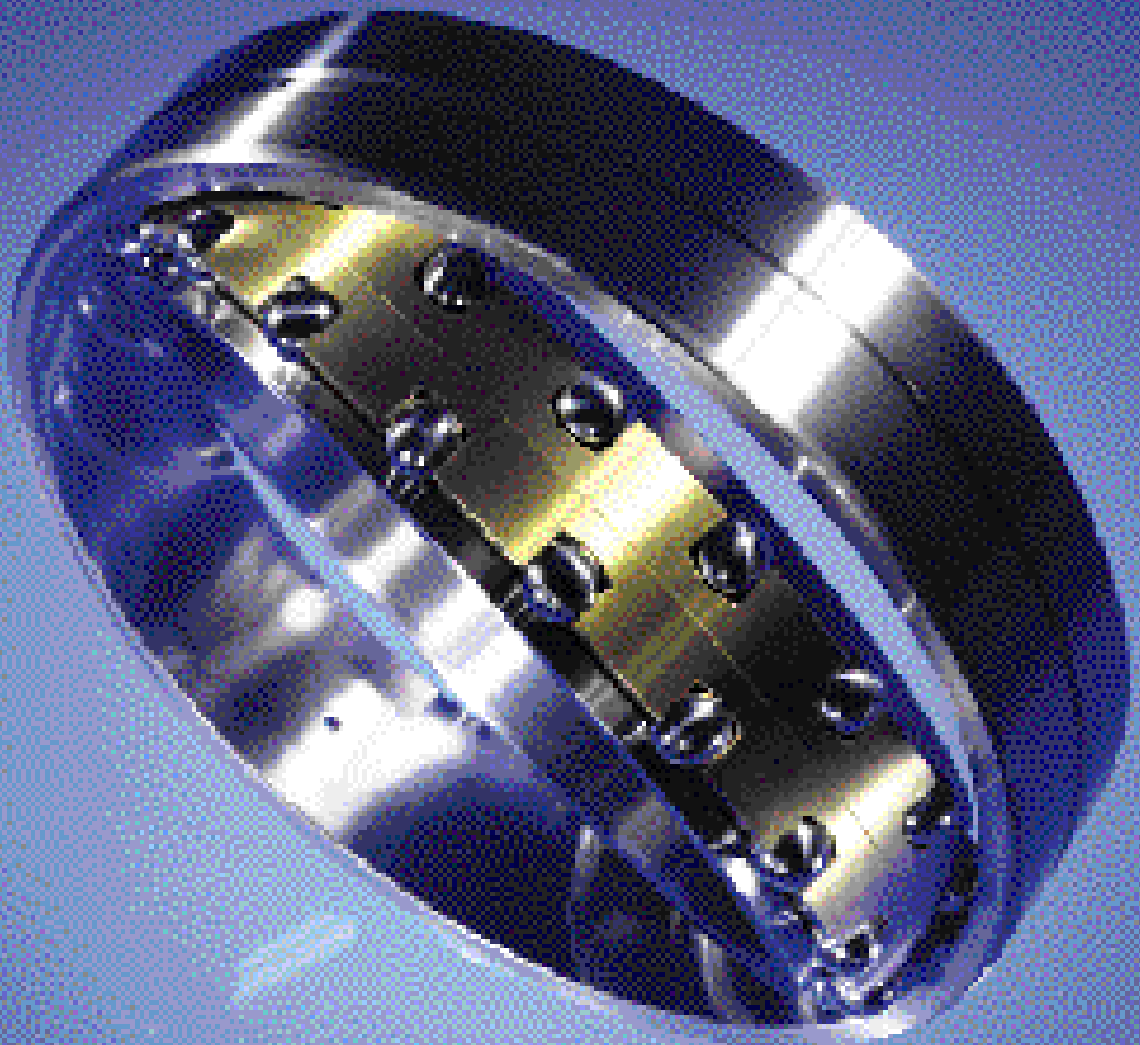
SKF

Longer service intervals for spreader rolls in supercalenders



Large self-aligning ball bearings

Lower operating temperatures

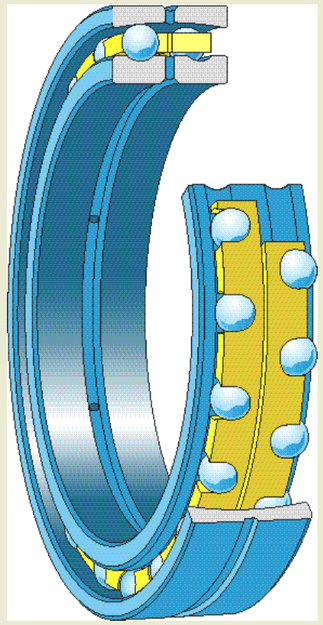
Lower maintenance costs

Better paper quality

SKF

Large SKF self-aligning ball bearings for new performance standards

Fig 1



Large SKF self-aligning ball bearing

The bearings

Large SKF self-aligning ball bearings **(→ Fig 1)** have been developed as an alternative to spherical roller bearings for applications where low friction is more important than high load carrying capacity. Because of their design, self-aligning ball bearings offer low frictional resistance and this characteristic is enhanced by the internal design – a combination of ball and cage assembly design and appropriate radial internal clearance.

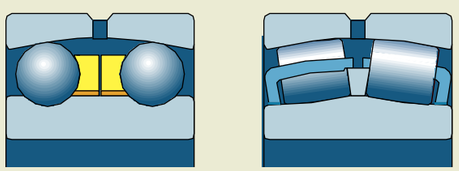
The advantages

Because of the much smaller point contact between ball and raceway, friction is much lower in a ball bearing than in a roller bearing where there is line contact between roller and raceway. This means, that self-aligning ball bearings have a number of advantages over comparable spherical roller bearings:

- ability to operate at higher speeds,
- less heat generation at the bearing position, and
- less thermal deformation of associated components

They only require some 10 to 15 % of the requisite minimum load to ensure their proper slip-free operation. This is partly due to the appreciably lighter weight of the rolling element complement **(→ Fig 2)**. In combination with the reduced friction this brings the following advantages in lightly loaded applications:

Fig 2



Comparison of ball and roller bearing

- extended relubrication intervals and reduced maintenance requirements because there is less “stressing” of the lubricant,
- more favourable performance at high speeds and/or with rapidly alternating loads,
- quieter operation.

These advantages with large SKF self-aligning ball bearings are the answer in cases where self-alignment is a must and where spherical roller bearings do not perform optimally because of too light loads or too high speeds.

For shaft diameters above 130 mm the only self-aligning bearings available so far have been spherical roller bearings. The boundary dimensions of large SKF self-aligning ball bearings are identical to those of spherical roller bearings in the particular size range. This is apparent from the bearing designation, where the initial 1 indicates a self-aligning ball bearing instead of the 2 used for spherical roller bearings. The second and third numbers indicate the Dimension Series according to ISO 15:1998 and the last two figures identify the bore size for both types of bearing.

