PBC Linear™

Lubrication for Linear Roller Bearings and Raceways

Minimize Corrosion and Maximize the Life of Linear Roller Bearing Systems

Introduction

Linear roller bearing systems offer distinct advantages in applications where high speed or quick change of direction is required. Due to the fact that their diameter is larger, they also perform well in contaminated environments where they roll over or "push" particulate from the raceway. However, due to the nature of the design having both steel bearing races and a steel linear raceway, lubrication must be present to minimize the results of this metal-to-metal contact and extend the life of the system. This white paper examines and instructs on the proper use of lubricants with the linear roller bearing systems manufactured by PBC Linear.

Internal Roller Lubrication

All smaller diameter rollers (in the Redi-Rail®, IVT™, V-Guide, Commercial Rail, Hardened Crown Roller families, and smaller diameter Hevi-Rail® bearings) are internally lubricated for long life. No additional lubrication is necessary for the internal rolling elements of the bearing. The rollers are sealed (or shielded) against the operating environment to prevent the egress of lubricant, and prevent ingress of contaminants. Some larger rollers (in the Hevi-Rail family) are supplied with a grease access point and the internal components can be re-lubricated using a zerk fitting.

Raceway/Guideway Lubrication

To ensure long life, it is necessary to have a thin film of lubrication on the Raceway/Railway at all times. When properly applied, lubrication:

- Reduces wear
- Reduces stress on the contact surfaces
- Reduces friction (and therefore heat buildup)
- Allows for operation at designed specifications of the product (de-rating is required for un-lubricated applications)
- Helps protect the metal surfaces against corrosion (rust and fretting corrosion)

Lubrication Type

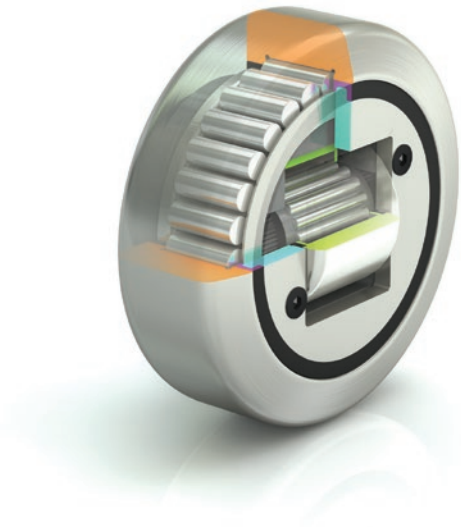
Technical, environmental, ecological and economic factors will determine whether oil or grease should be used in an application. One of the most significant factors in the lubrication selected is the environmental conditions. If extreme conditions are expected, it is highly recommended that either PBC Linear or a representative from a lubrication company is consulted. This includes heavy contamination, when the expected particle size is smaller than 0.1 mm (0.005 in) as small particles can more easily bypass seals and wipers.

CAUTION! The compatibility of lubricants must always be checked! This check should be done under both static and dynamic conditions and within the operating environment. Some lubricants may have unexpected, negative reactions with the plastics, elastomers or non-ferrous metals within the products. It is possible to draw upon previous and practical experience or guidelines from the lubricant manufacturer. When in doubt, consult the lubricant manufacturer.

Initial Lubrication (during installation)

PBC Linear guides and raceways are shipped with a preservative lubrication applied to the raceway. During installation, it is necessary to apply additional lubrication. Provided there are no application conflicts, PBC recommends high quality **lithium soap grease** as the initial lubricant. This grease should be applied to the entire raceway, not just the portion used during normal operation. Oil or grease may be used for re-lubrication.

NOTE: Coated/Plated rails, Commercial Rail, Hardened Crown Roller and Hevi-Rail rails are typically shipped without any preservative lubrication. (Visit our blog Hevi-Rail Heavy Duty Roller Bearing Design Tips to learn more about sandblasting and finishing Hevi-Rail rails.)



One of the most significant factors in the lubrication selected is the environmental conditions.

Periodic Lubrication/Maintenance

The lubrication interval is dependent on many operating and environmental conditions, such as load, stroke, velocity, acceleration, mounting position/orientation, type of lubrication used, temperature, humidity, UV exposure, etc. The actual lubrication interval should be determined by tests conducted under actual application conditions.

