SKF bearings with solid oil

The third lubrication choice

The Power of Knowledge Engineering


ROTTNE RK 62
25m
ROTTNE
SOLID

SKF bearings with solid oil – the third lubrication choice

There are three ways to supply oil to a ball or roller bearing:

- **oil bath, oil recirculation or nozzles**
- **oil in a thickened form (grease)**
- **solid oil, where oil is retained in a polymer matrix**

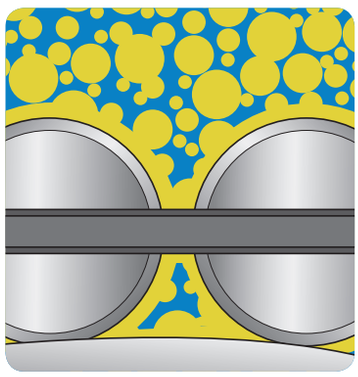
Benefits of solid oil

Solid oil, which was developed for applications where traditional relubrication methods are not practical, can provide a number of benefits, including:

- **supplies more oil to the bearing than grease**
- **keeps contaminants out of the bearing cavity**
- **eliminates the need for relubrication**
- **eliminates the need for seals to retain the lubricant**
- **resistant to chemicals**
- **can withstand high g-forces**
- **environmentally friendly**

About solid oil

Solid oil is an oil-saturated, polymer matrix that completely fills the free space in the bearing, encapsulating both the rolling elements and cage. The polymer material has a porous structure, with millions of micro-pores, to hold the lubricating oil. The pores are so small that the oil is retained in the material by surface tension.



Solid oil forms a narrow gap around the rolling elements and raceways. The oil in the micro pores will seep into the gap.

As the oil-filled polymer material is pressed into the bearing, a very narrow gap forms around the rolling elements and raceways, enabling the bearing components to rotate freely. The oil, which seeps into the gap, provides good lubrication for the bearing, right from the start.

When to use solid oil

Typical solid oil application areas

- dirty or humid
- aggressive chemicals
- very cold
- centrifugal forces
- vertical shafts
- hard to reach
- oscillating movements
- high cleanliness demands

In most applications, standard greases and oils provide an adequate amount of lubricant to a bearing. However, in cases where accessibility to the bearing for relubrication purposes is impractical or impossible, solid oil is an excellent solution. Solid oil can also be used effectively in applications where premature bearing failure is the result of high levels of contamination.

Solid oil is really two solutions in one. It provides lubricant to the bearing and acts as an extremely effective seal.

Advantages of solid oil

Consistent lubricant supply

When a metal surface, like the raceway of a bearing, slides against solid oil, it is coated with an even and consistent film of oil. Then, with only a moderate increase in operating temperature, oil is pushed toward the surface of the polymer matrix. This "flow" of oil within the polymer matrix occurs because the oil has a higher coefficient of thermal expansion than the polymer matrix and because the viscosity of the oil decreases with increasing temperature.

When the bearing stops running, excess oil is reabsorbed into the polymer matrix.

More lubricant available

A bearing with solid oil contains two to four times more oil than a conventional grease-lubricated bearing. This is because the bearing is completely filled with the solid oil, whereas a grease-lubricated bearing normally operates with approximately one third of its free space filled with grease.

Keeps contaminants out

Because solid oil fills the bearing cavity completely, it is difficult for contaminants to reach the bearing contact surfaces.

In highly contaminated environments, SKF recommends filling the free space in the housing with a suitable grease to provide an additional layer of protection.

Eliminates relubrication

Solid oil contains such a large reservoir of oil that relubrication is not required.

No seals required

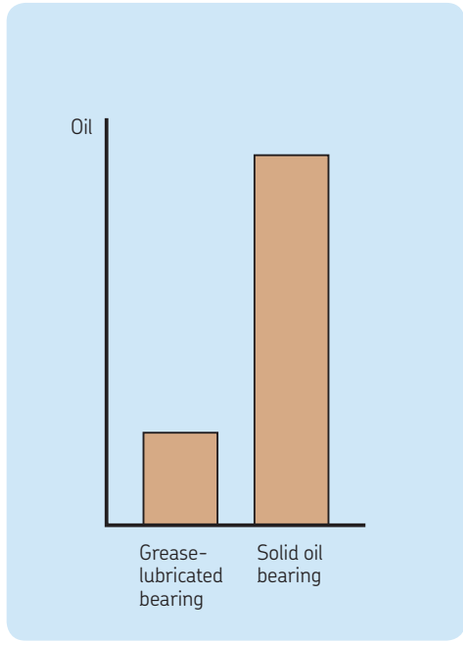
Seals are not needed to retain the lubricant in the bearing, even on vertical shafts. However, if the arrangement already incorporates seals, they should be retained as extra protection against contamination.

Resistant to chemicals

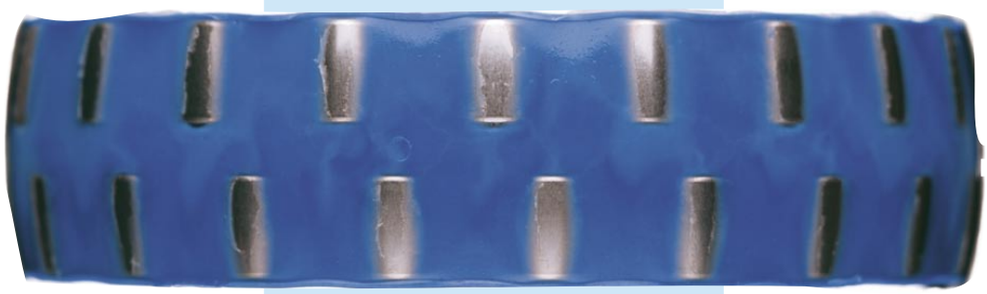
The solid oil polymer matrix is unaffected by most chemicals. However, organic solvents like kerosene, will remove the oil from the polymer matrix.

