





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 a 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 **Diagram 1**.

However, **since axial load capacity is limited, self-aligning bearings are not suitable for applications with heavy axial loads.**

Furthermore, if an adapter is used on the tapered bore of the inner diameter, installation and disassembly are much simpler and for this reason adapters are often used on equipment with drive shafts.

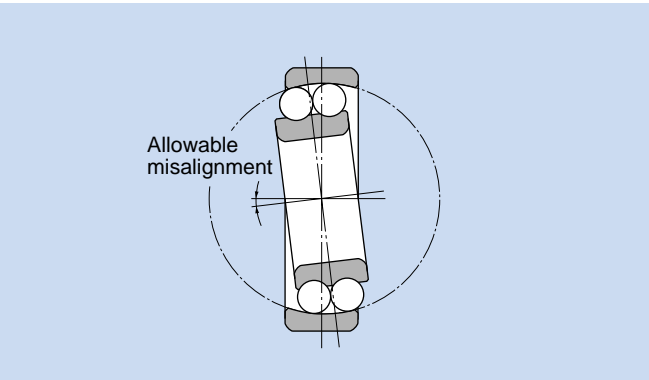


Diagram 1.

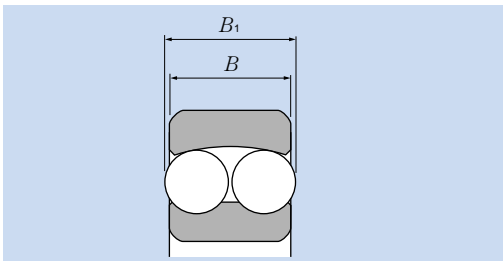
2. Standard cage types

Self aligning ball bearings use pressed cages with the exception of the 1200-1206 series which use molded resin cages. The material characteristics of the resin cages make them unsuitable for use in applications where temperatures exceed 120°C.

3. Ball protrusion

Bearings with part numbers listed in **Diagram 2** below have balls which protrude slightly from the bearing face.

Their degree of protrusion is listed in **Diagram 2**.



Units mm

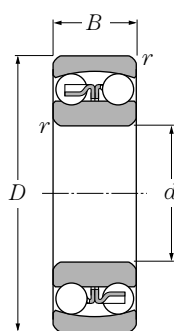
Bearing number	Width dimension B	Total width dimension B_1
1318 (K)	43	45
1319 (K)	45	48
1320 (K)	47	52
1321	49	54
1322 (K)	50	55

Diagram 2.

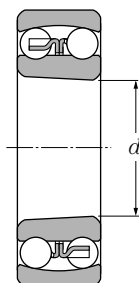
4. Allowable misalignment angle

Listed below are the allowable misalignment angles for bearings with self-aligning characteristics when placed under normal load conditions. This degree of allowable misalignment may be limited by the design of structures around the bearing.

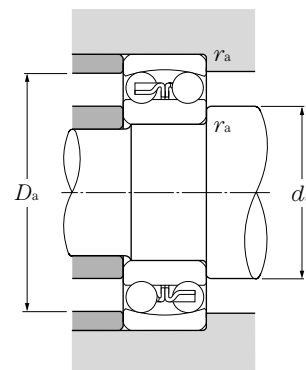
Allowable misalignment under normal loads (loads equivalent to 0.09 C_r): 0.07 rad (4°)
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Cylindrical bore



