

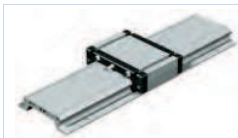






Linear guides

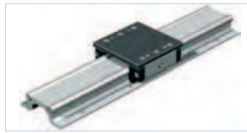
Overview

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Linear guides

Overview

LFS-12-3 Linear guide rails



2-34

with LW 2 trolley
with LW 8 trolley
with WS7 aluminium slide

LFS-12-10 Linear guide rails



2-36

with LW 4 trolley
with WS8 aluminium slide
with dual track set 1 + 2

LFS-16-120 Linear guide rail



2-38

with 2 or 4 IWS 1 aluminium slide
with 2 or 4 ILS 1 steel slides

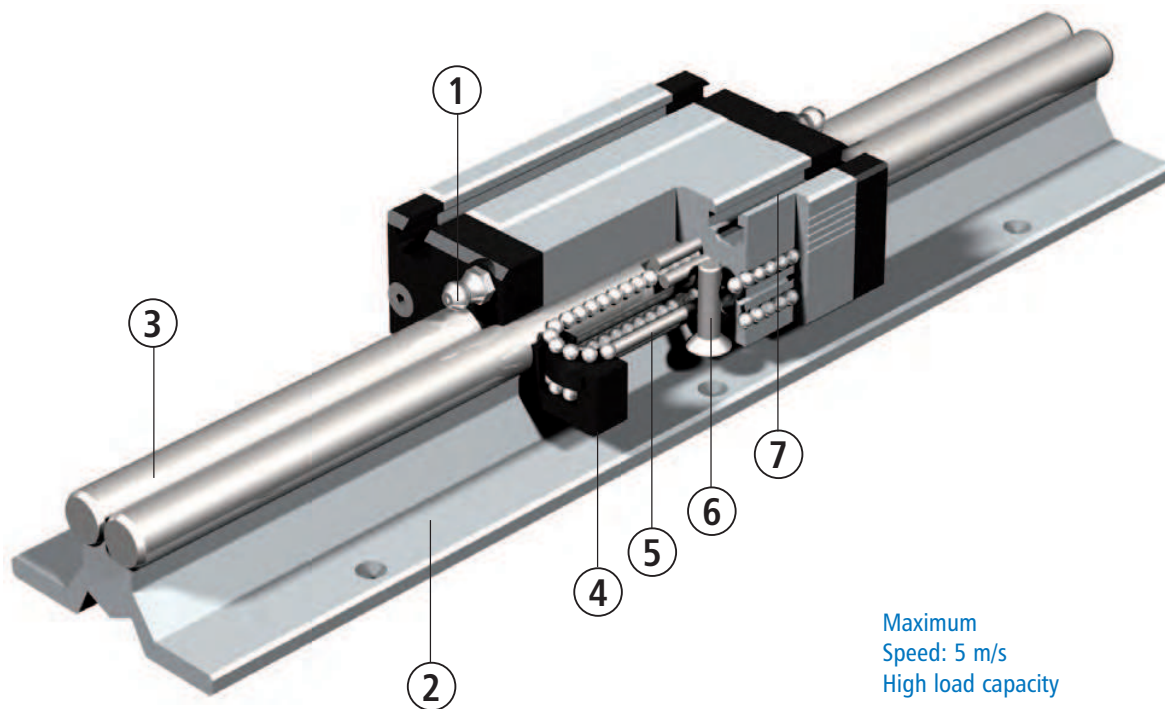
Accessories

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Operating loads calculation

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Linear guide slide function



Maximum
Speed: 5 m/s
High load capacity

Aluminium shaft slides

The patented shaft slides are perfectly suited for assembling of complex multiple axis systems for handling and machining.

The wide range of models covers a multitude of applications.

All models can be produced to order with various profile lengths (70, 100, 150 and 200 mm).

1. Lubrication options to both sides for the recirculating balls.
2. The basic supports for all linear guides are extruded aluminium profiles compliant with DIN EN 12020-2, which are provided with T-slot inserts for fastening in the body of the profile or with drilled hole fixing points.
3. Precision steel shafts with a hardness of 60 ± 2 HRC are used as guide rails. All LFS-8 versions are optionally available with stainless steel shafts.
4. The recirculating ball steering systems are glass fibre reinforced.
5. There are patented recirculating balls in the linear slide. Ball bearings run in each case between two ground steel pins and the guidance shaft.
6. The slide is adjusted with self-locking setting screws. This is how the rows of balls and shafts or pins are used with each other and thus prestressed. The slide are preset in the factory to the correct stress. All shaft slides are optionally available in a stainless version.
7. To secure transport loads, slot plates, etc., the shaft slide are provided with T-slot inserts or fixing borings.

General notes

Load capacity and working life

Installation site

In principal, the installation site for linear guides can be chosen anywhere. You merely have to consider whether all the forces and moments arising are below the maximum values for the relevant axes.

Temperatures

All linear guides are designed for continuous operation at ambient temperatures of up to 60 °C. In short-term operation, maximum temperatures of 80 °C are permissible.

Linear guides are unsuitable for temperatures below freezing.

Straightness/Warping

The aluminium profiles used are extruded profiles, which exhibit divergences regarding straightness and may be warped, owing to the manufacturing process.

The tolerance of this deviation is set out in DIN EN 12020-2.

In the worst case, the linear guide deviations equal these limits, but typically they are lower.

In order to achieve the desired guidance accuracy, the guide must be aligned using shims or clamped to a bearing service machined to the corresponding accuracy. This achieves tolerances of at least 0.1 mm/1000 mm.

Principles

Load capacity and working life

The dimensioning of a linear guide is based on the load capacity of the individual elements. The load capacity is described by:

- the dynamic load factor C
- the static load factor C0
- the static torques M0X, M0Y and M0Z

The basis of the dynamic load factors according to DIN is a nominal working life of 100,000 m displacement path. Far East suppliers often quote load factors for a nominal working life of 50,000 m displacement path; this produces load factor figures which are approximately 20% higher than those according to DIN.

Dynamic load capacity

The fatigue characteristics of the material determine the dynamic load capacity. The working life - the fatigue period - also depends on:

- the stress on the linear guide
- the speed at which the linear guide moves
- the statistical randomness of the first damage occurring

Useful life

Useful life means the working life actually achieved by a linear guide. The useful life may differ from the computed working life.

The following can lead to premature failure through wear or fatigue:

- Misalignments between guide rails or guidance elements
- Contamination of the guide rails
- Insufficient lubrication
- Oscillating motion with very small lifts (formation of grooves)
- Vibrations at rest (formation of grooves)

Owing to the multiplicity of installation and operating relationships, it is impossible to determine the useful life of a linear guide exactly in advance. The safest way to make an accurate estimate of the useful life is, as before, a comparison with similar installations.

Linear guide rails

LFS-8-1 LFS-8-2

Figure:
LFS-8-1 with
aluminium slide WS 1/70



Figure:
LFS-8-2 with
aluminium slide WS 1/70

Features

- W 30 x H 20 mm (LFS-8-1)
W 30 x H 32.5 mm (LFS-8-2)
- 2 precision steel shafts Ø 8
- Anti-twist lock
- Aluminium shaft housing profile, naturally anodised
- Fixing from below with M6 tapped rails in the T-key insert
- Conditionally self-supporting
- Special lengths to order
- Weights: approx. 1.6 kg/m (LFS-8-1)
approx. 2.0 kg/m (LFS-8-2)

Options:

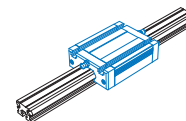
- Stainless steel version
- Drilled for M6 (LFS-8-1 only)

Ordering key

235 00X XXXX

LFS-8-1/standard = **0** Length in mm (in 100 mm raster)
LFS-8-1/stainless = **1** e.g. **0029** = Length 298
LFS-8-2/standard = **2** **0299** = Length 2998
LFS-8-2/stainless = **3** Steel shaft length: total length L - 3 mm

Profile up to 6000 mm available without impact connection, steel shafts divided.



Aluminium slide

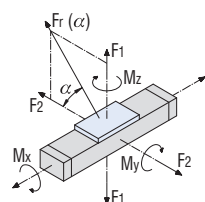
- With recirculating ball guide
- Clamping surface plane milled
- M6 T-key inserts
- Central lubrication option
- Adjustable for no play
- Option: stainless steel version

Load data

Shaft slide WS 1/70	
C ₀	3114 N
C	1846 N
F ₁ static	2659 N
F ₁ dynamic	1576 N
F ₂ static	3114 N
F ₂ dynamic	1846 N
M _x static	37.3 Nm
M _y static	100.5 Nm
M _z static	117.6 Nm
M _x dynamic	22.1 Nm
M _y dynamic	59.5 Nm
M _z dynamic	69.7 Nm

Shaft slide WS 1	
C ₀	4590 N
C	2390 N
F ₁ static	3920 N
F ₁ dynamic	2041 N
F ₂ static	4590 N
F ₂ dynamic	2390 N
M _x static	55.0 Nm
M _y static	148.1 Nm
M _z static	173.4 Nm
M _x dynamic	28.6 Nm
M _y dynamic	77.1 Nm
M _z dynamic	90.2 Nm

Trolley LW 6	
C ₀	2160 N
C	4000 N
F ₁ static	4320 N
F ₁ dynamic	3792 N
F ₂ static	2160 N
F ₂ dynamic	4000 N
M _x static	121.1 Nm
M _y static	194.4 Nm
M _z static	97.2 Nm
M _x dynamic	106.3 Nm
M _y dynamic	170.6 Nm
M _z dynamic	180.0 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

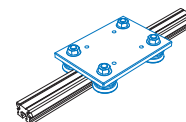
$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$

