



## 1. Types, construction and characteristics

Spherical roller bearings consist of an outer ring having a continuous spherical raceway within which operates two rows of barrel-shaped rollers which are in turn guided by an inner ring with two raceways separated by a center rib. (Refer to **Diagram 1**) This bearing has self-aligning properties, and therefore is suited for use where misalignment between the inner and outer rings occurs from housing installation error or shaft flexure.

Spherical roller bearings have a large capacity for radial loads, axial loads in either direction, and complex loads. They are also suited for applications where vibration and shock loads are encountered. When operating under axial loads, however, it is desirable to maintain conditions so that  $F_a/F_r \leq 2e$  in order to prevent sliding movement along the row of rollers not receiving the axial load. (For the value of  $e$ , refer to dimension tables.)

As shown in **Table 1**, in addition to standard type there are various other types of spherical roller bearings. Among these, **Type E** has a particularly high load capacity.

In addition to bearings with cylindrical bore diameters, those with tapered bore diameters are also available. Bearings with tapered bore diameters are specified by attaching the suffix "K" to the end of the bearing's basic number. The standard taper ratio is 1:12 for bearings with a "K" suffix, but for bearings in series 240 and 241 the suffix "K30" indicates the taper ratio for a bearing is 1:30. Most tapered bore bearings incorporate the use of adapters and withdrawal sleeves for shaft mounting.

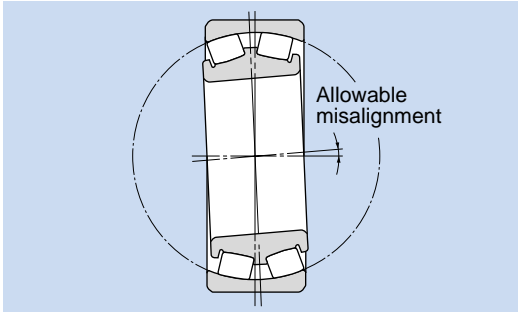
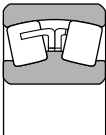
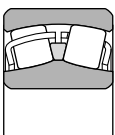

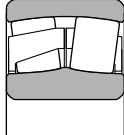


Diagram 1.

Table 1 Types of spherical roller bearings

Type	Standard type (B type)	C type	213 type	E type
Construction				
Bearing series	Does not include C type	Series 222, 223, and 213 with bore dia. of 50 mm or less; series 24024 to 24038.	Series 213 with bore dia. of 50 mm or more	Series 22211 to 22218
Rollers	Asymmetrical	Symmetrical	Asymmetrical	Symmetrical
Roller guide method	Unified inner ring center rib	Separable guide ring between rows on inner raceway	Separable guide ring between rows on outer raceway	High precision cage (center rib, guide ring)
Cage type	Pressed Cage; machined cage	Pressed Cage	Machined cage	Molded resin cage

## 2. Standard cage types

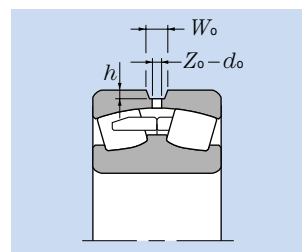
Standard cage types for self-aligning bearings are shown in **Table 2**. In general, pressed cages are standard for small sized bearings, and machined cages are standard for large sized bearings.

E type bearings use as their standard cage type a cage molded from a newly developed glass fiber reinforced **polyamide 46 resin which has excellent heat resistance qualities (allowable operating temperatures up to 150°C)**, strength, as well as unsurpassed oil resistance.

Nonetheless, for certain applications with high speed specifications, large vibration and shock load conditions, and extremely high operating temperature ranges, this molded polyamide 46 resin cage cannot be used as standard. Please consult **NTN Engineering** concerning applications with these sorts of operating conditions.

**Table 2 Standard cage types**

Bearing series	Molded resin cage	Pressed cage	Machined cage
239	-	-	23932 ~ 239/1400
230	-	23022B ~ 23048B	23052B ~ 230/1120B
240	-	24024C ~ 24038C	24024B ~ 240/1120B
231	-	23120B ~ 23136B	23138B ~ 231/900B
241	-	-	24122B ~ 241/710B
222	22211E ~ 22218E	22208C ~ 22210C 22211B ~ 22236B	22238B ~ 22264B
232	-	-	23218B ~ 232/750B
213	-	21308C ~ 21310C	21311 ~ 21322
223	-	22308C ~ 22310C 22311B ~ 22328B	22330B ~ 22360B



**Table 3 Oil inlet and oil groove dimensions**

Units mm

Nominal bearing width		Oil groove width $W_o$	Oil inlet diameter $d_o$	Oil groove depth $h$	
over	including			Width series 1, 2, 3	Width series 4
-	30	6	3	1.2	1.0
30	45	7	4	1.5	1.1
45	60	9	5	1.5	1.3
60	80	11	6	2.0	1.5
80	100	14	8	2.5	2.0
100	120	16	10	3.0	2.5
120	160	20	12	3.5	3.0
160	200	27	16	5.0	3.5
200	315	33	20	6.0	5.0
315	-	42	25	7.0	6.5

**Table 4 Oil inlet number**

Nominal bearing outer diameter mm	Oil inlet number $Z_o$
over up to including	
- 320	4
320 1 010	8
1 010 -	12

If a pin is necessary to prevent outer ring rotation, contact **NTN Engineering**.

## 3. Oil inlets and oil groove dimensions

Spherical roller bearings with an outer diameter of 320mm or more are provided with an oil inlet and oil groove on the outer ring for the purpose of supplying lubricant to the bearing's moving parts. When necessary, oil inlets and oil grooves can also be provided on bearings with outer diameters less than 320 mm. In such cases, please add the supplementary suffix code "D1" to the end of the bearing number, and contact **NTN Engineering**. (Refer to page A-29)

**Table 3** lists dimensions for oil inlets and oil grooves.

**Table 4** contains information about the number of oil inlets.

## 4. Allowable misalignment

Spherical roller bearings possess the same self-aligning properties as other self-aligning bearings. The allowable misalignment angle will vary according to dimension series and load conditions, but the following misalignment angles are generally standard:

Normal load (loads equivalent to 0.09 sC <sub>1</sub> ):	.....0.009rad (0.5°)
Light load:	.....0.035rad (2°)

## 5. Adapters and withdrawal sleeves

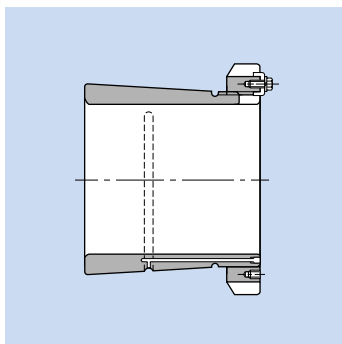
Adapters are used for installation of bearings with tapered bore diameters on cylindrical shafts. Withdrawal sleeves are also used to install and disassemble bearings with tapered bore diameters onto and off of cylindrical shafts. In disassembling the bearing from the shaft, the nut is pressed down against the edge of the inner ring utilizing the bolt provided on the withdrawal sleeve, and then the sleeve is drawn away from the bearing's inner diameter surface.

For bearings with a bore diameter of 200 mm or more, high pressure oil (hydraulic) type adapters and withdrawal sleeves have been standardized to make installation and disassembly easier. As shown in **Diagram 2** construction is designed to reduce friction by injecting high pressure oil between the surfaces of the adapter sleeve and bearing inner bore by means of a pressure fitting.

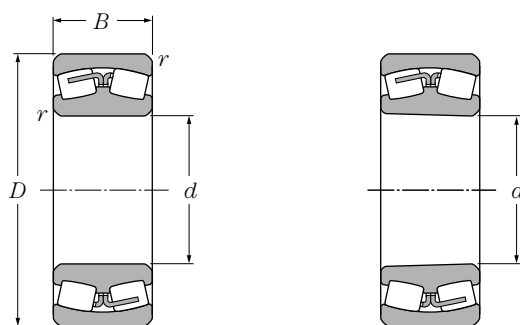
If the oil supply inlet is attached in the nut side of the adapter, the supplementary suffix "HF" should be added to the bearing number; if the oil supply inlet is attached on the opposite side, the suffix "HB" should be added to the bearing number. For adapter sleeves, the supplementary suffix "H" is added to the bearing's number in both cases.

For the hydraulic sleeve's nut, the supplementary suffix "SP" should be added to the nut's part number if a threaded bolt hole will be provided for installation / disassembly purposes; if a hole for a hydraulic pressure fitting will be provided, "SPB" should be added to the end of the nut's part number.

For more information regarding high pressure oil (hydraulic) adapters and withdrawal sleeves, please refer to their special catalog.



