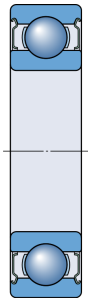
1. Abstract

Calculation overview



Deep groove ball bearing

SKF Explorer

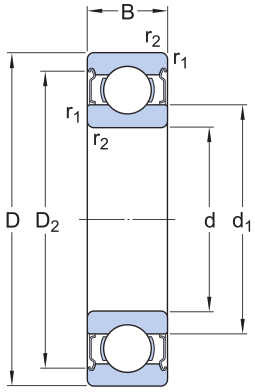
	Bearing rating life		Grease	Static safety factor	Frictional moment	Power loss
Designation	Basic	SKF life	Catalogue grease life		Total	
	L_{10h} (h)	L_{10mh} (h)	L_{10} (h)	S_0	M (Nmm)	P_{loss} (W)
W 638/4-2Z	23300	2390	88200	2.78	0.25	0.013

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

2. Input

2.1. Bearing data



		Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Clearance class
Designation	Bearing type				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)	
W 638/4-2Z	Deep groove ball bearing	4.0	9.0	4.0	0.364	0.114	0.005	140000.0	70000.0	Normal

2.2. Loads, Speed and Temperature

Shaft orientation	Horizontal
Rotating ring	Inner ring rotation

	Forces		Speed	Temperature		Case weight
	Radial (F_r) (kN)	Axial (F_a) (kN)	(r/min)	Inner ring (°C)	Outer ring (°C)	
LC1	0.041	0.0	500.0	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

	Lubricant	Effective EP additives	Contamination	
Designation	Name		Method	Cleanliness / Factor
W 638/4-2Z	LHT23	False	Detailed guidelines	High cleanliness

2.4. Fits and tolerances

	Requirements		Calculated interference	Include Smoothing	Easy axial displacement of inner ring on shaft
Designation	Guidance	Load direction rotating ring			
W 638/4-2Z	True	rotating	False	False	False

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)
W 638/4-2Z	8.88	2.78	0.04	0.041

3.2. Bearing minimum load

	Reaction forces		Minimum load	
Designation	Radial	Axial		Requirements
	F_r (kN)	F_a (kN)	F_{rm} (kN)	met?
W 638/4-2Z	0.041	0.0	< 0.001	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
W 638/4-2Z	110000	0.64	1.23

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
W 638/4-2Z	10.1	88.6	424	0.11

3.5. Grease life and relubrication interval

	Catalogue grease life	Speed factor
Designation		Speed x mean diameter
	L_{10} (h)	nd_m (mm/min)
W 638/4-2Z	88200	3170

3.6. Bearing rating life

	Bearing rating life		SKF life modification factor	Contamination factor
Designation	Basic	SKF		
	L_{10h} (h)	L_{10mh} (h)	a_{skf}	η_c
W 638/4-2Z	23300	2390	0.1	0.03

Consideration

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3.7. Bearing friction & power loss

	Frictional moment		Friction sources				Power loss
Designation	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)
W 638/4-2Z	0.25	0.29	0.02	0.22	0	0	0.013

3.8. Bearing frequencies

	Rotational frequencies				Frequency of over-rolling		
Designation	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)
W 638/4-2Z	8.333	0.0	3.125	15.619	36.461	21.873	31.239

3.9. Fits and tolerances

Note
Typically, it is not sufficient to use an interference fit alone to axially locate a bearing ring on a cylindrical seat.

3.9.1. Recommended tolerance class

	Tolerance Class	
Designation	Shaft	Housing
W 638/4-2Z	h6	N7

Consideration
The recommendation for the tolerance classes is based on the load case with the highest equivalent dynamic load.

Consideration
Valid for solid steel shaft and split or non-split cast iron or steel housings.

3.9.2. 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)
W 638/4-2Z	-8	0	-8	0	-8	0	-19	-4	N/A	N/A

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

3.9.3. Fits, Theoretical Interference (+) / Clearance (-)

	Shaft			Housing		
Designation	Probable minimum	Middle	Probable maximum	Probable minimum	Middle	Probable maximum
	(µm)	(µm)	(µm)	(µm)	(µm)	(µm)
W 638/4-2Z	-8	0	8	-4	7	19