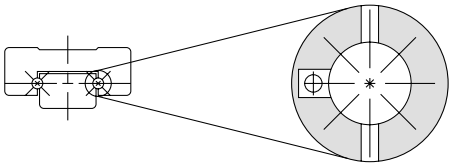
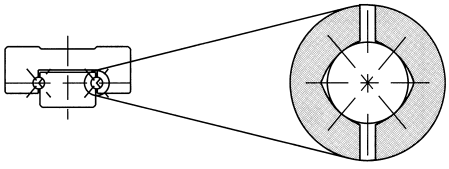
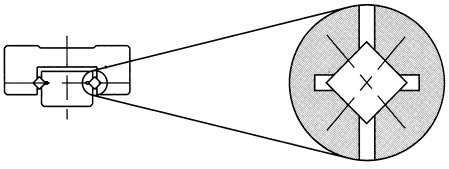
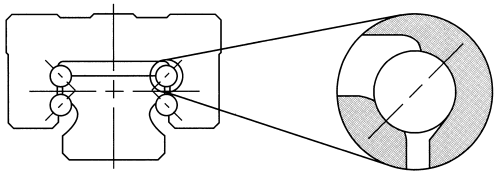
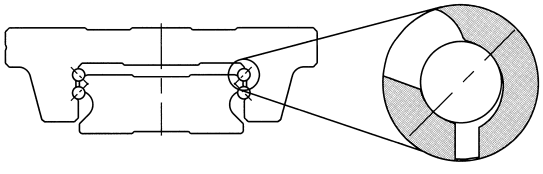
SLIDE GUIDE

SLIDE GUIDE

NB slide guides are high-precision and high-rigidity linear bearings designed to utilize the motion of rolling elements. They have numerous advantageous characteristics including low friction, no stick/slip, and smooth linear motion even under high load conditions. Since they can maintain their high-efficiency and high-functionality characteristics for an extended period of time, they meet a wide range of needs, from general industrial to precision machinery.

TYPE

Table A-1 Types

	rolling element	cross-section geometry and contact structure	advantages	pages
miniature type	ball element	retained ball, 2-row, 4-point contact (SEBS-B type) 	● rerained ball type ● available in all stainless steel ● 2-row, compact ● small, light, cost effective	P.A-16
		2-row, 4-point contact (SEB-A type) 	● 2-row, compact ● small, light, cost effective ● available in various types ● available in stainless steel	P.A-16
	roller	crossroller (SER type) 	● smallest roller guide ● crossroller, high precision ● available in all stainless steel	P.A-38
high-rigidity type	ball element	4-row, 2-point contact (SGL type) 	● high self-centering characteristics ● high loading capacity due to large number of ball elements ● high dust preventive control with side seal and under seal ● available in anticorrosion treatment	P.A-50
		4-row, 2-point contact (SGW type) 	● high-moment resistant ● low-height design ● smooth motion due to large number of ball elements ● high dust preventive control with side seal and under seal ● available in anticorrosion treatment	P.A-68

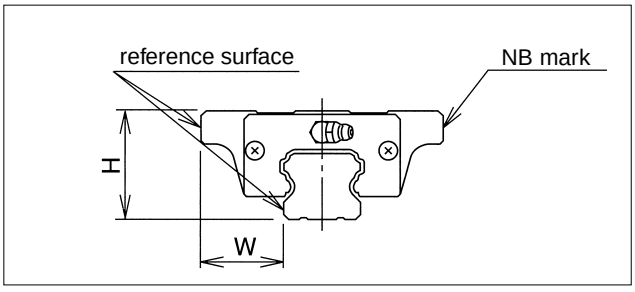
ACCURACY MEASUREMENT METHOD

The accuracy of slide guides is measured by fixing the rail to the datum base. The accuracy is expressed in terms of the average value at the center portion.

Dimensional Tolerance and Paired Guide Difference:

The accuracy of the slide guide is obtained by measuring the height, H, and width, W, as shown in Figure A-1. The dimensional tolerance is measured for each of the blocks attached to the rail and is expressed in terms of the deviation from the reference value. The paired-guide difference is obtained by measuring the blocks attached to the rail and is expressed in terms of the difference between the maximum and minimum values.

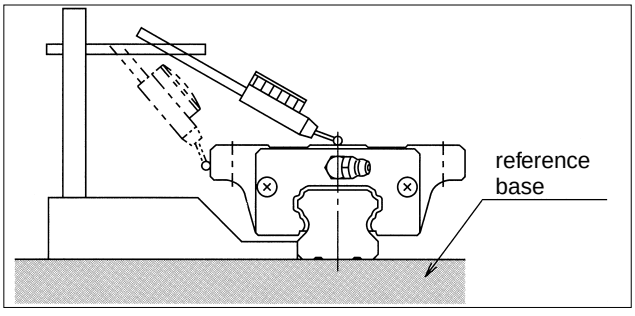
Figure A-1 Accuracy Measurement



Motion Accuracy:

The rail is first fixed to the reference base. The motion accuracy is obtained by measuring the difference in the indicator readings when the block is moved along the entire span of the rail.

Figure A-2 Measurement Method for Motion Accuracy



Notation for Number of Rails and Paired Guide Difference:

When more than two rails are used in parallel, the guide difference must be measured on more than one block. For measuring the height, H, the number of rails can be specified by simply indicating the necessary number of rails in the part number call-out. For measuring the width, W, contact NB.

