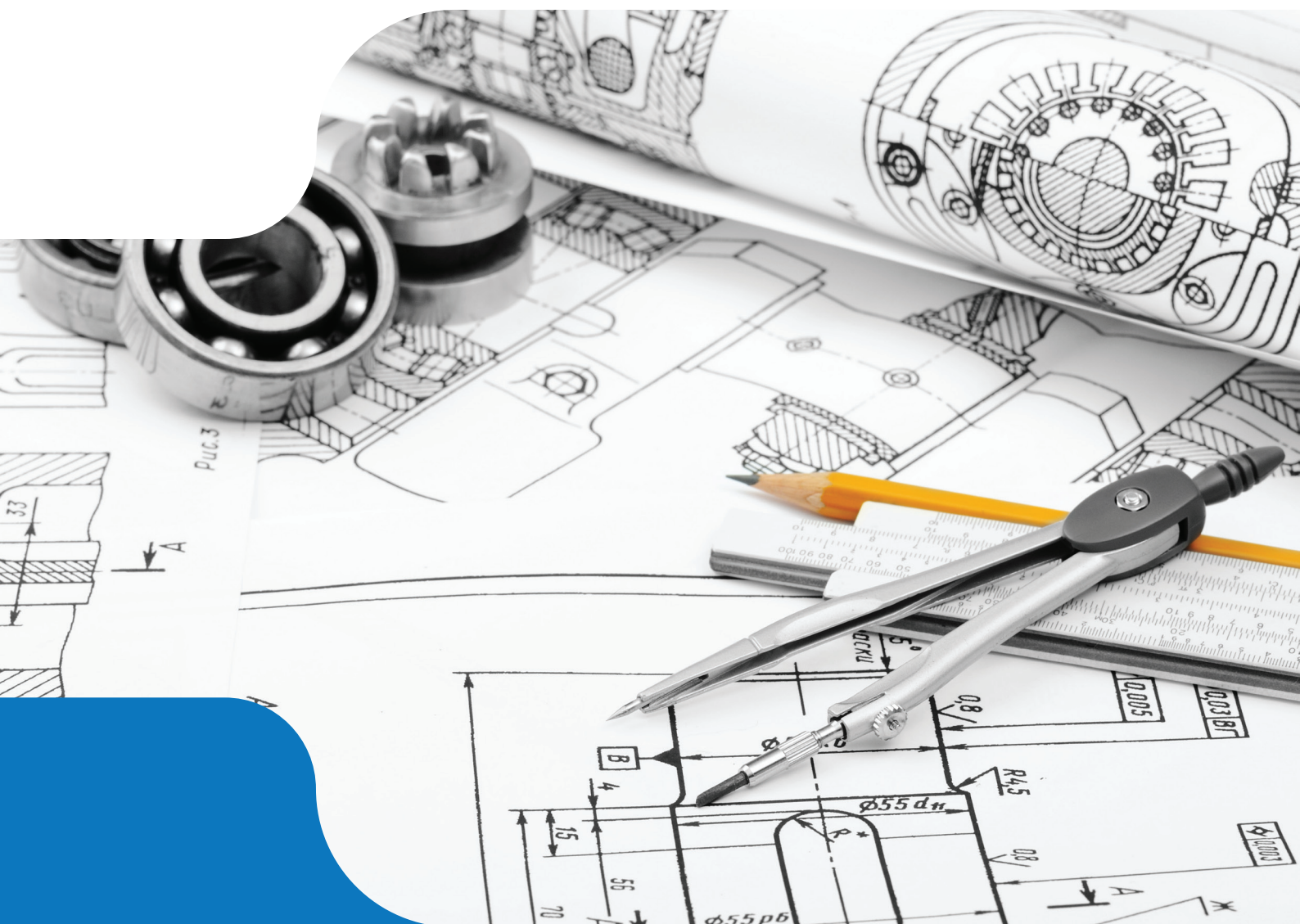




# Improve reliability and performance with SKF deep groove ball bearings

Reliable bearing solutions for demanding applications



# SKF Explorer bearings

## World standard for endurance and performance

Deep groove ball bearings are the most widely used bearing type around the world. They are particularly versatile, simple in design, non-separable, suitable for high and very high speeds and are robust in operation, requiring little maintenance.

