

Structure and Features

Spherical Bearings models SB and SA1 are self-aligning plain bearings designed for heavy loads. The inner and outer rings of these models use high-carbon chromium bearing steel that is hardened, ground, phosphate-coated and seized with molybdenum disulfide (MoS_2).

The Spherical Bearing is capable of receiving a large radial load and thrust loads in both directions. Furthermore, because of its high resistance to impact loads, the Spherical Bearing is optimal for low-speed, heavy-load rocking components such as the cylinder clevises or hinges of construction and civil-engineering machinery, the suspensions of trucks and the bolster anchors of electric cars.

Types and Features

Model SB



The most popular type of spherical bearing in Japan, model SB has wide spherical contact areas and is used as a bearing for heavy loads. The outer ring is split at two points, enabling the inner ring to be accommodated.

Model SA1



This type of spherical bearing is widely used in Europe. The outer ring is split at one point (outer rings with diameter of ϕ 100 or thicker are split at two points), and the width and thickness are smaller than model SB. Thus, this model can be used in small spaces. Types attached with highly dust-preventive dust seals on both ends (model SA1 ... UU) are also available.

Accuracy Standards

The dimensional tolerances of the Spherical Bearing are defined as indicated in table 1.

Table 1 Accuracy of the Spherical Bearing
Unit: μm

Nominal dimension of the inner diameter (d) and the outer diameter (D) (mm)		Tolerance in inner diameter (dm)		Tolerance in outer diameter (Dm)		Tolerance of the inner or outer ring in width (B ₁ , B)	
Above	Or less	Upper	Lower	Upper	Lower	Upper	Lower
10	18	0	- 8	—	—	0	-120
18	30	0	-10	0	- 9	0	-120
30	50	0	-12	0	-11	0	-120
50	80	0	-15	0	-13	0	-150
80	120	0	-20	0	-15	0	-200
120	150	0	-25	0	-18	0	-250
150	180	0	-25	0	-25	0	-250
180	250	0	-30	0	-30	0	-300
250	315	—	—	0	-35	0	-350
315	400	—	—	0	-40	0	-400

Note 1: "dm" and "Dm" represent the arithmetic averages of the maximum and minimum diameters obtained in measuring the inner and outer diameters at two points.

Note 2: The dimensional tolerances of the inner and outer diameters are the values before they are surface-treated.

Note 3: The dimensional tolerance of the outer ring is the value before it is split.

Note 4: Tolerances of the inner and outer diameters in width (B₁, B) are assumed to be equal, and obtained from the nominal dimension of the inner diameter of the inner ring.

Radial Clearance

Table 2 shows radial clearances of the Spherical Bearing.

Table 2 Radial Clearances of the Spherical Bearing
Unit: μm

Bearing inner diameter (d) (mm)		Radial clearance	
Above	Or less	Min.	Max.
—	17	70	125
17	30	75	140
30	50	85	150
50	65	90	160
65	80	95	170
80	100	100	185
100	120	110	200
120	150	120	215
150	240	130	230

Note 1: The radial clearance indicates the value before the outer ring is split.

Note 2: The axial clearance is approximately twice the radial clearance.

Fitting

The fitting between the Spherical Bearing and the shaft or the housing is selected according to the service conditions. Table 3 shows recommended values.

Table 3 Recommended Fitting Values

Service conditions		Shaft	Housing
Inner ring rotational load	Normal load	k6	H7
	Indeterminate load	m6	H7
Outer ring rotational load	Normal load	g6	M7
	Indeterminate load	h6	N7

Note 1: If the product is to be installed so that the inner ring rotates and the fitting with the shaft is to be clearance fitting, harden the surface of the shaft in advance.

Note 2: "N7" is recommended for light alloy housings.

Shaft Designing

If the inner ring is to be fit onto the shaft in clearance fitting and the product is to be used under a heavy load, the shaft may slip on the inner circumference of the inner ring. To prevent the slippage, the shaft hardness must be 58 HRC or higher and the surface roughness must be 0.80 μm or below.

Permissible Tilt Angle

The permissible tilt angle of the Spherical Bearing varies according to the shaft shape as indicated in table 4.

