VKE

HYBRID BEARINGS

Hybrid bearings combine rings made of bearing steel and rolling elements made of bearing grade silicon nitride (Si3N4).
VKE hybrid bearings, which are dimensionally interchangeable with similarly sized all-steel bearings, can substantially improve reliability and robustness when incorporated into new or existing industrial equipment. This is particularly true in all applications where the bearings are often exposed to potentially damaging abrasive particles, inadequate lubrication, vibration or stray electric currents such as

- Pumps
- Compressors
- Electric drives
- Generators
- Gear boxes
- Machine tool spindles

Why ceramic rolling elements in bearings?

Bearing grade silicon nitride, an engineered ceramic material, has a uniform and clean microstructure, which is extremely hard and tough. The material, which can be used as an insulator, is chemically inert.
It is also dimensionally stable at higher operating temperatures. All these factors contribute to its suitability as a rolling bearing material.

Features and benefits

- Prevent passage of electric current

Silicon nitride is an electrical insulator.

- Ability to run at higher speeds

– Lower density: The density of silicon nitride is 60% lower than steel, resulting in much lighter rolling elements. This means lower inertial forces, which enable higher speeds and more rapid starts and stops.
– Low friction: Silicon nitride’s low coefficient of friction reduces frictional wear, enabling the bearing to run faster, cooler and longer than an all-steel bearing, even under poor lubrication conditions. This means that hybrid bearings can maximize the effects of the lubricant, reduce noise levels and generate less frictional heat, while providing longer bearing service life.
– Higher modulus of elasticity: The ceramic material has a 50% higher modulus of elasticity than steel. The ceramicrolling elements, therefore, increase bearing stiffness.
– Lower coefficient of thermal expansion:
Ceramic material has a thermal expansion that is only 29% of steel. This means less sensitivity of the rolling elements to temperature differences for more accurate preload control.

- Extend bearing service life

Hybrid bearings can extend bearing service life in applications where poor lubrication is caused by any of the following conditions:
– High temperatures
– Vertical shaft
– Outer ring rotation
– Air streams
Silicon nitride and steel are an excellent combination of materials. The friction coefficient between silicon nitride and steel is lower than steel-on-steel for a dry sliding contact. The adhesion between silicon nitride and steel is low, micro welding does not occur and there is no risk of smearing. As a result, hybrid bearings can generate less frictional heat even when there is a very thin lubricant film.

•Extend grease life
Hybrid bearings generate less frictional heat than same sized all-steel bearings especially at high speeds. Lower bearing operating temperatures have a beneficial effect on bearing service life and relubrication intervals. Depending on the application and operating conditions, the grease can last at least 2 times longer (under some specific conditions, it can be up to 10 times). Mainly used k2n-40 and k2p-40 lubricants for standart DIN 51825.
•Resist wear caused by solid contaminants
Silicon nitride is very hard. Harder, in fact, than most contaminants typically found in a bearing. As a result, ceramic rolling elements, will either crush solid contaminants or push them into the steel raceways. This temporarily creates a depression, with raised edges, in the raceway. The damage is quickly overrolled and flattened by each subsequent rolling element.
•Resist false brinelling
Silicon nitride rolling elements on steel raceways have high wear/corrosion-resistance, corrosion that otherwise might occur when bearings at standstill are exposed to vibrations.

Comparison of material properties

Properties	Bearing steel	Bearing grade silicon nitride
Compressive strength [MPa]	~2 300	3 000
Tensile strength [MPa]	~1 900	800
Elastic modulus [GPa]	210	310
Hardness HV10 [kg/mm^2]	700	1 600
Electrical resistivity [Ωm]	0,4 × 10^{-6} (conductor)	10^{12} (insulator)
Density [g/cm^3]	7,9	3,2
Coefficient of thermal elongation [10^{-6}/K]	11,7	3