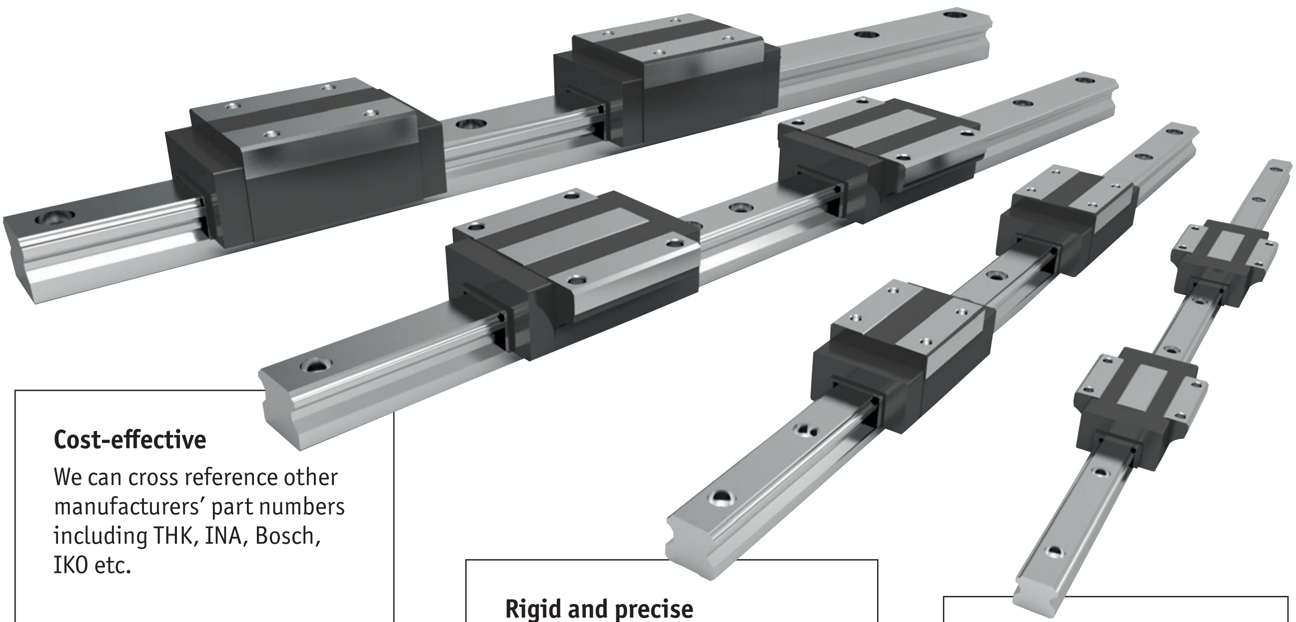
## L1016 Linear guideways

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**

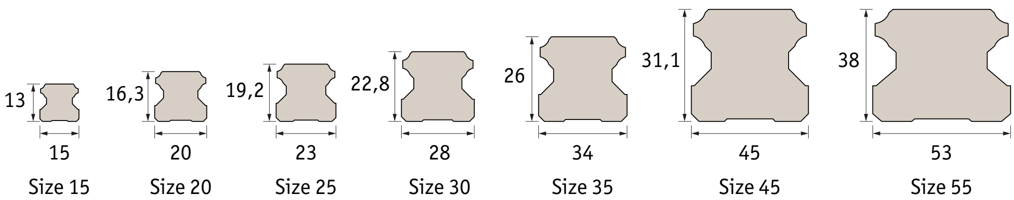
- High load rating.
- High moment load capacity.

**Stocked**

7 rail profiles ready for same day despatch.

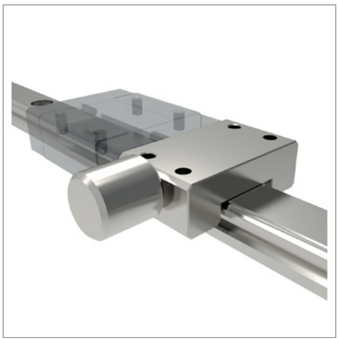
Lengths up to 4 metres.

**Rail sizes**

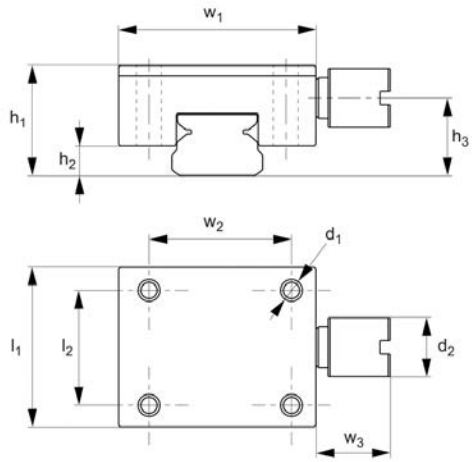


# Manual Clamps for Miniature Rail

for L1010 and L1012



## L1010.CL

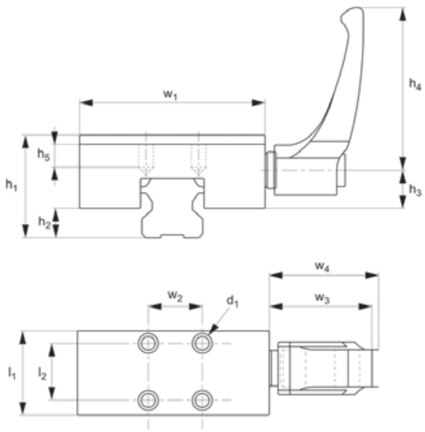





**Material**
Corrosion resistant stainless steel, hardened (similar to 440C).

**Technical Notes**
The manual rail clamps are used alongside the rail carriges. Activating the clamping knob presses the clamp contact surfaces onto the rail, clamping it in place.