L 96 × W 72 × H 28.5 mm (WS 1/70)
(weight: approx. 0.4 kg)

Part no.: **223100 0070**
Stainless steel: **223101 0070**

L 126 × W 72 × H 28.5 mm (WS 1)
(weight: approx. 0.5 kg)

Part no.: **223100**
Stainless steel: **223101**



Trolley LW 6

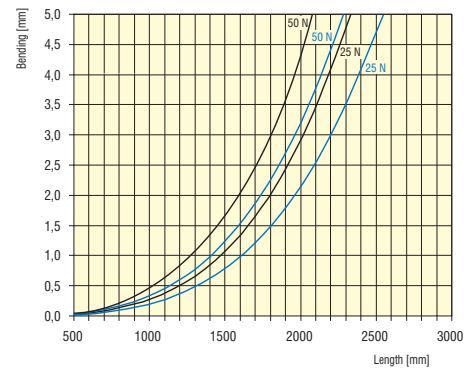
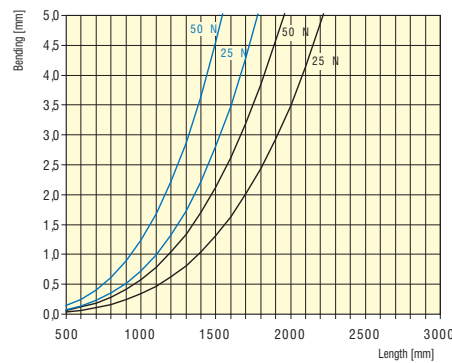
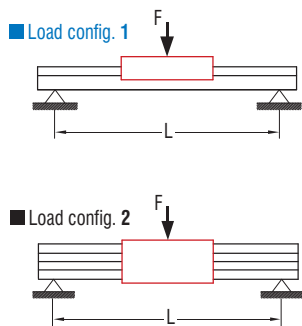
- L 125 x W 90 x H 7.7 mm
- ground steel plate
- 4 rollers Ø 31, sealed for life
- adjustable for no play
- weight: approx. 1 kg

Part no.: **223011**

Linear guide rails

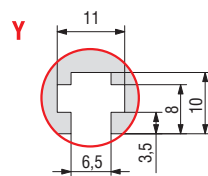
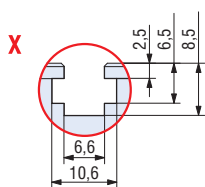
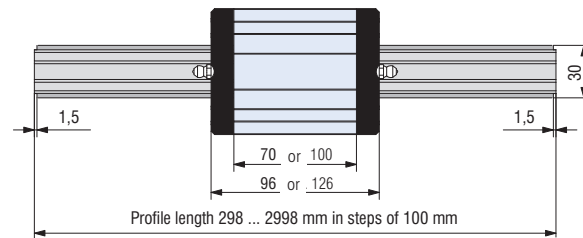
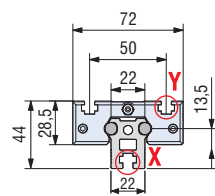
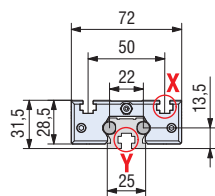
LFS-8-1 LFS-8-2

Bending

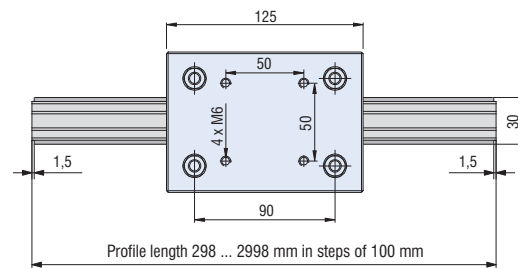
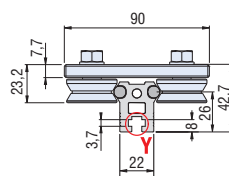
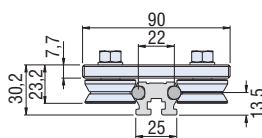


Dimensioned drawings

LFS-8-1 or LFS-8-2 with aluminium slide WS 1/70 or WS 1



LFS-8-1 or LFS-8-2 with trolley LW6



Linear guide rails

LFS-8-3



Features

- W 115 x H 25.5 mm
- 2 precision steel shafts Ø 8
- Particularly resistant to twisting
- Aluminium shaft housing profile, naturally anodised
- Fixing from above through M6 drillings in the raster 100 mm
- Conditionally self-supporting
- Special lengths to order
- Weight: approx. 3.2 kg/m
- Option: stainless steel version

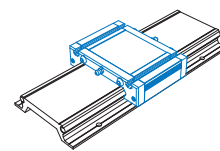
Ordering key

235 00X XXXX

Standard = 4 Length in mm (in 100 mm raster)
 Stainless = 5 e.g. 0029 = Length 296
 0299 = Length 2996

Length overall L - 1 mm

Profile up to 6000 mm available without impact connection, steel shafts divided.



Aluminium slide

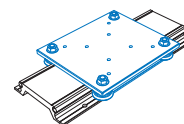
- With recirculating ball guide
- Clamping surface plane milled
- M6 T-key inserts
- Central lubrication option
- Adjustable for no play
- Option: stainless steel version

L 96 x W 130 x H 32 mm (WS 3/70)
 (weight: approx. 0.5 kg)

Part no.: **223103 0070**
 Stainless steel: **223103 1070**

L 176 x W 130 x H 32 mm (WS 3)
 (weight: approx. 0.9 kg)

Part no.: **223103**
 Stainless steel: **223103 1000**



Trolley LW 7

- L 175 x W 150 x H 7.5 mm
- ground steel plate
- 4 rollers Ø 31, sealed for life
- adjustable for no play
- weight: approx. 2 kg

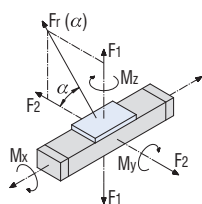
Part no.: **223012**

Load data

Shaft slide WS 3/70	
C ₀	3141 N
C	1879 N
F ₁ static	2682 N
F ₁ dynamic	1604 N
F ₂ static	3141 N
F ₂ dynamic	1879 N
M _x static	115.7 Nm
M _y static	105.3 Nm
M _z static	123.3 Nm
M _x dynamic	69.2 Nm
M _y dynamic	62.9 Nm
M _z dynamic	73.7 Nm

Shaft slide WS 3	
C ₀	6945 N
C	3190 N
F ₁ static	5931 N
F ₁ dynamic	2724 N
F ₂ static	6945 N
F ₂ dynamic	3190 N
M _x static	255.9 Nm
M _y static	232.8 Nm
M _z static	272.5 Nm
M _x dynamic	117.5 Nm
M _y dynamic	106.9 Nm
M _z dynamic	125.1 Nm

Trolley LW 7	
C ₀	2160 N
C	4000 N
F ₁ static	4320 N
F ₁ dynamic	3792 N
F ₂ static	2160 N
F ₂ dynamic	4000 N
M _x static	246.8 Nm
M _y static	302.4 Nm
M _z static	151.2 Nm
M _x dynamic	216.7 Nm
M _y dynamic	265.4 Nm
M _z dynamic	280 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

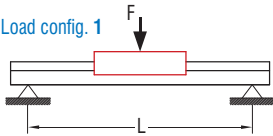
$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$

Linear guide rails

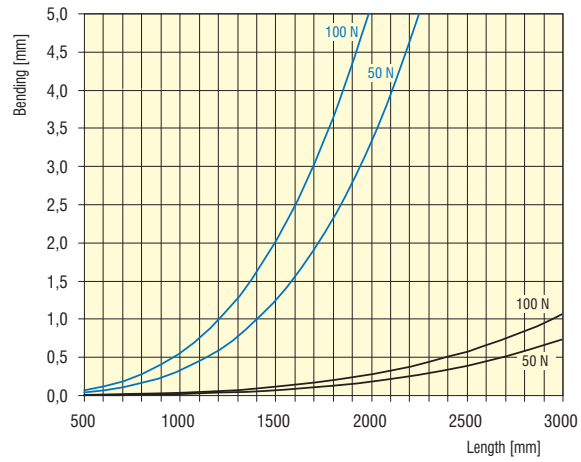
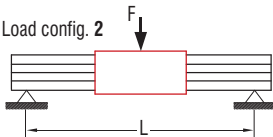
LFS-8-3

Bending

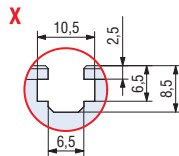
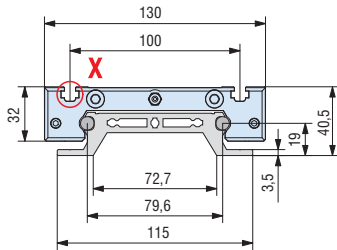
■ Load config. 1



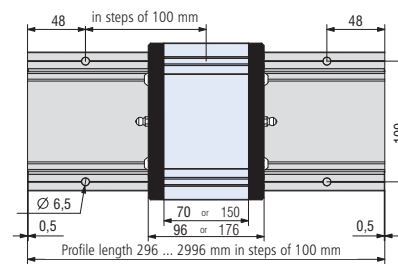
■ Load config. 2



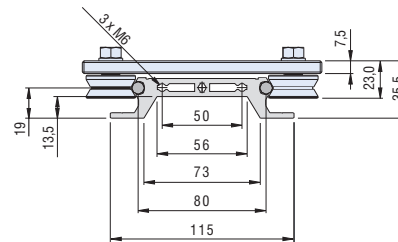
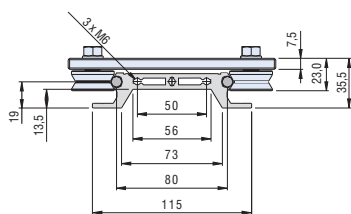
Dimensioned drawings



