			

13 Speed

Maximum: m/s

14 Acceleration

Maximum: m/s²

15 Mode of operation

Duty cycle: %

Length of one operation cycle: s

16 Specification life

Operating hours per day: h

requisite life: h

17 Dynamic diagram

S [mm]

t [s]

SKF

18 Accuracy class

(Details can be found in the LLT product catalog on **page 13**)

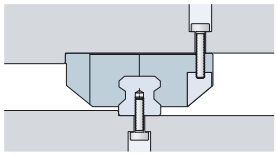
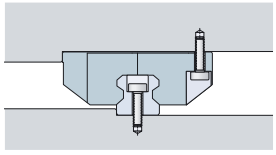
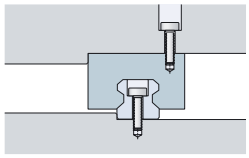
☐ P5 (standard) ☐ P3 (High accuracy) ☐ P1 (Precision)

19 Preload class

(Details can be found in the LLT product catalog on **page 12**)

☐ T0 (Zero preload) ☐ T1 (Light preload 2% C) ☐ T2 (Medium preload 8% C)

20 Mounting

			
Carriages	☐ Flange type, mounted from above	☐ Flange type, mounted from below	☐ Slim type, mounted from above
			
Rails	☐ Mounted from above	☐ Mounted from below	☐ Other

Customer interface

21 Environmental conditions

22 Remarks / Special request / Sketch

D

SKF – the knowledge engineering company

From the company that invented the self-aligning ball bearing more than 100 years ago, SKF has evolved into a knowledge engineering company that is able to draw on five technology platforms to create unique solutions for its customers. These platforms include bearings, bearing units and seals, of course, but extend to other areas including: lubricants and lubrication systems, critical for long bearing life in many applications; mechatronics that combine mechanical and electronics knowledge into systems for more effective linear motion and sensorized solutions; and a full range of services, from design and logistics support to conditioning monitoring and reliability systems.

Though the scope has broadened, SKF continues to maintain the world's leadership in the design, manufacture and marketing of rolling bearings, as well as complementary products such as radial seals. SKF also holds an increasingly important position in the market for linear motion products, high-precision aerospace bearings, machine tool spindles and plant maintenance services.

The SKF Group is globally certified to ISO 14001, the international standard for environmental management, as well as OHSAS 18001, the health and safety management standard. Individual divisions have been approved for quality certification in accordance with ISO 9001 and other customer specific requirements.

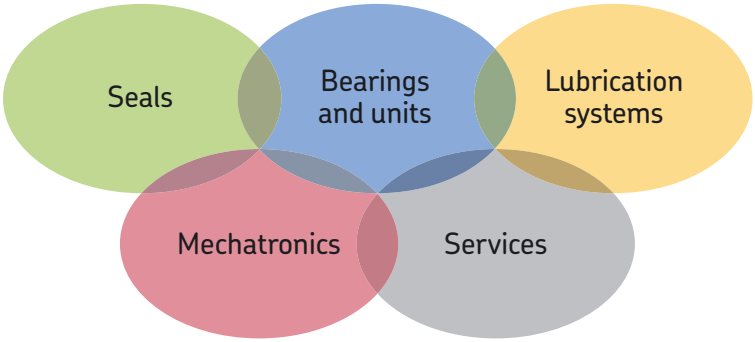
With over 100 manufacturing sites worldwide and sales companies in 70 countries, SKF is a truly international corporation. In addition, our distributors and dealers in some 15 000 locations around the world, an e-business marketplace and a global distribution system put SKF close to customers for the supply of both products and services. In essence, SKF solutions are available wherever and whenever customers need them. Overall, the SKF brand and the corporation are stronger than ever. As the knowledge engineering company, we stand ready to serve you with world-class product competencies, intellectual resources, and the vision to help you succeed.



© Airbus – photo: e×m company, H. Goussé

Evolving by-wire technology
SKF has a unique expertise in fast-growing by-wire technology, from fly-by-wire, to drive-by-wire, to work-by-wire. SKF pioneered practical fly-by-wire technology and is a close working partner with all aerospace industry leaders. As an example, virtually all aircraft of the Airbus design use SKF by-wire systems for cockpit flight control.

SKF is also a leader in automotive by-wire technology, and has partnered with automotive engineers to develop two concept cars, which employ SKF mechatronics for steering and braking. Further by-wire development has led SKF to produce an all-electric forklift truck, which uses mechatronics rather than hydraulics for all controls.







Harnessing wind power
The growing industry of wind-generated electric power provides a source of clean, green electricity. SKF is working closely with global industry leaders to develop efficient and trouble-free turbines, providing a wide range of large, highly specialized bearings and condition monitoring systems to extend equipment life of wind farms located in even the most remote and inhospitable environments.



Working in extreme environments
In frigid winters, especially in northern countries, extreme sub-zero temperatures can cause bearings in railway axleboxes to seize due to lubrication starvation. SKF created a new family of synthetic lubricants formulated to retain their lubrication viscosity even at these extreme temperatures. SKF knowledge enables manufacturers and end user customers to overcome the performance issues resulting from extreme temperatures, whether hot or cold. For example, SKF products are at work in diverse environments such as baking ovens and instant freezing in food processing plants.



Developing a cleaner cleaner
The electric motor and its bearings are the heart of many household appliances. SKF works closely with appliance manufacturers to improve their products' performance, cut costs, reduce weight, and reduce energy consumption. A recent example of this cooperation is a new generation of vacuum cleaners with substantially more suction. SKF knowledge in the area of small bearing technology is also applied to manufacturers of power tools and office equipment.



Maintaining a 350 km/h R&D lab
In addition to SKF's renowned research and development facilities in Europe and the United States, Formula One car racing provides a unique environment for SKF to push the limits of bearing technology. For over 50 years, SKF products, engineering and knowledge have helped make Scuderia Ferrari a formidable force in F1 racing. (The average racing Ferrari utilizes more than 150 SKF components.) Lessons learned here are applied to the products we provide to automakers and the aftermarket worldwide.



Delivering Asset Efficiency Optimization
Through SKF Reliability Systems, SKF provides a comprehensive range of asset efficiency products and services, from condition monitoring hardware and software to maintenance strategies, engineering assistance and machine reliability programmes. To optimize efficiency and boost productivity, some industrial facilities opt for an Integrated Maintenance Solution, in which SKF delivers all services under one fixed-fee, performance-based contract.



Planning for sustainable growth
By their very nature, bearings make a positive contribution to the natural environment, enabling machinery to operate more efficiently, consume less power, and require less lubrication. By raising the performance bar for our own products, SKF is enabling a new generation of high-efficiency products and equipment. With an eye to the future and the world we will leave to our children, the SKF Group policy on environment, health and safety, as well as the manufacturing techniques, are planned and implemented to help protect and preserve the earth's limited natural resources. We remain committed to sustainable, environmentally responsible growth.



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