**Diagram 2.**



Cylindrical bore

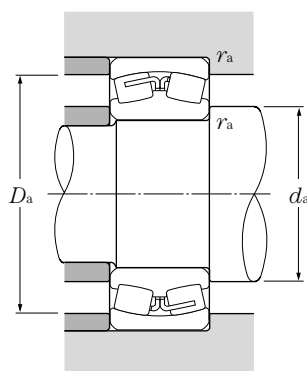
Tapered bore  
taper 1:12

$d$  25 ~ 75mm

Boundary dimensions				Basic load ratings				Limiting speeds <sup>①</sup>		Bearing numbers	
mm				dynamic	static	dynamic	static	rpm		cylindrical bore	tapered bore <sup>②</sup>
$d$	$D$	$B$	$r_{s\min}$ <sup>③</sup>	$C_r$ kN	$C_{or}$ kN	$C_r$ kgf	$C_{or}$ kgf	grease	oil		
25	52	18	1	36.5	36	3,750	3,650	6,500	10,000	22205C	22205CK
30	62	20	1	49	49	5,000	5,000	5,700	8,800	22206C	22206CK
35	72	23	1.1	69.5	71	7,050	7,200	4,900	7,500	22207C	22207CK
40	80	23	1.1	79	88.5	8,050	9,000	4,300	6,600	22208C	22208CK
	90	23	1.5	88	90	8,950	9,150	3,200	4,900	21308C	21308CK
	90	33	1.5	121	128	12,300	13,000	3,800	5,900	22308C	22308CK
45	85	23	1.1	82.5	95	8,400	9,700	3,800	5,900	22209C	22209CK
	100	25	1.5	102	106	10,400	10,800	2,900	4,400	21309C	21309CK
	100	36	1.5	148	167	15,100	17,000	3,400	5,300	22309C	22309CK
50	90	23	1.1	86	102	8,750	10,400	3,500	5,300	22210C	22210CK
	110	27	2	118	127	12,000	12,900	2,600	4,000	21310C	21310CK
	110	40	2	186	212	19,000	21,600	3,100	4,800	22310C	22310CK
55	100	25	1.5	118	144	12,000	14,700	3,200	4,900	22211E	22211EK
	100	25	1.5	93.5	110	9,500	11,200	3,200	4,200	22211B	22211BK
	120	29	2	145	163	14,800	16,600	2,400	3,700	21311	21311K
	120	43	2	204	234	20,800	23,900	2,800	4,400	22311B	22311BK
60	110	28	1.5	150	182	15,300	18,500	2,900	4,500	22212E	22212EK
	110	28	1.5	115	147	11,700	15,000	2,900	4,500	22212B	22212BK
	130	31	2.1	167	191	17,100	19,500	2,200	3,400	21312	21312K
	130	46	2.1	238	273	24,300	27,800	2,600	4,000	22312B	22312BK
65	120	31	1.5	177	217	18,000	22,200	2,700	4,200	22213E	22213EK
	120	31	1.5	143	179	14,600	18,300	2,700	4,200	22213B	22213BK
	140	33	2.1	194	228	19,800	23,200	2,000	3,100	21313	21313K
	140	48	2.1	265	320	27,100	32,500	2,400	3,700	22313B	22313BK
70	125	31	1.5	184	232	18,700	23,600	2,500	3,900	22214E	22214EK
	125	31	1.5	154	201	15,700	20,500	2,500	3,900	22214B	22214BK
	150	35	2.1	220	262	22,400	26,800	1,900	2,900	21314	21314K
	150	51	2.1	325	380	33,000	39,000	2,300	3,500	22314B	22314BK
75	130	31	1.5	190	246	19,400	25,100	2,300	3,600	22215E	22215EK

① This value was achieved with machined cages and molded resin cages; for pressed cages, 75% of this value is allowable.

② "K" indicates bearings have tapered bore with a taper ratio of 1: 12. ③ Smallest allowable dimension for chamfer dimension  $r$ .



## Equivalent bearing load

dynamic

$$P_r = X F_r + Y F_a$$

$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	$Y_1$	0.67	$Y_2$

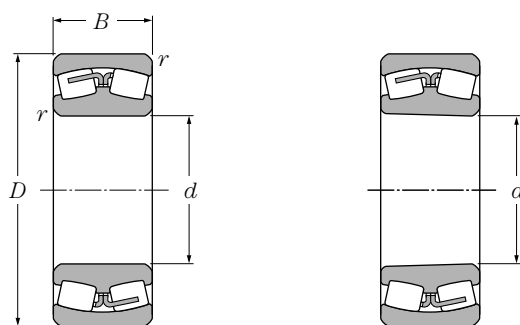
## static

$$P_{or} = F_r + Y_0 F_a$$

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

Abutment and fillet dimensions					Constant	Axial load factors			Mass (approx.)	
mm									kg	
$d_a$	$d_a$	$D_a$	$r_{as}$	$e$	$Y_1$	$Y_2$	$Y_0$		cylindrical bore	tapered bore
min	max	min	max							
31		46	1	0.35	1.92	2.86	1.88		0.186	0.182
36		56	1	0.33	2.07	3.09	2.03		0.287	0.282
42		65	1	0.32	2.09	3.11	2.04		0.446	0.437
47		73	1	0.29	2.35	3.50	2.30		0.526	0.515
48.5		81.5	1.5	0.26	2.55	3.80	2.50		0.705	0.694
48.5		81.5	1.5	0.38	1.76	2.62	1.72		0.974	0.951
52		78	1	0.27	2.50	3.72	2.44		0.584	0.572
53.5		91.5	1.5	0.26	2.60	3.87	2.54		0.927	0.912
53.5		91.5	1.5	0.36	1.86	2.77	1.82		1.33	1.3
57		83	1	0.25	2.69	4.01	2.63		0.63	0.616
60		100	2	0.26	2.64	3.93	2.58		1.21	1.19
60		100	2	0.37	1.80	2.69	1.76		1.79	1.75
63.5	67	89.5	91.5	1.5	0.24	2.83	4.21	2.76	0.808	0.79
63.5			91.5	1.5	0.28	2.42	3.61	2.37	0.85	0.832
65			110	2	0.25	2.69	4.01	2.63	1.71	1.69
65			110	2	0.40	1.68	2.50	1.64	2.3	2.25
68.5	72	98	101.5	1.5	0.25	2.75	4.09	2.69	1.09	1.07
68.5			101.5	1.5	0.27	2.49	3.71	2.44	1.15	1.13
72			118	2	0.25	2.69	4.00	2.63	2.1	2.07
72			118	2	0.42	1.62	2.42	1.59	2.9	2.83
73.5	78.5	107	111.5	1.5	0.25	2.71	4.04	2.65	1.43	1.4
73.5			111.5	1.5	0.28	2.42	3.60	2.37	1.5	1.47
77			128	2	0.25	2.69	4.00	2.63	2.55	2.51
77			128	2	0.38	1.79	2.67	1.75	3.45	3.37
78.5	83.5	112.5	116.5	1.5	0.24	2.86	4.25	2.79	1.51	1.47
78.5			116.5	1.5	0.26	2.55	3.80	2.50	1.55	1.52
82			138	2	0.25	2.69	4.00	2.63	3.18	3.14
82			138	2	0.37	1.81	2.70	1.77	4.22	4.12
83.5	89	117.5	121.5	1.5	0.22	3.00	4.47	2.94	1.59	1.55

Note: Upon request, bearings with oil inlets and oil grooves on the outer ring can also be manufactured. In such cases, please add the suffix "D1" to the end of the bearing number. (Example: 22214BD1)



Cylindrical bore

Tapered bore  
taper 1:12

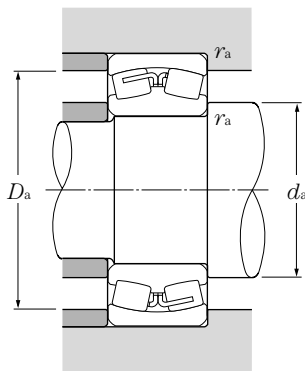
$d$  75 ~ 120mm

Boundary dimensions				Basic load ratings				Limiting speeds <sup>①</sup>		Bearing numbers	
mm				dynamic kN	static kN	dynamic kgf	static kgf	rpm		cylindrical bore	tapered <sup>②</sup> bore
$d$	$D$	$B$	$r_{s\min}$ <sup>③</sup>	$C_r$	$C_{or}$	$C_r$	$C_{or}$	grease	oil		
75	130	31	1.5	166	223	16,900	22,800	2,300	3,600	22215B	22215BK
	160	37	2.1	239	287	24,300	29,300	1,800	2,700	21315	21315K
	160	55	2.1	330	410	33,500	42,000	2,100	3,200	22315B	22315BK
80	140	33	2	213	277	21,700	28,200	2,200	3,400	22216E	22216EK
	140	33	2	179	239	18,300	24,400	2,200	3,400	22216B	22216BK
	170	39	2.1	260	315	26,500	32,000	1,700	2,500	21316	21316K
	170	58	2.1	385	470	39,500	48,000	2,000	3,000	22316B	22316BK
85	150	36	2	251	320	25,600	33,000	2,100	3,200	22217E	22217EK
	150	36	2	206	272	21,000	27,800	2,100	3,200	22217B	22217BK
	180	41	3	289	355	29,500	36,000	1,600	2,400	21317	21317K
	180	60	3	415	510	42,500	52,000	1,900	2,900	22317B	22317BK
90	160	40	2	292	385	29,800	39,500	1,900	3,000	22218E	22218EK
	160	40	2	256	345	26,200	35,000	1,900	3,000	22218B	22218BK
	160	52.4	2	315	455	32,500	46,500	1,800	2,800	23218B	23218BK
	190	43	3	320	400	32,500	40,500	1,500	2,300	21318	21318K
	190	64	3	480	590	49,000	60,000	1,800	2,700	22318B	22318BK
95	170	43	2.1	294	390	30,000	39,500	1,800	2,800	22219B	22219BK
	200	45	3	335	420	34,000	43,000	1,400	2,100	21319	21319K
	200	67	3	500	615	51,000	63,000	1,600	2,500	22319B	22319BK
100	165	52	2	310	470	31,500	47,500	1,700	2,600	23120B	23120BK
	180	46	2.1	315	415	32,000	42,500	1,700	2,700	22220B	22220BK
	180	60.3	2.1	405	580	41,500	59,000	1,600	2,500	23220B	23220BK
	215	47	3	370	465	37,500	47,500	1,300	2,000	21320	21320K
	215	73	3	605	755	61,500	77,000	1,600	2,400	22320B	22320BK
110	170	45	2	282	455	28,800	46,500	1,800	2,800	23022B	23022BK
	180	56	2	370	580	37,500	59,500	1,500	2,400	23122B	23122BK
	180	69	2	450	755	46,000	77,000	1,500	2,400	24122B	24122BK30
	200	53	2.1	410	570	42,000	58,000	1,600	2,400	22222B	22222BK
	200	69.8	2.1	515	760	52,500	77,500	1,400	2,200	23222B	23222BK
	240	50	3	495	615	50,500	62,500	1,200	1,800	21322	21322K
	240	80	3	745	930	76,000	95,000	1,400	2,200	22322B	22322BK
120	180	46	2	296	495	30,000	50,500	1,700	2,600	23024B	23024BK

① This value was achieved with machined cages and molded resin cages; for pressed cages, 75% of this value is allowable.

② Bearings appended with "K" have a tapered bore ratio of 1:12; bearings appended with "K30" have a tapered bore ratio of 1:30.

