Technical Information

Configurations and behavior of the slider under yawing moment M$_Z$

Individual slider under load moment M$_Z$

When an overhung load in an application with a single slider per rail causes an M$_z$ moment in one direction, a 4 to 6 roller Compact Rail slider is available. These sliders are available in both configuration A and B in regards to the roller arrangement to counter the acting M$_z$ moment load. The moment capacity of these sliders in the M$_z$-direction varies significantly through spacing L$_1$ and L$_2$ in accordance with the direction of rotation of M$_z$.

Especially in the use of two parallel rails, for example with a T+U-system, it is extremely important to pay attention to the correct combination of the slider configuration A and B, in order to use the maximum load capacities of the slider.

The diagrams below illustrate this concept of the A and B configuration for sliders with 4 and 6 rollers. The maximum allowable Mz-moment is identical in both directions for all 3 and 5 roller sliders.

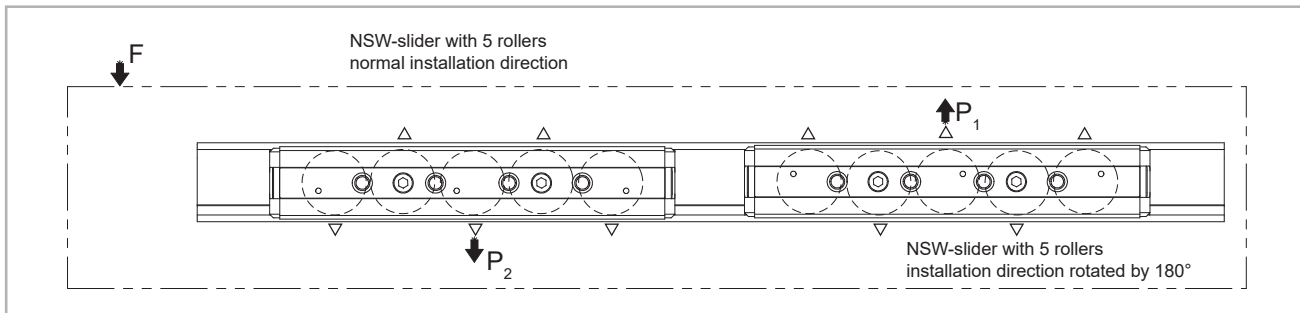### Slider with 4 rollers Configuration A
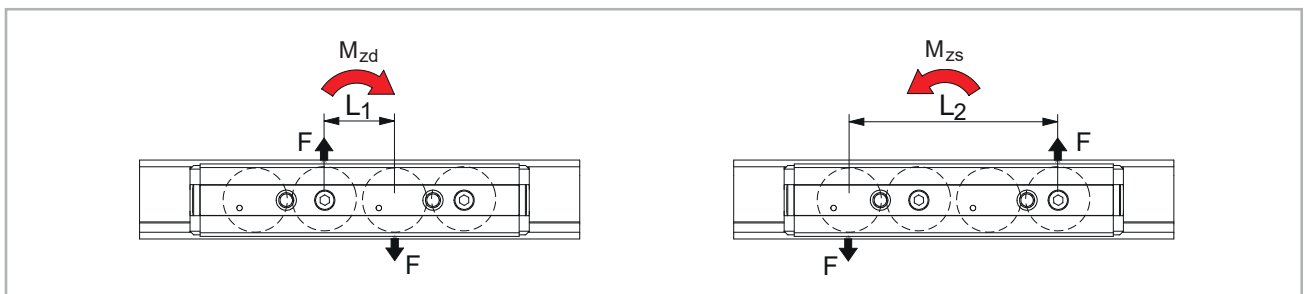
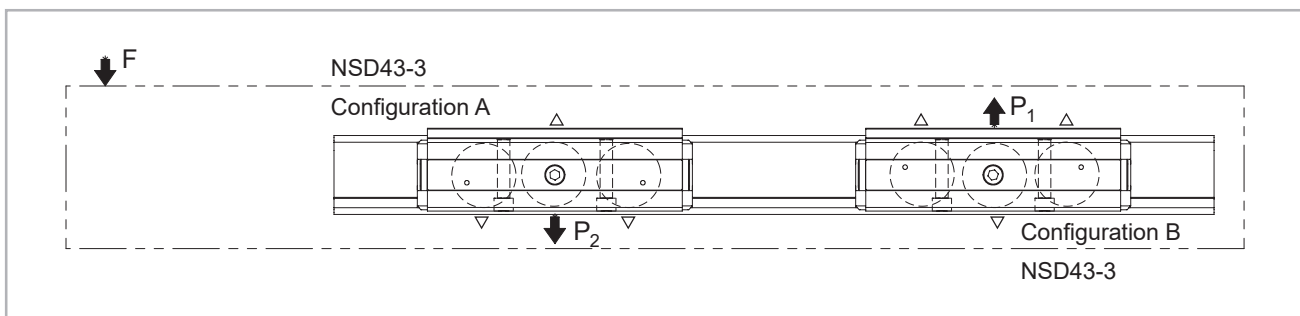### Slider with 4 rollers Configuration B
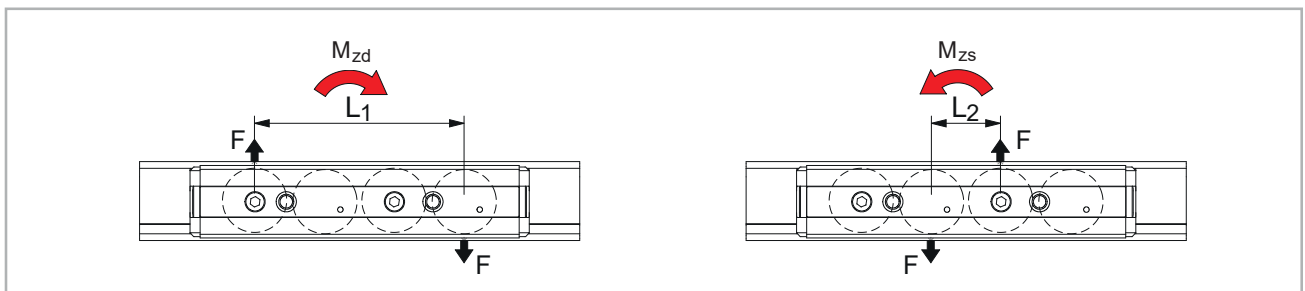
Two sliders under M_Z moment load

When an overhung load acts on an application with two sliders per rail and causes an M_Z-moment in one direction, different support reactions occur on the two sliders. For this reason, an optimal arrangement of slider configurations must be achieved to reach the maximum load capacities. In practice, when using NSW-sliders with 3 or 5 rollers, the two sliders must be installed rotated by 180° so that the slider is always loaded on the side with the highest number of rollers (with NSA sliders this is not possible due to different rail geometries). For an even number of rollers this has no effect.

## NSW-slider under load moment M_Z

NSW-slider with 5 rollers
normal installation direction

NSW-slider with 5 rollers
installation direction rotated by 180°

NSD-slider under load moment M_Z

NSD43-3

Configuration A

Configuration B

NSD43-3

## Slider configurations for various load cases

Arrangement DS
This is the recommended arrangement for use of two sliders under M_z-moment when using one rail.
Also see: Two sliders under M_z moment load.
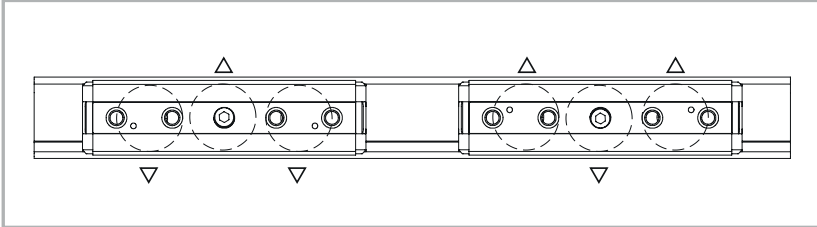
Arrangement DD
When using a pair of guide rails with two sliders each under M_z-moment load, the second system should be designed in arrangement DD. This results in the following combination: one guide rail with two sliders in arrangement DS and the other guide rail with 2 sliders in arrangement DD. This allows even load and moment distribution between the two parallel rails.
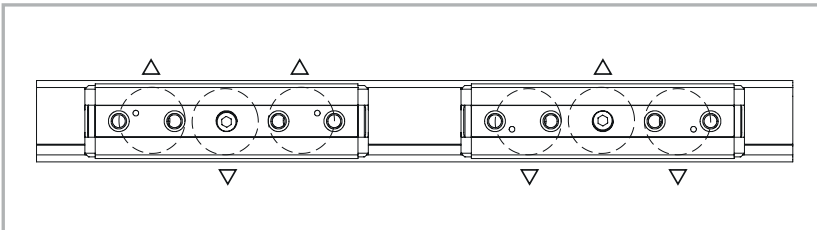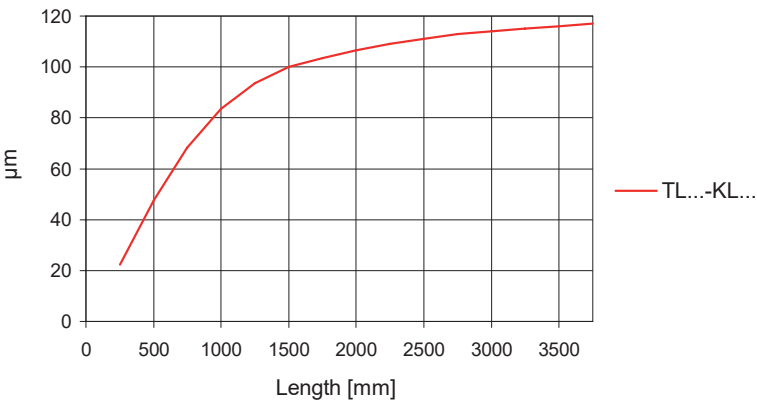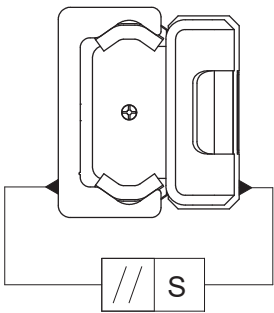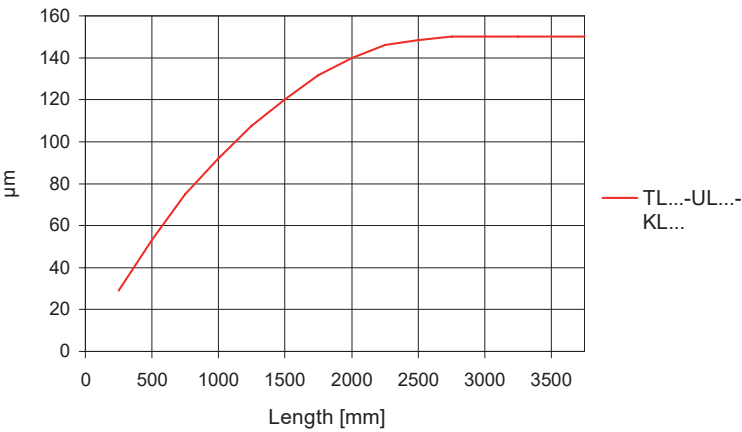