Tapered bore
taper 1:12



d 10 ~ 35mm

Boundary dimensions				Basic load ratings				Limiting speeds		Bearing numbers		Abutment and fillet dimensions		
mm				dynamic kN	static kN	dynamic kgf	static kgf	rpm		cylindrical bore	tapered ^② bore	d_a min	D_a max	r_{as} max
d	D	B	$r_{s \min}$ ^①	C_r	C_{or}	C_r	C_{or}	grease	oil					
10	30	9	0.6	5.50	1.19	560	122	21,000	24,000	1200		14	26	0.6
	30	14	0.6	7.30	1.59	745	162	19,000	23,000	2200		14	26	0.6
	35	11	0.6	7.25	1.62	740	165	18,000	21,000	1300		14	31	0.6
	35	17	0.6	10.1	2.15	1,030	219	17,000	20,000	2300		14	31	0.6
12	32	10	0.6	5.60	1.27	570	130	18,000	22,000	1201		16	28	0.6
	32	14	0.6	7.60	1.73	775	177	17,000	20,000	2201		16	28	0.6
	37	12	1	9.45	2.16	965	221	16,000	18,000	1301		17	32	1
	37	17	1	11.8	2.71	1,200	277	15,000	17,000	2301		17	32	1
15	35	11	0.6	7.45	1.75	760	178	16,000	19,000	1202		19	31	0.6
	35	14	0.6	7.70	1.85	785	188	15,000	18,000	2202		19	31	0.6
	42	13	1	9.55	2.30	975	234	13,000	16,000	1302		20	37	1
	42	17	1	12.0	2.90	1,230	295	13,000	15,000	2302		20	37	1
17	40	12	0.6	7.90	2.01	805	205	14,000	17,000	1203		21	36	0.6
	40	16	0.6	9.80	2.41	995	246	13,000	16,000	2203		21	36	0.6
	47	14	1	12.5	3.20	1,280	325	12,000	14,000	1303		22	42	1
	47	19	1	14.4	3.55	1,470	365	11,000	14,000	2303		22	42	1
20	47	14	1	9.90	2.61	1,010	266	13,000	15,000	1204	1204K	25	42	1
	47	18	1	12.6	3.30	1,280	335	12,000	14,000	2204	2204K	25	42	1
	52	15	1.1	12.4	3.35	1,270	340	11,000	13,000	1304	1304K	26.5	45.5	1
	52	21	1.1	18.1	4.70	1,850	480	10,000	12,000	2304	2304K	26.5	45.5	1
25	52	15	1	12.1	3.30	1,230	335	11,000	13,000	1205	1205K	30	47	1
	52	18	1	12.3	3.45	1,250	350	10,000	12,000	2205	2205K	30	47	1
	62	17	1.1	18.0	5.00	1,830	510	9,100	11,000	1305	1305K	31.5	55.5	1
	62	24	1.1	24.4	6.60	2,490	670	8,500	10,000	2305	2305K	31.5	55.5	1
30	62	16	1	15.6	4.65	1,590	475	9,200	11,000	1206	1206K	35	57	1
	62	20	1	15.2	4.50	1,550	460	8,600	10,000	2206	2206K	35	57	1
	72	19	1.1	21.3	6.30	2,170	645	7,700	9,100	1306	1306K	36.5	65.5	1
	72	27	1.1	31.5	8.75	3,200	895	7,200	8,500	2306	2306K	36.5	65.5	1
35	72	17	1.1	15.8	5.10	1,610	520	8,000	9,400	1207	1207K	41.5	65.5	1
	72	23	1.1	21.5	6.60	2,190	670	7,500	8,800	2207	2207K	41.5	65.5	1
	80	21	1.5	25.1	7.85	2,560	800	6,800	8,000	1307	1307K	43	72	1.5
	80	31	1.5	39.5	11.3	4,000	1,150	6,300	7,400	2307	2307K	43	72	1.5

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

Equivalent bearing load dynamic

$$P_r = XF_r + YF_a$$

$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.65	Y_2

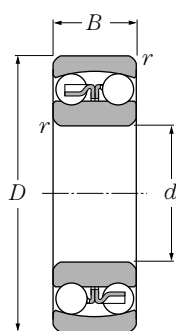
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$$P_{or} = F_r + Y_o F_a$$

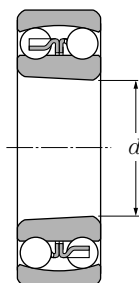
For values of e , Y_1 , Y_2 and Y_o
see the table below.

Constant e	Axial load factors			Mass	
	Y_1	Y_2	Y_o	cylindrical bore kg (approx.)	tapered bore
0.32	2	3.09	2.09	0.033	
0.64	0.98	1.52	1.03	0.047	
0.34	1.85	2.87	1.94	0.058	
0.67	0.95	1.46	0.99	0.083	
0.36	1.76	2.73	1.85	0.04	
0.58	1.09	1.69	1.14	0.051	
0.33	1.91	2.95	2	0.066	
0.61	1.03	1.59	1.08	0.091	
0.33	1.91	2.95	2	0.049	
0.50	1.25	1.94	1.31	0.06	
0.34	1.86	2.88	1.95	0.092	
0.52	1.22	1.88	1.27	0.114	
0.31	2.03	3.14	2.12	0.072	
0.51	1.23	1.90	1.29	0.088	
0.32	1.97	3.06	2.07	0.128	
0.52	1.22	1.88	1.28	0.156	
0.29	2.2	3.4	2.3	0.116	0.114
0.49	1.3	2.01	1.36	0.14	0.137
0.29	2.16	3.34	2.26	0.16	0.158
0.51	1.23	1.9	1.29	0.206	0.201
0.28	2.28	3.53	2.39	0.138	0.135
0.41	1.55	2.39	1.62	0.157	0.153
0.28	2.28	3.53	2.39	0.255	0.251
0.48	1.32	2.05	1.39	0.334	0.326
0.25	2.55	3.94	2.67	0.217	0.213
0.38	1.64	2.53	1.72	0.256	0.25
0.26	2.40	3.72	2.52	0.383	0.377
0.44	1.42	2.2	1.49	0.496	0.485
0.23	2.71	4.2	2.84	0.317	0.312
0.37	1.69	2.61	1.77	0.392	0.382
0.25	2.48	3.84	2.60	0.5	0.492
0.46	1.37	2.13	1.44	0.671	0.653

