

# Self-Aligning Ball Bearings



## 1. Design features and characteristics

The outer ring raceway of self-aligning ball bearings forms a spherical surface whose center is common to the bearing center. The inner ring of the bearing has two raceways.

The balls, cage, and inner ring of these bearings are capable of shifting in order to compensate for a certain degree of misalignment with the outer rings. As a result, the bearing is able to align itself and compensate for shaft / housing finishing unevenness, bearing fitting error, and other sources of misalignment as shown in **Fig. 1**.

Since axial load capacity is limited, self-aligning ball bearings are not suitable for applications with heavy axial loads.

It is recommended to use an adapter on a self-aligning ball bearing with a tapered bore inner diameter for ease of installation and disassembly. These bearings and adapters are often used on drive shaft applications.

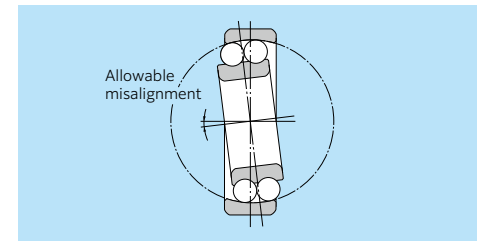


Fig. 1

## 2. Standard cage type

All bearing series are equipped with a pressed cage, except 2321S and 2322S, which are equipped with a machined cage.

Table 1 Standard cage types of spherical ball bearings

Cage type	Pressed steel cage		Machined cage
Bearing series or model	12 and 13 series	22 and 23 series	2321S, 2322S

## 3. Ball protrusion

Bearings with part numbers listed in **Table 2** below have balls which protrude slightly from the bearing face as illustrated in **Fig. 2**. The total width dimensions are shown in **Table 2**.

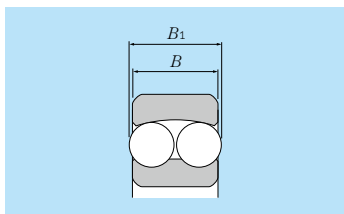


Fig. 2

Table 2 Unit: mm

Bearing numbers	Width dimension $B$	Total width dimension $B_1$
2222S (K)	53	54
2316S (K)	58	59
2319S (K)	67	68
2320S (K)	73	74
2321S	77	78
2322S (K)	80	81
1318S (K)	43	46
1319S (K)	45	49
1320S (K)	47	53
1321S	49	55
1322S (K)	50	56

## 4. Allowable misalignment angle

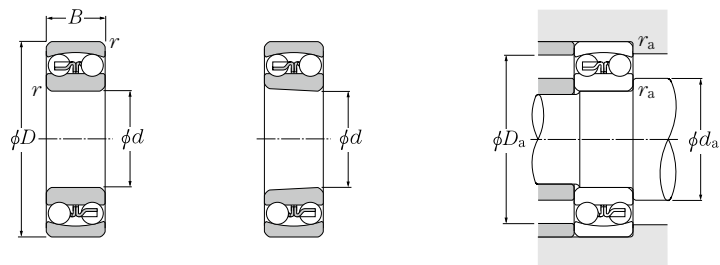
The allowable misalignment angle can be determined by the following function. This degree of allowable misalignment may be limited by the design of mating components around the bearing.

Normal load ..... 1/15

## 5. Precautions for using self-aligning ball bearings

Self-aligning ball bearings are unable to support large axial loads and therefore axial loading shall be limited.

Please consider using self-aligning roller bearings when a large axial load is to be applied.



