

SLIDE GUIDE

BALL SPLINE
ROTARY BALL SPLINE

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SLIDE BUSH

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SLIDE BUSH

ISOTECH, inc.

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SLIDE BUSH

The NB slide bush is a linear motion mechanism utilizing the rotational motion of ball elements. Since linear motion is obtained using a simple mechanism, the slide bush can be used in a wide variety of applications, including transportation equipment, food processing equipment, and semiconductor equipment.

STRUCTURE AND ADVANTAGES

The NB slide bush consists of the outer cylinder and a ball retainer that guide the circulation of the ball elements, resulting in smooth linear motion.

Compact Mechanism:

The NB slide bush uses a round shaft for the guide, resulting in effective space utilization, which allows for compact designs.

A Wide Variety of Shapes and Installation Methods:

The NB slide bush is available in various shapes, which make it suitable for various types of installations : lightweight, standard, clearance adjustable, open, flange, and double-wide types.

Selection According to Environment:

Standard and anticorrosion NB slide bushes are available. Additionally, options available are both metallic retainers suitable for use in harsh environments and low acoustic, low-cost resin retainers.

These options can be specified according to application need.

Compatibility:

The NB slide bush is fully compatible with a variety of shaft types.

Low Friction:

The raceway surface is precision ground. Since the contact surface between the ball elements and the raceway surface is minimized, the NB slide bush provides low friction when compared to other linear motion mechanisms.

GM type series:

The GM Slide Bush makes efficient use of resin components making it possible to achieve an overall weight reduction of 30~50% when compared with the SM Slide Bush.

The ball return section is configured completely in resin material, which provides for low noise operation.

Figure D-1 Basic Structure of NB Slide Bush (GM)

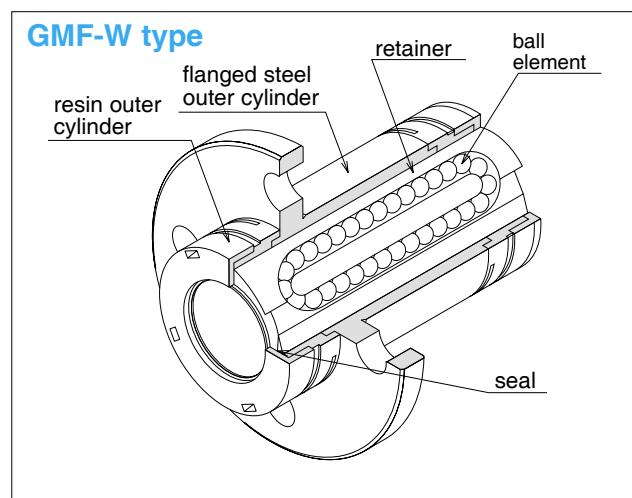
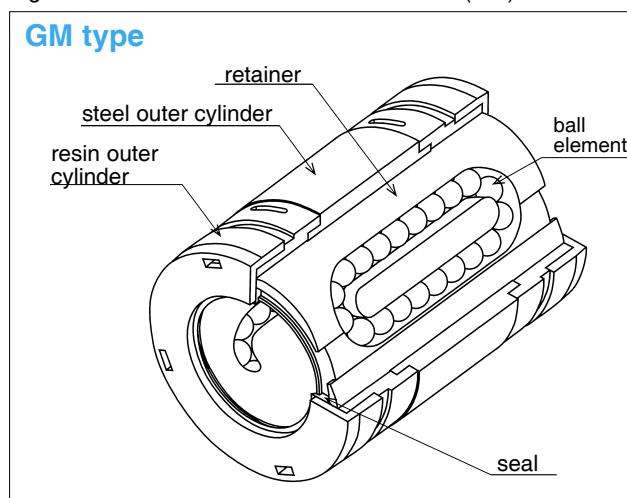
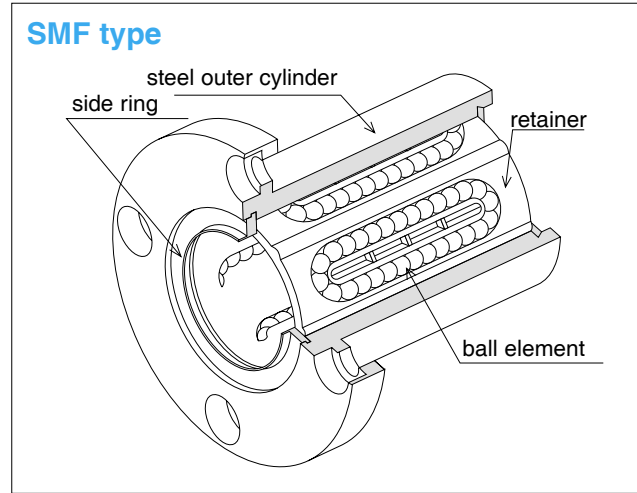
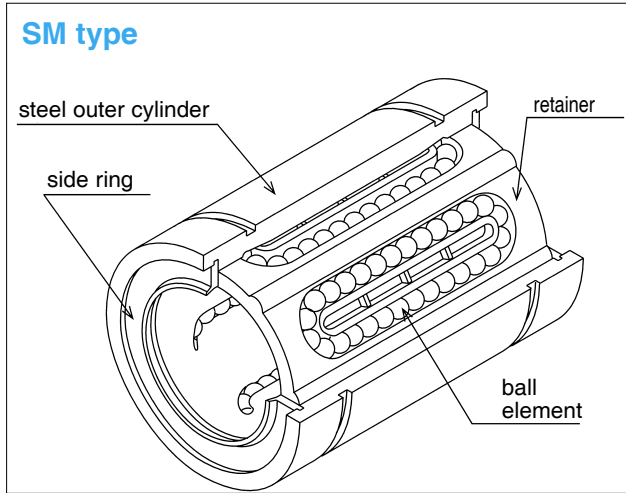


