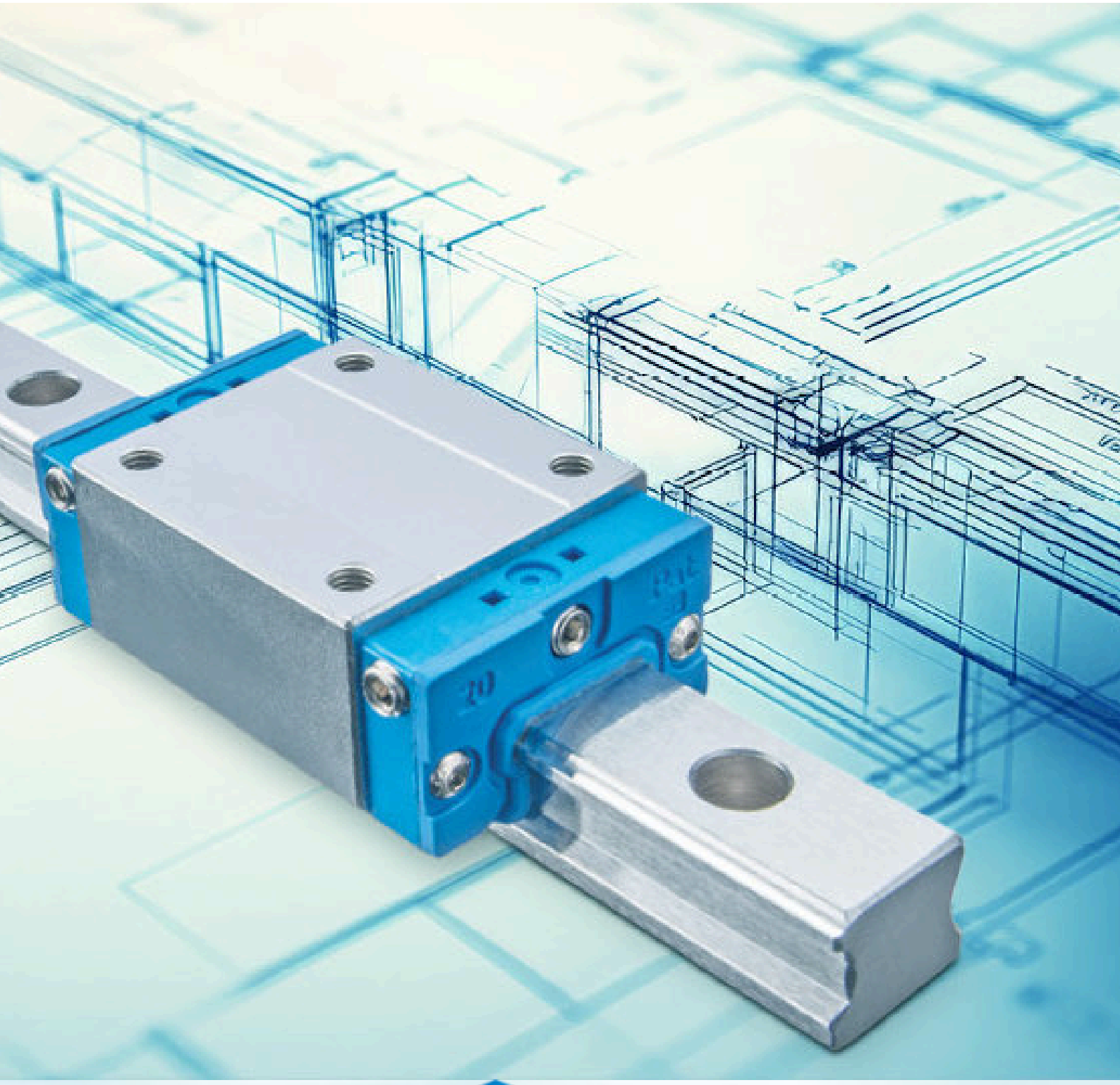
NTN

ALL ABOUT LINEAR MOTION



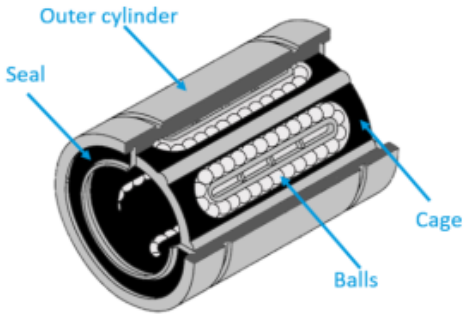
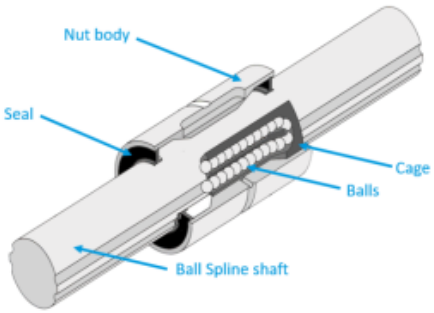
linearwizard.com

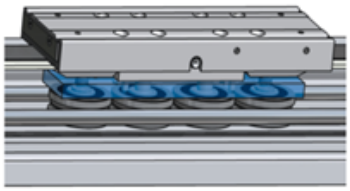
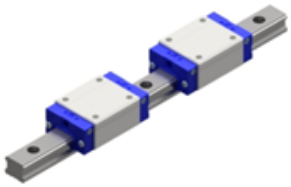
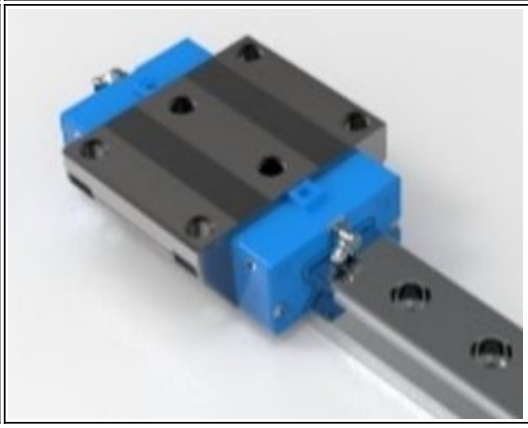
Types of linear guides

Linear guides are presented below as one type of linear system. Linear guides are among the most important guide systems on the market, mainly because they can be used universally.

Types of linear guides

A distinction is mainly made between two types of linear guides: Shaft guides and rail guides. Both can be subdivided into different types. Types of shaft guides are ball bushings, ball cage guides and ball splines. There are four main types of rail guides, also known as *profiled rail guides*, including track roller guides, flat rail guides, ball guides and roller guides. Some of these can be further differentiated; the following table provides a general overview.

Kind	Types	Picture	Subtypes
Shaft guides	Ball bushings		• Standard ball bushes • Super ball bushings • Ball sleeves
	Ball cage guides		
	Ball splines		

Rail guides	Track roller guides		
	Flat sliding guides		• Re-circulating roller bearing units
			• Ball, roller or needle cages
	Ball guides		• Ball guides without/with ball re-circulation or • Number of raceways (2, 4, 6 or 8) or • Arrangement of the raceways (DF or DB) or • with/without ball chain The distinctions can be applied individually. Several criteria may also apply.
	Roller guides		• Roller guides with/without roller re-circulation or • Arrangement of the raceways (DF or DB) or • with/without roller chain The distinctions can be applied individually. Several criteria may also apply.

If you are not only interested in the types of linear guides, but also in the calculation principles that need to be taken into account and how they are installed, you will find the relevant articles on linearwizard.com.

Shaft guides

All shaft guides have balls as rolling elements and have point contact with round shafts or surface contact with the raceway of ball spline shafts. They are generally used for axial movements.

Ball bushings

Ball bushings are also known colloquially as “linear ball bearings”. As they do not have a raceway in the associated shafts, the rolling contact is a point contact. Standard ball bushings consist of a solid outer cylinder behind which the balls and cage are located, and super ball bushings consist of a plastic base body in which steel parts with the raceways are inserted. An (incorporated) seal can also be used. Ball bushings are often used in computers, (3D) printers and in the packaging industry, for example.

Ball bushings are available in numerous versions, designs and lengths, including closed (image), open, adjustable and super ball bushings.

