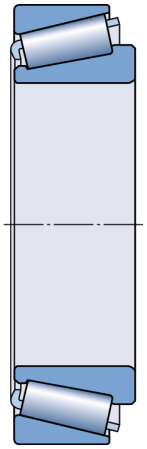
Bearing A - Mainshaft

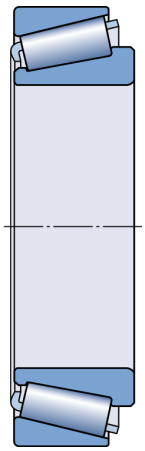
Bearing in position A mounted in the mainshaft



Emanuele Mariniello

July 14, 2020

1. Abstract



Tapered roller bearing

■ SKF Explorer ▶ Popular item

Designation	Load Cases	Life model	
		Basic	SKF life
		L_{10h}	L_{10mh}
		h	
▶ 320/22 X	LC1	30500	149000
	LC2	14900	100000
	LC3	77200	> 2x10^5
	LC4	68300	> 2x10^5
	LC5	25200	> 2x10^5
	combined	**29900**	**> 2x10^5**

** SKF rating life (L_{10mh}) for steel-steel bearings; GBLM load based life (L_{10GMh}) for hybrid bearings*

warnings

! LC1,LC2 : - For rating life results above 100000 hours, other failure modes than those included in the current rating life models will dominate and limit the life of the bearing.

! LC3,LC4,LC5 : - For rating life results above 100000 hours, other failure modes than those included in the current rating life models will dominate and limit the life of the bearing. More info

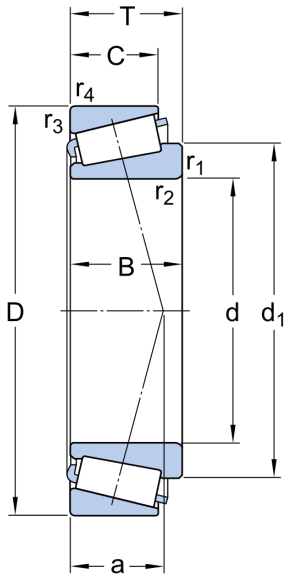
! LC3,LC4,LC5 : - High viscosity ratio k, no asperity contact. k>4 will no further increase bearing rating life but result in higher viscous frictional losses. Operating temperature must be given more attention More info

! Results are based on default operating conditions. Please, review and adjust operating conditions where needed

! LC1,LC2,LC3,LC4,LC5 : - The radial load is introducing an axial load that needs to be supported by a second bearing.

2. Input

2.1. Bearing data



Designation	Bearing type	Principal dimensions			Basic load ratings		Fatigue load limit
					Dynamic	Static	
		d	D	B	C	C_0	P_u
		mm			*kN*		
▶ 320/22 X	Tapered roller bearing	22	44	15	30.9	29	2.85

Designation	Speed ratings	
	Reference	Limiting
	n_{ref}	n_{lim}
	r/min	
▶ 320/22 X	13000	15000

2.2. Loads, Speed and Temperature

	Forces		Speed	Temperature		Case weight
	Radial (F_r)	Axial (F_a)		Inner ring	Outer ring	
	kN		*r/min*	*°C*		
LC1	2.335	0.253	2988.51	70	65	1
LC2	2.54	0.253	4627.36	70	65	1
LC3	1.222	0.253	10246.31	70	65	1
LC4	1.207	0.253	12079.85	70	65	1
LC5	1.545	0.253	14344.83	70	65	1

- *Maximum temperature is used for calculating the actual viscosity, kappa, a_{SKF} and SKF rating life.*
- *Mean temperature is used for calculating bearing friction and power loss.*

2.3. Lubrication

Designation	Lubricant			Effective EP additives
	Type	Method	Name	
▶ 320/22 X	Grease	SKF grease	LGMT 2: all purpose industrial and automotive	False

Designation	Contamination
	Method
▶ 320/22 X	Detailed guidelines

3. Results

3.1. Bearing loads

Designation	Load Cases	Load ratio	Equivalent dynamic load
		C/P	P
			kN
▶ 320/22 X	LC1	13.23	2.34
	LC2	12.16	2.54
	LC3	25.29	1.22
	LC4	25.61	1.21
	LC5	20.01	1.54

3.2. Bearing minimum load

Designation	Load Cases	Reaction forces		Minimum load		
		Radial	Axial			met?
		F_r	F_a	$F_{r\,m}$	$F_{a\,m}$	
		kN				
▶ 320/22 X	LC1	2.335	0.253	0.52	0.62	yes
	LC2	2.54	0.253	0.52	0.67	yes
	LC3	1.222	0.253	0.52	0.32	yes
	LC4	1.207	0.253	0.52	0.32	yes
	LC5	1.545	0.253	0.52	0.41	yes

warnings

! LC1,LC2,LC3,LC4,LC5 : - The radial load is introducing an axial load that needs to be supported by a second bearing.

3.3. Lubrication conditions

Designation	Load Cases	Operating viscosity			Viscosity ratio
		Actual	Rated	Rated @ 40 °C	
		ν	ν_1	ν_{ref}	K
		mm²/s			
▶ 320/22 X	LC1	28.0	12.0	35.7	2.32
	LC2	28.0	9.75	27.5	2.87
	LC3	28.0	6.78	17.5	4.12
	LC4	28.0	6.32	16.0	4.43
	LC5	28.0	5.88	14.7	4.75

3.4. Bearing rating life

Designation	Load Cases	Bearing rating life		SKF life modification factor	Contamination factor
		Basic	SKF		
		L_{10h}	L_{10mh}	a_{skf}	η_c
		h			
▶ 320/22 X	LC1	30500	149000	4.88	0.34
	LC2	14900	100000	6.72	0.39
	LC3	77200	> 2x10^5	50.0	0.49
	LC4	68300	> 2x10^5	50.0	0.49
	LC5	25200	> 2x10^5	50.0	0.49
	combined	**29900**	**> 2x10^5**		

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