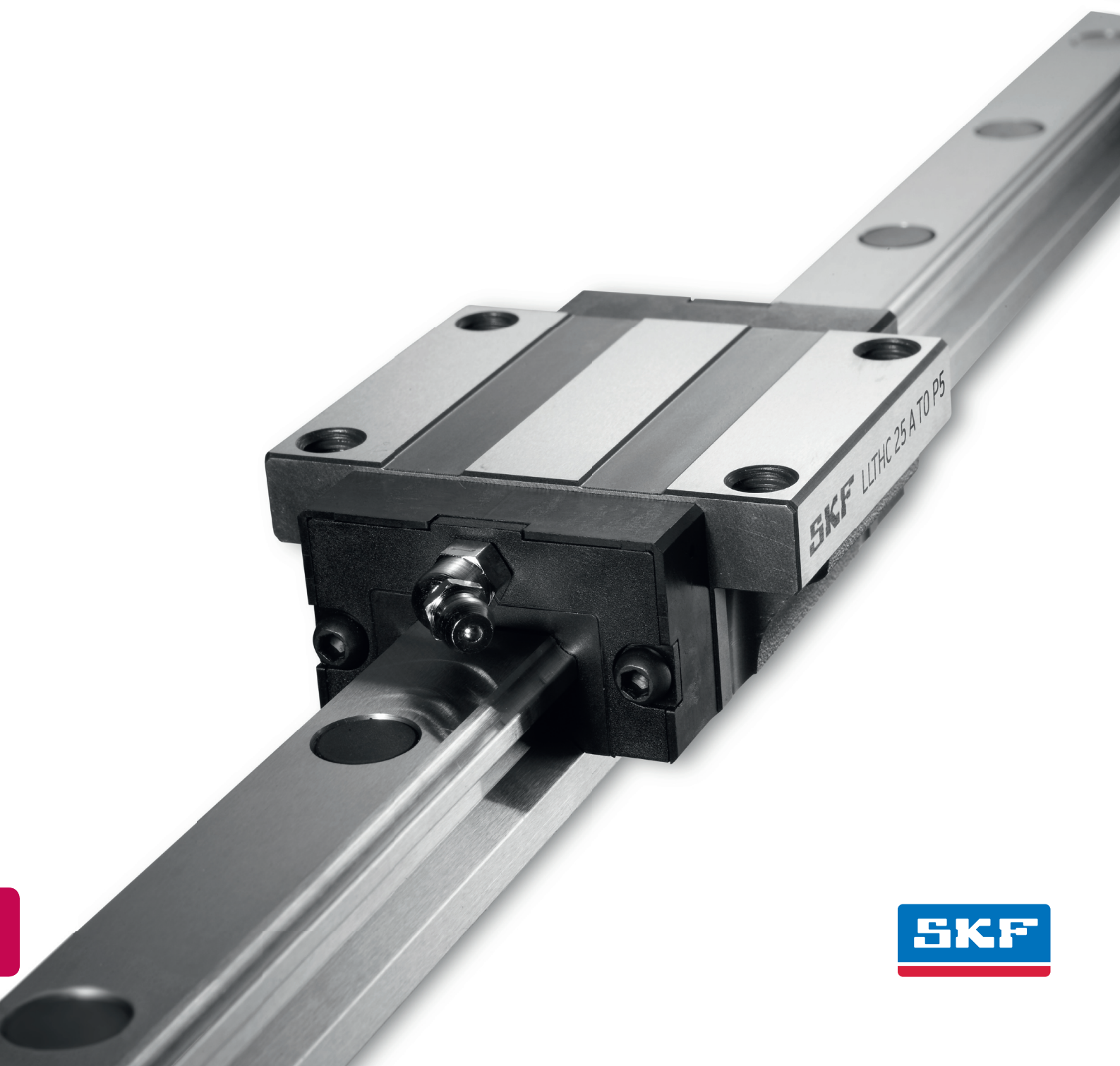


Profile rail guides LLT





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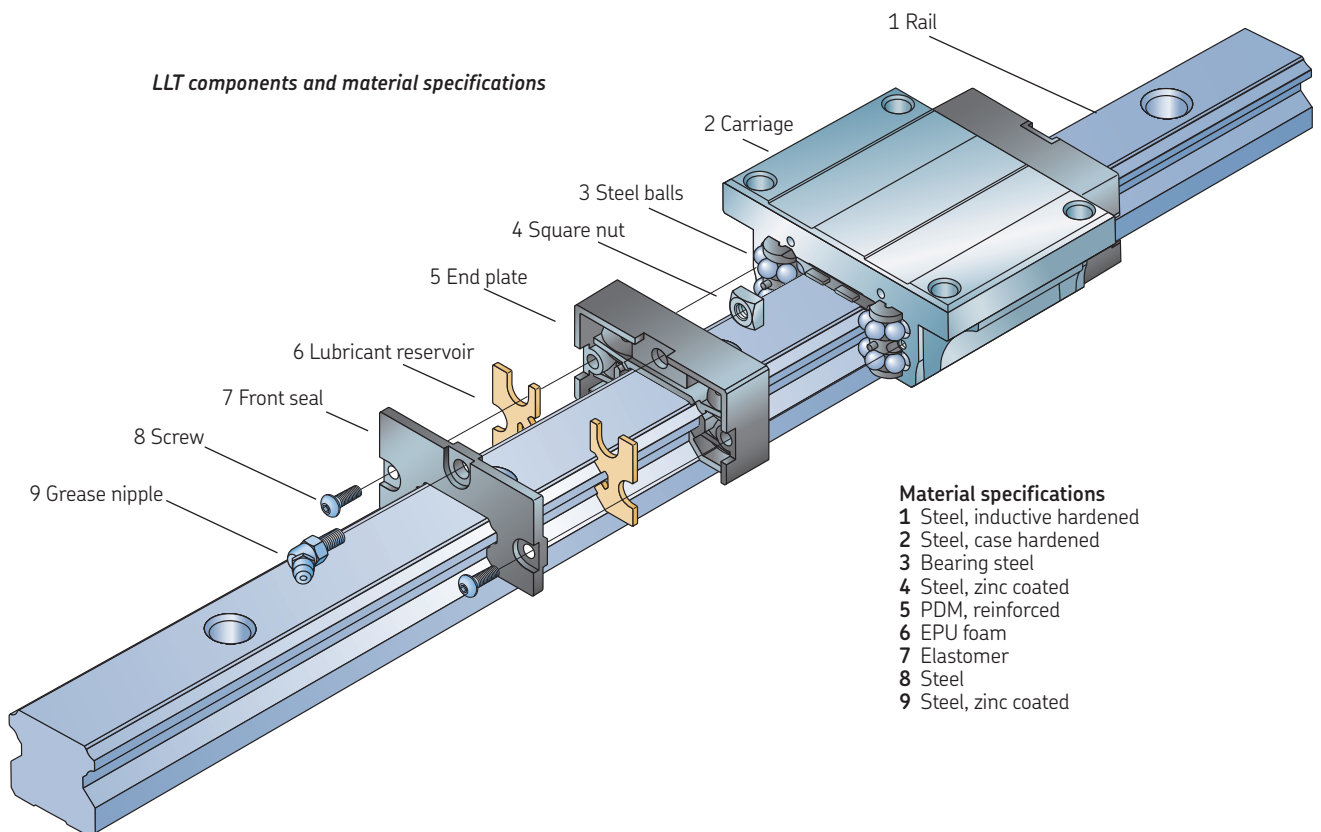
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1 Profile rail guide system – introduction

The following instructions will help you mount the SKF profile rail guide system. Read these instructions before starting to mount. Failure to properly mount the rail guide system could result in short service life or even cause a safety risk.

The SKF catalogue *Profile rail guides LLT* completes this mounting instruction and should therefore be hold ready.



2 Mounting the profile rail guide system

2.1 Shipment

Profile rails are delivered in their own packaging.

Please remove the rails carefully from their packaging. Unwrap the profile rail from the sleeve.

Do not recycle the packaging until the installation has been finished. The packaging can protect this product from damage during the mounting process.

2.2 Mounting of carriages

⚠ CAUTION

Take care the ends of the profile rail guides are chamfered and deburred, to avoid damage on front seals or internal components.

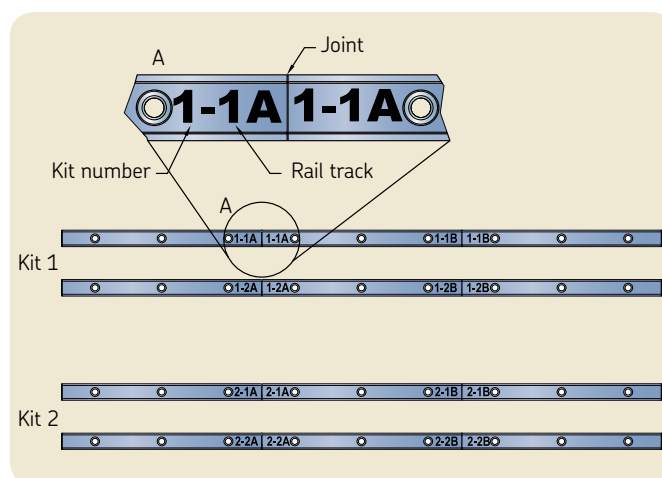
Apply oil or grease to the profile rails chamfer and the front seal of the carriage.

Slide the carriage carefully and straight on the profile rail, avoiding any misalignment.

2.3 Jointed rail tracks

Jointed rail tracks are generally used when the longest rails length available (approximately 4 000 mm) does not cover the entire rail length of an application in one piece. We recommend the use of grinded locating edges. This will ensure an accurate raceway alignment across the joint and prevent the dislocation due to shock loads. If the interface structure construction does not provide a reference surface, fix the rail joints with a clamping device and make sure that any excess load does not change the rail position. All section rails are numbered continuously close to the joint to prevent a mistake.

For jointed rail tracks, please make sure there is no gap greater than 0,02 mm between the sections.



2.4 General requirement for the stop edges design and screw size

The corner radii between the reference surface and the mounting surface have to be smaller than the chamfer of the LLT rail or LLT carriage (please refer to **table 1** for detailed information). The contact between rail or carriage and the reference surface is very fundamental for the function and the power transmission.

