Technical data

Load Rating & Life

Under normal conditions, the linear rail system can be damaged by metal fatigue as the result of repeated stress. The repeated stress causes flaking of the raceways and steel balls. The life of linear rail system is defined as the total travel distance that the linear rail system travels until flaking occurs.

Nominal Life : L (km)

We define the nominal life as the total distance of travel (L=km) without flaking by 90% of a group of an identical group of linear rail systems operating under the same condition.

$$L = \left(\frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P_C} \right)^3 \times 50\,\text{km}$$

- L (km) : Nominal life
- P_C(N) : Calculated load
- C (N) : Basic dynamic load rating
- f_H : Hardness factor
- f_T : Temperature factor
- f_C : Contact factor
- f_W : Load factor

Basic Dynamic Load Rating : C (kN)

The basic dynamic load rating C is a statistical number and it is based on 90% of the bearings surviving 50 km of travel carrying the full load.

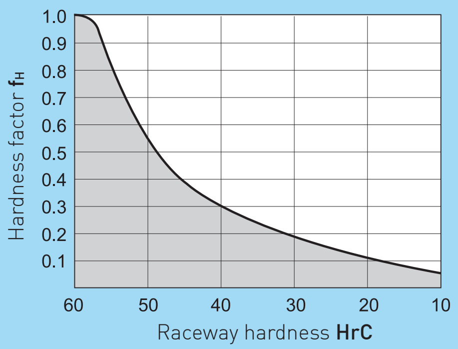
Basic Static Load Rating : Co (kN)

If an excessive load or shock is applied to the linear rail system in the static or dynamic state, permanent but local deformation can occur to the steel balls and raceway. The Basic Static Load Rating is the maximum load the bearing can accept without affecting the dynamic life. This value is usually associated with a permanent deformation of the race way surface of 0.0001 time the ball diameter

Hardness factor (fH)

To optimize the load capacity of a linear rail system, the hardness of the rail should be HRC 58~62.

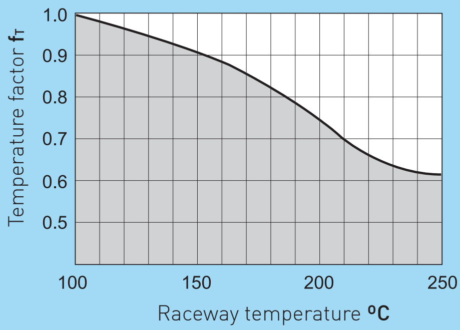
- The value for linear rail system is normally 1.0 since the linear rail system has sufficient hardness.



Temperature factor (fT)

If the temperature of the linear rail system is over 100°C, The hardness of the block and rail will be reduced, and as the result, the temperature factor, ft should be taken into Account.

- The value for linear rail system is normally 1.0 when operation temperature is under 80°C.
- Please contact us if you need linear rail system with over 80°C working condition.



Contact factor (f_c)

When two or more blocks are used in close contact, it is hard to obtain a uniform load distribution because of mounting errors and tolerances. The basic dynamic load C should be multiplied by the contact factor f_c shown here.

Number of blocks in close contact	Contact factor fc
2	0.81
3	0.72
4	0.66
5	0.61
6 or more	0.6
Normal condition	1.0

Load factor (f_w)

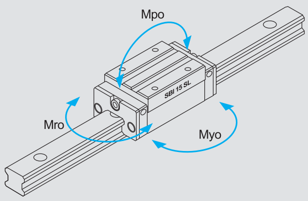
Operating machines create vibrations. The effects of vibrations are difficult to calculate precisely. Refer to the following table to compensate for these vibrations.

Vibration and Impact	Velocity (V)	Load factor f_w
Very slight	Very slow V≤0.25 m/s	1 ~ 1.2
Slight	Low 0.25<V≤1.0 m/s	1.2 ~ 1.5
Moderate	Medium 1.0<V≤2.0 m/s	1.5 ~ 2.0
Strong	High V<2.0 m/s	2.0 ~ 3.5

Static Permissible Moment : Mo (kN.m)

These load are maximum moments or torque loads that can be applied to the bearing without damaging the bearing or affecting subsequent dynamic life.

