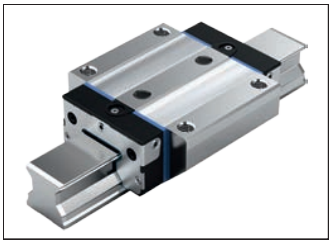
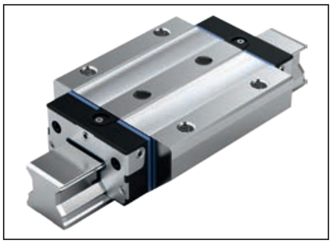
Product Description High Precision Version

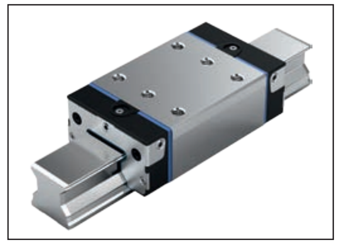
Design styles of the high precision roller runner blocks



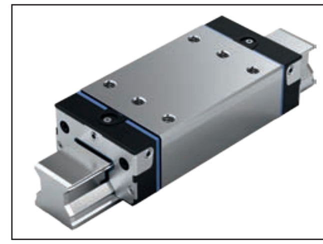
FNS – Flanged, normal, standard height



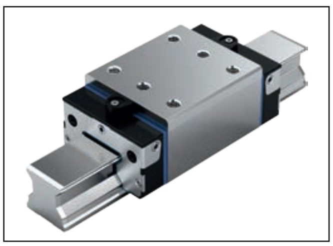
FLS – Flanged, long, standard height



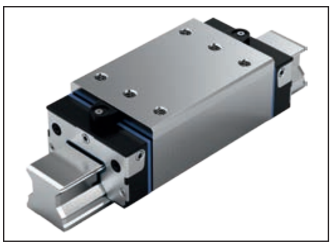
SNS – Slimline, normal, standard height



SLS – Slimline, long, standard height



SNH – Slimline, normal, high

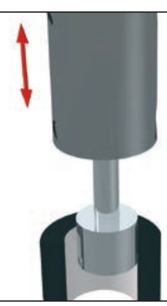


SLH – Slimline, long, high

Application examples

Rexroth high precision roller runner blocks are especially suited for the following applications:

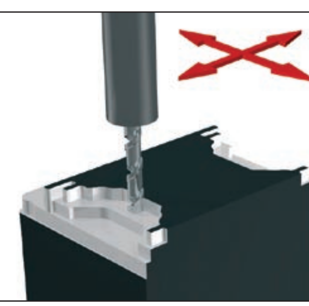
Grinding



Grinding of fitting bores

Internal cylindrical grinding

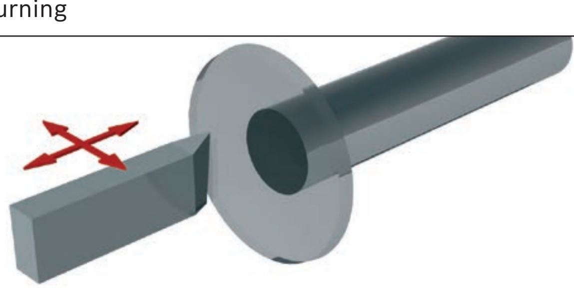
Milling



Mold insert milling

Hard milling

Turning



Turning of plastic optical lenses

High precision turning

These are just a few examples of the many possible applications. Simply ask us.
We'll find the right solution for your needs.

Product Description High Precision Version

Highlights

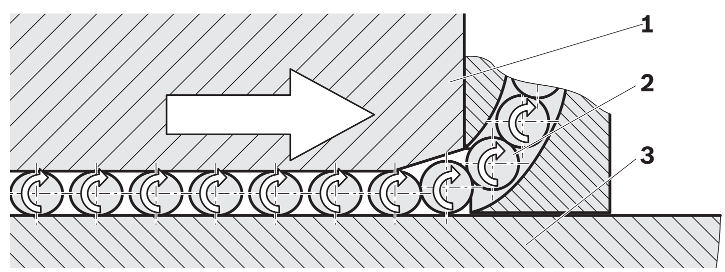
- Increased travel accuracy
- Significantly reduced frictional drag variations and low frictional drag, especially under an applied external load
- Highest precision
- Superior quality
- Extremely low impact on surrounding environment due to minimal oil preservation
- Patented entry zone design enhances travel accuracy

Comparison

Conventional roller runner blocks

If the roller runner block has a conventional entry zone, this can only be designed for a specific load point.

Entry zone geometry for conventional roller runner blocks



1 Roller runner block **2** Rollers **3** Roller guide rail

Roller entry

- The rollers are guided to the beginning of the entry zone by the roller recirculation track.
- When the distance between the roller runner block (1) and the roller guide rail (3) becomes smaller than the roller diameter, the roller (2) is subjected to loading (preload) in a series of pulses.
- The preload increases in the entry zone and reaches a maximum in the load-bearing zone. The roller transmits the force from the roller runner block to the roller guide rail.
- The kinematic and geometric conditions cause spaces to develop between the rollers.

