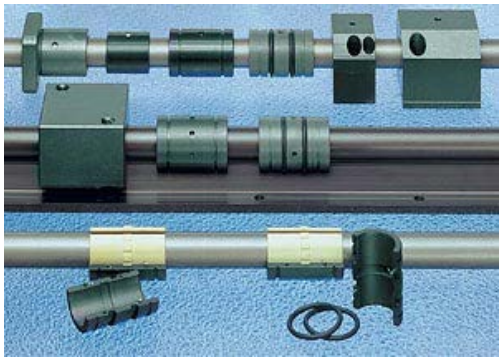
TECHTALK DESIGN ADVICE SERIES

5 LINEAR BEARING MISTAKES YOU DON'T KNOW YOU'RE MAKING



During my travels over the past 12 years, I've heard that some customers have experienced binding or irregular motion when using plain bearings for a linear application. With some pointers and tips, this issue is easy to avoid and can make the difference between a successful application and a problematic one.

Below are five installation mistakes that may cause linear plain bearings to bind and chatter, as well as the symptoms and solutions for each problem.

1. The bearings are not spaced far enough apart relative to the cantilevered load or drive force.

2. The bearings are mounted to a surface that is not flat or rigid, or the rails and/or bearings are not aligned correctly.

3. The rails or shafting are not spaced far enough apart relative to the load.

4. A spray-on lubricant or grease was applied to the bearings.

5. The load is too heavy for a hand-powered application.

1. **The bearings are not spaced far enough apart relative to the cantilevered load or drive force.**

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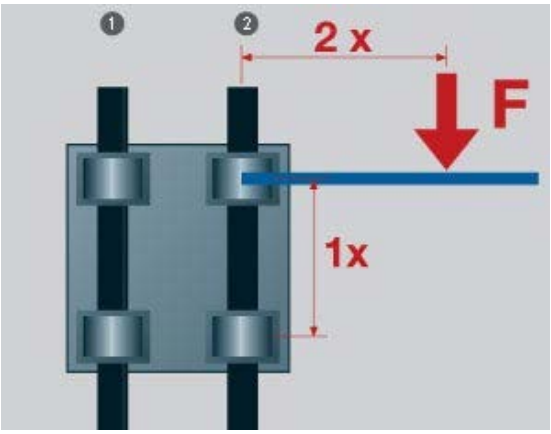


Symptom: The bearing sets chatter as they slide in one or both directions of travel (when carrying a cantilevered load) or, the bearings do not move at all (when moved by a highly offset drive force).

Solution: First, increase the center-to-center distances of the bearings along one rail and in the same direction as the axis of travel. Using a design tool, such as igus®' lifetime calculator, is helpful to determine if the bearings are properly spaced and that all the possible parameters have been considered.

Second, designate one side of the system as the "fixed" side, one as the "floating" side and—I cannot stress this enough—follow the 2:1 rule. This states that for every inch between the bearings, the payload's center of gravity (COG) should not go any further than two inches from this rail.

For in-depth information on this topic, read an archived installment of our TechTalk: The 2:1 rule and Fixed and Floating Bearings.

2. The bearings are mounted to a surface that is not flat or rigid, or the rails and/or bearings are not aligned correctly.

Symptom: The linear bearing system will bind in certain areas of travel or on certain areas of the rails.

Solution: If the tolerances cannot be improved, use bearings that "float" in the direction of the error (again, refer to our The 2:1 rule and Fixed and Floating Bearings TechTalk). Alternatively, use a linear guide system, like igus®' DryLin® WS-10-40 that minimizes assembly tolerances. Also, make sure the bearings or carriages are properly aligned. Avoid over-torquing the bearing's guide rails into plastic or aluminum extrusions because it may cause the carriage to bind in those areas.

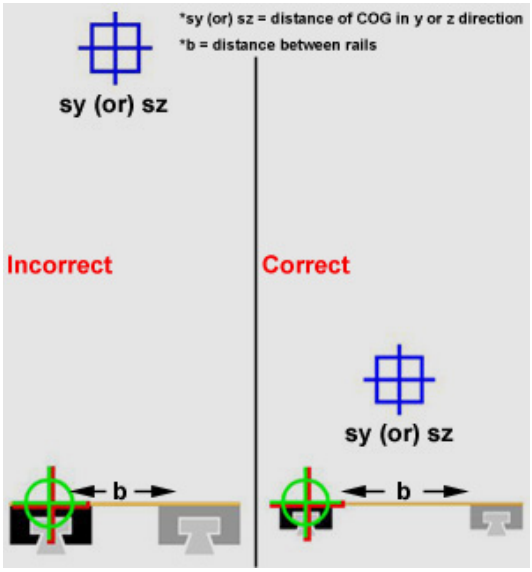
A great tip I share with my customers working with welded frames or uneven equipment assemblies is to use bearings with extra clearance. Typically, square-shaft bearings are more forgiving than round-shaft types because they are better able to float when specified. igus® offers its DryLin® T,DryLin® W and ,DryLin® N linear guides in square styles.

3. The rails or shafting are not spaced far enough apart relative to the load.

Symptom: An irregular or chattering motion may occur because the rails are too close together for a load-offset in either the y or z axis (perpendicular to the axis of travel, which is typically designated x axis).

Solution: For every inch between the rails, you need to make sure that your COG is within five inches. So if you have five inches between rails, your COG needs to be less than 25 inches or chattering may occur. To make this easier, use the 5:1 rule for the center-of-gravity-to-rail spacing. If you have room, make the spacing even wider and remember, if you were making a triangle you'd want to make it equilateral, not isosceles.

sy (or) sz must be < 5 x b. The picture on the left is incorrect because the COG is greater than fives times the distance between the rails, while the picture on the right is correct because the COG is less than fives time the distance between the rails.



4. A spray-on lubricant or grease was applied to the bearings.

Symptom: The linear bearing system ran smoothly for a number of cycles, but after a number of cycles, friction forces increased or binding occurred.

Solution: Plastic bushings are a great alternative to metal ball bearings since they are dry-running and do not require external lubrication. igus®' line of plastic bushings, for example, use dry lubricants such as PTFE and silicone. Most lubricants (especially ones that contain propellants) might absorb dirt and become more viscous over time, which can cause more friction when used with a plastic bushing. Avoid applying lubricant and trust online lifetime calculators. However, if a lubricant must be applied, lightweight petroleum-based oils are best. For more about the hidden costs and pitfalls of lubricated bearings, read our whitepaper: The True Cost of Bearing Lubrication.

5. The load is too heavy for a hand-powered application.

Symptom: The system cannot be pushed by hand even though the 2:1 rule was followed. Bearings that slide have a higher coefficient of friction (COF = 0.25) compared to bearings that roll.

Solution: If you still want to move the system by hand, but avoid the maintenance and higher costs that come along with using ball bearings, a hybrid bearing that both rolls and slides is an ideal solution. When using a traditional plastic sliding bearing, remember that for every 10 pounds of radial load, a minimum of 2.5 pounds of push-force is needed (this will be higher with cantilevered loads). If you choose a hybrid bearing, reduce this by 0.5 pounds for every 10 pounds of radial load.

I'm interested in hearing about your bearing applications that didn't run smoothly and how the issue was solved. Or, if you are currently struggling with one of these scenarios, I would like to help you find a solution. E-mail me at mmowry@igus.com.

Useful links

Learn more about DryLin® linear bearings and guides

E-mail the product expert

Download The True Cost of Lubrication white paper