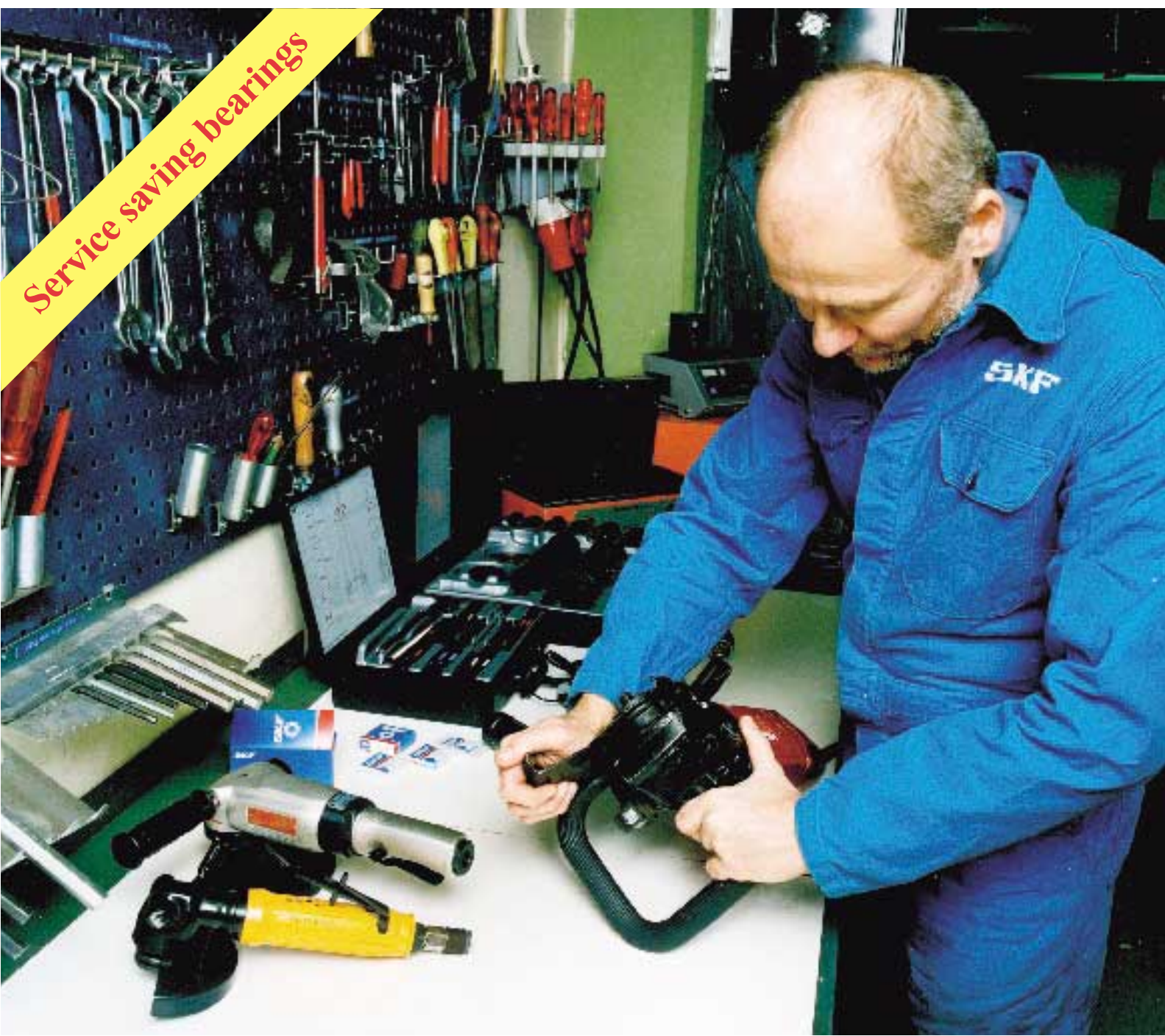


# SKF

## SKF hybrid bearings for professional hand tools

For servicing and upgrading products



# SKF hybrid bearings for

SKF has selected a range of grease-lubricated hybrid bearings<sup>1)</sup> that are especially suitable for the repair and upgrading of high-speed hand tools powered by:

- air-turbine motors
- electrical motors
- pneumatic motors

This range of hybrid bearings offers a replacement of conventional all-steel grease-lubricated bearings in professional hand tools.