Entry zone

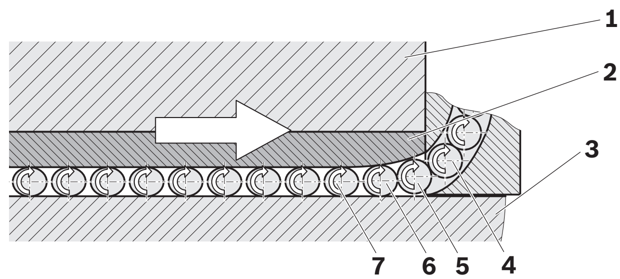
Conventional roller runner blocks have a fixed entry zone. The depth of the entry zone must be designed to withstand high loading, since smooth roller entry must be assured even under very high loads.

- On the one hand, there should be as many load-bearing rollers as possible at any one time in the roller runner block to ensure optimal load capacity of the linear bearing.
  ⇒ Shortest possible entry zone
- On the other hand, the increase in loading of the rollers upon entry should be as slow and smooth as possible, in order to maximize the geometrical travel accuracy.
  ⇒ Shallowest (longest) possible entry zone

These are conflicting aims (short versus long entry zone).

High precision roller runner blocks

New entry zone geometry for high precision roller runner blocks
High precision roller runner blocks have an innovative entry zone. The rollers enter the load-bearing zone very smoothly, i.e. without any load pulsation.



1 Roller runner block
2 Steel segment
3 Roller guide rail
4 – 7 Rollers

Roller entry

- The rollers (4) are guided to the beginning of the entry zone by the roller recirculation track.
- The roller (5) can enter.
- As the distance between the steel segment and the roller guide rail becomes smaller than the roller diameter, the roller is gradually and uniformly subjected to loading (preload).
- The preload is thus smoothly increased until the rollers (7) have reached their maximum preload.

Innovative solution from Rexroth:

The optimized entry zone
The functionality of the entry zone is key. The steel segments are manufactured with such precision that the load on them increases with the convex curvature. This results in especially smooth roller entry behavior.
The rollers are no longer guided into the load-bearing zone in pulses by an inclined entry channel but by a very smooth flexing curve, which ideally transitions tangentially into the load-bearing zone.
The extremely smooth roller entry behavior and the optimized adjustment of the entry zone in response to the actual load are a great advantage of these high precision roller runner blocks.

Characteristic features

1 Highest travel accuracy
2 Minimal frictional drag variation
3 The conflicting aims are resolved

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Frictional drag variations

Definition

The total frictional drag of a roller runner block is composed of the following components:

1 Roller friction

2 Friction of the seals

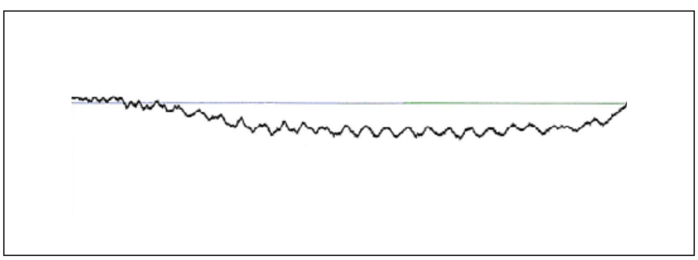
3 Friction in the roller recirculation elements and recirculation tracks

Variations in frictional drag can be especially troublesome in certain operating environments.

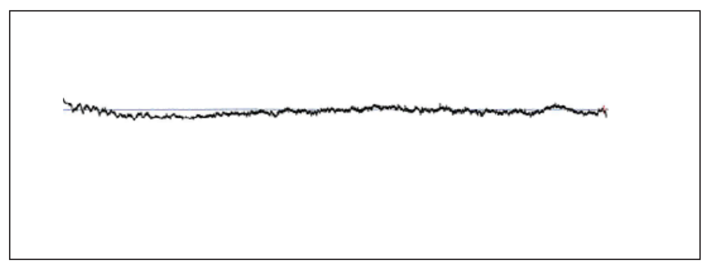
These variations are mainly due to the following fact:

The rollers have to transition from the load-free zone to the load-bearing zone. Through its innovative design, the optimized roller entry zone minimizes the variations, which also permits better control of the linear drive.