SKF Explorer™ deep groove ball bearings provide superior performance and are certified internationally. Explorer bearings provide the following benefits:

- Higher dynamic load carrying capacity
- Reduced noise and vibration levels
- Less frictional heat
- Significantly longer bearing service life

These benefits reduce environmental impact by enabling downsizing and reducing both lubricant and energy consumption. Just as importantly, SKF Explorer bearings can reduce the need for maintenance as well as contribute to increased productivity.

### Quiet precision

SKF Explorer deep groove ball bearings are produced to higher precision than the ISO Normal tolerances.

- P6 dimensional accuracy

Width tolerance is reduced to:

- 0/-60 µm for OD < 110 mm
- 0/-100 µm for larger bearings

Running accuracy corresponds to:

- P5 tolerances for OD < 52 mm
- P6 tolerances for OD < 110 mm
- Normal tolerances for larger bearings.

### Certified performance

The SKF Explorer performance class has been certified by Net Norske Veritas and Germanischer Lloyd to last longer than standard bearings.

### Shields and seals

Depending on the operational requirements, SKF deep groove ball bearings are available in a range of sealed for life options.

- Z shields
- RSL or RZ low friction seals
- RSH or RS1 contacting seals

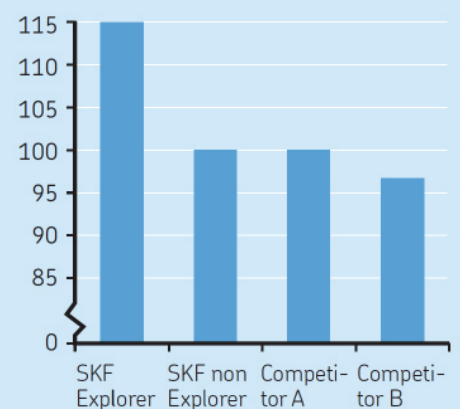
### Cage types

Depending on the design, series and size, SKF deep groove ball bearings are fitted with one of the following cage designs.

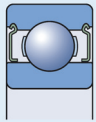
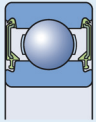
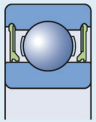
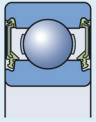
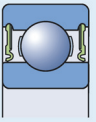
Suffix	Material
-	Steel Ribbon or riveted ball centred
TN9	Polyamide PA66 glass fibre reinforced
VG1561	Polyamide (E2 bearing cage) PA46 glass fibre reinforced
TNH	PEEK glass fibre reinforced PEEK
M	Brass Ball centred machined brass
MA	Outer ring guided machined brass
MB	Inner ring guided machined brass



Increased basic rating life L<sub>10</sub>



The effect of the cooler running as well as the different sealing solutions can be evaluated by using the SKF rating life calculation.

					
	<b>Shield Z</b>	<b>Low-friction seal</b> RSL                  RZ		<b>Contact seal</b> RSH                  RS1 <sup>1)</sup>	
<b>Application Series <sup>2)</sup></b>	607 - 6026 625 - 6222 635 - 6319	607 - 6005 626 - 6205 6300 - 6304	6006 - 6008 6206, 6208 6305, 6306	607 - 6005 626 - 6205 6300 - 6304	6006 - 6026 6206 - 6221 6305 - 6319
<b>Characteristics <sup>3)</sup></b>					
Low friction	+++	++	+++	0	0
Speed ability	+++	+++	+++	0	0
Grease retention	0	+++	+	+++	++
Dust Exclusion	0	++	+	+++	+++
Static water exclusion	-	0	-	+++	++
Dynamic water exclusion	-	0	-	+	+
High pressure water exclusion	-	0	-	+++	0