LFS-8-3 with aluminium slide WS 3/70 or WS 3



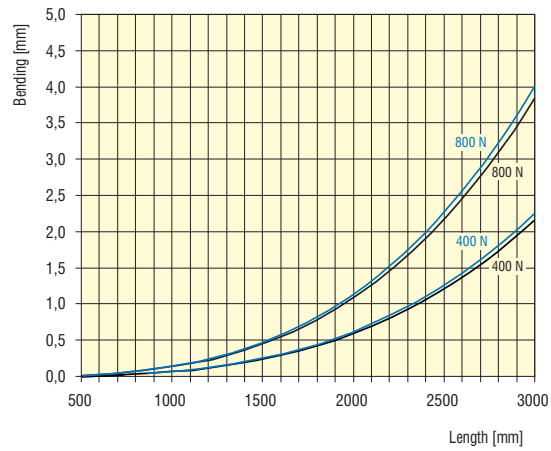
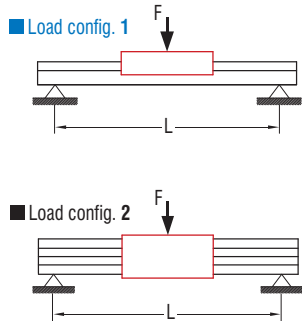
LFS-8-3 with trolley LW7



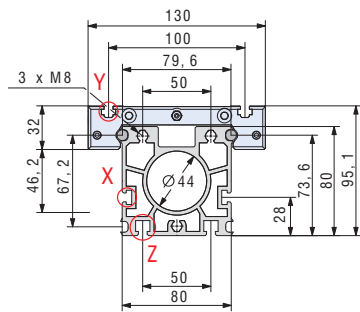
Linear guide rails

LFS-8-4

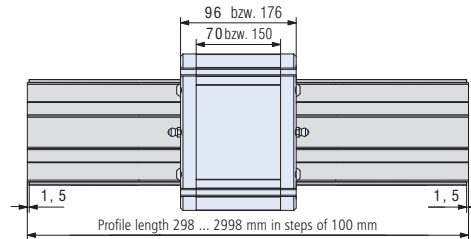
Bending



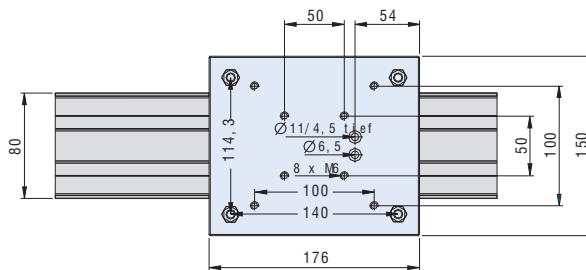
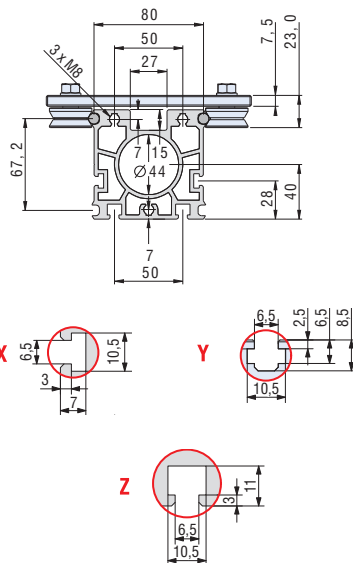
Dimensioned drawings



LFS-8-3 with aluminium slide WS 3/70 or WS 3



LFS-8-4 with trolley LW 7



Linear guide rails

LFS-12-1

Figure:
2 precision steel shafts with
aluminium slide WS 4 and
Shaft housing blocks

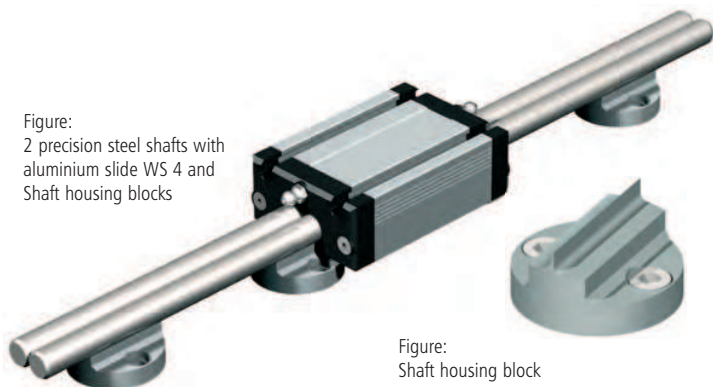


Figure:
Shaft housing block

Features

- W 40 x H 27 mm
- 2 precision steel shafts Ø 12
- anti-twist
- aluminium shaft housing blocks
- securing from above or below with M6 drillings in the housing blocks
- guide any length up to 3m
- special lengths to order
- weight: approx. 1.9 kg/m

Ordering key

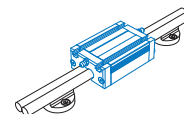
227 312 XXXX

Length in mm (in 100 mm raster)
e.g. **0298** = Length 298
2998 = Length 2998

Special lengths to order

N.B.!

The part no. refers to one steel shaft only !



Aluminium slide

- clamping surface plane milled
- weight: approx. 0.3 kg
- option: stainless steel version

L 94 x W 62 x H 31.5 mm (WS 4/70)

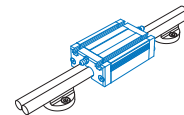
Part no.: **223104 0070**

Stainless steel: **223104 1070**

L 124 x W 62 x H 31.5 mm (WS 4)

Part no.: **223104**

Stainless steel: **223104 1000**

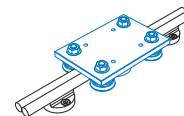


Steel slide LS 1

L 91 x W 60 x H 32 mm

- clamping surface ground
- weight: approx. 0.8 kg

Part no.: **223006**



Trolley LW 3

L 125 x W 85 x H 7.7 mm

- ground steel plate
- weight: approx. 0.9 kg

Part no.: **223008**

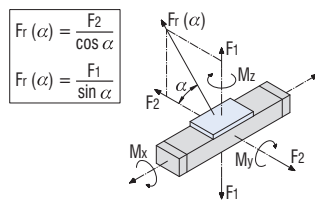
Shaft housing blocks

- Ø 40 mm, hole spacing 28 mm
- cast zinc, VE 10 units

Part no.: **221501**

Load data

Shaft slide WS 4/70		Shaft slide WS 4		Steel slide LS 1		Trolley LW 8	
C ₀	3003 N	C ₀	4868 N	C ₀	3508 N	C ₀	2160 N
C	1873 N	C	2426 N	C	2105 N	C	4000 N
F ₁ static	2821 N	F ₁ static	4157 N	F ₁ static	3549 N	F ₁ static	4320 N
F ₁ dynamic	1599 N	F ₁ dynamic	2071 N	F ₁ dynamic	2130 N	F ₁ dynamic	3846 N
F ₂ static	3303 N	F ₂ static	4868 N	F ₂ static	3508 N	F ₂ static	2160 N
F ₂ dynamic	1873 N	F ₂ dynamic	2426 N	F ₂ dynamic	2105 N	F ₂ dynamic	4000 N
M _x static	29.8 Nm	M _x static	43.9 Nm	M _x static	36.2 Nm	M _x static	109.5 Nm
M _y static	105.3 Nm	M _y static	155.2 Nm	M _y static	129.0 Nm	M _y static	194.4 Nm
M _z static	123.3 Nm	M _z static	181.7 Nm	M _z static	127.5 Nm	M _z static	97.2 Nm
M _x dynamic	16.8 Nm	M _x dynamic	21.8 Nm	M _x dynamic	21.7 Nm	M _x dynamic	97.4 Nm
M _y dynamic	59.7 Nm	M _y dynamic	77.3 Nm	M _y dynamic	77.4 Nm	M _y dynamic	173.0 Nm
M _z dynamic	69.9 Nm	M _z dynamic	90.5 Nm	M _z dynamic	76.5 Nm	M _z dynamic	180.0 Nm

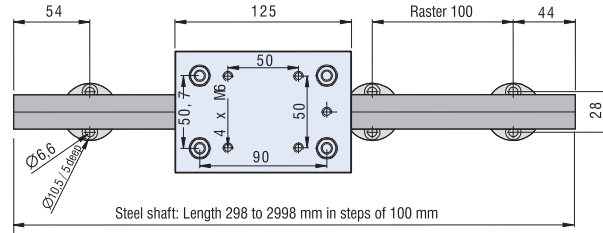
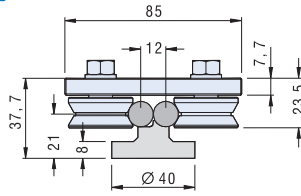


Linear guide rails

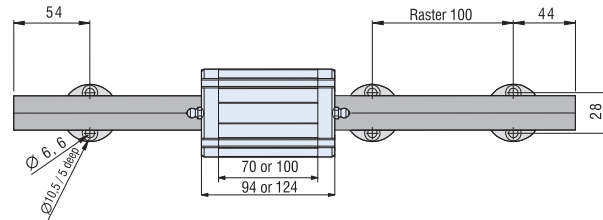
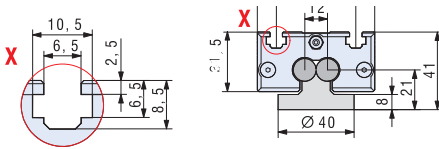
LFS-12-1

