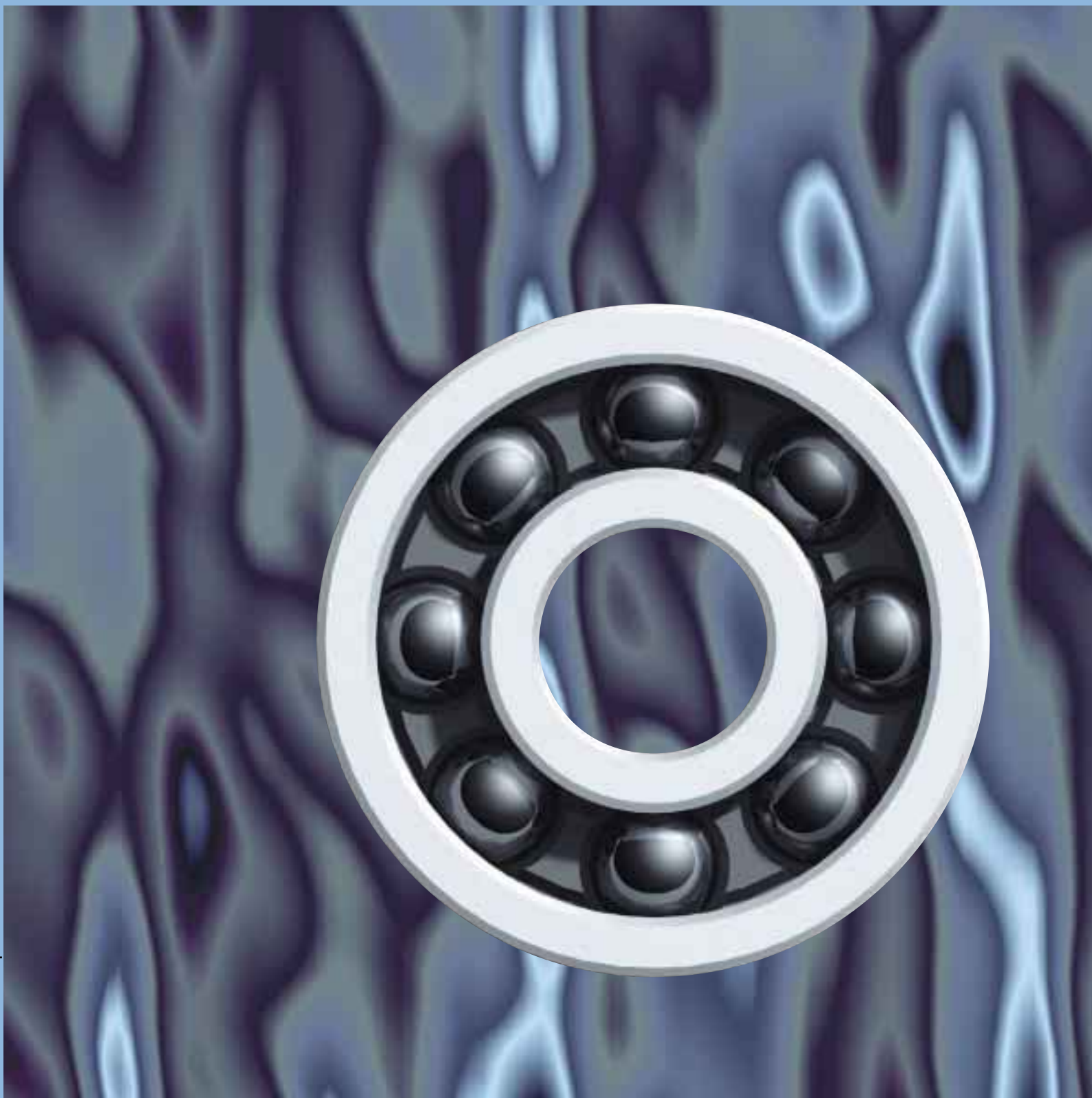
SKF

# Hybrid bearings

## Ceramic rolling elements create new opportunities



## What is a hybrid bearing?

Hybrid bearings have rings of bearing steel and rolling elements of ceramic material. The engineering ceramic silicon nitride is produced from powder in a compacting process acting at high temperature (~1 800 °C) and at high pressure (~200 MPa). This process, specified by SKF, creates a solid ceramic material, without any porosity and with good toughness.

