

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 ($10^{-6}/\text{K}$)	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

SKF hybrid bearings give superior grease life, especially in situations with difficult running conditions. SKF hybrid bearings with SKF WT grease have shown to have a very long service life even at high speeds and high temperatures. The diagram to the right shows one example where the life of WT grease in hybrid bearings was four times longer than in corresponding all-steel bearings. Longer bearing life reduces the need for maintenance on the machine, contributes to reducing costly interruptions in the production process and gives high reliability.

ELECTRICAL INSULATION

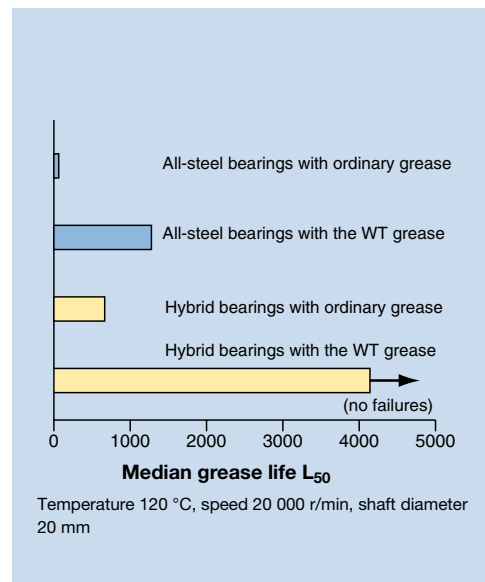
Damage occurs when electrical current passes through a bearing, i.e. flows from one bearing component to another. The result is washboarding, craters on the rings and rolling elements, and premature aging of the lubricant. Thanks to the electrical insulation capability of silicon nitride, this type of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

TOLERANT TO POOR LUBRICATION CONDITIONS

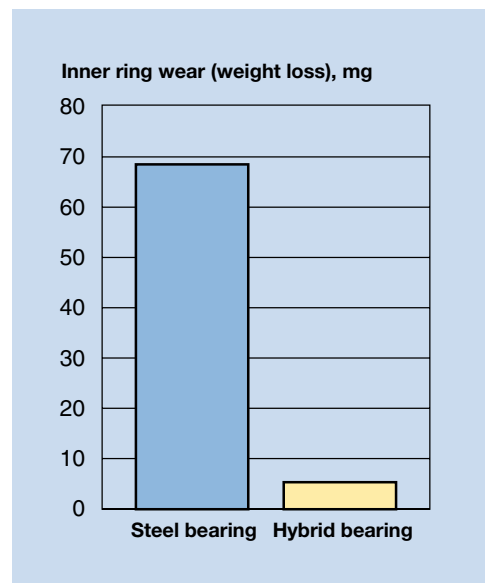
Hybrid bearings outperform all-steel bearings when it comes to poor lubrication and contaminated environments. Tests show superior scuffing resistance of silicon nitride-metal contact under pure sliding, thanks to the smoother surface and hardness of the ceramic rolling element. Scuffing, or smearing,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

HIGH SPEED CAPABILITY

SKF hybrid bearings can be operated at higher speeds than the ratings given for equivalent all-steel bearings. Silicon nitride rolling elements have only 40 % of the weight of steel rolling elements. This implies that the centrifugal forces from the rolling elements will be significantly lower in a hybrid bearing. The friction and thus temperature rise will be lower, which makes it possible to increase the speed.



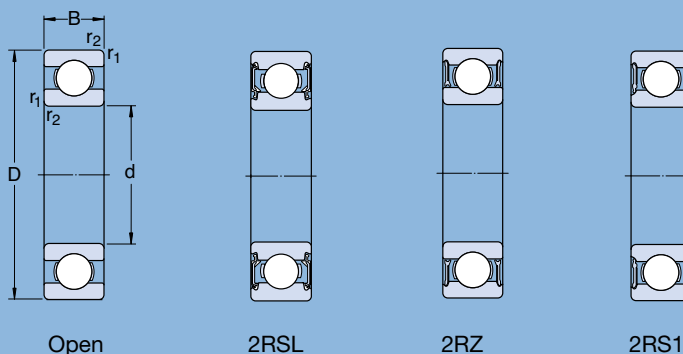
Grease life performance



Wear performance under contaminated oil conditions

SKF selection of hybrid bearings

SKF stocks the following selection of hybrid bearings. For other bearing dimensions and designs, please ask your local SKF supplier for availability.



