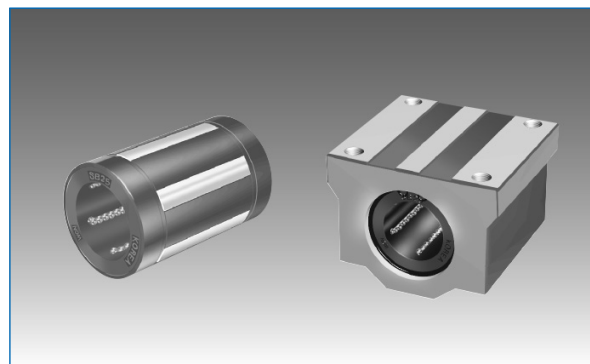


Super Ball Bushing Contents



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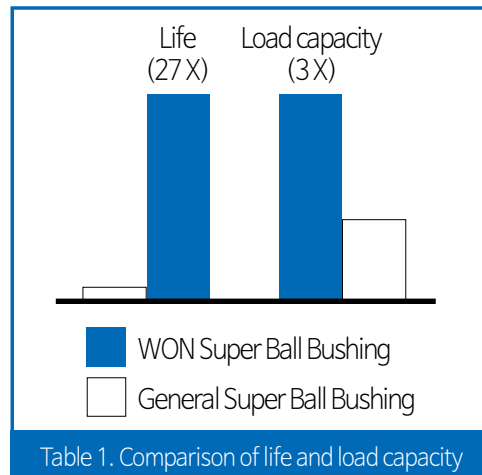
1 Features of Super Ball Bushing

WON ST localized super ball bushing for the first time in Korea. WON Super Ball Bushing with heavy load & self-aligning type has significant features as follows.

1. 27 times longer service life (3 times more load capacity)

WON Super Ball Bushing has about 3 times more dynamic load rating capacity than a general ball bushing with the same specifications. Therefore, its travel life is 27 times longer.

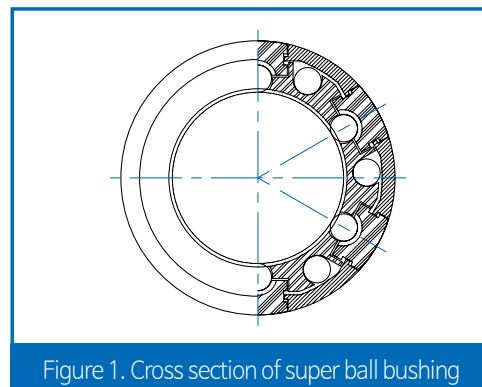
- The plate of a super ball bushing is made of the special steel with heat treatment. The precisely polished raceway of a ball is designed to be a fewer larger than diameter of the ball in order to be suitable for rolling motion of the ball and high load.
- The 0.5° self-aligning function helps to make even distribution of ball load and to prevent partial intensive pressure that causes a shortened service life.



2. 0.5° Self-aligning

The outer side of the plate of WON Super Ball Bushing is curved so as to have 0.5 ° self-aligning function in the direction of shaft length. This function helps to absorb the increased pressure between the corner of a ball bushing and a shaft, which is caused by inconsistency between the center lines of the ball bushing and the shaft, and thereby to distribute evenly load on each ball. In addition, it helps to make a ball easily come in and out of the load-carrying area and thus supports smooth running.

(It is recommended to design a system composed of two shafts, each of which has two ball bushings.)

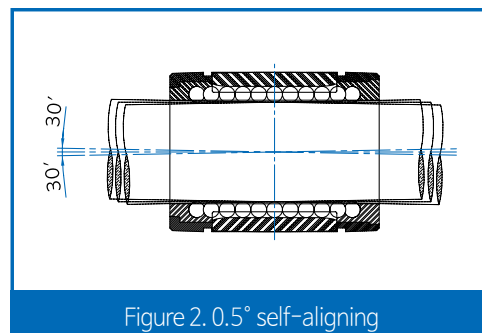


3. Compatibility

WON Super Ball Bushing is classified into Asia Series (SB) and Europe Series (SBE). SB Series has compatibility, since its installation dimensions are equal to those of general ball bushing products used domestically.

4. Fast speed and acceleration

A super ball bushing supports 3m/sec of velocity and 150m/sec² of acceleration without shortening its service life.



5. Easy adjustment of gap

When the bearing plate in the radial direction is installed in the housing making it possible to adjust clearance, it is easy to adjust a gap in the radial direction in order for precise travel without runout.

- Zero gap adjustment

After WON Super Ball Bushing is installed in the housing supporting clearance adjustment, insert a shaft. Adjust the gap with an adjustment screw until you feel a tiny resistance at the time of turning the shaft.

- Preload

To apply preload, set a shaft, which is smaller as many as a preload level (μ) than the shaft (diameter: d) to be used, to zero gap.

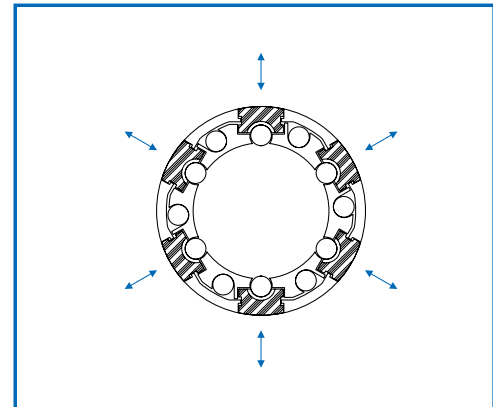


Figure 3. Gap adjustment

6. Reduction in installation cost

The self-aligning function of a super ball bushing helps to absorb inaccurate processing or inaccuracy of installation and thus to drive smoothly. Therefore, it saves installation time and cost.

7. Smooth driving

The self-aligning function makes it easy for a ball to enter in the load-carrying area. Since the outer sleeve and retainer are made of light and anti-wear polyamide, it supports smooth driving with low inertial force and noise. In the condition of oil lubrication without any seal, the maximum coefficient of friction is 0.001.

8. Available temperature

If a super ball bushing is used at above 100°C, it shortens its service life.
(Figure 6. See the temperature factor in the calculation of life.)

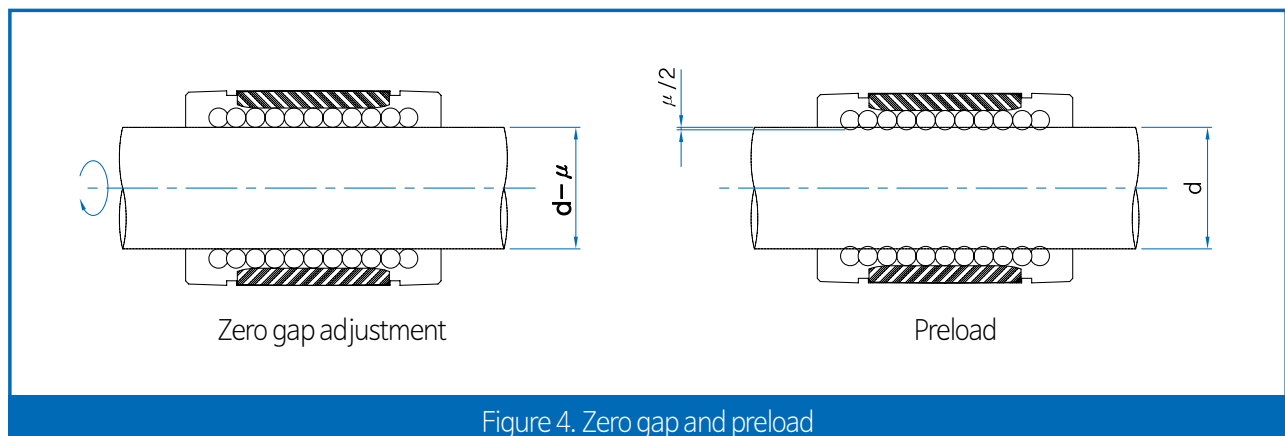


Figure 4. Zero gap and preload

2 Types of Super Ball Bushing

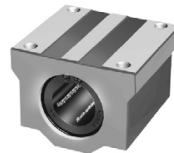
1. Asia Series



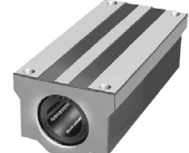
SB Bearing



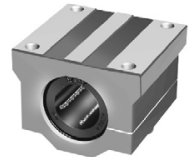
SBO Bearing



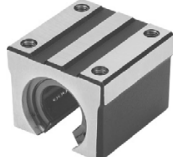
SH Block



SHW Block



SH-A Block



SHO Block

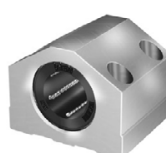
2. Europe Series



SBE Bearing



SBEO Bearing



CS Block



CS-A Block



CSW Block



CSW-A Block



CSO Block



CSO-A Block



CSOW Block



CSOW-A Block

Super Ball Bushing

3. Inch Series



SBA Bearing



SBAO Bearing

3 Life of Super Ball Bushing

A linear motion system has rolling linear motion by bearing load. For this reason, the raceway surface and a rolling element of the system have repetitive stress all the times. Accordingly, if the system reaches a certain travel distance, its raceway or rolling element surface faces a fatigue crack and a scale-like shape appears on part of the surface. Such a phenomenon is called flaking.

Life of a linear motion system refers to a total travel distance until the initial flaking arises on the raceway surface or a rolling element.

1. Basic dynamic load rating (C)

Basic dynamic load rating refers to the load with a constant direction and size, which makes it possible for 90% in one group of linear motion systems to run 50km without any material damage caused by fatigue when each one of the systems runs under the same condition. A value of basic dynamic load rating is described in the table of dimensions.

2. Hardness factor (f_H)

If a ball bushing has a low hardness factor of shaft, its life is shortened.

$$L = \left(\frac{C}{P} \cdot f_H \cdot f_T \cdot f_D \right)^3 \cdot 50(\text{km})$$

- L : Running distance life (km)
- C : Basic dynamic load rating (N)
- T : Basic dynamic rated torque (N · m)
- P : Applied load (N)
- f_H : Hardness factor (See Figure 5.)
- f_T : Temperature facto (See Figure 6.)
- f_D : Load direction factor (See Figure 8.)

$$L_h = \frac{L \cdot 10^3}{2 \times l_s \times n_1 \times 60} (\text{hr})$$

- L_h : Rating life (hr)
- L : Running distance life (km)
- l_s : Stroke length (m)
- n₁ : Number of strokes per minute (opm)

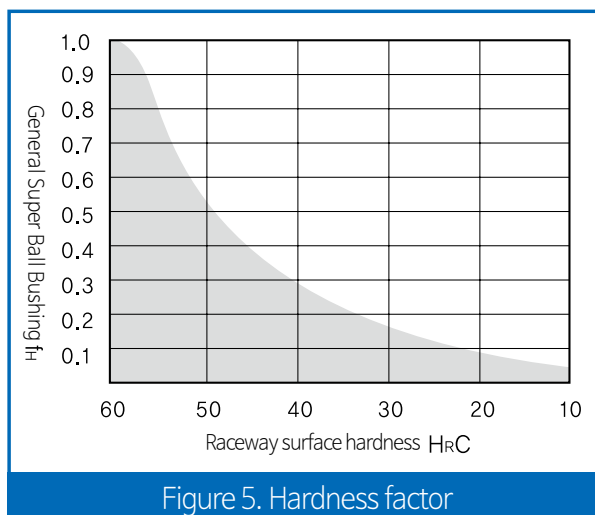


Figure 5. Hardness factor

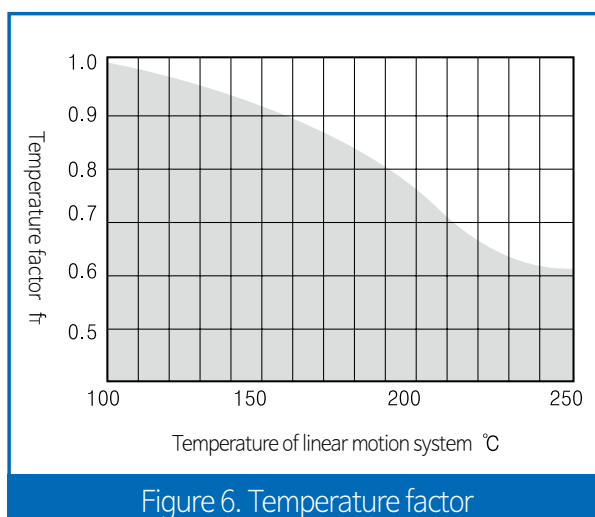


Figure 6. Temperature factor

3. Temperature factor (f_T)

If a super ball bushing is used at above 100 °C, it shortens its service life. (Figure 6.)

4. Load direction factor (f_D)

The values of the basic load rating C and C_0 , shown in the table of dimensions, mean the values when the load direction is the 'min' position (Figure 7). The values of C and C_0 are changed differently depending on a load direction, as shown in Figure 8.

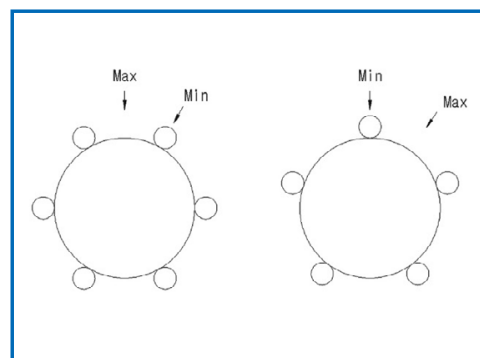


Figure 7. Load direction and load capacity

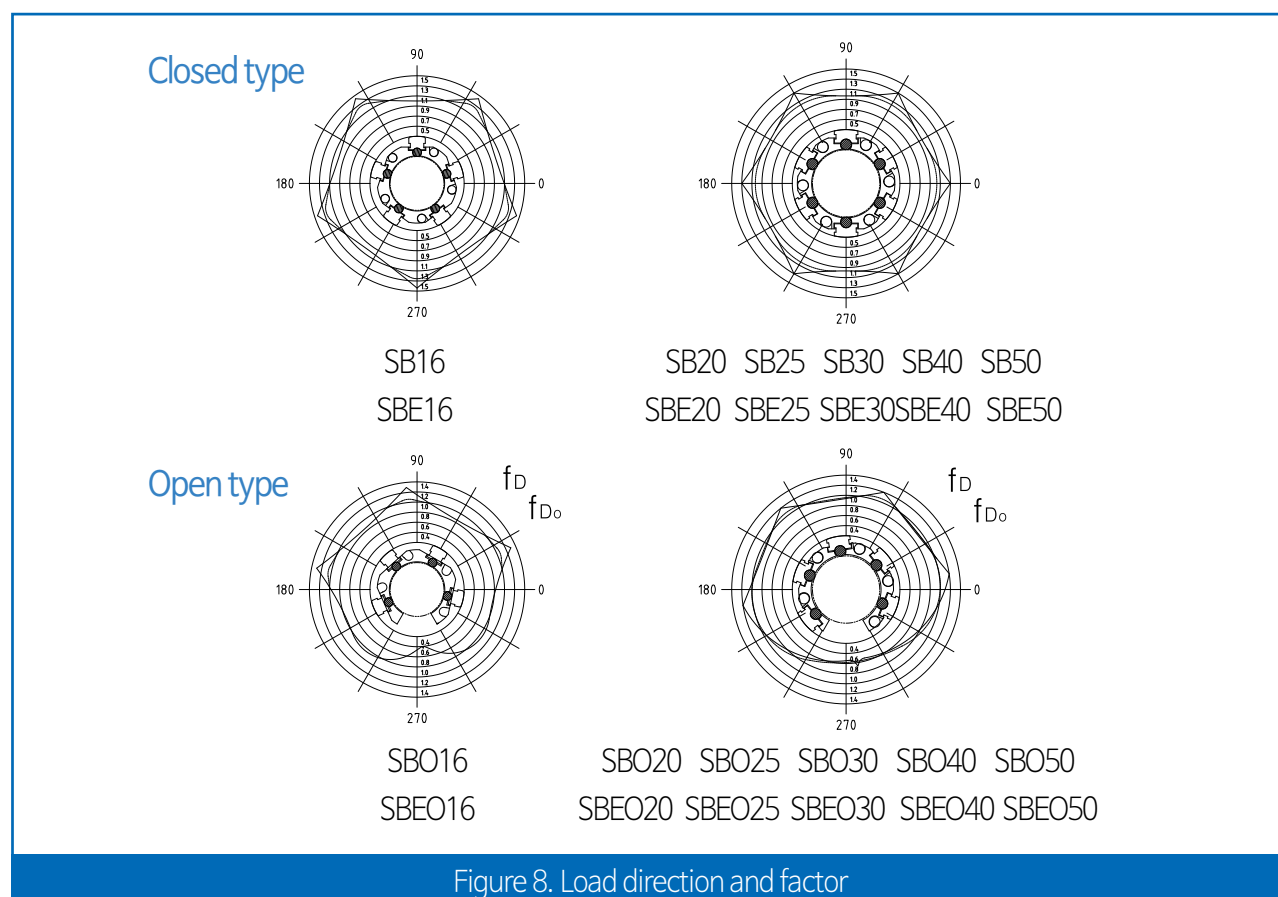


Figure 8. Load direction and factor

5. Basic static load rating (C_0)

Basic static load rating refers to the load with a constant direction and size in the condition where the total permanent deformation of the rolling element and raceway surface is 0.0001 times more than diameter of a ball as elasticity of the contact part with maximum stress is out of its limit. If inertial force exceeds basic static load rating in the condition of vibration, impacts, or fast velocity, a super ball bushing fails to have smooth linear motion and shortens its service life greatly. Be careful.