③ Smallest allowable dimension for chamfer dimension  $r$ .



## Equivalent bearing load

dynamic

$$P_r = X F_r + Y F_a$$

$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	$Y_1$	0.67	$Y_2$

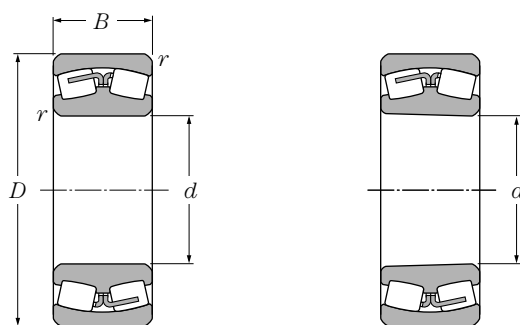
## static

$$P_{or} = F_r + Y_0 F_a$$

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

Abutment and fillet dimensions					Constant	Axial load factors			Mass (approx.)	
mm									kg	
$d_a$		$D_a$		$r_{as}$	$e$	$Y_1$	$Y_2$	$Y_0$	cylindrical bore	tapered bore
min	max	min	max	max						
83.5		121.5	1.5	0.24	2.81	4.19	2.75	1.65	1.61	
87		148	2	0.24	2.84	4.23	2.78	3.81	3.76	
87		148	2	0.37	1.80	2.69	1.76	5.25	5.13	
90	94.5	125.5	130	2	0.22	3.01	4.48	2.94	1.99	1.94
90			130	2	0.26	2.64	3.93	2.58	2.15	2.11
92			158	2	0.23	2.95	4.39	2.88	4.53	4.47
92			158	2	0.37	1.80	2.69	1.76	6.05	5.91
95	100.5	135	140	2	0.23	2.96	4.41	2.90	2.49	2.43
95			140	2	0.26	2.60	3.88	2.55	2.66	2.61
99			166	2.5	0.25	2.69	4.00	2.63	5.35	5.28
99			166	2.5	0.37	1.82	2.71	1.78	7.1	6.94
100	107.5	144	150	2	0.24	2.86	4.25	2.79	3.24	3.16
100			150	2	0.26	2.55	3.80	2.49	3.5	3.42
100			150	2	0.33	2.04	3.03	1.99	4.45	4.32
104			176	2.5	0.24	2.83	4.22	2.77	6.3	6.21
104			176	2.5	0.37	1.80	2.69	1.76	8.35	8.16
107			158	2	0.26	2.63	3.92	2.57	4.1	4.01
109			186	2.5	0.23	3.00	4.46	2.93	7.1	7
109			186	2.5	0.37	1.80	2.69	1.76	9.76	9.54
110			155	2	0.32	2.12	3.15	2.07	4.3	4.16
112			168	2	0.26	2.55	3.80	2.49	4.95	4.84
112			168	2	0.34	1.98	2.94	1.93	6.47	6.28
114			201	2.5	0.22	3.01	4.48	2.94	8.89	8.78
114			201	2.5	0.37	1.80	2.69	1.76	12.4	12.1
120			160	2	0.26	2.59	3.85	2.53	3.71	3.58
120			170	2	0.31	2.17	3.24	2.13	5.4	5.22
120			170	2	0.38	1.76	2.63	1.73	7.07	6.96
122			188	2	0.27	2.51	3.74	2.46	7.2	7.04
122			188	2	0.35	1.91	2.84	1.86	9.71	9.43
124			226	2.5	0.21	3.20	4.77	3.13	11.2	11.1
124			226	2.5	0.36	1.87	2.79	1.83	17.1	16.7
130			170	2	0.25	2.69	4.01	2.63	4.05	3.9

Note: Upon request, bearings with oil inlets and oil grooves on the outer ring can also be manufactured. In such cases, please add the suffix "D1" to the end of the bearing number. (Example: **23024BD1**)



Cylindrical bore

Tapered bore  
taper 1:12

$d$  120 ~ 160mm

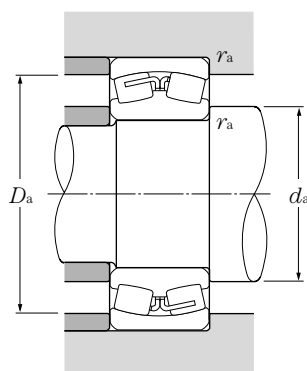
Boundary dimensions				Basic load ratings				Limiting speeds <sup>①</sup>		Bearing numbers	
mm				dynamic kN	static kN	dynamic kgf	static kgf	rpm		cylindrical bore	tapered <sup>②</sup> bore
$d$	$D$	$B$	$r_{s\ min}$ <sup>③</sup>	$C_r$	$C_{or}$	$C_r$	$C_{or}$	grease	oil		
120	180	60	2	390	670	39,500	68,500	1,500	2,300	24024B	24024BK30
	180	60	2	395	695	40,000	71,000	1,500	2,300	24024C	24024CK30
	200	62	2	455	705	46,500	71,500	1,400	2,100	23124B	23124BK
	200	80	2	575	945	58,500	96,500	1,400	2,100	24124B	24124BK30
	215	58	2.1	485	700	49,500	71,500	1,400	2,200	22224B	22224BK
	215	76	2.1	585	880	59,500	89,500	1,300	2,000	23224B	23224BK
	260	86	3	880	1,120	89,500	114,000	1,300	2,000	22324B	22324BK
130	200	52	2	375	620	38,500	63,500	1,500	2,300	23026B	23026BK
	200	69	2	505	895	51,500	91,000	1,300	2,100	24026B	24026BK30
	200	69	2	490	860	50,000	87,500	1,300	2,100	24026C	24026CK30
	210	64	2	495	795	50,500	81,000	1,300	2,000	23126B	23126BK
	210	80	2	585	995	60,000	102,000	1,300	2,000	24126B	24126BK30
	230	64	3	570	790	58,000	80,500	1,300	2,000	22226B	22226BK
	230	80	3	685	1,060	70,000	108,000	1,200	1,900	23226B	23226BK
140	280	93	4	1,000	1,290	102,000	131,000	1,200	1,800	22326B	22326BK
	210	53	2	405	690	41,000	70,500	1,400	2,200	23028B	23028BK
	210	69	2	510	945	52,000	96,500	1,200	1,900	24028B	24028BK30
	210	69	2	520	940	53,000	95,500	1,200	1,900	24028C	24028CK30
	225	68	2.1	540	895	55,000	91,000	1,200	1,800	23128B	23128BK
	225	85	2.1	670	1,150	68,500	117,000	1,200	1,800	24128B	24128BK30
	250	68	3	685	975	70,000	99,500	1,200	1,900	22228B	22228BK
150	250	88	3	805	1,270	82,000	129,000	1,100	1,700	23228B	23228BK
	300	102	4	1,130	1,460	115,000	149,000	1,100	1,700	22328B	22328BK
	225	56	2.1	445	775	45,500	79,000	1,300	2,000	23030B	23030BK
	225	75	2.1	585	1,060	59,500	108,000	1,200	1,800	24030B	24030BK30
	225	75	2.1	600	1,090	61,000	111,000	1,200	1,800	24030C	24030CK30
	250	80	2.1	730	1,190	74,500	121,000	1,100	1,700	23130B	23130BK
	250	100	2.1	885	1,520	90,500	155,000	1,100	1,700	24130B	24130BK30
160	270	73	3	775	1,160	79,000	119,000	1,100	1,700	22230B	22230BK
	270	96	3	935	1,460	95,000	149,000	1,000	1,600	23230B	23230BK
	320	108	4	1,270	1,750	130,000	179,000	1,000	1,600	22330B	22330BK
	220	45	2	320	610	33,000	62,500	1,300	2,000	23932	23932K
	240	60	2.1	505	885	51,500	90,000	1,200	1,900	23032B	23032BK
160	240	80	2.1	650	1,200	66,500	122,000	1,100	1,700	24032B	24032BK30
	240	80	2.1	665	1,250	67,500	127,000	1,100	1,700	24032C	24032CK30

① This value was achieved with machined cages and molded resin cages; for pressed cages, 75% of this value is allowable.

② Bearings appended with "K" have a tapered bore ratio of 1:12; bearings appended with "K30" have a tapered bore ratio of 1:30.

③ Smallest allowable dimension for chamfer dimension  $r$ .





## Equivalent bearing load

dynamic

$$P_r = X F_r + Y F_a$$

$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
$X$	$Y$	$X$	$Y$
1	$Y_1$	0.67	$Y_2$