Arrangement DA
Standard arrangement if no other information is given. This arrangement is recommended if the load point is located within the two outside points of the sliders.
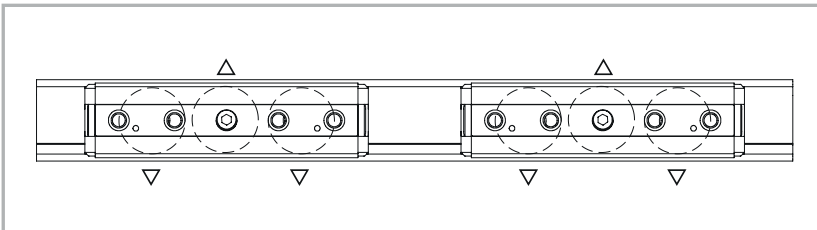
Linear accuracy

Linear accuracy is defined as the maximum deviation of the slider in the rail based on the side and support surface during straight line movement. The linear accuracy, depicted in the graphs below, applies to rails that are carefully installed with all the provided screws on a level and rigid foundation.
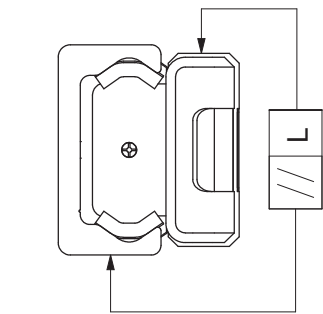
Deviation of accuracy with two 3 roller sliders in one rail

Type	TL..., UL..., KL...
ΔL (mm) Slider with equal arrangement	0,2
ΔL (mm) Slider with opposite arrangement	1,0
ΔS (mm)	0,05

Supported sides

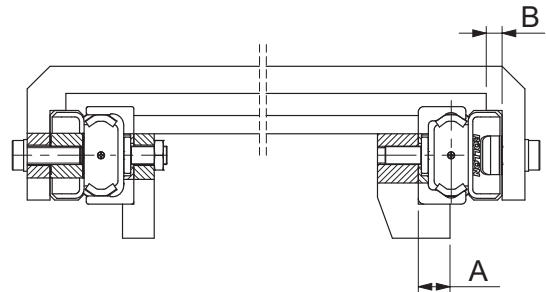If a higher system rigidity is required, a support of the rail sides is recommended, which can also be used as the reference surface. The minimum required support depth can be taken from the adjacent table.

Rail size	A (mm)	B (mm)
18	5	4
28	8	4
43	14	5
63	18	5

T+U-system tolerance compensation

Axial deviations in parallelism

This problem occurs fundamentally by insufficient precision in the axial parallelism of the mounting surfaces, which results in an excessive load on the slider and thus causes drastically reduced service life. The use of fixed bearing and compensating bearing rail (T+U-system) solves the unique problem of aligning two track, parallel guide systems. By using a T+U-system, the T-rail takes over the motion of the track while the U-rail serves as a support bearing and takes only radial forces and M_z moments.

3,9 mm

$-S_1$ $B_{min.}$ $B_{nom.}$ $+S_2$ $B_{max.}$
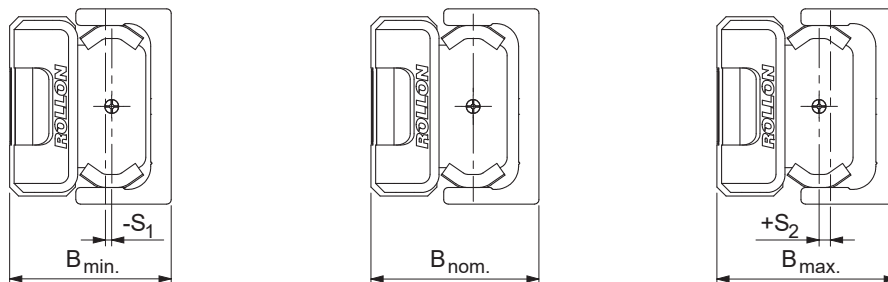
T+U-system maximum offset

U-rails have flat parallel raceways that allow free lateral movement of the sliders. The maximum axial offset that can be compensated for in each slider of the U-rail is made up of the combined values S_1 and S_2 listed in the table. Considered from a nominal value B_{nom} as the starting point, S_1 indicates the maximum offset into the rail, while S_2 represents the maximum offset towards the outside of the rail.

Slider type	S_1	S_2	B_{min}	B_{nom}	B_{max}
			mm		
NSW18	0,3	1,1	16,2	16,5	17,6
NSW28	0,6	1,3	23,3	23,9	25,2
NSW43	1,4	2,5	35,6	37	39,5
NSW63	0,4	3,5	50,1	50,5	54
CSW18	0,	1,1	14,7	15	16,1
CSW28	0,6	1,3	23,3	23,9	25,2
CSW43	1,4	2,5	35,6	37	39,5
CSW63	0,4	3,5	49,4	49,8	53,3

The application example in the adjacent drawing shows that the T+U-system implements a problem-free function of the slider even with an angled offset in the mounting surfaces.

If the length of the guide rails is known, the maximum allowable angle deviation of the screwed surfaces can be determined using this formula. (The slider in the U-rail moves here from the innermost position S_1 to outermost position S_2.)

$$\alpha = \arctan \frac{S}{L}$$

S = Sum of S_1 and S_2

L = Length of rail

The following table contains guidelines for this maximum angle deviation **α**, achievable with the longest guide rail from one piece.

Size	Rail length (mm)	Offset S (mm)	Angle α (°)
18	2000	1.4	0.040
28	3200	1.9	0.034
43	3600	3.9	0.062
63	3600	3.9	0.062

The T+U-system can be designed in different arrangements. A T-rail accepts the vertical components of load. A U-rail attached underneath the component to be guided prevents the vertical panel from swinging and is used as moment support. In addition, a vertical offset in the structure, as well as possible existing unevenness of the support surface, is compensated.

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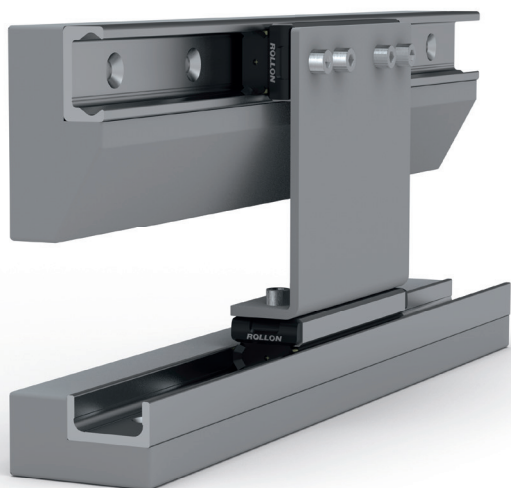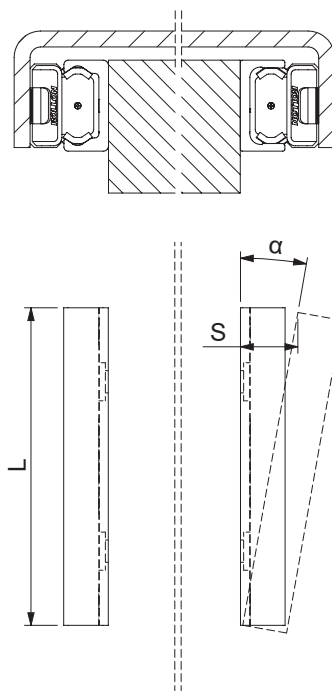
K+U-system tolerance compensation

## Deviations in parallelism in two planes

The K+U-system, like the T+U-system, can compensate for axial deviations in parallelism. Additionally, the K+U system has the option of rotating the slider in the rail, which will compensate for other deviations in parallelism, e.g. height offset.

The unique raceway contour of the K-rail allows the slider a certain rotation around its longitudinal axis, with the same linear precision as with a T-rail. With the use of a K+U-system, the K-rail accounts for the main loads and the motion of the track. The U-rail is used as a support bearing and takes only radial forces and M_z moments. The K-rail must always be installed so that the radial load of the slider is always supported by at least 2 load bearing roller sliders, which lie on the V-shaped raceway (reference line) of the rail.

K-rails and sliders are available in both sizes 43 and 63. The custom NSA-slider may only be used in K-rails and cannot be exchanged with other Compact Rail sliders. The maximum allowable rotation angle of the NSA and NSW-sliders are shown in the following table and figure. α_1 is the maximum rotation angle counterclockwise, α_2 is clockwise.

| Slider type	α_1 (°)	α_2 (°)
NSA43 and NSW43	2	2
NSA63 and NSW63	1	1

Values referred to NSW slider in U rail
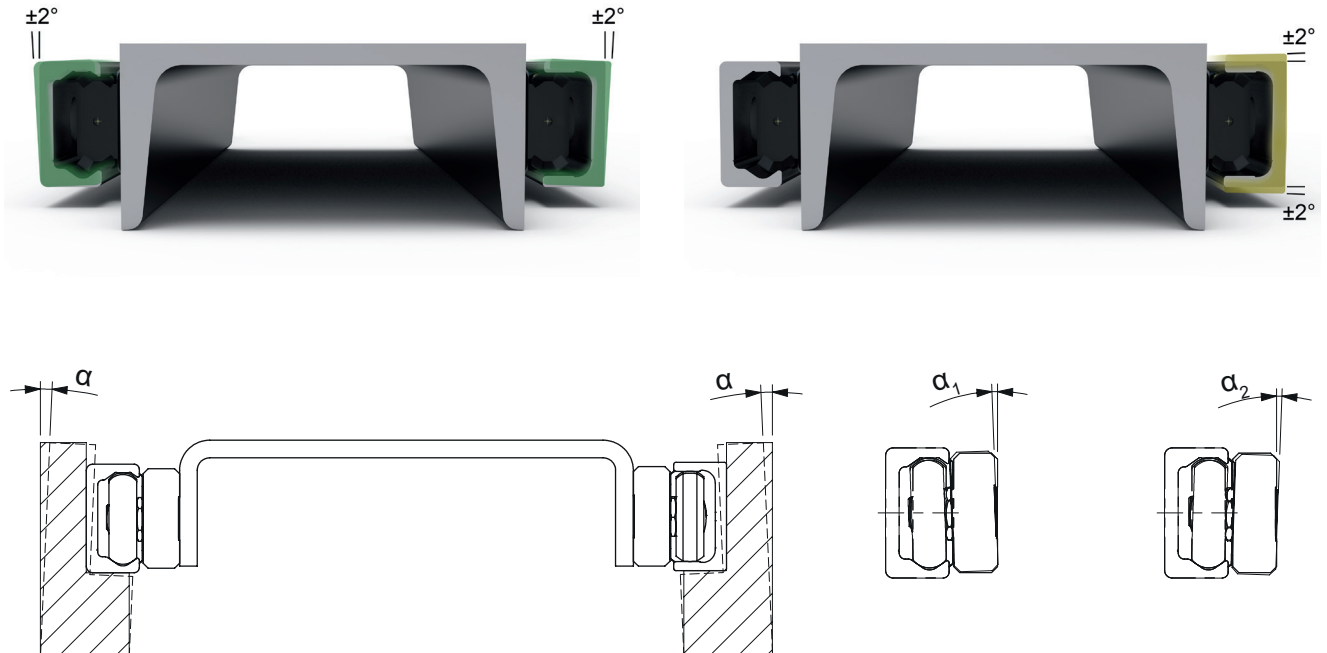
K+U-system maximum offset