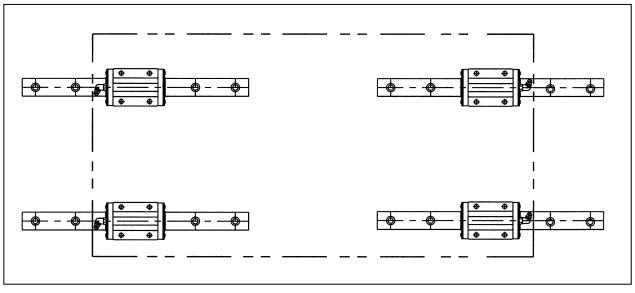
Note When four rails are used as illustrated in Figure A-3, W4 should be specified in the call-out. Please indicate the number of rails when ordering.

example part number

SGL25TF2-350/ W 2

symbol for number of rails
W 2 : 2 parallel rows
W 3 : 3 parallel rows

Figure A-3 4-Parallel Rows



RIGIDITY AND PRE-LOAD

The rolling elements of the slide guide deform elastically due to the applied load. The amount of deformation depends on the type of rolling element. It is proportional to the 2/3rd power for ball elements. For rollers, it is proportional to the 0.9th power. In either case, the amount of deformation decreases as the applied load increases. Greater rigidity is achieved by applying a pre-load.

A pre-load causes internal stress within the slide guide, resulting in some reduction in lifetime. However, when the part is used under shock or vibration loading conditions, a pre-load will absorb the load and will actually help lengthen the life of the part. Because the pre-load causes elastic deformation of the rolling elements, it becomes less tolerable to the installation dimensional difference. Extreme care should be exercised in machining the installation surface.

Three primary ranges of pre-loads are available from NB: normal, light, and medium. This allows the user to select the appropriate level for the application.

Figure A-4 Elastic Deformation of Rolling Elements

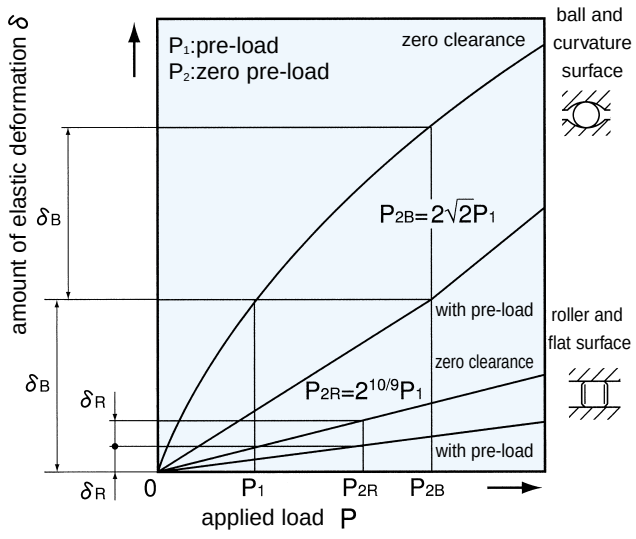


Table A-2 Type of Pre-Load

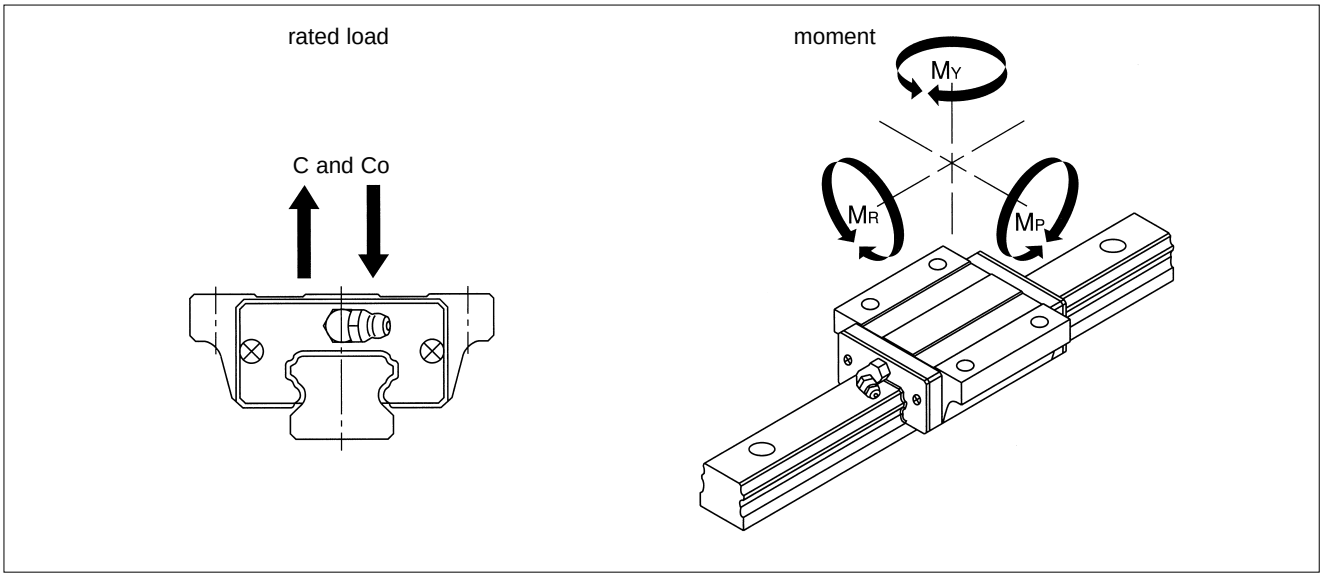
type of pre-load	symbol	effect of pre-load					operating environment
		vibration absorption ability	self-aligning ability	lifetime	rigidity	frictional resistance	
standard	none	increases	reduces	reduces	increases	increases	minute vibration is applied, accurate motion is required, moment is applied in a given direction
light	T1						light vibration is applied, slight torsion is applied, moment is applied
medium	T2						shock and vibration are applied, over-hang load is applied, torsion is applied

RATED LOAD AND RATED LIFE

Loading Direction and Rated Load:

A slide guide experiences load and moment, as shown in Figure A-5. For each load and moment, the Basic load rating and allowable static moment are defined.