Regarding the different components of LLT profile rail guides, the following options can be considered:

The flange-type carriages can be fastened from above (→ **fig. 1**) and below (→ **fig. 2**).

The slim-type carriages can be fastened from above (→ **fig. 3**). Rails can be fastened from both above (→ **fig. 2 and 3**) and below (→ **fig. 1**).

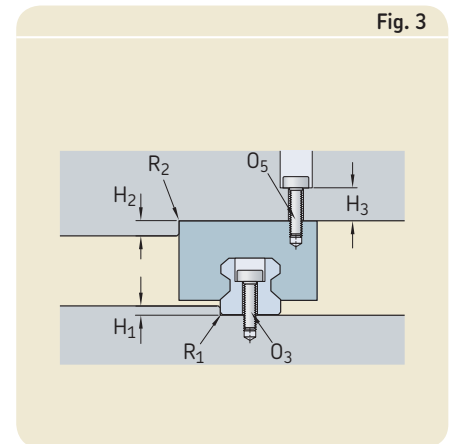
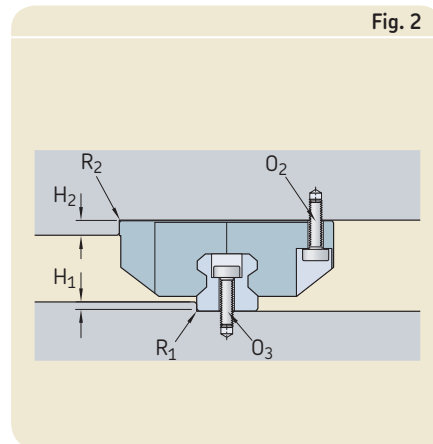
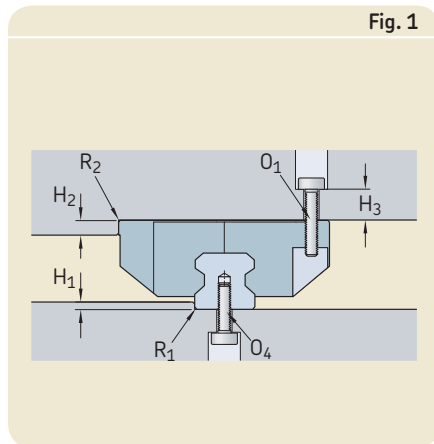


Table 1

Stop edges, corner radii and screw sizes

Size	Dimensions			H ₂	R ₂ max	H ₃ ¹⁾	Screw		O ₃ ¹⁾	O ₄ ¹⁾	O ₅ ²⁾
	H ₁ min	H ₁ max	R ₁ max				O ₁ ISO 4762	O ₂			
–	mm						4 Piece		Rail		
15	2,5	3,5	0,4	4	0,6	6	M5 x 12	M4 x 12	M4 x 20	M5 x 12	M4 x 12
20	2,5	4,0	0,6	5	0,6	9	M6 x 16	M5 x 16	M5 x 25	M6 x 16	M5 x 16
25	3,0	5,0	0,8	5	0,8	10	M8 x 20	M6 x 18	M6 x 30	M6 x 20	M6 x 18
30	3,0	5,0	0,8	6	0,8	10	M10 x 20	M8 x 20	M8 x 30	M8 x 20	M8 x 20
35	3,5	6,0	0,8	6	0,8	13	M10 x 25	M8 x 25	M8 x 35	M8 x 25	M8 x 25
45	4,5	8,0	0,8	8	0,8	14	M12 x 30	M10 x 30	M12 x 45	M12 x 30	M10 x 30

¹⁾ The stated values are only recommendations

²⁾ For carriage type SU two screws are sufficient to withstand the maximum load.

2.5 Parallelism of two profile rails

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

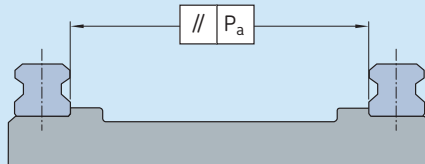
The values for the deviation in parallelism P_a are applicable to all carriage types.

Deviation in parallelism P_a slightly increases the preload. If the values are outside the specified range in **table 2**, the rail guide system's service life will be less than normal.

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 2

Deviation in parallelism P_a



Size	Tolerance class T_0	T_1 (2% C)	T_2 (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	–

2.6 Permissible offset

Permissible height deviation

Permissible values for height deviation are applicable for all carriage types. If values S_1 (→ **table 3**) and S_2 (→ **table 4**) for height deviation are within the specified range, the service life of the rail guide system will not be influenced.

