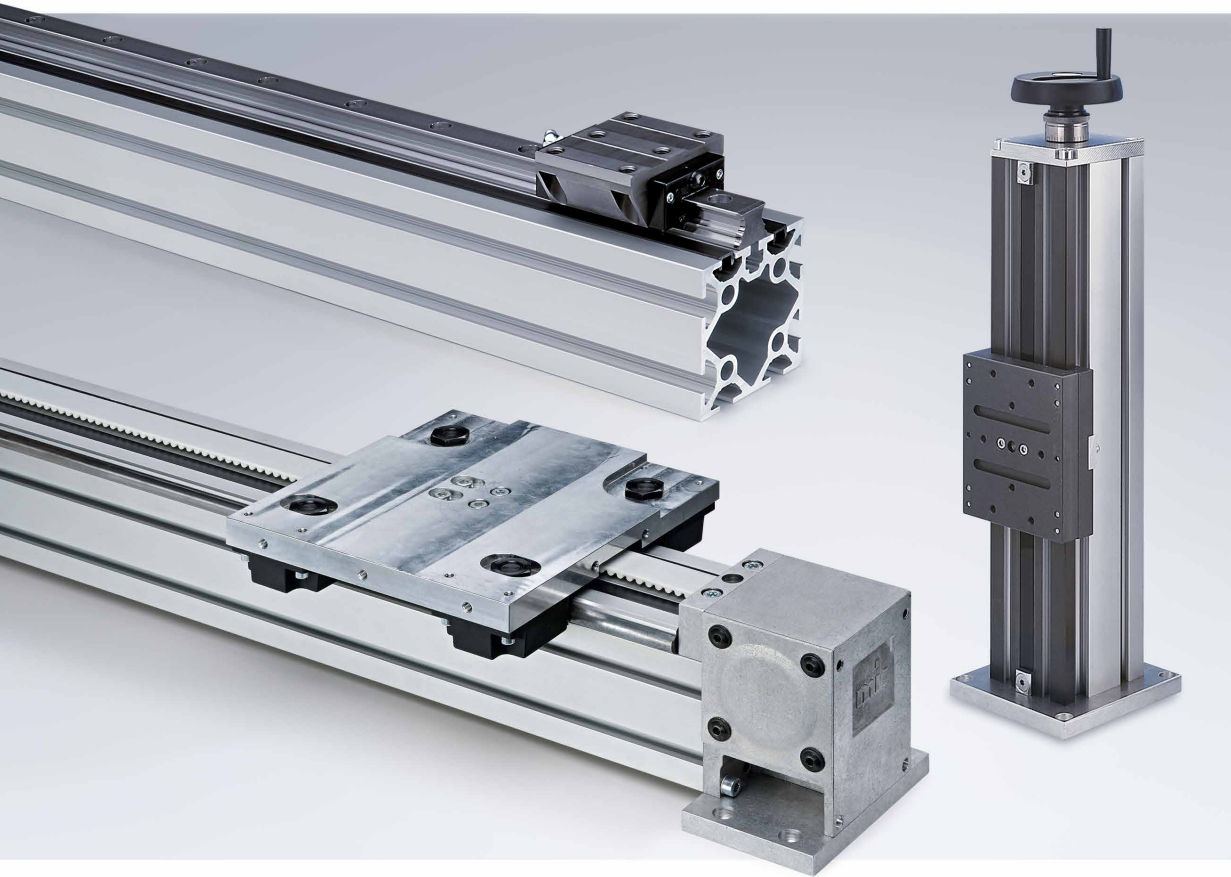




Linear Technology

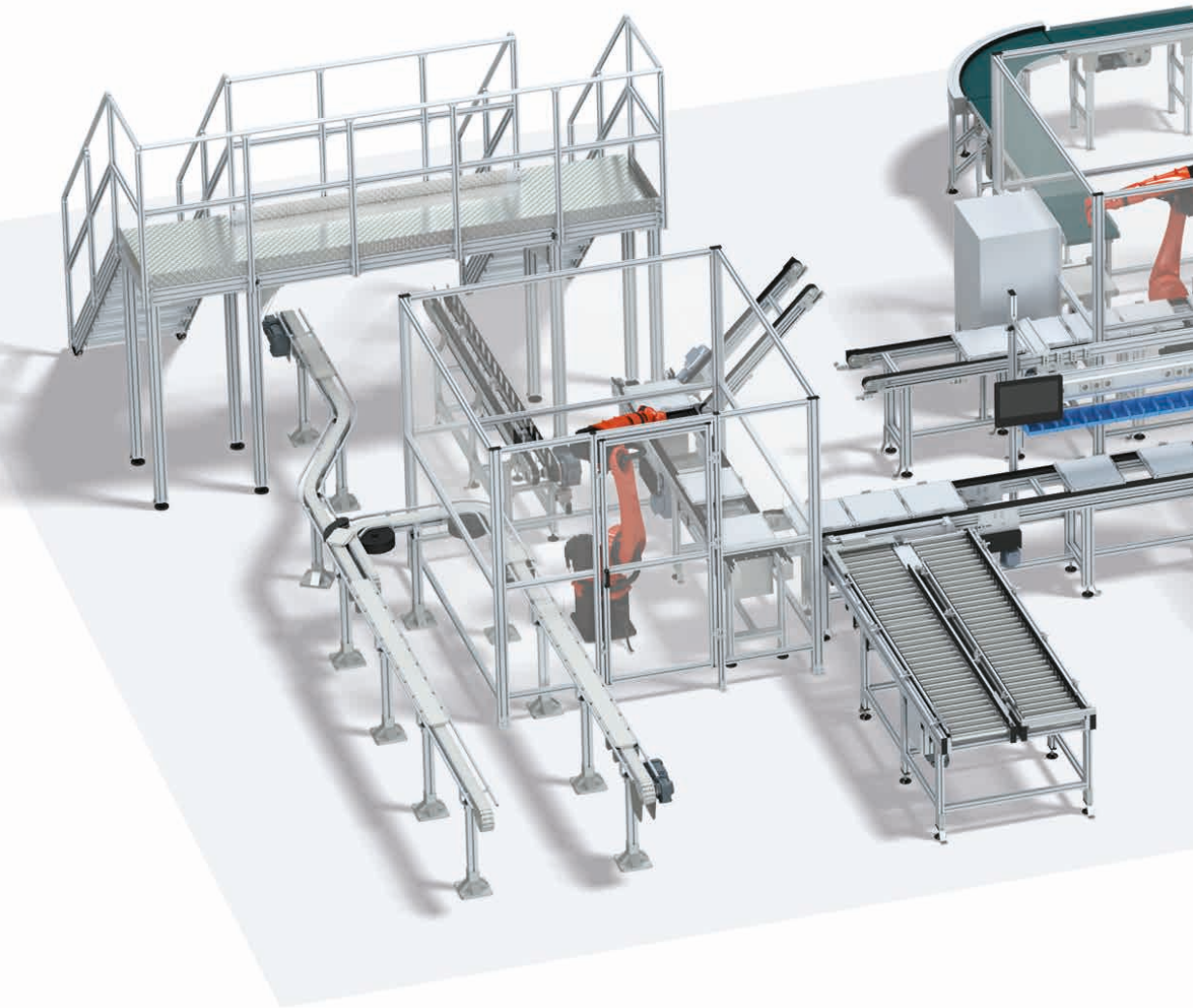


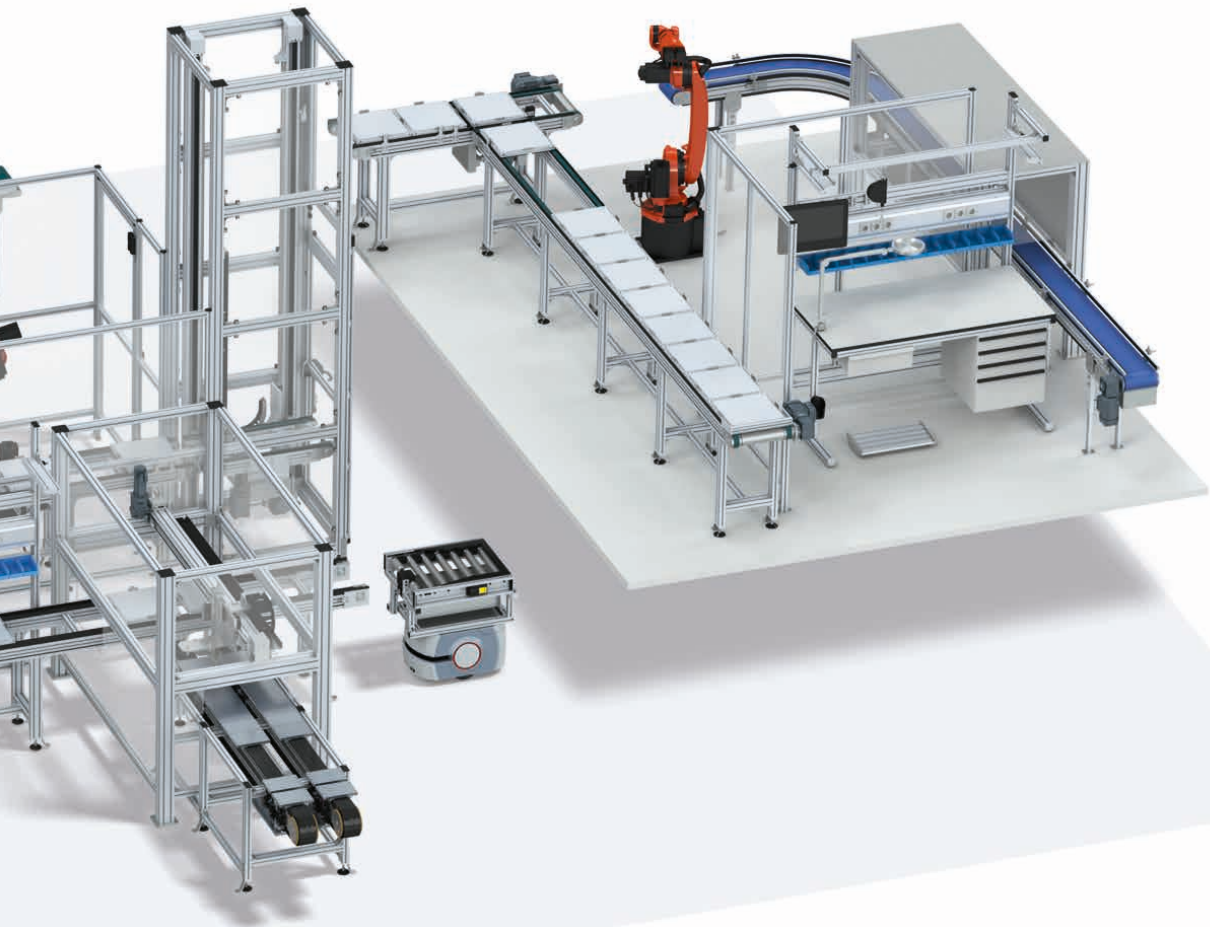
Always precisely positioned.

Edition 7.0

Modular Construction Kit for Factory Automation

» From individual components to complete solutions. «





The **mk Technology Group** is a leading supplier of profile and conveyor technology. The mk construction kit is based on an aluminium profile system that makes it modular and scalable.

Our **conveyor technology** includes belt conveyors, timing belt conveyors, modular belt conveyors, chain conveyors and roller conveyors in numerous designs as well as pallet systems for the reliable interlinking of assembly and production processes.

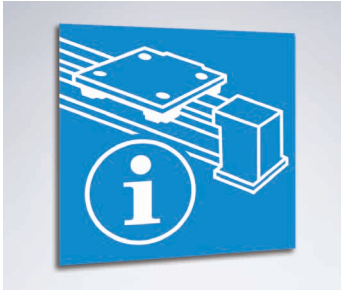
Our **profile technology** includes the profile system and the guarding, workstations, stairs, platforms and machine frames that are based on it.

Our **linear technology** complements the portfolio with functions for precise linear movements and handling applications.

mk also uses the modular construction kit to develop tried-and-tested **solutions** for in-house material flows – customised to specific customer requirements.

Reliable **after-sales service** completes our offering.

Overview of Sections



Information on Linear Technology

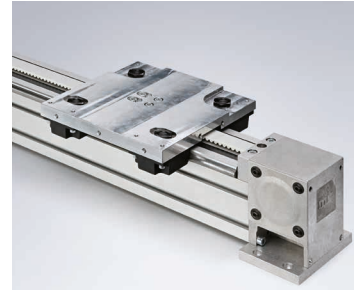
Introduction and Benefits
Selecting a Linear Guide

1

Gliding Assemblies

Introduction and Benefits
Adjusting Units VST 2015
Adjusting Units VST 2011

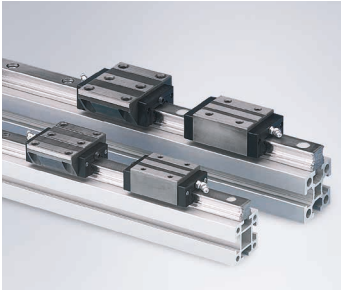
2



Track Roller Assemblies

Introduction and Benefits
Selecting Mounting Profiles
Individual Components
Linear Units Series 40
Linear Units Series 50
Linear Units Series 60
Linear Modules with
Timin Belts (LZR)

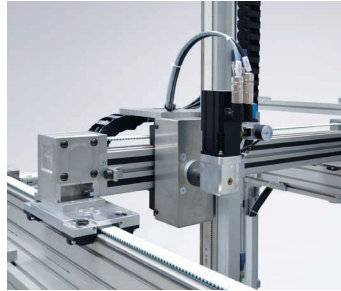
3



**Recirculating
Ball Bearing Guides**

4

Introduction and Benefits	68
Recirculating Ball Bearing 25	72
Recirculating Ball Bearing 30	74



Examples from Practice

5

Gliding Assemblies	76
Track Roller Assemblies	78
Recirculating Ball Bearing Guides	86

Chapter 1 Introduction and Benefits

1



» Reliable and precise linear motion. «

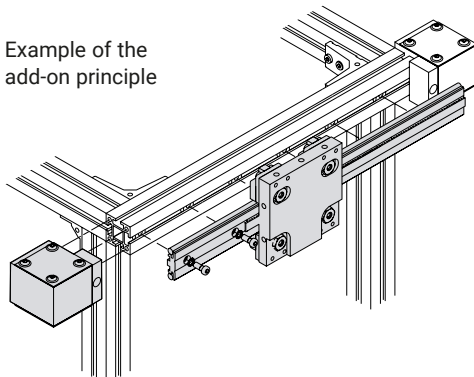
mk linear technology is the name for our portfolio of gliding assemblies, track roller assemblies and recirculating ball bearing guides that provide highly precise and reliable linear motion, and that are designed to meet your specific requirements.

Whether you need manual adjusting units or driven linear modules with a timing belt for handling applications, we're happy to advise you on how the optimal linear guides can achieve both exact directional movement and low-friction transport.

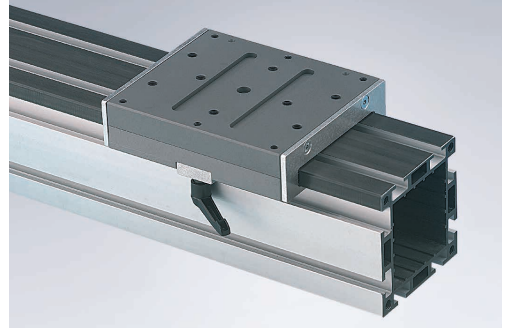
mk's linear technology components are fully compatible with mk profile technology. Installing linear guides allows you to quickly and easily implement linear movements into your machine frames. This method reduces the materials required for the solution, since a separate support structure for the linear motion is not required.

Benefits of mk Linear Technology

- The wide range of guides are designed to meet the customer's requirements and provide optimum function
- Compatible with mk profile series to save materials, costs and space: guides can be mounted directly on the existing support structure
- Uncomplicated and rapid setup of linear guides based on the add-on principle
- mk clamping profile ensures precise travel for maximum parallelism of the guide rods
- Highly reliable operation thanks to high-quality materials and tested third-party parts
- mk engineers provide expert advice and assistance in designing your system



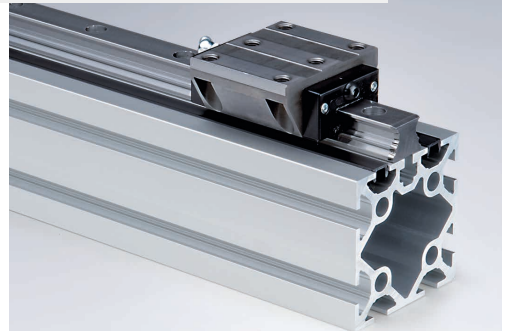
Gliding Assemblies



Track Roller Assemblies



Recirculating Ball Bearing Guides

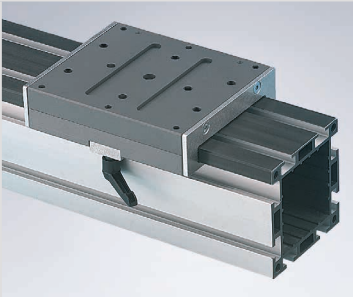


Selecting a Linear Guide

1

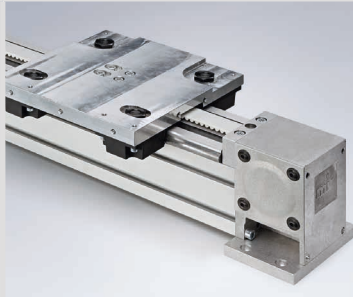
Properties and Benefits of the Different Types of Guide

The following criteria influence the selection of the type of guide to be used for your task and environmental conditions.



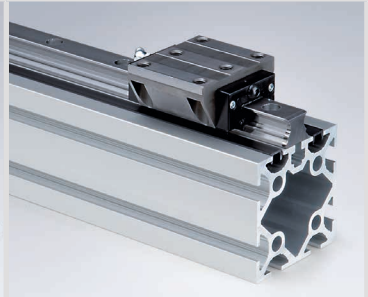
Gliding Assemblies

- For applications that require manual adjustment
- High static load capacity
- Low-maintenance
- Good dry-running characteristics
- Good damping
- Compact design
- Low-noise running



Track Roller Assemblies

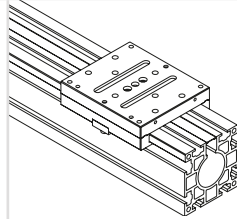
- Compensates for relatively large alignment errors
- Well suited for harsh environmental conditions such as dust, chips, etc.
- High acceleration up to $a = 50 \text{ m/s}^2$
- High travel speeds up to $v = 10 \text{ m/s}$
- Low rolling resistance
- mk clamping profile ensures precise travel for maximum parallelism of the guide rods
- Simple and economical guide design also makes it an attractive solution for longer lengths
- Multi-axial, i.e. can be loaded in all directions (forces and torques)
- Eccentrics allow you to adjust the pre-tension



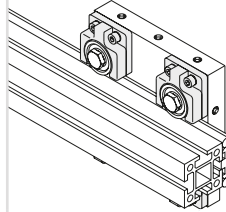
Recirculating Ball Bearing Guides

- High load capacity and high stiffness
- Compact design
- Just one track for different types of roller carriage
- Lightly pre-tensioned (standard), available with play or high pre-tension
- Medium to high acceleration up to $a = 30 \text{ m/s}^2$
- Medium to high speed up to $v = 5 \text{ m/s}$
- Four-row multi-axial recirculating ball bearing guide bears loads in all directions (forces and torques)
- High precision with appropriate contact surfaces

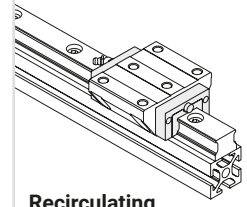
Selection Matrix for Linear Guides



Gliding Assemblies



Track Roller Assemblies



**Recirculating
Ball Bearing Guides**

Running performance

High

•

•

Low

•

Precision

Very high

•

High

•

Medium

•

Low

Speed

Very high

•

High

•

Medium

Low

•

Load capacity

Very high

•

High

•

Medium

•

Low

Stiffness

Very high

High

•

Medium

•

•

Low

Maintenance

With restrictions

•

Regularly

•

•

Frequently

Chapter 2 Gliding Assemblies – Introduction and Benefits

2



» A simple solution
for manual
positioning tasks. «

Our adjusting units (VST) are gliding assemblies in which the different guide components, the profile and the carriages operate on gliding elements rather than being separated by roller bearings. The large contact surfaces and special coating make the gliding assemblies virtually maintenance free. The adjusting units can be supplied in different shapes and combinations as required.

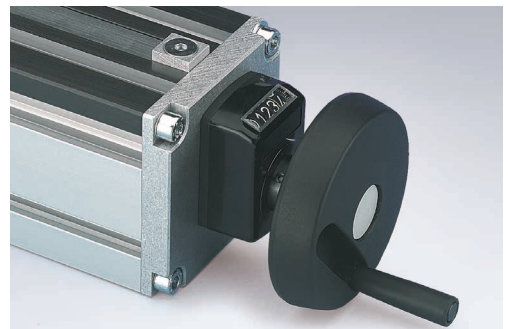
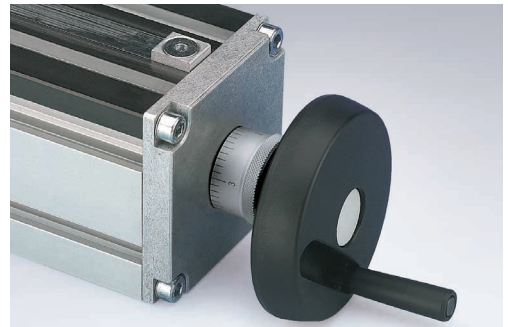
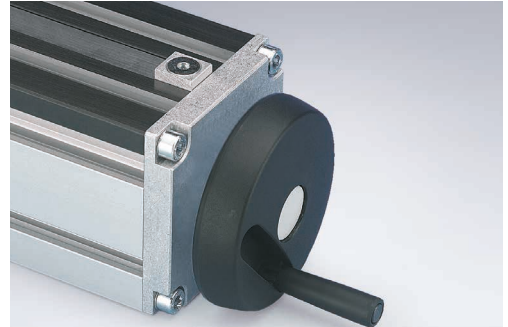
The two basic sizes of adjusting unit use mk 2015 (50x50) and mk 2011 (100x100) aluminium profiles as the profiles. A high-quality coating is mechanically applied to the contact surfaces to ensure good gliding properties and a wear-resistant surface. The standard version of the adjusting units is equipped with ball-bearing-mounted trapezoidal threaded spindles with POM nuts, which are protected from dirt by a stainless steel cover. The nuts, the bearing and the gliding assembly are low maintenance. Custom modifications are available on request, e.g. rust-proof spindles, bronze trapezoidal nuts, ball screws or motorised drives.

The position of the slide carriages can be adjusted with different operating options. When using the adjusting unit with a handwheel, you turn the wheel manually and cannot view the adjustment. When using the adjusting unit with a handwheel and scaling, the adjustment can be viewed on the scaling. In the option of the adjusting unit with a handwheel and mechanical digital display, the adjustment can be viewed on the digital display.

If requested, the adjusting units can also be operated with a motor. The maximum speed is $v = 1 \text{ m/min}$.

Features of mk Gliding Assemblies

- For applications that require manual adjustment
- High static load capacity
- Low-maintenance
- Good dry-running characteristics
- Good damping
- Compact design
- Low-noise running

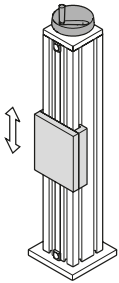


Gliding Assemblies – Introduction and Benefits

2

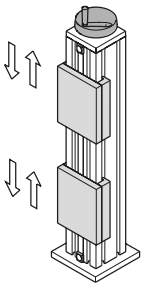
Designs

Adjusting unit with one slide carriage

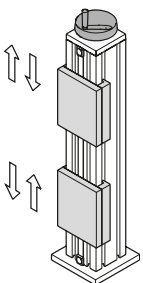


Adjusting unit with two slide carriages (even adjustment)

Independently adjustable lower carriages available as an option

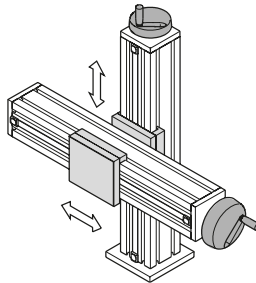


Adjusting unit with two slide carriages (even adjustment)



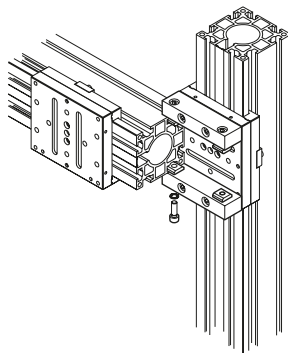
Combinations

A connecting kit lets you combine two adjusting units into one two-axis system.



Connecting kit for cross-VST 2015
B46.07.020

Connecting kit for cross-VST 2011
B46.07.021



Clamping Levers and Wipers

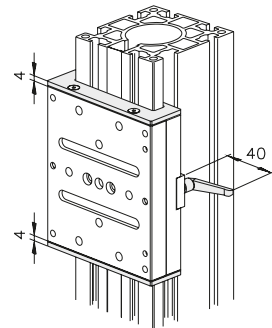
The felt wiper prevents solid objects from entering between the slide carriages and guide. It can easily be bolted onto the standard slide carriages as an accessory.

In the standard system, the slide carriage is clamped using a clamping plate that is fastened by tightening a screw. This can also be done using an optional clamping lever.

Wiper VST 2015
B03.00.011

Wiper VST 2011
B03.00.012

Clamping lever K M6x40
K110030061



Sample order

Adjusting unit	VST 2011-H		
Item no.	B85.00.020		
Length	L = mm		
Stroke	H = mm		
Operating option	Handwheel	Scaling	Digital*
Base plate	Version A	Version B	
Felt wiper	Yes	No	
Clamping lever	Yes	No	

For the adjusting unit with two slide carriages with even adjustment, please specify whether it uses one or two trapezoidal nuts.

With two trapezoidal nuts, Lx = mm (+_ 2 mm)

*For the digital display, please specify "Front" or "Top" for the reading direction and display of numbers.



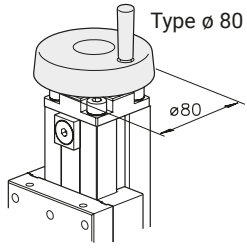
Gliding Assemblies

Adjusting Units VST 2015

Mounting profile: mk 2015 (50 x 50 mm)
 Trapezoid-thread spindle: Tr 16 x 4
 Axial spindle load: 500 N
 Standard lengths L: 250 mm, 500 mm, 750 mm and 1000 mm

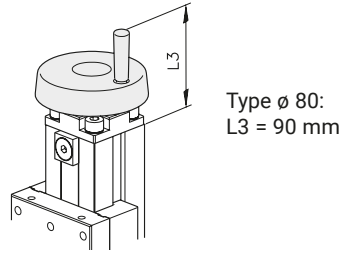
The stroke per revolution is 4 mm, the minimum stroke length is 10 mm, and the maximum length L = 1400 mm.