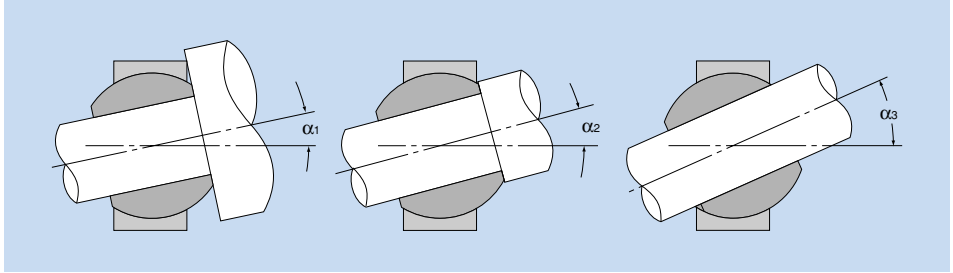


Table 4 Permissible Tilt Angle
Unit: degree

Unit: degree

Model No.	Permissible tilt angle		
	α_1	α_2	α_3
SB 12	5	7	18
SB 15	4	6	18
SB 20	3	4	14
SB 22	4	6	16
SB 25	4	5	16
SB 30	4	6	17
SB 35	4	5	14
SB 40	4	6	12
SB 45	4	5	13
SB 50	4	5	16
SB 55	4	6	16
SB 60	4	6	18
SB 65	4	5	16
SB 70	4	5	15
SB 75	4	5	18
SB 80	4	5	18
SB 85	4	6	16
SB 90	4	5	16
SB 95	4	5	17
SB 100	4	5	18
SB 110	4	5	16
SB 115	4	5	14
SB 120	4	6	15
SB 130	4	5	14
SB 150	4	5	12

Model No.	Permissible tilt angle		
	α_1	α_2 ^(note)	α_3
SA1 12	8	11(6)	25
SA1 15	6	8(5)	18
SA1 17	7	10(7)	23
SA1 20	6	9(6)	21
SA1 25	6	7(4)	18
SA1 30	4	6(4)	16
SA1 35	5	6(4)	16
SA1 40	5	7(4)	16
SA1 45	6	7(4)	16
SA1 50	5	6(4)	15
SA1 60	5	6(3)	14
SA1 70	5	6(4)	14
SA1 80	4	6(4)	14
SA1 90	4	5(3)	12
SA1 100	5	7(5)	14
SA1 110	5	6(4)	15
SA1 120	4	6(4)	15
SA1 140	5	7(5)	16
SA1 160	6	8(6)	13
SA1 180	5	6(5)	16
SA1 200	6	7(6)	13
SA1 220	6	8(6)	15
SA1 240	6	8(6)	17

Note: The values in the parentheses apply to types attached with a seal.

Lubrication

The spherical sliding surface of the Spherical Bearing is seized with a solid lubricant film of molybdenum disulfide. This enables the Spherical Bearing to be used over a relatively long period without further lubrication under a static load, in low-speed rocking motion or in intermittent rotary motion. However, it is generally necessary to replenish grease on a regular basis. If a heavy load is applied, consider using lithium soap group grease containing molybdenum disulfide. The inner and outer rings of the spherical bearing have greasing holes as a means to facilitate the flow of the lubricant inside the bearing.

Lubrication Interval

Since the Spherical Bearing is delivered without being applied with a lubricant, it is necessary to replenish an appropriate amount of grease after installing the Spherical Bearing. We recommend filling grease also to the space surrounding the Spherical Bearing. It is also recommendable to shorten the lubrication interval in the start-up period in order to lighten the initial wear and extend the service life.

The lubrication interval varies according to the magnitude of the load, frequency of the vibrations and other conditions. Provide lubrication while referring to the values in table 5 as a guide.

Table 5 Lubrication Interval

Type of load	Required minimum lubrication interval
Unilateral load	G/40
Varying load	G/180

G: Service life of the bearing (total number of rocking motions or total number of revolutions)

Dust Prevention

Spherical Bearing model SA1 is provided with a seal designed to prevent humidity or other deleterious material from entering the bearing. This seal is effective in increasing the service life of the bearing.

The seal for Spherical Bearing model SA1 is made of oil-resistant synthetic rubber and has double lips as the sealing element. These lips closely contact the spherical inner ring.

The seal can be used within the temperature range between -30°C and 80°C, and is highly resistant to wear and capable of operating for a long period of time.