1) See SKF General Catalogue for more information on seal design  
2) Availability to be checked with SKF or SKF distributors  
3) Symbols: +++ = excellent, ++ = very good, + = good, 0 = fair, - = not recommended

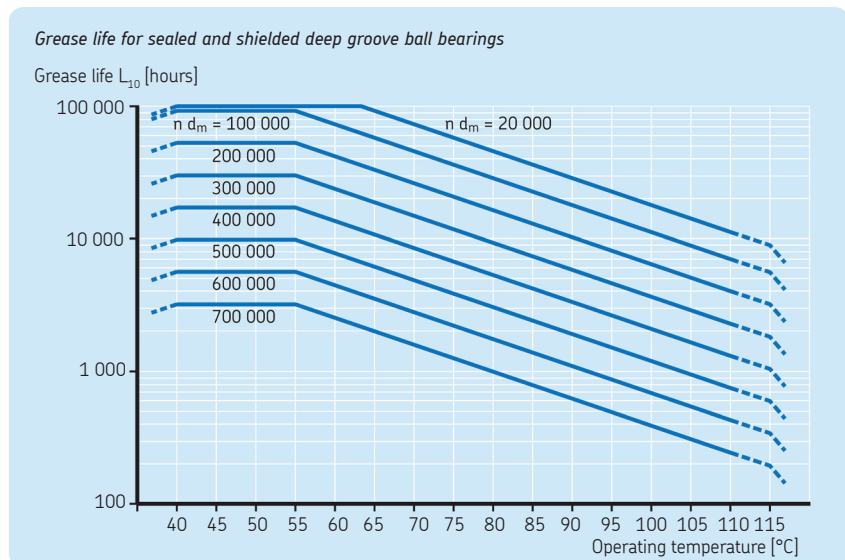
Characteristics	Standard grease <sup>1)</sup>		High temp <sup>2)</sup>	Low temp	Wide temp	Wide temp and silent running
<b>Bearing outside diameter</b>	≤ 62 mm	> 62 mm	All	All	All	All
<b>SKF grease code</b>	MT47	MT33	GXN	LT20	GWB	LHT23
<b>Suffix in designation</b>	-	-	HT	LT	WT	LHT23
<b>Consistency class (NLGI)</b>	2	3	2	2	2-3	2
<b>Thickener</b>	Lithium		Polyurea	Lithium	Polyurea	Lithium
<b>Base oil</b>	Mineral		Mineral	Diester	Ester	Ester
<b>Temperature range, °C <sup>3)</sup></b>	-30 to +110	-30 to +120	-40 to +150	-55 to +110	-40 to +160	-50 to +140
<b>Grease Performance factor <sup>4)</sup></b>	1	1	2	1	4	2

1) Except for deep groove ball bearings in the 618 and 619 series with an outside diameter up to 30 mm  
2) US standard may differ, based on GJN grease  
3) For safe operating temperatures, see the SKF General Catalogue, section "Lubrication – Temperature range – the SKF traffic light concept"  
4) For grease life calculation based on GPF, consult SKF

The grease life for capped bearings depends on the operating temperature and the speed factor. It can be obtained from the diagrams and is valid for the following operating conditions.

- horizontal shaft
- inner ring rotation
- light load ( $P \leq 0,05 C$ )
- operating temperature within the "green" temperature zone of the grease
- stationary machine
- low vibration levels

Additional information may be found on [www.skf.com](http://www.skf.com) or in the SKF General Catalog



# SKF Energy Efficient bearings

## Lower friction for reduced energy use

### Design features

The operating conditions typically are characterised by light to normal loads at relatively high speeds. Typical examples include electric motors, pumps, conveyors and fans.

- C/P ≥ 8
- Speed > 1 000 r/min
- - 50° to 150°C

### Features

- Low friction polymer cage
- Long life grease for high speed

### Value for the customer

- High speed capability
- Lower operating temperatures
- Increased service life

### Shielded E2 design

SKF Energy Efficient deep groove ball bearings are fitted with sheet steel shields, primarily intended for applications where the inner ring rotates. If the outer ring rotates, there is a risk of grease leakage at high speed.