Dimensioned drawings

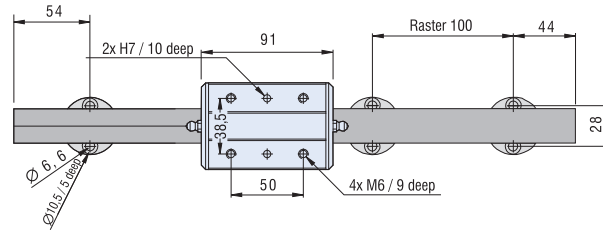
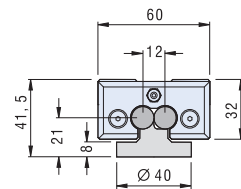
LFS-12-1 with trolley LW 3



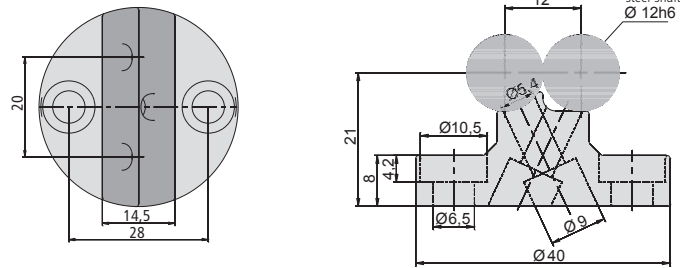
LFS-12-1 with Shaft slide WS 4/70 or WS 4



LFS-12-1 with steel slide LS 1



Shaft housing block



Linear guide rail

LFS-12-11



Features

- W 20 x H 31 mm
- Precision steel shaft Ø 12
- Aluminium shaft housing profile, naturally anodised
- Securing from below with M6 tapped rail in T-slot insert on flat surface
- Special lengths available on request
- Weight: approx. 1.3 kg/m

Ordering key

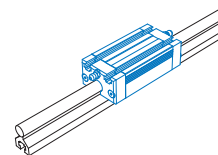
220 002 XXXX

Length in mm

e.g. **0298** = Length 298

0998 = Length 998

Profile length = Length overall L -2 mm



Aluminium slides

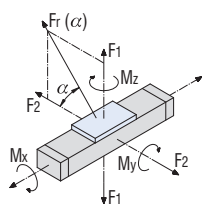
- With recirculating ball guide
- M6 T-slot inserts
- Central lubrication system option
- Adjustable for no play
- Option: stainless steel version

Load data

Shaft slides WS 6/70	
C ₀	3303 N
C	1873 N
F ₁ static	2821 N
F ₁ dynamic	1599 N
F ₂ static	3303 N
F ₂ dynamic	1873 N
M _x static	-
M _y static	105.3 Nm
M _z static	123.3 Nm
M _x dynamic	-
M _y dynamic	59.7 Nm
M _z dynamic	69.9 Nm

Shaft slides WS 6	
C ₀	4868 N
C	2426 N
F ₁ static	4157 N
F ₁ dynamic	2071 N
F ₂ static	4868 N
F ₂ dynamic	2426 N
M _x static	-
M _y static	155.2 Nm
M _z static	181.7 Nm
M _x dynamic	-
M _y dynamic	77.3 Nm
M _z dynamic	90.5 Nm

Trolley LW 5	
C ₀	2160 N
C	4000 N
F ₁ static	4320 N
F ₁ dynamic	3846 N
F ₂ static	2160 N
F ₂ dynamic	4000 N
M _x static	-
M _y static	162.0 Nm
M _z static	81.0 Nm
M _x dynamic	-
M _y dynamic	144.2 Nm
M _z dynamic	150.0 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$

L 96 x W 50 x H 31.5 mm (WS 6/70)
(weight: approx. 0.3 kg)

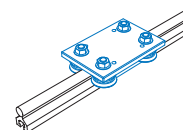
Part no.: **223106 0070**

Stainless steel: **223106 1070**

L 126 x W 50 x H 31,5 mm (WS 6)
(weight: approx. 0.5 kg)

Part no.: **223106**

Stainless steel: **223106 1000**



Trolley LW 5

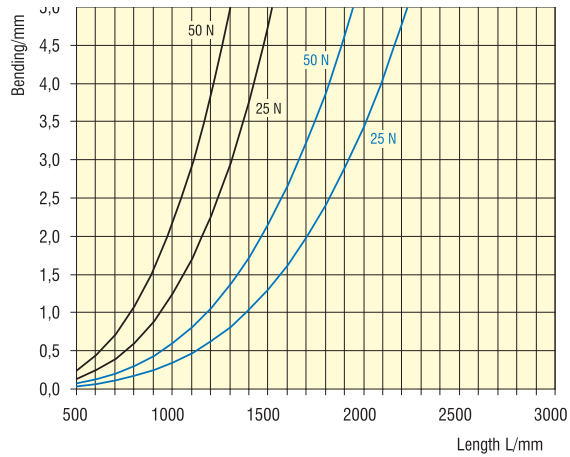
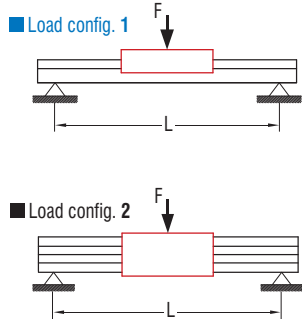
- L 110 x W 75 x H 7.7 mm
- Ground steel plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: 0.81 kg

Part no.: **223010**

Linear guide rail

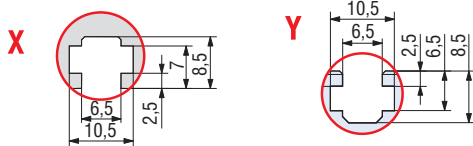
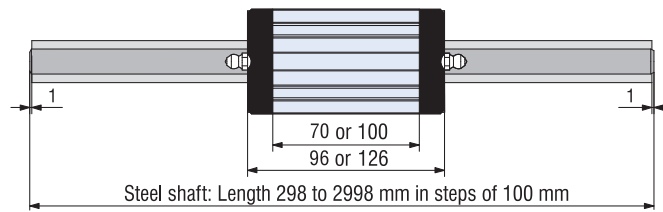
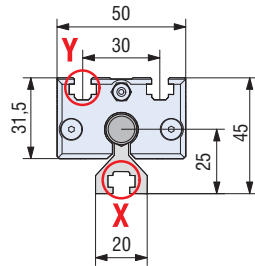
LFS-12-11

Bending

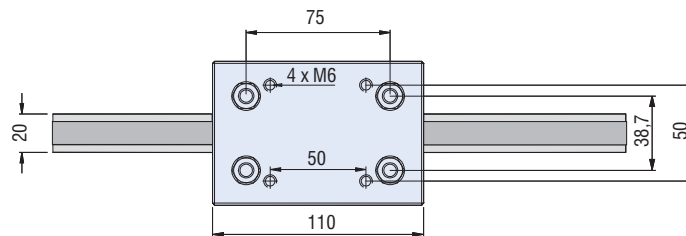
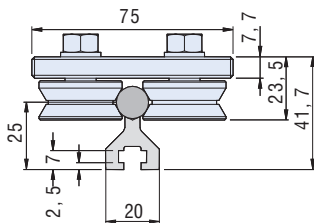


Dimensioned drawings

LFS-12-11 with aluminium slides WS 6/70 or WS 6



LFS-12-11 with trolley LW5



Linear guide rail

LFS-12-2



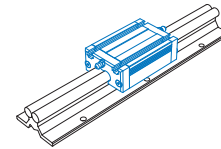
Features

- W 62 x H 31 mm
- 2 precision steel shafts Ø 12
- Anti-twist lock
- Aluminium shaft housing profile, naturally anodised
- High parallelism through patented shaft housing outline
- High guidance accuracy
- Securing from above or below using drilled holes Ø 6.5 in 100 mm raster on flat surface
- Lengths in 100 mm raster
- Max. length up to 2998 mm
- Special lengths to order
- Weight: approx. 3.3 kg/m

Ordering key

235 200 XXXX

Length in mm
 e.g. **0298** = Length 298
0998 = Length 998
 Profile length = Length overall L -2 mm



Aluminium slides

- With recirculating ball guide
- Clamping surface plane milled
- Option: stainless steel version

L 94 x W 62 x H 31.5 mm (WS 4/70)
 (weight: approx. 0.33 kg)

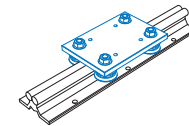
Part no.: **223104 0070**

Stainless steel: **223104 1070**

L 124 x W 62 x H 31.5 mm (WS 4)
 (weight: approx. 0.46 kg)

Part no.: **223104**

Stainless steel: **223104 1000**



Trolley LW 3

- L 125 x W 85 x H 7.7 mm
- Ground steel plate
- Weight: 0.93 kg

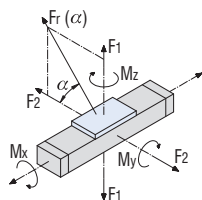
Part no.: **223008**

Load data

Shaft slides WS 4/70	
C ₀	3003 N
C	1873 N
F ₁ static	2821 N
F ₁ dynamic	1599 N
F ₂ static	3303 N
F ₂ dynamic	1873 N
M _x static	29.8 Nm
M _y static	105.3 Nm
M _z static	123.3 Nm
M _x dynamic	16.8 Nm
M _y dynamic	59.7 Nm
M _z dynamic	69.9 Nm

Shaft slides WS 4	
C ₀	4868 N
C	2426 N
F ₁ static	4157 N
F ₁ dynamic	2071 N
F ₂ static	4868 N
F ₂ dynamic	2426 N
M _x static	43.9 Nm
M _y static	155.2 Nm
M _z static	181.7 Nm
M _x dynamic	21.8 Nm
M _y dynamic	77.3 Nm
M _z dynamic	90.5 Nm

Trolley LW 3	
C ₀	2160 N
C	4000 N
F ₁ static	4320 N
F ₁ dynamic	3846 N
F ₂ static	2160 N
F ₂ dynamic	4000 N
M _x static	109.5 Nm
M _y static	194.4 Nm
M _z static	97.2 Nm
M _x dynamic	97.4 Nm
M _y dynamic	173.0 Nm
M _z dynamic	180.0 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

