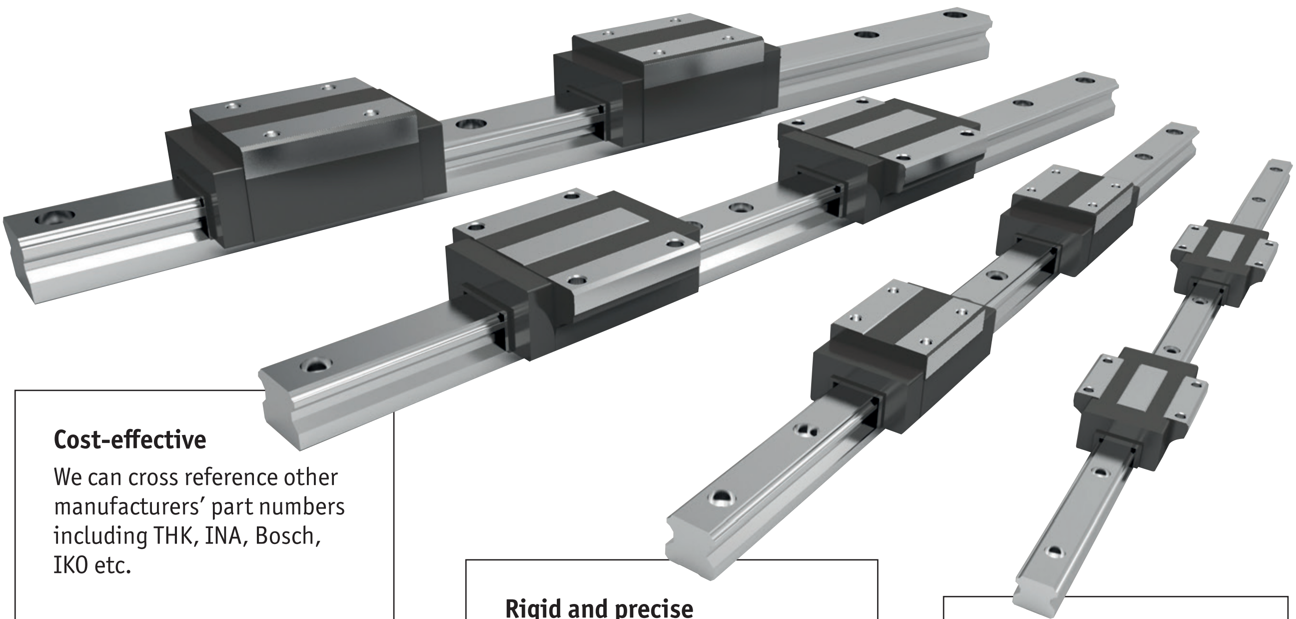
L1016 Linear guideways

Linear guideways are widely used throughout industry for heavy-duty and precise applications.

Precision high load rails

The use of steel balls and the design of the carriages and guideways mean that the rails can accept very heavy loads and significant moment loads. Our rails have circular as opposed to friction coefficient, lower driving resistance, lower wear and lower energy consumption.



Cost-effective

We can cross reference other manufacturers' part numbers including THK, INA, Bosch, IKO etc.

Rigid and precise

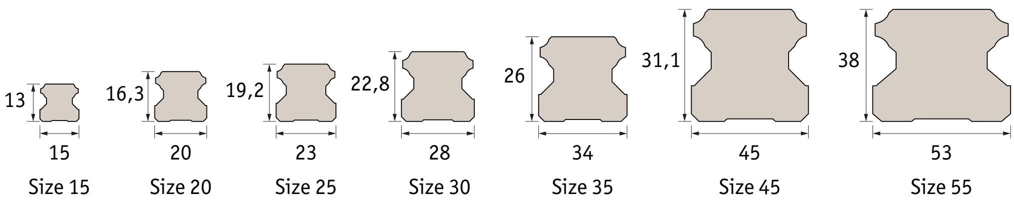
- High load rating.
- High moment load capacity.

Stocked

7 rail profiles ready for same day despatch.

Lengths up to 4 metres.

Rail sizes

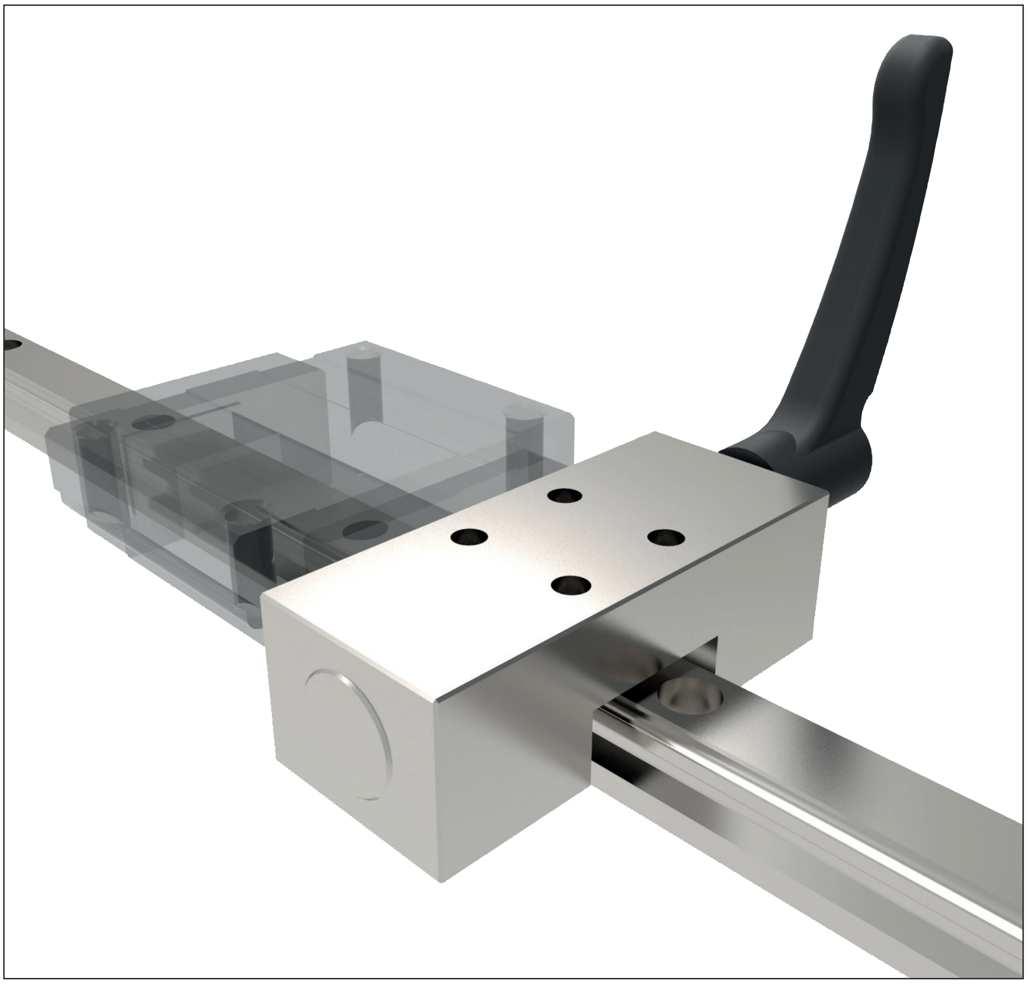


Manual rail clamps

- Many of our customers wish to lock their moving element in position on the rails. Whilst this can be relatively simply achieved with the use of an adjustable clamping handle and thrust pad, we also offer a clamping element which can be integrated into your rail/system design.
- This is available in the standard manual version as well as (on request) a pneumatic version for linear guideways only (not compact rail systems).
- These manual clamps have a holding force of up to 2,000N.
- They are relatively compact in shape. Please bear in mind the extra space required for the clamping element when calculating the total stroke you require.

Applications

- Table cross beams.
- Sliding beds.
- Width adjustment stops.
- Positioning of optical equipment.



The manual rail clamps are used alongside the standard flanged or unflanged rail carriages. When selecting ensure:

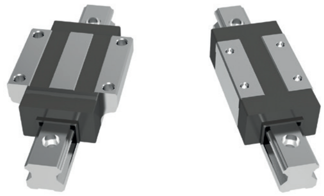
a) the rail clamp suits the rail that you are using.

b) that the total assembly height of the rail clamp is the same as that of the rail carriage L1016.U or L1016.F.

Linear Guideways from Automotion Components

- **Carriage types**

Flanged



Unflanged

Carriage lengths

Long | Standard | Short

Rail types

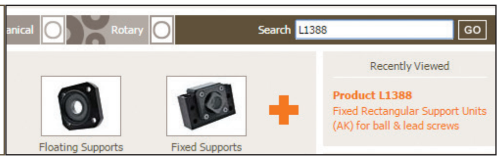
Standard - stocked	Bottom threaded - on request
(Counterbore holes in top face)	(No holes in top face)

CAD - Download in 3 easy steps

Most of our products are available to download directly from our website. Get the CAD you need for your application in minutes, no registration required.

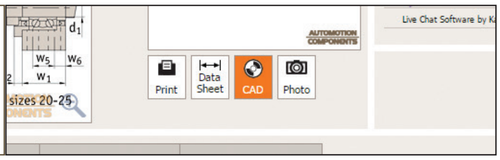
Step: 1 find the part you need

Find the part or enter the Automotion part number into the search bar.



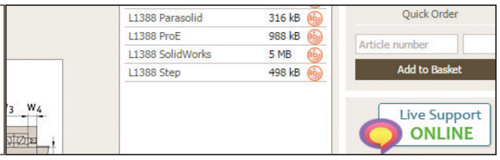
Step 2: Choose the CAD option

Click on the CAD button below the product window to the right of the drawing.



Step 3: Download your format

Choose the the format you require, and download it to your computer.



Load capacities – explained

- A number of load figures are stated for load capacity:

  Dynamic Load – this is the main figure considered for linear guideways. It is the moving load that the system can bear. It takes account of the total moving load as well as considerations such as impact, vibration and fatigue.

  Static Load – this is a load that is constant for an extended time (i.e. the dead load the system can bear before any movement). It can be in tension or compression.

  For these linear guideways the radial and axial load capacities are the same.

  Moment loads are twisting loads generated by offset loads in either X, Y or Z planes. Moment loads can be reduced by adding further carriages or rails to reduce any twisting of the carriage due to the load offset.

Straightness of rails

- The measurements of the straightness of the system are taken from the running accuracy of the sliders over the length of the rails (given in microns) – see system precision page.
- For standard accuracy this equates to around 20 microns for a metre length, increasing to 35 microns for a 4 metre length.

What lengths can be provided?

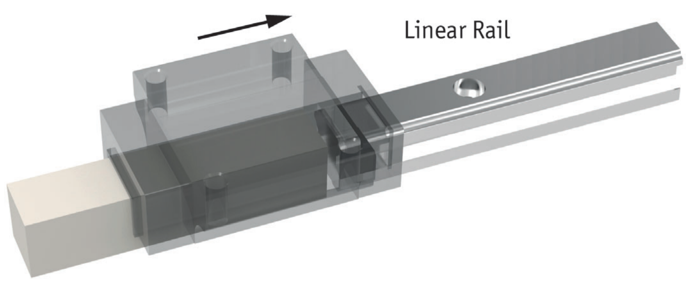
- We have standard rail lengths. These are based on the hole pitch of the rails and end machining to provide an equidistant length to the first and last hole centre.
- However we can cut the rail (from stock) to any length required – we just need to know the distance required to the first hole.
- In general our cutting procedures allow for a ±2mm accuracy on the overall rail length. If greater accuracy than this is required then we have to machine the end accurately (rather than cut it) and this involves extra time and cost.
- Standard maximum length for each rail size is around 4 metres. Rails can be joined together but the preparation needs to be made in our workshop. The rails will be marked clearly with the ends to be placed adjacent to each other.

Installation

- The linear guideways are very accurate and as a result need to be installed on accurately prepared surfaces – please see installation instructions. If the two rails are installed parallel to each other, they need to be accurately aligned – see assembly precision page.
- If you are not able to prepare the surface as accurately as required you might want to consider using our Compact Rail system, as this has a master rail (T rail) and a slave rail (U rail) that allows for structural inaccuracies.

Mounting the carriages to the rails

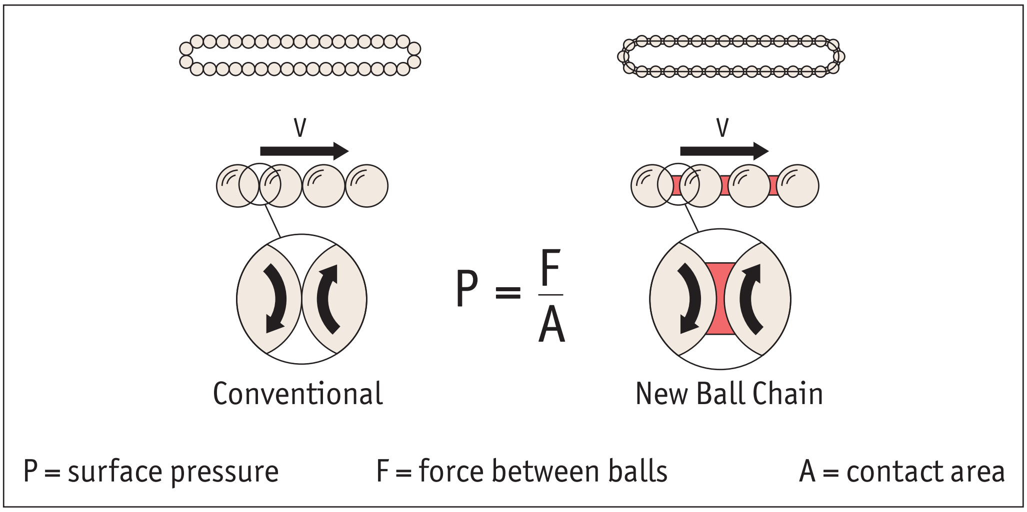
- In general the carriages will be supplied separately to the rails. To install the carriage onto the rails, offer the carriage up to the rails and slide it onto the rail itself.



New ball chain technology

Our new and improved linear guideway systems include the latest "ball chain" technology with the following benefits:

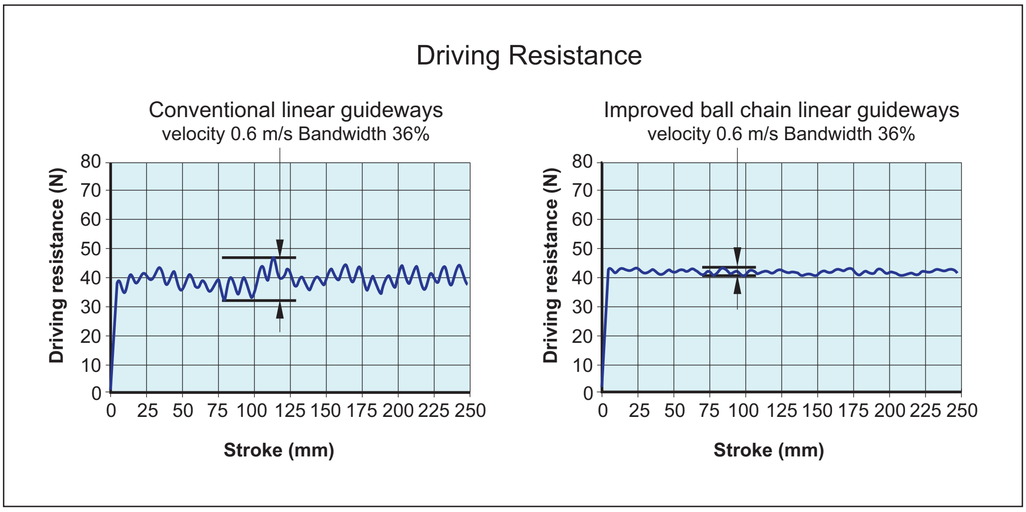
- Higher maximum velocity.
- Lower heat generation
- Lower noise generation.
- Very smooth running.
- Optimised lubrication system
- Even load distribution
- Longer service life



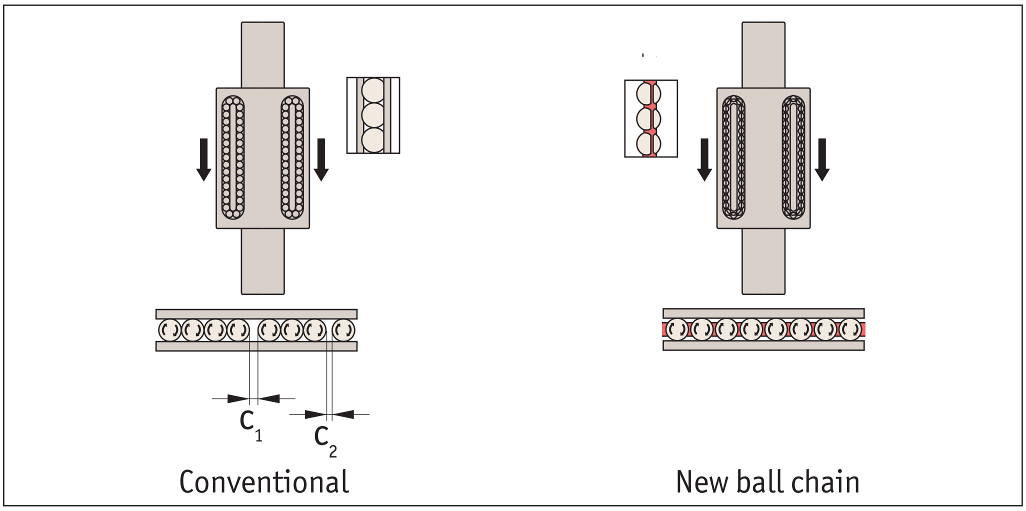
The rotating balls in conventional profile rail guides have point contact between each other. The rotation speed at the contact point is double the speed of the balls. The contact area (A) is so small that the surface pressure (P) tends towards infinity. This leads to heating and wear of the balls and the linear guide system.

The chain system in our new linear guides have a relatively large contact area (A), this significantly reduces the surface area pressure (P). The rotation speeds at the contact surfaces of ball and chain are the same. The ball chain is used to transport the lubricant and to create a lubrication film on the balls. The design of the carriage allows effective supply of lubricant from the lubricant connection to the circulation areas of the ball chains.

This design of the of the ball chain ends in connection with the spacer ball closes the circulation and makes the movement of the carriage smooth and quiet.

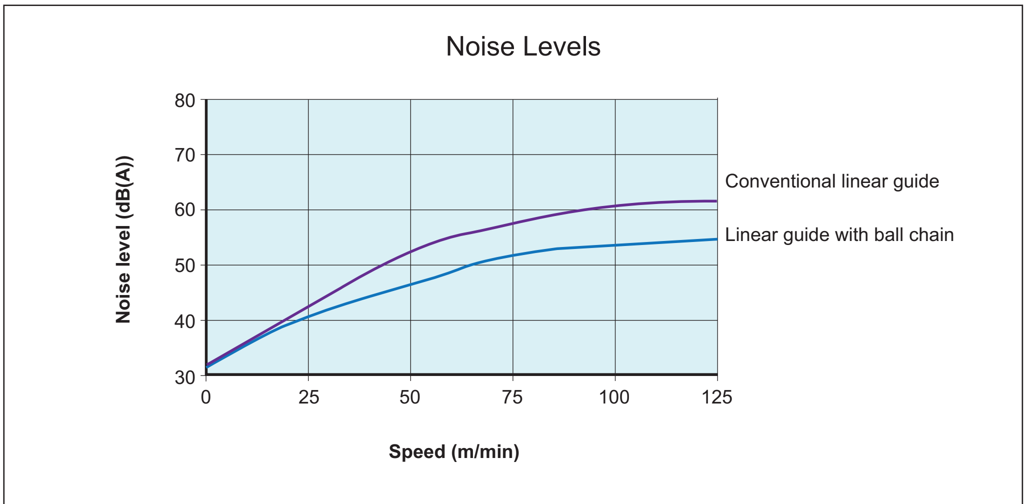


New technology



It is not possible to keep the distance of the balls (C_1, C_2) constant in conventional linear guides. These irregular distances between the balls lead to uneven running behaviour.

The new ball chain system also allows the balls to be continuously supplied with lubricant, which reduces wear of the metal. This significantly extends the service life of the system and reduces lubricant and the maintenance intervals.



We can coat our rail wih two types of corrosion protective finishes:

- Raydent coating; this is an electro-chemical process that applies a black oxide-ceramic layer (approx. 1 micron thick) that penetrates into the metal. As coating takes place at 0C the parts are not deformed. Good resistance against acids, bases and solvents.
- Chemical nickel coating; this offers a good resistance to corrosion, abrasion and chemicals. Black finish.

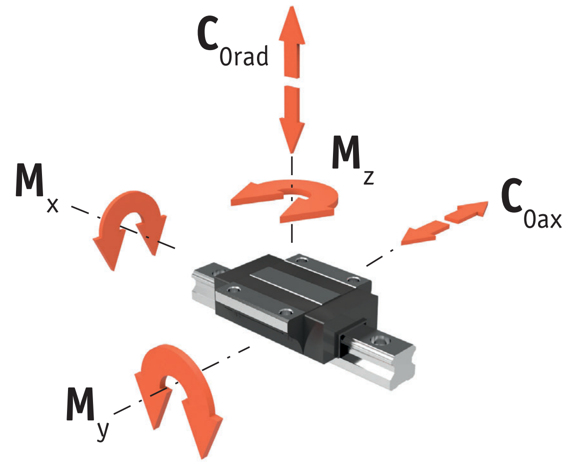
  Please ask our technical department to help you select the best coating.

All of our rails are issued with oil-resistant plastic caps used to cover the screw holes. If there are aggressive chemicals present we can also provide brass versions of these caps.
Where there may be a high level of dust, dirt, weld splatters etc. we can provide bellows covers to protect the rails.

Technical Information

Load capacities - Flanged standard carriages

Load capacity overview - L1016.F Flanged carriages



Part no.	Type	Length	Max. load capacities kN		Max. static moments Nm		
			Dynamic Load C kN	Static load $C_{0rad + ax}$ kN	M_x Nm	M_y Nm	M_z Nm
L1016.F15	Flanged	Standard	11,67	19,90	137	120	120
L1016.F15-L	Flanged	Long	14,12	24,05	166	171	171
L1016.F20	Flanged	Standard	17,98	30,96	289	224	224
L1016.F20-L	Flanged	Long	23,30	40,11	376	366	366
L1016.F25	Flanged	Standard	25,25	41,73	447	358	358
L1016.F25-L	Flanged	Long	32,44	53,63	576	577	577
L1016.F25-XL	Flanged	Extra Long	36,58	64,30	691	833	833
L1016.F30	Flanged	Standard	37,33	55,50	719	560	560
L1016.F30-L	Flanged	Long	48,35	71,88	931	836	836
L1016.F30-XL	Flanged	Extra Long	53,83	88,18	1142	1361	1361
L1016.F35	Flanged	Standard	53,31	82,66	1307	991	991
L1016.F35-L	Flanged	Long	66,61	103,29	1633	1424	1424
L1016.F35-XL	Flanged	Extra Long	73,29	127,68	2020	2330	2330
L1016.F45	Flanged	Standard	73,14	111,30	2353	1559	1559
L1016.F45-L	Flanged	Long	86,99	132,39	2798	2170	2170
L1016.F45-XL	Flanged	Extra Long	100,52	166,87	3527	3455	3455
L1016.F55	Flanged	Standard	88,26	136,62	3385	2361	2361
L1016.F55-L	Flanged	Long	119,10	183,14	4538	4202	4202
L1016.F55-XL	Flanged	Extra Long	161,43	259,71	6430	6617	6617

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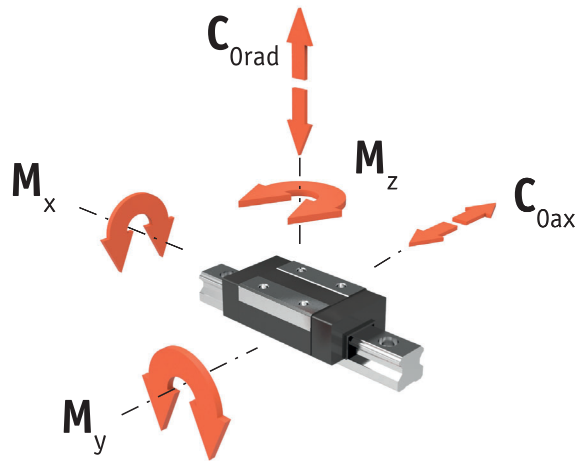
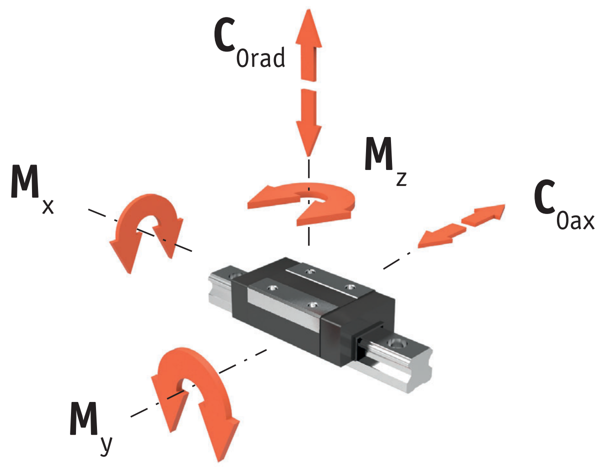
Load capacity overview - L1016.U Unflanged carriages



Part no.	Type	Length	Max. load capacities kN		Max. static moments Nm		
			dyn. C_{rad} dyn. C_{ax}	stat. C_{0rad} stat. C_{0ax}	M_x	M_y	M_z
L1016.U15	Unflanged	Standard	11,67	19,90	137	120	120
L1016.U20	Unflanged	Standard	17,98	30,96	289	224	224
L1016.U20-L	Unflanged	Long	23,30	40,11	376	366	366
L1016.U25	Unflanged	Standard	25,25	41,73	447	358	358
L1016.U25-L	Unflanged	Long	32,44	53,63	576	577	577
L1016.U25-XL	Unflanged	Extra Long	36,58	64,30	691	833	833
L1016.U30	Unflanged	Standard	37,33	55,50	719	560	560
L1016.U30-L	Unflanged	Long	48,35	71,88	931	836	836
L1016.U30-XL	Unflanged	Extra Long	53,83	88,18	1142	1361	1361
L1016.U35	Unflanged	Standard	53,31	82,66	1307	991	991
L1016.U35-L	Unflanged	Long	66,61	103,29	1633	1424	1424
L1016.U35-XL	Unflanged	Extra Long	73,29	127,68	2020	2330	2330
L1016.U45	Unflanged	Standard	73,14	111,30	2353	1559	1559
L1016.U45-L	Unflanged	Long	86,99	132,39	2798	2170	2170
L1016.U45-XL	Unflanged	Extra Long	100,52	166,87	3527	3455	3455
L1016.U55	Unflanged	Standard	88,26	136,62	3385	2361	2361
L1016.U55-L	Unflanged	Long	119,10	183,14	4538	4202	4202
L1016.U55-XL	Unflanged	Extra Long	161,43	259,71	6430	6617	6617

Linear Guideways from Automotion Components

Load capacity overview - L1016.UL Unflanged low height carriages



Part no.	Type	Length	Max. load capacities kN		Max. static moments Nm		
			dyn. C_{rad} dyn. C_{ax}	stat. C_{0rad} stat. C_{0ax}	M_x	M_y	M_z
L1016.UL15-S	Unflanged	Short	5,81	9,90	69	32	32
L1016.UL15	Unflanged	Standard	11,67	19,90	137	120	120
L1016.UL15-L	Unflanged	Long	14,12	24,05	166	171	171
L1016.UL20-S	Unflanged	Short	9,25	15,63	148	66	66
L1016.UL20	Unflanged	Standard	17,98	30,96	289	224	224
L1016.UL25-S	Unflanged	Short	12,87	21,34	230	103	103
L1016.UL25	Unflanged	Standard	25,25	41,73	447	358	358
L1016.UL30-S	Unflanged	Short	18,50	27,51	356	153	153
L1016.UL30	Unflanged	Standard	37,33	55,50	719	560	560
L1016.UL30-L	Unflanged	Long	48,35	71,88	931	836	836
L1016.UL30-XL	Unflanged	Extra Long	53,83	88,18	1142	1361	1361
L1016.UL35-S	Unflanged	Short	26,72	41,43	655	275	275
L1016.UL35	Unflanged	Standard	53,31	82,66	1307	991	991
L1016.UL35-L	Unflanged	Long	66,61	103,29	1633	1424	1424
L1016.UL35-XL	Unflanged	Extra Long	73,29	127,68	2020	2330	2330
L1016.UL45	Unflanged	Standard	73,14	111,30	2353	1559	1559
L1016.UL45-L	Unflanged	Long	86,99	132,39	2798	2170	2170
L1016.UL45-XL	Unflanged	Extra Long	100,52	166,87	3527	3455	3455
L1016.UL55	Unflanged	Standard	88,26	136,62	3385	2361	2361
L1016.UL55-L	Unflanged	Long	119,10	183,14	4538	4202	4202
L1016.UL55-XL	Unflanged	Extra Long	161,43	259,71	6430	6617	6617

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Radial clearance/preload

Radial clearance describes the value for the radial movement of the carriage at a constant vertical load, while the carriage moves in longitudinal direction.

Preload is defined as an effective load on the rolling element in the interior of the carriage in order to remove an existing clearance or to increase the rigidity.

The linear guideways are available in the two different preload classes K_0 or K_1, see table below.

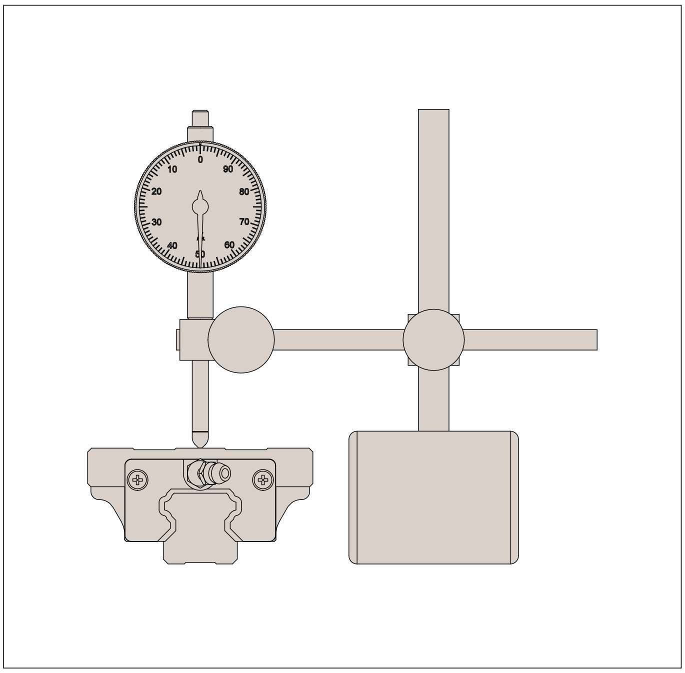
The preload influences the rigidity, precision and torque resistance and also affects the service life and displacement force.

The radial clearance for the respective preload classes are listed below.

Degree of preload	Preload class	Preload
No clearance	K_0	0
Small preload	K_1	0,02 x C*

*C is the dynamic load capacity.

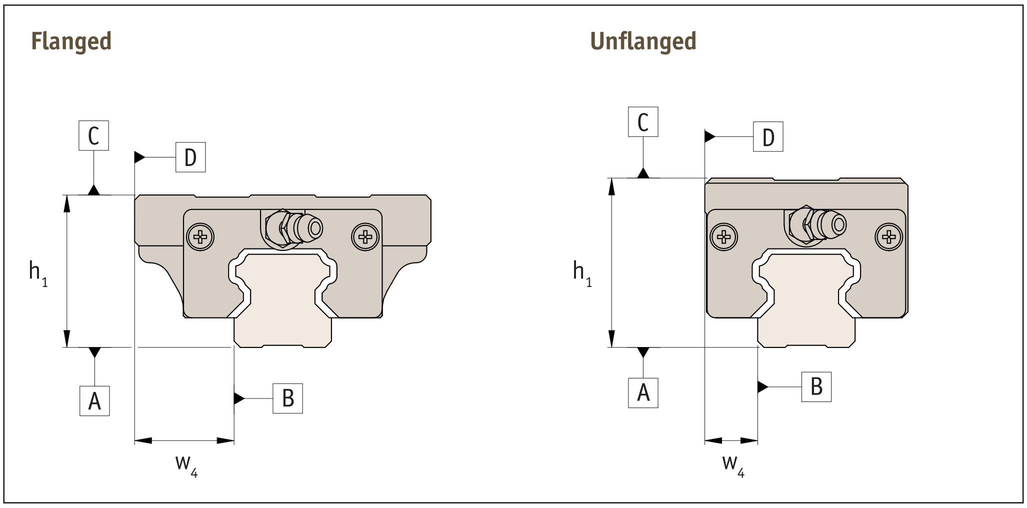
Size	Radial clearance of the preload classes μ	
	K_0 Impact free and easy movement	K_1 Small moments, one rail application, low vibrations
15	-3 to +3	-8 to -4
20	-3 to +3	-8 to -4
25	-4 to +4	-10 to -5
30	-4 to +4	-11 to -5
35	-5 to +5	-12 to -6
45	-6 to +6	-15 to -7
55	-7 to +7	-19 to -8



Technical Information

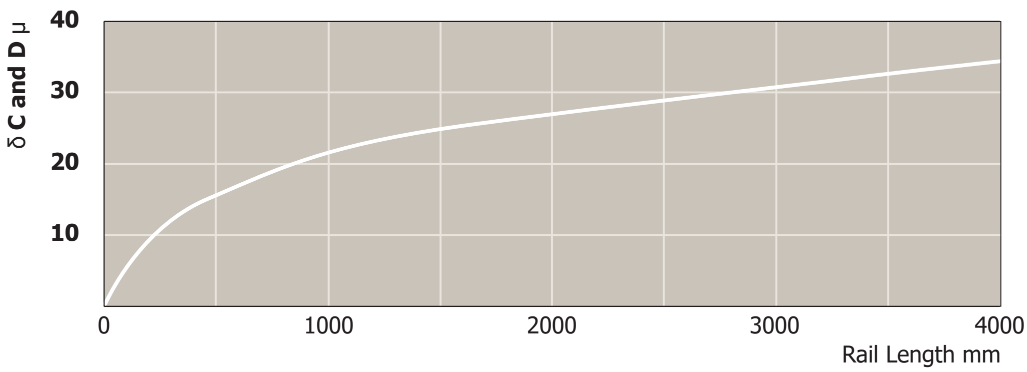
System precision

Precision means the guide accuracy or the maximum deviation of the carriage based on the side and support surfaces during the movement along the rails.



	Normal Precision (N)	H Precision (H)	P Precision (P)
Height tolerance h_1	±0,1	±0,4	0
Width tolerance w_4			-0,04
Guide accuracy of raceway C based on surface A	δ C see graph below		
Guide accuracy of raceway D based on surface B	δ D see graph below		

Running tolerances



Lubrication

Linear guideway rails must generally be lubricated before commissioning. They can be lubricated with oil or grease. The correct lubricant selection has a large influence on the service life and the function of the rail, insufficient lubrication and tribocorrosion can ultimately lead to total failure.

As well as reducing friction and wear, lubricants also serve as sealant, noise reducer and corrosion protection for the linear guide. Different lubricants for special applications are available upon request (e.g. lubricant with FDA approval for use in the food industry).

Our linear guideways are coated with an anti-corrosion resistant oil at the factory.
This coating needs to be removed prior to installation, then lubricated as follows:

Important instructions for lubrication

- Linear guideways must be lubricated for operation.
- The carriage must be moved back and forth during lubrication.
- The lubricant is inserted through a lubrication nipple.
- There should be a thin film of lubricant on the rail surface at all times.
- Primary lubricated systems have an increased displacement resistance.
- Please contact us if oil lubrication is used for vertical use.
- If the stroke is <2 or >15 times the carriage length, the lubrication intervals should be reduced.

Grease lubrication

We recommend the use of a lithium emulsified lubricant NLGI Class 2 for lubrication.

Oil lubrication

We recommend a synthetic oil for operating temperatures between 0°C and +70°C.

Relubrication

- Relubrication of the system must be done before the lubricant used has become dirty or shows signs of discolouration.
- Relubrication should be performed at operating temperature. The carriage must be moved back and forth during re-lubrication.
- If the stroke is <2 or >15 times the carriage length, the lubrication intervals should be more frequent.