6. Housing and shaft tolerance

To use WON Super Ball Bushing, it is necessary to prepare a housing. The tolerance of inside diameter of the housing affects precision and life of the device. For the housing and shaft tolerance of WON Super Ball Bushing, see Tables 2 to 7.

- Housing tolerance

Table 2. Asia Series

Unit : mm

Model No.	SB 16	SB 20	SB 25	SB 30	SB 40
Inside diameter (D)	28	32	40	45	60
Tolerance(H7)	+0.021 0	+0.025 0			+0.030 0

Table 3. Europe Series

Unit : mm

Model No.	SBE 16	SBE 20	SBE 25	SBE 30	SBE 40	SBE 50
Inside diameter (D)	26	32	40	47	62	75
Tolerance(H7)	+0.021 0	+0.025 0			+0.030 0	

Table 4. Inch Series

Unit : inch

Model No.	SBA 4	SBA 6	SBA 8	SBA 10	SBA 12	SBA 16	SBA 20	SBA24
Inside diameter (D)	0.5	0.625	0.875	1.125	1.25	1.5625	2	2.375
Tolerance(H7)	+0.0007 0		+0.0008 0		+0.0010 0		+0.0012 0	

- Shaft Tolerance

Table 5. Asia Series

Unit : mm

Model No.	SB 16	SB 20	SB 25	SB 30	SB 40
Axial diameter	16	20	25	30	40
Tolerance(h6)	0 -0.011	0 -0.013			0 -0.016

Table 6. Europe Series

Unit : mm

Model No.	SBE 16	SBE 20	SBE 25	SBE 30	SBE 40	SBE 50
Axial diameter	16	20	25	30	40	50
Tolerance(h6)	0 -0.011	0 -0.013			0 -0.016	

Table 7. Inch Series

Unit : inch

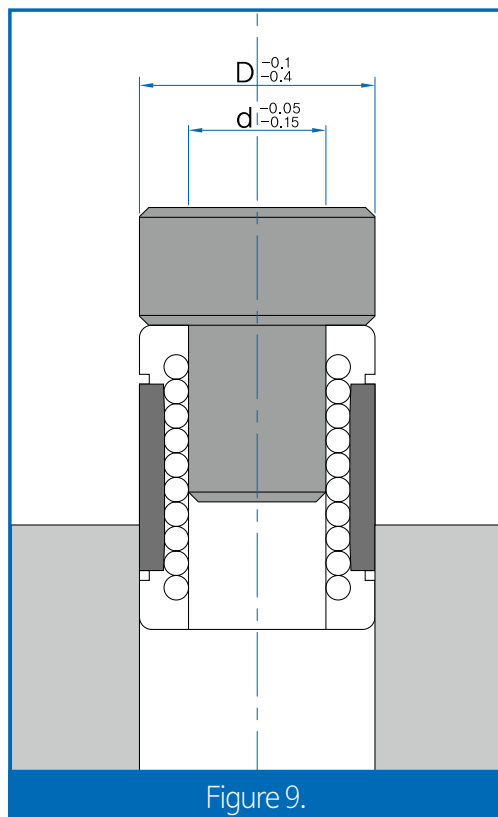
Model No.	SBA 4	SBA 6	SBA 8	SBA 10	SBA 12	SBA 16	SBA 20	SBA24
Axial diameter	0.25	0.375	0.5	0.625	0.75	1	1.25	1.5
Tolerance(h6)	-0.0002 -0.0006		-0.0002 -0.0007		-0.0003 -0.0008		-0.0004 -0.0010	

4 Assembly

As for WON Super Ball Bushing, good to use a jig in order for housing fitting. In this case, be careful not to impose any pressure on a retainer or seal. For shaft fitting, required to get corner of a shaft chamfered, and careful not to make Won Super Ball Bushing tilted in assembly.

Life shortening in a short distance

In a short stroke distance, life of a shaft is shorter than that of a ball bushing. Possible to shorten a service life up to about 70% depending on a stroke distance.

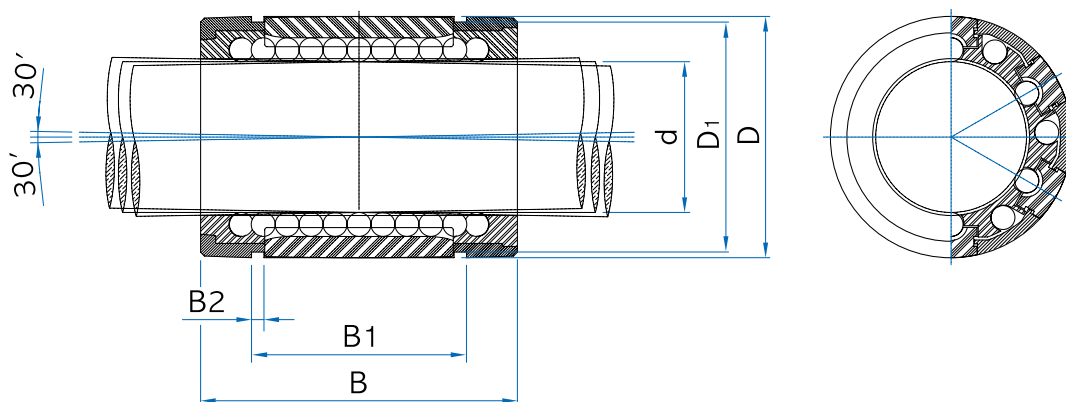


SB Series

Asia Series Super Ball Bushing



Closed type



Unit : mm

Model No.			Main dimensions					Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
No seal	Seal on one side	Seals on both sides	D	D ₁	B	B ₁	B ₂			Dynamic C (N)	Static Co (N)	
SB 16	SB 16U	SB 16UU	28	27	37	26.5	1.6	16	5	1240	800	34
SB 20	SB 20U	SB 20UU	32	30.5	42	30.5	1.6	20	6	2280	1400	58
SB 25	SB 25U	SB 25UU	40	38.5	59	44	1.9	25	6	3980	2465	120
SB 30	SB 30U	SB 30UU	45	43	64	48	1.7	30	6	4420	2800	148
SB 40	SB 40U	SB 40UU	60	58	80	60.9	2.05	40	6	8980	5460	314

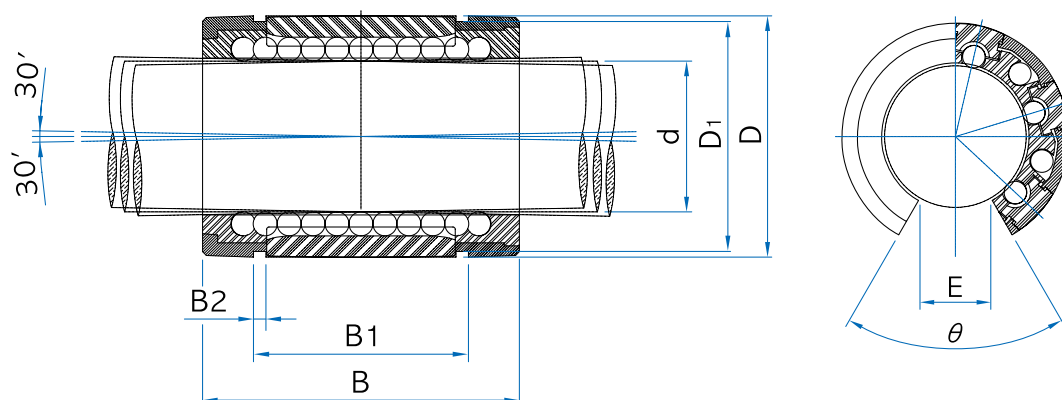
1N ≒ 0.102kgf

SBO Series

Asia Series Super Ball Bushing



Open Type



Unit : mm

Model No.			Main dimensions						Angle θ	Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
No seal	Seal on one side	Seals on both sides	D	D ₁	B	B ₁	B ₂	E				Dynamic C (N)	Static Co (N)	
SBO 16	SBO 16U	SBO 16UU	28	27	37	26.5	1.6	11	60°	16	4	1410	960	26
SBO 20	SBO 20U	SBO 20UU	32	30.5	42	30.5	1.6	11	60°	20	5	2300	1430	48
SBO 25	SBO 25U	SBO 25UU	40	38.5	59	44	1.9	12.5	60°	25	5	4030	2540	100
SBO 30	SBO 30U	SBO 30UU	45	43	64	48	1.7	15	60°	30	5	4475	2890	122
SBO 40	SBO 40U	SBO 40UU	60	58	80	60.9	2.05	20	60°	40	5	9100	5625	262

1N $\approx$ 0.102kgf

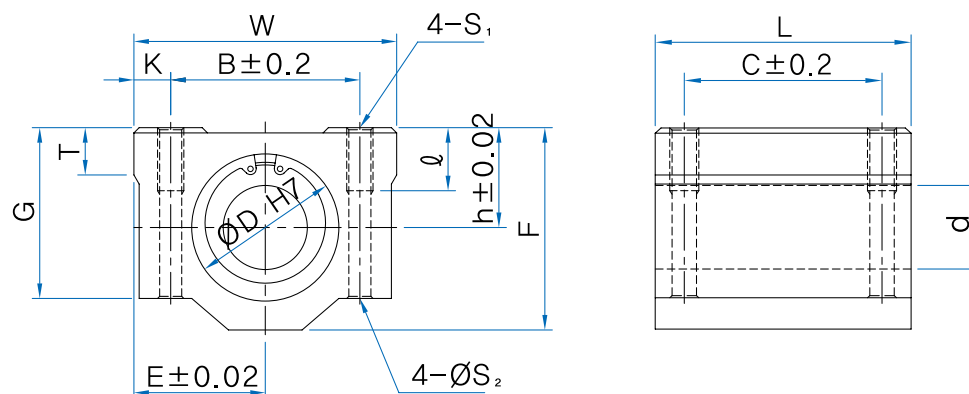
Super Ball Bushing

SH Series

Asia Series Super Ball Bushing Block



Closed Type (Ball Bushing: 1 pc of SB series)



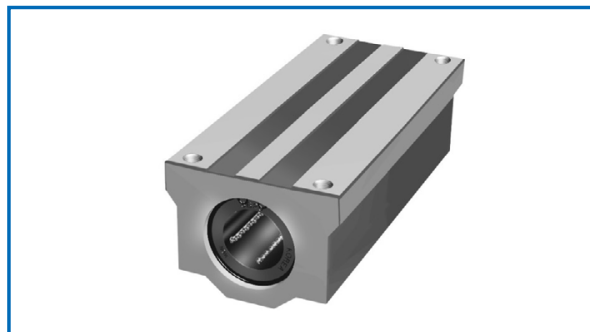
Unit : mm

Model No.	Main dimensions								Mounting dimensions						Diameter of shaft d	Basic load rating		Weight (g)
	D	h	E	W	L	F	G	T	B	C	K	S ₁	S ₂	ℓ		Dynamic C (N)	Static C ₀ (N)	
SH 16UU	28	19	25	50	44	38.5	32.5	9	36	34	7	M5	4.3	12	16	1240	800	148
SH 20UU	32	21	27	54	50	41	35	11	40	40	7	M6	5.2	12	20	2280	1400	198
SH 25UU	40	26	38	76	67	51.5	42	12	54	50	11	M8	7	18	25	3980	2465	472
SH 30UU	45	30	39	78	72	59.5	49	15	58	58	10	M8	7	18	30	4420	2800	589
SH 40UU	60	40	51	102	90	78	62	20	80	60	11	M10	8.7	25	40	8980	5460	1225
SH 50UU	75	52	61	122	110	102	80	25	100	80	11	M10	8.7	25	50	12965	7940	2420

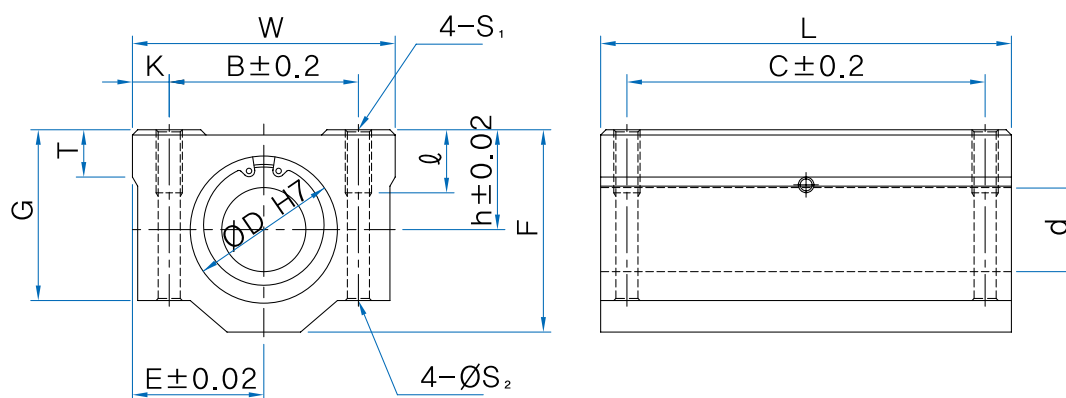
1N ≒ 0.102kgf

SHW Series

Asia Series Super Ball Bushing Block



Double Closed Type (Ball Bushing: 2pcs of SB Series)



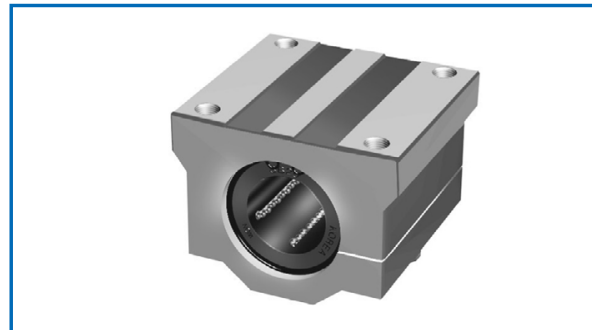
Unit : mm

Model No.	Main dimensions								Mounting dimensions					Diameter of shaft d	Basic load rating		Weight (g)
	D	h	E	W	L	F	G	T	B	C	K	S ₁	S ₂	ℓ	Dynamic C (N)	Static Co (N)	
SHW 16UU	28	19	25	50	85	38.5	32.5	9	36	60	7	M5	4.3	12	1965	1600	308
SHW 20UU	32	21	27	54	96	41	35	11	40	70	7	M6	5.2	12	3615	2800	422
SHW 25UU	40	26	38	76	130	51.5	42	12	54	100	11	M8	7	18	6315	4930	972
SHW 30UU	45	30	39	78	140	59.5	49	15	58	110	10	M8	7	18	7015	5600	1180
SHW 40UU	60	40	51	102	175	78	62	20	80	140	11	M10	8.7	25	14255	10920	2461

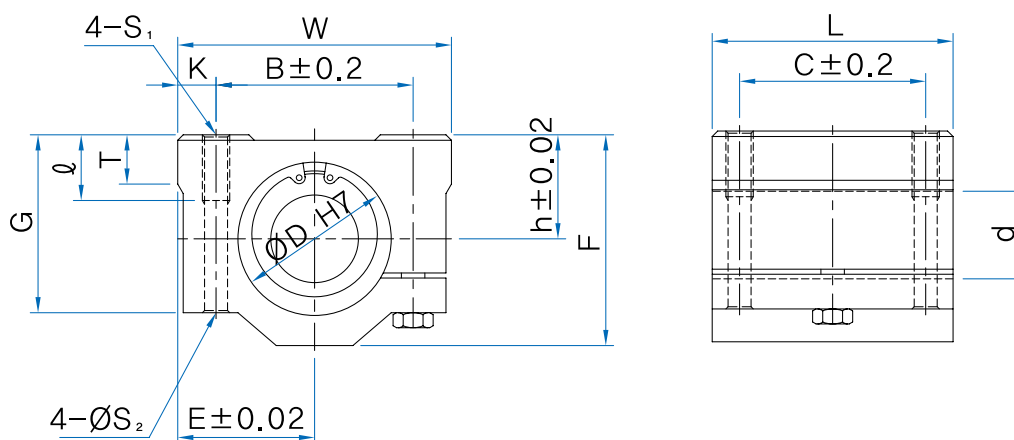
1N ≒ 0.102kgf

SH-A Series

Asia Series Super Ball Bushing Block



Closed and Clearance Adjustment Type (Ball Bushing: 1 pc of SB Series)



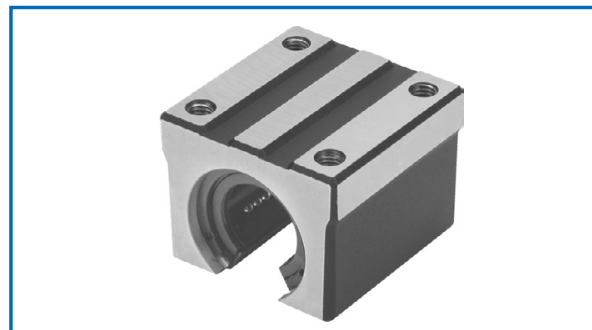
Unit : mm

Model No.	Main dimensions								Mounting dimensions						Diameter of shaft d	Basic load rating		Weight (g)
	D	h	E	W	L	F	G	T	B	C	K	S ₁	S ₂	ℓ		Dynamic C (N)	Static C ₀ (N)	
SH 16AUU	28	19	25	50	44	38.5	32.5	9	36	34	7	M5	4.3	12	16	1240	800	160
SH 20AUU	32	21	27	54	50	41	35	11	40	40	7	M6	5.2	12	20	2280	1400	218
SH 25AUU	40	26	38	76	67	51.5	42	12	54	50	11	M8	7	18	25	3980	2465	490
SH 30AUU	45	30	39	78	72	59.5	49	15	58	58	10	M8	7	18	30	4420	2800	610
SH 40AUU	60	40	51	102	90	78	62	20	80	60	11	M10	8.7	25	40	8980	5460	1200
SH 50AUU	75	52	61	122	110	102	80	25	100	80	11	M10	8.7	25	50	12965	7940	2400

