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Linear guide system PS 4-20
Installation guide

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Contents

General safety information

The details and information in the installation guide are provided for the purposes of describing the product and its assembly only. This information does not discharge the user from the obligation to carry out his own assessments and checks. It is important to bear in mind that our products are subject to a natural process of wear and ageing.

These notes contain important information that will enable you to use the product safely and appropriately. When sold, rented out or otherwise passed on to another party, this product must be handed over with the installation guide.

When installing, operating and maintaining a driven linear guide system, it is important to ensure all moving elements are secured so they cannot be switched on and moved unintentionally. Rotating and moving parts can cause serious injury! You must therefore read and follow the safety instructions set out below. All work on and with a driven linear guide system must be performed with "safety first" in mind.
Always switch off the drive assembly before you start working on the driven linear guide system.
Ensure the drive unit is not switched on unintentionally, e.g. by affixing warning notices at the activation point or by removing the fuse from the power supply.
Do not place your hand within the operating range of the driven linear guide system's moving parts when the unit is still switched on.
Fit guards and covers to the moving parts of the driven linear guide system to ensure they are not touched unintentionally.
Observe the regulations pertaining to accident prevention and environmental protection that apply in the country and place of work where the product is being used.
Use only item products that are in perfect working order. Failure to use original spare parts will invalidate the product warranty!
Check the product for obvious defects.
Use the product only within the performance range described in the technical data.
Ensure that all the safety equipment associated with the product is present, properly installed and in full working order.
Do not alter the position of safety equipment, circumvent it or render it ineffective.

The components of the driven linear guide system described here correspond to the state of the art and take into account the general principles of safety applicable at the time this installation guide was published. Nevertheless, failure to observe the safety instructions and warning notices in this installation guide may result in personal injury and damage to property.
We will assume no liability for any resulting damage or injury.

We reserve the right to make technical changes that represent technical advances. Keep these installation notes in a place where they can be easily accessed by all users. Observe the directions contained in the main user guide for the completed machine.

The general safety information applies to the entire lifecycle of the partly completed machine.

During transportation
Observe the handling instructions on the packaging. Until it is installed, the product must be stored in its original packaging, protected from moisture and damage. Ensure that moving parts are secured when in transit and cannot cause any damage.

During installation
Always deactivate the power to the relevant system part and ensure it is not live before installing the product and/or plugging it in or unplugging it. Ensure the system cannot be switched back on. Lay cables and lines in such a way that they cannot be damaged and do not represent a trip hazard. Avoid areas that pose slip, trip and fall hazards.

During commissioning
Allow the product to acclimatise for a few hours before starting to use it. Ensure that the partly completed machine is securely and safely integrated into the completed machine. Only start up a product that has been installed in full.

During operation
Ensure that only persons who have been authorised by the operator have access to the immediate operating area of the system. This also applies when the system is not in operation. It must not be possible to actuate moving parts unintentionally. During emergencies, malfunctions or other irregularities, deactivate the system and ensure that it cannot be switched back on. Prevent the possibility of persons becoming trapped in the system's hazard zone.

During cleaning
Close all openings with suitable protective equipment to ensure that cleaning agents cannot penetrate the system. Do not use aggressive cleaning substances. Do not use a high-pressure cleaner when cleaning the system.

During maintenance and servicing work
Carry out the prescribed maintenance work at the intervals stipulated in the user guide. Ensure that no line links, connections or components are removed while the system is live and under pressure. Ensure the system cannot be switched back on.

During disposal
Dispose of the product in accordance with the national and international regulations that apply in your country.

1.1 Correct use

When installed, linear guide system PS 4-20 is a component part of a linear axis, motorised product or manually moved product as defined in Machinery Directive 2006/42/EC (partly completed machine). The driven linear guide system must only be used in accordance with the technical data and safety requirements set out in the documentation supplied. Internal company requirements and the regulations that apply in the country where the product is being used must be observed. You must not make any design modifications to the driven linear guide system yourself. We will assume no liability for any resulting damage or injury.

You may only install, operate and maintain the driven linear guide system if:

- The driven linear guide system has been integrated properly and safely into the completed machine,
- You have carefully read and understood the installation guide,
- You are appropriately qualified,
- You are authorised to do so by your company,
- You are using only original equipment from the manufacturer.

Unsafe or inappropriate use of the driven linear guide system runs a risk of serious injury through crushing and cuts.