Lubrication intervals

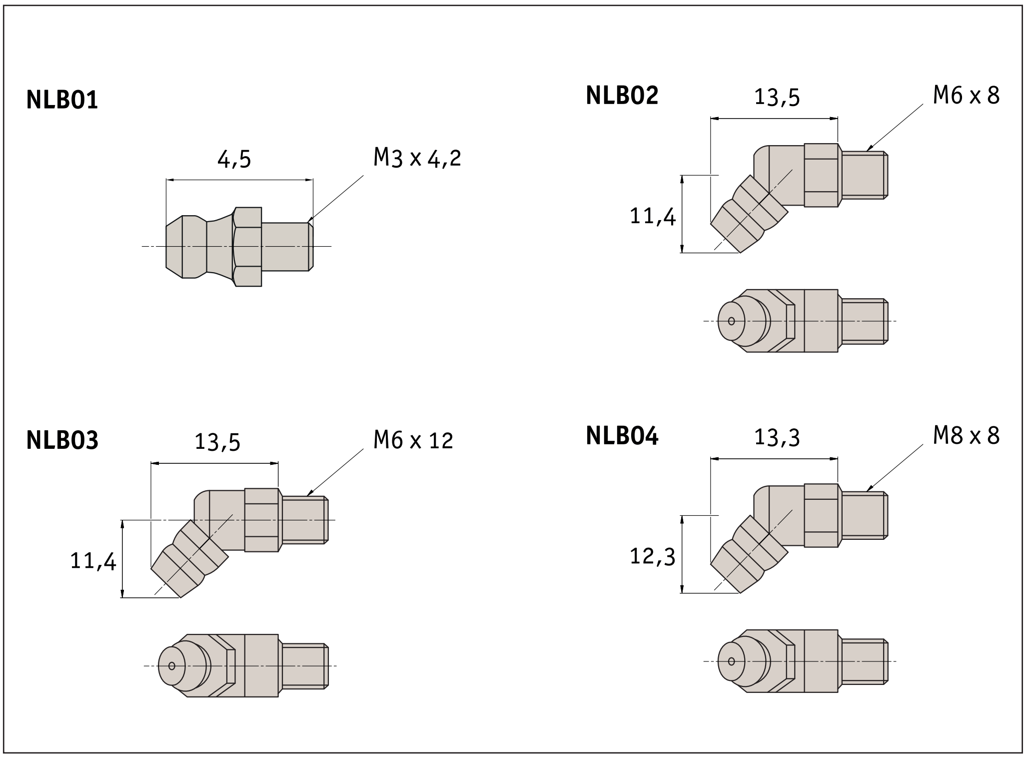
Operating speed, stroke length and ambient conditions influence the selection of time between lubrication intervals. Establishing a safe lubrication interval is based solely on the applications and conditions. However, a lubrication interval should not be longer than one year.

Lubrication nipple

The following lubrication nipples are supplied.

Other lubrication nipples, such as lubrication adapters with hose inlet or with quick-coupling, are available on request.

Lubrication nipple	Size
NLB01	15
NLB02	20
	25
NLB03	30
	35
NLB04	45
	55



Surface treatment

There are numerous application-specific surface treatments available for profile rails of the linear guideway product family, for example, black oxide coating (X), hard chrome plating (XC) or nickel plating (NIC) and an FDA-approval type for use in the food industry. For more information please contact us on 0845 850 99 40.

Linear guideways have a low friction characteristic and thus low displacement resistance. The low start-up friction (breakaway force) is almost identical to the moving friction (running resistance).

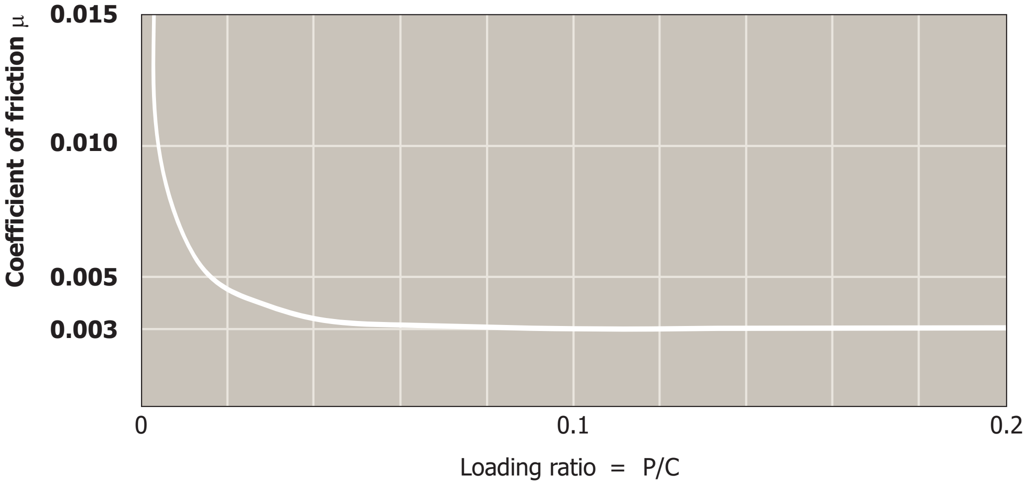
The displacement resistance (F_m) is dependent upon several factors:

- Friction of the sealing system.
- Friction of the balls with each other.
- Friction between balls and redirection.
- Rolling resistance of the balls in the running grooves.
- Resistance of lubricant in the carriage.
- Resistance caused by contamination in the lubricant.
- Preload for increased rigidity.
- Moment load.

Resistance of the seals f

Type	Max. seal resistance N
L1016.15	2,5 N
L1016.20	3,5 N
L1016.25	5,0 N
L1016.30	10,0 N
L1016.35	12,0 N
L1016.45	20,0 N
L1016.55	22,0 N

Coefficient of friction μ



P = Load
C = Dynamic load capacity

Displacement resistance F_m

The following formula is used for approximate calculation of the displacement resistance. Please note that the level of preload or the viscosity of the lubricant used can also influence the displacement resistance.

$$F_m = \mu \cdot F + n.f$$

F_m = Displacement resistance (N)
μ = Coefficient of friction
F = Load (N)
f = Resistance of the seals (N)
n = Number of sliders

Linear guideways have a coefficient of friction of approx. μ = 0.002 - 0.003

The given static load capacity (C_0) for each carriage represents the maximum permissible load value, which if exceeded causes permanent deformations of the raceways and adversely affects the operating performance.

Checking the load must be done as follows:

- Through determination of the simultaneously occurring forces and moments for each carriage.
- By checking these values with the corresponding load capacities.

$$S_0 > \frac{C_0}{(F_x \cdot f_c)} \quad S_0 > \frac{C_0}{(F_y \cdot f_c)} \quad S_0 > \frac{M_x}{(M_1 \cdot f_c)} \quad S_0 > \frac{M_y}{(M_2 \cdot f_c)} \quad S_0 > \frac{M_z}{(M_3 \cdot f_c)}$$

F_x, F_y = radial and axial resultants of external forces (N)

M_1, M_2, M_3 = external moments (Nm)

C_0 = static load capacity (N)

M_x, M_y, M_z = maximum permissible moments in the different loading directions (Nm)

f_c = contact factor (see next page)

S_0 = safety factor

The safety factors

The safety factor S_0 can lie on the lower given limit if the forces can be determined with sufficient precision. If impacts and vibrations affect the system, overloads might occur, then the higher value should be selected.

Reduced safety results from simultaneously occurring forces and moments.

For more information please contact our technical department.

Operating conditions	S_0
Normal operation	1,0 ~ 1,5
Loading with vibration or shock effect	1,5 ~ 2,0
Loading with strong vibration or impacts	2,0 ≥ 3,5

Calculation of 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 50 Km. The relationship between calculated service life L_{Km} (in Km), dynamic load capacity C (in N) and equivalent load P (in N) is given in the formula below.

$$L_{Km} = \left(\frac{C}{P} \cdot \frac{f_c \cdot f_t}{f_i} \right)^3 \cdot 50 \text{ Km}$$

f_c = Contact factor
f_i = Application coefficient
f_t = Temperature factor
C = Dynamic load (N)
P = See below (N)

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 from the formula below.

$$P = |F_X| + |F_Y| + \left(\frac{|M_1|}{M_x} + \frac{|M_2|}{M_y} + \frac{|M_3|}{M_z} \right) C_0$$

Contact factor f_c

The contact factor f_c refers to applications in which several carriages pass the same rail section. If two or more carriages are moved over the same point on a rail, the static and dynamic loading values must be multiplied with the numbers from the table below.

Number of carriages	1	2	3	4	5
f_c	1	0,81	0,72	0,66	0,61

Application coefficient f_i

The application coefficient f_i can be understood as the dynamic safety factor.
Refer to the table below for the values.

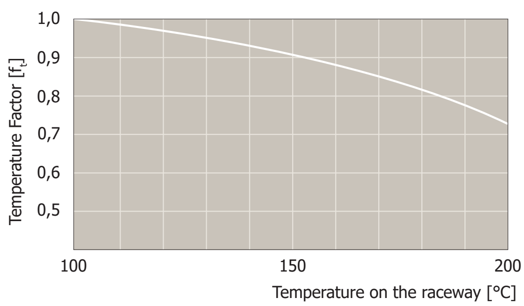
Operating conditions	Speed	f_i
Neither external impacts nor vibrations	Low speed V ≤ 15 m/min.	1 - 1,5
Light impacts or vibrations	Average speed < V ≤ 60 m/min.	1,5 - 2
Average and high external impacts or vibration	High speed V > 60 m/min.	2 - 3,5

Temperature factor f_t

If the temperature affecting the system exceeds 100°C, the temperature factor f_t must be included in the service life calculation.

Note 1: For temperatures above 80°C, the seals and end caps must be designed for higher thermal resistance.

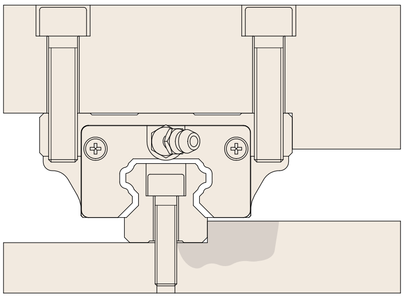
Note 2: Special processing to ensure the movement of the guides is required for temperatures above 120°C.



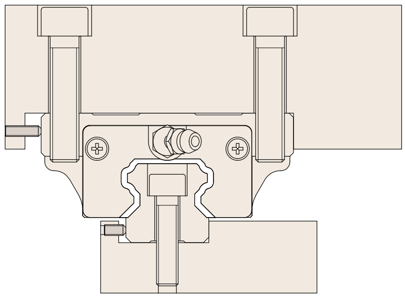
Installation examples

The following drawings illustrate some assembly examples for rail/carriage combinations corresponding to the structure of various machine frames.

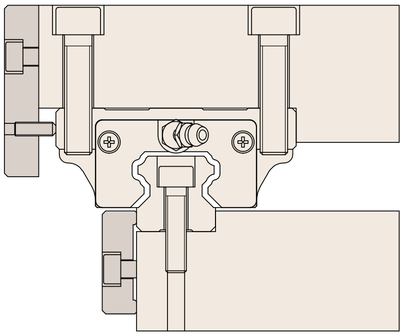
Example 1
Assembly of carriage and rail on shoulder edges



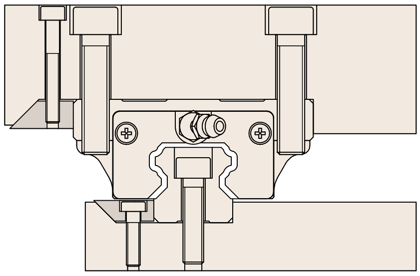
Example 2
Securing carriage and rail using set screws



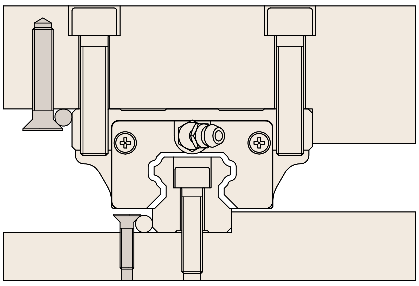
Example 3
Securing carriage and rail using pressure plates



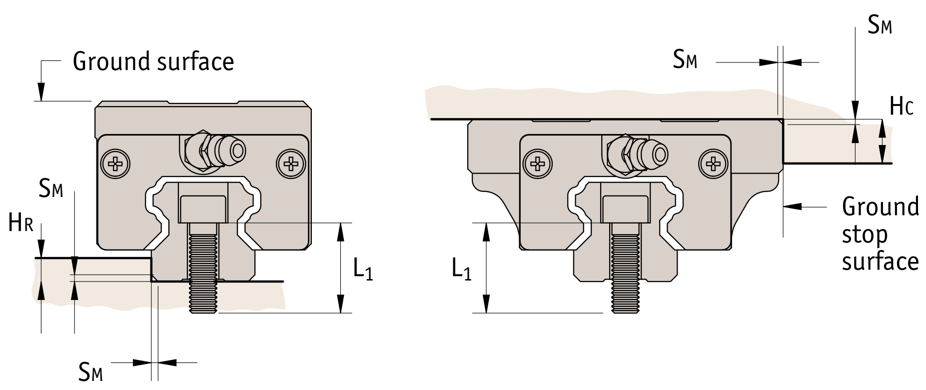
Example 4
Securing carriage and rail using taper gibs



Example 5
Securing carriage and rail using bolts



The given radii and shoulder heights in the table must be observed when assembling rails and carriages on the stop edges to ensure perfect seating of carriages or guideways.

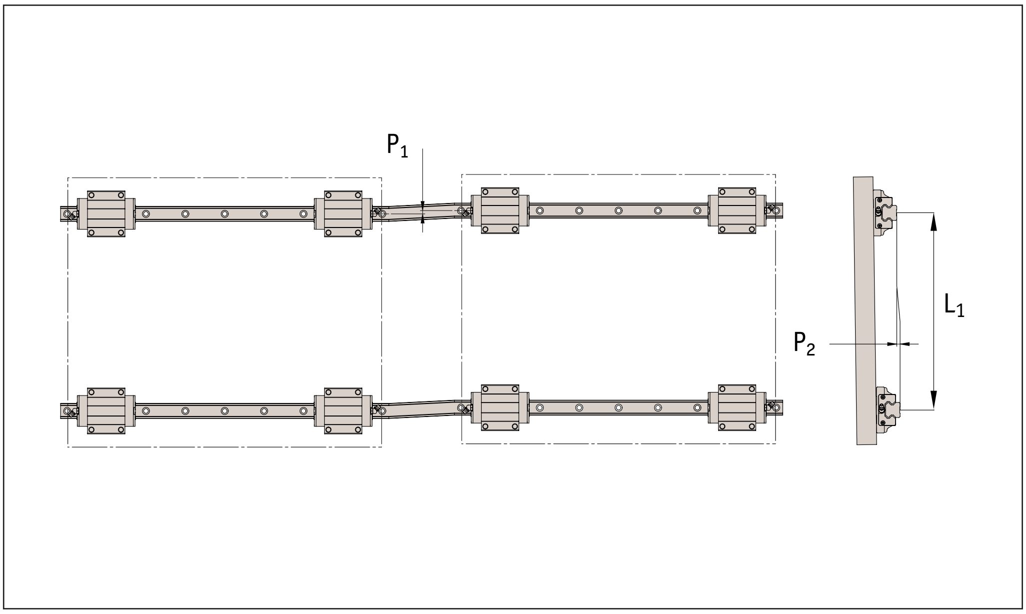


Size	Sm	Hr	Hc	L_1
15	0,6	3,1	5	M4 x 16
20	0,9	4,3	6	M5 x 20
25	1,1	5,6	7	M6 x 25
30	1,4	6,8	8	M8 x 30
35	1,4	7,3	9	M8 x 30
45	1,6	8,7	11	M12 x 40
55	1,6	11,8	12	M14 x 45

Values in mm. HR* is the maximum height when using side seal on carriage.

Assembly precision

The maximum permissible deviations of the rail surfaces for assembly are given in the following drawing and the table below.

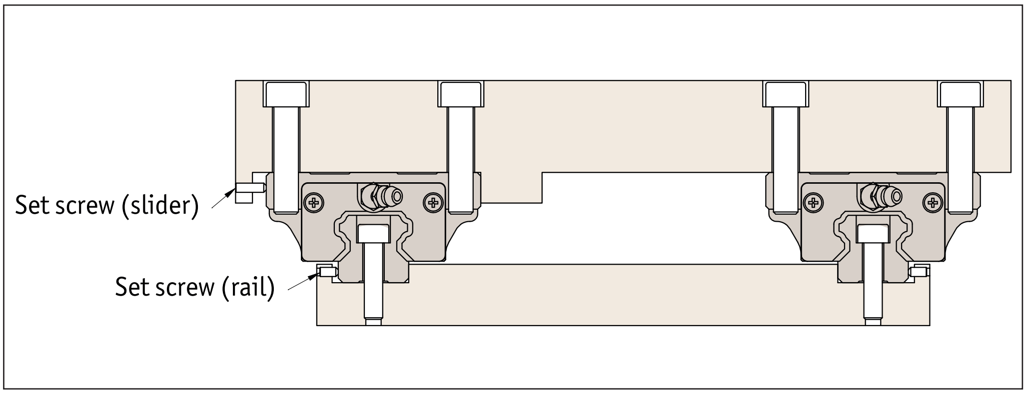


Size	Permissible tolerance for parallelism P_1 μ		Calculator factor (x) P_2 μ ($P_2 = L_1$ x (calculation factor))	
	K_1	K_0	K_1	K_0
15	18	25	0,17	0,26
20	20	25	0,17	0,26
25	22	30	0,17	0,26
30	30	40	0,22	0,34
35	35	50	0,30	0,42
45	40	60	0,34	0,50
55	50	70	0,42	0,60

The bolt sizes to be used and optimum tightening torques for rail assembly are listed in the table below.

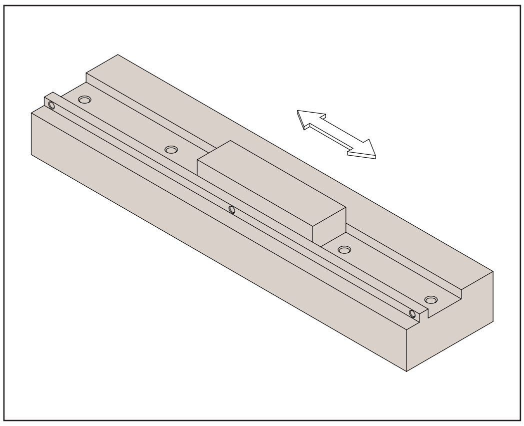
Bolt	Tightening torque M_t Nm	
	Steel 10,9	Steel 12,9
M 4	4,4	5,1
M 5	8,7	10
M 6	15	18
M 8	36	43
M12	125	145
M14	200	235

Assembly process



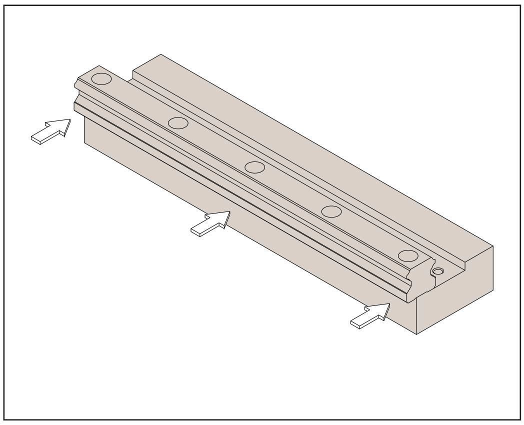
Fixing guide rails 1

Whet the assembly surface with a whetstone and also remove burrs, unevenness and dirt. Note: All linear guides are preserved with anti-corrosion oil at the factory. This protection must be removed before installation. In doing so, please ensure that the surfaces are coated with low-viscosity oil for the purpose of further protection against corrosion.

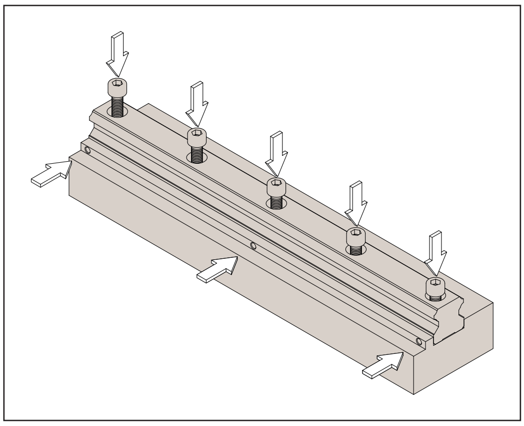


Fixing guide rails 2

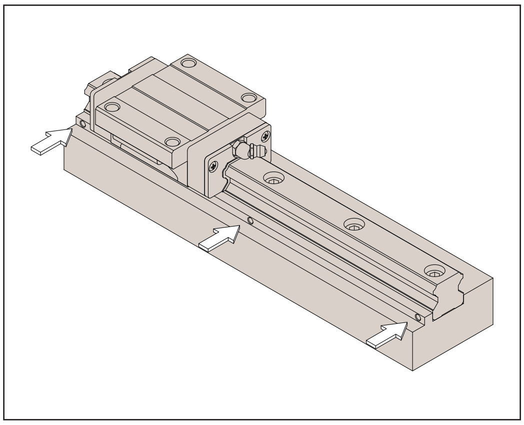
Carefully lay the guide rail on the assembly surface and slightly tighten the fixing screws so that the guide rail lightly touches the assembly surface (align the guide rail along the shoulder edge of the assembly surface). Note: The fixing screws of the linear guide must be clean. Check if the fixing holes are located in the correct place when you insert the bolts. A forced tightening of a fixing screw in an offset hole can negatively affect accuracy.



Fixing guide rails 2 continued



Fixing guide rails 3
Tighten the thrust bolts on the guide rail until there is close contact on the side stop surface.



Fixing guide rails 4
Tighten the fixing screws with a torque wrench to the prescribed torque.
Note: For a high degree of accuracy, the fixing screws of the guide rail must be tightened in sequence outward from the centre.

Fixing guide rails 5
Assemble the other rails in the same manner to complete the installation of the guide rails.

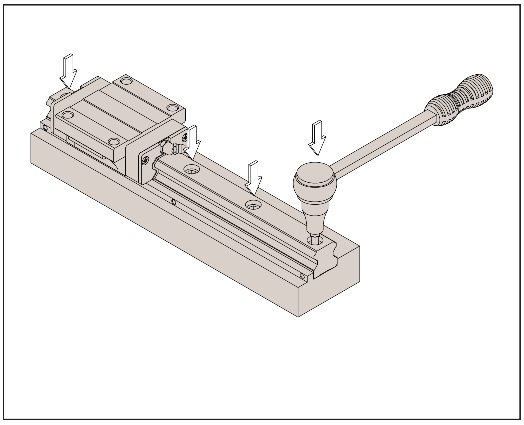
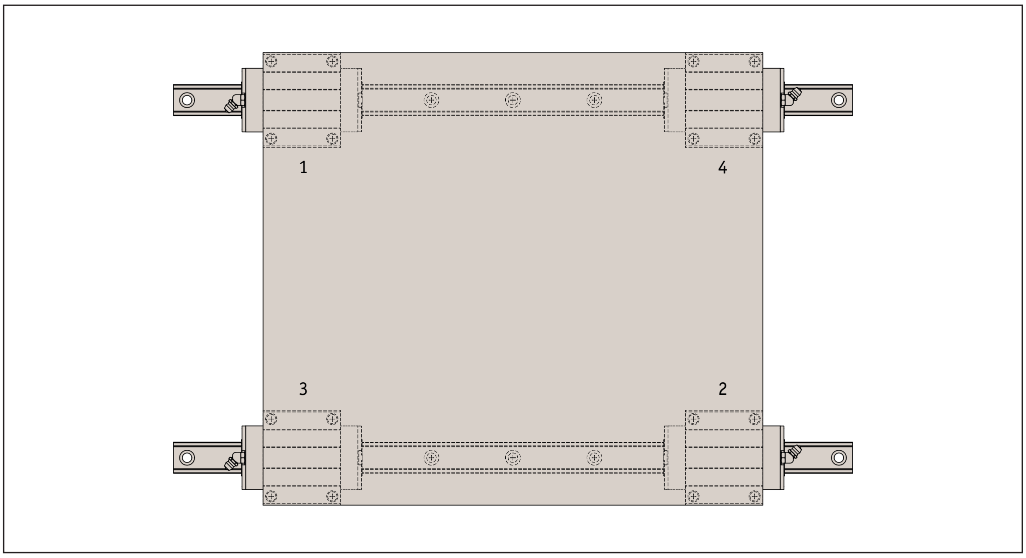


Table assembly 1
Set the table carefully on the carriage and tighten the fixing screws only lightly.

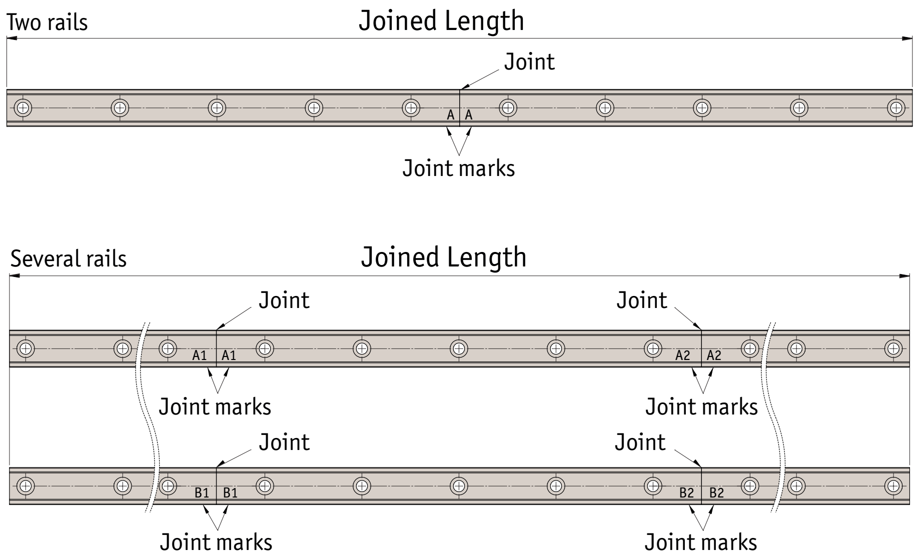
Table assembly 2
Press the carriage on the main guide side with the thrust bolts against the shoulder edge of the table and position the table.

Table assembly 3
Tighten the fixing screws on the main side and the lateral side completely tight to finish the installation. Note: To attach the table uniformly, tighten the fixing screws diagonally (1, 2, 3, 4).

This method saves time when straightening the guide rail and makes the manufacture of positioning pins unnecessary, which considerably reduces assembly time.



Joining rails
Guide rails longer than the one part maximum length are put together from two or more rails. When putting guide rails together, ensure the register marks are positioned correctly.



Miniature Linear Guideways

Introduction

Miniature linear guideway systems are widely used throughout industry for precise, compact applications.

Precise and stainless

The gothic arch shape of the rails have a 45° contact ensuring similar load capacities in all directions. Use of a large number of stainless steel balls enables a high moment and load capacity within a compact space. These smooth running rails have low break-away forces and a low coefficient of friction.

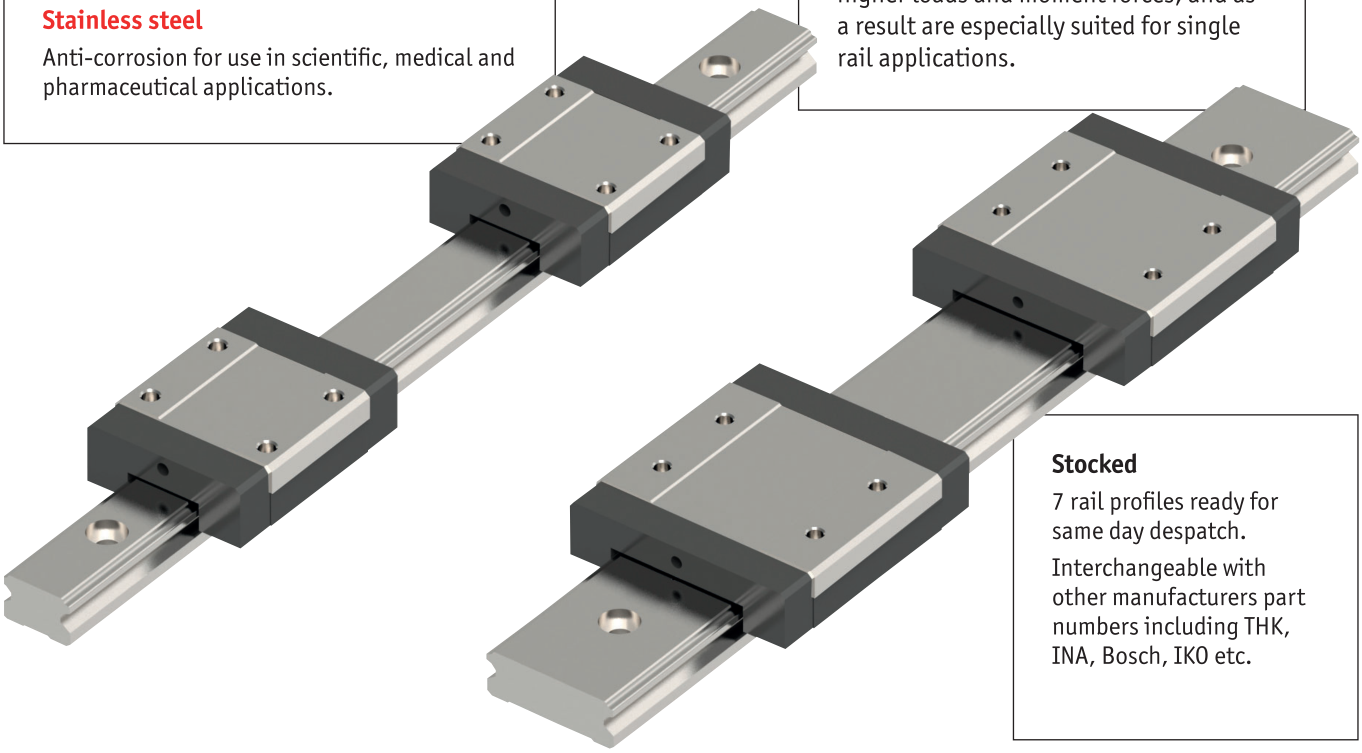
Standard and wide versions

Our standard width is a compact, high performance rail in six sizes.

The wide version can generally accept higher loads and moment forces, and as a result are especially suited for single rail applications.

Stainless steel

Anti-corrosion for use in scientific, medical and pharmaceutical applications.



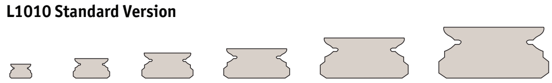
Stocked

7 rail profiles ready for same day despatch.

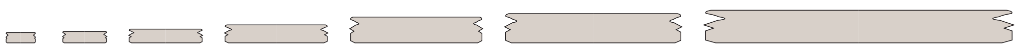
Interchangeable with other manufacturers part numbers including THK, INA, Bosch, IKO etc.

Rail sizes

L1010 Standard Version



L1012 Wide Version



Load capacities – explained

- A number of load figures are stated for load capacity:

  Dynamic loads – this is the main figure considered for miniature linear guideways. It is the moving load that the system can bear. It takes account of the total moving load as well as considerations such as impact, vibration and fatigue.

  Static loads – this is a load that is constant for an extended time (i.e. the dead load the system can bear before any movement). It can be in tension or compression.

  For these miniature linear guideways the radial and axial load capacities are the same.

  Moment loads are twisting loads generated by offset loads in either X, Y or Z planes. Moment loads can be reduced by adding further carriages or rails to reduce any twisting of the carriage due to the load offset.

Why is there a standard width and a wide version rail?

- The wider version system is generally used as a single rail system as it can accept higher loads and moment loads, whilst maintaining a very low height.
- The standard width rail can be used either as stand-alone rails or are more frequently used as a pair of rails in parallel.

Straightness of rails

- The measurements of the straightness of the system are taken from the running accuracy of the sliders over the length of the rails (given in microns) – see accuracy and preload page. For standard accuracy this equates to around 15µ for a 300mm length, increasing to 25µ for a 1 metre length.

What lengths can be provided?

- We have standard rail lengths. These are based on the hole pitch of the rails and end machining to provide an equidistant length to the first and last hole centre.
- However we can cut the rail (from stock) to any length required – we just need to know the distance required for the first hole.
- In general our cutting procedures allow for a ±2mm accuracy on the overall rail length. If greater accuracy than this is required then we have to machine the end accurately (rather than cut it) and this involves extra time and cost.
- Standard maximum length for each rail size is around 1 metre. Rails can be joined together but the preparation needs to be made in our workshop. The rails will be marked clearly with the ends to be placed adjacent to each other.

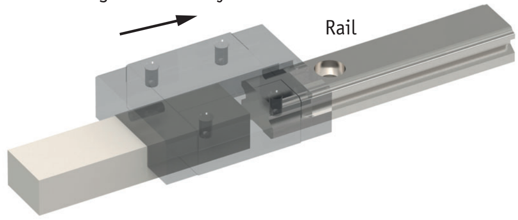
Installation

- The miniature linear guideways are very accurate and as a result need to be installed on accurately prepared surfaces - please see installation instructions. If two rails are installed in parallel, they need to be precisely aligned - see assembly precision page.

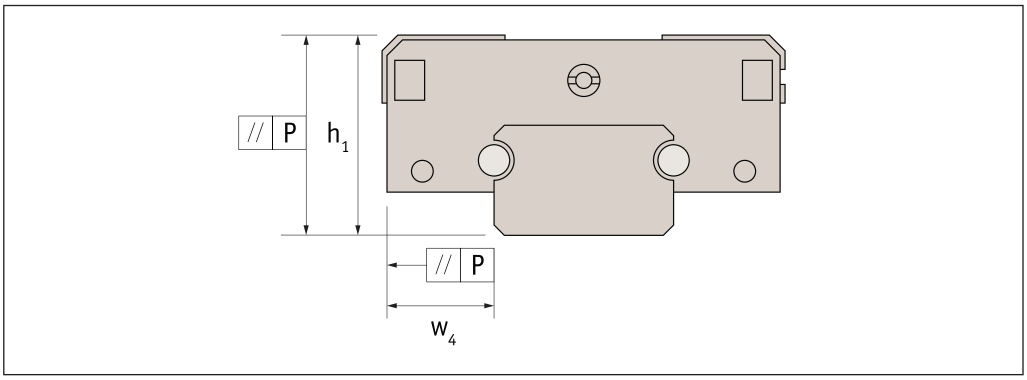
Mounting the carriages to the rails

- In general the carriages will be supplied separately to the rails. The carriages are supplied mounted on plastic “dummy” blocks. To install the carriage onto the rails, offer the carriage (still on its dummy block) up to the rails and slide off the dummy block and onto the rail itself.

  Do not simply remove the carriage from the dummy block, as some of the bearings might become displaced, rendering the carriage unusable.

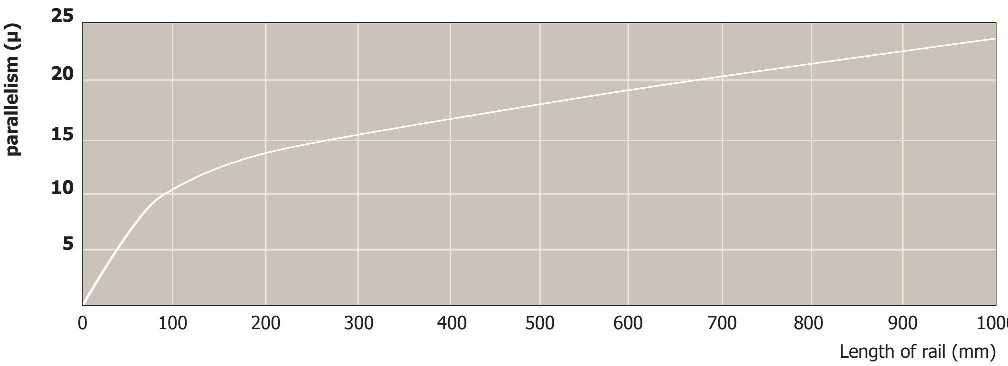


Precision



	Dimensions	μ
h_1	Height tolerance h_1	±40
h_1	Permissible height difference of different carriages at the same position on the rail	25
W_4	Width tolerance w_4	±40
W_4	Permissible width difference of different carriages at the same position on the rail	30

Running accuracy

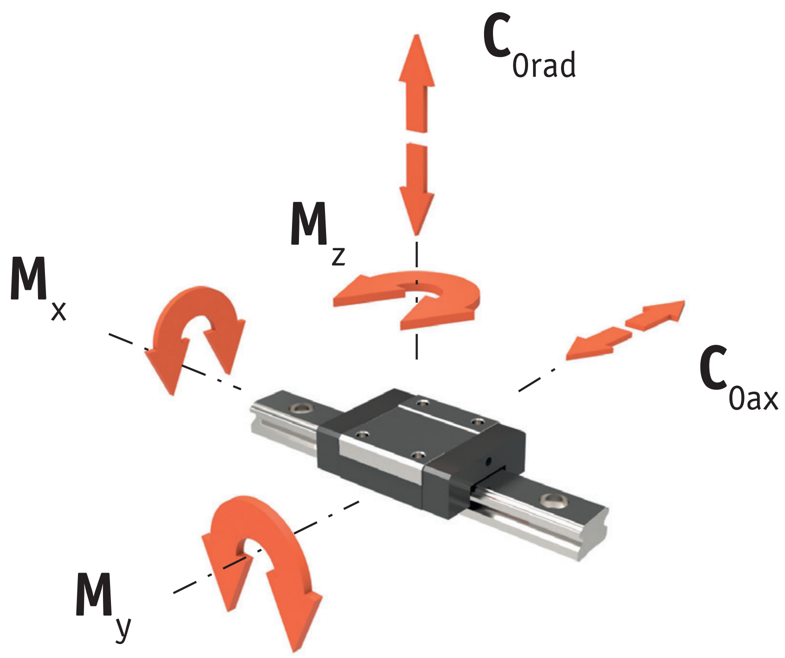


Preload

The miniature linear guideways are available in the two different preload classes K_0 and K_S. The preload influences the rigidity, precision and torque resistance as well as offering the product service life and displacement force. The standard preload is K_0.