It must be noted that the slider in the U-rail will turn during the movement and rotation of the slider in the K-rail to allow an axial offset. During the combined effect of these movements, you must not exceed the maximum values. If a maximum rotated NSW-slider is observed (2° for size 43 and 1° for size 63), the maximum and minimum position of the slider in the U-rail results from the values B_{0max} and B_{0min}, which are already considered by the additional rotation caused axial offset. B_{0nom} is a recommended nominal starting value for the position of a NSW-slider in the U-rail of a K+U-system.

Slider type	B_{0min} (mm)	B_{0nom} (mm)	B_{0max} (mm)
NSW43	37,6	38,85	40,1
NSW63	49,85	51,80	53,75
CSW43	37,6	38,85	40,1
CSW63	49,85	51,80	53,75

$B_{0\ min.}$ $B_{0\ nom.}$ $B_{0\ max.}$
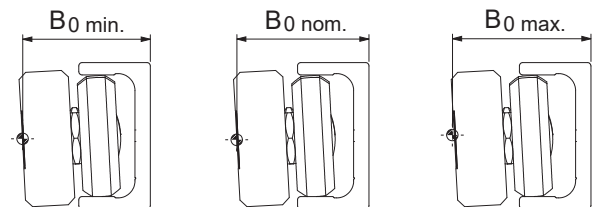
If a K-rail is used in combination with a U-rail, with guaranteed problem-free running and without extreme slider load, a pronounced height difference between the two rails can also be compensated for. The following illustration shows the maximum height offset b of the mounting surfaces in relation to the distance a of the rails.

b - maximum height offset (mm)

a - distance between the rails (mm)

Size 43
Size 63
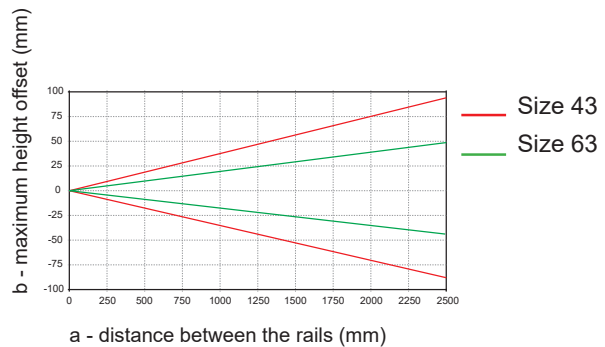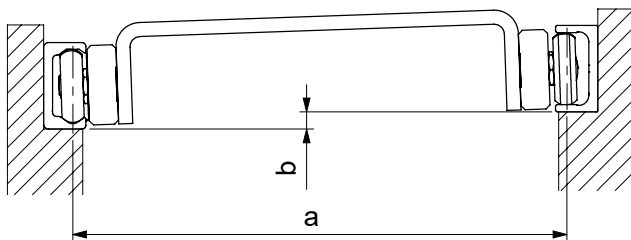
Even the K+U-system can be used in different arrangements. If the same example as with the T+U-system is observed, this solution, in addition to the prevention of vibrations and moments, also enables the compensation of larger deviations in parallelism in the vertical direction, without negative consequences to the guide. This is particularly important for longer strokes as it is more difficult to obtain a correct vertical parallelism.
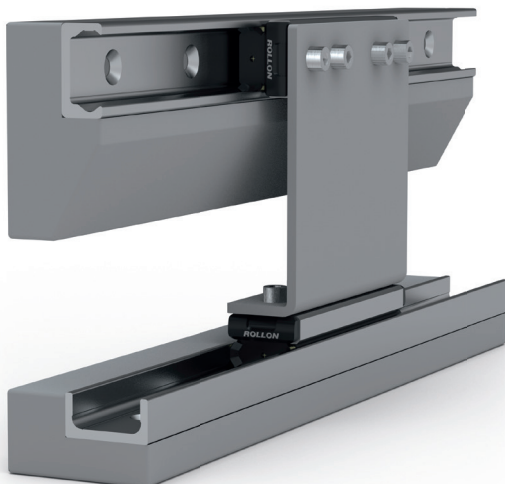
Preload

Preload classes

The factory installed systems, consisting of rails and sliders, are available in two preload classes. Standard preload K1 means a rail-slider combination with minimum preload which means the rollers are adjusted free of clearance for optimal running properties. Usually preload K2 is used for rail-slider systems for increasing the rigidity. When using a system with K2 preload a reduction of the loading capacities and service life must be taken into consideration.

This coefficient y is used in the calculation formula for checking the static load and lifetime. The interference is the difference between the contact lines of the rollers and the raceways of the rail.

| Preload class	Reduction y	Interference* (mm)	Rail type
K1	-	0.01	all
K2	0,1	0.03	T, U...18
		0.04	T, U...28
		0.06	T, U, K...43,
			T, U, K...63

*Measured on the largest interior dimension between the raceways

External preload

The unique design of the Compact Rail product family enables applying a partial external preload on selected locations along the entire guide. An external preload can be applied by pressure along the side surfaces of the guide rail according to the drawing below. This local preload results in higher rigidity only at the locations where it is necessary (e.g. on reversing points with high dynamic auxiliary forces). This partial preload increases the service life of the linear guide by avoiding a continually increased preload over the entire length of the guide. Also the required drive force of the linear carriage in the non-pre-loaded areas is reduced.

The amount of the externally applied preload is determined using two dial indicators by measuring the deformation of the rail sides. These are deformed by thrust blocks with pressure screws. The external preload must be applied when the slider is not directly located in the pressure zone.

Size	A (mm)
18	40
28	55
43	80
63	120

Dial indicator for determining the side deformation

Thrust block

Pressure screws

A minimum
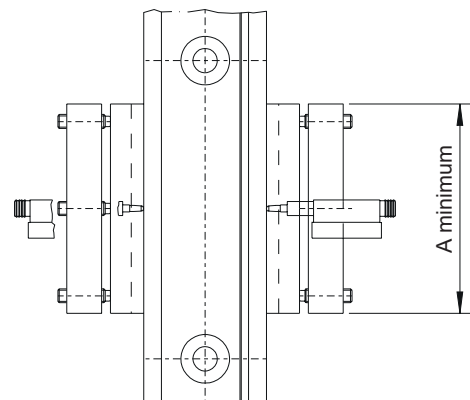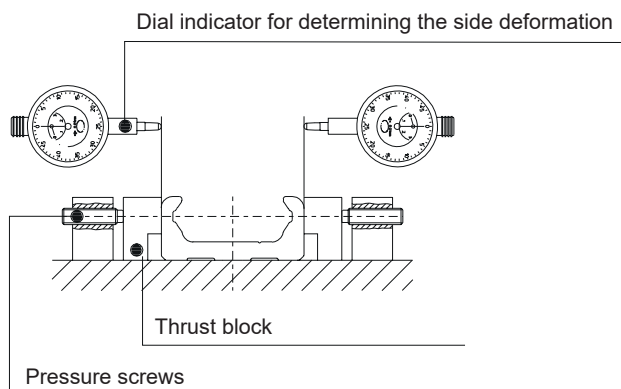
The graph below indicates the value of the equivalent load as a function of the total deformation of both rail sides. The data relates to sliders with three rollers.
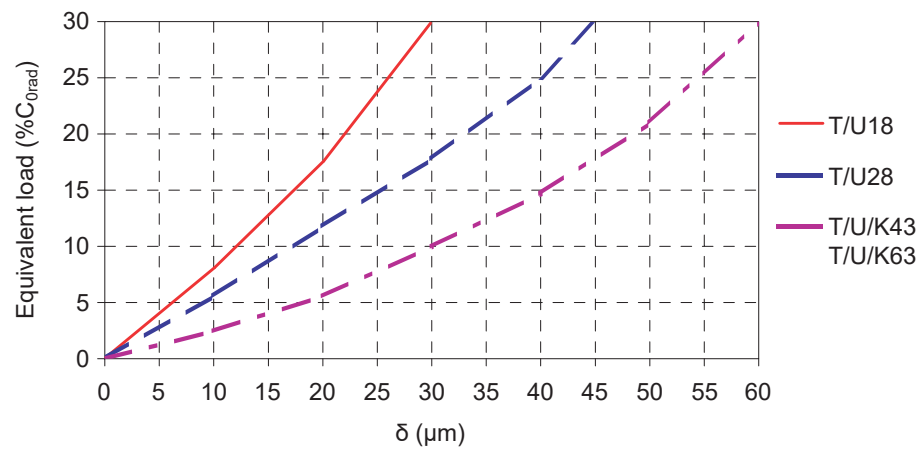
Drive force

Frictional resistance

The drive force required for moving the slider is determined by the combined resistance of the rollers, wipers and seals. The ground raceways and rollers have a minimal coefficient of friction, which remains almost the same in both the static and dynamic state. The wiper and longitudinal seals are designed for an optimum protection of the system, without a significant negative influence on the quality of motion. The overall friction of the Compact Rail also depends on external factors such as lubrication, preload and additional forces. The table below contains the co-efficients of friction for each slider type.
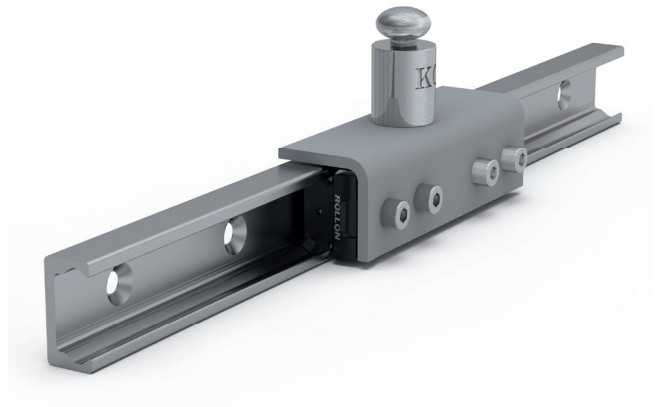
Size	μ Roller friction	μ_W Wiper friction	μ_S Friction of longitudinal seals
18	0.003	$\dfrac{\ln(m \cdot 1000)^*}{0.98 \cdot m \cdot 1000}$	0.0015
28	0.003	$\dfrac{\ln(m \cdot 1000)^*}{0.06 \cdot m \cdot 1000}$	$\dfrac{\ln(m \cdot 1000)^*}{0.15 \cdot m \cdot 1000}$
43	0.005		
63	0.006		

*Kilograms must be used for load m

The values given in the table apply to external loads, which, with sliders with three rollers, are at least 10% of the maximum load rating. For calculating the driving force for lower loads, please contact Rollco.

