



# KS PERMAGLIDE® Plain Bearings

## Recommendations for Lubrication of Plain Bearings

**In terms of the operating mode, we distinguish between three different functional systems:**

- Dry-running, maintenance-free plain bearings
- Grease-lubricated, low-maintenance plain bearings
- Hydrodynamically operated plain bearings

Plain bearings that work on the principles of hydrodynamics can satisfy the various requirements comparatively well. In this way, oil-lubricated plain bearings in particular can be designed for optimum, reliable operation with the aid of modern calculation methods.

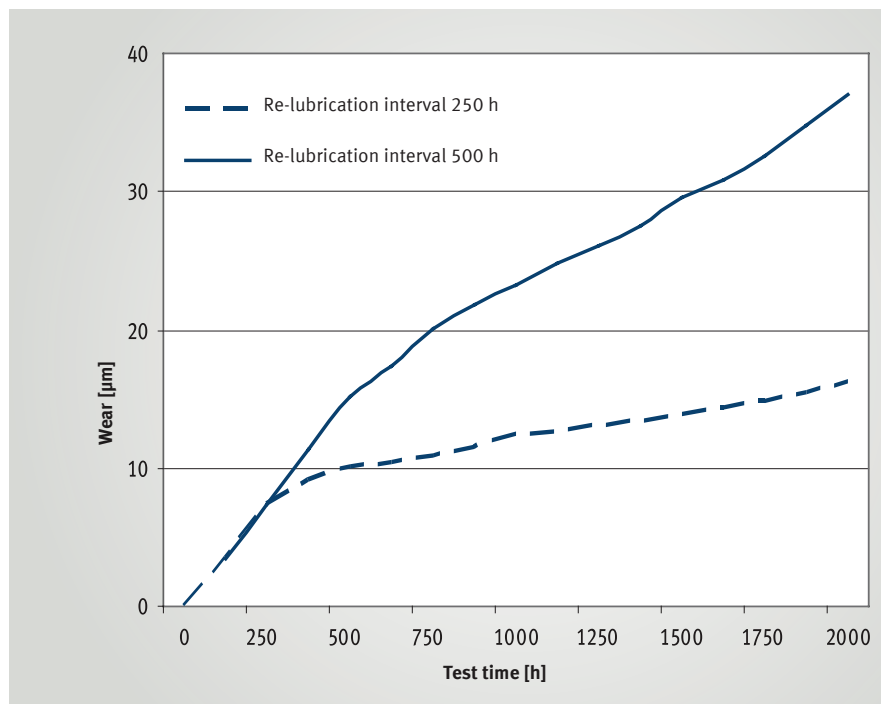
Low-maintenance plain bearings are generally lubricated with grease. The quantity of grease applied during installation is normally sufficient for the entire service life.

If a grease-lubricated plain bearing is used in difficult conditions, subsequent lubrication is recommended.

Where lubrication with oil or grease is not possible or not permissible, use is made of maintenance-free, dry-running plain bearings.

### Grease lubrication of KS PERMAGLIDE® P2 plain bearings

The durability of a P2 plain bearing is also influenced by the type of grease used. In particular, the coefficient of friction, the load bearing capacity and the permissible operating temperature depend on the lubricating grease. Ageing resistance is also of importance for problem-free operation.



Wear curve of P2 plain bearing (schematic)

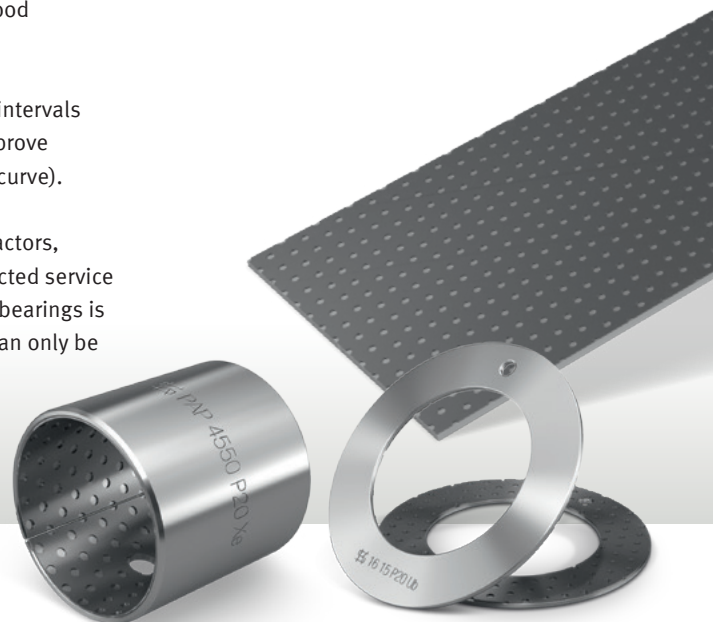
Types of grease that are basically suitable are:

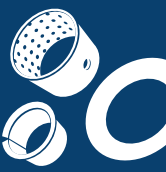
- Lithium-soap greases (ageing-resistant)
- Barium-soap greases (good adhesion)
- Aluminium-soap greases (good wettability)

We recommend performing realistic tests to check the suitability of KS PERMAGLIDE® plain bearings for the application concerned.

Correctly timed re-lubrication intervals extend the service life and improve operational safety (Fig.: Wear curve).

Due to the many influencing factors, however, calculating the expected service life of grease-lubricated plain bearings is fraught with uncertainty and can only be used as a guide.





### Lubrication of P1 plain bearings

In certain applications, it may be necessary to provide grease or oil lubrication for the contact surface between the P1 plain bearing and the interacting sliding part. This may result in considerable deviations from the expected service life. The use of grease or oil can both shorten or extend the service life (see table).

On the one hand, the prevention of solid lubricant transfer during run-in shortens the service life. On the other hand, the presence of grease or oil promotes so-called paste formation. Paste formation refers to the mixing of grease or small quantities of oil with abraded material from the contact zone. The paste becomes deposited in the run-out zone in the direction of rotation and hampers heat dissipation. Some of the paste is carried back into the contact zone, where it encourages wear. Solid lubricants with zinc sulphide or molybdenum disulphide additives increase the likelihood of paste formation.

If it is not possible to avoid lubricating P1 plain bearings with grease, the following action can be taken to counteract paste formation:

- Regular re-lubrication (e.g. with lithium-soap grease)
- Provision of bores or grooves in the run-out zone to allow deposition of the paste.

### Attention

Bores or grooves reduce the cross sectional area of the bush wall. If they amount to >10%, this must be taken into account in the calculation (reliable fit, pressfit). P2 plain bearings must be lubricated.

Operating conditions	Influence on service life	Explanation
Continuous operation in liquid lubricants	Greatly extends service life	Mixed friction or hydrodynamic states occur here. The lubricant conveys the frictional heat out of the contact zone. In the hydrodynamic state, the plain bearing operates virtually without wear.
Continuous operation in lubricating greases (KS PERMAGLIDE® P1 materials)	Shortens or extends service life	Solid additives such as MoS <sub>2</sub> or ZnS promote paste formation and can shorten the service life. Design action (bore/grooves in the run-out zone) and regular re-lubrication can extend the nominal service life (KS PERMAGLIDE® catalogue, item no. 50003863, section 6, "Lubrication")

### *Influence of lubrication on service life*

### Plain bearing damage due to ageing of greases

Ageing can lead to the over-acidification of greases and cause corrosion in non-ferrous metals such as bronze. Organic ester oils or greases are environmentally safe, but form alcohol and free acids in the presence of moisture. Alcohols are hygroscopic and promote hydrolysis. The free acids can lead to oxidation of the non-ferrous metals in plain bearings.

### Note

In the interests of safety, the pH value of the grease should be checked at an early stage and at regular intervals. In cases of doubt, contact Motorservice for assessment of your type of grease by our Technical Service.

### Lubrication of KS PERMAGLIDE® P14 plain bearings

Mineral oil-based greases should be used for the lubrication of KS PERMAGLIDE® P14 plain bearings, e.g. mineral oil-based lithium soap grease.

### Note on the lubrication of unleaded and leaded KS PERMAGLIDE® plain bearings

Exposure tests with KS PERMAGLIDE® P23 materials and synthetic ester-based oils already revealed distinct lead corrosion with lead depletion in the upper sliding layer of the KS PERMAGLIDE® P23 material after approx. 500 hours at 120 °C. The unleaded version of the KS PERMAGLIDE® material P203 remained virtually intact in the same tests. The above results can be applied to all leaded KS PERMAGLIDE® materials.

### Further information on KS PERMAGLIDE® plain bearings

KS PERMAGLIDE® catalogue, item no. 50003863