



## NIPPON BEARING

2833 Chiya, Ojiya-city, Niigata-pref., 947-8503 JAPAN  
Phone:+81 (0)258-82-0011 FAX:+81 (0)258-81-1135  
Overseas direct call:+81 (0)3-5615-2812  
Overseas direct fax:+81 (0)3-5615-2813  
<https://www.nipponbearing.com/>  
tex@nipponbearing.com

### NB CORPORATION OF AMERICA

930 Muirfield Drive, Hanover Park, IL60133, U.S.A.  
Phone:(630)295-8880 FAX:(630)295-8881  
TOLL FREE:(800)521-2045

#### Western Regional Office

2107 N. First St. San Jose, CA 95131, U.S.A.  
Phone:(408)441-0799 FAX:(408)441-0988  
TOLL FREE:(888)562-4175

#### Eastern Regional Office

400 Morris Avenue, Suite 224, Denville, NJ 07834, U.S.A.  
Phone:(201)236-3886 FAX:(201)236-5112  
TOLL FREE:(800)981-8190

<http://www.nbcorporation.com>  
info@nbcorporation.com

### NB EUROPE B.V.

Boekweitstraat 21, 2153 GK Nieuw-Vennep, The Netherlands  
Phone:+31 (0)252-463-200 FAX:+31 (0)252-463-209  
<http://www.nbeurope.com>  
info@nbeurope.com

### NB CHINA CO.,LTD.

Room 108, Building 2, Randong Commercial Center No.150,  
Lane 2161 Wanyuan Road, Minhang District, Shanghai 201103,  
P.R. China  
Phone:+021-52286811  
<http://www.nipponbearing.com/chinese/index.html>  
info@nb-china.com.cn

### NIPPON BEARING MALAYSIA SDN. BHD.

1-01-01A, Menara IJM Land, No.1, Lebuhr Tnuku Kudin 3, 11700,  
Gelugor, Penang, Malaysia  
Phone:+60-4-656-2191  
info@nipponbearing.com.my

NB LINEAR SYSTEMS

General Catalog

No.179E

NIPPON BEARING

# NB

## LINEAR SYSTEMS

General Catalog No.179E



NIPPON BEARING



NIPPON BEARING

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NB LINEAR SYSTEMS  
 TECHNICAL INFORMATION Eng-1~54

SLIDE WAY • SLIDE TABLE  
 MINIATURE SLIDE • GONIO WAY ··· A-1~82



BALL SPLINE  
 ROTARY BALL SPLINE  
 STROKE BALL SPLINE  
 BALL SCREW SPLINE ··········· B-1~73



SLIDE BUSH ··········· C-1~147



TOP BALL ··········· D-1~25



STROKE BUSH  
 SLIDE ROTARY BUSH ··· E-1~28



SLIDE SHAFT  
 SHAFT ··········· F-1~36



ACTUATOR ··········· G-1~126



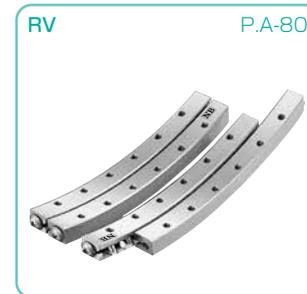
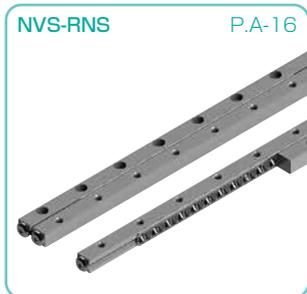
SLIDE SCREW ··········· H-1~7



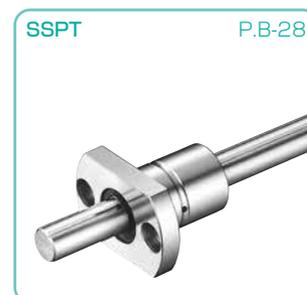
TECHNICAL REFERENCE Tech-1~7  
 INDEX INDEX-1~10

# CONTENTS

SLIDE WAY/SLIDE TABLE/MINIATURE SLIDE/GONIO WAY



BALL SPLINE



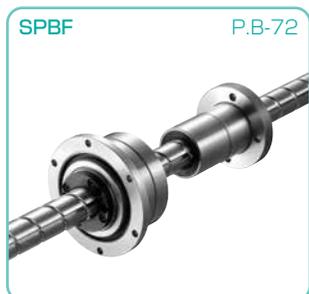
### ROTARY BALL SPLINE



### STROKE BALL SPLINE



### BALL SCREW SPLINE



### SLIDE BUSH



SMF-W P.C- 42  
KBF-W P.C- 94  
SWF-W P.C-114



SMK-W P.C- 44  
KBK-W P.C- 96  
SWK-W P.C-116



SMT-W P.C-46



TRFC P.C-66



TRKC P.C-68



TRF-E P.C-70



SMFC P.C-48  
KBFC P.C-98



SMKC P.C- 50  
KBKC P.C-100



SMTC P.C-52



TRK-E P.C-72



TQF-E P.C-74



TQK-E P.C-76



SMF-W-E P.C-54



SMK-W-E P.C-56



SMT-W-E P.C-58



TQF-W-E P.C-78



TQK-W-E P.C-80



GM P.C-118



TRF P.C-60



TRK P.C-62



TRT P.C-64



GM-W P.C-119



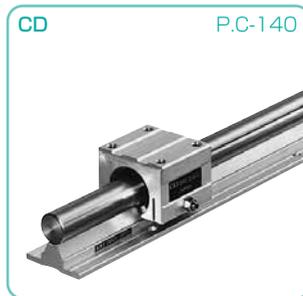
SMA P.C-120



SMA-W P.C-122



TOPBALL

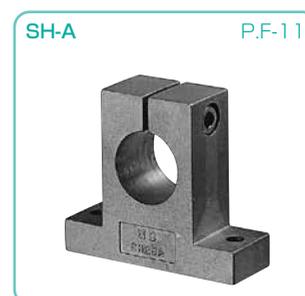
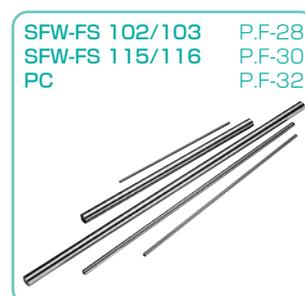
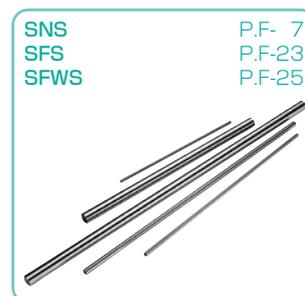




STROKE BUSH / SLIDE ROTARY BUSH



SLIDE SHAFT / SHAFT

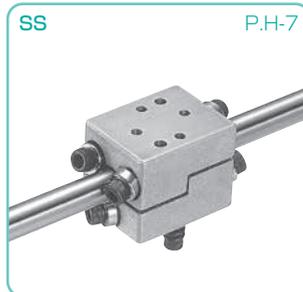




**ACTUATOR**



**SLIDE SCREW**



# NB LINEAR SYSTEMS ENGINEERING INFORMATION

**NB LINEAR SYSTEMS**

ADVANTAGES ..... Eng-2  
 PROCESS FOR SELECTING NB LINEAR SYSTEMS ..... Eng-3  
 ALLOWABLE LOAD ..... Eng-4  
 LIFE ..... Eng-5  
 RATED LIFE CALCULATION EXAMPLE 1 ..... Eng-20  
 RATED LIFE CALCULATION EXAMPLE 2 ..... Eng-26  
 RATED LIFE CALCULATION EXAMPLE 3 ..... Eng-32  
 RATED LIFE CALCULATION EXAMPLE 4 ..... Eng-38  
 RATED LIFE CALCULATION EXAMPLE 5 ..... Eng-41  
 RATED LIFE CALCULATION EXAMPLE 6 ..... Eng-44  
 RIGIDITY AND PRELOAD ..... Eng-48  
 FRICTIONAL RESISTANCE AND REQUIRED THRUST ..... Eng-49  
 OPERATING ENVIRONMENT ..... Eng-50  
 LUBRICATION ..... Eng-51  
 NB MAINTENANCE KIT ..... Eng-53  
 PRECAUTIONS FOR HANDLING AND USE ..... Eng-54

# NB LINEAR SYSTEMS

The NB linear systems is a linear motion mechanism which utilizes the rolling motion of ball and/or roller elements. NB offers a wide range of linear motion products of high precision quality that contribute to the size and weight reduction of machinery and equipment.

## ADVANTAGES

### Low Friction and Excellent Response

The dynamic friction of the ball or roller elements is substantially lower than that of full-face surface sliding friction. Since the difference between dynamic and static frictional resistance is small, motion response is excellent in terms of positioning accuracy and in high speed applications with acceleration and deceleration.

### High Precision and Smooth Movement

The NB linear systems is designed for the rolling elements to achieve extremely smooth motion. The raceway surface is finished by precision grinding for high precision movement with optimal clearance.

### High Load Capacity and Long Travel Life

Despite the compactness of the NB linear systems, the system uses relatively large rolling elements on a long raceway resulting in a high load capacity and a long travel life.

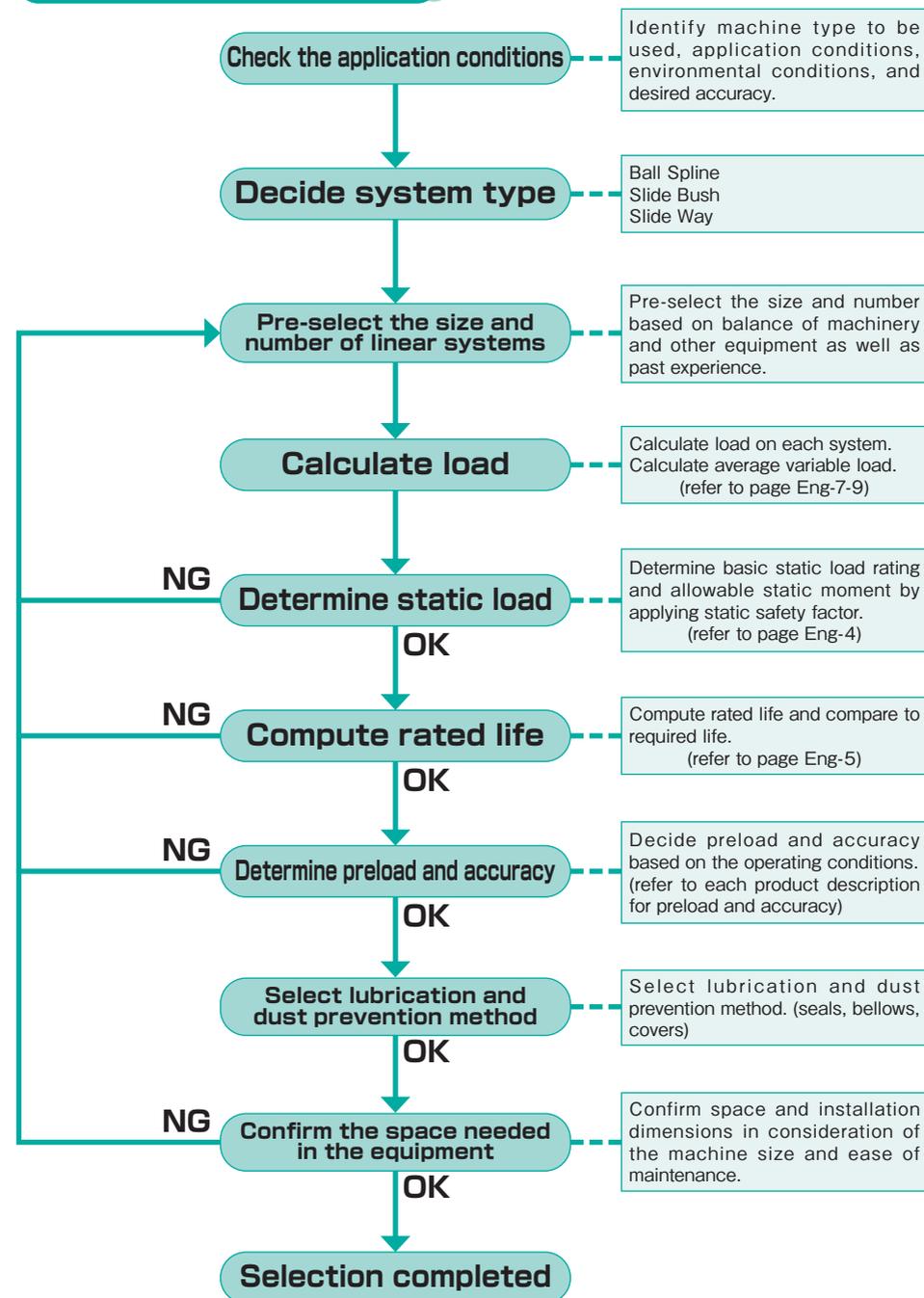
### Ease of Installation

The NB linear systems shortens machining and assembly time compared with that of a full-face surface sliding bearing.

### Variety of Types

A wide variety of types and sizes of the NB linear systems are available to best serve the purpose for every application and requirement.

## PROCESS FOR SELECTING NB LINEAR SYSTEMS



ALLOWABLE LOAD

Load and Moment

A load is applied to the linear systems as Figure 1-1 shows. Sometimes moment loads are applied to, for example, slide guides. Load and moment are defined as follows.

Basic Static Load Rating (compliant with ISO14728-2\*) and Allowable Static Moment

When excess load or impact load is applied to the linear systems while it is stationary or moving slowly, a permanent deformation occurs on the rolling elements and the race way.

If this deformation exceeds a certain limit, it causes vibration and noise during operation resulting in a non-smooth motion and a shorter life time. To prevent this permanent deformation and deterioration in motion accuracy, the basic static load rating (C<sub>0</sub>) is given as the allowable load for the linear systems. This basic static load rating is defined as the static load that results in the maximum allowable stress at the center of the contact surface between the rolling elements and the race way. The sum of the permanent deformation of the rolling element and that of the race way is 0.0001 time the diameter of the rolling element. In the linear systems, a moment load may be present in addition to the static load. The allowable static moments are defined by M<sub>P</sub>, M<sub>Y</sub>, and M<sub>R</sub> as illustrated in Figure 1-1.

\*1: This does not apply to some products.

Allowable Load and Static Safety Factor

The basic static load rating and allowable static moment define the maximum static load in each direction, however, these maximum static loads are not necessarily applicable depending on the operating conditions, the mounting accuracy, and the required motion accuracy. Therefore, an allowable load with a safety factor must be obtained. The minimum static safety factor is listed in Table 1-1.

Allowable Load

$$P_{max} \leq C_0 / f_s \dots\dots\dots (1)$$

Allowable Moment

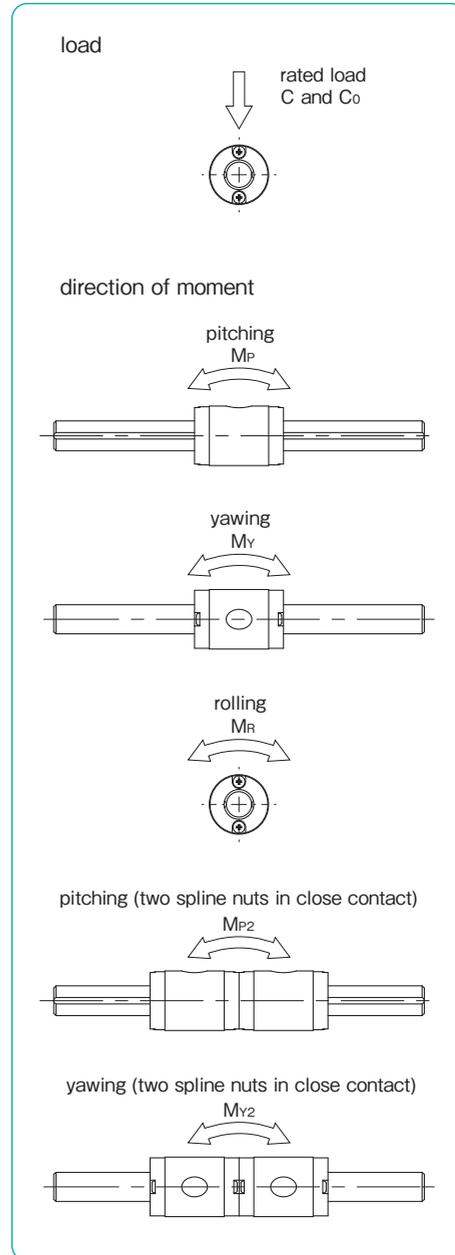
$$M_{max} \leq (M_P, M_Y, M_R, M_{P2}, M_{Y2}) / f_s \dots\dots (2)$$

f<sub>s</sub>: static safety factor C<sub>0</sub>: basic static load rating (N)  
 P<sub>max</sub>: allowable load (N)  
 M<sub>P</sub>, M<sub>R</sub>, M<sub>Y</sub>, M<sub>P2</sub>, M<sub>Y2</sub>: allowable static moment (N · m)  
 M<sub>max</sub>: allowable moment (N · m)

Table 1-1 Minimum Static Safety Factor (f<sub>s</sub>)

operating conditions	static safety factor
normal	1~2
smooth motion required	2~4
vibration/impact loading	3~5

Figure 1-1 Load and Moment



LIFE

Life of a Linear Systems

When a linear systems reciprocates under loading, a continuous stress acts on it, ultimately causing flaking of its race way surface due to material fatigue. The distance a linear system travels before this flaking occurs is defined as the life of the linear system. A linear systems can also become inoperable due to sintering, cracking, pitting, or rusting, however, these causes are differentiated from flaking because they are related to installation accuracy, operating environment, and relubrication method.

Rated Life

Even when a group of linear systems from the same production lot operated under identical conditions, the life time can differ due to differences in the material fatigue failure characteristics. This fact prevents from determining the exact life time of a single linear systems for use. Therefore, the rated life is defined statistically as the distance of 90% of the linear systems travel before causing flaking.

Basic Dynamic Load Rating (compliant with ISO14728-1\*) and Basic Dynamic Torque Rating

The life of a linear systems is expressed in terms of the distance traveled. Therefore, the life of a linear systems is calculated reversely by using the allowable load that achieves a certain travel distance. This allowable load is called the basic dynamic load rating. The basic dynamic load rating is defined as a constant load in weight and direction that can achieve a travel distance of 50x10<sup>3</sup>m on the linear systems. NB assumes the load is applied from the top as a normal radial load, because basic dynamic load ratings change depending on the applied load direction. The basic dynamic load ratings in the dimensional tables are based on this assumption. Ball splines can carry torque loading, so the basic dynamic torque rating is defined for the Ball Spline.

\*2: This does not apply to some products.

Rated Life Estimation

The rated life estimation depends on the type of the rolling element. Equations (3) and (4) are used for the ball element and for the roller element, respectively. Equation (5) is used when torque loading is present.

balls are used as the rolling element

$$L = \left(\frac{C}{P}\right)^3 \cdot 50 \dots\dots\dots (3)$$

rollers are used as the rolling element

$$L = \left(\frac{C}{P}\right)^{10/3} \cdot 50 \dots\dots\dots (4)$$

torque loading is present

$$L = \left(\frac{C_T}{T}\right)^3 \cdot 50 \dots\dots\dots (5)$$

L: rated life (km) C: basic dynamic load rating (N)  
 P: applied load (N) C<sub>T</sub>: basic dynamic torque rating (N · m)  
 T: applied torque (N · m)

In the actual application, numerous variable factors are present such as in guide rail/shaft accuracy, in mounting conditions, in operating conditions, vibration and shock, etc. Therefore, calculating the actual applied load accurately is extremely difficult. In general, the calculation is simplified by using coefficients representing these factors: hardness coefficient (f<sub>H</sub>), temperature coefficient (f<sub>T</sub>), contact coefficient (f<sub>C</sub>), and applied load coefficient (f<sub>w</sub>). Taking these coefficients into account, Equations (3) to (5) become Equations (6) to (8).

balls are used as the rolling element

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

rollers are used as the rolling element

$$L = \left(\frac{f_H \cdot f_T \cdot f_C \cdot C}{f_w \cdot P}\right)^{10/3} \cdot 50 \dots\dots\dots (7)$$

torque loading is present

$$L = \left(\frac{f_H \cdot f_T \cdot f_C \cdot C_T}{f_w \cdot T}\right)^3 \cdot 50 \dots\dots\dots (8)$$

L: rated life (km) f<sub>H</sub>: hardness coefficient  
 f<sub>T</sub>: temperature coefficient f<sub>C</sub>: contact coefficient  
 f<sub>w</sub>: applied load coefficient P: applied load (N)  
 C: basic dynamic load rating (N)  
 C<sub>T</sub>: basic dynamic torque rating (N · m)  
 T: applied torque (N · m)

When the travel distance per unit time is constant, the rated life can be expressed in terms of time (hour). Equation (9) shows the relationship between stroke length, number of cycles per minute, and the life time.

$$L_h = \frac{L \cdot 10^6}{2 \cdot \ell_s \cdot n_1 \cdot 60} \dots\dots\dots (9)$$

L<sub>h</sub>: life time (hr) ℓ<sub>s</sub>: stroke length (mm)  
n<sub>1</sub>: number of cycles per minute (cpm)

Figure 1-2 Hardness Coefficient

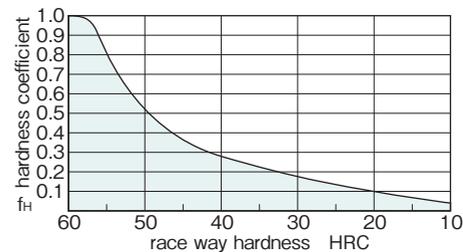


Figure 1-3 Temperature Coefficient

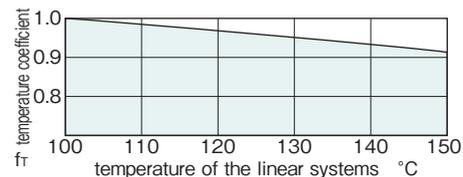


Table 1-2 Contact Coefficient

number of linear bearings in close contact on rail/shaft	contact coefficient f <sub>c</sub>
1	1.00
2	0.81
3	0.72
4	0.66
5	0.61

Table 1-3 Applied Load Coefficient

operating conditions		applied load coefficient f <sub>w</sub>
loading	velocity	
no shock and vibration	0.25 m/s less	1.0~1.5
low shock and vibration	1 m/s less	1.5~2.0
high shock and vibration	1 m/s more	2.0~3.5

•Hardness Coefficient (f<sub>H</sub>)

In the linear systems, the guide rail or shaft works as race way of the rolling elements. Therefore, the hardness of the rail or shaft is an important factor in determining the rated load. The rated load decreases as the hardness decrease below 58HRC. NB products hold appropriate hardness by advanced heat treatment technology. In case of using the rail or shaft of insufficient hardness, please take the hardness coefficient (Figure 1-2) into the life calculation equation.

•Temperature Coefficient (f<sub>T</sub>)

In order to give low wear characteristics NB products are hardened by heat treatment. If the temperature of the linear systems exceeds 100°C, the hardness is decreased by tempering effect, so as the rated load decreases. Figure 1-3 shows the temperature coefficient as hardness changes with temperature.

•Contact Coefficient (f<sub>c</sub>)

When more than one bearing is used in close contact, the contact coefficient should be taken into consideration due to the variation of products and the accuracy of the mounting surface. Table 1-2 shows the contact coefficient for life calculation.

•Applied Load Coefficient (f<sub>w</sub>)

The actual applied load on a liner system can be greater than the calculated load due to impact, vibration, or inertia. Hence, an appropriate applied load coefficient(table 1-3) must be incorporated into a life calculation.

There are separate applied load coefficient tables for TOPBALL products on page D-4.

Calculation of Applied Load (1)

Tables 1-4 and 1-5 show the formulas of applied load calculation for typical applications.

W: applied load (N) P<sub>1</sub> - P<sub>4</sub>: load applied to linear systems (N) X,Y: linear systems span (mm)  
x, y, ℓ: distance to applied load or to working center of gravity (mm) g: gravitational acceleration (9.8 x 10<sup>3</sup>mm/s<sup>2</sup>)  
V: velocity (mm/s) t: acceleration time (sec) t<sub>s</sub>: deceleration time (sec)

Table 1-4 Applied Load Calculation (1)

	condition	applied load calculation formula
under static conditions or constant velocity motion	2 horizontal axes 	
	2 horizontal axes, over-hang 	$P_1 = \frac{1}{4}W + \frac{x_0}{2X}W + \frac{y_0}{2Y}W$ $P_2 = \frac{1}{4}W - \frac{x_0}{2X}W + \frac{y_0}{2Y}W$ $P_3 = \frac{1}{4}W + \frac{x_0}{2X}W - \frac{y_0}{2Y}W$ $P_4 = \frac{1}{4}W - \frac{x_0}{2X}W - \frac{y_0}{2Y}W$ <p>Note : if the calculation results in a negative value, the loading direction is in the opposite direction.</p>
	2 horizontal axes, moving axes 	

Table 1-5 Applied Load Calculation (2)

	condition	applied load calculation formula
under static conditions or constant velocity motion	2 horizontal, side axes 	$P_1=P_2=P_3=P_4=\frac{l_1}{2Y}W$ $P_{1S}=P_{3S}=\frac{1}{4}W+\frac{X_0}{2X}W$ $P_{2S}=P_{4S}=\frac{1}{4}W-\frac{X_0}{2X}W$
	2 vertical axes 	$P_1=P_2=P_3=P_4=\frac{l_1}{2X}W$ $P_{1S}=P_{2S}=P_{3S}=P_{4S}=\frac{l_2}{2X}W$
under constant acceleration conditions	2 horizontal axes 	under acceleration $P_1=P_3=\frac{1}{4}W\left(1+\frac{2V_1l_1}{gt_1X}\right)$ $P_2=P_4=\frac{1}{4}W\left(1-\frac{2V_1l_1}{gt_1X}\right)$ under deceleration $P_1=P_3=\frac{1}{4}W\left(1-\frac{2V_1l_1}{gt_3X}\right)$ $P_2=P_4=\frac{1}{4}W\left(1+\frac{2V_1l_1}{gt_3X}\right)$ under constant velocity $P_1=P_2=P_3=P_4=\frac{1}{4}W$ ※g: acceleration of gravity (9.8 × 10 <sup>3</sup> mm/sec <sup>2</sup> )

• Equivalent Coefficient

The linear systems are generally used with two axes, each axis with a couple of bearings installed. However, due to a space limitation, there must be an application in which one axis with one or two bearings in close contact installed. In such a case, multiply the applied moment by the equivalent moment coefficient shown in Tables 1-7~1-28 for applied load calculation. The following is a formula for calculating the equivalent moment load when a moment is applied to the linear systems.

$P=E \cdot M$

P: equivalent moment load per bearing (N)  
 E: equivalent moment coefficient  
 M: applied moment (N · mm)

Calculation of Applied Load (2)

Table 1-6 shows the formulas for determining the applied load when moment is applied to the linear systems.

W: applied load (N) P: load applied to the linear system (N) l: distance to applied load or to working center of gravity (mm)

Table 1-6 Applied Load Calculation (3)

	condition	applied load calculation formula
1 axis application	1 horizontal axis, 1 bearing 	$P=W+E_{P1}Wl_1+E_{R1}Wl_2$ E <sub>P1</sub> : M <sub>P</sub> equivalent coefficient with 1 bearing used E <sub>R</sub> : M <sub>R</sub> equivalent coefficient
	1 sideways axis, 1 bearing 	$P=W+E_{V1}Wl_1+E_{R1}Wl_2$ E <sub>V1</sub> : M <sub>V</sub> equivalent coefficient with 1 bearing used E <sub>R</sub> : M <sub>R</sub> equivalent coefficient
	1 vertical axis, 1 bearing 	$P=E_{P1}Wl_1+E_{V1}Wl_2$ E <sub>P1</sub> : M <sub>P</sub> equivalent coefficient with 1 bearing used E <sub>V1</sub> : M <sub>V</sub> equivalent coefficient with 1 bearing used
2 axes application	2 horizontal axes, 1 bearing each 	$P=W/2+Wl_2/Y+E_{P1}Wl_1/2$ E <sub>P1</sub> : M <sub>P</sub> equivalent coefficient with 1 bearing used Y: span between the two axes centers
	2 sideways axes, 1 bearing each 	$P=W/2+E_{V1}Wl_2/2+Wl_1/Y$ E <sub>V1</sub> : M <sub>V</sub> equivalent coefficient with 1 bearing used Y: span between the two axes centers
	2 vertical axes, 1 bearing each 	$P=E_{P1}Wl_1/2+E_{V1}Wl_2/2$ E <sub>P1</sub> : M <sub>P</sub> equivalent coefficient with 1 bearing used E <sub>V1</sub> : M <sub>V</sub> equivalent coefficient with 1 bearing used

Table 1-7 Ball Spline (1) · Rotary Ball Spline (1) unit: 1/mm

part number				equivalent coefficient		
				E <sub>1</sub>	E <sub>2</sub>	E <sub>T</sub>
<b>SSP 4</b>	—	—	—	$6.19 \times 10^{-1}$	$1.18 \times 10^{-1}$	1.16
<b>SSP 6</b>	<b>SPR 6</b>	—	<b>SPB 6KP</b>	$4.47 \times 10^{-1}$	$5.70 \times 10^{-2}$	$9.50 \times 10^{-1}$
<b>SSP 8</b>	<b>SPR 8</b>	—	<b>SPB 8KP</b>	$3.88 \times 10^{-1}$	$5.74 \times 10^{-2}$	$7.76 \times 10^{-1}$
<b>SSP 10</b>	<b>SPR 10</b>	—	<b>SPB 10KP</b>	$2.82 \times 10^{-1}$	$4.37 \times 10^{-2}$	$6.18 \times 10^{-1}$
<b>SSP 13A</b>	<b>SPR 13</b>	—	<b>SPB 13KP</b>	$3.57 \times 10^{-1}$	$4.49 \times 10^{-2}$	$1.25 \times 10^{-1}$
<b>SSP 16A</b>	<b>SPR 16</b>	<b>SPB 16</b>	<b>SPB 16KP</b>	$2.43 \times 10^{-1}$	$3.75 \times 10^{-2}$	$1.02 \times 10^{-1}$
<b>SSP 20A</b>	<b>SPR 20A</b>	<b>SPB 20</b>	<b>SPB 20KP</b>	$1.48 \times 10^{-1}$	$2.91 \times 10^{-2}$	$8.40 \times 10^{-2}$
<b>SSP 25A</b>	<b>SPR 25A</b>	<b>SPB 25</b>	<b>SPB 25KP</b>	$1.37 \times 10^{-1}$	$2.29 \times 10^{-2}$	$6.76 \times 10^{-2}$
<b>SSP 30A</b>	<b>SPR 30A</b>	—	—	$1.28 \times 10^{-1}$	$1.58 \times 10^{-2}$	$5.28 \times 10^{-2}$
<b>SSP 40A</b>	<b>SPR 40A</b>	—	—	$1.05 \times 10^{-1}$	$1.28 \times 10^{-2}$	$4.01 \times 10^{-2}$
<b>SSP 50A</b>	<b>SPR 50A</b>	—	—	$9.41 \times 10^{-2}$	$1.59 \times 10^{-2}$	$2.20 \times 10^{-2}$
<b>SSP 60A</b>	<b>SPR 60A</b>	—	—	$9.02 \times 10^{-2}$	$1.45 \times 10^{-2}$	$2.32 \times 10^{-2}$
<b>SSP 80A</b>	—	—	—	$5.43 \times 10^{-2}$	$1.03 \times 10^{-2}$	$1.67 \times 10^{-2}$
<b>SSP 80AL</b>	—	—	—	$3.76 \times 10^{-2}$	$7.72 \times 10^{-3}$	$1.67 \times 10^{-2}$
<b>SSP100A</b>	—	—	—	$4.78 \times 10^{-2}$	$8.79 \times 10^{-3}$	$1.33 \times 10^{-2}$
<b>SSP100AL</b>	—	—	—	$3.33 \times 10^{-2}$	$6.74 \times 10^{-3}$	$1.33 \times 10^{-2}$
<b>SSP 20</b>	<b>SPR 20</b>	—	—	$1.79 \times 10^{-1}$	$2.26 \times 10^{-2}$	$8.50 \times 10^{-2}$
<b>SSP 25</b>	<b>SPR 25</b>	—	—	$1.55 \times 10^{-1}$	$1.94 \times 10^{-2}$	$6.74 \times 10^{-2}$
<b>SSP 30</b>	<b>SPR 30</b>	—	—	$1.28 \times 10^{-1}$	$1.58 \times 10^{-2}$	$5.63 \times 10^{-2}$
<b>SSP 40</b>	<b>SPR 40</b>	—	—	$1.05 \times 10^{-1}$	$1.28 \times 10^{-2}$	$4.25 \times 10^{-2}$
<b>SSP 50</b>	<b>SPR 50</b>	—	—	$1.07 \times 10^{-1}$	$1.69 \times 10^{-2}$	$2.33 \times 10^{-2}$
<b>SSP 60</b>	<b>SPR 60</b>	—	—	$9.77 \times 10^{-2}$	$1.44 \times 10^{-2}$	$2.65 \times 10^{-2}$

E<sub>1</sub>: equivalent moment coefficient with 1 nut used E<sub>2</sub>: equivalent moment coefficient with 2 nuts used in close contact  
E<sub>T</sub>: torque equivalent coefficient

Table 1-8 Ball Spline (2) unit: 1/mm

part number	equivalent coefficient				
	E <sub>P1</sub>	E <sub>P2</sub>	E <sub>Y1</sub>	E <sub>Y2</sub>	E <sub>T</sub>
<b>SSP 4AM</b>	$7.42 \times 10^{-1}$	$1.30 \times 10^{-1}$	$4.25 \times 10^{-1}$	$7.53 \times 10^{-2}$	$4.38 \times 10^{-1}$
<b>SSP 5AM</b>	$5.52 \times 10^{-1}$	$8.66 \times 10^{-2}$	$4.53 \times 10^{-1}$	$7.12 \times 10^{-2}$	$2.86 \times 10^{-1}$
<b>SSP 6AM</b>	$5.06 \times 10^{-1}$	$7.82 \times 10^{-2}$	$4.15 \times 10^{-1}$	$6.42 \times 10^{-2}$	$2.45 \times 10^{-1}$
<b>SSP 8AM</b>	$4.40 \times 10^{-1}$	$6.51 \times 10^{-2}$	$3.62 \times 10^{-1}$	$5.36 \times 10^{-2}$	$1.84 \times 10^{-1}$
<b>SSP 10AM</b>	$3.66 \times 10^{-1}$	$5.47 \times 10^{-2}$	$3.01 \times 10^{-1}$	$4.49 \times 10^{-2}$	$1.48 \times 10^{-1}$

E<sub>P1</sub>: M<sub>P</sub> equivalent coefficient with 1 nut used E<sub>P2</sub>: M<sub>P</sub> equivalent coefficient with 2 nuts used in close contact  
E<sub>Y1</sub>: M<sub>Y</sub> equivalent coefficient with 1 nut used E<sub>Y2</sub>: M<sub>Y</sub> equivalent coefficient with 2 nuts used in close contact  
E<sub>T</sub>: torque equivalent coefficient

Table 1-9 Stroke Ball Spline unit: 1/mm

part number	equivalent coefficient		
	E <sub>1</sub>	E <sub>2</sub>	E <sub>T</sub>
<b>SPLFS 6</b>	$2.68 \times 10^{-1}$	$6.67 \times 10^{-1}$	$7.89 \times 10^{-1}$
<b>SPLFS 8</b>	$2.57 \times 10^{-1}$	$6.48 \times 10^{-2}$	$6.13 \times 10^{-1}$
<b>SPLFS 10</b>	$2.09 \times 10^{-1}$	$5.25 \times 10^{-2}$	$4.91 \times 10^{-1}$
<b>SPLFS 13</b>	$1.96 \times 10^{-1}$	$4.90 \times 10^{-2}$	$1.50 \times 10^{-1}$
<b>SPLFS 16</b>	$1.59 \times 10^{-1}$	$3.97 \times 10^{-2}$	$1.22 \times 10^{-1}$

E<sub>1</sub>: equivalent moment coefficient with 1 nut used E<sub>2</sub>: equivalent moment coefficient with 2 nuts used in close contact  
E<sub>T</sub>: torque equivalent coefficient

Table 1-10 Rotary Ball Spline (2) · Ball Screw Spline unit: 1/mm

part number	equivalent coefficient E <sub>RM</sub>	part number	equivalent coefficient E <sub>RM</sub>
<b>SPR 8</b>	$1.29 \times 10^{-1}$	<b>SPB 20</b>	$1.71 \times 10^{-2}$
<b>SPR 10</b>	$1.03 \times 10^{-1}$	<b>SPB 25</b>	$1.47 \times 10^{-2}$
<b>SPR 13</b>	$6.78 \times 10^{-2}$	<b>SPB 6KP</b>	$7.62 \times 10^{-2}$
<b>SPR 16</b>	$5.45 \times 10^{-2}$	<b>SPB 8KP</b>	$6.78 \times 10^{-2}$
<b>SPR 20A</b>	$4.48 \times 10^{-2}$	<b>SPB 10KP</b>	$5.92 \times 10^{-2}$
<b>SPR 25A</b>	$3.55 \times 10^{-2}$	<b>SPB 13KP</b>	$4.78 \times 10^{-2}$
<b>SPR 30A</b>	$3.25 \times 10^{-2}$	<b>SPB 16KP</b>	$3.89 \times 10^{-2}$
<b>SPR 40A</b>	$2.60 \times 10^{-2}$	<b>SPB 20KP</b>	$3.42 \times 10^{-2}$
<b>SPR 50A</b>	$2.16 \times 10^{-2}$	<b>SPB 25KP</b>	$2.84 \times 10^{-2}$
<b>SPR 60A</b>	$1.86 \times 10^{-2}$	<b>BSB 16</b>	$1.20 \times 10^{-2}$
<b>SPR 20</b>	$4.93 \times 10^{-2}$	<b>BSB 20</b>	$9.47 \times 10^{-3}$
<b>SPR 25</b>	$3.89 \times 10^{-2}$	<b>BSB 25</b>	$8.10 \times 10^{-3}$
<b>SPR 30</b>	$3.25 \times 10^{-2}$	<b>BSB 16KP</b>	$2.21 \times 10^{-2}$
<b>SPR 40</b>	$2.60 \times 10^{-2}$	<b>BSB 20KP</b>	$1.89 \times 10^{-2}$
<b>SPR 50</b>	$2.26 \times 10^{-2}$	<b>BSB 25KP</b>	$1.57 \times 10^{-2}$
<b>SPR 60</b>	$2.00 \times 10^{-2}$		

E<sub>RM</sub>: rotational portion equivalent coefficient

Table 1-11 Slide Bush SM·TQF type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>SM 3</b>	1.24	2.13×10 <sup>-1</sup>
<b>SM 4</b>	1.21	1.78×10 <sup>-1</sup>
<b>SM 5</b>	8.96×10 <sup>-1</sup>	1.40×10 <sup>-1</sup>
<b>SM 6</b>	7.29×10 <sup>-1</sup>	1.09×10 <sup>-1</sup>
<b>SM 8s</b>	7.19×10 <sup>-1</sup>	1.20×10 <sup>-1</sup>
<b>SM 8</b>	5.46×10 <sup>-1</sup>	8.42×10 <sup>-2</sup>
<b>SM 10</b>	4.55×10 <sup>-1</sup>	7.02×10 <sup>-2</sup>
<b>SM 12</b>	4.32×10 <sup>-1</sup>	6.64×10 <sup>-2</sup>
<b>SM 13</b>	4.06×10 <sup>-1</sup>	6.21×10 <sup>-2</sup>
<b>SM 16/TQF 16</b>	3.59×10 <sup>-1</sup>	5.46×10 <sup>-2</sup>
<b>SM 20/TQF 20</b>	3.07×10 <sup>-1</sup>	4.70×10 <sup>-2</sup>
<b>SM 25/TQF 25</b>	2.17×10 <sup>-1</sup>	3.33×10 <sup>-2</sup>
<b>SM 30/TQF 30</b>	1.99×10 <sup>-1</sup>	3.07×10 <sup>-2</sup>
<b>SM 35/TQF 35</b>	1.71×10 <sup>-1</sup>	2.70×10 <sup>-2</sup>
<b>SM 40/TQF 40</b>	1.64×10 <sup>-1</sup>	2.51×10 <sup>-2</sup>
<b>SM 50</b>	1.20×10 <sup>-1</sup>	1.89×10 <sup>-2</sup>
<b>SM 60</b>	1.13×10 <sup>-1</sup>	1.75×10 <sup>-2</sup>
<b>SM 80</b>	8.18×10 <sup>-2</sup>	1.36×10 <sup>-2</sup>
<b>SM100</b>	6.66×10 <sup>-2</sup>	1.11×10 <sup>-2</sup>
<b>SM120</b>	5.63×10 <sup>-2</sup>	9.38×10 <sup>-3</sup>
<b>SM150</b>	4.62×10 <sup>-2</sup>	7.71×10 <sup>-3</sup>

E<sub>1</sub>: equivalent coefficient with 1 bush used  
E<sub>2</sub>: equivalent coefficient with 2 bushes used in close contact

Table 1-12 Slide Bush SM-G-L type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>SM 6G-LUU</b>	4.14×10 <sup>-1</sup>	7.39×10 <sup>-2</sup>
<b>SM 8G-LUU</b>	3.17×10 <sup>-1</sup>	5.90×10 <sup>-2</sup>
<b>SM10G-LUU</b>	2.53×10 <sup>-1</sup>	4.78×10 <sup>-2</sup>
<b>SM12G-LUU</b>	2.28×10 <sup>-1</sup>	4.47×10 <sup>-2</sup>
<b>SM13G-LUU</b>	2.03×10 <sup>-1</sup>	4.03×10 <sup>-2</sup>
<b>SM16G-LUU</b>	1.78×10 <sup>-1</sup>	3.45×10 <sup>-2</sup>
<b>SM20G-LUU</b>	1.53×10 <sup>-1</sup>	3.06×10 <sup>-2</sup>
<b>SM25G-LUU</b>	1.09×10 <sup>-1</sup>	2.17×10 <sup>-2</sup>
<b>SM30G-LUU</b>	9.59×10 <sup>-2</sup>	1.97×10 <sup>-2</sup>

E<sub>1</sub>: equivalent coefficient with 1 bush used  
E<sub>2</sub>: equivalent coefficient with 2 bushes used in close contact

Table 1-13 Slide Bush SM-W·TQF-W type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>SM 3W</b>	4.12×10 <sup>-1</sup>	—
<b>SM 4W</b>	4.03×10 <sup>-1</sup>	—
<b>SM 5W</b>	2.99×10 <sup>-1</sup>	—
<b>SM 6W</b>	2.43×10 <sup>-1</sup>	—
<b>SM 8W</b>	1.82×10 <sup>-1</sup>	—
<b>SM 10W</b>	1.52×10 <sup>-1</sup>	—
<b>SM 12W</b>	1.44×10 <sup>-1</sup>	—
<b>SM 13W</b>	1.35×10 <sup>-1</sup>	—
<b>SM 16W/TQF 16W</b>	1.19×10 <sup>-1</sup>	—
<b>SM 20W/TQF 20W</b>	1.02×10 <sup>-1</sup>	—
<b>SM 25W/TQF 25W</b>	7.24×10 <sup>-2</sup>	—
<b>SM 30W/TQF 30W</b>	6.63×10 <sup>-2</sup>	—
<b>SM 35W/TQF 35W</b>	5.70×10 <sup>-2</sup>	—
<b>SM 40W/TQF 40W</b>	5.47×10 <sup>-2</sup>	—
<b>SM 50W</b>	4.01×10 <sup>-2</sup>	—
<b>SM 60W</b>	3.77×10 <sup>-2</sup>	—

E<sub>1</sub>: equivalent coefficient with 1 bush used

Table 1-14 Slide Bush TRF type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>TRF 6</b>	6.46×10 <sup>-2</sup>	—
<b>TRF 8</b>	4.90×10 <sup>-2</sup>	—
<b>TRF10</b>	4.07×10 <sup>-2</sup>	—
<b>TRF12</b>	3.92×10 <sup>-2</sup>	—
<b>TRF13</b>	3.66×10 <sup>-2</sup>	—
<b>TRF16</b>	3.20×10 <sup>-2</sup>	—
<b>TRF20</b>	2.80×10 <sup>-2</sup>	—
<b>TRF25</b>	2.00×10 <sup>-2</sup>	—
<b>TRF30</b>	1.85×10 <sup>-2</sup>	—
<b>TRF35</b>	1.68×10 <sup>-2</sup>	—
<b>TRF40</b>	1.45×10 <sup>-2</sup>	—
<b>TRF50</b>	1.16×10 <sup>-2</sup>	—
<b>TRF60</b>	1.11×10 <sup>-2</sup>	—

E<sub>1</sub>: equivalent coefficient with 1 bush used

Table 1-15 Slide Bush KB type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>KB 3</b>	1.28	2.13×10 <sup>-1</sup>
<b>KB 4</b>	1.05	1.75×10 <sup>-1</sup>
<b>KB 5</b>	5.40×10 <sup>-1</sup>	9.00×10 <sup>-2</sup>
<b>KB 8</b>	5.61×10 <sup>-1</sup>	8.00×10 <sup>-2</sup>
<b>KB10</b>	4.21×10 <sup>-1</sup>	7.02×10 <sup>-2</sup>
<b>KB12</b>	4.02×10 <sup>-1</sup>	6.20×10 <sup>-2</sup>
<b>KB16</b>	3.77×10 <sup>-1</sup>	5.73×10 <sup>-2</sup>
<b>KB20</b>	3.29×10 <sup>-1</sup>	4.49×10 <sup>-2</sup>
<b>KB25</b>	2.14×10 <sup>-1</sup>	3.37×10 <sup>-2</sup>
<b>KB30</b>	2.08×10 <sup>-1</sup>	2.96×10 <sup>-2</sup>
<b>KB40</b>	1.64×10 <sup>-1</sup>	2.51×10 <sup>-2</sup>
<b>KB50</b>	1.20×10 <sup>-1</sup>	1.89×10 <sup>-2</sup>
<b>KB60</b>	1.21×10 <sup>-1</sup>	1.55×10 <sup>-2</sup>
<b>KB80</b>	7.34×10 <sup>-2</sup>	1.22×10 <sup>-2</sup>
<b>KB 8W</b>	1.87×10 <sup>-1</sup>	—
<b>KB12W</b>	1.34×10 <sup>-1</sup>	—
<b>KB16W</b>	1.25×10 <sup>-1</sup>	—
<b>KB20W</b>	1.10×10 <sup>-1</sup>	—
<b>KB25W</b>	7.14×10 <sup>-2</sup>	—
<b>KB30W</b>	6.96×10 <sup>-2</sup>	—
<b>KB40W</b>	5.47×10 <sup>-2</sup>	—
<b>KB50W</b>	4.02×10 <sup>-2</sup>	—
<b>KB60W</b>	4.11×10 <sup>-2</sup>	—

E<sub>1</sub>: equivalent coefficient with 1 bush used  
E<sub>2</sub>: equivalent coefficient with 2 bushes used in close contact

Table 1-16 Slide Bush GM type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>GM 6</b>	6.43×10 <sup>-1</sup>	1.08×10 <sup>-1</sup>
<b>GM 8</b>	4.92×10 <sup>-1</sup>	8.20×10 <sup>-2</sup>
<b>GM10</b>	4.21×10 <sup>-1</sup>	7.01×10 <sup>-2</sup>
<b>GM12</b>	3.85×10 <sup>-1</sup>	6.42×10 <sup>-2</sup>
<b>GM13</b>	3.78×10 <sup>-1</sup>	6.29×10 <sup>-2</sup>
<b>GM16</b>	3.25×10 <sup>-1</sup>	5.42×10 <sup>-2</sup>
<b>GM20</b>	2.75×10 <sup>-1</sup>	4.58×10 <sup>-2</sup>
<b>GM25</b>	1.98×10 <sup>-1</sup>	3.30×10 <sup>-2</sup>
<b>GM30</b>	1.82×10 <sup>-1</sup>	3.03×10 <sup>-2</sup>

E<sub>1</sub>: equivalent coefficient with 1 bush used  
E<sub>2</sub>: equivalent coefficient with 2 bushes used in close contact

Table 1-17 Slide Bush SW type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>SWS 2</b>	8.90×10 <sup>-1</sup>	1.48×10 <sup>-1</sup>
<b>SWS 3</b>	8.01×10 <sup>-1</sup>	1.33×10 <sup>-1</sup>
<b>SW 4</b>	7.95×10 <sup>-1</sup>	1.05×10 <sup>-1</sup>
<b>SW 6</b>	6.98×10 <sup>-1</sup>	9.75×10 <sup>-2</sup>
<b>SW 8</b>	4.09×10 <sup>-1</sup>	6.23×10 <sup>-2</sup>
<b>SW10</b>	3.54×10 <sup>-1</sup>	5.33×10 <sup>-2</sup>
<b>SW12</b>	3.10×10 <sup>-1</sup>	4.76×10 <sup>-2</sup>
<b>SW16</b>	2.29×10 <sup>-1</sup>	3.40×10 <sup>-2</sup>
<b>SW20</b>	1.94×10 <sup>-1</sup>	3.01×10 <sup>-2</sup>
<b>SW24</b>	1.69×10 <sup>-1</sup>	2.59×10 <sup>-2</sup>
<b>SW32</b>	1.19×10 <sup>-1</sup>	1.87×10 <sup>-2</sup>
<b>SW40</b>	9.23×10 <sup>-2</sup>	1.54×10 <sup>-2</sup>
<b>SW48</b>	7.84×10 <sup>-2</sup>	1.31×10 <sup>-2</sup>
<b>SW64</b>	5.47×10 <sup>-2</sup>	9.11×10 <sup>-3</sup>
<b>SW 4W</b>	2.65×10 <sup>-1</sup>	—
<b>SW 6W</b>	2.33×10 <sup>-1</sup>	—
<b>SW 8W</b>	1.37×10 <sup>-1</sup>	—
<b>SW10W</b>	1.18×10 <sup>-1</sup>	—
<b>SW12W</b>	1.03×10 <sup>-1</sup>	—
<b>SW16W</b>	7.62×10 <sup>-2</sup>	—
<b>SW20W</b>	6.47×10 <sup>-2</sup>	—
<b>SW24W</b>	5.62×10 <sup>-2</sup>	—
<b>SW32W</b>	3.98×10 <sup>-2</sup>	—

E<sub>1</sub>: equivalent coefficient with 1 bush used  
E<sub>2</sub>: equivalent coefficient with 2 bushes used in close contact

Table 1-18 Slide Bush GM-W type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>GM 6W</b>	3.54×10 <sup>-1</sup>	6.53×10 <sup>-2</sup>
<b>GM 8W</b>	2.38×10 <sup>-1</sup>	4.96×10 <sup>-2</sup>
<b>GM10W</b>	2.20×10 <sup>-1</sup>	4.50×10 <sup>-2</sup>
<b>GM12W</b>	2.07×10 <sup>-1</sup>	3.81×10 <sup>-2</sup>
<b>GM13W</b>	1.94×10 <sup>-1</sup>	3.76×10 <sup>-2</sup>
<b>GM16W</b>	1.71×10 <sup>-1</sup>	3.44×10 <sup>-2</sup>
<b>GM20W</b>	1.37×10 <sup>-1</sup>	2.69×10 <sup>-2</sup>
<b>GM25W</b>	9.03×10 <sup>-2</sup>	1.94×10 <sup>-2</sup>
<b>GM30W</b>	9.55×10 <sup>-2</sup>	1.78×10 <sup>-2</sup>

E<sub>1</sub>: equivalent coefficient with 1 bush used  
E<sub>2</sub>: equivalent coefficient with 2 bushes used in close contact

Table 1-19 TOPBALL TK type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>TK 8</b>	4.91 × 10 <sup>-1</sup>	8.18 × 10 <sup>-2</sup>
<b>TK10</b>	4.17 × 10 <sup>-1</sup>	6.95 × 10 <sup>-2</sup>
<b>TK12</b>	3.70 × 10 <sup>-1</sup>	6.17 × 10 <sup>-2</sup>
<b>TK16</b>	3.30 × 10 <sup>-1</sup>	5.49 × 10 <sup>-2</sup>
<b>TK20</b>	2.55 × 10 <sup>-1</sup>	4.24 × 10 <sup>-2</sup>
<b>TK25</b>	1.90 × 10 <sup>-1</sup>	3.16 × 10 <sup>-2</sup>
<b>TK30</b>	1.66 × 10 <sup>-1</sup>	2.76 × 10 <sup>-2</sup>
<b>TK40</b>	1.42 × 10 <sup>-1</sup>	2.36 × 10 <sup>-2</sup>
<b>TK50</b>	1.11 × 10 <sup>-1</sup>	1.84 × 10 <sup>-2</sup>

E<sub>1</sub>: equivalent coefficient with 1 bush used  
E<sub>2</sub>: equivalent coefficient with 2 bushes used in close contact

Table 1-20 TOPBALL TW type unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>TW 3</b>	8.70 × 10 <sup>-1</sup>	1.45 × 10 <sup>-1</sup>
<b>TW 4</b>	6.57 × 10 <sup>-1</sup>	1.09 × 10 <sup>-1</sup>
<b>TW 6</b>	5.17 × 10 <sup>-1</sup>	8.60 × 10 <sup>-2</sup>
<b>TW 8</b>	3.55 × 10 <sup>-1</sup>	5.90 × 10 <sup>-2</sup>
<b>TW10</b>	3.00 × 10 <sup>-1</sup>	5.00 × 10 <sup>-2</sup>
<b>TW12</b>	2.66 × 10 <sup>-1</sup>	4.40 × 10 <sup>-2</sup>
<b>TW16</b>	1.90 × 10 <sup>-1</sup>	3.10 × 10 <sup>-2</sup>
<b>TW20</b>	1.66 × 10 <sup>-1</sup>	2.70 × 10 <sup>-2</sup>
<b>TW24</b>	1.44 × 10 <sup>-1</sup>	2.40 × 10 <sup>-2</sup>
<b>TW32</b>	1.08 × 10 <sup>-1</sup>	1.80 × 10 <sup>-2</sup>

E<sub>1</sub>: equivalent coefficient with 1 bush used  
E<sub>2</sub>: equivalent coefficient with 2 bushes used in close contact

Table 1-21 Slide Rotary Bush unit : 1/mm

part number	equivalent coefficient	
	E <sub>1</sub>	E <sub>2</sub>
<b>SRE 6</b>	6.83 × 10 <sup>-1</sup>	1.14 × 10 <sup>-1</sup>
<b>SRE 8</b>	4.98 × 10 <sup>-1</sup>	8.31 × 10 <sup>-2</sup>
<b>SRE10</b>	4.12 × 10 <sup>-1</sup>	6.86 × 10 <sup>-2</sup>
<b>SRE12</b>	4.19 × 10 <sup>-1</sup>	6.98 × 10 <sup>-2</sup>
<b>SRE13</b>	3.93 × 10 <sup>-1</sup>	6.54 × 10 <sup>-2</sup>
<b>SRE16</b>	3.40 × 10 <sup>-1</sup>	5.66 × 10 <sup>-2</sup>
<b>SRE20</b>	2.90 × 10 <sup>-1</sup>	4.84 × 10 <sup>-2</sup>
<b>SRE25</b>	1.98 × 10 <sup>-1</sup>	3.29 × 10 <sup>-2</sup>
<b>SRE30</b>	1.80 × 10 <sup>-1</sup>	3.01 × 10 <sup>-2</sup>
<b>SRE40</b>	1.52 × 10 <sup>-1</sup>	2.54 × 10 <sup>-2</sup>
<b>RK12</b>	4.32 × 10 <sup>-1</sup>	6.64 × 10 <sup>-2</sup>
<b>RK16</b>	3.59 × 10 <sup>-1</sup>	5.46 × 10 <sup>-2</sup>
<b>RK20</b>	3.07 × 10 <sup>-1</sup>	4.70 × 10 <sup>-2</sup>
<b>RK25</b>	2.17 × 10 <sup>-1</sup>	3.33 × 10 <sup>-2</sup>
<b>RK30</b>	1.99 × 10 <sup>-1</sup>	3.07 × 10 <sup>-2</sup>

E<sub>1</sub>: equivalent coefficient with 1 bush used  
E<sub>2</sub>: equivalent coefficient with 2 bushes used in close contact

Table 1-22(1) Slide Table NVT type (1) unit : 1/mm

part number	equivalent coefficient		
	E <sub>P</sub>	E <sub>Y</sub>	E <sub>R</sub>
<b>NVT1025</b>	2.28 × 10 <sup>-1</sup>	2.67 × 10 <sup>-1</sup>	1.48 × 10 <sup>-1</sup>
<b>NVT1035</b>	9.77 × 10 <sup>-1</sup>	4.00 × 10 <sup>-1</sup>	8.99 × 10 <sup>-1</sup>
<b>NVT1045</b>	2.81 × 10 <sup>-1</sup>	2.47 × 10 <sup>-1</sup>	3.33 × 10 <sup>-1</sup>
<b>NVT1055</b>	2.42 × 10 <sup>-1</sup>	2.03 × 10 <sup>-1</sup>	3.57 × 10 <sup>-1</sup>
<b>NVT1065</b>	1.71 × 10 <sup>-1</sup>	1.59 × 10 <sup>-1</sup>	2.79 × 10 <sup>-1</sup>
<b>NVT1075</b>	1.54 × 10 <sup>-1</sup>	1.39 × 10 <sup>-1</sup>	2.98 × 10 <sup>-1</sup>
<b>NVT1085</b>	1.25 × 10 <sup>-1</sup>	1.17 × 10 <sup>-1</sup>	2.61 × 10 <sup>-1</sup>
<b>NVT2035</b>	1.50 × 10 <sup>-1</sup>	1.73 × 10 <sup>-1</sup>	1.11 × 10 <sup>-1</sup>
<b>NVT2050</b>	1.61 × 10 <sup>-1</sup>	1.63 × 10 <sup>-1</sup>	1.64 × 10 <sup>-1</sup>
<b>NVT2065</b>	1.24 × 10 <sup>-1</sup>	1.28 × 10 <sup>-1</sup>	1.41 × 10 <sup>-1</sup>
<b>NVT2080</b>	1.15 × 10 <sup>-1</sup>	1.14 × 10 <sup>-1</sup>	1.64 × 10 <sup>-1</sup>
<b>NVT2095</b>	9.50 × 10 <sup>-2</sup>	9.55 × 10 <sup>-2</sup>	1.49 × 10 <sup>-1</sup>
<b>NVT2110</b>	8.81 × 10 <sup>-2</sup>	8.64 × 10 <sup>-2</sup>	1.64 × 10 <sup>-1</sup>
<b>NVT2125</b>	8.15 × 10 <sup>-2</sup>	7.85 × 10 <sup>-2</sup>	1.74 × 10 <sup>-1</sup>
<b>NVT2140</b>	7.13 × 10 <sup>-2</sup>	6.93 × 10 <sup>-2</sup>	1.63 × 10 <sup>-1</sup>
<b>NVT2155</b>	6.47 × 10 <sup>-2</sup>	6.23 × 10 <sup>-2</sup>	1.72 × 10 <sup>-1</sup>
<b>NVT2170</b>	6.11 × 10 <sup>-2</sup>	5.81 × 10 <sup>-2</sup>	1.80 × 10 <sup>-1</sup>
<b>NVT2185</b>	5.77 × 10 <sup>-2</sup>	5.41 × 10 <sup>-2</sup>	1.86 × 10 <sup>-1</sup>
<b>NVT3055</b>	3.88 × 10 <sup>-1</sup>	2.17 × 10 <sup>-1</sup>	2.95 × 10 <sup>-1</sup>
<b>NVT3080</b>	9.68 × 10 <sup>-2</sup>	1.02 × 10 <sup>-1</sup>	8.64 × 10 <sup>-2</sup>
<b>NVT3105</b>	8.56 × 10 <sup>-2</sup>	8.66 × 10 <sup>-2</sup>	9.64 × 10 <sup>-2</sup>
<b>NVT3130</b>	8.07 × 10 <sup>-2</sup>	7.59 × 10 <sup>-2</sup>	1.24 × 10 <sup>-1</sup>
<b>NVT3155</b>	5.55 × 10 <sup>-2</sup>	5.58 × 10 <sup>-2</sup>	9.16 × 10 <sup>-2</sup>
<b>NVT3180</b>	5.11 × 10 <sup>-2</sup>	5.07 × 10 <sup>-2</sup>	9.61 × 10 <sup>-2</sup>
<b>NVT3205</b>	4.76 × 10 <sup>-2</sup>	4.66 × 10 <sup>-2</sup>	1.00 × 10 <sup>-1</sup>
<b>NVT3230</b>	4.45 × 10 <sup>-2</sup>	4.31 × 10 <sup>-2</sup>	1.03 × 10 <sup>-1</sup>
<b>NVT4085</b>	1.01 × 10 <sup>-1</sup>	1.07 × 10 <sup>-1</sup>	6.57 × 10 <sup>-2</sup>
<b>NVT4125</b>	9.63 × 10 <sup>-2</sup>	8.82 × 10 <sup>-2</sup>	9.84 × 10 <sup>-2</sup>
<b>NVT4165</b>	5.99 × 10 <sup>-2</sup>	5.95 × 10 <sup>-2</sup>	7.03 × 10 <sup>-2</sup>
<b>NVT4205</b>	4.34 × 10 <sup>-2</sup>	4.41 × 10 <sup>-2</sup>	6.30 × 10 <sup>-2</sup>
<b>NVT4245</b>	4.07 × 10 <sup>-2</sup>	3.98 × 10 <sup>-2</sup>	7.42 × 10 <sup>-2</sup>
<b>NVT4285</b>	3.31 × 10 <sup>-2</sup>	3.28 × 10 <sup>-2</sup>	6.61 × 10 <sup>-2</sup>

E<sub>P</sub>: M<sub>P</sub> equivalent coefficient E<sub>Y</sub>: M<sub>Y</sub> equivalent coefficient  
E<sub>R</sub>: M<sub>R</sub> equivalent coefficient

Table 1-22(2) Slide Table NVT type (2) unit : 1/mm

part number	equivalent coefficient		
	E <sub>P</sub>	E <sub>Y</sub>	E <sub>R</sub>
<b>NVT6110</b>	1.76 × 10 <sup>-1</sup>	1.21 × 10 <sup>-1</sup>	1.46 × 10 <sup>-1</sup>
<b>NVT6160</b>	5.85 × 10 <sup>-2</sup>	5.98 × 10 <sup>-2</sup>	6.01 × 10 <sup>-2</sup>
<b>NVT6210</b>	4.79 × 10 <sup>-2</sup>	4.72 × 10 <sup>-2</sup>	6.96 × 10 <sup>-2</sup>
<b>NVT6260</b>	4.13 × 10 <sup>-2</sup>	4.01 × 10 <sup>-2</sup>	6.96 × 10 <sup>-2</sup>
<b>NVT6310</b>	2.92 × 10 <sup>-2</sup>	2.96 × 10 <sup>-2</sup>	5.33 × 10 <sup>-2</sup>
<b>NVT6360</b>	2.66 × 10 <sup>-2</sup>	2.67 × 10 <sup>-2</sup>	5.54 × 10 <sup>-2</sup>
<b>NVT6410</b>	2.48 × 10 <sup>-2</sup>	2.43 × 10 <sup>-2</sup>	6.30 × 10 <sup>-2</sup>
<b>NVT9210</b>	7.95 × 10 <sup>-2</sup>	6.07 × 10 <sup>-2</sup>	7.19 × 10 <sup>-2</sup>
<b>NVT9310</b>	3.28 × 10 <sup>-2</sup>	3.24 × 10 <sup>-2</sup>	4.38 × 10 <sup>-2</sup>
<b>NVT9410</b>	2.37 × 10 <sup>-2</sup>	2.35 × 10 <sup>-2</sup>	4.09 × 10 <sup>-2</sup>
<b>NVT9510</b>	1.82 × 10 <sup>-2</sup>	1.83 × 10 <sup>-2</sup>	3.51 × 10 <sup>-2</sup>

E<sub>P</sub>: M<sub>P</sub> equivalent coefficient E<sub>Y</sub>: M<sub>Y</sub> equivalent coefficient  
E<sub>R</sub>: M<sub>R</sub> equivalent coefficient

Table 1-23 Slide Table HVT type unit: 1/mm

part number	equivalent coefficient		
	E <sub>P</sub>	E <sub>Y</sub>	E <sub>R</sub>
HVT2035	3.33×10 <sup>-1</sup>	2.91×10 <sup>-1</sup>	1.11×10 <sup>-1</sup>
HVT2050	1.63×10 <sup>-1</sup>	1.83×10 <sup>-1</sup>	1.11×10 <sup>-1</sup>
HVT2065	1.72×10 <sup>-1</sup>	1.58×10 <sup>-1</sup>	1.11×10 <sup>-1</sup>
HVT2080	1.29×10 <sup>-1</sup>	1.21×10 <sup>-1</sup>	1.11×10 <sup>-1</sup>
HVT2095	9.26×10 <sup>-2</sup>	9.77×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
HVT2110	9.35×10 <sup>-2</sup>	8.97×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
HVT2125	7.94×10 <sup>-2</sup>	7.70×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
HVT2140	6.39×10 <sup>-2</sup>	6.63×10 <sup>-2</sup>	1.10×10 <sup>-1</sup>
HVT2155	6.46×10 <sup>-2</sup>	6.26×10 <sup>-2</sup>	1.12×10 <sup>-1</sup>
HVT2170	5.73×10 <sup>-2</sup>	5.57×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
HVT2185	4.90×10 <sup>-2</sup>	5.03×10 <sup>-2</sup>	1.12×10 <sup>-1</sup>
HVT3055	1.84×10 <sup>-1</sup>	1.63×10 <sup>-1</sup>	7.20×10 <sup>-2</sup>
HVT3080	1.22×10 <sup>-1</sup>	1.13×10 <sup>-1</sup>	7.16×10 <sup>-2</sup>
HVT3105	9.20×10 <sup>-2</sup>	8.66×10 <sup>-2</sup>	7.16×10 <sup>-2</sup>
HVT3130	7.34×10 <sup>-2</sup>	7.00×10 <sup>-2</sup>	7.13×10 <sup>-2</sup>
HVT3155	6.13×10 <sup>-2</sup>	5.90×10 <sup>-2</sup>	7.16×10 <sup>-2</sup>
HVT3180	5.25×10 <sup>-2</sup>	5.09×10 <sup>-2</sup>	7.14×10 <sup>-2</sup>
HVT3205	4.31×10 <sup>-2</sup>	4.46×10 <sup>-2</sup>	7.14×10 <sup>-2</sup>
HVT3230	4.32×10 <sup>-2</sup>	4.21×10 <sup>-2</sup>	7.13×10 <sup>-2</sup>
HVT3255	3.67×10 <sup>-2</sup>	3.79×10 <sup>-2</sup>	7.15×10 <sup>-2</sup>
HVT3280	3.70×10 <sup>-2</sup>	3.63×10 <sup>-2</sup>	7.15×10 <sup>-2</sup>
HVT3305	3.20×10 <sup>-2</sup>	3.28×10 <sup>-2</sup>	7.15×10 <sup>-2</sup>
HVT4085	1.17×10 <sup>-1</sup>	1.07×10 <sup>-1</sup>	4.99×10 <sup>-2</sup>
HVT4125	6.47×10 <sup>-2</sup>	6.93×10 <sup>-2</sup>	4.99×10 <sup>-2</sup>
HVT4165	5.92×10 <sup>-2</sup>	5.65×10 <sup>-2</sup>	4.99×10 <sup>-2</sup>
HVT4205	4.21×10 <sup>-2</sup>	4.41×10 <sup>-2</sup>	4.99×10 <sup>-2</sup>
HVT4245	3.49×10 <sup>-2</sup>	3.62×10 <sup>-2</sup>	5.00×10 <sup>-2</sup>
HVT4285	3.13×10 <sup>-2</sup>	3.22×10 <sup>-2</sup>	5.03×10 <sup>-2</sup>
HVT4325	2.70×10 <sup>-2</sup>	2.77×10 <sup>-2</sup>	5.01×10 <sup>-2</sup>
HVT4365	2.60×10 <sup>-2</sup>	2.54×10 <sup>-2</sup>	5.01×10 <sup>-2</sup>
HVT4405	2.21×10 <sup>-2</sup>	2.25×10 <sup>-2</sup>	5.02×10 <sup>-2</sup>

E<sub>P</sub>: M<sub>P</sub> equivalent coefficient E<sub>Y</sub>: M<sub>Y</sub> equivalent coefficient  
E<sub>R</sub>: M<sub>R</sub> equivalent coefficient

Table 1-24(1) Slide Table SVT type (1) unit: 1/mm

part number	equivalent coefficient		
	E <sub>P</sub>	E <sub>Y</sub>	E <sub>R</sub>
SVT1025	2.66×10 <sup>-1</sup>	3.24×10 <sup>-1</sup>	1.48×10 <sup>-1</sup>
SVT1035	3.09×10 <sup>-1</sup>	2.72×10 <sup>-1</sup>	1.48×10 <sup>-1</sup>
SVT1045	1.70×10 <sup>-1</sup>	1.86×10 <sup>-1</sup>	1.48×10 <sup>-1</sup>
SVT1055	1.49×10 <sup>-1</sup>	1.61×10 <sup>-1</sup>	1.47×10 <sup>-1</sup>
SVT1065	1.34×10 <sup>-1</sup>	1.43×10 <sup>-1</sup>	1.48×10 <sup>-1</sup>
SVT1075	1.11×10 <sup>-1</sup>	1.17×10 <sup>-1</sup>	1.48×10 <sup>-1</sup>
SVT1085	1.02×10 <sup>-1</sup>	1.07×10 <sup>-1</sup>	1.48×10 <sup>-1</sup>
SVT2035	1.66×10 <sup>-1</sup>	2.02×10 <sup>-1</sup>	1.11×10 <sup>-1</sup>
SVT2050	1.45×10 <sup>-1</sup>	1.64×10 <sup>-1</sup>	1.11×10 <sup>-1</sup>
SVT2065	1.23×10 <sup>-1</sup>	1.37×10 <sup>-1</sup>	1.11×10 <sup>-1</sup>
SVT2080	1.28×10 <sup>-1</sup>	1.19×10 <sup>-1</sup>	1.11×10 <sup>-1</sup>
SVT2095	1.10×10 <sup>-1</sup>	1.03×10 <sup>-1</sup>	1.11×10 <sup>-1</sup>
SVT2110	7.59×10 <sup>-2</sup>	8.06×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
SVT2125	6.93×10 <sup>-2</sup>	7.31×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
SVT2140	7.00×10 <sup>-2</sup>	6.72×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
SVT2155	6.45×10 <sup>-2</sup>	6.22×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
SVT2170	5.14×10 <sup>-2</sup>	5.32×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
SVT2185	4.82×10 <sup>-2</sup>	5.00×10 <sup>-2</sup>	1.11×10 <sup>-1</sup>
SVT3055	2.01×10 <sup>-1</sup>	1.75×10 <sup>-1</sup>	7.14×10 <sup>-2</sup>
SVT3080	1.22×10 <sup>-1</sup>	1.12×10 <sup>-1</sup>	7.14×10 <sup>-2</sup>
SVT3105	7.55×10 <sup>-2</sup>	8.13×10 <sup>-2</sup>	7.14×10 <sup>-2</sup>
SVT3130	6.06×10 <sup>-2</sup>	6.44×10 <sup>-2</sup>	7.10×10 <sup>-2</sup>
SVT3155	6.14×10 <sup>-2</sup>	5.86×10 <sup>-2</sup>	7.13×10 <sup>-2</sup>
SVT3180	5.13×10 <sup>-2</sup>	4.94×10 <sup>-2</sup>	7.11×10 <sup>-2</sup>
SVT3205	4.73×10 <sup>-2</sup>	4.58×10 <sup>-2</sup>	7.12×10 <sup>-2</sup>
SVT3230	3.83×10 <sup>-2</sup>	3.98×10 <sup>-2</sup>	7.13×10 <sup>-2</sup>
SVT3255	3.85×10 <sup>-2</sup>	3.75×10 <sup>-2</sup>	7.14×10 <sup>-2</sup>
SVT3280	3.63×10 <sup>-2</sup>	3.54×10 <sup>-2</sup>	7.12×10 <sup>-2</sup>
SVT3305	3.08×10 <sup>-2</sup>	3.17×10 <sup>-2</sup>	7.13×10 <sup>-2</sup>
SVT4085	8.25×10 <sup>-2</sup>	9.33×10 <sup>-2</sup>	4.98×10 <sup>-2</sup>
SVT4125	6.08×10 <sup>-2</sup>	6.63×10 <sup>-2</sup>	4.98×10 <sup>-2</sup>
SVT4165	6.22×10 <sup>-2</sup>	5.82×10 <sup>-2</sup>	4.96×10 <sup>-2</sup>
SVT4205	4.86×10 <sup>-2</sup>	4.62×10 <sup>-2</sup>	4.97×10 <sup>-2</sup>
SVT4245	3.98×10 <sup>-2</sup>	3.82×10 <sup>-2</sup>	4.97×10 <sup>-2</sup>
SVT4285	3.40×10 <sup>-2</sup>	3.27×10 <sup>-2</sup>	4.97×10 <sup>-2</sup>
SVT4325	2.93×10 <sup>-2</sup>	2.85×10 <sup>-2</sup>	4.97×10 <sup>-2</sup>
SVT4365	2.59×10 <sup>-2</sup>	2.52×10 <sup>-2</sup>	4.97×10 <sup>-2</sup>
SVT4405	2.20×10 <sup>-2</sup>	2.26×10 <sup>-2</sup>	4.97×10 <sup>-2</sup>

E<sub>P</sub>: M<sub>P</sub> equivalent coefficient E<sub>Y</sub>: M<sub>Y</sub> equivalent coefficient  
E<sub>R</sub>: M<sub>R</sub> equivalent coefficient

Table 1-24(2) Slide Table SVT type (2) unit: 1/mm

part number	equivalent coefficient		
	E <sub>P</sub>	E <sub>Y</sub>	E <sub>R</sub>
SVT6110	6.81×10 <sup>-2</sup>	7.70×10 <sup>-2</sup>	4.43×10 <sup>-2</sup>
SVT6160	5.03×10 <sup>-2</sup>	5.49×10 <sup>-2</sup>	4.44×10 <sup>-2</sup>
SVT6210	3.98×10 <sup>-2</sup>	4.23×10 <sup>-2</sup>	4.44×10 <sup>-2</sup>
SVT6260	3.26×10 <sup>-2</sup>	3.45×10 <sup>-2</sup>	4.43×10 <sup>-2</sup>
SVT6310	2.78×10 <sup>-2</sup>	2.91×10 <sup>-2</sup>	4.46×10 <sup>-2</sup>
SVT6360	2.80×10 <sup>-2</sup>	2.70×10 <sup>-2</sup>	4.45×10 <sup>-2</sup>
SVT6410	2.43×10 <sup>-2</sup>	2.36×10 <sup>-2</sup>	4.44×10 <sup>-2</sup>
SVT6460	2.13×10 <sup>-2</sup>	2.07×10 <sup>-2</sup>	4.42×10 <sup>-2</sup>
SVT6510	1.91×10 <sup>-2</sup>	1.86×10 <sup>-2</sup>	4.43×10 <sup>-2</sup>
SVT9210	3.51×10 <sup>-2</sup>	3.92×10 <sup>-2</sup>	2.78×10 <sup>-2</sup>
SVT9310	3.14×10 <sup>-2</sup>	2.94×10 <sup>-2</sup>	2.78×10 <sup>-2</sup>
SVT9410	2.41×10 <sup>-2</sup>	2.58×10 <sup>-2</sup>	2.78×10 <sup>-2</sup>
SVT9510	1.98×10 <sup>-2</sup>	2.09×10 <sup>-2</sup>	2.77×10 <sup>-2</sup>
SVT9610	2.00×10 <sup>-2</sup>	1.92×10 <sup>-2</sup>	2.77×10 <sup>-2</sup>
SVT9710	1.69×10 <sup>-2</sup>	1.63×10 <sup>-2</sup>	2.76×10 <sup>-2</sup>
SVT9810	1.37×10 <sup>-2</sup>	1.42×10 <sup>-2</sup>	2.76×10 <sup>-2</sup>
SVT9910	1.22×10 <sup>-2</sup>	1.26×10 <sup>-2</sup>	2.78×10 <sup>-2</sup>
SVT91010	1.10×10 <sup>-2</sup>	1.13×10 <sup>-2</sup>	2.77×10 <sup>-2</sup>

E<sub>P</sub>: M<sub>P</sub> equivalent coefficient E<sub>Y</sub>: M<sub>Y</sub> equivalent coefficient  
E<sub>R</sub>: M<sub>R</sub> equivalent coefficient

Table 1-25 Slide Table NYT type unit: 1/mm

part number	equivalent coefficient		
	E <sub>P</sub>	E <sub>Y</sub>	E <sub>R</sub>
NYT1025	2.28×10 <sup>-1</sup>	2.67×10 <sup>-1</sup>	2.67×10 <sup>-1</sup>
NYT1035	9.77×10 <sup>-1</sup>	4.00×10 <sup>-1</sup>	1.63
NYT1045	2.81×10 <sup>-1</sup>	2.47×10 <sup>-1</sup>	6.00×10 <sup>-1</sup>
NYT1055	2.42×10 <sup>-1</sup>	2.03×10 <sup>-1</sup>	6.42×10 <sup>-1</sup>
NYT1065	1.71×10 <sup>-1</sup>	1.59×10 <sup>-1</sup>	5.01×10 <sup>-1</sup>
NYT1075	1.54×10 <sup>-1</sup>	1.39×10 <sup>-1</sup>	5.35×10 <sup>-1</sup>
NYT1085	1.25×10 <sup>-1</sup>	1.17×10 <sup>-1</sup>	4.68×10 <sup>-1</sup>
NYT2035	1.50×10 <sup>-1</sup>	1.73×10 <sup>-1</sup>	1.53×10 <sup>-1</sup>
NYT2050	1.61×10 <sup>-1</sup>	1.63×10 <sup>-1</sup>	2.28×10 <sup>-1</sup>
NYT2065	1.24×10 <sup>-1</sup>	1.28×10 <sup>-1</sup>	1.96×10 <sup>-1</sup>
NYT2080	1.15×10 <sup>-1</sup>	1.14×10 <sup>-1</sup>	2.27×10 <sup>-1</sup>
NYT2095	9.50×10 <sup>-2</sup>	9.55×10 <sup>-2</sup>	2.07×10 <sup>-1</sup>
NYT2110	8.81×10 <sup>-2</sup>	8.64×10 <sup>-2</sup>	2.27×10 <sup>-1</sup>
NYT2125	8.15×10 <sup>-2</sup>	7.85×10 <sup>-2</sup>	2.41×10 <sup>-1</sup>
NYT3055	3.88×10 <sup>-1</sup>	2.17×10 <sup>-1</sup>	4.74×10 <sup>-1</sup>
NYT3080	9.68×10 <sup>-2</sup>	1.02×10 <sup>-1</sup>	1.39×10 <sup>-1</sup>
NYT3105	8.56×10 <sup>-2</sup>	8.66×10 <sup>-2</sup>	1.55×10 <sup>-1</sup>
NYT3130	8.07×10 <sup>-2</sup>	7.59×10 <sup>-2</sup>	2.00×10 <sup>-1</sup>
NYT3155	5.55×10 <sup>-2</sup>	5.58×10 <sup>-2</sup>	1.48×10 <sup>-1</sup>
NYT3180	5.11×10 <sup>-2</sup>	5.07×10 <sup>-2</sup>	1.55×10 <sup>-1</sup>
NYT3205	4.76×10 <sup>-2</sup>	4.66×10 <sup>-2</sup>	1.61×10 <sup>-1</sup>

E<sub>P</sub>: M<sub>P</sub> equivalent coefficient E<sub>Y</sub>: M<sub>Y</sub> equivalent coefficient  
E<sub>R</sub>: M<sub>R</sub> equivalent coefficient

Table 1-26 Slide Table HYT type unit: 1/mm

part number	equivalent coefficient		
	E <sub>P</sub>	E <sub>Y</sub>	E <sub>R</sub>
HYT2035	3.33×10 <sup>-1</sup>	2.91×10 <sup>-1</sup>	1.55×10 <sup>-1</sup>
HYT2050	1.63×10 <sup>-1</sup>	1.83×10 <sup>-1</sup>	1.54×10 <sup>-1</sup>
HYT2065	1.72×10 <sup>-1</sup>	1.58×10 <sup>-1</sup>	1.54×10 <sup>-1</sup>
HYT2080	1.29×10 <sup>-1</sup>	1.21×10 <sup>-1</sup>	1.54×10 <sup>-1</sup>
HYT2095	9.26×10 <sup>-2</sup>	9.77×10 <sup>-2</sup>	1.54×10 <sup>-1</sup>
HYT2110	9.35×10 <sup>-2</sup>	8.97×10 <sup>-2</sup>	1.54×10 <sup>-1</sup>
HYT2125	7.94×10 <sup>-2</sup>	7.70×10 <sup>-2</sup>	1.54×10 <sup>-1</sup>
HYT3055	1.84×10 <sup>-1</sup>	1.63×10 <sup>-1</sup>	1.15×10 <sup>-1</sup>
HYT3080	1.22×10 <sup>-1</sup>	1.13×10 <sup>-1</sup>	1.15×10 <sup>-1</sup>
HYT3105	9.20×10 <sup>-2</sup>	8.66×10 <sup>-2</sup>	1.15×10 <sup>-1</sup>
HYT3130	7.34×10 <sup>-2</sup>	7.00×10 <sup>-2</sup>	1.15×10 <sup>-1</sup>
HYT3155	6.13×10 <sup>-2</sup>	5.90×10 <sup>-2</sup>	1.15×10 <sup>-1</sup>
HYT3180	5.25×10 <sup>-2</sup>	5.09×10 <sup>-2</sup>	1.15×10 <sup>-1</sup>
HYT3205	4.31×10 <sup>-2</sup>	4.46×10 <sup>-2</sup>	1.15×10 <sup>-1</sup>

E<sub>P</sub>: M<sub>P</sub> equivalent coefficient E<sub>Y</sub>: M<sub>Y</sub> equivalent coefficient  
E<sub>R</sub>: M<sub>R</sub> equivalent coefficient

Table 1-27 Slide Table SYT type unit: 1/mm

part number	equivalent coefficient		
	E <sub>P</sub>	E <sub>V</sub>	E <sub>R</sub>
SYT1025	2.66×10 <sup>-1</sup>	3.24×10 <sup>-1</sup>	2.66×10 <sup>-1</sup>
SYT1035	3.09×10 <sup>-1</sup>	2.72×10 <sup>-1</sup>	2.66×10 <sup>-1</sup>
SYT1045	1.70×10 <sup>-1</sup>	1.86×10 <sup>-1</sup>	2.66×10 <sup>-1</sup>
SYT1055	1.49×10 <sup>-1</sup>	1.61×10 <sup>-1</sup>	2.64×10 <sup>-1</sup>
SYT1065	1.34×10 <sup>-1</sup>	1.43×10 <sup>-1</sup>	2.65×10 <sup>-1</sup>
SYT1075	1.11×10 <sup>-1</sup>	1.17×10 <sup>-1</sup>	2.66×10 <sup>-1</sup>
SYT1085	1.02×10 <sup>-1</sup>	1.07×10 <sup>-1</sup>	2.66×10 <sup>-1</sup>
SYT2035	1.66×10 <sup>-1</sup>	2.02×10 <sup>-1</sup>	1.53×10 <sup>-1</sup>
SYT2050	1.45×10 <sup>-1</sup>	1.64×10 <sup>-1</sup>	1.54×10 <sup>-1</sup>
SYT2065	1.23×10 <sup>-1</sup>	1.37×10 <sup>-1</sup>	1.54×10 <sup>-1</sup>
SYT2080	1.28×10 <sup>-1</sup>	1.19×10 <sup>-1</sup>	1.54×10 <sup>-1</sup>
SYT2095	1.10×10 <sup>-1</sup>	1.03×10 <sup>-1</sup>	1.54×10 <sup>-1</sup>
SYT2110	7.59×10 <sup>-2</sup>	8.06×10 <sup>-2</sup>	1.53×10 <sup>-1</sup>
SYT2125	6.93×10 <sup>-2</sup>	7.31×10 <sup>-2</sup>	1.54×10 <sup>-1</sup>
SYT3055	2.01×10 <sup>-1</sup>	1.75×10 <sup>-1</sup>	1.15×10 <sup>-1</sup>
SYT3080	1.22×10 <sup>-1</sup>	1.12×10 <sup>-1</sup>	1.15×10 <sup>-1</sup>
SYT3105	7.55×10 <sup>-2</sup>	8.13×10 <sup>-2</sup>	1.15×10 <sup>-1</sup>
SYT3130	6.06×10 <sup>-2</sup>	6.44×10 <sup>-2</sup>	1.14×10 <sup>-1</sup>
SYT3155	6.14×10 <sup>-2</sup>	5.86×10 <sup>-2</sup>	1.15×10 <sup>-1</sup>
SYT3180	5.13×10 <sup>-2</sup>	4.94×10 <sup>-2</sup>	1.15×10 <sup>-1</sup>
SYT3205	4.73×10 <sup>-2</sup>	4.58×10 <sup>-2</sup>	1.15×10 <sup>-1</sup>

E<sub>P</sub>: M<sub>P</sub> equivalent coefficient E<sub>V</sub>: M<sub>V</sub> equivalent coefficient  
E<sub>R</sub>: M<sub>R</sub> equivalent coefficient

Table 1-28 Miniature Slide SYBS type unit: 1/mm

part number	equivalent coefficient		
	E <sub>P</sub>	E <sub>V</sub>	E <sub>R</sub>
SYBS 6-13	8.57×10 <sup>-1</sup>	7.20×10 <sup>-1</sup>	8.57×10 <sup>-1</sup>
SYBS 6-21	5.53×10 <sup>-1</sup>	4.57×10 <sup>-1</sup>	8.51×10 <sup>-1</sup>
SYBS 8-11	9.17×10 <sup>-1</sup>	7.54×10 <sup>-1</sup>	6.03×10 <sup>-1</sup>
SYBS 8-21	4.83×10 <sup>-1</sup>	4.04×10 <sup>-1</sup>	5.94×10 <sup>-1</sup>
SYBS 8-31	3.57×10 <sup>-1</sup>	3.00×10 <sup>-1</sup>	5.92×10 <sup>-1</sup>
SYBS12-23	4.33×10 <sup>-1</sup>	3.63×10 <sup>-1</sup>	3.13×10 <sup>-1</sup>
SYBS12-31	3.57×10 <sup>-1</sup>	3.00×10 <sup>-1</sup>	3.13×10 <sup>-1</sup>
SYBS12-46	2.33×10 <sup>-1</sup>	1.96×10 <sup>-1</sup>	3.11×10 <sup>-1</sup>
SYBS17-23	4.25×10 <sup>-1</sup>	3.57×10 <sup>-1</sup>	2.67×10 <sup>-1</sup>
SYBS17-31	3.26×10 <sup>-1</sup>	2.74×10 <sup>-1</sup>	2.66×10 <sup>-1</sup>
SYBS17-46	2.23×10 <sup>-1</sup>	1.88×10 <sup>-1</sup>	2.66×10 <sup>-1</sup>

E<sub>P</sub>: M<sub>P</sub> equivalent coefficient E<sub>V</sub>: M<sub>V</sub> equivalent coefficient  
E<sub>R</sub>: M<sub>R</sub> equivalent coefficient

### Average Applied Load

The load applied to a linear systems generally varies with the travel distance depending on how the system is operated. This includes the start/stop processes of the reciprocating motion and work on the system. The average applied load is used to compute the life corresponding to the actual application conditions.

①When the load varies in a step manner with the travel distance (Figure 1-7).

ℓ<sub>1</sub> is the travel distance under load P<sub>1</sub>

ℓ<sub>2</sub> is the travel distance under load P<sub>2</sub>

⋮

ℓ<sub>n</sub> is the travel distance under load P<sub>n</sub>

The average applied load P<sub>m</sub> is obtained by the following equation.

$$P_m = \sqrt[3]{\frac{1}{\ell}(P_1^3 \ell_1 + P_2^3 \ell_2 + \dots + P_n^3 \ell_n)} \dots (10)$$

P<sub>m</sub>: average applied load (N) ℓ: total travel distance (mm)

②When the applied load varies linearly with the travel distance (Figure 1-8), the average applied load P<sub>m</sub> is approximated by the following equation.

$$P_m \doteq \frac{1}{3}(P_{min} + 2P_{max}) \dots (11)$$

P<sub>min</sub>: minimum applied load (N)  
P<sub>max</sub>: maximum applied load (N)

③When the applied load draws a sine-curve as shown by Figures 1-9 (a) and (b), the average applied load P<sub>m</sub> is approximated by the following equations.

Figure1-9(a)  $P_m \doteq 0.65P_{max}$  ⋯⋯⋯ (12)

Figure1-9(b)  $P_m \doteq 0.75P_{max}$  ⋯⋯⋯ (13)

Figure 1-4 Applied Load Varies Stepwise

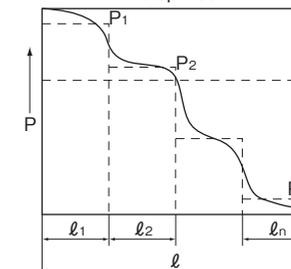


Figure 1-5 Applied Load Varies Linearly

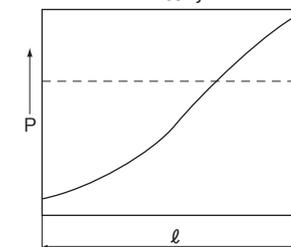
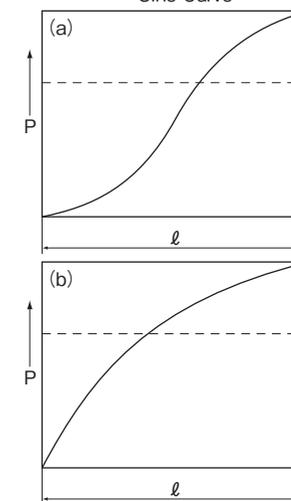


Figure 1-6 Applied Load Varies Sine-Curve



**RATED LIFE CALCULATION EXAMPLE 1**

**2 Horizontal Axes, 2 Blocks each, Considering Acceleration/Deceleration**

**Operating Conditions**

part number: SM20  
 basic dynamic load rating  $C=882\text{N}$   
 basic static load rating  $C_0=1370\text{N}$   
 block span:  $L_{\text{unit}}=150\text{mm}$   
 shaft span:  $L_{\text{rail}}=150\text{mm}$   
 drive:  $Y_d=50\text{mm}$   
 $Z_d=-50\text{mm}$   
 mass:  $m_1=15\text{kg}$   $X_1=100\text{mm}$   
 $Y_1=-60\text{mm}$   
 $Z_1=120\text{mm}$   
 $m_2=10\text{kg}$   $X_2=150\text{mm}$   
 $Y_2=100\text{mm}$   
 $Z_2=150\text{mm}$   
 velocity:  $V_{\text{max}}=100\text{mm/s}$   
 time:  $t_1=0.1\text{s}$   
 $t_2=1.4\text{s}$   
 $t_3=0.1\text{s}$   
 acceleration:  $a_1=1\text{m/s}^2$   
 $a_3=1\text{m/s}^2$   
 stroke:  $l_s=150\text{mm}$   
 number of cycles per minute:  $n_1=17\text{cpm}$

Figure 1-7

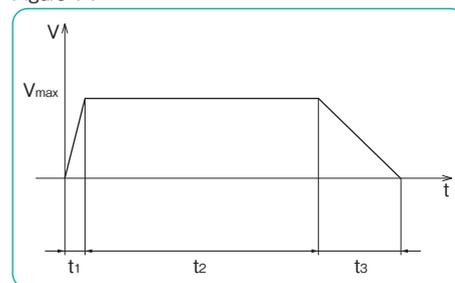
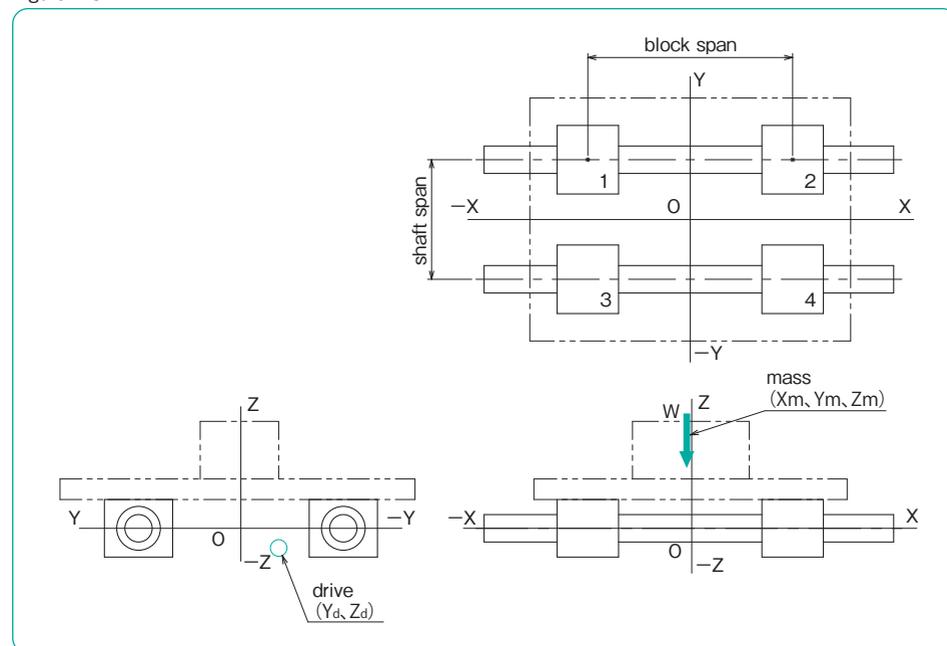


Figure 1-8



**① Calculating Moment Applied to the Unit**

(acceleration)

pitching  $Ma_1 = m \cdot g \cdot X_m - m \cdot a_1 \cdot (Z_m - Z_d)$

$Ma_1 = 15 \times 9.8 \times (100) - 15 \times 1 \times \{(120) - (-50)\} + 10 \times 9.8 \times (150) - 10 \times 1 \times \{(150) - (-50)\} = 24850 \text{N} \cdot \text{mm}$

yawing  $Ma_2 = -m \cdot a_1 \cdot (Y_m - Y_d)$

$Ma_2 = -15 \times 1 \times \{(-60) - (50)\} - 10 \times 1 \times \{(100) - (-50)\} = 11500 \text{N} \cdot \text{mm}$

rolling  $Ma_3 = m \cdot g \cdot Y_m$

$Ma_3 = 15 \times 9.8 \times (-60) + 10 \times 9.8 \times (100) = 980 \text{N} \cdot \text{mm}$

(constant)

pitching  $M_1 = m \cdot g \cdot X_m$

$M_1 = 15 \times 9.8 \times (100) + 10 \times 9.8 \times (150) = 29400 \text{N} \cdot \text{mm}$

yawing  $M_2 = 0$

$M_2 = 0 \text{N} \cdot \text{mm}$

rolling  $M_3 = m \cdot g \cdot Y_m$

$M_3 = 15 \times 9.8 \times (-60) + 10 \times 9.8 \times (100) = 980 \text{N} \cdot \text{mm}$

(deceleration)

pitching  $Md_1 = m \cdot g \cdot X_m + m \cdot a_3 \cdot (Z_m - Z_d)$

$Md_1 = 15 \times 9.8 \times (100) + 15 \times 1 \times \{(120) - (-50)\} + 10 \times 9.8 \times (150) + 10 \times 1 \times \{(150) - (-50)\} = 33950 \text{N} \cdot \text{mm}$

yawing  $Md_2 = m \cdot a_3 \cdot (Y_m - Y_d)$

$Md_2 = 15 \times 1 \times \{(-60) - (50)\} + 10 \times 1 \times \{(100) - (-50)\} = -1150 \text{N} \cdot \text{mm}$

rolling  $Md_3 = m \cdot g \cdot Y_m$

$Md_3 = 15 \times 9.8 \times (-60) + 10 \times 9.8 \times (100) = 980 \text{N} \cdot \text{mm}$

**② Calculating Load Applied to the Slide Bush**

(acceleration)

slide bush 1 vertical direction  $Fra_1 = \frac{m \cdot g}{4} - \frac{Ma_1}{2 \cdot L_{\text{unit}}} + \frac{Ma_3}{2 \cdot L_{\text{rail}}}$

$Fra_1 = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} - \frac{24850}{2 \times 150} + \frac{-980}{2 \times 150} = -18.32 \text{N}$

horizontal direction  $Fsa_1 = \frac{Ma_2}{2 \cdot L_{\text{unit}}}$

$Fsa_1 = \frac{1150}{2 \times 150} = 3.83 \text{N}$

slide bush 2 vertical direction  $Fra_2 = \frac{m \cdot g}{4} + \frac{Ma_1}{2 \cdot L_{\text{unit}}} + \frac{Ma_3}{2 \cdot L_{\text{rail}}}$

$Fra_2 = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} + \frac{24850}{2 \times 150} + \frac{980}{2 \times 150} = 147.35 \text{N}$

horizontal direction  $Fsa_2 = -\frac{Ma_2}{2 \cdot L_{\text{unit}}}$

$Fsa_2 = -\frac{1150}{2 \times 150} = -3.83 \text{N}$

slide bush 3

vertical direction 
$$F_{ra3} = \frac{m \cdot g}{4} - \frac{M_{a1}}{2 \cdot L_{unit}} - \frac{M_{a3}}{2 \cdot L_{rail}}$$

$$F_{ra3} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} - \frac{24850}{2 \times 150} - \frac{980}{2 \times 150} = -24.85N$$

horizontal direction 
$$F_{sa3} = \frac{M_{a2}}{2 \cdot L_{unit}}$$

$$F_{sa3} = \frac{1150}{2 \times 150} = 3.83N$$

slide bush 4

vertical direction 
$$F_{ra4} = \frac{m \cdot g}{4} + \frac{M_{a1}}{2 \cdot L_{unit}} - \frac{M_{a3}}{2 \cdot L_{rail}}$$

$$F_{ra4} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} + \frac{24850}{2 \times 150} - \frac{980}{2 \times 150} = 140.82N$$

horizontal direction 
$$F_{sa4} = -\frac{M_{a2}}{2 \cdot L_{unit}}$$

$$F_{sa4} = -\frac{1150}{2 \times 150} = -3.83N$$

(constant)

slide bush 1

vertical direction 
$$F_{r1} = \frac{m \cdot g}{4} - \frac{M_1}{2 \cdot L_{unit}} + \frac{M_3}{2 \cdot L_{rail}}$$

$$F_{r1} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} - \frac{24850}{2 \times 150} + \frac{980}{2 \times 150} = -33.48N$$

horizontal direction 
$$F_{s1} = \frac{M_2}{2 \cdot L_{unit}} = 0$$

slide bush 2

vertical direction 
$$F_{r2} = \frac{m \cdot g}{4} + \frac{M_1}{2 \cdot L_{unit}} + \frac{M_3}{2 \cdot L_{rail}}$$

$$F_{r2} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} + \frac{24850}{2 \times 150} + \frac{980}{2 \times 150} = 162.52N$$

horizontal direction 
$$F_{s2} = -\frac{M_2}{2 \cdot L_{unit}} = 0$$

slide bush 3

vertical direction 
$$F_{r3} = \frac{m \cdot g}{4} - \frac{M_1}{2 \cdot L_{unit}} - \frac{M_3}{2 \cdot L_{rail}}$$

$$F_{r3} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} - \frac{24850}{2 \times 150} - \frac{980}{2 \times 150} = -40.02N$$

horizontal direction 
$$F_{s3} = \frac{M_2}{2 \cdot L_{unit}} = 0$$

slide bush 4

vertical direction 
$$F_{r4} = \frac{m \cdot g}{4} + \frac{M_1}{2 \cdot L_{unit}} - \frac{M_3}{2 \cdot L_{rail}}$$

$$F_{r4} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} + \frac{24850}{2 \times 150} - \frac{980}{2 \times 150} = 155.98N$$

horizontal direction 
$$F_{s4} = -\frac{M_2}{2 \cdot L_{unit}} = 0$$

(deceleration)

slide bush 1

vertical direction 
$$F_{rd1} = \frac{m \cdot g}{4} - \frac{M_{d1}}{2 \cdot L_{unit}} + \frac{M_{d3}}{2 \cdot L_{rail}}$$

$$F_{rd1} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} - \frac{24850}{2 \times 150} + \frac{980}{2 \times 150} = -48.65N$$

horizontal direction 
$$F_{sd1} = \frac{M_{d2}}{2 \cdot L_{unit}}$$

$$F_{sd1} = \frac{-1150}{2 \times 150} = -3.83N$$

slide bush 2

vertical direction 
$$F_{rd2} = \frac{m \cdot g}{4} + \frac{M_{d1}}{2 \cdot L_{unit}} + \frac{M_{d3}}{2 \cdot L_{rail}}$$

$$F_{rd2} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} + \frac{24850}{2 \times 150} + \frac{980}{2 \times 150} = 177.68N$$

horizontal direction 
$$F_{sd2} = -\frac{M_{d2}}{2 \cdot L_{unit}}$$

$$F_{sd2} = -\frac{-1150}{2 \times 150} = 3.83N$$

slide bush 3

vertical direction 
$$F_{rd3} = \frac{m \cdot g}{4} - \frac{M_{d1}}{2 \cdot L_{unit}} - \frac{M_{d3}}{2 \cdot L_{rail}}$$

$$F_{rd3} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} - \frac{24850}{2 \times 150} - \frac{980}{2 \times 150} = -55.18N$$

horizontal direction 
$$F_{sd3} = \frac{M_{d2}}{2 \cdot L_{unit}}$$

$$F_{sd3} = \frac{-1150}{2 \times 150} = -3.83N$$

slide bush 4

vertical direction 
$$F_{rd4} = \frac{m \cdot g}{4} + \frac{M_{d1}}{2 \cdot L_{unit}} - \frac{M_{d3}}{2 \cdot L_{rail}}$$

$$F_{rd4} = \frac{15 \times 9.8}{4} + \frac{10 \times 9.8}{4} + \frac{24850}{2 \times 150} - \frac{980}{2 \times 150} = 171.15N$$

horizontal direction 
$$F_{sd4} = -\frac{M_{d2}}{2 \cdot L_{unit}}$$

$$F_{sd4} = -\frac{-1150}{2 \times 150} = 3.83N$$

### ③ Calculating Equivalent Load

Pr in the vertical direction and Ps in the horizontal direction are calculated by the following equations.

$$\begin{aligned} Pr &= |Fr| \\ Ps &= |k \cdot Fs| \end{aligned} \quad k=1 \text{ for SM}$$

Table 1-29

	acceleration	constant	deceleration
slide bush 1	Pr <sub>a1</sub> =18.32	Pr <sub>1</sub> =33.48	Pr <sub>d1</sub> =48.65
	Ps <sub>a1</sub> =3.83	Ps <sub>1</sub> =0	Ps <sub>d1</sub> =3.83
slide bush 2	Pr <sub>a2</sub> =147.35	Pr <sub>2</sub> =162.52	Pr <sub>d2</sub> =177.68
	Ps <sub>a2</sub> =3.83	Ps <sub>2</sub> =0	Ps <sub>d2</sub> =3.83
slide bush 3	Pr <sub>a3</sub> =24.85	Pr <sub>3</sub> =40.02	Pr <sub>d3</sub> =55.18
	Ps <sub>a3</sub> =3.83	Ps <sub>3</sub> =0	Ps <sub>d3</sub> =3.83
slide bush 4	Pr <sub>a4</sub> =140.82	Pr <sub>4</sub> =155.98	Pr <sub>d4</sub> =171.15
	Ps <sub>a4</sub> =3.83	Ps <sub>4</sub> =0	Ps <sub>d4</sub> =3.83

Calculating Dynamic Equivalent Load

$$P = Pr + Ps$$

Pa<sub>1</sub> = Pr<sub>a1</sub> + Ps<sub>a1</sub> = 18.32 + 3.83 = 22.15(N)  
calculating in the same manner

Table 1-30

	acceleration	constant	deceleration
slide bush 1	Pa <sub>1</sub> =22.15	P <sub>1</sub> =33.48	Pd <sub>1</sub> =52.48
slide bush 2	Pa <sub>2</sub> =151.18	P <sub>2</sub> =162.52	Pd <sub>2</sub> =181.52
slide bush 3	Pa <sub>3</sub> =28.68	P <sub>3</sub> =40.02	Pd <sub>3</sub> =59.02
slide bush 4	Pa <sub>4</sub> =144.65	P <sub>4</sub> =155.98	Pd <sub>4</sub> =174.98

Calculating Average Equivalent Load

$$P_m = \sqrt[3]{\frac{1}{\ell_s} \times \left\{ (Pa^3 \times \frac{V_{max} \times t_1}{2}) + (P^3 \times V_{max} \times t_2) + (Pd^3 \times \frac{V_{max} \times t_3}{2}) \right\}}$$

$$P_{m1} = \sqrt[3]{\frac{1}{150} \times \left\{ (22.15^3 \times \frac{100 \times 0.1}{2}) + (33.48^3 \times 100 \times 1.4) + (52.8^3 \times \frac{100 \times 0.1}{2}) \right\}} = 34.26(N)$$

$$P_{m2} = \sqrt[3]{\frac{1}{150} \times \left\{ (151.18^3 \times \frac{100 \times 0.1}{2}) + (162.52^3 \times 100 \times 1.4) + (181.52^3 \times \frac{100 \times 0.1}{2}) \right\}} = 162.87(N)$$

$$P_{m3} = \sqrt[3]{\frac{1}{150} \times \left\{ (28.68^3 \times \frac{100 \times 0.1}{2}) + (40.02^3 \times 100 \times 1.4) + (59.02^3 \times \frac{100 \times 0.1}{2}) \right\}} = 40.71(N)$$

$$P_{m4} = \sqrt[3]{\frac{1}{150} \times \left\{ (144.65^3 \times \frac{100 \times 0.1}{2}) + (155.98^3 \times 100 \times 1.4) + (174.98^3 \times \frac{100 \times 0.1}{2}) \right\}} = 156.35(N)$$

### ④ Calculating Rated Life

Decide each coefficient

f<sub>H</sub> : hardness coefficient f<sub>H</sub>=1 for hardness of bush is 58HRC or more

f<sub>T</sub> : temperature coefficient f<sub>T</sub>=1 operating temperature is below 100°C (80°C is maximum for Bush with resin retainer)

f<sub>C</sub> : contact coefficient considering the use of bushing in close contact f<sub>C</sub>=1 for bushes are not in close contact

f<sub>w</sub> : applied load coefficient f<sub>w</sub>=1.5 for V<sub>max</sub>=100mm/s

Calculating Rated Life

Selecting Slide Bush 2 that carries the maximum dynamic equivalent load

$$L = \left( \frac{f_H \times f_T \times f_C}{f_w} \times \frac{C}{P_m} \right)^3 \times 50$$

$$L = \left( \frac{1 \times 1 \times 1}{1.5} \times \frac{882}{162.87} \right)^3 \times 50 = 2352.59(\text{km})$$

Calculating Life Time

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

$$L_h = \frac{2352.59 \times 10^6}{2 \times 150 \times 17 \times 60} = 7688(\text{hour})$$

### ⑤ Calculating Static Safety Factor

Calculating Static Equivalent Load

$$P_0 = Pr + Ps$$

P<sub>0a1</sub> = Pr<sub>a1</sub> + Ps<sub>a1</sub> = 18.32 + 3.83 = 22.15(N)  
calculating in the same manner

Table 1-31

	acceleration	constant	deceleration
slide bush 1	P <sub>0a1</sub> =22.15	P <sub>01</sub> =33.48	P <sub>0d1</sub> =52.48
slide bush 2	P <sub>0a2</sub> =151.18	P <sub>02</sub> =162.52	P <sub>0d2</sub> =181.52
slide bush 3	P <sub>0a3</sub> =28.68	P <sub>03</sub> =40.02	P <sub>0d3</sub> =59.02
slide bush 4	P <sub>0a4</sub> =144.65	P <sub>04</sub> =155.98	P <sub>0d4</sub> =174.98

Selecting Slide Bush 2 that carries the maximum static equivalent load during deceleration

$$f_s = \frac{C_0}{P_0}$$

$$f_s = \frac{C_0}{P_{0d2}} = \frac{1370}{181.52} = 7.5$$

**RATED LIFE CALCULATION EXAMPLE 2**

**1 Horizontal Axis, 2 Blocks, Considering Acceleration/Deceleration**

**Operating Conditions**

part number: SSP25A  
 basic dynamic load rating  $C=12.8\text{kN}$   
 basic static load rating  $C_0=23.4\text{kN}$   
 block span:  $L_{\text{unit}}=600\text{mm}$   
 drive:  $Y_d=-110\text{mm}$   
 $Z_d=-50\text{mm}$   
 mass:  $m_1=10\text{kg}$   $X_1=0\text{mm}$   
 $Y_1=0\text{mm}$   
 $Z_1=100\text{mm}$   
 $m_2=18\text{kg}$   $X_2=-150\text{mm}$   
 $Y_2=-100\text{mm}$   
 $Z_2=150\text{mm}$   
 velocity:  $V_{\text{max}}=150\text{mm/s}$   
 time:  $t_1=0.1\text{s}$   
 $t_2=1.9\text{s}$   
 $t_3=0.1\text{s}$   
 acceleration:  $a_1=1.5\text{m/s}^2$   
 $a_3=1.5\text{m/s}^2$   
 stroke:  $l_s=300\text{mm}$   
 number of cycles per minute:  $n_1=14\text{cpm}$

Figure 1-9

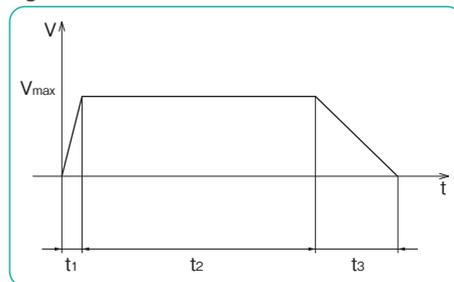
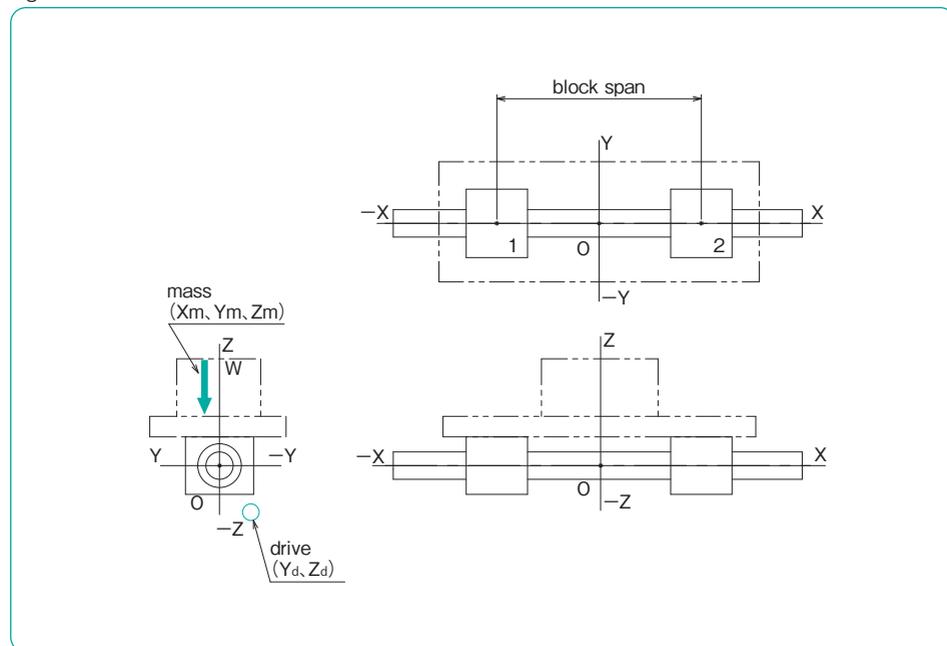


Figure 1-10



**① Calculating Moment Applied to the Unit**

(acceleration)

pitching  $M_{a1} = m \cdot g \cdot X_m - m \cdot a_1 \cdot (Z_m - Z_d)$

$M_{a1} = 10 \times 9.8 \times (0) - 10 \times 1.5 \times \{(100) - (-50)\} + 18 \times 9.8 \times (-120) - 18 \times 1.5 \times \{(150) - (-50)\} = -31560\text{N} \cdot \text{mm}$

yawing  $M_{a2} = -m \cdot a_1 \cdot (Y_m - Y_d)$

$M_{a2} = -10 \times 1.5 \times \{(0) - (-110)\} - 18 \times 1.5 \times \{(-100) - (-110)\} = -1280\text{N} \cdot \text{mm}$

rolling  $M_{a3} = m \cdot g \cdot Y_m$

$M_{a3} = -10 \times 9.8 \times (0) + 18 \times 9.8 \times (-100) = -17640\text{N} \cdot \text{mm}$

(constant)

pitching  $M_1 = m \cdot g \cdot X_m$

$M_1 = 10 \times 9.8 \times (0) - 18 \times 9.8 \times (-150) = -26460\text{N} \cdot \text{mm}$

yawing  $M_2 = 0$

$M_2 = 0\text{N} \cdot \text{mm}$

rolling  $M_3 = m \cdot g \cdot Y_m$

$M_3 = 10 \times 9.8 \times (0) + 18 \times 9.8 \times (-100) = -17640\text{N} \cdot \text{mm}$

(deceleration)

pitching  $M_{d1} = m \cdot g \cdot X_m + m \cdot a_3 \cdot (Z_m - Z_d)$

$M_{d1} = 10 \times 9.8 \times (0) + 10 \times 1.5 \times \{(100) - (-50)\} + 18 \times 9.8 \times (-150) + 18 \times 1.5 \times \{(150) - (-50)\} = -21360\text{N} \cdot \text{mm}$

yawing  $M_{d2} = m \cdot a_3 \cdot (Y_m - Y_d)$

$M_{d2} = 10 \times 1.5 \times \{(0) - (-110)\} + 18 \times 1.5 \times \{(-100) - (-110)\} = 1280\text{N} \cdot \text{mm}$

rolling  $M_{d3} = m \cdot g \cdot Y_m$

$M_{d3} = 10 \times 9.8 \times (0) + 18 \times 9.8 \times (-100) = -17640\text{N} \cdot \text{mm}$

② Calculating Load Applied to the Nut

<acceleration>

Ball Spline 1

vertical direction  $F_{ra1} = \frac{m \cdot g}{2} - \frac{Ma_1}{L_{unit}}$   
 $F_{ra1} = \frac{10 \times 9.8}{2} + \frac{18 \times 9.8}{2} - \frac{-31560}{600} = 189.8\text{N}$

horizontal direction  $F_{sa1} = \frac{Ma_2}{L_{unit}}$   
 $F_{sa1} = \frac{-1280}{600} = -2.13\text{N}$

rolling moment  $M_{ra1} = \frac{Ma_3}{2}$   
 $M_{ra1} = \frac{-17640}{2} = -8820\text{N} \cdot \text{mm}$

Ball Spline 2

vertical direction  $F_{ra2} = \frac{m \cdot g}{2} + \frac{Ma_1}{L_{unit}}$   
 $F_{ra2} = \frac{10 \times 9.8}{2} + \frac{18 \times 9.8}{2} + \frac{-31560}{600} = 84.6\text{N}$

horizontal direction  $F_{sa2} = \frac{Ma_2}{L_{unit}}$   
 $F_{sa2} = \frac{-1280}{600} = -2.13\text{N}$

rolling moment  $M_{ra2} = \frac{Ma_3}{2}$   
 $M_{ra2} = \frac{-17640}{2} = -8820\text{N} \cdot \text{mm}$

<constant>

Ball Spline 1

vertical direction  $F_{r1} = \frac{m \cdot g}{2} - \frac{M_1}{L_{unit}}$   
 $F_{r1} = \frac{10 \times 9.8}{2} + \frac{18 \times 9.8}{2} - \frac{-26460}{600} = 181.3\text{N}$

horizontal direction  $F_{s1} = \frac{M_2}{L_{unit}} = 0$

rolling moment  $M_{r1} = \frac{M_3}{2}$   
 $M_{r1} = \frac{-17640}{2} = -8820\text{N} \cdot \text{mm}$

Ball Spline 2

vertical direction  $F_{r2} = \frac{m \cdot g}{2} + \frac{M_1}{L_{unit}}$   
 $F_{r2} = \frac{10 \times 9.8}{2} + \frac{18 \times 9.8}{2} + \frac{-26460}{600} = 93.1\text{N}$

horizontal direction  $F_{s2} = -\frac{M_2}{L_{unit}} = 0$

rolling moment  $M_{r2} = \frac{M_3}{2}$   
 $M_{r2} = \frac{-17640}{2} = -8820\text{N} \cdot \text{mm}$

<deceleration>

Ball Spline 1

vertical direction  $F_{rd1} = \frac{m \cdot g}{2} - \frac{Md_1}{L_{unit}}$   
 $F_{rd1} = \frac{10 \times 9.8}{2} + \frac{18 \times 9.8}{2} - \frac{-21360}{600} = 172.8\text{N}$

horizontal direction  $F_{sd1} = \frac{Md_2}{L_{unit}}$   
 $F_{sd1} = \frac{1280}{600} = 2.13\text{N}$

rolling moment  $M_{rd1} = \frac{Md_3}{2}$   
 $M_{rd1} = \frac{-17640}{2} = -8820\text{N} \cdot \text{mm}$

Ball Spline 2

vertical direction  $F_{rd2} = \frac{m \cdot g}{2} + \frac{Md_1}{L_{unit}}$   
 $F_{rd2} = \frac{10 \times 9.8}{2} + \frac{18 \times 9.8}{2} + \frac{-21360}{600} = 101.6\text{N}$

horizontal direction  $F_{sd2} = -\frac{Md_2}{L_{unit}}$   
 $F_{sd2} = -\frac{1280}{600} = -2.13\text{N}$

rolling moment  $M_{rd2} = \frac{Md_3}{2}$   
 $M_{rd2} = \frac{-17640}{2} = -8820\text{N} \cdot \text{mm}$

### ③ Calculating Equivalent Load

Pr in the vertical direction and Ps in the horizontal direction are calculated by the following equations.

$$Pr = |Fr| + |Er \cdot Mr|$$

$$Ps = |k \cdot Fs|$$

$E_2 = 0.229$  for SSP25A  
 $k = 1$  for SSP-A

$$Pr_1 = |Fr_1| + |Er \cdot Mr_1| = |189.8| + |0.229 \times (-8820)| = 2209.58 \text{ (N)}$$

calculating in the same manner

Table 1-32

	acceleration	constant	deceleration
Ball Spline 1	$Pr_{a1} = 2209.58$	$Pr_1 = 2201.08$	$Pr_{d1} = 2192.58$
	$Ps_{a1} = 2.13$	$Ps_1 = 0$	$Ps_{d1} = 2.13$
Ball Spline 2	$Pr_{a2} = 2104.38$	$Pr_2 = 2112.88$	$Pr_{d2} = 2121.38$
	$Ps_{a2} = 2.13$	$Ps_2 = 0$	$Ps_{d2} = 2.13$

Calculating Dynamic Equivalent Load

$$P = Pr + Ps$$

$$Pa_1 = Pr_{a1} + Ps_{a1} = 2209.58 + 2.13 = 2211.71 \text{ (N)}$$

calculating in the same manner

Table 1-33

	acceleration	constant	deceleration
Ball Spline 1	$Pa_1 = 2211.71$	$P_1 = 2201.08$	$Pd_1 = 2194.71$
Ball Spline 2	$Pa_2 = 2106.51$	$P_2 = 2112.88$	$Pd_2 = 2123.51$

Calculating Average Equivalent Load

$$P_m = \sqrt[3]{\frac{1}{\ell_s} \times \left\{ (Pa^3 \times \frac{V_{max} \times t_1}{2}) + (P^3 \times V_{max} \times t_2) + (Pd^3 \times \frac{V_{max} \times t_3}{2}) \right\}}$$

$$P_{m1} = \sqrt[3]{\frac{1}{300} \times \left\{ (2211.71^3 \times \frac{150 \times 0.1}{2}) + (2201.08^3 \times 150 \times 1.9) + (2194.71^3 \times \frac{150 \times 0.1}{2}) \right\}} = 2201.19 \text{ (N)}$$

$$P_{m2} = \sqrt[3]{\frac{1}{300} \times \left\{ (2106.51^3 \times \frac{150 \times 0.1}{2}) + (2112.88^3 \times 150 \times 1.9) + (2123.51^3 \times \frac{150 \times 0.1}{2}) \right\}} = 2112.99 \text{ (N)}$$

### ④ Calculating Rated Life

Decide each coefficient

$f_H$ : **hardness coefficient**  $f_H = 1$  for hardness of spline nut is 58HRC or more

$f_T$ : **temperature coefficient**  $f_T = 1$  operating temperature is below 100°C (80°C is maximum for SSP-A)

$f_C$ : **contact coefficient** considering the use of nut in close contact  
 $f_C = 1$  for nuts are not in close contact

$f_W$ : **applied load coefficient**  $f_W = 1.5$  for  $V_{max} = 150 \text{ mm/s}$

Calculating Rated Life

Selecting Ball Spline 1 that carries the maximum dynamic equivalent load

$$L = \left( \frac{f_H \times f_T \times f_C}{f_W} \times \frac{C}{P_m} \right)^3 \times 50$$

$$L = \left( \frac{1 \times 1 \times 1}{1.5} \times \frac{12800}{2201.19} \right)^3 \times 50 = 2913.10 \text{ (km)}$$

Calculating Life Time

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

$$L_h = \frac{2913.10 \times 10^6}{2 \times 300 \times 14 \times 60} = 5779 \text{ (hour)}$$

### ⑤ Calculating Static Safety Factor

Equation for Static Equivalent Load

$$P_0 = Pr + Ps$$

$$P_{0a1} = Pr_{a1} + Ps_{a1} = 2209.58 + 2.13 = \text{(N)}$$

calculating in the same manner

Table 1-34

	acceleration	constant	deceleration
Ball Spline 1	$P_{0a1} = 2211.71$	$P_{01} = 2201.08$	$P_{0d1} = 2194.71$
Ball Spline 2	$P_{0a2} = 2106.51$	$P_{02} = 2112.88$	$P_{0d2} = 2123.51$

Selecting Ball Spline 1 that carries the maximum static equivalent load during acceleration

$$f_s = \frac{C_0}{P_0}$$

$$f_s = \frac{C_0}{P_{0a1}} = \frac{23400}{2211.71} = 10$$

**RATED LIFE CALCULATION EXAMPLE 3**

**2 Vertical Axes, 1 Bush each, Considering Acceleration/Deceleration**

**Operating Conditions**

part number: SM30W  
 basic dynamic load rating  $C=2.49\text{kN}$   
 basic static load rating  $C_0=5.49\text{kN}$   
 shaft span:  $L_{\text{rail}}=80\text{mm}$   
 drive:  $Y_d=20\text{mm}$   
 $Z_d=-20\text{mm}$   
 mass:  $m_1=5\text{kg}$   $X_1=0\text{mm}$   
 $Y_1=0\text{mm}$   
 $Z_1=30\text{mm}$   
 $m_2=20\text{kg}$   $X_2=40\text{mm}$   
 $Y_2=50\text{mm}$   
 $Z_2=20\text{mm}$   
 velocity:  $V_{\text{max}}=150\text{mm/s}$   
 time:  $t_1=0.1\text{s}$   
 $t_2=0.7\text{s}$   
 $t_3=0.1\text{s}$   
 acceleration:  $a_1=1.5\text{m/s}^2$   
 $a_3=1.5\text{m/s}^2$   
 stroke:  $l_s=120\text{mm}$   
 number of cycles per minute:  $n_1=33\text{cpm}$

Figure 1-11

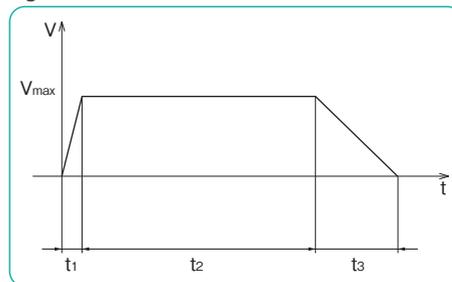
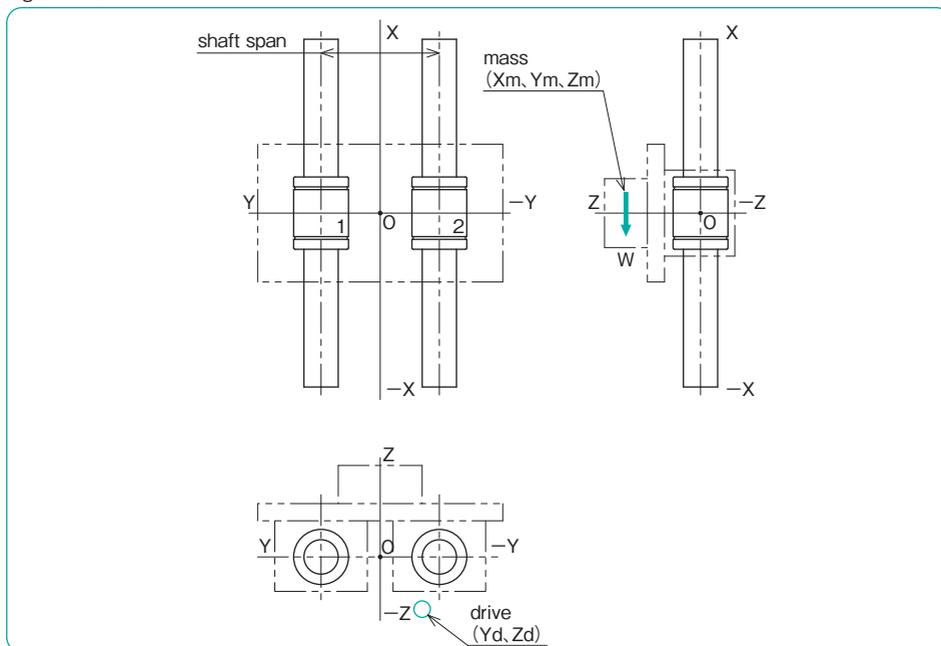


Figure 1-12



**① Calculating Moment Applied to the Unit**

**<acceleration>**

pitching  $M_{a1} = m \cdot g \cdot (Z_m - Z_d) + m \cdot a_1 \cdot (Z_m - Z_d)$   
 $M_{a1} = 5 \times 9.8 \times \{(30) - (-20)\} + 5 \times 1.5 \times \{(30) - (-20)\} + 20 \times 9.8 \times \{(20) - (-20)\} + 20 \times 1.5 \times \{(20) - (-20)\} = 11865\text{N} \cdot \text{mm}$   
 yawing  $M_{a2} = m \cdot g \cdot (Y_m - Y_d) + m \cdot a_1 \cdot (Y_m - Y_d)$   
 $M_{a2} = 5 \times 9.8 \times \{(0) - (20)\} + 5 \times 1.5 \times \{(0) - (20)\} + 20 \times 9.8 \times \{(50) - (20)\} + 20 \times 1.5 \times \{(50) - (20)\} = 5650\text{N} \cdot \text{mm}$   
 rolling  $M_{a3} = 0$

**<constant>**

pitching  $M_1 = m \cdot g \cdot (Z_m - Z_d)$   
 $M_1 = 5 \times 9.8 \times \{(30) - (-20)\} + 20 \times 9.8 \times \{(20) - (-20)\} = 10290\text{N} \cdot \text{mm}$   
 yawing  $M_2 = m \cdot g \cdot (Y_m - Y_d)$   
 $M_2 = 5 \times 9.8 \times \{(0) - (20)\} + 20 \times 9.8 \times \{(50) - (20)\} = 4900\text{N} \cdot \text{mm}$   
 rolling  $M_3 = 0$

**<deceleration>**

pitching  $M_{d1} = m \cdot g \cdot (Z_m - Z_d) - m \cdot a_3 \cdot (Z_m - Z_d)$   
 $M_{d1} = 5 \times 9.8 \times \{(30) - (-20)\} - 5 \times 1.5 \times \{(30) - (-20)\} + 20 \times 9.8 \times \{(20) - (-20)\} - 20 \times 1.5 \times \{(20) - (-20)\} = 8715\text{N} \cdot \text{mm}$   
 yawing  $M_{d2} = m \cdot g \cdot (Y_m - Y_d) - m \cdot a_3 \cdot (Y_m - Y_d)$   
 $M_{d2} = 5 \times 9.8 \times \{(0) - (20)\} - 5 \times 1.5 \times \{(0) - (20)\} + 20 \times 9.8 \times \{(50) - (20)\} - 20 \times 1.5 \times \{(50) - (20)\} = 4150\text{N} \cdot \text{mm}$   
 rolling  $M_{d3} = 0$

**② Calculating Load Applied to the Slide Bush**

**<acceleration>**

Bush 1  
 vertical direction  $F_{ra1} = \frac{M_{a3}}{L_{\text{rail}}} = 0$   
 horizontal direction  $F_{sa1} = 0$   
 pitching  $M_{pa1} = \frac{M_{a1}}{2}$   
 $M_{pa1} = \frac{11865}{2} = 5932.5\text{N} \cdot \text{mm}$   
 yawing  $M_{ya1} = \frac{M_{a2}}{2}$   
 $M_{ya1} = \frac{5650}{2} = 2825\text{N} \cdot \text{mm}$

Bush 2

$$\text{vertical direction } Fr_2 = \frac{Ma_3}{L_{\text{rail}}} = 0$$

$$\text{horizontal direction } Fsa_2 = 0$$

$$\text{pitching } Mpa_2 = \frac{Ma_1}{2}$$

$$Mpa_2 = \frac{11865}{2} = 5932.5 \text{ N} \cdot \text{mm}$$

$$\text{yawing } Mya_2 = \frac{Ma_2}{2}$$

$$Mya_2 = \frac{5650}{2} = 2825 \text{ N} \cdot \text{mm}$$

&lt;constant&gt;

Bush 1

$$\text{vertical direction } Fr_1 = \frac{M_3}{L_{\text{rail}}} = 0$$

$$\text{horizontal direction } Fs_1 = 0$$

$$\text{pitching } Mp_1 = \frac{M_1}{2}$$

$$Mp_1 = \frac{10290}{2} = 5145 \text{ N} \cdot \text{mm}$$

$$\text{yawing } My_1 = \frac{M_2}{2}$$

$$My_1 = \frac{4900}{2} = 2450 \text{ N} \cdot \text{mm}$$

Bush 2

$$\text{vertical direction } Fr_2 = \frac{M_3}{L_{\text{rail}}} = 0$$

$$\text{horizontal direction } Fs_2 = 0$$

$$\text{pitching } Mp_2 = \frac{M_1}{2}$$

$$Mp_2 = \frac{10290}{2} = 5145 \text{ N} \cdot \text{mm}$$

$$\text{yawing } My_2 = \frac{M_2}{2}$$

$$My_2 = \frac{4900}{2} = 2450 \text{ N} \cdot \text{mm}$$

&lt;deceleration&gt;

Bush 1

$$\text{vertical direction } Frd_1 = \frac{Md_3}{L_{\text{rail}}} = 0$$

$$\text{horizontal direction } Fsd_1 = 0$$

$$\text{pitching } Mpd_1 = \frac{Md_1}{2}$$

$$Mpd_1 = \frac{8715}{2} = 4357.5 \text{ N} \cdot \text{mm}$$

$$\text{yawing } Myd_1 = \frac{Md_2}{2}$$

$$Myd_1 = \frac{4150}{2} = 2075 \text{ N} \cdot \text{mm}$$

Bush 2

$$\text{vertical direction } Frd_2 = \frac{Md_3}{L_{\text{rail}}} = 0$$

$$\text{horizontal direction } Fsd_2 = 0$$

$$\text{pitching } Mpd_2 = \frac{Md_1}{2}$$

$$Mpd_2 = \frac{8715}{2} = 4357.5 \text{ N} \cdot \text{mm}$$

$$\text{yawing } Myd_2 = \frac{Md_2}{2}$$

$$Myd_2 = \frac{4150}{2} = 2075 \text{ N} \cdot \text{mm}$$

### ③ Calculating Equivalent Load

©Pr in the vertical direction and Ps in the horizontal direction are calculated by the following equations.

$$Pr = |Fr| + |E_1 \cdot Mp|$$

$$Ps = |k \cdot Fs| + |E_1 \cdot My|$$

$E_1 = 6.63 \times 10^{-2}$  for SM30W

$k = 1$  for Slide Bush

Table 1-35

	acceleration	constant	deceleration
bush 1	$Pr_{a1} = 393.3$	$Pr_1 = 341.1$	$Pr_{d1} = 288.9$
	$Ps_{a1} = 187.3$	$Ps_1 = 162.4$	$Ps_{d1} = 137.6$
bush 2	$Pr_{a2} = 393.3$	$Pr_2 = 341.1$	$Pr_{d2} = 288.9$
	$Ps_{a2} = 187.3$	$Ps_2 = 162.4$	$Ps_{d2} = 137.6$

©Equation for Dynamic Equivalent Load

$$P = Pr + Ps$$

$Pa_1 = Pr_{a1} + Ps_{a1} = 393.3 + 187.3 = 580.6(N)$

calculating in the same manner

Table 1-36

	acceleration	constant	deceleration
bush 1	$Pa_1 = 580.6$	$P_1 = 503.5$	$Pd_1 = 426.5$
bush 2	$Pa_2 = 580.6$	$P_2 = 503.5$	$Pd_2 = 426.5$

©Calculating Average Equivalent Load

$$Pm = \sqrt[3]{\frac{1}{l_s} \times \left\{ (Pa^3 \times \frac{V_{max} \times t_1}{2}) + (P^3 \times V_{max} \times t_2) + (Pd^3 \times \frac{V_{max} \times t_3}{2}) \right\}}$$

$$Pm_1 = \sqrt[3]{\frac{1}{120} \times \left\{ (580.6^3 \times \frac{150 \times 0.1}{2}) + (503.5^3 \times 150 \times 0.7) + (426.5^3 \times \frac{150 \times 0.1}{2}) \right\}} = 505.0(N)$$

$$Pm_2 = \sqrt[3]{\frac{1}{120} \times \left\{ (580.6^3 \times \frac{150 \times 0.1}{2}) + (503.5^3 \times 150 \times 0.7) + (426.5^3 \times \frac{150 \times 0.1}{2}) \right\}} = 505.0(N)$$

### ④ Calculating Rated Life

Decide each coefficient

$f_H$ : hardness coefficient  $f_H = 1$  for hardness of bush is 58HRC or more

$f_T$ : temperature coefficient  $f_T = 1$  operating temperature is below 100°C  
(80°C is maximum for Bush with resin retainer)

$f_C$ : contact coefficient  $f_C = 1$  for bushes are not in close contact

$f_W$ : applied load coefficient  $f_W = 1.5$  for  $V_{max} = 150mm/s$

©Calculating Rated Life

Selecting Bush 1 that carries the maximum equivalent load

$$L = \left( \frac{f_H \times f_T \times f_C}{f_W} \times \frac{C}{P_m} \right)^3 \times 50$$

$$L = \left( \frac{1 \times 1 \times 1}{1.5} \times \frac{2490}{505.0} \right)^3 \times 50 = 1775(km)$$

©Calculating Life Time

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

$$L_h = \frac{1775 \times 10^6}{2 \times 120 \times 33 \times 60} = 3735(hour)$$

### ⑤ Calculating Static Safety Factor

©Equation for Static Equivalent Load

$$Po = Pr + Ps$$

$Po_{a1} = Pr_{a1} + Ps_{a1} = 393.3 + 187.3 = 580.6(N)$

calculating in the same manner

Table 1-37

	acceleration	constant	deceleration
bush 1	$Po_{a1} = 580.6$	$Po_1 = 503.5$	$Pod_1 = 426.5$
bush 2	$Po_{a2} = 580.6$	$Po_2 = 503.5$	$Pod_2 = 426.5$

Selecting Bush 1 that carries the maximum static equivalent load

$$f_s = \frac{C_0}{P_0}$$

$$f_s = \frac{C_0}{Po_{a1}} = \frac{5490}{580.6} = 9.4$$



④ Calculating Rated Life

Decide each coefficient

$f_H$  : hardness coefficient  $f_H=1$  for hardness of ball spline is 58HRC or more

$f_T$  : temperature coefficient  $f_T=1$  operating temperature is below 100°C (80°C is maximum for rotary ball spline)

$f_C$  : contact coefficient considering the use of nut in close contact  $f_C=1$  for nuts are not in close contact

$f_W$  : applied load coefficient  $f_W=1.5$  for  $V_{max}=50\text{mm/s}$  when there's no impact nor vibration.

◎ Calculating Rated Life

$$L = \left( \frac{f_H \times f_T \times f_C}{f_W} \times \frac{C}{P_m} \right)^3 \times 50$$

$$L = \left( \frac{1 \times 1 \times 1}{1.5} \times \frac{12.8 \times 1000}{1705} \right)^3 \times 50 = 6268.3(\text{km})$$

◎ Calculating Life Time

$$L_h = \frac{L}{2 \times l_s \times n_1 \times 60}$$

$$L_h = \frac{6268.3 \times 1000 \times 1000}{2 \times 50 \times 20 \times 60} = 5.22 \times 10^4 (\text{hour})$$

⑤ Calculating Static Safety Factor

$$f_s = \frac{C_0}{P_{max}}$$

$$f_s = \frac{23.4 \times 10^3}{1861.6} = 12.6$$

RATED LIFE CALCULATION EXAMPLE 5

SPR cross roller bearing, using equivalent coefficient  $E_{RM}$

1 Horizontal Axis, 1 Nut, Outer Ring Fixed, Rotating Outer Cylinder and Shaft, X-direction position of Shaft Fixed.

Operating Conditions

part number: SPR25A

cross roller bearing basic dynamic load rating  $C_R=9.63\text{kN}$

cross roller bearing basic static load rating  $C_{0R}=12.7\text{kN}$

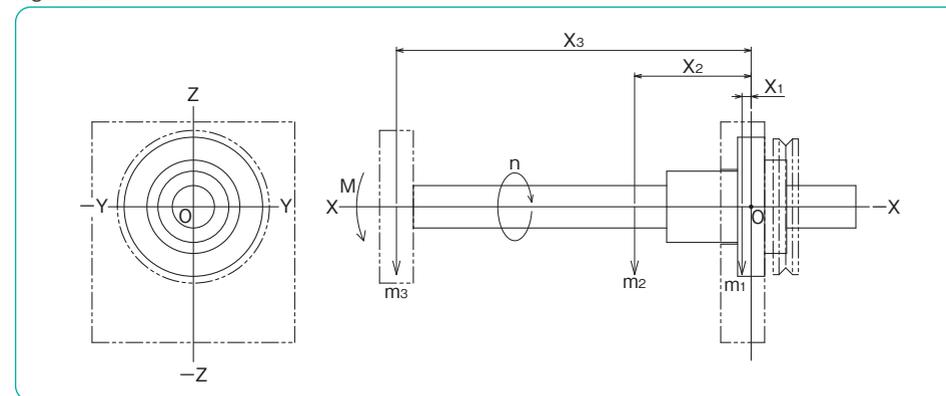
mass :  $m_1=0.81\text{kg}$   $X_1=5.4\text{mm}$

$m_2=1\text{kg}$   $X_2=69\text{mm}$

$m_3=10\text{kg}$   $X_3=210\text{mm}$

Revolutions :  $n=600\text{rpm}$

Figure 1-14



① Calculating Moment Applied to the Cross Roller Bearing

$$M = g \cdot (m_1 \cdot x_1 + m_2 \cdot x_2 + m_3 \cdot x_3)$$

$$M = 9.8 \times (0.81 \times 5.4 + 1 \times 69 + 10 \times 210) = 21299.1 \text{ N} \cdot \text{mm}$$

② Calculating Load Applied to the Cross Roller Bearing

vertical direction (Radial Load)  $F_r = g \cdot (m_1 + m_2 + m_3)$

$$F_r = 9.8 \times (0.81 + 1 + 10) = 115.7 \text{ N}$$

Axial load  $F_a = 0$

※Radial Load: Force acting in a direction perpendicular to the axis of rotation of a crossed roller bearing  
Axial load: Force acting in a direction parallel to the rotation axis of a cross roller bearing

③ Calculate Dynamic Equivalent Load

$$P = X \cdot (F_r + E_{RM} \cdot M) + Y \cdot F_a$$

rotational equivalent coefficient  $E_{RM} = 3.55 \times 10^{-2} (1/\text{mm})$  for SPR25A

dynamic radial load coefficient: X

dynamic axial load coefficient: Y

calculate load coefficient: X, Y using equation below

$$\frac{F_a}{F_r + E_{RM} \cdot M} = \frac{0}{115.7 + 3.55 \times 10^{-2} \times 21299.1} < 1.5$$

differentiate	X	Y
$\frac{F_a}{F_r + E_{RM} \cdot M} \leq 1.5$	1	0.45
$\frac{F_a}{F_r + E_{RM} \cdot M} > 1.5$	0.67	0.67

Thus, X=1, Y=0.45

$$P = 1 \times (115.7 + 3.55 \times 10^{-2} \times 21299.1) + 0.45 \times 0 = 871.8 \text{ N}$$

④ Calculating Rated Life

Decide each coefficient

$f_H$ : hardness coefficient  $f_H = 1$  for hardness of cross roller bearing is 58HRC or more

$f_T$ : temperature coefficient  $f_T = 1$  operating temperature is below 100°C  
(80°C is maximum for rotary ball spline)

$f_C$ : contact coefficient considering the use of nut in close contact  
 $f_C = 1$  for nuts are not in close contact

$f_W$ : applied load coefficient  $f_W = 1.5$  for  $V_{max} = 50 \text{ mm/s}$  when there's no impact nor vibration.

◎ Calculating Rated Life

$$L = \left( \frac{f_H \times f_T \times f_C}{f_W} \times \frac{C_{RR}}{P} \right)^{\frac{10}{3}} \times 10^6$$

$$L = \left( \frac{1 \times 1 \times 1}{1.5} \times \frac{9.63 \times 1000}{871.8} \right)^{\frac{10}{3}} \times 10^6 = 7.77 \times 10^8 \text{ rev}$$

◎ Calculating Life Time

$$L_h = \frac{L}{n \times 60}$$

$$L_h = \frac{7.77 \times 10^8}{600 \times 60} = 2.16 \times 10^4 \text{ (hour)}$$

⑤ Calculating Static Safety Factor

◎ Calculating Static Equivalent Load

static equivalent load  $P_0 = X_0 \cdot (F_r + E_{RM} \cdot M) + Y_0 \cdot F_a$

static radial load coefficient:  $X_0 = 1$

static axial load coefficient:  $Y_0 = 0.44$

$$P_0 = 1 \times (115.7 + 3.55 \times 10^{-2} \times 21299.1) + 0.44 \times 0 = 871.8 \text{ N}$$

$$f_s = \frac{C_{OR}}{P_0}$$

$$f_s = \frac{12.7 \times 10^3}{871.8} = 14.6$$

**RATED LIFE CALCULATION EXAMPLE 6**

**Horizontal Use - Considering Moment Loads that Change with Stroke**

acceleration and deceleration are not considered

**Operating Conditions**

part number: SVT3105  
 basic dynamic load rating  $C=6.03\text{kN}$   
 basic static load rating  $C_0=7.78\text{kN}$

drive:  $Y_d=0\text{mm}$   
 $Z_d=50\text{mm}$

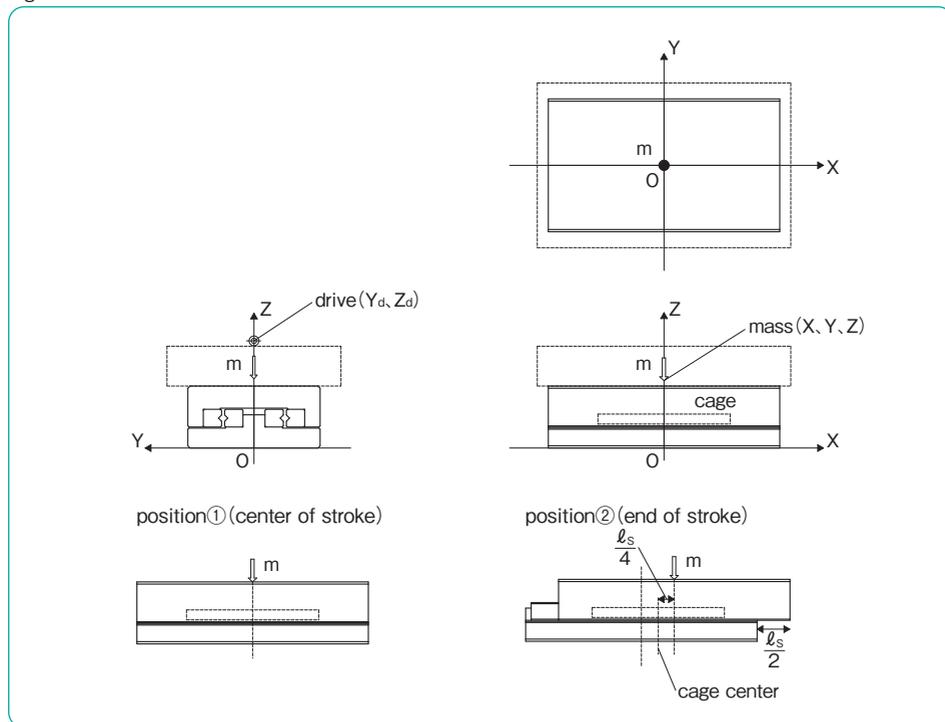
mass:  $m=10\text{kg}$   $X=0\text{mm}$   
 $Y=0\text{mm}$   
 $Z=30\text{mm}$

velocity:  $V_{ave}=100\text{mm/s}$  ※Only constant speed is considered.

stroke:  $l_s=60\text{mm}$

round trip per minute:  $n_1=50\text{cpm}$

Figure 1-15



**① Calculating Load and Moment Applied to the Slide Table**

**<position ① center of stroke>**

◎Applied Load

vertical direction  $F_{r1}=m \cdot g$

$F_{r1}=10 \times 9.8=98\text{N}$

horizontal direction  $F_{s1}=0$

◎Moment

pitching  $M_{Pc}=0$

yawing  $M_{Yc}=0$

rolling  $M_{Rc}=0$

**<position ② end of stroke>**

◎Applied Load

vertical direction  $F_{r2}=m \cdot g$

$F_{r2}=10 \times 9.8=98\text{N}$

horizontal direction  $F_{s2}=0$

◎Moment

pitching  $M_{PE}=\frac{l_s}{4} \cdot m \cdot g$

$M_{PE}=\frac{60}{4} \times 10 \times 9.8=1470\text{N} \cdot \text{mm}$

yawing  $M_{YE}=0$

rolling  $M_{RE}=0$

### ② Calculating Equivalent Load

◎ Calculate the converted load in the vertical direction  $P_r$  using the following equation

$$Pr = |Fr| + |E_P \cdot M_P| + |E_R \cdot M_R|$$

$$Ps = |k \cdot Fs| + |E_Y \cdot M_Y| \quad k=1 \text{ for SVT}$$

Table 1-38

position ① center of stroke	position ② end of stroke
$Pr_1 = 98$	$Pr_2 = 209.0$
$Ps_1 = 0$	$Ps_2 = 0$

◎ Calculate Dynamic Equivalent Load

$$P = Pr + Ps$$

Table 1-39

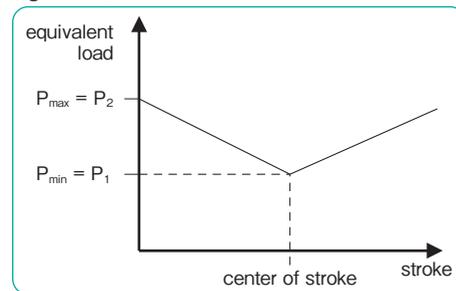
position ① center of stroke	position ② end of stroke
$P_1 = 98$	$P_2 = 209.0$

◎ Calculate Average Load

$$P_m = \frac{1}{3} (P_{\min} + 2 \cdot P_{\max})$$

$$P_m = \frac{1}{3} (98 + 2 \times 209.0) = 171.99(\text{N})$$

Figure 1-16



### ③ Calculating Rated Life

Decide each coefficient

$f_H$ : **hardness coefficient**  $f_H=1$  for hardness of slide table is 58HRC or more

$f_T$ : **temperature coefficient**  $f_T=1$  operating temperature is below 100°C

$f_C$ : **contact coefficient** considering the use of slide table in close contact  
 $f_C=1$  for slide table are not in close contact

$f_W$ : **applied load coefficient**  $f_W=1.5$  for  $V_{\max}=100\text{mm/s}$

◎ Calculating Rated Life

$$L = \left( \frac{f_H \times f_T \times f_C}{f_W} \times \frac{C}{P_m} \right)^{\frac{10}{3}} \times 50$$

$$L = \left( \frac{1 \times 1 \times 1}{1.5} \times \frac{6030}{171.99} \right)^{\frac{10}{3}} \times 50 = 1825490(\text{km})$$

◎ Calculating Life Time

$$L_h = \left( \frac{L \times 10^3}{2 \times l_s \times n_1 \times 60} \right)$$

$$L_h = \left( \frac{1825490 \times 10^3}{2 \times 60 \times 50 \times 60} \right) = 5070(\text{hour})$$

### ④ Calculating Static Safety Factor

◎ Calculating Static Equivalent Load

$$P_0 = Pr + Ps$$

Table 1-40

position ① center of stroke	position ② end of stroke
$P_{01} = 98$	$P_{02} = 209.0$

Calculate the static safety factor for position ② where the static equivalent load is largest

$$f_s = \frac{C_0}{P_0}$$

$$f_s = \frac{C_0}{P_{02}} = \frac{7780}{209.0} = 37$$

### RIGIDITY AND PRELOAD

#### Effect of Preload and Rigidity

The rigidity of a linear systems must be taken into consideration when it is to be used in high-precision positioning devices or high-precision machinery. Preloaded slide guides and ball splines, which use balls as the rolling elements, are available upon request to meet the need for greater rigidity.

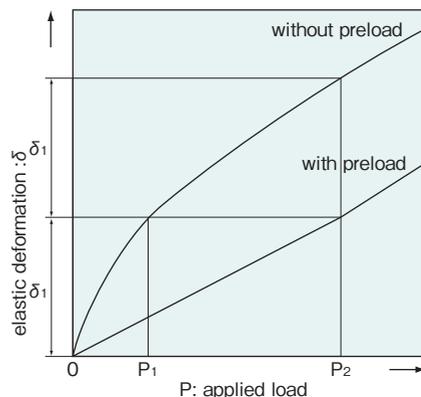
If a force is applied to the ball elements without preload, an elastic deformation proportional to the applied force to the 2/3 power will result. Therefore, the elastic deformation is relatively large during the initial loading stage, however then becomes smaller as the load increases.

Preloading on the rolling elements absorbs the deformation of the block under the same loading. Please contact NB for available data in regard to rigidity.

#### Types of Preload and its Specification

Preload is categorized into three ranges: standard, light, and medium for option. In the NB linear systems, preload is applied by installing rolling elements that are slightly larger than standard. Therefore, the specification of the preload is expressed by a negative value.

Figure 1-17 Applied Load versus Block Deformation



### FRICTIONAL RESISTANCE AND REQUIRED THRUST

The static friction of a linear systems is extremely low. Since the difference between the static and dynamic friction is marginal, stable motion can be achieved from low to high speed. The frictional resistance (required thrust) can be obtained from the load and the seal resistance unique to each type of system using the following equation:

$$F = \mu \cdot W + f \dots\dots\dots (14)$$

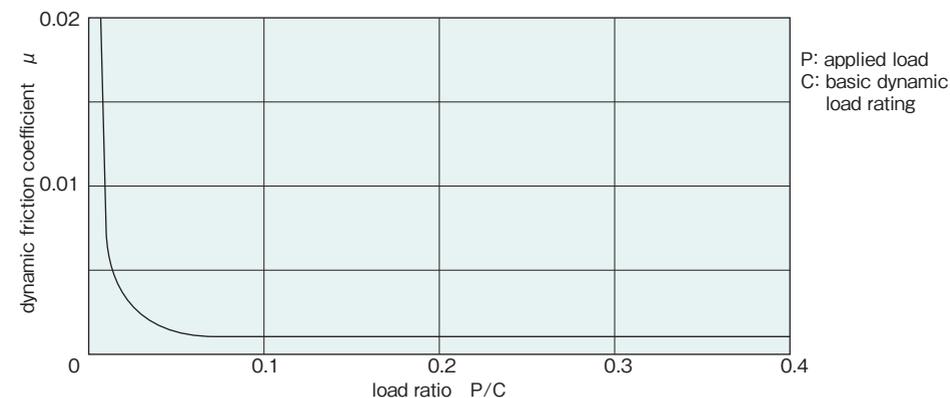
F: frictional resistance (N)    μ: dynamic friction coefficient  
W: applied load (N)    f: seal resistance (N)

The dynamic friction coefficient varies with the applied load, preload, viscosity of the lubricant, and other factors. However, the values given in Table 1-41 are used for the normal loading condition (20% of basic dynamic load rating) without any preload. The seal resistance depends on the seal-lip condition as well as on the condition of the lubricant, however, it does not change proportionally with the applied load, which commonly is expressed by a constant value of 2 to 5 N.

Table 1-41 Dynamic Friction Coefficient

product	type	dynamic friction coefficient (μ)
Ball Spline	SSP	0.004~0.006
Rotary Ball Spline	SPR·SPB SPBR	0.004~0.006
Stroke Ball Spline	SPLFS	0.001~0.003
Slide Bush	SM·KB SW·GM SMA·SME	0.002~0.003
Top Ball	TK·TKA TKE·TKD TW·TWA TWJ·TWD	0.002~0.003
Stroke Bush	SR	0.0006~0.0012
Slide Rotary Bush	SRE	0.002~0.003
	RK	0.002~0.003
Slide Way	NV·HV·SV·RV	0.001~0.003
Slide Table	NVT·NYT·HVT· HYT·SVT·SYT	0.001~0.003
Miniature Slide	SYBS	0.001~0.003

Figure 1-18 Applied Load versus Dynamic Friction Coefficient



**OPERATING ENVIRONMENT**

**Temperature Range**

The NB linear systems are heat-treated in order to harden the surface. Therefore, if the temperature of the linear systems exceeds 100°C, the hardness and load rating will be reduced (refer to page Eng-6, hardness coefficient). If resin is used in any one of the components, the systems cannot be used in a high-temperature environment. The recommended operating temperature ranges for each type of linear systems are listed in Table 1-42.

Table 1-42 Major Types and Recommended Temperature Range

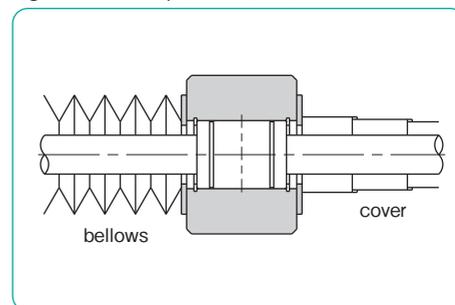
component material	includes resin	steel	stainless	other
operating temperature range	-20°C~80°C	-20°C~110°C	-20°C~140°C*	
Ball Spline	SSP/SSPF		SPLFS	
Rotary Ball Spline	SPR/SPB			
Ball Screw Spline	SPBR/SPBF			
Slide Bush	SM G/SMS G KB G/KBS G SW G/SWS G GM	SM/KB/SW	SMS/KBS/SWS	
Top Ball	TK/TW			
Stroke Bush		SR/SR-B		
Slide Rotary Bush	RK	SRE		
Slide Way	NV/NVS	HV/SV/RV	HVS/SVS/NVS-RNS	
Slide Table	NVT/NYT	HVT·HYT·SVT·SYT	HYTS·SYTS	NVTS/HVTS/SVTS**
Miniature Slide			SYBS	
Slide Screw		SS		

\* If the system is made of stainless steel and has a seal, the temperature range is up to 120°C  
 \*\* Please contact NB if the system is to be used out of room temperatures.

**Operating Environment**

Foreign particles or dust in the linear systems affects the motion accuracy and shortens the life time. Standard seals will perform well for dust prevention under normal operating conditions, however, in a harsh environment it is necessary to attach bellows or protective covers as Figure 1-19 shows.

Figure 1-19 Example of Dust Prevention



**LUBRICATION**

**Lubrication**

The objective of lubrication includes the reduction of friction among the rolling elements as well as between the rolling elements and the raceway, preventing of sintering, reduction of wear, and prevention of rust by forming a film over the surface.

To maximize the performance of a linear systems, the lubricant type and a lubrication method appropriate for the operating environment should be selected.

In addition, the steel part of the product is applied with rust-preventing oil that has little effect on the lubrication.

Table 1-43 (1) Lubrication

lubrication	type
grease lubrication	lithium soap based grease urea grease
oil lubrication	Turbine Oil ISO Standard VG32 ~ 68

Both oil and grease lubrication are applicable. Please select proper lubricant and its method in conformity to operating conditions.

Table 1-43 (2) Pre-applied Lubricant

product	lubrication
Ball Spline	lithium soap based grease pre-applied
Rotary Ball Spline	lithium soap based grease pre-applied
Stroke Ball Spline	lithium soap based grease pre-applied
Ball Screw Spline	lithium soap based grease pre-applied
Slide Bush	anti-rust oil only
Top Ball	anti-rust oil only
Stroke Bush	anti-rust oil only
Slide Rotary Bush	anti-rust oil only
Slide Shaft	anti-rust oil only
Slide Way · Slide Table	lithium soap based grease pre-applied
Miniature Slide	lithium soap based grease pre-applied
Gonio Way	lithium soap based grease pre-applied
Actuator	lithium soap based grease pre-applied
Slide Screw	radial ball bearings part lithium based grease pre-applied

For products applied with "anti-rust oil only", remove the anti-rust oil from the factory and enclose the lubricant before use.

The product with "Lithium Soap Grease pre-applied" is filled with grease and can be used as is. When installing the product, it is recommended to remove the rust preventive oil from the mounting surface before assembling.

**Lubrication Interval**

Please relubricate with a similar type of grease periodically depending on the operating condition. The recommended relubrication period is about 6 months or 1,000 km of travel distance under normal condition. It is possible to extend the lubrication interval. A felt seal (P.C-15) is available for the slide bush. By installing a double lip seal (P.C-14) for slide bush, it is possible to prevent grease leakage and extend the lubrication interval.

### Grease for Special Environments

NB provides the following optional greases. Please select one in accordance with the use conditions of your linear system. To ensure that the special greases perform as intended, they are filled into the product after degreasing, and no anti-rust oil is applied to the product.

#### ●KGLA Grease (Low Dust Generation Grease)

KGLA Grease has an excellent property of low dust generation using a lithium-type thickening agent. It is ideal for use in a clean room. Furthermore, the dynamic friction resistance value is small, which is advantageous for suppressing rolling resistance even in special environments.

#### ●KGU Grease (Low Dust Generation Grease)

KGU Grease uses Urea-type thickening agent which has features including a superior low dust generation property, highly stable in oxidation due to no metallic elements, and has excellent durability and heat resistance.

Table 1-44 Main Property

item	grease name	
	KGLA Grease	KGU Grease
appearance	whitish-yellow	light brown
base oil	synthetic oil and refined oil mixed	synthetic oil and refined oil mixed
kinematic viscosity of base oil (mm <sup>2</sup> /s, 40°C)	25	100
thickening agent	lithium soap	urea
mixture viscosity	260	248
drop point (°C)	195	280 or higher
copper plate corrosion (100°C, 24hrs)	passed	passed
evaporation (mass%)	0.3	0.09 (99°C 22h)
oil separation (mass%100°C, 24hrs)	4.6	0.5
oxidation stability (MPa99°C, 100hrs)	0.025	0.015
bearing corrosion prevention (52°C, 48hrs)	passed	passed
operating temperature range (°C)	-40~120	-30~160

#### ●KGF Grease (Anti-fretting/Anti-corrosion Grease)

With urea-type thickening agent used, KGF Grease is very effective to prevent fretting and corrosion.

Table 1-45 Main Property

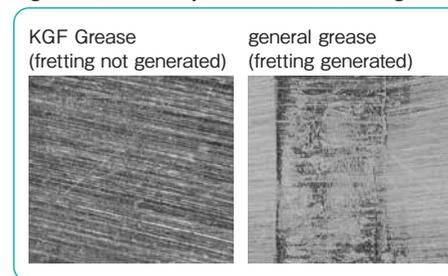
item	grease name KGF Grease
appearance	brown
base oil	synthetic oil
kinematic viscosity of base oil (mm <sup>2</sup> /s, 40°C)	approx. 25
thickening agent	urea
mixture viscosity	285
drop point (°C)	250 or higher
copper plate corrosion (100°C, 24 hrs)	passed
evaporation (mass%)	0.22 (99°C 22h)
oil separation (mass%100°C, 24 hrs)	0.3
oxidation stability (MPa99°C, 100 hrs)	0.035
bearing corrosion prevention (52°C, 48 hrs)	passed
operating temperature range (°C)	-50~170

### Anti-fretting/Anti-corrosion Test Data

Table 1-46 Test Conditions

item	content
tested item	NVT4165
stroke	2 mm
acceleration	2.4G
average acceleration	0.1 m/s
cycle per minute	1,450 cpm
grease injection volume	0.5 cc
total travel distance	184 km
total cycles	46 million cycles

Figure 1-20 Raceway Condition after Testing



#### ●Grease for the food processing industry (NSF H1 certified) is available.

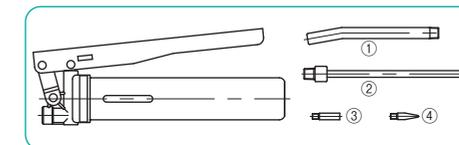
It is the most suitable combination for the food processing applications to use this type of grease with stainless steel products. Please contact NB for details.

## NB MAINTENANCE KIT

There are two types of maintenance kit available at NB.

### 1. Grease Gun Set: GG1

Different types of nozzles are adaptable to a variety of products including Actuators and products with grease-fitting.



product	Slide Bush	Slide Rotary Bush	Actuator	Others
①lubricant nozzle (φ10)	TR □ -Q TQ □ (30,35,40) SMA-W SME-W	SMA-RW	BG (46,55)	-
③ and ② lubricant nozzle (φ 5)	TQ □ (16,20,25)	-	BG (20,26,33) BH (23,30)	-
④ and ② lubricant nozzle	-	-	-	Applied with ball screw or lubrication hole

In the case of difficulty in pumping, due to internal grease adhesion or shape of the bearing, please use nozzle ④ to apply grease directly onto running grooves.

### 2. Grease Dispenser: TU2

Syringe dispenser is recommended for limited space applications.



- ① Lubricant Nozzle (19G)  
Needle Diameter : φ1.08  
Needle Inner Diameter : φ0.72 (for KGF Grease)
- ② Lubricant Nozzle (17G)  
Needle Diameter : φ1.49  
Needle Inner Diameter : φ1.11 (for KGLA · KGU Grease)

## PRECAUTIONS FOR HANDLING AND USE

Please follow the instructions below to maintain the accuracy of NB linear systems as a precision part and for a safety use.

- ⚠ (1) Notes on Handling
- ① Any shock load caused by rough handling (such as dropping or hitting with hammer) may cause a scar or dent on the raceway which will hinder smooth movement and shorten expected travel life. Also be aware that such impact may damage the resin parts.
  - ② Never try to disassemble the product. Doing so may cause an entry of contamination or deterioration of assembly accuracy.
  - ③ The blocks or the outer cylinders may move just by tilting the rail or the shaft. Be careful not to let them fall off from the rail or the shaft by mistake.
  - ④ The accuracy on the mounting surface and parallelism of the rails or the shafts after assembly are important factors to optimize the performance of the linear systems. Exercise adequate care for mounting accuracy.
- ⚠ (2) Notes on Use
- ① Be careful not to let dust or foreign particles enter the linear systems during use.
  - ② When using the linear systems under an environment where dust or coolant may scatter, protect the system with a cover or bellows.
  - ③ When the NB linear systems is used in a manner that its rail is fixed to the ceiling and downward load is applied to the block (s) or the outer cylinder (s), if the block or the outer cylinder breaks, it may fall off from the rail and drop to the floor. Provide additional measures for preventing dropping of the block or the outer cylinder, such as a safety catch.
- ⚠ (3) Instructions in considering the "Life Time" of a Linear System
- ① When the load applied to a block or an outer cylinder exceeds 0.5 time of the basic dynamic load rating ( $P > 0.5C$ ), the actual life of the systems may become shorter than a calculated life time. Therefore, it is recommended to use the systems with 0.5C or lower.
  - ② In the repetition of very minute stroke, where the rolling element, a steel ball or a cylindrical roller, makes only less than a half turn, early wear called fretting occurs at the contact points between the rolling elements and the raceway. There is no perfect measure to avoid this, but the life of the system can be extended by using anti-fretting grease and moving the blocks or the outer cylinders for the full stroke length once in a few thousand times of use.  
Anti-fretting grease is available as an option. Please select it for applications with very minute stroke length.
- ⚠ (4) Mixture of different types of grease
- Mixing different types of greases does not only reduce the original lubricating performance of the grease, but may also lead to product defect.  
Before filling with new grease, clean your equipment and remove old grease first.

# SLIDE WAY SLIDE TABLE MINIATURE SLIDE GONIO WAY

## SLIDE WAY

STRUCTURE AND ADVANTAGES	A-2
TYPES	A-3
SPECIFICATION	A-4
ACCURACY	A-4
RATED LIFE	A-4
LOAD RATING	A-5
STROKE	A-6
LUBRICATION AND DUST PREVENTION	A-7
MOUNTING	A-7
SHAPE OF MOUNTING SURFACE	A-7
INSTALLATION PROCEDURE OF NV TYPE	A-8
INSTALLATION PROCEDURE OF HV&SV TYPE	A-9
SPECIAL MOUNTING SCREW BT TYPE	A-10
USE AND HANDLING PRECAUTIONS	A-11
DIMENSION TABLE	A-12~

## SLIDE TABLE

STRUCTURE AND ADVANTAGES	A-34
TYPES	A-35
SPECIFICATION	A-35
ACCURACY	A-36
RATED LIFE	A-36
LOAD RATING	A-36
USE AND HANDLING PRECAUTIONS	A-37
SPECIAL REQUIREMENTS	A-37
DIMENSION TABLE	A-38~

## MINIATURE SLIDE

STRUCTURE AND ADVANTAGES	A-64
SPECIFICATION	A-65
ACCURACY	A-65
LOAD RATING	A-65
RATED LIFE	A-65
MOUNTING	A-66
USE AND HANDLING PRECAUTIONS	A-67
DIMENSION TABLE	A-68~

## GONIO WAY

STRUCTURE AND ADVANTAGES	A-70
SPECIFICATION	A-71
ACCURACY OF RVF TYPE	A-71
ACCURACY OF RV TYPE	A-71
RATED LIFE	A-72
MOUNTING OF RVF TYPE	A-72
MOUNTING OF RV TYPE	A-74
SHAPE OF MOUNTING SURFACE	A-75
RVF TYPE 2 AXES AND SPECIAL REQUIREMENTS	A-76
USE AND HANDLING PRECAUTIONS	A-77
DIMENSION TABLE	A-78~

# SLIDE WAY

The NB slide way is a non-recirculating linear motion bearing utilizing precision rollers. It is used primarily in optical and measurement equipment where high precision movement is required.

## STRUCTURE AND ADVANTAGES

The NB slide way NV type comprises of precisely ground rails and R-retainers with built-in STUDROLLERS and precision rollers. The rails have been optimally designed so that the STUDROLLERS move smoothly, and the STUDROLLERS and precision rollers incorporated in the R-retainers enable slip-free operation between the raceway surface and the rollers resulting in motion with minimal frictional resistance.

SV and SVW types consist of precision ground rails and precision caged-rollers. Since caged-rollers do not recirculate, there is only a minimum frictional resistance fluctuation. Also, there is a minimum difference between the static and dynamic frictional resistances.

The HV and HVW types are performance-enhancing products that have been redesigned from conventional products (SV Type) in terms of raceway groove contact length, roller pitch, etc. Compared to SV Type, the allowable load and rated life distance have been increased. Installation is completely compatible with SV type, and simply by replacing, it contributes to improving the durability of equipment, or allows for size reduction and compactness with the same performance.

### Non-slip! STUDROLLER System (Rivet Roller Structure)

The STUDROLLER system is based on a new concept to provide complete prevention of roller cage slippage during operation. This system permits usage in all orientations and positions.

Figure A-1 STUDROLLER System



### Suitable for Minute Motion

Because the frictional resistance is extremely small and there is only little difference between the static and dynamic frictional resistances, the NB slide way is well suited for minute motion, resulting in highly accurate linear movement.

### Low-Speed Stability

Since the frictional resistance fluctuation is small even under low-load conditions, stable motion is obtained at from low to high speeds.

### High Rigidity and High Load Capacity

Rollers have a larger contact area than steel balls, resulting in less elastic deformation, and since they are non-circulating, they have a large number of effective rolling elements, resulting in high rigidity and high load capacity.

In addition, the NV/HV type has a new rail design that increases the contact length between the rollers and the raceway groove by 30 to 58% compared to the SV type (see Figure A-2), and also reduces the roller pitch and increases the number of rollers. By increasing the number of rollers, the rated load has been increased by 1.3 to 2.5 times.

### Low Noise

The slide way never produces recirculation noise

nor roller-contact noise due to a use of roller cage, resulting in quiet motion.

### All Stainless Steel Type Available

Anti-corrosion models NVS-RNS, HVS, HVWS, SVS, and SVWS use stainless steel for all component parts making them ideal for clean rooms.

### Anti-corrosion Specification

In addition to the stainless steel model, you can also select the LB model with low-temperature black chrome treatment. To enhance the rust prevention effect, surface treatment is applied to the rails and the end piece is made of stainless steel.

Figure A-2 Roller Contact Profile

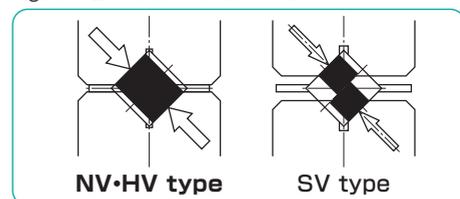


Figure A-3 Structure of NV type

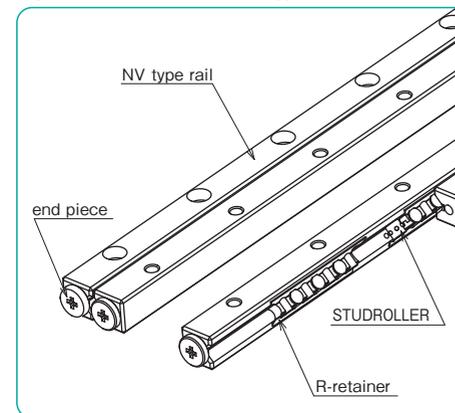
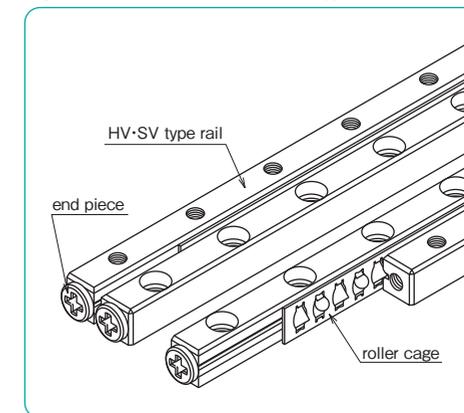


Figure A-4 Structure of HV·SV type



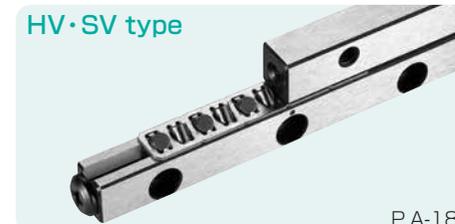
※To the NV type, fastening plates are attached for the purpose of maintaining the center position of the R-retainer before assembly. Please see Installation Procedure on page A-8 and remove the fastening plates before use.

## TYPES



P.A-12

The NV slide way consists of a set of four rails, two R-retainers, and eight end pieces. It permits flexible design of the table which will best suit your application. The NVS-RNS type has all stainless steel components, which is suitable for anti-corrosion, high temperature and vacuum requirements.



P.A-18

One set includes four rails and two R-type roller cages incorporating precision rollers in a cross shape.

HVS and SVS types are all made of stainless steel, so they show sufficient performance even in areas prone to corrosion.



P.A-30

One set includes one W-type rail with V grooves on both sides, two HV or SV-type rails and two R-type roller cages.

Since it uses a W-type rails, a more compact design is possible. All-stainless steel HVWS and SVWS types are also available.

## SPECIFICATION

Refer to table A-1 for NB Slide Way material and operating temperature range.

Table A-1 Material and Operating Temperature Range

type	rail	R-retainer/ roller cage	roller	operating temperature range
NV	steel	resin	steel	-20°C~80°C
NVS	stainless steel		stainless steel	
NVS-RNS	stainless steel	stainless steel	stainless steel	-20°C~140°C
NV-RN	steel		steel	-20°C~110°C
HV	steel	stainless steel	steel	-20°C~110°C
HVS	stainless steel		stainless steel	-20°C~140°C
HVW	steel		steel	-20°C~110°C
HVWS	stainless steel		stainless steel	-20°C~140°C
SV	steel	stainless steel	steel	-20°C~110°C
SV-RA		aluminum		
SVS	stainless steel	stainless steel	stainless steel	-20°C~140°C
SVS-RAS		aluminum		
SVW	steel	stainless steel	steel	-20°C~110°C
SVW-RA		aluminum		
SVWS		stainless steel		
SVWS-RAS	stainless steel	aluminum	stainless steel	-20°C~140°C

## ACCURACY

The accuracy of the slide way is represented as parallelism measured across the full length with a method shown in Figure A-6. It is classified as high (blank), precision (P), or ultra precision (UP). Special accuracies can also be accommodated. Please contact NB for details.

Figure A-5 Parallelism

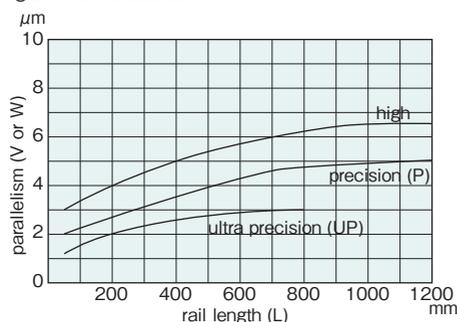
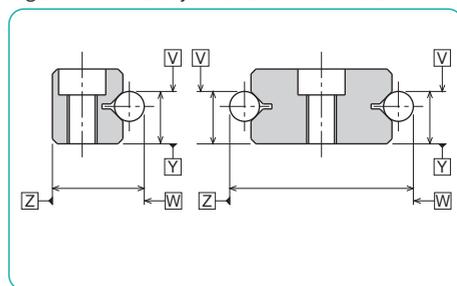


Figure A-6 Accuracy Measurement Method



Ultra precision grade is available from size 1 to size 9.

## LOAD RATING

The load rating for the slide way is obtained using the equations listed in Table A-2.

Table A-2 Load Rating

condition	double-rail parallel usage
direction of load	
basic dynamic load rating C	$C = \left\{ 2P \left( \frac{Z}{2} - 1 \right) \right\}^{\frac{1}{36}} \cdot \left( \frac{Z}{2} \right)^{\frac{3}{4}} \cdot 2^{\frac{7}{9}} \cdot C_1$
basic static load rating Co	$C_o = \frac{Z}{2} \cdot C_{o1} \cdot 2$
allowable load F	$F = \frac{Z}{2} \cdot F_1 \cdot 2$

C: basic dynamic load rating (N)  
 Co: basic static load rating (N)  
 F: allowable load (N)  
 C1: basic dynamic load rating per roller (N)  
 Co1: basic static load rating per roller (N)  
 F1: allowable load per roller (N)  
 Z: number of rollers per cage  
 Z/2: number of effective rollers (round down to whole number)  
 P: roller pitch (mm)

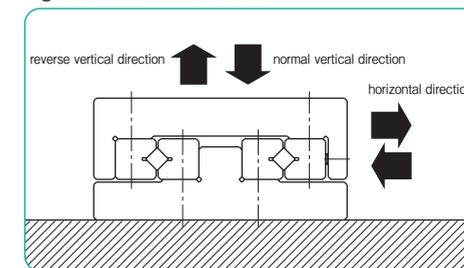
The load rating of the NV type differs depending on the direction of the load.

Table A-3 Change of Load Rating Corresponding to Load Direction

basic dynamic load rating	normal vertical direction	1.0×C
	horizontal direction	0.85×C
	reverse vertical direction	0.7×C
basic static load rating	normal vertical direction	1.0×Co
	horizontal direction	0.85×Co
	reverse vertical direction	0.7×Co

※ There may be a difference depending on the size. Please contact NB for details.  
 Consideration has been given to holes for STUDROLLERS in the raceway surface in calculation of load ratings.

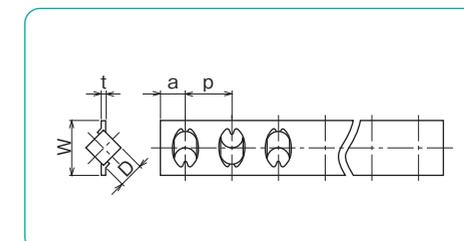
Figure A-7 Direction of Load



## R·RS TYPE

– Standard Roller Cage –  
 part number structure

example **RS 6 - 15Z**  
 specification R: standard roller RS: stainless steel roller  
 number of rollers 6  
 size 15Z



part number		D	t	W	p	a	C1	Co1	F1
standard	anti-corrosion	mm	mm	mm	mm	mm	N	N	N
R 1	RS 1	1.5	0.2	3.8	2.5	2	154	119	39.6
R 2	RS 2	2	0.3	5.6	4	2.5	360	293	97.6
R 3	RS 3	3	0.4	7.6	5	3	824	649	216
R 4	RS 4	4	0.4	10.4	7	4.5	1,660	1,320	440
R 6	RS 6	6	0.7	14	8.5	5.5	3,840	2,960	986
R 9	RS 9	9	0.7	19	14	7.5	9,330	7,070	2,350
R12	RS12	12	1.0	25	20	10	18,900	14,500	4,830

cage material: stainless steel C1: dynamic load rating per roller Co1: static load rating per roller  
 F1: allowable load per roller

## RATED LIFE

The life of the slide way and the slide table is calculated with the following equations:

Rated Life

$$L = \left( \frac{f_r \cdot C}{f_w \cdot P} \right)^{10/3} \cdot 50$$

L: rated life (km) fr: temperature coefficient fw: applied load coefficient  
 C: basic dynamic load rating (N) P: applied load (N)  
 ※ Please refer to page Eng-6 for the coefficients.

Life Time

$$L_h = \frac{L \cdot 10^6}{2 \cdot l_s \cdot n_1 \cdot 60}$$

Lh: life time (hr) ls: stroke length (mm)  
 n1: number of cycles per minute (cpm)

## RH·RHS TYPE

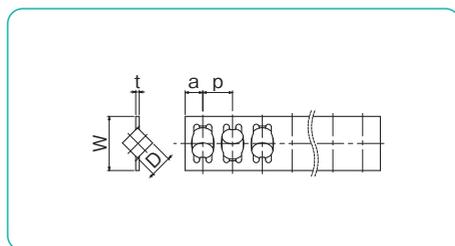
(HV·HVW Type standard roller cage)

part number structure

example **RH 3 - 15Z**

specification  
 RH: standard roller  
 RHS: stainless steel roller

number of rollers  
 size



part number	D	t	W	p	a	C <sub>1</sub>	C <sub>01</sub>	F <sub>1</sub>	
standard	mm	mm	mm	mm	mm	N	N	N	
<b>RH2</b>	<b>RHS2</b>	2	0.4	5.6	3	2	442	381	127
<b>RH3</b>	<b>RHS3</b>	3	0.5	7.6	4.2	2.5	1,160	1,000	333
<b>RH4</b>	<b>RHS4</b>	4	0.5	10.4	5.2	3.1	2,260	1,960	656

cage type: stainless steel C<sub>1</sub>: dynamic load rating per roller C<sub>01</sub>: static load rating per roller  
 F<sub>1</sub>: allowable load per roller

## RA·RAS TYPE

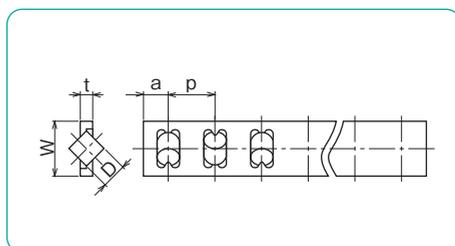
– Aluminum Roller Cage –

part number structure

example **RAS 6 - 15Z**

specification  
 RA: standard roller  
 RAS: stainless steel roller

number of rollers  
 size



part number	D	t	W	p	a	C <sub>1</sub>	C <sub>01</sub>	F <sub>1</sub>	
standard	mm	mm	mm	mm	mm	N	N	N	
<b>RA3</b>	<b>RAS3</b>	3	1.2	7.6	5	3	824	649	216
<b>RA4</b>	<b>RAS4</b>	4	1.4	10.4	7	4.5	1,660	1,320	440
<b>RA6</b>	<b>RAS6</b>	6	2.1	14	8.5	5.5	3,840	2,960	986
<b>RA9</b>	<b>RAS9</b>	9	3.0	20	14	7.5	9,330	7,070	2,350

cage material: aluminum alloy C<sub>1</sub>: dynamic load rating per roller C<sub>01</sub>: static load rating per roller  
 F<sub>1</sub>: allowable load per roller

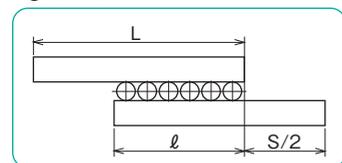
## STROKE

Please contact NB for a non-standard stroke length for the NV type. When the stroke of HV·SV type or HVW·SVW type is changed, the stroke length must be determined and the load rating should be re-estimated as follows.

### Stroke of HV·SV type, HVW·SVW type

When the slide way moves along the rail, the cage moves half the distance traveled by the slide way in the same direction. Therefore, although the work may be fixed on the table, the distance between the load center and the cage center will change. To achieve stable accuracy, determine the stroke and the length of the rail as follows.

Figure A-8



Rail Length (L)  
 When the stroke is 400mm or over  
 $S \leq L/1.5$   
 When the stroke is less than 400 mm,  
 $S \leq L$

l: cage length (mm) S: stroke (mm)  
 L: rail length (mm)

Cage length (l)  
 $l \leq L - \frac{S}{2}$   
 Number of rollers (Z)  
 $Z = \frac{l - 2a}{p} + 1$

a,p: Please refer to roller cage dimensions (page A-5,6)

## LUBRICATION AND DUST PREVENTION

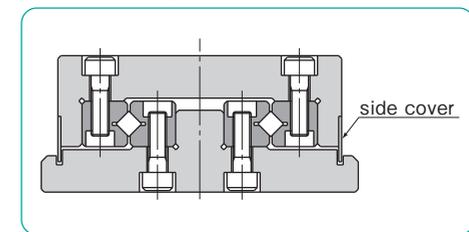
### Lubrication

The slide way is pre-lubricated with lithium soap-based grease No.00 prior to shipment for immediate use. Make sure to relubricate with a similar type of grease periodically according to the operating conditions. NB also provides low dust generation grease. Please refer to page Eng-51 for details.

### Dust Prevention

Foreign particles or dust in the slide way affects the motion accuracy and shortens the life time. In a harsh environment please provide side covers for dust prevention. (refer to Figure A-9)

Figure A-9 Example of Dust Prevention Mechanism



## MOUNTING

### Example

Figure A-10 NV type, HV type, SV type

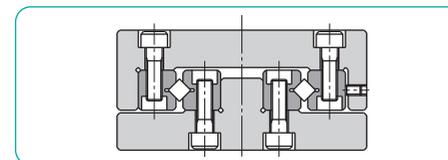
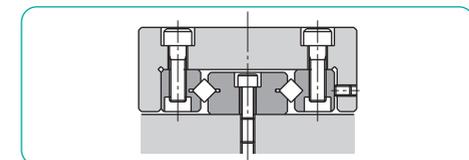


Figure A-11 HVW type, SVW type

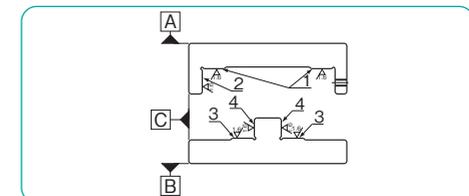


### Accuracy of Mounting Surface

To maximize the performance of the NB slide way, it is recommended that the accuracy of the mounting surface to be equal to or greater than the degree of parallelism of the slide way.

- Parallelism of surface 1 against surface A
- Perpendicularity of surface 2 against surface A
- Parallelism of surface 3 against surface B
- Perpendicularity of surface 4 against surface B
- Parallelism of surface 2 against surface C
- Parallelism of surface 4 against surface C

Figure A-12 Accuracy of Mounting Surface



### Tapped Hole for Preload Adjustment Screws

The recommended pitch of the adjustment screws should be installed in the same location as the rail mounting bolts, and the height should be aligned with the center of the raceway groove.

(refer to page A-8, Figure A-13 and page A-9, Figure A-16 (e, f, g).)

Page A-9, Table A-5 shows the sizes of tapped holes.

## SHAPE OF MOUNTING SURFACE

Slide way NV and HV·SV types are generally mounted by contacting the reference surface of the rail to the shoulder provided on the mounting surface. For the shoulder shape, provide relief at the corner as shown in Figure A-13 so that it does not interfere with the reference corner of the rail. If it is necessary to mount NV or HV·SV types without relief, then it can be used with rounded corners as shown in Figure A-14. Table A-4 shows the corner radius of the mounting surface.

Figure A-13 Relief on the Mounting Surface

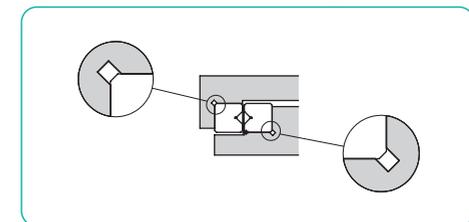


Figure A-14 Corner Radius

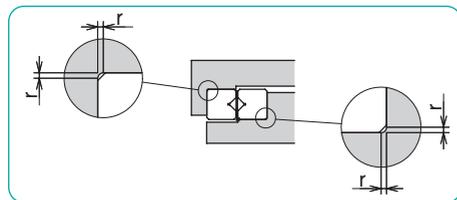


Table A-4 Maximum Corner Radius unit : mm

part number	maximum corner radius r
NV1, SV1	0.1
NV2, HV2, SV2	
NV3, HV3, SV3	0.2
NV4, HV4, SV4	0.4
NV6, SV6	0.7
NV9, SV9	0.8
NV12, SV12	1.0

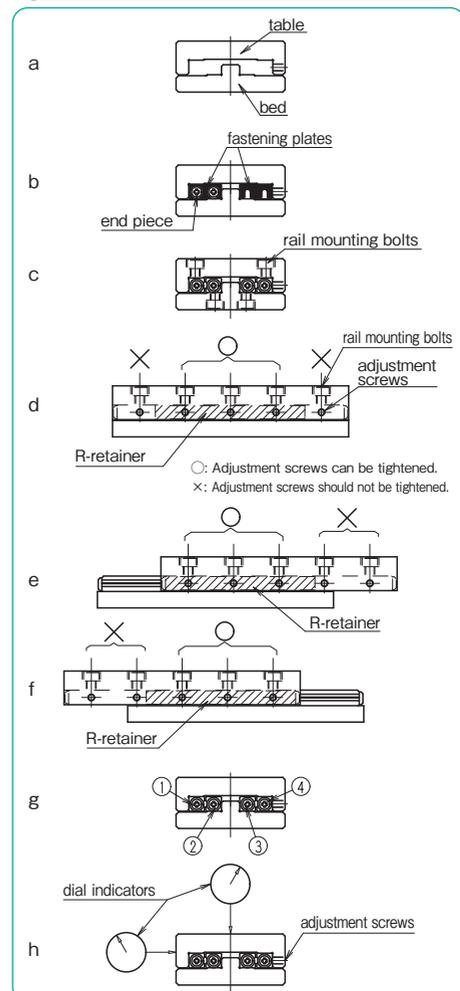
## INSTALLATION PROCEDURE OF NV TYPE

### Installation Procedure

※Please read "Use and Handling Precautions" before installation.

- Remove burrs, scratches, and dust from the rail-mounting surface of the bed and the table, be careful to prevent contamination during assembly.
- Apply low-viscosity oil to the contact surfaces, and align the bed and the table. (Figure A-15a)
- Set the reference surface onto the mounting surface with the rails fastened. Set the table in the center position, and tighten the adjustment screws lightly so that almost no gap remains. (Figure A-15b)
- Keep the table in the center, tighten the rail mounting bolts lightly, loosen the end pieces of both ends, and remove the fastening plates. Following this, lightly retighten the end pieces. (Figure A-15c)
- While maintaining the conditions of (4), gently move the assembly through its stroke to check if the maximum stroke is secured, and if there is no irregularity.
- Move the table to the center and slightly loosen the rail mounting bolts. Tighten only the adjustment screws on the R-retainer with the recommended torque shown in Table A-5. (Figure A-15d)
- Gently move the table to one stroke end, and check that the table has surely come into contact with the external mechanical stopper. Following this, tighten the adjustment screws in the same manner as (6). (Figure A-15e)
- Move the table to the opposite stroke end, and tighten in the same manner as (6). (Figure A-15f)
- Tighten and fix the mounting bolts of the track ①, ②, ③ with the recommended tightening torque shown in Table A-6. (Figure A-15g) At this time, fix the mounting bolts on the R retainer in order while moving the table as described in (6) to (8).
- Set the dial indicators to the center of the table and to the side (reference surface) of the table. (Figure A-15h)
- Perform the final preload adjustment. While moving the table back and forth, repeat steps (6) to (8) until the dial indicators show a minimum deviation. Loosen the adjustment screws one by one and retighten them to the recommended tightening torque.
- Fasten rail 4 securely with the recommended torque. As for the adjustment screws, successively tighten the rail mounting bolts on the R-retainer by moving the table.
- Recheck the motion accuracy while moving the table.
- Tighten the end pieces finally.

Figure A-15 Installation Method



As d, e, f in the Figure shows it is recommended to match the position and pitch of adjustment screws with rail mounting bolts, and also the height of them with the same as the center of raceway groove.

## INSTALLATION PROCEDURE OF HV & SV TYPE

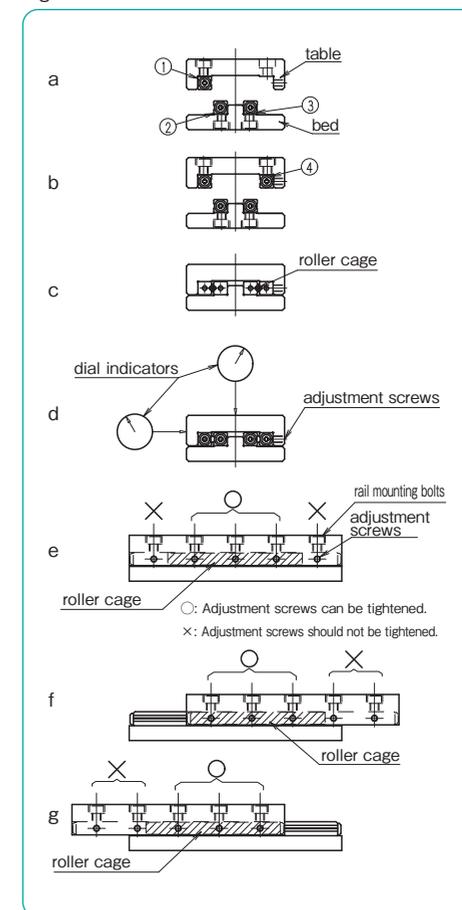
### Installation Procedure

- Remove burrs, scratches, and dust from the rail-mounting surface of the bed and the table, be careful to prevent contamination during assembly.
- Apply low-viscosity oil to each mounting surface and fix the track bases ① ~ ③ with the specified torque (Table A-6) while keeping the mounting surface of the table and bed in close contact with the track base mounting surface. (Figure A-16a)
- Temporarily attach rail ④ on the adjustment side. (Turn the mounting bolt until it lightly stops, then loosen it slightly.) (Figure A-16b)
- Remove end pieces on one end. Carefully insert roller cages between rails. (Figure A-16c)
- Re-attach end pieces.
- Move the table slowly to each stroke end to position roller cages at the center of the rails.
- Set the dial indicators to the center of the table and to the side (reference surface) of the table. (Figure A-16d)
- Move the table to the center and lightly tighten only the adjusting screw on the roller cage. (Figure A-16e)
- Move the table to the stroke end on one side and lightly tighten the adjusting screw as in (8). (Figure A-16f)
- Move the table to the opposite stroke end and lightly tighten the adjusting screw as in (8). (Figure A-16g)
- Repeat steps (8) ~ (10) until there are no gaps on the table. If there is no gap, the deflection on the dial gauge will not change from minimum value when the table is moved from side to side. Please do not apply an excessive preload since the final adjustment is done in step (12).
- Make final adjustment of preload. Repeat steps (8) ~ (10) and tighten the adjustment screws with the recommended torque listed in Table A-5.
- Fasten the rail ④ securely with the recommended torque. As with the adjustment screws, successively tighten the rail mounting bolts by moving the table.

Table A-5 Recommended Torque for Adjustment Screw Unit:N·m

part number	size	torque
NV1, SV1	M2	0.008
NV2, SV2	M3	0.012
NV3, SV3	M4	0.05
NV4, SV4	M4	0.08
NV6, SV6	M5	0.20
NV9, SV9	M6	0.40
NV12, SV12	M6	0.80

Figure A-16 Installation Method



As e, f, g in the Figure shows it is recommended to match the position and pitch of adjustment screws with rail mounting bolts, and also the height of them with the same as the center of raceway groove.

Table A-6 Recommended Torque for Rail Mounting Bolt Unit:N·m

size	torque
M2	0.4
M3	1.4
M4	3.2
M5	6.6
M6	11.2
M8	27.6
M10	55.0

(for steel alloy screw)

**SPECIAL MOUNTING SCREW BT TYPE**

In case of mounting slide way by screws from the counterbore side, threaded holes become the pilot holes. Thus, pilot hole's clearance will be less than a standard clearance hole for a screw. NB offers reduced shoulder screws for mounting SlideWay from bottom when larger screw clearance is required due to preload adjustment or inaccuracy of mating threaded holes. This special mounting screw made of alloy steel is stocked, and custom stainless steel version is available as a special order. Please contact NB for details.

Figure A-17 Special Mounting Screw

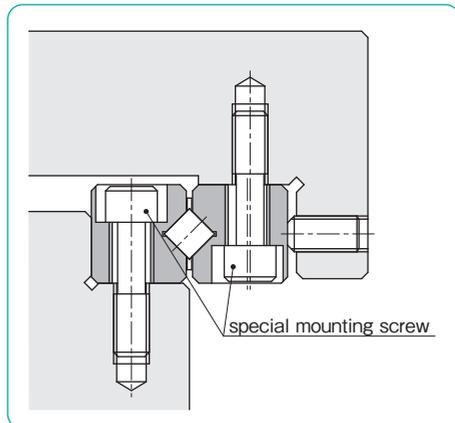
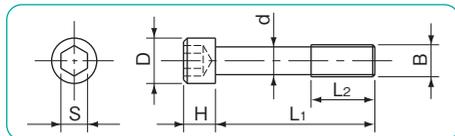


Table A-7 Special Mounting Screw

part number	B	d mm	D mm	H mm	L1 mm	L2 mm	S mm	applicable size
<b>BT 3</b>	M3	2.3	5	3	12	5	2.5	NV 3, HV 3, SV 3
<b>BT 4</b>	M4	3.1	5.8	4	15	7	3	NV 4, HV 4, SV 4
<b>BT 6</b>	M5	3.9	8	5	20	8	4	NV 6, SV 6
<b>BT 9</b>	M6	4.6	8.5	6	30	12	5	NV 9, SV 9
<b>BT12</b>	M8	6.25	11.3	8	40	17	6	NV12, SV12

**USE AND HANDLING PRECAUTIONS**

**Careful Handling**

Dropping the slide way causes the rolling elements to make dents in the raceway surface. This will prevent smooth motion and will also affect accuracy. Be sure to handle the product with care. The NV type is packaged as a set of rails and R-retainers. Do not separate or disassemble until assembly/installation is completed. Precision is not guaranteed if disassembled.

**Fastening Plates**

For the NV type, fastening plates are attached at both end faces of the rails to maintain the R-retainer center position prior to assembly. The fastening plates are not required after the NV type is mounted to a table and bed, however, when removal of the NV type is necessary such as when it will be reassembled, be sure to return the R-retainer to the proper center position, secure the fastening plates with the end pieces, and then remove the NV type.

**Specified Allowable Stroke**

For the NV type, exceeding the specified stroke (over-stroke) shall cause the raceway surface of the rail to be damaged and the performance of the STUDROLLER to drastically deteriorate. Be sure to provide external mechanical stoppers.

**Adjustment**

Using the product with insufficient accuracy of the mounting surface or before adjusting the preload will cause the motion accuracy of the product to drop and will have a negative influence upon product life and accuracy. Make sure to assemble, install, and adjust the product with care.

**Caution against Excess Preload**

It is essential to give preload on the Slide Way products in order to assure rigidity and accuracy. However, excess preload causes damage on the raceways and roller cages/R-retainers. On installation, please follow the installation procedure and recommended torque on page A-8 ~ 9.

**Operating Temperature**

The NV type uses resin parts. Please use the product in environments that are lower than 80°C .

**Use as a Set**

The accuracy of the rails has been matched within each set. Note that the accuracy will be affected when the rails of different sets are combined.

**Cage Slippage**

For the HV/HVW·SV/SVW type, the cage can slip under high-speed motion, vertical application, unbalanced-loading, and vibrating conditions. It is advised that the stroke be set with sufficient margin and an excessive preload should be avoided. It is also recommended that the rails be cycled to perform the maximum stroke several times, so that the cage returns to its center position.

**End Pieces**

End pieces are attached to each end of the slide way to prevent removal of the cage. Do not use them as a mechanical stopper.

**Knock Pin Hole**

When using HVW·SVW type knock pin holes to attach a slide way, please do the hole-machining on the mounting surface after attaching the W type rail. After machining, remove the chips completely and wash as required.

# NV TYPE

-NV1/NV2/NV3-

STUDROLLER System



## part number structure

example NVS 2 150 41Z UP -KGLA

example NV 3 075 13Z -LB -KGF

specification  
NV: standard  
NVS: anti-corrosion

size

rail length

number of rollers

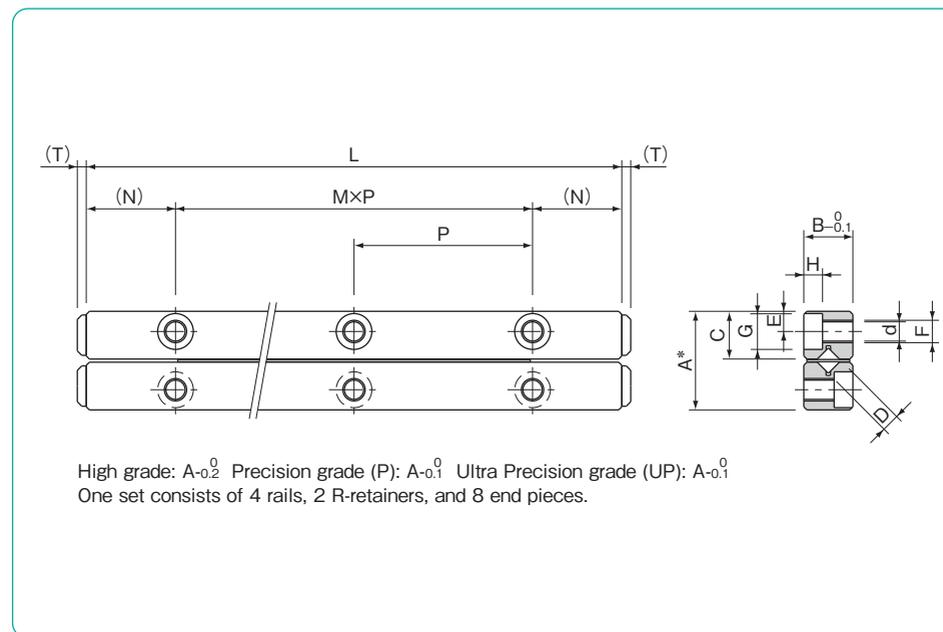
grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGU: urea-based low dust generation grease  
-KGF: anti-fretting grease

with low temperature black chrome treatment

accuracy grade  
blank: high  
P: precision  
UP: ultra precision

※Stainless steel rollers are used for anti-corrosion model. -LB is available as a custom product except for high precision, please contact NB for details.

part number		stroke ST mm	roller diameter D mm	number of rollers Z	L mm	A mm	B mm	C mm
standard	anti-corrosion							
NV 1020- 5Z	NVS 1020- 5Z	12	1.5	5	20	8.5	4	4.03
1030- 7Z	1030- 7Z	23		7	30			
1040-11Z	1040-11Z	28		11	40			
1050-15Z	1050-15Z	34		15	50			
1060-19Z	1060-19Z	40		19	60			
1070-23Z	1070-23Z	45		23	70			
1080-27Z	1080-27Z	51		27	80			
NV 2030- 5Z	NVS 2030- 5Z	18		5	30			
2045- 9Z	2045- 9Z	25	9	45				
2060-15Z	2060-15Z	30	15	60				
2075-19Z	2075-19Z	40	19	75				
2090-23Z	2090-23Z	50	23	90				
2105-27Z	2105-27Z	65	27	105				
2120-33Z	2120-33Z	70	33	120				
2135-37Z	2135-37Z	80	37	135				
2150-41Z	2150-41Z	90	41	150				
2165-47Z	2165-47Z	95	47	165				
2180-51Z	2180-51Z	100	51	180				
NV 3050- 9Z	NVS 3050- 9Z	25	9	50	18	8	8.65	
3075-13Z	3075-13Z	48	13	75				
3100-19Z	3100-19Z	60	19	100				
3125-23Z	3125-23Z	83	23	125				
3150-29Z	3150-29Z	90	29	150				
3175-35Z	3175-35Z	103	35	175				
3200-41Z	3200-41Z	113	41	200				
3225-43Z	3225-43Z	150	43	225				



major dimensions								basic load rating dynamic C N	static Co N	mass (one set) g	size
M×P mm	N mm	E mm	F	d mm	G mm	H mm	T mm				
1×10	5	1.8	M2	1.65	3	1.4	0.8	734	849	9	1020
2×10								1,250	1,690	13	1030
3×10								1,720	2,540	18	1040
4×10								2,160	3,390	22	1050
5×10								2,560	4,240	26	1060
6×10								2,960	5,090	31	1070
7×10								3,330	5,940	35	1080
1×15	7.5	2.5	M3	2.55	4.4	2	1.2	1,360	1,520	33	2030
2×15								2,330	3,050	49	2045
3×15								3,990	6,110	62	2060
4×15								4,740	7,630	74	2075
5×15								5,460	9,160	91	2090
6×15								6,160	10,600	103	2105
7×15								6,830	12,200	120	2120
8×15								7,490	13,700	132	2135
9×15								8,130	15,200	149	2150
10×15								9,370	18,300	161	2165
11×15								9,970	19,800	174	2180
1×25	12.5	3.5	M4	3.3	6	3.1	2	6,150	8,060	97	3050
2×25								8,440	12,100	140	3075
3×25								12,500	20,100	192	3100
4×25								14,400	24,200	245	3125
5×25								16,300	28,200	290	3150
6×25								19,800	36,300	337	3175
7×25								21,500	40,300	385	3200
8×25								23,200	44,300	434	3225

# NV TYPE

-NV4/NV6/NV9/NV12-

STUDROLLER System



## part number structure

example **NVS 6 200 19Z UP -KGLA**

example **NV 9 300 21Z -LB -KGF**

specification  
NV: standard  
NVS: anti-corrosion

size

rail length

number of rollers

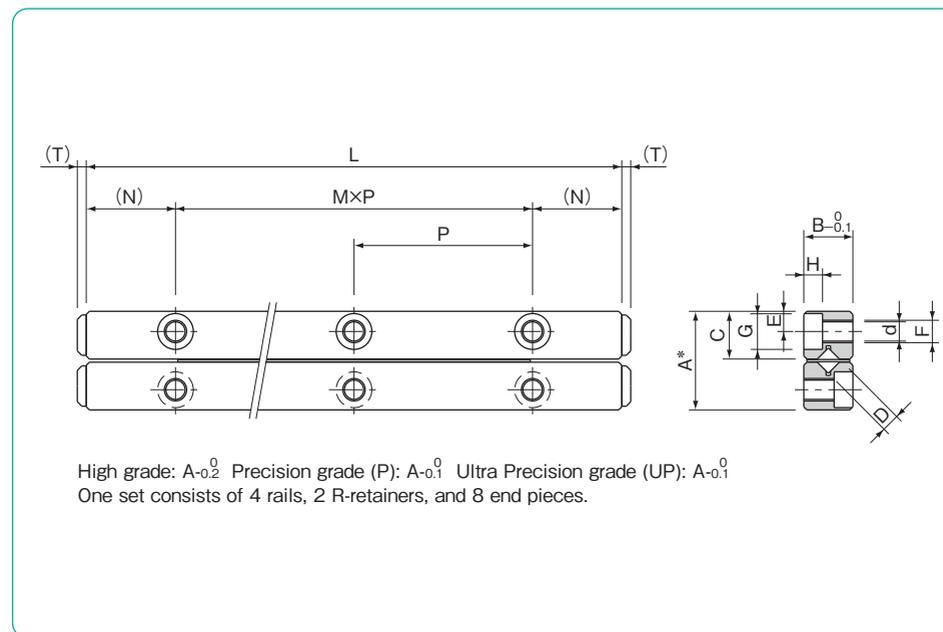
grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGU: urea-based low dust generation grease  
-KGF: anti-fretting grease

with low temperature black chrome treatment

accuracy grade  
blank: high  
P: precision  
UP: ultra precision

※Stainless steel rollers are used for anti-corrosion model. -LB is available as a custom product except for high precision, please contact NB for details. NV12 is not supported with UP class.

part number		stroke ST mm	roller diameter D mm	number of rollers Z	L mm	A mm	B mm	C mm
standard	anti-corrosion							
NV 4080-9Z	NVS4080-9Z	60	4	9	80	22	11	10.65
4120-17Z	4120-17Z	75		17	120			
4160-23Z	4160-23Z	105		23	160			
4200-29Z	4200-29Z	130		29	200			
4240-37Z	4240-37Z	143		37	240			
4280-43Z	4280-43Z	170		43	280			
NV 6100-9Z	NVS6100-9Z	63	6	9	100	31	15	15.15
6150-15Z	6150-15Z	85		15	150			
6200-19Z	6200-19Z	135		19	200			
6250-25Z	6250-25Z	158		25	250			
6300-31Z	6300-31Z	180		31	300			
6350-35Z	6350-35Z	230		35	350			
6400-39Z	6400-39Z	275	39	400				
NV 9200-13Z	—	120	9	13	200	44	22	21.5
9300-21Z	—	170		21	300			
9400-29Z	—	220		29	400			
9500-35Z	—	300		35	500			
NV12300-15Z	—	180	12	15	300	58	28	28.5
12400-21Z	—	230		21	400			
12500-27Z	—	280		27	500			
12600-31Z	—	380		31	600			



major dimensions								basic load rating dynamic C N	static Co N	mass (one set) g	size
M×P mm	N mm	E mm	F	d mm	G mm	H mm	T mm				
1×40	20	4.5	M5	4.3	8	4.2	2	12,100	15,700	265	4080
2×40								20,700	31,500	400	4120
3×40								28,500	47,200	530	4160
4×40								32,100	55,100	660	4200
5×40								39,000	70,900	800	4240
6×40								45,600	86,600	930	4280
1×50	25	6	M6	5.2	9.5	5.2	3	29,600	37,500	650	6100
2×50								50,900	75,100	970	6150
3×50								60,600	93,900	1,300	6200
4×50								69,800	112,000	1,620	6250
5×50								87,400	150,000	1,940	6300
6×50								95,800	169,000	2,360	6350
7×50	104,000	187,000	2,780	6400							
1×100	50	9	M8	6.8	10.5	6.2	4	96,100	128,000	2,720	9200
2×100								143,000	213,000	4,080	9300
3×100								186,000	298,000	5,440	9400
4×100								226,000	384,000	6,790	9500
2×100	50	12	M10	8.5	13.5	8.2	4	228,000	317,000	6,770	12300
3×100								271,000	397,000	9,040	12400
4×100								352,000	555,000	11,300	12500
5×100								391,000	635,000	13,560	12600

1N≒0.102kgf

# NVS-RNS TYPE

—Special Environments Type—

# NV-RN TYPE

—All Steel Type—



STUDROLLER System

### part number structure

example **NVS 4 200 -RNS 27Z -P -KGLA**

example **NV 3 050 -RN 9Z -LB -KGF**

specification  
**NV**: standard  
**NVS**: anti-corrosion

size

rail length

cage type  
**RNS**: stainless steel cage  
 stainless steel roller  
**RN**: stainless steel cage  
 steel roller

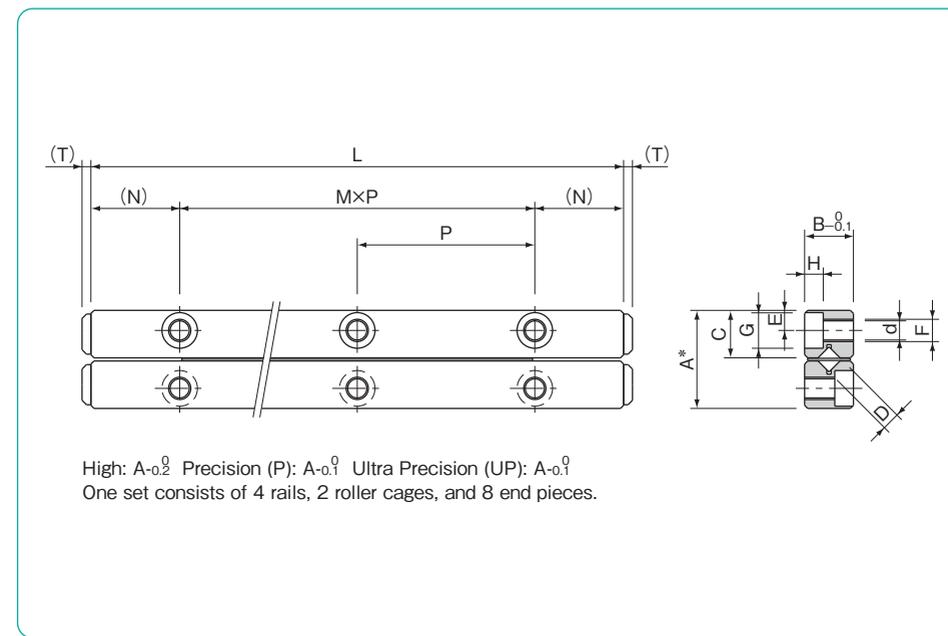
number of rollers

grease symbol (refer to page Eng-51)  
**blank**: standard grease  
**-KGLA**: lithium-based low dust generation grease  
**-KGU**: urea-based low dust generation grease  
**-KGF**: anti-fretting grease

with low temperature black chrome treatment

accuracy grade **blank**: high  
**P**: precision  
**UP**: ultra precision

※Stainless steel rollers are used for anti-corrosion model. -LB is available as a custom product except for high precision, please contact NB for details.



part number		stroke	roller diameter	number of rollers	major dimensions								
special environments type	all steel type	ST mm	D mm	Z	L mm	A mm	B mm	C mm	M×P mm				
NVS2030-RNS 7Z	NV 2030-RN 7Z	15	2	7	30	12	6	5.7	1×15				
2045-RNS11Z	2045-RN11Z	20		11	45				2×15				
2060-RNS13Z	2060-RN13Z	30		13	60				3×15				
2075-RNS17Z	2075-RN17Z	40		17	75				4×15				
2090-RNS21Z	2090-RN21Z	50		21	90				5×15				
2105-RNS23Z	2105-RN23Z	65		23	105				6×15				
2120-RNS27Z	2120-RN27Z	70		27	120				7×15				
2135-RNS31Z	2135-RN31Z	80		31	135				8×15				
2150-RNS33Z	2150-RN33Z	90		33	150				9×15				
2165-RNS37Z	2165-RN37Z	95		37	165				10×15				
2180-RNS43Z	2180-RN43Z	100	43	180	11×15								
NVS3050-RNS 9Z	NV 3050-RN 9Z	20	3	9	50	18	8	8.65	1×25				
3075-RNS13Z	3075-RN13Z	38		13	75				2×25				
3100-RNS17Z	3100-RN17Z	55		17	100				3×25				
3125-RNS21Z	3125-RN21Z	70		21	125				4×25				
3150-RNS25Z	3150-RN25Z	85		25	150				5×25				
3175-RNS29Z	3175-RN29Z	103		29	175				6×25				
3200-RNS33Z	3200-RN33Z	113		33	200				7×25				
3225-RNS35Z	3225-RN35Z	150		35	225				8×25				
NVS4080-RNS 9Z	NV 4080-RN 9Z	58		4	9				80	22	11	10.65	1×40
4120-RNS17Z	4120-RN17Z	60			17				120				2×40
4160-RNS21Z	4160-RN21Z	98	21		160	3×40							
4200-RNS27Z	4200-RN27Z	115	27		200	4×40							
4240-RNS31Z	4240-RN31Z	143	31		240	5×40							
4280-RNS37Z	4280-RN37Z	170	37		280	6×40							

※Some specification values are different from those of NV standard type. Please contact NB for details.