Figure A-5 Direction of Loading



Rated Life Calculation:

Two types of rolling elements are used in NB slide guides: ball or roller elements. There is a different equation for calculating the rated life of each type.

For ball element slide guides (types SEB, SGL and SGW), the equation is:

$$L=\left(\frac{fc}{fw}\cdot\frac{C}{P}\right)^{3}\cdot 50\cdots\cdots\cdots\cdots\cdots\cdots\cdots(6)$$

For roller element slide guides (type SER), the equations is:

$$L=\left(\frac{fc\cdot f_T}{fw}\cdot\frac{C}{P}\right)^{10/3}\cdot 50\cdots\cdots\cdots\cdots\cdots\cdots(7)$$

L : travel life (km) fc : contact coefficent
f_T : temperature coefficent fw : load coefficent
C : basic dynamic load rating (N) P : load (N)

※Refer to page Eng. 5 for a description of each coefficient
※The contact coefficient is used when two or more slides are used in close proximity to each other.

If the stroke distance and frequency are constant, life can be expressed in terms of time, the equation is:

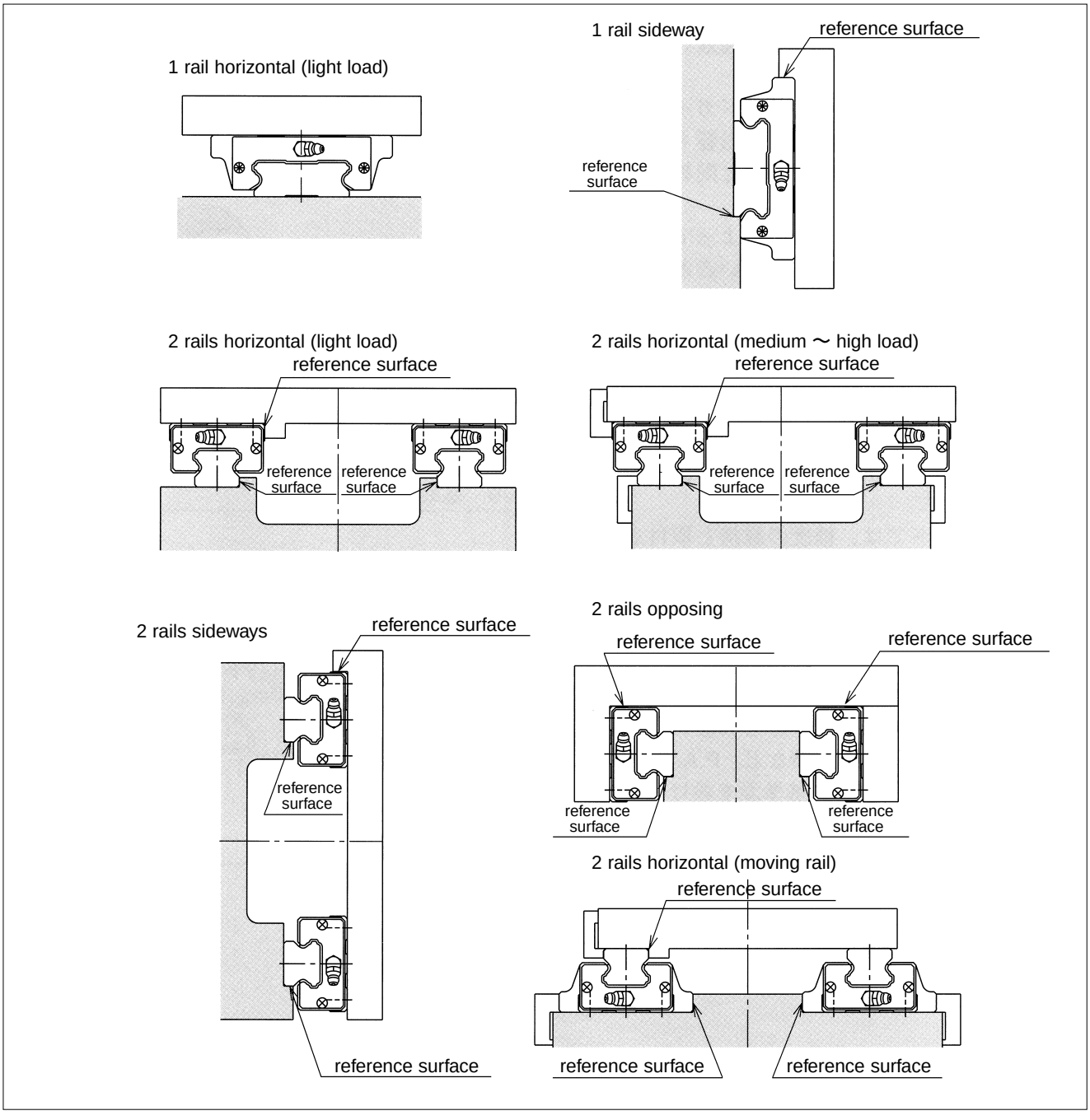
$$\frac{L\cdot 10^{3}}{2\cdot \ell s\cdot n_1\cdot 60}$$

Lh : travel life in time (hr) ℓs : stroke distance (mm)
L : travel life (km) n_1 : stroke frequency per min (cpm)

MOUNTING

Slide guides have a high rated load capacity in spite of their compact size. They can be used in various types of machinery and other equipment using various methods. Figure A-6 shows some representative slide guide arrangements.

