

NSK

DOUBLE-ROW BALL BEARINGS
CUSTOMIZED BALL BEARINGS



Double Row Ball Bearings and Customized Ball Bearings





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Tailormade Solutions





Everything is possible. NSK special bearings are manufactured according to your specific requirements. The only thing "standard" with all our products is the NSK Quality.

Our products are manufactured to a high standard of quality and reliability, and our management system is certified in accordance with national and international standards. We take responsibility for our total process – when it comes to the environment, too:
We take it for granted that raw materials and energy must

be used efficiently and that waste must be reduced to the minimum.

Outer ring according to customer requirements ›

Diameter

- › Width
- › With groove
- › With bore/thread

Profile

- › Spherical
- › Gothic arch
- › V-profile
- › Groove turned or ground

Seals according to customer requirements

Standard

- › ZR/2ZR
- › RSR/2RSR

Special solutions

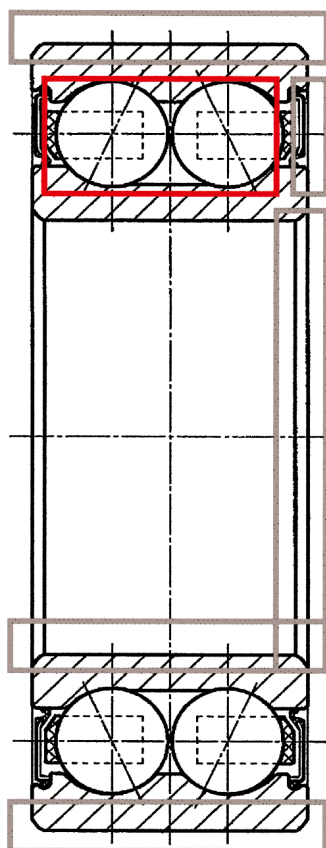
- › Multi-lipped
- › Labyrinth seal
- › Three-part sealing

Inner ring according to customer requirements

Bore

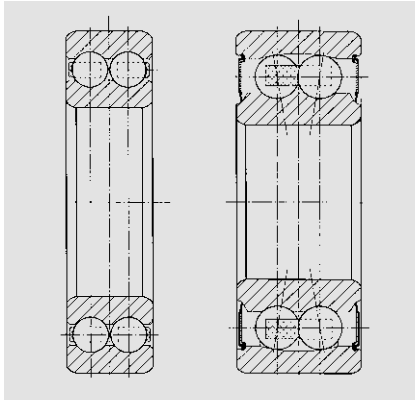
- › Diameter
- › Cone
- › Teeth
- › Groove
- › Thread

Width



Internal design
for load ratings:
DIN/ISO 76
DIN/ISO 281

Products and applications



Double Row Ball Bearings

30 mm–180 mm external diameter
(Deep Groove, Angular Contact and Self Aligning Ball Bearings and various versions)

Deep Groove Ball Bearings in:

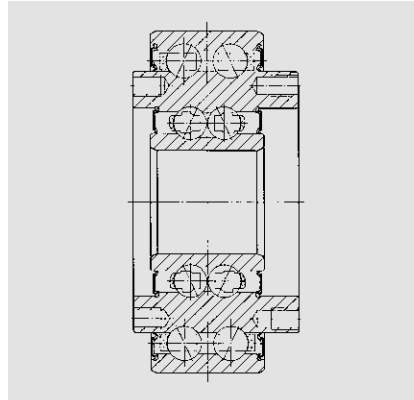
- › Wheel Bearings
- › Belt Tensioners
- › Fans

Angular Contact Ball Bearings in:

- › The Automobile Industry
- › Shaft Encoders
- › Gearboxes
- › Wood Processing Machines
- › Compressors
- › Mast Guide Rollers
- › Pumps
- › Wheel Bearings
- › Belt-Tensioners
- › Tachometers

Self Aligning Ball Bearings in:

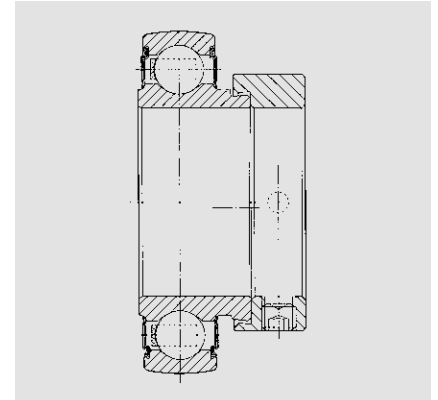
- › Blowers
- › Wood Processing Machines
- › Agricultural Machines
- › Extraction Fans
- › Textile Machines
- › Rollers



Double Row Customized Ball Bearings

for applications such as the in-house design of double row clutch-release bearings based on standard bearing or new designs:

- › Wire-Straightening Machines
- › Electromagnetic clutches (for example)
- › Conveyor Equipment
- › Lifting Equipment
- › Wood Processing Machines
- › Chain Pulleys
- › Pulleys
- › Pulleys for overhead chain conveyors
- › Linear Guides
- › Rope Pulleys
- › All types of Tension Pulleys



Radial Insert Bearing with outer ring

for harvesting machines (special designs, suitable for applications where there is high exposure to contamination and for high-pressure cleaning)

- › Conveyor Belts
- › Housed Bearing Units
- › Chain Conveyors
- › Agriculture Machines
- › Support Rollers
- › Fans



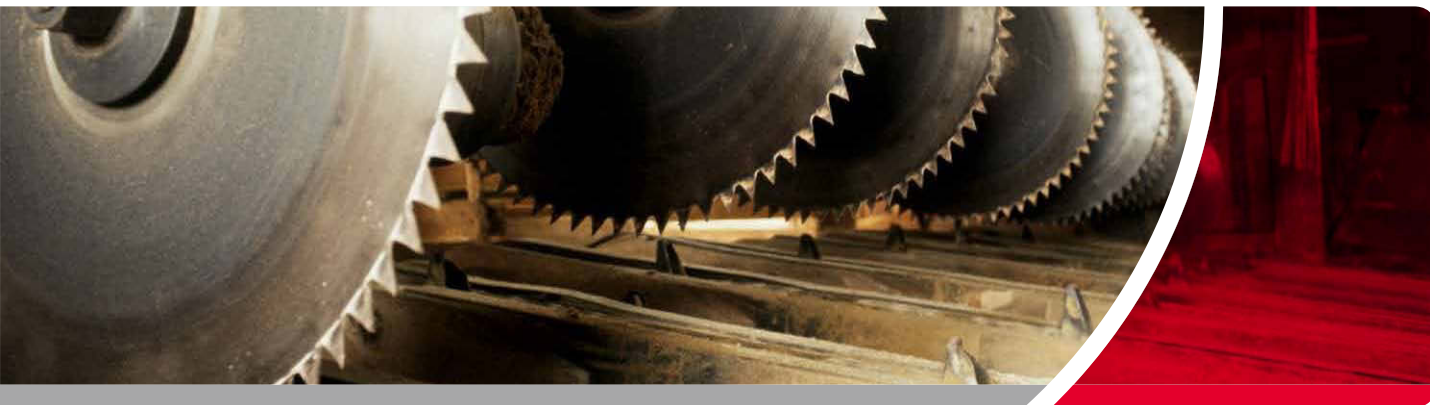
Standard Production Program

Basic Types	Open	ZR	ZZR	RSR	2RSR	N, NR	K	TNG-Cage	J-Cage	C2, C3
1201-1203	●							●	○	●
1204-1213	●						●	●	○	●
1214	○						○	○	○	○
1215	●						●	●	○	●
1302-1303	●							●	○	●
1304-1311	●						●	●	○	●
1312	●						●		●	●
2201-2203	●				●			●	○	●
2204-2213	●				●		●	●	○	●
2302-2303	●				●			●	○	●
2304	●						●		●	●
2304	●				●			●		●
2305-2313	●				●		●	●	○	●
2314	●						●		●	●
11204-11212	●							●	○	●
11305-11310	●							●	○	●
11504-11510	●							●	○	●
3200B-3218B	●	●	●	●	●	●		●		●
3301B-3315B	●	●	●	●	●	●		●		●
3200-3214	○					○			○	○
3302-3313	○					○			○	○
3314	●					●			●	●
LB3200B-LB3207B			●		●			●		
LZ3200B-KZ3207B			●		●			●		
4200-4218	●							●	○	●
4302-4315	●							●	○	●

Special bearings on enquiry
 ● Standard
 ○ on enquiry

Self Aligning Ball Bearings





Self Aligning Ball Bearings are double row bearings with a spherical outer ring raceway. The bearings therefore facilitate angle adjustment and are suitable for compensating for angular misalignment.