N mm	E mm	F mm	d mm	G mm	H mm	T mm	basic load rating		mass (one set) g	size
							dynamic C N	static Co N		
7.5	2.5	M3	2.55	4.4	2	1.2	2,320	3,050	30	2030
							3,190	4,580	44	2045
							3,190	4,580	58	2060
							4,000	6,110	73	2075
							4,760	7,630	87	2090
							5,490	9,160	101	2105
							6,190	10,600	115	2120
							6,870	12,200	130	2135
							6,870	12,200	144	2150
							7,530	13,700	158	2165
12.5	3.5	M4	3.3	6	3.1	2	8,800	16,800	173	2180
							6,150	8,060	102	3050
							8,460	12,100	151	3075
							10,600	16,100	200	3100
							12,600	20,100	249	3125
							14,500	24,200	297	3150
							16,400	28,200	346	3175
							18,200	32,200	395	3200
							19,900	36,300	443	3225
							12,100	15,700	269	4080
20	4.5	M5	4.3	8	4.2	2	20,800	31,500	405	4120
							24,800	39,300	536	4160
							32,200	55,100	670	4200
							35,800	63,000	801	4240
							39,200	70,900	935	4280

1N≒0.102kgf

# HV TYPE

-HV2/HV3-

Upgraded model



## part number structure

example **HVS 2 150 34Z UP -KGLA**

example **HV 3 200 33Z -LB -KGF**

specification  
HV: standard  
HVS: anti-corrosion

size

rail length

number of rollers

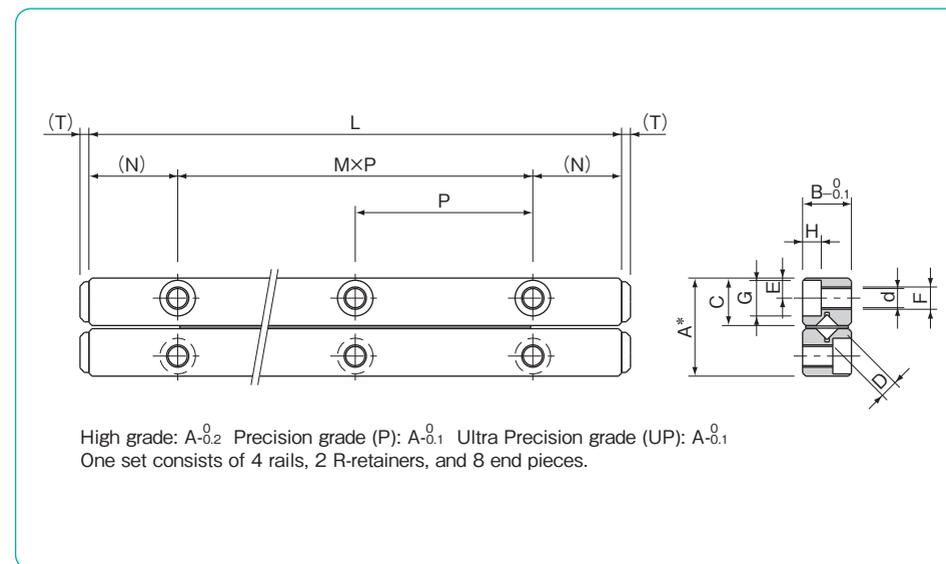
grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGU: urea-based low dust generation grease  
-KGF: anti-fretting grease

with low temperature black chrome treatment

accuracy grade blank: high  
P: precision  
UP: ultra precision

※Stainless steel rollers are used for anti-corrosion model. (refer to page A-6)  
-LB is available as a custom product except for high precision, please contact NB for details.

part number		stroke	roller diameter	number of rollers	major dimensions					
standard	anti-corrosion	ST mm	D mm	Z	L mm	A mm	B mm	C mm	M×P mm	
HV 2030- 6Z	HVS 2030- 6Z	22	2	6	30	12	6	5.7	1×15	
2045-10Z	2045-10Z	28		10	45				2×15	
2060-14Z	2060-14Z	34		14	60				3×15	
2075-17Z	2075-17Z	46		17	75				4×15	
2090-21Z	2090-21Z	52		21	90				5×15	
2105-24Z	2105-24Z	64		24	105				6×15	
2120-28Z	2120-28Z	70		28	120				7×15	
2135-30Z	2135-30Z	88		30	135				8×15	
2150-34Z	2150-34Z	94		34	150				9×15	
2165-38Z	2165-38Z	100		38	165				10×15	
2180-43Z	2180-43Z	100		43	180				11×15	
HV 3050- 8Z	HVS 3050- 8Z	31	3	8	50	18	8	8.65	1×25	
3075-11Z	3075-11Z	56		11	75				2×25	
3100-16Z	3100-16Z	64		16	100				3×25	
3125-20Z	3125-20Z	80		20	125				4×25	
3150-25Z	3150-25Z	88		25	150				5×25	
3175-28Z	3175-28Z	113		28	175				6×25	
3200-33Z	3200-33Z	121		33	200				7×25	
3225-37Z	3225-37Z	137		37	225				8×25	
3250-42Z	3250-42Z	145		42	250				9×25	
3275-45Z	3275-45Z	170		45	275				10×25	
3300-50Z	3300-50Z	178		50	300				11×25	
3325-53Z	3325-53Z	203		53	325				12×25	
3350-58Z	3350-58Z	211		58	350				13×25	



major dimensions							basic load rating		mass (one set)	size
N mm	E mm	F mm	d mm	G mm	H mm	T mm	dynamic C N	static Co N	g	
7.5	2.5	M3	2.55	4.4	2	1.2	1,850	2,290	30	2030
							2,760	3,810	44	2045
							3,600	5,340	59	2060
							4,000	6,110	73	2075
							4,760	7,630	87	2090
							5,490	9,160	101	2105
							6,190	10,600	116	2120
							6,530	11,400	130	2135
							7,200	12,900	144	2150
							7,850	14,500	158	2165
							8,490	16,000	173	2180
12.5	3.5	M4	3.3	6	3.1	2	6,150	8,060	102	3050
							7,330	10,000	150	3075
							10,600	16,100	200	3100
							12,600	20,100	249	3125
							14,500	24,200	298	3150
							16,400	28,200	346	3175
							18,200	32,200	396	3200
							19,900	36,300	445	3225
							22,500	42,300	494	3250
							23,300	44,300	542	3275
							25,700	50,400	592	3300
26,500	52,400	640	3325							
28,900	58,400	690	3350							

1N≐0.102kgf

# HV TYPE

-HV4-

Upgraded model



## part number structure

example **HVS 4 160 20Z UP -KGLA**

example **HV 4 360 47Z -LB -KGF**

specification  
HV: standard  
HVS: anti-corrosion

size

rail length

number of rollers

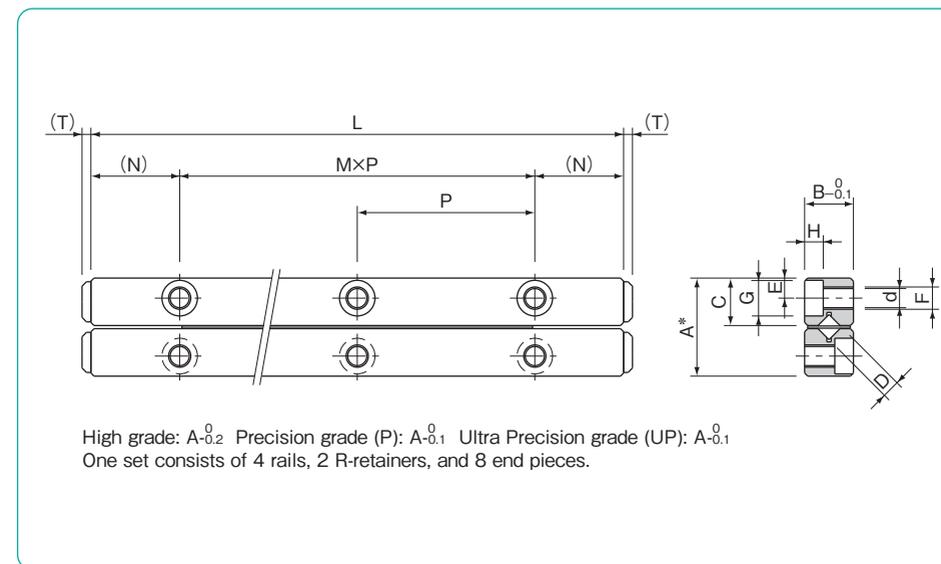
grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGLU: urea-based low dust generation grease  
-KGF: anti-fretting grease

with low temperature black chrome treatment

accuracy grade blank: high  
P: precision  
UP: ultra precision

※Stainless steel rollers are used for anti-corrosion model. (refer to page A-6)  
-LB is available as a custom product except for high precision, please contact NB for details.

part number		stroke ST mm	roller diameter D mm	number of rollers Z	L mm	A mm	B mm	C mm	M×P mm
standard	anti-corrosion								
HV 4080- 9Z	HVS 4080- 9Z	64	4	9	80	22	11	10.65	1×40
4120-15Z	4120-15Z	82		15	120				2×40
4160-20Z	4160-20Z	110		20	160				3×40
4200-25Z	4200-25Z	138		25	200				4×40
4240-31Z	4240-31Z	155		31	240				5×40
4280-36Z	4280-36Z	183		36	280				6×40
4320-42Z	4320-42Z	201		42	320				7×40
4360-47Z	4360-47Z	229		47	360				8×40
4400-52Z	4400-52Z	257		52	400				9×40
4440-58Z	4440-58Z	274		58	440				10×40
4480-63Z	4480-63Z	302		63	480				11×40



major dimensions							basic load rating		mass (one set) g	size
N mm	E mm	F mm	d mm	G mm	H mm	T mm	dynamic C N	static Co N		
20	4.5	M5	4.3	8	4.2	2	12,100	15,700	270	<b>4080</b>
							18,700	27,500	404	<b>4120</b>
							24,800	39,300	536	<b>4160</b>
							28,600	47,200	669	<b>4200</b>
							34,000	59,000	802	<b>4240</b>
							39,200	70,900	935	<b>4280</b>
							44,200	82,700	1,070	<b>4320</b>
							47,500	90,600	1,210	<b>4360</b>
							52,200	102,000	1,340	<b>4400</b>
							56,900	114,000	1,470	<b>4440</b>
							59,900	122,000	1,600	<b>4480</b>

1N≒0.102kgf

# SV TYPE

-SV1/SV2-



## part number structure

example SVS 2 150 26Z UP -KGLA

example SV 1 020 5Z -LB -KGF

specification  
SV: standard  
SVS: anti-corrosion

size

rail length

number of rollers

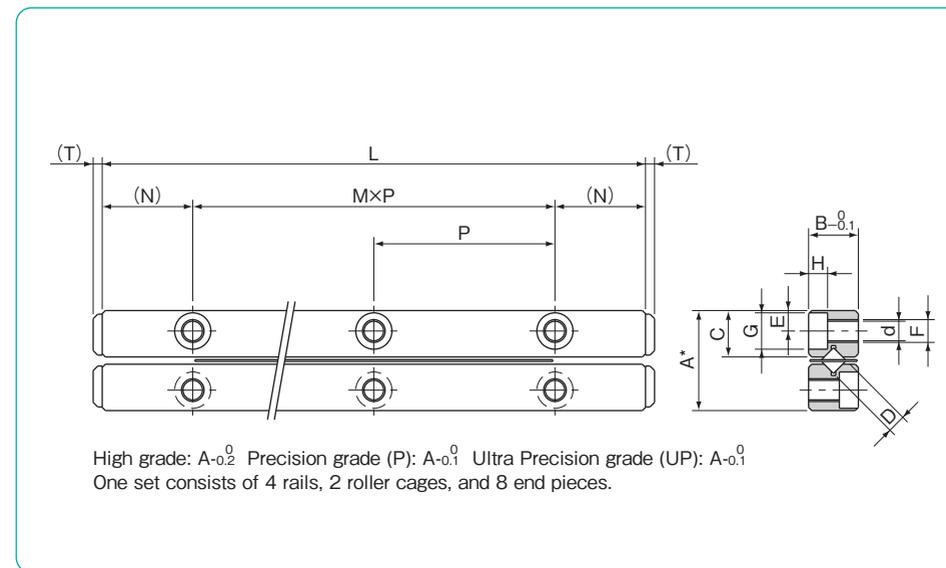
grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGU: urea-based low dust generation grease  
-KGF: anti-fretting grease

with low temperature black chrome treatment

accuracy grade blank: high  
P: precision  
UP: ultra precision

※Stainless steel rollers are used for anti-corrosion model. (refer to page A-5)  
-LB is available as a custom product except for high precision, please contact NB for details.

part number		stroke ST mm	roller diameter D mm	number of rollers Z	L mm	A mm	B mm	C mm
standard	anti-corrosion							
SV 1020-5Z	SVS 1020-5Z	12	1.5	5	20	8.5	4	3.8
1030-7Z	1030-7Z	20		7	30			
1040-10Z	1040-10Z	27		10	40			
1050-13Z	1050-13Z	32		13	50			
1060-16Z	1060-16Z	37		16	60			
1070-19Z	1070-19Z	42		19	70			
1080-21Z	1080-21Z	50		21	80			
SV 2030-5Z	SVS 2030-5Z	18		5	30			
2045-8Z	2045-8Z	24	8	45				
2060-11Z	2060-11Z	30	11	60				
2075-13Z	2075-13Z	44	13	75				
2090-16Z	2090-16Z	50	16	90				
2105-18Z	2105-18Z	64	18	105				
2120-21Z	2120-21Z	70	21	120				
2135-23Z	2135-23Z	84	23	135				
2150-26Z	2150-26Z	90	26	150				
2165-29Z	2165-29Z	95	29	165				
2180-32Z	2180-32Z	100	32	180				



major dimensions								basic load rating dynamic C N	static Co N	mass (one set) g	size
M×P mm	N mm	E mm	F	d mm	G mm	H mm	T mm				
1×10	5	1.8	M2	1.65	3	1.4	0.8	464	476	11	1020
2×10								641	714	14	1030
3×10								959	1,190	18	1040
4×10								1,100	1,420	22	1050
5×10								1,380	1,900	26	1060
6×10								1,510	2,140	30	1070
7×10								1,650	2,380	34	1080
1×15	7.5	2.5	M3	2.55	4.4	2	1.2	1,090	1,170	28	2030
2×15								1,900	2,340	42	2045
3×15								2,270	2,930	55	2060
4×15								2,620	3,510	69	2075
5×15								3,280	4,680	83	2090
6×15								3,590	5,270	96	2105
7×15								3,900	5,860	110	2120
8×15								4,210	6,440	123	2135
9×15								4,790	7,610	137	2150
10×15								5,080	8,200	151	2165
11×15								5,640	9,370	165	2180

1N≐0.102kgf

# SV TYPE

-SV3/SV4-



## part number structure

example **SVS 4 200 -RAS 19Z -UP -KGLA**

example **SV 3 350 - 49Z -LB -KGU**

specification  
**SV**: standard  
**SVS**: anti-corrosion

size  
 rail length

cage type  
**blank**: standard cage  
**RA**: aluminum cage, standard roller  
**RAS**: aluminum cage, stainless steel roller

grease symbol (refer to page Eng-51)  
**blank**: standard grease  
**-KGLA**: lithium-based low dust generation grease  
**-KGU**: urea-based low dust generation grease  
**-KGF**: anti-fretting grease

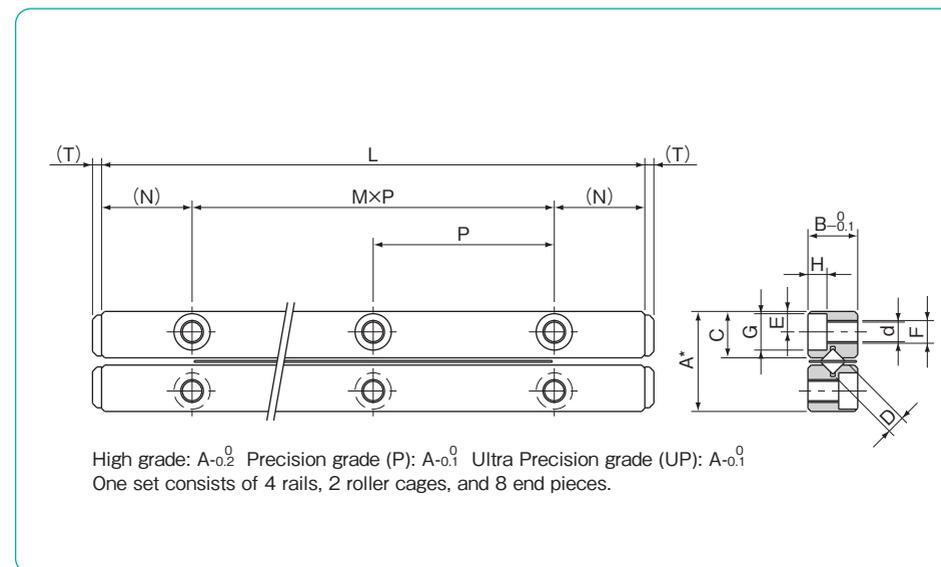
with low temperature black chrome treatment

accuracy grade **blank**: high  
**P**: precision  
**UP**: ultra precision

number of rollers

※Stainless steel rollers are used for anti-corrosion model. (refer to page A-5)  
 -LB is available as a custom product except for high precision, please contact NB for details.

part number		stroke	roller diameter	number of rollers	L	A	B	C
standard	anti-corrosion	ST mm	D mm	Z	mm	mm	mm	mm
SV 3050-7Z	SVS 3050-7Z	28	3	7	50	18	8	8.3
3075-10Z	3075-10Z	48		10	75			
3100-14Z	3100-14Z	58		14	100			
3125-17Z	3125-17Z	78		17	125			
3150-21Z	3150-21Z	88		21	150			
3175-24Z	3175-24Z	105		24	175			
3200-28Z	3200-28Z	115		28	200			
3225-31Z	3225-31Z	135		31	225			
3250-35Z	3250-35Z	145		35	250			
3275-38Z	3275-38Z	165		38	275			
3300-42Z	3300-42Z	175		42	300			
3325-45Z	3325-45Z	195		45	325			
3350-49Z	3350-49Z	205		49	350			
SV 4080-7Z	SVS 4080-7Z	58	4	7	80	22	11	10.2
4120-11Z	4120-11Z	82		11	120			
4160-15Z	4160-15Z	105		15	160			
4200-19Z	4200-19Z	130		19	200			
4240-23Z	4240-23Z	150		23	240			
4280-27Z	4280-27Z	175		27	280			
4320-31Z	4320-31Z	200		31	320			
4360-35Z	4360-35Z	225		35	360			
4400-39Z	4400-39Z	250		39	400			
4440-43Z	4440-43Z	270		43	440			
4480-47Z	4480-47Z	295		47	480			



major dimensions								basic load rating	static	mass	size
M×P mm	N mm	E mm	F	d mm	G mm	H mm	T mm	dynamic C N	Co N	(one set) g	
1×25	12.5	3.5	M4	3.3	6	3.1	2	3,490	3,890	94	<b>3050</b>
2×25								5,230	6,490	135	<b>3075</b>
3×25								6,810	9,080	187	<b>3100</b>
4×25								7,560	10,300	234	<b>3125</b>
5×25								9,000	12,900	281	<b>3150</b>
6×25								10,300	15,500	327	<b>3175</b>
7×25								11,700	18,100	374	<b>3200</b>
8×25								12,300	19,400	421	<b>3225</b>
9×25								13,600	22,000	468	<b>3250</b>
10×25								14,800	24,600	514	<b>3275</b>
11×25								16,000	27,200	561	<b>3300</b>
12×25								16,600	28,500	608	<b>3325</b>
13×25								17,800	31,100	655	<b>3350</b>
1×40	20	4.5	M5	4.3	8	4.2	2	7,110	7,920	255	<b>4080</b>
2×40								10,600	13,200	385	<b>4120</b>
3×40								13,800	18,400	510	<b>4160</b>
4×40								16,800	23,700	635	<b>4200</b>
5×40								19,700	29,000	770	<b>4240</b>
6×40								22,400	34,300	905	<b>4280</b>
7×40								25,100	39,600	1,020	<b>4320</b>
8×40								27,600	44,800	1,160	<b>4360</b>
9×40								30,200	50,100	1,280	<b>4400</b>
10×40								32,600	55,400	1,410	<b>4440</b>
11×40								35,000	60,700	1,540	<b>4480</b>

1N≒0.102kgf

# SV TYPE

-SV6/SV9-



## part number structure

example **SVS 6 200 -RAS 16Z -UP -KGLA**  
 example **SV 9 300 - 15Z -LB -KGU**

specification  
**SV**: standard  
**SVS**: anti-corrosion

size  
 rail length

cage type  
**blank**: standard cage  
**RA**: aluminum cage, standard roller  
**RAS**: aluminum cage, stainless steel roller

grease symbol (refer to page Eng-51)  
**blank**: standard grease  
**-KGLA**: lithium-based low dust generation grease  
**-KGU**: urea-based low dust generation grease  
**-KGF**: anti-fretting grease

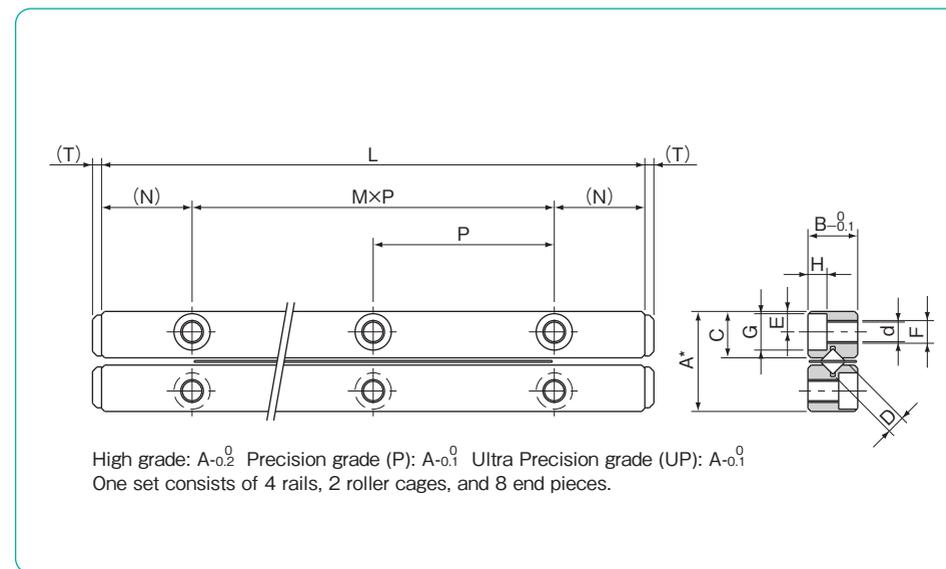
with low temperature black chrome treatment

accuracy grade **blank**: high  
**P**: precision  
**UP**: ultra precision

number of rollers

※Stainless steel rollers are used for anti-corrosion model. (refer to page A-5)  
 -LB is available as a custom product except for high precision, please contact NB for details.

part number		stroke ST mm	roller diameter D mm	number of rollers Z	L mm	A mm	B mm	C mm
standard	anti-corrosion							
SV 6100-8Z	SVS 6100-8Z	55	6	8	100	31	15	14.2
6150-12Z	6150-12Z	85		12	150			
6200-16Z	6200-16Z	120		16	200			
6250-20Z	6250-20Z	150		20	250			
6300-24Z	6300-24Z	185		24	300			
6350-28Z	6350-28Z	215		28	350			
6400-32Z	6400-32Z	245		32	400			
6450-36Z	6450-36Z	280		36	450			
6500-40Z	6500-40Z	310		40	500			
6600-49Z	6600-49Z	360		49	600			
SV 9200-10Z	SVS 9200-10Z	115	9	10	200	44	22	20.2
9300-15Z	9300-15Z	175		15	300			
9400-20Z	9400-20Z	235		20	400			
9500-25Z	9500-25Z	295		25	500			
9600-30Z	9600-30Z	355		30	600			
9700-35Z	9700-35Z	415		35	700			
9800-40Z	9800-40Z	475		40	800			
9900-45Z	9900-45Z	535		45	900			
91000-50Z	91000-50Z	595		50	1,000			



major dimensions								basic load rating dynamic C N	static Co N	mass (one set) g	size
M×P mm	N mm	E mm	F	d mm	G mm	H mm	T mm				
1×50	25	6	M6	5.2	9.5	5.2	3	20,700	23,600	628	6100
2×50								28,500	35,500	942	6150
3×50								35,700	47,300	1,260	6200
4×50								42,500	59,200	1,570	6250
5×50								49,000	71,000	1,880	6300
6×50								55,300	82,800	2,200	6350
7×50								61,400	94,700	2,510	6400
8×50								67,300	106,000	2,830	6450
9×50								73,100	118,000	3,140	6500
11×50								84,200	142,000	3,770	6600
1×100	50	9	M8	6.8	10.5	6.2	4	60,900	70,700	2,720	9200
2×100								79,300	98,900	4,030	9300
3×100								104,000	141,000	5,380	9400
4×100								120,000	169,000	6,700	9500
5×100								143,000	212,000	8,050	9600
6×100								158,000	240,000	9,230	9700
7×100								180,000	282,000	10,500	9800
8×100								193,000	311,000	11,900	9900
9×100								214,000	353,000	13,000	91000

1N≒0.102kgf

# SV TYPE

-SV12-



### part number structure

example **SVS 12 500 17Z P -KGLA**  
 example **SV 12 300 10Z -LB -KGU**

specification  
**SV:** standard  
**SVS:** anti-corrosion

size

rail length

number of rollers

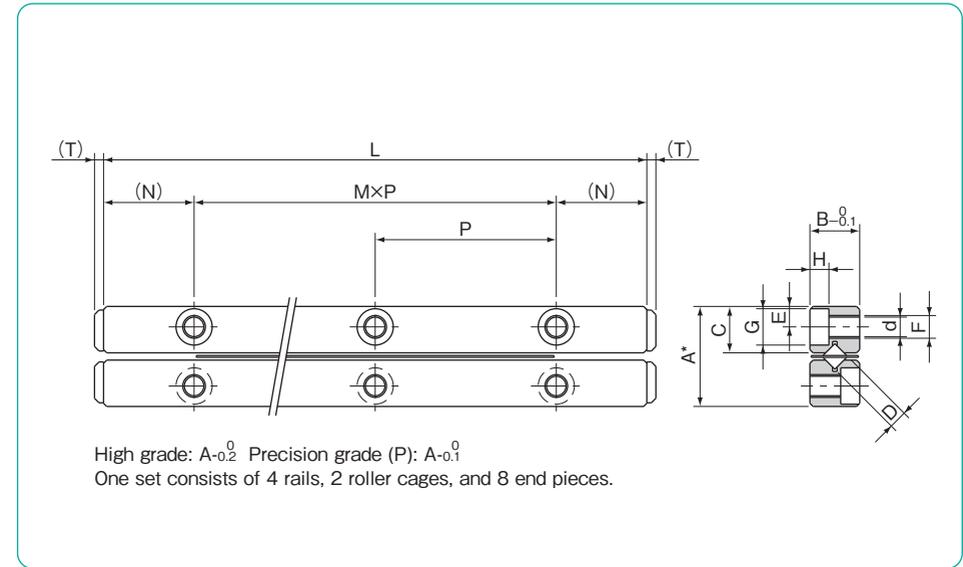
grease symbol (refer to page Eng-51)  
**blank:** standard grease  
**-KGLA:** lithium-based low dust generation grease  
**-KGU:** urea-based low dust generation grease  
**-KGF:** anti-fretting grease

with low temperature black chrome treatment

accuracy grade **blank:** high  
**P:** precision

※Stainless steel rollers are used for anti-corrosion model. (refer to page A-5)  
 -LB is available as a custom product except for high precision, please contact NB for details.

part number		stroke ST mm	roller diameter D mm	number of rollers Z	L mm	A mm	B mm	C mm
standard	anti-corrosion							
<b>SV 12300-10Z</b>	<b>SVS 12300-10Z</b>	200	12	10	300	58	28	27
<b>12400-14Z</b>	<b>12400-14Z</b>	240		14	400			
<b>12500-17Z</b>	<b>12500-17Z</b>	320		17	500			
<b>12600-21Z</b>	<b>12600-21Z</b>	360		21	600			
<b>12700-24Z</b>	<b>12700-24Z</b>	440		24	700			
<b>12800-28Z</b>	<b>12800-28Z</b>	480		28	800			
<b>12900-31Z</b>	<b>12900-31Z</b>	560		31	900			
<b>121000-34Z</b>	<b>121000-34Z</b>	640		34	1,000			
<b>121100-38Z</b>	—	680		38	1,100			
<b>121200-42Z</b>	—	720		42	1,200			



major dimensions								basic load rating dynamic C N	static Co N	mass (one set) g	size
M×P mm	N mm	E mm	F	d mm	G mm	H mm	T mm				
2×100	50	12	M10	8.5	13.5	8.2	4	124,000	145,000	6,880	<b>12300</b>
3×100								162,000	203,000	9,090	<b>12400</b>
4×100								180,000	232,000	11,400	<b>12500</b>
5×100								214,000	290,000	13,700	<b>12600</b>
6×100								247,000	348,000	15,800	<b>12700</b>
7×100								279,000	406,000	18,200	<b>12800</b>
8×100								294,000	435,000	20,500	<b>12900</b>
9×100								324,000	493,000	22,800	<b>121000</b>
10×100								354,000	551,000	25,000	<b>121100</b>
11×100								382,000	609,000	27,300	<b>121200</b>

1N≒0.102kgf

# HVW TYPE

Upgraded model



## part number structure

example HVWS 4 200 25Z UP -KGLA

example HVW 2 090 21Z -LB -KGU

specification  
HVW: standard  
HVWS: anti-corrosion

size

rail length

number of rollers

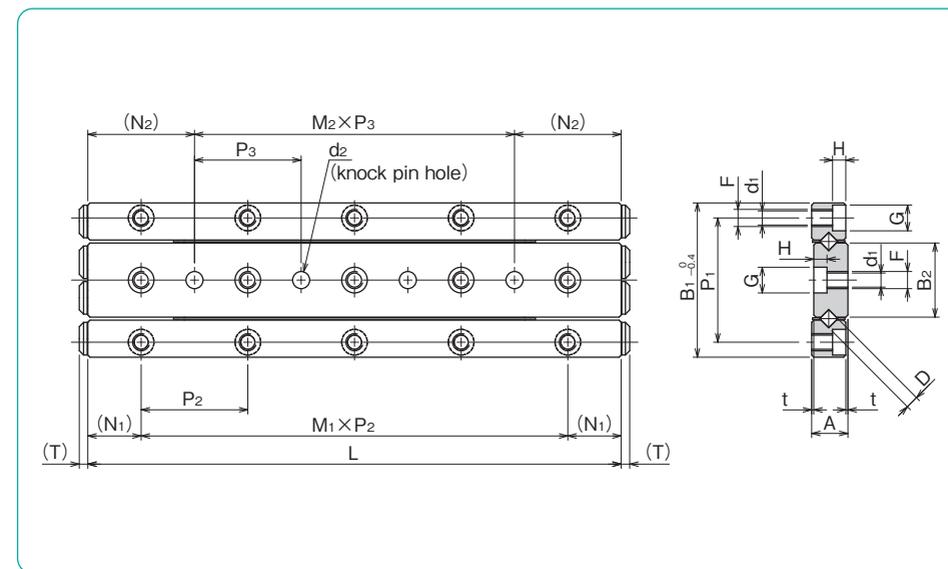
grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGU: urea-based low dust generation grease  
-KGF: anti-fretting grease

with low temperature black chrome treatment

accuracy grade blank: high  
P: precision  
UP: ultra precision

※Stainless steel rollers are used for anti-corrosion model. (refer to page A-6)  
-LB is available as a custom product except for high precision, please contact NB for details.

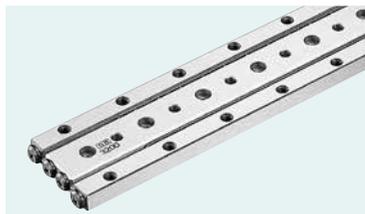
part number		stroke	roller diameter	number of rollers	major dimensions																		
standard	anti-corrosion	ST mm	D mm	Z	L mm	A mm	t mm	B <sub>1</sub> mm	B <sub>2</sub> mm	C mm	P <sub>1</sub> mm	M <sub>1</sub> × P <sub>2</sub> mm	basic load rating		mass (one set)	size							
HVW 2030- 6Z	HVWS 2030- 6Z	22	2	6	30	6.5	0.5	24	11.4	5.7	19	1 × 15	15	3	1.2	1,850	2,290	30	2030				
2045-10Z	2045-10Z	28		10	45							2 × 15								2,760	3,810	45	2045
2060-14Z	2060-14Z	34		14	60							3 × 15								3,600	5,340	59	2060
2075-17Z	2075-17Z	46		17	75							4 × 15								4,000	6,110	74	2075
2090-21Z	2090-21Z	52		21	90							5 × 15								4,760	7,630	88	2090
2105-24Z	2105-24Z	64		24	105							6 × 15								5,490	9,160	102	2105
2120-28Z	2120-28Z	70		28	120							7 × 15								6,190	10,600	117	2120
HVW 3050- 8Z	HVWS 3050- 8Z	31	3	8	50	8.5	0.5	36	17.3	8.65	29	1 × 25	25	4	2	6,150	8,060	104	3050				
3075-11Z	3075-11Z	56		11	75							2 × 25								7,330	10,000	152	3075
3100-16Z	3100-16Z	64		16	100							3 × 25								10,600	16,100	202	3100
3125-20Z	3125-20Z	80		20	125							4 × 25								12,600	20,100	251	3125
3150-25Z	3150-25Z	88		25	150							5 × 25								14,500	24,200	301	3150
3175-28Z	3175-28Z	113		28	175							6 × 25								16,400	28,200	349	3175
3200-33Z	3200-33Z	121		33	200							7 × 25								18,200	32,200	399	3200
HVW 4080- 9Z	HVWS 4080- 9Z	64	4	9	80	11.5	0.5	44	21.3	10.65	35	1 × 40	40	5	2	12,100	15,700	273	4080				
4120-15Z	4120-15Z	82		15	120							2 × 40								18,700	27,500	408	4120
4160-20Z	4160-20Z	110		20	160							3 × 40								24,800	39,300	542	4160
4200-25Z	4200-25Z	138		25	200							4 × 40								28,600	47,200	675	4200
4240-31Z	4240-31Z	155		31	240							5 × 40								34,000	59,000	810	4240
4280-36Z	4280-36Z	183		36	280							6 × 40								39,200	70,900	943	4280



major dimensions										basic load rating		mass (one set)	size
N <sub>1</sub> mm	F	d <sub>1</sub> mm	G mm	H mm	M <sub>2</sub> × P <sub>3</sub> mm	N <sub>2</sub> mm	d <sub>2</sub> mm	T mm	C N	Co N	g		
7.5	M3	2.55	4.4	2	—	15	3 <sup>+0.010</sup> <sub>0</sub>	1.2	1,850	2,290	30	2030	
					1 × 15				2,760	3,810	45	2045	
					2 × 15				3,600	5,340	59	2060	
					3 × 15				4,000	6,110	74	2075	
					4 × 15				4,760	7,630	88	2090	
					5 × 15				5,490	9,160	102	2105	
					6 × 15				6,190	10,600	117	2120	
12.5	M4	3.3	6	3.1	—	25	4 <sup>+0.012</sup> <sub>0</sub>	2	6,150	8,060	104	3050	
					1 × 25				7,330	10,000	152	3075	
					2 × 25				10,600	16,100	202	3100	
					3 × 25				12,600	20,100	251	3125	
					4 × 25				14,500	24,200	301	3150	
					5 × 25				16,400	28,200	349	3175	
					6 × 25				18,200	32,200	399	3200	
20	M5	4.3	8	4.2	—	40	5 <sup>+0.012</sup> <sub>0</sub>	2	12,100	15,700	273	4080	
					1 × 40				18,700	27,500	408	4120	
					2 × 40				24,800	39,300	542	4160	
					3 × 40				28,600	47,200	675	4200	
					4 × 40				34,000	59,000	810	4240	
					5 × 40				39,200	70,900	943	4280	

1N≒0.102kgf

# SVW TYPE



## part number structure

example **SVWS 4 200 -RAS 19Z -UP -KGLA**

example **SVW 1 050 - 13Z -LB -KGU**

specification  
**SVW**: standard  
**SVWS**: anti-corrosion

size  
 rail length

cage type  
**blank**: standard cage  
**RA**: aluminum cage, standard roller  
**RAS**: aluminum cage, stainless steel roller

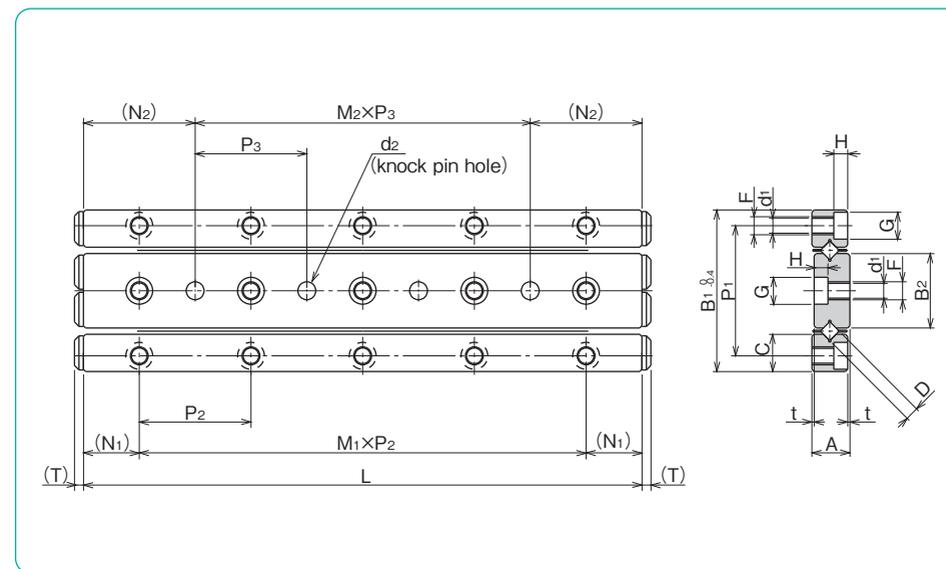
grease symbol (refer to page Eng-51)  
**blank**: standard grease  
**-KGLA**: lithium-based low dust generation grease  
**-KGU**: urea-based low dust generation grease  
**-KGF**: anti-fretting grease

with low temperature black chrome treatment

accuracy grade **blank**: high  
**P**: precision  
**UP**: ultra precision

number of rollers

※Stainless steel rollers are used for anti-corrosion model. (refer to page A-5)  
 Aluminum cage is not available for size 1 and 2.  
 -LB is available as a custom product except for high precision, please contact NB for details.



part number		stroke	roller diameter	number of rollers	major dimensions														
standard	anti-corrosion	ST mm	D mm	Z	L mm	A mm	t mm	B <sub>1</sub> mm	B <sub>2</sub> mm	C mm	P <sub>1</sub> mm	M <sub>1</sub> × P <sub>2</sub> mm	basic load rating		mass (one set)	size			
															dynamic C N	static Co N	g		
<b>SVW 1020- 5Z</b>	<b>SVWS 1020- 5Z</b>	12	1.5	5	20	4.5	0.5	17	7.6	3.8	13.4	1 × 10	10	2 <sup>+0.010</sup> <sub>0</sub>	0.8	464	476	11	<b>1020</b>
<b>1030- 7Z</b>	<b>1030- 7Z</b>	20		7	30							2 × 10				641	714	14	<b>1030</b>
<b>1040-10Z</b>	<b>1040-10Z</b>	27		10	40							3 × 10				959	1,190	18	<b>1040</b>
<b>1050-13Z</b>	<b>1050-13Z</b>	32		13	50							4 × 10				1,100	1,420	22	<b>1050</b>
<b>1060-16Z</b>	<b>1060-16Z</b>	37		16	60							5 × 10				1,380	1,900	26	<b>1060</b>
<b>1070-19Z</b>	<b>1070-19Z</b>	42		19	70							6 × 10				1,510	2,140	30	<b>1070</b>
<b>1080-21Z</b>	<b>1080-21Z</b>	50		21	80							7 × 10				1,650	2,380	34	<b>1080</b>
<b>SVW 2030- 5Z</b>	<b>SVWS 2030- 5Z</b>	18	2	5	30	6.5	0.5	24	11	5.5	19	1 × 15	15	3 <sup>+0.010</sup> <sub>0</sub>	1.2	1,090	1,170	28	<b>2030</b>
<b>2045- 8Z</b>	<b>2045- 8Z</b>	24		8	45							2 × 15				1,900	2,340	42	<b>2045</b>
<b>2060-11Z</b>	<b>2060-11Z</b>	30		11	60							3 × 15				2,270	2,930	55	<b>2060</b>
<b>2075-13Z</b>	<b>2075-13Z</b>	44		13	75							4 × 15				2,620	3,510	69	<b>2075</b>
<b>2090-16Z</b>	<b>2090-16Z</b>	50		16	90							5 × 15				3,280	4,680	83	<b>2090</b>
<b>2105-18Z</b>	<b>2105-18Z</b>	64		18	105							6 × 15				3,590	5,270	96	<b>2105</b>
<b>2120-21Z</b>	<b>2120-21Z</b>	70		21	120							7 × 15				3,900	5,860	110	<b>2120</b>
<b>SVW 3050- 7Z</b>	<b>SVWS 3050- 7Z</b>	28	3	7	50	8.5	0.5	36	16.6	8.3	29	1 × 25	25	4 <sup>+0.012</sup> <sub>0</sub>	2	3,490	3,890	94	<b>3050</b>
<b>3075-10Z</b>	<b>3075-10Z</b>	48		10	75							2 × 25				5,230	6,490	135	<b>3075</b>
<b>3100-14Z</b>	<b>3100-14Z</b>	58		14	100							3 × 25				6,810	9,080	187	<b>3100</b>
<b>3125-17Z</b>	<b>3125-17Z</b>	78		17	125							4 × 25				7,560	10,300	234	<b>3125</b>
<b>3150-21Z</b>	<b>3150-21Z</b>	88		21	150							5 × 25				9,000	12,900	281	<b>3150</b>
<b>3175-24Z</b>	<b>3175-24Z</b>	105		24	175							6 × 25				10,300	15,500	327	<b>3175</b>
<b>3200-28Z</b>	<b>3200-28Z</b>	115		28	200							7 × 25				11,700	18,100	374	<b>3200</b>
<b>SVW 4080- 7Z</b>	<b>SVWS 4080- 7Z</b>	58	4	7	80	11.5	0.5	44	20.4	10.2	35	1 × 40	40	5 <sup>+0.012</sup> <sub>0</sub>	2	7,110	7,920	255	<b>4080</b>
<b>4120-11Z</b>	<b>4120-11Z</b>	82		11	120							2 × 40				10,600	13,200	385	<b>4120</b>
<b>4160-15Z</b>	<b>4160-15Z</b>	105		15	160							3 × 40				13,800	18,400	510	<b>4160</b>
<b>4200-19Z</b>	<b>4200-19Z</b>	130		19	200							4 × 40				16,800	23,700	635	<b>4200</b>
<b>4240-23Z</b>	<b>4240-23Z</b>	150		23	240							5 × 40				19,700	29,000	770	<b>4240</b>
<b>4280-27Z</b>	<b>4280-27Z</b>	175		27	280							6 × 40				22,400	34,300	905	<b>4280</b>

major dimensions										basic load rating		mass (one set)	size	
N <sub>1</sub> mm	F	d <sub>1</sub> mm	G mm	H mm	M <sub>2</sub> × P <sub>3</sub> mm	N <sub>2</sub> mm	d <sub>2</sub> mm	T mm			dynamic C N	static Co N	g	
5	M2	1.65	3	1.4	—	10	2 <sup>+0.010</sup> <sub>0</sub>	0.8			464	476	11	<b>1020</b>
					1 × 10				641	714	14	<b>1030</b>		
					2 × 10				959	1,190	18	<b>1040</b>		
					3 × 10				1,100	1,420	22	<b>1050</b>		
					4 × 10				1,380	1,900	26	<b>1060</b>		
					5 × 10				1,510	2,140	30	<b>1070</b>		
					6 × 10				1,650	2,380	34	<b>1080</b>		
7.5	M3	2.55	4.4	2	—	15	3 <sup>+0.010</sup> <sub>0</sub>	1.2			1,090	1,170	28	<b>2030</b>
					1 × 15				1,900	2,340	42	<b>2045</b>		
					2 × 15				2,270	2,930	55	<b>2060</b>		
					3 × 15				2,620	3,510	69	<b>2075</b>		
					4 × 15				3,280	4,680	83	<b>2090</b>		
					5 × 15				3,590	5,270	96	<b>2105</b>		
					6 × 15				3,900	5,860	110	<b>2120</b>		
12.5	M4	3.3	6	3.1	—	25	4 <sup>+0.012</sup> <sub>0</sub>	2			3,490	3,890	94	<b>3050</b>
					1 × 25				5,230	6,490	135	<b>3075</b>		
					2 × 25				6,810	9,080	187	<b>3100</b>		
					3 × 25				7,560	10,300	234	<b>3125</b>		
					4 × 25				9,000	12,900	281	<b>3150</b>		
					5 × 25				10,300	15,500	327	<b>3175</b>		
					6 × 25				11,700	18,100	374	<b>3200</b>		
20	M5	4.3	8	4.2	—	40	5 <sup>+0.012</sup> <sub>0</sub>	2			7,110	7,920	255	<b>4080</b>
					1 × 40				10,600	13,200	385	<b>4120</b>		
					2 × 40				13,800	18,400	510	<b>4160</b>		
					3 × 40				16,800	23,700	635	<b>4200</b>		
					4 × 40				19,700	29,000	770	<b>4240</b>		
					5 × 40				22,400	34,300	905	<b>4280</b>		

1N≒0.102kgf

# SLIDE TABLE

The NB slide table is a precision table equipped with a slide way. Its high-precision and low-friction characteristics make it well suited for use in electronics automatic-assembly machines, optical measurement devices, etc.

## STRUCTURE AND ADVANTAGES

The NB slide table consists of a slide way sandwiched between an accurately machined table and a bed. Stoppers are provided inside the table.

### STUDROLLER system

The STUDROLLER system (slideway NV type) that prevents roller slippage is used for the linear motion part of NVT (S) type and NYT (S) type.

### Upgraded Model

For the linear motion components of HVT (S) and HYT (S) types, we use a Slideway HV type which is a product with improved performance that has been redesigned from the conventional product (SV type).

### High Accuracy

The mounting surfaces of the table and bed are precision finished to ensure high precision linear motion, resulting in a high performance slide way.

### Low Friction

Its non-recirculating mechanism provides stable motion at from low to high speeds.

### Compact and High Rigidity

Being designed compactly, the NB slide table holds the high load capacity and high rigidity characteristics.

### No Need for Adjustment

The table is carefully assembled so that the accuracy and preload are optimized, it can be used immediately without any further adjustment.

### Ease of Mounting

Standardized mounting holes are provided in the table and bed. High precision linear motion can be achieved simply by mounting.

### anti-corrosion · surface treatment

The anti-corrosion model combines a corrosion-resistant slideway with a table and bed made of stainless steel or aluminum alloy.

In addition to the anti-corrosion model, you can select the LB model with low-temperature black chrome treatment. To enhance the rust prevention effect, surface treatment is applied to the slideway rail and steel parts other than aluminum alloy, and the end pieces and screws are made of stainless steel.

Figure A-18 Structure of NVT type

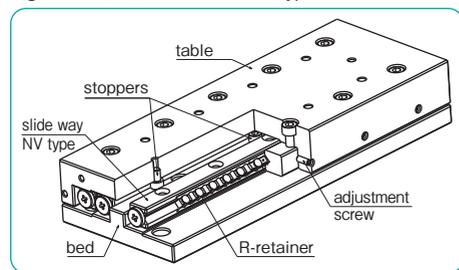


Figure A-20 Structure of HVT · SVT type

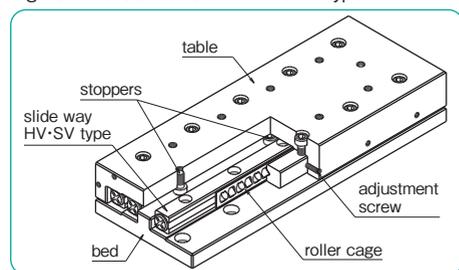


Figure A-19 Structure of NYT type

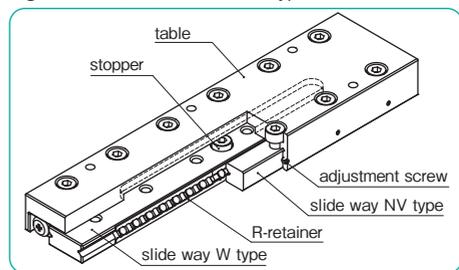
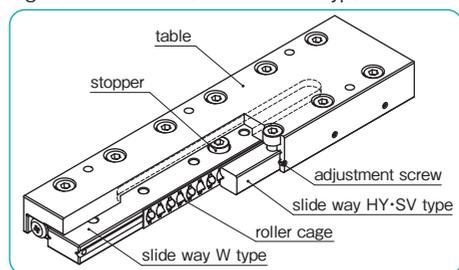


Figure A-21 Structure of HYT · SYT type



## TYPES

NVT · NVTS type STUDROLLER System



P.A-38

NYT · NYTS type STUDROLLER System



P.A-42

HVT · HVTS type, SVT · SVTS type



P.A-46

HYT · HYTS type, SYT · SYTS type



P.A-50

The NVT type slide table incorporates the NV type slide way. The table and bed have been precision machined to provide a high degree of accuracy and the product can be used, without any need for troublesome accuracy or preload adjustments. In the NVTS type, the anti-corrosion NVS type slide way is sandwiched between an accurately machined aluminum table and bed.

The NYT/NYTS type is a thin, compact slide table, utilizing the studroller system. Either tapped or counterbore mounting type (D type) is available. The anti-corrosion type NYTS slide table is made of all stainless steel components except for R-retainer.

Between the precision-ground table and bed, the HVT type has a performance-enhanced HV type rail, and the SVT type has an SV type rail installed. The anti-corrosion type has an aluminum table and bed, the HVTS type has an anti-corrosion slideway HVS model with improved performance, and the SVTS type has an anti-corrosion slideway SVS model.

A thin and compact slide table that uses an integrated rail. Two types are available: tapped type and counterbore hole type (D type) which can be selected according to the usage.

The HYT type incorporates the HV type rail with improved performance, and the SYT type incorporates the SV type rail.

The anti-corrosion HYTS · SYTS type slide table is made of all stainless steel components.

## SPECIFICATION

Refer to table A-8 for NB Slide Table material and operating temperature range.

Table A-8 Material and Operating Temperature Range

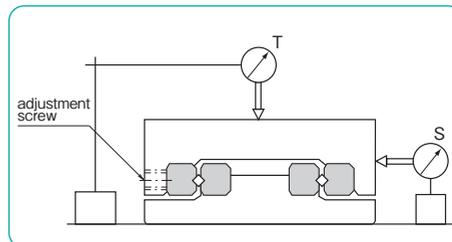
type	slide way			table/bed	operating temperature range
	rail	R-retainer/roller cage	roller		
NVT	steel	resin	steel	steel	-20°C ~ 80°C
NVTS	stainless steel		stainless steel	aluminum	5°C ~ 35°C*1
NYT (-D)	steel		steel	steel	-20°C ~ 80°C
NYTS (-D)	stainless steel		stainless steel	stainless steel	-20°C ~ 80°C
HVT	steel	stainless steel	steel	steel	-20°C ~ 110°C
HVTS	stainless steel		stainless steel	aluminum	5°C ~ 35°C*1
HYT (-D)	steel		steel	steel	-20°C ~ 110°C
HYTS (-D)	stainless steel		stainless steel	stainless steel	-20°C ~ 140°C
SVT	steel	stainless steel	steel	steel	-20°C ~ 110°C
SVTS	stainless steel		stainless steel	aluminum	5°C ~ 35°C*1
SYT (-D)	steel		steel	steel	-20°C ~ 110°C
SYTS (-D)	stainless steel		stainless steel	stainless steel	-20°C ~ 140°C

\*1 Please contact NB if the system is to be used out of this temperature range.

### ACCURACY

The motion accuracy of a slide table is measured by placing indicators at the center of the top and side surface of the table, as illustrated in Figure A-22. It is expressed in terms of the indicator deviation when the table is moved the full stroke without any load. For accuracy, please see the dimension tables.

Figure A-22 Accuracy Measurement Method



### RATED LIFE

The life of an NB slide table is calculated using the following equations.

Rated Life

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

L: rated life(km) f<sub>T</sub>: temperature coefficient f<sub>W</sub>: applied load coefficient  
C: basic dynamic load rating(N) P: applied load(N)  
\*Please refer to page Eng-6 for the coefficients.

Life Time

$$L_h = \frac{L \cdot 10^6}{2 \cdot l_s \cdot n \cdot 60}$$

L<sub>h</sub>: life time (hr) l<sub>s</sub>: stroke length (mm)  
n: number of cycles per minute (cpm)

### LOAD RATING

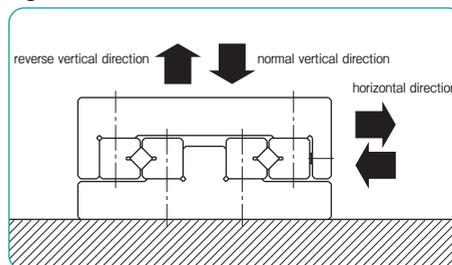
The load rating of the slide table NVT type and NYT type differs depending on the direction of the load.

Table A-9 Change of Load Rating Corresponding to Load Direction

basic dynamic load rating	normal vertical direction	1.0×C
	horizontal direction	0.85×C
	reverse vertical direction	0.74×C
basic static load rating	normal vertical direction	1.0×C <sub>0</sub>
	horizontal direction	0.84×C <sub>0</sub>
	reverse vertical direction	0.68×C <sub>0</sub>

\*There may be a difference depending on the size. Please contact NB for details. Consideration has been given to holes for STUDROLLERS in the raceway surface in calculation of load ratings.

Figure A-23 Direction of Load



### USE AND HANDLING PRECAUTIONS

#### Careful Handling

Dropping the slide table causes the rolling elements to make dents in the raceway surface. This will prevent smooth motion and will also affect accuracy. Be sure to handle the product with care.

#### Dust Prevention

Dust and foreign particles affect the accuracy and lifetime of a slide table. A slide table used in a harsh environment should be protected with a cover.

#### Lubrication

The slide table is prelubricated with lithium soap based grease No.00 prior to shipment for immediate use. Make sure to relubricate with a similar type of grease periodically depending on the operating conditions.

#### Cage Slippage

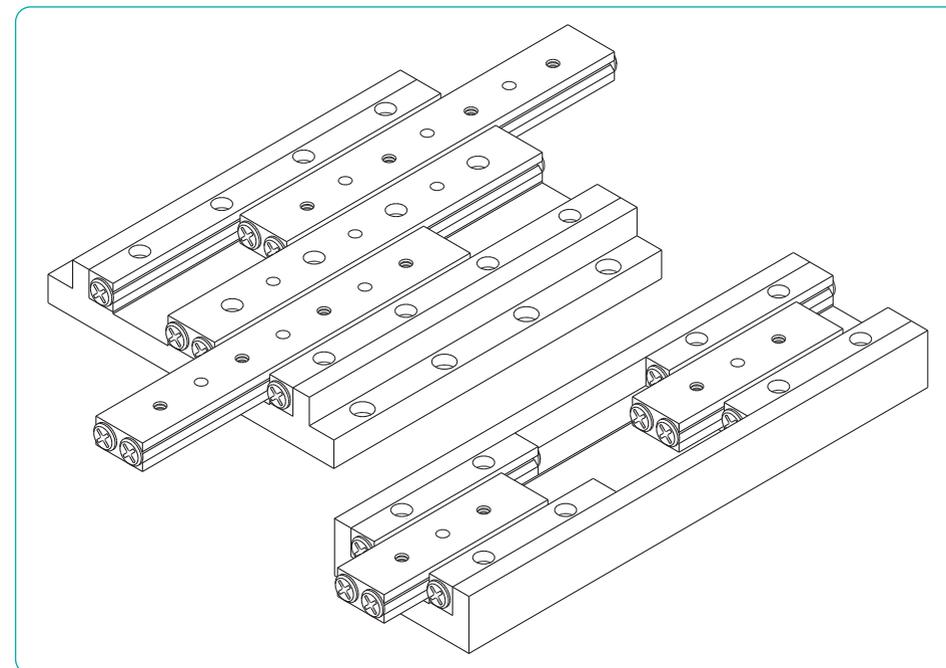
For the HVT·SVT type, HYT·SYT type, the cage can slip under high-speed motion, vertical application, unbalanced-loading, and vibrating conditions. It is advised that the motion speed be kept under 0.5m/s under general operating conditions. It is also recommended that the rails be cycled to perform the maximum stroke several times, so that the cage returns to its central position.

#### Adjustment/Installation Screw

The NB slide table is adjusted to achieve optimum accuracy and preload. The adjustment screw and rail installation screws should be kept untouched.

### SPECIAL REQUIREMENTS

NB can machine tables to meet special requirements, including tables with a micrometer head and tables for projectors. Please contact NB for details.



# NVT TYPE

-NVT1/NVT2/NVT3-

STUDROLLER System



## part number structure

example **NVT 3 205 -LB -KGLA**

specification  
 NVT: standard  
 NVTS: anti-corrosion

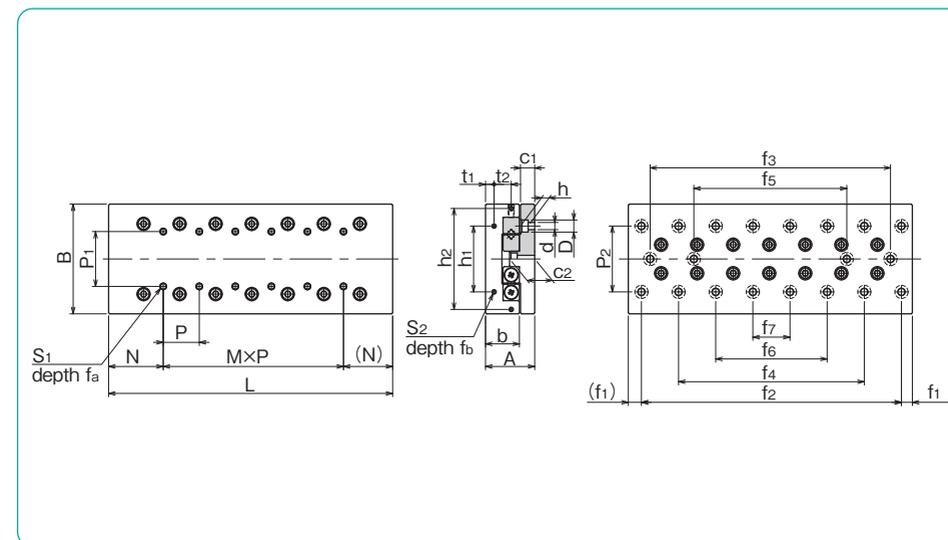
size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

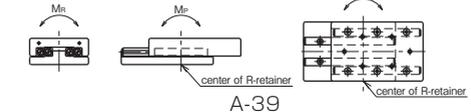
with low temperature black chrome treatment

part number		stroke	major dimensions				table-top mounting hole dimensions					table-end mounting hole dimensions					
standard	anti-corrosion	ST mm	A mm	B mm	L mm	b mm	P <sub>1</sub> mm	S <sub>1</sub> mm	f <sub>a</sub> mm	N mm	M×P mm	h <sub>1</sub> mm	h <sub>2</sub> mm	t <sub>1</sub> mm	t <sub>2</sub> mm	S <sub>2</sub> mm	f <sub>b</sub> mm
NVT1025	NVTS1025	12			25						—						
1035	1035	18			35					1×10							
1045	1045	25			45					2×10							
1055	1055	32	17±0.1	30 <sup>-0.4</sup>	55	11	10	M2	4	12.5	3×10	12	—	2.5	—	M2	6
1065	1065	40			65						4×10						
1075	1075	45			75						5×10						
1085	1085	50			85						6×10						
NVT2035	NVTS2035	18			35						—						
2050	2050	30			50						1×15						
2065	2065	40			65						2×15						
2080	2080	50			80						3×15						
2095	2095	60			95						4×15						
2110	2110	70	21±0.1	40 <sup>-0.4</sup>	110	14	15	M3	6	17.5	5×15	16	—	3.4	—	M2	6
2125	2125	80			125						6×15						
2140	2140	90			140						7×15						
2155	2155	100			155						8×15						
2170	2170	110			170						9×15						
2185	2185	120			185						10×15						
NVT3055	NVTS3055	30			55						—						
3080	3080	45			80						1×25						
3105	3105	60			105						2×25						
3130	3130	75			130						3×25						
3155	3155	90	28±0.1	60±0.1	155	18.5	25	M4	8	27.5	4×25	40	—	5.5	—	M3	6
3180	3180	105			180						5×25						
3205	3205	130			205						6×25						
3230	3230	155			230						7×25						



bed-surface mounting hole dimensions											accuracy ※(deviation)		basic load rating dynamic static		allowable static moment			mass		size			
P <sub>2</sub> mm	d×D×h mm	c <sub>1</sub> mm	c <sub>2</sub> mm	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	f <sub>4</sub> mm	f <sub>5</sub> mm	f <sub>6</sub> mm	f <sub>7</sub> mm	T μm	S μm	C N	Co N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m	M <sub>R</sub> N·m	NVT g	NVTS g				
22	2.5×4.5×2.5	5.5	9	3.5	18	—	—	—	—	—	2	4	734	849	3.73	3.18	5.73	87	39	1025			
					28	—	—	—	—	—	2	4	1,250	1,690	1.73	4.22	1.88	124	55	1035			
					38	—	—	—	—	—	—	—	—	2	4	1,720	2,540	9.05	10.3	7.62	160	71	1045
					48	—	28	—	—	—	—	—	—	2	5	2,160	3,390	14.0	16.7	9.50	195	87	1055
					58	—	38	—	—	—	—	—	—	2	5	2,560	4,240	24.8	26.7	15.2	231	103	1065
					68	—	48	—	—	—	—	—	—	2	5	2,960	5,090	33.0	36.7	17.1	267	119	1075
					78	—	58	—	—	—	—	—	—	2	5	3,330	5,940	47.7	50.6	22.8	303	136	1085
30	3.5×6.5×3.5	6.5	10.9	5	25	—	—	—	—	—	2	4	1,360	1,520	10.1	8.8	13.7	200	95	2035			
					40	—	—	—	—	—	—	—	2	4	2,330	3,050	18.9	18.7	18.6	287	140	2050	
					55	—	—	—	—	—	—	—	—	2	5	3,190	4,580	36.9	35.7	32.4	377	182	2065
					70	—	40	—	—	—	—	—	—	2	5	3,990	6,110	53.2	53.8	37.3	455	225	2080
					85	—	55	—	—	—	—	—	—	2	5	4,740	7,630	80.3	79.9	51.1	550	260	2095
					100	—	70	—	—	—	—	—	—	3	6	5,460	9,160	104	106	56.0	640	295	2110
					115	—	85	—	—	—	—	—	—	3	6	6,160	10,600	130	135	60.9	730	340	2125
					130	—	100	—	70	—	—	—	—	3	6	6,830	12,200	171	176	74.7	810	370	2140
					145	—	115	—	85	—	—	—	—	3	6	8,130	15,200	235	244	88.4	890	410	2155
					160	—	130	—	100	—	—	—	—	3	7	8,750	16,800	275	289	93.3	980	450	2170
175	—	145	—	115	85	—	—	—	3	7	9,370	18,300	317	338	98.3	1,070	490	2185					
40	4.5×8×4.5	9	15	10	35	—	—	—	—	—	2	5	6,150	8,060	20.8	37.2	27.3	643	303	3055			
					60	—	—	—	—	—	—	—	2	5	8,440	12,100	125	119	140	960	445	3080	
					85	—	—	—	—	—	—	—	—	3	6	10,500	16,100	188	186	167	1,260	590	3105
					110	—	—	—	—	—	—	—	—	3	6	14,400	24,200	300	319	195	1,580	725	3130
					135	85	—	—	—	—	—	—	—	3	6	16,300	28,200	508	505	308	1,860	860	3155
					160	110	—	—	—	—	—	—	—	3	7	18,100	32,200	630	635	335	2,160	1,000	3180
					185	135	85	—	—	—	—	—	—	3	7	19,800	36,300	763	779	362	2,460	1,140	3205
					210	160	110	—	—	—	—	—	—	3	7	21,500	40,300	906	936	390	2,780	1,310	3230

※For accuracy (T, S), refer to Figure A-22 (page A-36). 1N ≒ 0.102kgf 1N · m ≒ 0.102kgf · m



# NVT TYPE

-NVT4/NVT6/NVT9-

STUDROLLER System



## part number structure

example **NVT 6 210 -LB -KGLA**

specification  
 NVT: standard  
 NVTS: anti-corrosion

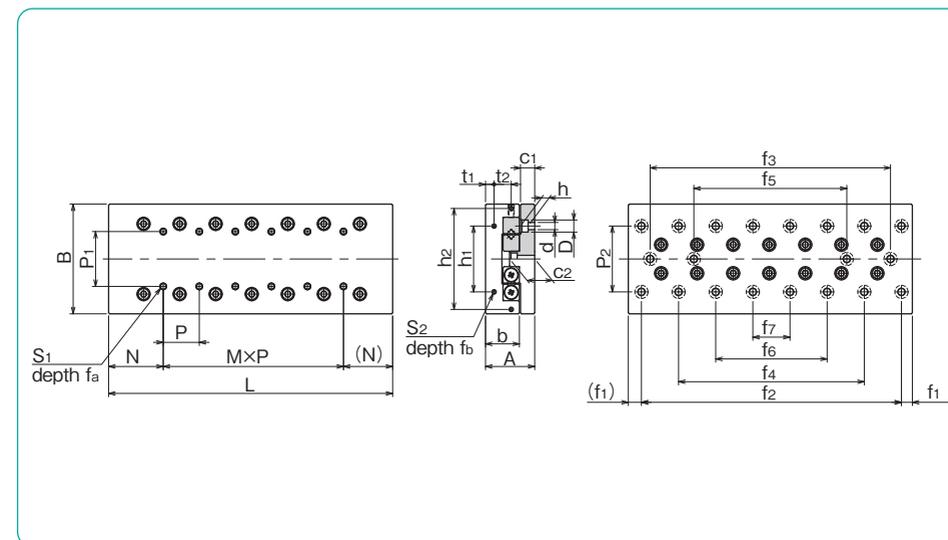
size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

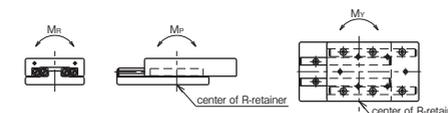
part number		stroke ST mm	major dimensions				table-top mounting hole dimensions					table-end mounting hole dimensions					
standard	anti-corrosion		A mm	B mm	L mm	b mm	P <sub>1</sub> mm	S <sub>1</sub> mm	f <sub>a</sub> mm	N mm	M×P mm	h <sub>1</sub> mm	h <sub>2</sub> mm	t <sub>1</sub> mm	t <sub>2</sub> mm	S <sub>2</sub> mm	f <sub>b</sub> mm
<b>NVT4085</b>	<b>NVTS4085</b>	50	35±0.1	80±0.1	85	24	40	M5	10	42.5	—	55	—	6.5	—	M3	6
<b>4125</b>	<b>4125</b>	75			125						1×40						
<b>4165</b>	<b>4165</b>	105			165						2×40						
<b>4205</b>	<b>4205</b>	130			205						3×40						
<b>4245</b>	<b>4245</b>	155			245						4×40						
<b>4285</b>	<b>4285</b>	185	285	5×40													
<b>NVT6110</b>	<b>NVTS6110</b>	60	45±0.1	100±0.1	110	31	50	M6	12	55	—	60	92	8	15	M4	8
<b>6160</b>	<b>6160</b>	95			160						1×50						
<b>6210</b>	<b>6210</b>	130			210						2×50						
<b>6260</b>	<b>6260</b>	165			260						3×50						
<b>6310</b>	<b>6310</b>	200			310						4×50						
<b>6360</b>	<b>6360</b>	235			360						5×50						
<b>6410</b>	<b>6410</b>	265			410						6×50						
<b>NVT9210</b>	—	130	210	—													
<b>9310</b>	—	180	310	—													
<b>9410</b>	—	220	410	—													
<b>9510</b>	—	300	510	—													
			60±0.1	145±0.1	43	85	M8	16	105	1×100	90	135	11	20	M4	8	
										3×100							



bed-surface mounting hole dimensions											accuracy ※(deviation)		basic load rating dynamic static		allowable static moment			mass		size
P <sub>2</sub> mm	d×D×h mm	c <sub>1</sub> mm	c <sub>2</sub> mm	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	f <sub>4</sub> mm	f <sub>5</sub> mm	f <sub>6</sub> mm	f <sub>7</sub> mm	T μm	S μm	C N	Co N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m	M <sub>R</sub> N·m	NVT g	NVTS g	
55	5.5×10×5.4	10.5	18	10	65	—	—	—	—	—	2	5	12,100	15,700	156	147	239	1,710	790	<b>4085</b>
					105	—	—	—	—	—	3	6	20,700	31,500	327	357	320	2,520	1,160	<b>4125</b>
					145	—	—	—	—	—	3	7	24,700	39,300	656	660	559	3,320	1,530	<b>4165</b>
					185	105	—	—	—	—	3	7	32,100	55,100	1,270	1,250	874	4,130	1,900	<b>4205</b>
					225	145	—	—	—	—	3	7	39,000	70,900	1,740	1,780	956	4,930	2,270	<b>4245</b>
					265	185	—	—	—	—	3	7	42,400	78,700	2,380	2,400	1,190	5,730	2,630	<b>4285</b>
60	7×11.5×7	13	23	10	90	—	—	—	—	—	3	6	29,600	37,500	213	310	256	3,300	1,720	<b>6110</b>
					140	—	—	—	—	—	3	6	40,700	56,300	963	941	936	4,850	2,510	<b>6160</b>
					190	90	—	—	—	—	3	7	60,600	93,900	1,960	1,990	1,350	6,310	3,290	<b>6210</b>
					240	140	—	—	—	—	3	7	69,800	112,000	2,710	2,790	1,610	7,790	4,080	<b>6260</b>
					290	190	—	—	—	—	3	7	78,800	131,000	4,490	4,420	2,460	9,260	4,860	<b>6310</b>
					340	240	140	—	—	—	4	8	87,400	150,000	5,630	5,610	2,710	10,900	5,740	<b>6360</b>
					390	290	190	—	—	—	4	8	104,000	187,000	7,540	7,700	2,970	12,460	6,620	<b>6410</b>
90	9×14×9	16	29	55	100	—	—	—	—	—	3	6	96,100	128,000	1,610	2,110	1,780	12,550	—	<b>9210</b>
					200	—	—	—	—	—	3	6	143,000	213,000	6,490	6,580	4,860	18,000	—	<b>9310</b>
					300	—	—	—	—	—	3	7	186,000	298,000	12,600	12,700	7,290	24,010	—	<b>9410</b>
					400	—	—	—	—	—	3	7	206,000	341,000	18,700	18,600	9,720	30,100	—	<b>9510</b>

※For accuracy (T, S), refer to Figure A-22 (page A-36).

1N≒0.102kgf 1N·m≒0.102kgf·m



# NYT TYPE

STUDROLLER System



## part number structure

example **NYT 2 065 -LB -KGLA**

specification  
 NYT: standard  
 NYTS: anti-corrosion

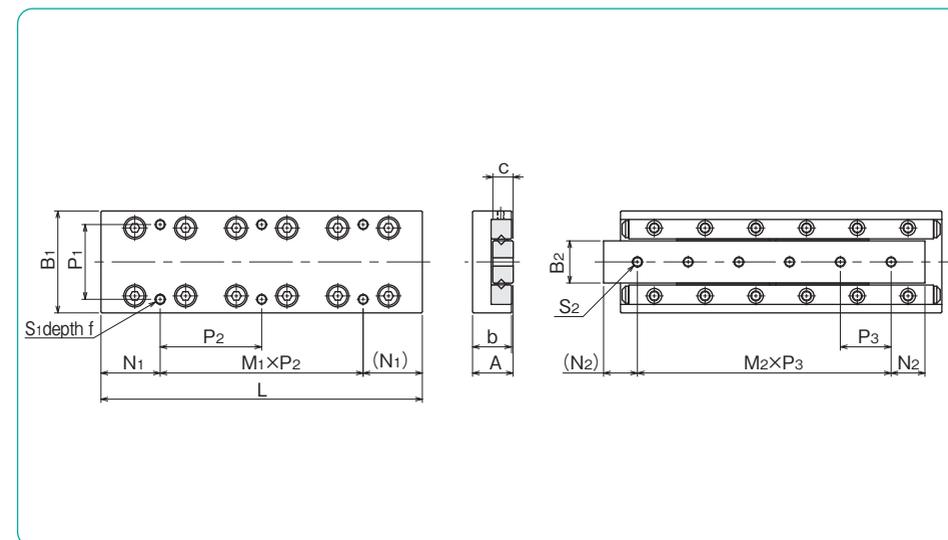
size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

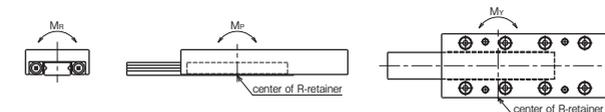
with low temperature black chrome treatment

part number		stroke ST mm	major dimensions						table-top mounting hole dimensions				
standard	anti-corrosion		A mm	B <sub>1</sub> mm	L mm	b mm	B <sub>2</sub> mm	c mm	P <sub>1</sub> mm	S <sub>1</sub>	f mm	N <sub>1</sub> mm	M <sub>1</sub> ×P <sub>2</sub> mm
NYT 1025	NYTS 1025	12	8±0.1	20±0.1	25	7.5	7.06	4	14	M2.6	3	3.5	1×18
1035	1035	18			35							1×28	
1045	1045	25			45							1×20	
1055	1055	32			55							1×30	
1065	1065	40			65							2×20	
1075	1075	45			75							1×30	
1085	1085	50			85							2×30	
NYT 2035	NYTS 2035	18	12±0.1	30±0.1	35	11.5	12.4	6	22	M3	5	3.5	1×28
2050	2050	30			50							1×43	
2065	2065	40			65							1×30	
2080	2080	50			80							1×45	
2095	2095	60			95							2×30	
2110	2110	70			110							1×45	
2125	2125	80			125							2×45	
NYT 3055	NYTS 3055	30	16±0.1	40±0.1	55	15.5	16.7	8	30	M4	7	7.5	1×40
3080	3080	45			80							1×65	
3105	3105	60			105							1×50	
3130	3130	75			130							1×75	
3155	3155	90			155							2×50	
3180	3180	105			180							1×75	
3205	3205	130			205							2×75	



bed-surface mounting hole dimensions S <sub>2</sub>	accuracy ※(deviation)		basic load rating static		allowable static moment			mass g	size		
	T μm	S μm	C N	Co N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m	M <sub>R</sub> N·m				
M2.6	5	2×7.5	2	4	734	849	3.73	3.18	3.18	25	1025
	7.5	2×10	2	4	1,250	1,690	1.73	4.22	1.04	35	1035
	7.5	3×10	2	5	1,720	2,540	9.05	10.3	4.23	45	1045
	7.5	4×10	2	5	2,160	3,390	14.0	16.7	5.28	55	1055
	7.5	5×10	2	5	2,560	4,240	24.8	26.7	8.46	65	1065
	7.5	6×10	2	5	2,960	5,090	33.0	36.7	9.51	76	1075
	7.5	7×10	2	5	3,330	5,940	47.7	50.6	12.7	86	1085
M3	7.5	1×20	2	4	1,360	1,520	10.1	8.80	9.93	84	2035
	10	2×15	2	4	2,330	3,050	18.9	18.7	13.4	120	2050
	10	3×15	2	5	3,190	4,580	36.9	35.7	23.4	157	2065
	10	4×15	2	5	3,990	6,110	53.2	53.8	26.9	190	2080
	10	5×15	2	5	4,740	7,630	80.3	79.9	36.9	225	2095
	10	6×15	2	5	5,460	9,160	104	106	40.4	265	2110
	10	7×15	2	5	6,160	10,600	130	135	44.0	305	2125
M4	10	1×35	2	5	6,150	8,060	20.8	37.2	17.0	228	3055
	15	2×25	2	5	8,440	12,100	125	119	87.2	345	3080
	15	3×25	3	5	10,500	16,100	188	186	104	450	3105
	15	4×25	3	5	14,400	24,200	300	319	121	570	3130
	15	5×25	3	5	16,300	28,200	508	505	191	665	3155
	15	6×25	3	5	18,100	32,200	630	635	208	780	3180
	15	7×25	3	5	19,800	36,300	763	779	225	890	3205

※For accuracy (T, S), refer to Figure A-22 (page A-36). 1N≐0.102kgf 1N·m≐0.102kgf·m



# NYT-D TYPE

STUDROLLER System



## part number structure

example **NYT 3 125 -D -LB -KGLA**

specification  
 NYT: standard  
 NYTS: anti-corrosion

size

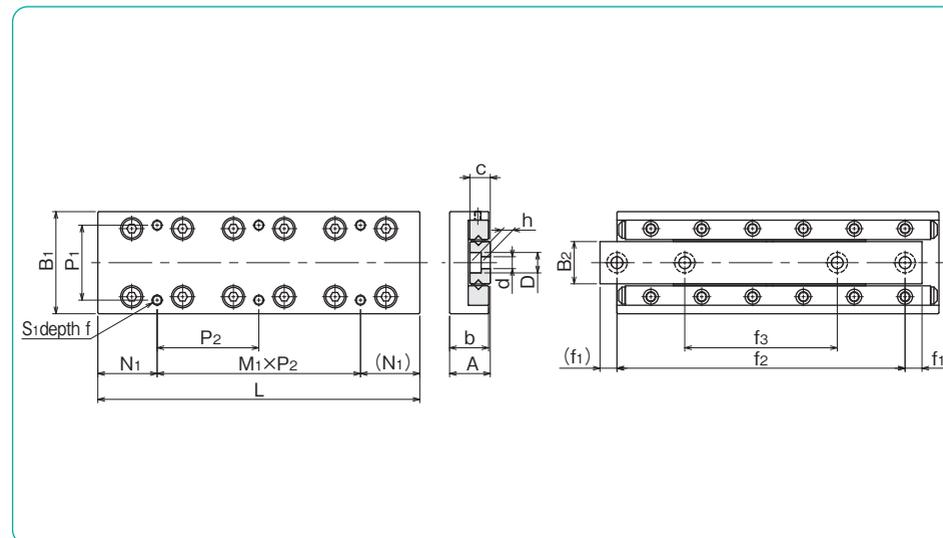
table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

with counterbore

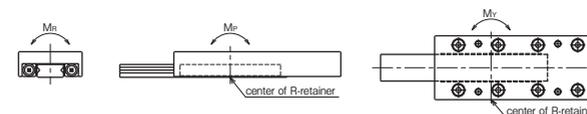
part number		stroke	major dimensions						table-top mounting hole dimensions				
standard	anti-corrosion	ST mm	A mm	B <sub>1</sub> mm	L mm	b mm	B <sub>2</sub> mm	c mm	P <sub>1</sub> mm	S <sub>1</sub>	f mm	N <sub>1</sub> mm	M <sub>1</sub> ×P <sub>2</sub> mm
NYT 1025-D	NYTS 1025-D	12	8±0.1	20±0.1	25	7.5	7.06	4	14	M2.6	3	3.5	1×18
1035-D	1035-D	18			35							3.5	1×28
1045-D	1045-D	25			45							12.5	1×20
1055-D	1055-D	32			55							12.5	1×30
1065-D	1065-D	40			65							12.5	2×20
1075-D	1075-D	45			75							22.5	1×30
1085-D	1085-D	50			85							12.5	2×30
NYT 2035-D	NYTS 2035-D	18	12±0.1	30±0.1	35	11.5	12.4	6	22	M3	5	3.5	1×28
2050-D	2050-D	30			50							3.5	1×43
2065-D	2065-D	40			65							17.5	1×30
2080-D	2080-D	50			80							17.5	1×45
2095-D	2095-D	60			95							17.5	2×30
2110-D	2110-D	70			110							32.5	1×45
2125-D	2125-D	80			125							17.5	2×45
NYT 3055-D	NYTS 3055-D	30	16±0.1	40±0.1	55	15.5	16.7	8	30	M4	7	7.5	1×40
3080-D	3080-D	45			80							7.5	1×65
3105-D	3105-D	60			105							27.5	1×50
3130-D	3130-D	75			130							27.5	1×75
3155-D	3155-D	90			155							27.5	2×50
3180-D	3180-D	105			180							52.5	1×75
3205-D	3205-D	130			205							27.5	2×75



bed-surface mounting hole dimensions d×D×h mm	accuracy ※(deviation)			basic load rating		allowable static moment			mass g	size		
	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	T μm	S μm	C N	Co N	M <sub>P</sub> N·m			M <sub>Y</sub> N·m	M <sub>R</sub> N·m
2.5×4.1×2.2	3.5	18	—	2	4	734	849	3.73	3.18	3.18	25	<b>1025</b>
	5	25	—	2	4	1,250	1,690	1.73	4.22	1.04	35	<b>1035</b>
	3.5	38	25	2	5	1,720	2,540	9.05	10.3	4.23	45	<b>1045</b>
	3.5	48	29	2	5	2,160	3,390	14.0	16.7	5.28	55	<b>1055</b>
	5	55	31	2	5	2,560	4,240	24.8	26.7	8.46	65	<b>1065</b>
	5	65	35	2	5	2,960	5,090	33.0	36.7	9.51	76	<b>1075</b>
	5	75	40	2	5	3,330	5,940	47.7	50.6	12.7	86	<b>1085</b>
3.5×6×3.3	5	25	—	2	4	1,360	1,520	10.1	8.80	9.93	84	<b>2035</b>
	7.5	35	—	2	4	2,330	3,050	18.9	18.7	13.4	120	<b>2050</b>
	5	55	33	2	5	3,190	4,580	36.9	35.7	23.4	157	<b>2065</b>
	5	70	40	2	5	3,990	6,110	53.2	53.8	26.9	190	<b>2080</b>
	5	85	45	2	5	4,740	7,630	80.3	79.9	36.9	225	<b>2095</b>
	7.5	95	50	2	5	5,460	9,160	104	106	40.4	265	<b>2110</b>
	7.5	110	55	2	5	6,160	10,600	130	135	44.0	305	<b>2125</b>
4.5×7.5×4.3	7.5	40	—	2	5	6,150	8,060	20.8	37.2	17.0	228	<b>3055</b>
	6	68	43	2	5	8,440	12,100	125	119	87.2	345	<b>3080</b>
	7.5	90	55	3	5	10,500	16,100	188	186	104	450	<b>3105</b>
	7.5	115	65	3	5	14,400	24,200	300	319	121	570	<b>3130</b>
	7.5	140	95	3	5	16,300	28,200	508	505	191	665	<b>3155</b>
	7.5	165	85	3	5	18,100	32,200	630	635	208	780	<b>3180</b>
	7.5	190	90	3	5	19,800	36,300	763	779	225	890	<b>3205</b>

※For accuracy (T, S), refer to Figure A-22 (page A-36).

1N≒0.102kgf 1N·m≒0.102kgf·m



# HVT TYPE

-HVT2/HVT3-

Upgraded model



## part number structure

example **HVT 3 205 -LB -KGLA**

specification  
 HVT: standard  
 HVTS: anti-corrosion

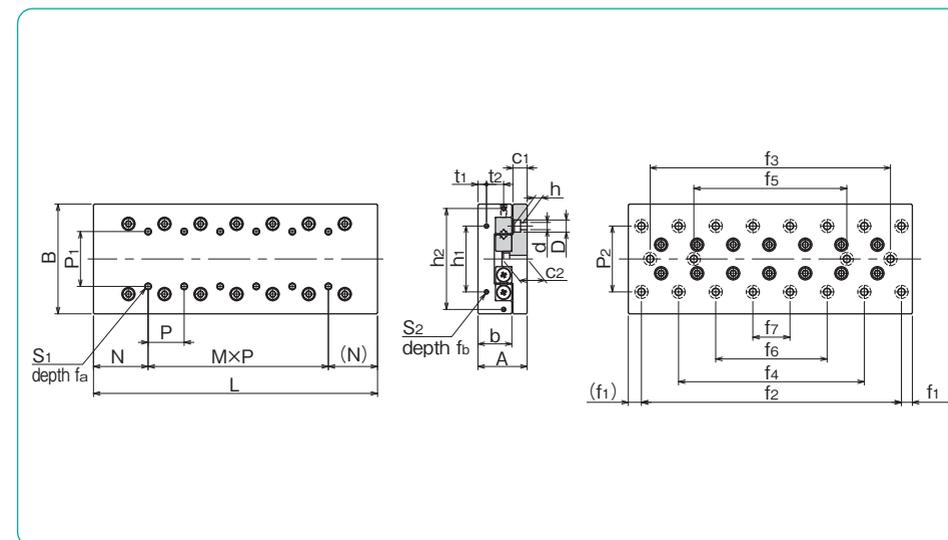
size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

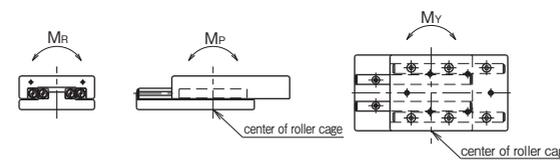
with low temperature black chrome treatment

part number		stroke ST mm	major dimensions				table-top mounting hole dimentions				table-end mounting hole dimentions				d×D×h mm					
standard	anti-corrosion		A mm	B mm	L mm	b mm	P <sub>1</sub> mm	S <sub>1</sub> mm	f <sub>a</sub> mm	N mm	M×P mm	h <sub>1</sub> mm	h <sub>2</sub> mm	t <sub>1</sub> mm	t <sub>2</sub> mm	S <sub>2</sub> mm	f <sub>b</sub> mm	P <sub>2</sub> mm		
HVT 2035	HVTS 2035	18	21 <sup>±0.1</sup>	40 <sup>-0.2 -0.4</sup>	35	14	15	M3	6	17.5	16	-	-	-	-	-	6	30	3.5×6.5×3.5	
2050	2050	30			50															1×15
2065	2065	40			65															2×15
2080	2080	50			80															3×15
2095	2095	60			95															4×15
2110	2110	70			110															5×15
2125	2125	80			125															6×15
2140	2140	90			140															7×15
2155	2155	100			155															8×15
2170	2170	110			170															9×15
2185	2185	120	185	10×15																
HVT 3055	HVTS 3055	30	28 <sup>±0.1</sup>	60 <sup>±0.1</sup>	55	18.5	25	M4	8	27.5	40	-	5.5	-	-	-	6	40	4.5×8×4.5	
3080	3080	45			80															1×25
3105	3105	60			105															2×25
3130	3130	75			130															3×25
3155	3155	90			155															4×25
3180	3180	105			180															5×25
3205	3205	130			205															6×25
3230	3230	155			230															7×25
3255	3255	180			255															8×25
3280	3280	205			280															9×25
3305	3305	230			305															10×25



bed-surface mounting hole dimentions							accuracy *(deviation)		basic load rating		allowable static moment			mass		size		
C <sub>1</sub> mm	C <sub>2</sub> mm	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	f <sub>4</sub> mm	f <sub>5</sub> mm	f <sub>6</sub> mm	f <sub>7</sub> mm	T μm	S μm	C N	Co N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m	M <sub>R</sub> N·m		HVT g	HVTS g
6.5	10.9	5	25	-	-	-	-	-	2	4	1,850	2,290	6.87	7.86	20.6	200	95	<b>2035</b>
			40	-	-	-	-	-	2	4	2,320	3,050	18.7	16.7	27.4	288	138	<b>2050</b>
			55	-	-	-	-	-	2	5	3,190	4,580	26.7	28.9	41.2	377	180	<b>2065</b>
			70	-	40	-	-	-	2	5	4,000	6,110	47.5	50.4	54.9	461	221	<b>2080</b>
			85	-	55	-	-	-	2	5	4,380	6,870	74.2	70.3	61.8	550	264	<b>2095</b>
			100	-	70	-	-	-	3	6	5,130	8,400	89.8	93.6	75.6	639	307	<b>2110</b>
			115	-	85	-	-	-	3	6	5,840	9,930	125	129	89.3	728	349	<b>2125</b>
			130	-	100	-	70	-	3	6	6,190	10,600	166	160	96.2	812	390	<b>2140</b>
			145	-	115	-	85	-	3	6	6,870	12,200	189	195	109	901	433	<b>2155</b>
			160	-	130	-	100	-	3	7	7,530	13,700	239	246	123	987	475	<b>2170</b>
175	-	145	-	115	85	3	7	7,850	14,500	296	288	130	1,080	517	<b>2185</b>			
9	15	10	35	-	-	-	-	-	2	5	6,150	8,060	43.7	49.6	112	655	309	<b>3055</b>
			60	-	-	-	-	-	2	5	8,460	12,100	99.0	107	169	960	453	<b>3080</b>
			85	-	-	-	-	-	3	6	10,600	16,100	175	186	225	1,270	596	<b>3105</b>
			110	-	-	-	-	-	3	6	12,600	20,100	274	287	282	1,570	740	<b>3130</b>
			135	85	-	-	-	-	3	6	14,500	24,200	395	410	338	1,870	881	<b>3155</b>
			160	110	-	-	-	-	3	7	16,400	28,200	537	554	395	2,180	1,030	<b>3180</b>
			185	135	85	-	-	-	3	7	17,300	30,200	701	677	423	2,470	1,170	<b>3205</b>
			210	160	110	-	-	-	3	7	19,000	34,200	791	812	480	2,780	1,310	<b>3230</b>
			235	185	135	-	-	-	3	7	19,900	36,300	988	959	508	3,080	1,460	<b>3255</b>
			260	210	160	110	-	-	3	7	21,600	40,300	1090	1110	564	3,380	1,600	<b>3280</b>
			285	235	185	135	-	-	3	7	22,500	42,300	1320	1290	592	3,690	1,740	<b>3305</b>

※For accuracy (T, S), refer to Figure A-22 (page A-36). 1N ≃ 0.102kgf 1N·m ≃ 0.102kgf·m



# HVT TYPE

-HVT4-

Upgraded model



## part number structure

example **HVT 4 285 -LB -KGLA**

specification  
 HVT: standard  
 HVTS: anti-corrosion

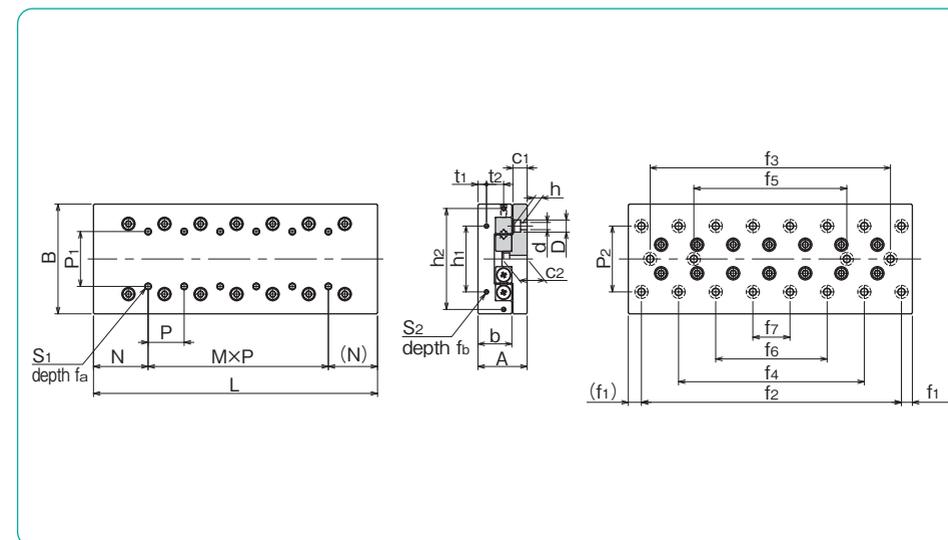
size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

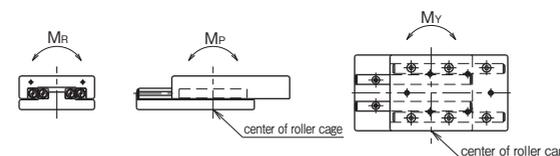
part number		stroke	major dimensions				table-top mounting hole dimensions				table-end mounting hole dimensions						d×D×h		
standard	anti-corrosion	ST mm	A mm	B mm	L mm	b mm	P <sub>1</sub> mm	S <sub>1</sub> mm	f <sub>a</sub> mm	N mm	M×P mm	h <sub>1</sub> mm	h <sub>2</sub> mm	t <sub>1</sub> mm	t <sub>2</sub> mm	S <sub>2</sub> mm	f <sub>b</sub> mm	P <sub>2</sub> mm	d×D×h mm
HVT 4085	HVTS 4085	50	35 <sup>±0.1</sup>	80 <sup>±0.1</sup>	85	24	40	M5	10	42.5	—	55	—	6.5	—	M3	6	55	5.5×10×5.4
4125	4125	75			1×40														
4165	4165	105			2×40														
4205	4205	130			3×40														
4245	4245	155			4×40														
4285	4285	185			5×40														
4325	4325	210			6×40														
4365	4365	235			7×40														
4405	4405	265			8×40														



bed-surface mounting hole dimensions										accuracy % (deviation)		basic load rating		allowable static moment			mass		size
C <sub>1</sub> mm	C <sub>2</sub> mm	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	f <sub>4</sub> mm	f <sub>5</sub> mm	f <sub>6</sub> mm	f <sub>7</sub> mm	T μm	S μm	dynamic C N	static C <sub>0</sub> N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m	M <sub>R</sub> N·m	HVT g	HVTS g	size	
10.5	18	10	65	—	—	—	—	—	2	5	14,400	19,600	167	183	393	1,700	791	<b>4085</b>	
			105	—	—	—	—	—	3	6	18,700	27,500	425	397	551	2,510	1,170	<b>4125</b>	
			145	—	—	—	—	—	3	7	24,800	39,300	664	695	787	3,330	1,550	<b>4165</b>	
			185	105	—	—	—	—	3	7	28,600	47,200	1,120	1,070	945	4,130	1,930	<b>4205</b>	
			225	145	—	—	—	—	3	7	34,000	59,000	1,690	1,630	1,180	4,940	2,310	<b>4245</b>	
			265	185	—	—	—	—	3	7	37,500	66,900	2,140	2,080	1,330	5,750	2,690	<b>4285</b>	
			305	225	145	—	—	—	4	8	42,600	78,700	2,910	2,840	1,570	6,550	3,060	<b>4325</b>	
			345	265	185	—	—	—	4	8	47,500	90,600	3,490	3,560	1,810	7,360	3,440	<b>4365</b>	
			385	305	225	—	—	—	4	8	50,600	98,400	4,460	4,370	1,960	8,170	3,820	<b>4405</b>	

※For accuracy (T, S), refer to Figure A-22 (page A-36).

1N ≒ 0.102kgf 1N · m ≒ 0.102kgf · m



# HYT TYPE

Upgraded model



## part number structure

example **HYT 2 110 -LB -KGLA**

specification  
 HYT: standard  
 HYTS: anti-corrosion

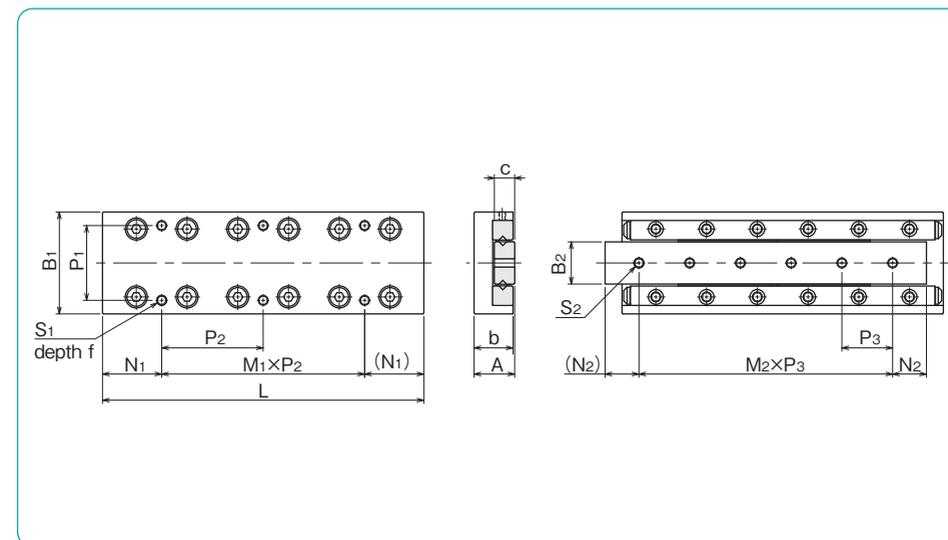
size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

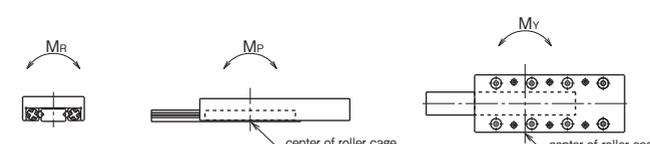
part number		stroke ST mm	major dimensions						table-top mounting hole dimensions					
standard	anti-corrosion		A mm	B <sub>1</sub> mm	L mm	b mm	B <sub>2</sub> mm	c mm	P <sub>1</sub> mm	S <sub>1</sub> mm	f mm	N <sub>1</sub> mm	M <sub>1</sub> × P <sub>2</sub> mm	
HYT 2035	HYTS 2035	18	12 <sup>±0.1</sup>	30 <sup>±0.1</sup>	35	11.5	12.4	6	22	M3	5	3.5	1 × 28	
2050	2050	30			50							3.5	1 × 43	
2065	2065	40			65							17.5	1 × 30	
2080	2080	50			80							17.5	1 × 45	
2095	2095	60			95							17.5	2 × 30	
2110	2110	70			110							32.5	1 × 45	
2125	2125	80			125							17.5	2 × 45	
HYT 3055	HYTS 3055	30			16 <sup>±0.1</sup>							40 <sup>±0.1</sup>	55	15.5
3080	3080	45	80	7.5		1 × 65								
3105	3105	60	105	27.5		1 × 50								
3130	3130	75	130	27.5		1 × 75								
3155	3155	90	155	27.5		2 × 50								
3180	3180	105	180	52.5		1 × 75								
3205	3205	130	205	27.5		2 × 75								



S <sub>2</sub>	bed-surface mounting hole dimensions		accuracy ※ (deviation)		basic load rating		allowable static moment			mass g	size
	N <sub>2</sub> mm	M <sub>2</sub> × P <sub>3</sub> mm	T μm	S μm	C N	C <sub>0</sub> N	M <sub>P</sub> N · m	M <sub>Y</sub> N · m	M <sub>R</sub> N · m		
M3	7.5	1 × 20	2	4	1,850	2,290	6.87	7.86	14.8	82	2035
	10	2 × 15	2	4	2,320	3,050	18.7	16.7	19.8	119	2050
	10	3 × 15	2	5	3,190	4,580	26.7	28.9	29.7	155	2065
	10	4 × 15	2	5	4,000	6,110	47.5	50.4	39.7	191	2080
	10	5 × 15	2	5	4,380	6,870	74.2	70.3	44.6	227	2095
	10	6 × 15	2	5	5,130	8,400	89.8	93.6	54.6	264	2110
	10	7 × 15	2	5	5,840	9,930	125	129	64.5	300	2125
	M4	10	1 × 35	2	5	6,150	8,060	43.7	49.6	70.1	240
15		2 × 25	2	5	8,460	12,100	99.0	107	105	351	3080
15		3 × 25	3	5	10,600	16,100	175	186	140	463	3105
15		4 × 25	3	5	12,600	20,100	274	287	175	574	3130
15		5 × 25	3	5	14,500	24,200	395	410	210	685	3155
15		6 × 25	3	5	16,400	28,200	537	554	245	797	3180
15		7 × 25	3	5	17,300	30,200	701	677	263	906	3205

※For accuracy (T, S), refer to Figure A-22 (page A-36).

1N ≒ 0.102kgf 1N · m ≒ 0.102kgf · m

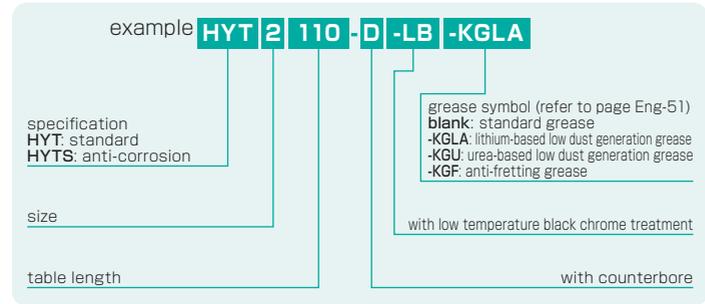


# HYT-D TYPE

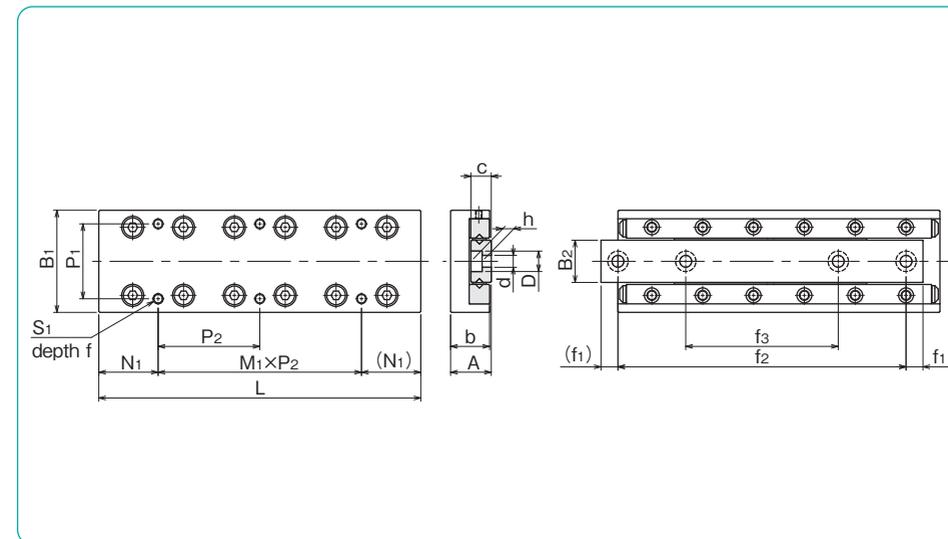
Upgraded model



## part number structure



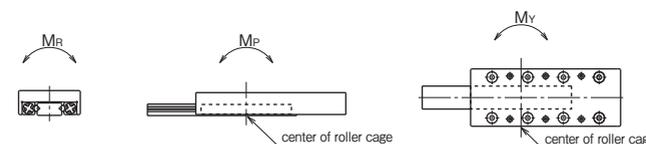
part number		stroke ST mm	major dimensions						table-top mounting hole dimensions				
standard	anti-corrosion		A mm	B <sub>1</sub> mm	L mm	b mm	B <sub>2</sub> mm	c mm	P <sub>1</sub> mm	S <sub>1</sub>	f mm	N <sub>1</sub> mm	M <sub>1</sub> ×P <sub>2</sub> mm
HYT 2035-D	HYTS 2035-D	18	12 <sup>±0.1</sup>	30 <sup>±0.1</sup>	35	11.5	12.4	6	22	M3	5	3.5	1×28
2050-D	2050-D	30			50							3.5	1×43
2065-D	2065-D	40			65							17.5	1×30
2080-D	2080-D	50			80							17.5	1×45
2095-D	2095-D	60			95							17.5	2×30
2110-D	2110-D	70			110							32.5	1×45
2125-D	2125-D	80			125							17.5	2×45
HYT 3055-D	HYTS 3055-D	30			16 <sup>±0.1</sup>							40 <sup>±0.1</sup>	55
3080-D	3080-D	45	80	7.5		1×65							
3105-D	3105-D	60	105	27.5		1×50							
3130-D	3130-D	75	130	27.5		1×75							
3155-D	3155-D	90	155	27.5		2×50							
3180-D	3180-D	105	180	52.5		1×75							
3205-D	3205-D	130	205	27.5		2×75							



bed-surface mounting hole dimensions d × D × h mm	accuracy ※ (deviation)			basic load rating static		allowable static moment			mass g	size		
	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	T μm	S μm	C N	C <sub>0</sub> N	M <sub>P</sub> N·m			M <sub>Y</sub> N·m	M <sub>R</sub> N·m
3.5×6×3.3	5	25	—	2	4	1,850	2,290	6.87	7.86	14.8	81	2035
	7.5	35	—	2	4	2,320	3,050	18.7	16.7	19.8	117	2050
	5	55	33	2	5	3,190	4,580	26.7	28.9	29.7	152	2065
	5	70	40	2	5	4,000	6,110	47.5	50.4	39.7	189	2080
	5	85	45	2	5	4,380	6,870	74.2	70.3	44.6	225	2095
	7.5	95	50	2	5	5,130	8,400	89.8	93.6	54.6	262	2110
	7.5	110	55	2	5	5,840	9,930	125	129	64.5	299	2125
	4.5×7.5×4.3	7.5	40	—	2	5	6,150	8,060	43.7	49.6	70.1	238
6		68	43	2	5	8,460	12,100	99.0	107	105	345	3080
7.5		90	55	3	5	10,600	16,100	175	186	140	457	3105
7.5		115	65	3	5	12,600	20,100	274	287	175	570	3130
7.5		140	95	3	5	14,500	24,200	395	410	210	681	3155
7.5		165	85	3	5	16,400	28,200	537	554	245	794	3180
7.5		190	90	3	5	17,300	30,200	701	677	263	903	3205

※For accuracy (T, S), refer to Figure A-22 (page A-36).

1N ≅ 0.102kgf 1N·m ≅ 0.102kgf·m



# SVT TYPE

-SVT1/SVT2-



## part number structure

example **SVT 2 170 -LB -KGLA**

specification  
 SVT: standard  
 SVTS: anti-corrosion

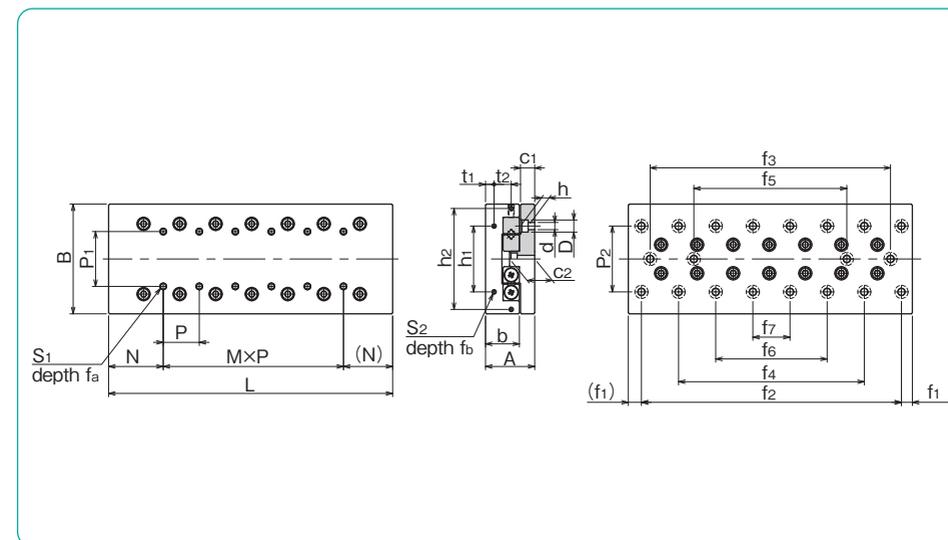
size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

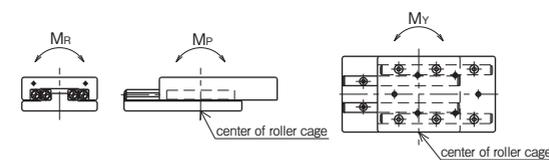
part number		stroke ST mm	major dimensions			table-top mounting hole dimensions					table-end mounting hole dimensions						
standard	anti-corrosion		A mm	B mm	L mm	b mm	P <sub>1</sub> mm	S <sub>1</sub> mm	f <sub>a</sub> mm	N mm	M×P mm	h <sub>1</sub> mm	h <sub>2</sub> mm	t <sub>1</sub> mm	t <sub>2</sub> mm	S <sub>2</sub> mm	f <sub>b</sub> mm
<b>SVT 1025</b>	<b>SVTS 1025</b>	12		25													
<b>1035</b>	<b>1035</b>	18		35						1×10							
<b>1045</b>	<b>1045</b>	25		45						2×10							
<b>1055</b>	<b>1055</b>	32	17 <sup>±0.1</sup>	30 <sup>-0.4</sup>	55	11	10	M2	4	12.5	3×10	12	-	2.5	-	M2	6
<b>1065</b>	<b>1065</b>	40		65						4×10							
<b>1075</b>	<b>1075</b>	45		75						5×10							
<b>1085</b>	<b>1085</b>	50		85						6×10							
<b>SVT 2035</b>	<b>SVTS 2035</b>	18		35													
<b>2050</b>	<b>2050</b>	30		50						1×15							
<b>2065</b>	<b>2065</b>	40		65						2×15							
<b>2080</b>	<b>2080</b>	50		80						3×15							
<b>2095</b>	<b>2095</b>	60		95						4×15							
<b>2110</b>	<b>2110</b>	70	21 <sup>±0.1</sup>	40 <sup>-0.4</sup>	110	14	15	M3	6	17.5	5×15	16	-	3.4	-	M2	6
<b>2125</b>	<b>2125</b>	80		125						6×15							
<b>2140</b>	<b>2140</b>	90		140						7×15							
<b>2155</b>	<b>2155</b>	100		155						8×15							
<b>2170</b>	<b>2170</b>	110		170						9×15							
<b>2185</b>	<b>2185</b>	120		185						10×15							



bed-surface mounting hole dimensions											accuracy ※(deviation)		basic load rating dynamic static		allowable static moment			mass		size
P <sub>2</sub> mm	d×D×h mm	c <sub>1</sub> mm	c <sub>2</sub> mm	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	f <sub>4</sub> mm	f <sub>5</sub> mm	f <sub>6</sub> mm	f <sub>7</sub> mm	T μm	S μm	C N	Co N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m	M <sub>R</sub> N·m	SVT g	SVTS g	
22	2.5×4.5×2.5	5.5	9	3.5	18	-	-	-	-	-	2	4	464	476	1.79	1.47	3.22	82	36	<b>1025</b>
					28	-	-	-	-	-	2	4	805	952	3.08	3.50	6.45	120	50	<b>1035</b>
					38	-	-	-	-	-	2	4	959	1,190	6.98	6.40	8.06	158	69	<b>1045</b>
					48	-	28	-	-	-	2	5	1,100	1,420	9.53	8.81	9.68	190	83	<b>1055</b>
					58	-	38	-	-	-	2	5	1,240	1,660	12.4	11.6	11.2	225	98	<b>1065</b>
					68	-	48	-	-	-	2	5	1,510	2,140	19.3	18.3	14.5	260	113	<b>1075</b>
					78	-	58	-	-	-	2	5	1,650	2,380	23.4	22.3	16.1	295	128	<b>1085</b>
					85	-	-	-	-	-	2	5	1,650	2,380	23.4	22.3	16.1	295	128	<b>1085</b>
30	3.5×6.5×3.5	6.5	10.9	5	25	-	-	-	-	-	2	4	1,090	1,170	7.04	5.78	10.5	195	90	<b>2035</b>
					40	-	-	-	-	-	2	4	1,510	1,750	12.1	10.7	15.8	280	133	<b>2050</b>
					55	-	-	-	-	-	2	5	1,900	2,340	19.1	17.1	21.1	370	175	<b>2065</b>
					70	-	40	-	-	-	2	5	2,620	3,510	27.4	29.6	31.6	450	220	<b>2080</b>
					85	-	55	-	-	-	2	5	2,950	4,100	37.4	39.9	36.9	540	250	<b>2095</b>
					100	-	70	-	-	-	3	6	3,280	4,680	61.7	58.1	42.2	630	285	<b>2110</b>
					115	-	85	-	-	-	3	6	3,590	5,270	76.1	72.1	47.5	720	330	<b>2125</b>
					130	-	100	-	70	-	3	6	4,210	6,440	92.0	95.9	58.1	800	360	<b>2140</b>
					145	-	115	-	85	-	3	6	4,500	7,030	109	113	63.3	880	400	<b>2155</b>
					160	-	130	-	100	-	3	7	4,790	7,610	148	143	68.6	970	440	<b>2170</b>
175	-	145	-	115	85	3	7	5,080	8,200	170	164	73.9	1,060	480	<b>2185</b>					

※For accuracy (T, S), refer to Figure A-22 (page A-36).

1N ≃ 0.102kgf 1N · m ≃ 0.102kgf · m



# SVT TYPE

-SVT3/SVT4-



## part number structure

example **SVT 4 205 -LB -KGLA**

specification  
 SVT: standard  
 SVTS: anti-corrosion

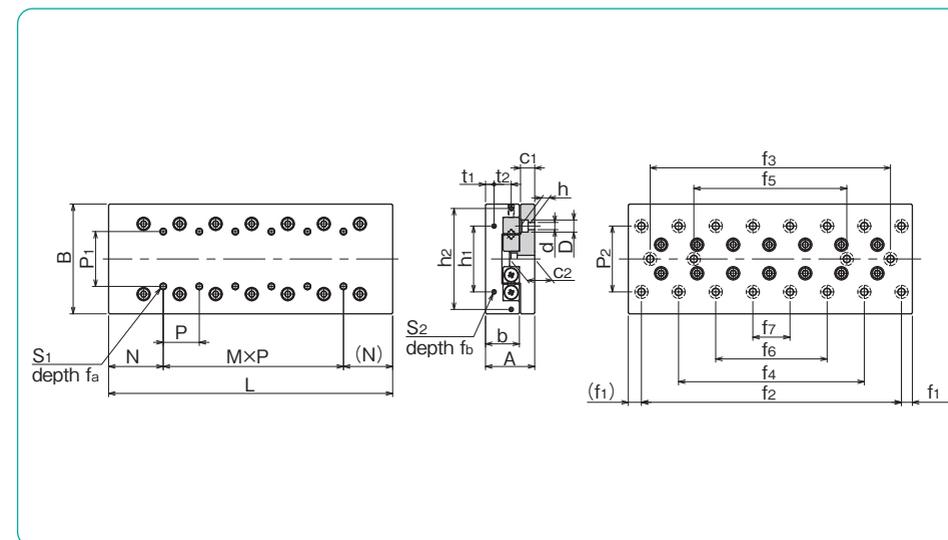
size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

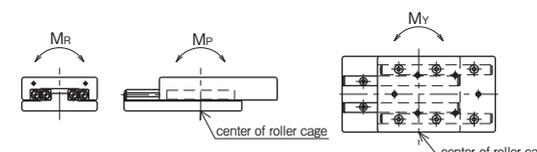
with low temperature black chrome treatment

part number		stroke	major dimensions				table-top mounting hole dimensions				table-end mounting hole dimensions						
standard	anti-corrosion	ST mm	A mm	B mm	L mm	b mm	P <sub>1</sub> mm	S <sub>1</sub>	f <sub>a</sub> mm	N mm	M×P mm	h <sub>1</sub> mm	h <sub>2</sub> mm	t <sub>1</sub> mm	t <sub>2</sub> mm	S <sub>2</sub>	f <sub>b</sub> mm
<b>SVT 3055</b>	<b>SVTS 3055</b>	30			55					—							
<b>3080</b>	<b>3080</b>	45			80					1×25							
<b>3105</b>	<b>3105</b>	60			105					2×25							
<b>3130</b>	<b>3130</b>	75			130					3×25							
<b>3155</b>	<b>3155</b>	90	28 <sup>±0.1</sup>	60 <sup>±0.1</sup>	155	18.5	25	M4	8	27.5	4×25	40	—	5.5	—	M3	6
<b>3180</b>	<b>3180</b>	105			180					5×25							
<b>3205</b>	<b>3205</b>	130			205					6×25							
<b>3230</b>	<b>3230</b>	155			230					7×25							
<b>3255</b>	<b>3255</b>	180			255					8×25							
<b>3280</b>	<b>3280</b>	205			280					9×25							
<b>3305</b>	<b>3305</b>	230			305					10×25							
<b>SVT 4085</b>	<b>SVTS 4085</b>	50			85					—							
<b>4125</b>	<b>4125</b>	75			125					1×40							
<b>4165</b>	<b>4165</b>	105			165					2×40							
<b>4205</b>	<b>4205</b>	130			205					3×40							
<b>4245</b>	<b>4245</b>	155	35 <sup>±0.1</sup>	80 <sup>±0.1</sup>	245	24	40	M5	10	42.5	4×40	55	—	6.5	—	M3	6
<b>4285</b>	<b>4285</b>	185			285					5×40							
<b>4325</b>	<b>4325</b>	210			325					6×40							
<b>4365</b>	<b>4365</b>	235			365					7×40							
<b>4405</b>	<b>4405</b>	265			405					8×40							



bed-surface mounting hole dimensions											accuracy ※(deviation)		basic load rating dynamic static		allowable static moment			mass		size		
P <sub>2</sub> mm	d×D×h mm	c <sub>1</sub> mm	c <sub>2</sub> mm	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	f <sub>4</sub> mm	f <sub>5</sub> mm	f <sub>6</sub> mm	f <sub>7</sub> mm	T μm	S μm	C N	Co N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m	M <sub>R</sub> N·m	SVT g	SVTS g	size		
40	4.5×8×4.5	9	15	10	35	—	—	—	—	—	2	5	3,490	3,890	19.4	22.2	54.5	640	300	<b>3055</b>		
					60	—	—	—	—	—	—	—	2	5	5,230	6,490	53.0	58.0	90.9	955	440	<b>3080</b>
					85	—	—	—	—	—	3	6	6,030	7,780	103	95.7	109	1,250	580	<b>3105</b>		
					110	—	—	—	—	—	3	6	7,560	10,300	170	160	145	1,570	715	<b>3130</b>		
					135	85	—	—	—	—	3	6	9,000	12,900	210	220	181	1,850	850	<b>3155</b>		
					160	110	—	—	—	—	3	7	10,300	15,500	302	314	218	2,150	990	<b>3180</b>		
					185	135	85	—	—	—	3	7	11,000	16,800	355	367	236	2,450	1,130	<b>3205</b>		
					210	160	110	—	—	—	3	7	11,700	18,100	472	455	254	2,740	1,270	<b>3230</b>		
					235	185	135	—	—	—	3	7	12,900	20,700	537	552	290	3,040	1,410	<b>3255</b>		
					260	210	160	110	—	—	3	7	13,600	22,000	606	622	309	3,360	1,540	<b>3280</b>		
					285	235	185	135	—	—	3	7	14,200	23,300	757	735	327	3,660	1,680	<b>3305</b>		
					55	5.5×10×5.4	10.5	18	10	65	—	—	—	—	—	2	5	7,110	7,920	96.0	84.9	159
105	—	—	—	—						—	3	6	10,600	13,200	217	199	265	2,500	1,140	<b>4125</b>		
145	—	—	—	—						—	3	7	13,800	18,400	296	316	371	3,300	1,510	<b>4165</b>		
185	105	—	—	—						—	3	7	16,800	23,700	488	513	477	4,100	1,870	<b>4205</b>		
225	145	—	—	—						—	3	7	19,700	29,000	729	759	584	4,900	2,240	<b>4245</b>		
265	185	—	—	—						—	3	7	22,400	34,300	1,010	1,050	690	5,700	2,600	<b>4285</b>		
305	225	145	—	—						—	4	8	25,100	39,600	1,350	1,390	796	6,500	3,000	<b>4325</b>		
345	265	185	—	—						—	4	8	27,600	44,800	1,730	1,780	902	7,300	3,300	<b>4365</b>		
385	305	225	—	—						—	4	8	28,900	47,500	2,160	2,100	955	8,100	3,700	<b>4405</b>		

※For accuracy (T, S), refer to Figure A-22 (page A-36). 1N ≅ 0.102kgf 1N · m ≅ 0.102kgf · m



# SVT TYPE

-SVT6/SVT9-



## part number structure

example **SVT 6 210 -LB -KGLA**

specification  
 SVT: standard  
 SVTS: anti-corrosion

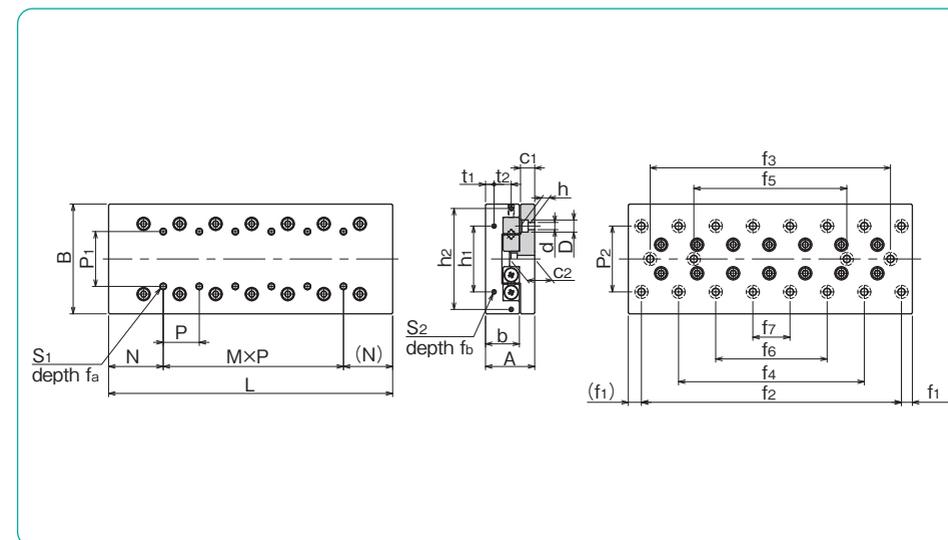
size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

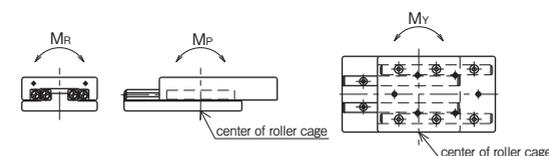
part number		stroke	major dimensions				table-top mounting hole dimensions					table-end mounting hole dimensions					
standard	anti-corrosion	ST mm	A mm	B mm	L mm	b mm	P <sub>1</sub> mm	S <sub>1</sub> mm	f <sub>a</sub> mm	N mm	M×P mm	h <sub>1</sub> mm	h <sub>2</sub> mm	t <sub>1</sub> mm	t <sub>2</sub> mm	S <sub>2</sub> mm	f <sub>b</sub> mm
<b>SVT 6110</b>	<b>SVTS 6110</b>	60			110						—						
<b>6160</b>	<b>6160</b>	95			160					1×50							
<b>6210</b>	<b>6210</b>	130			210					2×50							
<b>6260</b>	<b>6260</b>	165			260					3×50							
<b>6310</b>	<b>6310</b>	200	45 <sup>±0.1</sup>	100 <sup>±0.1</sup>	310	31	50	M6	12	55	4×50	60	92	8	15	M4	8
<b>6360</b>	<b>6360</b>	235			360					5×50							
<b>6410</b>	<b>6410</b>	265			410					6×50							
<b>6460</b>	<b>6460</b>	300			460					7×50							
<b>6510</b>	<b>6510</b>	335			510					8×50							
<b>SVT 9210</b>	—	130			210					—							
<b>9310</b>	—	180			310					1×100							
<b>9410</b>	—	350			410					2×100							
<b>9510</b>	—	450			510					3×100							
<b>9610</b>	—	550	60 <sup>±0.1</sup>	145 <sup>±0.1</sup>	610	43	85	M8	16	105	4×100	90	135	11	20	M4	8
<b>9710</b>	—	650			710					5×100							
<b>9810</b>	—	750			810					6×100							
<b>9910</b>	—	850			910					7×100							
<b>91010</b>	—	950			1,010					8×100							



bed-surface mounting hole dimensions													accuracy ※(deviation)		basic load rating dynamic static		allowable static moment			mass				
P <sub>2</sub> mm	d×D×h mm	c <sub>1</sub> mm	c <sub>2</sub> mm	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	f <sub>4</sub> mm	f <sub>5</sub> mm	f <sub>6</sub> mm	f <sub>7</sub> mm	T μm	S μm	C N	Co N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m	M <sub>R</sub> N·m	SVT g	SVTS g	size				
60	7×11.5×7	13	23	10	90	—	—	—	—	—	3	6	16,500	17,700	260	230	400	3,280	1,705	<b>6110</b>				
					140	—	—	—	—	—	—	—	3	6	24,700	29,600	588	539	666	4,820	2,480	<b>6160</b>		
					190	90	—	—	—	—	—	—	—	3	7	32,200	41,400	1,040	978	933	6,270	3,255	<b>6210</b>	
					240	140	—	—	—	—	—	—	—	3	7	39,200	53,200	1,630	1,540	1,200	7,740	4,030	<b>6260</b>	
					290	190	—	—	—	—	—	—	—	3	7	45,800	65,100	2,340	2,240	1,460	9,200	4,805	<b>6310</b>	
					340	240	140	—	—	—	—	—	—	—	4	8	52,200	76,900	2,750	2,850	1,730	10,740	5,580	<b>6360</b>
					390	290	190	—	—	—	—	—	—	—	4	8	58,400	88,800	3,660	3,770	2,000	12,190	6,355	<b>6410</b>
					440	340	240	—	—	—	—	—	—	—	4	8	64,400	100,000	4,700	4,830	2,260	13,800	7,130	<b>6460</b>
					490	390	290	190	—	—	—	—	—	—	4	8	70,200	112,000	5,870	6,010	2,530	15,300	7,905	<b>6510</b>
					90	9×14×9	16	29	55	100	—	—	—	—	—	3	7	51,100	56,500	1,610	1,440	2,030	12,520	—
200	—	—	—	—						—	—	—	3	7	79,300	98,900	3,150	3,360	3,560	17,950	—	<b>9310</b>		
300	100	—	—	—						—	—	—	—	4	8	79,300	98,900	4,110	3,840	3,560	23,950	—	<b>9410</b>	
400	200	—	—	—						—	—	—	—	4	8	96,600	127,000	6,420	6,080	4,580	30,090	—	<b>9510</b>	
500	300	100	—	—						—	—	—	—	4	9	112,000	155,000	7,760	8,090	5,600	35,990	—	<b>9610</b>	
600	400	200	—	—						—	—	—	—	4	9	128,000	183,000	10,800	11,200	6,620	41,890	—	<b>9710</b>	
700	500	300	100	—						—	—	—	—	5	10	136,000	197,000	14,400	13,900	7,130	47,790	—	<b>9810</b>	
800	600	400	200	—						—	—	—	—	5	10	151,000	226,000	18,500	17,900	8,140	53,690	—	<b>9910</b>	
900	700	500	300	100						—	—	—	—	5	10	165,000	254,000	23,100	22,400	9,160	59,590	—	<b>91010</b>	

※For accuracy (T, S), refer to Figure A-22 (page A-36).

1N ≅ 0.102kgf 1N · m ≅ 0.102kgf · m



# SYT TYPE

-SYT1/SYT2/SYT3-



## part number structure

example **SYT 2 110 -LB -KGLA**

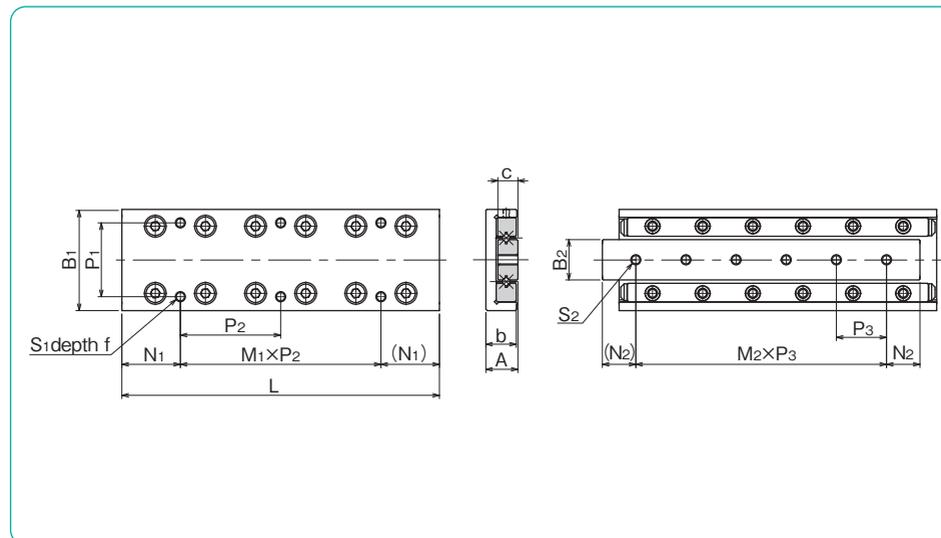
specification  
 SYT: standard  
 SYTS: anti-corrosion

size

table length

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

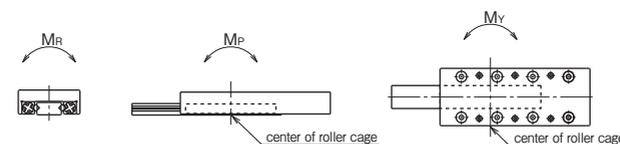


part number		stroke ST mm	major dimensions						table-top mounting hole dimensions		
standard	anti-corrosion		A mm	B <sub>1</sub> mm	L mm	b mm	B <sub>2</sub> mm	c mm	P <sub>1</sub> mm	S <sub>1</sub>	f mm
<b>SYT 1025</b>	<b>SYTS 1025</b>	12	8±0.1	20±0.1	25	7.5	6.6	4	14	M2.6	3
<b>1035</b>	<b>1035</b>	18			35						
<b>1045</b>	<b>1045</b>	25			45						
<b>1055</b>	<b>1055</b>	32			55						
<b>1065</b>	<b>1065</b>	40			65						
<b>1075</b>	<b>1075</b>	45			75						
<b>1085</b>	<b>1085</b>	50			85						
<b>SYT 2035</b>	<b>SYTS 2035</b>	18	12±0.1	30±0.1	35	11.5	12	6	22	M3	5
<b>2050</b>	<b>2050</b>	30			50						
<b>2065</b>	<b>2065</b>	40			65						
<b>2080</b>	<b>2080</b>	50			80						
<b>2095</b>	<b>2095</b>	60			95						
<b>2110</b>	<b>2110</b>	70			110						
<b>2125</b>	<b>2125</b>	80			125						
<b>SYT 3055</b>	<b>SYTS 3055</b>	30	16±0.1	40±0.1	55	15.5	16	8	30	M4	7
<b>3080</b>	<b>3080</b>	45			80						
<b>3105</b>	<b>3105</b>	60			105						
<b>3130</b>	<b>3130</b>	75			130						
<b>3155</b>	<b>3155</b>	90			155						
<b>3180</b>	<b>3180</b>	105			180						
<b>3205</b>	<b>3205</b>	130			205						

N <sub>1</sub> mm		M <sub>1</sub> ×P <sub>2</sub> mm		bed-surface mounting hole dimensions		accuracy ※(deviation)		basic load rating		allowable static moment			mass	size
N <sub>1</sub>	M <sub>1</sub> ×P <sub>2</sub>	S <sub>2</sub>	N <sub>2</sub>	M <sub>2</sub> ×P <sub>3</sub>	T	S	C	Co	M <sub>P</sub>	M <sub>Y</sub>	M <sub>R</sub>	g		
mm	mm	mm	mm	mm	μm	μm	N	N	N·m	N·m	N·m			
3.5	1×18	M2.6	5	2×7.5	2	4	464	476	1.79	1.47	1.79	22	<b>1025</b>	
3.5	1×28		7.5	2×10	2	4	805	952	3.08	3.50	3.58	33	<b>1035</b>	
12.5	1×20		7.5	3×10	2	5	959	1,190	6.98	6.40	4.48	42	<b>1045</b>	
12.5	1×30		7.5	4×10	2	5	1,100	1,420	9.53	8.81	5.37	52	<b>1055</b>	
12.5	2×20		7.5	5×10	2	5	1,240	1,660	12.4	11.6	6.27	63	<b>1065</b>	
22.5	1×30		7.5	6×10	2	5	1,510	2,140	19.3	18.3	8.06	72	<b>1075</b>	
12.5	2×30		7.5	7×10	2	5	1,650	2,380	23.4	22.3	8.96	83	<b>1085</b>	
3.5	1×28	M3	7.5	1×20	2	4	1,090	1,170	7.04	5.78	7.63	79	<b>2035</b>	
3.5	1×43		10	2×15	2	4	1,510	1,750	12.1	10.7	11.4	113	<b>2050</b>	
17.5	1×30		10	3×15	2	5	1,900	2,340	19.1	17.1	15.2	150	<b>2065</b>	
17.5	1×45		10	4×15	2	5	2,620	3,510	27.4	29.6	22.8	185	<b>2080</b>	
17.5	2×30		10	5×15	2	5	2,950	4,100	37.4	39.9	26.7	215	<b>2095</b>	
32.5	1×45		10	6×15	2	5	3,280	4,680	61.7	58.1	30.5	255	<b>2110</b>	
17.5	2×45		10	7×15	2	5	3,590	5,270	76.1	72.1	34.3	295	<b>2125</b>	
7.5	1×40	M4	10	1×35	2	5	3,490	3,890	19.4	22.2	33.8	225	<b>3055</b>	
7.5	1×65		15	2×25	2	5	5,230	6,490	53.0	58.0	56.4	340	<b>3080</b>	
27.5	1×50		15	3×25	3	5	6,030	7,790	103	95.7	67.7	440	<b>3105</b>	
27.5	1×75		15	4×25	3	5	7,560	10,300	170	160	90.3	560	<b>3130</b>	
27.5	2×50		15	5×25	3	5	9,000	12,900	210	220	112	655	<b>3155</b>	
52.5	1×75		15	6×25	3	5	10,300	15,500	302	314	135	770	<b>3180</b>	
27.5	2×75		15	7×25	3	5	11,000	16,800	355	367	146	880	<b>3205</b>	

※For accuracy (T, S), refer to Figure A-22 (page A-36).

1N≐0.102kgf 1N·m≐0.102kgf·m

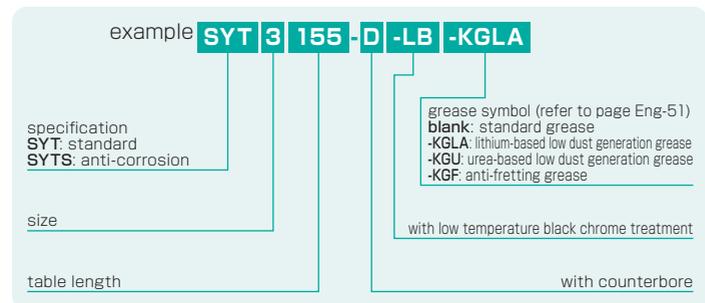


# SYT-D TYPE

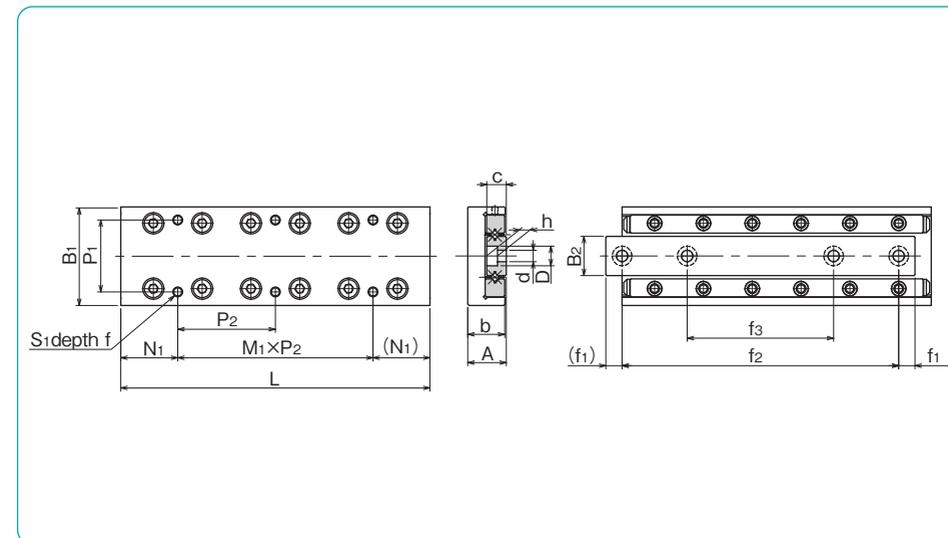
-SYT1/SYT2/SYT3-



## part number structure

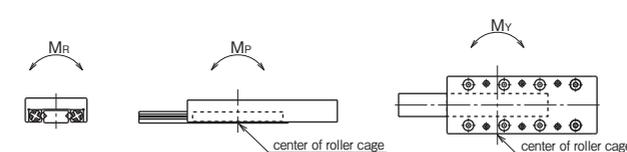


part number		stroke ST mm	major dimensions						table-top mounting hole dimensions			
standard	anti-corrosion		A mm	B <sub>1</sub> mm	L mm	b mm	B <sub>2</sub> mm	c mm	P <sub>1</sub> mm	S <sub>1</sub> mm	f mm	N <sub>1</sub> mm
SYT1025-D	SYTS1025-D	12	8±0.1	20±0.1	25	7.5	6.6	4	14	M2.6	3	3.5
1035-D	1035-D	18			35							12.5
1045-D	1045-D	25			45							12.5
1055-D	1055-D	32			55							22.5
1065-D	1065-D	40			65							12.5
1075-D	1075-D	45			75							22.5
1085-D	1085-D	50			85							12.5
SYT2035-D	SYTS2035-D	18			12±0.1							30±0.1
2050-D	2050-D	30	50	17.5								
2065-D	2065-D	40	65	17.5								
2080-D	2080-D	50	80	17.5								
2095-D	2095-D	60	95	17.5								
2110-D	2110-D	70	110	32.5								
2125-D	2125-D	80	125	17.5								
SYT3055-D	SYTS3055-D	30	16±0.1	40±0.1		55	15.5	16	8	30	M4	
3080-D	3080-D	45			80	7.5						
3105-D	3105-D	60			105	27.5						
3130-D	3130-D	75			130	27.5						
3155-D	3155-D	90			155	27.5						
3180-D	3180-D	105			180	52.5						
3205-D	3205-D	130			205	27.5						



M <sub>1</sub> ×P <sub>2</sub> mm	bed-surface mounting hole dimensions			accuracy ※(deviation)		basic load rating		allowable static moment			mass g	size	
	d×D×h mm	f <sub>1</sub> mm	f <sub>2</sub> mm	f <sub>3</sub> mm	T μm	S μm	dynamic C N	static C <sub>0</sub> N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m			M <sub>R</sub> N·m
1×18	2.5×4.1×2.2	3.5	18	—	2	4	464	476	1.79	1.47	1.79	22	1025
1×28		5	25	—	2	4	805	952	3.08	3.50	3.58	33	1035
1×20		3.5	38	25	2	5	959	1,190	6.98	6.40	4.48	42	1045
1×30		3.5	48	29	2	5	1,100	1,420	9.53	8.81	5.37	52	1055
2×20		5	55	31	2	5	1,240	1,660	12.4	11.6	6.27	63	1065
1×30		5	65	35	2	5	1,510	2,140	19.3	18.3	8.06	72	1075
2×30		5	75	40	2	5	1,650	2,380	23.4	22.3	8.96	83	1085
1×28		3.5×6×3.3	5	25	—	2	4	1,090	1,170	7.04	5.78	7.63	79
1×43	7.5		35	—	2	4	1,510	1,750	12.1	10.7	11.4	113	2050
1×30	5		55	33	2	5	1,900	2,340	19.1	17.1	15.2	150	2065
1×45	5		70	40	2	5	2,620	3,510	27.4	29.6	22.8	185	2080
2×30	5		85	45	2	5	2,950	4,100	37.4	39.9	26.7	215	2095
1×45	7.5		95	50	2	5	3,280	4,680	61.7	58.1	30.5	255	2110
2×45	7.5		110	55	2	5	3,590	5,270	76.1	72.1	34.3	295	2125
1×40	7.5		40	—	2	5	3,490	3,890	19.4	22.2	33.8	225	3055
1×65	4.5×7.5×4.3	6	68	43	2	5	5,230	6,490	53.0	58.0	56.4	340	3080
1×50		7.5	90	55	3	5	6,030	7,780	103	95.7	67.7	440	3105
1×75		7.5	115	65	3	5	7,560	10,300	170	160	90.3	560	3130
2×50		7.5	140	95	3	5	9,000	12,900	210	220	112	655	3155
1×75		7.5	165	85	3	5	10,300	15,500	302	314	135	770	3180
2×75		7.5	190	90	3	5	11,000	16,800	355	367	146	880	3205

※For accuracy (T, S), refer to Figure A-22 (page A-36). 1N≒0.102kgf 1N·m≒0.102kgf·m



# MINIATURE SLIDE

The NB miniature slide SYBS type is a limited stroke table with the most compact envelope dimensions, featuring two ball raceway grooves. The SYBS type utilizes balls as the rolling elements. The ultra compact design contributes greatly to the creation of smaller and lighter industrial machinery and equipment of all types.

## STRUCTURE AND ADVANTAGES

The NB miniature slide incorporates a unique integrated ball cage between the table and bed. All components have been produced with high precision machining.

### Ultra Compact Design

The table height of the SYBS type is 3.2~8mm and the width is 6~17mm. This compact size when compared with conventional slide tables helps to realize the miniaturization of machinery and equipment.

### Low Friction · Low Noise

Since the rolling ball elements do not recirculate, the frictional resistance will not vary significantly resulting in smooth, high precision operation. Additionally, the

ball cage greatly reduces the contact noise of the rolling elements bringing about a low-noise operation.

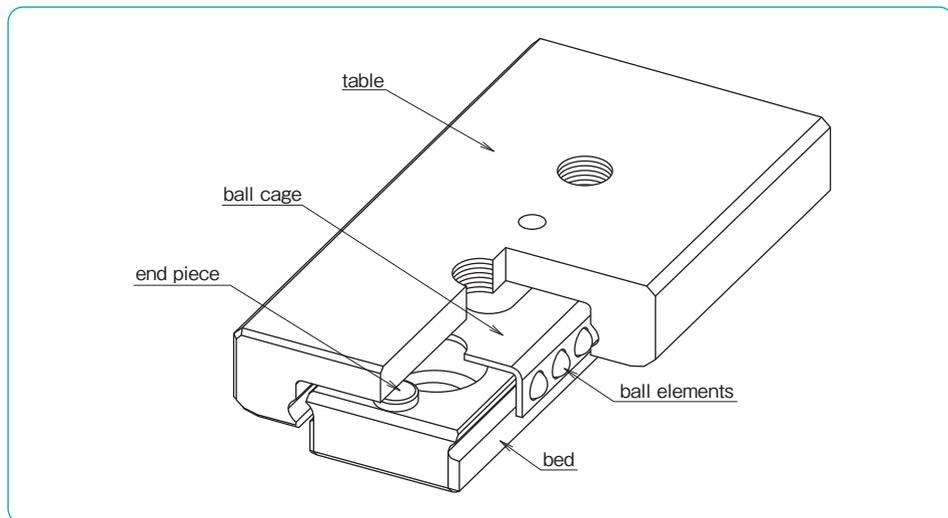
### High Accuracy

The ball raceway grooves of each of the bed and table are processed through simultaneous precision machining resulting in minimal processing errors, and bringing about extremely smooth, precision linear movement.

### Stainless Steel Structure

The SYBS type is made of all stainless steel components. This allows for use in corrosive or high temperature applications. The SYBS is a perfect component for vacuum or clean room environments.

Figure A-24 Structure of SYBS type



## SPECIFICATION

Refer to table A-10 for NB Miniature Slide material and operating temperature range.

Table A-10 Material and Operating Temperature Range

type	table/bed	ball cage	ball elements	operating temperature range
SYBS	stainless steel	stainless steel	stainless steel	-20°C~140°C

## ACCURACY

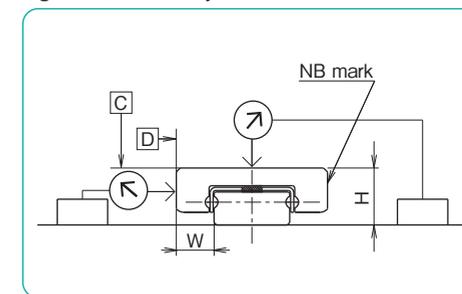
Table A-11 shows the accuracy of the SYBS miniature slide.

The deviation is measured as Figure A-25 illustrates. Dial indicators are placed to the center of the table's top and the reference surface side (opposite from the NB mark) and then the table is moved the full stroke without any load.

Table A-11 Accuracy unit : mm

item	tolerance
height H	±0.020
width W	±0.025
deviation from center of surface C	0.004
deviation from center of surface D	0.006

Figure A-25 Accuracy Measurement Method



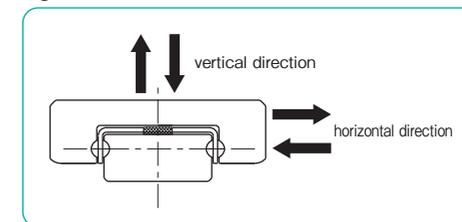
## LOAD RATING

The load rating of the miniature slide varies depending on the direction of the applied load.

Table A-12 Change of Load Rating Corresponding to Load Direction

basic dynamic load rating	vertical direction	1.00×C
load rating	horizontal direction	1.19×C
basic static load rating	vertical direction	1.00×Co
load rating	horizontal direction	1.19×Co

Figure A-26 Direction of Load



## RATED LIFE

The life of an NB miniature slide is calculated using the following equations:

Rated Life

$$L = \left( \frac{f_T}{f_w} \cdot \frac{C}{P} \right)^3 \cdot 50$$

L: rated life (km) f<sub>T</sub>: temperature coefficient  
f<sub>w</sub>: applied load coefficient C: basic dynamic load rating (N)  
P: applied load (N)

\* Refer to page Eng-6 for the coefficient.

Life Time

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

L<sub>h</sub>: life time (hr) ℓ<sub>s</sub>: stroke length (mm)  
n<sub>1</sub>: number of cycles per minute (cpm)

**MOUNTING**

**Mounting Surface Profile**

In most general installations, the miniature slide is mounted by pushing the reference surface of the bed and table against a shoulder that is set up on the mounting surface. Machined undercuts should be used in the corners of the shoulder (as illustrated in Figure A-27) so that the corners will not interfere with the reference surfaces of the bed and table. Table A-13 lists the recommended shoulder heights of the mounting reference surfaces.

When installing the miniature slide table without providing machined undercuts, the corner radius should be realigned as illustrated in Figure A-28. Table A-14 lists the values of the corner radius of the mounting surface.

Figure A-27 Mounting Surface Profile-1

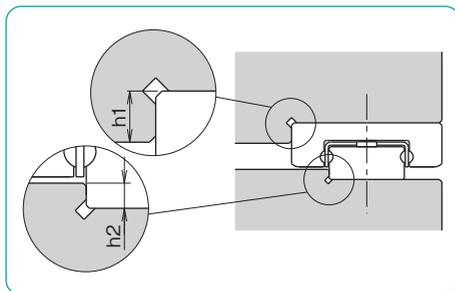


Table A-13 Shoulder Height on Mounting Reference Surface  
unit : mm

part number	shoulder height for table h1	shoulder height for bed h2
SYBS 6	1.0	0.5
SYBS 8	1.2	0.8
SYBS12	1.5	0.8
SYBS17	2.5	1

Figure A-28 Mounting Surface Profile-2

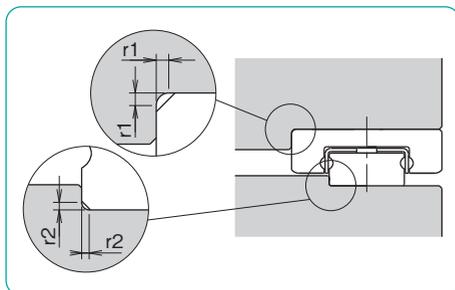


Table A-14 Maximum Corner Radius  
unit : mm

part number	mounting surface for table	mounting surface for bed
	r1	r2
SYBS 6	0.1	0.05
SYBS 8	0.15	0.1
SYBS12	0.15	0.1
SYBS17	0.3	0.3

**Recommended Torque Value**

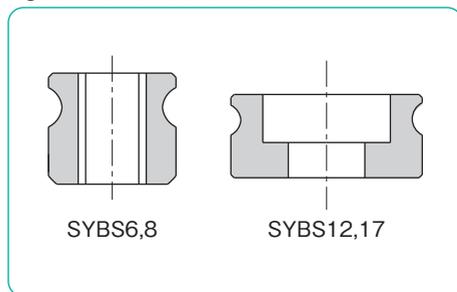
The bed should be tightened with a consistent torque by using a torque wrench. Table A-15 lists the recommended torque.

Table A-15 Recommended Torque  
unit : N · m

size	torque
M1	0.03
M1.6	0.15
M2	0.3

(for stainless steel screw A2-70)

Figure A-29 Profile of SYBS Bed



**Mounting Example and Mounting Screw**

All the mounting holes are for SYBS6,8,12 fully through-hole. Mount SYBS6,8,12 as illustrated in Figure A-30 after considering the size of mounting screw, the maximum penetration depth, and the height of the bed. Make certain that the mounting screws do not interfere with the ball cage; otherwise, the accuracy and travel life will be affected adversely. Special screws for SYBS type are available from NB. Please refer to Table A-16 for dimensions of mounting screws.

Figure A-30 Mounting Example

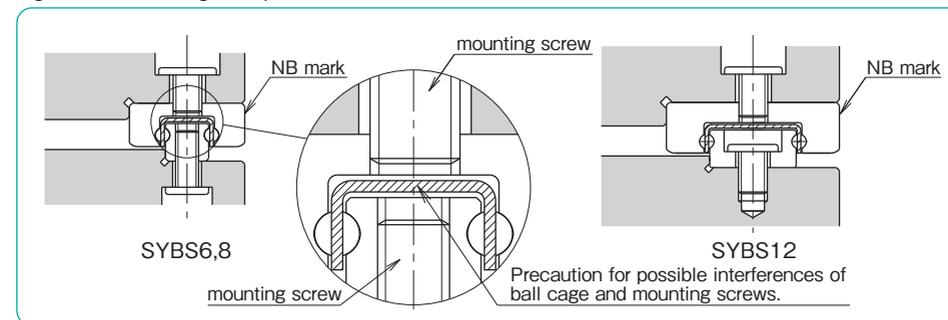
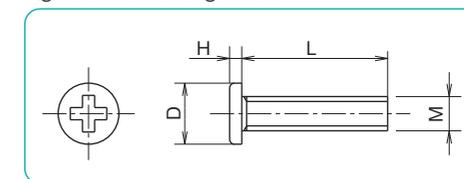


Table A-16 Mounting Screw (stainless steel)

M (size)	D mm	H mm	pitch mm	L mm
M1	1.8	0.45	0.25	5
M1.4	2.5	0.5	0.3	6
M1.6	2.3	0.5	0.35	4, 5, 6
M2	3	0.6	0.4	6

Figure A-31 Mounting Screw



**USE AND HANDLING PRECAUTIONS**

**Preload**

The SYBS miniature slide is provided with a slightly positive clearance type only.

**End Piece**

On both ends of the SYBS miniature slide bed section, screws are attached to prevent the ball cage from escaping. Please note that the screws are designed only to prevent the ball cage from escaping and are not intended for the use as a mechanical stopper. The ball cage may become deformed on contact with the stopper and this will result in a negative affect of the accuracy and travel life.

**Lubrication**

NB miniature slide SYBS type is supplied with an initial application of lithium soap grease No.0 and therefore is ready for immediate use. Make sure to

relubricate with a similar type of grease periodically according to the operating conditions. For use in clean rooms or vacuum environments, miniature slide tables without grease or with customer specified grease are available. NB also provides low dust generation grease. Please refer to page Eng-51 for details.

**Cage Slippage**

For the SYBS type, the cage can slip under high-speed motion, vertical application, unbalanced-loading, and vibrating conditions. It is advised that the motion speed be kept under 0.5m/s under general operating conditions. It is also recommended that the table be cycled to perform the maximum stroke several times, so that the cage returns to its center position.

# SYBS TYPE



## part number structure

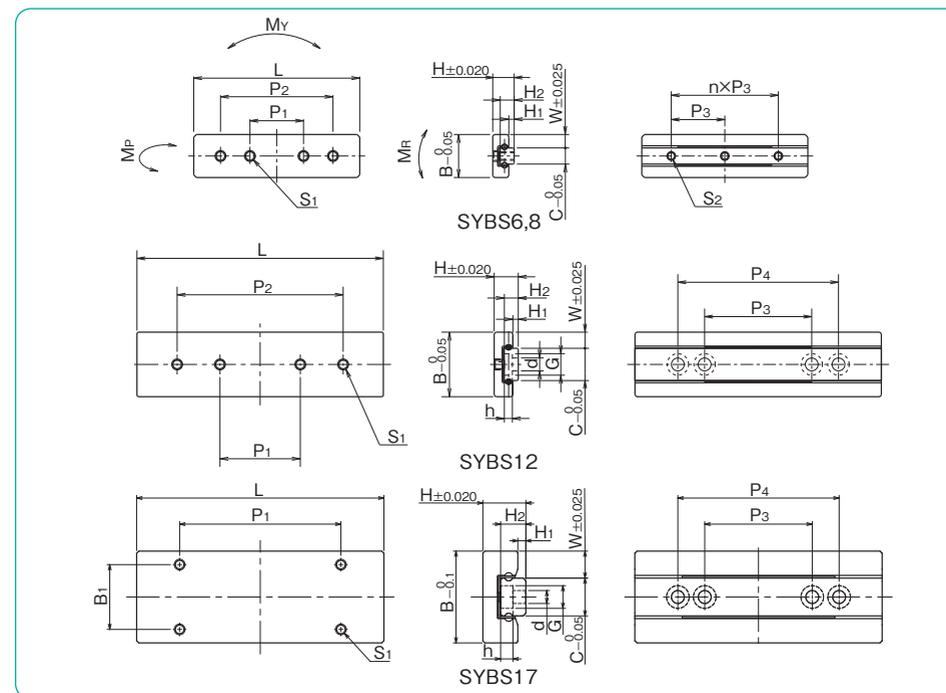
example **SYBS 8 31 -KGLA**

SYBS type

size

table length

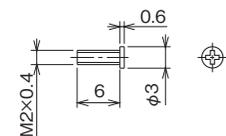
grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease



part number	major dimensions				table-top dimensions						S <sub>1</sub> maximum screw penetration depth mm
	H mm	W mm	H <sub>1</sub> mm	stroke mm	B mm	L mm	P <sub>1</sub> mm	P <sub>2</sub> mm	B <sub>1</sub> mm		
SYBS 6-13	3.2	2	0.7	5	6	13	6	—	—	M1.4	0.5
SYBS 6-21				12		21	10	—	—		
SYBS 8-11	4	2.5	1	4	8	11	5.5	—	—	0.7	
SYBS 8-21				12		21	10	—	—		
SYBS 8-31				18		31	10	21	—		
SYBS12-23	4.5	3	1	12	12	23	8	—	—	M2	1.2
SYBS12-31				18		31	15	—	—		
SYBS12-46				28		46	15	31	—		
SYBS17-23	8	5	1.5	14	17	23	10	—	—	3	
SYBS17-31				19		31	20	—	12		
SYBS17-46				29		46	30	—	—		

※1: Custom mounting screws are provided with the SYBS-12 type only. Other screw sizes are also available. (Please refer to page A-67)

SYBS12 bed mounting screw



H <sub>2</sub> mm	C mm	bed-surface dimensions					basic load rating		allowable static moment			mass g	size
		d×G×h mm	S <sub>2</sub>	P <sub>3</sub> mm	n mm	P <sub>4</sub> mm	C dynamic N	C <sub>0</sub> static N	M <sub>P</sub> N·m	M <sub>Y</sub> N·m	M <sub>R</sub> N·m		
2.0	2	—	M1	7	1	—	154	180	0.21	0.25	0.21	1.4	6-13
				7	2	—	229	315	0.57	0.69	0.37	2.2	6-21
2.6	3	—	M1.6	5	1	—	201	211	0.23	0.28	0.35	2.0	8-11
				10	1	—	368	493	1.02	1.22	0.83	3.7	8-21
2.6	6	2.4×4×1.5 <sup>※1</sup>	—	10	2	—	473	704	1.97	2.35	1.19	5.5	8-31
				15	—	—	404	563	1.30	1.55	1.80	7.6	12-23
				15	—	—	473	704	1.97	2.35	2.25	10.2	12-31
				20	—	30	658	1,120	4.80	5.72	3.60	15.2	12-46
4.7	7	2.4×4.2×2.3	—	15	—	—	775	888	2.09	2.49	3.33	19.2	17-23
				15	—	—	984	1,240	3.80	4.53	4.66	26.2	17-31
				20	—	30	1,350	1,950	8.75	10.4	7.32	38.4	17-46

1N ≒ 0.102kgf 1N·m ≒ 0.102kgf·m

# GONIO WAY

The NB gonio way is a curved cross roller slide way. It is a curved motion bearing utilizing low-friction, non-recirculating precision rollers. It is used when there is a need to change the gradient or obtain an accurate gradient angle without changing the center of rotation in high-precision optical and measurement equipment.

## STRUCTURE AND ADVANTAGES

The NB gonio way RVF type consists of curved tracking bases with precisely ground V-grooves and flat installation surfaces, as well as curved roller cages. The NB gonio way RV type consists of curved rails with precisely machined V-grooves and curved roller cages. Precision rollers are employed as the rolling elements, since the rolling elements do not recirculate, the frictional resistance will not vary significantly, providing curved movement with extremely low frictional resistance.

### Low Frictional Resistance and Minute Motion

The precision grinding and curved roller cage allow for extremely low frictional resistance. The negligible difference between static and dynamic frictions allows the gonio way to follow minute movements accurately, realizing curved movement of high accuracy.

### Low Noise

Since NB gonio way employs a non-recirculating design, there is no noise from the circulating area. In addition, the curved roller cage realizes quiet operation without contact noise between the rolling elements.

### High Rigidity and High Load Capacity

The rollers provide a larger contact area and less

elastic deformation compared to the ball elements. Additionally, since the rollers do not recirculate, the effective number of rotating elements is larger, resulting in high rigidity and high load capacity.

### Flat Installation Surface

The flat installation surfaces of the RVF type do not require complicated machining of tables and beds when installing the product. As a result, machining costs can be reduced greatly.

### Same Rotation Center

The curved V-grooves, which are finished with a precise grinding process, provide an accurate center of rotation. Furthermore, the products are composed to provide identical rotation centers when products of each size are installed to two axes. (refer to Table A-25.)

Figure A-32 Structure of Gonio Way RVF type

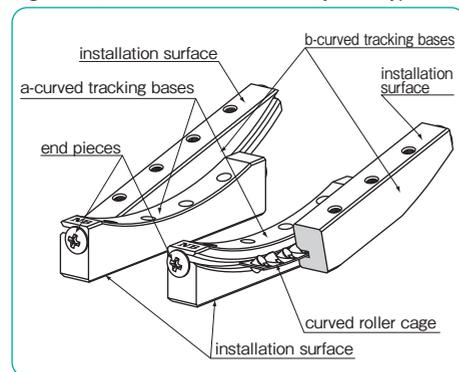
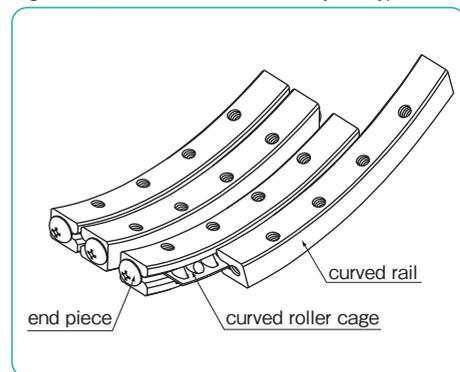


Figure A-33 Structure of Gonio Way RV type



## SPECIFICATION

Refer to table A-17 for NB Gonio Way material and operating temperature range.

Table A-17 Material and Operating Temperature Range

type	curved rail	curved roller cage	roller	operating temperature range
RVF	steel	stainless steel	steel	-20°C~110°C
RV				

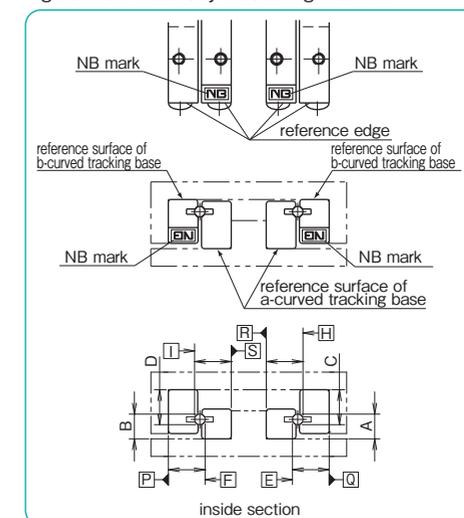
## ACCURACY OF RVF TYPE

The accuracies of the gonio way RVF type are represented by mutual dimensional errors and parallelism of four rails, using the procedure as shown in Figure A-34.

Table A-18 Accuracy unit: μm

part number	mutual error between A and B mutual error between C and D		parallelism of E,F,H,I
	RVF2050- 70	10	
RVF2050- 87			
RVF2050-103			
RVF2050-120			
RVF3070- 85			
RVF3070-110			
RVF3100-125			
RVF3100-160			

Figure A-34 Accuracy Measuring Method



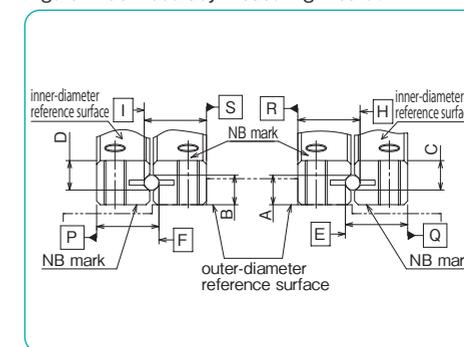
## ACCURACY OF RV TYPE

The accuracies of the gonio way RV type are represented by mutual dimensional errors and parallelism of four rails, using the procedure as shown in Figure A-35.

Table A-19 Accuracy unit: μm

part number	mutual error between A and B mutual error between C and D		parallelism of E,F,H,I
	RV2040- 50	10	
RV2060- 60			
RV3070- 90			
RV3070-110			
RV3100-160			

Figure A-35 Accuracy Measuring Method



The reference surfaces are located on the opposite side of the NB mark. There are inner reference surface and outer reference surface in one set of RV.

## RATED LIFE

The life of a gonio way is obtained using the following equations.

Rated Life

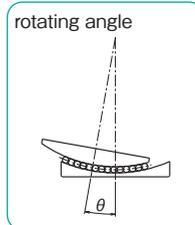
$$L = \frac{90}{\theta} \times \left( \frac{f_T}{f_w} \times \frac{C}{P} \right)^{10}$$

L: travel life (10<sup>6</sup>cycles) θ: rotating angle (degree)  
 C: basic dynamic load rating (N) P: applied load (N)  
 f<sub>T</sub>: temperature coefficient f<sub>w</sub>: applied load coefficient  
 ※Refer to page Eng-6 for the coefficients.

Life Time

$$L_h = \frac{L \times 10^6}{60 \times n}$$

L<sub>h</sub>: life time (hr)  
 n: number of cycles per minute (cpm)



## MOUNTING OF RVF TYPE

### Accuracy of Mounting Surface

To maximize the performance of NB gonio way, it is important to finish the installation surface with high accuracies.

- Parallelism of surface 1 against surface A
- Perpendicularity of surface 2 against surface A
- Perpendicularity of surface 5 against surface A
- Parallelism of surface 3 against surface B
- Perpendicularity of surface 4 against surface B
- Perpendicularity of surface 6 against surface B
- Parallelism of surface 2 against surface C
- Parallelism of surface 4 against surface C

Figure A-36 Accuracy of Mounting Surface

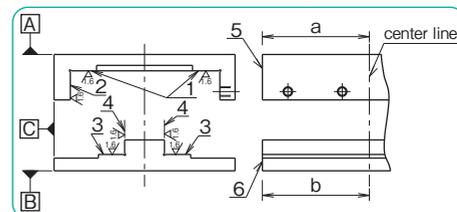


Figure A-37 Example of Installation of RVF type

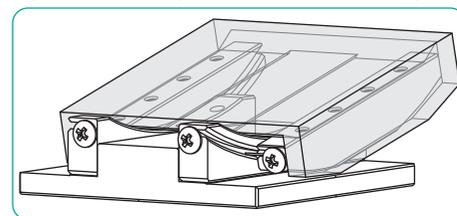
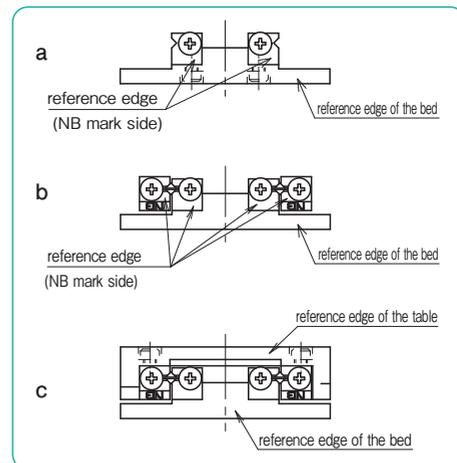


Figure A-38 Installation Method (1)



### Tapped Hole for Preload Adjustment Screws

The recommended pitch of the adjustment screws should be installed in the same location as the rail mounting bolts, and the height should be aligned with the center of the raceway groove. (refer to page A-73, Figure A-39 (d, e, f,))  
 Page A-73, Table A-20 shows the sizes of tapped holes.

### Installation Procedure

#### Setting the curved tracking bases temporarily

- (1) Remove burrs, stains, and dust from the installation surfaces of the curved tracking bases of tables and beds. Foreign particles must be kept out of the assembly work as well.
- (2) Apply low viscosity oil to contact surfaces, check the reference edges of an a-curved tracking base and bed, and then tighten the screws temporarily. (Figure A-38a)
- (3) Align the reference edges (NB mark side) of a b-curved tracking base and an a-curved tracking base to the same orientation. Then, insert the curved roller cages between the curved tracking bases at the center area. Make sure that the curved roller cages will not interfere with the curved raceway grooves of the curved roller tracking bases. (Figure A-38b)
- (4) Check the reference edge of the table, set the table over the b-curved tracking base, and then secure the table temporarily. (Figure A-38c)

#### Setting four curved tracking bases in parallel position

- (5) Move the table to the maximum stroke ends of both sides and adjust the setting so that the curved roller cage is positioned at the center of the curved tracking base.
- (6) Move the table to the center position and tighten the adjustment screws with ※slightly strong torque by using a torque wrench. (Figure A-39d)  
 ※"Slightly strong torque" here means slightly stronger than the torque at which the oscillation of the dial indicator is stabilized at the minimum value when the table is moved right and left, or when pressure is applied to the rolling direction while the dial indicator is attached to the side face (reference side) of the table. (Figure A-39i)
- (7) Move the table to the maximum stroke end of one side and tighten the adjustment screws on the curved roller cage with the same torque as in step (6). (Figure A-39e)
- (8) Move the table to the maximum stroke end of the other side and tighten the adjustment screws with a torque wrench by repeating the procedure above. (Figure A-39f)

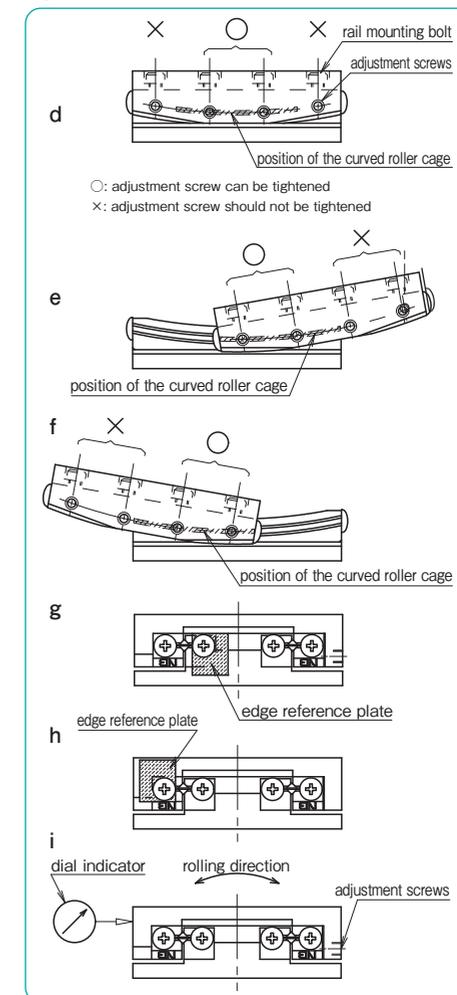
#### Securing the curved tracking bases

- (9) Mount an edge reference plate between the reference edge of the a-curved tracking base and end piece, press it against the reference edge of the bed, and then tighten only the rail mounting bolts in the middle. (Figure A-39g)
- (10) Repeat the procedure above to mount an edge reference plate between the reference edge of the b-curved tracking base and the end piece. Press it against the reference edge of the bed, and then tighten only the rail mounting bolts in the middle. (Figure A-39h) In order to maintain parallelism of curved tracking bases, do not cycle the table during this process and make sure that there is no clearance between the edge of the table and the edge reference plate.
- (11) Secure the rest of the rail mounting bolts on the curved roller cage one by one by moving the table as instructed in steps (7) and (8).

#### Adjusting the preload

- (12) Move the table to the right and left with the test indicator attached to the side face of the table (reference side). Or, apply pressure in the rolling direction and confirm that the oscillation of the indicator is stabilized at the minimum level. (Figure A-39i)
- (13) Return the rail mounting bolts on the b-curved tracking base at the adjustment screw side to the temporary setting.
- (14) Return the table to the center position, slightly loosen the adjustment screws in the middle, and then gradually loosen the adjustment screws on the curved roller cage while moving the table as instructed in steps (7) and (8) Make sure not to reduce the preload too much.
- (15) Finally, secure the b-curved tracking base at the adjustment screw side, which has been installed temporarily. Secure the rail mounting bolts on the curved roller cage one by one by moving the table as instructed above.

Figure A-39 Installation Method (2)



As d, e, f in the Figure shows it is recommended to match the position and pitch of adjustment screws with rail mounting bolts, and also the height of them with the same as the center of raceway groove.

Table A-20 Recommended Torque for Adjustment Screw unit:N·m

part number	size	torque
RVF2	M3	0.012
RVF3	M4	0.05

Table A-21 Recommended Torque for Rail Mounting Bolts unit:N·m

size	tightening torque
M2.5	0.65
M3	1.0

(for stainless steel screw A2-70)

## MOUNTING OF RV TYPE

### Accuracy of Mounting Surface

The accuracy of surfaces 1, 2, 3, and 4 (Figure A-40) directly affect the motion accuracy.

To maximize the performance of NB gonio way, it is important to finish the installation surface with high accuracies.

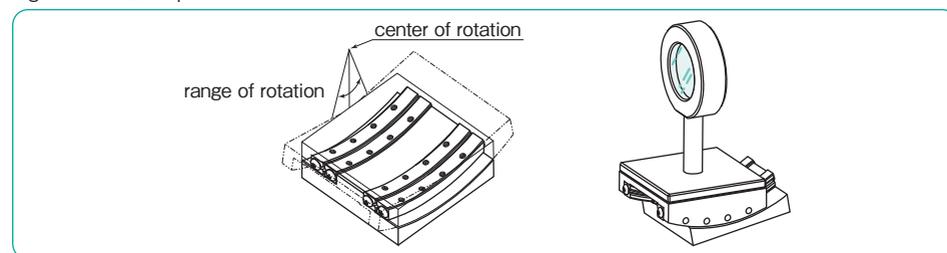
### Tapped Hole for Preload Adjustment Screws

The recommended pitch of the adjustment screws should be installed in the same location as the rail mounting bolts, and the height should be aligned with the center of the raceway groove.

(refer to page A-75, Figure A-43 (e, f, g).)

Page A-75, Table A-22 shows the sizes of tapped holes.

Figure A-41 Example of Installation



### Installation Procedure

- (1) Remove burrs, dirt, dust, etc. from the table and the installation surfaces of the bed.
- (2) Apply a low viscosity oil to contact surfaces. Fix the rail ①inner-diameter reference surface, ②outer-diameter reference surface and ③outer-diameter reference surface by tightening bolts to the specified torque. (Table A-23, Figure A-42a)
- (3) Temporarily attach the rail ④inner-diameter reference surface on curved rail to the adjustment side. (Figure A-42b)
- (4) Remove the end pieces on one side of the rails and insert roller cages to the center. (Figure A-42c)
- (5) Re-attach end pieces.
- (6) Move the table to the right and left (in the direction of the stroke) to position roller cages at the center of the curved rails.
- (7) Set an indicator at the side of the table on the reference surface. (Figure A-42d)
- (8) Move the table to one of the stroke ends and tighten the adjustment screws slightly. (Figure A-43e)

Figure A-40 Accuracy of Mounting Surface

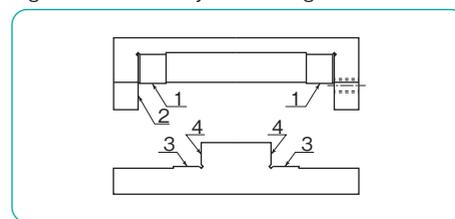
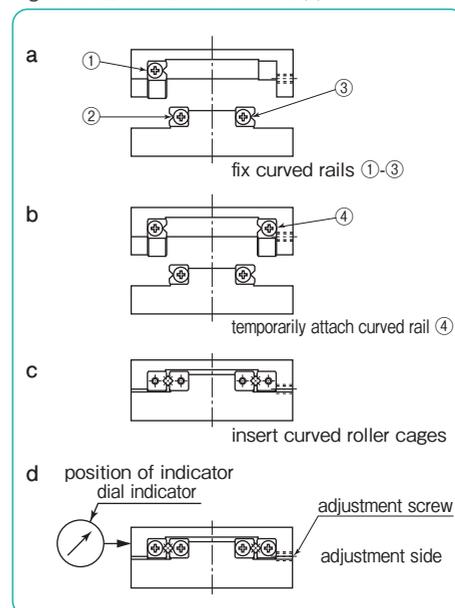


Figure A-42 Installation Method (1)



- (9) Move the table fully to the other stroke end and tighten the adjustment screws slightly. (Figure A-43f)
- (10) Move the table to the center and lightly tighten adjustment screws. (Figure A-43g)
- (11) Repeat steps (8)~(10) until there is no clearance around the table. If there is no clearance, the indicator will show a minimum fluctuation value when the table is moved to the right and left. Exercise care so as not to apply an excessive preload.
- (12) Repeat steps (8)~(10) and tighten the adjustment screws uniformly by using a torque wrench.
- (13) Fix the rail ④inner-diameter reference surface. Tighten the rail mounting bolts sequentially by moving the table in the same manner as with the adjustment screws.

Table A-22 Recommended Torque for Adjustment Screw unit:N·m

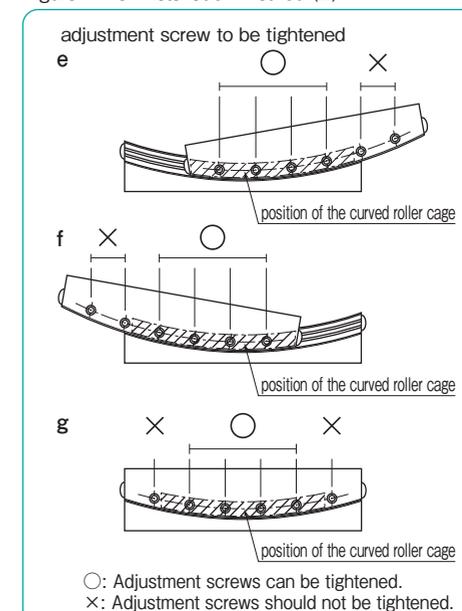
part number	size	torque
RV2	M3	0.012
RV3	M4	0.05

Table A-23 Recommended Torque for Rail Mounting Bolt unit:N·m

size	torque
M3	1.0

(for stainless steel screw A2-70)

Figure A-43 Installation Method (2)



## SHAPE OF MOUNTING SURFACE

Slide way RVF and RV types are generally mounted by contacting the reference surface of the rail to the shoulder provided on the mounting surface. For the shoulder shape, provide relief at the corner as shown in Figure A-44 so that it does not interfere with the reference corner of the rail.

If it is necessary to mount RVF or RV types without relief, then it can be used with rounded corners as shown in Figure A-45. Table A-24 shows the corner radius of the mounting surface.

Figure A-45 Corner Radius

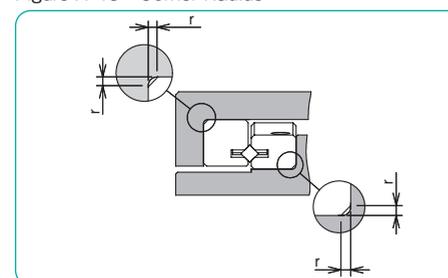


Figure A-44 Relief on the Mounting Surface

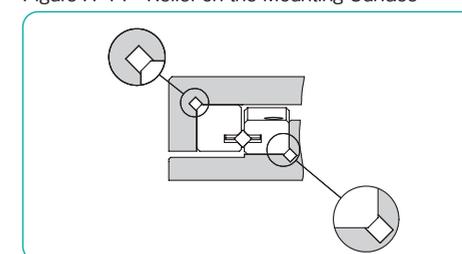


Table A-24 Maximum Corner Radius unit : mm

part number	maximum corner radius r
RVF2 RV2	0.05
RVF3 RV3	0.1

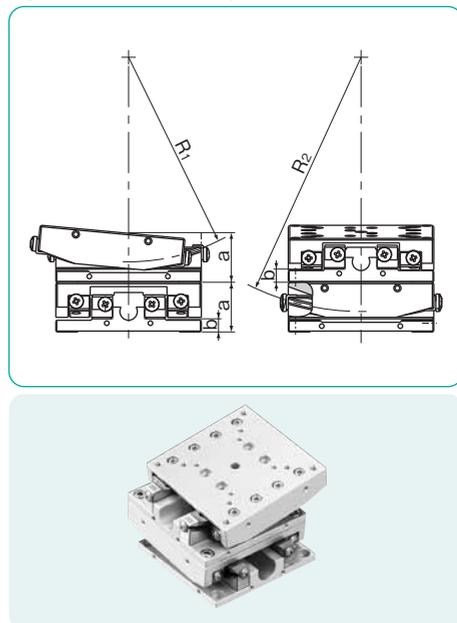
**RVF TYPE 2 AXES AND SPECIAL SPECIFICATIONS**

When incorporating RVF type units onto two axes as illustrated in Figure A-46, adjust the height of one lifting axis as instructed in Table A-25. Then, adjust dimension b (the height of the installation surface of the a-curved tracking base) in Figure A-46 according to the table in order to obtain the identical rotation center for the two axes. In addition, requests can be made for custom specifications including table units fitted for two axes, non-standard lengths for curved tracking bases, the radius of rotation, the rotation range, and the number of rollers. Contact NB for further information.

Table A-25 Two Axes Specification unit:mm

part number combination	a	R <sub>1</sub>	R <sub>2</sub>
RVF2050- 70 RVF2050- 87	17	70	87
RVF2050-103 RVF2050-120	17	103	120
RVF3070- 85 RVF3070-110	25	85	110
RVF3100-125 RVF3100-160	35	125	160

Figure A-46 Two Axes Specification



**USE AND HANDLING PRECAUTIONS**

**Lubrication**

NB gonio ways are lubricated using lithium soap No.00 based grease prior to shipment, so they can be used immediately. Make sure to relubricate with a similar type of grease periodically according to the operating conditions. NB also provides low dust generation grease for the linear system. Please refer to page Eng-51 for further details.

**Dust Prevention**

If a foreign matter, such as dust and dirt, enters the inside of the NB gonio way, it will deteriorate the accuracy and life of the system. A gonio way used in a harsh environment should be protected with a cover.

**Operating Environment**

The recommended operating temperature range of the NB gonio way is -20°C to 110°C.

**Adjustment**

Inaccuracy in mounting surface or improper adjustment of preload will reduce the motion accuracy, resulting in skewing and shortening of gonio way life. The adjustment should be carried out carefully.

**Cage Slippage**

For the NB Gonio Way, the cage can slip under high-speed motion, vertical application, unbalanced-loading, and vibrating conditions. It is recommended that the rotation range be set with sufficient margin and an excessive preload should be avoided. It is also recommended that the rails be cycled to perform the maximum stroke several times, so that the cage returns to its center position.

**End Pieces**

End pieces are attached to each end of the NB gonio way to prevent removal of the curved roller cage. Do not use as a mechanical stopper.

**Careful Handling**

Dropping the NB gonio way causes the rolling elements to make dents in the raceway surface. This will prevent smooth motion and will also affect accuracy. Be sure to handle the product with care.

**Use as a Set**

The accuracy of the rails has been matched within each set. Note that the accuracy will be affected when the rails of different sets are combined.

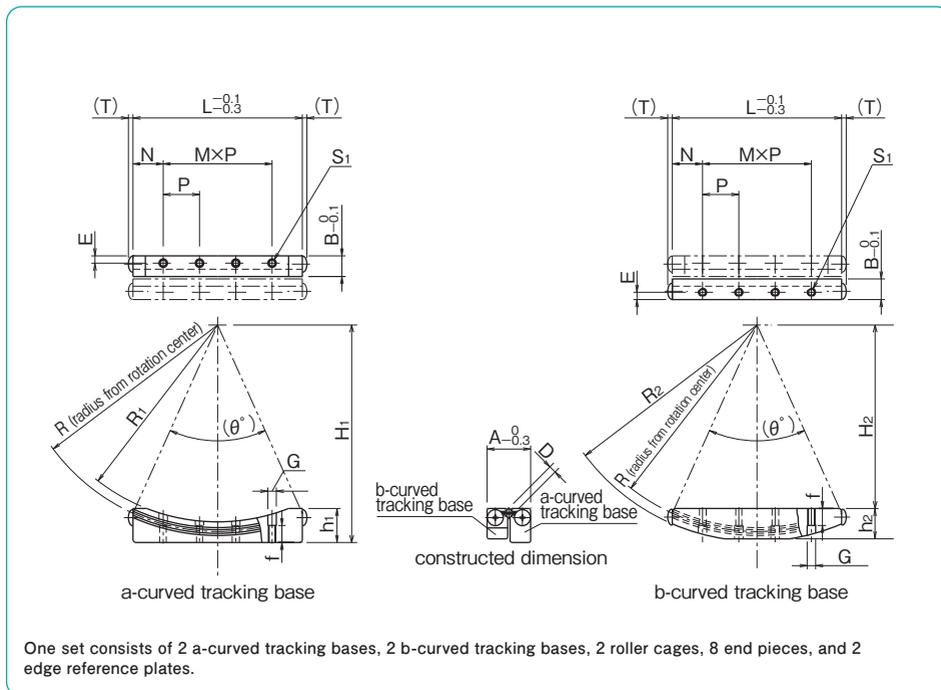
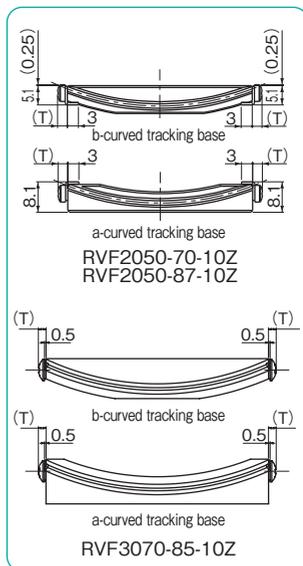
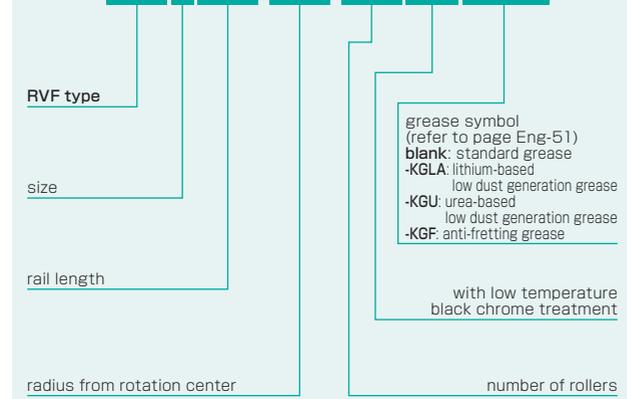
# RVF TYPE

– Gonio Way flat-installation-surface –



## part number structure

example **RVF 3 100 125 16Z -LB -KGF**



part number	rotation range	roller diameter D mm	number of rollers Z	major dimensions									
				L mm	R mm	R <sub>1</sub> mm	R <sub>2</sub> mm	H <sub>1</sub> mm	H <sub>2</sub> mm	h <sub>1</sub> mm	h <sub>2</sub> mm	A mm	B mm
RVF2050- 70-10Z	± 5°	2	10	50	70	67	73	72.5	64.5	7.5	7.5	15	7.25
RVF2050- 87-10Z			10		87	84	89.5	89.5	81.5	7.5	7.5		
RVF2050-103-10Z			10		103	100	106	105.5	97.5	7.5	8		
RVF2050-120- 9Z			9		120	117	123	122.5	114.5	7.5	8		
RVF3070- 85-10Z	± 10°	3	10	70	85	81	89	89.5	75.5	14	12.5	18	8.5
RVF3070-110-10Z			10		110	106	114	114.5	100.5	12.8	12.5		
RVF3100-125-16Z			16		125	121	129	129.5	110.5	17.5	18		
RVF3100-160-14Z			14		160	156	164	164.5	145.5	15	18		

※ Please refer to page A-82 for information on cage dimensions.

M×P mm	N mm	E mm	S <sub>1</sub>	f mm	G mm	T mm	θ°	basic load rating		mass (one set) g	part number
								dynamic C N	static C <sub>0</sub> N		
3×12.5	6.25	2.5	M2.5	4	3	2.3	41.8°	1,180	2,400	66	RVF2050- 70-10Z
							33.4°	1,060	2,430	70	RVF2050- 87-10Z
3×13	5.5	3	M3	7	3.5	1.5	28.1°	998	2,440	70	RVF2050-103-10Z
							24.0°	751	1,970	70	RVF2050-120- 9Z
3×15	12.5	3	M3	7	3.5	2.4	48.6°	2,680	5,530	182	RVF3070- 85-10Z
							37.1°	2,440	5,620	182	RVF3070-110-10Z
5×15	12.5	3	M3	7	3.5	1.9	47.2°	3,520	8,850	327	RVF3100-125-16Z
							36.4°	2,860	7,890	323	RVF3100-160-14Z

1N≒0.102kgf

# RV TYPE

— Gonio Way —



## part number structure

example **RV 3 070 - 110 - 10Z -LB -KGF**

RV type

size

rail length

radius from rotation center

grease symbol  
(refer to page Eng-51)

**blank:** standard grease

**-KGLA:** lithium-based

**-KGL:** low dust generation grease

**-KGU:** urea-based

**-KGL:** low dust generation grease

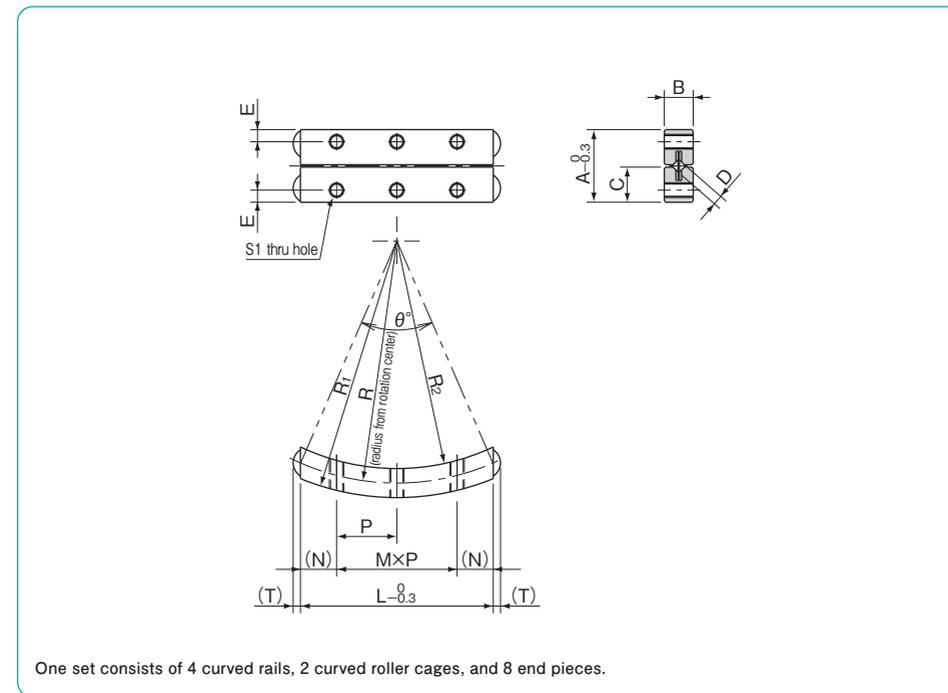
**-KGF:** anti-fretting grease

with low temperature  
black chrome treatment

number of rollers

part number	rotation range	roller diameter D mm	number of rollers Z	major dimensions						
				L mm	R mm	R <sub>1</sub> mm	R <sub>2</sub> mm	A mm	B mm	C mm
RV2040- 50- 7Z	±10°	2	7	40	50	53	47	15	6	7.25
RV2060- 60-12Z			12	60	60	63	57			
RV3070- 90-11Z	±10°	3	11	70	90	94	86	18	8	8.5
RV3070-110-10Z			10	70	110	114	106			
RV3100-160-14Z			14	100	160	164	156			

※ Please refer to page A-82 for information on cage dimensions.



One set consists of 4 curved rails, 2 curved roller cages, and 8 end pieces.

M×P mm	N mm	E mm	S <sub>1</sub>	T mm	θ°	basic load rating		mass (one set) g	part number
						dynamic C N	static Co N		
2×12.5	7.5	2.5	M3	1.5	47.2°	820	1,440	49	RV2040- 50- 7Z
3×12.5	11.25				60.0°	1,490	2,800	75	RV2060- 60-12Z
3×15	12.5	3	M3	1.9	45.8°	2,640	5,550	137	RV3070- 90-11Z
3×15					37.1°	2,440	5,620	135	RV3070-110-10Z
5×15					36.4°	2,860	7,890	193	RV3100-160-14Z

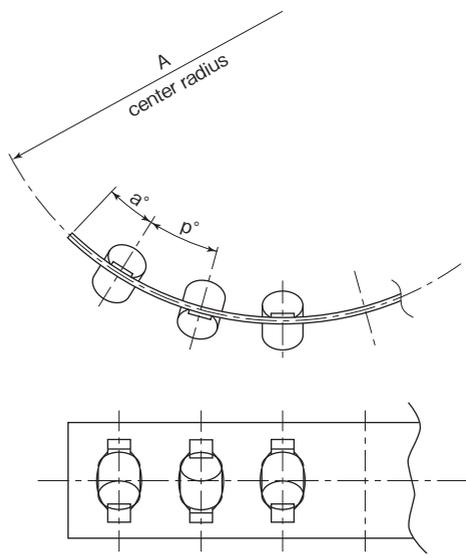
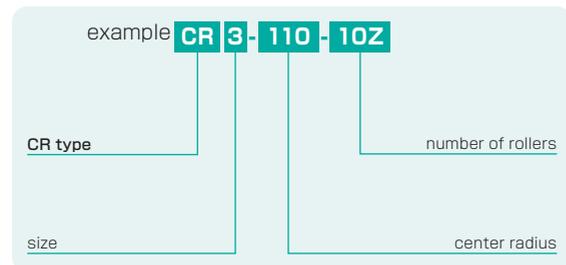
1N≒0.102kgf

# CR TYPE

— Standard Curved Roller Cage —



part number structure



part number	roller diameter D mm	center radius A mm	t mm	w mm	p°	a°	applicable type
CR2- 50- 7Z	2	50	0.3	5.6	4.6°	2.9°	RV
CR2- 60-12Z		60			3.8°	2.4°	RV
CR2- 70-10Z		70			3.3°	2.0°	RVF
CR2- 87-10Z		87			2.6°	1.6°	RVF
CR2-103-10Z		103			2.2°	1.4°	RVF
CR2-120- 9Z		120			1.9°	1.2°	RVF
CR3- 85-10Z	3	85	0.4	7.2	3.4°	2.0°	RVF
CR3- 90-11Z		90			3.2°	1.9°	RV
CR3-110-10Z		110			2.6°	1.5°	RVF,RV
CR3-125-16Z		125			2.3°	1.3°	RVF
CR3-160-14Z		160			1.8°	1.0°	RVF,RV

# BALL SPLINE ROTARY BALL SPLINE STROKE BALL SPLINE BALL SCREW SPLINE

## BALL SPLINE

STRUCTURE AND ADVANTAGES B-2  
 TYPES ..... B-3  
 SPECIFICATION ..... B-4  
 ACCURACY ..... B-5  
 PRELOAD AND CLEARANCE ..... B-6  
 RIGIDITY AND PRELOAD ..... B-7  
 STRENGTH OF SPLINE SHAFT ..... B-8  
 LOAD RATING ..... B-10  
 CALCULATION OF DEFLECTION AND DEFLECTION ANGLE OF SPLINE SHAFT ..... B-11  
 ALLOWABLE ROTATIONAL SPEED OF SPLINE SHAFT ..... B-12  
 RATED LIFE CALCULATION ..... B-13  
 MOUNTING ..... B-13  
 OPERATING CONDITIONS ..... B-14  
 LUBRICATION ..... B-14  
 HOLLOW SPLINE SHAFT ..... B-14  
 SPECIAL REQUIREMENTS ..... B-15  
 NUT ORIENTATION ..... B-15  
 USE AND HANDLING PRECAUTIONS ..... B-15  
 MOUNTING ..... B-16  
 DIMENSION TABLE ..... B-20  
 STANDARD AND MAXIMUM LENGTH ..... B-32  
 COMMERCIAL BALL SPLINE ..... B-33  
 EXAMPLES OF MACHINING ..... B-34

## ROTARY BALL SPLINE

STRUCTURE AND ADVANTAGES B-36  
 SPECIFICATION ..... B-37  
 ACCURACY OF SPR TYPE ..... B-37  
 ACCURACY OF SPB TYPE ..... B-39  
 PRELOAD AND CLEARANCE ..... B-40  
 HOLLOW SPLINE SHAFT ..... B-40  
 SPECIAL REQUIREMENTS ..... B-40  
 MOUNTING ..... B-41  
 LUBRICATION ..... B-42  
 NUT ORIENTATION ..... B-43  
 OPERATING CONDITIONS ..... B-44  
 APPLICATION EXAMPLES ..... B-45  
 DIMENSION TABLE ..... B-46~

## STROKE BALL SPLINE

STRUCTURE AND ADVANTAGES B-52  
 SPECIFICATION ..... B-53  
 ACCURACY ..... B-53  
 PRELOAD AND CLEARANCE ..... B-54  
 COMPARISON OF DYNAMIC FRICTIONAL RESISTANCE ..... B-54  
 NUT ORIENTATION ..... B-55  
 USE AND HANDLING PRECAUTIONS ..... B-55  
 DIMENSION TABLE ..... B-56~

## BALL SCREW SPLINE

STRUCTURE AND ADVANTAGES B-58  
 SPECIFICATION ..... B-60  
 PRELOAD ..... B-60  
 USE AND HANDLING PRECAUTIONS ..... B-60  
 ACCURACY ..... B-61  
 SPBR (-KP) TYPE MOTION PATTERN ..... B-63  
 SPBF (-KP) TYPE MOTION PATTERN ..... B-64  
 MOUNTING ..... B-65  
 DIMENSION TABLE ..... B-66~

# BALL SPLINE

The NB ball spline is a linear motion mechanism utilizing the rolling motion of ball elements that can sustain loads and transfer torque simultaneously. It can be used in a wide variety of applications including robotics and transport type equipment.

## STRUCTURE AND ADVANTAGES

The NB ball spline consists of a spline shaft with raceway grooves and a spline nut. The spline nut consists of an outer cylinder (main body), retainer, side rings, and ball elements that is designed and manufactured to achieve a reliably smooth motion.

### High Load Capacity and Long Travel Life

The raceway grooves are machined to a radius close to that of the ball elements. The large ball contact area results in high load capacity and long travel life.

### Wide Variety of Configurations

Spline shaft sizes with diameters from 4mm to 100mm are available. Several types of Spline nut are available: cylindrical types (SSP/SSPM), and flange types (SSPF/SSPT). Material option of Stainless steel (SUS440C or equivalent) is also available. They can be specified to suit various applications.

### Anti-corrosion Specification

In addition to the stainless steel version, you can also select the LB option with low-temperature black chrome treatment. The surface treatment is applied to the shaft and outer cylinder body for rust prevention.

### High Accuracy Torque Transmission

Due to the effective contact angle between the

raceway grooves and the balls, the NB ball spline can transfer large torque. By adjusting preload it is possible to obtain a higher rigidity and a higher positioning accuracy.

### Ease of Additional Custom Machining

Since a round shaft with raceway grooves is used, NB ball spline shafts can be easily machined to customized specifications.

### High-Speed Motion and High-Speed Rotation

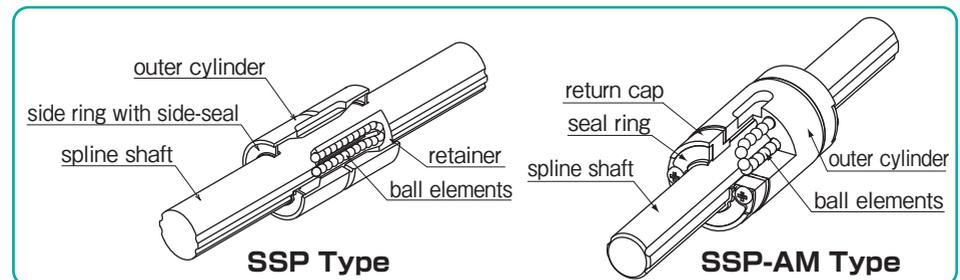
The outer cylinder is compact and well balanced, resulting in good performance at high speed.

### Light Weight and Compactness

The NB ball spline SSP-AM type has a smaller spline-nut diameter compared to the conventional SSP type nut on the same shaft diameter. The SSP-AM type is best suited for the chip-mounter head device and the multi-axial applications. Anti-corrosion type is also available.

comparison between SSP4AM and SSP4 nut outer dia. 20% smaller  
nut length 25% shorter

Figure B-1 Basic Structure of NB Ball Spline



## TYPES

### TYPES OF SPLINE NUT

A wide variety of spline nut designs are available and all spline nuts come with side-seals as a standard feature.

Table B-1 Types of Spline Nut

type of nut		shape and advantage	page
cylindrical type	SSP SSPS	<ul style="list-style-type: none"> <li>cylindrical spline nut with key groove</li> <li>with special key</li> <li>nominal diameter: SSP4-100 : SSPS4-25</li> </ul>	P.B-18
	SSP-AM SSPS-AM	<ul style="list-style-type: none"> <li>light and compact nut</li> <li>countersink for fixing (SSP4AM)</li> <li>with special key</li> <li>nominal diameter: 4-10</li> </ul>	P.B-20
	SSPM	<ul style="list-style-type: none"> <li>cylindrical spline nut without key groove</li> <li>with two lock plates for fixing</li> <li>nominal diameter: 6-10</li> </ul>	P.B-22
flange type	SSPF SSPFS	<ul style="list-style-type: none"> <li>spline nut with flange</li> <li>nominal diameter: SSPF6-60 : SSPFS6-25</li> </ul>	P.B-24
	SSPT	<ul style="list-style-type: none"> <li>spline nut with a two side cut flange</li> <li>nominal diameter: 6-10</li> </ul>	P.B-26
	SSPT-AM SSPK-AM SSPTS-AM SSPKS-AM	<ul style="list-style-type: none"> <li>light and compact nut with flange</li> <li>nominal diameter: 4-10</li> </ul>	P.B-28

### TYPES OF SPLINE SHAFT

Depending on the application requirements, either a ground spline shaft or a non-ground (commercial grade) spline shaft is available.

Table B-2

type of spline shaft	shape and advantage
ground spline shaft	 <ul style="list-style-type: none"> <li>• precision ground and precision machined surface finish</li> <li>• high precision</li> <li>• possible to machine ends of spline shaft and surface treatment</li> <li>• nominal diameter: 4-100</li> </ul>
commercial shaft (non-ground)	 <ul style="list-style-type: none"> <li>• for general industrial use</li> <li>• cost effective</li> <li>• possible to machine ends of spline shaft and surface treatment</li> <li>• nominal diameter: 20-50</li> <li>• maximum length: 5000mm (refer to page B-33)</li> </ul>

### SPECIFICATION

Table B-3 shows the NB Ball Spline material and operating temperature.

