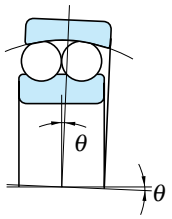
KOYO

Self-aligning ball bearings

Self-aligning ball bearings have a spherical outer ring raceway, the center of whose curvature meets that of the bearing itself, so that the inner ring, balls and cage continue to rotate, aligning themselves if they have become misaligned within design limits.

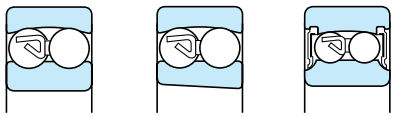


θ : Allowable aligning angle

This type of bearing is suitable when the displacement of the centers around which the shaft and housing rotate and shaft deflection are likely to occur.

Bearings with a tapered bore can easily be fit to the shaft with an adapter assembly.

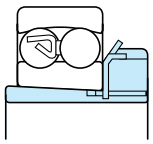
Self-aligning ball bearings



Cylindrical bore | Tapered bore | Sealed bore

Bore diameter **10 – 100 mm**

Adapter assemblies



Bore diameter **17 – 90 mm**

Boundary dimensions	The dimensions of standard series are as specified in JIS B 1512.
Tolerances	As specified in JIS B 1514, class 0.
Radial internal clearance	As specified in JIS B 1520. (refer to Table 2-5 on p. A 14.)
Standard cages	• Staggered type pressed steel cage [application : all dimensional range of 12, 13, 22...2RS and 23...2RS series] • Snap type pressed steel cage [application : all dimensional range of 22 series and those of No. 2300 thru 2316] • Copper alloy machined cage (application : bearings of No. 2317 thru 2320)
Allowable aligning angle	• 12 and 22 series ..... 0.044 rad (2.5˚) • 13 and 23 series ..... 0.052 rad (3˚) • 22...2RS and 23...2RS series.. 0.026 rad (1.5˚)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

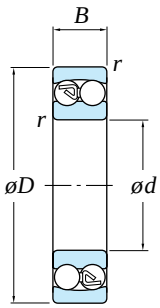
$F_a / F_r \leq e$		$F_a / F_r > e$	
X	Y	X	Y
1	Y_1	0.65	Y_2

Static equivalent radial load

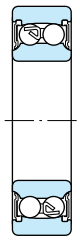
$P_{0r} = F_r + Y_0 F_a$

Self-aligning ball bearings

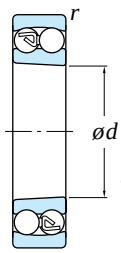
d 10 – 35 mm



Cylindrical bore

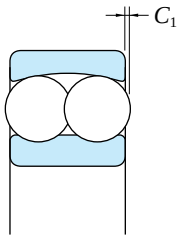


Sealed



Tapered bore

[Note] Protruding distance of balls



Balls of the following bearing protrude by C_1 from the bearing side.

Bearing No.	C_1 (mm)
2216	0.2 (approx.)

