1.5. Static Safety Factor

The basic static load rating C_0 refers to the static load with constant direction and magnitude, under which the sum of the permanent deformation of the roller and the permanent deformation of the raceway accounts for 0.0001 times of the roller's diameter in the contact area where the maximum stress is applied (if the deformation exceeds this level, it will affect the rotation). This value is indicated as "C_0" in the dimensional tables in the "THK General Catalog - Product Specifications," provided separately. When a load is statically or dynamically applied, it is necessary to consider the static safety factor as shown below.

$$\frac{C_0}{P_0} = f_S$$

where

f_S : Static safety factor (see table 3)

C_0 : Basic static load rating (N)

P_0 : Static radial load (N)

Table 3 Static Safety Factor (f_S)

Load conditions	Lower limit of f_S
Normal load	1 to 2
Impact load	2 to 3

Static Equivalent Radial Load P_0

The static equivalent radial load of the Cross-Roller Ring is obtained from the following equation.

$$P_0 = X_0 \cdot \left(Fr + \frac{2M}{dp} \right) + Y_0 \cdot Fa$$

where

P_0 : Static equivalent radial load (N)

Fr : Radial load (N)

Fa : Axial load (N)

M : Moment (N-mm)

X_0 : Static radial factor ($X_0=1$)

Y_0 : Static axial factor ($Y_0=0.44$)

dp : Roller pitch circle diameter (mm)

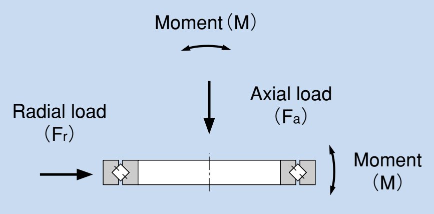

Fig. 5

[Example of calculating a static safety factor]

Assuming that model RB25025 is used under the following conditions, calculate its static safety factor (f_S).

m_1 =100 kg
m_2 =200 kg
m_3 =300 kg
D_1 =300 mm
D_2 =150 mm
H =200 mm
C =69.3 kN
C_0 =150 kN
dp =277.5 mm
F =100 N
ω =2 rad/s (ω: angular speed)

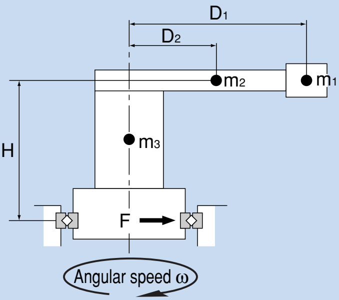

Fig. 6

Radial load: $Fr = F + m_1 \cdot D_1 \times 10^{-3} \cdot \omega^2 + m_2 \cdot D_2 \times 10^{-3} \cdot \omega^2$
$= 100 + 100 \cdot 300 \times 10^{-3} \cdot 2^2 + 200 \cdot 150 \times 10^{-3} \cdot 2^2$
$= 340$ N

Axial load: $Fa = (m_1 + m_2 + m_3) \times g$
$= (100 + 200 + 300) \times 9.807$
$= 5884.2$ N

Moment: $M = m_1 \cdot g \times D_1 + m_2 \cdot g \times D_2 + (m_1 \cdot D_1 \times 10^{-3} \cdot \omega^2 + m_2 \cdot D_2 \times 10^{-3} \cdot \omega^2) \times H$
$= 100 \cdot 9.807 \times 300 + 200 \cdot 9.807 \times 150 +$
$(100 \cdot 300 \times 10^{-3} \cdot 2^2 + 200 \cdot 150 \times 10^{-3} \cdot 2^2) \times 200$
$= 636420$ N·mm

Therefore, the static equivalent radial load (P_0) is obtained as follows.

$$P_0 = X\left(Fr + \frac{2M}{dp}\right) + Y \cdot Fa = 1 \times \left(340 + \frac{2 \cdot 636420}{277.5}\right) + 0.44 \times 5884.2 = 7515.8 \text{ N}$$

$$\therefore f_S = \frac{150 \times 10^3}{7515.8} = 20$$

Thus, the static safety factor (f_S) is 20.