### Value for the customer

- Reduced energy use compared to sealed SKF Explorer bearings
- Longer grease life
- Bore sizes range from 5 to 60 mm

### Sealed E2 design

These bearings are supplied with new low friction contact seals. The new seals are made from acrylonitrile-butadiene rubber (NBR) and reinforced with a sheet steel insert.

The seal lip, which has a thin and flexible design, minimises the frictional moment, while effectively protecting the bearing from contaminants.

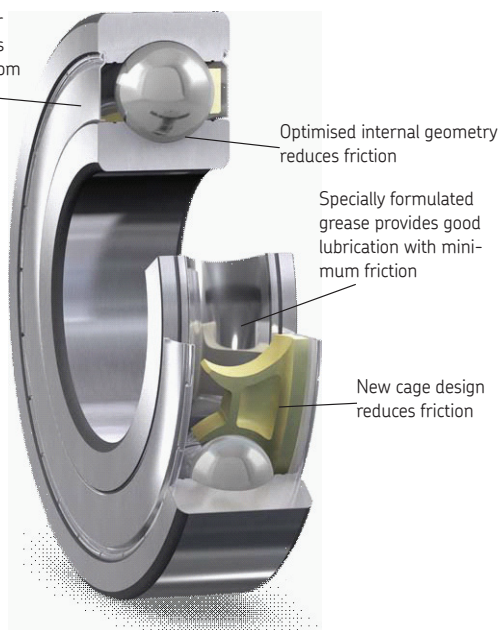
### Value for the customer

- Reduced energy use compared to sealed SKF Explorer bearings
- Highly effective seals
- Suitable for harsh environments

#### Grease in SKF Energy Efficient deep groove ball bearings

Thickener	Lithium soap
Base oil type	Synthetic oil
NLGI consistency class	2
Temperature range [°C]	-50    55    150    190
[°F]	-60    130    300    375

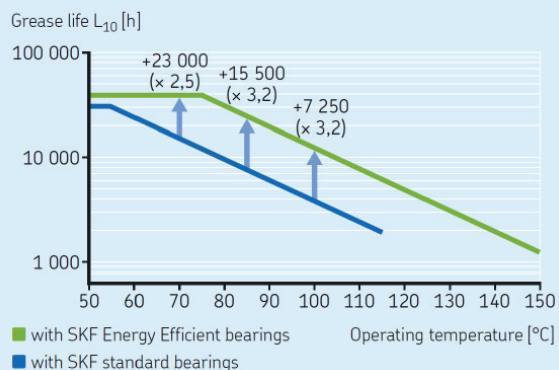
Low-friction seals or shields on both sides protect effectively from contamination and retain the grease fill



The distinctive mark for SKF Energy Efficient products

#### Grease life comparison between SKF Energy Efficient and standard SKF deep groove ball bearings

Operating conditions: Speed factor A = 300 000 mm/min  
Load: P = 0,066 C



Requirement	Shields			Contact Seals	
	Z	RSH	E2 RSH	RSH	E2 RSH
Low friction	+++	0	+		
High speed	+++	0	+		
Grease retention	0	+++	+++		
Dust exclusion	0	+++	+++		
Water exclusion					
static	-	+++	+++		
dynamic	-	+	+		
high pressure	-	+++	+++		

Symbols: +++ = best    ++ = very good    + = good  
0 = fair    - = not recommended



# SKF Insocoat & Hybrid bearings

## Taking care of stray electric currents

As frequency converters have increased in popularity, so have the number of premature bearing failures. Stray electric currents caused by frequency converters are unavoidable, however they are manageable.

### INSOCOAT bearings: Sealed against conductivity

INSOCOAT is a standard all-steel bearing that is plasma-sprayed with a ceramic coating to either the inner or outer ring. INSOCOAT bearings have the same boundary dimensions as standard SKF deep groove ball bearings.