Ball sleeves have a similar system to standard ball bushings, particularly in terms of structure and function. While the former has a solid outer body, ball sleeves are made from deep-drawn sheet metal, which is why they can be more cost-effective than ball bushings.

Ball cage guides

Ball cage guide systems also have balls as rolling elements. They are characterized by precision in movement and are capable of high loads. As ball cage guide systems do not have recirculating balls, the movements are absolutely smooth and jerk-free. Applications for ball cage guide systems include column guides for presses, as well as applications in measurement technology.

Ball splines

The ball spline shaft on which they are mounted gives the ball splines their name.

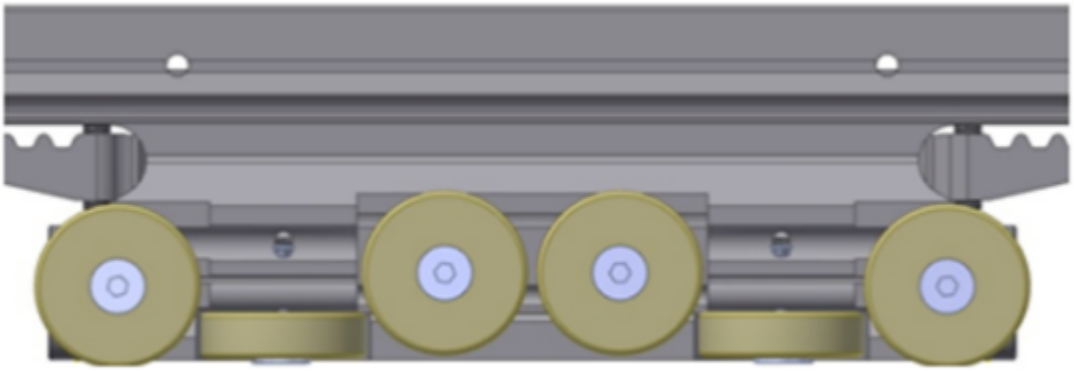
Nuts of ball splines are mounted on a shaft that has raceways for balls. In addition to the ball spline shaft, another important component is a nut body in which the balls and cage are located. A seal can be used as an option. Ball splines have raceways ground into a round shaft. This means that the rolling elements of the ball splines have surface contact with the raceway. Ball splines are used, for example, in the packaging or printing machine industry.

Rail guides

Rail guides can be divided into four main types (track roller guides, flat rail guides, ball guides and roller guides), some of which are further differentiated.

Track roller guides

The carriages of track roller guides contain specially moulded track rollers. The track roller is comparable to roller bearings, but with a profiled outer ring. Ground shafts pressed into an aluminium rail or solid steel rails can form the track of the track roller. The advantages of track roller guides over linear guides are very high speeds with relatively low friction and the fact that they are generally considered to be cost-effective. Track roller guides are used in automation technology (robots, conveyor belts), in safety doors on machine tools and in medical devices.



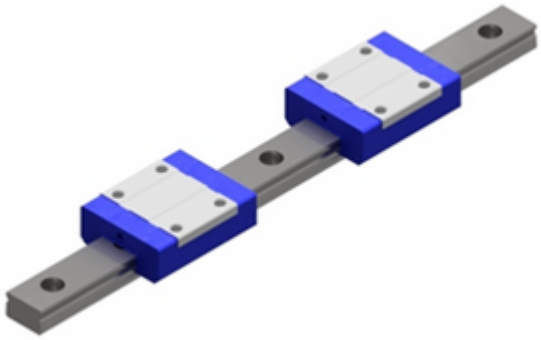
One of the alternatives to the standard version is the polymer roller guide shown here.

Flat rail guides

Flat guides include recirculating roller bearing units, which are rarely used today, as well as ball, roller or needle roller cages. Recirculating roller bearings have a cylindrical rolling element, so there is line contact with the raceway. The rollers move around a supporting body that has a guide rib in the direction of travel. Recirculating roller shoes have a theoretically unlimited stroke. They have a high load capacity and high rigidity but can only absorb forces in the radial direction. In the past, recirculating roller bearing units were used in applications where the highest load capacity and rigidity were required, such as in machine tools. Ball, roller and needle roller cages keep the rolling elements at a distance from each other and thus prevent mutual contact; they also have the task of guiding the rolling elements parallel to the axis and thus minimizing the effects of misalignment. Needle roller and cage assemblies are ideal for applications with high loads. Their main advantage is that they are light and compact, which means they require little installation space. Due to their design, cage guides have a limited stroke. All cage guides also have relatively low friction and move absolutely smoothly. They are used in laboratory equipment, microscopes and measurement technology.