Handwheel

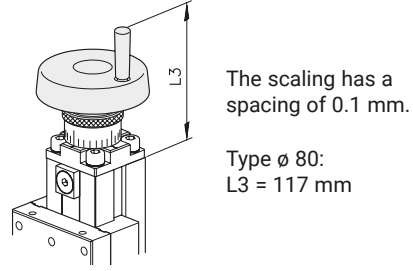


Scaling

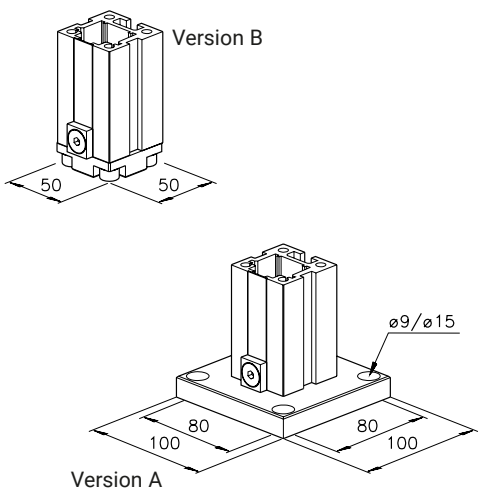
System 2015 without scale



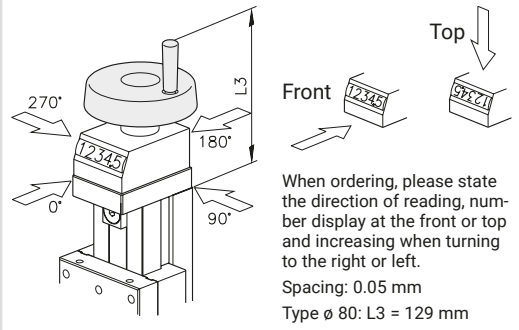
System 2015 with scale



Base Plates

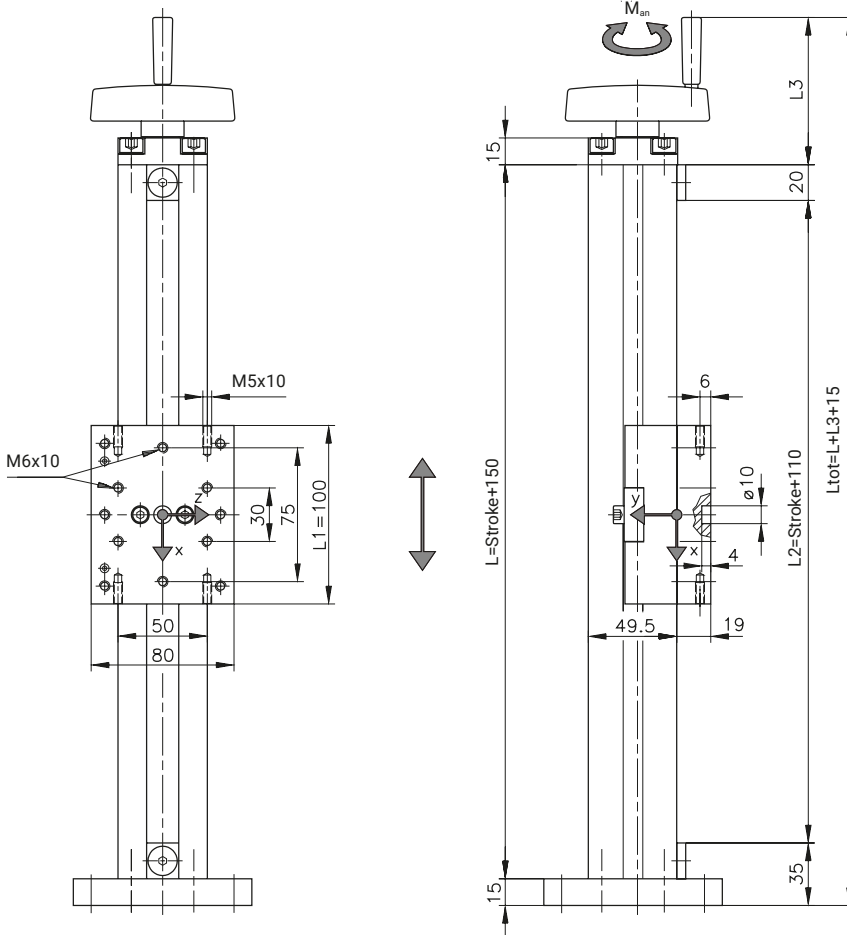


System 2015 with Mechanical Digital Display



VST 2015 with One Slide Carriage

2



Designs

Design	Without scale	Scale	Digital display
Designation	VST 2015-H	VST 2015-S	VST 2015-D
Type	∅ 80	∅ 80	∅ 80
Item no.	B85.00.015	B85.00.016	B85.00.017

Maximum load specifications for VST 2015

F_y [N]	F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	M_{Drive} [Nm]	n [min ⁻¹]	v [m/min]
750	750	25	25	25	2.5	250	1

Check max. load specifications for slide carriages, and suitability for use if necessary

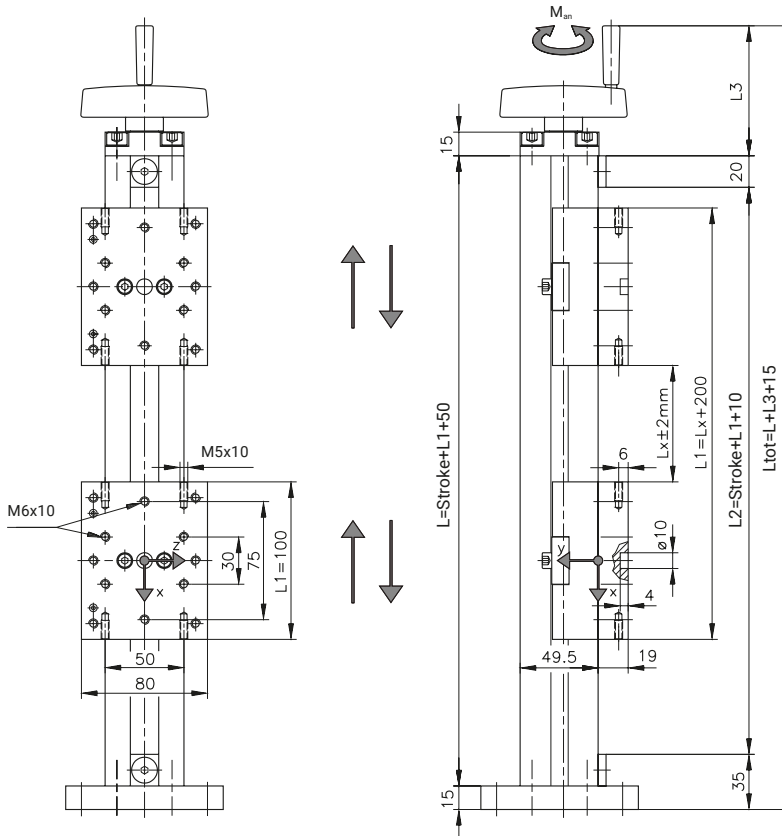
Gliding Assemblies

VST 2015 with Two Synchronised or Independent Slide Carriages

Options:

VST with two trapezoidal nuts: the two slide carriages are synchronised (see the arrow directions)

VST with one trapezoidal nut: the lower slide carriages can be separately adjusted manually



Designs

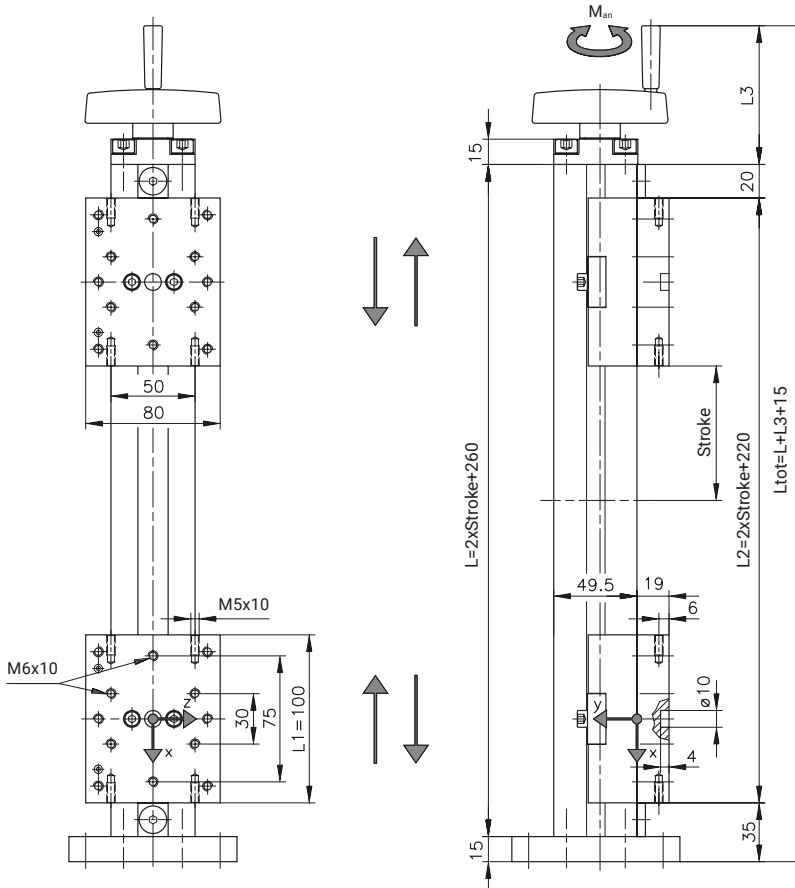
Design	Without scale	Scale	Digital display
Designation	VST 2015-H-2	VST 2015-S-2	VST 2015-D-2
Type	∅ 80	∅ 80	∅ 80
Item no.	B85.00.115	B85.00.116	B85.00.117

Maximum load specifications for VST 2015

F_y^* [N]	F_z^* [N]	M_x^* [Nm]	M_y^* [Nm]	M_z^* [Nm]	M_{Drive} [Nm]	n [min ⁻¹]	v [m/min]
750	750	25	25	25	2.5	250	1

Check max. load specifications for slide carriages, and suitability for use if necessary. *Max. load specifications per slide carriage.

VST 2015 with Two Synchronised Slide Carriages (standard L max. = 750 mm)



Designs

Design	Without scale	Scale	Digital display
Designation	VST 2015-H-G	VST 2015-S-G	VST 2015-D-G
Type	ø 80	ø 80	ø 80
Item no.	B85.00.215	B85.00.216	B85.00.217

Maximum load specifications for VST 2015

F_y^* [N]	F_z^* [N]	M_x^* [Nm]	M_y^* [Nm]	M_z^* [Nm]	M_{Drive} [Nm]	n [min ⁻¹]	v [m/min]
750	750	25	25	25	2.5	250	1

Check max. load specifications for slide carriages, and suitability for use if necessary. *Max. load specifications per slide carriage.



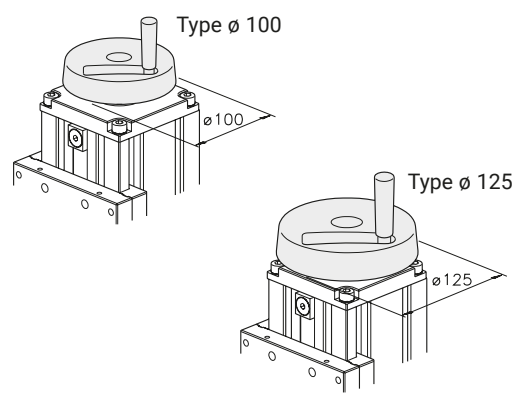
Gliding Assemblies

Adjusting Units VST 2011

Mounting profile: mk 2011 (100 x 100 mm)
 Trapezoid-thread spindle: Tr 20 x 4
 Axial spindle load: 1000 N
 Standard lengths L: 250 mm, 500 mm, 750 mm and 1000 mm

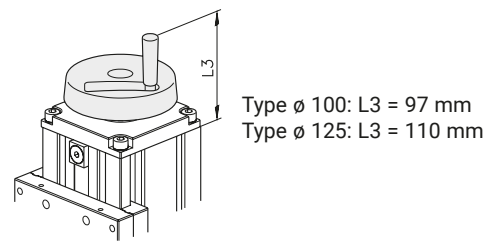
The stroke per revolution is 4 mm, the minimum stroke length is 10 mm, and the maximum length L = 1400 mm.

Handwheel



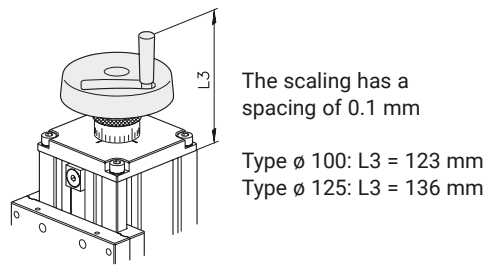
Scaling

System 2011 without scale



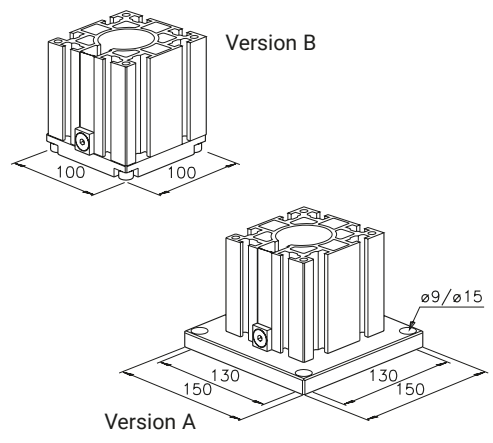
Type ø 100: L3 = 97 mm
 Type ø 125: L3 = 110 mm

System 2011 with scale

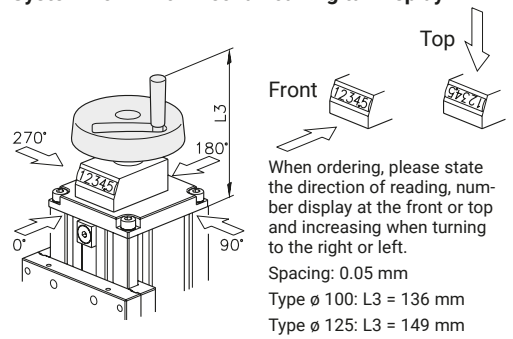


The scaling has a spacing of 0.1 mm
 Type ø 100: L3 = 123 mm
 Type ø 125: L3 = 136 mm

Base Plates



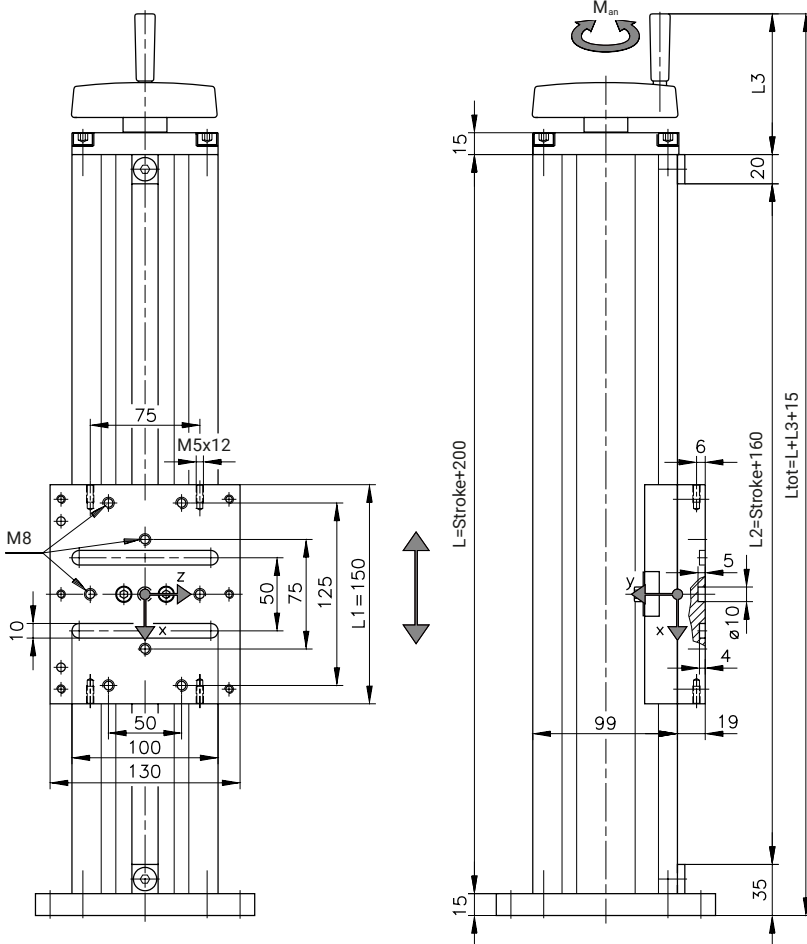
System 2011 with Mechanical Digital Display



When ordering, please state the direction of reading, number display at the front or top and increasing when turning to the right or left.
 Spacing: 0.05 mm
 Type ø 100: L3 = 136 mm
 Type ø 125: L3 = 149 mm

VST 2011 with One Slide Carriage

2



Designs

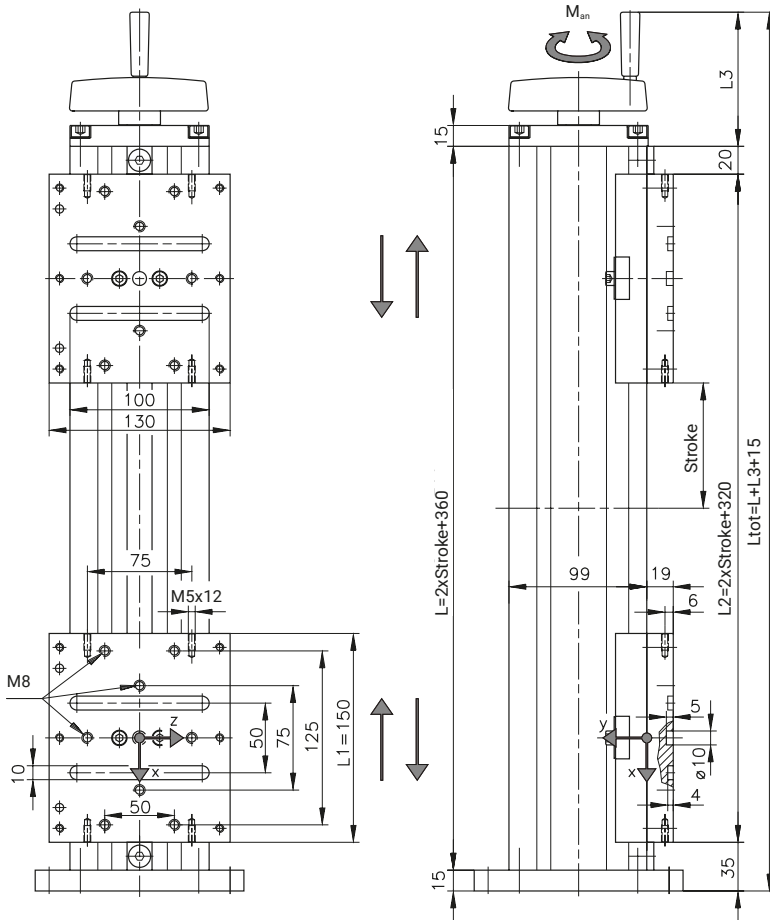
Design	Without scale		Scale		Digital display	
Designation	VST 2011-H	VST 2011-H	VST 2011-S	VST 2011-S	VST 2011-D	VST 2011-D
Type	∅ 100	∅ 125	∅ 100	∅ 125	∅ 100	∅ 125
Item no.	B85.00.020	B85.00.025	B85.00.021	B85.00.026	B85.00.022	B85.00.027

Maximum load specifications for VST 2011

F_y [N]	F_z [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	M_{Drive} [Nm]	n [min ⁻¹]	v [m/min]
2000	2000	75	100	100	6	250	1

Check max. load specifications for slide carriages, and suitability for use if necessary.

VST 2011 with Two Synchronised Slide Carriages



Designs

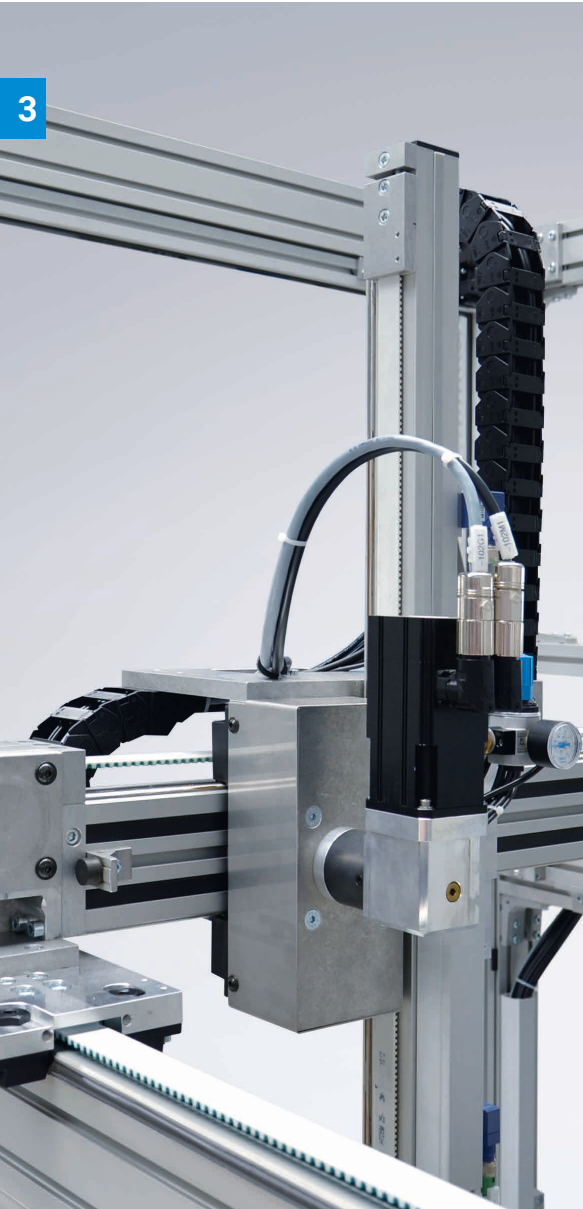
Design	Without scale		Scale		Digital display	
Designation	VST 2011-H-G	VST 2011-H-G	VST 2011-S-G	VST 2011-S-G	VST 2011-D-G	VST 2011-D-G
Type	∅ 100	∅ 125	∅ 100	∅ 125	∅ 100	∅ 125
Item no.	B85.00.220	B85.00.225	B85.00.221	B85.00.226	B85.00.222	B85.00.227

Maximum load specifications for VST 2011

F_y^*	F_z^*	M_x^*	M_y^*	M_z^*	M_{Drive}	n	v
[N]	[N]	[Nm]	[Nm]	[Nm]	[Nm]	[min ⁻¹]	[m/min]
2000	2000	75	100	100	6	250	1

Check max. load specifications for slide carriages, and suitability for use if necessary. *Max. load specifications per slide carriage.

Chapter 3 Track Roller Assemblies – Introduction and Benefits



» Linear modules based on track roller assemblies. «

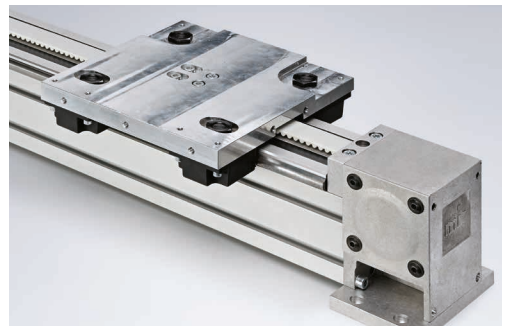
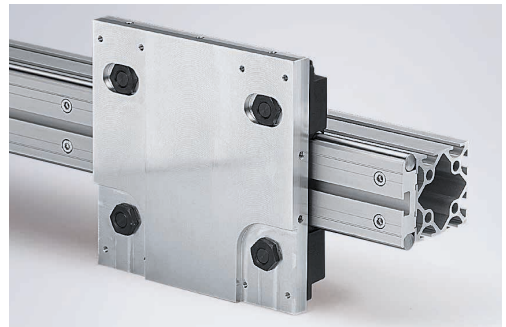
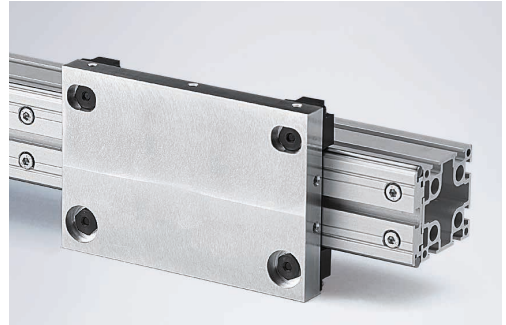
Because of their rigid structure, track roller assemblies offer high accelerations and speeds over a long service life and allow for fast positioning with high repeatability.

They are excellently suited for both single-axis applications and use as multi-axis systems. Linear systems constructed from these modules can meet even the most demanding technical and financial requirements.

Track roller assemblies consist of a linear guide with a matching roller carriage. The guide is built from a standard mk profile that acts as the mounting profile and guide rods that are mounted to the mounting profile with a clamping profile. The roller carriage consists of a support plate and guide rollers, which can be custom-configured to meet your specific requirements. The guide rollers have eccentric bearings to prevent play in the guide. The series and the dimensions chosen for the mounting profile are key factors that determine the linear module design.

Linear Module with Timing Belt (LZR)

Linear modules based on track roller assemblies are usually equipped with a high-powered drive connected via a timing belt. The components of the timing belt drive responsible for transferring the power, such as the deflection bearings and the connectors, are mounted on the mounting profile at the head end. The motor can be connected directly via the shaft end or indirectly on request. LZRs are the preferred solutions for implementing handling systems with an X-Y-Z axis.



Benefits of mk Track Roller Assemblies

- Compensates for relatively large alignment errors
- Well suited for harsh environmental conditions such as dust, chips, etc.
- High acceleration up to $a = 50 \text{ m/s}^2$
- High travel speeds up to $v = 10 \text{ m/s}$
- Low rolling resistance
- mk clamping profile ensures precise travel for maximum parallelism of the guide rods
- Simple and economical guide design also makes it an attractive solution for longer lengths
- Multi-axial, i.e. can be loaded in all directions (forces and torques)
- Eccentrics allow you to adjust the pre-tension

Track Roller Assemblies – Introduction and Benefits

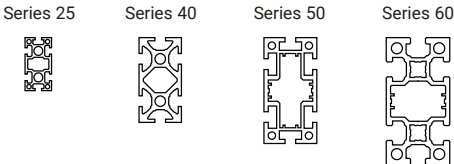
Mounting Profiles

The linear units and modules shown in the catalogue are based on mk's own profile system. Note the series and dimensions of the mounting profiles.