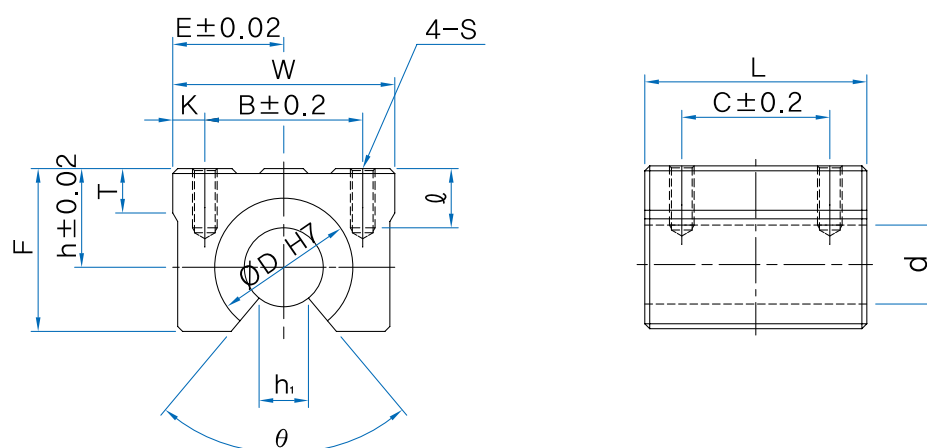
1N ≒ 0.102kgf

SHO Series

Asia Series Super Ball Bushing Block



Open Type (Ball Bushing: 1 pc of SBO Series)



Unit : mm

Model No.	Main dimensions								Mounting dimensions						Diameter of shaft d	Basic load rating		Weight (g)
	D	h	E	W	L	F	G	T	B	C	K	S ₁	S ₂	ℓ		Dynamic C (N)	Static Co (N)	
SHO 16UU	28	20	22.5	45	45	33	9	11	60°	32	30	6.5	M5	12	16	1410	960	124
SHO 20UU	32	23	24	48	50	39	11	11	60°	35	35	6.5	M6	12	20	2300	1430	178
SHO 25UU	40	27	30	60	65	47	14	12.5	60°	40	40	10	M6	12	25	4030	2540	352
SHO 30UU	45	33	35	70	70	56	15	15	60°	50	50	10	M8	18	30	4475	2890	507
SHO 40UU	60	42	45	90	90	72	20	20	60°	65	65	12.5	M10	20	40	9100	5625	1055

1N ≒ 0.102kgf

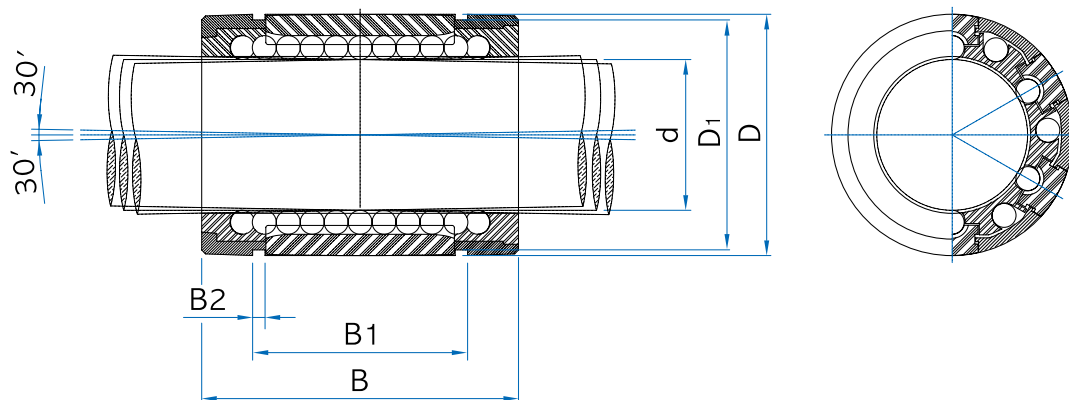
Super Ball Bushing

SBE Series

Europe Series Super Ball Bushing



Closed Type



Unit : mm

Model No.			Main dimensions					Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
No seal	Seal on one side	Seals on both sides	D	D ₁	B	B ₁	B ₂			Dynamic C (N)	Static Co (N)	
SBE 16	SBE 16U	SBE 16UU	26	24.5	36	25	1.4	16	5	1140	710	26
SBE 20	SBE 20U	SBE 20UU	32	30.5	45	31.5	1.65	20	6	2280	1400	60
SBE 25	SBE 25U	SBE 25UU	40	38.5	58	44	2	25	6	4280	2740	120
SBE 30	SBE 30U	SBE 30UU	47	46.4	68	52	1.6	30	6	5020	3365	184
SBE 40	SBE 40U	SBE 40UU	62	58	80	60.5	2.15	40	6	8980	5460	342
SBE 50	SBE 50U	SBE 50UU	75	71	100	77.5	3.65	50	6	12965	7940	586

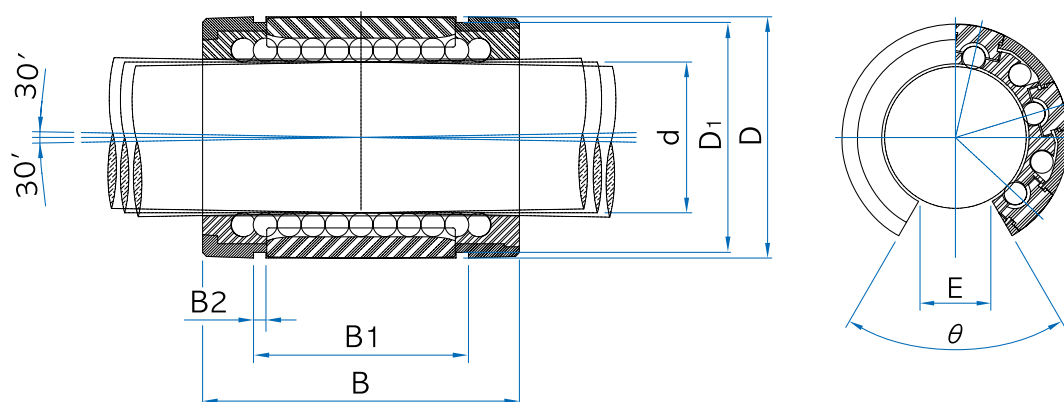
1N ≒ 0.102kgf

SBEO Series

Europe Series Super Ball Bushing



Open Type



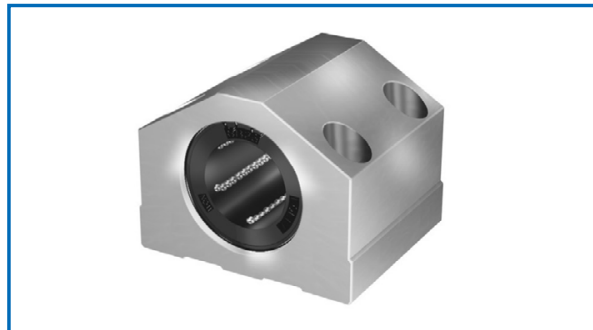
Unit : mm

Model No.			Main dimensions						Angle θ	Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
No seal	Seal on one side	Seals on both sides	D	D ₁	B	B ₁	B ₂	E				Dynamic C (N)	Static Co (N)	
SBEO 16	SBEO 16U	SBEO 16UU	26	24.5	36	25	1.4	9	68°	16	4	1330	910	20
SBEO 20	SBEO 20U	SBEO 20UU	32	30.5	45	31.5	1.65	9	55°	20	5	2310	1445	50
SBEO 25	SBEO 25U	SBEO 25UU	40	38.5	58	44	2	11.5	57°	25	5	4330	2820	100
SBEO 30	SBEO 30U	SBEO 30UU	47	46.4	68	52	1.6	14	57°	30	5	5080	3460	154
SBEO 40	SBEO 40U	SBEO 40UU	62	58	80	60.5	2.15	19.5	56°	40	5	9095	5625	286
SBEO 50	SBEO 50U	SBEO 50UU	75	71	100	77.5	3.65	22.5	54°	50	5	13130	8175	486

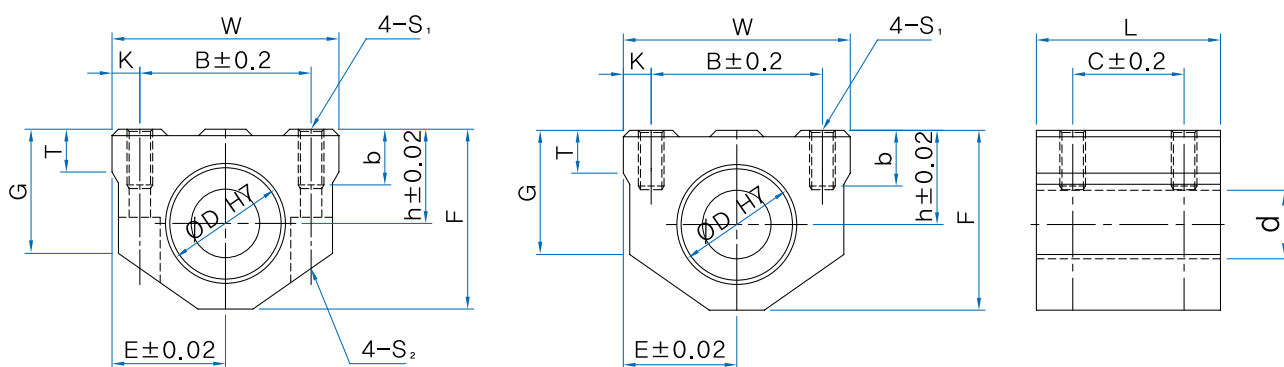
1N $\approx$ 0.102kgf

CS Series

Europe Series Super Ball Bushing



Closed Type (Ball Bushing: 1 pc of SBE Series)



B Type

Unit : mm

Model No.	Main dimensions							Mounting dimensions							Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
	D	h	E	W	L	F	G	T	B	C	K	b	S ₁	S ₂			Dynamic C (N)	Static Co (N)	
CS 16UU	26	22	26.5	53	43	42	29	10	40	26	6.5	13	M6	—	16	5	1140	710	204
CS 16UU-B														M5					
CS 20UU	32	25	30	60	54	50	34	12	45	32	7.5	18	M8	—	20	6	2280	1400	340
CS 20UU-B														M6					
CS 25UU	40	30	39	78	67	60	40	15	60	40	9	22	M10	—	25	6	4280	2740	636
CS 25UU-B														M8					
CS 30UU	47	35	43.5	87	79	70	48	17	68	45	9.5	22	M10	—	30	6	5020	3365	970
CS 30UU-B														M8					
CS 40UU	62	45	54	108	91	90	62	22	86	58	11	26	M12	—	40	6	8980	5460	1740
CS 40UU-B														M10					
CS 50UU	75	50	66	132	113	105	68	25	108	50	12	34	M16	—	50	6	12965	7940	2922
CS 50UU-B														M12					

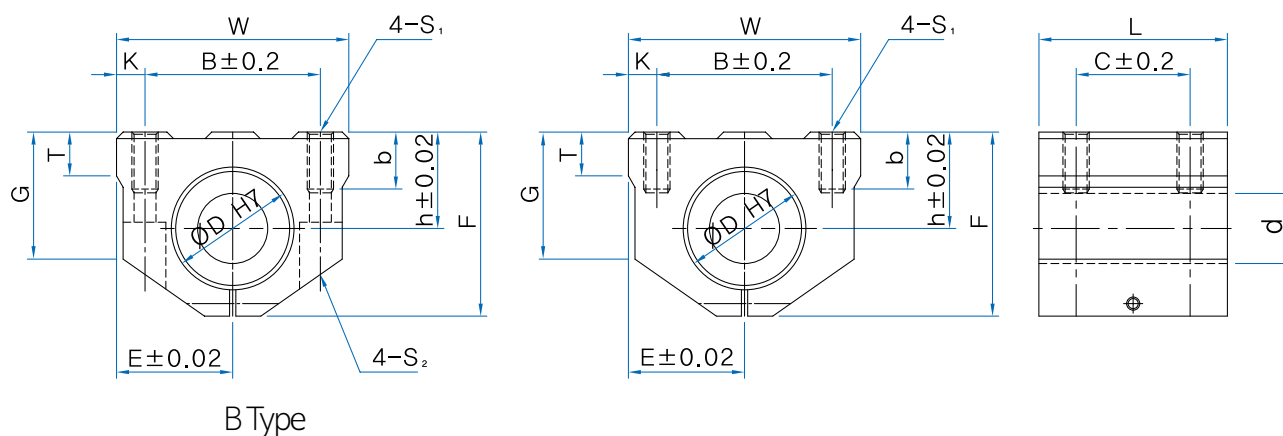
1N ≒ 0.102kgf

CS-A Series

Europe Series Super Ball Bushing



Double Closed Type (Ball Bushing: 2pcs of SBE Series)



B Type

Unit : mm

Model No.	Main dimensions								Mounting dimensions						Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
	D	h	E	W	L	F	G	T	B	C	K	b	S ₁	S ₂			Dynamic C (N)	Static C ₀ (N)	
CS 16AUU	26	22	26.5	53	43	42	29	10	40	26	6.5	13	M6	—	16	5	1140	710	192
CS 16AUU-B														M5					
CS 20AUU	32	25	30	60	54	50	34	12	45	32	7.5	18	M8	—	20	6	2280	1400	322
CS 20AUU-B														M6					
CS 25AUU	40	30	39	78	67	60	40	15	60	40	9	22	M10	—	25	6	4280	2740	632
CS 25AUU-B														M8					
CS 30AUU	47	35	43.5	87	79	70	48	17	68	45	9.5	22	M10	—	30	6	5020	3365	965
CS 30AUU-B														M8					
CS 40AUU	62	45	54	108	91	90	62	22	86	58	11	26	M12	—	40	6	8980	5460	1736
CS 40AUU-B														M10					
CS 50AUU	75	50	66	132	113	105	68	25	108	50	12	34	M16	—	50	6	12965	7940	2910
CS 50AUU-B														M12					

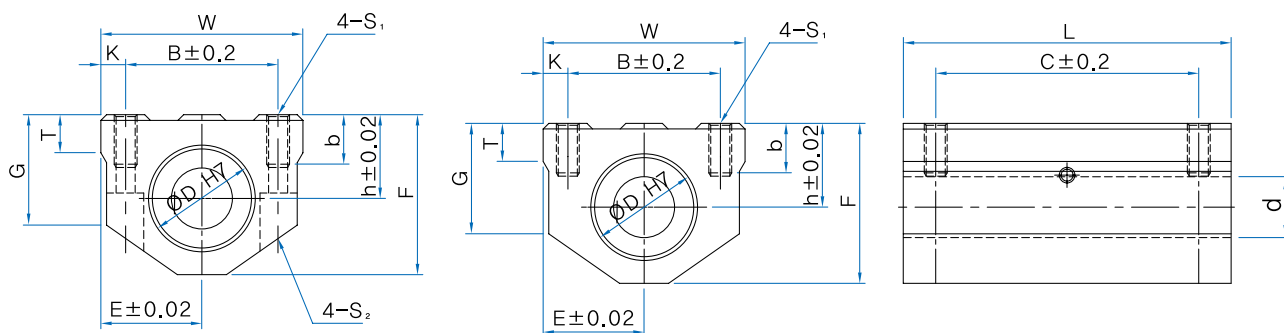
1N ≒ 0.102kgf

CSW Series

Europe Series Super Ball Bushing



Double Closed Type (Ball Bushing: 2pcs of SBE Series)



B Type

Unit : mm

Model No.	Main dimensions								Mounting dimensions						Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
	D	h	E	W	L	F	G	T	B	C	K	b	S ₁	S ₂			Dynamic C (N)	Static Co (N)	
CSW 16 UU	26	22	26.5	53	84	42	29	10	40	64	6.5	13	M6	—	16	5	1810	1420	380
CSW 16 UU-B														M5					
CSW 20 UU	32	25	30	60	104	50	34	12	45	76	7.5	18	M8	—	20	6	3615	2800	640
CSW 20 UU-B														M6					
CSW 25 UU	40	30	39	78	130	60	40	15	60	94	9	22	M10	—	25	6	6790	5480	1248
CSW 25 UU-B														M8					
CSW 30 UU	47	35	43.5	87	152	70	48	17	68	106	9.5	22	M10	—	30	6	7965	6730	1890
CSW 30 UU-B														M8					
CSW 40 UU	62	45	54	108	176	90	62	22	86	124	11	26	M12	—	40	6	14255	10920	3404
CSW 40 UU-B														M10					
CSW 50 UU	75	50	66	132	224	105	68	25	108	160	12	34	M16	—	50	6	20580	15880	5856
CSW 50 UU-B														M12					