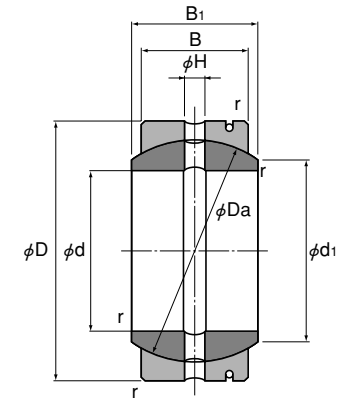
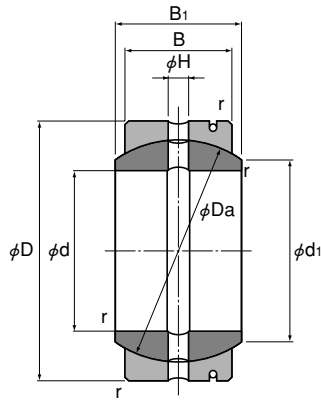
If the product is used in an environment where sand or soil matter may enter the bearing, the service life of the seal is shortened. In such cases, we recommend lubricating the product on a regular basis.

Permissible Service Temperature

The permissible service temperature of the Spherical Bearing is limited between -30°C and 80°C depending on the seal material and determined by the permissible service temperature range of the grease used.

Installation

When installing the Spherical Bearing, pay attention to the mounting orientation so that the slit of the outer ring receives a minimum load. Also note that the Spherical Bearing cannot receive a thrust load alone.

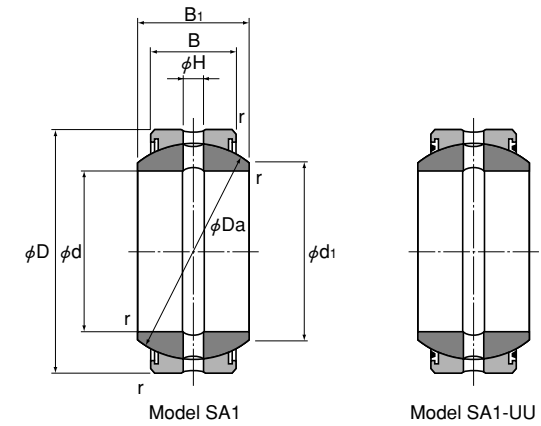
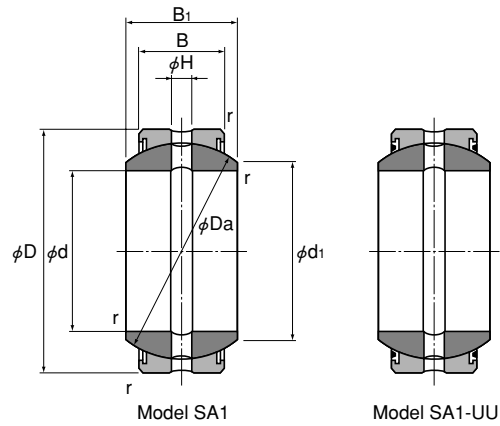


Unit: mm

Model No.	Major dimensions								Basic load rating		Mass
	Inner diameter d	Outer diameter D	Outer ring width B	Inner ring width B ₁	d ₁	Da	H	r	C kN	C ₀ kN	kg
SB 12	12	22	9	11	14	18	1.5	0.5	3.82	95.3	0.019
SB 15	15	26	11	13	17.5	22	2.5	0.5	5.69	142	0.028
SB 20	20	32	14	16	23	28	2.5	0.5	9.22	230	0.053
SB 22	22	37	16	19	25.5	32	2.5	0.5	12.1	301	0.085
SB 25	25	42	18	21	29	36	4	0.5	15.3	381	0.116
SB 30	30	50	23	27	36	45	4	1	24.3	609	0.225
SB 35	35	55	26	30	40	50	4	1	30.6	765	0.3
SB 40	40	62	28	33	44	55	4	1	36.3	906	0.375
SB 45	45	72	31	36	50.5	62	6	1	45.2	1130	0.6
SB 50	50	80	36	42	58.5	72	6	1	61	1530	0.87
SB 55	55	90	40	47	64.5	80	6	1	75.3	1880	1.26
SB 60	60	100	45	53	72.5	90	6	1	95.3	2380	1.7
SB 65	65	105	47	55	76	94	6	1	104	2600	2.05