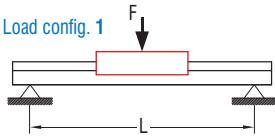
$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$

Linear guide rail

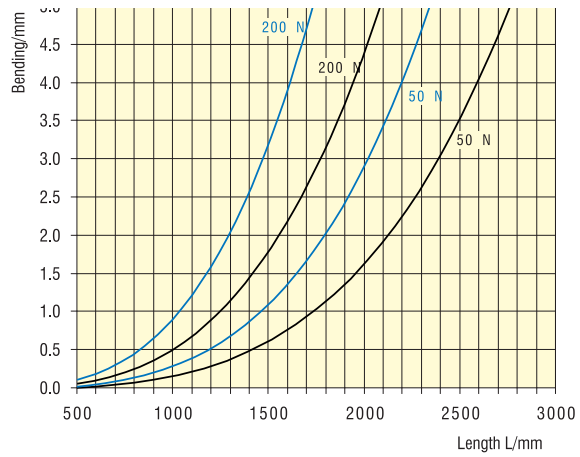
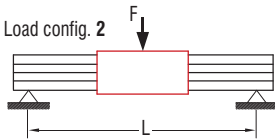
LFS-12-2

Bending

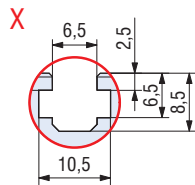
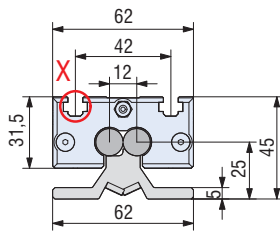
■ Load config. 1



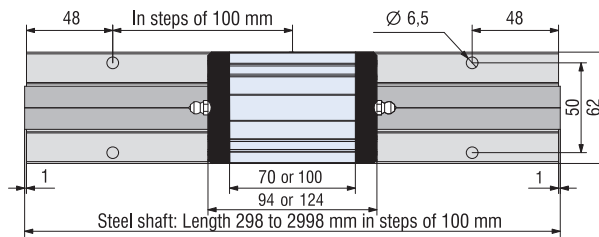
■ Load config. 2



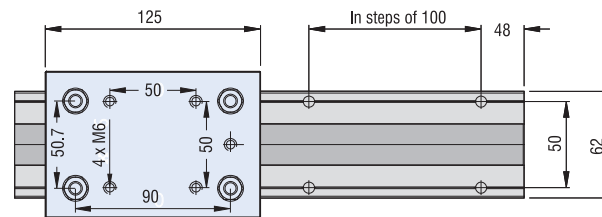
Dimensioned drawings



LFS-12-2 with aluminium slides WS 4/70 or WS 4



LFS-12-2 with trolley LW3



Linear guide rail

LFS-12-3



Features

- W 90 x H 31 mm
- 2 precision steel shafts Ø 12
- Anti-twist
- Aluminium shaft housing profile, naturally anodised
- increased shaft spacing allows higher torques to be absorbed
- Securing from above or below with M6 drillings in 100 mm raster
- Any guide length
- Weight: approx. 3.9 kg/m

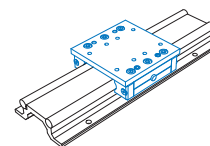
Ordering key

235 300 XXXX

Length in mm (in 100 mm raster)
e.g. **0029** = Length 298
0299 = Length 2998

Profile length = Length overall L -2 mm

Special lengths over 3000 mm with rod linkage to order.



Slides

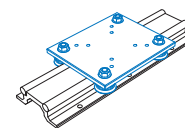
- Ground steel plate
- Central lubrication system option
- Adjustable for no play

L 100 x W 100 x H 32 mm (WS 7/70)
(weight: approx. 0.8 kg)

Part no.: **223107 0070**

L 200 x W 100 x H 32 mm (WS 7)
(weight: approx. 1.7 kg)

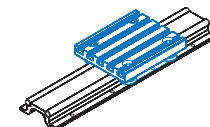
Part no.: **223107**



Trolley LW 8

- L 150 x W 125 x H 7.5 mm
- Ground steel plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: 1.51 kg

Part no.: **223013**



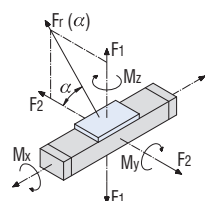
Trolley LW 2

- L 150 x W 125 x H 34.5 mm
- Aluminium T-slot plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: 0.97 kg

Part no.: **223005**

Load data

Shaft slides WS 7/70		Shaft slides WS 7		Trolley LW 2		Trolley LW 8	
C ₀	3303 N	C ₀	7303 N	C ₀	3114 N	C ₀	2160 N
C	1873 N	C	3179 N	C	1846 N	C	4000 N
F ₁ static	2821 N	F ₁ static	6237 N	F ₁ static	2659 N	F ₁ static	4320 N
F ₁ dynamic	1599 N	F ₁ dynamic	2715 N	F ₁ dynamic	1576 N	F ₁ dynamic	3846 N
F ₂ static	3303 N	F ₂ static	7303 N	F ₂ static	3114 N	F ₂ static	2160 N
F ₂ dynamic	1873 N	F ₂ dynamic	3179 N	F ₂ dynamic	1846 N	F ₂ dynamic	4000 N
M _x static	82.0 Nm	M _x static	181.2 Nm	M _x static	216.0 Nm	M _x static	189.2 Nm
M _y static	105.3 Nm	M _y static	232.8 Nm	M _y static	100.5 Nm	M _y static	248.4 Nm
M _z static	123.3 Nm	M _z static	272.5 Nm	M _z static	108.0 Nm	M _z static	124.2 Nm
M _x dynamic	46.4 Nm	M _x dynamic	78.8 Nm	M _x dynamic	168.4 Nm	M _x dynamic	168.4 Nm
M _y dynamic	59.7 Nm	M _y dynamic	101.3 Nm	M _y dynamic	192.3 Nm	M _y dynamic	221.1 Nm
M _z dynamic	69.9 Nm	M _z dynamic	118.6 Nm	M _z dynamic	200.0 Nm	M _z dynamic	230.0 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

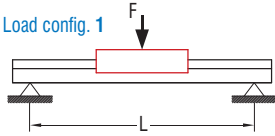
$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$

Linear guide rail

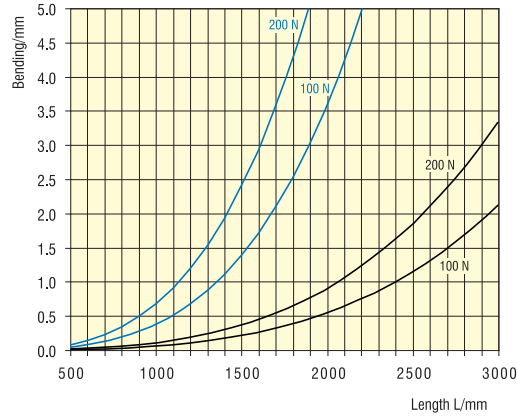
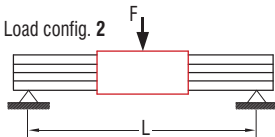
LFS-12-3

Bending

■ Load config. 1

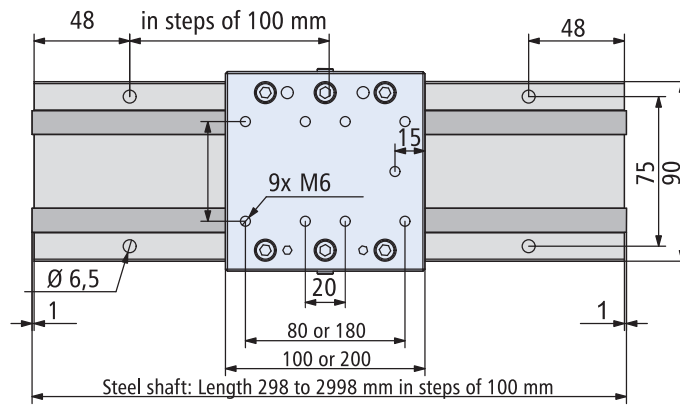


■ Load config. 2

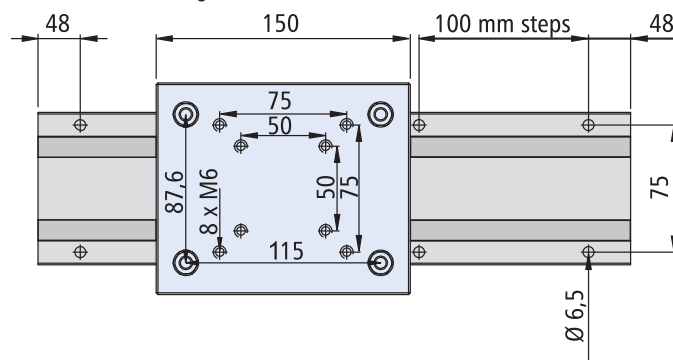


Dimensioned drawings

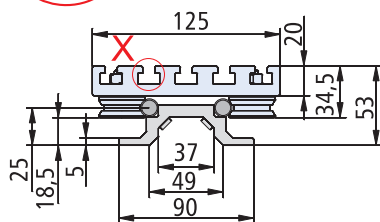
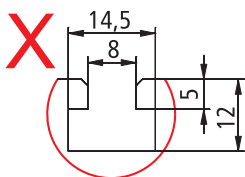
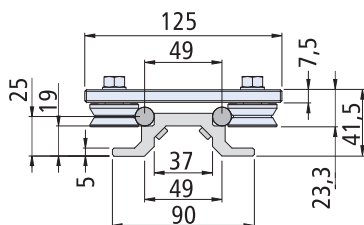
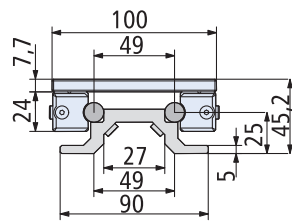
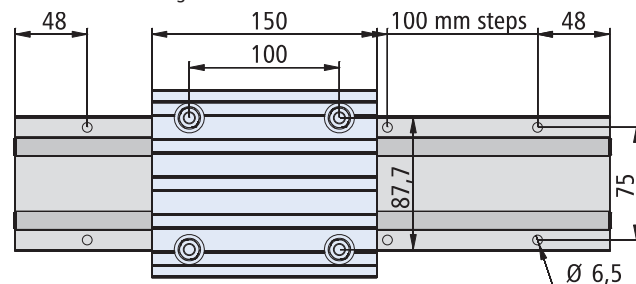
LFS-12-3 with aluminium slides WS 7