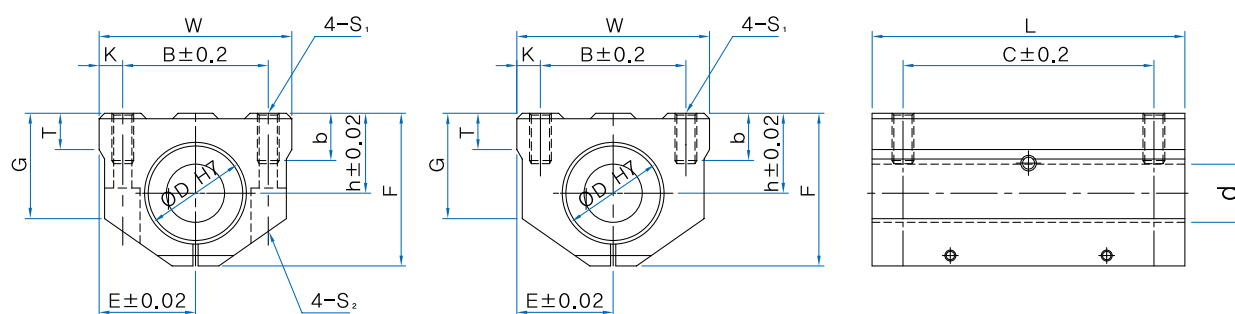
1N ≒ 0.102kgf

CSW-A Series

Europe Series Super Ball Bushing



Closed and Clearance Adjustment Type (Ball Bushing: 2pcs of SBE Series)



B Type

Unit : mm

Model No.	Main dimensions								Mounting dimensions						Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
	D	h	E	W	L	F	G	T	B	C	K	b	S ₁	S ₂			Dynamic C (N)	Static Co (N)	
CSW 16AUU	26	22	26.5	53	84	42	29	10	40	64	6.5	13	M6	—	16	5	1810	1420	364
CSW 16AUU-B														M5					
CSW 20AUU	32	25	30	60	104	50	34	12	45	76	7.5	18	M8	—	20	6	3615	2800	614
CSW 20AUU-B														M6					
CSW 25AUU	40	30	39	78	130	60	40	15	60	94	9	22	M10	—	25	6	6790	5480	1212
CSW 25AUU-B														M8					
CSW 30AUU	47	35	43.5	87	152	70	48	17	68	106	9.5	22	M10	—	30	6	7965	6730	1252
CSW 30AUU-B														M8					
CSW 40AUU	62	45	54	108	176	90	62	22	86	124	11	26	M12	—	40	6	14255	10920	3310
CSW 40AUU-B														M10					
CSW 50AUU	75	50	66	132	224	105	68	25	108	160	12	34	M16	—	50	6	20580	15880	5856
CSW 50AUU-B														M12					

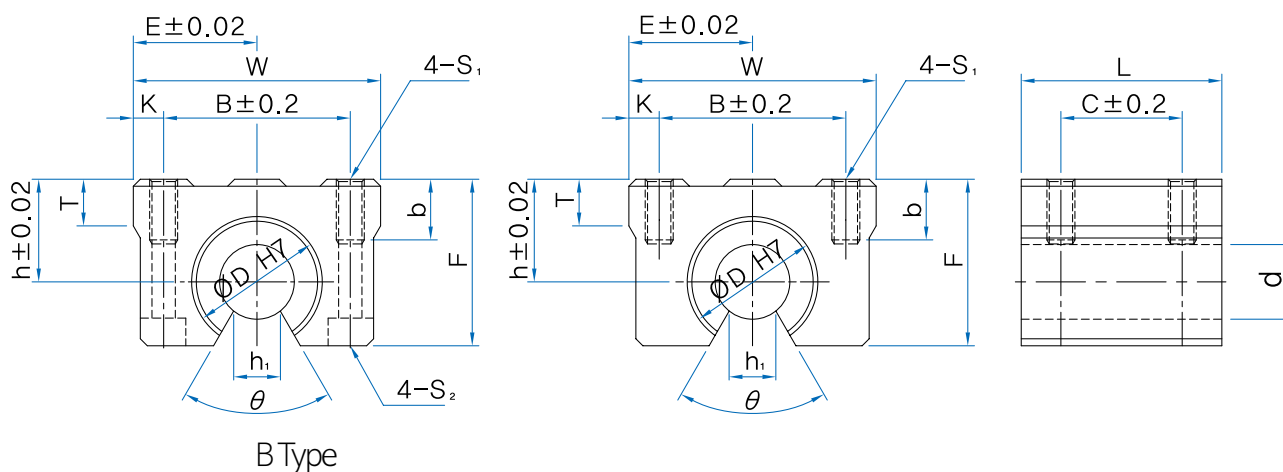
1N ≙ 0.102kgf

CSO Series

Europe Series Super Ball Bushing



Open Type (Ball Bushing: 1pc of SBEO Series)



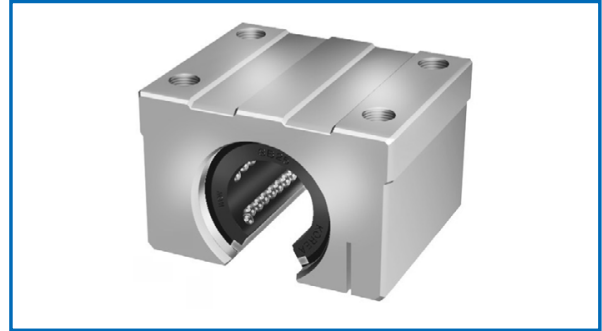
Unit : mm

Model No.	Main dimensions									Mounting dimensions						Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
	D	h	E	W	L	F	T	h1	θ	B	C	K	b	S1	S2			Dynamic C (N)	Static Co (N)	
CSO 16UU	26	22	26.5	53	43	35	8	9	68°	40	26	6.5	13	M6	—	16	4	1330	910	160
CSO 16UU-B															M5					
CSO 20UU	32	25	30	60	54	42	10	9	55°	45	32	7.5	18	M8	—	20	5	2310	1445	280
CSO 20UU-B															M6					
CSO 25UU	40	30	39	78	67	51	13	11.5	57°	60	40	9	22	M10	—	25	5	4330	2820	552
CSO 25UU-B															M8					
CSO 30UU	47	35	43.5	87	79	60	15	14	57°	68	45	9.5	22	M10	—	30	5	5080	3460	846
CSO 30UU-B															M8					
CSO 40UU	62	45	54	108	91	77	20	19.5	56°	86	58	11	26	M12	—	40	5	9095	5625	1516
CSO 40UU-B															M10					
CSO 50UU	75	50	66	132	113	88	25	22.5	54°	108	50	12	34	M16	—	50	5	13130	8175	2546
CSO 50UU-B															M12					

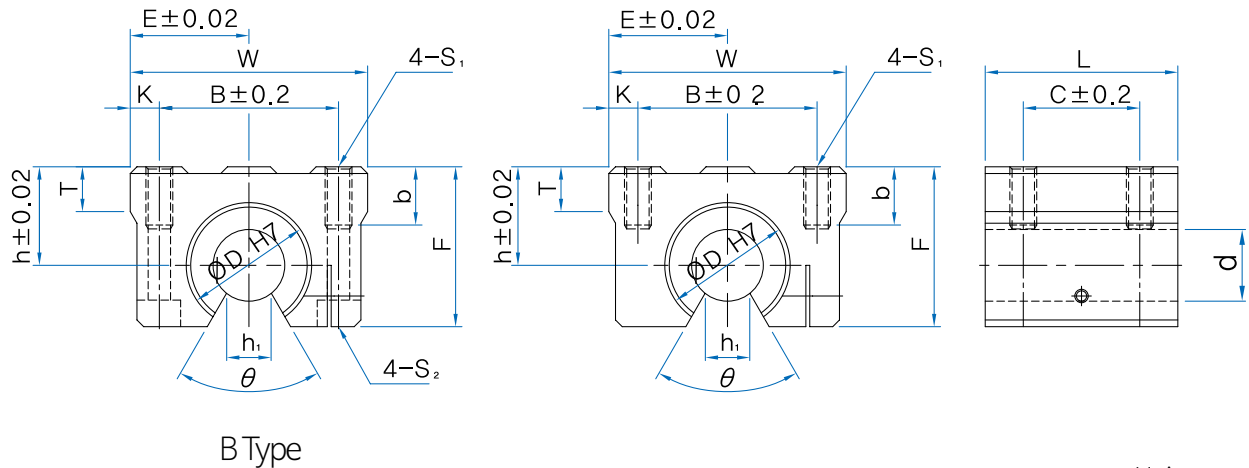
1N ≙ 0.102kgf

CSO-A Series

Europe Series Super Ball Bushing



Open Type (Ball Bushing: 1pc of SBEO Series)



Unit : mm

Model No.	Main dimensions									Mounting dimensions						Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
	D	h	E	W	L	F	T	h ₁	θ	B	C	K	b	S ₁	S ₂			Dynamic C (N)	Static Co (N)	
CSO 16AUU	26	22	26.5	53	43	35	8	9	68°	40	26	6.5	13	M6	-	16	4	1330	910	158
CSO 16AUU-B															M5					
CSO 20AUU	32	25	30	60	54	42	10	9	55°	45	32	7.5	18	M8	-	20	5	2310	1445	277
CSO 20AUU-B															M6					
CSO 25AUU	40	30	39	78	67	51	13	11.5	57°	60	40	9	22	M10	-	25	5	4330	2820	548
CSO 25AUU-B															M8					
CSO 30AUU	47	35	43.5	87	79	60	15	14	57°	68	45	9.5	22	M10	-	30	5	5080	3460	840
CSO 30AUU-B															M8					
CSO 40AUU	62	45	54	108	91	77	20	19.5	56°	86	58	11	26	M12	-	40	5	9095	5625	1510
CSO 40AUU-B															M10					
CSO 50AUU	75	50	66	132	113	88	25	22.5	54°	108	50	12	34	M16	-	50	5	13130	8175	2535
CSO 50AUU-B															M12					

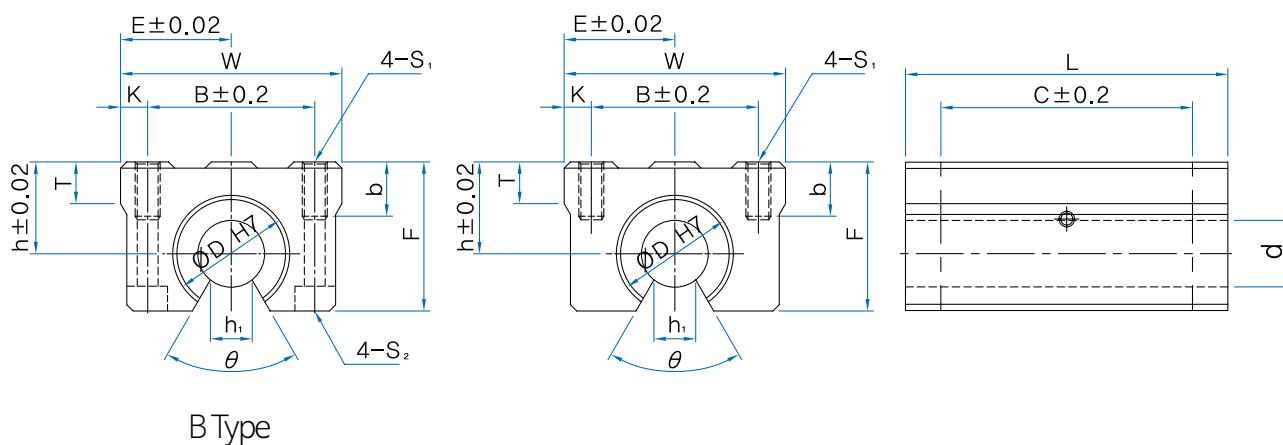
1N ≙ 0.102kgf

CSOW Series

Europe Series Super Ball Bushing



Double Open Type (Ball Bushing: 2pcs of SBEO Series)



Unit : mm

Model No.	Main dimensions									Mounting dimensions						Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
	D	h	E	W	L	F	T	h1	θ	B	C	K	b	S1	S2			Dynamic C (N)	Static Co (N)	
CSOW 16UU	26	22	26.5	53	84	35	8	9	68°	40	64	6.5	13	M6	-	16	4	2110	1820	338
CSOW 16UU-B															M5					
CSOW 20UU	32	25	30	60	104	42	10	9	55°	45	76	7.5	18	M8	-	20	5	3660	2890	552
CSOW 20UU-B															M6					
CSOW 25UU	40	30	39	78	130	51	13	11.5	57°	60	94	9	22	M10	-	25	5	6870	5640	1092
CSOW 25UU-B															M8					
CSOW 30UU	47	35	43.5	87	152	60	15	14	57°	68	106	9.5	22	M10	-	30	5	8060	6920	1656
CSOW 30UU-B															M8					
CSOW 40UU	62	45	54	108	176	77	20	19.5	56°	86	124	11	26	M12	-	40	5	14430	11250	3062
CSOW 40UU-B															M10					
CSOW 50UU	75	50	66	132	224	88	25	22.5	54°	108	160	12	35	M16	-	50	5	20840	16350	5042
CSOW 50UU-B															M12					

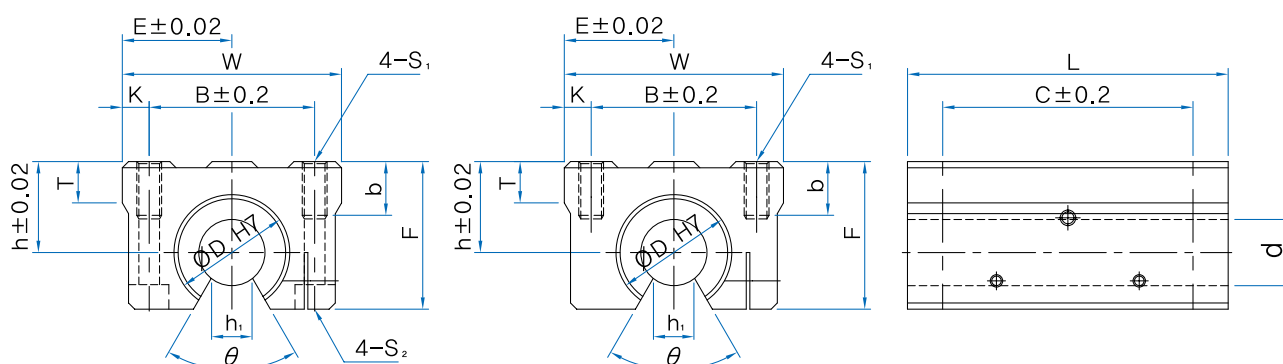
1N ≒ 0.102kgf

CSOW-A Series

Europe Series Super Ball Bushing



Double Open and Clearance Adjustment Type (Ball Bushing: 2pcs of SBEO Series)



B Type

Unit : mm

Model No.	Main dimensions									Mounting dimensions						Diameter of shaft d	No. of ball rows	Basic load rating		Weight (g)
	D	h	E	W	L	F	T	h1	θ	B	C	K	b	S1	S2			Dynamic C (N)	Static Co (N)	
CSOW 16AUU	26	22	26,5	53	84	35	8	9	68°	40	64	6,5	13	M6	—	16	4	2110	1820	330
CSOW 16AUU-B															M5					
CSOW 20AUU	32	25	30	60	104	42	10	9	55°	45	76	7,5	18	M8	—	20	5	3660	2890	540
CSOW 20AUU-B															M6					
CSOW 25AUU	40	30	39	78	130	51	13	11,5	57°	60	94	9	22	M10	—	25	5	6870	5640	1080
CSOW 25AUU-B															M8					
CSOW 30AUU	47	35	43,5	87	152	60	15	14	57°	68	106	9,5	22	M10	—	30	5	8060	6920	1645
CSOW 30AUU-B															M8					
CSOW 40AUU	62	45	54	108	176	77	20	19,5	56°	86	124	11	26	M12	—	40	5	14430	11250	3045
CSOW 40AUU-B															M10					
CSOW 50AUU	75	50	66	132	224	88	25	22,5	54°	108	160	12	35	M16	—	50	5	20840	16350	5030
CSOW 50AUU-B															M12					

1N ≒ 0.102kgf

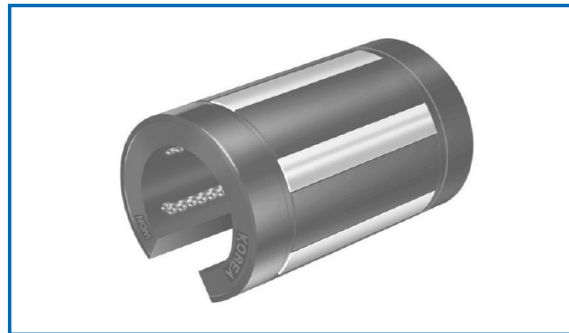
SBA Series

Inch Series Ball Bushing



SBAO Series

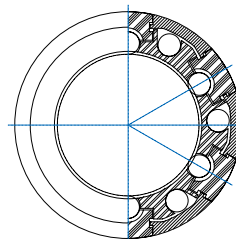
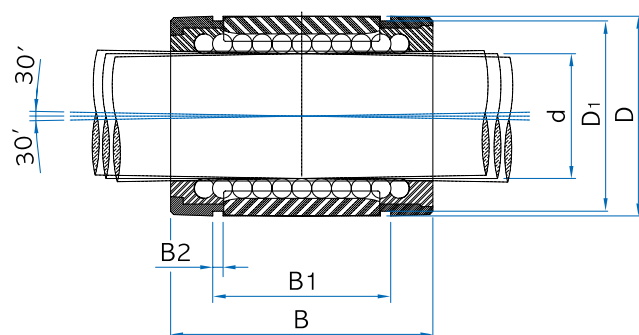
Inch Series Ball Bushing



