Extra large (XL) hybrid deep groove ball bearings from SKF – the basics

Designed and developed especially for large wind turbines, SKF XL hybrid deep groove ball bearings insulate against electric currents while providing high reliability and excellent performance.

Why ceramic rolling elements 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.

Why choose SKF?

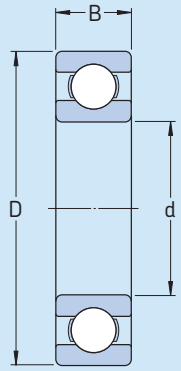
To ensure optimum quality, SKF has comprehensive material and rolling element specifications for the bearing grade silicon nitride in combination with a thorough quality assurance. The specifications include requirements on material strength, macro- and microstructure, hardness, toughness and rolling contact fatigue behaviour, and on finished rolling element surface appearance.

Furthermore, the components in a hybrid bearing are chosen to correspond to the high performance of the silicon nitride rolling elements.

Hybrid bearings have rings of bearing steel and rolling elements of bearing grade silicon nitride (ceramic)

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
Electr. 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



Principal dimensions			Basic load ratings dynamic	static	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C*	C_0*				
mm			kN		r/min		kg	–
110	240	50	187,5	174,8	8 000	4 300	9,50	**6322/HC5C3S0VA970**
120	260	55	200,3	198,7	7 500	4 000	12,8	**6324/HC5C3S0VA970**
130	280	58	212,2	222,8	6 700	3 800	16,0	**6326/HC5C3S0VA970**
140	300	62	265,9	265,9	6 300	3 600	16,6	**6328/HC5C3S0VA970**
150	320	65	288,7	306,5	6 000	3 200	23,0	**6330/HC5C3S0VA970**
160	340	68	330,9	391,1	5 300	2 800	25,3	**6332/HC5C3S0VA970**
170	360	72	330,9	391,1	5 300	2 800	31,4	**6334/HC5C3S0VA970**
180	380	75	330,9	391,1	5 300	2 800	37,8	**6336/HC5C3PS0VA970**

* Effective values for these specific hybrid deep groove ball bearings

Extended service life

SKF hybrid bearings provide superior grease life, especially in situations with difficult operating conditions.

Small to medium sized sealed SKF hybrid deep groove ball bearings are lubricated with SKF electric motor grease. Tests have shown that these bearings provide a longer service life than all-steel bearings (→ **diagram 1**).

Tolerant to poor lubrication conditions

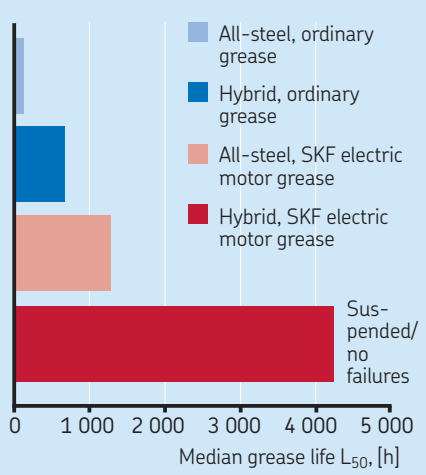
Hybrid bearings outperform all-steel bearings in terms of wear-resistance when it comes to operating under poor lubrication and contaminated conditions. Tests also have proven the superior behaviour of silicon nitride when contacting metal raceways under pure sliding conditions, thanks to the smoother surface and the higher hardness of the ceramic rolling elements (→ **diagram 2**).

SKF selection of XL hybrid deep groove ball bearings for generators in wind turbines

SKF manufactures and stocks a wide selection of XL hybrid deep groove ball bearings (→ table above), covering the most commonly used sizes in generators for mainstream wind turbines.

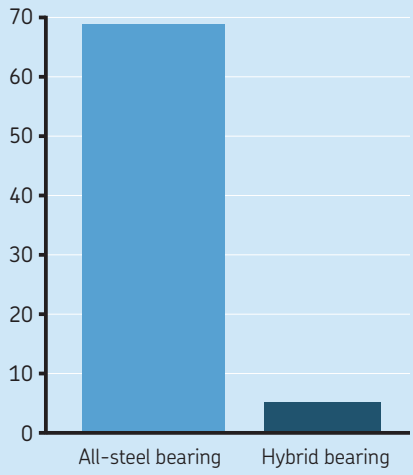
For multi-megawatt wind turbine generators, which require other bearing sizes or other bearing arrangements, SKF can supply customized solutions.

Diagram 1



Grease life performance – test result where the grease life in SKF hybrid bearings is four times longer than in the corresponding all-steel bearings

Diagram 2



Wear performance under contaminated lubricant conditions

Supplementary designations

HC5	Ceramic rolling elements
C3, C3P	Radial clearance
S0	Heat stabilization
VA970	Special design for generators in wind turbine applications

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