1.3. Rated Load

Static Safety Factor f_s

The LM Roller may receive an unexpected external force while it is stationary or operative due to the generation of an inertia caused by vibrations and impact or start-up and stop. It is necessary to consider a static safety factor against such a working load.

where

$$f_s = \frac{f_c \cdot C_0}{P_c}$$

f_s : Static safety factor
f_c : Contact factor (see table 2 on page I-10)
C_0 : Basic static load rating (kN)
P_c : Calculated load (kN)

■Reference value of static safety factor

The static safety factors indicated in table 1 are the lower limits of reference values in the respective service conditions.

Table 1 Reference Values of Static Safety Factors (f_s)

Machine using the LM system	Service conditions	Lower limit of f_s
General industrial machinery	Without vibrations or impact	1 to 1.3
	With vibrations or impact	2 to 3
Machine tools	Without vibrations or impact	1 to 1.5
	With vibrations or impact	2.5 to 7

Rated Life

The rated life of the LM Roller is obtained using the basic dynamic load rating (C) indicated in the corresponding dimensional table in the "THK General Catalog - Product Specifications,"provided separately, and the following equation.

where

$$L = \left(\frac{f_H \cdot f_C \cdot f_T}{f_W} \cdot \frac{C}{P_C}\right)^{\frac{10}{3}} \times 100$$

L : Rated life (km)
(The total number of revolutions that 90% of a group of identical LM Roller units independently operating under the same conditions can achieve without showing flaking)
C : Basic dynamic load rating (kN)
P_C : Calculated radial load (kN)
f_H : Hardness factor (see Fig. 2)
f_T : Temperature factor (see Fig. 3 on page I-10)
f_C : Contact factor (see table 2 on page I-10)
f_W : Load factor (see table 3 on page I-10)

Calculating the Service Life Time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

where

$$L_h = \frac{L \times 10^6}{2 \times \ell_s \times n_1 \times 60}$$

L_h : Service life time (h)
ℓ_s : Stroke length (mm)
n_1 : Number of reciprocations per minute (min^{-1})

■f_H : Hardness factor

To maximize the load capacity of the LM system, the hardness of the raceways needs to be between 58 to 64 HRC.
If the hardness is lower than this range, the basic dynamic load rating and the basic static load rating decrease. Therefore, it is necessary to multiply each rating by the respective hardness factor (f_H).

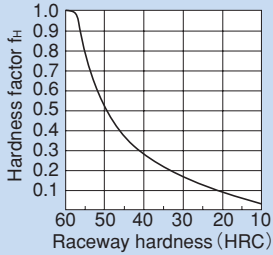

Fig. 2 Hardness factor (f_H)

■f_T : Temperature factor

If the temperature of the atmosphere surrounding the operating LM Roller exceeds 100℃, take into account the adverse effect of the high temperature and multiply the basic load ratings by the temperature factor indicated in Fig. 3.

Note: The normal service temperature of the LM Roller is 80℃ at a maximum. If the ambient temperature exceeds 80℃, contact THK.

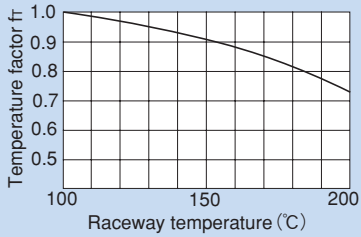

Fig. 3 Temperature factor (f_T)

■f_C : Contact factor

When multiple LM Roller units are used in near close contact with each other, their linear motion is affected by moments and mounting accuracy, making it difficult to achieve uniform load distribution. In such applications, multiply the basic load rating (C) and (C_0) by the corresponding contact factor in table 2.

Note: If uneven load distribution is expected in a large machine, take into account the respective contact factor indicated in table 2.

Table 2 Contact Factor (f_C)

Number of LM Roller units in close contact with each other	Contact factor f_C
2	0.81
3	0.72
4	0.66
5	0.61
Normal use	1

■f_W : Load factor

In general, reciprocating machines tend to involve vibrations or impact during operation. It is difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when the actual load applied to the LM Roller cannot be obtained, or when speed and impact have a significant influence, divide the basic load rating (C or C_0), by the corresponding load factor in table 3 of empirically obtained data.

Table 3 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low V≦0.25m/s	1 to 1.2
Weak	Slow 0.25<V≦1m/s	1.2 to 1.5
Medium	Medium 1<V≦2m/s	1.5 to 2
Strong	High V>2m/s	2 to 3.5