Figure A-6 Slide Guide Arrangements



Mounting Surface Shape and Accuracy:

NB slide guides are designed and fabricated to be accurately mounted by attaching them to a machined mounting base. One approach is to provide a shoulder on the mounting surface and align the reference surface of the rail or block against this surface (Figure A-7). To avoid corner interference, an escape groove should be provided at the shoulder corner or the radius of the shoulder corner should be smaller than the radius of the slide guide corner. The accuracy of the rail surface affects the accuracy of the machinery or other equipment along with the slide guide motion accuracy. The accuracy of the mounting surface should be equivalent to that of the desired slide guide motion accuracy. The specified pre-load may not be achieved due to deformation of the block, for example, the mounted block surface is not flat. Refer to Figure A-8. Careful attention should therefore be given to achieve the specified flatness.

Figure A-7 Shape of Mounting Surface

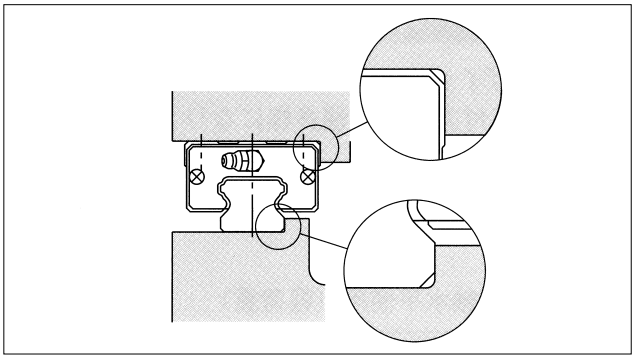
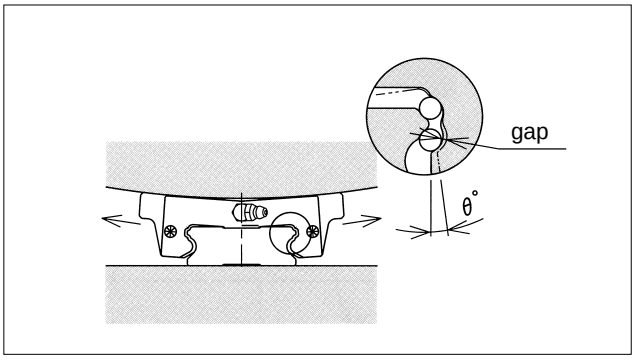


Figure A-8 Effect of Flatness

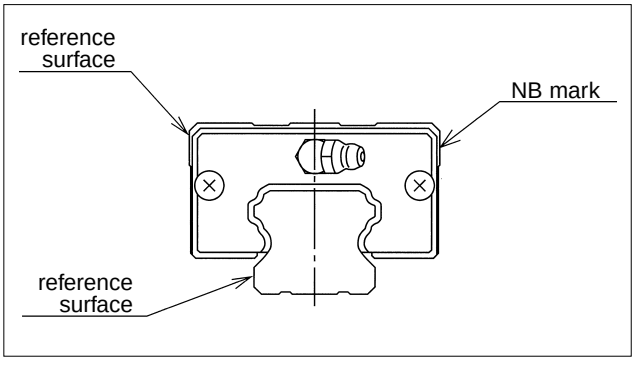


Reference Surface Indication:

Reference surfaces are provided to enable accurate and simplified mounting. They are placed in the same direction on the block and the rail, as shown in Figure A-9. They are located on the side opposite to the NB mark.

Depending on the mounting arrangement, the standard reference surface may not ensure mounting accuracy (for example, 1 rail sideway or 2 rails opposing, page A7, Figure A-6). In such cases, NB can provide a reference surface on the opposite side. This should be specified when ordering.

Figure A-9 Reference Surfaces



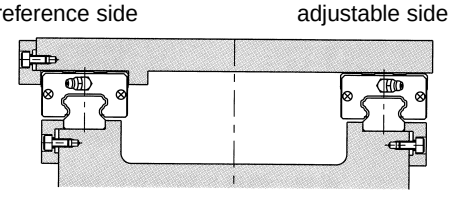
Mounting:

In general, a slide guide is used with 2 rails in parallel. In that case, one rail is on the so-called reference side and the other is the so-called adjustable side.

● Applications where shock/vibration loading and high load are involved and high accuracy is required.

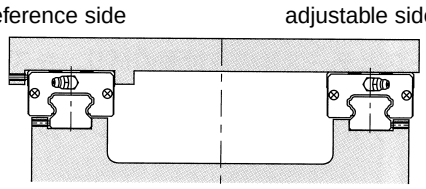
The effect of shock and vibration on accuracy is eliminated by mounting on the slide guide a side piece, which is typically a side plate (Figure A-10), tightening set screws (Figure A-11), or a tapered gib (Figure A-12).

Figure A-10 Mounting of Side Plate



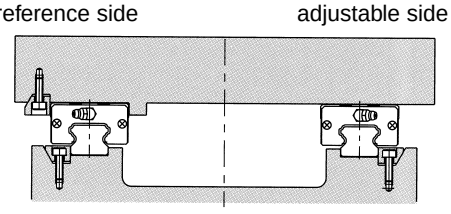
Provide an escape groove in the side plate, and push slightly protruding portion from the bed table.

Figure A-11 Mounting of Tightening Set Screw



Because space is limited in the guide rail portion, small screws must be used. Use as many screws as necessary for the length of the rail.

Figure A-12 Mounting of Tapered Gib



By rotating mounting screws of the tapered gib, the gib applies a side force to the slide guide. The groove shape and surrounding dimensions must be carefully designed to achieve the desired force.

● Applications where light load and low speed are involved.

Figures A-13～15 show the mounting methods when high accuracy is not required or the load capacity of the slide guide is sufficient due to a light load or low speed. In these cases, a side piece or reference surface may not be required.