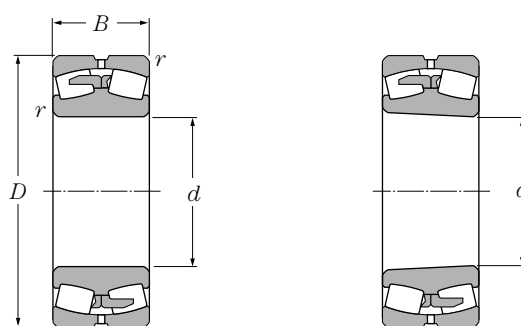
## static

$$P_{or} = F_r + Y_0 F_a$$

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

Abutment and fillet dimensions			Constant	Axial load factors			Mass (approx.)	
$d_a$	$D_a$	$r_{as}$	$e$	$Y_1$	$Y_2$	$Y_0$	cylindrical bore	tapered bore
mm	mm	mm					kg	
min	max	max					bore	bore
130	170	2	0.33	2.06	3.07	2.02	5.48	5.39
130	170	2	0.32	2.12	3.15	2.07	5.48	4.91
130	190	2	0.31	2.17	3.24	2.13	7.7	7.46
130	190	2	0.40	1.68	2.50	1.64	10.3	10.1
132	203	2	0.27	2.47	3.68	2.42	9.1	8.89
132	203	2	0.36	1.89	2.82	1.85	12.1	11.7
134	246	2.5	0.37	1.80	2.69	1.76	21.5	21
140	190	2	0.26	2.63	3.92	2.57	5.9	5.69
140	190	2	0.34	1.98	2.95	1.94	8.08	7.95
140	190	2	0.32	2.12	3.15	2.07	7.91	7.78
140	200	2	0.30	2.23	3.32	2.18	8.47	8.2
140	200	2	0.38	1.78	2.65	1.74	11	10.8
144	216	2.5	0.28	2.39	3.56	2.33	11.2	10.9
144	216	2.5	0.35	1.92	2.86	1.88	14.3	13.9
148	262	3	0.37	1.81	2.69	1.77	26.8	26.2
150	200	2	0.25	2.73	4.06	2.67	6.35	6.12
150	200	2	0.32	2.09	3.12	2.05	8.57	8.43
150	200	2	0.30	2.23	3.32	2.18	8.48	7.66
152	213	2	0.30	2.25	3.35	2.20	10.2	9.86
152	213	2	0.38	1.80	2.68	1.76	13.3	13.1
154	236	2.5	0.28	2.39	3.55	2.33	14	13.7
154	236	2.5	0.36	1.90	2.83	1.86	18.8	18.2
158	282	3	0.37	1.80	2.69	1.76	33.8	33
162	213	2	0.24	2.76	4.11	2.70	7.73	7.45
162	213	2	0.33	2.06	3.07	2.02	10.7	10.5
162	213	2	0.30	2.25	3.34	2.20	10.5	10.3
162	238	2	0.32	2.11	3.15	2.06	15.6	15.1
162	238	2	0.40	1.69	2.51	1.65	20.2	20
164	256	2.5	0.27	2.46	3.66	2.4	18.1	17.7
164	256	2.5	0.36	1.88	2.79	1.83	24.1	23.4
168	302	3	0.35	1.92	2.86	1.88	42.7	41.8
170	210	2	0.18	3.69	5.49	3.61	5.5	5.33
172	228	2	0.25	2.74	4.09	2.68	9.42	9.09
172	228	2	0.32	2.10	3.13	2.06	13	12.8
172	228	2	0.31	2.18	3.24	2.13	12	11.8

Note: When the outer diameter of a Spherical Roller Bearing is 320mm or larger, an oil groove is on OD. See page B-230 on dimensions. We can make bearings with oil hole or oil groove in the outer ring, per your request, for an outer diameter of 320mm or less. Such bearings are indicated by attaching "D1" to the end of the bearing number. (ex. **23032BD1**)



Cylindrical bore

Tapered bore  
taper 1:12

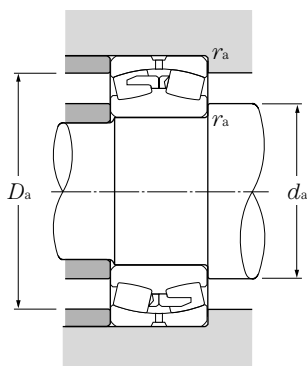
$d$  160 ~ 200mm

Boundary dimensions				Basic load ratings				Limiting speeds <sup>①</sup>		Bearing numbers	
mm				dynamic	static	dynamic	static	rpm		cylindrical bore	tapered <sup>②</sup> bore
$d$	$D$	$B$	$r_{s\ min}$ <sup>③</sup>	$C_r$ kN	$C_{or}$ kN	$C_r$ kgf	$C_{or}$ kgf	grease	oil		
160	270	86	2.1	840	1,370	85,500	140,000	1,000	1,600	23132B	23132BK
	270	109	2.1	1,040	1,780	106,000	181,000	1,000	1,600	24132B	24132BK30
	290	80	3	870	1,290	88,500	132,000	1,000	1,600	22232B	22232BK
	290	104	3	1,050	1,660	107,000	170,000	960	1,500	23232B	23232BK
	340	114	4	1,410	1,990	144,000	203,000	940	1,500	22332B	22332BK
170	230	45	2	330	650	34,000	66,000	1,200	1,900	23934	23934K
	260	67	2.1	630	1,080	64,000	110,000	1,100	1,800	23034B	23034BK
	260	90	2.1	800	1,470	81,500	150,000	1,000	1,600	24034B	24034BK30
	260	90	2.1	815	1,500	83,000	153,000	1,000	1,600	24034C	24034CK30
	280	88	2.1	885	1,490	90,500	152,000	960	1,500	23134B	23134BK
	280	109	2.1	1,080	1,880	110,000	191,000	960	1,500	24134B	24134BK30
	310	86	4	1,000	1,520	102,000	155,000	980	1,500	22234B	22234BK
180	310	110	4	1,180	1,960	120,000	200,000	910	1,400	23234B	23234BK
	360	120	4	1,540	2,180	157,000	223,000	880	1,400	22334B	22334BK
	250	52	2	440	835	45,000	85,000	1,200	1,800	23936	23936K
	280	74	2.1	740	1,290	75,500	132,000	1,100	1,700	23036B	23036BK
	280	100	2.1	965	1,770	98,500	181,000	950	1,500	24036B	24036BK30
	280	100	2.1	965	1,770	98,500	181,000	950	1,500	24036C	24036CK30
	300	96	3	1,030	1,730	105,000	176,000	900	1,400	23136B	23136BK
	300	118	3	1,250	2,210	127,000	225,000	900	1,400	24136B	24136BK30
190	320	86	4	1,040	1,610	106,000	164,000	920	1,400	22236B	22236BK
	320	112	4	1,230	2,000	125,000	204,000	850	1,300	23236B	23236BK
	380	126	4	1,740	2,560	177,000	261,000	830	1,300	22336B	22336BK
	260	52	2	460	890	47,000	91,000	1,100	1,700	23938	23938K
	290	75	2.1	755	1,350	77,000	138,000	1,000	1,600	23038B	23038BK
	290	100	2.1	995	1,850	102,000	188,000	900	1,400	24038B	24038BK30
	290	100	2.1	970	1,820	98,500	186,000	900	1,400	24038C	24038CK30
	320	104	3	1,190	2,020	122,000	206,000	850	1,300	23138B	23138BK
200	320	128	3	1,420	2,480	144,000	253,000	850	1,300	24138B	24138BK30
	340	92	4	1,160	1,810	118,000	185,000	860	1,300	22238B	22238BK
	340	120	4	1,400	2,330	143,000	237,000	790	1,200	23238B	23238BK
	400	132	5	1,870	2,790	191,000	284,000	780	1,200	22338B	22338BK
	280	60	2.1	545	1,100	56,000	112,000	1,000	1,600	23940	23940K
200	310	82	2.1	915	1,620	93,000	165,000	960	1,500	23040B	23040BK
	310	109	2.1	1,160	2,140	118,000	219,000	850	1,300	24040B	24040BK30

① This value was achieved with machined cages and molded resin cages; for pressed cages, 75% of this value is allowable.

② Bearings appended with "K" have a tapered bore ratio of 1:12; bearings appended with "K30" have a tapered bore ratio of 1:30.

③ Smallest allowable dimension for chamfer dimension  $r$ .



## 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	$Y_1$	0.67	$Y_2$

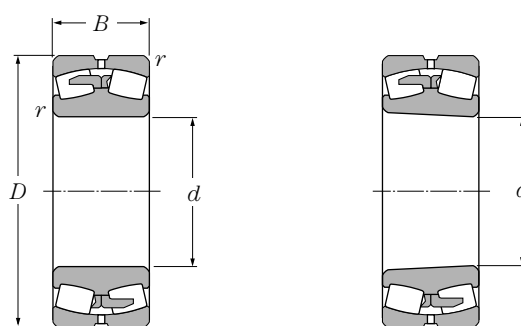
### static

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

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

Abutment and fillet dimensions			Constant	Axial load factors			Mass (approx.)	
mm							kg	
$d_a$	$D_a$	$r_{as}$	$e$	$Y_1$	$Y_2$	$Y_o$	cylindrical bore	tapered bore
min	max	max						
172	258	2	0.32	2.11	3.15	2.07	19.8	19.2
172	258	2	0.40	1.67	2.48	1.63	26	25.6
174	276	2.5	0.28	2.42	3.60	2.37	22.7	22.2
174	276	2.5	0.36	1.86	2.77	1.82	30	29.1
178	322	3	0.35	1.94	2.89	1.90	50.8	49.7
180	220	2	0.17	3.91	5.83	3.83	5.8	5.62
182	248	2	0.25	2.66	3.96	2.60	12.7	12.3
182	248	2	0.34	1.98	2.95	1.94	17.7	17.4
182	248	2	0.31	2.16	3.22	2.12	17.4	17.1
182	268	2	0.31	2.15	3.21	2.11	21.5	20.8
182	268	2	0.39	1.74	2.59	1.70	27.2	26.8
188	292	3	0.28	2.39	3.56	2.34	28	27.3
188	292	3	0.36	1.87	2.79	1.83	36.8	35.7
188	342	3	0.34	1.96	2.91	1.91	59.8	58.5
190	240	2	0.19	3.52	5.25	3.45	8.21	7.95
192	268	2	0.26	2.59	3.85	2.53	16.7	16.1
192	268	2	0.35	1.91	2.85	1.87	23.3	22.9
192	268	2	0.33	2.04	3.04	2.00	23	22.6
194	286	2.5	0.32	2.11	3.15	2.07	25.1	24.2
194	286	2.5	0.39	1.72	2.56	1.68	34.3	33.8
198	302	3	0.27	2.49	3.70	2.43	29.3	28.6
198	302	3	0.35	1.91	2.84	1.86	39	37.8
198	362	3	0.34	1.97	2.93	1.92	70	68.5
200	250	2	0.18	3.81	5.67	3.73	8.6	8.34
202	278	2	0.26	2.65	3.94	2.59	17.7	17.1
202	278	2	0.33	2.03	3.02	1.98	24.3	23.9
202	278	2	0.31	2.16	3.22	2.12	23	22.6
204	306	2.5	0.33	2.07	3.09	2.03	35.3	34.2
204	306	2.5	0.40	1.69	2.51	1.65	42.8	42.2
208	322	3	0.27	2.47	3.68	2.42	36.6	35.8
208	322	3	0.36	1.89	2.82	1.85	47.6	46.2
212	378	4	0.34	1.97	2.94	1.93	81	79.3
212	268	2	0.17	3.91	5.82	3.82	12.1	11.7
212	298	2	0.26	2.59	3.85	2.53	22.7	21.9
212	298	2	0.35	1.94	2.89	1.90	31	30.5

