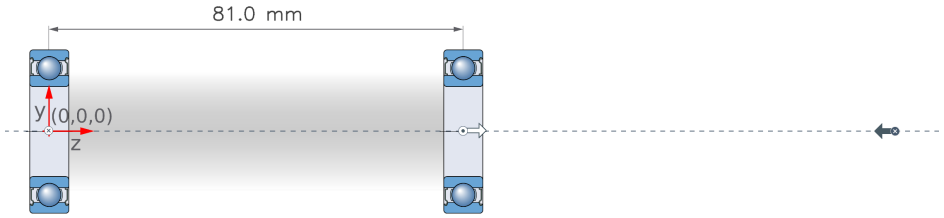
1. Abstract

Calculation overview



Deep groove ball bearing
Non-Locating

Deep groove ball bearing
Locating

SKF Explorer

		Bearing rating life		Grease	Static safety factor	Frictional moment	Power loss
	Designation	Basic	SKF life	Catalogue grease life		Total	
		L_{10h} (h)	L_{10mh} (h)	L_{10} (h)	S_0	M (Nmm)	P_{loss} (W)
Left	6004-2Z	> 2x10^5	> 2x10^5	80100	13.8	4.75	0.03
Right	6005-2Z	20200	8510	17000	4.29	181	1.1

Left bearing

Consideration

All calculated values are best estimates resulting from the input data and assumptions, and well-recognized data sources, and well-established calculation methods.
SKF follows standards and methods suggested by Greenhouse Gas Protocol for CO_2 estimates.
For details about data, methods, and assumptions used, follow the link below.
If you intend to use these values for decision making, contact SKF for more details and correct interpretation of calculation results.
The values calculated by SKF Bearing Select should not be compared with values obtained from other tools or sources, unless you are confident about the data sources, methods and assumptions used. More info

Consideration

Grease consumption is almost zero, therefore CO_2 emissions are not calculated.

Consideration

Low viscosity ratio k, reduced asperity contact. It is recommended to select a higher viscosity lubricant or improve cooling. It is not appropriate to look at basic rating life only. Instead use SKF rating life method. Recommended to use anti-wear (AW) or extreme pressure (EP) additives to reduce wear More info

Consideration

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.

Right bearing

Consideration

Grease consumption is almost zero, therefore CO_2 emissions are not calculated.

Consideration

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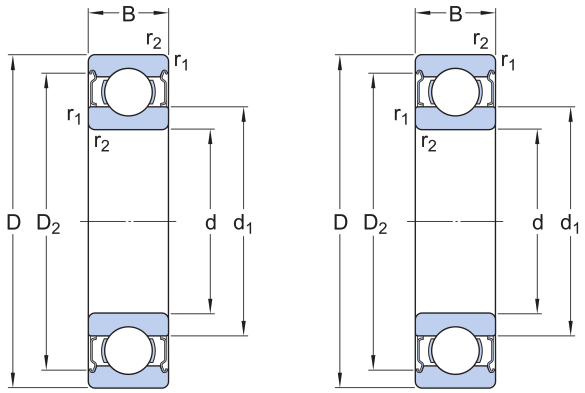
2. Input

2.1. Bearing data



	Designation	Bearing type	Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Clearance class
						Dynamic	Static		Reference	Limiting	
			d (mm)	D (mm)	B (mm)	C (kN)	C_0 (kN)	P_u (kN)	n_{ref} (r/min)	n_{lim} (r/min)	
Left	6004-2Z	Deep groove ball bearing	20.0	42.0	12.0	9.95	5.0	0.212	38000.0	19000.0	Normal
Right	6005-2Z	Deep groove ball bearing	25.0	47.0	12.0	11.9	6.55	0.275	32000.0	16000.0	Normal

2.2. Loads & Speed

Locating	1	
Bearing distance	81.0	mm
Shaft orientation	Vertical	
Rotating ring	Inner ring rotation	

		Coordinate system	Coordinates			Forces			Speed	Case weight
	Load		x|r (mm)	y|θ (mm|deg)	z (mm)	Fx|Fr (kN)	Fy|Fθ (kN)	Fz (kN)	(r/min)	
LC1	F1	Cartesian	0.0	0.0	375.0	0.1	0.0	-2.5	60.0	1

2.3. Temperature

	Left		Right	
Load cases	Inner ring (°C)	Outer ring (°C)	Inner ring (°C)	Outer ring (°C)
LC1	30	30	30	30

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.

