

SKF

SKF bearings with Solid Oil – the third lubrication choice





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There are three ways to ensure good oil lubrication of a ball or roller bearing.

1. Supply oil directly
2. Supply oil in thickened form as grease
3. Solid Oil where the oil is retained in a polymer matrix. Solid Oil was developed for use in applications where the two traditional methods above cannot be used

What is Solid Oil?

Solid Oil is a polymer matrix, saturated with a lubricating oil, which completely fills the internal space in a bearing and encapsulates the cage and rolling elements. Solid Oil uses the cage as a reinforcement element and rotates with it. By releasing the oil, Solid Oil provides good lubrication for the rolling elements and raceways during operation.

The polymer material has a porous structure with millions of micro-pores which hold the lubricating oil. The pores are so small that the oil is retained in the material by surface tension. Oil represents an average of 70 % by weight of the material.

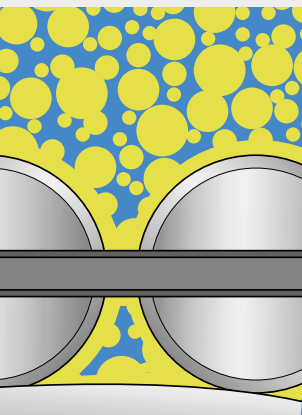
The oil-filled polymer material is pressed into the bearing. A very narrow gap will form around the rolling elements and raceways during the moulding process, allowing the bearing components to rotate freely. The oil which seeps into the gap will provide good lubrication for the bearing right from the start.

Solid Oil has unique advantages

- It keeps the oil in position
- It brings more oil to the bearing than grease
- It keeps contaminants out
- It makes maintenance unnecessary – no relubrication needed
- It does not need seals
- It is environmentally friendly
- It is resistant to chemicals
- It can withstand large “g” forces



Millions of micro-pores retain the oil in Solid Oil.



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



When should Solid Oil be used?

In most applications, ordinary greases and lubricating oils will provide satisfactory lubrication to the bearing giving it an acceptable service life. However, there may be cases where lack of accessibility means that relubrication is virtually impossible, or where very good contaminant exclusion is required. Solid Oil may be the answer, as it provides “lubrication for life” and good sealing.

The Solid Oil advantages

It keeps the oil in position

A metallic surface sliding against Solid Oil is guaranteed an even and consistent film of oil. A moderate increase in temperature will cause oil to be pushed towards the surface of the polymer matrix as the thermal expansion of the oil is greater than that of the polymer matrix. The viscosity of the oil will also decrease with increasing temperature. When the bearing stops running, excess oil will be re-absorbed by the polymer matrix.

It brings more oil to the bearing

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 internal space filled with grease.

It keeps contaminants out

As the bearing is completely filled with the Solid Oil it is difficult for contaminants to penetrate. To reinforce this protection it is recommended, where appropriate, to fill the free space in the bearing housing with a suitable grease.

It makes maintenance unnecessary

Relubrication is not required as Solid Oil contains such a large reservoir of oil that it will outlast the life of the bearing.

It does not need seals

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

It is environmentally friendly

Solid Oil is environmentally friendly as it will not leak from the bearing.

It is resistant to chemicals

The polymer matrix of the Solid Oil is unaffected by most chemicals. However, organic



solvents, e.g. kerosene, will remove the oil from the polymer matrix.

It withstands large “g” forces

The bearing with the Solid Oil forms a “solid” unit from which the lubricant cannot be expelled even when subjected to considerable centrifugal force

Typical Solid Oil application areas

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



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

Solid Oil applications



Papermaking

Solid Oil has been found beneficial in the papermaking industry. First in the wood treatment process where it protects the bearing against impurities and then in pulp preparation where the chemical stability of the polymer is

Solid Oil keeps contaminants out during the wood treatment process.



Solid Oil tolerates the chemicals in the pulp preparation process and the humidity in the wire roll section.



invaluable. In the papermaking machine itself, Solid Oil has been used successfully on the wire rolls of the wet section. Finally the Solid Oil has the advantage when cutting the paper to size as the absence of lubricant leakage means clean paper.