| Order No. | For rail | $h_1$ | $l_1$ | $w_1$ | $h_2$ | $h_3$ | $l_2$ | $w_2$ | $w_3$ | $d_1$ | $d_2$ | Holding force kgf | Torque to Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1010.CL07 | L1010.07 | 8 | 12 | 17 | 2 | 4.3 | 8 | 12 | 7 | M2 | 6 | 65 | 0.11 |
| L1010.CL09 | L1010.09 | 10 | 17 | 20 | 2.7 | 5.35 | 11 | 15 | 9 | M3 | 8 | 100 | 0.17 |
| L1010.CL12 | L1010.12 | 13 | 19 | 27 | 3.5 | 7.15 | 13 | 20 | 10 | M3 | 10 | 150 | 0.35 |
| L1010.CL15 | L1010.15 | 16 | 20 | 32 | 5 | 8.05 | 14 | 25 | 14 | M3 | 12 | 180 | 0.75 |
| L1012.CL14 | L1012.14 | 9 | 12 | 25 | 3 | 4.3 | 8 | 19 | 6.65 | M2 | 6 | 65 | 0.10 |
| L1012.CL18 | L1012.18 | 12 | 17 | 30 | 4.2 | 5.85 | 11 | 23 | 9 | M3 | 8 | 100 | 0.17 |
| L1012.CL24 | L1012.24 | 14 | 19 | 40 | 4 | 7.65 | 13 | 30 | 10 | M3 | 10 | 150 | 0.35 |
| L1012.CL42 | L1012.42 | 16 | 22 | 60 | 4.5 | 8.55 | 15 | 45 | 14.7 | M4 | 12 | 180 | 0.75 |




# L1016.CL



**Material**
Aluminium body, steel contact faces.

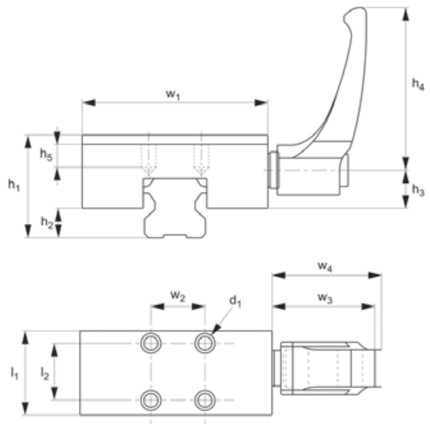
**Technical Notes**
The manual rail clamps are used in conjunction with the rail carriages L1016.F and L1016.U (flanged and unflanged). By adjusting the clamping lever, the contact sections are pressed into contact with the rail, clamping the carriage in place.

| Order No. | For rail | $h_1$ | $l_1$ | $w_1$ | $h_2$ | $h_3$ | $h_4$ | $l_2$ | $w_2$ | $w_3$ | $w_4$ | $d_1$ | Holding force N | Torque to Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1016.CL15-24 | 15 | 24 | 25 | 47 | 4.5 | 12.5 | 44 | 17 | 17 | 30.5 | 33.5 | M 4 | 1200 | 5 |
| L1016.CL15-28 | 15 | 28 | 25 | 47 | 4.5 | 12.5 | 44 | 17 | 17 | 30.5 | 33.5 | M 4 | 1200 | 5 |
| L1016.CL20-28 | 20 | 28 | 24 | 60 | 8.0 | 13.0 | 63 | 15 | 15 | 38.5 | 41.5 | M 5 | 1200 | 7 |
| L1016.CL20-30 | 20 | 30 | 24 | 60 | 8.0 | 13.0 | 63 | 15 | 15 | 38.5 | 41.5 | M 5 | 1200 | 7 |
| L1016.CL25-33 | 25 | 33 | 30 | 70 | 9.0 | 15.0 | 63 | 20 | 20 | 38.5 | 41.5 | M 6 | 1200 | 7 |
| L1016.CL25-36 | 25 | 36 | 30 | 70 | 9.0 | 15.0 | 63 | 20 | 20 | 38.5 | 41.5 | M 6 | 1200 | 7 |
| L1016.CL25-40 | 25 | 40 | 30 | 70 | 9.0 | 15.0 | 63 | 20 | 20 | 38.5 | 41.5 | M 6 | 1200 | 7 |
| L1016.CL30-42 | 30 | 42 | 39 | 90 | 12.0 | 21.5 | 78 | 22 | 22 | 46.5 | 50.5 | M 6 | 2000 | 15 |
| L1016.CL35-48 | 35 | 48 | 39 | 100 | 13.0 | 21.5 | 78 | 24 | 24 | 46.5 | 50.5 | M 8 | 2000 | 15 |
| L1016.CL45-60 | 45 | 60 | 44 | 120 | 12.0 | 26.5 | 78 | 26 | 26 | 46.5 | 50.5 | M10 | 2000 | 15 |
| L1016.CL55-70 | 55 | 70 | 49 | 140 | 17.0 | 31.0 | 95 | 30 | 30 | 56.5 | 61.5 | M14 | 2000 | 22 |

# Rail Clamp
## for aluminium rail L1018



# L1018.CL




**Material**
Aluminium body, plastic contact faces.

**Technical Notes**
By adjusting the clamping lever, the contact sections are pressed into contact with the rail, clamping the carriage in place.
Suitable for our aluminium linear rails L1018.

| Order No. | For rail | $h_1$ | $l_1$ | $w_1$ | $h_2$ | $h_3$ | $h_4$ | $l_2$ | $w_2$ | $w_3$ | $w_4$ | $d_1$ | Holding force N | Torque to Nm max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1018.CL15-24 | 15 | 24 | 20 | 34 | 4.5 | 12.9 | 40 | 10 | 10 | 29.9 | 33.3 | M 3 | 130 | 3 |
| L1018.CL20-30 | 20 | 30 | 24 | 44 | 6.0 | 16.0 | 40 | 12 | 12 | 29.9 | 33.4 | M 4 | 250 | 3 |
| L1018.CL25-36 | 25 | 36 | 30 | 48 | 7.0 | 19.6 | 44 | 15 | 15 | 29.8 | 33.3 | M 5 | 330 | 3 |

- **Carriage types**

Flanged

Unflanged

**Carriage lengths**

Long

Standard

Short

**Rail types**

Standard - stocked

(Counterbore holes in top face)

Bottom threaded - on request

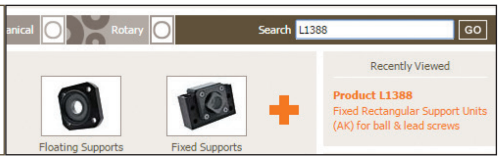
(No holes in top face)

## 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.

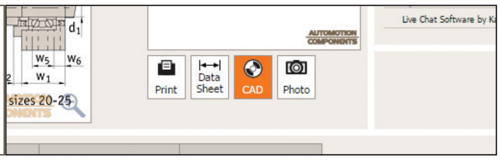
**Step: 1 find the part you need**

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



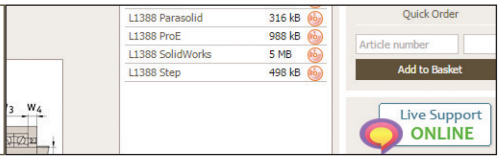

**Step 2: Choose the CAD option**

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.