Conventional roller runner block



High precision roller runner block



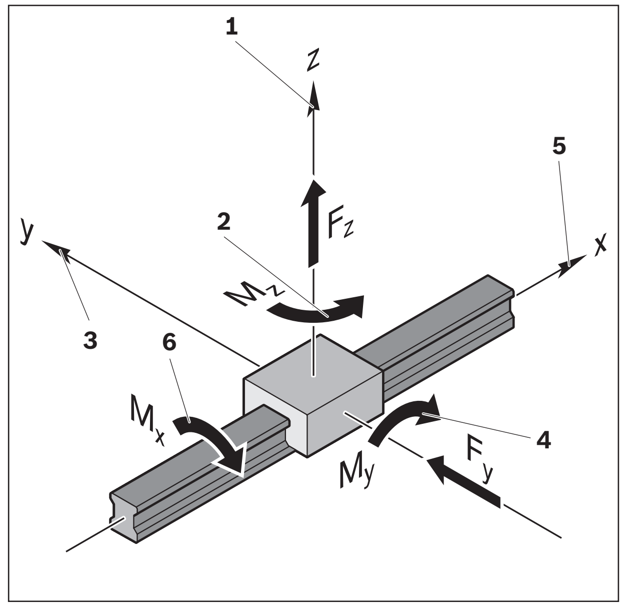
Travel accuracy

Definition

Ideally, the roller runner block should move in a straight line along the roller guide rail in the direction of the X-axis. In practice, however, deviations occur in all six degrees of freedom. Travel accuracy is the term used to describe the closeness of the movement to the ideal straight line.

The six different degrees of freedom

1 Vertical offset (linear deviation in the Z-direction)
2 Yawing (rotation about the Z-axis)
3 Lateral offset (linear deviation in the Y direction)
4 Pitching (rotation about the Y-axis)
5 Translation (linear motion in the X-direction)
6 Rolling (rotation about the X-axis)



Causes of travel inaccuracy

Travel accuracy is influenced by the following parameters:
1. The finish of the mounting base to which the roller guide rail fastened.
2. Parallelism errors between the contact surfaces of the roller guide rail and the running tracks.
3. Elastic deformations of the roller guide rail under the mounting screws.
4. Variations in accuracy as rollers enter and exit the load-bearing zone.

Optimization potential

Re 1.: Machine the mounting base for the roller guide rail with the greatest possible precision (beyond the control of Bosch Rexroth).
Re 2.: The deviation can be influenced by choosing an appropriate accuracy class for the roller guide rail.
Re 3.: Reduce the tightening torque. The tightening torque for the fastening screws has a proportional effect. Reducing the torque will lessen the compression of the rail material.
⇒ Reduced geometric variation in travel characteristics

⚠ NOTE: This may result in a decrease in the transmittable forces and moments.

Re 4.: The patented, optimized entry zone design of the Rexroth high precision roller runner blocks minimizes these accuracy deviations.

Potential further improvements:

- Use of long roller runner blocks
- Installation of additional roller runner blocks per roller guide rail

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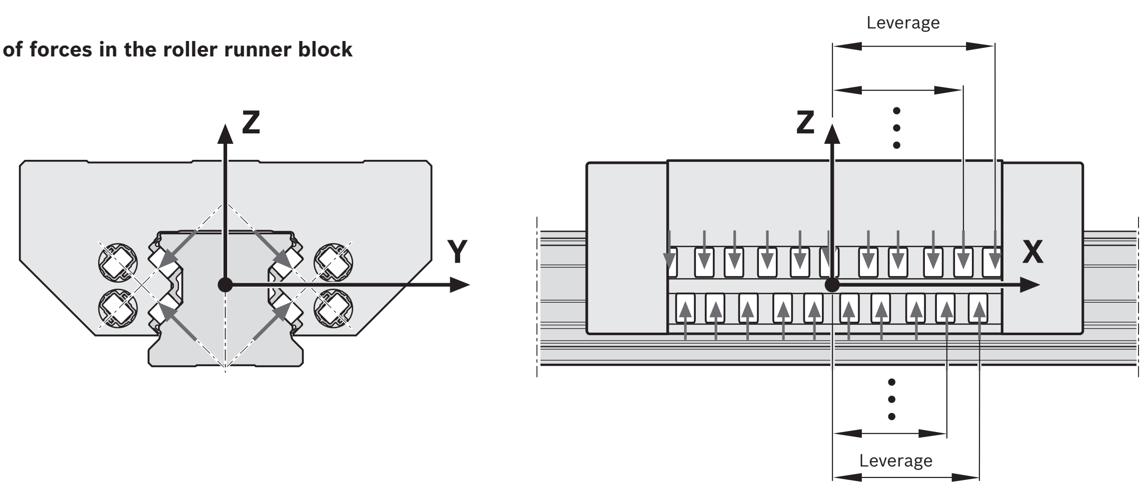
The deviations measured are due to the following phenomenon

A roller circuit contains a number n of load-bearing rollers. When the roller runner block is moved in the direction of travel, a new roller engages in the entry zone. Now there are n+1 load-bearing rollers. This creates an imbalance between the four rows of load-bearing rollers. Because the rollers enter the load-bearing zones randomly, the roller runner block begins to rotate in an attempt to restore the balance. As the roller runner block moves further on, a roller leaves the load-bearing part of the circuit through the run-out zone. This again creates an imbalance between the four load-bearing roller circuits, which the roller runner block again attempts to correct by rotating.
This effect is clearly shown in the diagram at right.

