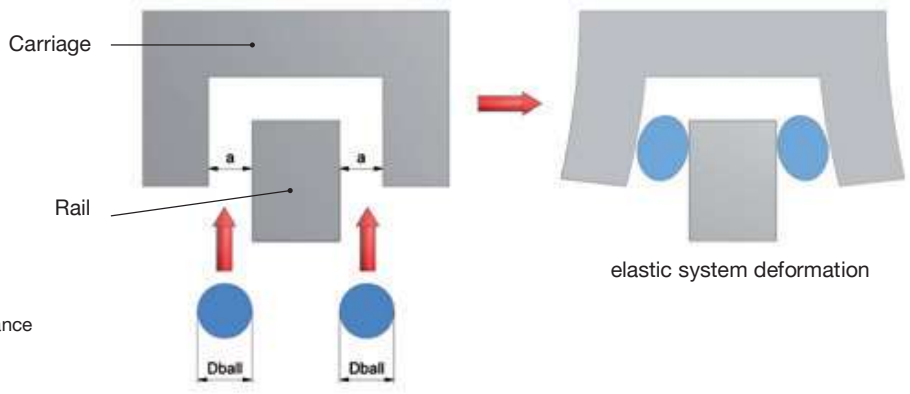
2.6 Preload/rigidity

2.6.1 Preload classes

Linear guides can be preloaded to increase the rigidity of the system or to improve the spring compression behaviour of the total system. The elastic deformation of the tracks and the balls under load is smaller for preloaded carriages than in non-preloaded ones. The disadvantages of preloaded systems are: increased driving resistance and a resulting reduction in service life time. The preload is not considered in the normal service life time calculation when it is within the ranges specified in Table 2.6. The preload in a linear guide system is achieved by using rolling elements that are oversized by a specific factor (Figure 2.17).
The preload is defined by the radial clearance resulting from the over sizing of the rolling elements.



a Race way distance
D_{ball} Ball diameter

Figure 2.17 Preloading by over sizing of the balls

NTN-SNR linear guides are produced in different preload classes (Table 2.6). The individual preload classes correspond to a preload of the rolling elements that is defined by a percentage rate of the dynamic load rating C.

Table 2.6 Preload class

	Description	Preload class
No preload	Z0	0
Low preload	Z1	up to 2% of C
Medium preload	Z2	up to 4% of C
High preload	Z3	up to 8% of C
Special preload	ZX	According customer request

Example for the selection of the preload class

Table 2.7 Application areas for different preload classes

	Without preload (Z0)	Low preload (Z1)	Medium and high preload (Z2/Z3)
Application conditions	> Two-rail system > Weak external effects > Low load > Low friction > Low accuracy	> One-rail system > Low load > High accuracy > Self-supporting design > High dynamics	> Strong vibrations > High-performance processing > Strong external effects
Applications	> Welding machines > Cutting machines > Feeding systems > Tool changer > X and Y axes for general industrial applications > Packaging machines	> Precision coordinate tables > Manipulators > Z-axes for general industrial applications > Measuring devices > PC-board drilling machines	> Processing centres > NC turning machine > Milling machines > Grinding machines

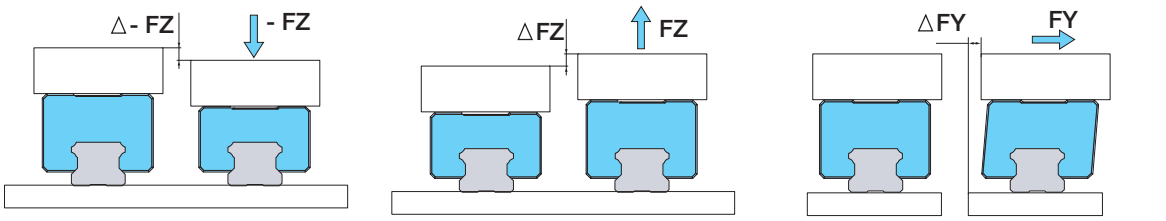
Table 2.8 Radial clearance of linear guides [µm]

	Z0	Z1	Z2	Z3
LGM...07	-2…+2	-3…0	-	-
LGM…09	-2…+2	-3…0	-	-
LGM…12	-3…+3	-6…0	-	-
LGM…15	-5…+5	-10…0	-	-
LGB…15	-3…+3	-8…-4	-13…-9	-18…-14
LGB…20	-3…+3	-8…-4	-14…-9	-19…-14
LGB…25	-4…+4	-10…-5	-17…-11	-23…-18
LGB…30	-4…+4	-11…-5	-18…-12	-25…-19
LGB…35	-5…+5	-12…-6	-20…-13	-27…-20
LGB…45	-6…+6	-15…-7	-23…-15	-32…-24
LGB…55	-7…+7	-19…-8	-29…-20	-38…-30

We recommend that you contact our NTN-SNR application engineers to select the optimal preload.

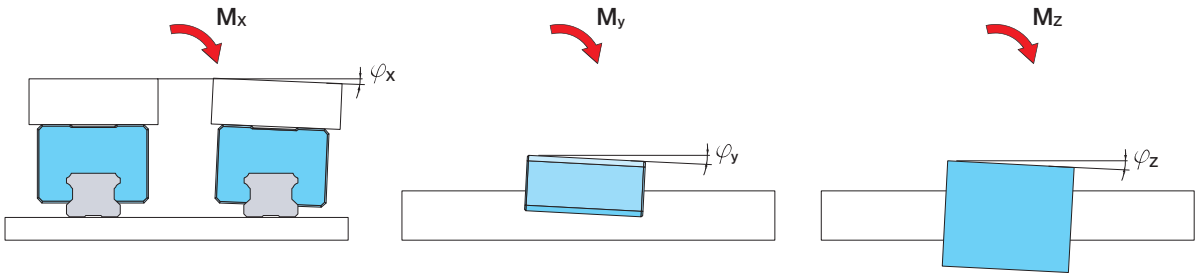
2.6.2 Rigidity

The rigidity of a carriage is defined by the relationship between the external load and the resulting elastic deformation in the load direction. The rigidity is an important parameter for the selection of the system, as the rigidity values vary according to the type and version of the NTN-SNR linear guide systems. The rigidity values discriminate between deformation due to load in the main load directions (Figure 2.18) and angular deformation due to torque load (Figure 2.19).



a) Radial load / pressure b) Radial load / tension c) Tangential load / lateral load

Figure 2.18 Deformation due to load in the main load directions



a) Rolling b) Pitching c) Yawing

Figure 2.19 Angular deformation due to torque load