Linear Guideways from Automotion Components

LINEAR GUIDEWAYS

ov-linear-guideways-overview-rnh - Updated - 23-02-2023

### 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?

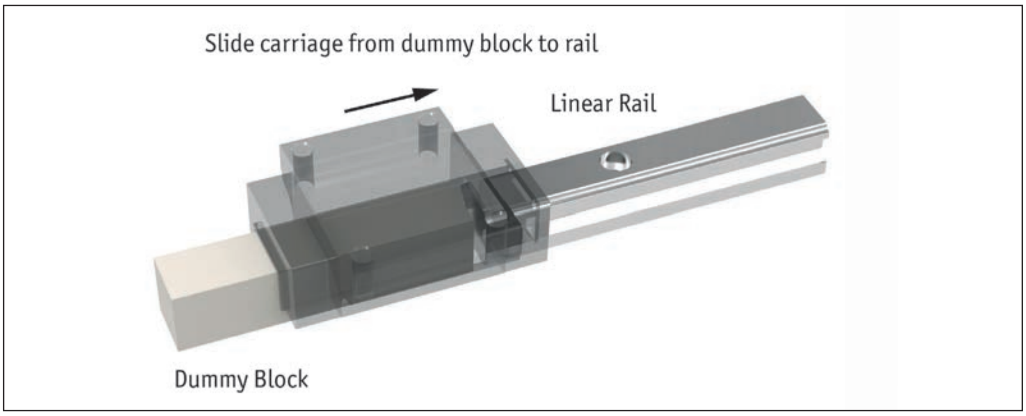
- We have standard rail lengths. These are based on the hole pitch of the rails and end machining to provide an equidistant length to the first and last hole centre.
- However we can cut the rail (from stock) to any length required – we just need to know the distance required to the first hole.
- In 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

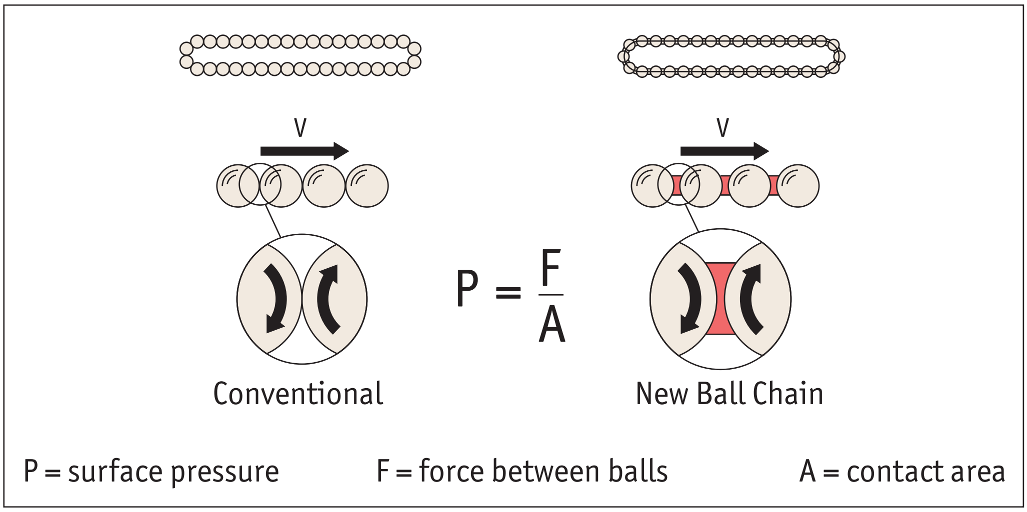
- In general the carriages will be supplied separately to the rails. To install the carriage onto the rails, offer the carriage up to the rails and slide it onto the rail itself.



## New ball chain technology

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

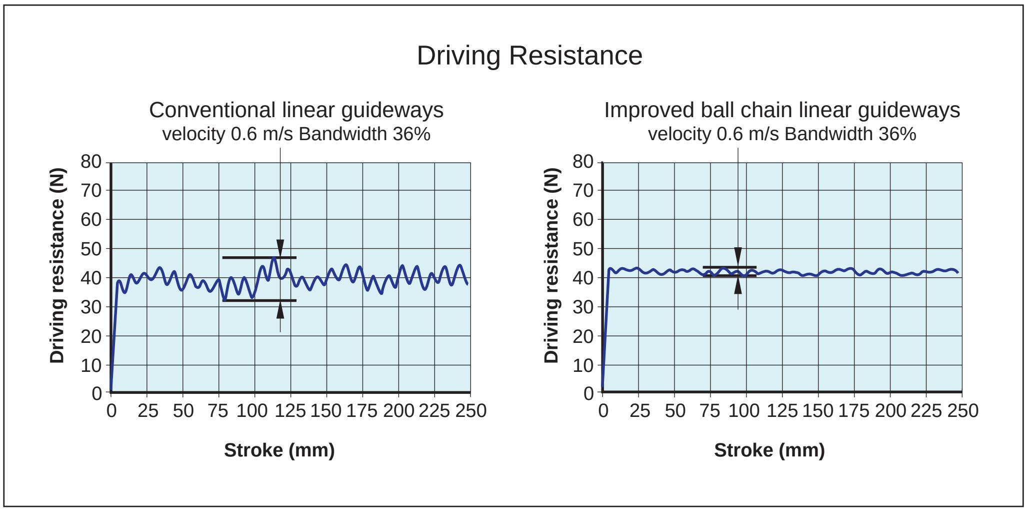
- Higher maximum velocity.
- Lower heat generation
- Lower noise generation.
- Very smooth running.
- Optimised lubrication system
- Even load distribution
- Longer service life




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.