Figure D-2 Basic Structure of NB Slide Bush (SM, KB, SW)



TYPES

Table D-1 Types (1)

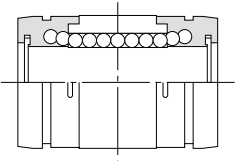
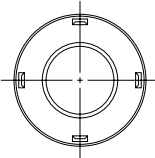
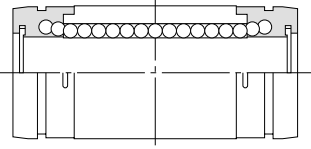
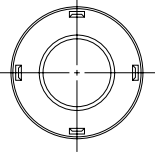
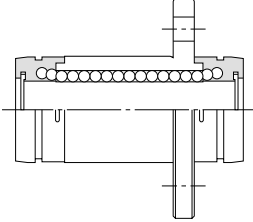



type		standard	page
GM/GW type 		GM	D- 12
		GW	D-114
GM double-wide type 		GM-W	D- 13
GM double-wide flange type 		GMF-W	D- 14
		GMK-W	D- 16
		GMT-W	D- 18

Table D-2 Types (2)

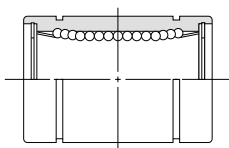
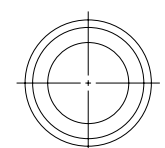
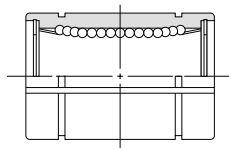
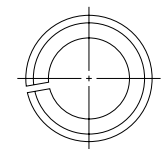
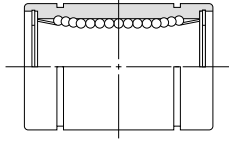
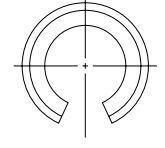
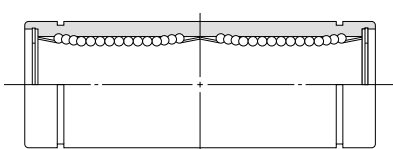
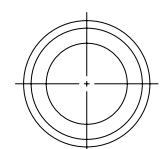
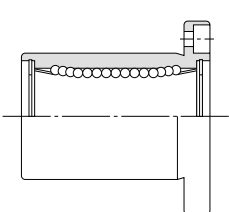