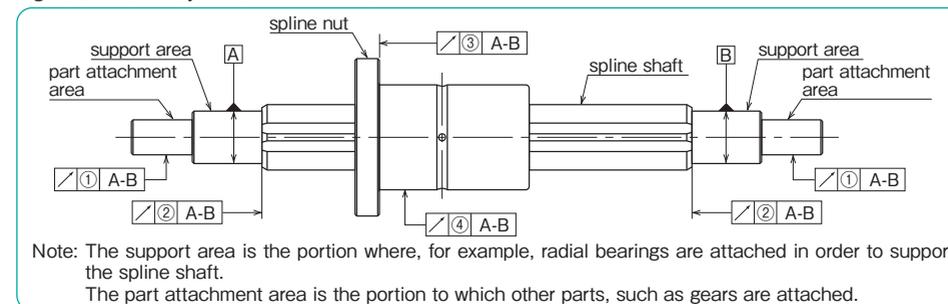
Table B-3 Material and Operating Temperature Range

type	nut		spline shaft	operating temperature range
	outer cylinder	return cap /retainer		
SSP	steel	resin	steel	-20°C~80°C
SSP -C				
SSP -AM				
SSPM				
SSPF				
SSPF -C				
SSPT				
SSPT -AM				
SSPK -AM				
SSPS				
SSPS -AM	stainless steel		stainless steel	
SSPFS				
SSPTS -AM				
SSPKS -AM				

### ACCURACY

The NB ball spline is measured for accuracy at the points shown in Figure B-2 and categorized as either high-grade (blank) or precision-grade (P). Contact NB for accuracy information on the commercial type ball spline.

Figure B-2 Accuracy Measurement Points



#### Tolerance of Spline Shaft Groove Torsion (Max.)

The groove torsion is indicated per 100mm, arbitrarily set as the effective length of the spline shaft section.

Table B-4

Tolerance of Spline Shaft Groove Torsion (Max.)

type of shaft	ground shaft	
	high	precision (P)
accuracy grade		
tolerance	13μm/100mm	6μm/100mm

Table B-5 Tolerance Relative to Spline Support Area (Max.)

unit: μm

part number	radial runout of part attachment area ①		radial runout of the end of the spline shaft section ② (when grinding is requested on the drawing)		radial runout of the flange ③	
	high-grade	precision-grade	high-grade	precision-grade	high-grade	precision-grade
SSP 4·4AM	14	8	9	6	11	8
SSP 5AM						
SSP 6·6AM						
SSP 8·8AM						
SSP 10·10AM	17	10	11	8	13	9
SSP 13A						
SSP 16A						
SSP 20A	22	13	13	9	16	11
SSP 25A						
SSP 30A						
SSP 40A						
SSP 50A	25	15	16	11	19	13
SSP 60A						
SSP 80A						
SSP 80AL						
SSP100A	29	17	19	13	22	15
SSP 80AL						
SSP100AL						
SSP 20	19	12	11	8	13	9
SSP 25						
SSP 30						
SSP 40	22	13	13	9	16	11
SSP 50						
SSP 60						
SSP 40	25	15	16	11	19	13
SSP 50						
SSP 60						
SSP 50	29	17	19	13	22	15
SSP 60						
SSP 60						

Table B-6 ④ Radial Runout of Outer Surface of Spline Nut Relative to Spline Shaft Support Area (Max.) unit:  $\mu\text{m}$

total length of spline shaft (mm)	greater than	or less	4 4AM		5AM 6 6AM		8 8AM		10 10AM		size 13A 16A 20A·20		25A·25 30A·30		40A·40 50A·50		60A·60 80A 80AL		100A 100AL	
			high-grade	precision grade	high-grade	precision grade	high-grade	precision grade	high-grade	precision grade	high-grade	precision grade	high-grade	precision grade						
—	200	46	26	46	26	46	26	36	20	34	18	32	18	32	16	30	16	30	16	
200	315	89	—	89	57	89	57	54	32	45	25	39	21	36	19	34	17	32	17	
315	400	—	—	126	—	126	82	68	41	53	31	44	25	39	21	36	19	34	17	
400	500	—	—	—	—	163	—	82	51	62	38	50	29	43	24	38	21	35	19	
500	630	—	—	—	—	—	—	102	65	75	46	57	34	47	27	41	23	37	20	
630	800	—	—	—	—	—	—	—	—	92	58	68	42	54	32	45	26	40	22	
800	1,000	—	—	—	—	—	—	—	—	115	75	83	52	63	38	51	30	43	24	
1,000	1,250	—	—	—	—	—	—	—	—	153	97	102	65	76	47	59	35	48	28	
1,250	1,600	—	—	—	—	—	—	—	—	256*	180*	210	140	175	105	70	43	55	33	
1,600	2,000	—	—	—	—	—	—	—	—	394	314	311	241	224	154	179	109	65	40	

★ SSP13A, 16A maximum length: 1,500mm  
 ★★ Please contact NB for shaft lengths exceeding 2,000mm.

PRELOAD AND CLEARANCE

The preload is categorized into three different levels: standard, light (T1), and medium (T2). A preload cannot be specified with the commercial grade spline shaft.

Table B-7 Preload and Clearance unit:  $\mu\text{m}$

part number	standard	light* (T1)	medium** (T2)
SSP 4·4AM	0~+3	-3~0	-
SSP 5AM			
SSP 6·6AM			
SSP 8·8AM			
SSP 10·10AM	-3~+1	-8~-3	-13~-8
SSP 13A			
SSP 16A			
SSP 20A·20	-4~+2	-12~-4	-20~-12
SSP 25A·25			
SSP 30A·30			
SSP 40A·40			
SSP 50A·50	-6~+3	-18~-6	-30~-18
SSP 60A·60			
SSP 80A			
SSP 80AL			
SSP100A	-8~+4	-24~-8	-40~-24
SSP100AL			

Table B-8 Preload and Operating Condition

preload	preload symbol	operating conditions
standard	blank	minute vibration is applied. a precise motion is required. a torque in a given direction is applied.
light	T1*	slight vibration is applied. slight torsional load is applied. cyclic torque is applied.
medium	T2**	shock/vibration is applied. over-hang load is applied. torsional load is applied.

\*.\* Since the contrary relation of preload and dynamic frictional resistance, dynamic frictional resistance will increase when applying preload.  
 \*\*. The outer diameter of the outer cylinder of SSP and SSPF type medium preload (T2) products may be deformed by preload and deviate from the tolerance of the dimension table.

RIGIDITY AND PRELOAD

The rolling elements of the ball spline deform elastically due to the applied load. The amount of deformation depends on the type of rolling element. It is proportional to the 2/3 power for ball elements. For rollers, it is proportional to the 9/10 power. In either case, the rate of deformation decreases as the applied load increases. Greater rigidity is achieved by applying a preload.

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

Figure B-3 Elastic Deformation of Rolling Elements

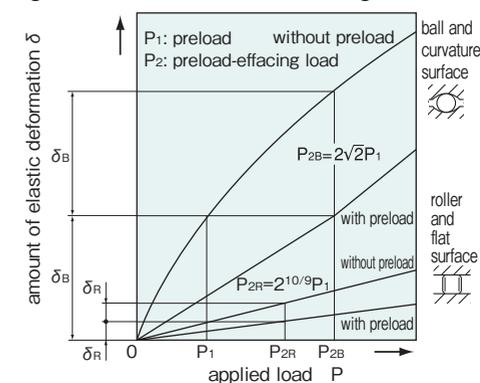


Table B-9 Level of Preload

preload	symbol	effect of preload					operating conditions	applicable part number
		vibration absorption ability	self-aligning ability	lifetime	rigidity	frictional resistance		
clearance	---	increases	reduces	reduces	increases	increases	light motion is required. installation errors to be absorbed.	Please contact NB
standard	blank	increases	reduces	reduces	increases	increases	minute vibration is applied. accurate motion is required. moment is applied in a given direction.	SSP, SSP-AM, SPR, SPB, SPLFS, SPBR
light	T1	increases	reduces	reduces	increases	increases	light vibration is applied. light torsional load is applied. moment is applied.	SSP, SSP-AM, SPR, SPB
medium	T2	increases	reduces	reduces	increases	increases	shock and vibration are applied. over-hang load is applied. torsional load is applied.	SSP, SPR, SPB

**STRENGTH OF SPLINE SHAFT**

The ball spline has larger load ratings compared to ball bush. Also, the ball spline can sustain radial load, moment (bending moment) and torque (twisting moment) at the same time. Thus, it is necessary to consider the strength of ball spline shaft.

Using the following equations, select the size of ball spline.

$$\sigma \geq \frac{M}{Z} \dots\dots\dots (1)$$

$\sigma$ : permissible bending stress of spline shaft(98N/mm<sup>2</sup>)  
 M: bending moment onto spline shaft(N·mm)  
 Z: modulus of section(mm<sup>3</sup>)  
 (refer to Table B-10 on page B-9)

**Twisting Moment Only**

$$\tau_a \geq \frac{T}{Z_p} \dots\dots\dots (2)$$

$\tau_a$ : permissible twisting stress of spline shaft(49N/mm<sup>2</sup>)  
 T: twisting moment onto spline shaft(N·mm)  
 Z<sub>p</sub>: polar modulus of section(mm<sup>3</sup>)  
 (refer to Table B-10 on page B-9)

**Bending Moment and Twisting Moment Combined**

Calculate equivalent bending moment (Me) by using equation (3).Then, substitute Me into equation (1) for shaft size selection.

$$M_e = \frac{1}{2} \{M + \sqrt{(M^2 + T^2)}\} \dots\dots\dots (3)$$

Me: equivalent bending moment(N·mm)  
 M: bending moment onto spline shaft(N·mm)  
 T: twisting moment onto spline shaft(N·mm)

**Rigidity of Spline Shaft**

The rigidity of spline shaft is expressed in the torsional angle ( $\theta$ ) caused by twisting moment. For high accuracy smooth motion, it is necessary to keep the torsional angle within 0.25° per 1,000mm.

$$\theta = \frac{T \cdot L}{G \cdot I_p} \cdot \frac{360}{2\pi} \dots\dots\dots (4)$$

$$\text{Rigidity} = 0.25^\circ \geq \frac{1,000}{L} \theta \dots\dots\dots (5)$$

$\theta$ : torsional angle(°)  
 T: twisting moment onto spline shaft(N·mm)  
 L: spline shaft length(mm)  
 G: shearing modulus(SUJ2) 7.9×10<sup>4</sup>(N/mm<sup>2</sup>)  
 (SUS) 7.69×10<sup>4</sup>(N/mm<sup>2</sup>)  
 I<sub>p</sub>: polar moment of inertia of area(mm<sup>4</sup>)  
 (refer to Table B-10 on page B-9)

Figure B-4 Bending Moment

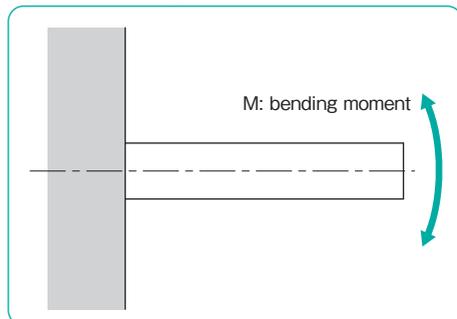


Figure B-5 Twisting Moment

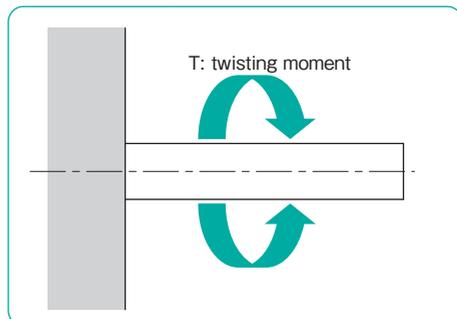


Figure B-6 Deformation of Spline Shaft by Twisting Moment

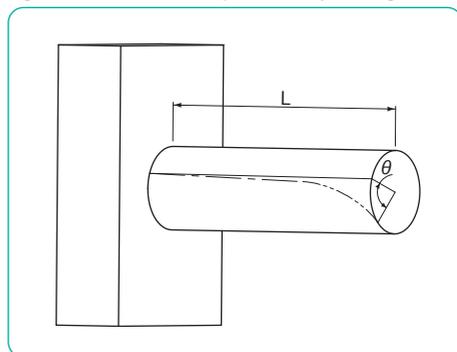


Table B-10 (1) Cross-sectional Characteristics of Spline Shaft (1)

part number	lx moment of inertia of area mm <sup>4</sup>	ly moment of inertia of area mm <sup>4</sup>	Zx modulus of section mm <sup>3</sup>	Zy modulus of section mm <sup>3</sup>
SSP 4	1.17×10 <sup>1</sup>	1.23×10 <sup>1</sup>	5.90	6.15
SSP 6	5.91×10 <sup>1</sup>	6.20×10 <sup>1</sup>	1.97×10 <sup>1</sup>	2.07×10 <sup>1</sup>
SSP 8	1.90×10 <sup>2</sup>	1.97×10 <sup>2</sup>	4.76×10 <sup>1</sup>	4.94×10 <sup>1</sup>
SSP 10	4.60×10 <sup>2</sup>	4.81×10 <sup>2</sup>	9.22×10 <sup>1</sup>	9.62×10 <sup>1</sup>
SSP 13A	1.31×10 <sup>3</sup>	1.38×10 <sup>3</sup>	2.03×10 <sup>2</sup>	2.13×10 <sup>2</sup>
SSP 16A	2.98×10 <sup>3</sup>	3.16×10 <sup>3</sup>	3.73×10 <sup>2</sup>	3.96×10 <sup>2</sup>
SSP 20A	7.35×10 <sup>3</sup>	7.74×10 <sup>3</sup>	7.36×10 <sup>2</sup>	7.74×10 <sup>2</sup>
SSP 25A	1.79×10 <sup>4</sup>	1.88×10 <sup>4</sup>	1.43×10 <sup>3</sup>	1.51×10 <sup>3</sup>
SSP 30A	3.65×10 <sup>4</sup>	3.94×10 <sup>4</sup>	2.44×10 <sup>3</sup>	2.63×10 <sup>3</sup>
SSP 40A	1.14×10 <sup>5</sup>	1.24×10 <sup>5</sup>	5.73×10 <sup>3</sup>	6.24×10 <sup>3</sup>
SSP 50A	2.80×10 <sup>5</sup>	3.04×10 <sup>5</sup>	1.12×10 <sup>4</sup>	1.22×10 <sup>4</sup>
SSP 60A	5.90×10 <sup>5</sup>	6.32×10 <sup>5</sup>	1.97×10 <sup>4</sup>	2.11×10 <sup>4</sup>
SSP 80A	1.93×10 <sup>6</sup>	1.99×10 <sup>6</sup>	4.83×10 <sup>4</sup>	4.98×10 <sup>4</sup>
SSP 80AL				
SSP100A	4.68×10 <sup>6</sup>	4.86×10 <sup>6</sup>	9.38×10 <sup>4</sup>	9.72×10 <sup>4</sup>
SSP100AL				
SSP 20	5.03×10 <sup>3</sup>	5.35×10 <sup>3</sup>	5.54×10 <sup>2</sup>	5.89×10 <sup>2</sup>
SSP 25	1.27×10 <sup>4</sup>	1.36×10 <sup>4</sup>	1.10×10 <sup>3</sup>	1.19×10 <sup>3</sup>
SSP 30	2.74×10 <sup>4</sup>	2.99×10 <sup>4</sup>	1.96×10 <sup>3</sup>	2.14×10 <sup>3</sup>
SSP 40	8.70×10 <sup>4</sup>	9.52×10 <sup>4</sup>	4.66×10 <sup>3</sup>	5.09×10 <sup>3</sup>
SSP 50	2.15×10 <sup>5</sup>	2.37×10 <sup>5</sup>	9.19×10 <sup>3</sup>	1.01×10 <sup>4</sup>
SSP 60	4.49×10 <sup>5</sup>	4.95×10 <sup>5</sup>	1.59×10 <sup>4</sup>	1.76×10 <sup>4</sup>
SSP 4AM	1.18×10 <sup>1</sup>	1.26×10 <sup>1</sup>	6.01	6.28
SSP 5AM	2.77×10 <sup>1</sup>	3.00×10 <sup>1</sup>	1.11×10 <sup>1</sup>	1.20×10 <sup>1</sup>
SSP 6AM	5.89×10 <sup>1</sup>	6.26×10 <sup>1</sup>	1.96×10 <sup>1</sup>	2.09×10 <sup>1</sup>
SSP 8AM	1.88×10 <sup>2</sup>	1.98×10 <sup>2</sup>	4.71×10 <sup>1</sup>	4.96×10 <sup>1</sup>
SSP10AM	4.53×10 <sup>2</sup>	4.82×10 <sup>2</sup>	9.06×10 <sup>1</sup>	9.65×10 <sup>1</sup>

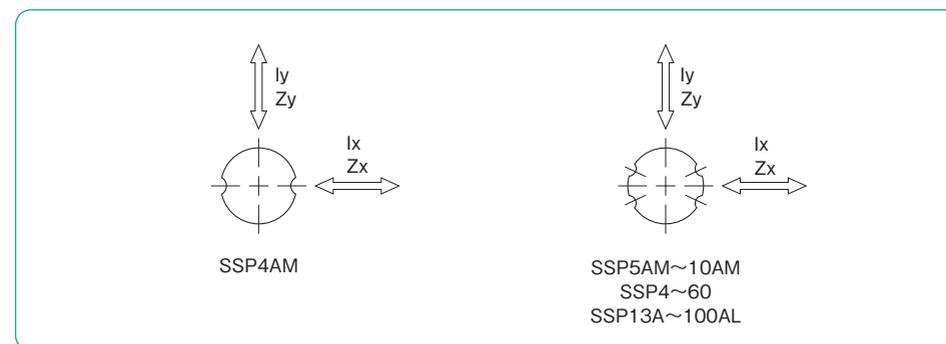


Table B-10 (2) Cross-sectional Characteristics of Spline Shaft (2)

part number	I <sub>P</sub> polar moment of inertia of area mm <sup>4</sup>	Z <sub>P</sub> polar modulus of section mm <sup>3</sup>	C=1/48EI	
			SUJ2 1/N · mm <sup>2</sup>	equivalent to SUS440C
SSP 4	2.41 × 10 <sup>1</sup>	1.20 × 10 <sup>1</sup>	8.57 × 10 <sup>-9</sup>	8.83 × 10 <sup>-9</sup>
SSP 6	1.21 × 10 <sup>2</sup>	4.04 × 10 <sup>1</sup>	1.71 × 10 <sup>-9</sup>	1.76 × 10 <sup>-9</sup>
SSP 8	3.88 × 10 <sup>2</sup>	9.69 × 10 <sup>1</sup>	5.32 × 10 <sup>-10</sup>	5.47 × 10 <sup>-10</sup>
SSP 10	9.42 × 10 <sup>2</sup>	1.88 × 10 <sup>2</sup>	2.19 × 10 <sup>-10</sup>	2.26 × 10 <sup>-10</sup>
SSP 13A	2.70 × 10 <sup>3</sup>	4.16 × 10 <sup>2</sup>	7.66 × 10 <sup>-11</sup>	7.89 × 10 <sup>-11</sup>
SSP 16A	6.15 × 10 <sup>3</sup>	7.68 × 10 <sup>2</sup>	3.39 × 10 <sup>-11</sup>	3.49 × 10 <sup>-11</sup>
SSP 20A	1.51 × 10 <sup>4</sup>	1.51 × 10 <sup>3</sup>	1.38 × 10 <sup>-11</sup>	1.42 × 10 <sup>-11</sup>
SSP 25A	3.68 × 10 <sup>4</sup>	2.94 × 10 <sup>3</sup>	5.65 × 10 <sup>-12</sup>	5.82 × 10 <sup>-12</sup>
SSP 30A	7.57 × 10 <sup>4</sup>	5.05 × 10 <sup>3</sup>	2.79 × 10 <sup>-12</sup>	—
SSP 40A	2.39 × 10 <sup>5</sup>	1.20 × 10 <sup>4</sup>	8.83 × 10 <sup>-13</sup>	—
SSP 50A	5.86 × 10 <sup>5</sup>	2.34 × 10 <sup>4</sup>	3.60 × 10 <sup>-13</sup>	—
SSP 60A	1.22 × 10 <sup>6</sup>	4.08 × 10 <sup>4</sup>	1.71 × 10 <sup>-13</sup>	—
SSP 80A	3.92 × 10 <sup>6</sup>	9.81 × 10 <sup>4</sup>	5.24 × 10 <sup>-14</sup>	—
SSP 80AL				
SSP100A	9.55 × 10 <sup>6</sup>	1.91 × 10 <sup>5</sup>	2.16 × 10 <sup>-14</sup>	—
SSP100AL				
SSP 20	1.04 × 10 <sup>4</sup>	1.14 × 10 <sup>3</sup>	2.01 × 10 <sup>-11</sup>	2.07 × 10 <sup>-11</sup>
SSP 25	2.63 × 10 <sup>4</sup>	2.29 × 10 <sup>3</sup>	7.97 × 10 <sup>-12</sup>	8.21 × 10 <sup>-12</sup>
SSP 30	5.73 × 10 <sup>4</sup>	4.10 × 10 <sup>3</sup>	3.69 × 10 <sup>-12</sup>	—
SSP 40	1.82 × 10 <sup>5</sup>	9.75 × 10 <sup>3</sup>	1.16 × 10 <sup>-12</sup>	—
SSP 50	1.01 × 10 <sup>5</sup>	1.93 × 10 <sup>4</sup>	4.69 × 10 <sup>-13</sup>	—
SSP 60	9.46 × 10 <sup>5</sup>	3.35 × 10 <sup>4</sup>	2.25 × 10 <sup>-13</sup>	—
SSP 4AM	2.44 × 10 <sup>1</sup>	1.23 × 10 <sup>1</sup>	8.56 × 10 <sup>-9</sup>	8.82 × 10 <sup>-9</sup>
SSP 5AM	5.77 × 10 <sup>1</sup>	2.31 × 10 <sup>1</sup>	3.65 × 10 <sup>-9</sup>	3.76 × 10 <sup>-9</sup>
SSP 6AM	1.22 × 10 <sup>2</sup>	4.05 × 10 <sup>1</sup>	1.72 × 10 <sup>-9</sup>	1.77 × 10 <sup>-9</sup>
SSP 8AM	3.86 × 10 <sup>2</sup>	9.66 × 10 <sup>1</sup>	5.37 × 10 <sup>-10</sup>	5.53 × 10 <sup>-10</sup>
SSP10AM	9.35 × 10 <sup>2</sup>	1.87 × 10 <sup>2</sup>	2.23 × 10 <sup>-10</sup>	2.30 × 10 <sup>-10</sup>

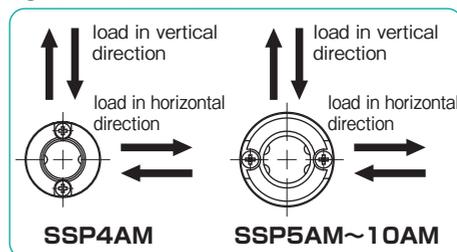
**LOAD RATING**

The load rating for SSP-AM type depends on the direction of load.

Table B-11 LOAD RATING

		SSP4AM	SSP5AM~10AM
basic dynamic load rating	vertical	C	C
	horizontal	1.73×C	1.22×C
basic static load rating	vertical	C <sub>0</sub>	C <sub>0</sub>
	horizontal	1.73×C <sub>0</sub>	1.22×C <sub>0</sub>

Figure B-7 Load Direction



**CALCULATION OF DEFLECTION AND DEFLECTION ANGLE OF SPLINE SHAFT**

The following formulas are used to obtain the deflection and its angle of the ball spline shaft. Typical conditions are listed in Table B-12.

Table B-12 Formulas for Calculating Deflection and Deflection Angle

support method	specification	formula for deflection	formula for deflection angle
1 support   support		$\delta_{\max} = \frac{P\ell^3}{48EI} = P\ell^3C$	$i_1 = 0$ $i_2 = \frac{P\ell^2}{16EI} = 3P\ell^2C$
2 fixed   fixed		$\delta_{\max} = \frac{P\ell^3}{192EI} = \frac{1}{4}P\ell^3C$	$i_1 = 0$ $i_2 = 0$
3 support   support		$\delta_{\max} = \frac{5p\ell^4}{384EI} = \frac{5}{8}p\ell^4C$	$i_2 = \frac{p\ell^3}{24EI} = 2p\ell^3C$
4 fixed   fixed		$\delta_{\max} = \frac{p\ell^4}{384EI} = \frac{1}{8}p\ell^4C$	$i_2 = 0$
5 support   support		$\delta_1 = \frac{Pa^3}{6EI} \left(2 + \frac{3b}{a}\right) = 8Pa^3 \left(2 + \frac{3b}{a}\right)C$ $\delta_{\max} = \frac{Pa^3}{24EI} \left(\frac{3\ell^2}{a^2} - 4\right) = 2Pa^3 \left(\frac{3\ell^2}{a^2} - 4\right)C$	$i_1 = \frac{Pab}{2EI} = 2PabC$ $i_2 = \frac{Pa(a+b)}{2EI} = 2Pa(a+b)C$
6 fixed   fixed		$\delta_1 = \frac{Pa^3}{6EI} \left(2 - \frac{3a}{\ell}\right) = 8Pa^3 \left(2 - \frac{3a}{\ell}\right)C$ $\delta_{\max} = \frac{Pa^3}{24EI} \left(2 + \frac{3b}{a}\right) = 2Pa^3 \left(2 + \frac{3b}{a}\right)C$	$i_1 = \frac{Pa^2b}{2EI\ell} = \frac{24Pa^2bC}{\ell}$ $i_2 = 0$
7 fixed   free		$\delta_{\max} = \frac{P\ell^3}{3EI} = 16P\ell^3C$	$i_1 = \frac{P\ell^2}{2EI} = 24P\ell^2C$ $i_2 = 0$
8 fixed   free		$\delta_{\max} = \frac{p\ell^4}{8EI} = 6p\ell^4C$	$i_1 = \frac{p\ell^3}{6EI} = 8p\ell^3C$ $i_2 = 0$
9 support   support		$\delta_{\max} = \frac{\sqrt{3}Mo\ell^2}{216EI} = \frac{2\sqrt{3}}{9}Mo\ell^2C$	$i_1 = \frac{Mo\ell}{12EI} = 4Mo\ell C$ $i_2 = \frac{Mo\ell}{24EI} = 2Mo\ell C$
10 fixed   fixed		$\delta_{\max} = \frac{Mo\ell^2}{216EI} = \frac{2}{9}Mo\ell^2C$	$i_1 = \frac{Mo\ell}{16EI} = 3Mo\ell C$ $i_2 = 0$

$\delta_1$ : deflection at the concentrated load point (mm)  $\delta_{\max}$ : maximum deflection (mm)  $i_1$ : deflection angle at the concentrated load point (rad)  $i_2$ : deflection angle at the support point (rad)  $Mo$ : moment (N · mm)  $P$ : concentrated load (N)  $p$ : uniformly distributed load (N/mm)  $a, b$ : concentrated load point distance (mm)  $\ell$ : span (mm)  $I$ : moment of inertia of area (mm<sup>4</sup>) (refer to Table B-10 on page B-9)  $E$ : modulus of longitudinal elasticity (SUJ2)  $2.06 \times 10^5$  (N/mm<sup>2</sup>) (SUS)  $2.0 \times 10^5$  (N/mm<sup>2</sup>)  $C$ :  $1/48EI$  (1/N · mm<sup>2</sup>)

### ALLOWABLE ROTATIONAL SPEED OF SPLINE SHAFT

When the rotational speed is increased and approaches the spline shaft resonant frequency, the spline shaft is disabled from further operation. This speed is called the critical speed and can be obtained by the following equations. In order to leave a sufficient safety margin, the allowable operating speed should be set at about 80% of the calculated value.

Using the following equations, select the size of ball spline shaft. First, calculate  $\lambda$  and A by equation (2) and (3) then, substitute the values into equation (1).

$$N_c = 60 \cdot \frac{\lambda^2}{2\pi \cdot L^2} \cdot \sqrt{\frac{E \cdot I_d \times 10^3}{\gamma \cdot A}} \dots \dots \dots (1)$$

$N_c$ : critical speed (rpm)  
 $L$ : support distance (mm)  
 $E$ : modulus of longitudinal elasticity (SUJ2)  $2.06 \times 10^5$  (N/mm<sup>2</sup>)  
 (SUS)  $2.0 \times 10^5$  (N/mm<sup>2</sup>)  
 $\gamma$ : density (SUJ2)  $7.85 \times 10^{-6}$  (kg/mm<sup>3</sup>)  
 (SUS)  $7.75 \times 10^{-6}$  (kg/mm<sup>3</sup>)

$I_d$ : Minimum Moment of Inertia of Area (mm<sup>4</sup>)

$$I_d = \frac{\pi \cdot d^4}{64} \dots \dots \dots (2)$$

$d$ : maximum machined-down diameter with no spline grooves left (refer to Table B-13)

A: Minimum Cross-sectional Area of the Spline Shaft (mm<sup>2</sup>)

$$A = \frac{\pi \cdot d^2}{4} \dots \dots \dots (3)$$

$d$ : maximum machined-down diameter with no spline grooves left (refer to Table B-13)

$\lambda$ : coefficient of mounting method (refer to Figure B-8)

- fixed-free  $\lambda = 1.875$
- supported-supported  $\lambda = 3.142$
- fixed-supported  $\lambda = 3.927$
- fixed-fixed  $\lambda = 4.730$

Figure B-8 Mounting Method

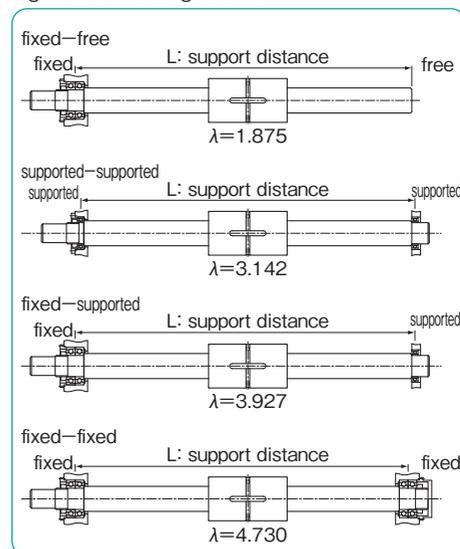
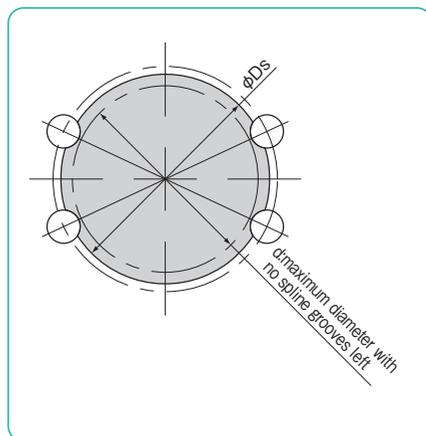


Table B-13 Spline Shaft Profile

part number	d: maximum diameter with no spline grooves left mm	part number	d: maximum diameter with no spline grooves left mm
SSP 4	3.5	SSP20	16.4
SSP 6	5.3	SSP25	20.6
SSP 8	7.2	SSP30	24.8
SSP 10	9	SSP40	33.1
SSP 13A	11.7	SSP50	41.4
SSP 16A	14.2	SSP60	49.7
SSP 20A	17.9		
SSP 25A	22.4	SSP 4AM	3.4
SSP 30A	26.8	SSP 5AM	4.3
SSP 40A	35.5	SSP 6AM	5.2
SSP 50A	44.6	SSP 8AM	7.1
SSP 60A	54	SSP10AM	8.8
SSP 80A			
SSP 80AL	73.9		
SSP100A			
SSP100AL	92		

The maximum diameter (d) is recommended as the shaft diameter of the support area leaving no spline grooves after end-machining.



### RATED LIFE CALCULATION

When the ball elements are used as the rolling elements in ball splines, the following equations are used to calculate the life of ball spline:

For radial load  $L = \left(\frac{f_c \cdot C}{f_w \cdot P}\right)^3 \cdot 50$       For torque load  $L = \left(\frac{f_c \cdot C_T}{f_w \cdot T}\right)^3 \cdot 50$

$L$ : rated life (km)     $f_c$ : contact coefficient     $f_w$ : load coefficient  
 $C$ : basic dynamic load rating (N)     $P$ : applied load (N)  
 $C_T$ : basic dynamic torque rating (N·m)     $T$ : applied torque (N·m)  
 \* Refer to page Eng-6 for the coefficients  
 \*\* The load rating of the commercial spline is approximately 70% of the standard ball spline.

$$L_h = \frac{L \cdot 10^6}{2 \cdot l_s \cdot n_1 \cdot 60}$$

$L_h$ : life time (hr)     $l_s$ : stroke length (mm)  
 $L$ : rated life (km)     $n_1$ : number of cycles per minute (cpm)

### MOUNTING

#### Fit between Spline Nut and Housing

A transition fit is used for the SSP/SSPM-type spline nut and its housing bore to minimize the clearance. If high accuracy is not required, then a clearance fit can be used. Regarding the SSPT/SSPF type spline nut, for a light load and little torque application a hole slightly larger than the outer diameter of the nut can suffice. The mounting surface for the flange influences the perpendicularity and parallelism. Please make sure that the accuracy of the mounting surface is correct.

#### Insertion of Spline Nut

When inserting a spline nut into the housing, use a jig like the one shown in Figure B-10. Carefully insert the nut so as to not hit the side ring and seal.

Table B-15 Recommended Jig Dimensions unit: mm

part number	D	d	part number	D	d
SSP 4	9.5	3.5	SSP20	31.5	16.5
SSP 6	13.5	5	SSP25	36.5	20.5
SSP 8	15.5	7	SSP30	44.5	25
SSP 10	20.5	8.5	SSP40	59.5	33
SSP 13A	23.5	12	SSP50	74	41
SSP 16A	30.5	14.5	SSP60	89	50
SSP 20A	34.5	18			
SSP 25A	41.5	22.5	SSP 4AM	7.5	3
SSP 30A	46.5	27	SSP 5AM	9.5	4
SSP 40A	63.5	35.6	SSP 6AM	11.5	5
SSP 50A	79	44	SSP 8AM	14.5	7
SSP 60A	89	53.5	SSP10AM	18.5	8.5
SSP 80A					
SSP 80AL	119	74			
SSP100A					
SSP100AL	149	92			

Figure B-9 Radial Load and Torque Load

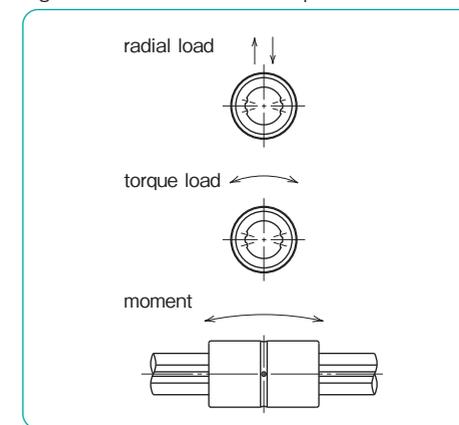
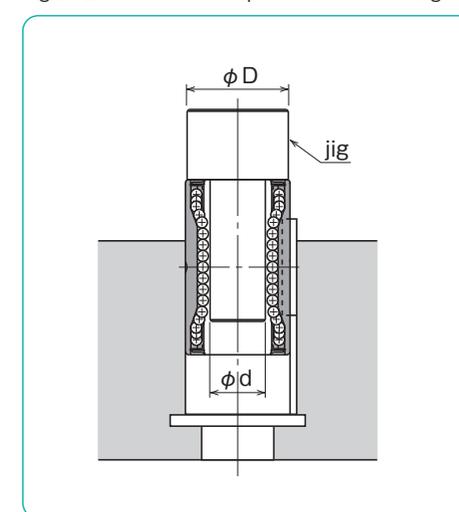


Table B-14 Fit for the Spline Nut

type of spline nut	clearance fit	transition fit
SSP	H7	J6
SSP-AM		
SSPM		

Figure B-10 Insertion of Spline Nut into Housing



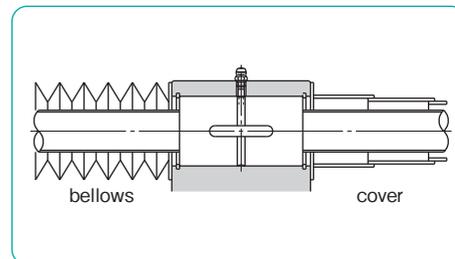
## OPERATING CONDITIONS

The performance of the ball spline is affected by the operating conditions of the application. The operating conditions should, therefore be carefully taken into consideration.

### Dust Prevention

Foreign particles or dust in the ball spline nut affects the motion accuracy and shortens the life time. Standard seals will perform well against dust prevention under normal operating conditions; however, in a harsh environment, it is necessary to attach bellows or protective covers. (refer to Figure B-11)

Figure B-11 Example of Dust Prevention



### Operating Temperature

Since the retainer is made of resin, the operating temperature should never exceed 80°C.

## LUBRICATION

The NB ball spline is prelubricated with lithium soap based grease prior to shipment for immediate use. Please re-lubricate with a similar type of grease periodically depending on the operating conditions.

Low dust generation grease is available from NB standard grease. (refer to page Eng-51)

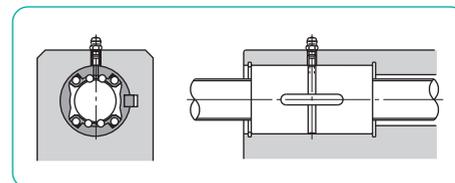
For use in special environments such as clean room and in vacuum, products without lubricant or with specified lubricant can be used depending on the situation. Please contact NB for further information.

A special syringe lubricant dispenser (refer to Figure page Eng-53) is available from NB as an option.

Please consider this for narrow spaces or when it is difficult to inject grease.

The NB ball spline has seals as standard. The seals work well to contain the grease inside the nut especially for the ground shaft, since the seal shape approximates the spline shaft profile.

Figure B-12 Example of Lubrication Mechanism

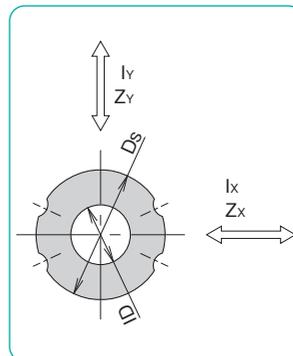


## HOLLOW SPLINE SHAFT

NB provides hollow shafts. It can be used for running cable, air piping, and weight reduction. Table B-16 shows the standard hollow shaft. If you are looking for a standard hollow shaft, specify the symbol "T" after the total length of the spline shaft in the part number. It is possible to manufacture the inner diameter different from the standard hollow shaft, if so please contact NB.

Table B-16 Standard Hollow Spline Shaft

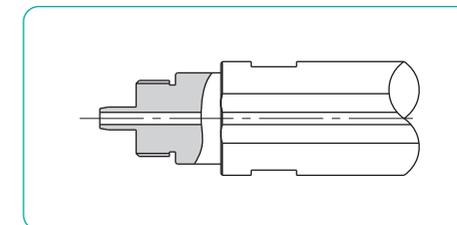
part number	shaft diameter Ds mm	inner diameter ID mm	moment of inertia of area		modulus of section	
			$I_x$ mm <sup>4</sup>	$I_y$ mm <sup>4</sup>	$Z_x$ mm <sup>3</sup>	$Z_y$ mm <sup>3</sup>
SSP 4	4	1.5	$1.15 \times 10^1$	$1.21 \times 10^1$	5.77	6.02
SSP 6	6	2	$5.83 \times 10^1$	$6.13 \times 10^1$	$1.94 \times 10^1$	$2.04 \times 10^1$
SSP 8	8	3	$1.86 \times 10^2$	$1.93 \times 10^2$	$4.66 \times 10^1$	$4.84 \times 10^1$
SSP 10	10	4	$4.48 \times 10^2$	$4.69 \times 10^2$	$8.97 \times 10^1$	$9.37 \times 10^1$
SSP 13A	13	6	$1.26 \times 10^3$	$1.32 \times 10^3$	$1.93 \times 10^2$	$2.03 \times 10^2$
SSP 16A	16	8	$2.78 \times 10^3$	$2.96 \times 10^3$	$3.48 \times 10^2$	$3.70 \times 10^2$
SSP 20A	20	10	$6.87 \times 10^3$	$7.25 \times 10^3$	$6.87 \times 10^2$	$7.25 \times 10^2$
SSP 25A	25	15	$1.54 \times 10^4$	$1.64 \times 10^4$	$1.23 \times 10^3$	$1.31 \times 10^3$
SSP 4AM	4	1.5	$1.16 \times 10^1$	$1.23 \times 10^1$	5.88	6.16
SSP 5AM	5	2	$2.69 \times 10^1$	$2.92 \times 10^1$	$1.08 \times 10^1$	$1.17 \times 10^1$
SSP 6AM	6	2	$5.82 \times 10^1$	$6.18 \times 10^1$	$1.94 \times 10^1$	$2.06 \times 10^1$
SSP 8AM	8	3	$1.84 \times 10^2$	$1.94 \times 10^2$	$4.61 \times 10^1$	$4.86 \times 10^1$
SSP 10AM	10	4	$4.40 \times 10^2$	$4.70 \times 10^2$	$8.81 \times 10^1$	$9.40 \times 10^1$



## SPECIAL REQUIREMENTS

Based on customer drawings and requirements NB offers shaft-end machining, spline nut machining, surface treatment, etc. Please contact NB for special requirements.

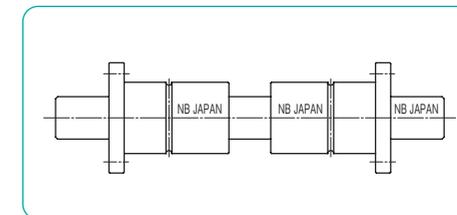
Figure B-13 Example of Shaft-end Machining



## NUT ORIENTATION

Unless otherwise specified, the orientation of two NB ball spline nuts SSPM, SSPF, SSPT and SSPT(K)-AM type is shown in Figure B-14. In other cases please specify the orientation of nut(s) with shaft.

Figure B-14 Nut Orientation and NB mark



## USE AND HANDLING PRECAUTIONS

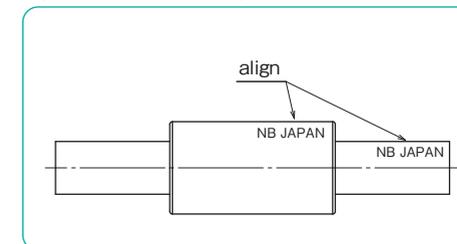
NB ball spline must be handled with care as it is a precise component. Please note the following points.

### A Set of Spline Nut and Spline Shaft

The ball spline's accuracy and preload is guaranteed when spline nut and shaft are aligned as shown in Figure B-15. Please make sure to align the NB marks when reinserting the shaft.

When inserting the spline shaft into the spline nut, ensure that the ball elements do not drop out. This is done by aligning the raceway grooves of the shaft with the rows of ball elements and the seal lip of the nut. Then, carefully insert the spline shaft through the spline nut. In case that the nut is preloaded, please exercise additional care.

Figure B-15 NB mark Alignment



### Excessive Moment

One spline nut can sustain high moments, however, excessive moment makes the spline nut unbalanced and unstable during motion. Please use more than one spline nut for high moment or high accuracy applications.

MOUNTING

Mounting of SSP Type

Examples of installing the SSP type are shown in Figures B-16 and B-17.

Figure B-16 Using a Retaining Ring

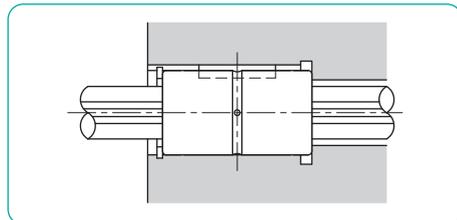
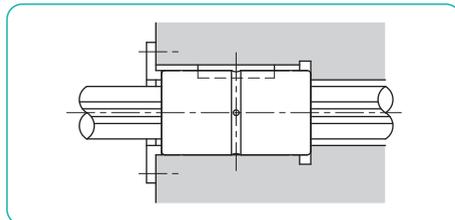


Figure B-17 Using a Push Plate



Key

The SSP and SSP-AM type spline nut come with a key shown in Figure B-18.

Figure B-18 Key for SSP Type

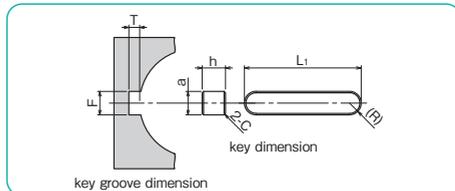


Table B-17 Major Dimensions of Key and Key Groove

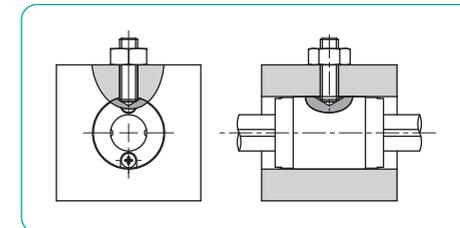
part number	key dimensions						recommended key groove dimensions			
	a mm	tolerance μm	h mm	tolerance μm	L <sub>1</sub> mm	C mm	F mm	tolerance μm	T mm	tolerance mm
SSP 4	2		2		6		2		1	
SSP 6	2.5	+16 + 6	2.5	0 -25	10.5	0.2	2.5	+21 +11	1.5	+0.1 0
SSP 8	2.5		2.5		10.5		2.5		1.5	
SSP 10	3		3		13		3		1.7	
SSP 13A	3		3		15		3		1.7	
SSP 16A	3.5	+24 +12	3.5	0 -30	17.5		3.5	+30 +18	1.8	+0.2 0
SSP 20A	4		4		29	0.5	4		1.8	
SSP 25A	4		4		36	0.3	4		1.8	
SSP 30A	4		4		42	0.5	4		1.8	
SSP 40A	6		6		52	0.5	6		2.8	
SSP 50A	8	+30/+15	7	0 -36	58	0.5	8	+37.5/+22.5	3.3	+0.2 0
SSP 60A	12		8		67	0.8	12		3.3	
SSP 80A	16	+36 +18	10		76	0.5	16	+45 +27	4.3	
SSP 80AL					110		4.3			
SSP100A	20	+43 +22	13	0 -43	110	0.8	20	+53.5 +32.5	6.4	
SSP100AL					160		6.4			
SSP 20	4	+24	4	0	26	0.2	4	+30	1.8	+0.1
SSP 25	5	+12	5	-30	33	0.3	5	+18	2.3	0
SSP 30	7	+30	7		41	0.3	7	+37.5	3.3	
SSP 40	10	+15	8	0	55	0.5	10	+22.5	3.8	+0.2
SSP 50	15	+36	10	-36	60	0.5	15	+45	5.3	0
SSP 60	18	+18	11	0/-43	68	0.5	18	+27	5.4	
SSP 5AM	2	+16 + 6	2	0 -25	6	0.2	2	+21 +11	1	+0.1 0
SSP 6AM	2		2		8		2		1	
SSP 8AM	2.5		2.5		8.5		2.5		1.5	
SSP10AM	3		3		11		3		1.7	

For anti-corrosion specification, the material of the key is stainless steel.

Mounting of SSP4AM Type

Example of installing the SSP4AM type are shown in Figure B-19. M2 screw is used for mounting. In process of mounting, please be careful with spline nut.

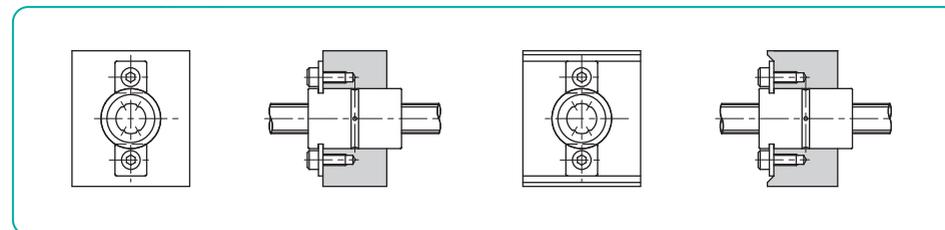
Figure B-19 Mounting of SSP4AM Type



Mounting of SSPM Type

Examples of installing the SSPM type are shown in Figures B-20~25.

Figure B-20 Using F Type Lock Plates



F Type Lock Plate (Standard Plate)

The lock plate shown in Figure B-21 is provided with the SSPM spline nut. Material: SUS304CSP

Table B-18 F Type Lock Plate

part number	K mm	G mm	t mm	R mm	applicable spline nut
FP 6	6.8	2.9	1.0	0.5	SSPM 6
FP 8	8.5	3.5	1.2	0.5	SSPM 8
FP10	8.5	3.5	1.2	0.5	SSPM10

Figure B-21 F Type Lock Plate

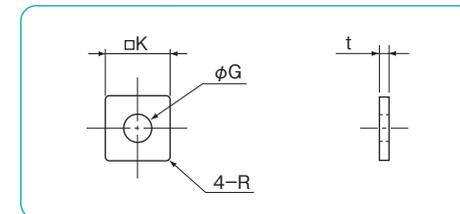
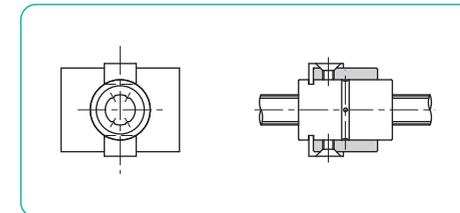


Figure B-22 Using LP Type Lock Plates



**LP Type Lock Plate (Optional Plate)**

The LP type lock plate is also available for purchase with the SSPM spline nut.

Material: SUS304CSP

Figure B-23 LP Type Lock Plate

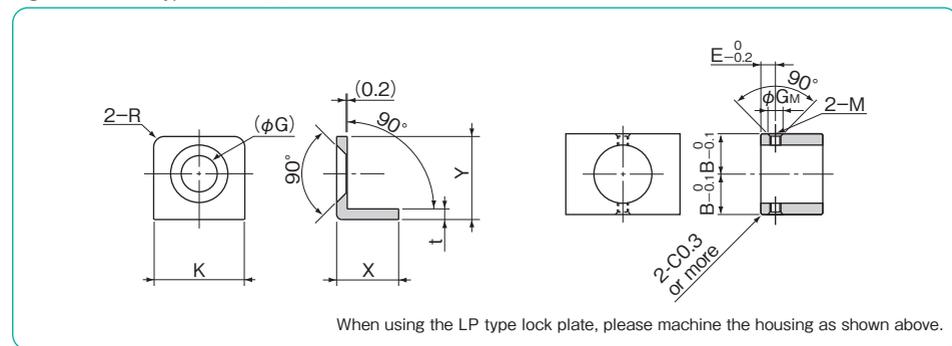


Table B-19 LP Type Lock Plate

part number	lock plate major dimensions						machined housing dimensions				applicable spline nut
	K mm	G mm	t mm	R mm	X mm	Y mm	B mm	E mm	G <sub>M</sub> mm	M	
LP 6	8.6	3.8	1.0	1	5.85	7.8	11.1	3.3	3.5	M2.5	SSPM 6
LP 8	9.15	4.5	1.2	1	6.45	9.2	12.3	4.0	4.2	M3	SSPM 8
LP10	9.15	4.5	1.2	1	6.45	9.2	14.8	4.0	4.2	M3	SSPM10

Figure B-24 Using Special Lock Plates (1)

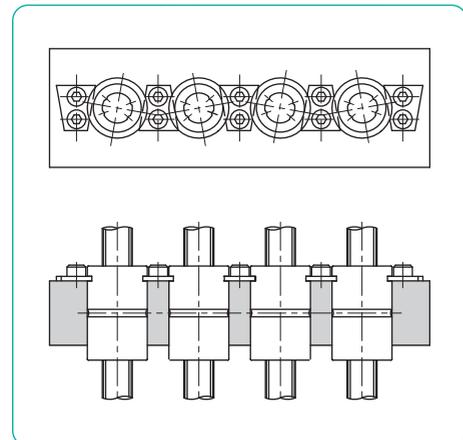
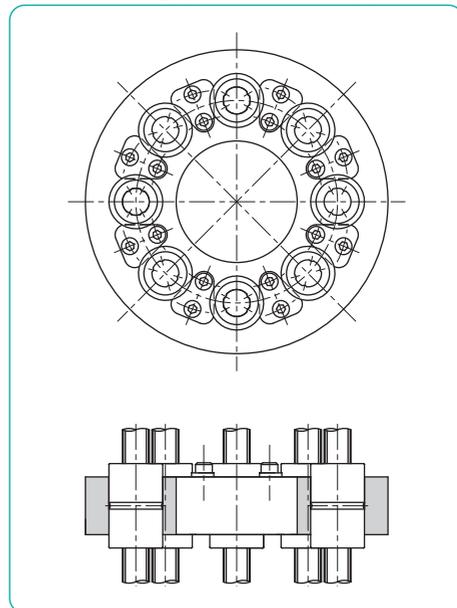


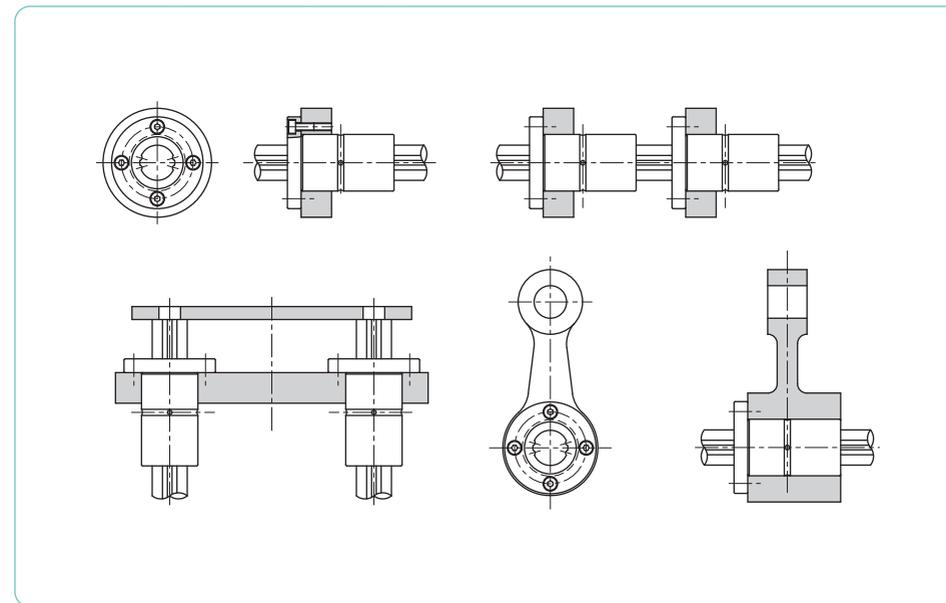
Figure B-25 Using Special Lock Plates (2)



**Mounting of SSPF Type**

Examples of installing the SSPF type are shown in Figure B-26.

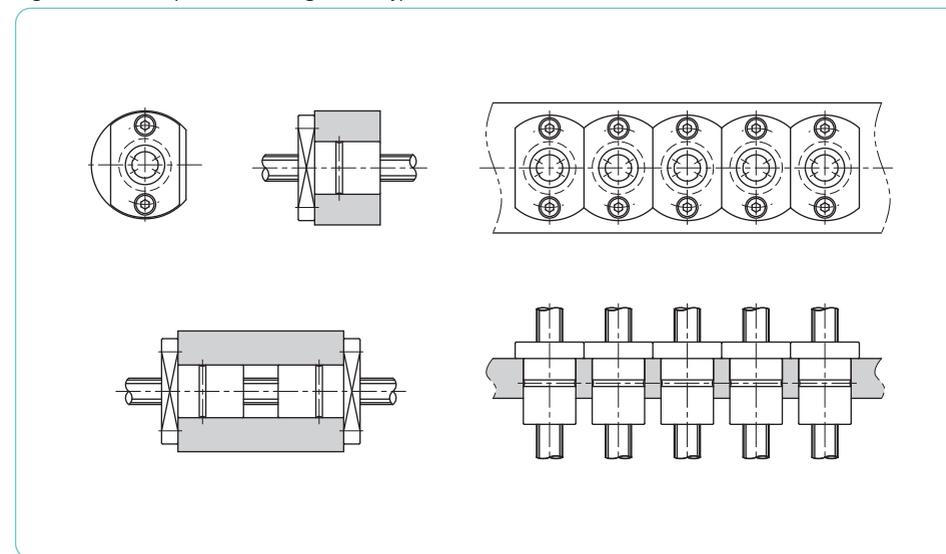
Figure B-26 Examples of installing SSPF Type



**Mounting of SSPT Type**

Examples of installing SSPT type are shown in Figure B-27.

Figure B-27 Examples of installing SSPT Type



# SSP TYPE

— Cylindrical Spline Nut —



## part number structure

example **SSP 25A -1 T1-450 T -P -LB -KGLA /CU**

example **SSP 80A L -2 T1-600 -P -LB -KGLA /CU**

specification  
 SSP: standard  
 SSPS: anti-corrosion

nominal diameter

nut length\*1  
 blank: standard  
 L: long

number of nuts attached to one shaft

preload symbol  
 blank: standard  
 T1: light  
 T2: medium

spline shaft total length

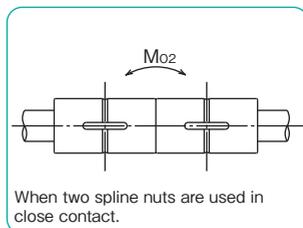
with special specification  
 grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

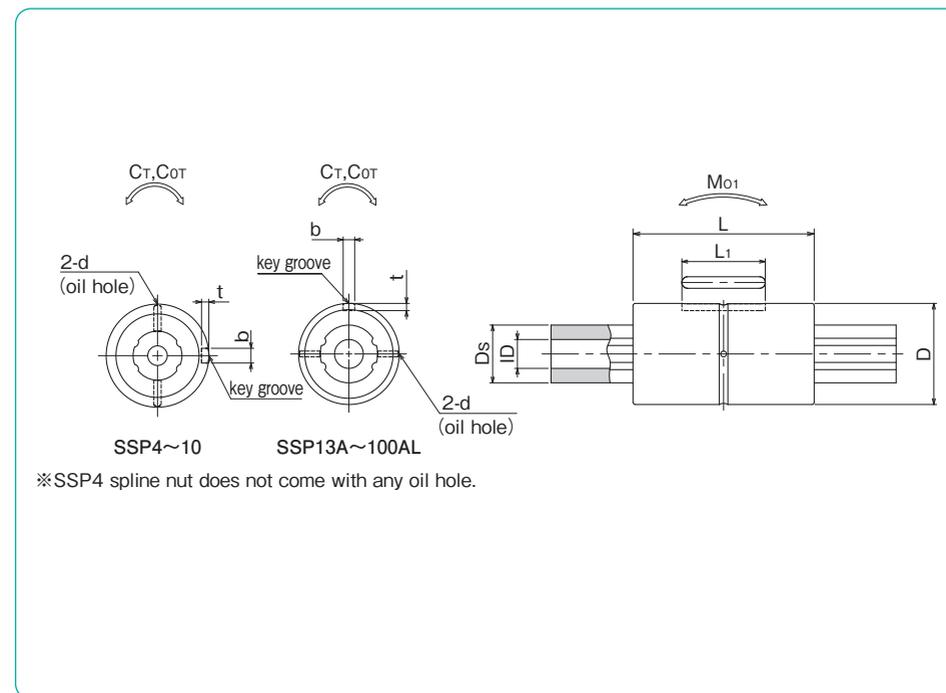
accuracy grade  
 blank: high  
 P: precision

hollow spline shaft  
 (not available in stainless steel)  
 blank: standard shaft  
 T: standard hollow shaft\*2

\*1: only for 80A, 100A  
 \*2: For standard hollow shafts, refer to P.B-14 for specifications.



When two spline nuts are used in close contact.



part number		D mm	tolerance μm	L mm	tolerance mm	major dimensions			L <sub>1</sub> mm	d mm
standard	anti-corrosion					b mm	tolerance μm	t mm		
SSP 4	SSPS 4	10	0/-9	16	2	2	1.2	6	—	
SSP 6	SSPS 6	14	0	25	2.5	+14	1.2	10.5	1	
SSP 8	SSPS 8	16	-11	25	2.5	0	1.2	10.5	1.5	
SSP 10	SSPS10	21	0	33	3	0	1.5	13	1.5	
SSP 13A	SSPS13A	24	-13	36	3	-0.2	1.5	15	1.5	
SSP 16A	SSPS16A	31	0	50	3.5	0	2	17.5	2	
SSP 20A	SSPS20A	35	0	63	4	+18	2.5	29	2	
SSP 25A	SSPS25A	42	-16	71	4	0	2.5	36	3	
SSP 30A	—	47	0	80	4	0	2.5	42	3	
SSP 40A	—	64	0	100	6	0	3.5	52	4	
SSP 50A	—	80	-19	125	8	+22/0	4	58	4	
SSP 60A	—	90	0	140	12	+27	5	67	4	
SSP 80A	—	120	-22	160	16	0	6	76	5	
SSP 80AL	—	120	0	217	16	0	6	110	5	
SSP100A	—	150	0	185	20	+33	7	110	5	
SSP100AL	—	150	-25	248	20	0	7	160	5	
SSP 20	SSPS20	32	0	60	4	+18	2.5	26	2	
SSP 25	SSPS25	37	-16	70	5	0	3	33	3	
SSP 30	—	45	0	80	7	+22	4	41	3	
SSP 40	—	60	0	100	10	0	4.5	55	4	
SSP 50	—	75	-19	112	15	+27	5	60	4	
SSP 60	—	90	0/-22	127	18	0	6	68	4	

SSP type spline nut comes with a key (refer to page B-16).

D <sub>s</sub> mm	tolerance μm	ID (inner diameter) mm	basic torque rating		basic load rating		allowable static moment		mass		size
			dynamic C <sub>T</sub> N·m	static C <sub>0T</sub> N·m	dynamic C kN	static C <sub>0</sub> kN	Mo <sub>1</sub> N·m	Mo <sub>2</sub> N·m	nut kg	shaft kg/m	
4	0	1.5	0.74	1.05	0.86	1.22	1.97	10.3	0.0065	0.10	4
6	-12	2	1.5	2.4	1.22	2.28	5.1	40	0.019	0.21	6
8	0	3	2.1	3.7	1.45	2.87	7.4	50	0.023	0.38	8
10	-15	4	4.4	8.2	2.73	5.07	18.0	116	0.054	0.60	10
13	0	6	21	39.2	2.67	4.89	13.7	109	0.07	1.0	13A
16	-18	8	60	110	6.12	11.2	46	299	0.15	1.5	16A
20	0	10	105	194	8.9	16.3	110	560	0.22	2.4	20A
25	-21	15	189	346	12.8	23.4	171	1,020	0.33	3.7	25A
30	0	—	307	439	18.6	23.2	181	1,470	0.36	5.38	30A
40	0	—	674	934	30.8	37.5	358	2,940	0.95	9.55	40A
50	-25	—	1,290	2,950	40.3	64.9	690	4,080	1.9	15.0	50A
60	0	—	1,570	3,420	47.7	79.5	881	5,470	2.3	21.6	60A
80	-30	—	4,500	6,460	92.8	108	1,990	10,500	6.4	39	80A
			5,980	9,690	123	162	4,310	20,980	9.1		80AL
100	0	—	9,180	12,000	151	160	3,350	18,200	11.2	61	100A
	-35	—	12,100	18,000	200	240	7,210	35,600	15.8		100AL
18.2	0	—	83	133	7.84	11.3	63	500	0.2	2.0	20
23	-21	—	162	239	12.3	16.1	104	830	0.22	3.1	25
28	0	—	289	412	18.6	23.2	181	1,470	0.35	4.8	30
37.4	0	—	637	882	30.8	37.5	358	2,940	0.81	8.6	40
47	-25	—	1,390	3,180	46.1	74.2	696	4,400	1.5	13.1	50
56.5	0/-30	—	2,100	4,800	58.0	127	1,300	8,800	2.5	19	60

1kN≒102kgf 1N·m≒0.102kgf·m

# SSP-AM TYPE

– Light and Compact Type –

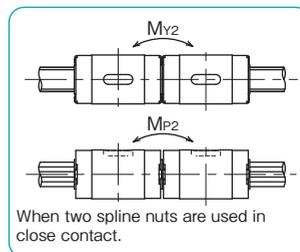


## part number structure

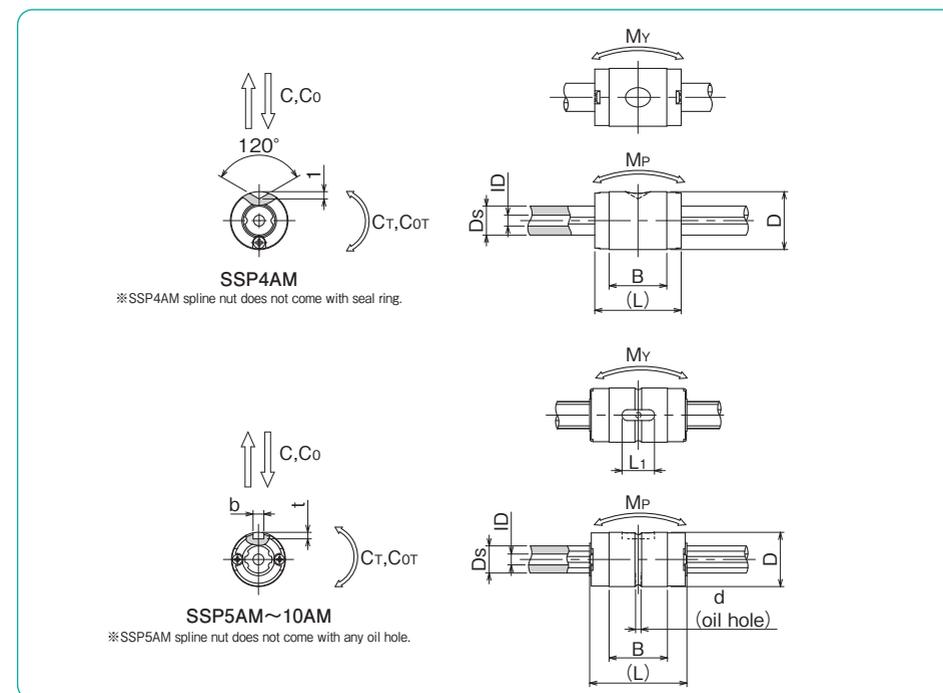
example **SSP 8 AM - 1 - T1 - 450 T - P - LB - KGLA / CU**

specification SSP AM: standard SSPS AM: anti-corrosion	with special specification
nominal diameter	grease symbol (refer to page Eng-51) blank: standard grease -KGLA: lithium-based low dust generation grease -KGU: urea-based low dust generation grease -KGF: anti-fretting grease
number of nuts attached to one shaft	with low temperature black chrome treatment
preload symbol blank: standard T1: light	accuracy grade blank: high P: precision
spline shaft total length	
hollow spline shaft (not available in stainless steel) blank: standard shaft T: standard hollow shaft*	

\*For standard hollow shafts, refer to P.B-14 for specifications.  
Note:SSP(S)4AM does not come with side-seals.



When two spline nuts are used in close contact.



part number		major dimensions									
standard	anti-corrosion	D tolerance	L	B	b tolerance	t	L <sub>1</sub>	d	D <sub>s</sub>	h7 tolerance	
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
SSP 4AM	SSPS 4AM	8	12	8	—	—	—	—	—	4	
SSP 5AM	SSPS 5AM	10	18	10.8	2	1.2	6	—	5	0 -12	
SSP 6AM	SSPS 6AM	12	21	13	2	1.2	8	1	6	0	
SSP 8AM	SSPS 8AM	15	25	14.9	2.5	1.5	8.5	1.2	8	0	
SSP10AM	SSPS10AM	19	30	18	3	1.8	11	1.5	10	-15	

SSP (S) 5AM-10AM type spline nut come with a key (refer to page B-16).

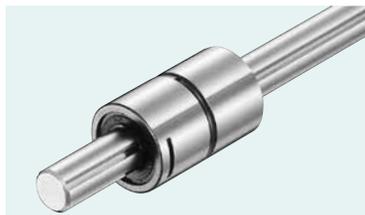
ID (inner diameter)	basic torque rating		basic load rating		allowable static moment		mass		size
	dynamic C <sub>T</sub>	static C <sub>0T</sub>	dynamic C	static C <sub>0</sub>	M <sub>P2</sub>	M <sub>Y2</sub>	nut	shaft	
mm	N · m	N · m	N	N	N · m	N · m	g	g/100mm	
1.5	0.72	1.00	314	438	0.59 3.36	1.03 5.82	2.5	9.7	<b>4AM</b>
2	2.33	4.05	825	1,160	2.10 13.4	2.56 16.3	5.1	14.9	<b>5AM</b>
2	2.95	5.27	890	1,290	2.55 16.5	3.11 20.1	9.2	21.6	<b>6AM</b>
3	5.85	9.83	1,330	1,810	4.11 27.8	5.00 33.8	15.8	38.4	<b>8AM</b>
4	12.4	19.4	2,270	2,870	7.84 52.5	9.53 63.9	30.7	59.8	<b>10AM</b>

Allowable static moment M<sub>P2</sub> and M<sub>Y2</sub> are the values when two spline nuts are used on close contact.

1kN≒102kgf 1N · m≒0.102kgf · m

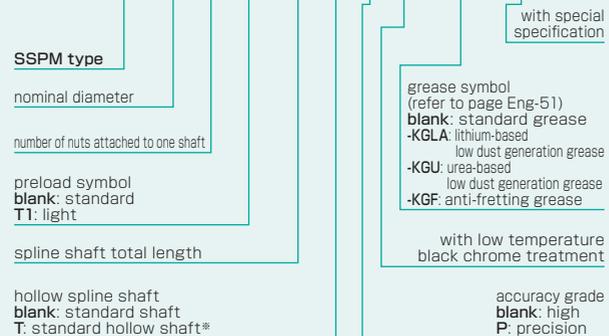
# SSPM TYPE

– Keyless Spline Nut –

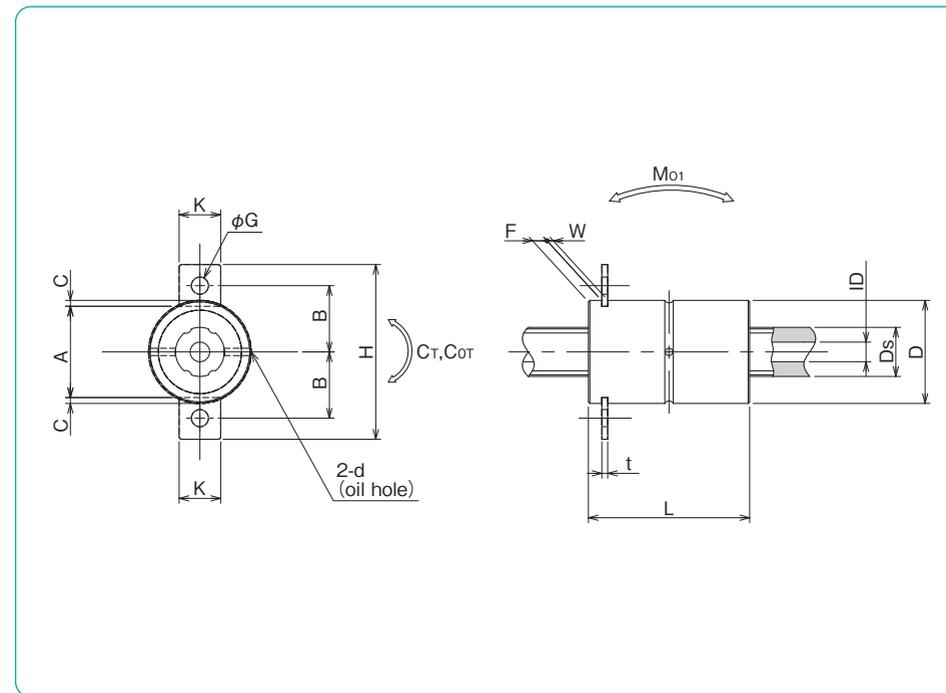
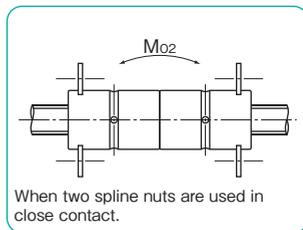


## part number structure

example **SSPM 10-2-T1-200 T-P-LB-KGLA /CU**



\*For standard hollow shafts, refer to P.B-14 for specifications.



part number	major dimensions											
	D mm	tolerance $\mu m$	L mm	tolerance mm	F mm	W mm	C mm	A mm	d mm	B mm	H mm	K mm
<b>SSPM 6</b>	14	0	25	0	2.2	1.1	1.0	12.0	1	9.4	25.6	6.8
<b>SSPM 8</b>	16	-11	25	-0.2	2.7	1.3	1.2	13.6	1.5	11	30.6	8.5
<b>SSPM10</b>	21	0/-13	33	-0.2	2.7	1.3	1.2	18.6	1.5	13.5	35.6	8.5

Two F type lock plates per SSPM type spline nut are provided (refer to page B-17).

G mm	t mm	D <sub>s</sub> mm	tolerance $\mu m$	ID (inner diameter) mm	basic torque rating		basic load rating		allowable static moment		mass		size
					dynamic C <sub>T</sub> N · m	static C <sub>OT</sub> N · m	dynamic C kN	static C <sub>o</sub> kN	static M <sub>O1</sub> N · m	static M <sub>O2</sub> N · m	nut kg	shaft kg/m	
2.9	1.0	6	0/-12	2	1.5	2.4	1.22	2.28	5.1	40	0.019	0.21	<b>6</b>
3.5	1.2	8	0	3	2.1	3.7	1.45	2.87	7.4	50	0.023	0.38	<b>8</b>
3.5	1.2	10	-15	4	4.4	8.2	2.73	5.07	18.0	116	0.054	0.60	<b>10</b>

1kN ≅ 102kgf 1N · m ≅ 0.102kgf · m

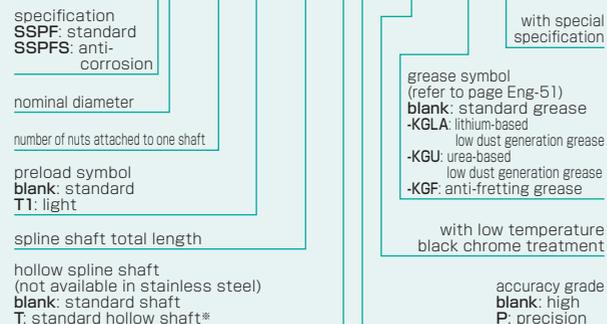
# SSPF TYPE

— Flange Type Nut —

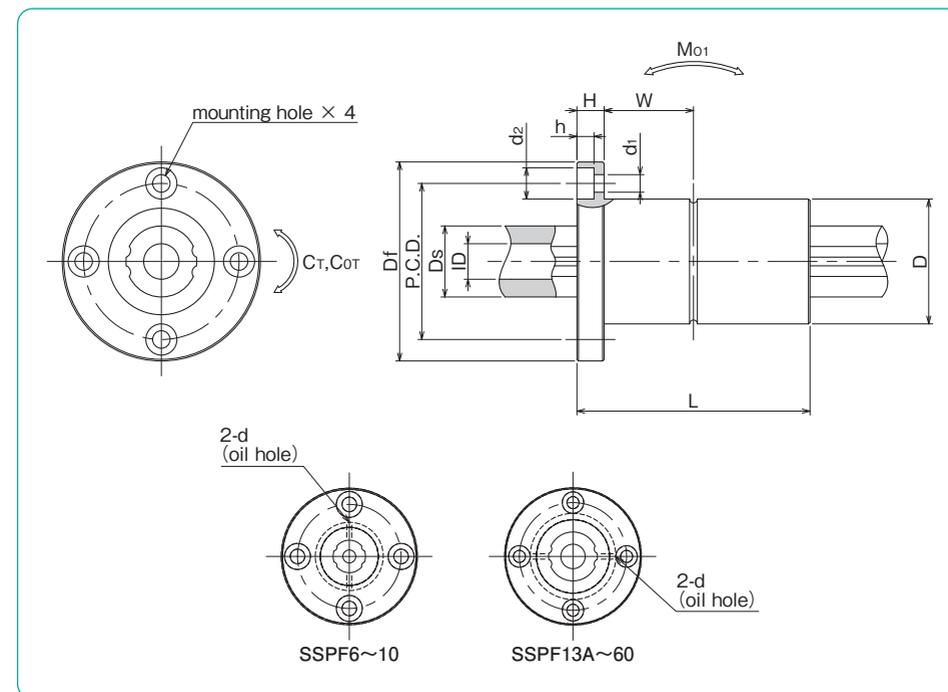
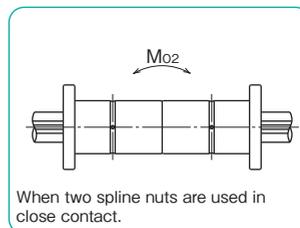


## part number structure

example **SSPF 25A - 2 - T1 - 450 T - P - LB - KGLA /CU**



\*For standard hollow shafts, refer to P.B-14 for specifications.



part number		D		L		major dimensions				
standard	anti-corrosion	mm	tolerance $\mu m$	mm	tolerance mm	Df mm	H mm	P.C.D. mm	$d_1 \times d_2 \times h$ mm	W mm
SSPF 6	SSPFS 6	14	0	25		30	5	22	3.4×6.5×3.3	7.5
SSPF 8	SSPFS 8	16	-11	25		32	5	24	3.4×6.5×3.3	7.5
SSPF10	SSPFS10	21	0	33	0	42	6	32	4.5×8×4.4	10.5
SSPF13A	SSPFS13A	24	-13	36	-0.2	43	7	33	4.5×8×4.4	11
SSPF16A	SSPFS16A	31		50		50	7	40	4.5×8×4.4	18
SSPF20A	SSPFS20A	35	0	63		58	9	45	5.5×9.5×5.4	22.5
SSPF25A	SSPFS25A	42	-16	71		65	9	52	5.5×9.5×5.4	26.5
SSPF30A	—	47		80		75	10	60	6.6×11×6.5	30
SSPF40A	—	64	0	100	0	100	14	82	9×14×8.6	36
SSPF50A	—	80	-19	125	-0.3	124	16	102	11×17.5×11	46.5
SSPF60A	—	90	0/-22	140		129	18	107	11×17.5×11	52
SSPF20	SSPFS20	32		60	0/-0.2	51	7	40	4.5×8×4.4	23
SSPF25	SSPFS25	37	0	70		60	9	47	5.5×9.5×5.4	26
SSPF30	—	45	-16	80		70	10	54	6.6×11×6.5	30
SSPF40	—	60	0	100	0	90	14	72	9×14×8.6	36
SSPF50	—	75	-19	112	-0.3	113	16	91	11×17.5×11	40
SSPF60	—	90	0/-22	127		129	18	107	11×17.5×11	45.5

d	Ds	ID (inner diameter)	basic torque rating		basic load rating		allowable static moment		mass		size	
			dynamic $C_T$	static $C_{OT}$	dynamic C	static $C_o$	$M_{O1}$	$M_{O2}$	nut kg	shaft kg/m		
1	6	0/-12	2	1.5	2.4	1.22	2.28	5.1	40	0.037	0.21	6
1.5	8	0	3	2.1	3.7	1.45	2.87	7.4	50	0.042	0.38	8
1.5	10	-15	4	4.4	8.2	2.73	5.07	18.0	116	0.094	0.6	10
1.5	13	0	6	21	39.2	2.67	4.89	13.7	109	0.1	1	13A
2	16	-18	8	60	110	6.12	11.2	46	299	0.2	1.5	16A
2	20	0	10	105	194	8.9	16.3	110	560	0.33	2.4	20A
3	25	0	15	189	346	12.8	23.4	171	1,020	0.45	3.7	25A
3	30	-21	—	307	439	18.6	23.2	181	1,470	0.55	5.38	30A
4	40	0	—	674	934	30.8	37.5	358	2,940	1.41	9.55	40A
4	50	-25	—	1,290	2,950	40.3	64.9	690	4,080	2.73	15.0	50A
4	60	0/-30	—	1,570	2,620	47.7	79.5	881	5,470	3.2	21.6	60A
2	18.2	0	—	83	133	7.84	11.3	63	500	0.22	2	20
3	23	-21	—	162	239	12.3	16.1	104	830	0.32	3.1	25
3	28	0	—	289	412	18.6	23.2	181	1,470	0.51	4.8	30
4	37.4	0	—	637	882	30.8	37.5	358	2,940	1.15	8.6	40
4	47	-25	—	1,390	3,180	46.1	74.2	696	4,400	2.1	13.1	50
4	56.5	0/-30	—	2,100	4,800	58.0	127	1,300	8,800	3.3	19	60

1kN=102kgf 1N·m=0.102kgf·m

# SSPT TYPE

– Two Side Cut Flange Type –



## part number structure

example **SSPT 10-2-T1-200 T-P-LB-KGLA/CU**

SSPT type

nominal diameter

number of nuts attached to one shaft

preload symbol  
blank: standard  
T1: light

spline shaft total length

hollow spline shaft  
blank: standard shaft  
T: standard hollow shaft\*

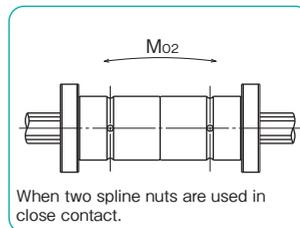
with special specification

grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGU: urea-based low dust generation grease  
-KGF: anti-fretting grease

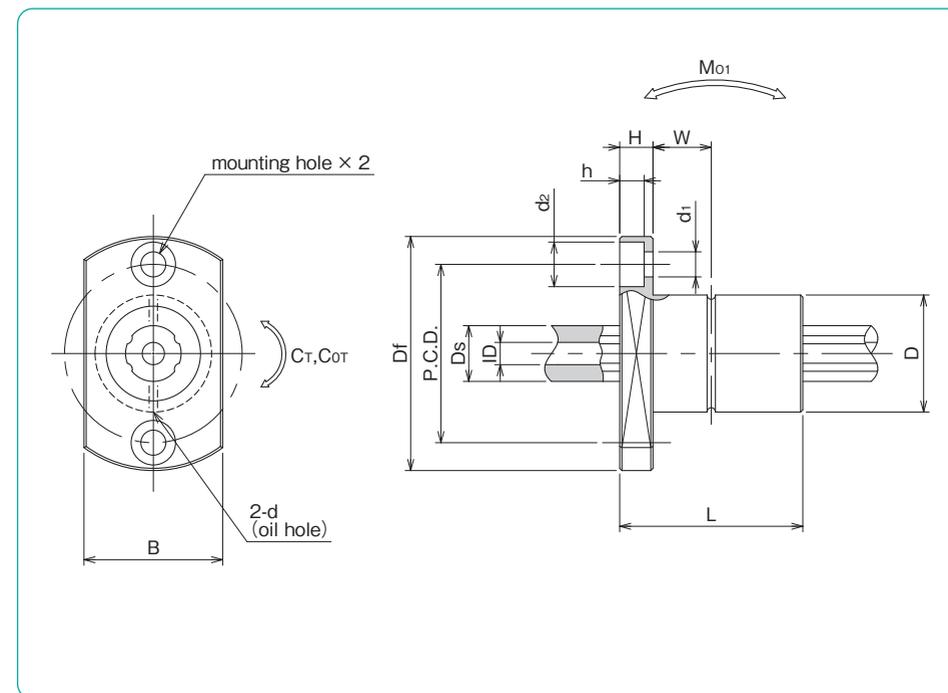
with low temperature black chrome treatment

accuracy grade  
blank: high  
P: precision

\*For standard hollow shafts, refer to P.B-14 for specifications.



When two spline nuts are used in close contact.



part number	D		L		major dimensions					W
	mm	tolerance μm	mm	tolerance mm	Df	B	H	P.C.D.	d <sub>1</sub> × d <sub>2</sub> × h	
SSPT 6	14	0	25	0	30	18	5	22	3.4 × 6.5 × 3.3	7.5
SSPT 8	16	-11	25	-0.2	32	21	5	24	3.4 × 6.5 × 3.3	7.5
SSPT 10	21	0/-13	33	-0.2	42	25	6	32	4.5 × 8 × 4.4	10.5

d	Ds	ID (inner diameter)	basic torque rating		basic load rating		allowable static moment		mass		size
			dynamic C <sub>T</sub>	static C <sub>0T</sub>	dynamic C	static C <sub>0</sub>	M <sub>O1</sub>	M <sub>O2</sub>	nut	shaft	
1	6	2	1.5	2.4	1.22	2.28	5.1	40	0.029	0.21	6
1.5	8	3	2.1	3.7	1.45	2.87	7.4	50	0.035	0.38	8
1.5	10	4	4.4	8.2	2.73	5.07	18.0	116	0.075	0.6	10

1kN ≅ 102kgf 1N · m ≅ 0.102kgf · m

# SSPT-AM TYPE SSPK-AM TYPE

— Light and Compact Flange Type —

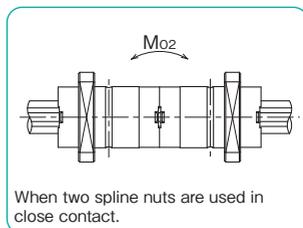


## part number structure

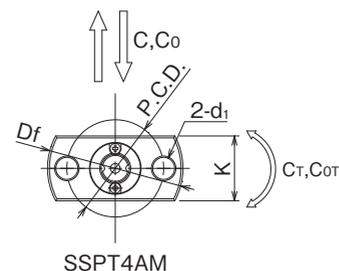
example **SSP 8 AM - 1 - T1 - 450 T - P - LB - KGLA / CU**

specification (4AM) SSPT AM: standard SSPTS AM: anti-corrosion (5AM~10AM) SSPK AM: standard SSPKS AM: anti-corrosion	nominal diameter	number of nuts attached to one shaft	preload symbol blank: standard T1: light	spline shaft total length	grease symbol (refer to page Eng-51) blank: standard grease -KGLA: lithium-based low dust generation grease -KGU: urea-based low dust generation grease -KGF: anti-fretting grease	with special specification	with low temperature black chrome treatment	accuracy grade blank: high P: precision	hollow spline shaft (not available in stainless steel) blank: standard shaft T: standard hollow shaft*
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\*For standard hollow shafts, refer to P.B-14 for specifications.  
Note: Nut material of SSPT-AM and SSPK-AM is stainless steel.

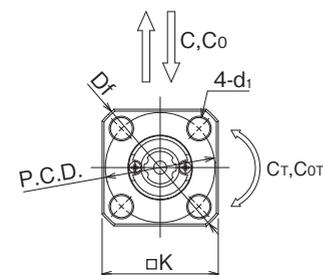


When two spline nuts are used in close contact.



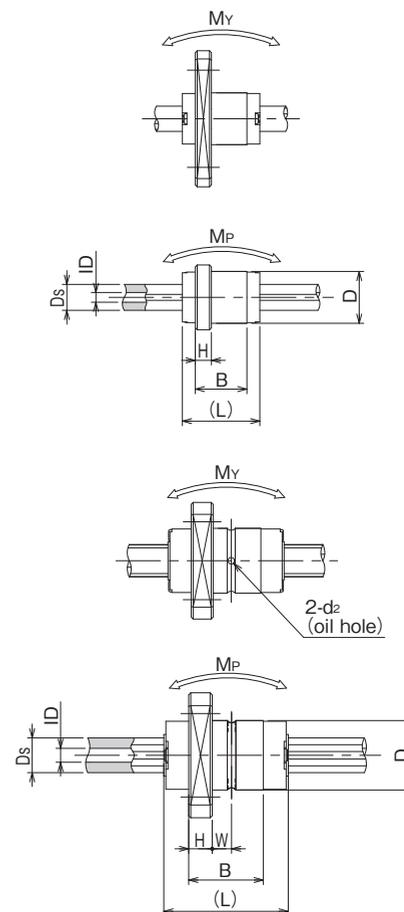
SSPT4AM

※SSPT4AM spline nut does not come with seal ring.



SSPK5AM~10AM

※SSPK5AM spline nut does not come with oil groove.



part number		D h6 tolerance		major dimensions							
standard	anti-corrosion	mm	μm	L	B	Df	K	H	P.C.D.	d1	W
SSPT 4AM	SSPTS 4AM	8	0	12	8	21	10	2.5	15	3.4	—
SSPK 5AM	SSPKS 5AM	10	-9	18	10.8	23	18	3.4	17	3.4	2.8
SSPK 6AM	SSPKS 6AM	12	0	21	13	25	20	3	19	3.4	3.5
SSPK 8AM	SSPKS 8AM	15	-11	25	14.9	28	22	3.95	22	3.4	3.5
SSPK10AM	SSPKS10AM	19	0 -13	30	18	36	28	4	28	4.5	5

d2	Ds h7 tolerance	ID (inner diameter)	basic torque rating		basic load rating		allowable static moment		mass		size
			dynamic C <sub>T</sub>	static Co <sub>T</sub>	dynamic C	static Co	M <sub>P</sub> N·m	M <sub>V</sub> N·m	nut g	shaft g/100mm	
—	4	1.5	0.72	1.00	314	438	0.59 3.36	1.03 5.82	5.0	9.7	4AM
1	5	2	2.33	4.05	825	1,160	2.10 13.4	2.56 16.3	10.7	14.9	5AM
1	6	2	2.95	5.27	890	1,290	2.55 16.5	3.11 20.1	14.7	21.6	6AM
1.2	8	3	5.85	9.83	1,330	1,810	4.11 27.8	5.00 33.8	23.9	38.4	8AM
1.5	10	4	12.4	19.4	2,270	2,870	7.84 52.5	9.53 63.9	44.0	59.8	10AM

Allowable static moment M<sub>P2</sub> and M<sub>V2</sub> are the values when two spline nuts are used in close contact. 1N≒102gf 1N·m≒102gf·m

STANDARD AND MAXIMUM LENGTH

Standard and maximum length of NB ball spline shaft are shown in Table B-20.

Table B-20 Standard and Maximum Length of SSP Type

unit : mm

size	standard length					maximum length	
						high-grade	precision-grade P
4	100	150	200	300		315	200
5	150	200	300	400		400	315
6	150	200	300	400		400	315
8	150	200	300	400	500	500	400
10	200	300	400	500	600	630	630
13A	200	300	400	500	600	1,500	1,500
16A	200	300	400	500	600	1,500	1,500
20A	300	500	1,000				
25A	300	500	1,000				
30A	300	500	1,000				
40A	500	1,000					
50A	500	1,000					
60A	500	1,000					
80A	—						
80AL	—						
100A	—						
100AL	—						
20	300	500	1,000				
25	300	500	1,000				
30	300	500	1,000				
40	500	1,000					
50	500	1,000					
60	500	1,000					

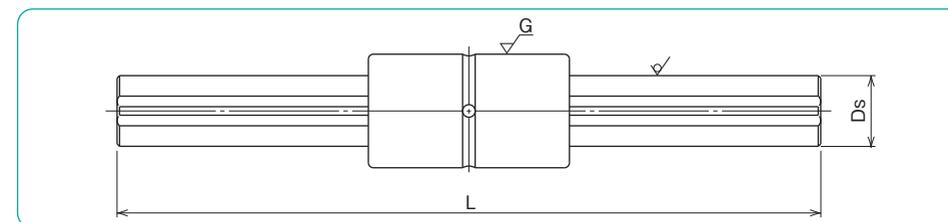
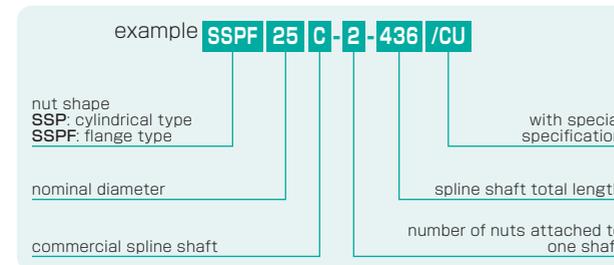
• Applicable to rotary ball spline SPR, SPB-KP, SPB type and stroke spline SPLFS type, except for precision-grade of SPR and SPLFS type.

• Please contact NB for shaft lengths exceeding maximum length.

COMMERCIAL BALL SPLINE



part number structure



part number		Ds mm	basic torque rating		basic load rating		allowable static moment	
			C <sub>T</sub> N·m	C <sub>0T</sub> N·m	C kN	C <sub>0</sub> kN	M <sub>01</sub> N·m	M <sub>02</sub> N·m
SSP20A	SSPF20A	20	73.5	135	6.23	11.4	77.0	392
SSP25A	SSPF25A	25	132	242	8.96	16.3	119	714
SSP30A	SSPF30A	30	214	307	13.0	16.2	126	1,020
SSP40A	SSPF40A	40	471	653	21.5	26.2	250	2,050
SSP50A	SSPF50A	50	903	2,060	28.2	45.4	483	2,850
SSP20	SSPF20	18.2	58.1	93.1	5.48	7.91	44.1	350
SSP25	SSPF25	23	113	167	8.61	11.2	72.8	581
SSP30	SSPF30	28	202	288	13.0	16.2	126	1,020
SSP40	SSPF40	37.4	445	617	21.5	26.2	250	2,050
SSP50	SSPF50	47	973	2,220	32.2	51.9	487	3,080

- Tolerance of total length  
total length up to 4,000: JIS B0405 coarse grade  
total length greater than 4,000: ±5.0mm  
contact NB for tolerances other than those listed above
- Please refer to dimension tables for nut shape and dimensions.
- The above rated torque, rated load, and static allowable moment are approximately 70% of the values of the ground shaft.

nominal diameter	standard length L					
	mm					
all size	500	1,000	2,000	3,000	4,000	5,000

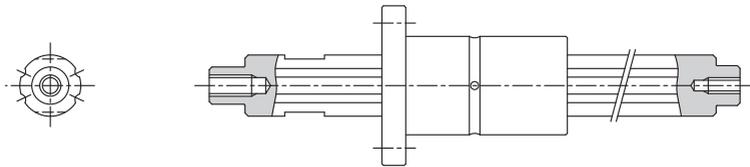
• contact NB for special specifications based on the customer's drawings for further consideration.

**EXAMPLES OF MACHINING**

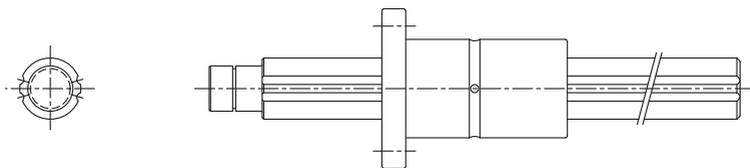
**Center tap on both ends and milling**



**Step-down on both ends, center tap and milling**



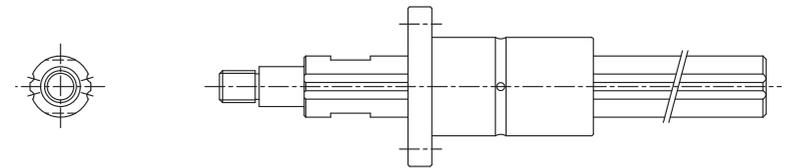
**Ring groove on step-down**



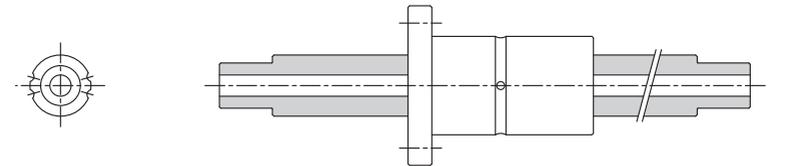
**Step-down, center tap and key groove**



**Threading on step-down and milling**



**Step-down on both ends with hollow spline shaft**



We can also handle a variety of other machining. Additional machining to outer cylinder is also available. Please contact NB for details.

# ROTARY BALL SPLINE

The NB rotary ball spline can be used for both rotational motion and linear motion. The applications include SCARA robots, vertical shaft of assembly equipment, tool changers, and loaders, etc.

## STRUCTURE AND ADVANTAGES

The NB Rotary Ball Spline nut consists of a spline nut and a rotating portion using either cross rollers for SPR or balls for SPB.

### High Accuracy

Ball Splines transfer torque and achieve accurate positioning in the linear direction.

By adding the rotating portion, Rotary Ball Splines can achieve accurate positioning in the linear and rotational directions.

### Half the Parts, Reduction in Installation Cost

The Spline nut and rotary bearing are combined in order to significantly reduce the number of parts, compared to conventional system. The combination also reduces the housing thickness to a minimum, resulting in light weight and easy installation.

Figure B-28 Structure of SPR type

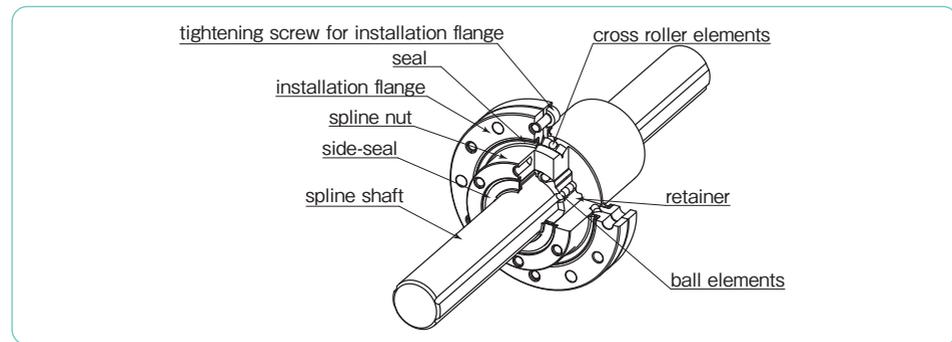
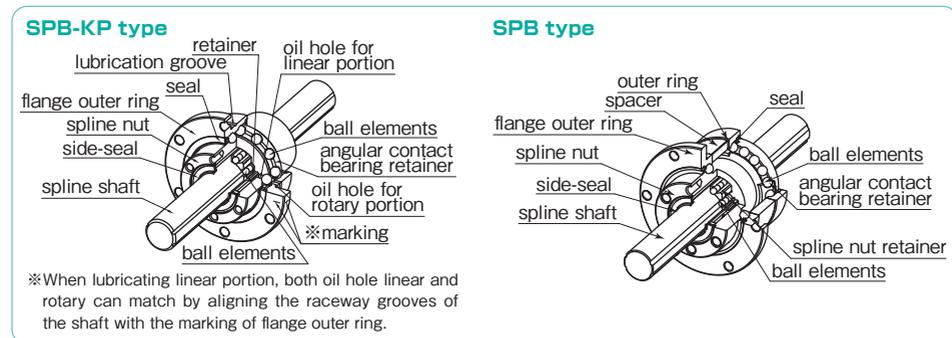


Figure B-29 Structure of SPB-KP type and SPB type



## SPECIFICATION

Refer to table B-21 for NB rotary ball spline material and operating temperature range.

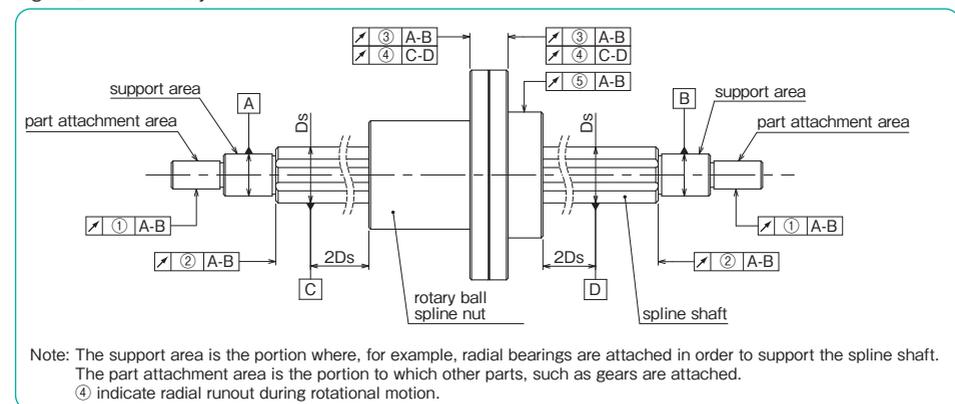
Table B-21 Material and Operating Temperature Range

type	nut		spline shaft	operating temperature range
	outer cylinder	return cap /retainer		
SPR	steel	resin	steel	-20°C~80°C
SPB-KP				
SPB				

## ACCURACY OF SPR TYPE

The accuracy of SPR type is measured at the points shown in Figure B-30.

Figure B-30 Accuracy Measurement Points



## Tolerance of Spline Shaft Groove Torsion (Max.)

The groove torsion is indicated per 100mm, arbitrarily set as the effective length of the spline shaft section.

Table B-22 Tolerance of Spline Shaft Groove Torsion (Max.)

tolerance
13 μm/100mm

Table B-23 Tolerance Relative to Spline Support Area (Max.)

unit: μm

part number	①radial runout of part attachment area	②radial runout of the end of the spline shaft section (when grinding is requested on the drawing)	③radial runout of the flange						
SPR 6	14	9	14						
SPR 8									
SPR10									
SPR13	19	11	18						
SPR16									
SPR20A									
SPR25A									
SPR30A									
SPR40A									
SPR50A	25	16	25						
SPR60A									
SPR20				19	11	18			
SPR25									
SPR30							13	13	21
SPR40									
SPR50	25	16	25						
SPR60									

Table B-24 Tolerance during rotational movement of the cross roller rotating part (Max.) unit :  $\mu\text{m}$

part number	④radial runout of part attachment area
SPR 6	10
SPR 8	
SPR10	
SPR13	
SPR16	
SPR20A	
SPR25A	
SPR30A	
SPR40A	
SPR50A	15
SPR60A	
SPR20	10
SPR25	
SPR30	
SPR40	
SPR50	
SPR60	15

Table B-25 ⑤Radial Runout of Outer Surface of Nut Relative to Spline Support Area (Max.) unit :  $\mu\text{m}$

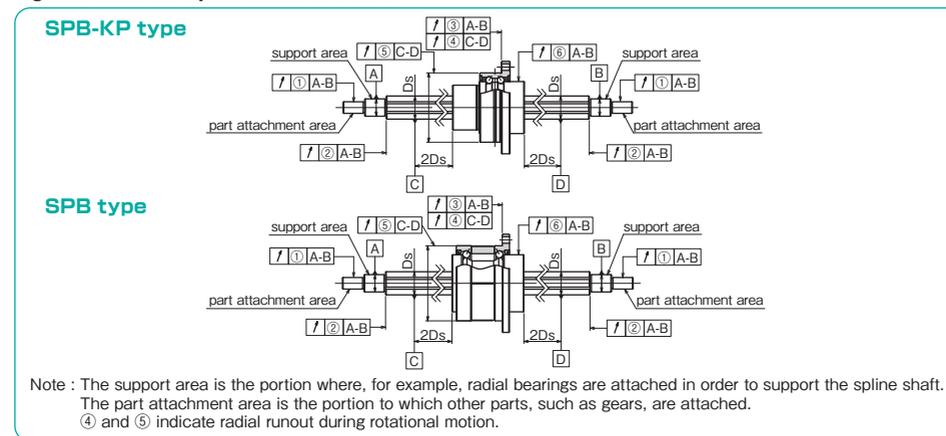
spline shaft total length (mm)		size					
greater than	or less	6 8	10	13 16 20A,20	25A,25 30A,30	40A,40 50A,50	60A,60
—	200	46	36	34	32	32	30
200	315	89	54	45	39	36	34
315	400	126	68	53	44	39	36
400	500	163*	82	62	50	43	38
500	630	—	102	75	57	47	41
630	800	—	—	92	68	54	45
800	1,000	—	—	115	83	63	51
1,000	1,250	—	—	153	102	76	59
1,250	1,600	—	—	256*	210	175	70
1,600	2,000	—	—	394	311	224	179

\*SPR6 shaft Max. length: 400mm SPR13, SPR16 Max.length: 1,500mm.  
 ※ Please contact NB for spline shafts exceeding 2,000mm.

ACCURACY OF SPB TYPE

The accuracy of SPB type is measured at the points shown in Figure B-31.

Figure B-31 Accuracy Measurement Points



Tolerance of Spline Shaft Groove Torsion (Max.)

The groove torsion is indicated per 100mm, arbitrarily set as the effective length of the spline shaft section.

Table B-26 Tolerance of Spline Shaft Groove Torsion (Max.)

accuracy grade	high	precision (P)
tolerance	13 $\mu\text{m}/100\text{mm}$	6 $\mu\text{m}/100\text{mm}$

Table B-27 Tolerance Relative to Spline Support Area (Max.)

unit :  $\mu\text{m}$

part number	①radial runout of part attachment area		②radial runout of the end of the spline shaft section (when grinding is requested on the drawing)		③radial runout of the flange	
	high-grade	precision-grade(P)	high-grade	precision-grade(P)	high-grade	precision-grade(P)
SPB 6KP	14	8	9	6	14	10
SPB 8KP						
SPB10KP	17	10	11	8	18	13
SPB13KP						
SPB16KP,16						
SPB20KP,20	19	12	13	9	21	16
SPB25KP,25	22	13				

Table B-28 Tolerance of Angular Contact Bearing Rotation (Max.) unit :  $\mu\text{m}$

part number	④runout of flange mounting side		⑤radial runout of outer ring	
	high-grade	precision-grade(P)	high-grade	precision-grade(P)
SPB 6KP	6	6	8	8
SPB 8KP				
SPB10KP				
SPB13KP	8	8	9	9
SPB16KP,16				
SPB20KP,20			10	10
SPB25KP,25				

Table B-29 ⑥Radial Runout of Spline Nut Relative to Spline Support Area(Max.) unit :  $\mu\text{m}$

spline shaft total length (mm)		size									
greater than	or less	6	8	10	13,16,20	25	6	8	10	13,16,20	25
—	200	46	26	46	26	36	20	34	18	32	18
200	315	89	57	89	57	54	32	45	25	39	21
315	400	126	—	126	82	68	41	53	31	44	25
400	500	—	—	163	—	82	51	62	38	50	29
500	630	—	—	—	—	102	65	75	46	57	34
630	800	—	—	—	—	—	—	92	58	68	42
800	1,000	—	—	—	—	—	—	115	75	83	52
1,000	1,250	—	—	—	—	—	—	153	97	102	65
1,250	1,600	—	—	—	—	—	—	256*	180*	210	140
1,600	2,000	—	—	—	—	—	—	394	314	311	241

\*SPB16, 13KP, and 16KP shaft maximum length : 1,500mm.  
 ※Please contact NB for spline shafts exceeding 2,000mm.

PRELOAD AND CLEARANCE

Preload and clearance of linear motion are available with a standard preload(blank), light preload(T1), and medium preload(T2).

Table B-30 Preload and Clearance of SPR Type unit :  $\mu\text{m}$

part number	standard	light (T1)	medium (T2)
SPR 6	0~+3	- 3 ~ 0	-
SPR 8			
SPR10			
SPR13	-3~+1	- 8~-3	-13~- 8
SPR16			
SPR20A	-4~+2	-12~-4	-20~-12
SPR25A			
SPR30A			
SPR40A	-6~+3	-18~-6	-30~-18
SPR50A			
SPR60A			
SPR20	-4~+2	-12~-4	-20~-12
SPR25			
SPR30			
SPR40			
SPR50	-6~+3	-18~-6	-30~-18
SPR60			

Table B-31 Preload and Clearance of SPB-KP and SPB Type (Linear Motion) unit :  $\mu\text{m}$

part number	standard	light (T1)	medium (T2)
SPB 6KP	0~+3	-3 ~ 0	-
SPB 8KP			
SPB10KP			
SPB13KP	-3~+1	-8~-3	-13~- 8
SPB16KP,16			
SPB20KP,20	-4~+2	-12~-4	-20~-12
SPB25KP,25			

Please contact NB for other than preload standards above.

Table B-32 Preload and Operating Conditions

preload	symbol	operating conditions
standard	blank	minute vibration is applied. a precise motion is required. moment is applied in a given direction.
light*	T1	light vibration is applied. light torsional load is applied. cyclic torque is applied.
medium*	T2	shock/vibration is applied. over-hang load is applied. torsional load is applied.

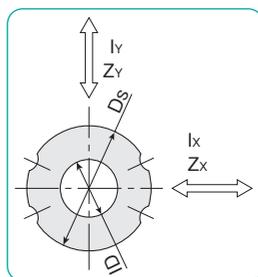
\* Since the contrary relation of preload and dynamic frictional resistance, dynamic friction resistance will increase when applying preload.

HOLLOW SPLINE SHAFT

NB provides hollow shafts. It can be used for running cable, air piping, and weight reduction. Table B-33 shows the standard hollow shaft. If you are looking for a standard hollow shaft, specify the symbol "T" after the total length of the spline shaft in the part number. It is possible to manufacture the inner diameter different from the standard hollow shaft, if so please contact NB.

Table B-33 Standard Hollow Spline Shaft

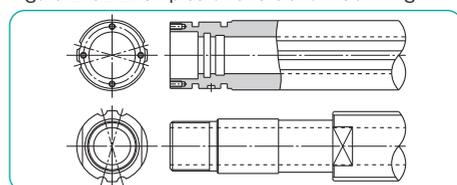
nominal diameter		outer diameter	inner diameter	moment of inertia of area		modulus of section	
SPR	SPB-KP SPB	Ds mm	ID mm	lx mm <sup>4</sup>	ly	Zx mm <sup>3</sup>	Zy
6	6	6	2	$5.83 \times 10^1$	$6.13 \times 10^1$	$1.94 \times 10^1$	$2.04 \times 10^1$
8	8	8	3	$1.86 \times 10^2$	$1.93 \times 10^2$	$4.66 \times 10^1$	$4.84 \times 10^1$
10	10	10	4	$4.48 \times 10^2$	$4.69 \times 10^2$	$8.97 \times 10^1$	$9.37 \times 10^1$
13	13	13	6	$1.26 \times 10^3$	$1.32 \times 10^3$	$1.93 \times 10^2$	$2.03 \times 10^2$
16	16	16	8	$2.78 \times 10^3$	$2.96 \times 10^3$	$3.48 \times 10^2$	$3.70 \times 10^2$
20A	20	20	10	$6.87 \times 10^3$	$7.25 \times 10^3$	$6.87 \times 10^2$	$7.25 \times 10^2$
25A	25	25	15	$1.54 \times 10^4$	$1.64 \times 10^4$	$1.23 \times 10^3$	$1.31 \times 10^3$



SPECIAL REQUIREMENTS

NB provides customization such as shaft-end machining, spline nut machining, and surface treatment per customer requests. Please contact NB for the inner diameter of SPR20~SPR60.

Figure B-32 Examples of Shaft-end Machining



MOUNTING

The flange attachment screws of SPR type have been pre-adjusted for smooth rotary movement and should never be loosened. Shock loading to the flange assembly should be avoided as this can degrade the accuracy of movement and deteriorate the overall performance.

The spacer of SPB type is properly adjusted to produce the best preload condition. Shock loading to the spacer should be avoided as this can change the preload condition and deteriorate the accuracy. Please fix the mounting screws diagonally. The recommended torque values for medium-hardness steel screws are listed in Table B-34.

Table B-34 Recommended Torque unit : N·m

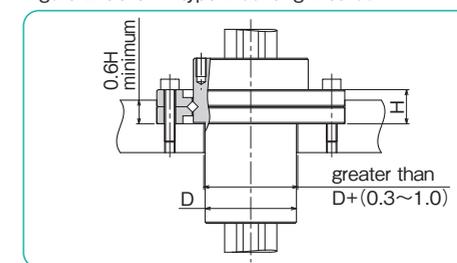
mounting screw	M2	M2.5	M3	M4	M5	M6	M8
recommended torque	0.4	0.9	1.4	3.2	6.6	11.2	27.6

(for alloy steel screw)

SPR Type

When the flange of SPR type is to be used with a faucet joint (as shown in Figure B-33) the housing bore should be machined to a tolerance of H7 and to a minimum depth of 60% of the flange thickness. If only a light load is applied to the SPR in operation, the flange can be used without a pilot end.

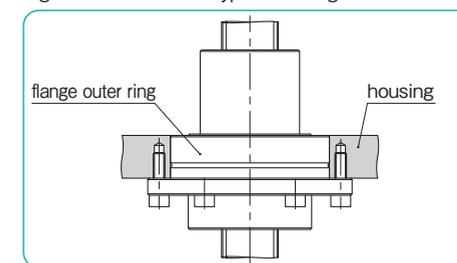
Figure B-33 SPR type Mounting Method



SPB-KP Type

The housing bore for the SPB-KP type should be matched to a tolerance of H7 and keep enough depth ( as shown in Figure B-34) so that the outer ring is inside the housing.

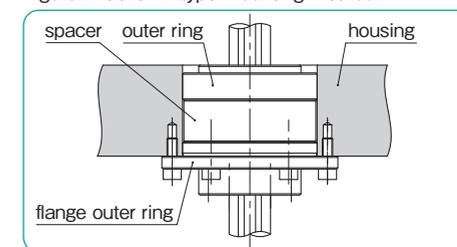
Figure B-34 SPB-KP type Mounting Method



SPB Type

The housing bore for the SPB type should be machined to a tolerance of H7 and contain enough depth so that the outer ring is inside the housing. If not, the outer ring may fall off.

Figure B-35 SPB type Mounting Method



Insertion of Spline Shaft

When inserting the spline shaft into the rotary ball spline nut, ensure that the ball elements do not drop out. This is done by aligning the raceway grooves of the shaft with the rows of ball elements and seal -lip of the nut. Then, carefully insert the spline shaft through the spline nut.

LUBRICATION

Since NB rotary ball spline nuts are equipped with seals at both the spline portion and the rotational portion, the lubricant is retained for an extended period of time. The spline nut is prelubricated with lithium soap based grease prior to shipment for immediate use. Please relubricate with a similar type of grease periodically depending on the operating conditions.

Low dust generation grease is available from NB standard grease. (refer to page Eng-51) However, an oil lubricant is recommended for high-speed applications. A grease fitting or machining oil holes is optional (Figure B-36-39), please contact NB for details.

SPR Type

A grease fitting for rotational portion and machining oil hole for spline portion are optional.

Figure B-36 Example of Installed Grease Fitting

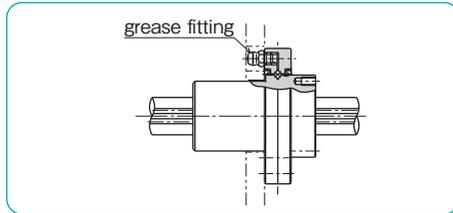
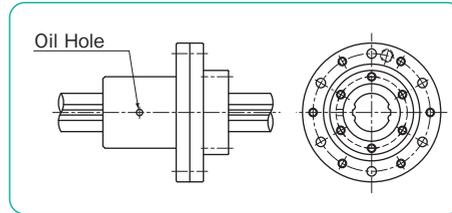


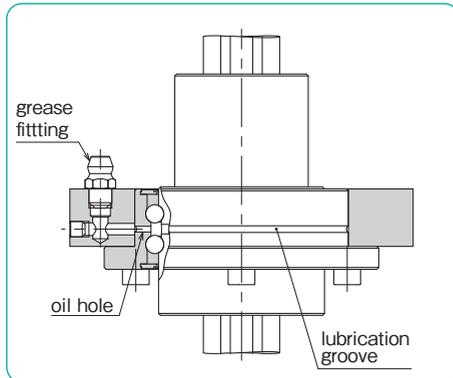
Figure B-37 SPR type Oil Hole



SPB-KP Type

Lubrication is done through oil hole on the outer ring. It is applied the spline portion and the cross roller portion simultaneously.

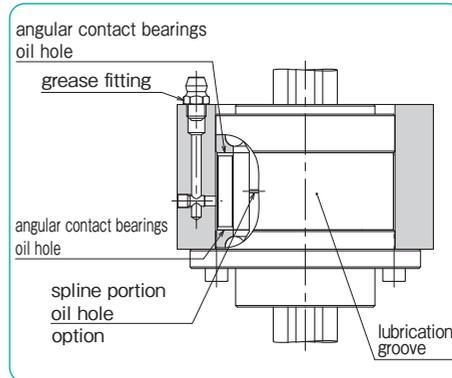
Figure B-38 SPB-KP type Oil Hole



SPB Type

Rotational portion has an oil hole as a standard. For lubrication, it is recommended to mount a grease fitting or oil hole to housing. Machining oil hole for spline portion is available. Please contact NB.

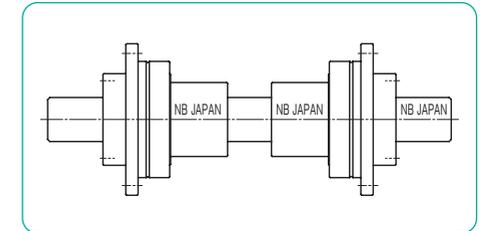
Figure B-39 SPB type Oil Hole



NUT ORIENTATION

Unless otherwise specified, the orientation of two nuts SPR, SPB-KP and SPB type is shown in Figure B-40. In other cases please specify the orientation of nut(s) with shaft.

Figure B-40 Nut Orientation and NB mark



OPERATING CONDITIONS

A Set of Spline Nut and Spline Shaft

The ball spline's accuracy and preload is guaranteed when spline nut and shaft are aligned as shown in Figure B-41. Please make sure to align the NB marks when reinserting the shaft.

At this time, both NB marks on the nut and shaft should be aligned in the same direction as when delivered.

When inserting the spline shaft into the spline nut, ensure that the ball elements do not drop out. This is done by aligning the reaway grooves of the shaft with the rows of ball elements and the seal lip of the nut. Then, carefully insert the spline shaft through the spline nut. In case that the nut is preloaded, please exercise additional care. And also, do not disassemble the spline nut.

SPR Type

Please do not loosen the fastening screws for installation flange. The fastening screws are properly adjusted. Please handle with great care, the accuracy is affected if an excessive impact is applied.

SPB Type

Please do not adjust the spacer. The spacer is adjusted to provide a proper spacing for the best preload condition. Please handle with great care, the accuracy is affected if the spacer is slipped by an impact, etc..

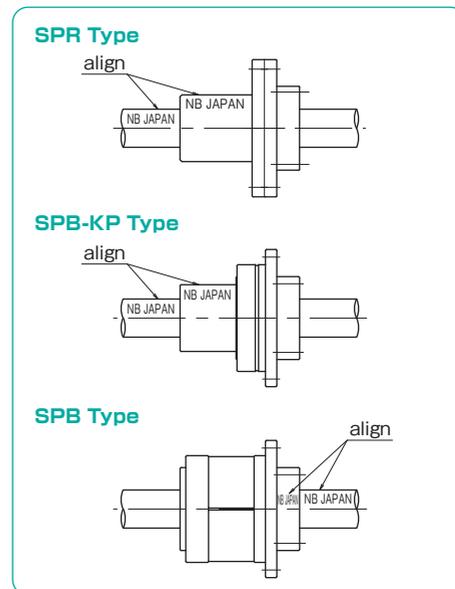
Operating Temperature

Resin retainers are used in the rotary ball spline, since the operating temperature should never exceed 80°C.

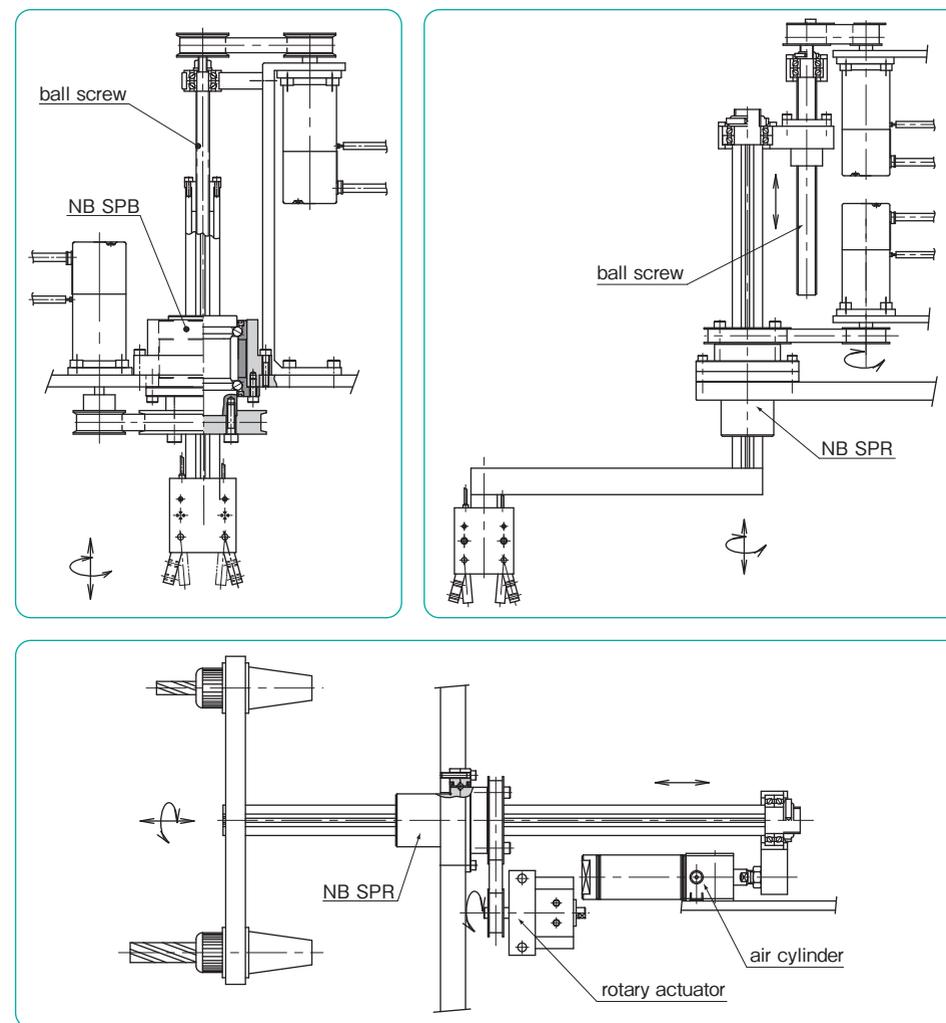
Dust Prevention

Foreign particles or dust in the rotary ball spline nut affect the motion accuracy and shorten the lifetime. Standard seals will perform well for dust prevention under normal operating conditions; however, in a harsh environment, it is necessary to attach bellows or protective covers.

Figure B-41 NB mark Alignment



APPLICATION EXAMPLES

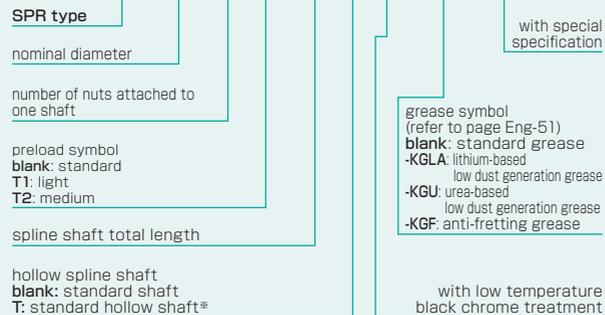


# SPR TYPE

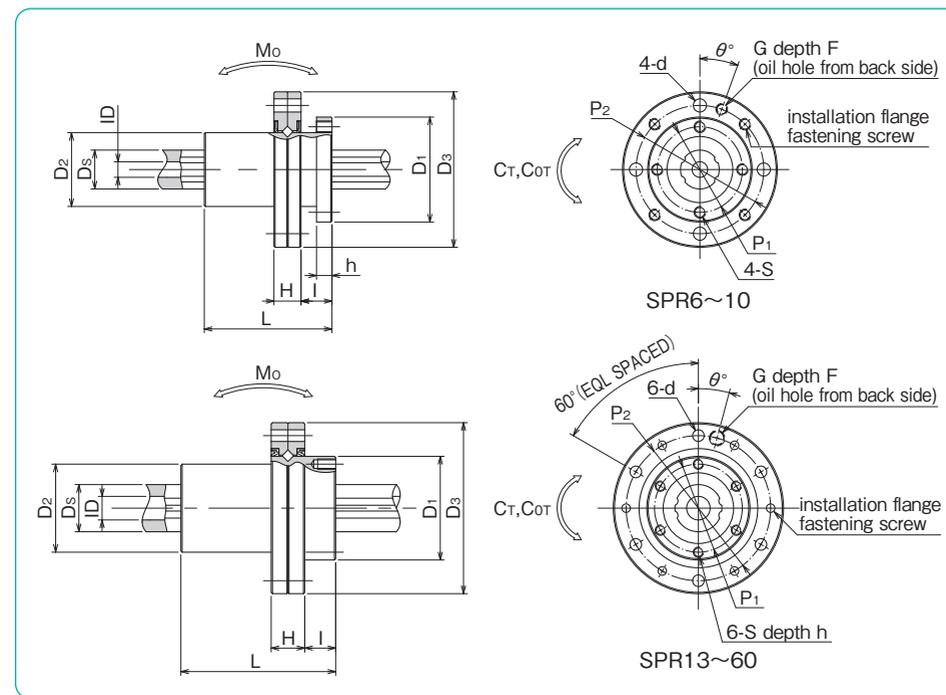


## part number structure

example **SPR 25A - 2 - T1 - 450 T - LB - KGLA /CU**



\*For standard hollow shafts, refer to P.B-40 for specifications.



part number	major dimensions					major dimensions of cross roller bearing							spline shaft		
	D <sub>1</sub>	D <sub>2</sub>	L	P <sub>1</sub>	S	h	I	H	D <sub>3</sub>	P <sub>2</sub>	d	G	F	$\theta$	D <sub>s</sub>
	mm	mm	mm	P.C.D.	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
SPR 6	20	13	25	16	M2	2.5	5	6.5	30	24	2.4	M3	5	20°	6
SPR 8	22	15	25	18	M2.5	3	6	6.5	33	27	2.9	M3	5	20°	8
SPR10	27	19	33	22	M3	4	8	7	40	33	3.4	M3	5	20°	10
SPR13	29	24	36	24	M3	5	8	9	50	42	3.4	M3	5	15°	13
SPR16	36	31	50	30	M4	6	10	11	60	50	4.5	M3	5	15°	16
SPR20A	44	35	63	38	M4	7	12	13	72	62	4.5	M6×0.75	5.5	15°	20
SPR25A	55	42	71	47	M5	8	13	16	82	72	4.5	M6×0.75	7	15°	25
SPR30A	61	47	80	52	M6	10	17	17	100	86	6.6	M6×0.75	7.5	15°	30
SPR40A	76	64	100	66	M6	10	23	20	120	104	9	M6×0.75	9	15°	40
SPR50A	92	80	125	80	M8	13	24	22	134	118	9	M6×0.75	10	15°	50
SPR60A	107	90	140	95	M8	13	25	25	155	137	9	M6×0.75	11.5	15°	60
SPR20	40	34	60	34	M4	7	12	13	66	56	4.5	M6×0.75	5.5	15°	18.2
SPR25	50	40	70	42	M5	8	13	16	78	68	4.5	M6×0.75	7	15°	23
SPR30	61	47	80	52	M6	10	17	17	100	86	6.6	M6×0.75	7.5	15°	28
SPR40	76	62	100	64	M6	10	23	20	120	104	9	M6×0.75	9	15°	37.4
SPR50	88	75	112	77	M8	13	24	22	130	114	9	M6×0.75	10	15°	47
SPR60	102	90	127	90	M8	13	25	25	150	132	9	M6×0.75	11.5	15°	56.5

Please contact NB for the grease fitting and relubrication method.

ID (inner diameter)	ball spline				cross roller bearing			allowable static moment Mo	moment of inertia for the spline nut	moment of inertia for the spline shaft	moment of inertia for the rotating part	mass		size
	basic torque rating		basic load rating		basic load rating							nut	shaft	
	dynamic C <sub>T</sub>	static Co <sub>T</sub>	dynamic C	static Co	dynamic C <sub>R</sub>	static Co <sub>R</sub>	maximum revolutions							
2	1.5	2.4	1.22	2.28	0.6	0.5	2,940	5.1	0.01	9.45×10 <sup>-6</sup>	0.04	0.04	0.21	6
3	2.1	3.7	1.45	2.87	1.2	1.10	2,580	7.4	0.01	3.02×10 <sup>-5</sup>	0.05	0.05	0.38	8
4	4.4	8.2	2.73	5.07	2.4	2.45	2,060	18.0	0.03	7.35×10 <sup>-5</sup>	0.12	0.09	0.60	10
6	21	39.2	2.67	4.89	2.9	3.70	1,350	13.7	0.11	2.11×10 <sup>-4</sup>	0.32	0.17	1.0	13
8	60	110	6.12	11.2	5.6	6.70	1,080	46	0.38	4.79×10 <sup>-4</sup>	0.79	0.33	1.5	16
10	105	194	8.9	16.3	6.55	8.79	890	110	0.91	1.18×10 <sup>-3</sup>	1.93	0.57	2.4	20A
15	189	346	12.8	23.4	9.63	12.7	700	171	2.41	2.87×10 <sup>-3</sup>	3.73	0.81	3.7	25A
—	307	439	18.6	23.2	11.8	17.1	640	181	3.74	5.93×10 <sup>-3</sup>	9.43	1.19	5.38	30A
—	674	934	30.8	37.5	23.0	32.3	510	358	13.0	1.42×10 <sup>-2</sup>	22.4	2.25	9.55	40A
—	1,290	2,950	40.3	64.9	27.8	44.0	430	690	34.1	4.56×10 <sup>-2</sup>	36.8	3.57	15.0	50A
—	1,570	3,420	47.7	79.5	29.0	48.8	370	881	62.2	9.54×10 <sup>-2</sup>	73.8	5.03	21.6	60A
—	83	133	7.84	11.3	5.90	7.35	980	63	0.66	8.11×10 <sup>-4</sup>	1.37	0.45	2.0	20
—	162	239	12.3	16.1	9.11	11.5	770	104	1.71	2.05×10 <sup>-3</sup>	3.20	0.75	3.1	25
—	289	412	18.6	23.2	11.8	17.1	640	181	4.08	4.47×10 <sup>-3</sup>	9.43	1.25	4.8	30
—	637	882	30.8	37.5	23.0	32.3	510	358	13.0	1.42×10 <sup>-2</sup>	22.4	2.30	8.6	40
—	1,390	3,180	46.1	74.2	27.2	42.1	450	696	25.5	3.54×10 <sup>-2</sup>	32.8	3.10	13.1	50
—	2,100	4,800	58.0	127	26.5	42.6	400	1,300	52.8	7.38×10 <sup>-2</sup>	67.5	4.70	19	60

\*Maximum revolutions with grease lubrication.

Contact NB for further information in case oil lubrication is required.

1kN=102kgf 1N·m=0.102kgf·m

# SPB-KP TYPE



## part number structure

example **SPB 20 KP - 1 - T1 - 450 T - P -LB -KGLA /CU**

SPB KP type

nominal diameter

number of nuts attached to one shaft

preload symbol  
blank: standard  
T1: light  
T2: medium

spline shaft total length

hollow spline shaft  
blank: standard shaft  
T: standard hollow shaft\*

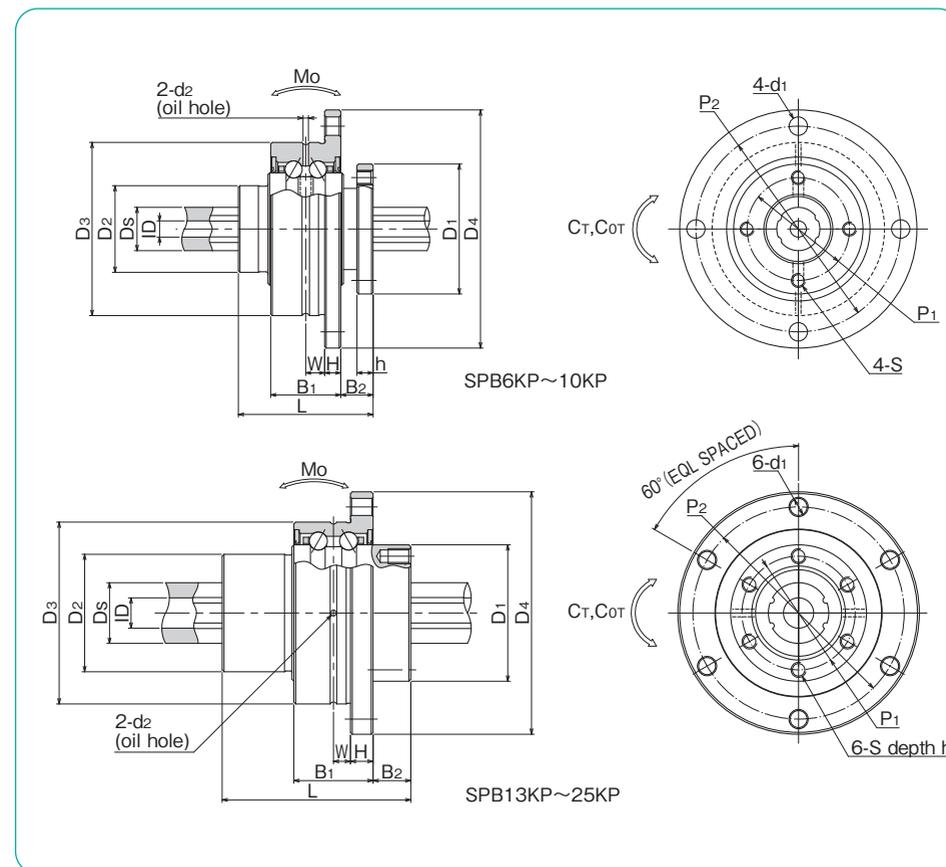
with special specification

grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGU: urea-based low dust generation grease  
-KGF: anti-fretting grease

with low temperature black chrome treatment

accuracy grade  
blank: high  
P: precision

\*For standard hollow shafts, refer to P.B-40 for specifications.



part number	major dimensions						major dimensions of angular contact bearing										
	D <sub>1</sub> h7	D <sub>2</sub>	L	P <sub>1</sub>	S	h	D <sub>3</sub> g6	D <sub>4</sub>	H	B <sub>1</sub>	B <sub>2</sub>	P <sub>2</sub>	d <sub>1</sub>	W	d <sub>2</sub>		
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		
SPB 6KP	20		14	25	16	M2	3	28	-7 -20	38	3	13	6	33	2.4	3.5	1
SPB 8KP	24	0	16	25	19	M2.6	3	32		44	3	13	6	38	3.4	3.5	1
SPB10KP	28	-21	21	33	23	M3	4	36	-9	48	3	15	9	42	3.4	4.5	1
SPB13KP	30		24	36	25	M3	5	44	-25	56	4	18	9	50	3.4	5	1
SPB16KP	36	0	31	50	30	M4	6	48		64	6	21	10	56	4.5	4.5	1.5
SPB20KP	43.5	-25	35	63	36	M5	8	56	-10	72	6	21	12	64	4.5	4.5	1.5
SPB25KP	52	0 -30	42	71	44	M5	8	66	-29	86	7	25	13	75	5.5	5.5	1.5

spline shaft	ID (inner diameter)	rotary ball spline				angular contact bearings			allowable static moment Mo	moment of inertia for the spline nut	moment of inertia for the spline shaft	moment of inertia for the rotating part	mass		
		basic torque rating		basic load rating		basic load rating		maximum revolutions					nut	shaft	size
		dynamic	static	dynamic	static	dynamic	static								
6	2	1.5	2.4	1.22	2.28	4.35	2.74	8,100	5.1	0.01	9.45 × 10 <sup>-6</sup>	0.08	0.07	0.21	6
8	3	2.1	3.7	1.45	2.87	4.54	3.13	7,000	7.4	0.03	3.02 × 10 <sup>-5</sup>	0.13	0.10	0.38	8
10	4	4.4	8.2	2.73	5.07	6.86	4.82	6,200	18.0	0.06	7.35 × 10 <sup>-5</sup>	0.21	0.14	0.60	10
13	6	21	39.2	2.67	4.89	9.45	7.01	5,000	13.7	0.16	2.11 × 10 <sup>-4</sup>	0.49	0.23	1.0	13
16	8	60	110	6.12	11.2	10.2	8.56	4,200	46	0.43	4.79 × 10 <sup>-4</sup>	0.90	0.37	1.5	16
20	10	105	194	8.9	16.3	10.9	10.1	3,600	110	1.00	1.18 × 10 <sup>-3</sup>	1.44	0.55	2.4	20
25	15	189	346	12.8	23.4	13.7	12.9	3,100	171	2.22	2.87 × 10 <sup>-3</sup>	3.36	0.84	3.7	25

\*Maximum revolutions with grease lubrication.  
Contact NB for further information in case oil lubrication is required.

1kN=102kgf 1N·m=0.102kgf·m

# SPB TYPE



## part number structure

example **SPB 20 - 1 - T1 - 450 T - P - LB - KGLA /CU**

SPB type

nominal diameter

number of nuts attached to one shaft

preload symbol  
blank: standard  
T1: light  
T2: medium

spline shaft total length

hollow spline shaft  
blank: standard shaft  
T: standard hollow shaft\*

with special specification

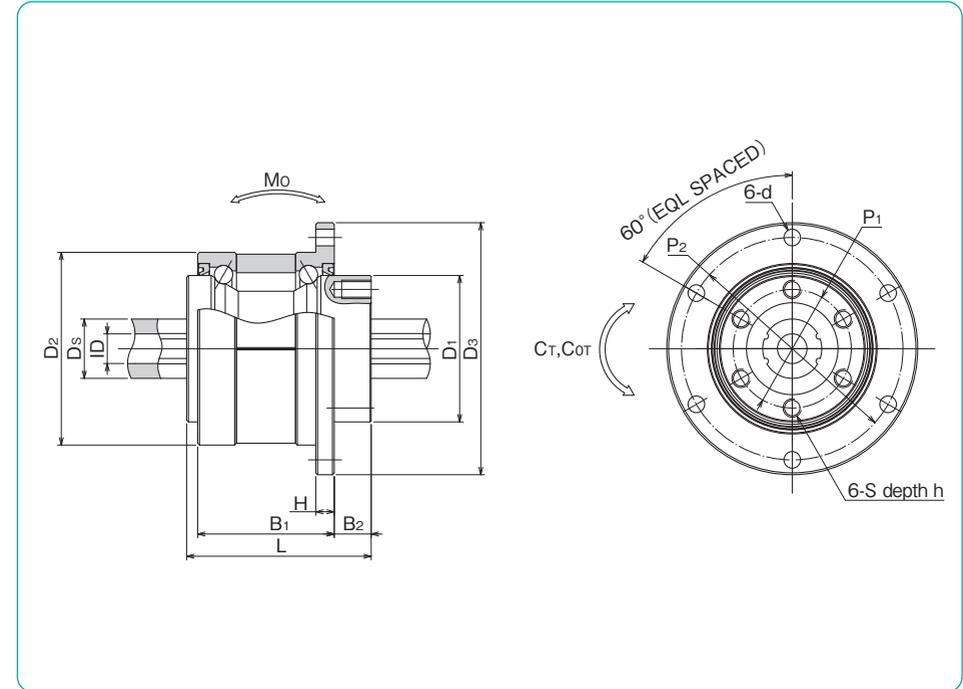
grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGU: urea-based low dust generation grease  
-KGF: anti-fretting grease

with low temperature black chrome treatment

accuracy grade  
blank: high  
P: precision

\*For standard hollow shafts, refer to P.B-40 for specifications.

part number	major dimensions						major dimensions of angular contact bearing								spline shaft	
	D <sub>1</sub> h7 tolerance		L	P <sub>1</sub> P.C.D.	S	h	D <sub>2</sub>	D <sub>3</sub>	H	B <sub>1</sub>	B <sub>2</sub>	P <sub>2</sub> P.C.D.	d	D <sub>s</sub>	tolerance	
	mm	μm	mm	mm	mm	mm	μm	mm	mm	mm	mm	mm	mm	mm	μm	
<b>SPB16</b>	39.5	0	50	32	M5	8	52	0	68	5	37	10	60	4.5	16	0/-18
<b>SPB20</b>	43.5	-25	63	36	M5	8	56	-7	72	6	48	12	64	4.5	20	0
<b>SPB25</b>	53	0/-30	71	45	M6	8	62	-7	78	6	55	13	70	4.5	25	-21



ID (inner diameter) mm	rotary ball spline				angular contact bearings			allowable static moment M <sub>o</sub> N·m	moment of inertia for the spline nut kg·cm <sup>2</sup>	moment of inertia for the spline shaft kg·cm <sup>2</sup> /mm	moment of inertia for the rotating part kg·cm <sup>2</sup>	mass		size
	torque rating		load rating		load rating		nut					shaft		
	basic C <sub>T</sub> N·m	static C <sub>oT</sub> N·m	dynamic C kN	static C <sub>o</sub> kN	dynamic C <sub>R</sub> kN	static C <sub>oR</sub> kN	kg					kg/m		
8	60	110	6.12	11.2	13.0	12.8	4,000	46	0.59	4.79 × 10 <sup>-4</sup>	1.63	0.54	1.5	<b>16</b>
10	105	194	8.9	16.3	17.4	17.2	3,600	110	1.01	1.18 × 10 <sup>-3</sup>	2.55	0.70	2.4	<b>20</b>
15	189	346	12.8	23.4	22.1	22.5	3,200	171	2.00	2.87 × 10 <sup>-3</sup>	3.85	0.92	3.7	<b>25</b>

\*Maximum revolutions with grease lubrication.

Contact NB for further information in case oil lubrication is required.

1kN≒102kgf 1N·m≒0.102kgf·m

# STROKE BALL SPLINE

The NB stroke ball spine SPLFS type is a highly accurate linear motion bearing with a limited stroke, to which both radial load and torque can be applied at the same time. It operates with extremely low dynamic friction.

## STRUCTURE AND ADVANTAGES

The NB stroke ball spline consists of a nut and a shaft both with raceway grooves. The flanged spline nut consists of an outer cylinder, a retainer, side-rings, and ball elements. Since the retainer in the nut is equipped with ball pockets, the ball elements do not contact each other, which allows for a smooth linear motion. The stroke is limited since the retainer is a non-circulating type. For normal operation, it is recommended to consider 80% of the maximum stroke shown in the dimension table as an actual stroke length.

### Extremely low Dynamic Friction and Low Noise

The rolling elements are separated by the ball pockets so that they do not contact each other. The stroke length is limited, but extremely low dynamic friction and low noise are realized because the rolling elements do not circulate.

### Compact-Size

With the nut about 20% smaller than those of conventional ball splines, it contributes to space saving.

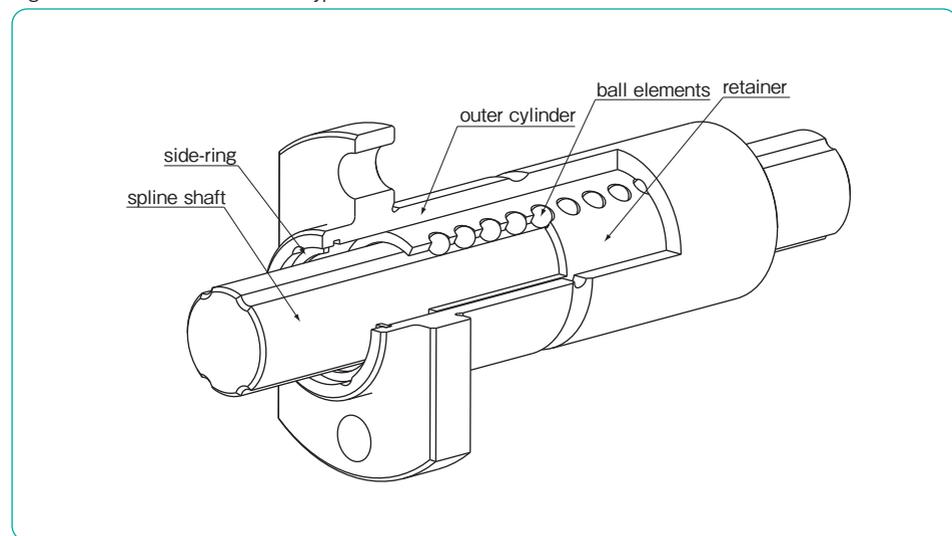
### All Stainless Steel Type

Since all the components are made of stainless steel, this stroke ball spline has an excellent corrosion resistance and heat resistance (operating temperature: -20 to 140°C). It is ideal for clean room or vacuum applications.

### Lubrication

A lubricant groove and two lubrication holes are provided on the outer surface of the nut, which allows for an easy designing of grease replenishment.

Figure B-42 Structure of SPLFS type



## SPECIFICATION

Refer to table B-35 for NB stroke ball spline material and operating temperature range.

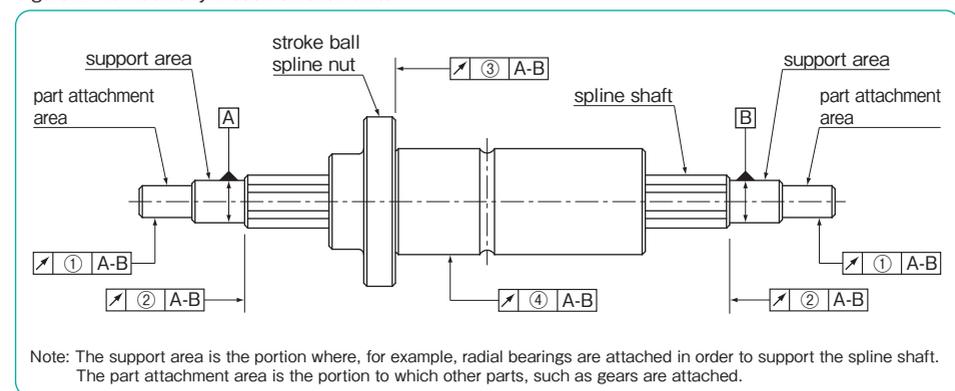
Table B-35 Material and Operating Temperature Range

type	nut		spline shaft	operating temperature range
	outer cylinder	retainer		
SPLFS	stainless steel	stainless steel	stainless steel	-20°C~140°C

## ACCURACY

The accuracy of the NB stroke ball spline is measured at the points shown in Figure B-43.

Figure B-43 Accuracy Measurement Points



### Tolerance of Spline Shaft Groove Torsion (Max.)

The groove torsion is indicated per 100mm, arbitrarily set as the effective length of the spline shaft section.

Table B-36 Tolerance of Spline Shaft Groove Torsion (Max.)

tolerance
13μm/100mm

Table B-37 Tolerance Relative to Spline Support Area (Max.)

unit: μm

part number	① radial runout of part attachment area	② radial runout of the end of the spline shaft section	③ radial runout of the flange
SPLFS 6	14	9	11
SPLFS 8	14	9	11
SPLFS10	17	9	13
SPLFS13	19	11	13
SPLFS16	19	11	13

Table B-38 ④Radial Runout of Outer Surface of Spline Nut Relative to Spline Support Area (Max.)

unit: μm

spline shaft total length (mm)		size		
greater than	or less	6, 8	10	13, 16
-	200	46	36	34
200	315	89	54	45
315	400	126	68	53
400	500	163*	82	62
500	630	-	102	75
630	800	-	-	92
800	1,000	-	-	115
1,000	1,250	-	-	153
1,250	1,500	-	-	256

\* SPLFS6 maximum shaft length: 400 mm

PRELOAD AND CLEARANCE

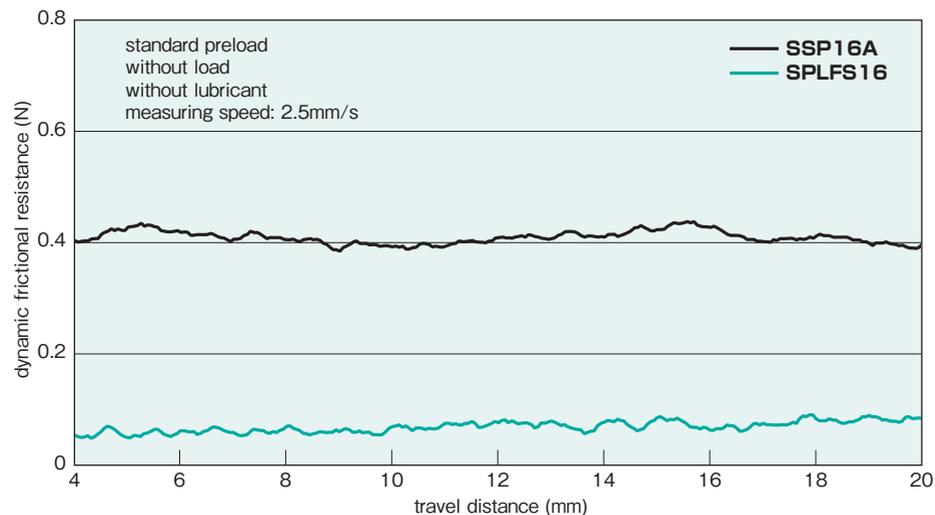
Preload and clearance are expressed in terms of clearance in the rotational direction. For the SPLFS type, only the standard preload is available as shown in Table B-39. Please contact NB if a special preload is required.

Table B-39 Preload and Clearance unit:  $\mu\text{m}$

part number	standard
SPLFS 6	-4~0
SPLFS 8	-4~0
SPLFS10	-4~0
SPLFS13	-4~0
SPLFS16	-4~0

COMPARISON OF DYNAMIC FRICTIONAL RESISTANCE

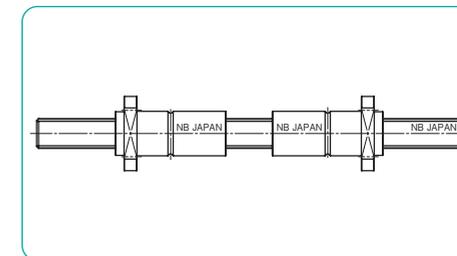
Figure B-44 Comparison of Dynamic Frictional Resistance



NUT ORIENTATION

Unless otherwise specified, the orientation of two nuts NB stroke ball spline is shown in Figure B-45. In other cases please specify the orientation of nut(s) with shaft.

Figure B-45 Nut Orientation and NB mark



USE AND HANDLING PRECAUTIONS

A Set of Spline Nut and Spline Shaft

The ball spline's accuracy and preload is guaranteed when spline nut and shaft are aligned as shown in Figure B-46. Please make sure to align the NB marks when reinserting the shaft.

At this time, both NB marks on the nut and shaft should be aligned in the same direction as when delivered.

When inserting the spline shaft into the spline nut, ensure that the ball elements do not drop out. This is done by aligning the raceway grooves of the shaft with the rows of ball elements and the seal lip of the nut. Then, carefully insert the spline shaft through the spline nut. In case that the nut is preloaded, please exercise additional care. And also, do not disassemble the spline nut.

Dust Prevention

Since the stroke ball spline is designed and manufactured for operation with an extremely low dynamic frictional resistance, seals that increase frictional resistance are not equipped as a standard feature. Please contact NB for a special requirement of seals. For use under harsh conditions, the stroke ball spline should be protected using bellows and protective covers.

Maximum Stroke

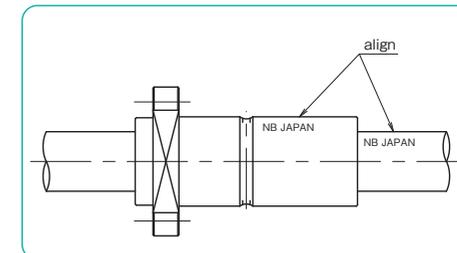
The maximum stroke in the dimension table is the stroke limit.

Retainer Slippage

If the stroke ball spline is used at a high speed or with a vertical shaft, or under an asymmetric load or oscillation, a retainer slippage may occur. For general operation, it is recommended to consider 80% of the maximum stroke length shown in the dimension table as the stroke length.

To prevent the retainer slippage, it is recommended to conduct a full-stroke movement of the nut whenever necessary in order for the retainer to be relocated to the center.

Figure B-46



# SPLFS TYPE

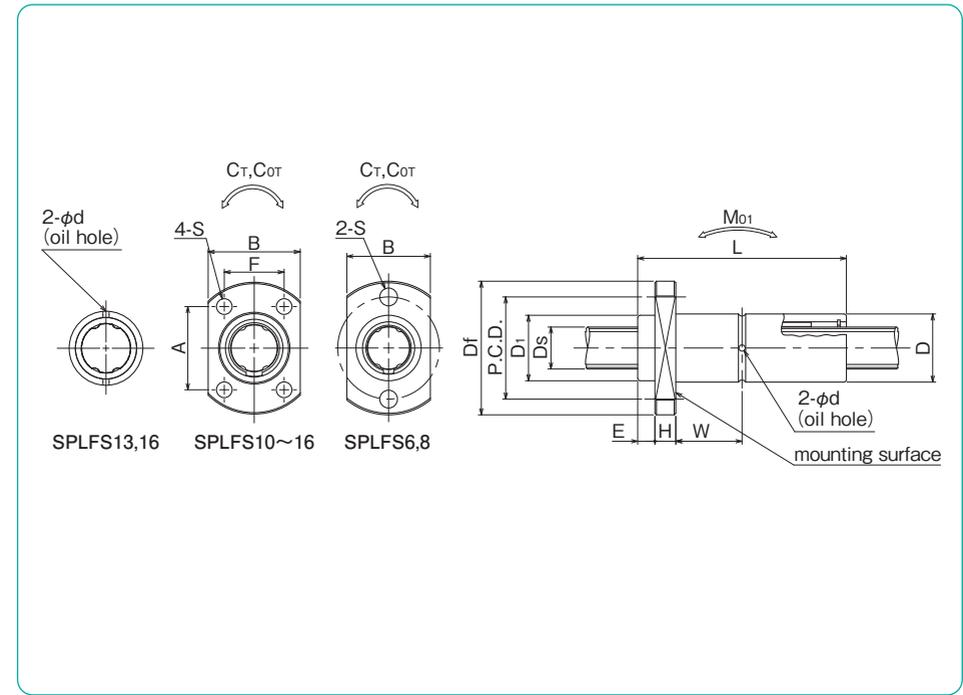
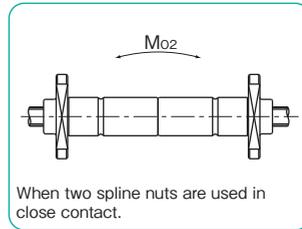
– Two Side Cut Flange Type –



## part number structure

example **SPLFS 16 - 2 - 200 -LB -KGLA /CU**

SPLFS type	with special specification
nominal diameter	grease symbol (refer to page Eng-51) blank: standard grease -KGLA: lithium-based low dust generation grease -KGU: urea-based low dust generation grease -KGF: anti-fretting grease
number of nuts attached to one shaft	
spline shaft total length	with low temperature black chrome treatment



part number	maximum stroke		D tolerance $\mu\text{m}$	D <sub>1</sub> mm	L tolerance mm	major dimensions							
	mm	mm				E mm	D <sub>f</sub> mm	H mm	B mm	P.C.D. mm	A mm	F mm	
<b>SPLFS 6</b>	22	11	0	10	40	-0.2	3.3	23	4	14	17	-	-
<b>SPLFS 8</b>	20	13		12.5	40		3.3	25.5	4	16	19.5	-	-
<b>SPLFS 10</b>	28	16	-8	15.5	50	-0.2	3.3	28.5	5	20	-	18	13
<b>SPLFS 13</b>	24	20		19.5	50		4.8	36	5	25	-	22	17
<b>SPLFS 16</b>	26	24	-9	23.5	60	-	4.8	40	7	29	-	25	19

S mm	W mm	d mm	D <sub>s</sub> mm	D <sub>s</sub> tolerance $\mu\text{m}$	basic torque rating		basic load rating		allowable static moment		mass		
					dynamic C <sub>T</sub> N·m	static C <sub>OT</sub> N·m	dynamic C kN	static C <sub>o</sub> kN	M <sub>O1</sub> N·m	M <sub>O2</sub> N·m	nut g	shaft kg/m	size
3.4	12.7	1.2	6	0/-12	2.3	3.8	1.8	3.0	11.2	45	21.5	0.21	<b>6</b>
3.4	12.7	1.2	8	0	3.3	5.5	2.02	3.37	13.1	52	27.0	0.38	<b>8</b>
3.4	16.7	1.5	10	-15	6.5	10.9	3.21	5.35	25.6	102	47.7	0.6	<b>10</b>
3.4	15.2	1.5	13	0	27.6	50.7	4.15	7.6	38.8	155	75.3	1.0	<b>13</b>
4.5	18.2	2.0	16	-18	62.8	115	7.66	14	88.3	353	123.5	1.5	<b>16</b>

1kN≐102kgf    1N·m≐0.102kgf·m

# BALL SCREW SPLINE

## STRUCTURE AND ADVANTAGES

The NB Ball Screw Spline consists of a highly accurate and highly rigid Ball Screw nut and Ball Spline nut attached to the ball screw spline shaft which has a screw groove and spline grooves.

SPBR type has a Rotary Ball Screw nut and Rotary Ball Spline nut.

Rotary Ball Screw nut is an integration of ball screw nut and angular contact bearings.

Rotary Ball Spline nut is an integration of ball spline nut and angular contact bearings.

SPBF type has a Rotary Ball Screw nut and a Ball Spline nut.

A single axis of the NB Ball Screw Spline can provide positioning, linear and rotary motion as well as combined spiral motion.

The typical applications are SCARA robot, assembly machine, loader, etc.

Figure B-47 Structure of SPBR-KP type, SPBF-KP type

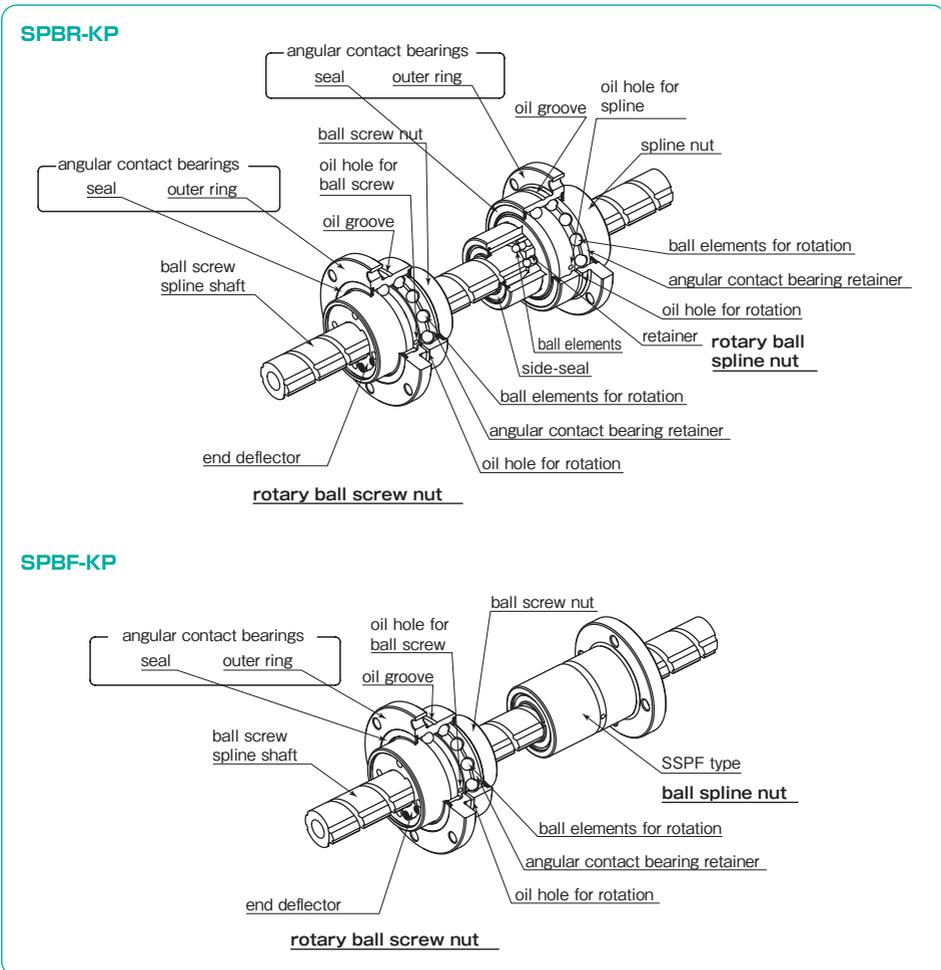
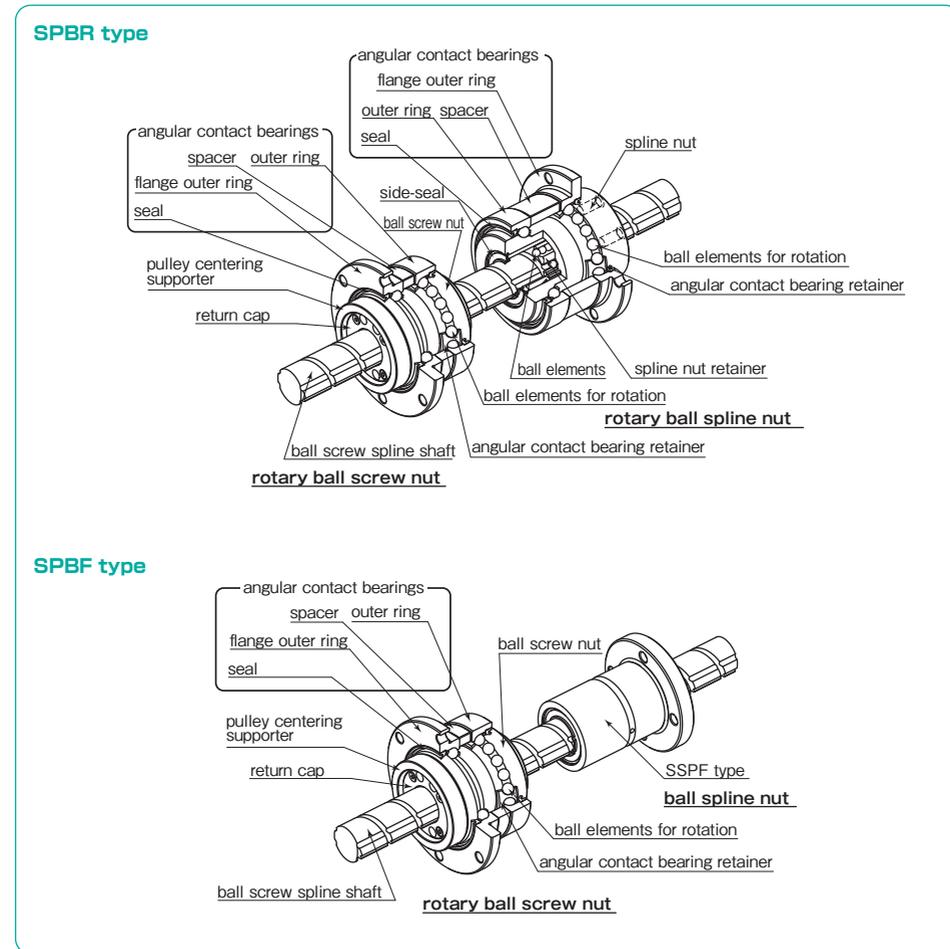


Figure B-48 Structure of SPBR type, SPBF type



**SPECIFICATION**

Refer to table B-40 for NB ball screw spline material and operating temperature range.

Table B-40 Material and Operating Temperature Range

type	nut		spline shaft	operating temperature range
	outer cylinder	return cap/retainer		
SPBR	steel	resin	steel	-20°C~80°C
SPBF				

**PRELOAD**

The preload is properly adjusted for the ball screw nut, spline nut, and angular contact bearings. Please contact NB for preload specification.

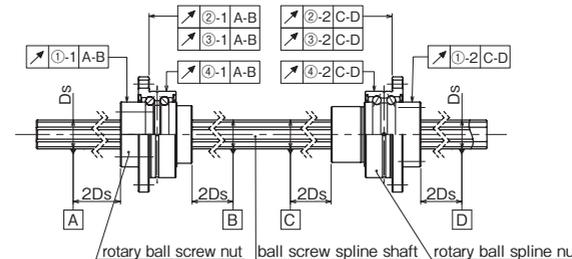
**USE AND HANDLING PRECAUTIONS**

- Please do not adjust the spacer for SPBR and SPBF type. The spacer is adjusted to provide a proper spacing for the best preload condition.
- Please do not remove the Rotary Ball Screw nut from the shaft. There is no ball-retainer in the Rotary Ball Screw nut.
- Please use the pulley centering supporter when attaching the pulley to the return-cap for SPBR and SPBF type.

**ACCURACY**

The NB Ball Screw Spline is measured for accuracy at the points shown in Figure B-49. Figure B-49 Accuracy Measurement points

SPBR-KP type



SPBF-KP type

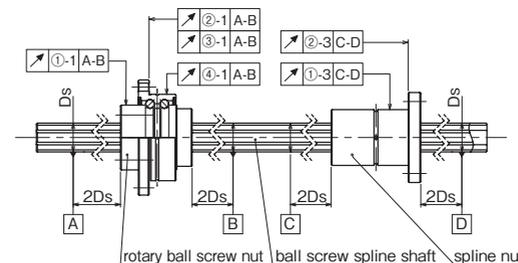


Table B-41 Tolerance of Spline Shaft Groove Torsion (Max.)

tolerance
13μm/100mm

The groove torsion is indicated per 100mm, arbitrarily set within the effective length of the spline shaft section.

Table B-42 Grade of Ball Screw Groove

C5
----

Applied to lead angle accuracy only

Table B-43 Accuracy tolerance of each component (Max.)

unit: μm

part number	① radial runout of the outer surface			② radial runout of flange attachment surface		
	①-1	①-2	①-3	②-1	②-2	②-3
SPBR16KP,SPBF16KP	15	33	33	16	18	13
SPBR20KP,SPBF20KP	19	39	39			
SPBR25KP,SPBF25KP						

Table B-44 Accuracy tolerance during rotational movement of angular rotating area (Max.)

unit: μm

part number	③ radial runout of flange mounting side		④ radial runout of outer ring	
	③-1	③-2	④-1	④-2
SPBR16KP	8	8	9	9
SPBR20KP			10	10
SPBR25KP				

Figure B-50 Accuracy Measurement points

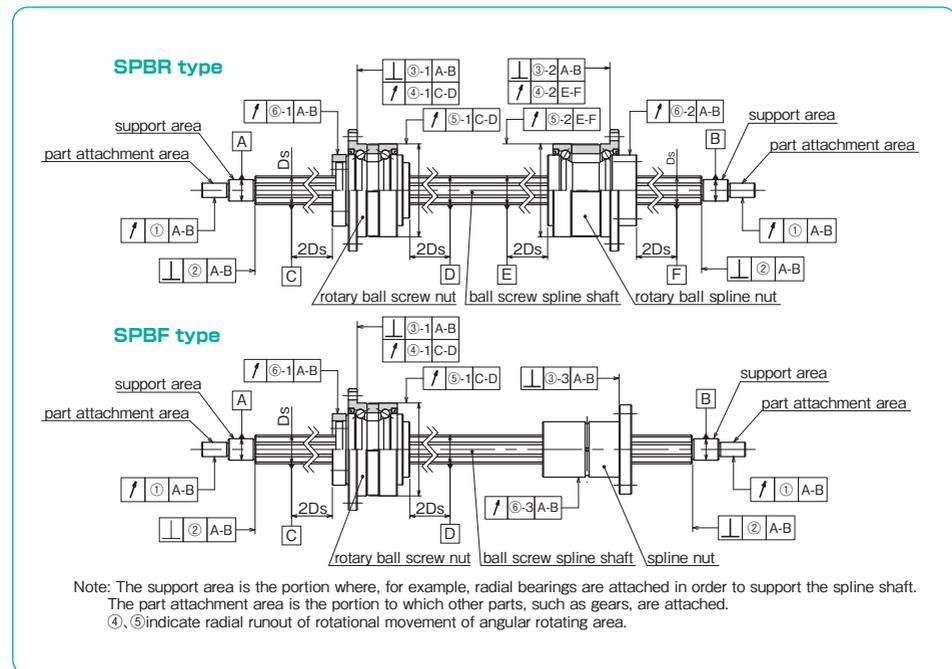


Table B-45 Tolerance of Spline Shaft Groove Torsion (Max.)

tolerance
13μm/100mm

The groove torsion is indicated per 100mm, arbitrarily set within the effective length of the spline shaft section.

Table B-47 Tolerance Relative to Spline Support Area (Max.)

part number	① radial runout of the component attachment area	② radial runout of the spline shaft surface (Applicable only for ground shaft)	③ radial runout of flange attachment surface		
			③-1	③-2	③-3
SPBR16,SPBF16 SPBR20,SPBF20	19	11	16	18	13
SPBR25,SPBF25	22	13	18	21	16

Table B-48 Accuracy tolerance during rotational movement of angular rotating area (Max.)

part number	④ radial runout of flange mounting side		⑤ radial runout of outer ring	
	④-1	④-2	⑤-1	⑤-2
SPBR16 SPBR20 SPBR25	8	8	9	10

Table B-46 Grade of Ball Screw Groove

C5
----

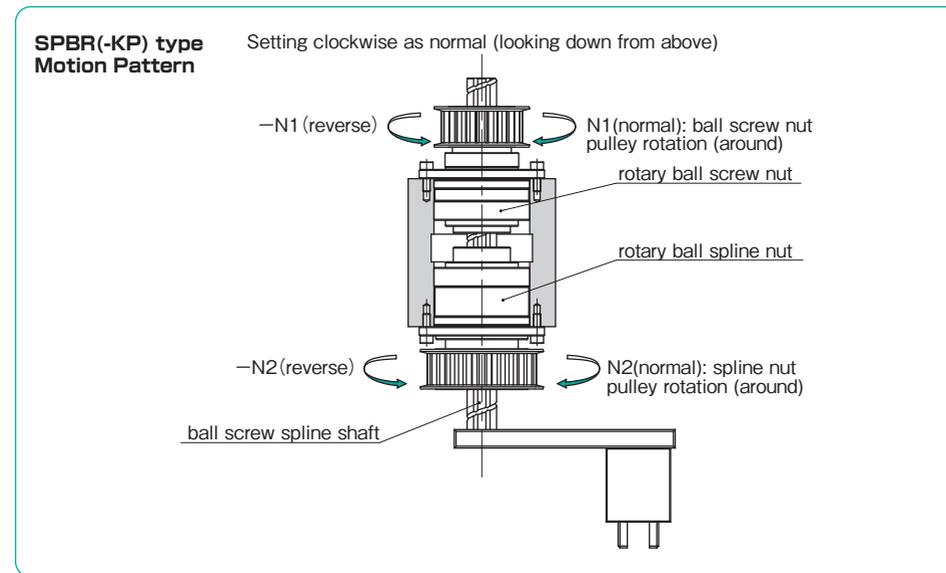
Applied to lead angle accuracy only

Table B-49 Radial Runout of Spline Nut Relative to Spline Support Area (Max.)

ball screw spline shaft total length (mm)	part number: SPBR, SPBF			
	⑥-1	⑥-2	⑥-3	⑥-4
greater than	16,20	25	16,20	25
or less	16,20	25	16,20	25
200	315	45	40	25
315	400	55	45	31
400	500	60	50	38
500	630	75	60	46
630	800	90	70	58
800	1,000	120	85	75

SPBR (-KP) TYPE MOTION PATTERN

One set of SPBR(-KP) type can handle linear, rotational, and spiral motion.



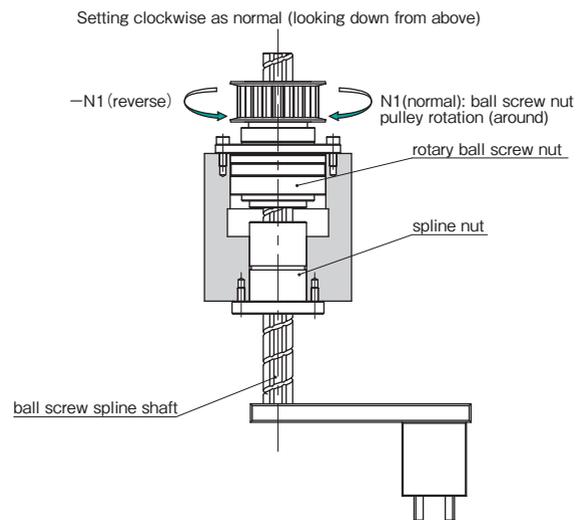
motion	input		motion direction	output		
	ball screw nut	spline nut		travel distance (linear direction)	revolution (rotational direction)	
	N <sub>1</sub> (normal)	0	①	L=N <sub>1</sub> ·R (up)	0	
	-N <sub>1</sub> (reverse)	0	②	L=-N <sub>1</sub> ·R (down)	0	
	N <sub>1</sub> =N <sub>2</sub> (normal)	(normal)	①	0	N <sub>2</sub> (normal)	
	-N <sub>1</sub> =-N <sub>2</sub> (reverse)	(reverse)	②	0	-N <sub>2</sub> (reverse)	
	0	N <sub>2</sub> (normal)	①	L=N <sub>2</sub> ·R (down)	N <sub>2</sub> (normal)	
	0	-N <sub>2</sub> (reverse)	②	L=-N <sub>2</sub> ·R (up)	-N <sub>2</sub> (reverse)	
	N <sub>1</sub> (normal)	N <sub>2</sub> (normal)	①	L=(N <sub>2</sub> - (±N <sub>1</sub> ))·R	in case of N <sub>2</sub> - (±N <sub>1</sub> )>0 (down)	N <sub>2</sub> (normal)
			④		in case of N <sub>2</sub> - (±N <sub>1</sub> )<0 (up)	
	-N <sub>1</sub> (reverse)	-N <sub>2</sub> (reverse)	③	L=(-N <sub>2</sub> - (±N <sub>1</sub> ))·R	in case of -N <sub>2</sub> - (±N <sub>1</sub> )>0 (down)	-N <sub>2</sub> (reverse)
			②		in case of -N <sub>2</sub> - (±N <sub>1</sub> )<0 (up)	

L: travel distance [mm] R: ball screw lead [mm] N<sub>1</sub>: ball screw nut pulley rotation (around) N<sub>2</sub>: ball spline nut pulley rotation (around)

SPBF (-KP) TYPE MOTION PATTERN

SPBF(-KP) type can handle linear motion.

SPBF(-KP) type Motion Pattern



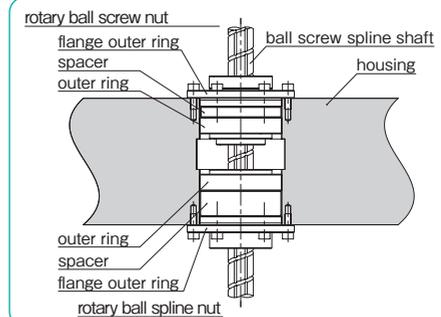
motion	input	motion direction	output
	ball screw nut		travel distance (linear direction)
	N <sub>1</sub> (normal)	①	L=N <sub>1</sub> ·R (up)
	-N <sub>1</sub> (reverse)	②	L=-N <sub>1</sub> ·R (down)

L : travel distance [mm] R : ball screw lead [mm] N<sub>1</sub> : ball screw nut pulley rotation (around)

MOUNTING

For SPBR and SPBF types, please finish the holes of the housing with H7 tolerance as shown in Figure B-51 and ensure that both the flange outer ring and outer ring are inserted into the housing. If the flange is not inserted deeply, it may not be able to receive the load properly, or if only the flange outer ring is inserted deeply, the spacer may slip out, which may reduce the accuracy and make it unusable.

Figure B-51 Mounting of SPBR type



# SPBR-KP TYPE



## part number structure

example **SPBR 20 KP-450 T-LB-KGLA /CU**

SPBR-KP type

nominal diameter

ball screw spline shaft total length

hollow shaft

with special specification

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

Note : Hollow shaft is used for standard type.

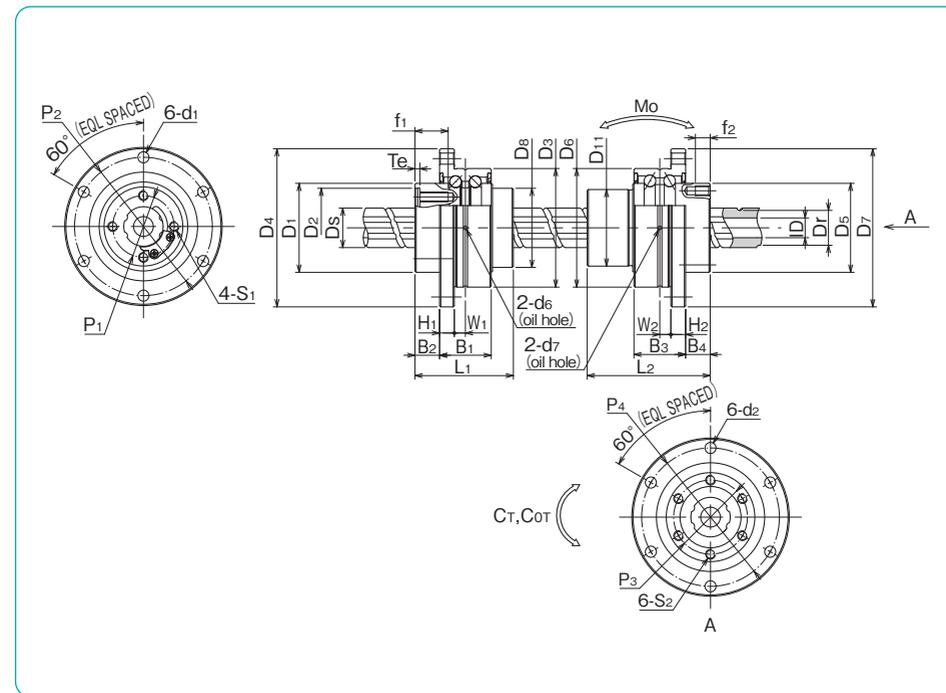
## ROTARY BALL SCREW NUT

part number	major dimensions										major dimensions of angular contact bearings							
	D <sub>1</sub>	h7	D <sub>2</sub>	H7	D <sub>8</sub>	L <sub>1</sub>	P <sub>1</sub>	S <sub>1</sub>	f <sub>1</sub>	T <sub>e</sub>	D <sub>3</sub>	g6	D <sub>4</sub>	H <sub>1</sub>	B <sub>1</sub>	B <sub>2</sub>	P <sub>2</sub>	d <sub>1</sub>
	mm	tolerance μm	mm	tolerance μm	mm	mm	P.C.D. mm		mm	mm	mm	tolerance μm	mm	mm	mm	mm	P.C.D. mm	mm
SPBR16KP	36	0	32		32	40	25	M4	13.5	2	48	-9/-25	64	6	21	10	56	4.5
SPBR20KP	43.5	-25	39	+25 0	39	48	31	M5	16.5	2.5	56	-10	72	6	21	11	64	4.5
SPBR25KP	52	0/-30	47		47	58	38	M6	20	3	66	-29	86	7	25	13	75	5.5

## ROTARY BALL SPLINE NUT

part number	major dimensions							major dimensions of angular contact bearings							
	D <sub>5</sub>	h7	D <sub>11</sub>	L <sub>2</sub>	P <sub>3</sub>	S <sub>2</sub>	f <sub>2</sub>	D <sub>6</sub>	g6	D <sub>7</sub>	H <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	P <sub>4</sub>	d <sub>2</sub>
	mm	tolerance μm	mm	mm	P.C.D. mm		mm	mm	tolerance μm	mm	mm	mm	mm	P.C.D. mm	mm
SPBR16KP	36	0	31	50	30	M4	6	48	-9/-25	64	6	21	10	56	4.5
SPBR20KP	43.5	-25	35	63	36	M5	8	56	-10	72	6	21	12	64	4.5
SPBR25KP	52	0/-30	42	71	44	M5	8	66	-29	86	7	25	13	75	5.5

\*Please select the smallest maximum revolutions (rpm) in case that more than one portion rotate at the same time.  
 ※Maximum revolutions with grease lubrication.  
 \*Moment of inertia is calculated excluding the angular contact bearings.  
 \*Maximum length of ball screw spline shaft : 600mm



W <sub>1</sub>	d <sub>6</sub>	ball screw spline shaft D <sub>s</sub>	shaft inner diameter ID	lead	root diameter D <sub>r</sub>	ball screw basic load rating		angular contact bearings basic load rating		moment of inertia for the nut	moment of inertia for the ball screw shaft	mass		ball screw nut maximum revolutions based on Dm-N	size	
						dynamic Ca	static Coa	dynamic Car	static Coar			maximum revolutions	nut			shaft
mm	mm	mm	mm	mm	mm	kN	kN	kN	kN	kg·cm <sup>2</sup>	kg·cm <sup>2</sup> /mm	kg	kg/m	rpm		
4.5	1.5	16	8	16	13.7	4.3	6.5	7.30	11.3	4,400	0.43	4.19×10 <sup>-4</sup>	0.36	1.10	4,210	16
4.5	1.5	20	10	20	17.5	5.7	9.4	7.69	13.3	3,700	1.01	1.05×10 <sup>-3</sup>	0.53	1.73	3,360	20
5.5	1.5	25	15	25	21.7	8.5	14.6	10.5	19.4	3,100	2.49	2.35×10 <sup>-3</sup>	0.90	2.27	2,710	25

W <sub>2</sub>	d <sub>7</sub>	ball spline basic load rating				angular contact bearings basic load rating			allowable static moment Mo	moment of inertia	mass nut	size
		dynamic C <sub>τ</sub>	static C <sub>0τ</sub>	dynamic C	static C <sub>0</sub>	dynamic C <sub>R</sub>	static C <sub>0R</sub>	maximum revolutions				
mm	mm	N·m	N·m	kN	kN	kN	kN	rpm	N·m	kg·cm <sup>2</sup>	kg	
4.5	1.5	60	110	6.12	11.2	10.2	8.56	4,200	46	0.43	0.37	16
4.5	1.5	105	194	8.9	16.3	10.9	10.1	3,600	110	1.00	0.55	20
5.5	1.5	189	346	12.8	23.4	13.7	12.9	3,100	171	2.22	0.84	25

# SPBF-KP TYPE



## part number structure

example **SPBF 20 KP-450 T -LB -KGLA /CU**

SPBF-KP type

nominal diameter

ball screw spline shaft total length

hollow shaft

with special specification

grease symbol (refer to page Eng-51)  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

Note : Hollow shaft is used for standard type.

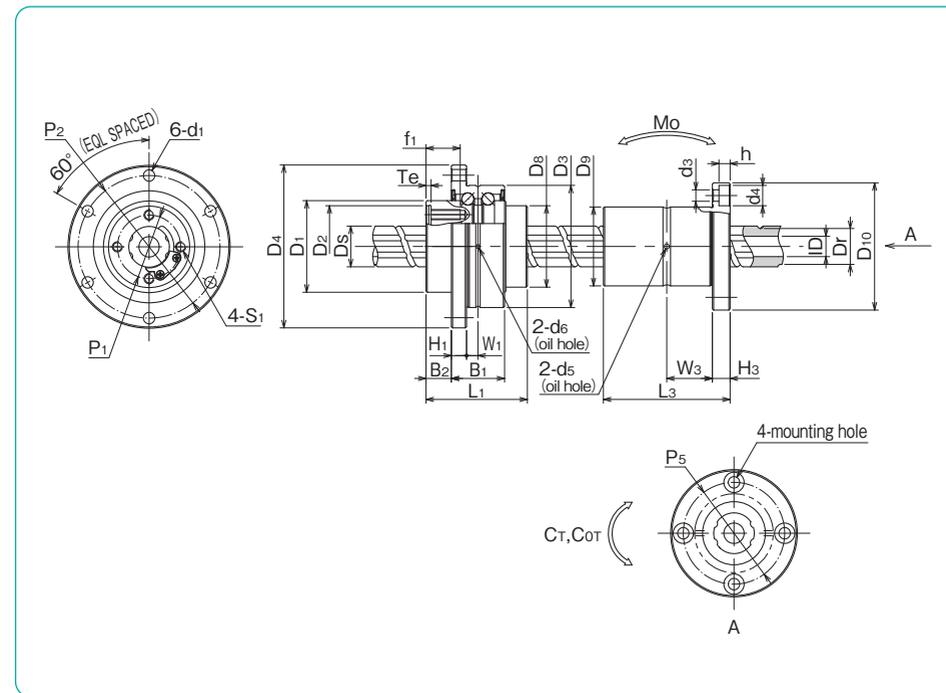
## ROTARY BALL SCREW NUT

part number	major dimensions									major dimensions of angular contact bearings								
	D <sub>1</sub> mm	h7 tolerance μm	D <sub>2</sub> mm	H7 tolerance μm	D <sub>8</sub> mm	L <sub>1</sub> mm	P <sub>1</sub> P.C.D. mm	S <sub>1</sub>	f <sub>1</sub> mm	T <sub>e</sub> mm	D <sub>3</sub> mm	g6 tolerance μm	D <sub>4</sub> mm	H <sub>1</sub> mm	B <sub>1</sub> mm	B <sub>2</sub> mm	P <sub>2</sub> P.C.D. mm	d <sub>1</sub> mm
SPBF16KP	36	0	32	32	32	40	25	M4	13.5	2	48	-9/-25	64	6	21	10	56	4.5
SPBF20KP	43.5	-25	39	+25 0	39	48	31	M5	16.5	2.5	56	-10	72	6	21	11	64	4.5
SPBF25KP	52	0/-30	47		47	58	38	M6	20	3	66	-29	86	7	25	13	75	5.5

## BALL SPLINE NUT

part number	major dimensions							
	D <sub>9</sub> mm	h6 tolerance μm	L <sub>3</sub> mm	tolerance mm	D <sub>10</sub> mm	H <sub>3</sub> mm	P <sub>5</sub> P.C.D. mm	d <sub>3</sub> ×d <sub>4</sub> ×h mm
SPBF16KP	31		50	0	50	7	40	4.5×8×4.4
SPBF20KP	35	0 -16	63	-0.2	58	9	45	5.5×9.5×5.4
SPBF25KP	42		71	0/-0.3	65	9	52	5.5×9.5×5.4

\*Please select the smallest maximum revolutions (rpm) in case that more than one portion rotate at the same time.  
 ※Maximum revolutions with grease lubrication.  
 -Moment of inertia is calculated excluding the angular contact bearings.  
 -Maximum length of ball screw spline shaft : 600mm



W <sub>1</sub> mm	d <sub>6</sub> mm	ball screw spline shaft D <sub>5</sub> mm	shaft inner diameter ID mm	lead mm	root diameter D <sub>r</sub> mm	ball screw basic load rating dynamic C <sub>a</sub> kN	static C <sub>0a</sub> kN	angular contact bearings basic load rating dynamic C <sub>aR</sub> kN	static C <sub>0aR</sub> kN	angular contact bearings ※ maximum revolutions rpm	moment of inertia for the nut kg·cm <sup>2</sup>	moment of inertia for the ball screw shaft kg·cm <sup>2</sup> /mm	mass nut kg	shaft kg/m	ball screw nut maximum revolutions based on Dm·N rpm	size
4.5	1.5	16	8	16	13.7	4.3	6.5	7.30	11.3	4,400	0.43	4.19×10 <sup>-4</sup>	0.36	1.10	4,210	16
4.5	1.5	20	10	20	17.5	5.7	9.4	7.69	13.3	3,700	1.01	1.05×10 <sup>-3</sup>	0.53	1.73	3,360	20
5.5	1.5	25	15	25	21.7	8.5	14.6	10.5	19.4	3,100	2.49	2.35×10 <sup>-3</sup>	0.90	2.27	2,710	25

W <sub>3</sub> mm	d <sub>5</sub> mm	basic torque rating		basic load rating		allowable static moment M <sub>0</sub> N·m	moment of inertia kg·cm <sup>2</sup>	mass nut kg	size
		dynamic C <sub>T</sub> N·m	static C <sub>0T</sub> N·m	dynamic C kN	static C <sub>0</sub> kN				
18	2	60	110	6.12	11.2	46	0.43	0.2	16
22.5	2	105	194	8.9	16.3	110	1.00	0.33	20
26.5	3	189	346	12.8	23.4	171	2.22	0.45	25

# SPBR TYPE



## part number structure

example **SPBR 20 - 450 T -LB -KGLA /CU**

SPBR type: with special specification

nominal diameter: 20

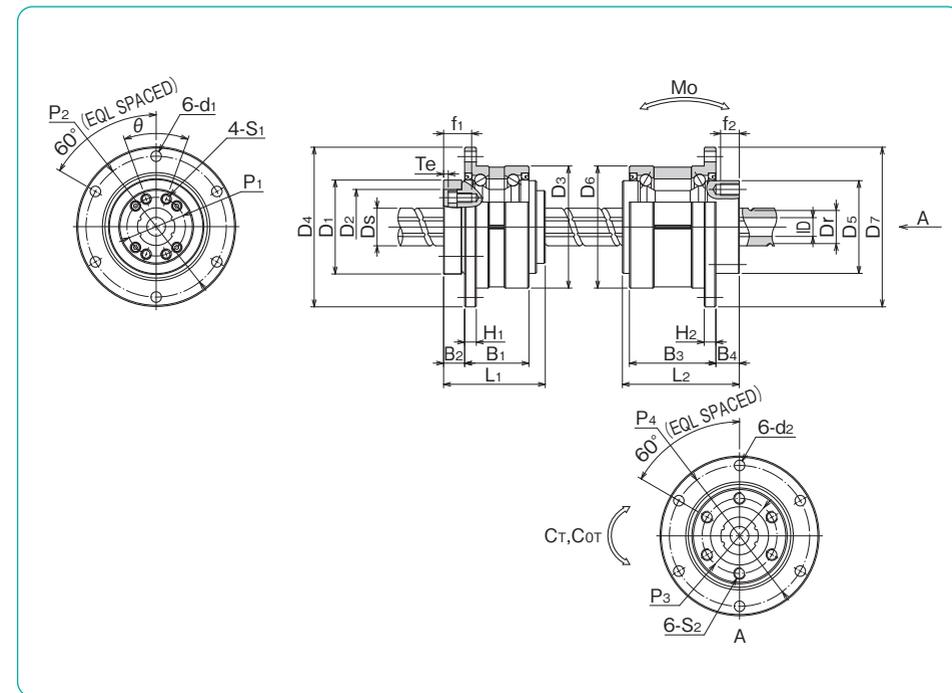
ball screw spline shaft total length: 450

hollow spline shaft: T: standard hollow shaft\*

grease symbol (refer to page Eng-51):  
 blank: standard grease  
 -KGLA: lithium-based low dust generation grease  
 -KGU: urea-based low dust generation grease  
 -KGF: anti-fretting grease

with low temperature black chrome treatment

\*For standard hollow shafts, refer to P.B-40 for specifications.



## ROTARY BALL SCREW NUT

part number	major dimensions										major dimensions of angular contact bearings						
	D <sub>1</sub> h7	D <sub>2</sub> H7	L <sub>1</sub>	P <sub>1</sub>	θ	S <sub>1</sub>	f <sub>1</sub>	T <sub>e</sub>	D <sub>3</sub>	D <sub>4</sub>	H <sub>1</sub>	B <sub>1</sub>	B <sub>2</sub>	P <sub>2</sub>	d <sub>1</sub>		
	mm	μm	mm	P.C.D. mm	°	mm	mm	mm	mm	μm	mm	mm	mm	P.C.D. mm	mm		
<b>SPBR16</b>	40	0	32	43.5	25	40°	M4	12	2	52	0	68	5	27.5	9	60	4.5
<b>SPBR20</b>	50	-25	39	54	31	40°	M5	16	2	62	-7	78	6	34	11	70	4.5
<b>SPBR25</b>	58	0/-30	47	65	38	40°	M6	19	3	72	0	92	8	43	12.5	81	5.5

ball screw spline shaft D <sub>s</sub>	ID (inner diameter)	lead	root diameter D <sub>r</sub>	ball screw basic load rating		angular contact bearings			moment of inertia for the nut	moment of inertia for the ball screw shaft	mass		ball screw nut maximum revolutions based on D <sub>m</sub> -N rpm	size
				dynamic C <sub>a</sub>	static C <sub>oa</sub>	dynamic C <sub>R</sub>	static C <sub>oR</sub>	maximum revolutions			nut	shaft		
				kN	kN	kN	kN	rpm			kg	kg/m		
16	8	16	13.4	4.62	8.59	11.1	22.2	4,000	0.60	4.43×10 <sup>-4</sup>	0.45	1.47	4,170	16
20	10	20	17.2	5.77	12.2	14.4	30.5	3,200	1.75	1.12×10 <sup>-3</sup>	0.76	2.33	3,410	20
25	15	25	21.9	8.62	19.2	18.2	39.8	2,800	3.86	2.74×10 <sup>-3</sup>	1.26	3.65	2,690	25

## ROTARY BALL SPLINE NUT

part number	major dimensions						major dimensions of angular contact bearings						
	D <sub>5</sub> h7	L <sub>2</sub>	P <sub>3</sub>	S <sub>2</sub>	f <sub>2</sub>	D <sub>6</sub>	D <sub>7</sub>	H <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	P <sub>4</sub>	d <sub>2</sub>	
	h7 mm	mm	P.C.D. mm	mm	mm	μm	mm	mm	mm	mm	P.C.D. mm	mm	
<b>SPBR16</b>	39.5	50	32	M5	8	52	0	68	5	37	10	60	4.5
<b>SPBR20</b>	43.5	63	36	M5	8	56	-7	72	6	48	12	64	4.5
<b>SPBR25</b>	53	71	45	M6	8	62	0	78	6	55	13	70	4.5

ball spline				angular contact bearings			allowable static moment Mo	moment of inertia	mass nut
basic torque rating dynamic C <sub>T</sub>	static C <sub>oT</sub>	basic load rating dynamic C	static C <sub>o</sub>	dynamic C <sub>R</sub>	static C <sub>oR</sub>	maximum revolutions			
N·m	N·m	kN	kN	kN	kN	rpm	N·m	kg·cm <sup>2</sup>	kg
60	110	6.12	11.2	13.0	12.8	4,000	46	0.59	0.54
105	194	8.9	16.3	17.4	17.2	3,600	110	1.01	0.70
189	346	12.8	23.4	22.1	22.5	3,200	171	2.00	0.92

\*Please select the smallest maximum revolutions (rpm) in case that more than one portion rotate at the same time.  
 ※Maximum revolutions with grease lubrication.  
 •Moment of inertia is calculated excluding the angular contact bearings.  
 •Maximum length of ball screw spline shaft : 1,000mm

# SPBF TYPE



## part number structure

example **SPBF 20 - 450 T -LB -KGLA /CU**

SPBF type

nominal diameter

ball screw spline shaft total length

hollow spline shaft  
blank: standard shaft  
T: standard hollow shaft\*

with special specification

grease symbol (refer to page Eng-51)  
blank: standard grease  
-KGLA: lithium-based low dust generation grease  
-KGU: urea-based low dust generation grease  
-KGF: anti-fretting grease

with low temperature black chrome treatment

\*For standard hollow shafts, refer to P.B-40 for specifications.

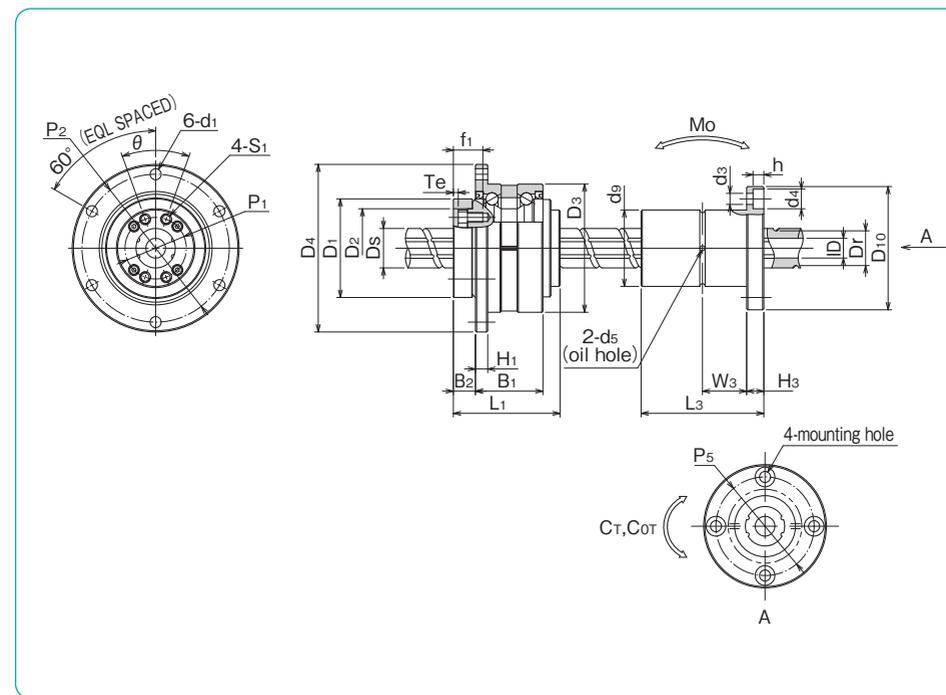
## ROTARY BALL SCREW NUT

part number	major dimensions										major dimensions of angular contact bearings					
	D <sub>1</sub> h7	D <sub>2</sub> H7	L <sub>1</sub>	P <sub>1</sub> P.C.D.	θ	S <sub>1</sub>	f <sub>1</sub>	T <sub>e</sub>	D <sub>3</sub>	D <sub>4</sub>	H <sub>1</sub>	B <sub>1</sub>	B <sub>2</sub>	P <sub>2</sub> P.C.D.	d <sub>1</sub>	
	mm	μm	mm	mm	°	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
<b>SPBF16</b>	40	0	32	43.5	25	40°	M4	12	2	52	68	5	27.5	9	60	4.5
<b>SPBF20</b>	50	-25	39	54	31	40°	M5	16	2	62	78	6	34	11	70	4.5
<b>SPBF25</b>	58	0/-30	47	65	38	40°	M6	19	3	72	92	8	43	12.5	81	5.5

## BALL SPLINE NUT

part number	major dimensions							
	D <sub>9</sub> h6	L <sub>3</sub>	D <sub>10</sub>	H <sub>3</sub>	P <sub>5</sub> P.C.D.	d <sub>3</sub> ×d <sub>4</sub> ×h		
	mm	mm	mm	mm	mm	mm	mm	mm
<b>SPBF16</b>	31	50	50	7	40	4.5×8×4.4		
<b>SPBF20</b>	35	63	58	9	45	5.5×9.5×5.4		
<b>SPBF25</b>	42	71	65	9	52	5.5×9.5×5.4		

- Please select the smallest maximum revolutions (rpm) in case that more than one portion rotate at the same time.
- ※Maximum revolutions with grease lubrication.
- Moment of inertia is calculated excluding the angular contact bearings.
- Maximum length of ball screw spline shaft : 1,000mm



ball screw spline shaft D <sub>s</sub>	ID (inner diameter)	lead	root diameter Dr	ball screw basic load rating		angular contact bearings basic load rating		moment of inertia for the nut	moment of inertia for the ball screw shaft	mass		ball screw nut maximum revolutions based on Dm·N rpm	size	
				dynamic Ca kN	static Coa kN	dynamic Ca <sub>R</sub> kN	static Coa <sub>R</sub> kN			nut kg	shaft kg/m			
16	8	16	13.4	4.62	8.59	11.1	22.2	4,000	0.60	4.43×10 <sup>-4</sup>	0.46	1.47	4,170	16
20	10	20	17.2	5.77	12.2	14.4	30.5	3,200	1.75	1.12×10 <sup>-3</sup>	0.76	2.33	3,410	20
25	15	25	21.9	8.62	19.2	18.2	39.8	2,800	3.86	2.74×10 <sup>-3</sup>	1.26	3.65	2,690	25

W	d <sub>5</sub>	basic torque rating		basic load rating		allowable static moment Mo	moment of inertia	mass nut
		dynamic C <sub>T</sub> N·m	static Co <sub>T</sub> N·m	dynamic C kN	static Co kN			
18	2	60	110	6.12	11.2	46	0.59	0.2
22.5	2	105	194	8.9	16.3	110	1.01	0.33
26.5	3	189	346	12.8	23.4	171	2.00	0.45

# SLIDE BUSH

## SLIDE BUSH

STRUCTURE AND ADVANTAGES	C-2
TYPES	C-3
BLOCK SERIES	C-6
SPECIFICATIONS	C-7
ACCURACY	C-7
LIFE CALCULATION	C-8
LOAD RATING FOR OPEN TYPE SLIDE BUSH	C-8
MOUNTING	C-9
FIT SERIES	C-13
LUBRICATION	C-14
DUST PREVENTION	C-14
COUNTERMEASURE FOR DUST PREVENTION	C-15
SURFACE TREATMENT ANTIRUST EFFECT	C-16
SPECIAL SPECIFICATIONS	C-16
USE AND HANDLING PRECAUTIONS	C-17
DIMENSION TABLE	C-18~

# 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 manufacturing equipment.

## STRUCTURE AND ADVANTAGES

The outer cylinder of slide bush contains a ball retainer that is perfectly designed to control the circulation of ball elements, resulting in smooth linear motion.

### Compact Mechanism

The NB slide bush uses a round shaft for the guiding axis, resulting in space-saving, which allows for compact designs.

### A Wide Variety of Shapes and Installation Methods

The NB slide bush is available in various types, standard, clearance-adjustable, open, flange, etc., for a various applications.

### Selection According to Environment

NB slide bushes are available in standard and anti-corrosion types. Available options include steel-retainer suitable for use in harsh environments and resin retainer for low acoustic, low-cost requirement. Other options can be specified according to the application requirements.

### Compatibility

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

### Doublelip-Seal

Doublelip-seals reduce the grease leakage, keeping the same function as UU seals which prevent the foreign particles from entering the bush. (see page C-14)

### 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 compared to other linear motion mechanisms.

### GM Series

The GM slide bush makes efficient use of resin sub-parts making it possible to achieve an overall weight reduction of 30~50% compared with the SM slide bush. The ball return section is made of resin material, which serves for low noise operation. Also, cost-effectiveness expands the use of slide bush in many applications.

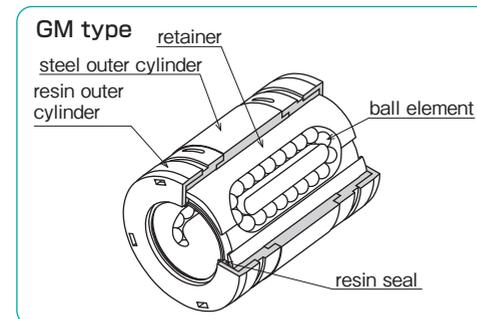
### Block Type Series

Block type series is a unit of NB slide bush and a block type housing. A variety of block types are available such as precision-machined blocks, resin-made blocks, and cost-effective units, each contributes to higher accuracy, light-weight, and low-cost and design-time saving, respectively.

### FIT Series

FIT series is a combination of NB slide bush and precision-machined shaft. The best-fit between slide bush and shaft achieves a smooth, high-accuracy performance meeting the customer requirements. (see page C-13)

Figure C-2 Basic Structure of NB Slide Bush (GM)



## TYPES

Table C-1 Type (1)

type	standard	anti-corrosion	page
standard type	<b>SM</b>	<b>SMS</b>	C- 18
	<b>KB</b>	<b>KBS</b>	C- 82
	<b>SW</b>	<b>SWS</b>	C-102
clearance-adjustable (AJ) type	<b>SM-AJ</b>	<b>SMS-AJ</b>	C- 20
	<b>KB-AJ</b>	<b>KBS-AJ</b>	C- 84
	<b>SW-AJ</b>	<b>SWS-AJ</b>	C-104
open (OP) type	<b>SM-OP</b>	<b>SMS-OP</b>	C- 22
	<b>KB-OP</b>	<b>KBS-OP</b>	C- 86
	<b>SW-OP</b>	<b>SWS-OP</b>	C-106
long type	<b>SM-G-L</b>	—	C- 24
double-wide type	<b>SM-W</b>	<b>SMS-W</b>	C- 26
	<b>KB-W</b>	<b>KBS-W</b>	C- 88
	<b>SW-W</b>	<b>SWS-W</b>	C-108

Figure C-1 Basic Structure of NB Slide Bush (SM, KB, SW)

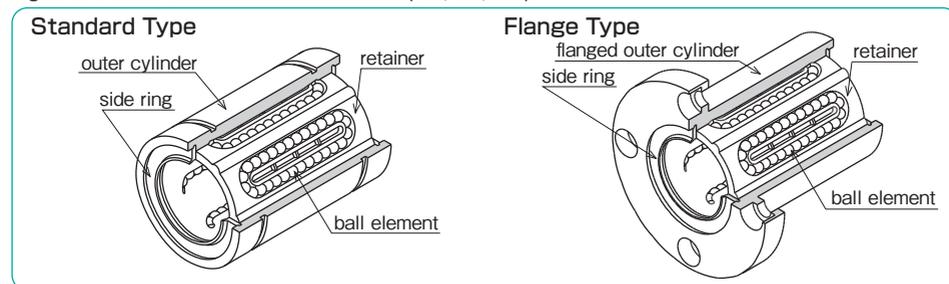


Table C-2 Type (2)

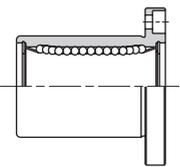
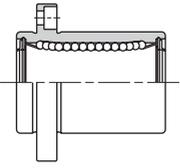
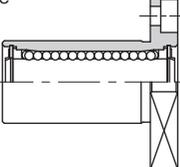
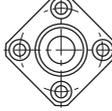
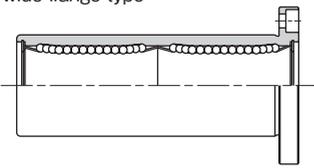
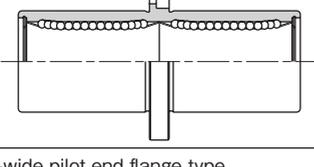
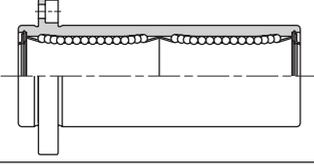
type		standard	anti-corrosion	page
flange type 		<b>SMF</b>	<b>SMSF</b>	C- 28
		<b>KBF</b>	<b>KBSF</b>	C- 90
		<b>SWF</b>	<b>SWSF</b>	C-110
		<b>SMK</b>	<b>SMSK</b>	C- 30
		<b>KBK</b>	<b>KBSK</b>	C- 92
		<b>SWK</b>	<b>SWSK</b>	C-112
		<b>SMT</b>	<b>SMST</b>	C- 32
flange type with pilot end 		<b>SMF-E</b>	<b>SMSF-E</b>	C- 34
		<b>SMK-E</b>	<b>SMSK-E</b>	C- 36
		<b>SMT-E</b>	<b>SMST-E</b>	C- 38
long flange type 		<b>SMK-G-L</b>	-	C- 40
double wide flange type 		<b>SMF-W</b>	<b>SMSF-W</b>	C- 42
		<b>KBF-W</b>	<b>KBSF-W</b>	C- 94
		<b>SWF-W</b>	<b>SWSF-W</b>	C-114
		<b>SMK-W</b>	<b>SMSK-W</b>	C- 44
		<b>KBK-W</b>	<b>KBSK-W</b>	C- 96
		<b>SWK-W</b>	<b>SWSK-W</b>	C-116
		<b>SMT-W</b>	<b>SMST-W</b>	C- 46
center mount flange type 		<b>SMFC</b>	<b>SMSFC</b>	C- 48
		<b>KBFC</b>	<b>KBSFC</b>	C- 98
		<b>SMKC</b>	<b>SMSKC</b>	C- 50
		<b>KBKC</b>	<b>KBSKC</b>	C-100
		<b>SMT-C</b>	<b>SMST-C</b>	C- 52
double-wide pilot end flange type 		<b>SMF-W-E</b>	<b>SMSF-W-E</b>	C- 54
		<b>SMK-W-E</b>	<b>SMSK-W-E</b>	C- 56
		<b>SMT-W-E</b>	<b>SMST-W-E</b>	C- 58

Table C-3 Type (3)

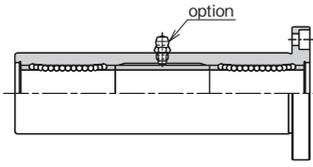
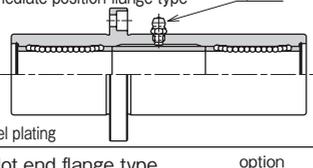
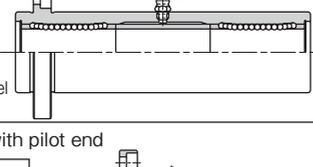
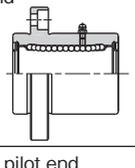
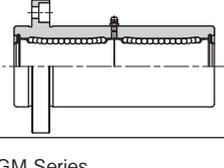
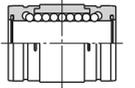
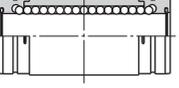
type		standard	page
triple wide flange type 		<b>TRF</b>	C- 60
		<b>TRK</b>	C- 62
		<b>TRT</b>	C- 64
※ Outer cylinder is treated with electroless nickel plating			
triple-wide intermediate position flange type 		<b>TRFC</b>	C- 66
		<b>TRKC</b>	C- 68
※ Outer cylinder is treated with electroless nickel plating			
triple-wide pilot end flange type 		<b>TRF-E</b>	C- 70
		<b>TRK-E</b>	C- 72
※ Outer cylinder is treated with electroless nickel plating			
flange type with pilot end 		<b>TQF-E</b>	C- 74
		<b>TQK-E</b>	C- 76
Grease fitting is standard			
double flange type with pilot end 		<b>TQF-W-E</b>	C- 78
		<b>TQK-W-E</b>	C- 80
Grease fitting is standard			

Table C-4 Type (4) GM Series

type		standard	page
GM single type 		<b>GM</b>	C-118
GM double-wide type 		<b>GM-W</b>	C-119

**BLOCK SERIES**

	single	double-wide
<p><b>SMA·AK·SWA Type</b></p> <p>This type is the most commonly used standard type. The housing is made of aluminum alloy. The wide (W) type is also available for SMA and AK types.</p>	<p>SMA type</p>  <p>P.C-120</p>	<p>SMA-W type</p>  <p>P.C-122</p>
	<p>AK type</p>  <p>P.C-124</p>	<p>AK-W type</p>  <p>P.C-126</p>
	<p>SWA type</p>  <p>P.C-142</p>	
<p><b>SMP Type</b></p> <p>The housing has a self-aligning feature. This feature will absorb inaccuracy of the installation base so that a smooth movement is expected.</p>	<p>SMP type</p>  <p>P.C-128</p>	
<p><b>SMJ · SWJ Type</b></p> <p>Clearance-adjustment is achieved by creating a slit on the SMA/SWA type housing. Less clearance between block and shaft results in higher positioning accuracy by tightening the adjustment screw.</p>	<p>SMJ type</p>  <p>P.C-130</p>	<p>SWJ type</p>  <p>P.C-144</p>
<p><b>SME·SMD·SWD Type</b></p> <p>Open type housing allows a support from below so that a deflection of the shaft is minimized for high loading or long-stroke applications. The wide(W) type is also available for SME type.</p>	<p>SME type</p>  <p>P.C-132</p>	<p>SME-W type</p>  <p>P.C-134</p>
	<p>SMD type</p>  <p>P.C-136</p>	<p>SWD type</p>  <p>P.C-146</p>
<p><b>CE·CD Type</b></p> <p>This type is a unit of block(s), shaft, and support rail that contributes to a total cost reduction. The maximum length is 2,000mm for the support rail and for the shaft the maximum length is 4,000mm.</p>	<p>CE type</p>  <p>P.C-138</p>	
	<p>CD type</p>  <p>P.C-140</p>	

**SPECIFICATIONS**

**Series**

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

Table C-5 Series and Use Location

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

◎ generally used ○ rarely used

**Allowable Load**

NB slide bushes are categorized into three functional types depending on the number and location of retainers: single, double, and triple. Table C-6 shows load ratings and static moment in comparison. The single type uses only one retainer, so when a moment load is to be applied, the double or triple type is recommended.

