

# **TECHNICAL INFORMATION**

## **LINEAR RAIL SBI**

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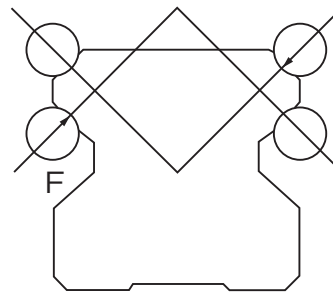
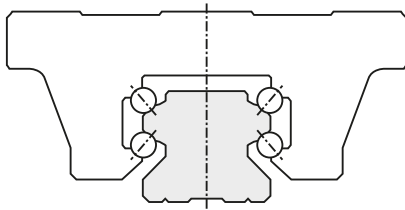
## Product overview

Linear Rail SBI is a guide system with high load capacity that can be used for most linear applications. The blocks use four ball rows, enabling high load capacity in all directions. Linear Rail SBI is designed with a relatively low rail profile and wide base resulting in great rigidity. There is a wide range of block sizes and executions to meet a broad range of requirements. All rail sizes available in either top or bottom mounting versions. The linear rail guides can be delivered with different types of surface treatments.

The guide blocks can be configured with different sealings and wipers suitable for various environmental conditions.

## Characteristics

- **Circular arc groove**  
Two-point ball contact combine high load capacity with low and even rolling friction over the full load range.
- **45° angle of contact**  
Four rows of circular arc groove contact balls at an angle of 45 degrees provides the same capacity in all four main directions.



## Application areas

Rail guides have a wide area of use. They are suitable for most applications that needs a linear movement.

## System description

### End seal

New double lip structure which improves resistance to dust and particle contamination.

### Retainer

Ball retainer plates now snap assembled to the blocks and this unique assembly method allows an amount of internal self-alignment and load sharing while maintaining rigid ball control.

### Bearing block

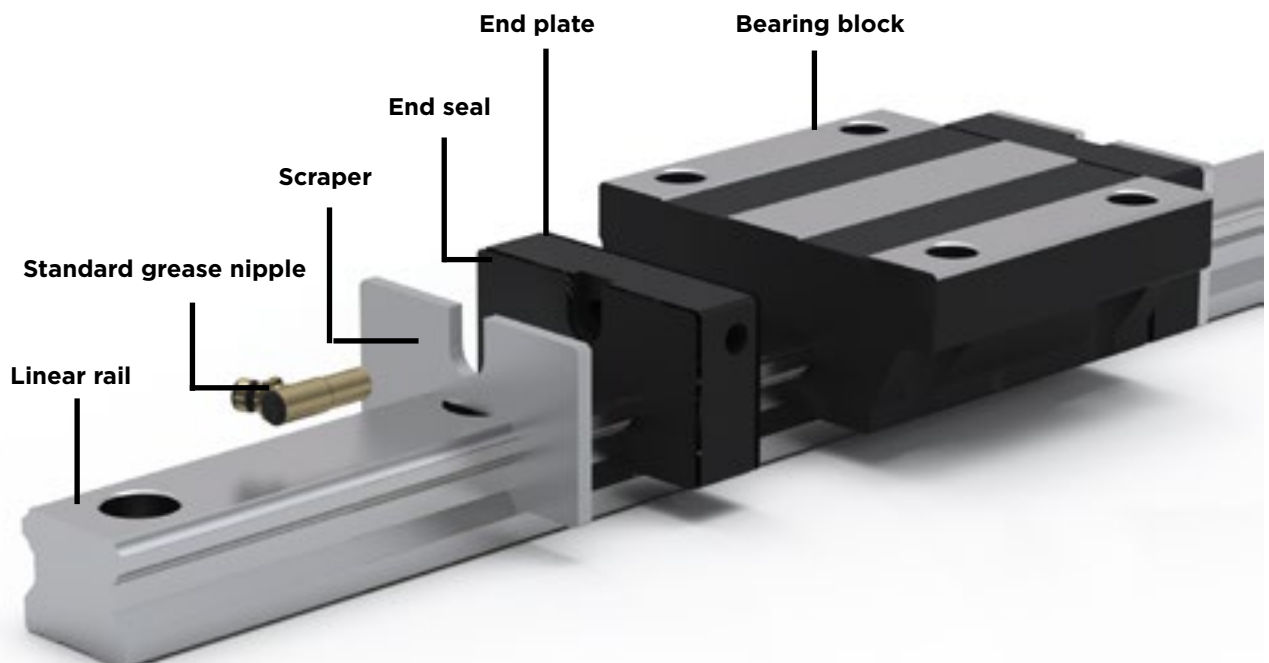
Highly rigid structure with a larger recirculation radius for the smooth movement and longer block length for higher load capacity.

