

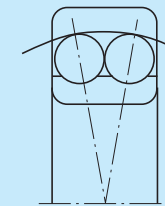
SELF-ALIGNING BALL BEARINGS

SELF-ALIGNING BALL BEARINGS Bore Diameter 5 – 110 mm..... B78

DESIGN, TYPES, AND FEATURES

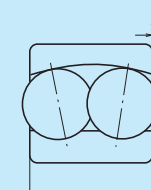
The outer ring has a spherical raceway and its center of curvature coincides with that of the bearing; therefore, the axis of the inner ring, balls and cage can deflect to some extent around the bearing center. This type is recommended when the alignment of the shaft and housing is difficult and when the shaft may bend. Since the contact angle is small, the axial load capacity is low.

Pressed steel cages are usually used.



PROTRUSION AMOUNT OF BALLS

Among self-aligning ball bearings, there are some in which the balls protrude from the side face as shown below. This protrusion amount b_1 is listed in the following table.



Bearing No.	b_1 (mm)
2222(K), 2316(K)	0.5
2319(K), 2320(K) 2321, 2322(K)	0.5
1318(K)	1.5
1319(K)	2
1320(K), 1321 1322(K)	3

TOLERANCES AND RUNNING

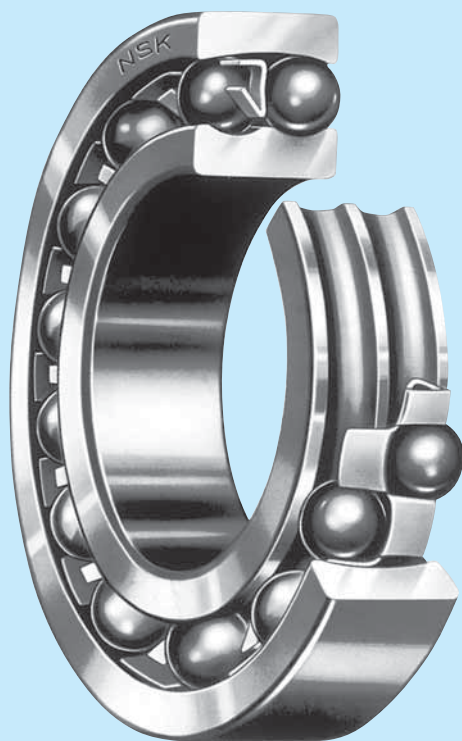
ACCURACY..... Table 8.2 (Pages A60 to A63)

RECOMMENDED FITS..... Table 9.2 (Page A84)
Table 9.4 (Page A85)

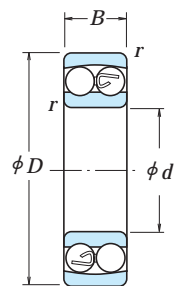
INTERNAL CLEARANCE..... Table 9.12 (Page A90)

PERMISSIBLE MISALIGNMENT

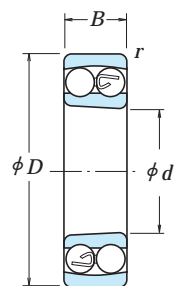
The permissible misalignment of self-aligning ball bearings is approximately 0.07 to 0.12 radian (4° to 7°) under normal loads. However, depending on the surrounding structure, such an angle may not be possible. Use care in the structural design.



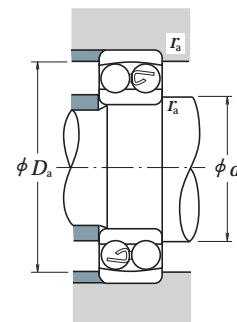
Bore Diameter 5 – 30 mm



Cylindrical Bore



Tapered Bore



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$F_a/F_r \leq e$		$F_a/F_r > e$	
X	Y	X	Y
1	Y_3	0.65	Y_2

Static Equivalent Load

$$P_0 = F_r + Y_0 F_a$$

The values of e , Y_2 , Y_3 , and Y_0

are listed in the table below.