Permissible height deviation in lateral direction (→ **table 3**)

$$S_1 = a Y$$

where

S_1 = Permissible height deviation [mm]

a = Distance between the rails [mm]

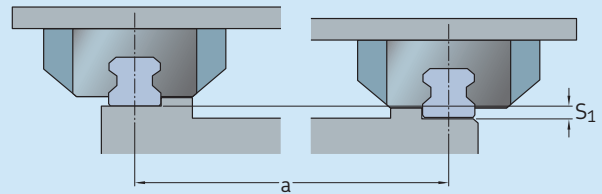
Y = Calculation factor lateral direction

Table 3

Permissible height deviation in lateral direction

Calculation factor Y for carriages

Calculation factor	Preload T_0	T_1 Preload (2% C)	T_2 Preload (8% C)
Y	$4,3 \times 10^{-4}$	$2,8 \times 10^{-4}$	$1,7 \times 10^{-4}$
Y (carriage type SU)	$5,2 \times 10^{-4}$	$3,4 \times 10^{-4}$	–



NOTE: The height tolerance H for the carriages has to be taken into consideration (please refer to catalog *Profile rail guides LLT* **table 3** for detailed information). Subtract H from S_1 to determine final per-

missible height deviation. If the result for $S_1 < 0$, new product selection is necessary and related to preload and/or precision class.

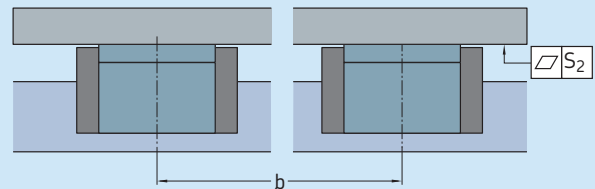
Permissible height deviation in longitudinal direction (→ **table 4**)

Table 4

Permissible height deviation in longitudinal direction

Calculation factor X for carriages

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



$$S_2 = b X$$

where

S_2 = Permissible height deviation [mm]

b = Distance between the carriages [mm]

X = Calculation factor longitudinal direction

NOTE: The maximum difference, ΔH , for the carriages has to be taken into consideration (please refer to catalogue *Profile rail guides LLT* for detailed information). Subtract ΔH 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.

3 Mounting the profile rails

3.1 Preparation

The threaded holes on the interface structure must be prepared based on the rail size. For hole distances and sizes, please refer to SKF catalog *Profile rail guides LLT*.

Make sure that the contact surfaces are free of burrs, unevenness, nicks and damaged spots. Use oil stone if necessary to smooth contact surface (→ **fig. 4**). Check the locating surface for dimensional and position accuracy. Inspect the corner radii and shoulder height (→ **2.3 Jointed rail tracks**).

Clean the contact surfaces thoroughly. Do not clean with nitro. Preferably use low-viscosity (spindle) oil and slightly coat them.



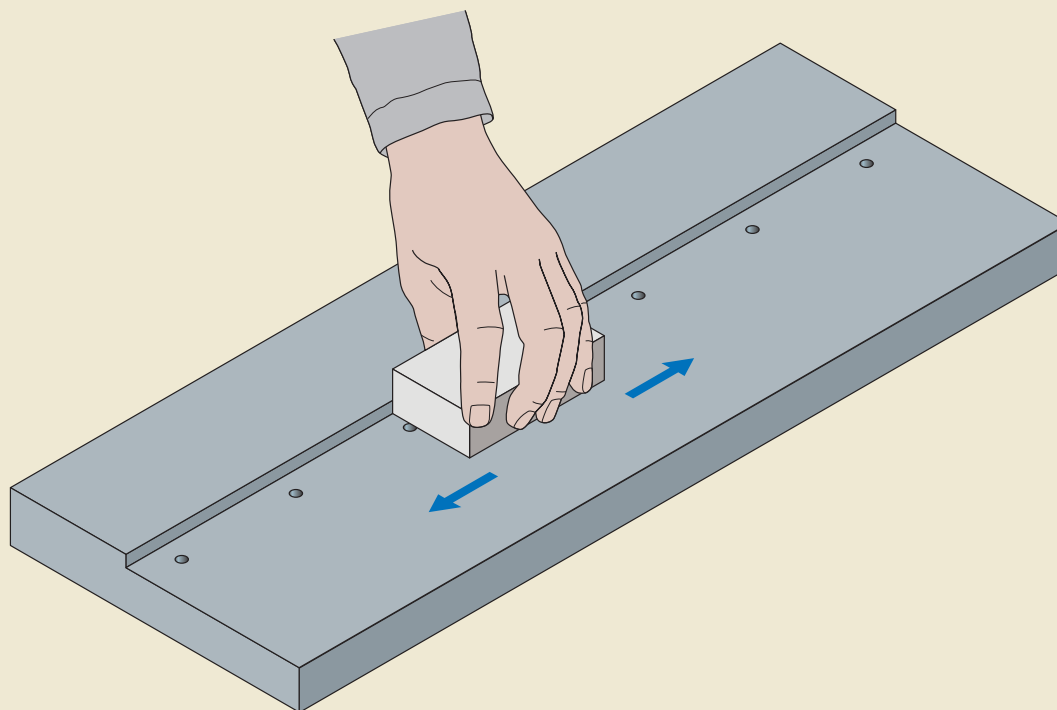
Note!

Clean also the rail countersinks and the screws – dry contact between screw-heads and rail subsurfaces transfer higher lateral force.

Remove the corrosion inhibitor off of the reference surface using washing oil. The unprotected areas are now prone to rust. Coat them apart from the countersinks slightly with low-viscosity oil.

Please make sure the rails, machine bed, mounting plate and fastening screws have the same room temperature at the time of installation.