Equipment for snow and ice

Solid Oil has a very low starting torque in the cold compared with grease as the rolling elements do not need to overcome the stiffness of a grease. This energy-saving property has been appreciated, for example, in bearings for ski lifts and piste machinery.



Solid Oil does not leak oil onto the paper.

Pneumatically operated couplings

When the bearing outer ring rotates in a grease-lubricated bearing arrangement, grease is thrown out of the bearing and inadequate lubrication may result. The expelled grease is deposited on the engaging members and the function of the coupling is endangered. These problems have been completely eliminated using Solid Oil.

Cranes and traverses

The freedom from maintenance provided by Solid Oil can be exploited in many applications where bearings are difficult to reach, e.g. over-head cranes and hoists.

Mixers

In equipment used to stir and mix chemicals, e.g. electrolytes for dry cell batteries, the resistance of Solid Oil to aggressive substances is valuable.

In addition ...

... it is important that lubricant does not leak and pollute when polishing chips in the electronic industry.

... this is also important in the food processing industry. Solid Oil will not be washed out by high-pressure cleaning as is the case with normal lubricating greases. However, if such cleaning is applied the bearing arrangement must be allowed to dry to minimise the risk of rust forming in the bearing due to entrained water. The bearing arrangement should always be inspected after such an incident.

Solid Oil is also insensitive to impurities such as flour dust. Leakage which would contaminate the process will not occur.

... in certain printing presses where the printing ink solvent can quickly wash grease out of a bearing.

... in pumps and agitators in sewage works, where sludge contaminates the bearings.



Solid Oil is useful in inaccessible positions.



In a ski lift Solid Oil is appreciated. It does not leak oil on the passengers and in the cold it has much lower starting torque than grease, which saves energy.

Technical data

W64

Bearings with Solid Oil have suffix W64.

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 mm ² /s	at 40 °C
	19 mm ² /s	at 100 °C

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.

Bearing types available

Most normal sizes of SKF ball and roller bearings can be supplied with the Solid Oil.

Bearings fitted with large-volume cages made of polyamide or machined brass are less favourable for Solid Oil, see speeds table.

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:

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

Bearings with Solid Oil can be heated to a maximum of 100 °C for mounting purposes

Load carrying capacity

The basic dynamic load ratings for the Solid Oil bearings are the same as for the corresponding standard bearings.

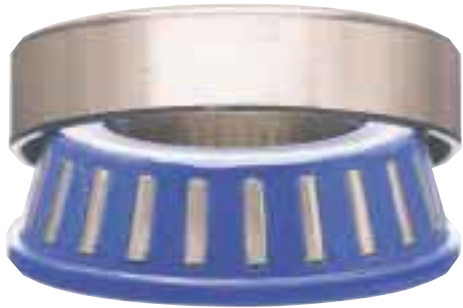
Limiting speeds

An indication of the limiting speeds is given below by the $n \times d_m$ factor – rotational speed (r/min) times the bearing mean 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 theoretical bearing life is extended if the operating temperature is kept low.



Limits of Solid Oil

- Temperature
- Speed



These speed limits apply to open (unsealed) bearings. For bearings with integral seals 80 % of the quoted values should be used.

Generally, when bearings with Solid Oil are to operate under extreme conditions, it is advisable to contact SKF for advice and support.

SKF bearing type	$n \times d_m$ (max)
Single row deep groove ball bearings	300 000
Angular contact ball bearings	150 000
Self-aligning ball bearings	150 000
Cylindrical roller bearings	150 000
Spherical roller bearings	
– E-design	42 500
– other designs	85 000
Taper roller bearings	45 000
Ball bearings with polyamide cage (including Y-bearings)	40 000

$$n \times d_m = n \times 0,5 (d + D)$$

where

n = speed, r/min

d = bearing bore diameter, mm

D = bearing outside diameter, mm



If the operating conditions are extreme, please contact SKF for advice and support.

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Publication **4827 E**

Printed in Sweden on environmentally friendly, chlorine-free paper (Multiart Silk) by SG idé och tryck ab.