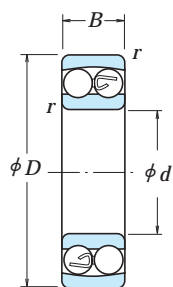
Boundary Dimensions (mm)				Basic Load Ratings (N)				Limiting Speeds (min ⁻¹)		Bearing Cylindrical Bore
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> _{min.}	<i>C_r</i>	<i>C_{0r}</i>	(kgf)		Grease	Oil	
5	19	6	0.3	2 530	475	258	49	30 000	36 000	135
6	19	6	0.3	2 530	475	258	49	30 000	36 000	126
7	22	7	0.3	2 750	600	280	61	26 000	32 000	127
8	22	7	0.3	2 750	600	280	61	26 000	32 000	108
9	26	8	0.6	4 150	895	425	91	26 000	30 000	129
10	30	9	0.6	5 550	1 190	570	121	22 000	28 000	1200
	30	14	0.6	7 450	1 590	760	162	24 000	28 000	2200
	35	11	0.6	7 350	1 620	750	165	20 000	24 000	1300
	35	17	0.6	9 200	2 010	935	205	18 000	22 000	2300
12	32	10	0.6	5 700	1 270	580	130	22 000	26 000	1201
	32	14	0.6	7 750	1 730	790	177	22 000	26 000	2201
	37	12	1	9 650	2 160	985	221	18 000	22 000	1301
	37	17	1	12 100	2 730	1 240	278	17 000	22 000	2301
15	35	11	0.6	7 600	1 750	775	179	18 000	22 000	1202
	35	14	0.6	7 800	1 850	795	188	18 000	22 000	2202
	42	13	1	9 700	2 290	990	234	16 000	20 000	1302
	42	17	1	12 300	2 910	1 250	296	14 000	18 000	2302
17	40	12	0.6	8 000	2 010	815	205	16 000	20 000	1203
	40	16	0.6	9 950	2 420	1 010	247	16 000	20 000	2203
	47	14	1	12 700	3 200	1 300	325	14 000	17 000	1303
	47	19	1	14 700	3 550	1 500	365	13 000	16 000	2303
20	47	14	1	10 000	2 610	1 020	266	14 000	17 000	1204
	47	18	1	12 800	3 300	1 310	340	14 000	17 000	2204
	52	15	1.1	12 600	3 350	1 280	340	12 000	15 000	1304
	52	21	1.1	18 500	4 700	1 880	480	11 000	14 000	2304
25	52	15	1	12 200	3 300	1 250	335	12 000	14 000	1205
	52	18	1	12 400	3 450	1 270	350	12 000	14 000	2205
	62	17	1.1	18 200	5 000	1 850	510	10 000	13 000	1305
	62	24	1.1	24 900	6 600	2 530	675	9 500	12 000	2305
30	62	16	1	15 800	4 650	1 610	475	10 000	12 000	1206
	62	20	1	15 300	4 550	1 560	460	10 000	12 000	2206
	72	19	1.1	21 400	6 300	2 190	645	8 500	11 000	1306
	72	27	1.1	32 000	8 750	3 250	895	8 000	10 000	2306

Note (1) The suffix K represents bearings with tapered bores (1 : 12)

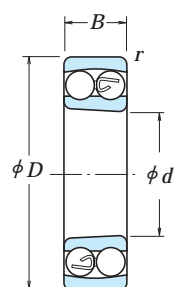
Remarks For the dimensions related to adapters, refer to Page B358.