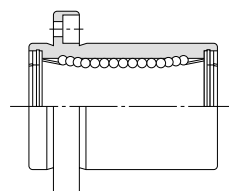


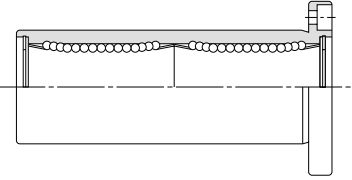


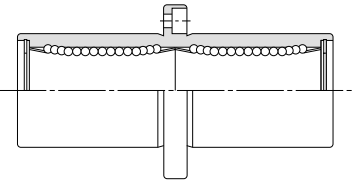


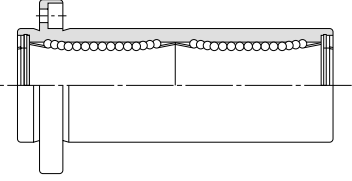


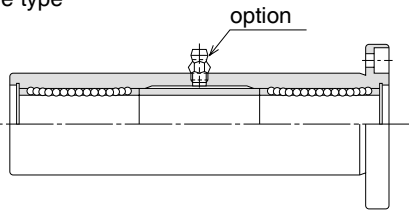

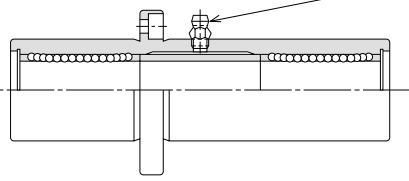
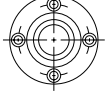
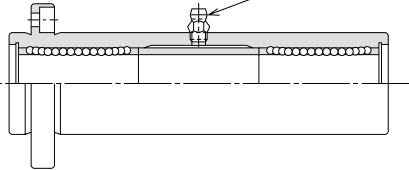
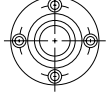
type		standard	anticorrosion	page	
standard type 		SM	SMS	D- 20	
		KB	KBS	D- 70	
		SW	SWS	D- 92	
clearance-adjustable (AJ) type 		SM-AJ	SMS-AJ	D- 22	
		KB-AJ	KBS-AJ	D- 72	
		SW-AJ	SWS-AJ	D- 94	
open (OP) type 		SM-OP	SMS-OP	D- 24	
		KB-OP	KBS-OP	D- 74	
		SW-OP	SWS-OP	D- 96	
double-wide type 		SM-W	SMS-W	D- 26	
		KB-W	KBS-W	D- 76	
		SW-W	SWS-W	D- 98	
flange type 		SMF	SMSF	D- 28	
		KBF	KBSF	D- 78	
		SWF	SWSF	D-100	
		SMK	SMSK	D- 30	
		KBK	KBSK	D- 80	
		SWK	SWSK	D-102	
		SMT	SMST	D- 32	
		KBT	KBST	D- 82	
		SWT	SWST	D-104	
flange type with pilot end 		SMF-E	SMSF-E	D- 34	
			SMK-E	SMSK-E	D- 36
			SMT-E	SMST-E	D- 38

Table D-3 Types (3)

type		standard	anticorrosion	page	
double wide flange type 		SMF-W	SMSF-W	D- 40	
		KBF-W	KBSF-W	D- 84	
		SWF-W	SWSF-W	D-106	
		SMK-W	SMSK-W	D- 42	
		KBK-W	KBSK-W	D- 86	
		SWK-W	SWSK-W	D-108	
center mount flange type 		SMFC	SMSFC	D- 46	
		KBFC	KBSFC	D- 88	
		SWFC	SWSFC	D-110	
		SMKC	SMSKC	D- 48	
		KBKC	KBSKC	D- 90	
		SWKC	SWSKC	D-112	
double-wide pilot end flange type 		SMF-W-E	SMSF-W-E	D- 52	
			SMK-W-E	SMSK-W-E	D- 54
			SMT-W-E	SMST-W-E	D- 56
triple wide flange type 		TRF	—	D- 58	
		TRK	—	D- 60	
triple-wide intermediate position flange type 		TRFC	—	D- 62	
		TRKC	—	D- 64	
triple-wide pilot end flange type 		TRF-E	—	D- 66	
		TRK-E	—	D- 68	

SPECIFICATIONS

Dimensional Series:

The NB slide bush is available in three primary dimensional series, each with different dimensions and tolerances depending on the location of use. Select the series most appropriate for your location.

Allowable Load:

NB slide bushes are categorized into three functional types depending on the number and location of retainers: single, double, and triple. The single type uses only one retainer, so when a moment load is to be applied, the double or triple type should be used.

Material:

The standard NB slide bush uses a bearing steel outer cylinder. The anti-corrosion NB slide bush uses Martensitic stainless steel. Single-body steel (stainless steel for the anticorrosion type) retainers and resin retainers for low acoustic operation can be specified.