### End-plate

Manufactured with a new high rigidity engineered plastic. Designed to withstand the highest of unplanned impact loads without breaking.

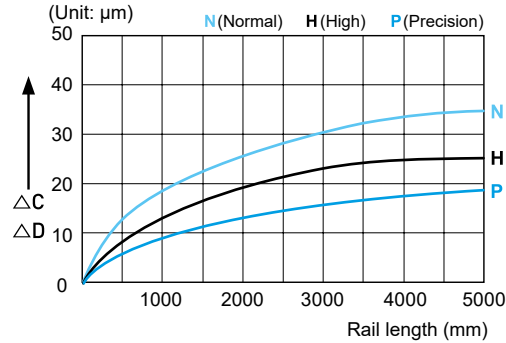
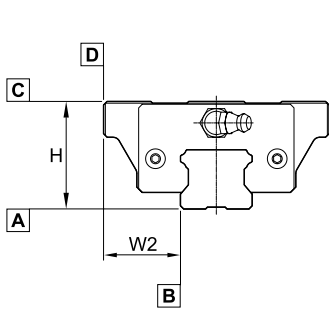
### Return tube plate

The end plate and reversing ramps of new ball return tubes are now moulded as one complete body. This allows for smoother ball rotation through the critical transition points, significantly improving rolling performance and better lubricant retention inside the bearing.



# Precision classes (µm)

Precision classes are divided into three classes. (Standard version is N.)



Item	Standard 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 the rail-to-block lateral distance W2 distance among blocks	0,03	0,015	0,007
Running parallelism of surface <b>C</b> with surface <b>A</b>		Δ C	
Running parallelism of surface <b>D</b> with surface <b>B</b>		Δ D	

N: Normal    H: High    P: Precision

## Friction

The static and dynamic coefficient of friction of the SBI linear rail systems are so small that they minimize the required driving force and temperature increase.

$$F_{rn} = \mu \times F$$

$F_{rn}$  = Friction (N)  
 F = Load (N)

Friction factor approx.  $\mu = 0,002 - 0,004$

### Friction factors

- Load
- Preload
- Velocity
- Lubrication

In general, the light 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.

# 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	Volume of preload	Conditions	Example
K0 (No preload)	Clearance within 0,01 mm	<ul style="list-style-type: none"> <li>Where the load direction is constant, impact and vibration are light</li> <li>Precision is not required</li> </ul>	<ul style="list-style-type: none"> <li>Welding machine</li> <li>Binding machine</li> <li>Automatic wrapping machine</li> <li>Material handling equipment</li> </ul>
K1 (Normal preload) Standard version	Max. 0,02 C	<ul style="list-style-type: none"> <li>Where the load direction is constant, impact and vibration are light</li> <li>Precision is not required</li> </ul>	<ul style="list-style-type: none"> <li>Welding machine</li> <li>Binding machine</li> <li>Automatic wrapping machine</li> <li>Material handling equipment</li> </ul>
K2 (Light preload)	0,04 ~ 0,06 C	<ul style="list-style-type: none"> <li>Where overhung loads or moment occur</li> <li>Single axis operation</li> <li>Light load that requires precision</li> </ul>	<ul style="list-style-type: none"> <li>Measuring equipment</li> <li>Electric discharge machine</li> <li>High speed material handling equipment</li> <li>NC drilling machine</li> <li>Industrial robot</li> <li>Z axis for general industrial equipment</li> </ul>
K3 (Heavy preload)	0,08 ~ 0,10 C	<ul style="list-style-type: none"> <li>Where rigidity is required, vibration and impact are present</li> <li>Engineered machinery for heavy equipment</li> </ul>	<ul style="list-style-type: none"> <li>Machining center</li> <li>NC lathe</li> <li>Grinding machine</li> <li>Milling machine</li> <li>Vertical axis of machine tool</li> </ul>

\*K3 Preload is not available for SBI 15.

## 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.

The nominal life is defined 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.

**Nominal Life (km):**  $L = \left(\frac{C}{P}\right)^3 \times 50 \text{ km}$

- L: Nominal life
- P: Load
- C: Basic dynamic load rating (N)

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.

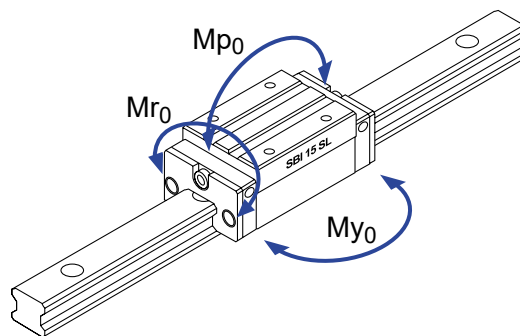
### Basic Static Load Rating: $C_0$ (N)

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.