While the actual lubrication intervals are application specific and determined only through testing, the following guidelines can *typically* be used as a starting reference point under "*normal*" conditions:

- Re-lubrication every 1,000 km; 50,000 cycles or six months (whichever occurs first).

Oil Filled Polymer Lubricator

Some PBC Linear products offer a high quality polymer lubricator. PBC uses an advanced, oil filled porous polymer which has been tested to show better performance and longer life than similar wiper/lubricators made of oil or grease filled felt. In some applications, this special lubricator will last the life of the application without additional re-lubrication.

This lubricant within the polymer is NSF registered for both H1 & H2 applications (direct & indirect contact with food). It can also be used for wash down & industrial applications. The lubrication within the polymer contains corrosion inhibitors, anti-oxidants & extreme pressure (E.P.) additives. Table 1, below, shows some specific properties for the lubricant.

Table 1: Properties for Lubrication in Advanced Oil-Filled Plastic

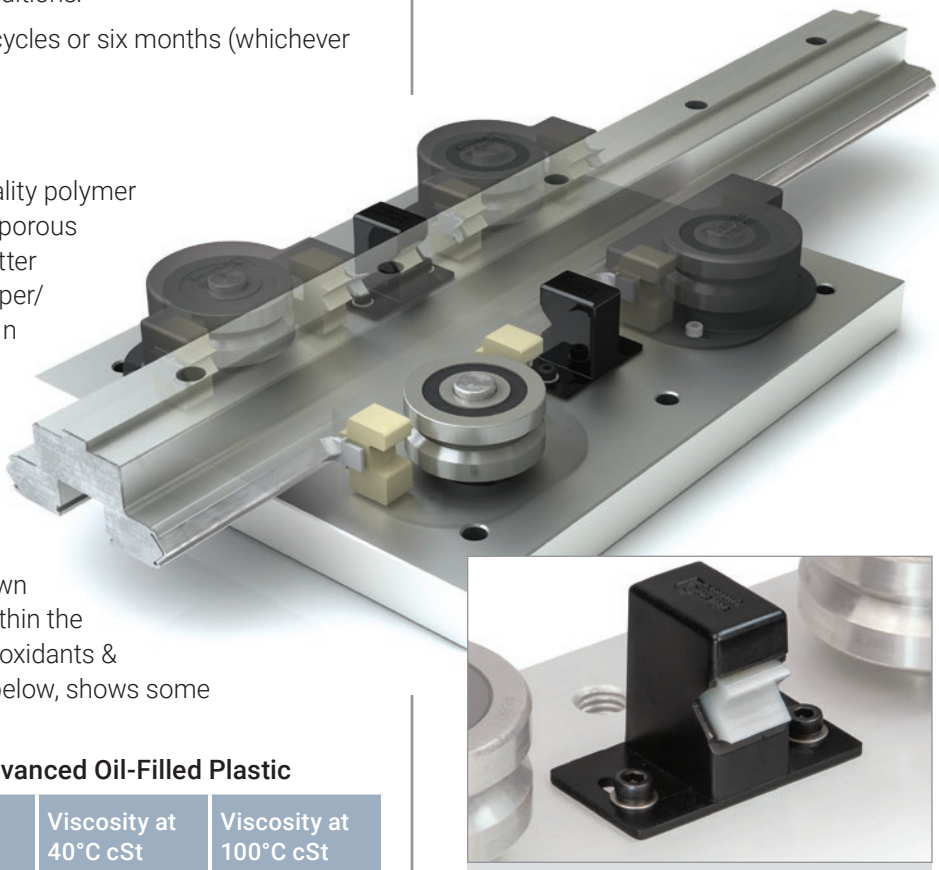
Upper Temp Limit	Lower Temp Limit	Specific Gravity	Viscosity at 40°C cSt	Viscosity at 100°C cSt
99° (210°F)	-40° (-40°F)	0.86	150	16.5

Used Lubricants

Used lubricants should be disposed of using environmentally-friendly methods. Most lubricant manufacturers have guidelines regarding their allowable storage, use and disposal. In addition, some countries have regulations regarding storage, use and disposal of lubricants for occupational safety and/or environmental protection. Furthermore, some companies may have adopted internationally accepted quality and standards policies (i.e. ISO14001) which will further regulate the use of lubricants within an application.