Improved service life will be achieved for hybrid bearings due to:

- extended grease life,
- good performance in air-streams and condensing water,
- high wear resistance against particulate contamination (sand, pigments, abrasives, steel, iron oxides etc),
- resistance to electric current.

Materials properties	Bearing steel	Bearing grade silicon nitride
Density [g/cm <sup>3</sup> ]	7,9	3,2
Hardness, HV10 [kg/mm <sup>2</sup> ]	700	1 600
Thermal expansion [×10 <sup>-6</sup> / °C]	12	3
Electrical resistivity [Ωcm]	0,4×10 <sup>-6</sup> (conductor)	~10 <sup>14</sup> (insulator)
Elastic modulus [GPa]	210	310

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





# professional hand tools

The ISO standard dimensions for deep groove ball bearings also apply to hybrid bearings. SKF hybrid bearings are manufactured with bearing steel outer and inner rings and bearing grade silicon nitride rolling elements.

The bearings are sealed at both sides by SKF low-friction seals (2RZ) of nitrile rubber reinforced with sheet steel. These have been specially developed for good protection against dust at normal and high speeds.

SKF's low-density, high-strength, cage of glass fibre reinforced polyamide 6,6 (TN9) is standard. Polyamide cages with their flexibility show good performance in deep groove ball bearings at high speeds.

The silicon nitride balls (HC5) are produced to a surface roughness less than  $R_a 0,020 \mu m$ . The ceramic balls give the bearings:

- high-speed performance thanks to low density and low friction;
- low wear rate due to their high hardness;
- improved grease-life, and resistance to seizure;
- resistance to electrical currents due to their insulating properties.

Greater bearing clearance than normal (C3) has been chosen to take account of temperature variations between the bearing rings, which can occur at high speeds.

SKF WT grease has been selected for its very long grease life in hybrid bearings (see diagram on grease life), wide temperature range and high-speed capability.

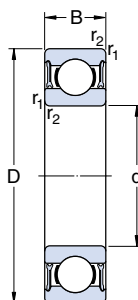
A lower grease fill than normal (F1) ensures a combination of good high-speed properties and long grease life.

**608 - 2RZ TN9 / HC5 C3 WT F1**



# SKF selection of hybrid bearings for hand tools

SKF stocks<sup>1)</sup> the following selection of hybrid bearings for servicing<sup>2)</sup> professional hand tools. For other bearing dimensions and designs, please ask your SKF supplier for availability.



Principal dimensions				Maximum speed <sup>3)</sup>	Mass	Designation <sup>4)</sup>
d	D	B	r <sub>1,2</sub> min			
mm				r/min	g	–
5	16	5	0,3	98 000	5	625-2RZTN9/HC5C3WTF1
6	19	6	0,3	77 000	8	626-2RZTN9/HC5C3WTF1
7	19	6	0,3	77 000	7	607-2RZTN9/HC5C3WTF1
	22	7	0,3	68 000	12	627-2RZTN9/HC5C3WTF1
8	22	7	0,3	68 000	12	608-2RZTN9/HC5C3WTF1
10	26	8	0,3	56 000	18	6000-2RZTN9/HC5C3WTF1
	30	9	0,6	50 000	32	6200-2RZTN9/HC5C3WTF1
12	28	8	0,3	50 000	22	6001-2RZTN9/HC5C3WTF1
	32	10	0,6	45 000	37	6201-2RZTN9/HC5C3WTF1
15	32	9	0,3	42 000	30	6002-2RZTN9/HC5C3WTF1
	35	8	0,6	39 000	44	6202-2RZTN9/HC5C3WTF1
17	35	10	0,3	38 000	38	6003-2RZTN9/HC5C3WTF1
20	42	12	0,6	32 000	62	6004-2RZTN9/HC5C3WTF1
25	47	12	0,6	28 000	73	6005-2RZTN9/HC5C3WTF1

