General technical data and calculations

Forces and moments

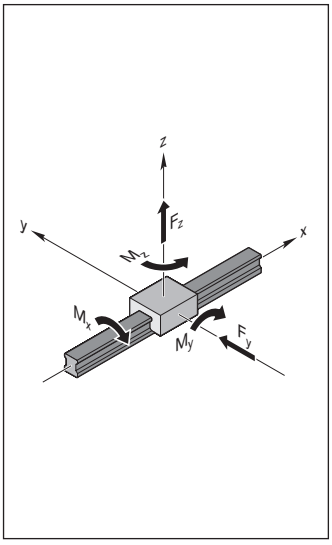
In Rexroth ball rail systems the raceways are arranged at a contact angle of 45°.
This results in the same load-bearing capacity of the entire system in all four major planes of load application.
The ball runner blocks may be subjected to both forces and load moments.

Forces in the four major planes of load application

- Tension F_z (positive Z-direction)
- Pressure $-F_z$ (negative Z-direction)
- Side load F_y (positive Y-direction)
- Side load $-F_y$ (negative Y-direction)

Moments

- Torsional moment M_x (around the X-axis)
- Longitudinal moment M_y (around the Y-axis)
- Longitudinal moment M_z (around the Z-axis)



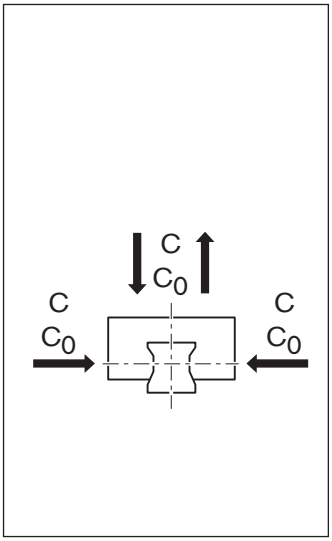
Definition of load capacities

Dynamic load capacity C

The radial load whose extent and direction cannot change that a linear anti-friction bearing can theoretically absorb for a nominal life covering 10^5 m (according to DIN ISO 14728-1).
Note: The dynamic load capacities in the tables are above the DIN or ISO values. These values have been confirmed in tests.

Static load capacity C_0

Static load in the load direction that corresponds to a calculated load in the center of the contact point with the greatest load between the rolling element (ball) and track zone (guide rail) of 4200 MPa.
Note: With this stress at the contact point, permanent overall deformation of the ball occurs that corresponds to about 0.0001 times the ball diameter. (according to DIN ISO 14728-1)



Definition of moment load capacities

Dynamic torsional moment load capacity M_t

Comparative dynamic moment about the X-axis which causes a load equivalent to the dynamic load capacity C.

Static torsional moment load capacity M_{t0}

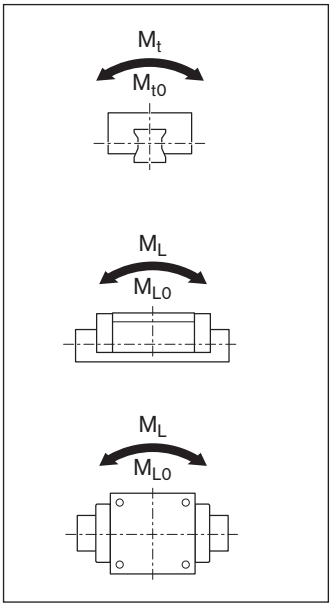
The comparable static moment around the X-axis that induces a load corresponding to the static load capacity C_0.

Dynamic longitudinal moment load M_L

The dynamic comparable dynamic moment around the transverse axis y or the vertical axis z that induces a load corresponding to the dynamic load capacity C.

Static longitudinal moment load M_{L0}

The static comparable dynamic moment around the transverse axis y or the vertical axis z that induces a load corresponding to the static load capacity C_0.



Definition and calculation of the nominal life

The calculated service life which an individual linear rolling bearing, or a group of apparently identical rolling element bearings operating under the same conditions, can attain with a 90 % probability, with contemporary, commonly used materials and manufacturing quality under conventional operating conditions (as per ISO 14728-1).

Nominal life in meters

$$(1)\quad L_{10} = \left(\frac{C}{F_m}\right)^3 \cdot 10^5\ m$$

Service life in operating hours with constant stroke and constant stroke repetition rate

$$(2)\quad L_{h\,10} = \frac{L_{10}}{2 \cdot s \cdot n \cdot 60}$$

If the stroke length s and the stroke repetition rate n are constant over the entire service life, you can use formula (2) to determine the service life in operating hours.

Nominal life at variable speed

$$(3)\quad L_{h\,10} = \frac{L_{10}}{60 \cdot v_m}$$

As an alternative, it is possible to use formula (3) to calculate the service life in operating hours using the average speed $v_{m.}$
This average speed v_m is calculated with speeds that can be changed on a stepwise basis using discrete time steps q_{tn} of the individual load stages (4).

$$(4)\quad V_m = \frac{|v_1| \cdot q_{t1} + |v_2| \cdot q_{t2} + \ldots + |v_n| \cdot q_{tn}}{100\ \%}$$

Modified service life

$$L_{na} = a_1 \cdot \left(\frac{C}{F_m}\right)^3 \cdot 10^5\ m$$

$$L_{ha} = \frac{L_{na}}{2 \cdot s \cdot n \cdot 60}$$

If a 90 percent requisite reliability is not enough, you must reduce the service life values by a factor of a_1 in accordance with the table below.

Requisite reliability (%)	L_{na}	Factor a_1
90	L_{10a}	1.00
95	L_{5a}	0.64
96	L_{4a}	0.55
97	L_{3a}	0.47
98	L_{2a}	0.37
99	L_{1a}	0.25

Notes

DIN ISO 14728-1 limits the validity of the formula (1) to dynamically equivalent loads $F_m < 0.5$ C. However, in our tests we verified that under ideal operating conditions this service life formula can be applied up to loads of $F_m = C$. Under some circumstances, with stroke lengths below 2 · ball runner block length B_1 (see the dimension tables) a load capacity reduction may be necessary. Please consult us.