Principal dimensions				Basic load ratings		Speed ratings ¹⁾		Mass	Designation
d	D	B	r _{1,2} min	C	C ₀	Reference speed	Limiting speed		
mm				kN		r/min		kg	-
5	16	5	0,3	1,14	0,38	130 000	85 000	0,0050	625-2RZTN9/HC5C3WTF1
6	19	6	0,3	2,34	0,95	110 000	70 000	0,0080	626-2RSLTN9/HC5C3WTF1
7	19	6	0,3	2,34	0,95	110 000	70 000	0,0070	607-2RSLTN9/HC5C3WTF1
	22	7	0,3	3,45	1,37	95 000	63 000	0,012	627-2RSLTN9/HC5C3WTF1
8	22	7	0,3	3,45	1,37	95 000	63 000	0,012	608-2RSLTN9/HC5C3WTF1
10	26	8	0,3	4,75	1,96	85 000	56 000	0,018	6000-2RSLTN9/HC5C3WT
	30	9	0,6	5,4	2,36	75 000	50 000	0,032	6200-2RSLTN9/HC5C3WT
12	28	8	0,3	5,4	2,36	75 000	50 000	0,022	6001-2RSLTN9/HC5C3WT
	32	10	0,6	7,28	3,1	67 000	45 000	0,037	6201-2RSLTN9/HC5C3WT
15	32	9	0,3	5,85	2,85	63 000	43 000	0,030	6002-2RSLTN9/HC5C3WT
	35	11	0,6	8,06	3,75	60 000	40 000	0,044	6202-2RSLTN9/HC5C3WT
17	35	10	0,3	6,37	3,25	56 000	38 000	0,038	6003-2RSLTN9/HC5C3WT
	40	12	0,6	9,95	4,75	53 000	34 000	0,059	6203-2RSLTN9/HC5C3WT
20	42	12	0,6	9,95	5	48 000	32 000	0,062	6004-2RSLTN9/HC5C3WT
	47	14	1	13,5	6,55	45 000	30 000	0,097	6204-2RSLTN9/HC5C3WT
25	47	12	0,6	11,9	6,55	40 000	28 000	0,073	6005-2RSLTN9/HC5C3WT
	52	15	1	14,8	7,8	38 000	26 000	0,12	6205-2RSLTN9/HC5C3WT
30	55	13	1	13,8	8,3	34 000	24 000	0,11	6006-2RZTN9/HC5C3WT
	62	16	1	20,3	11,2	32 000	22 000	0,18	6206-2RZTN9/HC5C3WT
35	62	14	1	16,8	10,2	30 000	20 000	0,15	6007-2RZTN9/HC5C3WT
	72	17	1,1	27	15,3	28 000	18 000	0,26	6207-2RZTN9/HC5C3WT
40	68	15	1	17,8	11,6	28 000	18 000	0,19	6008-2RZTN9/HC5C3WT
	80	18	1,1	32,5	19	24 000	16 000	0,34	6208-2RZTN9/HC5C3WT
45	85	19	1,1	35,1	21,6	22 000	14 000	0,42	6209-2RZTN9/HC5C3WT
	100	25	1,5	55,3	31,5	20 000	4 500	0,77	6309-2RS1TN9/HC5C3WT
50	80	16	1	22,9	16	22 000	5 000	0,25	6010-2RS1/HC5C3WT
	90	20	1,1	37,1	23,2	20 000	4 800	0,44	6210-2RS1/HC5C3WT
55	90	18	1,1	29,6	21,2	20 000	4 500	0,37	6011-2RS1/HC5C3WT
	100	21	1,5	46,2	29	19 000	4 300	0,59	6211-2RS1/HC5C3WT
60	95	18	1,1	30,7	23,2	19 000	4 300	0,39	6012-2RS1/HC5C3WT
	110	22	1,5	55,3	36	17 000	4 000	0,71	6212-2RS1/HC5C3WT
65	100	18	1,1	31,9	25	18 000	10 000	0,41	6013/HC5C3
	120	23	1,5	58,5	40,5	16 000	8 500	0,92	6213/HC5C3
70	110	20	1,1	39,7	31	16 000	9 000	0,57	6014/HC5C3
	125	24	1,5	63,7	45	15 000	8 500	0,99	6214/HC5C3
75	160	37	2,1	119	76,5	12 000	6 700	2,60	6315/HC5C3
80	170	39	2,1	130	86,5	12 000	6 300	2,80	6316/HC5C3
95	200	45	3	159	118	9 500	5 300	4,90	6319/HC5C3
110	240	50	3	203	180	8 000	4 500	8,15	6322/HC5C3

¹⁾ The values for "Reference speed" shown with the sealed bearings are valid for open basic design bearings to demonstrate the speed capability of these bearings. In case of sealed bearings the values listed for "Limiting speed" should not be exceeded. For further information on speeds please refer to SKF General Catalogue 5000.