2.5 Load-carrying capacity and rating life

Dynamic load rating C

When the dynamic loads are applied normal to the load zones with constant magnitude and direction, the rated life of a linear bearing can theoretically reach 10^5 m of travel.(The above is according to DIN636 Part 2)

$$C_{(50)} = 1.26 \cdot C_{(100)} \quad (2)$$

$$C_{(100)} = 0.79 \cdot C_{(50)} \quad (3)$$

$$L = \left(\frac{C}{P}\right)^3 \cdot 10^5 \quad (4)$$

$$L_h = \frac{L}{2 \cdot s \cdot n \cdot 60} = \frac{L}{v_m} \cdot \left(\frac{C}{P}\right)^3 \quad (5)$$

L	=	rating life in meter	(m)
L_h	=	rating life in hour	(h)
C	=	dynamic load rating	(N)
P	=	equivalent load	(N)
s	=	length of stroke	(m)
n	=	stroke repetition	(min^{-1})
v_m	=	average speed	(m/min)

Rating Life L

An individual linear bearing or a batch of identical linear bearings under the same running conditions, using common materials with normal manufacturing quality and operating conditions can reach a 90% survival rate at the calculated life.(The above is according to DIN 636 part2)

When the standard of 50 km travel distance is used, the dynamic load rating will exceed the value based on the standard DIN 636 by 20% or more. The relationship between two load ratings is based on formulas (2)and (3) above.

Calculation of rating life

Formulas (4) and (5) can be used when the equivalent dynamic load and the average speed are constant.

Equivalent dynamic load and speed

If the load and speed are not constant, each actual load and speed must be taken into account and both will influence the life.

Equivalent dynamic load

If there is a change in load only, the equivalent dynamic load can be calculated according to formula (6).

Equivalent speed

If there is a change in speed only, the equivalent speed can be calculated using formula (7).

If there are changes in both of the load and speed, the equivalent dynamic load can be calculated using formula (8).

$$P = \sqrt[3]{\frac{q_1 \cdot F_1^3 + q_2 \cdot F_2^3 + \cdots + q_n \cdot F_n^3}{100}} \quad (6)$$

$$\bar{v} = \frac{q_1 \cdot v_1 + q_2 \cdot v_2 + \cdots + q_n \cdot v_n}{100} \quad (7)$$

$$P = \sqrt[3]{\frac{q_1 \cdot v_1 \cdot F_1^3 + q_2 \cdot v_2 \cdot F_2^3 + \cdots + q_n \cdot v_n \cdot F_n^3}{100}} \quad (8)$$

$$P = |F_X| + |F_Y| \quad (9)$$

$$P = |F| + |M| \cdot \frac{C_0}{M_0} \quad (10)$$

P	=	equivalent dynamic load	(N)
q	=	percentage of stroke	(%)
F_1	=	discrete load steps	(N)
$\bar{v}$	=	average speed	(m/min)
v	=	discrete speed steps	(m/min)
F	=	external dynamic load	N
F_Y	=	external dynamic load, vertical	N
F_x	=	external dynamic load, horizontal	N
C_0	=	static load rating	N
M	=	static moment	Nm
M_0	=	static moment in direction of action	Nm

Combined dynamic load

If the linear bearing takes on load from an arbitrary angle, its equivalent dynamic load rating is calculated using formula(9).

Combined load in combination with a moment

If both load and moment act on the linear guide, the equivalent dynamic load can be calculated by the formula (10).

ⓘ According to DIN636 Part 1, the equivalent load(P) shall not exceed 1/2C.