These guidelines and regulations must be followed. Care should be exercised as to not specify a lubricant which is forbidden.

Some PBC Linear products offer a high quality polymer lubricator.



▲ Lube holder with spring loaded polymer lubricator

Lubrication Failure

Contamination and *Lack of Lubrication* are the two primary causes of (ball based) linear guide failures. Lack of lubrication will cause *Fretting Corrosion* which can cause permanent system damage and eventually lead to system failure. As it applies to this product, *Fretting Corrosion* is a form of damage caused as a combination of corrosion and abrasive wear. *Fretting Corrosion* can typically be seen as a reddish discoloration on either mating raceway (track or roller). *Fretting Corrosion* can sometimes be confused with Rust. Both are signs that additional lubrication is necessary ***and*** the re-lubrication period must be decreased.

Operation in an Un-Lubricated State

While not recommended, it is possible to run most systems without lubrication; however, there will be significant reductions to maximum load, maximum speed and expected life. Table 2, below, shows that a typical un-lubricated system will have a significantly reduced maximum load and a reduced maximum speed when compared to a properly lubricated system.

Table 2: Typical Reductions for Max Load & Speed for Un-Lubricated Systems

Product		Lubricated	Un-Lubricated	Reduction
Example A	Max Load kg	100	25	75%
	Max Speed m/s	2	1.5	25%

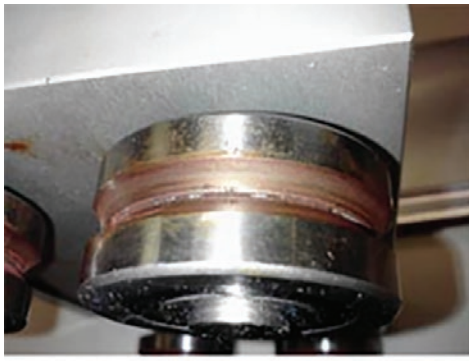
In addition to significant reductions in maximum load and speed, un-lubricated system will also experience an extreme reduction in expected life. Table 3, below, shows the expected life for both a lubricated and un-lubricated system for two different products with two different applied loads. The approximate reduction in lifetime has also been calculated.

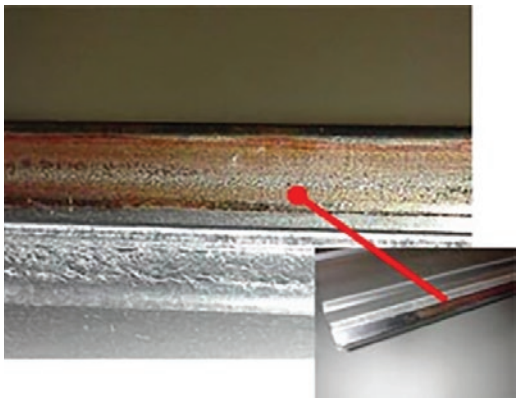
Table 3: Typical Life Reductions for Un-Lubricated Systems

Product		Lubricated	Un-Lubricated	Reduction
Example B	Applied Load 1 kg	45.4	45.4	—
	Life 1 m	5,410,200	88,900	≈ 98%
	Applied Load 2 kg	22.7	22.7	—
	Life 2 m	22,860,000	533,400	≈ 98%
Example C	Applied Load 3 kg	45.4	45.4	—
	Life 3 m	50,800,000	863,600	≈ 98%
	Applied Load 4 kg	90.7	90.7	—
	Life 4 m	8,382,000	152,400	≈ 98%

NOTE: Actual performance will vary depending upon specific application conditions. PBC Linear has removed the actual product name from the examples listed above as the results may not be repeatable, depending upon specific application conditions. While these values are typical, specific reductions should be determined by tests conducted under actual application conditions.

Contact an Application Engineer at PBC Linear to discuss your specific design challenge.





Lack of lubrication will cause *Fretting Corrosion* which is a combination of corrosion and abrasive wear that can cause permanent system damage and eventually lead to system failure.

Further Information

For questions, contact a PBC Linear Application Engineer to discuss your application. You can contact an engineer directly by calling 1.800.962.8979 (from within the USA) or +1.815.389.5600 (from outside the USA). If you prefer, e-mail an engineer at: appeng@pbclinear.com

Version

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