Self Aligning Ball Bearings are manufactured with cylindrical and tapered bores. The bearings with tapered bore are predominantly fitted to shafts with adapter sleeves.

The cages of these bearings are normally made of glass-fibre reinforced Polyamide 66. Bearings with these cages are marked with the designation "TNG". The cages of some of the small bearings are made of Polyamide 66 without glass-fibre reinforcement. These are marked with the designation "TN".

A very few bearings (Version J) are mass produced with cages made of pressed steel. The bearings which are normally fitted with plastic cages are also available on request with cages made of pressed steel "J".

Series 22.. and 23.. Self Aligning Bearings are also available sealed on both sides. These bearings are marked with the designation "2RS".

Tolerances

The bearings are only manufactured to the standard tolerance P0.

Bearing clearance

Self Aligning Bearings with cylindrical bores are normally manufactured with standard radial clearance C0 and those with a tapered bore with radial clearance C3. Bearings with other clearances are available on enquiry. The clearances can be found in the table on the next page.

Self Aligning Ball Bearings

Seals

NSK manufactures Series 22.. and 23.. Self Aligning Ball Bearings, not only as an open version but also with seals on both sides of the bearing. These seals are made of nitrile rubber and are reinforced with a steel disc embedded in the rubber. The seals are fixed in the outer ring and seal against the inner ring with a friction sealing lip.

Sealed Self Aligning Ball Bearings are filled with enough grease at the factory to last the normal life span of the bearing. The bearings are therefore maintenance free. Note that sealed Self Aligning Bearings have a lower load-carrying capacity than open bearings of the same type. During installation, it is essential that they are not twisted, as otherwise the seals may be forced out of position.

Angle adjustment facility

Self Aligning Bearings facilitate angle adjustment. The permitted angle of tilt from the central position for Series 12.. and 22.. open bearings is 2.5° and for Series 13.. and 23.. is 3°. With sealed bearings, the permitted angle of tilt is 1.5°.

Dynamic equivalent bearing load

$$P = F_r + Y_1 \cdot F_a \quad [\text{kN}] \text{ for } F_a/F_r \leq e$$
$$P = 0.65 \cdot F_r + Y_2 \cdot F_a \quad [\text{kN}] \text{ for } F_a/F_r > e$$

The factors e , Y_1 and Y_2 can be found in the bearing tables.

Basic rating life

$$L_h = \frac{1,000,000}{n \cdot 60} \cdot \left(\frac{C}{P} \right)^3 \quad (\text{Running hours})$$

$$f_h = f_n \cdot \frac{C}{P} \quad (\text{Factors } f_h \text{ and } f_n \text{ see tables on p. 40/41})$$

Static equivalent bearing load

$$P_0 = F_r + Y_0 \cdot F_a \quad [\text{kN}]$$

The factor Y_0 can be found in the bearing tables.

Basic static load rating

$$S_0 = \frac{C_0}{P_0}$$

Radial bearing clearance of Self Aligning Ball Bearings with cylindrical bore without load

Rated size of bore (mm)	above	6	10	14	18	24	30	40	50
	up to	10	14	18	24	30	40	50	65
C2	min.	2	2	3	4	5	6	6	7
	max.	9	10	12	14	16	18	19	21
C0 Standard	min.	6	6	8	10	11	13	14	16
	max.	17	19	21	23	24	29	31	36
C3	min.	12	13	15	17	19	23	25	30
	max.	25	26	28	30	35	40	44	50
C4	min.	19	21	23	25	29	34	37	45
	max.	33	35	37	39	46	53	57	69
C5	min.	27	30	32	34	40	46	50	62
	max.	42	48	50	52	58	66	71	88

Note: Bearing clearances in μm

Radial bearing clearance of Self Aligning Ball Bearings with tapered bore without load

