Solid Oil Bearings

Relubrication-free solutions for wet environments

The Power of Knowledge Engineering

Content

Reduce downtime and maintenance cost and contaminated environments

The Challenge of Wet and Contaminated Environments

Bearings operating in wet or contaminated environments often suffer from reduced reliability and shortened service life, leading to costly maintenance and unplanned downtime. This is especially true for applications exposed to harsh elements or those requiring frequent washdowns, such as in food, beverage, and pharmaceutical processing.

While frequent relubrication is sometimes attempted to extend bearing life, it often proves ineffective and introduces the risk of product contamination by expelled grease (>>Fig. 1).


Fig. 1

Moisture Threats to Bearing Performance

High moisture levels and water exposure create unique challenges for bearings. When water infiltrates the bearing's internal space, it degrades lubricant effectiveness, accelerating wear, increasing frictional heat, and promoting corrosion of rolling elements and raceways.

In industries with rigorous hygiene standards, high-pressure washdowns compound the problem. These washdowns can force seals to deflect inward, allowing water ingress and grease washout. This not only risks product contamination but also reduces remaining lubrication, drastically shortening bearing lifespan.


Water contamination of bearings can degrade lubrication causing wear and corrosion damage


High pressure washdowns can deflect and open seals, contaminating and washing out the lubricating grease

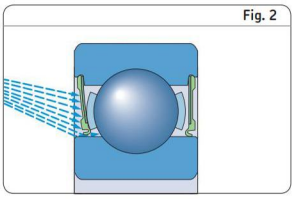
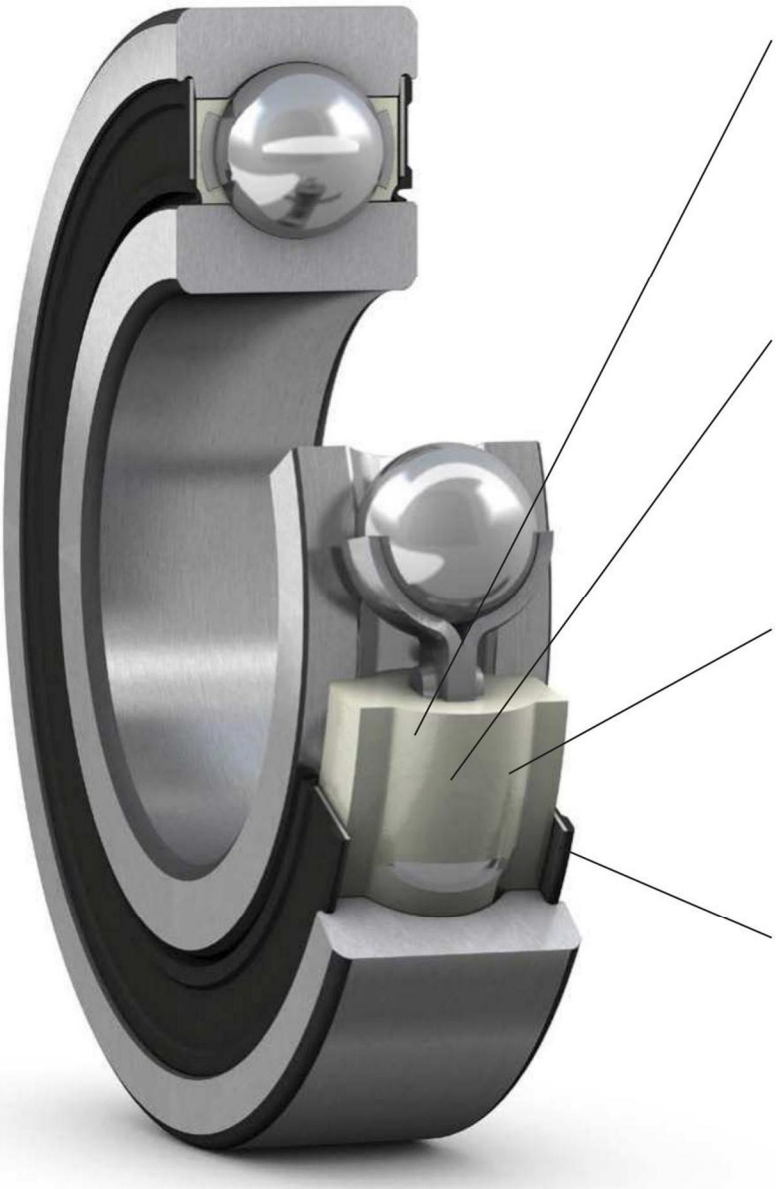