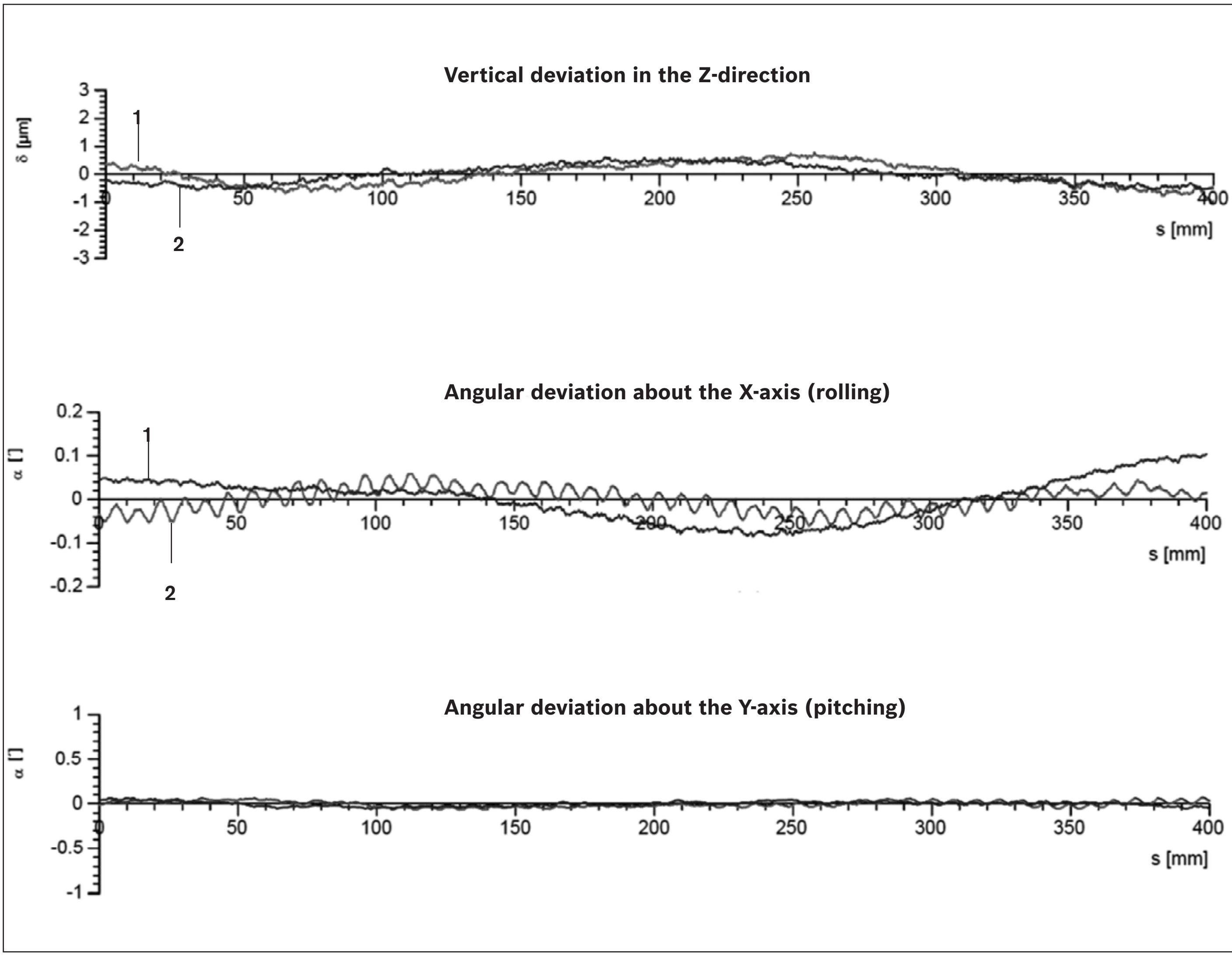
As demonstrated in practical applications, the short-wave inaccuracies have a period equivalent to approximately twice the roller diameter.
The remaining long-wave deviation is the result of the causes 1, 2 and 3 described earlier (mounting base finish, parallelism error, and elastic deformation of the roller guide rail under the fastening screws).

Distribution of forces in the roller runner block



Direct comparison of the travel accuracy of two roller runner blocks

The diagrams clearly show that the short-wave inaccuracies can be very significantly reduced by the new, optimized design of the entry zone.



1) High precision version
2) Conventional version