Calculation of drive force

The minimum required drive force for the slider is determined with the co-efficients of friction and the following formula.

$F = (\mu + \mu_w + \mu_s) \cdot m \cdot g$	m = mass (kg) g = 9.81 m/s^2

Example calculation:

If a NSW43 slider is used with a radial load of 100 kg, the result is μ = 0.005; from the formula the following is calculated:
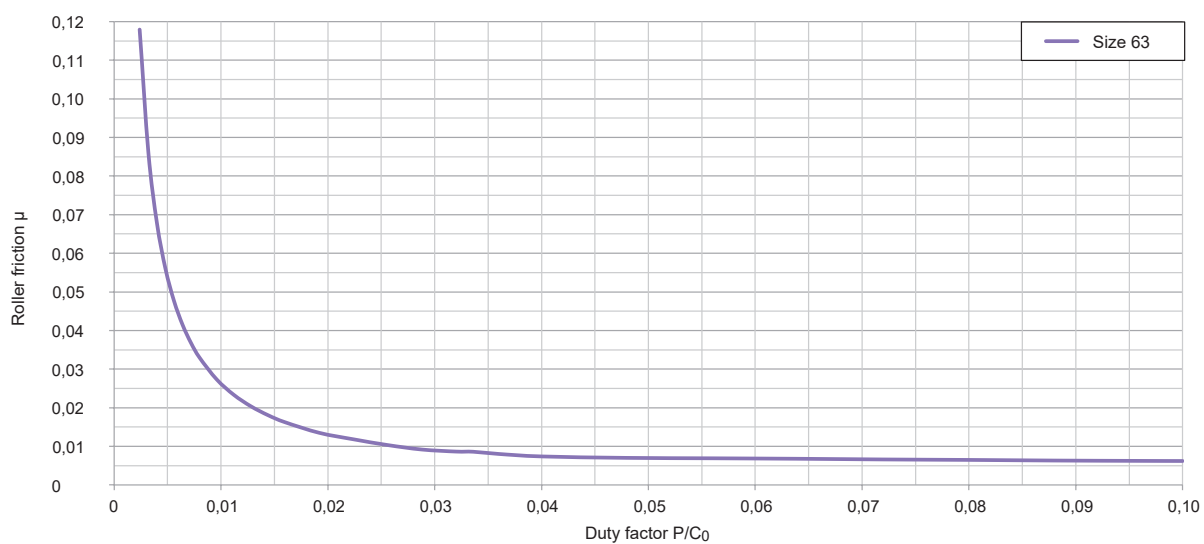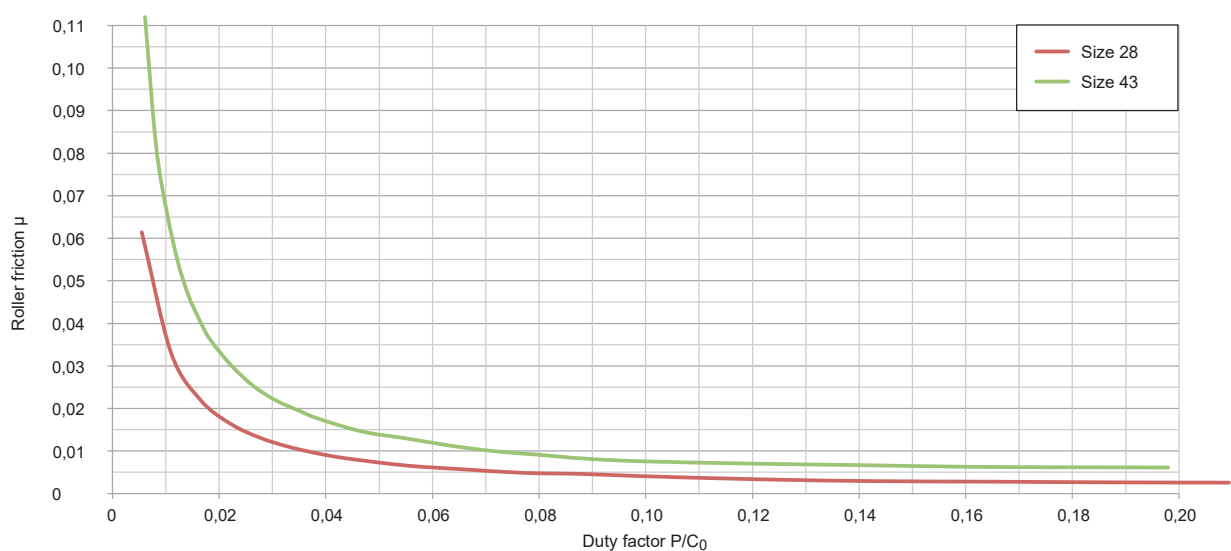
$$\mu_s = \frac{\ln(100\,000)}{0.15 \cdot 100\,000} = 0.00076$$

$$\mu_w = \frac{\ln(100\,000)}{0.06 \cdot 100\,000} = 0.0019$$

This is the minimum drive force for this example:

$$F = (0.005 + 0.0019 + 0.00076) \cdot 100 \cdot 9.81 = 7.51 \text{ N}$$

# Light load friction coefficient estimates
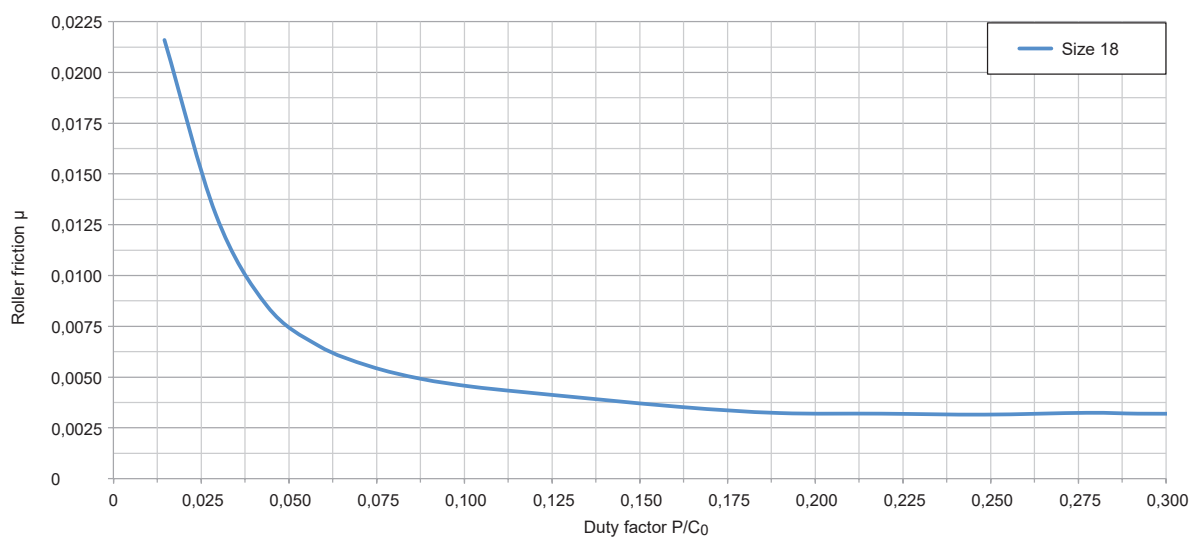
Installation instructions
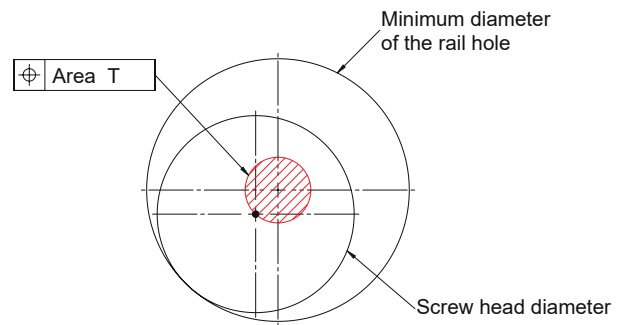
Fixing holes

V-holes with 90° bevels

The selection of rails with 90° countersunk holes is based on the precise alignment of the threaded holes for installation. Here the complex alignment of the rail to an external reference is omitted, since the rail aligns during installation by the self-centering of the countersunk screws on the existing hole pattern.
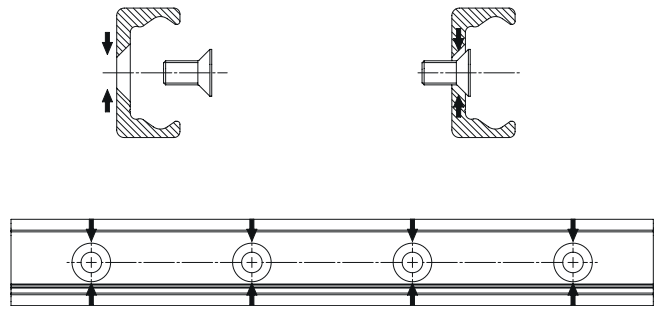
C-holes with cylindrical counterbore

When a rail with counterbored holes is delivered, the Torx® screws are provided in the right quantity. The cylindrical screw has, as shown, some play in the countersunk fixing hole, so that an optimum alignment of the rail can be achieved during installation. The area T is the diameter of the possible offset, in which the screw center point can move during the precise alignment.

Rail type	Area T (mm)
TLC18 - ULC18	Ø 1.0
TLC28 - ULC28	Ø 1.0
TLC43 - ULC43 - KLC43	Ø 2.0
TLC63 - ULC63 - KLC63	Ø 0.5

Chamfers

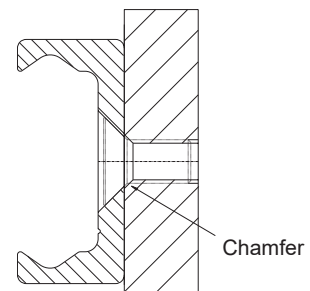Chamfers must be made for both C-holes and V-holes rails. The minimum chamfers on the fixing threads are listed on the table below.