Fig. 2

Seals deflected by high pressure washing

Features and benefits of bearings with Solid Oil



Longer lubricant life

- Large amount of oil available
- Eliminates lubricant churning
- High quality, synthetic oil resists oxidation

Resists washout

- Solid Oil cannot be washed out of the bearing
- Water cannot mix with the oil or Solid Oil polymer

Virtually eliminates lubricant leakage

- Solid Oil retains oil in the bearing
- Integral bearing seals increase the oil retention even further

Protects against the ingress of contaminants

- Close osculation between Solid Oil and the rollers and raceways significantly reduces the ingress of contaminants
- Provides additional support for integral bearing seals

Applications

Food and beverage, pharmaceutical

Maintaining ultra-hygienic conditions is critical in food,beverage,and pharmaceutical processing.Machinery is frequently cleaned with high-pressure washdowns and strong detergents to meet sanitation requirements. Preventing contamination(e.g., from lubricant leaks) is essential,so all materials must be safe for incidental product contact and easily detectable if contamination arises.

Bottle filling station

In standard bottle filling stations,bottles are cleaned,filled and sealed in one seamless line.Maintaining cleanliness is critical for food safety,often resulting in a wet environment due to frequent washing.

Customer issue

A customer experienced premature bearing failures in their stainless steel deep groove ball bearings,which were factory-sealed and greased for life.During high-pressure washdowns,the internal seals deformed, allowing cleaning fluids to infiltrate the bearing housing.The pressure washed out most of the grease and contaminated the remaining lubricant.

This led to inadequate lubrication,drastically shortening bearing life,while the expelled grease created a serious product contamination risk.The resulting unplanned maintenance, frequent bearing replacements, and costly production downtime significantly impacted both productivity and profitability.

Solution

Sealed stainless steel deep groove ball bearings with food-grade Solid Oil:

- Extended service life – Increased bearing durability from 12 weeks to 2+ years,minimizing replacements.
- Superior seal performance – Effectively prevents lubricant leakage and resists high-pressure washout.
- Hygienic & maintenance-free – Easy-to-clean design requiring virtually no regreasing or servicing.
- Lower maintenance costs – Reduces unplanned downtime and bearing replacement expenses.
- Reliable under harsh conditions – Engineered for robust,uninterrupted operation in demanding environments.
- Enhanced food safety – Eliminates grease leakage risk,ensuring compliance with hygiene standards.
- Sustainable performance – Minimizes lubricant waste and environmental impact.

Marine

In the marine industry,deck machinery faces extreme conditions,including harsh environments and constant exposure to saltwater spray. Offshore maintenance of this equipment is both hazardous and labor-intensive,underscoring the need for durable,weather-resistant components—especially bearings—engineered for long-lasting reliability.Given the high operational and financialcosts of downtime,bearing failures are simply unacceptable.

Deck machinery

Heave compensation systems are a key example of deck machinery used on marine vessels. These systems mitigate wave motion to ensure stable equipment operation.Large rope sheaves absorb vessel movement,allowing operations to continue even in rough seas.Failure of this critical system can lead to catastrophic damage to sensitive—and costly—drilling equipment.