Boundary dimensions (mm)				Basic load ratings (kN)				Limiting speeds (min⁻¹)			Bearing No.			(Refer.) Mass (kg)	
				Open		Sealed type		Grease lub.		Oil lub.	Cylindrical bore	Sealed type	Tapered bore		
d	*D*	*B*	*r* min.	C_r	C_{0r}	C_r	C_{0r}	Open	2RS	Open	Open	2RS	Open	Cylindrical bore	Tapered bore
10	30	9	0.6	5.50	1.20	–	–	23 000	–	28 000	**1200**	**–**	**–**	0.034	–
	30	14	0.6	7.40	1.60	5.40	1.20	23 000	15 000	29 000	**2200**	**2RS**	**–**	0.047	–
12	32	10	0.6	5.60	1.25	–	–	21 000	–	26 000	**1201**	**–**	**–**	0.040	–
	32	14	0.6	7.65	1.75	5.60	1.25	21 000	14 000	26 000	**2201**	**2RS**	**–**	0.053	–
	37	12	1	9.40	2.15	–	–	18 000	–	22 000	**1301**	**–**	**–**	0.067	–
	37	17	1	9.70	2.30	–	–	16 000	–	22 000	**2301**	**–**	**–**	0.095	–
15	35	11	0.6	7.45	1.75	–	–	18 000	–	22 000	**1202**	**–**	**–**	0.049	–
	35	14	0.6	7.70	1.85	7.45	1.75	18 000	12 000	22 000	**2202**	**2RS**	**–**	0.060	–
	42	13	1	9.55	2.30	–	–	16 000	–	20 000	**1302**	**–**	**–**	0.094	–
	42	17	1	12.1	2.90	9.55	2.30	14 000	11 000	20 000	**2302**	**2RS**	**–**	0.114	–
17	40	12	0.6	7.90	2.00	–	–	16 000	–	20 000	**1203**	**–**	**–**	0.073	–
	40	16	0.6	9.80	2.40	7.90	2.00	16 000	11 000	20 000	**2203**	**2RS**	**–**	0.088	–
	47	14	1	12.5	3.20	–	–	14 000	–	17 000	**1303**	**–**	**–**	0.130	–
	47	19	1	14.5	3.60	12.5	3.20	13 000	9 400	18 000	**2303**	**2RS**	**–**	0.158	–
20	47	14	1	9.90	2.60	–	–	14 000	–	17 000	**1204**	**–**	**1204K**	0.120	0.118
	47	18	1	12.6	3.30	9.90	2.60	14 000	9 100	17 000	**2204**	**2RS**	**2204K**	0.140	0.136
	52	15	1.1	12.4	3.30	–	–	13 000	–	15 000	**1304**	**–**	**1304K**	0.163	0.161
	52	21	1.1	18.0	4.70	12.4	3.35	11 000	8 300	15 000	**2304**	**2RS**	**2304K**	0.209	0.205
25	52	15	1	12.1	3.30	–	–	12 000	–	14 000	**1205**	**–**	**1205K**	0.141	0.138
	52	18	1	12.6	3.50	12.1	3.30	12 000	7 900	15 000	**2205**	**2RS**	**2205K**	0.163	0.158
	62	17	1.1	18.0	5.00	–	–	9 900	–	12 000	**1305**	**–**	**1305K**	0.257	0.252
	62	24	1.1	24.4	6.60	17.6	4.95	9 400	6 600	13 000	**2305**	**2RS**	**2305K**	0.335	0.327
30	62	16	1	15.6	4.65	–	–	9 900	–	12 000	**1206**	**–**	**1206K**	0.220	0.216
	62	20	1	15.6	4.65	15.6	4.65	10 000	6 600	12 000	**2206**	**2RS**	**2206K**	0.260	0.254
	72	19	1.1	21.3	6.30	–	–	8 700	–	11 000	**1306**	**–**	**1306K**	0.387	0.381
	72	27	1.1	31.4	8.75	21.3	6.30	8 000	5 800	11 000	**2306**	**2RS**	**2306K**	0.500	0.489
35	72	17	1.1	15.8	5.10	–	–	8 500	–	10 000	**1207**	**–**	**1207K**	0.323	0.317
	72	23	1.1	21.6	6.60	15.8	5.10	8 500	5 700	10 000	**2207**	**2RS**	**2207K**	0.403	0.396
	80	21	1.5	25.1	7.85	–	–	7 600	–	9 300	**1307**	**–**	**1307K**	0.510	0.502
	80	31	1.5	39.4	11.3	25.1	7.85	7 100	5 100	9 800	**2307**	**2RS**	**2307K**	0.675	0.657

Remark) Standard cage types used for the above bearings are described earlier in this section.