Seals:

The seals effectively retain the lubricant within the slide bush, extending the time between lubrications. The UU type has seals on both sides. The U type has a seal only on one side and is available for the standard, clearance adjustable, and open types. Nitril rubber, which has low wear and good sealing characteristics, is used as the seal material.

※ Resin seals are used for GM type.

Table D-4 Dimensional Series and Use Location

series		location			
		Japan	Asia	Europe	North America
mm dimension	GM	◎	◎	○	○
	SM	◎	◎	○	○
	KB	○	○	◎	○
inch dimension	SW	○	○	○	◎

◎ generally used ○ rarely used

Table D-5 Comparison of Allowable Loads

type	basic dynamic load rating	basic static load rating	allowable static moment
single	1	1	1
GM-W	1.6	2	4 approx.
double	1.6	2	6 approx.
triple	1.6	2	21 approx.

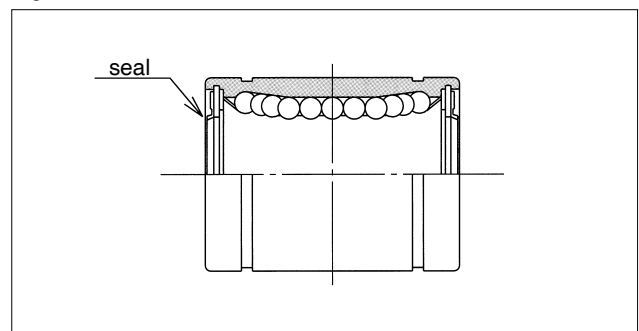
※ The single type is designated as "1" for comparison purposes.

Table D-6 Operating Environment Temperature

material		temperature range
outer cylinder	retainer	
steel	steel	-20°C ~ 110°C
	resin	-20°C ~ 80°C
stainless	steel	-20°C ~ 140°C*
	resin	-20°C ~ 80°C

* When a slide bush with seals is used, the temperature should never exceed 120°C.

Figure D-2 Seal Profile



LIFE CALCULATION

Since ball elements are used as the rolling element in the NB slide bush, Equation (6) is used to calculate the Travel life.

$$L = \left(\frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P} \right)^3 \cdot 50 \dots \dots \dots (6)$$

L : travel life (Km) f_H : hardness coefficient
 f_T : temperature coefficient f_W : load coefficient
 C : basic dynamic load rating P : load (N)
 *Refer to page Eng. 5 for the coefficient.

If the stroke distance and number of strokes per unit time are constant, the life is calculated using Equation (9).

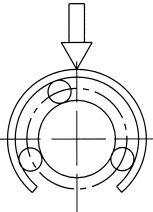
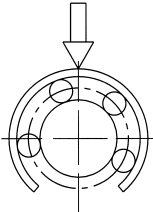
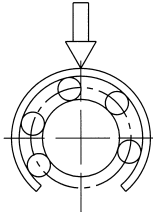
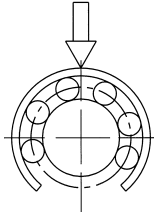
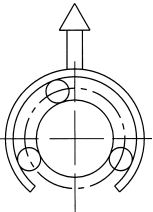
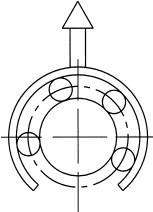
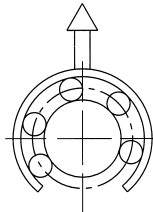
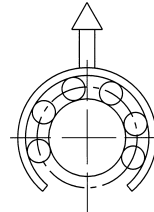
$$L_h = \frac{L \cdot 10^3}{2 \cdot \ell \cdot s \cdot n_1 \cdot 60} \dots \dots \dots (9)$$

Lh : travel life in time (h) ℓ s : stroke distance (mm)
 L : travel life (Km) n_1 : stroke frequency per min (cpm)

LOAD RATING FOR OPEN TYPE SLIDE BUSH

In the open type slide bush, an opening is provided to allow the shaft to be supported from underneath. When a load is constantly applied in the direction of the opening (for example, when used with a vertical shaft or when an overhang loading is applied), the rated load decreases due to the reduction in the number of rows of ball elements that are loaded. Therefore, the load rating must be calibrated at the time of design based on the direction of the loading.