Note: When the outer diameter of a Spherical Roller Bearing is 320mm or larger, an oil groove is on OD. See page B-230 on dimensions. We can make bearings with oil hole or oil groove in the outer ring, per your request, for an outer diameter of 320mm or less. Such bearings are indicated by attaching "D1" to the end of the bearing number. (ex. **23040BD1**)



Cylindrical bore

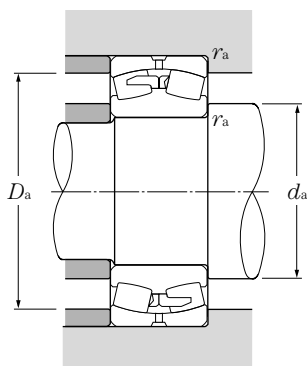
Tapered bore  
taper 1:12

**d 200 ~ 280mm**

Boundary dimensions				Basic load ratings				Limiting speeds		Bearing numbers	
mm				dynamic	static	dynamic	static	rpm		cylindrical bore	tapered <sup>①</sup> bore
d	D	B	r <sub>s min</sub> <sup>②</sup>	C <sub>r</sub>	C <sub>or</sub>	C <sub>r</sub>	C <sub>or</sub>	grease	oil		
<b>200</b>	340	112	3	1,350	2,270	137,000	231,000	800	1,200	23140B	23140BK
	340	140	3	1,630	2,900	166,000	295,000	800	1,200	24140B	24140BK30
	360	98	4	1,310	2,010	134,000	205,000	820	1,300	22240B	22240BK
	360	128	4	1,610	2,640	165,000	269,000	750	1,200	23240B	23240BK
	420	138	5	2,040	3,050	208,000	310,000	740	1,100	22340B	22340BK
<b>220</b>	300	60	2.1	565	1,170	57,500	119,000	930	1,400	23944	23944K
	340	90	3	1,060	1,920	108,000	195,000	870	1,300	23044B	23044BK
	340	118	3	1,350	2,570	138,000	262,000	770	1,200	24044B	24044BK30
	370	120	4	1,540	2,670	157,000	272,000	720	1,100	23144B	23144BK
	370	150	4	1,880	3,400	192,000	345,000	720	1,100	24144B	24144BK30
	400	108	4	1,580	2,460	161,000	251,000	730	1,100	22244B	22244BK
	400	144	4	2,010	3,350	205,000	340,000	670	1,000	23244B	23244BK
<b>240</b>	460	145	5	2,350	3,500	240,000	360,000	660	1,000	22344B	22344BK
	320	60	2.1	565	1,190	58,000	121,000	840	1,300	23948	23948K
	360	92	3	1,130	2,140	116,000	219,000	790	1,200	23048B	23048BK
	360	118	3	1,410	2,770	144,000	282,000	700	1,100	24048B	24048BK30
	400	128	4	1,730	3,050	177,000	310,000	650	1,000	23148B	23148BK
	400	160	4	2,110	3,800	215,000	390,000	650	1,000	24148B	24148BK30
	440	120	4	1,940	3,100	198,000	315,000	660	1,000	22248B	22248BK
	440	160	4	2,430	4,100	247,000	420,000	610	940	23248B	23248BK
<b>260</b>	500	155	5	2,720	4,100	278,000	420,000	600	930	22348B	22348BK
	360	75	2.1	760	1,580	77,500	161,000	770	1,200	23952	23952K
	400	104	4	1,420	2,620	144,000	267,000	720	1,100	23052B	23052BK
	400	140	4	1,830	3,550	186,000	365,000	640	980	24052B	24052BK30
	440	144	4	2,140	3,850	219,000	395,000	600	920	23152B	23152BK
	440	180	4	2,510	4,600	256,000	470,000	600	920	24152B	24152BK30
	480	130	5	2,230	3,600	228,000	365,000	610	930	22252B	22252BK
	480	174	5	2,760	4,700	281,000	480,000	560	860	23252B	23252BK
<b>280</b>	540	165	6	3,100	4,750	320,000	485,000	550	850	22352B	22352BK
	380	75	2.1	830	1,750	84,500	179,000	710	1,100	23956	23956K
	420	106	4	1,510	2,920	154,000	297,000	660	1,000	23056B	23056BK
	420	140	4	1,950	3,950	199,000	405,000	590	900	24056B	24056BK30
	460	146	5	2,300	4,250	234,000	435,000	550	850	23156B	23156BK
	460	180	5	2,730	5,200	278,000	530,000	550	850	24156B	24156BK30
<b>280</b>	500	130	5	2,310	3,800	236,000	390,000	560	860	22256B	22256BK

① Bearings appended with "K" have a tapered bore ratio of 1:12; bearings appended with "K30" have a tapered bore ratio of 1:30.

② Smallest allowable dimension for chamfer dimension r.



## 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	$Y_1$	0.67	$Y_2$

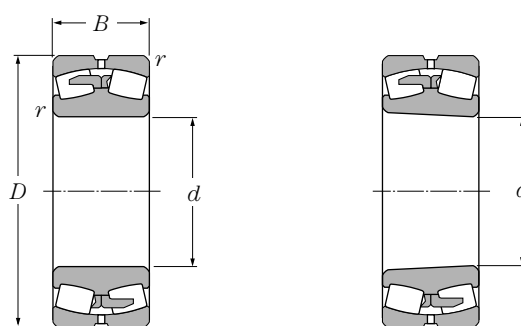
### static

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

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

Abutment and fillet dimensions			Constant	Axial load factors			Mass (approx.)	
$d_a$	$D_a$	$r_{as}$						
mm	mm	mm					kg	
min	max	max	$e$	$Y_1$	$Y_2$	$Y_o$	cylindrical bore	tapered bore
214	326	2.5	0.33	2.05	3.05	2.00	43.3	42
214	326	2.5	0.41	1.64	2.44	1.60	53.4	52.6
218	342	3	0.28	2.45	3.64	2.39	44	43
218	342	3	0.36	1.88	2.79	1.83	57.2	55.5
222	398	4	0.34	1.98	2.95	1.94	93.2	91.2
232	288	2	0.19	3.62	5.39	3.54	13.1	12.7
234	326	2.5	0.26	2.59	3.85	2.53	29.9	28.8
234	326	2.5	0.34	1.97	2.94	1.93	40.2	39.6
238	352	3	0.33	2.07	3.09	2.03	53.3	51.6
238	352	3	0.41	1.66	2.47	1.62	67	66
238	382	3	0.27	2.46	3.66	2.40	60.4	59.1
238	382	3	0.36	1.85	2.76	1.81	80	77.6
242	438	4	0.33	2.06	3.07	2.02	117	115
252	308	2	0.16	4.13	6.15	4.04	14	13.6
254	346	2.5	0.25	2.69	4.01	2.63	33.4	32.2
254	346	2.5	0.32	2.09	3.12	2.05	43	42.3
258	382	3	0.32	2.11	3.15	2.07	65.8	63.8
258	382	3	0.40	1.69	2.51	1.65	82.2	80.9
258	422	3	0.28	2.43	3.62	2.38	81.7	80
258	422	3	0.37	1.83	2.72	1.79	108	105
262	478	4	0.32	2.10	3.13	2.06	148	145
272	348	2	0.19	3.53	5.26	3.45	24	23.3
278	382	3	0.26	2.63	3.92	2.57	48.5	46.8
278	382	3	0.34	1.96	2.91	1.91	65.2	64.1
278	422	3	0.33	2.05	3.06	2.01	91.4	88.6
278	422	3	0.41	1.63	2.43	1.60	114	112
282	458	4	0.28	2.45	3.64	2.39	106	104
282	458	4	0.37	1.83	2.72	1.79	141	137
288	512	5	0.32	2.13	3.18	2.09	183	179
292	368	2	0.17	3.88	5.78	3.79	26.4	25.6
298	402	3	0.25	2.73	4.06	2.67	52.4	50.6
298	402	3	0.33	2.06	3.07	2.02	69	67.9
302	438	4	0.32	2.13	3.18	2.09	97.7	94.6
302	438	4	0.39	1.73	2.58	1.69	120	118
302	478	4	0.26	2.57	3.83	2.51	112	110

Note: Please refer to page B-230 for outer ring oil inlet and oil groove dimensions.