Ball guides

The rolling elements of ball bearing guides are balls and have surface contact with the raceway. In terms of their characteristics, they cannot be divided into different subtypes, unlike most of the previously mentioned types of linear guides. Versions of ball guides are categorized according to their design, with one or more of the following distinctions being applicable. Ball guides are available with and without recirculating balls. If they do not have a recirculating of balls, the rolling elements travel half the distance of the table, whereas if they have a recirculating ball bearing, the rolling elements move in a closed circuit in the carriage. There are differences from ball guide to ball guide in terms of their raceways; they can have two, four, six or eight raceways. In addition, the raceways can be arranged in a DF or DB arrangement (NTN only offers ball guides with the raceway arrangement in DF). It is also possible to use the ball guides with or without a ball chain. are areas of application in almost all branches of industry, particularly in machine tool construction, automation technology, the woodworking industry and semiconductor and electronics production.



A linear guide with ball chain is shown here.

Roller guides

As their name suggests, roller guides have rollers as rolling elements. The rolling contact is therefore a line contact, which means that roller guides are highly resilient and have a higher level of rigidity compared to ball guides. They can be used with or without roller recirculation (comparable to ball recirculation, see the previous paragraph for more information). As with ball guides, raceway arrangements in DF or DB arrangement are possible, and roller guides can also be designed with or without a roller chain. In applications that require a high load capacity and high rigidity at the same time, it is advisable to use roller guides, for example in machine tools.

You may also be interested in

Basics of linear motion

Are you new to the field of linear motion and want to get an overview of what is meant by “linear motion“ and what characterises linear systems? Then this article is perfect for you. What is a linear system? A linear system is a machine component that performs a translational movement. To ensure safe use and prevent the ingress of
Read more »

Types of linear axis

Alongside linear guides, screw drives and ball bushings linear axis are an important product in the field of linear motion. Although the first linear axis came onto the market in the early 1990s, they only became established as a standard component for industrial applications at the beginning of the current century. It should be emphasized that there is no uniform
Read more »

Types of screw drives

You may have heard of ball screws before. These are certainly the best known of the screw drives, but they are not the only ones, as trapezoidal screw drives are a second type. This article will focus on the former, but you will still find everything you need to know about both types here. Design, mode of operation and areas
Read more »

Materials

This article is the right address for you if you want to find out more about the materials used in linear systems. First of all, all components that need to be robust are made of steel, including the rolling elements, the guide rails and the carriages. General information on the materials In addition to steel, various other materials are used
Read more »

Point, surface and line contact

If you have already dealt with the point and linear contact of rolling bearings, you will recognise a few things. As with rolling bearings, the rolling elements of linear guide systems have either a ball or roller shape. The contact with a raceway (rolling contact) is different for balls and rollers due to their round or elongated shape. With rolling
Read more »

History of linear motion

Linear motion has been around for a very long time – its history even stretches back to ancient times! In ancient Egypt, it was necessary to transport heavy loads from one place to another to build palaces and pyramids. Creative ideas were already being put into practice back then, as it was of course not possible to simply pull the
Read more »

Make the world **NAMERAKA**

SCAN THE QR-CODE
AND DISCOVER
ROLLING BEARING
KNOWLEDGE

NTN Wälzlager GmbH compiles the information for this website with great care and endeavors to ensure that it is up-to-date, correct and complete. SNR Wälzlager GmbH accepts no liability and is not liable for any material or non-material damage caused by the use of the service, unless it can be proven to be the result of intent or gross negligence.

© NTN Wälzlager GmbH
NTN Europe - 1 Rue des Usines, 74010 Annecy
www.ntn-snr.com

NTN | SNR | BCA BEARINGS | BOWER | Brands of NTN corporation