Figure A-13 Without Side Piece

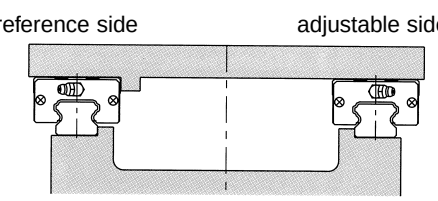


Figure A-14 No Datum Surface on Adjustable Side

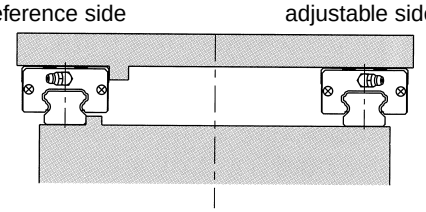
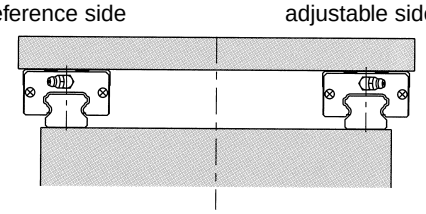


Figure A-15 Without Datum Surface



Mounting Method:

When reference surfaces are provided for both the table and the base, use the following procedure to mount the slide guide.

1. Remove burrs, scratches, dust, etc. from the base and table. Apply a low viscosity oil to the base and the table. Place the slide guide on the base carefully. Temporarily fix the rail mounting bolts.

2. Tighten the screw for the side piece so that the installation reference surface and the rail reference surface are in contact. If a side piece is not provided, use a C clamp to position the mounting reference surface and the rail reference surface so that they contact each other.

3. Tighten the mounting bolts to the specified torque, and complete the mounting of the rail. The rail is designed so that its accuracy is optimum when the bolts are tightened to the specified value. Refer to the recommended torgue table for each product type for the specified torque.

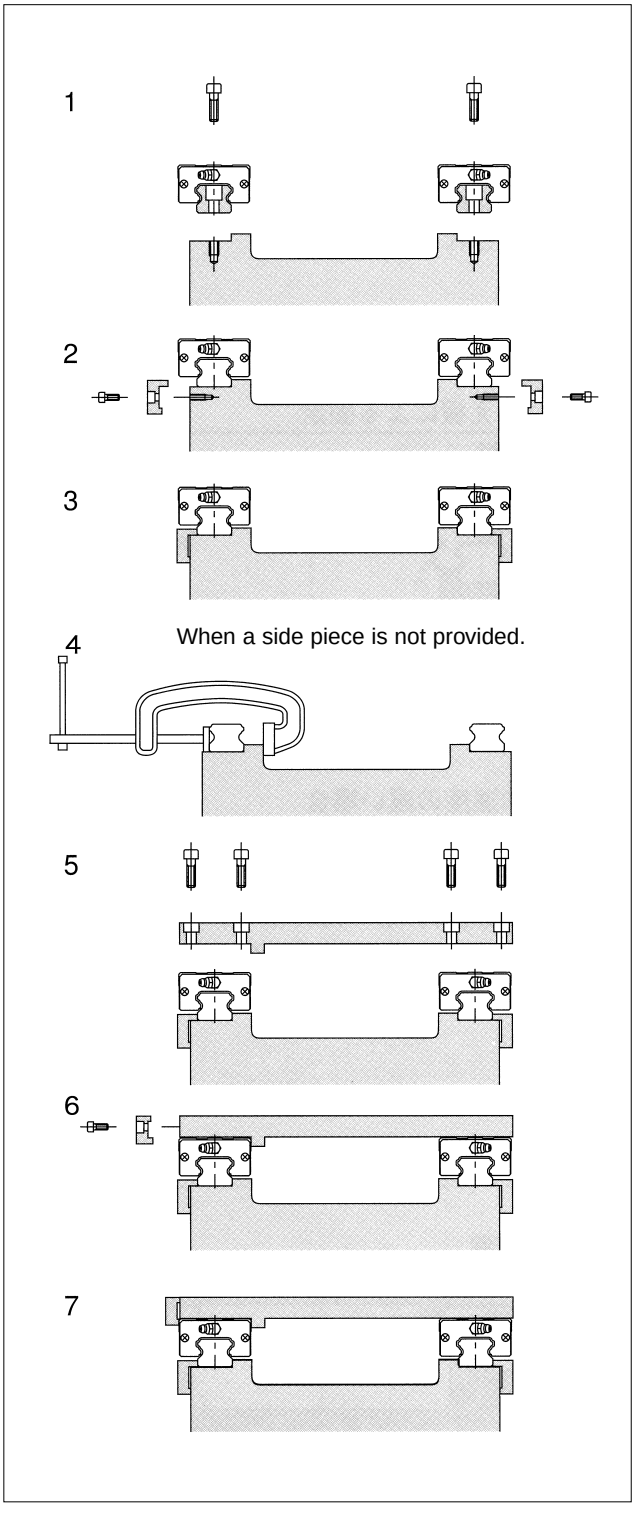
4. Repeat steps 2 and 3 for the rail on the adjustable side.

5. Move the blocks at the mounting location of the table, and place the table softly. Then slightly tighten the screws.

6. Position the reference surface of the block against the table. Tighten the mounting screws in a diagonal sequence.

7. Repeat steps 5 and 6 for the block on the adjustable side.

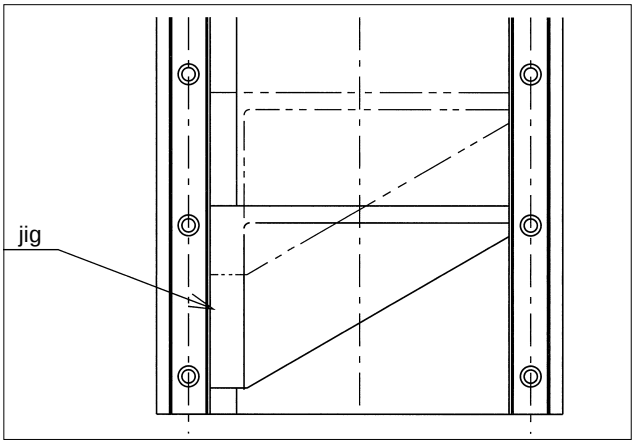
Figure A-16 Mounting Using Reference Surfaces



When reference surface is not provided on adjustable side:

When a reference surface is not provided on the adjustable side, mount the 2 rails in parallel by using a jig, as mounted in Figure A-17. After mounting the reference-side guide, install the adjustable-side guide.

