

Load Rating

Service Life of an LM System

When an LM System rolls under a load, its raceway and rolling elements (balls or rollers) constantly receive repetitive stress. After reaching a certain limit, the raceway fractures from fatigue and part of the surface flakes like scales. This phenomenon is called flaking.

The service life of an LM System refers to the total travel distance until the first event of flaking due to rolling fatigue of the material occurs on the raceway or the rolling element.

Nominal Life

The service life of an LM System is subject to slight variations even under the same operating conditions. Therefore, it is necessary to use the nominal life defined below as a reference value for obtaining the service life of the LM System.

The nominal life means the total travel distance that 90% of a group of identical LM System units can achieve without flaking.

Basic Load Rating

An LM System has two types of basic load ratings: basic dynamic load rating (C), which is used to calculate the service life, and basic static load rating (C_0), which defines the static permissible limit.

Basic Dynamic Load Rating C

The basic dynamic load rating (C) indicates the load with constant direction and magnitude, under which the rated life (L) is $L = 50$ km for an LM System using balls, or $L = 100$ km for an LM System using rollers, when a group of identical LM System units independently operate under the same conditions.

The basic dynamic load rating (C) is used to calculate the service life when an LM System operates under a load.

Note: Specific values of each LM System model are indicated in the dimensional table for the corresponding model number.

Basic Static Load Rating C_0

If an LM System receives an excessively large load or a large impact when it is stationary or operative, permanent deformation occurs between the raceway and the rolling element. If the permanent deformation exceeds a certain limit, it will prevent the LM System from moving smoothly.

The basic static load rating is a static load with a constant direction and magnitude whereby the sum of the permanent deformation of the rolling element and that of the raceway on the contact area under the maximum stress is 0.0001 times the rolling element diameter. With an LM System, the basic static load rating is defined for the radial load.

The basic static load rating C_0 is used for calculating the static safety factor relative to the working load.

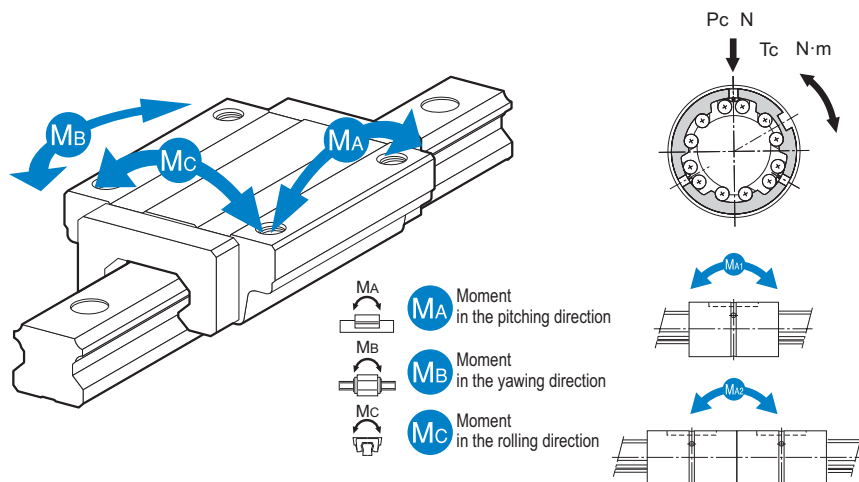
Note: Specific values of each LM System model are indicated in the dimensional table for the corresponding model number.

Static Permissible Moment M_0

When an LM System receives a moment, the rolling elements on both ends receive the maximum stress due to uneven distribution of the stress on the rolling elements within the LM System.

The permissible static moment (M_0) means the moment with constant direction and magnitude, under which the sum of the permanent deformation of the rolling element and the permanent deformation of the raceway is 0.0001 times the rolling element's diameter in the contact area where the maximum stress is applied.

With an LM System, the static permissible moment is defined in three directions: M_A , M_B , and M_C .



P_c : Radial load

T_c : Moment in the torque direction

M_{A1} : Moment in the pitching direction

M_{A2} : Moment in the pitching direction

Note: The specific static permissible moment value of each LM System model is provided in the section on the permissible moments of each model.

Static Safety Factor f_s

When an LM System is stationary or in motion, an unexpected external force may be applied due to vibrations, impacts, or inertia caused by starting and stopping. It is necessary to take a static safety factor into account with regard to this type of applied load.

Static Safety Factor f_s

The static safety factor (f_s) is determined by the ratio of the load capacity (basic static load rating C_0) of an LM System to the load applied on the LM System.

$$f_s = \frac{f_c \cdot C_0}{P} \quad \text{or} \quad f_s = \frac{f_c \cdot M_0}{M} \quad \dots\dots\dots (1)$$

- f_s : Static safety factor
- f_c : Contact factor (see Table 1 on **B 0-12**)
- C_0 : Basic static load rating
- M_0 : Static permissible moment (M_A , M_B and M_C)
- P : Calculated load
- M : Calculated moment