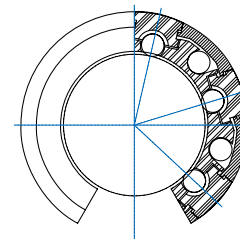
Unit : inch

Model No.	Main dimensions							Diameter of shaft		No. of ball rows	Basic load rating		Weight (g)
	D	B	Tolerance	B1	Tolerance	B2	D1	d	Tolerance		Dynamic C (N)	Static Co (N)	
SBA4	0.5	0.75	0 -0.015	0.515	0 -0.015	0.039	0.4687	0.25	0 -0.0005	4	265	355	4.08
SBA6	0.625	0.875	0 -0.015	0.703	0 -0.015	0.039	0.588	0.375	0 -0.0005	4	420	530	6.35
SBA8	0.875	1.25	0 -0.02	1.032	0 -0.02	0.0459	0.8209	0.5	0 -0.0005	4	1020	1290	19.50
SBA10	1.125	1.5	0 -0.02	1.112	0 -0.02	0.0559	1.059	0.625	0 -0.0005	5	1780	2220	46.72
SBA12	1.25	1.625	0 -0.02	1.272	0 -0.02	0.0559	1.176	0.75	0 -0.0005	6	2090	2620	55.79
SBA16	1.5625	2.25	0 -0.02	1.886	0 -0.02	0.0679	1.4687	1	0 -0.0005	6	3780	4710	120.20
SBA20	2	2.625	0 -0.025	2.011	0 -0.025	0.0679	1.8859	1.25	0 -0.0006	6	5470	6800	219.99
SBA24	2.375	3	0 -0.03	2.422	0 -0.03	0.0859	2.2389	1.5	0 -0.0006	6	6580	8220	340.19

※ 1 inch=25.4mm
1N ≒ 0.102kgf



SBA Series



SBAO Series

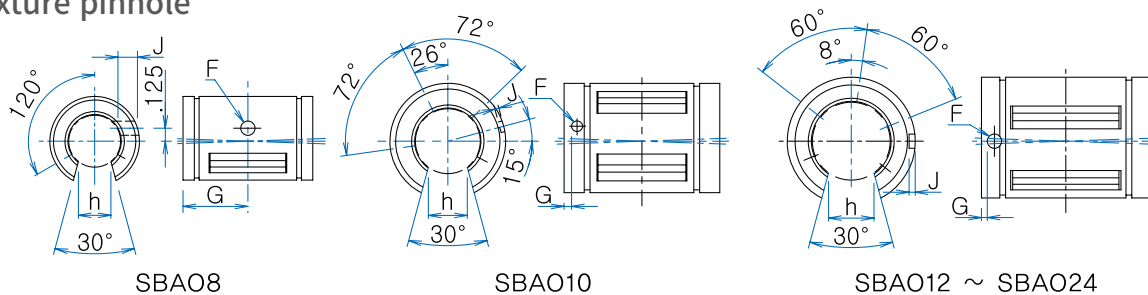
Unit : inch

Model No.	Main dimensions								Diameter of shaft		Fixture pinhole			No. of ball rows	Basic load rating		Weight (g)
	D	B	Tolerance	B1	Tolerance	B2	D1	h	d	Tolerance	F	G	J		Dynamic C (N)	Static Co (N)	
SBAO8	0.875	1.25	0 -0.02	1.032	0 -0.02	0.0459	0.8209	0.313	0.5	0 -0.0005	0.136	0.625	Penetrated	3	1020	1290	14.97
SBAO10	1.125	1.5	0 -0.02	1.112	0 -0.02	0.0559	1.059	0.375	0.625	0 -0.0005	0.105	0.125	0.039	4	1780	2220	37.65
SBAO12	1.25	1.625	0 -0.02	1.272	0 -0.02	0.0559	1.176	0.438	0.75	0 -0.0005	0.136	0.125	0.059	5	2090	2620	46.27
SBAO16	1.5625	2.25	0 -0.02	1.886	0 -0.02	0.0679	1.4687	0.563	1	0 -0.0005	0.136	0.125	0.047	5	3780	4710	99.79
SBAO20	2	2.625	0 -0.025	2.011	0 -0.025	0.0679	1.8859	0.625	1.25	0 -0.0006	0.201	0.1875	0.09	5	5470	6800	190.06
SBAO24	2.375	3	0 -0.03	2.422	0 -0.03	0.0859	2.2389	0.75	1.5	0 -0.0006	0.201	0.1875	0.09	5	6580	8220	289.85

※ 1 inch=25.4mm
1N ≒ 0.102kgf

Super Ball Bushing

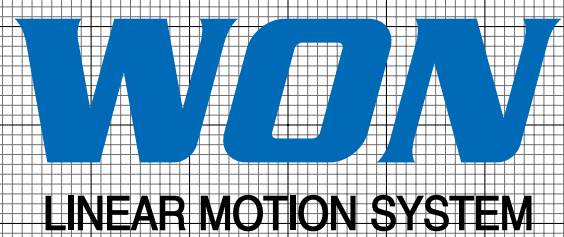
Fixture pinhole



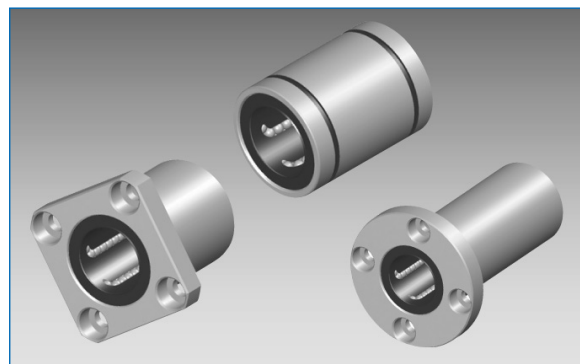
SBAO8

SBAO10

SBAO12 ~ SBAO24



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1 Linear Ball Bushing

WON Linear Ball Bushing Linear Motion Series has the infinite linear motion system in combination with a cylindrical linear motion shaft. Since a load ball and a linear motion shaft have a contact point, the device has low allowable load, but has a rolling motion with minimum frictional resistance and a highly precise and light motion.

1. Structure and Features

In the linear ball bushing linear motion series, the ball rolling surface of the linear motion shaft and outer sleeve has a cylindrical shape, and the load balls are aligned in the linear motion shaft direction by a retainer, as shown in Figure 1.

The outer sleeve is made of high carbon chromium bearing steel. The inside diameter and outside diameter are polished after heat treatment.

2. Compatibility

This product has compatibility because the dimensional tolerance of each part of a linear ball bushing is standardized. A linear motion shaft is easily cylindrical-polished. So, it is possible to obtain fitting clearance with high precision.

3. Outer sleeve with rigidity

Since the outer sleeve is made of strong bearing steel, it is possible to put a needle bearing in the outside diameter.

4. Retainer with high precision

A retainer guiding 4 to 6 ball rows has an integral structure. So, it guides the ball direction accurately and helps to secure stable running precision.

5. Use

A linear ball bushing is widely applied to various kinds of equipment, such as computer and peripheral equipment, measuring equipment, auto recording equipment, 3D measuring equipment, multi-axis drilling machine, punching press, tool grinder, automatic gas cutting machine, printing machine, food packing machine, linear motion guides, athletic equipment, and wood equipment.

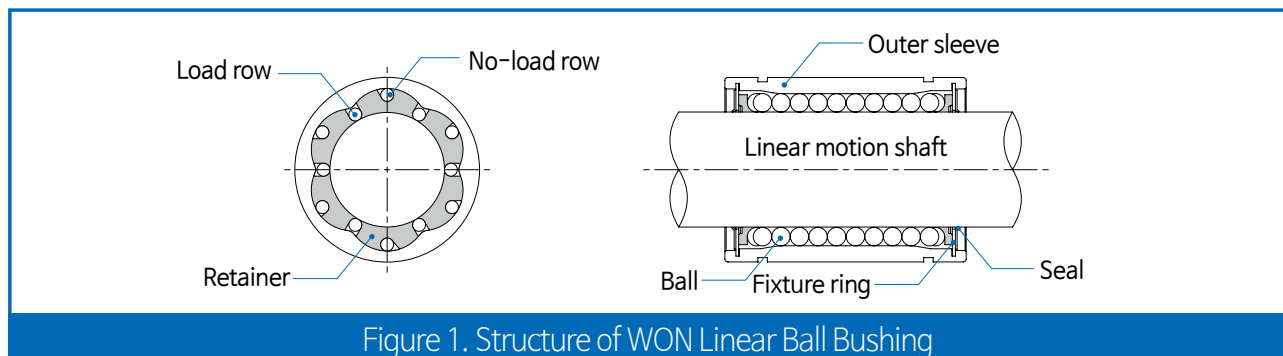
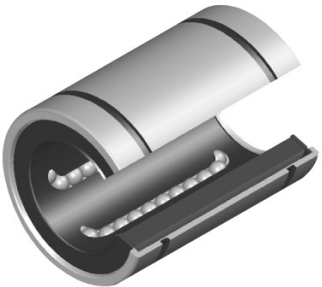
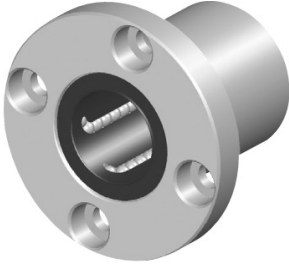
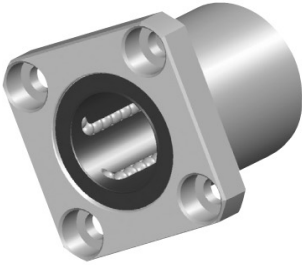
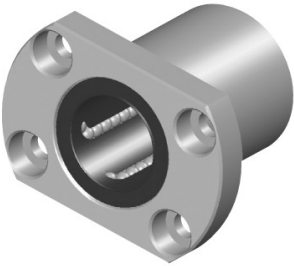
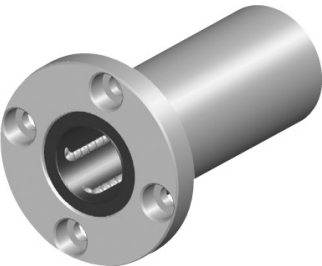


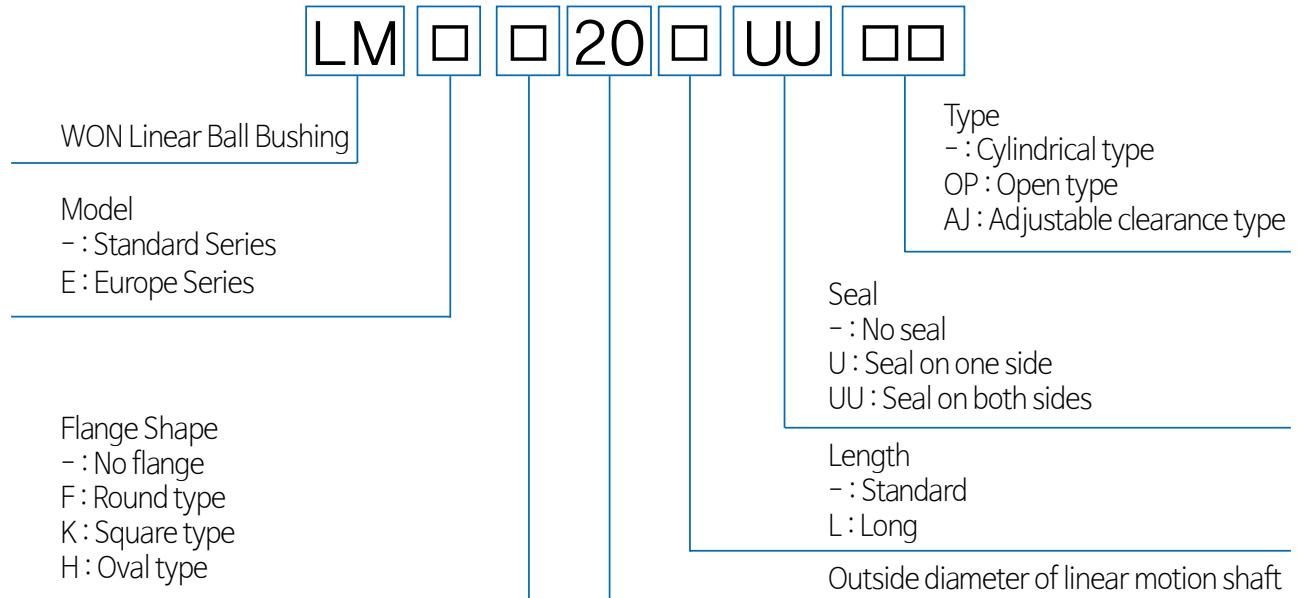
Figure 1. Structure of WON Linear Ball Bushing

2 Types and Features

Classification	Type	Shape and Feature	
Linear Ball Bushing	Standard Type LM LME		Cylindrical shape with high precision
	Open Type LM□OP LME□OP		Cutting the one ball row of the outer sleeve and using it in the place where a shaft support is used
	Adjustable Clearance Type LM□AJ LME□AJ		Cutting in the length direction of the outer sleeve and easily adjusting a shaft and a gap
	Long Type LM□L LME□L		Two retainers connected to the outer sleeve; optimal to the place to which moment is applied

Classification	Type	Shape and Feature	
Flange Type Linear Ball Bushing	Round Type LMF		An integral structure; easy-to-install
	Square Type LMK		Lower height of the center than that of round-type flange; supporting compact design
	Oval Type LMH		Lower height of the center than that of round-type flange; supporting compact design
	Long type LMF□L LMK□L		Two retainers connected to the outer sleeve; optimal to the place to which moment is applied

3 Model number composition of linear ball bushing



1. Precision specification

The precision values of the inside diameter, outside diameter, width, etc. of a linear ball bushing are described in the table of dimensions. The precision values of the inside diameter and outside diameter of the adjustable clearance type (..AJ) and open type (..OP) mean the values before opening.

2. Load rating and life

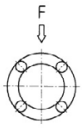
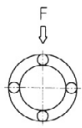
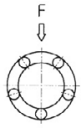
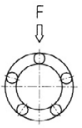
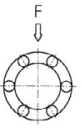
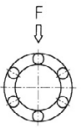
The load rating of a linear ball bushing depends on position of a ball for a load direction. The value of the basic load rating presented in the table of dimensions means the value at the time when a load ball in the row 1 is right under load. If the ball installed has symmetric load for a load direction, load rating increases as shown in Figure 2, and thus life performance of the device can be improved. Life of a linear ball bushing is calculated in the following formula:

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

$$L_{100} = \left(\frac{f_H \cdot f_C \cdot f_T}{f_W} \times \frac{C_{100}}{P} \right)^3 \times 100$$

L	: Rating life	(km)
L ₁₀₀	: Rating life	(km)
C	: Basic load rating	(N)
C ₁₀₀	: Basic load rating (C/1.26)	(N)
P	: Load	
f _H	: Hardness factor	
f _W	: Load factor	
f _C	: Contact factor	
f _T	: Temperature factor	

Figure 2. Load rating according to ball-row arrangement

No. of ball rows	Ball position		No. of ball rows	Ball position		No. of ball rows	Ball position	
	Max. load	Min. load		Max. load	Min. load		Max. load	Min. load
4			5			6		
	$F=1.41 \times C$	$F=C$		$F=1.46 \times C$	$F=C$		$F=1.26 \times C$	$F=C$

C: See the table of dimensions

- If one outer sleeve or two in contact is used and moment is applied, it is required to calculate the equivalent radial load at the time when moment is applied.

$$P_U \triangleq K \cdot M$$

P_U : Equivalent radial load (N)
(when moment is applied)

K : Equivalent factor (See Tables 1 to 3.)

M : Load moment (N · mm)

In this case, P_U should be within basic static load rating (C_0).

- If both moment and radial load are applied at the same time, it is necessary to calculate a life in the way of adding up the radial load and equivalent radial load. After the value (L) is obtained in the above formula, it is possible to calculate life hours in the following formula in the condition where the length of stroke and the number of strokes are constant.

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

L_h : Life hours (hr)

l_s : Stroke length (m)

n_1 : Number of strokes per minute (o.p.m)

- In the case of short stroke, it is possible to calculate life hours in the way of multiplying basic static load rating by length factor (K_c).

3. An example of calculation

The main influential factors on the determination of an optimal linear bushing model number are maximum load and life. How to calculate an expected life and to determine an appropriate linear ball bushing model number is presented in the following example.

–Service conditions–

- Operating speed

$$\begin{aligned} V &= 2 \times l_s \times n_1 \\ &= 2 \times 0.250 \times 60 \\ &= 30 \text{ m/min} \quad (f_w = 1.6) \end{aligned}$$

Applied load : 250 N (P)

Stroke : 0.0250 m (l_s)

Number of strokes per minute : 60 (n_1)

Hardness of linear motion shaft : HRC 60 ($f_H=1.0$)

4. Calculation of expected life

In the conditions where basic dynamic load rating based on 50km travel and the values of other factors are 1.0, it is necessary to determine an appropriate model number that is used to expect life hours. In the above conditions, let's try the model number LM40UU.

$$L = \left(\frac{1.0 \times 1.0 \times 1.0}{1.6} \times \frac{2,150}{250} \right)^3 \times 50 \quad L_h = \frac{7,764 \times 10^3}{2 \times 0.250 \times 60 \times 60}$$

$$\cong 7,764 \text{ km} \quad \cong 4,313 \text{ hours}$$

In the assumption that life of a linear ball bushing hours are 15,000,
 $L = 15,000 \times 2 \times 0.250 \times 10^{-3} \times 60 \times 60 = 27,000 \text{ km}$

$$C = \frac{250 \times 1.6}{1.0 \times 1.0 \times 1.0} \times \sqrt[3]{\frac{27,000}{50}}$$

$$\cong 3,257 \text{ N}$$

Accordingly, the linear ball bushing model number that meets the above conditions is determined to be LM50UU, whose basic dynamic load rating is 3,822N

4 Equivalent factor

Table 1. Equivalent factor of LM Series

Model No.	Equivalent factor : K	
	1 ball bushing	2 ball bushings in contact
LM 5	1.253	0.178
LM 6	0.553	0.162
LM 8S	0.708	0.166
LM 8	0.442	0.128
LM 10	0.389	0.101
LM 12	0.389	0.097
LM 13	0.343	0.093
LM 16	0.279	0.084
LM 20	0.257	0.071
LM 25	0.163	0.054
LM 30	0.153	0.049
LM 35	0.143	0.045
LM 40	0.117	0.040
LM 50	0.096	0.032
LM 60	0.093	0.028

Note: The equivalent factor of LMF/K/H and SH Series is equal to that of LM Series.