Cylindrical bore

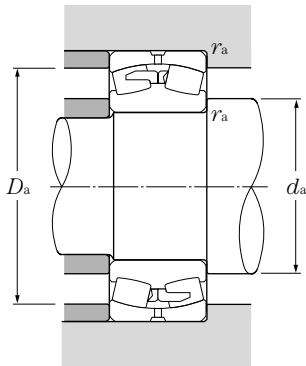
Tapered bore  
taper 1:12

$d$  280 ~ 380mm

Boundary dimensions				Basic load ratings				Limiting speeds		Bearing numbers	
mm				dynamic	static	dynamic	static	rpm		cylindrical bore	tapered <sup>①</sup> bore
$d$	$D$	$B$	$r_{s\ min}$ <sup>②</sup>	$C_r$	$C_{or}$	$C_r$	$C_{or}$	grease	oil		
280	500	176	5	2,930	5,150	298,000	525,000	510	790	23256B	23256BK
	580	175	6	3,500	5,350	360,000	545,000	500	780	22356B	22356BK
300	420	90	3	1,110	2,320	113,000	237,000	650	1,000	23960	23960K
	460	118	4	1,890	3,550	193,000	365,000	610	940	23060B	23060BK
	460	160	4	2,450	4,950	250,000	505,000	540	840	24060B	24060BK30
	500	160	5	2,750	5,000	280,000	510,000	510	780	23160B	23160BK
	500	200	5	3,300	6,400	340,000	650,000	510	780	24160B	24160BK30
	540	140	5	2,670	4,350	272,000	440,000	510	790	22260B	22260BK
	540	192	5	3,450	6,000	355,000	615,000	470	730	23260B	23260BK
320	620	185	7.5	3,600	5,400	365,000	550,000	470	720	22360B	22360BK
	440	90	3	1,140	2,460	116,000	251,000	610	930	23964	23964K
	480	121	4	1,960	3,850	200,000	395,000	570	880	23064B	23064BK
	480	160	4	2,510	5,200	255,000	530,000	500	780	24064B	24064BK30
	540	176	5	3,100	5,800	320,000	590,000	470	730	23164B	23164BK
	540	218	5	3,850	7,300	390,000	745,000	470	730	24164B	24164BK30
	580	150	5	3,100	5,050	315,000	515,000	480	730	22264B	22264BK
340	580	208	5	4,000	7,050	410,000	720,000	440	680	23264B	23264BK
	460	90	3	1,220	2,650	124,000	270,000	570	870	23968	23968K
	520	133	5	2,310	4,550	235,000	465,000	530	820	23068B	23068BK
	520	180	5	3,000	6,200	305,000	630,000	470	720	24068B	24068BK30
	580	190	5	3,600	6,600	365,000	670,000	440	680	23168B	23168BK
	580	243	5	4,600	8,950	470,000	910,000	440	680	24168B	24168BK30
360	620	224	6	4,450	8,000	455,000	815,000	410	630	23268B	23268BK
	480	90	3	1,320	2,930	135,000	298,000	530	820	23972	23972K
	540	134	5	2,370	4,700	242,000	480,000	500	770	23072B	23072BK
	540	180	5	3,100	6,600	320,000	675,000	440	680	24072B	24072BK30
	600	192	5	3,750	7,050	385,000	715,000	410	630	23172B	23172BK
	600	243	5	4,600	9,150	470,000	935,000	410	630	24172B	24172BK30
380	650	232	6	4,850	8,700	495,000	885,000	380	590	23272B	23272BK
	520	106	4	1,560	3,550	159,000	360,000	500	770	23976	23976K
	560	135	5	2,510	5,150	256,000	525,000	470	720	23076B	23076BK
	560	180	5	3,250	7,100	330,000	725,000	410	640	24076B	24076BK30
	620	194	5	3,900	7,500	400,000	765,000	390	590	23176B	23176BK
380	620	243	5	4,800	9,650	490,000	985,000	390	590	24176B	24176BK30

① Bearings appended with "K" have a tapered bore ratio of 1:12; bearings appended with "K30" have a tapered bore ratio of 1:30.

② Smallest allowable dimension for chamfer dimension  $r$ .



## 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	$Y_1$	0.67	$Y_2$

**static**

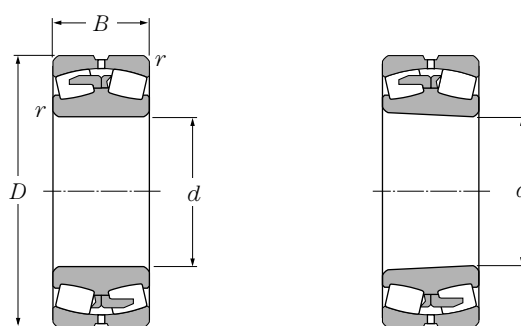
$$P_{or} = F_r + Y_o F_a$$

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

Abutment and fillet dimensions			Constant	Axial load factors			Mass (approx.)	
mm							kg	
$d_a$ min	$D_a$ max	$r_{as}$ max	$e$	$Y_1$	$Y_2$	$Y_o$	cylindrical bore	tapered bore
302	478	4	0.36	1.90	2.83	1.86	150	145
308	552	5	0.31	2.16	3.22	2.12	224	220
314	406	2.5	0.20	3.34	4.98	3.27	40	38.7
318	442	3	0.25	2.66	3.96	2.60	72.4	70.2
318	442	3	0.34	1.97	2.93	1.92	98	96.4
322	478	4	0.32	2.11	3.15	2.07	131	127
322	478	4	0.40	1.69	2.51	1.65	161	159
322	518	4	0.26	2.57	3.83	2.51	141	138
322	518	4	0.36	1.88	2.79	1.83	193	187
336	584	6	0.32	2.13	3.17	2.08	270	265
334	426	2.5	0.19	3.50	5.21	3.42	43	41.7
338	462	3	0.25	2.73	4.06	2.67	78.2	75.5
338	462	3	0.33	2.06	3.07	2.02	103	101
342	518	4	0.33	2.06	3.07	2.02	167	162
342	518	4	0.40	1.67	2.48	1.63	207	204
342	558	4	0.26	2.57	3.83	2.51	172	168
342	558	4	0.36	1.86	2.77	1.82	243	236
354	446	2.5	0.17	3.91	5.83	3.83	44.7	43.3
362	498	4	0.25	2.68	3.99	2.62	104	100
362	498	4	0.34	1.98	2.95	1.94	140	138
362	558	4	0.33	2.05	3.06	2.01	210	204
362	558	4	0.42	1.61	2.39	1.57	269	265
368	592	5	0.37	1.84	2.75	1.80	300	291
374	466	2.5	0.17	3.99	5.93	3.90	47.2	45.7
382	518	4	0.24	2.78	4.14	2.72	110	106
382	518	4	0.33	2.06	3.07	2.02	147	145
382	578	4	0.32	2.11	3.15	2.07	222	215
382	578	4	0.40	1.67	2.48	1.63	281	277
388	622	5	0.36	1.87	2.78	1.83	339	329
398	502	3	0.19	3.54	5.27	3.46	69.9	67.7
402	538	4	0.24	2.87	4.27	2.80	115	111
402	538	4	0.30	2.23	3.32	2.18	153	150
402	598	4	0.31	2.16	3.22	2.12	235	228
402	598	4	0.39	1.73	2.58	1.69	292	287

Note: Please refer to page B-230 for outer ring oil inlet and oil groove dimensions.





Cylindrical bore

Tapered bore  
taper 1:12

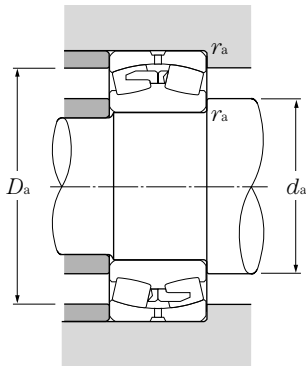
$d$  380 ~ 500mm

Boundary dimensions				Basic load ratings				Limiting speeds		Bearing numbers	
mm				dynamic	static	dynamic	static	rpm		cylindrical bore	tapered <sup>①</sup> bore
$d$	$D$	$B$	$r_{s\ min}$ <sup>②</sup>	$C_r$	$C_{or}$	$C_r$	$C_{or}$	grease	oil		
<b>380</b>	680	240	6	5,200	9,650	530,000	985,000	360	550	23276B	23276BK
<b>400</b>	540	106	4	1,580	3,650	161,000	370,000	470	720	23980	23980K
	600	148	5	2,980	6,050	305,000	615,000	440	680	23080B	23080BK
	600	200	5	3,850	8,400	390,000	855,000	390	600	24080B	24080BK30
	650	200	6	4,200	8,050	425,000	820,000	360	560	23180B	23180BK
	650	250	6	5,100	10,300	520,000	1,060,000	360	560	24180B	24180BK30
	720	256	6	5,850	10,600	595,000	1,080,000	340	520	23280B	23280BK
<b>420</b>	560	106	4	1,630	3,850	166,000	390,000	450	690	23984	23984K
	620	150	5	3,100	6,400	315,000	650,000	420	640	23084B	23084BK
	620	200	5	3,850	8,450	395,000	865,000	370	570	24084B	24084BK30
	700	224	6	5,200	9,950	530,000	1,020,000	350	530	23184B	23184BK
	700	280	6	6,150	12,200	625,000	1,240,000	350	530	24184B	24184BK30
	760	272	7.5	6,550	12,000	665,000	1,230,000	320	490	23284B	23284BK
<b>440</b>	600	118	4	2,030	4,700	207,000	480,000	420	650	23988	23988K
	650	157	6	3,300	6,850	335,000	695,000	400	610	23088B	23088BK
	650	212	6	4,300	9,450	440,000	960,000	350	540	24088B	24088BK30
	720	226	6	5,200	10,100	530,000	1,030,000	330	500	23188B	23188BK
	720	280	6	6,450	13,100	660,000	1,330,000	330	500	24188B	24188BK30
	790	280	7.5	6,900	12,800	705,000	1,310,000	300	470	23288B	23288BK
<b>460</b>	620	118	4	2,100	4,950	214,000	505,000	400	620	23992	23992K
	680	163	6	3,600	7,450	365,000	760,000	370	580	23092B	23092BK
	680	218	6	4,600	10,200	470,000	1,040,000	330	510	24092B	24092BK30
	760	240	7.5	5,700	11,400	585,000	1,160,000	310	470	23192B	23192BK
	760	300	7.5	7,100	14,500	725,000	1,480,000	310	470	24192B	24192BK30
	830	296	7.5	7,750	14,500	790,000	1,470,000	290	440	23292B	23292BK
<b>480</b>	650	128	5	2,330	5,500	238,000	565,000	380	590	23996	23996K
	700	165	6	3,650	7,700	370,000	785,000	360	550	23096B	23096BK
	700	218	6	4,650	10,500	475,000	1,070,000	320	490	24096B	24096BK30
	790	248	7.5	6,200	12,300	635,000	1,260,000	290	450	23196B	23196BK
	790	308	7.5	7,450	15,300	760,000	1,560,000	290	450	24196B	24196BK30
	870	310	7.5	8,300	15,500	845,000	1,580,000	270	420	23296B	23296BK
<b>500</b>	670	128	5	2,370	5,600	242,000	570,000	360	560	239/500	239/500K
	720	167	6	3,850	8,300	390,000	845,000	340	530	230/500B	230/500BK

① Bearings appended with "K" have a tapered bore ratio of 1:12; bearings appended with "K30" have a tapered bore ratio of 1:30.

② Smallest allowable dimension for chamfer dimension  $r$ .