### Static Permissible Moment: $M_0$ (Nm)

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

- $M_{r0}$ : Moment in rolling direction
- $M_{p0}$ : Moment in pitching direction
- $M_{y0}$ : Moment in yawing direction





# Life calculation

The equation of nominal life for linear rail system is shown as below.

## Calculation of nominal life

- L (km): Nominal life
- PC(N): Calculated load
- C (N): Basic dynamic load rating
- fC: Contact factor
- fW: Load factor

$$L = \left( \frac{f_c}{f_w} \cdot \frac{C}{P_c} \right)^3 \times 50$$

## Contact Factor (fc)

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 factors fc shown here.

Number of blocks in close contact	Contact factor fc
Normal condition	1,0
2	0,81
3	0,72
4	0,66
5	0,61
6 or more	0,6

## Load Factor (fw)

Reciprocating 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	Load factor fw
Very slight	Very low $V \leq 0,25 \text{ m/s}$	1 - 1,2
Slight	Low $0,25 < V \leq 1,0 \text{ m/s}$	1,2 - 1,5
Moderate	Medium $1,0 < V \leq 2,0 \text{ m/s}$	1,5 - 2,0
Strong	High $V > 2,0 \text{ m/s}$	2,0 - 3,5

## Temperature

Please contact us if you need linear rail system with over 80°C working condition.

## Static safety factor: fs

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

$$f_s = \frac{C_0}{P} \quad (\text{radial load})$$

$$f_s = \frac{M_0}{M} \quad (\text{moment load})$$

- C<sub>0</sub>: Basic static load
- P: Load
- M<sub>0</sub>: Static permissible moment (Mr<sub>0</sub>, Mp<sub>0</sub>, My<sub>0</sub>)
- M: 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

## Lubrication

Lubrication for linear rail system is a key part of its performance:

- To reduce friction and wearing for each moving part.
- To eliminate the heat on linear rail system.
- To prevent corrosion on inside and outside of linear rail system.
- Dust-prevention.

### Lubricants Interval

Lubricants intervals vary according to the environment and working condition of machine. Therefore, below lubricant intervals are recommended. Do not mix oil and grease systems.

Item	Lubrication
Grease	Normal working condition 100 km/6 months
Oil	Volume and contamination of oil according to manual inspection

### Classification and Selection of Lubrication

Lubricant for linear rail system must be selected after considering vibration, clean room, vacuum and working condition. For special working conditions please contact Rollco.

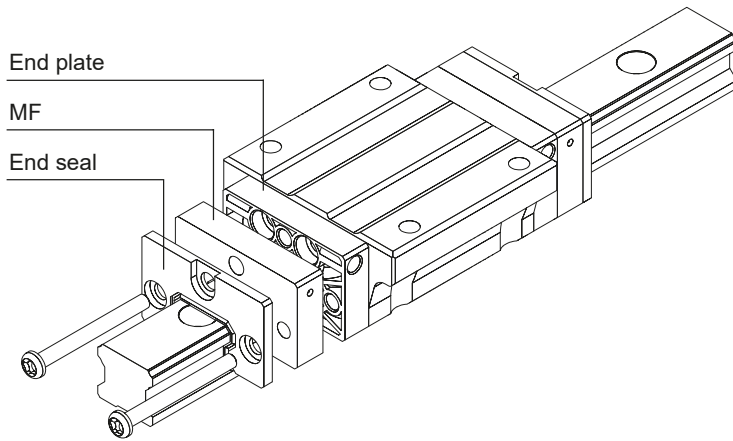
Item	Application	Brand
Normal working condition	Multipurpose industrial application	RA Grease NLGI 1.5



# Self-lubrication container MF

Where the grease feeding is not easy, self-lubricant container MF are available as options. The MF self-lubrication unit consist of a container that contains grease impregnated felt that supplies a small and continuous grease film directly and only on the four raceways of the rail profile. This result in a very precise and long-lived lubrication in exactly the most effective spots. See our website or contact us for further information.