Table C-6 Load Comparison

type	basic dynamic load rating	basic static load rating	allowable static moment
single	1	1	1
long	1.3	1.8	approx. 4
GM-W	1.6	2	approx. 4
SM double	1.6	2	approx. 6
triple	1.6	2	approx.21

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

**Material and Operating Condition**

The outer cylinder of standard type is made of bearing steel and the outer cylinder of anti-corrosion type is made of Martensitic stainless steel. The retainer is available in steel (stainless steel for anticorrosion), and resin for low acoustic operation. The steel retainer is made of one plate (seamless type). The operating temperature range of the NB slide bush block series is based on the built-in slide bush. The range of SMA-W and SME-W blocks is -20°C to 80°C, regardless of the built-in slide bush.

Table C-7 Material and Operating Temperature Range

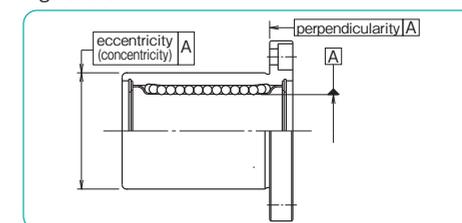
type	outer cylinder	retainer	ball element	operating temperature range	
standard type	SM, KB, SW	steel	steel	-20°C~110°C	
	SM-G, KB-G, SW-G	steel		resin	-20°C~ 80°C
	TQF-G, TQK-G				
GM					
anti-corrosion type	SMS, KBS, SWS	stainless steel	stainless steel	-20°C~140°C*	
	SMS-G, KBS-G, SWS-G		resin	-20°C~ 80°C	
standard type	TRF, TRK	steel with electroless	steel	-20°C~110°C	
	TRF-G, TRK-G, TRT-G	nikel plating	resin	-20°C~ 80°C	

※ If a seal is used in the slide bush, the temperatures is up to 120°C . Please contact NB if a temperature rage exceeds 140°C .

**ACCURACY**

The accuracy of the NB slide bush is represented as eccentricity (concentricity) and perpendicularity as shown in Fig. C-3.

Figure C-3



The accuracy of CE·CD-type support rails are measured as shown in Figure C-4.

Figure C-4 Accuracy Measurement

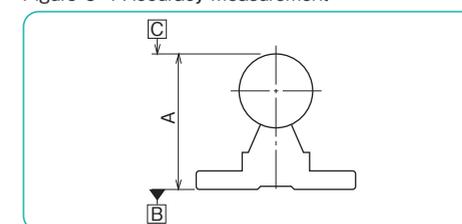
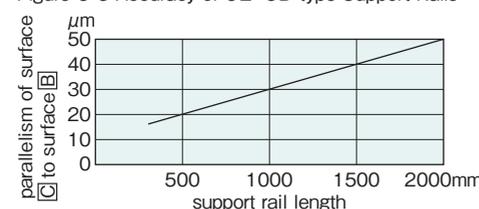


Figure C-5 Accuracy of CE·CD-type Support Rails



### LIFE CALCULATION

Since ball elements are used as the rolling element in the NB slide bush, the following equation is used to calculate the travel life.

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

L: rated life (km) f<sub>H</sub>: hardness coefficient  
 f<sub>T</sub>: temperature coefficient f<sub>C</sub>: contact coefficient  
 f<sub>W</sub>: applied load coefficient C: basic dynamic load rating (N)  
 P: applied load (N)  
 \*Refer to page Eng-5 for the coefficients.

If the stroke distance and number of strokes per unit time are constant, the life time is calculated using the following equation.

$$L_h = \frac{L \cdot 10^6}{2 \cdot l_s \cdot n \cdot 60}$$

L<sub>h</sub>: life time (hr) l<sub>s</sub>: stroke length (mm)  
 L: rated life (km) n: number of cycles per minute (cpm)

### LOAD RATING FOR OPEN TYPE SLIDE BUSH

For the open type slide bush an opening is provided to allow the shaft to be supported from underneath. In case a load is constantly applied in the direction of the opening (for example, being used with a vertical shaft or an overhang loading is applied), the load rating decreases due to less number of loaded rows of ball elements (Table C-8). Therefore, the load rating must be calibrated at the time of design based on the direction of the loading.

Table C-8 Direction of Load and Basic Static Load Rating

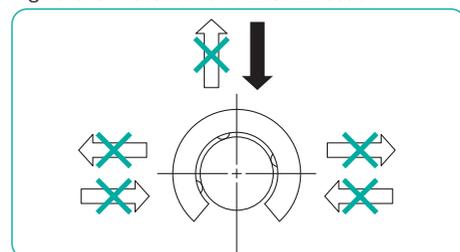
part number	SM10G~16G-OP KB10G~16G-OP SW 8G~10G-OP SME (D) 10G~16G CE (D) 16	SM20 (G) -OP KB20 (G) -OP SW12 (G) -OP SME (D) 20 CE (D) 20	SM25 (G) ~100-OP KB25 (G) ~80-OP SW16 (G) ~64-OP SME25~50 SMD25~30 CE (D) 25~30	SM120,150-OP
loading from above				
	C	C	C	C
loading from below				
	0.64C	0.54C	0.57C	0.35C

### Open type slide bush 3-row type Precautions for use

The open slide bush with 3 ball rows and steel cage specifications cannot be used depending on the direction of load. (See Figure C-6)

Also, please note that the clearance cannot be adjusted.

Figure C-6 Precautions for Load Direction



### MOUNTING

Examples of Mounting methods are shown in Figures C-7~10.

Figure C-7 Standard Type

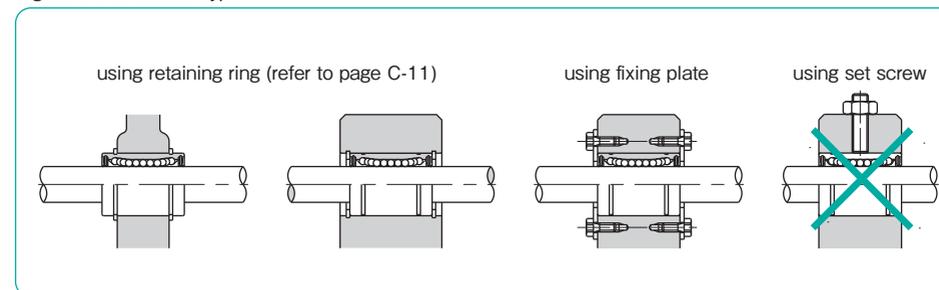


Figure C-8 Clearance Adjustable Type

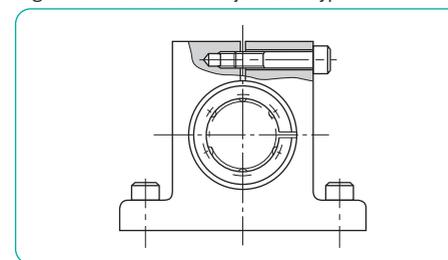


Figure C-9 Open Type

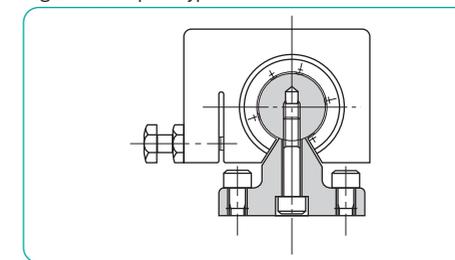
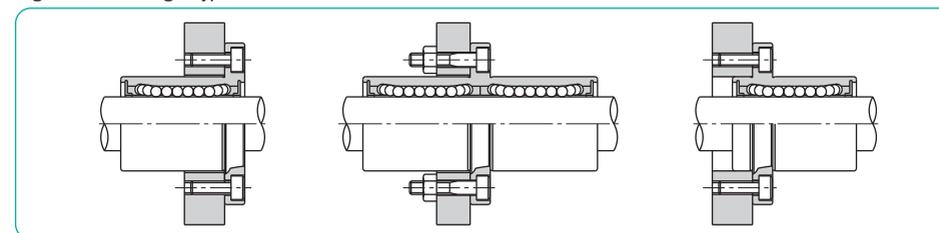


Figure C-10 Flange Type



### Notes on Shaft Selection:

In order to ensure a high accuracy motion of the bush, it is essential to select a high quality shaft. In selecting a shaft, please take note of:

- Hardness: 58HRC or more (refer to hardness coefficient on page Eng-5) recommended
  - Surface Roughness: less than Ra0.4 recommended
- Please refer to recommended fit at P.C-10 for the outer diameter tolerance.

Fit

The clearance fit shown in Table C-9 to 11 are generally used for the shaft of the NB slide bush. If you want to eliminate the gap and improve the accuracy, use the transition fit. In addition, NB is currently working with the shaft (also for the FIT series).

Also, when adjusting the clearance with the clearance adjustment type or open type, be careful not to make the preload excessive by using the radial clearance allowance in the dimension table as a guide.

The flange type is usually inserted into a mounting hole larger than the outer cylinder, but when using the outer cylinder as an inlay, H7 tolerance is recommended.

Table C-9 Recommended Fit

series	accuracy grade	shaft diameter		housing inner diameter	
		clearance fit	transition fit	clearance fit	transition fit
SM	high	g6	h6	H7	J7
	precision(P)	g5	h5	H6	J6
SM-G-L	high	g6	—	H7	—
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	—
GM	high	g6	h6	H7	—
GM-W	high	g6	—	H7	—

Table C-10 Recommended Fit (Flange Type)

series	shaft diameter	
	clearance fit	transition fit
SMF/TQF	g6	h6
SMK-G-L	g6	—
SMF-W/TQF-W	g6	—
TRF	g6	—
KBF	h6	j6
KBF-W	h6	—
SWF	g6	h6
SWF-W	g6	—

Table C-11 Recommended Fit (Block series)

series	shaft diameter	
	clearance fit	transition fit
SMA/AK SMP	g6	h6
SMA-W/AK-W SME/SME-W	g6	—

Retaining Ring for Mounting

It is possible to mount NB slide bush by retaining ring. It is recommended to select the retaining ring with reference to the Table C-12

Figure C-11 Retaining Ring

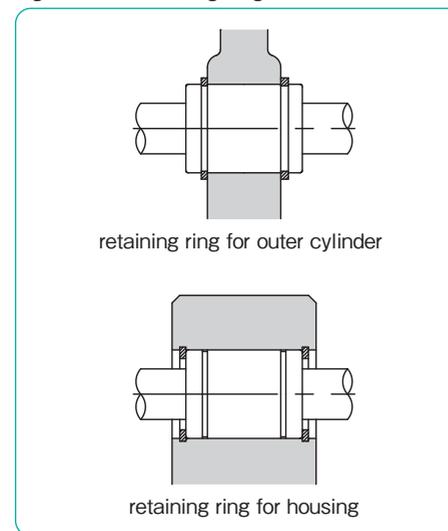


Table C-12 Applicable retaining ring

part number	size of retaining ring for outer cylinder	size of retaining ring for housing
SM 3 KB 3	—	※ 7
SM 4 KB 4	—	※ 8
SM 5	10	※ 10
SM 6 GM 6 KB 5	12	※ 12
SM 8s	15	15
SM 8 GM 8	15	15
	KB 8	16
SM 10 GM10 KB10	19	19
SM 12 GM12	21	21
	KB12	22
SM 13 GM13	※ 23	※ 23
	KB16	26
SM 16 GM16	28	28
SM 20 GM20 KB20	32	32
SM 25 GM25 KB25	40	40
SM 30 GM30	45	45
	KB30	※ 47
SM 35	52	52
SM 40	60	60
	KB40	62
	KB50	75
SM 50	80	80
SM 60 KB60	90	90
SM 80 KB80	120	120
SM100	※ 150	※ 150
SM120	※ 180	※ 180
SM150	※ 210	※ 210

※ part is not in the JIS standard. Please contact NB for details.

### Mounting Surface Profile

Slide bush block series are generally mounted by pressing the reference surface of the block against the shoulder provided on the mounting surface. An undercut as shown in figure C-12 or a radius corner as shown in figure 13 should be provided at the corner of the shoulder in order to avoid interference with the corner of the reference surface of the block. The maximum corner radius values are shown in Table C-13.

Figure C-12 Relief on the Mounting Surface

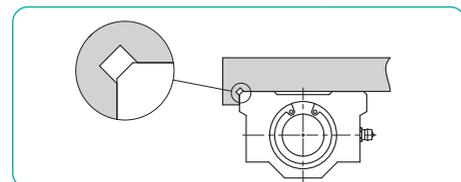


Figure C-13 Corner Radius

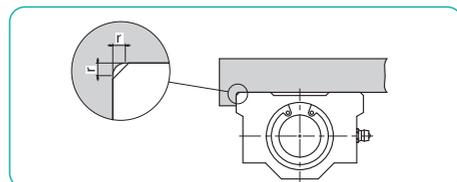


Table C-13 Maximum Corner Radius Values

unit: 1/mm

maximum corner radius values r								
size	applicable block type							size
	SMA SMA-W	AK AK-W	SMJ	SME	SME-W	SMD	CE CD	
3	0.3	-	-	-	-	-	-	3
4								4
5								5
6	0.5	0.5	0.5	1.0	1.0	-	-	6
8								8
10								10
12								12
13								13
16								16
20	1.0	1.0	1.0	1.0	1.0	0.5	0.5	20
25								25
30								30
35								35
40	-	-	-	-	-	-	-	40
50								50
60								60

### Reference Surface

The NB slide units have a reference surface as shown in Figure C-14. Accuracy is achieved by simply pushing the reference surface against the shoulder of the installation surface. (Excluding SMP types)

The SMP type has a reference surface on the opposite side of the adjustment bolt as shown in Figure C-15.

Figure C-14 Reference Surface

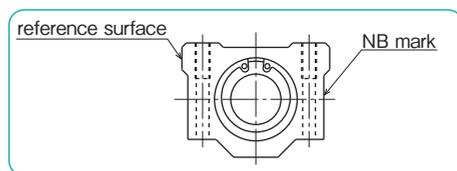
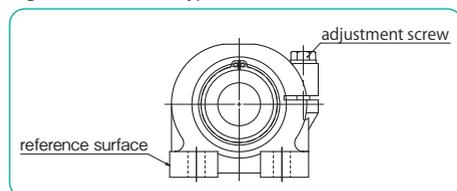


Figure C-15 SMP type reference side

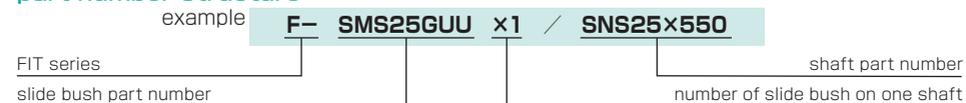


### FIT SERIES

Due to the combined tolerances of the bush's bore and the shaft's diameter, accuracy can be affected by clearance or increased dynamic friction caused by preloading.

NB's FIT Series takes advantages of the lower cost slide bush and the precision ground shaft to achieve a target clearance in order for the linear system to produce a smooth, high-accuracy performance.

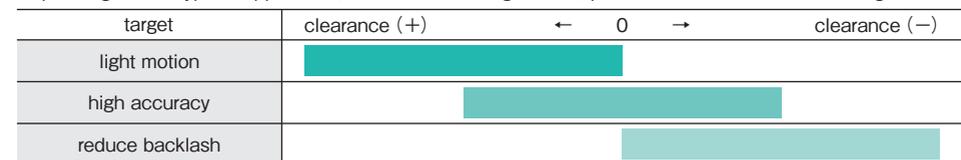
### part number structure



- Please refer to corresponding catalog pages for details.
- Please specify on the drawing about the shaft machining, radial clearance, match-marking, etc.

### Recommended Radial Clearance

Depending on the type of application, the clearance range varies, please use the chart below as a guideline.



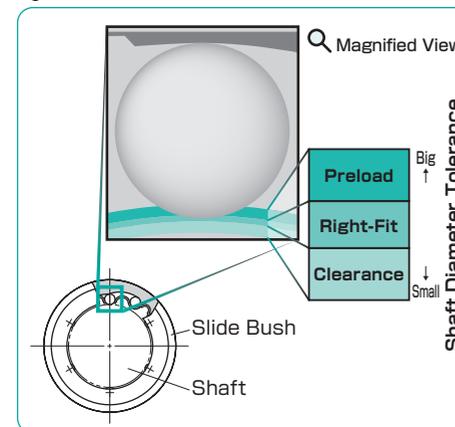
### Slide Bush, Radial Clearance (-), Negative Limit

Negative clearance is opted to reduce backlash. Please refer to the chart below for the negative clearance limits.

size	3~8	10~13	16~25	30~35	40	50~60
radial clearance limit	±0μm	-4μm	-6μm	-8μm	-10μm	-13μm

- The off-center of the housing causes uneven loading on the slide bush, please pay special attention to the centering of the housing especially when negative clearance is a requirement.
- Please contact NB for details on the extra preloading requirement or on other part numbers like SRE, SR, etc.

Figure C-16 Radial Clearance between Slide Bush and Shaft



## LUBRICATION

It is important to lubricate the slide bush for an accurate operation and for a long life. Anti-rust oil is applied to NB slide bush prior to shipment. The NB selected anti-rust oil has a little effect on the lubricant, however, please apply lubricant after cleaning the slide bush by, for example, kerosene, etc.

### Grease Lubricant

Prior to usage, please apply grease, then re-lubricate periodically according to the operating conditions. (Lithium soap-based grease is recommended.) Re-lubrication can be done by directly applying grease inside the ball bush or by using a grease fitting as Figure C-17 shows.

A special low dust generating grease is optional for clean room application, please refer to page Eng-39.

### Oil Lubricant

Prior to usage, please apply oil directly to the shaft surface or by using an oil hole as Figure C-18 shows. Turbine oil (ISO standard VG32-68) is recommended.

Oil holes can be machined (see Figure C-18) in the center portion of the outer cylinder. Please contact NB for oil hole specification.

Figure C-17 Grease Fitting

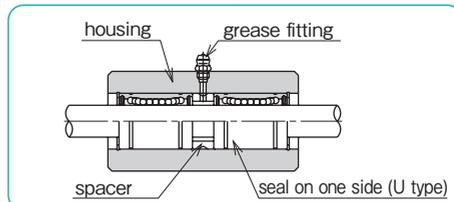
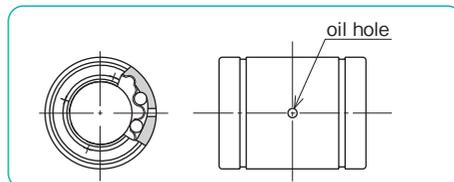


Figure C-18 Oil Hole -Specification-



## DUST PREVENTION

### Seal

The seals prevent dust from entering the slide bush in order to retain the motion accuracy, resulting in a long life time. The UU type is a standard option that has seals on both sides. The U type has a seal on one side only 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 and GW series.

### Doublelip-Seal

A doublelip-seal is a combination of outside lip-seal and inside lip-seal. Outside lip-seal prevents foreign particles from entering the bush and inside lip-seal prevents grease from leaking out of the bush.

By the doublelip-seal, the seal resistance shall be increased by some margin. Applicable Part Number: SM(S) 6 to 30, TRF 6 to 30.

Please refer to the dimension table for seal option.

### Fluororubber Seal

For a high temperature application, fluororubber seals are available on the SMS series size 3 to 30. Please contact NB for details.

Figure C-19 Seal Profile

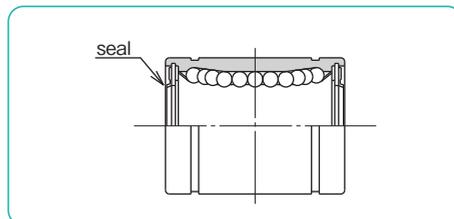
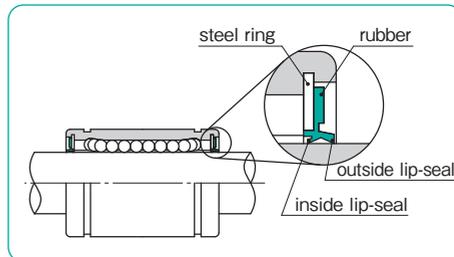


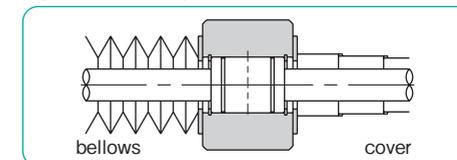
Figure C-20 Doublelip-Seal



## COUNTERMEASURE FOR DUST PREVENTION

A smooth ball circulation is hindered by dust or foreign particles inside the slide bush. Seals on both sides is a standard option for the NB slide bush, however, in a harsh environment it is necessary to attach bellows or protective covers.

Figure C-21 Example of Dust Prevention



### Felt Seal (Except Flange Type)

If the above dust prevention mechanism is difficult to design, a felt seal is recommended. Due to the oil impregnation effect of the felt, it is possible to extend the lubrication interval and to improve dust resistance.

#### ● Instruction

The felt seal is used by press-fitting into a housing which is manufactured according to the recommended fits in Table C-9.

Stopper of slide bush is necessary other than felt seal.

Insert it between the slide bush and retaining ring as shown in the left figure of Fig. C-23, or provide a place to press fit outside the retaining ring as shown in the right figure.

※At the time of shipment, the oil impregnation to the felt seal is not applied.

Figure C-22 Felt Seal

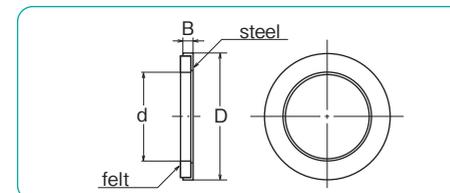


Figure C-23 Example of Felt Seal Installation

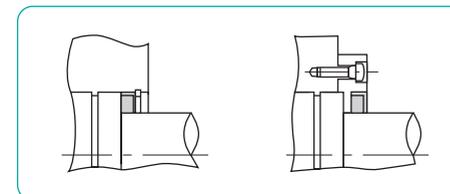


Table C-14

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	SM 10 / GM10
FLM 12	12	21	3	SM 12 / GM12
FLM 13	13	23	3	SM 13 / GM13
FLM 16	16	28	4	SM 16 / GM16
FLM 20	20	32	4	SM 20 / GM20
FLM 25	25	40	5	SM 25 / GM25
FLM 30	30	45	5	SM 30 / GM30
FLM 35	35	52	5	SM 35
FLM 40	40	60	5	SM 40

**SURFACE TREATMENT AND ANTIRUST EFFECT**

In order to adapt various kinds of environment, NB provides flange bushes with surface treatment as a standard.

Table C-15 Surface Treatment

part number	surface treatment	anti-rust effect	color
SK	electroless nickel plating	◎	silver
LF	low temperature black chrome treatment with fluoride coating	◎	black
SB	black oxide (excluding anti-corrosion type)	△	black
SC	industrial chrome plating	○	silver
standard	High-carbon chromium bearing steel ( without surface treatment)	—*2	silver
anti-corrosion	Martensite stainless steel (without surface treatment)	○	silver

◎:excellent ◎:highly effective ○:effective △:mildly effective

\*1 : Please note that tolerance of bushes with surface treatment may be different from the tolerance in dimension table. Please contact NB for details of thickness of plating.

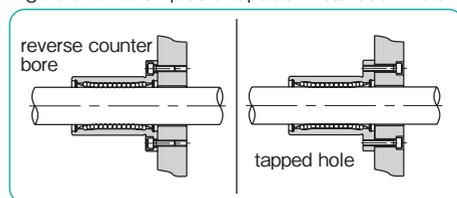
\*2 : In order to prevent corrosion, please do not leave de-greased standard bush without surface treatment.

**SPECIAL SPECIFICATIONS**

●Special Specifications

Please contact NB for more information on surface treatment, oil hole (Figure C-18), flange mounting hole (Figure C-24), etc.

Figure C-24 Examples of Special Installation Hole



Special mounting holes will be required for installations such as Figure C-25 shows. Please contact NB for special requirements.

Figure C-25 Special Installation of SMJ Type

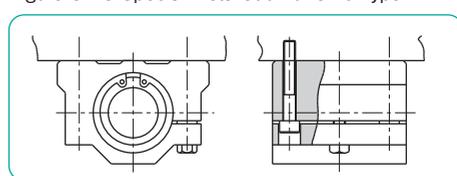


Figure C-25 shows an example of special mounting of SMJ type. Please contact NB for special installation for such specifications or other products.

**USE AND HANDLING PRECAUTIONS**

The NB slide bush is a precision component, please handle with care to maintain its high motion accuracy.

The slide bush is designed for linear motion, so that for applications in which a combination of linear and rotational motion is a requirement, let us recommend Stroke Bush, Slide Rotary Bush, or Rotary Ball Spline.

**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 C-27. 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 install the bush by aligning it with the center of the bore. Excessive force may drop out the ball elements 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. Please check the parallelism by moving the slide bush back and forth the length of stroke to check for freedom of movement before final fixing of the shaft. Please refer to page F-3 for shaft specifications.

**GM Type**

Please avoid a tension load when retaining rings are used for installation.

**Clearance Adjustment**

On the clearance adjustment type please avoid excessive preloading. In the same manner please do not apply excessive torque when tightening the screws.

Figure C-26 Direction of Motion

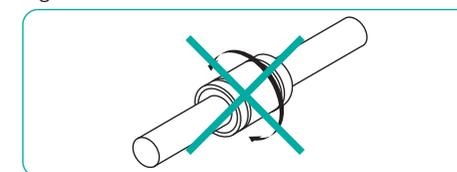


Figure C-27 Insertion of Slide Bush

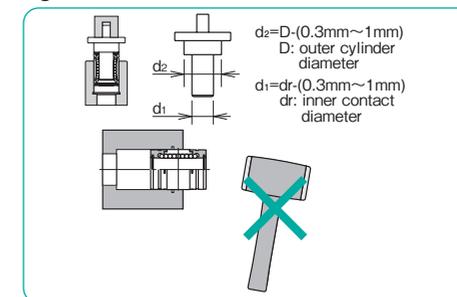
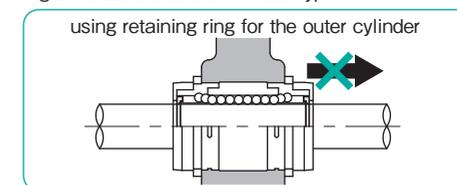


Figure C-28 Installation of GM Type



# SM TYPE

– Standard Type –



## part number structure

example **SMS 25 G UU-P**

specification  
**SM:** standard  
**SMS:** anti-corrosion

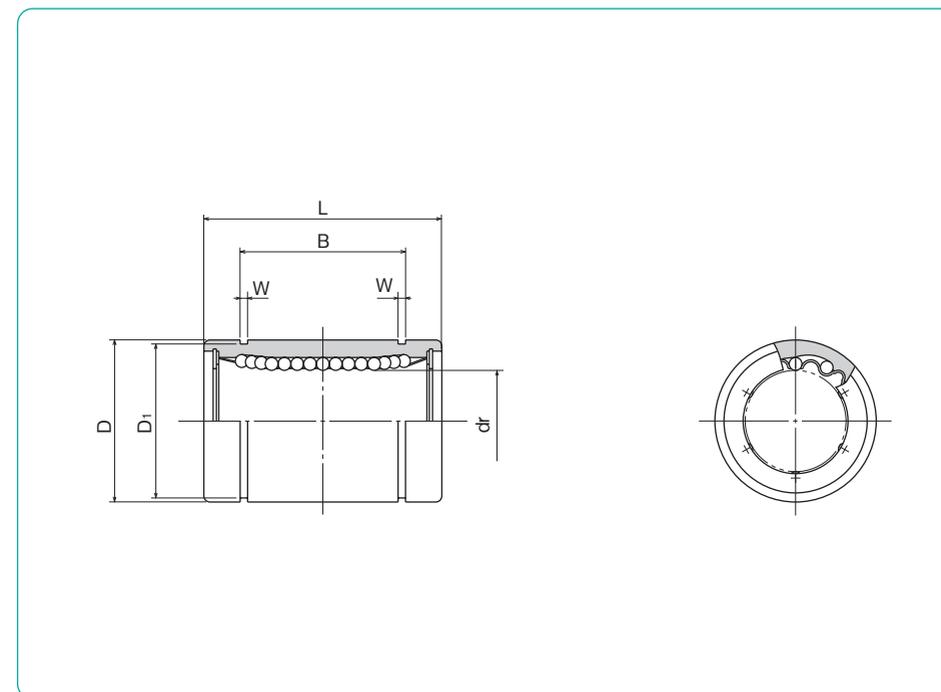
inner contact diameter (dr)

retainer material  
**blank:** standard/steel  
**G:** resin

accuracy grade  
**blank:** high  
**P:** precision

seal  
**blank:** without seal  
**U:** seal on one side  
**UU:** seals on both sides  
**Z:** doublelip-seal on one side  
**ZZ:** doublelip-seals on both sides

Doublelip-seal is available for size 6 to 30.



part number		number of ball circuits	major dimensions		mm	dr tolerance $\mu\text{m}$		D tolerance $\mu\text{m}$	
standard	anti-corrosion		mm	precision		high	mm	mm	
SM 3	SM 3G	4	3	7			0		
SM 4	SM 4G	4	4	8			0		
SM 5	SM 5G	4	5	10			-5	-8	
SM 6	SM 6G	4	6	12					
SM 8s	SM 8sG	4	8	15				0	
SM 8	SM 8G	4	8	15				-11	
SM 10	SM10G	4	10	19			0	0	
SM 12	SM12G	4	12	21			-6	-9	
SM 13	SM13G	4	13	23					
SM 16	SM16G	4	16	28					
SM 20	SM20G	5	20	32					
SM 25	SM25G	6	25	40			0	0	
SM 30	SM30G	6	30	45			-7	-10	
SM 35	SM35G	6	35	52					
SM 40	SM40G	6	40	60			0	0	
SM 50	SM50G	6	50	80			-8	-12	
SM 60	SM60G	6	60	90			0	0	
SM 80	SM80G	6	80	120			-9	-15	
SM100	-	6	100	150			0	0	
SM120	-	8	120	180			-10	-20	
SM150	-	8	150	210			0/-13	0/-25	

mm	L tolerance mm	B tolerance mm		W mm	D1 mm	eccentricity		radial clearance (maximum) $\mu\text{m}$	basic load rating dynamic C N	static Co N	mass g	shaft diameter mm
		mm	mm			precision $\mu\text{m}$	high $\mu\text{m}$					
10		-	-	-	-				69	105	1.4	3
12	0	-	-	-	-	4	8		88	127	2.0	4
15	-0.12	10.2		1.1	9.6			-3	167	206	4.0	5
19		13.5		1.1	11.5				206	265	8.5	6
17		11.5		1.1	14.3				176	216	11	8
24		17.5		1.1	14.3				274	392	17	8
29	0	22	0	1.3	18	8	12		372	549	36	10
30	-0.2	23	-0.2	1.3	20			-4	510	784	42	12
32		23		1.3	22				510	784	49	13
37		26.5		1.6	27				774	1,180	76	16
42		30.5		1.6	30.5			-6	882	1,370	100	20
59		41		1.85	38	10	15		980	1,570	240	25
64		44.5		1.85	43				1,570	2,740	270	30
70	0	49.5	0	2.1	49			-8	1,670	3,140	425	35
80	-0.3	60.5	-0.3	2.1	57	12	20	-10	2,160	4,020	654	40
100		74		2.6	76.5			-13	3,820	7,940	1,700	50
110		85		3.15	86.5				4,700	10,000	2,000	60
140		105.5		4.15	116	17	25		7,350	16,000	4,520	80
175	0	125.5	0	4.15	145			-20	14,100	34,800	8,600	100
200	-0.4	158.6	-0.4	4.15	175	20	30	-25	16,400	40,000	15,000	120
240		170.6		5.15	204	25	40		21,100	54,300	20,250	150

1N=0.102kgf

# SM-AJ TYPE

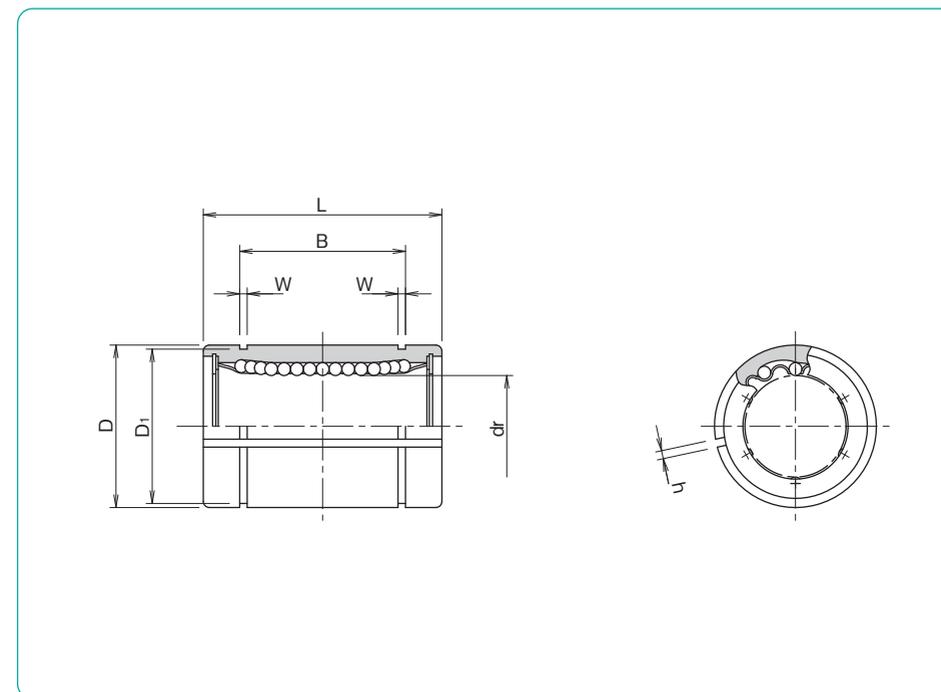
– Clearance Adjustable Type –



## part number structure

example **SMS 25 G UU -AJ**

specification SM: standard SMS: anti-corrosion	inner contact diameter (dr)	retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	clearance-adjustable	seal blank: without seal U: seal on one side UU: seals on both sides
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part number		number of ball circuits	dr mm	major dimensions			
standard	anti-corrosion			D mm	D tolerance*		
steel retainer	resin retainer	stainless retainer	resin retainer	mm	μm		
—	SM 6G-AJ	—	SMS 6G-AJ	4	6	12	0
—	SM 8sG-AJ	—	SMS 8sG-AJ	4	8	15	-11
—	SM 8G-AJ	—	SMS 8G-AJ	4	8	15	0
—	SM10G-AJ	—	SMS10G-AJ	4	10	19	-9
SM 12-AJ	SM12G-AJ	SMS 12-AJ	SMS12G-AJ	4	12	21	0
SM 13-AJ	SM13G-AJ	SMS 13-AJ	SMS13G-AJ	4	13	23	-13
SM 16-AJ	SM16G-AJ	SMS 16-AJ	SMS16G-AJ	4	16	28	0
SM 20-AJ	SM20G-AJ	SMS20-AJ	SMS20G-AJ	5	20	32	0
SM 25-AJ	SM25G-AJ	SMS25-AJ	SMS25G-AJ	6	25	40	-16
SM 30-AJ	SM30G-AJ	SMS30-AJ	SMS30G-AJ	6	30	45	0
SM 35-AJ	SM35G-AJ	SMS35-AJ	SMS35G-AJ	6	35	52	0
SM 40-AJ	SM40G-AJ	SMS40-AJ	SMS40G-AJ	6	40	60	-19
SM 50-AJ	SM50G-AJ	SMS50-AJ	SMS50G-AJ	6	50	80	0
SM 60-AJ	SM60G-AJ	SMS60-AJ	SMS60G-AJ	6	60	90	0
SM 80-AJ	SM80G-AJ	—	—	6	80	120	-22
SM100-AJ	—	—	—	6	100	150	0
SM120-AJ	—	—	—	8	120	180	-25
SM150-AJ	—	—	—	8	150	210	0/-29

\* Accuracy is measured prior to machining clearance slit.

mm	L tolerance mm	mm	B tolerance mm	W mm	D <sub>1</sub> mm	h mm	eccentricity* μm	basic load rating		mass g	shaft diameter mm
								dynamic C N	static C <sub>0</sub> N		
19	0 -0.2	13.5	0 -0.2	1.1	11.5	1	12	206	265	7.5	6
17				1.1	14.3	1		176	216	10	8
24				1.1	14.3	1		274	392	14.7	8
29				1.3	18	1		372	549	29	10
30				1.3	20	1.5		510	784	41	12
32				1.3	22	1.5		510	784	48	13
37	0 -0.3	17.5	0 -0.3	1.6	27	1.5	15	774	1,180	75	16
42				1.6	30.5	1.5		882	1,370	98	20
59				1.85	38	2		980	1,570	237	25
64				1.85	43	2.5		1,570	2,740	262	30
70				2.1	49	2.5		1,670	3,140	420	35
80				2.1	57	3		2,160	4,020	640	40
100	0 -0.4	22	0 -0.4	2.6	76.5	3	20	3,820	7,940	1,680	50
110				3.15	86.5	3		4,700	10,000	1,980	60
140				4.15	116	3		7,350	16,000	4,400	80
175				4.15	145	3		14,100	34,800	8,540	100
200				4.15	175	3		16,400	40,000	14,900	120
240				5.15	204	3		21,100	54,300	20,150	150

1N≒0.102kgf

# SM-OP TYPE

– Open Type –



## part number structure

example **SMS25G UU-OP**

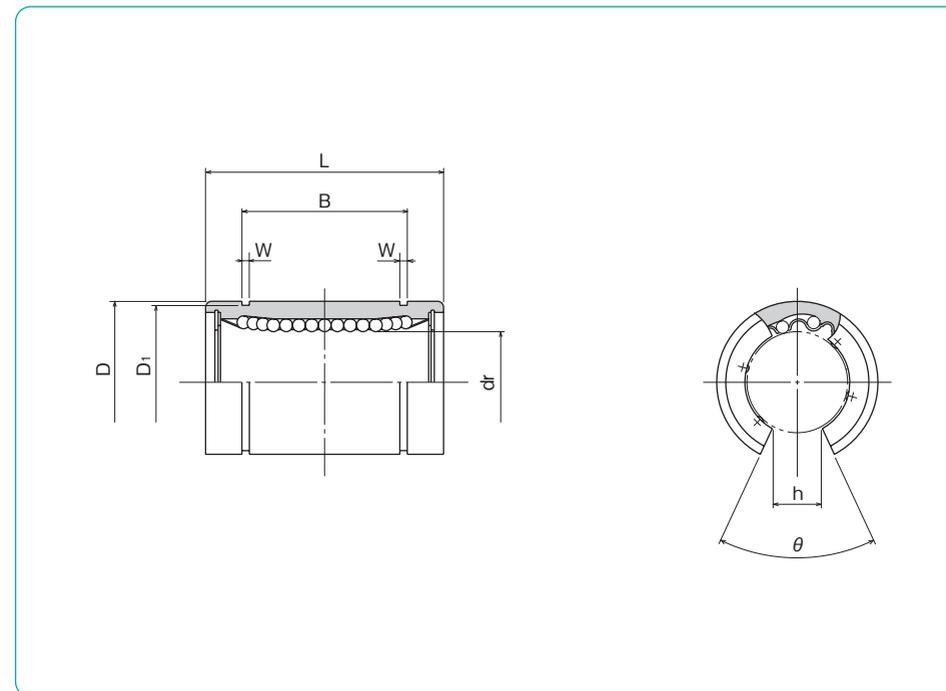
specification  
**SM**: standard  
**SMS**: anti-corrosion

inner contact diameter (dr)

retainer material  
**blank**: standard/steel  
 anti-corrosion/stainless steel  
**G**: resin

open type

seal  
**blank**: without seal  
**U**: seal on one side  
**UU**: seals on both sides



part number				number of ball circuits	mm	dr tolerance* μm	major dimensions	
standard steel retainer	resin retainer	anti-corrosion stainless retainer	resin retainer				mm	D tolerance* μm
–	SM10G-OP	–	SMS10G-OP	3	10		19	
SM 12-OP	SM12G-OP	SMS12-OP	SMS12G-OP	3	12	0	21	0
SM 13-OP	SM13G-OP	SMS13-OP	SMS13G-OP	3	13	– 9	23	–13
SM 16-OP	SM16G-OP	SMS16-OP	SMS16G-OP	3	16		28	
SM 20-OP	SM20G-OP	SMS20-OP	SMS20G-OP	4	20	0	32	0
SM 25-OP	SM25G-OP	SMS25-OP	SMS25G-OP	5	25	–10	40	–16
SM 30-OP	SM30G-OP	SMS30-OP	SMS30G-OP	5	30		45	
SM 35-OP	SM35G-OP	SMS35-OP	SMS35G-OP	5	35	0	52	0
SM 40-OP	SM40G-OP	SMS40-OP	SMS40G-OP	5	40	–12	60	–19
SM 50-OP	SM50G-OP	SMS50-OP	SMS50G-OP	5	50		80	
SM 60-OP	SM60G-OP	SMS60-OP	SMS60G-OP	5	60	0	90	0
SM 80-OP	SM80G-OP	–	–	5	80	–15	120	–22
SM100-OP	–	–	–	5	100	0	150	0
SM120-OP	–	–	–	6	120	–20	180	–25
SM150-OP	–	–	–	6	150	0/–25	210	0/–29

\* Accuracy is measured prior to machining open slit.

mm	L tolerance mm	B tolerance mm		W mm	D1 mm	h mm	θ	eccentricity* μm	basic load rating		mass g	shaft diameter mm
		mm	mm						C N	Co N		
29	0 –0.2	22	0 –0.2	1.3	18	6.8	80°	12	372	549	23	10
30		23		1.3	20	8	80°		510	784	32	12
32		23		1.3	22	9	80°		510	784	37	13
37		26.5		1.6	27	11	80°		774	1,180	58	16
42		30.5		1.6	30.5	11	60°		882	1,370	79	20
59	0 –0.3	41	0 –0.3	1.85	38	12	50°	15	980	1,570	203	25
64		44.5		1.85	43	15	50°		1,570	2,740	228	30
70		49.5		2.1	49	17	50°		1,670	3,140	355	35
80		60.5		2.1	57	20	50°		2,160	4,020	546	40
100		74		2.6	76.5	25	50°		3,820	7,940	1,420	50
110	0 –0.4	85	0 –0.4	3.15	86.5	30	50°	25	4,700	10,000	1,650	60
140		105.5		4.15	116	40	50°		7,350	16,000	3,750	80
175		125.5		4.15	145	50	50°		14,100	34,800	7,200	100
200		158.6		4.15	175	85	80°		16,400	40,000	11,600	120
240		170.6		5.15	204	105	80°		21,100	54,300	15,700	150

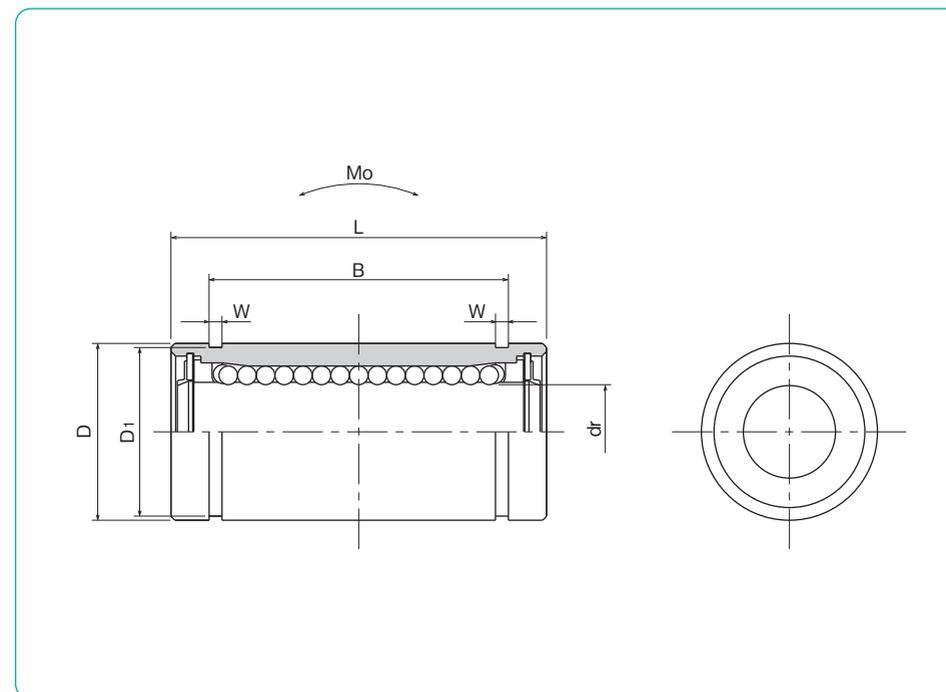
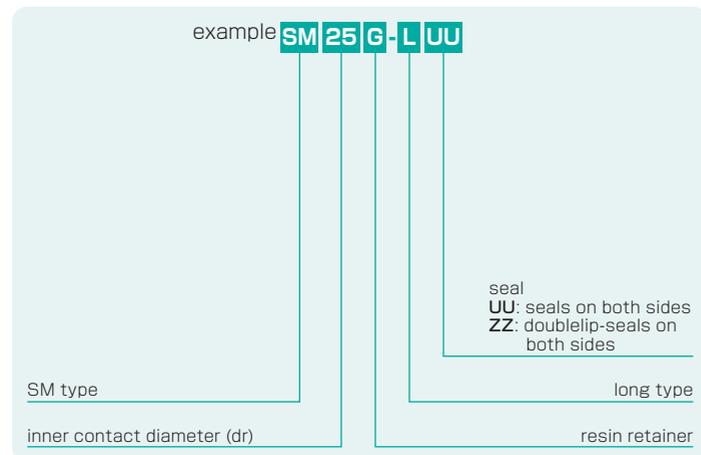
1N≐0.102kgf

# SM-G-L TYPE

– Long Type –



## part number structure



part number*	number of ball circuits	dr		D		major dimensions			
		mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$	mm	tolerance mm	mm	tolerance mm
SM 6G-LUU	4	6	0	12	0	26	0	20.5	-0.2
SM 8G-LUU	4	8		15	-13	32		25.5	
SM10G-LUU	4	10		19		39		32	
SM12G-LUU	4	12		21	0	41		34	
SM13G-LUU	4	13		23	-16	45		36	
SM16G-LUU	4	16		28		53		42	
SM20G-LUU	5	20	-12	32	0	59	47.5	0	
SM25G-LUU	6	25		40	-19	83	69		
SM30G-LUU	6	30		45		90	75		
									-0.3

\* Seals-on-both-sides is standard.

W	D1	eccentricity	basic load rating		allowable static moment	mass	shaft diameter
			dynamic C	static Co			
mm	mm	$\mu\text{m}$	N	N	$\text{N} \cdot \text{m}$	g	mm
1.1	11.5	15	262	476	1.15	10	6
1.1	14.3		352	615	1.94	19	8
1.3	18		493	1,000	3.98	38	10
1.3	20		637	1,430	6.26	43	12
1.3	22		682	1,560	7.68	62	13
1.6	27		1,039	2,350	13.2	99	16
1.6	30.5	20	1,160	2,740	17.9	125	20
1.85	38		1,300	2,960	27.2	315	25
1.85	43		2,160	5,880	61.3	347	30

1N  $\div$  0.102kgf 1N  $\cdot$  m  $\div$  0.102kgf  $\cdot$  m

# SM-W TYPE

– Double-Wide Type –



## part number structure

example **SMS 25 G W UU**

specification  
**SM**: standard  
**SMS**: anti-corrosion

inner contact diameter (dr)

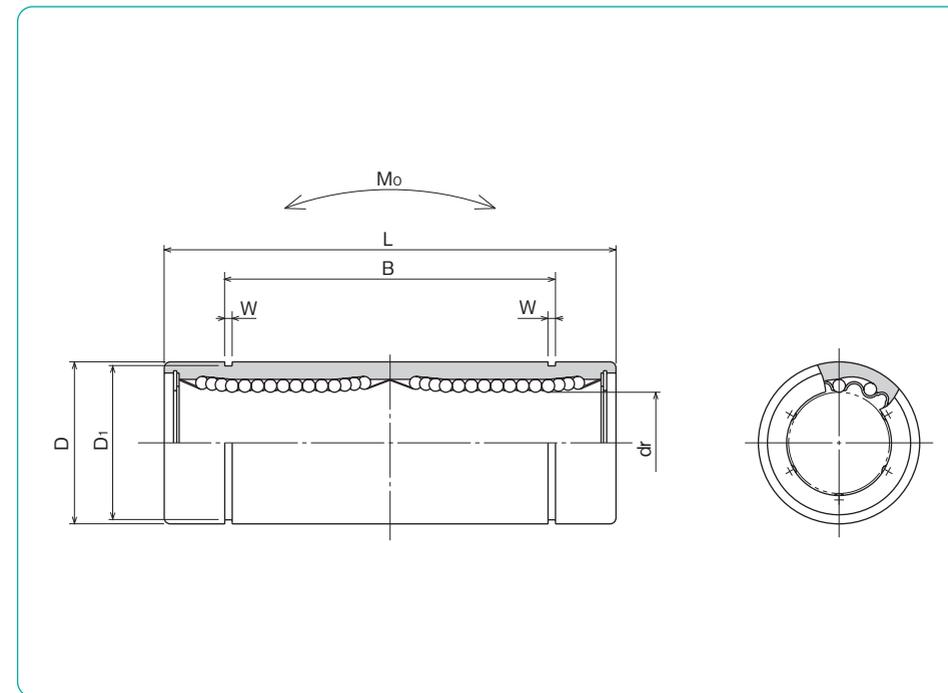
retainer material  
**blank**: standard/steel  
 anti-corrosion/stainless steel  
**G**: resin

seal  
**blank**: without seal  
**UU**: seals on both sides  
**ZZ**: doublelip-seals on both sides

double-wide type

Doublelip-seal is available for size 6 to 30.

part number		number of ball circuits	major dimensions				
standard	anti-corrosion		dr	D			
steel retainer	resin retainer	stainless retainer	resin retainer	mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$
SM 3W	SM 3GW	SMS 3W	SMS 3GW	4	3	7	0
SM 4W	SM 4GW	SMS 4W	SMS 4GW	4	4	8	-11
SM 5W	SM 5GW	SMS 5W	SMS 5GW	4	5	10	0
SM 6W	SM 6GW	SMS 6W	SMS 6GW	4	6	12	-13
SM 8W	SM 8GW	SMS 8W	SMS 8GW	4	8	15	0
SM10W	SM10GW	SMS10W	SMS10GW	4	10	19	-16
SM12W	SM12GW	SMS12W	SMS12GW	4	12	21	0
SM13W	SM13GW	SMS13W	SMS13GW	4	13	23	-19
SM16W	SM16GW	SMS16W	SMS16GW	4	16	28	0
SM20W	SM20GW	SMS20W	SMS20GW	5	20	32	-12
SM25W	SM25GW	SMS25W	SMS25GW	6	25	40	0
SM30W	SM30GW	SMS30W	SMS30GW	6	30	45	-22
SM35W	SM35GW	SMS35W	SMS35GW	6	35	52	0
SM40W	SM40GW	SMS40W	SMS40GW	6	40	60	-25
SM50W	SM50GW	SMS50W	SMS50GW	6	50	80	0
SM60W	SM60GW	SMS60W	SMS60GW	6	60	90	0/-25



mm	L tolerance mm	B tolerance mm		W mm	D <sub>1</sub> mm	eccentricity $\mu\text{m}$	basic load rating		allowable static moment $M_o$ N·m	mass g	shaft diameter mm			
		mm	mm				dynamic C N	static Co N						
19	0	—	—	—	—	10	138	210	0.51	3.2	3			
23		—	—	—	—		176	254	0.63	4.8	4			
28		20.4	0	1.1	9.6		265	412	1.38	11	5			
35		27		1.1	11.5		323	530	2.18	16	6			
45		35		1.1	14.3		431	784	4.31	31	8			
55	44	1.3		18	588	1,100	7.24	62	10					
57	46	1.3		20	813	1,570	10.9	80	12					
61	-0.3	46	-0.3	1.3	22	15	813	1,570	11.6	90	13			
70		53		1.6	27		1,230	2,350	19.7	145	16			
80		61		1.6	30.5		1,400	2,740	26.8	180	20			
112		82		1.85	38		1,560	3,140	43.4	440	25			
123		89		1.85	43		2,490	5,490	82.8	480	30			
135	0	99	0	2.1	49	20	2,650	6,270	110	795	35			
151		121		2.1	57		3,430	8,040	147	1,170	40			
192		148		2.6	76.5		6,080	15,900	397	3,100	50			
209		-0.4		170	-0.4		3.15	86.5	25	7,550	20,000	530	3,500	60

1N  $\approx$  0.102kgf 1N·m  $\approx$  0.102kgf·m

# SMF TYPE

– Round Flange Type –



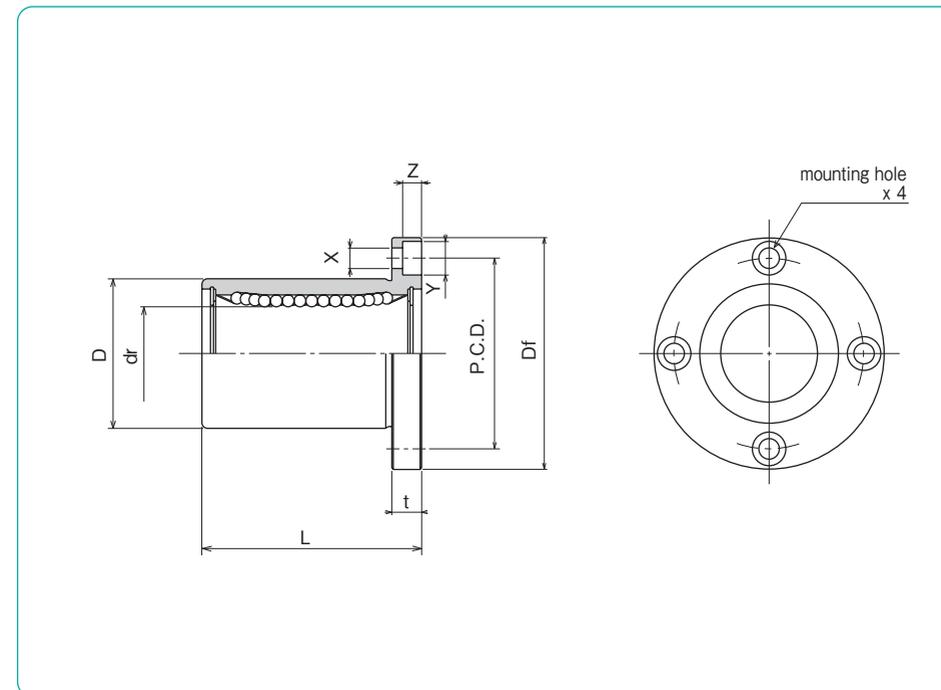
## part number structure

example **SMSF 25 G UU-SK**

specification SMF: standard SMSF: anti-corrosion	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating
inner contact diameter (dr)	seal blank: without seal UU: seals on both sides ZZ: doublelip-seals on both sides
retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	

Doublelip-seal is available for size 6 to 30.

part number				number of ball circuits	dr mm	major dimensions		
standard steel retainer	anti-corrosion resin retainer	stainless steel retainer	resin retainer			D mm	tolerance μm	L ±0.3 mm
SMF 6	SMF 6G	SMSF 6	SMSF 6G	4	6	12	0	19
SMF 8s	SMF 8sG	SMSF 8s	SMSF 8sG	4	8	15	-13	17
SMF 8	SMF 8G	SMSF 8	SMSF 8G	4	8	15		24
SMF 10	SMF10G	SMSF10	SMSF10G	4	10	19		29
SMF 12	SMF12G	SMSF12	SMSF12G	4	12	21	0	30
SMF 13	SMF13G	SMSF13	SMSF13G	4	13	23	-16	32
SMF 16	SMF16G	SMSF16	SMSF16G	4	16	28		37
SMF 20	SMF20G	SMSF20	SMSF20G	5	20	32	0	42
SMF 25	SMF25G	SMSF25	SMSF25G	6	25	40	-19	59
SMF 30	SMF30G	SMSF30	SMSF30G	6	30	45		64
SMF 35	SMF35G	SMSF35	SMSF35G	6	35	52	0	70
SMF 40	SMF40G	SMSF40	SMSF40G	6	40	60	-22	80
SMF 50	SMF50G	SMSF50	SMSF50G	6	50	80		100
SMF 60	SMF60G	SMSF60	SMSF60G	6	60	90	0	110
SMF 80	—	—	—	6	80	120	-25	140
SMF100	—	—	—	6	100	150	0/-29	175



Df mm	t mm	flange P.C.D. mm	X×Y×Z mm	eccentricity μm	perpendicularity μm	basic load rating		mass g	shaft diameter mm
						dynamic C N	static Co N		
28	5	20	3.5×6×3.1	12	12	206	265	24	6
32	5	24	3.5×6×3.1			176	216	32	8
32	5	24	3.5×6×3.1			274	392	37	8
40	6	29	4.5×7.5×4.1			372	549	72	10
42	6	32	4.5×7.5×4.1			510	784	76	12
43	6	33	4.5×7.5×4.1			510	784	88	13
48	6	38	4.5×7.5×4.1	774	1,180	120	16		
54	8	43	5.5×9×5.1	15	15	882	1,370	180	20
62	8	51	5.5×9×5.1			980	1,570	340	25
74	10	60	6.6×11×6.1			1,570	2,740	470	30
82	10	67	6.6×11×6.1			1,670	3,140	650	35
96	13	78	9×14×8.1			2,160	4,020	1,060	40
116	13	98	9×14×8.1			3,820	7,940	2,200	50
134	18	112	11×17×11.1	25	25	4,700	10,000	3,000	60
164	18	142	11×17×11.1			7,350	16,000	5,800	80
200	20	175	14×20×13.1			14,100	34,800	10,600	100

1N≒0.102kgf

# SMK TYPE

– Square Flange Type –



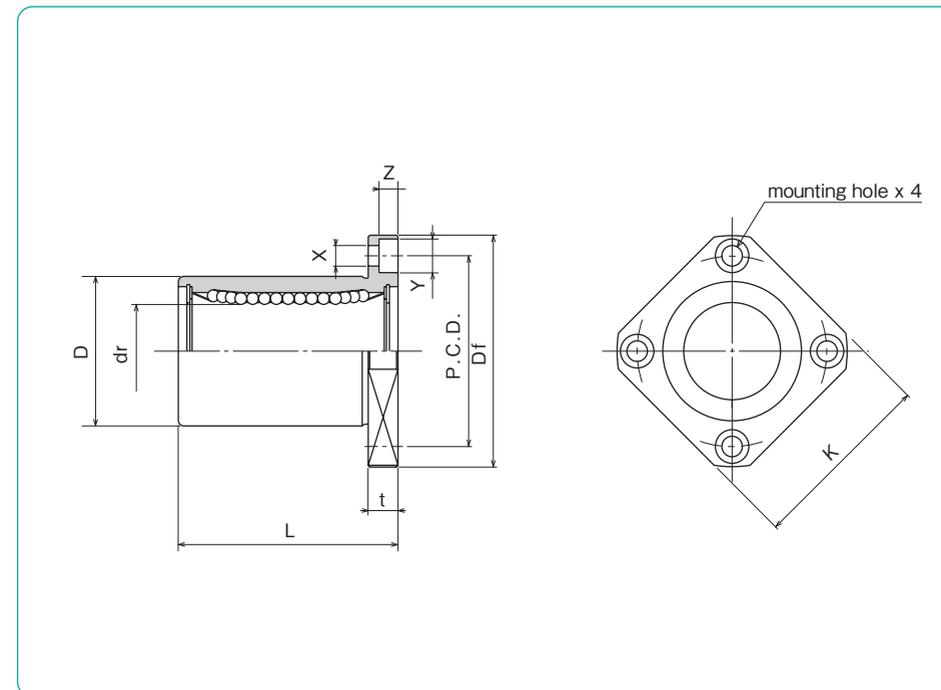
## part number structure

example **SMSK 25 G UU-SK**

specification <b>SMK</b> : standard <b>SMSK</b> : anti-corrosion	inner contact diameter (dr)	retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating	seal <b>blank</b> : without seal <b>UU</b> : seals on both sides <b>ZZ</b> : doublelip-seals on both sides
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Doublelip-seal is available for size 6 to 30.

part number				number of ball circuits	dr		major dimensions		
standard steel retainer	resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
SMK 6	SMK 6G	SMSK 6	SMSK 6G	4	6	0	12	0	19
SMK 8s	SMK 8sG	SMSK 8s	SMSK 8sG	4	8	-9	15	-13	17
SMK 8	SMK 8G	SMSK 8	SMSK 8G	4	8	0	15	0	24
SMK 10	SMK10G	SMSK10	SMSK10G	4	10	-9	19	-16	29
SMK 12	SMK12G	SMSK12	SMSK12G	4	12	0	21	0	30
SMK 13	SMK13G	SMSK13	SMSK13G	4	13	-10	23	-19	32
SMK 16	SMK16G	SMSK16	SMSK16G	4	16	0	28	0	37
SMK 20	SMK20G	SMSK20	SMSK20G	5	20	-12	32	-22	42
SMK 25	SMK25G	SMSK25	SMSK25G	6	25	0	40	0	59
SMK 30	SMK30G	SMSK30	SMSK30G	6	30	-10	45	-19	64
SMK 35	SMK35G	SMSK35	SMSK35G	6	35	0	52	0	70
SMK 40	SMK40G	SMSK40	SMSK40G	6	40	-12	60	-22	80
SMK 50	SMK50G	SMSK50	SMSK50G	6	50	0	80	0	100
SMK 60	SMK60G	SMSK60	SMSK60G	6	60	0	90	0	110
SMK 80	-	-	-	6	80	-15	120	-25	140
SMK100	-	-	-	6	100	0/-20	150	0/-29	175



Df mm	K mm	flange			eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		mass g	shaft diameter mm
		t mm	P.C.D. mm	X×Y×Z mm			dynamic C N	static Co N		
28	22	5	20	3.5×6×3.1	12	12	206	265	18	6
32	25	5	24	3.5×6×3.1			176	216	24	8
32	25	5	24	3.5×6×3.1			274	392	29	8
40	30	6	29	4.5×7.5×4.1			372	549	52	10
42	32	6	32	4.5×7.5×4.1			510	784	57	12
43	34	6	33	4.5×7.5×4.1			510	784	72	13
48	37	6	38	4.5×7.5×4.1	774	1,180	104	16		
54	42	8	43	5.5×9×5.1	15	15	882	1,370	145	20
62	50	8	51	5.5×9×5.1			980	1,570	300	25
74	58	10	60	6.6×11×6.1			1,570	2,740	375	30
82	64	10	67	6.6×11×6.1			1,670	3,140	560	35
96	75	13	78	9×14×8.1			2,160	4,020	880	40
116	92	13	98	9×14×8.1			3,820	7,940	2,000	50
134	106	18	112	11×17×11.1	25	25	4,700	10,000	2,560	60
164	136	18	142	11×17×11.1			7,350	16,000	5,300	80
200	170	20	175	14×20×13.1			14,100	34,800	9,900	100

1N=0.102kgf

# SMT TYPE

– Two Side Cut Flange Type –



## part number structure

example **SMST 25 G UU -SK**

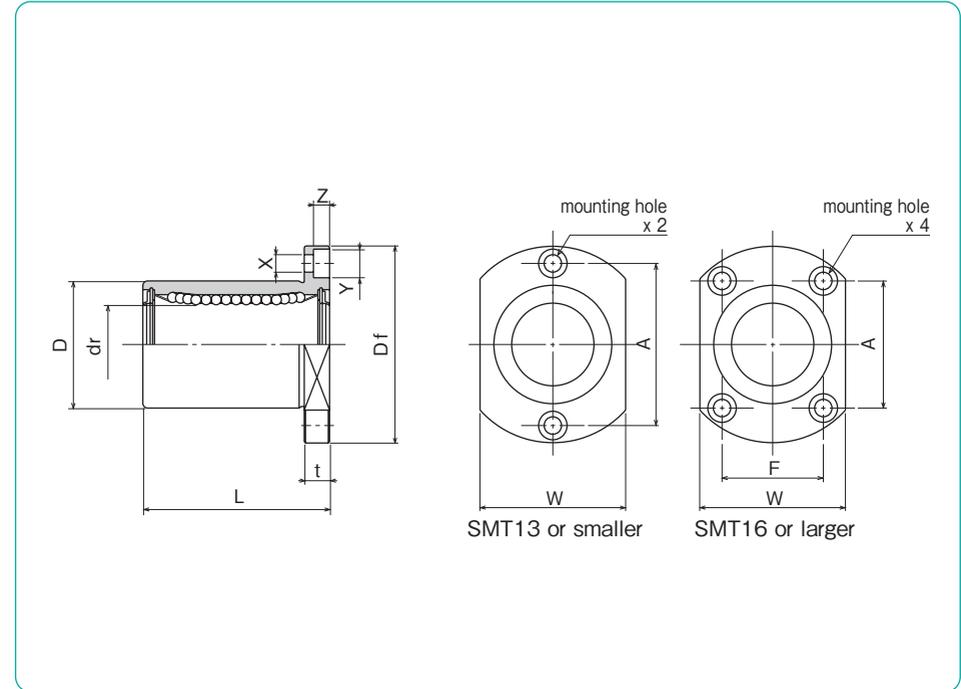
specification  
**SMT**: standard  
**SMST**: anti-corrosion

inner contact diameter (dr)

retainer material  
**blank**: standard/steel  
 anti-corrosion/stainless steel  
**G**: resin

outer cylinder surface treatment  
**blank**: no surface treatment  
**SK**: electroless nickel plating  
**LF**: low temperature black chrome treatment with fluoride coating  
**SB**: black oxide (not available on anti-corrosion type)  
**SC**: industrial chrome plating

seal  
**UU**: seals on both sides  
**ZZ**: doublelip-seals on both sides



part number*				number of ball circuits	major dimensions			
standard		anti-corrosion			dr	D	L	
steel retainer	resin retainer	stainless retainer	resin retainer	mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$	$\pm 0.3$ mm
<b>SMT 6UU</b>	<b>SMT 6GUU</b>	<b>SMST 6UU</b>	<b>SMST 6GUU</b>	4	6	12	0	19
<b>SMT 8UU</b>	<b>SMT 8GUU</b>	<b>SMST 8UU</b>	<b>SMST 8GUU</b>	4	8	15	-13	24
<b>SMT 10UU</b>	<b>SMT 10GUU</b>	<b>SMST 10UU</b>	<b>SMST 10GUU</b>	4	10	19	0	29
<b>SMT 12UU</b>	<b>SMT 12GUU</b>	<b>SMST 12UU</b>	<b>SMST 12GUU</b>	4	12	21	0	30
<b>SMT 13UU</b>	<b>SMT 13GUU</b>	<b>SMST 13UU</b>	<b>SMST 13GUU</b>	4	13	23	-16	32
<b>SMT 16UU</b>	<b>SMT 16GUU</b>	<b>SMST 16UU</b>	<b>SMST 16GUU</b>	4	16	28		37
<b>SMT 20UU</b>	<b>SMT 20GUU</b>	<b>SMST 20UU</b>	<b>SMST 20GUU</b>	5	20	32	0	42
<b>SMT 25UU</b>	<b>SMT 25GUU</b>	<b>SMST 25UU</b>	<b>SMST 25GUU</b>	6	25	40	-19	59
<b>SMT 30UU</b>	<b>SMT 30GUU</b>	<b>SMST 30UU</b>	<b>SMST 30GUU</b>	6	30	45		64

\* Seals-on-both-sides is standard.

Df mm	W mm	flange				eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		mass g	shaft diameter mm
		t mm	A mm	F mm	X×Y×Z mm			dynamic C N	static Co N		
28	18	5	20	—	3.5×6×3.1	12	12	206	265	21	6
32	21	5	24	—	3.5×6×3.1			274	392	33	8
40	25	6	29	—	4.5×7.5×4.1			372	549	64	10
42	27	6	32	—	4.5×7.5×4.1			510	784	68	12
43	29	6	33	—	4.5×7.5×4.1			510	784	81	13
48	34	6	31	22	4.5×7.5×4.1	774	1,180	112	16		
54	38	8	36	24	5.5×9×5.1	15	15	882	1,370	167	20
62	46	8	40	32	5.5×9×5.1			980	1,570	325	25
74	51	10	49	35	6.6×11×6.1			1,570	2,740	388	30

1N≒0.102kgf

# SMF-E TYPE

– Round Flange Type with Pilot End –



## part number structure

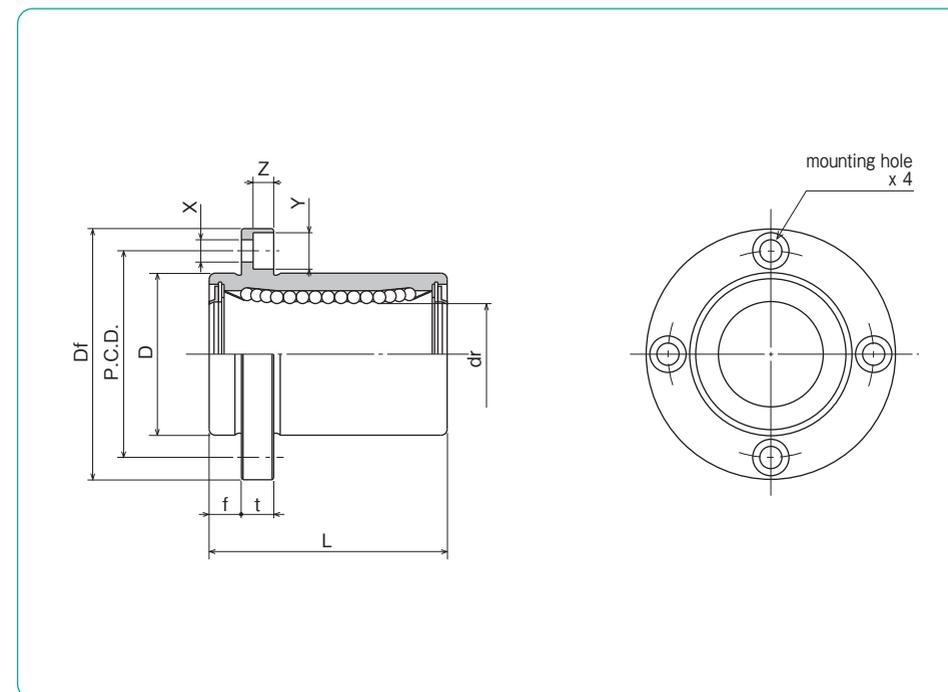
example **SMSF 25 G UU -E -SK**

specification SMF: standard SMSF: anti-corrosion	inner contact diameter (dr)	retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating	with pilot end
			seal UU: seals on both sides ZZ: doublelip-seals on both sides	

Doublelip-seal is available for size 6 to 30.

part number*				number of ball circuits	dr		major dimensions		
standard steel retainer	standard resin retainer	anti-corrosion stainless steel retainer	anti-corrosion resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
SMF 6UU-E	SMF 6GUU-E	SMSF 6UU-E	SMSF 6GUU-E	4	6	12	0	19	
SMF 8UU-E	SMF 8GUU-E	SMSF 8UU-E	SMSF 8GUU-E	4	8	15	-13	24	
SMF 10UU-E	SMF 10GUU-E	SMSF 10UU-E	SMSF 10GUU-E	4	10	19	0	29	
SMF 12UU-E	SMF 12GUU-E	SMSF 12UU-E	SMSF 12GUU-E	4	12	21	0	30	
SMF 13UU-E	SMF 13GUU-E	SMSF 13UU-E	SMSF 13GUU-E	4	13	23	-16	32	
SMF 16UU-E	SMF 16GUU-E	SMSF 16UU-E	SMSF 16GUU-E	4	16	28		37	
SMF 20UU-E	SMF 20GUU-E	SMSF 20UU-E	SMSF 20GUU-E	5	20	32	0	42	
SMF 25UU-E	SMF 25GUU-E	SMSF 25UU-E	SMSF 25GUU-E	6	25	40	-19	59	
SMF 30UU-E	SMF 30GUU-E	SMSF 30UU-E	SMSF 30GUU-E	6	30	45		64	
SMF 35UU-E	SMF 35GUU-E	—	—	6	35	52	0	70	
SMF 40UU-E	SMF 40GUU-E	—	—	6	40	60	0	80	
SMF 50UU-E	SMF 50GUU-E	—	—	6	50	80	-22	100	
SMF 60UU-E	SMF 60GUU-E	—	—	6	60	90	0/-25	110	

\* Seals-on-both-sides is standard.



f mm	Df mm	flange			eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		mass g	shaft diameter mm
		t mm	P.C.D. mm	X×Y×Z mm			dynamic C N	static Co N		
5	28	5	20	3.5×6×3.1	12	12	206	265	24	6
5	32	5	24	3.5×6×3.1			274	392	37	8
6	40	6	29	4.5×7.5×4.1			372	549	72	10
6	42	6	32	4.5×7.5×4.1			510	784	76	12
6	43	6	33	4.5×7.5×4.1			510	784	88	13
6	48	6	38	4.5×7.5×4.1			774	1,180	120	16
8	54	8	43	5.5×9×5.1	15	15	882	1,370	180	20
8	62	8	51	5.5×9×5.1			980	1,570	340	25
10	74	10	60	6.6×11×6.1			1,570	2,740	470	30
10	82	10	67	6.6×11×6.1			1,670	3,140	650	35
13	96	13	78	9×14×8.1			2,160	4,020	1,060	40
13	116	13	98	9×14×8.1			3,820	7,940	2,200	50
18	134	18	112	11×17×11.1	25	25	4,700	10,000	3,000	60

1N≒0.102kgf

# SMK-E TYPE

– Square Flange Type with Pilot End –



## part number structure

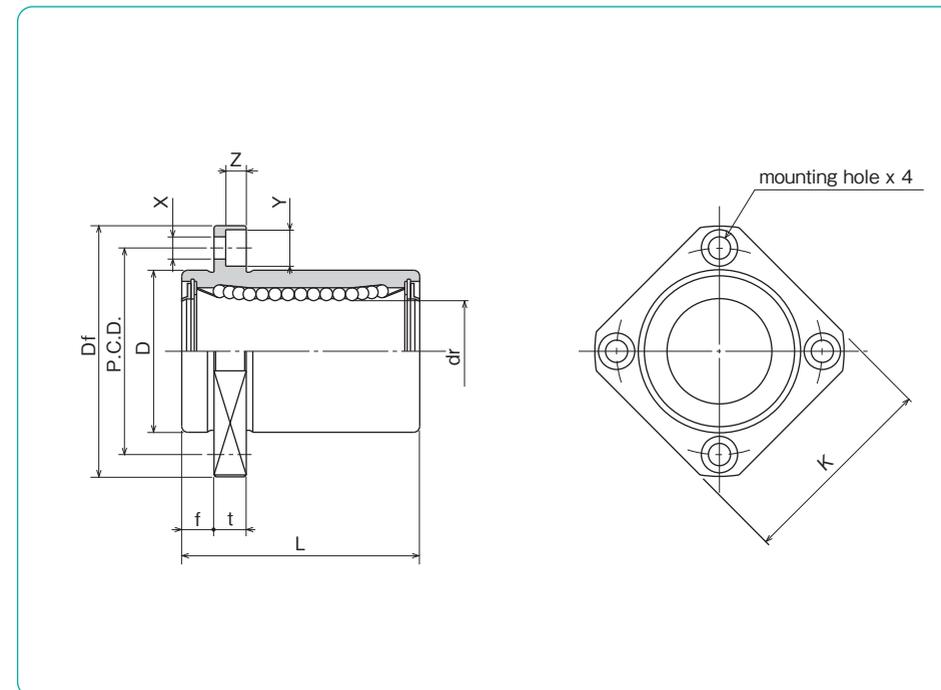
example **SMSK 25 G UU -E -SK**

specification SMK: standard SMSK: anti-corrosion	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating
inner contact diameter (dr)	with pilot end
retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	seal UU: seals on both sides ZZ: doublelip-seals on both sides

Doublelip-seal is available for size 6 to 30.

part number*				number of ball circuits	dr mm	dr tolerance μm	major dimensions		
standard steel retainer	standard resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer				D mm	D tolerance μm	L ±0.3 mm
SMK 6UU-E	SMK 6GUU-E	SMSK 6UU-E	SMSK 6GUU-E	4	6	0	12	19	
SMK 8UU-E	SMK 8GUU-E	SMSK 8UU-E	SMSK 8GUU-E	4	8	-9	15	24	
SMK 10UU-E	SMK 10GUU-E	SMSK 10UU-E	SMSK 10GUU-E	4	10	0	19	29	
SMK 12UU-E	SMK 12GUU-E	SMSK 12UU-E	SMSK 12GUU-E	4	12	-9	21	30	
SMK 13UU-E	SMK 13GUU-E	SMSK 13UU-E	SMSK 13GUU-E	4	13	-16	23	32	
SMK 16UU-E	SMK 16GUU-E	SMSK 16UU-E	SMSK 16GUU-E	4	16	-16	28	37	
SMK 20UU-E	SMK 20GUU-E	SMSK 20UU-E	SMSK 20GUU-E	5	20	0	32	42	
SMK 25UU-E	SMK 25GUU-E	SMSK 25UU-E	SMSK 25GUU-E	6	25	-10	40	59	
SMK 30UU-E	SMK 30GUU-E	SMSK 30UU-E	SMSK 30GUU-E	6	30	-12	45	64	
SMK 35UU-E	SMK 35GUU-E	—	—	6	35	0	52	70	
SMK 40UU-E	SMK 40GUU-E	—	—	6	40	-12	60	80	
SMK 50UU-E	SMK 50GUU-E	—	—	6	50	-12	80	100	
SMK 60UU-E	SMK 60GUU-E	—	—	6	60	0/-15	90	110	

\* Seals-on-both-sides is standard.



f mm	Df mm	flange			eccentricity μm	perpendicularity μm	basic load rating		mass g	shaft diameter mm
mm	mm	K mm	t mm	P.C.D. mm			X×Y×Z mm	dynamic C N		
5	28	22	5	20	12	12	206	265	18	6
5	32	25	5	24			274	392	29	8
6	40	30	6	29			372	549	52	10
6	42	32	6	32			510	784	57	12
6	43	34	6	33			510	784	72	13
6	48	37	6	38			774	1,180	104	16
8	54	42	8	43	15	15	882	1,370	145	20
8	62	50	8	51			980	1,570	300	25
10	74	58	10	60			1,570	2,740	375	30
10	82	64	10	67			1,670	3,140	560	35
13	96	75	13	78			2,160	4,020	880	40
13	116	92	13	98			3,820	7,940	2,000	50
18	134	106	18	112	25	25	4,700	10,000	2,560	60

1N≐0.102kgf

# SMT-E TYPE

– Two Side Cut Pilot End Flange Type –



## part number structure

example **SMST 25 G UU -E -SK**

specification  
**SMT:** standard  
**SMST:** anti-corrosion

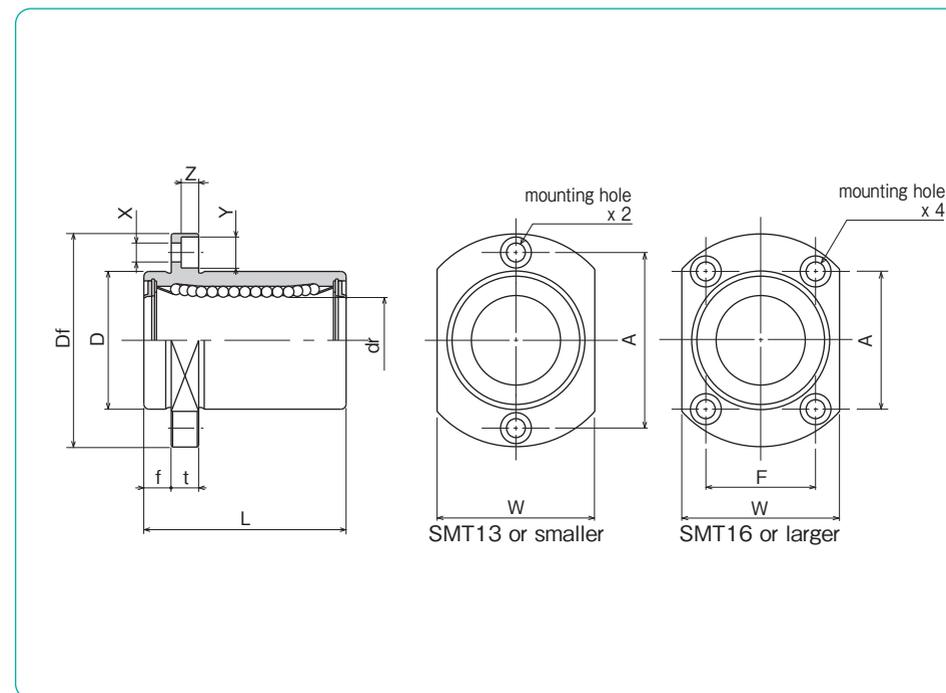
inner contact diameter (dr)

retainer material  
**blank:** standard/steel  
 anti-corrosion/stainless steel  
**G:** resin

outer cylinder surface treatment  
**blank:** no surface treatment  
**SK:** electroless nickel plating  
**LF:** low temperature black chrome treatment with fluoride coating  
**SB:** black oxide (not available on anti-corrosion type)  
**SC:** industrial chrome plating

with pilot end

seal  
**UU:** seals on both sides  
**ZZ:** doublelip-seals on both sides



part number*				number of ball circuits	dr		major dimensions		
standard steel retainer	standard resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
SMT 6UU-E	SMT 6GUU-E	SMST 6UU-E	SMST 6GUU-E	4	6	12	0	19	
SMT 8UU-E	SMT 8GUU-E	SMST 8UU-E	SMST 8GUU-E	4	8	15	-13	24	
SMT10UU-E	SMT10GUU-E	SMST10UU-E	SMST10GUU-E	4	10	19	0	29	
SMT12UU-E	SMT12GUU-E	SMST12UU-E	SMST12GUU-E	4	12	21	0	30	
SMT13UU-E	SMT13GUU-E	SMST13UU-E	SMST13GUU-E	4	13	23	-16	32	
SMT16UU-E	SMT16GUU-E	SMST16UU-E	SMST16GUU-E	4	16	28		37	
SMT20UU-E	SMT20GUU-E	SMST20UU-E	SMST20GUU-E	5	20	32	0	42	
SMT25UU-E	SMT25GUU-E	SMST25UU-E	SMST25GUU-E	6	25	40	-19	59	
SMT30UU-E	SMT30GUU-E	SMST30UU-E	SMST30GUU-E	6	30	45		64	

\* Seals-on-both-sides is standard.

f mm	Df mm	flange				eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		mass g	shaft diameter mm	
		W mm	t mm	A mm	F mm			X×Y×Z mm	dynamic C N			static Co N
5	28	18	5	20	—	3.5×6×3.1	12	12	206	265	21	6
5	32	21	5	24	—	3.5×6×3.1			274	392	33	8
6	40	25	6	29	—	4.5×7.5×4.1			372	549	64	10
6	42	27	6	32	—	4.5×7.5×4.1			510	784	68	12
6	43	29	6	33	—	4.5×7.5×4.1	510	784	81	13		
6	48	34	6	31	22	4.5×7.5×4.1	774	1,180	112	16		
8	54	38	8	36	24	5.5×9×5.1	882	1,370	167	20		
8	62	46	8	40	32	5.5×9×5.1	980	1,570	325	25		
10	74	51	10	49	35	6.6×11×6.1	1,570	2,740	388	30		

1N≒0.102kgf

# SMK-G-L TYPE

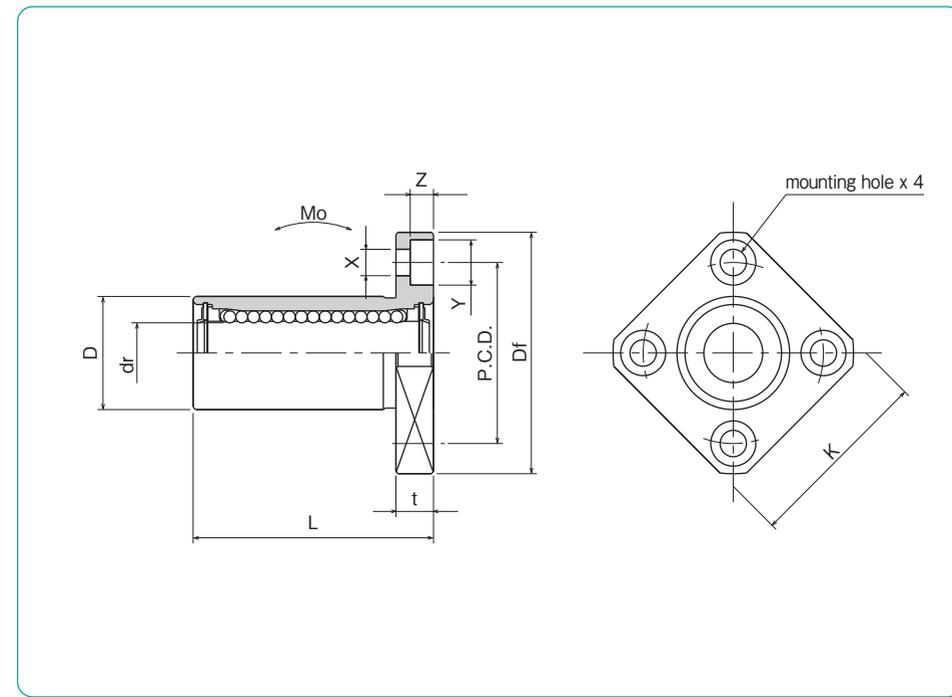
– Square Flange Long type –



## part number structure

example **SMK 25 G - L UU - SK**

SMK type	inner contact diameter (dr)	resin retainer	outer cylinder surface treatment	seal	long type
			blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating	UU: seals on both sides ZZ: doublelip-seals on both sides	



part number*	number of ball circuits	dr		D		major dimensions				
		mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm	Df mm	K mm	t mm	P.C.D. mm
SMK 6G-LUU	4	6	0	12	0	26	28	22	5	20
SMK 8G-LUU	4	8		15	-13	32	32	25	5	24
SMK 10G-LUU	4	10		19	-16	39	40	30	6	29
SMK 12G-LUU	4	12		21		0	41	42	32	6
SMK 13G-LUU	4	13	23	0		45	43	34	6	33
SMK 16G-LUU	4	16	28	0		53	48	37	6	38
SMK 20G-LUU	5	20	-12	32	0	59	54	42	8	43
SMK 25G-LUU	6	25		40	-19	83	62	50	8	51
SMK 30G-LUU	6	30		45	0	90	74	58	10	60

\* Seals-on-both-sides is standard.

X × Y × Z mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $M_o$ N · m	mass g	shaft diameter mm
			dynamic C N	static $C_o$ N			
3.5 × 6 × 3.1	15	15	262	476	1.15	20	6
3.5 × 6 × 3.1			352	615	1.94	32	8
4.5 × 7.5 × 4.1			493	1,000	3.98	59	10
4.5 × 7.5 × 4.1			637	1,430	6.26	67	12
4.5 × 7.5 × 4.1			682	1,560	7.68	88	13
4.5 × 7.5 × 4.1	20	20	1,039	2,350	13.2	125	16
5.5 × 9 × 5.1			1,160	2,740	17.9	170	20
5.5 × 9 × 5.1			1,300	2,960	27.2	380	25
6.6 × 11 × 6.1			2,160	5,880	61.3	460	30

1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# SMF-W TYPE

– Round Flange Double-Wide Type –



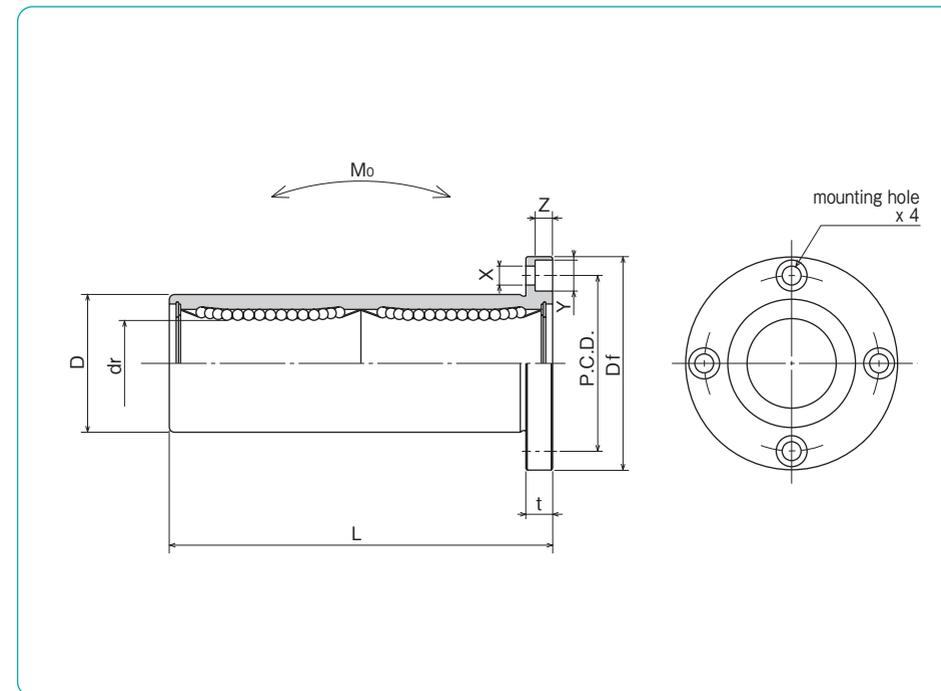
## part number structure

example **SMSF 25 G W UU -SK**

specification SMF: standard SMSF: anti-corrosion	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating
inner contact diameter (dr)	seal blank: without seal UU: seals on both sides ZZ: doublelip-seals on both sides
retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	double-wide type

Doublelip-seal is available for size 6 to 30.

part number				number of ball circuits	dr		major dimensions		
standard steel retainer	resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
SMF 6W	SMF 6GW	SMSF 6W	SMSF 6GW	4	6		12	0	35
SMF 8W	SMF 8GW	SMSF 8W	SMSF 8GW	4	8		15	-13	45
SMF10W	SMF10GW	SMSF10W	SMSF10GW	4	10	0	19		55
SMF12W	SMF12GW	SMSF12W	SMSF12GW	4	12	-10	21	0	57
SMF13W	SMF13GW	SMSF13W	SMSF13GW	4	13		23	-16	61
SMF16W	SMF16GW	SMSF16W	SMSF16GW	4	16		28		70
SMF20W	SMF20GW	SMSF20W	SMSF20GW	5	20	0	32	0	80
SMF25W	SMF25GW	SMSF25W	SMSF25GW	6	25	-12	40	-19	112
SMF30W	SMF30GW	SMSF30W	SMSF30GW	6	30		45		123
SMF35W	SMF35GW	SMSF35W	SMSF35GW	6	35	0	52	0	135
SMF40W	SMF40GW	SMSF40W	SMSF40GW	6	40	-15	60	-22	151
SMF50W	SMF50GW	SMSF50W	SMSF50GW	6	50		80		192
SMF60W	SMF60GW	SMSF60W	SMSF60GW	6	60	0/-20	90	0/-25	209



Df mm	t mm	flange P.C.D. mm	X × Y × Z mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $M_o$ N · m	mass g	shaft diameter mm
						dynamic C N	static $C_o$ N			
28	5	20	3.5 × 6 × 3.1	15	15	323	530	2.18	31	6
32	5	24	3.5 × 6 × 3.1			431	784	4.31	51	8
40	6	29	4.5 × 7.5 × 4.1			588	1,100	7.24	98	10
42	6	32	4.5 × 7.5 × 4.1			813	1,570	10.9	110	12
43	6	33	4.5 × 7.5 × 4.1			813	1,570	11.6	130	13
48	6	38	4.5 × 7.5 × 4.1			1,230	2,350	19.7	190	16
54	8	43	5.5 × 9 × 5.1	20	20	1,400	2,740	26.8	260	20
62	8	51	5.5 × 9 × 5.1			1,560	3,140	43.4	540	25
74	10	60	6.6 × 11 × 6.1			2,490	5,490	82.8	680	30
82	10	67	6.6 × 11 × 6.1			2,650	6,270	110	1,020	35
96	13	78	9 × 14 × 8.1	25	25	3,430	8,040	147	1,570	40
116	13	98	9 × 14 × 8.1			6,080	15,900	397	3,600	50
134	18	112	11 × 17 × 11.1			7,550	20,000	530	4,500	60

1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# SMK-W TYPE

– Square Flange Double-Wide Type –

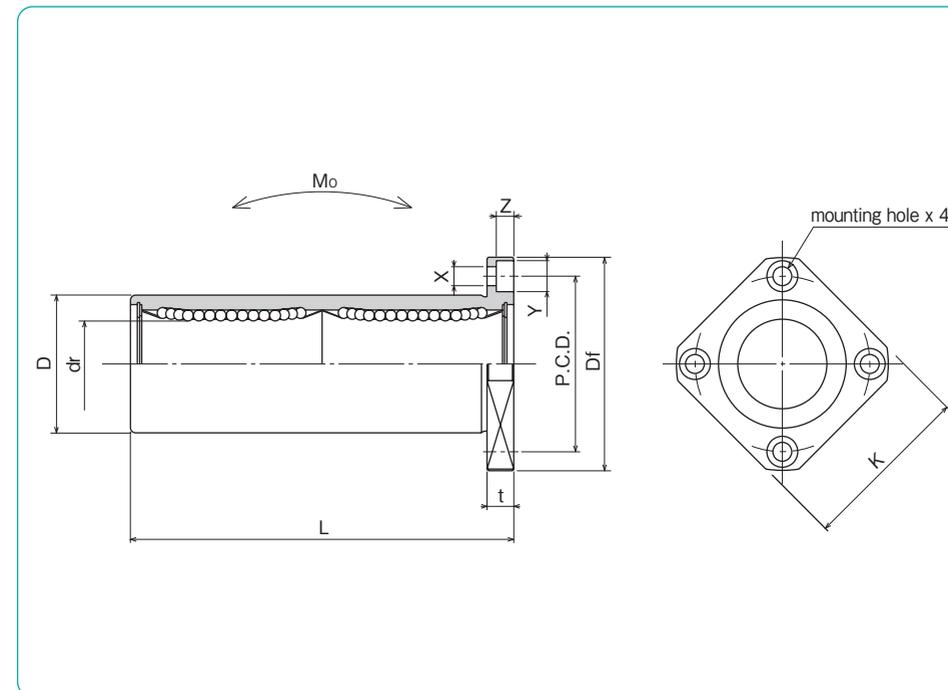


## part number structure

example **SMSK 25 G W UU-SK**

specification <b>SMK</b> : standard <b>SMSK</b> : anti-corrosion	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating
inner contact diameter (dr)	seal <b>blank</b> : without seal <b>UU</b> : seals on both sides <b>ZZ</b> : doublelip-seals on both sides
retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	double-wide type

Doublelip-seal is available for size 6 to 30.



part number				number of ball circuits	dr		major dimensions		
standard steel retainer	resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
SMK 6W	SMK 6GW	SMSK 6W	SMSK 6GW	4	6	0	12	0	35
SMK 8W	SMK 8GW	SMSK 8W	SMSK 8GW	4	8	0	15	-13	45
SMK 10W	SMK 10GW	SMSK 10W	SMSK 10GW	4	10	0	19	0	55
SMK 12W	SMK 12GW	SMSK 12W	SMSK 12GW	4	12	-10	21	0	57
SMK 13W	SMK 13GW	SMSK 13W	SMSK 13GW	4	13	0	23	-16	61
SMK 16W	SMK 16GW	SMSK 16W	SMSK 16GW	4	16	0	28	0	70
SMK20W	SMK20GW	SMSK20W	SMSK20GW	5	20	0	32	0	80
SMK25W	SMK25GW	SMSK25W	SMSK25GW	6	25	-12	40	-19	112
SMK30W	SMK30GW	SMSK30W	SMSK30GW	6	30	0	45	0	123
SMK35W	SMK35GW	SMSK35W	SMSK35GW	6	35	0	52	0	135
SMK40W	SMK40GW	SMSK40W	SMSK40GW	6	40	-15	60	-22	151
SMK50W	SMK50GW	SMSK50W	SMSK50GW	6	50	0	80	0	192
SMK60W	SMK60GW	SMSK60W	SMSK60GW	6	60	0/-20	90	0/-25	209

Df mm	K mm	flange			eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $\text{N} \cdot \text{m}$	mass g	shaft diameter mm		
		t mm	P.C.D. mm	X×Y×Z mm			dynamic C N	static Co N					
28	22	5	20	3.5×6×3.1	15	15	323	530	2.18	25	6		
32	25	5	24	3.5×6×3.1			431	784	4.31	43	8		
40	30	6	29	4.5×7.5×4.1			588	1,100	7.24	78	10		
42	32	6	32	4.5×7.5×4.1			813	1,570	10.9	90	12		
43	34	6	33	4.5×7.5×4.1			813	1,570	11.6	108	13		
48	37	6	38	4.5×7.5×4.1			1,230	2,350	19.7	165	16		
54	42	8	43	5.5×9×5.1	20	20	1,400	2,740	26.8	225	20		
62	50	8	51	5.5×9×5.1			1,560	3,140	43.4	500	25		
74	58	10	60	6.6×11×6.1			2,490	5,490	82.8	590	30		
82	64	10	67	6.6×11×6.1			2,650	6,270	110	930	35		
96	75	13	78	9×14×8.1			25	25	3,430	8,040	147	1,380	40
116	92	13	98	9×14×8.1					6,080	15,900	397	3,400	50
134	106	18	112	11×17×11.1	7,550	20,000			530	4,060	60		

1N  $\approx$  0.102kgf 1N  $\cdot$  m  $\approx$  0.102kgf  $\cdot$  m

# SMT-W TYPE

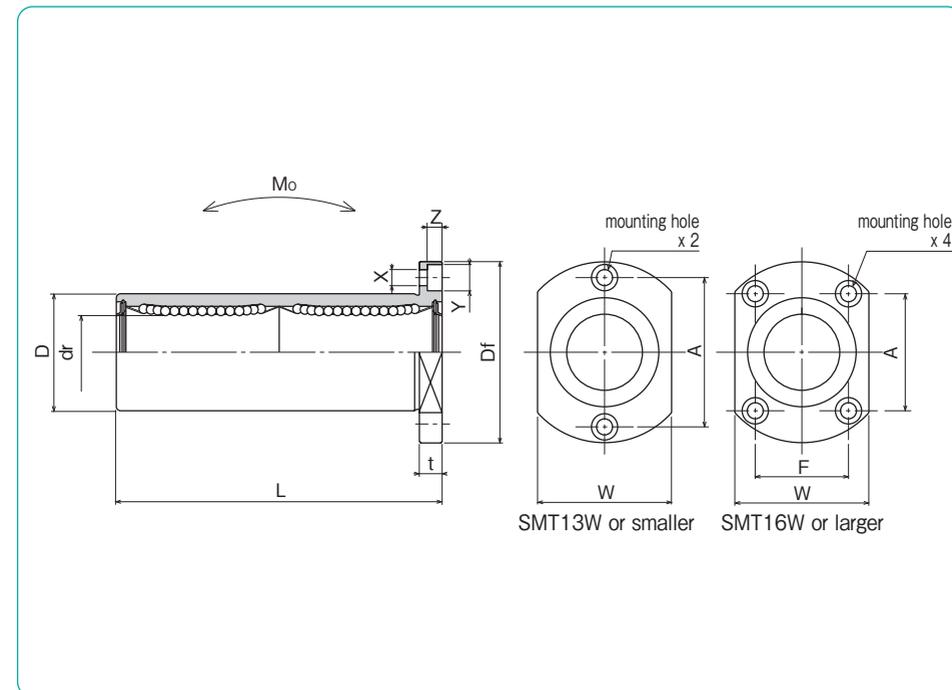
– Two Side Cut Double-Wide Flange Type –



## part number structure

example **SMST 25 G W UU -SK**

specification SMT: standard SMST: anti-corrosion	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating
inner contact diameter (dr)	seal UU: seals on both sides ZZ: doublelip-seals on both sides
retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	double-wide type



part number*				number of ball circuits	major dimensions		
standard steel retainer	standard resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		dr mm	D mm	L mm
					tolerance μm	tolerance μm	±0.3 mm
SMT 6WUU	SMT 6GWUU	SMST 6WUU	SMST 6GWUU	4	6	12	35
SMT 8WUU	SMT 8GWUU	SMST 8WUU	SMST 8GWUU	4	8	15	45
SMT10WUU	SMT10GWUU	SMST10WUU	SMST10GWUU	4	10	19	55
SMT12WUU	SMT12GWUU	SMST12WUU	SMST12GWUU	4	12	21	57
SMT13WUU	SMT13GWUU	SMST13WUU	SMST13GWUU	4	13	23	61
SMT16WUU	SMT16GWUU	SMST16WUU	SMST16GWUU	4	16	28	70
SMT20WUU	SMT20GWUU	SMST20WUU	SMST20GWUU	5	20	32	80
SMT25WUU	SMT25GWUU	SMST25WUU	SMST25GWUU	6	25	40	112
SMT30WUU	SMT30GWUU	SMST30WUU	SMST30GWUU	6	30	45	123

\* Seals-on-both-sides is standard.

Df mm	W mm	flange				X×Y×Z mm	eccentricity μm	perpendicularity μm	basic load rating		allowable static moment Mo N·m	mass g	shaft diameter mm
		t mm	A mm	F mm	C N				Co N				
28	18	5	20	—	3.5×6×3.1	15	15	323	530	2.18	28	6	
32	21	5	24	—	3.5×6×3.1			431	784	4.31	47	8	
40	25	6	29	—	4.5×7.5×4.1			588	1,100	7.24	90	10	
42	27	6	32	—	4.5×7.5×4.1			813	1,570	10.9	102	12	
43	29	6	33	—	4.5×7.5×4.1			813	1,570	11.6	123	13	
48	34	6	31	22	4.5×7.5×4.1			1,230	2,350	19.7	182	16	
54	38	8	36	24	5.5×9×5.1	20	20	1,400	2,740	26.8	247	20	
62	46	8	40	32	5.5×9×5.1			1,560	3,140	43.4	525	25	
74	51	10	49	35	6.6×11×6.1			2,490	5,490	82.8	645	30	

1N ≅ 0.102kgf    1N · m ≅ 0.102kgf · m

# SMFC TYPE

– Center Mount Round Flange Type –



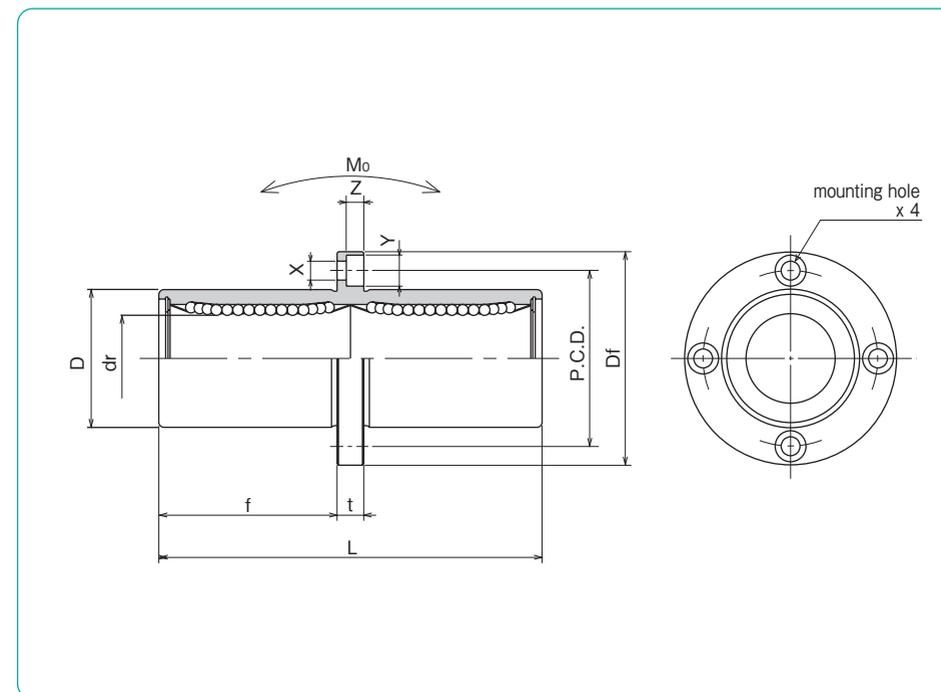
## part number structure

example **SMSFC 25 G UU -SK**

specification <b>SMFC</b> : standard <b>SMSFC</b> : anti-corrosion	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating
inner contact diameter (dr)	seal <b>blank</b> : without seal <b>UU</b> : seals on both sides <b>ZZ</b> : doublelip-seals on both sides
retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	

Doublelip-seal is available for size 6 to 30.

part number				number of ball circuits	dr		major dimensions		
standard steel retainer	anti-corrosion resin retainer	stainless steel retainer	resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
SMFC 6	SMFC 6G	SMSFC 6	SMSFC 6G	4	6	0	12	0	35
SMFC 8	SMFC 8G	SMSFC 8	SMSFC 8G	4	8	0	15	-13	45
SMFC10	SMFC10G	SMSFC10	SMSFC10G	4	10	0	19	0	55
SMFC12	SMFC12G	SMSFC12	SMSFC12G	4	12	-10	21	0	57
SMFC13	SMFC13G	SMSFC13	SMSFC13G	4	13	-10	23	-16	61
SMFC16	SMFC16G	SMSFC16	SMSFC16G	4	16	-10	28	-16	70
SMFC20	SMFC20G	SMSFC20	SMSFC20G	5	20	0	32	0	80
SMFC25	SMFC25G	SMSFC25	SMSFC25G	6	25	-12	40	-19	112
SMFC30	SMFC30G	SMSFC30	SMSFC30G	6	30	-12	45	-19	123
SMFC35	SMFC35G	SMSFC35	SMSFC35G	6	35	0	52	0	135
SMFC40	SMFC40G	SMSFC40	SMSFC40G	6	40	-15	60	-22	151
SMFC50	SMFC50G	SMSFC50	SMSFC50G	6	50	-15	80	-22	192
SMFC60	SMFC60G	SMSFC60	SMSFC60G	6	60	0/-20	90	0/-25	209



f mm	Df mm	flange			eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $M_o$ N·m	mass g	shaft diameter mm
		t mm	P.C.D. mm	X×Y×Z mm			dynamic C N	static Co N			
15	28	5	20	3.5×6×3.1	15	15	323	530	2.18	31	6
20	32	5	24	3.5×6×3.1			431	784	4.31	51	8
24.5	40	6	29	4.5×7.5×4.1			588	1,100	7.24	98	10
25.5	42	6	32	4.5×7.5×4.1			813	1,570	10.9	110	12
27.5	43	6	33	4.5×7.5×4.1			813	1,570	11.6	130	13
32	48	6	38	4.5×7.5×4.1			1,230	2,350	19.7	190	16
36	54	8	43	5.5×9×5.1	20	20	1,400	2,740	26.8	260	20
52	62	8	51	5.5×9×5.1			1,560	3,140	43.4	540	25
56.5	74	10	60	6.6×11×6.1			2,490	5,490	82.8	680	30
62.5	82	10	67	6.6×11×6.1	25	25	2,650	6,270	110	1,020	35
69	96	13	78	9×14×8.1			3,430	8,040	147	1,570	40
89.5	116	13	98	9×14×8.1			6,080	15,900	397	3,600	50
95.5	134	18	112	11×17×11.1	30	30	7,550	20,000	530	4,500	60

1N  $\approx$  0.102kgf 1N·m  $\approx$  0.102kgf·m

# SMKC TYPE

– Center Mount Square Flange Type –



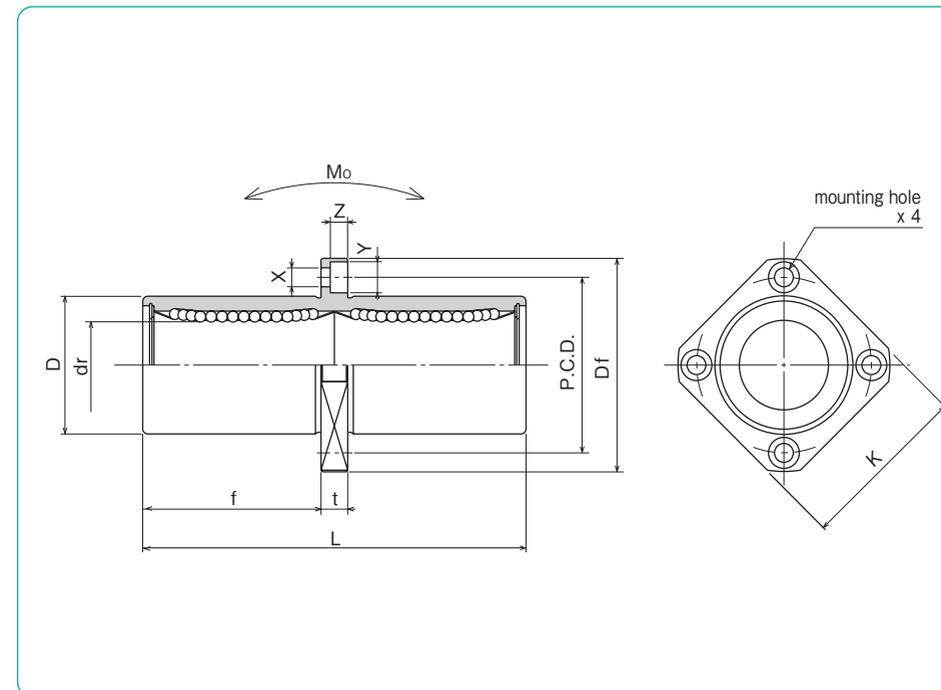
## part number structure

example **SMSKC 25 G UU -SK**

specification <b>SMKC</b> : standard <b>SMSKC</b> : anti-corrosion	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating
inner contact diameter (dr)	seal <b>blank</b> : without seal <b>UU</b> : seals on both sides <b>ZZ</b> : doublelip-seals on both sides
retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	

Doublelip-seal is available for size 6 to 30.

part number				number of ball circuits	dr		major dimensions		
standard steel retainer	resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
SMKC 6	SMKC 6G	SMSKC 6	SMSKC 6G	4	6	0	12	0	35
SMKC 8	SMKC 8G	SMSKC 8	SMSKC 8G	4	8	0	15	-13	45
SMKC10	SMKC10G	SMSKC10	SMSKC10G	4	10	0	19	0	55
SMKC12	SMKC12G	SMSKC12	SMSKC12G	4	12	-10	21	0	57
SMKC13	SMKC13G	SMSKC13	SMSKC13G	4	13	0	23	-16	61
SMKC16	SMKC16G	SMSKC16	SMSKC16G	4	16	0	28	0	70
SMKC20	SMKC20G	SMSKC20	SMSKC20G	5	20	0	32	0	80
SMKC25	SMKC25G	SMSKC25	SMSKC25G	6	25	-12	40	-19	112
SMKC30	SMKC30G	SMSKC30	SMSKC30G	6	30	0	45	0	123
SMKC35	SMKC35G	SMSKC35	SMSKC35G	6	35	0	52	0	135
SMKC40	SMKC40G	SMSKC40	SMSKC40G	6	40	-15	60	-22	151
SMKC50	SMKC50G	SMSKC50	SMSKC50G	6	50	0	80	0	192
SMKC60	SMKC60G	SMSKC60	SMSKC60G	6	60	0/-20	90	0/-25	209



f mm	Df mm	flange			eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $\text{N} \cdot \text{m}$	mass g	shaft diameter mm	
		K mm	t mm	P.C.D. mm			X × Y × Z mm	dynamic C N				static Co N
15	28	22	5	20	3.5 × 6 × 3.1	15	15	323	530	2.18	25	6
20	32	25	5	24	3.5 × 6 × 3.1			431	784	4.31	43	8
24.5	40	30	6	29	4.5 × 7.5 × 4.1			588	1,100	7.24	78	10
25.5	42	32	6	32	4.5 × 7.5 × 4.1			813	1,570	10.9	90	12
27.5	43	34	6	33	4.5 × 7.5 × 4.1			813	1,570	11.6	108	13
32	48	37	6	38	4.5 × 7.5 × 4.1	20	20	1,230	2,350	19.7	165	16
36	54	42	8	43	5.5 × 9 × 5.1			1,400	2,740	26.8	225	20
52	62	50	8	51	5.5 × 9 × 5.1			1,560	3,140	43.4	500	25
56.5	74	58	10	60	6.6 × 11 × 6.1			2,490	5,490	82.8	590	30
62.5	82	64	10	67	6.6 × 11 × 6.1			2,650	6,270	110	930	35
69	96	75	13	78	9 × 14 × 8.1	25	25	3,430	8,040	147	1,380	40
89.5	116	92	13	98	9 × 14 × 8.1			6,080	15,900	397	3,400	50
95.5	134	106	18	112	11 × 17 × 11.1			7,550	20,000	530	4,060	60

1N  $\approx$  0.102kgf 1N  $\cdot$  m  $\approx$  0.102kgf  $\cdot$  m

# SMTC TYPE

– Two Side Cut Center Flange Type –



## part number structure

example **SMTC 25 G UU -SK**

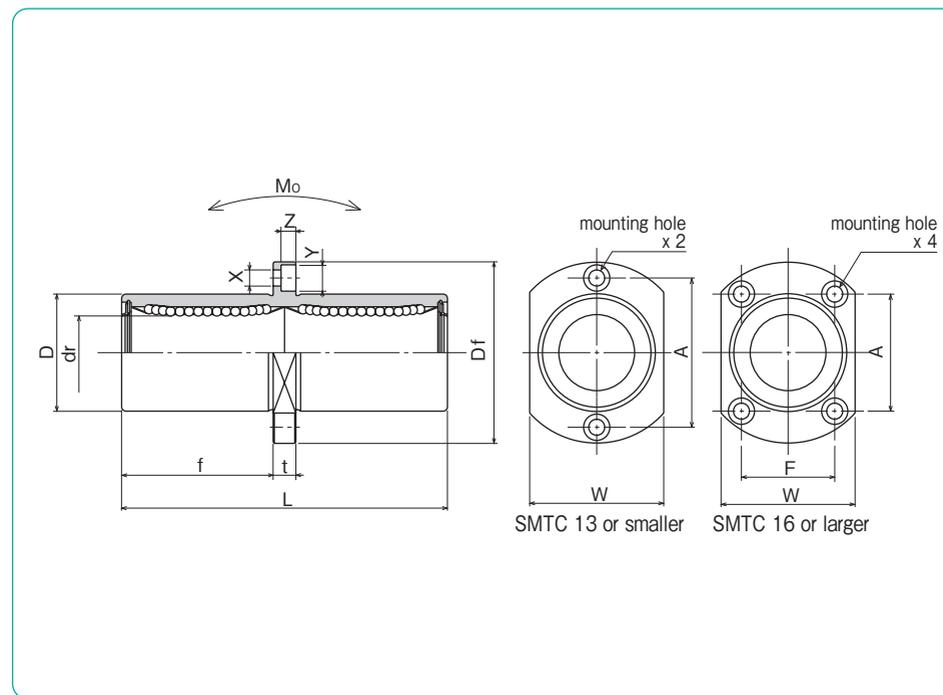
specification  
**SMTC**: standard  
**SMSTC**: anti-corrosion

inner contact diameter (dr)

retainer material  
**blank**: standard/steel  
 anti-corrosion/stainless steel  
**G**: resin

outer cylinder  
 surface treatment  
**blank**: no surface treatment  
**SK**: electroless nickel plating  
**LF**: low temperature black chrome  
 treatment with fluoride coating  
**SB**: black oxide (not available on  
 anti-corrosion type)  
**SC**: industrial chrome plating

seal  
**UU**: seals on both sides  
**ZZ**: doublelip-seals on both sides



part number*				number of ball circuits	major dimensions			
standard steel retainer	resin retainer	anti-corrosion stainless retainer	resin retainer		dr mm	D mm	L ±0.3 mm	
				mm	tolerance μm	mm	tolerance μm	
SMTC 6UU	SMTC 6GUU	SMSTC 6UU	SMSTC 6GUU	4	6	12	0	35
SMTC 8UU	SMTC 8GUU	SMSTC 8UU	SMSTC 8GUU	4	8	15	-13	45
SMTC10UU	SMTC10GUU	SMSTC10UU	SMSTC10GUU	4	10	19	0	55
SMTC12UU	SMTC12GUU	SMSTC12UU	SMSTC12GUU	4	12	21	0	57
SMTC13UU	SMTC13GUU	SMSTC13UU	SMSTC13GUU	4	13	23	-16	61
SMTC16UU	SMTC16GUU	SMSTC16UU	SMSTC16GUU	4	16	28		70
SMTC20UU	SMTC20GUU	SMSTC20UU	SMSTC20GUU	5	20	32	0	80
SMTC25UU	SMTC25GUU	SMSTC25UU	SMSTC25GUU	6	25	40	-19	112
SMTC30UU	SMTC30GUU	SMSTC30UU	SMSTC30GUU	6	30	45		123

\* Seals-on-both-sides is standard.

flange							eccentricity μm	perpendicularity μm	basic load rating		allowable static moment Mo N·m	mass g	shaft diameter mm
f mm	Df mm	W mm	t mm	A mm	F mm	X×Y×Z mm			dynamic C N	static Co N			
15	28	18	5	20	—	3.5×6×3.1	15	15	323	530	2.18	28	6
20	32	21	5	24	—	3.5×6×3.1			431	784	4.31	47	8
24.5	40	25	6	29	—	4.5×7.5×4.1			588	1,100	7.24	90	10
25.5	42	27	6	32	—	4.5×7.5×4.1			813	1,570	10.9	102	12
27.5	43	29	6	33	—	4.5×7.5×4.1			813	1,570	11.6	123	13
32	48	34	6	31	22	4.5×7.5×4.1			1,230	2,350	19.7	182	16
36	54	38	8	36	24	5.5×9×5.1	20	20	1,400	2,740	26.8	247	20
52	62	46	8	40	32	5.5×9×5.1			1,560	3,140	43.4	525	25
56.5	74	51	10	49	35	6.6×11×6.1			2,490	5,490	82.8	645	30

1N ÷ 0.102kgf 1N · m ÷ 0.102kgf · m

# SMF-W-E TYPE

— Round Flange Double-Wide Pilot End Type —

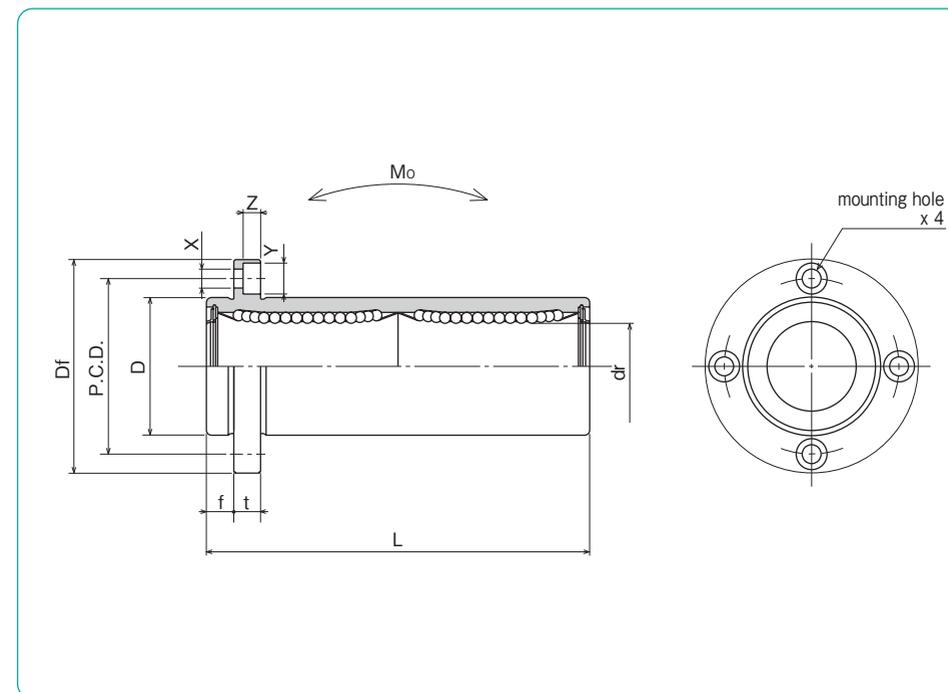


## part number structure

example **SMSF 25 G W UU - E - SK**

specification <b>SMF</b> : standard <b>SMSF</b> : anti-corrosion	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating
inner contact diameter (dr)	with pilot end
retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	seal <b>UU</b> : seals on both sides <b>ZZ</b> : doublelip-seals on both sides
double-wide type	

Doublelip-seal is available for size 6 to 30.



part number*				number of ball circuits	dr		major dimensions		
standard	anti-corrosion	resin retainer	stainless retainer		mm	tolerance $\mu\text{m}$	D	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
SMF 6WUU-E	SMF 6GWUU-E	SMSF 6WUU-E	SMSF 6GWUU-E	4	6	12	0	35	
SMF 8WUU-E	SMF 8GWUU-E	SMSF 8WUU-E	SMSF 8GWUU-E	4	8	15	-13	45	
SMF 10WUU-E	SMF 10GWUU-E	SMSF 10WUU-E	SMSF 10GWUU-E	4	10	19	0	55	
SMF 12WUU-E	SMF 12GWUU-E	SMSF 12WUU-E	SMSF 12GWUU-E	4	12	21	0	57	
SMF 13WUU-E	SMF 13GWUU-E	SMSF 13WUU-E	SMSF 13GWUU-E	4	13	23	-16	61	
SMF 16WUU-E	SMF 16GWUU-E	SMSF 16WUU-E	SMSF 16GWUU-E	4	16	28		70	
SMF 20WUU-E	SMF 20GWUU-E	SMSF 20WUU-E	SMSF 20GWUU-E	5	20	32	0	80	
SMF 25WUU-E	SMF 25GWUU-E	SMSF 25WUU-E	SMSF 25GWUU-E	6	25	40	-19	112	
SMF 30WUU-E	SMF 30GWUU-E	SMSF 30WUU-E	SMSF 30GWUU-E	6	30	45		123	
SMF 35WUU-E	SMF 35GWUU-E	—	—	6	35	52	0	135	
SMF 40WUU-E	SMF 40GWUU-E	—	—	6	40	60	0	151	
SMF 50WUU-E	SMF 50GWUU-E	—	—	6	50	80	-22	192	
SMF 60WUU-E	SMF 60GWUU-E	—	—	6	60	90	0/-25	209	

\* Seals-on-both-sides is standard.

flange					eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $\text{N} \cdot \text{m}$	mass g	shaft diameter mm
f mm	Df mm	t mm	P.C.D. mm	X × Y × Z mm			dynamic C N	static Co N			
5	28	5	20	3.5 × 6 × 3.1	15	15	323	530	2.18	31	6
5	32	5	24	3.5 × 6 × 3.1			431	784	4.31	51	8
6	40	6	29	4.5 × 7.5 × 4.1			588	1,100	7.24	98	10
6	42	6	32	4.5 × 7.5 × 4.1			813	1,570	10.9	110	12
6	43	6	33	4.5 × 7.5 × 4.1			813	1,570	11.6	130	13
6	48	6	38	4.5 × 7.5 × 4.1			1,230	2,350	19.7	190	16
8	54	8	43	5.5 × 9 × 5.1	20	20	1,400	2,740	26.8	260	20
8	62	8	51	5.5 × 9 × 5.1			1,560	3,140	43.4	540	25
10	74	10	60	6.6 × 11 × 6.1			2,490	5,490	82.8	680	30
10	82	10	67	6.6 × 11 × 6.1			2,650	6,270	110	1,020	35
13	96	13	78	9 × 14 × 8.1	25	25	3,430	8,040	147	1,570	40
13	116	13	98	9 × 14 × 8.1			6,080	15,900	397	3,600	50
18	134	18	112	11 × 17 × 11.1			7,550	20,000	530	4,500	60

1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# SMK-W-E TYPE

— Square Flange Double-Wide Pilot End Type —

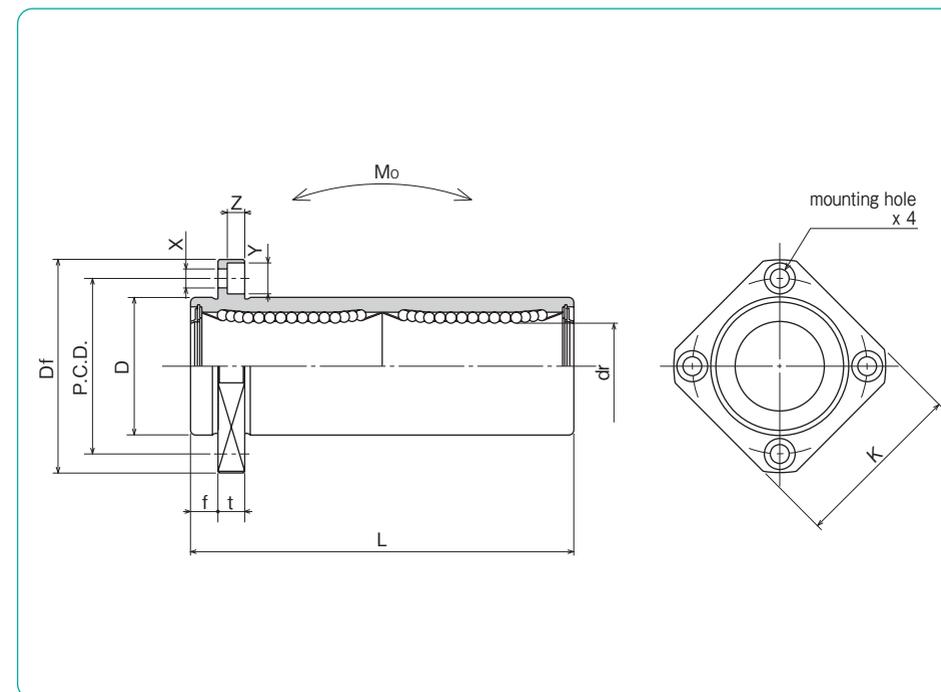


## part number structure

example **SMSK 25 G W UU - E - SK**

specification <b>SMK</b> : standard <b>SMSK</b> : anti-corrosion	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating
inner contact diameter (dr)	with pilot end
retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	seal <b>UU</b> : seals on both sides <b>ZZ</b> : doublelip-seals on both sides
double-wide type	

Doublelip-seal is available for size 6 to 30.



part number*				number of ball circuits	major dimensions		
standard steel retainer	anti-corrosion resin retainer	stainless steel retainer	resin retainer		dr	D	L
mm	mm	mm	mm	mm	mm	mm	
SMK 6WUU-E	SMK 6GWUU-E	SMSK 6WUU-E	SMSK 6GWUU-E	4	6	12	35
SMK 8WUU-E	SMK 8GWUU-E	SMSK 8WUU-E	SMSK 8GWUU-E	4	8	15	45
SMK 10WUU-E	SMK 10GWUU-E	SMSK 10WUU-E	SMSK 10GWUU-E	4	10	19	55
SMK 12WUU-E	SMK 12GWUU-E	SMSK 12WUU-E	SMSK 12GWUU-E	4	12	21	57
SMK 13WUU-E	SMK 13GWUU-E	SMSK 13WUU-E	SMSK 13GWUU-E	4	13	23	61
SMK 16WUU-E	SMK 16GWUU-E	SMSK 16WUU-E	SMSK 16GWUU-E	4	16	28	70
SMK 20WUU-E	SMK 20GWUU-E	SMSK 20WUU-E	SMSK 20GWUU-E	5	20	32	80
SMK 25WUU-E	SMK 25GWUU-E	SMSK 25WUU-E	SMSK 25GWUU-E	6	25	40	112
SMK 30WUU-E	SMK 30GWUU-E	SMSK 30WUU-E	SMSK 30GWUU-E	6	30	45	123
SMK 35WUU-E	SMK 35GWUU-E	—	—	6	35	52	135
SMK 40WUU-E	SMK 40GWUU-E	—	—	6	40	60	151
SMK 50WUU-E	SMK 50GWUU-E	—	—	6	50	80	192
SMK 60WUU-E	SMK 60GWUU-E	—	—	6	60	90	209

\* Seals-on-both-sides is standard.

f	Df	flange			P.C.D.	X×Y×Z	eccentricity	perpendicularity	basic load rating		allowable static moment	mass	shaft diameter
		K	t	mm					C	Co			
mm	mm	mm	mm	mm	mm	mm	μm	μm	N	N	N·m	g	mm
5	28	22	5	20	3.5×6×3.1	15	15	323	530	2.18	25	6	
5	32	25	5	24	3.5×6×3.1			431	784	4.31	43	8	
6	40	30	6	29	4.5×7.5×4.1			588	1,100	7.24	78	10	
6	42	32	6	32	4.5×7.5×4.1			813	1,570	10.9	90	12	
6	43	34	6	33	4.5×7.5×4.1			813	1,570	11.6	108	13	
6	48	37	6	38	4.5×7.5×4.1			1,230	2,350	19.7	165	16	
8	54	42	8	43	5.5×9×5.1	20	20	1,400	2,740	26.8	225	20	
8	62	50	8	51	5.5×9×5.1			1,560	3,140	43.4	500	25	
10	74	58	10	60	6.6×11×6.1			2,490	5,490	82.8	590	30	
10	82	64	10	67	6.6×11×6.1			2,650	6,270	110	930	35	
13	96	75	13	78	9×14×8.1	25	25	3,430	8,040	147	1,380	40	
13	116	92	13	98	9×14×8.1			6,080	15,900	397	3,400	50	
18	134	106	18	112	11×17×11.1			7,550	20,000	530	4,060	60	

1N≒0.102kgf 1N·m≒0.102kgf·m

# SMT-W-E TYPE

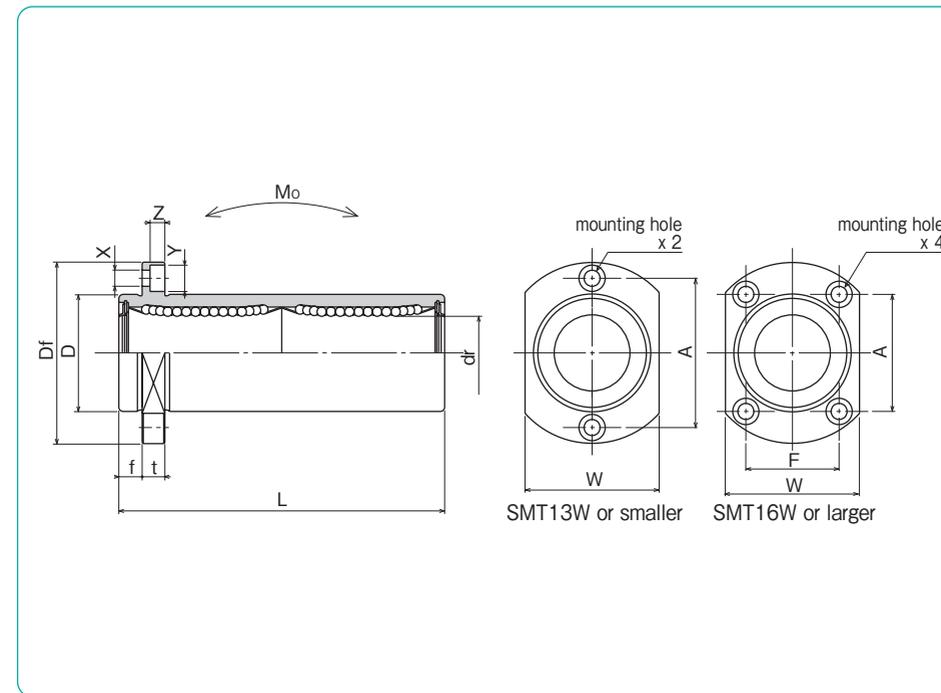
— Two Side Cut Double-Wide Flange Pilot End Type —



## part number structure

example **SMST 25 G W UU - E - SK**

specification <b>SMT</b> : standard <b>SMST</b> : anti-corrosion	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating
inner contact diameter (dr)	with pilot end
retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	seal <b>UU</b> : seals on both sides <b>ZZ</b> : doublelip-seals on both sides
double-wide type	



part number*				number of ball circuits	major dimensions			
standard steel retainer	standard resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		dr	D	L	
				mm	tolerance μm	mm	tolerance μm	±0.3 mm
SMT 6WUU-E	SMT 6GWUU-E	SMST 6WUU-E	SMST 6GWUU-E	4	6	12	0	35
SMT 8WUU-E	SMT 8GWUU-E	SMST 8WUU-E	SMST 8GWUU-E	4	8	15	-13	45
SMT10WUU-E	SMT10GWUU-E	SMST10WUU-E	SMST10GWUU-E	4	10	19	0	55
SMT12WUU-E	SMT12GWUU-E	SMST12WUU-E	SMST12GWUU-E	4	12	21	0	57
SMT13WUU-E	SMT13GWUU-E	SMST13WUU-E	SMST13GWUU-E	4	13	23	-16	61
SMT16WUU-E	SMT16GWUU-E	SMST16WUU-E	SMST16GWUU-E	4	16	28		70
SMT20WUU-E	SMT20GWUU-E	SMST20WUU-E	SMST20GWUU-E	5	20	32	0	80
SMT25WUU-E	SMT25GWUU-E	SMST25WUU-E	SMST25GWUU-E	6	25	40	-19	112
SMT30WUU-E	SMT30GWUU-E	SMST30WUU-E	SMST30GWUU-E	6	30	45		123

\* Seals-on-both-sides is standard.

f	Df	flange				eccentricity	perpendicularity	basic load rating		allowable static moment	mass	shaft diameter	
		W	t	A	F			dynamic C	static Co				
mm	mm	mm	mm	mm	mm	mm	μm	μm	N	N	N·m	g	mm
5	28	18	5	20	—	3.5×6×3.1	15	15	323	530	2.18	28	6
5	32	21	5	24	—	3.5×6×3.1			431	784	4.31	47	8
6	40	25	6	29	—	4.5×7.5×4.1			588	1,100	7.24	90	10
6	42	27	6	32	—	4.5×7.5×4.1			813	1,570	10.9	102	12
6	43	29	6	33	—	4.5×7.5×4.1			813	1,570	11.6	123	13
6	48	34	6	31	22	4.5×7.5×4.1			1,230	2,350	19.7	182	16
8	54	38	8	36	24	5.5×9×5.1	20	20	1,400	2,740	26.8	247	20
8	62	46	8	40	32	5.5×9×5.1			1,560	3,140	43.4	525	25
10	74	51	10	49	35	6.6×11×6.1			2,490	5,490	82.8	645	30

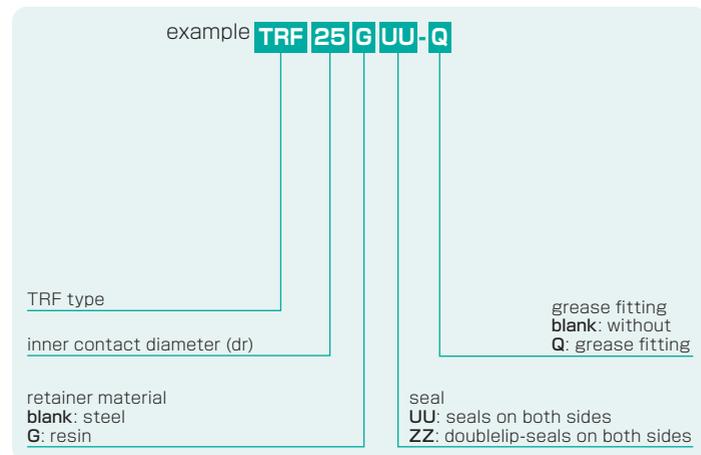
1N ÷ 0.102kgf 1N · m ÷ 0.102kgf · m

# TRF TYPE

– Triple-Wide Round Flange Type –



## part number structure



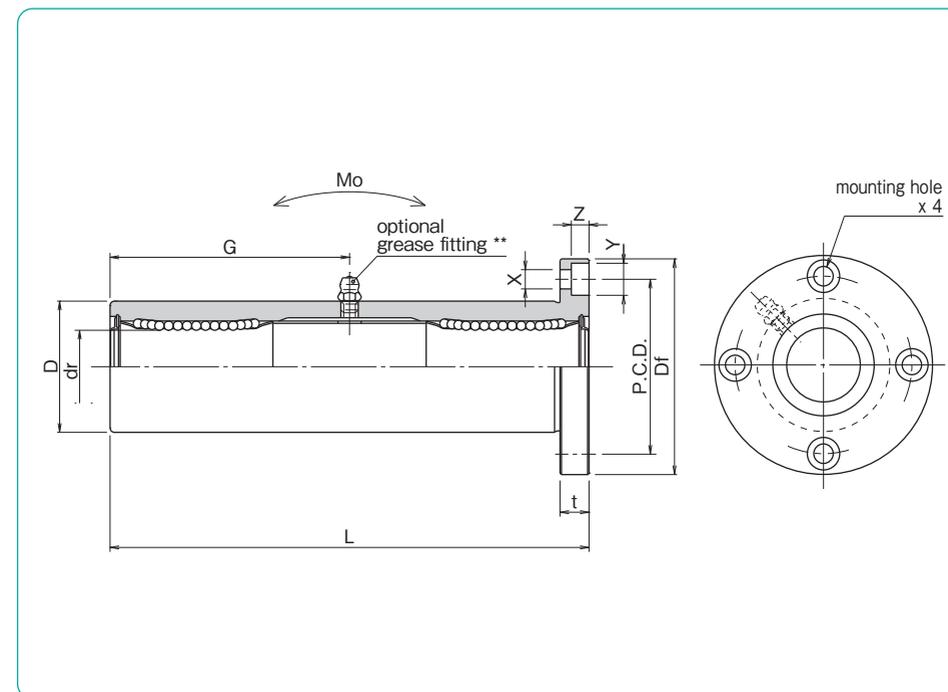
Doublelip-seal is available for size 6 to 30.

part number*		number of ball circuits	dr		major dimensions		
steel retainer	resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
TRF 6UU	TRF 6GUU	4	6		15	0/-18	51
TRF 8UU	TRF 8GUU	4	8	0	19		66
TRF10UU	TRF10GUU	4	10	-12	23	0	80
TRF12UU	TRF12GUU	4	12		26	-21	84
TRF13UU	TRF13GUU	4	13	0	28		90
TRF16UU	TRF16GUU	4	16	-15	32	0	103
TRF20UU	TRF20GUU	5	20		40	-25	118
TRF25UU	TRF25GUU	6	25	0	45		165
TRF30UU	TRF30GUU	6	30	-18	52	0	182
TRF35UU	TRF35GUU	6	35		60	-30	200
TRF40UU	TRF40GUU	6	40	0	65		230
TRF50UU	TRF50GUU	6	50	-21	85	0	290
TRF60UU	TRF60GUU	6	60	0/-25	100	-35	310

Outer cylinder is treated with electroless nickel plating.

\* Seals-on-both-sides is standard.

\*\* TRF6: A-MT6x1 TRF8: A-M6x1 TRF10~30: A-M6F TRF35~60: A-R1/8



Df mm	t mm	flange P.C.D. mm	X × Y × Z mm	grease fitting G mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $\text{N} \cdot \text{m}$	mass g	shaft diameter mm
							dynamic C N	static Co N			
32	5	24	3.5 × 6 × 3.1	20.5	20	20	323	530	8.2	66	6
40	6	29	4.5 × 7.5 × 4.1	29			431	784	16.0	135	8
43	6	33	4.5 × 7.5 × 4.1	38			588	1,100	27.0	222	10
46	6	36	4.5 × 7.5 × 4.1	41			813	1,570	40.1	248	12
48	6	38	4.5 × 7.5 × 4.1	45			813	1,570	42.9	308	13
54	8	43	5.5 × 9 × 5.1	51	25	25	1,230	2,350	73.5	412	16
62	8	51	5.5 × 9 × 5.1	59			1,400	2,740	98.0	752	20
74	10	60	6.6 × 11 × 6.1	82.5			1,560	3,140	157	1,244	25
82	10	67	6.6 × 11 × 6.1	91			2,490	5,490	297	1,636	30
96	13	78	9 × 14 × 8.1	100			2,650	6,270	373	2,580	35
101	13	83	9 × 14 × 8.1	115	30	30	3,430	8,040	553	2,950	40
129	18	107	11 × 17 × 11.1	145			6,080	15,900	1,370	6,860	50
144	18	122	11 × 17 × 11.1	155			7,550	20,000	1,800	9,660	60

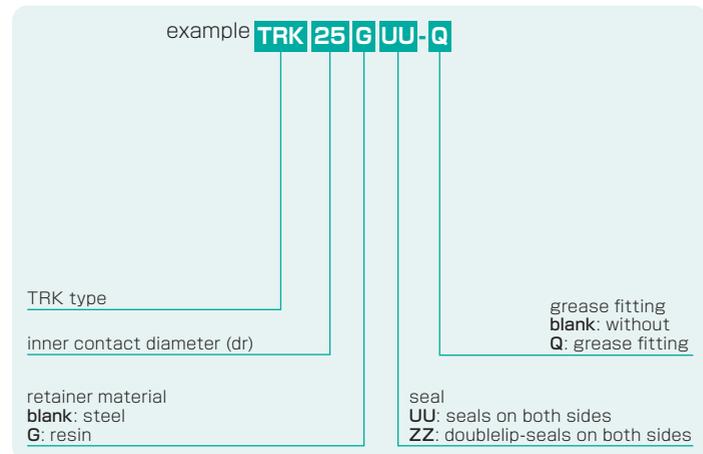
1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# TRK TYPE

– Triple-Wide Square Flange Type –



## part number structure



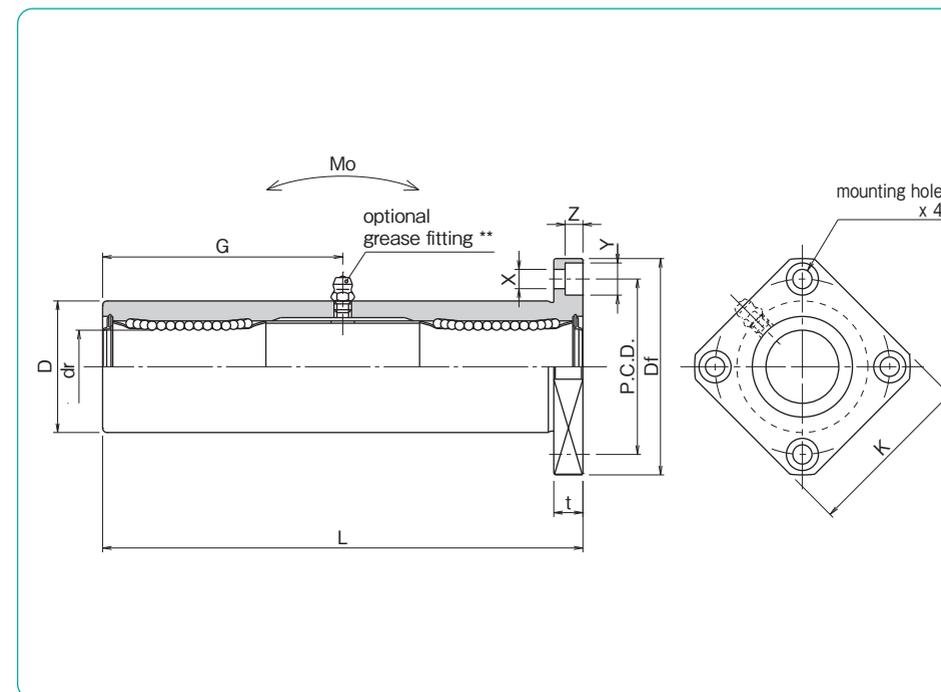
Doublelip-seal is available for size 6 to 30.

part number*		number of ball circuits	dr		major dimensions		
steel retainer	resin retainer		mm	tolerance $\mu\text{m}$	D	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
TRK 6UU	TRK 6GUU	4	6		15	0/-18	51
TRK 8UU	TRK 8GUU	4	8	0	19		66
TRK 10UU	TRK 10GUU	4	10	-12	23	0	80
TRK 12UU	TRK 12GUU	4	12		26	-21	84
TRK 13UU	TRK 13GUU	4	13	0	28		90
TRK 16UU	TRK 16GUU	4	16	-15	32	0	103
TRK 20UU	TRK 20GUU	5	20		40	-25	118
TRK 25UU	TRK 25GUU	6	25	-18	45		165
TRK 30UU	TRK 30GUU	6	30		52	0	182
TRK 35UU	TRK 35GUU	6	35	0	60	-30	200
TRK 40UU	TRK 40GUU	6	40	-21	65		230
TRK 50UU	TRK 50GUU	6	50		85	0	290
TRK 60UU	TRK 60GUU	6	60	0/-25	100	-35	310

Outer cylinder is treated with electroless nickel plating.

\* Seals-on-both-sides is standard.

\*\* TRK6: A-MT6x1 TRK8: A-M6x1 TRK10~30: A-M6F TRK35~60: A-R1/8



Df mm	K mm	flange			grease fitting G mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $\text{N} \cdot \text{m}$	mass g	shaft diameter mm
		t mm	P.C.D. mm	X×Y×Z mm				dynamic C N	static Co N			
32	25	5	24	3.5×6×3.1	20.5	20	20	323	530	8.2	58	6
40	30	6	29	4.5×7.5×4.1	29			431	784	16.0	117	8
43	34	6	33	4.5×7.5×4.1	38			588	1,100	27.0	207	10
46	35	6	36	4.5×7.5×4.1	41			813	1,570	40.1	228	12
48	37	6	38	4.5×7.5×4.1	45			813	1,570	42.9	286	13
54	42	8	43	5.5×9×5.1	51	25	25	1,230	2,350	73.5	376	16
62	50	8	51	5.5×9×5.1	59			1,400	2,740	98.0	714	20
74	58	10	60	6.6×11×6.1	82.5			1,560	3,140	157	1,163	25
82	64	10	67	6.6×11×6.1	91			2,490	5,490	297	1,543	30
96	75	13	78	9×14×8.1	100			2,650	6,270	373	2,400	35
101	80	13	83	9×14×8.1	115	30	30	3,430	8,040	553	2,510	40
129	100	18	107	11×17×11.1	145			6,080	15,900	1,370	6,400	50
144	116	18	122	11×17×11.1	155			7,550	20,000	1,800	9,200	60

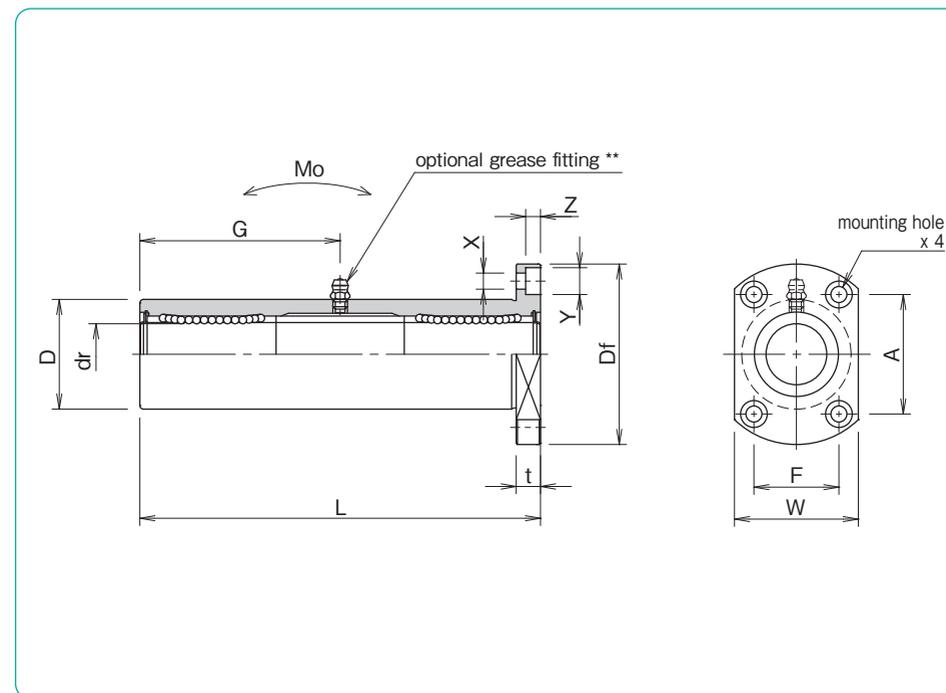
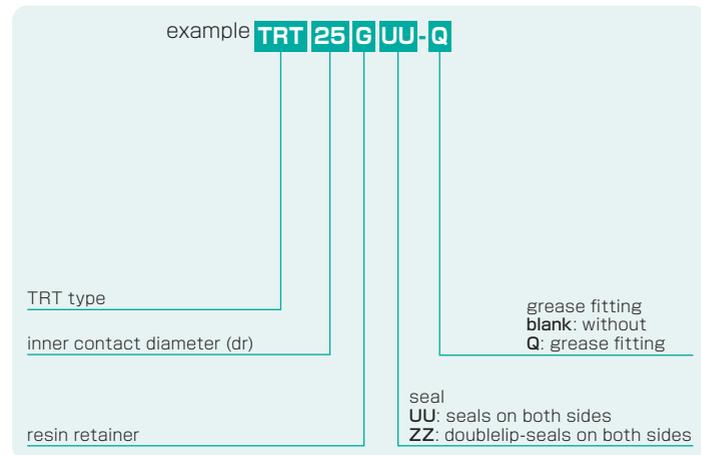
1N  $\approx$  0.102kgf 1N  $\cdot$  m  $\approx$  0.102kgf  $\cdot$  m

# TRT TYPE

– Triple-Wide Two Side Cut Flange Type –



## part number structure



part number*	number of ball circuits	dr		D		major dimensions					flange	
		mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm	Df mm	W mm	t mm	A mm	F mm	
TRT12GUU	4	12	0	26	0	84	46	32	6	28	22	
TRT13GUU	4	13		28	-21	90	48	34	6	31	22	
TRT16GUU	4	16	-15	32	0	103	54	38	8	36	24	
TRT20GUU	5	20	40	-25		118	62	46	8	40	32	
TRT25GUU	6	25	-18	45	0/-30	165	74	51	10	49	35	
TRT30GUU	6	30		52		182	82	58	10	55	38	

Outer cylinder is treated with electroless nickel plating.

\* Seals-on-both-sides is standard.

\*\*TRT12G~30G: A-M6F

X × Y × Z mm	grease fitting G mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating dynamic C N	static Co N	allowable static moment Mo N · m	mass g	shaft diameter mm
4.5 × 7.5 × 4.1	41	20	20	813	1,570	40.1	236	12
4.5 × 7.5 × 4.1	45			813	1,570	42.9	291	13
5.5 × 9 × 5.1	51	25	25	1,230	2,350	73.5	388	16
5.5 × 9 × 5.1	59			1,400	2,740	98.0	720	20
6.6 × 11 × 6.1	82.5			1,560	3,140	157	1,160	25
6.6 × 11 × 6.1	91			2,490	5,490	297	1,555	30

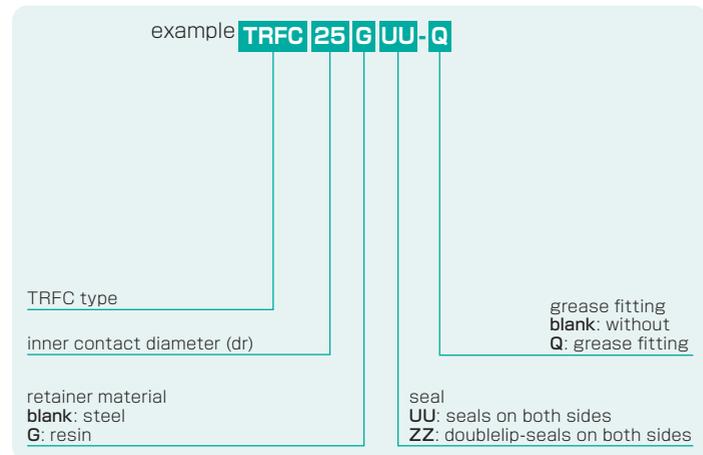
1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# TRFC TYPE

— Triple-Wide Intermediate Position Round Flange Type —



## part number structure



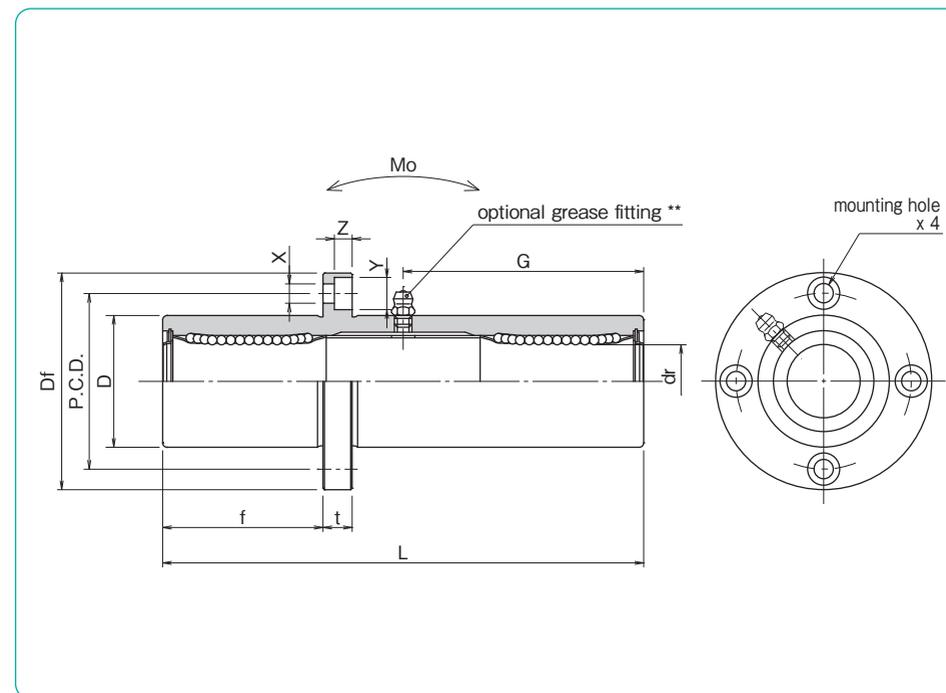
Doublelip-seal is available for size 6 to 30.

part number*		number of ball circuits	dr		major dimensions		
steel retainer	resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
TRFC 6UU	TRFC 6GUU	4	6	0	15	0/-18	51
TRFC 8UU	TRFC 8GUU	4	8	-12	19		66
TRFC 10UU	TRFC 10GUU	4	10		23	0	80
TRFC 12UU	TRFC 12GUU	4	12	0	26	-21	84
TRFC 13UU	TRFC 13GUU	4	13	-15	28		90
TRFC 16UU	TRFC 16GUU	4	16		32	0	103
TRFC 20UU	TRFC 20GUU	5	20	0	40	-25	118
TRFC 25UU	TRFC 25GUU	6	25	-18	45		165
TRFC 30UU	TRFC 30GUU	6	30	0	52	0	182
TRFC 35UU	TRFC 35GUU	6	35	-21	60	-30	200
TRFC 40UU	TRFC 40GUU	6	40	0	65		230
TRFC 50UU	TRFC 50GUU	6	50		85	0	290
TRFC 60UU	TRFC 60GUU	6	60	0/-25	100	-35	310

Outer cylinder is treated with electroless nickel plating.

\* Seals-on-both-sides is standard.

\*\* TRFC6: A-MT6x1 TRFC8: A-M6x1 TRFC10~30: A-M6F TRFC35~60: A-R1/8



f mm	Df mm	flange			grease fitting G mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $\text{N} \cdot \text{m}$	mass g	shaft diameter mm
		t mm	P.C.D. mm	X×Y×Z mm				dynamic C N	static Co N			
17	32	5	24	3.5×6×3.1	20.5	20	20	323	530	8.2	66	6
22	40	6	29	4.5×7.5×4.1	29			431	784	16.0	135	8
27	43	6	33	4.5×7.5×4.1	38			588	1,100	27.0	222	10
28	46	6	36	4.5×7.5×4.1	41			813	1,570	40.1	248	12
30	48	6	38	4.5×7.5×4.1	45			813	1,570	42.9	308	13
35	54	8	43	5.5×9×5.1	51	25	25	1,230	2,350	73.5	412	16
40	62	8	51	5.5×9×5.1	59			1,400	2,740	98.0	752	20
55	74	10	60	6.6×11×6.1	82.5			1,560	3,140	157	1,244	25
61	82	10	67	6.6×11×6.1	91			2,490	5,490	297	1,636	30
67	96	13	78	9×14×8.1	100			2,650	6,270	373	2,580	35
77	101	13	83	9×14×8.1	115	30	30	3,430	8,040	553	2,950	40
97	129	18	107	11×17×11.1	145			6,080	15,900	1,370	6,860	50
104	144	18	122	11×17×11.1	155			7,550	20,000	1,800	9,660	60

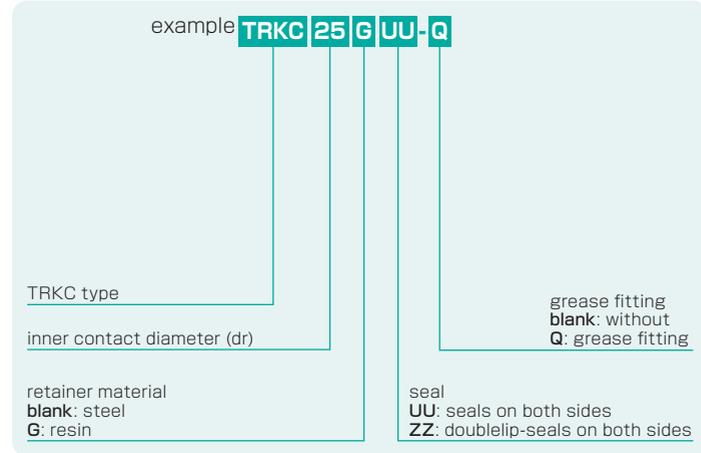
1N  $\approx$  0.102kgf 1N  $\cdot$  m  $\approx$  0.102kgf  $\cdot$  m

# TRKC TYPE

— Triple-Wide Intermediate Position Square Flange Type —



## part number structure



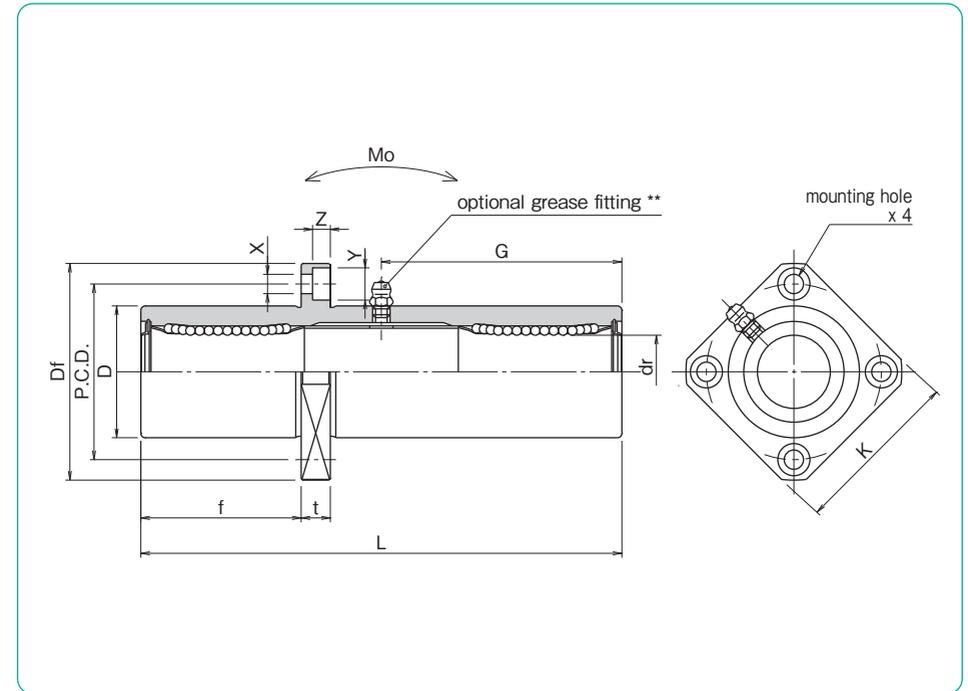
Doublelip-seal is available for size 6 to 30.

part number*		number of ball circuits	dr		major dimensions		
steel retainer	resin retainer		mm	tolerance $\mu\text{m}$	D	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
TRKC 6UU	TRKC 6GUU	4	6		15	0/-18	51
TRKC 8UU	TRKC 8GUU	4	8	0	19		66
TRKC 10UU	TRKC 10GUU	4	10	-12	23	0	80
TRKC 12UU	TRKC 12GUU	4	12		26	-21	84
TRKC 13UU	TRKC 13GUU	4	13	0	28		90
TRKC 16UU	TRKC 16GUU	4	16	-15	32		103
TRKC 20UU	TRKC 20GUU	5	20		40	0	118
TRKC 25UU	TRKC 25GUU	6	25	0	45	-25	165
TRKC 30UU	TRKC 30GUU	6	30	-18	52		182
TRKC 35UU	TRKC 35GUU	6	35		60	0	200
TRKC 40UU	TRKC 40GUU	6	40	0	65	-30	230
TRKC 50UU	TRKC 50GUU	6	50	-21	85	0	290
TRKC 60UU	TRKC 60GUU	6	60	0/-25	100	-35	310

Outer cylinder is treated with electroless nickel plating.

\* Seals-on-both-sides is standard.

\*\* TRKC6: A-MT6x1 TRKC8: A-M6x1 TRKC10~30: A-M6F TRKC35~60: A-R1/8



f mm	Df mm	flange			P.C.D. mm	X×Y×Z mm	grease fitting G mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment Mo N·m	mass g	shaft diameter mm
		K mm	t mm	C N						Co N				
17	32	25	5	24	3.5×6×3.1	20.5	20	20	323	530	8.2	58	6	
22	40	30	6	29	4.5×7.5×4.1	29			431	784	16.0	117	8	
27	43	34	6	33	4.5×7.5×4.1	38			588	1,100	27.0	207	10	
28	46	35	6	36	4.5×7.5×4.1	41			813	1,570	40.1	228	12	
30	48	37	6	38	4.5×7.5×4.1	45			813	1,570	42.9	286	13	
35	54	42	8	43	5.5×9×5.1	51	25	25	1,230	2,350	73.5	376	16	
40	62	50	8	51	5.5×9×5.1	59			1,400	2,740	98.0	714	20	
55	74	58	10	60	6.6×11×6.1	82.5			1,560	3,140	157	1,163	25	
61	82	64	10	67	6.6×11×6.1	91			2,490	5,490	297	1,543	30	
67	96	75	13	78	9×14×8.1	100			2,650	6,270	373	2,400	35	
77	101	80	13	83	9×14×8.1	115	30	30	3,430	8,040	553	2,510	40	
97	129	100	18	107	11×17×11.1	145			6,080	15,900	1,370	6,400	50	
104	144	116	18	122	11×17×11.1	155			7,550	20,000	1,800	9,200	60	

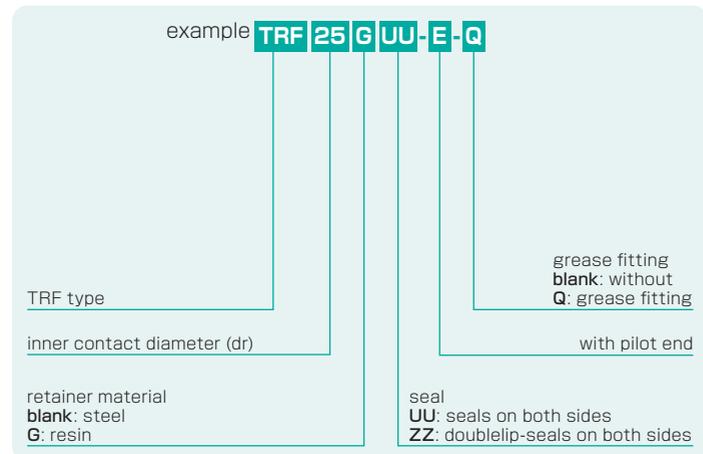
1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# TRF-E TYPE

– Triple-Wide Round Flange Pilot End Type –



## part number structure



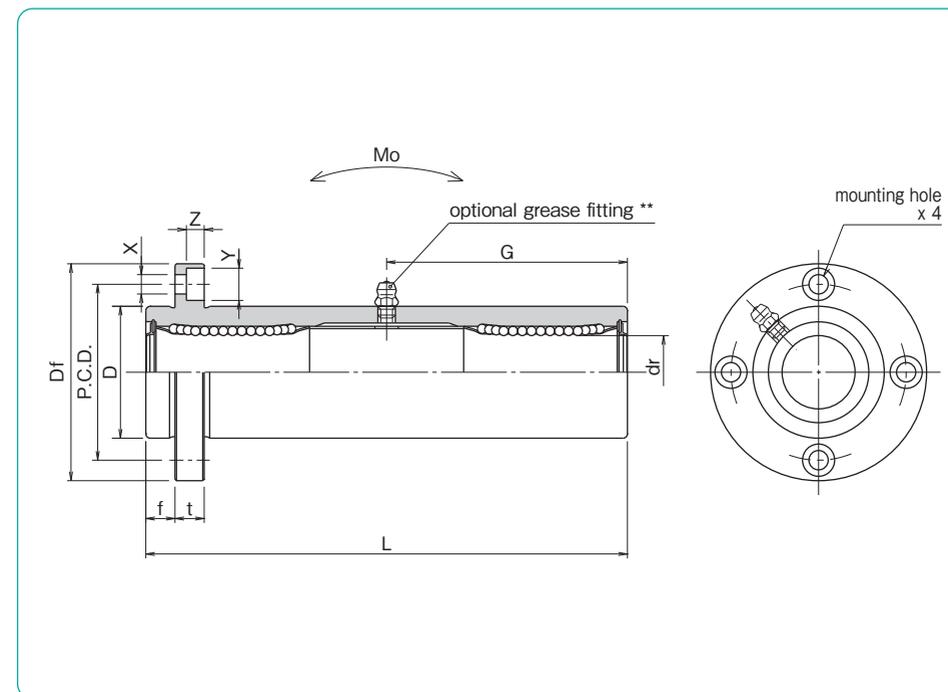
Doublelip-seal is available for size 6 to 30.

part number*		number of ball circuits	dr		major dimensions		
steel retainer	resin retainer		mm	tolerance $\mu\text{m}$	D	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
TRF 6UU-E	TRF 6GUU-E	4	6	0	15	0/-18	51
TRF 8UU-E	TRF 8GUU-E	4	8	-12	19		66
TRF 10UU-E	TRF 10GUU-E	4	10		23	0	80
TRF 12UU-E	TRF 12GUU-E	4	12		26	-21	84
TRF 13UU-E	TRF 13GUU-E	4	13	0	28		90
TRF 16UU-E	TRF 16GUU-E	4	16	-15	32		103
TRF 20UU-E	TRF 20GUU-E	5	20		40	0	118
TRF 25UU-E	TRF 25GUU-E	6	25	0	45	-25	165
TRF 30UU-E	TRF 30GUU-E	6	30	-18	52		182
TRF 35UU-E	TRF 35GUU-E	6	35		60	0	200
TRF 40UU-E	TRF 40GUU-E	6	40	0	65	-30	230
TRF 50UU-E	TRF 50GUU-E	6	50	-21	85	0	290
TRF 60UU-E	TRF 60GUU-E	6	60	0/-25	100	-35	310

Outer cylinder is treated with electroless nickel plating.

\* Seals-on-both-sides is standard.

\*\* TRF6: A-MT6x1 TRF8: A-M6x1 TRF10~30: A-M6F TRF35~60: A-R1/8



f mm	Df mm	flange			grease fitting G mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $\text{N} \cdot \text{m}$	mass g	shaft diameter mm
		t mm	P.C.D. mm	X×Y×Z mm				dynamic C N	static Co N			
5	32	5	24	3.5×6×3.1	20.5	20	20	323	530	8.2	66	6
6	40	6	29	4.5×7.5×4.1	29			431	784	16.0	135	8
6	43	6	33	4.5×7.5×4.1	38			588	1,100	27.0	222	10
6	46	6	36	4.5×7.5×4.1	41			813	1,570	40.1	248	12
6	48	6	38	4.5×7.5×4.1	45			813	1,570	42.9	308	13
8	54	8	43	5.5×9×5.1	51			1,230	2,350	73.5	412	16
8	62	8	51	5.5×9×5.1	59	25	25	1,400	2,740	98.0	752	20
10	74	10	60	6.6×11×6.1	82.5			1,560	3,140	157	1,244	25
10	82	10	67	6.6×11×6.1	91			2,490	5,490	297	1,636	30
13	96	13	78	9×14×8.1	100			2,650	6,270	373	2,580	35
13	101	13	83	9×14×8.1	115			3,430	8,040	553	2,950	40
18	129	18	107	11×17×11.1	145			6,080	15,900	1,370	6,860	50
18	144	18	122	11×17×11.1	155	30	30	7,550	20,000	1,800	9,660	60

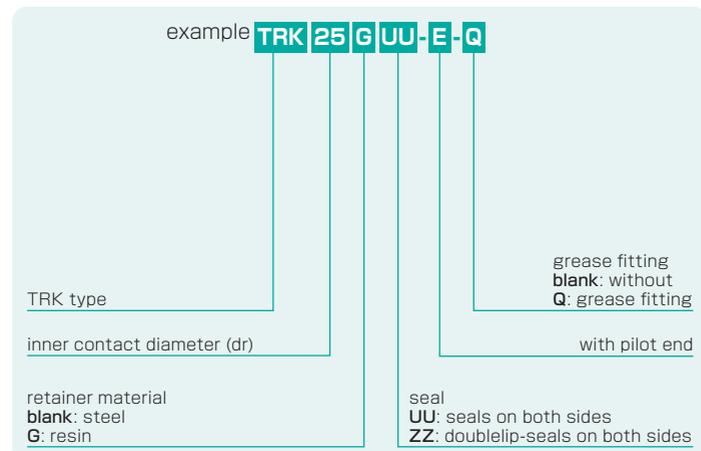
1N  $\approx$  0.102kgf 1N  $\cdot$  m  $\approx$  0.102kgf  $\cdot$  m

# TRK-E TYPE

– Triple-Wide Square Flange Pilot End Type –



## part number structure



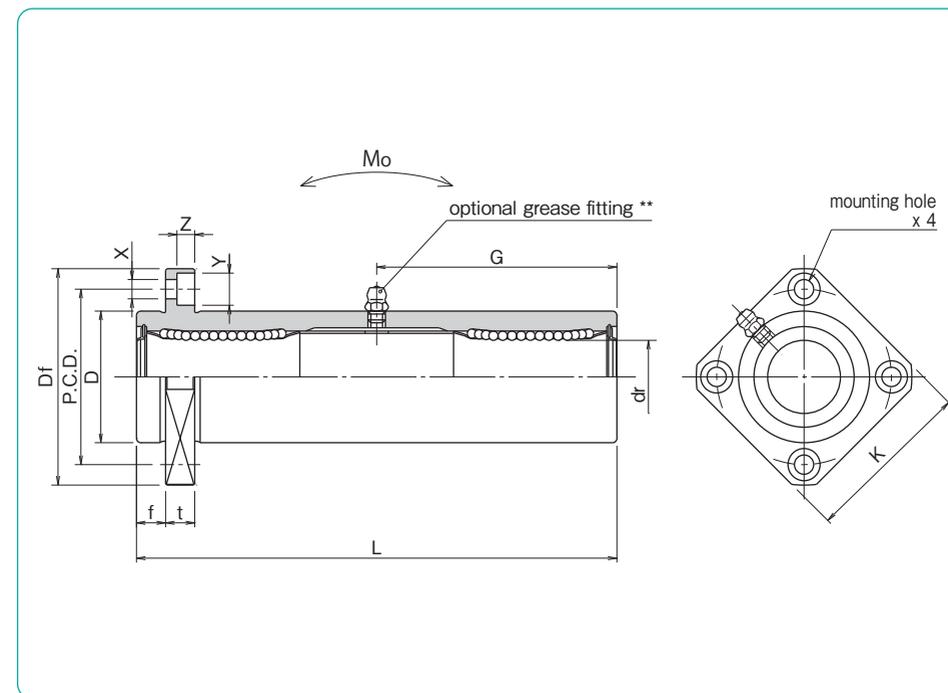
Doublelip-seal is available for size 6 to 30.

part number*		number of ball circuits	major dimensions			
steel retainer	resin retainer		dr mm	tolerance $\mu\text{m}$	D mm	L $\pm 0.3$ mm
TRK 6UU-E	TRK 6GUU-E	4	6	0	15	51
TRK 8UU-E	TRK 8GUU-E	4	8	-12	19	66
TRK 10UU-E	TRK 10GUU-E	4	10	0	23	80
TRK 12UU-E	TRK 12GUU-E	4	12	-21	26	84
TRK 13UU-E	TRK 13GUU-E	4	13	0	28	90
TRK 16UU-E	TRK 16GUU-E	4	16	-15	32	103
TRK 20UU-E	TRK 20GUU-E	5	20	0	40	118
TRK 25UU-E	TRK 25GUU-E	6	25	-18	45	165
TRK 30UU-E	TRK 30GUU-E	6	30	0	52	182
TRK 35UU-E	TRK 35GUU-E	6	35	-30	60	200
TRK 40UU-E	TRK 40GUU-E	6	40	0	65	230
TRK 50UU-E	TRK 50GUU-E	6	50	-21	85	290
TRK 60UU-E	TRK 60GUU-E	6	60	0/-25	100	310

Outer cylinder is treated with electroless nickel plating.

\* Seals-on-both-sides is standard.

\*\* TRK6: A-MT6x1 TRK8: A-M6x1 TRK10~30: A-M6F TRK35~60: A-R1/8



f mm	Df mm	flange			grease fitting G mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment Mo N·m	mass g	shaft diameter mm	
		K mm	t mm	P.C.D. mm				X×Y×Z mm	dynamic C N				static Co N
5	32	25	5	24	3.5×6×3.1	20.5	20	20	323	530	8.2	58	6
6	40	30	6	29	4.5×7.5×4.1	29			431	784	16.0	117	8
6	43	34	6	33	4.5×7.5×4.1	38			588	1,100	27.0	207	10
6	46	35	6	36	4.5×7.5×4.1	41	25	25	813	1,570	40.1	228	12
6	48	37	6	38	4.5×7.5×4.1	45			813	1,570	42.9	286	13
8	54	42	8	43	5.5×9×5.1	51			1,230	2,350	73.5	376	16
8	62	50	8	51	5.5×9×5.1	59	30	30	1,400	2,740	98.0	714	20
10	74	58	10	60	6.6×11×6.1	82.5			1,560	3,140	157	1,163	25
10	82	64	10	67	6.6×11×6.1	91			2,490	5,490	297	1,543	30
13	96	75	13	78	9×14×8.1	100	30	30	2,650	6,270	373	2,400	35
13	101	80	13	83	9×14×8.1	115			3,430	8,040	553	2,510	40
18	129	100	18	107	11×17×11.1	145			6,080	15,900	1,370	6,400	50
18	144	116	18	122	11×17×11.1	155			7,550	20,000	1,800	9,200	60

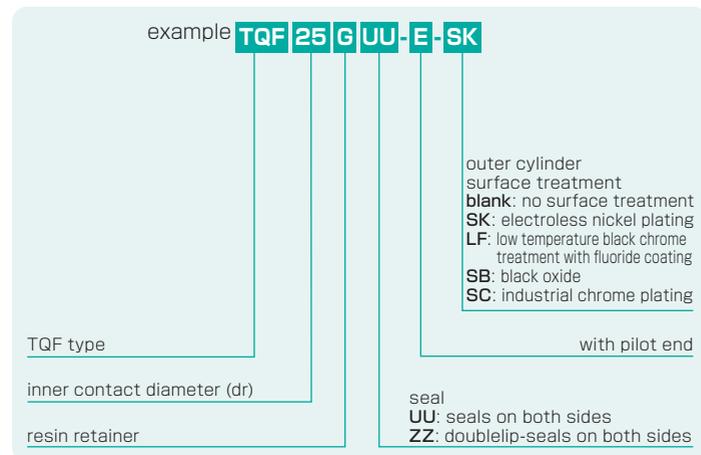
1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# TQF-E TYPE

– Round Flange Type with Pilot End –



## part number structure

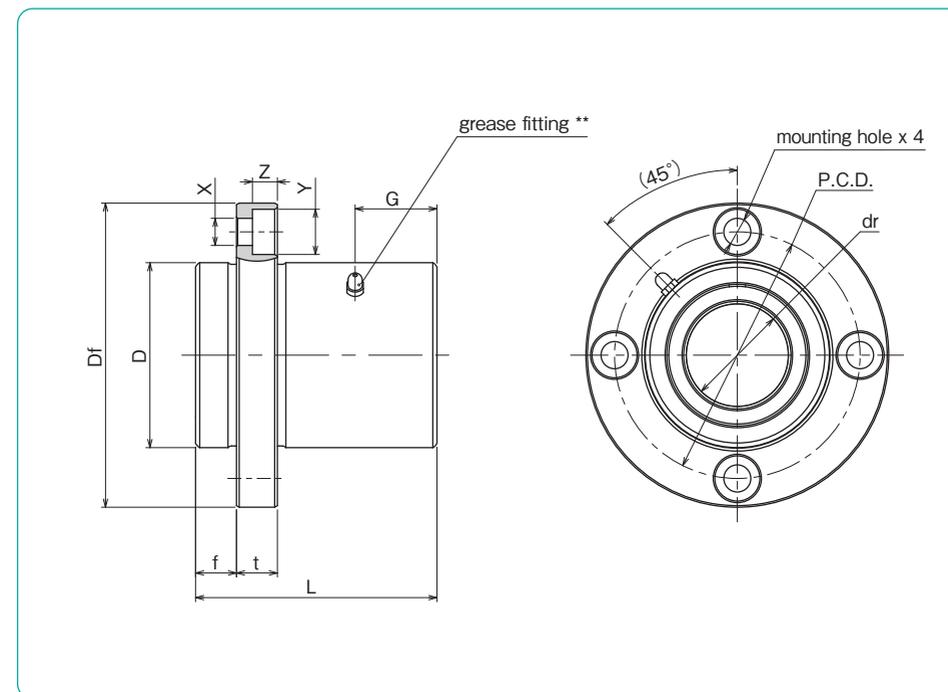


Doublelip-seal is available for size 16 to 30.

part number*	number of ball circuits	dr		D		major dimensions				
		mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm	f mm	Df mm	t mm	flange P.C.D. mm
<b>TQF16GUU-E</b>	4	16	0/-9	32	0	37	8	54	8	43
<b>TQF20GUU-E</b>	5	20	0	40	-19	42	8	62	8	51
<b>TQF25GUU-E</b>	6	25	-10	45	0	59	10	74	10	60
<b>TQF30GUU-E</b>	6	30	0	52	-22	64	10	82	10	67
<b>TQF35GUU-E</b>	6	35	0	60	0	70	13	96	13	78
<b>TQF40GUU-E</b>	6	40	-12	65	0	80	13	101	13	83

\* Seals-on-both-sides is standard.

\*\*TQF16G~25G : M3-1 grease fitting TQF30G~40G : A-M6x1  
 Surface treatment is optional.



X×Y×Z mm	grease fitting	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		mass g	shaft diameter mm
	G mm			dynamic C N	static Co N		
5.5×9×5.1	12	12	12	774	1,180	205	16
5.5×9×5.1	14	15	15	882	1,370	334	20
6.6×11×6.1	20			980	1,570	568	25
6.6×11×6.1	21	20	20	1,570	2,740	737	30
9×14×8.1	23			1,670	3,140	1,170	35
9×14×8.1	27			2,160	4,020	1,330	40

1N≐0.102kgf

# TQK-E TYPE

– Square Flange Type with Pilot End –



## part number structure

example) **TQK 25 G UU-E-SK**

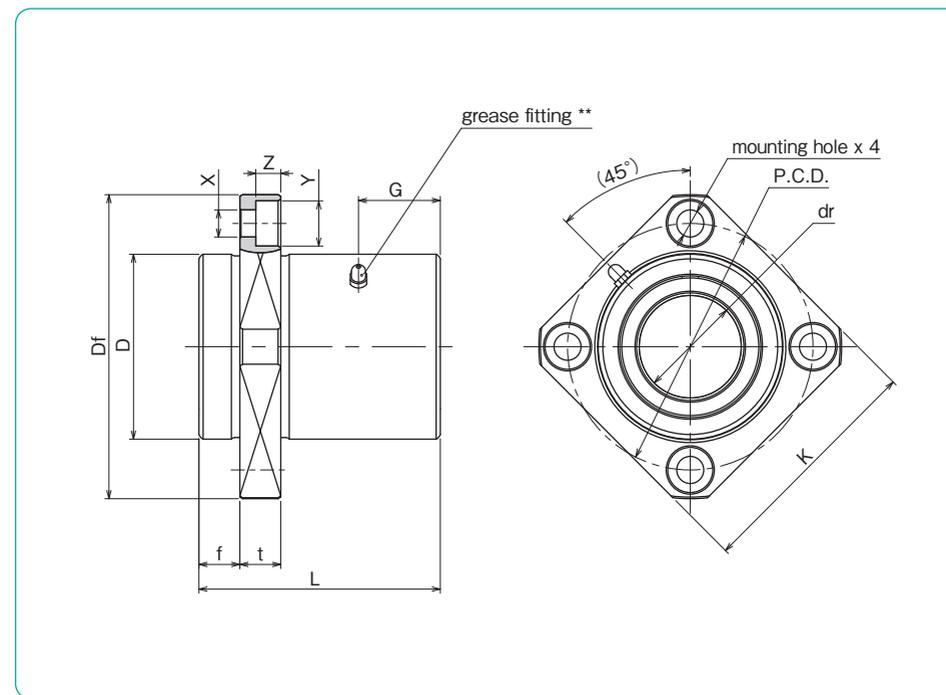
TQK type	25	G	UU	E	SK
inner contact diameter (dr)					
resin retainer					
					with pilot end
					outer cylinder surface treatment
					blank: no surface treatment
					SK: electroless nickel plating
					LF: low temperature black chrome treatment with fluoride coating
					SB: black oxide
					SC: industrial chrome plating
					seal
					UU: seals on both sides
					ZZ: doublelip-seals on both sides

Doublelip-seal is available for size 16 to 30.

part number*	number of ball circuits	dr		D		major dimensions					flange	
		mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm	f mm	Df mm	K mm	t mm	P.C.D. mm	
TQK16GUU-E	4	16	0/-9	32	0	37	8	54	42	8	43	
TQK20GUU-E	5	20	0	40	-19	42	8	62	50	8	51	
TQK25GUU-E	6	25	-10	45	0	59	10	74	58	10	60	
TQK30GUU-E	6	30	0	52	-22	64	10	82	64	10	67	
TQK35GUU-E	6	35	0	60	0	70	13	96	75	13	78	
TQK40GUU-E	6	40	-12	65	0	80	13	101	80	13	83	

\* Seals-on-both-sides is standard.

\*\*TQK16G~25G : M3-1 grease fitting TQK30G~40G : A-M6x1  
Surface treatment is optional.



X×Y×Z mm	grease fitting	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		mass g	shaft diameter mm
	G mm			dynamic C N	static Co N		
5.5×9×5.1	12	12	12	774	1,180	170	16
5.5×9×5.1	14	15	15	882	1,370	297	20
6.6×11×6.1	20			980	1,570	490	25
6.6×11×6.1	21	20	20	1,570	2,740	639	30
9×14×8.1	23			1,670	3,140	989	35
9×14×8.1	27			2,160	4,020	1,040	40

1N≒0.102kgf

# TQF-W-E TYPE

— Round Flange Double-Wide Pilot End Type —



## part number structure

example **TQF 25 G W UU - E - SK**

TQF type	25	G	W	UU	E	SK
inner contact diameter (dr)						
resin retainer						
double-wide type						
						with pilot end
						seal
						UU: seals on both sides
						ZZ: doublelip-seals on both sides
						outer cylinder
						surface treatment
						blank: no surface treatment
						SK: electroless nickel plating
						LF: low temperature black chrome treatment with fluoride coating
						SB: black oxide
						SC: industrial chrome plating

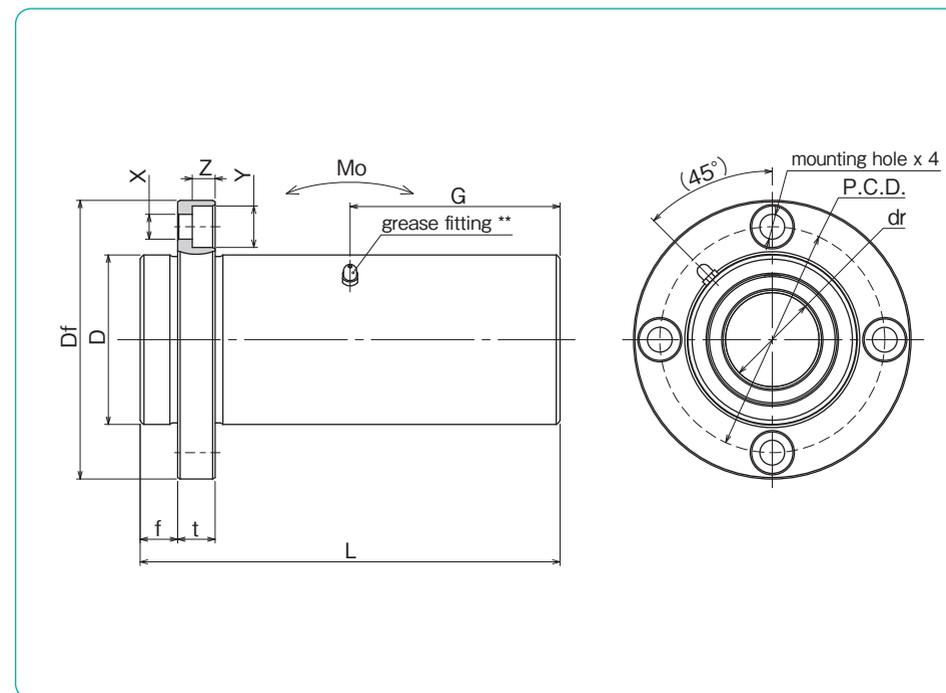
Doublelip-seal is available for size 16 to 30.

part number*	number of ball circuits	dr		D		major dimensions				flange	
		mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm	f mm	Df mm	t mm	P.C.D. mm	
TQF16GWUU-E	4	16	0/-9	32	0	70	8	54	8	43	
TQF20GWUU-E	5	20	0	40	-19	80	8	62	8	51	
TQF25GWUU-E	6	25	-12	45	0	112	10	74	10	60	
TQF30GWUU-E	6	30	0	52	-22	123	10	82	10	67	
TQF35GWUU-E	6	35	0	60	0	135	13	96	13	78	
TQF40GWUU-E	6	40	-15	65	-22	151	13	101	13	83	

\* Seals-on-both-sides is standard.

\*\*TQF16G~25G : M3-1 grease fitting TQF30G~40G : A-M6x1

Surface treatment is optional.



X × Y × Z mm	grease fitting G mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating dynamic C N	static Co N	allowable static moment Mo N · m	mass g	shaft diameter mm
5.5 × 9 × 5.1	35	15	15	1,230	2,350	19.7	317	16
5.5 × 9 × 5.1	40	20	20	1,400	2,740	26.8	552	20
6.6 × 11 × 6.1	56			1,560	3,140	43.4	916	25
6.6 × 11 × 6.1	61.5	25	25	2,490	5,490	82.8	1,217	30
9 × 14 × 8.1	67.5			2,650	6,270	110	1,880	35
9 × 14 × 8.1	75.5			3,430	8,040	147	2,140	40

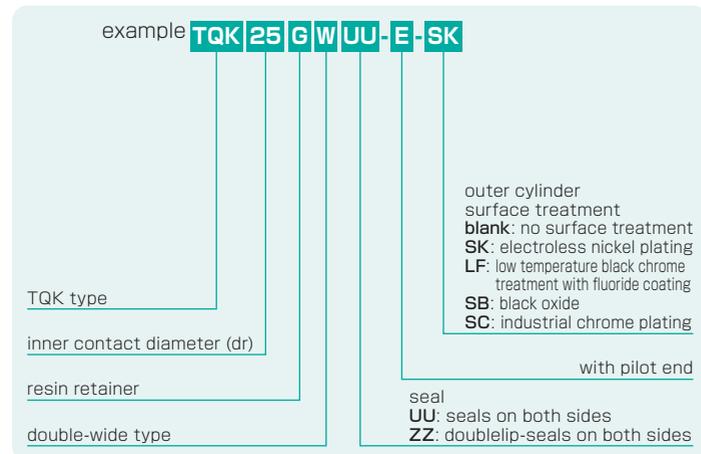
1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# TQK-W-E TYPE

— Square Flange Double-Wide Pilot End Type —



## part number structure



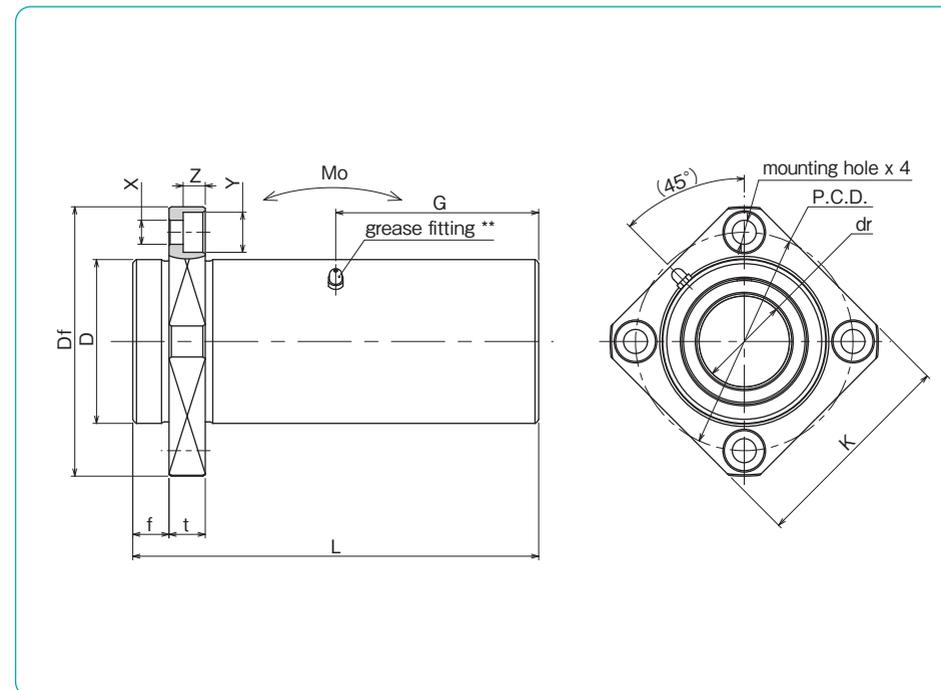
Doublelip-seal is available for size 16 to 30.

part number*	number of ball circuits	dr		D		major dimensions					flange	
		mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm	f mm	Df mm	K mm	t mm	P.C.D. mm	
TQK16GWUU-E	4	16	0/-10	32	0	70	8	54	42	8	43	
TQK20GWUU-E	5	20	0	40	-19	80	8	62	50	8	51	
TQK25GWUU-E	6	25	-12	45	0	112	10	74	58	10	60	
TQK30GWUU-E	6	30	0	52	-22	123	10	82	64	10	67	
TQK35GWUU-E	6	35	0	60	0	135	13	96	75	13	78	
TQK40GWUU-E	6	40	-15	65	0	151	13	101	80	13	83	

\* Seals-on-both-sides is standard.

\*\*TQK16G~25G : M3-1 grease fitting TQK30G~40G : A-M6x1

Surface treatment is optional.