- VL0241 Electrical resistance: min. 50 MΩ,  
Breakdown voltage: max. operating 1 000 V DC
- VL0246 Electrical resistance: min. 150 MΩ,  
Breakdown voltage: max. operating 3 000 V DC
- VL2071 Electrical resistance: min. 50 MΩ,  
Breakdown voltage: max. operating 1 000 V DC
- VL2074 Electrical resistance: min. 150 MΩ,  
Breakdown voltage: max. operating 2 000 V DC.

Comparison of the material properties of bearing steel and silicon nitride

Material properties	Bearing steel	Bearing grade silicon nitride
<b>Mechanical properties</b>		
Density (g/cm <sup>3</sup> )	7,9	3,2
Hardness, HV10 (kg/mm <sup>2</sup> )	700	1 600
Modulus of elasticity (GPa)	210	310
Thermal expansion (10 <sup>-6</sup> /K)	12	3
<b>Electrical properties (at 1 MHz)</b>		
Electrical resistivity (Ω m)	0,4 x 10 <sup>-6</sup> (conductor)	10 <sup>12</sup> (insulator)
Dielectric strength (kV/mm)	-	15
Relative dielectric constant	-	8

### Hybrid bearings: More than an insulator

Hybrid bearings have rings made of bearing steel and rolling elements made of bearing grade silicon nitride (Si<sub>3</sub>N<sub>4</sub>). In addition to being an excellent insulator, hybrid bearings have higher speed capabilities and will provide longer bearing service life under the same operating conditions than a similarly sized all-steel bearing.

#### Features

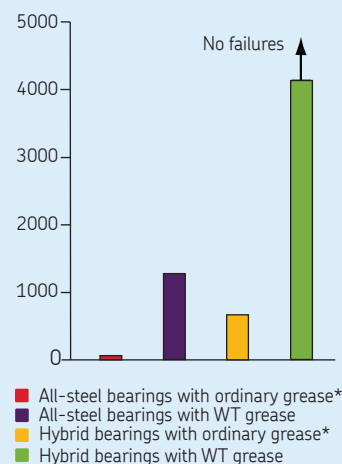
- The perfect solution for life cycle cost reduction
- Long service life in applications with poor lubrication
- The most reliable solution to prevent electrical erosion especially in variable speed drives
- High wear resistance
- Ability to run at high speed
- Extended service life under liquid ingress conditions and particle contamination
- Increased grease service life

#### Bearing suffix

- C3 Radial internal clearance greater than Normal
- HC5 Silicon nitride rolling element
- WT Polyurea grease, NLGI 2-3, -40 to +160 C

Long grease life with WT grease in hybrid bearings

Median grease life L<sub>50</sub> [hours]



\* At +120°C (max temperature for ordinary grease)



# SKF Solid Oil ball bearings

## The third option for bearing lubrication

Solid oil is an oil-saturated, polymer matrix that completely fills the free space in the bearing, encapsulating both the rolling elements and cage.

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.

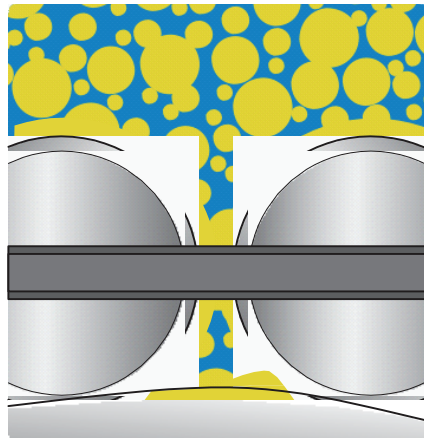
### Advantages of Solid Oil

#### Consistent lubricant supply

With the polymer matrix filling the entire void of the bearing, an oil supply is available to every moving part of the bearing. During operation, variation in thermal expansion in the matrix pushes oil to the surface of the polymer to lubricate. When the bearing stops, the matrix is able to reabsorb the excess oil.

#### 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 100% filled with the solid oil, while a grease-lubricated bearing typically operates with approximately one third of its free space filled with grease. A high lubricant fill volume however results in higher friction and lowers the rotational speed limit of the bearing.