Type	Preload classes	
	Small K_0	Standard K_s
	Very quiet running (μ)	Quiet and precise running (μ)
L1010.03 & L1012.06	+3 to 0	+1 to 0
L1010.05 & L1012.10	+3 to 0	+1 to 0
L1010.07 & L1012.14	+4 to 0	+2 to 0
L1010.09 & L1012.18	+4 to 0	+2 to 0
L1010.12 & L1012.24	+5 to 0	+2 to 0
L1010.15 & L1012.42	+6 to 0	+3 to 0

L1010 - Standard width

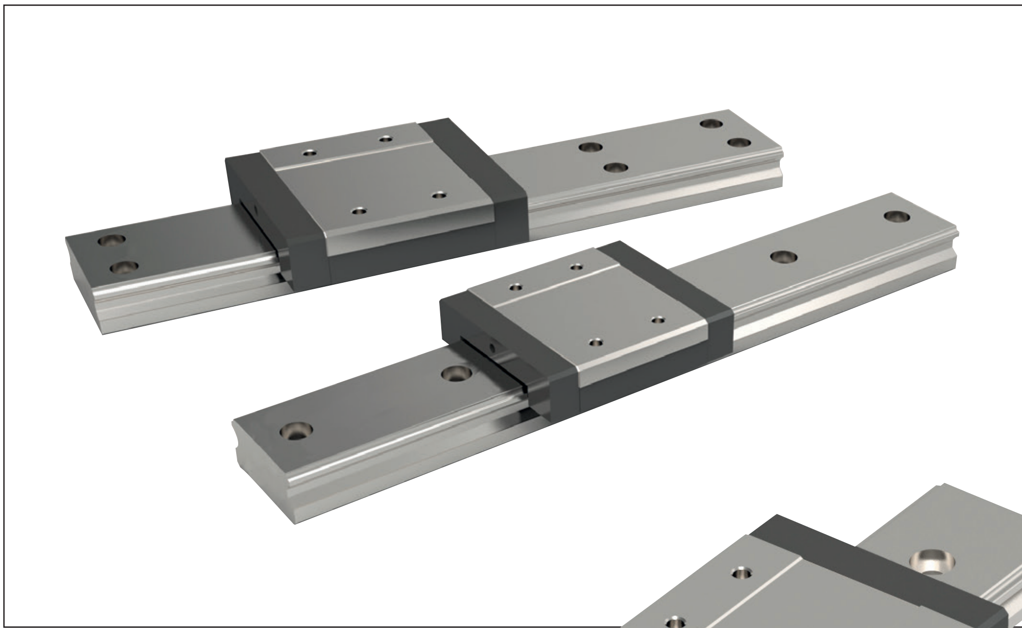


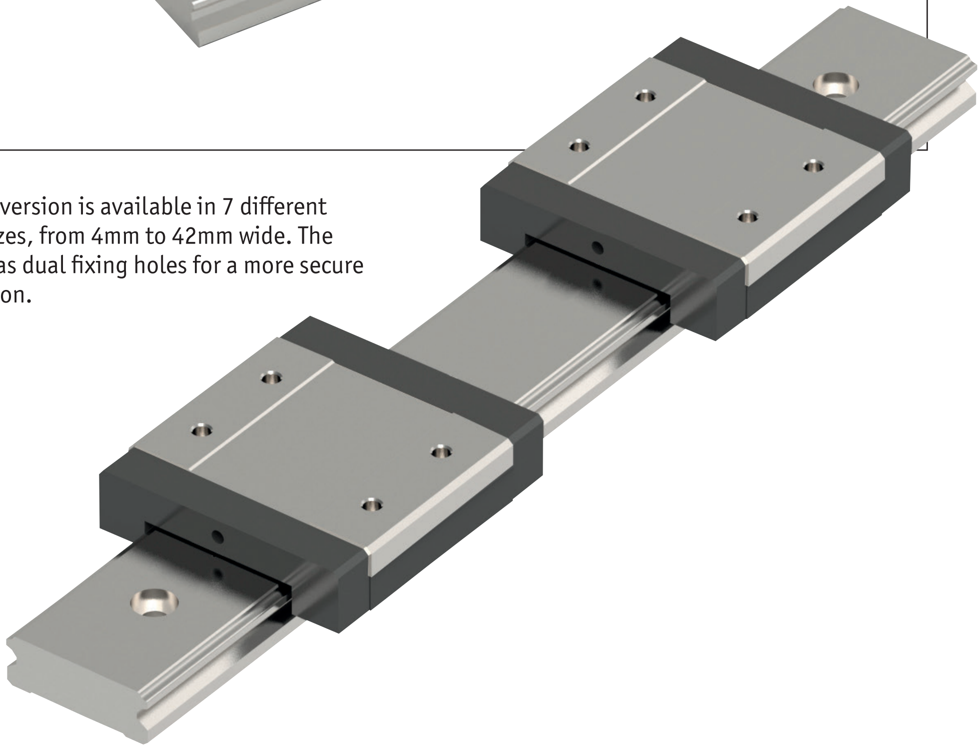
Type	Max. load capacities		Max. static moment loads		
	dyn. C_{rad} & C_{ax} N	stat. C_{0rad} & C_{0ax} N	M_x Nm	M_y Nm	M_z Nm
L1010.C03	190	310	0,6	0,4	0,4
L1010.C03L	295	575	0,9	1,1	1,1
L1010.C05	335	550	1,7	1,0	1,0
L1010.C05L	470	900	2,4	2,1	2,1
L1010.C07	890	1400	5,2	3,3	3,3
L1010.C07L	1310	2440	9,0	7,7	7,7
L1010.C09	1570	2495	11,7	6,4	6,4
L1010.C09L	2135	3880	18,2	12,4	12,4s
L1010.C12	2308	3465	21,5	12,9	12,9
L1010.C12L	3240	5630	34,9	30,2	30,2
L1010.C15	3810	5590	43,6	27,0	27,0
L1010.C15L	5350	9080	70,0	63,0	63,0

ov-mlg-load-standard-width-rnh - Updated - 28-02-2023

Wide version

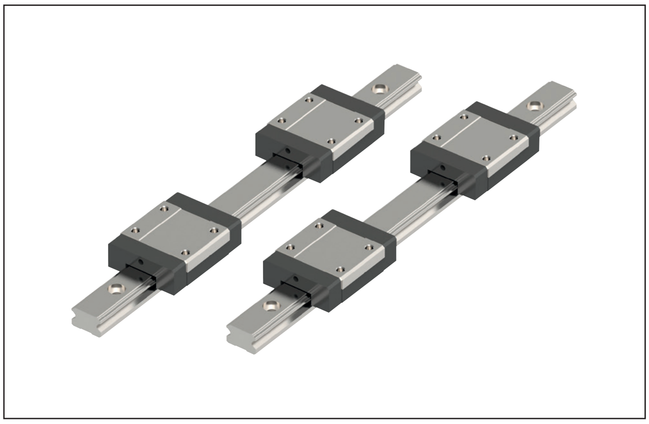
Miniature linear guideways come in two types - standard width and wide version. The standard width is a compact, high performance rail, often used in pairs as it takes smaller load forces than the wide version. For standard width products, please see part no. L1010.



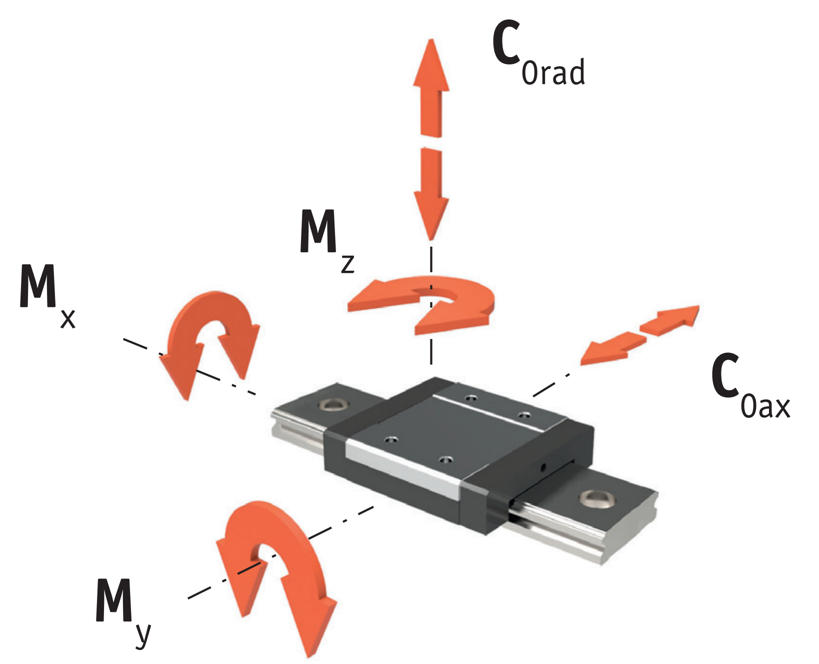


The wide version is available in 7 different profile sizes, from 4mm to 42mm wide. The size 42 has dual fixing holes for a more secure installation.

The wide version is often used in single rail applications due to its increase load capacities, unlike the standard width, which is predominately used in pairs.



L1012 - Wide version



Type	Max. load capacities		Max. static moment loads		
	dyn. C_{rad} & C_{ax} N	stat. C_{0rad} & C_{0ax} N	M_x Nm	M_y Nm	M_z Nm
L1012.C04L	310	625	1,6	1,2	1,2
L1012.C06	280	530	1,6	0,9	0,9
L1012.C06L	370	800	2,5	1,9	1,9
L1012.C10	475	900	4,6	2,2	2,2
L1012.C10L	615	1315	6,8	4,1	4,1
L1012.C14	1180	2095	15	7,3	7,3
L1012.C14L	1570	3140	22,6	14,9	14,9
L1012.C18	2030	3605	33,2	13,7	13,7
L1012.C18L	2550	4990	45,9	26,7	26,7
L1012.C24	3065	5200	63,7	26,3	26,3
L1012.C24L	4070	7800	33,2	13,7	13,7
L1012.C42	5065	8385	171,7	45,7	45,7
L1012.C42L	6725	12580	257	93,1	93,1

Friction

The miniature linear guideways profile system has a low friction characteristic with constant running resistance and low breakaway force.

Causes of friction

- Friction of the sealing system.
- Friction of the balls with each other.
- Friction between balls and redirection.
- Rolling resistance of the balls in the gothic arch running grooves.
- Resistance of lubricant in the carriage.
- Resistance caused by contamination in the lubricant.

Friction with lubricated end seal			
Type	$N_{max.}$	Type	$N_{max.}$
L1010.05	0,08	L1012.06	0,2
L1010.07	0,1	L1012.10	0,2
L1010.09	0,1	L1012.14	0,4
L1010.12	0,4	L1012.18	0,8
L1010.15	1,0	L1012.24	1,0
		L1012.42	1,0

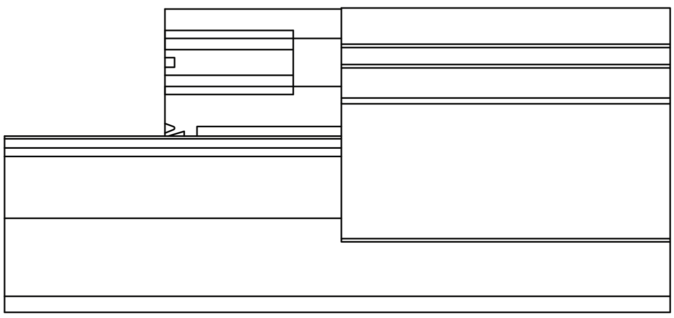
$$F_m = \mu \cdot F$$

F_m = friction force (N)
F = load (N)

Miniature linear guideways rails have a coefficient of friction of approximately μ = 0,002 - 0,003

Seal

The carriages of the miniature linear guideways are equipped with end seals on both sides.
The design of the end seal ensures a good and dust-proof seal. This extends the product service life, reduces the loss of lubricant and guarantees the optimum system lubrication over a long time. The special design of the stripper allows a low seal resistance and has no adverse influence on the running of the system.



Lubrication

The contact points between ball and track are separated from each other by a microscopically thin oil film. The lubrication ensures:

- Reduced friction.
- Reduced wear.
- Corrosion protection.
- Better thermal distribution and therefore increase in life.

Important instructions for lubrication

- The profile rails must be lubricated for operation.
- The carriage must be moved back and forth during lubrication.
- The lubricant can also be applied to the tracks.
- The lubricant can be injected into the lubrication holes on both sides of the carriage.
- There should be a thin film of lubricant on the rail surface at all times.
- If the stroke is <2 or >15 times the carriage length, the lubrication intervals should be more frequent.

Type	First lubrication cm^3
L1010.C05	0,04
L1010.C07	0,12
L1010.C09	0,23
L1010.C12	0,41
L1010.C15	0,78

Type	First lubrication cm^3
L1012.C10	0,05
L1012.C14	0,23
L1012.C18	0,30
L1012.C24	0,52
L1012.C42	0,87

Grease lubrication

When using grease lubrication, we recommend synthetic-oil based lithium grease with a viscosity according to ISO VG 32-100.

Oil lubrication

We recommend CLP or CGLP synthetic oil (DIN 51517) or HLP (DIN 51524) and a viscosity range conforming to ISO VG32-100 for operating temperatures between 0°C and +70°C. We recommend a viscosity according to ISO VG 10 for use at low temperatures. For application-specific special lubrication please contact the sales department.

Relubrication

- Relubrication of the system must be done before the lubricant has become dirty or shows signs of discolouration.
- An application of approx. 50% of the quantity used for first lubrication is sufficient for re-lubrication.
- Relubrication is performed at operating temperature. During relubrication, the carriage should be moved back and forth.
- If the stroke is <2 or >15 times the carriage length, the lubrication intervals should be more frequent.

Lubrication intervals

Operating speed, stroke length and ambient conditions influence the selection of time between lubrication intervals.

Establishing a safe lubrication interval is based on the specific applications and operating conditions. However, a lubrication interval should not be greater than one year.

Static Load (P_0) and static moment load (M_0)

Permissible static load

The permissible static load of the miniature linear guideways profile rail is limited by:

- Static load of each linear guide.
- Permissible load of the fixing screws.
- Permissible load of all components used in the surrounding construction.
- Static safety factor, which is required by the application.

The equivalent static load and the static moment are the largest load, or the largest moment load, which are calculated based on formulae 3 and 4.

Static load capacity C_0

The static load capacity C_0 of ball recirculating guides is defined according to DIN 636, Part 2 as the load which gives a Hertzian stress of 4,200 MPa with the existing lubrication between track and balls in the centre of the highest loaded contact surface.

Note: In the loading centre, there is a permanent deformation of approx. 0.01 % of the ball diameter under this load (according to DIN 636, Part 2).

Static safety factor S_0

When observing the static safety factor S_0 the miniature linear guideways profile rails allow a permissible operation and high running precision as is required for each application.

For calculation of the static safety factor S_0, see below.

$S_0 = C_0 / P_0$ **Formula 1**

$S_0 = M_0 / M$ **Formula 2**

$P_0 = F_{max}$ **Formula 3**

$M_0 = M_{max}$ **Formula 4**

Operating conditions	S_0
Normal operation	1 ~ 2
Loading with vibration or shock effect	2 ~ 3
High precision and smooth running	≥ 3

S_0 = static safety factor

C_0 = static load capacity in loading direction (N)

P_0 = equivalent static load (N)

M_0 = static moment in loading direction (Nm)

M = equivalent static moment in loading direction (Nm)

Dynamic load capacity C

If the dynamic loads work vertically with equal size and direction, the calculated service life of the linear guide can theoretically reach 100 Km travel (as per DIN 636, Part 2).

Combined load in combination with a moment

If both load and moment loads work on the profile rails, the equivalent dynamic load is calculated with formula 9. According to DIN 636, Part 1, the equivalent load should not exceed 0.5 x C.

Equivalent dynamic load and speed

With changing load and speed, these must be considered individually since each parameter influences the service life.

Equivalent dynamic load

If only the load changes, the equivalent dynamic load can be calculated with formula 5.

Equivalent speed

If only the speed changes, the equivalent speed is calculated with formula 6.

If speed and load change, the equivalent dynamic load is calculated with formula 7.

Combined dynamic load

With combined exterior load in an arbitrary angle, the equivalent dynamic load is calculated with formula 8.

$$P = \sqrt[3]{\frac{q_1 \cdot F_1^{\,3} + q_2 \cdot F_2^{\,3} + \cdots q_n \cdot F_n^{\,3}}{100}}$$ **Formula 5**

$$\bar{v} = \frac{q_1 \cdot v_1 + q_2 \cdot v_2 + \ldots q_n \cdot v_n}{100}$$ **Formula 6**

$$P = \sqrt[3]{\frac{q_1 \cdot v_1 \cdot F_1^{\,3} + q_2 \cdot v_2 \cdot F_2^{\,3} + \cdots q_n \cdot v_n \cdot F_n^{\,3}}{100}}$$ **Formula 7**

$$P = |F_X| + |F_Y|$$ **Formula 8**

$$P = |F_X| + |F_Y| + \left(\frac{|M_1|}{M_x} + \frac{|M_2|}{M_y} + \frac{|M_3|}{M_z} \cdot C_0 \right)$$ **Formula 9**

P = equivalent dynamic load (N)
q = stroke (in %)
F_1 = individual load levels (N)
v = average speed (m/min)
$\bar{v}$ = individual speed levels (m/min)
F = external dynamic load (N)
F_Y = external dynamic load – vertical (N)
F_X = external dynamic load – horizontal (N)
C_0 = static load capacity (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)

Technical Information

Service life

An example of a profile rail or a batch of identical profile rails under the same running conditions, which use ordinary materials with normal service life and operating conditions, can reach 90% of the calculated service life (as per DIN 636 Part 2).

By taking 50 Km travel as a basis, the dynamic load capacity is usually 20% over thevalues as per the DIN standard. The relationship between the two load capacities can be seen from formulae 10 and 11.

Calculation of service life

Formulae 12 and 13 are used for calculating the service life, if equivalent dynamic load and average speed are constant.

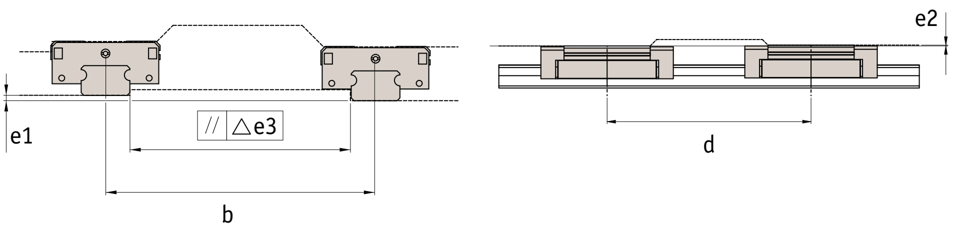
$$C_{(50)} = 1{,}26 \cdot C_{(100)} \qquad \textbf{Formula 10}$$

$$C_{(100)} = 0{,}79 \cdot C_{(50)} \qquad \textbf{Formula 11}$$

$$L = \left(\frac{C_{(100)}}{P}\right)^3 \cdot 10^5 \qquad \textbf{Formula 12}$$

$$L_h = \frac{L}{2 \cdot s \cdot n \cdot 60} = \frac{L}{V_m} \cdot \left(\frac{C}{P}\right)^3 \qquad \textbf{Formula 13}$$

L = service life based on 100,000 (m)
L_h = service life (h)
C = dynamic load capacity (N)
P = equivalent dynamic load (N)
s = stroke length (m)
n = stroke frequency (min^{-1})
V_m = average speed (m/min)



$e1\ (mm) = b\ (mm) \cdot f_1 \cdot 10^{-4}$ Formula 14

$e2\ (mm) = d\ (mm) \cdot f_2 \cdot 10^{-5}$ Formula 15

3 Formula 16

Type	f_1	f_2	f_3
L1010.C05	4	8	2
L1010.C05L	3	5	2
L1010.C07	5	11	4
L1010.C07L	4	6	4
L1010.C09	5	11	6
L1010.C09L	5	7	5
L1010.C12	6	13	8
L1010.C12L	5	8	8
L1010.C15	7	11	12
L1010.C15L	7	8	11
L1012.C04	2	5	2
L1012.C04L	2	3	1
L1012.C06	2	5	2
L1012.C06L	2	3	2
L1012.C10	2	6	4
L1012.C10L	2	4	4
L1012.C18	2	7	6
L1012.C18L	2	5	5
L1012.C24	3	8	8
L1012.C24L	2	5	7
L1012.C42	2	9	11
L1012.C42L	2	5	10

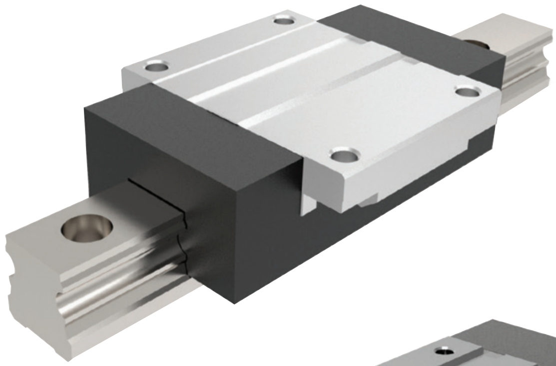
Tightening torque for fixing screws Nm			
Screw Quality 12,9	Steel	Cast iron	Non-ferrous metal
M2	0,6	0,4	0,3
M3	1,8	1,3	1,0
M4	4,0	2,5	2,0

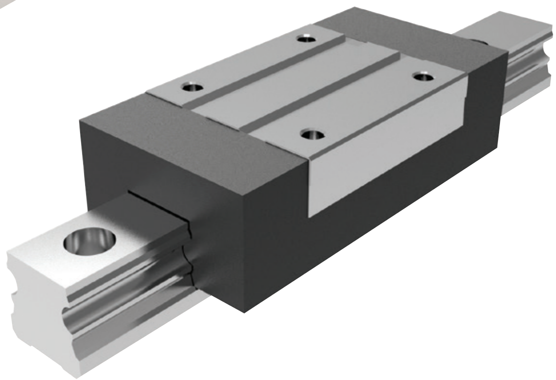
Aluminium Linear Guideways

Introduction

Product overview

Automotion aluminium profile rails and ball bearing runner blocks are designed especially for all sorts of linear movements and are therefore suitable for use in most type of applications.
The rails consist of profiled aluminium, having two pressed-in hardened stainless steel shafts serving as the raceways for the balls of the runner blocks.
Advantages are the light-weight and corrosive resistant materials. Fixing holes in the attachment surfaces enable machine parts to be directly mounted onto the runner blocks.
With this combination, it is possible for us to offer a guide system, which achieves a good price/performance ratio.





Product range

- There are two versions of our carriages: flanged and unflanged.
- There are two accuracies for our carriages: standard precision (0) and a high precision called “P” (available on request).
- The standard carriage is not pre-loaded.
- The dynamic load rating (C in the data tables) is based on a service life of 100 Km.

Advantages

- Compact, light-weight design with a weight saving of 60% compared to steel versions.
- Same fixing hole dimensions as steel, ball linear guideway systems.
- Much greater parallelism and height offsets of mounting bases possible, providing a degree of misalignment.
- Performs well in aggressive environments (dust, shavings etc.).
- Significantly better corrosion resistance compared to steel versions.
- Carriages initially greased in-factory, therefore provided with long-term lubrication.
- Due to ball retainers in the carriages, carriages can be removed from the rail without any loss of balls.
- Complete interchangeability between other manufacturers steel rail systems.
- Both sides of rail are reference edges. The carriages have one reference edge, which can be verified by turning it on the rail.

Application range:

Speed	$v_{max} = 2$ m/s
Acceleration	$a_{max} = 30$ m/s^2
Temperature	T = 0° - 60°C

Applications

Our rails can be used in a broad range of applications - especially in light machinery, handling technology, jigs and fixtures, assembly technology, manual displacement systems, machine enclosures, door – and window technology, display systems, aerospace, medical, food and many more.
Our aluminium rail guides cannot be used in the following applications:
- Main axis of a CNC or tooling machine.
- Aggressive and dusty enviroments.
- Oscillating conveyor systems.
- Danger of life or physical systems (for example unsecured overhead installation).

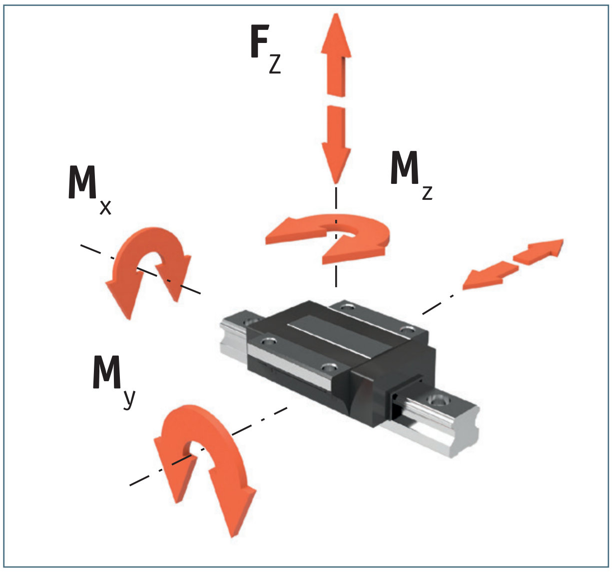
Determination of the carriage size:

1. Pre-select the carriages
2. Determine F_{comb} (see below)
3. Calculate the ratio of the dynamic load capacity "C" of the selected carriages relative to F_{comb} (F_{comb} divided by "C")

If F_{comb} /C > 0.4: carriages is sized too small, select the next largest size and repeat the calculation (step 2 and 3).

The ratio must always be F_{comb} / C≤ 0.4, otherwise F_{max} will be exceeded.

Note:
The load ratio F_{comb} / C is the quotient of the equivalent dynamic load on the bearing divided by the dynamic load capacity "C".



Calculation of load on bearing for a carriage:

$$F_{comb} = b \cdot \left(|F_Z| + |F_Y| + C \cdot \frac{|M_x|}{M_t} + C \cdot \frac{|M_y|}{M_L} + C \cdot \frac{|M_Z|}{M_L} \right)$$

F_{comb}	=	combined equivalent load	(N)	
F_Y, F_Z	=	Dynamic load	(N)	
M_X	=	torque of the X-axis [1)]	(Nm)	
M_Y	=	torque of the Y-axis [2)]	(Nm)	
M_Z	=	Moment um die Z-Achse [2)]	(Nm)	
M_t	=	dynamic torsional moment load capacity	(Nm)	For values, see carriage data tables
M_L	=	dynamic longitudinal moment load capacity	(Nm)	For values, see carriage data tables
C	=	dynamic load capacity	(N)	For values, see carriage data tables
b	=	operating factor, (see below)		For values, see table "Recommended values for operating factors "b".

1) Torque M_X will only be fully effective in an application with a single guide rail.
2) Torque M_Y or M_X will only be fully effective when only a single carriage is mounted on one guide rail.

Recommended operating factors b:

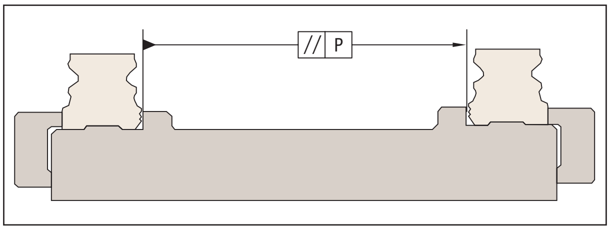
Values for operating factors b	
1,0	Clean environment, low technical demands, manual operation
1,5	In a linear motion axis with ball screw drive
2,0	Linear motion axis with toothed belt drive
6,0	Linear motion axis with pneumatic drive
9,0	In very dirty environments

Static load rating

A static load rating can not be easily determined, because of the composite material (aluminium/stainless steel combination). Instead of this, you can find the values F_{max} and M_{max}.

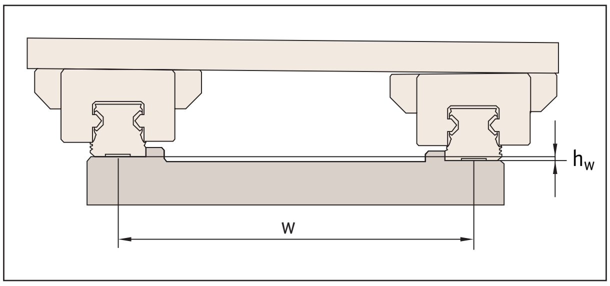
Parallelism

Please note the parallelism is required in the structure for correct installation. Parallelism of the installed rails is measured at the guide rails and the carriages.
Any parallelism offset will cause a slight increase in preload on one side of the assembly.
As long as values specified in the table are met, the effect of parallelism offsets on the service life can generally be neglected.



Size	Permissible deviation in parallelism P_{max}	
	Standard	Preload
15	0,027	0,018
20	0,031	0,021
25	0,034	0,022

mm



Calculation factor f	Standard	Preload
f	$1{,}2 \cdot 10^{-3}$	$0{,}75 \cdot 10^{-3}$

Height deviation

Permissible height deviation in lateral direction "h_w"

$$h_w \leq w.f$$

h_w = Allowable height deviation (mm)
w = Distance between rails (mm)
f = Calculation factor

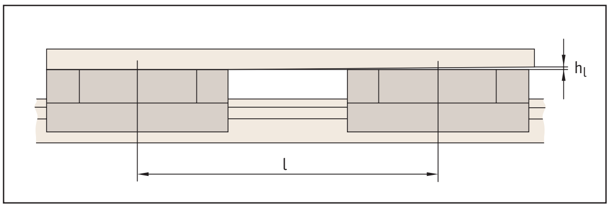
Allowable height deviation in longitudinal direction

Allowable height deviation in longitudinal direction "h_l"

$$h_l \leq b \cdot g$$

h_l = Permissible height deviation (mm)
b = Distance between carriages (mm)
g = Calculation factor

$$h_l = l \times [6 \times 10^{-4}]$$



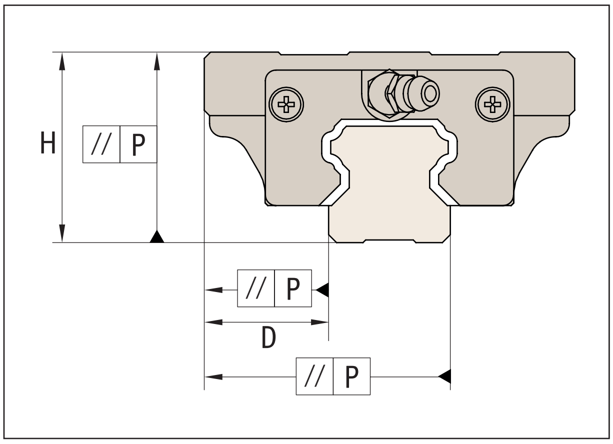
Calculation factor	Standard	Preload
g	6×10^{-4}	$2{,}1 \times 10^{-4}$

Height tolerance "H"

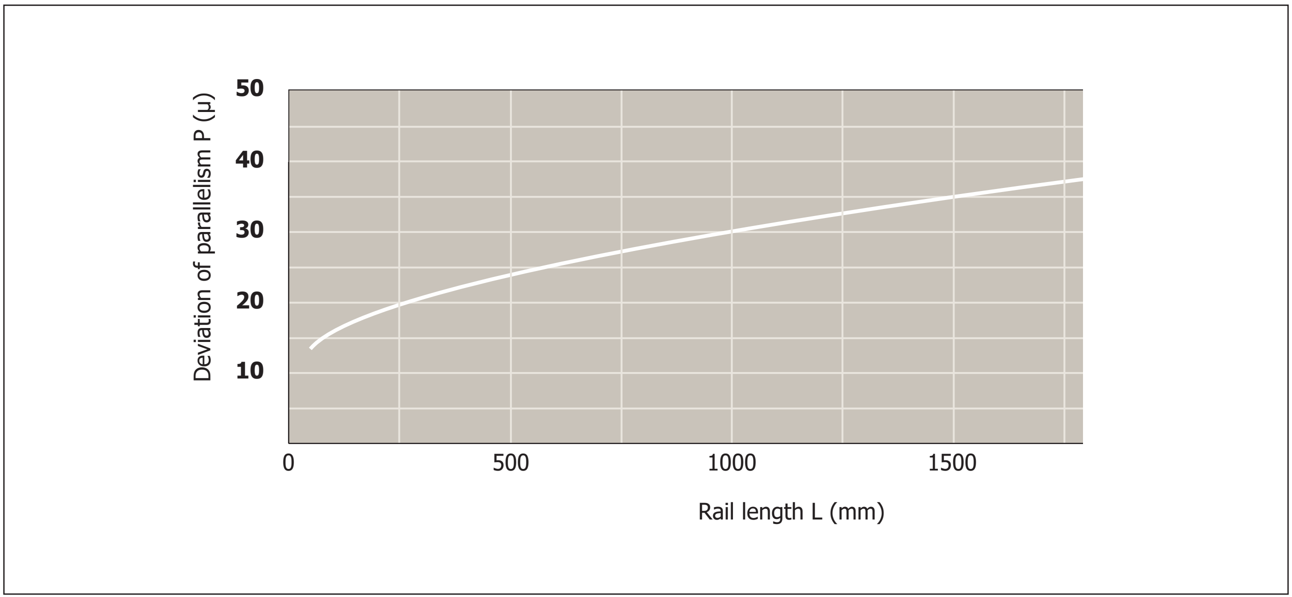
The height tolerance of several carriages on a rail is maximum ±30μ. In a combination of several carriages and rails the maximum is ±120μ.

Side tolerance "D"

The maximum side tolerance of several carriages on a rail is ±30 μ. In a combination of several carriages and rails, the maximum is ±70 μ.



Deviation of parallelism



We aim to achieve a lifetime lubrication, which we define as at least 30,000Km. The following conditions apply:

- Initial greasing with Dynalub 510
- Mounted seal unit
- No exposure to metal-working fluids
- Ambient temperature T = 20° to 30°C

First, the ratio F_{comb} / C is calculated with F_{comb} according to the formula on the previous page and the dynamic load rating C from the data tables. With this value you go then in to the diagram below.

If F_{comb} / C ≤ 0,15, it lies in the zone A of the diagram bellow.

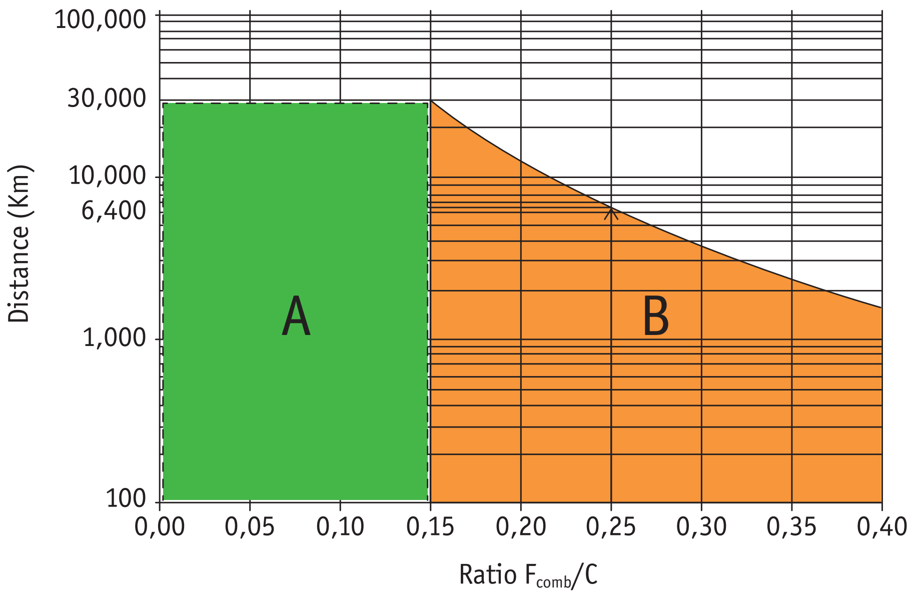
This means it will have lifetime lubrication.

With 0,15 < F_{comb}/C ≤ 0,4 it lies in the zone B of the diagram below.

For this you must distinguish two cases:
For example F_{comb} / C = 0,25 goes up to 6400km.

a) If the running distance required is < 6400 km, then there is a lifetime lubrication here.
b) If the running distance required is > 6400 km, then instead of the sealed unit, you should use the lubrication unit option.

If value F_{comb}/C > 0,4 then F_{max} is exceeded.