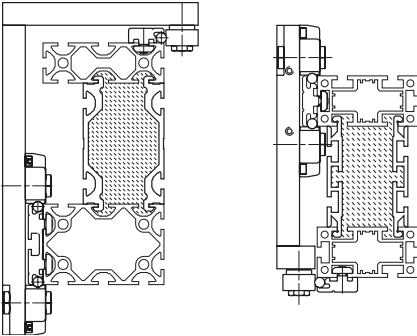
Mounting profiles can also be used in combination with foamed combined profiles to construct gantries.

The suitability for use (deformation) and strength calculation are decisive factors for the mounting profile. A deformation of 1 mm/m is permitted for the function of the linear guide. The deformation and strength are calculated based on the basic rules of technical mechanics.

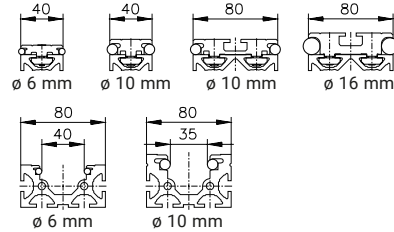
Examples of mk Mounting Profiles



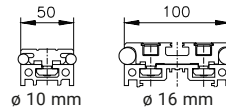
Examples of Foamed Combined Profiles



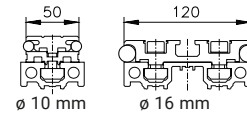
Series 40 Profile Guides



Series 50 Profile Guides

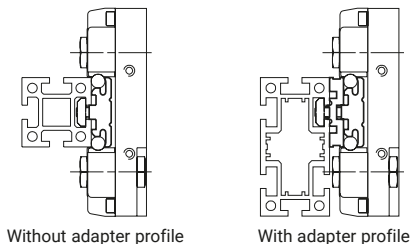


Series 60 Profile Guides



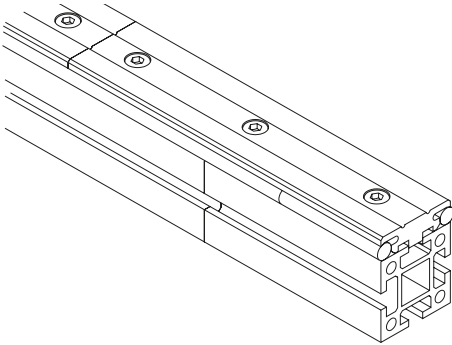
Adapter Profiles

Adapter profiles enable a wide variety of possible combinations. They are used to create the necessary distance for the roller carriage in cases where the dimensions of the mounting profile exceed the clamping profile. Some profiles can also be adapted between different profile series.



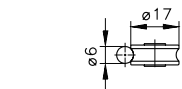
Stock lengths

The maximum length of linear units is 6000 mm. It can be exceeded by mounting multiple mounting profiles with clamping profiles and guide rods set on joins that are mounted staggered with each other.

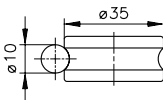


Guides

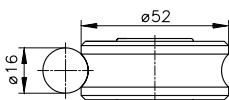
The load capacity of the guide is based primarily on the diameter of the guide rod and on the corresponding guide roller. mk offers four guide rod diameters. The guide rods (ground h6) are made from the material Cf 53 as standard, but are also available as options made from X46 Cr13 with corrosion resistance or galvanised Cf 53 with corrosion protection.



Guide rod 6
0.22 kg/m



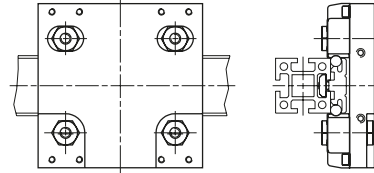
Guide rod 10
0.62 kg/m



Guide rod 16
1.58 kg/m

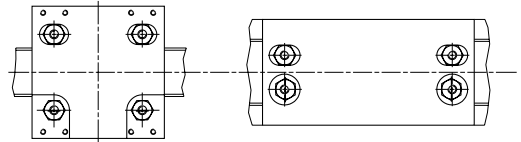
Roller Carriage

The mk roller carriage comes with four rollers as standard, but is also available as an option with three or two rollers on request.



Example of external track rollers

Example of internal track rollers

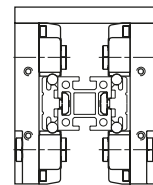
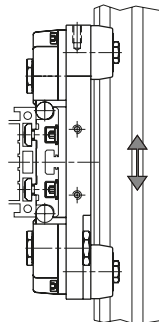


Designs

The mk roller carriage is available with the standard design (see above) and two additional designs.

Cross-carriage

Double-roller carriage



Track Roller Assemblies – Introduction and Benefits

3

Design of the Track Rollers

The indicated static load carrying capacities can be used as a guideline for the preliminary selection of track rollers. These values are the maximum allowable unit loads and include a static safety factor $s_0 = 4$ in relation to the plastic deformation of the roller bearings within the steel track roller. For stainless steel components, these values must be reduced by 30%.

The load values shown for the axial load (F_y) and radial load (F_z) are for moment-free loads. The allowable moments are the result of opposing offset loads.

Combined loads must be verified separately. A combined load is a single point load which, with a 50 mm offset for example, also introduces a moment. Careful consideration must be given to combined loads which cause torsion.

When arranging track rollers, it is important that the track rollers only transfer compressive loads in the radial direction. The centric track rollers are especially suitable for handling radial loads, especially in the F_z direction. The centric track rollers are prevented from twisting by using a steel bushing.

Application Notes

Care must be taken to ensure that the track rollers are installed in an unloaded condition. In most cases, readjustment of the eccentric track rollers under load causes premature wear. For “normal” applications (up to $a = 3 \text{ m/s}^2$), the track rollers should be set so that they rotate as they travel along the track but you can still prevent this rotation by placing your thumb and index finger on the circumference of the roller.

For applications requiring a speed of over $a = 3 \text{ m/s}^2$, the track rollers require further pre-tensioning, and you can then no longer manually prevent the rollers from rotating. As an additional safety measure, we recommend securing the eccentric bushings with adhesive to prevent them from slipping. To prevent corrosion and increased abrasion, sufficient lubrication must also be used.

Calculations

When confirming the suitability of particular track rollers, a distinction must be made between static and the dynamic loading. Static loads are loads that are transferred at the contact point between the rod and the track roller while the roller is not rotating. That is to say that dynamic loads, or loads along other axes, must also be considered.

It is helpful to first confirm the static and then the dynamic load calculations. The allowable static axial and radial track roller loads and the static and dynamic safety factors of the most highly loaded rollers must be confirmed. The maximum track roller loads are technically considered mechanical contact loads (supported loads).

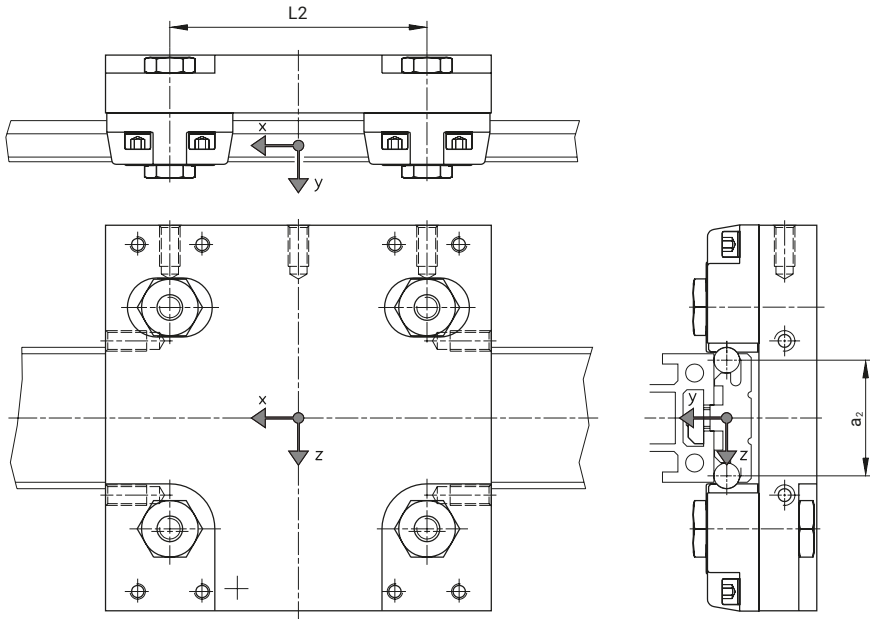
The static safety factor and dynamic safety factor are derived from the relationship between the allowable load capacity C_w and the available equivalent load P .

Recommended Guidelines

Up to $v = 3 \text{ m/s}$ and $a = 3 \text{ m/s}^2$, full load capacity of the track rollers with $s_0 \geq 4$ and $2 < s_D \leq 5$.

For high dynamic loads with $a > 10 \text{ m/s}^2$ and speeds of up to $v = 10 \text{ m/s}$, the load values must be reduced.

Technical Specifications for Track Roller Assemblies



Static safety factor:

$$s_o = \frac{C_{ow}}{P_o} \geq 4 = s_o \text{ recomm.}$$

Dynamic safety factor:

$$s_D = \frac{C_w}{P} \geq 5 = s_D \text{ recomm.}$$

Nominal service life:

$$L_h = \left(\frac{C_w}{P}\right)^3 [10^5 \text{ m}]$$

Equivalent loads

– Static:

$$P_o = x_o \cdot F_{ro} + y_o \cdot F_{ao} [N]$$

– Dynamic:

$$P = x \cdot F_r + y \cdot F_a [N]$$

Factors from the table

- Static: roller stationary
- Dynamic: roller rotating

Track roller loads

– Radial:

$$F_{r(o)} = \pm \frac{F_{z(o)}}{2} \pm \frac{M_{y(o)}}{L_2} [N]$$

– Axial:

$$F_{a(o)} = \pm \frac{F_{y(o)}}{4} \pm \frac{M_{x(o)}}{2 \cdot a_2} \pm \frac{M_{z(o)}}{2 \cdot L_2} [N]$$

Highest loaded roll (that is, with the largest value respectively)

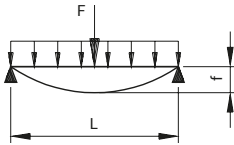
Load specifications

Item no.	Designation Guide with	Rod ø	F _{ro-max} [N]	F _{ao-max} [N]	F _{r(o)} ≥ F _{a(o)}				F _{r(o)} < F _{a(o)}				C _{ow} [N]	C _w [N] based on 10 ⁵ m
					x _o	y _o	x	y	x _o	y _o	x	y		
K101100003	LR 6	6	175	60	1.2	3.6	1.0	3.1	0.9	3.6	0.5	3.9	890	1270
K101100001	LR 10	10	1000	300	1.2	4.0	1.0	3.4	0.9	4.0	0.5	4.3	5100	8500
K101100002	LR 16	16	2000	500	1.2	4.8	1.0	3.9	1.0	5.0	0.5	4.8	9500	16800
K101100006	LR 20	20	3250	825	1.2	4.9	1.0	4.0	1.1	5.0	0.5	4.9	16600	29500

Selecting Mounting Profiles Series 40

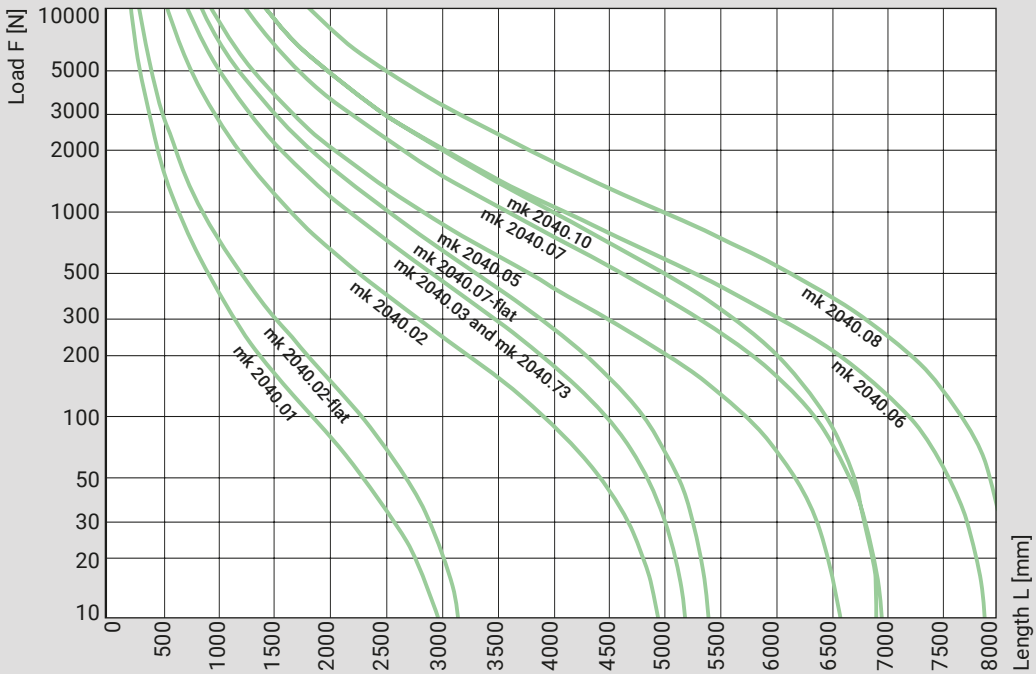
Selection Based on Load and Length

Example



$F = 300 \text{ N}$
 $L = 1500 \text{ mm}$
 \Rightarrow suitable profile mk 2040.02-flat
 with $\frac{f}{L} \leq \frac{1}{1000}$

With point load at centre and profile weight for the case: $\frac{f}{L} = \frac{1}{1000}$



Calculating the Deflection

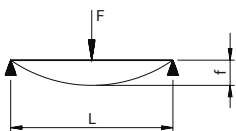
Use our online tool at www.mk-group.com/en/deflection

$$\sigma_b = \frac{M_{bmax}}{W_{x,y}}$$

$$S = \frac{R_{p0.2}}{\sigma_b}$$

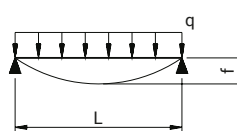
$R_{p0.2} = 200 \text{ N/mm}^2$ (AlMgSi 0.5 F25)

$R_{p0.2} = 215 \text{ N/mm}^2$ (AlMgSi 0.7 F27)



$$M_{bmax} = \frac{F \cdot L}{4}$$



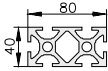
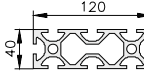
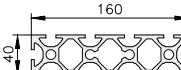
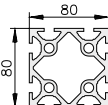
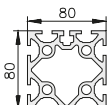
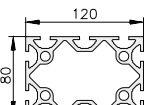
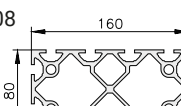
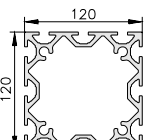
$$f = \frac{F \cdot L^3}{48 \cdot E \cdot I_{x,y}}$$



$$M_{bmax} = \frac{q \cdot L^2}{8}$$

$$f = \frac{5}{384} \cdot \frac{q \cdot L^4}{E \cdot I_{x,y}}$$

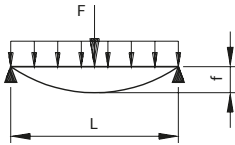
Mounting Profiles with Properties

	Area A [mm ²]	Mass m [kg/m]	Moments of inertia		Section moduli	
			I _x [cm ⁴]	I _y [cm ⁴]	W _x [cm ³]	W _y [cm ³]
<div style="display: flex; justify-content: space-between; align-items: center;">  Series 40 Profiles 3 </div>						
mk 2040.01 54.01. 	742	2.00	12.10	12.10	6.06	6.06
mk 2040.02 54.02. 	1340	3.62	83.30	22.60	20.80	11.30
mk 2040.05 54.05. 	1740	4.69	257.00	31.60	43.70	15.80
mk 2040.06 54.06. 	2320	6.26	576.00	41.40	72.00	20.70
mk 2040.03 54.03. 	2060	5.57	150.00	150.00	37.40	37.40
mk 2040.73 54.73. 	2110	5.72	150.00	150.00	37.10	37.40
mk 2040.07 54.07. 	2580	6.96	441.00	208.00	73.40	52.10
mk 2040.08 54.08. 	3500	9.46	949.00	272.00	119.00	68.00
mk 2040.10 54.10. 	3060	8.26	585.00	585.00	97.50	97.50

Selecting Mounting Profiles Series 50

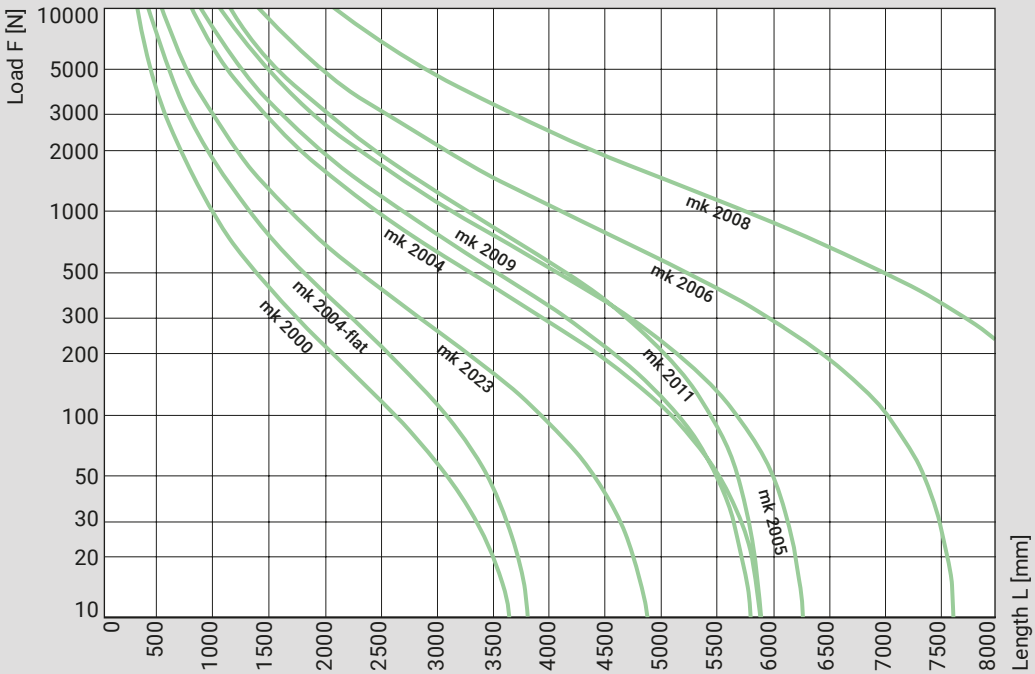
Selection Based on Load and Length

Example



$F = 400 \text{ N}$
 $L = 2000 \text{ mm}$
 \Rightarrow suitable profile mk 2004-flat
 with $\frac{f}{L} \leq \frac{1}{1000}$

With point load at centre and profile weight for the case: $\frac{f}{L} = \frac{1}{1000}$



Calculating the Deflection

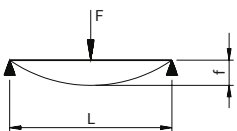
Use our online tool at www.mk-group.com/en/deflection

$$\sigma_b = \frac{M_{bmax}}{W_{x,y}}$$

$$S = \frac{R_{p0.2}}{\sigma_b}$$

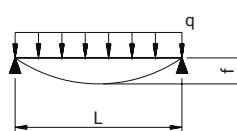
$R_{p0.2} = 200 \text{ N/mm}^2$ (AlMgSi 0.5 F25)

$R_{p0.2} = 215 \text{ N/mm}^2$ (AlMgSi 0.7 F27)



$$M_{bmax} = \frac{F \cdot L}{4}$$



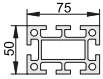
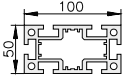
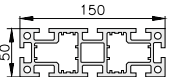
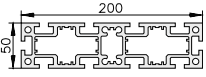
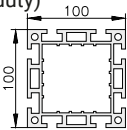
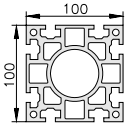
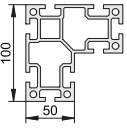
$$f = \frac{F \cdot L^3}{48 \cdot E \cdot I_{x,y}}$$



$$M_{bmax} = \frac{q \cdot L^2}{8}$$

$$f = \frac{5}{384} \cdot \frac{q \cdot L^4}{E \cdot I_{x,y}}$$

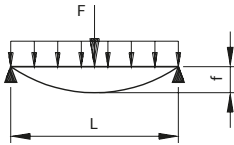
Mounting Profiles with Properties

		Area A [mm ²]	Mass m [kg/m]	Moments of inertia		Section moduli	
				I _x [cm ⁴]	I _y [cm ⁴]	W _x [cm ³]	W _y [cm ³]
Series 50 Profiles							
mk 2000 51.00.		1080	2.85	29.90	29.90	12.00	12.00
mk 2023 51.23.		1400	3.78	89.3	39.6	23.8	15.8
mk 2004 51.04.		1810	4.87	200.00	55.40	40.00	22.10
mk 2006 51.06.		2600	7.00	597.00	80.50	79.70	32.10
mk 2008 51.08.		3370	9.09	1300.00	107.00	130.00	42.70
mk 2005 (light duty) 51.05.		2650	7.00	335.00	335.00	67.00	67.00
mk 2011 51.11.		3670	9.70	383.00	383.00	76.70	76.70
mk 2009 51.09.		2320	6.27	239	239	42	42

Selecting Mounting Profiles Series 60

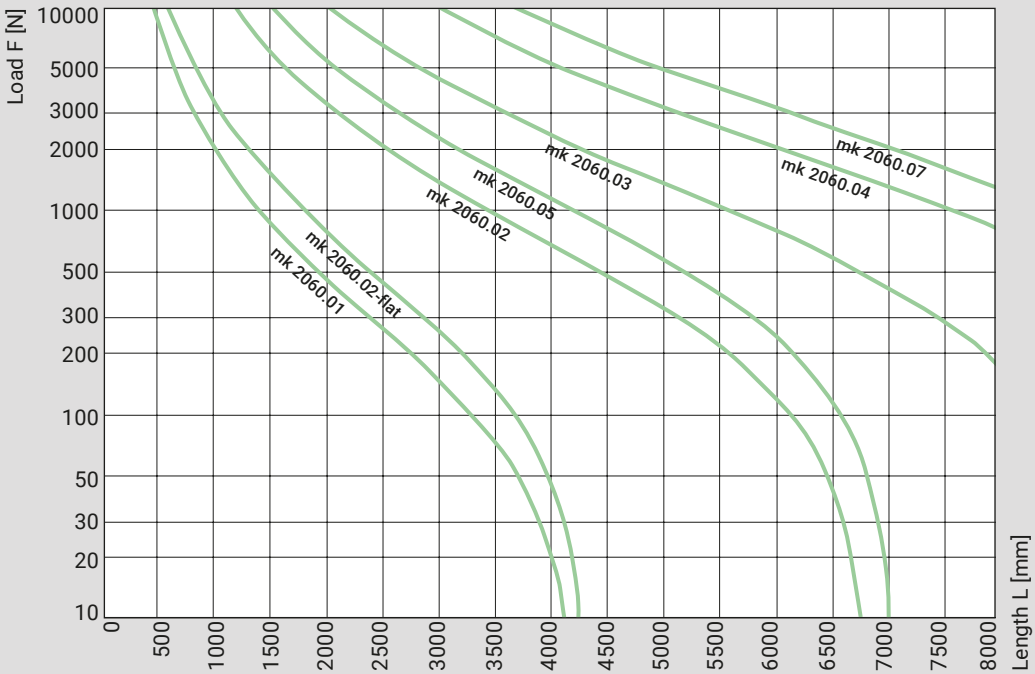
Selection Based on Load and Length

Example



$F = 800 \text{ N}$
 $L = 4500 \text{ mm}$
 \Rightarrow suitable profile mk 2060.05
 with $\frac{f}{L} \leq \frac{1}{1000}$

With point load at centre and profile weight for the case: $\frac{f}{L} = \frac{1}{1000}$



Calculating the Deflection

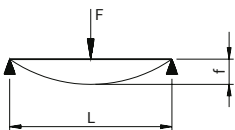
Use our online tool at www.mk-group.com/en/deflection

$$\sigma_b = \frac{M_{bmax}}{W_{x,y}}$$

$$S = \frac{R_{p0.2}}{\sigma_b}$$

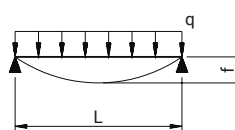
$R_{p0.2} = 200 \text{ N/mm}^2$ (AlMgSi 0.5 F25)

$R_{p0.2} = 215 \text{ N/mm}^2$ (AlMgSi 0.7 F27)



$$M_{bmax} = \frac{F \cdot L}{4}$$



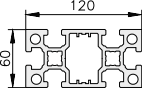
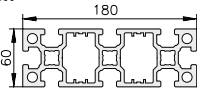
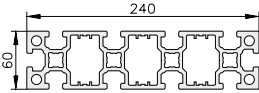
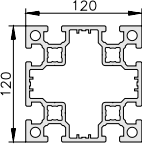
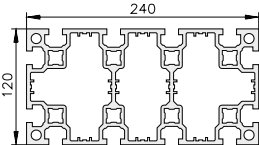
$$f = \frac{F \cdot L^3}{48 \cdot E \cdot I_{x,y}}$$



$$M_{bmax} = \frac{q \cdot L^2}{8}$$

$$f = \frac{5}{384} \cdot \frac{q \cdot L^4}{E \cdot I_{x,y}}$$

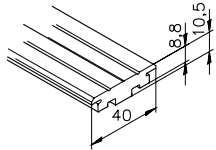
Mounting Profiles with Properties

	Area A [mm ²]	Mass m [kg/m]	Moments of inertia		Section moduli	
			I _x [cm ⁴]	I _y [cm ⁴]	W _x [cm ³]	W _y [cm ³]
Series 60 Profiles						
mk 2060.01 60.01. 	1600	4.31	60.20	60.20	20.00	20.00
mk 2060.02 60.02. 	2580	6.95	404.00	103.00	67.30	34.50
mk 2060.03 60.03. 	3540	9.57	1210.00	147.00	134.00	48.90
mk 2060.04 60.04. 	4520	12.20	2660.00	190.00	221.00	63.30
mk 2060.05 60.05. 	3800	10.30	660.00	660.00	110.00	110.00
mk 2060.07 60.07. 	6700	18.10	4090.00	1180.00	340.00	169.00

Individual Components

3

Clamping Profiles for Series 40

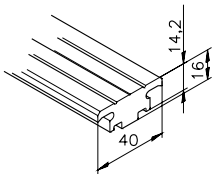


Profile mk 2038.30

0.79 kg/m

Stock length	38.30.6100
Cut	38.30.