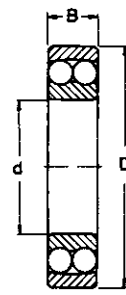
Rated size of bore (mm)	above	18	24	30	40	50
	up to	24	30	40	50	65
C2	min.	7	9	12	14	18
	max.	17	20	24	27	32
C0	min.	13	15	19	22	27
	max.	26	28	35	39	47
C3 Standard	min.	20	23	29	33	41
	max.	33	39	46	52	61
C4	min.	28	33	40	45	56
	max.	42	50	59	65	80
C5	min.	37	44	52	58	73
	max.	55	62	72	79	99

Note: Bearing clearances in μm

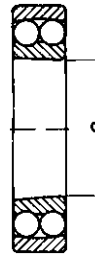
Self Aligning Ball Bearings

Bore 10 – 75 mm

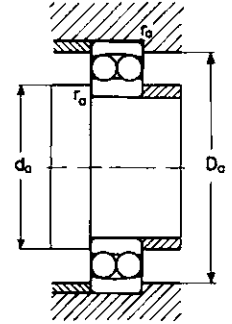
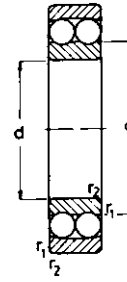
Dimensions				Abbreviation for		Load ratings		Speed limits		Abutment dimensions			Factors				Weight	Abbreviation
d	D	B	r _{1,2} min	cylindrical bore	tapered bore	dyn. C	stat. C ₀	Grease	Oil	d _a min	D _a max	r _a max	e	Y ₁	Y ₂	Y ₀		
mm								kN		min ⁻¹		mm				F _a /F _r ≤ e	F _a /f _r > e	
10	30	9	0.6	1200TN	—	5.50	1.53	24,000	30,000	14.0	26.0	0.6	0.32	2.0	3.00	2.1	0.034	1200TN
	30	14	0.6	2200TN	—	7.20	2.04	24,000	30,000	14.0	26.0	0.6	0.66	1.0	1.50	1.0	0.047	2200TN
12	32	10	0.6	1201TNG	—	5.60	1.27	24,000	30,000	16.0	28.0	0.6	0.37	1.7	2.60	1.8	0.040	1201TNG
	32	14	0.6	2201ETNG	—	9.00	1.96	20,000	26,000	16.0	28.0	0.6	0.53	1.2	1.85	1.3	0.053	2201ETNG
	37	12	1.0	1301TN	—	9.50	2.16	18,000	22,000	17.0	32.0	1.0	0.35	1.8	2.80	1.9	0.067	1301TN
15	35	11	0.6	1202TNG	—	7.50	1.76	20,000	26,000	19.0	31.0	0.6	0.34	1.9	2.90	2.0	0.049	1202TNG
	35	14	0.6	2202ETNG	—	9.15	2.08	19,000	24,000	19.0	31.0	0.6	0.46	1.4	2.10	1.4	0.060	2202ETNG
	42	13	1.0	1302TN	—	9.50	2.28	17,000	20,000	20.0	37.0	1.0	0.35	1.8	2.80	1.9	0.094	1302TN
	42	17	1.0	2302ETNG	—	12.00	2.90	16,000	19,000	20.0	37.0	1.0	0.51	1.2	1.90	1.3	0.110	2302ETNG
17	40	12	0.6	1203TNG	—	8.00	2.04	18,000	22,000	21.0	36.0	0.6	0.33	1.9	3.00	2.0	0.073	1203TNG
	40	16	0.6	2203ETNG	—	11.40	2.75	16,000	19,000	21.0	36.0	0.6	0.46	1.4	2.10	1.4	0.088	2203ETNG
	47	14	1.0	1303TN	—	12.50	3.20	15,000	18,000	22.0	42.0	1.0	0.32	1.9	3.00	2.0	0.130	1303TN
	47	19	1.0	2303TN	—	14.30	3.55	14,000	17,000	22.0	42.0	1.0	0.53	1.2	1.90	1.3	0.160	2303TN
20	47	14	1.0	1204TNG	1204KTNGC3	10.00	2.65	15,000	18,000	25.0	42.0	1.0	0.28	2.2	3.50	2.3	0.120	1204TNG
	47	18	1.0	2204ETNG	2204EKTNGC3	14.30	3.55	14,000	17,000	25.0	42.0	1.0	0.44	1.5	2.20	1.5	0.140	2204ETNG
	52	15	1.1	1304TNG	1304KTNGC3	12.50	3.35	13,000	16,000	26.5	45.5	1.0	0.29	2.2	3.30	2.3	0.160	1304TNG
	52	21	1.1	2304J	2304KJ3	18.00	4.65	13,000	16,000	26.5	45.5	1.0	0.51	1.2	1.90	1.3	0.210	2304J