Note

- Take account of the general service life of lubricants.
- If other lubricants are used, this may lead to a reduction in the re-lubrication intervals, the achievable travel in short-stroke applications and the load capacities. Possible chemical interactions between the plastic materials, lubricants and preservative oils must also be taken into account.
- Do not use greases with solid particles such as graphite or MoS_2.
- If your application involves more demanding environmental requirements such as clean room, vacuum, food industry, increased exposure to fluids or aggressive media, extreme temperatures, please consult us. These situations must be investigated on a case by case basis and may require the use of a special lubricant.

X Rails

Introduction

The X rail system is a highly cost-effective product made of zinc plated steel (L1970), the stainless steel version (L1971) has a high level of corrosion resistance.

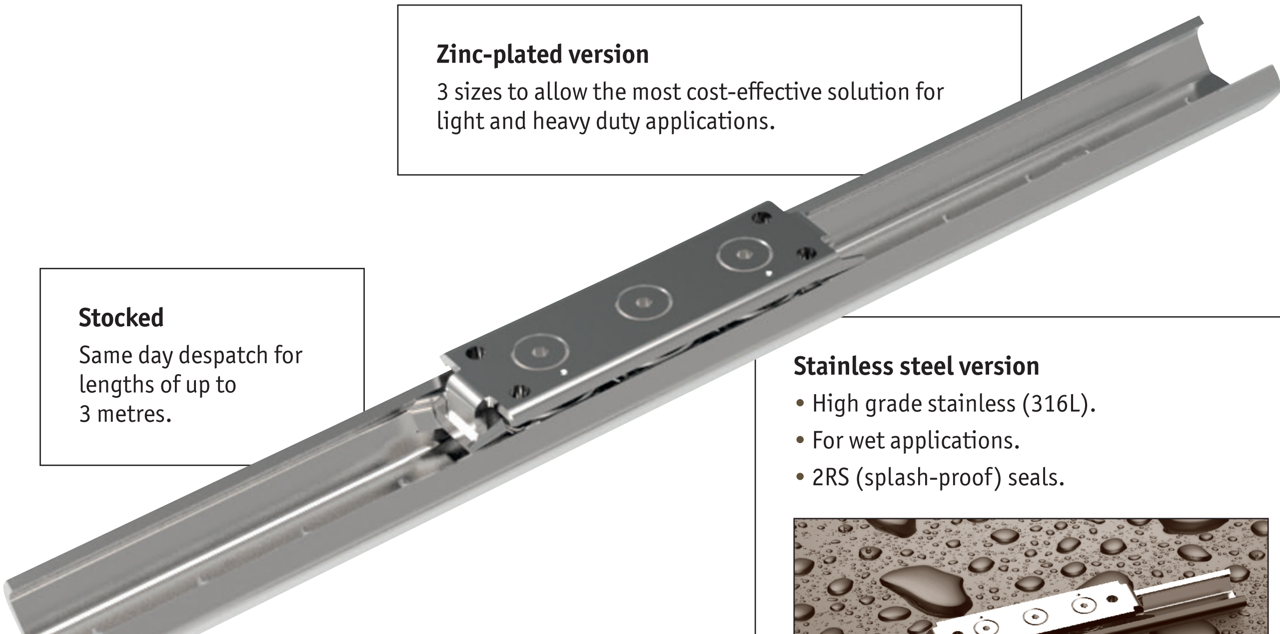
Cost-effective and corrosion resistant

The X rail is relatively inexpensive as it is based on a rolled formed, steel section.
It allows for adjustments due to misalignment of the structure that it is being used on and with internal raceways is suited for robust use but is not suitable for applications having significant moment loads.

The stainless steel (316L) version uses FDA and USDA compliant materials.

Zinc-plated version

3 sizes to allow the most cost-effective solution for light and heavy duty applications.

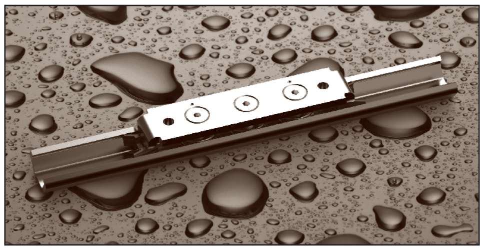


Stocked

Same day despatch for lengths of up to 3 metres.

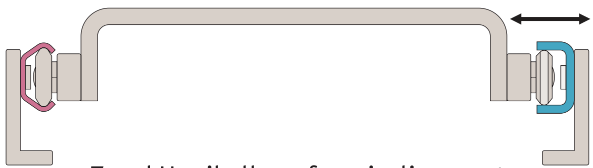
Stainless steel version

- High grade stainless (316L).
- For wet applications.
- 2RS (splash-proof) seals.

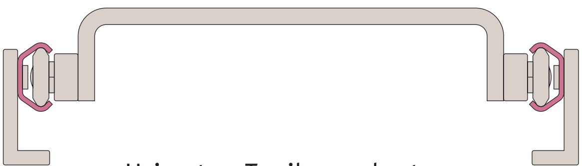


Flexibility in set-up

X rail allows the sliders one rail to remain fixed in place but allows some lateral movement of the sliders in the other rail to adapt to any misalignment.



T and U rail allows for misalignment



Using two T rails good set-up accuracy is required

ov-x-rail-intro-lnh - Updated - 08-03-2023

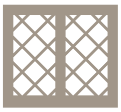
X Rails

Specifications and applications

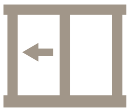
Specifications

- Maximum speed 1,5 m/s.
- Maximum acceleration 2 m/s².
- Maximum rail length 3120 mm.
- Three rail sizes 20, 30 and 45.
- Temperature range steel -30°C to +120°C.
- Temperature range stainless -30°C to +100°C.
- Sliders have two fixed rollers and one eccentric roller for adjustment of preload.
- Two slider body types; solid slider version and low profile slider version (T rails only).
- Joining of rails together, if required please discuss with our Technical Department.
- Not suitable for large moment loads (in this case use two or more sliders/rails to reduce moment loads).
- For applications with high moment and/or higher precision loads please use our Compact Rail System.

Applications



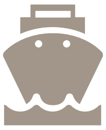
Safety guarding
Extending protective systems
sliding gates
automatic pick & place



Sliding doors & windows
Internal sliding doors
gates • roof lights
display cases

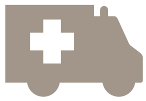
Medical technology
X-ray equipment
dental chairs
bed extensions

Food, drink & pharmaceuticals
Food handling conveyors
pharmaceutical factories
stainless display equipment

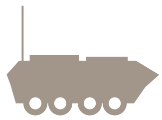


Transport (naval)
Sliding hatches
pull-out storage

Transport (rail)
Seat adjustment
sliding doors
battery removal units



Transport (automotive)
Ambulance sliding systems
fire fighting vehicles
sliding panels



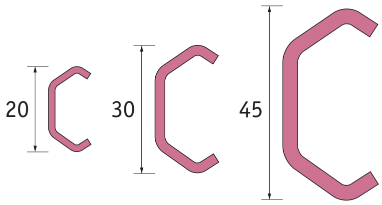
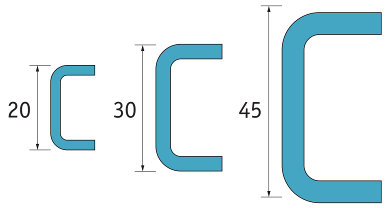
Transport (military)
Sliding seats
protective hatches
stretcher extensions

Water & waste
Sliding protective hatches
wash down applications
water tank doors

L1970 Zinc-plated steel version

Solid body slider	Low profile slider
	
L1970.CEST/U (2Z dust proof seals)	L1970.CES (2Z dust proof seals)

ZINC PLATED — Zinc-Plated Steel

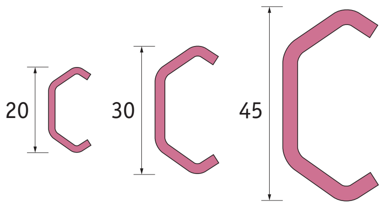
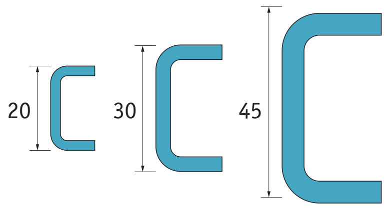
T Rail (master)	U Rail (slave)
	
size 20 size 30 size 45	size 20 size 30 size 45
L1970.TES	L1970.UES

ZINC PLATED — Zinc-Plated Steel

L1971 Stainless Steel version

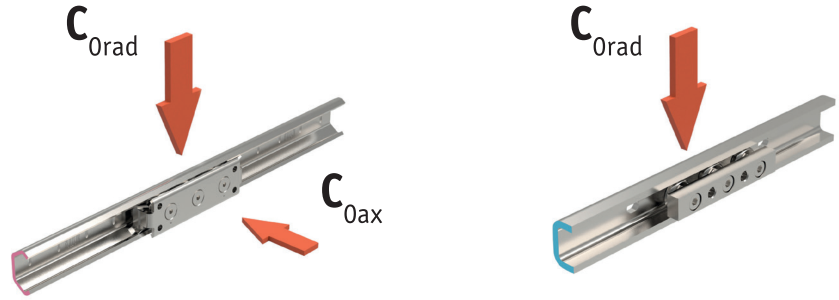
Solid body	Low profile slider
	
L1971.CEXT/U (2RS splash proof seals)	L1971.CEX (2RS splash proof seals)

316L — Stainless Steel

T Rail (master)	U Rail (slave)
	
size 20 size 30 size 45	size 20 size 30 size 45

316L — Stainless Steel

Two rail types



T Rail (master)
Accepts radial and axial loads

U Rail (slave)
Radial loads only
Compensates for misalignment

Selecting the correct rail

Firstly

The decision needs to be made if zinc plated steel or stainless steel rails and sliders are required.

- The zinc plated steel version (L1970) of the product is considerably less expensive than the 316L stainless steel type (L1971).
- The rollers in the zinc plated (L1970) sliders are protected by 2Z metal bearing covers. These are not meant to be used in anything other than a dry environment.
- The L1971 stainless steel X rail system is resistant to water and many chemicals. The slider rollers have rubber 2RS roller seals – being water resistant (not to be used fully submersed).

Secondly

The size of system to be used is selected.

- There are three different rail and slider sizes: 20, 30 and 45.
- The load that is being carried and its shape needs to be considered. The X rail system is not really suited for moment loads. If moment loads exist then two or more rails/sliders should be used to off-set this. Typically 2, 4 or more sliders are used and the load carried should be divided over the number of sliders bearing in mind that if using a U rail slider along with a T rail, the U rail sliders do not have any axial load capacity.
- The rails are supplied in standard lengths of 1040mm, 2080mm and 3120mm – and can easily be cut to other required lengths by Automotion (on request).

Finally

Decide whether a low profile slider or a solid body slider is required (low profile sliders are only available for T rails). The low profile (L1970.CES and L1971.CEX) sliders are less expensive than the solid body sliders.

Please note

It is very important to ensure that the correct low profile fixing screws are used with this rail (see part no. L1970.S for zinc plated steel and L1971.S for stainless steel). Using other higher profile heads may lead to contact between the underside of the slider and the top of the screws.

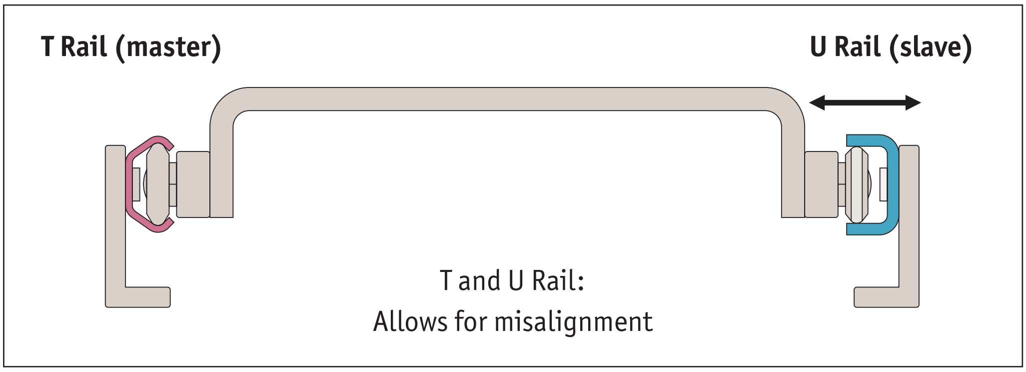
T rails (master) and U rails (slave)

It is often the case, with the X rail system, that two T rails are used in the system design. However, where there are substantial alignment issues it is better to use a T rail (master) and U rail (slave) as below.

This allows the slider in the T rail to remain fixed in the place, but allows some lateral movement of the sliders in the U rail to adapt to any misalignment and avoid any issues of stiction.

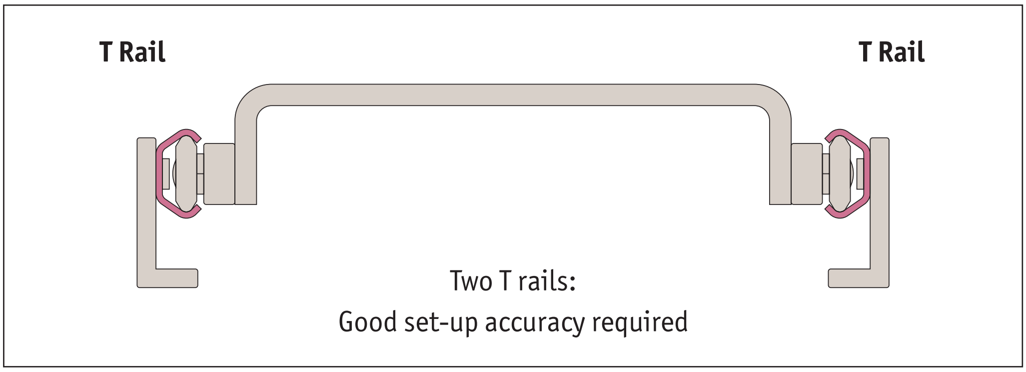
U rails have flat parallel raceways that allow free lateral movement of the sliders. The maximum lateral movement for each size rail is shown in the table that follows.

T and U rails



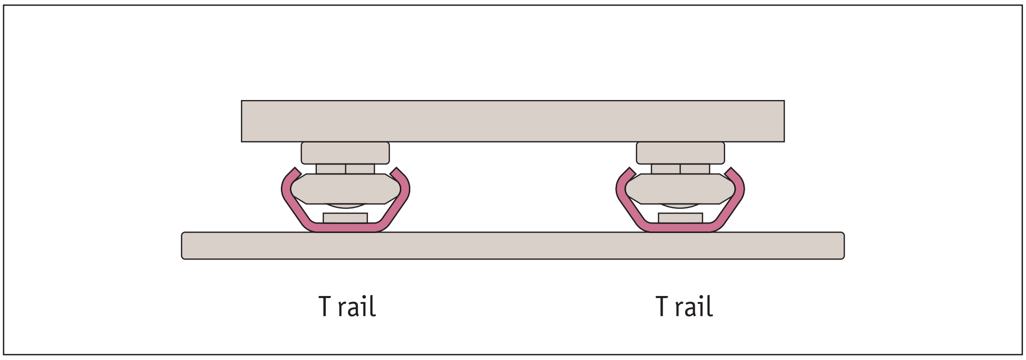
T and T rails

Some customers prefer to use two T rails as shown below. Whilst this is acceptable, a greater degree of accuracy is required in the structure on which the system is used.

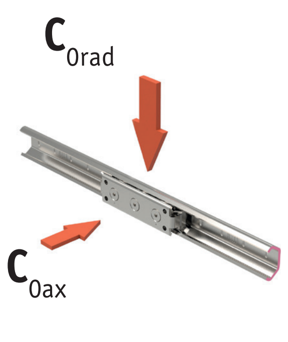


It is however also acceptable (but not the preferred method), to use the rails as below but the alignment accuracy needed is slightly greater and in this set up only T type rails can be used. In this instance we recommend the use of solid body sliders L1970.CEST (steel) or L1971.CEXT (stainless) rather than the low profile sliders.

Ensure a significant margin of safety is applied to the load ratings or consider using our hardened steel Compact Rail System.

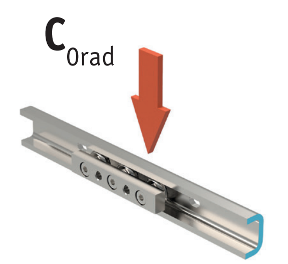


L1970 and L1971 slider load ratings for T rails



Part no.	Material	Body	C_{0rad} N	C_{0ax} N
L1970.20T-060	Steel	Solid	326	185
L1970.30T-080	Steel	Solid	870	435
L1970.45T-120	Steel	Solid	1740	935
L1970.20T-080	Steel	Low Profile	326	185
L1970.30T-088	Steel	Low Profile	870	435
L1970.45T-150	Steel	Low Profile	1740	935
L1971.20T-060	Stainless Steel	Solid	300	170
L1971.30T-080	Stainless Steel	Solid	800	400
L1971.45T-120	Stainless Steel	Solid	1600	860
L1971.20T-080	Stainless Steel	Low Profile	300	170
L1971.30T-088	Stainless Steel	Low Profile	800	400
L1971.45T-160	Stainless Steel	Low Profile	1600	860

L1970 and L1971 slider load ratings for U rails



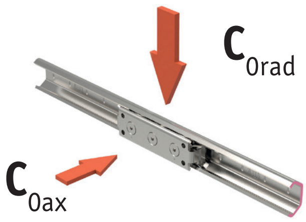
Part no.	Material	Body	C_{0rad} N	C_{0ax} N
L1970.20U-060	Steel	Solid	326	-
L1970.30U-080	Steel	Solid	870	-
L1970.45U-120	Steel	Solid	1740	-
L1971.20U-060	Stainless Steel	Solid	300	-
L1971.30U-080	Stainless Steel	Solid	800	-
L1971.45U-120	Stainless Steel	Solid	1600	-

U rail sliders cannot accept axial loads

Orientation of rails

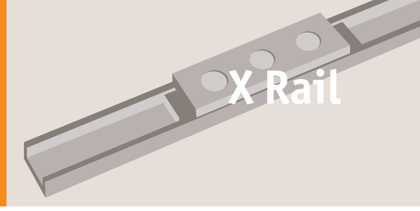
The radial load that the sliders can take is significantly higher than the axial load, so where possible the rails should be set up with the sliders taking the loads in this plane.

Recommended



Non-preferred

Radial load rating is typically 2 x axial load rating



Why should I consider using the X Rail system?

The X rail system is very cost-effective.

Using a master (T rail) and slave rail (U rail), the structure onto which the rail is installed does not have to be machined as accurately as when using other rail systems - this can result in major cost savings for many projects.

It is highly resistant to dirt. The L1971 stainless steel X rail is very corrosion resistant and can be used in wet environments (not submerged).

Are there any disadvantages?

The X rail system is made of a rolled formed section. It is not suited to high moment loads. If moment loads are present then typically more sliders and/or an extra rail is used to provide a system where less moment loads are applied to the sliders.

If you have applications with significant moment loads we would recommend the use of our Compact Rail System which is made from cold drawn steel section and has hardened raceways.

How do I change the smoothness of the running of the sliders in the rails?

Each slider is supplied with a small spanner. This can be used to push the eccentric roller towards the top of the rail (making it run more stiffly), or pulled away slightly to make the sliders run very smoothly. The eccentric rollers are clearly marked and the slider should be installed the correct way up in the rail. Generally this is with the fixed rollers towards the bottom of the rail (providing the loading points). The simple instructions are shown in the catalogue.

I want to use the rail outside or in a slightly wet environment?

The stainless steel version (L1971) is made of highly corrosion resistant 316L stainless steel. The rollers are also stainless steel but harder (440C stainless) and are fitted with 2RS rubber seals (splash proof). They can be used outside and in marine applications (e.g. sliding doors and hatches).

Do you hold these parts in stock?

Yes.

Can I get CAD files of these parts?

Most of the 3D models (in many formats) are available for download directly from our website www.automotioncomponents.co.uk

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CAD - Download in 3 easy steps

Most of our products are available to download directly from our website. Get the CAD you need for your application in minutes, no registration required.

Step 1: Find the part you need

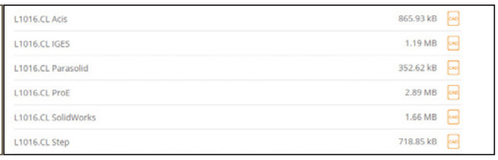
Find the part or enter the Automotion part number into the search bar.

Step 2: Choose the CAD option

Click on the CAD button below the product window to the right of the drawing.

Step 3: Download your format

Choose the the format you require, and download it to your computer.

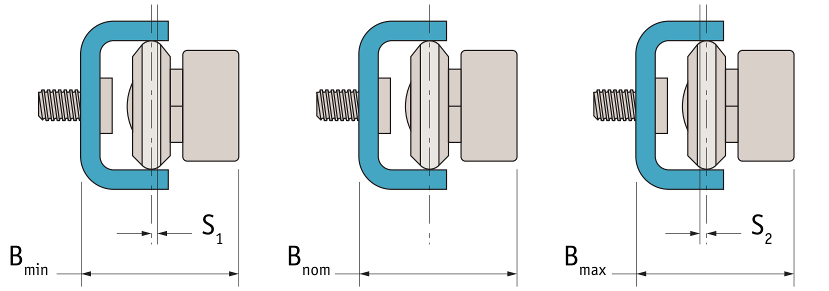


Slave rail compensation

In a T+U-System, the slider in the T rail carries axial and radial loads and guides the movement of the slider in the U rail. U rails have flat parallel raceways that allow free lateral movement for the sliders.

The maximum freedom a slider in the U rail can offer can be calculated using the values S_1 and S_2. With nominal value B_{nom} as the starting point, S_1 indicates the maximum allowed movement into the rail, while S_2 represents the maximum offset towards the outside of the rail.

If the length of the rail is known, the maximum allowable angle of deviation of the mounting surface is shown below. In this case the slide in the U rail has the freedom to travel from the innermost position S_1 to the outermost position S_2.

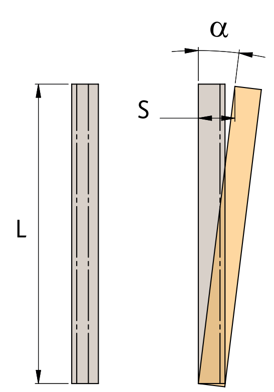


U rail size	S_1	S_2	B_{min}	B_{nom}	B_{max}
20	0,60	0,60	17,65	18,25	18,85
30	1,00	1,00	26,95	27,95	28,95
45	1,75	1,75	35,50	37,25	39,00

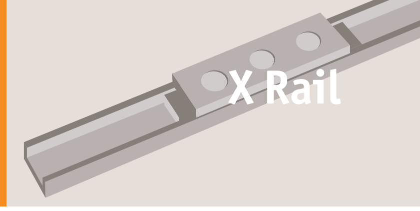
Guideline for maximum angle deviation α, achievable with the longest guide rail

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

S^* = sum of S_1 and S_2
L = length of the rail

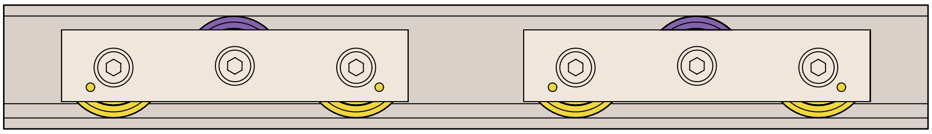


Size	Rail length	Offset S*	Angle α °
20	3120	1,2	0,022
30	3120	2,0	0,037
45	3120	3,5	0,064



The standard arrangement of the sliders (when used in a horizontal application) is as follows:

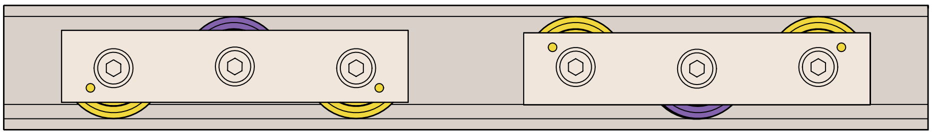
Arrangement 1



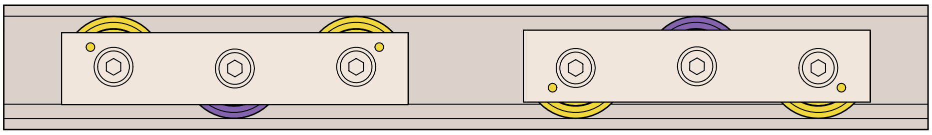
Note orientation of fixed rollers

For other applications (e.g. horizontal or vertical) the alternative arrangements are as follows:

Arrangement 2



Arrangement 3



Note orientation of fixed rollers

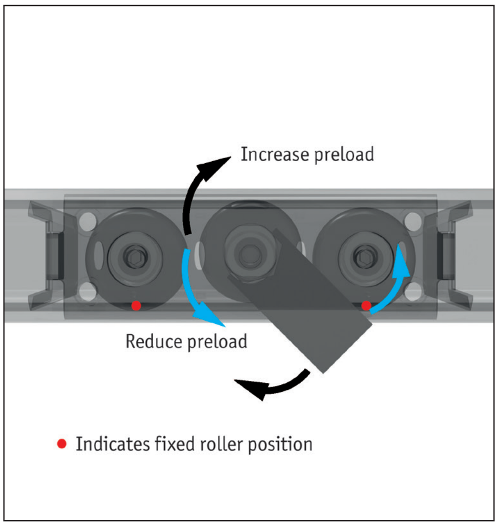
Fixed Roller

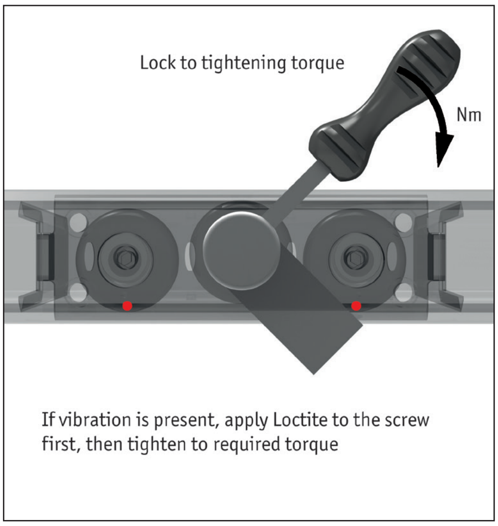
Eccentric Roller

Adjusting the sliders

If delivered separately, or if the sliders need to be installed in another rail, the sliders must be re-adjusted. In this case, follow the instructions below.

The "•" or "V" marked on the slider indicates the direction of the fixed rollers.





The sliders have three large rollers. The two at either end are fixed and the direction of these fixed positions is marked on the sliders with a dot or an arrow.

Insert the sliders into the rails with the fixed rollers set to take the load in the best direction.

The middle roller is on an eccentric pivot that is easily adjusted (using the thin spanner that is supplied with them and a hexagon key). This allows the preload of the system to be set as required – stiff or free running.

Generally the sliders will not be inserted into the rails when leaving the factory. To set the sliders to the required preload is a simple procedure:

- Ensure raceways are clean.
- Remove the small plastic wipers (from the low profile sliders) and insert the slider into the rail.
- Slightly loosen the centre roller (using the spanner and a hexagon key).
- For U rails a packer should be used to set the slider in its middle lateral position.
- Use the flat spanner provided to move the middle roller on its eccentric to adjust the stiffness of its running. Not too loose so that there is excess play and not too tight that a lot of friction is generated.
- Lock the roller in the desired position with the spanner and a hexagon key.
- Move the slider the length of the rail to check required running – it should move easily with no play at any point on the rail.
- Tighten the fixing screw to the correct torque – whilst holding the spanner in place to ensure no further movement (see correct torque values in table below.
- Finally (if using a slider with a wiper), re-install the wipers if required.

Size	Tightening torque Nm
20	3
30	7
45	12

The compact rail systems are unique. They have many major advantages over other rail systems.

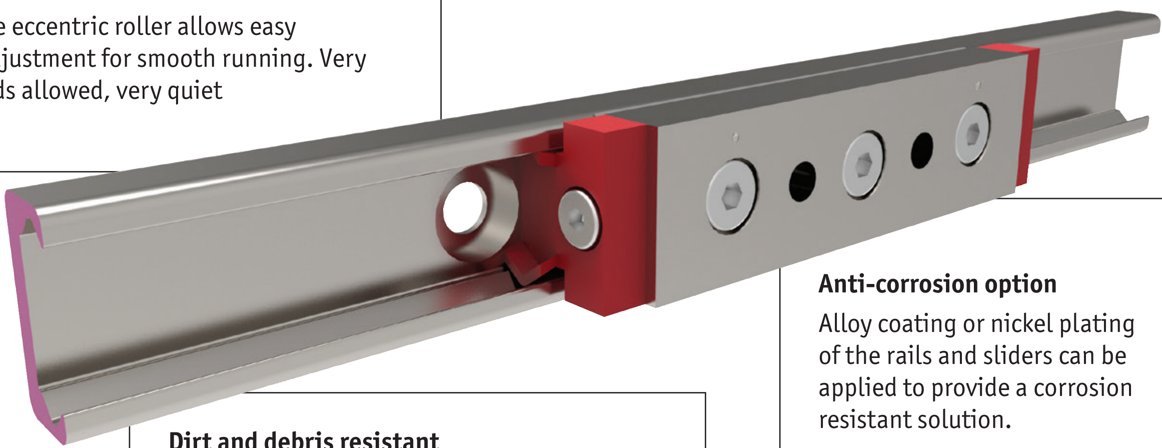
Easy and cost-effective to set up

The rails are easy to set up and can adjust for some misalignment of the structure on which it is being used. The compact rail system achieves this by using a master (T type) rail, and a slave (U type) rail. This allows the sliders in the T rail to remain fixed in place but allows lateral movement of the sliders in the U rail to adapt to any misalignment and avoid any issues of stiction.

Slave (U) rails have flat, parallel raceways that allow free lateral movement of the sliders. This flexibility can mean a large saving in the machining of the structure surface making it a very cost-effective solution.

Fast, smooth and quiet

The unique eccentric roller allows easy preload adjustment for smooth running. Very high speeds allowed, very quiet operation.



Anti-corrosion option

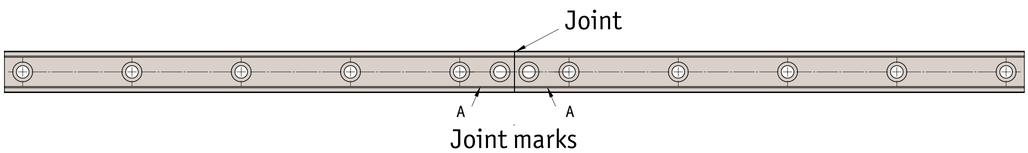
Alloy coating or nickel plating of the rails and sliders can be applied to provide a corrosion resistant solution.

Dirt and debris resistant

The internal raceways are resistant to dirt and debris, larger roller bearings with seals and wipers are used (compared to small ball bearings on other systems).

Unlimited rail lengths

Rails can be easily joined together for unlimited rail lengths, and extra hole needs to be machined at the joint area. The rails need to be selected so they are “matched” and a joining tool needs to be used to align the rails.



Compact Rails

Specifications and applications

Specifications

- Maximum speed 9 m/s.
- Maximum acceleration 20 m/s².
- Maximum unjoined rail length 3600 mm.
- 4 rail sizes – 18, 28, 35 and 43.
- Three rail types - T rail, U rail and K rail.
- Rail lengths from 160mm upwards.
- Rail raceways hardened and ground.
- Accuracy 0,15mm over 3,5 metres.
- Maximum radial load per slider is 15,000 N.
- Temperature range -30°C to +120°C.
- Roller bearings seals either 2Z (dust proof) or 2RS (splash proof), lubricated for life.
- Roller bearings from 100Cr6.
- Easy adjustment of preload.
- Three slider body types.
- Rails can be joined together, please contact our Technical Department for details.
- Special anti-corrosion coatings and finishes on request.

Applications

Special purpose & packaging machines
Precision positioning systems
handling units
robotic systems • cutting machines

Seating
Sliding seats
disability ramps
seat extensions

Safety guarding
Extending protective systems
sliding gates
automatic pick & place

Sliding doors & windows
Internal sliding doors
gates • roof lights
display cases

Photography & lighting
Sliding tracks
positioning of lights
shielding systems

Medical technology
X-ray equipment
dental chairs
bed extensions

Food, drink & pharmaceuticals
Food handling conveyors
pharmaceutical factories
stainless display equipment

Transport (naval)
Sliding hatches
pull-out storage

Transport (rail)
Seat adjustment
sliding doors
battery removal units

Transport (automotive)
Ambulance sliding systems
fire fighting vehicles
sliding panels

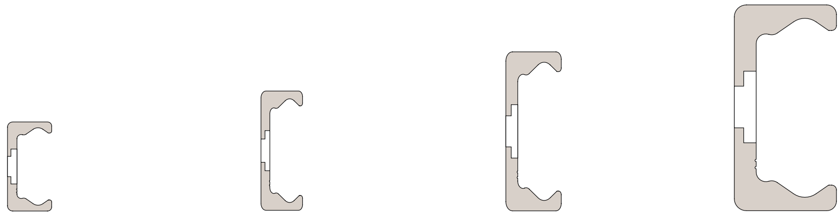
Transport (military)
Sliding seats
protective hatches
stretcher extensions

Compact Rail

Overview

Compact Rail from Automotion Components

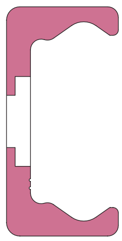
Rail sizes



size 18 | size 28 | size 35 | size 43

Rail types

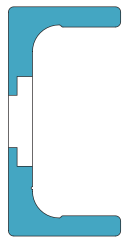
T Rail (master)



Master rail

Accepts radial and axial loads

U Rail (slave)



Slave rail

Compensates for misalignment in one plane

Sliders

Solid body, front mount - Type CL

Solid steel, zinc plated body
with removable end wipers
side seals, fixing in top face

Solid body, front mount - Type CS

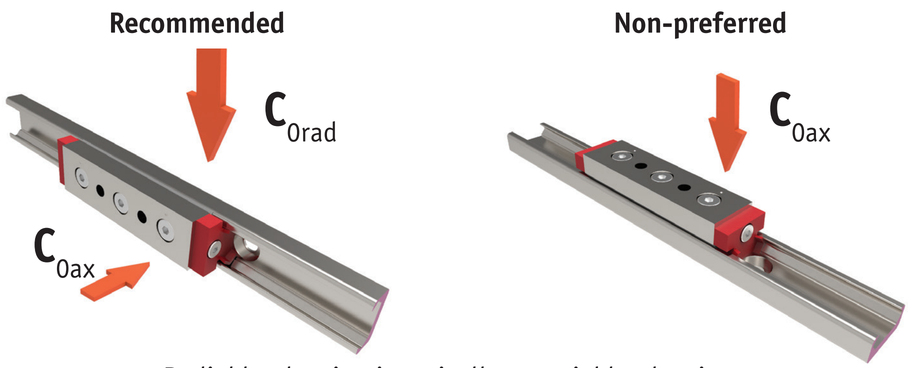
Narrow body, solid steel
zinc plated
with removable end wipers
no side seals, fixing on top face

Solid body, side mount - Type CR

Solid steel, zinc plated body
with removable end wipers
side seals, fixing in side of body

Orientation of rails

The radial load that the sliders can take is significantly higher than the axial load, so where possible the rails should be set up with the sliders taking the loads in this plane.



Radial load rating is typically 2 x axial load rating

One of the key benefits of the compact rail system is that it compensates for misalignment in the structure. This often results in a major cost saving when compared to the use of other guideways which have to be very accurately installed.

The compact rail system achieves this by using a master (T type) rail, and a slave (U type) rail. This allows the slides in the T rail to remain fixed in place but allows lateral movement of the sliders in the U rail to adapt to any misalignment and avoid any issues of stiction.

U rails have flat, parallel raceways that allow free lateral movement of the sliders.
The maximum lateral movement for each size is shown in later tables.

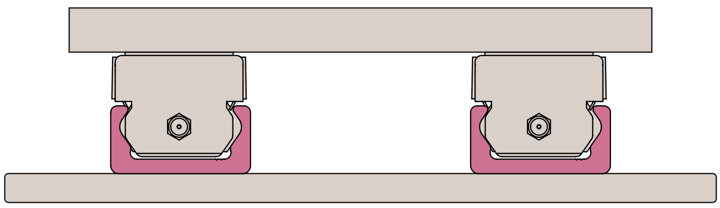
T Rail (master) **U Rail (slave)**

This rail set-up allows for some lateral misalignment

Using flat rails

It is acceptable (but not the preferred method), to use rails as below but the alignment accuracy needed is slightly greater and in this set-up only T type rails can be used.

In this case the axial load figure C_{0ax} should be used in any calculations (which is considerably less than the radial load figure C_{0rad}).



Why should I consider using compact rails?

- Compact rails have a number of major advantages over the traditional use of recirculating ball linear guideways. Using a master (T) rail and slave rail (U) rail, the structure onto which the rails are installed does not have to be machined so accurately – this can result in major cost savings for many projects.
- The raceways of the compact rail system are on the inside of the rail profile, and this, highly effective side and end sealing, and the use of large diameter roller bearings(as opposed to miniature ball bearings), means that the system is highly resistant to dirt and debris.
- Unlike linear guideways, the preload of the sliders can be adjusted as required. This can result in a very smooth running system.
- Rails can be easily joined together to make unlimited rail lengths.
- The rails and sliders can be provided with alloy coating and stainless steel roller bearings for applications that may become wet.