X × Y × Z mm	grease fitting G mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating dynamic C N	static Co N	allowable static moment Mo N · m	mass g	shaft diameter mm
5.5 × 9 × 5.1	35	15	15	1,230	2,350	19.7	282	16
5.5 × 9 × 5.1	40	20	20	1,400	2,740	26.8	515	20
6.6 × 11 × 6.1	56			1,560	3,140	43.4	838	25
6.6 × 11 × 6.1	61.5	25	25	2,490	5,490	82.8	1,120	30
9 × 14 × 8.1	67.5			2,650	6,270	110	1,710	35
9 × 14 × 8.1	75.5			3,430	8,040	147	1,960	40

1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# KB TYPE (Euro Standard)

– Standard Type –



### part number structure

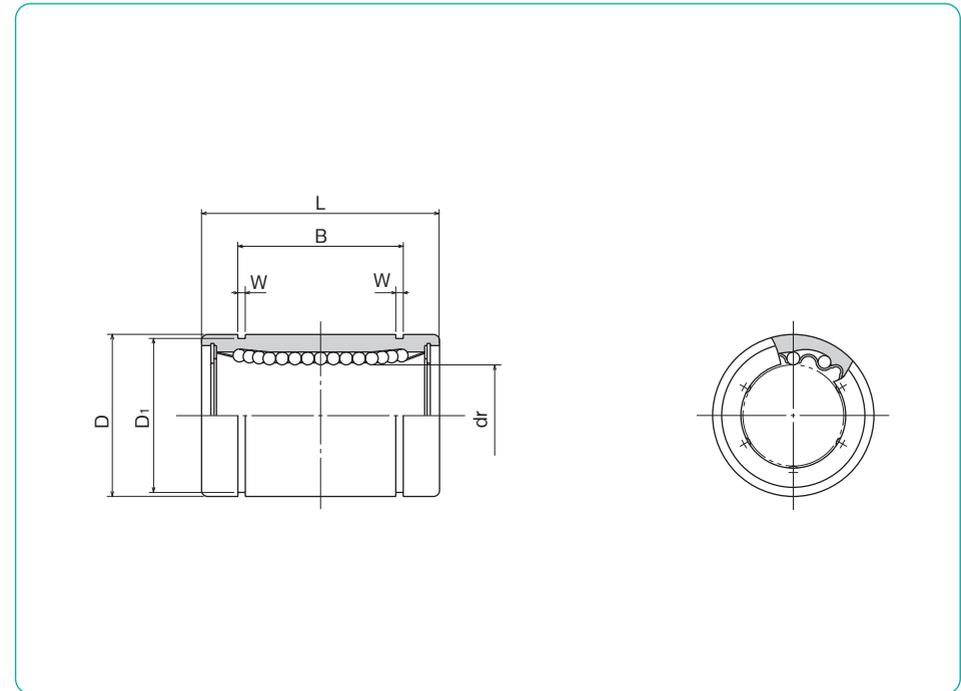
example **KBS 25 G UU**

specification  
**KB:** standard  
**KBS:** anti-corrosion

inner contact diameter (dr)

retainer material  
**blank:** standard/steel  
**G:** anti-corrosion/stainless steel  
**UU:** resin

seal  
**blank:** without seal  
**U:** seal on one side  
**UU:** seals on both sides



part number				number of ball circuits	dr		major dimensions	
standard steel retainer	resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$
KB 3	KB 3G	KBS 3	KBS 3G	4	3		7	
KB 4	KB 4G	KBS 4	KBS 4G	4	4		8	0
KB 5	KB 5G	KBS 5	KBS 5G	4	5	+ 8	12	- 8
KB 8	KB 8G	KBS 8	KBS 8G	4	8	0	16	
KB10	KB10G	KBS10	KBS10G	4	10		19	0
KB12	KB12G	KBS12	KBS12G	4	12		22	- 9
KB16	KB16G	KBS16	KBS16G	4	16	+ 9	26	
KB20	KB20G	KBS20	KBS20G	5	20	- 1	32	0
KB25	KB25G	KBS25	KBS25G	6	25	+11	40	-11
KB30	KB30G	KBS30	KBS30G	6	30	- 1	47	
KB40	KB40G	KBS40	KBS40G	6	40	+13	62	0
KB50	KB50G	KBS50	KBS50G	6	50	- 2	75	-13
KB60	KB60G	KBS60	KBS60G	6	60		90	0
KB80	-	-	-	6	80	+16/-4	120	-15

mm	L	B		W	D <sub>1</sub>	eccentricity $\mu\text{m}$	radial clearance (maximum) $\mu\text{m}$	basic load rating		mass g	shaft diameter mm
	tolerance mm	mm	tolerance mm	mm	mm			dynamic C N	static Co N		
10	0	-	-	-	-	10	- 3	69	105	1.4	3
12	-0.12	-	-	-	-			88	127	2	4
22	0	14.5	-0.2	1.1	11.5			206	265	11	5
25		16.5		1.1	15.2	265	402	22	8		
29		22		1.3	18	372	549	36	10		
32		-0.2		22.9	1.3	21	510	784	45	12	
36		-0.3		24.9	1.3	24.9	578	892	60	16	
45	31.5		1.6	30.3	862	1,370	102	20			
58	44.1		1.85	37.5	980	1,570	235	25			
68	0	52.1	0	1.85	44.5	15	- 8	1,570	2,740	360	30
80		-0.3		60.6	-0.3			2.15	59	2,160	4,020
100	0	77.6	0	2.65	72	17	-13	3,820	7,940	1,250	50
125		101.7		3.15	86.5			4,700	9,800	2,220	60
165		-0.4		133.7	-0.4			4.15	116	7,350	16,000

1N=0.102kgf

# KB-AJ TYPE (Euro Standard)

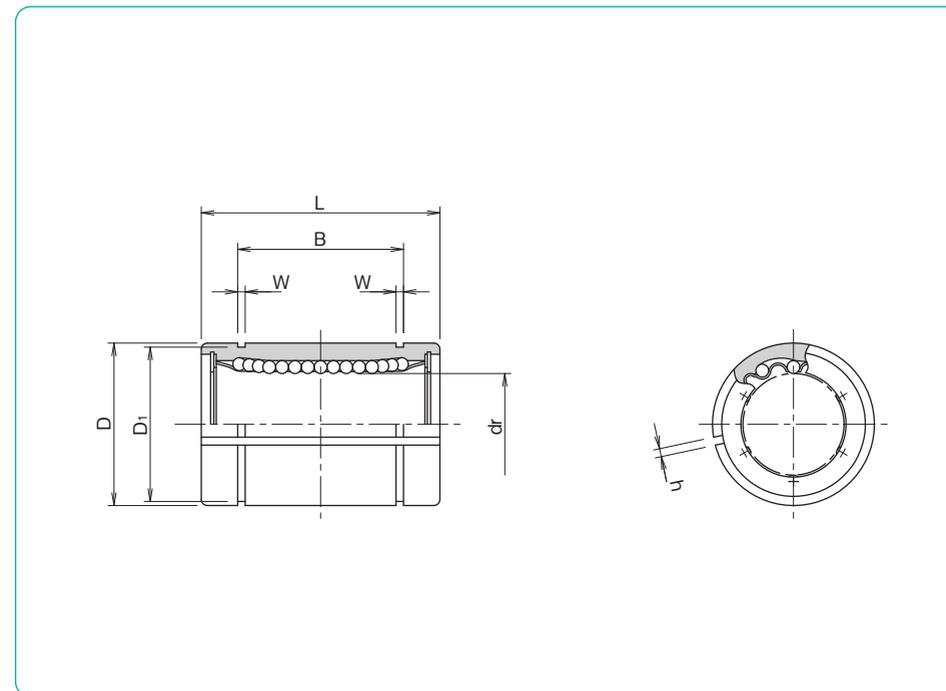
– Clearance Adjustable Type –



## part number structure

example **KBS 25 G UU -AJ**

specification KB: standard KBS: anti-corrosion	inner contact diameter (dr)	retainer material blank: standard/steel G: resin	clearance-adjustable	seal blank: without seal U: seal on one side UU: seals on both sides
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part number		number of ball circuits	dr		major dimensions	
standard	anti-corrosion		mm	tolerance* μm	D	tolerance* μm
—	KB 5G-AJ	—	5		12	0
—	KB 8G-AJ	—	8	+ 8	16	- 8
—	KB10G-AJ	—	10	0	19	0
KB12-AJ	KB12G-AJ	KBS12-AJ	12		22	0
KB16-AJ	KB16G-AJ	KBS16-AJ	16	+ 9	26	- 9
KB20-AJ	KB20G-AJ	KBS20-AJ	20	- 1	32	0
KB25-AJ	KB25G-AJ	KBS25-AJ	25	+11	40	0
KB30-AJ	KB30G-AJ	KBS30-AJ	30	- 1	47	-11
KB40-AJ	KB40G-AJ	KBS40-AJ	40	+13	62	0
KB50-AJ	KB50G-AJ	KBS50-AJ	50	- 2	75	-13
KB60-AJ	KB60G-AJ	KBS60-AJ	60		90	0
KB80-AJ	—	—	80	+16/-4	120	-15

\* Accuracy is measured prior to machining clearance slit.

mm	L	B		W	D <sub>1</sub>	h	eccentricity* μm	basic load rating		mass g	shaft diameter mm
	tolerance mm	mm	tolerance mm					dynamic C N	static Co N		
22		14.5		1.1	11.5	1	12	206	265	10	5
25		16.5		1.1	15.2	1		265	402	19.5	8
29	0	22	0	1.3	18	1		372	549	29	10
32	-0.2	22.9	-0.2	1.3	21	1.5		510	784	44	12
36		24.9		1.3	24.9	1.5		578	892	59	16
45		31.5		1.6	30.3	2	15	862	1,370	100	20
58		44.1		1.85	37.5	2		980	1,570	230	25
68	0	52.1	0	1.85	44.5	2		1,570	2,740	355	30
80	-0.3	60.6	-0.3	2.15	59	3	17	2,160	4,020	758	40
100		77.6		2.65	72	3		3,820	7,940	1,230	50
125	0	101.7	0	3.15	86.5	3	20	4,700	9,800	2,170	60
165	-0.4	133.7	-0.4	4.15	116	3		7,350	16,000	5,000	80

1N≒0.102kgf

# KB-OP TYPE (Euro Standard)

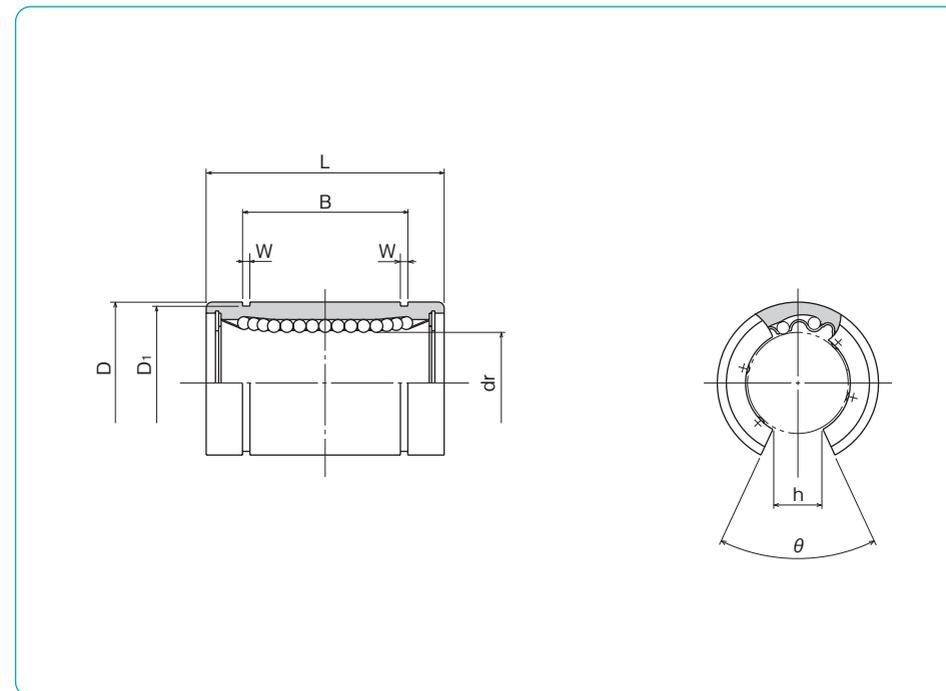
– Open Type –



## part number structure

example **KBS 25 G UU-OP**

specification KB: standard KBS: anti-corrosion	inner contact diameter (dr)	retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	seal blank: without seal U: seal on one side UU: seals on both sides
			open type



part number				number of ball circuits	dr		major dimensions	
standard steel retainer	resin retainer	anti-corrosion stainless retainer	resin retainer		mm	tolerance* $\mu\text{m}$	D mm	tolerance* $\mu\text{m}$
—	KB10G-OP	—	KBS10G-OP	3	10	+ 8	19	0
KB12-OP	KB12G-OP	KBS12-OP	KBS12G-OP	3	12	0	22	- 9
KB16-OP	KB16G-OP	KBS16-OP	KBS16G-OP	3	16	+ 9	26	0
KB20-OP	KB20G-OP	KBS20-OP	KBS20G-OP	4	20	- 1	32	-11
KB25-OP	KB25G-OP	KBS25-OP	KBS25G-OP	5	25	+11	40	0
KB30-OP	KB30G-OP	KBS30-OP	KBS30G-OP	5	30	- 1	47	0
KB40-OP	KB40G-OP	KBS40-OP	KBS40G-OP	5	40	+13	62	-13
KB50-OP	KB50G-OP	KBS50-OP	KBS50G-OP	5	50	- 2	75	0
KB60-OP	KB60G-OP	KBS60-OP	KBS60G-OP	5	60		90	-15
KB80-OP	—	—	—	5	80	+16/-4	120	

\* Accuracy is measured prior to machining open slit.

mm	L tolerance mm	B tolerance mm		W mm	D <sub>1</sub> mm	h mm	$\theta$	eccentricity* $\mu\text{m}$	basic load rating		mass g	shaft diameter mm
		mm	mm						dynamic C N	static Co N		
29		22		1.3	18	6.8	80°	12	372	549	23	10
32	0	22.9	0	1.3	21	7.5	78°		510	784	35	12
36	-0.2	24.9	-0.2	1.3	24.9	10	78°		578	892	48	16
45		31.5		1.6	30.3	10	60°	15	862	1,370	84	20
58		44.1		1.85	37.5	12.5	60°		980	1,570	195	25
68	0	52.1	0	1.85	44.5	12.5	50°		1,570	2,740	309	30
80	-0.3	60.6	-0.3	2.15	59	16.8	50°	17	2,160	4,020	665	40
100		77.6		2.65	72	21	50°		3,820	7,940	1,080	50
125	0	101.7	0	3.15	86.5	27.2	54°		4,700	9,800	1,900	60
165	-0.4	133.7	-0.4	4.15	116	36.3	54°	20	7,350	16,000	4,380	80

1N=0.102kgf

# KB-W TYPE (Euro Standard)

– Double-Wide Type –



## part number structure

example **KBS 25 G W UU**

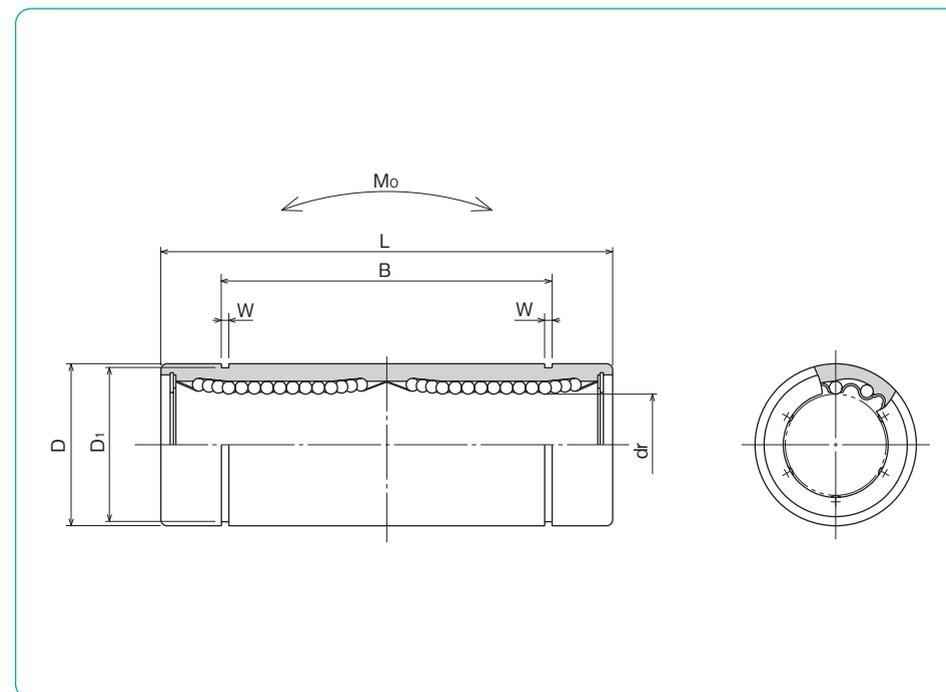
specification  
**KB:** standard  
**KBS:** anti-corrosion

inner contact diameter (dr)

retainer material  
**blank:** standard/steel  
 anti-corrosion/stainless steel  
**G:** resin

seal  
**blank:** without seal  
**UU:** seals on both sides

double-wide type



part number				number of ball circuits	dr		major dimensions	
standard steel retainer	resin retainer	anti-corrosion stainless retainer	resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$
KB 8W	KB 8GW	KBS 8W	KBS 8GW	4	8	+ 9	16	0/-9
KB 12W	KB 12GW	KBS 12W	KBS 12GW	4	12	- 1	22	0
KB 16W	KB 16GW	KBS 16W	KBS 16GW	4	16	+ 11	26	-11
KB 20W	KB 20GW	KBS 20W	KBS 20GW	5	20	- 1	32	0
KB 25W	KB 25GW	KBS 25W	KBS 25GW	6	25	+ 13	40	-13
KB 30W	KB 30GW	KBS 30W	KBS 30GW	6	30	- 2	47	0
KB 40W	KB 40GW	KBS 40W	KBS 40GW	6	40	+ 16	62	0
KB 50W	KB 50GW	KBS 50W	KBS 50GW	6	50	- 4	75	-15
KB 60W	KB 60GW	KBS 60W	KBS 60GW	6	60		90	0/-20

mm	L tolerance mm	mm	B tolerance mm	W mm	D <sub>1</sub> mm	eccentricity $\mu\text{m}$	basic load rating		allowable static moment Mo N·m	mass g	shaft diameter mm
							dynamic C N	static Co N			
46		33		1.1	15.2	15	421	804	4.3	40	8
61	0	45.8	0	1.3	21		813	1,570	11.7	80	12
68	-0.3	49.8	-0.3	1.3	24.9		921	1,780	14.2	115	16
80		61		1.6	30.5	17	1,370	2,740	25.0	180	20
112		82		1.85	38		1,570	3,140	44.0	430	25
123		104.2		1.85	44.5		2,500	5,490	78.9	615	30
151	0	121.2	0	2.15	59	20	3,430	8,040	147	1,400	40
192	-0.4	155.2	-0.4	2.65	72		6,080	15,900	396	2,320	50
209		170		3.15	86.5		25	7,550	20,000	487	3,920

1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# KBF TYPE (Euro Standard)

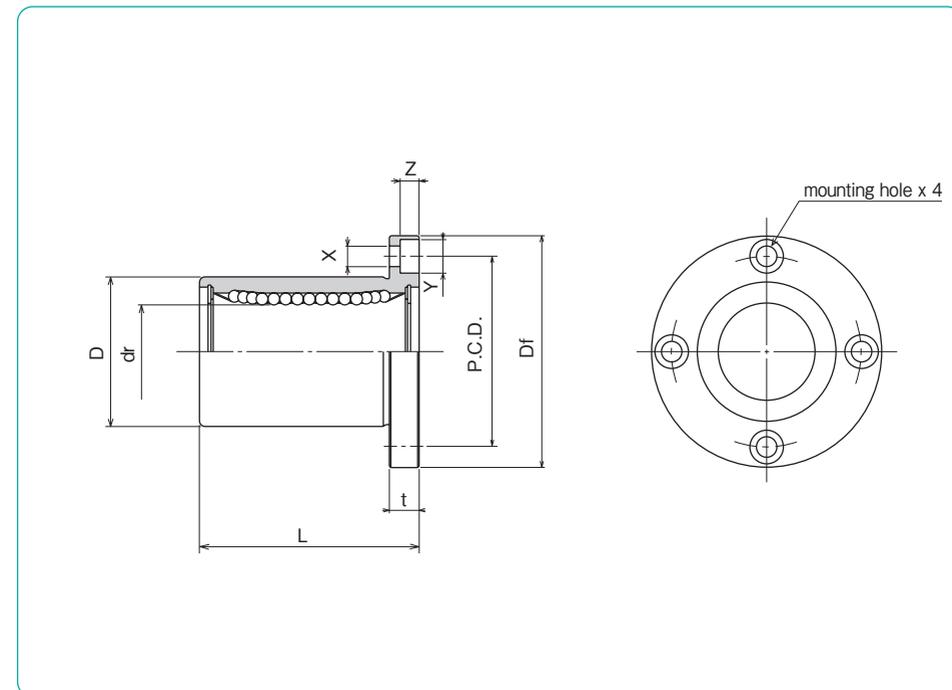
– Round Flange Type –



## part number structure

example **KBSF 25 G UU-SK**

specification KBF: standard KBSF: anti-corrosion	inner contact diameter (dr)	retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating	seal blank: without seal UU: seals on both sides
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part number				number of ball circuits	dr		major dimensions		
standard steel retainer	resin retainer	anti-corrosion stainless retainer	resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
—	KBF 5G	—	KBSF 5G	4	5	+ 8	12	0	22
KBF 8	KBF 8G	KBSF 8	KBSF 8G	4	8	0	16	-13	25
KBF12	KBF12G	KBSF12	KBSF12G	4	12	0	22	0	32
KBF16	KBF16G	KBSF16	KBSF16G	4	16	+ 9	26	-16	36
KBF20	KBF20G	KBSF20	KBSF20G	5	20	- 1	32	0	45
KBF25	KBF25G	KBSF25	KBSF25G	6	25	+11	40	0	58
KBF30	KBF30G	KBSF30	KBSF30G	6	30	- 1	47	-19	68
KBF40	KBF40G	KBSF40	KBSF40G	6	40	+13	62	0	80
KBF50	KBF50G	KBSF50	KBSF50G	6	50	- 2	75	-22	100
KBF60	KBF60G	KBSF60	KBSF60G	6	60	0	90	0	125
KBF80	—	—	—	6	80	+16/-4	120	-25	165

Df mm	t mm	flange P.C.D. mm	X × Y × Z mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		mass g	shaft diameter mm
						dynamic C N	static Co N		
28	5	20	3.5 × 6 × 3.1	12	12	206	265	26	5
32	5	24	3.5 × 6 × 3.1			265	402	41	8
42	6	32	4.5 × 7.5 × 4.1			510	784	80	12
46	6	36	4.5 × 7.5 × 4.1			578	892	103	16
54	8	43	5.5 × 9 × 5.1	15	15	862	1,370	182	20
62	8	51	5.5 × 9 × 5.1			980	1,570	335	25
76	10	62	6.6 × 11 × 6.1			1,570	2,740	560	30
98	13	80	9 × 14 × 8.1	17	17	2,160	4,020	1,175	40
112	13	94	9 × 14 × 8.1			3,820	7,940	1,745	50
134	18	112	11 × 17 × 11.1	20	20	4,700	9,800	3,220	60
164	18	142	11 × 17 × 11.1			7,350	16,000	6,420	80

1N  $\approx$  0.102kgf

# KBK TYPE (Euro Standard)

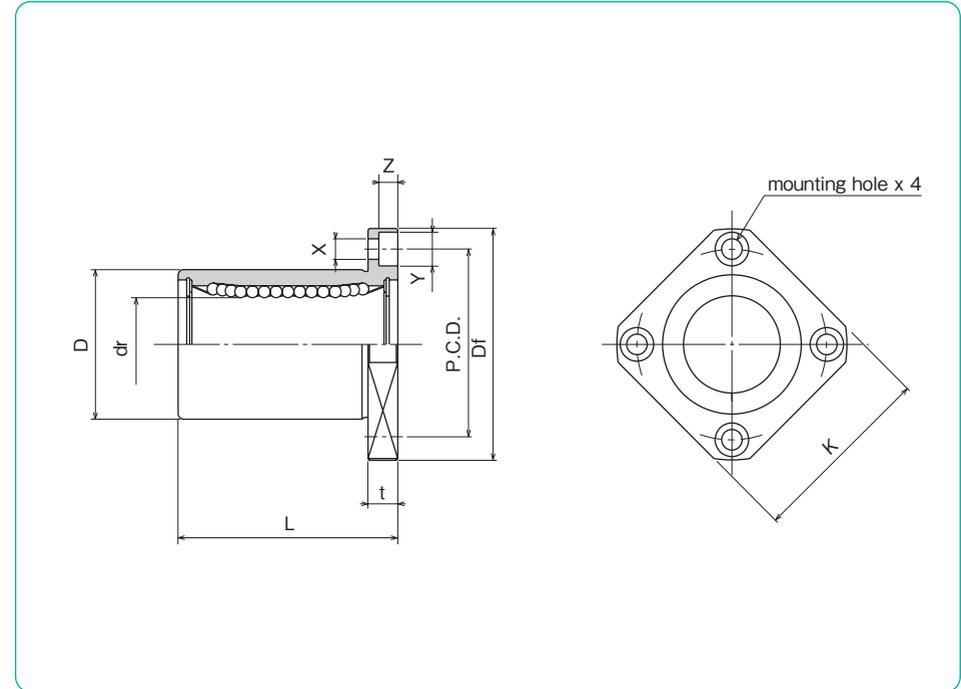
– Square Flange Type –



### part number structure

example **KBSK 25 G UU-SK**

specification KBK: standard KBSK: anti-corrosion	inner contact diameter (dr)	retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating	seal blank: without seal UU: seals on both sides
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part number				number of ball circuits	dr		major dimensions		
standard steel retainer	resin retainer	anti-corrosion stainless retainer	resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
—	KBK 5G	—	KBSK 5G	4	5		12	0	22
KBK 8	KBK 8G	KBSK 8	KBSK 8G	4	8	+ 8	16	-13	25
KBK 12	KBK 12G	KBSK 12	KBSK 12G	4	12	0	22	0	32
KBK 16	KBK 16G	KBSK 16	KBSK 16G	4	16	+ 9	26	-16	36
KBK 20	KBK 20G	KBSK 20	KBSK 20G	5	20	- 1	32		45
KBK 25	KBK 25G	KBSK 25	KBSK 25G	6	25	+11	40	0	58
KBK 30	KBK 30G	KBSK 30	KBSK 30G	6	30	- 1	47	-19	68
KBK 40	KBK 40G	KBSK 40	KBSK 40G	6	40		62	0	80
KBK 50	KBK 50G	KBSK 50	KBSK 50G	6	50	+13	75	-22	100
KBK 60	KBK 60G	KBSK 60	KBSK 60G	6	60	- 2	90	0	125
KBK 80	—	—	—	6	80	+16/-4	120	-25	165

Df mm	K mm	flange			eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		mass g	shaft diameter mm
		t mm	P.C.D. mm	X×Y×Z mm			dynamic C N	static Co N		
28	22	5	20	3.5×6×3.1	12	12	206	265	20	5
32	25	5	24	3.5×6×3.1			265	402	33	8
42	32	6	32	4.5×7.5×4.1			510	784	64	12
46	35	6	36	4.5×7.5×4.1			578	892	90	16
54	42	8	43	5.5×9×5.1	15	15	862	1,370	147	20
62	50	8	51	5.5×9×5.1			980	1,570	295	25
76	60	10	62	6.6×11×6.1			1,570	2,740	465	30
98	75	13	80	9×14×8.1	17	17	2,160	4,020	975	40
112	88	13	94	9×14×8.1			3,820	7,940	1,545	50
134	106	18	112	11×17×11.1			4,700	9,800	2,780	60
164	136	18	142	11×17×11.1	20	20	7,350	16,000	5,920	80

1N≒0.102kgf

# KBF-W TYPE (Euro Standard)

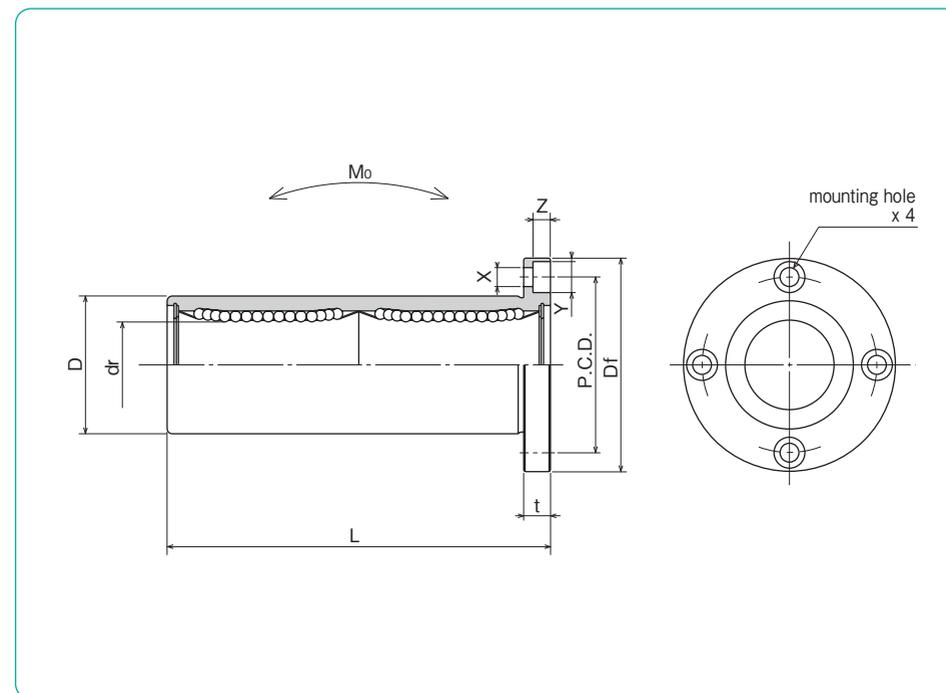
– Round Flange Double-Wide Type –



## part number structure

example **KBSF 25 G W UU-SK**

specification KBF: standard KBSF: anti-corrosion	inner contact diameter (dr)	retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating	seal blank: without seal UU: seals on both sides	double-wide type
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part number				number of ball circuits	dr		major dimensions		
standard steel retainer	standard resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
KBF 8W	KBF 8GW	KBSF 8W	KBSF 8GW	4	8	+ 9	16	0/-13	46
KBF12W	KBF12GW	KBSF12W	KBSF12GW	4	12	- 1	22	0	61
KBF16W	KBF16GW	KBSF16W	KBSF16GW	4	16	+ 11	26	-16	68
KBF20W	KBF20GW	KBSF20W	KBSF20GW	5	20	- 1	32	0	80
KBF25W	KBF25GW	KBSF25W	KBSF25GW	6	25	+ 13	40	-19	112
KBF30W	KBF30GW	KBSF30W	KBSF30GW	6	30	- 2	47	0	123
KBF40W	KBF40GW	KBSF40W	KBSF40GW	6	40	+ 16	62	0	151
KBF50W	KBF50GW	KBSF50W	KBSF50GW	6	50	- 4	75	-22	192
KBF60W	KBF60GW	KBSF60W	KBSF60GW	6	60		90	0/-25	209

Df mm	t mm	flange P.C.D. mm	X × Y × Z mm	eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $M_o$ N · m	mass g	shaft diameter mm
						dynamic C N	static $C_o$ N			
32	5	24	3.5 × 6 × 3.1	15	15	421	804	4.3	59	8
42	6	32	4.5 × 7.5 × 4.1			813	1,570	11.7	110	12
46	6	36	4.5 × 7.5 × 4.1			921	1,780	14.2	160	16
54	8	43	5.5 × 9 × 5.1	17	17	1,370	2,740	25.0	260	20
62	8	51	5.5 × 9 × 5.1			1,570	3,140	44.0	540	25
76	10	62	6.6 × 11 × 6.1			2,500	5,490	78.9	815	30
98	13	80	9 × 14 × 8.1	20	20	3,430	8,040	147	1,805	40
112	13	94	9 × 14 × 8.1			6,080	15,900	396	2,820	50
134	18	112	11 × 17 × 11.1			7,550	20,000	487	4,920	60

1N = 0.102kgf 1N · m = 0.102kgf · m

# KBK-W TYPE (Euro Standard)

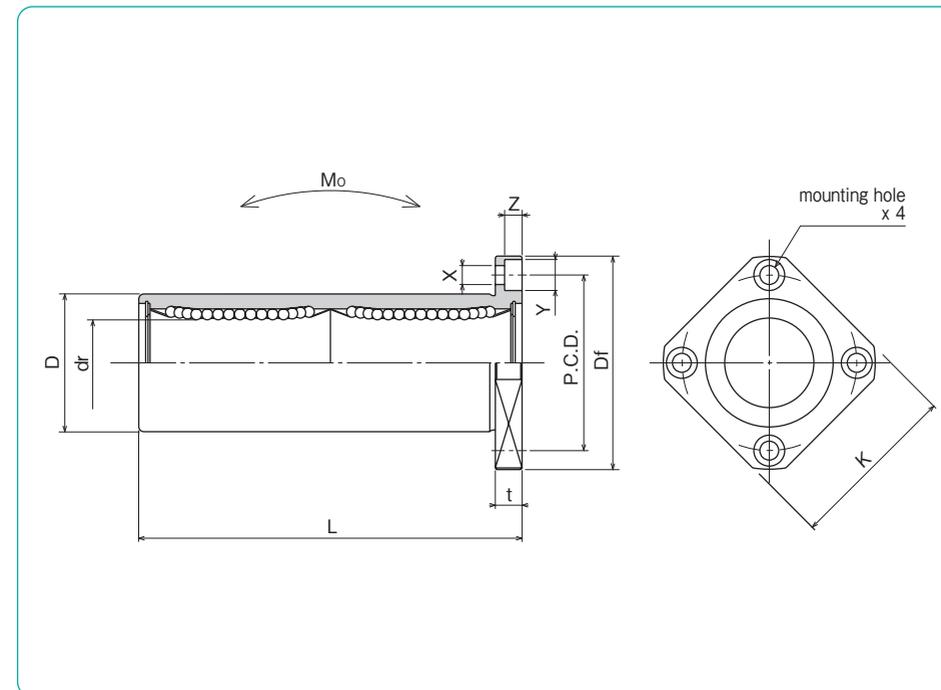
– Square Flange Double-Wide Type –



## part number structure

example **KBSK 25 G W UU-SK**

specification <b>KBK</b> : standard <b>KBSK</b> : anti-corrosion	inner contact diameter (dr)	retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating	seal <b>blank</b> : without seal <b>UU</b> : seals on both sides	double-wide type
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part number				number of ball circuits	dr		major dimensions		
standard steel retainer	resin retainer	anti-corrosion stainless retainer	anti-corrosion resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
KBK 8W	KBK 8GW	KBSK 8W	KBSK 8GW	4	8	+ 9	16	0/-13	46
KBK 12W	KBK 12GW	KBSK 12W	KBSK 12GW	4	12	- 1	22	0	61
KBK 16W	KBK 16GW	KBSK 16W	KBSK 16GW	4	16	+ 11	26	-16	68
KBK 20W	KBK 20GW	KBSK 20W	KBSK 20GW	5	20	- 1	32	0	80
KBK 25W	KBK 25GW	KBSK 25W	KBSK 25GW	6	25	+ 13	40	-19	112
KBK 30W	KBK 30GW	KBSK 30W	KBSK 30GW	6	30	- 2	47	-19	123
KBK 40W	KBK 40GW	KBSK 40W	KBSK 40GW	6	40	+ 16	62	0	151
KBK 50W	KBK 50GW	KBSK 50W	KBSK 50GW	6	50	- 4	75	-22	192
KBK 60W	KBK 60GW	KBSK 60W	KBSK 60GW	6	60	- 4	90	0/-25	209

Df mm	K mm	flange			eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $M_o$ N·m	mass g	shaft diameter mm
		t mm	P.C.D. mm	X×Y×Z mm			dynamic C N	static Co N			
32	25	5	24	3.5×6×3.1	15	15	421	804	4.3	51	8
42	32	6	32	4.5×7.5×4.1			813	1,570	11.7	90	12
46	35	6	36	4.5×7.5×4.1			921	1,780	14.2	135	16
54	42	8	43	5.5×9×5.1	17	17	1,370	2,740	25.0	225	20
62	50	8	51	5.5×9×5.1			1,570	3,140	44.0	500	25
76	60	10	62	6.6×11×6.1			2,500	5,490	78.9	720	30
98	75	13	80	9×14×8.1	20	20	3,430	8,040	147	1,600	40
112	88	13	94	9×14×8.1			6,080	15,900	396	2,620	50
134	106	18	112	11×17×11.1			7,550	20,000	487	4,480	60

1N  $\div$  0.102kgf 1N · m  $\div$  0.102kgf · m

# KBFC TYPE (Euro Standard)

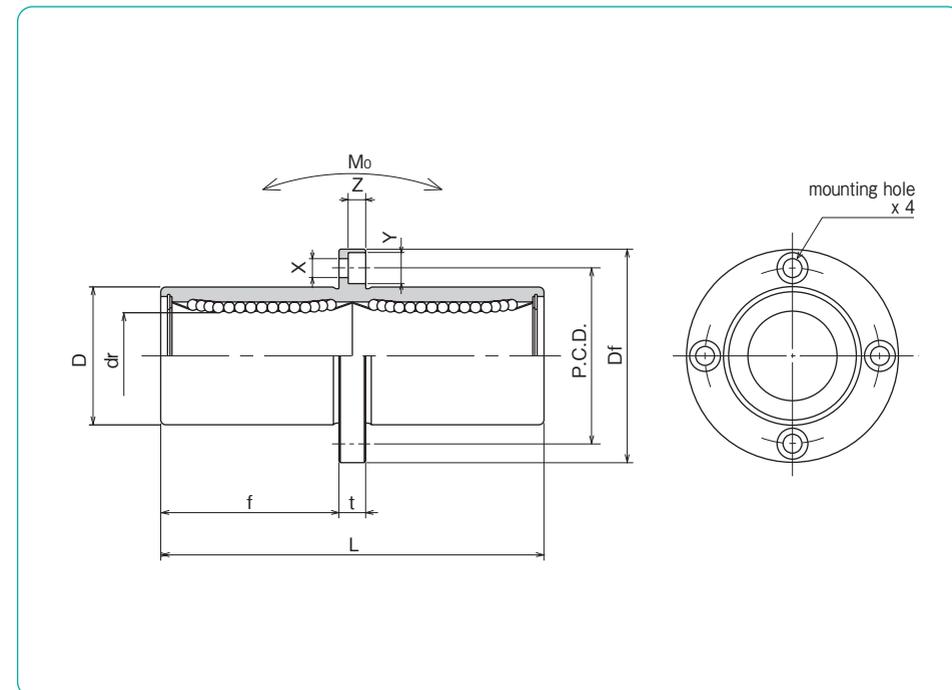
– Center Mount Round Flange Type –



## part number structure

example **KBSFC 25 G UU -SK**

specification KBFC: standard KBSFC: anti-corrosion	inner contact diameter (dr)	retainer material blank: standard/steel G: resin	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating	seal blank: without seal UU: seals on both sides
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part number				number of ball circuits	dr		major dimensions		
standard	anti-corrosion	number of ball circuits	mm		tolerance $\mu\text{m}$	D	tolerance $\mu\text{m}$	L	$\pm 0.3$ mm
steel retainer	resin retainer	stainless retainer	resin retainer						
KBFC 8	KBFC 8G	KBSFC 8	KBSFC 8G	4	8	+ 9	16	0/-13	46
KBFC12	KBFC12G	KBSFC12	KBSFC12G	4	12	- 1	22	0	61
KBFC16	KBFC16G	KBSFC16	KBSFC16G	4	16	+11	26	-16	68
KBFC20	KBFC20G	KBSFC20	KBSFC20G	5	20	- 1	32	0	80
KBFC25	KBFC25G	KBSFC25	KBSFC25G	6	25	+13	40	-19	112
KBFC30	KBFC30G	KBSFC30	KBSFC30G	6	30	- 2	47	0	123
KBFC40	KBFC40G	KBSFC40	KBSFC40G	6	40	+16	62	0	151
KBFC50	KBFC50G	KBSFC50	KBSFC50G	6	50	- 4	75	-22	192
KBFC60	KBFC60G	KBSFC60	KBSFC60G	6	60		90	0/-25	209

f	Df	flange			eccentricity	perpendicularity	basic load rating		allowable static moment	mass	shaft diameter
		t	P.C.D.	X×Y×Z			dynamic C	static Co			
mm	mm	mm	mm	mm	$\mu\text{m}$	$\mu\text{m}$	N	N	N·m	g	mm
20.5	32	5	24	3.5×6×3.1	15	15	421	804	4.3	59	8
27.5	42	6	32	4.5×7.5×4.1			813	1,570	11.7	110	12
31	46	6	36	4.5×7.5×4.1			921	1,780	14.2	160	16
36	54	8	43	5.5×9×5.1	17	17	1,370	2,740	25.0	260	20
52	62	8	51	5.5×9×5.1			1,570	3,140	44.0	540	25
56.5	76	10	62	6.6×11×6.1			2,500	5,490	78.9	815	30
69	98	13	80	9×14×8.1	20	20	3,430	8,040	147	1,805	40
89.5	112	13	94	9×14×8.1			6,080	15,900	396	2,820	50
95.5	134	18	112	11×17×11.1			7,550	20,000	487	4,920	60

1N  $\div$  0.102kgf 1N · m  $\div$  0.102kgf · m

# KBKC TYPE (Euro Standard)

– Center Mount Square Flange Type –



## part number structure

example **KB****SKC** **25** **G** **UU**-**SK**

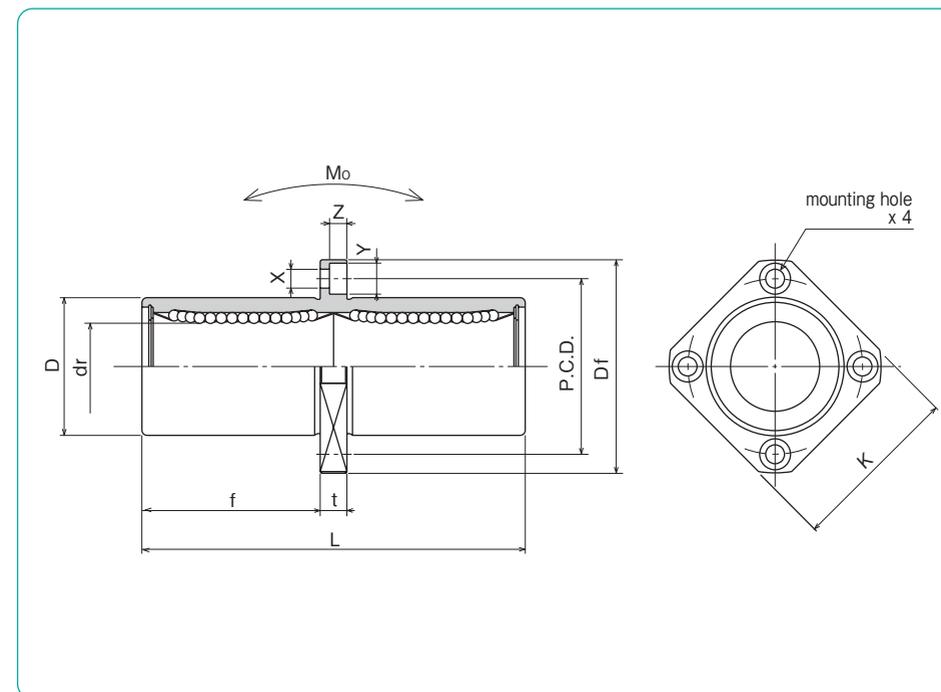
specification  
**KBKC**: standard  
**KBSKC**: anti-corrosion

inner contact diameter (dr)

retainer material  
**blank**: standard/steel  
 anti-corrosion/stainless steel  
**G**: resin

outer cylinder surface treatment  
**blank**: no surface treatment  
**SK**: electroless nickel plating  
**LF**: low temperature black chrome treatment with fluoride coating  
**SB**: black oxide (not available on anti-corrosion type)  
**SC**: industrial chrome plating

seal  
**blank**: without seal  
**UU**: seals on both sides



part number				number of ball circuits	dr		major dimensions		
standard steel retainer	anti-corrosion resin retainer	stainless steel retainer	resin retainer		mm	tolerance $\mu\text{m}$	D mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm
<b>KBKC 8</b>	<b>KBKC 8G</b>	<b>KBSKC 8</b>	<b>KBSKC 8G</b>	4	8	+ 9	16	0/-13	46
<b>KBKC12</b>	<b>KBKC12G</b>	<b>KBSKC12</b>	<b>KBSKC12G</b>	4	12	- 1	22	0	61
<b>KBKC16</b>	<b>KBKC16G</b>	<b>KBSKC16</b>	<b>KBSKC16G</b>	4	16	+ 11	26	-16	68
<b>KBKC20</b>	<b>KBKC20G</b>	<b>KBSKC20</b>	<b>KBSKC20G</b>	5	20	- 1	32	0	80
<b>KBKC25</b>	<b>KBKC25G</b>	<b>KBSKC25</b>	<b>KBSKC25G</b>	6	25	+ 13	40	-19	112
<b>KBKC30</b>	<b>KBKC30G</b>	<b>KBSKC30</b>	<b>KBSKC30G</b>	6	30	- 2	47	0	123
<b>KBKC40</b>	<b>KBKC40G</b>	<b>KBSKC40</b>	<b>KBSKC40G</b>	6	40	+ 16	62	0	151
<b>KBKC50</b>	<b>KBKC50G</b>	<b>KBSKC50</b>	<b>KBSKC50G</b>	6	50	- 4	75	-22	192
<b>KBKC60</b>	<b>KBKC60G</b>	<b>KBSKC60</b>	<b>KBSKC60G</b>	6	60		90	0/-25	209

f mm	Df mm	flange				eccentricity $\mu\text{m}$	perpendicularity $\mu\text{m}$	basic load rating		allowable static moment $\text{N} \cdot \text{m}$	mass g	shaft diameter mm
		K mm	t mm	P.C.D. mm	X×Y×Z mm			dynamic C N	static Co N			
20.5	32	25	5	24	3.5×6×3.1	15	15	421	804	4.3	51	8
27.5	42	32	6	32	4.5×7.5×4.1			813	1,570	11.7	90	12
31	46	35	6	36	4.5×7.5×4.1			921	1,780	14.2	135	16
36	54	42	8	43	5.5×9×5.1	17	17	1,370	2,740	25.0	225	20
52	62	50	8	51	5.5×9×5.1			1,570	3,140	44.0	500	25
56.5	76	60	10	62	6.6×11×6.1			2,500	5,490	78.9	720	30
69	98	75	13	80	9×14×8.1	20	20	3,430	8,040	147	1,600	40
89.5	112	88	13	94	9×14×8.1			6,080	15,900	396	2,620	50
95.5	134	106	18	112	11×17×11.1			7,550	20,000	487	4,480	60

1N  $\div$  0.102kgf 1N  $\cdot$  m  $\div$  0.102kgf  $\cdot$  m

# SW TYPE (Inch Standard)

– Standard Type –



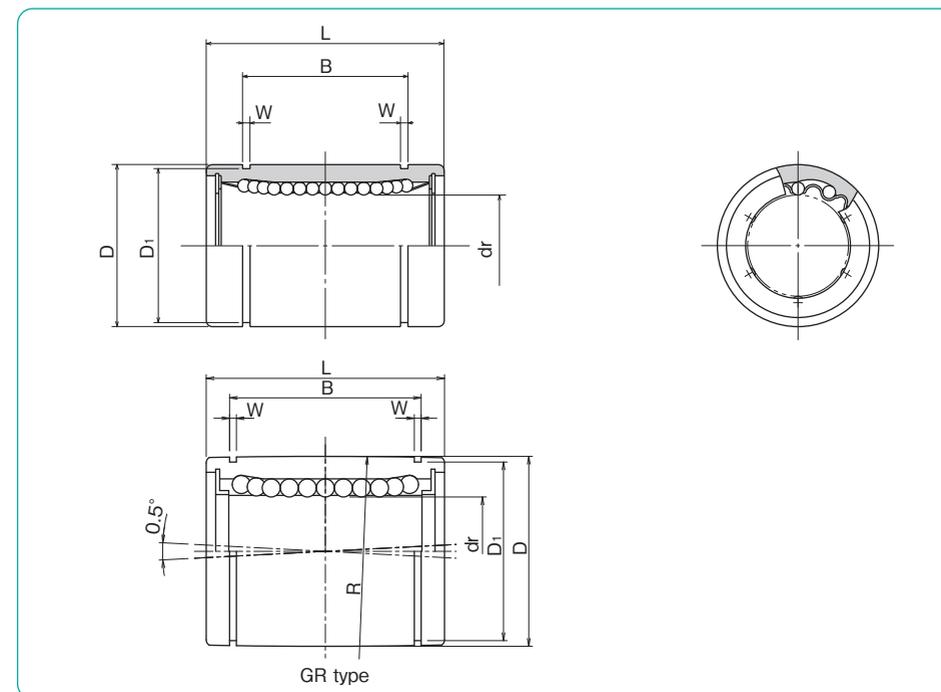
## part number structure

example **SWS16GRUU-P**

specification <b>SW</b> : standard <b>SWS</b> : anti-corrosion	size	retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	accuracy grade <b>blank</b> : high <b>P</b> : precision	self aligning <b>blank</b> : non self aligning <b>R</b> : self aligning *
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\* Precision grade is not available for the self-aligning type.  
\*Seals are not available on SWS2 and SWS3.

\*Self-aligning is available only with resin retainer for size 4 to 32 of carbon steel cylinder.



steel retainer	part number		major dimensions		number of ball circuits	D		dr	tolerance inch/(μm)	tolerance inch/(μm)	tolerance inch/(μm)	tolerance inch/(μm)		
	standard	resin retainer	stainless retainer	resin retainer		inch (mm)	tolerance precision						inch (mm)	tolerance inch/(μm)
-	-	-	<b>SWS2</b>	<b>SWS2G</b>	4	.1250 (3.175)	-	-.00035 (-8)	0 (.3125 7.938)	-.00040 (-9)	0 (.3125 7.938)	0 (.3125 7.938)		
-	-	-	<b>SWS3</b>	<b>SWS3G</b>	4	.1875 (4.763)	-	-.00035 (-8)	0 (.3750 9.525)	-.00040 (-9)	0 (.3750 9.525)	0 (.3750 9.525)		
<b>SW4</b>	<b>SW4G</b>	<b>SW4GR</b>	<b>SWS4</b>	<b>SWS4G</b>	4	.2500 (6.350)	-	-.00025 (-6)	0 (.5000 12.700)	-.00040 (-10)	0 (.5000 12.700)	0 (.5000 12.700)		
<b>SW6</b>	<b>SW6G</b>	<b>SW6GR</b>	<b>SWS6</b>	<b>SWS6G</b>	4	.3750 (9.525)	0 (.00025 -6)	-.00040 (-10)	0 (.6250 15.875)	0 (.6250 15.875)	0 (.6250 15.875)	0 (.6250 15.875)		
<b>SW8</b>	<b>SW8G</b>	<b>SW8GR</b>	<b>SWS8</b>	<b>SWS8G</b>	4	.5000 (12.700)	0 (.00025 -6)	-.00040 (-10)	0 (.8750 22.225)	0 (.8750 22.225)	0 (.8750 22.225)	0 (.8750 22.225)		
<b>SW10</b>	<b>SW10G</b>	<b>SW10GR</b>	<b>SWS10</b>	<b>SWS10G</b>	4	.625 (15.875)	0 (.00025 -6)	-.00040 (-10)	0 (1.1250 28.575)	0 (1.1250 28.575)	0 (1.1250 28.575)	0 (1.1250 28.575)		
<b>SW12</b>	<b>SW12G</b>	<b>SW12GR</b>	<b>SWS12</b>	<b>SWS12G</b>	5	.7500 (19.050)	0 (.00030 -7)	-.00040 (-10)	0 (1.2500 31.750)	0 (1.2500 31.750)	0 (1.2500 31.750)	0 (1.2500 31.750)		
<b>SW16</b>	<b>SW16G</b>	<b>SW16GR</b>	<b>SWS16</b>	<b>SWS16G</b>	6	1.0000 (25.400)	0 (.00035 -8)	-.00040 (-10)	0 (1.5625 39.688)	0 (1.5625 39.688)	0 (1.5625 39.688)	0 (1.5625 39.688)		
<b>SW20</b>	<b>SW20G</b>	<b>SW20GR</b>	<b>SWS20</b>	<b>SWS20G</b>	6	1.2500 (31.750)	0 (.00035 -8)	-.00040 (-10)	0 (2.0000 50.800)	0 (2.0000 50.800)	0 (2.0000 50.800)	0 (2.0000 50.800)		
<b>SW24</b>	<b>SW24G</b>	<b>SW24GR</b>	<b>SWS24</b>	<b>SWS24G</b>	6	1.5000 (38.100)	0 (.00035 -8)	-.00040 (-10)	0 (2.3750 60.325)	0 (2.3750 60.325)	0 (2.3750 60.325)	0 (2.3750 60.325)		
<b>SW32</b>	<b>SW32G</b>	<b>SW32GR</b>	<b>SWS32</b>	<b>SWS32G</b>	6	2.0000 (50.800)	0 (.00040 -9)	-.00040 (-10)	0 (3.0000 76.200)	0 (3.0000 76.200)	0 (3.0000 76.200)	0 (3.0000 76.200)		
<b>SW40</b>	-	-	-	-	6	2.5000 (63.500)	0 (.00040 -9)	-.00040 (-10)	0 (3.7500 95.250)	0 (3.7500 95.250)	0 (3.7500 95.250)	0 (3.7500 95.250)		
<b>SW48</b>	-	-	-	-	6	3.0000 (76.200)	0 (.00040 -9)	-.00040 (-10)	0 (4.5000 114.300)	0 (4.5000 114.300)	0 (4.5000 114.300)	0 (4.5000 114.300)		
<b>SW64</b>	-	-	-	-	6	4.0000 (101.600)	0 (.00040 -9)	-.00040 (-10)	0 (6.0000 152.400)	0 (6.0000 152.400)	0 (6.0000 152.400)	0 (6.0000 152.400)		

L	tolerance inch/(mm)	B		W	D1	eccentricity		radial clearance (maximum) inch/(μm)	basic load rating		mass g	shaft diameter inch (mm)
		inch (mm)	tolerance inch/(mm)			precision inch/(μm)	high inch/(μm)		C N	Co N		
		inch (mm)	tolerance inch/(mm)			inch (mm)	inch (mm)					
.5000 (12.700)	-	.3681 (9.35)	-	.0280 (0.710)	.2902 (7.370)	-	.0003 (8)	-.0001 (-2)	59	76	2.8	1/8 (3.175)
.5625 (14.275)	-	.4311 (10.95)	-	.0280 (0.710)	.3520 (8.940)	-	.0003 (8)	-	91	110	3.6	3/16 (4.763)
.7500 (19.050)	0 (-.008 -0.2)	.5110 (12.98)	0 (-.008 -0.2)	.0390 (0.992)	.4687 (11.906)	-	.0003 (8)	-.0001 (-3)	206	265	9.5	1/4 (6.350)
.8750 (22.225)	-	.6358 (16.15)	-	.0390 (0.992)	.5880 (14.935)	-	.0003 (8)	-	225	314	15	3/8 (9.525)
1.2500 (31.750)	-	.9625 (24.46)	-	.0459 (1.168)	.8209 (20.853)	.0003 (8)	.0005 (12)	-.0001 (-4)	510	784	42	1/2 (12.700)
1.5000 (38.100)	-	1.1039 (28.575)	-	.0559 (1.422)	1.0590 (26.899)	-	.0003 (8)	-.0001 (-4)	774	1,180	85	5/8 (15.875)
1.6250 (41.275)	-	1.1657 (29.61)	-	.0559 (1.422)	1.1760 (29.870)	.0004 (10)	.0006 (15)	-.0002 (-6)	862	1,370	104	3/4 (19.050)
2.2500 (57.150)	-	1.7547 (44.57)	-	.0679 (1.727)	1.4687 (37.306)	-	.0004 (10)	-.0002 (-6)	980	1,570	220	1 (25.400)
2.6250 (66.675)	0 (-.012 -0.3)	2.0047 (50.92)	0 (-.012 -0.3)	.0679 (1.727)	1.8859 (47.904)	.0005 (12)	.0008 (20)	-.0003 (-8)	1,570	2,740	465	1-1/4 (31.750)
3.0000 (76.200)	-	2.4118 (61.26)	-	.0859 (2.184)	2.2389 (56.870)	-	.0005 (12)	-.0003 (-8)	2,180	4,020	720	1-1/2 (38.100)
4.0000 (101.600)	-	3.1917 (81.07)	-	.1029 (2.616)	2.8379 (72.085)	-	.0007 (17)	-.0005 (-13)	3,820	7,940	1,310	2 (50.800)
5.0000 (127.000)	-	3.9760 (100.99)	-	.1200 (3.048)	3.5519 (90.220)	.0007 (17)	.0010 (25)	-.0005 (-13)	4,700	10,000	2,600	2-1/2 (63.500)
6.0000 (152.400)	0 (-.016 -0.4)	4.726 (120.04)	0 (-.016 -0.4)	.1200 (3.048)	4.3100 (109.474)	-	.0007 (17)	-.0008 (-20)	7,350	16,000	4,380	3 (76.200)
8.0000 (203.200)	-	6.258 (158.95)	-	.1389 (3.530)	5.745 (145.923)	.0008 (20)	.0012 (30)	-.0008 (-20)	14,100	34,800	10,200	4 (101.600)

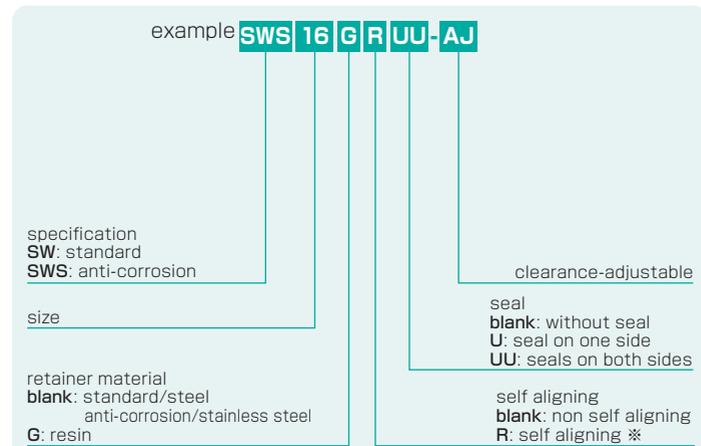
1N≒0.225lbf 1kg≒2.205lbf

# SW-AJ TYPE (Inch Standard)

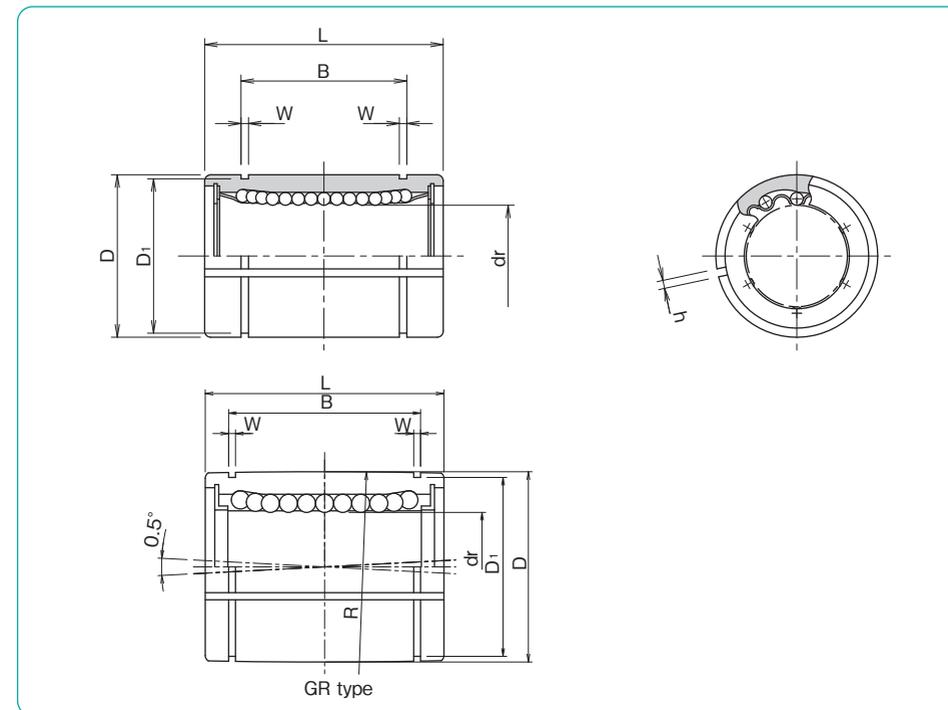
– Clearance Adjustable Type –



## part number structure



\*Self-aligning is available only with resin retainer for size 8 to 32 of carbon steel cylinder.



steelretainer	partnumber		number ofball circuits	dr		majordimensions		
	standard resinretainer	anti-corrosion stainless retainer resinretainer		inch (mm)	tolerance* inch/(μm)	inch (mm)	tolerance* inch/(μm)	
-	SW4G-AJ	-	-	SWS4G-AJ	4	.2500 (6.350)	.5000 (12.700)	-0.0045 (-11)
-	SW6G-AJ	-	-	SWS6G-AJ	4	.3750 (9.525)	.6250 (15.875)	0 (-9)
SW8-AJ	SW8G-AJ	SW8GR-AJ	SWS8-AJ	SWS8G-AJ	4	.5000 (12.700)	.8750 (22.225)	-0.0050 (-13)
SW10-AJ	SW10G-AJ	SW10GR-AJ	SWS10-AJ	SWS10G-AJ	4	.625 (15.875)	1.1250 (28.575)	0 (-11)
SW12-AJ	SW12G-AJ	SW12GR-AJ	SWS12-AJ	SWS12G-AJ	5	.7500 (19.050)	1.2500 (31.750)	-0.0065 (-16)
SW16-AJ	SW16G-AJ	SW16GR-AJ	SWS16-AJ	SWS16G-AJ	6	1.0000 (25.400)	1.5625 (39.688)	0 (-12)
SW20-AJ	SW20G-AJ	SW20GR-AJ	SWS20-AJ	SWS20G-AJ	6	1.2500 (31.750)	2.0000 (50.800)	-0.0075 (-19)
SW24-AJ	SW24G-AJ	SW24GR-AJ	SWS24-AJ	SWS24G-AJ	6	1.5000 (38.100)	2.3750 (60.325)	0 (-22)
SW32-AJ	SW32G-AJ	SW32GR-AJ	SWS32-AJ	SWS32G-AJ	6	2.0000 (50.800)	3.0000 (76.200)	0 (-25)
SW40-AJ	-	-	-	-	6	2.5000 (63.500)	3.7500 (95.250)	-0.0090 (-23)
SW48-AJ	-	-	-	-	6	3.0000 (76.200)	4.5000 (114.300)	0 (-25)
SW64-AJ	-	-	-	-	6	4.0000 (101.600)	6.0000 (152.400)	-0.0100 (-25)

\* Accuracy is measured prior to machining clearance slit.

L		B		W	D1	h	eccentricity* inch (μm)	basicloadrating		mass g	shaft diameter inch (mm)
inch (mm)	tolerance inch/(mm)	inch (mm)	tolerance inch/(mm)	inch (mm)	inch (mm)	inch (mm)		dynamic C N	static Co N		
.7500 (19.050)	0 (-0.2)	.5100 (12.98)	0 (-0.2)	.0390 (0.992)	.4687 (11.906)	.04 (1)	.0005 (12)	206	265	7.5	1/4 (6.350)
.8750 (22.225)		.6358 (12.15)		.0390 (0.992)	.5880 (14.935)	.04 (1)		225	314	13.5	3/8 (9.525)
1.2500 (31.750)		.9625 (24.46)		.0459 (1.168)	.8209 (20.853)	.06 (1.5)		510	784	41	1/2 (12.700)
1.5000 (38.100)		1.1039 (28.04)		.0559 (1.422)	1.0590 (26.899)	.06 (1.5)		774	1,180	83	5/8 (15.875)
1.6250 (41.275)	0 (-0.3)	1.1657 (29.61)	0 (-0.3)	.0559 (1.422)	1.1760 (29.870)	.06 (1.5)	.0006 (15)	862	1,370	102	3/4 (19.050)
2.2500 (57.150)		1.7547 (44.57)		.0679 (1.727)	1.4687 (37.306)	.06 (1.5)		980	1,570	218	1 (25.400)
2.6250 (66.675)		2.0047 (50.92)		.0679 (1.727)	1.8859 (47.904)	.10 (2.5)		1,570	2,740	455	1-1/4 (31.750)
3.0000 (76.200)		2.4118 (61.26)		0.859 (2.184)	2.2389 (56.870)	.12 (3)		2,180	4,020	710	1-1/2 (38.100)
4.0000 (101.600)	0 (-0.4)	3.1917 (81.07)	0 (-0.4)	.1029 (2.616)	2.8379 (72.085)	.12 (3)	.0010 (25)	3,820	7,940	1,290	2 (50.800)
5.0000 (127.000)		3.9760 (100.99)		.1200 (3.048)	3.5519 (90.220)	.12 (3)		4,700	10,000	2,560	2-1/2 (63.500)
6.0000 (152.400)		4.726 (120.04)		.1200 (3.048)	4.3100 (109.474)	.12 (3)		7,350	16,000	4,350	3 (76.200)
8.0000 (203.200)		6.258 (158.95)		.1389 (3.530)	5.745 (145.923)	.12 (3)		14,100	34,800	10,150	4 (101.600)

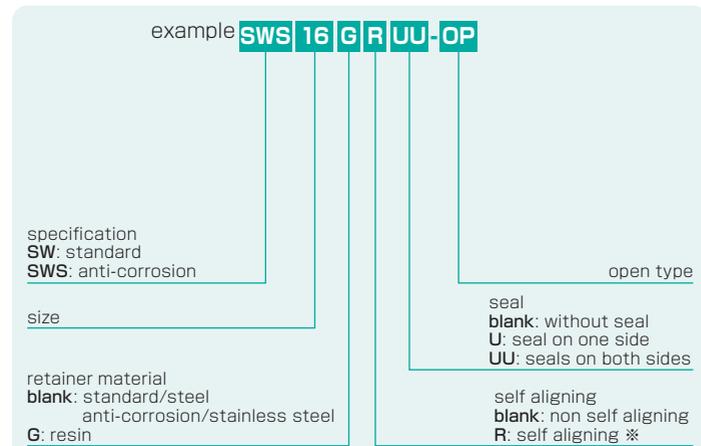
1N≒0.225lbf 1kg≒2.205lbs

# SW-OP TYPE (Inch Standard)

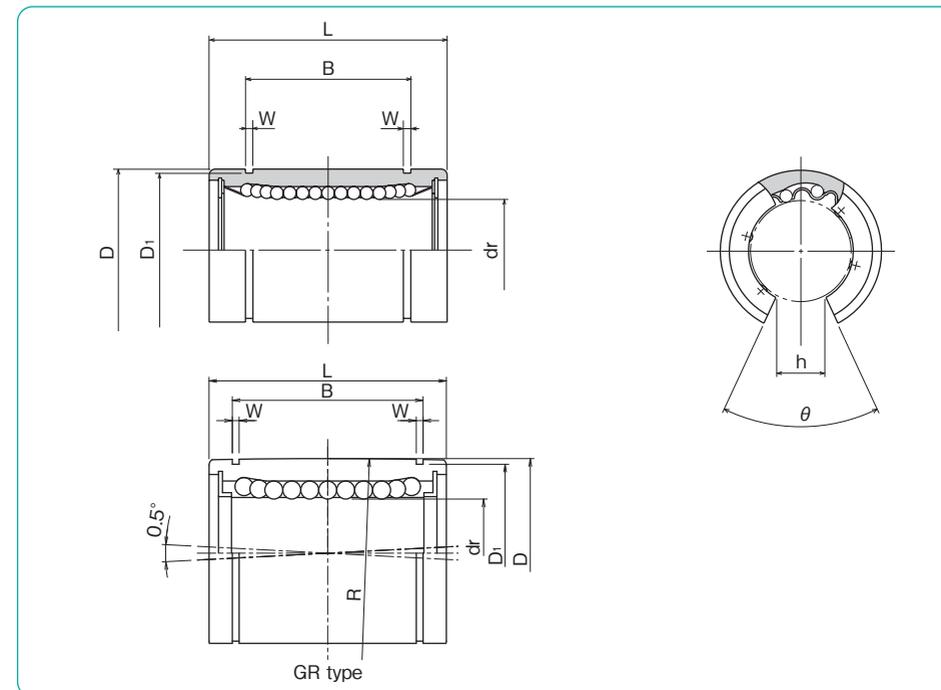
– Open Type –



## part number structure



\*Self-aligning is available only with resin retainer for size 8 to 32 of carbon steel cylinder.



steel retainer	part number		steel retainer	resin retainer	number of ball circuits	major dimensions			
	standard	anti-corrosion				dr		D	
	resin retainer	steel retainer	resin retainer		inch (mm)	tolerance* inch/(μm)	inch (mm)	tolerance* inch/(μm)	
SW 8-OP	SW 8G-OP	SW 8GR-OP	SWS 8-OP	SWS 8G-OP	3	.5000 (12.700)	0 (-0.00040)	.8750 (22.225)	0 (-0.00050)
SW10-OP	SW10G-OP	SW10GR-OP	SWS10-OP	SWS10G-OP	3	.625 (15.875)	0 (-0.00040)	1.1250 (28.575)	0 (-0.00050)
SW12-OP	SW12G-OP	SW12GR-OP	SWS12-OP	SWS12G-OP	4	.7500 (19.050)	0 (-0.00040)	1.2500 (31.750)	0 (-0.00065)
SW16-OP	SW16G-OP	SW16GR-OP	SWS16-OP	SWS16G-OP	5	1.0000 (25.400)	0 (-0.00040)	1.5625 (39.688)	0 (-0.00065)
SW20-OP	SW20G-OP	SW20GR-OP	SWS20-OP	SWS20G-OP	5	1.2500 (31.750)	0 (-0.00040)	2.0000 (50.800)	0 (-0.00075)
SW24-OP	SW24G-OP	SW24GR-OP	SWS24-OP	SWS24G-OP	5	1.5000 (38.100)	0 (-0.00050)	2.3750 (60.325)	0 (-0.00075)
SW32-OP	SW32G-OP	SW32GR-OP	SWS32-OP	SWS32G-OP	5	2.0000 (50.800)	0 (-0.00050)	3.0000 (76.200)	0 (-0.00075)
SW40-OP	-	-	-	-	5	2.5000 (63.500)	0 (-0.00060)	3.7500 (95.250)	0 (-0.00090)
SW48-OP	-	-	-	-	5	3.0000 (76.200)	0 (-0.00060)	4.5000 (114.300)	0 (-0.00090)
SW64-OP	-	-	-	-	5	4.0000 (101.600)	0 (-0.00080)	6.0000 (152.400)	0 (-0.00100)

\* Accuracy is measured prior to machining clearance slit.

L	B	W	D1	h	θ	eccentricity*	basic load rating		mass	shaft diameter
							dynamic C	static Co		
inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (μm)	N	N	g	inch (mm)
1.2500 (31.750)	.9625 (24.46)	.0459 (1.168)	.8209 (20.853)	.3125 (7.9375)	80°	.0005 (12)	510	784	32	1/2 (12.700)
1.5000 (38.100)	1.1039 (28.04)	.0559 (1.422)	1.0590 (26.899)	.375 (9.5250)	80°	.0005 (12)	774	1,180	64	5/8 (15.875)
1.6250 (41.275)	1.1657 (29.61)	.0559 (1.422)	1.1760 (29.870)	.4375 (11.1125)	60°	.0006 (15)	862	1,370	86	3/4 (19.050)
2.2500 (57.150)	1.7547 (44.57)	.0679 (1.727)	1.4687 (37.306)	.5625 (14.2875)	50°	.0006 (15)	980	1,570	190	1 (25.400)
2.6250 (66.675)	2.0047 (50.92)	.0679 (1.727)	1.8859 (47.904)	.625 (15.875)	50°	.0008 (20)	1,570	2,740	390	1-1/4 (31.750)
3.0000 (76.200)	2.4118 (61.26)	.0859 (2.184)	2.2389 (56.870)	.75 (19.05)	50°	.0008 (20)	2,180	4,020	610	1-1/2 (38.100)
4.0000 (101.600)	3.1917 (81.07)	.1029 (2.616)	2.8379 (72.085)	1.0 (25.40)	50°	.0010 (25)	3,820	7,940	1,120	2 (50.800)
5.0000 (127.000)	3.9760 (100.99)	.1200 (3.048)	3.5519 (90.220)	1.25 (31.75)	50°	.0010 (25)	4,700	10,000	2,230	2-1/2 (63.500)
6.0000 (152.400)	4.726 (120.04)	.1200 (3.048)	4.3100 (109.474)	1.5 (38.10)	50°	.0012 (30)	7,350	16,000	3,750	3 (76.200)
8.0000 (203.200)	6.258 (158.95)	.1389 (3.530)	5.745 (145.923)	2.0 (50.80)	50°	.0012 (30)	14,100	34,800	8,740	4 (101.60)

1N≒0.225lbf 1kg≒2.205lbs

# SW-W TYPE (Inch Standard)

– Double-Wide Type –



## part number structure

example **SWS 16 G W UU**

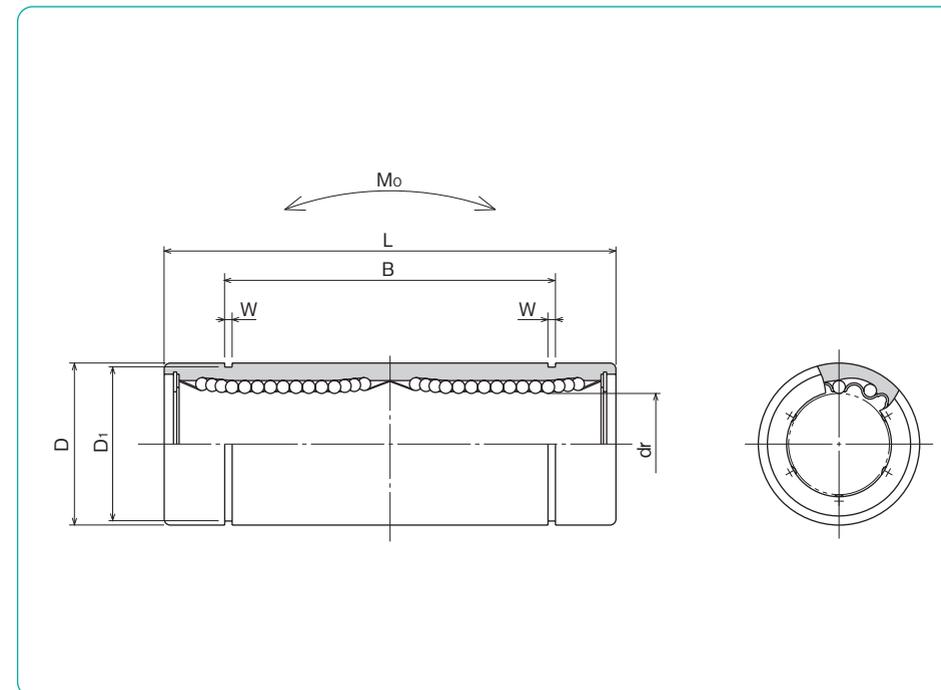
specification  
**SW**: standard  
**SWS**: anti-corrosion

size

retainer material  
**blank**: standard/steel  
 anti-corrosion/stainless steel  
**G**: resin

seal  
**blank**: without seal  
**UU**: seals on both sides

double-wide type



part number		number of ball circuits	major dimensions				
standard	anti-corrosion		dr	D			
steel retainer	resin retainer	stainless retainer	resin retainer	inch (mm)	tolerance inch/(μm)	inch (mm)	tolerance inch/(μm)
SW 4W	SW 4GW	SWS 4W	SWS 4GW	.2500 (6.350)		.5000 (12.700)	<sup>0</sup> <sub>-.00050 (-13)</sub>
SW 6W	SW 6GW	SWS 6W	SWS 6GW	.3750 (9.525)	<sup>0</sup> <sub>-.00040 (-10)</sub>	.6250 (15.875)	<sup>0</sup> <sub>-.00065 (-16)</sub>
SW 8W	SW 8GW	SWS 8W	SWS 8GW	.5000 (12.700)		.8750 (22.225)	<sup>0</sup> <sub>-.00075 (-19)</sub>
SW 10W	SW 10GW	SWS 10W	SWS 10GW	.6250 (15.875)	<sup>0</sup> <sub>-.00050 (-12)</sub>	1.1250 (28.575)	<sup>0</sup> <sub>-.00090 (-22)</sub>
SW 12W	SW 12GW	SWS 12W	SWS 12GW	.7500 (19.050)		1.2500 (31.750)	<sup>0</sup> <sub>-.00100 (-25)</sub>
SW 16W	SW 16GW	SWS 16W	SWS 16GW	1.0000 (25.400)	<sup>0</sup> <sub>-.00060 (-15)</sub>	1.5625 (39.688)	<sup>0</sup> <sub>-.00100 (-25)</sub>
SW 20W	SW 20GW	SWS 20W	SWS 20GW	1.2500 (31.750)		2.0000 (50.800)	
SW 24W	SW 24GW	SWS 24W	SWS 24GW	1.5000 (38.100)		2.3750 (60.325)	
SW 32W	SW 32GW	SWS 32W	SWS 32GW	2.0000 (50.800)		3.0000 (76.200)	

L		B		W	D <sub>1</sub>	eccentricity	basic load rating		allowable static moment	mass	shaft diameter
inch (mm)	tolerance inch/(mm)	inch (mm)	tolerance inch/(mm)				dynamic C	static Co			
1.3750 (34.925)		1.0220 (25.959)		.0390 (0.992)	.4687 (11.906)	.0006 (15)	323	530	2.0	17.5	1/4 (6.350)
1.5938 (40.481)	<sup>0</sup> <sub>-.012 (-0.3)</sub>	1.2716 (32.298)	<sup>0</sup> <sub>-.012 (-0.3)</sub>	.0390 (0.992)	.5880 (14.935)		353	630	2.7	28	3/8 (9.525)
2.3750 (60.325)	<sup>0</sup> <sub>-.016 (-0.4)</sub>	1.9250 (48.895)	<sup>0</sup> <sub>-.016 (-0.4)</sub>	.0459 (1.168)	.8209 (20.853)	.0008 (20)	813	1,570	11.5	80	1/2 (12.700)
2.8125 (71.438)		2.2079 (56.080)		.0559 (1.422)	1.0590 (26.899)		1,230	2,350	20.0	160	5/8 (15.875)
3.0937 (78.581)		2.3314 (59.218)		.0559 (1.422)	1.1760 (29.870)	.0010 (25)	1,370	2,740	26.5	195	3/4 (19.050)
4.2813 (108.744)		3.5094 (89.139)		.0679 (1.727)	1.4687 (37.306)		1,570	3,140	41.2	410	1 (25.400)
5.0000 (127.000)		4.0094 (101.839)		.0679 (1.727)	1.8859 (47.904)	.0012 (30)	2,500	5,490	84.8	820	1-1/4 (31.750)
5.6875 (144.463)		4.8236 (122.519)		.0859 (2.184)	2.2389 (56.870)		3,430	8,040	143	1,250	1-1/2 (38.100)
7.7500 (196.850)		6.3834 (162.138)		.1029 (2.616)	2.8379 (72.085)		6,080	15,900	399	2,350	2 (50.800)

1N≒0.225lbf 1N·m≒0.738lb·ft  
 1kg≒2.205lbs

# SWF TYPE (Inch Standard)

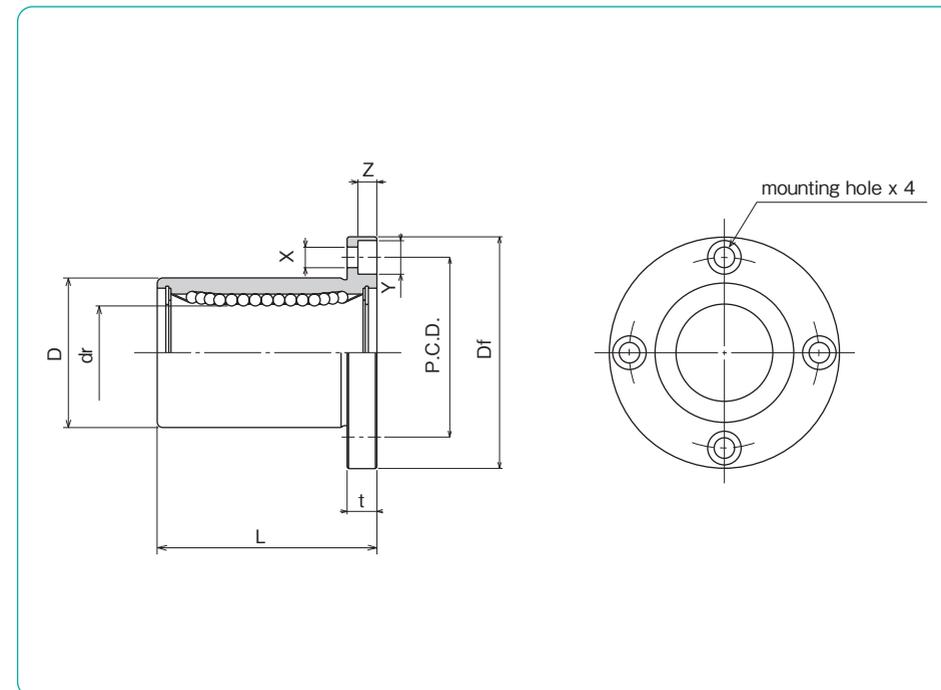
– Round Flange Type –



## part number structure

example **SWSF 16 G UU-SK**

specification SWF: standard SWSF: anti-corrosion	size	retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	outer cylinder surface treatment blank: no surface treatment SK: electroless nickel plating LF: low temperature black chrome treatment with fluoride coating SB: black oxide (not available on anti-corrosion type) SC: industrial chrome plating	seal blank: without seal UU: seals on both sides
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part number				number of ball circuits	major dimensions		
standard steel retainer	anti-corrosion resin retainer	stainless steel retainer	resin retainer		dr	D	L
inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	
SWF 4	SWF 4G	SWSF 4	SWSF 4G	4	.2500 (6.350)	.5000 (12.700)	.7500 (19.050)
SWF 6	SWF 6G	SWSF 6	SWSF 6G	4	.3750 (9.525)	.6250 (15.875)	.8750 (22.225)
SWF 8	SWF 8G	SWSF 8	SWSF 8G	4	.5000 (12.700)	.7500 (19.050)	1.2500 (31.750)
SWF10	SWF10G	SWSF10	SWSF10G	4	.6250 (15.875)	1.1250 (28.575)	1.5000 (38.100)
SWF12	SWF12G	SWSF12	SWSF12G	5	.7500 (19.050)	1.2500 (31.750)	1.6250 (41.275)
SWF16	SWF16G	SWSF16	SWSF16G	6	1.0000 (25.400)	1.5625 (39.688)	2.2500 (57.150)
SWF20	SWF20G	SWSF20	SWSF20G	6	1.2500 (31.750)	2.0000 (50.800)	2.6250 (66.675)
SWF24	SWF24G	SWSF24	SWSF24G	6	1.5000 (38.100)	2.3750 (60.325)	3.0000 (76.200)
SWF32	SWF32G	SWSF32	SWSF32G	6	2.0000 (50.800)	3.0000 (76.200)	4.0000 (101.600)
SWF40	—	—	—	6	2.5000 (63.500)	3.7500 (95.250)	5.0000 (127.000)
SWF48	—	—	—	6	3.0000 (76.200)	4.5000 (114.300)	6.0000 (152.400)
SWF64	—	—	—	6	4.0000 (101.600)	6.0000 (152.400)	8.0000 (203.200)

Df	t	flange		eccentricity	perpendicularity	basic load rating		mass	shaft diameter
		P.C.D.	X × Y × Z			dynamic C	static Co		
inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (μm)	inch (μm)	N	N	g	inch (mm)
1.2500 (31.750)	.2187 (5.556)	.8750 (22.225)	.1560 × .2500 × .1410 (3.969 × 6.350 × 3.572)	.0005 (12)	.0005 (12)	206	265	32	1/4 (6.350)
1.5000 (38.100)	.2500 (6.350)	1.0620 (26.988)	.1875 × .2970 × .1720 (4.763 × 7.541 × 4.366)	.0005 (12)	.0005 (12)	225	314	47	3/8 (9.525)
1.7500 (44.450)	.2500 (6.350)	1.312 (33.338)	.1875 × .2970 × .1720 (4.763 × 7.541 × 4.366)	.0005 (12)	.0005 (12)	510	784	88	1/2 (12.700)
2.0000 (50.800)	.2500 (6.350)	1.5620 (39.688)	.1875 × .2970 × .1720 (4.763 × 7.541 × 4.366)	.0005 (12)	.0005 (12)	774	1,180	140	5/8 (15.875)
2.1875 (55.563)	.3125 (7.938)	1.7187 (43.656)	.2187 × .3440 × .2030 (5.556 × 8.731 × 5.159)	.0006 (15)	.0006 (15)	862	1,370	190	3/4 (19.050)
2.5000 (63.500)	.3125 (7.938)	2.0310 (51.594)	.2187 × .3440 × .2030 (5.556 × 8.731 × 5.159)	.0006 (15)	.0006 (15)	980	1,570	325	1 (25.400)
3.1250 (79.375)	.3750 (9.525)	2.5625 (65.088)	.2812 × .4060 × .2656 (7.144 × 10.319 × 6.747)	.0008 (20)	.0008 (20)	1,570	2,740	665	1-1/4 (31.750)
3.7500 (95.250)	.5000 (12.700)	3.0625 (77.788)	.3440 × .5000 × .3280 (8.731 × 12.700 × 8.334)	.0008 (20)	.0008 (20)	2,180	4,020	1,100	1-1/2 (38.100)
4.3750 (111.125)	.5000 (12.700)	3.6875 (93.662)	.3440 × .5000 × .3280 (8.731 × 12.700 × 8.334)	.0010 (25)	.0010 (25)	3,820	7,940	1,760	2 (50.800)
5.3750 (136.525)	.7500 (19.050)	4.5625 (115.887)	.4062 × .6250 × .3750 (10.319 × 15.875 × 9.525)	.0010 (25)	.0010 (25)	4,700	10,000	3,570	2-1/2 (63.500)
6.1250 (155.575)	.7500 (19.050)	5.3125 (134.937)	.4062 × .6250 × .3750 (10.319 × 15.875 × 9.525)	.0010 (25)	.0010 (25)	7,350	16,000	5,600	3 (76.200)
8.0000 (203.200)	.8750 (22.225)	7.0000 (177.800)	.5000 × .7125 × .5000 (12.700 × 18.097 × 12.700)	.0012 (30)	.0012 (30)	14,100	34,800	12,000	4 (101.600)

1N ≅ 0.225lbf 1kg ≅ 2.205lbf

# SWK TYPE (Inch Standard)

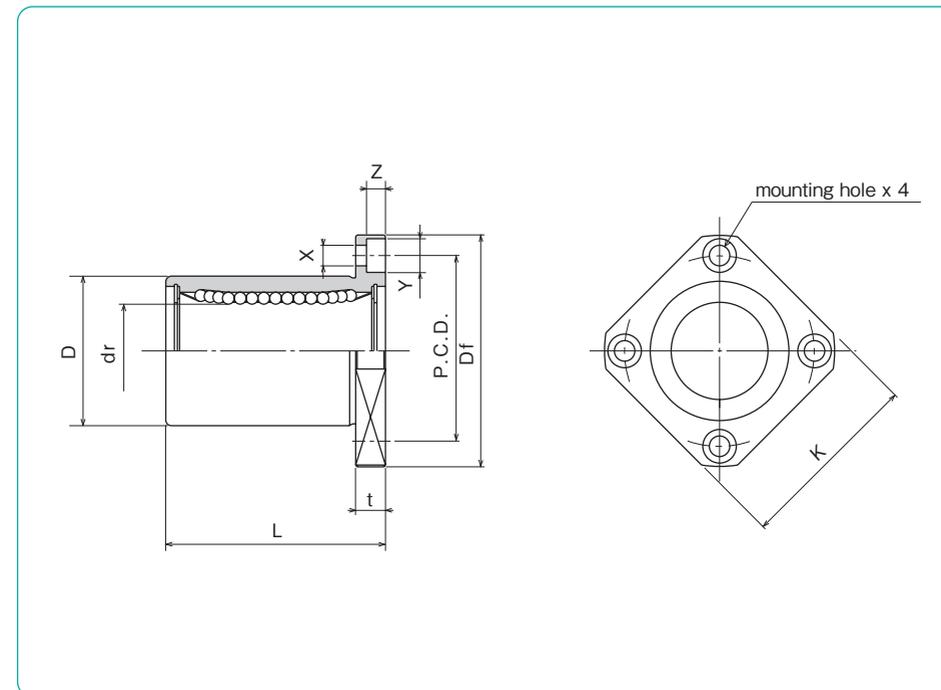
– Square Flange Type –



## part number structure

example **SWSK 16 G UU-SK**

specification <b>SWK</b> : standard <b>SWSK</b> : anti-corrosion	size	retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating	seal <b>blank</b> : without seal <b>UU</b> : seals on both sides
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part number		major dimensions		number of ball circuits	dr		D		L ±0.012 (±0.3) inch/(mm)
standard steel retainer	anti-corrosion resin retainer	inch (mm)	tolerance inch/(μm)		inch (mm)	tolerance inch/(μm)	inch (mm)	tolerance inch/(μm)	
<b>SWK 4</b>	<b>SWK 4G</b>	<b>SWSK 4</b>	<b>SWSK 4G</b>	4	.2500 (6.350)	<sup>0</sup> (-.0005)	.5000 (12.700)	<sup>0</sup> (-.0005)	.7500 (19.050)
<b>SWK 6</b>	<b>SWK 6G</b>	<b>SWSK 6</b>	<b>SWSK 6G</b>	4	.3750 (9.525)	<sup>0</sup> (-.0004)	.6250 (15.875)	<sup>0</sup> (-.0006)	.8750 (22.225)
<b>SWK 8</b>	<b>SWK 8G</b>	<b>SWSK 8</b>	<b>SWSK 8G</b>	4	.5000 (12.700)	<sup>0</sup> (-.0004)	.7500 (19.050)	<sup>0</sup> (-.0006)	1.2500 (31.750)
<b>SWK 10</b>	<b>SWK 10G</b>	<b>SWSK 10</b>	<b>SWSK 10G</b>	4	.6250 (15.875)	<sup>0</sup> (-.0004)	1.1250 (28.575)	<sup>0</sup> (-.0006)	1.5000 (38.100)
<b>SWK 12</b>	<b>SWK 12G</b>	<b>SWSK 12</b>	<b>SWSK 12G</b>	5	.7500 (19.050)	<sup>0</sup> (-.0004)	1.2500 (31.750)	<sup>0</sup> (-.0007)	1.6250 (41.275)
<b>SWK 16</b>	<b>SWK 16G</b>	<b>SWSK 16</b>	<b>SWSK 16G</b>	6	1.0000 (25.400)	<sup>0</sup> (-.0010)	1.5625 (39.688)	<sup>0</sup> (-.0007)	2.2500 (57.150)
<b>SWK 20</b>	<b>SWK 20G</b>	<b>SWSK 20</b>	<b>SWSK 20G</b>	6	1.2500 (31.750)	<sup>0</sup> (-.0005)	2.0000 (50.800)	<sup>0</sup> (-.0009)	2.6250 (66.675)
<b>SWK 24</b>	<b>SWK 24G</b>	<b>SWSK 24</b>	<b>SWSK 24G</b>	6	1.5000 (38.100)	<sup>0</sup> (-.0005)	2.3750 (60.325)	<sup>0</sup> (-.0009)	3.0000 (76.200)
<b>SWK 32</b>	<b>SWK 32G</b>	<b>SWSK 32</b>	<b>SWSK 32G</b>	6	2.0000 (50.800)	<sup>0</sup> (-.0005)	3.0000 (76.200)	<sup>0</sup> (-.0010)	4.0000 (101.600)
<b>SWK 40</b>	—	—	—	6	2.5000 (63.500)	<sup>0</sup> (-.0006)	3.7500 (95.250)	<sup>0</sup> (-.0010)	5.0000 (127.000)
<b>SWK 48</b>	—	—	—	6	3.0000 (76.200)	<sup>0</sup> (-.0006)	4.5000 (114.300)	<sup>0</sup> (-.0011)	6.0000 (152.400)
<b>SWK 64</b>	—	—	—	6	4.0000 (101.600)	<sup>0</sup> (-.0008)	6.0000 (152.400)	<sup>0</sup> (-.0011)	8.0000 (203.200)

flange					eccentricity inch (μm)	perpendicularity inch (μm)	basic load rating		mass g	shaft diameter inch (mm)
Df	K	t	P.C.D.	X×Y×Z inch/(mm)			dynamic C N	static Co N		
1.2500 (31.750)	1.0000 (25.400)	.2187 (5.556)	.8750 (22.225)	.1560 x .2500 x .1410 (3.969 x 6.350 x 3.572)	.0005 (12)	.0005 (12)	206	265	25	1/4 (6.350)
1.5000 (38.100)	1.2500 (31.750)	.2500 (6.350)	1.0620 (26.988)	.1875 x .2970 x .1720 (4.763 x 7.541 x 4.366)			225	314	32	3/8 (9.525)
1.7500 (44.450)	1.3750 (34.925)	.2500 (6.350)	1.312 (33.338)	.1875 x .2970 x .1720 (4.763 x 7.541 x 4.366)			510	784	68	1/2 (12.700)
2.0000 (50.800)	1.5000 (38.100)	.2500 (6.350)	1.5620 (39.688)	.1875 x .2970 x .1720 (4.763 x 7.541 x 4.366)			774	1,180	124	5/8 (15.875)
2.1875 (55.563)	1.6875 (42.863)	.3125 (7.938)	1.7187 (43.656)	.2187 x .3440 x .2030 (5.556 x 8.731 x 5.159)	.0006 (15)	.0006 (15)	862	1,370	150	3/4 (19.050)
2.5000 (63.500)	2.0000 (50.800)	.3125 (7.938)	2.0310 (51.594)	.2187 x .3440 x .2030 (5.556 x 8.731 x 5.159)			980	1,570	280	1 (25.400)
3.1250 (79.375)	2.5000 (63.500)	.3750 (9.525)	2.5625 (65.088)	.2812 x .4060 x .2656 (7.144 x 10.319 x 6.747)			1,570	2,740	580	1-1/4 (31.750)
3.7500 (95.250)	3.0000 (76.200)	.5000 (12.700)	3.0625 (77.788)	.3440 x .5000 x .3280 (8.731 x 12.700 x 8.334)			2,180	4,020	930	1-1/2 (38.100)
4.3750 (111.125)	3.5000 (88.900)	.5000 (12.700)	3.6875 (93.662)	.3440 x .5000 x .3280 (8.731 x 12.700 x 8.334)	.0008 (20)	.0008 (20)	3,820	7,940	1,580	2 (50.800)
5.3750 (136.525)	4.3750 (111.125)	.7500 (19.050)	4.5625 (115.887)	.4062 x .6250 x .3750 (10.319 x 15.875 x 9.525)			4,700	10,000	3,200	2-1/2 (63.500)
6.1250 (155.575)	5.0000 (127.000)	.7500 (19.050)	5.3125 (134.937)	.4062 x .6250 x .3750 (10.319 x 15.875 x 9.525)			7,350	16,000	5,000	3 (76.200)
8.0000 (203.200)	6.7500 (171.450)	.8750 (22.225)	7.0000 (177.800)	.5000 x .7125 x .5000 (12.700 x 18.097 x 12.700)	.0012 (30)	.0012 (30)	14,100	34,800	11,300	4 (101.600)

1N ≅ 0.225lbf 1kg ≅ 2.205lbf

# SWF-W TYPE (Inch Standard)

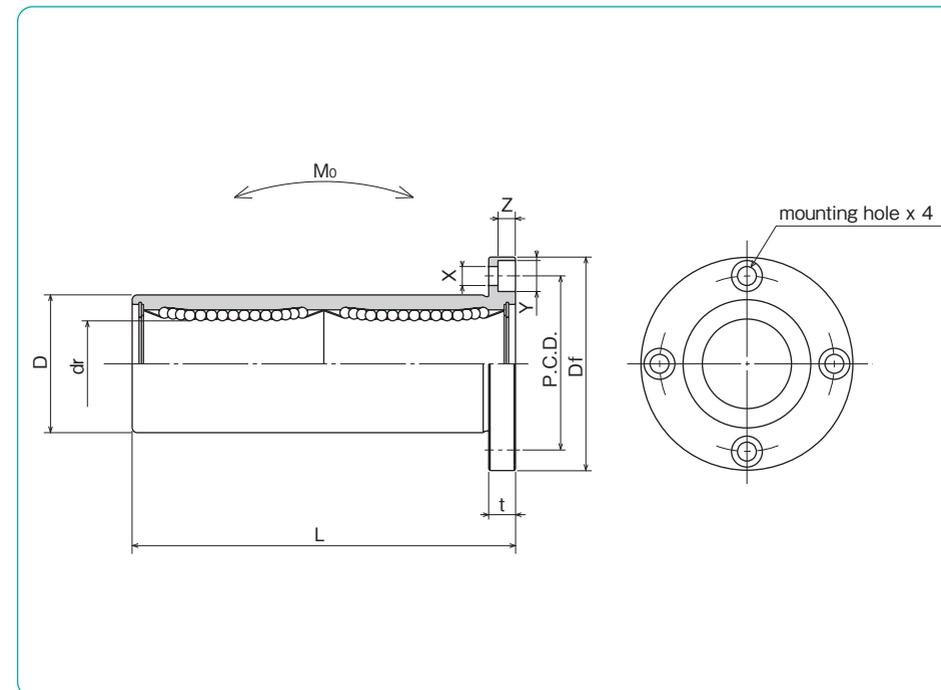
– Round Flange Double-Wide Type –



## part number structure

example **SWSF 16 G W UU -SK**

specification <b>SWF</b> : standard <b>SWSF</b> : anti-corrosion	size	retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating	seal <b>blank</b> : without seal <b>UU</b> : seals on both sides	double-wide type
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part number				number of ball circuits	major dimensions		
standard steel retainer	anti-corrosion resin retainer	stainless steel retainer	resin retainer		dr	D	L
inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	
SWF 4W	SWF 4GW	SWSF 4W	SWSF 4GW	4	.2500 (6.350)	.5000 (12.700)	1.3750 (34.925)
SWF 6W	SWF 6GW	SWSF 6W	SWSF 6GW	4	.3750 (9.525)	.6250 (15.875)	1.5938 (40.481)
SWF 8W	SWF 8GW	SWSF 8W	SWSF 8GW	4	.5000 (12.700)	.8750 (22.225)	2.3750 (60.325)
SWF10W	SWF10GW	SWSF10W	SWSF10GW	4	.6250 (15.875)	1.1250 (28.575)	2.8125 (71.438)
SWF12W	SWF12GW	SWSF12W	SWSF12GW	5	.7500 (19.050)	1.2500 (31.750)	3.0937 (78.581)
SWF16W	SWF16GW	SWSF16W	SWSF16GW	6	1.0000 (25.400)	1.5625 (39.688)	4.2813 (108.744)
SWF20W	SWF20GW	SWSF20W	SWSF20GW	6	1.2500 (31.750)	2.0000 (50.800)	5.0000 (127.000)
SWF24W	SWF24GW	SWSF24W	SWSF24GW	6	1.5000 (38.100)	2.3750 (60.325)	5.6875 (144.463)
SWF32W	SWF32GW	SWSF32W	SWSF32GW	6	2.0000 (50.800)	3.0000 (76.200)	7.7500 (196.850)

flange				eccentricity	perpendicularity	basic load rating		allowable static moment	mass	shaft diameter
Df	t	P.C.D.	X × Y × Z			dynamic C	static Co			
inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (μm)	inch (μm)	N	N	N · m	g	inch (mm)
1.2500 (31.750)	.2187 (5.556)	.8750 (22.225)	.1563 × .2500 × .1406 (3.969 × 6.350 × 3.572)	.0006 (15)	.0006 (15)	323	530	2.0	40	1/4 (6.350)
1.5000 (38.100)	.2500 (6.350)	1.0625 (26.988)	.1875 × .2969 × .1719 (4.763 × 7.541 × 4.366)			353	630	2.7	60	3/8 (9.525)
1.7500 (44.450)	.2500 (6.350)	1.3125 (33.338)	.1875 × .2969 × .1719 (4.763 × 7.541 × 4.366)			813	1,570	11.5	126	1/2 (12.700)
2.0000 (50.800)	.2500 (6.350)	1.5625 (39.688)	.1875 × .2969 × .1719 (4.763 × 7.541 × 4.366)			1,230	2,350	20.0	215	5/8 (15.875)
2.1875 (55.563)	.3125 (7.938)	1.7188 (43.656)	.2188 × .3438 × .2031 (5.556 × 8.731 × 5.159)	.0008 (20)	.0008 (20)	1,370	2,740	26.5	280	3/4 (19.050)
2.5000 (63.500)	.3125 (7.938)	2.0313 (51.594)	.2188 × .3438 × .2031 (5.556 × 8.731 × 5.159)			1,570	3,140	41.2	515	1 (25.400)
3.1250 (79.375)	.3750 (9.525)	2.5625 (65.088)	.2813 × .4063 × .2656 (7.144 × 10.319 × 6.747)	.0010 (25)	.0010 (25)	2,500	5,490	84.8	1,020	1-1/4 (31.750)
3.7500 (95.250)	.5000 (12.700)	3.0625 (77.788)	.3437 × .5000 × .3281 (8.731 × 12.700 × 8.334)			3,430	8,040	143	1,630	1-1/2 (38.100)
4.3750 (111.125)	.5000 (12.700)	3.6875 (93.662)	.3437 × .5000 × .3281 (8.731 × 12.700 × 8.334)	.0012 (30)	.0012 (30)	6,080	15,900	399	2,800	2 (50.800)

1N ≅ 0.225lbf 1N · m ≅ 0.738lbf · ft  
1kg ≅ 2.205lbs

# SWK-W TYPE (Inch Standard)

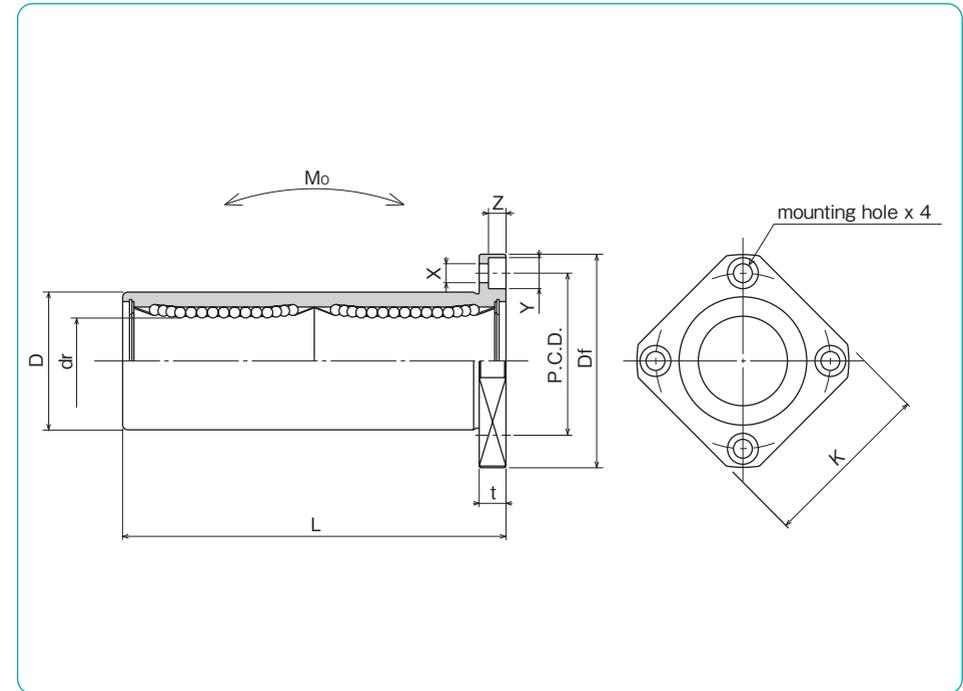
– Square Flange Double-Wide Type –



### part number structure

example **SWSK 16 G W UU -SK**

specification <b>SWK</b> : standard <b>SWSK</b> : anti-corrosion	size	retainer material <b>blank</b> : standard/steel anti-corrosion/stainless steel <b>G</b> : resin	outer cylinder surface treatment <b>blank</b> : no surface treatment <b>SK</b> : electroless nickel plating <b>LF</b> : low temperature black chrome treatment with fluoride coating <b>SB</b> : black oxide (not available on anti-corrosion type) <b>SC</b> : industrial chrome plating	seal <b>blank</b> : without seal <b>UU</b> : seals on both sides	double-wide type
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part number				number of ball circuits	major dimensions				
standard		anti-corrosion			dr		D		L
steel retainer	resin retainer	stainless retainer	resin retainer		inch (mm)	tolerance inch/(μm)	inch (mm)	tolerance inch/(μm)	±.012 (±0.3) inch/(mm)
<b>SWK 4W</b>	<b>SWK 4GW</b>	<b>SWSK 4W</b>	<b>SWSK 4GW</b>	4	.2500 (6.350)		.5000 (12.700)	<sup>0</sup> <sub>-.00050 (-13)</sub>	1.3750 (34.925)
<b>SWK 6W</b>	<b>SWK 6GW</b>	<b>SWSK 6W</b>	<b>SWSK 6GW</b>	4	.3750 (9.525)	<sup>0</sup> <sub>-.00040 (-10)</sub>	.6250 (15.875)	<sup>0</sup> <sub>-.00065 (-16)</sub>	1.5938 (40.481)
<b>SWK 8W</b>	<b>SWK 8GW</b>	<b>SWSK 8W</b>	<b>SWSK 8GW</b>	4	.5000 (12.700)		.8750 (22.225)	<sup>0</sup> <sub>-.00075 (-19)</sub>	2.3750 (60.325)
<b>SWK 10W</b>	<b>SWK 10GW</b>	<b>SWSK 10W</b>	<b>SWSK 10GW</b>	4	.6250 (15.875)		1.1250 (28.575)	<sup>0</sup> <sub>-.00090 (-22)</sub>	2.8125 (71.438)
<b>SWK 12W</b>	<b>SWK 12GW</b>	<b>SWSK 12W</b>	<b>SWSK 12GW</b>	5	.7500 (19.050)	<sup>0</sup> <sub>-.00050 (-12)</sub>	1.2500 (31.750)	<sup>0</sup> <sub>-.00075 (-19)</sub>	3.0937 (78.581)
<b>SWK 16W</b>	<b>SWK 16GW</b>	<b>SWSK 16W</b>	<b>SWSK 16GW</b>	6	1.0000 (25.400)		1.5625 (39.688)	<sup>0</sup> <sub>-.00090 (-22)</sub>	4.2813 (108.744)
<b>SWK 20W</b>	<b>SWK 20GW</b>	<b>SWSK 20W</b>	<b>SWSK 20GW</b>	6	1.2500 (31.750)	<sup>0</sup> <sub>-.00060 (-15)</sub>	2.0000 (50.800)	<sup>0</sup> <sub>-.00100 (-25)</sub>	5.0000 (127.000)
<b>SWK 24W</b>	<b>SWK 24GW</b>	<b>SWSK 24W</b>	<b>SWSK 24GW</b>	6	1.5000 (38.100)		2.3750 (60.325)	<sup>0</sup> <sub>-.00100 (-25)</sub>	5.6875 (144.463)
<b>SWK 32W</b>	<b>SWK 32GW</b>	<b>SWSK 32W</b>	<b>SWSK 32GW</b>	6	2.0000 (50.800)		3.0000 (76.200)	<sup>0</sup> <sub>-.00100 (-25)</sub>	7.7500 (196.850)

Df		flange				eccentricity inch (μm)	perpendicularity inch (μm)	basic load rating		allowable static moment Mo N·m	mass g	shaft diameter inch/(mm)
inch/(mm)	inch/(mm)	t inch/(mm)	P.C.D. inch/(mm)	X×Y×Z inch/(mm)	dynamic C N			static Co N				
1.2500 (31.750)	1.0000 (25.400)	.2188 (5.556)	.8750 (22.225)	.1563×.2500×.1406 (3.969×6.350×3.572)	.0006 (15)	.0006 (15)	323	530	2.0	33	1/4 (6.350)	
1.5000 (38.100)	1.2500 (31.750)	.2500 (6.350)	1.0625 (26.988)	.1875×.2969×.1719 (4.763×7.541×4.366)	.0006 (15)	.0006 (15)	353	630	2.7	45	3/8 (9.525)	
1.7500 (44.450)	1.3750 (34.925)	.2500 (6.350)	1.3125 (33.338)	.1875×.2969×.1719 (4.763×7.541×4.366)	.0008 (20)	.0008 (20)	813	1,570	11.5	106	1/2 (12.700)	
2.0000 (50.800)	1.5000 (38.100)	.2500 (6.350)	1.5625 (39.688)	.1875×.2969×.1719 (4.763×7.541×4.366)	.0010 (25)	.0010 (25)	1,230	2,350	20.0	200	5/8 (15.875)	
2.1875 (55.563)	1.6875 (42.863)	.3125 (7.938)	1.7188 (43.656)	2.188×.3438×.2031 (5.556×8.731×5.159)	.0010 (25)	.0010 (25)	1,370	2,740	26.5	240	3/4 (19.050)	
2.5000 (63.500)	2.0000 (50.800)	.3125 (7.938)	2.0313 (51.594)	2.188×.3438×.2031 (5.556×8.731×5.159)	.0012 (30)	.0012 (30)	1,570	3,140	41.2	470	1 (25.400)	
3.1250 (79.375)	2.5000 (63.500)	.3750 (9.525)	2.5625 (65.088)	2.813×.4063×.2656 (7.144×10.319×6.747)	.0012 (30)	.0012 (30)	2,500	5,490	84.8	935	1-1/4 (31.750)	
3.7500 (95.250)	3.0000 (76.200)	.5000 (12.700)	3.0625 (77.788)	.3437×.5000×.3281 (8.731×12.700×8.334)	.0012 (30)	.0012 (30)	3,430	8,040	143	1,460	1-1/2 (38.100)	
4.3750 (111.125)	3.5000 (88.900)	.5000 (12.700)	3.6875 (93.662)	.3437×.5000×.3281 (8.731×12.700×8.334)	.0012 (30)	.0012 (30)	6,080	15,900	399	2,620	2 (50.800)	

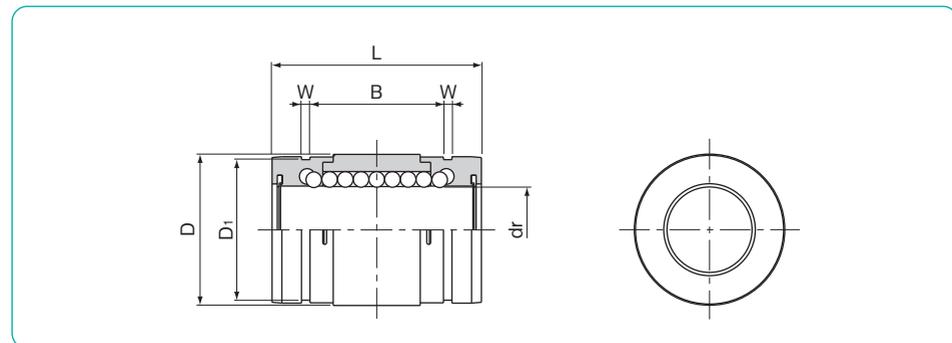
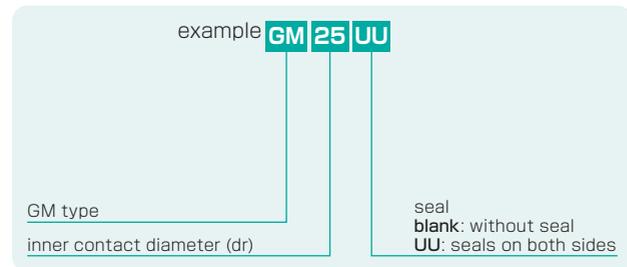
1N≒0.225lbf 1N·m≒0.738lb·ft  
1kg≒2.205lbs

# GM TYPE

– Single Type –



## part number structure



part number	number of ball circuits	dr mm	major dimensions						basic load rating dynamic C N	static Co N	mass g
			tolerance $\mu\text{m}$	D mm	L mm	B mm	W mm	D <sub>1</sub> mm			
GM 6	4	6	0	12	19	11.3	1.1	11.5	206	265	5
GM 8	4	8	0	15	24	15.3	1.1	14.3	274	392	10
GM10	4	10	0	19	29	19.4	1.3	18	372	549	18
GM12	4	12	-9	21	30	20.4	1.3	20	510	784	23
GM13	4	13	-9	23	32	20.4	1.3	22	510	784	27
GM16	4	16	-9	28	37	23.3	1.6	27	774	1,180	45
GM20	6	20	0	32	42	27.3	1.6	30.5	882	1,370	70
GM25	6	25	-10	40	59	37.3	1.85	38	980	1,570	150
GM30	6	30	-10	45	64	40.8	1.85	43	1,570	2,740	180

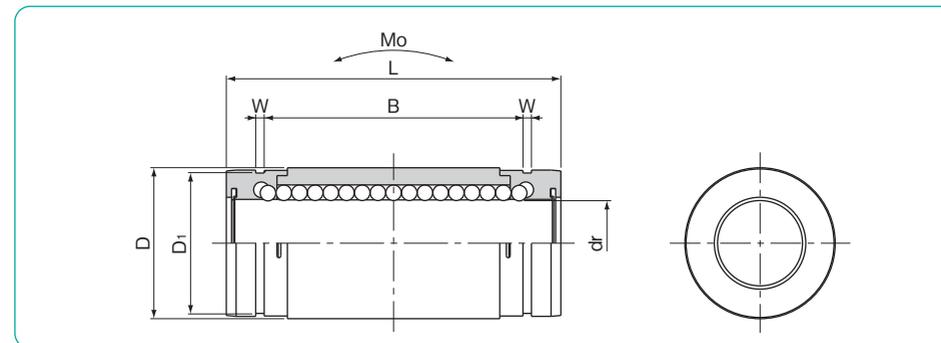
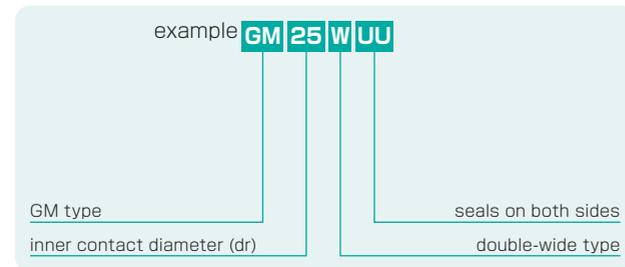
1N $\approx$ 0.102kgf

# GM-W TYPE

– Double-Wide Type –



## part number structure



part number	number of ball circuits	dr mm	major dimensions						basic load rating dynamic C N	static Co N	allowable static moment Mo N·m	mass g
			tolerance $\mu\text{m}$	D mm	L mm	B mm	W mm	D <sub>1</sub> mm				
GM 6W UU	4	6	0	12	28	20.3	1.1	11.5	323	530	1.5	9
GM 8W UU	4	8	0	15	36	27.3	1.1	14.3	431	784	3.3	18
GM10W UU	4	10	0	19	41	31.4	1.3	18	588	1,100	5.0	31
GM12W UU	4	12	-10	21	46	36.4	1.3	20	813	1,570	7.6	42
GM13W UU	4	13	-10	23	48	36.4	1.3	22	813	1,570	8.1	50
GM16W UU	4	16	-12	28	53	39.3	1.6	27	1,230	2,350	13.8	76
GM20W UU	6	20	0	32	65	50.3	1.6	30.5	1,400	2,740	20.0	130
GM25W UU	6	25	-12	40	91	69.3	1.85	38	1,560	3,140	34.8	280
GM30W UU	6	30	-12	45	99	75.8	1.85	43	2,490	5,490	57.5	334

\*UU type is standard.

1N $\approx$ 0.102kgf 1N·m $\approx$ 0.102kgf·m

# SMA TYPE

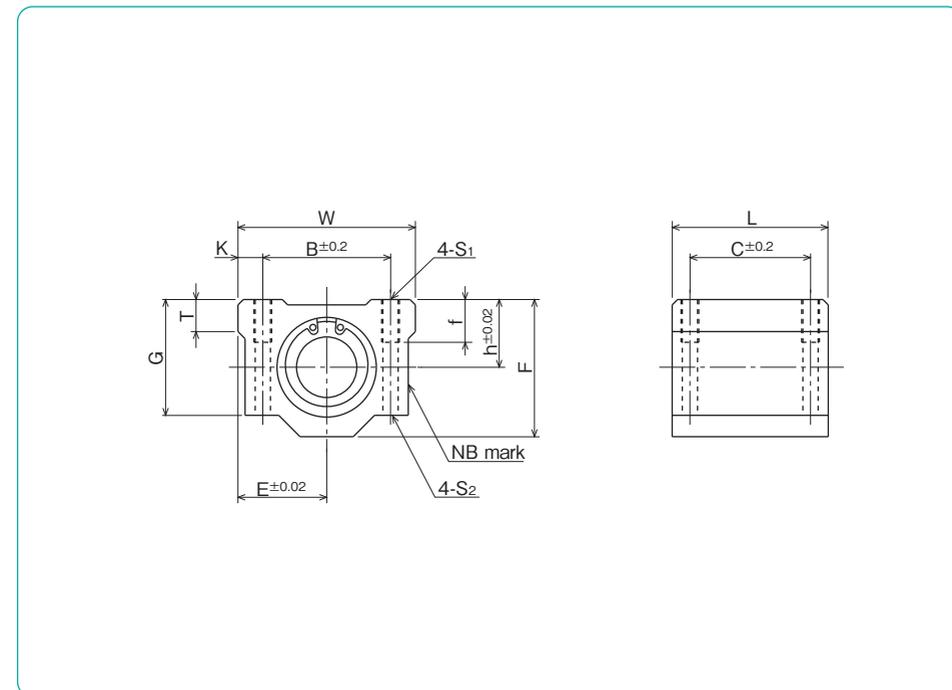
– Block Type –



## part number structure

example **SMSA 25 G UU**

specification SMA: standard SMSA: anti-corrosion	inner contact diameter	retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	seal blank: without seal UU: seals on both sides
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part number	inner contact diameter		outer dimensions							major dimensions	
	mm	tolerance μm	h mm	E mm	W mm	L mm	F mm	G mm	T mm		
SMA 3GUU	3		5	8	16	13	10	8	—		
SMA 4GUU	4	0	5.5	8.5	17	15	11	9	—		
SMA 5GUU	5	- 8	7	11	22	18	14	11	—		
SMA 6GUU	6		9	15	30	25	18	15	6		
SMA 8GUU	8		11	17	34	30	22	18	6		
SMA 10GUU	10	0	13	20	40	35	26	21	8		
SMA 12GUU	12	- 9	15	21	42	36	28	24	8		
SMA 13GUU	13		15	22	44	39	30	24.5	8		
SMA 16GUU	16		19	25	50	44	38.5	32.5	9		
SMA 20GUU	20	0	21	27	54	50	41	35	11		
SMA 25GUU	25	-10	26	38	76	67	51.5	42	12		
SMA 30GUU	30		30	39	78	72	59.5	49	15		
SMA 35GUU	35	0	34	45	90	80	68	54	18		
SMA 40GUU	40	-12	40	51	102	90	78	62	20		
SMA 50GUU	50		52	61	122	110	102	80	25		
SMA 60GUU	60	0/-15	58	66	132	122	114	94	30		

mounting dimensions						basic load rating		mass g	shaft diameter mm
B mm	C mm	K mm	S <sub>1</sub>	f mm	S <sub>2</sub> mm	dynamic C N	static Co N		
11	8	2.5	M2	—	—	69	105	5	3
12	10	2.5	M3	—	—	88	127	7	4
16	12	3	M3	—	—	167	206	14	5
20	15	5	M4	8	3.4	206	265	34	6
24	18	5	M4	8	3.4	274	392	52	8
28	21	6	M5	12	4.3	372	549	92	10
30.5	26	5.75	M5	12	4.3	510	784	102	12
33	26	5.5	M5	12	4.3	510	784	120	13
36	34	7	M5	12	4.3	774	1,180	200	16
40	40	7	M6	12	5.2	882	1,370	255	20
54	50	11	M8	18	7	980	1,570	600	25
58	58	10	M8	18	7	1,570	2,740	735	30
70	60	10	M8	18	7	1,670	3,140	1,100	35
80	60	11	M10	25	8.7	2,160	4,020	1,590	40
100	80	11	M10	25	8.7	3,820	7,940	3,340	50
108	90	12	M12	25	10.7	4,700	10,000	4,270	60

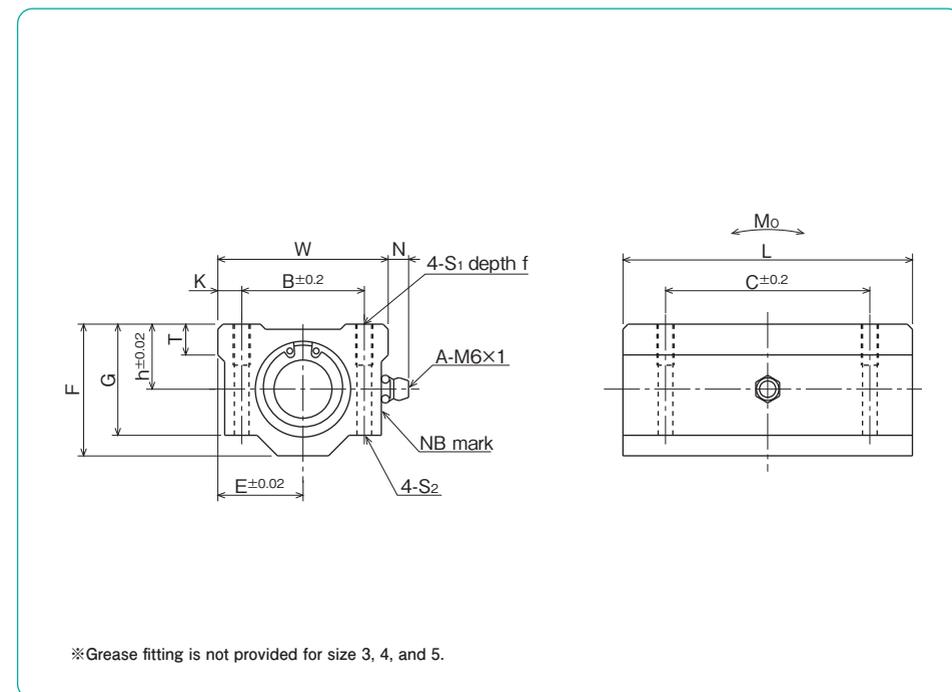
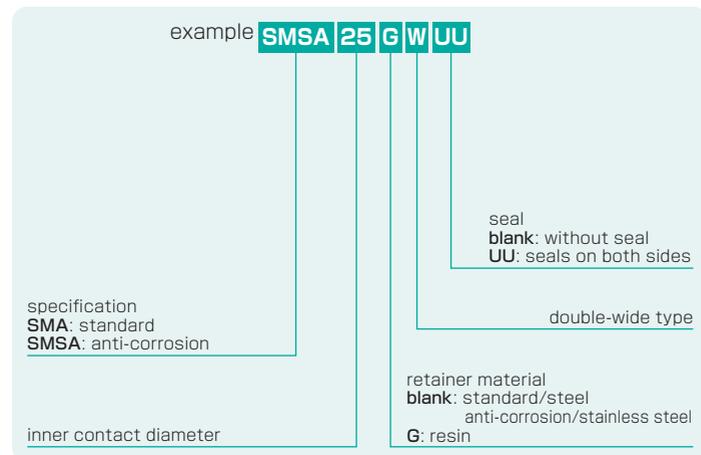
1N≒0.102kgf

# SMA-W TYPE

– Double-Wide Block Type –



## part number structure



part number	inner contact diameter		major dimensions							
	mm	tolerance $\mu m$	h mm	E mm	W mm	L mm	F mm	G mm	T mm	N mm
SMA 3GWUU	3	0 - 8	5	8	16	23	10	8	—	—
SMA 4GWUU	4		5.5	8.5	17	27	11	9	—	—
SMA 5GWUU	5		7	11	22	33	14	11	—	—
SMA 6GWUU	6	0 - 9	9	15	30	48	18	15	6	7
SMA 8GWUU	8		11	17	34	58	22	18	6	7
SMA 10GWUU	10		13	20	40	68	26	21	8	7
SMA 12GWUU	12		15	21	42	70	28	24	8	6.5
SMA 13GWUU	13		15	22	44	75	30	24.5	8	6.5
SMA 16GWUU	16	0 - 10	19	25	50	85	38.5	32.5	9	6
SMA 20GWUU	20		21	27	54	96	41	35	11	7
SMA 25GWUU	25		26	38	76	130	51.5	42	12	4
SMA 30GWUU	30		30	39	78	140	59.5	49	15	5
SMA 35GWUU	35		34	45	90	155	68	54	18	5.5
SMA 40GWUU	40		40	51	102	175	78	62	20	5
SMA 50GWUU	50	0 - 12	52	61	122	215	102	80	25	5
SMA 60GWUU	60		58	66	132	240	114	94	30	5

mounting dimensions						basic load rating		allowable static moment $M_o$ N · m	mass g	shaft diameter mm
B mm	C mm	K mm	$S_1$	f mm	$S_2$ mm	dynamic C N	static $C_o$ N			
11	16	2.5	M2	—	—	108	206	0.49	10	3
12	20	2.5	M3	—	—	137	255	0.72	13	4
16	25	3	M3	—	—	265	412	1.54	27	5
20	36	5	M4	8	3.4	323	530	2.18	63	6
24	42	5	M4	8	3.4	431	784	4.31	102	8
28	46	6	M5	12	4.3	588	1,100	7.24	180	10
30.5	50	5.75	M5	12	4.3	813	1,570	10.9	205	12
33	50	5.5	M5	12	4.3	813	1,570	11.6	240	13
36	60	7	M5	12	4.3	1,230	2,350	19.7	400	16
40	70	7	M6	12	5.2	1,400	2,740	26.8	570	20
54	100	11	M8	18	7	1,560	3,140	43.4	1,200	25
58	110	10	M8	18	7	2,490	5,490	82.8	1,480	30
70	120	10	M8	18	7	2,650	6,270	110	2,200	35
80	140	11	M10	25	8.7	3,430	8,040	147	3,200	40
100	160	11	M10	25	8.7	6,080	15,900	397	6,700	50
108	180	12	M12	25	10.7	7,550	20,000	530	8,560	60

1N  $\approx$  0.102kgf 1N · m  $\approx$  0.102kgf · m

# AK TYPE

– Compact Block Type –



## part number structure

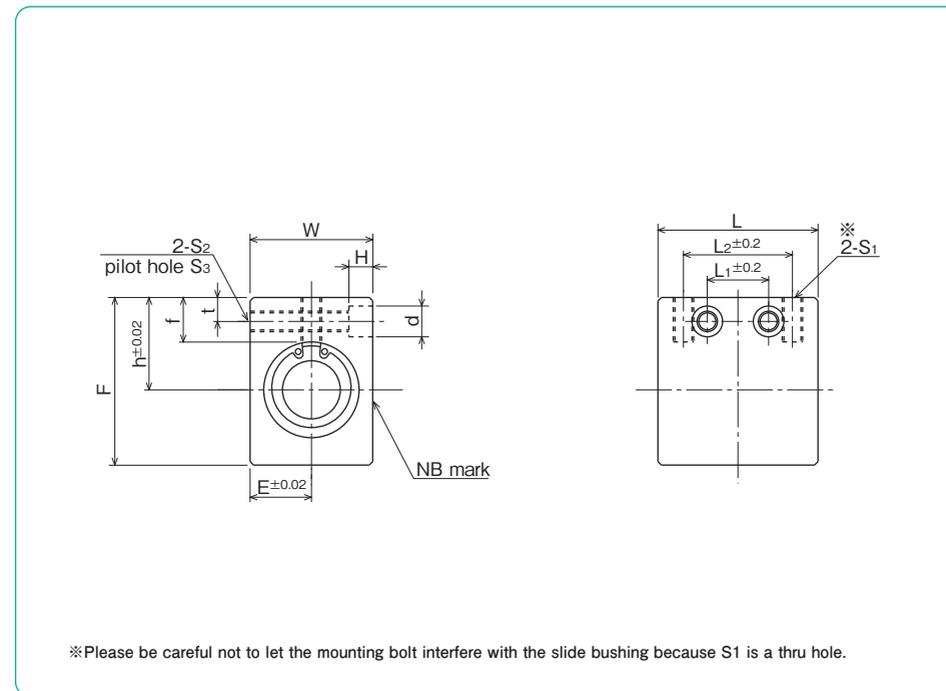
example **AKS25G UU**

specification  
**AK**: standard  
**AKS**: anti-corrosion

seal  
**blank**: without seal  
**UU**: seals on both sides

retainer material  
**blank**: standard/steel  
 anti-corrosion/stainless steel  
**G**: resin

inner contact diameter



part number	inner contact diameter		outer dimensions					major dimensions	
	mm	tolerance μm	h mm	E mm	W mm	F mm	L mm	L <sub>2</sub> mm	S <sub>1</sub>
<b>AK 6GUU</b>	6	- 9	14	8	16	22	27	18	M4
<b>AK 8GUU</b>	8		16	10	20	26	32	20	M5
<b>AK 10GUU</b>	10		19	13	26	32	39	27	M6
<b>AK 12GUU</b>	12		20	14	28	34	40	27	M6
<b>AK 13GUU</b>	13		25	15	30	43	42	28	M6
<b>AK 16GUU</b>	16		27	18	36	49	47	32	M6
<b>AK 20GUU</b>	20	0	31	21	42	54	52	36	M8
<b>AK 25GUU</b>	25		37	26	52	65	69	42	M10
<b>AK 30GUU</b>	30		40	29	58	71	74	44	M10

f mm	mounting dimensions						basic load rating	mass g	shaft diameter mm	
	L <sub>1</sub> mm	t mm	S <sub>2</sub>	S <sub>3</sub> mm	d mm	H mm	dynamic C N			static Co N
8	9	5	M4	3.5	6	5	206	265	25	6
8.5	10	5	M4	3.5	6	5	274	392	47	8
9.5	15	6	M5	4.5	8	6	372	549	98	10
9.5	15	6	M5	4.5	8	6	510	784	109	12
13.5	16	7	M6	5.2	9	7	510	784	154	13
13	18	7	M6	5.2	9	7	774	1,180	235	16
15	18	8	M8	7	11	8	882	1,370	302	20
17	22	9	M10	8.9	14	10	980	1,570	664	25
17.5	22	9	M10	8.9	14	10	1,570	2,740	800	30

1N≐0.102kgf

# AK-W TYPE

– Double-Wide Compact Block Type –



## part number structure

example **AKS 25 G W UU**

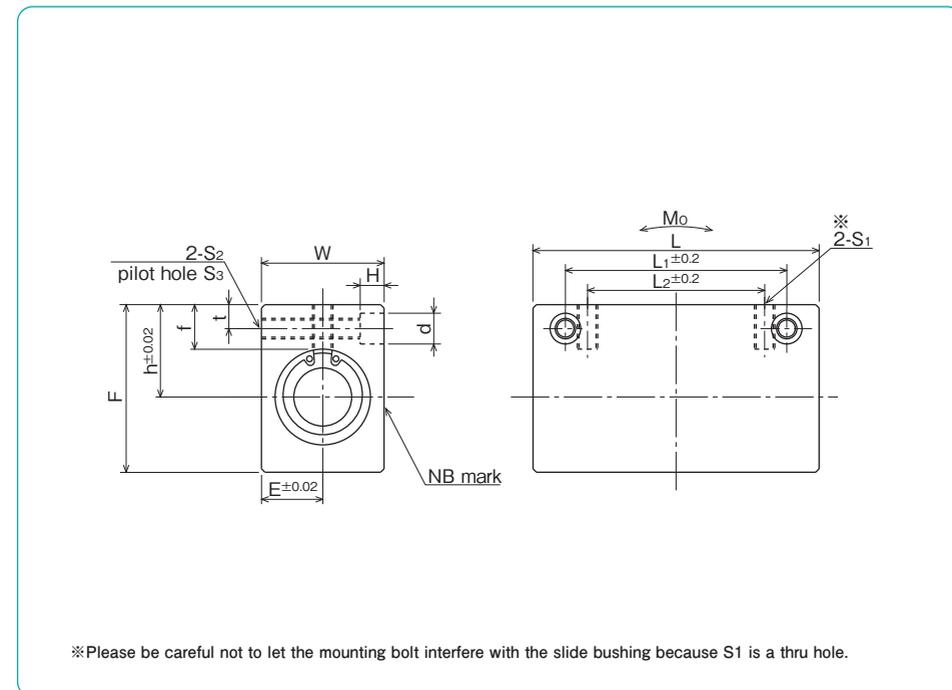
specification  
 AK: standard  
 AKS: anti-corrosion

inner contact diameter

retainer material  
 blank: standard/steel  
 anti-corrosion/stainless steel  
 G: resin

seal  
 blank: without seal  
 UU: seals on both sides

double-wide type



part number	inner contact diameter		outer dimensions					major dimensions		
	mm	tolerance μm	h mm	E mm	W mm	F mm	L mm	L <sub>2</sub> mm	S <sub>1</sub>	
AK 6GWUU	6	0 - 9	14	8	16	22	46	20	M4	
AK 8GWUU	8		16	10	20	26	56	30	M5	
AK10GWUU	10		19	13	26	32	68	36	M6	
AK12GWUU	12		20	14	28	34	70	36	M6	
AK13GWUU	13		25	15	30	43	74	42	M6	
AK16GWUU	16		27	18	36	49	84	52	M6	
AK20GWUU	20	0 -10	31	21	42	54	94	58	M8	
AK25GWUU	25		37	26	52	65	128	80	M10	
AK30GWUU	30		40	29	58	71	138	90	M10	

f mm	mounting dimensions						basic load rating		allowable static moment Mo N · m	mass g	shaft diameter mm
	L <sub>1</sub> mm	t mm	S <sub>2</sub>	S <sub>3</sub> mm	d mm	H mm	dynamic C N	static Co N			
8	30	5	M4	3.5	6	5	323	530	2.18	47	6
8.5	42	5	M4	3.5	6	5	431	784	4.31	89	8
9.5	50	6	M5	4.5	8	6	588	1,100	7.24	186	10
9.5	50	6	M5	4.5	8	6	813	1,570	10.9	206	12
13.5	55	7	M6	5.2	9	7	813	1,570	11.6	292	13
13	65	7	M6	5.2	9	7	1,230	2,350	19.7	445	16
15	70	8	M8	7	11	8	1,400	2,740	26.8	580	20
17	100	9	M10	8.9	14	10	1,560	3,140	43.4	1,300	25
17.5	110	9	M10	8.9	14	10	2,490	5,490	82.8	1,560	30

1N ≙ 0.102kgf 1N · m ≙ 0.102kgf · m

# SMP TYPE

– Pillow Block Type –



## part number structure

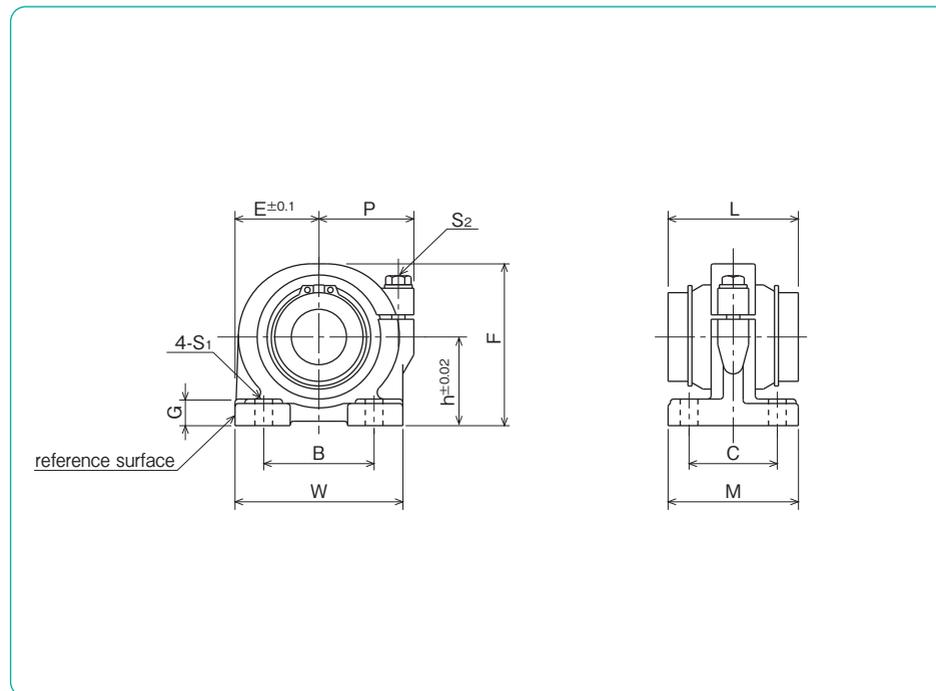
example **SMP 25 G UU**

SMP type

inner contact diameter

seal  
blank: without seal  
UU: seals on both sides

retainer material  
blank: steel  
G: resin



part number	inner contact diameter		major dimensions							
	mm	tolerance	h mm	E mm	outer dimensions				G mm	M mm
		μm			W mm	L mm	F mm			
SMP13GUU	13	0	25	25	50	32	46	8	36	
SMP16GUU	16	- 9	29	27.5	55	37	53	10	40	
SMP20GUU	20	0	34	32.5	65	42	62	12	48	
SMP25GUU	25		-10	40	38	76	59	73	12	59
SMP30GUU	30	0	45	42.5	85	64	84	15	69	
SMP35GUU	35		-12	50	49	98	70	94	15	76
SMP40GUU	40	0	60	62	124	80	112	18	86	
SMP50GUU	50		-15	70	72	144	100	134	20	105
SMP60GUU	60	0/-15	82	84.5	169	110	154	23	115	

P mm	mounting dimensions			adjustment screw size	recommended torque N · m	basic load rating		mass g	shaft diameter mm
	B mm	C mm	S <sub>1</sub> mm			dynamic C N	static C <sub>0</sub> N		
	30	30	26	7 (M5)	M5	3	510	784	270
32	35	29	7 (M5)	M5	3	774	1,180	380	16
37	40	35	8 (M6)	M6	5.5	882	1,370	680	20
43	50	40	8 (M6)	M6	5.5	980	1,570	1,000	25
49	58	46	10 (M8)	M8	13.5	1,570	2,740	1,400	30
58	62	53	12 (M10)	M10	29	1,670	3,140	2,100	35
68	76	64	12 (M10)	M10	29	2,160	4,020	3,700	40
80	100	70	14 (M12)	M12	29	3,820	7,940	6,100	50
88	115	80	14 (M12)	M12	29	4,700	10,000	8,700	60

1N≐0.102kgf

# SMJ TYPE

– Clearance Adjustable Type –



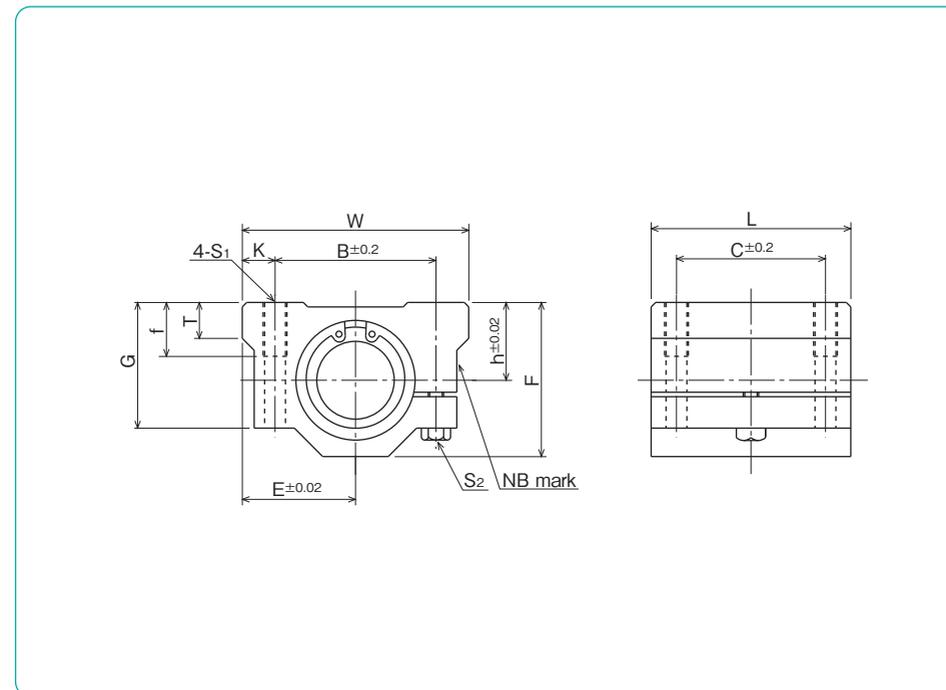
## part number structure

example **SMSJ 25 G UU**

specification SMJ: standard SMSJ: anti-corrosion	inner contact diameter	retainer material blank: standard/steel* anti-corrosion/stainless steel* G: resin	seal blank: without seal UU: seals on both sides
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\*Size 10 is provided with resin retainer type only.

part number	inner contact diameter mm	major dimensions							
		h mm	E mm	outer dimensions			G mm	T mm	B mm
				W mm	L mm	F mm			
SMJ10GUU	10	13	20	40	35	26	21	8	28
SMJ12GUU	12	15	21	42	36	28	24	8	30.5
SMJ13GUU	13	15	22	44	39	30	24.5	8	33
SMJ16GUU	16	19	25	50	44	38.5	32.5	9	36
SMJ20GUU	20	21	27	54	50	41	35	11	40
SMJ25GUU	25	26	38	76	67	51.5	42	12	54
SMJ30GUU	30	30	39	78	72	59.5	49	15	58
SMJ35GUU	35	34	45	90	80	68	54	18	70
SMJ40GUU	40	40	51	102	90	78	62	20	80
SMJ50GUU	50	52	61	122	110	102	80	25	100
SMJ60GUU	60	58	66	132	122	114	94	30	108



mounting dimensions				adjustment screw size S <sub>2</sub>	basic load rating		mass g	shaft diameter mm
C mm	K mm	S <sub>1</sub>	f mm		dynamic C N	static C <sub>0</sub> N		
21	6	M5	12	M4	372	549	92	10
26	5.75	M5	12	M4	510	784	102	12
26	5.5	M5	12	M4	510	784	120	13
34	7	M5	12	M4	774	1,180	200	16
40	7	M6	12	M5	882	1,370	255	20
50	11	M8	18	M6	980	1,570	600	25
58	10	M8	18	M6	1,570	2,740	735	30
60	10	M8	18	M6	1,670	3,140	1,100	35
60	11	M10	25	M8	2,160	4,020	1,590	40
80	11	M10	25	M8	3,820	7,940	3,340	50
90	12	M12	25	M10	4,700	10,000	4,270	60

1N≐0.102kgf

# SME TYPE

– Open Block Type –



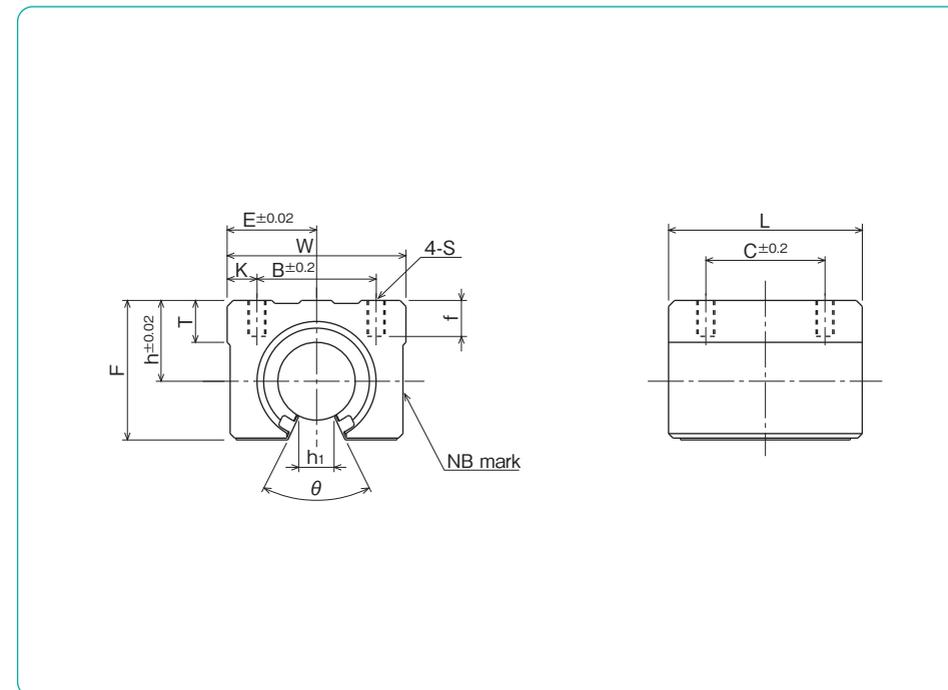
## part number structure

example **SMSE 25 G UU**

specification SME: standard SMSE: anti-corrosion	inner contact diameter	retainer material blank: standard/steel* anti-corrosion/stainless steel* G: resin	seal blank: without seal UU: seals on both sides
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\*Size 10 is provided with resin retainer type only.

part number	inner contact diameter mm	major dimensions							
		h mm	E mm	W mm	outer dimensions				$\theta$
					L mm	F mm	T mm	$h_1$ mm	
SME10GUU	10	15	18	36	32	24	7	6	80°
SME13GUU	13	17	20	40	39	28	8	8.5	80°
SME16GUU	16	20	22.5	45	45	33	9	10	80°
SME20GUU	20	23	24	48	50	39	11	10	60°
SME25GUU	25	27	30	60	65	47	14	11.5	50°
SME30GUU	30	33	35	70	70	56	15	14	50°
SME35GUU	35	37	40	80	80	63	18	16	50°
SME40GUU	40	42	45	90	90	72	20	19	50°
SME50GUU	50	53	60	120	110	92	25	23	50°



mounting dimensions					basic load rating		mass g	shaft diameter mm
B mm	C mm	K mm	S	f mm	dynamic C N	static Co N		
25	20	5.5	M5	10	372	549	65	10
28	26	6	M5	10	510	784	100	13
32	30	6.5	M5	12	774	1,180	150	16
35	35	6.5	M6	12	882	1,370	200	20
40	40	10	M6	12	980	1,570	450	25
50	50	10	M8	18	1,570	2,740	630	30
55	55	12.5	M8	18	1,670	3,140	925	35
65	65	12.5	M10	20	2,160	4,020	1,330	40
94	80	13	M10	20	3,820	7,940	3,000	50

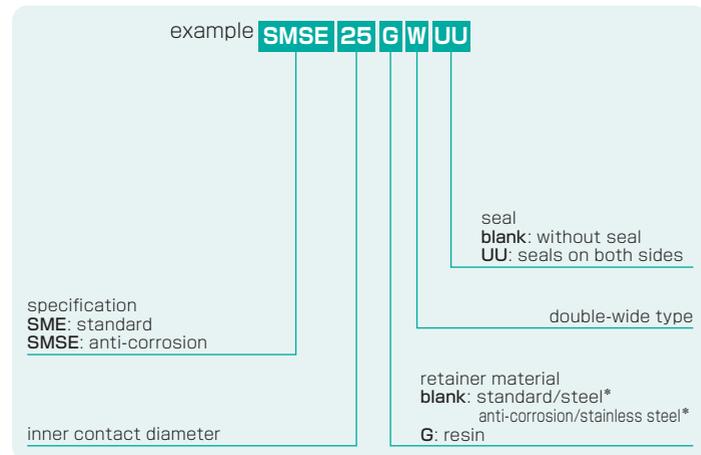
1N · m ≒ 0.102kgf · m

# SME-W TYPE

— Double-wide Open Block Type —

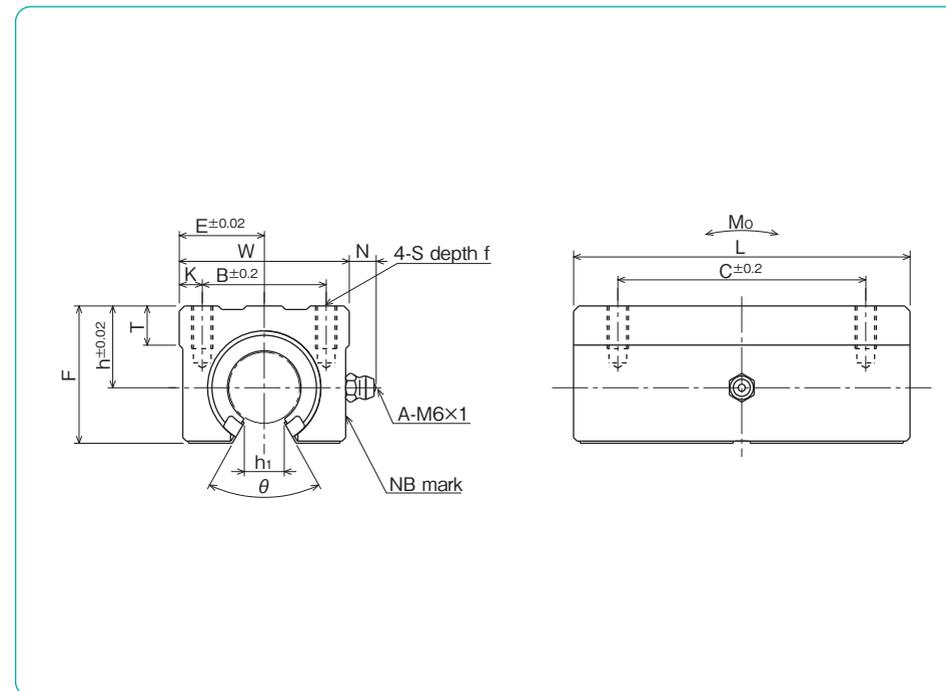


## part number structure



\*Size 10 is provided with resin retainer type only.

part number	inner contact diameter mm	major dimensions								
		h mm	E mm	W mm	outer dimensions			N mm	h <sub>1</sub> mm	θ
					L mm	F mm	T mm			
<b>SME10GWUU</b>	10	15	18	36	65	24	7	7.5	6	80°
<b>SME13GWUU</b>	13	17	20	40	75	28	8	7.5	8.5	80°
<b>SME16GWUU</b>	16	20	22.5	45	85	33	9	7.5	10	80°
<b>SME20GWUU</b>	20	23	24	48	95	39	11	7.5	10	60°
<b>SME25GWUU</b>	25	27	30	60	130	47	14	7.5	11.5	50°
<b>SME30GWUU</b>	30	33	35	70	140	56	15	7.5	14	50°



mounting dimensions					basic load rating		※allowable static moment Mo N·m	mass g	shaft diameter mm
B mm	C mm	K mm	S	f mm	dynamic C N	static Co N			
25	40	5.5	M5	10	588	1,100	4.63	140	10
28	50	6	M5	10	813	1,570	7.42	200	13
32	60	6.5	M5	12	1,230	2,350	12.6	300	16
35	70	6.5	M6	12	1,400	2,740	14.5	400	20
40	90	10	M6	12	1,560	3,140	24.7	900	25
50	100	10	M8	18	2,490	5,490	47.2	1,260	30

1N≐0.102kgf 1N·m≐0.102kgf·m

※Steel or stainless steel cages with an inscribed circle diameter of 16 or less cannot receive moment loads.

# SMD TYPE

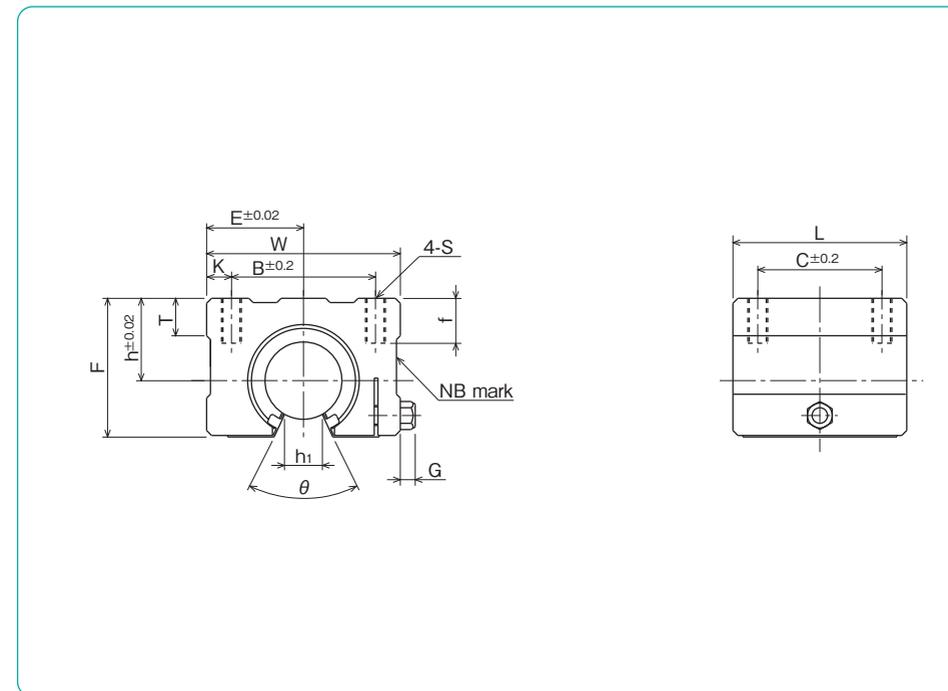
— Open Block with Clearance Adjustable Type —



## part number structure

example **SMSD 25 G UU**

specification SMD: standard SMSD: anti-corrosion	inner contact diameter	retainer material blank: standard/steel anti-corrosion/stainless steel G: resin	seal blank: without seal UU: seals on both sides
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part number	inner contact diameter mm	h mm	E mm	W mm	outer dimensions			major dimensions			
					L mm	F mm	T mm	G mm	h <sub>1</sub> mm	θ	
SMD16GUU	16	20	25	50	45	33	9	6	10	80°	
SMD20GUU	20	23	27	54	50	39	11	7	10	60°	
SMD25GUU	25	27	38	76	65	47	14	7	11.5	50°	
SMD30GUU	30	33	39	78	70	56	15	7	14	50°	

mounting dimensions					basic load rating		mass g	shaft diameter mm
B mm	C mm	K mm	S	f mm	dynamic C N	static Co N		
36	30	7	M5	12	774	1,180	170	16
40	35	7	M6	12	882	1,370	240	20
54	40	11	M6	12	980	1,570	580	25
58	50	10	M8	18	1,570	2,740	720	30

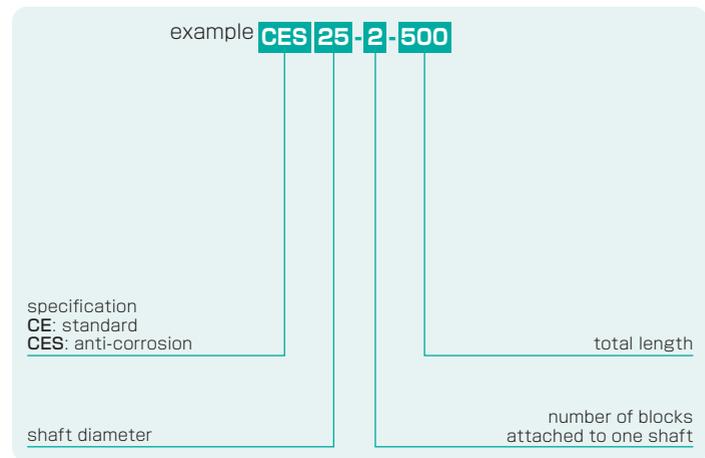
1N≐0.102kgf

# CE TYPE

– Non-Clearance Adjustable Type –

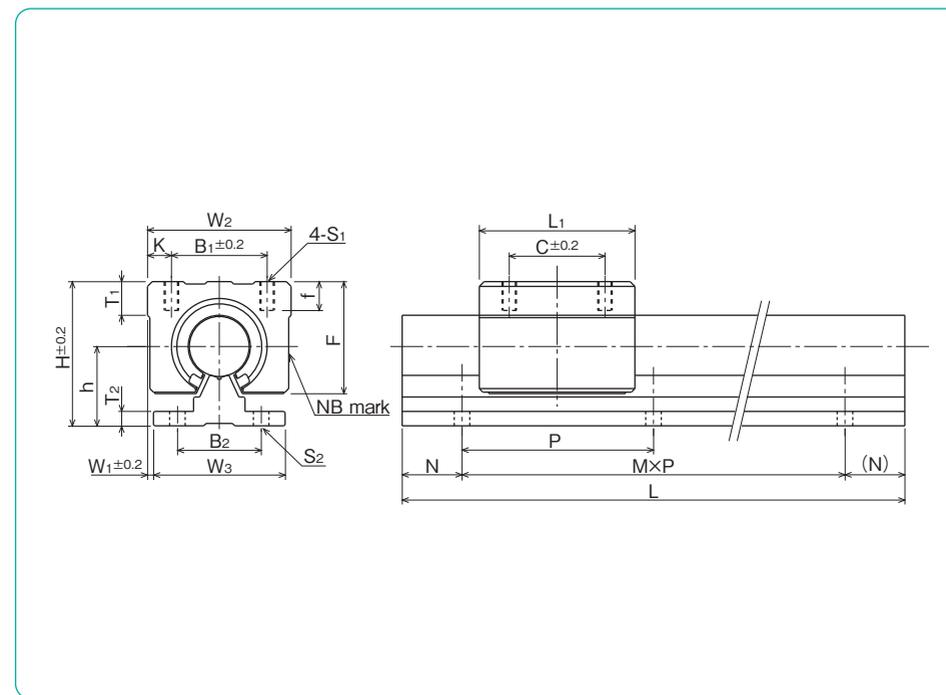


## part number structure



※Inside bush is a resin retainer type with seals.

part number		shaft diameter	assembly dimension	block dimension										major dimensions						
standard	anti-corrosion			tolerance g6 μm	H	h	W <sub>1</sub>	W <sub>2</sub>	F	L <sub>1</sub>	B <sub>1</sub>	C	K	T <sub>1</sub>	S <sub>1</sub>	f	W <sub>3</sub>	B <sub>2</sub>	T <sub>2</sub>	P
<b>CE16</b>	<b>CES16</b>	16	-6 -17	45	25	2.5	45	33	45	32	30	6.5	9	M5	12	40	30	5	150	5.5
<b>CE20</b>	<b>CES20</b>	20		50	27	1.5	48	39	50	35	35	6.5	11	M6	12	45	30	5	150	5.5
<b>CE25</b>	<b>CES25</b>	25	-7 -20	60	33	2.5	60	47	65	40	40	10	14	M6	12	55	35	6	200	6.5
<b>CE30</b>	<b>CES30</b>	30		70	37	5	70	56	70	50	50	10	15	M8	18	60	40	7	200	6.5



support rail dimensions L (M,N)				basic load rating		mass		size
mm				dynamic C N	static Co N	block g	rail kg/m	
300 (1,75)	500 (3,25)	800 (5,25)	1,000 (6,50)	774	1,180	150	2.58	<b>16</b>
300 (1,75)	500 (3,25)	800 (5,25)	1,000 (6,50)	882	1,370	200	3.49	<b>20</b>
1,500 (9,75)	1,800 (11,75)	2,000 (13,25)		980	1,570	450	5.31	<b>25</b>
300 (1,50)	500 (2,50)	800 (3,100)	1,000 (4,100)	1,570	2,740	630	7.39	<b>30</b>
1,500 (7,50)	1,800 (8,100)	2,000 (9,100)						

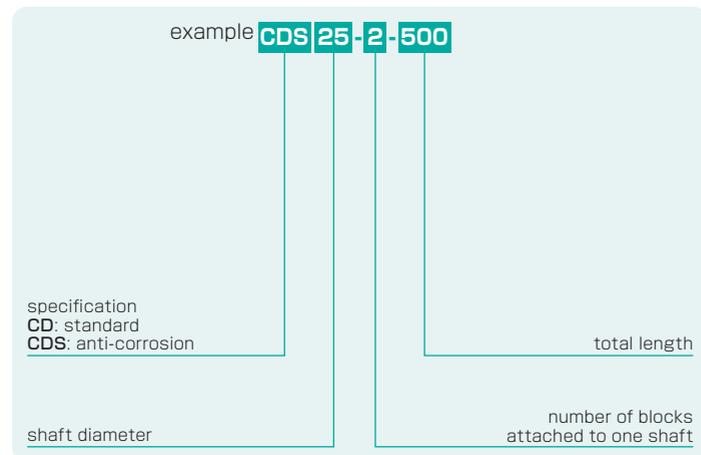
1N≐0.102kgf

# CD TYPE

– Clearance Adjustable Type –

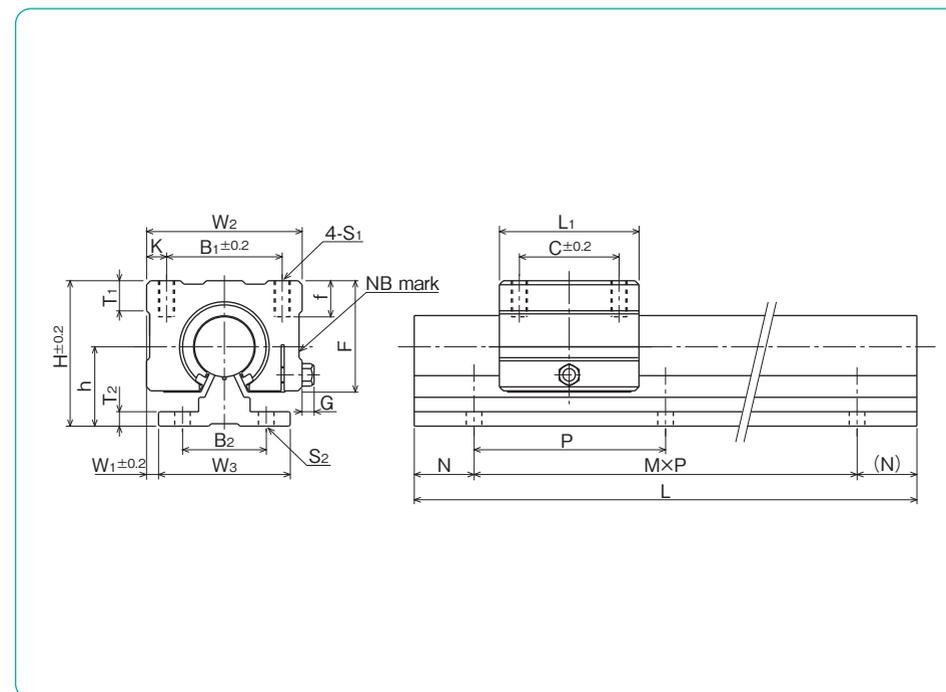


## part number structure



※Inside bush is a resin retainer type with seals.

part number		shaft diameter	assembly dimension													block dimension					major dimensions				
standard	anti-corrosion		mm	tolerance g6 μm	H	h	W <sub>1</sub>	W <sub>2</sub>	F	L <sub>1</sub>	B <sub>1</sub>	C	K	T <sub>1</sub>	S <sub>1</sub>	f	G	W <sub>3</sub>	B <sub>2</sub>	T <sub>2</sub>	P	S <sub>2</sub>			
<b>CD16</b>	<b>CDS16</b>	16	-6 -17	45	25	5	50	33	45	36	30	7	9	M5	12	6	40	30	5	150	5.5				
<b>CD20</b>	<b>CDS20</b>	20		50	27	4.5	54	39	50	40	35	7	11	M6	12	7	45	30	5	150	5.5				
<b>CD25</b>	<b>CDS25</b>	25	-7 -20	60	33	10.5	76	47	65	54	40	11	12	M6	12	7	55	35	6	200	6.5				
<b>CD30</b>	<b>CDS30</b>	30		70	37	9	78	56	70	58	50	10	15	M8	18	7	60	40	7	200	6.5				



support rail dimensions L (M,N)				basic load rating		mass		size
mm				dynamic C	static Co	block g	rail kg/m	
300 (1,75)	500 (3,25)	800 (5,25)	1,000 (6,50)	774	1,180	170	2.58	<b>16</b>
1,500 (9,75)	1,800 (11,75)	2,000 (13,25)						
300 (1,75)	500 (3,25)	800 (5,25)	1,000 (6,50)	882	1,370	240	3.49	<b>20</b>
1,500 (9,75)	1,800 (11,75)	2,000 (13,25)						
300 (1,50)	500 (2,50)	800 (3,100)	1,000 (4,100)	980	1,570	580	5.31	<b>25</b>
1,500 (7,50)	1,800 (8,100)	2,000 (9,100)						
300 (1,50)	500 (2,50)	800 (3,100)	1,000 (4,100)	1,570	2,740	720	7.39	<b>30</b>
1,500 (7,50)	1,800 (8,100)	2,000 (9,100)						

1N≒0.102kgf

# SWA TYPE (Inch Standard)

– Block Type –



## part number structure

example **SWA 20 G R UU**

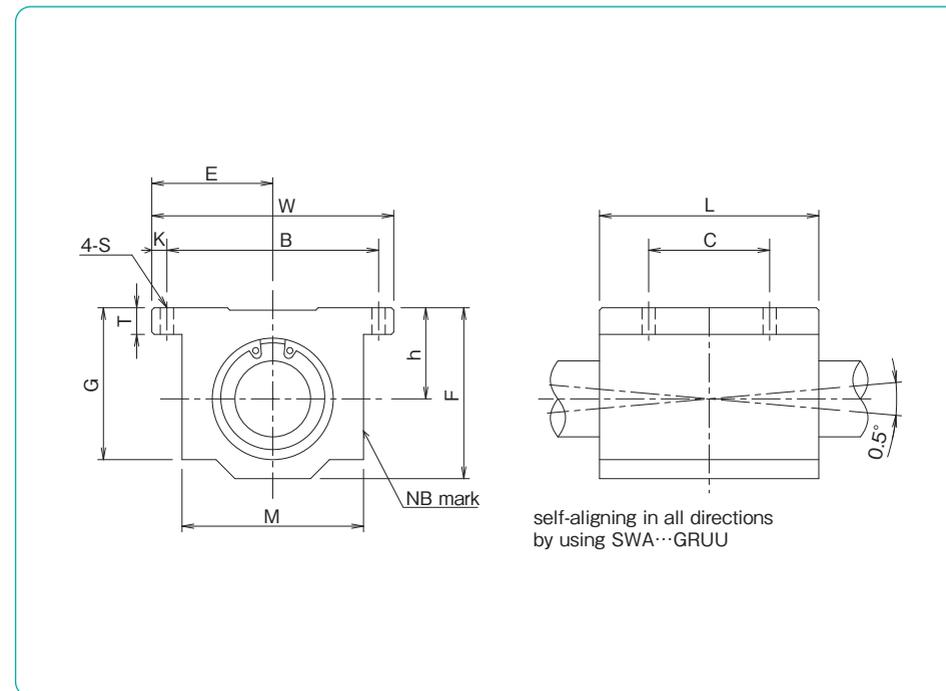
specification  
**SWA**: standard  
**SWSA**: anti-corrosion

size

retainer material  
**blank**: standard/steel  
 anti-corrosion/stainless steel  
**G**: resin

seal  
**blank**: without seal  
**UU**: seals on both sides

self-aligning  
 (SWA-resin retainer only)



part number	inner contact diameter		major dimensions				
	tolerance		outer dimensions				
	inch/(mm)	inch/(μm)	h ±.001/(±0.02) inch/(mm)	E ±.001/(±0.02) inch/(mm)	W inch/(mm)	L inch/(mm)	F inch/(mm)
<b>SWA 4GUU</b>	.2500 (6.350)	0 −.00040 (−9)	.4370 (11.100)	.8125 (20.638)	1.625 (41.28)	1.188 (30.16)	.813 (20.64)
<b>SWA 6GUU</b>	.3750 (9.525)		.5000 (12.700)	.8750 (22.225)	1.750 (44.45)	1.313 (33.34)	.938 (23.82)
<b>SWA 8GUU</b>	.5000 (12.700)		.6870 (17.450)	1.0000 (25.400)	2.000 (50.80)	1.688 (42.86)	1.250 (31.75)
<b>SWA 10GUU</b>	.6250 (15.875)	0 −.00040 (−10)	.8750 (22.225)	1.2500 (31.750)	2.500 (63.50)	1.938 (49.21)	1.625 (41.28)
<b>SWA 12GUU</b>	.7500 (19.050)		.9370 (23.800)	1.3750 (34.925)	2.750 (69.85)	2.063 (52.39)	1.750 (44.45)
<b>SWA 16GUU</b>	1.0000 (25.400)		1.1870 (30.150)	1.6250 (41.275)	3.250 (82.55)	2.813 (71.44)	2.188 (55.56)
<b>SWA 20GUU</b>	1.2500 (31.750)	0 −.00050 (−12)	1.5000 (38.100)	2.0000 (50.800)	4.000 (101.60)	3.625 (92.08)	2.813 (71.44)
<b>SWA 24GUU</b>	1.5000 (38.100)		1.7500 (44.450)	2.3750 (60.325)	4.750 (120.65)	4.000 (101.60)	3.250 (82.55)
<b>SWA 32GUU</b>	2.0000 (50.800)		2.1250 (53.975)	3.0000 (76.200)	6.000 (152.40)	5.000 (127.00)	4.063 (103.19)

Product of NB Corporation of America

T	G	M	mounting dimensions				dynamic C	static Co	mass
			B	C	K	S			
			±.01/(±0.2) inch/(mm)	±.01/(±0.2) inch/(mm)	inch/(mm)	inch/(mm)			
.188 (4.76)	.750 (19.05)	1.000 (25.40)	1.312 (33.33)	.750 (19.05)	.156 (3.96)	.156 (3.96)	206	265	45
.188 (4.76)	.875 (22.23)	1.125 (28.58)	1.437 (36.50)	.875 (22.23)	.156 (3.96)	.156 (3.96)	225	314	62
.250 (6.35)	1.125 (28.58)	1.375 (34.93)	1.688 (42.88)	1.000 (25.40)	.156 (3.96)	.156 (3.96)	510	784	130
.281 (7.14)	1.437 (36.50)	1.750 (44.45)	2.125 (53.98)	1.125 (28.58)	.188 (4.76)	.188 (4.76)	774	1,180	240
.313 (7.94)	1.563 (39.69)	1.875 (47.63)	2.375 (60.33)	1.250 (31.75)	.188 (4.76)	.188 (4.76)	862	1,370	290
.375 (9.53)	1.938 (49.21)	2.375 (60.33)	2.875 (73.03)	1.750 (44.45)	.188 (4.76)	.219 (5.56)	980	1,570	615
.438 (11.11)	2.500 (63.50)	3.000 (76.20)	3.500 (88.90)	2.000 (50.80)	.250 (6.35)	.219 (5.56)	1,570	2,740	1,300
.500 (12.70)	2.875 (73.03)	3.500 (88.90)	4.125 (104.78)	2.500 (63.50)	.313 (7.94)	.281 (7.14)	2,160	4,020	1,900
.625 (15.88)	3.625 (92.08)	4.500 (114.30)	5.250 (133.35)	3.250 (82.55)	.375 (9.53)	.413 (10.50)	3,820	7,940	3,600

SI UNIT 1N≐0.225lbf  
 1kg≐2.205lbs

# SWJ TYPE (Inch Standard)

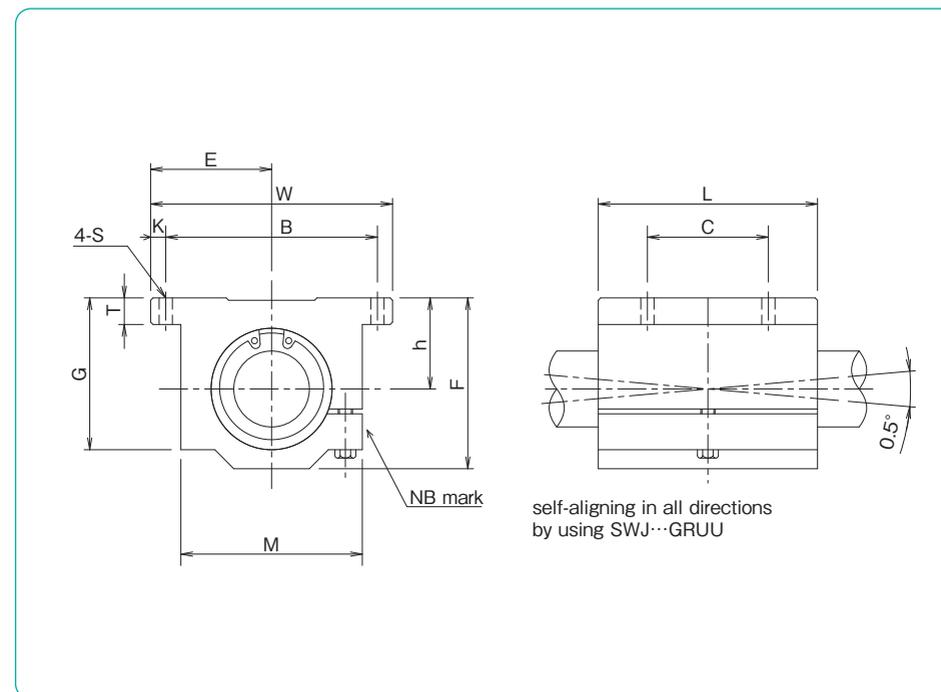
– Clearance Adjustable Block Type –



## part number structure

example **SWJ 20 G R UU**

- specification**  
**SWJ**: standard  
**SWSJ**: anti-corrosion
- size**
- retainer material**  
**blank**: standard/steel  
     anti-corrosion/stainless steel  
**G**: resin
- seal**  
**blank**: without seal  
**UU**: seals on both sides
- self-aligning**  
 (SWJ-resin retainer only)



part number	inner contact diameter inch/(mm)	major dimensions outer dimensions				
		h ±.001/(±0.02) inch/(mm)	E ±.001/(±0.02) inch/(mm)	W inch/(mm)	L inch/(mm)	F inch/(mm)
<b>SWJ 4GUU</b>	.2500 (6.350)	.4370 (11.100)	.8125 (20.638)	1.625 (41.28)	1.188 (30.16)	.813 (20.64)
<b>SWJ 6GUU</b>	.3750 (9.525)	.5000 (12.700)	.8750 (22.225)	1.750 (44.45)	1.313 (33.34)	.938 (23.82)
<b>SWJ 8GUU</b>	.5000 (12.700)	.6870 (17.450)	1.0000 (25.400)	2.000 (50.80)	1.688 (42.86)	1.250 (31.75)
<b>SWJ 10GUU</b>	.6250 (15.875)	.8750 (22.225)	1.2500 (31.750)	2.500 (63.50)	1.938 (49.21)	1.625 (41.28)
<b>SWJ 12GUU</b>	.7500 (19.050)	.9370 (23.800)	1.3750 (34.925)	2.750 (69.85)	2.063 (52.39)	1.750 (44.45)
<b>SWJ 16GUU</b>	1.0000 (25.400)	1.1870 (30.150)	1.6250 (41.275)	3.250 (82.55)	2.813 (71.44)	2.188 (55.56)
<b>SWJ 20GUU</b>	1.2500 (31.750)	1.5000 (38.100)	2.0000 (50.800)	4.000 (101.60)	3.625 (92.08)	2.813 (71.44)
<b>SWJ 24GUU</b>	1.5000 (38.100)	1.7500 (44.450)	2.3750 (60.325)	4.750 (120.65)	4.000 (101.60)	3.250 (82.55)
<b>SWJ 32GUU</b>	2.0000 (50.800)	2.1250 (53.975)	3.0000 (76.200)	6.000 (152.40)	5.000 (127.00)	4.063 (103.19)

Product of NB Corporation of America

T	G	M	mounting dimensions				dynamic C	static Co	mass
			B ±.01/(±0.2) inch/(mm)	C ±.01/(±0.2) inch/(mm)	K inch/(mm)	S inch/(mm)			
.188 (4.76)	.750 (19.05)	1.000 (25.40)	1.312 (33.33)	.750 (19.05)	.156 (3.96)	.156 (3.96)	206	265	45
.188 (4.76)	.875 (22.23)	1.125 (28.58)	1.437 (36.50)	.875 (22.23)	.156 (3.96)	.156 (3.96)	225	315	62
.250 (6.35)	1.125 (28.58)	1.375 (34.93)	1.688 (42.88)	1.000 (25.40)	.156 (3.96)	.156 (3.96)	510	784	130
.281 (7.14)	1.437 (36.50)	1.750 (44.45)	2.125 (53.98)	1.125 (28.58)	.188 (4.76)	.188 (4.76)	774	1,180	240
.313 (7.94)	1.563 (39.69)	1.875 (47.63)	2.375 (60.33)	1.250 (31.75)	.188 (4.76)	.188 (4.76)	862	1,370	290
.375 (9.53)	1.938 (49.21)	2.375 (60.33)	2.875 (73.03)	1.750 (44.45)	.188 (4.76)	.219 (5.56)	980	1,570	615
.438 (11.11)	2.500 (63.50)	3.000 (76.20)	3.500 (88.90)	2.000 (50.80)	.250 (6.35)	.219 (5.56)	1,570	2,740	1,300
.500 (12.70)	2.875 (73.03)	3.500 (88.90)	4.125 (104.78)	2.500 (50.80)	.313 (7.94)	.281 (7.14)	2,160	4,020	1,900
.625 (15.88)	3.625 (92.08)	4.500 (114.30)	5.250 (133.35)	3.250 (82.55)	.375 (9.53)	.413 (10.50)	3,820	7,940	3,600

SI UNIT 1N≒0.225lbf  
1kg≒2.205lbs

# SWD TYPE (Inch Standard)

– Open Block Type –



## part number structure

example **SWD 20 G R UU**

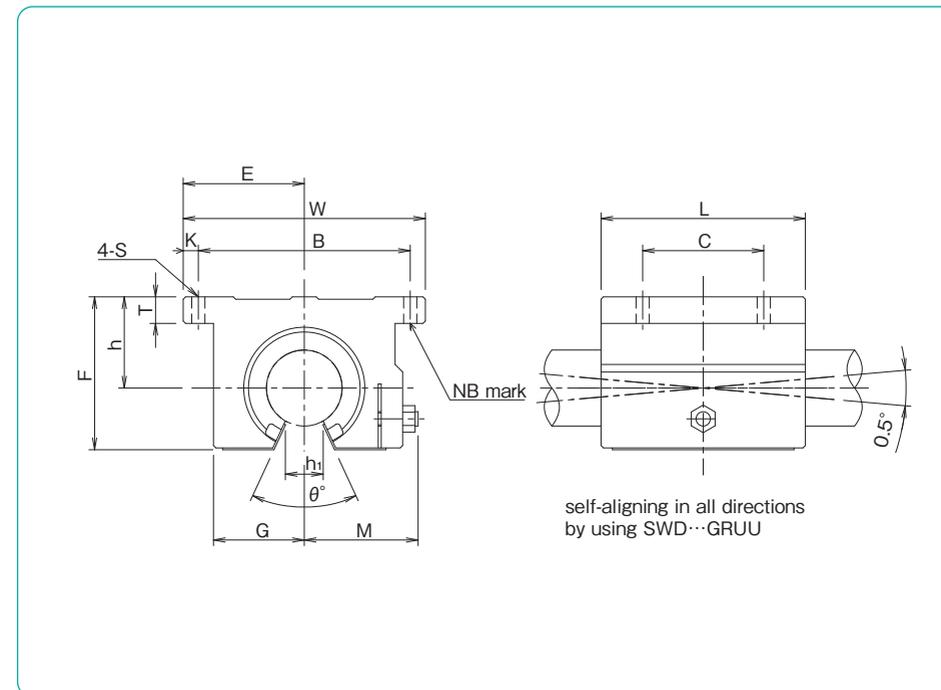
specification  
**SWD**: standard  
**SWSD**: anti-corrosion

size

retainer material  
**blank**: standard/steel  
 anti-corrosion/stainless steel  
**G**: resin

seal  
**blank**: without seal  
**UU**: seals on both sides

self-aligning  
 (SWD-resin retainer only)



part number	major dimensions							
	inner contact diameter inch/(mm)	h ±.001/(±0.02) inch/(mm)	E ±.001/(±0.02) inch/(mm)	W inch/(mm)	L inch/(mm)	F inch/(mm)	outer dimensions	
							T inch/(mm)	G inch/(mm)
<b>SWD 8GUU</b>	.5000 (12.700)	.6870 (17.450)	1.0000 (25.400)	2.000 (50.80)	1.500 (38.10)	1.100 (27.94)	.250 (6.35)	.688 (17.5)
<b>SWD 10GUU</b>	.6250 (15.875)	.8750 (22.225)	1.2500 (31.750)	2.500 (63.50)	1.750 (44.45)	1.375 (34.93)	.281 (7.14)	.875 (22.23)
<b>SWD 12GUU</b>	.7500 (19.050)	.9370 (23.800)	1.3750 (34.950)	2.750 (69.85)	1.875 (47.63)	1.535 (39.00)	.315 (8.00)	.937 (23.80)
<b>SWD 16GUU</b>	1.0000 (25.400)	1.1870 (30.150)	1.6250 (41.300)	3.250 (82.55)	2.625 (66.68)	1.975 (50.17)	.375 (9.53)	1.188 (30.18)
<b>SWD 20GUU</b>	1.2500 (31.750)	1.5000 (38.100)	2.0000 (50.800)	4.000 (101.60)	3.375 (85.73)	2.485 (63.12)	.437 (11.10)	1.500 (38.10)
<b>SWD 24GUU</b>	1.5000 (38.100)	1.7500 (44.450)	2.3750 (60.325)	4.750 (120.65)	3.750 (95.25)	2.910 (73.90)	.500 (12.70)	1.750 (44.45)
<b>SWD 32GUU</b>	2.0000 (50.800)	2.1250 (53.975)	3.0000 (76.200)	6.000 (152.4)	4.750 (120.65)	3.660 (92.90)	.625 (15.88)	2.250 (57.15)

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M	h <sub>1</sub>	θ	mounting dimensions				basic load rating		mass
			B ±.01/(±0.2) inch/(mm)	C ±.01/(±0.2) inch/(mm)	K inch/(mm)	S inch/(mm)	dynamic C N	static C <sub>0</sub> N	
.98 (24.89)	.3425 (8.70)	80°	1.688 (42.88)	1.000 (25.40)	.156 (3.96)	.156 (3.96)	510	784	98
1.15 (29.21)	.375 (9.53)	80°	2.125 (53.98)	1.125 (28.58)	.188 (4.76)	.188 (4.76)	774	1,180	185
1.23 (31.24)	.4375 (11.11)	60°	2.375 (60.33)	1.250 (31.75)	.188 (4.76)	.188 (4.76)	862	1,370	235
1.48 (37.59)	.5625 (14.29)	50°	2.875 (73.03)	1.750 (44.45)	.188 (4.76)	.219 (5.56)	980	1,570	530
1.88 (47.75)	.625 (15.88)	50°	3.500 (88.90)	2.000 (50.80)	.250 (6.35)	.219 (5.56)	1,570	2,740	1,080
2.12 (53.85)	.750 (19.05)	50°	4.125 (104.78)	2.500 (63.50)	.313 (7.94)	.281 (7.14)	2,160	4,020	1,620
2.70 (68.58)	1.00 (25.40)	50°	5.250 (133.35)	3.250 (82.55)	.375 (9.53)	.413 (10.50)	3,820	7,940	3,100

SI UNIT 1N≒0.225lbf  
 1kg≒2.205lbs

# TOPBALL

## TOPBALL

STRUCTURE AND ADVANTAGES	····· D-2
TYPES	····· D-3
SPECIFICATION	····· D-4
LIFE CALCULATION	····· D-4
RELATION BETWEEN BALL CIRCUITS AND LOAD RATING	D-4
MOUNTING	····· D-5
ANTI-CORROSIVE TYPE	····· D-7
USE AND HANDLING PRECAUTIONS	D-7
DIMENSION TABLE	····· D-8~

# TOPBALL

The NB TOPBALL is a linear motion mechanism utilizing the rotational motion of ball elements. NB's self-aligning TOPBALL can be designed into many different applications such as factory automated equipment, machine tools, industrial machines, electrical equipment, optical and measuring instruments.

## STRUCTURE AND ADVANTAGES

### Higher Load Capacity and Longer Travel life

NB's uniquely designed load plate provides circular arch contact to the ball element resulting in a greater dispersion of the load, enabling TOPBALL to provide up to three times the load capacity therefore 27 times the travel life of conventional slide bushings.

### Self Aligning Capability

Load plates are thinner at the ends to provide a pivot point at the center of the plate. The center acts as a fulcrum to compensate for any slight misalignment between the shaft and the housing bore that might be caused by inaccurate machining, mounting errors or shaft deflection.

Straight load plate ST option is available for non self-alignment.

### Floating Seal

NB's unique floating seal design allows for self-alignment while maintaining equal and constant contact to the shaft. Seals do not add to the overall length of the bushing allowing for more compact designs.

### High Speed

TOPBALL meets high speed requirements. The maximum speed is 5m/s.

### Clearance Adjustable

TOPBALL load plates are designed to "float" in the outer sleeve which allows for clearance between the ball elements and shaft to best suit application requirements.

### TOPBALL Unit

This is a TOPBALL with a housing. The housing has the most appropriate bore tolerance that optimizes TOPBALL's performance.

### Tolerance interchangeable with Asian Metric Slide Bush Type

Shaft diameter tolerance for TMF and TMA types is the same as Asian Metric slide Bush (refer to "Clearance and Fit" in page D-5).

TMF type is an easy to mount flange type. Mounting dimensions of TMA type are the same as those of Asian Metric SMA type which makes replacement easy.

Figure D-1 Circular Arch Design and Ground Surface Raceway

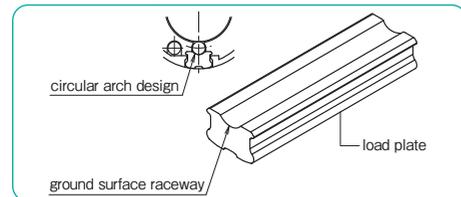


Figure D-3 Basic Structure of TK

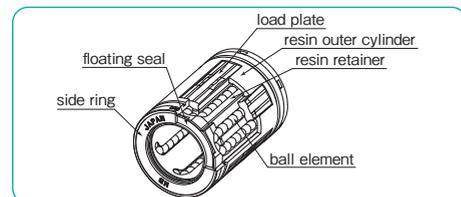
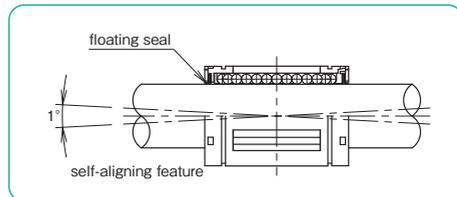


Figure D-2 Floating Seal and Self-aligning Feature



## TYPES

Table D-1 Types

		Metric Series		Inch Series	
TOPBALL	closed type	TK  P.D-8	TW  P.D-10		
	open type	TK-OP  P.D-8	TW-OP  P.D-10		
TOPBALL Unit	closed type	TKA  P.D-12	TKA-W  P.D-13	TWA  P.D-20	TWA-W  P.D-21
	adjustable type	/		TWJ  P.D-22	TWJ-W  P.D-23
	open type	TKE  P.D-14	TKE-W  P.D-15	/	
	adjustable-open type	TKD  P.D-16	TKD-W  P.D-17	TWD  P.D-24	TWD-W  P.D-25
	Tolerance interchangeable with Asian Metric Slide Bush Type	TMF  P.D-18	TMA  P.D-19	/	

## SPECIFICATION

Refer to Table D-2 for NB TOPBALL material and operating temperature range. The operating temperature range of the NB TOPBALL UNIT series is based on the built-in TOPBALL.

Table D-2 Material and Operating Temperature Range

type		outer cylinder	retainer	load plate	ball	operating temperature range
standard	TK	resin	resin	steel	steel	-20°C~80°C
	TW					
	TW-H					
anti-corrosion	TK-SK			steel with electroless nickel plating	stainless steel	
	TW-SK					
	TW-H-SK					

## LIFE CALCULATION

Since ball elements are used as the rolling element in the NB TOPBALL, the following equation is used to calculate the rated life.

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

L: rated life (km) f<sub>H</sub>: hardness coefficient  
 f<sub>T</sub>: temperature coefficient f<sub>C</sub>: contact coefficient  
 f<sub>W</sub>: applied load coefficient (Table D-3)  
 C: basic dynamic load rating (N) P: applied load (N)  
 \*Refer to page Eng-6 for the coefficients.

### Applied Load Coefficient (f<sub>w</sub>)

When calculating the applied load, the weight of the mass, inertial force, moment resulting from the motion, and the variation with time should be accurately estimated. However, it is very difficult to accurately estimate the applied load due to the existence of numerous variables, including the start/stop conditions of the reciprocating motion and of the shock/vibration. Estimation is simplified by using the values given in Table D-3.

If the stroke and number of cycles per unit time are constant, the life time is calculated using the following equation.

$$L_h = \frac{L \cdot 10^6}{2 \cdot \ell_s \cdot n \cdot 60}$$

L<sub>h</sub>: life time (hr) ℓ<sub>s</sub>: stroke length (mm)  
 L: rated life (km) n: number of cycles per minute (cpm)

Table D-3 Applied Load Coefficient

operating conditions	applied load coefficient f <sub>w</sub>
no shock/vibration 0.25m/s or less	1.0~1.5
low shock/vibration 1m/s or less	1.5~2.0
high shock/vibration 1.5m/s or less	2.0~3.5
high shock/vibration 3m/s or less	3.5~4.0
5m/s or less	4.0 or more

## RELATION BETWEEN BALL CIRCUITS AND LOAD RATING

The load rating varies according to the loaded position on the circumference. The value in the dimension table indicates the lowest load rating with the load placed on top of one ball circuit. Table D-4 shows the load ratio for the TK and TW TOPBALL.

Table D-4 Load Positions

size		TK8	TK10~TK16	TK20~TK50	TW3~TW8	TW10	TW12~TW32
C (dynamic load rating in the table)							
C <sub>max</sub> (maximum dynamic load rating)							
load ratio C <sub>max</sub> /C	C <sub>max</sub> /C	1.414	1.463	1.280	1.414	1.463	1.280
C <sub>z</sub> (dynamic load rating in reverse direction)							
load ratio C <sub>z</sub> /C	C <sub>z</sub> /C	—	0.44 <small>(except for TK10)</small>	0.60	0.70 <small>(TW8 only)</small>	0.44	0.57

## MOUNTING

### Clearance and Fit

An appropriate clearance between TOPBALL and shaft is required in TOPBALL operation. Inadequate clearance may cause early failure and/or poor, rough movement. Proper clearance is determined by shaft diameter and housing bore. Table D-5 show recommended tolerances of the shaft and housing bore.

### Tolerance of TMF and TMA type

Shaft diameter tolerance of TMF and TMA types matches that of Asian Metric Slide Bush:g6.

Table D-6 shows recommended tolerances of TMF and TMA types. Please insert TMF type into an installation bore which is slightly larger than the outer cylinder.

### Shaft and Housing

To optimize NB TOPBALL performance, high precision shafts and housings are required.

1. Shaft: Dimensional tolerance, surface roughness and hardness greatly affect the traveling performance of the TOPBALL.

The shaft must be manufactured to the following tolerances.

- A. Surface roughness of Ra0.4 or less.
- B. Hardness of 58 HRC or more (refer to page Eng-6).
- C. The proper tolerance of the shaft diameter is recommended on Table D-5.

The NB Shaft is an ideal component manufactured to meet these specifications. Please see pages F-1 ~ for details.

2. Housing: There are a wide range of designs and manufacturing techniques for housings. NB TOPBALL Units are available as standard products. When housings are prepared separately please refer to Table D-5 for a proper fit.

### Mounting

TK type TOPBALL is designed to be press fitted into the housing bore. When inserting bushing, however, don't apply excess force nor shock load which may cause permanent damage. For TW type TOPBALL, examples of mounting are shown in Figures D-4~7.

### Examples of Mounting

Figures D-4 to D-7 illustrate mounting methods as example.

Figure D-4 Use of Holding Plates

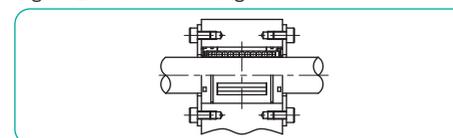
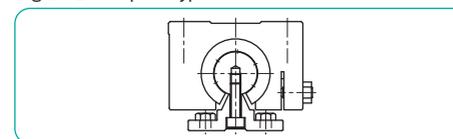


Figure D-6 Open Type



\* Please contact NB for SA type support rails' compatibility with the TOPBALL units.

Table D-5 Recommended Tolerance for Shaft Dia. and Housing Bore

part number	shaft dia.		housing bore	
	dr mm	tol. (h6) μm	D mm	tol. (H7) μm
TK 8	8	0	16	+18/0
TK10	10	-9	19	+21 0
TK12	12	0	22	
TK16	16	-11	26	
TK20	20	0 -13	32	+25 0
TK25	25		40	
TK30	30		47	
TK40	40	0	62	+30
TK50	50	-16	75	0

Table D-6 Recommended Tolerance (TMF,TMA type)

part number	shaft dia.	
	dr mm	tol. (g6) μm
TMF16	—	16
TMF20	TMA20	20
TMF25	TMA25	25
		-6/-17
		-7
		-20

Figure D-5 Use of Retaining Rings

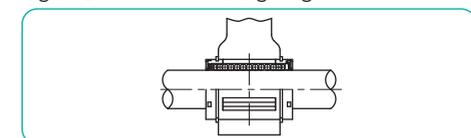
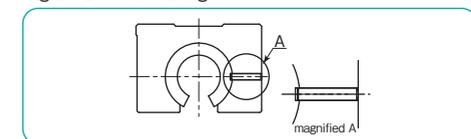


Figure D-7 Pin Fixing



\* Please fix by the pin for open type housing .

### Retaining Ring for Mounting

It is possible to mount NB TOP BALL by retaining ring. It is recommended to select the retaining ring with reference to the Table D-7.

Figure D-8 Retaining Ring

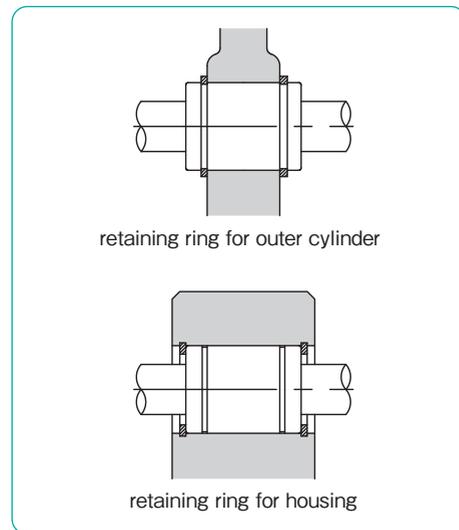


Table D-7 Applicable retaining ring

size	size of retaining ring for outer cylinder	size of retaining ring for housing
TK 8	16	16
TK10	19	19
TK12	22	22
TK16	26	26
TK20	32	32
TK25	40	40
TK30	※ 47	47
TK40	62	62
TK50	75	75

※ part is not in the JIS standard. Please contact NB for details.

### Mounting Surface Shape

Topball unit series are generally mounted by pushing pressing the reference surface of of the block against the shoulder provided on the mounting surface. An undercut as shown in figure D-9 or a radius corner as shown in figure D-10 should be provided at the corner of the shoulder in order to avoid interference with the corner of the reference surface of the block. The maximum corner radius values are shown in Table D-8.

Figure D-9 Radius corner shape of the mounting surface

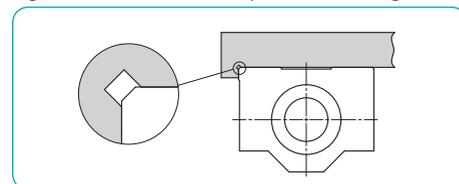


Figure D-10 undercut shape of the mounting surface

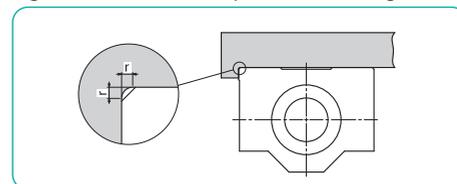


Table D-8 Maximum roundness of corners

Unit : mm

Size	Maximum roundness of corners r						Size	
	Applicable block type							
	TKA	TKA-W	TKE	TKE-W	TKD	TKD-W	TMA	
8	0.3	0.3	—	—	—	—	—	8
10			0.3	0.3	0.3	0.3		10
12	0.5	0.5	0.3	0.3	0.3	0.3	1.0	12
16			0.5	0.5	0.5	0.5		16
20			0.5	0.5	0.5	0.5		20
25			0.5	0.5	0.5	0.5		25
30			0.5	0.5	0.5	0.5		30
40	—	—	—	—	—	—	—	40
50								50

### ANTI-CORROSIVE TYPE

A special TOPBALL is also available for anti-corrosive requirements. Please specify with a suffix "-SK" for either TOPBALL or TOPBALL Unit part number. The load plates are electroless nickel plated and balls are made of stainless steel.

Table D-9

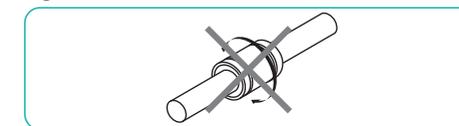
part number	material	
	load plate	ball element
-SK	electroless nickel plate	stainless steel

### USE AND HANDLING PRECAUTIONS

#### Rotational motion not supported

The NB TOPBALL is designed only for linear motion, so that for applications in which a combination of linear and rotational motion is a requirement, Stroke Bush (P. E-2), Slide Rotary Bush (P. E-10), or Rotary Ball Spline (P. B-32) are recommended.

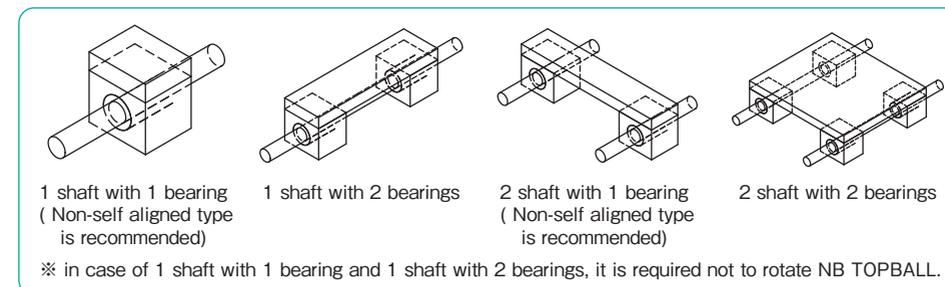
Figure D-11



#### Self Alignment

When used with a single bearing on a single shaft or with a single bearing each on 2 shafts, Self-Alignment causes either shafts or bearings to tilt. To avoid tilting, 2 shafts with 2 bearings on each shaft is recommended. Non-self aligned "ST" type is available only for Euro Metric TK type TOPBALL in size 12 to 40. Please contact NB for details.

Figure D-12



#### Operating Temperature Range

The operating temperature range is from -20°C to 80 °C . In case of operation at a temperature outside of this range, please contact NB.

#### Dust Prevention

Foreign particles and dust in the NB TOPBALL affect the motion accuracy and shorten product life. Standard seals will perform well for dust prevention under normal operating conditions, however, in harsh environment it may be necessary to attach protective covers.

#### Lubrication

It is important to lubricate the NB TOPBALL for an accurate operation and for a long life. Anti-rust oil is applied to the NB TOPBALL prior to shipment only. The NB selected anti-rust oil has a little to no effect on lubricants, however, please apply lubricant after cleaning the TOPBALL, for example, using kerosene, etc. For grease lubrication, lithium soap-based grease is recommended. A special low dust generating grease is also available for clean room application. Please refer to page Eng-51 for details.

#### Operating Speed

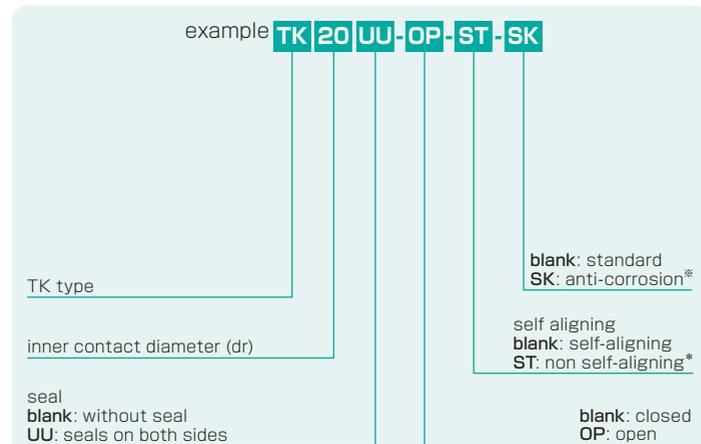
The maximum speed is 5m/s. Product life time may be shortened if operating speed is more than 3m/s due to wear of resin components. Please set applied load coefficient and static safety factor with a margin.

# TK TYPE

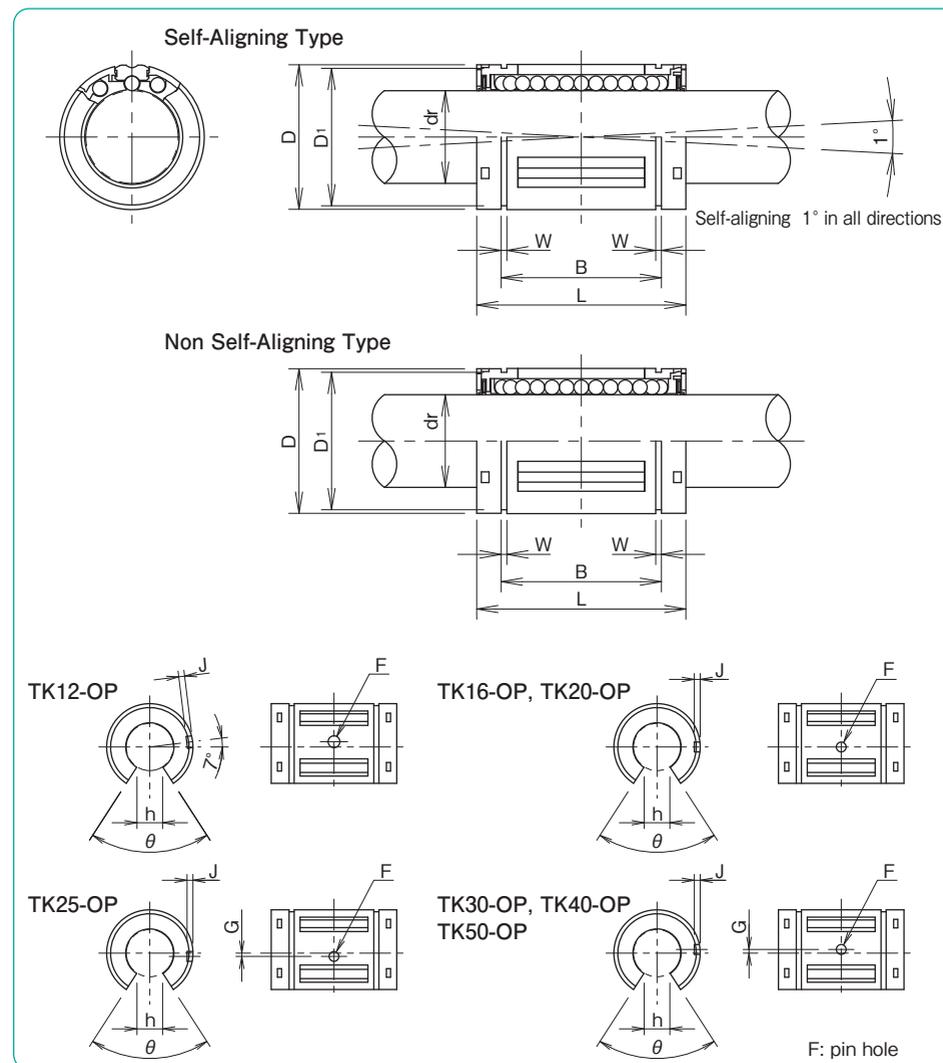
– TOPBALL Metric Type –



## part number structure



※For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.  
\*ST option is available for size 12 to 40



part number		major dimensions										
closed type		open type		dr*		D		L				
number of ball circuits	mass g	number of ball circuits	mass g	mm	tolerance μm	mm	mm	mm	tolerance mm			
TK 8	4	7.2	—	—	—	8	16	25	±0.2			
TK10	5	13.9	—	—	10	+ 8	19	29				
TK12	5	21	TK12-OP	4	17	12	0	22		32		
TK16	5	26	TK16-OP	4	35	16	+ 9	26		36		
TK20	6	54	TK20-OP	5	48	20	- 1	32		45		
TK25	6	122	TK25-OP	5	103	25	+11	40		58		
TK30	6	193	TK30-OP	5	177	30	- 1	47		68		
TK40	6	354	TK40-OP	5	275	40	+13	62		80		
TK50	6	615	TK50-OP	5	520	50	-2	75		100		

One-sided seal is also available. Please contact NB for details.  
\* Based on nominal housing bore

mm	B tolerance mm	W mm	D <sub>1</sub> mm	h mm	θ	open type			basic load rating dynamic C N	static Co N	shaft diameter mm	
						F <sup>H11</sup> mm	G mm	J mm				
16.5	-0.2	1.1	15.2	—	—	3	—	—	423	534	8	
22.0		1.3	18	—	—		—	—	750	935	10	
22.9		1.3	21	6.5	66°		—	0.7	1,020	1,290	12	
24.9		1.3	24.9	9	68°		—	1.0	1,250	1,550	16	
31.5	0	1.6	30.3	9	55°		5	—	1.0	2,090	2,630	20
44.1		1.85	37.5	11.5	57°			1.5	1.5	3,780	4,720	25
52.1		1.85	44.5	14	57°			2	1.7	5,470	6,810	30
60.6		2.15	59	19.5	56°			1.5	2.4	6,590	8,230	40
77.6	-0.3	2.65	72	22.5	54°			2.5	2.7	10,800	13,500	50

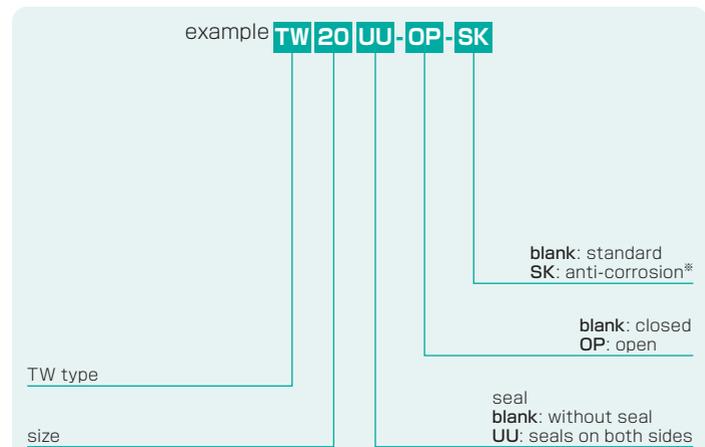
1N≒0.102kgf

# TW TYPE

– TOPBALL Inch Type –



## part number structure



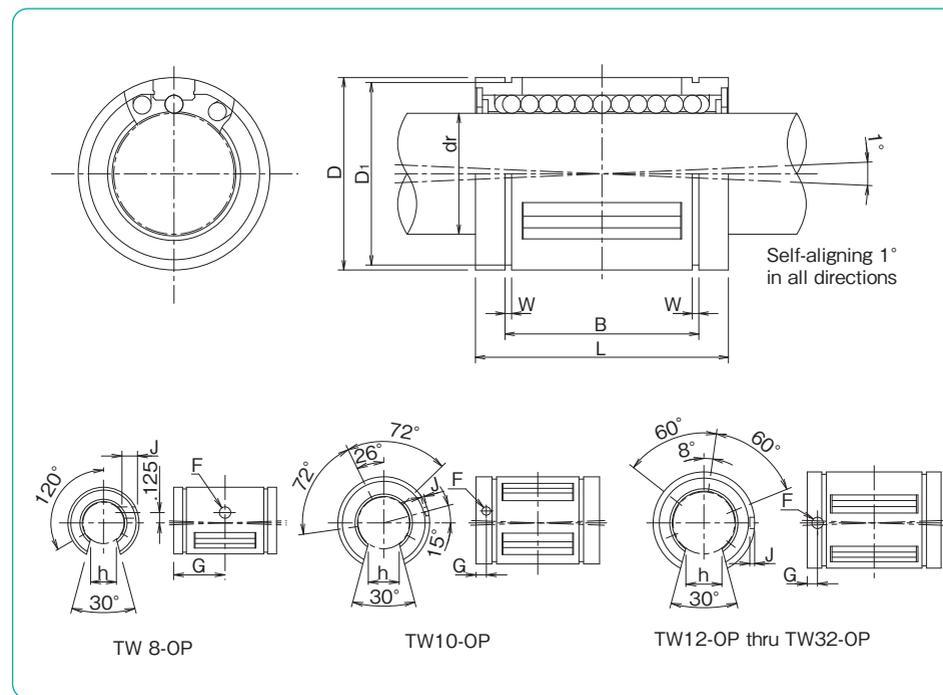
\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.

part number						major dimensions					
closed type			open type			dr*		D			L
number of ball circuits	mass lbs		number of ball circuits	mass lbs		inch	tolerance inch	inch	inch	inch	tolerance inch
TW 3	4	.004	—	—	—	.1875	0	.3750	.562	±.008	
TW 4	4	.009	—	—	.2500	.5000		.750	0		
TW 6	4	.014	—	—	.3750	.6250		.875	-.015		
TW 8	4	.043	TW 8-OP	3	.033	.5000		.8750	1.250	0	
TW 10	5	.103	TW 10-OP	4	.083	.6250		1.1250	1.500		
TW 12	6	.123	TW 12-OP	5	.102	.7500	1.2500	1.625	-.020		
TW 16	6	.265	TW 16-OP	5	.220	1.0000	1.5625	2.250	0		
TW 20	6	.485	TW 20-OP	5	.419	1.2500	2.0000	2.625		0/- .025	
TW 24	6	.750	TW 24-OP	5	.639	1.5000	2.3750	3.000	0/- .030		
TW 32	6	1.411	TW 32-OP	5	1.168	2.0000	0/- .0008	3.0000	4.000	0/- .040	

\* Based on nominal housing bore

\*\* Seals are not available on TW3.

\*\*\* One-sided seal is also available. Please contact NB for details.