Fig. 4



3.2 Mounting the master rail

- 1 Place the profile rail gently onto the prepared interface structure.
- 2 Insert screws and check they fit unobstructed and without creating tension.
- 3 Partially tighten the screws so that the rail is still loose.
- 4 Push in the rail so that it closely contacts the locating surface (→ **fig. 5**). If necessary, press the rails in place with clamping strip, c-clamp or a retaining strip (→ **3.4 Mounting a retaining strip**). In case no lateral support is provided, for alignment use a straightedge (→ **fig. 6**) or an external reference surface (→ **fig. 7**).
- 5 Using a torque wrench, tighten the mounting screws, beginning from the center alternating to the ends (→ **fig. 8**), to the designated torque (→ **table 5**).

Fig. 5

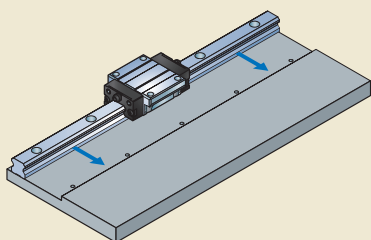


Fig. 6

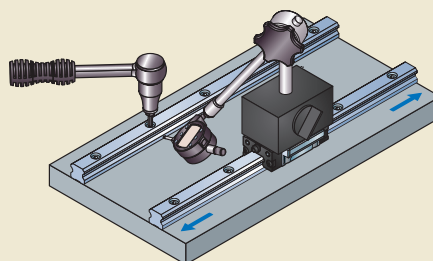


Fig. 7

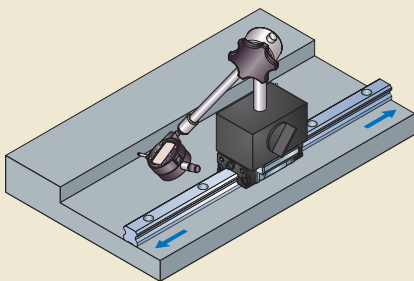


Fig. 8

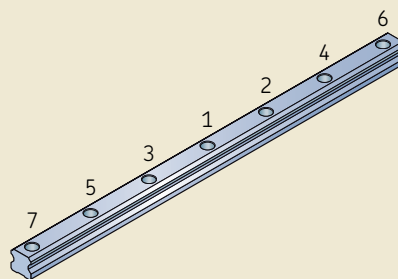


Table 5

Tightening torques of mounting screws

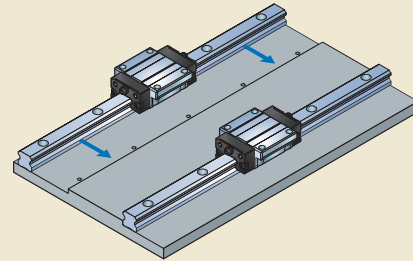
Screw strength class	Screw	M4	M5	M6	M8	M10	M12
–	Nm						
for counterparts made out of steel or cast iron							
8.8		2,9	5,75	9,9	24	48	83
12.9		4,95	9,7	16,5	40	81	140
for counterparts made out of aluminium							
8.8		1,93	3,83	6,6	16	32	55
12.9		3,3	6,47	11	27	54	93

3.3 Parallel alignment of subsidiary rail

The already aligned and fastened rail is defined as the master rail. Depending on the ambient/substructure (machine bed) design, there are several options for mounting subsidiary rails. Please choose the suitable option.

Option I

If reference surfaces are provided for both sides of the substructure (machine bed), please proceed as described before in 3.2 *Mounting the master rail*.



Option II

If no locating surfaces are provided on the substructure (machine bed), then proceed as follows: Align via mounting plate with two locating surfaces.

- 1 Push in the carriage so that it closely contacts the locating surface of the mounting plate (→ **fig. 9**).
- 2 Using a torque wrench, tighten the mounting screws, beginning from the center alternating to the ends (→ **fig. 8**), to the designated torque (→ **table 5**).
- 3 Mount the master rail to the substructure (machine bed) as described in 3.2 *Mounting the master rail*.

- 4 Place the subsidiary rail gently onto the prepared substructure (machine bed).
- 5 Insert screws and check their unobstructed movement (→ **fig. 10**).
- 6 Partially tighten the screws so that the rail is still loose.
- 7 Slide the mounting plate with the already fastened carriages on the rails and move it over the full stroke (→ **fig. 11**).
- 8 Start at one rail end and pre-fasten the rail screws with 1/3 torque in order so that it is close to the carriage while achieving the required parallelism (→ **fig. 12**). Double-check the function across full stroke and tight all rail screws, beginning from the center, alternating to the ends, with required torque (→ **table 5**).