Numbers	Abutment and Fillet Dimensions (mm)			Constant <i>e</i>	Axial Load Factors			Mass (kg)
	Tapered Bore ⁽¹⁾	<i>d_a</i> _{min.}	<i>D_a</i> _{max.}		<i>r_a</i> _{max.}	<i>Y₂</i>	<i>Y₃</i>	
—	7	17	0.3	0.34	2.9	1.9	1.9	0.009
—	8	17	0.3	0.34	2.9	1.9	1.9	0.008
—	9	20	0.3	0.31	3.1	2.0	2.1	0.013
—	10	20	0.3	0.31	3.1	2.0	2.1	0.016
—	13	22	0.6	0.32	3.1	2.0	2.1	0.021
—	14	26	0.6	0.32	3.1	2.0	2.1	0.033
—	14	26	0.6	0.64	1.5	0.98	1.0	0.042
—	14	31	0.6	0.35	2.8	1.8	1.9	0.057
—	14	31	0.6	0.71	1.4	0.89	0.93	0.077
—	16	28	0.6	0.36	2.7	1.8	1.8	0.039
—	16	28	0.6	0.58	1.7	1.1	1.1	0.048
—	17	32	1	0.33	2.9	1.9	2.0	0.066
—	17	32	1	0.60	1.6	1.1	1.1	0.082
—	19	31	0.6	0.32	3.1	2.0	2.1	0.051
—	19	31	0.6	0.50	1.9	1.3	1.3	0.055
—	20	37	1	0.33	2.9	1.9	2.0	0.093
—	20	37	1	0.51	1.9	1.2	1.3	0.108
—	21	36	0.6	0.31	3.1	2.0	2.1	0.072
—	21	36	0.6	0.50	1.9	1.3	1.3	0.085
—	22	42	1	0.32	3.1	2.0	2.1	0.13
—	22	42	1	0.51	1.9	1.2	1.3	0.15
1204 K	25	42	1	0.29	3.4	2.2	2.3	0.12
2204 K	25	42	1	0.47	2.1	1.3	1.4	0.133
1304 K	26.5	45.5	1	0.29	3.4	2.2	2.3	0.165
2304 K	26.5	45.5	1	0.50	1.9	1.2	1.3	0.193
1205 K	30	47	1	0.28	3.5	2.3	2.4	0.14
2205 K	30	47	1	0.41	2.4	1.5	1.6	0.15
1305 K	31.5	55.5	1	0.28	3.5	2.3	2.4	0.255
2305 K	31.5	55.5	1	0.47	2.1	1.4	1.4	0.319
1206 K	35	57	1	0.25	3.9	2.5	2.6	0.22
2206 K	35	57	1	0.38	2.5	1.6	1.7	0.249
1306 K	36.5	65.5	1	0.26	3.7	2.4	2.5	0.385
2306 K	36.5	65.5	1	0.44	2.2	1.4	1.5	0.48

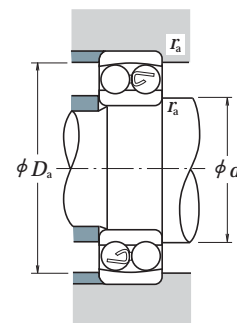
Bore Diameter 35 – 70 mm



Cylindrical Bore



Tapered Bore



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$F_a/F_r \leq e$		$F_a/F_r > e$	
X	Y	X	Y
1	Y_3	0.65	Y_2

Static Equivalent Load

$$P_0 = F_r + Y_0 F_a$$

The values of e , Y_2 , Y_3 , and Y_0

are listed in the table below.