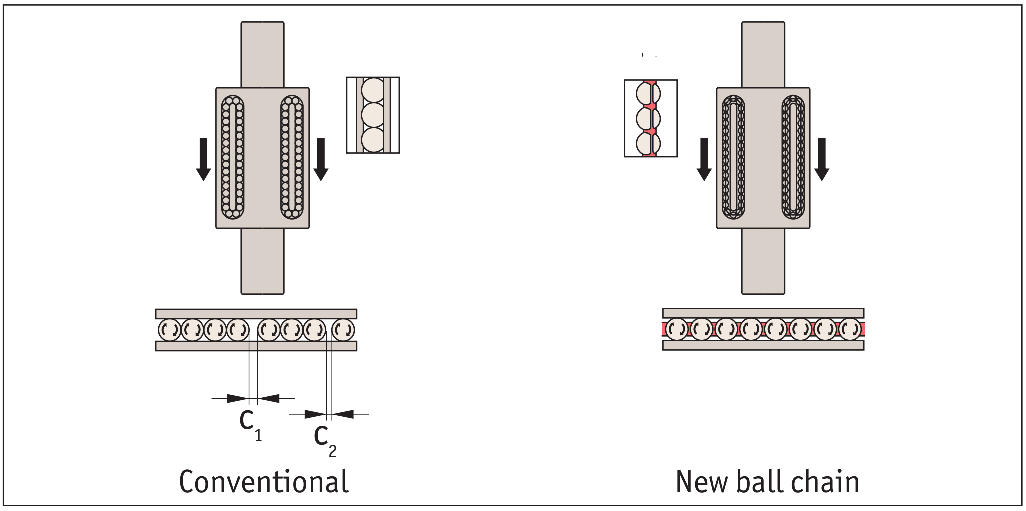
This design of the of the ball chain ends in connection with the spacer ball closes the circulation and makes the movement of the carriage smooth and quiet.





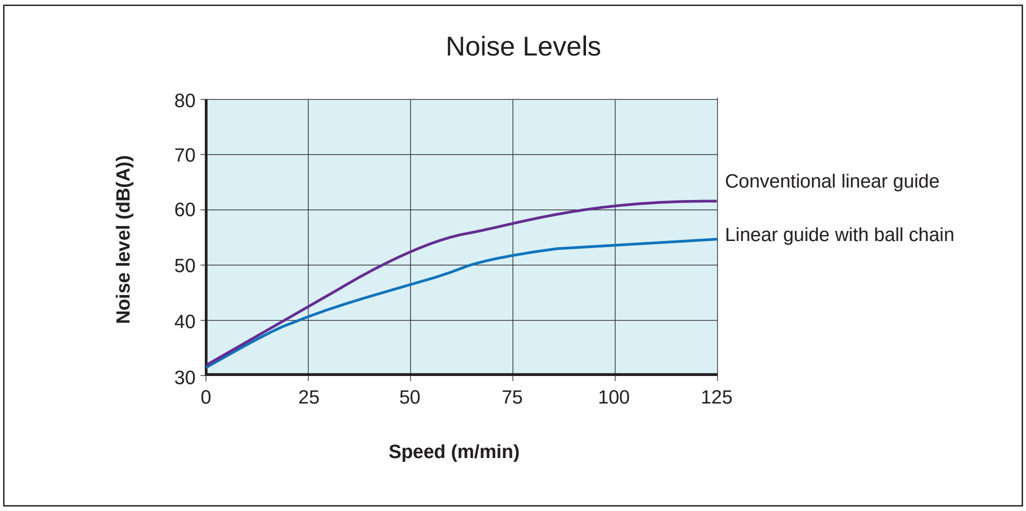

ov-linear-guideways-technical-ball-chain-technology-a-mh - Updated - 23-02-2023

### 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.



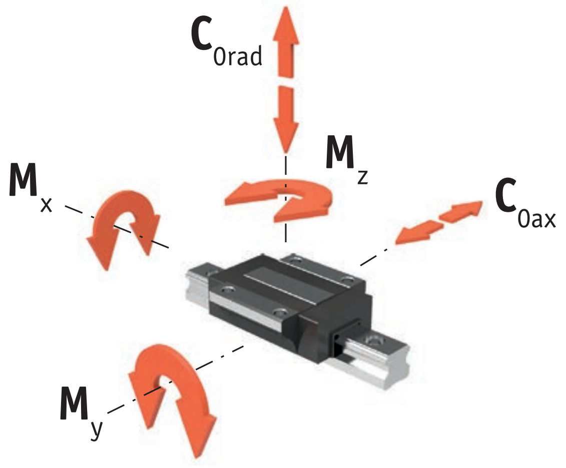

We can coat our rail wih two types of corrosion protective finishes:

- 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.

## Load capacity overview - L1016.F Flanged carriages

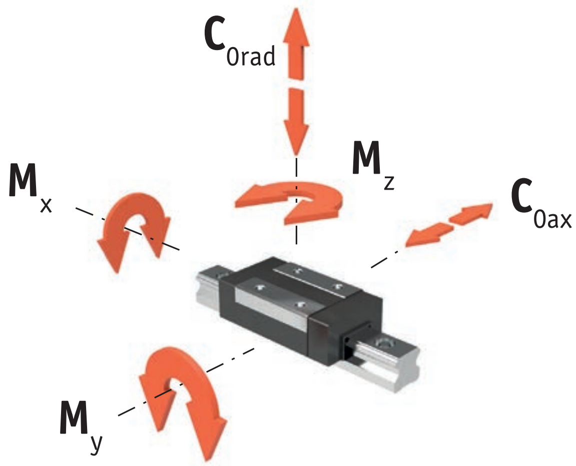



| Part no. | Type | Length | Max. load capacities kN | | Max. static moments Nm | | |
|---|---|---|---|---|---|---|---|
| | | | Dynamic Load C kN | Static load $C_{0rad+ax}$ kN | $M_x$ Nm | $M_y$ Nm | $M_z$ Nm |
| **L1016.F15** | Flanged | Standard | 11,67 | 19,90 | 137 | 120 | 120 |
| **L1016.F15-L** | 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 |



