

## SKF Explorer self-aligning roller bearings upgraded for even longer service life

SKF has upgraded its SKF Explorer self-aligning roller bearing assortment by improving wear resistance. This was done with a new heat treatment that substantially improves the hardness of the bearing steel with maintained toughness.

This breakthrough is particularly important for applications where there are high levels of contamination or where lubrication conditions are inadequate. The potential rating life increase can be calculated using the information below.

Table 1

Adjusted contamination factor and viscosity ratio values for upgraded self-aligning roller bearings

Contamination conditions	Contamination factor $\eta_c$	Adjusted contamination factor $\eta_{c, adj}$
Typical contamination	0,2	0,4
Slight contamination	0,5	0,6
Normal cleanliness	0,7	0,7
Lubrication conditions	Viscosity ratio $\kappa$	Adjusted viscosity ratio $\kappa_{adj}$
Very thin film	0,4	0,5
	0,6	0,7
	0,8	0,9
	1	1
Min. recommended film	1	1

Table 2

Estimated rating life factor for upgraded spherical roller bearings and CARB bearings

$\eta_c$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0
4,0	1,0	2,0	1,3	1,0	1,0	1,0	1,0	1,0	1,0	1,0
		2,0	2,0	1,8	1,5	1,2				
3,0	1,0	2,0	1,8	1,0	1,0	1,0	1,0	1,0	1,0	1,0
		2,0	2,0	1,7	1,5	1,2				
2,0	1,0	2,0	2,0	1,4	1,0	1,0	1,0	1,0	1,0	1,0
		2,0	1,9	1,6	1,4	1,2				
1,0	1,0	2,0	2,0	2,0	1,6	1,3	1,0	1,0	1,0	1,0
		1,9	1,6	1,4	1,3	1,1				
0,9	1,1	2,0	2,0	1,9	1,6	1,2	1,2	1,2	1,1	1,0
	1,0	1,8	1,6	1,4	1,3	1,1	1,1	1,1	1,1	1,1
0,8	1,2	2,0	2,0	1,8	1,5	1,5	1,6	1,7	1,7	1,3
	1,1	1,7	1,5	1,3	1,2	1,2	1,3	1,3	1,3	1,3
0,7	1,2	2,0	2,0	1,6	1,5	1,6	1,7	1,8	1,9	2,0
	1,1	1,6	1,4	1,3	1,2	1,3	1,3	1,3	1,4	1,4
0,6	1,2	2,0	1,8	1,5	1,6	1,7	1,8	1,9	2,0	2,0
	1,1	1,5	1,4	1,3	1,3	1,3	1,4	1,4	1,4	1,4
0,5	1,3	1,9	1,6	1,6	1,8	1,9	2,0	2,0	2,0	2,0
	1,2	1,4	1,3	1,3	1,4	1,4	1,4	1,5	1,5	1,5
0,4	1,3	1,6	1,6	1,8	1,9	2,0	2,0	2,0	2,0	2,0
	1,2	1,3	1,3	1,4	1,4	1,5	1,5	1,6	1,6	1,6
0,3	1,0	1,3	1,2	1,2	1,1	1,0	1,0	1,0	1,0	1,0
		1,2	1,1	1,1	1,1					
0,2	1,0	1,1	1,1	1,1	1,0	1,0	1,0	1,0	1,0	1,0
		1,1	1,0	1,0						
0,1	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0

Light loads  $C/P \approx 20$

Heavy loads  $C/P \approx 6$

### Calculating the improvement

The SKF rating life method is generally used to calculate the life of rolling bearings.

For roller bearings, the following applies:

$$L_{10m} = a_{SKF} \left( \frac{C}{P} \right)^{\frac{10}{3}}$$

$$L_{10mh} = a_{SKF} \frac{1\ 000\ 000}{60\ n} \left( \frac{C}{P} \right)^{\frac{10}{3}}$$

where

$L_{10m}$  = basic rating life  
[millions of revolutions]

$a_{SKF}$  = SKF life modification factor

$C$  = basic dynamic load rating [kN]

$P$  = equivalent dynamic bearing load [kN]

$L_{10mh}$  = SKF rating life [operating hours]

$n$  = rotational speed [r/min]



This calculation method takes fatigue, lubrication and contamination into account – not wear.