Fig. 9

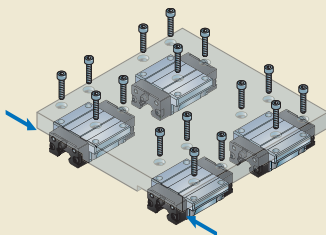


Fig. 10

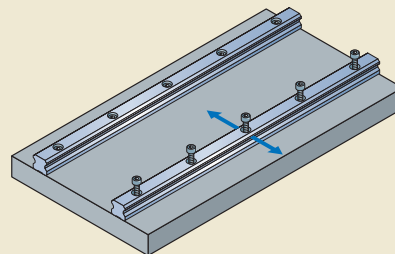


Fig. 11

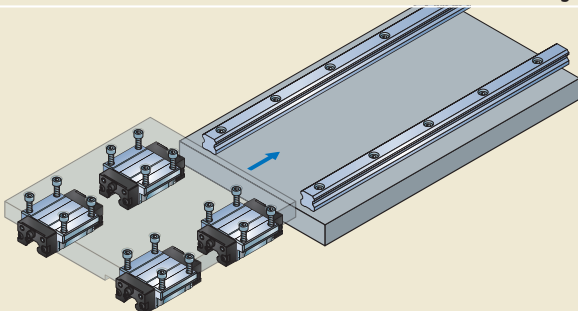
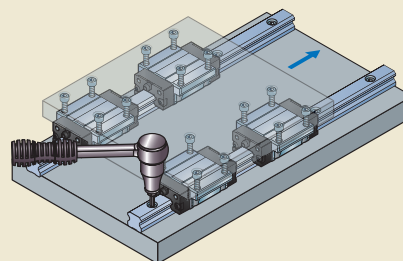


Fig. 12



Option III

If no locating surfaces are provided on the substructure (machine bed), then proceed as follows:

- 1 Place the subsidiary profile rail gently onto the prepared substructure (machine bed).
- 2 Insert screws and check their unobstructed movement (→ **fig. 13**).
- 3 Partially tighten the screws so that the rail is still loose.
- 4 Slide on a carriage on the already mounted master rail. Affix the dial gauge to the top of the carriage and preferably close to the measuring point. Place the measuring head to the center of the grinded reference surface of the subsidiary rail (→ **fig. 14**).
- 5 Start at one rail end and pre-fasten the rail screws with 1/3 torque in order, so that it is close to the measuring position while achieving the required parallelism (→ **fig. 15**).
- 6 Double-check the parallelism across full stroke and tighten all rail screws, beginning from the center, alternating to the ends (→ **fig. 8**), with designated torque (→ **table 5**). Use a torque wrench.

Fig. 13

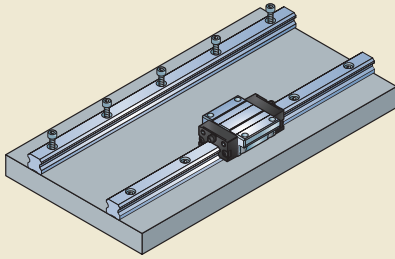


Fig. 14

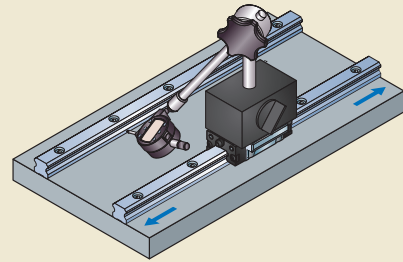
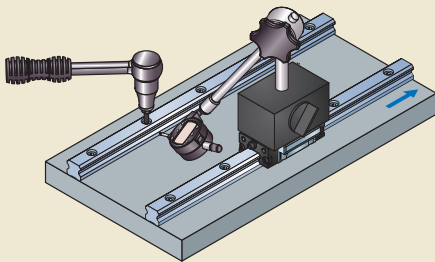


Fig. 15

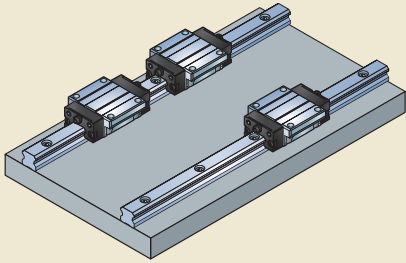


Option IV

Alignment via mounting plate: if no locating surfaces are provided on the mounting plate and the substructure (machine bed), then proceed as follows:

- 1 Place the subsidiary profile rail gently onto the prepared substructure (machine bed).
- 2 Insert screws and check their unobstructed movement.
- 3 Partially tighten the screws so that the rail is still loose.
- 4 Slide on two carriages on the already mounted master rail and one carriage on the subsidiary rail (→ **fig. 16**).
- 5 Mount a mounting plate on the two carriages on the master rail and tighten the screws.

Fig. 16



- 6 Loosely attach the carriage on the subsidiary rail to the mounting plate.
 - 7 Affix the dial gauge to the top of the mounting plate and preferably close to the measuring point. Place the measuring head to the center of the grinded reference side of the carriage on the subsidiary rail (→ **fig. 17**).
 - 8 Start at one rail end and pre-fasten the rail screws with 1/3 torque in order, so that it is close to the measuring position while achieving the required parallelism (→ **fig. 18**).
- Double-check the parallelism across full stroke and tighten all rail screws, beginning from the center, alternating to the ends, with designated torque (→ **table 5**). Use a torque wrench.