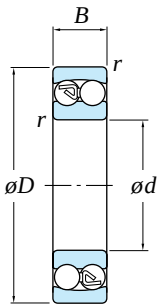
d 40 – 90 mm

Boundary dimensions (mm)				Basic load ratings (kN)				Limiting speeds (min⁻¹)			Bearing No.			(Refer.) Mass (kg)	
				Open		Sealed type		Grease lub.		Oil lub.	Cylindrical bore	Sealed type	Tapered bore		
d	*D*	*B*	*r* min.	C_r	C_{0r}	C_r	C_{0r}	Open	2RS	Open	Open	2RS	Open	Cylindrical bore	Tapered bore
40	80	18	1.1	19.2	6.50	–	–	7 500	–	9 200	**1208**	**–**	**1208K**	0.417	0.411
	80	23	1.1	22.4	7.40	19.2	6.50	7 600	5 000	9 300	**2208**	**2RS**	**2208K**	0.505	0.494
	90	23	1.5	29.5	9.70	–	–	6 900	–	8 400	**1308**	**–**	**1308K**	0.715	0.704
	90	33	1.5	44.9	13.5	29.5	9.70	6 200	4 600	8 600	**2308**	**2RS**	**2308K**	0.925	0.903
45	85	19	1.1	21.8	7.35	–	–	7 000	–	8 500	**1209**	**–**	**1209K**	0.465	0.459
	85	23	1.1	23.3	8.15	21.8	7.35	7 000	4 600	8 500	**2209**	**2RS**	**2209K**	0.545	0.533
	100	25	1.5	38.1	12.7	–	–	6 100	–	7 500	**1309**	**–**	**1309K**	0.957	0.942
	100	36	1.5	54.4	16.7	38.1	12.7	5 600	4 100	7 700	**2309**	**2RS**	**2309K**	1.23	1.20
50	90	20	1.1	22.7	8.10	–	–	6 500	–	7 900	**1210**	**–**	**1210K**	0.525	0.515
	90	23	1.1	23.3	8.50	22.7	8.10	6 500	4 300	7 900	**2210**	**2RS**	**2210K**	0.590	0.577
	110	27	2	43.4	14.1	–	–	5 600	–	6 800	**1310**	**–**	**1310K**	1.21	1.19
	110	40	2	64.6	20.3	43.4	14.1	5 100	3 700	7 000	**2310**	**2RS**	**2310K**	1.64	1.60
55	100	21	1.5	26.8	10.0	–	–	5 800	–	7 100	**1211**	**–**	**1211K**	0.705	0.693
	100	25	1.5	26.8	10.0	26.8	10.0	5 800	3 900	7 100	**2211**	**2RS**	**2211K**	0.810	0.792
	120	29	2	51.3	17.9	–	–	5 000	–	6 200	**1311**	**–**	**1311K**	1.58	1.56
	120	43	2	75.3	24.0	51.3	17.9	4 600	3 400	6 400	**2311**	**2RS**	**2311K**	2.10	2.05
60	110	22	1.5	30.2	11.5	–	–	5 200	–	6 400	**1212**	**–**	**1212K**	0.900	0.885
	110	28	1.5	34.1	12.6	30.2	11.5	5 300	3 500	6 500	**2212**	**2RS**	**2212K**	1.09	1.07
	130	31	2.1	57.2	20.8	–	–	4 500	–	5 500	**1312**	**–**	**1312K**	1.96	1.93