Customer issue

A customer applied standard spherical roller bearings with grease lubrication and external seals in a heave compensation system's rope sheaves but encountered critical issues:

- Grease washout – Seawater flushed lubrication from the bearings
- Saltwater contamination – Leading to accelerated corrosion
- Premature bearing failure – Drastically reduced service life
- Increased operational costs – Due to frequent replacements and downtime

Solution

Our Sealed Spherical Roller Bearings with Solid Oil – integrated into a Three-Barrier Solution – delivered a durable, maintenance-free answer to critical challenges:

- Enhanced Reliability – Extended bearing service life under harsh conditions
- Zero Relubrication Needed – Eliminated offshore greasing and associated HSE risks
- Cost Efficiency – Slashed maintenance expenses significantly

Material handling

Cranes employed in material handling operations must endure extreme mechanical and physical stresses.Their bearings must support heavy loads while maintaining reliability and resistance to harsh weather conditions.Failures in crane systems can lead to severe financial losses,operational disruptions,and,in worst-case scenarios,pose life-threatening risks.

Port cranes

Port and deck cranes are exposed to saltwater spray,which can compromise bearings in critical components such as wheels,drums,and rope sheaves.Water ingress may lead to lubrication failure,accelerated wear,and corrosion.To mitigate the risk of premature bearing failure,frequent relubrication is often required to flush out moisture and contaminated grease,as well as replenish grease washed away by water.However,manual relubrication is labor-intensive and poses safety hazards for maintenance workers.

Customer issue

The trolley crane wheels in this application originally used standard spherical roller bearings with grease lubrication and external seals. However, several critical issues arose:

- Water ingress led to lubrication breakdown, accelerated wear,and bearing corrosion.
- Premature bearing failure reduced crane reliability and drove up maintenance expenses.
- Frequent manual relubrication introduced safety risks and increased operational costs.

Solution

The upgrade to sealed spherical roller bearings with Solid Oil technology – while maintaining the existing sealing system – delivered significant operational improvements:

- Enhanced reliability and extended bearing service life
- Permanent lubrication eliminated relubrication requirements
- Superior protection against harsh weather conditions
- Reduced maintenance complexity and downtime

Product information

Assortment

The FHD standard assortment of bearings with Solid Oil includes:

- Deep groove ball bearings
- Spherical roller bearings
- Y-bearings
- Tapered roller bearings
- Cylindrical roller bearings
- Self-aligning ball bearings

The assortment comprises a standard variant with high-quality synthetic oil (designated W64) for mostapplications and a food-grade variant (W64F) using NSF H1-registered oil for food processing.FHD can supply other bearing types with Solid Oil for specialized applications,except CARB toroidal roller bearings and those with large-volume cages,as insufficient internal space prevents proper oil distribution.For details on custom solutions,consult the FHD application engineering service.

Sealing solutions

For optimal performance in wet or harsh environments,bearings with Solid Oil and integral contact seals are strongly recommended whenever possible.The combination of Solid Oil and contacting seals enhances sealing efficiency, as the Solid Oil provides axial support to prevent seal deflection and gap formation under pressure (see Fig. 2, page 4).
For further details on sealing solutions,consult the FHD Rolling Bearings Catalogue or contact the FHD Application Engineering Service.

Table 1

Technical specifications for bearings and units with Solid Oil

Characteristic		Standard variant	Food grade variant
Designation suffix		W64	W64F
Base oil viscosity	mm²/s		
at 40 °C *(105 °F)*		150	220
at 100 °C *(210 °F)*		20	25
NSF H1 food grade		no	yes
Operating temperature	°C *(°F)*		
Maximum continuous		85 *(185)*	85 *(185)*
Minimum start-up temperatures		–50 *(–60)*	–25 *(–15)*
Maximum intermittent		95 *(205)*	95 *(205)*
Relubrication-free		yes	yes

Bearing data

Bearings and units with Solid Oil retain the same dimensions,tolerances,and internal clearances as their standard counterparts.Table 1 compares the key characteristics of general-purpose (W64) and food-grade (W64F) variants equipped with Solid Oil.

Load carrying capacity

Bearings with Solid Oil maintain the same basic dynamic and static load ratings as standard FHD bearings.