Cylindrical bore

Tapered bore

d 10 ~ 35mm

	Boundary dimensions			Basic load rating		Fatigue load limit kN C <sub>u</sub>	Allowable speed		Bearing numbers		Installation-related dimensions		
	mm	mm	mm	dynamic kN	static kN		Grease lubrication	Oil lubrication	Cylindrical bore	Tapered bore <sup>2)</sup>	d <sub>a</sub> mm Min.	D <sub>a</sub> mm Max.	r <sub>as</sub> mm Max.
10	30	9	0.6	5.55	1.19	0.049	22 000	28 000	1200S	—	14.0	26.0	0.6
	30	14	0.6	7.45	1.59	0.067	24 000	28 000	2200S	—	14.0	26.0	0.6
	35	11	0.6	7.35	1.62	0.074	20 000	24 000	1300S	—	14.0	31.0	0.6
	35	17	0.6	9.20	2.01	0.096	18 000	22 000	2300S	—	14.0	31.0	0.6
12	32	10	0.6	5.70	1.27	0.053	22 000	26 000	1201S	—	16.0	28.0	0.6
	32	14	0.6	7.75	1.73	0.089	22 000	26 000	2201S	—	16.0	28.0	0.6
	37	12	1	9.65	2.16	0.078	18 000	22 000	1301S	—	17.0	32.0	1
	37	17	1	12.1	2.73	0.120	17 000	22 000	2301S	—	17.0	32.0	1
15	35	11	0.6	7.60	1.75	0.072	18 000	22 000	1202S	—	19.0	31.0	0.6
	35	14	0.6	7.80	1.85	0.095	18 000	22 000	2202S	—	19.0	31.0	0.6
	42	13	1	9.70	2.29	0.081	16 000	20 000	1302S	—	20.0	37.0	1
	42	17	1	12.3	2.91	0.130	14 000	18 000	2302S	—	20.0	37.0	1
17	40	12	0.6	8.00	2.01	0.083	16 000	20 000	1203S	—	21.0	36.0	0.6
	40	16	0.6	9.95	2.42	0.130	16 000	20 000	2203S	—	21.0	36.0	0.6
	47	14	1	12.7	3.20	0.110	14 000	17 000	1303S	—	22.0	42.0	1
	47	19	1	14.7	3.55	0.160	13 000	16 000	2303S	—	22.0	42.0	1
20	47	14	1	10.0	2.61	0.110	14 000	17 000	1204S	1204SK	25.0	42.0	1
	47	18	1	12.8	3.30	0.140	14 000	17 000	2204S	2204SK	25.0	42.0	1
	52	15	1.1	12.6	3.35	0.140	12 000	15 000	1304S	1304SK	26.5	45.5	1
	52	21	1.1	18.5	4.70	0.210	11 000	14 000	2304S	2304SK	26.5	45.5	1
25	52	15	1	12.2	3.30	0.130	12 000	14 000	1205S	1205SK	30.0	47.0	1
	52	18	1	12.4	3.45	0.200	12 000	14 000	2205S	2205SK	30.0	47.0	1
	62	17	1.1	18.2	5.00	0.150	10 000	13 000	1305S	1305SK	31.5	55.5	1
	62	24	1.1	24.9	6.60	0.290	9 500	12 000	2305S	2305SK	31.5	55.5	1
30	62	16	1	15.8	4.65	0.190	10 000	12 000	1206S	1206SK	35.0	57.0	1
	62	20	1	15.3	4.55	0.260	10 000	12 000	2206S	2206SK	35.0	57.0	1
	72	19	1.1	21.4	6.30	0.190	8 500	11 000	1306S	1306SK	36.5	65.5	1
	72	27	1.1	32.0	8.75	0.380	8 000	10 000	2306S	2306SK	36.5	65.5	1
35	72	17	1.1	15.9	5.10	0.210	8 500	10 000	1207S	1207SK	41.5	65.5	1
	72	23	1.1	21.7	6.60	0.320	8 500	10 000	2207S	2207SK	41.5	65.5	1
	80	21	1.5	25.3	7.85	0.280	7 500	9 500	1307S	1307SK	43.0	72.0	1.5
	80	31	1.5	40.0	11.3	0.480	7 100	9 000	2307S	2307SK	43.0	72.0	1.5

1) Smallest allowable dimension for chamfer dimension r. 2) "K" indicates bearings having a tapered bore with a taper ratio of 1:12

Dynamic equivalent radial load

$$P_r = X F_r + Y F_a$$

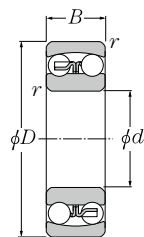
$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y <sub>1</sub>	0.65	Y <sub>2</sub>

Static equivalent radial load

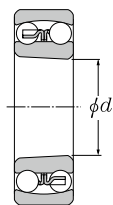
$$P_{0r} = F_r + Y_0 F_a$$

For values of e, Y<sub>1</sub>, Y<sub>2</sub> and Y<sub>0</sub> see the table below.