Seal symbol	Combination
MF	End plate + Self lubricant container (MF) + End seals



## MF Container Lifetime Test

**Performance test**  
SBG20SL-1-K1-1500

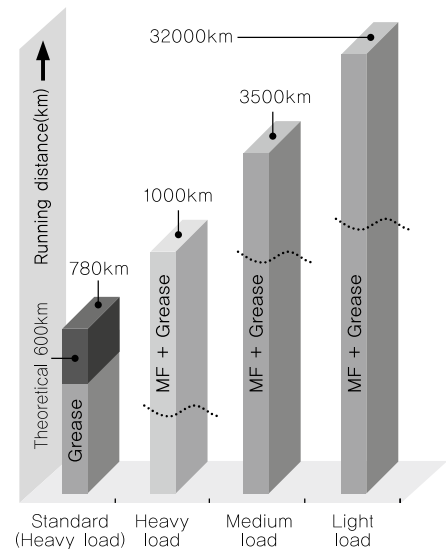
Condition	Heavy	Medium	Light
Load	4900 N	2500 N	1000 N
Velocity	20 m/min	20 m/min	20 m/min
Theoretical lifetime	600 km	1500 km	-

### Grease feeding:

The MF container may be re-charged by adding grease to hole inside of block with a syringe.

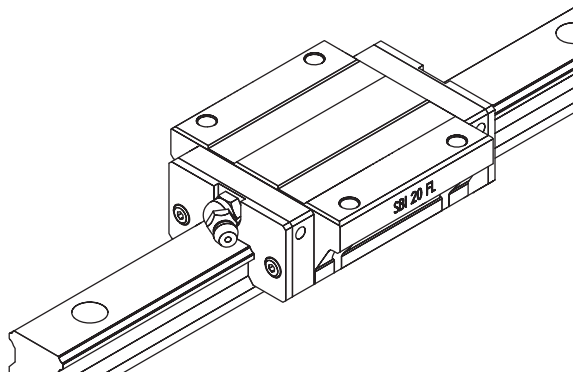
Caution: If MF container is required to use in special working conditions like clean room, please contact Rollco.

When ordering Lubrication unit MF, the block is delivered without grease nipple. If need of grease nipple, please order side grease nipple type.



## Lubrication ports

Front grease fitting for linear rail system is standard grease fitting.



When greasing is difficult because of limited space in front of the grease nipple, the side grease fitting can be supplied.



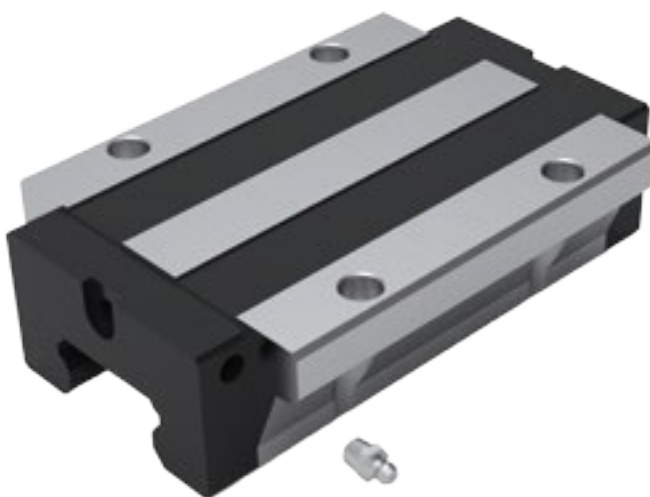
SBI 15-25 FL/FLL side grease fitting  
(require one FS nipple connector)



SBI SL side grease fitting



SBI 30-45 FL/FLL side grease fitting  
(require two FS nipple connectors)



SBI 55 and 65 FL/FLL side grease fitting

## Grease nipples

For information about grease nipples, please see our website.

### Port sizes for grease nipple

Type	Port size	
	Front	Side
SBI 15	M4	M4
SBI 20	M6	M4
SBI 25	M6	M4
SBI 30	M6	M6
SBI 35	M6	M6
SBI 45	PT 1/8	M6
SBI 55	PT 1/8	PT 1/8
SBI 65	PT 1/8	PT 1/8
SBI 20 FL/FLL	M6	M4
SBI 25 FL/FLL	M6	M4
SBI 30 FL/FLL	M6	M6
SBI 35 FL/FLL	M6	M6
SBI 45 FL/FLL	PT 1/8	M6

### Seal options

Combination	Seal symbol
End plate + End seals	No symbol (Standard)
End plate + End seals + High dust protection seal (DF)	DF
End plate + End seals + Scraper (ZZ)	ZZ
End plate + End seals + High dust protection seal (DF) + Scraper (ZZ)	DFZZ
End plate + Self lubricant container (MF) + End seals	MF
End plate + Self lubricant container (MF) + End seals + Scraper (ZZ)	MFZZ

## Raydent treatment

The rails and blocks can be supplied with the surface treatment Raydent. The treatment gives a corrosion resistant and patented black surface. Stainless steel balls are available on special request and for a few sizes only.

Please contact Rollco for more information.