## 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	$Y_1$	0.67	$Y_2$

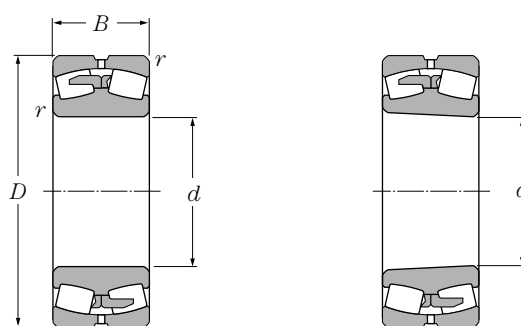
**static**

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

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

Abutment and fillet dimensions			Constant	Axial load factors			Mass (approx.)	
mm							kg	
$d_a$ min	$D_a$ max	$r_{as}$ max	$e$	$Y_1$	$Y_2$	$Y_o$	cylindrical bore	tapered bore
408	652	5	0.36	1.89	2.82	1.85	380	369
418	522	3	0.18	3.71	5.53	3.63	73	70.7
422	578	4	0.24	2.80	4.16	2.73	149	144
422	578	4	0.32	2.09	3.11	2.04	202	200
428	622	5	0.31	2.21	3.28	2.16	264	256
428	622	5	0.38	1.77	2.63	1.73	329	324
428	692	5	0.37	1.81	2.69	1.77	457	443
438	542	3	0.17	3.95	5.88	3.86	76.2	73.8
442	598	4	0.24	2.85	4.24	2.78	157	152
442	598	4	0.32	2.13	3.18	2.09	210	207
448	672	5	0.32	2.11	3.15	2.07	354	343
448	672	5	0.40	1.69	2.51	1.65	440	433
456	724	6	0.36	1.86	2.77	1.82	544	528
458	582	3	0.18	3.66	5.46	3.58	101	98
468	622	5	0.24	2.85	4.24	2.78	181	175
468	622	5	0.32	2.11	3.15	2.07	245	241
468	692	5	0.31	2.15	3.21	2.11	370	358
468	692	5	0.39	1.75	2.61	1.71	456	449
476	754	6	0.36	1.88	2.80	1.84	600	582
478	602	3	0.17	3.95	5.88	3.86	107	104
488	652	5	0.23	2.88	4.29	2.82	206	200
488	652	5	0.31	2.15	3.21	2.11	276	272
496	724	6	0.31	2.14	3.19	2.10	443	429
496	724	6	0.39	1.71	2.55	1.67	550	541
496	794	6	0.36	1.87	2.78	1.83	704	683
502	628	4	0.18	3.85	5.73	3.76	123	119
508	672	5	0.23	2.94	4.38	2.88	217	209
508	672	5	0.30	2.22	3.30	2.17	285	280
516	754	6	0.31	2.15	3.21	2.11	492	477
516	754	6	0.39	1.74	2.59	1.70	608	600
516	834	6	0.36	1.87	2.78	1.83	814	790
522	648	4	0.17	4.02	5.98	3.93	131	127
528	692	5	0.23	2.98	4.44	2.91	226	218

Note: Please refer to page B-230 for outer ring oil inlet and oil groove dimensions.



Cylindrical bore

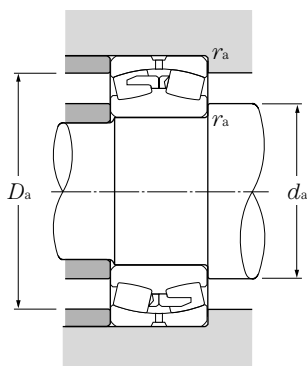
Tapered bore  
taper 1:12

**d 500 ~ 670mm**

Boundary dimensions				Basic load ratings				Limiting speeds		Bearing numbers	
mm				dynamic	static	dynamic	static	rpm		cylindrical bore	tapered <sup>①</sup> bore
d	D	B	r <sub>s min</sub> <sup>②</sup>	C <sub>r</sub>	C <sub>0r</sub>	C <sub>r</sub>	C <sub>0r</sub>	grease	oil		
500	720	218	6	4,750	10,900	485,000	1,110,000	300	460	240/500B	240/500BK30
	830	264	7.5	6,950	13,700	705,000	1,400,000	280	430	231/500B	231/500BK
	830	325	7.5	8,050	16,700	825,000	1,700,000	280	430	241/500B	241/500BK30
	920	336	7.5	9,400	17,800	960,000	1,820,000	260	400	232/500B	232/500BK
530	710	136	5	2,640	6,450	269,000	655,000	340	520	239/530	239/530K
	780	185	6	4,400	9,350	445,000	955,000	320	490	230/530B	230/530BK
	780	250	6	5,600	12,700	570,000	1,290,000	280	430	240/530B	240/530BK30
	870	272	7.5	7,000	14,200	715,000	1,450,000	260	400	231/530B	231/530BK
	870	335	7.5	8,300	17,400	850,000	1,770,000	260	400	241/530B	241/530BK30
	980	355	9.5	10,400	19,800	1,060,000	2,020,000	240	370	232/530B	232/530BK
560	750	140	5	2,830	6,700	288,000	680,000	320	490	239/560	239/560K
	820	195	6	4,800	10,500	490,000	1,070,000	300	450	230/560B	230/560BK
	820	258	6	6,100	14,100	620,000	1,440,000	260	400	240/560B	240/560BK30
	920	280	7.5	7,650	15,500	780,000	1,580,000	240	370	231/560B	231/560BK
	920	355	7.5	9,950	20,800	1,010,000	2,120,000	240	370	241/560B	241/560BK30
	1,030	365	9.5	11,100	21,100	1,130,000	2,150,000	220	340	232/560B	232/560BK
600	800	150	5	3,150	7,800	325,000	795,000	290	450	239/600	239/600K
	870	200	6	5,250	12,000	535,000	1,220,000	270	420	230/600B	230/600BK
	870	272	6	6,450	15,600	655,000	1,590,000	240	370	240/600B	240/600BK30
	980	300	7.5	9,000	18,400	920,000	1,880,000	220	340	231/600B	231/600BK
	980	375	7.5	10,700	23,200	1,090,000	2,360,000	220	340	241/600B	241/600BK30
	1,090	388	9.5	12,200	23,700	1,240,000	2,420,000	210	320	232/600B	232/600BK
630	850	165	6	3,700	9,250	375,000	945,000	270	420	239/630	239/630K
	920	212	7.5	5,900	13,000	600,000	1,330,000	260	400	230/630B	230/630BK
	920	290	7.5	7,550	17,900	770,000	1,830,000	230	350	240/630B	240/630BK30
	1,030	315	7.5	9,600	19,900	975,000	2,030,000	210	320	231/630B	231/630BK
	1,030	400	7.5	11,600	25,000	1,180,000	2,550,000	210	320	241/630B	241/630BK30
	1,150	412	12	13,700	26,800	1,400,000	2,740,000	190	300	232/630B	232/630BK
670	900	170	6	4,100	10,300	420,000	1,050,000	250	390	239/670	239/670K
	980	230	7.5	6,550	14,600	665,000	1,490,000	240	360	230/670B	230/670BK
	980	308	7.5	8,650	20,600	885,000	2,100,000	210	320	240/670B	240/670BK30
	1,090	336	7.5	11,000	22,800	1,120,000	2,330,000	190	300	231/670B	231/670BK
	1,090	412	7.5	12,700	28,000	1,300,000	2,850,000	190	300	241/670B	241/670BK30
	1,220	438	12	16,100	32,000	1,640,000	3,250,000	180	280	232/670B	232/670BK

① Bearings appended with "K" have a tapered bore ratio of 1:12; bearings appended with "K30" have a tapered bore ratio of 1:30.

② Smallest allowable dimension for chamfer dimension r.



## 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	$Y_1$	0.67	$Y_2$

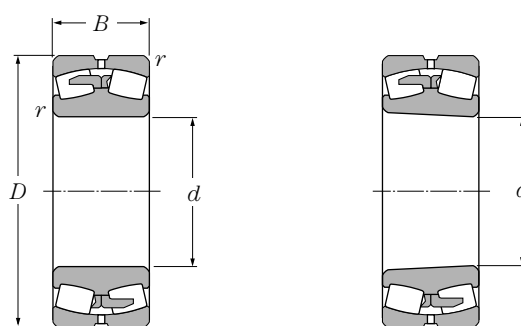
### static

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

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

Abutment and fillet dimensions			Constant	Axial load factors			Mass (approx.)	
mm							kg	
$d_a$	$D_a$	$r_{as}$	$e$	$Y_1$	$Y_2$	$Y_o$	cylindrical bore	tapered bore
min	max	max						
528	692	5	0.30	2.28	3.40	2.23	295	290
536	794	6	0.32	2.12	3.16	2.08	584	566
536	794	6	0.39	1.72	2.57	1.69	716	705
536	884	6	0.39	1.74	2.59	1.70	1,000	971
552	688	4	0.17	3.94	5.87	3.86	157	152
558	752	5	0.22	3.03	4.52	2.97	306	295
558	752	5	0.30	2.24	3.33	2.19	413	406
566	834	6	0.30	2.22	3.30	2.17	653	633
566	834	6	0.38	1.79	2.67	1.75	800	788
574	936	8	0.39	1.74	2.59	1.70	1,200	1,170
582	728	4	0.16	4.09	6.09	4.00	182	176
588	792	5	0.22	3.03	4.51	2.96	353	340
588	792	5	0.30	2.29	3.40	2.24	467	459
596	884	6	0.30	2.27	3.38	2.22	752	729
596	884	6	0.39	1.75	2.61	1.71	948	934
604	986	8	0.36	1.88	2.80	1.84	1,360	1,320
622	778	4	0.18	3.85	5.73	3.76	218	211
628	842	5	0.21	3.17	4.72	3.10	400	386
628	842	5	0.29	2.33	3.47	2.28	544	535
636	944	6	0.30	2.22	3.30	2.17	908	880
636	944	6	0.37	1.81	2.70	1.77	1,130	1,110
644	1,046	8	0.36	1.86	2.77	1.82	1,540	1,490
658	822	5	0.18	3.66	5.45	3.58	277	268
666	884	6	0.22	3.14	4.67	3.07	481	464
666	884	6	0.30	2.28	3.40	2.23	657	646
666	994	6	0.30	2.27	3.38	2.22	1,050	1,020
666	994	6	0.38	1.78	2.66	1.74	1,330	1,310
684	1,096	10	0.36	1.87	2.78	1.83	1,900	1,840
698	872	5	0.18	3.76	5.59	3.67	317	307
706	944	6	0.22	3.07	4.57	3.00	594	573
706	944	6	0.29	2.29	3.41	2.24	794	781
706	1,054	6	0.30	2.22	3.30	2.17	1,250	1,210
706	1,054	6	0.37	1.83	2.73	1.79	1,530	1,510
724	1,166	10	0.36	1.89	2.81	1.85	2,270	2,200

Note: Please refer to page B-230 for outer ring oil inlet and oil groove dimensions.