ov-linear-guideways-load-L1016F-rnh - Updated - 24-02-2023

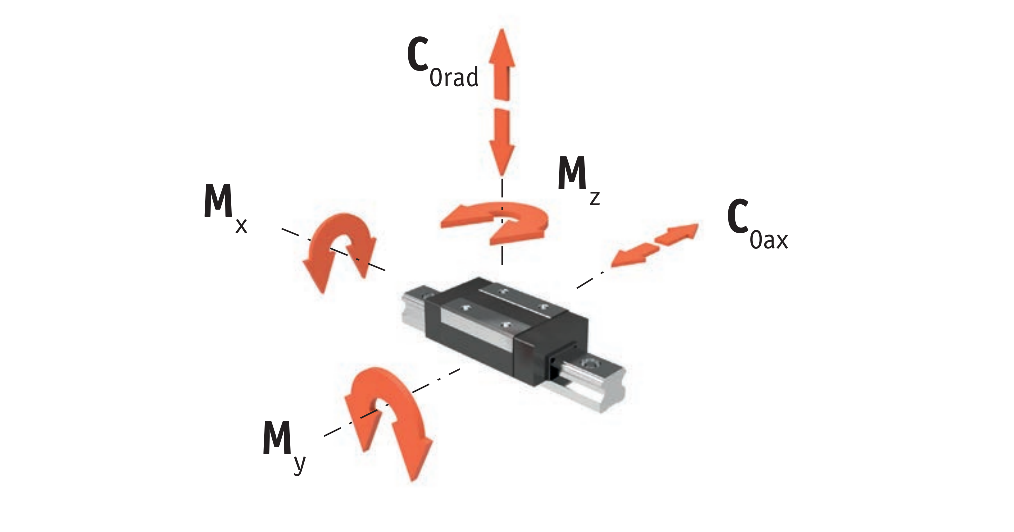
### Load capacity overview - L1016.U Unflanged carriages




| 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 |

ov-linear-guideways-load-L1016U-lnh - Updated - 27-02-2023

### 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 |



ov-linear-guideways-load-L1016UL-rnh - Updated - 27-02-2023

### 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.

## 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.

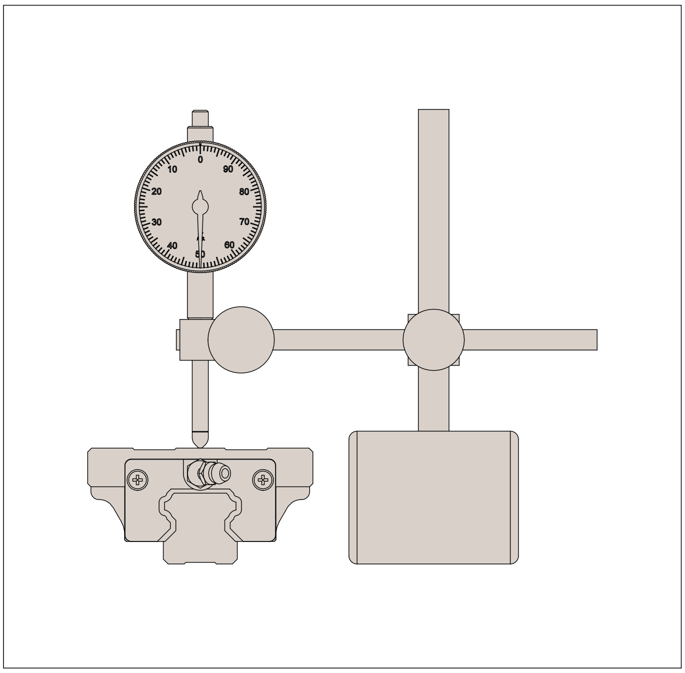
The preload influences the rigidity, precision and torque resistance and also affects the service life and displacement force.

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 |



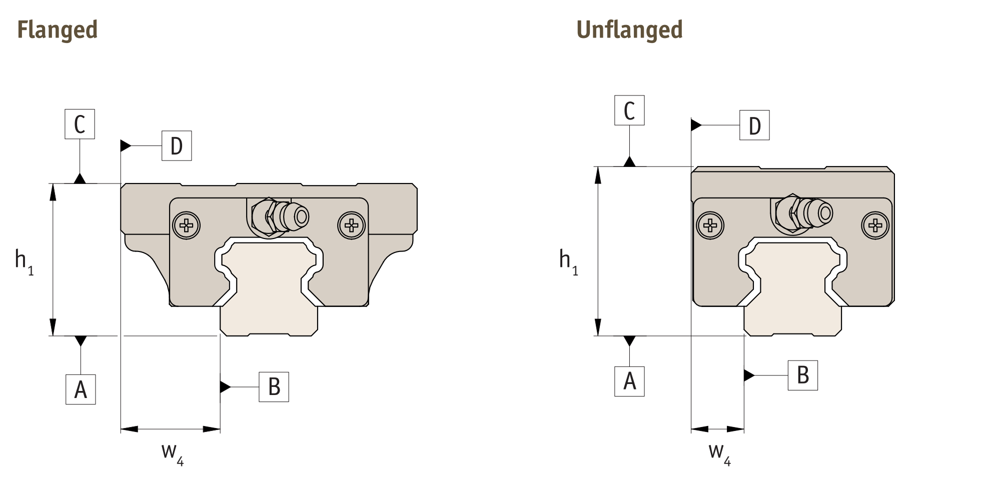
# Technical Information

## System precision



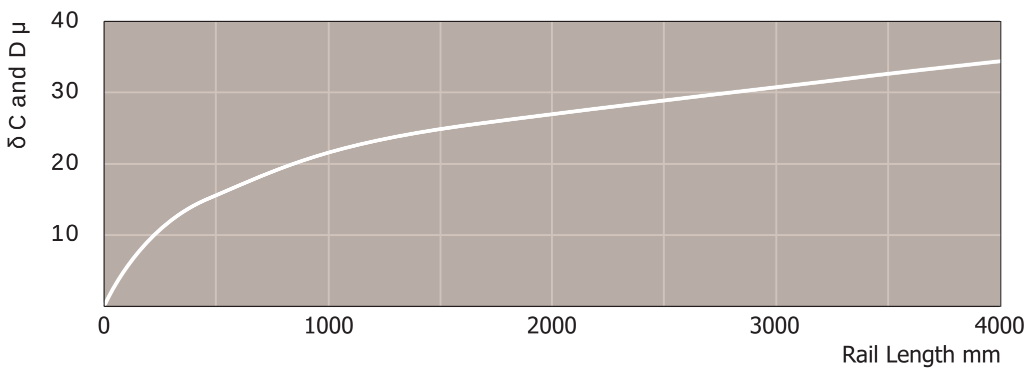


Precision means the guide accuracy or the maximum deviation of the carriage based on the side and support surfaces during the movement along the rails.




| | 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.