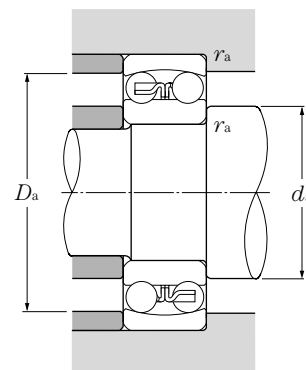




Cylindrical bore



Tapered bore
taper 1:12



d 40 ~ 75mm

Boundary dimensions				Basic load ratings				Limiting speeds		Bearing numbers		Abutment and fillet dimensions		
mm				dynamic kN	static kN	dynamic kgf	static kgf	rpm		cylindrical bore	tapered ^② bore	d_a mm	D_a mm	r_{as} mm
d	D	B	$r_{s\ min}$ ^①	C_r	C_{or}	C_r	C_{or}	grease	oil			min	max	max
40	80	18	1.1	19.3	6.55	1,970	665	7,100	8,400	1208	1208K	46.5	73.5	1
	80	23	1.1	22.3	7.35	2,270	750	6,700	7,900	2208	2208K	46.5	73.5	1
	90	23	1.5	29.6	9.70	3,000	990	6,000	7,000	1308	1308K	48	82	1.5
	90	33	1.5	45.0	13.5	4,600	1,380	5,600	6,600	2308	2308K	48	82	1.5
45	85	19	1.1	21.9	7.35	2,230	750	6,400	7,500	1209	1209K	51.5	78.5	1
	85	23	1.1	23.2	8.15	2,360	830	6,000	7,100	2209	2209K	51.5	78.5	1
	100	25	1.5	38.0	12.7	3,900	1,300	5,400	6,300	1309	1309K	53	92	1.5
	100	36	1.5	54.0	16.7	5,500	1,700	5,000	5,900	2309	2309K	53	92	1.5
50	90	20	1.1	22.7	8.10	2,320	830	5,800	6,800	1210	1210K	56.5	83.5	1
	90	23	1.1	23.2	8.45	2,370	865	5,500	6,400	2210	2210K	56.5	83.5	1
	110	27	2	43.5	14.1	4,400	1,440	4,900	5,800	1310	1310K	59	101	2
	110	40	2	64.5	20.2	6,550	2,060	4,600	5,400	2310	2310K	59	101	2
55	100	21	1.5	26.8	10.0	2,730	1,020	5,300	6,200	1211	1211K	63	92	1.5
	100	25	1.5	26.5	9.90	2,700	1,010	5,000	5,800	2211	2211K	63	92	1.5
	120	29	2	51.5	17.9	5,250	1,820	4,500	5,200	1311	1311K	64	111	2
	120	43	2	75.5	24.0	7,700	2,450	4,200	4,900	2311	2311K	64	111	2
60	110	22	1.5	30.0	11.5	3,100	1,180	4,900	5,800	1212	1212K	68	102	1.5
	110	28	1.5	34.0	12.6	3,450	1,290	4,600	5,400	2212	2212K	68	102	1.5
	130	31	2.1	57.0	20.8	5,850	2,130	4,100	4,800	1312	1312K	71	119	2
	130	46	2.1	87.0	28.2	8,850	2,880	3,800	4,500	2312	2312K	71	119	2
65	120	23	1.5	31.0	12.5	3,150	1,280	4,500	5,300	1213	1213K	73	112	1.5
	120	31	1.5	43.5	16.4	4,450	1,670	4,200	5,000	2213	2213K	73	112	1.5
	140	33	2.1	62.0	22.9	6,350	2,330	3,800	4,500	1313	1313K	76	129	2
	140	48	2.1	96.0	32.5	9,800	3,300	3,600	4,200	2313	2313K	76	129	2
70	125	24	1.5	34.5	13.8	3,550	1,410	4,200	4,900	1214		78	117	1.5
	125	31	1.5	44.0	17.1	4,500	1,740	3,900	4,600	2214		78	117	1.5
	150	35	2.1	74.5	27.7	7,600	2,830	3,500	4,200	1314		81	139	2
	150	51	2.1	109	37.5	11,100	3,850	3,300	3,900	2314		81	139	2
75	130	25	1.5	39.0	15.7	3,950	1,600	3,900	4,600	1215	1215K	83	122	1.5
	130	31	1.5	44.5	17.8	4,500	1,820	3,700	4,300	2215	2215K	83	122	1.5
	160	37	2.1	79.5	30.0	8,100	3,050	3,300	3,900	1315	1315K	86	149	2
	160	55	2.1	123	43.0	12,500	4,350	3,100	3,600	2315	2315K	86	149	2