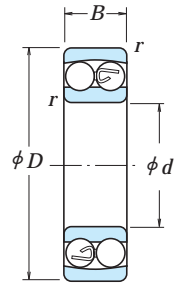
Boundary Dimensions (mm)				Basic Load Ratings (N)				Limiting Speeds (min ⁻¹)		Bearing Cylindrical Bore
d	D	B	$r_{min.}$	C_r	C_{0r}	(kgf)		Grease	Oil	
						C_r	C_{0r}			
35	72	17	1.1	15 900	5 100	1 620	520	8 500	10 000	1207
	72	23	1.1	21 700	6 600	2 210	675	8 500	10 000	2207
	80	21	1.5	25 300	7 850	2 580	800	7 500	9 500	1307
	80	31	1.5	40 000	11 300	4 100	1 150	7 100	9 000	2307
40	80	18	1.1	19 300	6 500	1 970	665	7 500	9 000	1208
	80	23	1.1	22 400	7 350	2 290	750	7 500	9 000	2208
	90	23	1.5	29 800	9 700	3 050	990	6 700	8 500	1308
	90	33	1.5	45 500	13 500	4 650	1 380	6 300	8 000	2308
45	85	19	1.1	22 000	7 350	2 240	750	7 100	8 500	1209
	85	23	1.1	23 300	8 150	2 380	830	7 100	8 500	2209
	100	25	1.5	38 500	12 700	3 900	1 300	6 000	7 500	1309
	100	35	1.5	55 000	16 700	5 600	1 700	5 600	7 100	2309
50	90	20	1.1	22 800	8 100	2 330	830	6 300	8 000	1210
	90	23	1.1	23 300	8 450	2 380	865	6 300	8 000	2210
	110	27	2	43 500	14 100	4 450	1 440	5 600	6 700	1310
	110	40	2	65 000	20 200	6 650	2 060	5 000	6 300	2310
55	100	21	1.5	26 900	10 000	2 750	1 020	6 000	7 100	1211
	100	25	1.5	26 700	9 900	2 720	1 010	6 000	7 100	2211
	120	29	2	51 500	17 900	5 250	1 820	5 000	6 300	1311
	120	43	2	76 500	24 000	7 800	2 450	4 800	6 000	2311
60	110	22	1.5	30 500	11 500	3 100	1 180	5 300	6 300	1212
	110	28	1.5	34 000	12 600	3 500	1 290	5 300	6 300	2212
	130	31	2.1	57 500	20 800	5 900	2 130	4 500	5 600	1312
	130	46	2.1	88 500	28 300	9 000	2 880	4 300	5 300	2312
65	120	23	1.5	31 000	12 500	3 150	1 280	4 800	6 000	1213
	120	31	1.5	43 500	16 400	4 450	1 670	4 800	6 000	2213
	140	33	2.1	62 500	22 900	6 350	2 330	4 300	5 300	1313
	140	48	2.1	97 000	32 500	9 900	3 300	3 800	4 800	2313
70	125	24	1.5	35 000	13 800	3 550	1 410	4 800	5 600	1214
	125	31	1.5	44 000	17 100	4 500	1 740	4 500	5 600	2214
	150	35	2.1	75 000	27 700	7 650	2 830	4 000	5 000	1314
	150	51	2.1	111 000	37 500	11 300	3 850	3 600	4 500	2314

Note (1) The suffix K represents bearings with tapered bores (1 : 12)

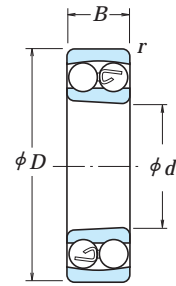
Remarks For the dimensions related to adapters, refer to Page B358 and B359.

Numbers	Abutment and Fillet Dimensions (mm)			Constant e	Axial Load Factors			Mass (kg) approx.	
	Tapered Bore ⁽¹⁾	d_a min.	D_a max.		r_a max.	Y_2	Y_3		Y_0
1207 K	—	41.5	65.5	1	0.23	4.2	2.7	2.8	0.32
	—	41.5	65.5	1	0.37	2.6	1.7	1.8	0.378
	—	43	72	1.5	0.26	3.8	2.5	2.6	0.51
	—	43	72	1.5	0.46	2.1	1.4	1.4	0.642
1208 K	—	46.5	73.5	1	0.22	4.3	2.8	2.9	0.415
	—	46.5	73.5	1	0.33	3.0	1.9	2.0	0.477
	—	48	82	1.5	0.24	4.0	2.6	2.7	0.715
	—	48	82	1.5	0.43	2.3	1.5	1.5	0.889
1209 K	—	51.5	78.5	1	0.21	4.7	3.0	3.1	0.465
	—	51.5	78.5	1	0.30	3.2	2.1	2.2	0.522
	—	53	92	1.5	0.25	4.0	2.6	2.7	0.955
	—	53	92	1.5	0.41	2.4	1.5	1.6	1.2
1210 K	—	56.5	83.5	1	0.21	4.7	3.1	3.2	0.525
	—	56.5	83.5	1	0.28	3.4	2.2	2.3	0.564
	—	59	101	2	0.23	4.2	2.7	2.8	1.25
	—	59	101	2	0.42	2.3	1.5	1.6	1.58
1211 K	—	63	92	1.5	0.20	4.9	3.2	3.3	0.705
	—	63	92	1.5	0.28	3.5	2.3	2.4	0.746
	—	64	111	2	0.23	4.2	2.7	2.8	1.6
	—	64	111	2	0.41	2.4	1.5	1.6	2.03
1212 K	—	68	102	1.5	0.18	5.3	3.4	3.6	0.90
	—	68	102	1.5	0.28	3.5	2.3	2.4	1.03
	—	71	119	2	0.23	4.3	2.8	2.9	2.03
	—	71	119	2	0.40	2.4	1.6	1.6	2.57
1213 K	—	73	112	1.5	0.17	5.7	3.7	3.8	1.15
	—	73	112	1.5	0.28	3.5	2.3	2.4	1.4
	—	76	129	2	0.23	4.2	2.7	2.9	2.54
	—	76	129	2	0.39	2.5	1.6	1.7	3.2
—	—	78	117	1.5	0.18	5.3	3.4	3.6	1.3
	—	78	117	1.5	0.26	3.7	2.4	2.5	1.52
	—	81	139	2	0.22	4.4	2.8	3.0	3.19
	—	81	139	2	0.38	2.6	1.7	1.8	3.9