Table 2. Equivalent factor of LM-L Series

Model No.	Equivalent factor : K
	1 ball bushing
LM 5L	0.223
LM 6L	0.201
LM 8L	0.151
LM 10L	0.118
LM 12L	0.113
LM 13L	0.107
LM 16L	0.096
LM 20L	0.082
LM 25L	0.060
LM 30L	0.053
LM 35L	0.050
LM 40L	0.043
LM 50L	0.034
LM 60L	0.031

Note: The equivalent factor of LMF/K/H-L Series is equal to that of LM-L Series

Table 3. Equivalent factor of LME Series

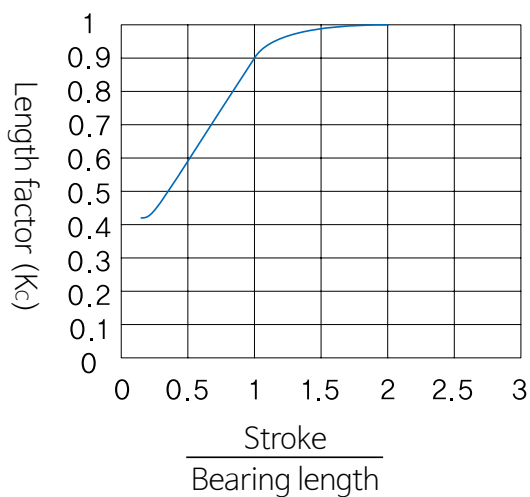
Model No.	Equivalent factor : K	
	1 ball bushing	2 ball bushings in contact
LME 5	0.669	0.123
LME 8	0.514	0.116
LME 12	0.389	0.090
LME 16	0.343	0.081
LME 20	0.291	0.063
LME 25	0.209	0.052
LME 30	0.167	0.045
LME 40	0.127	0.039
LME 50	0.105	0.031
LME 60	0.093	0.024

Note: The equivalent factor of LMF/K/H and SH Series is equal to that of LM Series.

Application of short stroke

If short stroke is applied, life of a linear ball bushing is shorter than that of a shaft.

If short stroke is applied, the basic dynamic load rating required is in proportion to the length factor (K_c), as shown in Figure 3.

Figure 3. Length factor (K_c)

5 Lubrication and Friction

A linear ball bushing is sometimes used in the no-lubrication state. Generally, grease or oil lubrication is applied.

1. Grease lubrication

A linear ball bushing is coated with rust-prevention oil at the time of initial shipment. Therefore, after the device needs to be washed with clean white oil or an organic solvent, it is required to coat it with grease.

In the case of “..UU” type (seals on the both ends), it is required to coat ball rows of a linear ball bushing with grease before use. In the case of no seal, either apply the above process, or coat a linear shaft with grease. It is recommended to use lithium grease (JIS2) with good quality.

2. Use of lubricant

If a lubricant is used for lubrication, there is no need of removal the anti-rust oil applied already. It is recommended to use a lubricant whose ISO viscosity is in the range of VG15~100.

Available temperature range	Viscosity
-30°C~50°C	VG15~46
50°C~80°C	VG46~100

General lubricants are turbine oil, machine oil, and spline oil. Drop a lubricant on a linear motion shaft, or inject a lubricant in the oil inlet after processing a housing, as shown in Figure 4.

Our company also manufactures a product that has an oil inlet on the outside diameter of a linear ball bushing as customer request. For more information, please contact WON ST.

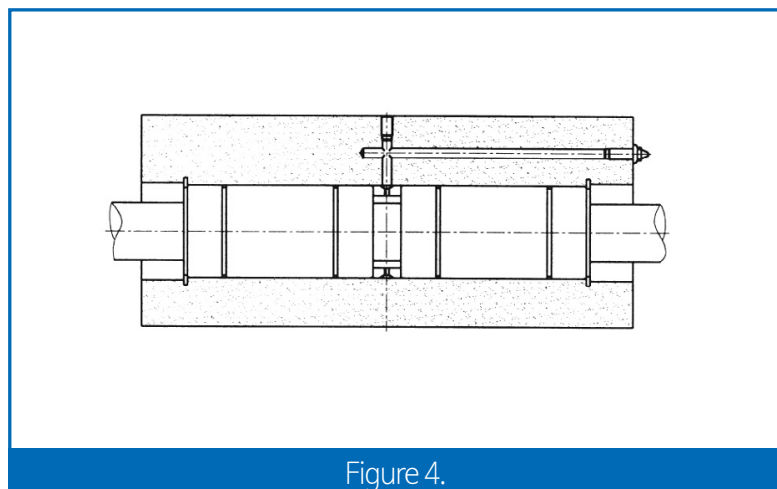


Figure 4.

In the case of a seal type, a seal removes a lubricant. Except for a type of the seal on one side, no oil dropping is applied.

3. Coefficient of friction

A linear ball bushing makes a rolling motion with the use of balls as a rolling element in the rolling surface, so that it has low frictional resistance. In particular, there is greatly less static friction, and almost no dynamic friction. Therefore, the device does not generate any stick sleep, and supports transfer highly precisely.

Generally, a coefficient of friction is shown in Figure 5.

Frictional resistance force can be calculated in the following formula:

$$F = \mu \cdot P + f_s$$

F : Frictional force (N)

f_s : Seal resistance (1.3 ~ 204 N)

P : Externally applied load (vertical load to the central line of shaft)) (N)

μ : Coefficient of friction (dynamic or static)

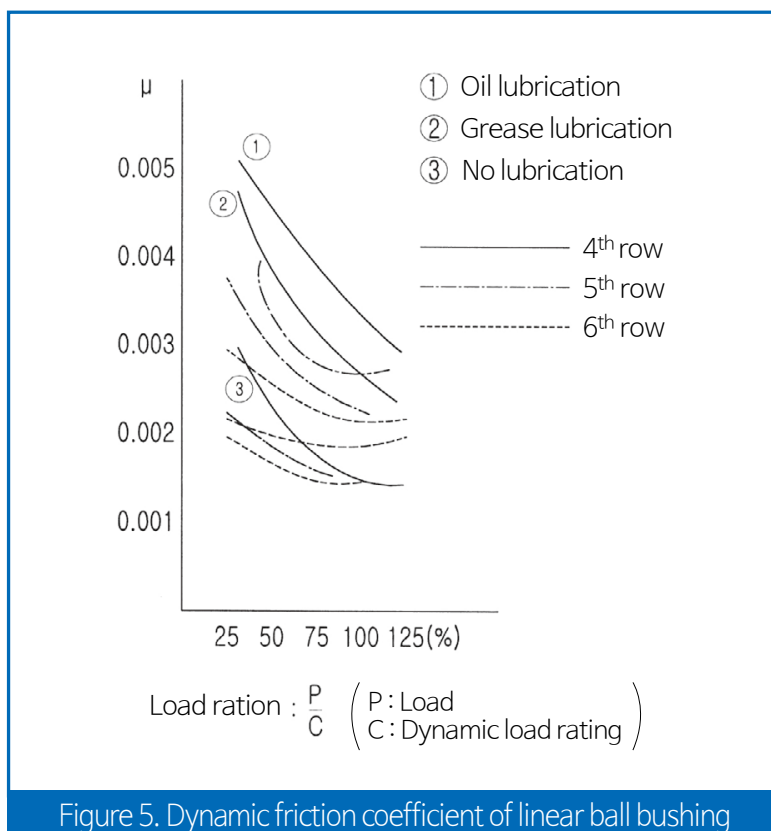


Figure 5. Dynamic friction coefficient of linear ball bushing

6 Assembly

1. Inside diameter of housing

Table 4 presents the recommended tolerance of the inside diameter of the housing in a linear ball bushing. Commonly, a housing fit is a clearance fit. To remove clearance, it is necessary to apply a transition fit.

Table 4. Inside diameter tolerance of housing

Type		Housing	
Model No.	Precision	Clearance fit	Transition fit
LM	High (H)	H7	J7
LME	–	H7	K6, J6
LMF LMK LMH LM-L LMF-L LMK-L LMH-L	–	H7	J7

2. Clearance of outer sleeve and linear motion shaft

If you need to combine a linear ball bushing with a linear motion shaft, it is necessary to apply a running fit generally. To remove clearance, apply precise clearance.

Table 5. Outside diameter tolerance of shaft

Type		LMshaft	
Model No.	Precision	Normal clearance	Precision clearance
LM	High (H)	f6, g6	h6
LME	–	h7	k6
LMF LMK LMH LM-L LMF-L LMK-L LMH-L	–	f6, g6	h6

Note 1. If you need to set clearance to a minus value after mounting, the value should not exceed the tolerance of radial clearance shown in the table of dimensions.

Note 2. In Case Unit SH, SHW, and SHO Series, the tolerance of a shaft should be equivalent to a high level.

3. Mounting of outer sleeve

Mounting the outer sleeve of a linear ball bushing does not require the direction of a linear motion shaft and high precision. Nevertheless, it is required to avoid hammering for fixture. For the tolerance of inside diameter of a housing, see Table 4.

4. Standard mounting

An example of the mounting of standard-type linear ball bushing is illustrated in Figures 6 and 7. Fix the device with the use of a snap ring, a fixing plate, and so on.

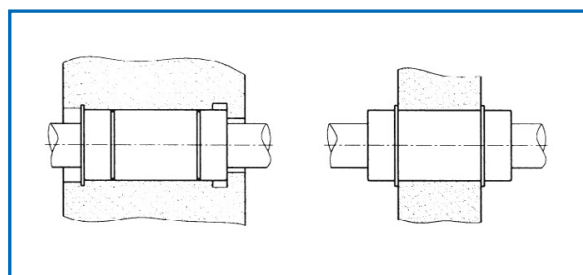


Figure 6. An example of snap ring mounting

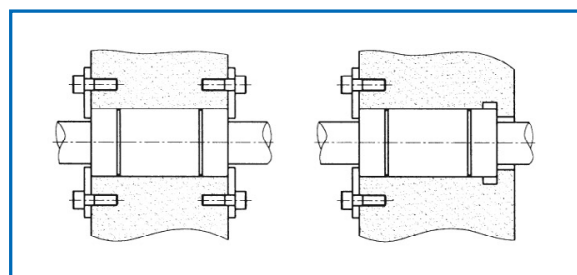


Figure 7. An example of fixing plate

5. Retaining ring for mounting (for reference)

For the retaining ring for fixture in Linear Ball Bushing LM Series, see the following table.

Model No.	Retaining ring			
	For outside diameter (for shaft)		For inside diameter (for bore)	
	C-Type Concentric	C-Type Concentric	C-Type Concentric	C-Type Concentric
LM 5	10	10	10	10
LM 6	12	12	12	12
LM 8	—	15	15	15
LM 8S	—	15	15	15
LM 10	19	19	19	19
LM 12	21	21	21	21
LM 13	23	22	23	—
LM 16	28	—	28	28
LM 20	32	—	32	32
LM 25	40	40	40	40
LM 30	45	45	45	45
LM 35	52	52	52	52
LM 40	—	60	60	60
LM 50	—	80	80	80
LM 60	—	90	90	90

Note: The table is commonly applied to LM and LM-L.

6. Setscrew mounting prohibited

Avoid fixing the outside diameter of the outer sleeve with the use of one setscrew, which causes deformation of the outer sleeve.

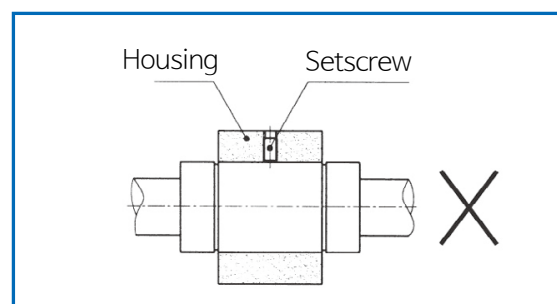
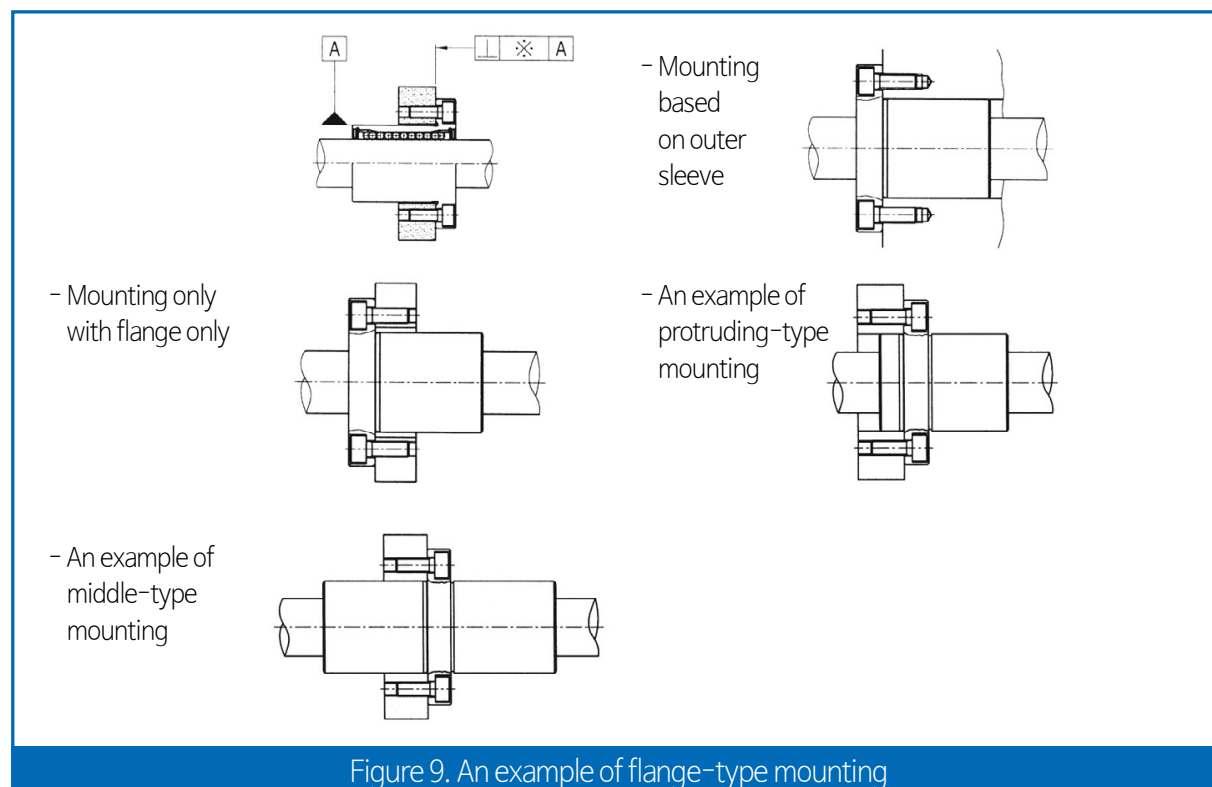


Figure 8. An example of setscrew mounting

7. Flange-type mounting

LMF, LMK, and LMH (including long-type) Series have the integral structure of flange and outer sleeve. Therefore, it is possible to fix only with the flange.

Note: In the case of the mounting based on outer sleeve, pay attention to the shape tolerance in the table of dimensions.

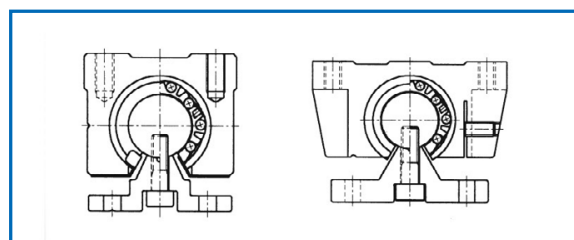
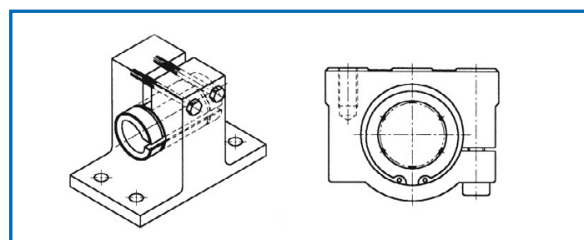


8. Adjustable-type mounting

As for the clearance adjustment of the adjustable type (..AJ), it is possible to adjust the clearance of a linear ball bushing and a linear motion shaft easily by using an adjustable housing. At this time, the cutting part of the linear ball bushing is positioned at 90° of the cutting part of the housing, and thus it is possible to apply an even change in the circumferential direction. (See Figure 10.)