25	52	15	1.0	1205TNG	1205KTNGC3	12.20	3.35	13,000	16,000	30.0	47.0	1.0	0.27	2.4	3.70	2.5	0.140	1205TNG
	52	18	1.0	2205ETNG	2205EKTNGC3	17.00	4.40	12,000	15,000	30.0	47.0	1.0	0.35	1.8	2.80	1.9	0.160	2205ETNG
	62	17	1.1	1305TNG	1305KTNGC3	18.00	5.00	11,000	14,000	31.5	55.5	1.0	0.28	2.3	3.50	2.4	0.260	1305TNG
	62	24	1.1	2305TNG	2305KTNGC3	24.50	6.55	10,000	13,000	31.5	55.5	1.0	0.48	1.3	2.00	1.4	0.340	2305TNG
30	62	16	1.0	1206TNG	1206KTNGC3	15.60	4.65	11,000	14,000	35.0	57.0	1.0	0.25	2.5	3.90	2.7	0.220	1206TNG
	62	20	1.0	2206ETNG	2206EKTNGC3	25.50	6.95	9,500	12,000	35.0	57.0	1.0	0.30	2.1	3.30	2.2	0.260	2206ETNG
	72	19	1.1	1306TNG	1306KTNGC3	21.20	6.30	9,000	11,000	36.5	65.5	1.0	0.26	2.4	3.70	2.5	0.390	1306TNG
	72	27	1.1	2306TNG	2306KTNGC3	31.50	8.65	8,500	10,000	36.5	65.5	1.0	0.45	1.4	2.20	1.5	0.500	2306TNG
35	72	17	1.1	1207TNG	1207KTNGC3	16.00	5.20	9,500	12,000	41.5	65.5	1.0	0.22	2.8	4.30	2.9	0.320	1207TNG
	72	23	1.1	2207ETNG	2207EKTNGC3	32.00	9.00	8,000	9,500	41.5	65.5	1.0	0.30	2.1	3.30	2.2	0.400	2207ETNG
	80	21	1.5	1307TNG	1307KTNGC3	25.00	8.00	8,000	9,500	43.0	72.0	1.5	0.26	2.5	3.80	2.6	0.510	1307TNG
	80	31	1.5	2307TNG	2307KTNGC3	39.00	11.20	7,500	9,000	43.0	72.0	1.5	0.47	1.4	2.10	1.4	0.680	2307TNG
40	80	18	1.1	1208TNG	1208KTNGC3	19.30	6.55	8,500	10,000	46.5	73.5	1.0	0.22	2.9	4.5	3.0	0.420	1208TNG
	80	23	1.1	2208ETNG	2208EKTNGC3	31.50	9.50	7,500	9,000	46.5	73.5	1.0	0.26	2.4	3.8	2.5	0.510	2208ETNG
	90	23	1.5	1308TNG	1308KTNGC3	29.00	9.65	7,000	8,500	48.0	82.0	1.5	0.25	2.5	3.9	2.6	0.720	1308TNG
	90	33	1.5	2308TNG	2308KTNGC3	45.00	13.40	6,700	8,000	48.0	82.0	1.5	0.43	1.5	2.3	1.5	0.93	2308TNG
45	85	19	1.1	1209TNG	1209KTNGC3	22.00	7.35	7,500	9,000	51.5	78.5	1.0	0.21	3.0	4.7	3.2	0.47	1209TNG
	85	23	1.1	2209ETNG	2209EKTNGC3	28.00	9.00	7,000	8,500	51.5	78.5	1.0	0.26	2.4	3.8	2.5	0.55	2209ETNG
	100	25	1.5	1309TNG	1309KTNGC3	38.00	12.90	6,300	7,500	53.0	92.0	1.5	0.25	2.5	3.9	2.6	0.96	1309TNG
	100	36	1.5	2309TNG	2309KTNGC3	54.00	16.30	6,000	7,000	53.0	92.0	1.5	0.43	1.5	2.3	1.6	1.25	2309TNG
50	90	20	1.1	1210TNG	1210KTNGC3	22.80	8.15	7,000	8,500	56.5	83.5	1.0	0.19	3.2	4.9	3.3	0.53	1210TNG
	90	23	1.1	2210ETNG	2210EKTNGC3	28.00	9.50	6,700	8,000	56.5	83.5	1.0	0.22	2.6	4.1	3.7	0.59	2210ETNG
	110	27	2.0	1310TNG	1310KTNGC3	41.50	14.30	5,600	6,700	59.0	101.0	2.0	0.24	2.6	4.0	2.7	1.20	1310TNG
	110	40	2.0	2310TNG	2310KTNGC3	64.00	20.00	5,300	6,300	59.0	101.0	2.0	0.43	1.5	2.3	1.5	1.65	2310TNG