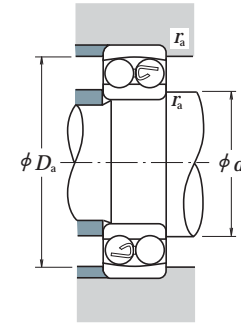
Bore Diameter 75 – 110 mm



Cylindrical Bore



Tapered Bore



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$F_a / F_r \leq e$		$F_a / F_r > e$	
X	Y	X	Y
1	Y_3	0.65	Y_2

Static Equivalent Load

$$P_0 = F_r + Y_0 F_a$$

The values of e , Y_2 , Y_3 , and Y_0

are listed in the table below.

Boundary Dimensions (mm)				Basic Load Ratings (N) (kgf)				Limiting Speeds (min ⁻¹)		Bearing Cylindrical Bore
d	D	B	r min.	C _r	C _{0r}	C _r	C _{0r}	Grease	Oil	
75	130	25	1.5	39 000	15 700	4 000	1 600	4 300	5 300	1215
	130	31	1.5	44 500	17 800	4 550	1 820	4 300	5 300	2215
	160	37	2.1	80 000	30 000	8 150	3 050	3 800	4 500	1315
	160	55	2.1	125 000	43 000	12 700	4 400	3 400	4 300	2315
80	140	26	2	40 000	17 000	4 100	1 730	4 000	5 000	1216
	140	33	2	49 000	19 900	5 000	2 030	4 000	5 000	2216
	170	39	2.1	89 000	33 000	9 100	3 400	3 600	4 300	1316
	170	58	2.1	130 000	45 000	13 200	4 600	3 200	4 000	* 2316
85	150	28	2	49 500	20 800	5 050	2 120	3 800	4 500	1217
	150	36	2	58 500	23 600	5 950	2 400	3 800	4 800	2217
	180	41	3	98 500	38 000	10 000	3 850	3 400	4 000	1317
	180	60	3	142 000	51 500	14 500	5 250	3 000	3 800	2317
90	160	30	2	57 500	23 500	5 850	2 400	3 600	4 300	1218
	160	40	2	70 500	28 700	7 200	2 930	3 600	4 300	2218
	190	43	3	117 000	44 500	12 000	4 550	3 200	3 800	* 1318
	190	64	3	154 000	57 500	15 700	5 850	2 800	3 600	2318
95	170	32	2.1	64 000	27 100	6 550	2 770	3 400	4 000	1219
	170	43	2.1	84 000	34 500	8 550	3 500	3 400	4 000	2219
	200	45	3	129 000	51 000	13 200	5 200	3 000	3 600	* 1319
	200	67	3	161 000	64 500	16 400	6 550	2 800	3 400	* 2319
100	180	34	2.1	69 500	29 700	7 100	3 050	3 200	3 800	1220
	180	46	2.1	94 500	38 500	9 650	3 900	3 200	3 800	2220
	215	47	3	140 000	57 500	14 300	5 850	2 800	3 400	* 1320
	215	73	3	187 000	79 000	19 100	8 050	2 400	3 200	* 2320
105	190	36	2.1	75 000	32 500	7 650	3 300	3 000	3 600	1221
	190	50	2.1	109 000	45 000	11 100	4 550	3 000	3 600	2221
	225	49	3	154 000	64 500	15 700	6 600	2 600	3 200	* 1321
	225	77	3	200 000	87 000	20 400	8 850	2 400	3 000	* 2321
110	200	38	2.1	87 000	38 500	8 900	3 950	2 800	3 400	1222
	200	53	2.1	122 000	51 500	12 500	5 250	2 800	3 400	* 2222
	240	50	3	161 000	72 000	16 400	7 300	2 400	3 000	* 1322
	240	80	3	211 000	94 500	21 600	9 650	2 200	2 800	* 2322