9. Open-type mounting

For the open type (..OP), it is also possible to use a clearance adjustable housing. Commonly, light preload is applied. Please be careful not to apply excessive preload.



10. Shaft support mounting

In Shaft Support WK Series, it is possible to fix a device to a table easily with a mounting bolt. With a jointing bolt, it is possible to install a linear motion shaft firmly.

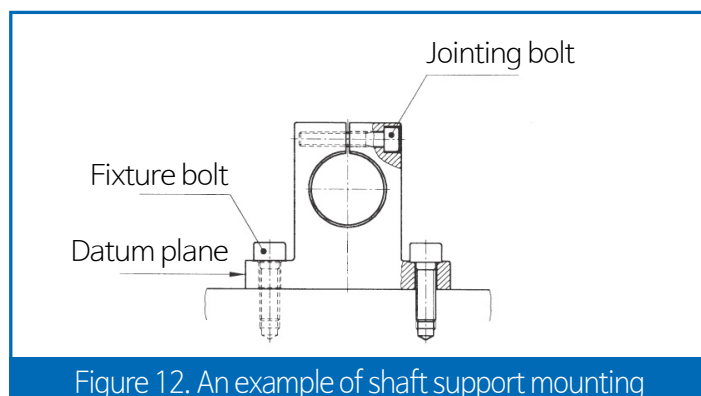


Figure 12. An example of shaft support mounting

7 Caution for Use

1. Assembly of outer sleeve

To combine a standard-type linear ball bushing to a housing, use either a jig for even hitting and insertion in order to prevent a side plate or seal from being hit directly, or a bed plate for light indentation. (See Figure 14.)

2. Insertion of linear motion shaft

In case of the insertion of a linear motion shaft, if the linear motion shaft tilts, a ball can fall, or a retainer has deformation. Therefore, slowly assemble after setting the center rightly. (See Figure 15.)

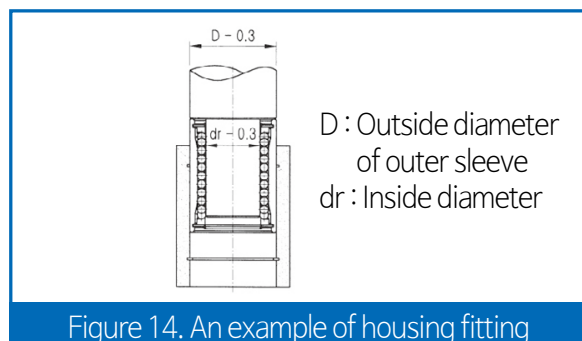


Figure 14. An example of housing fitting

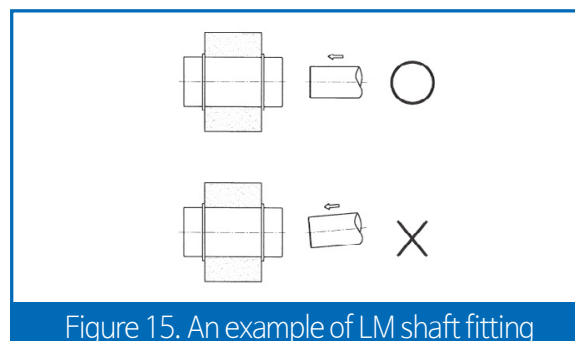


Figure 15. An example of LM shaft fitting

3. When moment load applied

As for a linear ball bushing, it is required to apply even load to the entire length of rolling surface of a ball.

In particular, if moment is applied, it is required to use more than two linear ball bushings for one linear motion shaft, and to set the mounting distance between linear ball bushings as long as possible.

If moment load works, it is required to calculate equivalent radial load and check a model number.

(See Tables 1, 2, and 3).

4. Avoid rotation motion

A linear ball bushing is not suitable for rotary motion in terms of its structure. (See Figure 16.) If it rotates by force, ball creeping can cause wear and retainer damage. Be careful.

5. Caution for mounting open-type linear ball bushing with three ball rows

To install an open-type three-ball-row linear ball bushing, it is required to consider load distribution. It is recommended to install the device as shown in Figure 17.

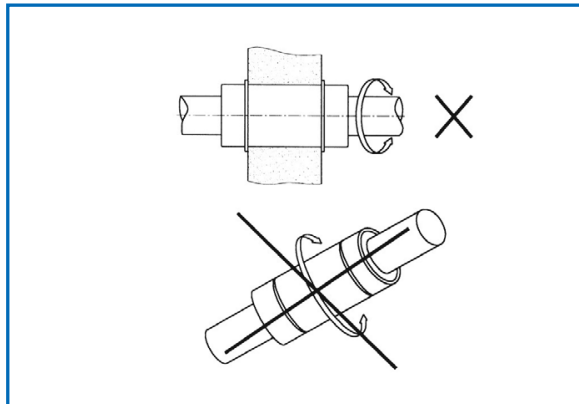


Figure 16. An example of motion direction

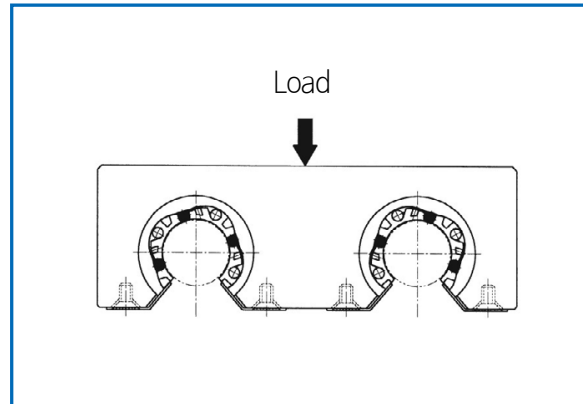
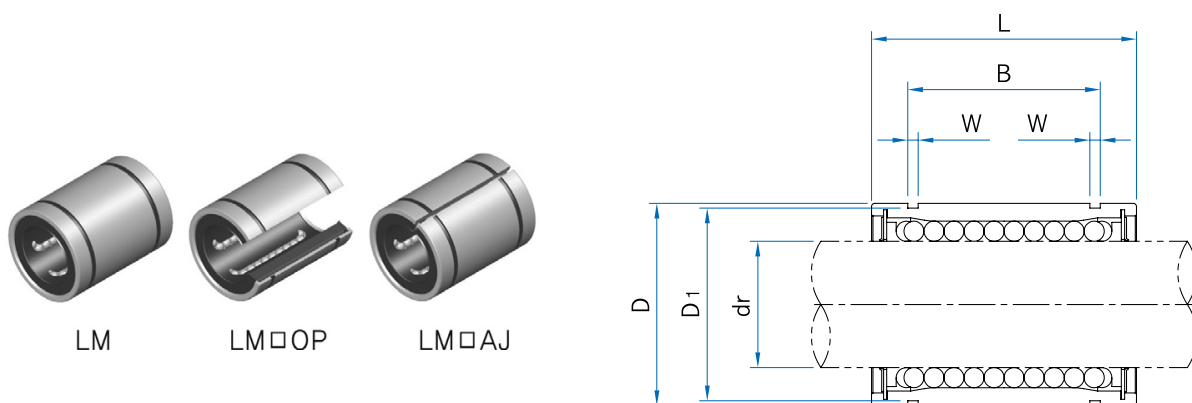


Figure 17. An example of LM12 & LM13 mounting

LM Series

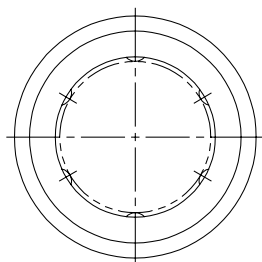


Unit : mm

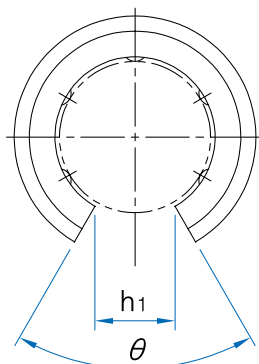
LM Series						Basic load rating		Inside diameter	
Cylindrical Type		Open type(OP)		Adjustable type(AJ)		Dynamic C(N)	Static Co(N)	dr (mm)	Tolerance (μm)
Model No.	No. of ball rows	Model No.	No. of ball rows	Model No.	No. of ball rows				
LM4UU	4	-	-	-	-	88	127	4	$\begin{smallmatrix} 0 \\ -8 \end{smallmatrix}$
LM5UU	4	-	-	-	-	167	206	5	$\begin{smallmatrix} 0 \\ -8 \end{smallmatrix}$
LM6UU	4	-	-	LM 6UUAJ	4	206	265	6	$\begin{smallmatrix} 0 \\ -9 \end{smallmatrix}$
LM8SUU	4	-	-	LM8SUUAJ	4	176	216	8	
LM8UU	4	-	-	LM 8UUAJ	4	274	392	8	
LM10UU	4	-	-	LM10UUAJ	4	372	549	10	
LM12UU	4	LM12UUOP	3	LM12UUAJ	4	510	784	12	
LM13UU	4	LM13UUOP	3	LM13UUAJ	4	510	784	13	
LM16UU	5	LM16UUOP	4	LM16UUAJ	5	774	1180	16	$\begin{smallmatrix} 0 \\ -10 \end{smallmatrix}$
LM20UU	5	LM20UUOP	4	LM20UUAJ	5	882	1370	20	
LM25UU	6	LM25UUOP	5	LM25UUAJ	6	980	1570	25	
LM30UU	6	LM30UUOP	5	LM30UUAJ	6	1570	2740	30	
LM35UU	6	LM35UUOP	5	LM35UUAJ	6	2160	3140	35	$\begin{smallmatrix} 0 \\ -12 \end{smallmatrix}$
LM40UU	6	LM40UUOP	5	LM40UUAJ	6	3820	4020	40	
LM50UU	6	LM50UUOP	5	LM50UUAJ	6	3820	7940	50	$\begin{smallmatrix} 0 \\ -15 \end{smallmatrix}$
LM60UU	6	LM60UUOP	5	LM60UUAJ	6	4700	10000	60	

Note: As for surface treatment, plating or Raydent treatment is applicable.

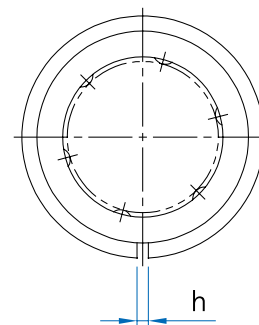
1N $\doteq$ 0.102kgf



LM



LM□OP



LM□AJ

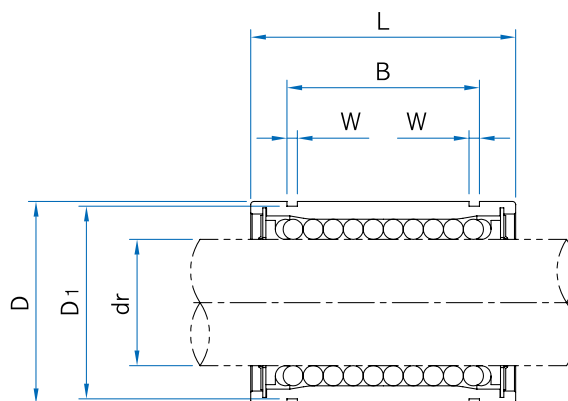
Unit : mm

Dimensions (mm)											Wgt* (g)	Tolerance of radial direction clearance (μ m)	Model No.
D (mm)	Tolerance (μ m)	L (mm)	Tolerance (μ m)	B (mm)	Tolerance (μ m)	W	D1	h	h1	θ (°)			
8	0	12	0	-	-	-	-	-	-	-	2	-3	LM4UU
10	-9	15	-0.12	10.2	0	1.1	9.6	-	-	-	4		LM5UU
12	-11	19	0	13.5		1.1	11.5	1	-	-	8.5		LM6UU
15		17		11.5		1.1	14.3	1	-	-	11		LM8SUU
15		24		17.5		1.1	14.3	1	-	-	17		LM8UU
19	-13	29		22	-0.2	1.3	18	1	6.8	80°	36	-4	LM10UU
21		30		23		1.3	20	1.5	8	80°	42		LM12UU
23		32		23		1.3	22	1.5	9	80°	49		LM13UU
28		37		26.5		1.6	27	1.5	11	80°	76	-6	LM16UU
32	-16	42	0	30.5	0	1.6	30.5	1.5	11	60°	100		LM20UU
40		59		41		1.85	38	2	12	50°	240		LM25UU
45		64		44.5		1.85	43	2.5	15	50°	270	-8	LM30UU
52	-19	70	0	49.5	0	2.1	49	2.5	17	50°	425		LM35UU
60		80		60.5		2.1	57	3	20	50°	654	-10	LM40UU
80		100		74		2.6	76.5	3	25	50°	1700	-13	LM50UU
90	-22	110		85		3.15	86.5	3	30	50°	2000		LM60UU

※ Based on cylindrical type

1N $\doteq$ 0.102kgf

LME Series



Unit : mm

LME Series						Basic load rating		Inside diameter	
Cylindrical Type		Open type (OP)		Adjustable clearance type(AJ)		Dyn C (N)	Stat. Co (N)		
Model No.	No. of ball rows	Model No.	No. of ball rows	Model No.	No. of ball rows				
LME5UU	4	—	—	LME5UUAJ	4	206	265	5	+8 0
LME8UU	4	—	—	LME8UUAJ	4	265	402	8	
LME12UU	4	LME12UUOP	3	LME12UUAJ	4	510	784	12	
LME16UU	5	LME16UUOP	4	LME16UUAJ	5	578	892	16	+9 -1
LME20UU	5	LME20UUOP	4	LME20UUAJ	5	862	1370	20	
LME25UU	6	LME25UUOP	5	LME25UUAJ	6	980	1570	25	+11 -1
LME30UU	6	LME30UUOP	5	LME30UUAJ	6	1570	2740	30	
LME40UU	6	LME40UUOP	5	LME40UUAJ	6	2160	4020	40	+13 -2
LME50UU	6	LME50UUOP	5	LME50UUAJ	6	3820	7940	50	
LME60UU	6	LME60UUOP	5	LME60UUAJ	6	4700	9800	60	

Note: As for surface treatment, plating or Raydent treatment is applicable.

1N ≒ 0.102kgf

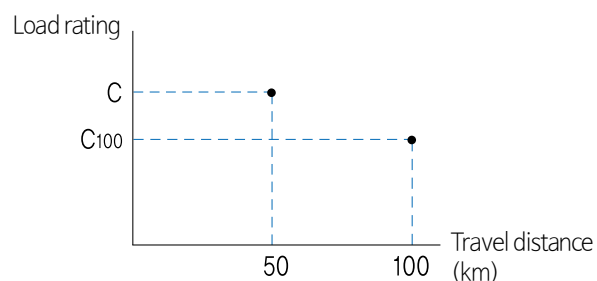
- Reference to basic dynamic load rating

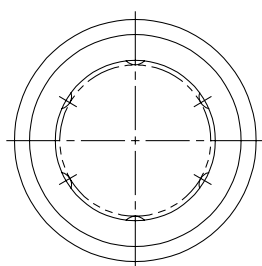
Basic dynamic load rating is based on the 50km stroke.

In the case of 100km as a base, it is necessary to divide the C value in the table by 1.26.

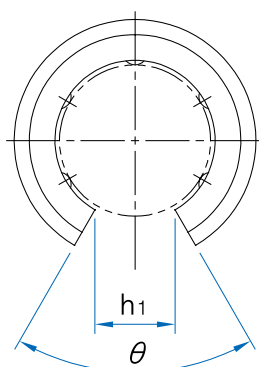
E.g. LME 20 C : 860 N C₁₀₀ : 682 N

$$L = \left(\frac{C}{P} \right)^3 \times 50 \text{ km}, L = \left(\frac{C_{100}}{P} \right)^3 \times 100 \text{ km},$$

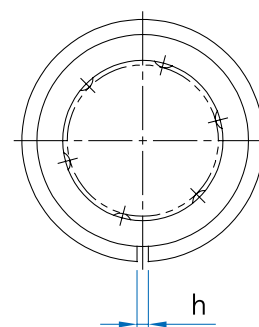




LME



LME□OP



LME□AJ

Unit : mm

Dimensions (mm)										Wgt* (g)	Tolerance of radial direction clearance (μ m)	Part No.	
D		L		B		W	D ₁	h	h ₁				θ (°)
(mm)	Tol. (μ m)	(mm)	Tol. (mm)	(mm)	Tol. (mm)								
12	0	22	0 -0.2	14.5	0 -0.3	1.1	11.5	1	-	-	11	-3	LME5UU
16	-8	25		16.5		1.1	15.2	1	-	-	22		LME8UU
22	0	32		22.9		1.3	21	1.5	7.5	78°	45	-4	LME12UU
26	-9	36		24.9		1.3	24.9	1.5	10	78°	60		LME16UU
32	0 -11	45		31.5		1.6	30.3	2	10	60°	102	-6	LME20UU
40		58	44.1	0 -0.4	1.85	37.5	2	12.5	60°	235	LME25UU		
47		68	52.1		1.85	44.5	2	12.5	50°	360	-8	LME30UU	
62	0	80	60.6		2.15	59	3	16.8	50°	770		LME40UU	
75	-13	100	77.6		2.65	72	3	21	50°	1250	-13	LME50UU	
90	0 -15	125	0 -0.4		101.7	3.15	86.5	3	27.2	54°		2220	LME60UU

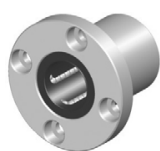
※ based on cylindrical flange type

1N $\approx$ 0.102kgf

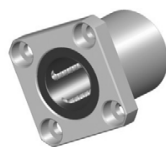
Note: As for surface treatment, plating or Raydent treatment is applicable.