Size	Chamfer C-holes (mm)	Chamfer V-holes (mm)
18	0.5 x 45°	0.5 x 45°
28	0.6 x 45°	1 x 45°
43	1 x 45°	1 x 45°
63	0.5 x 45°	1 x 45°

Example for fixing with Torx® screws (custom design)

Chamfer
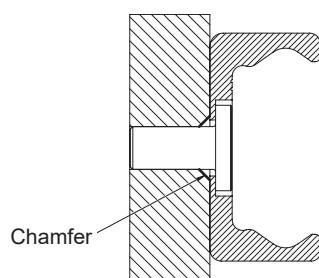
Example for fixing with countersunk screws

Chamfer

Adjusting the sliders

Normally the linear guides are delivered as a system consisting of rail and adjusted sliders. If rail and slider are delivered separately or if the slider is installed in another raceway, the preload must be set again.
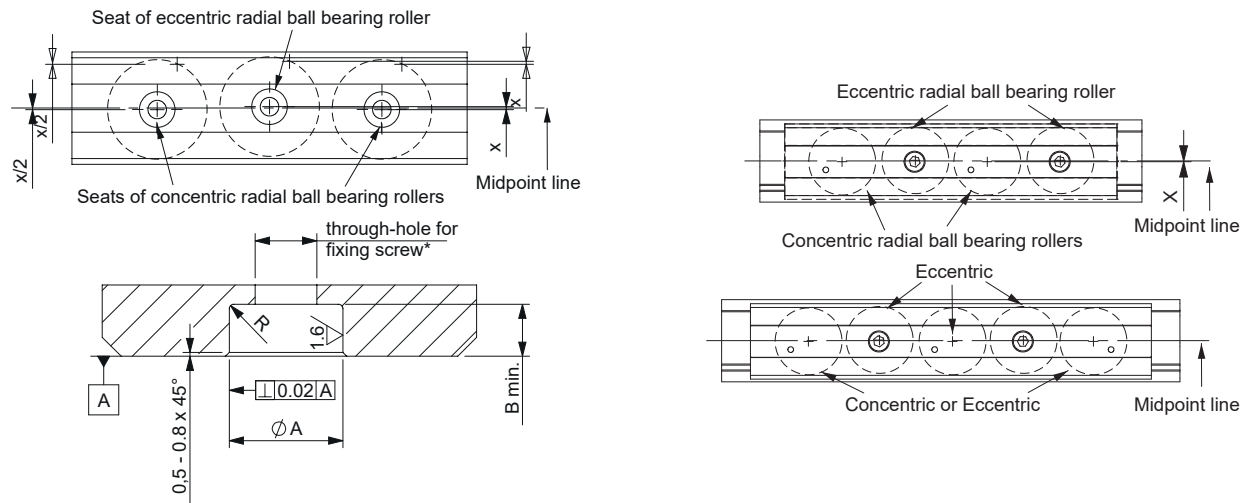
Setting the preload:

1. Verify that the raceways are clean and take the wipers off to obtain a more sensitive feeling for correct preload setting.
2. Insert the slider in the rail. Slightly loosen the fixing screws of the roller pins (no marking) to be adjusted.
3. Position the slider on one end of the rail.
4. For the U rails there must be a thin support (e.g. set key) under the ends of the slider body to ensure the horizontal alignment of the slider in the flat raceways.
5. Insert the included special flat wrench from the side between the rail and the slider. Take care to insert it from one end of the slider, slip it under the lateral sealing and then slide it until the eccentric roller to be adjusted is reached.
6. By turning the flat key clockwise, the roller to be adjusted is pressed against the upper track and the slider is then without play. Avoid a preload that is too high. It generates increased wear and reduces the service life.
7. While holding the correct position of the roller with the adjustment key, the fixing screw can be carefully tightened. The exact tightening torque will be checked later (see fig. and table below).
8. Move the slider in the rail and check the preload over the entire length of the rail. It should move easily and the slider should not have play at any location of the rail.
9. For sliders with more than 3 rollers, repeat this process with each eccentric roller. Make sure that all rollers have even contact to the tracks.
10. Now tighten the fixing screws with the specified tightening torque from the table while the flat key holds the angle adjustment of the pin. A special thread in the roller pin secures the set position.
11. Ensure proper lubrication of the raceways.

Slider size	Tightening torque (Nm)
18	3
28	7
43	12
63	35

While holding the correct position of the roller with the adjustment key, the fixing screw can be carefully tightened. Tightening torque, see table above).

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Use of radial ball bearing rollers

Seat of eccentric radial ball bearing roller

Seats of concentric radial ball bearing rollers

Midpoint line

through-hole for fixing screw*

R

1.6

A

0.5 - 0.8 x 45°

0.02 A

Ø A

B min.

Eccentric radial ball bearing roller

Concentric radial ball bearing rollers

Midpoint line

Eccentric

Concentric or Eccentric

Midpoint line

If purchasing "Radial ball bearing rollers" to install on your own structure we advise:

• Using a maximum of 2 concentric radial ball bearing rollers.
• Offset the seats of the concentric radial ball bearing rollers with respect to those of the eccentric radial ball bearing rollers according to the table.

| Slider size	X (mm)	Ø A (mm)	B min. (mm)	Radius R (mm)
18	0.30	6 + 0.025/+0.01	2.1	0.5
28	0.64	10 + 0.03/+0.01	4.0	0.5
43	0.72	12 + 0.05/+0.02	5.5	1
63	0.55	18 + 0.02/-0.02	7	1

Installing the single rail

The T- and K-rails can be installed in two positions relative to the external force. For axial loading of the slider (see pos. 2 in fig. below), the load capacity is reduced because of the decline in contact area caused by the change in position. Therefore, the rails should be installed in such a way that the load on the rollers acts in the radial direction (pos. 1 in fig. below). The number of fixing holes in the rail in combination with screws of property class 10.9 is dimensioned in accordance with the load capacity values. For critical applications with vibrations or higher demand for rigidity, a support of the rail (pos. 3 in fig. below) is advantageous.

This reduces deformation of the sides and the load on the screws. The installation of a rail with countersunk holes requires an external reference for alignment. This reference can also be used simultaneously as rail support if required. All information in this section on alignment of the rails, refers to rails with counterbored holes. Rails with countersunk holes self-align using the specified fixing hole pattern.
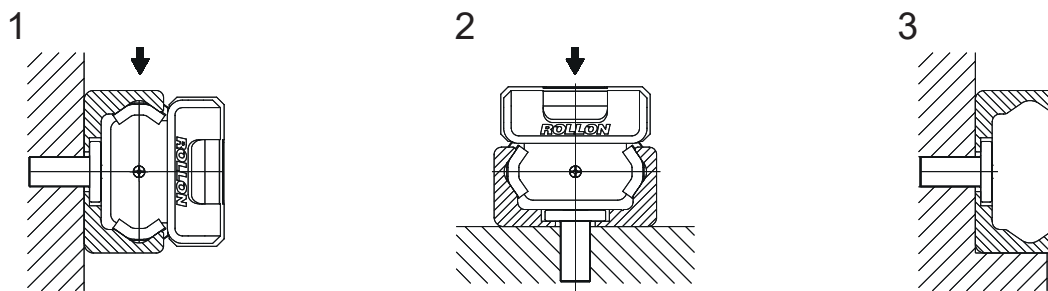
## Rail installation with reference surface as support

1. Remove unevenness, burrs and dirt from the support surface.
2. Press the rail against the support surface and insert all screws without tightening them.
3. Start tightening the fixing screws to the specified torque on one end of the rail while continuing to hold pressure on the rail against the support surface.
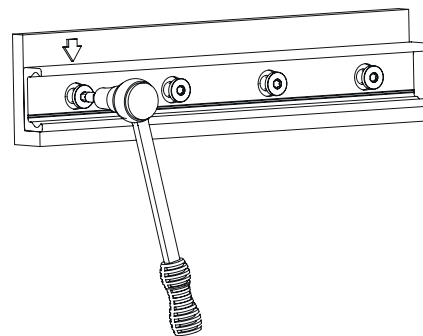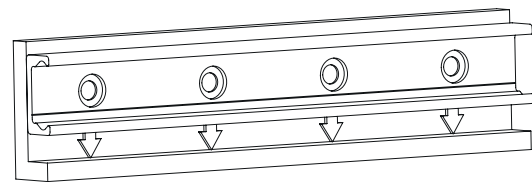
Screw type	Torx® tightening torque (Nm)	Countersunk tightening torque (Nm)
M4 (T..., U... 18)	3	3
M5 (T..., U... 28)	9	6
M8 (T..., U..., K... 43)	22	25
M8 (T..., U..., K... 63)	35	30

Rail installation without support

1. Carefully lay the guide rail with installed slider on the mounting surface and slightly tighten the fixing screws so that the guide rail lightly touches the mounting surface.

2. Install a dial indicator so that the offset of the rail to a reference line can be measured.
    Now position the slider in the center of the rail and set the dial indicator to zero. Move the slider back and forth between each two hole spacings and carefully align the rail. Fasten the three center screws of this area now with the the specified tightening torque, see fig. to the right.

3. Now position the slider on one end of the rail and carefully align the rail to zero on the dial indicator.

4. Begin to tighten the screws as specified while moving the slider together with the dial indicator. Make sure that it does not show any significant deflection. Repeat this procedure from the other end of the rail.
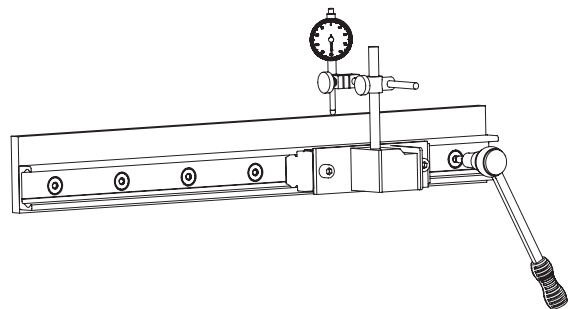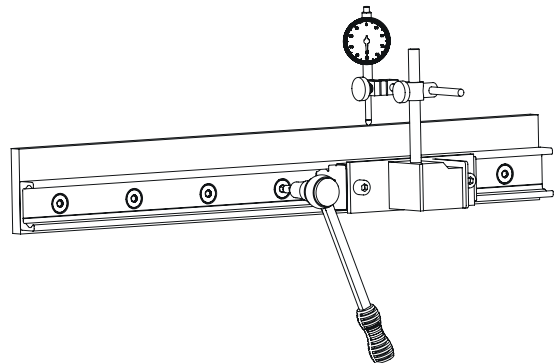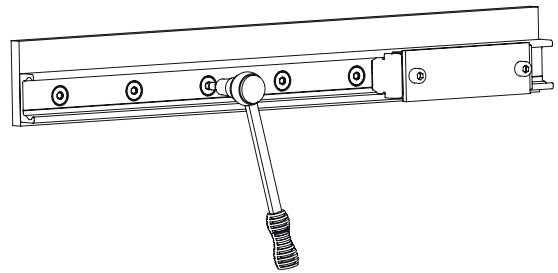
Parallel installation of two rails

If two T-rails or a T+U-system are installed, the height difference of the two rails must not exceed a certain value (obtainable from the table below) in order to ensure proper guiding. These maximum values result from the ma-ximum allowable twisting angle of the rollers in the raceways (see tab. below). These values account for a load capacity reduction of 30% on the T-rail and must absolutely be maintained in every case.