2.4. Lubrication

		Lubricant	Effective EP additives	Contamination	
	Designation	Name		Method	Cleanliness / Factor
Left	6004-2Z	MT47	False	Detailed guidelines	High cleanliness
Right	6005-2Z	MT47	False	Detailed guidelines	High cleanliness

2.5. CO_2 emissions settings

	Designation	Input energy mix manually	Geographical location	Period of interest [Years]	Time operational [%]
Left	6004-2Z	False	European Union	1	100
Right	6005-2Z	False	European Union	1	100

2.6. Fits and tolerances

		Requirements	Tolerance Class		Calculated interference	Include Smoothing
	Designation	Guidance	Housing	Shaft		
Left	6004-2Z	False	G7	g6	True	True
Right	6005-2Z	False	G7	g6	True	True

3. Results

3.1. Loads & static safety

		Load ratio	Static safety factor	Equivalent dynamic load	Equivalent static load
	Designation	C/P	S_0	P (kN)	P_0 (kN)
Left	6004-2Z	27.41	13.8	0.36	0.363
Right	6005-2Z	4.18	4.29	2.85	1.53

3.2. Bearing minimum load

		Reaction forces		Minimum load	
	Designation	Radial	Axial		Requirements
		F_r (kN)	F_a (kN)	F_{rm} (kN)	met?
Left	6004-2Z	0.363	0	0.00936	yes
Right	6005-2Z	0.463	2.5	0.0126	yes

3.3. Adjusted reference speed

		Adjusted reference speed	Adjustment factors	
	Designation		For bearing load P	For oil viscosity
		n_{ar} (r/min)	f_p	f_v
Left	6004-2Z	43200	0.97	1.18
Right	6005-2Z	17400	0.52	1.06

3.4. Lubrication conditions

		Operating viscosity			Viscosity ratio
	Designation	Actual	Rated	Rated @ 40 °C	
		ν (mm^2/s)	ν_1 (mm^2/s)	ν_{ref} (mm^2/s)	κ
Left	6004-2Z	128	247	137	0.51
Right	6005-2Z	128	229	128	0.55

3.5. Grease life and relubrication interval

	Designation	Catalogue grease life	Speed factor
			Speed x mean diameter
		L_{10} (h)	nd_m (mm/min)
Left	6004-2Z	80100	1860
Right	6005-2Z	17000	2160

3.6. Bearing rating life

	Designation	Bearing rating life		SKF life modification factor	Contamination factor
		Basic	SKF		
		L_{10h} (h)	L_{10mh} (h)	a_{skf}	η_c
Left	6004-2Z	> 2x10^5	> 2x10^5	1.19	0.29
Right	6005-2Z	20200	8510	0.42	0.33

Left bearing

Consideration

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Consideration

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.

Right bearing

Consideration

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3.7. Bearing friction & power loss

	Designation	Frictional moment		Friction sources				Power loss
		Total	At start 20-30°C and zero speed	Rolling	Sliding	Seals	Drag loss	
		M (Nmm)	M_{start} (Nmm)	M_{rr} (Nmm)	M_{sl} (Nmm)	M_{seal} (Nmm)	M_{drag} (Nmm)	P_{loss} (W)
Left	6004-2Z	4.75	4.23	1.76	2.99	0	0	0.03
Right	6005-2Z	181	238	16.4	165	0	0	1.1

3.8. Bearing frequencies

	Designation	Rotational frequencies				Frequency of over-rolling		
		Inner ring	Outer ring	Rolling element set & cage	Rolling element about its axis	Point on inner ring	Point on outer ring	Rolling element
		f_i(Hz)	f_e(Hz)	f_c(Hz)	f_r(Hz)	f_{ip} (Hz)	f_{ep}(Hz)	f_{rp}(Hz)
Left	6004-2Z	1.0	0.0	0.398	2.339	5.422	3.578	4.677
Right	6005-2Z	1.0	0.0	0.406	2.574	5.937	4.063	5.148

3.9. Estimation of CO_2 emissions over period of interest

	Designation	CO_2 emissions caused by bearing production	CO_2 emissions during bearing operation - over period of interest			Resources consumed during bearing operation - over period of interest	
			Frictional power loss	Grease consumption	Sum of CO_2 during operation	Energy	Grease
		kg of CO_2	kg of CO_2	kg of CO_2	kg of CO_2	kWh	kg
Left	6004-2Z	*0.3 (Learn more)	0.1	0.0	0.1	0.26	0.0
Right	6005-2Z	*0.3 (Learn more)	4.6	0.0	4.6	10.0	0.0

* Value is not designation specific, but based on bearing mass

Left bearing

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Consideration

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Right bearing

Consideration

Grease consumption is almost zero, therefore CO_2 emissions are not calculated.

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3.10. Fits and tolerances

3.10.1. Tolerances

		Shaft outer diameter		Bearing bore		Bearing outer diameter		Housing bore		Smoothing	
	Designation	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Shaft and bearing bore	Bearing outer ring and housing
		(µm)	(µm)	(µm)	(µm)	(µm)	(µm)	(µm)	(µm)	(µm)	(µm)
Left	6004-2Z	-20	-7	-10	0	-11	0	9	34	7	12
Right	6005-2Z	-20	-7	-10	0	-11	0	9	34	7	12

Consideration

For the tolerances calculation, the normal tolerance for the bearing bore and outer diameter is used.

3.10.2. Fits, Probable Interference (+) / Clearance (-)

		Shaft			Housing		
	Designation	Probable minimum	Middle	Probable maximum	Probable minimum	Middle	Probable maximum
		(µm)	(µm)	(µm)	(µm)	(µm)	(µm)
Left	6004-2Z	-24	-16	-7	-53	-39	-25
Right	6005-2Z	-24	-16	-7	-53	-39	-25