Used for \varnothing 6 mm guide rod

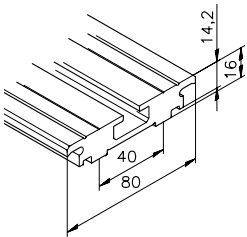


Profile mk 2038.31

1.07 kg/m

Stock length	38.31.6100
Cut	38.31.

Used for \varnothing 10 mm guide rod

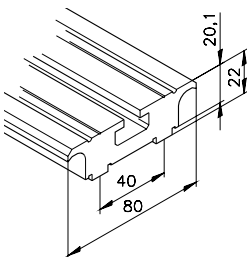


Profile mk 2038.32

0.44 kg/m

Stock length	38.32.6100
Cut	38.32.

Used for \varnothing 10 mm guide rod



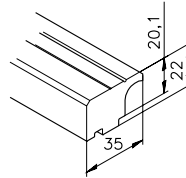
Profile mk 2038.33

2.96 kg/m

Stock length	38.33.6100
Cut	38.33.

Used for \varnothing 16 mm guide rod

Clamping Profiles for Series 40

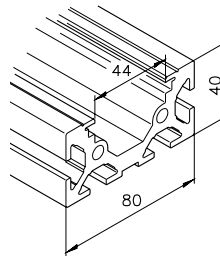


Profile mk 2038.07

1.50 kg/m

Stock length	38.07.6100
Cut	38.07.

Used for \varnothing 16 mm guide rod

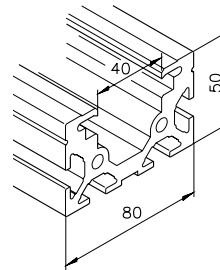


Profile mk 2038.75

3.41 kg/m

Stock length	38.75.6100
Cut	38.75.

Used for \varnothing 6 mm guide rod
Internal guide



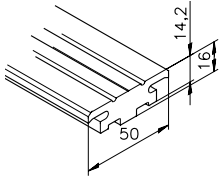
Profile mk 2038.77

4.34 kg/m

Stock length	38.77.6100
Cut	38.77.

Used for \varnothing 10 mm guide rod
Internal guide

Clamping Profiles for Series 50



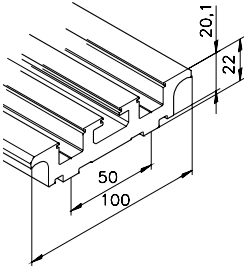
Profile mk 2038.41

1.36 kg/m

Stock length **38.41.6100**

Cut **38.41.**

Used for \varnothing 10 mm guide rod



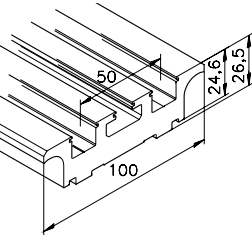
Profile mk 2038.44

3.09 kg/m

Stock length **38.44.6100**

Cut **38.44.**

Used for \varnothing 16 mm guide rod



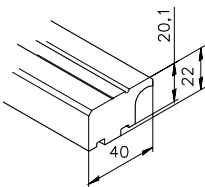
Profile mk 2038.46

3.97 kg/m

Stock length **38.46.6100**

Cut **38.46.**

Used for \varnothing 20 mm guide rod



Profile mk 2038.12

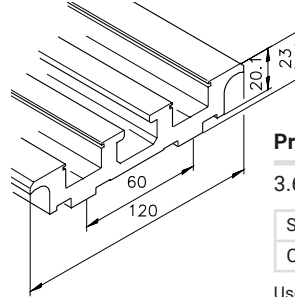
1.77 kg/m

Stock length **38.12.6100**

Cut **38.12.**

Used for \varnothing 16 mm guide rod

Clamping Profiles for Series 60



Profile mk 2038.36

3.62 kg/m

Stock length **38.36.6100**

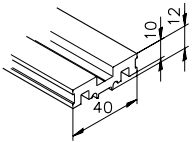
Cut **38.36.**

Used for \varnothing 16 mm guide rod

Individual Components

3

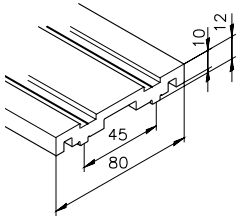
Adapter Profiles for Series 40 and 50



Profile mk 2038.55

0.77 kg/m

Stock length	38.55.6100
Cut	38.55.

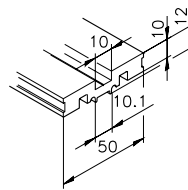


Profile mk 2038.56

1.67 kg/m

Stock length	38.56.6100
Cut	38.56.

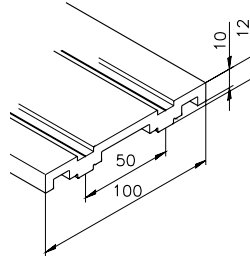
Adapter Profiles for Series 50



Profile mk 2038.60

1.04 kg/m

Stock length	38.60.6100
Cut	38.60.



Profile mk 2038.61

1.90 kg/m

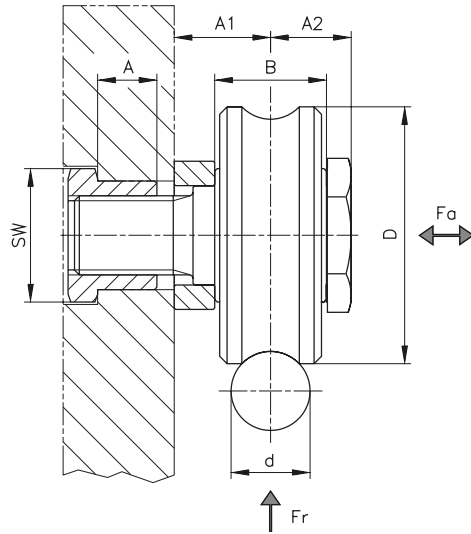
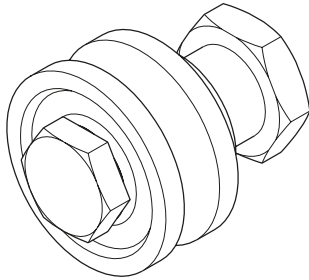
Stock length	38.61.6100
Cut	38.61.

Individual Components

3

Guide Rollers

for $\varnothing 6$, $\varnothing 10$, $\varnothing 16$, $\varnothing 20$ guide rods



Technical Values

Item no.	D [mm]	B [mm]	A [mm]	A1 [mm]	A2 [mm]	SW [mm]	d for Rod	Consisting of:			
								Track roller	Bolt	Spacer ring	Bushing
B60.02.017 centric	17	8	6	7	7	13	$\varnothing 6^*$	K101100003	25.51.3201	25.51.3301	25.51.3101
B60.02.018 eccentric	17	8	6	7	7	13	$\varnothing 6^*$	K101100003	25.51.3201	25.51.3301	25.51.3102
B60.02.015 centric	35	15.9	12	12.5	13	22	$\varnothing 10^*$	K101100001	05.06.0003	14.04.0003	06.01.0013
B60.02.016 eccentric	35	15.9	12	12.5	13	22	$\varnothing 10^*$	K101100001	05.06.0003	14.04.0003	06.01.0014
B60.02.013 centric	52	22.6	12	19.5	16.3	27	$\varnothing 16^*$	K101100002	05.06.0007	14.04.0004	06.01.0018
B60.02.014 eccentric	52	22.6	12	19.5	16.3	27	$\varnothing 16^*$	K101100002	05.06.0007	14.04.0004	06.01.0017
B60.02.011 centric	72	25.8	18	22	18	36	$\varnothing 20^*$	K101100006	05.06.0009	14.04.0020	06.01.0021
B60.02.012 eccentric	72	25.8	18	22	18	36	$\varnothing 20^*$	K101100006	05.06.0009	14.04.0020	06.01.0022

*For item numbers, see page 39

Guide rollers also available in stainless steel for all diameters.

Load Specifications per Roller

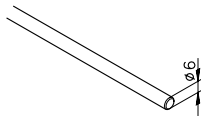
Value	Roller for $\varnothing 6$ mm rod	Roller for $\varnothing 10$ mm rod	Roller for $\varnothing 16$ mm rod	Roller for $\varnothing 20$ mm rod
so*	4	4	4	4
Fr	175N	1000N	2000N	3250N
Fa	60N	300N	500N	825N
Static load capacity Cow	890N	5100N	9500N	16600N
Dynamic load capacity Cw	1270N	8500N	16800N	29500N

*Static load safety factor against plastic deformation on the roller contact in the track roller.

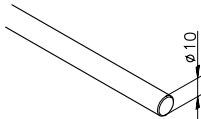
For stainless steel guide rods, these values must be reduced by 30%.

Guide Rods

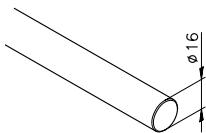
The stock length for Cf 53 and X46 Cr13 with corrosion resistance (magnetisable) is 4000 mm. For galvanised Cf 53 with corrosion protection, it is 3000 mm.



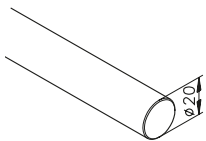
Guide rod 6
0.22 kg/m



Guide rod 10
0.62 kg/m



Guide rod 16
1.58 kg/m



Guide rod 20
2.47 kg/m

Item no.

Cf 53	Cf 53**	X46 Cr13
11,213	11,213	14,034

Ø	7003AK....*	7003DC....*	7003EC....*
Ø 6 mm	7003AK....*	7003DC....*	7003EC....*
Ø 10 mm	7003AA....*	7003DH....*	7003EH....*
Ø 16 mm	7003AM....*	7003DP....*	7003EP....*
Ø 20 mm	7003CM....*	7003DT....*	7003ET....*

...* Shaft length in mm
** Galvanised

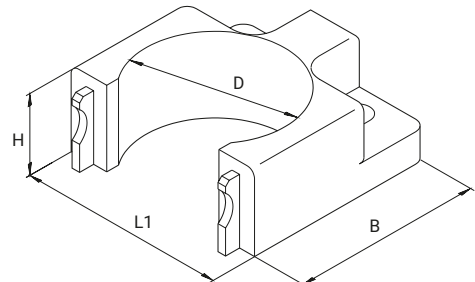
Wipers

Polyamide

The wipers act as a safety element (for protection against pinch points while guiding the roller) and also wipe coarse dirty from the guide rod.

With the wipers for rod diameters 10 and 16, a sealing lip clings to the guide rod and wipes away even finer particles.

The wipers for rod diameters 10 and 16 are also available on request with felt strips and lubrication nipples for lubrication with oil.



Technical Values

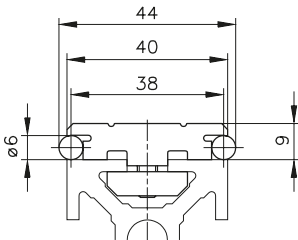
Item no.	d for Rod	L1 [mm]	B [mm]	H [mm]	D [mm]
B03.00.014	Ø 6***	25	22.5	11	19
B03.00.003	Ø 10	50	46	20	37
B03.00.004	Ø 16	70	64	30	56
B03.00.013	Ø 20***	100	80	35	76

***Wiper without sealing lip

Series 40 Linear Units

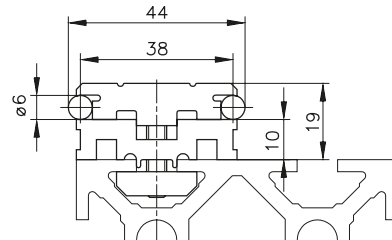
Profile Guide PF 6-38.30/55

The profile guide PF 6-38.30 with or without an adapter profile can be combined with the profiles from series 40 and the roller carriage shown on the next page. When combined, they form a linear unit.



Profile Guide PF 6-38.30
B51.04.042

1.8 kg/m
L1 up to 6000 mm



Profile Guide PF 6-38.30/55
B51.04.043

With adapter profile
2.6 kg/m
L1 up to 6000 mm

Borehole spacing specifications

Range: $75 \leq L1 \leq 6000$

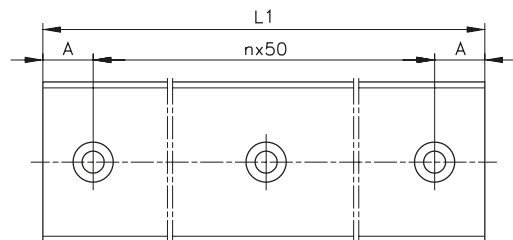
$12.5 \leq A < 37.5$

$$N = \frac{L1 - (2 \times A)}{50} + 1$$

L1 = length of the profile guide

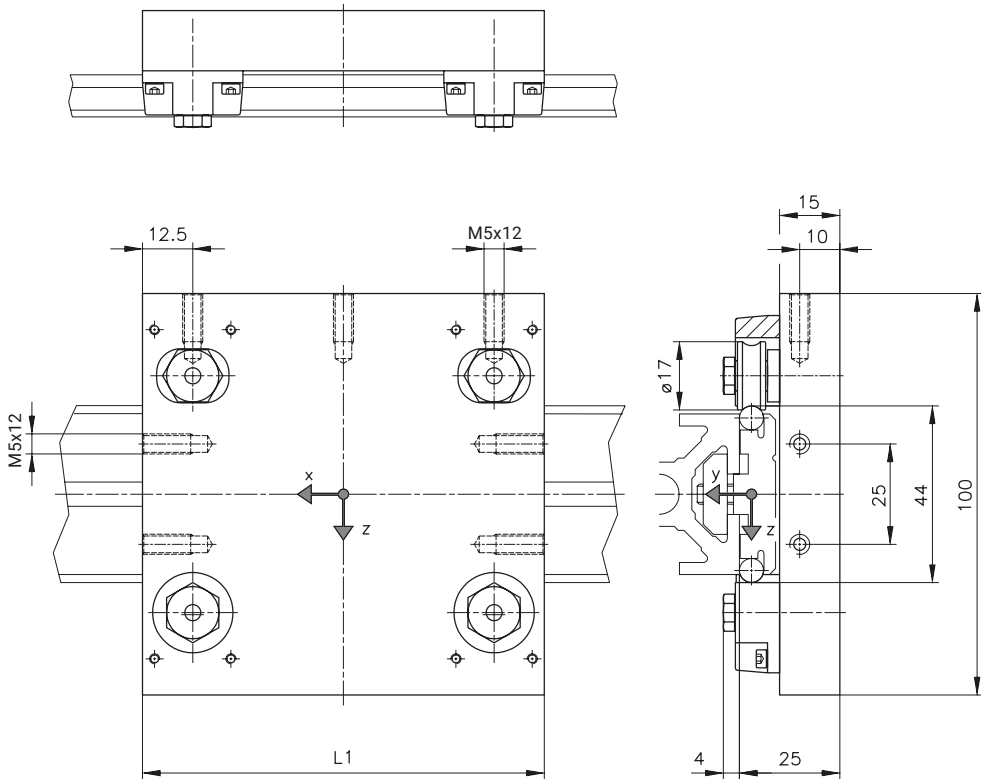
A = distance from the first borehole to the profile edge

N = number of screws



Roller Carriage LW 38.30-04

for Profile Guide PF 6-38.30/55



Technical Values

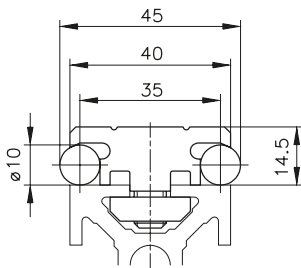
Item no.	Designation	L1 [mm]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]	m _{carriage} [kg]	Plate, individual
B90.40.041	LW 38.30-04	100	200	350	4	13	8	0.55	5009CC0100
B90.40.041	LW 38.30-04	160	200	350	4	23	14	0.8	5009CC0160

- Max. load specifications for $v \leq 10$ m/s and $a \leq 10$ m/s²; with $s_0 = 4$
- Max. acceleration $a = 50$ m/s² with reduced load
- Load application point max. 15 mm off-centre
- For X46 Cr13 rods and rollers, the load capacity must be reduced by 30%

Series 40 Linear Units

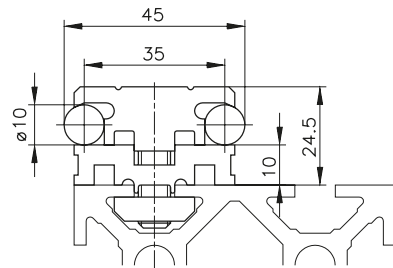
Profile Guide PF 10-38.31/55

The profile guide PF 10-38.31 with or without an adapter profile can be combined with the profiles from series 40 and the roller carriage shown on the next page. When combined, they form a linear unit.



Profile Guide PF 10-38.31
B51.04.046

2.8 kg/m
L1 up to 6000 mm



Profile Guide PF 10-38.31/55
B51.04.047

With adapter profile
3.6 kg/m
L1 up to 6000 mm

Borehole spacing specifications

Range: $150 \leq L1 \leq 6000$

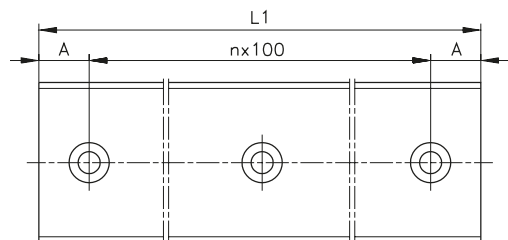
$25 \leq A < 75$

$$N = \frac{L1 - (2 \times A)}{100} + 1$$

L1 = length of the profile guide

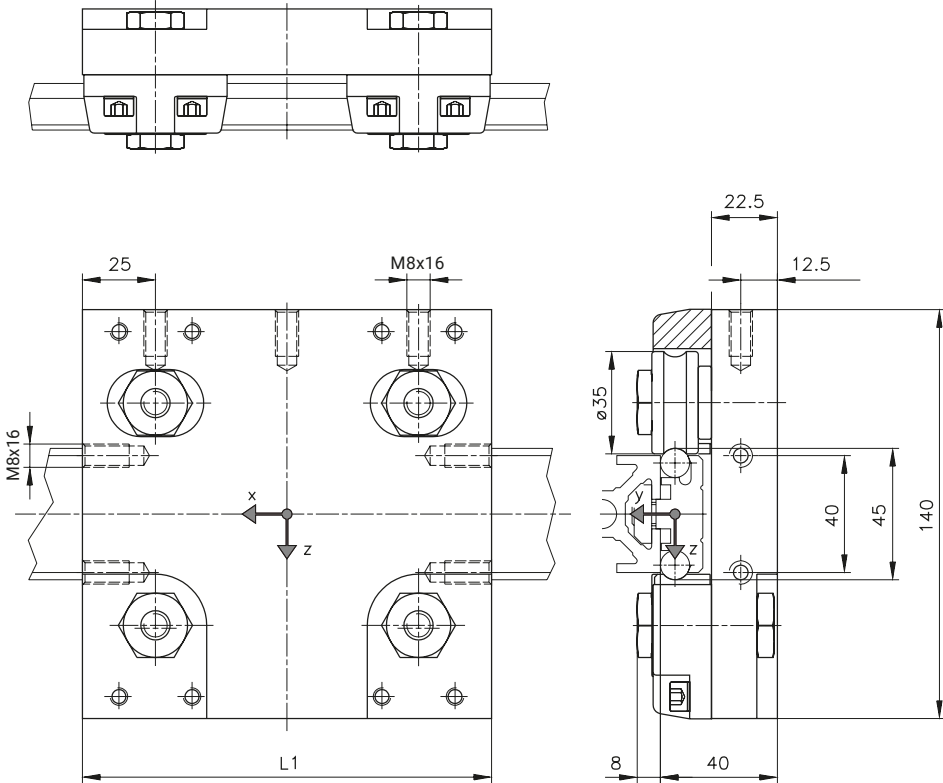
A = distance from the first borehole to the profile edge

N = number of screws



Roller Carriage LW 38.31-04

for Profile Guide PF 10-38.31/55



Technical Values

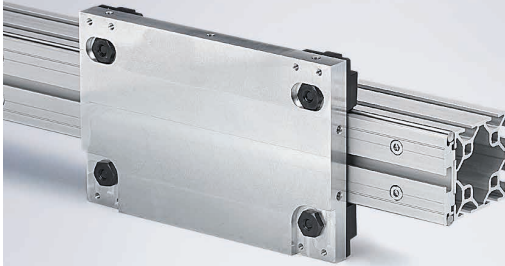
Item no.	Designation	L1 [mm]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]	m _{carriage} [kg]	Plate, individual
B90.40.042	LW 38.31-04	140	1000	2000	18	90	45	2	5009CD0140
B90.40.042	LW 38.31-04	240	1000	2000	18	190	95	2.8	5009CD0240

- Max. load specifications for $v \leq 10$ m/s and $a \leq 10$ m/s²; with $s_0 = 4$
- Max. acceleration $a = 50$ m/s² with reduced load
- Load application point max. 25 mm off-centre
- For X46 Cr13 rods and rollers, the load capacity must be reduced by 30%

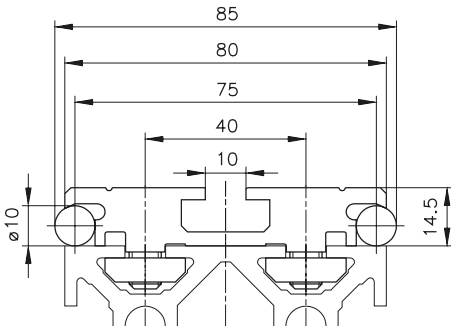
Series 40 Linear Units

Profile Guide PF 10-38.32/56

The profile guide PF 10-38.32 with or without an adapter profile can be combined with the profiles from series 40 and the roller carriage shown on the next page. When combined, they form a linear unit.

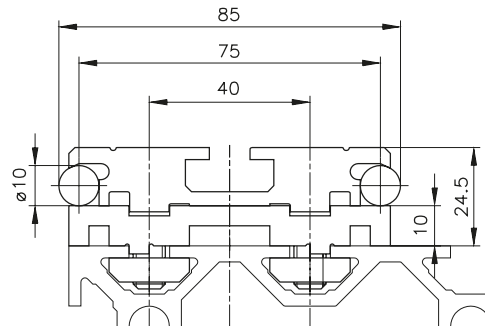


3



Profile Guide PF 10-38.32
B51.04.048

4 kg/m
L1 up to 6000 mm



Profile Guide PF 10-38.32/56
B51.04.049

With adapter profile
5,8 kg/m
L1 up to 6000 mm

Borehole spacing specifications

Range: $200 \leq L1 \leq 6000$

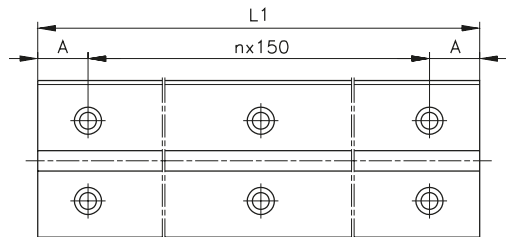
$25 \leq A < 100$

$$N = \left(\frac{L1 - (2 \times A)}{150} + 1 \right) \times 2$$

L1 = length of the profile guide

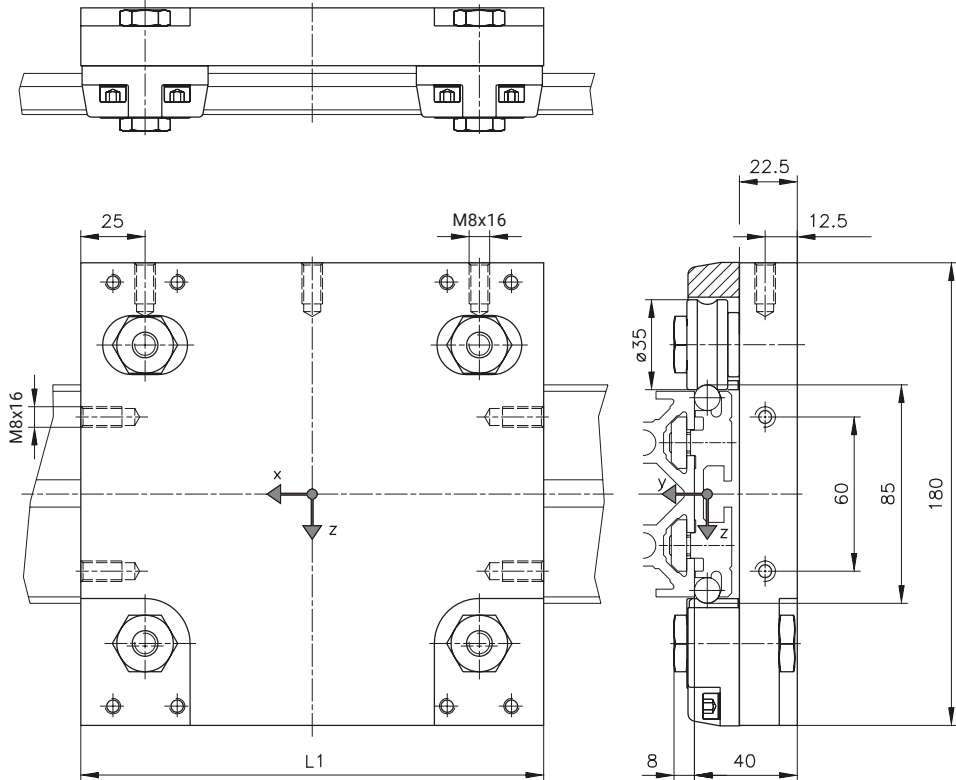
A = distance from the first borehole to the profile edge

N = number of screws



Roller Carriage LW 38.32-04

for Profile Guide PF 10-38.32/56



Technical Values

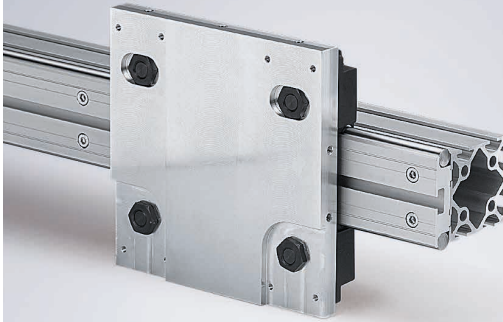
Item no.	Designation	L1 [mm]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]	m _{carriage} [kg]	Plate, individual
B90.40.043	LW 38.32-04	180	1000	2000	40	130	65	2.8	5009CE0180
B90.40.043	LW 38.32-04	280	1000	2000	40	230	115	3.8	5009CE0280

- Max. load specifications for $v \leq 10$ m/s and $a \leq 10$ m/s²; with $s_0 = 4$
- Max. acceleration $a = 50$ m/s² with reduced load
- Load application point max. 25 mm off-centre
- For X46 Cr13 rods and rollers, the load capacity must be reduced by 30%

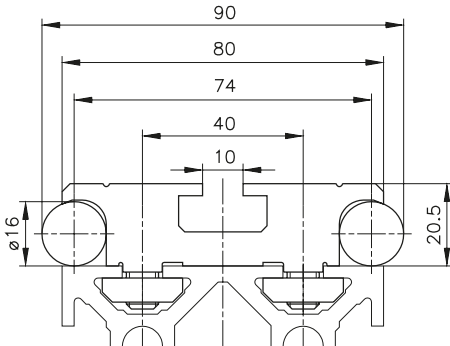
Series 40 Linear Units

Profile Guide PF 16-38.33/56

The profile guide PF 16-38.33 with or without an adapter profile can be combined with the profiles from series 40 and the roller carriage shown on the next page. When combined, they form a linear unit.