Table D-7 Direction of Load and Basic Static Load Rating

part number	SM10G~16G-OP KB12G~16G-OP SW 8G~10G-OP	SM20(G)-OP KB20(G)-OP SW12(G)-OP	SM25(G)~100-OP KB25(G)~80-OP SW16(G)~64-OP	SM120,150-OP
loading from above	Load P 	Load P 	Load P 	Load P 
	C	C	C	C
loading from below	Load P 	Load P 	Load P 	Load P 
	0.64C	0.54C	0.57C	0.35C

※ Excludes SM12G-OP and all 3-row steel retainer open types.

MOUNTING

Examples of Mounting methods are shown in Figures D-3 ~D-6.

Figure D-3 Standard Type

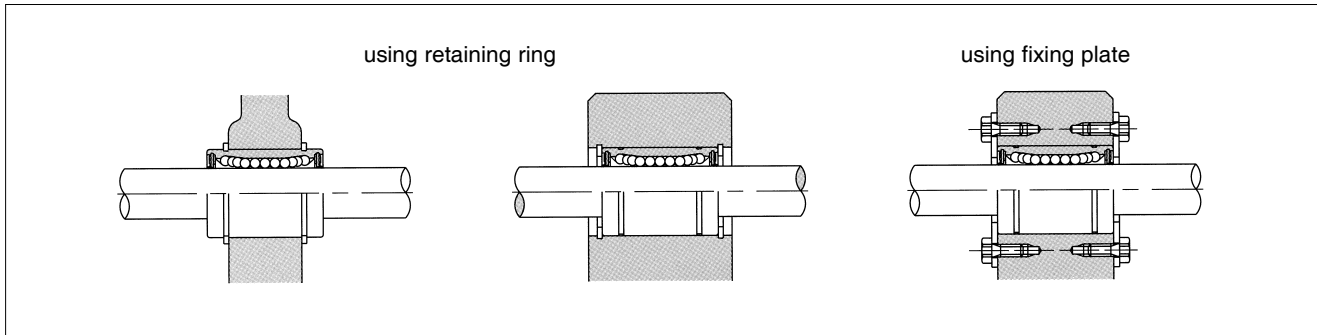


Figure D-4 Clearance Adjustable Type

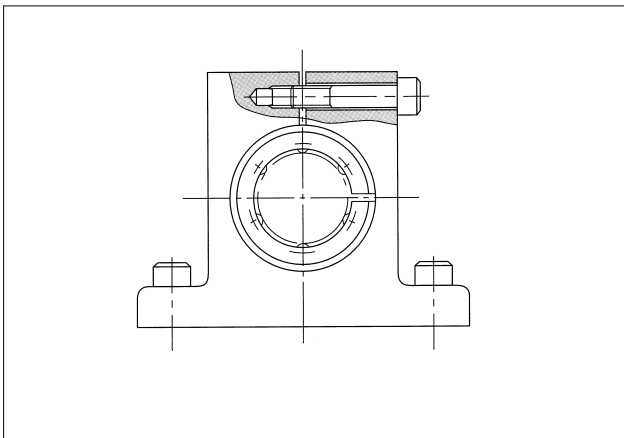


Figure D-5 Open Type

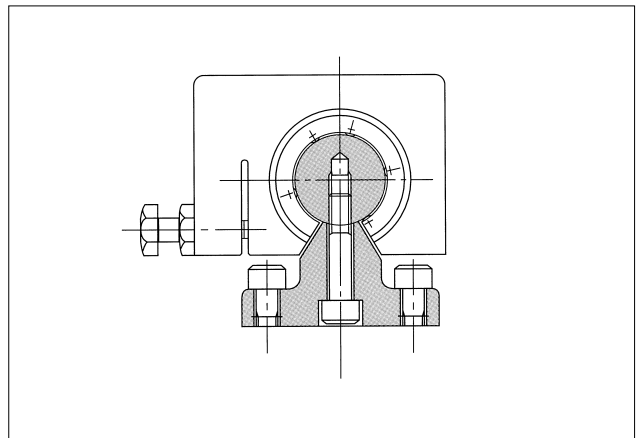
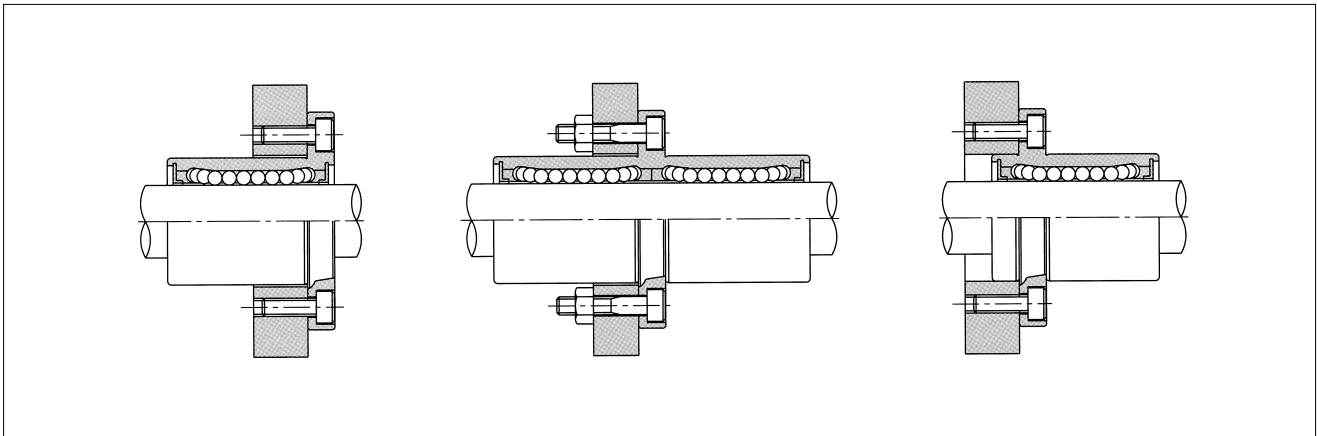


Figure D-6 Flange Type



These figures illustrate the basics of flange installation.

Fit:

The normal clearances listed in Table D-8 are generally used for the NB slide bush. The transition fit is used to reduce clearance and increase accuracy. Matching the clearance as specified between bush and shaft is also possible.

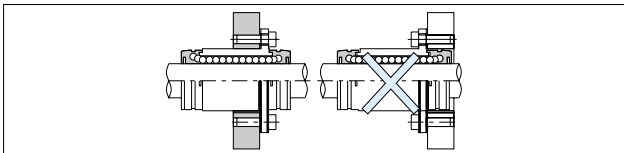
The pre-load for the clearance adjustable and open type slide bush must be adjusted carefully so that excessive pre-load does not exceed limits, based on the radial clearances listed in the table.

The flange-type bush is generally inserted into an installation bore, which is slightly larger than the outer cylinder. However, if the outer cylinder is used as the pilot type, H7 tolerance is recommended.

The recommended clearances for the flange type are listed in Table D-9.

The GM Flange type slide bush is properly installed as illustrated in Figure D-8. The resin external body of the GM Flange should not be used as a pilot type.

Figure D-8 Installation of GM Flange type



Notes on Installation:

When inserting a slide bush into a housing, carefully insert it by using a jig to apply a uniform pushing force at the end of the outer cylinder, as illustrated in Figure D-7. Motion performance may be diminished if an excessive force is applied to the resin portion of the outer cylinder, the side-ring, or the seal.

Ensure that all burrs are removed from the shaft and carefully insert the bush by aligning it with the center of the bore. The ball elements may drop out if excessive force is used during insertion.

When two or more shafts are used, the parallelism of the shafts will greatly affect the motion characteristics and life of the slide bush. The parallelism should be adjusted by moving the slide bush back and forth the