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

Equivalent bearing load dynamic

$$P_r = XF_r + YF_a$$

$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.65	Y_2

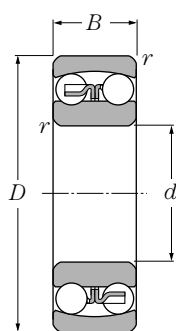
static

$$P_{or} = F_r + Y_o F_a$$

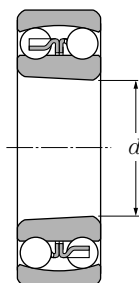
For values of e , Y_1 , Y_2 and Y_o
see the table below.

Constant e	Axial load factors			Mass	
	Y_1	Y_2	Y_o	cylindrical bore kg (approx.)	tapered bore
0.22	2.81	4.35	2.95	0.414	0.407
0.33	1.91	2.95	2.00	0.493	0.482
0.25	2.57	3.98	2.69	0.709	0.698
0.43	1.45	2.25	1.52	0.918	0.895
0.21	2.99	4.63	3.13	0.457	0.448
0.30	2.07	3.20	2.17	0.54	0.528
0.25	2.56	3.95	2.68	0.953	0.938
0.41	1.53	2.36	1.60	1.23	1.2
0.21	3.07	4.75	3.21	0.515	0.504
0.28	2.23	3.45	2.33	0.583	0.569
0.23	2.7	4.19	2.83	1.2	1.18
0.42	1.49	2.3	1.56	1.63	1.59
0.20	3.19	4.94	3.34	0.692	0.679
0.28	2.24	3.47	2.35	0.787	0.769
0.23	2.71	4.20	2.84	1.58	1.56
0.41	1.53	2.37	1.6	2.1	2.05
0.18	3.41	5.27	3.57	0.879	0.864
0.28	2.26	3.5	2.37	1.08	1.06
0.22	2.85	4.42	2.99	1.96	1.93
0.40	1.56	2.41	1.63	2.59	2.52
0.17	3.70	5.73	3.88	1.13	1.11
0.28	2.26	3.5	2.37	1.44	1.41
0.23	2.74	4.25	2.87	2.42	2.38
0.38	1.64	2.54	1.72	3.2	3.12
0.18	3.48	5.38	3.64	1.24	
0.26	2.38	3.68	2.49	1.52	
0.22	2.83	4.37	2.96	2.99	
0.38	1.67	2.59	1.75	3.92	
0.17	3.61	5.58	3.78	1.33	1.31
0.25	2.52	3.89	2.63	1.58	1.54
0.22	2.81	4.35	2.95	3.55	3.5
0.38	1.65	2.55	1.72	4.78	4.66