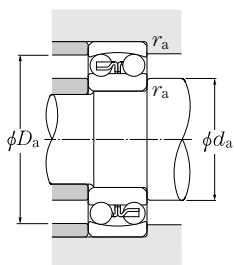
Constant	Axial load factors			Mass kg (approx.)
	e	Y <sub>1</sub>	Y <sub>2</sub>	
0.32	2.00	3.10	2.10	0.034
0.64	0.98	1.50	1.00	0.046
0.35	1.80	2.80	1.90	0.059
0.71	0.89	1.40	0.93	0.078
0.36	1.80	2.70	1.80	0.041
0.58	1.10	1.70	1.10	0.051
0.33	1.90	2.90	2.00	0.068
0.60	1.10	1.60	1.10	0.087
0.32	2.00	3.10	2.10	0.050
0.50	1.30	1.90	1.30	0.058
0.33	1.90	2.90	2.00	0.101
0.51	1.20	1.90	1.30	0.113
0.31	2.00	3.10	2.10	0.074
0.50	1.30	1.90	1.30	0.089
0.32	2.00	3.10	2.10	0.130
0.51	1.20	1.90	1.30	0.160
0.29	2.20	3.40	2.30	0.120
0.47	1.30	2.10	1.40	0.142
0.29	2.20	3.40	2.30	0.164
0.50	1.20	1.90	1.30	0.207
0.28	2.30	3.50	2.40	0.140
0.41	1.50	2.40	1.60	0.160
0.28	2.30	3.50	2.40	0.261
0.47	1.40	2.10	1.40	0.332
0.25	2.50	3.90	2.60	0.220
0.38	1.60	2.50	1.70	0.262
0.26	2.40	3.70	2.50	0.391
0.44	1.40	2.20	1.50	0.500
0.23	2.70	4.20	2.80	0.330
0.37	1.70	2.60	1.80	0.403
0.26	2.50	3.80	2.60	0.520
0.46	1.40	2.10	1.40	0.671



Cylindrical bore



Tapered bore



Dynamic equivalent radial load

$$P_r = X F_r + Y F_a$$

$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y <sub>1</sub>	0.65	Y <sub>2</sub>

Static equivalent radial load

$$P_{0r} = F_r + Y_0 F_a$$

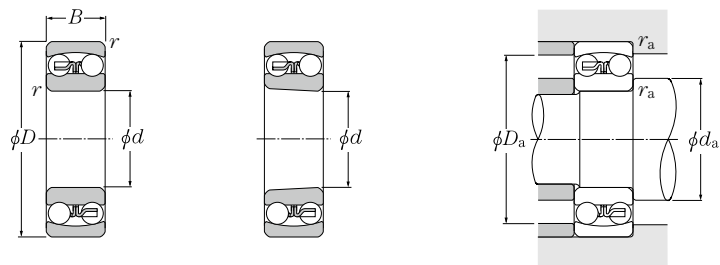
For values of  $e$ ,  $Y_1$ ,  $Y_2$  and  $Y_0$  see the table below.

