2. STATIC LOAD RATINGS AND STATIC EQUIVALENT LOADS

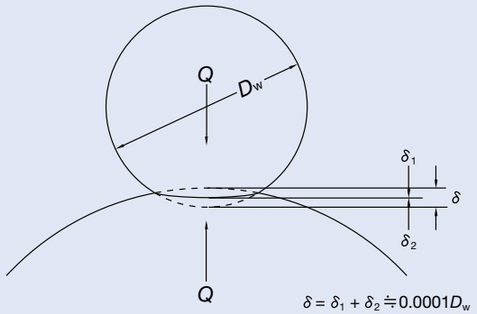
Static Load Ratings

When subjected to an excessive load or a strong shock load, rolling bearings may incur a local permanent deformation of the rolling elements and raceway surface if the elastic limit is exceeded. The nonelastic deformation increases in area and depth as the load increases, and when the load exceeds a certain limit, the smooth running of the bearing is impeded.
The basic static load rating is defined as that static load which produces the following calculated contact stress at the center of the contact area between the rolling element subjected to the maximum stress and the raceway surface.

For ball bearings : 4 200MPa
For roller bearings : 4 000MPa

In this most heavily contacted area, the sum of the permanent deformation of the rolling element and that of the raceway is nearly 0.0001 times the rolling element's diameter. The basic static load rating C_0 is written C_{0r} for radial bearings and C_{0a} for thrust bearings in the bearing tables.

Fig. 2.1 The Relation between Indentations and Basic Static Load Rating



Static Equivalent Loads

The static equivalent load is a hypothetical load that produces a contact stress equal the maximum stress under actual conditions, while the bearing is stationary (including very slow rotation or oscillation), in the area of contact between the most heavily stressed rolling element and bearing raceway.
The static radial load passing through the bearing center is taken as the static equivalent load for radial bearings, while the static axial load in the direction coinciding with the central axis is taken as the static equivalent load for thrust bearings.
Static equivalent load on radial bearings.
The greater of the two values calculated from the following equations should be adopted as the static equivalent load on radial bearings.

$$P_0 = X_0 F_r + Y_0 F_a$$
$$P_0 = F_r$$

Static equivalent load on thrust bearings:

$$P_0 = X_0 F_r + F_a \quad \alpha \neq 90^\circ$$

Table 2.1 Static Equivalent Load $P_0 = X_0 F_r + Y_0 F_a$

Contact Angle	Single DT		DB or DF	
	X_0	Y_0	X_0	Y_0
15	0.5	0.46	1	0.92
18	0.5	0.42	1	0.84
25	0.5	0.38	1	0.76
30	0.5	0.33	1	0.66
40	0.5	0.26	1	0.52

where
P_0 : Static equivalent load (N)
F_r : Radial load (N)
F_a : Axial load (N)
X_0 : Static radial load factor
Y_0 : Static axial load factor

When single or DT mounting and $F_r > 0.5F_r + Y_0F_a$, use $P_0 = F_r$

Permissible Static Load Factor

The permissible static equivalent load on bearings varies depending on the basic static load rating and also their application and operating conditions.
The permissible static load factor is a safety factor that is applied to the basic static load rating, and it is defined by the ratio in equation below:

$$f_S = (C_0 / P_0)$$

where
C_0 : Basic static load rating (N)
P_0 : Static equivalent load (N)

Table 2.2 Values of Permissible Static Load Factor f_s

Operating conditions	Lower limit of f_s	
	Ball bearings	Roller bearings
Low-noise applications	2.0	3.0
Bearings subjected to vibration and shock loads	1.5	2.0
Standard operating conditions	1.0	1.5

Permissible Axial Loads

In order to optimize bearing performance, NSK has defined the permissible axial loads statistically, based on the following 2 situations:

1 --The limiting load at which a contact ellipse is generated between the ball and raceway due to a change in the contact angle when a radial bearing, which is under an axial load, rides over the shoulder of the raceway groove.
2 --The value of a static equivalent load P_0 which is determined from the basic static load rating C_0 using static axial load factor Y_0.

The permissible axial load is determined by the lower of the two values defined above.
This value has been proven through experience, and includes a safety factor.
(Refer to the bearing tables for permissible axial loads)

Fig. 2.2 Contact Ellipse and the Limiting Axial Loads