	130	46	2.1	87.2	28.3	57.1	20.8	4 200	3 000	5 800	**2312**	**2RS**	**2312K**	2.60	2.53
65	120	23	1.5	31.0	12.5	–	–	4 800	–	5 800	**1213**	**–**	**1213K**	1.15	1.13
	120	31	1.5	43.5	16.4	31.0	12.5	4 900	3 200	5 900	**2213**	**2RS**	**2213K**	1.46	1.43
	140	33	2.1	61.7	22.9	–	–	4 300	–	5 200	**1313**	**–**	**1313K**	2.45	2.41
	140	48	2.1	95.8	32.5	62.1	22.9	3 800	2 900	5 300	**2313**	**2RS**	**2313K**	3.23	3.15
70	125	24	1.5	34.6	13.8	–	–	4 600	–	5 700	**1214**	**–**	**–**	1.26	–
	125	31	1.5	43.9	17.1	34.6	13.8	4 600	3 100	5 600	**2214**	**2RS**	**–**	1.52	–
	150	35	2.1	74.0	27.7	–	–	4 000	–	4 900	**1314**	**–**	**–**	2.99	–
	150	51	2.1	89.6	31.7	74.1	27.7	3 600	2 600	4 900	**2314**	**2RS**	**–**	4.23	–
75	130	25	1.5	38.8	15.7	–	–	4 300	–	5 300	**1215**	**–**	**1215K**	1.36	1.34
	130	31	1.5	44.2	17.8	38.8	15.7	4 300	2 900	5 300	**2215**	**2RS**	**2215K**	1.62	1.58
	160	37	2.1	78.9	29.9	–	–	4 000	–	4 900	**1315**	**–**	**1315K**	3.56	3.51
	160	55	2.1	103	36.8	81.8	30.5	3 400	2 600	4 600	**2315**	**2RS**	**2315K**	5.13	5.01
80	140	26	2	39.8	17.0	–	–	4 000	–	4 900	**1216**	**–**	**1216K**	1.67	1.64
	140	33	2	49.0	19.9	39.8	17.0	4 100	2 700	5 000	**2216**	**2RS**	**2216K**	2.01	1.97
	170	39	2.1	88.1	33.1	–	–	3 500	–	4 300	**1316**	**–**	**1316K**	4.18	4.12
	170	58	2.1	129	45.7	88.4	33.1	3 100	2 300	4 300	**2316**	**2RS**	**2316K**	6.10	5.96
85	150	28	2	49.2	20.8	–	–	3 800	–	4 600	**1217**	**–**	**1217K**	2.07	2.04
	150	36	2	58.3	23.6	49.2	20.8	3 800	2 500	4 600	**2217**	**2RS**	**2217K**	2.52	2.46
	180	41	3	97.3	37.8	–	–	3 300	–	4 000	**1317**	**–**	**1317K**	4.98	4.91
	180	60	3	141	51.5	–	–	3 000	–	4 100	**2317**	**–**	**2317K**	7.05	6.89
90	160	30	2	56.8	23.4	–	–	3 500	–	4 300	**1218**	**–**	**1218K**	2.52	2.48
	160	40	2	67.7	27.2	54.1	23.1	3 500	2 400	4 300	**2218**	**2RS**	**2218K**	3.40	3.33
	190	43	3	116	44.4	–	–	3 100	–	3 800	**1318**	**–**	**1318K**	5.80	5.71
	190	64	3	153	57.9	–	–	2 800	–	3 900	**2318**	**–**	**2318K**	8.44	8.25