$d$  40 ~ 75mm

	Boundary dimensions			Basic load rating		Fatigue load limit	Allowable speed		Bearing numbers		Installation-related dimensions		
	mm	mm	mm	dynamic	static		Grease	Oil	Cylindrical bore	Tapered bore <sup>2)</sup>	mm	mm	mm
$d$	$D$	$B$	$r_{s \min}^{1)}$	$C_r$	$C_{0r}$	kN	$C_u$	min <sup>-1</sup>			$d_a$	$D_a$	$r_{as}$
								lubrication	lubrication		Min.	Max.	Max.
40	80	18	1.1	19.3	6.50	0.260	7 500	9 000	<b>1208S</b>	<b>1208SK</b>	46.5	73.5	1
	80	23	1.1	22.4	7.35	0.390	7 500	9 000	<b>2208S</b>	<b>2208SK</b>	46.5	73.5	1
	90	23	1.5	29.8	9.70	0.300	6 700	8 500	<b>1308S</b>	<b>1308SK</b>	48.0	82.0	1.5
	90	33	1.5	45.5	13.5	0.580	6 300	8 000	<b>2308S</b>	<b>2308SK</b>	48.0	82.0	1.5
45	85	19	1.1	22.0	7.35	0.290	7 100	8 500	<b>1209S</b>	<b>1209SK</b>	51.5	78.5	1
	85	23	1.1	23.3	8.15	0.510	7 100	8 500	<b>2209S</b>	<b>2209SK</b>	51.5	78.5	1
	100	25	1.5	38.5	12.7	0.330	6 000	7 500	<b>1309S</b>	<b>1309SK</b>	53.0	92.0	1.5
	100	36	1.5	55.0	16.7	0.710	5 600	7 100	<b>2309S</b>	<b>2309SK</b>	53.0	92.0	1.5
50	90	20	1.1	22.8	8.10	0.330	6 300	8 000	<b>1210S</b>	<b>1210SK</b>	56.5	83.5	1
	90	23	1.1	23.3	8.45	0.570	6 300	8 000	<b>2210S</b>	<b>2210SK</b>	56.5	83.5	1
	110	27	2	43.5	14.1	0.350	5 600	6 700	<b>1310S</b>	<b>1310SK</b>	59.0	101	2
	110	40	2	65.0	20.2	0.860	5 000	6 300	<b>2310S</b>	<b>2310SK</b>	59.0	101	2
55	100	21	1.5	26.9	10.0	0.400	6 000	7 100	<b>1211S</b>	<b>1211SK</b>	63.0	92.0	1.5
	100	25	1.5	26.7	9.90	0.720	6 000	7 100	<b>2211S</b>	<b>2211SK</b>	63.0	92.0	1.5
	120	29	2	51.5	17.9	0.400	5 000	6 300	<b>1311S</b>	<b>1311SK</b>	64.0	111	2
	120	43	2	76.5	24.0	1.00	4 800	6 000	<b>2311S</b>	<b>2311SK</b>	64.0	111	2
60	110	22	1.5	30.5	11.5	0.460	5 300	6 300	<b>1212S</b>	<b>1212SK</b>	68.0	102	1.5
	110	28	1.5	34.0	12.6	0.840	5 300	6 300	<b>2212S</b>	<b>2212SK</b>	68.0	102	1.5
	130	31	2.1	57.5	20.8	0.510	4 500	5 600	<b>1312S</b>	<b>1312SK</b>	71.0	119	2
	130	46	2.1	88.5	28.3	1.20	4 300	5 300	<b>2312S</b>	<b>2312SK</b>	71.0	119	2
65	120	23	1.5	31.0	12.5	0.500	4 800	6 000	<b>1213S</b>	<b>1213SK</b>	73.0	112	1.5
	120	31	1.5	43.5	16.4	0.920	4 800	6 000	<b>2213S</b>	<b>2213SK</b>	73.0	112	1.5
	140	33	2.1	62.5	22.9	0.670	4 300	5 300	<b>1313S</b>	<b>1313SK</b>	76.0	129	2
	140	48	2.1	97.0	32.5	1.40	3 800	4 800	<b>2313S</b>	<b>2313SK</b>	76.0	129	2
70	125	24	1.5	35.0	13.8	0.550	4 800	5 600	<b>1214S</b>	—	78.0	117	1.5
	125	31	1.5	44.0	17.1	1.10	4 500	5 600	<b>2214S</b>	—	78.0	117	1.5
	150	35	2.1	75.0	27.7	0.690	4 000	5 000	<b>1314S</b>	—	81.0	139	2
	150	51	2.1	111	37.5	1.60	3 600	4 500	<b>2314S</b>	—	81.0	139	2
75	130	25	1.5	39.0	15.7	0.630	4 300	5 300	<b>1215S</b>	<b>1215SK</b>	83.0	122	1.5
	130	31	1.5	44.5	17.8	1.20	4 300	5 300	<b>2215S</b>	<b>2215SK</b>	83.0	122	1.5
	160	37	2.1	80.0	30.0	0.720	3 800	4 500	<b>1315S</b>	<b>1315SK</b>	86.0	149	2
	160	55	2.1	125	43.0	1.80	3 400	4 300	<b>2315S</b>	<b>2315SK</b>	86.0	149	2

1) Smallest allowable dimension for chamfer dimension  $r$ . 2) "K" indicates bearings having a tapered bore with a taper ratio of 1:12

Constant	Axial load factors			Mass
	$e$	$Y_1$	$Y_2$	
0.22	2.8	4.3	2.9	0.420
0.33	1.9	3.0	2.0	0.506
0.24	2.6	4.0	2.7	0.727
0.43	1.5	2.3	1.5	0.918
0.21	3.0	4.7	3.1	0.470
0.30	2.1	3.2	2.2	0.556
0.25	2.6	4.0	2.7	0.971
0.41	1.5	2.4	1.6	1.200
0.21	3.1	4.7	3.2	0.535
0.28	2.2	3.4	2.3	0.598
0.23	2.7	4.2	2.8	1.230
0.42	1.5	2.3	1.6	1.630
0.20	3.2	4.9	3.3	0.708
0.28	2.3	3.5	2.4	0.807
0.23	2.7	4.2	2.8	1.600
0.41	1.5	2.4	1.6	2.080
0.18	3.4	5.3	3.6	0.910
0.28	2.3	3.5	2.4	1.100
0.23	2.8	4.3	2.9	2.000
0.40	1.6	2.4	1.6	2.580
0.17	3.7	5.7	3.8	1.160
0.28	2.3	3.5	2.4	1.500
0.23	2.7	4.2	2.9	2.470
0.39	1.6	2.5	1.7	3.200
0.18	3.4	5.3	3.6	1.300
0.26	2.4	3.7	2.5	1.550
0.22	2.8	4.4	3.0	3.030
0.38	1.7	2.6	1.8	3.900
0.17	3.6	5.6	3.8	1.360
0.25	2.5	3.9	2.6	1.600
0.22	2.8	4.4	2.9	3.630
0.38	1.6	2.5	1.7	4.780