Numbers	Abutment and Fillet Dimensions (mm)			Constant e	Axial Load Factors			Mass (kg) approx.	
	Tapered Bore ⁽¹⁾	d _a min.	D _a max.		r _a max.	Y ₂	Y ₃		Y ₀
1215 K	83	122	1.5	0.17	5.6	3.6	3.8	1.41	
	83	122	1.5	0.25	3.9	2.5	2.6	1.6	
	86	149	2	0.22	4.4	2.8	2.9	3.65	
	86	149	2	0.38	2.5	1.6	1.7	4.77	
1216 K	89	131	2	0.16	6.0	3.9	4.1	1.73	
	89	131	2	0.25	3.9	2.5	2.7	1.97	
	91	159	2	0.22	4.5	2.9	3.1	4.31	
	91	159	2	0.39	2.5	1.6	1.7	5.54	
1217 K	94	141	2	0.17	5.7	3.7	3.8	2.09	
	94	141	2	0.25	3.9	2.5	2.6	2.48	
	98	167	2.5	0.21	4.6	2.9	3.1	5.13	
	98	167	2.5	0.37	2.6	1.7	1.8	6.56	
1218 K	99	151	2	0.17	5.8	3.8	3.9	2.55	
	99	151	2	0.27	3.7	2.4	2.5	3.13	
	103	177	2.5	0.22	4.3	2.8	2.9	5.94	
	103	177	2.5	0.38	2.6	1.7	1.7	7.76	
1219 K	106	159	2	0.17	5.8	3.7	3.9	3.21	
	106	159	2	0.27	3.7	2.4	2.5	3.87	
	108	187	2.5	0.23	4.3	2.8	2.9	6.84	
	108	187	2.5	0.38	2.6	1.7	1.8	9.01	
1220 K	111	169	2	0.17	5.6	3.6	3.8	3.82	
	111	169	2	0.27	3.7	2.4	2.5	4.53	
	113	202	2.5	0.24	4.1	2.7	2.8	8.46	
	113	202	2.5	0.38	2.6	1.7	1.8	11.6	
1221 K	—	116	179	2	0.18	5.5	3.6	3.7	4.52
	—	116	179	2	0.28	3.5	2.3	2.4	6.64
	—	118	212	2.5	0.23	4.2	2.7	2.9	10
	—	118	212	2.5	0.38	2.6	1.7	1.7	14.4
1222 K	121	189	2	0.17	5.7	3.7	3.9	5.33	
	121	189	2	0.28	3.5	2.2	2.3	6.64	
	123	227	2.5	0.22	4.4	2.8	3.0	12	
	123	227	2.5	0.37	2.6	1.7	1.8	17.4	

Notes ⁽¹⁾ The suffix K represents bearings with tapered bores (1 : 12)

(*) The balls of the bearings marked * protrude slightly from the bearing face. The protrusion amounts are shown on

Page B77.

Remarks For the dimensions related to adapters, refer to Pages B360 and B361.