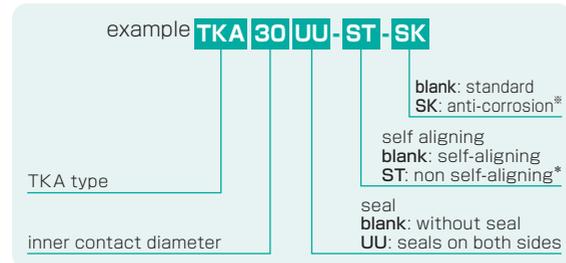
B	W	D <sub>1</sub>	h	open type			basic load rating		nominal shaft diameter	
inch	inch	inch	inch	F	G	J	dynamic C	static Co	inch	
tolerance inch	inch	inch	inch	inch	inch	inch	lbf	lbf	inch	
—	—	—	—	—	—	—	35	47	3/16	
.515	0	.0390	.4687	—	—	—	60	80	1/4	
.703	-.015	.0390	.5880	—	—	—	95	120	3/8	
1.032	0	.0459	.8209	.313	.136	.6250	through	230	290	1/2
1.112		.0559	1.0590	.375	.105	.1250	.0390	400	500	5/8
1.272		.0559	1.1760	.438	.136	.1250	.0590	470	590	3/4
1.886		.0679	1.4687	.563	.136	.1250	.0470	850	1,060	1
2.011		0/- .025	.0679	1.8859	.625	.201	.1875	.0900	1,230	1,530
2.422	0/- .030	.0859	2.2389	.750	.201	.1875	.0900	1,480	1,850	1-1/2
3.206	0/- .040	.1029	2.8379	1.000	.265	.3125	through	2,430	3,040	2

1inch=25.4mm  
1lbs≐0.454kg  
1lbf≐4.448N

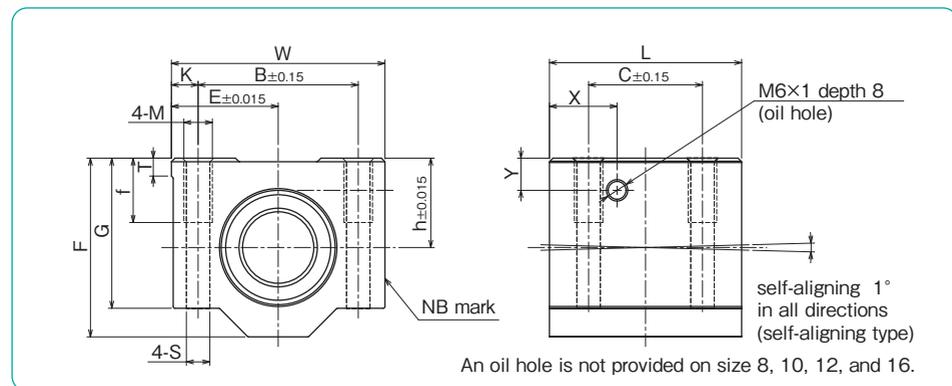
# TKA TYPE (Euro Standard)

– Block Type –

## part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.  
\*ST option is available for size 12 to 40



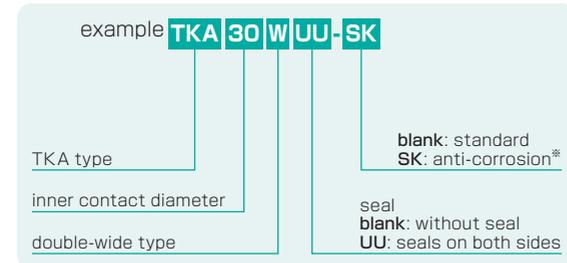
part number	inner contact diameter mm	major dimensions									mounting dimensions					basic load rating		mass g	
		h	E	W	L	F	G	T	X	Y	B	C	K	M	f	S	dynamic C <sub>N</sub>		static Co N
TKA 8UU	8	15	17.5	35	32	28	22	5	—	—	25	20	5	M4	9	3.3	423	534	59
TKA 10UU	10	16	20	40	36	31.5	25	5	—	—	29	20	5.5	M5	11	4.3	750	935	90
TKA 12UU	12	18	21.5	43	39	35	28	5	—	—	32	23	5.5	M5	11	4.3	1,020	1,290	116
TKA 16UU	16	22	26.5	53	43	42	35	5	—	—	40	26	6.5	M6	13	5.3	1,250	1,550	205
TKA 20UU	20	25	30	60	54	50	42	5	19	9	45	32	7.5	M8	18	6.6	2,090	2,630	326
TKA 25UU	25	30	39	78	67	60	48	7	22.5	10	60	40	9	M10	22	8.4	3,780	4,720	624
TKA 30UU	30	35	43.5	87	79	70	58	8	26	11.5	68	45	9.5	M10	22	8.4	5,470	6,810	980
TKA 40UU	40	45	54	108	91	90	72	10	26.5	14	86	58	11	M12	26	10.5	6,590	8,230	1,670
TKA 50UU	50	50	66	132	113	105	85	12	43.5	12.5	108	50	12	M16	34	13.5	10,800	13,500	2,950

1N≒0.102kgf

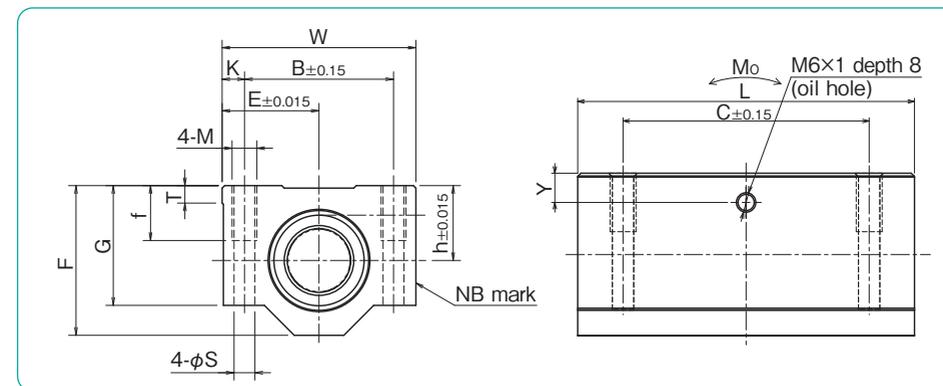
# TKA-W TYPE (Euro Standard)

– Double-Wide Block Type –

## part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	inner contact diameter mm	major dimensions									mounting dimensions					basic load rating		allowable static moment Mo N·m	mass g
		h	E	W	L	F	G	T	Y	B	C	K	M	f	S	dynamic C <sub>N</sub>	static Co N		
TKA 8WUU	8	15	17.5	35	62	28	22	5	6.5	25	50	5	M4	9	3.3	685	1,060	6.53	119
TKA 10WUU	10	16	20	40	70	31.5	25	5	7	29	52	5.5	M5	11	4.3	1,210	1,870	13.4	175
TKA 12WUU	12	18	21.5	43	76	35	28	5	7.5	32	56	5.5	M5	11	4.3	1,650	2,580	20.9	227
TKA 16WUU	16	22	26.5	53	84	42	35	5	9.5	40	64	6.5	M6	13	5.3	2,020	3,100	28.2	390
TKA 20WUU	20	25	30	60	104	50	42	5	9	45	76	7.5	M8	18	6.6	3,390	5,260	62.0	630
TKA 25WUU	25	30	39	78	130	60	48	7	10	60	94	9	M10	22	8.4	6,120	9,440	149	1,210
TKA 30WUU	30	35	43.5	87	152	70	58	8	11.5	68	106	9.5	M10	22	8.4	8,860	13,600	247	1,880
TKA 40WUU	40	45	54	108	176	90	72	10	14	86	124	11	M12	26	10.5	10,600	16,400	349	3,280

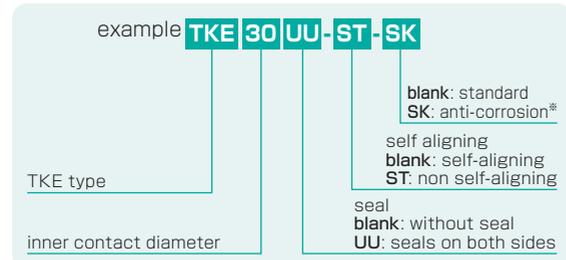
1N≒0.102kgf

# TKE TYPE (Euro Standard)

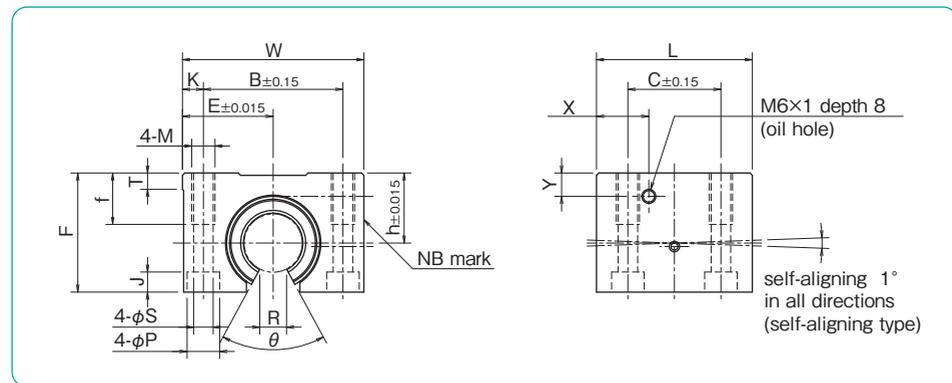
– Open Block Type –



## part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	inner contact diameter	major dimensions										mounting dimensions										basic load rating			mass
		h	E	W	L	F	T	R	θ	X	Y	B	C	K	M	f	S	P	J	dynamic C	static Co	mass			
TKE12UU	12	18	21.5	43	39	28	5	6.5	66°	14.5	7.5	32	23	5.5	M5	11	4.3	8	4.5	1,020	1,290	99			
TKE16UU	16	22	26.5	53	43	35	5	9	68°	15.5	9.5	40	26	6.5	M6	13	5.3	9.5	5.5	1,250	1,550	175			
TKE20UU	20	25	30	60	54	42	5	9	55°	19	9	45	32	7.5	M8	18	6.6	11	6.5	2,090	2,630	275			
TKE25UU	25	30	39	78	67	51	7	11.5	57°	22.5	10	60	40	9	M10	22	8.4	14	8.6	3,780	4,720	558			
TKE30UU	30	35	43.5	87	79	60	8	14	57°	26	11.5	68	45	9.5	M10	22	8.4	14	8.6	5,470	6,810	860			
TKE40UU	40	45	54	108	91	77	10	19.5	56°	26.5	14	86	58	11	M12	26	10.5	17.5	10.8	6,590	8,230	1,490			
TKE50UU	50	50	66	132	113	88	12	22.5	54°	43.5	12.5	108	50	12	M16	34	13.5	20	13	10,800	13,500	2,500			

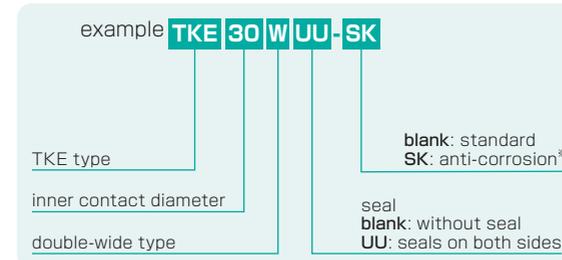
1N≐0.102kgf

# TKE-W TYPE (Euro Standard)

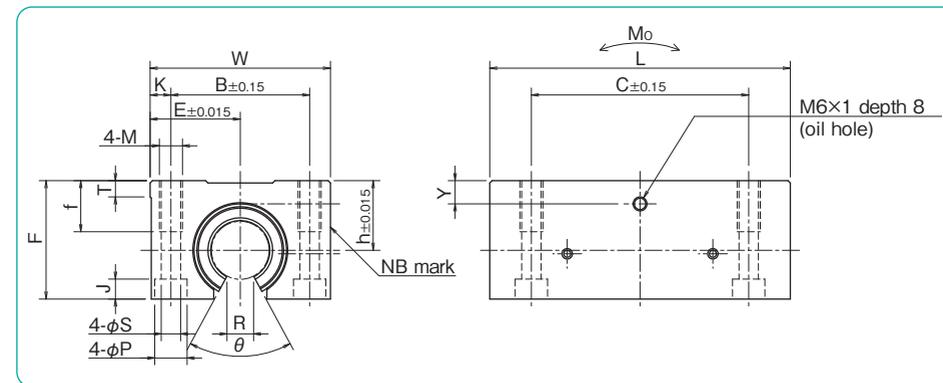
– Double-Wide Open Block Type –



## part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	inner contact diameter	major dimensions										mounting dimensions										basic load rating			allowable static moment		mass
		h	E	W	L	F	T	R	θ	Y	B	C	K	M	f	S	P	J	dynamic C	static Co	allowable static moment Mo	mass					
TKE12WUU	12	18	21.5	43	76	28	5	6.5	66°	7.5	32	56	5.5	M5	11	4.3	8	4.5	1,650	2,580	11.3	190					
TKE16WUU	16	22	26.5	53	84	35	5	9	68°	9.5	40	64	6.5	M6	13	5.3	9.5	5.5	2,020	3,100	15.2	312					
TKE20WUU	20	25	30	60	104	42	5	9	55°	9	45	76	7.5	M8	18	6.6	11	6.5	3,390	5,260	35.3	505					
TKE25WUU	25	30	39	78	130	51	7	11.5	57°	10	60	94	9	M10	22	8.4	14	8.6	6,120	9,440	85.2	1,050					
TKE30WUU	30	35	43.5	87	152	60	8	14	57°	11.5	68	106	9.5	M10	22	8.4	14	8.6	8,860	13,600	140	1,630					
TKE40WUU	40	45	54	108	176	77	10	19.5	56°	14	86	124	11	M12	26	10.5	17.5	10.8	10,600	16,400	199	2,880					

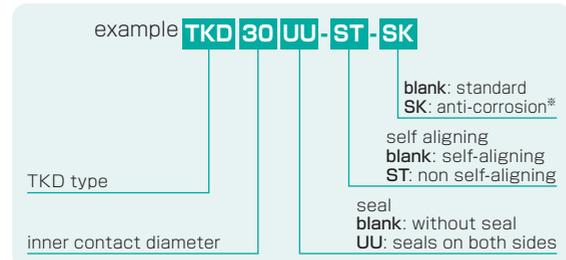
1N≐0.102kgf

# TKD TYPE (Euro Standard)

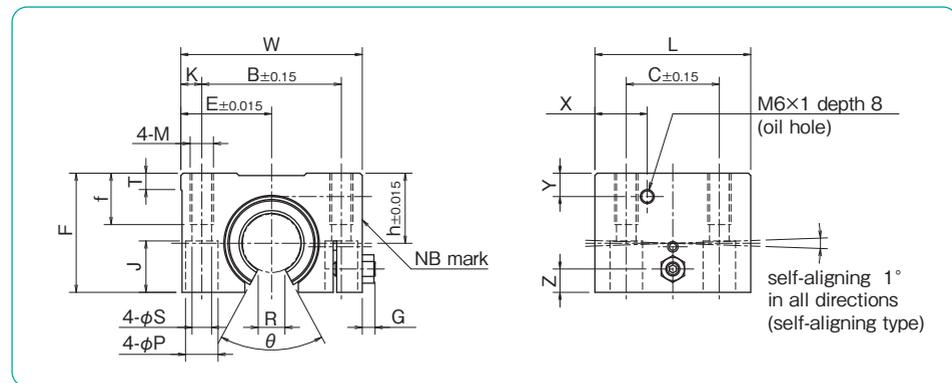
– Clearance Adjustable Open Block Type –



### part number structure



※For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	inner contact diameter	major dimensions											mounting dimensions										basic load rating			allowable static moment	mass
		h	E	W	L	F	G	Z	T	R	θ	X	Y	B	C	K	M	f	S	P	J	dynamic C	static Co	mass N			
TKD12UU	12	18	21.5	43	39	28	3.2	5	5	6.5	66°	14.5	7.5	32	23	5.5	M5	11	4.3	8	11.5	1,020	1,290	99			
TKD16UU	16	22	26.5	53	43	35	3.2	6	5	9	68°	15.5	9.5	40	26	6.5	M6	13	5.3	9.5	14	1,250	1,550	175			
TKD20UU	20	25	30	60	54	42	4	8	5	9	55°	19	9	45	32	7.5	M8	18	6.6	11	18	2,090	2,630	275			
TKD25UU	25	30	39	78	67	51	5.5	10	7	11.5	57°	22.5	10	60	40	9	M10	22	8.4	14	22	3,780	4,720	558			
TKD30UU	30	35	43.5	87	79	60	5.5	12	8	14	57°	26	11.5	68	45	9.5	M10	22	8.4	14	26	5,470	6,810	860			
TKD40UU	40	45	54	108	91	77	5	15	10	19.5	56°	26.5	14	86	58	11	M12	26	10.5	17.5	33	6,590	8,230	1,490			
TKD50UU	50	50	66	132	113	88	7	17	12	22.5	54°	43.5	12.5	108	50	12	M16	34	13.5	20	39	10,800	13,500	2,450			

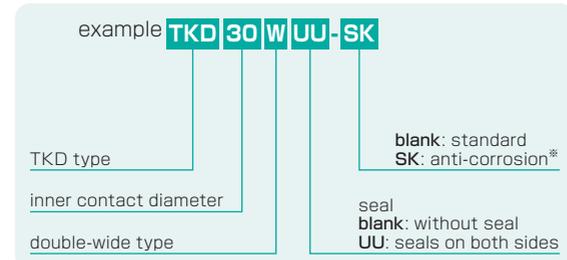
1N ≅ 0.102kgf

# TKD-W TYPE (Euro Standard)

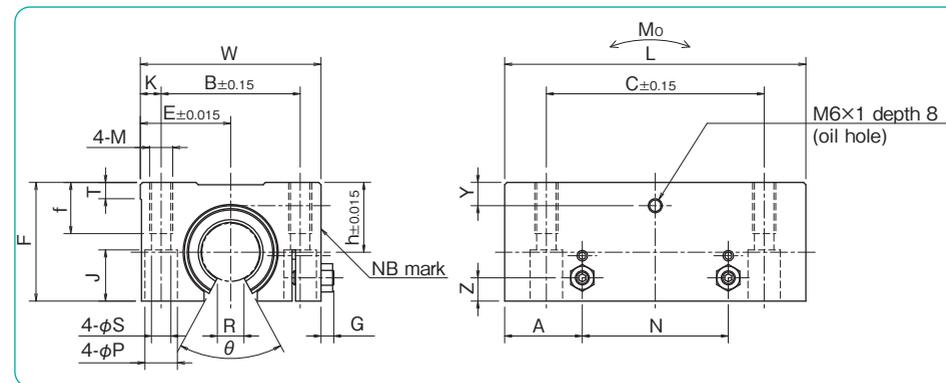
– Clearance Adjustable Double-Wide Open Block Type –



### part number structure



※For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	inner contact diameter	major dimensions											mounting dimensions										basic load rating			allowable static moment	mass
		h	E	W	L	F	G	Z	A	N	T	R	θ	Y	B	C	K	M	f	S	P	J	dynamic C	static Co	mass N		
TKD12WUU	12	18	21.5	43	76	28	3.2	5	19.5	37	5	6.5	66°	7.5	32	5.5	M5	11	4.3	8	11.5	1,650	2,580	11.3	190		
TKD16WUU	16	22	26.5	53	84	35	3.2	6	21.5	41	5	9	68°	9.5	40	6.5	M6	13	5.3	9.5	14	2,020	3,100	15.2	312		
TKD20WUU	20	25	30	60	104	42	4	8	27	50	5	9	55°	9	45	7.5	M8	18	6.6	11	18	3,390	5,260	35.3	505		
TKD25WUU	25	30	39	78	130	51	5.5	10	33.5	63	7	11.5	57°	10	60	9.5	M10	22	8.4	14	22	6,120	9,440	85.2	1,050		
TKD30WUU	30	35	43.5	87	152	60	5.5	12	39.5	73	8	14	57°	11.5	68	10.5	M10	22	8.4	14	26	8,860	13,600	140	1,630		
TKD40WUU	40	45	54	108	176	77	5	15	45.5	85	10	19.5	56°	14	86	12.5	M12	26	10.5	17.5	33	10,600	16,400	199	2,880		

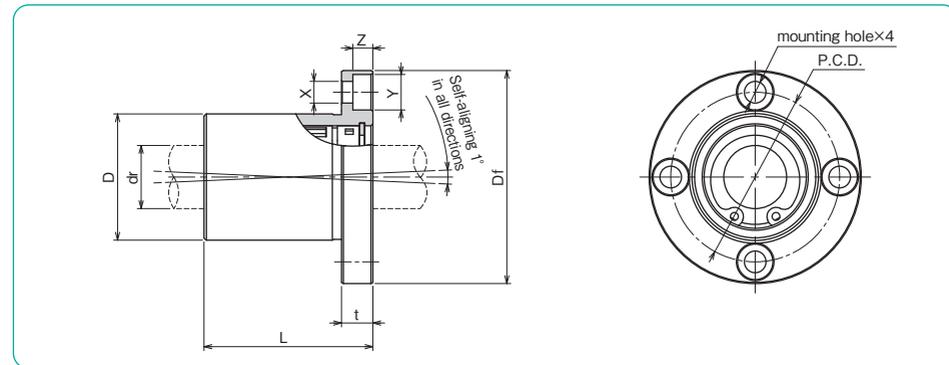
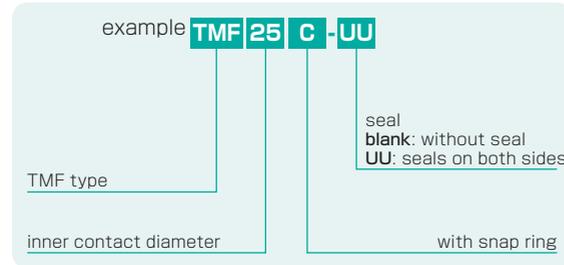
1N ≅ 0.102kgf

## TMF TYPE

– Tolerance interchangeable with Asian Metric Slide Bush Type –



### part number structure



part number	number of ball circuits	dr Recommended shaft diameter : gb mm	major dimensions						basic load rating		mass g	shaft diameter mm
			D tolerance μm	L mm	Df mm	t mm	flange P.C.D mm	X×Y×Z mm	dynamic C N	static Co N		
TMF16CUU	5	16	32	43	54	8	43	5.5×9×5.1	1,250	1,550	216	16
TMF20CUU	6	20	40	54	62	8	51	5.5×9×5.1	2,090	2,630	347	20
TMF25CUU	6	25	45	67	74	10	60	6.6×11×6.1	3,780	4,720	488	25

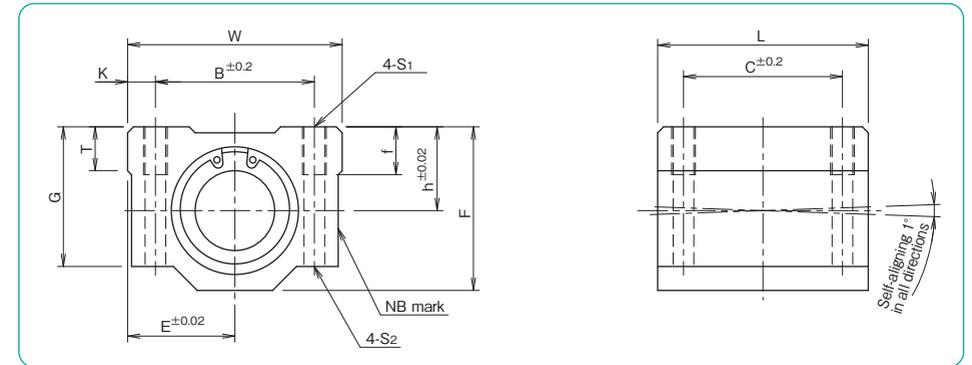
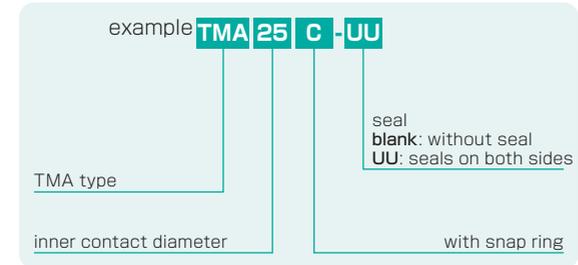
1N≐0.102kgf

## TMA TYPE

– Tolerance interchangeable with Asian Metric Slide Bush Type –



### part number structure



part number	inner contact diameter Recommended shaft diameter : gb mm	major dimensions										basic load rating		mass g	shaft diameter mm			
		outer dimensions					mounting dimensions					dynamic C N	static Co N					
		h	E	W	L	F	G	T	B	C	K	S <sub>1</sub>	f	S <sub>2</sub>				
TMA20CUU	20	21	27	54	53	41	35	11	40	40	7	M6	12	5.2	2,090	2,630	221	20
TMA25CUU	25	26	38	76	67	51.5	42	12	54	50	11	M8	18	7	3,780	4,720	475	25

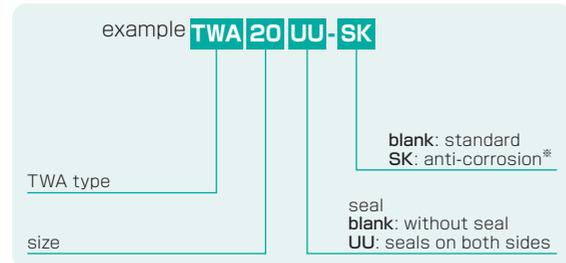
1N≐0.102kgf

# TWA TYPE (Inch Standard)

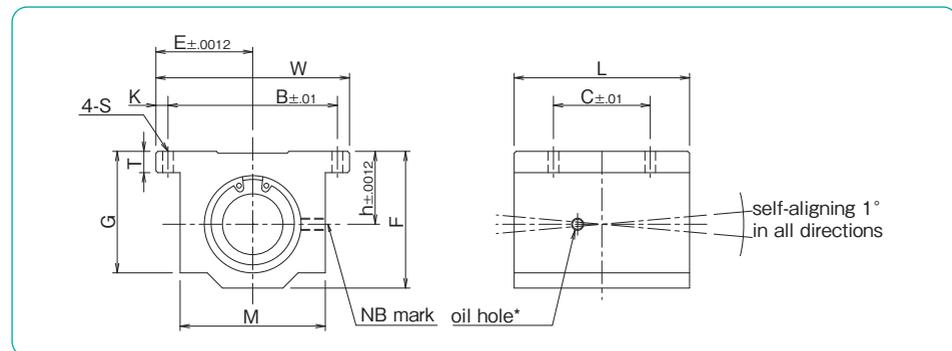
– Block Type –



## part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	nom. shaft dia.	major dimensions								mounting dimensions				basic load rating		mass
		h	E	W	L	F	T	G	M	B	C	K	S	dynamic C	static Co	
TWA 4UU	1/4	.4370	.8125	1.625	1.188	.813	.188	.750	1.000	1.312	.750	.156	.156	60	80	.090
TWA 6UU	3/8	.5000	.8750	1.750	1.313	.938	.188	.875	1.125	1.437	.875	.156	.156	95	120	.120
TWA 8UU	1/2	.6870	1.0000	2.000	1.688	1.250	.250	1.125	1.375	1.688	1.000	.156	.156	230	290	.248
TWA 10UU	5/8	.8750	1.2500	2.500	1.938	1.625	.281	1.437	1.750	2.125	1.125	.188	.188	400	500	.465
TWA 12UU	3/4	.9370	1.3750	2.750	2.063	1.750	.313	1.563	1.875	2.375	1.250	.188	.188	470	590	.553
TWA 16UU	1	1.1870	1.6250	3.250	2.813	2.188	.375	1.938	2.375	2.875	1.750	.188	.219	850	1060	1.200
TWA 20UU	1-1/4	1.5000	2.0000	4.000	3.625	2.813	.438	2.500	3.000	3.500	2.000	.250	.219	1230	1530	2.380
TWA 24UU	1-1/2	1.7500	2.3750	4.750	4.000	3.250	.500	2.875	3.500	4.125	2.500	.313	.281	1480	1850	3.460
TWA 32UU	2	2.1250	3.0000	6.000	5.000	4.063	.625	3.625	4.500	5.250	3.250	.375	.406	2430	3040	6.830

\* Provided with push-in oil fitting for 1/4" to 1/2" sizes. Sizes from 5/8" to 2" offer a 1/4-28 tapped hole with a plug for adding a fitting if desired.  
Product of NB Corporation of America

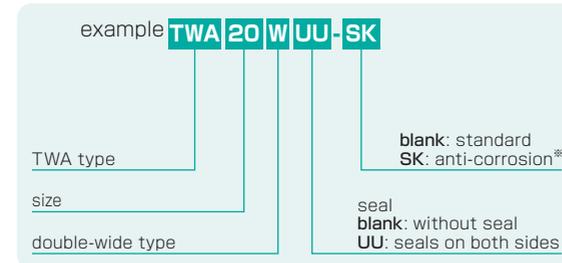
1inch=25.4mm  
1lbs≐0.454kg  
1lbf≐4.448N

# TWA-W TYPE (Inch Standard)

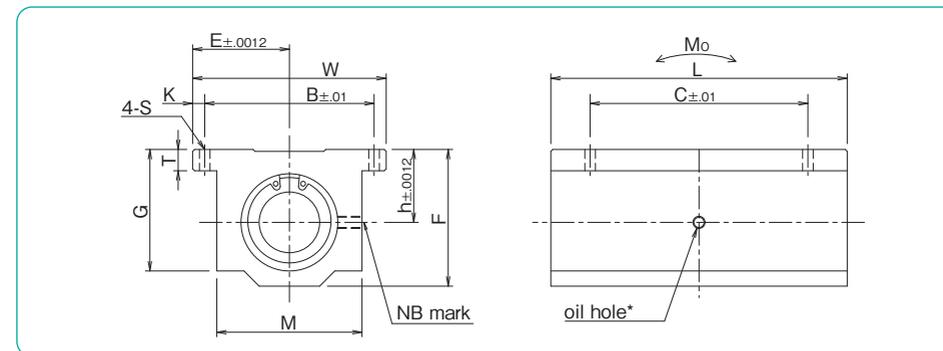
– Double-Wide Block Type –



## part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	nom. shaft dia.	major dimensions								mounting dimensions				basic load rating		allowable static moment	mass
		h	E	W	L	F	T	G	M	B	C	K	S	dynamic C	static Co	Mo	
TWA 4WUU	1/4	.4370	.8125	1.625	2.500	.813	.188	.750	1.000	1.312	2.000	.156	.156	96	160	26.8	.190
TWA 6WUU	3/8	.5000	.8750	1.750	2.750	.938	.188	.875	1.125	1.437	2.250	.156	.156	150	240	52.2	.250
TWA 8WUU	1/2	.6870	1.0000	2.000	3.500	1.250	.250	1.125	1.375	1.688	2.500	.156	.156	370	580	183	.510
TWA 10WUU	5/8	.8750	1.2500	2.500	4.000	1.625	.281	1.437	1.750	2.125	3.000	.188	.188	640	1000	373	1.000
TWA 12WUU	3/4	.9370	1.3750	2.750	4.500	1.750	.313	1.563	1.875	2.375	3.500	.188	.188	750	1180	496	1.200
TWA 16WUU	1	1.1870	1.6250	3.250	6.000	2.188	.375	1.938	2.375	2.875	4.500	.188	.219	1360	2120	1260	2.400
TWA 20WUU	1-1/4	1.5000	2.0000	4.000	7.500	2.813	.438	2.500	3.000	3.500	5.500	.250	.219	1970	3060	2100	5.000
TWA 24WUU	1-1/2	1.7500	2.3750	4.750	9.000	3.250	.500	2.875	3.500	4.125	6.500	.313	.281	2370	3700	2900	7.800

\* Provided with push-in oil fitting for 1/4" to 1/2" sizes. Sizes from 5/8" to 1-1/2" offer a 1/4-28 tapped hole with a plug for adding a fitting if desired.  
Product of NB Corporation of America

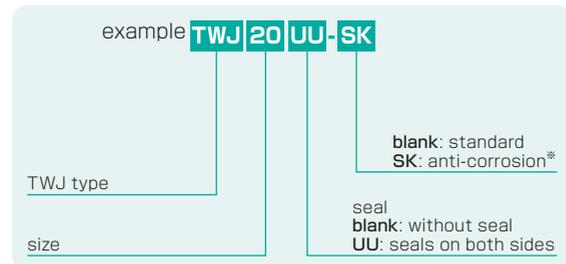
1inch=25.4mm  
1lbs≐0.454kg  
1lbf≐4.448N  
1lbf · in≐0.112N · m

# TWJ TYPE (Inch Standard)

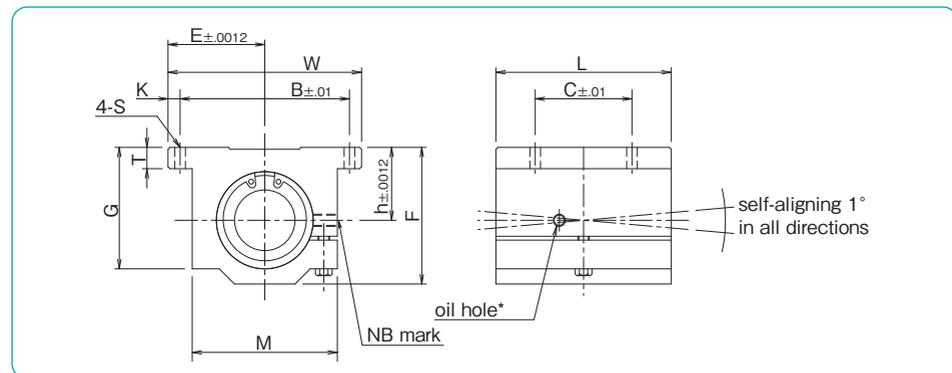
— Clearance Adjustable Block Type —



### part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	nom. shaft dia. inch	major dimensions								mounting dimensions				basic load rating		mass lbs
		h inch	E inch	W inch	L inch	F inch	T inch	G inch	M inch	B inch	C inch	K inch	S inch	C lbf	static Co lbf	
TWJ 4UU	1/4	.4370	.8125	1.625	1.188	.813	.188	.750	1.000	1.312	.750	.156	.156	60	80	.090
TWJ 6UU	3/8	.5000	.8750	1.750	1.313	.938	.188	.875	1.125	1.437	.875	.156	.156	95	120	.120
TWJ 8UU	1/2	.6870	1.0000	2.000	1.688	1.250	.250	1.125	1.375	1.688	1.000	.156	.156	230	290	.248
TWJ 10UU	5/8	.8750	1.2500	2.500	1.938	1.625	.281	1.437	1.750	2.125	1.125	.188	.188	400	500	.465
TWJ 12UU	3/4	.9370	1.3750	2.750	2.063	1.750	.313	1.563	1.875	2.375	1.250	.188	.188	470	590	.553
TWJ 16UU	1	1.1870	1.6250	3.250	2.813	2.188	.375	1.938	2.375	2.875	1.750	.188	.219	850	1060	1.200
TWJ 20UU	1-1/4	1.5000	2.0000	4.000	3.625	2.813	.438	2.500	3.000	3.500	2.000	.250	.219	1230	1530	2.380
TWJ 24UU	1-1/2	1.7500	2.3750	4.750	4.000	3.250	.500	2.875	3.500	4.125	2.500	.313	.281	1480	1850	3.460
TWJ 32UU	2	2.1250	3.0000	6.000	5.000	4.063	.625	3.625	4.500	5.250	3.250	.375	.406	2430	3040	6.830

\* Provided with push-in oil fitting for 1/4" to 1/2" size. Sizes from 5/8" to 2" offer a 1/4-28 tapped hole with a plug for adding a fitting if desired.  
Product of NB Corporation of America

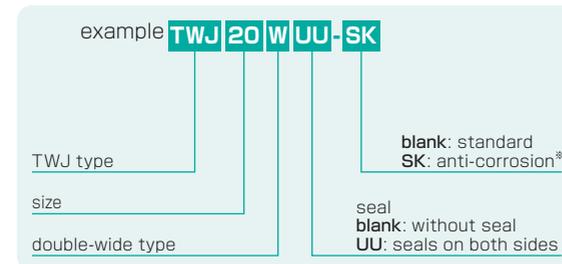
1inch=25.4mm  
1lbs≈0.454kg  
1lbf=4.448N

# TWJ-W TYPE (Inch Standard)

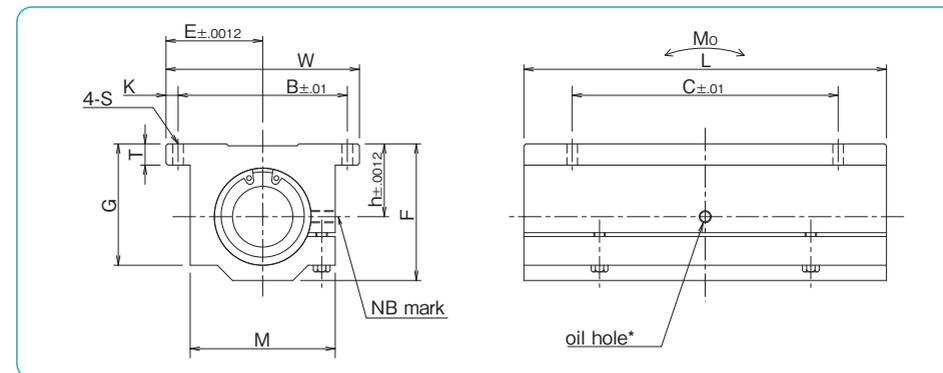
— Clearance Adjustable Double-Wide Block Type —



### part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	nom. shaft dia. inch	major dimensions								mounting dimensions				basic load rating		allowable static moment		mass lbs
		h inch	E inch	W inch	L inch	F inch	T inch	G inch	M inch	B inch	C inch	K inch	S inch	C lbf	static Co lbf	lbf·in	lbf·in	
TWJ 4WUU	1/4	.4370	.8125	1.625	2.500	.813	.188	.750	1.000	1.312	2.000	.156	.156	96	160	26.8	.190	
TWJ 6WUU	3/8	.5000	.8750	1.750	2.750	.938	.188	.875	1.125	1.437	2.250	.156	.156	150	240	52.2	.250	
TWJ 8WUU	1/2	.6870	1.0000	2.000	3.500	1.250	.250	1.125	1.375	1.688	2.500	.156	.156	370	580	183	.510	
TWJ 10WUU	5/8	.8750	1.2500	2.500	4.000	1.625	.281	1.437	1.750	2.125	3.000	.188	.188	640	1000	373	1.000	
TWJ 12WUU	3/4	.9370	1.3750	2.750	4.500	1.750	.313	1.563	1.875	2.375	3.500	.188	.188	750	1180	496	1.200	
TWJ 16WUU	1	1.1870	1.6250	3.250	6.000	2.188	.375	1.938	2.375	2.875	4.500	.188	.219	1360	2120	1260	2.400	
TWJ 20WUU	1-1/4	1.5000	2.0000	4.000	7.500	2.813	.438	2.500	3.000	3.500	5.500	.250	.219	1970	3060	2100	5.000	
TWJ 24WUU	1-1/2	1.7500	2.3750	4.750	9.000	3.250	.500	2.875	3.500	4.125	6.500	.313	.281	2370	3700	2900	7.800	

\* Provided with push-in oil fitting for 1/4" to 1/2" size. Sizes from 5/8" to 1-1/2" offer a 1/4-28 tapped hole with a plug for adding a fitting if desired.  
Product of NB Corporation of America

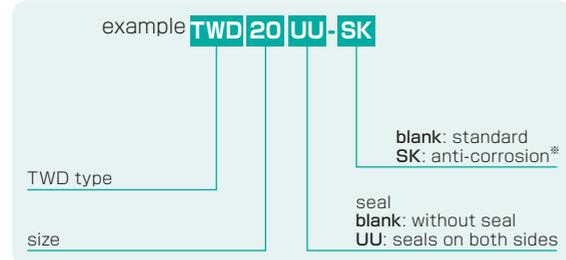
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1lbs≈0.454kg  
1lbf=4.448N  
1lbf·in≈0.112N·m

# TWD TYPE (Inch Standard)

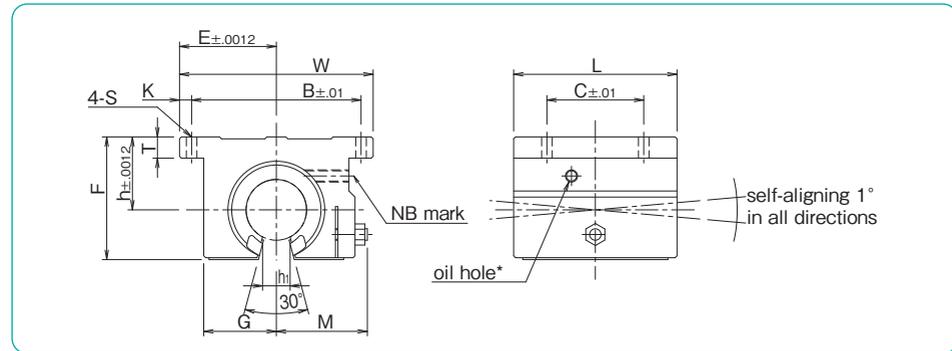
– Open Block Type –



## part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	nom. shaft dia. inch	major dimensions									mounting dimensions				basic load rating		mass lbs
		h	E	W	L	F	T	G	M	h <sub>1</sub>	B	C	K	S	dynamic C lbf	static Co lbf	
TWD 8UU	1/2	.6870	1.000	2.000	1.500	1.100	.250	.688	.86	.260	1.688	1.000	.156	.156	230	290	.188
TWD 10UU	5/8	.8750	1.2500	2.500	1.750	1.405	.281	.875	1.06	.319	2.125	1.125	.188	.188	400	500	.365
TWD 12UU	3/4	.9370	1.3750	2.750	1.875	1.535	.315	.937	1.12	.386	2.375	1.250	.188	.188	470	590	.452
TWD 16UU	1	1.1870	1.6250	3.250	2.625	1.975	.375	1.188	1.40	.512	2.875	1.750	.188	.218	850	1060	1.010
TWD 20UU	1-1/4	1.5000	2.0000	4.000	3.375	2.485	.437	1.500	1.88	.596	3.500	2.000	.250	.218	1230	1530	1.980
TWD 24UU	1-1/2	1.7500	2.3750	4.750	3.750	2.910	.500	1.750	2.12	.681	4.125	2.500	.313	.281	1480	1850	2.950
TWD 32UU	2	2.1250	3.0000	6.000	4.750	3.660	.625	2.250	2.70	.933	5.250	3.250	.375	.406	2430	3040	5.840

\* Provided with push-in oil fitting for 1/2" size only. Sizes from 5/8" to 2" offer a 1/4-28 tapped hole with a plug for adding a fitting if desired.  
Product of NB Corporation of America

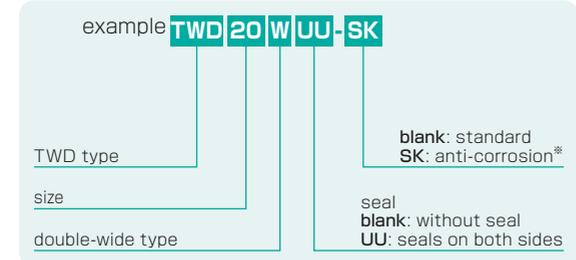
1inch=25.4mm  
1lbs≐0.454kg  
1lbf≐4.448N

# TWD-W TYPE (Inch Standard)

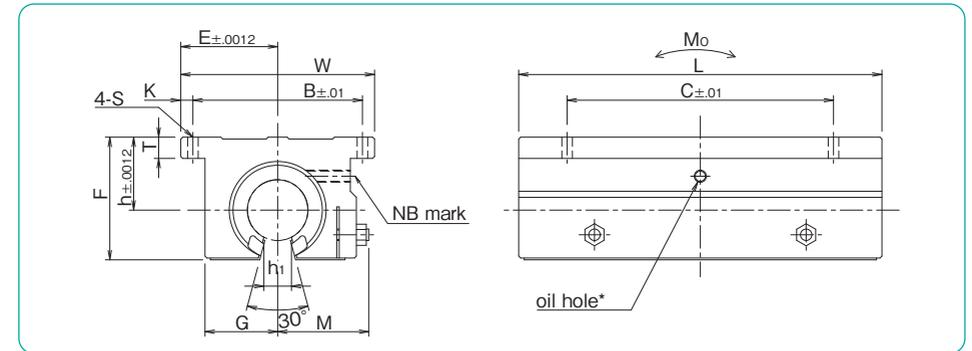
– Double-Wide Open Block Type –



## part number structure



\*For anti-corrosion the load plates are electroless nickel plated with stainless steel balls.



part number	nom. shaft dia. inch	major dimensions									mounting dimensions				basic load rating		allowable static moment	mass lbs
		h	E	W	L	F	T	G	M	h <sub>1</sub>	B	C	K	S	dynamic C lbf	static Co lbf	Mo lbf·in	
TWD 8WUU	1/2	.6870	1.000	2.000	3.500	1.100	.250	.688	.86	.260	1.688	2.500	.156	.156	370	580	128	.400
TWD 10WUU	5/8	.8750	1.2500	2.500	4.000	1.405	.281	.875	1.06	.319	2.125	3.000	.188	.188	640	1000	164	.800
TWD 12WUU	3/4	.9370	1.3750	2.750	4.500	1.535	.315	.937	1.12	.386	2.375	3.500	.188	.188	750	1180	283	1.000
TWD 16WUU	1	1.1870	1.6250	3.250	6.000	1.975	.375	1.188	1.40	.512	2.875	4.500	.188	.218	1360	2120	719	2.000
TWD 20WUU	1-1/4	1.5000	2.0000	4.000	7.500	2.485	.437	1.500	1.88	.569	3.500	5.500	.250	.218	1970	3060	1200	4.200
TWD 24WUU	1-1/2	1.7500	2.3750	4.750	9.000	2.910	.500	1.750	2.12	.681	4.125	6.500	.313	.281	2370	3700	1650	6.700

\* Provided with push-in oil fitting for 1/2" size only. Sizes from 5/8" to 1-1/2" offer a 1/4-28 tapped hole with a plug for adding a fitting if desired.  
Product of NB Corporation of America

1inch=25.4mm  
1lbs≐0.454kg  
1lbf≐4.448N  
1lbf·in≐0.112N·m

# STROKE BUSH SLIDE ROTARY BUSH

## STROKE BUSH

STRUCTURE AND ADVANTAGES	E-2
TYPE	E-2
SPECIFICATION	E-3
ALLOWABLE SPEED FOR COMBINED ROTATION AND STROKE MOTION	E-3
RATED LOAD AND RATED LIFE	E-3
FIT	E-3
MOUNTING	E-4
LUBRICATION	E-4
USE AND HANDLING PRECAUTIONS	E-5
DIMENSION TABLE	E-6~

## SLIDE ROTARY BUSH SRE SERIES

STRUCTURE AND ADVANTAGES	E-10
TYPE	E-11
SPECIFICATION	E-11
RATED LOAD AND RATED LIFE	E-12
FIT	E-13
MOUNTING	E-13
APPLICATION EXAMPLES	E-14
USE AND HANDLING PRECAUTIONS	E-15
FELT SEAL	E-15
DIMENSION TABLE	E-16~

## SLIDE ROTARY BUSH RK TYPE

STRUCTURE AND ADVANTAGES	E-26
SPECIFICATION	E-26
FIT	E-27
LIFE CALCULATION	E-27
DIMENSION TABLE	E-28

# STROKE BUSH

The NB stroke bush is a linear and rotational motion mechanism utilizing the rotational motion of ball elements between an outer cylinder and a shaft. It is compact and can withstand high loading.

The retainer is made of a light metal alloy with high wear resistance. Smooth motion is achieved under high-speed and high-acceleration conditions.

Although the linear motion is limited to a specific stroke length, the combined rotation and stroke motion is achieved with very little frictional resistance.

The NB stroke bush can be conveniently used in a variety of applications.

## STRUCTURE AND ADVANTAGES

The retainer in the NB stroke bush positions the ball elements in a zigzag arrangement. The inner surface of the outer cylinder is finished by precision grinding, resulting in smooth motion of the ball elements. Each of the ball elements is held in a separate hole and smooth motion is achieved for both rotational motion and linear motion. The retainer moves half the length of the linear motion, therefore, the stroke length is limited to approximately twice the length the retainer can travel within the outer cylinder.

### High Precision

High-carbon chromium bearing steel is used for the outer cylinder. It is heat treated and ground to achieve high rigidity and accuracy.

### Ease of Mounting and Replacement

The highly accurate fabrication of the NB stroke bush results in uniform dimensions, facilitating parts replacement and housing fabrication.

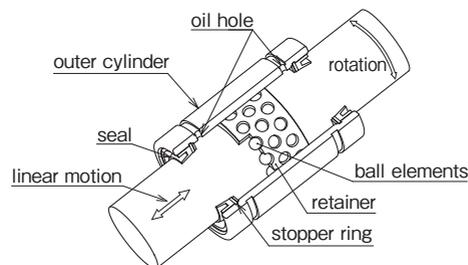
### Light Weight and Space Saving

The use of an aluminum alloy for the retainer and the thin-wall outer cylinder makes the NB stroke bush light weight and compact.

### Lubrication

One lubrication hole is provided on each oil groove of the outer cylinder, making it easy to lubricate the SR stroke bush.

Figure E-1 Structure of SR Stroke Bush



## TYPE

Table E-1 Type

	Standard Type	Double Retainer Type
SR TYPE	 P.E-6	SR-B TYPE  P.E-8

## SPECIFICATION

Refer to Table E-2 for NB Stroke Bush material and operating temperature range.

Table E-2 Material and Operating Temperature Range

type	outer cylinder	retainer	operating temperature range
SR	steel	aluminum	-20°C~110°C
SR-B			

## ALLOWABLE SPEED FOR COMBINED ROTATION AND STROKE MOTION

The allowable speed for combined rotation and stroke motion is obtained from the following equation:

The value of DN is given as follows depending on the lubrication method.

$$DN \geq dm \cdot n + 10 \cdot \ell s \cdot n_1$$

for oil lubrication	DN=600,000
for grease lubrication	DN=300,000

note:  $n \leq 5,000$   $\ell s \cdot n_1 \leq 50,000$

## RATED LOAD AND RATED LIFE

The relationship between the rated load and life of the stroke bush is expressed as follows:

$$L = \left( \frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P} \right)^3 \times 10^6$$

L: rated life  $f_H$ : hardness coefficient  
 $f_T$ : temperature coefficient  $f_C$ : contact coefficient  
 $f_W$ : applied load coefficient  
 C: basic dynamic load rating (N)  
 P: applied load (N)  
 ※Refer to page Eng-6 for the coefficients.

●For combined rotation and stroke motion

$$L_h = \frac{L}{60\sqrt{(dm \cdot n)^2 + (10 \cdot \ell s \cdot n_1)^2} / dm}$$

●For stroke motion

$$L_h = \frac{L}{600 \cdot \ell s \cdot n_1 / (\pi \cdot dm)}$$

L: life time (hr)  $\ell s$ : stroke length (mm)  
 n: revolutions per min. (rpm)  
 $n_1$ : number of cycles per minute (cpm)  
 dm: ball pitch diameter (mm)  $\approx 1.15$  dr

## FIT

The fits generally used between the shaft and the housing are listed in Table E-3. The inner contact diameters of the SR stroke bush are listed in the dimension tables. The shaft diameter tolerance should be selected to achieve the desired amount of radial clearance (see Table E-4). Please pay attention that high-speed linear motion can cause the retainer to slip due to inertial force.

In selecting a shaft, please take note of:  
 Hardness: 58HRC or more (refer to hardness coefficient on page Eng-6) recommended  
 Surface Roughness: less than Ra0.4 recommended

Table E-3

normal operating condition		vertical use or highly accurate case	
shaft	housing	shaft	housing
k5,m5	H6,H7	n5,p6	J6,J7

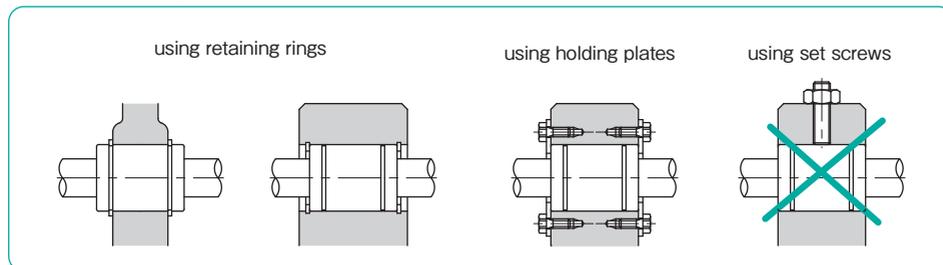
Table E-4 Radial Clearance Negative Limit

part number	limit ( $\mu$ m)
6	-2
8~10	-3
12~16	-4
20~30	-5
35~50	-6
60~80	-8
100	-10

## MOUNTING

Examples of mounting methods of Stroke Bush are shown in Figure E-2. To avoid deformation, do not fix outer cylinder by using set screw.

Figure E-2 Mounting Method



## LUBRICATION

Appropriate lubrication is needed to ensure the accuracy of NB Stroke Bush and to maintain bearing life. Anti-rust oil is applied to NB Stroke Bush prior to shipment. The NB selected anti-rust oil has a little to no effect on lubricants, however, please apply lubricant only after cleaning Stroke Bush with kerosene, etc.

### Grease Lubricant

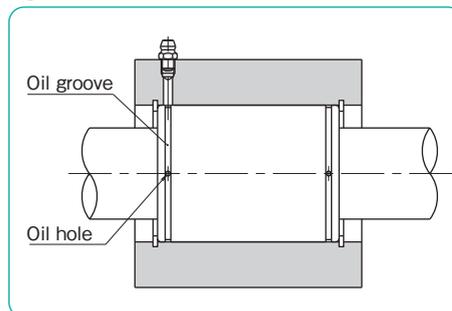
Prior to usage, please apply grease, and re-lubricate periodically according to the operating conditions. (Lithium soap-based grease is recommended.) Relubrication can be done by directly applying grease inside the ball bush or by using oil hole as Figure E-3 shows.

A special low dust generation grease is optional for clean room application. Please refer to page Eng-51.

### Oil Lubricant

Prior to usage, please apply oil directly to the shaft surface or by using oil hole as Figure E-3 shows. Turbine oil (ISO standard VG32-68) is recommended.

Figure E-3 Oil hole



## USE AND HANDLING PRECAUTIONS

### Maximum Stroke

The maximum stroke in the dimension table is the stroke limit.

### Retainer Slippage

The retainer can slip under high-speed motion, vertical application, unbalanced-loading, and vibrating conditions. It is suggested that the stroke to be set as a 80% of the maximum stroke in the dimension table. It is also recommended that the bush be cycled to perform the maximum stroke several times, so that the retainer returns to its central position.

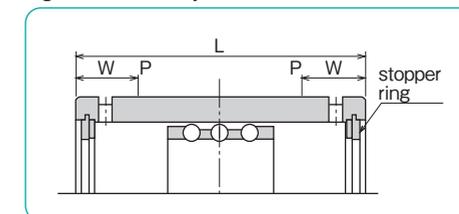
### Accuracy

The accuracies of the SR stroke bush are stated in the dimension tables. Since the outer cylinder deforms due to tension from the retaining ring, the dimension of the outer cylinder is an average value at points P, where calculated using the following equation:

$$W = 4 + L/8$$

W: the distance from the end of the outer cylinder to measurement point P  
L: the length of the outer cylinder

Figure E-4 Outer Cylinder Measurement Points



### Operating Temperature Range

The operating temperature is ranging from -20 °C to 110°C. In case of operation at temperature outside this range, please contact NB.

### Dust Prevention

Dust and other contaminations affect the bush's lifetime and accuracy if dust or particle enter into inside of bush. Although seals work under a normal environment, in a harsh environment, it is necessary to attach protective covers.

# SR TYPE

—Standard Type—

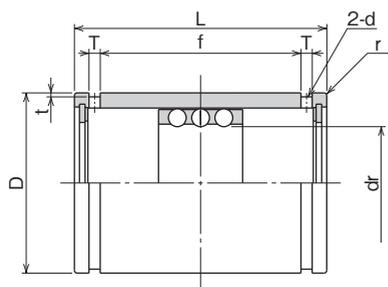


## part number structure

example **SR 20**

SR type

inner contact diameter (dr)



part number	maximum stroke mm	number of rows	dr		D		major dimensions					basic load rating		mass g	
			mm	tolerance μm	mm	tolerance μm	L	f	T	t	d	r	dynamic C N		static Co N
SR 6	19	3	6	+22	12	0	20	11.3	1.1	0.5	1	0.5	216	147	8.9
SR 8	24	3	8	+13	15	-11	24	17.1	1.5	0.5	1.2	0.5	343	245	15.6
SR 10	30	3	10	+19	19	0	30	22.7	1.5	0.5	1.2	0.5	637	461	28.8
SR 12	32	3	12	+27	23	-13	32	24.5	1.5	0.5	1.2	0.5	1,070	813	42
SR 16	40	3	16	+16	28	-13	37	29.1	1.5	0.7	1.3	0.5	1,180	990	71
SR 20	50	3	20	+33	32	0	45	35.8	2	0.7	1.5	0.5	1,260	1,170	99
SR 25	50	3	25	+20	37	-16	45	35.8	2	0.7	1.6	1	1,330	1,330	117
SR 30	82	3	30	+45	45	-19	65	53.5	2.5	1	2	1	2,990	3,140	205
SR 35	92	3	35	+52	52	0	70	58.5	2.5	1	2	1.5	3,140	3,530	329
SR 40	108	3	40	+41	60	0	80	68.3	2.5	1	2	1.5	4,120	4,800	516
SR 50	138	3	50	+25	72	-19	100	86.4	3	1	2.5	1.5	5,540	6,910	827
SR 60	138	3	60	+49	85	0	100	86.4	3	1	2.5	2	5,980	8,230	1,240
SR 80	132	3	80	+30	110	-22	100	86	3	1.5	2.5	2	7,840	12,200	2,050
SR100	132	3	100	+58/+36	130	0/-25	100	86	3	1.5	2.5	2	8,430	14,700	2,440

1N≒0.102kgf

# SR-UU TYPE

—Standard Type with Seals—



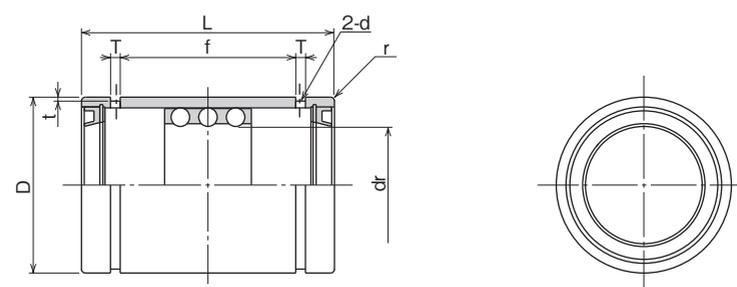
## part number structure

example **SR 20 UU**

SR type

inner contact diameter (dr)

seals on both sides



part number	maximum stroke mm	number of rows	dr		D		major dimensions					basic load rating		mass g	
			mm	tolerance μm	mm	tolerance μm	L	f	T	t	d	r	dynamic C N		static Co N
SR 8UU	14	3	8	+22	15	0/-11	24	12.3	1.5	0.5	1.2	0.5	343	245	15.6
SR 10UU	16	3	10	+13	19	0	30	15.5	1.5	0.5	1.2	0.5	637	461	28.8
SR 12UU	18	3	12	+27	23	-13	32	17.1	1.5	0.5	1.2	0.5	1,070	813	42
SR 16UU	26	3	16	+16	28	-13	37	21.1	1.5	0.7	1.3	0.5	1,180	990	71
SR 20UU	36	3	20	+33	32	0	45	26.8	2	0.7	1.5	0.5	1,260	1,170	99
SR 25UU	36	3	25	+20	37	-16	45	26.8	2	0.7	1.6	1	1,330	1,330	117
SR 30UU	68	3	30	+45	45	-16	65	45.1	2.5	1	2	1	2,990	3,140	205
SR 35UU	76	3	35	+41	52	0	70	50.1	2.5	1	2	1.5	3,140	3,530	329
SR 40UU	91	3	40	+25	60	0	80	59.9	2.5	1	2	1.5	4,120	4,800	516
SR 50UU	116	3	50	+49	72	-19	100	77.4	3	1	2.5	1.5	5,540	6,910	827
SR 60UU	117	3	60	+30	85	0	100	77.4	3	1	2.5	2	5,980	8,230	1,240
SR 80UU	110	3	80	+58/+36	110	-22	100	77	3	1.5	2.5	2	7,840	12,200	2,050
SR100UU	110	3	100	+58/+36	130	0/-25	100	77	3	1.5	2.5	2	8,430	14,700	2,440

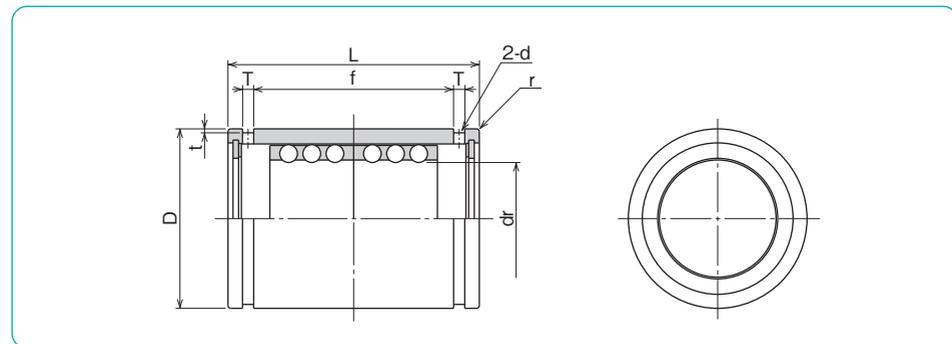
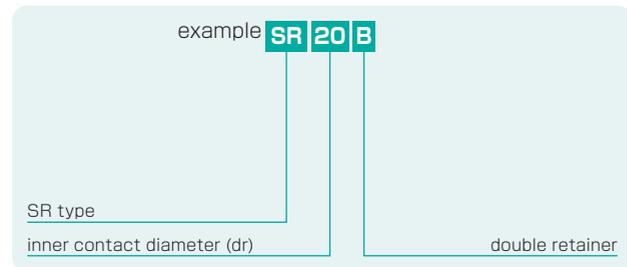
1N≒0.102kgf

# SR-B TYPE

–Double Retainer Type–



## part number structure



part number	maximum stroke mm	number of rows	major dimensions										basic load rating		mass g	
			dr mm	tolerance μm	D mm	tolerance μm	L mm	tolerance mm	f mm	T mm	t mm	d mm	r mm	C N		Co N
SR 8B	8	6	8	+22	15	0/-11	24	0	17.1	1.5	0.5	1.2	0.5	549	490	16.8
SR 10B	8	6	10	+13	19	0	30	0	22.7	1.5	0.5	1.2	0.5	1,030	931	31.2
SR 12B	8	6	12	+27	23	-13	32	-0.2	24.5	1.5	0.5	1.2	0.5	1,720	1,630	46
SR 16B	16	6	16	+16	28	0	37	0	29.1	1.5	0.7	1.3	0.5	1,910	1,980	75
SR 20B	20	6	20	+20	32	0	45	0	35.8	2	0.7	1.5	0.5	2,060	2,320	106
SR 25B	20	6	25	+33	37	0	45	0	35.8	2	0.7	1.6	1	2,170	2,670	125
SR 30B	44	6	30	+20	45	-16	65	0	53.5	2.5	1	2	1	4,800	6,270	220
SR 35B	54	6	35	+41	52	0	70	0	58.5	2.5	1	2	1.5	5,050	7,060	346
SR 40B	66	6	40	+25	60	-19	80	-0.3	68.3	2.5	1	2	1.5	6,710	9,560	540
SR 50B	88	6	50	+25	72	-19	100	0	86.4	3	1	2.5	1.5	8,970	13,800	862
SR 60B	88	6	60	+49	85	0	100	0	86.4	3	1	2.5	2	9,700	16,500	1,290
SR 80B	76	6	80	+30	110	-22	100	0	86	3	1.5	2.5	2	12,700	24,300	2,110
SR100B	76	6	100	+58/+36	130	0/-25	100	-0.4	86	3	1.5	2.5	2	13,700	29,400	2,520

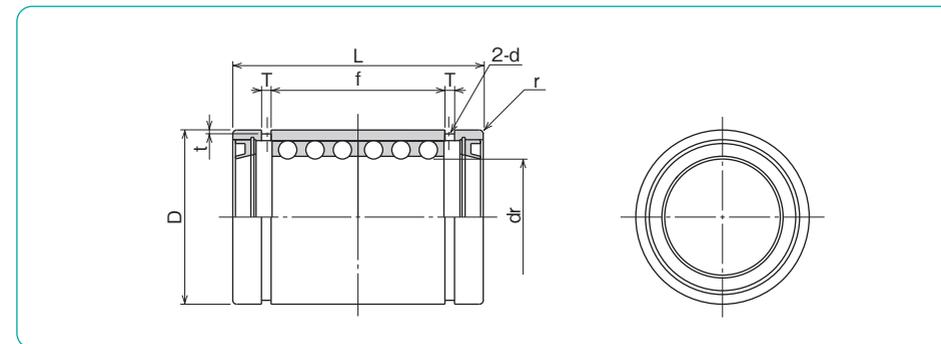
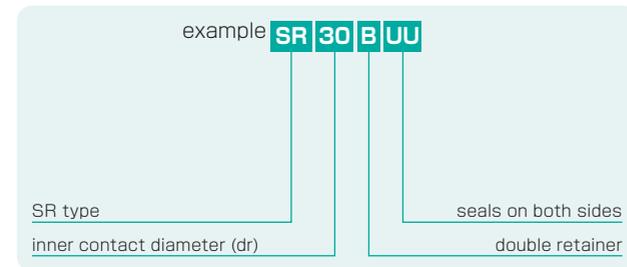
1N≒0.102kgf

# SR-BUU TYPE

–Double Retainer Type with Seals–



## part number structure



part number	maximum stroke mm	number of rows	major dimensions										basic load rating		mass g	
			dr mm	tolerance μm	D mm	tolerance μm	L mm	tolerance mm	f mm	T mm	t mm	d mm	r mm	C N		Co N
SR 30BUU	30	6	30	+33/+20	45	0/-16	65	0	17.1	1.5	0.5	1.2	0.5	549	490	16.8
SR 35BUU	38	6	35	+41	52	0	70	0	22.7	1.5	0.5	1.2	0.5	1,030	931	31.2
SR 40BUU	49	6	40	+25	60	-19	80	-0.3	24.5	1.5	0.5	1.2	0.5	1,720	1,630	46
SR 50BUU	66	6	50	+25	72	-19	100	0	29.1	1.5	0.7	1.3	0.5	1,910	1,980	75
SR 60BUU	67	6	60	+49	85	0	100	0	35.8	2	0.7	1.5	0.5	2,060	2,320	106
SR 80BUU	54	6	80	+30	110	-22	100	0	35.8	2	0.7	1.6	1	2,170	2,670	125
SR100BUU	54	6	100	+58/+36	130	0/-25	100	-0.4	53.5	2.5	1	2	1	4,800	6,270	220

1N≒0.102kgf

# SLIDE ROTARY BUSH SRE SERIES

The NB Slide Rotary Bush SRE Series provides rotary and linear motion functions. Linear motion with unlimited stroke and rotary motion are merged into a single bush resulting in great space saving compared with a combination of any conventional bearings. There are three types; standard, flange, and unit type with sizes ranging from 6 to 40.

## STRUCTURE AND ADVANTAGES

NB Slide Rotary Bush features a special retainer fitted into cylindrical steel outer cylinder and is designed to guide steel balls for smooth circulation in its retainer. The retainer is also designed to rotate freely towards radial direction and offers smooth linear and rotary motions.

### Smooth Operation

The inner surface of the outer cylinder allows smooth operation of linear and rotary motions while maintaining a uniform load distribution.

### High Load Capacity

The use of comparatively large diameter steel balls enhances the load capacity.

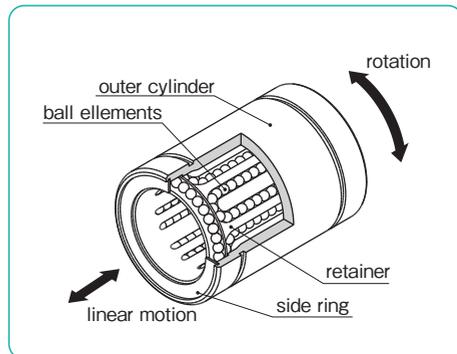
### Smooth Rotation

The positioning of the steel balls in a cylindrical formation inside the retainer enables a smooth rotational motion regardless of the installation direction.

### Complete Interchangeability

NB Slide Rotary series is completely interchangeable with SM type Slide Bush, SMK type Flanged Slide Bush and SMA(W) type, AK(W) type and SMP type.

Figure E-5 Structure of Slide Rotary Bush SRE type



## TYPE

Table E-5 Type

Standard Type		Square Flange Type	
SRE TYPE		SREK TYPE	
	P.E-16		P.E-18
Block Type		Unit	
Block Type		Double-Wide Block Type	
SMA-R TYPE		SMA-RW TYPE	
	P.E-20		P.E-21
AK-R TYPE		AK-RW TYPE	
	P.E-22		P.E-23
SMP-R TYPE			
	P.E-24		

## SPECIFICATION

Refer to Table E-6 for NB Slide Rotary Bush material and operating temperature range. The operating temperature range of the NB Slide Rotary UNIT series is based on the built-in Slide Rotary Bush.

Table E-6 Material and Operating Temperature Range

type	outer cylinder	retainer	operating temperature range
SRE	steel	stainless steel	-20°C~110°C
SREK			

**RATED LOAD AND RATED LIFE**

The rated life and load rating are defined as follows.

**Rated Life**

When a group of slide rotary bearings of the same type are used under the same conditions, the rated life is defined as the total number of rotations made without causing flaking by 90% of the bearings.

**Basic Dynamic Load Rating**

The basic dynamic load rating is defined as the load with a constant magnitude and direction at which a rated life of  $10^6$  rotations can be achieved.

**Basic Static Load Rating**

The basic static load rating is defined as the load with a constant direction that would result in a certain contact stress at the mid-point of the rolling element and tracking surface that are experiencing the maximum stress.

Equation (1) gives the relation between the applied load and the rated life of the slide rotary bush.

$$L = \left( \frac{f_H \cdot f_T \cdot f_C \cdot C}{f_W \cdot P} \right)^3 \times 10^6 \dots\dots\dots (1)$$

L: rated life (rotations)  $f_H$ : hardness coefficient  
 $f_T$ : temperature coefficient  $f_C$ : contact coefficient  
 $f_W$ : applied load coefficient C: basic dynamic load rating (N)  
 P: applied load (N)  
 ※Refer to page Eng-6 for the coefficients.

Since the slide rotary bush is used in applications with combined linear and rotary motions, the life time is obtained using Equations (2) and (3).

●When linear and rotary motions are combined

$$L_h = \frac{L}{60\sqrt{(dm \cdot n)^2 + (10 \cdot \ell s \cdot n_1)^2} / dm} \dots\dots (2)$$

●When only linear motion is involved

$$L_h = \frac{L}{600 \cdot \ell s \cdot n_1 / (\pi \cdot dm)} \dots\dots\dots (3)$$

$L_h$ : life time (hr)  $\ell s$ : stroke length (mm)  $n$ : revolutions per minute (rpm)  $n_1$ : number of cycles per minute (cpm)  
 $dm$ : ball pitch diameter (mm)  $\approx 1.15dr$  ( $dr$  is the inner contact diameter of the SRE series)

**Calculation Example**

The life of SRE20 type NB slide rotary bush is calculated based on the following conditions.

- Conditions  
 Motion: Linear and rotational combined Load:  $P=30N$  Stroke:  $\ell s=200mm$   
 Revolutions per minute:  $n=15rpm$  Number of cycles per minute:  $n_1=10cpm$   
 Shaft surface hardness: greater than 58 HRC  
 Operating temperature: room temperature Other: single shaft with single bush

- Calculation  
 Basic dynamic load rating:  $C=647 N$   
 Based on the above conditions, the life is calculated using the following coefficient values.  
 Hardness coefficient  $f_H=1$ , Temperature coefficient  $f_T=1$ , Contact coefficient  $f_C=1$   
 Applied load coefficient,  $f_W=1.5$

Rated life

$$L = \left( \frac{f_H \cdot f_T \cdot f_C \cdot C}{f_W \cdot P} \right)^3 \times 10^6$$

$$= \left( \frac{1 \times 1 \times 1}{1.5} \cdot \frac{647}{30} \right)^3 = 2,972 \times 10^6 \text{ (rotations)}$$

Life (in hours)

$$L_h = \frac{L}{60\sqrt{(dm \cdot n)^2 + (10 \cdot \ell s \cdot n_1)^2} / dm}$$

$$= \frac{2,972 \times 10^6}{60\sqrt{(1.15 \times 20 \times 15)^2 + (10 \times 200 \times 10)^2} / (1.15 \times 20)}$$

$$= 56,900 \text{ (h)}$$

**FIT**

**Shaft**

In order to ensure high accuracy motion of Slide Rotary Bush SRE type, it is essential to select a high quality shaft. In selecting a shaft, please take note of:

- Outer diameter tolerance: g6 recommended
- Surface hardness: 58HRC or higher  
 For a shaft with surface hardness less than 58HRC, make a correction in life calculation by adding hardness coefficient.
- Surface roughness: lower than Ra0.4 or better

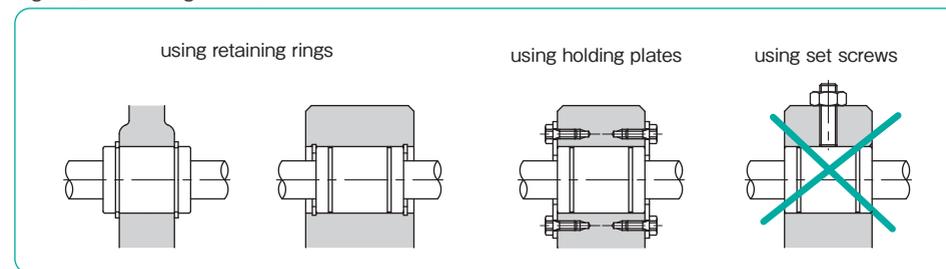
**Housing**

Inner diameter tolerance: H7 recommended

**MOUNTING**

Examples of mounting methods are shown in Figure E-6. Please do not fix outer cylinder by using set screw to avoid deformation.

Figure E-6 Mounting Method

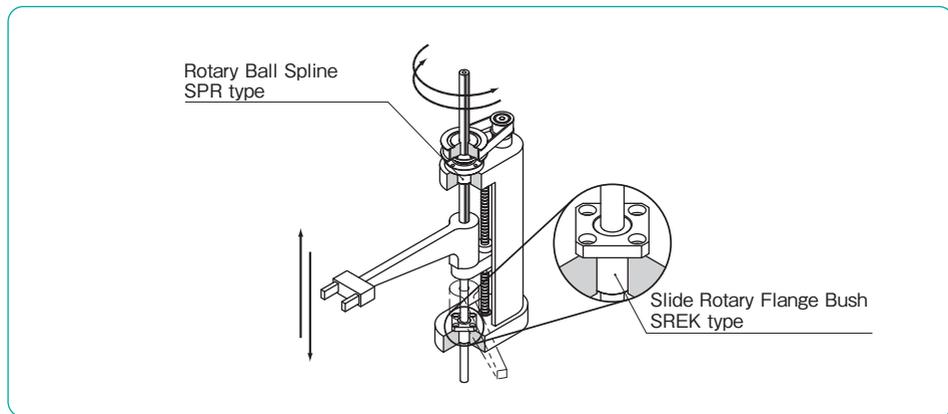


**Mounting Surface Shape**

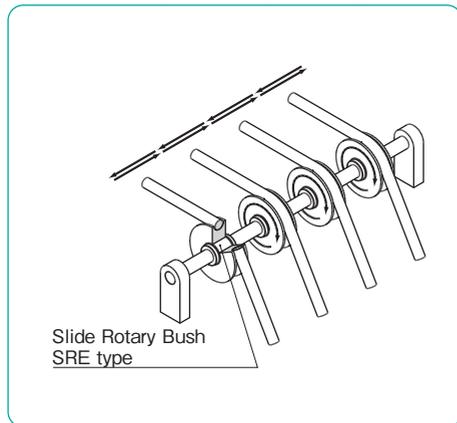
The slide rotary bush unit series is generally mounted by pressing the reference surface of the block against the shoulder provided on the mounting surface. For the shape of the shoulder, please refer to the shape of the slide bush block series (P.C-12)

APPLICATION EXAMPLES

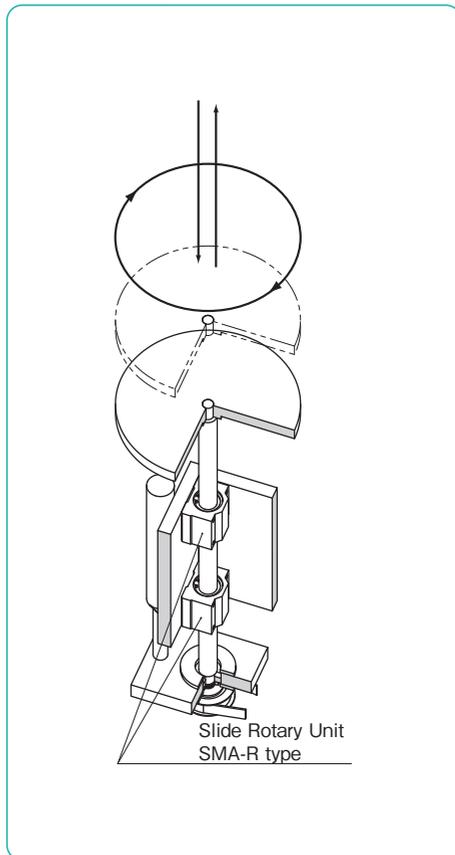
Application Example 1 Vertical Shaft Robot Arm



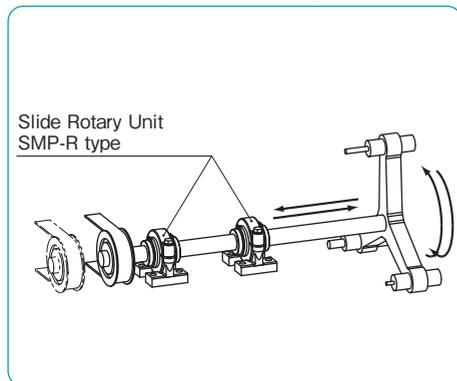
Application Example 2 Multiple Gearing Idler



Application Example 4 Turntable



Application Example 3 Tool Changer



USE AND HANDLING PRECAUTIONS

Lubrication

Lubrication is needed (1) to prevent heat fusing by reducing friction between the rolling elements and the tracking surface, (2) to reduce wear of the structural elements, and (3) to prevent rusting. Lubrication affects both the performance and life of the bush. A lubrication method and a lubrication agent appropriate to the operating conditions should be selected. For oil lubrication, turbine oil (ISO standard VG32-68) is recommended. For grease lubrication, lithium soap based grease No. 2 is recommended. The replenishment interval depends on the operating conditions.

Dust Prevention

Dust and other contaminants affect the bush's lifetime and accuracy. Appropriate prevention methods are thus important.

Operating Temperature Range

The operating temperature is ranging from -20°C to 110°C. In case of operation at a temperature outside this range, please contact NB.

Retainer Material

The standard material of SRE Retainer is stainless steel. When requiring other material, please contact NB.

FELT SEAL

A felt seal FLM strengthens lubrication characteristics and extends relubrication period of the slide rotary bush. At the time of shipment, the oil impregnation to the felt seal is not applied.

Figure E-7 Felt Seal

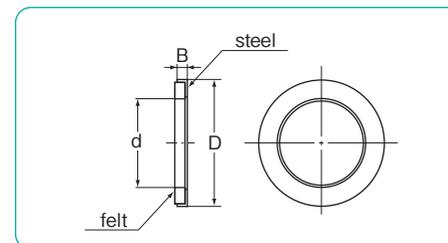


Table E-7 Felt Seal Dimensions

part number	major dimensions (mm)			applicable slide rotary bush
	d	D	B	
FLM 6	6	12	2	SRE 6
FLM 8	8	15	2	SRE 8
FLM 10	10	19	3	SRE 10
FLM 12	12	21	3	SRE 12
FLM 13	13	23	3	SRE 13
FLM 16	16	28	4	SRE 16
FLM 20	20	32	4	SRE 20
FLM 25	25	40	5	SRE 25
FLM 30	30	45	5	SRE 30
FLM 40	40	60	5	SRE 40

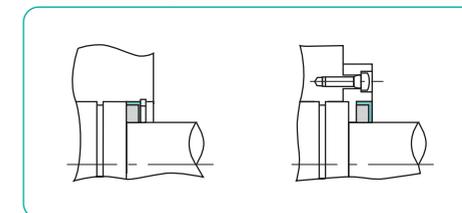
Instruction

The felt seal is used by press-fitting into a housing which is manufactured according to the recommended fits.

Stopper of slide rotary bush is necessary other than felt seal.

Insert it between the slide rotary bush and retaining ring as shown in the left figure of Figure E-8, or provide a place to press fit outside the retaining ring as shown in the right figure.

Figure E-8 Example of Installation



# SRE TYPE

– Standard type –

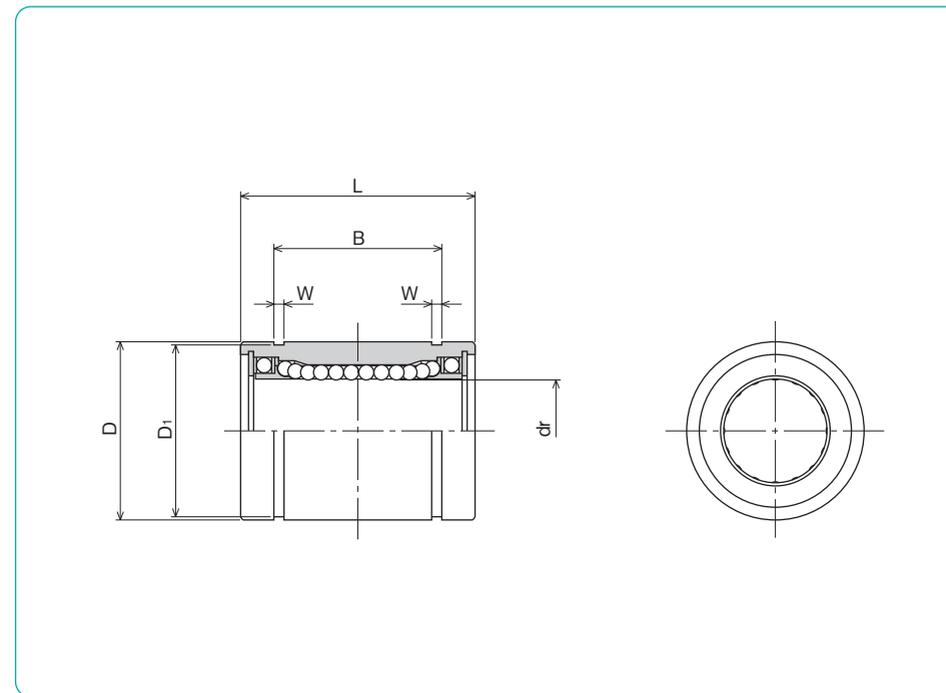


## part number structure

example **SRE 25**

SRE type

inner contact diameter (dr)



part number	dr		D		major dimensions			
	mm	tolerance μm	mm	tolerance μm	mm	tolerance mm	mm	tolerance mm
<b>SRE 6</b>	6		12	0	19		13.5	
<b>SRE 8</b>	8	+4	15	-11	24		17.5	
<b>SRE10</b>	10	-5	19		29	0	22	0
<b>SRE12</b>	12	+3	21	0	30	-0.2	23	-0.2
<b>SRE13</b>	13	-6	23	-13	32		23	
<b>SRE16</b>	16		28		37		26.5	
<b>SRE20</b>	20	+3	32	0	42		30.5	
<b>SRE25</b>	25	-7	40	-16	59	0	41	0
<b>SRE30</b>	30		45		64	-0.3	44.5	-0.3
<b>SRE40</b>	40	+3/-8	60	0/-19	80		60.5	

※If the inner contact diameter exceeds 40 mm, please contact NB.

W	D <sub>1</sub>	basic load rating		allowable revolutions per minute rpm	mass g	part number
		dynamic C N	static Co N			
1.1	11.5	78	176	300	10	<b>SRE 6</b>
1.1	14.3	137	314	300	20	<b>SRE 8</b>
1.3	18	157	372	300	39	<b>SRE10</b>
1.3	20	274	588	300	42	<b>SRE12</b>
1.3	22	323	686	300	56	<b>SRE13</b>
1.6	27	451	882	250	97	<b>SRE16</b>
1.6	30.5	647	1,180	250	133	<b>SRE20</b>
1.85	38	882	1,860	250	293	<b>SRE25</b>
1.85	43	1,180	2,650	200	371	<b>SRE30</b>
2.1	57	1,960	4,020	200	778	<b>SRE40</b>

1N≒0.102kgf

# SREK TYPE

– Square Flange type –

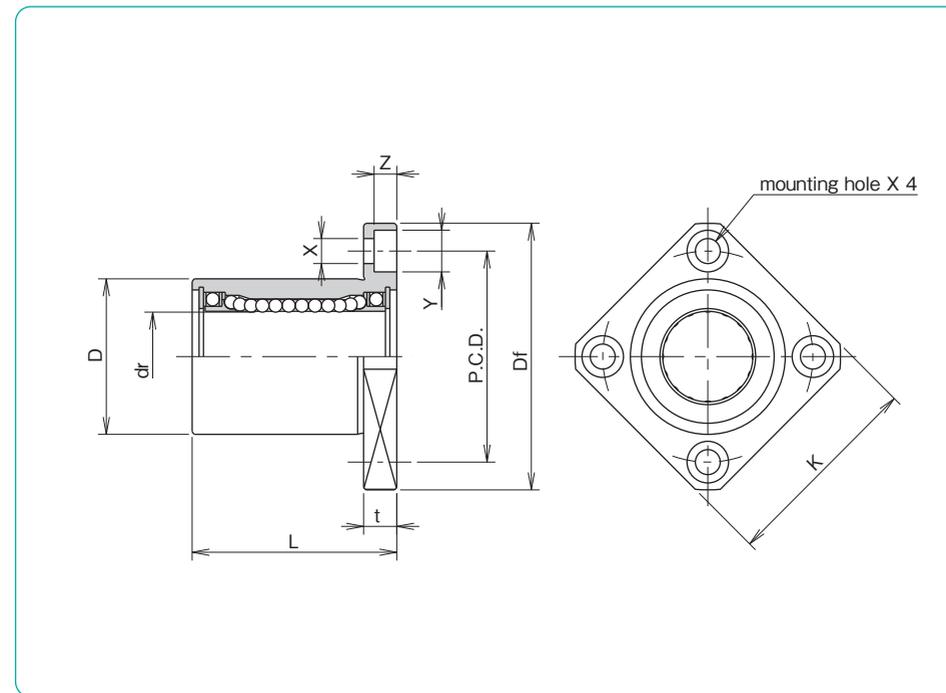


## part number structure

example **SREK 25**

SREK type

inner contact diameter (dr)



part number	dr		D		major dimensions			
	mm	tolerance $\mu\text{m}$	mm	tolerance $\mu\text{m}$	L $\pm 0.3$ mm	Df mm	K mm	flange t mm
<b>SREK 6</b>	6	+4 -5	12	0	19	28	22	5
<b>SREK 8</b>	8		15	-13	24	32	25	5
<b>SREK 10</b>	10		19		29	40	30	6
<b>SREK 12</b>	12	+3 -6	21	0	30	42	32	6
<b>SREK 13</b>	13		23	-16	32	43	34	6
<b>SREK 16</b>	16		28		37	48	37	6
<b>SREK 20</b>	20	+3 -7	32	0	42	54	42	8
<b>SREK 25</b>	25		40	-19	59	62	50	8
<b>SREK 30</b>	30		45		64	74	58	10

P.C.D. mm	X×Y×Z mm	perpendicularity $\mu\text{m}$	basic load rating		allowable revolutions per minute	mass g	part number
			dynamic C N	static Co N			
20	3.5×6×3.1	12	78	176	300	21	<b>SREK 6</b>
24	3.5×6×3.1		137	314	300	33	<b>SREK 8</b>
29	4.5×7.5×4.1		157	372	300	61	<b>SREK 10</b>
32	4.5×7.5×4.1		274	588	300	67	<b>SREK 12</b>
33	4.5×7.5×4.1		323	686	300	83	<b>SREK 13</b>
38	4.5×7.5×4.1		451	882	250	126	<b>SREK 16</b>
43	5.5×9×5.1	15	647	1,180	250	178	<b>SREK 20</b>
51	5.5×9×5.1		882	1,860	250	355	<b>SREK 25</b>
60	6.6×11×6.1		1,180	2,650	200	483	<b>SREK 30</b>

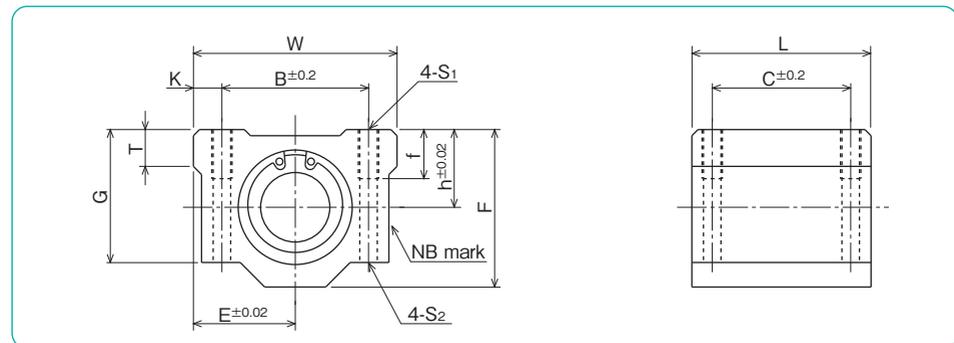
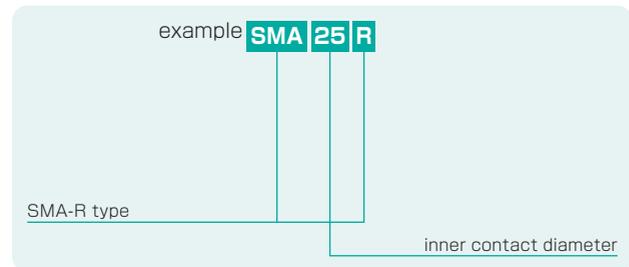
1N≐0.102kgf

# SMA-R TYPE

–Block type–



## part number structure



part number	inner contact diameter		major dimensions													basic load rating		allowable revolutions per minute	mass g				
	mm	μm	outer dimensions				mounting dimensions					dynamic	static	dynamic	static								
			h	E	W	L	F	G	T	B	C	K	S <sub>1</sub>	f	S <sub>2</sub>	C	Co	N	Co	N	rpm	rpm	g
SMA 6R	6		9	15	30	25	18	15	6	20	15	5	M4	8	3.4	78	176	300	33				
SMA 8R	8	+4	11	17	34	30	22	18	6	24	18	5	M4	8	3.4	137	314	300	55				
SMA 10R	10	-5	13	20	40	35	26	21	8	28	21	6	M5	12	4.3	157	372	300	93				
SMA 12R	12		15	21	42	36	28	24	8	30.5	26	5.75	M5	12	4.3	274	588	300	104				
SMA 13R	13	+3	15	22	44	39	30	24.5	8	33	26	5.5	M5	12	4.3	323	686	300	128				
SMA 16R	16	-6	19	25	50	44	38.5	32.5	9	36	34	7	M5	12	4.3	451	882	250	216				
SMA 20R	20		21	27	54	50	41	35	11	40	40	7	M6	12	5.2	647	1,180	250	286				
SMA 25R	25	+3	26	38	76	67	51.5	42	12	54	50	11	M8	18	7	882	1,860	250	645				
SMA 30R	30	-7	30	39	78	72	59.5	49	15	58	58	10	M8	18	7	1,180	2,650	200	824				
SMA 40R	40	+3/-8	40	51	102	90	78	62	20	80	60	11	M10	25	8.7	1,960	4,020	200	1,719				

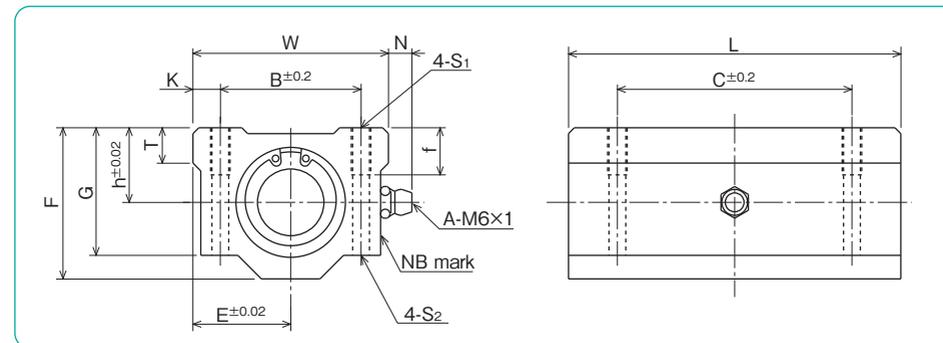
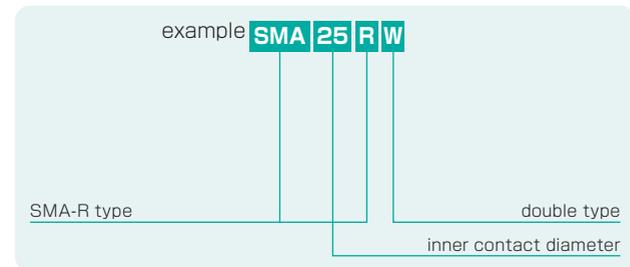
1N≒0.102kgf

# SMA-RW TYPE

–Double-Wide Block type–



## part number structure



part number	inner contact diameter		major dimensions													basic load rating		allowable revolutions per minute	mass g					
	mm	μm	outer dimensions				mounting dimensions					dynamic	static	dynamic	static									
			h	E	W	L	F	G	T	N	B	C	K	S <sub>1</sub>	f	S <sub>2</sub>	C	Co	N	Co	N	rpm	rpm	g
SMA 6RW	6		9	15	30	48	18	15	6	7	20	36	5	M4	8	3.4	126	352	300	68				
SMA 8RW	8	+4	11	17	34	58	22	18	6	7	24	42	5	M4	8	3.4	222	628	300	113				
SMA 10RW	10	-5	13	20	40	68	26	21	8	7	28	46	6	M5	12	4.3	254	744	300	188				
SMA 12RW	12		15	21	42	70	28	24	8	6.5	30.5	50	5.75	M5	12	4.3	444	1,180	300	210				
SMA 13RW	13	+3	15	22	44	75	30	24.5	8	6.5	33	50	5.5	M5	12	4.3	523	1,370	300	254				
SMA 16RW	16	-6	19	25	50	85	38.5	32.5	9	6	36	60	7	M5	12	4.3	731	1,760	250	431				
SMA 20RW	20		21	27	54	96	41	35	11	7	40	70	7	M6	12	5.2	1,050	2,360	250	568				
SMA 25RW	25	+3	26	38	76	130	51.5	42	12	4	54	100	11	M8	18	7	1,430	3,720	250	1,282				
SMA 30RW	30	-7	30	39	78	140	59.5	49	15	5	58	110	10	M8	18	7	1,910	5,300	200	1,638				
SMA 40RW	40	+3/-8	40	51	102	175	78	62	20	5	80	140	11	M10	25	8.7	3,180	8,040	200	3,419				

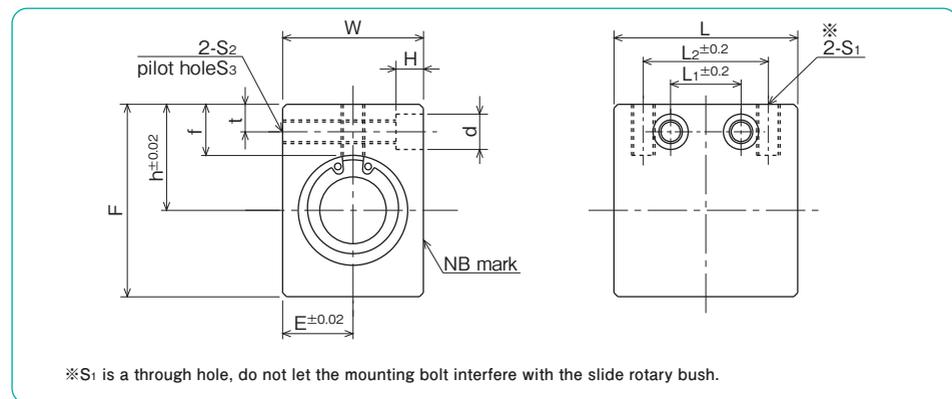
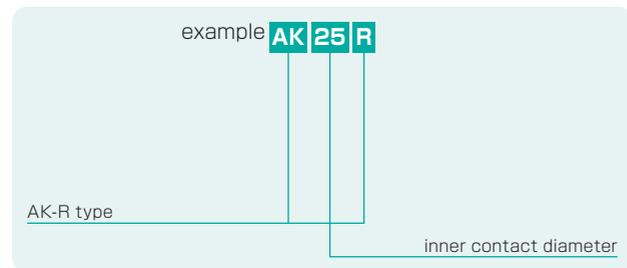
1N≒0.102kgf

# AK-R TYPE

—Compact Block type—



## part number structure



part number	inner contact diameter		major dimensions													basic load rating		allowable revolutions per minute	mass	
	mm	μm	h	E	W	F	L	L <sub>2</sub>	S <sub>1</sub>	f	L <sub>1</sub>	t	S <sub>2</sub>	S <sub>3</sub>	d	H	C			Co
AK 6R	6		14	8	16	22	27	18	M4	8	9	5	M4	3.5	6	5	78	176	300	27
AK 8R	8	+4	16	10	20	26	32	20	M5	8.5	10	5	M4	3.5	6	5	137	314	300	48
AK10R	10	-5	19	13	26	32	39	27	M6	9.5	15	6	M5	4.5	8	6	157	372	300	94
AK12R	12		20	14	28	34	40	27	M6	9.5	15	6	M5	4.5	8	6	274	588	300	105
AK13R	13	+3	25	15	30	43	42	28	M6	13.5	16	7	M6	5.2	9	7	323	686	300	151
AK16R	16	-6	27	18	36	49	47	32	M6	13	18	7	M6	5.2	9	7	451	882	250	238
AK20R	20		31	21	42	54	52	36	M8	15	18	8	M8	7	11	8	647	1,180	250	328
AK25R	25	+3	37	26	52	65	69	42	M10	17	22	9	M10	8.9	14	10	882	1,860	250	669
AK30R	30	-7	40	29	58	71	74	44	M10	17.5	22	9	M10	8.9	14	10	1,180	2,650	200	856

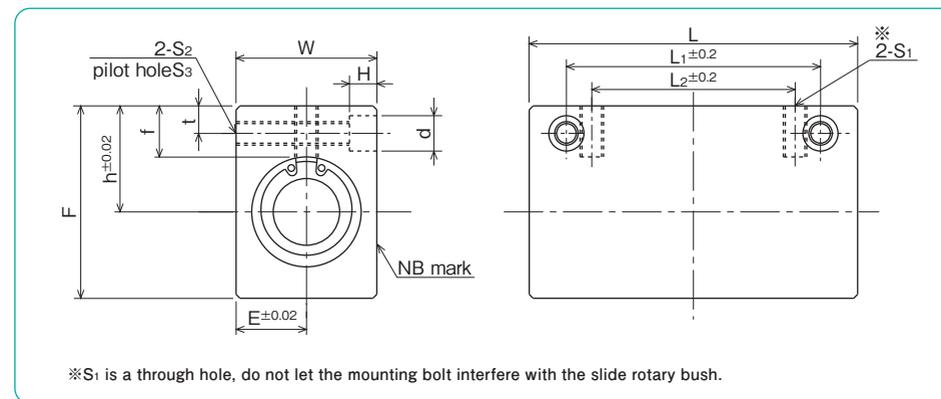
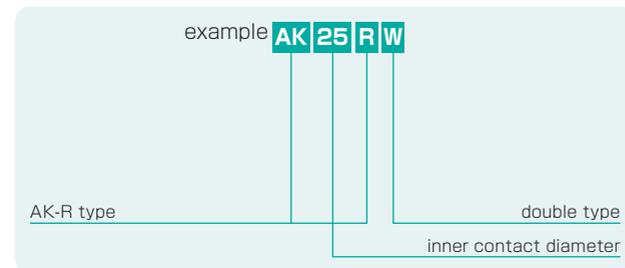
1N≐0.102kgf

# AK-RW TYPE

—Double-Wide Compact Block type—



## part number structure



part number	inner contact diameter		major dimensions													basic load rating		allowable revolutions per minute	mass	
	mm	μm	h	E	W	F	L	L <sub>2</sub>	S <sub>1</sub>	f	L <sub>1</sub>	t	S <sub>2</sub>	S <sub>3</sub>	d	H	C			Co
AK 6RW	6		14	8	16	22	46	20	M4	8	30	5	M4	3.5	6	5	126	352	300	48
AK 8RW	8	+4	16	10	20	26	56	30	M5	8.5	42	5	M4	3.5	6	5	222	628	300	89
AK10RW	10	-5	19	13	26	32	68	36	M6	9.5	50	6	M5	4.5	8	6	254	744	300	175
AK12RW	12		20	14	28	34	70	36	M6	9.5	50	6	M5	4.5	8	6	444	1,180	300	196
AK13RW	13	+3	25	15	30	43	74	42	M6	13.5	55	7	M6	5.2	9	7	523	1,370	300	281
AK16RW	16	-6	27	18	36	49	84	52	M6	13	65	7	M6	5.2	9	7	731	1,760	250	450
AK20RW	20		31	21	42	54	94	58	M8	15	70	8	M8	7	11	8	1,050	2,360	250	626
AK25RW	25	+3	37	26	52	65	128	80	M10	17	100	9	M10	8.9	14	10	1,430	3,720	250	1,299
AK30RW	30	-7	40	29	58	71	138	90	M10	17.5	110	9	M10	8.9	14	10	1,910	5,300	200	1,662

1N≐0.102kgf

# SMP-R TYPE

—Pillow Block type—

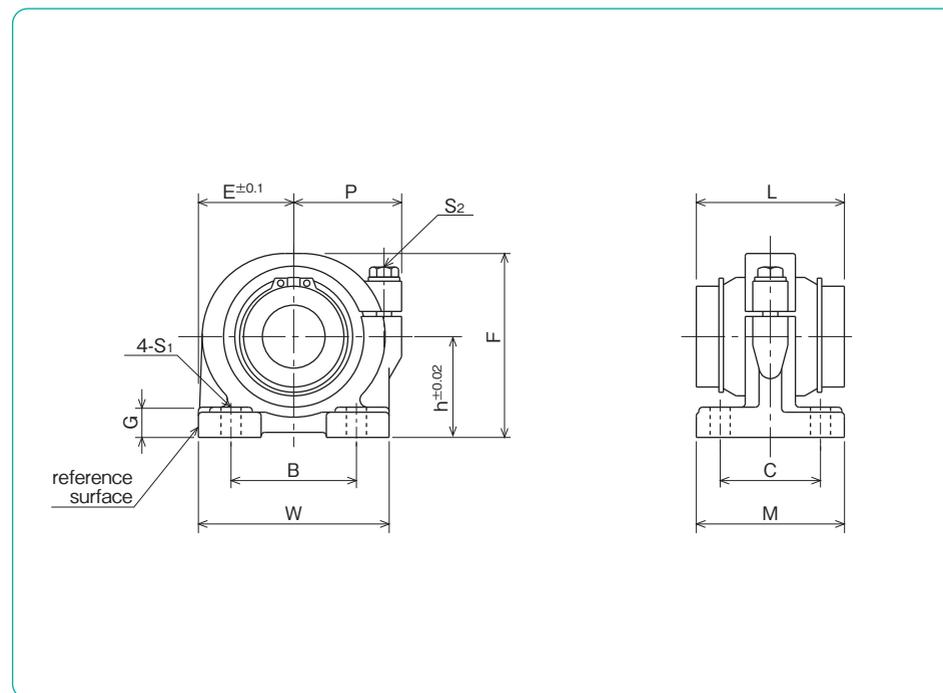


## part number structure

example **SMP 25 R**

SMP-R type

inner contact diameter



part number	inner contact diameter		major dimensions						
	mm	tolerance $\mu\text{m}$	h mm	E mm	W mm	outer dimensions			
						L mm	F mm	G mm	M mm
<b>SMP13R</b>	13	+3	25	25	50	32	46	8	36
<b>SMP16R</b>	16	-6	29	27.5	55	37	53	10	40
<b>SMP20R</b>	20	+3 -7	34	32.5	65	42	62	12	48
<b>SMP25R</b>	25		40	38	76	59	73	12	59
<b>SMP30R</b>	30		45	42.5	85	64	84	15	69
<b>SMP40R</b>	40	+3/-8	60	62	124	80	112	18	86

P mm	mounting dimensions			adjustment screw size $S_2$	recommended torque N·m	basic load rating		allowable revolutions per minute	mass g	part number
	B mm	C mm	$S_1$ mm			dynamic C N	static $C_0$ N			
30	30	26	7 (M5)	M5	3	323	686	300	266	<b>SMP13R</b>
32	35	29	7 (M5)	M5	3	451	882	250	369	<b>SMP16R</b>
37	40	35	8 (M6)	M6	5.5	647	1,180	250	690	<b>SMP20R</b>
43	50	40	8 (M6)	M6	5.5	882	1,860	250	970	<b>SMP25R</b>
49	58	46	10 (M8)	M8	13.5	1,180	2,650	200	1,420	<b>SMP30R</b>
68	76	64	12 (M10)	M10	29	1,960	4,020	200	3,585	<b>SMP40R</b>

1N  $\approx$  0.102kgf

# SLIDE ROTARY BUSH RK TYPE

NB's RK type slide rotary bush is a highly accurate and high load capacity bearing providing smooth continuous linear and rotational motions. Its structure imposes no constraints on linear and rotational motions. It is much more compact than a standard slide bush with separate rotational bearing.

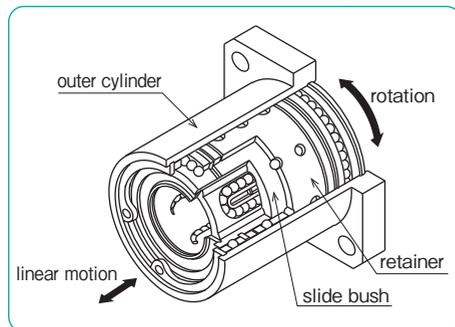
## STRUCTURE AND ADVANTAGES

The RK type slide rotary bush uses a retainer similar to that used in the SR type stroke bush. This retainer gives a smooth motion in a high rotational application.

SM type slide bush is incorporated, providing the stable and smooth linear motion.

Relatively large ball elements are used for high load capacity.

Figure E-9 Structure of RK Slide Rotary Bush



1. A smooth unlimited linear and rotational motion is obtained.
2. There is no need to machine separate housing.
3. High accuracy is ensured for extended period of usage.
4. Its high compatibility eliminates replacement problems.

## SPECIFICATION

Refer to Table E-8 for NB Slide Rotary Bush RK material and operating temperature range.

The operating temperature range of the NB Slide Rotary UNIT series is based on the built-in Slide Rotary Bush.

Table E-8 Material and Operating Temperature Range

type	outer cylinder	retainer	slide bush		operating temperature range
			outer cylinder	retainer	
RK	steel	aluminum	steel	resin	-20°C~80°C

## FIT

### Shaft

In order to ensure high accuracy motion of Slide Rotary Bush RK type, it is essential to select a high quality shaft. In selecting a shaft, please take note of:

Outer diameter tolerance: h5 recommended

Surface hardness: 58HRC or higher

For a shaft with surface hardness less than 58HRC, make a correction in life calculation by adding hardness coefficient.

Surface roughness: lower than Ra0.4 or better

### Housing

Inner diameter tolerance is not requested. Please insert into an installation bore which is slightly larger than the outer cylinder.

## LIFE CALCULATION

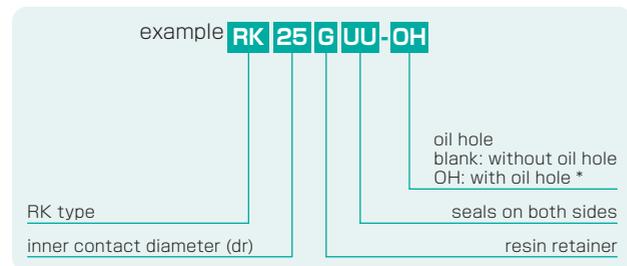
$$L = \left( \frac{f_H \cdot f_T \cdot f_C \cdot C}{f_W \cdot P} \right)^3 \times 50$$

L: rated life (km) f<sub>H</sub>: hardness coefficient  
 f<sub>T</sub>: temperature coefficient f<sub>C</sub>: contact coefficient  
 f<sub>W</sub>: applied load coefficient  
 C: basic dynamic load rating (N) P: applied load (N)  
 ※Refer to page Eng-6 for the coefficients.

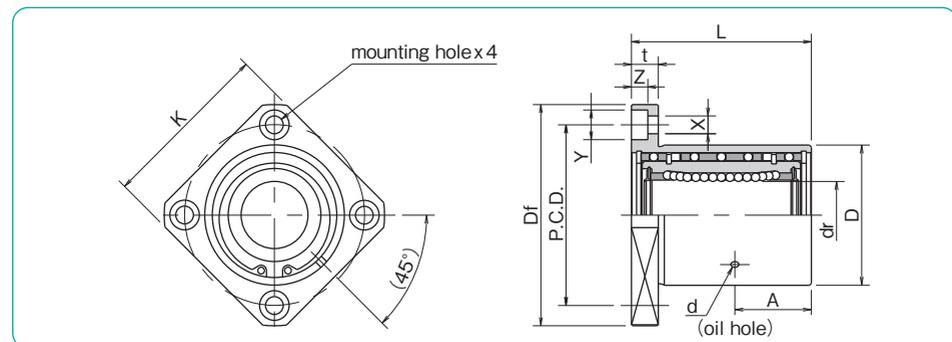
# RK TYPE



## part number structure



\*Oil hole is for rotary-portion lubrication.



part number	dr		D		major dimensions										basic load rating		allowable revolutions per minute	mass g
	mm	tolerance μm	mm	tolerance μm	L	A	d	Df	K	t	P.C.D.	X×Y×Z	C	Co				
<b>RK12GUU</b>	12	0	32	0	36	15	2	54	42	8	43	5.5×9×5.1	510	784	500	180		
<b>RK16GUU</b>	16	-9	40	0	45	19.5	2	62	50	8	51	5.5×9×5.1	774	1,180	500	280		
<b>RK20GUU</b>	20	0	45	-25	50	±0.3	21.5	3	74	58	10	60	6.6×11×6.1	882	1,370	400	420	
<b>RK25GUU</b>	25	-10	52	0	67	28.5	3	82	64	10	67	6.6×11×6.1	980	1,570	400	680		
<b>RK30GUU</b>	30		60	-30	74	31	3	96	75	13	78	9×14×8.1	1,570	2,740	400	990		

1N≒0.102kgf

# SLIDE SHAFT SHAFT

## SLIDE SHAFT

- ADVANTAGES ..... F-2
- TYPES ..... F-3
- CALCULATION OF DEFLECTION AND DEFLECTION ANGLE ..... F-4
- NB SHAFT SN TYPE ..... F-6
- NB STAINLESS STEEL SHAFT SNS TYPE ..... F-7
- NB HOLLOW SHAFT SNT TYPE ..... F-8
- NB CENTER-LINED TAPPED SHAFT SN(S)B TYPE ..... F-9
- SHAFT SUPPORTER AND SHAFT SUPPORT RAIL ..... F-10
- ACCURACY OF SA TYPE SUPPORT RAIL ..... F-10
- SHAFT SUPPORTER SH-A TYPE ..... F-11
- SHAFT SUPPORTER SH TYPE ..... F-12
- SHAFT SUPPORTER SHF TYPE ..... F-13
- SHAFT SUPPORT RAIL SA TYPE ..... F-14
- SHAFT SUPPORTER WH-A TYPE (INCH SIZE) ..... F-16
- SHAFT SUPPORT RAIL WA TYPE (INCH SIZE) ..... F-18
- LOW SHAFT SUPPORT RAIL LWA TYPE (INCH SIZE) ..... F-19
- SHAFT SUPPORT ASSEMBLY WSS TYPE (STANDARD TYPE) ..... F-20
- SHAFT SUPPORT ASSEMBLY WSS-SS TYPE (STAINLESS TYPE) ..... F-21
- NBCA SHAFT SF TYPE ..... F-22
- NBCA STAINLESS STEEL SHAFT SFS TYPE ..... F-23
- NBCA INCH SHAFT SFW TYPE ..... F-24
- NBCA INCH STAINLESS STEEL SHAFT SFWS TYPE ..... F-25
- NBCA INCH PRE-DRILLED SHAFT SFW-PD TYPE ..... F-26
- NBCA INCH PRE-DRILLED STAINLESS STEEL SHAFT SFWS-PD TYPE ..... F-27
- FORMAT SINGLE END TAPPED INCH SHAFT SFW TYPE ..... F-28
- FORMAT BOTH ENDS TAPPED INCH SHAFT SFW TYPE ..... F-29
- FORMAT THREADED INCH SHAFTS SFW TYPE (SINGLE END THREADED) ..... F-30
- FORMAT THREADED INCH SHAFTS SFW TYPE (BOTH ENDS THREADED) ..... F-31
- PRE-CUT SLIDE SHAFTS PC TYPE ..... F-32
- FIT SERIES ..... F-33

## GENERAL MACHINE SHAFTING

- ADVANTAGES ..... F-34
- MACHINING SPECIFICATIONS ..... F-34
- EXAMPLES OF MACHINING① ..... F-35
- EXAMPLES OF MACHINING② ..... F-36

# SLIDE SHAFT

The NB shaft can be used in a wide range of applications as a mechanical component from straight shaft to spindle shaft. NB's expertise in machining and heat-treatment turns into manufacturing spindle shaft, roll shaft, and general machinery shaft for rotational motion. NB's high accuracy technology answers various shaft machining requirements.

## ADVANTAGES

### Advanced Machining Technology

NB performs a wide variety of highly accurate machining processes to provide custom shafting from relatively simple machining, such as tapping and shaft stepping to the more demanding high-speed rotating shafts and spindles. NB can also answer the special grinding and bore machining requirements.

### Excellent Wear Resistance

Most commonly used materials are high-carbon chromium bearing steel (SUJ2) and martensite stainless steel (SUS440C or equivalent). NB's advanced heat-treatment technology gives these materials an excellent wear resistance by quenching and tempering to achieve a uniform hardened layer in the circumferential and axial directions. The cross-sectional picture below shows the hardened layer-depth of the NB shaft.

Hardened Layer  
(cross section)



### Surface Roughness

Precision grinding results in a surface roughness of less than Ra0.4.

### Wide Selection of Shaft Types

- SN type, SNS type, SNT type,
- SNB, SNSB type (Center-lined tapped shaft)
- Spindle shaft, roll shaft

### Special Requirements

Based on the customer drawings and specifications NB will answer the customer requirements in material (SCM, SKS etc.), heat-treatment, surface treatment, etc.

### Shaft Supporter and Shaft Support Rail

These components ease the shaft installation and help save the design/assembling time. (refer to page F-10)

### FIT Series

This series is a set of NB slide bush and NB shaft. By precise shaft-grinding, FIT series achieves the best-fit clearance adjustment for a smooth, high accuracy linear motion. (refer to page F-33)

## TYPES

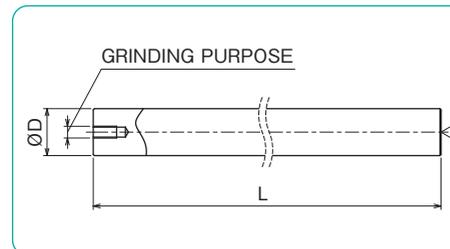
### SN/SNS/SNT type (NB Shaft)



### SNB/SNSB type (NB Center-lined Tapped Shaft)



### Machining tap hole for grinding



NB shaft is a high-precision shaft that can be used with slide bush or any other bearings. A wide range of machining is provided for customer drawings and requirements.

Table F-1 Specifications

type	SN type	SNS type	SNT type
material	SUJ2	equivalent to SUS440C	SUJ2 (hollow shaft)
outer diameter tolerance	g6 or to be specified		
hardness	60HRC or more	56HRC or more	60HRC or more
surface roughness	Ra0.4 or less		
page	page F-6	page F-7	page F-8

Center-lined tapped shafts are standardized series for easy selection that can be used with the SA shaft support rails. (refer to page F-14)

Table F-2 Specifications

type	SNB type	SNSB type
material	SUJ2	equivalent to SUS440C
outer diameter tolerance	g6 or to be specified	
hardness	60HRC or more	56HRC or more
surface roughness	Ra0.4 or less	
page	page F-9	

For large diameter straight shafts, a tap hole is machined on one end for cylindrical grinding. Refer to Table F-3 for details.

Table F-3 Grinding Purpose

outer diameter φD (mm)	shaft length L (mm)	tap for grinding purpose on one side only
φ30 or less	—	not required
over φ30 and φ40 or less	over 2,000mm	M8 × 16
over φ40 and φ50 or less	over 1,300mm	M10 × 20
over φ50 and φ70 or less	over 650mm	M10 × 20
over φ70 and φ100 or less	all lengths	M12 × 24
over φ100	all lengths	M16 × 32

### CALCULATION OF DEFLECTION AND DEFLECTION ANGLE

The following formulas are used to obtain the deflection and its angle of the shaft. Typical conditions are listed in Table F-4.

Table F-4 Formulas for Calculating Deflection and Deflection Angle

support method	specification	formula for deflection	formula for deflection angle
1 support   support		$\delta_{max} = \frac{P\ell^3}{48EI} = P\ell^3C$	$i_1 = 0$ $i_2 = \frac{P\ell^2}{16EI} = 3P\ell^2C$
2 fixed   fixed		$\delta_{max} = \frac{P\ell^3}{192EI} = \frac{1}{4}P\ell^3C$	$i_1 = 0$ $i_2 = 0$
3 support   support		$\delta_{max} = \frac{5p\ell^4}{384EI} = \frac{5}{8}p\ell^4C$	$i_2 = \frac{p\ell^3}{24EI} = 2p\ell^3C$
4 fixed   fixed		$\delta_{max} = \frac{p\ell^4}{384EI} = \frac{1}{8}p\ell^4C$	$i_2 = 0$
5 support   support		$\delta_1 = \frac{Pa^2}{6EI} \left( 2 + \frac{3b}{a} \right) = 8Pa^3 \left( 2 + \frac{3b}{a} \right) C$ $\delta_{max} = \frac{Pa^3}{24EI} \left( \frac{3\ell^2}{a^2} - 4 \right) = 2Pa^3 \left( \frac{3\ell^2}{a^2} - 4 \right) C$	$i_1 = \frac{Pab}{2EI} = 24PabC$ $i_2 = \frac{Pa(a+b)}{2EI} = 24Pa(a+b)C$
6 fixed   fixed		$\delta_1 = \frac{Pa^2}{6EI} \left( 2 - \frac{3a}{\ell} \right) = 8Pa^3 \left( 2 - \frac{3a}{\ell} \right) C$ $\delta_{max} = \frac{Pa^3}{24EI} \left( 2 + \frac{3b}{a} \right) = 2Pa^3 \left( 2 + \frac{3b}{a} \right) C$	$i_1 = \frac{Pa^2b}{2EI\ell} = \frac{24Pa^2bC}{\ell}$ $i_2 = 0$
7 fixed   free		$\delta_{max} = \frac{P\ell^3}{3EI} = 16P\ell^3C$	$i_1 = \frac{P\ell^2}{2EI} = 24P\ell^2C$ $i_2 = 0$
8 fixed   free		$\delta_{max} = \frac{p\ell^4}{8EI} = 6p\ell^4C$	$i_1 = \frac{p\ell^3}{6EI} = 8p\ell^3C$ $i_2 = 0$
9 support   support		$\delta_{max} = \frac{\sqrt{3}Mo\ell^2}{216EI} = \frac{2\sqrt{3}}{9}Mo\ell^2C$	$i_1 = \frac{Mo\ell}{12EI} = 4Mo\ell C$ $i_2 = \frac{Mo\ell}{24EI} = 2Mo\ell C$
10 fixed   fixed		$\delta_{max} = \frac{Mo\ell^2}{216EI} = \frac{2}{9}Mo\ell^2C$	$i_1 = \frac{Mo\ell}{16EI} = 3Mo\ell C$ $i_2 = 0$

$\delta_1$ : deflection at the concentrated load point (mm)  $\delta_{max}$ : maximum deflection (mm)  $i_1$ : deflection angle at the concentrated load point (rad)  
 $i_2$ : deflection angle at the support point (rad) Mo: moment (N·mm) P: concentrated load (N)  
 p: uniformly distributed load (N/mm) a,b: concentrated load point distance (mm)  $\ell$ : span (mm) I: moment of inertia of area (mm<sup>4</sup>)  
 E: modulus of longitudinal elasticity (SUJ2)  $2.06 \times 10^5$  (N/mm<sup>2</sup>) (SUS)  $2.0 \times 10^5$  (N/mm<sup>2</sup>) C:  $1/48EI$  ( $1/N \cdot mm^2$ )

The moment of inertia of area (I) is obtained using the following formulas:

● For solid shaft

● For hollow shaft

$$I = \frac{\pi D^4}{64}$$

$$I = \frac{\pi}{64} (D^4 - d^4)$$

I: moment of inertia of area (mm<sup>4</sup>)

D: outer diameter (mm) d: inner diameter (mm)

The values of the moment of inertia of area and C (=1/48 EI) for NB shafts are listed in Table F-5 and F-6.

### Calculation Examples

1. Calculating the maximum deflection of a 30mm shaft with a 500mm span when a concentrated load of 980 N is applied at the mid-point of the shaft ... (neglecting the shaft weight)

① In case the support method is support-support:

From the given conditions, P = 980 N,  $\ell = 500$ mm  
 From Table F-5, C for an outer diameter of 30 mm,  
 C =  $2.54 \times 10^{-8}$  (N·mm<sup>2</sup>).

Substituting these values into the corresponding formula (No. 1) in Table F-4,  
 $\delta_{max} = P\ell^3C = 0.31$  (mm)

② In case the support method is fixed-fixed:

Substituting the values into the corresponding formula (No. 2) given in Table F-4,

$$\delta_{max} = \frac{1}{4}P\ell^3C = 0.08$$
 (mm)

2. Calculating the maximum deflection of a 60mm shaft with an inner diameter of 32 mm and a 2,000 mm span by its own weight ...

From Table F-6, C for an outer diameter of 60 mm,  
 C =  $1.73 \times 10^{-13}$  (N·mm<sup>2</sup>)

The mass per unit length of a shaft with an outer diameter of 60 mm and an inner diameter of 32 mm is 15.9kg/m. Therefore, a uniformly distributed load of 0.156 N/mm is applied. Substituting these values into the formula (No. 3) given in Table F-4.

$$\delta_{max} = \frac{5}{8}p\ell^4C = 0.27$$
 (mm)

Table F-5 Solid Shaft

outer diameter D (mm)	moment of inertia of area I (mm <sup>4</sup> )	C=1/48EI (1/N·mm <sup>2</sup> ) SUJ2	equivalent to SUS440C
3	3.98	$2.54 \times 10^{-8}$	$2.62 \times 10^{-8}$
4	$1.26 \times 10$	$8.05 \times 10^{-9}$	$8.29 \times 10^{-9}$
5	$3.07 \times 10$	$3.30 \times 10^{-9}$	$3.40 \times 10^{-9}$
6	$6.36 \times 10$	$1.59 \times 10^{-9}$	$1.64 \times 10^{-9}$
8	$2.01 \times 10^2$	$5.03 \times 10^{-10}$	$5.18 \times 10^{-10}$
10	$4.91 \times 10^2$	$2.06 \times 10^{-10}$	$2.12 \times 10^{-10}$
12	$1.02 \times 10^3$	$9.94 \times 10^{-11}$	$1.02 \times 10^{-10}$
13	$1.40 \times 10^3$	$7.21 \times 10^{-11}$	$7.43 \times 10^{-11}$
15	$2.49 \times 10^3$	$4.07 \times 10^{-11}$	$4.19 \times 10^{-11}$
16	$3.22 \times 10^3$	$3.14 \times 10^{-11}$	$3.24 \times 10^{-11}$
20	$7.85 \times 10^3$	$1.29 \times 10^{-11}$	$1.33 \times 10^{-11}$
25	$1.92 \times 10^4$	$5.27 \times 10^{-12}$	$5.43 \times 10^{-12}$
30	$3.98 \times 10^4$	$2.54 \times 10^{-12}$	$2.62 \times 10^{-12}$
35	$7.37 \times 10^4$	$1.37 \times 10^{-12}$	$1.41 \times 10^{-12}$
40	$1.26 \times 10^5$	$8.05 \times 10^{-13}$	$8.29 \times 10^{-13}$
50	$3.07 \times 10^5$	$3.30 \times 10^{-13}$	$3.40 \times 10^{-13}$
60	$6.36 \times 10^5$	$1.59 \times 10^{-13}$	$1.64 \times 10^{-13}$
80	$2.01 \times 10^6$	$5.03 \times 10^{-14}$	$5.18 \times 10^{-14}$
100	$4.91 \times 10^6$	$2.06 \times 10^{-14}$	$2.12 \times 10^{-14}$
120	$1.02 \times 10^7$	$9.94 \times 10^{-15}$	—
150	$2.49 \times 10^7$	$4.07 \times 10^{-15}$	—

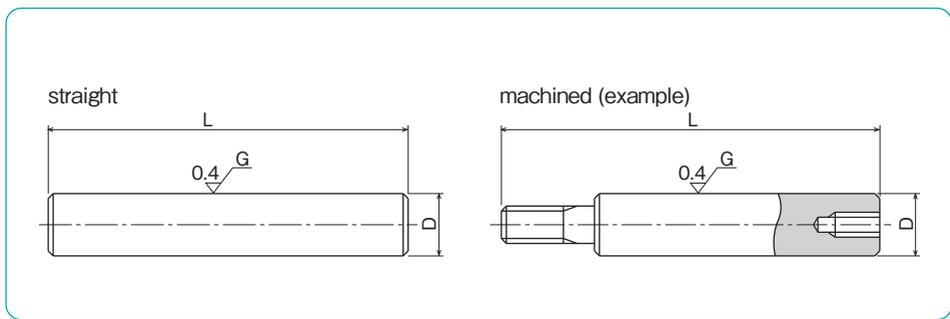
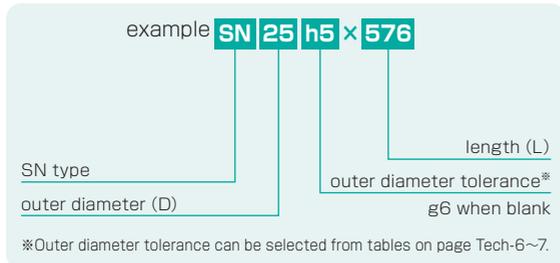
Table F-6 Hollow Shaft

outer diameter D (mm)	inner diameter d (mm)	moment of inertia of area I (mm <sup>4</sup> )	C=1/48EI (1/N·mm <sup>2</sup> )
6	2	$6.28 \times 10$	$1.61 \times 10^{-9}$
8	3	$1.97 \times 10^2$	$5.13 \times 10^{-10}$
10	4	$4.78 \times 10^2$	$2.11 \times 10^{-10}$
12	5	$9.87 \times 10^2$	$1.02 \times 10^{-10}$
13	6	$1.34 \times 10^3$	$7.55 \times 10^{-11}$
16	8	$3.02 \times 10^3$	$3.36 \times 10^{-11}$
20	10	$7.36 \times 10^3$	$1.37 \times 10^{-11}$
25	15	$1.67 \times 10^4$	$6.06 \times 10^{-12}$
30	16	$3.65 \times 10^4$	$2.77 \times 10^{-12}$
35	19	$6.73 \times 10^4$	$1.50 \times 10^{-12}$
40	20	$1.18 \times 10^5$	$8.57 \times 10^{-13}$
50	26	$2.84 \times 10^5$	$3.56 \times 10^{-13}$
60	32	$5.85 \times 10^5$	$1.73 \times 10^{-13}$
80	48	$1.75 \times 10^6$	$5.78 \times 10^{-14}$

# SN TYPE

– NB Shaft –

## part number structure



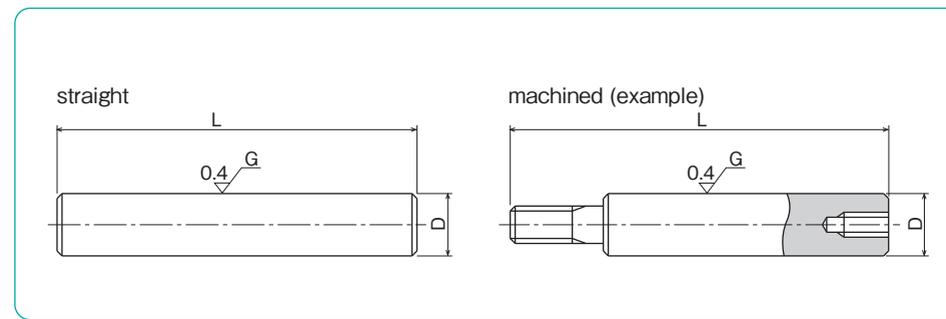
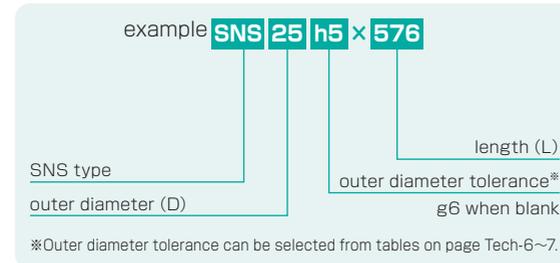
part number	outer diameter D	tolerance	length L	mass
	mm	g6 μm	mm	kg/m
SN 3	3	-2/-8	50 ↔ 400	0.06
SN 4	4	-4	100 ↔ 500	0.10
SN 5	5	-12	100 ↔ 700	0.16
SN 6	6	-12	100 ↔ 1,000	0.23
SN 8	8	-5	200 ↔ 1,500	0.40
SN 10	10	-14	200 ↔ 2,000	0.62
SN 12	12	-6	200 ↔ 3,000	0.89
SN 13	13	-6	200 ↔ 3,000	1.04
SN 15	15	-17	300 ↔ 3,000	1.39
SN 16	16	-17	300 ↔ 3,000	1.58
SN 20	20	-7	300 ↔ 4,000	2.47
SN 25	25	-20	300 ↔ 4,000	3.85
SN 30	30	-20	300 ↔ 4,000	5.55
SN 35	35	-9	400 ↔ 4,000	7.55
SN 40	40	-9	400 ↔ 4,000	9.87
SN 50	50	-25	500 ↔ 4,000	15.4
SN 60	60	-10	600 ↔ 4,000	22.2
SN 80	80	-29	800 ↔ 4,000	39.5
SN100	100	-12	1,000 ↔ 4,000	61.7
SN120	120	-34	1,500 ↔ 4,000	88.8
SN150	150	-14/-39	1,500 ↔ 4,000	139

material: high-carbon chromium bearing steel (SUJ2) hardness: 60HRC (HV697) or more  
Tolerances other than g6 are available upon request.

# SNS TYPE

– NB Stainless Steel Shaft –

## part number structure



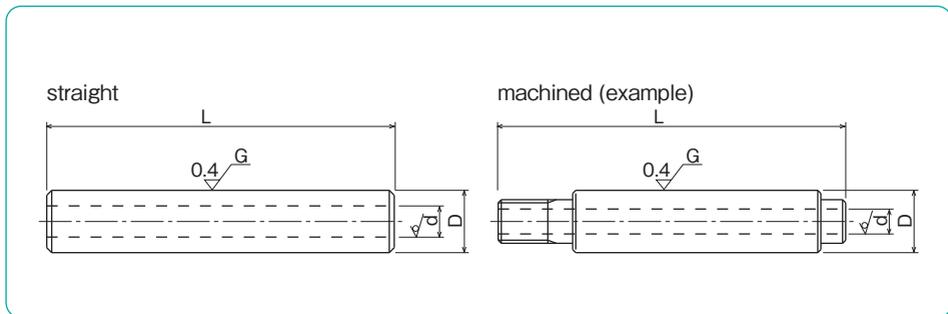
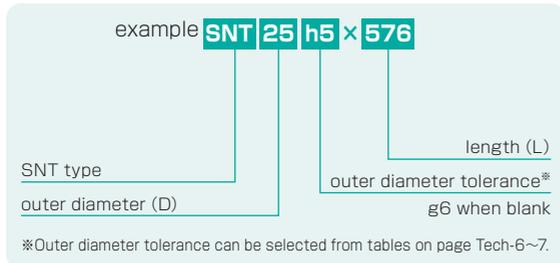
part number	outer diameter D	tolerance	length L	mass
	mm	g6 μm	mm	kg/m
SNS 3	3	-2/-8	50 ↔ 300	0.06
SNS 4	4	-4	100 ↔ 400	0.10
SNS 5	5	-12	100 ↔ 500	0.16
SNS 6	6	-12	100 ↔ 600	0.22
SNS 8	8	-5	200 ↔ 1,000	0.39
SNS 10	10	-14	200 ↔ 1,500	0.61
SNS 12	12	-6	200 ↔ 2,500	0.88
SNS 13	13	-17	200 ↔ 3,000	1.03
SNS 16	16	-17	300 ↔ 3,000	1.56
SNS 20	20	-7	300 ↔ 4,000	2.43
SNS 25	25	-20	300 ↔ 4,000	3.80
SNS 30	30	-20	300 ↔ 4,000	5.48
SNS 35	35	-9	400 ↔ 4,000	7.46
SNS 40	40	-25	400 ↔ 4,000	9.75
SNS 50	50	-25	500 ↔ 4,000	15.2
SNS 60	60	-10	600 ↔ 4,000	21.9
SNS 80	80	-29	800 ↔ 4,000	39.0
SNS100	100	-12/-34	1,000 ↔ 4,000	60.9

material: martensite stainless steel (equivalent to SUS440C)  
hardness: 56HRC (HV613) or more  
Tolerances other than g6 are available upon request.

# SNT TYPE

— NB Hollow Shaft —

## part number structure



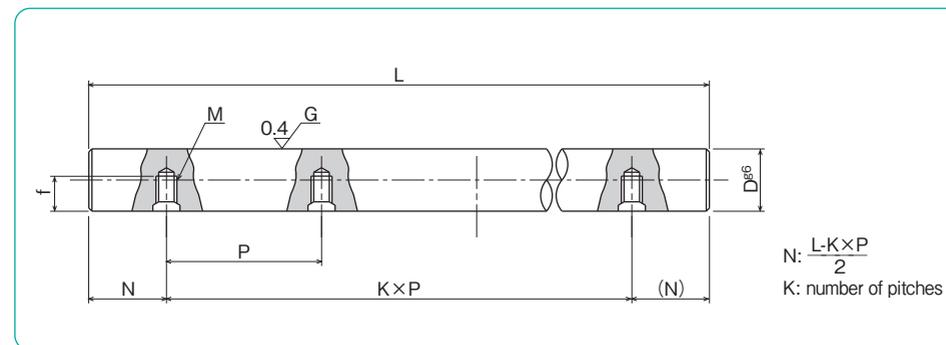
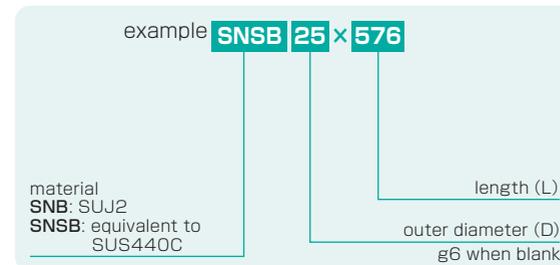
part number	outer diameter D mm	tolerance g6 μm	inner diameter d mm	length L mm	mass kg/m
SNT 6	6	-4/-12	2	100 ↔ 400	0.20
SNT 8	8	-5	3	200 ↔ 600	0.34
SNT 10	10	-14	4	200 ↔ 1,000	0.52
SNT 12	12	-6	5	200 ↔ 1,500	0.73
SNT 13	13	-17	6	200 ↔ 1,500	0.82
SNT 16	16	-	8	300 ↔ 2,500	1.18
SNT 20	20	-7	10	300 ↔ 4,000	1.85
SNT 25	25	-20	15	300 ↔ 4,000	2.46
SNT 30	30	-	16	300 ↔ 4,000	3.97
SNT 35	35	-9	19	400 ↔ 4,000	5.32
SNT 40	40	-25	20	400 ↔ 4,000	7.39
SNT 50	50	-	26	500 ↔ 4,000	11.3
SNT 60	60	-10	32	600 ↔ 4,000	15.9
SNT 80	80	-29	48	800 ↔ 4,000	25.3

material: high-carbon chromium bearing steel (SUJ2)  
hardness: 60HRC (HV697) or more  
Tolerances other than g6 are available upon request.

# NB CENTER-LINED TAPPED SHAFT

A larger diameter shaft can overcome problems in maintaining precision functionality when a high or unbalanced load is applied. A combination of the center-lined tapped shaft together with the SA type support rail is ideal in such cases. (see pages F-14,15) The center-lined tapped shaft is standardized to simplify shaft selection.

## part number structure



## NB Center-Lined Tapped Shaft

part number	outer diameter D mm	tolerance g6* μm	pitch P mm	screw size M	tap depth f mm	maximum length L <sub>max</sub> mm
SNB10	10	-5/-14	100	M4	4.5	1,500
SNB12	12	-6	100	M4	5.5	1,800
SNB13	13	-17	100	M4	6	2,000
SNB16	16	-	150	M5	7	3,000
SNB20	20	-7	150	M6	9	4,000
SNB25	25	-20	200	M6	12	4,000
SNB30	30	-	200	M8	15	4,000
SNB35	35	-9	200	M8	15	4,000
SNB40	40	-25	300	M8	18	4,000
SNB50	50	-	300	M10	22	4,000

material: high-carbon chromium bearing steel (SUJ2)  
hardness: 60HRC (HV697) or more  
\*g6 is a standard tolerance of the outer diameter.

## NB Center-Lined Tapped Stainless Steel Shaft

part number	outer diameter D mm	tolerance g6* μm	pitch P mm	screw size M	tap depth f mm	maximum length L <sub>max</sub> mm
SNSB16	16	-6/-17	150	M5	7	2,000
SNSB20	20	-7	150	M6	9	3,000
SNSB25	25	-20	200	M6	12	4,000
SNSB30	30	-	200	M8	15	4,000
SNSB35	35	-9	200	M8	15	4,000
SNSB40	40	-25	300	M8	18	4,000
SNSB50	50	-	300	M10	22	4,000

material: martensite stainless steel (equivalent to SUS440C)  
hardness: 56HRC (HV613) or more  
\*g6 is a standard tolerance of the outer diameter.

SHAFT SUPPORTER AND SHAFT SUPPORT RAIL

These components save design/assembling time and ease shaft installation.

SH·SH-A·WH-A type

These are most commonly used compact shaft supporters. SH type is made of cast iron and SH-A/WH-A type is made of aluminum casting.



SHF·SHF-FC type

These are flanged type shaft supporters for a compact design. SHF is made of aluminum casting and SHF-FC (shaft diameter 35 and over) is made of cast iron.



SA·WA·LWA type (shaft support rail)

These support rails support shafts from below to avoid shaft deflection for a long-stroke/high load application. This type is made of aluminum alloy.



ACCURACY OF SA TYPE SUPPORT RAIL

The accuracy of the SA support rails are measured as shown in Figure F-1.

Figure F-1 Measurement Method

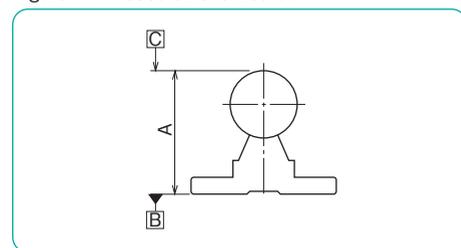
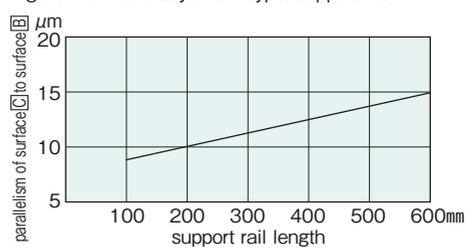
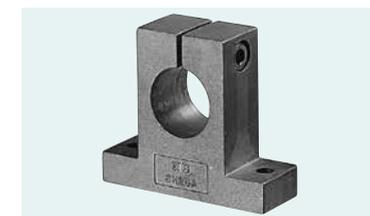


Figure F-2 Accuracy of SA type Support Rail

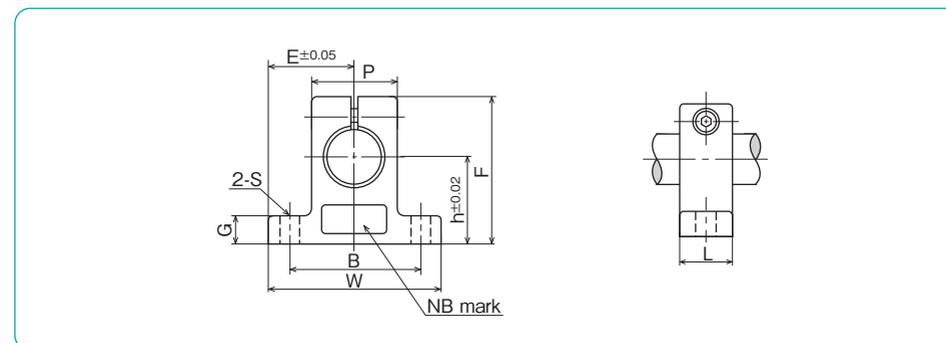
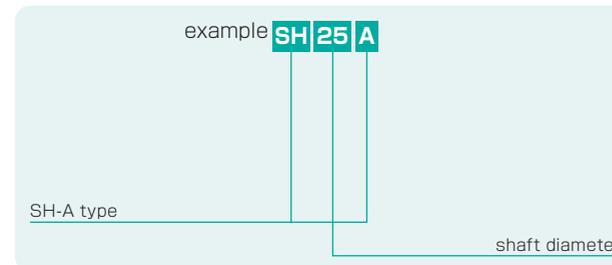


SH-A TYPE

– Shaft Supporter –



part number structure



part number	shaft diameter mm	major dimensions									tightening screw size	recommended torque N·m	mass g
		h	E	W	L	F	G	P	B	S			
SH 8A	8	20	21	42	14	32.8	6	18	32	5.5 (M5)	M4	2	24
SH10A	10	20	21	42	14	32.8	6	18	32	5.5 (M5)	M4	2	24
SH12A	12	23	21	42	14	37.5	6	20	32	5.5 (M5)	M4	2	30
SH13A	13	23	21	42	14	37.5	6	20	32	5.5 (M5)	M4	2	30
SH16A	16	27	24	48	16	44	8	25	38	5.5 (M5)	M4	2	40
SH20A	20	31	30	60	20	51	10	30	45	6.6 (M6)	M5	3	70
SH25A	25	35	35	70	24	60	12	38	56	6.6 (M6)	M6	5.5	130
SH30A	30	42	42	84	28	70	12	44	64	9 (M8)	M6	5.5	180
SH35A	35	50	49	98	32	82	15	50	74	11 (M10)	M8	13.5	270
SH40A	40	60	57	114	36	96	15	60	90	11 (M10)	M8	13.5	420
SH50A	50	70	63	126	40	120	18	74	100	14 (M12)	M12	29	750
SH60A	60	80	74	148	45	136	18	90	120	14 (M12)	M12	29	1,100



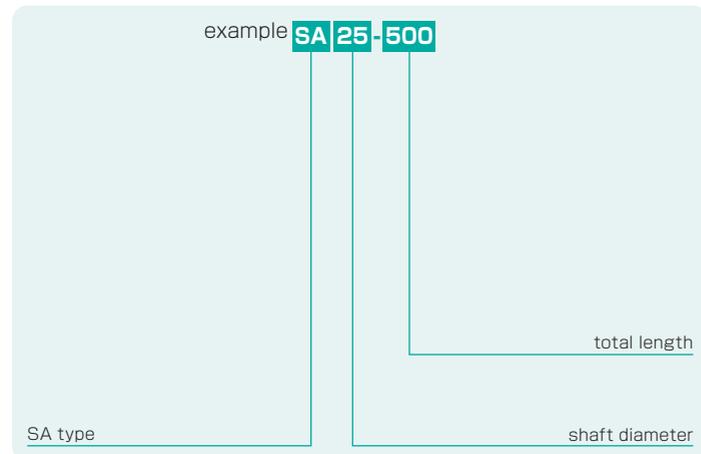
# SA TYPE

– Shaft Support Rail –

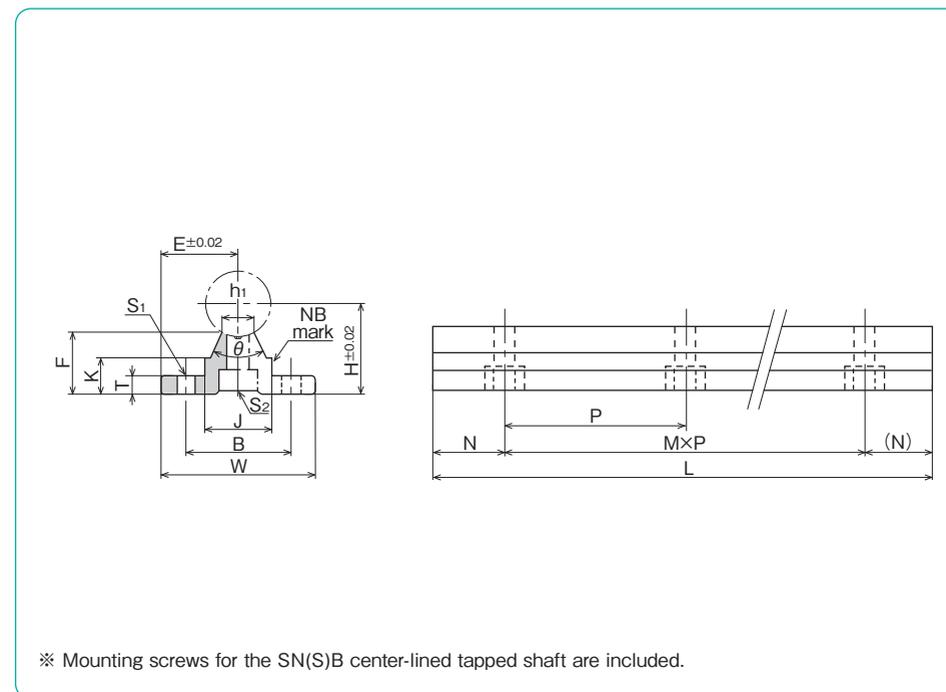


## part number structure

example SA 25 - 500



part number	shaft diameter mm	major dimensions											mass g					
		H	E	W	L	F	T	K	J	h <sub>1</sub>	θ	B		N	M×P	S <sub>1</sub>	S <sub>2</sub>	
SA10-200	10	18	16	32	200	13.5	4	8.9	12.4	4.7	80°	22	50	1×100	4.5	M4	110	
SA10-300					300								50	2×100				160
SA10-400					400								50	3×100				220
SA10-500					500								50	4×100				270
SA10-600					600								50	5×100				330
SA13-200	13	21	17	34	200	15	4.5	9.8	15	6	80°	25	50	1×100	4.5	M4	140	
SA13-300					300								50	2×100				210
SA13-400					400								50	3×100				280
SA13-500					500								50	4×100				350
SA13-600					600								50	5×100				420
SA16-200	16	25	20	40	200	17.8	5	11.7	18.5	8	80°	30	25	1×150	5.5	M5	200	
SA16-300					300								75	1×150				300
SA16-400					400								50	2×150				400
SA16-500					500								25	3×150				500
SA16-600					600								75	3×150				600
SA20-200	20	27	22.5	45	200	17.7	5	10	19	8	50°	30	25	1×150	5.5	M6	200	
SA20-300					300								75	1×150				300
SA20-400					400								50	2×150				400
SA20-500					500								25	3×150				510
SA20-600					600								75	3×150				610
SA25-200	25	33	27.5	55	200	21	6	12	21.5	8	50°	35	25	1×150	6.5	M6	290	
SA25-300					300								50	1×200				430
SA25-400					400								100	1×200				580
SA25-500					500								50	2×200				730
SA25-600					600								100	2×200				880



※ Mounting screws for the SN(S)B center-lined tapped shaft are included.

part number	shaft diameter mm	major dimensions											mass g					
		H	E	W	L	F	T	K	J	h <sub>1</sub>	θ	B		N	M×P	S <sub>1</sub>	S <sub>2</sub>	
SA30-200	30	37	30	60	200	22.8	7	13	26.5	10.3	50°	40	25	1×150	6.5	M8	360	
SA30-300					300								50	1×200				550
SA30-400					400								100	1×200				730
SA30-500					500								50	2×200				920
SA30-600					600								100	2×200				1,100
SA35-200	35	43	32.5	65	200	26.5	8	15.5	28	13	50°	45	25	1×150	9	M8	460	
SA35-300					300								50	1×200				700
SA35-400					400								100	1×200				950
SA35-500					500								50	2×200				1,190
SA35-600					600								100	2×200				1,420
SA40-200	40	48	37.5	75	200	29.4	9	17	38	16	50°	55	25	1×150	9	M8	630	
SA40-300					300								75	1×150				960
SA40-400					400								50	1×300				1,290
SA40-500					500								100	1×300				1,610
SA40-600					600								150	1×300				1,950
SA50-200	50	62	47.5	95	200	38.8	11	21	45	20	50°	70	25	1×150	11	M10	1,000	
SA50-300					300								75	1×150				1,500
SA50-400					400								50	1×300				2,000
SA50-500					500								100	1×300				2,500
SA50-600					600								150	1×300				3,000

# WH-A TYPE

– Shaft Supporter –  
(Inch Standard)



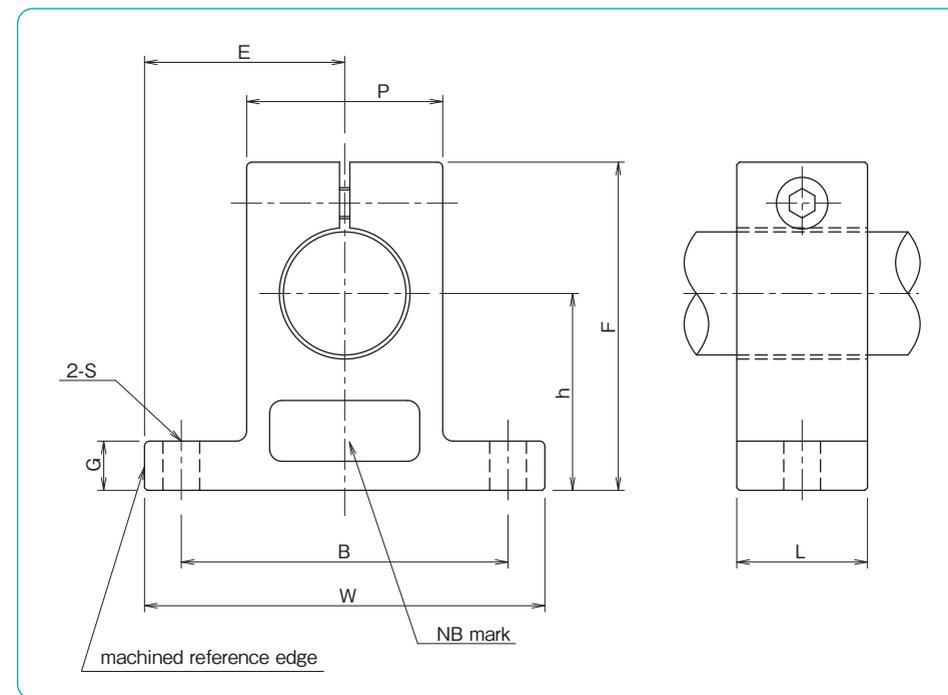
## part number structure

example **WH 24 A**

WH-A type

size

part number	shaft diameter inch	major dimensions				
		h ±.001 inch	E ±.005 inch	W inch	L inch	F inch
<b>WH 4A</b>	.2500	.6875	.7500	1.500	.500	1.063
<b>WH 6A</b>	.3750	.7500	.8125	1.625	.563	1.187
<b>WH 8A</b>	.5000	1.0000	1.0000	2.000	.625	1.625
<b>WH 10A</b>	.6250	1.0000	1.2500	2.500	.688	1.750
<b>WH 12A</b>	.7500	1.2500	1.2500	2.500	.750	2.063
<b>WH 16A</b>	1.0000	1.5000	1.5315	3.063	1.000	2.500
<b>WH 20A</b>	1.2500	1.7500	1.8750	3.750	1.125	3.000
<b>WH 24A</b>	1.5000	2.0000	2.1875	4.375	1.250	3.437
<b>WH 32A</b>	2.0000	2.5000	2.7500	5.500	1.500	4.375



major dimensions					mass lbs	part number
G inch	P inch	B ±.01 inch	S inch	bolt# inch		
.250	.500	1.125	.156	# 6	.033	<b>WH 4A</b>
.250	.688	1.250	.156	# 6	.044	<b>WH 6A</b>
.250	.875	1.500	.188	# 8	.075	<b>WH 8A</b>
.313	1.000	1.875	.218	# 10	.106	<b>WH 10A</b>
.313	1.250	2.000	.218	# 10	.156	<b>WH 12A</b>
.375	1.500	2.500	.281	1/4	.294	<b>WH 16A</b>
.438	2.000	3.000	.346	5/16	.531	<b>WH 20A</b>
.500	2.250	3.500	.346	5/16	.725	<b>WH 24A</b>
.625	3.000	4.500	.406	3/8	1.400	<b>WH 32A</b>

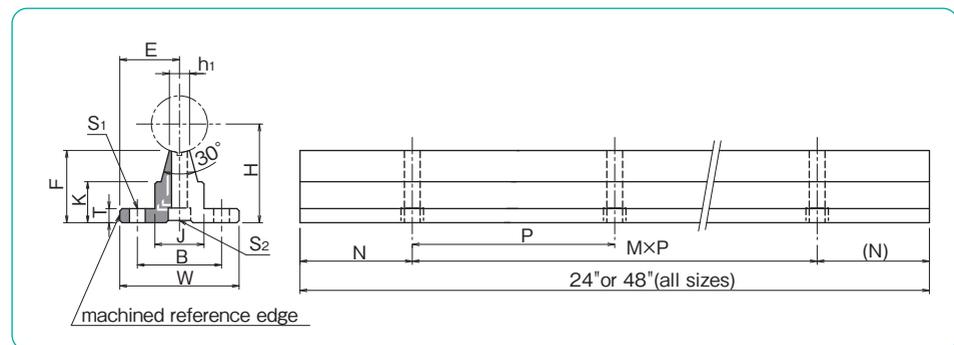
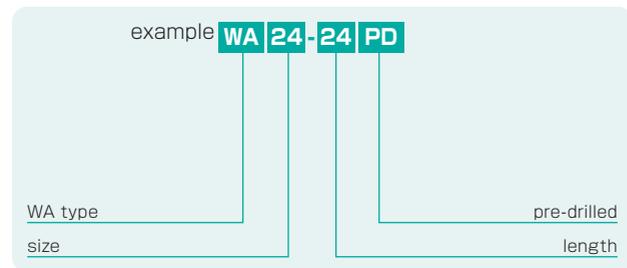
1kg≒2.205lbs  
1lb≒0.454kg

# WA TYPE

– Shaft Support Rail –  
(Inch Standard)



## part number structure



part number	shaft diameter inch	major dimensions								mounting dimensions				mass lbs				
		H ±.001 inch	E ±.005 inch	W inch	F inch	T inch	K inch	J inch	h <sub>1</sub> inch	B ±.01 inch	N inch	M×P inch	S <sub>1</sub> hole inch		S <sub>2</sub> hole inch			
WA 8-	24PD	.5000	1.125	.7500	1.500	.903	.188	.466	.500	.255	1.000	2	5×4	.169	#6	.169	#6	1.326
	48PD												11×4					2.652
WA10-	24PD	.6250	1.125	.8125	1.625	.841	.250	.423	.500	.276	1.125	2	5×4	.193	#8	.193	#8	1.488
	48PD												11×4					2.976
WA12-	24PD	.7500	1.500	.8750	1.750	1.158	.250	.592	.625	.322	1.250	3	3×6	.221	#10	.221	#10	2.100
	48PD												7×6					4.200
WA16-	24PD	1.0000	1.750	1.0625	2.125	1.280	.250	.727	.875	.359	1.500	3	3×6	.281	1/4	.281	1/4	2.776
	48PD												7×6					5.552
WA20-	24PD	1.2500	2.125	1.2500	2.500	1.537	.313	.799	1.100	.437	1.875	3	3×6	.343	5/16	.343	5/16	4.060
	48PD												7×6					8.120
WA24-	24PD	1.5000	2.500	1.5000	3.000	1.798	.375	.922	1.375	.558	2.250	4	2×8	.343	5/16	.406	3/8	5.840
	48PD												5×8					11.680
WA32-	24PD	2.0000	3.250	1.8750	3.750	2.322	.500	1.450	1.500	.800	2.750	4	2×8	.406	3/8	.531	1/2	9.500
	48PD												5×8					19.000

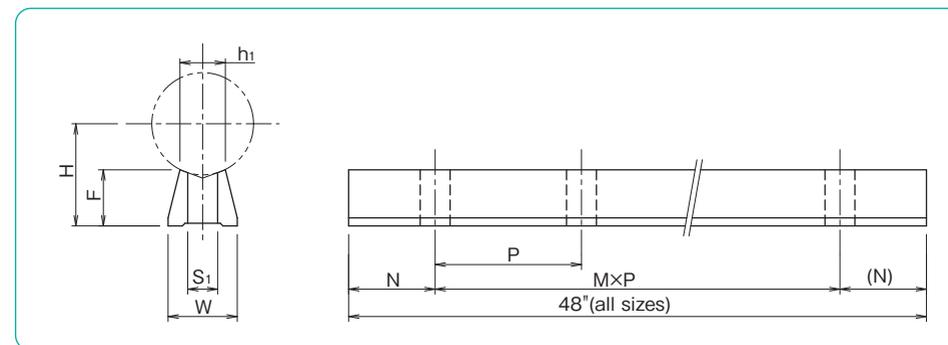
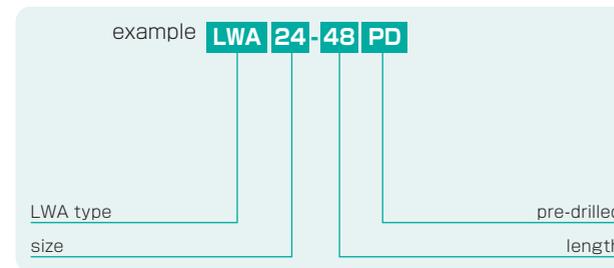
All sizes are also available without pre-drilled mounting holes.  
Complete shaft-rail assemblies are also available as well as custom drilling and lengths.  
Please send drawings with customer specifications.  
Product of NB Corporation of America

# LWA TYPE

– Low Shaft Support Rail –  
(Inch Standard)



## part number structure



part number	shaft diameter inch	major dimensions			mounting dimensions				mass lb
		H ±.002 inch	W inch	F inch	N inch	M×P inch	h <sub>1</sub> inch	S <sub>1</sub> inch	
LWA 8-48 PD	.5000	.5625	.37	.342	2	11×4	0.25	.169	0.11
LWA 10-48 PD	.6250	.6875	.45	.405	2	11×4	0.276	.193	0.17
LWA 12-48 PD	.7500	.7500	.51	.409	3	7×6	0.317	.220	0.20
LWA 16-48 PD	1.0000	1.0000	.69	.545	3	7×6	0.422	.283	0.35
LWA 20-48 PD	1.2500	1.1875	.78	.617	3	7×6	0.520	.343	0.44
LWA 24-48 PD	1.5000	1.3750	.93	.691	4	5×8	0.630	.406	0.58
LWA 32-48 PD	2.0000	1.7500	1.18	.836	4	5×8	0.824	.531	0.89

Product of NB Corporation of America  
1kg≅2.205lbs  
1lb≅0.454kg

## WSS TYPE

– Shaft Support Assembly –  
(Standard Type)

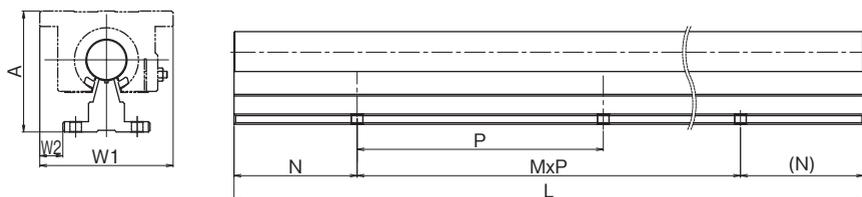


### part number structure

example **WSS 16 x 36**

outer diameter

length



Part Number	Outer Diameter inch/mm	Outer Assembly Dimensions			Base Mounting Holes		Maximum Length	Weight lbs/ft kg/m
		A inch/mm	W1 inch/mm	W2 inch/mm	N inch/mm	P inch/mm		
<b>WSS 8</b>	1/2	1.812	2.000	0.2500	2.000	4.000	168	1.26
	12.700	46.02	50.80	6.35	50.80	101.60	4267.2	1.88
<b>WSS 10</b>	5/8	2.000	2.500	0.4375	2.000	4.000	180	1.83
	15.875	50.80	63.50	11.11	50.80	101.60	4572.0	2.72
<b>WSS 12</b>	3/4	2.437	2.750	0.5000	3.000	6.000	204	2.50
	19.050	61.90	69.85	12.70	76.20	152.40	5181.6	3.72
<b>WSS 16</b>	1	2.937	3.250	0.5625	3.000	6.000	204	4.06
	25.400	74.60	82.55	14.29	76.20	152.40	5181.6	6.04
<b>WSS 20</b>	1-1/4	3.625	4.000	0.7500	3.000	6.000	204	6.28
	31.750	92.08	101.60	19.05	76.20	152.40	5181.6	9.35
<b>WSS 24</b>	1-1/2	4.250	4.750	0.8750	4.000	8.000	204	8.60
	38.100	107.95	120.65	22.23	101.60	203.20	5181.6	12.8
<b>WSS 32</b>	2	5.375	6.000	1.1250	4.000	8.000	204	14.88
	50.800	136.53	152.40	28.58	101.60	203.20	5181.6	22.14

Product of NB Corporation of America

## WSS-SS TYPE

– Shaft Support Assembly –  
(Stainless Steel Type)

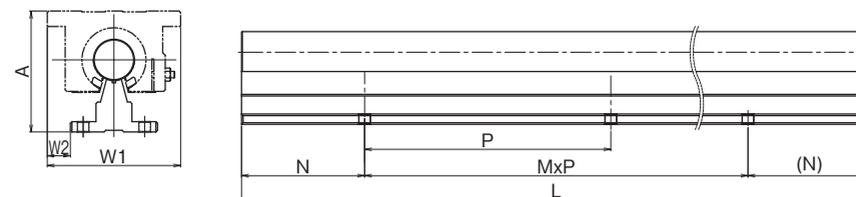


### part number structure

example **WSS 8 x 36-SS**

outer diameter

length



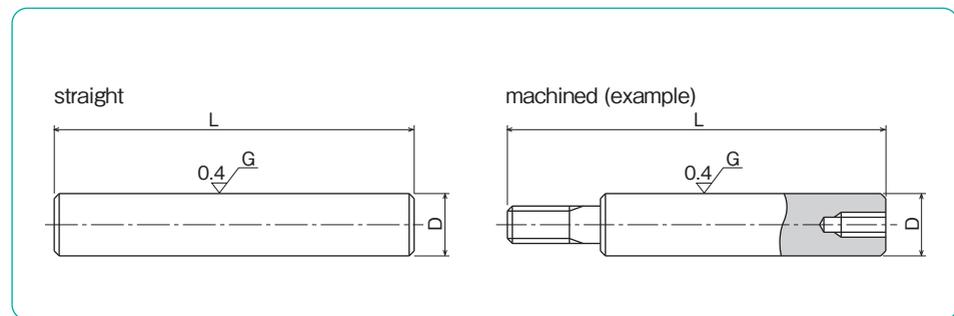
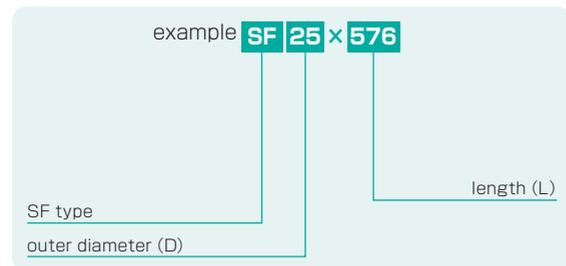
Part Number	Outer Diameter inch/mm	Outer Assembly Dimensions			Base Mounting Holes		Maximum Length	Weight lbs/ft kg/m
		A inch/mm	W1 inch/mm	W2 inch/mm	N inch/mm	P inch/mm		
<b>WSS 8-SS</b>	1/2	1.812	2.000	0.2500	2.000	4.000	158	1.26
	12.700	46.02	50.80	6.35	50.80	101.60	4013.2	1.88
<b>WSS 10-SS</b>	5/8	2.000	2.500	0.4375	2.000	4.000	158	1.83
	15.875	50.80	63.50	11.11	50.80	101.60	4013.2	2.72
<b>WSS 12-SS</b>	3/4	2.437	2.750	0.5000	3.000	6.000	158	2.50
	19.050	61.90	69.85	12.70	76.20	152.40	4013.2	3.72
<b>WSS 16-SS</b>	1	2.937	3.250	0.5625	3.000	6.000	158	4.06
	25.400	74.60	82.55	14.29	76.20	152.40	4013.2	6.04
<b>WSS 20-SS</b>	1-1/4	3.625	4.000	0.7500	3.000	6.000	158	6.28
	31.750	92.08	101.60	19.05	76.20	152.40	4013.2	9.35
<b>WSS 24-SS</b>	1-1/2	4.250	4.750	0.8750	4.000	8.000	158	8.60
	38.100	107.95	120.65	22.23	101.60	203.20	4013.2	12.8
<b>WSS 32-SS</b>	2	5.375	6.000	1.1250	4.000	8.000	204	14.88
	50.800	136.53	152.40	28.58	101.60	203.20	5181.6	22.14

Product of NB Corporation of America

# SF TYPE

– NBCA Shaft –

## part number structure



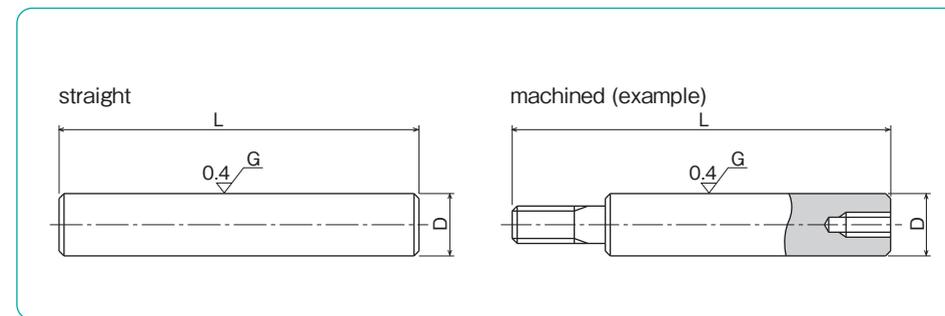
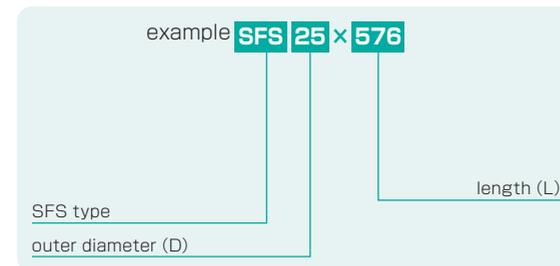
part number	outer diameter		length L	mass
	D	tolerance		
	mm	g6 μm	mm	Kg/m
SF 6	6	-4/-12	100 ← 3000	0.23
SF 8	8	- 5	100 ← 3000	0.40
SF 10	10	-14	100 ← 3000	0.62
SF 12	12		100 ← 3000	0.89
SF 13	13	- 6	100 ← 3000	1.04
SF 15	15	-17	100 ← 3000	1.39
SF 16	16		100 ← 3000	1.58
SF 20	20	- 7	100 ← 3000	2.47
SF 25	25	-20	100 ← 3000	3.85
SF 30	30		100 ← 3000	5.55
SF 35	35	- 9	100 ← 3000	7.55
SF 40	40	-25	100 ← 3000	9.87
SF 50	50		100 ← 3000	15.4

material: CF53 or Equivalent hardness: 60HRC (HV697) or more  
Product of NB Corporation of America

# SFS TYPE

– NBCA Stainless Steel Shaft –

## part number structure



part number	outer diameter		length L	mass
	D	tolerance		
	mm	g6 μm	mm	Kg/m
SFS 6	6	-4/-12	100 ← 3000	0.22
SFS 8	8	- 5	100 ← 3000	0.39
SFS 10	10	-14	100 ← 3000	0.61
SFS 12	12		100 ← 3000	0.88
SFS 13	13	- 6	100 ← 3000	1.03
SFS 16	16	-17	100 ← 3000	1.56
SFS 20	20		100 ← 3000	2.43
SFS 25	25	- 7	100 ← 3000	3.80
SFS 30	30	-20	100 ← 3000	5.48
SFS 35	35		100 ← 3000	7.46
SFS 40	40	- 9	100 ← 3000	9.75
SFS 50	50	-25	100 ← 3000	15.2

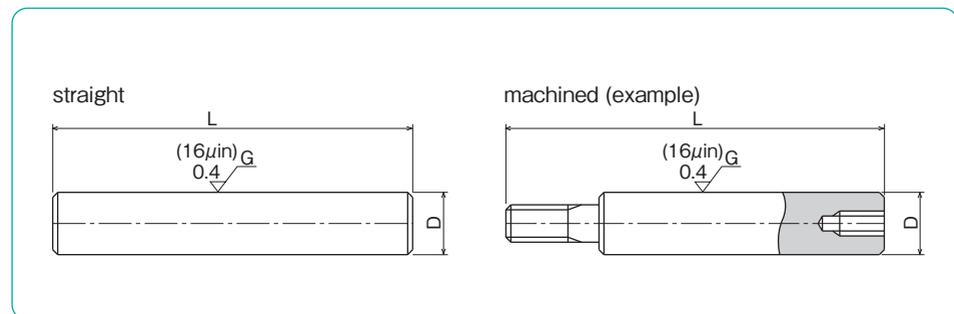
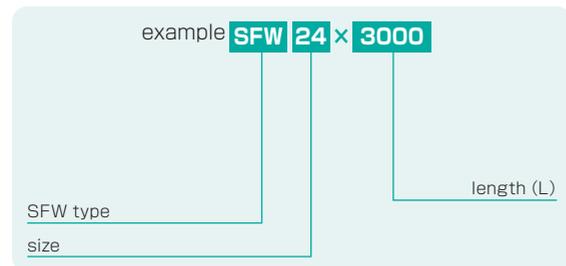
material: X46Cr13 or Equivalent  
hardness: 52HRC (HV544) or more  
Product of NB Corporation of America

# SFW TYPE

– NBCA Inch Shaft –



## part number structure



Part Number	Outer Diameter D		Length L	Mass
	inch/mm	inch/µm		
SFW 4	1/4		120	0.014
	6.350		50.8 ← → 3048	0.25
SFW 6	3/8		120	0.031
	9.525		50.8 ← → 3048	0.56
SFW 8	1/2	-.0005	120	0.056
	12.700		50.8 ← → 3048	0.99
SFW 10	5/8	-.0010	120	0.086
	15.875		50.8 ← → 3048	1.55
SFW 12	3/4	-.25	120	0.125
	19.050		50.8 ← → 3048	2.24
SFW 16	1		120	0.222
	25.400		50.8 ← → 3048	3.98
SFW 20	1-1/4		120	0.348
	31.750		50.8 ← → 3048	6.22
SFW 24	1-1/2	-.0006~-.0011	120	0.500
	38.100		50.8 ← → 3048	8.95
SFW 32	2	-.0006~-.0013	120	0.890
	50.800		50.8 ← → 3048	15.91

material: CF53 or Equivalent  
hardness: 60 HRC or more  
Product of NB Corporation of America

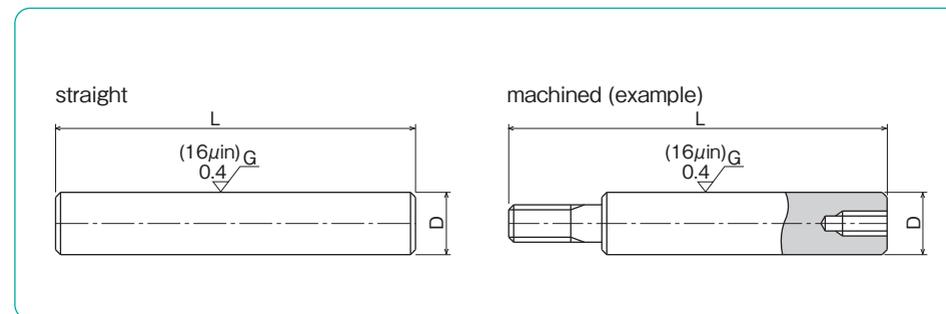
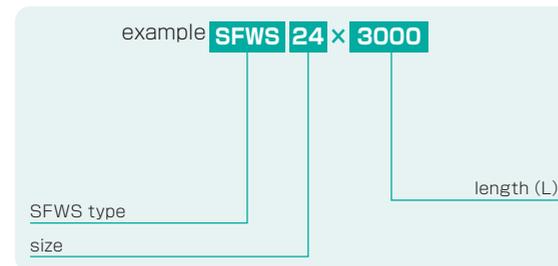
1kg≒2.205lbs

# SFWS TYPE

– NBCA Inch Stainless Steel Shaft –



## part number structure



Part Number	Outer Diameter D		Length L	Mass
	inch/mm	inch/µm		
SFWS 2	1/8	-.0002~-.0005	16	0.004
	3.175		50.8 ← → 406.4	0.10
SFWS 3	3/16	-.0002~-.0006	16	0.008
	4.763		50.8 ← → 406.4	0.20
SFWS 4	1/4		120	0.014
	6.350		50.8 ← → 3048	0.25
SFWS 6	3/8		120	0.031
	9.525		50.8 ← → 3048	0.56
SFWS 8	1/2	-.0005	120	0.056
	12.700		50.8 ← → 3048	0.99
SFWS 10	5/8	-.0010	120	0.086
	15.875		50.8 ← → 3048	1.55
SFWS 12	3/4	-.25	120	0.125
	19.050		50.8 ← → 3048	2.24
SFWS 16	1		120	0.222
	25.400		50.8 ← → 3048	3.98
SFWS 20	1-1/4		120	0.348
	31.750		50.8 ← → 3048	6.22
SFWS 24	1-1/2	-.0006~-.0011	120	0.500
	38.100		50.8 ← → 3048	8.95
SFWS 32	2	-.0006~-.0013	120	0.890
	50.800		50.8 ← → 3048	15.91

material: X46Cr13 or Equivalent  
hardness: 52 HRC or more  
Product of NB Corporation of America

1kg≒2.205lbs

# SFW-PD

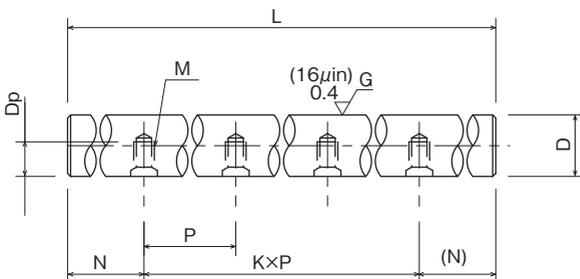
– NBCA Inch Pre-Drilled Shaft –



## part number structure

example **SFW 24 x 72 - PD**

SFW type size      pre-drilled shaft length (L in inches)



$$N: \frac{L-K \times P}{2}$$

K: number of pitches

Part Number	Outer Diameter		Pitch P inch/mm	Bolt Size M	Tapped Hole Depth Dp inch/mm	Maximum Length L inch/mm
	D inch/mm	inch/µm				
<b>SFW 8-PD</b>	1/2	-.0005	4	# 6-32	0.280	168
	12.700	-.0010			7.1	4267.2
<b>SFW 10-PD</b>	5/8	-13	101.6	# 8-32	0.350	180
	15.875	-25			8.9	4572
<b>SFW 12-PD</b>	3/4	-.0005	6	# 10-32	0.400	204
	19.050				10.2	5181.6
<b>SFW 16-PD</b>	1	-.0010	152.4	1/4-20	0.500	204
	25.400	-13			12.7	5181.6
<b>SFW 20-PD</b>	1-1/4	-25	203.2	5/16-18	0.650	204
	31.750	-25			16.5	5181.6
<b>SFW 24-PD</b>	1-1/2	-.0006	8	3/8-16	0.700	204
	38.100	-.0011			17.8	5181.6
		-15				
<b>SFW 32-PD</b>	2	-.0006	203.2	1/2-13	0.850	204
	50.800	-.0013			21.6	5181.6
		-15				
		-33				

material: CF53 or Equivalent  
hardness: 60 HRC or more  
Product of NB Corporation of America

1kg≒2.205lbs

# SFWS-PD

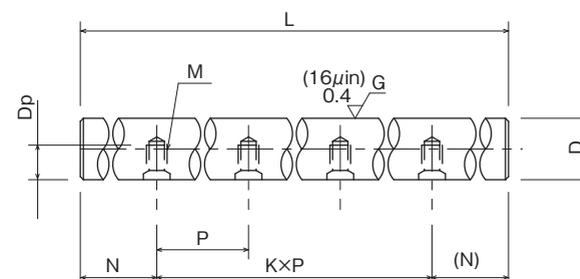
– NBCA Inch Pre-Drilled Stainless Steel Shaft –



## part number structure

example **SFWS 24 x 72 - PD**

SFWS type size      pre-drilled shaft length (L in inches)



$$N: \frac{L-K \times P}{2}$$

K: number of pitches

Part Number	Outer Diameter		Pitch P inch/mm	Bolt Size M	Tapped Hole Depth Dp inch/mm	Maximum Length L inch/mm
	D inch/mm	inch/µm				
<b>SFWS 8-PD</b>	1/2	-.0005	4	# 6-32	0.280	158
	12.700	-.0010			7.1	4013.2
<b>SFWS 10-PD</b>	5/8	-13	101.6	# 8-32	0.350	158
	15.875	-25			8.9	4013.2
<b>SFWS 12-PD</b>	3/4	-.0005	6	# 10-32	0.400	158
	19.050				10.2	4013.2
<b>SFWS 16-PD</b>	1	-.0010	152.4	1/4-20	0.500	158
	25.400	-13			12.7	4013.2
<b>SFWS 20-PD</b>	1-1/4	-25	203.2	5/16-18	0.650	158
	31.750	-25			16.5	4013.2
<b>SFWS 24-PD</b>	1-1/2	-.0006	8	3/8-16	0.700	158
	38.100	-.0011			17.8	4013.2
		-15				
<b>SFWS 32-PD</b>	2	-.0006	203.2	1/2-13	0.850	158
	50.800	-.0013			21.6	4013.2
		-15				
		-33				

material: X46Cr13 or Equivalent  
hardness: 52 HRC or more  
Product of NB Corporation of America

1kg≒2.205lbs

### SFW-FS102/SFWS-FS102 TYPE

– Format Single End Tapped Inch Shaft –

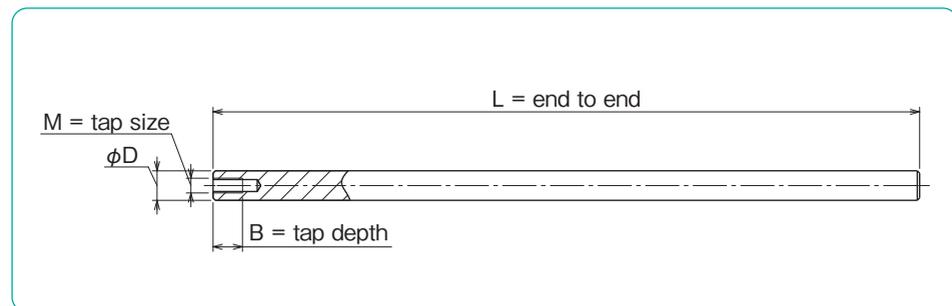


#### part number structure

example **SFW 16 × 18 - FS102**

material  
**SFW:** CF53 or Equivalent  
**SFWS:** X46Cr13 or Equivalent  
 size

FS102-Single End Tapped length(L in inches)



Part Number		Outer Diameter		Tap Size M	Tap Depth B	Length										
SFW	SFWS	D inch/mm	inch/μm			in mm										
SFW 4-FS102		1/4	6.350	# 5-40	0.250"	6	8			12	18	24				
						152.4	203.2			304.8	457.2	609.6				
SFW 6-FS102	SFWS 6-FS102	3/8	9.525	# 8-32	0.330"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 8-FS102	SFWS 8-FS102	1/2	12.700	1/4-20	0.500"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 10-FS102	SFWS 10-FS102	5/8	15.875	1/4-20	0.500"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 12-FS102	SFWS 12-FS102	3/4	19.050	5/16-18	0.625"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 16-FS102	SFWS 16-FS102	1	25.400	3/8-16	0.750"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 20-FS102	SFWS 20-FS102	1-1/4	31.750	1/2-13	1.000"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 24-FS102	SFWS 24-FS102	1-1/2	38.100	5/8-11	1.250"	6				12	18	24	36			
									152.4				304.8	457.2	609.6	914.4

hardness of SFW: 60 HRC or more  
 hardness of SFWS: 52 HRC or more  
 Product of NB Corporation of America  
 \* SFWS is not available

### SFW-FS103/SFWS-FS103 TYPE

– Format Both Ends Tapped Inch Shaft –

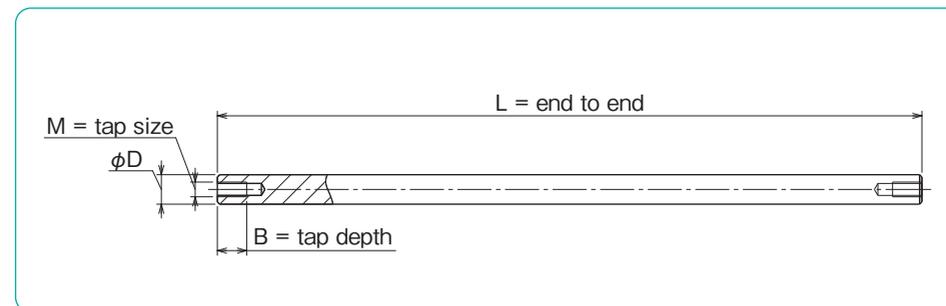


#### part number structure

example **SFWS 16 × 18 - FS103**

material  
**SFW:** CF53 or Equivalent  
**SFWS:** X46Cr13 or Equivalent  
 size

FS103-Both Ends Tapped length(L in inches)

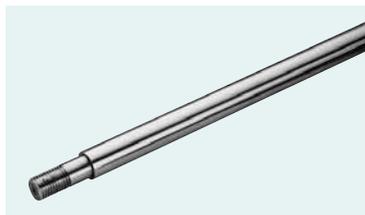


Part Number		Outer Diameter		Tap Size M	Tap Depth B	Length										
SFW	SFWS	D inch/mm	inch/μm			in mm										
SFW 4-FS103		1/4	6.350	# 5-40	0.250"	6	8			12	18	24				
						152.4	203.2			304.8	457.2	609.6				
SFW 6-FS103	SFWS 6-FS103	3/8	9.525	# 8-32	0.330"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 8-FS103	SFWS 8-FS103	1/2	12.700	1/4-20	0.500"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 10-FS103	SFWS 10-FS103	5/8	15.875	1/4-20	0.500"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 12-FS103	SFWS 12-FS103	3/4	19.050	5/16-18	0.625"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 16-FS103	SFWS 16-FS103	1	25.400	3/8-16	0.750"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 20-FS103	SFWS 20-FS103	1-1/4	31.750	1/2-13	1.000"	6	8*	9*	10*	12	18	24	36			
									152.4	203.2	228.6	254	304.8	457.2	609.6	914.4
SFW 24-FS103	SFWS 24-FS103	1-1/2	38.100	5/8-11	1.250"	6				12	18	24	36			
									152.4				304.8	457.2	609.6	914.4

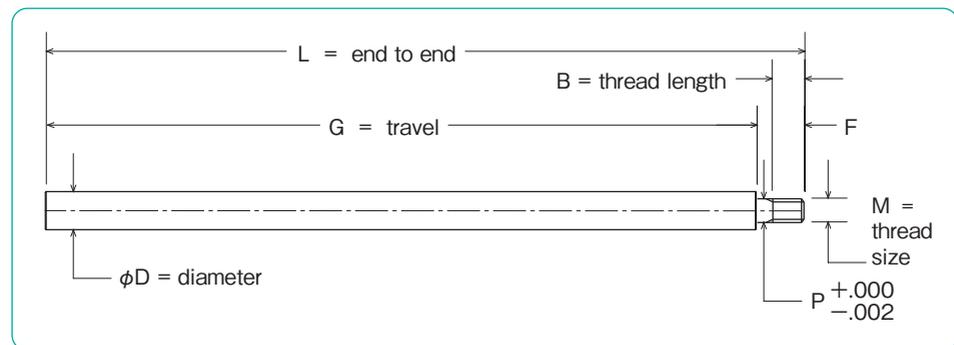
hardness of SFW: 60 HRC or more  
 hardness of SFWS: 52 HRC or more  
 Product of NB Corporation of America  
 \* SFWS is not available

# SFW-FS115 TYPE

– Format Single End Threaded Inch Shafts –



## part number structure

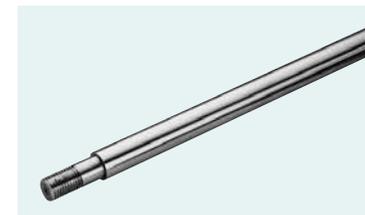


Part Number	Outer Diameter		Thread Size M	Thread Length B	Journal Length F	Journal DIA P	4" Travel	6" Travel	8" Travel	12" Travel	24" Travel	36" Travel	48" Travel
	D	inch/μm					G Length L						
SFW 6-FS115	3/8	-0.0005 -0.0010	1/4-20	0.31	0.50	0.250	4.500	6.500	8.500	12.500	24.500		
	9.525			7.87	12.70	6.35	114.3	165.1	215.9	317.5	622.3		
SFW 8-FS115	1/2	-0.0005 -0.0010	5/16-18	0.39	0.63	0.313	4.625	6.625	8.625	12.625	24.625		
	12.700			9.91	15.88	7.95	117.5	168.3	219.1	320.7	625.5		
SFW 10-FS115	5/8	-0.0005 -0.0010	3/8-16	0.47	0.75	0.375	4.750	6.750	8.750	12.750	24.750		
	15.875			11.94	19.05	9.53	120.7	171.5	222.3	323.9	628.7		
SFW 12-FS115	3/4	-13 -25	1/2-13	0.63	1.00	0.500	5.000	7.000	9.000	13.000	25.000		
	19.050			16.00	25.40	12.70	127.0	177.8	228.6	330.2	635.0		
SFW 16-FS115	1	-0.0005 -0.0010	5/8-11	0.78	1.25	0.625		7.250	9.250	13.250	25.250	37.250	
	25.400			19.81	31.75	15.88	184.2	235.0	336.6	641.4	946.2		
SFW 20-FS115	1-1/4	-0.0005 -0.0010	3/4-10	0.94	1.50	0.750		7.500	9.500	13.500	25.500	37.500	
	31.750			23.88	38.10	19.05	190.5	241.3	342.9	647.7	952.5		
SFW 24-FS115	1-1/2	-0.0006~-0.0011 -15~-27	1-8	1.25	2.00	1.000		10.000	14.000	26.000	38.000	50.000	
	38.100			31.75	50.80	25.40		254.0	355.6	660.4	965.2	1270.0	

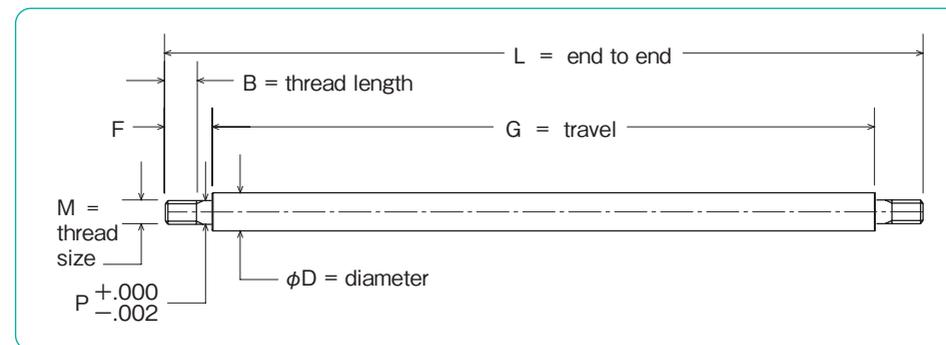
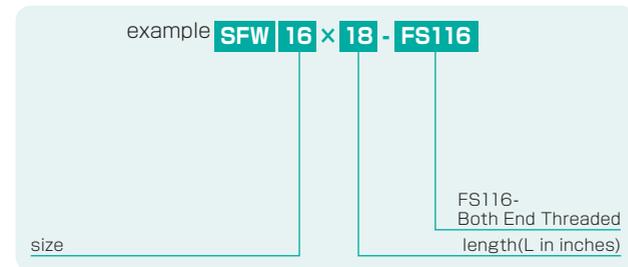
material: CF53 or Equivalent  
 hardness: 60 HRC or more  
 stainless steel sizes are available on this series by quote only  
 Product of NB Corporation of America

# SFW-FS116 TYPE

– Format Both Ends Threaded Inch Shafts –



## part number structure



Part Number	Outer Diameter		Thread Size M	Thread Length B	Journal Length F	Journal DIA P	4" Travel	6" Travel	8" Travel	12" Travel	24" Travel	36" Travel	48" Travel
	D	inch/μm					G Length L						
SFW 6-FS116	3/8	-0.0005 -0.0010	1/4-20	0.31	0.50	0.250	5.000	7.000	9.000	13.000	25.000		
	9.525			7.87	12.70	6.35	127.0	177.8	228.6	330.2	635.0		
SFW 8-FS116	1/2	-0.0005 -0.0010	5/16-18	0.39	0.63	0.313	5.250	7.250	9.250	13.250	25.250		
	12.700			9.91	15.88	7.95	133.4	184.2	235.0	336.6	641.4		
SFW 10-FS116	5/8	-0.0005 -0.0010	3/8-16	0.47	0.75	0.375	5.500	7.500	9.500	13.500	25.500		
	15.875			11.94	19.05	9.53	139.7	190.5	241.3	355.6	647.7		
SFW 12-FS116	3/4	-13 -25	1/2-13	0.63	1.00	0.500	6.000	8.000	10.000	14.000	26.000		
	19.050			16.00	25.40	12.70	152.4	203.2	254.0	355.6	660.4		
SFW 16-FS116	1	-0.0005 -0.0010	5/8-11	0.78	1.25	0.625		8.500	10.500	14.500	26.500	38.500	
	25.400			19.81	31.75	15.88	215.9	266.7	368.3	673.1	977.9		
SFW 20-FS116	1-1/4	-0.0005 -0.0010	3/4-10	0.94	1.50	0.750		9.000	11.000	15.000	27.000	39.000	
	31.750			23.88	38.10	19.05	228.6	279.4	381.0	685.8	990.6		
SFW 24-FS116	1-1/2	-0.0006~-0.0011 -15~-27	1-8	1.25	2.00	1.000		12.000	16.000	28.000	40.000	52.000	
	38.100			31.75	50.80	25.40		304.8	406.4	711.2	1016.0	1320.8	

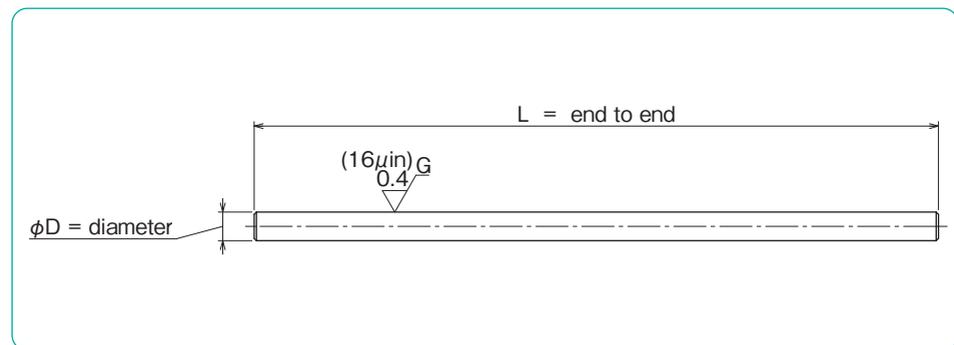
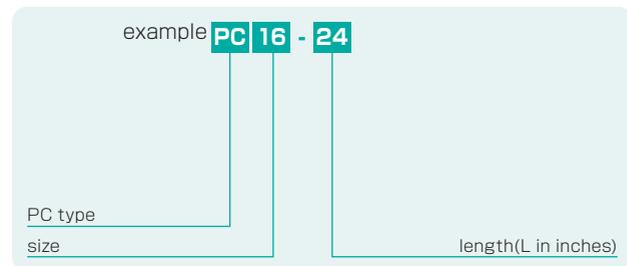
material: CF53 or Equivalent  
 hardness: 60 HRC or more  
 stainless steel sizes are available on this series by quote only  
 Product of NB Corporation of America

# PC TYPE

– Pre-Cut Slide Shafts –



## part number structure



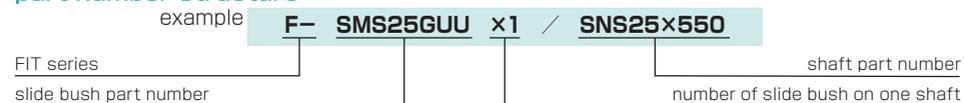
Part Number	Outer Diameter		Length L							Mass	
	D inch/mm	inch/μm	inch/mm								
PC 4	1/4	-0.0005	6	12	18	24				0.014 0.25	
	6.350		152.4	304.8	457.2	609.6					
PC 6	3/8	-0.0010	6	12	18	24				0.031 0.56	
	9.525		152.4	304.8	457.2	609.6					
PC 8	1/2	-0.0010		12	18	24	30	36		0.056 0.99	
	12.700			304.8	457.2	609.6	762	914.4			
PC 10	5/8	-0.0010		12	18	24	30	36		0.086 1.55	
	15.875			304.8	457.2	609.6	762	914.4			
PC 12	3/4	-0.0010			18	24	30	36	42	48	0.125 2.24
	19.050				457.2	609.6	762	914.4	1066.8	1219.2	
PC 16	1	-0.0010			18	24	30	36	42	48	0.222 3.98
	25.400				457.2	609.6	762	914.4	1066.8	1219.2	
PC 20	1-1/4	-0.0010			18	24	30	36	42	48	0.348 6.22
	31.750				457.2	609.6	762	914.4	1066.8	1219.2	
PC 24	1-1/2	-0.0010			18	24		36		48	0.500 8.95
	38.100				457.2	609.6		914.4		1219.2	

material: CF53 or Equivalent  
 hardness: 60 HRC or more  
 Product of NB Corporation of America

## FIT SERIES

Due to the combined tolerances of the bush's bore and the shaft's diameter, accuracy can be affected by clearance or increased dynamic friction caused by preloading.  
 NB's FIT Series takes advantages of the lower cost slide bush and the precision ground shaft to achieve a target clearance in order for the linear system to produce a smooth, high-accuracy performance.

## part number structure



- Please refer to corresponding catalog pages for details.
- Please specify on the drawing about the shaft machining, radial clearance, match-marking, etc.

## Recommended Radial Clearance

Depending on the type of application, the clearance range varies, please use the chart below as a guideline.

target	clearance (+)	← 0 →	clearance (-)
light motion	[Bar chart showing positive clearance range]		
high accuracy	[Bar chart showing zero clearance range]		
no play	[Bar chart showing negative clearance range]		

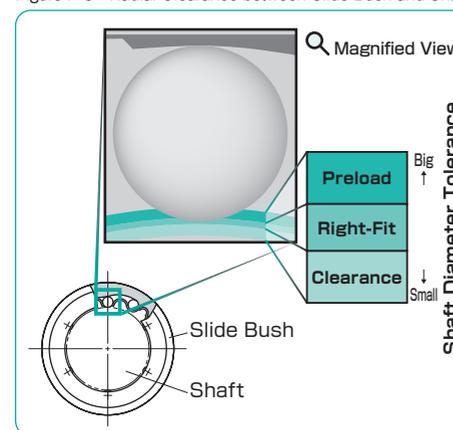
## Slide Bush, Radial Clearance (-), Negative Limit

Negative clearance is opted to reduce backlash. Please refer to the chart below for the negative clearance limits.

size	3~8	10~13	16~25	30~35	40	50~60
radial clearance limit	±0μm	-4μm	-6μm	-8μm	-10μm	-13μm

- The off-center of the housing causes uneven loading on the slide bush, please pay special attention to the centering of the housing especially when negative clearance is a requirement.
- Please contact NB for details on the extra preloading requirement or on other part numbers like SRE, SR, etc.

Figure F-3 Radial Clearance between Slide Bush and Shaft



# GENERAL MACHINE SHAFTING

NB general machine shafts are made to customer drawings. Integrated production from material sourcing, machining, heat treatments, surface treatments and final inspection, NB does it all.

## ADVANTAGES

### Variety of Machining Capabilities

From small to large, various shaft machining is available.

### Surface Treatment

Various surface treatments are available such as hard chrome, electroless nickel plating, and low temperature black chrome.

### Heat Treatment

Various heat treatments are available such as carburizing and induction hardening.

### THERMAL-SPRAYING CERAMIC-COATING SPECIFICATIONS

Parts that require wear and corrosion resistance can be thermal-sprayed with a ceramic material per NB's ceramic-coating specifications. Ceramic-coating can be applied to a wide variety of materials. The pores in the coated layer result in good lubrication characteristics and can be sealed to achieve high corrosion resistance.

## MACHINING SPECIFICATIONS

Materials	High Carbon Chromium Bearing Steel (SUJ2)	Surface Treatment	Hard Chrome	
	Chrome Molybdenum Steel (JIS SCM415, 420, 435)		Low Temperature Black Chrome	
	Structural Carbon Steel (JIS S45C)		Electroless Nickel Plating	
	Martensite Stainless Steel (SUS440)		Thermal Spray Ceramic Coating	
	Austenite Stainless Steel (SUS303, 304)		Others	Gauging with customer supplied nuts and bearings
	Tool Steel (JIS SK4)			Triangular and trapezoidal thread grinding available
Tool Steel (JIS SKS3)				
Heat Treatment	Induction Hardening			
	Induction Hardening (deep)			
	Carburizing and quenching			

Machining Ability	Process Details / Manufacturing Contents	Maximum Machinable Diameter	Maximum Machinable Length	Remarks / Notes
	Centerless Grinding	φ60 mm outer diameter	4,000mm	
	External Grinder	φ400 mm outer diameter	4,000mm	
	Internal Grinder	φ200 mm inner diameter	300mm	Allowable work length: up to 1,100 mm
		φ350 mm inner diameter	300mm	
	Vertical Grinder	φ630 mm outer diameter	300mm	
	Lathe	φ400	3,800mm	
	Horizontal Machining Center	φ350	2,000mm	Up to 3,000 kg
Vertical Machining Center	φ300	3,000mm	Up to 3,000 kg	
BT / Gun Drilling	φ80	2,000mm	Up to 4,000 mm long with both end machining for less than φ120 Up to 2,000 mm long for φ120 and over	

## EXAMPLES OF MACHINING ①

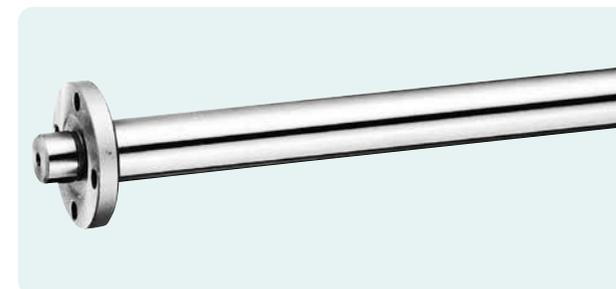
Roll Shaft



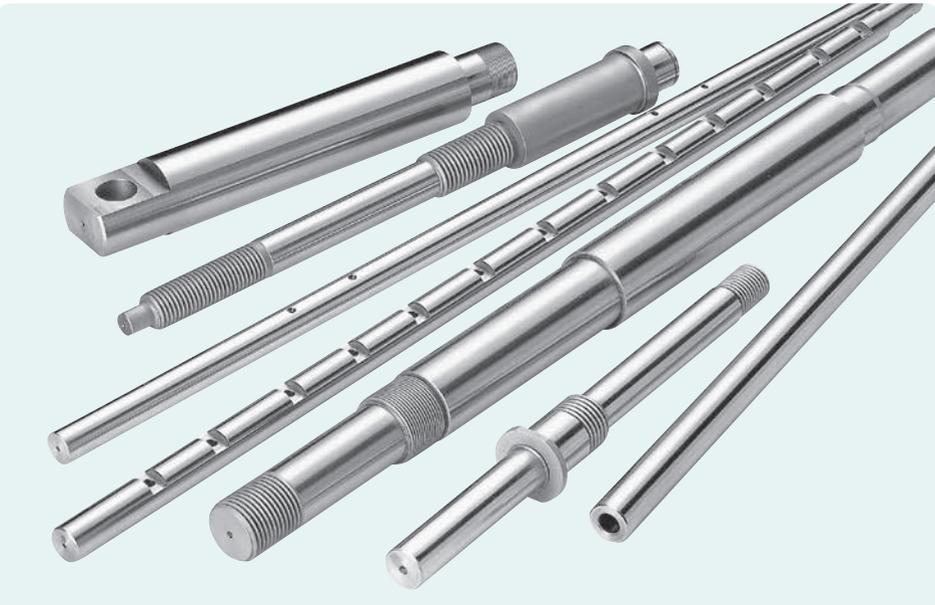
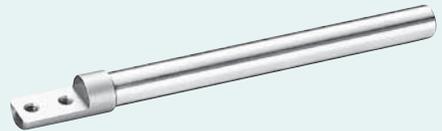
Quill Shaft



Ceramic-Coating



EXAMPLES OF MACHINING ②



# ACTUATOR

## ACTUATOR

ADVANTAGES ..... G-2  
 LIST OF AVAILABLE BG·BH ..... G-4  
 RATED LIFE ..... G-6

## BG TYPE

BG PART NUMBER STRUCTURE · G-10  
 BG SPECIFICATIONS ..... G-12  
 BG ALLOWABLE SPEED AND STROKE LIMIT · G-13  
 BG ACCURACY ..... G-14  
 BG DIMENSION TABLE ..... G-16  
 BG MOTOR BRACKET CONFIGURATIONS & APPLICABLE MOTORS · G-32  
 BG EXPOSED BRACKET R0 · G-48  
 BG RETURN PULLEY UNIT ..... G-50  
 BG LOW HOUSING ..... G-52  
 BG BELLOWS ..... G-54  
 BG SENSOR ..... G-63  
 BG PNP SENSOR ..... G-74  
 BG POSITIONING PIN HOLE ..... G-75  
 BG LUBRICATION ..... G-80  
 BG 2 AXES COMBINED BRACKET · G-81

## BH TYPE

BH PART NUMBER STRUCTURE · G-82  
 BH SPECIFICATIONS ..... G-84  
 BH ALLOWABLE SPEED AND STROKE LIMIT · G-85  
 BH ACCURACY ..... G-86  
 BH DIMENSION TABLE ..... G-88  
 BH MOTOR BRACKET CONFIGURATIONS & APPLICABLE MOTORS · G-98  
 BH EXPOSED BRACKET R0 ..... G-108  
 BH RETURN PULLEY UNIT ..... G-109  
 BH SENSOR ..... G-111  
 BH PNP SENSOR ..... G-117  
 BH POSITIONING PIN HOLE ..... G-118  
 BH LUBRICATION ..... G-122

## ACTUATOR APPENDIX

USE AND HANDLING PRECAUTIONS · G-123  
 OPERATING TEMPERATURE ..... G-123  
 LUBRICATION ..... G-123  
 SENSOR SPECIFICATIONS ..... G-124

# ACTUATOR

ADJUSTMENT FREE, SPACE SAVING, HIGH ACCURACY, HIGH RIGIDITY

## SINGLE AXIS ACTUATOR

BG·BH series is a compact single axis actuator which integrates a slide guide and precision ballscrew.



## ADVANTAGES

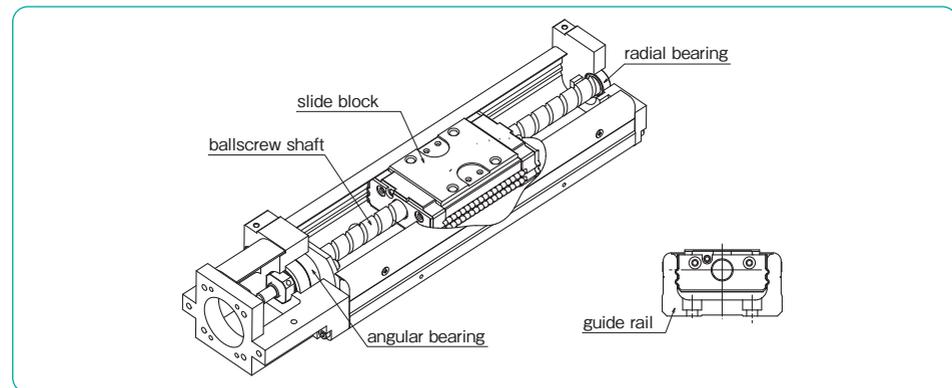
### Adjustment Free (Built-in support unit)

Built-in support unit and integration of the slide guide and precision ballscrew eliminates complex precision adjustment and reduces installation time dramatically.

### Space Saving (Low height profile)

The "U" shaped guide rail and integrated slide block and precision ballscrew make compact designs.

Figure G-1 Structure



### High Accuracy (Precisely evaluated, precisely guaranteed)

BG series precision grade (P) guarantees positioning repeatability  $\pm 1 \mu\text{m}$ . Inspection data sheet is attached to BG series only, measured value can be confirmed.

Table G-1 Accuracy

part number	BG series		BH series	
	P grade	H grade	U grade	W grade
positioning repeatability	$\pm 1 \mu\text{m}$	$\pm 3 \mu\text{m}$	$\pm 5 \mu\text{m}$	$\pm 10 \mu\text{m}$

### High Rigidity (Gothic arch groove profile)

Four or two-circuit and four-point contact structure in linear motion part provide very high rigidity. And "U" shaped guide rail provide very high rigidity against bending moment and deflection and can be used for cantilevered application.

Figure G-2 Block Displacement against Radial Load

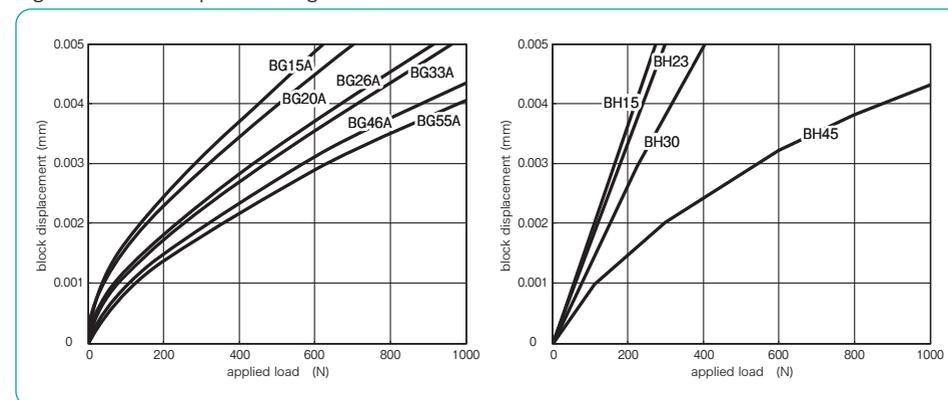


Figure G-3 Ball Contact Profile

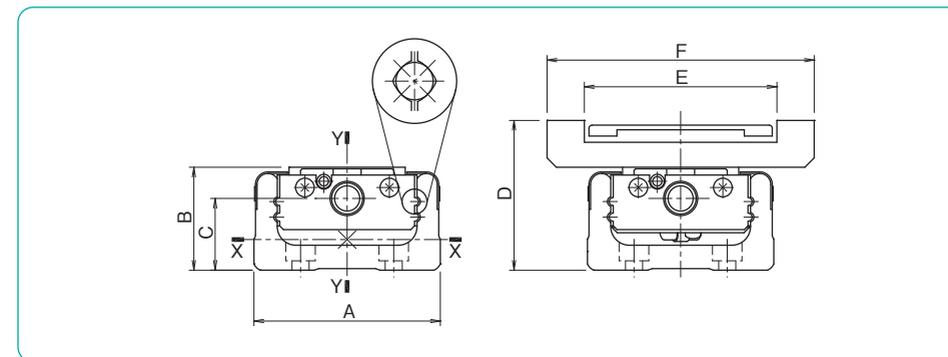


Table G-2 Cross-sectional Dimensions · Moment of Inertia of Area of Guide Rail

part number	A	B	C	D	E	F	moment of inertia of area(mm <sup>4</sup> )		mass W (kg/100mm)
							I <sub>x</sub> (X Axis)	I <sub>y</sub> (Y Axis)	
BG15	30	15	9.5	25	32	44	$1.22 \times 10^3$	$1.56 \times 10^4$	0.12
BG20	40	20	12.5	32	37	52	$6.50 \times 10^3$	$6.00 \times 10^4$	0.25
BG26	50	26	16	40	47	62	$1.69 \times 10^4$	$1.47 \times 10^5$	0.38
BG33	60	33	18	48	62	86	$5.11 \times 10^4$	$3.42 \times 10^5$	0.60
BG46	86	46	32	68	88	112	$2.42 \times 10^5$	$1.49 \times 10^6$	1.24
BG55	100	55	32	80	95	124	$2.29 \times 10^5$	$2.28 \times 10^6$	1.50
part number	A	B	C	D	E	F	moment of inertia of area(mm <sup>4</sup> )		mass W (kg/100mm)
							I <sub>x</sub> (X Axis)	I <sub>y</sub> (Y Axis)	
BH15	30	15	10	25	32	44	$2.71 \times 10^3$	$2.36 \times 10^4$	0.15
BH23	50.5	23	15.4	36	42	57	$1.44 \times 10^4$	$1.37 \times 10^5$	0.41
BH30	60.5	30	21.3	45	61	80	$3.88 \times 10^4$	$3.14 \times 10^5$	0.56
BH45	86.5	45	31.5	67	88	112	$1.45 \times 10^5$	$1.26 \times 10^6$	1.11

LIST OF AVAILABLE BG·BH

Table G-3 Ballscrew Shaft Diameter and Lead

part number	BG series							BH series			
	BG15	BG20	BG26	BG33		BG46	BG55	BH15	BH23	BH30	BH45
positioning	P grade: ± 1 μm							U grade: ± 5 μm			
repeatability	H grade: ± 3 μm							W grade: ± 10 μm			
shaft diameter(mm)	6	6	8	10	12	15	20	6	8	10	15
lead (mm)	1	○	○					○			
	2	○		○	▲			○	○		
	4				▲					○	
	5		○	○	○		▲	▲		○	○
	10				○			○	○	○	○
	20					○	○	○			○

○ : standard ▲ : manufactured by order

Table G-4 Stroke Limit

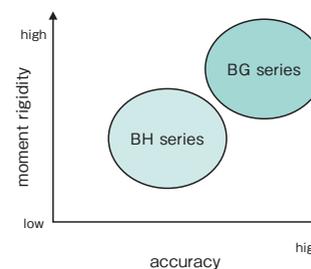
size	block type	rail length														
		75	100	125	150	175	200	250	300	340	400	440	500	540	600*	640
BH15	1 long block	—	60	—	110	—	160	—	—	—	—	—	—	—	—	—
	2 long blocks	—	—	—	70	—	120	—	—	—	—	—	—	—	—	—
BG15	1 long block	30	55	80	105	130	155	—	—	—	—	—	—	—	—	—
	2 long blocks	—	—	46	71	96	121	—	—	—	—	—	—	—	—	—
BG20	1 long block	—	43	—	93	—	143	—	—	—	—	—	—	—	—	—
	2 long blocks	—	—	—	51	—	101	—	—	—	—	—	—	—	—	—
BH23	1 long block	—	—	—	76	—	126	176	226	—	—	—	—	—	—	—
	2 long blocks	—	—	—	—	—	57	107	157	—	—	—	—	—	—	—
BG26	1 long block	—	—	—	73	—	123	173	223	—	—	—	—	—	—	—
	2 long blocks	—	—	—	—	—	61	111	161	—	—	—	—	—	—	—
BH30	1 long block	—	—	—	60	—	110	—	210	—	310	—	410	—	510	—
	2 long blocks	—	—	—	—	—	—	—	126	—	226	—	326	—	426	—
BG33	1 long block	—	—	—	60	—	110	—	210	—	310	—	410	—	510	—
	2 long blocks	—	—	—	—	—	—	—	133	—	233	—	333	—	433	—
BH45	1 short block	—	—	—	85	—	135	—	235	—	335	—	435	—	535	—
	2 short blocks	—	—	—	34	—	84	—	184	—	284	—	384	—	484	—
BG46	1 long block	—	—	—	—	—	—	—	219	—	319	—	419	—	519	—
	2 long blocks	—	—	—	—	—	—	—	104	—	204	—	304	—	404	—
BG55	1 short block	—	—	—	—	—	—	—	249	—	349	—	449	—	549	—
	2 short blocks	—	—	—	—	—	—	—	164	—	264	—	364	—	464	—
BG46	1 long block	—	—	—	—	—	—	—	209	—	309	—	409	—	509	—
	2 long blocks	—	—	—	—	—	—	—	100	—	200	—	300	—	400	—
BG55	1 short block	—	—	—	—	—	—	—	245	—	345	—	445	—	545	—
	2 short blocks	—	—	—	—	—	—	—	172	—	272	—	372	—	472	—

Table G-5 Allowable Speed

size	ballscrew lead(mm)	rail length														
		75	100	125	150	175	200	250	300	340	400	440	500	540	600*	640
BH15	1	—	133	—	133	—	90	—	—	—	—	—	—	—	—	—
	2	—	260	—	260	—	180	—	—	—	—	—	—	—	—	—
BG15	1	185	185	185	185	185	185	—	—	—	—	—	—	—	—	—
	2	370	370	370	370	370	370	—	—	—	—	—	—	—	—	—
BG20	1	—	187	—	187	—	187	—	—	—	—	—	—	—	—	—
	5	—	925	—	925	—	925	—	—	—	—	—	—	—	—	—
BH23	2	—	—	—	200	—	200	200	200	—	—	—	—	—	—	—
	5	—	—	—	490	—	490	490	490	—	—	—	—	—	—	—
BG26	2	—	—	—	281	—	281	281	281	—	—	—	—	—	—	—
	5	—	—	—	694	—	694	694	694	—	—	—	—	—	—	—
BH30	4	—	—	—	320	—	320	320	320	—	320	—	320	—	240	—
	5	—	—	—	400	—	400	400	400	—	400	—	400	—	300	—
BG33	10	—	—	—	810	—	810	810	810	—	810	—	810	—	600	—
	5	—	—	—	550	—	550	550	550	—	550	—	460	—	310	—
BH45	10	—	—	—	1,100	—	1,100	1,100	1,100	—	1,100	—	930	—	620	—
	20	—	—	—	1,500	—	1,500	1,500	1,500	—	1,500	—	1,500	—	1,500	—
BG46	5	—	—	—	—	—	—	—	260	—	260	—	260	—	260	—
	10	—	—	—	—	—	—	—	520	—	520	—	520	—	520	—
BG55	20	—	—	—	—	—	—	—	1,040	—	1,040	—	1,040	—	1,040	—
	10	—	—	—	—	—	—	—	740	—	740	—	740	—	740	—
BG46	20	—	—	—	—	—	—	—	1,480	—	1,480	—	1,480	—	1,480	—
	10	—	—	—	—	—	—	—	740	—	740	—	740	—	740	—

- \*Available for only H grade accuracy
- Guide rail length 750mm is only available for BH3010.
- Short blocks are not available for BG3320
- Please consult with NB when using custom rail length, exceeding max. rail length and falling under min. rail length.

