



Whitepaper

# Lubrication of Linear Bearings

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Understanding linear bearings, as well as the differences between them, is critical to ensure long-term, trouble-free performance in many different markets. Klüber Lubrication has prepared this explanation as a general guide. If a more detailed explanation is required, please contact your nearest Klüber Lubrication representative or the manufacturer of the lubricant you are using.

In this article we will cover the different types of linear bearings commonly used, types of friction and some of the lubrication solutions we could offer.

## Overall, the main differences between a rolling element bearing and a linear bearing are:

- Linear bearings require far more lubricant than rotating bearings
- Mixed friction at the beginning and end of each stroke
- Lubricant is spread across the guide rail or spindle during motion

## Ball Screw

### Description:

A form of linear actuator which translates rotational motion to linear. The threaded shaft provides a helical raceway for the ball bearings, acting as a precision screw. A ball screw is similar to a ball bearing in the sense that the majority of the friction is rolling friction.

### Lubrication:

Ball screws can be lubricated with oil, grease or solid lubricants depending on application. For this article we will focus mostly on grease and oil lubrication.

The screw surface should be lightly coated with grease in order to prevent corrosion. The nut can be filled from 30-70% of its free space. Some nuts have wipers to help keep the grease in and can be filled completely.

A general rule of thumb for re-lubrication of a ball screw (up to 70°C) is after 500,000 revolutions or 6 months. After each 10° above 70°C, the re-lube interval should be cut in half. Re-lubrication quantities should be equal to 30% of the nut-free space. Re-lubrication should be discussed with a local Klüber Lubrication representative as it is based on exact application criteria. To distribute the grease thoroughly, it is recommended that the screw runs 2-10 times its operational stroke.

Some ball screws also incorporate support bearings to help with load. These bearings are either designed for re-lubrication or lubricated for life. The amount of lubrication and lubrication type is calculated from the bearing type, temperature, speed and load. These support bearings should be monitored and maintained if included in the ball screw design. Re-lubricating the support bearing is different from the ball screw itself because the grease is sealed or shielded and cannot escape. Consult with your local Klüber Lubrication representative for proper re-lubrication of the ball screw support bearings.

# Lubrication of Linear Bearings

## Linear Guide

### Description:

A linear motion device that is based on a block and rail system. The block moves back and forth along the rail. In most cases there are re-circulating balls that help the linear guide move. The balls are rotating in a linear direction unlike a ball screw where the rotational motion is converted to linear. Some linear guides can be a hybrid of different types of linear bearings, like ball screws or lead screws. For linear guides, a majority of the friction is sliding and rolling. The sliding comes from the flat surfaces in contact and the rolling comes for the re-circulating balls if the linear guide incorporates these. Some linear guides with polymers are self-lubricating.

### Lubrication:

Linear guides can be lubricated with oil, grease or solid lubricants depending on the application. As with the ball screws, we will also be focusing on oil and grease lubrication.

The rails that the guides slide on should be lightly coated to prevent corrosion, like ball screws. A linear guide is usually filled between 50-70% of its free space. This number will vary for different temperatures, speeds and types of linear guides. With a linear guide you have to make sure there is enough lubricant for the sliding components and the recirculation balls if the linear guide incorporates these. Similarly, you must make sure there is not too much lubricant that will resist movement.

For a linear guide that is vertically oriented, the re-lubrication interval is usually cut in half. A vertically mounted linear guide is the most challenging to lubricate because there is more lubrication lost. The re-lubrication interval is usually 6 months. The re-lubrication amount should be discussed with a Klüber Lubrication representative based on exact application criteria. When the grease is applied, the guide should be oscillating back and forth 2-10 times for proper lubrication.

## Lead Screw

### Description:

A lead screw is similar to a ball screw as it also incorporates a nut as the moving component. Instead of rotational rolling balls transitioning to linear motion, a lead screw is rotational sliding friction converted into the linear motion. A lead screw is similar to how a bolt is threaded into a nut except on a rail instead of a bolt.

### Lubrication:

Lead screws can also be lubricated with a number of different lubricants, greases, oils and solids. We will focus on oil and grease lubrication. Since the lead screw is solely sliding friction, the products will change as well. In many lead screw applications, we incorporate

solids and coatings to support the high amount of sliding friction. Re-lubrication rates are about 6 months but should be discussed with a Klüber representative. The nut of the lead screw can sometimes be a polymer that is self-lubricating. For re-lubrication and procedures, see the ball screw section.

## Products to Be Used in Linear Bearings

### Oils

Industry	Linear Type	Product	Description
General/Corrosion	All	Klübersynth MZ 4-17	Excellent Corrosion Protection
General	Rolling motion guides	Klüberoil GEM 1 Series	Good corrosion/wear protection
General	Sideways	Lamora D 68,220	Good towards cooling lubricants
Food-NSF H1	All	Klüberoil 4 UH1 Series	Good wear protection
Bio-Degradable	All	Klüberbio C 2-46	Good wear protection

### Fluid Greases

Industry	NLGI Grade	Recommendation	Description
Low speed (< 15 m/min)	NLGI 00 - 000	MICROLUBE GB 00	EP/AW, without solid lubricants
General	NLGI 00	Klübersynth BEM 44-4600	Low starting torque
Medium speed (15 to 60 m/min)	NLGI 000	CENTOPLEX GLP 500	Good pressure absorption capacity
Medium speeds, higher temperatures	NLGI 0 - 00	ISOFLEX TOPAS NCA 5051	Low friction and smooth running
Food industry	NLGI 000	Klüberfood NH1 94-6000	NSF H1 with good load

### Greases

Industry	Linear Type	Recommendation
Rolling motion guides	< 15 m/min	Staburags NBU 12/300 KP
	15 to 60 m/min	Staburags NBU 8 EP
	>60 m/min	ISOFLEX NCA 15
Lead screw (plastic nut)	< 15 m/min	POLYLUB GLY 801
Lead screw (metal nut)	15 to 60 m/min	Klüberplex BEM 41-132
Multi-purpose with sliding and rolling	High temp/speed	Klübersynth BME 44-42
	Clean room	Barrierta KM 192
	Food	Klüberfood NH1 94-301
	Bio-degradable	Klüberbio LG 39-701 N

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