※ Based on cylindrical flange type

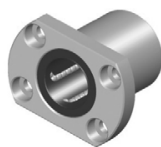
LMF/K/H Series Flange Type



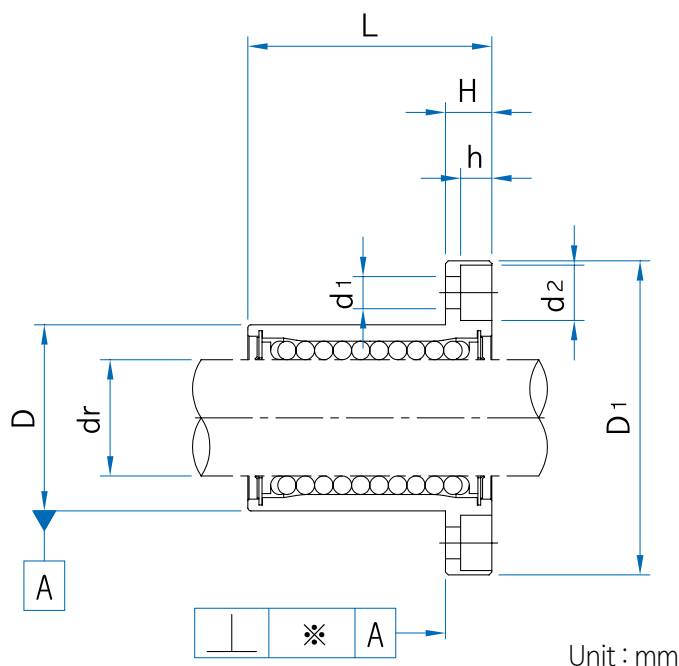
LMF



LMK



LMH



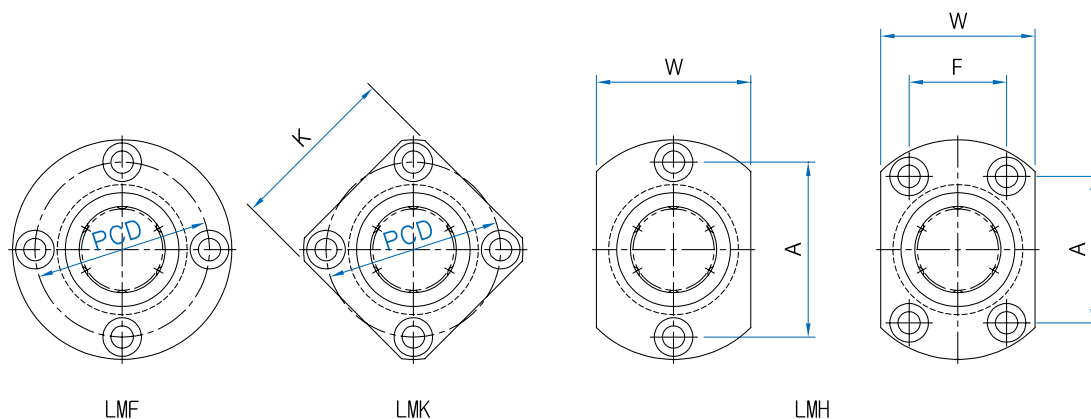
Unit : mm

Model No.			No. of ball rows	Weight* (g)	Tolerance of radial direction clearance (μm)	Basic load rating		Inside diameter	
Round type	Square type	Oval type				Dynamic C (N)	Static Co (N)	dr (mm)	Tolerance (μm)
LMF6UU	LMK6UU	-	4	24	-3	206	265	6	0 -9
LMF8UU	LMK8UU	-	4	37		274	392	8	
LMF10UU	LMK10UU	LMH10UU	4	72	-4	372	549	10	
LMF12UU	LMK12UU	LMH12UU	4	76		510	784	12	
LMF13UU	LMK13UU	LMH13UU	4	88		510	784	13	
LMF16UU	LMK16UU	LMH16UU	5	120	-6	774	1180	16	0 -10
LMF20UU	LMK20UU	LMH20UU	5	180		882	1370	20	
LMF25UU	LMK25UU	LMH25UU	6	340	-8	980	1570	25	0 -10
LMF30UU	LMK30UU	LMH30UU	6	470		1570	2740	30	
LMF35UU	LMK35UU	-	6	650	-10	1670	3140	35	0 -12
LMF40UU	LMK40UU	-	6	1060		2160	4020	40	
LMF50UU	LMK50UU	-	6	2200	-13	3820	7940	50	0 -15
LMF60UU	LMK60UU	-	6	3000		4700	10000	60	

Note: As for surface treatment, plating or Raydent treatment is applicable.

※ Based on cylindrical flange type

1N ≒ 0.102kgf



Unit : mm

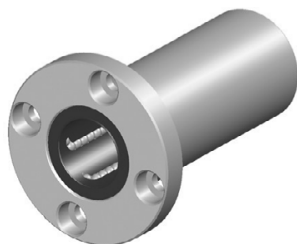
Main dimensions (mm)													Model No.
Outside diameter(D)		Length(L)		D1	H	PCD	K	W	A	F	※ (μm)	d1 x d2 x h	
(mm)	Tol. (μm)	(mm)	Tol. (mm)										
12	0 -11	19	0 -0.2	28	5	20	22	18	20	-	12	3.5x6x3.1	LMF/K/H6UU
15		24		32	5	24	25	21	24	-	12		LMF/K/H8UU
19	0 -13	29		40	6	29	30	25	29	-	12	4.5x7.5x4.1	LMF/K/H10UU
21		30		42	6	32	32	27	32	-	12		LMF/K/H12UU
23		32		43	6	33	34	29	33	-	12		LMF/K/H13UU
28		37		48	6	38	37	34	31	22	12		LMF/K/H16UU
32	0 -16	42	0 -0.3	54	8	43	42	38	36	24	15	5.5x9x5.1	LMF/K/H20UU
40		59		62	8	51	50	46	40	32	15		LMF/K/H25UU
45		64		74	10	60	58	51	49	35	15	6.6x11x6.1	LMF/K/H30UU
52	0 -19	70		82	10	67	64	-	-	-	20		LMF/K/H35UU
60		80		96	13	78	75	-	-	-	20	9x14x8.1	LMF/K/H40UU
80		100		116	13	98	92	-	-	-	20		LMF/K/H50UU
90	0 -22	110			134	18	112	106	-	-	-	25	11x17x11.1

1N ≒ 0.102kgf

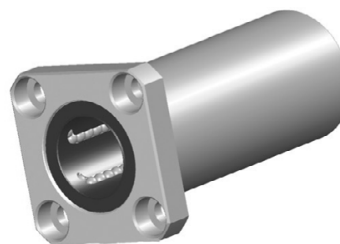
Linear Ball Bushing

LMF/K□L Series

Flange Type



LMF□L



LMK□L

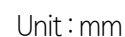
Unit : mm

Model No.		No. of ball rows	Weight※ (g)	Tolerance of radial direction clearance (μm)	Basic load rating		Inside diameter	
Round type	Square type				Dynamic load rating C (N)	Static load rating Co (N)	dr (mm)	Tolerance (μm)
LMF6LUU	LMK6LUU	4	31	-3	323	529	6	0 -10
LMF8LUU	LMK8LUU	4	51		431	784	8	
LMF10LUU	LMK10LUU	4	98		588	1100	10	
LMF12LUU	LMK12LUU	4	110	-4	813	1570	12	
LMF13LUU	LMK13LUU	4	130		813	1570	13	
LMF16LUU	LMK16LUU	5	190	-6	1230	2350	16	0 -12
LMF20LUU	LMK20LUU	5	260		1400	2740	20	
LMF25LUU	LMK25LUU	6	540		1560	3140	25	
LMF30LUU	LMK30LUU	6	680	-8	2490	5490	30	0 -15
LMF35LUU	LMK35LUU	6	1020		2650	6270	35	
LMF40LUU	LMK40LUU	6	1570	-10	3430	8040	40	
LMF50LUU	LMK50LUU	6	3600	-13	6080	15900	50	
LMF60LUU	LMK60LUU	6	4500		7550	20000	60	0 -20

Note: As for surface treatment, plating or Raydent treatment is applicable.

※ Based on cylindrical flange type

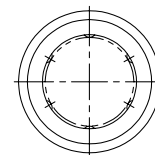
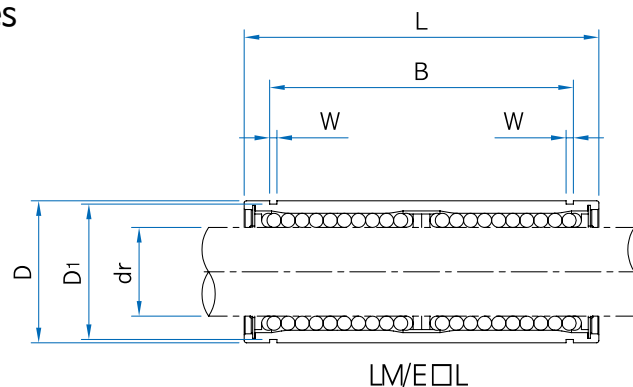
1N ≒ 0.102kgf



Linear Ball Bushing

$$1\text{N} \doteq 0.102\text{kgf}$$

LM□L / LME□L Series



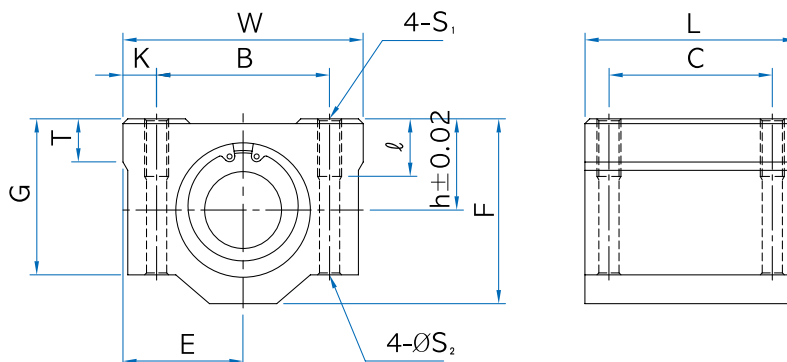
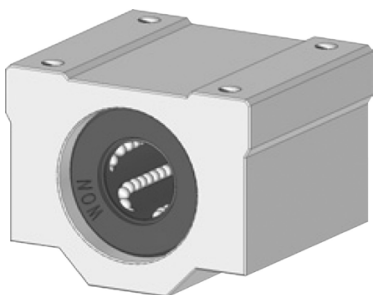
Unit : mm

LM□L Series		Inside diameter		Main dimensions (mm)								Wgt* (g)	Basic load rating			
Model No.	No. of ball rows			D		L		B		W	D1		Dynamic C(N)	Static Co(N)		
		dr (mm)	Tol. (μm)	(mm)	Tol. (μm)	(mm)	Tol. (mm)	(mm)	Tol. (mm)							
LM6LUU	4	6	0 -10	12	0 -13	35	0 -0.3	27	0 -0.4	1.1	11.5	16	323	530		
LM8LUU	4	8		15		45		35		1.1	14.3	31	431	784		
LM10LUU	4	10		19	0 -16	55		44		1.3	18	62	588	1100		
LM12LUU	4	12		21		57		46		1.3	20	80	813	1570		
LM13LUU	4	13		23		61		46		1.3	22	90	813	1570		
LM16LUU	5	16		28	70	53		1.6		27	145	1230	2350			
LM20LUU	5	20	0 -12	32	0 -19	80	0 -0.4	61	0 -0.5	1.6	30.5	180	1400	2740		
LM25LUU	6	25		40		112		82		1.85	38	440	1560	3140		
LM30LUU	6	30	45	123	89	1.85		43		480	2490	5490				
LM35LUU	6	35	52	135	99	2.1		49		795	2650	6270				
LM40LUU	6	40	0 -15	60	0 -22	151		0 -0.4		121	0 -0.5	2.1	57	1170	3430	8040
LM50LUU	6	50		80		192				148		2.6	76.5	3100	6080	15900
LM60LUU	6	60	0 -20	90	0 -25	209		170		3.15	86.5	3500	7550	20000		
LME□L Series																
LME8LUU	4	8	+9 -1	16	0/-9	46	0 -0.3	33	0 -0.4	1.1	15.2	40	421	804		
LME12LUU	4	12	+11 -1	22	0 -11	61		45.8		1.3	21	80	813	1570		
LME16LUU	5	16		26		68		49.8		1.3	24.9	115	921	1780		
LME20LUU	5	20	-1	32	0 -13	80	0 -0.4	61	0 -0.5	1.6	30.5	180	1370	2740		
LME25LUU	6	25	+13 -2	40		0 -13		112		82	1.85	38	430	1570	3140	
LME30LUU	6	30	47	123				104.2		1.85	44.5	615	2500	5490		
LME40LUU	6	40	+16 -4	62	0 -15	151		0 -0.4		121.2	0 -0.5	2.15	59	1400	3430	8040
LME50LUU	6	50		75		192				155.2		2.65	72	2320	6080	15900
LME60LUU	6	60		90		0/-20				209		170	3.15	86.5	3900	7550

Note: As for surface treatment, plating or Raydent treatment is applicable.

1N ≒ 0.102kgf

SC Series



Unit : mm

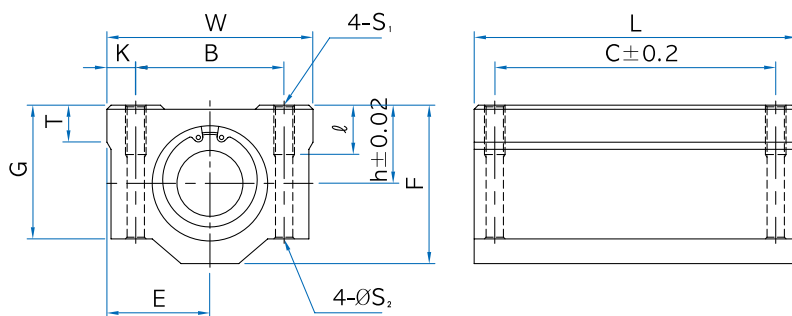
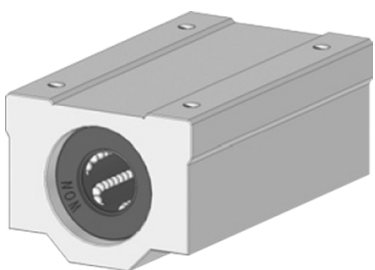
Model No.	Weight (g)	Main dimensions							Mounting dimensions					Di- ame- ter of shaft d	No. of ball rows	Basic load rating	
		h	E	W	L	F	G	T	B	C	K	ℓ	S ₂			Dy- namic C (N)	Static C ₀ (N)
SC8UU	52	11	17	34	30	22	18	6	24	18	5	8	3.4	8	4	260	400
SC10UU	92	13	20	40	35	26	22	8	28	21	6	12	4.3	10	4	370	540
SC12UU	102	15	21	42	36	29	25	8	30.5	26	5.75	12	4.3	12	4	410	490
SC13UU	123	15	22	44	39	30	26	8	33	26	5.5	12	4.3	13	4	500	770
SC16UU	189	19	25	50	44	38.5	35	9	36	34	7	12	4.3	16	5	770	1170
SC20UU	237	21	27	54	50	41	36	11	40	40	7	12	5.2	20	5	860	1370
SC25UU	555	26	38	76	67	51.5	41	12	54	50	11	18	7	25	6	980	1560
SC30UU	685	30	39	78	72	59.5	49	15	58	58	10	18	7	30	6	1560	2740
SC35UU	1100	34	45	90	80	68	54	18	70	60	10	18	7	35	6	1660	3130
SC40UU	1600	40	51	102	90	78	62	20	80	60	11	25	8.7	40	6	2150	4010
SC50UU	3350	52	61	122	110	102	80	24	100	80	11	25	8.7	50	6	3820	7930

Note: 1) LM□□UU jointed.

2) SH□□UU marked in the side of the product.

1N ≒ 0.102kgf

SCWN Series



Unit : mm

Model No.	Main dimensions							Mounting dimensions					Di- ame- ter of shaft d	No. of ball rows	Basic load rating	
	h	E	W	L	F	G	T	B	C	K	ℓ	S ₂			Dy- namic C (N)	Static C ₀ (N)
SCWN 10UU	13	20	40	68	26	22	8	28	46	6	12	4.3	10	4	588	1100
SCWN 12UU	15	21	42	70	29	25	8	30.5	50	5.75	12	4.3	12	4	813	1570
SCWN 13UU	15	22	44	75	30	26	8	33	50	5.5	12	4.3	13	4	813	1570
SCWN 16UU	19	25	50	85	38.5	35	9	36	60	7	12	4.3	16	5	1230	2350
SCWN 20UU	21	27	54	96	41	36	11	40	70	7	12	5.2	20	5	1400	2740
SCWN 25UU	26	38	76	130	51.5	41	12	54	100	11	18	7	25	6	1560	3140
SCWN 30UU	30	39	78	140	59.5	49	15	58	110	10	18	7	30	6	2490	5490
SCWN 35UU	34	45	90	155	68	54	18	70	120	10	18	7	35	6	2650	6270
SCWN 40UU	40	51	102	175	78	62	20	80	140	11	25	8.7	40	6	3430	8040
SCWN 50UU	50	61	122	215	102	80	24	100	160	11	25	8.7	50	6	6080	15900

Note: 1) LM □□UU 2EA jointed

2) SHW □□UU marked in the side of the product

1N ≒ 0.102kgf