Size	α
18	1 mrad (0.057°)
28	2.5 mrad (0.143°)
43	3 mrad (0.171°)
63	5 mrad (0.286°)

Example:
NSW43: if a = 500 mm; b= a*tanα = 1.5 mm

Two Parallel T-rails

When using two T-rails, the maximum parallelism deviation must not be exceeded. Otherwise stresses can occur, which can result in a reduction in load capacity and service life.

| Size	K1	K2
18	0.03	0.02
28	0.04	0.03
43	0.05	0.04
63	0.06	0.05

Note: For parallelism problems, it is recommended to use a T+U or K+U system, since these combinations compensate for inaccuracies.
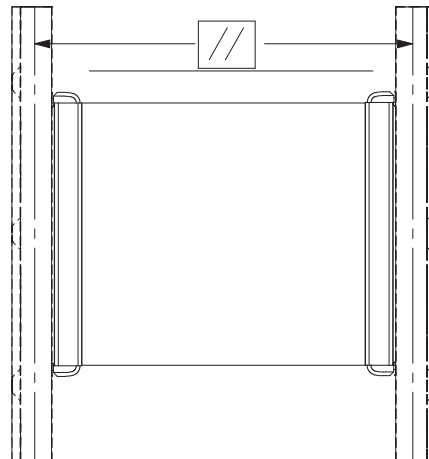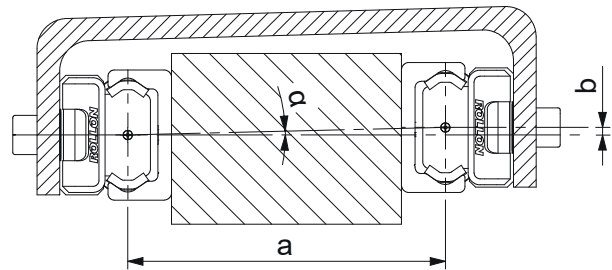
Parallel installation of two T-rails

A

1. Clean chips and dirt from the prepared mounting surfaces and fasten the first rail as described in the section on installation of a single rail.

2. Fasten the second rail on the ends and the center. Tighten the screws in Position A and measure the distance between the raceways of the two rails.

B

3. Fasten the rail in Position B so that the distance between the raceways does not exceed the measured values in Position A while maintaining the tolerances for parallel rail installation.

4. Fasten the screw in Position C so that the distance of the raceways is as close to an average between the two values from A and B as possible.

5. Fasten all other screws and check the specified tightening torque of all fixing screws.

C
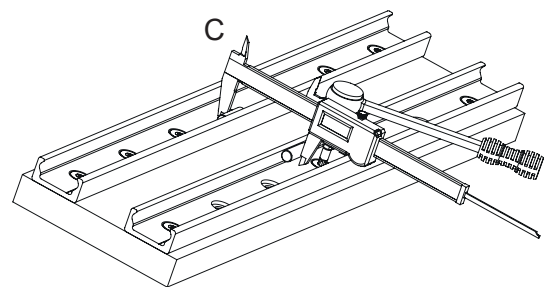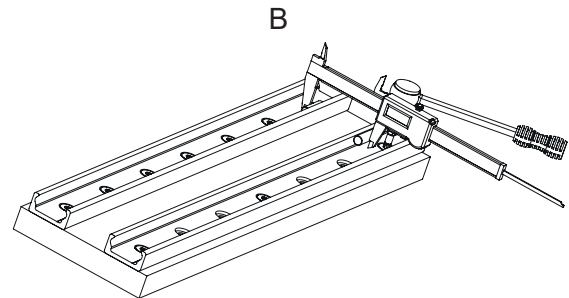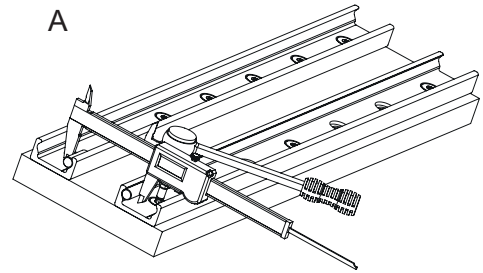
Installation of the T+U- or the K+U-system

When using a two-track parallel linear guide we recommend the use of a fixed bearing / compensating bearing system: The combination of T+U-rails for compensation of deviations in parallelism or the K+U-system to compensate for deviations in parallelism in two planes.

Installation steps

1. For a fixed bearing / compensating bearing system the fixed bearing rail is always installed first. This is then used as a reference for the compensating bearing rail. Then proceed as described in the section on installation of a single rail.

2. Install the compensating bearing rail and only tighten the fixing screws slightly.

3. Insert the sliders in the rails and install the element to be moved, without tightening its screws.

4. Insert the element in the center of the rails and tighten it, use screws class 10.9.

5. Tighten the center rail fixing screws to the specified torque.

6. Move the element to one end of the rail and start tightening the rest of the screws in the direction away from the slider.
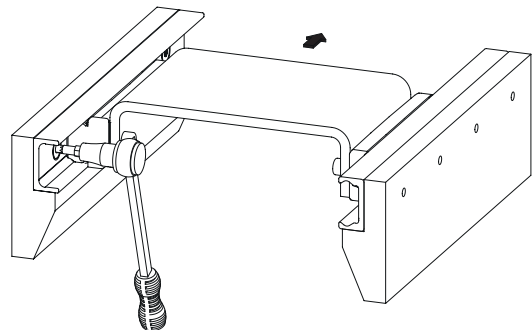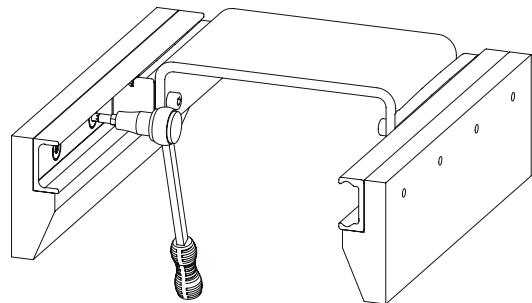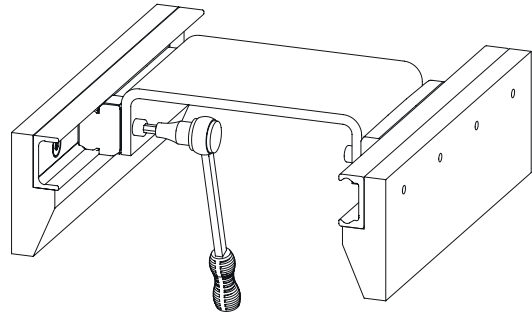
Joined rails

If long guide rails are required, two or more rails can be joined to the desired length. When putting guide rails together, be sure that the register marks shown in fig. below are positioned correctly.

For applications with parallel joined guide rails we suggest them to be fabricated asymmetric.
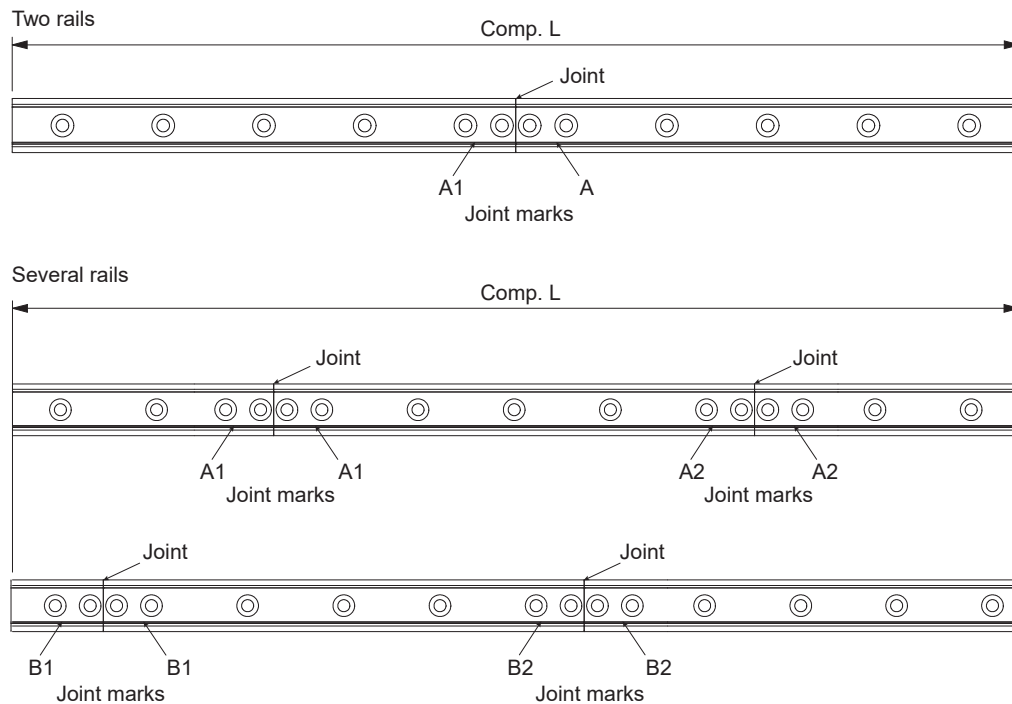
General information
See product description for the maximum available rail length in one piece. Longer lengths are achieved by joining two or more rails (joined rails).

