Rolling Bearing Equivalent Load and Rating Life

Equivalent dynamic load of a rolling bearing from radial and axial loads with X and Y factors, and the L10 rating life in revolutions and hours.

Method: Budynas and Nisbett; Shigley's Mechanical Engineering Design; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Radial load	6.0000	kN
Axial load	2.0000	kN
Radial factor (bearing catalogue)	0.56000	
Axial factor (bearing catalogue)	1.6000	
Basic dynamic load rating	33.000	kN
Life exponent	Ball bearings (3)	
Speed	1,450.0	rpm
Load (service) factor	1.2000	

Calculated results

Parameter	Value	Unit
Equivalent dynamic load	7.8720	kN
Rating life (million revolutions)	73.669	
Rating life	846.77	h

Notes for this case

- X and Y depend on the bearing type and on F_a/(C₀) and F_a/F_r: take them from the bearing maker's catalogue. If F_a/F_r is below the catalogue's e, X = 1 and Y = 0 (the larger of XF_r + YF_a and F_r is used here).

Formula and method

$$P = f_s \max(XF_r + YF_a,\ F_r), \quad L_{10} = \left(\frac{C}{P}\right)^p \text{ million rev}, \quad L_{10h} = \frac{10^6 L_{10}}{60N}$$

Variables

F_r	Radial load	N
F_a	Axial load	N
X	Radial factor (bearing catalogue)	-
Y	Axial factor (bearing catalogue)	-
C	Basic dynamic load rating	N
p	Life exponent	-
N	Speed	1/s
f_s	Load (service) factor	-
P	Equivalent dynamic load	N
L_{10}	Rating life (million revolutions)	-
L_{10h}	Rating life	s

Method and standards

Basic rating life.

Assumptions and limits

- Basic rating life; normal lubrication and cleanliness.
- There is no input for the catalogue's e: when F_a/F_r ≤ e, enter X = 1 and Y = 0 yourself. The larger of XF_r + YF_a and F_r is used as a guard.
- The roller exponent is the exact 10/3.

References

- Budynas and Nisbett
- Shigley's Mechanical Engineering Design
- 10th ed. (McGraw-Hill, 2015)
- ch. 11 (equivalent radial load P = XF_r + YF_a; L_{10} = (C/P)^a)

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/machine-design/bearing-equivalent-load-life

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.