FAG



FAG Hybrid Deep Groove Ball Bearings for Spreader Rolls

Technical Product Information

SCHAEFFLER GROUP
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FAG Hybrid Deep Groove Ball Bearings for Spreader Rolls

Application · Bearing selection

Application

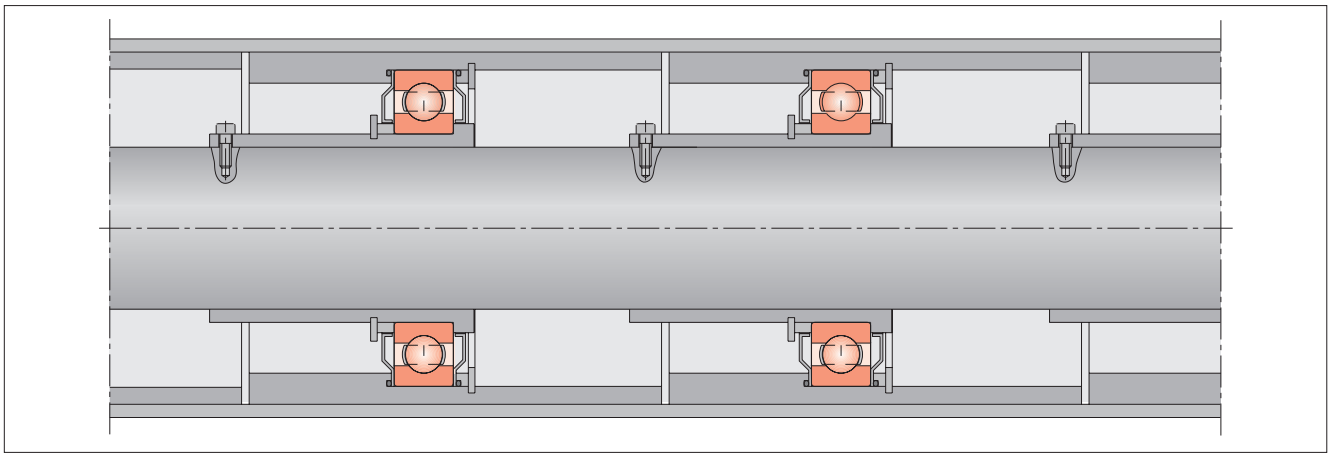
Spreader rolls are installed in the wet section and in the dryer section of paper machines. They are also found in the finishing and converting sections. They guide the felt cloth (in the wet section) and/or the paper web, keeping it smooth and flattening longitudinal creases.
Spreader rolls consist of a stationary axle which is bent symmetrically to its longitudinal axis, and around which the roll shell rotates. To enable the roll shell to follow the bent axle, it consists of a number of tube-shaped sections of steel with identical diameters. Each tube section is supported in a deep groove ball bearing in such a way that it can rotate freely and has angular freedom. The outer ring of the bearings rotates (circumferential load).
Depending on the case of application, the tube sections are provided with a shared flexible rubber cover. They are relatively light and, at a small wrap angle (max. 30 degrees), they are only slightly loaded by the web tension.

Bearing selection

In the wet section of a paper machine, the rolls work at temperatures of ca. 40 °C; in the dryer section, they are exposed to temperatures of up to 200 °C (infrared drying).
In the dryer section and in the finishing section, the rolls are usually driven only by the web running over them at speeds of up to 2 000 m/min (in the finishing section, some rolls have a separate drive system where wrap angles are extremely small).
Future speeds in the finishing section may well exceed 3 000 m/min. This results in speed indices ($n \cdot d_m$) in the order of ca. $2 \cdot 10^5$ to 10^6 min^{-1} mm.
A fatigue life of well over 100 000 hours was calculated for conventional deep groove ball bearings in spreader rolls. Often, however, lives of much less than 20 000 hours are achieved in practice.
Slippage, and brief periods during which the elements in rolling contact are not separated by a lubricating film, result in starved lubrication.

Requirements on the bearings:

- Smooth running (masses to be moved shall be as small as possible)
- Reduced risk of slippage and avoidance of damage due to slippage
- Utilisation of standardised bearing components
- Radial clearance to C3
- Increased running accuracy (T52BW)
- Reduced O.D. tolerance
- Reduced width tolerance.



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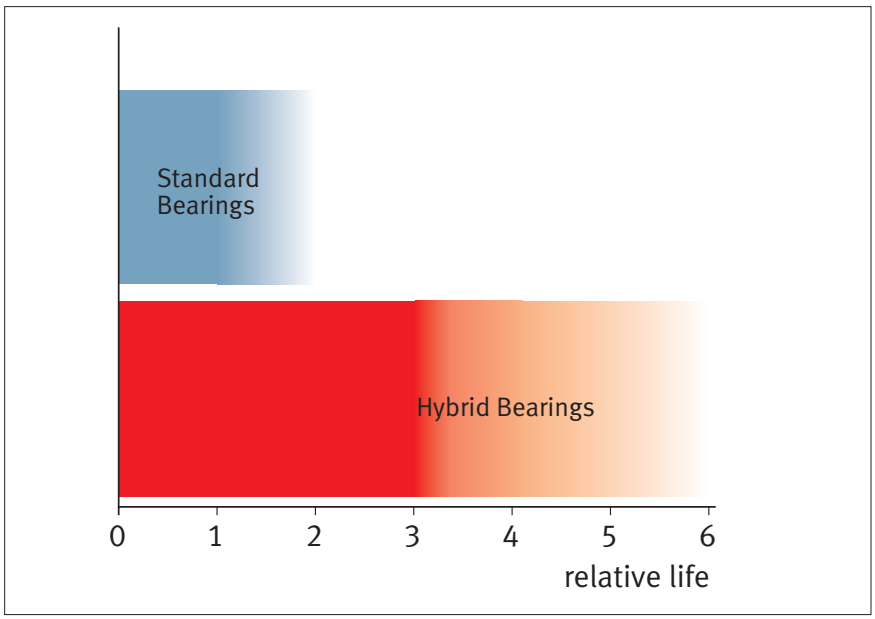
Bearing selection · Bearing clearance, fit tolerances