We then machine the rail ends at a right angle to the impact surface and mark them. Additional fixing screws are included with the delivery, which ensure a problem-free transition of the slider over the joints, if the following installation procedures are followed. Two additional threaded holes (see fig.) are required in the load-bearing structure. The included end fixing screws correspond to the installation screws for the rails for cylindrical counterbores. The joining rail alignment fixture for aligning the rail joint can be ordered.
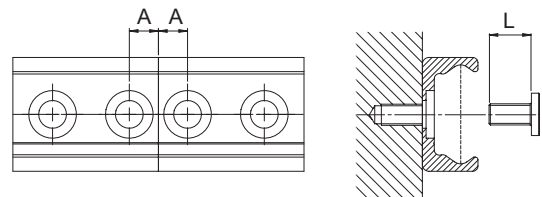
Rail type	A (mm)	Threaded hole (load-bearing structure)	L (mm)	Alignment fixture
T..., U...18	7	M4	8	AT18
T..., U...28	8	M5	10	AT28
T..., U...43	11	M8	16	AT43
T..., U...63	8	M8	20	AT63
K...43	11	M8	16	AK43
K...63	8	M8	20	AK63

Installation of joined rails

After the fixing holes for the rails are made in the load-bearing structure, the joined rails can be installed according to the following procedure:

1. Fix the individual rails on the mounting surface by tightening all screws except for each last one on the rail joint.

2. Install the end fixing screws without tightening them (see fig. to the right).

3. Place the alignment fixture on the rail joint and tighten both set screws uniformly, until the raceways are aligned.

4. After the previous step (3) it must be checked if both rail backs lie evenly on the mounting surface. If a gap has formed there, this must be shimmed.

5. The bottom of the rails should be supported in the area of the transition. Here a possible existing gap must be looked for, which must be closed for correct support of the rail ends by shims.

6. Insert the key through the holes in the alignment fixture and tighten the screws on the rail ends.

7. For rails with 90° countersunk holes, tighten the remaining screws starting from the rail joint in the direction of the rail center. For rails with cylindrical counter-sunk holes, first adjust the rail to an external reference, then proceed as described above.

8. Remove the alignment fixture from the rail.
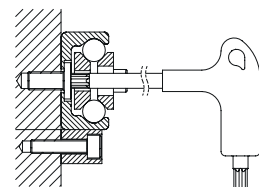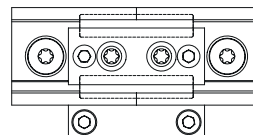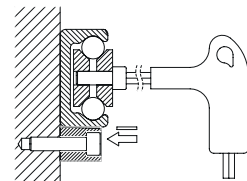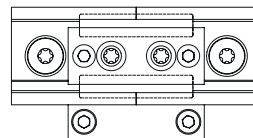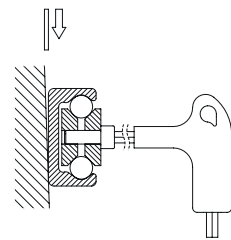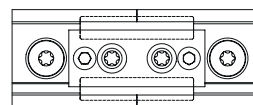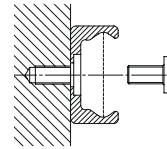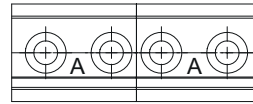
Offset of fixing holes

Principle representation of offset
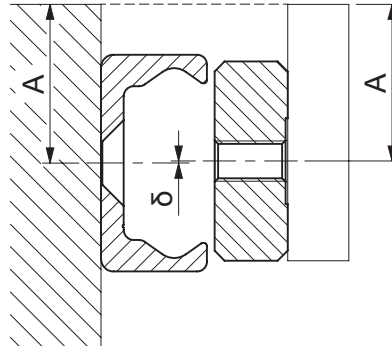
Configueration	Size	δ nominal (mm)	δ maximum (mm)	δ minimum (mm)
TLC / NSW	18	0	+0.5	-0.5
TLC / NSW	28	0	+0.5	-0.5
TLC / NSW	43	0	+0.6	-0.6
TLC / NSW	63	0	+0.65	-0.65
KLC / NSA	43	0	+0.6	-0.6
KLC / NSA	63	0	+0.65	-0.65
ULC / NSW	18	0	+0.5	-0.5
ULC / NSW	28	0	+0.5	-0.5
ULC / NSW	43	0	+0.6	-0.6
ULC / NSW	63	0	+0.65	-0.65
TLV /NSW	18	0	+0.35	-0.35
TLV /NSW	28	0	+0.35	-0.35
TLV /NSW	43	0	+0.45	-0.45
TLV /NSW	63	0	+0.5	-0.5
KLV / NSA	43	0	+0.45	-0.45
KLV / NSA	63	0	+0.5	-0.5
ULV / NSW	18	0	+0.35	-0.35
ULV / NSW	28	0	+0.35	-0.35
ULV / NSW	43	0	+0.45	-0.45
ULV / NSW	63	0	+0.5	-0.5
TLC / CSW	18	0.35	0.75	-0.2
TLC / CSW	28	0.25	0.6	-0.35
TLC / CSW	43	0.35	0.8	-0.35
TLC / CSW	63	0.35	0.6	-0.35
KLC / CSWK	43	0.35	0.8	-0.35
KLC / CSWK	63	0.35	0.6	-0.35
ULC / CSW	18	0.3	0.7	-0.2
ULC / CSW	28	0.3	0.6	-0.3
ULC / CSW	43	0.4	0.75	-0.35
ULC / CSW	63	0.35	0.6	-0.25

Configueration	Size	δ nominal (mm)	δ maximum (mm)	δ minimum (mm)
TLV / CSW	18	0.35	0.6	-0.15
TLV / CSW	28	0.25	0.45	-0.3
TLV / CSW	43	0.35	0.65	-0.3
TLV / CSW	63	0.35	0.45	-0.35
KLV / CSWK	43	0.35	0.65	-0.3
KLV / CSWK	63	0.35	0.45	-0.35
ULV / CSW	18	0.3	0.55	-0.15
ULV / CSW	28	0.3	0.45	-0.25
ULV / CSW	43	0.4	0.6	-0.3
ULV / CSW	63	0.35	0.45	-0.25

ROLLCO

Lubrication

Roller pin lubrication

The bearings inside the rollers are lubricated for life. To reach the calculated service life, a film of lubricant should always be present between the raceway and roller, this also serves to protect against corrosion of the ground raceways.

Lubrication of the raceways

Proper lubrication during normal conditions:

- Reduces friction
- Reduces wear
- Reduces the load of the contact surfaces through elastic deformations
- Reduces running noise

Slider lubrication N-sliders

The NS-sliders are equipped with wiper heads that include lubricated felts which slowly release oil on the raceways for a long time. The wiper heads can be recharged from the front through a dedicated access hole by means of an oiling syringe.

The durability of the lubrication delivered by the wiper heads depends on the conditions of use. In the normal clean indoor applications, it is suggested to refill the oil every 0.5 million of cycles, 1000 km or 1 year of use, based on the value reached first. In different conditions, it could be necessary to refill more often, depending on the level of environment criticity. In case of severe dust and dirt conditions, it is suggested to change the entire wiper head with a new one.

When refilling the oil or the substituting the wiper heads, it is recommended to clean the raceways of the guide.

Lubricant	Thickening agent	Temperature range (°C)	Kinematic viscosity 40°C (mm^2/s)
Mineral oil	Lithium soap	-20… to +120	Approx 110

C-slider lubrication

Lubrication when using C-sliders

The C series sliders can be provided with wipers made of polyamide to remove contaminants on the raceways. Since the sliders do not have a self-lubrication kit, manual lubrication of the raceways is required. A guideline is to lubricate the raceways every 100 km or every 6 months. We recommend a roller bearing lubricant with a lithium base of average consistency (see table below).

Lubricant	Thickening agent	Temperature range (°C)	Kinematic viscosity 40°C (mm²/s)
Roller bearing lubricant	Lithium soap	-20... to +170	Approx 160

Different lubricants are available on request for special applications:

• FDA-approved lubricant for use in the food industry
• Specific lubricant for clean rooms
• Specific lubricant for the marine technology sector
• Specific lubricant for high and low temperatures

For specific information, contact Rollco.

Corrosion protection

All rails and slider bodies have a standard corrosion protection system by means of electrolytic-zinc plating according to ISO 2081. If increased corrosion protection is required, application-specific surface treatments are available upon request for rails and slider bodies e.g. approved nickel plated for use in the food industry. In this case, the chosen treatment must be specified in the order for both rails and sliders using the appropriate code shown in the table below. For more information contact Rollco.

Treatment	Characteristics
Zinc Plating ISO 2081 (standard)	Standard treatment for all sizes of rails and slider bodies, it is ideal for indoor applications. When applied to the rail, it is removed from the raceways by the subsequent grinding process. Zinc-plated sliders are supplied with steel rollers.
Aloy (Y) (extra cost)	Electrolytic plating with high resistance passivation, ideal for outdoor applications. When applied to the rail, it is removed from the raceways by the subsequent grinding process. Sliders ordered with Aloy treatment are supplied with stainless steel rollers to further increase the corrosion resistance.
E-coating (K) (extra cost)	As zinc-plated version with additional electro painting that provides a fine black finishing to the entire rail. When applied to the rail, the slider can partially remove the coating from the raceways on the running contact point after a period of use. Sliders ordered with E-Coating are supplied with stainless steel rollers to further increase the corrosion resistance.
Nickel Plating (N) (extra cost)	Provides high resistance to chemical corrosion and is ideal for applications in medical or food related environments. When applied to the rail, raceways are coated too. Sliders ordered with Nickel Plating treatment are supplied with stainless steel rollers to further increase the corrosion resistance.

Speed and acceleration

The Compact Rail product family is suitable for high operating speeds and accelerations.

Size	Speed (m/s)	Acceleration (m/s²)
18	3	10
28	5	15
43	7	15
63	9	20

Operating temperatures

The temperature range for continuous operation is:
-20 °C / +120 °C with occasional peaks up to +150 °C.

Calculation formulas

Static load

The radial load capacity rating, C_{0rad} the axial load capacity rating C_{0ax}, and moments M_x, M_y, M_z indicate the maximum permissible values of the load. Higher loads will have a detrimental effect on the running quality. A safety factor, S_0, is used to check the static load, which takes into account the basic parameters of the application and is defined more in detail in the following table:

Safety factor S_0

No shock nor vibration, smooth and low-frequency reverse, high assembly accuracy, no elastic deformations	1 - 1.5
Normal installation conditions	1.5 - 2
Shock and vibration, high-frequency reverse, significant elastic deformation	2 - 3.5

The ratio of the actual load to maximum permissible load may be as large as the reciprocal of the accepted safety factor, S_0, at the most.

$$\frac{P_{0rad}}{C_{0rad}} \leq \frac{1}{S_0} \qquad \frac{P_{0ax}}{C_{0ax}} \leq \frac{1}{S_0} \qquad \frac{M_1}{M_x} \leq \frac{1}{S_0} \qquad \frac{M_2}{M_y} \leq \frac{1}{S_0} \qquad \frac{M_3}{M_z} \leq \frac{1}{S_0}$$

The above formulas are valid for a single load case. If two or more forces are acting simultaneously, please check the following formula:

$$\frac{P_{0rad}}{C_{0rad}} + \frac{P_{0ax}}{C_{0ax}} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z} + y \leq \frac{1}{S_0}$$

P_{0rad} = effective radial load (N)
C_{0rad} = permissible radial load (N)
P_{0ax} = effective axial load (N)
C_{0ax} = permissible axial load (N)
$M_1, M_2, M_3,$ = external moments (Nm)
$M_x, M_y, M_z,$ = maximum permissible moments
     in the different loading directions (Nm)
y = reduction due to preload

The safety factor S_0 can lie on the lower given limit if the occurring forces can be determined with sufficient precision. If shock and vibration are present, the higher value should be selected. For dynamic applications higher safety is required. Please contact Rollco for technical support.