LFS-12-3 with Carriage LW 8

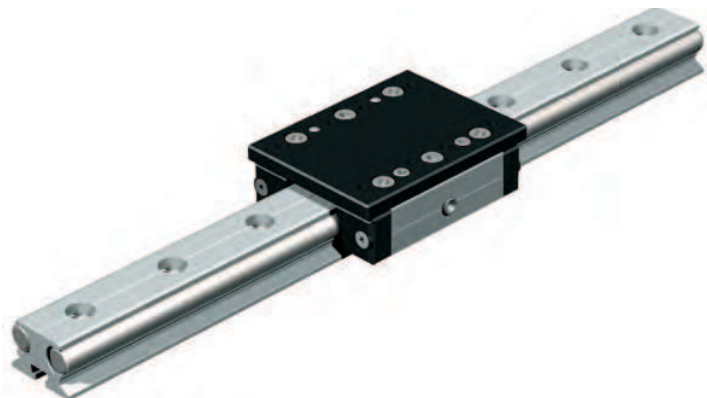


LFS-12-3 with Carriage LW 2



Linear guide rail

LFS-12-10



Features

- W 36 x H 24.5 mm
- 2 precision steel shafts Ø 12
- Anti-twist
- Aluminium shaft housing profile, naturally anodised
- Fixing from below with M6 tapped rail in T-slot insert and from above M6 drillings in the Raster 50 mm
- Conditionally self-supporting
- Special lengths to order
- Weight: approx. 2.9 kg/m

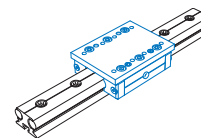
Ordering key

220 001 XXXX

Length in mm (in 100 mm raster)
e.g. **0300** = Length 296
3000 = Length 2996

Profile length = Length overall L -1 mm

Special lengths over 3000 mm with rod linkage to order.

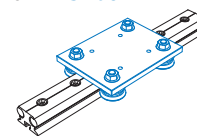


Slides

- Ground steel plate
- Lubrication system option
- Adjustable for no play

L 100 x W 75 x H 31.5 mm (WS 8/70)
(weight: approx. 0.7 kg)
Part no.: **223108 0070**

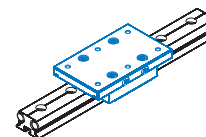
L 150 x W 75 x H 31.5 mm (WS 8)
(weight: approx. 1,0 kg)
Part no.: **223108**



Trolley LW 4

- L 125 x W 97 x H 7.7 mm
- Ground steel plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: 1.02 kg

Part no.: **223009**



For steel shafts Ø 12 mm

Dual track set 1

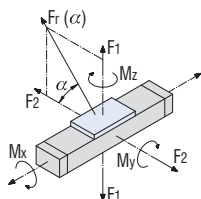
- L75 x W75 x H30.2 mm
 - With 2 SMALL linear ball bearings
- Part no.: **223001**

Dual track set 2

- L125 x W75 x H30.2 mm
 - With 2 LARGE linear ball bearings
- Part no.: **223002**

Load data

Slides WS 8/70		Slides WS 8		Trolley LW 4		Dual track set 1		Dual track set 2	
C ₀	3303 N	C ₀	4868 N	C ₀	2160 N	C ₀	645 N	C ₀	1905 N
C	1873 N	C	2426 N	C	4000 N	C	600 N	C	1125 N
F ₁ static	2821 N	F ₁ static	4157 N	F ₁ static	4320 N	F ₁ static	652 N	F ₁ static	1927 N
F ₁ dynamic	1599 N	F ₁ dynamic	2071 N	F ₁ dynamic	3846 N	F ₁ dynamic	607 N	F ₁ dynamic	1138 N
F ₂ static	3303 N	F ₂ static	4868 N	F ₂ static	2160 N	F ₂ static	645 N	F ₂ static	1905 N
F ₂ dynamic	1873 N	F ₂ dynamic	2426 N	F ₂ dynamic	4000 N	F ₂ dynamic	600 N	F ₂ dynamic	1125 N
M _x static	46.7 Nm	M _x static	68.8 Nm	M _x static	135.4 Nm	M _x static	16.0 Nm	M _x static	46.0 Nm
M _y static	105.3 Nm	M _y static	155.2 Nm	M _y static	194.4 Nm	M _y static	13.0 Nm	M _y static	119 Nm
M _z static	123.3 Nm	M _z static	181.7 Nm	M _z static	97.2 Nm	M _z static	13.0 Nm	M _z static	118 Nm
M _x dynamic	26.4 Nm	M _x dynamic	34.2 Nm	M _x dynamic	120.5 Nm	M _x dynamic	15.0 Nm	M _x dynamic	27.0 Nm
M _y dynamic	59.7 Nm	M _y dynamic	77.3 Nm	M _y dynamic	173.0 Nm	M _y dynamic	12.0 Nm	M _y dynamic	71.0 Nm
M _z dynamic	69.9 Nm	M _z dynamic	90.5 Nm	M _z dynamic	180.0 Nm	M _z dynamic	12.0 Nm	M _z dynamic	70.0 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

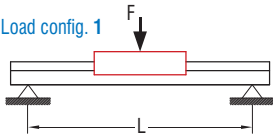
$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$

Linear guide rail

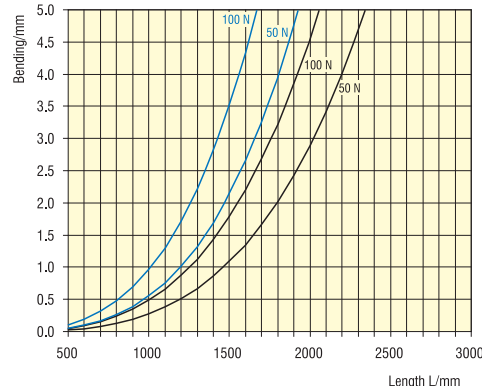
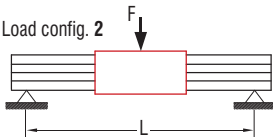
LFS-12-10

Bending

■ Load config. 1

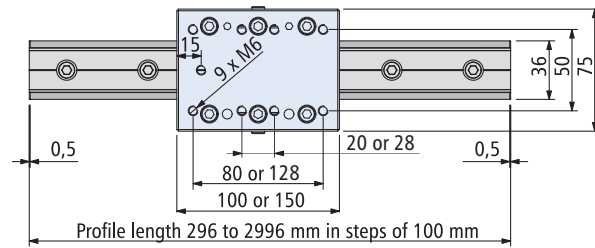
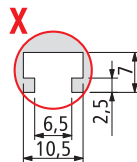
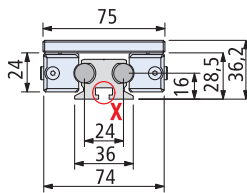


■ Load config. 2

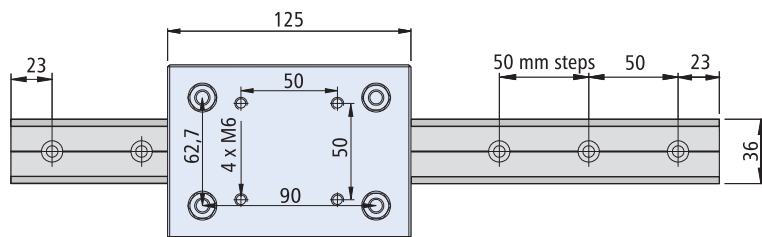
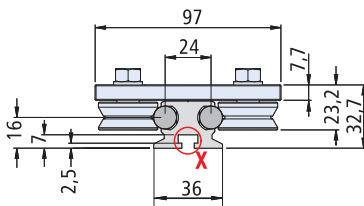


Dimensioned drawings

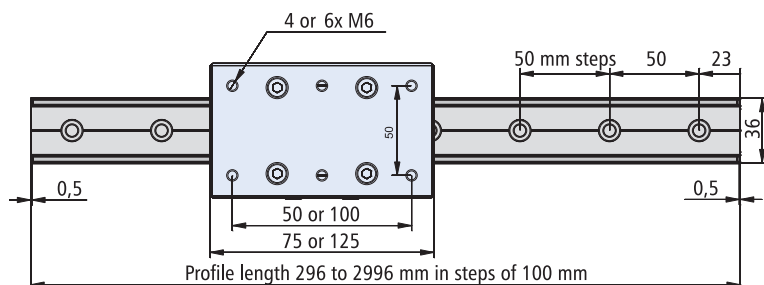
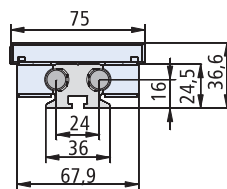
LFS-12-10 with slides WS 8