## High temperature design HT end-plate

If working temperature is more than 80°C, Rollco can supply the high temperature end-plate which is made of aluminum. Recommended working temperature: -30 ~ 150°C.

For high temperature applications we can replace all plastic components with steel or aluminum. Please contact us for more information.



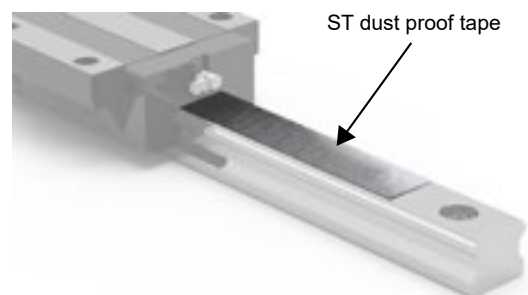
## Stainless ST Dustproof Tape

Stainless steel ST dustproof tape improves rail face sealing and works in conjunction with guide block seals. Conventional plastic plugs do not offer the same improved sealing performance.

### Installation of ST tape:

1. After assembling a rail to the bed, clean the surface of the rail and remove any oil.
2. Attach the ST tape slowly over the rail length to within 2 or 3 mm from each end of the rail.
3. After attachment to the rail, apply pressure with dry cloth 3 or 4 times along the length of the rail to release encapsulated epoxy. Tape should be applied 4 to 6 hours prior to use to allow initial bonding.

Note: It is strongly recommended to wear safety gloves, the edge of this tape is sharp and can cut as you attach it to the rail.

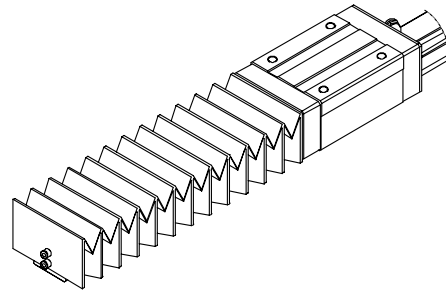


## Bellows

For the best protection of the linear rail system, bellows can be used.

Reference: SBI type: SH-DA

Please contact Rollco for more information.

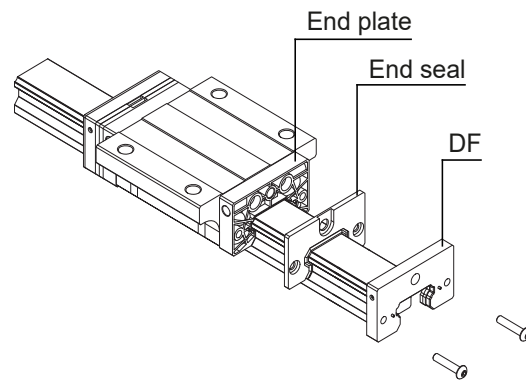


## High dust-proof seal DF

For protecting the linear rail system from fine foreign matter, use the high dust-proof DF seal. The high density felt in the DF unit contact the entire rail profile section, leaving no gaps for dust and debris to enter the block.

For DF to be most effective, it is recommended to either combine it with bottom mounted rails SBI-B or using the option ST Stainless Dustproof Tape.

See our website or contact us for further information.



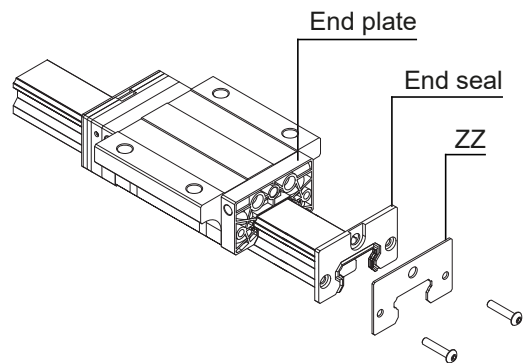
Seal symbol	Combination
DF	End plate + End seals + High dust protection seal (DF)

## ZZ Steel Scraper

Steel scrapers are used as outer shields if there is a need to wipe off large and potentially stick debris from the rail.

The steel scraper will protect and enhance the lifetime of the sealing system behind them. Works both with the standard seal and option MF and DF.

Please contact Rollco for more information.



Seal symbol	Combination
ZZ	End plate + End seal + Steel Scraper (ZZ)

## Selection of RCS Clamping Element

Because of the height difference of different rail guide blocks and to ensure the proper function of the RCS Clamping Element, the use of adapter plates is sometimes needed.