Cylindrical bore

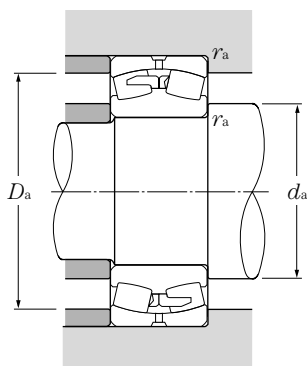
Tapered bore  
taper 1:12

$d$  710 ~ 1060mm

Boundary dimensions				Basic load ratings				Limiting speeds		Bearing numbers	
mm				dynamic	static	dynamic	static	rpm		cylindrical bore	tapered <sup>①</sup> bore
$d$	$D$	$B$	$r_{s\min}$ <sup>②</sup>	$C_r$	$C_{or}$	$C_r$	$C_{or}$	grease	oil		
710	950	180	6	4,450	11,500	450,000	1,170,000	240	370	239/710	239/710K
	1,030	236	7.5	7,200	16,200	730,000	1,650,000	220	340	230/710B	230/710BK
	1,030	315	7.5	9,300	22,500	945,000	2,300,000	200	300	240/710B	240/710BK30
	1,150	345	9.5	11,600	24,900	1,190,000	2,540,000	180	280	231/710B	231/710BK
	1,150	438	9.5	14,500	32,000	1,470,000	3,250,000	180	280	241/710B	241/710BK30
	1,280	450	12	16,300	32,500	1,660,000	3,300,000	170	260	232/710B	232/710BK
750	1,000	185	6	5,000	13,000	510,000	1,330,000	220	340	239/750	239/750K
	1,090	250	7.5	8,150	18,300	835,000	1,860,000	210	320	230/750B	230/750BK
	1,090	335	7.5	10,100	24,600	1,030,000	2,500,000	180	280	240/750B	240/750BK30
	1,220	365	9.5	12,800	27,200	1,310,000	2,780,000	170	260	231/750B	231/750BK
	1,360	475	15	18,200	36,500	1,860,000	3,750,000	160	240	232/750B	232/750BK
800	1,060	195	6	5,400	13,700	550,000	1,400,000	200	310	239/800	239/800K
	1,150	258	7.5	8,400	19,500	860,000	1,990,000	190	290	230/800B	230/800BK
	1,150	345	7.5	11,200	27,800	1,140,000	2,840,000	170	260	240/800B	240/800BK30
	1,280	375	9.5	14,400	31,000	1,460,000	3,150,000	150	240	231/800B	231/800BK
850	1,120	200	6	5,850	15,100	595,000	1,540,000	190	290	239/850	239/850K
	1,220	272	7.5	9,750	22,700	995,000	2,310,000	170	270	230/850B	230/850BK
	1,220	365	7.5	12,500	31,500	1,270,000	3,200,000	150	240	240/850B	240/850BK30
	1,360	400	12	15,500	34,000	1,580,000	3,500,000	140	220	231/850B	231/850BK
900	1,180	206	6	6,650	17,300	675,000	1,770,000	170	270	239/900	239/900K
	1,280	280	7.5	10,300	24,700	1,050,000	2,520,000	160	250	230/900B	230/900BK
	1,280	375	7.5	13,200	33,500	1,350,000	3,450,000	140	220	240/900B	240/900BK30
	1,420	412	12	16,800	38,000	1,720,000	3,850,000	130	200	231/900B	231/900BK
950	1,250	224	7.5	7,750	20,500	790,000	2,090,000	160	250	239/950	239/950K
	1,360	300	7.5	11,500	28,400	1,180,000	2,900,000	150	230	230/950B	230/950BK
	1,360	412	7.5	15,500	40,000	1,580,000	4,100,000	130	210	240/950B	240/950BK30
1000	1,320	236	7.5	8,600	22,700	875,000	2,310,000	150	230	239/1000	239/1000K
	1,420	308	7.5	12,400	30,000	1,260,000	3,050,000	140	220	230/1000B	230/1000BK
	1,420	412	7.5	16,000	42,000	1,640,000	4,250,000	120	190	240/1000B	240/1000BK30
1060	1,400	250	7.5	9,300	24,700	950,000	2,520,000	140	210	239/1060	239/1060K
	1,500	325	9.5	13,600	33,500	1,390,000	3,400,000	130	200	230/1060B	230/1060BK
	1,500	438	9.5	17,800	47,000	1,810,000	4,800,000	120	180	240/1060B	240/1060BK30

① Bearings appended with "K" have a tapered bore ratio of 1:12; bearings appended with "K30" have a tapered bore ratio of 1:30.

② Smallest allowable dimension for chamfer dimension  $r$ .



## 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	$Y_1$	0.67	$Y_2$

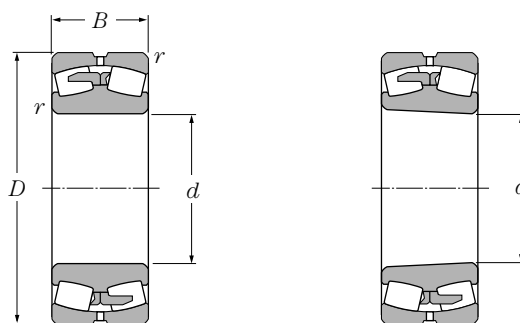
### static

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

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

Abutment and fillet dimensions			Constant	Axial load factors			Mass (approx.)	
mm							kg	
$d_a$	$D_a$	$r_{as}$	$e$	$Y_1$	$Y_2$	$Y_o$	cylindrical bore	tapered bore
min	max	max						
738	922	5	0.18	3.85	5.73	3.76	375	363
746	994	6	0.22	3.02	4.50	2.96	663	640
746	994	6	0.29	2.36	3.51	2.31	884	870
754	1,106	8	0.29	2.32	3.45	2.27	1,420	1,380
754	1,106	8	0.37	1.80	2.69	1.76	1,800	1,770
764	1,226	10	0.35	1.91	2.84	1.87	2,540	2,470
778	972	5	0.17	3.90	5.81	3.81	412	399
786	1,054	6	0.21	3.20	4.76	3.13	790	763
786	1,054	6	0.29	2.35	3.49	2.29	1,060	1,040
794	1,176	8	0.29	2.32	3.45	2.27	1,700	1,650
814	1,296	12	0.35	1.92	2.86	1.88	3,050	2,960
828	1,032	5	0.17	4.05	6.04	3.96	487	471
836	1,114	6	0.21	3.15	4.69	3.08	890	859
836	1,114	6	0.28	2.41	3.59	2.36	1,190	1,170
844	1,236	8	0.29	2.32	3.45	2.27	1,890	1,830
878	1,092	5	0.16	4.25	6.32	4.15	550	532
886	1,184	6	0.20	3.32	4.95	3.25	1,050	1,010
886	1,184	6	0.28	2.42	3.61	2.37	1,410	1,390
904	1,306	10	0.28	2.37	3.54	2.32	2,270	2,200
928	1,152	5	0.16	4.32	6.44	4.23	623	603
936	1,244	6	0.20	3.32	4.95	3.25	1,170	1,130
936	1,244	6	0.27	2.48	3.70	2.43	1,570	1,540
954	1,366	10	0.28	2.42	3.60	2.36	2,500	2,420
986	1,214	6	0.16	4.20	6.26	4.11	774	749
986	1,324	6	0.21	3.26	4.85	3.18	1,430	1,380
986	1,324	6	0.28	2.39	3.56	2.34	1,970	1,940
1,036	1,284	6	0.16	4.21	6.26	4.11	916	887
1,036	1,384	6	0.20	3.37	5.02	3.29	1,580	1,520
1,036	1,384	6	0.27	2.51	3.73	2.45	2,110	2,080
1,096	1,364	6	0.16	4.28	6.37	4.19	1,090	1,060
1,104	1,456	8	0.20	3.36	5.00	3.28	1,850	1,790
1,104	1,456	8	0.27	2.49	3.71	2.44	2,450	2,140

Note: Please refer to page B-230 for outer ring oil inlet and oil groove dimensions.



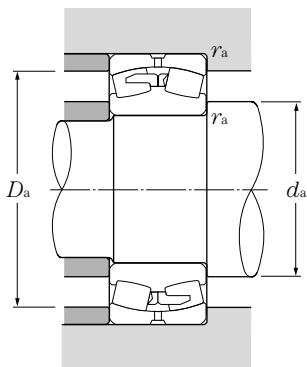
### Cylindrical bore

**Tapered bore  
taper 1:12**

**$d$  1120 ~ 1400mm**

[illegible]

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



### 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	$Y_1$	0.67	$Y_2$

**static**

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

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

Abutment and fillet dimensions			Constant	Axial load factors			Mass (approx.)	
mm							kg	
$d_a$	$D_a$	$r_{as}$	$e$	$Y_1$	$Y_2$	$Y_o$	cylindrical bore	tapered bore
min	max	max						
1,156	1,424	6	0.15	4.42	6.58	4.32	1,140	1,100
1,164	1,536	8	0.21	3.29	4.80	3.21	2,160	2,090
1,164	1,536	8	0.27	2.50	3.72	2.44	2,890	2,840
1,216	1,504	6	0.15	4.40	6.55	4.30	1,390	1,340
1,286	1,594	6	0.15	4.42	6.58	4.32	1,600	1,550
1,356	1,684	6	0.16	4.34	6.46	4.24	1,900	1,840
1,444	1,776	8	0.15	4.39	6.54	4.29	2,230	2,160

