



















INTRODUCTION TO BEARINGS

Definition

Bearings are mechanical elements that constrains relative motion between moving parts to only the desired motion.



Type of Bearings

Bearing Type	Series	
Deep Groove Ball Bearings	16000, 200, 300, 6000, 61800, 61900, 6200, 6300, 6400	
Angular Contact Ball Bearings	7200, 7300, 7400	
	3300, 5200, 5300, BA2B 459000	
Four-point Contact Ball Bearings	QJ200, QJ300	
Self-aligning Ball Bearings	1200, 1300, 1400, 2200, 2300	
Thrust Ball Bearings	51000, 52000	
	53000, 54000	
Spherical Roller Thrust Bearings	29200, 29300, 29400	
Cylindrical Roller Bearings	N, NJ, NU (200, 300, 400)	
	NUP (200, 300, 400)	
	NNU4000, NN3000	
Full Complement Cylindrical Roller Bearings	NCF, NJG	
	NNC4800, NNCF, NNCL, NNF	
Spherical Roller Bearings	21000, 22000, 23000, 24000, 452000, 453000, I series	
CARB®	C2200, C2300, C3000, C3100, C3200, C39/100, C4000, C5900, C6000	
Needle Roller Bearings	HK, NA, NK, NKI, NKIS, NKS, RNA	
Taper Roller Bearings	30000, 31000, 32000, 33000, T2, T4, T7	
	31300DF, 32000DF	

Characteristics – suitability of bearing for:								
radial capacity	axial capacity	speed	stiffness	quiet	low friction	compensation for misalignment	axial displacement possible in bearing	typical application
▲	●	+	▲	+	+	■	—	Textiles Power tools, Electric motors, Pumps, Gearboxes
▲	▲	▲	▲	▲	▲	■	—	Pumps, Compressors, Centrifuges
▲	▲	●	▲	●	●	—	—	Pumps, Compressors, Centrifuges
■	●	▲	●	●	●	—	—	Compressors
▲	■	▲	●	▲	▲	+	—	Fans, Paper making machines
—	▲	●	●	■	▲	—	—	Plastic extruder tools, Crane hooks
—	▲	●	●	■	●	—	—	Plastic extruder tools, Crane hooks
■	+	●	▲	■	●	+	—	Tunnel boring machines, Wind turbines, Cranes, Pumps, Electric motors
▲	—	+	▲	▲	▲	■	+	Traction motors, Electric motors, Gearboxes
▲	■	+	▲	●	▲	■	●	Traction motors, Electric motors, Gearboxes
+	—	+	+	▲	▲	—	+	Precision machines, Spindles
+	■	■	+	■	■	■	●	Elevators, Gearboxes
+	■	■	+	■	■	—	●	Cranes, Steel rolling mills, Wire ropes, Sheaves
■	+	●	▲	■	●	+	—	Fans, Paper, Gearboxes, Crushers, Vibrating screens
+	—	▲	+	●	●	+	+	Paper making machines, Gearboxes, Fans, Electric motors
▲	—	●	▲	●	■	—	+	Gearboxes (planetary), Alternators
▲	●	●	▲	●	●	■	—	Gearboxes, Cone crushers
+	●	●	+	●	●	■	—	Gearboxes, Rail car axle

Key	+	▲	●	■	—
	excellent	good	fair	poor	unsuitable

Selecting Bearing Size Using the Life Equations

Parameters

- C: the basic dynamic load rating
- C_0 : the basic static load rating:

$$C_0 = s_0 P_0$$

where

C_0 = basic static load rating

P_0 = equivalent static bearing load

s_0 = static safety factor

The basic rating equation:

$$L_{10} = \left(\frac{C}{P}\right)^p$$

where

L_{10} = basic rating life, millions of revolutions

C = basic dynamic load rating

P = equivalent dynamic bearing load

p = exponent of the life equation

Selecting Bearing Size Using the Life Equations

L_{10h} : Basic Rating operating hours:

$$L_{10h} = \frac{1\,000\,000}{60 n} L_{10}$$

where

L_{10h} = basic rating, operating hours

n = rotational speed, r/min

Factor of Safety

Table 6 Guideline values for static safety factor s_0

Type of operation	Rotating bearings						Non-rotating bearings	
	Requirements regarding quiet running							
	unimportant	normal	normal	high				
	Ball bearings	Roller bearings	Ball bearings	Roller bearings	Ball bearings	Roller bearings	Ball bearings	Roller bearings
Smooth, vibration-free	0.5	1	1	1.5	2	3	0.4	0.8
Normal	0.5	1	1	1.5	2	3.5	0.5	1
Pronounced shock loads ¹⁾	> 1.5	> 2.5	> 1.5	> 3	> 2	> 4	> 1	> 2

For spherical roller thrust bearings it is advisable to use $s_0 > 4$

¹⁾ Where the magnitude of the load is not known values of s_0 which are at least as large as those quoted above should be used. If the magnitude of the shock loads is exactly known, smaller values of s_0 can be applied