- Mro : Moment in rolling direction
- Mpo : Moment in pitching direction
- Myo : Moment in yawing direction



Static Safety Factor : fs

$$f_s = \frac{C_o}{P} \quad \text{(Radial Load)}$$

$$f_s = \frac{M_o}{M} \quad \text{(Moment Load)}$$

When calculating a load exerted on the linear rail system, both mean load and maximum load need to be considered. Operating machines create moment of inertia. When selecting the right linear rail system, consider all of the loads.

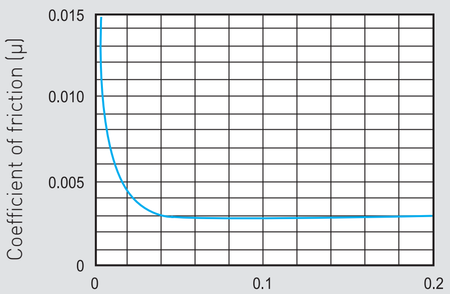
- Co : Basic Static Load Rating
- P : Pay Load
- Mo : Static Permissible Moment (Mpo, Mro, Myo)
- M : Pay Load Moment

Operating	Load conditions	fs
Normally stationary	Impact load or machine deflection is small	1,0 ~ 1,3
	Impact or twisting load is applied	2.0 ~ 3.0
Normally moving	Normal load is exerted or machine deflection is small	1.0 ~ 1.5
	Impact or twisting load is applied	2.5 ~ 7.0

Technical data

Frictional resistance

The static and dynamic coefficient of friction of the SBC linear rail systems are so small that they minimize the required driving force and temperature increase. Frictional force depends on load, preload, velocity and lubrication. In general, a load with high speed is more affected by the lubricant, while the medium or heavy load are more affected by the load and are less sensitive to lubrication selection.



Pay load ratio (P/C)
(Relationship between pay load and coefficient of friction)

Calculate comparison by different guide system

$$F = \mu \bullet P$$

- F : Frictional force
- μ : Coefficient of friction
- P : Load

P : Load
C : Basic dynamic load rating

(1) SBI Linear rail system
P : 5000N
μ: 0.003
F = 0.003 x 5000N = 15N

(2) Sliding linear rail system
P : 5000N
μ: 0.2
F = 0.2 x 5000N = 1000N

Life calculation

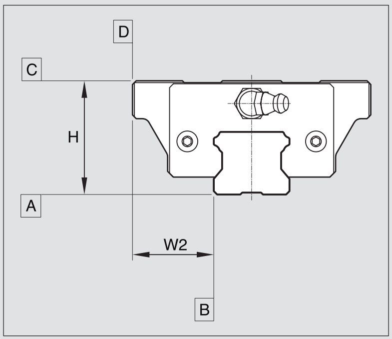
When the nominal life (L) is calculated. The life of linear rail system can be calculated by following equation, if the stroke and reciprocating cycles per minute are constant.

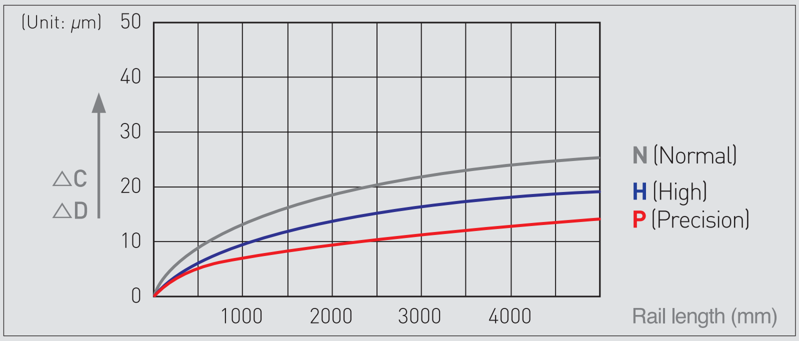
$$L_h = \frac{L \times 10^6}{2 \times \ell_s \times n_1 \times 60}$$

- L_h (h) : Hours of nominal life
- L (km) : Nominal life
- l_s (mm) : Stroke
- n_1 (min^{-1}) : Complete cycles per minute

Accuracy Standard

The accuracy of SBI is divided into three grades, **N** (Normal), **H** (High) and **P** (Precision).