As the upgraded bearing steel is more resistant to surface damage due to contaminated or poor lubrication conditions, it is important to consider this improvement when calculating bearing life. To do this, the factors for contamination level,  $\eta_c$ , or the viscosity ratio,  $\kappa$ , can be adjusted with the values in **table 1, page 1**.

There are two rules when calculating the expected increase in the life of upgraded SKF Explorer self-aligning roller bearings:

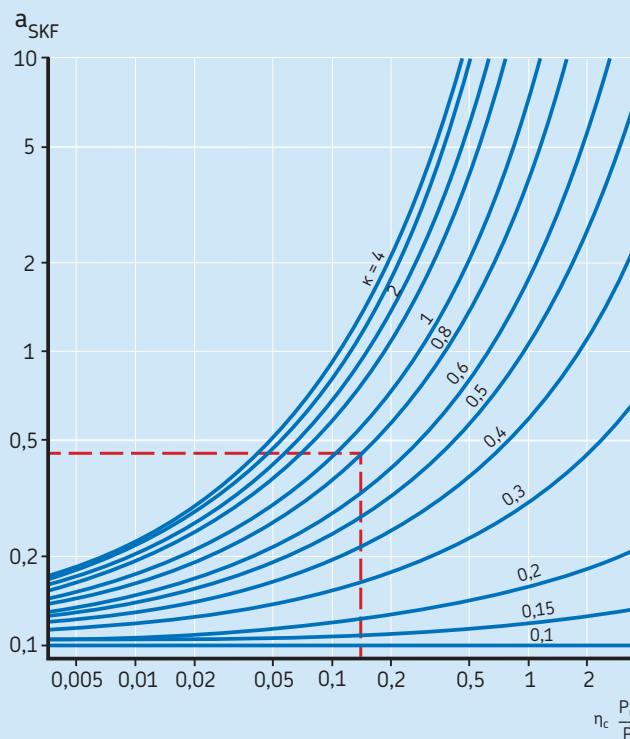
- The increase of the  $a_{SKF}$  factor is limited to 2.
- Either  $\eta_{c,adj}$  or  $\kappa_{adj}$ , whichever is larger, can be used when calculating the adjusted  $a_{SKF}$  factor.

As a result of further tests, the values in **table 1** and **table 2, page 1** may be adjusted in the future.

To make it easier to calculate the improvement, **table 2, page 1** contains life adjustment factors based on these two rules.

For additional information, contact the SKF application engineering service.

Diagram 1

Factor  $a_{SKF}$  for Explorer spherical roller bearings and CARB bearings

### Example

Bearing 22220 E:  $C = 425 \text{ kN}$ ;  $P_u = 49 \text{ kN}$  (SKF Rolling bearings catalogue 10000).

Operating conditions:

$P = 70 \text{ kN}$ ;  $\eta_c = 0,2$ ;  $\kappa = 0,8$

- 1 Calculate the SKF rating life using Online tools on skf.com or by calculations according to *SKF Rolling bearings catalogue 10000*.

$$\eta_c (P_u/P) = 0,2 \times 0,7 = 0,14;$$

$\kappa = 0,8$ . Insertion in **diagram 1** gives

$$a_{SKF} \approx 0,45$$

$$L_{10mh} = a_{SKF} \left( \frac{C}{P} \right)^{\frac{10}{3}}$$

$$= 0,45 \times (425/70)^{10/3} = 184 M_{rev}$$

- 2 Select the rating life factor from **table 2, page 1** for  $\eta_c = 0,2$ ;  $\kappa = 0,8$  and  $C/P \sim 6$  which is 1,7.

Accordingly, the expected rating life increase for the upgraded SKF Explorer bearing 22220 E in this case is 70%. The adjusted rating life is then  $184 M_{rev} \times 1,7 = 312 M_{rev}$ .

*Note: While upgraded SKF Explorer self-aligning roller bearings can operate longer under contaminated or inadequate lubrication conditions. Long bearing service life still depends on a clean, well lubricated operating environment.*