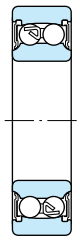
Remark) Standard cage types used for the above bearings are described earlier in this section.

Self-aligning ball bearings

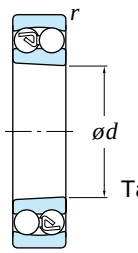
d 95 – 100 mm



Cylindrical bore

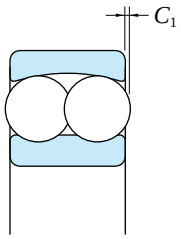


Sealed



Tapered bore

[Note] Protruding distance of balls



Balls of the following bearing protrude by C_1 from the bearing side.

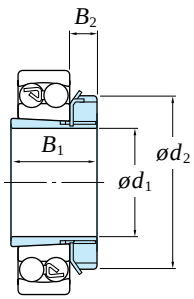
Bearing No.	C_1 (mm)
1319 1320	1.6 2.5 (approx.)

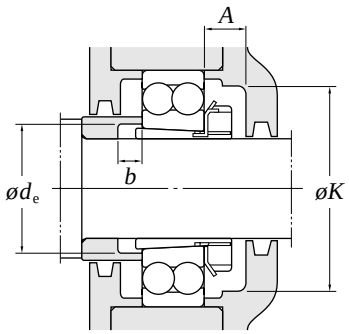
Boundary dimensions (mm)				Basic load ratings (kN)				Limiting speeds (min⁻¹)			Bearing No.			(Refer.) Mass (kg)	
				Open		Sealed type		Grease lub.		Oil lub.	Cylindrical bore	Sealed type	Tapered bore		
d	*D*	*B*	*r* min.	C_r	C_{0r}	C_r	C_{0r}	Open	2RS	Open	Open	2RS	Open	Cylindrical bore	Tapered bore
95	170	32	2.1	57.0	24.3	–	–	3 300	–	4 000	**1219**	**–**	**1219K**	3.10	3.05
	170	43	2.1	82.7	34.3	60.8	26.8	3 300	2 200	4 000	**2219**	**2RS**	**2219K**	4.10	4.00
	200	45	3	132	50.8	–	–	2 900	–	3 600	**1319**	**–**	**1319K**	6.69	6.59
	200	67	3	166	64.8	–	–	2 700	–	3 700	**2319**	**–**	**2319K**	9.79	9.57
100	180	34	2.1	69.0	29.7	–	–	3 100	–	3 800	**1220**	**–**	**1220K**	3.70	3.64
	180	46	2.1	80.9	34.0	69.0	29.7	3 100	2 100	3 800	**2220**	**2RS**	**2220K**	4.98	4.87
	215	47	3	143	57.3	–	–	2 800	–	3 400	**1320**	**–**	**1320K**	8.30	8.19
	215	73	3	183	73.4	–	–	2 400	–	3 400	**2320**	**–**	**2320K**	12.4	12.1

Remark) Standard cage types used for the above bearings are described earlier in this section.

Adapter assemblies for self-aligning ball bearings

d_1 17 – 45 mm





Boundary dimensions (mm)				Brg. bore (mm)	Designations	Mounting dimensions (mm)				Mass	(Refer.)	
d_1	B_1	d_2	B_2	d	Bearing + adapter ass'y	A min.	K min.	d_e min.	b min.	Brg. + adapter ass'y (kg)	Adapter sleeve No.	Locknut No.
17	24	32	7	20	1204K+**H204X**	–	–	23	5	0.159	A204X	AN04
	28	32	7	20	2204K+**H304X**	–	–	24	5	0.181	A304X	AN04
	28	32	7	20	1304K+**H304X**	–	–	24	8	0.206	A304X	AN04
	31	32	7	20	2304K+**H2304X**	–	–	24	5	0.254	A2304X	AN04
20	26	38	8	25	1205K+**H205X**	15	45	28	5	0.208	A205X	AN05
	29	38	8	25	2205K+**H305X**	15	45	29	5	0.233	A305X	AN05
	29	38	8	25	1305K+**H305X**	15	45	29	6	0.327	A305X	AN05
	35	38	8	25	2305K+**H2305X**	15	45	29	5	0.414	A2305X	AN05
25	27	45	8	30	1206K+**H206X**	15	50	33	5	0.315	A206X	AN06
	31	45	8	30	2206K+**H306X**	15	50	34	5	0.363	A306X	AN06
	31	45	8	30	1306K+**H306X**	15	50	34	6	0.490	A306X	AN06
	38	45	8	30	2306K+**H2306X**	15	50	35	5	0.615	A2306X	AN06
30	29	52	9	35	1207K+**H207X**	17	58	38	5	0.442	A207X	AN07
	35	52	9	35	2207K+**H307X**	17	58	39	5	0.538	A307X	AN07
	35	52	9	35	1307K+**H307X**	17	58	39	7	0.644	A307X	AN07
	43	52	9	35	2307K+**H2307X**	17	58	40	5	0.822	A2307X	AN07
35	31	58	10	40	1208K+**H208X**	17	65	44	5	0.585	A208X	AN08
	36	58	10	40	2208K+**H308X**	17	65	44	5	0.683	A308X	AN08
	36	58	10	40	1308K+**H308X**	17	65	44	5	0.893	A308X	AN08
	46	58	10	40	2308K+**H2308X**	17	65	45	5	1.13	A2308X	AN08
40	33	65	11	45	1209K+**H209X**	17	72	49	5	0.686	A209X	AN09
	39	65	11	45	2209K+**H309X**	17	72	49	8	0.781	A309X	AN09
	39	65	11	45	1309K+**H309X**	17	72	49	5	1.19	A309X	AN09
	50	65	11	45	2309K+**H2309X**	17	72	50	5	1.48	A2309X	AN09
45	35	70	12	50	1210K+**H210X**	19	76	53	5	0.789	A210X	AN10
	42	70	12	50	2210K+**H310X**	19	76	54	10	0.880	A310X	AN10
	42	70	12	50	1310K+**H310X**	19	76	54	5	1.49	A310X	AN10
	55	70	12	50	2310K+**H2310X**	19	76	56	5	1.96	A2310X	AN10