Are there any disadvantages?

- The compact rail system's accuracy is around 0,15mm over a 3 metre length – this is not as accurate as recirculating ball linear guideways.
- Recirculating ball linear guideways have higher load capacities for both axial and radial loads.

How do I change the smoothness of the running of the sliders in the rails?

- Each slider is supplied with a small spanner. This can be used to push the eccentric roller towards the top of the rail (making it run stiffly), or pulled away slightly to make the sliders run very smoothly. The eccentric rollers are clearly marked and the slider should be installed the correct way up in the rail. Generally this is with the fixed rollers towards the bottom of the rail (providing the loading points). The simple instructions are shown in the catalogue.

I want to use the rail outside or in a slightly wet environment?

- A nickel or alloy plating can be applied to the compact rail, this is our preferred anti-corrosion solution. Please see our anti-corrosion section for details.
- The sliders can also be nickel plated and provided with stainless 440C roller bearings with 2RS (splash-proof) seals.

What about if I want to motorise my application?

- We have a full range of motorised linear stages based on the compact rail systems – these are our uniline stages.
- Maximum stroke for these (in a single piece) is around 6 metres.

Do you hold these parts in stock?

- In general we hold all the rail in stock as well as most the most popular C series sliders.

Can I get CAD files of these parts?

- Most of the 3D models (in many formats) are available for download directly from our website **www.automotioncomponents.co.uk**

I am not sure which is the best rail/slider combination for my application?

- Please send us a sketch listing the main points of the application and our Technical Department will deal with this promptly. If required we can also arrange a visit to discuss the application and to show you the different systems available.

Anti-corrosion treatments

The compact rail systems have the following protective coatings as standard:

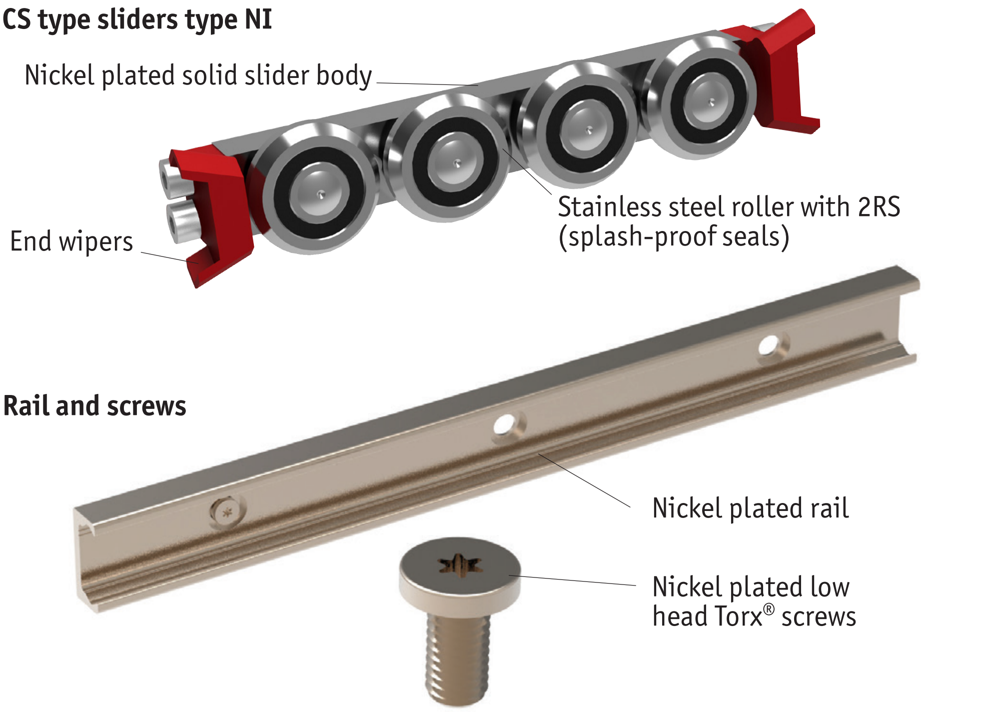
- Rails: zinc plated (with the exception of the area of the raceways themselves), these are ground after the plating process.
- Sliders have a zinc plated solid steel body.

We can upgrade the anti-corrosion protection of the system by offering the following:

- Nickel plating the rails. In this case the nickel plating is applied after the grinding of the raceways. In this way the whole of the rail is anti-corrosion protected.
- Sliders can also be fully nickel plated. Stainless steel (440C) rollers can be used with 2RS (splash proof) seals and stainless steel screws for the sliders.
- The special low head Torx screws can be supplied nickel plated.

Anti-corrosion protection option

CS type sliders type NI



Technical Information

A short system selection guide

This is a basic overview for rail system selection. For full technical details and advice please refer to the technical pages in our catalogue, or alternatively send details on a sketch to our Technical Department who will be happy to advise on the application.

1 Consider the size and overall weight of the load

- There are four different rail sizes (18, 28, 35 and 43).
- A large percentage of applications use size 28 or size 43 rails and sliders. Whilst rails can be used singly, for the majority of applications they are used in pairs (typically a T and a U rail).
- Normally at least two sliders are used per rail. So as a starting point, divide the total load (in Kg.) by the number of sliders and multiply by 10 to give the expected load per slider in Newtons. Compare this to the dynamic load C_{0rad} load ratings in the load capacity summary tables. More sliders can be added to increase the system load capacity, or select a slider with more roller bearings (the standard sliders have three roller bearings), up to six roller bearings per sliders are available.
- Where possible the rails should be installed on their side as this gives the maximum load rating per slider. Typically the radial load of a slider is twice its axial load rating.

2 Type of slider

- Our standard sliders are solid body, front mount with side seal type CL. These have a wide body and are available front mount and side mount.
- Some customers however prefer to use narrow solid steel body sliders type CS. These types do not have side seals.

3 System travel

- Thinking about the physical dimension of the load will give an indication of how far apart the sliders should be positioned in the rails. This, and the distance apart that the rails and the sliders are positioned, affect the moment loads that the sliders experience.
- The above factors will give a good indication of the rail size to be used. In many cases the rails size that could be used might be smaller than would be expected (due to the impressive load ratings of the sliders). In many cases customers quite often “up-size” the rail so that it “looks” more appropriate to the size of the load being carried.
- Considering the distance apart of the sliders and the movement (stroke) required in the system will determine the overall rail length required.
- Rails can be joined together to make unlimited rail lengths. For this we have to select suitable rails, machine the ends and add an extra fixing hole. The rails can then be aligned with a simple tool.

4 Rail types

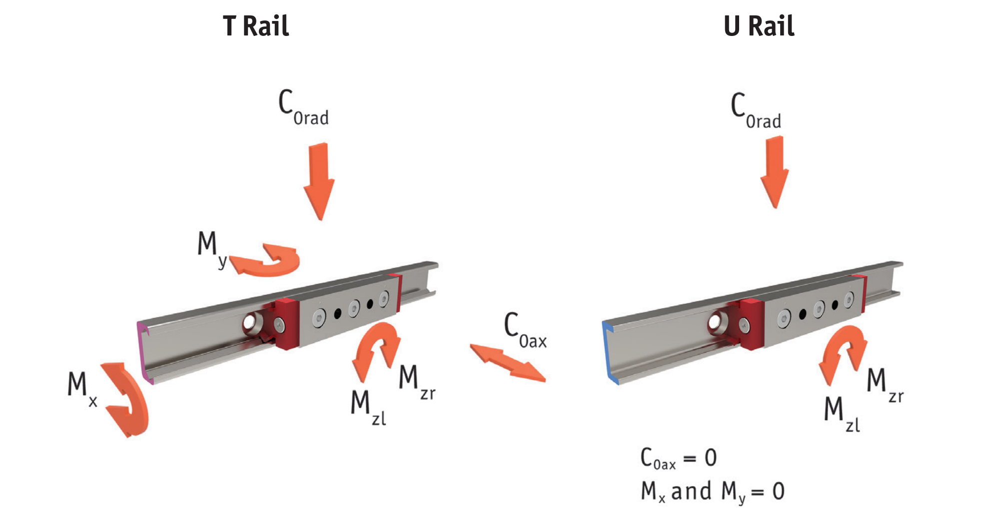
- Typically a T rail is used on one side and a U rail on the other. The U rail allows for lateral movement of the U slider in the U rail - this reduces the need for accuracy in the structure that the rails are used on, as the T rail becomes a master rail and the U rail a slave rail (unlike linear guideways where to prevent irregular movement the rails have to be aligned highly accurately).
- In some instances there can also be significant height inaccuracies and in this case the T rail can be replaced by a K rail (K rails cannot be used in vertical applications).
- There are two versions of each rails type. These end in either a C or a V and indicate the type of fixing screw required to fix the rail to the structure. The C (counterbored) type is most widely used compared to the V (countersunk) type. The counterbored fixing in the rails allows for more flexibility in the fixing hole position of the structure. Special low profile counterbore screws are provided with the type C rails.

5 Environment

- In normal, dry applications, the zinc plated finish of the rails combined with the standard 2Z (dust proof) seals of the roller bearings in the sliders is sufficient.
- In some cases the rails may become wet. In this case we have the option to apply a special coating to the rails, please discuss with our Technical Department. This has good corrosion resistance (see notes on Salt Spray tests), and should be combined with either nickel or alloy plated sliders with stainless steel rollers (440C), and 2RS roller bearing seals (splash proof) these are generally of the CL or CS type and are shown in the catalogue. The 2RS seals are “splash proof” - they cannot operate fully immersed.

Technical Information

Load capacities - Size 18



Part no.	No. of rollers	Load capacities and moments: Max. dyn. C N	Max. static C_{0rad} N	Max. static C_{0ax} N	M_x Nm	M_y Nm	M_z Nm: M_{zr}	M_{zl}
Side seal, front fixing								
L1918.18CL-060	3	1540	825	262	1,6	4,8	8,3	8,3
L1918.18CL-080-A	4	1540	825	310	2,9	7,1	8,3	24,9
L1918.18CL-080-B	4	1540	825	310	2,9	7,1	24,9	8,3
L1918.18CL-100	5	1832	978	365	2,9	9,5	24,9	24,9
L1918.18CL-120-A	6	1832	978	442	3,4	11,9	24,9	41,2
L1918.18CL-120-B	6	1832	978	422	3,4	11,9	41,2	24,9
Side seal, top fixing								
L1918.18CR-060-A	3	1540	825	262	1,6	4,8	8,3	8,3
L1918.18CR-060-B	3	1540	825	262	1,6	4,8	8,3	8,3
L1918.18CR-080-A	4	1540	825	310	2,9	7,1	8,3	24,9
L1918.18CR-080-B	4	1540	825	310	2,9	7,1	24,9	8,3
L1918.18CR-100-A	5	1832	978	365	2,9	9,5	24,9	24,9
L1918.18CR-100-B	5	1832	978	365	2,9	9,5	24,9	24,9
L1918.18CR-120-A	6	1832	978	442	3,4	11,9	24,9	41,2
L1918.18CR-120-B	6	1832	978	442	3,4	11,9	41,2	24,9
No side seal, front fixing								
L1918.18CS-060	3	1530	820	260	1,5	4,7	8,32	8,2
L1918.18CS-080-A	4	1530	820	300	2,8	7,0	8,2	24,7
L1918.18CS-080-B	4	1530	820	300	2,8	7,0	24,7	8,2
L1918.18CS-100	5	1830	975	360	2,8	9,4	24,7	24,7
L1918.18CS-120-A	6	1830	975	440	3,3	11,8	24,7	41,1
L1918.18CS-120-B	6	1830	975	440	3,3	11,8	41,1	24,7

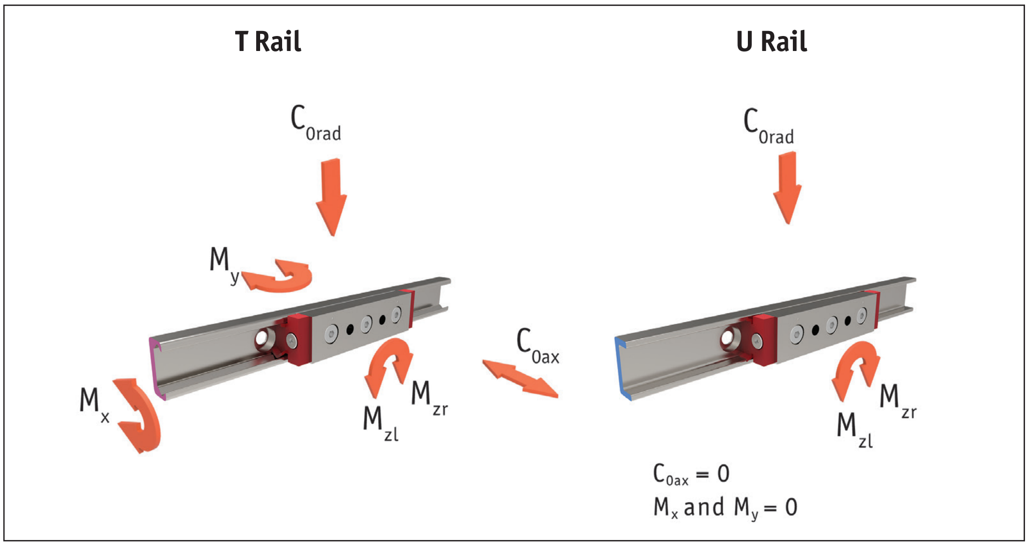
Important note

The load rating of the sliders tables apply to the use of the sliders in the T (master) rail.

For sliders in U rails:
$C_{0ax} = 0$
$M_x = 0$
$M_y = 0$

Technical Information

Load capacities - Size 28

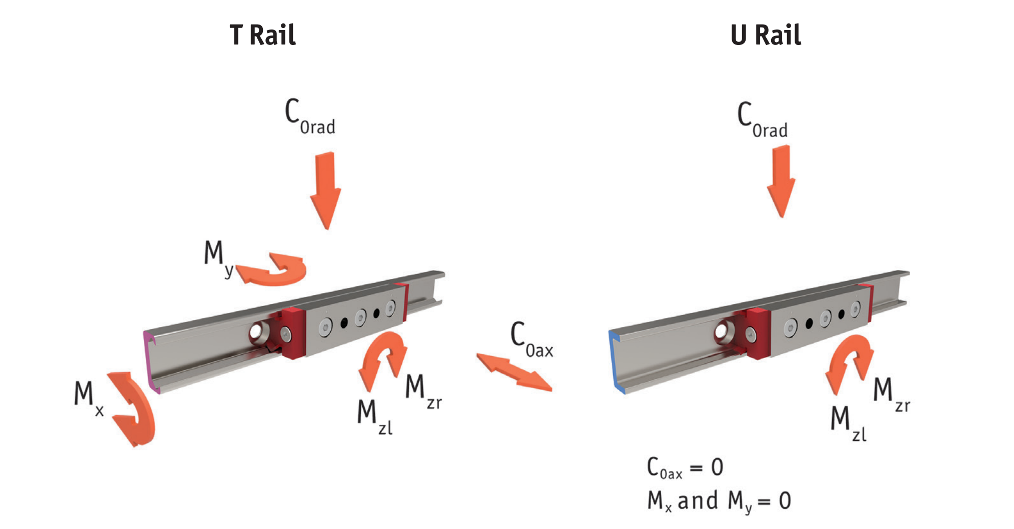


Important note

The value of the C sliders in the tables apply to the use of the sliders in the T (master) rail.

For C sliders in U rails:
$C_{0ax} = 0$
$M_x = 0$
$M_y = 0$

Part no.	No. of rollers	Load capacities and moments						
		Max. dyn. C N	Max. static C_{0rad} N	Max. static C_{0ax} N	M_x Nm	M_y Nm	M_z Nm	
							M_{zr}	M_{zl}
Side seal, front fixing								
L1928.28CL-080	3	4345	2213	652	6,4	16,4	28,0	28,0
L1928.28CL-100-A	4	4345	2213	765	11,8	22,3	28,0	84,1
L1928.28CL-100-B	4	4345	2213	765	11,8	22,3	84,1	27,2
L1928.28CL-125	5	5160	2630	919	11,8	30,0	84,1	84,1
L1928.28CL-150-A	6	5160	2630	1102	14,1	37,3	84,1	140,0
L1928.28CL-150-B	6	5160	2630	1102	14,1	37,3	140,0	84,1
Side seal, top fixing								
L1928.28CR-080-A	3	4345	2213	652	6,4	16,4	28,0	28,0
L1928.28CR-080-B	3	4345	2213	652	6,4	16,4	28,0	28,0
L1928.28CR-100-A	4	4345	2213	765	11,8	22,3	28,0	84,1
L1928.28CR-100-B	4	4345	2213	765	11,8	22,3	84,1	27,2
L1928.28CR-125-A	5	5160	2630	919	11,8	30,0	84,1	84,1
L1928.28CR-125-B	5	5160	2630	919	11,8	30,0	84,1	84,1
L1928.28CR-150-A	6	5160	2630	1102	14,1	37,3	84,1	140,0
L1928.28CR-150-B	6	5160	2630	1102	14,1	37,3	140,0	84,1
No side seal, front fixing								
L1928.28CS-080	3	4260	2170	640	6,2	16,0	27,2	27,2
L1928.28CS-100-A	4	4260	2170	750	11,5	21,7	27,2	81,7
L1928.28CS-100-B	4	4260	2170	750	11,5	21,7	81,7	27,2
L1928.28CS-125	5	5065	2580	900	11,5	29,0	81,7	81,7
L1928.28CS-150-A	6	5065	2580	1070	13,7	36,2	81,7	136,1
L1928.28CS-150-B	6	5065	2580	1070	13,7	36,2	136,1	81,7



Part no.	No. of rollers	Load capacities and moments						
							M_z Nm	
		Max. dyn. C N	Max. static C_{0rad} N	Max. static C_{0ax} N	M_x Nm	M_y Nm	M_{zr}	M_{zl}
Side seal, front fixing								
L1943.43CL-120	3	12300	5520	1580	23,7	60,1	104,7	104,7
L1943.43CL-150-A	4	12300	5520	1890	43,7	81,6	104,7	313,8
L1943.43CL-150-B	4	12300	5520	1890	43,7	81,6	313,8	104,5
L1943.43CL-190	5	14680	6560	2220	43,7	108,7	313,8	313,8
L1943.43CL-230-A	6	14680	6560	2650	52,5	136,0	313,8	523,0
L1943.43CL-230-B	6	14680	6560	2650	52,5	136,0	523,0	313,8
Side seal, top fixing								
L1943.43CR-120-A	3	12300	5520	1580	23,7	60,1	104,7	104,7
L1943.43CR-120-B	3	12300	5520	1580	23,7	60,1	104,7	104,7
L1943.43CR-150-A	4	12300	5520	1890	43,7	81,6	104,7	313,8
L1943.43CR-150-B	4	12300	5520	1890	43,7	81,6	313,8	104,5
L1943.43CR-190-A	5	14680	6560	2220	43,7	108,7	313,8	313,8
L1943.43CR-190-B	5	14680	6560	2650	52,5	136,0	313,8	523,0
L1943.43CR-230-A	6	14680	6560	2650	52,5	136,0	313,8	523,0
L1943.43CR-230-B	6	14680	6560	2650	52,5	136,0	523,0	313,8
No side seal, front fixing								
L1943.43CL-120	3	12280	5500	1570	26,6	60,0	104,5	104,5
L1943.43CL-150-A	4	12280	5500	1855	43,6	81,5	104,5	313,5
L1943.43CL-150-B	4	12280	5500	1855	43,6	81,5	313,5	104,5
L1943.43CL-190	5	14675	6540	2215	43,6	108,6	313,5	313,5
L1943.43CL-230-A	6	14675	6540	2645	52,0	135,8	313,5	522,5
L1943.43CL-230-B	6	14675	6540	2645	52,0	135,8	522,5	313,5

Important note

The value of the C sliders in the tables apply to the use of the sliders in the T (master) rail.

For C sliders in U rails:
$C_{0ax} = 0$
$M_x = 0$
$M_y = 0$

LONG LINEAR RAILS

Representation of slider arrangement for various load cases

Arrangement 1

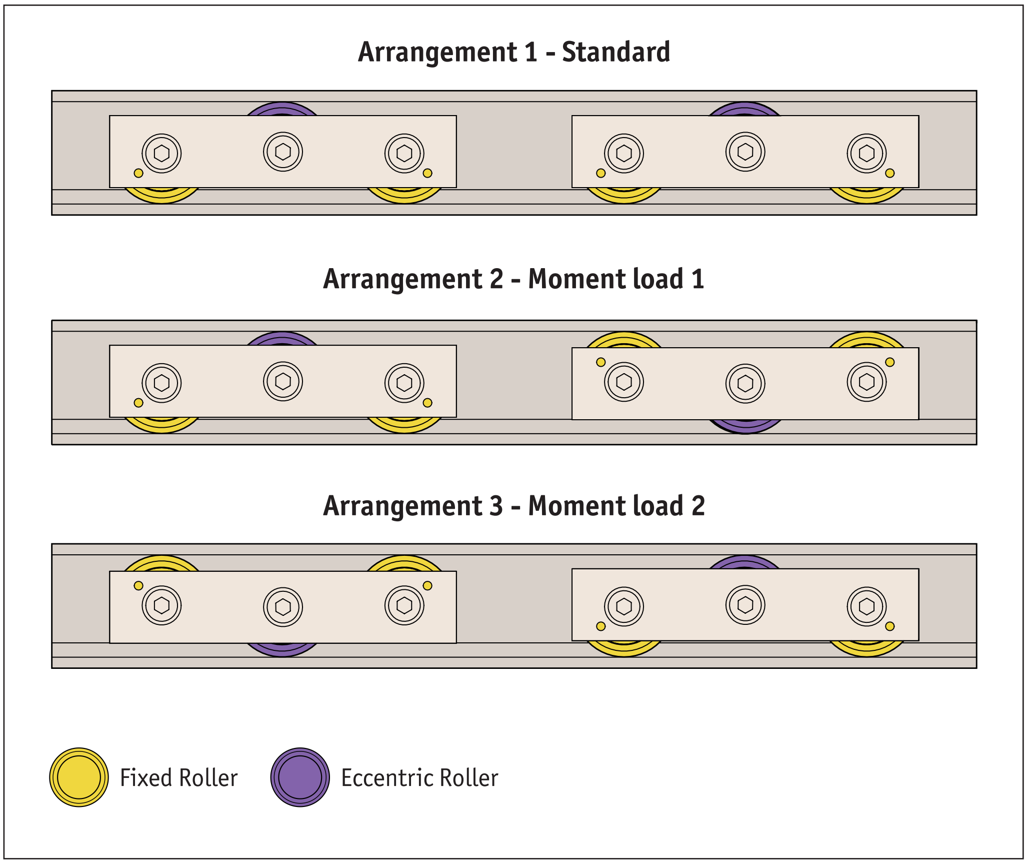
- Standard arrangement if no other information is given. This arrangement is recommended if the load point is located within the two outside points of the sliders.

Arrangement 2

- This is the recommended arrangement for use of two sliders under an M_z moment load when using one rail. Also see previous page: Two sliders under load moment M_z.

Arrangement 3

- For using a pair of guide rails with two sliders each under an M_z moment load, the second system should be designed in arrangement 3. This results in the following combination: Guide rail 1 with two sliders in arrangement 2 and guide rail 2 with two sliders in arrangement 3. This allows even load and moment load distribution between the two parallel rails.

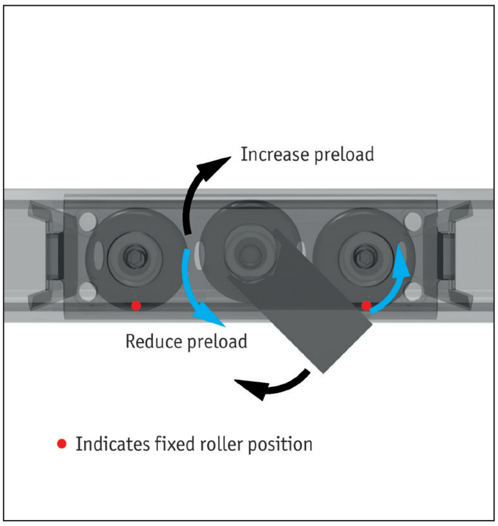


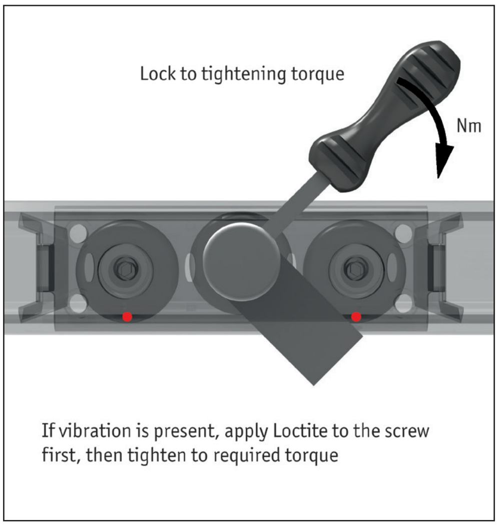
ov-compact-rails-slider-arrangements-lnh - Updated - 09-03-2023

Adjusting the sliders

If delivered separately, or if the sliders need to be installed in another rail, the sliders must be re-adjusted. In this case, follow the instructions below.

The "•" or "V" marked on the slider indicates the direction of the fixed rollers.





The sliders have three (or more) large roller bearings. In general, the two at either end are fixed and the direction of these fixed rollers is marked on the sliders with a dot or an arrow.

Insert the sliders into the rails with the fixed rollers set to take the load in the best direction.

The middle roller is on an eccentric pivot that is easily adjusted (using the thin spanner that is supplied with them and a hexagon key). This allows the preload of the system to be set as required – stiff or free running.

Generally the sliders will not be inserted into the rails when leaving the factory. To set the sliders to the required preload is a simple procedure:

- Ensure raceways are clean.
- Remove the small plastic end wipers and insert the slider into the rail.
- Slightly loosen the eccentric roller (using the spanner and a hexagon key).
- For U rails a packer should be used to set the slider in its middle lateral position.
- Use the flat spanner provided to move the middle roller on its eccentric to adjust the stiffness of its running. Not too loose so that there is excess play and not too tight that a lot of friction is generated.
- Lock the eccentric roller in the desired position with the spanner and a hexagon key.
- Move the slider the length of the rail to check required running – it should move easily with no play at any point on the rail.
- Tighten the fixing screw to the correct torque – whilst holding the spanner in place to ensure no further movement (see correct torque values in table below).
- Finally (if using a slider with a wiper), re-install the wipers if required.

Size	Tightening torque Nm
18	3
28	7
35	12
43	12

Technical Information

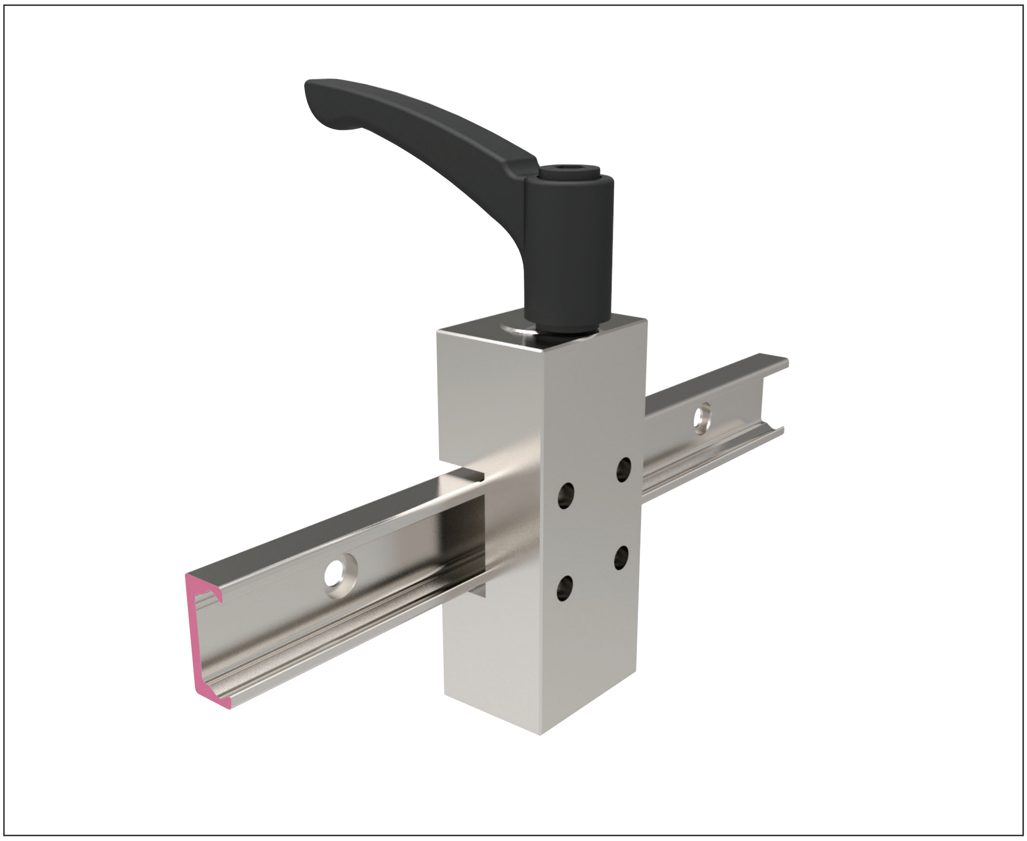
Manual rail clamps

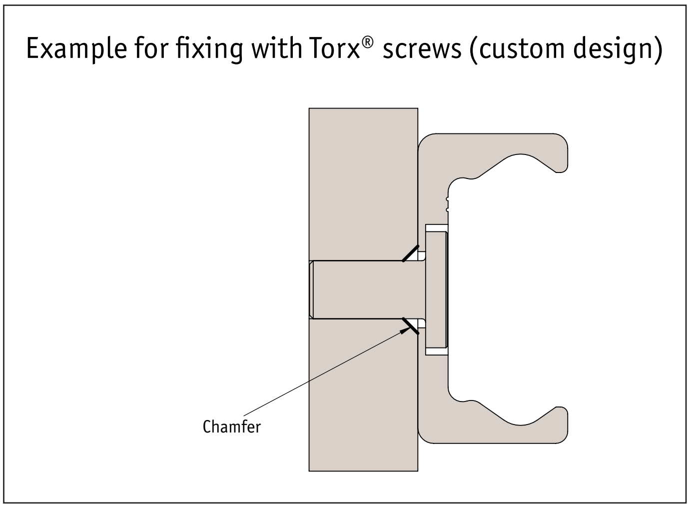
Manual rail clamps

- Many of our customers wish to lock their moving element in position on the rails. Whilst this can be relatively simply achieved with the use of an adjustable clamping handle and thrust pad, we also offer a clamping element which can be integrated into your rail/system design.
- This is available in the standard manual version as well as (on request) a pneumatic version for linear guideways only (not compact rail systems).
- These manual clamps have a holding force of up to 2,000N.
- They are relatively compact in shape. Please bear in mind the extra force required for the clamping element when calculating the total movement you require.

Applications

- Table cross beams.
- Sliding beds.
- Width adjustment stops.
- Positioning of optical equipment.



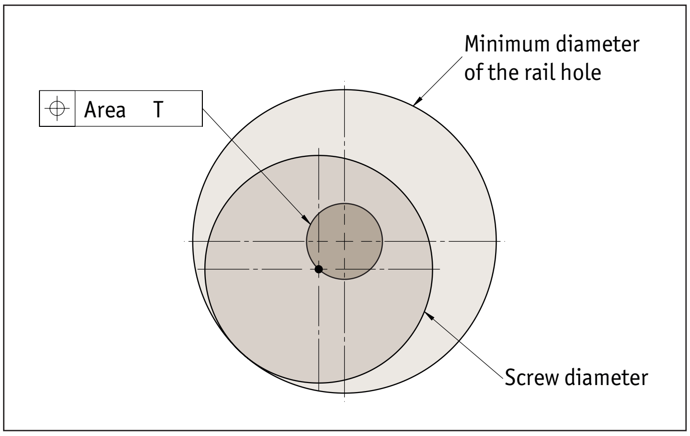


Size	Chamfer
18	0,5 x 45°
28	0,6 x 45°
35	0,5 x 45°
43	1,0 x 45°

Using counterbored hole rails

The low profile screws for counterbored holes are used with rails identified by T-C, U-C or K-C. The cylindrical screw allows some play in the countersunk fixing hole, so that an optimum alignment of the rail can be achieved during installation.

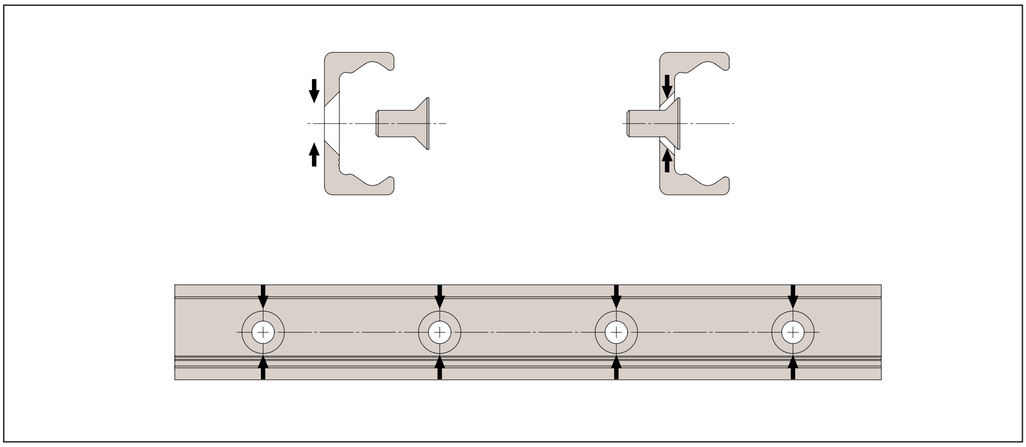
The area T is the diameter of the possible offset, in which the screw centre point can move during the alignment. The minimum chamfers on the fixing threads are listed in the table above.



Rail size	Area T
18	Ø 0,4
28	Ø 0,8
35	Ø 1,0
43	Ø 1,2

Using countersunk hole rails

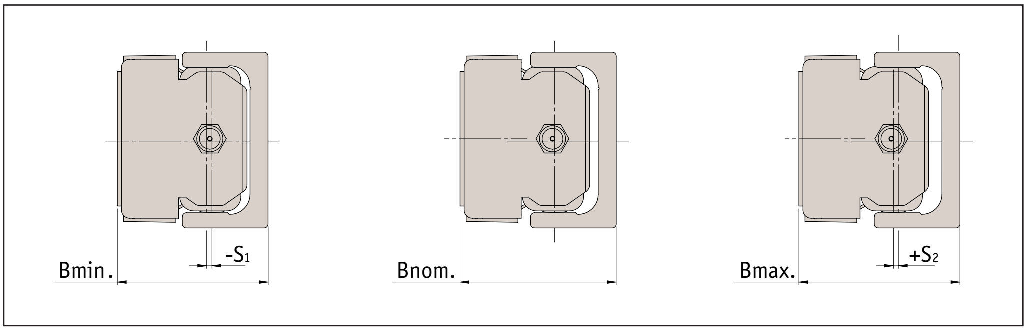
These rails are identified by T-V, U-V or K-V. The selection of rails with 90° countersunk holes requires the precise alignment of the threaded holes for installation. Here the complex alignment of the rail to an external reference is omitted, since the rail aligns during installation by the self-centering of the countersunk screws on the machined hole pattern.



T and 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 following 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.

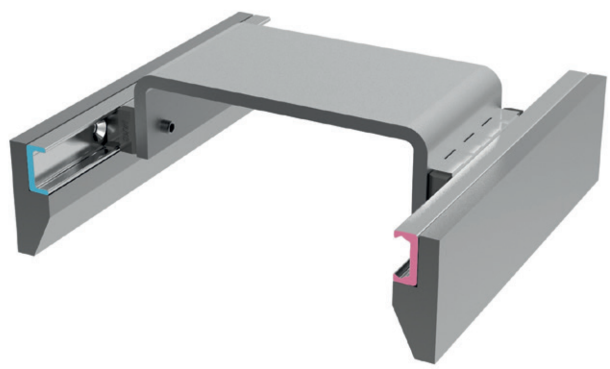


Slider type	S_1	S_2	B_{min}	B_{nom}	B_{max}
L1918.18CL/CS	0,3	1,1	14,7	15,0	16,1
L1918.18CR	0,3	1,1	14,7	15,0	16,1
L1928.28CL/CS	0,6	1,3	23,3	23,9	25,2
L1928.28CR	0,6	1,3	23,3	23,9	25,2
L1935.35CL/CS	1,3	2,7	28,8	30,1	32,8
L1935.35CR	1,3	2,7	28,8	30,1	32,8
L1943.43CL/CS	1,4	2,5	35,6	37,0	39,5
L1943.43CR	1,4	2,5	35,9	37,3	39,8

All values in mm.