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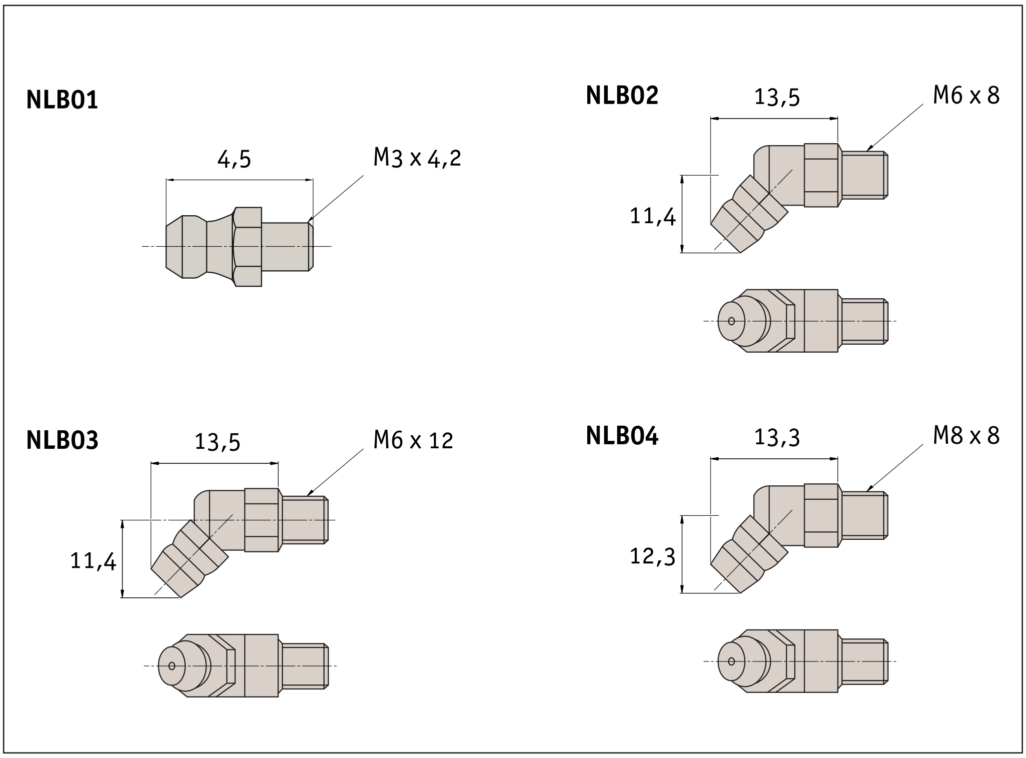
## Lubrication nipple

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).

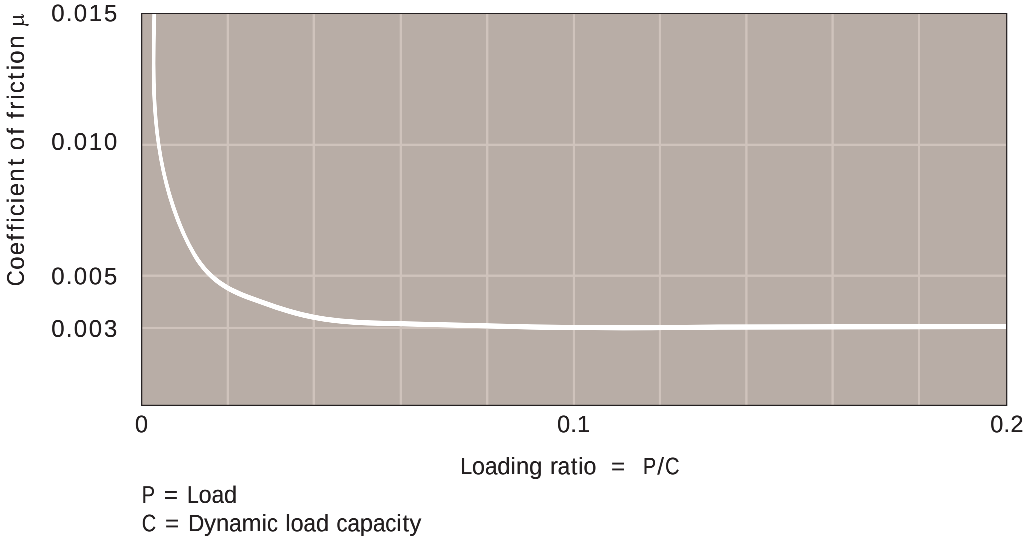
The displacement resistance ($F_m$) is dependent upon several factors:

- 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**




**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.

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

$f_c$ = 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.

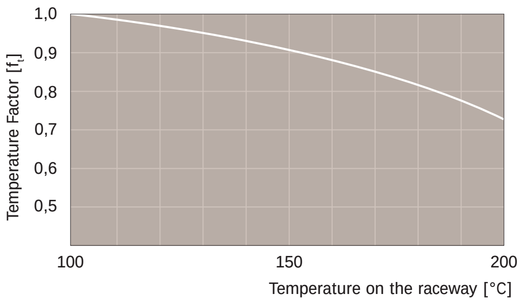
| Operating conditions | Speed | $f_i$ |
|---|---|---|
| Neither external impacts nor vibrations | Low speed V ≤ 15 m/min. | 1 - 1,5 |
| Light impacts or vibrations | Average speed < V ≤ 60 m/min. | 1,5 - 2 |
| Average and high external impacts or vibration | High speed V > 60 m/min. | 2 - 3,5 |

## 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.

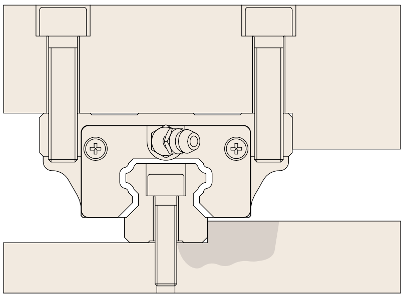
Note 1: For temperatures above 80°C, the seals and end caps must be designed for higher thermal resistance.