Table D-8 Normal Clearances

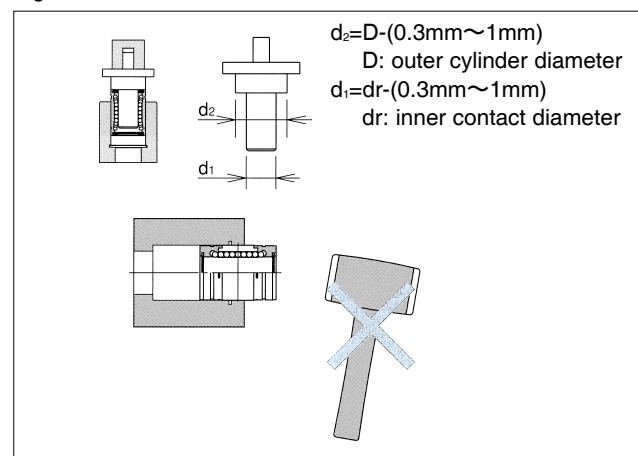
series	accuracy grade	shaft		housing	
		clearance fit	transition fit	clearance fit	transition fit
GM	high	g6	h6	H7	—
GM-W	high	g6	—	H7	—
SM	high	g6	h6	H7	J7
	precision (P)	g5	h5	H6	J6
SM-W	high	g6	—	H7	—
KB	high	h6	j6	H7	J7
KB-W	high	h6	—	H7	—
SW	high	g6	h6	H7	J7
	precision (P)	g5	h5	H6	J6
SW-W	high	g6	—	H7	—

Table D-9 Recommended Fit for Flange Type Bush

series	shaft	
	clearance fit	transition fit
GMF-W	g6	—
SMF	g6	h6
SMF-W	g6	—
TRF	g6	—
KBF	h6	j6
KBF-W	h6	—
SWF	g6	h6
SWF-W	g6	—

length of stroke to check for freedom of movement before final fixing of shaft.

Figure D-7 Insertion of Slide Bush



LUBRICATION

For a slide bush to continue operating accurately and have a long life, it must be lubricated on a regular basis. Anti-rust oil is applied to NB slide bush prior to shipment. When slide bushes are delivered, they should be cleaned with kerosene and dried, then a lubricant should be applied before usage.

Grease Lubricant:

Grease should be applied to the internal components of the slide bush. Grease should be periodically reapplied depending on the operating conditions. Reapplication may be done by adding the grease directly to the internal components or by using a mechanism similar to that as shown in Figure D-8. Lithium soap grease is recommended.

A special low dust generating grease for use in clean rooms is also available. Contact NB for further details.

Oil Lubricant:

Oil can be applied directly to the shaft or by using a mechanism similar to that shown in Figure D-8. Turbine oil (ISO standard VG32-68) is recommended for highspeed applications.

Lubrication oil holes can be fabricated (see Figure D-9) in the center portion of the outer cylinder to simplify oil application. Contact NB for further details.

Dust Prevention

If foreign particles such as dust or grinding chips are introduced into the slide bush, they will disrupt the smooth circulation of the ball elements. The NB slide bush is available with seals as an option. Bellows or protective covers should be used under harsh environmental operating conditions.

Figure D-8 Example of Mechanism for Applying Lubrication

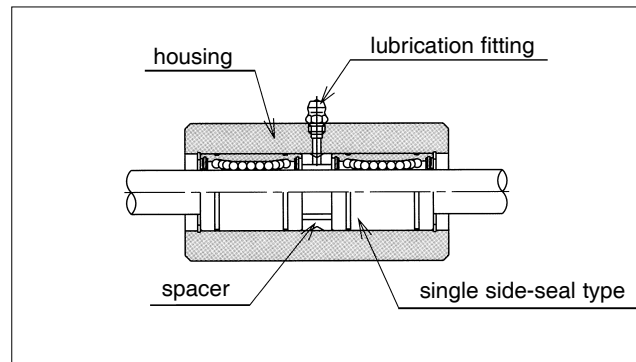


Figure D-9 Oil Hole (Custom Specification)

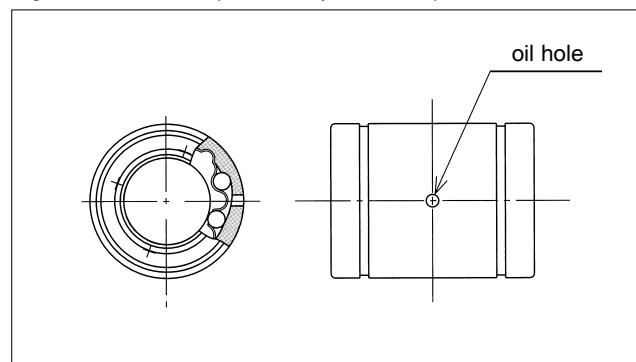
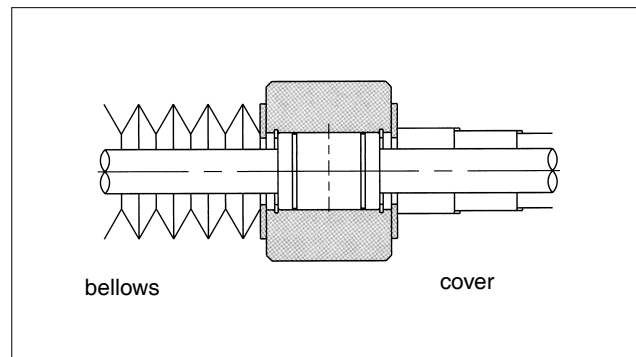