#### Keeps contaminants out

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

#### Eliminates relubrication

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

#### No seals required

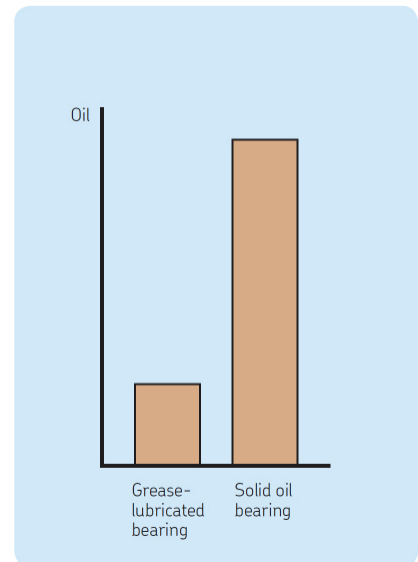
Seals are not needed to retain the lubricant in the bearing, even on vertical shafts. However, seals can provide extra protection against contamination.

#### 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

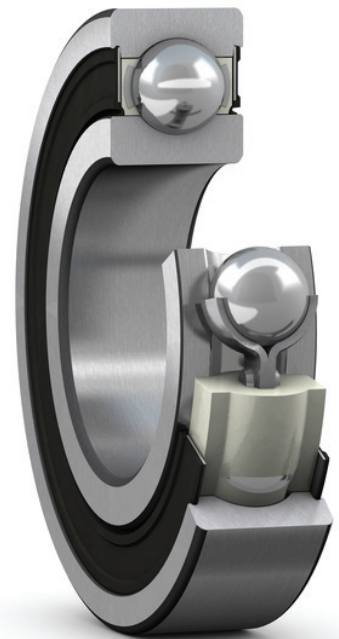
Solid oil becomes an integral part of the bearing so that lubricant cannot be expelled, even when subjected to high centrifugal forces.



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

#### Typical solid oil application areas

- Dirty or humid environment
- Aggressive chemicals\*
- Very cold
- Centrifugal forces
- Vertical shafts
- Hard to reach
- Oscillating movements
- High cleanliness demands



#### Technical details

	W64	W64F
Viscosity		
40 C	140	220
100 C	18	25
Colour	Blue	White
Min. Temp	-40	-20
Max. Temp	85	85
nDm (max)	300,000	300,000
Properties	Standard	NSF H1

# SKF DryLube bearings

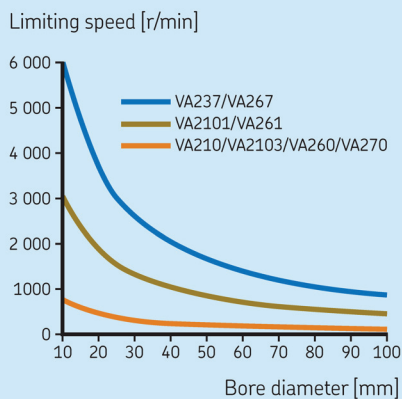
## Reliable performance for extreme temperatures

SKF DryLube bearings are designed to reduce machine operating costs, extend maintenance intervals and provide a high degree of operational reliability over a wide temperature range. SKF DryLube bearings are filled with a dry lubricant, based on graphite or molybdenum disulfide ( $\text{MoS}_2$ ) and a resin binder. The dry lubricant is injected into the free space of the bearing and cured until it solidifies.