Fig. 17

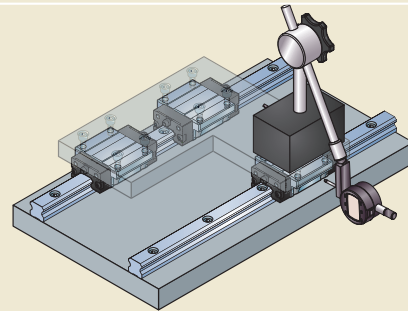
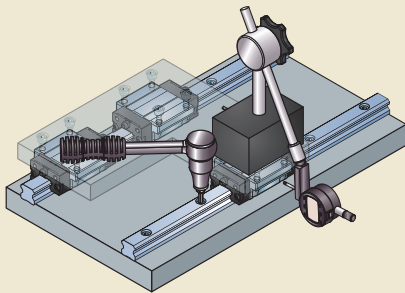


Fig. 18



3.4 Mounting a retaining strip

Profile rail guides can also be mounted without a locating surface. However, it is recommended to use a locating surface because it absorbs lateral forces and reduces the effort necessary to straighten the guides. Dimensions and guide values for permissible lateral forces will decrease if no lateral support is provided. For details refer to catalogue *Profile rail guides LLT*.

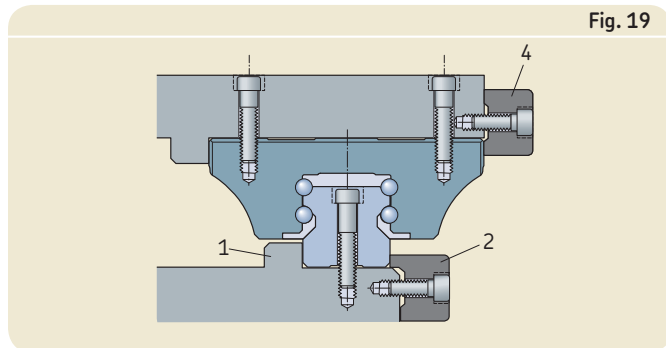


Fig. 19

Mount the retaining strip (→ **fig. 19**) with a torque wrench according to the permitted values (→ **table 6**). Fasten the rail screws with a torque wrench according to the values in **table 5**.

Check the straightness with a dial gauge by using a straight edge or an external reference edge (→ **3.2 fig. 5** and **fig. 6**).

Table 6		
Size	Screw size	Fastening torque M [Nm]
15...35	M5×20	5,5
45	M8×25	23

3.5 Mounting of the plastic caps

Plastic caps must be flush with the surface of the rail. Overhanging caps can damage the sealing and cause premature abrasion and failure of function. Too deeply inserted caps can gather dirt and do not cover the sharp edges of the countersinks.

Use a soft hammer and a flat transition piece and knock the caps straight and carefully into the retaining holes (→ **fig. 20**). Use a soft

material like plastic or aluminum without sharp edges to avoid any marks on the rail.

Check the straightness with a dial gauge by using a straight edge or an external reference edge (→ **3.2 fig. 5** and **fig. 6**).

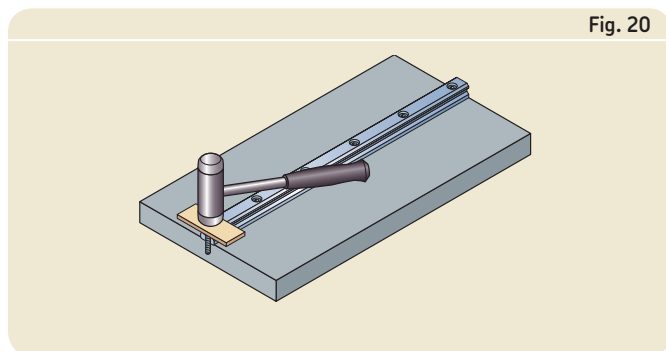


Fig. 20

4 Lubrication

4.1 Factory pre-lubrication

⚠ CAUTION

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.

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.

4.2 Initial lubrication

An initial lubrication is not required, as SKF profile rail guides are factory pre-lubricated and ready to mount. In cases where the factory lubrication is not appropriate and a different type of grease required, the carriages should be thoroughly cleaned and regreased prior to mounting. Please refer to **table 7** for the appropriate grease quantity and apply it as instructed below.

- 1 Grease each carriage according to the quantities listed in **table 7**.
- 2 Move the carriage three times backwards and forwards with stroke = carriage length.
- 3 Repeat steps **1** and **2** twice again for a total of 3 times.
- 4 Be sure a lubricating film is visible on the rail.

Table 7

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	–

4.3 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 8**. For appropriate grease quantity, refer to **table 7** and apply once.

Where contamination, use of coolants, vibration, shock loads etc. are part of the environmental conditions, re-lubricate more frequently.

Table 8

Size	Lubrication intervals ¹⁾ Under normal operating conditions, $v \leq 1$ m/s Travel under load $\leq 0,15$ C	
	km	$\leq 0,3$ C
–	–	–
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

4.4 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 $3 \times 1,4 \text{ cm}^3$ into the left and
 $3 \times 1,4 \text{ cm}^3$ 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.

4.5 Maintenance

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 of operation.

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

5 Accessories

5.1 Mounting the bellows

Bellows are available for all rail guide system sizes. The mounting is a simple and quick operation. The bellows are used to provide additional protection against dirt, dust and splashed liquids over the entire rail length.

Lubrication nipples are applied laterally and are accessible without disconnecting the bellows.