Cylindrical bore



Tapered bore (Taper 1:12)

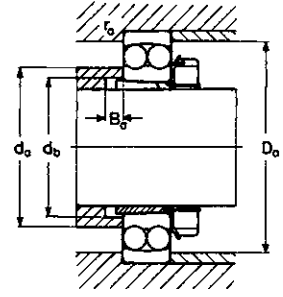
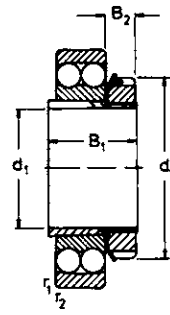
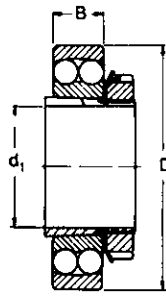


Dimensions				Abbreviation for		Load ratings		Speed limits		Abutment dimensions			Factors				Weight	Abbreviation
d	D	B	r _{1,2}	cylindrical bore	tapered bore	dyn. C	stat. C ₀	Grease	Oil	d _a min	D _a max	r _a max	e	Y ₁	Y ₂	Y ₀		
mm								kN		min ⁻¹		mm				F _a /F _r ≤ e	F _a /f _r > e	
55	100	21	1.5	1211TNG	1211KTNGC3	27.00	10.00	6,300	7,500	63.0	92.0	1.5	0.19	3.3	5.1	3.5	0.71	1211TNG
	100	25	1.5	2211ETNG	2211EKTNGC3	39.00	12.70	5,600	6,700	63.0	92.0	1.5	0.22	2.9	4.5	2.1	0.81	2211ETNG
	120	29	2.0	1311TNG	1311KTNGC3	51.00	18.00	5,000	6,000	64.0	111.0	2.0	0.24	2.7	4.1	2.8	1.60	1311TNG
	120	43	2.0	2311TNG	2311KTNGC3	75.00	23.60	4,800	5,600	64.0	111.0	2.0	0.42	1.5	2.3	1.6	2.10	2311TNG
60	110	22	1.5	1212TNG	1212KTNGC3	30.00	11.60	5,600	6,700	68.5	101.5	1.5	0.18	3.5	5.4	3.6	0.90	1212TNG
	110	28	1.5	2212ETNG	2212EKTNGC3	47.50	16.60	5,300	6,300	68.5	101.5	1.5	0.23	2.7	4.2	2.8	1.10	2212ETNG
	130	31	2.0	1312J	1312KJC3	57.50	20.80	4,800	5,600	72.0	118.0	2.0	0.23	2.8	4.3	2.9	1.95	1312TNG
	130	46	2.0	2312J	2312KJC3	88.50	28.30	4,300	5,300	72.0	118.0	2.0	0.40	1.6	2.4	1.7	2.60	2312TNG
65	120	23	1.5	1213TNG	1213KTNGC3	31.00	12.50	5,300	6,300	73.0	112.0	1.5	0.18	3.6	5.5	3.7	1.15	1213TNG
	120	31	1.5	2213ETNG	2213EKTNGC3	57.00	19.30	4,500	5,300	73.0	112.0	1.5	0.23	2.8	4.3	2.9	1.45	2213ETNG
	140	33	2.1	1313J	1313KTNGC3	62.50	22.90	4,300	5,300	76.0	128.0	2.0	0.23	2.8	4.3	2.9	2.45	1313J
	140	48	2.1	2313J	2313KTNGC3	96.50	32.50	4,000	4,800	76.0	128.0	2.0	0.39	1.6	2.5	1.7	3.25	2313J
70	125	24	1.5	1214TNG	—	34.50	13.70	5,000	6,000	78.0	116.5	1.5	0.19	3.3	5.1	3.5	1.25	1214TNG
	125	31	1.5	2214J	—	44.00	17.10	4,500	5,600	78.0	116.5	1.5	0.26	2.4	3.7	2.5	1.50	2214J
	150	35	2.1	1314J	—	67.50	25.10	4,000	5,000	81.0	138.0	2.0	0.22	2.8	4.4	3.0	3.00	1314J
	150	51	2.1	2314J	—	111.00	37.50	3,600	4,300	81.0	138.0	2.0	0.38	1.7	2.6	1.8	4.25	2314J
75	130	25	1.5	1215TNG	1215KTNGC3	39.00	15.60	4,800	5,600	83.5	121.5	1.5	0.17	3.6	5.6	3.8	1.35	1215TNG
	130	31	1.5	2215J	2215KJC3	44.50	17.80	4,300	5,300	83.5	121.5	1.5	0.25	2.5	3.9	2.6	1.60	2215J
	160	37	2.1	1315J	1315KJC3	80.00	30.00	3,800	4,500	87.0	148.0	2.0	0.22	2.8	4.4	3.0	3.55	1315J
	160	55	2.1	2315J	2315KJC3	125.00	43.00	3,400	4,300	87.0	148.0	2.0	0.38	1.6	2.6	1.7	5.15	2315J