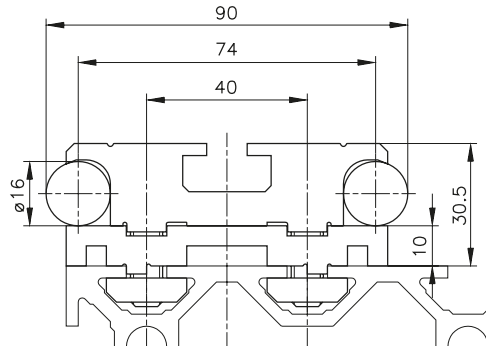


3



Profile Guide PF 16-38.33
B51.04.052

7 kg/m
L1 up to 6000 mm



Profile Guide PF 16-38.33/56
B51.04.053

With adapter profile
8.8 kg/m
L1 up to 6000 mm

Borehole spacing specifications

Range: $150 \leq L1 < 450$ $450 \leq L1 < 6000$

$25 \leq A < 75$

$125 \leq A < 225$

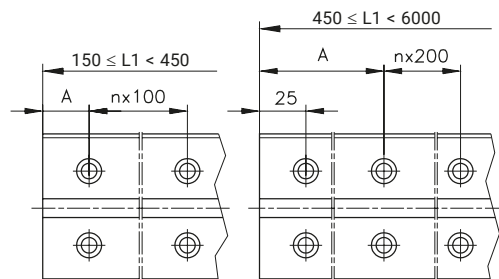
$$N = \left(\frac{L1 - (2 \times A)}{100} + 1 \right) \times 2$$

$$N = \left(\frac{L1 - (2 \times A)}{200} + 3 \right) \times 2$$

L1 = length of the profile guide

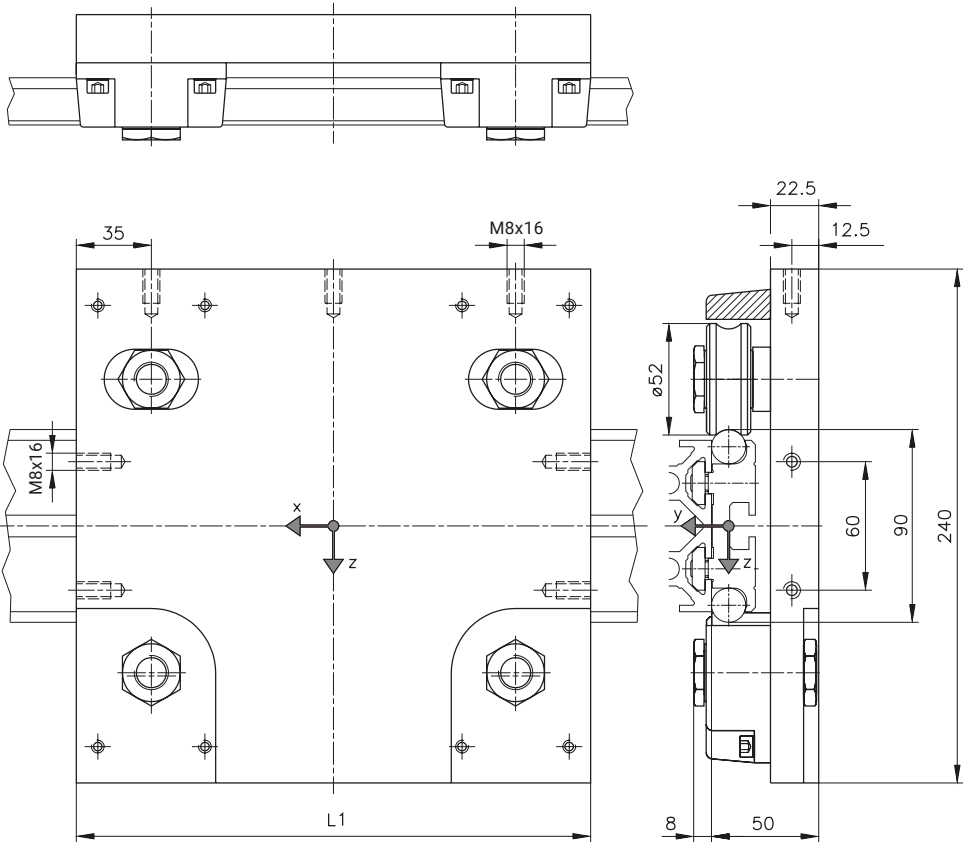
A = distance from the first borehole to the profile edge

N = number of screws



Roller Carriage LW 38.33-04

for Profile Guide PF 16-38.33/56



Technical Values

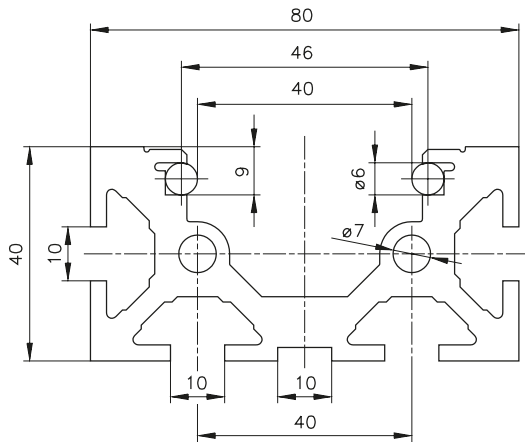
Item no.	Designation	L1 [mm]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]	m _{carriage} [kg]	Plate, individual
B90.40.044	LW 38.33-04	240	1600	4000	60	340	140	5.5	5009CF0240
B90.40.044	LW 38.33-04	400	1600	4000	60	660	260	8	5009CF0400

- Max. load specifications for $v \leq 10$ m/s and $a \leq 10$ m/s²; with $s_0 = 4$
- Max. acceleration $a = 50$ m/s² with reduced load
- Load application point max. 30 mm off-centre
- For X46 Cr13 rods and rollers, the load capacity must be reduced by 30%

Series 40 Linear Units

Internal Profile Guide PF 6-38.75

The profile guide PF 6-38.75 can be combined with the roller carriage shown on the next page. When combined, they form a linear unit.



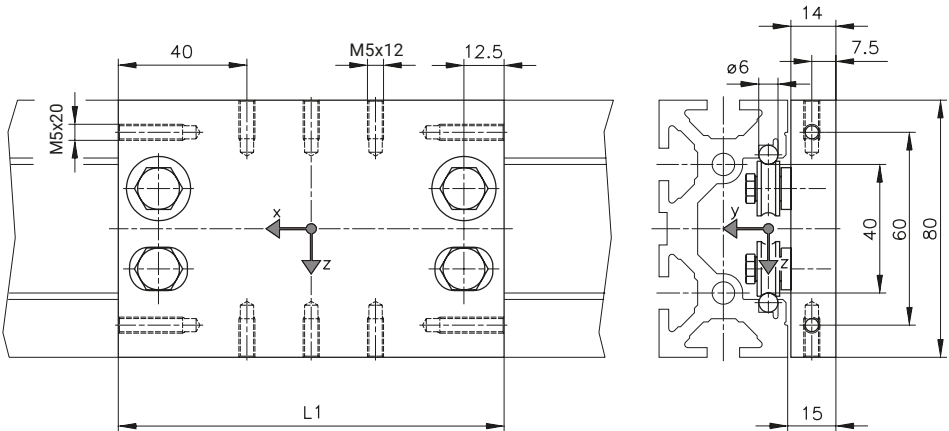
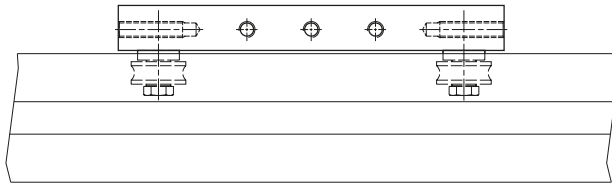
Profile Guide PF 6-38.75

B51.04.140

3.9 kg/m
L1 up to 6000 mm

Roller Carriage LW 38.75-44

For profile guide PF 6-38.75



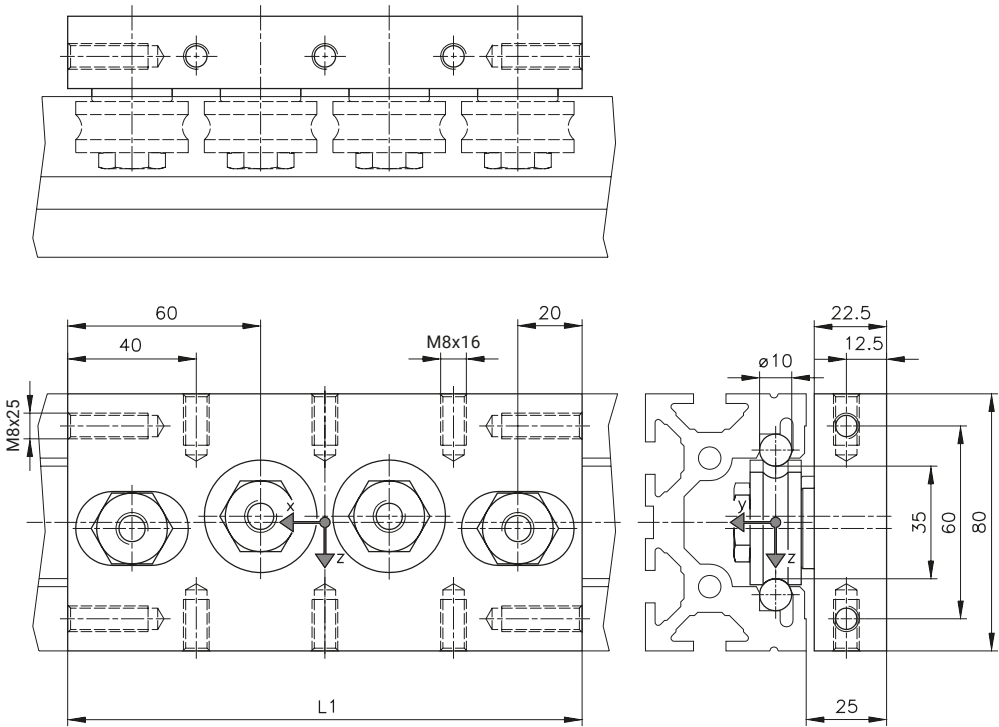
Technical Values

Item no.	Designation	L1 [mm]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]	m _{carriage} [kg]	Plate, individual
B90.40.441	LW 38.75-44	120	200	350	5	15	10	0.5	5009CN0120

- Max. load specifications for $v \leq 10$ m/s and $a \leq 10$ m/s²; with $s_0 = 4$
- Max. acceleration $a = 50$ m/s² with reduced load
- Load application point max. 15 mm off-centre
- For X46 Cr13 rods and rollers, the load capacity must be reduced by 30%

Roller Carriage LW 38.77-44

For profile guide PF 10-38.77



Technical Values

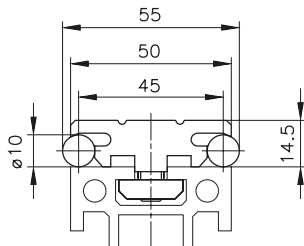
Item no.	Designation	L1 [mm]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]	m _{carriage} [kg]	Plate, individual
B90.40.443	LW 38.77-44	160	1000	1500	20	60	40	1.5	5009CO0160

- Max. load specifications for $v \leq 10$ m/s and $a \leq 10$ m/s²; with $s_0 = 4$
- Max. acceleration $a = 50$ m/s² with reduced load
- Load application point max. 25 mm off-centre
- For X46 Cr13 rods and rollers, the load capacity must be reduced by 30%

Series 50 Linear Units

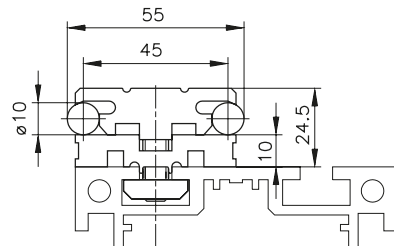
Profile Guide PF 10-38.41/60

The profile guide PF 10-38.41 with or without an adapter profile can be combined with the profiles from series 50 and the roller carriage shown on the next page. When combined, they form a linear unit.



Profile guide PF 10-38.41
B51.04.020

3 kg/m
L1 up to 6000 mm



Profile Guide PF 10-38.41/60
B51.04.015

With adapter profile
4.2 kg/m
L1 up to 6000 mm

Borehole spacing specifications

Range: $150 \leq L1 \leq 6000$

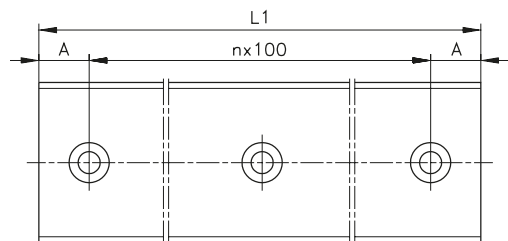
$25 \leq A < 75$

$$N = \frac{L1 - (2 \times A)}{100} + 1$$

L1 = length of the profile guide

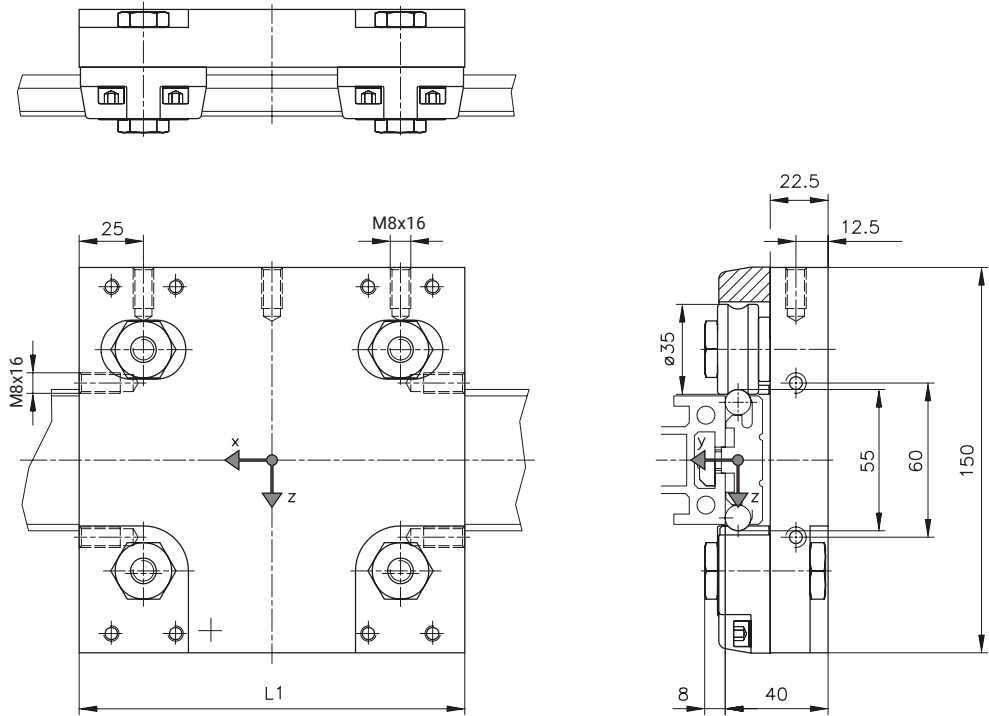
A = distance from the first borehole to the profile edge

N = number of screws



Roller Carriage LW 38.41-04

for Profile Guide PF 10-38.41/60



Technical Values

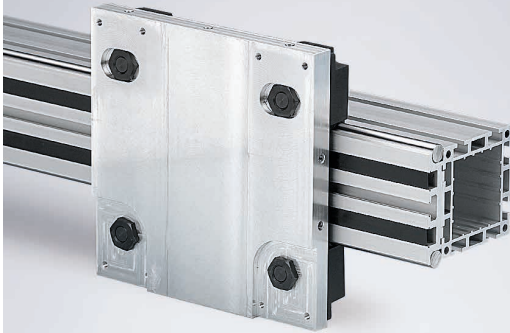
Item no.	Designation	L1 [mm]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]	m _{carriage} [kg]	Plate, individual
B90.50.042	LW 38.41-04	150	1000	2000	25	100	50	2.2	5009CG0150
B90.50.042	LW 38.41-04	250	1000	2000	25	200	100	3	5009CG0250

- Max. load specifications for $v \leq 10$ m/s and $a \leq 10$ m/s²; with $s_0 = 4$
- Max. acceleration $a = 50$ m/s² with reduced load
- Load application point max. 25 mm off-centre
- For X46 Cr13 rods and rollers, the load capacity must be reduced by 30%

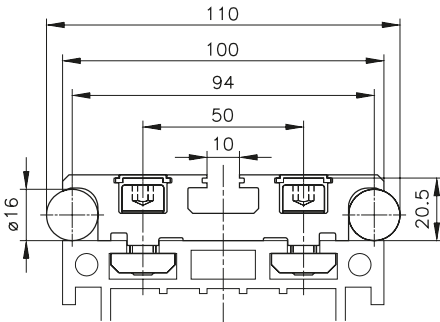
Series 50 Linear Units

Profile Guide PF 16-38.44/61

The profile guide PF 16-38.44 with or without an adapter profile can be combined with the profiles from series 50 and the roller carriage shown on the next page. When combined, they form a linear unit.

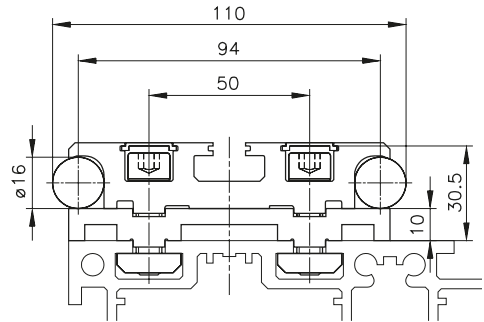


3



Profile guide PF 16-38.44
B51.04.004

6.8 kg/m
L1 up to 6000 mm



Profile guide PF 16-38.44/61
B51.04.016

With adapter profile
8.8 kg/m
L1 up to 6000 mm

Borehole spacing specifications

Range of app.: $150 \leq L1 < 450$ $450 \leq L1 < 6000$

$25 \leq A < 75$

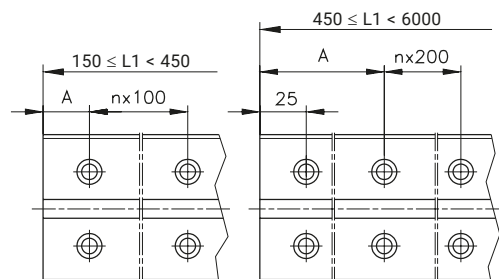
$125 \leq A < 225$

$$N = \left(\frac{L1 - (2 \times A)}{100} + 1 \right) \times 2 \quad N = \left(\frac{L1 - (2 \times A)}{200} + 3 \right) \times 2$$

L1 = length of the profile guide

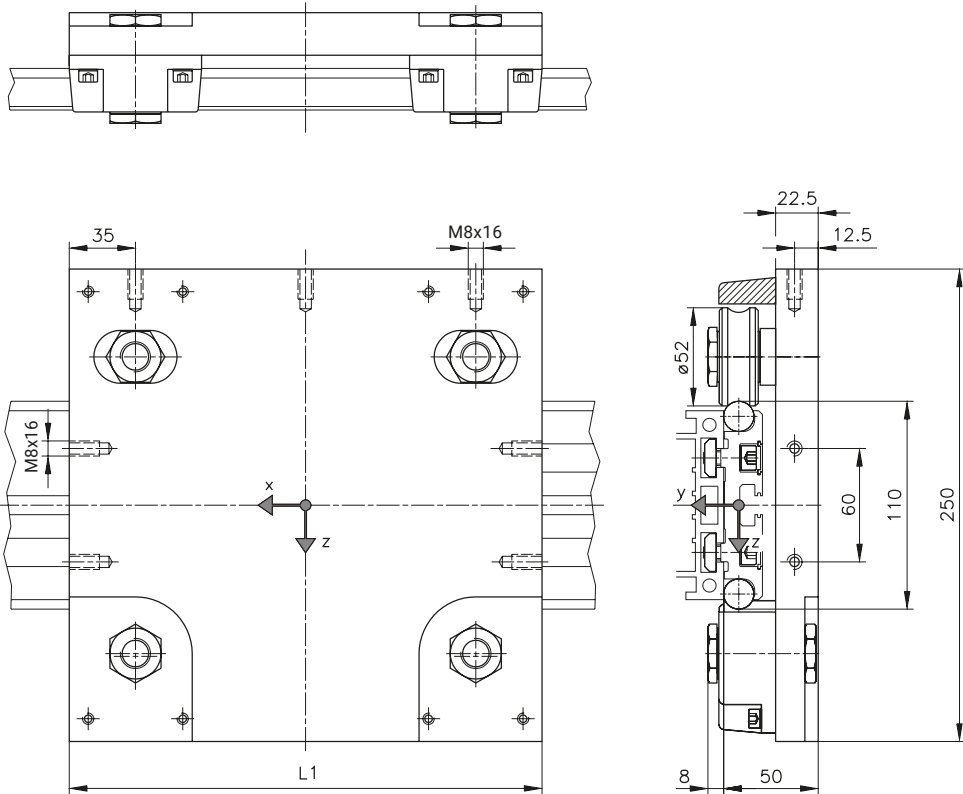
A = distance from the first borehole to the profile edge

N = number of screws



Roller Carriage LW 38.44-04

for Profile Guide PF 16-38.44/61



Technical Values

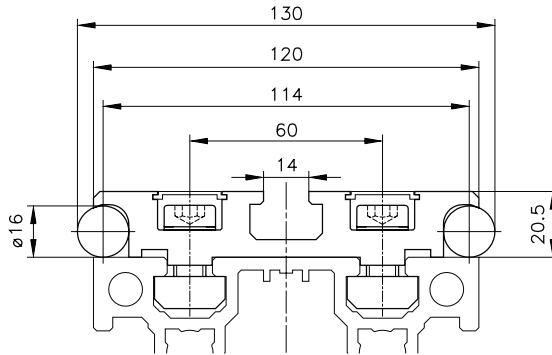
Item no.	Designation	L1 [mm]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]	m _{carriage} [kg]	Plate, individual
B90.50.044	LW 38.44-04	250	1600	4000	80	360	150	5.5	5009CI0250
B90.50.044	LW 38.44-04	450	1600	4000	80	760	300	8.5	5009CI0450

- Max. load specifications for $v \leq 10$ m/s and $a \leq 10$ m/s²; with $s_0 = 4$
- Max. acceleration $a = 50$ m/s² with reduced load
- Load application point max. 30 mm off-centre
- For X46 Cr13 rods and rollers, the load capacity must be reduced by 30%

Series 60 Linear Units

Profile guide PF 16-38.36

The profile guide PF 16-38.36 can be combined with the profiles from series 60 and the roller carriage shown on the next page. When combined, they form a linear unit.



Profile guide PF 16-38.36
B51.04.109

9.5 kg/m
L1 up to 6000 mm

Borehole spacing specifications

Range of app.: $150 \leq L1 < 450$ $450 \leq L1 < 6000$

$25 \leq A < 75$

$125 \leq A < 225$

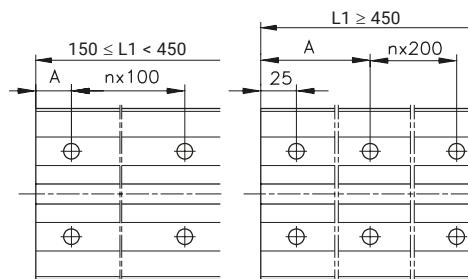
$$N = \left(\frac{L1 - (2 \times A)}{100} + 1 \right) \times 2$$

$$N = \left(\frac{L1 - (2 \times A)}{200} + 3 \right) \times 22$$

L1 = length of the profile guide

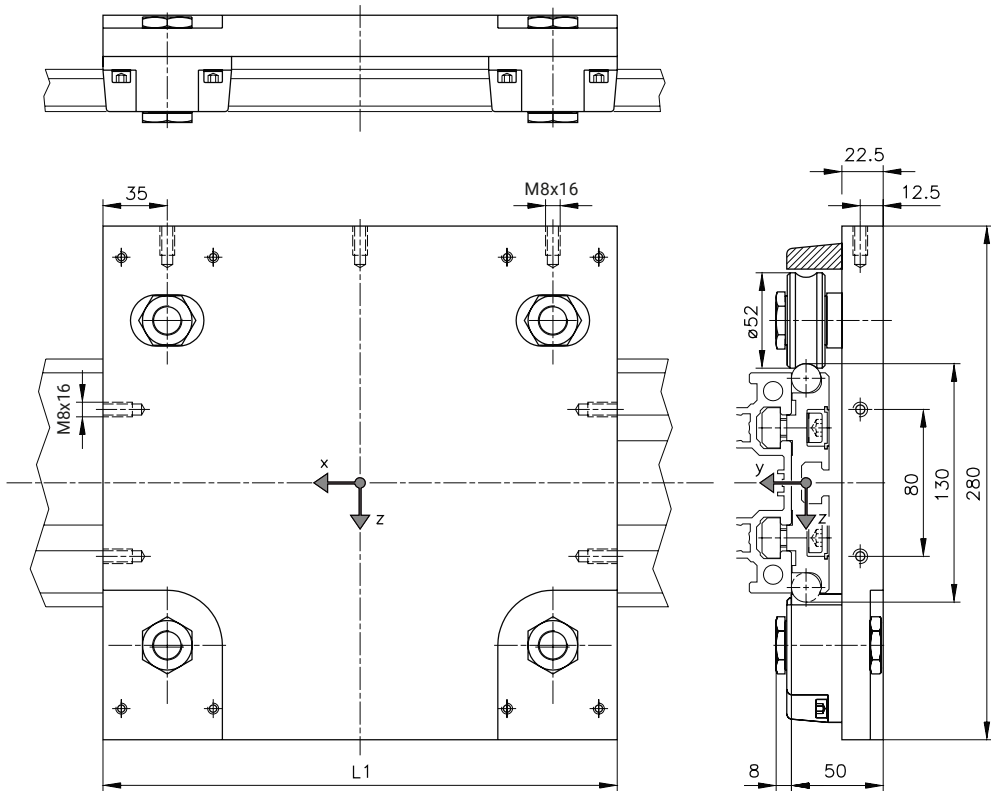
A = distance from the first borehole to the profile edge

N = number of screws



Roller Carriage LW 38.36-04

For profile guide PF 16-38.36



Technical Values

Item no.	Designation	L1 [mm]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]	m _{carriage} [kg]	Plate, individual
B90.60.042	LW 38.36-04	280	1600	4000	100	420	170	6.5	5009CL0280
B90.60.042	LW 38.36-04	480	1600	4000	100	820	330	10	5009CL0480

- Max. load specifications for $v \leq 10$ m/s and $a \leq 10$ m/s²; with $s_0 = 4$
- Max. acceleration $a = 50$ m/s² with reduced load
- Load application point max. 30 mm off-centre
- For X46 Cr13 rods and rollers, the load capacity must be reduced by 30%

Linear Modules LZR

Linear modules with timing belts (LZR) have a modular design and are installed on the track roller assemblies. Their basic components include the mounting profile, profile guide and carriage plate and the timing belt drive components required to transmit power, such as the pulleys and connectors.