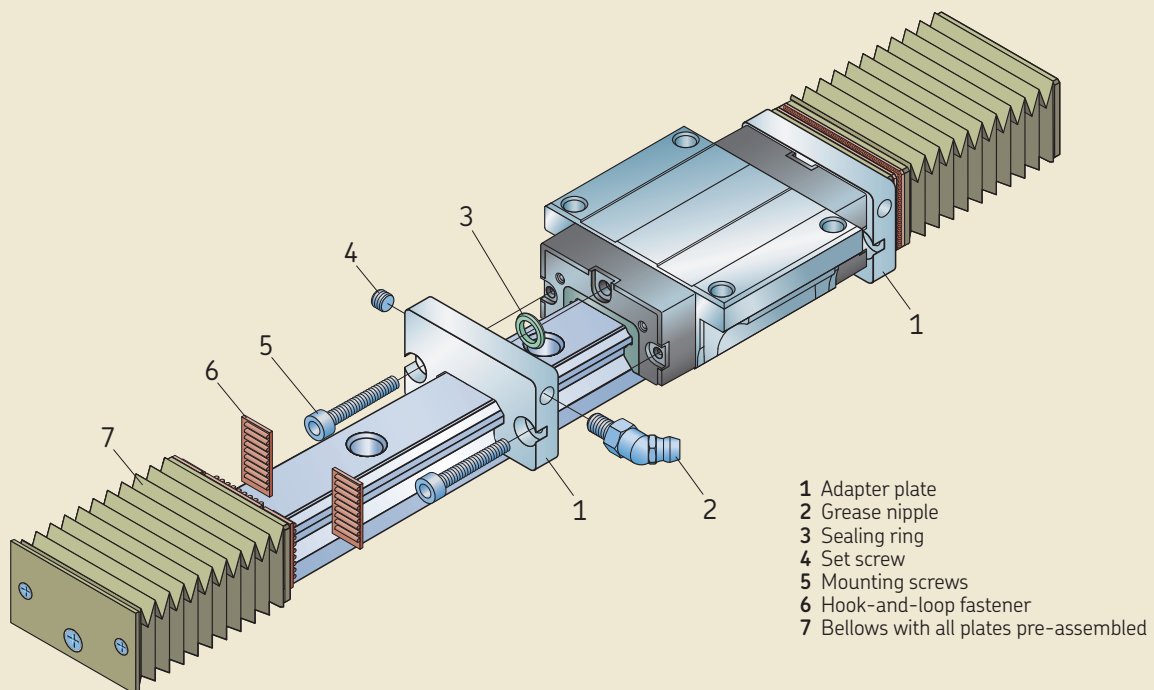
The bellow kit is delivered pre-assembled.

- 1 Remove the lubrication nipple and the two front screws from the carriage. Make sure the plastic parts do not fall off.
- 2 Place the O-ring seal into the adapter.
- 3 Attach the adapter to the carriage with the longer enclosed mounting screws.

- 4 Seal one (unused) lateral lubrication access with the set screw and attach the lubrication nipple to the opposite side.
- 5 Clean and degrease the front side of the adapter plate (→ **fig. 21**) thoroughly.
- 6 Slide on the bellow.
- 7 Screw the bellow end plate to the rail.
- 8 Take off the protective foil from the loop and hook joint.
- 9 Ensure proper alignment and press on firmly.

NOTE: To disconnect bellows, apply a flat lever on one side of the bellow interface and push apart carefully.

Fig. 14



5.2 Mounting the scraper plate

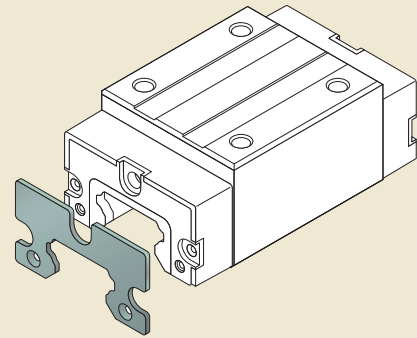
Fastening screws are supplied as standard.

During mounting, please ensure an even gap between the rail and scraper plate.

CAUTION

Remove the front screws of the carriage. Make sure that the plastic parts do not fall off.

Mount the scraper plate and tighten the screws.

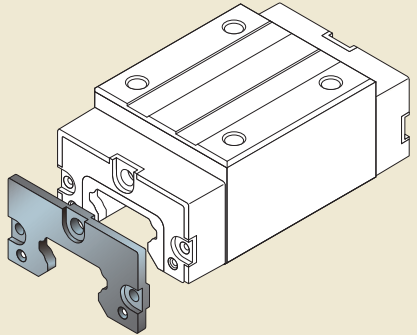


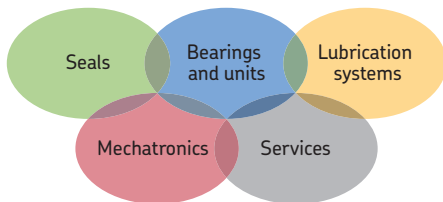
5.3 Mounting additional front seal

Fastening screws are supplied as standard.

CAUTION

Remove the front screws of the carriage. Make sure that the plastic parts do not fall off. Mount the front seal and tighten the screws.





The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

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