Cylindrical bore

Tapered bore

*d* 80 ~ 110mm

	Boundary dimensions			Basic load rating		Fatigue load limit kN <i>C<sub>u</sub></i>	Allowable speed		Bearing numbers		Installation-related dimensions		
	<i>d</i>	<i>D</i>	<i>B</i>	dynamic kN <i>C<sub>R</sub></i>	static kN <i>C<sub>0r</sub></i>		Grease lubrication	Oil lubrication	Cylindrical bore	Tapered bore <sup>2)</sup>	<i>d<sub>a</sub></i> mm Min.	<i>D<sub>a</sub></i> mm Max.	<i>r<sub>as</sub></i> mm Max.
80	140	26	2	40.0	17.0	0.680	4 000	5 000	<b>1216S</b>	<b>1216SK</b>	89	131	2
	140	33	2	49.0	19.9	1.30	4 000	5 000	<b>2216S</b>	<b>2216SK</b>	89	131	2
	170	39	2.1	89.0	33.0	0.800	3 600	4 300	<b>1316S</b>	<b>1316SK</b>	91	159	2
	170	58	2.1	130	45.0	1.90	3 200	4 000	<b>2316S</b>	<b>2316SK</b>	91	159	2
85	150	28	2	49.5	20.8	0.830	3 800	4 500	<b>1217S</b>	<b>1217SK</b>	94	141	2
	150	36	2	58.5	23.6	1.50	3 800	4 800	<b>2217S</b>	<b>2217SK</b>	94	141	2
	180	41	3	98.5	38.0	0.950	3 400	4 000	<b>1317S</b>	<b>1317SK</b>	98	167	2.5
	180	60	3	142	51.5	2.10	3 000	3 800	<b>2317S</b>	<b>2317SK</b>	98	167	2.5
90	160	30	2	57.5	23.5	0.940	3 600	4 300	<b>1218S</b>	<b>1218SK</b>	99	151	2
	160	40	2	70.5	28.7	1.80	3 600	4 300	<b>2218S</b>	<b>2218SK</b>	99	151	2
	190	43	3	117	44.5	1.20	3 200	3 800	<b>1318S</b>	<b>1318SK</b>	103	177	2.5
	190	64	3	154	57.5	2.40	2 800	3 600	<b>2318S</b>	<b>2318SK</b>	103	177	2.5
95	170	32	2.1	64.0	27.1	1.10	3 400	4 000	<b>1219S</b>	<b>1219SK</b>	106	159	2
	170	43	2.1	84.0	34.5	2.00	3 400	4 000	<b>2219S</b>	<b>2219SK</b>	106	159	2
	200	45	3	129	51.0	1.40	3 000	3 600	<b>1319S</b>	<b>1319SK</b>	108	187	2.5
	200	67	3	161	64.5	2.70	2 800	3 400	<b>2319S</b>	<b>2319SK</b>	108	187	2.5
100	180	34	2.1	69.5	29.7	1.20	3 200	3 800	<b>1220S</b>	<b>1220SK</b>	111	169	2
	180	46	2.1	94.5	38.5	2.30	3 200	3 800	<b>2220S</b>	<b>2220SK</b>	111	169	2
	215	47	3	140	57.5	1.60	2 800	3 400	<b>1320S</b>	<b>1320SK</b>	113	202	2.5
	215	73	3	187	79.0	3.30	2 400	3 200	<b>2320S</b>	<b>2320SK</b>	113	202	2.5
105	190	36	2.1	75.0	32.5	1.30	3 000	3 600	<b>1221S</b>	—	116	179	2
	190	50	2.1	109	45.0	2.60	3 000	3 600	<b>2221S</b>	—	116	179	2
	225	49	3	154	64.5	1.80	2 600	3 200	<b>1321S</b>	—	118	212	2.5
	225	77	3	200	87.0	3.60	2 400	3 000	<b>2321S<sup>3)</sup></b>	—	118	212	2.5
110	200	38	2.1	87.0	38.5	1.50	2 800	3 400	<b>1222S</b>	<b>1222SK</b>	121	189	2
	200	53	2.1	122	51.5	2.90	2 800	3 400	<b>2222S</b>	<b>2222SK</b>	121	189	2
	240	50	3	161	72.5	2.10	2 400	3 000	<b>1322S</b>	<b>1322SK</b>	123	227	2.5
	240	80	3	211	94.5	3.90	2 200	2 800	<b>2322S<sup>3)</sup></b>	<b>2322SK</b>	123	227	2.5