T (master) rails and U (slave) rails

It is often the case that two T rails are used in the system design but where there are substantial alignment issues it is better to use a T (master) rail and a U (slave) rail as below.



This allows the slider in the T rail to remain fixed in the place, but allows some lateral movement of the sliders in the U rail to adapt to any misalignment and avoid any issues of stiction.

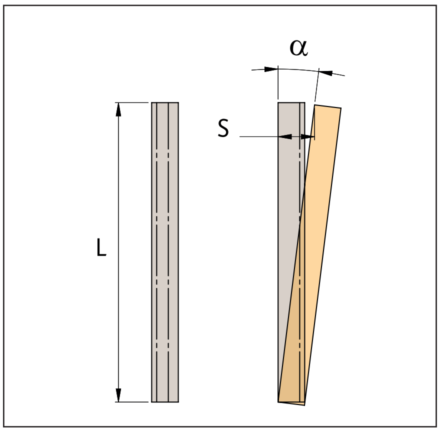
The application example in the following drawing shows that the T and U system implements a problem-free function of the slider even with an angled offset in the mounting surfaces.

If the length of the guide rails is known, the maximum allowable angle deviation of the 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 the rail



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

Rail size	Rail length	Offset S	Angle α °
18	2000	1,4	0,040
28	3200	1,9	0,034
35	3600	4	0,063
43	3600	3,9	0,062

The T and U system can be set up in different arrangements. In the example below, a T rail accepts the vertical components of a load. A U rail attached underneath the component to be guided prevents the vertical panel from swinging and is used as moment support.

In this way both a vertical offset in the structure, as well as possible existing unevenness of the support surface, are compensated for.

K and U System Tolerance Compensation

Deviations in Parallelism in Two Planes

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

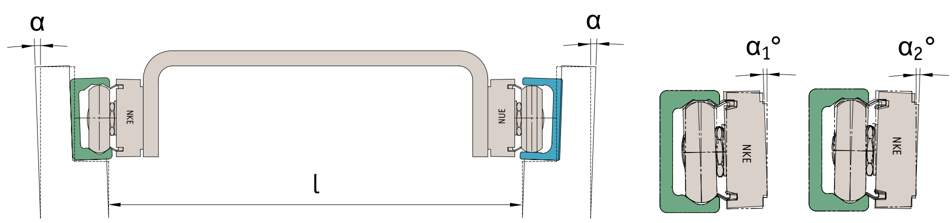
The unique raceway contour of the K rail allows the slider a certain rotation around its longitudinal axis with the same linear precision as with a T rail. With the use of a K and U system, the K rail accounts for the main loads and is the master rail. The U rail is used as a support bearing and takes 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 two load bearing roller sliders, which lie on the V-shaped raceway (reference line) of the rail.

K Rail (master) **U Rail (slave)**

Less used set-up but does allow for height and load misalignment.

K rails and sliders are available in both sizes 43 and 63. The NKE slider may only be used in K rails. The maximum allowable rotation angle of the NKE and NUE sliders are shown in the table. α_1 is the maximum rotation angle counterclockwise, α_2 is clockwise.

Slider Type	α_1°	α_2°
L1943.NKE43 L1943.NUE43	2	2
L1943.NKE63 L1943.NUE63	1	1

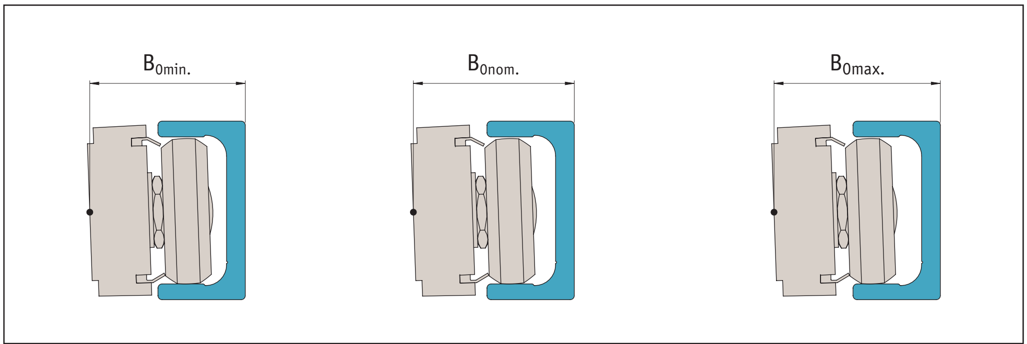


K rails are particularly useful where the distance between the rails is significant. It compensates for height misalignment and the particular errors of a structure.

K and U System Maximum Offset

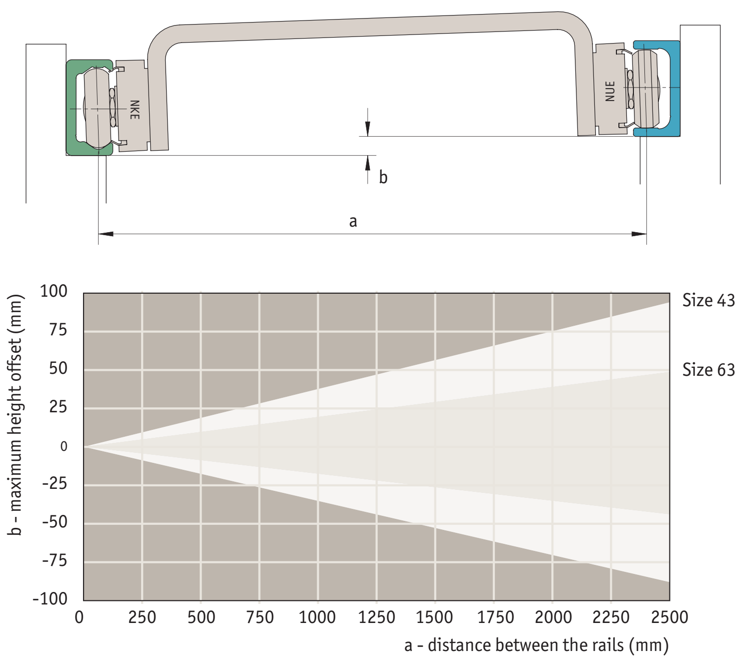
It must be noted that the slider in the U rail will turn during the movement and rotation of the slider in the K rail to allow an axial offset. During the combined effect of these movements, you must not exceed the maximum values (see table below). If a maximum rotated NUE slider is observed (2° for 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 NUE slider in the U rail of a K and U system.



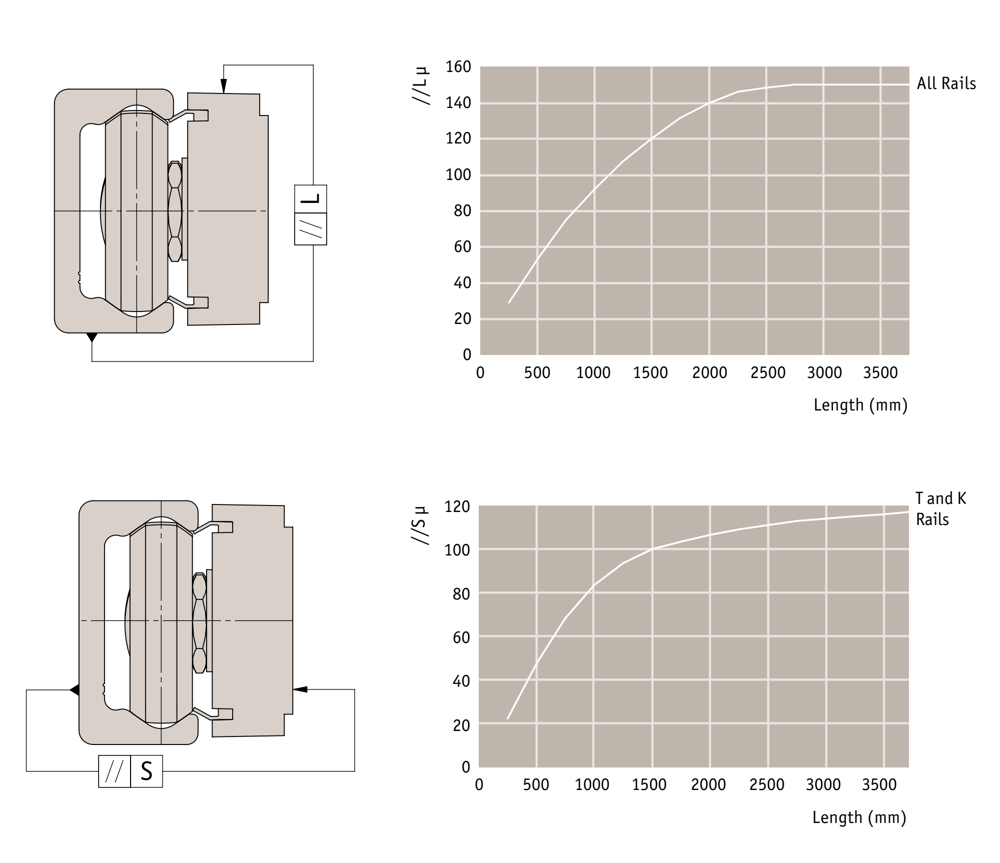
Slider Type	B_{0min}	B_{0nom}	B_{0max}
L1943.NUE43 L1943.NUE43L	37,60	38,85	40,10
L1943.CSW43	37,60	38,85	40,10
L1943.CDW43	37,90	39,15	40,40
L1963.CSW63	49,85	51,80	53,75
L1963.NUE63	50,95	52,70	53,45

If a K rail is used in combination with a U rail, 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.

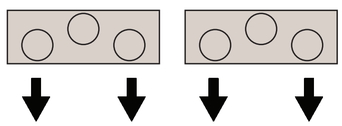
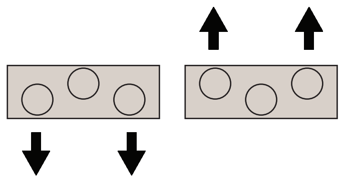


Linear accuracy

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 using all screw holes onto a level and rigid structure.



Deviation of accuracy with two 3 roller sliders in one rail

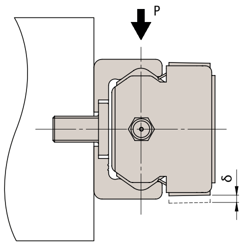
Type	All rails
Slider with equal arrangement 	δL = 0,2
Slider with opposite arrangement 	δL = 1,0
All	δS = 0,05

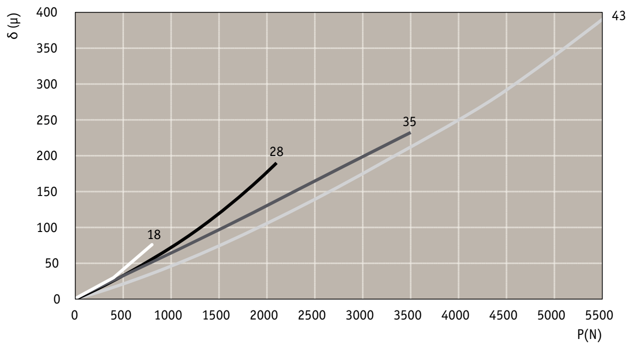
Total deformation

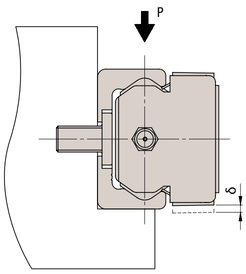
In the following deformation diagrams the total deviation of the linear guide is indicated under the effect of external loads P or moment loads M. As seen from the graphs, the rigidity can be increased by supporting the sides of the rails. The graph values indicate only the deformation of the linear guide, the supporting structure is assumed to be infinitely rigid.
All graphs refer to sliders with 3 rollers and K_1 preload (standard setting). An increased preload, K_2, reduces the deformation values by 25%.

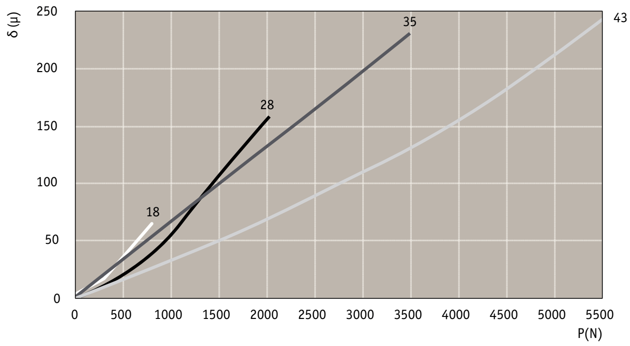
Size 18-43

Radial Load

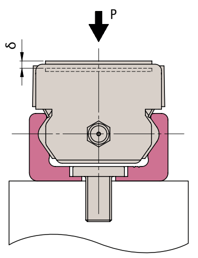


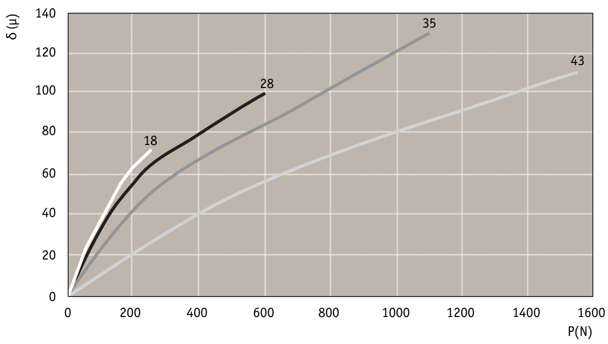




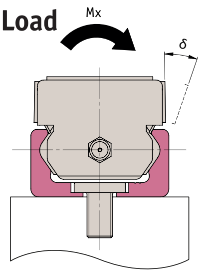


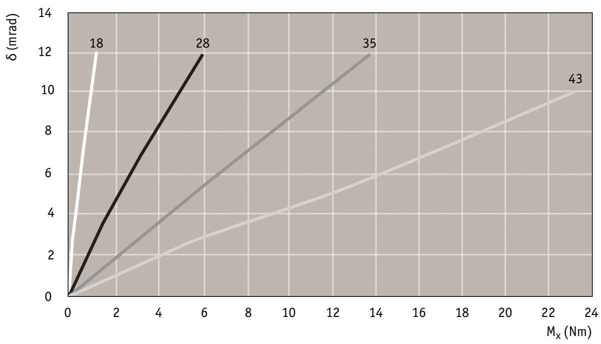
Axial Load





Moment Load





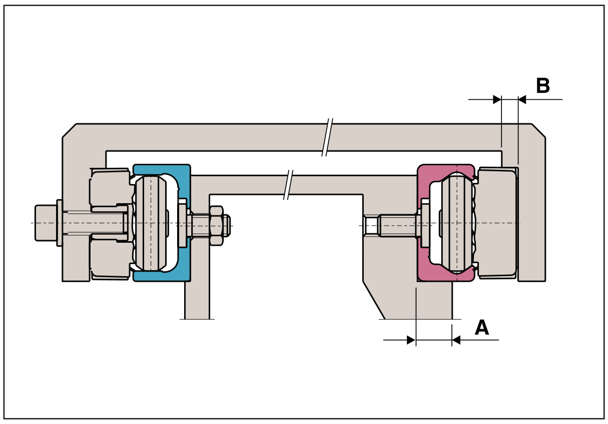
Compact Rail from Automotion Components

LONG LINEAR RAILS

ov-compact-rails-rigidity-a-rnh- Updated - 13-03-2023

Supported sides

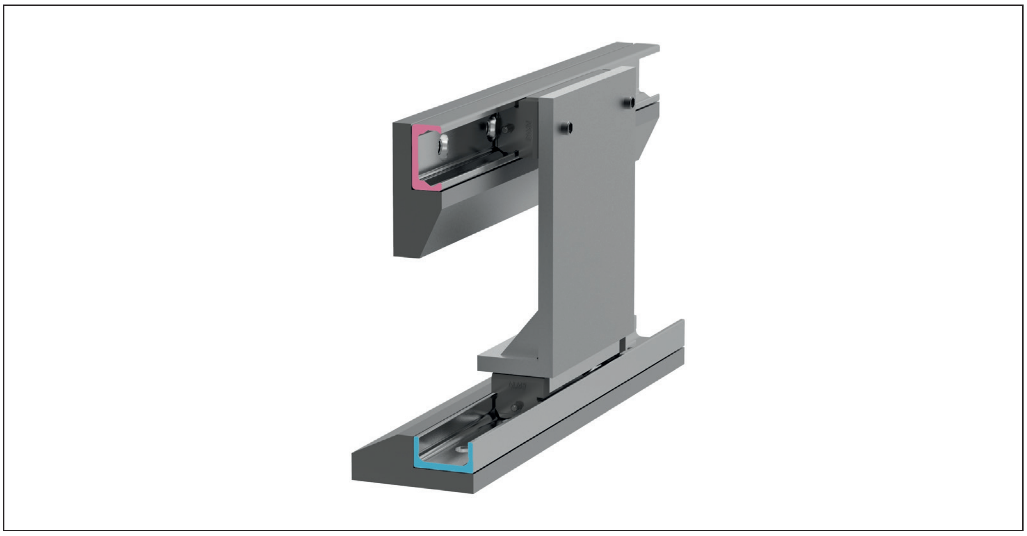
If a higher system rigidity is required, support of the rail sides is recommended, which can also be used as the reference surface. The minimum required support depth can be taken from the table.



Rail size	A	B
18	5	4
28	8	4
35	11	5
43	14	5

U rail offset

Even the K and U system can be used in different arrangements. If the same example as with the T and 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.

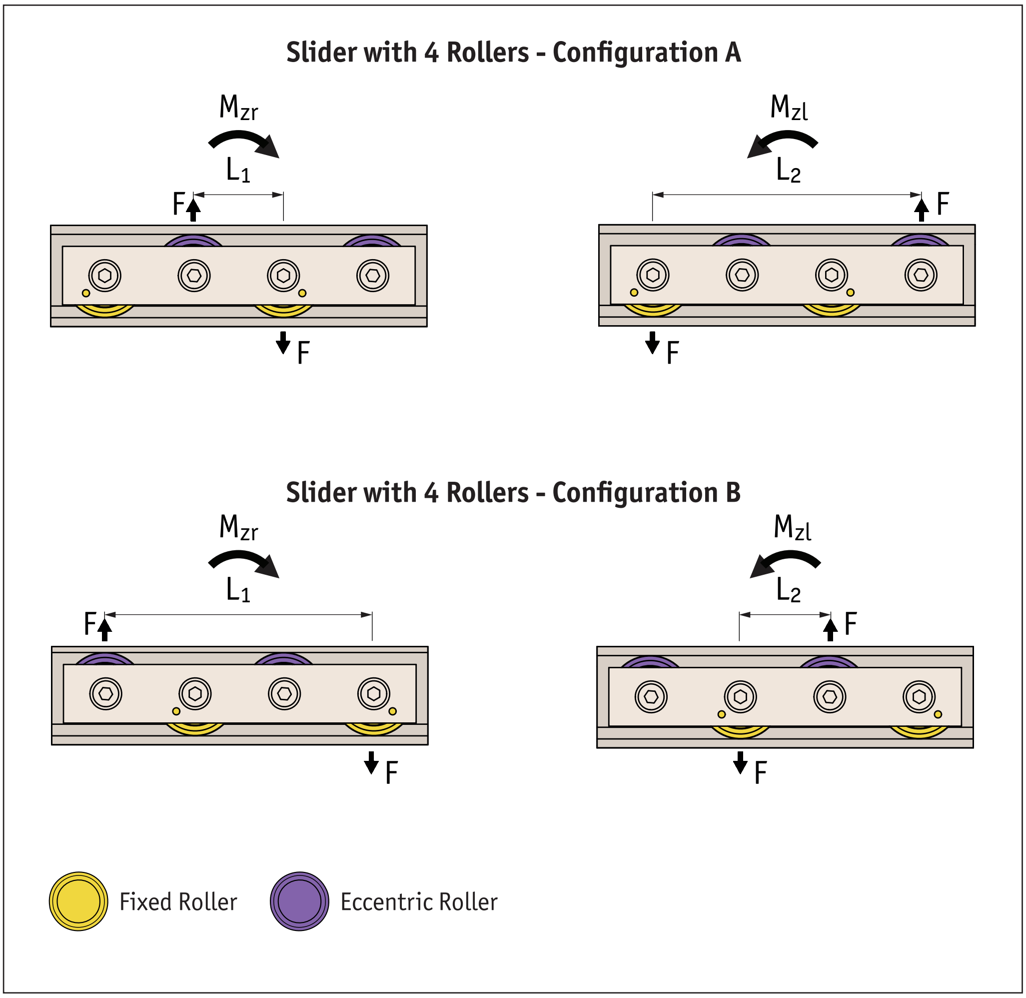


Configurations and behaviour of the sliders under yawing moments M_z

Individual slider under load moment M_z

When an overhanging 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 configurations A and B in regards to the roller arrangement (to counter the acting M_z moment). 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 when using 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 M_z moment is identical in both directions for all 3 and 5 roller sliders.



Two sliders under M_z moment loads

If an overhanging load acts in an application with two sliders per rail and thus causes an M_z moment in one direction, there are differing support reactions with the two sliders.

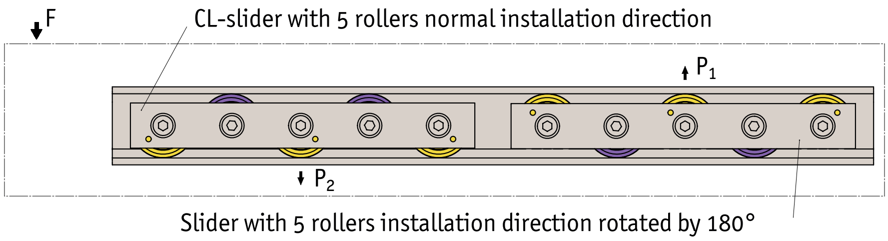
For this reason, an optimal arrangement of different slider configurations to reach the maximum load capacity must be applied.

In practice this means, sliders with 3 or 5 rollers, both sliders are installed rotated by 180° so that the slider is always loaded on the side with the most rollers.

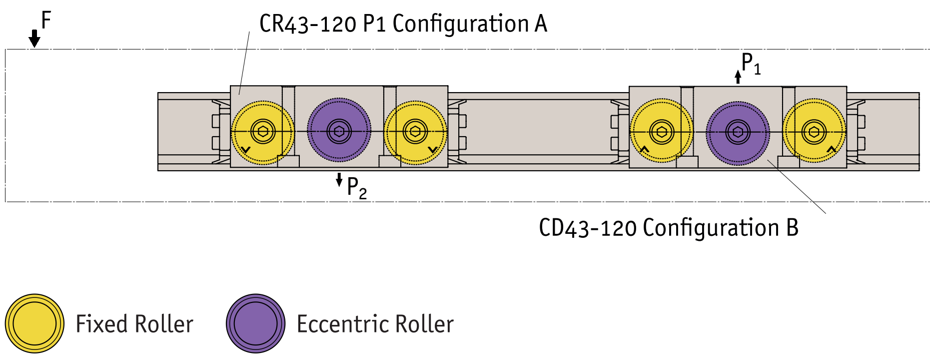
For an even number of rollers this has no effect.

The side mount slider with installation option from above or below cannot be installed due to the position of the rollers in reference to the installation side (therefore they are available in the configurations of both A and B).

Slider under M_z moment load



Slider under M_z moment load



Lubrication of the raceways

Proper lubrication during normal conditions:

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

To reach the calculated service life, a film of lubricant should always be present between the raceway and roller; this also protects against corrosion of the ground raceways.

Roller bearing lubrication

The bearings inside the rollers are lubricated for life. Custom lubrication of the roller sliders for use in high temperature environments or in the food industry is available upon request. For more information, please contact our Technical Department.

Lubrication when using sliders

The series sliders are provided with end wipers made of polyamide, to remove the 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 as a lubricant.

Lubricant	Thickening agent	Temperature range °C	Dynamic viscosity mPas
Roller bearing lubricant	Lithium soap	-30° to + 170°	4500

Replacement of N slider wiper head

Sliders CL and CR are equipped with a safety system made of longitudinal sealing gaskets and rigid, spring preloaded wipers on both sides of the head for automatic cleaning of the raceways. The slider heads can be removed for replacement. To do this it is necessary to loosen the fittings, which should be re-fastened after installing the new heads with the following tightening torque:

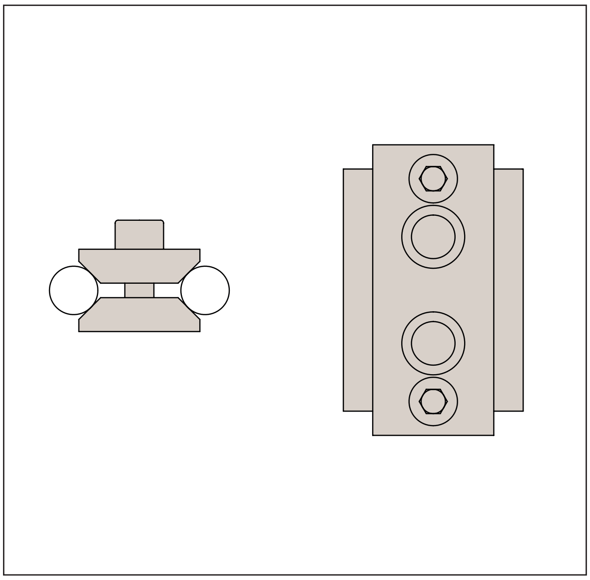
Slider type	Tightening torque Nm
Size 28	0,4 - 0,5
Size 43	0,6 - 0,7

Lubrication when using C sliders

The C series sliders are provided with end wipers made of polyamide, to remove the 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 as a lubricant.

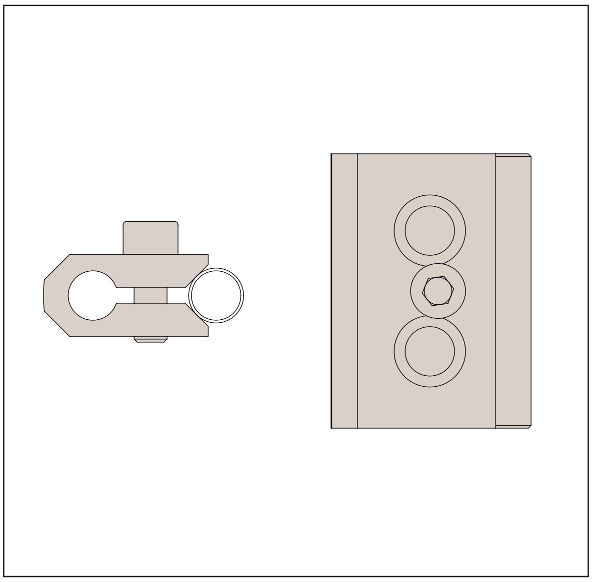
Lubricant	Thickening agent	Temperature range °C	Dynamic viscosity mPas
Roller bearing lubricant	Lithium soap	-30° to + 170°	4500

Alignment fixture AT (for T and U rail)



Rail size	Alignment fixture
L1918.AT18	AT 18
L1928.AT28	AT 28
L1935.AT35	AT 35
L1943.AT43	AT 43

Alignment fixture AK (for K rail)



Rail size	Alignment fixture
L1943.AK43	AK 43

The Choice Between X Rail and Compact Rail

The X rail system is considerably less expensive than compact rail system. However the compact rail is able to take significant moment loads (unlike the X rail) as the rails themselves are made from cold-drawn steel and have hardened raceways.

Occasionally we have applications where the cost of the standard compact rail sliders makes the combined cost of the compact rail system outweigh some of its benefits.

In these rare cases (and where there is a significant volume of product required) we can offer X rail sliders which fit directly into the compact rail.

Here is a comparison of the slider capacities:

	C N	C_{0rad} N	C_{0ax} N	M_x Nm	M_y Nm	M_{zs} Nm
L1918.NT18	1530	820	260	1,5	4,7	8,2
L1970.20T	1068	543	185	1,1	3,2	5,2
	C N	**C_{0rad} N**	**C_{0ax} N**	**M_x Nm**	**M_y Nm**	**M_{zs} Nm**
L1928.NTE28	4260	2170	640	6,2	16,0	27,2
L1970.30T	2882	1346	454	4,4	10,3	16,8
	C N	**C_{0rad} N**	**C_{0ax} N**	**M_x Nm**	**M_y Nm**	**M_{zs} Nm**
L1943.NTE43	12280	5500	1570	23,6	60,0	104,5
L1970.45T	8181	3307	1120	16,8	42,8	69,5

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Preload classes

The factory installed systems, consisting of rails and sliders, are available in two preload classes:

- Standard preload K_1 means a rail slider combination with minimum preload which means the rollers are adjusted free of clearance for optimal running properties
- Usually preload K_2 is used for rail slider systems for increasing the rigidity. When using a system with K_2 preload a reduction of the loading capacities and service life must be taken into consideration.

The excess is the distance between the contact lines of the roller pins minus y. This coefficient Y is used in the calculation formula for checking the static load.

Preload class	Excess*	Rail size	Reduction Y
K_1	0,01	all	-
K_2	0,03	18	0,1
	0,04	28	0,1
	0,05	35	0,1
	0,06	43 63	0,1

* Measured on the largest interior dimension between the raceways.

External preload

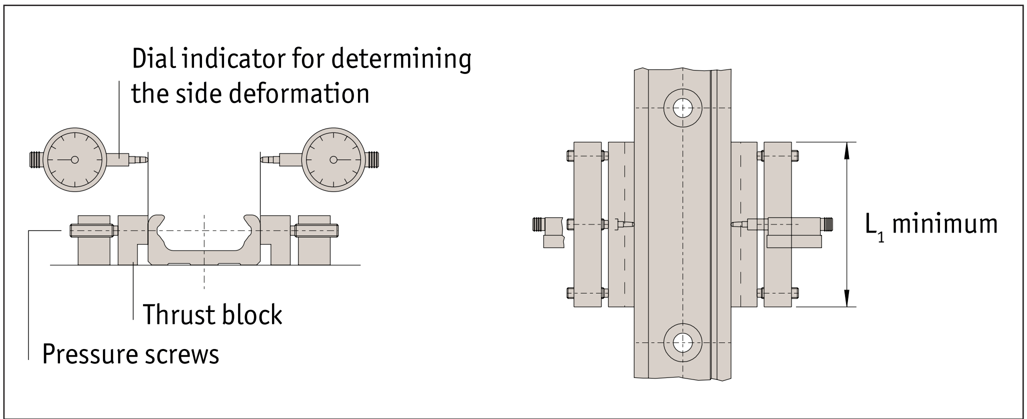
The unique design of the Compact Rail product family enables the application of a partial external preload on selected locations along the entire rail.

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 forces).

This partial preload increases the service life of the linear guide by avoiding a continually increased preload over the entire length of the rail. Also the required drive force of the linear slider in the non-preloaded areas is reduced.

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

Rail size	L_1
18	40
28	55
35	75
43	80



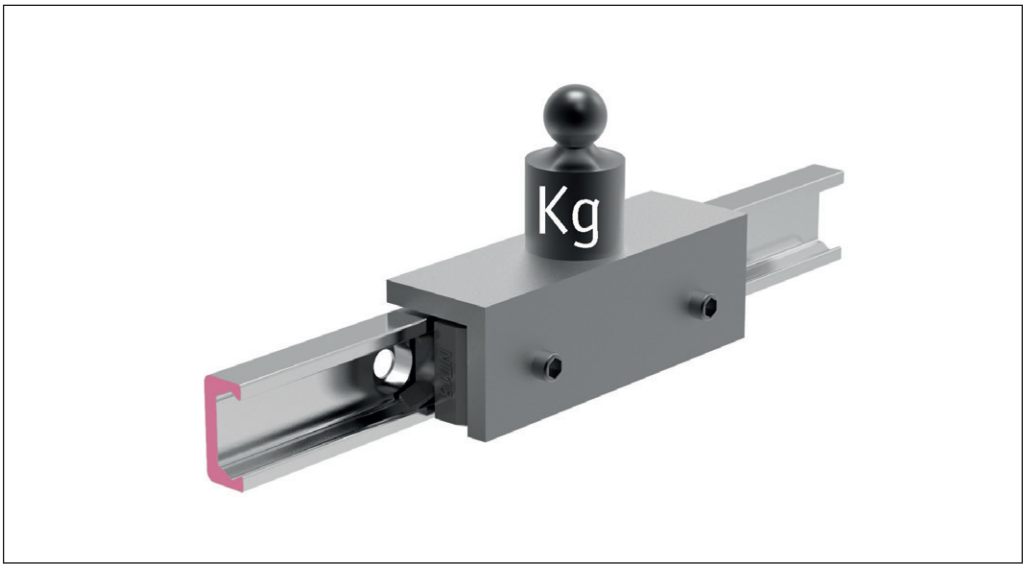
Drive force

Frictional resistance

The drive force required for moving the slider is determined by the combined resistance of the rollers, wipers and seals.

The surface machining of the 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 effect 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 following table contains the coefficients of friction for each slider type (for CS and CD sliders no friction occurs to μ_s).



Size	Roller friction μ	Wiper friction μ_w	Friction of longitudinal seals μ_s
18	0,003	$\frac{\ln(m \cdot 1000)}{0{,}98 \cdot m \cdot 1000}$	0,0015
28	0,003	$\frac{\ln(m \cdot 1000)}{0{,}06 \cdot m \cdot 1000}$	$\frac{\ln(m \cdot 1000)}{0{,}15 \cdot m \cdot 1000}$
35	0,005		
43	0,005		

Where m is load in kilograms.

The values given in the above 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 our Technical Department.

Calculation of drive force

The minimum required drive force for the slider is determined with the coefficients 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
μ = Roller friction
μ_w = Wiper friction
μ_s = Friction of longitudinal

Example calculation:
If an NTE43 slider is used with a radial load of 100 Kg, the result is $\mu = 0{,}005$ (from table); and from the formula the following is calculated:

$$\mu_s = \frac{\ln(100000)}{0{,}15 \cdot 100000} = 0{,}00076$$

$$\mu_w = \frac{\ln(100000)}{0{,}06 \cdot 100000} = 0{,}0019$$

Therefore the minimum driving force for this example:

$$F = (0{,}005 + 0{,}0019 + 0{,}00076) \cdot 100 \cdot 9{,}81 = 7{,}51\ N$$

The radial load capacity rating, C_{0rad},the axial load capacity rating C_{0ax}, and moments loads 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:

Conditions	Safety factor S_0
No shock or 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.

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

The above formulae are valid for a single load case.

If two or more forces are acting simultaneously, please check the following formula:

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

P_{0rad} = effective radial load
C_{0rad} = permissible radial load
P_{0ax} = effective axial load
C_{0ax} = permissible axial load
M_1 = effective moment in the X-direction
M_x = permissible moment in the X-direction
M_2 = effective moment in the Y-direction
M_y = permissible moment in the Y-direction
M_3 = effective moment in the Z-direction
M_z = permissible moment in the Z-direction
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 a higher safety level is required.

Calculation formulae

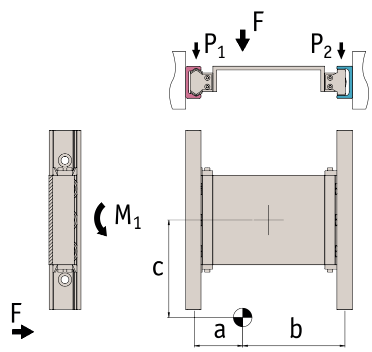
Example formulae for determining the forces on the most heavily loaded slider

The parameters in the formulae are shown below.