The LZR design facilitates the attachment of motors as standard. With the appropriately drilled shafts, the pulleys allow the motor to be attached directly on any side. In addition, shaft ends for flanged mounting of a gearmotor with a hollow shaft, adaptations with a motor flange and coupling and an indirect drive are available on request.

For electromotive drives using a stepper motor or servomotor, we recommend using the optional single-piece drive shafts.

The linear modules can be combined in two-axis and three-axis systems and in area gantries and three-dimensional gantries.

Level of Accuracy that can be achieved by Linear Modules with Timing Belts

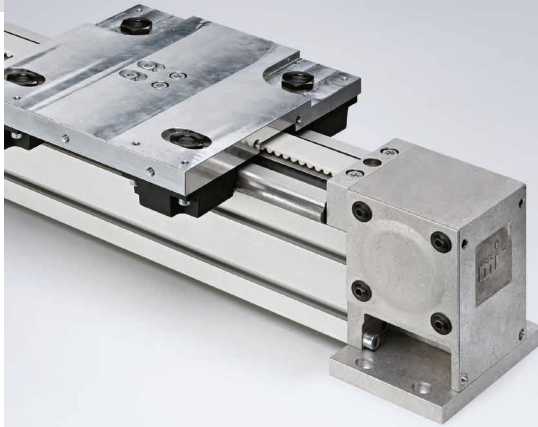
The LZR with a 8M-30-type timing belt can achieve the following values without a load:

Repeatability: 0.1 mm

Positioning accuracy: ± 0.2 mm

Reversal error: 0.2 mm

These values vary depending on the stroke length and application.



Order designation

LZR 2025-38.20-16

System designation

Mounting profile

Clamping profile

Timing belt width

Sample order

Linear module	LZR 2025-38.20-16
Item no.	B38.25.001
Stroke	=mm
Length	L =mm
Roller carriage length	L1 =mm
Drive shaft borehole	\varnothing =mm
Travel speed	v =m/s
Acceleration	a =m/s ²

Notes on the Load Specifications

For information about load specifications for track roller assemblies, refer to the information beginning on page 26.

Notes on the Load Specifications for Timing Belts

The standard timing belts used are PU (polyurethane) with steel cord tension members. Other types, including conductive belts, are available on request.

The maximum track roller assembly travel speed of $v = 10$ m/s can be achieved using timing belts with no reduction of the load capacities.

From $a > 10$ m/s² onwards, the values must be reduced by the usual load factors (e.g. without load peaks $s = 1$ to high load peaks $s = 2.5$).

The allowable tension loads are based on a 0.4% elongation of the timing belt.

The breaking strength of the belts is significantly higher. The normal usable belt pull strength (F_u) and required pretension (F_v) is approximately:

$$F_{\text{allowable}} = F_v + F_u \quad \text{with } F_v = F_u$$

Timing Belts	AT 5-16	5M-15	8M-30
F_{breaking}	3900 N	3600 N	14900 N
$F_{\text{allowable}}$	1200 N	1150 N	4000 N
$F_v = F_u$	600 N	575 N	2000 N

The usable starting torque results from the maximum usable belt pull strength, of the engaged teeth and the pitch diameter of the timing belt pulley.

The values for the mk LZR modules are:

Timing belt	AT 5-16	5M-15	8M-30
D_{Pitch}	41.4 mm	50.9 mm	71.3 mm
Z	26	32	28
M_{Drive}	12 Nm	15 Nm	70 Nm

Motor Selection/ Drive Design

For the drive selection, several factors must be considered, including the timing belt (especially the allowable belt pull strength and required stiffness) and the motor (especially the starting torque, the revolutions per minute and the resulting performance). The most important consideration is the required driving force. As a simple starting point for the calculations, the transition point from acceleration to constant speed can be used.

Constant acceleration (a = constant):

$$v = a \cdot t = \sqrt{2 \cdot a \cdot s}$$

Constant speed (v = constant):

$$v = \frac{s}{t}$$

Max. driving force:

$$F_{\text{Drive}} = F_a + F_{\text{Roll}} + F_{\text{Empty}} + F_{\text{Additional}}$$

$$F_a = m \cdot (a+g)$$

- with m = moving mass in kg
- a = const. acceleration in m/s²
- $g = 10$ m/s², for vertical travel
- $g = 0$ m/s², for horizontal travel

$$F_{\text{Roll}} = F_N \cdot \mu_{\text{Roll}}$$

with $F_N = F_G$ for horizontal travel

$$\mu_{\text{Roll}} = 0.05 \text{ for lightly preloaded track roller}$$

$F_{\text{Empty}} = 50$ to 100 N depending on the module and pre-tension of the timing belt

$F_{\text{Additional}} =$ additional loads from the application

$$F_{\text{Drive}} = m \cdot (a+g) + F_N \cdot 0.05 + 100 \text{ N} + F_{\text{Additional}}$$

For timing belt selection:

Indicated $F_{\text{Drive}} < F_u$

For motor selection:

$$M_{\text{req}} = \frac{F_{\text{Drive}} \cdot D_{\text{Pitch}} [\text{m}]}{2 \cdot \eta}$$

$$n_{\text{req}} = \frac{v \cdot 60}{D_{\text{Pitch}} [\text{m}] \cdot \pi}$$

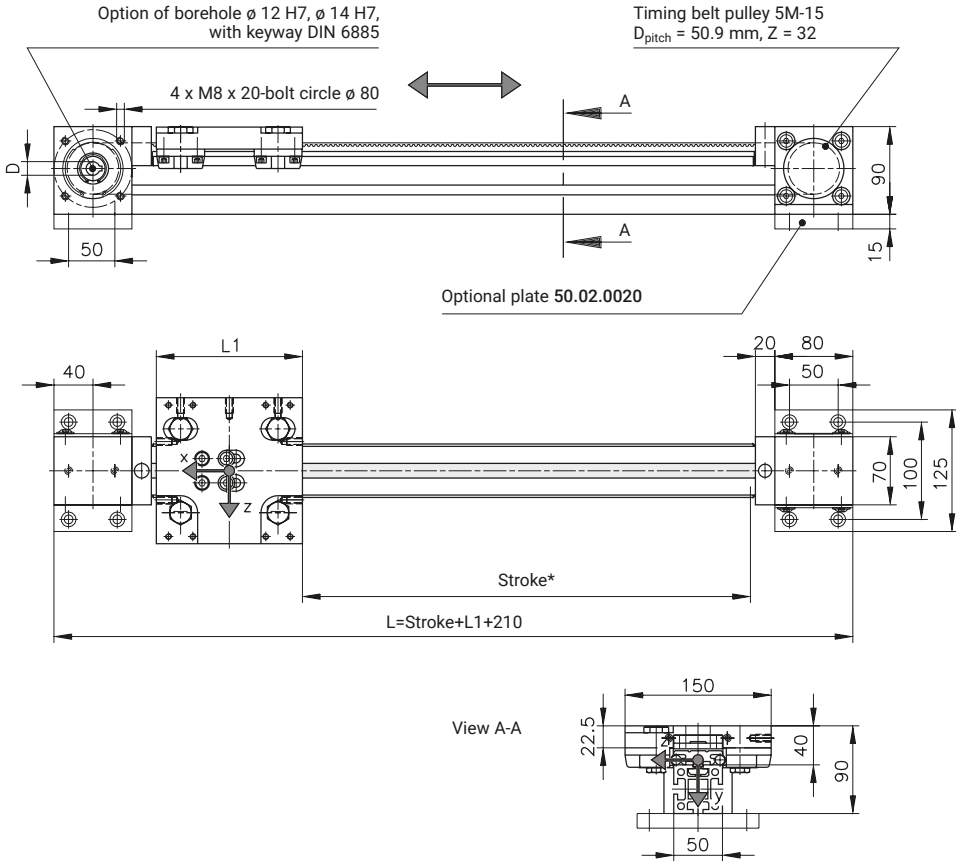
$$P_{\text{req}} = \frac{F_{\text{Drive}} \cdot v}{\eta}$$

With D_{Pitch} in m of timing belt pulley $\eta = 50$ to 75% depending on selected drive (gearbox, motor, etc.)

v in m/s

Linear Modules LZR

LZR 2000-38.41-15 with Plate Carriage



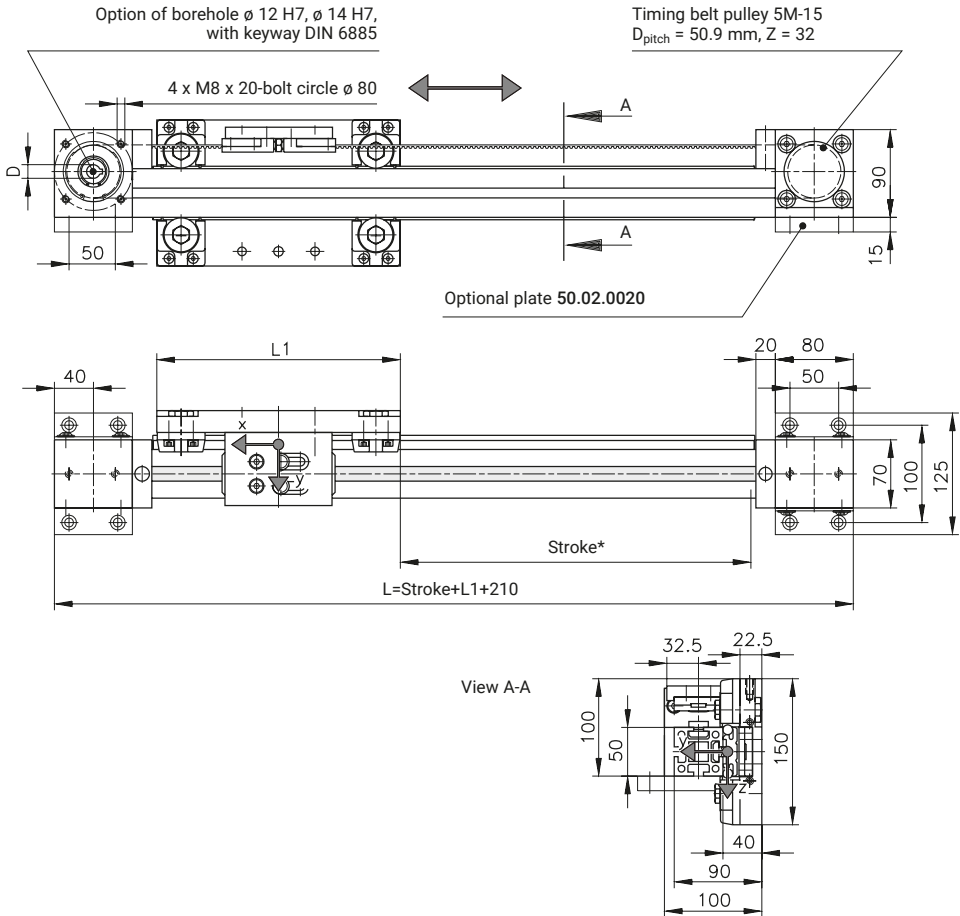
Load Specifications for LZR 2000-38.41-15 with Plate Carriage

Item no.	L1 [mm]	F_x^{**} [N]	F_{y0} [N]	F_{z0} [N]	M_{x0} [Nm]	M_{y0} [Nm]	M_{z0} [Nm]
B38.02.003	150	1150	1000	2000	25	100	50
B38.02.003	250	1150	1000	2000	25	200	100

* Maximum stroke between the mechanical stops. Note the discharge section!

** $F_x = F_{\text{allowable}}$; $F_u = 575\text{ N} = F_v$

LZR 2000-38.41-15 with Side Mounted Plate Carriage



Load Specifications for LZR 2000-38.41-15 with Side Mounted Plate Carriage

Item no.	L1 [mm]	F_x^{**} [N]	F_{y0} [N]	F_{z0} [N]	M_{x0} [Nm]	M_{y0} [Nm]	M_{z0} [Nm]
B38.02.007	250	1150	1000	2000	25	200	100

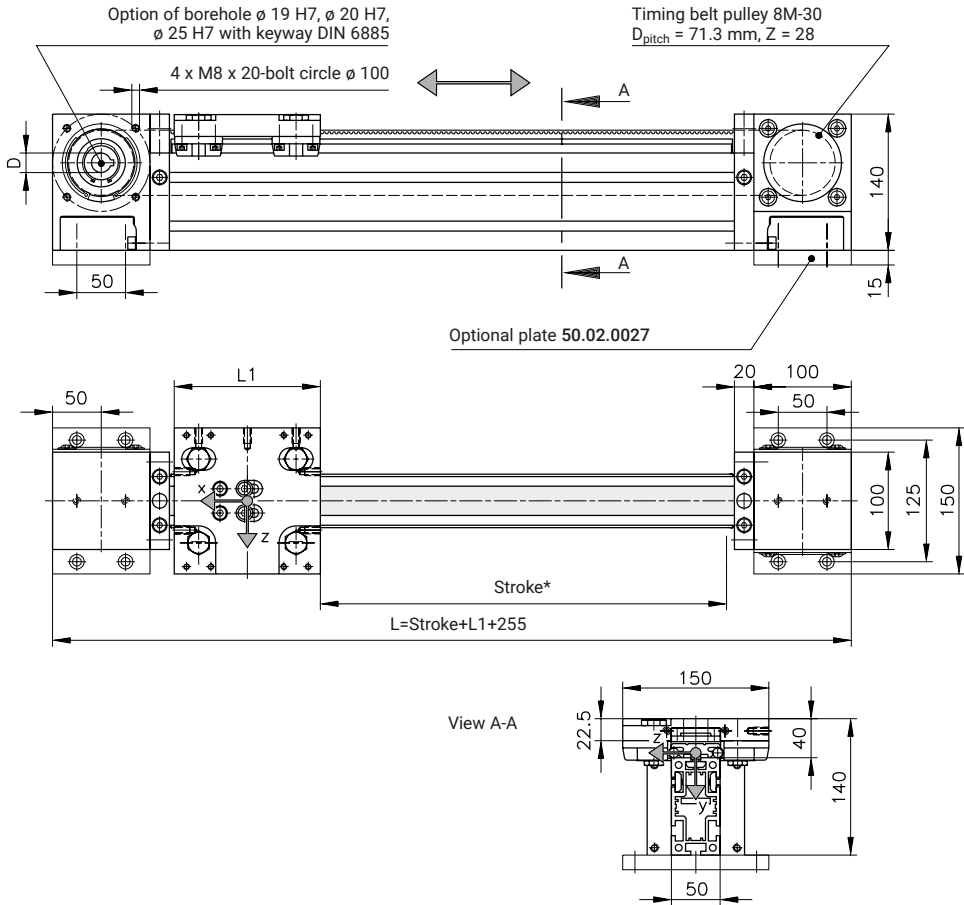
* Maximum stroke between the mechanical stops. Note the discharge section!

** $F_x = F_{allowable}$; $F_u = 575 \text{ N} = F_v$

Linear Modules LZR

3

LZR 2004-38.41-30 with Plate Carriage



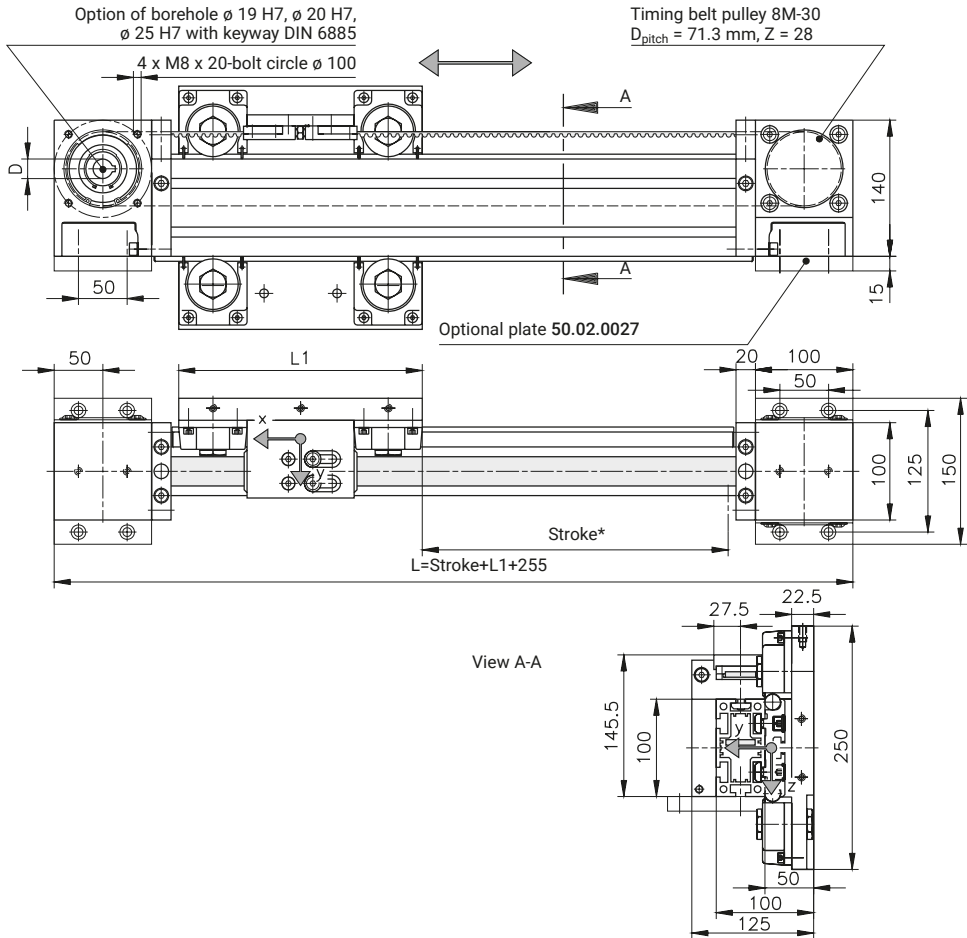
Load Specifications for LZR 2004-38.41-30 with Plate Carriage

Item no.	L1 [mm]	F_x^{**} [N]	F_{y0} [N]	F_{z0} [N]	M_{x0} [Nm]	M_{y0} [Nm]	M_{z0} [Nm]
B38.02.004	150	4000	1000	2000	25	100	50
B38.02.004	250	4000	1000	2000	25	200	100

* Maximum stroke between the mechanical stops. Note the discharge section!

** $F_x = F_{allowable}$; $F_u = 2000$ N = F_v

LZR 2004-38.44-30 with Side Mounted Plate Carriage



Load Specifications for LZR 2004-38.44-30 with Side Mounted Plate Carriage

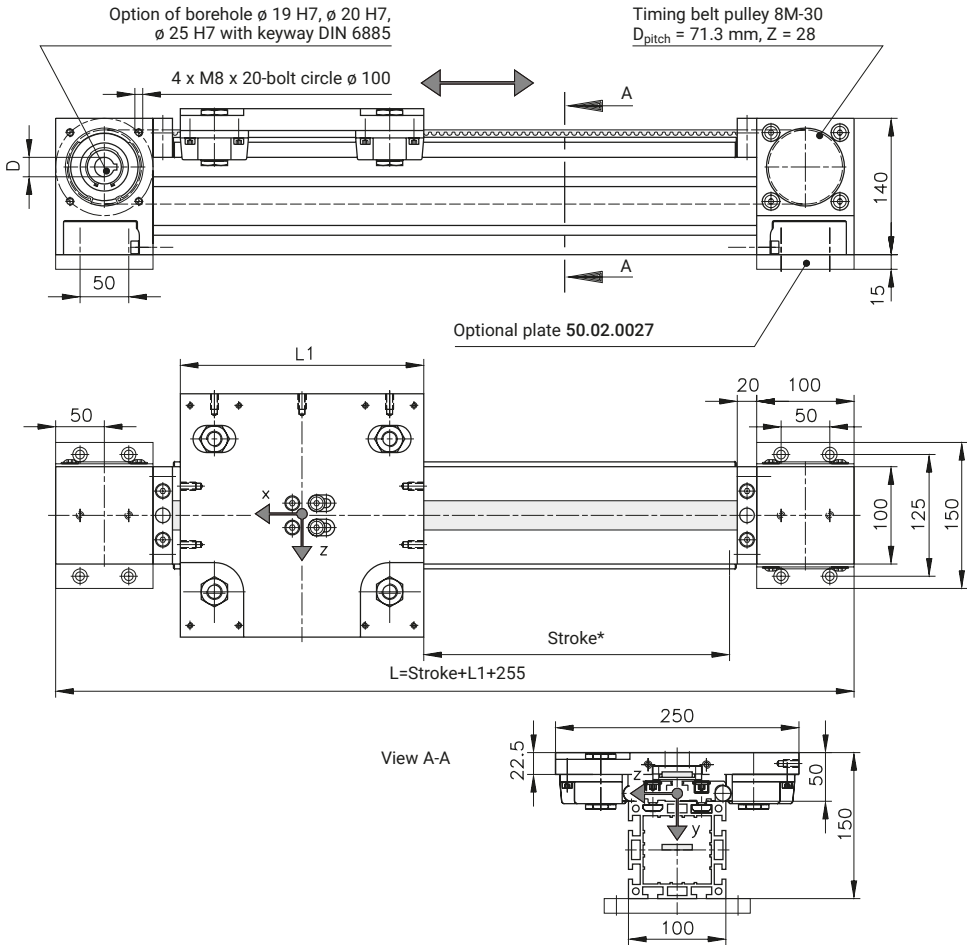
Item no.	L1 [mm]	F _x ** [N]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]
B38.02.005	250	4000	1600	4000	80	350	150
B38.02.005	450	4000	1600	4000	80	760	300

* Maximum stroke between the mechanical stops. Note the discharge section!

** F_x = F_{allowable}; F_u = 2000 N = F_v

Linear Modules LZR

LZR 2005-38.44-30 with Plate Carriage



Load Specifications for LZR 2005-38.44-30 with Plate Carriage

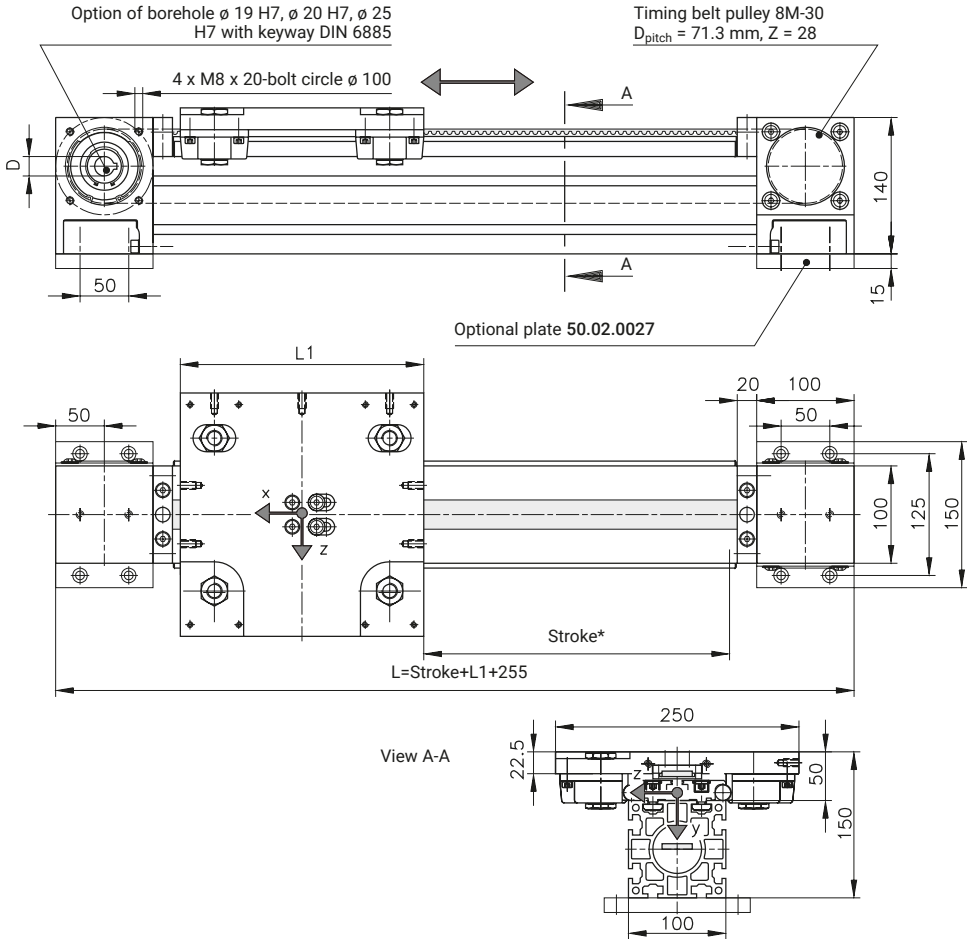
Item no.	L1 [mm]	F_x^{**} [N]	F_{y0} [N]	F_{z0} [N]	M_{x0} [Nm]	M_{y0} [Nm]	M_{z0} [Nm]
B38.02.006	250	4000	1600	4000	80	350	150
B38.02.006	450	4000	1600	4000	80	760	300

* Maximum stroke between the mechanical stops. Note the discharge section!