1) Smallest allowable dimension for chamfer dimension *r*. 2) "K" indicates bearings having a tapered bore with a taper ratio of 1:12. 3) A machined cage is the standard for 2321S and 2322S(K).

Dynamic equivalent radial load

$$P_r = X F_r + Y F_a$$

$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
<i>X</i>	<i>Y</i>	<i>X</i>	<i>Y</i>
1	<i>Y</i> <sub>1</sub>	0.65	<i>Y</i> <sub>2</sub>

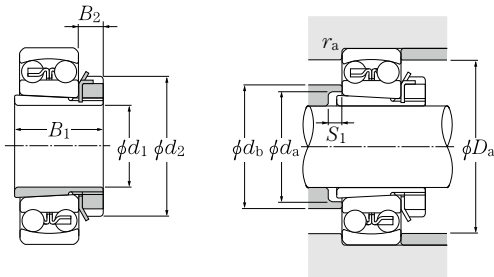
Static equivalent radial load

$$P_{0r} = F_r + Y_0 F_a$$

For values of *e*, *Y*<sub>1</sub>, *Y*<sub>2</sub> and *Y*<sub>0</sub> see the table below.

Constant	Axial load factors			Mass kg (approx.)
	<i>e</i>	<i>Y</i> <sub>1</sub>	<i>Y</i> <sub>2</sub>	
0.16	3.9	6.0	4.1	1.68
0.25	2.5	3.9	2.7	2.02
0.22	2.9	4.5	3.1	4.24
0.39	1.6	2.5	1.7	5.63
0.17	3.7	5.7	3.8	2.10
0.25	2.5	3.9	2.6	2.56
0.21	2.9	4.6	3.1	5.03
0.37	1.7	2.6	1.8	6.56
0.17	3.8	5.8	3.9	2.56
0.27	2.4	3.7	2.5	3.22
0.22	2.8	4.3	2.9	5.83
0.38	1.7	2.6	1.7	7.75
0.17	3.7	5.8	3.9	3.12
0.27	2.4	3.7	2.5	3.96
0.23	2.8	4.3	2.9	6.79
0.38	1.7	2.6	1.8	8.97
0.17	3.6	5.6	3.8	3.74
0.27	2.4	3.7	2.5	4.71
0.24	2.7	4.1	2.8	8.40
0.38	1.7	2.6	1.8	11.5
0.18	3.6	5.5	3.7	4.43
0.28	2.3	3.5	2.4	5.73
0.23	2.7	4.2	2.9	9.58
0.38	1.7	2.6	1.7	14.5
0.18	3.7	5.7	3.9	5.21
0.28	2.2	3.5	2.3	6.75
0.22	2.8	4.4	3.0	11.5
0.37	1.7	2.6	1.8	17.5

(For self-aligning ball bearings)