1.2 Improper use

Improper use is defined as any use of the product for purposes other than those authorised in the installation guide and under the definition of correct use.

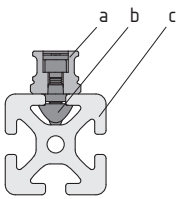
We will assume no liability for any resulting damage or injury.

Linear guide system PS 4-20

Four-row linear guide system (with full complement) on a profiled steel Rail. The individual Bearing Carriages can be loaded from all directions and can absorb moments around all axes. The key features of linear guide system PS 4-20 include high load-carrying capacity and rigidity and a compact design. Any Bearing Carriage PS 4-20 can be freely combined with any Linear Guide Rail PS 4-20, so that one or more Carriages can be mounted on one Rail and Carriages can be exchanged.

The linear guide system is pre-tensioned as standard.

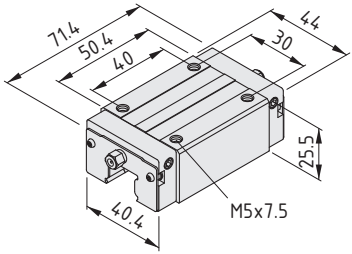
Linear guide system PS 4-20 comprises the following components:



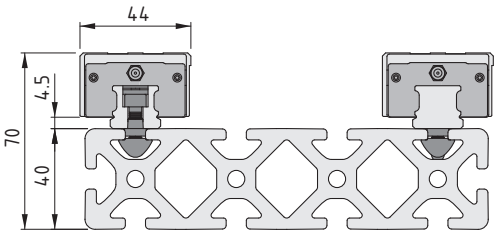
Linear Guide Rail PS 4-20	(a)
Assembly Set 8 PS 4-20 Rail	(b)
Line 8 profile	(c)

And Bearing Carriage PS 4-20:

The Carriage is supplied on an installation rail that should be removed only when undertaking installation.



The Carriages must be used in combination when seeking to accommodate high forces and moments. Solutions involving several Carriages on a single Rail and several Carriages on parallel Rails are also possible. Thanks to the special fastening geometry of the Rail and the installation sleeves, guide systems can be constructed that comprise parallel Rails on a single support profile, with no need for elaborate alignment measures.



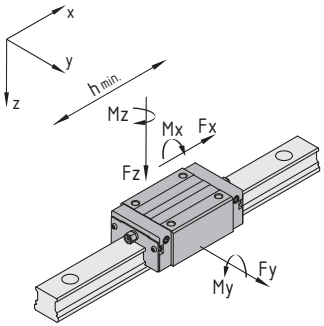
Carriage constructions comprising two or more Bearing Carriages running on two parallel Rails stop the individual Guide Rails from tilting in the profile groove and reduce torsional load. To retain the permitted positional tolerances when implementing a design such as this, the parallel Guide Rails must be mounted on one and the same support profile!

Guide Rails should not be connected end-to-end (e.g. to extend the length of the guide).

The use of parallel Rails on different support constructions will require the usual amount of alignment and fastening work typically associated with profile rail guides (machining screw-fit surfaces, using parallel segments, etc.).

Technical data

Static load rating:	C_0=27,000 N
Dynamic load rating:	C=13,100 N
Permissible static moment:	M_x=40 Nm M_y=M_z=20 Nm
Permissible load:	F_y=F_z=1850 N
Speed:	v_{max}=5 m/s
Acceleration:	a_{max}=150 m/s
Temperature range:	t=-10 to +100°C
Minimum stroke:	h_{min}=150 mm



Note: The static and dynamic load rating and moment are key characteristics of the rolling-ball contact between the Carriage and Rail and can be used to calculate the service life.

The permissible load for a linear guide system depends on the load-carrying capacity of the guiding elements, the strength of the screw connections and the design of the profile frame.

A minimum stroke length (h_{min}) is required to ensure that the rolling-ball contact is sufficiently lubricated. The Carriage is charged at the factory with lithium-based grease. Lithium-saponified grease with a mineral-oil base can be used for re-lubrication (e.g. article 0.0.644.87).

Due to the contact pressure of the wipers, a displacement force of 10 N per Bearing Carriage must be taken into account irrespective of the load.
The load rating is identical for loads on all spatial axes.

A static load safety factor S_0= C_0/ P greater than 4 should always be selected.
The dynamic load rating C is based on a nominal service life of 100,000 m travel, i.e. 90 percent of a sufficiently large sample of identical bearings achieve this duty cycle without any sign of material fatigue.