Figure A-17 Using a Jig



When reference surface is not provided on reference side:

When a reference surface is not provided on the reference side, mount the 2 rails by using a reference surface in the vicinity of the slide guide, as illustrated in Figure A-18.

Temporarily fix the slide guide to the base, and mount an indicator on the block. Two or more blocks should be used; they should be fixed using a measurement plate (Figure A-18).

Place the indicator against the reference surface of the base. Tighten the bolts from one end of the rail to ensure straightness. If there is no reference surface handy, use a straight edge to achieve straightness (Figure A-19).

Figure A-18 Using Base Reference Surface

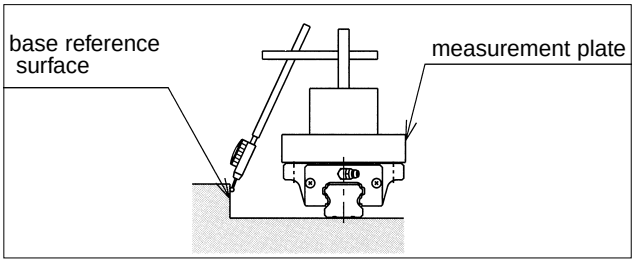
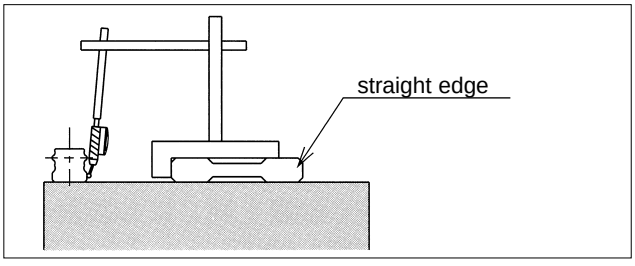


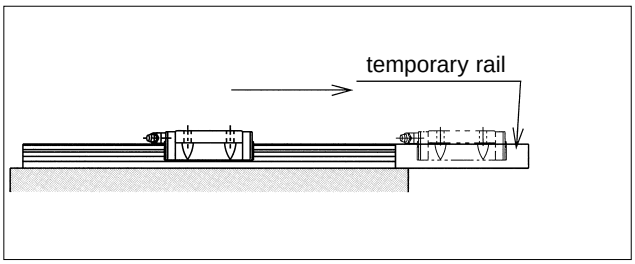
Figure A-19 Using a Straight Edge



Note:

The SEB-A and SER slide guides do not have ball element retainers, so if they must be removed from the mounting rail, use a temporary rail to prevent the ball elements from falling out will be necessary. Although the SEBS-B SGL and SGW slide guides do have ball element retainers, the ball elements may still fall out depending upon how the guide block is removed from the rail and also the pre-load condition. The use of a temporary rail is strongly recommended to prevent damage to the guide block (Figure A-20). Contact NB for information on temporary rails.

Figure A-20 Guide Block Removal



RAIL LENGTH

Guide Rail Length:

Single rails are fabricated as standards to the lengths shown in the dimensional tables for each type and series. Unless otherwise specified, the distance to the first hole from one end of the rail (referred to as dimension "N") is within the range specified in the dimensional tables. The guide rail is therefore fabricated according to the equation given below. For other than standard dimensional requirements, contact NB.

$$L = M \cdot P + 2N$$

L : length (mm) N : distance to the first hole center from the end of the rail (mm) P : hole pitch (mm) M : number of pitches.

Note:

Slide guide rails are machined with mounting holes as depicted in Figure A-21 during the initial fabrication process (before heat treatment). Specifying a different hole pitch or size will increase the cost and lead time, so please try to avoid changing these specifications.

Figure A-21 Guide Rail Mounting Hole

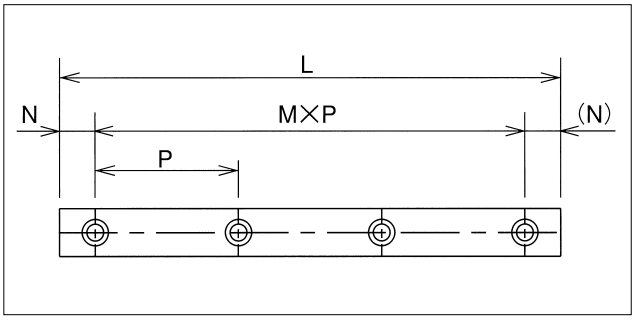
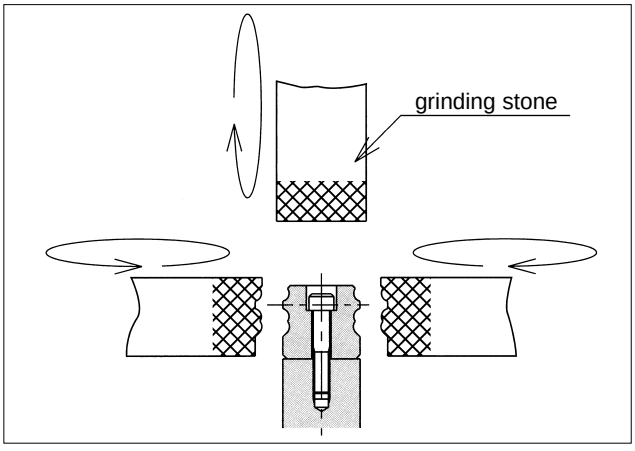


Figure A-22 Guide Rail Grinding Method



JOINT RAILS

Rails can be joined together to obtain a length which exceeds the specified maximum standard length. There are two ways to do this.