Rail type	Clamping element	Adapter plate
SBI15FL	RCS15	-
SBI15SL	RCS15	RCP 15-4
SBI15HL	RCS15	-
SBI15FV	RCS15	-
SBI15SV	RCS15	-
SBI20FL	RCS20	RCP 20-2
SBI20SL	RCS20	RCP 20-2
SBI20FLL	RCS20	RCP 20-2
SBI20SLL	RCS20	RCP 20-2
SBI20CL	RCS20	-
SBI20CLL	RCS20	-
SBI20FV	RCS20	-
SBI20SV	RCS20	-
SBI25FL	RCS25	-
SBI25SL	RCS25	RCP 25-4
SBI25FLL	RCS25	-
SBI25SLL	RCS25	RCP 25-4
SBI25HL	RCS25	-
SBI25HLL	RCS25	-
SBI30FL	RCS30	-
SBI30SL	RCS30	RCP 30-3
SBI30FLL	RCS30	-
SBI30SLL	RCS30	RCP 30-3
SBI30HL	RCS30	-
SBI30HLL	RCS30	-
SBI35FL	RCS35	-
SBI35SL	RCS35	RCP 35-7
SBI35FLL	RCS35	-
SBI35SLL	RCS35	RCP 35-7
SBI35HL	RCS35	-
SBI35HLL	RCS35	-

For other types - please contact Rollco.



## Selection of MK & MKS Clamping Element

Because of the height difference of different rail guide blocks and to ensure the proper function of the MK or MKS Clamping Elements, the use of adapter plates is sometimes needed.

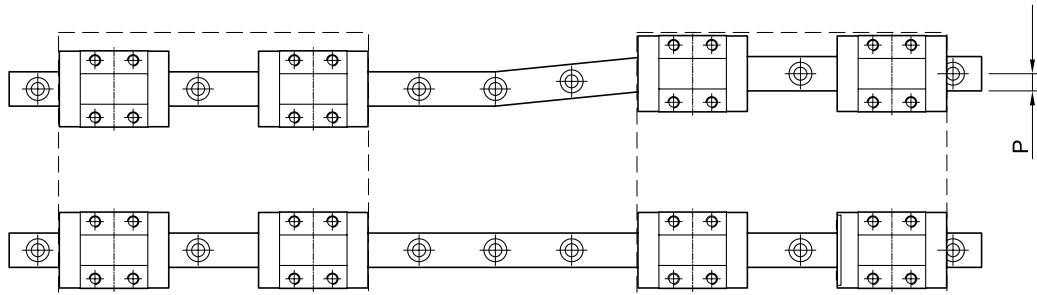
Rail type	Clamping element	Adapter plate
SBI15FL	MK1501A / MKS1501A	-
SBI15FLL	MK1501A / MKS1501A	-
SBI15FV	MK1501A / MKS1501A	-
SBI15HL	MK1501A / MKS1501A	-
SBI15HLL	MK1501A / MKS1501A	-
SBI15HLS	MK1501A / MKS1501A	-
SBI15SL	MK1501A / MKS1501A	PMK15-4
SBI15SLL	MK1501A / MKS1501A	PMK15-4
SBI15SV	MK1501A / MKS1501A	-
SBI20CL	MK2001A / MKS2001A	-
SBI20CLL	MK2001A / MKS2001A	-
SBI20CLS	MK2001A / MKS2001A	-
SBI20FL	MK2001A / MKS2001A	PMK20-2-A
SBI20FLL	MK2001A / MKS2001A	PMK20-2-A
SBI20FV	MK2001A / MKS2001A	-
SBI20SL	MK2001A / MKS2001A	PMK20-2-A
SBI20SLL	MK2001A / MKS2001A	PMK20-2-A
SBI20SV	MK2001A / MKS2001A	-
SBI25CL	MK2501A / MKS2501A	-
SBI25CLL	MK2501A / MKS2501A	-
SBI25FL	MK2501A / MKS2501A	PMK25-2
SBI25FLL	MK2501A / MKS2501A	PMK25-2
SBI25FV	MK2501A / MKS2501A	-
SBI25HL	MK2501A / MKS2501A	PMK25-2
SBI25HLL	MK2501A / MKS2501A	PMK25-2
SBI25SL	MK2501A / MKS2501A	PMK25-6
SBI25SLL	MK2501A / MKS2501A	PMK25-6
SBI25SV	MK2501A / MKS2501A	-
SBI30FL	MK3001A / MKS3001A	-
SBI30FLL	MK3001A / MKS3001A	-
SBI30HL	MK3001A / MKS3001A	-
SBI30HLL	MK3001A / MKS3001A	-
SBI30SL	MK3001A / MKS3001A	PMK30-3
SBI30SLL	MK3001A / MKS3001A	PMK30-3
SBI35FL	MK3501A / MKS3501A	-
SBI35FLL	MK3501A / MKS3501A	-