** $F_x = F_{allowable}$; $F_u = 2000 \text{ N} = F_v$

Linear Modules LZR

LZR 2011-38.44-30 with Plate Carriage



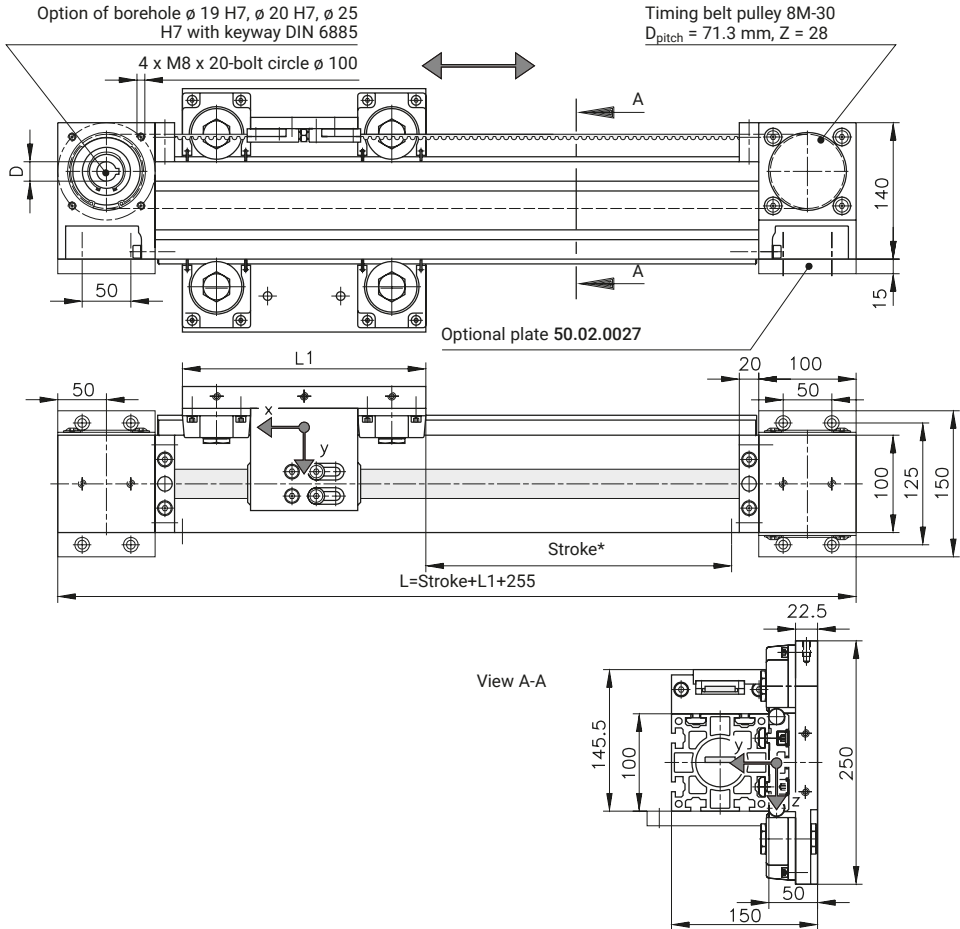
Load Specifications for LZR 2011-38.44-30 with Plate Carriage

Item no.	L1 [mm]	F _x ** [N]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]
B38.02.011	250	4000	1600	4000	80	350	150
B38.02.011	450	4000	1600	4000	80	760	300

* Maximum stroke between the mechanical stops. Note the discharge section!

** F_x = F_{allowable}; F_u = 2000 N = F_v

LZR 2011-38.44-30 with Side Mounted Plate Carriage



Load Specifications for LZR 2011-38.44-30 with Side Mounted Plate Carriage

Item no.	L1 [mm]	F _x ** [N]	F _{y0} [N]	F _{z0} [N]	M _{x0} [Nm]	M _{y0} [Nm]	M _{z0} [Nm]
B38.02.010	250	4000	1600	4000	80	350	150
B38.02.010	450	4000	1600	4000	80	760	300

* Maximum stroke between the mechanical stops. Note the discharge section!

** F_x = F_{allowable}; F_u = 2000 N = F_v

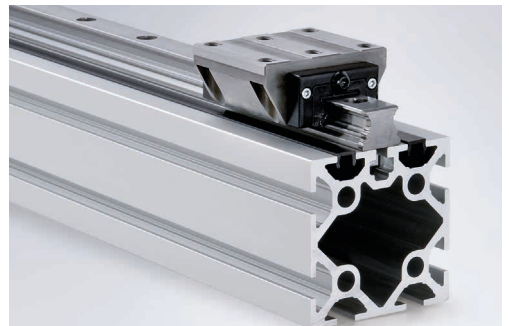
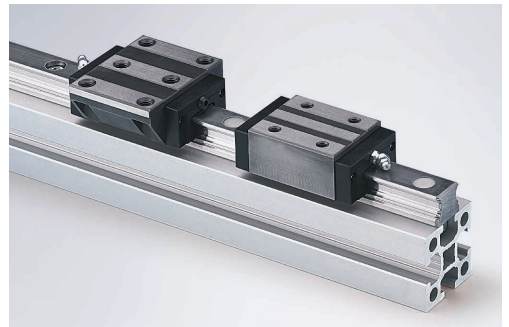
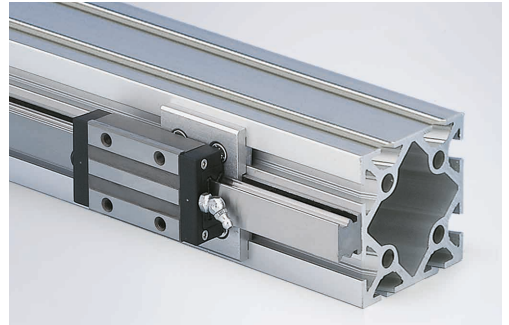
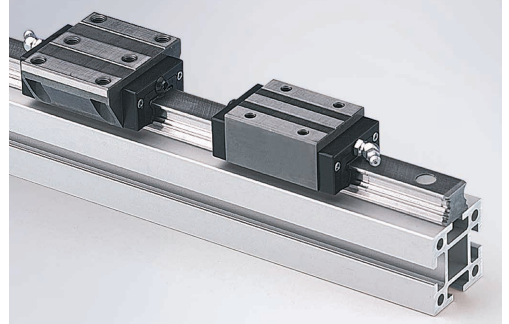


» Compact linear units with recirculating ball bearing guide. «

Recirculating ball bearing guides feature high load capacity along with outstanding precision. They have a very compact design. The recirculating ball bearing units can bear loads along multiple axes and are extremely stiff thanks to the steel rails mounted on the guide profile.

A recirculating ball bearing unit consists of a track and a guide carriage with four rows of interior ball bearings, which are recirculated in closed channels with plastic recirculation mechanisms. The recirculating ball bearing unit's roller carriage consists of hardened, ground steel and can be slid directly from the guard rail onto the track.

Our standard guide carriages are lightly pre-tensioned, making them suitable for most common applications. You may require higher pre-tension or no pre-tension, depending on your requirements. The guide carriages are custom-tailored to your specific conditions.



Benefits of mk Recirculating Ball Bearing Guides

- High load capacity and high stiffness
- Compact design
- Just one track for different types of roller carriage
- Lightly pre-tensioned (standard), available with play or high pre-tension
- Medium to high acceleration up to $a = 30\text{m/s}^2$
- Medium to high speed up to $v = 5\text{ m/s}$
- Four-row multi-axial recirculating ball bearing guide bears loads in all directions (forces and torques)
- High precision with appropriate contact surfaces

Recirculating Ball Bearing Guides

Recirculating Ball Bearing Units

General design

mk recirculating ball bearing units consist of a track and the guide carriage.

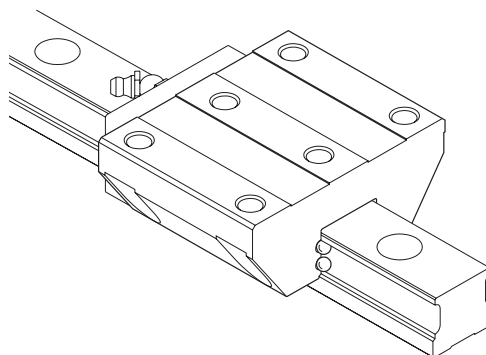
The roller carriage for the recirculating ball bearing unit is made from hardened and ground steel. Closed channels with plastic recirculation mechanisms recirculate the four rows of ball bearings. The roller carriage can be slid directly from the guard rail onto the track.

The recirculating ball bearing units can carry loads from any direction and have very rigid, heavy-duty linear guides.

The standard mk guide carriages are lightly pre-tensioned, making them suitable for most common applications. If multiple carriages are arranged on a rail or in parallel, then we recommend using carriages with no pre-tension and little play to provide better misalignment compensation and ease of movement.

For products with high rigidity or fluctuating loads, we recommend carriages with strong pre-tension and precise, rigid contact surfaces. mk can supply these versions on request.

The specified maximum load specifications already take into account a static safety factor of $s_0 = 5$ in relation to plastic deformation on the roller contact, and $s_0 = 2$ for screw connections with 8.8 screws.



Sample order for a guide

Recirculating ball bearing guide KU 25.10

Item no. **B51.04.404**

Size =mm

Length L =mm

Sample order for a carriage

Guide carriage KU 25.11

Item no. **K116041125**

Size =mm

Carriage Normal

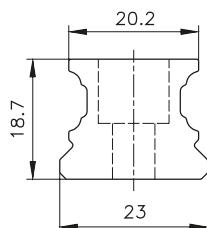


Recirculating Ball Bearing Guides

Recirculating Ball Bearing Guide KU 25.10

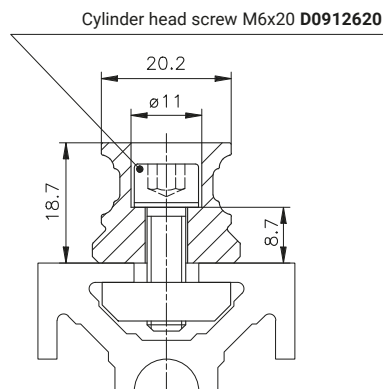
The track KU 25.10 must be combined into one unit with the guide carriages KU 25.11 and KU 25.13. However, they must be ordered individually.

The KU 25.10 track is especially suitable for Series 40 and 50. Due to its small contact surface, it is not suitable for the 14 mm slot in Series 60.



Track KU 25.10
K116041025

m = 2.7 kg/m



Track KU 25.10 with
mounting elements
B51.04.404

Borehole spacing specifications

Support rail, L up to 1980 mm, single piece

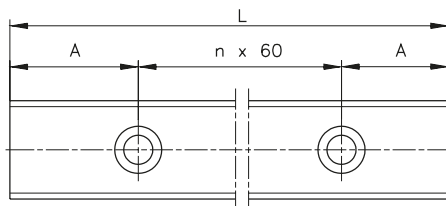
Scope of application for A: $20 \leq A < 50$

$$N = \frac{L1 - (2 \times A)}{60} + 1 \text{ (+1 per joint)}$$

L1 = length of the support rail

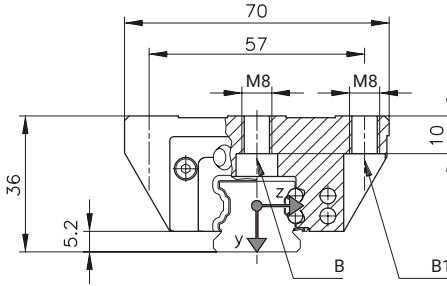
A = distance from the first borehole to the profile edge (symmetrical)

N = number of screws

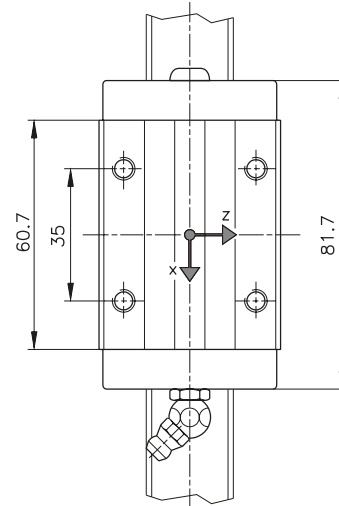
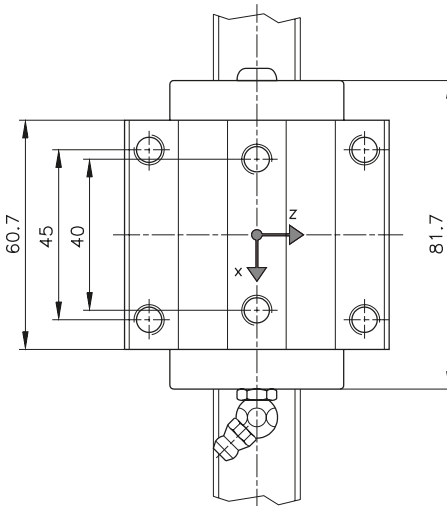
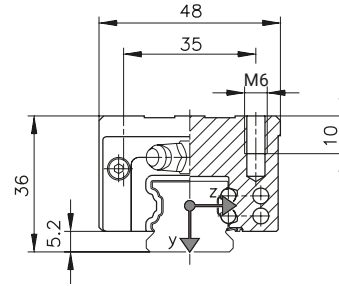


Guide Carriages

Guide carriage, normal
 KU 25.11



Guide carriage, narrow
 KU 25.13



B= through-bore for screw M6 DIN 6912

B1= through-bore for screw M6 DIN EN ISO 4762

Load specifications

Item no.	Designation	F_{y0} [N]	F_{z0}^* [N]	M_{x0} [Nm]	M_{y0} [Nm]	M_{z0} [Nm]	C_0 [N]	C_0 [N]	m_{carriage} [kg]
K116041125	KU 25.11	7000	7000	75	75	75	37,000	17,900	0.71
K116041325	KU 25.13	7000	7000	75	75	75	37,000	17,900	0.56

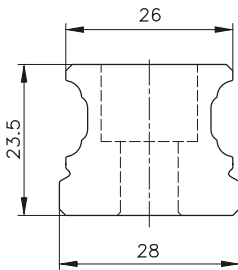
*Lateral load without close fit,
 only frictional connection on design profile with screw 8.8 – reduced to 2000N

Recirculating Ball Bearing Guides

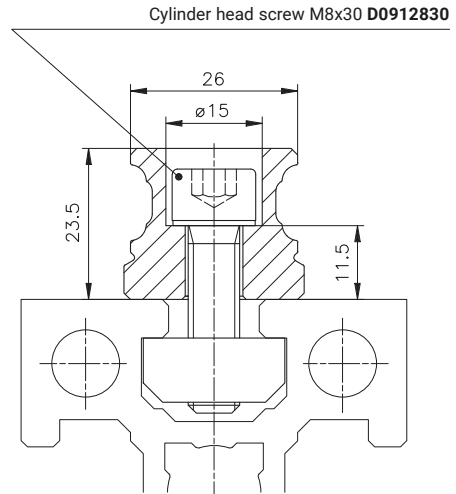
Recirculating Ball Bearing Guide KU 30.10

The track KU 30.10 must be combined into one unit with the guide carriages KU 30.11 and KU 30.13. However, they must be ordered individually.

The KU 30.10 track is especially suitable for Series 60.



Track KU 30.10
K116041030
 m = 4.3 kg/m



Track KU 30.10 with mounting elements
B51.04.406

Borehole spacing specifications

Support rail, L1 up to 2000 mm, single piece

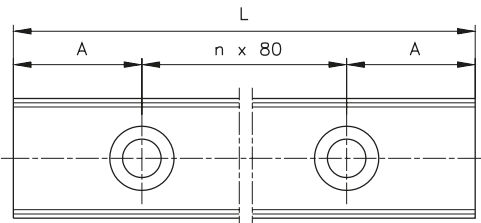
Scope of application for A: $20 \leq A < 60$

$$N = \frac{L1 - (2 \times A)}{80} + 1 \text{ (+1 per joint)}$$

L1 = length of the support rail

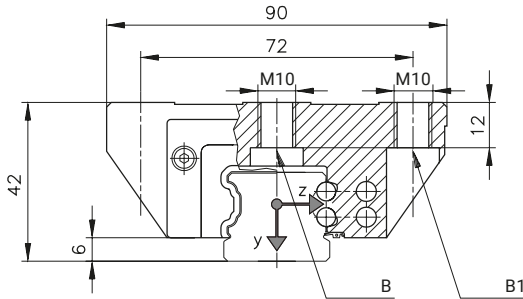
A = distance from the first borehole to the profile edge (symmetrical)

N = number of screws

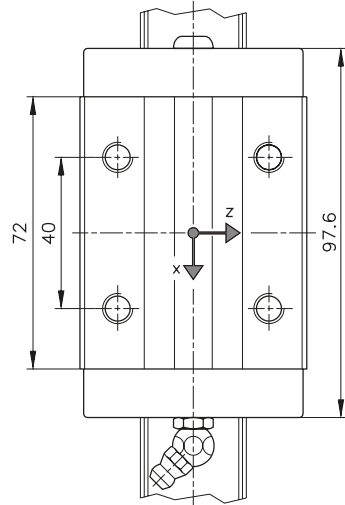
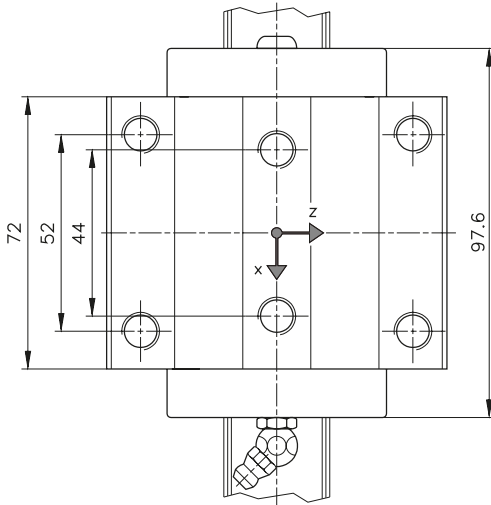
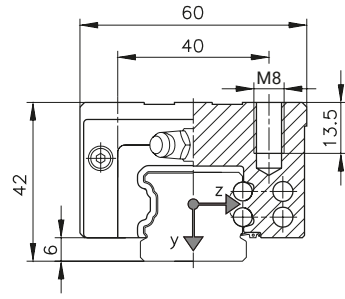


Guide Carriages

Guide carriage, normal
 KU 30.11



Guide carriage, narrow
 KU 30.13



B= through-bore for screw M8 DIN 6912

B1= through-bore for screw M8 DIN EN ISO 4762

Load specifications

Item no.	Designation	F_{y0} [N]	F_{z0}^* [N]	M_{x0} [Nm]	M_{y0} [Nm]	M_{z0} [Nm]	C_0 [N]	C_0 [N]	m_{carriage} [kg]
K116041130	KU 30.11	10000	10000	140	140	140	55,000	27,500	1.4
K116041330	KU 30.13	10000	10000	140	140	140	55,000	27,500	1.09

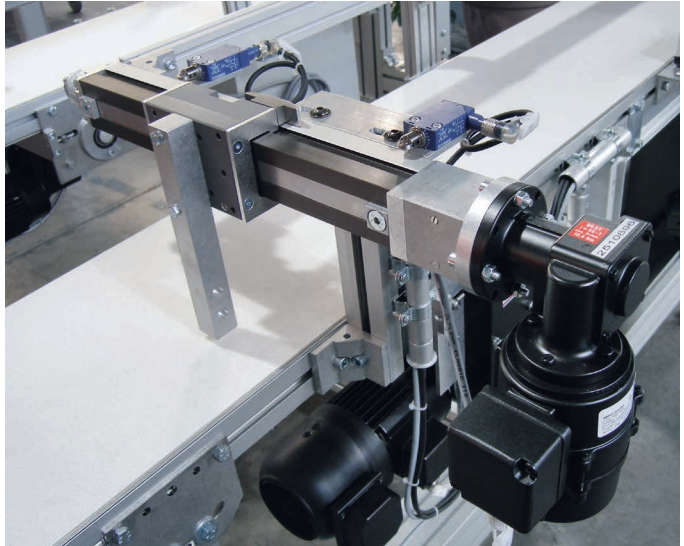
*Lateral load without close fit,
 only frictional connection on structural profile with screw 8.8 – reduced to 3500N

Gliding Assemblies

5



Electromotive VST 2015 with recirculating ball bearing guide



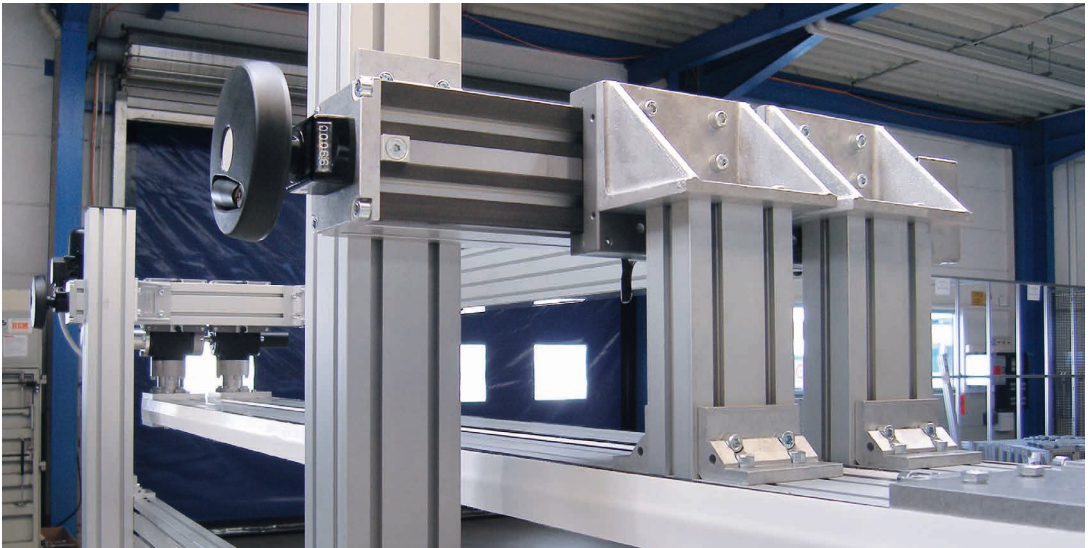
Dual electromotive VST 2015 for automatic width adjustment with scanning via safety limit switch



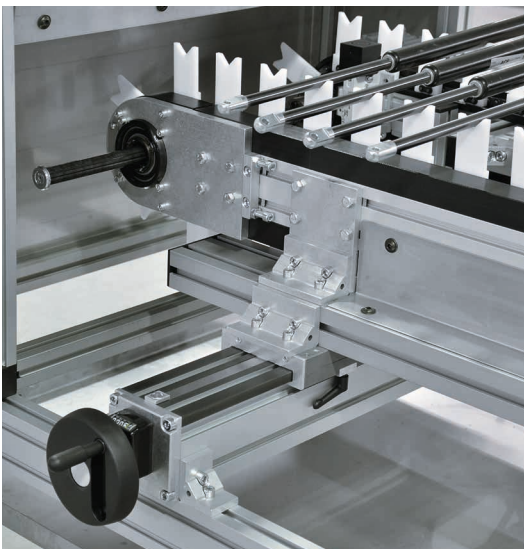
Dual VST 2015 with manual digital display for adjusting the stop bar



Manual two-axis adjustment system for holding a marking device with VST 2015



Dual VST 2011 for manual lane width adjustment on a side conveyor



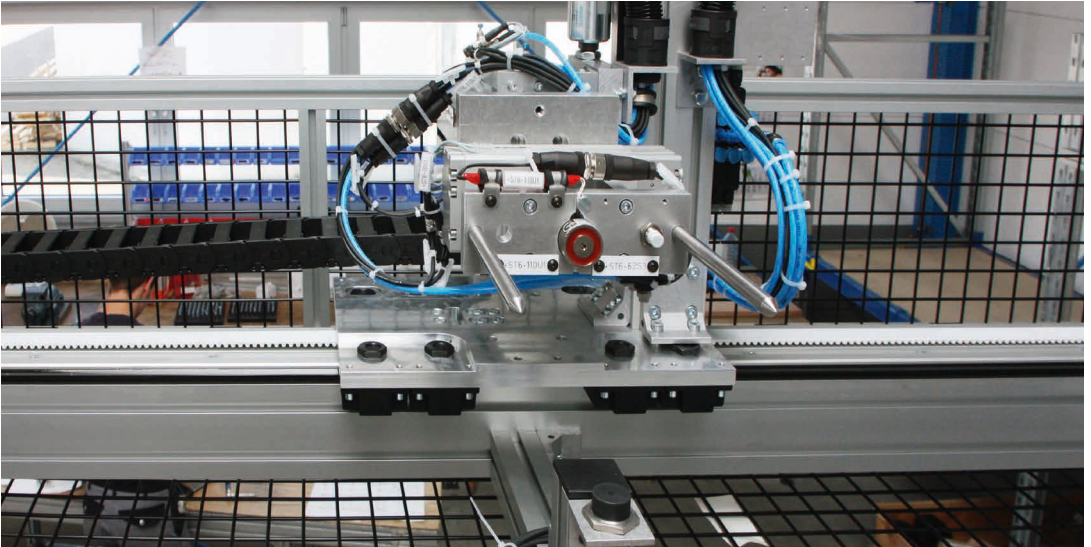
VST 2011 adjusting unit used for semi-automatic conveyor width adjustment in a chain conveyor system



Electromotive VST 2011 with custom measuring system on LZR 2005-38.44-30

Track Roller Assemblies

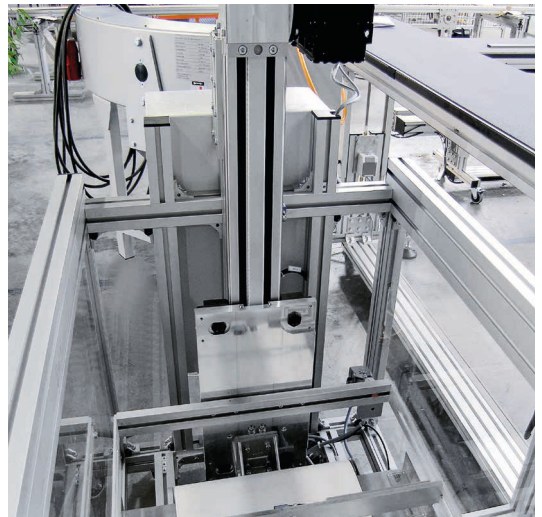
5



Horizontal slides comprised of linear module type LZR 2005-38.44-30 with fork grippers and swivel unit for moving and emptying workpiece baskets



Linear module type LZR 2005-38.44-30 as a direct length measuring system with measuring head on the roller carriage

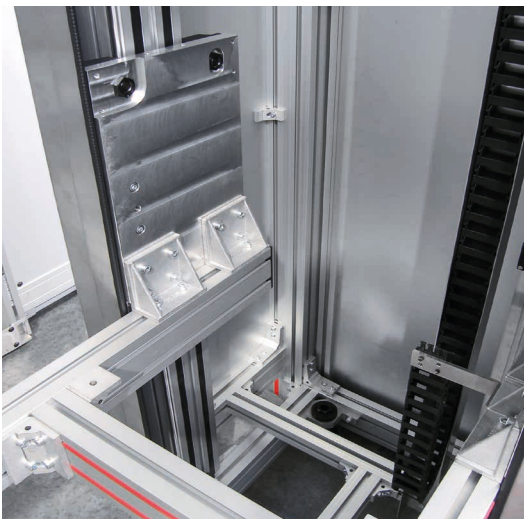


Linear module type LZR 2005-38.44-30 with motor and controller as a lift with a belt conveyor