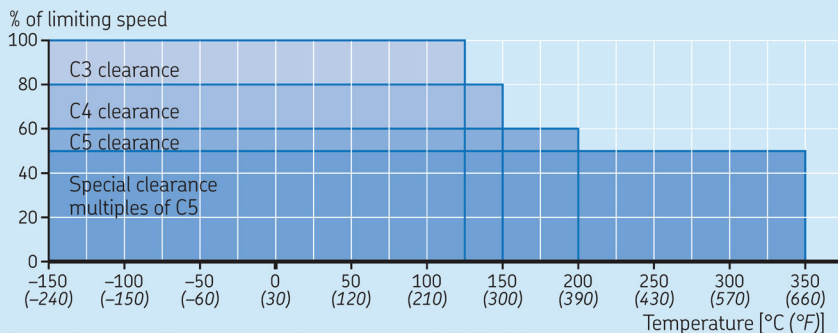
### Features and benefits

- effective lubrication for extreme temperature applications
- low start-up torque
- low frictional moment during operation
- higher speed capabilities than bearings with a graphite cage
- lubricated for the life of the bearing
- minimal lubricant loss
- suitable for very slow rotation or oscillating movements
- improved worker safety
- environmentally friendly compared to many oils and greases

### Guidelines for limiting speed of SKF DryLube radial bearings



### Selection guidelines for initial clearance of SKF DryLube deep groove ball bearings



Valid for bearings stabilized for the use at operating temperatures  $\leq 120^\circ\text{C}$  ( $250^\circ\text{F}$ ).

### ! WARNING!

Safety precautions for bearings with PFPE based low friction additives. PFPE oil is very stable and harmless under normal operating conditions up to  $+250^\circ\text{C}$ . However, if exposed to extreme temperatures such as those above  $300^\circ\text{C}$ , PFPE oils give off hazardous fumes. These fumes can be harmful to the eyes and to the lungs, if inhaled.

The following safety precautions should be observed:

- Follow the safety precautions in the appropriate material safety data sheet (MSDS).
- If there is a risk of human exposure and the bearing operating temperature is above  $300^\circ\text{C}$ , appropriate ventilation is required.

If the fumes have been inhaled, consult a doctor immediately.

The user is responsible for the correct use of the product during its service life and its proper disposal. SKF takes no responsibility for the improper handling of bearings with PFPE oil additives or for any injury resulting

### Characteristics of SKF DryLube bearings

Standard	VA210	VA2101	VA237	VA2103
Phosphated	VA260	VA261	VA267	VA270
<b>Lubrication</b>				
Graphite-based	Yes	Yes	Yes	-
$\text{MoS}_2$ based	-	-	-	Yes
Low-friction additive	-	Yes	Yes	-
Nano particles	-	-	Yes	-
NSF H1 food grade	Yes	-	-	-
Vacuum capability	-	-	-	Yes
Dry lubricant only	Yes	-	-	Yes
<b>Operating temperature</b>				
Minimum	$-60^\circ\text{C}$	$-60^\circ\text{C}$	$-60^\circ\text{C}$	$-150^\circ\text{C}$
Maximum				
• open bearings	$+250^\circ\text{C}$	$+250^\circ\text{C}$	$+250^\circ\text{C}$	$+250^\circ\text{C}$
• shielded bearings (2Z)	$+350^\circ\text{C}$	$+350^\circ\text{C}$	$+350^\circ\text{C}$	$+350^\circ\text{C}$
<b>Limiting speed [r/min]</b>				
	<u>15 000</u>	<u>60 000</u>	<u>120 000</u>	<u>15 000</u>
	$d_m$	$d_m$	$d_m$	$d_m$
$d_m = 0,5 (d + D)$				





## The building blocks of knowledge engineering

As the world leader in bearing technology for over a century, we have developed an extensive range of core technologies and services which build on our knowledge of rotating equipment and how machine components and industrial processes are interrelated. These include seals, lubrication, linear motion, machinery maintenance, asset management and mechatronics, which combines mechanics and electronics into intelligent systems.

And through working with customers in every major industry worldwide, we have wide experience in applying our technologies and services at each phase of the asset lifecycle, often providing application solutions that were never previously possible.

With a deep understanding of cultures and regions, we work in close partnership with our customers, combining our experience and knowledge to find solutions to their specific challenges. We help them improve productivity, reduce maintenance costs, improve energy efficiency, optimize designs, reduce time to market and reduce total cost of ownership. Ultimately – we make them more successful and profitable.

This is what we call “the power of knowledge engineering”.

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