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

Horizontal movement

Static test

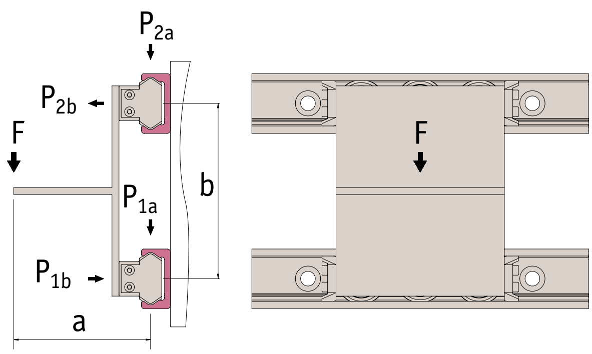


Slider load

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

in addition each slider is loaded by a moment:

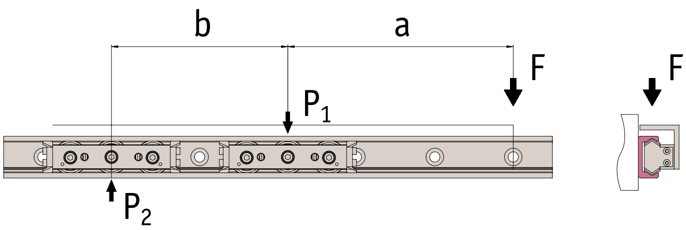
$$M_1 = \frac{F}{2} \cdot c$$



Slider load

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

$$P_{2b} \simeq P_{1b} = F \cdot \frac{a}{b}$$



Slider load

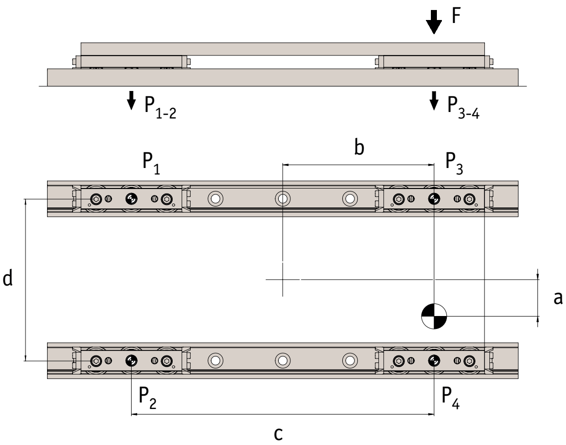
$$P_2 = F \cdot \frac{a}{b}$$

$$P_1 = P_2 + F$$

ov-compact-rails-loading-calculations-a-lnh - Updated - 13-03-2023

Horizontal movement

Static test



Slider load

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

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

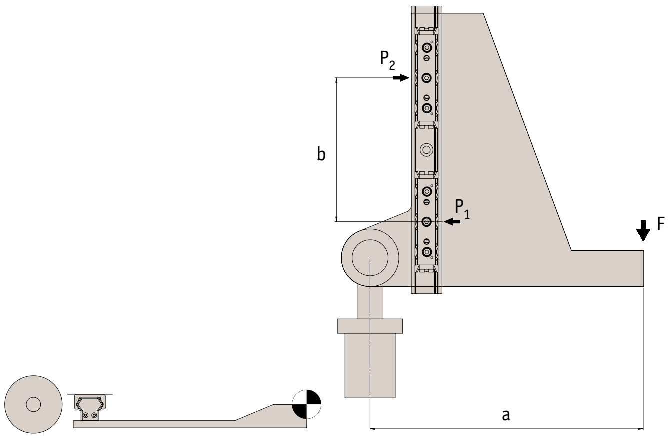
$$P_3 = \frac{F}{4} - \left(\frac{F}{2} \cdot \frac{b}{c}\right) - \left(\frac{F}{2} \cdot \frac{a}{d}\right)$$

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

Note: Its defined that slider number 4 is always located closest to the point where the force is applied.

Vertical movement

Static test

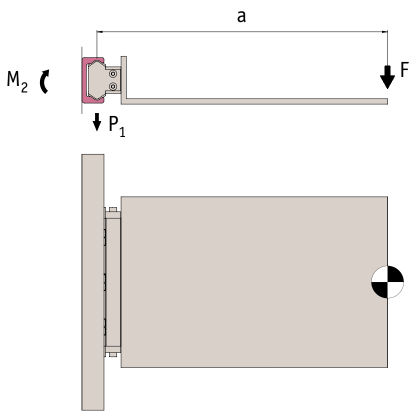


Slider load

$$P_{2a} \simeq P_{1b} = F \cdot \frac{a}{b}$$

Horizontal movement

Static test

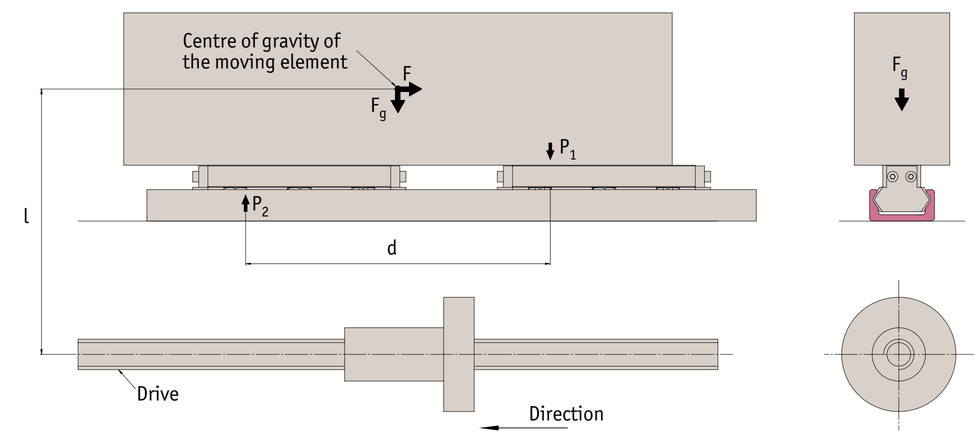


Slider load

$$P_1 = F$$

$$M_2 = F \cdot a$$

ov-compact-rails-loading-calculations-b-rnh - Updated - 13-03-2023



Horizontal movement

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

Inertial force	Slider load at time of reverse	
$F = m \cdot a$	$P_1 = \frac{F \cdot l}{d} + \frac{F_g}{2}$	$P_2 = \frac{F_g}{2} - \frac{F \cdot l}{d}$

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)

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 individual slider see Load Capacities. The following formulae link 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 in Km
C = dynamic load capacity in N
P = effective equivalent load in 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:

$$P_1 = P_r + \left(\frac{P_a}{C_{0ax}} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z} \right) \cdot C_{0rad}$$

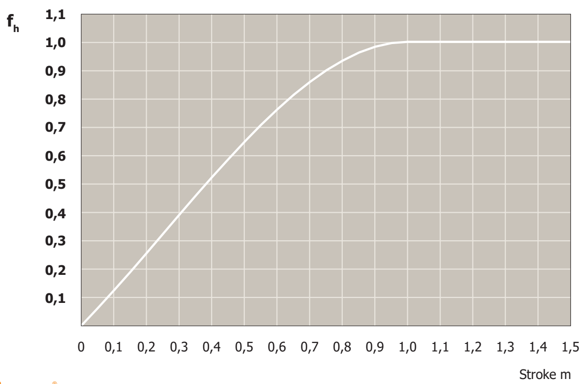
Here the external loads are assumed as constant in time. Brief loads, which do not exceed the maximum load capacities, do not have any relevant effect on the service life and can therefore be discounted. The contact factor f_c refers to applications in which several sliders pass the same rail section.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

Number of sliders	1	2	3	4
f_c	1,00	0,80	0,70	0,63

The application coefficient f_i takes into account the operational conditions in the service life calculation. It has similar significance to the safety factor S_0 in the static load test. It is calculated as described in the following table:

Conditions	Application coefficient f_i
Neither shocks or vibrations, smooth and low-frequency direction change; clean operating conditions; low speeds (<1 m/s)	1,0 - 1,5
Slight vibrations, average speeds (1 - 2.5 m/s) and average frequency of direction change	1,5 - 2,0
Shock and vibration, high speeds (>2.5 m/s) and high-frequency direction change; extreme dirt contamination	2,0 - 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 the run. The corresponding values are taken from the following graph (for strokes longer than 1m, f_h = 1):



Setting the preload

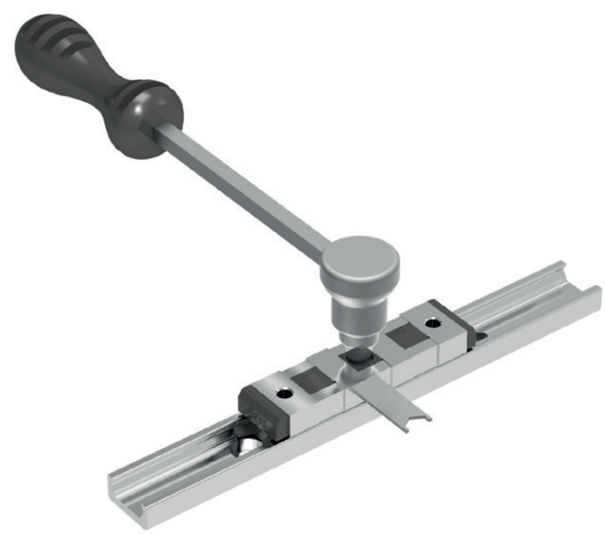
The slides have three or more large roller bearings. In the case of a standard three roller bearing slider, the two at either end are fixed and the direction of these fixed positions is marked on the sliders with a dot or an arrow. Insert the sliders in the rails with the fixed rollers set to take the load in the best direction.

The middle roller is on an eccentric that is easily adjusted using the thin spanner that is supplied with the sliders. This allows the preload of the system to be set as required - either stiff or free running.

Generally the slider will not be installed into the rails when leaving the factory. To set them to the required preload is a simple procedure:

- Ensure the raceways are clean.
- Insert the sliders in the rail (remove the small plastic wipers).
- Slightly loosen the eccentric roller (using the spanner and a hexagon key).
- For U rails, a packer should be used to set the slider in its middle lateral position.
- Use the flat spanner provided to move the eccentric roller (marked with a red dot on the screw) to adjust the stiffness of its running; not too loose so that there is excess play and not too tight that a lot of friction is generated.
- Lock the roller in the desired position with the spanner and a hexagon key.
- For sliders with more than one eccentric roller repeat this process with all the eccentric roller bearings; make sure that all the rollers have uniform contact with the rails.
- Move the slider along the length of the rail to check required running - it should move easily; with no play at any point on the rail.
- Tighten the fixing screw to the correct torque - whilst holding the spanner in place to ensure no further movement.
- Finally, if using a slider with a wiper that you have removed prior to installation - re-install the wipers if required.

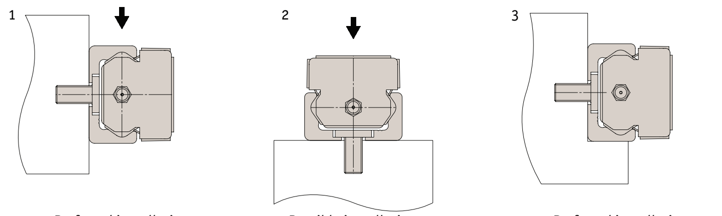
Slider size	Tightening torque Nm
18	3
28	7
35	12
43	12



Both the T and K type rails can be installed in two positions relative to the external force. For axial loading of the slider, the load capacity is reduced because of the decline in contact area caused by the change in position. Therefore, the rails should be installed where possible in such a way that the load of the rollers acts in the radial direction.

For critical applications with vibrations or a higher demand for rigidity, a support of the rail is beneficial.

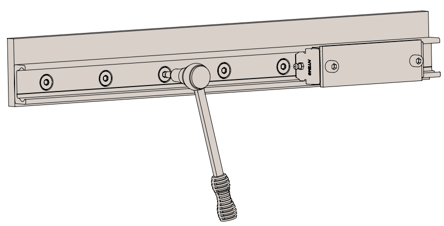
This reduces the deformation of the rail sides and the load on the screws. The installation of a rail with countersunk holes requires an external reference for alignment. This reference can also be used as a rail support if required. All information in this section on alignment of the rails, refers to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



Rail Installation Without Support

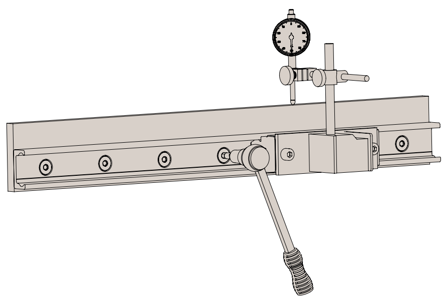
Rail Installation 1

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



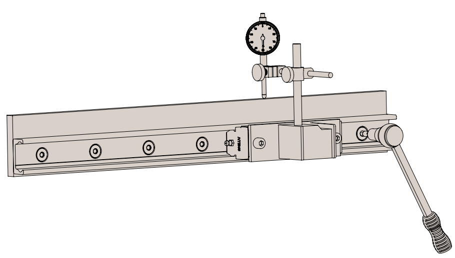
Rail Installation 2

- Install a dial indicator so that the offset of the rail to a reference line can be measured. Now position the slider in the centre 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 centre screws of this area with the specified tightening torque.
- Now position the slider on one end of the rail and carefully align the rail to zero on the dial indicator.



Rail Installation 3

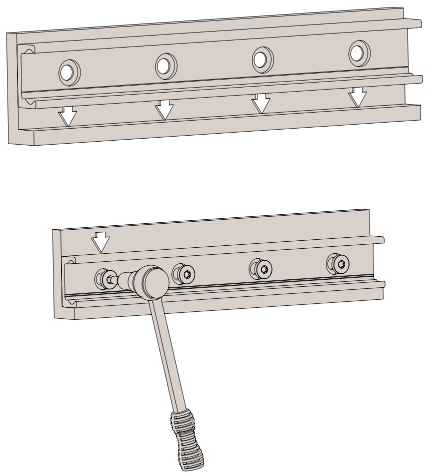
- Begin to tighten the screws as specified while moving the slider together with the dial indicator.
  Make sure that it does not show any significant deflection. Repeat this procedure from the other end of the rail.



Rail installation with reference surface as support

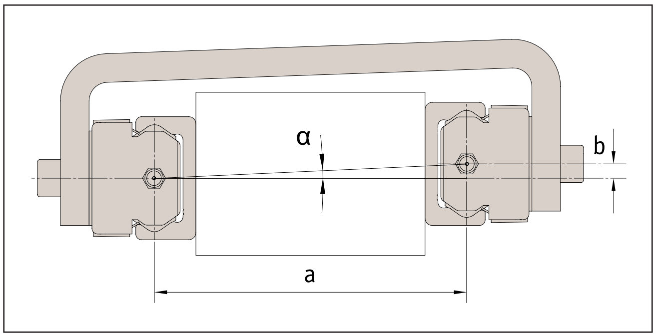
- Remove unevenness, burrs and dirt from the support surface.
- Press the rail against the support surface and insert all screws without tightening them.
- Start tightening the fixing screws to the specified torque on one end of the rail while continuing to hold pressure on the rail against the support surface.

Screw type	Rail size	Tightening torque Nm
M4	18	3
M5	28	9
M6	35	12
M8	43	22



Parallel installation of two rails

If two T rails or a T and U system are installed, the height difference of the two rails must not exceed a certain value, in order to ensure proper guiding. These maximum values result from the maximum allowable twisting angle of the rollers in the raceways. These values account for a load capacity reduction of 30% on the T rail and must be carefully observed.



Size	α
18	1,0 mrad (0,057°)
28	2,5 mrad (0,143°)
35	2,6 mrad (0,149°)
43	3,0 mrad (0,171°)

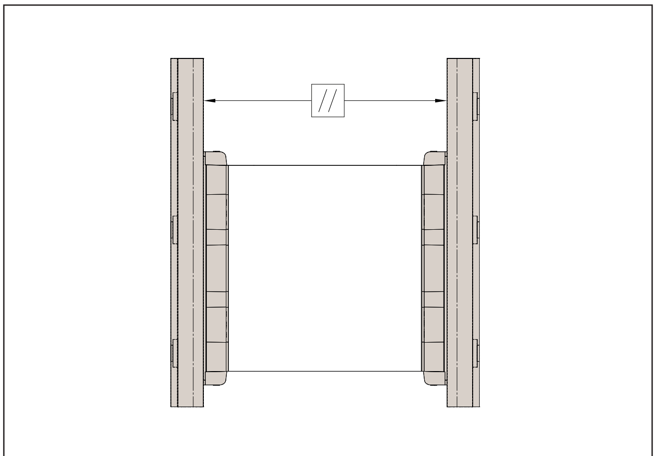
Example:

NTE43: if a = 500 mm

b = a*tanα = 1,5mm

Using two 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.



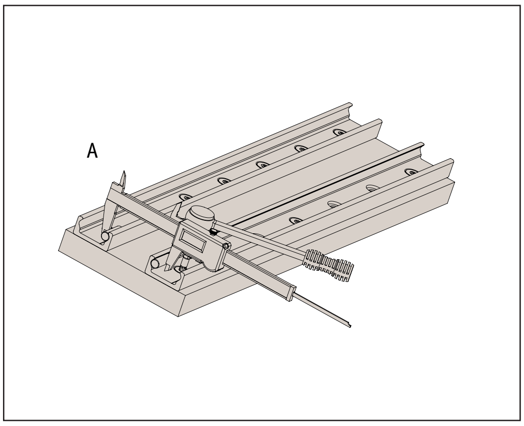
Size	//
18	0,03
28	0,04
35	0,04
43	0,05

For parallelism problems, it is recommended to use a T and U or K and U system, since these combinations compensate for inaccuracies. K_1 is the standard slider preload, K_2 is the increased preload setting where extra rigidity is required.

Flat, parallel installation of two T rails

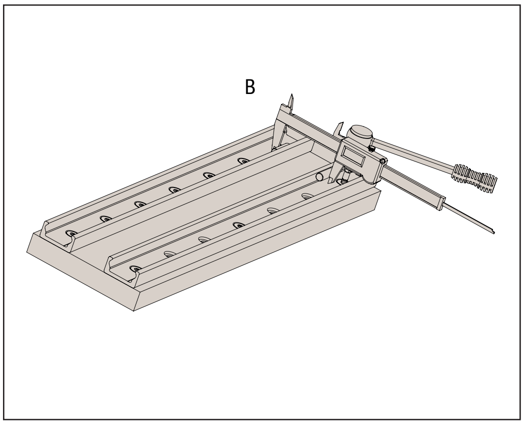
Parallel installation 1

- 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.
- Fasten the second rail at the ends and the centre.
- Tighten the screws in Position A and measure the distance between the raceways of the two rails, this can be aided by using a dowel positioned in the two raceway grooves.



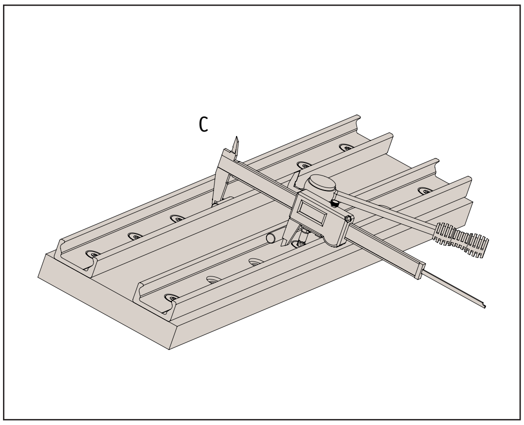
Parallel installation 2

- 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 installation.



Parallel installation 3

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

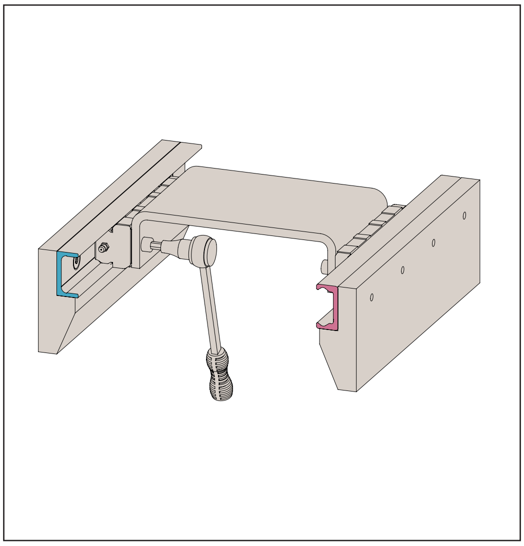


Installation of the T and U systems

When using a two-track parallel linear guide system we recommend the use of a master/slave rail system. The combination of T and U rails for compensating of deviations in parallelism or the K and U system to compensate for deviations in parallelism in two planes.

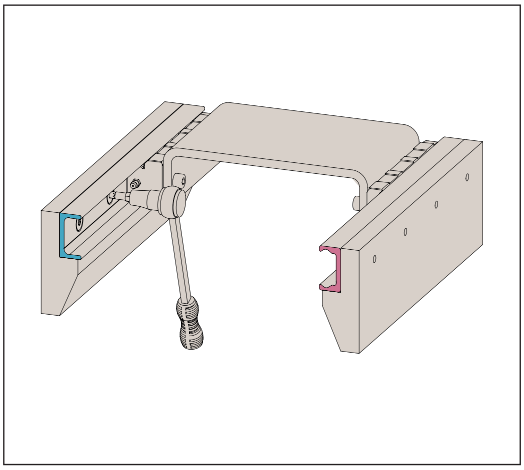
Installation step 1

- For a master/slave rail system the master (T) rail is always installed first. This is then used as a reference for the slave (U type) rail.
- Then proceed as described in the section on installation of a single rail.
- Install the master rail and only tighten the fixing screws slightly.
- Insert the sliders into the rails and install the element to be moved, without tightening the screws.
- Insert the element in the centre of the rails and tighten it to the correct tightening torque.



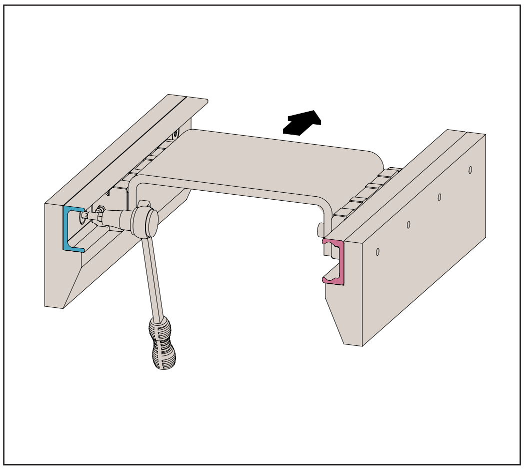
Installation step 2

- Tighten the centre rail fixing screws to the specified torque.

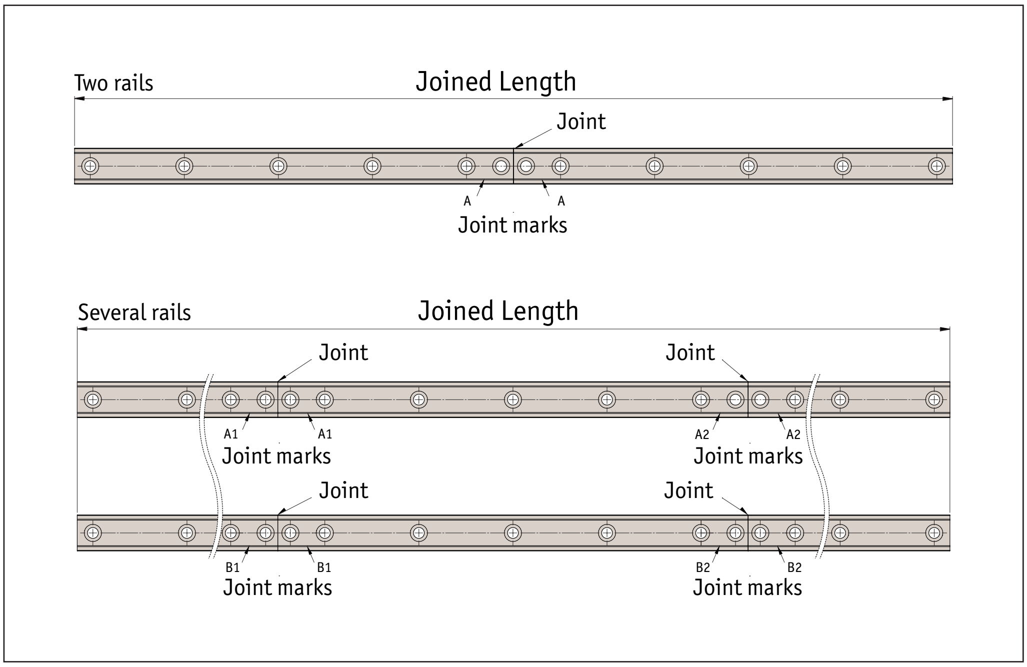


Installation step 3

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



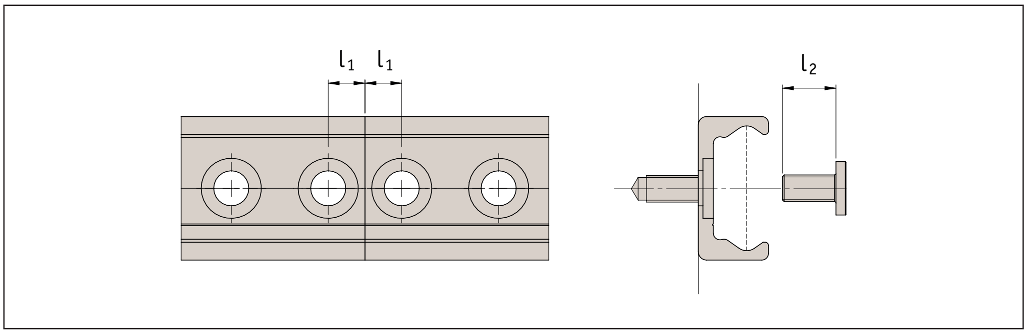
If long guide rails are required, two or more rails can be joined to the desired length. When putting guide rails together, be sure that the register marks shown below are positioned correctly.



General information

Each rail has a one piece maximum length. Longer lengths are achieved by joining two or more rails together (joined rails).

We then machine the rail ends at a right angle to the end face 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 are required in the load-bearing structure. The alignment tool for aligning the rail joint should be ordered (see below).



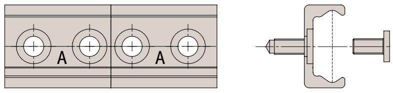
Rail size	l_1	Threaded hole (load bearing structure)	l_2	Alignment tool
18	7	M4	8	L1918.AT18
28	8	M5	10	L1928. AT28
35	10	M6	13	L1935. AT35
43	11	M8	16	L1943. AT43
K43	11	M8	16	L1943. AK43

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:

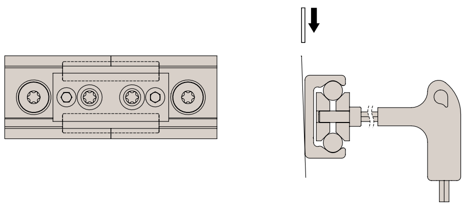
Installation of joined rails step 1

- Fix the individual rails on the mounting surface by tightening all screws except for each last one on the rail joint.
- Install the end fixing screws without tightening them.



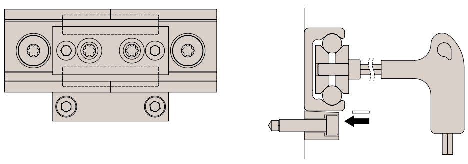
Installation of joined rails step 2

- Place the alignment fixture on the rail joint and tighten both set screws uniformly, until the raceways are aligned.
- After doing this, check if both rail backs lie evenly on the mounting surface. If a gap has formed there, it must be shimmed.



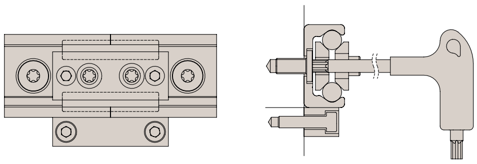
Installation of joined rails step 3

- The bottom of the rails should be supported in the area of the transition. Here a possible existing gap should be looked for, which if exists, should be eliminated by shimming.



Installation of joined rails step 4

- Insert the key through the holes in the alignment tool and tighten the screws on the rail ends.
- For rails with 90° countersunk holes, tighten the remaining screws starting from the rail joint in the direction of the rail centre. For rails with cylindrical countersunk holes, first adjust the rail to an external reference, then proceed as described above.
- Remove the alignment tool from the rail.



Easy Slide Rails

Introduction

The Easy Slide family of linear rails have a compact cross-section and low-friction movement.

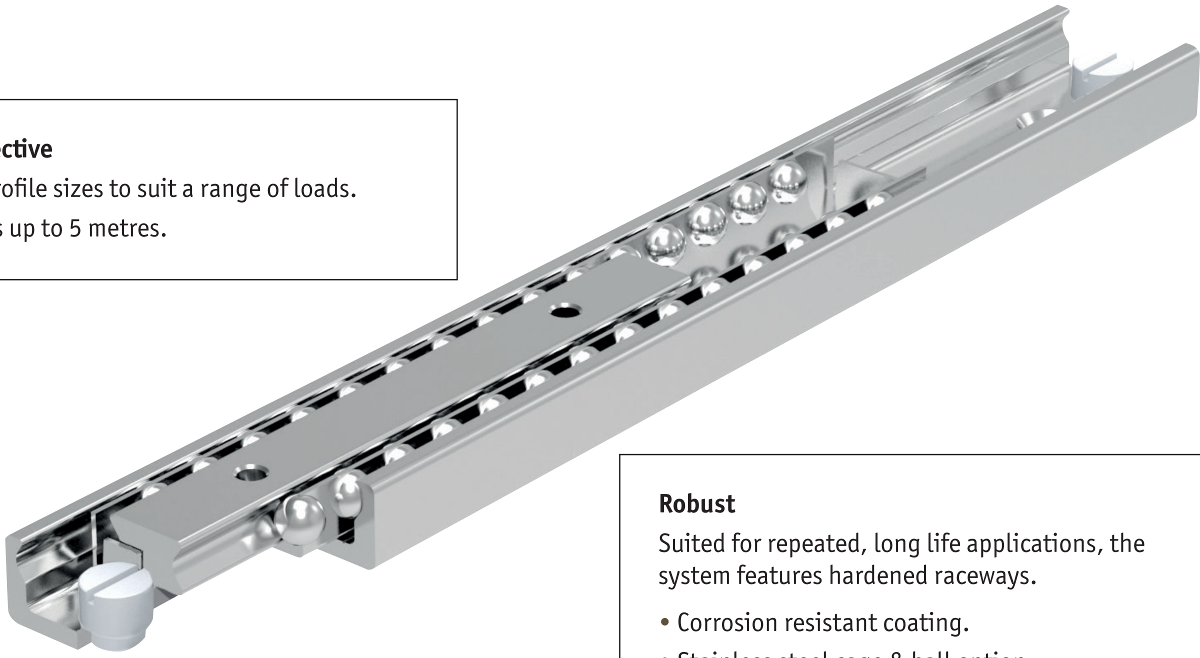
Robust and long service life

Easy Slide's range of cross-sectional rail sizes allow for applications in which high load capacities can be applied, combined with a very long service life.

This is achieved through producing the guide rails and sliders from cold-drawn bearing steel, the ball cage from steel and the balls from hardened bearing steel. The raceways of the guide rails and sliders are induction hardened. The system can be provided with anti-corrosion coating and stainless steel cages and balls.

Cost-effective

- 4 rail profile sizes to suit a range of loads.
- Lengths up to 5 metres.



Robust

Suited for repeated, long life applications, the system features hardened raceways.

- Corrosion resistant coating.
- Stainless steel cage & ball option.

Horizontal applications only

Please note: For high acceleration/deceleration movement, cage creep may occur especially with long ball cage versions. Please see technical notes to minimise this.

ov-easy-slide-introduction-lnh-Updated-15-03-2023

Specifications

- Available rail widths: 22, 28, 35, 43mm.
- Induction hardened raceways.
- Maximum rail length 1970mm.
- Rails and sliders made of cold-drawn steel.
- Balls made of hardened steel.
- Maximum operating speed 0,8 m/s.
- Temperature range -30°C to +140°C.
- Coefficient of friction ~ 0.01
- Electrolytic zinc-plating to ISO 2081; increased anti-corrosion protection and stainless steel balls on request.
- Linear accuracy 0,1mm/m stroke.
- For horizontal installation only.
- External end stops must be used.
- Fixing screws of class 10,9 must be used for all linear bearings.

Applications

Food, drink & pharmaceuticals
Food handling conveyors
pharmaceutical factories
stainless display equipment

Special purpose & packaging machines
Precision positioning systems
handling units • robotic systems
cutting machines

Logistics solutions
Container extensions
heavy duty extending systems
sliding doors

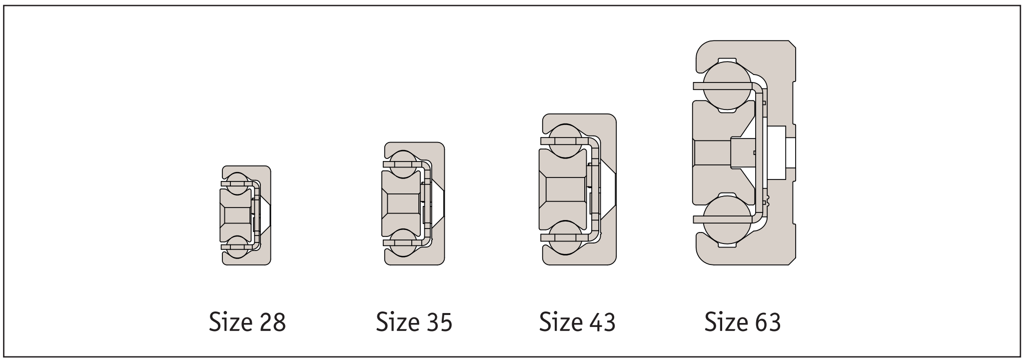
Construction
Seating
sliding panels

Transport (automotive)
Ambulance sliding systems
fire fighting vehicles
sliding panels

Transport (rail)
Seat adjustment
sliding doors
battery removal units

Medical technology
X-ray equipment
dental chairs
bed extensions

Rail Sizes

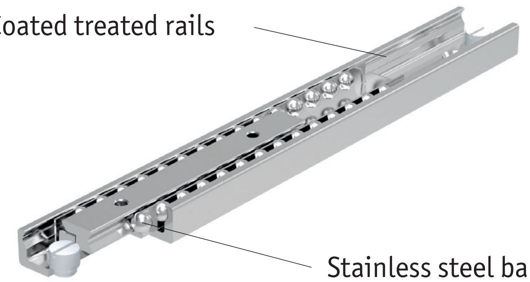


Anti-corrosion treatments

The telescopic slides have a standard electrolytic zinc plated coating (to ISO 2081).
We offer a number of alternatives to increase the anti-corrosion protection including nickel plating.

However, our preferred and most effective solution to inhibit corrosion is to apply a special corrosion resistant (ATCoat) plating to the rails and sliders and to combine this with stainless steel ball bearings.

This coating is applied after the zinc plating process and is a special trivalent chromium passivation that is approximately 4 microns thick (and is free of Chromium VI).
This applies a nano-particle coating and has extremely good results of 200 hours in salt spray tests before any signs of white rust.



Use with stainless steel fixing screws, strength class 10,9

Salt Spray Test (to DIN EN ISO 9227 NSS)

ATCoated after 720 hours salt spray

Chemical nickel plating after 360 hours

Testing conducted by independent institute

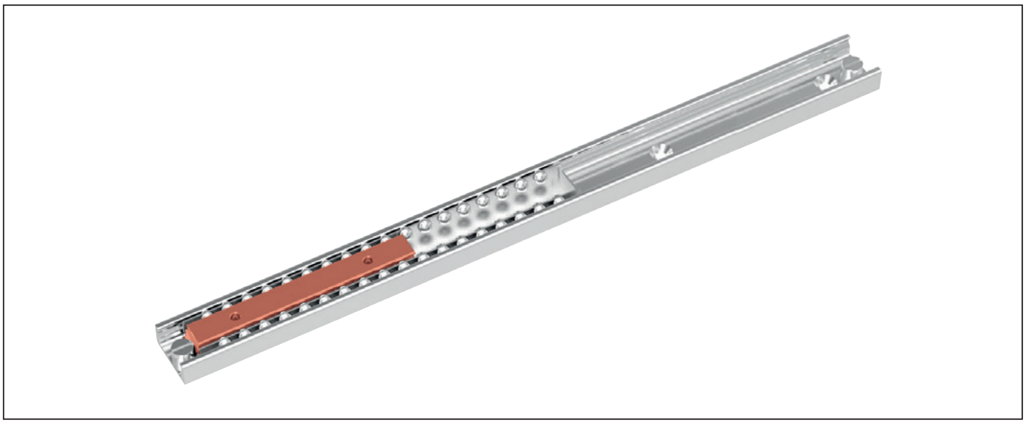
The corrosion resistant alloy coating on the telescopic slides is a soft coating and will (over time) wear off the raceways (which are subject to loads from the ball bearings) – this can be seen sometimes by a thin line on the raceways.
However, lubricating the raceways with grease (as recommended) ensures, as far as possible, the good corrosion properties of the overall coating.

This coating is often re-applied to linear guides and telescopic pullouts in the food and chemical industries; where they can be exposed to corrosive or aggressive environments.

The ATCoat has received USDA approved and also EU approved No.1935/2004 for use in the food industry.

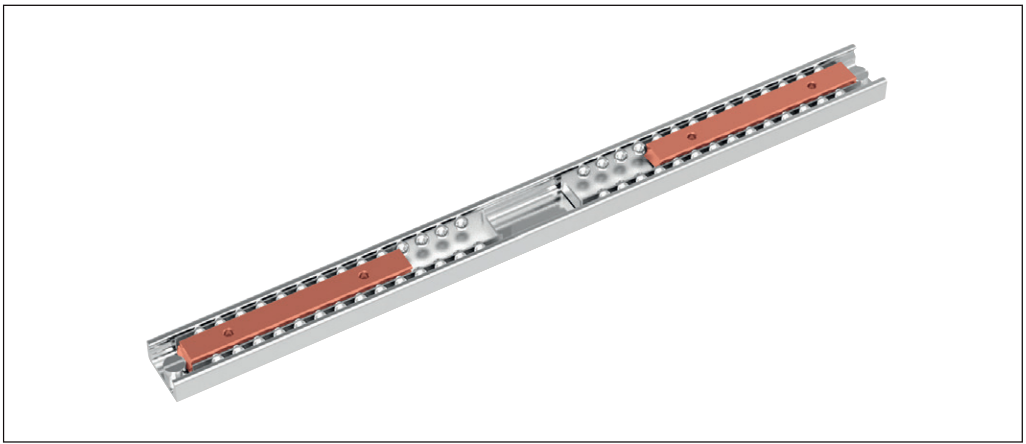
Single sliders

L1972 - This linear bearing consists of a guide rail and a slider that runs within the ball cage in the guide rail. High load capacities, compact cross-sections and simple and easy mounting characterise the series. Slider lengths can vary here as well and then form a total unit, which implements the required stroke.