Self Aligning Ball Bearings

With adapter sleeve | Shaft 17 – 65 mm

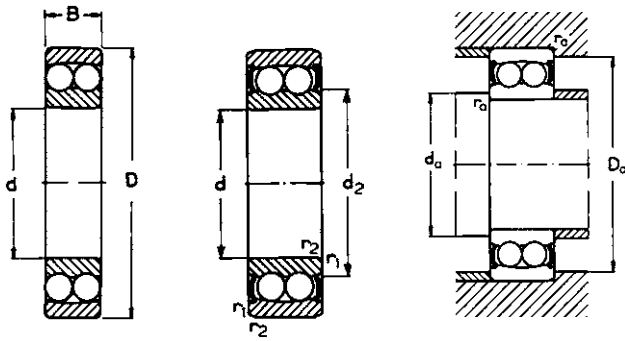
Dimensions				Abbreviation for		Load ratings		Speed limits		
d ₁ Shaft	D	B	r _{1,2} min	Bearing	Sleeve	dyn. C	stat. C ₀	Grease	Oil	
mm						kN		min ⁻¹		
17	47	14	1.0	1204KTNGC3	H204	10.00	2.65	15,000	18,000	
	47	18	1.0	2204EKTNGC3	H304	14.30	3.55	14,000	17,000	
	52	15	1.1	1304KTNGC3	H304	12.50	3.35	13,000	16,000	
	52	21	1.1	2304KJC3	H2304	18.00	4.65	13,000	16,000	
20	52	15	1.0	1205KTNGC3	H205	12.20	3.35	13,000	16,000	
	52	18	1.0	2205EKTNGC3	H305	17.00	4.40	12,000	15,000	
	62	17	1.1	1305KTNGC3	H305	18.00	5.00	11,000	14,000	
	62	24	1.1	2305KTNGC3	H2305	24.50	6.55	10,000	13,000	
25	62	16	1.0	1206KTNGC3	H206	15.60	4.65	11,000	14,000	
	62	20	1.0	2206EKTNGC3	H306	25.50	6.95	9,500	12,000	
	72	19	1.1	1306KTNGC3	H306	21.20	6.30	9,000	11,000	
	72	27	1.1	2306KTNGC3	H2306	31.50	8.65	8,500	10,000	
30	72	17	1.1	1207KTNGC3	H207	16.00	5.20	9,500	12,000	
	72	23	1.1	2207EKTNGC3	H307	32.00	9.00	8,000	9,500	
	80	21	1.5	1307KTNGC3	H307	25.00	8.00	8,000	9,500	
	80	31	1.5	2307KTNGC3	H2307	39.00	11.20	7,500	9,000	
35	80	18	1.1	1208KTNGC3	H208	19.30	6.55	8,500	10,000	
	80	23	1.1	2208EKTNGC3	H308	31.50	9.50	7,500	9,000	
	90	23	1.5	1308KTNGC3	H308	29.00	9.65	7,000	8,500	
	90	33	1.5	2308KTNGC3	H2308	45.00	13.40	6,700	8,000	
40	85	19	1.1	1209KTNGC3	H209	22.00	7.35	7,500	9,000	
	85	23	1.1	2209EKTNGC3	H309	28.00	9.00	7,000	8,500	
	100	25	1.5	1309KTNGC3	H309	38.00	12.90	6,300	7,500	
	100	36	1.5	2309KTNGC3	H2309	54.00	16.30	6,000	7,000	