Mounting

For hot mounting of bearings with Solid Oil (up to 120°C/248°F), induction heating is required. Avoid using heating plates or oil baths, as they may damage the polymer fill.

Friction characteristics

Bearings with Solid Oil exhibit the same friction characteristics as standard bearings, with the addition of a fixed friction component from the polymer filling.

Speed limits

The maximum speed limits for bearings and units with Solid Oil are determined by their continuous operating temperature limit of 85 °C (185 °F). Refer to Table 2 for recommended speeds at an ambient temperature of 20 °C (70 °F).
Ambient temperature refers to the immediate thermal environment of the bearing location, which may differ from room temperature. For bearing types not listed in Table 2, please consult FHD Application Engineering.
Under normal operating conditions at recommended speeds, bearings with Solid Oil typically experience a temperature rise of approximately 65°C (115°F) above ambient.
For operating temperatures exceeding 20°C (70°F), speed limits must be derated according to the reduction factors specified in Diagram 1.

Table 2

Recommended maximum speed limits for bearings and bearing units with Solid Oil for ambient temperature 20 °C

Bearing type	Recommended maximum speed limit n
–	r/min
Deep groove ball bearings	
single row with a stamped metal cage	300 000 / d_m
single row with a polymer cage	40 000 / d_m
double row	40 000 / d_m
Single row angular contact ball bearings	
with a stamped metal cage	150 000 / d_m
with a polymer cage	40 000 / d_m
Self-aligning ball bearings	
with a stamped metal cage	150 000 / d_m
with a polymer cage	40 000 / d_m
Cylindrical roller bearings	
with a stamped metal cage	150 000 / d_m
with a polymer cage	40 000 / d_m
Tapered roller bearings	45 000 / d_m
Spherical roller bearings	
E design	42 500 / d_m
CC design	85 000 / d_m
Y-bearings, Y-bearing units	40 000 / d_m

Where
$d_m = 0,5\,(d+D)$
For bearings with integral seals, use 80% of the quoted speed limits.

Calculation example

A deep groove ball bearing 6208/W64 is to operate atan ambient temperature of 50℃ (120 °F). What is the reduced speed limit?

1 Recommended maximum speed for 20 °C ambient temperature
Speed limit for 20 °C ambient temperature from **table 2**: 300 000 / d_m, single row deep groove ball bearing with stamped metal cage dimensions d = 40 mm, D = 80 mm

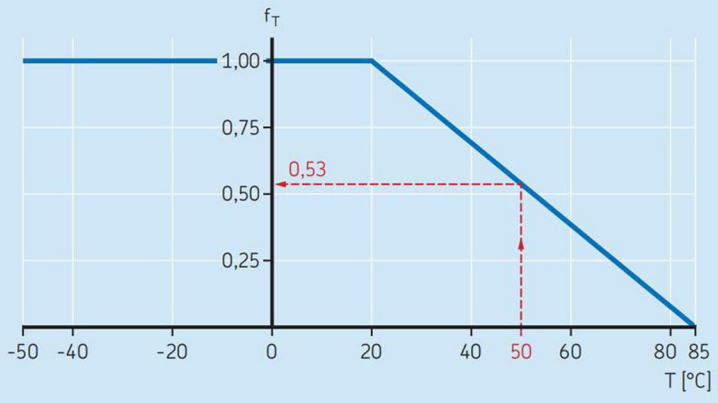
$$n = \frac{300\,000}{0,5\,(40 + 80)} = 5\,000 \text{ r/min}$$

2 Reduction for 50 °C ambient temperature
Speed reduction factor $f_T \approx 0,53$ from **diagram 1**

$$n_{reduced} = 5\,000\, f_T = 5\,000 \times 0,53 = 2\,650 \text{ r/min}$$

Diagram 1

Speed reduction factor f_T for ambient temperature above 20 °C



ANY OTHER QUESTIONS?

For further information about FHD's wide range of bearings with Solid Oil, contact us today.

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