1.4. Rated Life

The service life of the Cross-Roller Ring is obtained from the following equation.

$$L = \left(\frac{f_T \cdot C}{f_W \cdot P_C}\right)^{\frac{10}{3}} \times 10^6$$

where

L :Rated life
(The total number of revolutions that 90% of a group of identical Cross-Roller Ring units independently operating under the same conditions can achieve without showing flaking from rolling fatigue)

C :Basic dynamic load rating* (N)

P_C :Dynamic equivalent radial load (N)

f_T :Temperature factor (see Fig. 2)

f_W :Load factor (see table 1)

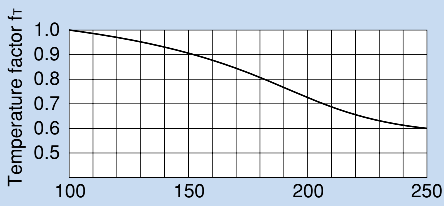

Fig. 2 Temperature Factor (f_T)

Note: The normal service temperature is 80℃ or below. If the product is to be used at a higher temperature, contact THK.

Table 1 Load Factor (f_W)

Service condition	f_W
Smooth motion without impact	1 to 1.2
Normal motion	1.2 to 1.5
Motion with severe impact	1.5 to 3

* Note: The basic dynamic load rating (C) of the Cross-Roller Ring shows the radial load with constant direction and magnitude, under which the rated life (L) is 1 million revolutions when a group of identical Cross-Roller Ring units independently operate under the same conditions. The basic dynamic load rating (C) is indicated in the "THK General Catalog - Product Specifications," provided separately.

Dynamic Equivalent Radial Load P_C

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

$$P_C = X \cdot \left(F_r + \frac{2M}{dp}\right) + Y \cdot F_a$$

where

P_C :Dynamic equivalent radial load (N)

Fr :Radial load (N)

Fa :Axial load (N)

M :Moment (N-mm)

X :Dynamic radial factor (see table 2)

Y :Dynamic axial factor (see table 2)

dp :Roller pitch circle diameter (mm)

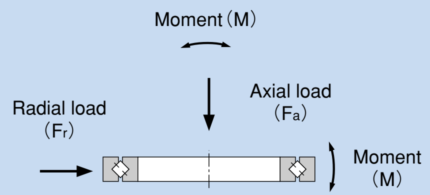

Fig. 3

Table 2 Dynamic Radial Factor and Dynamic Axial Factor

Classification	X	Y
$\frac{F_a}{F_r + 2M/dp} \leqq 1.5$	1	0.45
$\frac{F_a}{F_r + 2M/dp} > 1.5$	0.67	0.67

●If Fr = 0 and M = 0 N-mm, perform calculation while assuming that X = 0.67 and Y = 0.67.

●For service life calculation with a preload taken into account, contact THK.

[Example of calculating a service life]

Assuming that model RB25025 is used under the following conditions, calculate its rated life (L).

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)

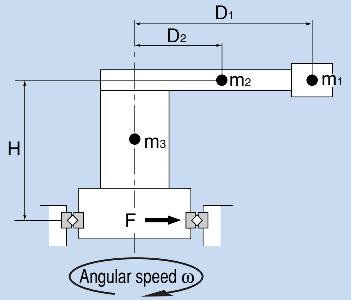

Fig. 4

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

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

$$\frac{F_a}{F_r + 2M/dp} = \frac{5884.2}{340 + 2 \times 636420/277.5} = 1.19 \leqq 1.5$$

$\therefore X = 1$, $Y = 0.45$

Therefore, the dynamic equivalent radial load (P_c) is obtained as follows.

$$P_c = X\left(F_r + \frac{2M}{dp}\right) + Y \cdot F_a = 1 \times \left(340 + \frac{2 \cdot 636420}{277.5}\right) + 0.45 \times 5884.2 = 7574.7 \text{ N}$$

If f_w = 1.2, the rated life is calculated as follows.

$$L = \left(\frac{f_T \cdot C}{f_w \cdot P_c}\right)^{\frac{10}{3}} = \left(\frac{1 \times 69.3 \times 10^3}{1.2 \times 7574.7}\right)^{\frac{10}{3}} \times 10^6 = 8.7 \times 10^8 \text{ (revolutions)}$$

Thus, the rated life (L) is 8.7×10^8 revolutions.