Withstands high g-forces

Solid oil becomes an integral part of the bearing so that lubricant cannot be expelled, even when subjected to high centrifugal forces.



A bearing with solid oil contains between two and four times more oil than a corresponding grease-lubricated bearing.



Technical data

Composition of solid oil

Solid oil is normally produced with a very high quality synthetic oil which is suitable for most applications.

Oil viscosity	140 mm²/s	at 40 °C (105 °F)
	19 mm²/s	at 100 °C (210°F)

Oils having other viscosities can also be used successfully, as can special oils for the food industry. Additives, such as rust inhibitors, can be added to solid oil to provide extra protection. For additional information, contact SKF.

Bearing types available

Most standard SKF bearings can be supplied with solid oil. Bearings fitted with large-volume cages made of polyamide or machined brass are not recommended for solid oil, because the space available for the solid oil matrix within the bearings is too limited.

Bearings with solid oil are identified by the designation suffix W64.

Temperature limits

The temperature limits for bearings lubricated with solid oil, measured on the bearing outer ring, are listed in **table 1**.

Load carrying capacity

The basic dynamic load ratings for solid oil bearings are the same as for corresponding standard bearings.

Note: The temperature limits in **table 1** apply to both open and sealed versions. In general, sealed bearings have higher operating temperatures.

Limiting speeds

Table 2 lists recommended limit values for the speed factor A.

$A = n \times d_m$

Where
A = speed factor [mm/min]
n = rotational speed [r/min]
d_m = bearing mean diameter
= 0.5 (d + D)
d = bearing bore diameter [mm]
D = bearing outside diameter [mm]

It is important to remember that the higher the speed, the higher the operating temperature. It may therefore be necessary to limit the bearing speed for high temperature operation so that the temperature limit for the solid oil is not exceeded. As with most lubricants, the service life of a bearing with solid oil is extended if the operating temperature is kept low.

The speed limits listed in **table 2** apply to open (unsealed) bearings.

For bearings with integral seals, 80% of the quoted values should be used.

If bearings with solid oil are to operate under extreme conditions, contact the SKF application engineering service for additional information.

Table 1

Temperature limits

Max. continuous operating temperature	85 °C (185 °F)
Max. intermittent operating temperature	95 °C (205 °F)
Min. start-up temperature (standard oil)	–40 °C (–40 °F)

Bearings with solid oil can be heated to a maximum of 100 °C (210 °F) for mounting purposes.

Table 2

Recommended limit for speed factor A

Bearing type	limit for A
Single row deep groove ball bearings with a steel cage	300 000
Ball bearings with a polyamide cage (including Y-bearings)	40 000
Angular contact ball bearings	150 000
Cylindrical roller bearings	150 000
Tapered roller bearings	45 000
Spherical roller bearings	
• E-design	42 500
• other designs	85 000

If temperature exceeds 20 °C the speed limit will be lower.

Our world faces serious issues

Diminishing energy supplies. Endangered water and air supplies. Overflowing and potentially hazardous landfills. Global warming.

In addition to other issues driving today's design engineers, a product's environmental impact is a major consideration. You need to be concerned with your product's energy efficiency, as well as its total life cycle.

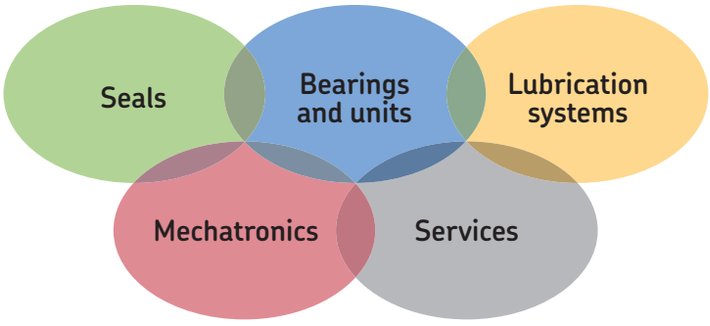
SKF supports your sustainability goals in a number of ways, many of which we are using in our manufacturing plants worldwide, as part of our BeyondZero initiative.

Solutions for sustainability

- Low friction, high capacity SKF Explorer bearings that enable machines to be downsized and more energy-efficient
- Specialized bearings such as CARB toroidal roller bearings that accommodate axial movement within the bearing, without inducing axial forces, and decrease power consumption.
- Mechatronic solutions that eliminate the need for hydraulics
- Engineered units that reduce the number and weight of components
- Built-in condition monitoring devices that enable end users to optimize efficiency and reduce energy use
- Sealed-for-life bearing units that require no additional lubrication
- Environmentally friendly lubricants and lubrication systems
- Magnetic bearings that run at high speeds with no surface contact or lubrication
- Lubrication distribution systems that optimize lubrication and minimize the use of lubricants and cutting oils

See inserts for more details about SKF solutions for mining, mineral processing and cement industries and auxiliary equipment.

The Power of Knowledge Engineering



The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management services. A global presence provides SKF customers uniform quality standards and worldwide product availability.

Publication **6920 EN** · February 2009

Printed in Sweden on environmentally friendly paper.