The application

These large SKF self-aligning ball bearings were developed together with the papermaking machine industry to meet the ever-increasing demands on spreader rolls in supercalenders **(→ Fig 3)**. Because of the length and design of this type of roll, several self-aligning bearings are required.

The size meant that spherical roller bearings were the only alternative although their load carrying capacity was far in excess of what was required. As speeds have increased over the years, friction has become a problem, because the heat generated by the bearings at high speeds causes the rolls to expand. This can be detrimental to paper quality and to the rolls, some of which have a polymer coating. By switching to dimensionally identical self-aligning ball bearings, it is possible to reduce the temperature increase by up to 90 %. For papermakers this translates into:

Supercalender

Fig 3

Table 1

Bore diameter d	Bearing designation	Radial clearance min	max	Corresponding spherical roller bearings
mm	–	µm		
150	**13030**	70	120	23030
180	**13036**	80	130	23036
200	**13940**	90	150	23940
220	**13944**	100	165	23944
240	**13948**	110	180	23948

- improved paper quality,
- longer lives of coated rolls,
- longer lubricant life and thus less maintenance
- improved machine availability.

Since the boundary dimensions are identical, to replace the existing spherical roller bearings in spreader rolls with these new self-aligning ball bearings requires no extra work **(→ Fig 4)**.

The range

Since the bearings have been developed initially for a particular application they have the same dimensions as the light series 230 and 239 spherical roller bearings **(Table 1)**.

Bearing data – general

Dimensions

The boundary dimensions are in accordance with ISO 15:1998.

Tolerances

The bearings are produced with normal tolerances for dimensional and running accuracy as prescribed in ISO 492:1994.

Radial internal clearance

The large SKF self-aligning ball bearings are produced with the radial internal clearance specified in Table 1 as standard. The limits of the smallest size correspond to the limits for C3 clearance according to ISO 5753: 1991; the clearance limits of the larger bearings are not standardised.