[unit: mm]

Item	N	H*	P
Tolerance for the height H	±0.1	**±0.04**	±0.02
Tolerance for the rail-to-block lateral distance W2	±0.1	**±0.04**	±0.02
Tolerance for the height H difference among blocks	0.03	**0.015**	0.007
Tolerance for rail-to-block lateral distance W2 difference among blocks	0.03	**0.015**	0.007
Running parallelism of surface C with surface A		Δ C	
Running parallelism of surface D with surface B		Δ D	

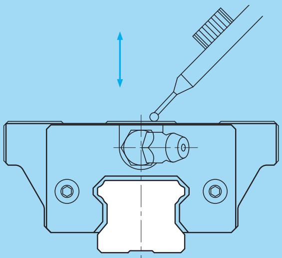
* :preferred type

Radial clearance

The block side to side movement by vibration is called clearance.

Clearance checking

After mounting the linear rail system, move the block up and down then check the change of value.



Preload

Preload affects the rigidity, internal-load and clearance. Also, it is very important to select appropriate preload according to applied load, impact and vibration expected in the application.

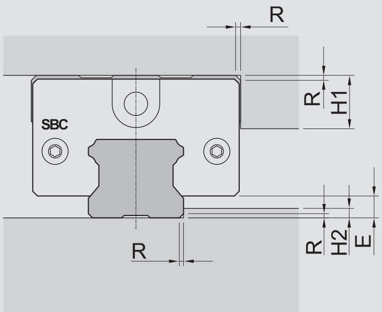
Preload	Conditions	Volume of preload
K0 (None)		Clearance within 0.01 mm
K1* (Normal)	• Where the load direction is constant, impact and vibration are light. • Precision is not required	0.00 - 0.02 C
K2 (Light)	• Where overhung loads or moment occur • Single axis operation. • Light load that requires precision.	0.04 - 0.06 C
K3 (Heavy)	• Where rigidity is required, vibration and impact are present. • Engineered machinery for heavy equipment	0.08 - 0.10 C

* :preferred type

Technical data

Shoulder height and fillet radius R

When the bearing and rail are installed on the table and base, the fillet radius, chamfer size and shoulder height must be considered.



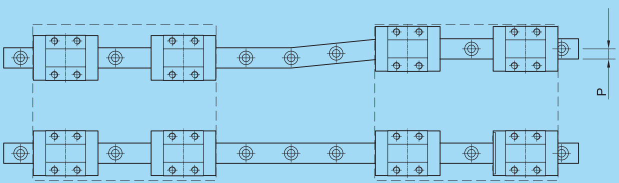
[unit: mm]

Model number	Fillet radius R	Shoulders height H1	Shoulders height H2	E
15	0.6	7	2.5	3
20	0.6	8	3.5	4.6
25	1	10	4.5	5.5
30	1	11	5	7
35	1	13	6	7.5
45	1.6	16	8	9
55	1.6	20	10	12
65	1.6	25	15	19

Permissible tolerance of mounting surface

Mounting errors can cause rolling resistance to motion. Due to the self adjusting feature of the SBC linear rail system, rolling resistance or bearing will not be affected as long as the permissible tolerance is observed as per the table shown.

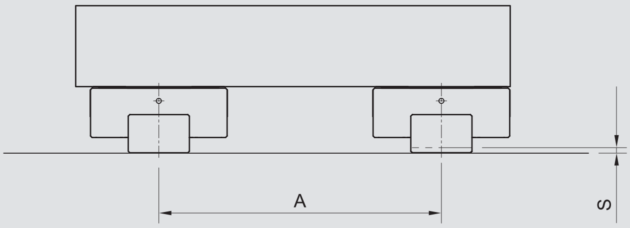
Permissible tolerance (P) of parallelism



[unit: mm]

Model	Preload classes		
	K1	K2	K3
15	0.025	0.018	-
20	0.025	0.020	0.018
25	0.030	0.022	0.020
30	0.040	0.030	0.027
35	0.050	0.035	0.030
45	0.060	0.040	0.035
55	0.070	0.050	0.045
65	0.080	0.060	0.055

Permissible tolerance (S) of two level offset



Formule:

S = A * y (mm)

Example:

A = 1500 mm
Preload = K1
Size = 25

S = A * y
S = 1500 * $0.06*10^{-3}$
S = 0.09 mm

Factor y

[unit: mm]

Model	Preload classes		
	K1 $*10^{-3}$	K2 $*10^{-3}$	K3 $*10^{-3}$
15	0.05	0.036	-
20	0.05	0.040	0.036
25	0.06	0.044	0.040
30	0.08	0.060	0.054
35	0.10	0.070	0.060
45	0.12	0.080	0.070
55	0.14	0.100	0.090
65	0.16	0.120	0.110