<sup>1)</sup> 609, 61902, 6203, 6204 and 6205 bearings can also be delivered in the 2RZTN9/HC5C3WTF1 design, but are not generally held in stock.

<sup>2)</sup> The use of SKF tools is recommended for replacement of bearings. This reduces the risk of damage to bearings.

<sup>3)</sup> The maximum speed should only serve as an approximate guideline. Lower speed limits may apply under high loads, high temperatures and other conditions. The hybrid bearings are intended for replacement of existing all-steel bearings, working under normal speeds and temperature conditions (see SKF General Catalogue).

<sup>4)</sup> SKF is devoted to continuously improving the quality of hybrid bearings. Therefore, changes to the material, design and grease of hybrid bearings for hand tools may be made without prior notice. There will be no detrimental effects on bearing performance as a result of such changes and interchangeability will be guaranteed.

# Properties of hybrid bearings

## Centrifugal forces in bearings

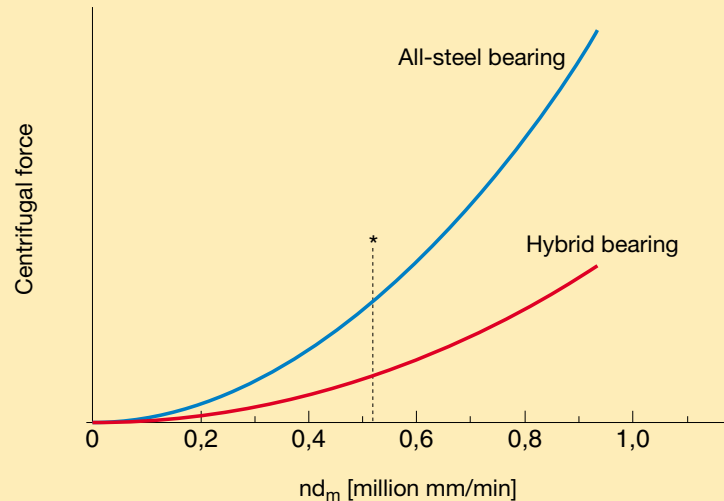
SKF hybrid bearings for professional hand tools can often be used at higher speeds than indicated by the speed ratings for grease-lubricated all-steel bearings given in the SKF General Catalogue. This is due to the lower density of silicon nitride compared to steel. The centrifugal force from a ceramic ball in a bearing is 40 % of that of a steel ball at the same speed. In the diagram the centrifugal forces from steel and silicon nitride balls are compared for bearings. Higher centrifugal loads cause higher bearing temperatures.

$$nd_m = n \times d_m \text{ [mm/min]}$$

$n$  = rotation speed [r/min]

$d_m = (d + D) / 2$   
= mean diameter [mm]