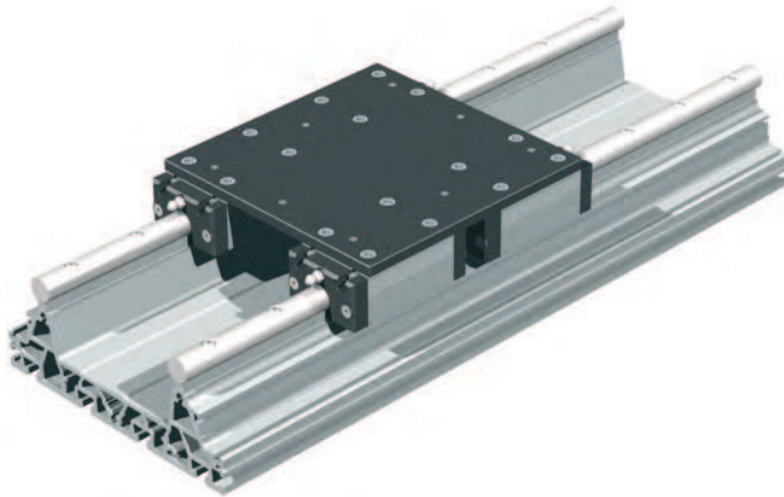
LFS-12-10 with trolley LW 4



LFS-12-10 with dual track set



Linear guide rail LFS-16-120



Features

- W 190 x H 61 mm
- 2 precision steel shafts Ø 16
- Anti-twist
- Aluminium shaft housing profile naturally anodised
- Securing from below with M6 tapped rail in T-slot profile
- Conditionally self-supporting
- Any guide length
- Weight: 10.2 kg/m

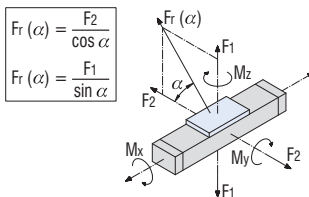
Ordering key

220 008 XXXX

Length in mm (in 100 mm raster)
 e.g. **0029** = Length 298
0299 = Length 2998

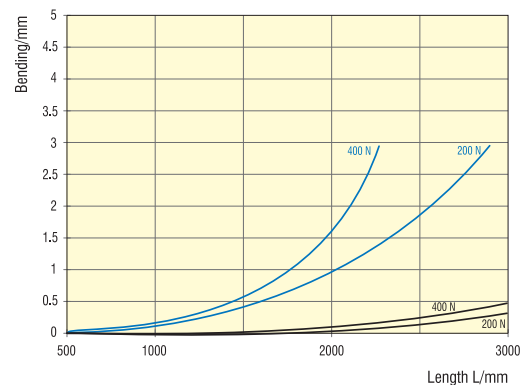
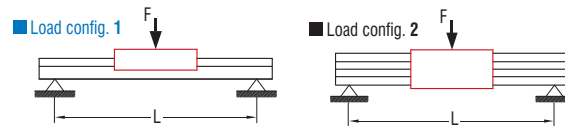
Profile length = Length overall L - 2 mm
 Special lengths available on request!

Load data



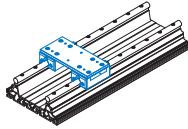
Einheit mit 2x IWS 1		Einheit mit 2x ILS 1		Einheit mit 4x IWS 1		Einheit mit 4x ILS 1	
C ₀	4929 N	C ₀	7598 N	C ₀	6572 N	C ₀	10130 N
C	2660 N	C	4857 N	C	3546 N	C	6476 N
F _{1 stat.}	4209 N	F _{1 stat.}	6488 N	F _{1 stat.}	5612 N	F _{1 stat.}	8650 N
F _{1 dyn.}	2271 N	F _{1 dyn.}	4148 N	F _{1 dyn.}	3028 N	F _{1 dyn.}	5530 N
F _{2 stat.}	4929 N	F _{2 stat.}	7598 N	F _{2 stat.}	6572 N	F _{2 stat.}	10130 N
F _{2 dyn.}	2660 N	F _{2 dyn.}	4857 N	F _{2 dyn.}	3546 N	F _{2 dyn.}	6476 N
M _{2 stat.}	253 Nm	M _{2 stat.}	389 Nm	M _{2 stat.}	337 Nm	M _{2 stat.}	519 Nm
M _{2 dyn.}	147 Nm	M _{2 dyn.}	195 Nm	M _{2 dyn.}	309 Nm	M _{2 dyn.}	476 Nm
M _{3 stat.}	173 Nm	M _{3 stat.}	228 Nm	M _{3 stat.}	361 Nm	M _{3 stat.}	557 Nm
M _{3 dyn.}	136 Nm	M _{3 dyn.}	249 Nm	M _{3 dyn.}	182 Nm	M _{3 dyn.}	332 Nm
M _{4 stat.}	79 Nm	M _{4 stat.}	124 Nm	M _{4 stat.}	167 Nm	M _{4 stat.}	304 Nm
M _{4 dyn.}	93 Nm	M _{4 dyn.}	146 Nm	M _{4 dyn.}	195 Nm	M _{4 dyn.}	356 Nm

Bending



Linear guide rail LFS-16-120

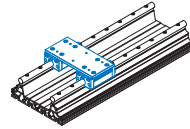
Slide unit with 2 × steel slides ILS 1 (kit)



- L 84 x W 178 x H 8 mm
- Ground steel plate
- 2 x ILS 1, central lubrication option
- Adjustable for no play
- Total weight: 2.30 kg

Part no.: **223240 0009**

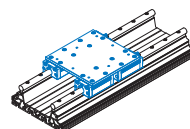
Slide unit with 2 × aluminium slides IWS 1 (kit)



- L 84 x W 178 x H 8 mm
- Ground steel plate
- 2 × IWS 1, central lubrication option
- Adjustable for no play
- Total weight: 1.50 kg

Part no.: **223240 0007**

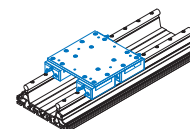
Slide unit with 4 × aluminium slides IWS 1 (kit)



- L 180 x W 178 x H 8 mm
- Ground steel plate
- 4 x IWS 1, central lubrication option
- Adjustable for no play

Part no.: **223240 0008**

Slide unit with 4 × steel slides ILS 1 (kit)

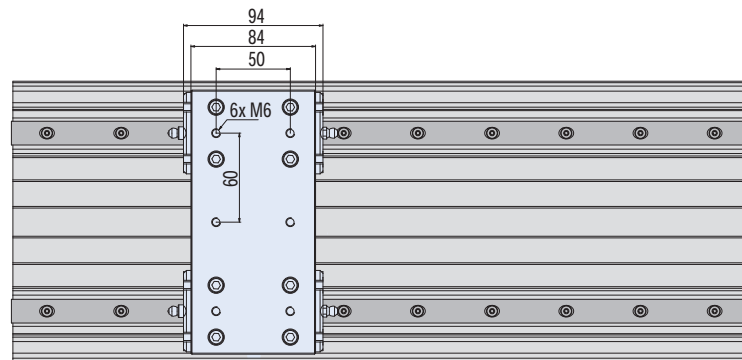
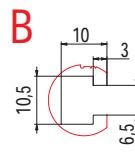
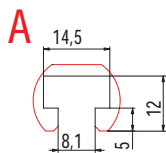
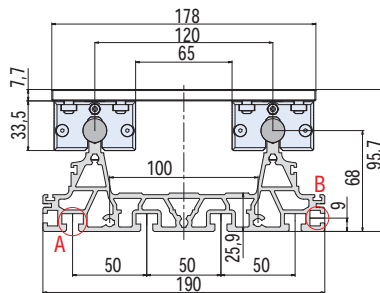


- L 180 x W 178 x H 8 mm
- ground steel plate
- 4 x ILS 1, central lubrication option
- Adjustable for no play

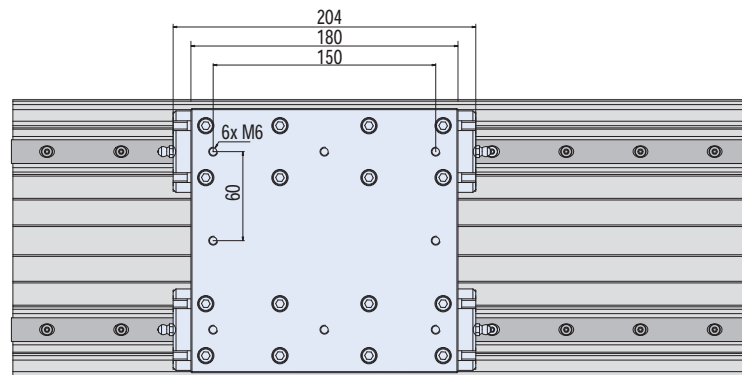
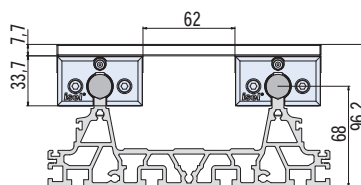
Part no.: **223240 0010**

Dimensioned drawings

Aluminium slides IWS 1



Steel slides ILS 1



Accessories

Tapped rail



M6 tapped rail

- 10 x 4 mm
- Galvanised
- M6 Ra 50 mm
- VE 3 units at 1 m

Part no.: **209 011**

Sliding nuts



M6 sliding nut (Figure 1)

- L 25 × W 10 × H 3.5 mm
- Galvanised
- VE 100 unit
- All except PT/RE 40, 65

Part no.: **209 001 0005**

2 × M6 sliding nuts (Figure 2)

- L 45 × W 10 × H 3.5
- Galvanised
- VE 50 unit
- For all except PT/RE 40, 65

Part no.: **209 002 0004**

2 × M6 sliding nuts (Figure 2)

- L 45 × W 13 × H 6 mm
- Galvanised
- 2 × M6 Ra 25 mm
- VE 25 unit
- For PT/RE 40, 65