Rail type	Clamping element	Adapter plate
SBI35HL	MK3501A / MKS3501A	-
SBI35HLL	MK3501A / MKS3501A	-
SBI35SL	MK3501A / MKS3501A	-
SBI35SLL	MK3501A / MKS3501A	-
SBI45FL	MK4501A / MKS4501A	PMK45-6
SBI45FLL	MK4501A / MKS4501A	PMK45-6
SBI45HL	MK4501A / MKS4501A	PMK45-6
SBI45HLL	MK4501A / MKS4501A	PMK45-6
SBI45SL	MK4501A / MKS4501A	PMK45-16
SBI45SLL	MK4501A / MKS4501A	PMK45-16
SBI55FL	MK5501A / MKS5501A	PMK55-6
SBI55FLL	MK5501A / MKS5501A	PMK55-6
SBI55HL	MK5501A / MKS5501A	PMK55-6
SBI55HLL	MK5501A / MKS5501A	PMK55-6
SBI55SL	MK5501A / MKS5501A	PMK55-16
SBI55SLL	MK5501A / MKS5501A	PMK55-16
SBI65FL	MK6501A / MKS6501A	-
SBI65FLL	MK6501A / MKS6501A	-
SBI65SL	MK6501A / MKS6501A	-
SBI65SLL	MK6501A / MKS6501A	-

For other types - please contact Rollco.

# Installation surface geometry position accuracy

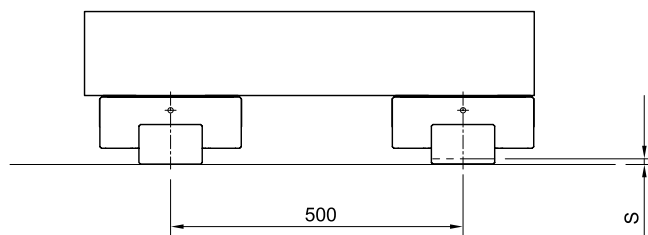
## Permissible tolerance (P) of parallelism



Model size	K1 (standard version)	K2 (light preload)	K3 (heavy preload)
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 height

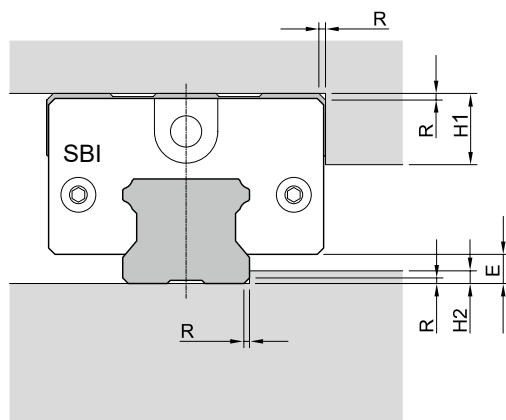
### Permissible tolerance (S) of two level offset



Model size	K1	K2	K3
15	0,13	0,085	-
20	0,13	0,085	0,05
25	0,13	0,085	0,07
30	0,17	0,11	0,09
35	0,21	0,15	0,12
45	0,25	0,17	0,14
55	0,30	0,21	0,17
65	0,35	0,25	0,20

## Shoulder height and fillet radius R

The corner of the machine table must be smaller than the chamfer of the linear guide to avoid interference. To consult on chamfer sizes and shoulder heights, please refer to the table below.

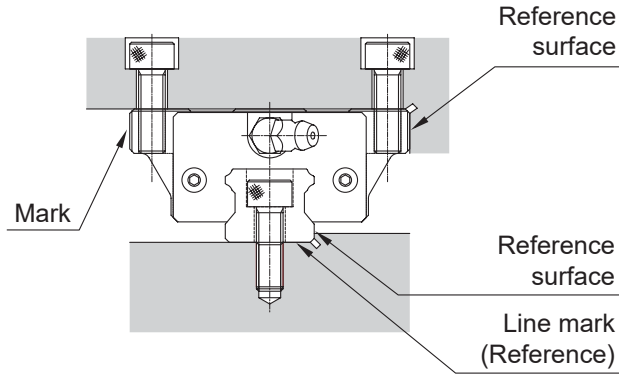


Model size	Fillet radius R	Shoulders height H1	Shoulders height H2	E
15	0,6	7	2,5	3
20	0,6	8	3,5	4,6
25	1	10	4,5	5,5
30	1	11	5	7
35	1	13	6	7,5
45	1,6	16	8	9
55	1,6	20	10	12
65	1,6	25	15	19