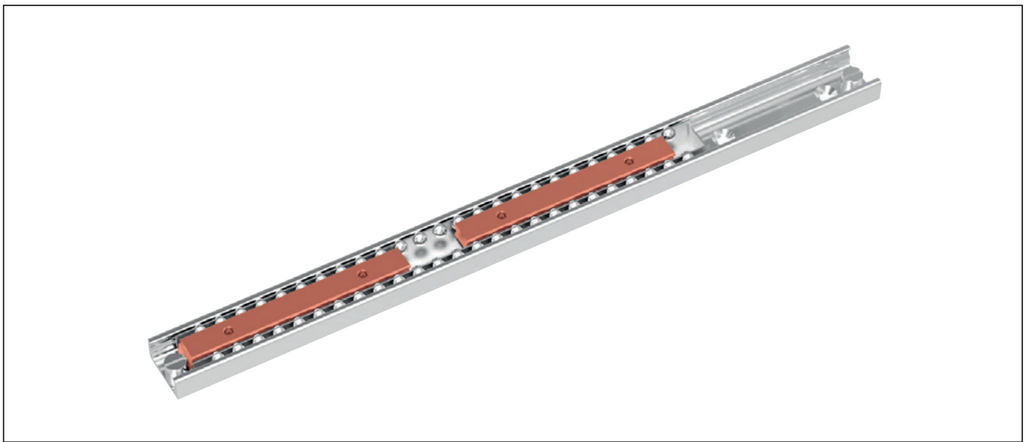
Multiple independent sliders

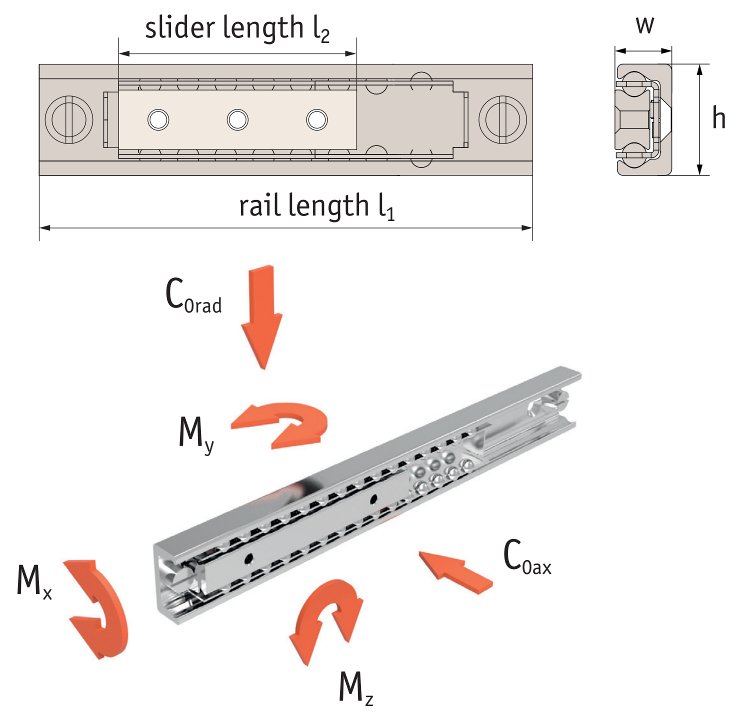
L1972.MI - Variant with several sliders, which each runs in its own ball cage, independently of each other, in the guide rail. Slider length and stroke for each slider can be different within one rail.



Multiple synchronised sliders

L1972.MS - Several sliders run in a common ball cage within the guide rails.
The slider lengths can vary here as well and then form a total unit, which implements the required stroke.





Rail Sizes h	Slider Length l_2	Width w	Maximum loads: C_{0rad} N	C_{0ax} N	M_x Nm	M_y Nm	M_z Nm
28	60	13	3480	2436	17,1	24	35
	80		4640	3248	22,7	43	62
	130		7540	5278	36,9	114	163
	210		12180	8526	59,7	298	426
	290		16820	11774	82,4	569	813
	370		21460	15022	105,1	926	1323
	450		26100	18270	127,9	1370	1958

Rail Sizes h	Slider Length l_2	Width w	Maximum loads: C_{0rad} N	C_{0ax} N	M_x Nm	M_y Nm	M_z Nm
35	130	17	9750	6825	47,2	148	211
	210		15750	11025	76,3	386	551
	290		21750	15225	105,3	736	1051
	370		27750	19425	134,4	1198	1711
	450		33750	23625	163,4	1772	2531
	530		39750	27825	192,5	2458	3511
	610		45750	32025	221,6	3256	4651
43	130	22	13910	9737	96,0	211	301
	210		22470	15729	155,1	551	786
	290		31030	21721	214,1	1050	1500
	370		39590	27713	273,2	1709	2441
	450		48150	33705	332,3	2528	3611
	530		56710	39697	391,4	3507	5009
	610		65270	45689	450,4	4645	6636

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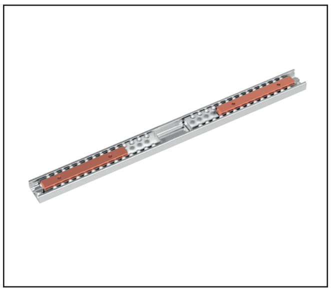
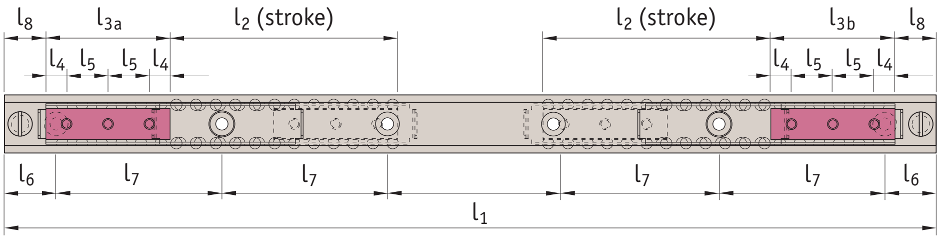




Technical Notes

Easy Slide with several independent slides. The total load capacity is based on the number of slides in the rail and their length.

The length and stroke of the individual slides can be different.

Tips

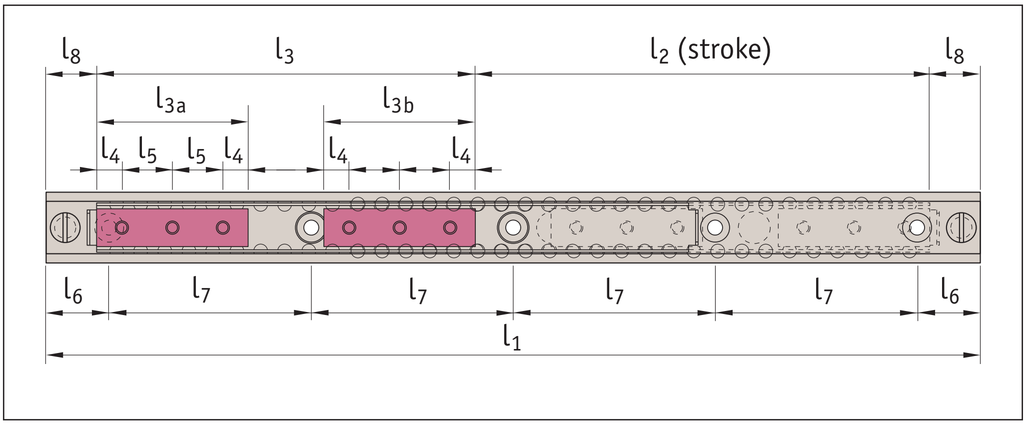
To ensure proper smooth movement, the stroke must be ≤ 7 x slider length.

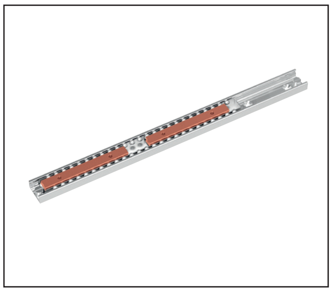
For full rail sizing see individual product pages L1972.SN22, SN28, SN38, SN43, SN63.

Rail Length $l_1 = [\, 2 \times (\, l_3 + l_2 \,) + (\, 2 \times l_8 \,)\,]$

Ordering Example

L1972.43	02	0290	0350	1330	G1	ATC
		l_3	l_2	l_1		
Rail size	Number of sliders (e.g. 2)	Slider length (e.g. 290mm)	Standard Stroke (e.g. 350mm)	Total rail length (e.g. 1330mm)	Preload if different from standard	Extra Anti-corrosion protection: ATC - ATCoat





Technical Notes

Easy Slide with several independent slides. The total load capacity is based on the number of slides in the rail and their length.

The length and stroke of the individual slides can be different.

Tips

To ensure proper smooth movement, the stroke must be ≤ 7 x slider length.

For full rail sizing see individual product pages L1972.SN22, SN28, SN38, SN43, SN63.

Ordering Example

	l_3	$l_{3a} + l_{3b}$	l_2	l_1		
L1972.43	0850	(370 + 290)	0400	1330	G1	ATC
Rail size	Apparent length of slider (e.g. 850mm)	Individual length of slider (e.g. 370 + 290mm)	Stroke (e.g. 400mm)	Total rail length (e.g. 1330mm)	Preload if different from standard	Extra Anti-corrosion protection: ATC - ATCoat

L1972.43 – 0850 – (370 + 290) – 0400 – 1330 – G1 – ATC

Static load

The maximum static loads of the L1972 series are defined by the slider lengths. These load capacities are valid for a loading point of forces and moments in the centre of the slider. The load capacities are independent of the position of the sliders inside the rails.

The radial load capacity, C_{0rad}, axial load capacity, C_{0ax}, and moments loads M_x, M_y and M_z indicate the maximum permissible values of the loads.

Higher loads adversely affect the running properties and the mechanical strength.

A safety factor, S_0, is used to check the static load, which takes into account the basic parameters of the application.

Conditions	Safety factor S_0
Neither shocks nor vibrations, smooth and low-frequency reverse; high assembly accuracy; no elastic deformations	1,0 - 1,5
Normal installation conditions	1,5 - 2,0
Shock and vibration, high-frequency reverse; significant elastic deformation	2,0 - 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 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 formulae above apply for a single load case. If there are two or more of the described forces simultaneously, the following check must be made:

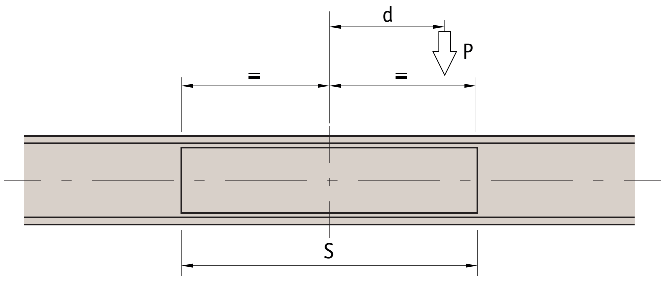
$$\frac{P_{0rad}}{C_{0rad}} + \frac{P_{0ax}}{C_{0ax}} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z} \leq \frac{1}{S_0}$$

P_{0rad} = effective radial load
C_{0rad} = permissible radial load
P_{0ax} = effective axial load
C_{0ax} = permissible axial load
M_1 = effective moment in the X-direction
M_x = permissible moment in the X-direction
M_2 = effective moment in the Y-direction
M_y = permissible moment in the Y-direction
M_3 = effective moment in the Z-direction
M_z = permissible moment in the Z-direction

ov-easy-slide-static-load-lnh-Updated-16-03-2023

Off-centre load P of the slider

For an off-centre load of the slider, the different load distribution on the balls must be accounted for with a reduction of the load capacity C. As shown, this reduction of the distance, d, from the loading point is dependent on the slider centre.



The value, q, is the position factor, the distance, d, is expressed in fractions of slider length S. The permissible load, P decreases as follows:

For a radial load

$$P = q \cdot C_{0rad}$$

For an axial load

$$P = q \cdot C_{0ax}$$

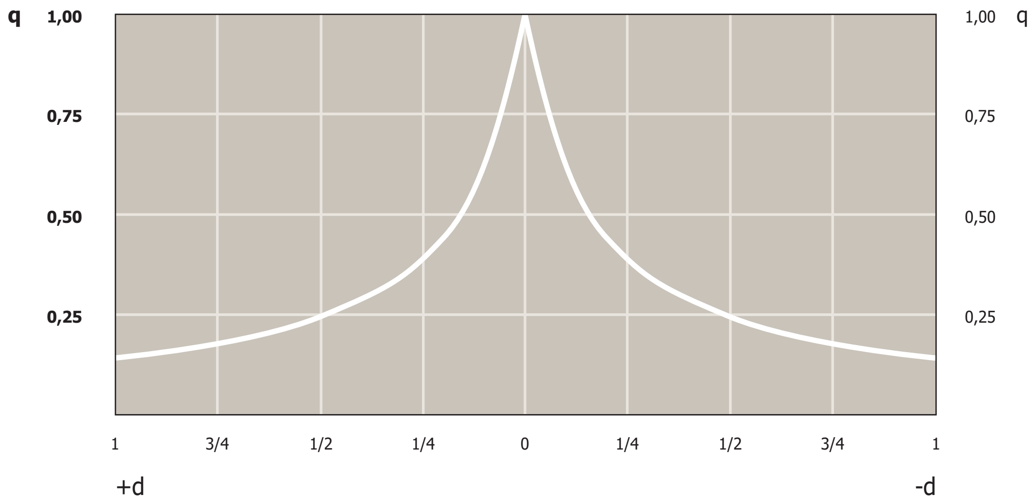
For the static load and the service life calculation, P_{0rad} and P_{0ax} must be replaced by the equivalent values calculated as follows, depending on whether the external load, P, acts:

Radially

$$P_{0rad} = \frac{P}{q}$$

Axially

$$P_{0ax} = \frac{P}{q}$$



Service life

The service life of a linear bearing depends on several factors, such as effective load, operating speed, installation precision, impacts and vibrations, operating temperature, ambient conditions and lubrication. The service life is defined as the time span between initial operation and the first fatigue or wear indications on the raceways.

In practice, the end of the service life must be defined as the time of bearing decommissioning due to its destruction or extreme wear of a component.

This is taken into account by an application coefficient, f_i so the service life consists of:

$$L_{km} = 100 \cdot \left(\frac{C_{0rad}}{W} \cdot \frac{1}{f_i} \right)^3$$

L_{km} = calculated service life (Km)

C_{0rad} = load capacity (N)

W = equivalent load (N)

f_i = application coefficient (see below)

Application coefficient f_i

Conditions	Application coefficient f_i
No impacts or vibrations, smooth and low-frequency direction change; clean operating conditions; low speeds (<0,5 m/s)	1,0 - 1,5
Slight vibrations, average speeds (0,5 - 0,7 m/s) and average frequency of direction change	1,5 - 2,0
Impacts and vibrations, high speeds (>0,7 m/s) and high-frequency direction change; very dirty environment	2,0 - 3,5

If the external load, P, is the same as the dynamic load capacity, C_{0rad}, (which of course must never be exceeded), the service life at ideal operating conditions (f_i = 1) amounts to 100Km.

For a single load P, the following applies:

$$W = P$$

If several external loads occur simultaneously, the equivalent load is calculated as follows:

$$W = P_{rad} + \left(\frac{P_{ax}}{C_{0ax}} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z} \right) \cdot C_{0rad}$$

Clearance and Preload

The SN series linear bearings are installed with no clearance as standard. For more information, please contact our Technical Department.

Preload classes		
Increased clearance	No clearance	Increased preload
G_1	Standard	K_1

Coefficient of friction
With correct lubrication and installation on level and rigid surfaces and sufficient parallelism for rail pairs, the friction value is less than or equal to 0,01. This value can vary depending on the installation situation.

Linear accuracy
With installation of the rails using all bolts on a perfectly plane support surface with the fixing holes in a straight line, the linear accuracy of the sliders to an external reference is as follows:

$$// = \frac{\sqrt{H}}{300} \text{ mm}$$

H = stroke

Speed
The linear bearings of the L1972 series can be used up to an operating speed of 0,8 m/s.

With high-frequency direction changes and the resulting high accelerations, as well as with long ball cages, there is a risk of cage creep (see instructions for use).

Temperature
The series can be used in ambient temperatures from -30°C to +170°C. A lithium lubricant for high operating temperatures is recommended for temperatures above +130°C.

Anti-corrosion protection
The L1972 series has a standard anti-corrosion protection (electrolytic zinc-plating to ISO 2081).

If increased anti-corrosion protection is required, the rails are available either with special coatings.

Numerous application-specific surface treatments are available upon request, e.g. as a nickel-plated design with FDA approval for use in the food industry. For more information, please contact our Technical Department.

Lubrication
Recommended lubrication intervals are heavily dependent upon the ambient conditions. Under normal conditions, lubrication is recommended after 100Km operational performance or after an operating period of 6 months.

In critical applications, the interval should be shorter. Please clean the raceways carefully before lubrication. Raceways and spaces of the ball cage are lubricated with a lithium lubricant of average consistency (roller bearing lubricant).

Different lubricants for special applications are available upon request, e.g. lubricant with FDA approval for use in the food industry.

For more information, please contact our Technical Department.

Cage creep
Under normal operating conditions, the cage moves in synchronisation with the carriage slider, but at half its speed; or to put it another way, the ball cage follows the relevant stroke, but travelling half the distance. In unfavourable operating conditions, e.g. fast-changing acceleration or heavy fluctuating strokes, it is not always possible to avoid cage slip from occurring. In this case, you should schedule a no-load stroke, if possible, in order to re-position the cage. If strokes fluctuate, you should also ensure adequate dimensioning of the drive that is used. You can use a friction coefficient of 0.1 for the relevant calculations.

Important note
Only to be used for horizontal movement.

Fixing screws

The rails of the SN series in sizes 22 to 43mm are fixed with countersunk head screws to DIN 7991.

Tightening torques of the standard fixing screws to be used

Rail sizes	Thread size	Property class	Tightening torque Nm
22	M4	10,9	4,3
28	M5		8,5
35	M6		14,6
43	M8		34,7

Installation instructions

Internal stops are used to stop the unloaded slider and the ball cage, these are not designed to stop a moving, loaded slider. Please use external stops for a loaded system.

To achieve optimum running properties, high service life and rigidity, it is necessary to fix the linear bearings with all accessible holes onto a rigid and level surface.

Instructions for use

For linear bearings of the L1972 series, the sliders are guided through a ball cage inside the rails. When the sliders run their course relative to the rails, the ball cage moves along for half the slider stroke. The stroke ends as soon as the slider reaches the end of the cage.

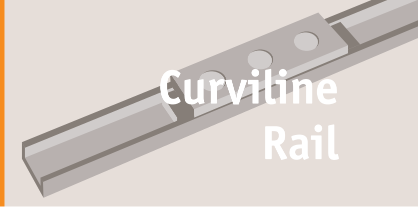
Normally the cage moves synchronously to the balls at half the speed of the slider. Any cage slip negatively affects the synchronous movement of the ball cage, causing it to reach the internal stops prematurely, this reduces the stroke. The stroke value can be normalised at any time by moving the slider to the stop in the stopped cage. This moving of the slider relative to the cage will have increased resistance, which is dependent on the working load.

The causes of "cage slip" can be installation accuracy, dynamics, and load changes.
The effects can be minimised by observing the following advice:

- The stroke should always remain constant and come as close as possible to the nominal stroke of the linear bearing.
- For applications with various strokes, make sure that the drive is sufficiently large enough to guarantee a movement of the slider relative to the cage; a coefficient of friction of 0,1 should be calculated for this.
- Another possibility is to include a maximum stroke without load into the working cycle in order to re-synchronise the slider and ball cage.

Parallelism errors or inaccuracies in the installation or in the mounting surfaces of mounted pairs can influence cage creep.

Series L1972 linear bearings should only be used for horizontal movement.



The Curviline rail system offers a cost-effective solution to curvi-linear applications.

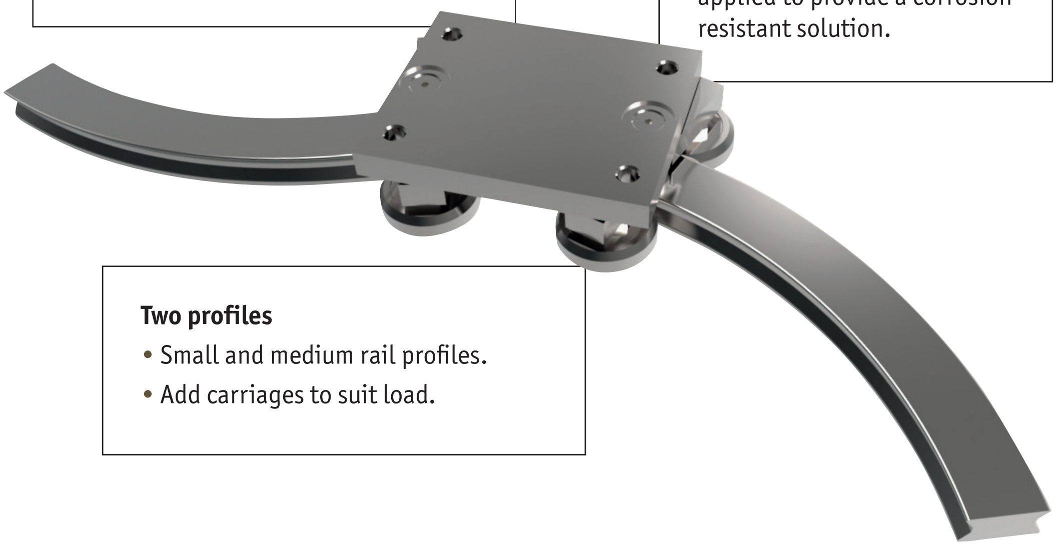
Flexibility when you need it

Constant radius, variable radius are available in standard radii, non-standard radii to your drawings are also possible. Straight and curved sections in a single length can be supplied.

Any radius
- From 120mm radius upwards.
- Standard and special radii.
- Angles up to 360°.

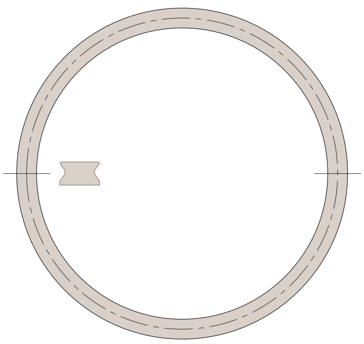
Anti-corrosion

Alloy coating or nickel plating of the rails and sliders can be applied to provide a corrosion resistant solution.

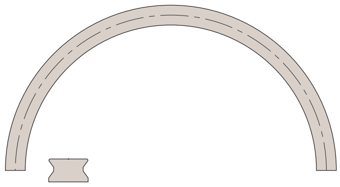


Two profiles
- Small and medium rail profiles.
- Add carriages to suit load.

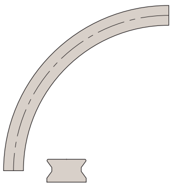
Examples



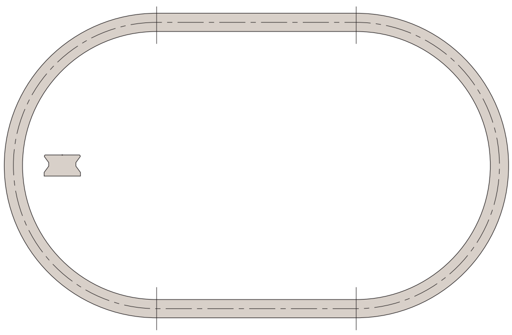
Circle



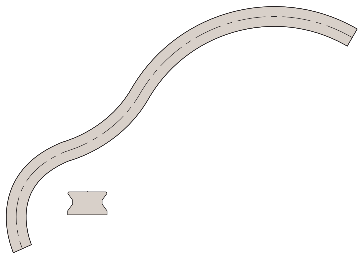
Semi-circle



Arcs



Ovals



Complex rails with varied radii and angles

Curviline Rail from Automotion Components

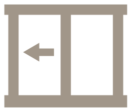
Curviline Rail

Specifications and applications

Specifications

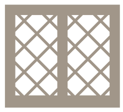
- Maximum speed 1,5 m/s.
- Maximum acceleration 2 m/s².
- Maximum rail length 3600 mm.
- Two rail sizes 16,5 and 23,5 mm width.
- Minimum radius 120 mm.
- Recommended hole pitch 80 mm.
- Radius tolerance ± 0,5 mm (± 1°).
- Maximum radial load per slider 1615N.
- Temperature range -30°C to +80°C.
- Roller bearing seals 2Z (dust proof), lubricated for life.
- Rollers from 100Cr6, (stainless versions with rubber seals 2RS available on request).
- Sliders are preload adjustable.
- Not suitable for moment loads.
- Special coatings and finishes available on request.

Applications

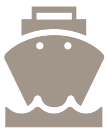


Sliding doors & windows
Internal sliding doors
gates • roof lights
display cases

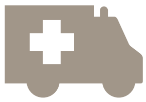
Special purpose & packaging machines
Precision positioning systems
handling units • robotic systems
cutting machines



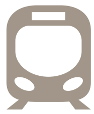
Safety guarding
Extending protective systems
sliding gates
automatic pick & place



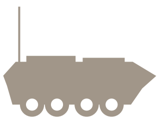
Transport (naval)
Sliding hatches
pull-out storage



Transport (automotive)
Ambulance sliding systems
fire fighting vehicles
sliding panels

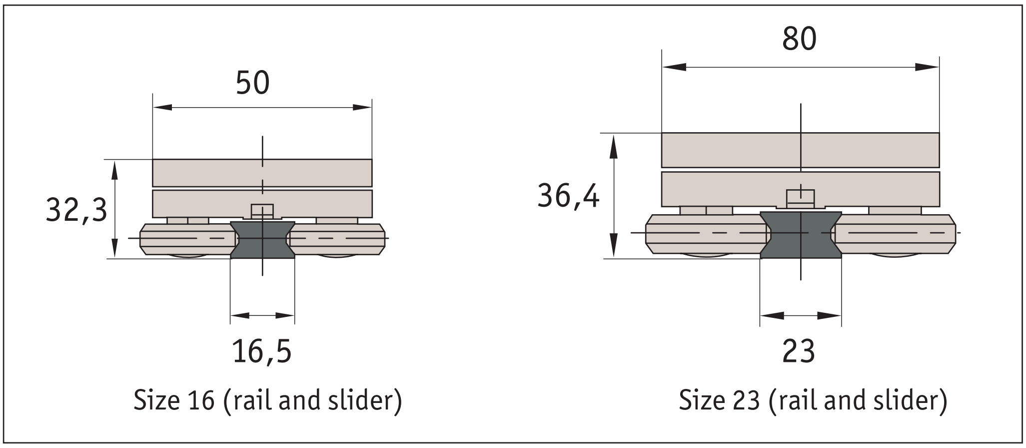


Transport (rail)
Seat adjustment
sliding doors
battery removal units



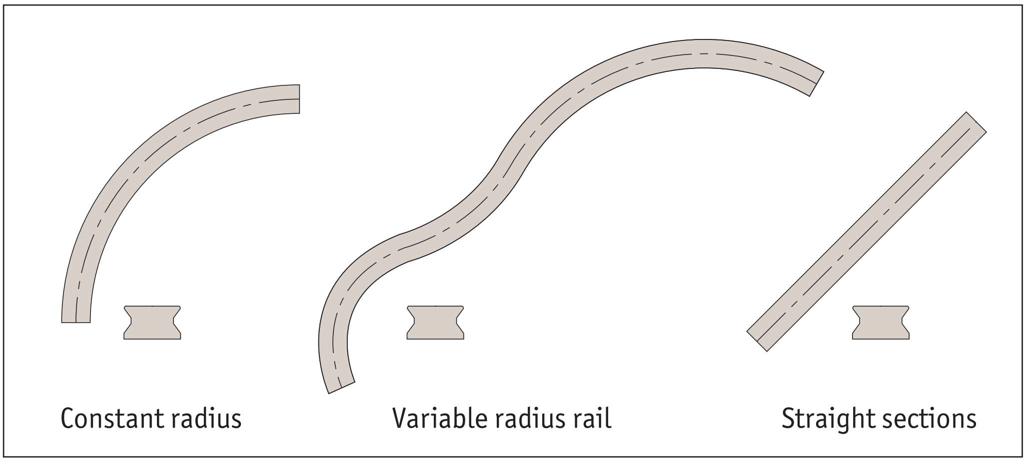
Transport (military)
Sliding seats
protective hatches
stretcher extensions

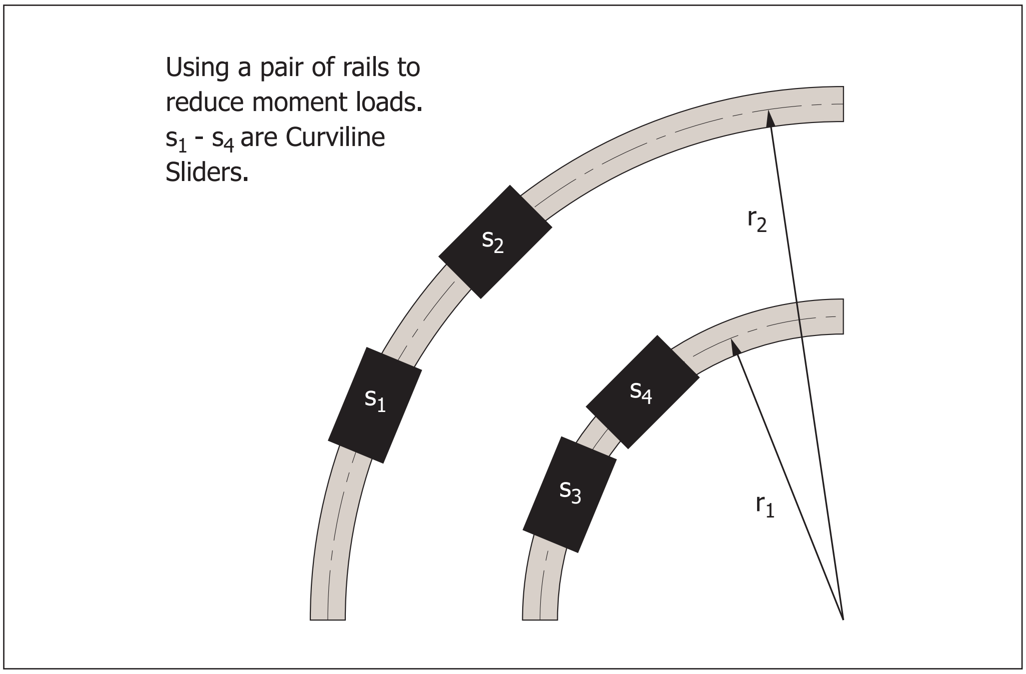
Rail sizes



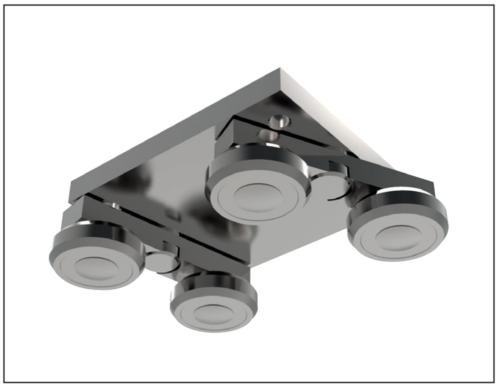
The sliders have eccentric rollers that are adjustable with the thin spanner that is supplied with them. This allows the preload of the system to be set as required – tight or free running.

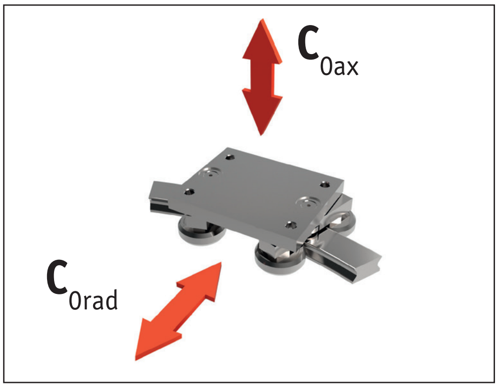
Rail types





Load capacities

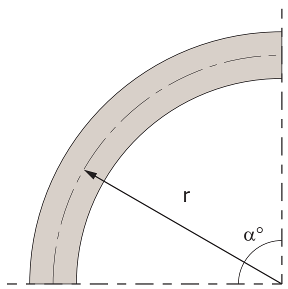




Slider type	C_{0ax} N	C_{0rad} N
L1978.CX16-070	390	560
L1978.CX23-100	1110	1600

Note: Reduce any moment loads by utilising two or more sliders and/or rails.

Constant radius

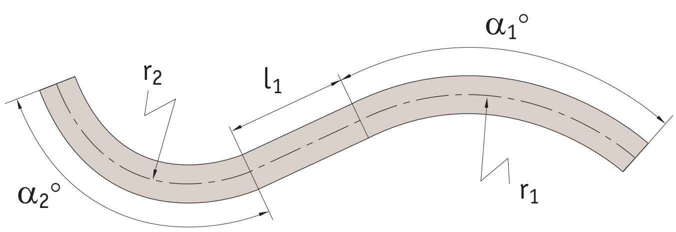


Ordering Example

L1978 • CRX16 – 0200 – 060 – X

- L1978: Product Number
- CRX16: Rail width (16 or 23)
- 0200: Radius: r (mm) 120 upwards
- 060: Angle: α° (0°-360°)
- X: Fixing hole type: CB - Counterbored, CS - Countersunk, TR - Threaded

Variable radius

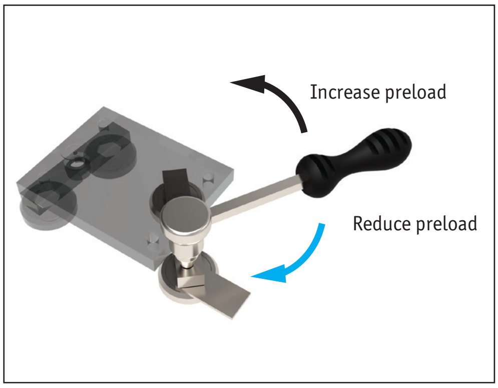


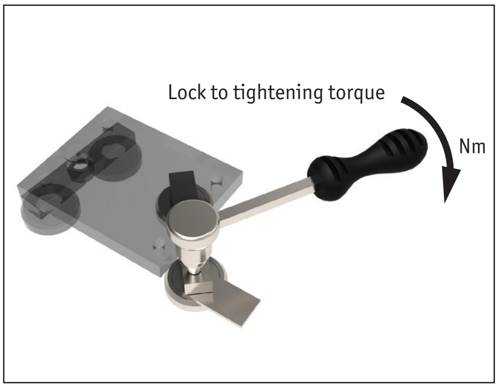
Ordering Example

L1978 • VRX16 – 0400 – 060 – 100 – 0200 – 090

- L1978: Product Number
- VRX16: Rail width (16 or 23)
- 0400: 1st Radius (mm) r_1>120
- 060: 1st Angle: (α_1°)
- 100: l_1 (>70 mm)
- 0200: 2nd Radius (mm) r_2>120
- 090: 2nd Angle: (α_2°)

Setting the preload





Slider type	Tightening torque Nm
L1978.CX16-070	7
L1978.CX23-100	12

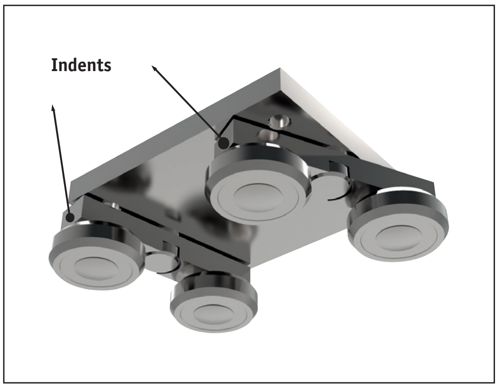
If the Curviline system is delivered as a system, the sliders are already set with no clearance. In this case fixing screws are secured with Loctite® at the factory.

If delivered separately, or if the sliders are to be installed in another track, the eccentric rollers must be re-adjusted.

Important: Loctite® must be applied to the roller fixing screws to prevent loosening.

- Wipe the raceways clean.
- Slightly loosen the fixing screws of the rollers. See below for details on how to identify the eccentric rollers.
- Position the slider(s) at the ends of the rail.
- Insert the flat spanner (provided) onto the hexagonal nut at the top of the roller.
- By turning the spanner clockwise the roller is pressed against the raceway and thus reduces the clearance. Please note that with increasing preload, the friction is also increased and thus the service life is reduced.
- Hold the roller with the spanner in the desired position and carefully tighten the fixing screw. The exact tightening torque will be checked later.
- Move the slider on the rail and check the preload over the entire length of the rail. It should move easily and the slider should have no play at any point of the rail.
- Now tighten the fixing screws to the specified tightening torque, whilst securing the roller bearing with the spanner. A special thread in the roller secures the set position.

Identify the eccentric/fixed rollers



The fixed rollers are identified by an indentation on the roller mounts. The eccentric roller mounts have NO indents.