## Why ceramics in bearings?

Silicon nitride, $Si_3N_4$, is a ceramic material with properties including high hardness, electrical insulation and low density, which contribute to its suitability as a bearing material.

| | Bearing steel | **Bearing silicon nitride** |
|---|---|---|
| Compressive strength (MPa) | 880 | 3 000 |
| Tensile strength (MPa) | 800 | 800 |
| Elastic modulus (GPa) | 210 | 310 |
| Hardness HV10 (kg/mm$^2$) | 700 | 1 600 |
| Electr. resistivity (Ωm) | $0,4 \times 10^{-6}$ (conductor) | $10^{12}$ (insulator) |
| Density (g/cm$^3$) | 7,9 | 3,2 |
| Coefficient of thermal elongation ($10^{-6}$/K) | 12 | 3 |

*Comparison of material properties: bearing steel and ceramics*

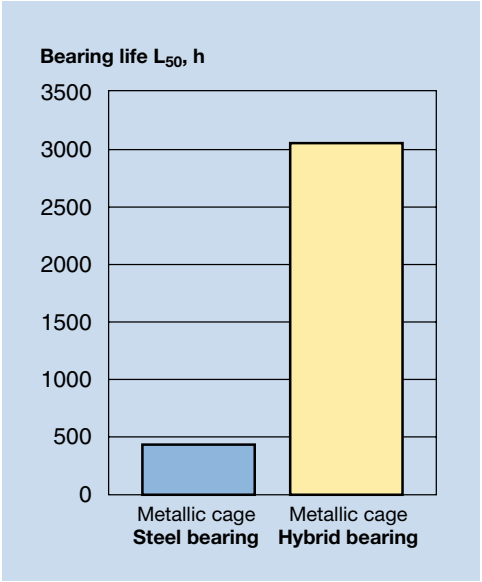
*Electric motor from ABB Motors equipped with an SKF 6208 hybrid bearing*

*Atlas Copco's turbo hand grinder GTG 40 is equipped with two SKF 627 hybrid bearings*

*SKF hybrid bearings are available in practically any rolling bearing design. Contact SKF regarding availability of the different types*

## Longer service life

The service life of a hybrid bearing is up to ten times longer than that of an all-steel bearing, especially in situations with difficult running conditions. This is possible thanks to substantially higher wear resistance, electrical insulation and flexibility regarding lubrication. Longer bearing life reduces the need for maintenance on your machine, contributes to reducing costly interruptions of your production and gives high reliability.



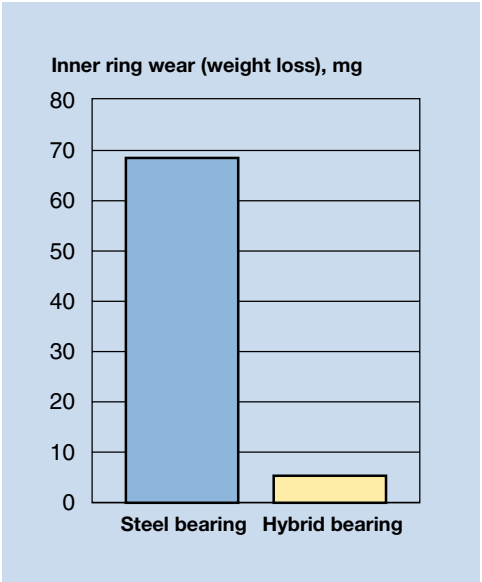

*Life comparisons – steel and hybrid greased bearings (no relubrication)*

## Electrical insulation

Damage occurs when electrical current passes through a bearing, i.e. flows from one bearing component to another. The result is washboarding, craters on the rings and rolling elements, and premature aging of the lubricant. Thanks to the electrical insulation capability of silicon nitride, this type of damage is avoided.

## Tolerant to poor lubrication conditions

Hybrid bearings outperform all-steel bearings when it comes to poor lubrication and contaminated environments. Tests show superior scuffing resistance of silicon nitride-metal contact under pure sliding, thanks to the smoother surface and hardness of the ceramic rolling element. Scuffing, or smearing, would cause vibrations in the bearing and lead to bearing failure.




*Wear performance under contaminated oil conditions*

## High speed capability

In high-speed applications, hybrid bearings offer two significant advantages compared to all-steel bearings. Firstly, the ceramic rolling elements have a lower density, and secondly they have a greater stiffness than rolling elements of bearing steel. These material properties result in lower friction, and consequently lower heat generation. Lightweight balls lead to lower centrifugal forces and therefore the bearing can withstand substantially higher shaft speeds than all-steel bearings. This enables the achievement of higher productivity and efficiency of the equipment.

# Ceramic bearings from SKF

## Three bearing types creating new opportunities

### All-ceramic bearing

The solution for severe environments, for example in metal industry and fluid machinery applications. Corrosion resistance, light weight, electrical insulation, and non-magnetism are some of the properties.

### Hybrid bearing

Gives long service life in a number of situations and excellent performance, for example in high-speed applications and under poor lubrication conditions. A suitable choice in electric motors, professional hand tools and fluid machinery thanks to the electrically insulating capability and superior wear resistance.

### Single-ball hybrid bearing

The self-healing bearing in contaminated environments such as automotive and industrial gearboxes. One single ceramic rolling element keeps the raceway smooth and free from particles thanks to the hardness of the ceramic material.

**SKF Ceramic Bearings – the SKF Group's team of specialists in ceramics for bearing applications**



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