Cages

These bearings are equipped with two piece machined brass cages **(→ Fig 5)**

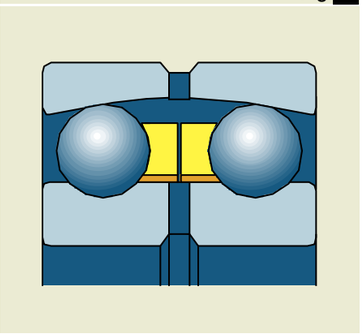
Lubrication

The bearings are suitable for both oil and grease lubrication. Great importance was attached during development work to maximum flexibility and compatibility with existing bearing arrangements. The outer ring has the annular groove and three lubrication holes of the W33 feature of the spherical roller bearings. Additionally, the inner ring has an annular groove and six lubrication holes to permit centralised lubricant supply via the inner ring **(→ Fig 6)**.

Fig 5

Two piece machined brass cage

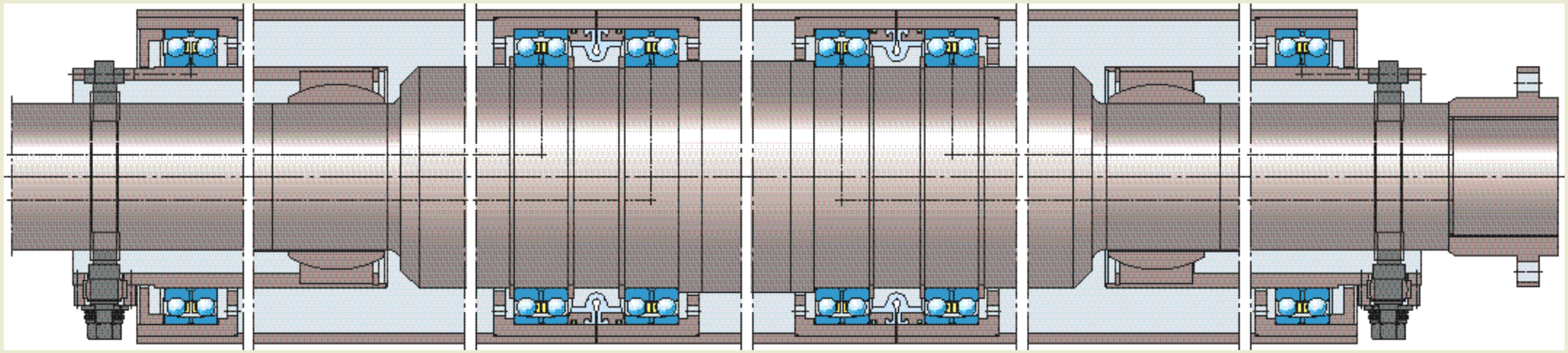
Fig 6



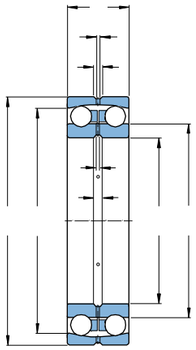
Annular groove and lubrication holes in both inner and outer rings

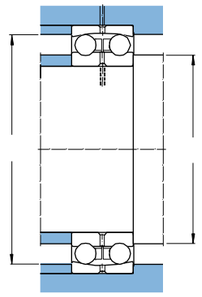
Spreader roll with large SKF self-aligning ball bearings

Fig 4



Large self-aligning ball bearings
d **150** – **240** mm





Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
d	D	B	C	C_0	P_u				
mm			N		N	r/min		kg	–
150	225	56	57 200	23 600	880	2 400	3 000	7,50	**13030**
180	280	74	95 600	40 000	1 340	1 900	2 400	16,0	**13036**
200	280	60	60 500	29 000	965	1 800	2 200	10,7	**13940**
220	300	60	60 500	30 500	965	1 800	2 200	11,0	**13944**
240	320	60	60 500	32 000	980	1 700	2 000	11,3	**13948**

Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_1	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
150	175	203	8,3	4,5	2,1	161	214	2	0,24	2,6	4,1	2,8
180	212	249	13,9	7,5	2,1	191	269	2	0,25	2,5	3,9	2,5
200	229	258	8,3	4,5	2,1	211	269	2	0,19	3,3	5,1	3,6
220	249	278	8,3	4,5	2,1	231	289	2	0,18	3,5	5,4	3,6
240	269	298	8,3	4,5	2,1	251	309	2	0,16	3,8	6,1	4

Publication **Dd 8014 E**

www.skf.com