Unit: mm

Model No.	Major dimensions								Basic load rating		Mass
	Inner diameter d	Outer diameter D	Outer ring width B	Inner ring width B ₁	d ₁	Da	H	r	C kN	C ₀ kN	kg
SB 70	70	110	50	58	81.5	100	8	1	118	2940	2.22
SB 75	75	120	55	64	89.5	110	8	1	142	3560	3.02
SB 80	80	130	60	70	97.5	120	8	1	170	4240	3.98
SB 85	85	135	63	74	100.5	125	8	1	185	4640	4.29
SB 90	90	140	65	76	105.5	130	8	1	199	4970	4.71
SB 95	95	150	70	82	113.5	140	8	1	230	5760	6.05
SB 100	100	160	75	88	121.5	150	10	1.5	265	6620	7.42
SB 110	110	170	80	93	130	160	10	1.5	301	7530	8.55
SB 115	115	180	85	98	132.5	165	10	1.5	330	8250	10.3
SB 120	120	190	90	105	140	175	10	1.5	371	9260	12.4
SB 130	130	200	95	110	148.5	185	10	1.5	414	10300	13.8
SB 150	150	220	105	120	166	205	10	1.5	507	12600	17



Unit: mm

Model No.		Major dimensions								Basic load rating		Mass
Standard type	Seal type	Inner diameter d	Outer diameter D	Outer ring width B	Inner ring width B ₁	d ₁	Da	H	r	C kN	C ₀ kN	kg
SA1 12	SA1 12UU	12	22	7	10	15	18	1.5	0.3	2.94	74.1	0.017
SA1 15	SA1 15UU	15	26	9	12	18.4	22	2.5	0.3	4.7	117	0.032
SA1 17	SA1 17UU	17	30	10	14	20.7	25	2.5	0.3	5.88	147	0.049
SA1 20	SA1 20UU	20	35	12	16	24.2	29	2.5	0.3	8.23	205	0.065
SA1 25	SA1 25UU	25	42	16	20	29.3	35.5	4	0.3	13.3	334	0.115
SA1 30	SA1 30UU	30	47	18	22	34.2	40.7	4	0.3	17.3	431	0.16
SA1 35	SA1 35UU	35	55	20	25	39.8	47	4	1	22.1	553	0.258
SA1 40	SA1 40UU	40	62	22	28	45	53	4	1	27.5	686	0.315
SA1 45	SA1 45UU	45	68	25	32	50.8	60	6	1	35.3	882	0.413
SA1 50	SA1 50UU	50	75	28	35	56	66	6	1	43.5	1090	0.56
SA1 60	SA1 60UU	60	90	36	44	66.8	80	6	1.5	67.7	1700	1.1
SA1 70	SA1 70UU	70	105	40	49	77.9	92	8	1.5	86.6	2170	1.54

Unit: mm

Model No.		Major dimensions								Basic load rating		Mass
Standard type	Seal type	Inner diameter d	Outer diameter D	Outer ring width B	Inner ring width B ₁	d ₁	Da	H	r	C kN	C ₀ kN	kg
SA1 80	SA1 80UU	80	120	45	55	89.4	105	8	1.5	111	2780	2.29
SA1 90	SA1 90UU	90	130	50	60	98.1	115	8	2	135	3380	2.84
SA1 100	SA1 100UU	100	150	55	70	109.5	130	8	2	169	4210	4.43
SA1 110	SA1 110UU	110	160	55	70	121.2	140	8	2	181	4530	4.94
SA1 120	SA1 120UU	120	180	70	85	135.6	160	8	2	264	6590	8.12
SA1 140	SA1 140UU	140	210	70	90	155.9	180	8	3	296	7410	11.3
SA1 160	SA1 160UU	160	230	80	105	170.2	200	10	3	376	9410	14.4
SA1 180	SA1 180UU	180	260	80	105	199	225	10	3	424	10600	18.9
SA1 200	SA1 200UU	200	290	100	130	213.5	250	10	3	588	14700	28.1
SA1 220	SA1 220UU	220	320	100	135	239.6	275	10	3.5	647	16200	36.1
SA1 240	SA1 240UU	240	340	100	140	265.3	300	10	3.5	706	17600	40.4

Note Model numbers "...100" or higher have double-slit outer rings.