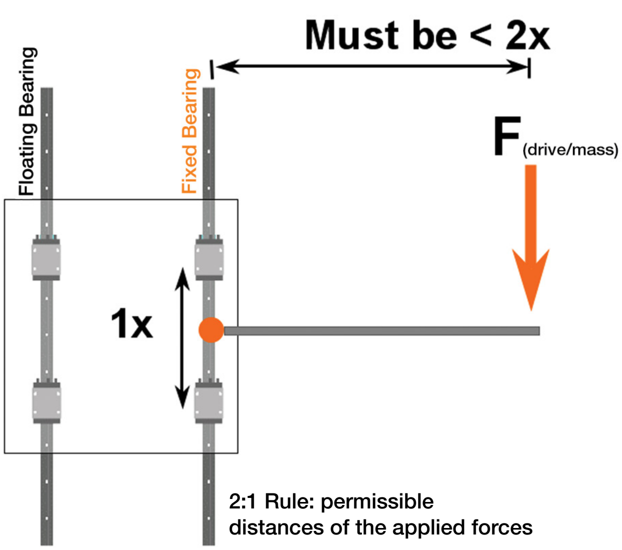
The 2:1 Rule

And how to define fixed/floating bearings



When using DryLin®, it is important to ensure that all acting forces follow the 2:1 rule. In a nutshell, if either the drive force (Fa) or applied load force (Fs) are a greater distance than twice the bearing length (wx), then a binding or chattering of the system can occur. This distance is measured from these forces to the rail closest to the drive force, which should be defined as the fixed bearing side. It is always a good idea to spread these bearings as far apart as your design will allow.

Example: When designing a four-bearing, two-rail system, and the two bearings on the fixed rail are 10-inches apart, then both the drive force and applied mass-force need to be within 20-inches of that rail. On the side closest to the drive force (Fa), you should spec fixed bearings and on the the other side, floating bearings. If you are using a one-rail system, you only need to use fixed bearings

Defining a Fixed and Floating Side

In a two-rail, four-bearing set up, it is important to define one rail as the fixed side: this should be the rail closest to the drive force. The other rail needs to be the floating side, which uses bearings with a little extra clearance: this should be the rail furthest from the drive force. You should only use two fixed bearings in any linear guide system to maximize the 2:1 ratio.

Fixed bearings give the system precision and optimize the 2:1 ratio. Floating bearings do not affect this ratio and only act as guides in the direction of the applied load.

Fixed – floating systems provide many benefits such as:

- Optimizing the 2:1 ratio
- Reducing the drive power needed to move the system (i.e. you can use a smaller motor, cylinder, etc.);
- Minimizing wear so the bearings will last longer
- Increasing the maximum permissible velocity
- Maintaining better precision (floating bearings) in the system over its lifetime
- Compensating for angular rail misalignments (floating bearings) so if a drive force is located in the center of the two rails, it is still beneficial to specify a floating side.

*If you do not use floating bearings, you must calculate your 2:1 from the rail furthest away (as a worst case scenario), which limits your design.

Frequently Asked Questions

Q. What happens the further my drive force/center of gravity gets from the fixed bearing side?

A. The greater the required drive force will be. The higher the wear will be in the system, the lower the max velocity. The increase in wear will lead to less accuracy over time.

Q. What if I use a larger motor/drive force, can I overcome the 2:1 Rule?

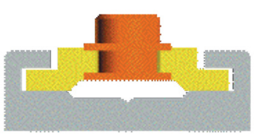
A. No, a larger moment will not overcome the friction-force and the system will not move properly. Essentially the more force you try to move it with, the greater the moment and friction-force becomes. The best thing to do is spread the bearings further apart on the fixed rail.

Q. What if I use all fixed bearings or all floating bearings?

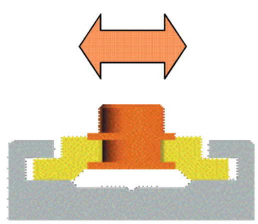
A. You have over-defined the system. Your 2:1 ratio should now be calculated from the acting force to the rail furthest away. You will need a higher drive force to move the system. You may see binding or chattering. There will be increased wear. The max permissible velocity will be reduced. The system will not be as accurate over time as it would if you used fixed and floating bearings.

DryLin® N - Floating Systems

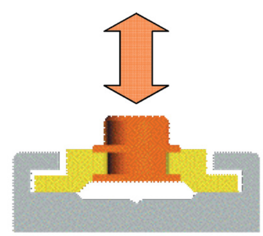
Maximum Float 0.02" (.5 mm)



Standard Version



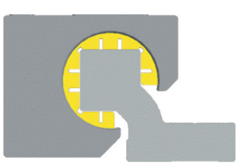
Horizontal Float "LLZ"



Vertical Float "LLY"

DryLin® W - Floating Systems

Maximum Float 0.08" (2 mm)



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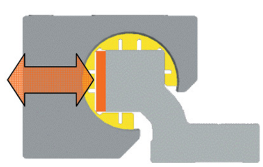
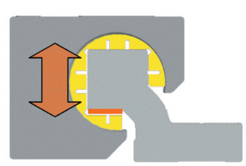