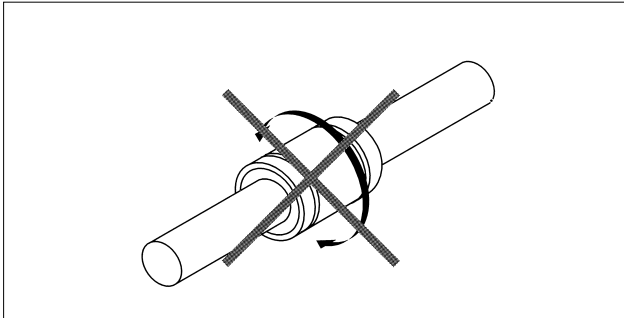
Figure D-10 Example of Dust Prevention



NOTES ON HANDLING

The NB slide bush is a precision device and therefore should always be handled with care. The slide bush is not designed for rotational motion. When applications require both rotating and linear motions, a stroke bush (page F-2), slide rotary bush (page F-8), or rotary ball spline (page B-32) should be considered.

Figure D-11 Direction of Motion



OTHER NOTES

● Flange Type Slide Bush with Surface-Treatment

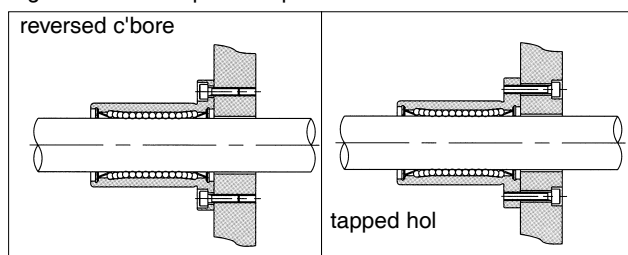
The following standard surface treatments are available:

SK	electroless nickel plating
RD	Raydent treatment
SB	black oxide (excludes anti-corrosion specification)
SC	industrial chrome plating

● Special Specifications

Contact NB for information for surface finish other than those listed above, oil hole (Figure D-9), or special mounting hole requirements for the flange-type bush.

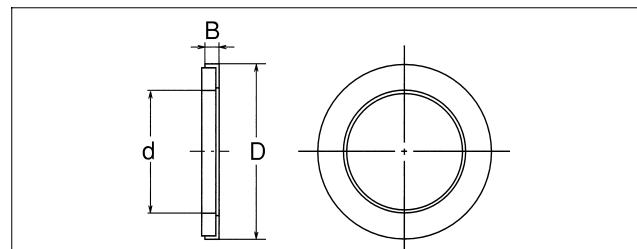
Figure D-12 Examples of Special Installation Holes



FELT SEAL

A felt seal may be used when lubrication is used with the NB slide bush. This felt seal improves the effect of the lubrication and increases the period between reapplications.

Figure D-13 Felt Seal



part number	major dimensions(mm)			applicable slide bush
	d	D	B	
FLM 6	6	12	2	SM 6/GM 6
FLM 8	8	15	2	SM 8/GM 8
FLM 10	10	19	3	SM10/GM10
FLM 12	12	21	3	SM12/GM12
FLM 13	13	23	3	SM13/GM13
FLM 16	16	28	4	SM16/GM16
FLM 20	20	32	4	SM20/GM20
FLM 25	25	40	5	SM25/GM25
FLM 30	30	45	5	SM30/GM30
FLM 35	35	52	5	SM 35
FLM 40	40	60	5	SM 40
FLM 50	50	80	10	SM 50
FLM 60	60	90	10	SM 60
FLM 80	80	120	10	SM 80
FLM100	100	150	10	SM100

Felt Seal Installation:

The felt seal should be installed as shown in Figure D-14.

Figure D-14 Example of Felt Seal Installation