System



unit:mm

700	740	750	840*	940*	980	rail length							block type	size		
						1,040*	1,080	1,140*	1,180	1,240*	1,280*	1,380*				
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 long block	BH15
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2 long blocks	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	BG15
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	BG20
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	BH23
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	BG26
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
610	—	660	—	—	—	—	—	—	—	—	—	—	—	—	—	BH30
526	—	576	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	BG33
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	619	—	719	819	—	—	—	—	—	—	—	—	—	—	—	BH45
—	504	—	604	704	—	—	—	—	—	—	—	—	—	—	—	
—	649	—	749	849	—	—	—	—	—	—	—	—	—	—	—	BG46
—	564	—	664	764	—	—	—	—	—	—	—	—	—	—	—	
—	609	—	709	809	—	909	—	1,009	—	1,109	—	—	—	—	—	BG55
—	500	—	600	700	—	800	—	900	—	1,000	—	—	—	—	—	
—	645	—	745	845	—	945	—	1,045	—	1,145	—	—	—	—	—	BG46
—	572	—	672	772	—	872	—	972	—	1,072	—	—	—	—	—	
—	—	—	—	—	834	—	934	—	1,034	—	1,134	—	1,234	—	—	BG55
—	—	—	—	—	711	—	811	—	911	—	1,011	—	1,111	—	—	

unit:mm/sec

700	740	750	840*	940*	980	rail length							ballscrew lead(mm)	size		
						1,040*	1,080	1,140*	1,180	1,240*	1,280*	1,380*				
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	BH15
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	BG15
—	—	—	—	—	—	—	—	—	—	—	—	—	—	2		
—	—	—	—	—	—											

**RATED LIFE**

To obtain the rated life of the BG·BH type, calculate the rated life of the guide portion, ballscrew portion and support bearing portion. Use the minimum value as the rated life of the BG and BH type.

**A. Life of Guide Portion**

Use the following equation for calculating the rated life of guide portion.

$$L_G = \left( \frac{f_c}{f_w} \cdot \frac{C}{P_T} \right)^3 \cdot 50 \dots\dots\dots (1)$$

$L_G$ : rated life (km)  $f_c$ : contact coefficient (refer to Table G-6)  
 $f_w$ : applied load coefficient (refer to Table G-7)  $C$ : basic dynamic load rating (N)  
 $P_T$ : calculated load applied to one block (N)

**A.1. Calculation of  $P_T$**

Before calculating the rated life using the equation (1), the calculated load applied to one block ( $P_T$ ) needs to be obtained in consideration of the moment load, etc. that will be actually applied.

For rapidly-accelerating or short stroke motion,  $P_T$  needs to be calculated with acceleration taken into consideration. The calculation of this acceleration will be carried out for the mass applied to BG·BH. Obtain the calculated load during uniform motion, acceleration, and deceleration, and use the average value of the three as  $P_T$ .

For the calculation of  $P_T$ , select an appropriate equation depending on the installation conditions of the guide.

It is also possible to calculate  $P_T$  without including the effect of acceleration by using the equation " $P_T = P_{TC}$  (see the equations (2), (5), and (8)). In this case, however, the obtained value is a rough approximation, so a selection with sufficient margin is recommended.

Table G-6 Contact Coefficient ( $f_c$ )

number of blocks in close contact on one axis	contact coefficient ( $f_c$ )
1	1.0
2	0.81

Table G-7 Applied Load Coefficient ( $f_w$ )

operating conditions		applied load coefficient ( $f_w$ )
vibration, impact	velocity	
none	0.25m/s or less	1.0 ~ 1.5
low	1m/s or less	1.5 ~ 2.0
high	1m/s or more	2.0 ~ 3.5

Table G-8 Moment Equivalent Coefficient

part number	$E_P$ (E2P)	$E_Y$ (E2Y)	$E_R$ (E2R)
BG15□□A	$2.82 \times 10^{-1}$	$2.37 \times 10^{-1}$	$9.35 \times 10^{-2}$
BG15□□B	$5.16 \times 10^{-2}$	$4.33 \times 10^{-2}$	$4.67 \times 10^{-2}$
BG20□□A	$2.25 \times 10^{-1}$	$1.89 \times 10^{-1}$	$7.84 \times 10^{-2}$
BG20□□B	$3.98 \times 10^{-2}$	$3.34 \times 10^{-2}$	$3.92 \times 10^{-2}$
BG26□□A	$1.51 \times 10^{-1}$	$1.27 \times 10^{-1}$	$5.88 \times 10^{-2}$
BG26□□B	$2.72 \times 10^{-2}$	$2.28 \times 10^{-2}$	$2.94 \times 10^{-2}$
BG33□□A	$1.26 \times 10^{-1}$	$1.06 \times 10^{-1}$	$4.55 \times 10^{-2}$
BG33□□B	$2.20 \times 10^{-2}$	$1.84 \times 10^{-2}$	$2.27 \times 10^{-2}$
BG33□□C	$2.31 \times 10^{-1}$	$1.94 \times 10^{-1}$	$4.55 \times 10^{-2}$
BG33□□D	$3.09 \times 10^{-2}$	$2.59 \times 10^{-2}$	$2.27 \times 10^{-2}$
BG46□□A	$8.39 \times 10^{-2}$	$7.04 \times 10^{-2}$	$3.17 \times 10^{-2}$
BG46□□B	$1.56 \times 10^{-2}$	$1.31 \times 10^{-2}$	$1.59 \times 10^{-2}$
BG46□□C	$1.39 \times 10^{-1}$	$1.17 \times 10^{-1}$	$3.17 \times 10^{-2}$
BG46□□D	$2.15 \times 10^{-2}$	$1.81 \times 10^{-2}$	$1.59 \times 10^{-2}$
BG55□□A	$6.80 \times 10^{-2}$	$5.71 \times 10^{-2}$	$2.74 \times 10^{-2}$
BG55□□B	$1.35 \times 10^{-2}$	$1.14 \times 10^{-2}$	$1.37 \times 10^{-2}$
BH15□□A	$2.70 \times 10^{-1}$	$2.45 \times 10^{-1}$	$9.64 \times 10^{-2}$
BH15□□B	$4.50 \times 10^{-2}$	$3.80 \times 10^{-2}$	$4.82 \times 10^{-2}$
BH23□□A	$1.52 \times 10^{-1}$	$1.37 \times 10^{-1}$	$5.22 \times 10^{-2}$
BH23□□B	$2.54 \times 10^{-2}$	$2.29 \times 10^{-2}$	$2.61 \times 10^{-2}$
BH30□□A	$1.17 \times 10^{-1}$	$9.83 \times 10^{-2}$	$4.54 \times 10^{-2}$
BH30□□B	$1.95 \times 10^{-2}$	$1.64 \times 10^{-2}$	$2.27 \times 10^{-2}$
BH45□□A	$8.39 \times 10^{-2}$	$7.04 \times 10^{-2}$	$3.17 \times 10^{-2}$
BH45□□B	$1.56 \times 10^{-2}$	$1.31 \times 10^{-2}$	$1.59 \times 10^{-2}$
BH45□□C	$1.26 \times 10^{-1}$	$1.06 \times 10^{-1}$	$3.17 \times 10^{-2}$
BH45□□D	$2.10 \times 10^{-2}$	$1.76 \times 10^{-2}$	$1.59 \times 10^{-2}$

\*The E2 coefficient is for two blocks being used in close contact.

**A.1.a.  $P_T$  for Horizontal Move (Horizontal Mounting)**

i) during uniform motion ( $P_{TC}$ )

$$P_{TC} = \frac{1}{n} \cdot W + E_P \cdot M_{PL} + E_Y \cdot M_{YL} + E_R \cdot M_{RL} \dots\dots\dots (2)$$

ii) during acceleration ( $P_{Ta}$ )

$$P_{Ta} = \frac{1}{n} \cdot W + E_P(M_{PL} + m \cdot a_a \cdot Z) + E_Y(M_{YL} + m \cdot a_a \cdot X) + E_R \cdot M_{RL} \dots\dots\dots (3)$$

Note that the values of ( $M_{PL} + m \cdot a_a \cdot Z$ ) and ( $M_{YL} + m \cdot a_a \cdot X$ ) will be treated as 0 (zero) when the calculated value is negative.

iii) during deceleration ( $P_{Td}$ )

$$P_{Td} = \frac{1}{n} \cdot W + E_P(M_{PL} + m \cdot a_d \cdot Z) + E_Y(M_{YL} + m \cdot a_d \cdot X) + E_R \cdot M_{RL} \dots\dots\dots (4)$$

Note that the values of ( $M_{PL} + m \cdot a_d \cdot Z$ ) and ( $M_{YL} + m \cdot a_d \cdot X$ ) will be treated as 0 (zero) when the calculated value is negative.

$P_{TC}$ : calculated load applied to a block during uniform motion (N)  $P_{Ta}$ : calculated load applied to a block during accelerating (N)  
 $P_{Td}$ : calculated load applied to a block during decelerating (N)  $n$ : number of blocks of BG·BH  $W$ : applied load (N)  $m$ : carrying mass (kg)

$a_a$ : acceleration during accelerating (m/sec<sup>2</sup>)  $a_d$ : acceleration during decelerating (m/sec<sup>2</sup>) (the negative value)  
 $X$ : distance between the center of BG·BH and the center of the carrying mass (mm)  $Y$ : distance between the center of BG·BH and the center of the carrying mass (mm)

$Z$ : distance between the center of BG·BH ballscrew and the center of the carrying mass (mm)  $E_P$ : moment equivalent coefficient in the pitching direction (refer to Table G-8)

$E_Y$ : moment equivalent coefficient in the yawing direction (refer to Table G-8)  $E_R$ : moment equivalent coefficient in the rolling direction (refer to Table G-8)

$M_{PL}$ : applied moment in the pitching direction (N·mm)  $M_{PL} = W \cdot Y$

$M_{YL}$ : applied moment in the yawing direction (N·mm)  $M_{YL} = 0$  (This case is not applicable)

$M_{RL}$ : applied moment in the rolling direction (N·mm)  $M_{RL} = W \cdot X$  \*Refer to Fig. G-8 for the direction of moment.

**A.1.b.  $P_T$  for Horizontal Move (Wall Mounting)**

i) during uniform motion ( $P_{TC}$ )

$$P_{TC} = \frac{1}{1.19 \cdot n} \cdot W + E_P \cdot M_{PL} + E_Y \cdot M_{YL} + E_R \cdot M_{RL} \dots\dots\dots (5)$$

ii) during acceleration ( $P_{Ta}$ )

$$P_{Ta} = \frac{1}{1.19 \cdot n} \cdot W + E_P(M_{PL} + m \cdot a_a \cdot Z) + E_Y(M_{YL} + m \cdot a_a \cdot X) + E_R \cdot M_{RL} \dots\dots\dots (6)$$

Note that the values of ( $M_{PL} + m \cdot a_a \cdot Z$ ) and ( $M_{YL} + m \cdot a_a \cdot X$ ) will be treated as 0 (zero) when the calculated value is negative.

iii) during deceleration ( $P_{Td}$ )

$$P_{Td} = \frac{1}{1.19 \cdot n} \cdot W + E_P(M_{PL} + m \cdot a_d \cdot Z) + E_Y(M_{YL} + m \cdot a_d \cdot X) + E_R \cdot M_{RL} \dots\dots\dots (7)$$

Note that the values of ( $M_{PL} + m \cdot a_d \cdot Z$ ) and ( $M_{YL} + m \cdot a_d \cdot X$ ) will be treated as 0 (zero) when the calculated value is negative.

$P_{TC}$ : calculated load applied to a block during uniform motion (N)  $P_{Ta}$ : calculated load applied to a block during accelerating (N)  
 $P_{Td}$ : calculated load applied to a block during decelerating (N)  $n$ : number of blocks of BG·BH  $W$ : applied load (N)  $m$ : carrying mass (kg)

$a_a$ : acceleration during accelerating (m/sec<sup>2</sup>)  $a_d$ : acceleration during decelerating (m/sec<sup>2</sup>) (the negative value)  
 $X$ : distance between the center of BG·BH and the center of the carrying mass (mm)  $Y$ : distance between the center of BG·BH and the center of the carrying mass (mm)

$Z$ : distance between the center of BG·BH ballscrew and the center of the carrying mass (mm)  $E_P$ : moment equivalent coefficient in the pitching direction (refer to Table G-8)

$E_Y$ : moment equivalent coefficient in the yawing direction (refer to Table G-8)  $E_R$ : moment equivalent coefficient in the rolling direction (refer to Table G-8)

$M_{PL}$ : applied moment in the pitching direction (N·mm)  $M_{PL} = 0$  (This case is not applicable)

$M_{YL}$ : applied moment in the yawing direction (N·mm)  $M_{YL} = W \cdot Y$

$M_{RL}$ : applied moment in the rolling direction (N·mm)  $M_{RL} = W \cdot Z$  \*Refer to Fig. G-8 for the direction of moment.

Figure G-4

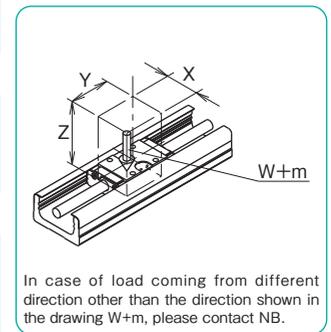
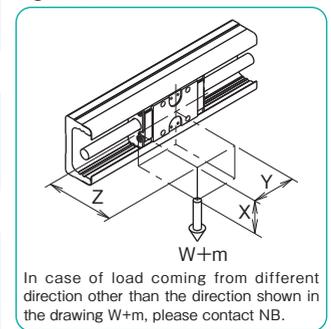


Figure G-5



**A.1.c. P<sub>T</sub> for Vertical Move**

i) during uniform motion (P<sub>Tc</sub>)

$$P_{Tc} = E_P \cdot M_{PL} + E_Y \cdot M_{YL} + E_R \cdot M_{RL} \dots\dots\dots (8)$$

ii) during acceleration (P<sub>Ta</sub>)

$$P_{Ta} = E_P(M_{PL} + m \cdot a_a \cdot Z) + E_Y(M_{YL} + m \cdot a_a \cdot X) + E_R \cdot M_{RL} \dots\dots\dots (9)$$

Note that the values of (M<sub>PL</sub>+m·a<sub>a</sub>·Z) and (M<sub>YL</sub>+m·a<sub>a</sub>·X) will be treated as 0 (zero) when the calculated value is negative.

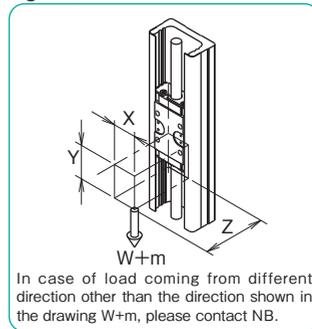
iii) during deceleration (P<sub>Td</sub>)

$$P_{Td} = E_P(M_{PL} + m \cdot a_d \cdot Z) + E_Y(M_{YL} + m \cdot a_d \cdot X) + E_R \cdot M_{RL} \dots\dots\dots (10)$$

Note that the values of (M<sub>PL</sub>+m·a<sub>d</sub>·Z) and (M<sub>YL</sub>+m·a<sub>d</sub>·X) will be treated as 0 (zero) when the calculated value is negative.

P<sub>Tc</sub>: calculated load applied to a block during uniform motion (N) P<sub>Ta</sub>: calculated load applied to a block during accelerating (N)  
 P<sub>Td</sub>: calculated load applied to a block during decelerating (N) n: number of blocks of BG·BH W: applied load (N) m: carrying mass (kg)  
 a<sub>a</sub>: acceleration during accelerating (m/sec<sup>2</sup>) a<sub>d</sub>: acceleration during decelerating (m/sec<sup>2</sup>) (the negative value)  
 X: distance between the center of BG·BH and the center of the carrying mass (mm) Y: distance between the center of BG·BH and the center of the carrying mass (mm)  
 Z: distance between the center of BG·BH ballscrew and the center of the carrying mass (mm) E<sub>P</sub>: moment equivalent coefficient in the pitching direction (refer to Table G-8)  
 E<sub>Y</sub>: moment equivalent coefficient in the yawing direction (refer to Table G-8) E<sub>R</sub>: moment equivalent coefficient in the rolling direction (refer to Table G-8)  
 M<sub>PL</sub>: applied moment in the pitching direction (N·mm) M<sub>PL</sub>=W·Z M<sub>YL</sub>: loaded moment in the yawing direction (N·mm) M<sub>YL</sub>=W·X  
 M<sub>RL</sub>: applied moment in the rolling direction (N·mm) M<sub>RL</sub>=0 \*Refer to Figure G-8 for the direction of moment.

Figure G-6



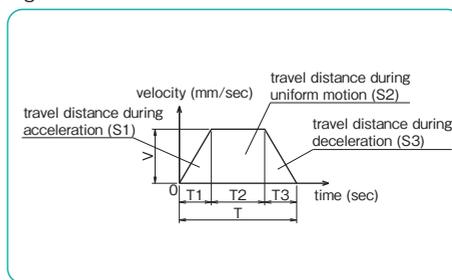
**A.1.d.**

Obtain the calculated load applied to a block (P<sub>T</sub>) by calculating the average load of each motion using an appropriate equation among those shown above according to the application.

$$P_T = \sqrt[3]{\frac{1}{(S1+S2+S3)} (P_{Ta}^3 \cdot S1 + P_{Tc}^3 \cdot S2 + P_{Td}^3 \cdot S3)} \dots\dots\dots (11)$$

P<sub>T</sub>: calculated load applied to one block (N)  
 S1: travel distance during acceleration (mm) (refer to Figure G-7)  
 S2: travel distance during uniform motion (mm) (refer to Figure G-7)  
 S3: travel distance during deceleration (mm) (refer to Figure G-7)  
 P<sub>Ta</sub>: calculated load applied to one block during accelerating (N)···equation (3), (6), and (9)  
 P<sub>Tc</sub>: calculated load applied to one block during uniform motion (N)···equation (2), (5), and (8)  
 P<sub>Td</sub>: calculated load applied to one block during decelerating (N)···equation (4), (7), and (10)

Figure G-7



**B. Life of Ballscrew and Support Bearing**

The life of ballscrew and support bearing can be calculated using a common equation, as shown below. Compare the dynamic load rating of the ballscrew and the support bearing and apply smaller value for calculation.

$$L_a = \left( \frac{1}{f_w} \cdot \frac{C_a \text{ or } C_b}{P_a} \right)^3 \cdot \ell \dots\dots\dots (12)$$

L<sub>a</sub>: rated life (km) f<sub>w</sub>: applied load coefficient (refer to Table G-7)  
 C<sub>a</sub>: basic dynamic load rating of the ballscrew (N)  
 C<sub>b</sub>: basic dynamic load rating of the support bearing (N)  
 P<sub>a</sub>: axial load (N) ℓ: ballscrew lead (mm)

**B.1. Calculation of P<sub>a</sub>**

Before calculating the life using the equation (12), calculate P<sub>a</sub> with acceleration taken into consideration. Calculate the load in each axial direction during uniform motion, acceleration, and deceleration and the obtained value is used as P<sub>a</sub>.

**B.1.a. For Horizontal Move**

i) during uniform motion (P<sub>ac</sub>)

$$P_{ac} = \mu \cdot W + F + f_b \cdot n \dots\dots\dots (13)$$

ii) during acceleration (P<sub>aa</sub>)

$$P_{aa} = \mu \cdot W + F + f_b \cdot n + (m + m_b \cdot n) a_a \dots\dots\dots (14)$$

iii) during deceleration (P<sub>ad</sub>)

$$P_{ad} = \mu \cdot W + F + f_b \cdot n + (m + m_b \cdot n) a_d \dots\dots\dots (15)$$

**B.1.b. For Vertical Move**

i) during uniform motion (P<sub>ac</sub>)

$$P_{ac} = (m + m_b \cdot n)g + F + f_b \cdot n \dots\dots\dots (16)$$

ii) during acceleration (P<sub>aa</sub>)

$$P_{aa} = (m + m_b \cdot n) \cdot (g + a_a) + F + f_b \cdot n \dots\dots\dots (17)$$

iii) during deceleration (P<sub>ad</sub>)

$$P_{ad} = (m + m_b \cdot n) \cdot (g + a_d) + F + f_b \cdot n \dots\dots\dots (18)$$

**B.1.c.**

Obtain the average axial load (P<sub>a</sub>) using an appropriate formula among those shown above depending on the application.

$$P_a = \sqrt[3]{\frac{1}{(S1+S2+S3)} (|P_{aa}|^3 \cdot S1 + |P_{ac}|^3 \cdot S2 + |P_{ad}|^3 \cdot S3)} \dots\dots\dots (19)$$

P<sub>a</sub>: average axial load (N)  
 S1: travel distance during acceleration (mm) (refer to Figure G-7)  
 S2: travel distance during uniform motion (mm) (refer to Figure G-7)  
 S3: travel distance during deceleration (mm) (refer to Figure G-7)  
 P<sub>aa</sub>: axial load during accelerating (N)···equation (14) and (17)  
 P<sub>ac</sub>: axial load during uniform motion (N)···equation (13) and (16)  
 P<sub>ad</sub>: axial load during decelerating (N)···equation (15) and (18)

Table G-9 Dynamic Frictional Resistance (f<sub>b</sub>) of a Single Block (Seal Resistance) unit: N

part number	U/W grade
BH15	2.0
BH23	2.5
BH30	2.5
BH45	7.5

part number	high (H)	precision (P)
BG15	0.8	1.8
BG20	2.3	4.9
BG26	5.4	9.8
BG33	4.4	10.2
BG46	7.4	13.3
BG55	9	16

P<sub>ac</sub>: axial load rating during uniform motion (N)  
 P<sub>aa</sub>: axial load rating during accelerating (N)  
 P<sub>ad</sub>: axial load rating during decelerating (N)  
 μ: friction coefficient (0.006) W: load applied to a block (N)  
 F: external force (load) applied to the axial direction (N)  
 f<sub>b</sub>: sliding resistance of a single block (N) (refer to Table G-9)  
 n: number of blocks of BG·BH m: carrying mass (kg)  
 m<sub>b</sub>: mass of a block of BG·BH (kg) (refer to page G-16~31 for BG type, page G-88~97 for BH type)  
 a<sub>a</sub>: acceleration during accelerating (m/sec<sup>2</sup>)  
 a<sub>d</sub>: acceleration during decelerating (m/sec<sup>2</sup>) (the negative value)  
 g: acceleration of gravity (9.8m/sec<sup>2</sup>)

# BG TYPE

## PART NUMBER STRUCTURE

Part number for BG type is described as follows.

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
BG	15	01	A	75	H	A0	L	K	P△□
		02	B	100	P	A1			G▲
				125		A2	C	KN	LB
				150		A3	J○○		PNP
				175		A4			
				200		A5			
						A6			
						A7			
						RO			

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
BG	26	02	A	150	H	A0	L	S	P△□
		05	B	200	P	A1			G▲
				250		A3	C	K	LB
				300		A5	J○○	SN	PNP
						A6		KN	
						A8			
						A9			
						AA			
						RO			

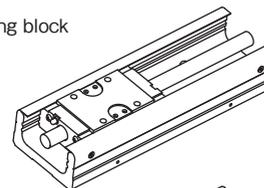
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
BG	46	10	A	340	H	A0	L	S	P△□
		20	B	440	P	A1			G▲
			C	540		A2	C	H	LB
			D	640		A3	J○○	K	PNP
				740		A4		SN	
				840		B0		HN	
				940		CO		KN	
				1040		DO			
				1140		D1			
				1240		RO			
						RA□			
						RB□			
						RC□			

\*Short blocks are not available for BG3320.

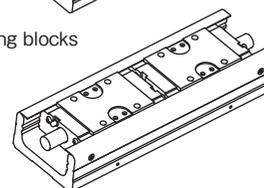
There is limitation on the length of rails depending on block type and accuracy grade. Please refer to page G-13~14 for details.

- ① BG type
- ② size
- ③ ballscrew lead (refer to page G-12)
- ④ type of block

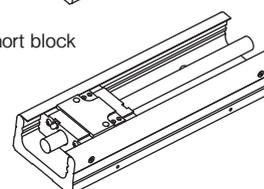
A: 1 long block



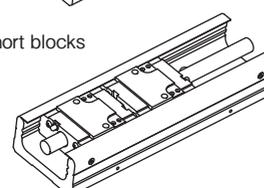
B: 2 long blocks



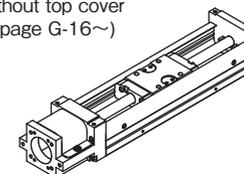
C: 1 short block



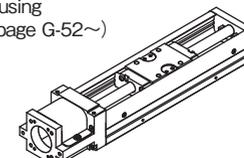
D: 2 short blocks



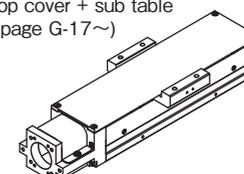
- ⑧ cover, low housing and bellows  
none: without top cover  
(refer to page G-16~)



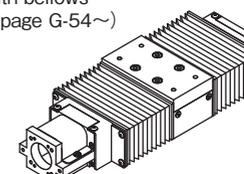
L: low housing  
(refer to page G-52~)



C: with top cover + sub table  
(refer to page G-17~)



J○○: with bellows  
(refer to page G-54~)



\*Drive block is located closest to motor bracket side.

⑤ guide rail length

\*Precision grade(P) has limitation on the length of rails. Please refer to page G-14 for details.

⑥ accuracy grade (refer to page G-14)

H	high grade
P	precision grade

⑦ motor bracket (refer to page G-32~35)

The number in the square □ after suffix RA, RB or RC indicates the mounting direction code. (refer to page G-50~51)

⑩ option

none	without option
P△□	with positioning pin hole (*1)
G▲	with special grease option (*2)
LB	with low temperature black chrome treatment (*3)
PNP	with PNP sensor

In case of multiple options, add + between each option. Example: (PS+LB+PNP)

○○ sensor cable outlet position  
(refer to page G-54)

⑨ sensor (refer to page G-63~)

none	without sensor
S	with slim-type / compact photomicro sensor
H	with close contact capable photomicro sensor
K	with proximity sensor
SN	S Specification without sensor
HN	H Specification without sensor
KN	K Specification without sensor

SN,HN, KN are attached with sensor rail and sensor dog only. No sensor is attached.

\*1: △ is S, W or R (refer to page G-75)  
□ is R (refer to page G-75)

\*2: ▲ is U, L or F (refer to page G-80)  
Grease is applied to slide guide, ballscrew, and angular bearings.

\*3: LB is applied to steel parts except for aluminum parts and radial bearings.  
For BG15, LB is applied to steel parts except for the drive block, aluminum parts, and radial bearings. Black chrome treatment is applied to the drive block.

SPECIFICATIONS

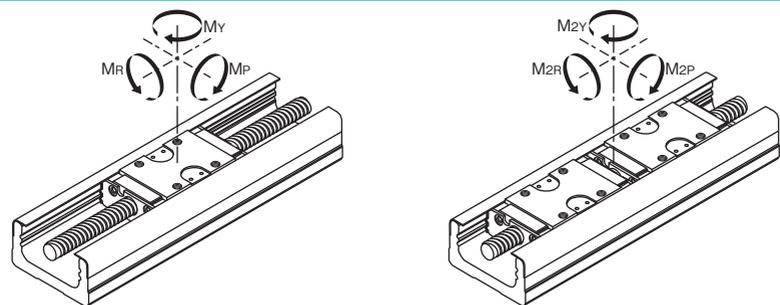
BG Type is categorized as either high grade (H) or precision grade (P). Precision grade(P) has limitation on the length of rails. (Please refer to page G-14.)

Table G-10 Specifications

part number		BG1501		BG1502		BG2001		BG2005		BG2602		BG2605		BG3305		BG3310		BG3320		BG4610		BG4620		BG5520			
accuracy grade		high	precision	high	precision	high	precision	high	precision	high	precision	high	precision	high	precision	high	precision	high	precision	high	precision	high	precision	high	precision		
guide	radial clearance	μm																									
	basic dynamic load C	kN																									
		2.42																									
	basic static load Co	kN																									
		4.76																									
	long block	allowable static moment	Mp	N·m																							
			17																								
		M2p	N·m																								
		92																									
		My	N·m																								
		20																									
	short block	allowable static moment	M2y	N·m																							
110																											
M2z		N·m																									
237																											
M2x		N·m																									
102																											
ballscrew	basic dynamic load C	kN																									
		-																									
	basic static load Co	kN																									
		-																									
	bearing support	allowable static moment	Mp	N·m																							
			-																								
M2p		N·m																									
-																											
shaft diameter	mm																										
	6																										
lead	mm																										
	1 2 1 5 2 5 5 10 20 10 20 20																										
spacer-ball ratio	-																										
basic dynamic load Ca	kN																										
	0.39 0.54 0.63 0.65 2.60 2.35 3.35 2.11 2.20 1.39 2.32 1.46 4.40 2.77 4.40 3.36 5.40 4.12																										
basic static load Coa	kN																										
	0.77 0.75 1.34 0.92 3.64 3.30 5.90 2.95 3.50 1.75 4.05 2.02 7.90 3.95 7.90 5.27 10.5 7.00																										
part number	-																										
basic dynamic load Cb	kN																										
	1.21																										
basic static load Ccb	kN																										
	1.08																										

\*Please consult with NB when using BG15, BG20 and BG26 series in the Precision grade with short and frequent stroke. (short stroke: BG1501= 2mm or less, BG1502= 4mm or less, BG2001= 7mm or less, BG2005= 25mm or less, BG2602= 14mm or less and BG2605= 25mm or less)  
 \* Mp, M2y and M2z are the allowable static moments when 2 blocks are used in close contact.  
 \* Short blocks are not available for BG3320.

Figure G-8 Direction of Moment



G-12

ALLOWABLE SPEED AND STROKE LIMIT

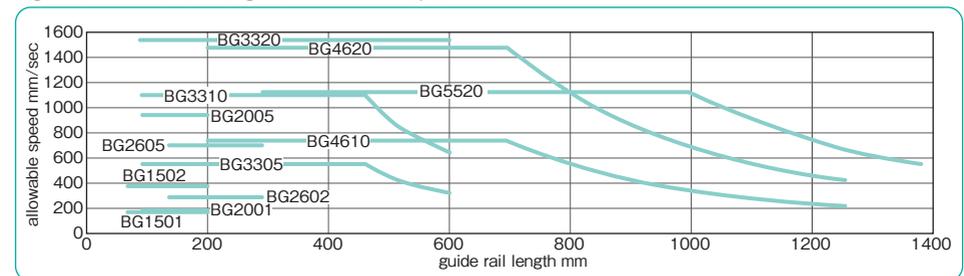
Allowable speed of BG type is subject to the type of motor and operating conditions. The speed may also be limited by the critical speed of the ball screw. Use caution when operating at high speeds or using long rails.

Table G-11 Allowable Speed and Stroke Limit

part number	rail length	stroke limit (mm)				allowable speed (mm/sec)		
		1 long block	2 long blocks	1 short block	2 short blocks	lead1	lead2	
BG15	75	30	-	-	-	185	370	
	100	55	-	-	-			
	125	80	46	-	-			
	150	105	71	-	-			
	175	130	96	-	-			
	200	155	121	-	-			
BG20	100	43	-	-	-	187	925	
	150	93	51	-	-			
	200	143	101	-	-			
	250	193	151	-	-			
BG26	150	73	-	-	-	281	694	
	200	123	61	-	-			
	250	173	111	-	-			
	300	223	161	-	-			
BG33	150	60	-	85	34	550	1,100	1,500
	200	110	-	135	84			
	300	210	133	235	184			
	400	310	233	335	284			
	500	410	333	435	384			
	600	510	433	535	484			
BG46	340	209	100	245	172	740	1,480	-
	440	309	200	345	272			
	540	409	300	445	372			
	640	509	400	545	472			
	740	609	500	645	572			
	840	709	600	745	672			
	940	809	700	845	772			
	1,040	909	800	945	872			
	1,140	1,009	900	1,045	972			
	1,240	1,109	1,000	1,145	1,072			
BG55	980	834	711	-	-	-	-	-
	1,080	934	811	-	-			
	1,180	1,034	911	-	-			
	1,280	1,134	1,011	-	-			
	1,380	1,234	1,111	-	-			
	1,480	1,334	1,211	-	-			

Short block type is not available for lead 20.

Figure G-9 Guide Rail Length and Allowable Speed



G-13

ACCURACY

Table G-12 shows accuracy of BG type.

Table G-12 Accuracy

part number	rail length mm	positioning repeatability		positioning accuracy		running parallelism B		backlash		*starting torque		
		high μm	precision μm	high μm	precision μm	high μm	precision μm	high μm	precision μm	high N·m	precision N·m	
BG15	75	±3	±1	40	20	20	10	5	2	0.01	0.012	
	100											
	125											
	150											
	175											
200												
BG20	100	±3	±1	50	20	25	10	5	2	0.01	0.012	
	150											
	200											
BG26	150	±3	±1	50	20	25	10	5	2	0.015	0.04	
	200											
	250											
	300											
BG33	150	±3 (±5)	±1 (±3)	30	15	25	10	5	2	0.07	0.15	
	200											
	300			35	20							
	400			40	25							15
	500			70	—							35
600	—	—	—	—	—	—	—	—	—	—		
BG46	340	±3 (±5)	±1 (±3)	35	20	35	15	5	2	0.10	0.15	
	440											
	540											
	640			40	25							
	740			50	30	40	20					
	840			80	—	50	—					
	940			—	—	—	—					
	1,040			—	—	—	—					
	1,140			—	—	—	—					
1,240	—	—	—	—								
BG55	980	±3	±1	80	35	50	25	5	2	0.12	0.17	
	1,080											
	1,180			40	30							
	1,280			—	—	—	—					
	1,380			—	—	—	—					

Above values are measured by using our selected motors.  
 \*Above specifications are based on using NB standard grease. Other grease may cause deviations.  
 The values in the parentheses are positioning repeatability when used with return pulley unit.

Positioning Repeatability

After setting an arbitrary position, from one end, move the drive block to this position and measure the stop position. Repeat the positioning and measurement process 7 times with respect to the setting position at the midpoint and near both ends of travel. Take the maximum difference and divide it by 2, then indicate it with a positive and negative sign as the test result.

$$\text{positioning repeatability} = \pm \frac{1}{2} (\text{maximum value of } \ell_n - \text{minimum value of } \ell_n)$$

Positioning Accuracy

Positioning is performed in one direction and the resulting position is set as the datum point. Take the difference between the actual travel distance and the commanded travel distance from the datum point. Continuing in the same direction (without returning to the start point) repeat this process randomly several times until nearing to the stroke limit. Express the accuracy by the absolute maximum difference.

$$\text{positioning accuracy} = (\Delta \ell_n)_{\text{max}}$$

Running Parallelism B

After fixing the guide rail onto the surface plate, placing the dial test indicator on the center of the slide block and connecting the indicator probe onto the mounting surface, run the block over the entire travel distance. Take the maximum deviation in readings as the test result.

Backlash

Using the feed screw to move the slide block a little, take the dial test indicator reading and make it the datum point. While in this position, thrust the block by a certain force in the same direction without using the feed screw. Release the thrust and read the return, then take the difference from the datum point. Repeat the same process at the midpoint and near both ends of travel. Take the maximum difference as the test result.

$$\text{Backlash} = \Delta \ell$$

Figure G-10 Positioning Repeatability

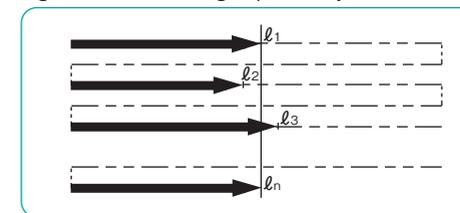


Figure G-11 Positioning Accuracy

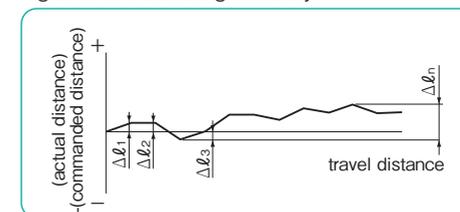


Figure G-12 Running Parallelism B

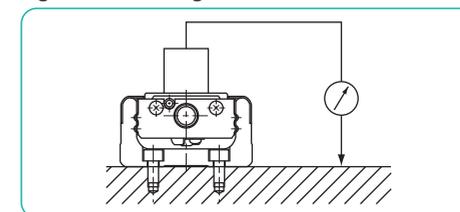
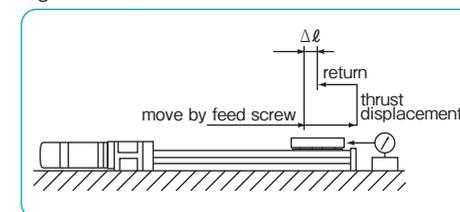
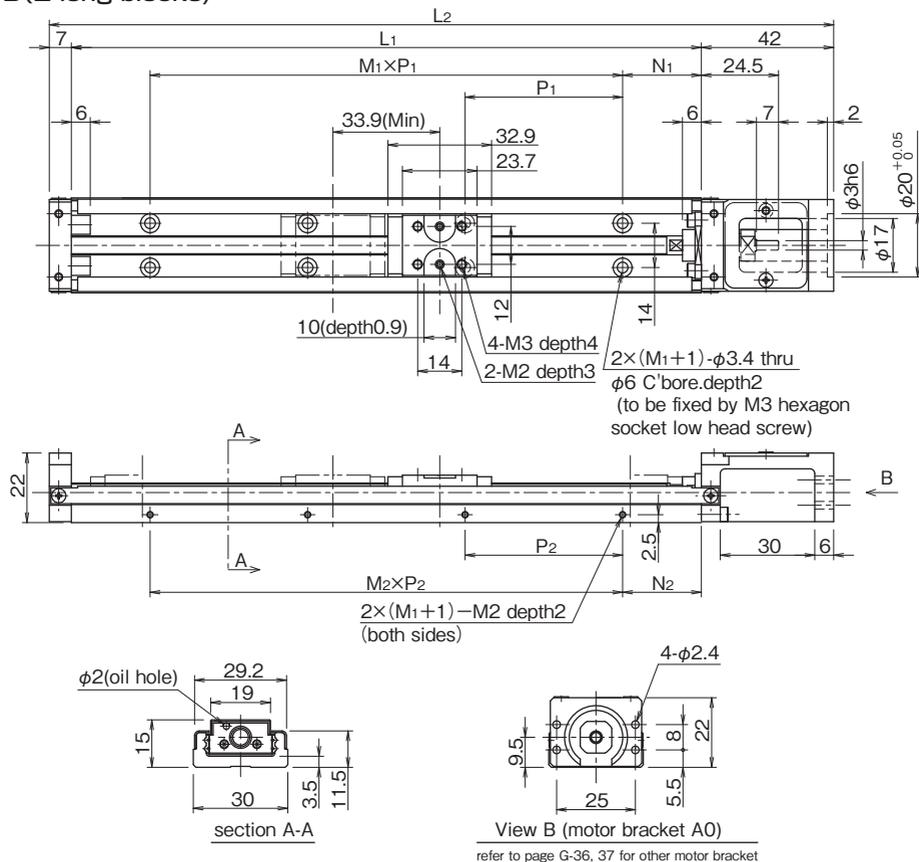


Figure G-13 Backlash



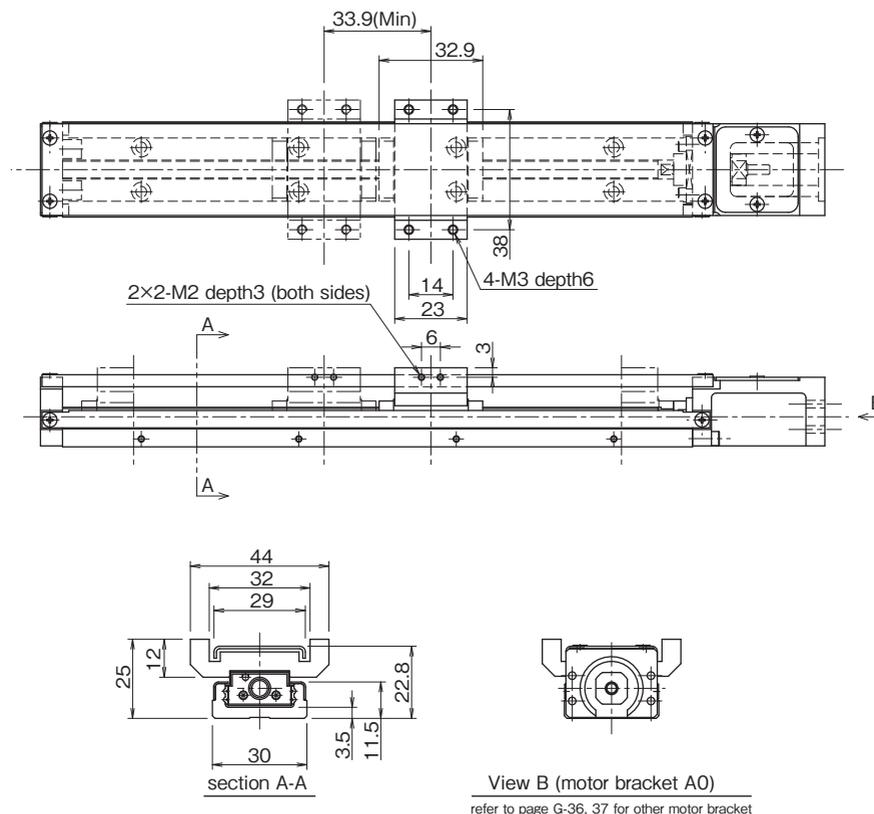
### BG15 –Without Top Cover–

A(1 long block)  
B(2 long blocks)



### BG15 –With Top Cover–

A(1 long block)  
B(2 long blocks)



part number <sup>3,4</sup>	stroke limit mm <sup>*1</sup>	dimensions mm						block mass kg <sup>*2</sup>		total mass kg	
		L <sub>1</sub>	L <sub>2</sub>	N <sub>1</sub>	M <sub>1</sub> ×P <sub>1</sub>	N <sub>2</sub>	M <sub>2</sub> ×P <sub>2</sub>	without top cover	with top cover	without top cover	with top cover
BG15□□ A-75	30	75	124	12.5	1×50	12.5	1×50	0.03	0.05	0.21	0.24
B	—	—	—	—	—	—	—	—	—	—	—
BG15□□ A-100	55	100	149	25	1×50	25	1×50	0.03	0.05	0.25	0.28
B	—	—	—	—	—	—	—	—	—	—	—
BG15□□ A-125	80	125	174	12.5	2×50	12.5	2×50	0.03	0.05	0.28	0.31
B	46							0.06	0.10	0.32	0.37
BG15□□ A-150	105	150	199	25	2×50	25	2×50	0.03	0.05	0.32	0.35
B	71							0.06	0.10	0.35	0.40
BG15□□ A-175	130	175	224	12.5	3×50	12.5	3×50	0.03	0.05	0.35	0.39
B	96							0.06	0.10	0.39	0.44
BG15□□ A-200	155	200	249	25	3×50	25	3×50	0.03	0.05	0.39	0.42
B	121							0.06	0.10	0.42	0.48

\*1: Stroke limit is a drive distance between both ends of the dampers.

\*2: Mass stated "with top cover" includes mass of sub tables.

\*3: For B type (2 long blocks), drive block is located closest to motor bracket side.

\*4: □ is ballscrew lead.

inertia (reference values)

unit:kg · m<sup>2</sup>

part number	rail length mm	long block			
		without top cover		with top cover	
		A 1 block	B 2 blocks	A 1 block	B 2 blocks
BG1501	75	1.06×10 <sup>-7</sup>	—	1.07×10 <sup>-7</sup>	—
	100	1.31×10 <sup>-7</sup>	—	1.31×10 <sup>-7</sup>	—
	125	1.56×10 <sup>-7</sup>	1.56×10 <sup>-7</sup>	1.56×10 <sup>-7</sup>	1.58×10 <sup>-7</sup>
	150	1.80×10 <sup>-7</sup>	1.81×10 <sup>-7</sup>	1.81×10 <sup>-7</sup>	1.82×10 <sup>-7</sup>
	175	2.05×10 <sup>-7</sup>	2.06×10 <sup>-7</sup>	2.06×10 <sup>-7</sup>	2.07×10 <sup>-7</sup>
BG1502	200	2.30×10 <sup>-7</sup>	2.31×10 <sup>-7</sup>	2.31×10 <sup>-7</sup>	2.32×10 <sup>-7</sup>
	75	1.09×10 <sup>-7</sup>	—	1.11×10 <sup>-7</sup>	—
	100	1.33×10 <sup>-7</sup>	—	1.35×10 <sup>-7</sup>	—
	125	1.58×10 <sup>-7</sup>	1.62×10 <sup>-7</sup>	1.60×10 <sup>-7</sup>	1.66×10 <sup>-7</sup>
	150	1.83×10 <sup>-7</sup>	1.86×10 <sup>-7</sup>	1.85×10 <sup>-7</sup>	1.90×10 <sup>-7</sup>
	175	2.08×10 <sup>-7</sup>	2.11×10 <sup>-7</sup>	2.10×10 <sup>-7</sup>	2.15×10 <sup>-7</sup>
	200	2.33×10 <sup>-7</sup>	2.36×10 <sup>-7</sup>	2.35×10 <sup>-7</sup>	2.40×10 <sup>-7</sup>

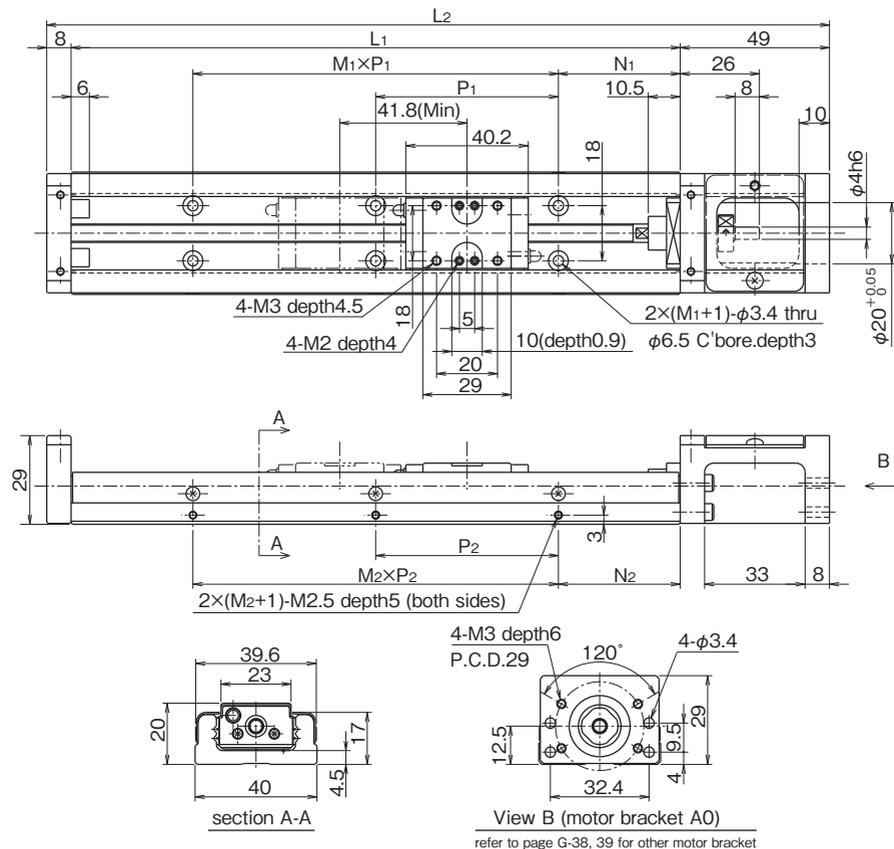
Key components and materials

part name	material	remarks
guide rail	stainless steel	
ballscrew shaft	steel	
slide block	steel	
motor bracket	aluminum alloy	white anodizing
housing	aluminum alloy	white anodizing
adapter plate	aluminum alloy	white anodizing
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	white anodizing

When LB option is selected, steel parts are treated with low temperature black chrome treatment. Black chrome treatment is applied to the slide block only.

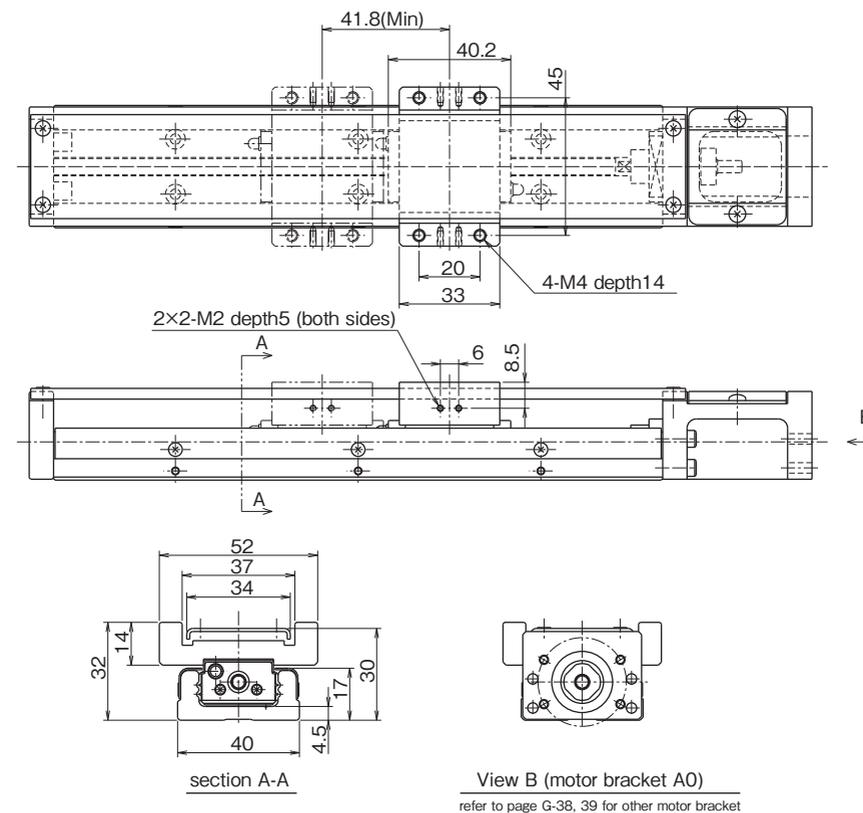
**BG20 –Without Top Cover–**

A(1 long block)  
B(2 long blocks)



**BG20 –With Top Cover–**

A(1 long block)  
B(2 long blocks)



part number <sup>*3,4</sup>	stroke limit mm <sup>*1</sup>	dimensions mm		dimensions mm			block mass kg <sup>*2</sup>		total mass kg		
		L <sub>1</sub>	L <sub>2</sub>	N <sub>1</sub>	M <sub>1</sub> ×P <sub>1</sub>	N <sub>2</sub>	M <sub>2</sub> ×P <sub>2</sub>	without top cover	with top cover	without top cover	with top cover
BG20□□A-100	43	100	157	20	1×60	20	1×60	0.07	0.11	0.45	0.50
B	—	—	—	—	—	—	—	—	—	—	—
BG20□□A-150	93	150	207	15	2×60	15	2×60	0.07	0.11	0.58	0.63
B	51	—	—	—				—	—	0.14	0.22
BG20□□A-200	143	200	257	40	—	—	—	0.07	0.11	0.71	0.77
B	101	—	—	—	—	—	—	0.14	0.22	0.78	0.88

\*1: Stroke limit is a drive distance between both ends of the dampers.

\*2: Mass stated "with top cover" includes mass of sub tables.

\*3: For B type (2 long blocks), drive block is located closest to motor bracket side.

\*4: □ is ballscrew lead.

inertia (reference values)

unit:kg · m<sup>2</sup>

part number	rail length mm	long block			
		without top cover		with top cover	
		A	B	A	B
BG2001	100	1.34×10 <sup>-7</sup>	—	1.35×10 <sup>-7</sup>	—
	150	1.83×10 <sup>-7</sup>	1.85×10 <sup>-7</sup>	1.84×10 <sup>-7</sup>	1.87×10 <sup>-7</sup>
	200	2.33×10 <sup>-7</sup>	2.35×10 <sup>-7</sup>	2.34×10 <sup>-7</sup>	2.37×10 <sup>-7</sup>
BG2005	100	1.76×10 <sup>-7</sup>	—	2.00×10 <sup>-7</sup>	—
	150	2.26×10 <sup>-7</sup>	2.70×10 <sup>-7</sup>	2.50×10 <sup>-7</sup>	3.18×10 <sup>-7</sup>
	200	2.76×10 <sup>-7</sup>	3.20×10 <sup>-7</sup>	3.00×10 <sup>-7</sup>	3.68×10 <sup>-7</sup>

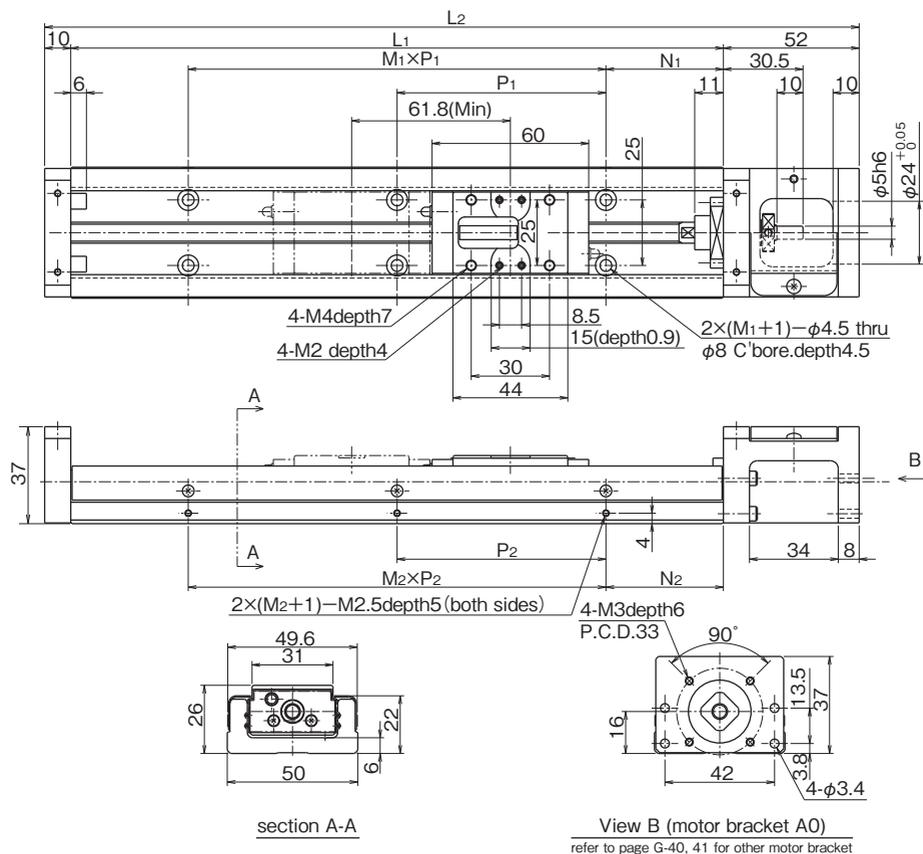
Key components and materials

part name	material	remarks
guide rail	stainless steel	
ballscrew shaft	steel	
slide block	steel	
motor bracket:A0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket: R0	aluminum alloy	white anodizing
housing	aluminum alloy	white anodizing
adapter plate	aluminum alloy	white anodizing
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	white anodizing

When LB option is selected, steel parts are treated with low temperature black chrome treatment.

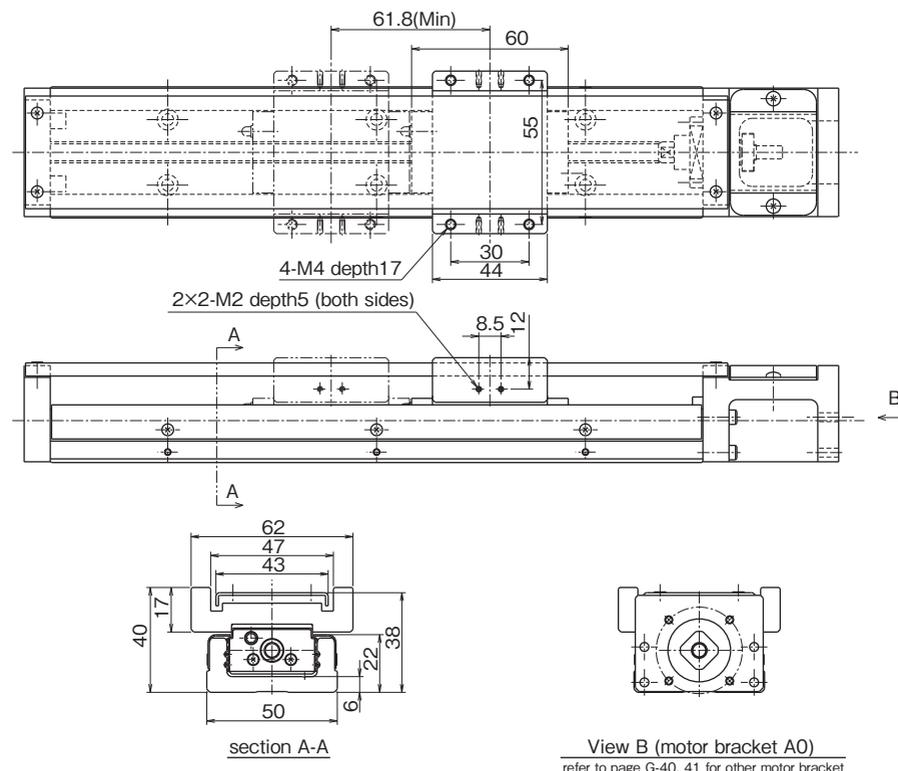
**BG26 –Without Top Cover–**

A(1 long block)  
B(2 long blocks)



**BG26 –With Top Cover–**

A(1 long block)  
B(2 long blocks)



part number <sup>3,4</sup>	stroke limit mm <sup>1</sup>	dimensions mm						block mass kg <sup>2</sup>		total mass kg	
		L <sub>1</sub>	L <sub>2</sub>	N <sub>1</sub>	M <sub>1</sub> ×P <sub>1</sub>	N <sub>2</sub>	M <sub>2</sub> ×P <sub>2</sub>	without top cover	with top cover	without top cover	with top cover
BG26□□A-150	73	150	212	35	1×80	35	1×80	0.17	0.24	0.93	1.07
B	—	—	—	—	—	—	—	—	—	—	—
BG26□□A-200	123	200	262	20	2×80	45	2×80	0.17	0.24	1.14	1.3
B	61							0.34	0.48	1.31	1.54
BG26□□A-250	173	250	312	45	—	—	—	0.17	0.24	1.36	1.53
B	111							0.34	0.48	1.53	1.78
BG26□□A-300	223	300	362	30	3×80	30	3×80	0.17	0.24	1.57	1.76
B	161							0.34	0.48	1.74	2.01

\*1: Stroke limit is a drive distance between both ends of the dampers.  
 \*2: Mass stated "with top cover" includes mass of sub tables.  
 \*3: For B type (2 long blocks), drive block is located closest to motor bracket side.  
 \*4: □ is ballscrew lead.

inertia (reference values)

part number	rail length mm	long block			
		without top cover		with top cover	
		A 1 block	B 2 blocks	A 1 block	B 2 blocks
BG2602	150	$6.08 \times 10^{-7}$	—	$6.16 \times 10^{-7}$	—
	200	$7.65 \times 10^{-7}$	$7.83 \times 10^{-7}$	$7.73 \times 10^{-7}$	$7.97 \times 10^{-7}$
	250	$9.22 \times 10^{-7}$	$9.39 \times 10^{-7}$	$9.29 \times 10^{-7}$	$9.54 \times 10^{-7}$
	300	$1.08 \times 10^{-6}$	$1.10 \times 10^{-6}$	$1.09 \times 10^{-6}$	$1.11 \times 10^{-6}$
BG2605	150	$6.99 \times 10^{-7}$	—	$7.44 \times 10^{-7}$	—
	200	$8.56 \times 10^{-7}$	$9.63 \times 10^{-7}$	$9.01 \times 10^{-7}$	$1.05 \times 10^{-6}$
	250	$1.01 \times 10^{-6}$	$1.12 \times 10^{-6}$	$1.06 \times 10^{-6}$	$1.21 \times 10^{-6}$
	300	$1.17 \times 10^{-6}$	$1.28 \times 10^{-6}$	$1.21 \times 10^{-6}$	$1.37 \times 10^{-6}$

unit:kg · m<sup>2</sup>

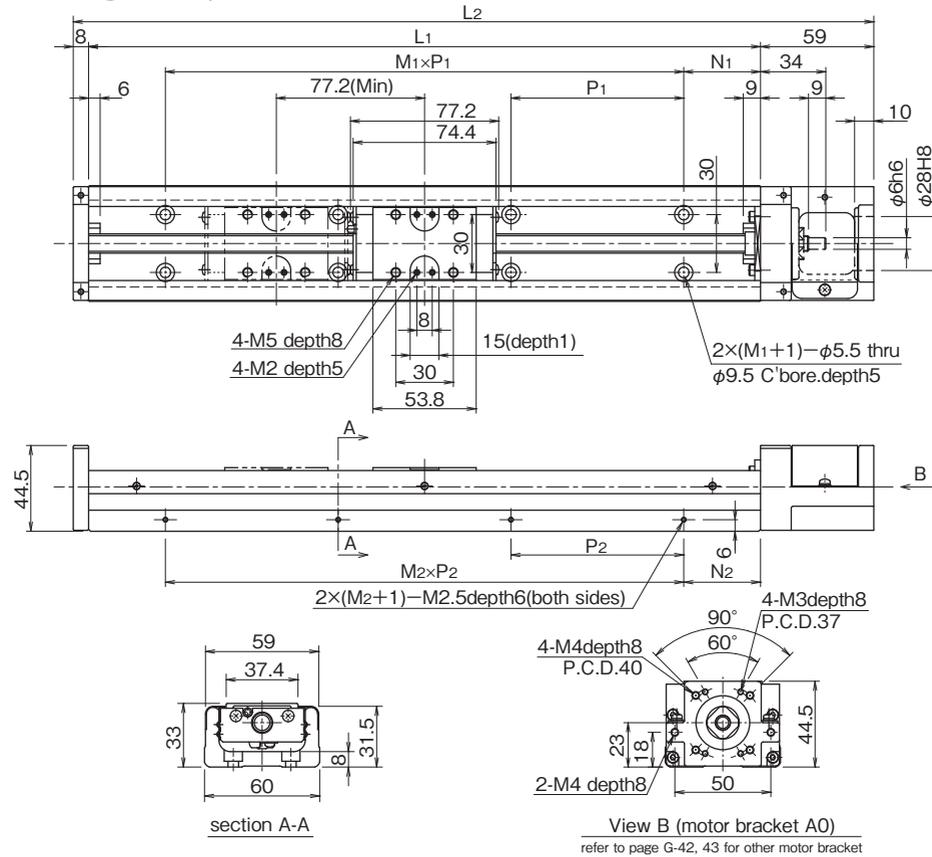
Key components and materials

part name	material	remarks
guide rail	stainless steel	
ballscrew shaft	steel	
side block	steel	
motor bracket: A0	aluminum alloy	baking acrylic painting: silvery-white color
motor bracket: R0	aluminum alloy	white anodizing
housing	aluminum alloy	white anodizing
adapter plate	aluminum alloy	white anodizing
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	white anodizing

When LB option is selected, steel parts are treated with low temperature black chrome treatment.

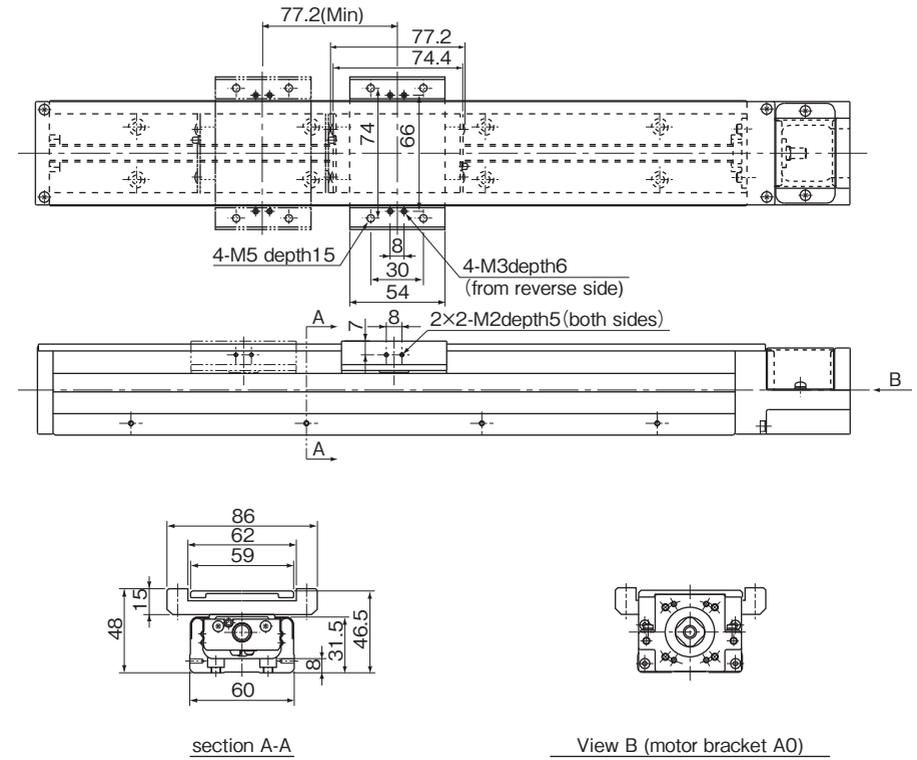
**BG33 –Without Top Cover–**

A(1 long block)  
B(2 long blocks)



**BG33 –With Top Cover–**

A(1 long block)  
B(2 long blocks)



part number <sup>*3,4</sup>	stroke limit mm <sup>*1</sup>	dimensions mm						block mass kg <sup>*2</sup>		total mass kg		
		L <sub>1</sub>	L <sub>2</sub>	N <sub>1</sub>	M <sub>1</sub> ×P <sub>1</sub>	N <sub>2</sub>	M <sub>2</sub> ×P <sub>2</sub>	without top cover	with top cover	without top cover	with top cover	
BG33□□A-150	60	150	217	25	1×100	25	1×100	0.3	0.4	1.6	1.8	
B	—	—	—	—	—	—	—	—	—	—	—	
BG33□□A-200	110	200	267	50	1×100	50	1×100	0.3	0.4	2	2.1	
B	—	—	—	—	—	—	—	—	—	—	—	
BG33□□A-300	210	300	367	50	2×100	50	2×100	0.3	0.4	2.6	2.8	
B	133	—	—					0.6	0.8	2.9	3.2	
BG33□□A-400	310	400	467					3×100	0.3	0.4	3.2	3.5
B	233	—	—					0.6	0.8	3.6	3.9	
BG33□□A-500	410	500	567	50	4×100	50	4×100	0.3	0.4	3.9	4.2	
B	333							0.6	0.8	4.2	4.6	
BG33□□A-600	510	600	667					5×100	0.3	0.4	4.6	4.9
B	433	0.6	0.8					4.9	5.3			

\*1: Stroke limit is a drive distance between both ends of the dampers.  
 \*2: Mass stated "with top cover" includes mass of sub tables.  
 \*3: For B type (2 long blocks), drive block is located closest to motor bracket side.  
 \*4: □ is ballscrew lead.

inertia (reference values)

part number	rail length mm	long block				unit:kg·m <sup>2</sup>	
		without top cover		with top cover		A	B
		A	B	A	B		
BG3305	150	1.64×10 <sup>-6</sup>	—	1.71×10 <sup>-6</sup>	—	A	B
	200	2.02×10 <sup>-6</sup>	—	2.09×10 <sup>-6</sup>	—		
	300	2.79×10 <sup>-6</sup>	2.99×10 <sup>-6</sup>	2.86×10 <sup>-6</sup>	3.13×10 <sup>-6</sup>		
	400	3.55×10 <sup>-6</sup>	3.75×10 <sup>-6</sup>	3.62×10 <sup>-6</sup>	3.89×10 <sup>-6</sup>		
	500	4.32×10 <sup>-6</sup>	4.52×10 <sup>-6</sup>	4.39×10 <sup>-6</sup>	4.66×10 <sup>-6</sup>		
	600	5.08×10 <sup>-6</sup>	5.28×10 <sup>-6</sup>	5.15×10 <sup>-6</sup>	5.42×10 <sup>-6</sup>		
BG3310	150	2.19×10 <sup>-6</sup>	—	2.47×10 <sup>-6</sup>	—	A	B
	200	2.57×10 <sup>-6</sup>	—	2.85×10 <sup>-6</sup>	—		
	300	3.34×10 <sup>-6</sup>	4.14×10 <sup>-6</sup>	3.61×10 <sup>-6</sup>	4.69×10 <sup>-6</sup>		
	400	4.10×10 <sup>-6</sup>	4.90×10 <sup>-6</sup>	4.38×10 <sup>-6</sup>	5.46×10 <sup>-6</sup>		
	500	4.87×10 <sup>-6</sup>	5.67×10 <sup>-6</sup>	5.15×10 <sup>-6</sup>	6.22×10 <sup>-6</sup>		
	600	5.63×10 <sup>-6</sup>	6.43×10 <sup>-6</sup>	5.91×10 <sup>-6</sup>	6.99×10 <sup>-6</sup>		
BG3320	150	5.94×10 <sup>-6</sup>	—	7.06×10 <sup>-6</sup>	—	A	B
	200	6.74×10 <sup>-6</sup>	—	7.85×10 <sup>-6</sup>	—		
	300	8.33×10 <sup>-6</sup>	1.15×10 <sup>-5</sup>	9.44×10 <sup>-6</sup>	1.38×10 <sup>-5</sup>		
	400	9.91×10 <sup>-6</sup>	1.31×10 <sup>-5</sup>	1.10×10 <sup>-5</sup>	1.53×10 <sup>-5</sup>		
	500	1.15×10 <sup>-5</sup>	1.47×10 <sup>-5</sup>	1.26×10 <sup>-5</sup>	1.69×10 <sup>-5</sup>		
	600	1.31×10 <sup>-5</sup>	1.63×10 <sup>-5</sup>	1.42×10 <sup>-5</sup>	1.85×10 <sup>-5</sup>		

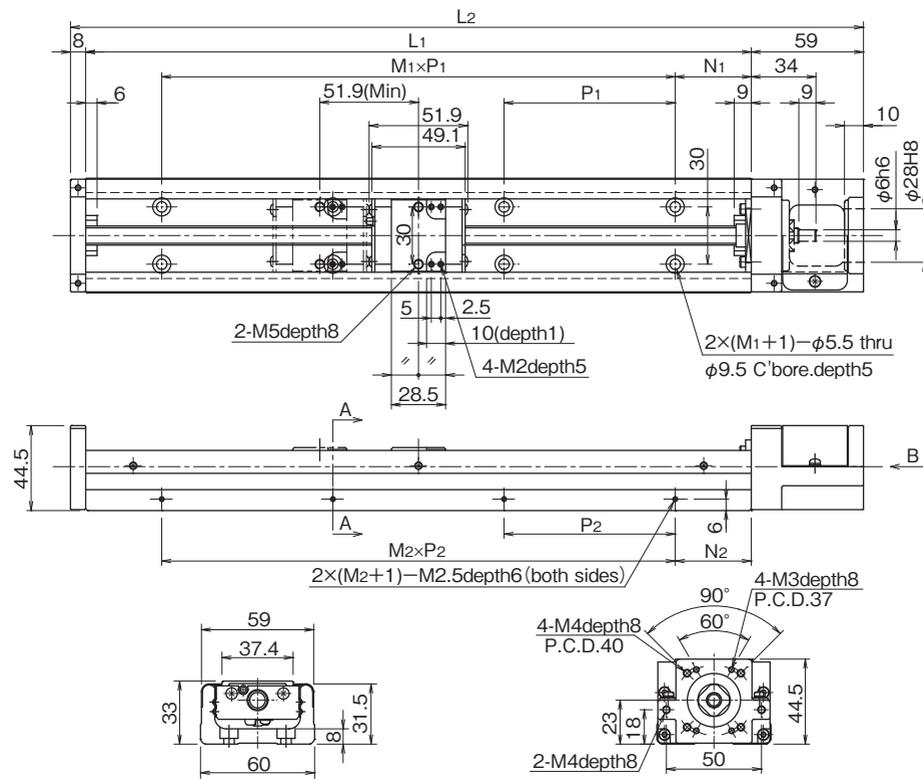
Key components and materials

part name	material	remarks
guide rail	steel	black oxide except for grinding processing part
ballscrew shaft	steel	
slide block	steel	
motor bracket: A0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket: R0	aluminum alloy	white anodizing
housing	aluminum die cast	baking acrylic painting: silvery-white color
low housing	aluminum alloy	white anodizing
adapter plate	steel	black oxide
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	white anodizing

When LB option is selected, steel parts are treated with low temperature black chrome treatment.

**BG33 –Without Top Cover–**

C(1 short block)  
D(2 short blocks)

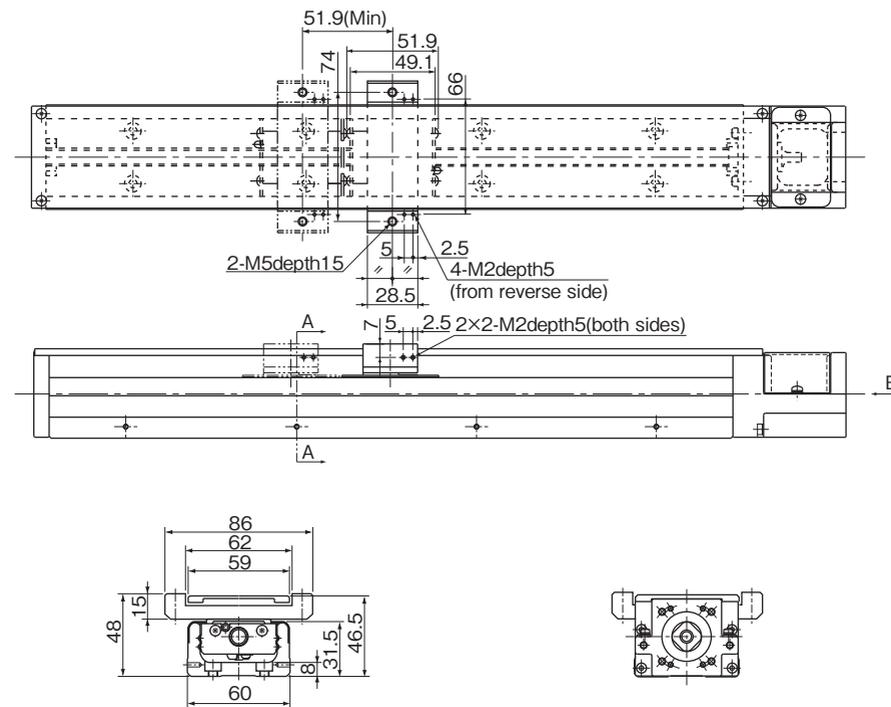


section A-A

View B (motor bracket A0)  
refer to page G-42, 43 for other motor bracket

**BG33 –With Top Cover–**

C(1 short block)  
D(2 short blocks)



section A-A

View B (motor bracket A0)  
refer to page G-42,43 for other motor bracket

part number <sup>3,4</sup>	stroke limit mm <sup>1</sup>	dimensions mm					block mass kg <sup>2</sup>		total mass kg		
		L <sub>1</sub>	L <sub>2</sub>	N <sub>1</sub>	M <sub>1</sub> ×P <sub>1</sub>	N <sub>2</sub>	M <sub>2</sub> ×P <sub>2</sub>	without top cover	with top cover	without top cover	with top cover
BG33□□C-150	85	150	217	25	1×100	25	1×100	0.15	0.2	1.5	1.6
	34							0.3	0.4	1.7	1.9
BG33□□C-200	135	200	267	50	2×100	50	2×100	0.15	0.2	1.8	2
	84							0.3	0.4	2	2.2
BG33□□C-300	235	300	367	3×100	50	3×100	3×100	0.15	0.2	2.5	2.6
	184							0.3	0.4	2.7	2.9
BG33□□C-400	335	400	467	4×100	50	4×100	4×100	0.15	0.2	3.1	3.3
	284							0.3	0.4	3.3	3.5
BG33□□C-500	435	500	567	5×100	50	5×100	5×100	0.15	0.2	3.8	4
	384							0.3	0.4	3.9	4.2
BG33□□C-600	535	600	667					0.15	0.2	4.4	4.7
	484							0.3	0.4	4.6	4.9

\*1: Stroke limit is a drive distance between both ends of the dampers.  
 \*2: Mass stated "with top cover" includes mass of sub tables.  
 \*3: For D type (2 short blocks), drive block is located closest to motor bracket side.  
 \*4: □ is ballscrew lead.  
 \*5: Ballscrew lead of 20mm is not available for BG33 short block type.

inertia (reference values)

unit:kg · m<sup>2</sup>

part number	rail length mm	short block			
		without top cover		with top cover	
		C	D	C	D
BG3305	150	1.56×10 <sup>-6</sup>	1.64×10 <sup>-6</sup>	1.60×10 <sup>-6</sup>	1.71×10 <sup>-6</sup>
	200	1.94×10 <sup>-6</sup>	2.03×10 <sup>-6</sup>	1.98×10 <sup>-6</sup>	2.10×10 <sup>-6</sup>
	300	2.71×10 <sup>-6</sup>	2.79×10 <sup>-6</sup>	2.75×10 <sup>-6</sup>	2.86×10 <sup>-6</sup>
	400	3.48×10 <sup>-6</sup>	3.56×10 <sup>-6</sup>	3.51×10 <sup>-6</sup>	3.63×10 <sup>-6</sup>
	500	4.24×10 <sup>-6</sup>	4.32×10 <sup>-6</sup>	4.28×10 <sup>-6</sup>	4.39×10 <sup>-6</sup>
BG3310	600	5.01×10 <sup>-6</sup>	5.09×10 <sup>-6</sup>	5.04×10 <sup>-6</sup>	5.16×10 <sup>-6</sup>
	150	1.88×10 <sup>-6</sup>	2.21×10 <sup>-6</sup>	2.02×10 <sup>-6</sup>	2.49×10 <sup>-6</sup>
	200	2.27×10 <sup>-6</sup>	2.59×10 <sup>-6</sup>	2.40×10 <sup>-6</sup>	2.87×10 <sup>-6</sup>
	300	3.03×10 <sup>-6</sup>	3.36×10 <sup>-6</sup>	3.17×10 <sup>-6</sup>	3.64×10 <sup>-6</sup>
	400	3.80×10 <sup>-6</sup>	4.12×10 <sup>-6</sup>	3.94×10 <sup>-6</sup>	4.40×10 <sup>-6</sup>
	500	4.56×10 <sup>-6</sup>	4.89×10 <sup>-6</sup>	4.70×10 <sup>-6</sup>	5.17×10 <sup>-6</sup>
600	5.33×10 <sup>-6</sup>	5.65×10 <sup>-6</sup>	5.47×10 <sup>-6</sup>	5.93×10 <sup>-6</sup>	

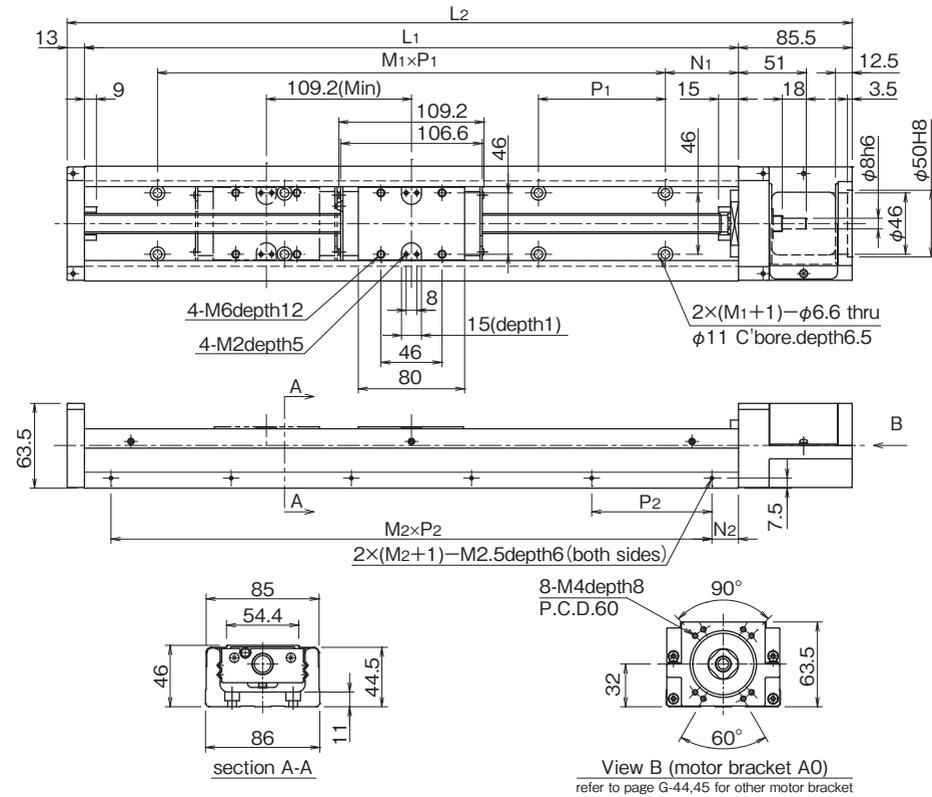
Key components and materials

part name	material	remarks
guide rail	steel	black oxide except for grinding processing part
ballscrew shaft	steel	
slide block	steel	
motor bracket: A0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket: R0	aluminum alloy	white anodizing
housing	aluminum die cast	baking acrylic painting: silvery-white color
low housing	aluminum alloy	white anodizing
adapter plate	steel	black oxide
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	white anodizing

When LB option is selected, steel parts are treated with low temperature black chrome treatment.

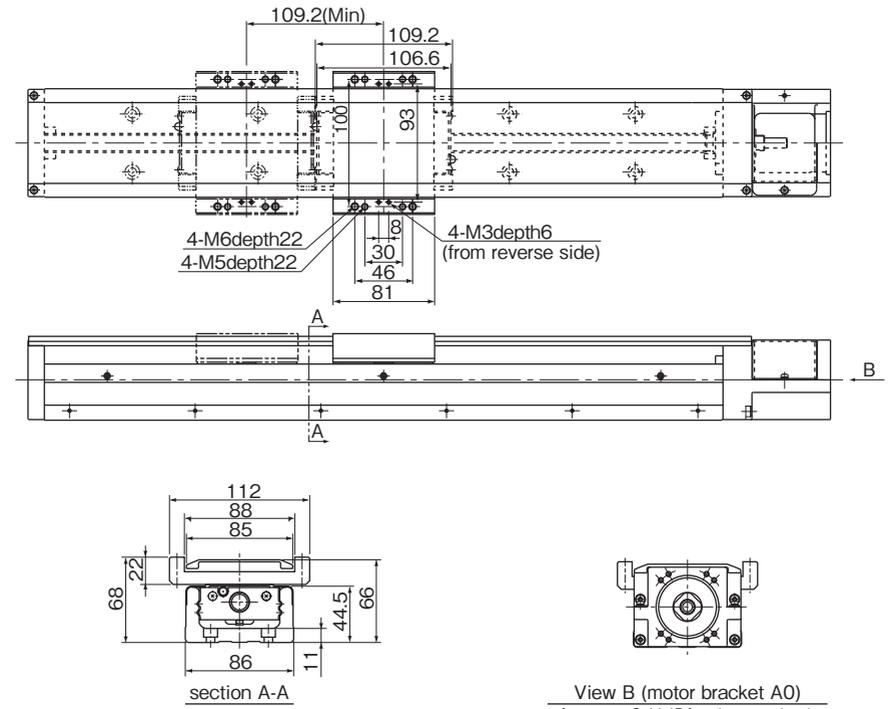
**BG46 –Without Top Cover–**

A(1 long block)  
B(2 long blocks)



**BG46 –With Top Cover–**

A(1 long block)  
B(2 long blocks)



part number <sup>3,4</sup>	stroke limit mm <sup>1</sup>	dimensions mm		block mass kg <sup>2</sup>		total mass kg					
		L <sub>1</sub>	L <sub>2</sub>	without top cover	with top cover	without top cover	with top cover				
BG46□□A-340	209	340	438.5	70	20	2×100	3×100	0.9	1.2	6.5	7
B	100						1.8	2.4	7.5	8	
BG46□□A-440	309	440	538.5			3×100	4×100	0.9	1.2	8	8.5
B	200	1.8	2.4			8.5	9.5				
BG46□□A-540	409	540	638.5			4×100	5×100	0.9	1.2	9	10
B	300	1.8	2.4			10	11				
BG46□□A-640	509	640	738.5			5×100	6×100	0.9	1.2	10.5	11
B	400	1.8	2.4			11.5	12.5				
BG46□□A-740	609	740	838.5			6×100	7×100	0.9	1.2	12	12.5
B	500	1.8	2.4			13	14				
BG46□□A-840	709	840	938.5			7×100	8×100	0.9	1.2	13	14
B	600	1.8	2.4			14	15.5				
BG46□□A-940	809	940	1,038.5	8×100	9×100	0.9	1.2	14.5	15.5		
B	700	1.8	2.4	15.5	16.5						
BG46□□A-1040	909	1,040	1,138.5	9×100	10×100	0.9	1.2	16	17		
B	800	1.8	2.4	17	18						
BG46□□A-1140	1,009	1,140	1,238.5	10×100	11×100	0.9	1.2	17.5	18.5		
B	900	1.8	2.4	18	19.5						
BG46□□A-1240	1,109	1,240	1,338.5	11×100	12×100	0.9	1.2	18.5	19.5		
B	1,000	1.8	2.4	19.5	21						

\*1: Stroke limit is a drive distance between both ends of the dampers.  
 \*2: Mass stated "with top cover" includes mass of sub tables.  
 \*3: For B type (2 long blocks), drive block is located closest to motor bracket side.  
 \*4: □ is ballscrew lead.

inertia (reference values)

unit:kg · m<sup>2</sup> refer to page G-44,45 for other motor bracket

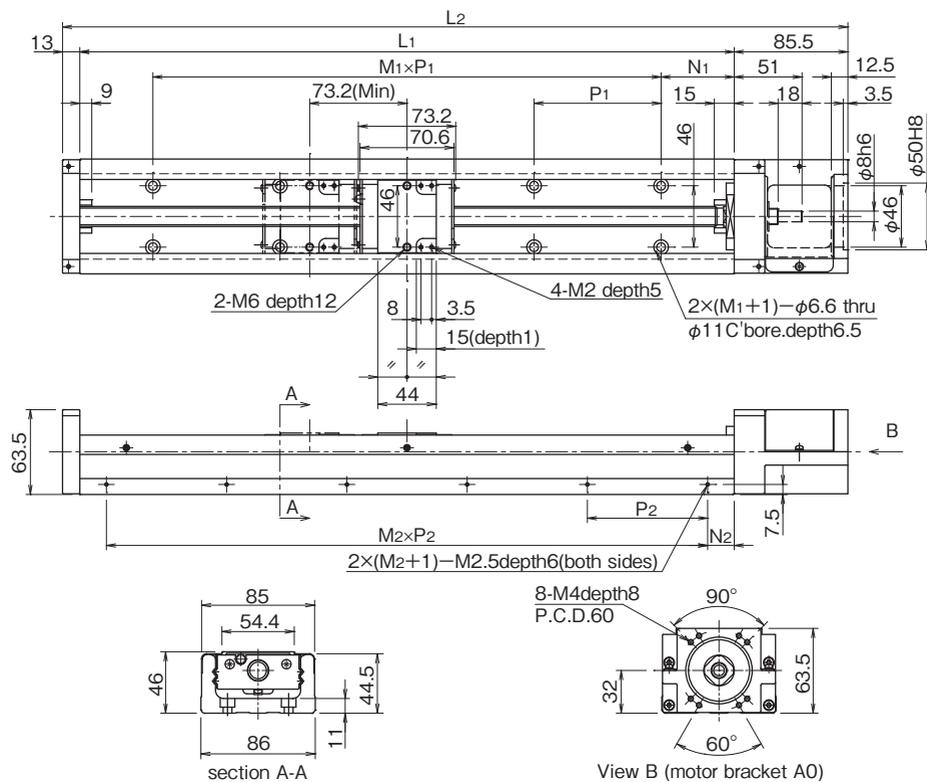
part number	rail length mm	long block				
		without top cover		with top cover		
		A	B	A	B	
BG4610	340	1.79×10 <sup>-5</sup>	2.02×10 <sup>-5</sup>	1.87×10 <sup>-5</sup>	2.17×10 <sup>-5</sup>	
	440	2.18×10 <sup>-5</sup>	2.41×10 <sup>-5</sup>	2.25×10 <sup>-5</sup>	2.56×10 <sup>-5</sup>	
	540	2.57×10 <sup>-5</sup>	2.79×10 <sup>-5</sup>	2.64×10 <sup>-5</sup>	2.95×10 <sup>-5</sup>	
	640	2.95×10 <sup>-5</sup>	3.18×10 <sup>-5</sup>	3.03×10 <sup>-5</sup>	3.33×10 <sup>-5</sup>	
	740	3.34×10 <sup>-5</sup>	3.57×10 <sup>-5</sup>	3.42×10 <sup>-5</sup>	3.72×10 <sup>-5</sup>	
	840	3.73×10 <sup>-5</sup>	3.96×10 <sup>-5</sup>	3.80×10 <sup>-5</sup>	4.11×10 <sup>-5</sup>	
	940	4.12×10 <sup>-5</sup>	4.35×10 <sup>-5</sup>	4.19×10 <sup>-5</sup>	4.50×10 <sup>-5</sup>	
	1,040	4.50×10 <sup>-5</sup>	4.74×10 <sup>-5</sup>	4.58×10 <sup>-5</sup>	4.88×10 <sup>-5</sup>	
	1,140	4.89×10 <sup>-5</sup>	5.12×10 <sup>-5</sup>	4.97×10 <sup>-5</sup>	5.27×10 <sup>-5</sup>	
	1,240	5.28×10 <sup>-5</sup>	5.51×10 <sup>-5</sup>	5.35×10 <sup>-5</sup>	5.66×10 <sup>-5</sup>	
	BG4620	340	2.47×10 <sup>-5</sup>	3.39×10 <sup>-5</sup>	2.78×10 <sup>-5</sup>	3.99×10 <sup>-5</sup>
		440	2.86×10 <sup>-5</sup>	3.77×10 <sup>-5</sup>	3.17×10 <sup>-5</sup>	4.38×10 <sup>-5</sup>
540		3.25×10 <sup>-5</sup>	4.16×10 <sup>-5</sup>	3.55×10 <sup>-5</sup>	4.77×10 <sup>-5</sup>	
640		3.63×10 <sup>-5</sup>	4.55×10 <sup>-5</sup>	3.94×10 <sup>-5</sup>	5.16×10 <sup>-5</sup>	
740		4.03×10 <sup>-5</sup>	4.94×10 <sup>-5</sup>	4.33×10 <sup>-5</sup>	5.55×10 <sup>-5</sup>	
840		4.41×10 <sup>-5</sup>	5.34×10 <sup>-5</sup>	4.71×10 <sup>-5</sup>	5.93×10 <sup>-5</sup>	
940		4.80×10 <sup>-5</sup>	5.72×10 <sup>-5</sup>	5.09×10 <sup>-5</sup>	6.32×10 <sup>-5</sup>	
1,040		5.19×10 <sup>-5</sup>	6.11×10 <sup>-5</sup>	5.48×10 <sup>-5</sup>	6.71×10 <sup>-5</sup>	
1,140		5.57×10 <sup>-5</sup>	6.50×10 <sup>-5</sup>	5.87×10 <sup>-5</sup>	7.09×10 <sup>-5</sup>	
1,240		5.96×10 <sup>-5</sup>	6.89×10 <sup>-5</sup>	6.26×10 <sup>-5</sup>	7.48×10 <sup>-5</sup>	

Key components and materials		
part name	material	remarks
guide rail	steel	black oxide except for grinding processing part
ballscrew shaft	steel	
slide block	steel	
motor bracket:A0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket:B0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket:C0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket:D0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket:R0	aluminum alloy	white anodizing
housing	aluminum die cast	baking acrylic painting: silvery-white color
low housing	aluminum alloy	white anodizing
adapter plate	steel	black oxide
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	white anodizing

When LB option is selected, steel parts are treated with low temperature black chrome treatment.

**BG46 –Without Top Cover–**

C(1 short block)  
D(2 short blocks)



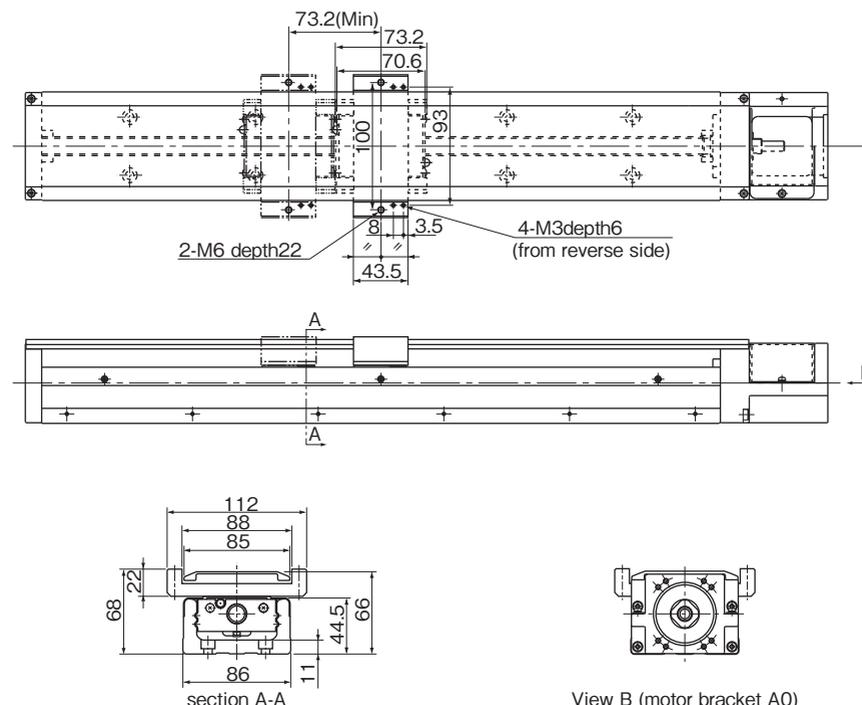
View B (motor bracket A0)  
refer to page G-44, 45 for other motor bracket

part number <sup>3,4</sup>	stroke limit mm <sup>-1</sup>	dimensions mm		block mass kg <sup>-2</sup>		total mass kg					
		L <sub>1</sub>	L <sub>2</sub>	without top cover	with top cover	without top cover	with top cover				
BG46□□C-340	245	340	438.5	70	20	2×100	3×100	0.5	0.7	6	6.5
D	172							1	1.4	6.5	7
BG46□□C-440	345	440	538.5			3×100	4×100	0.5	0.7	7.5	8
D	272							1	1.4	8	8.5
BG46□□C-540	445	540	638.5			4×100	5×100	0.5	0.7	8.5	9.5
D	372							1	1.4	9.5	10
BG46□□C-640	545	640	738.5			5×100	6×100	0.5	0.7	10	10.5
D	472							1	1.4	10.5	11.5
BG46□□C-740	645	740	838.5			6×100	7×100	0.5	0.7	11.5	12
D	572							1	1.4	12	13
BG46□□C-840	745	840	938.5			7×100	8×100	0.5	0.7	13	13.5
D	672							1	1.4	13.5	14
BG46□□C-940	845	940	1,038.5	8×100	9×100	0.5	0.7	14	15		
D	772					1	1.4	14.5	15.5		
BG46□□C-1040	945	1,040	1,138.5	9×100	10×100	0.5	0.7	15.5	16.5		
D	872					1	1.4	16	17		
BG46□□C-1140	1,045	1,140	1,238.5	10×100	11×100	0.5	0.7	17	18		
D	972					1	1.4	17.5	18.5		
BG46□□C-1240	1,145	1,240	1,338.5	11×100	12×100	0.5	0.7	18.5	19		
D	1,072					1	1.4	19	20		

\*1: Stroke limit is a drive distance between both ends of the dampers.  
\*2: Mass stated "with top cover" includes mass of sub tables.  
\*3: For D type (2 short blocks), drive block is located closest to motor bracket side.  
\*4: □ is ballscrew lead.

**BG46 –With Top Cover–**

C(1 short block)  
D(2 short blocks)



View B (motor bracket A0)  
refer to page G-44, 45 for other motor bracket

inertia (reference values) unit: kg · m<sup>2</sup>

part number	rail length mm	short block				
		without top cover		with top cover		
		C	D	C	D	
BG4610	340	1.69 × 10 <sup>-5</sup>	1.82 × 10 <sup>-5</sup>	1.74 × 10 <sup>-5</sup>	1.92 × 10 <sup>-5</sup>	
	440	2.08 × 10 <sup>-5</sup>	2.20 × 10 <sup>-5</sup>	2.13 × 10 <sup>-5</sup>	2.31 × 10 <sup>-5</sup>	
	540	2.46 × 10 <sup>-5</sup>	2.59 × 10 <sup>-5</sup>	2.52 × 10 <sup>-5</sup>	2.69 × 10 <sup>-5</sup>	
	640	2.85 × 10 <sup>-5</sup>	2.98 × 10 <sup>-5</sup>	2.90 × 10 <sup>-5</sup>	3.08 × 10 <sup>-5</sup>	
	740	3.24 × 10 <sup>-5</sup>	3.37 × 10 <sup>-5</sup>	3.29 × 10 <sup>-5</sup>	3.47 × 10 <sup>-5</sup>	
	840	3.63 × 10 <sup>-5</sup>	3.75 × 10 <sup>-5</sup>	3.67 × 10 <sup>-5</sup>	3.83 × 10 <sup>-5</sup>	
	940	4.02 × 10 <sup>-5</sup>	4.14 × 10 <sup>-5</sup>	4.06 × 10 <sup>-5</sup>	4.22 × 10 <sup>-5</sup>	
	1,040	4.41 × 10 <sup>-5</sup>	4.53 × 10 <sup>-5</sup>	4.44 × 10 <sup>-5</sup>	4.61 × 10 <sup>-5</sup>	
	1,140	4.79 × 10 <sup>-5</sup>	4.92 × 10 <sup>-5</sup>	4.83 × 10 <sup>-5</sup>	4.99 × 10 <sup>-5</sup>	
	1,240	5.18 × 10 <sup>-5</sup>	5.30 × 10 <sup>-5</sup>	5.22 × 10 <sup>-5</sup>	5.38 × 10 <sup>-5</sup>	
	BG4620	340	2.07 × 10 <sup>-5</sup>	2.58 × 10 <sup>-5</sup>	2.27 × 10 <sup>-5</sup>	2.98 × 10 <sup>-5</sup>
		440	2.46 × 10 <sup>-5</sup>	2.96 × 10 <sup>-5</sup>	2.66 × 10 <sup>-5</sup>	3.37 × 10 <sup>-5</sup>
540		2.84 × 10 <sup>-5</sup>	3.35 × 10 <sup>-5</sup>	3.05 × 10 <sup>-5</sup>	3.76 × 10 <sup>-5</sup>	
640		3.23 × 10 <sup>-5</sup>	3.74 × 10 <sup>-5</sup>	3.44 × 10 <sup>-5</sup>	4.14 × 10 <sup>-5</sup>	
740		3.62 × 10 <sup>-5</sup>	4.13 × 10 <sup>-5</sup>	3.82 × 10 <sup>-5</sup>	4.53 × 10 <sup>-5</sup>	
840		4.02 × 10 <sup>-5</sup>	4.51 × 10 <sup>-5</sup>	4.17 × 10 <sup>-5</sup>	4.82 × 10 <sup>-5</sup>	
940		4.41 × 10 <sup>-5</sup>	4.90 × 10 <sup>-5</sup>	4.56 × 10 <sup>-5</sup>	5.21 × 10 <sup>-5</sup>	
1,040		4.80 × 10 <sup>-5</sup>	5.29 × 10 <sup>-5</sup>	4.95 × 10 <sup>-5</sup>	5.59 × 10 <sup>-5</sup>	
1,140		5.18 × 10 <sup>-5</sup>	5.68 × 10 <sup>-5</sup>	5.34 × 10 <sup>-5</sup>	5.98 × 10 <sup>-5</sup>	
1,240		5.57 × 10 <sup>-5</sup>	6.06 × 10 <sup>-5</sup>	5.72 × 10 <sup>-5</sup>	6.37 × 10 <sup>-5</sup>	

Key components and materials

part name	material	remarks
guide rail	steel	black oxide except for grinding processing part
ballscrew shaft	steel	
side block	steel	
motor bracket: A0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket: B0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket: C0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket: D0	aluminum die cast	baking acrylic painting: silvery-white color
motor bracket: R0	aluminum alloy	white anodizing
housing	aluminum die cast	baking acrylic painting: silvery-white color
low housing	aluminum alloy	white anodizing
adapter plate	steel	black oxide
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	white anodizing

When LB option is selected, steel parts are treated with low temperature black chrome treatment.



MOTOR BRACKET CONFIGURATIONS & APPLICABLE MOTORS

NB provides optional motor brackets and adapter plates to easily install most popular motors.

Table G-13 (1) Applicable Motors

Applicable motors			Output	BG15	BG20	BG26	BG33	BG46	BG55		
				P.G-36 ~37	P.G-38 ~39	P.G-40 ~41	P.G-42 ~43	P.G-44 ~45	P.G-46 ~47		
AC Servo motor	Panasonic	E	MUMA5A	50W	-	AA	AA	B2	-	-	
			MUMA01	100W	-	AA	AA	B2	-		
			MUMA02	200W	-	-	-	A7	A2		-
			MUMA04	400W	-	-	-	-	-		-
		A5	MSME5A	50W	-	A3	A3	A2	C0	-	-
			MSME01	100W	-	-	-	A7	A2	-	
			MSME02	200W	-	-	-	-	-	-	
			MSME04	400W	-	-	-	-	A3	A2	
		A6	MSMF5A	50W	-	A3	A3	A2	C0	-	-
			MSMF01	100W	-	-	-	-	-	-	
			MSMF02	200W	-	-	-	A7	A2	-	
			MSMF04	400W	-	-	-	-	-	-	
	MITSUBISHI ELECTRIC	J3	HF-KP(MP)053	50W	-	A1	A1	A1	B0	-	-
			HF-KP(MP)13	100W	-	-	-	-	-	-	
			HF-KP(MP)23	200W	-	-	-	A6	A1	A0	
			HF-KP(MP)43	400W	-	-	-	-	-	-	
		J4	HF-KP(MP)73	750W	-	-	-	-	A4	A1	-
			HG-AK0136	10W	-	-	-	-	-	-	
			HG-AK0236	20W	A2	A9	A9	-	-	-	
			HG-AK0336	30W	-	-	-	-	-	-	
			HG-KR(MR)053	50W	-	A1	A1	A1	B0	-	
			HG-KR(MR)13	100W	-	-	-	-	-	-	
			HG-KR(MR)23	200W	-	-	-	A6	A1	A0	
			HG-KR(MR)43	400W	-	-	-	-	-	-	
	YASKAWA ELECTRIC	Σ-V mini	SGMMV-A1	10W	-	-	-	-	-	-	-
			SGMMV-A2	20W	A2	A9	A9	-	-	-	
			SGMMV-A3	30W	-	-	-	-	-	-	
		Σ-V	SGMJV(SGMAV)-A5	50W	-	-	-	-	-	-	-
	SGMJV(SGMAV)-01		100W	-	A1	A1	A1	B0	-		
	SGMAV-C2		150W	-	-	-	-	-	-		
	SGMJV(SGMAV)-02		200W	-	-	-	A6	-	-		
	SGMJV(SGMAV)-04		400W	-	-	-	-	A1	A0		
	SGMAV-06		550W	-	-	-	-	-	-		
	SGMJV(SGMAV)-08		750W	-	-	-	-	A4	A1		
	Σ-7		SGM7J(SGM7A)-A5	50W	-	-	-	-	-	-	
		SGM7J(SGM7A)-01	100W	-	A1	A1	A1	B0	-		
SGM7J(SGM7A)-C2		150W	-	-	-	-	-	-			
SGM7J(SGM7A)-02		200W	-	-	-	A6	-	-			
SGM7J(SGM7A)-04		400W	-	-	-	-	A1	A0			
SGM7J(SGM7A)-06		600W	-	-	-	-	-	-			
SGM7J(SGM7A)-08		750W	-	-	-	-	A4	A1			

Table G-13 (2) Applicable Motors

Applicable motors			Output	BG15	BG20	BG26	BG33	BG46	BG55		
				P.G-36 ~37	P.G-38 ~39	P.G-40 ~41	P.G-42 ~43	P.G-44 ~45	P.G-46 ~47		
AC Servo motor	SANYO DENKI	Q	Q1AA04003D	30W	-	-	-	-	-	-	
			Q1AA04005D	50W	-	A1	A1	A1	B0		
			Q1AA04010D	100W	-	-	-	-	-		-
			Q1AA06020D	200W	-	-	-	A6	A1		A0
			Q1AA06040D	400W	-	-	-	-	-		-
			Q1AA07075D	750W	-	-	-	-	A4		A1
		R	R2AA04005	50W	-	A1	A1	A1	B0	-	-
			R2AA04010	100W	-	-	-	-	-	-	
			R2AA06020	200W	-	-	-	A6	A1	A0	
			R2AA06040	400W	-	-	-	-	-	-	
			R2AA08075	750W	-	-	-	-	A4	A1	
			G	R88M-G05030	50W	-	A1	A1	A1	B0	
	R88M-G10030	100W		-	-	-	-	-	-		
	R88M-G20030	200W		-	-	-	A7	A2	-		
	R88M-G40030	400W		-	-	-	-	-	-		
	R88M-G75030	750W		-	-	-	-	A3	A2		
	G5	R88M-K05030		50W	-	A1	A1	A1	B0	-	-
		R88M-K10030	100W	-	-	-	-	-	-		
		R88M-K20030	200W	-	-	-	A7	A2	-		
		R88M-K40030	400W	-	-	-	-	A3	A2		
		R88M-K75030	750W	-	-	-	-	-	-		
		1S	R88M-1M10030	100W	-	A1	A1	A1	B0	-	
	R88M-1M20030		200W	-	-	-	A7	A2	-		
	R88M-1M40030		400W	-	-	-	-	-	-		
	R88M-1M75030		750W	-	-	-	-	A3	A2		
	KEYENCE	MV	MV-M005	50W	-	A1	A1	A1	B0	-	-
			MV-M010	100W	-	-	-	-	-	-	
			MV-M020	200W	-	-	-	A6	A1	A0	
			MV-M040	400W	-	-	-	-	-	-	
		SV	MV-M075	750W	-	-	-	-	A4	A1	
			SV(SV2)-M005	50W	-	A1	A1	A1	B0	-	
	FANUC	βis	SV(SV2)-M010	100W	-	-	-	A6	A1	A0	-
			SV(SV2)-M020	200W	-	-	-	-	-		
			SV(SV2)-M040	400W	-	-	-	-	-	-	
			SV(SV2)-M075	750W	-	-	-	-	A4	A1	
	βis	βis0.2/5000	50W	-	A1	A1	A1	B0	-	-	
		βis0.3/5000	100W	-	-	-	-	-	-		
		βis0.4/5000 ※	130W	-	-	-	A6	A1	A0		
		βis0.5/6000 ※	350W	-	-	-	-	-	-		
	βis1/6000	500W	-	-	-	-	-	-			

※ Please contact NB for the coupling because the motor shaft length will be shortened. NB can provide other types of motor brackets. Please contact NB for details.

MOTOR BRACKET CONFIGURATIONS & APPLICABLE MOTORS

Table G-14 (1) Applicable Motors

Applicable motors		Flange	BG15	BG20	BG26	BG33	BG46	BG55			
			P.G-36 ~37	P.G-38 ~39	P.G-40 ~41	P.G-42 ~43	P.G-44 ~45	P.G-46 ~47			
Stepper motor	ORIENTAL MOTOR	α step	AR	AR1	□20	A6	—	—	—	—	
				AR2	□28	A3	A6	A6	—	—	—
				AR46	□42	—	A5	A5	B1	—	—
			AR6	□60	—	—	—	A8	D0	—	
			AR9	□85	—	—	—	—	D1	A4	
			AR6	□60	—	—	—	—	—	—	
		AZ	AZM1	□20	A6	—	—	—	—	—	
			AZM2	□28	A3	A6	A6	—	—	—	
			AZM4	□42	—	A5	A5	B1	—	—	
			AZM6	□60	—	—	—	A8	D0	—	
			AZM9	□85	—	—	—	—	D1	A4	
			AZM6	□60	—	—	—	—	—	—	
		5 phase motor	RK II	RKS54	□42	—	A5	A5	B1	—	—
				RKS56	□60	—	—	—	A8	D0	—
				RKS59	□85	—	—	—	—	D1	A4
			CRK	CRK51	□20	A5	—	—	—	—	—
				CRK52	□28	A3	A6	A6	—	—	—
				CRK54	□42	—	A5	A5	B1	—	—
	CRK56	□60	—	—	—	A8	D0	—			
	CVK (PKP)	PK51	□20	A5	—	—	—	—	—		
		PKP52	□28	A3	A6	A6	—	—	—		
		PKP54	□42	—	A5	A5	B1	—	—		
		PKP56	□56.4	—	—	—	A5	—	—		
		PKP56□F	□60	—	—	—	A8	D0	—		
		PK59	□85	—	—	—	—	D1	A4		
	2 phase motor	CVK (PKP)	PKP21	□20	A6	—	—	—	—		
			PKP22	□28	A3	A6	A6	—	—		
			PKP24	□42	—	A5	A5	B1	—	—	
		PKP26	□56.4	—	—	—	A5	—	—		
		5 phase motor	F5	SH528	□28	A3	A6	A6	—	—	
SM542				□42	—	A5	A5	B1	—	—	
SM560	□60			—	—	—	A8	D0	—		
2 phase motor	F2	SM586	□85	—	—	—	D1	A5			
		SH228	□28	A3	A6	A6	—	—			
		SH142,103H52	□42	—	A5	A5	B1	—	—		
TECHNO DRIVE	5 phase motor	103H712	□56.4	—	—	—	A5	—			
		103H782(connector type)	□60	—	—	—	A8	D0			
		□K-S51□	□20	A6	—	—	—	—			
		□K-S52□	□28	A4	—	—	—	—			
		□K-S54□	□42	—	A5	A5	B1	—			
□K-S(M)56□	□60	—	—	—	A8	D0					
□K-M(G)59□	□85	—	—	—	—	D1	A5				

NB can provide other types of motor brackets. Please contact NB for details.

Table G-14 (2) Applicable Motors

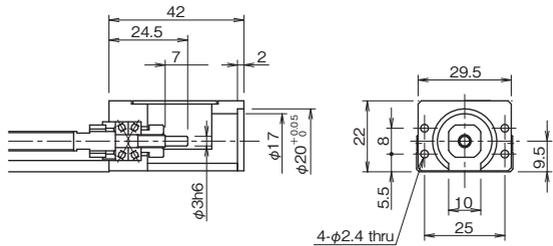
Applicable motors		Flange	BG15	BG20	BG26	BG33	BG46	BG55	
			P.G-36 ~37	P.G-38 ~39	P.G-40 ~41	P.G-42 ~43	P.G-44 ~45	P.G-46 ~47	
Stepper motor	TAMAGAWA SEIKI	2 phase motor	TS3692	□20	A6	—	—	—	—
			TS3641	□28	A3	A6	A6	—	—
			TS3617	□42	—	A5	A5	B1	—
		TS3690	□56.4	—	—	—	A5	—	
		TS3682	□20	A6	—	—	—	—	
		TS3667	□42	—	A5	A5	B1	—	
	5 phase motor	TS3624*	□60	—	—	—	A8	D0	
		TS3630	□86	—	—	—	—	D1	
		TS3630	□86	—	—	—	—	D1	
	i-STEP	TS3699N112	□28	A3	A6	A6	—	—	
		TS3699N172	□42	—	A5	A5	B1	—	
	TS3699N231(N232)	□56.4	—	—	—	A5	—		
Stepper servo	sammet electronics	Si servo	TS3692	□20	A6	—	—	—	—
			TS3641	□28	A3	A6	A6	—	—
			TS3617	□42	—	A5	A5	B1	—
			TS3653	□56.4	—	—	—	A5	—
			SM-L5MH	□28	A3	A6	A6	—	—
		Si super	SM-02MH/ SM-04MH	□42	—	A5	A5	B1	—
			SM-09MH/ SM-12MH	□56.4	—	—	—	A5	—

※ Please contact NB for the coupling because the motor shaft length will be shortened.

# BG15

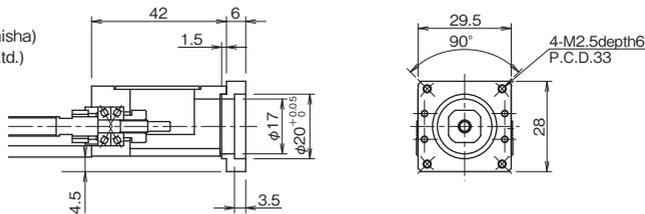
Figures inside ( ) indicates mass of the motor mount adapter plate.

## A0



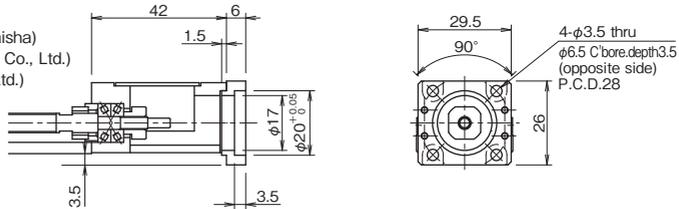
## A1 (Mass: 9g)

Recommended Coupling:  
XBW-15C2(Nabeya Bi-tech Kaisha)  
SFC-005DA2(Miki Pully Co., Ltd.)



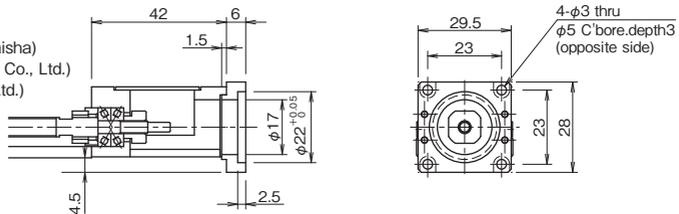
## A2 (Mass: 8g)

Recommended Coupling:  
XBW-15C2(Nabeya Bi-tech Kaisha)  
LAD-15C(Sakai Manufacturing Co., Ltd.)  
SFC-005DA2(Miki Pully Co., Ltd.)



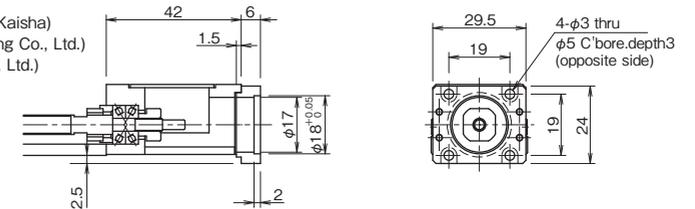
## A3 (Mass: 9g)

Recommended Coupling:  
XBW-15C2(Nabeya Bi-tech Kaisha)  
LAD-15C(Sakai Manufacturing Co., Ltd.)  
SFC-005DA2(Miki Pully Co., Ltd.)



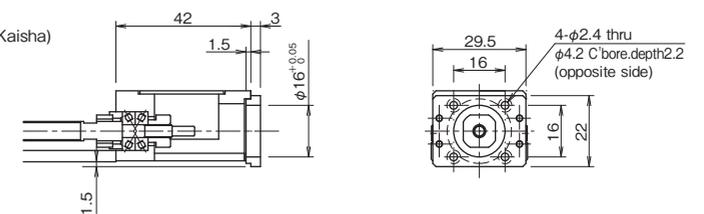
## A4 (Mass: 8g)

Recommended Coupling:  
XBW-15C2(Nabeya Bi-tech Kaisha)  
LAD-15C(Sakai Manufacturing Co., Ltd.)  
SFC-005DA2(Miki Pully Co., Ltd.)



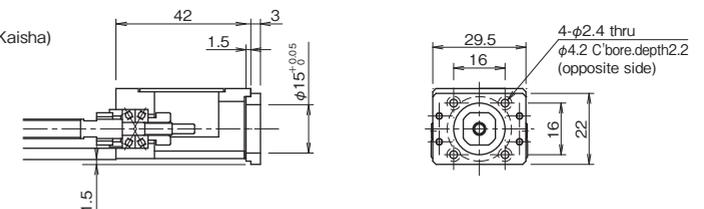
## A5 (Mass: 4g)

Recommended Coupling:  
XBW-15C2(Nabeya Bi-tech Kaisha)



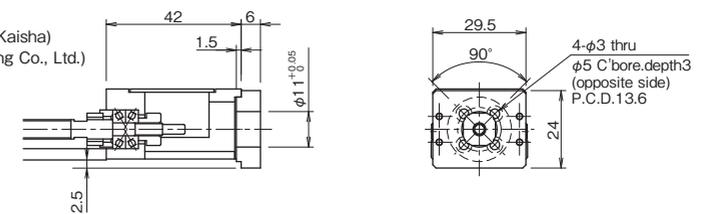
## A6 (Mass: 4g)

Recommended Coupling:  
XBW-15C2(Nabeya Bi-tech Kaisha)



## A7 (Mass: 11g)

Recommended Coupling:  
XBW-15C2(Nabeya Bi-tech Kaisha)  
LAD-15C(Sakai Manufacturing Co., Ltd.)

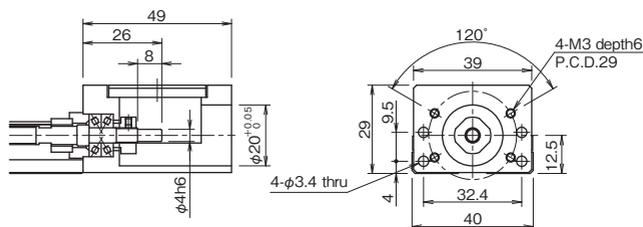


Attach the motor to the motor mount adapter plate first.

# BG20

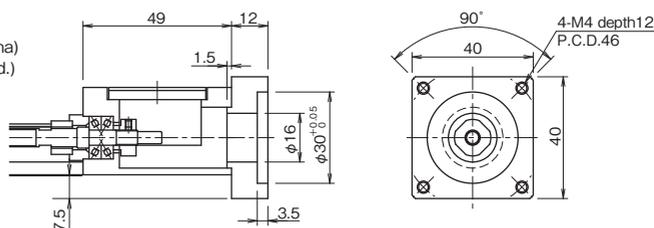
Figures inside ( ) indicates mass of the motor mount adapter plate.

## A0



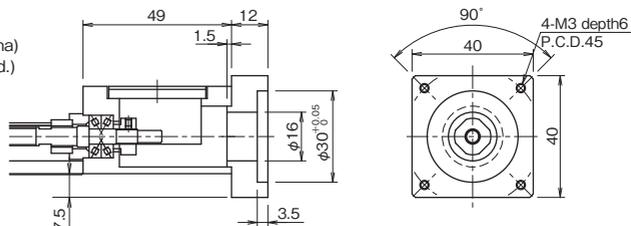
## A1 (Mass: 38g)

Recommended Coupling:  
XBW-19C2(Nabeya Bi-tech Kaisha)  
SFC-010DA2(Miki Pulley Co., Ltd.)



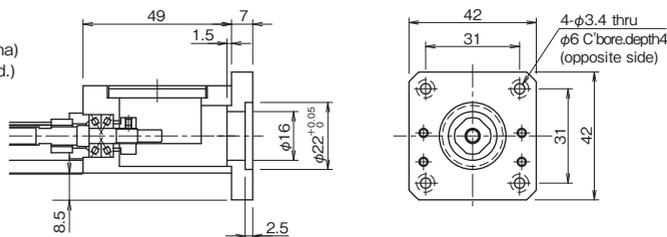
## A3 (Mass: 39g)

Recommended Coupling:  
XBW-19C2(Nabeya Bi-tech Kaisha)  
SFC-010DA2(Miki Pulley Co., Ltd.)



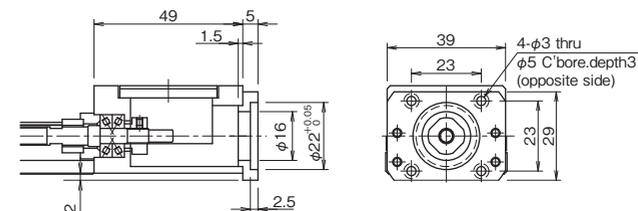
## A5 (Mass: 26g)

Recommended Coupling:  
XBW-19C2(Nabeya Bi-tech Kaisha)  
SFC-010DA2(Miki Pulley Co., Ltd.)



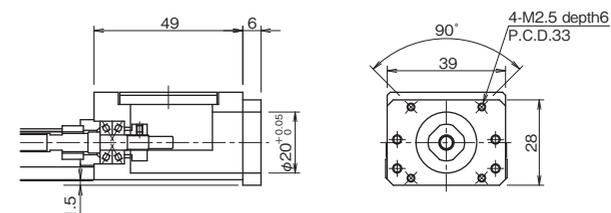
## A6 (Mass: 10g)

Recommended Coupling:  
XBW-19C2(Nabeya Bi-tech Kaisha)  
SFC-010DA2(Miki Pulley Co., Ltd.)



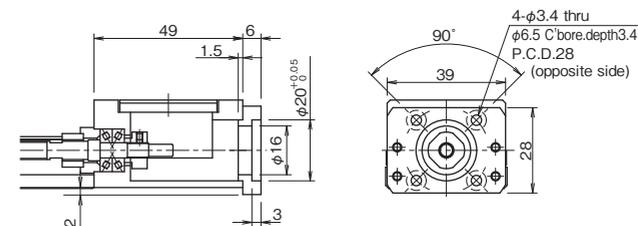
## A8 (Mass: 12g)

Recommended Coupling:  
XBW-19C2(Nabeya Bi-tech Kaisha)  
SFC-010DA2(Miki Pulley Co., Ltd.)



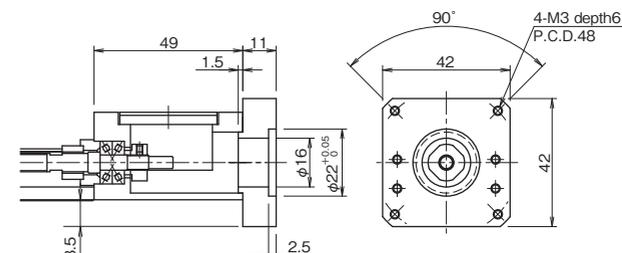
## A9 (Mass: 14g)

Recommended Coupling:  
XBW-19C2(Nabeya Bi-tech Kaisha)  
SFC-010DA2(Miki Pulley Co., Ltd.)



## AA (Mass: 46g)

Recommended Coupling:  
XBW-19C2(Nabeya Bi-tech Kaisha)  
SFC-010DA2(Miki Pulley Co., Ltd.)

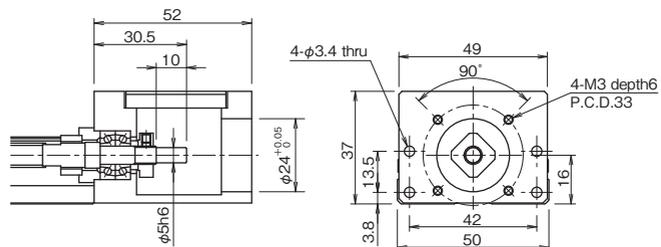


For configurations A5, A6, A9 and AA, attach the motor to the motor mount adapter plate first.

# BG26

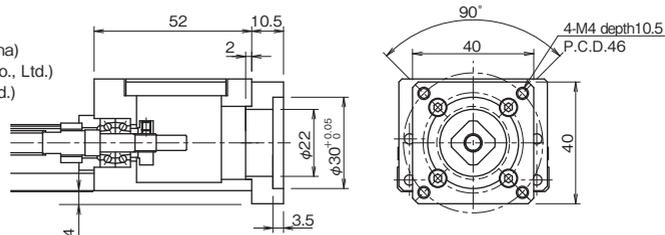
Figures inside ( ) indicates mass of the motor mount adapter plate.

## A0



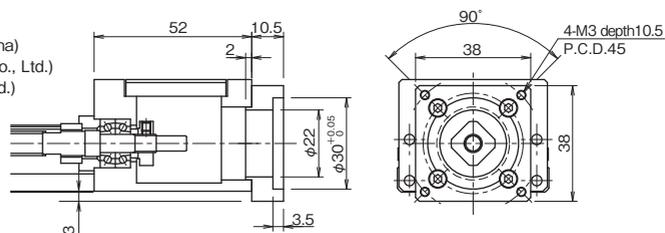
## A1 (Mass:28g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



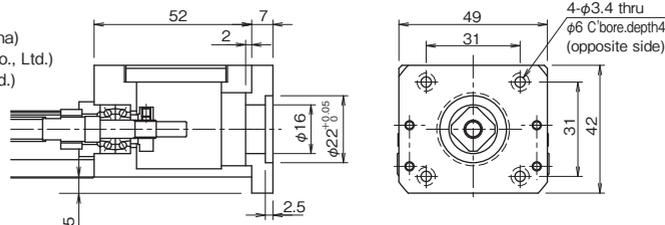
## A3 (Mass:24g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



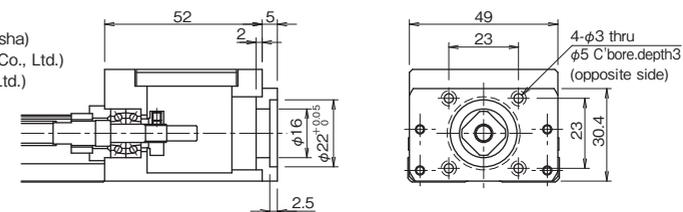
## A5 (Mass:32g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



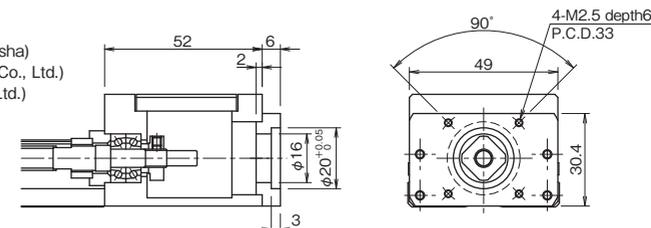
## A6 (Mass:16g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



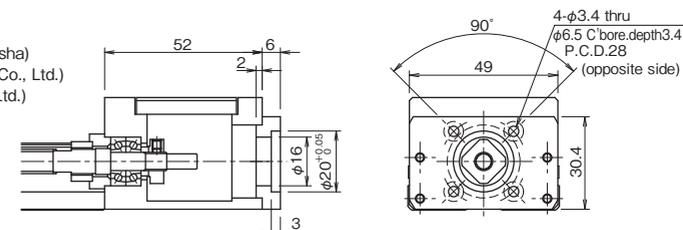
## A8 (Mass:21g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



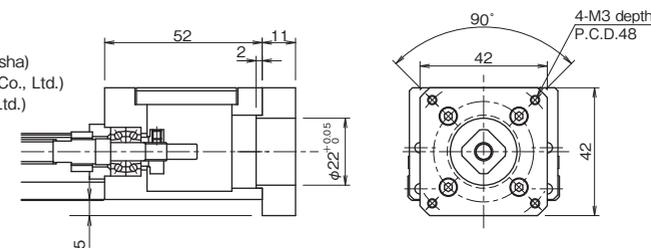
## A9 (Mass:21g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



## AA (Mass:41g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)

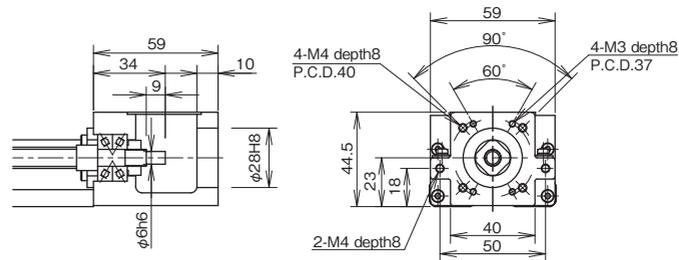


For configurations A5, A6 and A9, attach the motor to the motor mount adapter plate first.

# BG33

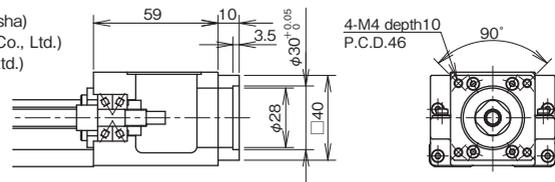
Figures inside ( ) indicates mass of the motor mount adapter plate.

## A0



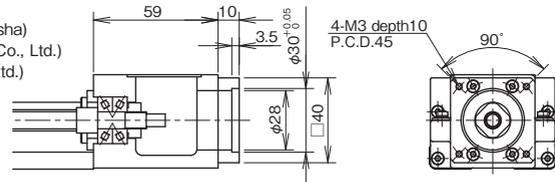
## A1 (Mass:66g)

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)  
 LAD-25C(Sakai Manufacturing Co., Ltd.)  
 SFC-020DA2(Miki Pulley Co., Ltd.)



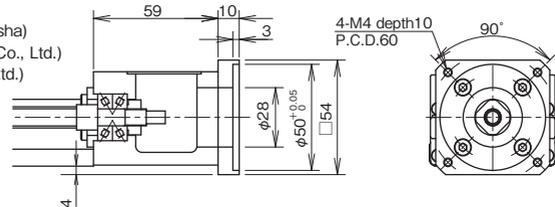
## A2 (Mass:67g)

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)  
 LAD-25C(Sakai Manufacturing Co., Ltd.)  
 SFC-020DA2(Miki Pulley Co., Ltd.)



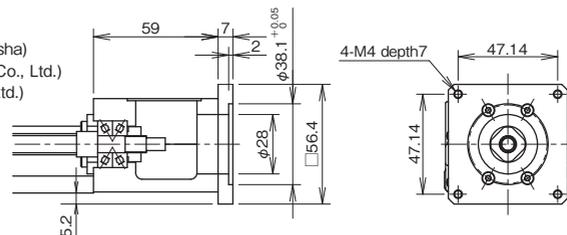
## A3 (Mass:133g)

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)  
 LAD-25C(Sakai Manufacturing Co., Ltd.)  
 SFC-020DA2(Miki Pulley Co., Ltd.)



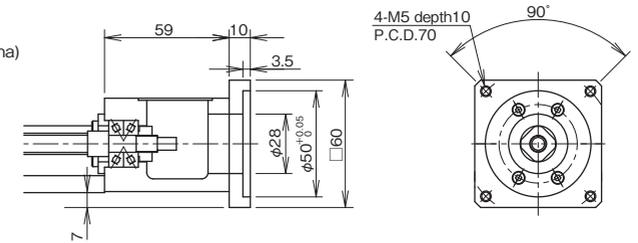
## A5 (Mass:125g)

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)  
 LAD-25C(Sakai Manufacturing Co., Ltd.)  
 SFC-020DA2(Miki Pulley Co., Ltd.)



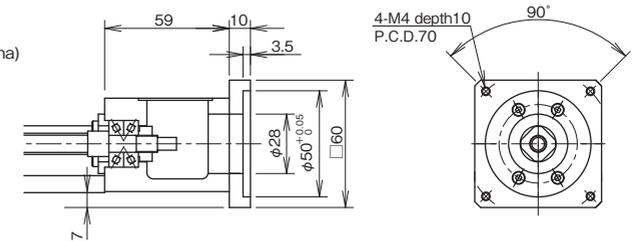
## A6 (Mass:215g)

Recommended Coupling:  
 XBW-27C2(Nabeya Bi-tech Kaisha)



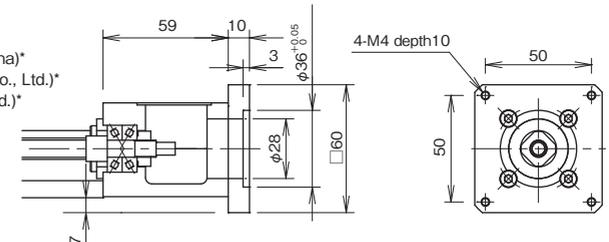
## A7 (Mass:215g)

Recommended Coupling:  
 XBW-27C2(Nabeya Bi-tech Kaisha)



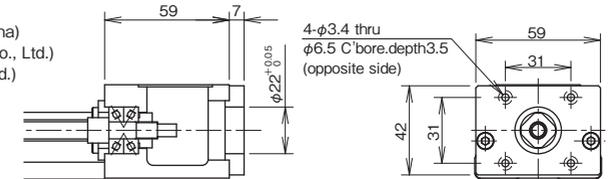
## A8 (Mass:212g)

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)\*  
 LAD-25C(Sakai Manufacturing Co., Ltd.)\*  
 SFC-020DA2(Miki Pulley Co., Ltd.)\*  
 \*Please contact NB if you are using  $\alpha$ STEP motor (Oriental Motor Co., Ltd.)



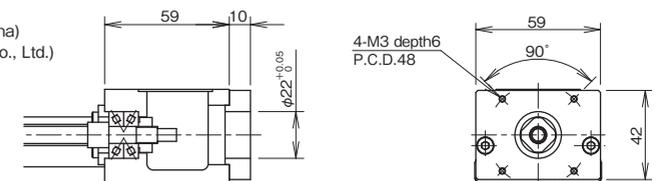
## B1 (Mass:111g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



## B2 (Mass:167g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-25C(Sakai Manufacturing Co., Ltd.)



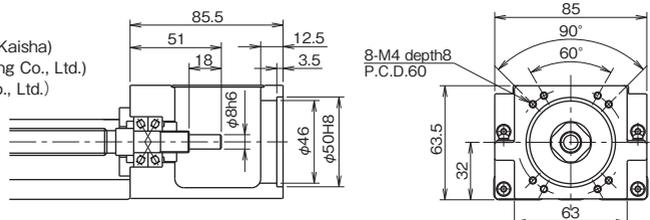
For configurations B1 and B2, attach the motor to the motor mount adapter plate first.

# BG46

Figures inside ( ) indicates mass of the motor mount adapter plate.

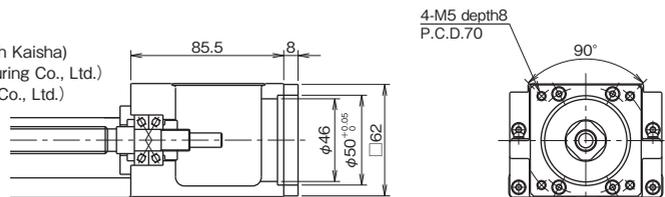
## AO

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)  
 LAD-25C(Sakai Manufacturing Co., Ltd.)  
 SFC-020DA2(Miki Pulley Co., Ltd.)



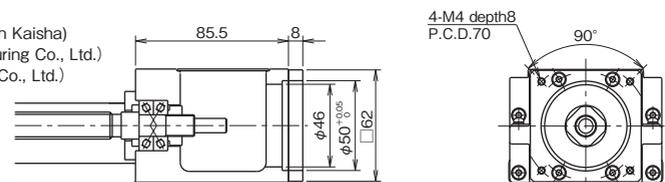
## A1 (Mass:103g)

Recommended Coupling:  
 XBW-34C3(Nabeya Bi-tech Kaisha)  
 LAD-30C(Sakai Manufacturing Co., Ltd.)  
 SFC-030DA2(Miki Pulley Co., Ltd.)



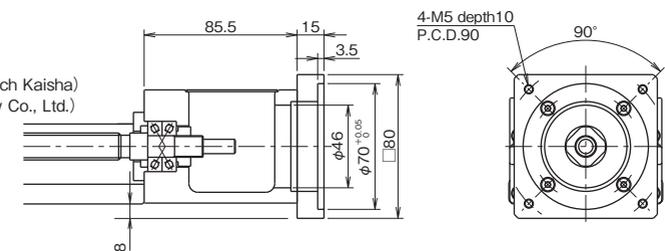
## A2 (Mass:106g)

Recommended Coupling:  
 XBW-34C3(Nabeya Bi-tech Kaisha)  
 LAD-30C(Sakai Manufacturing Co., Ltd.)  
 SFC-030DA2(Miki Pulley Co., Ltd.)



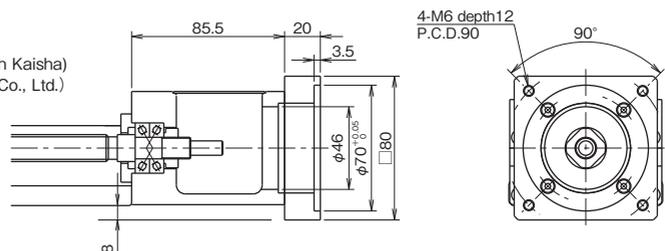
## A3 (Mass:448g)

Recommended Coupling  
 (200W-400W):  
 XBW-34C3(Nabeya Bi-tech Kaisha)  
 SFC-030DA2(Miki Pulley Co., Ltd.)  
 (750W):  
 XBW-39C2  
 (Nabeya Bi-tech Kaisha)  
 SFC-040DA2  
 (Miki Pulley Co., Ltd.)



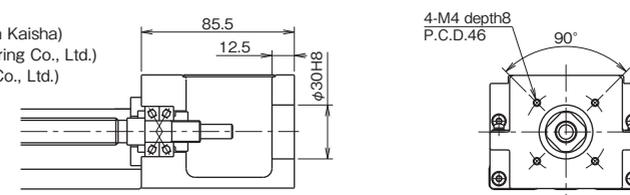
## A4 (Mass:628g)

Recommended Coupling:  
 XBW-39C2(Nabeya Bi-tech Kaisha)  
 SFC-040DA2(Miki Pulley Co., Ltd.)



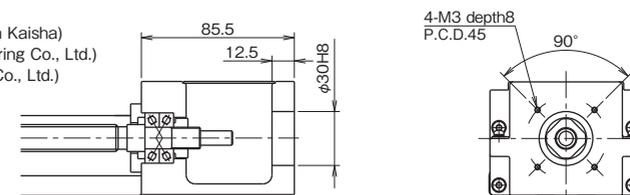
## BO

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)  
 LAD-25C(Sakai Manufacturing Co., Ltd.)  
 SFC-020DA2(Miki Pulley Co., Ltd.)



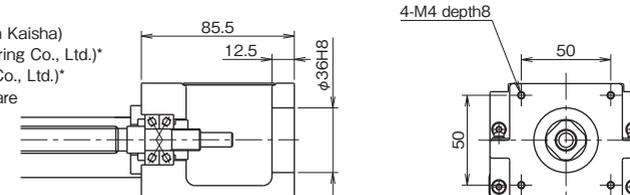
## CO

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)  
 LAD-25C(Sakai Manufacturing Co., Ltd.)  
 SFC-020DA2(Miki Pulley Co., Ltd.)



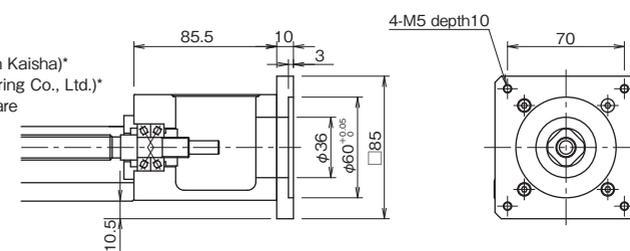
## DO

Recommended Coupling:  
 XBW-27C2(Nabeya Bi-tech Kaisha)  
 LAD-25C(Sakai Manufacturing Co., Ltd.)\*  
 SFC-020DA2(Miki Pulley Co., Ltd.)\*  
 \*Please contact NB if you are using αSTEP motor (Oriental Motor Co., Ltd.)



## D1 (Mass:435g)

Recommended Coupling:  
 XBW-34C3(Nabeya Bi-tech Kaisha)\*  
 LAD-35C(Sakai Manufacturing Co., Ltd.)\*  
 \*Please contact NB if you are using αSTEP motor (Oriental Motor Co., Ltd.)

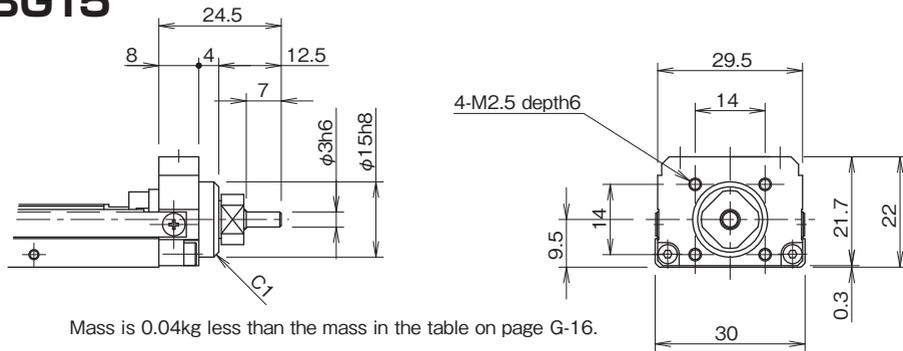




**EXPOSED BRACKET R0**

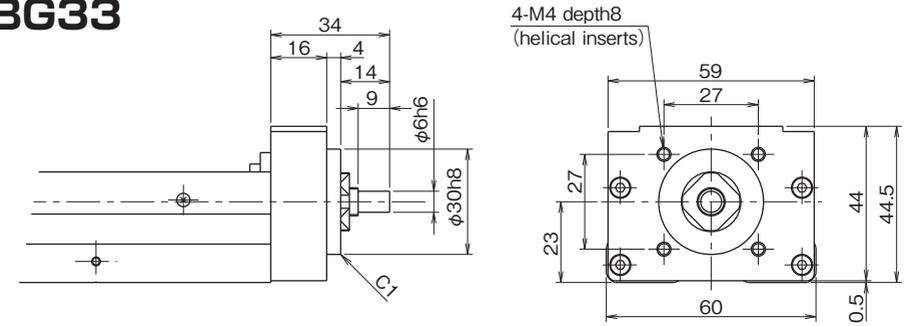
The ball screw shaft end is exposed with the exposed bracket R0 type. Please fabricate an original bracket in case the standard brackets are not applicable. R0 type is applicable with cover and with sensors.

**BG15**



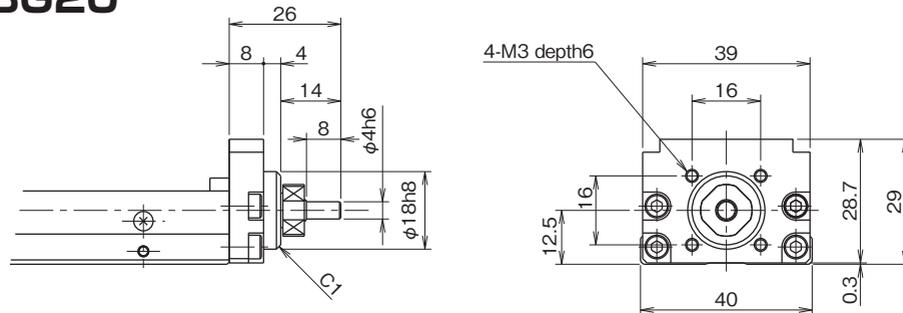
Mass is 0.04kg less than the mass in the table on page G-16.

**BG33**



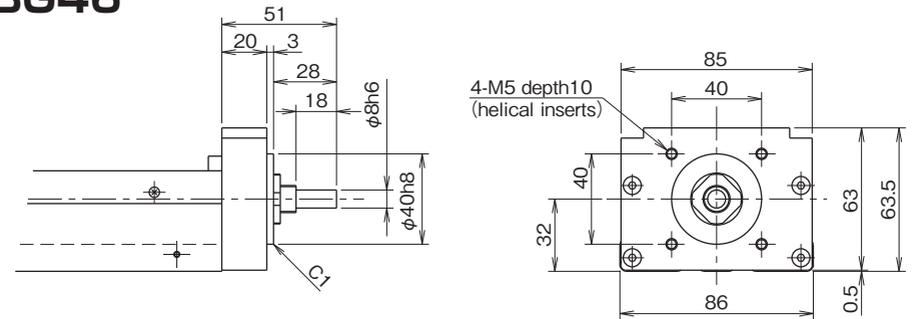
Mass is 0.1kg less than the mass in the table on page G-22, 24.

**BG20**



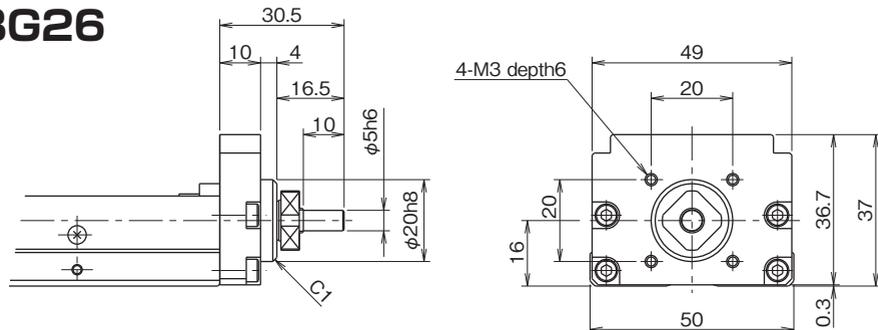
Mass is 0.04kg less than the mass in the table on page G-18.

**BG46**



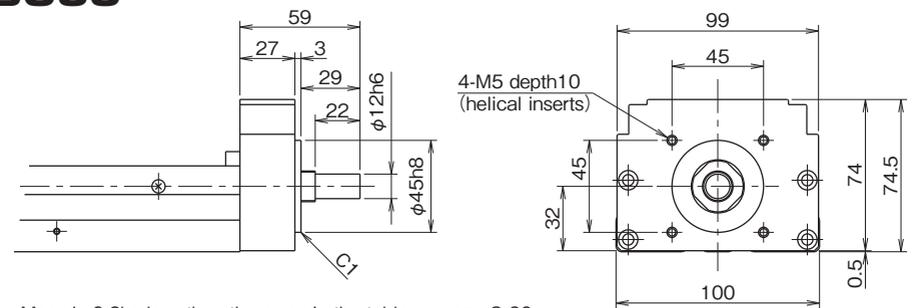
Mass is 0.3kg less than the mass in the table on page G-26, 28.

**BG26**



Mass is 0.08kg less than the mass in the table on page G-20.

**BG55**

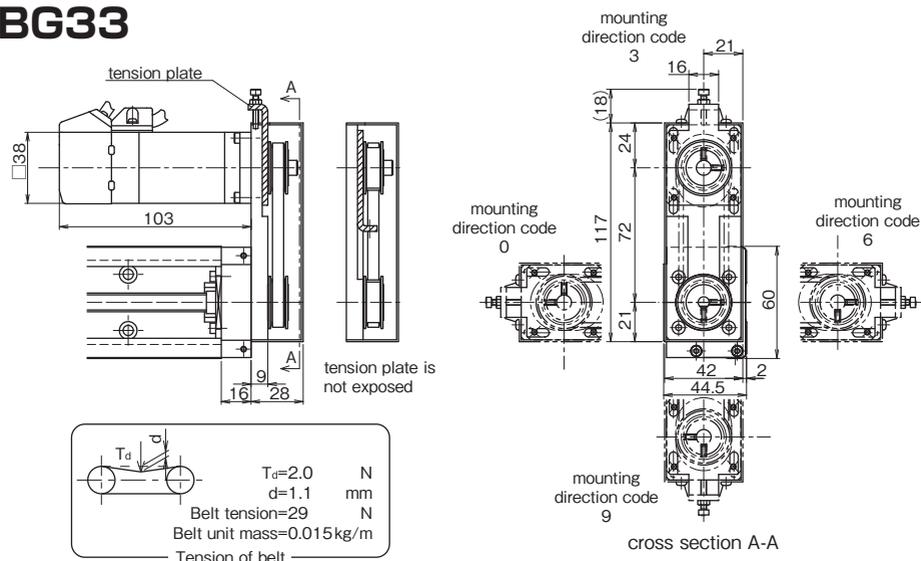


Mass is 0.3kg less than the mass in the table on page G-30.

RETURN PULLEY UNIT

Return pulley units in which a motor is connected with a timing belt are available for BG type. Its return structure allows the reduction of total length (available for BG33 and BG46).

BG33

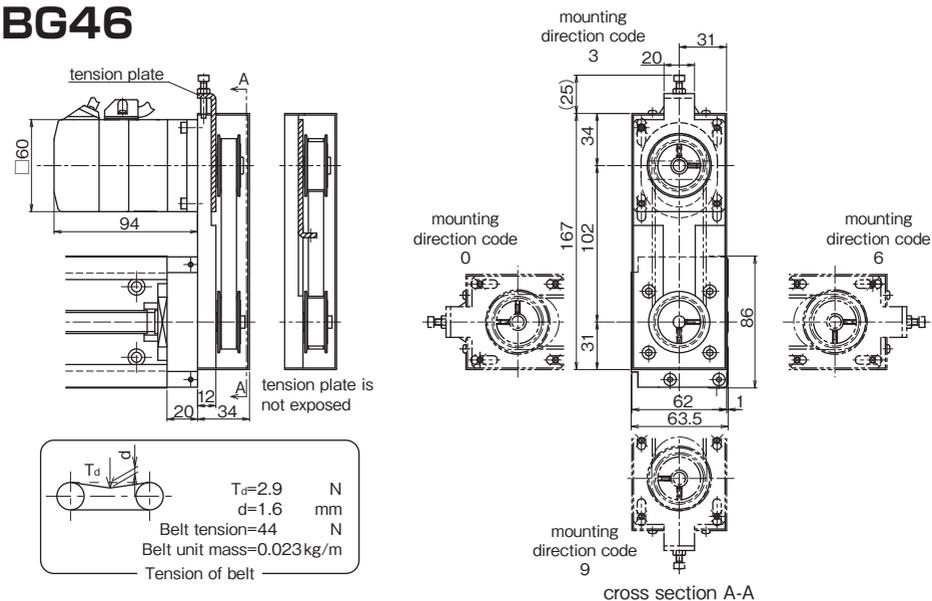


- 1.This drawing shows RA for MSMA01(Panasonic).
- 2.Installation position of Pulley Unit can be selected at 90° intervals (mounting direction code).
- 3.Applicable with cover and with sensors.  
Precaution for applying H type sensors  
When the motor is positioned at direction 3 or 9, H type sensors interfere if mounted on the side of motor.  
H type sensors must be mounted opposite to the motor.
- 4.Tension plate can be built in and is not exposed. (not applicable to RC)
- 5.0.2kg is added to the mass on page G-22 ~ 25.
- 6.Inertia is added  $2.22 \times 10^{-6} \text{kg} \cdot \text{m}^2$  to the value of Table on page G-22 ~ 25. (motor inertia not included)
- 7.Part number structure BG33\*\*\*-\*\*\*\*/☆☆□  
☆☆: Symbol of applicable motor bracket (refer to Table G-15)  
□: Mounting direction code (refer to cross section A-A)

Table G-15 Applicable Motor

motor bracket	applicable motors		output	flange	motor shaft diameter
RA	Panasonic	MINAS SERIES	50~100W	□38	φ8
RB	YASKAWA ELECTRIC	SIGMA SERIES	50~100W	□40	φ8
	MITSUBISHI ELECTRIC	MELSERVO SERIES	50~100W	□40	
	SANYO DENKI	SANMOTION Q1 SERIES	50~100W	□40	
RC	5 PHASE STEPPING MOTOR		-	□42	φ5

BG46



- 1.This drawing shows RA for MSMA02(Panasonic).
- 2.Installation position of Pulley Unit can be selected at 90° intervals (mounting direction code).
- 3.Applicable with cover and with sensors.  
Precaution for applying H type sensors  
When the motor is positioned at direction 3 or 9, H type sensors interfere if mounted on the side of motor.  
H type sensors must be mounted opposite to the motor.
- 4.Tension plate can be built in and is not exposed.
- 5.0.7kg is added to the mass on page G-26 ~ 29.
- 6.Inertia is added  $1.24 \times 10^{-5} \text{kg} \cdot \text{m}^2$  to the value of Table on page G-26 ~ 29. (motor inertia not included)
- 7.Parts number structure BG46\*\*\*-\*\*\*\*/☆☆□  
☆☆: Symbol of applicable motor bracket (refer to Table G-16)  
□: Mounting direction code (refer to cross section A-A)

Table G-16 Applicable Motor

motor bracket	applicable motors		output	flange	motor shaft diameter
RA	Panasonic	MINAS SERIES	200W	□60	φ11
RB	YASKAWA ELECTRIC	SIGMA SERIES	200W	□60	φ14
	MITSUBISHI ELECTRIC	MELSERVO SERIES	200W	□60	
	SANYO DENKI	SANMOTION Q1 SERIES	200W	□60	
RC	5 PHASE STEPPING MOTOR		-	□60	φ8

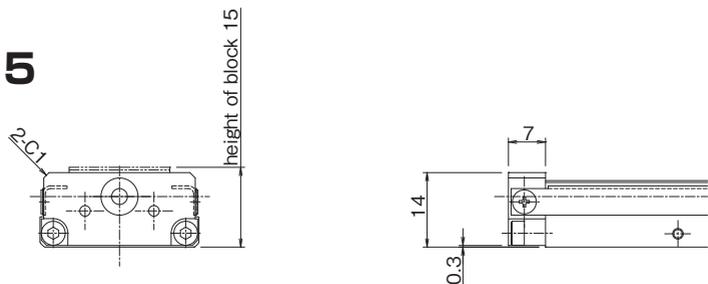
Return pulley units is available for sizes other than BG33 and BG46. Please contact NB.

**LOW HOUSING**

NB provides low housing with actuators. The height of housing is lower than the block. When the length of workpiece exceeds the guide block, it will interfere with standard housing. It is recommended to take low housing when long work is mounted.

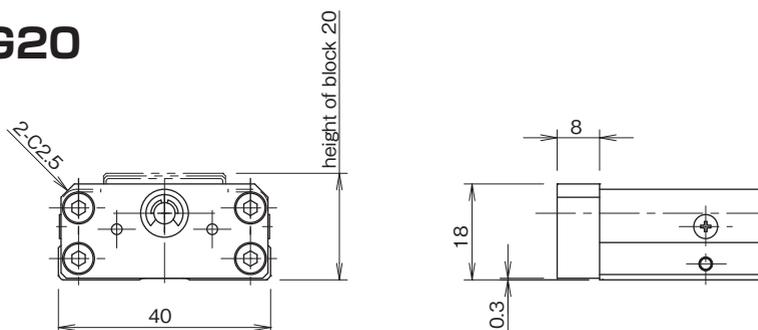
Please note that the height of motor bracket cannot be lower any more.

**BG15**



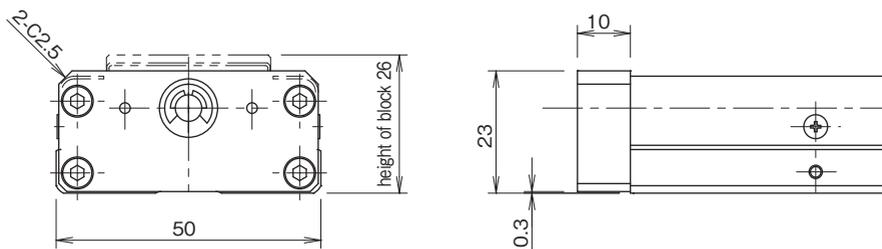
•Mass is 0.005kg less than the mass on page G-16.

**BG20**



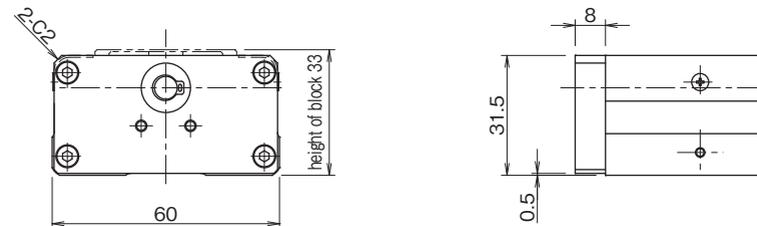
•Mass is 0.01kg less than the mass on page G-18.

**BG26**



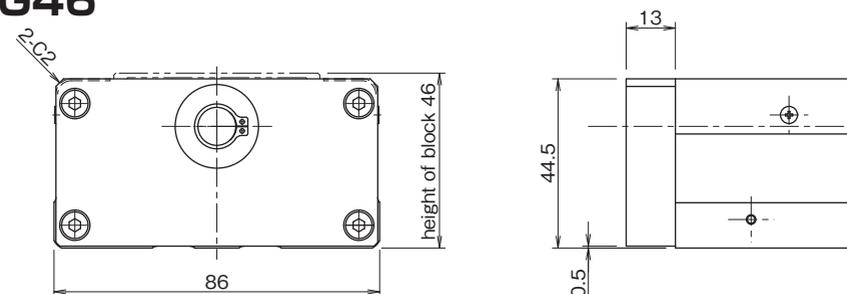
•Mass is 0.02kg less than the mass on page G-20.

**BG33**



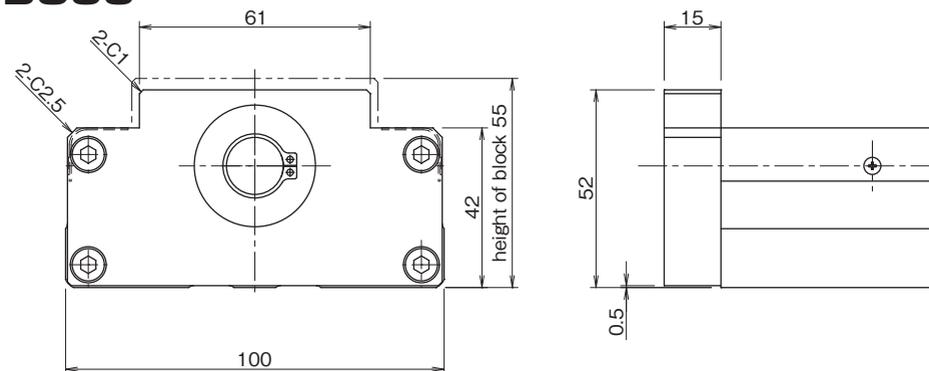
•Mass is 0.02kg less than the mass on page G-22, 24.

**BG46**



•Mass is 0.05kg less than the mass on page G-26, 28.

**BG55**



•Mass is 0.1kg less than the mass on page G-30.

**BELLOWS**

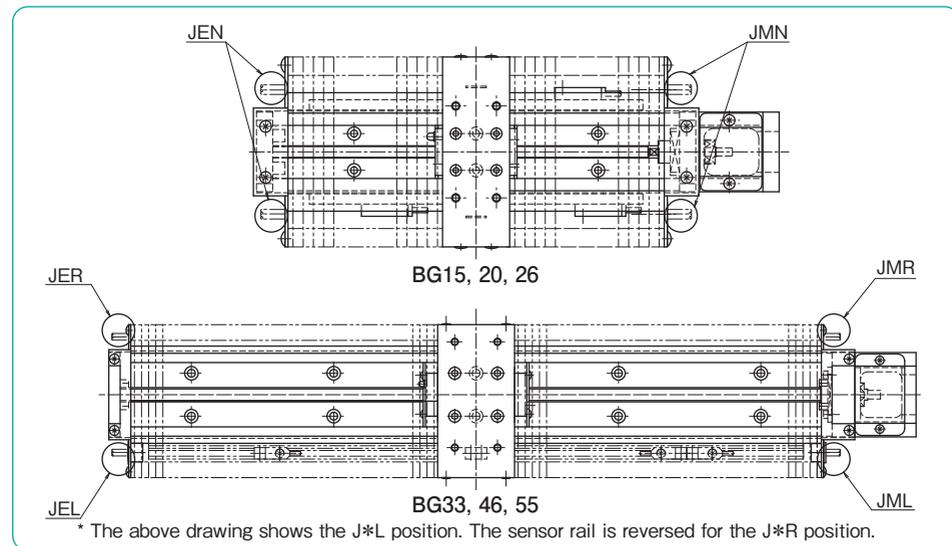
BG type can be specified with a cover or bellows for dust prevention. Bellows are securely fixed for various installation methods in positioning and directions. Sensor for bellows is limited to K (proximity sensor) type only, which is pre-installed at proper positions.

Please pay attention to the stroke limit of BG with bellows that is shorter than the standard stroke limit.

– Position of Sensor Cable Outlet –

The positions of the outlet for sensor cables can be selected as Figure G-14 shows.

Figure G-14 Position of Sensor Cable Outlet



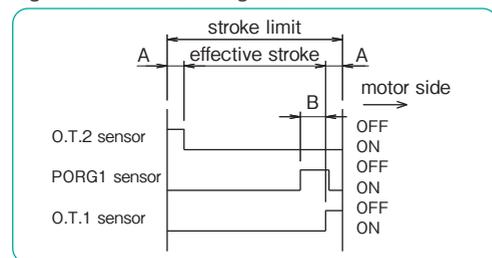
part number structure for bellows

1. J (for the first symbol)
2. Specification of the position of the sensor cable outlet  
Please select the motor side or the housing side.  
M: motor side E: housing side (end plate side)
3. Specification of the position of the sensor rail  
Please select the right hand or the left hand.  
R: on the right from the motor side  
L: on the left from the motor side  
\*N for BG15, 20, and 26 since the sensors are mounted on both the right and left hand.
4. JNN for without sensors
5. Sensor type is K (proximity sensor) type only (APM-D3 series: Azbil).

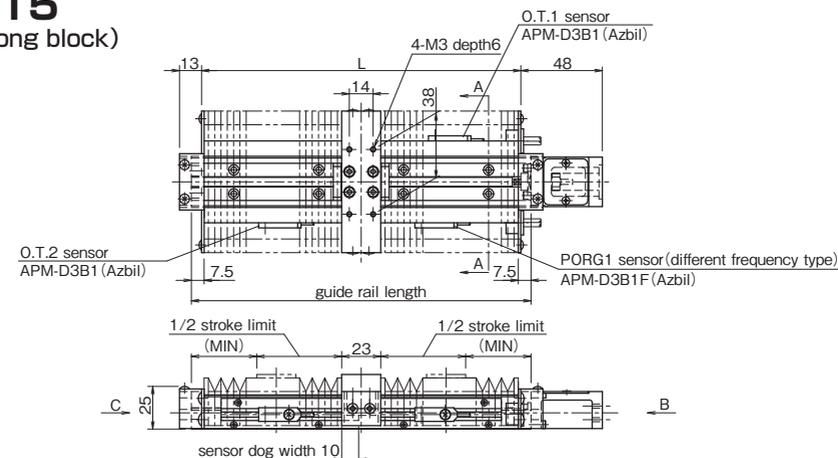
– Sensor Timing Chart –

The following chart shows the standard sensor arrangement.

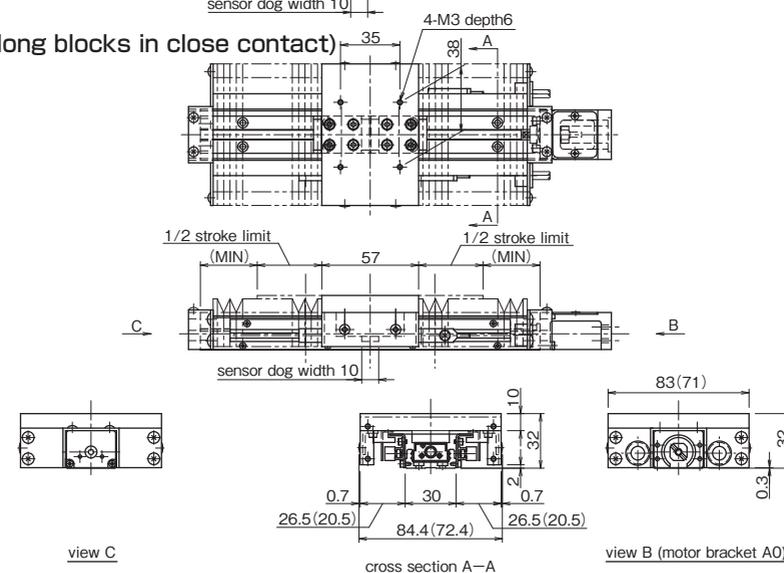
Figure G-15 Sensor Timing Chart



**BG15**  
A(1 long block)



B(2 long blocks in close contact)



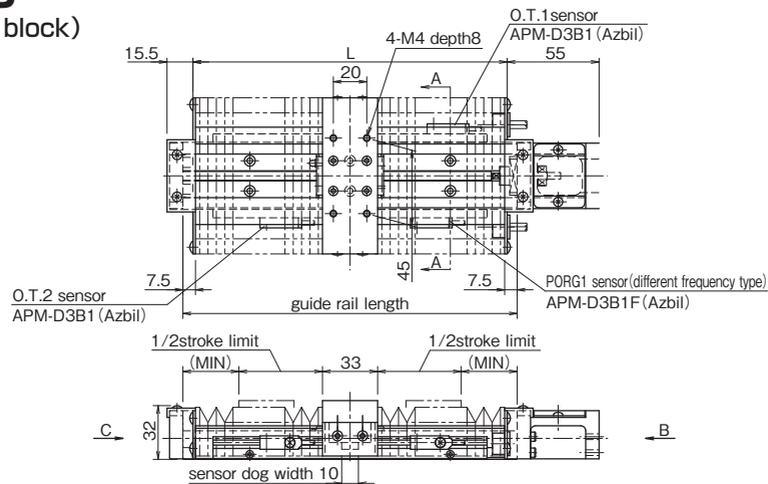
1. The drawings show the "JMN" configuration.
2. The numbers in the parentheses are the dimensions when sensors are not selected.
3. Please refer to page G-16 for dimensions that are not shown on the drawings.
4. material of bellows: composite resin sheet (glossy black)

rail length	L	1 long block			2 long blocks		
		stroke limit	effective stroke	MIN	stroke limit	effective stroke	MIN
75	—	—	—	—	—	—	—
100	—	—	—	—	—	—	—
125	113	43	33	29.5	—	—	—
150	138	60	50	33.5	40	30	26.5
175	163	85	75	33.5	59	49	29.5
200	188	100	90	38.5	76	60	33.5

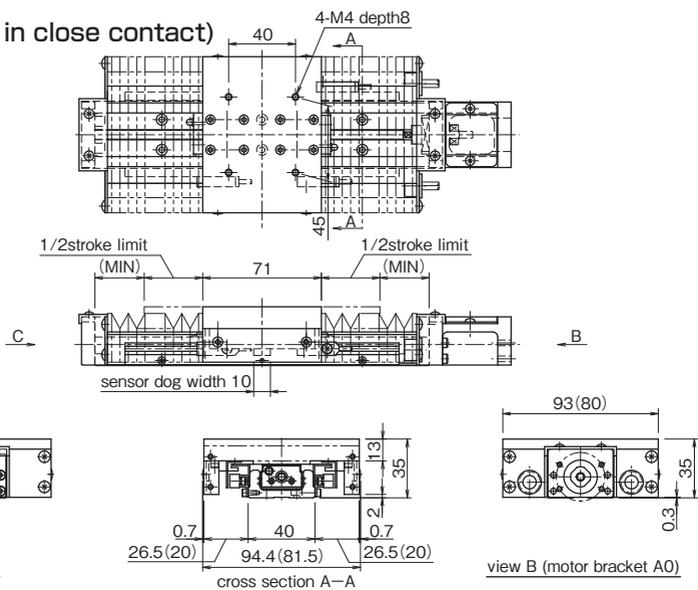
\* The rail mounting holes at the center cannot be used for the rail length 150 with two long blocks.

# BG20

A(1 long block)



B(2 long blocks in close contact)



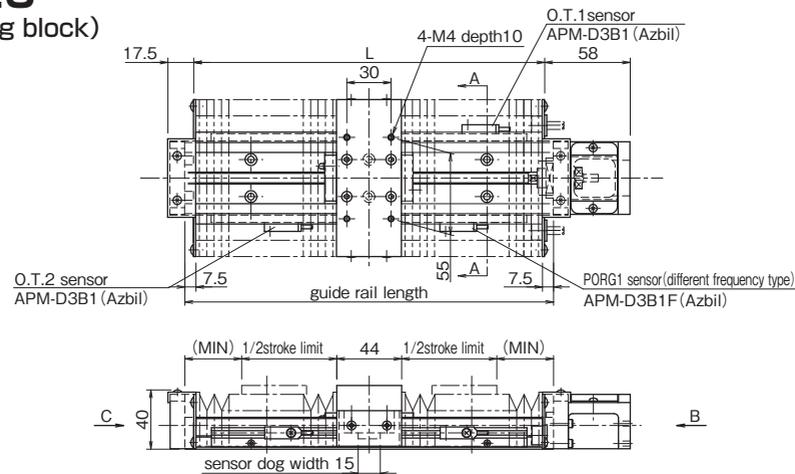
- 1.The drawings show the "JMN" configuration.
- 2.The numbers in the parentheses are the dimensions when sensors are not selected.
- 3.Please refer to page G-18 for dimensions that are not shown on the drawings.
- 4.material of bellows: composite resin sheet (glossy black)

rail length	L	1 long block		2 long blocks		
		stroke limit	effective stroke	MIN	stroke limit	effective stroke
100	—	—	—	—	—	—
150	138	58	48	29.5	32	22
200	188	100	90	33.5	70	60

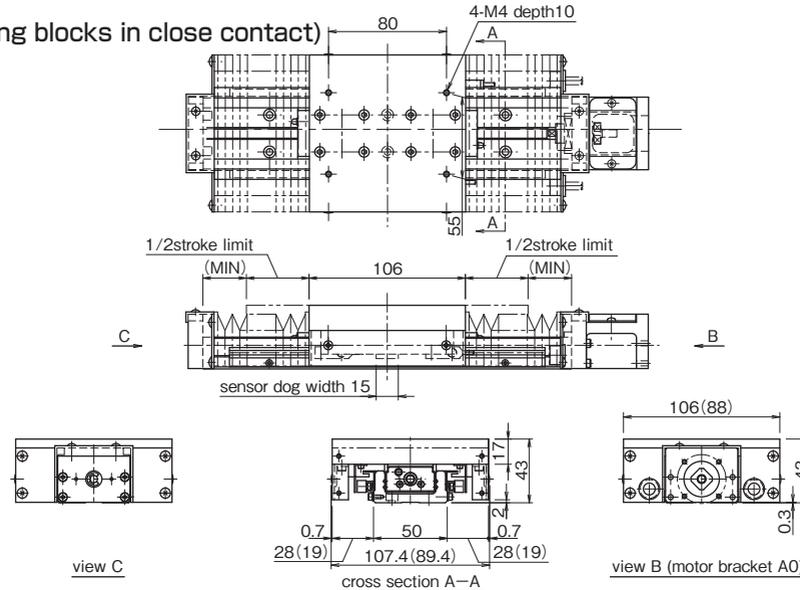
\* The rail mounting holes at the center cannot be used for the rail length 150 with two long blocks.

# BG26

A(1 long block)



B(2 long blocks in close contact)



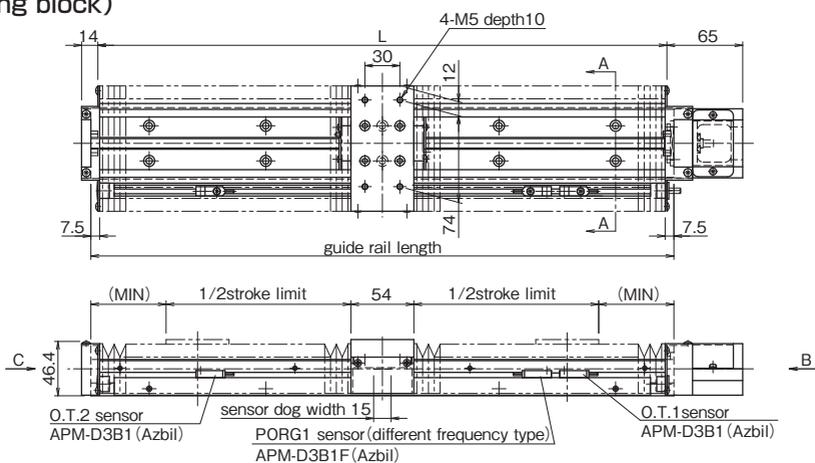
- 1.The drawings show the "JMN" configuration.
- 2.The numbers in the parentheses are the dimensions when sensors are not selected.
- 3.Please refer to page G-20 for dimensions that are not shown on the drawings.
- 4.material of bellows: composite resin sheet (glossy black)

rail length	L	1 long block		2 long blocks		
		stroke limit	effective stroke	MIN	stroke limit	effective stroke
150	138	53	43	26.5	—	—
200	188	97	87	29.5	41	31
250	238	129	119	38.5	85	75
300	288	169	159	43.5	127	117

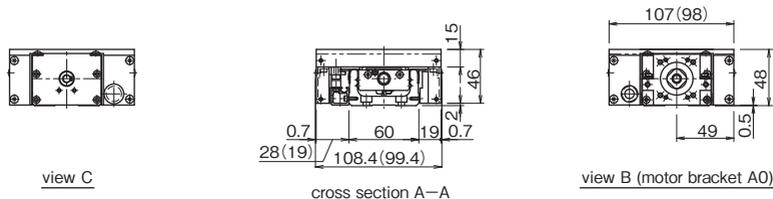
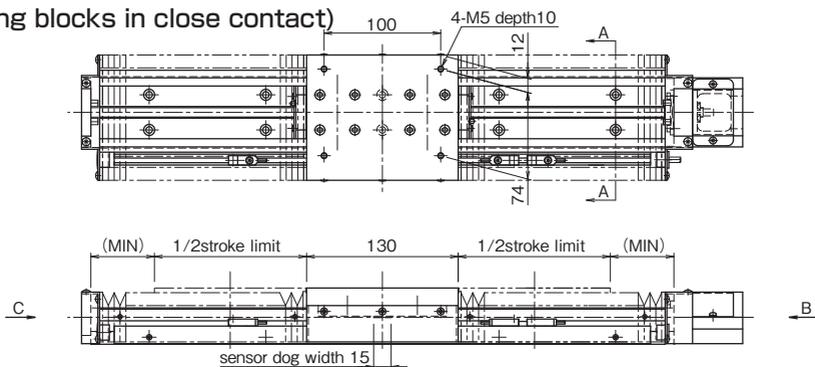
\* The rail mounting holes at the center cannot be used for the rail length 200 with two long blocks.

# BG33

## A(1 long block)



## B(2 long blocks in close contact)

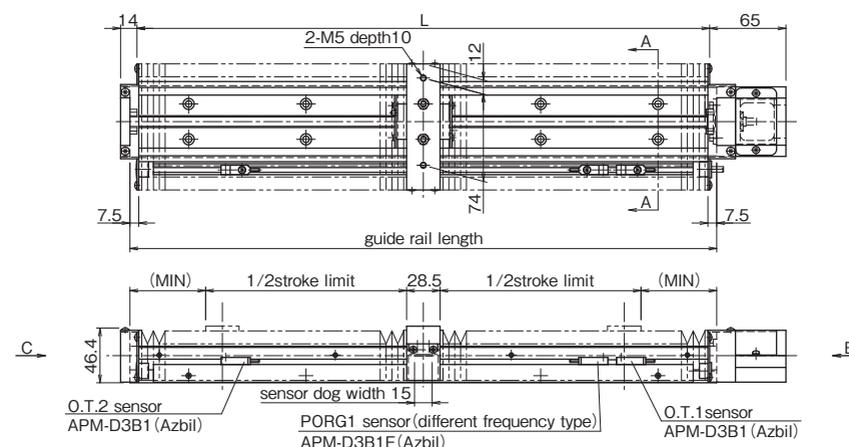


- The drawings show the "JML" configuration. The cross sections become reversed when "J \*R" is selected.
- The numbers in the parentheses are the dimensions when sensors are not selected.
- Please refer to page G-22 for dimensions that are not shown on the drawings.
- material of bellows: composite resin sheet (glossy black)

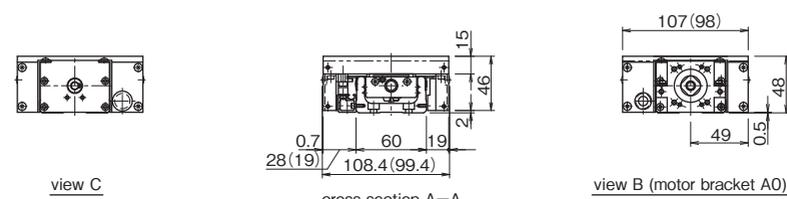
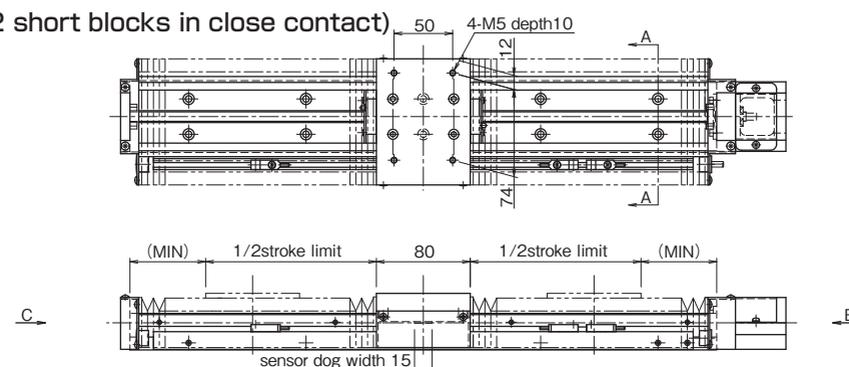
\*The rail mounting holes at the center cannot be used for the rail length 300 with two long blocks.

# BG33

## C(1 short block)



## D(2 short blocks in close contact)



- The drawings show the "JML" configuration. The cross sections become reversed when "J \*R" is selected.
- The numbers in the parentheses are the dimensions when sensors are not selected.
- Please refer to page G-24 for dimensions that are not shown on the drawings.
- material of bellows: composite resin sheet (glossy black)

\*The rail mounting holes at the center cannot be used for the rail length 300 with two long blocks.

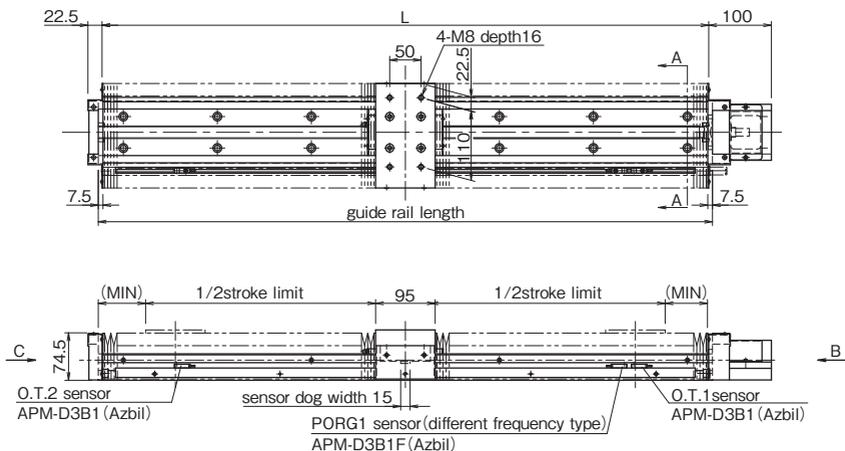
rail length	L	1 long block			2 long blocks		
		stroke limit	effective stroke	MIN	stroke limit	effective stroke	MIN
150	—	—	—	—	—	—	—
200	188	79	59	33.5	—	—	—
300*	288	159	139	43.5	103	83	33.5
400	388	237	217	54.5	183	163	43.5
500	488	317	297	64.5	261	241	54.5
600	588	395	375	75.5	341	321	64.5

rail length	L	1 short block			2 short blocks		
		stroke limit	effective stroke	MIN	stroke limit	effective stroke	MIN
150	138	68.5	48.5	26.5	—	—	—
200	188	104.5	84.5	33.5	67	47	26.5
300	288	184.5	164.5	43.5	143	123	38.5
400	388	262.5	242.5	54.5	211	191	54.5
500	488	342.5	322.5	64.5	291	271	64.5
600	588	404.5	384.5	83.5	369	349	75.5

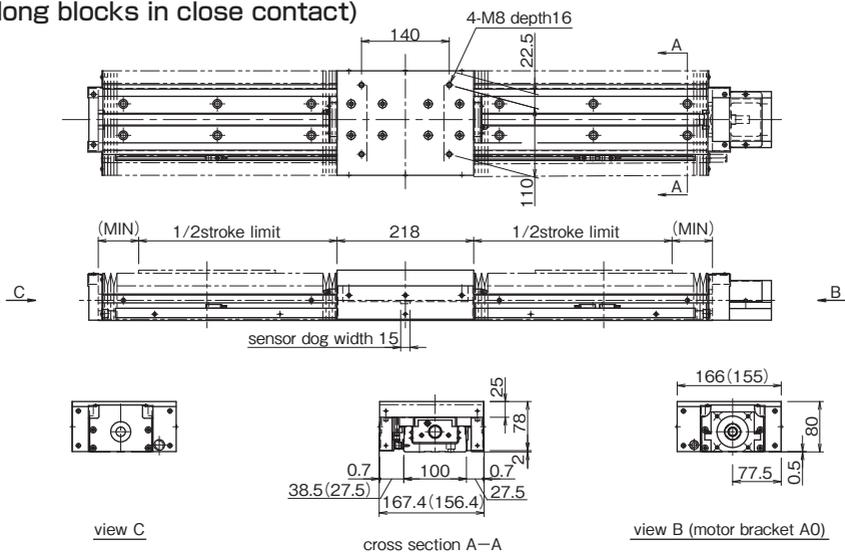


# BG55

A(1 long block)



B(2 long blocks in close contact)



- The drawings show the "JML" configuration. The cross sections become reversed when "J \*R" is selected.
- The numbers in the parentheses are the dimensions when sensors are not selected.
- Please refer to page G-30 for dimensions that are not shown on the drawings.
- material of bellows: composite resin sheet (glossy black)

rail length	L	1 long block		2 long blocks			
		stroke limit	effective stroke	MIN	stroke limit	effective stroke	MIN
980	968	734	714	75.5	633	613	64.5
1,080	1,068	812	792	86.5	711	691	75.5
1,180	1,168	912	892	86.5	789	769	86.5
1,280	1,268	992	972	96.5	889	869	86.5
1,380	1,368	1,070	1,050	107.5	969	949	96.5

# SENSOR

Photomicro sensor or proximity sensor can be attached to the BG actuator with our optional sensor-mounting rail (the same length as the guide rail length). Tapped holes are machined on both sides of the guide rail, allowing attachment of sensor to either side. Standard positioning (without special instruction from customer) would be to the left of the motor mount end. Sensor option includes the items that are listed below. Three types of sensor rail are available. (see Figure G-16) For details, please refer to page G-63~73. Depending on sizes, some sensor rail are not available. (See Figure G-16)

Table G-17 NPN Sensor

sensor code	sensor type	BG15	BG20	BG26	BG33	BG46	BG55
S	slim/compact type photomicro sensor	—	PM-L25 [3pcs] <sup>1</sup> (SUNX)				EE-SX674 [3pcs] <sup>2</sup> (OMRON)
H	close contact capable photomicro sensor						EE-SX671 [3pcs] <sup>2</sup> (OMRON)
K	proximity sensor (N.C.contact) <sup>3</sup>						APM-D3B1 [2pcs] <sup>1</sup> APM-D3B1F [1pc] <sup>1,4</sup> (Azbil)

- \*1 : length of cable: 1m
- \*2 : 3 pcs of sensor connector EE-1001 (OMRON) will be attached
- \*3 : normal close contact
- \*4 : different frequency type

Figure G-16 Sensor rail

sensor rail No.	sensor rail 1	sensor rail 2	sensor rail 3
	part number		
BG15	○	×	×
BG20	○	×	×
BG26	○	×	×
BG33	○	○	○
BG46	○	○	○
BG55	○	○	○

Symbols for without sensor

[N] after sensor code option indicates with sensor parts except for sensor. Sensor rail and sensor dog according to sensor code are attached.

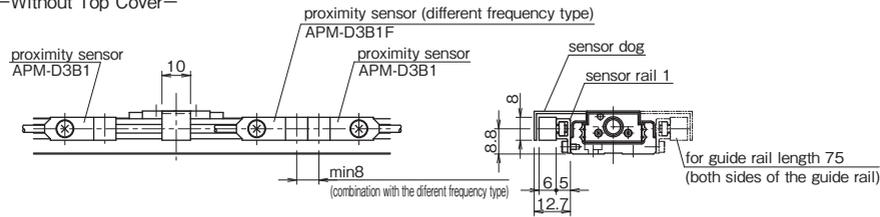
sensor code	S	H	K	SN	HN	KN
sensors (and sensor connectors)	○	○	○	×	×	×
sensor rail (and sensor mounting plates)	○	○	○	○	○	○
sensor dog	○	○	○	○	○	○

Notes The sensor mounting plates are also provided when needed. The sensor mounting plates are mounted on the sensor rail when shipping. Screw for mounting sensor is not provided.

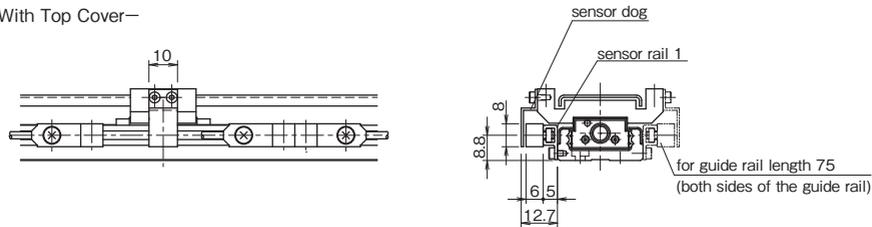
# BG15

## K Specification (Proximity Sensor)

—Without Top Cover—



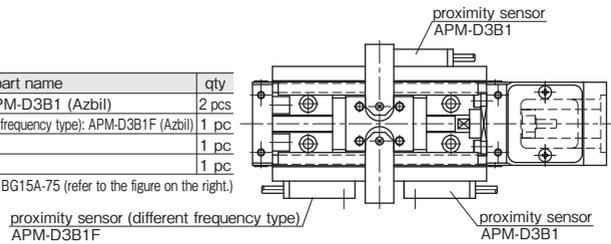
—With Top Cover—



Accessories

part name	qty
proximity sensor: APM-D3B1 (Azbil)	2 pcs
proximity sensor (different frequency type): APM-D3B1F (Azbil)	1 pc
sensor rail 1	1 pc
sensor dog	1 pc

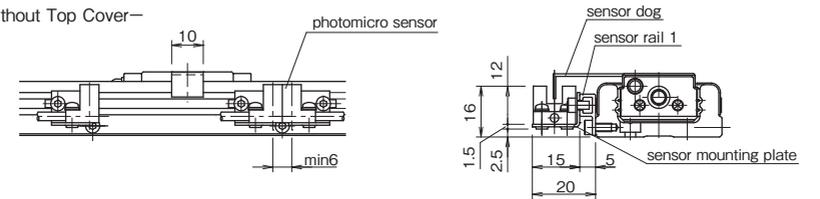
\*2 pcs of sensor dogs for BG15A-75 (refer to the figure on the right.)



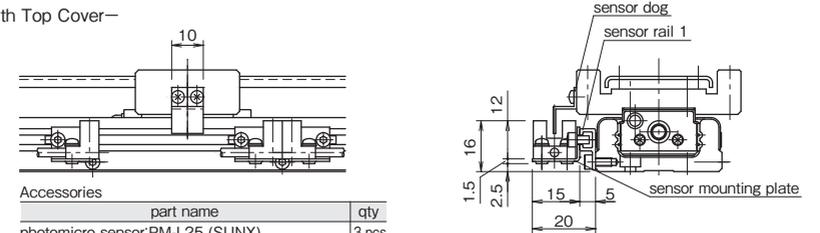
# BG20

## S Specification (Compact Photomicro Sensor)

—Without Top Cover—



—With Top Cover—

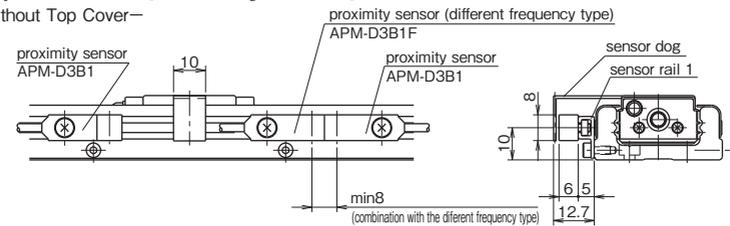


Accessories

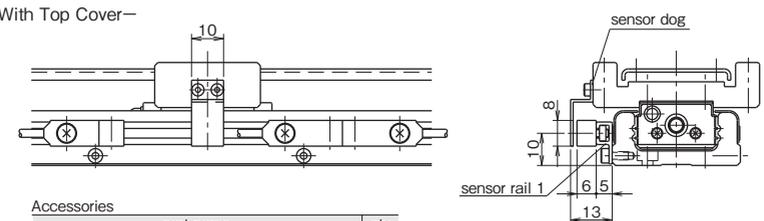
part name	qty
photomicro sensor: PM-L25 (SUNX)	3 pcs
sensor mounting plate	3 pcs
sensor rail 1	1 pc
sensor dog	1 pc

## K Specification (Proximity Sensor)

—Without Top Cover—



—With Top Cover—



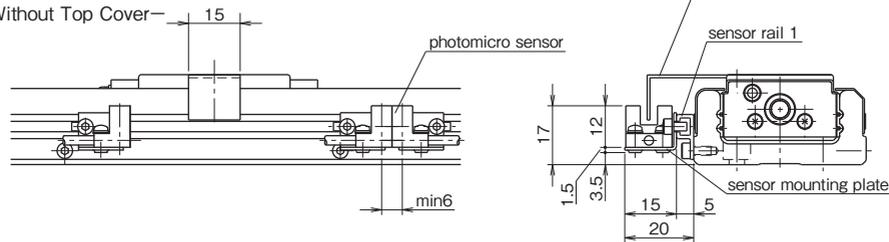
Accessories

part name	qty
proximity sensor: APM-D3B1 (Azbil)	2 pcs
proximity sensor (different frequency type): APM-D3B1F (Azbil)	1 pc
sensor rail 1	1 pc
sensor dog	1 pc

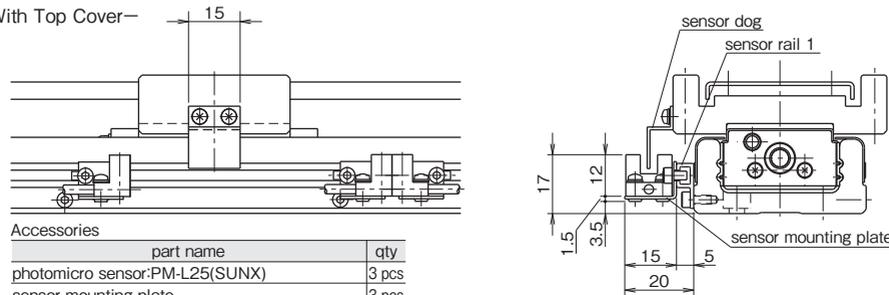
### BG26

#### S Specification (Compact Photomicro Sensor)

—Without Top Cover—



—With Top Cover—

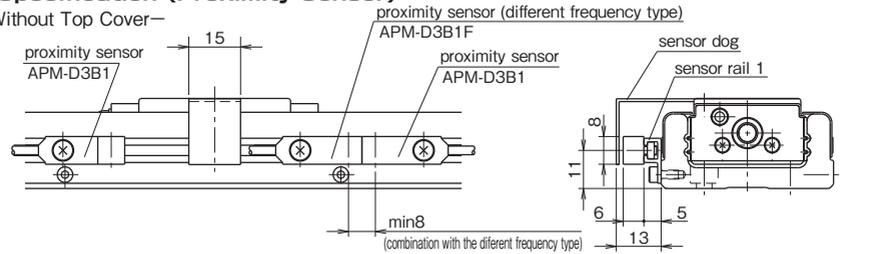


Accessories

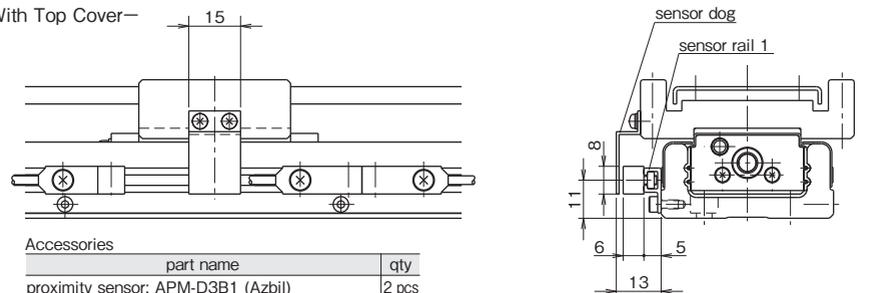
part name	qty
photomicro sensor:PM-L25(SUNX)	3 pcs
sensor mounting plate	3 pcs
sensor rail 1	1 pc
sensor dog	1 pc

#### K Specification (Proximity Sensor)

—Without Top Cover—



—With Top Cover—



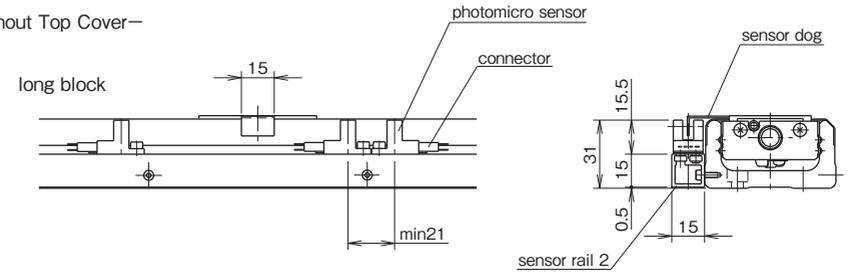
Accessories

part name	qty
proximity sensor: APM-D3B1 (Azbil)	2 pcs
proximity sensor (different frequency type):APM-D3B1F(Azbil)	1 pc
sensor rail 1	1 pc
sensor dog	1 pc

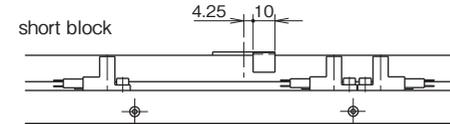
### BG33

#### S Specification (Slim-Type Photomicro Sensor)

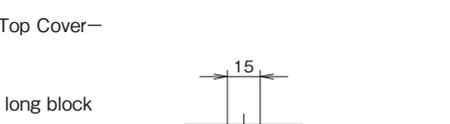
—Without Top Cover—



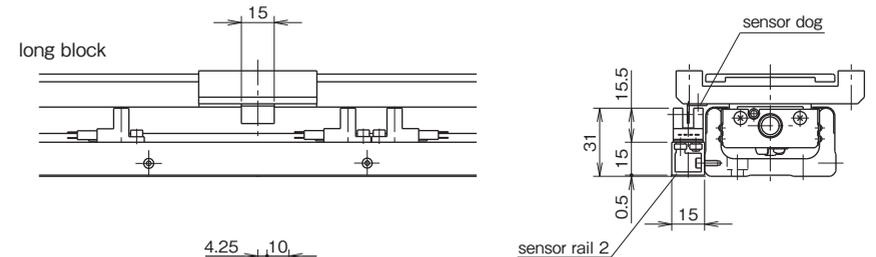
long block



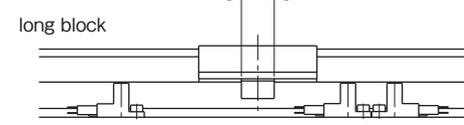
short block



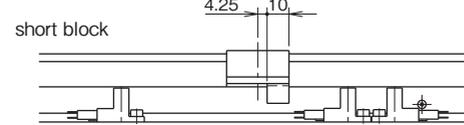
—With Top Cover—



long block



short block



Accessories

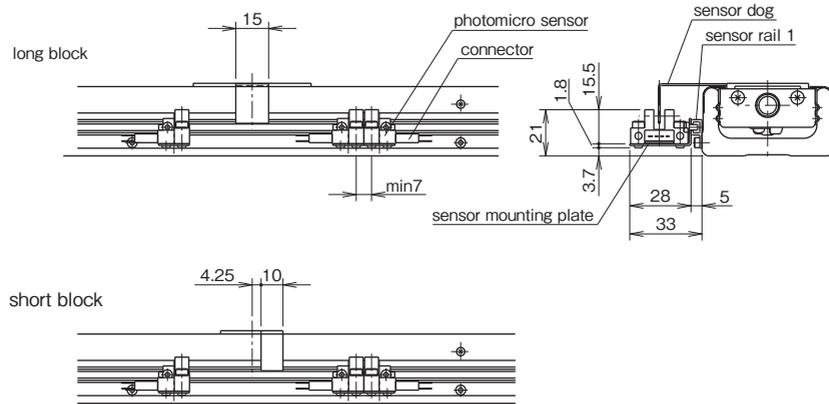
part name	qty
photomicro sensor: EE-SX674 (OMRON)	3 pcs
connector: EE-1001 (OMRON)	3 pcs
sensor rail 2	1 pc
sensor dog	*1 pc

\*2 pcs for BG33D-150.

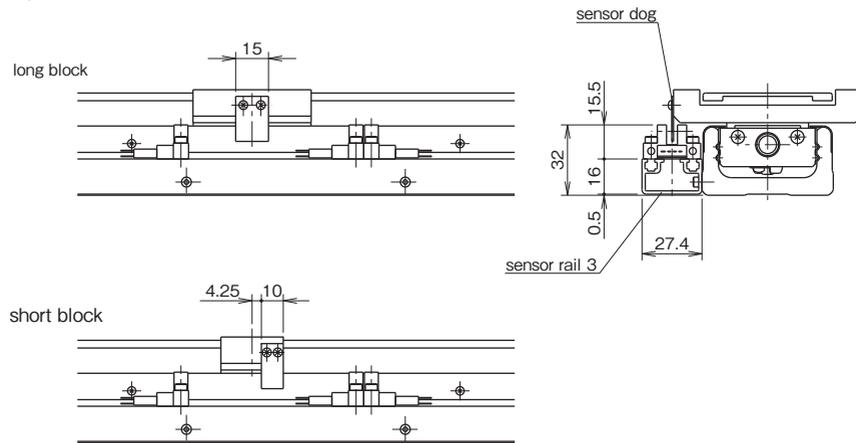
# BG33

## H Specification (Close Contact Capable Photomicro Sensor)

—Without Top Cover—



—With Top Cover—



Accessories

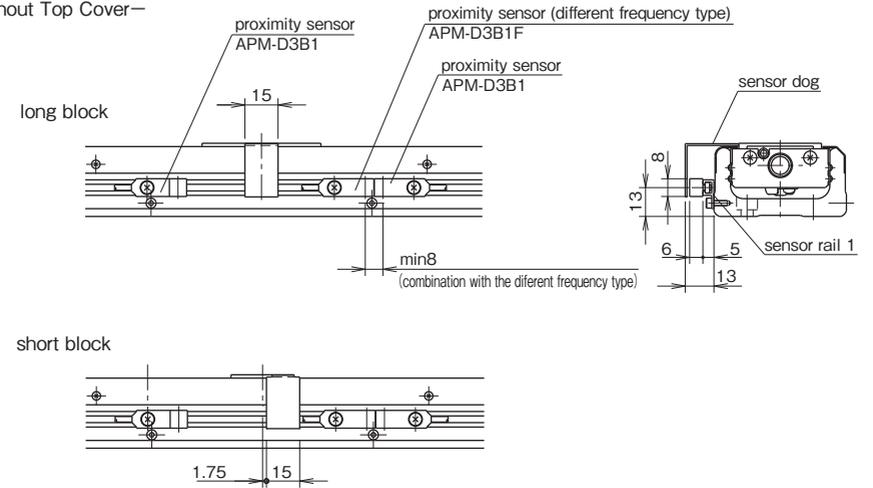
part name	qty
photomicro sensor: EE-SX671 (OMRON)	3 pcs
connector: EE-1001 (OMRON)	3 pcs
sensor mounting plate (only for the without cover type)	3 pcs
sensor rail 1 or 3	1 pc
sensor dog	*1 pc

\*2 pcs for BG33D-150.

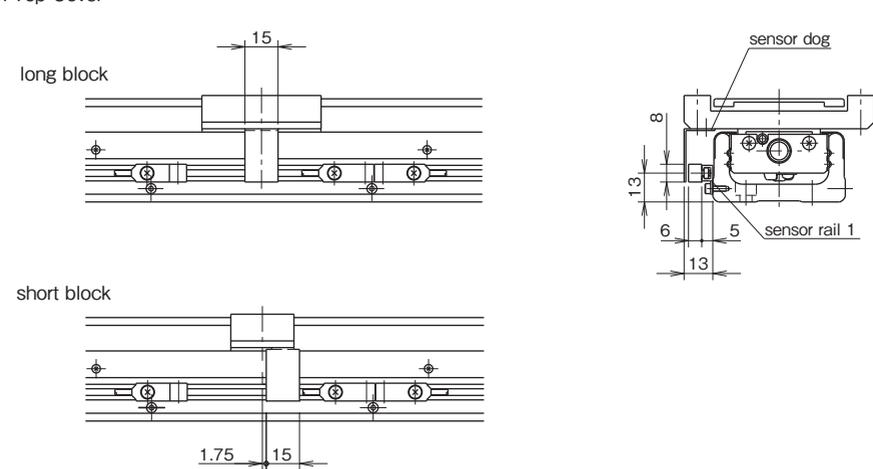
# BG33

## K Specification (Proximity Sensor)

—Without Top Cover—



—With Top Cover—



Accessories

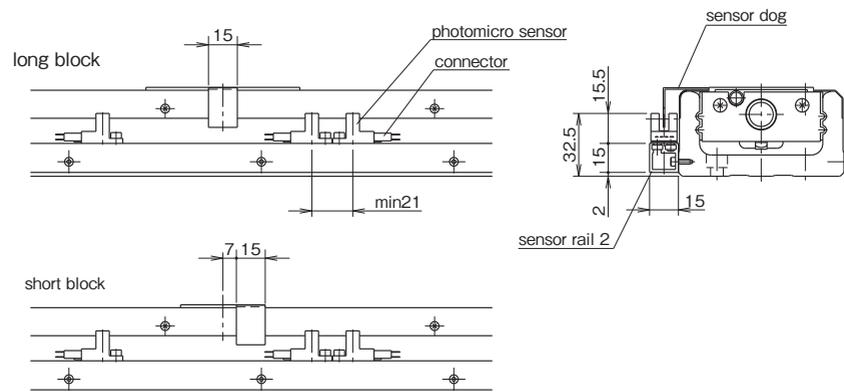
part name	qty
proximity sensor: APM-D3B1 (Azbil)	2 pcs
proximity sensor (different frequency type): APM-D3B1F (Azbil)	1 pc
sensor rail 1	1 pc
sensor dog	*1 pc

\*2 pcs for BG33D-150.