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

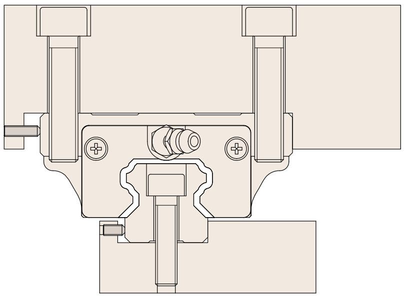


**Installation examples**
The following drawings illustrate some assembly examples for rail/carriage combinations corresponding to the structure of various machine frames.

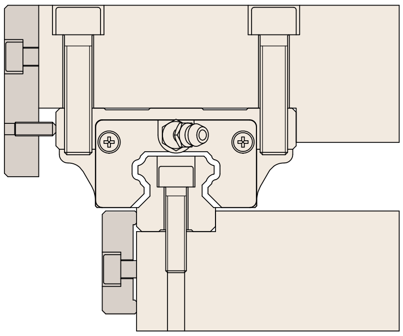
**Example 1**
Assembly of carriage and rail on shoulder edges



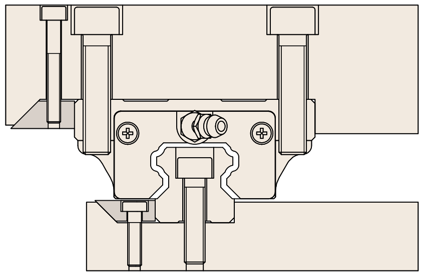
**Example 2**
Securing carriage and rail using set screws



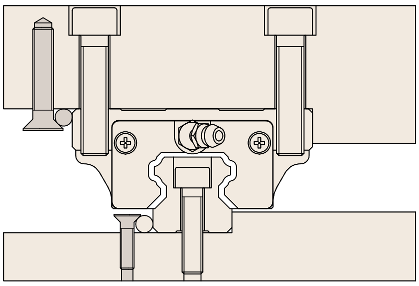
**Example 3**
Securing carriage and rail using pressure plates



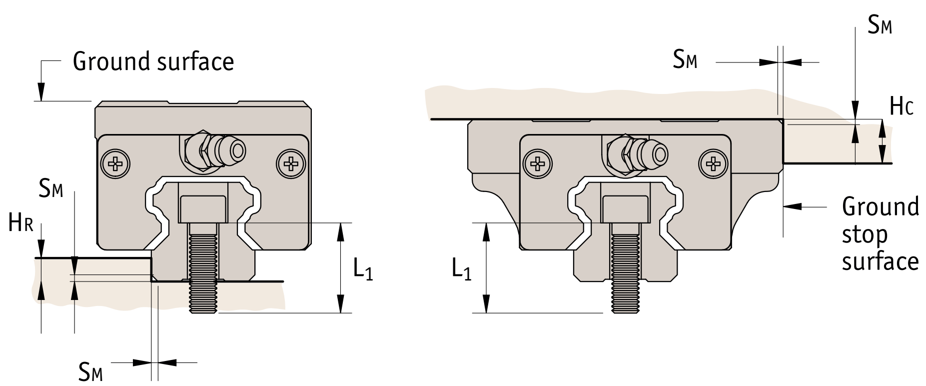
**Example 4**
Securing carriage and rail using taper gibs



**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.

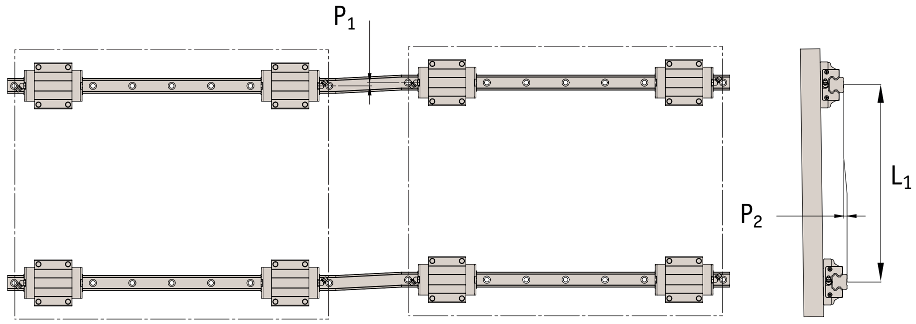



| Size | SM | HR | HC | L1 |
|---|---|---|---|---|
| 15 | 0,6 | 3,1 | 5 | M4 x 16 |
| 20 | 0,9 | 4,3 | 6 | M5 x 20 |
| 25 | 1,1 | 5,6 | 7 | M6 x 25 |
| 30 | 1,4 | 6,8 | 8 | M8 x 30 |
| 35 | 1,4 | 7,3 | 9 | M8 x 30 |
| 45 | 1,6 | 8,7 | 11 | M12 x 40 |
| 55 | 1,6 | 11,8 | 12 | M14 x 45 |

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.




| | | | $P_2 = L_1$ x (calculation factor) | |
|---|---|---|---|---|
| | Permissible tolerance for parallelism $P_1$ µ | | Calculator factor (x) $P_2$ µ | |
| Size | $K_1$ | $K_0$ | $K_1$ | $K_0$ |
| 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.

| | Tightening torque $M_t$ Nm | |
|---|---|---|
| Bolt | 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 |

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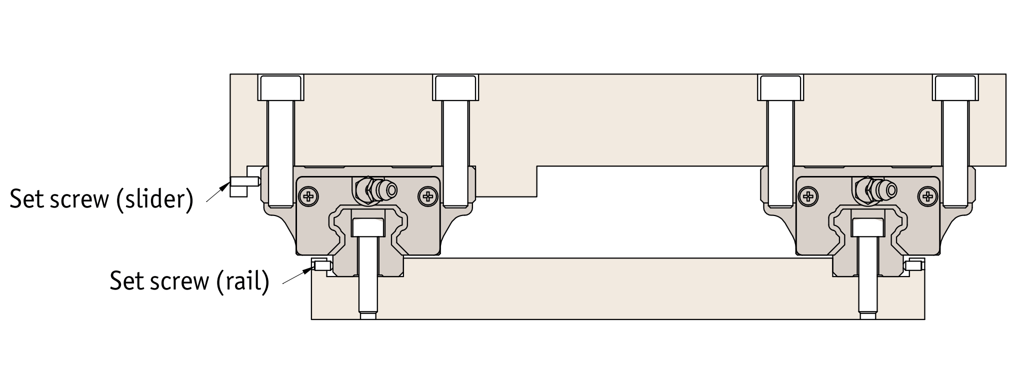
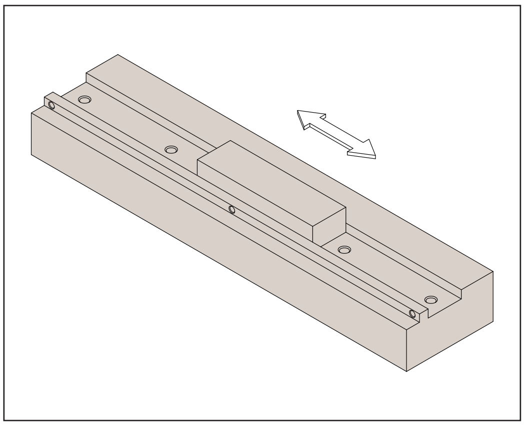
## Assembly process