- Place the joints at the same location for the right and left rails so as to make the design and maintenance simple (Figure A-23 ①).
- Place the joints for the right and left rails at different locations so that the block does not move over the two joints at the same time so as to minimize the effect of the joint on accuracy (Figure A-23 ②).

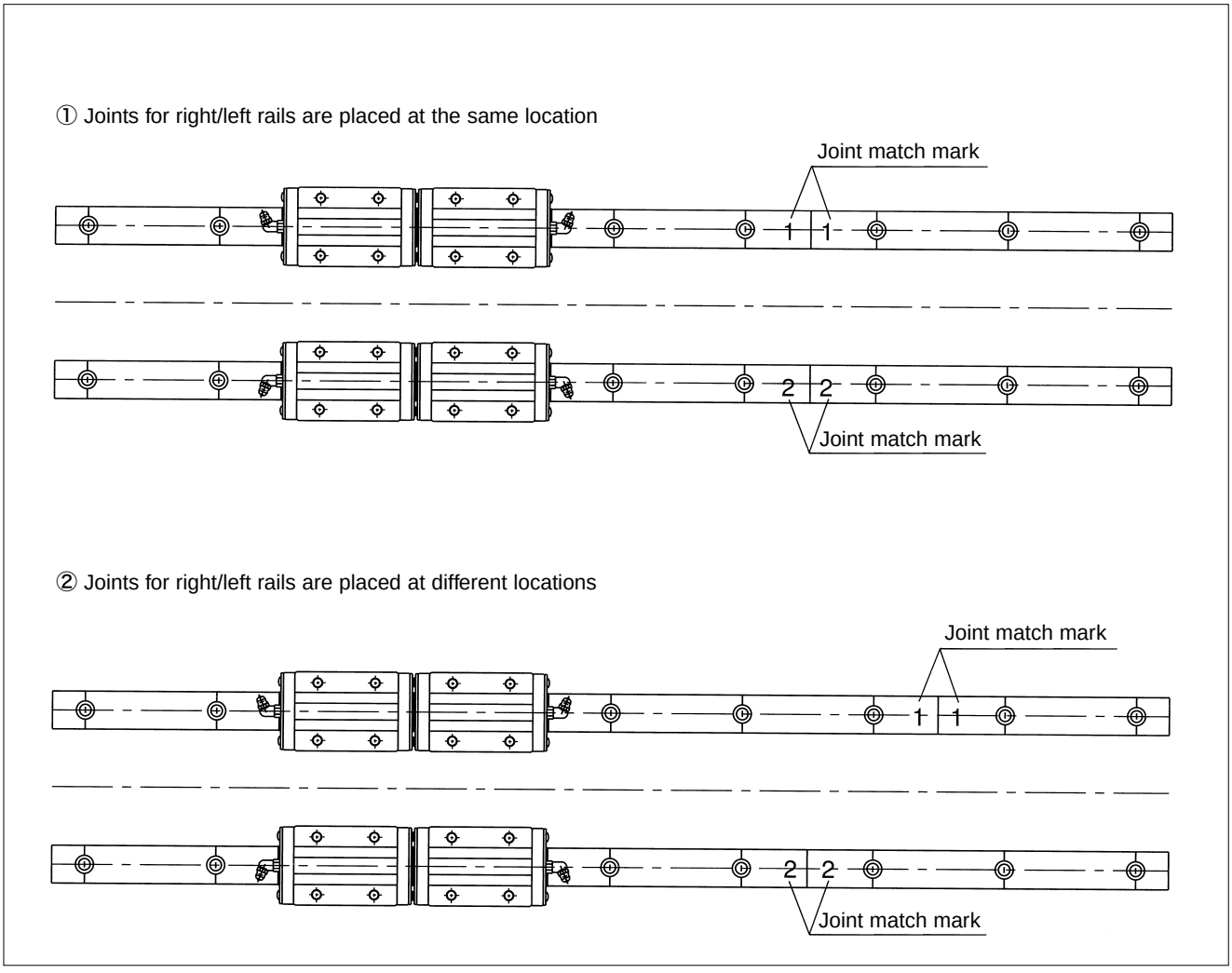
Please keep the following points in mind when using joint rails.

- To avoid dislocation at joints due to shock loading, provide a shoulder at the joint on the installation side.
- Use the joint marks provided.
- Tightly butt the rails to be joined so that there is no gap between them.

Notes:

The standard accuracy and pre-load grade are only available on joined rail systems. The SER type guide series can not be made with joined rails. Contact NB for further information on joining .

Figure A-23 Examples of Joined Guide Rails



DUST PREVENTION

Seals:

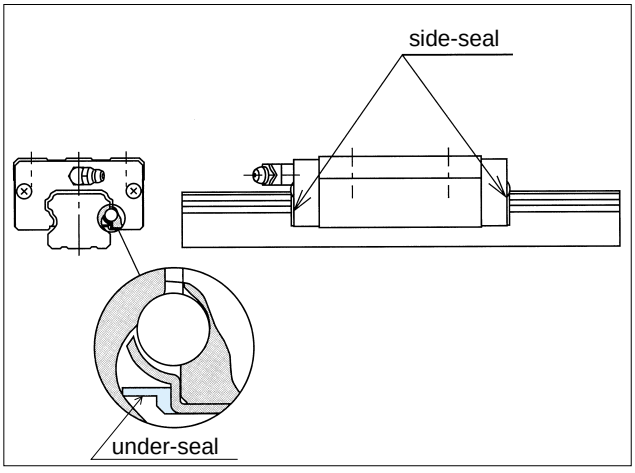
Side seal (Series: SEB, SER, SGL or SGW)

Slide guides with side-seals are used in typical environments to prevent dust from entering the guide block from above.