In each individual case, however, it is important to check the link to the connecting structure in order to verify that it is able to support the forces and moments applied to the linear guide system!

The bore grid on the contact face of the Bearing Carriage is designed to accommodate a Line 6 or 8 profile. However, carriages can of course also be designed in other forms. In such instances, the central ribs on the rear of the Bearing Carriage provide the sole contact surfaces. Button-Head Screws ISO 7380 and Locating Washer 6 D5 or Locating Washer 8 D5 can be used to fasten Profiles 6 or 8 to the Bearing Carriage.

Preparations for assembly

Important: Care and cleanliness during assembly of a linear guide system are crucial for the correct functioning and long service life of this machine element. For this reason, all components, the work bench and the connecting structure must be kept clean!

Compliance with the following instructions will ensure the greatest possible operating reliability by eliminating any errors during assembly. The Bearing Carriage is supplied in protective packaging. It is slotted onto a plastic protective rail that keeps the ball bearings in their tracks and provides protection against impacts.

The end caps of the Bearing Carriage, which are screwed onto the end faces, must not be removed under any circumstances!
Doing so would open and dislodge the re-circulating segments of the raceway, thus rendering the Bearing Carriage unusable.

In addition, tampering of this nature will invalidate any guarantee!

To ensure the linear guide system runs smoothly, all the fastening screws should be tightened under controlled conditions using the tightening torques specified in these instructions and in accordance with the screw tightening schedule. Furthermore, a chemical screw fixing agent should be used, particularly if it is at all likely that the screws could lose tension.
Check the cut edges of the Guide Rail and remove any burrs with an oilstone. Do not slide the Bearing Carriage onto the Rail until you need to, as the seal on the head can be damaged if not handled correctly.

Installing the Guide Rail

Due to internal stresses that can be generated when Rails are ground to shape, a Rail may not be perfectly straight when supplied.
However, the installation sleeves ensure that the Rail is in line with the profile.
If a Rail has to be shortened, it is important to ensure when subsequently aligning the Rail that the Carriage can be slotted on at the non-shortened end.

If the Rail is being installed flush to an enclosing construction, the Carriage must be slotted onto the Rail prior to assembly.

Profiles in a “light” or “E” variant should not be used as support profiles.

The permissible load for a linear guide system depends on the load-carrying capacity of the guiding elements, the strength of the screw connections and the design of the profile frame.

1. Using Assembly Set 8 PS 4-20 Rail (0.0.681.06) to fit a single Rail to one Line 8 groove

Place the Profile Rail upside down on a flat and firm surface.

Next, press the installation sleeves as far as they will go into the fastening bores of the Rail.

Swivel the T-Slot Nuts from the Fastening Sets into the profile groove and spread them out with the relevant spacing (60 mm).

Place the Rail on the groove, with the sleeves facing onto the groove. The holes in the Rail should be perfectly aligned with the holes in the T-Slot Nuts.

Insert fastening screws M5x18 into the holes on the Rail.
Tighten all the screws on the Rail by hand.
Next, tighten the screws in two stages:

First step: 4 Nm (all screws)
Second step: 8 Nm (max. torque for T-Slot Nut).

Finally, tap the caps gently into the holes.

2. Using Assembly Set 8 PS 4-20 Rail (0.0.681.06) to fit two parallel Rails to one profile

Install the first Rail as described under Point 1.

Installing the second Rail:
Place the second Rail upside down on a flat and firm surface. Next, press just **one** installation sleeve as far as it will go into the outermost fastening bore of the second Rail.

Swivel the T-Slot Nuts from the Fastening Sets into the profile groove and spread them out with the relevant spacing (60 mm). Place the second Rail on the groove, with the sleeve facing onto the groove. The holes in the Rail should be perfectly aligned with the holes in the T-Slot Nuts.

Insert fastening screws M5x18 into the holes on the Rail.
Tighten all the screws on the Rail by hand and then loosen them by ½ a turn.
Now place at least one Bearing Carriage on each Rail (see “Mounting the Bearing Carriage and lubricating the linear guide system”). Push the Bearing Carriage on the second Rail to the end where the **single** installation sleeve is. Move the Bearing Carriage on the first Rail so that it is level with the other Carriage.