a 17 ~ 50mm

	Boundary dimensions				Numbers		Installation-related dimensions					Mass <sup>1)</sup>
	mm				Bearing	Adapter	$d_a$	$d_b$	mm	$D_a$	$r_{as}$	kg
	$d_1$	$B_1$	$d_2$	$B_2$			Min.	Max.	$S_1$	Max.	Max.	(approx.)
<b>17</b>	24	32	7		1204SK;H 204	23	27	5	41	1	0.041	
	28	32	7		2204SK;H 304	24	28	5	41	1	0.045	
	28	32	7		1304SK;H 304	24	31	8	45	1	0.045	
	31	32	7		2304SK;H2304	24	28	5	45	1	0.049	
<b>20</b>	26	38	8		1205SK;H 205X	28	33	5	46	1	0.07	
	29	38	8		2205SK;H 305X	29	33	5	46	1	0.075	
	29	38	8		1305SK;H 305X	29	37	6	55	1	0.075	
	35	38	8		2305SK;H2305X	29	34	5	55	1	0.087	
<b>25</b>	27	45	8		1206SK;H 206X	33	39	5	56	1	0.099	
	31	45	8		2206SK;H 306X	34	39	5	56	1	0.109	
	31	45	8		1306SK;H 306X	34	44	6	65	1	0.109	
	38	45	8		2306SK;H2306X	35	40	5	65	1	0.126	
<b>30</b>	29	52	9		1207SK;H 207X	38	46	5	65	1	0.125	
	35	52	9		2207SK;H 307X	39	45	5	65	1	0.142	
	35	52	9		1307SK;H 307X	39	50	7	71.5	1.5	0.142	
	43	52	9		2307SK;H2307X	40	46	5	71.5	1.5	0.165	
<b>35</b>	31	58	10		1208SK;H 208X	44	52	5	73	1	0.174	
	36	58	10		2208SK;H 308X	44	50	5	73	1	0.189	
	36	58	10		1308SK;H 308X	44	56	5	81.5	1.5	0.189	
	46	58	10		2308SK;H2308X	45	52	5	81.5	1.5	0.224	
<b>40</b>	33	65	11		1209SK;H 209X	49	57	5	78	1	0.227	
	39	65	11		2209SK;H 309X	49	57	8	78	1	0.248	
	39	65	11		1309SK;H 309X	49	61	5	91.5	1.5	0.248	
	50	65	11		2309SK;H2309X	50	58	5	91.5	1.5	0.28	
<b>45</b>	35	70	12		1210SK;H 210X	53	62	5	83	1	0.274	
	42	70	12		2210SK;H 310X	54	63	10	83	1	0.303	
	42	70	12		1310SK;H 310X	54	67	5	100	2	0.303	
	55	70	12		2310SK;H2310X	56	65	5	100	2	0.362	
<b>50</b>	37	75	12		1211SK;H 211X	60	70	6	91.5	1.5	0.308	

1) Indicates adapter mass.

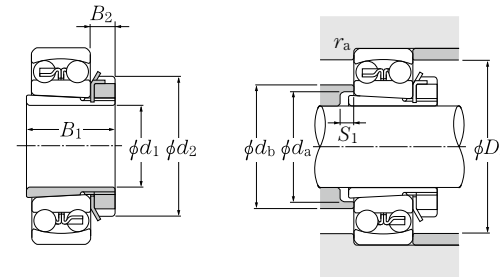
Note: 1. Refer to pages B-82 to B-85 for bearing dimensions, basic rated loads, and mass.

2. Adapters for series 12 bearings can also be used with H2 and H3 series bearings. Caution: the  $B_1$  dimension of H3 series bearings is longer than that of H2 series bearings.

3. Adapter numbers which are appended with the code "X" indicate narrow slit type adapters which use washers with straight inner tabs.

4. Refer to pages D-2 to D-7 and D-12 to D-14 for adapter locknut and washer dimensions.

(For self-aligning ball bearings)