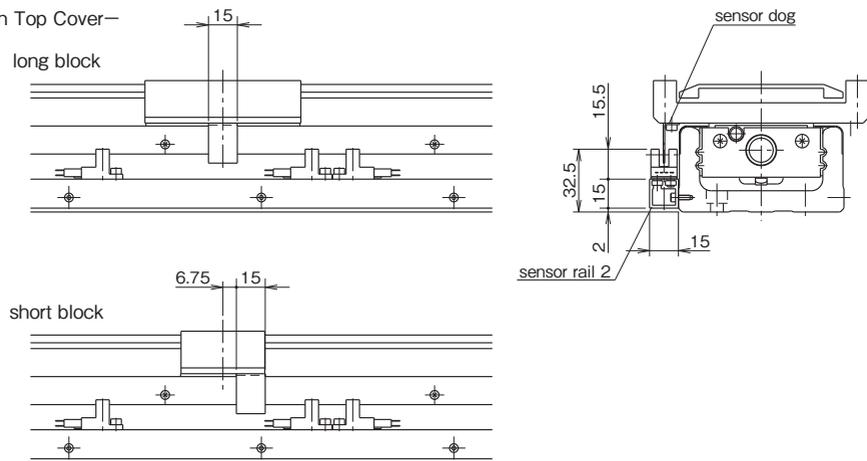
# BG46

## S Specification (Slim-Type Photomicro Sensor)

—Without Top Cover—



—With Top Cover—



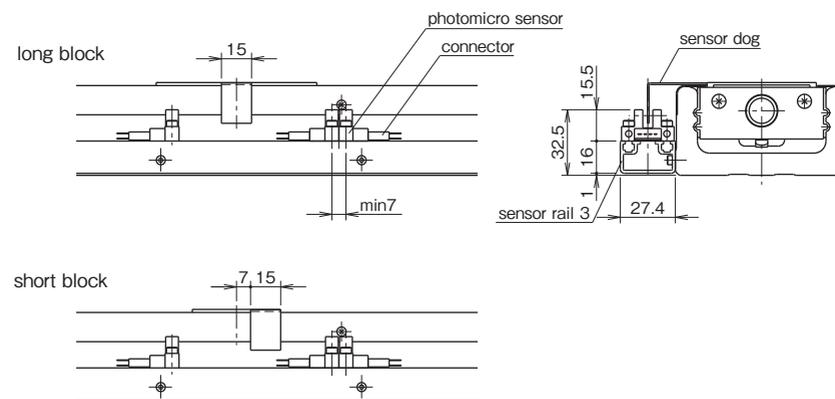
Accessories

part name	qty
photomicro sensor:EE-SX674 (OMRON)	3 pcs
connector: EE-1001 (OMRON)	3 pcs
sensor rail 2	1 pc
sensor dog	1 pc

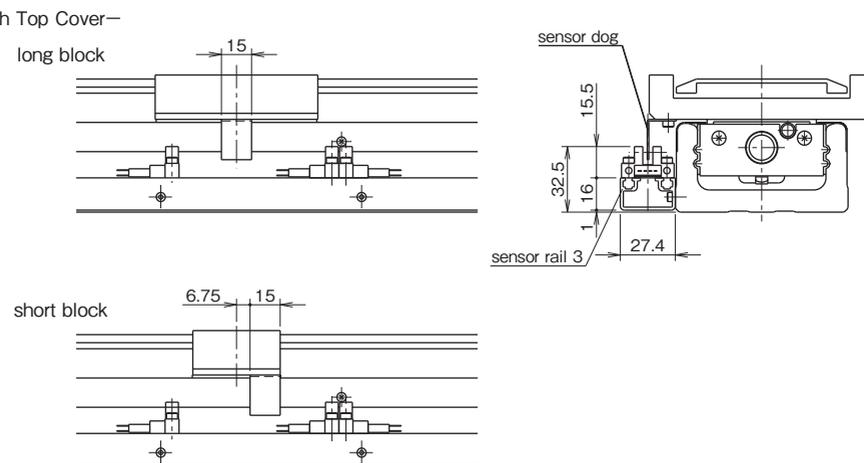
# BG46

## H Specification (Close Contact Capable Photomicro Sensor)

—Without Top Cover—



—With Top Cover—



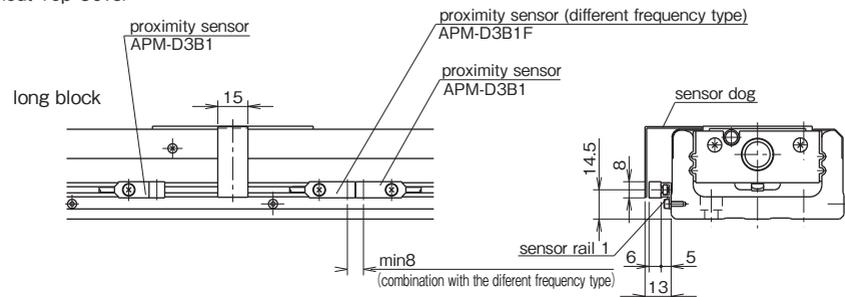
Accessories

part name	qty
photomicro sensor: EE-SX671 (OMRON)	3 pcs
connector: EE-1001 (OMRON)	3 pcs
sensor rail 3	1 pc
sensor dog	1 個

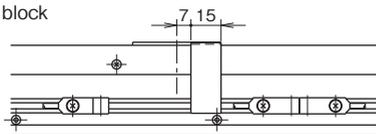
# BG46

## K Specification (Proximity Sensor)

—Without Top Cover—

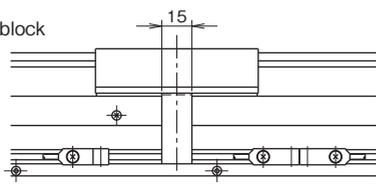


short block

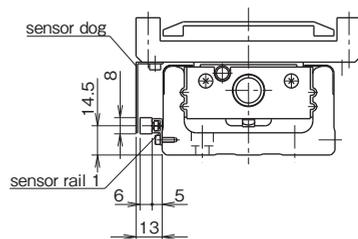
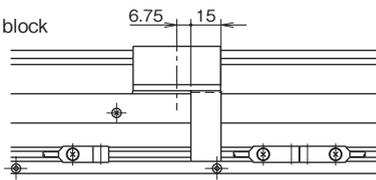


—With Top Cover—

long block



short block



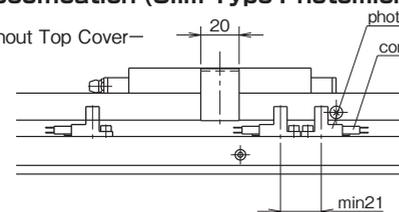
Accessories

part name	qty
proximity sensor: APM-D3B1 (Azbil)	2 pcs
proximity sensor (different frequency type): APM-D3B1F (Azbil)	1 pc
sensor rail 1	1 pc
sensor dog	1 pc

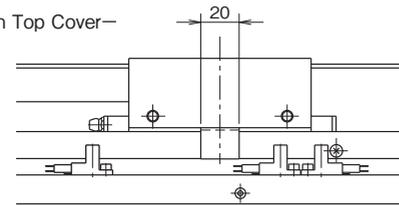
# BG55

## S Specification (Slim-Type Photomicro Sensor)

—Without Top Cover—

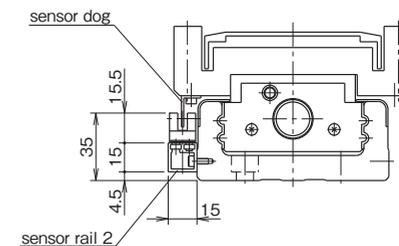
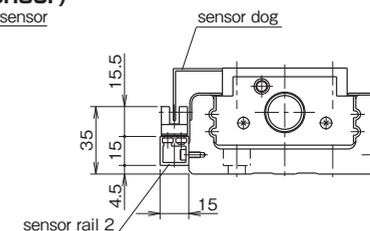


—With Top Cover—



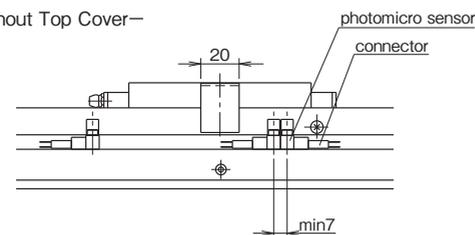
Accessories

part name	qty
photomicro sensor: EE-SX674 (OMRON)	3 pcs
connector: EE-1001 (OMRON)	3 pcs
sensor rail 2	1 pc
sensor dog	1 pc

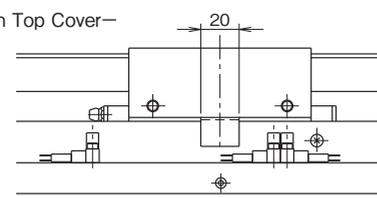


## H Specification (Close Contact Capable Photomicro Sensor)

—Without Top Cover—

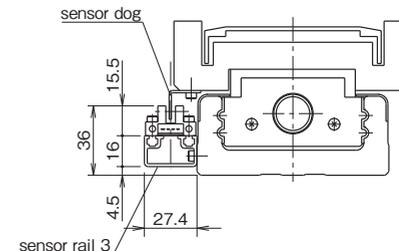
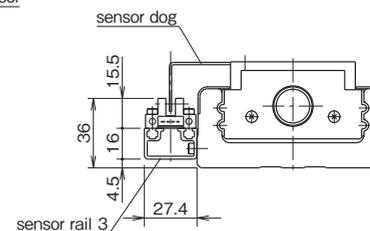


—With Top Cover—



Accessories

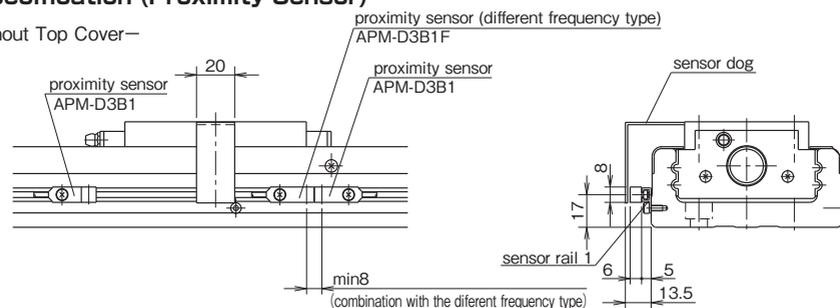
part name	qty
photomicro sensor: EE-SX671 (OMRON)	3 pcs
connector: EE-1001 (OMRON)	3 pcs
sensor rail 3	1 pc
sensor dog	1 pc



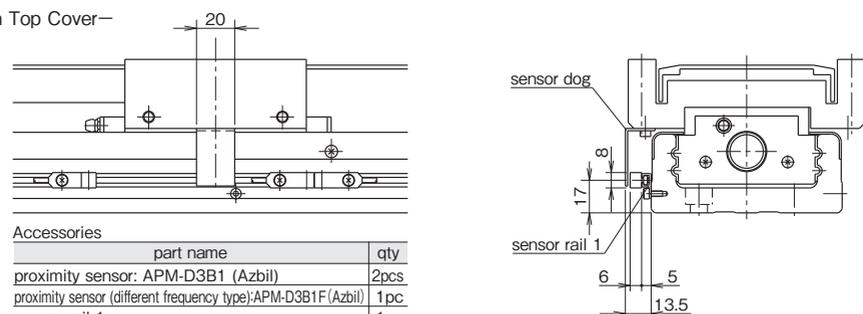
# BG55

## K Specification (Proximity Sensor)

—Without Top Cover—



—With Top Cover—



Accessories	
part name	qty
proximity sensor: APM-D3B1 (Azbil)	2pcs
proximity sensor (different frequency type):APM-D3B1F (Azbil)	1pc
sensor rail 1	1pc
sensor dog	1pc

## PNP SENSOR

BG type sensors can be changed to the PNP type by adding a sensor option code "PNP" at the end of the part number. Refer to Table G-18 for the model number of PNP type sensors.

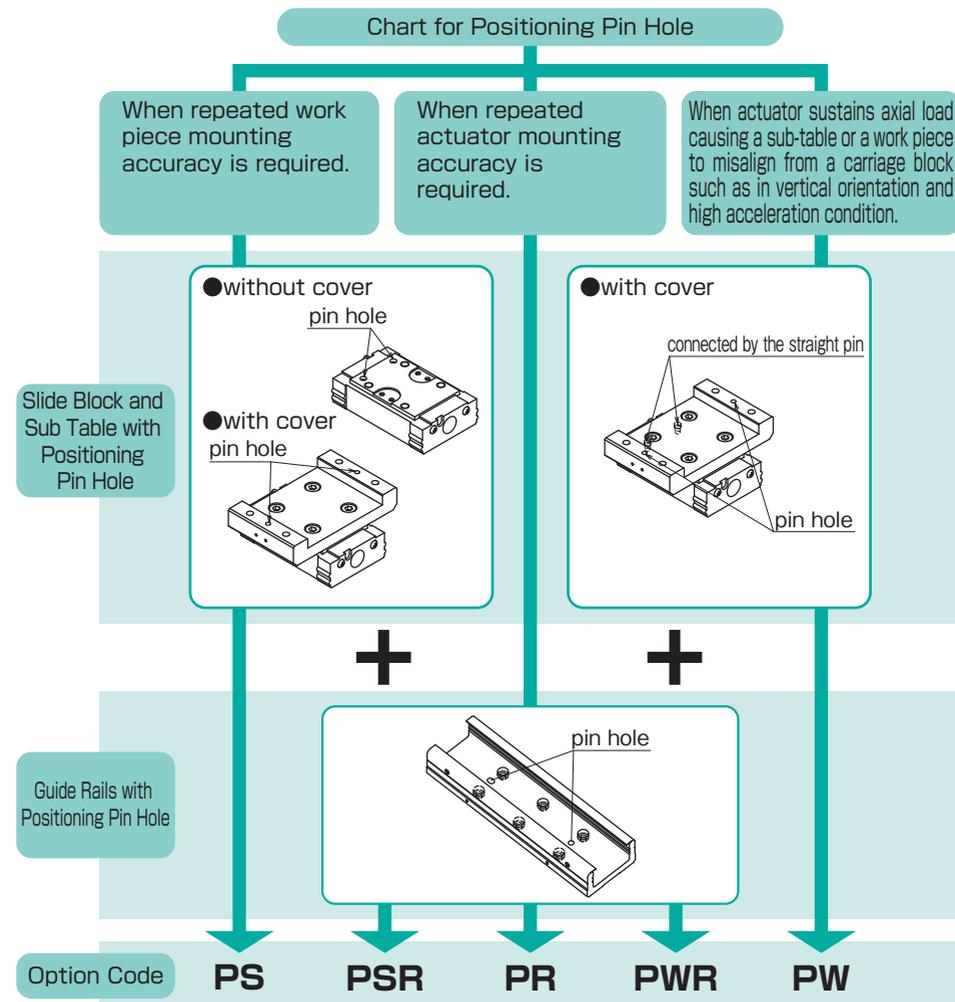
Table G-18 Standard (PNP) Sensor

sensor symbol	sensor type	BG15	BG20	BG26	BG33	BG46	BG55
S	slim/compact type photomicro sensor	—	PM-L25-P [3 pcs] <sup>*1</sup> (SUNX)	—	EE-SX674P [3 pcs] <sup>*2</sup> (OMRON)	—	—
H	close contact capable photomicro sensor	—	—	—	EE-SX671P [3 pcs] <sup>*2</sup> (OMRON)	—	—
K	proximity sensor (N.C. contact) <sup>*3</sup>	—	APM-D3E1 [2 pcs] <sup>*1</sup> APM-D3E1F [1 pc] <sup>*1,4</sup> (Azbil)	—	—	—	—

\*1: length of cable: 1m  
 \*2: 3 pcs of connector EE-1001 (OMRON) will be attached  
 \*3: normal close contact  
 \*4: different frequency type

## POSITIONING PIN HOLE

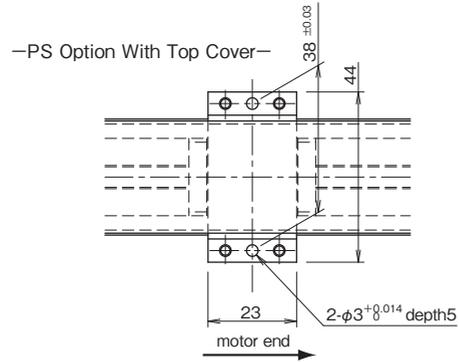
For the BG type, positioning pin holes can be provided on the slide block and sub table by adding the option code "PS" or "PW" in the end of the part number. The option code "PR" is used to provide the guide rail with positioning pin holes. When positioning pin holes are necessary on both the slide block/sub table and guide rail, please add the option code "PSR" or "PWR".



### Positioning Pin Hole for Slide Block and Sub Table

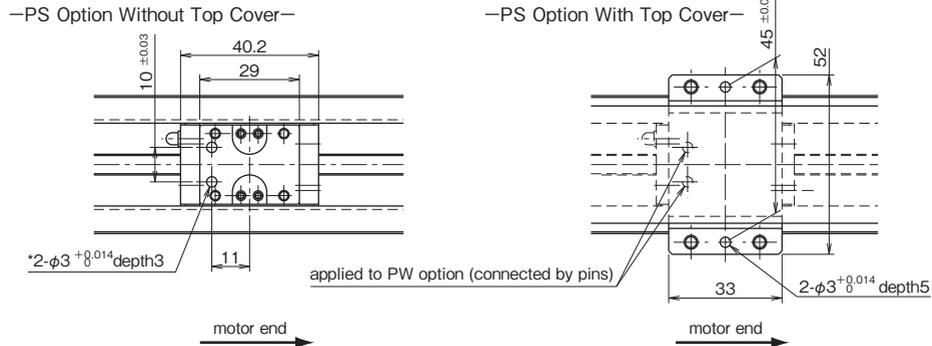
It is useful when exacting reassembly positioning is required. In case of two blocks used, both blocks are processed. When the code "PS" is specified, the drilling hole is processed only on the mounting surface (slide block or sub table). When the code "PW" is specified for a BH with a top cover, the slide block and sub table are connected by the straight pins at the location where the "PS" option specifies on the slide block. Note that NB does not supply straight pins for the "PS" option. Also NB can provide positioning pin holes with bellows. Please contact NB for details.

### BG15A,B (long block)



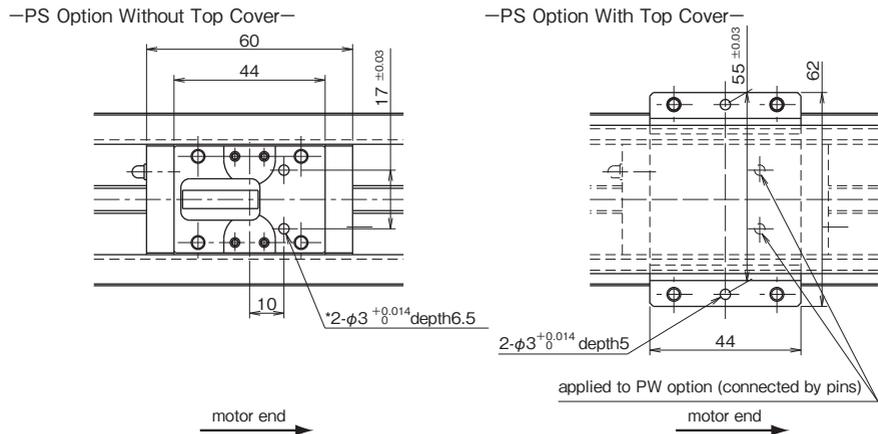
\*Please contact NB for the without-top-cover option or the "PW" option.

### BG20A,B (long block)



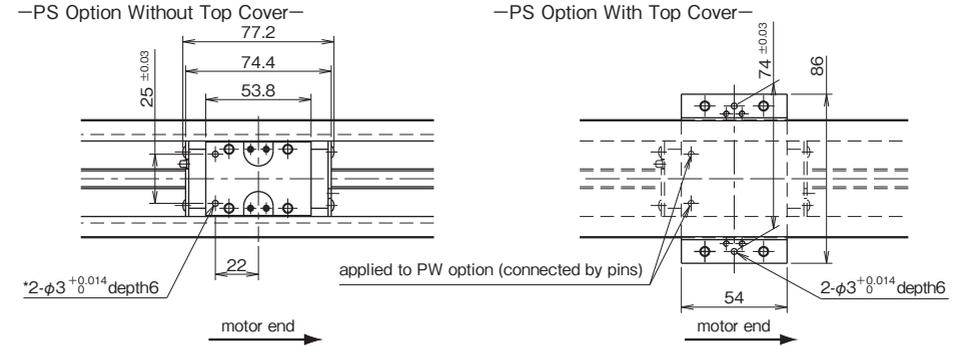
\*For some cases, a shallow counterbore of φ4 will be machined at the hole area with "\*" to remove a hardened layer.

### BG26A,B (long block)



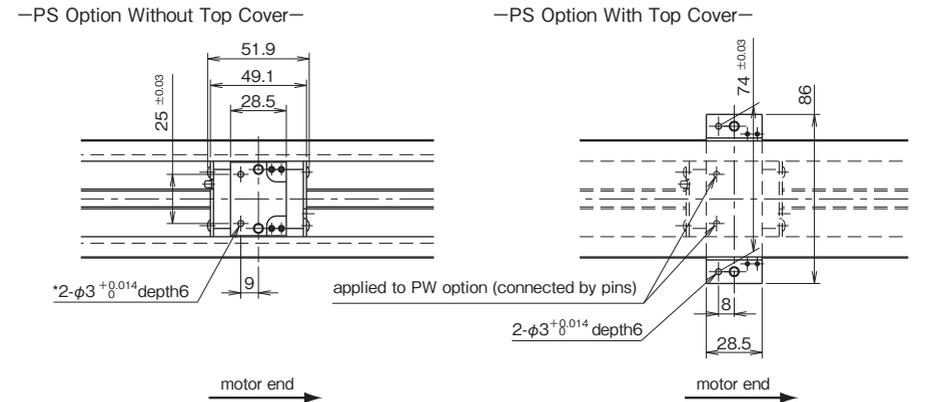
\*For some cases, a shallow counterbore of φ4 will be machined at the hole area with "\*" to remove a hardened layer.

### BG33A,B (long block)



\*For some cases, a shallow counterbore of φ4 will be machined at the hole area with "\*" to remove a hardened layer.

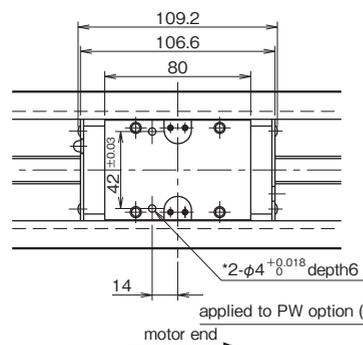
### BG33C,D (short block)



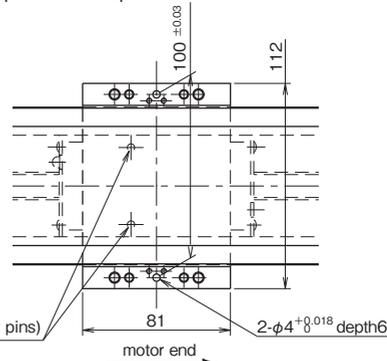
\*For some cases, a shallow counterbore of φ4 will be machined at the hole area with "\*" to remove a hardened layer.

### BG46A,B (long block)

—PS Option Without Top Cover—



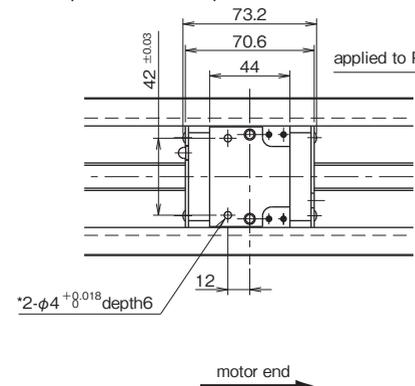
—PS Option With Top Cover—



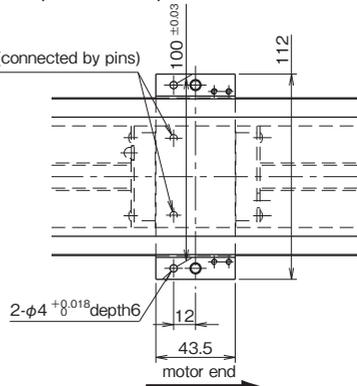
\*For some cases, a shallow counterbore of φ5 will be machined at the hole area with "\*" to remove a hardened layer.

### BG46C,D (short block)

—PS Option Without Top Cover—



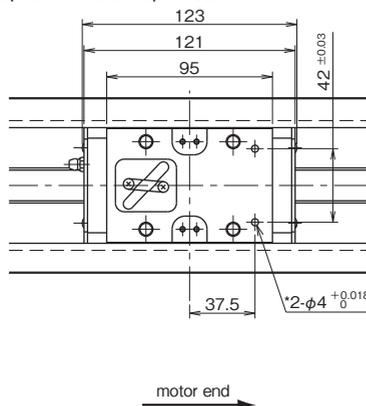
—PS Option With Top Cover—



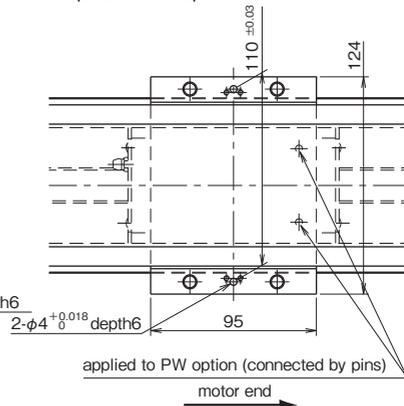
\*For some cases, a shallow counterbore of φ5 will be machined at the hole area with "\*" to remove a hardened layer.

### BG55A,B (long block)

—PS Option Without Top Cover—



—PS Option With Top Cover—



\*For some cases, a shallow counterbore of φ5 will be machined at the hole area with "\*" to remove a hardened layer.

### POSITIONING PIN HOLE FOR GUIDE RAIL

It is useful to use positioning pin holes on the guide rail when exacting reassembly positioning is required. NB does not supply straight pins. (JIS B1354-1988 parallel pin type A is recommended.) After the insertion of the straight pins in the guide rail base, the pins might interfere with the slide block. In the positioning process, please consider the base thickness. The length of the pin in the base shall be shorter than the base thickness. Please make sure that the pins shall not interfere with the slide block.

Figure G-17 Positioning Pin Hole Location

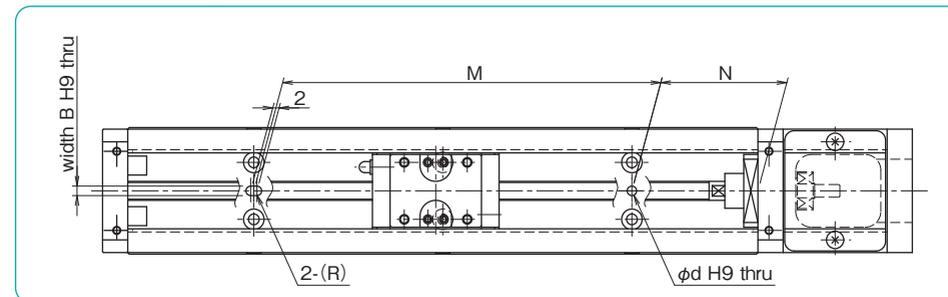


Table G-19 Positioning Pin Hole for Guide Rail

unit: mm

part number	pin length (base thickness)	major dimensions				φd	B
		rail length	N	M			
BG15	3.5 or less	75	12.5	50	φ3 <sup>+0.025</sup> <sub>0</sub>	3 <sup>+0.025</sup> <sub>0</sub>	
		100	25				
		125	12.5				
		150	25				
		175	12.5				
BG20	4.5 or less	200	25	150			
		100	20	60			
		150	15	120			
BG26	6 or less	200	40	120			
		150	35	80			
		250	45	160			
BG33	8 or less	300	30	240			
		150	25	100			
		200	50	200			
		300		300			
		400		400			
BG46	11 or less	500	70	500	φ5 <sup>+0.030</sup> <sub>0</sub>	5 <sup>+0.030</sup> <sub>0</sub>	
		600		500			
		340		200			
		440		300			
		540		400			
		640		500			
		740		600			
		840		700			
		940		800			
		1,040		900			
1,140	1,000						
BG55	13 or less	1,240	1,100				
		980	40	900			
		1,080	15	1,050			
		1,180	65				
		1,280	40	1,200			
1,380	15	1,350					

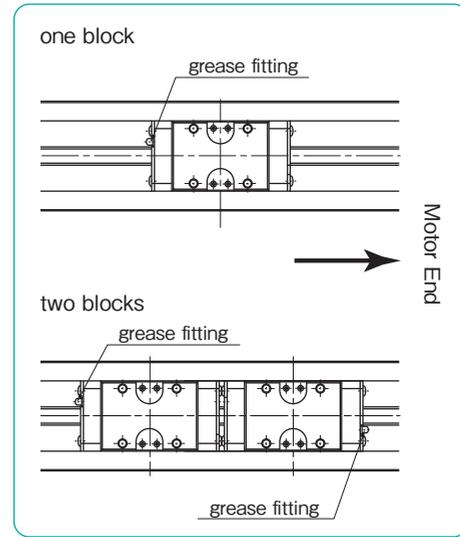
LUBRICATION

- BG type contains a lithium soap based grease. (Multemp PS No.2, KYODO YUSHI) Apply similar type of grease for the lubrication as required depending on the operating conditions.
- Use the grease fitting to lubricate the slide block. For ball screw portion apply grease directly to the surface of screw shaft. BG15 slide block has  $\phi 2\text{mm}$  oil holes instead of grease fitting.
- Unless otherwise instructed, a grease fitting is located as shown in Figure G-18.
- The grease can be changed to a high function type by adding a special grease option at the end of the part number. Please refer to Table G-20 for the grease type. Also refer to page Eng-51 for further details.

Table G-20 Applicable Grease

grease option	features	product name
none (standard)	—	Multemp PS No.2 (KYODO YUSHI)
GU	urea-type low dust generation grease; low sliding resistance	KGU Grease
GLA	lithium-type low dust generation grease	KGLA Grease
GF	urea-type anti-fretting grease	KGF Grease

Figure G-18 Location of Grease Fitting



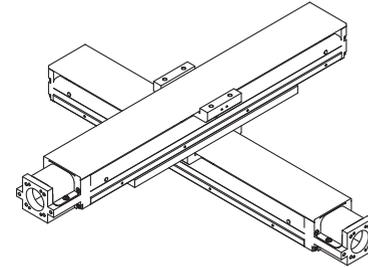
Two Axes Combined Bracket

NB provides optional brackets to combine two axes for BG20, 26, 33, 46 series. Each axis is available with one long block with top cover type only. Other combination can be available, please contact NB for details.

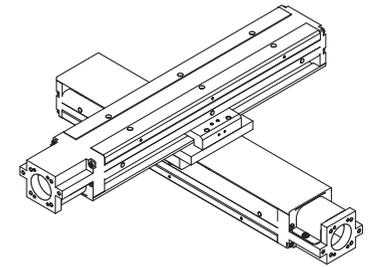
Combination Examples

Horizontal - Horizontal

- Type A  
Upper Axis: Fixed Rail, Moving Block

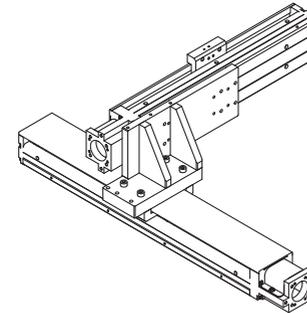


- Type B  
Upper Axis: Fixed Block, Moving Rail

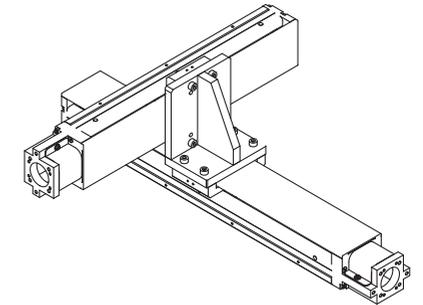


Horizontal - Sideway

- Type C  
Upper Axis: Fixed Rail, Moving Block

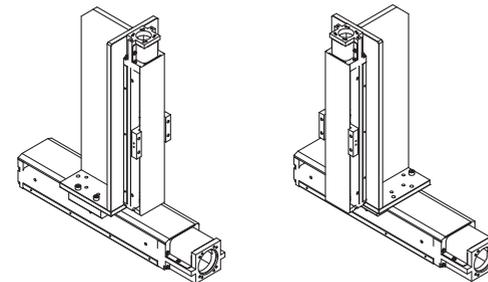


- Type D  
Upper Axis: Fixed Block, Moving Rail



Horizontal - Vertical

- Type E  
Upper Axis: Fixed Rail, Moving Block



# BH TYPE

## PART NUMBER STRUCTURE

Part number for BH type is described as follows.

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
BH	15	01	A	100	U	A0			G▲
		02	B	150	W	A1	C	K	LB
				200		A2			PNP
						A3			

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
BH	23	02	A	150	U	A0			P△□
		05	B	200	W	A1	C	S	G▲
				250		A3		K	LB
				300		A5			PNP
						A6			

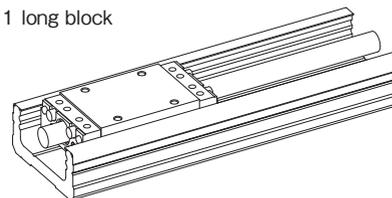
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
BH	30	04	A	150	U	A0			P△□
		05	B	200	W	A1	C	S	G▲
				300		A2		K	LB
				400		A3			PNP
				500		A4			
				600		A5			
				700		A7			
				750		B1			
						RO			
						RA□			
						RB□			

\*Guide rail length 750mm is only available for BH3010.

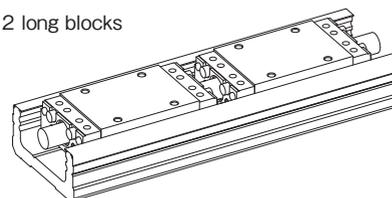
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
BH	45	05	A	340	U	A0			P△□
		10	B	440	W	A1	C	S	G▲
				540		A2		K	LB
				640		A3			PNP
				740		A4			
				840		A5			
				940		A6			
						RO			
						RA□			
						RB□			
						RC□			

- ① BH type
- ② size
- ③ ballscrew lead (refer to page G-84)
- ④ type of block

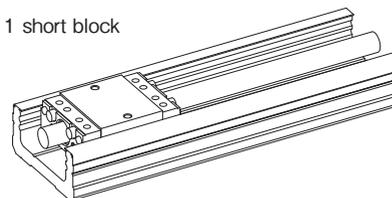
A: 1 long block



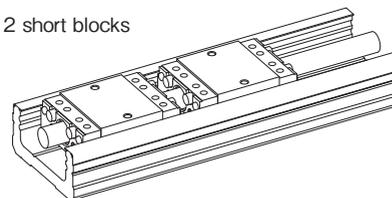
B: 2 long blocks



C: 1 short block

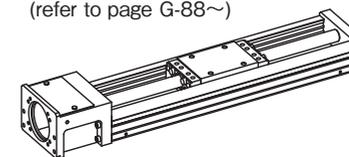


D: 2 short blocks

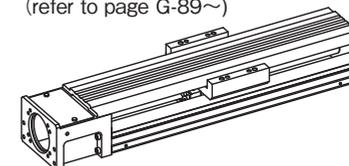


⑧ cover

none: without top cover  
(refer to page G-88~)



C: with top cover + sub table  
(refer to page G-89~)



⑨ sensor (refer to page G-111~)

none	without sensor
S	with slim-type / compact photomicro sensor
K	with proximity sensor

⑩ option

none	without option
P△□	with positioning pin hole (*1)
G▲	with special grease option (*2)
LB	with low temperature black chrome treatment (*3)
PNP	with PNP sensor

In case of multiple options, add + between each option.  
Example: (PS + LB + PNP)

\*1: △ is S, W or R (refer to page G-118)  
□ is R (refer to page G-118)

\*2: ▲ is U, L or F (refer to page G-122)  
Grease is applied to slide guide, ballscrew, and angular bearings.

\*3: LB is applied to steel parts except for aluminum parts and radial bearings.

\*Drive block is located closest to motor bracket side.

⑤ guide rail length

⑥ accuracy grade (refer to page G-86)

U	positioning repeatability $\pm 5 \mu\text{m}$
W	positioning repeatability $\pm 10 \mu\text{m}$

⑦ motor bracket (refer to page G-98, 99)

The number in the square □ after suffix RA, RB or RC indicates the mounting direction code.  
(refer to page G-108, 109)

**SPECIFICATIONS**

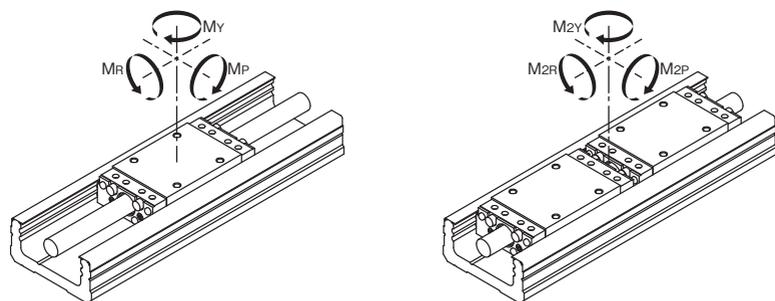
BH Type is categorized as either positioning repeatability  $\pm 5\mu\text{m}$  (U) or positioning repeatability  $\pm 10\mu\text{m}$  (W).

Table G-21 Specifications

part number			BH1501	BH1502	BH2302	BH2305	BH3004	BH3005	BH3010	BH4505	BH4510	BH4520		
accuracy grade			W	U	W	U	W	U	W	U	W	U		
guide	radial clearance	$\mu\text{m}$	-3 ~ 0		-3 ~ 0		-3 ~ 0			-5 ~ 0				
		basic dynamic load	C	1.6		4.3		7.0			27.0			
	basic static load	C <sub>0</sub>	2.7		7.0		11.8			45.0				
	allowable static moment	M <sub>P</sub>	N·m	10		46		101			572			
		M <sub>2P</sub>	N·m	60		276		606			3,432			
		M <sub>Y</sub>	N·m	11		51		120			681			
		M <sub>2Y</sub>	N·m	71		306		720			4,086			
		M <sub>R</sub>	N·m	28		134		260			1,410			
		M <sub>2R</sub>	N·m	56		268		520			2,820			
	short block	basic dynamic load	C								16.9			
		basic static load	C <sub>0</sub>								28.1			
		allowable static moment	M <sub>P</sub>	N·m	-		-		-			223		
			M <sub>2P</sub>	N·m	-		-		-			1,341		
			M <sub>Y</sub>	N·m	-		-		-			266		
M <sub>2Y</sub>			N·m	-		-		-			1,598			
M <sub>R</sub>	N·m	-		-		-			887					
M <sub>2R</sub>	N·m	-		-		-			1,774					
ball screw	shaft diameter	mm	6		8		10			15				
	lead	mm	1	2	2	5	4	5	10	5	10	20		
	basic dynamic load	C <sub>a</sub>	kN	0.39	0.54	1.8	1.9	3.0	3.0	2.0	5.1	5.1	3.1	
	basic static load	C <sub>0a</sub>	kN	0.77	0.76	3.2	3.1	5.3	5.3	3.2	10.5	10.5	6.6	
bearing support	part number	-	604 or equivalent		AC6-16DF or equivalent		708DFP5 or equivalent			5201A or equivalent				
	basic dynamic load	C <sub>b</sub>	kN		0.5		1.79		4.40		5.90			
	basic static load	C <sub>0b</sub>	kN		0.19		1.76		4.36		3.20			

M<sub>2P</sub>, M<sub>2Y</sub> and M<sub>2R</sub> are the allowable static moments when 2 blocks are used in close contact.

Figure G-19 Direction of Moment



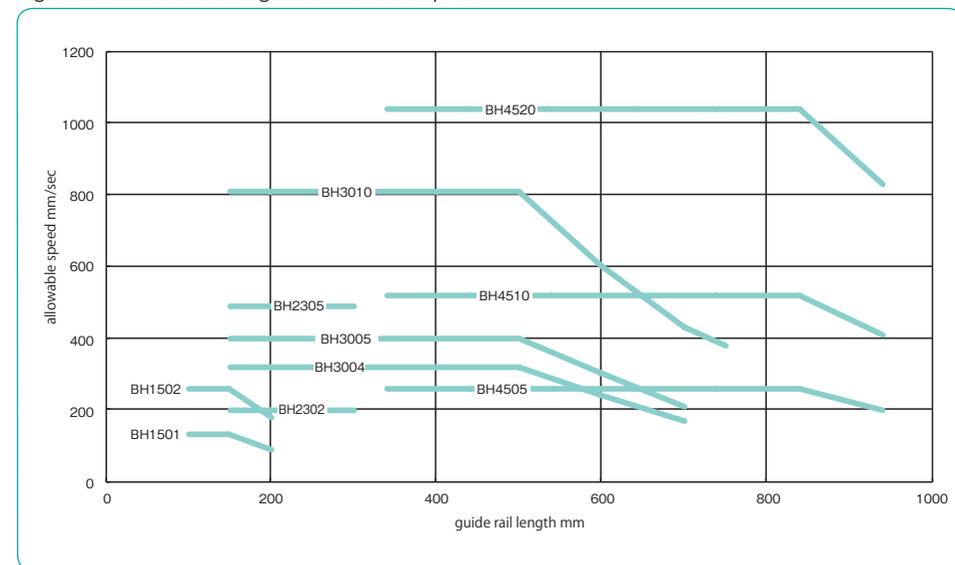
**ALLOWABLE SPEED AND STROKE LIMIT**

Allowable speed of BH type is subject to the type of motor and operating conditions. The speed may also be limited by the critical speed of the ballscrew. Use caution when operating at high speeds or using long rails.

Table G-22 Allowable Speed and Stroke Limit

part number	rail length	stroke limit (mm)				allowable speed (mm/sec)			
		1 long block	2 long blocks	1 short block	2 short blocks	lead1	lead2		
BH15	100	60	-	-	-	133	260		
	150	110	70	-	-				
	200	160	120	-	-				
BH23	150	76	-	-	-	200	490		
	200	126	57	-	-				
	250	176	107	-	-				
	300	226	157	-	-				
BH30	150	60	-	-	-	320	400	810	
	200	110	-	-	-				
	300	210	126	-	-				
	400	310	226	-	-				
	500	410	326	-	-	240	300	600	
	600	510	426	-	-	170	210	430	
	700	610	526	-	-	-	-	380	
	750	660	576	-	-	-	-	-	
Guide rail length 750mm is only available for lead10.									
part number	rail length	stroke limit (mm)				allowable speed (mm/sec)			
		1 long block	2 long blocks	1 short block	2 short blocks	lead5	lead10	lead20	
BH45	340	219	104	249	164	260	520	1,040	
	440	319	204	349	264				
	540	419	304	449	364				
	640	519	404	549	464				
	740	619	504	649	564	200	410	830	
	840	719	604	749	664				
	940	819	704	849	764				

Figure G-20 Guide Rail Length and Allowable Speed



ACCURACY

Table G-23 shows accuracy of BH type.

Table G-23 Accuracy

part number	rail length mm	positioning repeatability		positioning accuracy		running parallelism B		backlash		*starting torque	
		W μ m	U μ m	W μ m	U μ m	W μ m	U μ m	W μ m	U μ m	W N · m	U N · m
BH15	100	± 10	± 5	65		15		20	5	0.010	0.012
	150			70							
	200			75							
BH23	150	± 10	± 5	70		15		20	5	0.03	0.06
	200			75							
	250			85							
BH30	300	± 10	± 5	90		15		20	5	0.07	0.15
	150			70							
	200			80							
BH30	300	± 10	± 5	90		25		20	5	0.07	0.15
	400			95							
	500			100							
	600			110							
	700			120							
	750			130							
BH45	340	± 10	± 5	95		35		20	5	0.1	0.2
	440			100							
	540			110							
	640			120							
	740			130							
	840			150							
940	170										

Above values are measured by using our selected motors.

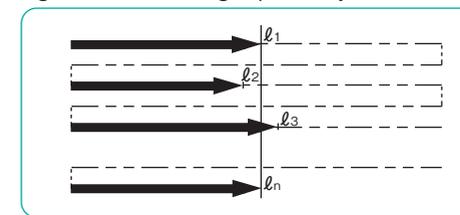
\*Above specifications are based on using NB standard grease. Other grease may cause deviations.

Positioning Repeatability

After setting an arbitrary position, from one end, move the drive block to this position and measure the stop position. Repeat the positioning and measurement process 7 times with respect to the setting position at the midpoint and near both ends of travel. Take the maximum difference and divide it by 2, then indicate it with a positive and negative sign as the test result.

$$\text{Positioning Repeatability} = \pm \frac{1}{2} ((\text{maximum value of } l_n) - (\text{minimum value of } l_n))$$

Figure G-21 Positioning Repeatability

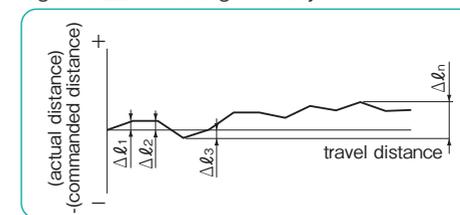


Positioning Accuracy

Positioning is performed in one direction and the resulting position is set as the datum point. Take the difference between the actual travel distance and the commanded travel distance from the datum point. Continuing in the same direction (without returning to the start point) repeat this process randomly several times until nearing to the stroke limit. Express the accuracy by the absolute maximum difference.

$$\text{Positioning Accuracy} = (\Delta l_n)_{\max}$$

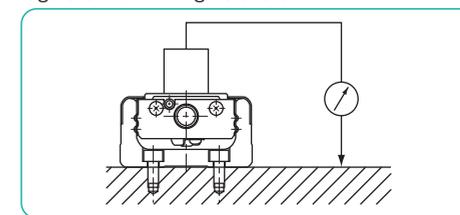
Figure G-22 Positioning Accuracy



Running Parallelism B

After fixing the guide rail onto the surface plate, placing the dial test indicator on the center of the slide block and connecting the indicator probe onto the mounting surface, run the block over the entire travel distance. Take the maximum deviation in readings as the test result.

Figure G-23 Running Parallelism B

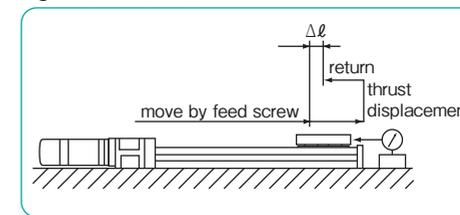


Backlash

Using the feed screw to move the slide block a little, take the dial test indicator reading and make it the datum point. While in this position, thrust the block by a certain force in the same direction without using the feed screw. Release the thrust and read the return, then take the difference from the datum point. Repeat the same process at the midpoint and near both ends of travel. Take the maximum difference as the test result.

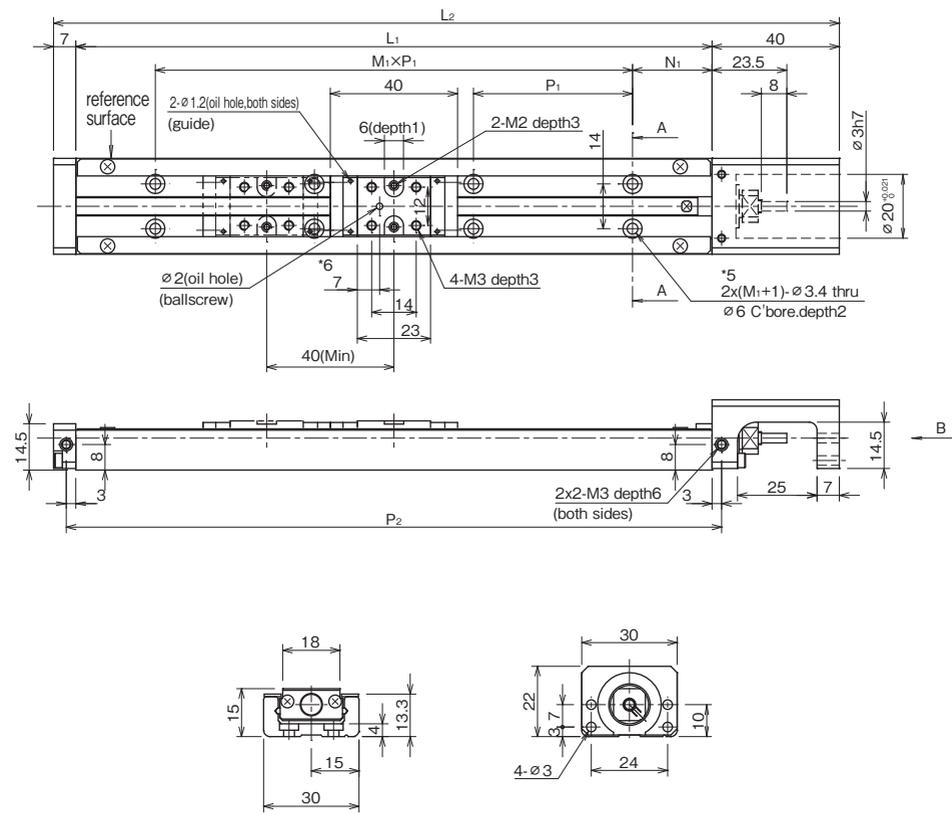
$$\text{Backlash} = \Delta l$$

Figure G-24 Backlash



### BH15 –Without Top Cover–

A(1 long block)  
B(2 long blocks)



section A-A

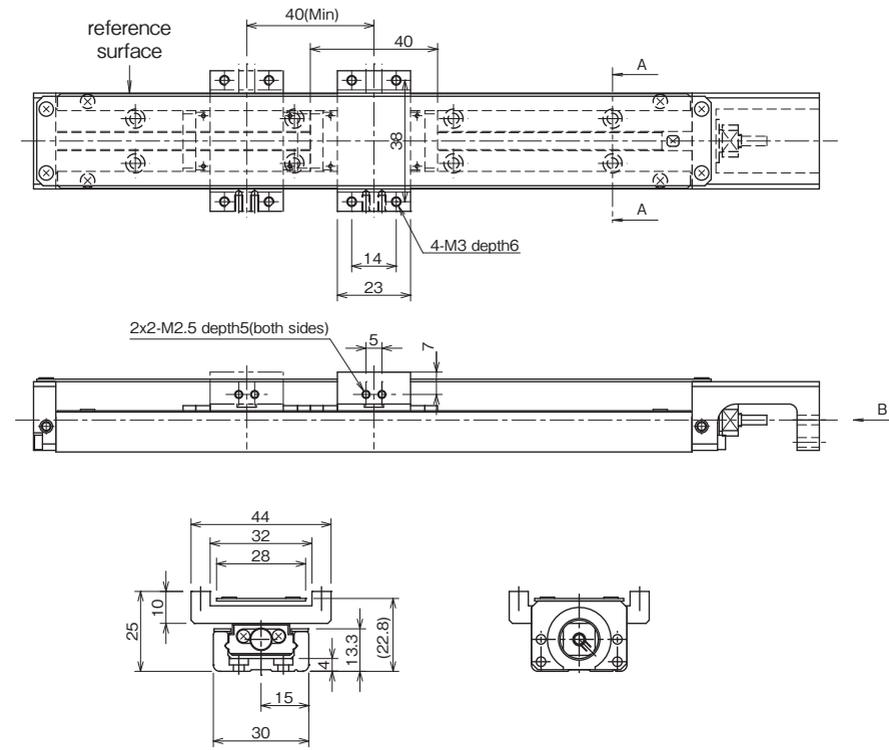
View B (motor bracket A0)  
refer to page G-102 for other motor bracket

part number <sup>3,4</sup>	stroke limit mm <sup>1</sup>	dimensions mm					block mass kg <sup>2</sup>		total mass kg	
		L <sub>1</sub>	L <sub>2</sub>	N <sub>1</sub>	M <sub>1</sub> × P <sub>1</sub>	P <sub>2</sub>	without top cover	with top cover	without top cover	with top cover
BH15 □□ A-100	60	100	147	25	1 × 50	106	0.03	0.05	0.28	0.31
B	—	—	—	—	—	—	—	—	—	—
BH15 □□ A-150	110	150	197	25	2 × 50	156	0.03	0.05	0.36	0.39
B	70						0.06	0.10	0.39	0.44
BH15 □□ A-200	160	200	247	25	3 × 50	206	0.03	0.05	0.45	0.48
B	120						0.06	0.10	0.48	0.53

\*1 : Stroke limit is a drive distance between both ends of the dampers.  
 \*2 : Mass stated "with top cover" includes mass of sub tables.  
 \*3 : For B type (2 long blocks), drive block is located closest to motor bracket side.  
 \*4 : □ is ballscrew lead.  
 \*5 : For mounting guide rail, use provided hexagon socket low head cap screws. (M3x5, stainless)  
 \*6 : The dimension is different depending on the lead. BH1501: 7mm, BH1502: 8mm

### BH15 –With Top Cover–

A(1 long block)  
B(2 long blocks)



section A-A

View B (motor bracket A0)  
refer to page G-102 for other motor bracket

inertia (reference values) unit : kg · m<sup>2</sup>

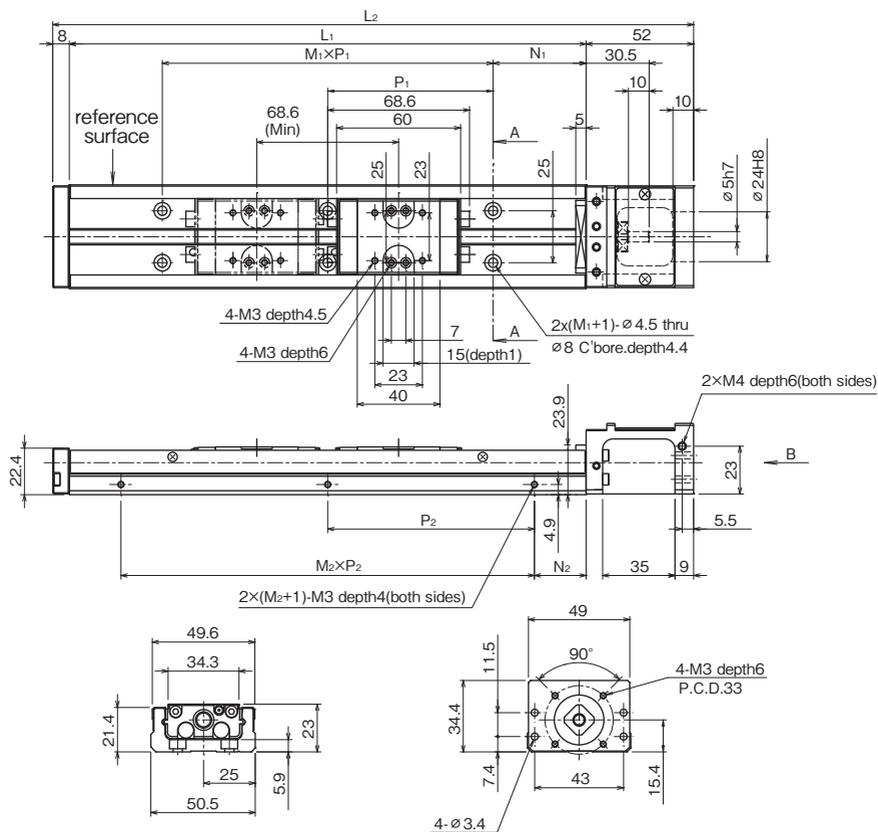
part number	rail length mm	long block			
		without top cover		with top cover	
		A 1 block	B 2 blocks	A 1 block	B 2 blocks
BH1501	100	1.11 × 10 <sup>-7</sup>	—	1.20 × 10 <sup>-7</sup>	—
	150	1.60 × 10 <sup>-7</sup>	1.61 × 10 <sup>-7</sup>	1.61 × 10 <sup>-7</sup>	1.62 × 10 <sup>-7</sup>
	200	2.10 × 10 <sup>-7</sup>	2.11 × 10 <sup>-7</sup>	2.11 × 10 <sup>-7</sup>	2.12 × 10 <sup>-7</sup>
BH1502	100	1.15 × 10 <sup>-7</sup>	—	1.16 × 10 <sup>-7</sup>	—
	150	1.64 × 10 <sup>-7</sup>	1.67 × 10 <sup>-7</sup>	1.66 × 10 <sup>-7</sup>	1.71 × 10 <sup>-7</sup>
	200	2.14 × 10 <sup>-7</sup>	2.17 × 10 <sup>-7</sup>	2.16 × 10 <sup>-7</sup>	2.20 × 10 <sup>-7</sup>

part name	material	remarks
guide rail	carbon steel	black oxide except for raceway grooves
ballscrew shaft	carbon steel	
slide block	chromium-molybdenum steel	
motor bracket	aluminum alloy	black anodizing
housing	aluminum alloy	black anodizing
adapter plate	aluminum alloy	black anodizing
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	

When LB option is selected, steel parts are treated with low temperature black chrome treatment.

### BH23 –Without Top Cover–

A(1 long block)  
B(2 long blocks)



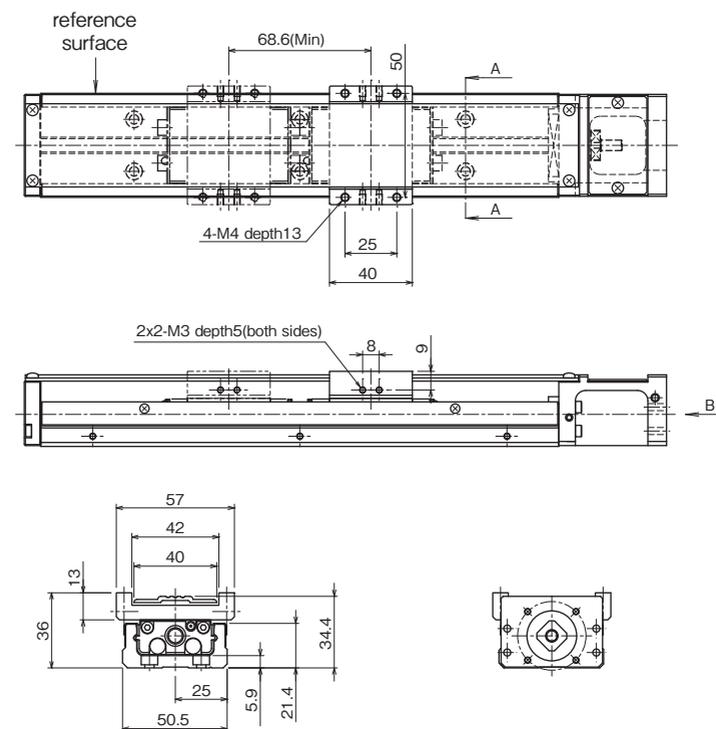
section A-A

View B (motor bracket A0)

refer to page G-103 for other motor bracket

### BH23 –With Top Cover–

A(1 long block)  
B(2 long blocks)



section A-A

View B (motor bracket A0)

refer to page G-103 for other motor bracket

part number <sup>3,4</sup>	stroke limit mm <sup>1</sup>	dimensions mm						block mass kg <sup>2</sup>		total mass kg	
		L <sub>1</sub>	L <sub>2</sub>	N <sub>1</sub>	M <sub>1</sub> × P <sub>1</sub>	N <sub>2</sub>	M <sub>2</sub> × P <sub>2</sub>	without top cover	with top cover	without top cover	with top cover
BH23 □□ A-150	76	150	210	35	1 × 80	25	1 × 100	0.14	0.26	1.00	1.11
B	—	—	—	—	—	—	—	—	—	—	—
BH23 □□ A-200	126	200	260	20	2 × 80	50	1 × 100	0.14	0.26	1.21	1.32
B	57							0.28	0.52	1.35	1.46
BH23 □□ A-250	176	250	310	45		25	2 × 100	0.14	0.26	1.41	1.52
B	107							0.28	0.52	1.56	1.67
BH23 □□ A-300	226	300	360	30	3 × 80	50	2 × 100	0.14	0.26	1.61	1.73
B	157							0.28	0.52	1.76	1.88

\*1: Stroke limit is a drive distance between both ends of the dampers.

\*2: Mass stated "with top cover" includes mass of sub tables.

\*3: For B type (2 long blocks), drive block is located closest to motor bracket side.

\*4: □ is ballscrew lead.

inertia (reference values)

unit : kg · m<sup>2</sup>

part number	rail length mm	long block			
		without top cover		with top cover	
		A 1 block	B 2 blocks	A 1 block	B 2 blocks
BH2302	150	6.07 × 10 <sup>-7</sup>	—	6.15 × 10 <sup>-7</sup>	—
	200	7.64 × 10 <sup>-7</sup>	7.79 × 10 <sup>-7</sup>	7.72 × 10 <sup>-7</sup>	7.87 × 10 <sup>-7</sup>
	250	9.21 × 10 <sup>-7</sup>	9.36 × 10 <sup>-7</sup>	9.29 × 10 <sup>-7</sup>	9.44 × 10 <sup>-7</sup>
	300	1.08 × 10 <sup>-6</sup>	1.09 × 10 <sup>-6</sup>	1.09 × 10 <sup>-6</sup>	1.10 × 10 <sup>-6</sup>
BH2305	150	6.96 × 10 <sup>-7</sup>	—	7.41 × 10 <sup>-7</sup>	—
	200	8.53 × 10 <sup>-7</sup>	9.46 × 10 <sup>-7</sup>	8.98 × 10 <sup>-7</sup>	9.92 × 10 <sup>-7</sup>
	250	1.01 × 10 <sup>-6</sup>	1.10 × 10 <sup>-6</sup>	1.06 × 10 <sup>-6</sup>	1.15 × 10 <sup>-6</sup>
	300	1.17 × 10 <sup>-6</sup>	1.26 × 10 <sup>-6</sup>	1.21 × 10 <sup>-6</sup>	1.31 × 10 <sup>-6</sup>

part name	material	remarks
guide rail	carbon steel	black oxide except for raceway grooves
ballscrew shaft	carbon steel	
slide block	chromium-molybdenum steel	
motor bracket	aluminum alloy	black anodizing
coupling cover	aluminum alloy	black anodizing
housing	aluminum alloy	black anodizing
adapter plate	aluminum alloy	black anodizing
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	

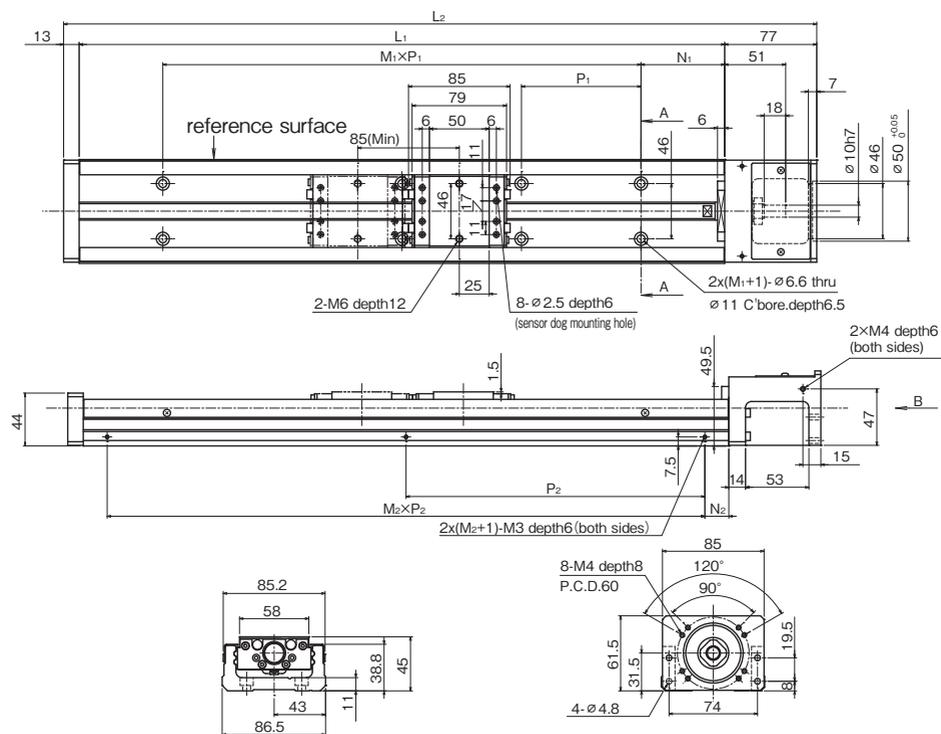
When LB option is selected, steel parts are treated with low temperature black chrome treatment.





### BH45 –Without Top Cover–

C(1 short block)  
D(2 short blocks)



section A-A

View B (motor bracket A0)

refer to page G-106, 107 for other motor bracket

part number <sup>3,4</sup>	stroke limit mm <sup>1</sup>	dimensions mm		block mass kg <sup>2</sup>			total mass kg				
		L <sub>1</sub>	L <sub>2</sub>	N <sub>1</sub>	M <sub>1</sub> × P <sub>1</sub>	N <sub>2</sub>	M <sub>2</sub> × P <sub>2</sub>	without top cover	with top cover		
BH45 □□ C-340	249	340	430	70	2 × 100	20	1 × 300	0.58	0.79	5.7	6.5
	D							164	1.16	1.58	6.3
BH45 □□ C-440	349	440	530		3 × 100		1 × 400	0.58	0.79	7	7.8
	D							264	1.16	1.58	7.6
BH45 □□ C-540	449	540	630		4 × 100		2 × 250	0.58	0.79	8.2	9.2
	D							364	1.16	1.58	8.8
BH45 □□ C-640	549	640	730		5 × 100		2 × 300	0.58	0.79	9.5	10.6
	D							464	1.16	1.58	10.1
BH45 □□ C-740	649	740	830	6 × 100	2 × 350	0.58	0.79	10.7	12		
	D					564	1.16	1.58	11.3	12.8	
BH45 □□ C-840	749	840	930	7 × 100	2 × 400	0.58	0.79	12	13.3		
	D					664	1.16	1.58	12.6	14.1	
BH45 □□ C-940	849	940	1,030	8 × 100	3 × 300	0.58	0.79	13.2	14.7		
	D					764	1.16	1.58	13.8	15.5	

\*1: Stroke limit is a travel distance between both ends of the dampers.

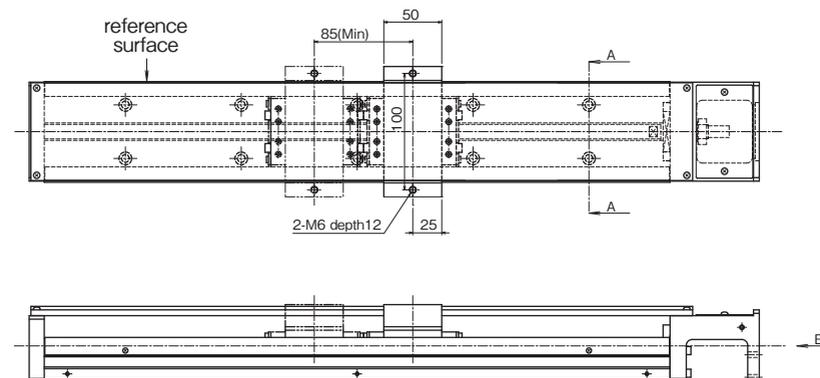
\*2: Mass stated "with top cover" includes mass of sub tables.

\*3: For D type (2 short blocks), drive block is located closest to motor bracket side.

\*4: □ is ballscrew lead.

### BH45 –With Top Cover–

C(1 short block)  
D(2 short blocks)



section A-A

View B (motor bracket A0)

refer to page G-106, 107 for other motor bracket

inertia (reference values)

unit : kg · m<sup>2</sup>

part number	rail length mm	short block			
		without top cover		with top cover	
		C	D	C	D
BH4505	340	1.61 × 10 <sup>-5</sup>	1.64 × 10 <sup>-5</sup>	1.62 × 10 <sup>-5</sup>	1.67 × 10 <sup>-5</sup>
	440	1.99 × 10 <sup>-5</sup>	2.03 × 10 <sup>-5</sup>	2.01 × 10 <sup>-5</sup>	2.06 × 10 <sup>-5</sup>
	540	2.38 × 10 <sup>-5</sup>	2.42 × 10 <sup>-5</sup>	2.40 × 10 <sup>-5</sup>	2.45 × 10 <sup>-5</sup>
	640	2.77 × 10 <sup>-5</sup>	2.81 × 10 <sup>-5</sup>	2.78 × 10 <sup>-5</sup>	2.83 × 10 <sup>-5</sup>
	740	3.16 × 10 <sup>-5</sup>	3.20 × 10 <sup>-5</sup>	3.17 × 10 <sup>-5</sup>	3.22 × 10 <sup>-5</sup>
BH4510	840	3.55 × 10 <sup>-5</sup>	3.59 × 10 <sup>-5</sup>	3.56 × 10 <sup>-5</sup>	3.61 × 10 <sup>-5</sup>
	940	3.94 × 10 <sup>-5</sup>	3.97 × 10 <sup>-5</sup>	3.95 × 10 <sup>-5</sup>	4.00 × 10 <sup>-5</sup>
	340	1.73 × 10 <sup>-5</sup>	1.88 × 10 <sup>-5</sup>	1.78 × 10 <sup>-5</sup>	1.98 × 10 <sup>-5</sup>
	440	2.12 × 10 <sup>-5</sup>	2.27 × 10 <sup>-5</sup>	2.17 × 10 <sup>-5</sup>	2.37 × 10 <sup>-5</sup>
	540	2.51 × 10 <sup>-5</sup>	2.66 × 10 <sup>-5</sup>	2.56 × 10 <sup>-5</sup>	2.76 × 10 <sup>-5</sup>
BH4520	640	2.90 × 10 <sup>-5</sup>	3.05 × 10 <sup>-5</sup>	2.95 × 10 <sup>-5</sup>	3.15 × 10 <sup>-5</sup>
	740	3.28 × 10 <sup>-5</sup>	3.44 × 10 <sup>-5</sup>	3.33 × 10 <sup>-5</sup>	3.54 × 10 <sup>-5</sup>
	840	3.67 × 10 <sup>-5</sup>	3.82 × 10 <sup>-5</sup>	3.72 × 10 <sup>-5</sup>	3.93 × 10 <sup>-5</sup>
	940	4.06 × 10 <sup>-5</sup>	4.21 × 10 <sup>-5</sup>	4.11 × 10 <sup>-5</sup>	4.31 × 10 <sup>-5</sup>
	340	2.23 × 10 <sup>-5</sup>	2.84 × 10 <sup>-5</sup>	2.43 × 10 <sup>-5</sup>	3.24 × 10 <sup>-5</sup>
BH4520	440	2.62 × 10 <sup>-5</sup>	3.23 × 10 <sup>-5</sup>	2.82 × 10 <sup>-5</sup>	3.63 × 10 <sup>-5</sup>
	540	3.01 × 10 <sup>-5</sup>	3.62 × 10 <sup>-5</sup>	3.21 × 10 <sup>-5</sup>	4.02 × 10 <sup>-5</sup>
	640	3.40 × 10 <sup>-5</sup>	4.00 × 10 <sup>-5</sup>	3.60 × 10 <sup>-5</sup>	4.41 × 10 <sup>-5</sup>
	740	3.78 × 10 <sup>-5</sup>	4.39 × 10 <sup>-5</sup>	3.99 × 10 <sup>-5</sup>	4.80 × 10 <sup>-5</sup>
	840	4.17 × 10 <sup>-5</sup>	4.78 × 10 <sup>-5</sup>	4.38 × 10 <sup>-5</sup>	5.19 × 10 <sup>-5</sup>
940	4.56 × 10 <sup>-5</sup>	5.17 × 10 <sup>-5</sup>	4.76 × 10 <sup>-5</sup>	5.57 × 10 <sup>-5</sup>	

part name	material	remarks
guide rail	carbon steel	black oxide except for raceway grooves
ballscrew shaft	carbon steel	
slide block	chromium-molybdenum steel	
motor bracket	aluminum alloy	black baked paint coating
coupling cover	aluminum alloy	black anodizing
housing	aluminum alloy	black anodizing
adapter plate	aluminum alloy	black anodizing
dust cover	aluminum alloy	white anodizing
sub table	aluminum alloy	white anodizing
top cover	aluminum alloy	

When LB option is selected, steel parts are treated with low temperature black chrome treatment.

MOTOR BRACKET CONFIGURATIONS & APPLICABLE MOTORS

NB provides optional motor brackets and adapter plates to easily install most popular motors.

Table G-24 (1) Applicable Motors

Applicable motors		Output	BH15	BH23	BH30	BH45		
			P.G-102	P.G-103	P.G-104 ~ 105	P.G-106 ~ 107		
AC Servo motor	Panasonic	A5	MSME5A	50W	—	A3	A2	A5
			MSME01	100W	—	—	—	—
			MSME02	200W	—	—	—	—
			MSME04	400W	—	—	—	A2
			MSME08	750W	—	—	—	—
		A6	MSMF5A	50W	—	A3	A2	A5
			MSMF01	100W	—	—	—	—
			MSMF02	200W	—	—	—	A2
	MSMF04		400W	—	—	—	—	
	MITSUBISHI ELECTRIC	J3	HF-KP(MP)053	50W	—	A1	A1	A4
			HF-KP(MP)13	100W	—	—	—	—
			HF-KP(MP)23	200W	—	—	A7	A1
			HF-KP(MP)43	400W	—	—	—	—
			HF-KP(MP)73	750W	—	—	—	—
		J4	HG-AKO136	10W	A1	—	—	—
			HG-AKO236	20W	—	—	—	—
HG-AKO336			30W	—	—	—	—	
HG-KR(MR)053			50W	—	A1	A1	A4	
HG-KR(MR)13			100W	—	—	—	—	
HG-KR(MR)23			200W	—	—	A7	A1	
HG-KR(MR)43			400W	—	—	—	—	
YASKAWA ELECTRIC	Σ - V mini	SGMMV-A1	10W	A1	—	—	—	
		SGMMV-A2	20W	—	—	—	—	
		SGMMV-A3	30W	—	—	—	—	
	Σ - V	SGMJV(SGMAV)-A5	50W	—	A1	A1	A4	
		SGMJV(SGMAV)-01	100W	—	—	—	—	
		SGMAV-C2	150W	—	—	—	—	
		SGMJV(SGMAV)-02	200W	—	—	A7	A1	
		SGMJV(SGMAV)-04	400W	—	—	—	—	
		SGMAV-06	550W	—	—	—	—	
		SGMJV(SGMAV)-08	750W	—	—	—	—	
		SGM7J(SGM7A)-A5	50W	—	A1	A1	A4	
	Σ - 7	SGM7J(SGM7A)-01	100W	—	—	—	—	
		SGM7J(SGM7A)-C2	150W	—	—	—	—	
		SGM7J(SGM7A)-02	200W	—	—	A7	A1	
		SGM7J(SGM7A)-04	400W	—	—	—	—	
SGM7J(SGM7A)-06		600W	—	—	—	—		
SGM7J(SGM7A)-08	750W	—	—	—	—			

Table G-24 (2) Applicable Motors

Applicable motors		Output	BH15	BH23	BH30	BH45		
			P.G-102	P.G-103	P.G-104 ~ 105	P.G-106 ~ 107		
AC Servo motor	SANYO DENKI	Q	Q1AA04003D	30W	—	A1	A1	A4
			Q1AA04005D	50W	—	—	—	—
			Q1AA04010D	100W	—	—	—	—
			Q1AA06020D	200W	—	—	A7	A1
			Q1AA06040D	400W	—	—	—	—
			Q1AA07075D	750W	—	—	—	—
		R	R2AA04005	50W	—	A1	A1	A4
			R2AA04010	100W	—	—	—	—
			R2AA06020	200W	—	—	A7	A1
			R2AA06040	400W	—	—	—	—
	R2AA08075	750W	—	—	—	—		
	OMRON	G	R88M-G05030	50W	—	A1	A1	A4
			R88M-G10030	100W	—	—	—	—
			R88M-G20030	200W	—	—	—	A2
			R88M-G40030	400W	—	—	—	—
			R88M-G75030	750W	—	—	—	—
		G5	R88M-K05030	50W	—	A1	A1	A4
			R88M-K10030	100W	—	—	—	—
			R88M-K20030	200W	—	—	—	A2
			R88M-K40030	400W	—	—	—	—
			R88M-K75030	750W	—	—	—	—
			R88M-1M10030	100W	—	A1	A1	A4
		1S	R88M-1M20030	200W	—	—	—	A2
			R88M-1M40030	400W	—	—	—	—
			R88M-1M75030	750W	—	—	—	—
		KEYENCE	MV	MV-M005	50W	—	A1	A1
	MV-M010			100W	—	—	—	—
	MV-M020			200W	—	—	A7	A1
	MV-M040			400W	—	—	—	—
	MV-M075			750W	—	—	—	—
	SV		SV(SV2)-M005	50W	—	A1	A1	A4
			SV(SV2)-M010	100W	—	—	—	—
			SV(SV2)-M020	200W	—	—	A7	A1
			SV(SV2)-M040	400W	—	—	—	—
			SV(SV2)-M075	750W	—	—	—	—
	FANUC	β is	β is0.2/5000	50W	—	A1	A1	A4
β is0.3/5000			100W	—	—	—	—	
β is0.4/5000 ※			130W	—	—	A7	A1	
β is0.5/6000 ※			350W	—	—	—	—	
β is1/6000			500W	—	—	—	—	

※Please contact NB for the coupling because the motor shaft length will be shortened. NB can provide other types of motor brackets. Please contact NB for details.

MOTOR BRACKET CONFIGURATIONS & APPLICABLE MOTORS

Table G-25 (1) Applicable Motors

Applicable motors				Flange	BH15	BH23	BH30	BH45	
					P.G-102	P.G-103	P.G-104 ~ 105	P.G-106 ~ 107	
Stepper motor	ORIENTAL MOTOR	α step	AR	AR2	□ 28	A3	A6	—	—
				AR46	□ 42	—	A5	B1	—
				AR6	□ 60	—	—	A4	A6
			AZ	AZM2	□ 28	A3	A6	—	—
				AZM4	□ 42	—	A5	B1	—
				AZM6	□ 60	—	—	A4	A6
		5 phase motor	RK II	RKS54	□ 42	—	A5	B1	—
				RKS56	□ 60	—	—	A4	A6
				CRK52	□ 28	A3	A6	—	—
			CRK	CRK54	□ 42	—	A5	B1	—
				CRK56	□ 60	—	—	A4	A6
				CVK (PKP)	PKP52	□ 28	A3	A6	—
	PKP54	□ 42	—		A5	B1	—		
	PKP56	□ 56.4	—		—	A5	—		
	2 phase motor	CVK (PKP)	PKP22	□ 28	A3	A6	—	—	
			PKP24	□ 42	—	A5	B1	—	
			PKP26	□ 56.4	—	—	A5	—	
		5 phase motor	F5	SH528	□ 28	A3	A6	—	—
				SM542	□ 42	—	A5	B1	—
				SM560	□ 60	—	—	A4	A6
	2 phase motor	F2	SH228	□ 28	A3	A6	—	—	
			SH142,103H52	□ 42	—	A5	B1	—	
			103H712	□ 56.4	—	—	A5	—	
			103H782 (connector type)	□ 60	—	—	A4	A6	
TECHNO DRIVE	5 phase motor	□ K-S54 □	□ 42	—	A5	B1	—		
		□ K-S(M)56 □	□ 60	—	—	A4	A6		

NB can provide other types of motor brackets. Please contact NB for details.

Table G-25 (2) Applicable Motors

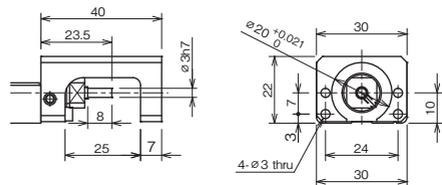
Applicable motors				Flange	BH15	BH23	BH30	BH45
					P.G-102	P.G-103	P.G-104 ~ 105	P.G-106 ~ 107
Stepper motor	TAMAGAWA SEIKI	2 phase motor	TS3641	□ 28	A3	A6	—	—
			TS3617	□ 42	—	A5	B1	—
			TS3690	□ 56.4	—	—	A5	—
		5 phase motor	TS3667	□ 42	—	A5	B1	—
			TS3624 *	□ 60	—	—	A4	A6
			i-STEP	TS3699N112	□ 28	A3	A6	—
	TS3699N172	□ 42		—	A5	B1	—	
	TS3699N231(N232)	□ 56.4		—	—	A5	—	
	sammei electronics	Si servo	TS3641	□ 28	A3	A6	—	—
			TS3617	□ 42	—	A5	B1	—
			TS3653	□ 56.4	—	—	A5	—
		Si super	SM-L5MH	□ 28	A3	A6	—	—
SM-02MH/SM-04MH			□ 42	—	A5	B1	—	
SM-09MH/SM-12MH			□ 56.4	—	—	A5	—	

※Please contact NB for the coupling because the motor shaft length will be shortened.

# BH15

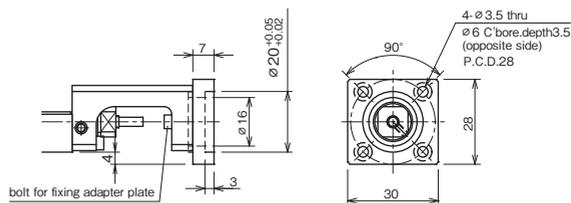
Figures inside( ) indicates mass of the motor mount adapter plate.

## A0



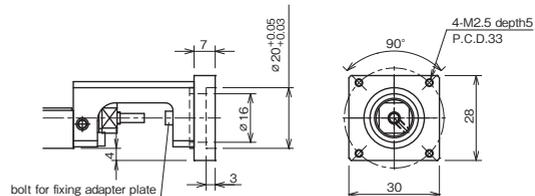
## A1 (Mass:10g)

Recommended Coupling:  
 XBW-15C2(Nabeya Bi-tech Kaisha)  
 LAD-15C(Sakai Manufacturing Co., Ltd.)  
 SFC-005DA2(Miki Pulley Co., Ltd.)



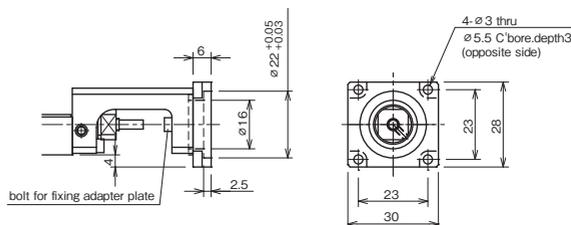
## A2 (Mass:10g)

Recommended Coupling:  
 XBW-15C2(Nabeya Bi-tech Kaisha)  
 SFC-005DA2(Miki Pulley Co., Ltd.)



## A3 (Mass:10g)

Recommended Coupling:  
 XBW-15C2(Nabeya Bi-tech Kaisha)  
 LAD-15C(Sakai Manufacturing Co., Ltd.)  
 SFC-005DA2(Miki Pulley Co., Ltd.)

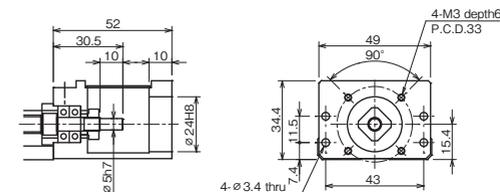


For configurations A1 and A3, attach the motor to the motor mount adapter plate first before mounting it to actuator.

# BH23

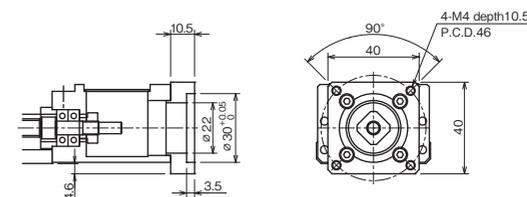
Figures inside( ) indicates mass of the motor mount adapter plate.

## A0



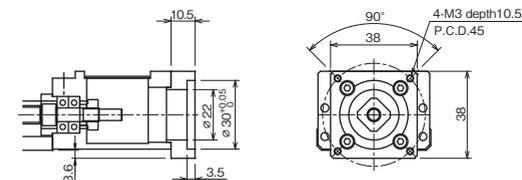
## A1 (Mass:28g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



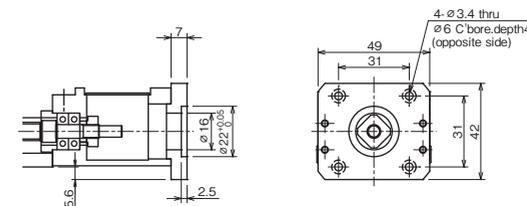
## A3 (Mass:24g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



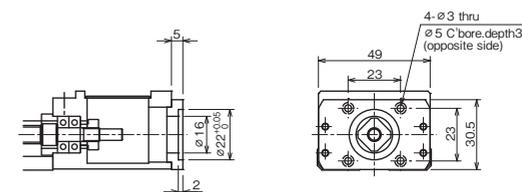
## A5 (Mass:32g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



## A6 (Mass:16g)

Recommended Coupling:  
 XBW-19C2(Nabeya Bi-tech Kaisha)  
 LAD-20C(Sakai Manufacturing Co., Ltd.)  
 SFC-010DA2(Miki Pulley Co., Ltd.)



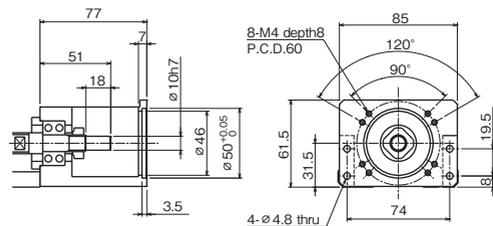
For configurations A5 and A6, attach the motor to the motor mount adapter plate first before mounting it to actuator.



# BH45

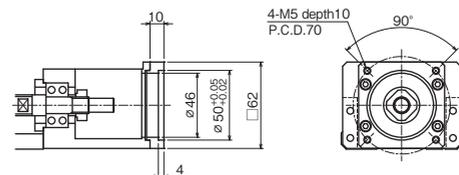
Figures inside ( ) indicates mass of the motor mount adapter plate.

## A0



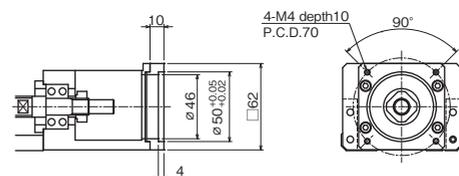
## A1 (Mass:53g)

Recommended Coupling:  
 XBW-34C3(Nabeya Bi-tech Kaisha)  
 LAD-30C (Sakai Manufacturing Co., Ltd.)  
 SFC-030DA2 (Miki Pulley Co., Ltd.)



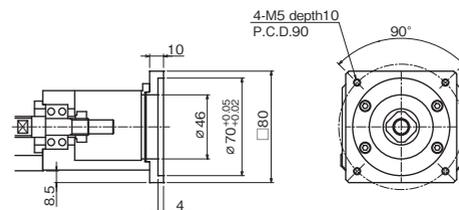
## A2 (Mass:53g)

Recommended Coupling:  
 XBW-34C3(Nabeya Bi-tech Kaisha)  
 LAD-30C (Sakai Manufacturing Co., Ltd.)  
 SFC-030DA2 (Miki Pulley Co., Ltd.)



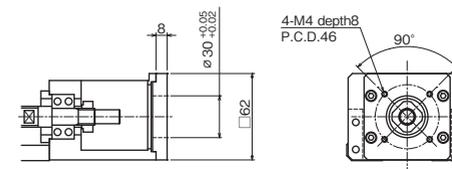
## A3 (Mass:103g)

(200W-400W)  
 Recommended Coupling:  
 XBW-34C3(Nabeya Bi-tech Kaisha)  
 SFC-030DA2 (Miki Pulley Co., Ltd.)  
 (750W)  
 Recommended Coupling:  
 XBW-39C2 (Nabeya Bi-tech Kaisha)  
 SFC-040DA2 (Miki Pulley Co., Ltd.)



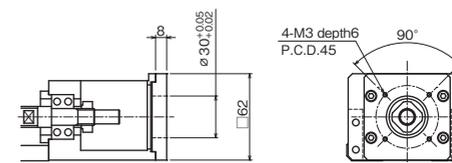
## A4 (Mass:73g)

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)  
 LAD-25C (Sakai Manufacturing Co., Ltd.)  
 SFC-020DA2 (Miki Pulley Co., Ltd.)



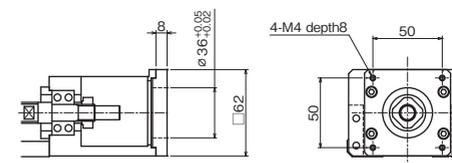
## A5 (Mass:73g)

Recommended Coupling:  
 XBW-25C2(Nabeya Bi-tech Kaisha)  
 LAD-25C (Sakai Manufacturing Co., Ltd.)  
 SFC-020DA2 (Miki Pulley Co., Ltd.)



## A6 (Mass:64g)

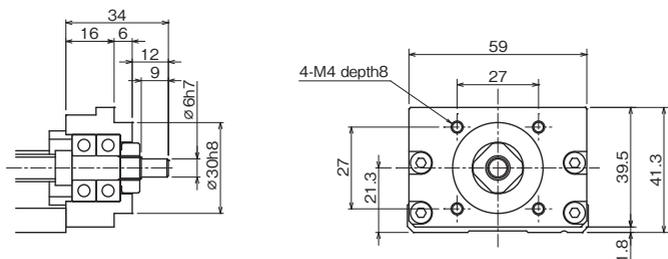
Recommended Coupling:  
 XBW-27C2(Nabeya Bi-tech Kaisha)  
 LAD-25C (Sakai Manufacturing Co., Ltd.)\*  
 SFC-020DA2 (Miki Pulley Co., Ltd.)\*  
 \*Please contact NB if you are using aSTEP motor (Oriental Motor Co., Ltd.)



EXPOSED BRACKET R0

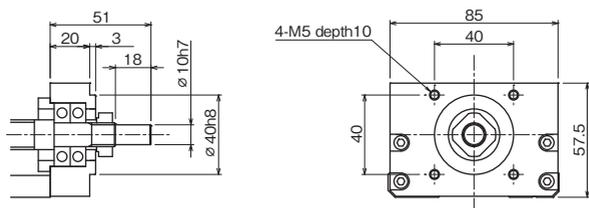
The BH type ballscrew shaft end is exposed with the exposed bracket R0 type. Please fabricate an original bracket in case the standard brackets are not applicable. R0 type is applicable with cover and with sensors.

BH30



Mass is 0.085kg less than the mass in the table on page G-92.

BH45

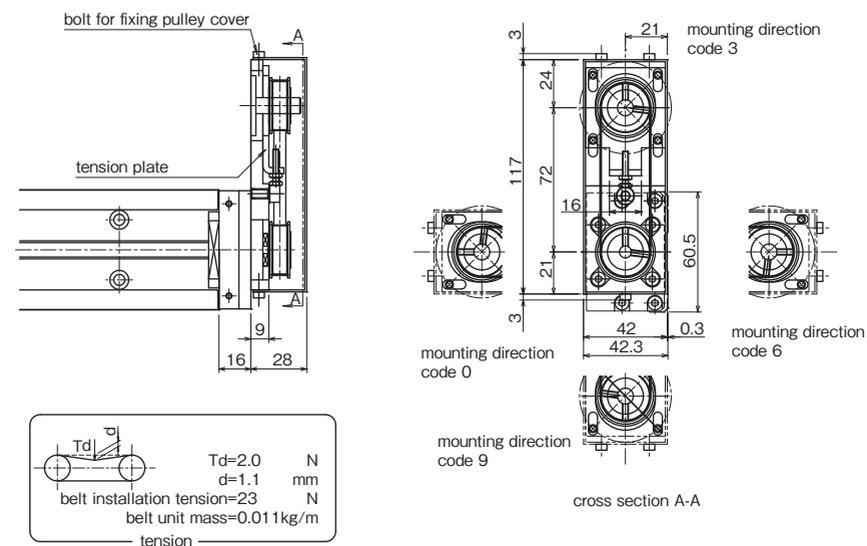


Mass is 0.26kg less than the mass in the table on page G-94 and G-96.

RETURN PULLEY UNIT

Return pulley units in which a motor is connected with a timing belt are available for BH type. Its return structure allows the reduction of total length (available for BH30 and BH45).

BH30

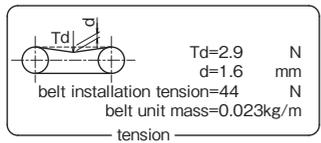
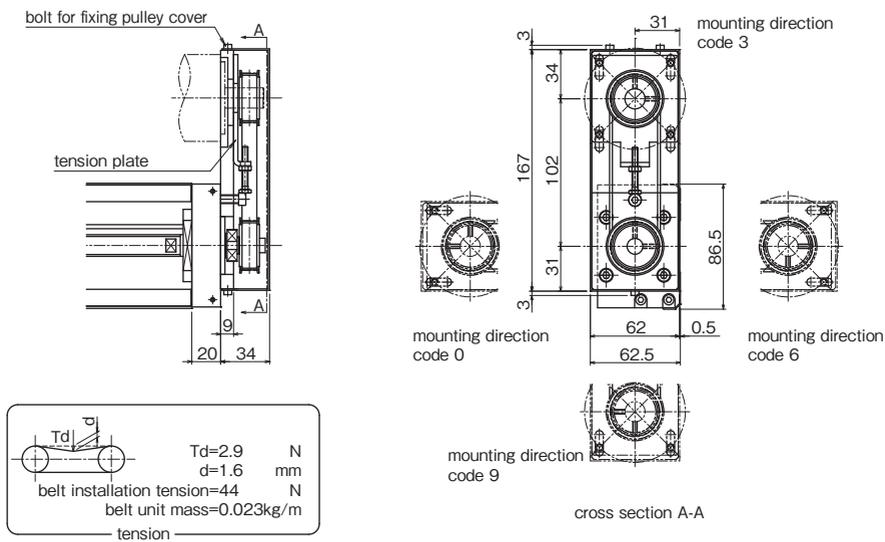


1. Installation position of Pulley Unit can be selected at 90° intervals (mounting direction code).
2. Applicable with cover and with sensors.
3. 0.2kg is added to the mass on page G-92.
4. Inertia is added 2.22x10<sup>-6</sup>kg · m<sup>2</sup> to the value on page G-93.
5. Part number structure BH30\*\*\*-\*\*\*\*/☆☆□  
 ☆☆: Symbol of applicable motor bracket (refer to Table G-26)  
 □: Mounting direction code (refer to cross section A-A)

Table G-26 Applicable Motor Bracket

motor bracket	applicable motors		rated output	flange	motor shaft dia.
RA	Panasonic	MINAS SERIES	50 ~ 100 W	□ 38	φ 8
RB	YASKAWA ELECTRIC	SIGMA SERIES	50 ~ 100 W	□ 40	φ 8
	MITSUBISHI ELECTRIC	MELSERVO SERIES	50 ~ 100 W	□ 40	
	SANYO DENKI	SANMOTION Q1 SERIES	50 ~ 100 W	□ 40	

# BH45



- 1.Installation position of Pulley Unit can be selected at 90° intervals (mounting direction code).
- 2.Applicable with cover and with sensors.
- 3.0.7kg is added to the mass on page G-94 and G-96.
- 4.Inertia is added  $1.24 \times 10^{-5} \text{kg} \cdot \text{m}^2$  to the value on page G-95 and G-97.
- 5.Part number structure BH45\*\*\*\*\*/☆☆□  
 ☆☆☆: Symbol of applicable motor bracket (refer to Table G-27)  
 □: Mounting direction code (refer to cross section A-A)

Table G-27 Applicable Motor Bracket

motor bracket	applicable motors		rated output	flange	motor shaft dia.
RA	Panasonic	MINAS SERIES	200 W	□ 60	φ 11
RB	YASKAWA ELECTRIC	SIGMA SERIES	200 W	□ 60	φ 14
	MITSUBISHI ELECTRIC	MELSERVO SERIES	200 W	□ 60	
	SANYO DENKI	SANMOTION Q1 SERIES	200 W	□ 60	
RC	5 PHASE STEPPING MOTOR		—	□ 60	φ 8

## SENSOR

Photomicro sensor or proximity sensor can be attached to the BH actuator with our optional sensor-mounting rail (refer to Table G-28). Tapped holes are machined on both sides of the guide rail, allowing attachment of sensor rail to either side. The case without special instruction from customer, standard positioning would be to the left of the motor mount end. When with two blocks, sensor dog is attached on the driving block as standard. Please change to attach sensor dog on the driven block if necessary.

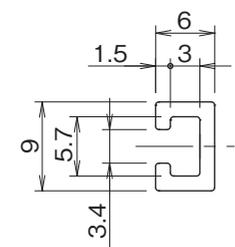
Table G-28 Standard (NPN) Sensor

sensor symbol	sensor type	BH15	BH23	BH30	BH45
S	slim/compact type photomicro sensor	—	PM-L25 [3 pcs] *1 (SUNX)	EE-SX674 [3 pcs] *2 (OMRON)	
K	proximity sensor (N.C. contact) *3		APM-D3B1 [2 pcs]*1 APM-D3B1F [1 pc]*1*4 (Azbil)		

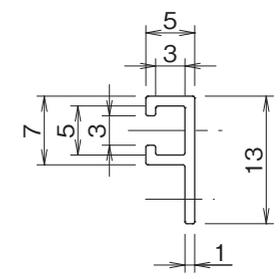
- \*1: length of cable: 1m
- \*2: 3 pcs of connector EE-1001 (OMRON) will be attached
- \*3: normal close contact
- \*4: different frequency type

Figure G-25 Sensor Rail

### BH15



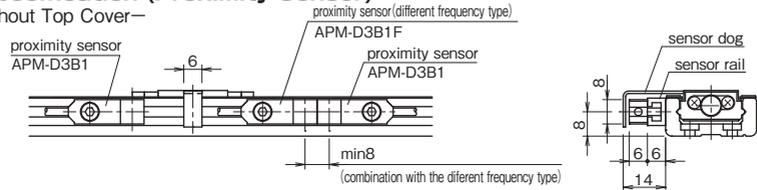
### BH23, 30, 45



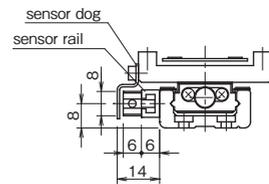
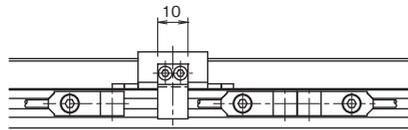
# BH15

## K Specification (Proximity Sensor)

—Without Top Cover—



—With Top Cover—

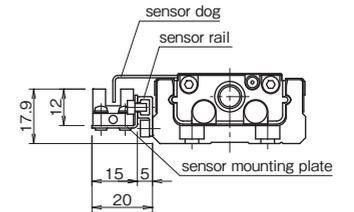
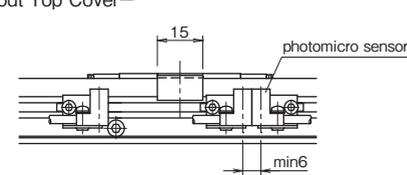


accessories		
part name	qty	
proximity sensor: APM-D3B1 (Azbil)	2 pcs	
proximity sensor (different frequency type): APM-D3B1F (Azbil)	1 pc	
sensor rail	1 pc	
sensor dog	1 pc	

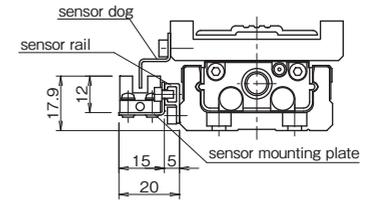
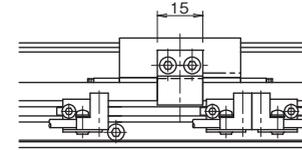
# BH23

## S Specification (Compact Photomicro Sensor)

—Without Top Cover—



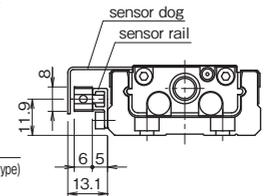
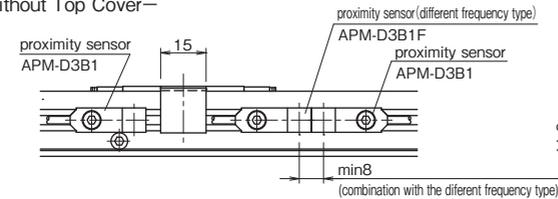
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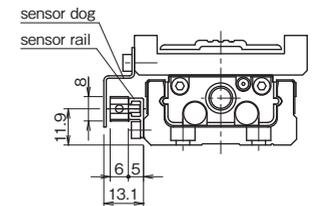
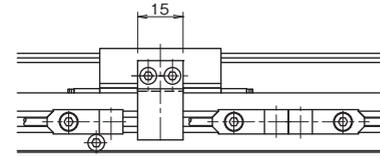
accessories		
part name	qty	
photomicro sensor: PM-L25 (SUNX)	3 pcs	
sensor mounting plate	3 pcs	
sensor rail	1 pc	
sensor dog	1 pc	

## K Specification (Proximity Sensor)

—Without Top Cover—



—With Top Cover—

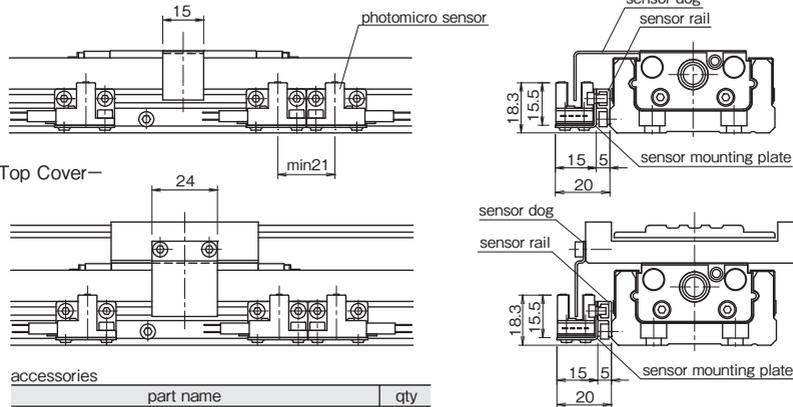


accessories		
part name	qty	
proximity sensor: APM-D3B1 (Azbil)	2 pcs	
proximity sensor (different frequency type): APM-D3B1F (Azbil)	1 pc	
sensor rail	1 pc	
sensor dog	1 pc	

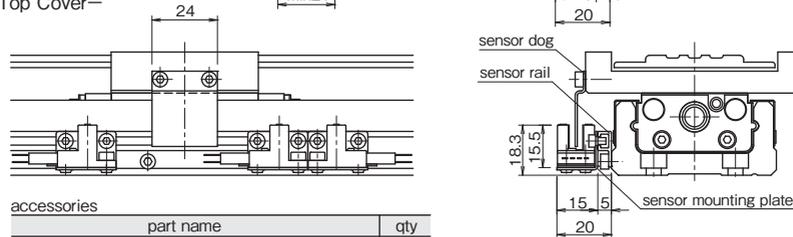
### BH30

#### S Specification (Slim-Type Photomicro Sensor)

—Without Top Cover—



—With Top Cover—

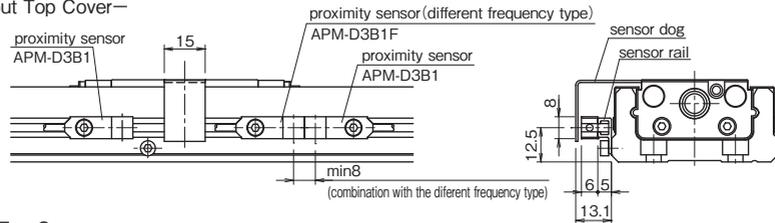


accessories

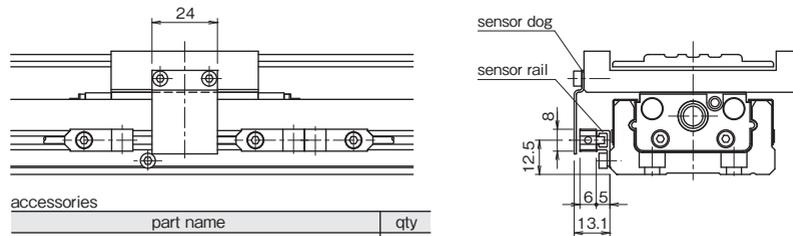
part name	qty
photomicro sensor: EE-SX674 (OMRON)	3 pcs
connector: EE-1001 (OMRON)	3 pcs
sensor mounting plate	3 pcs
sensor rail	1 pc
sensor dog	1 pc

#### K Specification (Proximity Sensor)

—Without Top Cover—



—With Top Cover—



accessories

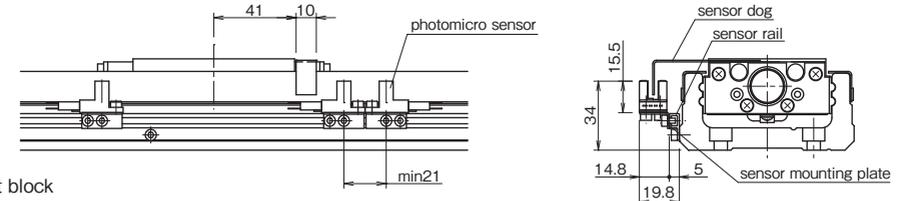
part name	qty
proximity sensor: APM-D3B1 (Azbil)	2 pcs
proximity sensor (different frequency type): APM-D3B1F (Azbil)	1 pc
sensor rail	1 pc
sensor dog	1 pc

### BH45

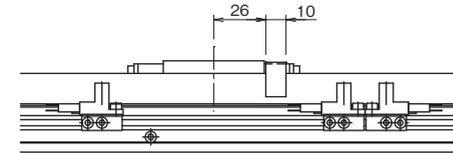
#### S Specification (Slim-Type Photomicro Sensor)

—Without Top Cover—

long block

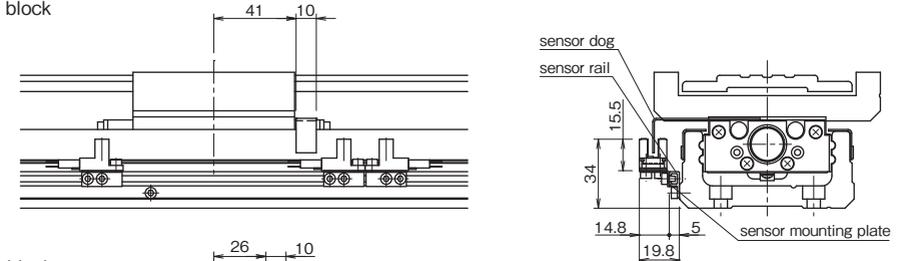


short block

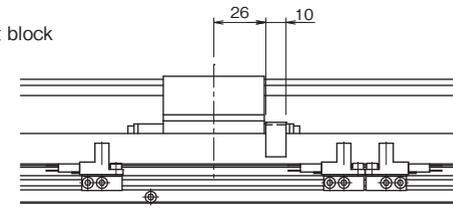


—With Top Cover—

long block



short block



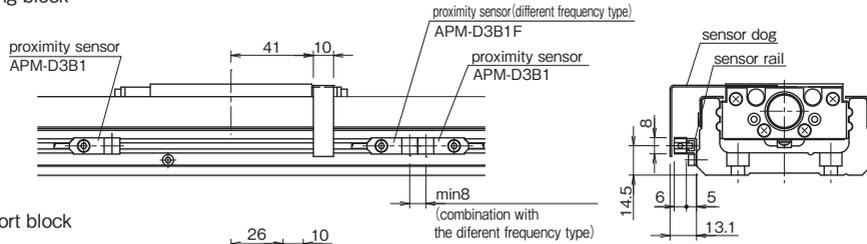
accessories

part name	qty
photomicro sensor: EE-SX674 (OMRON)	3 pcs
connector: EE-1001 (OMRON)	3 pcs
sensor mounting plate	3 pcs
sensor rail	1 pc
sensor dog	1 pc

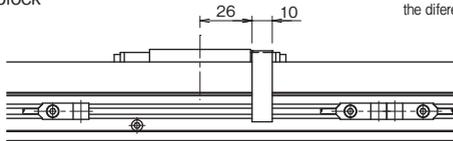
# BH45

## K Specification (Proximity Sensor)

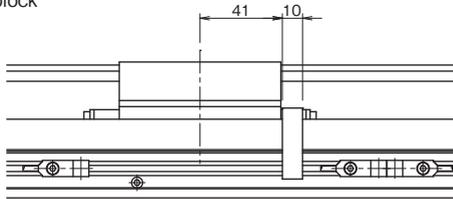
—Without Top Cover—  
long block



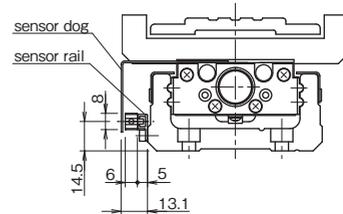
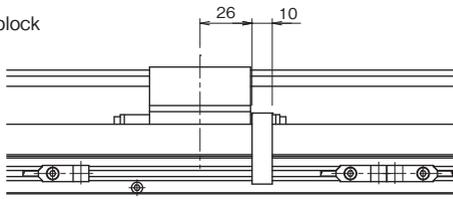
short block



—With Top Cover—  
long block



short block



## PNP SENSOR

For the BH type sensors can be changed to the PNP type by adding a sensor option code “PNP” at the end of the part number. Refer to Table G-29 for the model number of PNP type sensors.

Table G-29 Standard (PNP) Sensor

sensor symbol	sensor type	BH15	BH23	BH30	BH45
S	slim/compact type photomicro sensor	—	PM-L25-P [3 pcs] <sup>*1</sup> (SUNX)	EE-SX674P [3 pcs] <sup>*2</sup> (OMRON)	
K	proximity sensor (N.C. contact) <sup>*3</sup>		APM-D3E1 [2 pcs] <sup>*1</sup> APM-D3E1F [1 pc] <sup>*1*4</sup> (Azbil)		

<sup>\*1</sup>: length of cable: 1m

<sup>\*2</sup>: 3 pcs of connector EE-1001 (OMRON) will be attached

<sup>\*3</sup>: normal close contact

<sup>\*4</sup>: different frequency type

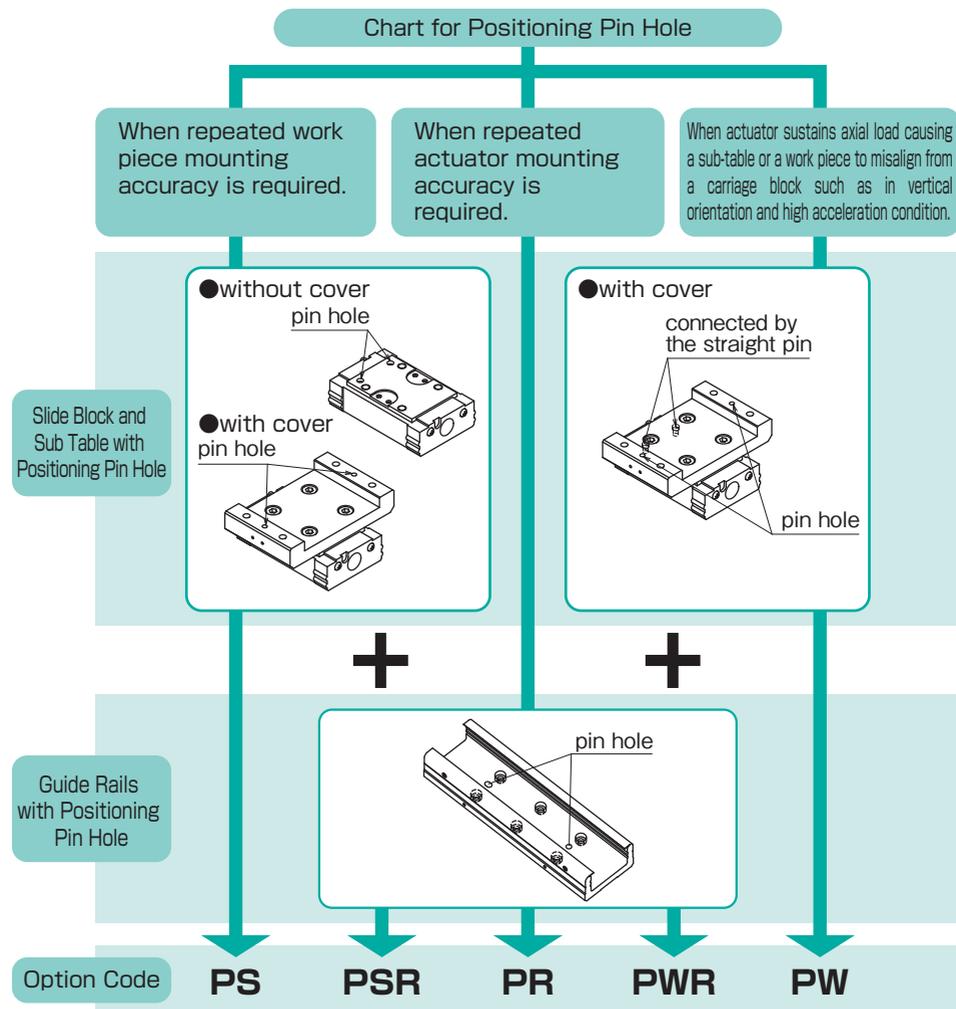
accessories

part name	qty
proximity sensor: APM-D3B1 (Azbil)	2 pcs
proximity sensor (different frequency type): APM-D3B1F (Azbil)	1 pc
sensor rail	1 pc
sensor dog	1 pc

## POSITIONING PIN HOLE

For the BH type, positioning pin holes can be provided on the slide block and sub table by adding the option code "PS" or "PW" in the end of the part number.

The option code "PR" is used to provide the guide rail with positioning pin holes. When positioning pin holes are necessary on both the slide block/sub table and guide rail, please add the option code "PSR" or "PWR"



### Positioning Pin Hole for Slide Block and Sub Table

It is useful when exacting reassembly positioning is required. In case of two blocks used, both blocks are processed.

When the code "PS" is specified, the drilling hole is processed only on the mounting surface (slide block or sub table). When the code "PW" is specified for a BH with a top cover, the slide block and sub table are connected by the straight pins at the location where the "PS" option specifies on the slide block.

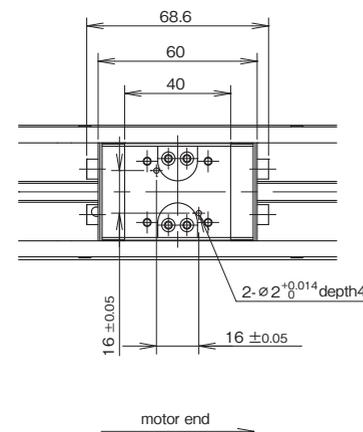
Note that NB does not supply straight pins for the "PS" option.

## BH15A,B (long block)

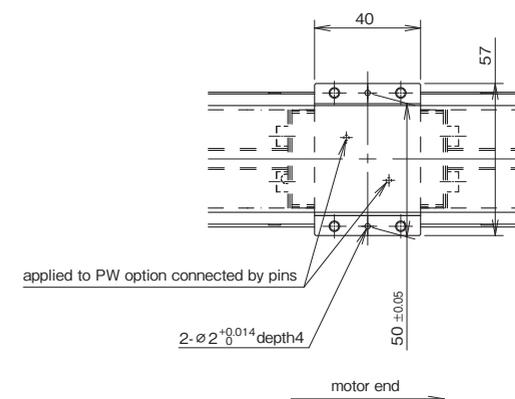
Positioning pin hole option is not available for BH15.

## BH23A,B (long block)

- PS Option Without Top Cover -

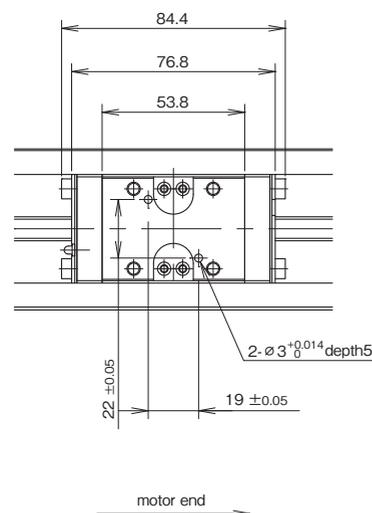


- PS Option With Top Cover -

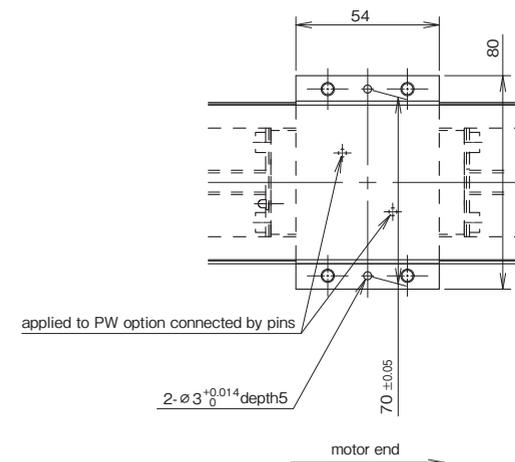


## BH30A,B (long block)

- PS Option Without Top Cover -

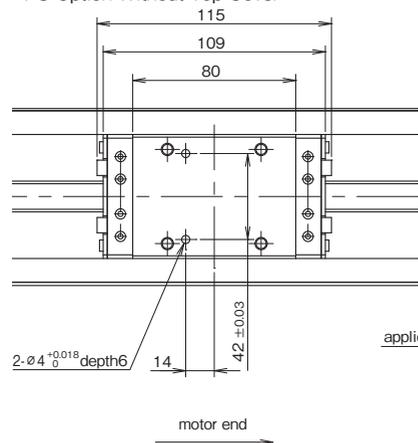


- PS Option With Top Cover -

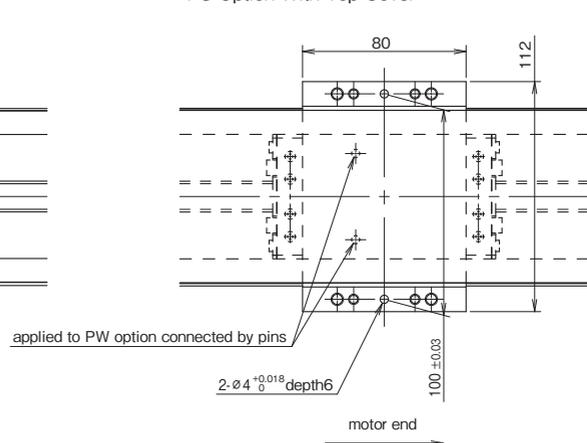


### BH45A,B (long block)

- PS Option Without Top Cover -

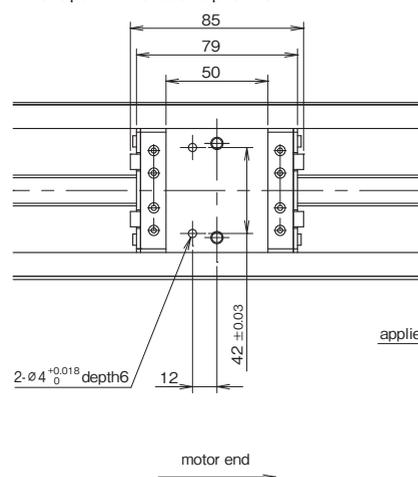


- PS Option With Top Cover -

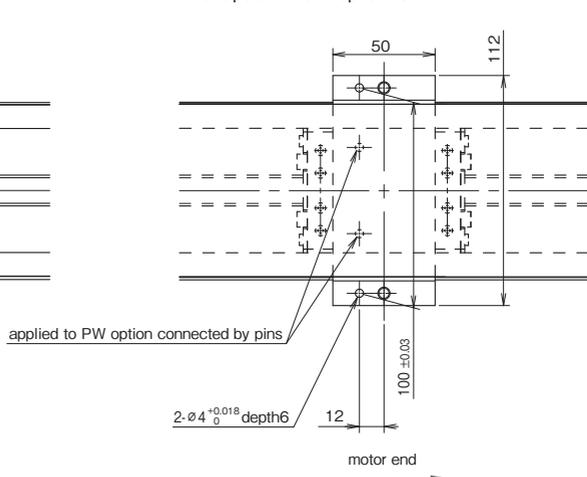


### BH45C,D (short block)

- PS Option Without Top Cover -



- PS Option With Top Cover -



### POSITIONING PIN HOLE FOR GUIDE RAIL

It is useful to use positioning pin holes on the guide rail when exacting reassembly positioning is required. NB does not supply straight pins.

After the insertion of the straight pins in the BH guide rail base, the pins might interfere with the slide block. In the positioning process, please consider the BH base thickness. The length of the pin in the BH base shall be shorter than the BH base thickness. Please make sure that the pins shall not interfere with the slide block.

Figure G-26 Positioning Pin Hole Location

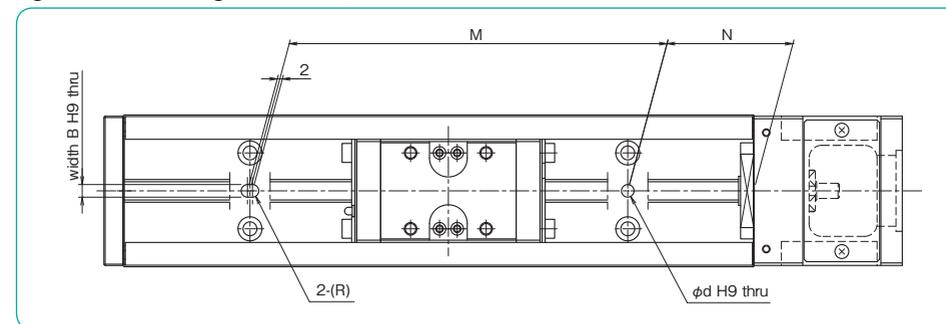


Table G-30 Positioning Pin Hole for Guide Rail

unit: mm

part number	pin length (BH base thickness)	rail length	N	M	$\phi d$	B
BH23	5.9 or less	150	35	80	$\phi 3^{+0.025}_0$	$\phi 3^{+0.025}_0$
		200	20	160		
		250	45			
		300	30	240		
BH30	8 or less	150	25	100	$\phi 5^{+0.030}_0$	$\phi 5^{+0.030}_0$
		200		200		
		300		300		
		400	50	400		
		500		500		
		600		600		
		700		700		
		750	25	700		
BH45	11 or less	340	70	200	$\phi 5^{+0.030}_0$	$\phi 5^{+0.030}_0$
		440		300		
		540		400		
		640		500		
		740		600		
		840		700		
		940		800		

Positioning pin hole option is not available for BH15.

LUBRICATION

- BH type contains a lithium soap based grease. (Multemp PS No.2, KYODO YUSHI) Apply similar type of grease for the lubrication as required depending on the operating conditions.
- For BH23, 30 use the grease fitting to lubricate the slide block. For ballscrew portion apply grease directly to the surface of screw shaft.  
BH15 slide block has  $\phi 2\text{mm}$  oil holes instead of grease fitting.  
BH45 does not have grease fitting, apply grease directly to the raceway surface of ballscrew shaft and guide.
- Unless otherwise instructed, a grease fitting is located as shown in Figure G-27.
- The grease can be changed to a high function type by adding a special grease option at the end of the part number. Please refer to Table G-31 for the grease type.

Figure G-27 Location of Grease Fitting

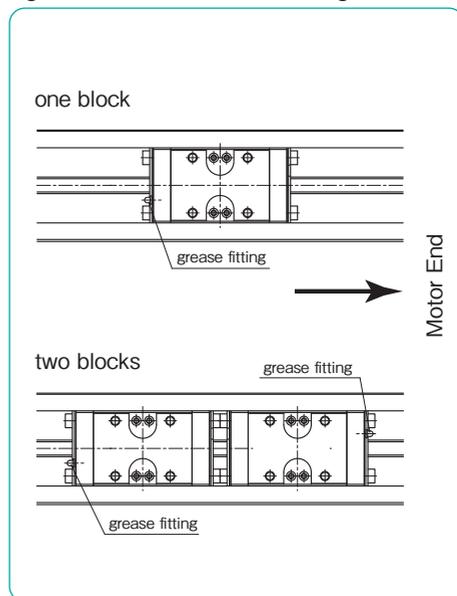


Table G-31 Applicable Grease

grease option	features	product name
none (standard)	—	Multemp PS No.2 (KYODO YUSHI)
GU	urea-type low dust generation; low sliding resistance grease	KGU Grease
GLA	lithium-type low dust generation grease	KGLA Grease
GF	urea-type anti-fretting grease	KGF Grease

ACTUATOR APPENDIX

USE AND HANDLING PRECAUTIONS

- Please handle as a precision component and avoid excessive vibration or shock.
- Rough handling will affect the smooth motion and reduce the precision performance and life time.
- DO NOT DISASSEMBLE. The accuracy of BG and BH type is preadjusted before delivery.
- Please allow for extra stroke length. If the guide block repeatedly collides with damper, it may cause damage.
- Depending upon the operating environment, dust and foreign particles may contaminate actuator and disrupt the ball circulation and precision performance.
- Please never touch the area at both stroke ends during operation. There is a danger for the fingers to be caught at the stroke end. Please pay enough attention to the guide rail area even when not in operation. There is a danger for the fingers to be injured by the dust cover.
- Anti-rust oil with little affect on the lubricant is applied to the guide rail and the block top surface. When mounting it is recommended that the turbine oil (ISO standard VG32- 64) is applied to the mounting surface for antirust effect after cleaning the contact surface.

OPERATING TEMPERATURE

- Resin parts are incorporated in the BG and BH type. Please avoid using BG and BH type above 80°C. Please use the product at 55°C or lower when sensor and/or bellows are optioned.

LUBRICATION

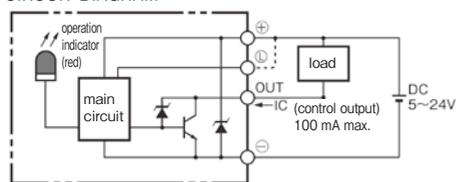
- The objective of lubrication includes the reduction of friction among the rolling elements as well as between the rolling elements and the raceway, prevention of sintering, reduction of wear, and the prevention of rust by forming a film over the surfaces. Please relubricate periodically depending on the operating conditions. The recommended relubrication interval is either of earlier period of about 6 months (3 months in case of 24 hours operation) or 1,000km of travel distance under normal conditions.

SENSOR SPECIFICATIONS

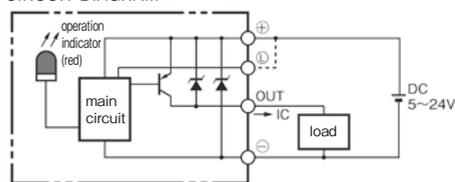
slim-type photomicro sensor (symbol: S) / OMRON CORPORATION

type	NPN type	EE-SX674
	PNP type	EE-SX674P
sensing distance	5 mm (slot width)	
standard sensing object	2 x 0.8 mm min. opaque object	
differential travel	0.025mm	
power supply voltage	5 to 24 V DC $\pm 10\%$ , ripple(P-P): 10% max.	
current consumption	12 mA max. (NPN), 12 mA max. (PNP)	
control output	NPN type	NPN open collector output models: At 5 to 24 V DC: 100 mA load current (Ic) with a residual voltage of 0.8 V max. When driving TTL: 40 mA load current (Ic) with a residual voltage of 0.4 V max.
	PNP type	PNP open collector output models: At 5 to 24 V DC: 50 mA load current (Ic) with a residual voltage of 1.3 V max.
output operation	Dark-On (+, L terminal open-circuit), Light-On (+, L terminal short-circuit)	
response frequency	1 kHz max. (3 kHz average)	
operation indicator	operation indicator (red) lit with incident	
ambient illumination (on receiver lens)	fluorescent light: 1000 lx max.	
ambient temperature	operating: -25 to 55 °C, storage: -30 to 80 °C	
ambient humidity	operating: 5 to 85 %RH, storage: 5 to 95 %RH	
vibration resistance	destruction: 20 to 2000 Hz, (with a peak acceleration of 100 m/s <sup>2</sup> )	
	1.5 mm double amplitude for 2 hrs (with 4-minute cycles) each in X, Y, and Z directions	
shock resistance	destruction: 500 m/s <sup>2</sup> for 3 times each in X, Y, and Z directions	
degree of protection	IEC 60529 IP 50	
connection method	connector type (direct soldering possible)	
weight	approx. 3 g	
material	case	Polybutylene terephthalate (PBT)
	cover	Polycarbonate (PC)
	emitter/receiver	

NPN type  
CIRCUIT DIAGRAM



PNP type  
CIRCUIT DIAGRAM

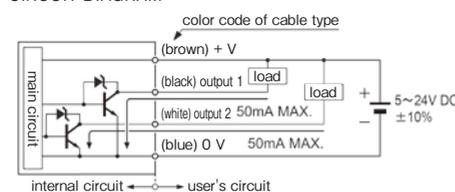


Please read the specifications and precautions of the manufacturer's catalogs or instruction manuals.

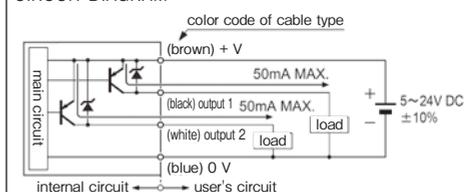
compact photomicro sensor (symbol: S) / Panasonic Industrial Devices SUNX Co., Ltd.

type	NPN type	PM-L25
	PNP type	PM-L25-P
sensing range	6 mm (fixed)	
minimum sensing object	0.8 x 1.2 mm opaque object	
hysteresis	0.05 mm or less	
repeatability	0.01 mm or less	
supply voltage	5 to 24 V DC $\pm 10\%$ , ripple (P-P): 10% or less	
current consumption	15 mA or less	
control output	NPN type	NPN open-collector transistor maximum sink current: 50 mA, applied voltage: 30 V DC or less (between output and 0 V) residual voltage: 2 V or less (at 50 mA sink current) 1 V or less (at 16 mA sink current)
	PNP type	PNP open-collector transistor maximum source current: 50 mA, applied voltage: 30 V DC or less (between output and + V) residual voltage: 2 V or less (at 50 mA sink current) 1 V or less (at 16 mA sink current)
output operation	incorporated with 2 outputs: Light-ON/Dark-ON	
response time	under light received condition: 20 $\mu$ s or less, under light interrupted condition: 80 $\mu$ s or less (response frequency: 3 kHz or more)	
operation indicator	orange LED (lights up under light received condition)	
ambient illuminance	fluorescent light: 1000 lx at the light-receiving face	
ambient temperature	operating: -25 to 55 °C (No dew condensation or icing allowed.), storage: -30 to 80 °C	
ambient humidity	5 to 85 %RH, storage: 5 to 95 %RH	
voltage withstandability	1000 V AC for one min. between all supply terminals connected together and enclosure	
insulation resistance	20 M $\Omega$ , or more, with 250 V DC megger between all supply terminals connected together and enclosure	
vibration resistance	10 to 2,000 Hz frequency, 1.5 mm double amplitude (maximum acceleration 196 m/s <sup>2</sup> ) in X, Y, and Z directions for two hours each	
shock resistance	15,000 m/s <sup>2</sup> acceleration (1,500 G approx.) in X, Y, and Z directions three times each	
cable	0.09 mm <sup>2</sup> 4-core cabtyre cable, PVC, 1 m long	
weight	Net weight: 10 g approx., Gross weight: 15 g approx.	
material	case	Polybutylene terephthalate (PBT)
	cover	Polycarbonate (PC)
	emitter/receiver	

NPN type  
CIRCUIT DIAGRAM



PNP type  
CIRCUIT DIAGRAM

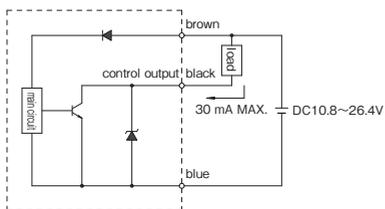


Please read the specifications and precautions of the manufacturer's catalogs or instruction manuals.

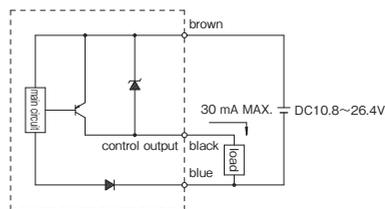
proximity sensor (symbol: K)/ Azbil CORPORATION

type	NPN type	APM-D3B1,APM-D3B1F (different-frequency type)
	PNP type	APM-D3E1,APM-D3E1F (different-frequency type)
rated sensing distance	2.5mm±15%	
standard target object	15x15 mm, 1 mm thick iron	
differential travel	15 % max. of sensing distance	
rated supply voltage	12/24 V DC	
operating voltage range	10.8 to 26.4 V DC	
current consumption	10 mA max.	
control output	NPN type	NPN transistor open collector switching current: 30 mA max. (resistive load) voltage drop: 1 V max. (switching current 30 mA) output dielectric strength: 26.4 V
	PNP type	PNP transistor open collector switching current: 30 mA max. (resistive load) voltage drop: 1 V max. (switching current 30 mA) output dielectric strength: 26.4 V
operation mode	normally closed (N.C.)	
operating frequency	120Hz	
indicator lamps	lights (red) when object approaches	
operating temperature range	-10 to 55 °C , storage: -25 to 70 °C	
operating humidity range	35 ~ 85%RH	
dielectric strength	1000 V AC (50/60 Hz) for one min. between case and electrically live metals	
insulation resistance	50 MΩ min. (by 500 V DC megger )	
vibration resistance	10 to 55 Hz, 1.5 mm peak-to-peak amplitude, 2 hrs in X, Y, and Z directions	
shock resistance	500 m/s <sup>2</sup> 3 times in X, Y, and Z directions	
protection	IP 67 (IEC 529)	
weight	approx. 10 g excl. cable (length of cable: 1 m)	

NPN type  
CIRCUIT DIAGRAM



PNP type  
CIRCUIT DIAGRAM



Please read the specifications and precautions of the manufacturer's catalogs or instruction manuals.

# SLIDE SCREW

## SLIDE SCREW

- STRUCTURE AND ADVANTAGES .....H-2
- SPECIFICATION .....H-3
- SIZE SELECTION .....H-3
- INSTALLATION .....H-6
- USE AND HANDLING PRECAUTIONS H-6
- SPECIAL REQUIREMENTS .....H-6
- DIMENSION TABLE .....H-7

# SLIDE SCREW

The NB slide screw converts rotational motion into linear motion by utilizing the friction between radial ball bearings and a shaft. This simple mechanism eases maintenance and installation work. The slide screw is most commonly used as transport devices in many types of machines, and is not intended for accurate positioning requirements.

## STRUCTURE AND ADVANTAGES

The NB slide screw consists of two aluminum blocks, each with three radial bearings with a fixed angle between them. A round shaft is inserted between the two blocks, and its rotation produces linear motion determined by the contact angle between the shaft and the bearings. For variable loads, the thrust is adjusted by turning the spring loaded thrust adjustment bolts.

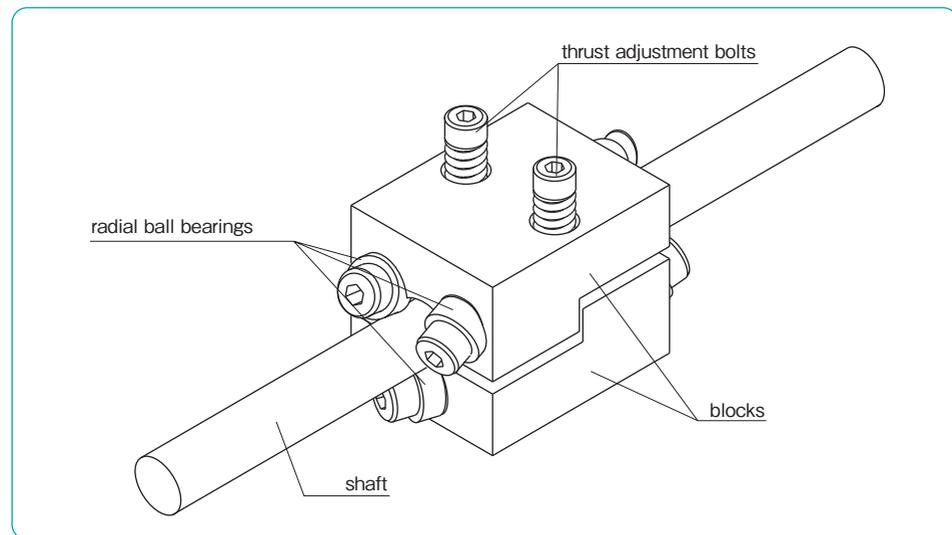
### Linear Motion on Round-shaft

The NB slide screw is suitable for long-stroke applications using a standard linear shaft.

### High Machine Efficiency

The slide screw utilizes the rotational motion of the bearings and drive shaft to achieve machine efficiency as high as 90%.

Figure H-1 Structure of NB Slide Screw



## SPECIFICATION

Refer to Table H-1 for NB Slide Screw material and operating temperature range.

Table H-1 Material and Operating Temperature Range

type	block	radial ball bearing	thrust adjustment bolts	operating temperature range
SS	aluminum	steel	steel with low temperature black chrome treatment	-20°C~110°C

## SIZE SELECTION

### Required Thrust

Tightening of the bolts creates a thrust force by pushing the bearings against the shaft. This results in a constant force being applied to the bearings regardless of the load.

The thrust should not be greater than required force in the application.

For the horizontal application, the frictional resistance is calculated by the following equation.

$$F_1 = \mu \cdot g \cdot W \dots\dots\dots (1)$$

F<sub>1</sub>: frictional resistance (N) μ: friction coefficient  
W: mass of work (kg)  
g: gravitational acceleration (9.8 m/sec<sup>2</sup>)

A sufficient safety margin should be achieved by setting μ = 0.01. Also, the inertia at starting and stopping should be taken into consideration.

$$F_2 = W \frac{dv}{dt} \dots\dots\dots (2)$$

F<sub>2</sub>: inertia (N) W: mass of work (kg)  
dv/dt: acceleration (m/sec<sup>2</sup>)

Therefore, the required thrust is its maximum at starting point due to the combination of frictional resistance and inertia.

$$F = F_1 + F_2 \dots\dots\dots (3)$$

F: thrust (N) F<sub>1</sub>: frictional resistance (N) F<sub>2</sub>: inertia (N)

### Rated Life

The rated life is expressed in terms of the number of revolutions of the drive shaft by Equation (4). The corresponding total travel distance and life time are given in Equations (5) and (6) respectively.

Rated life

$$L = \left(\frac{C_F}{F}\right)^3 10^6 \dots\dots\dots (4)$$

Total travel distance

$$L_s = \frac{L \cdot \ell}{10^6} \dots\dots\dots (5)$$

Life time

$$L_h = \frac{L}{60 \cdot n} \dots\dots\dots (6)$$

L: rated life (rev) C<sub>F</sub>: basic dynamic load rating (thrust) (N)  
F: thrust (N) L<sub>s</sub>: travel life (km) ℓ: lead (mm)  
L<sub>h</sub>: life time (hr) n: revolutions per min (rpm)

Table H-2 Basic Dynamic Load Rating (Thrust)

part number	C <sub>F</sub> :basic dynamic load rating (thrust) (N)
SS 6	98
SS 8	294
SS10	441
SS12	588
SS13	588
SS16	784
SS20	1,080
SS25	1,470
SS30	2,160

**Allowable Rotational Speed**

When the rotational speed is increased and approaches the shaft resonant frequency, the shaft is disabled from further operation. This speed is called the critical speed and can be obtained by the following equation. In order to leave a sufficient safety margin, the maximum operating speed should be set at about 80% of the calculated value.

$$N_c = \frac{60\lambda^2}{2\pi L^2} \cdot \sqrt{\frac{EI \times 10^3}{\gamma A}} \dots\dots\dots (7)$$

N<sub>c</sub>: critical speed (rpm)  
 E: modulus of direct elasticity (N/mm<sup>2</sup>)  
 γ: density (kg/mm<sup>3</sup>)  
 λ: installation coefficient (refer to Figure H-3)  
 L: support distance (mm)  
 I: geometrical moment of inertia (mm<sup>4</sup>)  
 A: cross-sectional area of the shaft (mm<sup>2</sup>)

If modulus of direct elasticity is 2.06×10<sup>5</sup>N/mm<sup>2</sup> and density is 7.85×10<sup>-6</sup>kg/mm<sup>3</sup>, the critical speed for a solid shaft is:

$$N_c = 12.2 \cdot \frac{\lambda^2}{L^2} \cdot D \times 10^6 \dots\dots\dots (8)$$

N<sub>c</sub>: critical speed (rpm)  
 λ: installation coefficient (refer to Figure H-3)  
 L: support distance (mm) D: shaft diameter (mm)

Figure H-2 Critical Speed and Support Distance

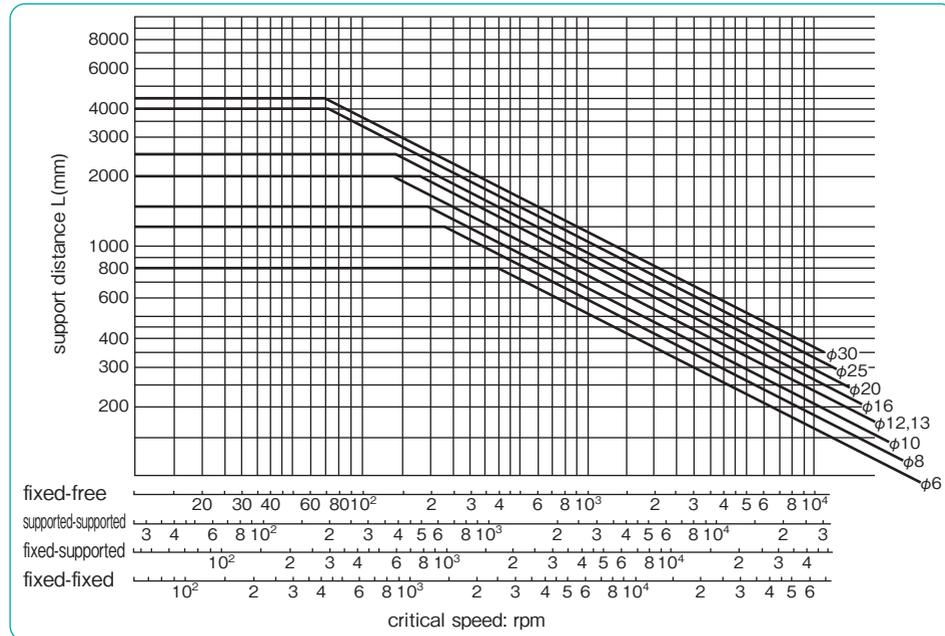
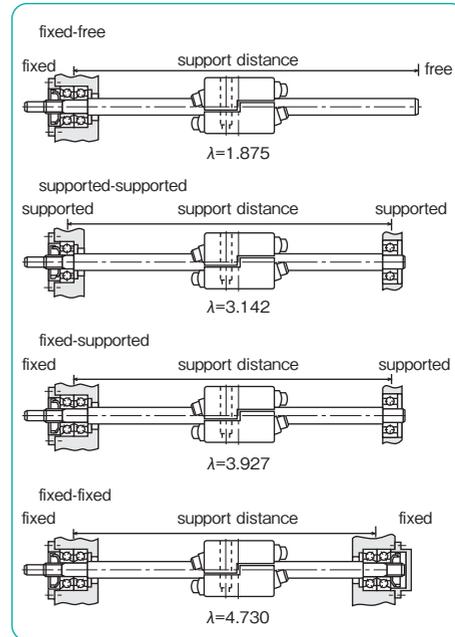


Figure H-3 Mounting of Slide Screw



**Calculation Example**

1. Selecting a slide screw that satisfies the following conditions:

- Support method: fixed-supported
- Support distance: 1,500 mm
- External force: 98 N
- Table mass: 50 kg
- Stroke distance: 1,200 mm
- Friction coefficient: 0.01
- Maximum speed of transfer: 12 m/min
- Cycles per minute: 4

● Determination of required thrust:  
 F = 98 + (0.01 × 50 × 9.8) = 102.9 N

Therefore, based on the maximum thrust in the dimension table, at least SS10 is required in size.

● Allowable rotational speed:  
 From Equation (8), according to the conditions, the critical speed N<sub>c</sub> is:

$$N_c = 12.2 \cdot \frac{\lambda^2}{L^2} \cdot D \times 10^6 \left[ \begin{matrix} \lambda = 3.927 \\ L = 1500\text{mm} \end{matrix} \right] = 83.6\text{D rev}$$

Applying a safety factor of 0.8, the maximum speed is given by:

$$V_{max} = \frac{0.8 \cdot N_c \cdot \ell}{1000} \text{ m/min}$$

(ℓ: lead mm)

The following table summarizes the results of the calculations above for SS10 to SS16.

Table H-3 Maximum Speed

part number	shaft diameter D mm	lead ℓ mm	critical speed N <sub>c</sub> rpm	maximum speed V <sub>max</sub> m/min
SS10-10	10	10	836	6.68
SS10-15		15		10.0
SS12-12	12	12	1,000	9.63
SS12-18		18		14.4
SS13-13	13	13	1,080	11.3
SS13-15		15		13.0
SS16-16	16	16	1,330	17.1
SS16-24		24		25.6

Therefore, the SS12-18, SS13-15, SS16-16 and SS16-24 slide screws satisfy the given conditions.

● Life Calculation

The life for the SS13-15 slide screw is calculated as follows. The rated life is obtained using Equation (4).

$$L = \left(\frac{C_F}{F}\right)^3 \times 10^6 = 186 \times 10^6 \text{ rev}$$

The average number of rotations that satisfies the conditions is:

$$n = \frac{1,200 \times 2 \times 4}{15} = 640 \text{ rev}$$

The life in terms of time is:

$$L_h = \frac{L}{60 \times n} = 4,840 \text{ (h)}$$

For the SS16-16 slide screw:

$$L = 4.40 \times 10^6 \text{ rev}$$

$$n = 600 \text{ rev}$$

$$L_h = 12,200 \text{ (h)}$$

2. Determining the maximum speed of transfer under the following conditions:

- Support method: fixed-supported
- Support distance: 2,000mm
- Slide screw selected: SS16-16

The critical speed is obtained from Equation (8):

$$N_c = 12.2 \cdot \frac{\lambda^2}{L^2} \cdot D \times 10^6 \left[ \begin{matrix} \lambda = 3.927 \\ L = 2000\text{mm} \\ D = 16\text{mm} \end{matrix} \right] = 752 \text{ rpm}$$

Applying a safety factor of 0.8, the maximum speed of transfer is:

$$V_{max} = \frac{0.8 \cdot N_c \cdot \ell}{1000} \text{ m/min } (\ell: \text{lead mm}) = 9.6 \text{ m/min}$$

### INSTALLATION

1. Clean dust from drive shaft.
2. Place shaft between upper and lower blocks. Lightly tighten thrust adjustment bolts until the clearance between the shaft and the bearings diminishes.
3. Temporarily attach the slide screw to the table.
4. Adjust the parallelism between the slide screw and the linear motion guides by manually moving the table back and forth. Fix the shaft accurately after the required parallelism is achieved.
5. Tighten the thrust adjustment bolts evenly while applying a thrust force to the table until slippage disappears. Care should be taken to avoid excessive tightening which results in shortening the rated life.

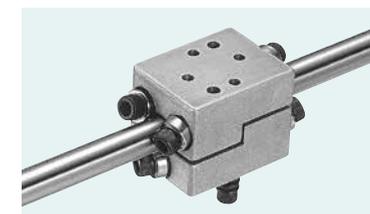
### USE AND HANDLING PRECAUTIONS

- It is recommended to use a heat-treated ground shaft such as NB shaft to prevent wear and to obtain smooth motion. (refer to page F-1)
- Since the slide screw utilizes the friction between the bearings and the shaft, the lead varies due to the effect of load variation, movement direction, and shaft conditions. As the values of standard lead are advisory, highly accurate positioning can be obtained by attaching a linear scale to the table.
- If the slide screw and linear motion guides are not parallel, an unbalanced load will be applied to the slide screw. Exercise care in controlling the parallelism.
- The slide screw slips on the shaft, if an excessive load is applied, in order to prevent damage. However, frequent slippage should be avoided in order not to shorten the travel life.
- Please transfer the radial load to linear motion guides since the radial load on the slide screw shortens the rated life. For long stroke applications, it is recommended to use linear and rotary motion components such as Slide Rotary Bush (refer to page E-10) along with a slide screw.

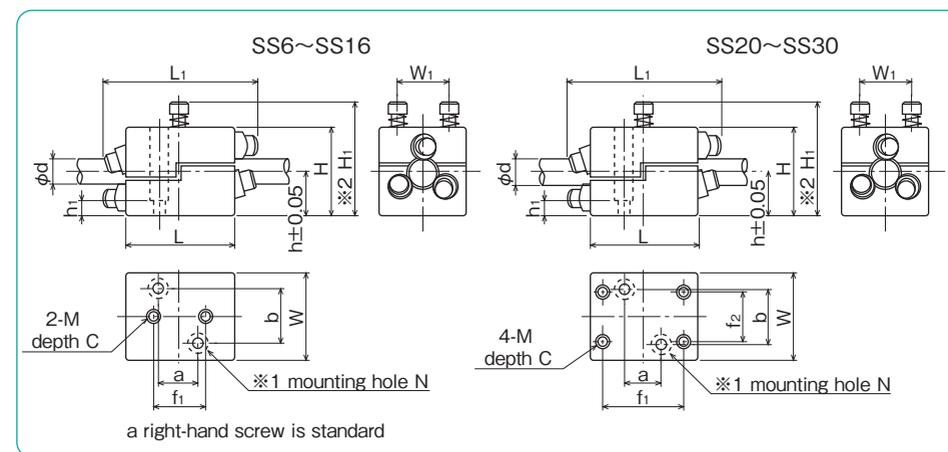
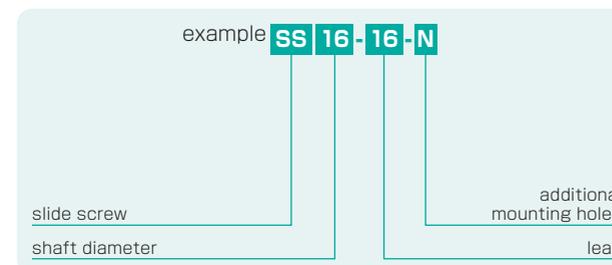
### SPECIAL REQUIREMENTS

NB can fabricate slide screws to meet special requirements, including screws with a special lead or a reverse lead. Contact NB for further information.

## SS TYPE



### part number structure



part number	shaft diameter		major dimensions														standard lead ※3	maximum thrust	maximum tightening torque	mass
	d	H	W	L	h	H <sub>1</sub>	L <sub>1</sub>	W <sub>1</sub>	f <sub>1</sub>	f <sub>2</sub>	a	b	M	C	N	h <sub>1</sub>				
SS 6	6	20.5	20	25	10	28	36	12	10	—	—	—	M3	6.5	—	—	6, 9	24.5	0.03	0.03
SS 8	8	28.5	28	40	14	40	56	18	18	—	—	—	M4	9	—	—	8,12	73.5	0.14	0.09
SS10	10	36.5	36	46	18	51	62	24	20	—	20	24	M4	12	M4	8	10,15	118	0.25	0.17
SS12	12	40.5	40	50	20	54	72	25	25	—	20	25	M5	12.5	M4	10	12,18	147	0.31	0.22
SS13	13	40.5	40	50	20	54	72	25	25	—	20	25	M5	12.5	M4	10	13,15	147	0.31	0.22
SS16	16	50.5	50	60	25	62	86	32	30	—	25	32	M5	16	M5	10	16,24	196	0.41	0.39
SS20	20	60.5	60	70	30	71	97	40	50	40	30	40	M6	12	M6	10	20,30	265	0.56	0.57
SS25	25	76.5	76	80	38	82	110	50	60	50	32	50	M8	12	M8	15	25	392	1.1	1.05
SS30	30	89	90	88	44	92	127	60	60	70	36	60	M8	15	M8	15	30,45	539	1.4	1.65

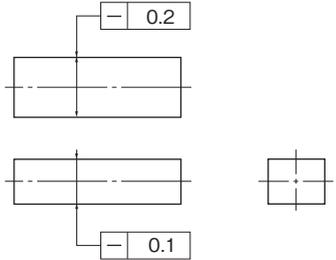
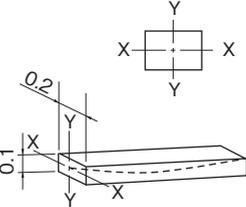
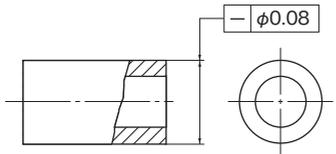
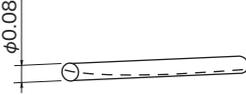
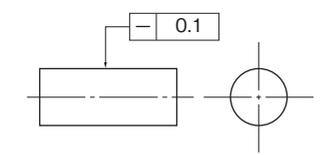
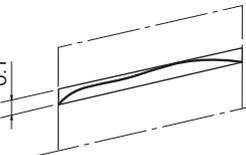
※1 The mounting holes are machined on request.      1N≐0.102kgf    1N·m≐0.102kgf·m  
 ※2 H<sub>1</sub> is the minimum height when the maximum thrust is applied.  
 ※3 The values of standard lead are advisory.



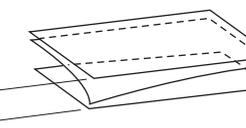
**TECHNICAL  
REFERENCE**

**DEFINITIONS AND DESIGNATIONS OF GEOMETRICAL DEVIATIONS (JIS B0621)**  
**TOLERANCING OF FORM, ORIENTATION, LOCATION AND RUN-OUT (JIS B0021)**

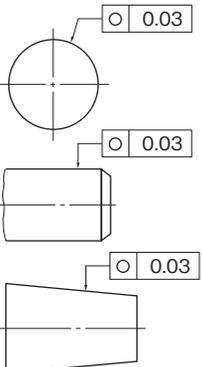
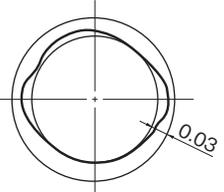
**STRAIGHTNESS** Straightness indicates the degree of deviation of a straight portion from the geometrical straight line.

<p>Straightness of two directions perpendicular to each other (Axis of a rectangular parallelepiped)</p> 	<p>Space inside the prism enclosed by two pairs of parallel planes with intervals of 0.2mm and 0.1mm in the directions of indicated arrows</p> 
<p>Straightness with no direction defined (Axis of a cylinder)</p> 	<p>Space inside a cylinder with a diameter of 0.08mm</p> 
<p>Straightness of a surface element (Generatrix of a cylinder)</p> 	<p>Space between a pair of parallel straight lines with an interval of 0.1mm on an arbitrary plane including the axis</p> 

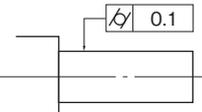
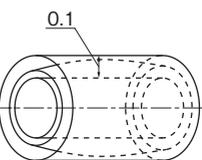
**FLATNESS** Flatness indicates the degree of deviation of a flat portion from the geometrical plane.

<p>General flatness</p> 	<p>Space between a pair of parallel planes with an interval of 0.1mm</p> 
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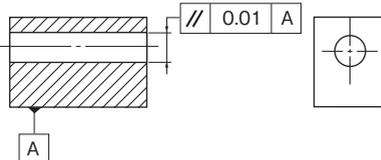
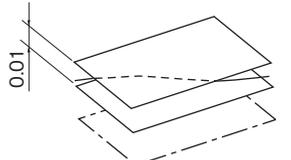
**CIRCULARITY** Circularity indicates the degree of deviation of a circular portion from the geometrical circle.

	<p>Space between two concentric circles with a radius difference of 0.03mm. Applicable to an arbitrary cross section perpendicular to the axis.</p> 
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**CYLINDRICITY** Cylindricity indicates the degree of deviation of a cylindrical portion from the geometrical cylindrical surface.

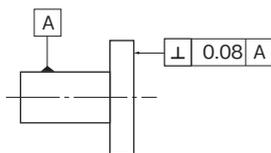
	<p>Space between two concentric cylinders with a radius difference of 0.1mm</p> 
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**PARALLELISM** Parallelism assumes a combination of two straight portions, a straight portion and a flat portion, or two flat portions which must be parallel to each other. Parallelism indicates, with one of the two portions as a reference, the degree of deviation of the other straight or flat portion from the geometrical straight line or plane parallel to the reference straight line or plane.

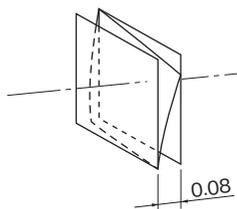
<p>Parallelism of a straight portion with respect to the reference plane (Axis of a hole)</p> 	<p>Space between two parallel planes with an interval of 0.01mm, parallel to the reference plane</p> 
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**PERPENDICULARITY** Perpendicularity assumes a combination of two straight portions, a straight portion and a flat portion, or two flat portions which must be perpendicular to each other. Perpendicularity indicates, with one of the two portions as a reference, the degree of deviation of the other straight or flat portion from the geometrical straight line or plane.

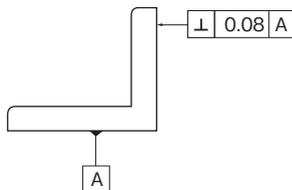
Perpendicularity of a flat portion with respect to the reference straight line (with the axis of a cylinder as a reference)



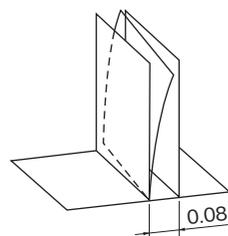
Space between two parallel planes with an interval of 0.08mm, perpendicular to the reference straight line



Perpendicularity of a flat portion with respect to the reference plane

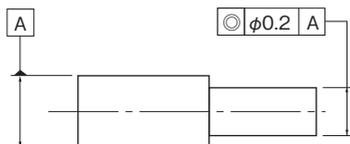


Space between two parallel planes with an interval of 0.08mm, perpendicular to the reference plane

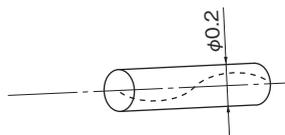


**CONCENTRICITY** Concentricity indicates the degree of deviation from the axis which must be on the same straight line as the reference axis.

Concentricity of a cylindrical portion



Space inside a cylinder with a diameter of 0.2mm, concentric with the reference axis



Hardness Conversion Table

Rockwell C scale hardness HRC (load 150kg)	Vickers Hardness HV	Brinell hardness HBW		Rockwell hardness		Shore hardness HS
		standard sphere	tungsten sphere	HRA A scale load 60 kg brale pressure point	HRBS B scale load 100 kg 1/16-inch-diameter sphere	
68	940	—	—	85.6	—	97
67	900	—	—	85.0	—	95
66	865	—	—	84.5	—	92
65	832	—	739	83.9	—	91
64	800	—	722	83.4	—	88
63	772	—	705	82.8	—	87
62	746	—	688	82.3	—	85
61	720	—	670	81.8	—	83
60	697	—	654	81.2	—	81
59	674	—	634	80.7	—	80
58	653	—	615	80.1	—	78
57	633	—	595	79.6	—	76
56	613	—	577	79.0	—	75
55	595	—	560	78.5	—	74
54	577	—	543	78.0	—	72
53	560	—	525	77.4	—	71
52	544	500	512	76.8	—	69
51	528	487	496	76.3	—	68
50	513	475	481	75.9	—	67
49	498	464	469	75.2	—	66
48	484	451	455	74.7	—	64
47	471	442	443	74.1	—	63
46	458	432	432	73.6	—	62
45	446	421	421	73.1	—	60
44	434	409	409	72.5	—	58
43	423	400	400	72.0	—	57
42	412	390	390	71.5	—	56
41	402	381	381	70.9	—	55
40	392	371	371	70.4	—	54
39	382	362	362	69.9	—	52
38	372	353	353	69.4	—	51
37	363	344	344	68.9	—	50
36	354	336	336	68.4	(109.0)	49
35	345	327	327	67.9	(108.5)	48
34	336	319	319	67.4	(108.0)	47
33	327	311	311	66.8	(107.5)	46
32	318	301	301	66.3	(107.0)	44
31	310	294	294	65.8	(106.0)	43
30	302	286	286	65.3	(105.5)	42
29	294	279	279	64.7	(104.5)	41
28	286	271	271	64.3	(104.0)	41
27	279	264	264	63.8	(103.0)	40
26	272	258	258	63.3	(102.5)	38
25	266	253	253	62.8	(101.5)	38
24	260	247	247	62.4	(101.0)	37
23	254	243	243	62.0	100.0	36
22	248	237	237	61.5	99.0	35
21	243	231	231	61.0	98.5	35
20	238	226	226	60.5	97.8	34
(18)	230	219	219	—	96.7	33
(16)	222	212	212	—	95.5	32
(14)	213	203	203	—	93.9	31
(12)	204	194	194	—	92.3	29
(10)	196	187	187	—	90.7	28
(8)	188	179	179	—	89.5	27
(6)	180	171	171	—	87.1	26
(4)	173	165	165	—	85.5	25
(2)	166	158	158	—	83.5	24
(0)	160	152	152	—	81.7	24

Shaft Dimensional Tolerance

diameter category mm	greater than or less	d6	e6	e7	f5	f6	f7	f8	g5	g6	g7	g8	h5
		upper lower											
-	3	-20 -26	-14 -20	-14 -24	-6 -10	-6 -12	-6 -16	-6 -20	-2 -6	-2 -8	-2 -12	-2 -16	0 -4
3	6	-30 -38	-20 -28	-20 -32	-10 -15	-10 -18	-10 -22	-10 -28	-4 -9	-4 -12	-4 -16	-4 -22	0 -5
6	10	-40 -49	-25 -34	-25 -40	-13 -19	-13 -22	-13 -28	-13 -35	-5 -11	-5 -14	-5 -20	-5 -27	0 -6
10	14	-50 -61	-32 -43	-32 -50	-16 -24	-16 -27	-16 -34	-16 -43	-6 -14	-6 -17	-6 -24	-6 -33	0 -8
14	18	-50 -61	-32 -43	-32 -50	-16 -24	-16 -27	-16 -34	-16 -43	-6 -14	-6 -17	-6 -24	-6 -33	0 -8
18	24	-65 -78	-40 -53	-40 -61	-20 -29	-20 -33	-20 -41	-20 -53	-7 -16	-7 -20	-7 -28	-7 -40	0 -9
24	30	-65 -78	-40 -53	-40 -61	-20 -29	-20 -33	-20 -41	-20 -53	-7 -16	-7 -20	-7 -28	-7 -40	0 -9
30	40	-80 -96	-50 -66	-50 -75	-25 -36	-25 -41	-25 -50	-25 -64	-9 -20	-9 -25	-9 -34	-9 -48	0 -11
40	50	-80 -96	-50 -66	-50 -75	-25 -36	-25 -41	-25 -50	-25 -64	-9 -20	-9 -25	-9 -34	-9 -48	0 -11
50	65	-100 -119	-60 -79	-60 -90	-30 -43	-30 -49	-30 -60	-30 -76	-10 -23	-10 -29	-10 -40	-10 -56	0 -13
65	80	-100 -119	-60 -79	-60 -90	-30 -43	-30 -49	-30 -60	-30 -76	-10 -23	-10 -29	-10 -40	-10 -56	0 -13
80	100	-120 -142	-72 -94	-72 -107	-36 -51	-36 -58	-36 -71	-36 -90	-12 -27	-12 -34	-12 -47	-12 -66	0 -15
100	120	-120 -142	-72 -94	-72 -107	-36 -51	-36 -58	-36 -71	-36 -90	-12 -27	-12 -34	-12 -47	-12 -66	0 -15
120	140	-145 -170	-85 -110	-85 -125	-43 -61	-43 -68	-43 -83	-43 -106	-14 -32	-14 -39	-14 -54	-14 -77	0 -18
140	160	-145 -170	-85 -110	-85 -125	-43 -61	-43 -68	-43 -83	-43 -106	-14 -32	-14 -39	-14 -54	-14 -77	0 -18
160	180	-145 -170	-85 -110	-85 -125	-43 -61	-43 -68	-43 -83	-43 -106	-14 -32	-14 -39	-14 -54	-14 -77	0 -18

Housing Bore Dimensional Tolerance

diameter category mm	greater than or less	D6	E6	E7	F5	F6	F7	F8	G5	G6	G7	G8	H5
		upper lower											
-	3	+26 +20	+20 +14	+24 +14	+10 +6	+12 +6	+16 +6	+20 +6	+6 +2	+8 +2	+12 +2	+16 +2	+4 0
3	6	+38 +30	+28 +20	+32 +20	+15 +10	+18 +10	+22 +10	+28 +10	+9 +4	+12 +4	+16 +4	+22 +4	+5 0
6	10	+49 +40	+34 +25	+40 +25	+19 +13	+22 +13	+28 +13	+35 +13	+11 +5	+14 +5	+20 +5	+27 +5	+6 0
10	14	+61 +50	+43 +32	+50 +32	+24 +16	+27 +16	+34 +16	+43 +16	+14 +6	+17 +6	+24 +6	+33 +6	+8 0
14	18	+61 +50	+43 +32	+50 +32	+24 +16	+27 +16	+34 +16	+43 +16	+14 +6	+17 +6	+24 +6	+33 +6	+8 0
18	24	+78 +65	+53 +40	+61 +40	+29 +20	+33 +20	+41 +20	+53 +20	+16 +7	+20 +7	+28 +7	+40 +7	+9 0
24	30	+78 +65	+53 +40	+61 +40	+29 +20	+33 +20	+41 +20	+53 +20	+16 +7	+20 +7	+28 +7	+40 +7	+9 0
30	40	+96 +80	+66 +50	+75 +50	+36 +25	+41 +25	+50 +25	+64 +25	+20 +9	+25 +9	+34 +9	+48 +9	+11 0
40	50	+96 +80	+66 +50	+75 +50	+36 +25	+41 +25	+50 +25	+64 +25	+20 +9	+25 +9	+34 +9	+48 +9	+11 0
50	65	+119 +100	+79 +60	+90 +60	+43 +30	+49 +30	+60 +30	+76 +30	+23 +10	+29 +10	+40 +10	+56 +10	+13 0
65	80	+119 +100	+79 +60	+90 +60	+43 +30	+49 +30	+60 +30	+76 +30	+23 +10	+29 +10	+40 +10	+56 +10	+13 0
80	100	+142 +120	+94 +72	+107 +72	+51 +36	+58 +36	+71 +36	+90 +36	+27 +12	+34 +12	+47 +12	+66 +12	+15 0
100	120	+142 +120	+94 +72	+107 +72	+51 +36	+58 +36	+71 +36	+90 +36	+27 +12	+34 +12	+47 +12	+66 +12	+15 0
120	140	+170 +145	+110 +85	+125 +85	+61 +43	+68 +43	+83 +43	+106 +43	+32 +14	+39 +14	+54 +14	+77 +14	+18 0
140	160	+170 +145	+110 +85	+125 +85	+61 +43	+68 +43	+83 +43	+106 +43	+32 +14	+39 +14	+54 +14	+77 +14	+18 0
160	180	+170 +145	+110 +85	+125 +85	+61 +43	+68 +43	+83 +43	+106 +43	+32 +14	+39 +14	+54 +14	+77 +14	+18 0

unit : μm

h6	h7	h8	h9	js5	js6	js7	j5	j6	k5	k6	m5	m6	diameter category mm
upper lower	greater than or less												
0 -6	0 -10	0 -14	0 -25	±2	±3	±5	±2	+4 -2	+4 0	+6 0	+6 +2	+8 +2	- 3
0 -8	0 -12	0 -18	0 -30	±2.5	±4	±6	+3 -2	+6 -2	+6 +1	+9 +1	+9 +4	+12 +4	3 6
0 -9	0 -15	0 -22	0 -36	±3	±4.5	±7.5	+4 -2	+7 -2	+7 +1	+10 +1	+12 +6	+15 +6	6 10
0 -11	0 -18	0 -27	0 -43	±4	±5.5	±9	+5 -3	+8 -3	+9 +1	+12 +1	+15 +7	+18 +7	10 14
0 -13	0 -21	0 -33	0 -52	±4.5	±6.5	±10.5	+5 -4	+9 -4	+11 +2	+15 +2	+17 +8	+21 +8	14 18
0 -16	0 -25	0 -39	0 -62	±5.5	±8	±12.5	+6 -5	+11 -5	+13 +2	+18 +2	+20 +9	+25 +9	18 24
0 -19	0 -30	0 -46	0 -74	±6.5	±9.5	±15	+6 -7	+12 -7	+15 +2	+21 +2	+24 +11	+30 +11	24 30
0 -22	0 -35	0 -54	0 -87	±7.5	±11	±17.5	+6 -9	+13 -9	+18 +3	+25 +3	+28 +13	+35 +13	30 40
0 -25	0 -40	0 -63	0 -100	±9	±12.5	±20	+7 -11	+14 -11	+21 +3	+28 +3	+33 +15	+40 +15	40 50
0 -25	0 -40	0 -63	0 -100	±9	±12.5	±20	+7 -11	+14 -11	+21 +3	+28 +3	+33 +15	+40 +15	50 65
0 -25	0 -40	0 -63	0 -100	±9	±12.5	±20	+7 -11	+14 -11	+21 +3	+28 +3	+33 +15	+40 +15	65 80
0 -25	0 -40	0 -63	0 -100	±9	±12.5	±20	+7 -11	+14 -11	+21 +3	+28 +3	+33 +15	+40 +15	80 100
0 -25	0 -40	0 -63	0 -100	±9	±12.5	±20	+7 -11	+14 -11	+21 +3	+28 +3	+33 +15	+40 +15	100 120
0 -25	0 -40	0 -63	0 -100	±9	±12.5	±20	+7 -11	+14 -11	+21 +3	+28 +3	+33 +15	+40 +15	120 140
0 -25	0 -40	0 -63	0 -100	±9	±12.5	±20	+7 -11	+14 -11	+21 +3	+28 +3	+33 +15	+40 +15	140 160
0 -25	0 -40	0 -63	0 -100	±9	±12.5	±20	+7 -11	+14 -11	+21 +3	+28 +3	+33 +15	+40 +15	160 180

## INDEX

A		
<b>AK</b>	Slide Bush: Compact Block Type	C- 124
<b>AK-G</b>	Slide Bush: Compact Block Type	C- 124
<b>AK-GW</b>	Slide Bush: Double-Wide Compact Block Type	C- 126
<b>AK-R</b>	Slide Rotary Bush: Compact Block Type	E- 22
<b>AK-RW</b>	Slide Rotary Bush: Double-Wide Compact Block Type	E- 23
<b>AK-W</b>	Slide Bush: Double-Wide Compact Block Type	C- 126
<b>AKS</b>	Slide Bush: Compact Block Type, Anticorrosion	C- 124
<b>AKS-G</b>	Slide Bush: Compact Block Type, Anticorrosion	C- 124
<b>AKS-GW</b>	Slide Bush: Double-Wide Compact Block Type, Anticorrosion	C- 126
<b>AKS-W</b>	Slide Bush: Double-Wide Compact Block Type, Anticorrosion	C- 126
B		
<b>BG</b>	Actuator: Integrated Guide and Ball Screw System	G- 10
<b>BH</b>	Actuator: Integrated Guide and Ball Screw System	G- 82
<b>BT</b>	Slide Way: Special Mounting Screw	A- 10
C		
<b>CD</b>	Slide Bush: Clearance Adjustable Type	C- 140
<b>CDS</b>	Slide Bush: Clearance Adjustable Type, Anticorrosion	C- 140
<b>CE</b>	Slide Bush: Non-Clearance Adjustable Type	C- 138
<b>CES</b>	Slide Bush: Non-Clearance Adjustable Type, Anticorrosion	C- 138
<b>CR</b>	Gonio Way: Curved Roller Cage	A- 82
F		
<b>FLM</b>	Slide Bush: Felt Seal	C- 15
<b>FP</b>	Ball Spline: Lock Plate	B- 17
G		
<b>GG1</b>	Grease Gun Set	Eng- 53
<b>GM</b>	Slide Bush: Light Weight Single Type	C- 118
<b>GM-W</b>	Slide Bush: Light Weight Double-Wide Type	C- 119
H		
<b>HV</b>	Slide Way: Upgraded Model	A- 18
<b>HVS</b>	Slide Way: Upgraded Model, Anticorrosion	A- 18
<b>HVT</b>	Slide Table: Upgraded Model	A- 46
<b>HVTS</b>	Slide Table: Upgraded Model, Anticorrosion	A- 46
<b>HVW</b>	Slide Way: Upgraded Model, Center Rail Type	A- 30
<b>HVWS</b>	Slide Way: Upgraded Model, Center Rail Type, Anticorrosion	A- 30
<b>HYT</b>	Slide Table: Upgraded Model, Compact Type	A- 50
<b>HYT-D</b>	Slide Table: Upgraded Model, Compact Type with Counterbored Rail	A- 52
<b>HYTS</b>	Slide Table: Upgraded Model, Compact Type, Anticorrosion	A- 50
<b>HYTS-D</b>	Slide Table: Upgraded Model, Compact Type with Counterbored Rail, Anticorrosion	A- 52

K		
<b>KB</b>	Slide Bush (Euro Standard): Standard Type	C- 82
<b>KB-AJ</b>	Slide Bush (Euro Standard): Clearance Adjustable Type	C- 84
<b>KB-G</b>	Slide Bush (Euro Standard): Standard Type	C- 82
<b>KB-G-AJ</b>	Slide Bush (Euro Standard): Clearance Adjustable Type	C- 84
<b>KB-G-OP</b>	Slide Bush (Euro Standard): Open Type	C- 86
<b>KB-GW</b>	Slide Bush (Euro Standard): Double-Wide Type	C- 88
<b>KB-OP</b>	Slide Bush (Euro Standard): Open Type	C- 86
<b>KB-W</b>	Slide Bush (Euro Standard): Double-Wide Type	C- 88
<b>KBF</b>	Slide Bush (Euro Standard): Round Flange Type	C- 90
<b>KBF-G</b>	Slide Bush (Euro Standard): Round Flange Type	C- 90
<b>KBF-GW</b>	Slide Bush (Euro Standard): Round Flange Double-Wide Type	C- 94
<b>KBF-W</b>	Slide Bush (Euro Standard): Round Flange Double-Wide Type	C- 94
<b>KBFC</b>	Slide Bush (Euro Standard): Center Mount Round Flange Type	C- 98
<b>KBFC-G</b>	Slide Bush (Euro Standard): Center Mount Round Flange Type	C- 98
<b>KBK</b>	Slide Bush (Euro Standard): Square Flange Type	C- 92
<b>KBK-G</b>	Slide Bush (Euro Standard): Square Flange Type	C- 92
<b>KBK-GW</b>	Slide Bush (Euro Standard): Square Flange Double-Wide Type	C- 96
<b>KBK-W</b>	Slide Bush (Euro Standard): Square Flange Double-Wide Type	C- 96
<b>KBKC</b>	Slide Bush (Euro Standard): Center Mount Square Flange Type	C- 100
<b>KBKC-G</b>	Slide Bush (Euro Standard): Center Mount Square Flange Type	C- 100
<b>KBS</b>	Slide Bush (Euro Standard): Standard Type, Anticorrosion	C- 82
<b>KBS-AJ</b>	Slide Bush (Euro Standard): Clearance Adjustable Type, Anticorrosion	C- 84
<b>KBS-G</b>	Slide Bush (Euro Standard): Standard Type, Anticorrosion	C- 82
<b>KBS-G-AJ</b>	Slide Bush (Euro Standard): Clearance Adjustable Type, Anticorrosion	C- 84
<b>KBS-G-OP</b>	Slide Bush (Euro Standard): Open Type, Anticorrosion	C- 86
<b>KBS-GW</b>	Slide Bush (Euro Standard): Double-Wide Type, Anticorrosion	C- 88
<b>KBS-OP</b>	Slide Bush (Euro Standard): Open Type, Anticorrosion	C- 86
<b>KBS-W</b>	Slide Bush (Euro Standard): Double-Wide Type, Anticorrosion	C- 88
<b>KBSF</b>	Slide Bush (Euro Standard): Round Flange Type, Anticorrosion	C- 90
<b>KBSF-G</b>	Slide Bush (Euro Standard): Round Flange Type, Anticorrosion	C- 90
<b>KBSF-GW</b>	Slide Bush (Euro Standard): Round Flange Double-Wide Type, Anticorrosion	C- 94
<b>KBSF-W</b>	Slide Bush (Euro Standard): Round Flange Double-Wide Type, Anticorrosion	C- 94
<b>KBSFC</b>	Slide Bush (Euro Standard): Center Mount Round Flange Type, Anticorrosion	C- 98
<b>KBSFC-G</b>	Slide Bush (Euro Standard): Center Mount Round Flange Type, Anticorrosion	C- 98
<b>KBSK</b>	Slide Bush (Euro Standard): Square Flange Type, Anticorrosion	C- 92
<b>KBSK-G</b>	Slide Bush (Euro Standard): Square Flange Type, Anticorrosion	C- 92
<b>KBSK-GW</b>	Slide Bush (Euro Standard): Square Flange Double-Wide Type, Anticorrosion	C- 96
<b>KBSK-W</b>	Slide Bush (Euro Standard): Square Flange Double-Wide Type, Anticorrosion	C- 96

<b>KBSKC</b> . . . . .	Slide Bush (Euro Standard): Center Mount Square Flange Type, Anticorrosion . . .	C- 100
<b>KBSKC-G</b> . . . . .	Slide Bush (Euro Standard): Center Mount Square Flange Type, Anticorrosion . . .	C- 100
<b>KGF-Grease</b> . . . . .	Anti-fretting/Anticorrosion . . . . .	Eng- 52
<b>KGLA-Grease</b> . . . . .	Low Dust-generation . . . . .	Eng- 52
<b>KGU-Grease</b> . . . . .	Low Dust-generation . . . . .	Eng- 52

**L**

<b>LP</b> . . . . .	Ball Spline: Lock Plate . . . . .	B- 18
<b>LWA</b> . . . . .	Shaft (Inch Standard): Low Shaft Support Rail . . . . .	F- 19

**N**

<b>NV</b> . . . . .	Slide Way: STUDROLLER System . . . . .	A- 12
<b>NV-RN</b> . . . . .	Slide Way: STUDROLLER System, All Steel Type . . . . .	A- 16
<b>NVS</b> . . . . .	Slide Way: STUDROLLER System, Anticorrosion . . . . .	A- 12
<b>NVS-RNS</b> . . . . .	Slide Way: STUDROLLER System, Special Environment Type, Anticorrosion . . . . .	A- 16
<b>NVT</b> . . . . .	Slide Table: STUDROLLER System . . . . .	A- 38
<b>NVTS</b> . . . . .	Slide Table: STUDROLLER System, Anticorrosion . . . . .	A- 38
<b>NYT</b> . . . . .	Slide Table:STUDROLLER System Compact Type . . . . .	A- 42
<b>NYT-D</b> . . . . .	Slide Table:STUDROLLER System Compact Type with Counterbored Rail . . . . .	A- 44
<b>NYTS</b> . . . . .	Slide Table:STUDROLLER System Compact Type,Anticorrosion . . . . .	A- 42
<b>NYTS-D</b> . . . . .	Slide Table:STUDROLLER System Compact Type with Counterbored Rail,Anticorrosion . . . . .	A- 44

**P**

<b>PC</b> . . . . .	Shaft: Pre-Cut Slide Shaft . . . . .	F- 32
---------------------	--------------------------------------	-------

**R**

<b>R</b> . . . . .	Slide Way: Roller Cage . . . . .	A- 5
<b>RA</b> . . . . .	Slide Way: Aluminum Roller Cage . . . . .	A- 6
<b>RAS</b> . . . . .	Slide Way: Aluminum Roller Cage, Anticorrosion . . . . .	A- 6
<b>RH</b> . . . . .	Slide Way: Upgraded Model, Roller Cage . . . . .	A- 6
<b>RHS</b> . . . . .	Slide Way: Upgraded Model, Roller Cage, Anticorrosion . . . . .	A- 6
<b>RK</b> . . . . .	Slide Rotary Bush . . . . .	E- 28
<b>RS</b> . . . . .	Slide Way: Roller Cage, Anticorrosion . . . . .	A- 5
<b>RV</b> . . . . .	Gonio Way . . . . .	A- 80
<b>RVF</b> . . . . .	Gonio Way: Flat-installation-surface Type . . . . .	A- 78

**SA**

<b>SA</b> . . . . .	Shaft: Shaft Support Rail . . . . .	F- 14
---------------------	-------------------------------------	-------

**SF**

<b>SF</b> . . . . .	Shaft: NBCA Shaft . . . . .	F- 22
<b>SFS</b> . . . . .	Shaft: NBCA Stainless Steel Shaft . . . . .	F- 23
<b>SFW</b> . . . . .	Shaft: NBCA Inch Shaft . . . . .	F- 24
<b>SFW-FS102</b> . . . . .	Shaft: Format Single End Tapped Inch Shaft . . . . .	F- 28
<b>SFW-FS103</b> . . . . .	Shaft: Format Both End Tapped Inch Shaft . . . . .	F- 29

<b>SFW-FS115</b> . . . . .	Shaft: Format Single End Threaded Inch Shaft . . . . .	F- 30
<b>SFW-FS116</b> . . . . .	Shaft: Format Both End Threaded Inch Shaft . . . . .	F- 31
<b>SFW-PD</b> . . . . .	Shaft: NBCA Inch Pre-Drilled Shaft . . . . .	F- 26
<b>SFWS</b> . . . . .	Shaft: NBCA Inch Shaft, Anticorrosion . . . . .	F- 25
<b>SFWS-FS102</b> . . . . .	Shaft: Format Single End Tapped Inch Shaft, Anticorrosion . . . . .	F- 28
<b>SFWS-FS103</b> . . . . .	Shaft: Format Both End Tapped Inch Shaft, Anticorrosion . . . . .	F- 29
<b>SFWS-PD</b> . . . . .	Shaft: NBCA Inch Pre-Drilled Shaft, Anticorrosion . . . . .	F- 27

**SH**

<b>SH</b> . . . . .	Shaft: Shaft Supporter . . . . .	F- 12
<b>SH-A</b> . . . . .	Shaft: Aluminum Shaft Supporter . . . . .	F- 11
<b>SHF</b> . . . . .	Shaft: Shaft Supporter Flange Type . . . . .	F- 13
<b>SHF-FC</b> . . . . .	Shaft: Shaft Supporter Flange Type Cast Iron . . . . .	F- 13

**SM**

<b>SM</b> . . . . .	Slide Bush: Standard Type . . . . .	C- 18
<b>SM-AJ</b> . . . . .	Slide Bush: Clearance Adjustable Type . . . . .	C- 20
<b>SM-G</b> . . . . .	Slide Bush: Standard Type . . . . .	C- 18
<b>SM-G-L</b> . . . . .	Slide Bush: Long Type . . . . .	C- 24
<b>SM-G-AJ</b> . . . . .	Slide Bush: Clearance Adjustable Type . . . . .	C- 20
<b>SM-G-OP</b> . . . . .	Slide Bush: Open Type . . . . .	C- 22
<b>SM-GW</b> . . . . .	Slide Bush: Double-Wide Type . . . . .	C- 26
<b>SM-OP</b> . . . . .	Slide Bush: Open Type . . . . .	C- 22
<b>SM-W</b> . . . . .	Slide Bush: Double-Wide Type . . . . .	C- 26
<b>SMA</b> . . . . .	Slide Bush: Block Type . . . . .	C- 120
<b>SMA-G</b> . . . . .	Slide Bush: Block Type . . . . .	C- 120
<b>SMA-GW</b> . . . . .	Slide Bush: Double-Wide Block Type . . . . .	C- 122
<b>SMA-R</b> . . . . .	Slide Rotary Bush: Block Type . . . . .	E- 20
<b>SMA-RW</b> . . . . .	Slide Rotary Bush: Double-Wide Block Type . . . . .	E- 21
<b>SMA-W</b> . . . . .	Slide Bush: Double-Wide Block Type . . . . .	C- 122
<b>SMD</b> . . . . .	Slide Bush: Clearance Adjustable Open Block Type . . . . .	C- 136
<b>SMD-G</b> . . . . .	Slide Bush: Clearance Adjustable Open Block Type . . . . .	C- 136
<b>SME</b> . . . . .	Slide Bush: Open Block Type . . . . .	C- 132
<b>SME-G</b> . . . . .	Slide Bush: Open Block Type . . . . .	C- 132
<b>SME-GW</b> . . . . .	Slide Bush: Double-Wide Open Block Type . . . . .	C- 134
<b>SME-W</b> . . . . .	Slide Bush: Double-Wide Open Block Type . . . . .	C- 134
<b>SMF</b> . . . . .	Slide Bush: Round Flange Type . . . . .	C- 28
<b>SMF-E</b> . . . . .	Slide Bush: Round Flange Pilot End Type . . . . .	C- 34
<b>SMF-G</b> . . . . .	Slide Bush: Round Flange Type . . . . .	C- 28
<b>SMF-G-E</b> . . . . .	Slide Bush: Round Flange Pilot End Type . . . . .	C- 34
<b>SMF-GW</b> . . . . .	Slide Bush: Round Flange Double-Wide Type . . . . .	C- 42

**SMF-GW-E** . . . Slide Bush: Round Flange Double-Wide Pilot End Type . . . . . C- 54

**SMF-W** . . . . . Slide Bush: Round Flange Double-Wide Type . . . . . C- 42

**SMF-W-E** . . . . . Slide Bush: Round Flange Double-Wide Pilot End Type . . . . . C- 54

**SMFC** . . . . . Slide Bush: Center Mount Round Flange Type . . . . . C- 48

**SMFC-G** . . . . . Slide Bush: Center Mount Round Flange Type . . . . . C- 48

**SMJ** . . . . . Slide Bush: Clearance Adjustable Block Type . . . . . C-130

**SMJ-G** . . . . . Slide Bush: Clearance Adjustable Block Type . . . . . C-130

**SMK** . . . . . Slide Bush: Square Flange Type . . . . . C- 30

**SMK-E** . . . . . Slide Bush: Square Flange Pilot End Type . . . . . C- 36

**SMK-G** . . . . . Slide Bush: Square Flange Type . . . . . C- 30

**SMK-G-E** . . . . . Slide Bush: Square Flange Pilot End Type . . . . . C- 36

**SMK-G-L** . . . . . Slide Bush: Square Flange Long Type . . . . . C- 40

**SMK-GW** . . . . . Slide Bush: Square Flange Double-Wide Type . . . . . C- 44

**SMK-GW-E** . . . . . Slide Bush: Square Flange Double-Wide Pilot End Type . . . . . C- 56

**SMK-W** . . . . . Slide Bush: Square Flange Double-Wide Type . . . . . C- 44

**SMK-W-E** . . . . . Slide Bush: Square Flange Double-Wide Pilot End Type . . . . . C- 56

**SMKC** . . . . . Slide Bush: Center Mount Square Flange Type . . . . . C- 50

**SMKC-G** . . . . . Slide Bush: Center Mount Square Flange Type . . . . . C- 50

**SMP** . . . . . Slide Bush: Pillow Block Type . . . . . C-128

**SMP-G** . . . . . Slide Bush: Pillow Block Type . . . . . C-128

**SMP-R** . . . . . Slide Rotary Bush: Pillow Block Type . . . . . E- 24

**SMS** . . . . . Slide Bush: Standard Type, Anticorrosion . . . . . C- 18

**SMS-AJ** . . . . . Slide Bush: Clearance Adjustable Type, Anticorrosion . . . . . C- 20

**SMS-G** . . . . . Slide Bush: Standard Type, Anticorrosion . . . . . C- 18

**SMS-G-AJ** . . . . . Slide Bush: Clearance Adjustable Type, Anticorrosion . . . . . C- 20

**SMS-G-OP** . . . . . Slide Bush: Open Type, Anticorrosion . . . . . C- 22

**SMS-GW** . . . . . Slide Bush: Double-Wide Type, Anticorrosion . . . . . C- 26

**SMS-OP** . . . . . Slide Bush: Open Type, Anticorrosion . . . . . C- 22

**SMS-W** . . . . . Slide Bush: Double-Wide Type, Anticorrosion . . . . . C- 26

**SMSA** . . . . . Slide Bush: Block Type, Anticorrosion . . . . . C-120

**SMSA-G** . . . . . Slide Bush: Block Type, Anticorrosion . . . . . C-120

**SMSA-GW** . . . . . Slide Bush: Double-Wide Block Type, Anticorrosion . . . . . C-122

**SMSA-W** . . . . . Slide Bush: Double-Wide Block Type, Anticorrosion . . . . . C-122

**SMSD** . . . . . Slide Bush: Clearance Adjustable Open Block Type, Anticorrosion . . . . . C-136

**SMSD-G** . . . . . Slide Bush: Clearance Adjustable Open Block Type, Anticorrosion . . . . . C-136

**SMSE** . . . . . Slide Bush: Open Block Type, Anticorrosion . . . . . C-132

**SMSE-G** . . . . . Slide Bush: Open Block Type, Anticorrosion . . . . . C-132

**SMSE-GW** . . . . . Slide Bush: Double-Wide Open Block Type, Anticorrosion . . . . . C-134

**SMSE-W** . . . . . Slide Bush: Double-Wide Open Block Type, Anticorrosion . . . . . C-134

**SMSF** . . . . . Slide Bush: Round Flange Type, Anticorrosion . . . . . C- 28

**SMSF-E** . . . . . Slide Bush: Round Flange Pilot End Type, Anticorrosion . . . . . C- 34

**SMSF-G** . . . . . Slide Bush: Round Flange Type, Anticorrosion . . . . . C- 28

**SMSF-G-E** . . . . . Slide Bush: Round Flange Pilot End Type, Anticorrosion . . . . . C- 34

**SMSF-GW** . . . . . Slide Bush: Round Flange Double-Wide Type, Anticorrosion . . . . . C- 42

**SMSF-GW-E** . . . . . Slide Bush: Round Flange Double-Wide Pilot End Type, Anticorrosion . . . . . C- 54

**SMSF-W** . . . . . Slide Bush: Round Flange Double-Wide Type, Anticorrosion . . . . . C- 42

**SMSF-W-E** . . . . . Slide Bush: Round Flange Double-Wide Pilot End Type, Anticorrosion . . . . . C- 54

**SMSFC** . . . . . Slide Bush: Center Mount Round Flange Type, Anticorrosion . . . . . C- 48

**SMSFC-G** . . . . . Slide Bush: Center Mount Round Flange Type, Anticorrosion . . . . . C- 48

**SMSJ** . . . . . Slide Bush: Clearance Adjustable Block Type, Anticorrosion . . . . . C-130

**SMSJ-G** . . . . . Slide Bush: Clearance Adjustable Block Type, Anticorrosion . . . . . C-130

**SMSK** . . . . . Slide Bush: Square Flange Type, Anticorrosion . . . . . C- 30

**SMSK-E** . . . . . Slide Bush: Square Flange Pilot End Type, Anticorrosion . . . . . C- 36

**SMSK-G** . . . . . Slide Bush: Square Flange Type, Anticorrosion . . . . . C- 30

**SMSK-G-E** . . . . . Slide Bush: Square Flange Pilot End Type, Anticorrosion . . . . . C- 36

**SMSK-GW** . . . . . Slide Bush: Square Flange Double-Wide Type, Anticorrosion . . . . . C- 44

**SMSK-GW-E** . . . . . Slide Bush: Square Flange Double-Wide Pilot End Type, Anticorrosion . . . . . C- 56

**SMSK-W** . . . . . Slide Bush: Square Flange Double-Wide Type, Anticorrosion . . . . . C- 44

**SMSK-W-E** . . . . . Slide Bush: Square Flange Double-Wide Pilot End Type, Anticorrosion . . . . . C- 56

**SMSKC** . . . . . Slide Bush: Center Mount Square Flange Type, Anticorrosion . . . . . C- 50

**SMSKC-G** . . . . . Slide Bush: Center Mount Square Flange Type, Anticorrosion . . . . . C- 50

**SMST** . . . . . Slide Bush: Two Side Cut Flange Type, Anticorrosion . . . . . C- 32

**SMST-E** . . . . . Slide Bush: Two Side Cut Pilot End Flange Type, Anticorrosion . . . . . C- 38

**SMST-G** . . . . . Slide Bush: Two Side Cut Flange Type, Anticorrosion . . . . . C- 32

**SMST-G-E** . . . . . Slide Bush: Two Side Cut Pilot End Flange Type, Anticorrosion . . . . . C- 38

**SMST-GW** . . . . . Slide Bush: Two Side Cut Double-Wide Flange Type, Anticorrosion . . . . . C- 46

**SMST-GW-E** . . . . . Slide Bush: Two Side Cut Double-Wide Flange Pilot End Type, Anticorrosion . . . . . C- 58

**SMST-W** . . . . . Slide Bush: Two Side Cut Double-Wide Flange Type, Anticorrosion . . . . . C- 46

**SMST-W-E** . . . . . Slide Bush: Two Side Cut Double-Wide Flange Pilot End Type, Anticorrosion . . . . . C- 58

**SMSTC** . . . . . Slide Bush: Two Side Cut Center Flange Type, Anticorrosion . . . . . C- 52

**SMSTC-G** . . . . . Slide Bush: Two Side Cut Center Flange Type, Anticorrosion . . . . . C- 52

**SMT** . . . . . Slide Bush: Two Side Cut Flange Type . . . . . C- 32

**SMT-E** . . . . . Slide Bush: Two Side Cut Pilot End Flange Type . . . . . C- 38

**SMT-G** . . . . . Slide Bush: Two Side Cut Flange Type . . . . . C- 32

**SMT-G-E** . . . . . Slide Bush: Two Side Cut Pilot End Flange Type . . . . . C- 38

**SMT-GW** . . . . . Slide Bush: Two Side Cut Double-Wide Flange Type . . . . . C- 46

**SMT-GW-E** . . . . . Slide Bush: Two Side Cut Double-Wide Flange Pilot End Type . . . . . C- 58

**SMT-W** . . . . . Slide Bush: Two Side Cut Double-Wide Flange Type . . . . . C- 46

<b>SMT-W-E</b> . . . . .	Slide Bush: Two Side Cut Double-Wide Flange Pilot End Type . . . . .	C- 58
<b>SMTC</b> . . . . .	Slide Bush: Two Side Cut Center Flange Type . . . . .	C- 52
<b>SMTC-G</b> . . . . .	Slide Bush: Two Side Cut Center Flange Type . . . . .	C- 52

**SN**

<b>SN</b> . . . . .	Shaft: NB Shaft . . . . .	F- 6
<b>SNB</b> . . . . .	Shaft: NB Center-lined Tapped Shaft . . . . .	F- 9
<b>SNS</b> . . . . .	Shaft: NB Shaft, Anticorrosion . . . . .	F- 7
<b>SNSB</b> . . . . .	Shaft: NB Center-lined Tapped Shaft, Anticorrosion . . . . .	F- 9
<b>SNT</b> . . . . .	Shaft: NB Pipe Shaft . . . . .	F- 8

**SP**

<b>SPB</b> . . . . .	Rotary Ball Spline . . . . .	B- 50
<b>SPB-KP</b> . . . . .	Rotary Ball Spline, Compact Type . . . . .	B- 48
<b>SPBF</b> . . . . .	Ball Screw Spline . . . . .	B- 72
<b>SPBF-KP</b> . . . . .	Ball Screw Spline: Compact Type . . . . .	B- 68
<b>SPBR</b> . . . . .	Ball Screw Spline . . . . .	B- 70
<b>SPBR-KP</b> . . . . .	Ball Screw Spline: Compact Type . . . . .	B- 66
<b>SPLFS</b> . . . . .	Stroke Ball Spline . . . . .	B- 56
<b>SPR</b> . . . . .	Rotary Ball Spline . . . . .	B- 46

**SR**

<b>SR</b> . . . . .	Stroke Bush: Standard . . . . .	E- 6
<b>SR-B</b> . . . . .	Stroke Bush: Double Retainer Type . . . . .	E- 8
<b>SR-BUU</b> . . . . .	Stroke Bush: Double Retainer Type with Seals . . . . .	E- 9
<b>SR-UU</b> . . . . .	Stroke Bush: Standard with Seals . . . . .	E- 7
<b>SRE</b> . . . . .	Slide Rotary Bush . . . . .	E- 16
<b>SREK</b> . . . . .	Slide Rotary Bush: Square Flange Type . . . . .	E- 18

**SS**

<b>SS</b> . . . . .	Slide Screw . . . . .	H- 7
<b>SSP</b> . . . . .	Ball Spline: Cylindrical Type . . . . .	B- 20
<b>SSP-AM</b> . . . . .	Ball Spline: Compact Cylindrical Type . . . . .	B- 22
<b>SSP-C</b> . . . . .	Ball Spline: Commercial Spline Assembly with SSP nut . . . . .	B- 33
<b>SSPF</b> . . . . .	Ball Spline: Round Flange Type . . . . .	B- 26
<b>SSPFS</b> . . . . .	Ball Spline: Round Flange Type, Anticorrosion . . . . .	B- 26
<b>SSPF-C</b> . . . . .	Ball Spline: Commercial Spline Assembly with SSPF nut . . . . .	B- 33
<b>SSPK-AM</b> . . . . .	Ball Spline: Light and Compact Flange Type . . . . .	B- 30
<b>SSPKS-AM</b> . . . . .	Ball Spline: Light and Compact Flange Type Anticorrosion . . . . .	B- 30
<b>SSPM</b> . . . . .	Ball Spline: Cylindrical Keyless Type . . . . .	B- 24
<b>SSPS</b> . . . . .	Ball Spline: Cylindrical Type, Anticorrosion . . . . .	B- 20
<b>SSPS-AM</b> . . . . .	Ball Spline: Compact Cylindrical Type, Anticorrosion . . . . .	B- 22
<b>SSPT</b> . . . . .	Ball Spline: Two Side Cut Flange Type . . . . .	B- 28

<b>SSPT-AM</b> . . . . .	Ball Spline: Compact Two Side Cut Flange Type . . . . .	B- 30
<b>SSPTS-AM</b> . . . . .	Ball Spline: Compact Two Side Cut Flange Type, Anticorrosion . . . . .	B- 30

**SV**

<b>SV</b> . . . . .	Slide Way . . . . .	A- 22
<b>SVS</b> . . . . .	Slide Way: Anticorrosion . . . . .	A- 22
<b>SVT</b> . . . . .	Slide Table . . . . .	A- 54
<b>SVTS</b> . . . . .	Slide Table: Anticorrosion . . . . .	A- 54
<b>SVW</b> . . . . .	Slide Way: Center Rail Type . . . . .	A- 32
<b>SVWS</b> . . . . .	Slide Way: Center Rail Type, Anticorrosion . . . . .	A- 32

**SW**

<b>SW</b> . . . . .	Slide Bush (Inch Standard): Standard Type . . . . .	C- 102
<b>SW-AJ</b> . . . . .	Slide Bush (Inch Standard): Clearance Adjustable Type . . . . .	C- 104
<b>SW-G</b> . . . . .	Slide Bush (Inch Standard): Standard Type . . . . .	C- 102
<b>SW-G-AJ</b> . . . . .	Slide Bush (Inch Standard): Clearance Adjustable Type . . . . .	C- 104
<b>SW-G-OP</b> . . . . .	Slide Bush (Inch Standard): Open Type . . . . .	C- 106
<b>SW-GR</b> . . . . .	Slide Bush (Inch Standard): Self-Aligning Type . . . . .	C- 102
<b>SW-GR-AJ</b> . . . . .	Slide Bush (Inch Standard): Self-Aligning, Clearance Adjustable Type . . . . .	C- 104
<b>SW-GR-OP</b> . . . . .	Slide Bush (Inch Standard): Self-Aligning, Open Type . . . . .	C- 106
<b>SW-GW</b> . . . . .	Slide Bush (Inch Standard): Double-Wide Type . . . . .	C- 108
<b>SW-OP</b> . . . . .	Slide Bush (Inch Standard): Open Type . . . . .	C- 106
<b>SW-W</b> . . . . .	Slide Bush (Inch Standard): Double-Wide Type . . . . .	C- 108
<b>SWA</b> . . . . .	Slide Bush (Inch Standard): Block Type . . . . .	C- 142
<b>SWA-G</b> . . . . .	Slide Bush (Inch Standard): Block Type . . . . .	C- 142
<b>SWA-GR</b> . . . . .	Slide Bush (Inch Standard): Self-Aligning, Block Type . . . . .	C- 142
<b>SWD</b> . . . . .	Slide Bush (Inch Standard): Clearance Adjustable Open Block Type . . . . .	C- 146
<b>SWD-G</b> . . . . .	Slide Bush (Inch Standard): Clearance Adjustable Open Block Type . . . . .	C- 146
<b>SWD-GR</b> . . . . .	Slide Bush (Inch Standard): Self-Aligning Clearance Adjustable Open Block Type . . . . .	C- 146
<b>SWJ</b> . . . . .	Slide Bush (Inch Standard): Clearance Adjustable Block Type . . . . .	C- 144
<b>SWJ-G</b> . . . . .	Slide Bush (Inch Standard): Clearance Adjustable Block Type . . . . .	C- 144
<b>SWJ-GR</b> . . . . .	Slide Bush (Inch Standard): Self-Aligning Clearance Adjustable Block Type . . . . .	C- 144
<b>SWF</b> . . . . .	Slide Bush (Inch Standard): Round Flange Type . . . . .	C- 110
<b>SWF-G</b> . . . . .	Slide Bush (Inch Standard): Round Flange Type . . . . .	C- 110
<b>SWF-GW</b> . . . . .	Slide Bush (Inch Standard): Round Flange Double-Wide Type . . . . .	C- 114
<b>SWF-W</b> . . . . .	Slide Bush (Inch Standard): Round Flange Double-Wide Type . . . . .	C- 114
<b>SWK</b> . . . . .	Slide Bush (Inch Standard): Square Flange Type . . . . .	C- 112
<b>SWK-G</b> . . . . .	Slide Bush (Inch Standard): Square Flange Type . . . . .	C- 112
<b>SWK-GW</b> . . . . .	Slide Bush (Inch Standard): Square Flange Double-Wide Type . . . . .	C- 116
<b>SWK-W</b> . . . . .	Slide Bush (Inch Standard): Square Flange Double-Wide Type . . . . .	C- 116
<b>SWS</b> . . . . .	Slide Bush (Inch Standard): Standard Type, Anticorrosion . . . . .	C- 102

**SWS-AJ** . . . . . Slide Bush (Inch Standard): Clearance Adjustable Type, Anticorrosion . . . C-104

**SWS-G** . . . . . Slide Bush (Inch Standard): Standard Type, Anticorrosion . . . . . C-102

**SWS-G-AJ** . . . . . Slide Bush (Inch Standard): Clearance Adjustable Type, Anticorrosion . . . C-104

**SWS-G-OP** . . . . . Slide Bush (Inch Standard): Open Type, Anticorrosion . . . . . C-106

**SWS-GW** . . . . . Slide Bush (Inch Standard): Double-Wide Type, Anticorrosion . . . . . C-108

**SWS-OP** . . . . . Slide Bush (Inch Standard): Open Type, Anticorrosion . . . . . C-106

**SWS-W** . . . . . Slide Bush (Inch Standard): Double-Wide Type, Anticorrosion . . . . . C-108

**SWSA** . . . . . Slide Bush (Inch Standard): Block Type, Anticorrosion . . . . . C-142

**SWSA-G** . . . . . Slide Bush (Inch Standard): Block Type, Anticorrosion . . . . . C-142

**SWSD** . . . . . Slide Bush (Inch Standard): Clearance Adjustable Open Block Type, Anticorrosion . . . C-146

**SWSD-G** . . . . . Slide Bush (Inch Standard): Clearance Adjustable Open Block Type, Anticorrosion . . . C-146

**SWSF** . . . . . Slide Bush (Inch Standard): Round Flange Type, Anticorrosion . . . . . C-110

**SWSF-G** . . . . . Slide Bush (Inch Standard): Round Flange Type, Anticorrosion . . . . . C-110

**SWSF-GW** . . . . . Slide Bush (Inch Standard): Round Flange Double-Wide Type, Anticorrosion . . . C-114

**SWSF-W** . . . . . Slide Bush (Inch Standard): Round Flange Double-Wide Type, Anticorrosion . . . C-114

**SWSJ** . . . . . Slide Bush (Inch Standard): Clearance Adjustable Block Type, Anticorrosion . . . C-144

**SWSJ-G** . . . . . Slide Bush (Inch Standard): Clearance Adjustable Block Type, Anticorrosion . . . C-144

**SWSK** . . . . . Slide Bush (Inch Standard): Square Flange Type, Anticorrosion . . . . . C-112

**SWSK-G** . . . . . Slide Bush (Inch Standard): Square Flange Type, Anticorrosion . . . . . C-112

**SWSK-GW** . . . . . Slide Bush (Inch Standard): Square Flange Double-Wide Type, Anticorrosion . . . C-116

**SWSK-W** . . . . . Slide Bush (Inch Standard): Square Flange Double-Wide Type, Anticorrosion . . . C-116

**SY**

**SYBS** . . . . . Miniature Slide: Ultra Compact Type . . . . . A-68

**SYT** . . . . . Slide Table: Compact Type . . . . . A-60

**SYT-D** . . . . . Slide Table: Compact Type with Counterbored Rail . . . . . A-62

**SYTS** . . . . . Slide Table: Compact Type, Anticorrosion . . . . . A-60

**SYTS-D** . . . . . Slide Table: Compact Type with Counterbored Rail, Anticorrosion . . . . . A-62

**TK**

**TK** . . . . . TOPBALL Slide Bush (Euro Standard): Standard Type . . . . . D-8

**TK-OP** . . . . . TOPBALL Slide Bush (Euro Standard): Open Type . . . . . D-8

**TKA** . . . . . Slide Bush using TOPBALL (Euro Standard): Block Type . . . . . D-12

**TKA-W** . . . . . Slide Bush using TOPBALL (Euro Standard): Double-Wide Block Type . . . . . D-13

**TKD** . . . . . Slide Bush using TOPBALL (Euro Standard): Clearance Adjustable Open Block Type . . . D-16

**TKD-W** . . . . . Slide Bush using TOPBALL (Euro Standard): Clearance Adjustable Double-Wide Open Block Type . . . D-17

**TKE** . . . . . Slide Bush using TOPBALL (Euro Standard): Open Block Type . . . . . D-14

**TKE-W** . . . . . Slide Bush using TOPBALL (Euro Standard): Double-Wide Open Block Type . . . . . D-15

**TM**

**TMA** . . . . . Slide Bush using TOPBALL, Block Type . . . . . D-19

**TMF** . . . . . Slide Bush using TOPBALL, Round Flange Type . . . . . D-18

**TQ**

**TQF-G-E** . . . . . Slide Bush with grease fitting : Round Flange with Pilot End Type . . . . . C-74

**TQF-GW-E** . . . . . Slide Bush with grease fitting : Round Flange Double-Wide with Pilot End Type . . . C-78

**TQK-G-E** . . . . . Slide Bush with grease fitting : Square Flange with Pilot End Type . . . . . C-76

**TQK-GW-E** . . . . . Slide Bush with grease fitting : Square Flange Double-Wide with Pilot End Type . . . C-80

**TR**

**TRF** . . . . . Slide Bush: Triple-Wide Round Flange Type . . . . . C-60

**TRF-E** . . . . . Slide Bush: Triple-Wide Round Flange Pilot End Type . . . . . C-70

**TRF-G** . . . . . Slide Bush: Triple-Wide Round Flange Type . . . . . C-60

**TRF-G-E** . . . . . Slide Bush: Triple-Wide Round Flange Pilot End Type . . . . . C-70

**TRFC** . . . . . Slide Bush: Triple-Wide Intermediate Position Round Flange Type . . . . . C-66

**TRFC-G** . . . . . Slide Bush: Triple-Wide Intermediate Position Round Flange Type . . . . . C-66

**TRK** . . . . . Slide Bush: Triple-Wide Square Flange Type . . . . . C-62

**TRK-E** . . . . . Slide Bush: Triple-Wide Square Flange Pilot End Type . . . . . C-72

**TRK-G** . . . . . Slide Bush: Triple-Wide Square Flange Type . . . . . C-62

**TRK-G-E** . . . . . Slide Bush: Triple-Wide Square Flange Pilot End Type . . . . . C-72

**TRKC** . . . . . Slide Bush: Triple-Wide Intermediate Position Square Flange Type . . . . . C-68

**TRKC-G** . . . . . Slide Bush: Triple-Wide Intermediate Position Square Flange Type . . . . . C-68

**TRT-G** . . . . . Slide Bush: Triple-Wide Two Side Cut Flange Type . . . . . C-64

**TU**

**TU2** . . . . . Grease Dispenser . . . . . Eng-53

**TW**

**TW** . . . . . TOPBALL Slide Bush (Inch Standard): Standard Type . . . . . D-10

**TW-OP** . . . . . TOPBALL Slide Bush (Inch Standard): Open Type . . . . . D-10

**TWA** . . . . . Slide Bush using TOPBALL (Inch Standard): Block Type . . . . . D-20

**TWA-W** . . . . . Slide Bush using TOPBALL (Inch Standard): Double-Wide Block Type . . . . . D-21

**TWD** . . . . . Slide Bush using TOPBALL (Inch Standard): Clearance Adjustable Open Block Type . . . D-24

**TWD-W** . . . . . Slide Bush using TOPBALL (Inch Standard): Clearance Adjustable Double-Wide Open Block Type . . . D-25

**TWJ** . . . . . Slide Bush using TOPBALL (Inch Standard): Clearance Adjustable Block Type . . . . . D-22

**TWJ-W** . . . . . Slide Bush using TOPBALL (Inch Standard): Clearance Adjustable Double-Wide Block Type . . . D-23

**W**

**WA** . . . . . Shaft (Inch Standard): Shaft Support Rail . . . . . F-18

**WH-A** . . . . . Shaft (Inch Standard): Aluminum Shaft Supporter . . . . . F-16

**WSS** . . . . . Shaft (Inch Standard): Shaft Support Assembly . . . . . F-20

**WSS-SS** . . . . . Shaft (Inch Standard): Shaft Support Assembly, Anticorrosion . . . . . F-21

## NIPPON BEARING CO.,LTD.

2833 Chiya, Ojiya-city, Niigata-pref., 947-8503 JAPAN  
Phone:+81 (0) 258-82-0011 FAX:+81 (0) 258-81-1135  
Overseas direct call:+81 (0) 3-5615-2812  
Overseas direct fax:+81 (0) 3-5615-2813  
<https://www.nipponbearing.com>  
tex@nipponbearing.com

## NB CORPORATION OF AMERICA

930 Muirfield Drive, Hanover Park, IL 60133, U.S.A.  
Phone: (630) 295-8880 FAX: (630) 295-8881  
TOLL FREE: (800) 521-2045

### Western Regional Office

2107 N. First St. San Jose, CA 95131, U.S.A.  
Phone: (408) 441-0799 FAX: (408) 441-0988  
TOLL FREE: (888) 562-4175

### Eastern Regional Office

400 Morris Avenue, Suite 224, Denville, NJ 07834, U.S.A.  
Phone: (201) 236-3886 FAX: (201) 236-5112  
TOLL FREE: (800) 981-8190

<http://www.nbcorporation.com>  
info@nbcorporation.com

## NB EUROPE B.V.

Boekweitstraat 21, 2153 GK Nieuw-Vennep, The Netherlands  
Phone:+31 (0) 252-463-200 FAX:+31 (0) 252-463-209  
<http://www.nbeurope.com>  
info@nbeurope.com

## NB CHINA CO.,LTD.

Room 108, Building 2, Randong Commercial Center No.150,  
Lane 2161 Wanyuan Road, Minhang District, Shanghai 201103,  
P.R. China  
Phone:+021-52286811  
<http://www.nipponbearing.com/chinese/index.html>  
info@nb-china.com.cn

## NIPPON BEARING MALAYSIA SDN. BHD.

1-01-01A, Menara IJM Land, No.1, Lebu Thuku Kudin 3, 11700,  
Gelugor, Penang, Malaysia  
Phone:+60-4-656-2191  
info@nipponbearing.com.my

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