5

Pneumatic linear module with PF 38.77 and LW 38.77-44
 as a transfer unit with 10 vacuum suction grippers



Double-LZR 2005-38.44-30 with side
 mounted carriage plate and
 cantilever for conveyor as lift



Linear unit LZR 2004-38.41-30
 drive coupled via a slip clutch

Track Roller Assemblies

5



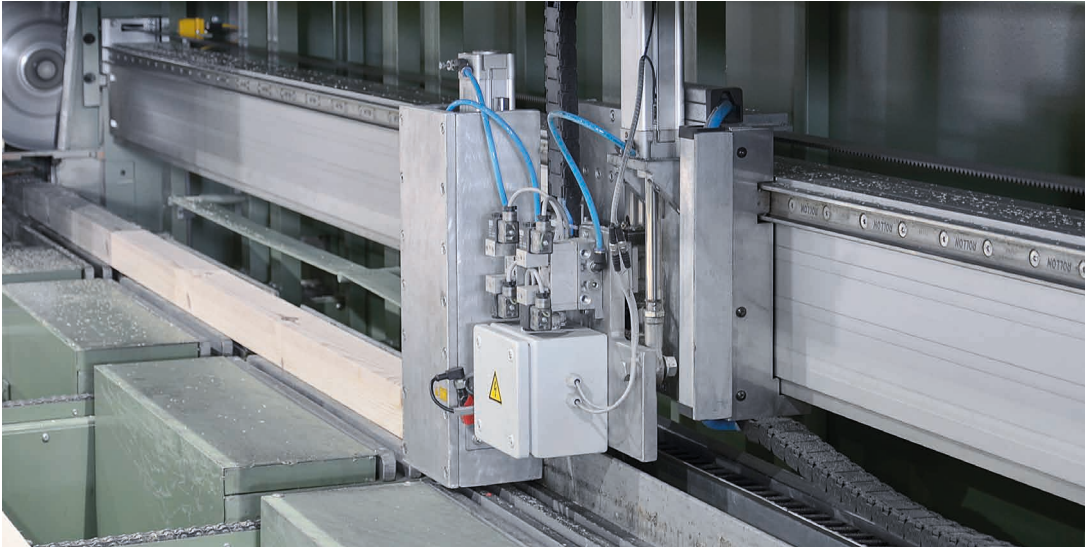
Two-dimensional gantry with vacuum gripper as a handling and loading system for steel. Two independent loading systems on a common X axis with gear rack with track rollers and riding rack drive



Base LZR 2005-38.44-30 with side roller carriage on foamed combined profile as gantry, with support rollers for torque loads and manual VST 2011 as Z axis

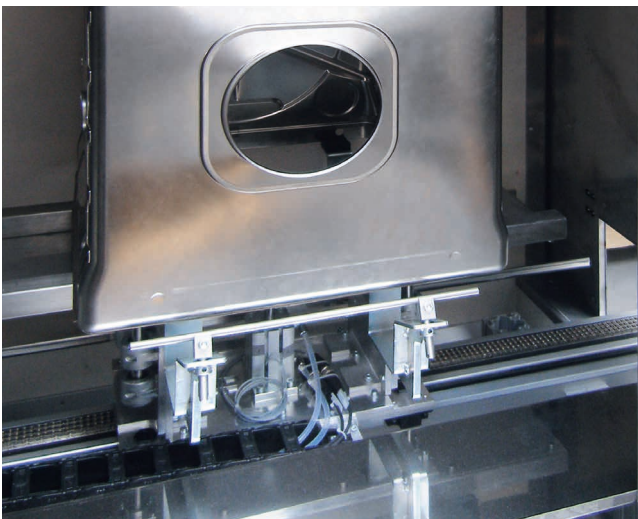


Two-axis gantry with driven linear modules, gripper and controller

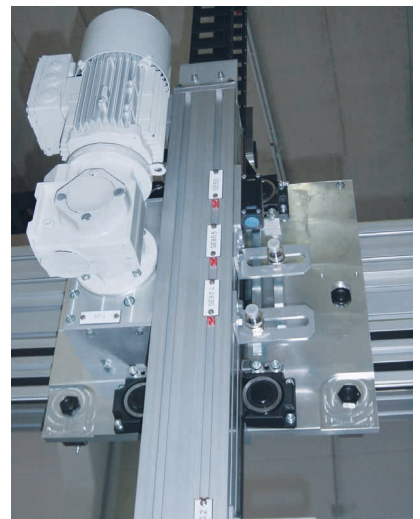


5

LZR Series 60 linear module based on the mk 2060.07 profile with track rollers and rails from Rollon



Linear module with chain for HT range and in ESD version Product intake with pneumatic lift for lifting/depositing before, in and after the oven



Gantry with LZR 2005 on foamed combined profile Roller carriage with support rollers as cross-carriage with LZR 2005 and Omega drive as X-Z surface gantry

Track Roller Assemblies

5



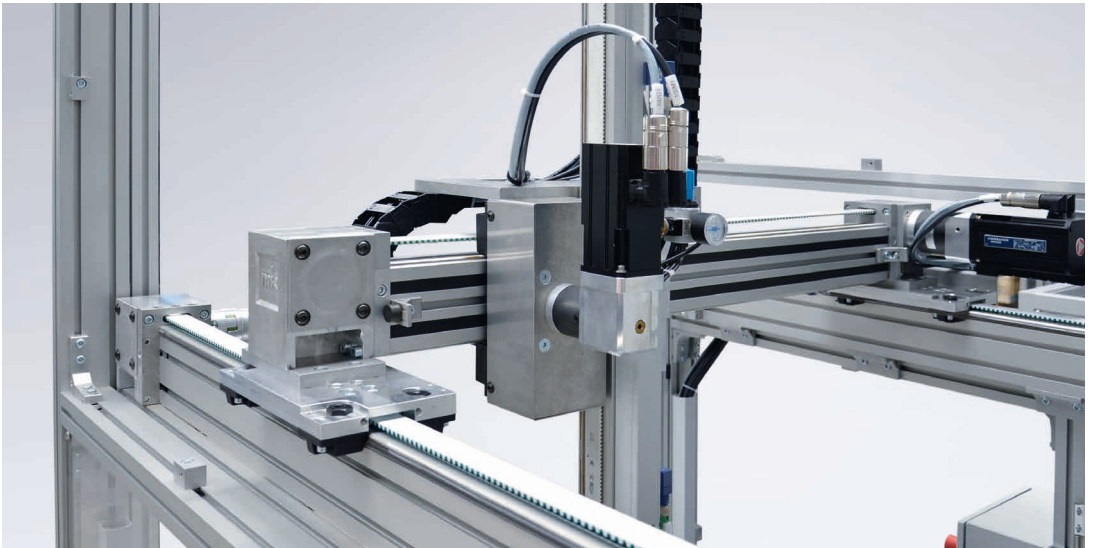
Linear module type LZR 2004-38.41-30 with absolute value rotary encoder mounted on the tail



Dual-axis linear module comprising LZR 2011-38.44.30 with side mounted carriage plate



Linear axis from linear module LZR 2005-38.44-30 with movable gripping and transfer system



5

Three-axis gantry with driven linear modules, gripper and controller



Dual LZR 2005-38.44 with cantilever for dual ZRF-P 2010 for lift and transfer from a dual ZRF-P as a lift-and-transfer module



Dual linear module type LZR 2005-38.44-30 with cantilever for conveyor as a lifting unit

Track Roller Assemblies

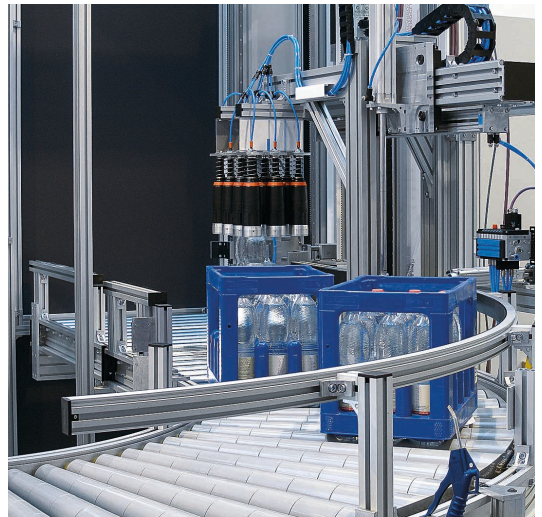
5



Two-axis gantry for handling sleeves with parallel gripper



X-Z gantry with gripper for transferring crankshafts. X axis as LZR with support roller and timing belts, Z axis with timing belt Omega drive and fall arrest



X-Z axis combination with pneumatic drive and vacuum grippers for loading and unloading beverage crates



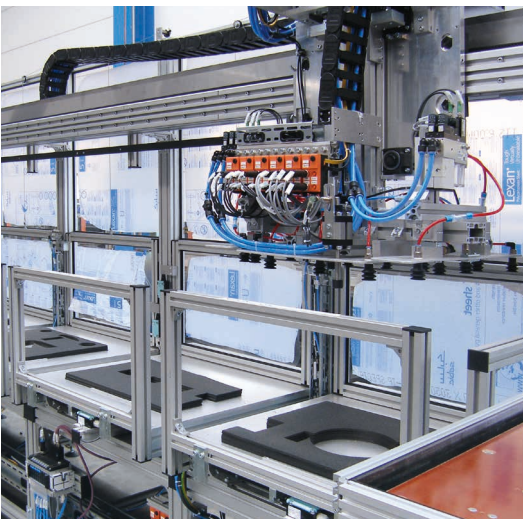
Gantry stand with telescopic gripper unit



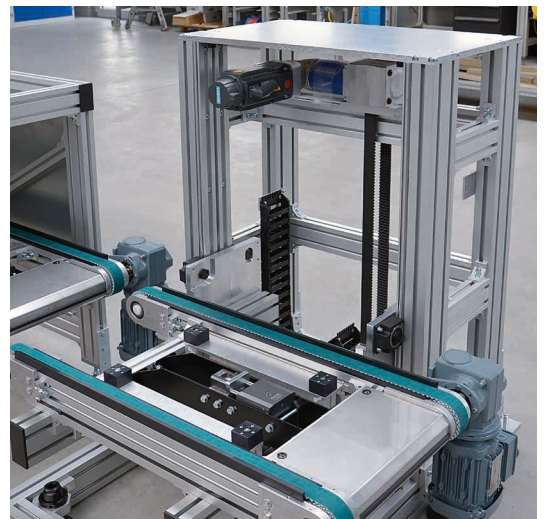
Horizontal axis with foamed combined profile for reinforcement



Lift for storage system



X-Z gantry with additional pneumatic weight balancing as a holder for a vacuum gripping system



Short stroke lift based on PF-38.44 linear guide system

Recirculating Ball Bearing Guides

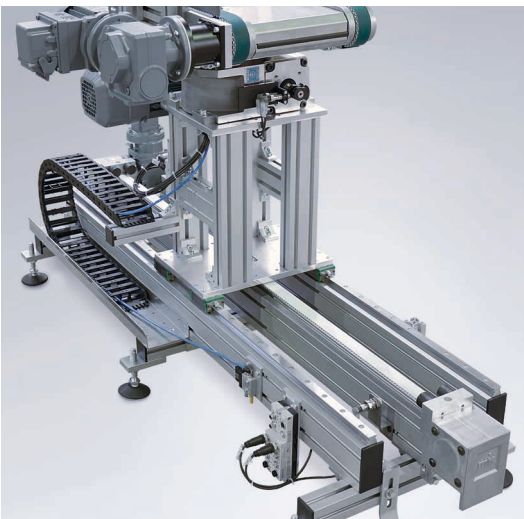
5



Lift station for lifting and lowering conveyors on two conveyor levels. Cross-conveyor unit with recirculating ball bearing guides positioned horizontally in the frame



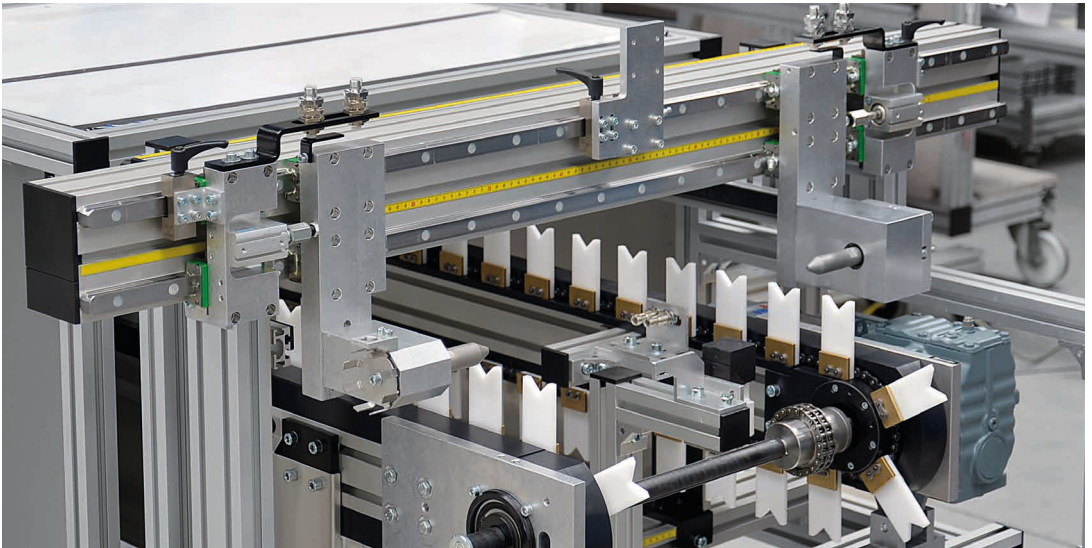
Lifting unit with KU 25 recirculating ball bearing guide and angle bracket



Shuttle system with rotary indexing table for pallet transport, guided via a double linear axis with recirculating ball bearing guide

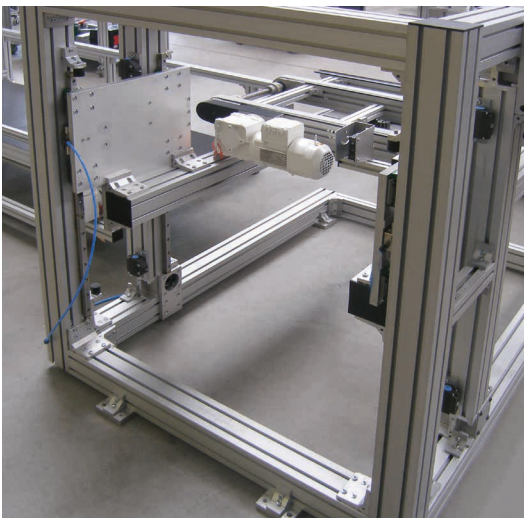


Frame for stress testing based on KU 30.10 recirculating ball bearing guide



5

Timing chain conveyor with alignment unit for camshafts using recirculating ball bearing guide



Lifting unit with LZR with recirculating ball bearing guide KU 25 with profile cantilever for supporting the ZRF-P 2010 conveyor



Two-track feed for machine loading. The separator can be adjusted for various diameters using a recirculating ball bearing guide

Recirculating Ball Bearing Guides

5



Recirculating ball bearing guide for pushing out containers, return of empty containers via LZR on the lower level



KHL short stroke lift: the connected belt conveyor is guided via a recirculating ball bearing guide with two guide carriages each



Stand-alone lift: the belt conveyor is operated via an electric lifting unit with KU30 recirculating ball bearing guide



5

Transfer shuttle with WT take up: Linear guide via recirculating ball bearing guide KU 25.11



Lift with lift and rotate unit, guide via recirculating ball bearing guide



Sleeve handling with recirculating ball bearing guide for guiding the parallel grippers

Index – by Search Terms

Adapter profiles	36	Recirculating ball bearing guide KU 25.10	72
Adjusting units VST 2011	18	Recirculating ball bearing guide KU 30.10	74
Adjusting units VST 2015	14	Recirculating ball bearing guides	68
Benefits of mk linear technology	6	Recirculating ball bearing guides, examples from practice	86
Chapter 1 Introduction and Benefits	6	Roller Carriage LW 38.30-04	41
Chapter 2 Gliding Assemblies – Introduction and Benefits	10	Roller Carriage LW 38.31-04	43
Chapter 3 Track Roller Assemblies – Introduction and Benefits	22	Roller Carriage LW 38.32-04	45
Chapter 4 Recirculating Ball Bearing Guides – Introduction and Benefits	68	Roller Carriage LW 38.33-04	47
Clamping profiles	34	Roller Carriage LW 38.36-04	57
Examples from practice gliding assemblies	76	Roller Carriage LW 38.41-04	53
Examples from practice linear technology	76	Roller Carriage LW 38.44-04	55
Examples from practice recirculating ball bearing guides	86	Roller Carriage LW 38.75-44	49
Examples from practice track roller assemblies	78	Roller Carriage LW 38.77-44	51
Gliding Assemblies	10	Selecting a linear guide	8
Gliding Assemblies, examples from practice	76	Selection Matrix for Linear Guides	9
Guide rods	39	Technical specifications for track roller assemblies	27
Guide rollers	38	Track roller assemblies	22
Individual components of track roller assemblies	34	Track roller assemblies, examples from practice	78
Linear modules, LZR	58	Wipers	39
Linear units, series 40	40		
LZR 2000-38.41-15, linear module	60		
LZR 2004-38.41-30, linear module	62		
LZR 2004-38.44-30, linear module	63		
LZR 2005-38.44-30, linear module	64		
LZR 2011-38.44-30, linear module	66		
Modular Construction Kit for Factory Automation	2		
Mounting profiles series 40	28		
Mounting profiles series 50	30		
Mounting profiles series 60	32		
Overview of Sections	4		
Profile guide PF 10-38.31/55	42		
Profile guide PF 10-38.32/56	44		
Profile guide PF 10-38.41/60	52		
Profile guide PF 10-38.77 (internal)	50		
Profile guide PF 16-38.33/56	46		
Profile guide PF 16-38.36	56		
Profile guide PF 16-38.44/61	54		
Profile guide PF 6-38.30/55	40		
Profile guide PF 6-38.75 (internal)	48		
Properties and Benefits of the Different Types of Guide	8		
Recirculating ball bearing 25	72		
Recirculating ball bearing 30	74		

Index – Items by Item Number

38.07.	Clamping profile mk 2038.07	34	7003EC....	Guide rod X46 Cr13	39
38.12.	Clamping profile mk 2038.12	35	7003EH....	Guide rod X46 Cr13	39
38.30.	Clamping profile mk 2038.30	34	7003EP....	Guide rod X46 Cr13	39
38.31.	Clamping profile mk 2038.31	34	7003ET....	Guide rod X46 Cr13	39
38.32.	Clamping profile mk 2038.32	34	B03.00.003	Wiper ø 10	39
38.33.	Clamping profile mk 2038.33	34	B03.00.004	Wiper ø 16	39
38.36.	Clamping profile mk 2038.36	35	B03.00.011	Wiper VST 2015	12
38.41.	Clamping profile mk 2038.41	35	B03.00.012	Wiper VST 2011	12
38.44. ...	Clamping profile mk 2038.44	35	B03.00.013	Wiper ø 20	39
38.46.	Clamping profile mk 2038.46	35	B03.00.014	Wiper ø 6	39
38.55.	Clamping profile mk 2038.55	36	B38.02.003	Linear module LZR 2000-38.41-15	60
38.56.	Clamping profile mk 2038.56	36	B38.02.004	Linear module LZR 2004-38.41-30	62
38.60.	Clamping profile mk 2038.60	36	B38.02.005	Linear module LZR 2004-38.41-30	63
38.61.	Clamping profile mk 2038.61	36	B38.02.006	Linear module LZR 2005-38.44-30	64
38.75.	Clamping profile mk 2038.75	34	B38.02.007	Linear module LZR 2000-38.41-15	61
38.77.	Clamping profile mk 2038.77	34	B38.02.009	Linear module LZR 2005-38.44-30	65
51.00.	Mounting profile mk 2000	31	B38.02.010	Linear module LZR 2011-38.44-30	67
51.04.	Profile mk 2004	31	B38.02.011	Linear module LZR 2011-38.44-30	66
51.05.	Mounting profile mk 2005	31	B46.07.020	Connecting kit	12
51.06.	Mounting profile mk 2006	31	B46.07.021	Connecting kit	12
51.08.	Mounting profile mk 2008	31	B51.04.004	Profile guide PF 1638.44	54
51.09.	Mounting profile mk 2009	31	B51.04.015	Profile guide PF 1038.41/60	52
51.11.	Mounting profile mk 2011	31	B51.04.016	Profile guide PF 1638.44/61	54
51.23.	Mounting profile mk 2023	31	B51.04.020	Profile guide PF 1038.41	52
54.01.	Mounting profile mk 2040.01	29	B51.04.042	Profile guide PF 638.30	40
54.02.	Profile mk 2040.02	29	B51.04.043	Profile guide PF 638.30/55	40
54.03.	Profile mk 2040.03	29	B51.04.046	Profile guide PF 1038.31	42
54.05.	Mounting profile mk 2040.05	29	B51.04.047	Profile guide PF 1038.31/55	42
54.06.	Mounting profile mk 2040.06	29	B51.04.048	Profile guide PF 1038.32	44
54.07.	Mounting profile mk 2040.07	29	B51.04.049	Profile guide PF 1038.32/56	44
54.08.	Mounting profile mk 2040.08	29	B51.04.052	Profile guide PF 1638.33	46
54.10.	Mounting profile mk 2040.10	29	B51.04.053	Profile guide PF 1638.33/56	46
54.73.	Mounting profile mk 2040.73	29	B51.04.109	Profile guide PF 1638.36	56
60.01.	Mounting profile mk 2060.01	33	B51.04.140	Profile guide PF 638.75	48
60.02.	Mounting profile mk 2060.02	33	B51.04.142	Profile guide PF 1038.77	50
60.03.	Mounting profile mk 2060.03	33	B51.04.404	Track, KU 25.10	72
60.04.	Mounting profile mk 2060.04	33	B51.04.406	Track, KU 30.10	74
60.05.	Mounting profile mk 2060.05	33	B60.02.011	Guide roller, centric	38
60.07.	Mounting profile mk 2060.07	33	B60.02.012	Guide roller, eccentric	38
7003AA....	Guide rod Cf 53	39	B60.02.013	Guide roller, centric	38
7003AK....	Guide rod Cf 53	39	B60.02.014	Guide roller, eccentric	38
7003AM....	Guide rod Cf 53	39	B60.02.015	Guide roller, centric	38
7003CM....	Guide rod Cf 53	39	B60.02.016	Guide roller, eccentric	38
7003DC....	Guide rod, galvan. Cf 53	39	B60.02.017	Guide roller, centric	38
7003DH....	Guide rod, galvan. Cf 53	39	B60.02.018	Guide roller, eccentric	38
7003DP....	Guide rod, galvan. Cf 53	39	B85.00.015	Adjusting unit VST 2015-H	15
7003DT....	Guide rod, galvan. Cf 53	39	B85.00.016	Adjusting unit VST 2015-S	15

B85.00.017	Adjusting unit VST 2015-D	15	B90.60.042	Roller carriage LW 38.3604 L1 280	57
B85.00.020	Adjusting unit VST 2011-H ø 100	19	B90.60.042	Roller carriage LW 38.3604 L1 280	57
B85.00.021	Adjusting unit VST 2011-S ø 100	19	K101100001	Track roller ø 10	27
B85.00.022	Adjusting unit VST 2011-D ø 100	19	K101100002	Track roller ø 16	27
B85.00.025	Adjusting unit VST 2011-H ø 125	19	K101100003	Track roller ø 6	27
B85.00.026	Adjusting unit VST 2011-S ø 125	19	K101100006	Track roller ø 20	27
B85.00.027	Adjusting unit VST 2011-D ø 125	19	K110030061	Clamping lever K M6x40	12
B85.00.115	Adjusting unit VST 2015-H-2	16	K116041025	Track, KU 25.10	72
B85.00.116	Adjusting unit VST 2015-S-2	16	K116041030	Track, KU 30.10	74
B85.00.117	Adjusting unit VST 2015-D-2	16	K116041125	Guide carriage KU 25.11	73
B85.00.120	Adjusting unit VST 2011-H-2 ø 100	20	K116041130	Guide carriage KU 30.11	75
B85.00.121	Adjusting unit VST 2011-S-2 ø 100	20	K116041325	Guide carriage KU 25.13	73
B85.00.122	Adjusting unit VST 2011-D-2 ø 100	20	K116041330	Guide carriage KU 30.13	75
B85.00.125	Adjusting unit VST 2011-H-2 ø 125	20			
B85.00.126	Adjusting unit VST 2011-S-2 ø 125	20			
B85.00.127	Adjusting unit VST 2011-D-2 ø 125	20			
B85.00.215	Adjusting unit VST 2015-H-G	17			
B85.00.216	Adjusting unit VST 2015-S-G	17			
B85.00.217	Adjusting unit VST 2015-D-G	17			
B85.00.220	Adjusting unit VST 2011-H-G ø 100	21			
B85.00.221	Adjusting unit VST 2011-S-G ø 100	21			
B85.00.222	Adjusting unit VST 2011-D-G ø 100	21			
B85.00.225	Adjusting unit VST 2011-H-G ø 125	21			
B85.00.226	Adjusting unit VST 2011-S-G ø 125	21			
B85.00.227	Adjusting unit VST 2011-D-G ø 125	21			
B90.40.041	Roller carriage LW 38.3004 L1 100	41			
B90.40.041	Roller carriage LW 38.3004 L1 100	41			
B90.40.042	Roller carriage LW 38.3104 L1 140	43			
B90.40.042	Roller carriage LW 38.3104 L1 140	43			
B90.40.043	Roller carriage LW 38.3204 L1 180	45			
B90.40.043	Roller carriage LW 38.3204 L1 280	45			
B90.40.044	Roller carriage LW 38.3304 L1 240	47			
B90.40.044	Roller carriage LW 38.3304 L1 240	47			
B90.40.441	Roller carriage LW 38.7544 L1 120	49			
B90.40.443	Roller carriage LW 38.7744 L1 160	51			
B90.50.042	Roller carriage LW 38.4104 L1 150	53			
B90.50.042	Roller carriage LW 38.4104 L1 150	53			
B90.50.044	Roller carriage LW 38.4404 L1 250	55			
B90.50.044	Roller carriage LW 38.4404 L1 250	55			



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