Slider load

Examples of formulas for determining the forces on the most heavily loaded slider

Horizontal movement
Static test
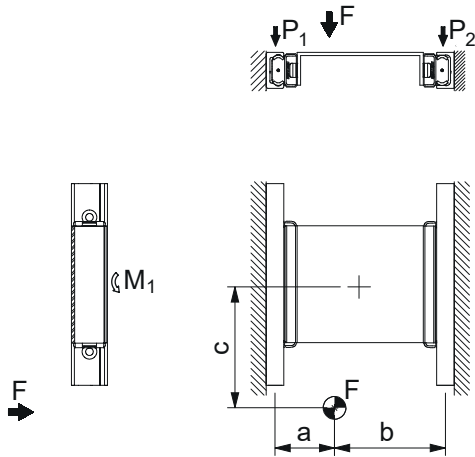
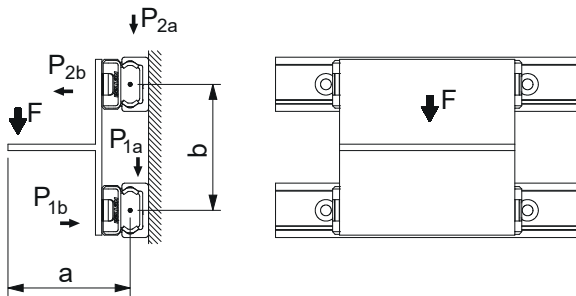**Slider load:**

$$P_1 = F \cdot \frac{b}{a+b}$$

$$P_2 = F - P_1$$

in addition each slider is
loaded by a moment:

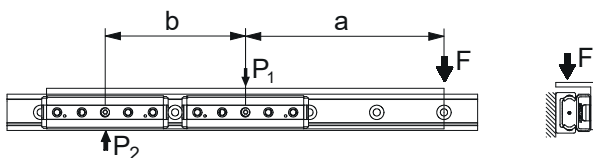$$M_1 = \frac{F}{2} \cdot C$$

Horizontal movement
Static test

Slider load:

$$P_{1a} \cong P_{2a} = \frac{F}{2}$$

$$P_{2b} \cong P_{1b} = F \cdot \frac{a}{b}$$
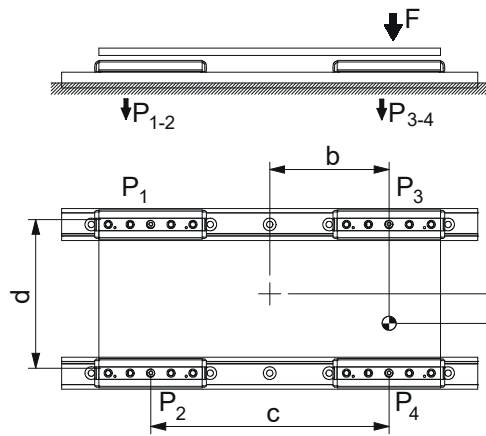
Horizontal movement
Static test

Slider load:

$$P_2 = F \cdot \frac{a}{b}$$

$$P_1 = P_2 + F$$

Note: Applies only if the distance between centers of
the sliders b > 2x slider length

Horizontal movement
Static test

Note: It is defined that slider no. 4 is always located closest to the point where the force is applied.

Slider load:

$$P_1 = \frac{F}{4} \left(\frac{F}{2} \cdot \frac{b}{c} \right) - \left(\frac{F}{2} \cdot \frac{a}{d} \right)$$
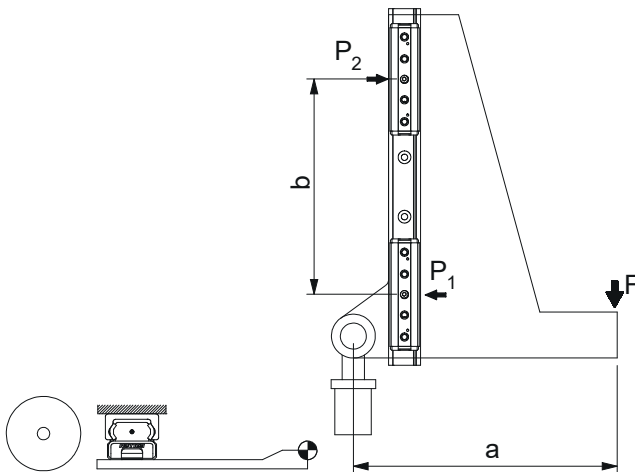
$$P_2 = \frac{F}{4} \left(\frac{F}{2} \cdot \frac{b}{c} \right) + \left(\frac{F}{2} \cdot \frac{a}{d} \right)$$

$$P_3 = \frac{F}{4} \left(\frac{F}{2} \cdot \frac{b}{c} \right) - \left(\frac{F}{2} \cdot \frac{a}{d} \right)$$

$$P_4 = \frac{F}{4} \left(\frac{F}{2} \cdot \frac{b}{c} \right) + \left(\frac{F}{2} \cdot \frac{a}{d} \right)$$

Vertical movement
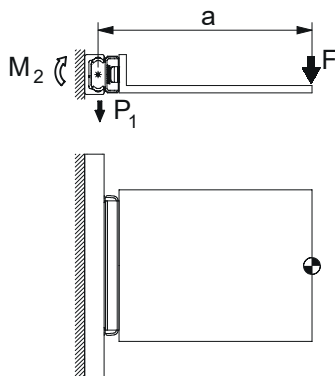Static test

Slider load:

$$P_1 \cong P_2 = F \cdot \frac{a}{b}$$

Note: Applies only if the distance between centers of the sliders b > 2x slider length
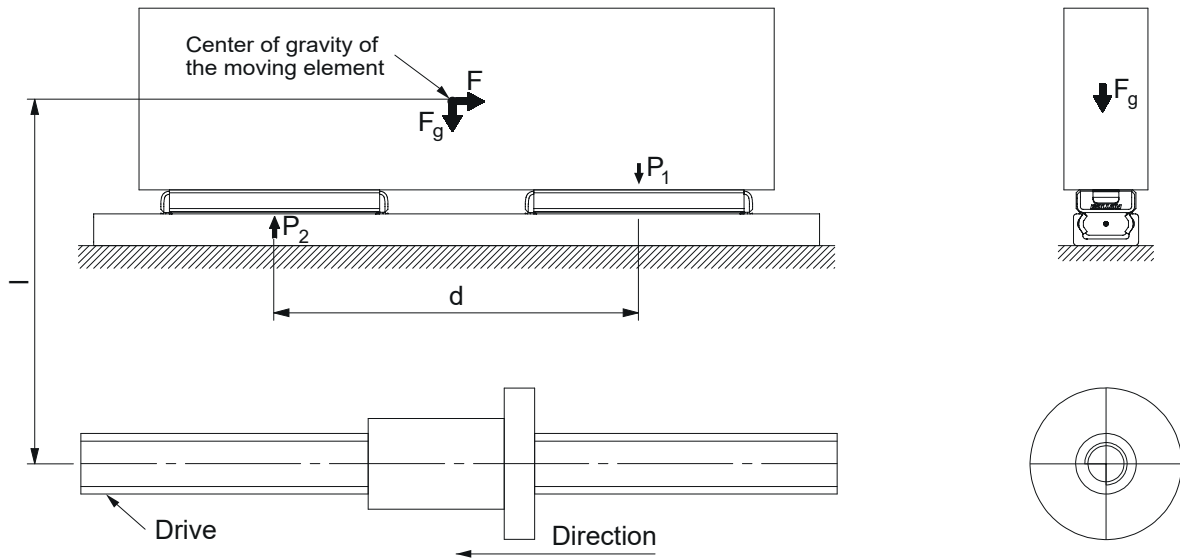
Horizontal movement
Static test

Slider load:

$$P_1 = F$$

$$M_2 = F \cdot a$$

Horizontal movement

Test with a moving element of the weight-force Fg at the instant the direction of movement changes

Inertial force

$$F = m \cdot a$$

Slider load at time of reverse

$$P_1 = \frac{F \cdot l}{d} + \frac{F_g}{2} \qquad P_2 = \frac{F_g}{2} - \frac{F \cdot l}{d}$$

Explanation of the calculation formula

F	=	effective force (N)
F_g	=	weight-force (N)
P_1, P_2, P_3, P_4	=	effective load on the slider (N)
M_1, M_2	=	effective moment (Nm)
m	=	mass (kg)
a	=	acceleration (m/s²)

Service life

The dynamic load capacity C is a conventional variable used for calculating the service life. This load corresponds to a nominal service life of 100 km. For values of the slider see from product data for each individual slider. The following formula links the calculated theoretical service life to the dynamic load capacity and the equivalent load:

$$L_{Km} = 100 \cdot \left(\frac{C}{P} \cdot \frac{f_c}{f_i} \cdot f_h \right)^3$$

L_{km} = theoretical service life (km)
C = dynamic load capacity (N)
P = effective equivalent load (N)
f_c = contact factor
f_i = application coefficient
f_h = stroke factor

The equivalent load P corresponds in its effects to the sum of the forces and moments working simultaneously on a slider. If these different load components are known, P results as follows:

$$P = P_r + \left(\frac{P_a}{C_{0ax}} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z} + y \right) \cdot C_{0rad}$$

y = reduction due to preload

Here the external loads are assumed as constant in time. Brief loads, which do not exceed the maximum load capacities, do not have any relevant effect on the service life and can therefore be neglected. The contact factor f_c refers to applications in which several sliders pass the same rail section. If two or more sliders move over the same point of a rail, the contact factor according to table below to be taken into account in the formula for calculation of the service life.

Number of sliders	1	2	3	4
f_c	1	0.8	0.7	0.63

The application coefficient f_i takes into account the operational conditions in the service life calculation. It has a similar significance to the safety factor S_O in the static load test. It is calculated as described in the following table:

f_i	
Neither shocks nor vibrations, smooth and low-frequency direction change; clean operating conditions; low speeds (<1 m/s)	1 - 1.5
Slight vibrations, average speeds (1 - 2.5 m/s) and average frequency of direction change	1.5 - 2
Shocks and vibrations, high speeds (> 2.5 m/s) and high-frequency direction change; extreme dirt contamination	2 - 3.5

The stroke factor f_h takes into account the higher load of the raceways and rollers during short strokes on the same total length of run. The corresponding values are taken from the following graph (for strokes longer than 1 m, f_h =1):