Now securely install the carriage superstructure that will create a mechanical connection between the two Rails.
The next step is to move the entire carriage comprising both Bearing Carriages by hand approximately 60 mm, gradually tightening the screws on the second Rail with the following torque:

First step: 4 Nm
Second step: 8 Nm (max. torque for T-Slot Nut)

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Mounting the Bearing Carriage and lubricating the linear guide system

Remove the Bearing Carriage from its protective packaging. The Bearing Carriage is charged with grease at the factory and can also be re-lubricated with lithium-based greases. If using oil-based lubricants, the grease should first be carefully wiped off the ball tracks.
Position the Bearing Carriage – still on its protective rail – in front of the Rail and slide it carefully onto the Rail, being careful not to tilt or twist the Bearing Carriage while doing so.
When sliding the Bearing Carriage onto the Rail, pay particular attention to the wipers in the end cap. They must not be dislodged from their seatings in the end cap and the lip seals must not be allowed to fold over.
If the lip seals are folded over despite careful fitting, they can be realigned by pushing the Bearing Carriage over the end of the Rail.
Push the Bearing Carriage once carefully along the entire length of the Rail, checking resistance. If you can feel friction, this is most likely due to the fact that the seals have not yet bedded in. This friction will diminish as the flexible elements settle and adjust to the Rail.
Ensure that the Bearing Carriage is supplied with lubricant, as this has a major influence on the service life of the linear guide system. Two different methods of lubrication can be used on the linear guide system:

- Oil lubrication: Minimum volume 0.9-1.2 cm^3
  Oil type: Only EP-additive oils for mixed friction, CLP to DIN 51 517 or LP to DIN 51 524. Viscosity between ISO-VG 32 and ISO-VG 68 for an operating temperature range of 0°C to 70°C. In the case of lower or higher operating temperatures, select alternative viscosity as appropriate. The oil can be topped up via the funnel-type lubricant nipple.
- Grease lubrication: Initial volume 1.0–2.0 g; or at least until grease is expelled.
  Grease types: Lithium-saponified greases with a mineral-oil base. The Bearing Carriages are filled with grease at the factory. The initial volume of grease should be applied by hand to the rows of ball bearings; one stroke of a grease gun should then be applied to the lubricant nipple to ensure that the lubrication channels are filled.

A funnel-type lubrication nipple with a 120° taper to DIN 3405 (Form D) is located at each end of the Bearing Carriage. However, it is only necessary to apply lubricant at one end of the Bearing Carriage.
While doing so, move the Bearing Carriage gently forward and back.

Important: All types of lubricant give rise to lubricant seepage.
For this reason, you should design the connecting structure to ensure that any seepage is caught and can be properly disposed of.

Place the carriage construction carefully onto the Bearing Carriage(s) and move the loosely-mounted complete carriage several times along the entire length of the Rail without applying any load. Next, screw the components together. In doing so, carefully select the correct screw length and, in particular, note the maximum permissible tightening torque for the screws.
Intended for use are four M5 screws, property class 12.9, to be tightened with the permissible tightening torque M_t= 10 Nm.

To complete the assembly process, move the Bearing Carriage(s) along the entire length of the Rail again, ensuring in particular that there is no backlash and that resistance is consistent.

The main causes of faults in linear guide system PS 4-20 are assembly errors, inadequate protection from soiling and insufficient lubrication. It is therefore important to ensure that the wipers, which also have a sealing function, are not damaged.
How frequently the linear guide system will need to be re-lubricated also depends on operating conditions.

Re-lubrication

In principle, the precise timing for subsequent lubrication and the volume of lubricant required should be determined under actual operating conditions. If the lubrication intervals are excessively long or if the volume of lubricant is inadequate, this will be indicated by a reddish-brown discolouration of the lubricant, primarily in the reversing position of the stroke movement. In such cases, re-lubricate immediately and correct the lubrication interval and volume of lubricant.
Clean the Rail and the lubricating nipple. Fill the Bearing Carriage via a lubricating nipple with the following volumes of lubricant:

- Oil lubrication: Approx. 0.02-0.04 cm^3/h
- Grease lubrication: Guide value 0.5-1 g; or at least until fresh grease is expelled.

Move the Bearing Carriage along the entire travel distance or for a distance of at least four times the length of the Bearing Carriage. Ensure that the Rails are covered with a visible film of lubricant along their entire length. Apply additional lubricant to the Rails, if necessary. Prior to any long period out of service and before resuming operation, the linear guide system should be re-lubricated with oil or grease.

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