Horizontal Float "LLZ"

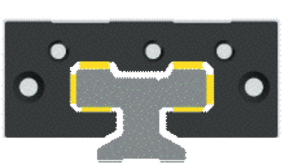


Vertical Float "LLY"

DryLin® W can alleviate edge pressure. Ideal for non-flat, even surfaces

DryLin® T - Floating Systems

Maximum Float 0.04" (1 mm)



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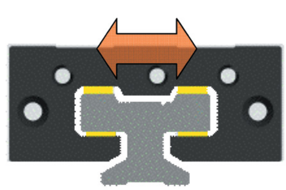
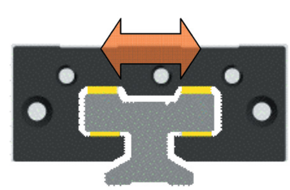


Horizontal Float "LLZ"



Vertical Float "LLY"

DryLin® R

DryLin® R linear 03 series plain bearings are self-aligning and offer great advantages in applications with parallel shafts. They are able to compensate for alignment and parallelism errors and should be used on the shaft furthest from the drive mechanism.

The design provides a raised spherical area on the outer diameter of the aluminum adapter for self-alignment. Load capacity is the same as the fixed version.

Even in unfavorable edge-load conditions, the load is supported by the entire projected surface.

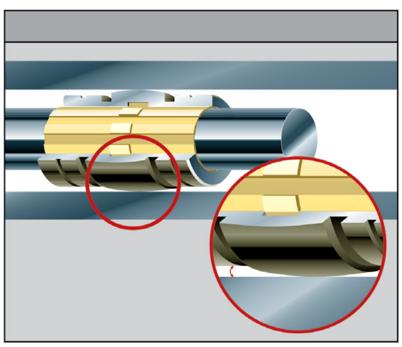
In order to compensate for parallelism errors between two shafts, the outer diameter is designed to be smaller than the housing bore diameter by 0.2 - 0.3 mm depending on size. With the use of mounted O-rings, these bearings have an elastic bearing seat.

Compensation for angle errors

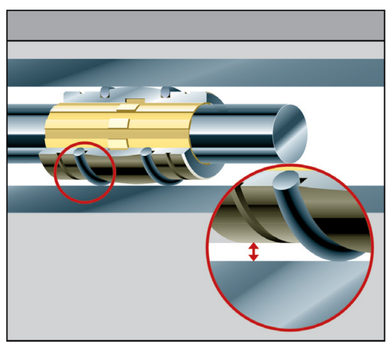
Series RJUI/RJUM/OJUI/OJUM-03	± 0.5°
Series RJUM/-06-LL/OJUM-06-LL	± 3.5°

Compensation of parallelism errors

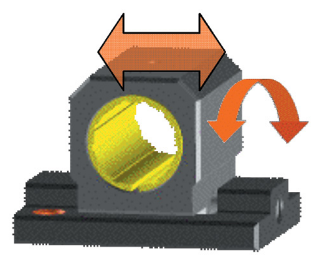
Series RJUI/RJUM/OJUI/OJUM-03	± 0.1 mm (0.004”)
Series RJUM-06-LL/OJUM-06-LL	± 3 mm (0.12”)



Spherical DryLin® adapters can compensate for alignment errors.

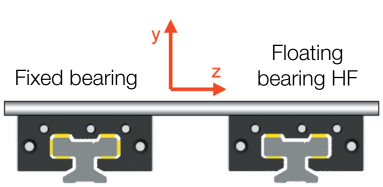


DryLin® R-03 bearings can compensate for parallelism errors using O-rings

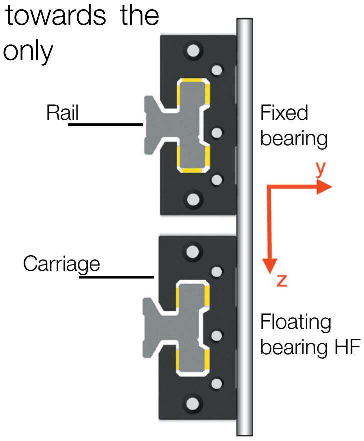


Self-aligning DryLin® R-06-LL bearings can compensate for parallelism errors up to ± .12” (3 mm)

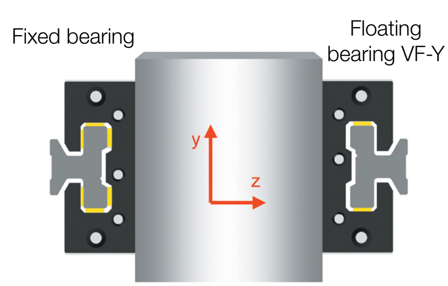
Floating Bearings Tip: Always float towards the other rail. DryLin® T shown as example only



Installation variation horizontal with floating bearing in the Z direction



Installation variation lateral with floating bearing in the Z direction



Horizontal mounting version with floating bearing in the Y direction and lateral mounting carriage

Learn more at www.igus.com/DryLin