



Load Ratings and Bearing Life

Elastohydrodynamics (EHD Effect)

The presence of a thin film of oil at the mutually contacting ball-to-raceway interface enhances the load capacity of a ball bearing. The lubricant life modifier nomograph (page 50) includes the effect of the elastohydrodynamic lubricant film and can be used to assist in lubricant selection.

Other Life Adjustments

Seldom are loads ideally applied. The conventional rating life often has to be modified due to application abnormalities, intentional or unknown. The following conditions have the practical effect of modifying the ideal, theoretical rating life (L_{10}).

- Vibration and/or shock-impact loads
- Angular misalignment
- Oscillatory duty
- High-speed effects
- Operation at elevated temperatures
- Fits
- Internal design

While it is difficult to provide the exact effect upon life under any of these conditions, NHBB can provide bearing life estimates based on semi-empirical data to help you forecast bearing life for your application.

Lubricant Life

In many instances a bearing's effective life is governed by the lubricant's life. This is usually the case for applications involving very light loads and/or very slow speeds. In such instances, the conventional fatigue life calculated will be unrealistically high. The lubricant's ability to provide sufficient film strength is affected by:

- Quantity and condition of the lubricant in the bearing
- Environmental conditions (e.g. ambient temperature, area cleanliness)
- The load-speed cycle

Specialized oils and greases are available which exhibit favorable performance characteristics over an extended period.



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Calculation of Fatigue Life

While miniature and instrument bearings may fail from causes other than fatigue, the fatigue life should be calculated to ensure against failure. To calculate fatigue life, follow the procedure in the table below.

Fatigue Life

Step	Item/Operation	Symbol	Pounds and Inches	
			Obtain from	Example
Given	Radial Load Thrust Load Speed	R T N	Given Given Given	2 lbs. 5 lbs. 15,000 RPM
1	Obtain lubricant viscosity (consult with factory)	V	—	15 cs.
2	Select bearing			SSR-3
3	Read dynamic load rating	C	page 10	140 lbs.
4	Read static load rating	C ₀	page 10	59 lbs.
5	Read ball size	D _b		3/32"
6	Select radial play range		page 35	P25
7	Obtain initial contact angle using D _b and table	α ₀	page 37	9.5°
8	Obtain T ¹ from T ¹ nomograph using C ₀ , T and α ₀ above	T ¹	page 46	9.5 lbs.
9	Obtain R ¹ from R ¹ nomograph using α ₀ above	R ¹	page 48	0.95 lbs.
10	Obtain PE where PE = T ¹ + R ¹ or PE = R whichever is greater	PE	9.5 + 0.95	10.45 lbs.
11	Obtain L _{B10} from B10 life nomograph (number of revolutions or hours) using C and PE above	L _{B10}	page 49	2700 hrs.
12	Obtain lubricant life modifier from lubricant effect nomograph using C, T + R, V and N above	a ₁	page 50	1.5
13	Obtain reliability life modifier (a ₂) from the table for L _{B10}	a ₂	page 43	0.50
14	Obtain design life L where L = a ₁ a ₂ L _{B10}	L	1.5 x 0.5 x 2700	2000 hrs.