a 50 ~ 85mm

	Boundary dimensions				Numbers		Installation-related dimensions					Mass <sup>1)</sup>
	mm				Bearing	Adapter	$d_a$	$d_b$	mm	$D_a$	$r_{as}$	kg
	$d_1$	$B_1$	$d_2$	$B_2$			Min.	Max.	$S_1$	Max.	Max.	(approx.)
<b>50</b>	45	75	12		2211SK;H 311X	60	69	11	91.5	1.5	0.345	
	45	75	12		1311SK;H 311X	60	73	6	110	2	0.345	
	59	75	12		2311SK;H2311X	61	71	6	110	2	0.42	
<b>55</b>	38	80	13		1212SK;H 212X	64	76	5	101.5	1.5	0.346	
	47	80	13		2212SK;H 312X	65	75	9	101.5	1.5	0.394	
	47	80	13		1312SK;H 312X	65	79	5	118	2	0.394	
	62	80	13		2312SK;H2312X	66	77	5	118	2	0.481	
<b>60</b>	40	85	14		1213SK;H 213X	70	83	5	111.5	1.5	0.401	
	50	85	14		2213SK;H 313X	70	81	8	111.5	1.5	0.458	
	50	85	14		1313SK;H 313X	70	85	5	128	2	0.458	
	65	85	14		2313SK;H2313X	72	84	5	128	2	0.557	
<b>65</b>	43	98	15		1215SK;H 215X	80	93	5	121.5	1.5	0.707	
	55	98	15		2215SK;H 315X	80	93	12	121.5	1.5	0.831	
	55	98	15		1315SK;H 315X	80	97	5	148	2	0.831	
	73	98	15		2315SK;H2315X	82	96	5	148	2	1.05	
<b>70</b>	46	105	17		1216SK;H 216X	85	100	5	130	2	0.882	
	59	105	17		2216SK;H 316X	86	98	12	130	2	1.03	
	59	105	17		1316SK;H 316X	86	103	5	158	2	1.03	
	78	105	17		2316SK;H2316X	87	103	5	158	2	1.28	
<b>75</b>	50	110	18		1217SK;H 217X	90	106	6	140	2	1.02	
	63	110	18		2217SK;H 317X	91	104	12	140	2	1.18	
	63	110	18		1317SK;H 317X	91	110	6	166	2.5	1.18	
	82	110	18		2317SK;H2317X	94	110	6	166	2.5	1.45	
<b>80</b>	52	120	18		1218SK;H 218X	95	111	6	150	2	1.19	
	65	120	18		2218SK;H 318X	96	112	10	150	2	1.37	
	65	120	18		1318SK;H 318X	96	116	6	176	2.5	1.37	
	86	120	18		2318SK;H2318X	99	117	6	176	2.5	1.69	
<b>85</b>	55	125	19		1219SK;H 219X	101	118	7	158	2	1.37	
	68	125	19		2219SK;H 319X	102	117	9	158	2	1.56	

1) Indicates adapter mass.

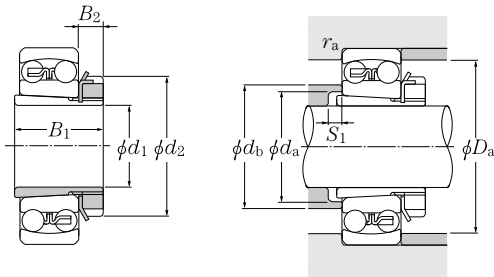
Note: 1. Refer to pages B-84 to B-87 for bearing dimensions, basic rated loads, and mass.

2. Adapters for series 12 bearings can also be used with H2 and H3 series bearings. Caution: the  $B_1$  dimension of H3 series bearings is longer than that of H2 series bearings.

3. Adapter numbers which are appended with the code "X" indicate narrow slit type adapters which use washers with straight inner tabs.

4. Refer to pages D-2 to D-7 and D-12 to D-14 for adapter locknut and washer dimensions.

(For self-aligning ball bearings)



**d** 85 ~ 100mm

	Boundary dimensions				Numbers		Installation-related dimensions					Mass <sup>1)</sup>
	mm				Bearing	Adapter	$d_a$ Min.	$d_b$ Max.	mm $S_1$ Min.	$D_a$ Max.	$r_{as}$ Max.	kg (approx.)
	$d_1$	$B_1$	$d_2$	$B_2$								
<b>85</b>	68	125	19	1319SK; <b>H 319X</b>	102	123	7	186	2.5	1.56		
	90	125	19	2319SK; <b>H2319X</b>	105	123	7	186	2.5	1.92		
<b>90</b>	58	130	20	1220SK; <b>H 220X</b>	106	125	7	168	2	1.49		
	71	130	20	2220SK; <b>H 320X</b>	107	123	8	168	2	1.69		
	71	130	20	1320SK; <b>H 320X</b>	107	130	7	201	2.5	1.69		
	97	130	20	2320SK; <b>H2320X</b>	110	129	7	201	2.5	2.15		
<b>100</b>	63	145	21	1222SK; <b>H 222X</b>	116	138	7	188	2	1.93		
	77	145	21	2222SK; <b>H 322X</b>	117	137	6	188	2	2.18		
	77	145	21	1322SK; <b>H 322X</b>	117	150	9	226	2.5	2.18		
	105	145	21	2322SK; <b>H2322X</b>	121	142	7	226	2.5	2.74		

1) Indicates adapter mass.

Note: 1. Refer to pages B-86 to B-87 for bearing dimensions, basic rated loads, and mass.

2. Adapters for series 12 bearings can also be used with H2 and H3 series bearings. Caution: the  $B_1$  dimension of H3 series bearings is longer than that of H2 series bearings.

3. Adapter numbers which are appended with the code "X" indicate narrow slit type adapters which use washers with straight inner tabs.

4. Refer to pages D-2 to D-9 and D-12 to D-14 for adapter locknut and washer dimensions.