d_1 50 – 90 mm

Boundary dimensions (mm) d_1	B_1	d_2	B_2	Brg. bore (mm) d	Designations Bearing + adapter ass'y	Mounting dimensions (mm) A min.	K min.	d_e min.	b min.	Mass Brg. + adapter ass'y (kg)	(Refer.) Adapter sleeve No.	Locknut No.
50	37	75	12	55	1211K+**H211X**	19	85	60	6	1.00	A211X	AN11
	45	75	12	55	2211K+**H311X**	19	85	60	11	1.14	A311X	AN11
	45	75	12	55	1311K+**H311X**	19	85	60	6	1.91	A311X	AN11
	59	75	12	55	2311K+**H2311X**	19	85	61	6	2.47	A2311X	AN11
55	38	80	13	60	1212K+**H212X**	20	90	61	5	1.23	A212X	AN12
	47	80	13	60	2212K+**H312X**	20	90	65	9	1.46	A312X	AN12
	47	80	13	60	1312K+**H312X**	20	90	65	5	2.32	A312X	AN12
	62	80	13	60	2312K+**H2312X**	20	90	66	5	3.01	A2312X	AN12
60	40	85	14	65	1213K+**H213X**	21	96	70	5	1.53	A213X	AN13
	50	85	14	65	2213K+**H313X**	21	96	70	8	1.89	A313X	AN13
	50	85	14	65	1313K+**H313X**	21	96	70	5	2.87	A313X	AN13
	65	85	14	65	2313K+**H2313X**	21	96	72	5	3.71	A2313X	AN13
65	43	98	15	75	1215K+**H215X**	23	110	80	5	2.05	A215X	AN15
	55	98	15	75	2215K+**H315X**	23	110	80	12	2.41	A315X	AN15
	55	98	15	75	1315K+**H315X**	23	110	80	5	4.34	A315X	AN15
	73	98	15	75	2315K+**H2315X**	23	110	82	5	6.06	A2315X	AN15
70	46	105	17	80	1216K+**H216X**	25	120	85	5	2.52	A216X	AN16
	59	105	17	80	2216K+**H316X**	25	120	86	12	3.00	A316X	AN16
	59	105	17	80	1316K+**H316X**	25	120	86	5	5.15	A316X	AN16
	78	105	17	80	2316K+**H2316X**	25	120	87	5	7.24	A2316X	AN16
75	50	110	18	85	1217K+**H217X**	27	128	90	6	3.06	A217X	AN17
	63	110	18	85	2217K+**H317X**	27	128	91	12	3.64	A317X	AN17
	63	110	18	85	1317K+**H317X**	27	128	91	6	6.09	A317X	AN17
	82	110	18	85	2317K+**H2317X**	27	128	94	6	8.34	A2317X	AN17
80	52	120	18	90	1218K+**H218X**	28	139	95	6	3.67	A218X	AN18
	65	120	18	90	2218K+**H318X**	28	139	96	10	4.70	A318X	AN18
	65	120	18	90	1318K+**H318X**	28	139	96	6	7.08	A318X	AN18
	86	120	18	90	2318K+**H2318X**	28	139	99	6	9.94	A2318X	AN18
85	55	125	19	95	1219K+**H219X**	29	145	101	7	4.42	A219X	AN19
	68	125	19	95	2219K+**H319X**	29	145	102	9	5.56	A319X	AN19
	68	125	19	95	1319K+**H319X**	29	145	102	7	8.15	A319X	AN19
	90	125	19	95	2319K+**H2319X**	29	145	105	7	11.5	A2319X	AN19
90	58	130	20	100	1220K+**H220X**	30	150	106	7	5.13	A220X	AN20
	71	130	20	100	2220K+**H320X**	30	150	107	8	6.56	A320X	AN20
	71	130	20	100	1320K+**H320X**	30	150	107	7	9.88	A320X	AN20
	97	130	20	100	2320K+**H2320X**	30	150	110	7	14.2	A2320X	AN20