Under seal (Series: SGL or SGW)

Slide guides with side and under seals are used in more harsh environments or to prevent dust entering from below.

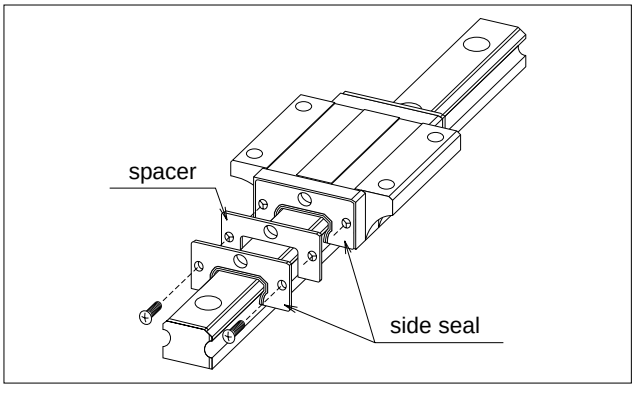
Figure A-24 Side-Seals and Under-Seals



Double Side Seal Option (Series: SGL)

With this option, the prevention against dust is greatly improved. Ideal for use in applications where bellows or covers are not able to be fitted over the system.

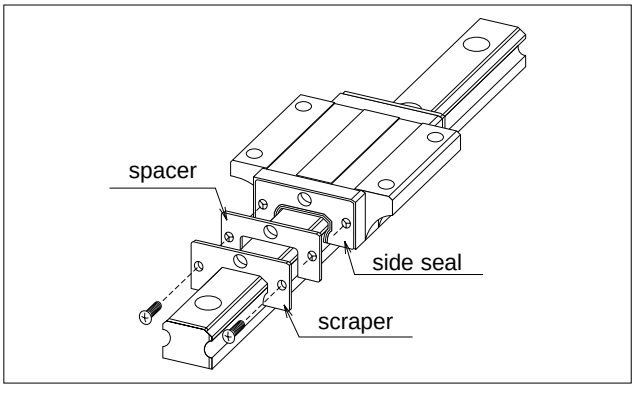
Figure A-25 Double Side-Seal



Scraper Option (Series: SGL)

When the working application environment has unfavorable foreign matter or debris such as welding splatter or cutting debris, the Scraper option provides an effective protective measure for the Guide Block.

Figure A-26 Scraper



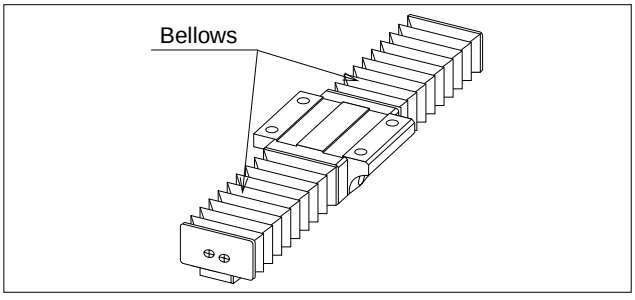
No Side Seal (Series: SEB or SER)

When the presence of dust or debris is extremely low and only minor motion resistance is desired, a No Side Seal option may be required. Be aware that with this option, that dust prevention can not be expected.

Bellows Option (Series: SGL)

This option fully covers the Slide Rail preventing dust, debris, and other foreign particles from disrupting the smooth linear motion movement. (Refer to Page A-54 for further details)

Figure A-27 Optional Bellows



Special Cap:

For SGL and SGW guides, special rail mounting caps are available to prevent dust from entering the installation mounting holes. These caps are installed after the rail is installed by using a jig and slowly inserting them into the holes until their top surface is flush with the rail surface.

Figure A-28 Special Cap Installation

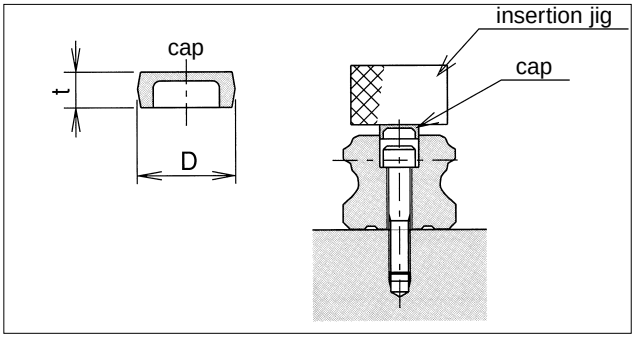


Table A-3 Special Caps

part number	dimensions		applicable slide guide		
	D mm	t mm	SGL-F, E, TF, TE	SGL-HTF, HTE	SGW type
F3	6.1	1.3	15	–	–
F4	7.5	1.1	15D	15	17,21,27
F5	9.7	2.5	20	20	–
F6	11.2	2.7	25,30	25	35
F8	14.3	3.65	35	30,35	–

LUBRICATION

Lithium soap grease is applied to NB slide guides before they are shipped so that they are ready for immediate use. The same type of grease should be added periodically depending on the operating conditions.

For use in clean rooms or vacuum environments, slide guides without grease are available. Slide guides lubricated with customer specified grease for special applications are also available.

NB also provides "K-Grease" for low dust generation lubricant. Please refer to page Eng-12 for further details.

CORROSION RESISTANCE

For corrosion resistance, the SEB and SER guides are available in stainless steel material option. Raydent surface treatment can be specified for the SGL and SGW guide series. This treatment is suitable for applications where corrosion resistance is required or periodic lubrication is difficult.