Part no.: **209 005 0001**

Angle sliding nut

2 × M6 (Figure 3)

- Galvanised
- VE 25 units
- For all except PT/RE 40, 65

Part no.: **209 021 0003**

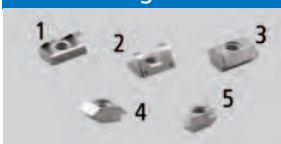
Special angle sliding nut

3 × M6 (Figure 4)

- Galvanised, VE 25 unit
- For all except PT/RE 40, 65

Part no.: **209 022 0003**

Sliding nuts



M5 sliding nuts

- Galvanised • VE 20 unit
 - For all except PT25, PT 50, PS 200, RE 40 and RE 65
- (Securing only possible from above)

with spring

Part no.: **209005 0002**

(M5/Figure 1)

Part no.: **209005 0003**

(M6/Figure 2)

with large chamfer

Part no.: **209005 0004**

(M6/Figure 3)

in rhombus shape

Part no.: **209005 0005**

(M5/Figure 4)

Part no.: **209005 0006**

(M6/Figure 5)

Linear ball bearing



For steel shafts \varnothing 12 mm

Linear ball bearing large

- L80 × W20 × H19 mm, VE 2 units

Part no.: **222 002 0001**

Linear ball bearing medium

- L60 × W20.5 × H17.8 mm, VE2 units

Part no.: **222 000**

Linear ball bearing small

- L40 × W20 × H19 mm, VE 2 units

Part no.: **222 001**

Grease/grease gun

Grease

Part no.: **299 032 0002**

Impact press for grease and oil

Part no.: **299 032 0003**

Guide shafts



Guide shaft SF 12/SF 16

- Precision steel shafts
- \varnothing 12 or 16 mm, length 3 m
- Hardened and ground
- With M5 blind hole tapping (SF12) or M6 (SF16) in 100 mm raster or with drilled holes for M4 (SF 12) or M5 (SF 16) in 100 mm raster

Part no.: **220019 0299**

(SF12, 3m, with blind holes for M5)

Part no.: **220020 0299**

(SF12, 3m, with stepped holes for M4)

Part no.: **220023 0299**

(SF16, 3m, with stepped holes for M5)

Part no.: **220024 0299**

(SF16, 3m, with blind holes for M6)

Rollers

Roller \varnothing 20 mm for SF 12

- With M4 tapped drilling
- VE 2 units

Part no.: **222 010**

Rollers

Roller \varnothing 21 mm

- Concentric
- VE 2 units

Part no.: **222 003**

- Eccentric

- VE 2 units

Part no.: **222 004**

Roller \varnothing 31 mm

- Concentric
- VE 2 units

Part no.: **222 006**

- Eccentric

- VE 2 units

Part no.: **222 007**

Operating loads calculation

Effective loading calculation

Various factors affect the calculation of the loading of isel guides. This includes the position of the C of G of the load, tensile and compressive forces, torques, load and acceleration forces.

For a linear bench on 4 bearings, the bearing forces are calculated according to the force application point for various load directions.

The dimension $LL/2$ is used as the dimension L (see dimensioned drawings for the relevant guides).

The calculation can also be applied to a slide configuration with 2 slides.

The load factor in this case is $CO/2$.

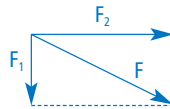
Combined load

If the load alignment of an element does not coincide with one of the main load directions, then the equivalent load is calculated:

$$P = |F_1| + |F_2|$$

If a force F and a torque M load an element simultaneously, then the dynamically equivalent load is:

$$P = |F| + |M| \cdot \frac{C_0}{M_{0(XYZ)}}$$



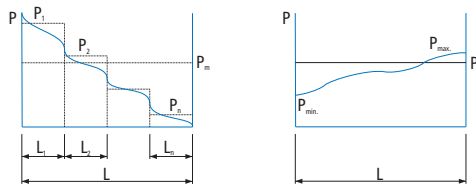
- P [N] dynamically equivalent load
- F [N] opposing force $= \sqrt{F_1^2 + F_2^2}$
- F1 [N] vertical component see sketch (4)
- F2 [N] horizontal component see sketch (4)
- C0 [N] static load factor
- M [Nm] opposing torque
- M0(XYZ) [Nm] static torque in the direction of the opposing torque

According to DIN, the dynamically equivalent load should not exceed the value $P = 0.5 \cdot C$.

Equivalent load calculation

Operating conditions

A incremental change B uniform change



Equivalent load

$$P = \sqrt[3]{\frac{1}{L} \cdot (P_1^3 \cdot L_1 + P_2^3 \cdot L_2 + P_3^3 \cdot L_3 + \dots + P_n^3 \cdot L_n)}$$

$$P = \frac{1}{3} \cdot (P_{min} + 2 \cdot P_{max})$$

- P dynamically equivalent load [N]
- P_{1...n} Individual load [N]
- L Total travel [m]
- L_{1...n} Individual travel [m]
- P_{min} smallest load [N]
- P_{max} largest load [N]

Static safety

Operating conditions

- Normal motion 1.0 - 3.0
- High speed 2.0 - 4.0
- With impacts and vibration 3.0 - 5.0

$$S_0 = \frac{C_0}{P_0} = \frac{M_0}{M}$$

- S₀ static load safety
- C₀ static load factor [N]
- P₀ statically equivalent bearing loading [N]
- M₀ static loading torque [Nm]
- M equivalent static torque [Nm]

Nominal working life

The nominal working life is achieved or exceeded by 90% of an adequately large quantity of identical bearings, before the first signs of material fatigue become apparent.

$$L = \left(\frac{C}{P}\right)^3$$

$$L_h = \frac{833}{H \cdot n_{osz}} \cdot \left(\frac{C}{P}\right)^3$$

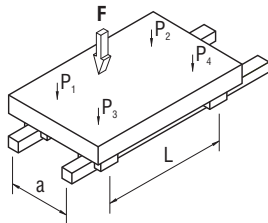
$$L_h = \frac{1666}{V} \cdot \left(\frac{C}{P}\right)^3$$

- L [m] nominal working life in units of 100,000 m
- L_h [h] nominal working life in hours run
- C [N] dynamic load factor
- P [N] dynamically equivalent load
- H [m] single stroke of the oscillating motion
- n_{osz} [min] Number of double strokes per minute
- v [m/min] average speed of movement

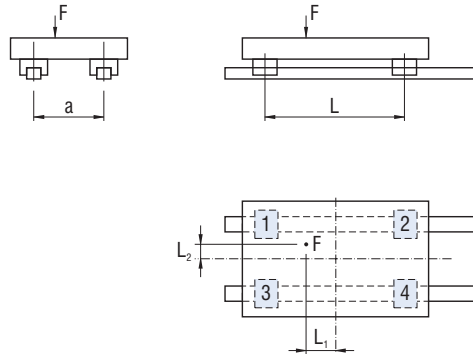
Operating loads calculation

Load vertical on the bench surface

Loading



Dimensioned figure



Load on a trolley

$$P_1 = \frac{F}{4} + \frac{F \cdot L_1}{2L} + \frac{F \cdot L_2}{2a}$$

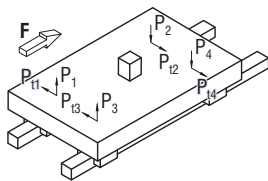
$$P_2 = \frac{F}{4} - \frac{F \cdot L_1}{2L} + \frac{F \cdot L_2}{2a}$$

$$P_3 = \frac{F}{4} + \frac{F \cdot L_1}{2L} - \frac{F \cdot L_2}{2a}$$

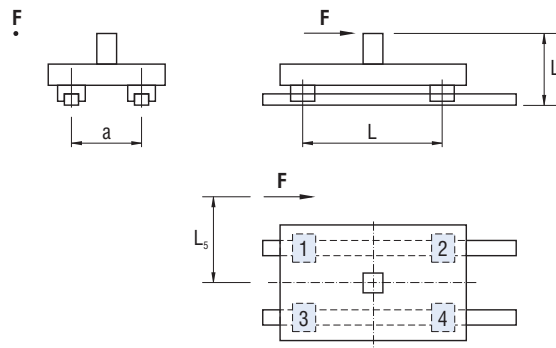
$$P_4 = \frac{F}{4} - \frac{F \cdot L_1}{2L} - \frac{F \cdot L_2}{2a}$$

Load in direction of motion

Loading



Dimensioned figure



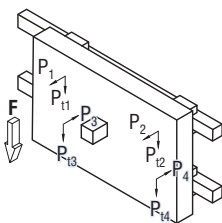
Load on a trolley

$$P_{1...4} = \frac{F \cdot L_6}{2L}$$

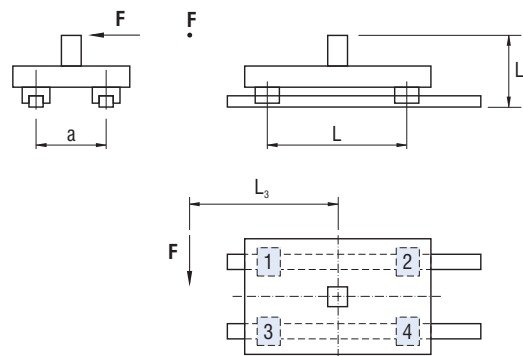
$$P_{11...14} = \frac{F \cdot L_5}{2L}$$

Load at right angles to the direction of motion

Loading



Dimensioned figure



Load on a trolley

$$P_{1...4} = \frac{F \cdot L_4}{2a}$$

$$P_{11} = P_{13} = \frac{F}{4} + \frac{F \cdot L_3}{2L}$$

$$P_{12} = P_{14} = \frac{F}{4} - \frac{F \cdot L_3}{2L}$$