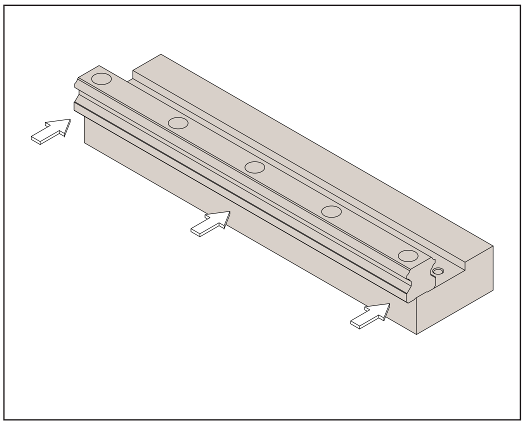

### Fixing guide rails 1

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.

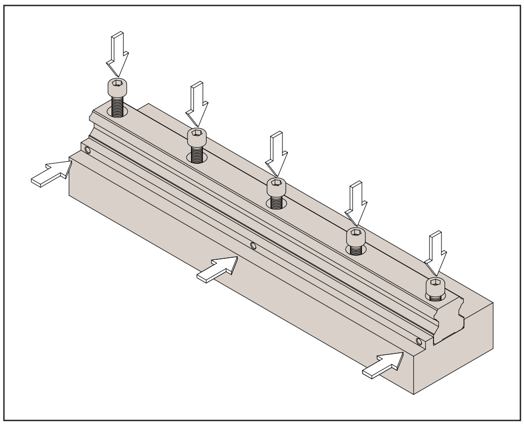


### Fixing guide rails 2

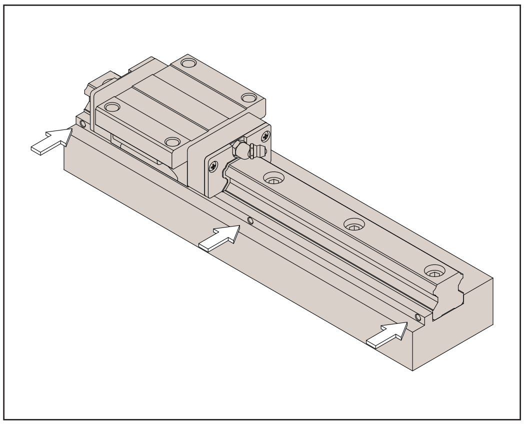
Carefully lay the guide rail on the assembly surface and slightly tighten the fixing screws so that the guide rail lightly touches the assembly surface (align the guide rail along the shoulder edge of the assembly surface). Note: The fixing screws of the linear guide must be clean. Check if the fixing 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.

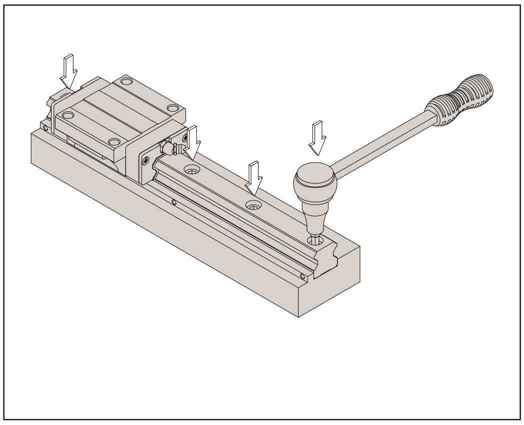
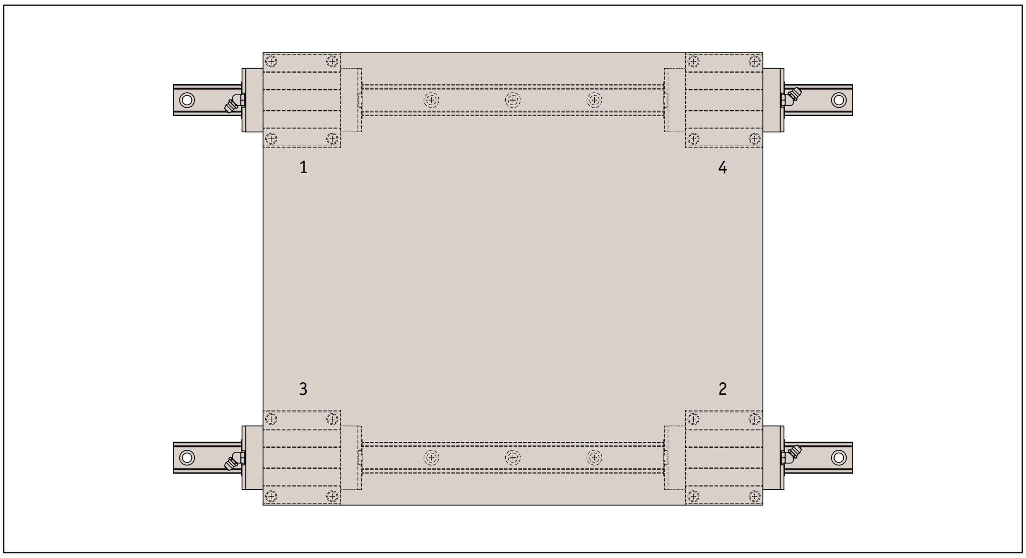


**Table assembly 1**
Set the table carefully on the carriage and tighten the fixing screws only lightly.

**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.