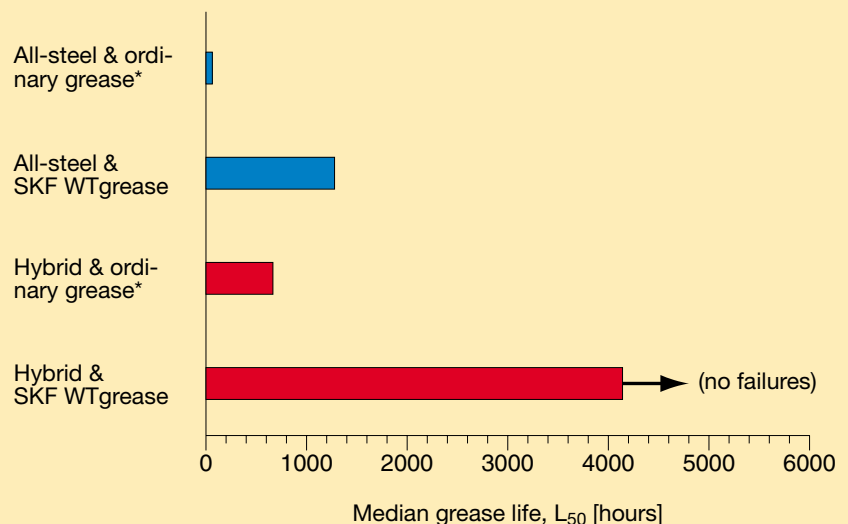
$L_{10h}$  = basic rating life, operating hours



\*Speed rating for all-steel bearing with grease lubrication ( $L_{10}$  life of 150 000 hours).

## Grease life in hybrid bearings

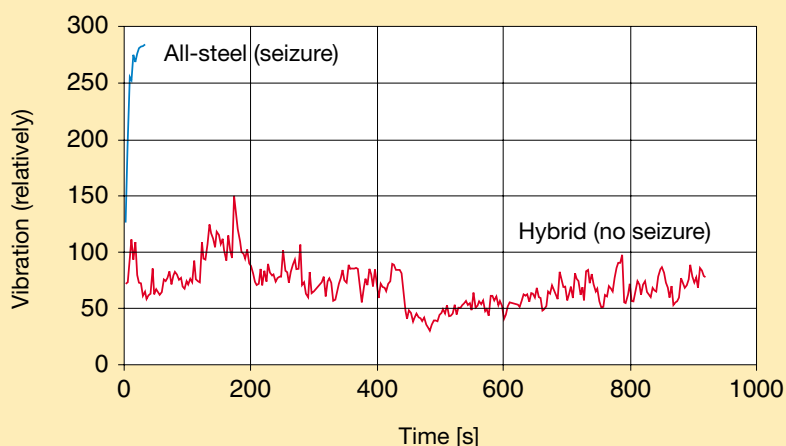
The use of silicon nitride bearing balls with SKF WT grease gives superior grease life at high speeds and high temperatures. This has, for example, been demonstrated in SKF R0F grease tests on bearings with TN9 cages, and shaft sizes of 20 mm. SKF hybrid bearings with SKF WT grease showed significantly extended grease-life, compared to all-steel bearings and hybrid bearings with ordinary grease. The tests were performed at 20 000 r/min (0,67 million mm/min) and +120 °C.



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

## Hybrid bearings under dry running conditions

SKF tests have shown that hybrid bearings resist dry running much better than all-steel bearings under poor lubrication. All-steel bearings seize earlier and at higher vibration levels compared with hybrid bearings. The good dry running properties of hybrid bearings are due to the thermal stability of the silicon nitride balls. The ceramic balls will not weld to the steel rings. Bearings, shaft size 25 mm, were tested without lubrication at a speed of 4 500 r/min. These tests showed that SKF hybrid bearings had smoother running with lower vibration and did not seize.



## SKF bearing fitting tools and maintenance products

SKF bearing fitting tools (for example TMFT 7D, TMFT 33) are designed for quick, precise and safe mounting of bearings with bore diameters from 5 to 50 mm. They can also be used to mount bushings, seal rings, belt pulleys etc. SKF delivers kits consisting of impact rings and one to three highstrength aluminium sleeves. The rings as well as the impact surface of the sleeves are made of a high strength engineering plastic,

giving high mechanical strength and impact fatigue resistance at a very low weight. All parts of the kits are clearly arranged in practical carrying cases. Selection charts are included. A variety of pullers, heaters, measuring equipment, lubricants etc. are also available from SKF to improve the quality of bearing performance.



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

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