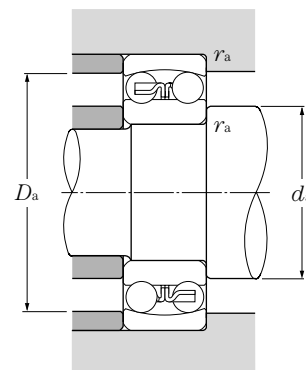




Cylindrical bore



Tapered bore
taper 1:12



d 80 ~ 110mm

Boundary dimensions				Basic load ratings				Limiting speeds		Bearing numbers		Abutment and fillet dimensions		
mm				dynamic kN	static kN	dynamic kgf	static kgf	rpm		cylindrical bore	tapered ^② bore	d_a min	D_a max	r_{as} max
d	D	B	$r_{s \min}$ ^①	C_r	C_{or}	C_r	C_{or}	grease	oil					
80	140	26	2	40.0	17.0	4,050	1,730	3,700	4,300	1216	1216K	89	131	2
	140	33	2	48.5	19.9	4,950	2,030	3,400	4,000	2216	2216K	89	131	2
	170	39	2.1	88.5	33.0	9,000	3,400	3,100	3,600	1316	1316K	91	159	2
	170	58	2.1	128	45.0	13,100	4,600	2,900	3,400	2316	2316K	91	159	2
85	150	28	2	49.0	20.8	5,000	2,120	3,500	4,100	1217	1217K	94	141	2
	150	36	2	58.0	23.6	5,950	2,400	3,200	3,800	2217	2217K	94	141	2
	180	41	3	97.5	38.0	9,950	3,850	2,900	3,400	1317	1317K	98	167	2.5
	180	60	3	140	51.5	14,300	5,250	2,700	3,200	2317	2317K	98	167	2.5
90	160	30	2	57.0	23.5	5,800	2,390	3,300	3,800	1218	1218K	99	151	2
	160	40	2	70.0	28.7	7,150	2,930	3,100	3,600	2218	2218K	99	151	2
	190	43	3	116	44.5	11,900	4,550	2,700	3,200	1318	1318K	103	177	2.5
	190	64	3	152	57.5	15,500	5,850	2,600	3,000	2318	2318K	103	177	2.5
95	170	32	2.1	64.0	27.1	6,500	2,770	3,100	3,600	1219	1219K	106	159	2
	170	43	2.1	83.5	34.5	8,500	3,500	2,900	3,400	2219	2219K	106	159	2
	200	45	3	132	51.0	13,400	5,200	2,600	3,000	1319	1319K	108	187	2.5
	200	67	3	165	64.5	16,800	6,550	2,400	2,800	2319	2319K	108	187	2.5
100	180	34	2.1	69.0	29.7	7,050	3,050	2,900	3,400	1220	1220K	111	169	2
	180	46	2.1	94.0	38.5	9,600	3,900	2,700	3,200	2220	2220K	111	169	2
	215	47	3	143	57.5	14,600	5,850	2,400	2,900	1320	1320K	113	202	2.5
	215	73	3	192	79.0	19,600	8,100	2,300	2,700	2320	2320K	113	202	2.5
105	190	36	2.1	74.5	32.5	7,600	3,300	2,800	3,300	1221		116	179	2
	190	50	2.1	109	45.0	11,100	4,550	2,600	3,100	2221		116	179	2
	225	49	3	156	64.5	15,900	6,600	2,300	2,700	1321		118	212	2.5
	225	77	3	205	87.0	20,900	8,850	2,200	2,600	2321		118	212	2.5
110	200	38	2.1	80.5	35.5	8,200	3,600	2,600	3,100	1222	1222K	121	189	2
	200	53	2.1	124	51.5	12,700	5,250	2,500	2,900	2222	2222K	121	189	2
	240	50	3	164	71.5	16,700	7,300	2,200	2,600	1322	1322K	123	227	2.5
	240	80	3	217	94.5	22,100	9,650	2,100	2,400	2322	2322K	123	227	2.5

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

Equivalent bearing load dynamic

$$P_r = XF_r + YF_a$$

$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.65	Y_2

static

$$P_{or} = F_r + Y_o F_a$$

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

Constant e	Axial load factors			Mass	
	Y_1	Y_2	Y_o	kg cylindrical bore (approx.)	tapered bore
0.16	3.9	6.04	4.09	1.65	1.62
0.25	2.52	3.9	2.64	1.99	1.95
0.22	2.92	4.52	3.06	4.17	4.11
0.39	1.63	2.52	1.71	5.65	5.51
0.17	3.67	5.68	3.85	2.06	2.03
0.25	2.49	3.86	2.61	2.54	2.49
0.21	2.94	4.55	3.08	4.96	4.89
0.37	1.71	2.64	1.79	6.55	6.39
0.17	3.76	5.82	3.94	2.51	2.47
0.27	2.35	3.64	2.47	3.19	3.12
0.22	2.8	4.34	2.94	5.78	5.69
0.38	1.67	2.58	1.75	7.75	7.56
0.17	3.74	5.79	3.92	3.1	3.05
0.27	2.36	3.65	2.47	3.89	3.8
0.23	2.76	4.27	2.89	6.69	6.59
0.38	1.67	2.59	1.75	9.05	8.83
0.17	3.64	5.64	3.82	3.7	3.64
0.27	2.35	3.64	2.46	4.65	4.54
0.24	2.65	4.11	2.78	8.3	8.19
0.37	1.69	2.61	1.77	11.5	11.2
0.18	3.56	5.52	3.73	4.34	
0.28	2.25	3.49	2.36	6.07	
0.23	2.73	4.22	2.86	10	
0.38	1.67	2.58	1.75	13.2	
0.18	3.44	5.33	3.61	5.15	5.07
0.28	2.24	3.47	2.35	7.1	6.94
0.22	2.85	4.4	2.98	11.8	11.7
0.37	1.71	2.65	1.79	15.8	15.4