In standard deep groove ball bearings with steel balls, the combination of materials (steel/steel – high adhesion) enhances wear in the event of lubricant film breakdowns as a result of slippage, significantly reducing the life of the bearings.
In order to achieve a satisfactory bearing life even in the difficult operating conditions prevailing in the high-speed range, with a risk of slippage, hybrid deep groove ball bearings (rolling bearing steel rings, ceramic balls) are used.
To reduce the revolving masses (ball-cage assembly), only half the (even) number of balls is provided. This means that a higher load acts on each ceramic ball, reducing the risk of slippage.

In view of the high speeds involved, we recommend using hybrid bearings with a P5 running accuracy. All the bearing types listed in the table are manufactured to P5 running accuracy (T52BW) as a standard.

Bearing clearance, fit tolerances

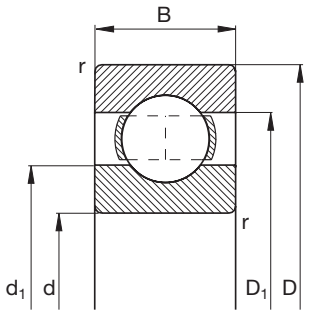
Differences in the web tension can cause the individual roll sections to tilt relative to each other. The required radial clearance (C3) permits a sufficiently large tilting clearance even at higher speeds. Where there is a risk of increased thermal stressing, e.g. in the event of web breaks in the area exposed to direct radiation from the infrared dryers, we recommend C4.
The rotating outer ring is fitted tightly into the tube section with M6 tolerance.
The inner ring is fitted loosely onto the stationary axle, which means that it can be mounted and dismounted easily.



The service life of a hybrid bearing can, under favourable conditions, be three times as long as that achieved with a standard bearing.

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Table



FAG Hybrid Deep Groove Ball Bearings

Codes	Dimensions						Mass ≈	Load rating		Limiting speed	Reference speed
	d	D	B	r_{min}	d_1	D_1		C	C_0	n_G	n_B
FAG	mm						kg	kN		min^{-1}	
F-HC808541.KL	180	225	22	1	194	211	1,64	27	26,5	6 300	2 850
F-HC808542.KL	190	240	24	1	206	224	2,05	30	30	6 000	2 800
F-HC808543.KL	200	250	24	1	216	234	2,16	31	32	6 000	2 650
F-HC808544.KL	220	270	24	1	236	255	2,42	32	34	5 600	2 380
F-HC808545.KL	240	300	28	1	260	281	3,68	41	43,5	4 800	2 320
F-HC808546.KL	260	320	28	1	279	300	3,95	42	46,5	4 300	2 120
F-HC808547.KL	280	350	33	1	302	328	5,89	56	62	3 800	2 010
F-HC808548.KL	300	380	38	1	326	354	8,38	66	72	3 600	1 910
F-HC808549.KL	320	400	38	1	346	375	8,88	68	77	3 400	1 760

FAG Hybrid Deep Groove Ball Bearings for Spreader Rolls

Lubrication, sealing · Requirements on greases · Tribological properties of ceramic balls · Higher cost effectiveness thanks to hybrid bearings

Lubrication, sealing

The lubricant is subjected to less stress, thanks to the small mass and favourable contact geometry of the ceramic balls. Low-friction special rolling bearing greases with a good oil retaining capability, which have a long life, are used. As the outer ring of the bearing rotates, there is a risk of the base oil being centrifuged from the lubricating grease relatively quickly, depending on the type of grease used. Field-proven sealing elements, which are especially optimised for oil tightness, safely keep the base oil inside the bearing.

Requirements on greases

- Optimized grease filling degree
- Special additive package especially for this material combination that works even under slippage conditions
- Special suitability of the base oil for low friction, high temperatures, a wide speed range and a long service life
- Suitable thickener system, especially for high centrifugal loads, with good oil retention properties and a lubrication supporting effect.

Tribological properties of ceramic balls

- Ceramic balls are less negatively affected by lubricating film breakdowns and starved lubrication conditions than steel balls as the elements in rolling contact are significantly less susceptible to adhesive wear.
- The smaller mass of the ceramic balls results in slighter gravitational forces of the ball-cage assembly.
- In applications where there is a risk of passage of electric current, the ceramic balls act like insulators.
- The modulus of elasticity of silicon nitride is ca. 1,5 times as high as that of rolling bearing steel. As a result, ceramic balls have a smaller contact area. Less heat is generated in the bearings, and the grease life is extended.

Higher cost effectiveness thanks to hybrid bearings

The system cost is determined not only by the bearing acquisition cost and the cost of the mating components. Another significant factor are the operating, repair and downtime costs.
A significantly reduced power consumption and maintenance cost contribute to a low operating cost. The hybrid ball bearings considerably extend the operating time of the spreader rolls.
The bearings have to be replaced less frequently, which extends the maintenance intervals and reduces the cost of machine downtimes, roll changes and roll repair.