## Block reference side

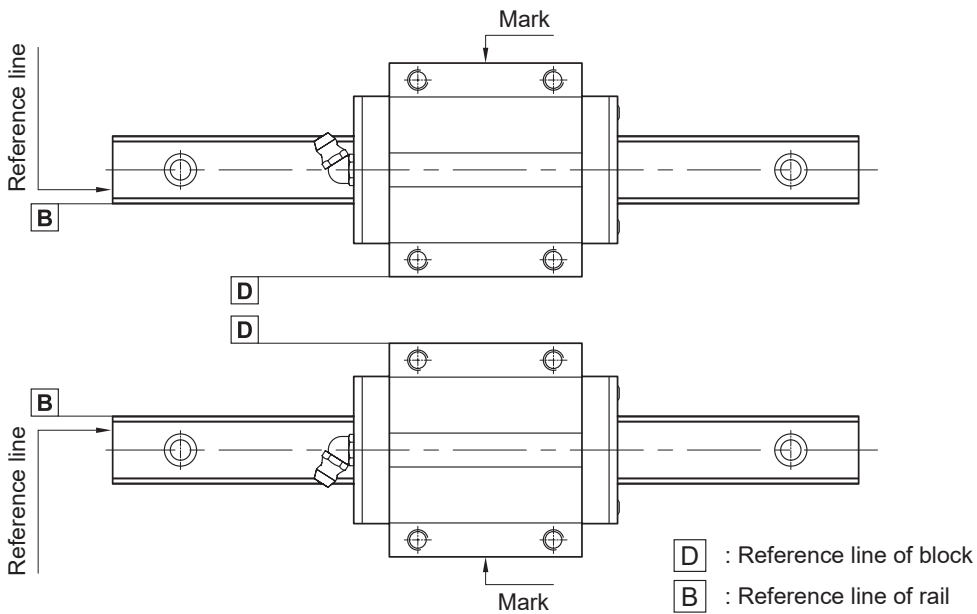
The unmarked edge of the block and the lined edge of the rail define the reference surfaces. Please note the methods below for locating these surfaces in your design.

### Master linear rail system



In case of two or more blocks keep the reference edge towards the same direction.

### Example of identifying reference line for pair usage



# Rail installation

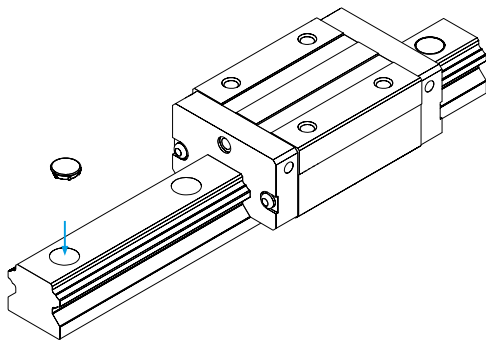
## Bolt mounting torque

The below mounting torque is recommended for mounting the rail.

Bolt	Rail	Mounting torque (Nm)		
		Steel	Cast iron	Aluminium
M4	SBI15	4,1	2,7	2,1
M5	SBI20	8,8	5,9	4,4
M6	SBI25	14	9,2	6,9
M8	SBI30, 35	30	20	15
M12	SBI45	118	78	59
M14	SBI55	157	105	78
M16	SBI65	196	131	98

## Hole cap RC

Contaminants invade into the bolt holes of the rail and pollute the inside of the bearing. You can use hole caps made from hardened rubber to fill the holes. Hole caps are provided with the rails.



### Hole cap mounting method:

1. Bolt the rail on the plate.
2. Put the hole cap on the rail mounting hole and place a larger plate on the cap. Then tap it with a hammer.
3. Check the hole cap to make sure it is properly seated.



# Rail

SBI 25 - 820 - 20 - 20 - R

Type

Size

Length of rail

Distance from end of rail to center of first hole

Distance from center of last hole to rail end

**Option**

R: Raydent treatment  
B: Bottom mounted rail  
Leave empty if standard

# Stainless ST Dustproof Tape

SBI 15 ST - 1000

Article No.

Length



# Block

SBI 25 FL - N - MF - ZZ - K1 - R

**Type**

**Size**

**Type of block**

FL, SL, FLL, SLL, HL, HLS, CL, CLS, HLL, CLL, FV or SV

**Nipple option**

N: Side nipple

Leave empty for standard front nipple

**Lubrication unit\***

MF: Self lubrication container

DF: High dust proof seal

Leave empty if standard

**Scraper**

ZZ: Steel scraper

Leave empty if standard

**Preload\*\***

K0: No preload

K1: Normal preload

K2: Light preload

K3: Heavy preload

**Option**

R: Raydent treatment

B: Bottom mounted rail

Leave empty if standard

\*When ordering Lubrication unit MF, the block is delivered without grease nipple. If need of grease nipple, please order side grease nipple type.

\*\* K3 Preload is not available for SBI15



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