45	90	20	1.1	1210KTNGC3	H210	22.90	8.15	7,000	8,500	
	90	23	1.1	2210EKTNGC3	H310	28.00	9.50	6,700	8,000	
	110	27	2.0	1310KTNGC3	H310	41.50	14.30	5,600	6,700	
	110	40	2.0	2310KTNGC3	H2310	64.00	20.00	5,300	6,300	
50	100	21	1.5	1211KTNGC3	H211	27.00	10.00	6,300	7,500	
	100	25	1.5	2211EKTNGC3	H311	39.00	12.70	5,600	6,700	
	120	29	2.0	1311KTNGC3	H311	51.00	18.00	5,000	6,000	
	120	43	2.0	2311KTNGC3	H2311	75.00	23.60	4,800	5,600	
55	110	22	1.5	1212KTNGC3	H212	30.00	11.60	5,600	6,700	
	110	28	1.5	2212EKTNGC3	H312	47.50	16.60	5,300	6,300	
	130	31	2.0	1312KJC3	H312	57.50	20.80	4,800	5,600	
	130	46	2.0	2312KJC3	H2312	88.50	28.30	4,300	5,300	
60	120	23	1.5	1213KTNGC3	H213	31.00	12.50	5,300	6,300	
	120	31	1.5	2213EKTNGC3	H313	57.00	19.30	4,500	5,300	
	140	33	2.1	1313KJC3	H313	62.50	22.90	4,300	5,300	
	140	48	2.1	2313KJC3	H2313	96.50	32.50	4,000	4,800	
65	130	25	1.5	1215KTNGC3	H215	39.00	15.60	4,800	5,600	
	130	31	1.5	2215KJC3	H315	44.50	17.80	4,300	5,300	
	160	37	2.1	1315KJC3	H315	80.00	30.00	3,800	4,500	
	160	55	2.1	2315KJC3	H2315	125.00	43.00	3,400	4,300	



	Dimensions (mm)			Abutment dimensions (mm)					Factors				Weight		Abbreviation
	d ₃	B ₁	B ₂	d _a	d _b	D _a	B _a	r _a	e	Y ₁	Y ₂	Y ₀	Bearing	Sleeve	
				max	min	max	min	max		Fa/fr ≤ e	Fa/fr > e		kg		
	32	24	7	27	23	42.0	5	1.0	0.28	2.2	3.5	2.3	0.12	0.041	1204KTNGC3
	32	28	7	27	23	42.0	5	1.0	0.44	1.5	2.2	1.5	0.14	0.045	2204EKTNGC3
	32	28	7	30	23	45.5	8	1.0	0.29	2.2	3.3	2.3	0.16	0.045	1304KTNGC3
	32	31	7	28	24	45.5	5	1.0	0.51	1.2	1.9	1.3	0.21	0.049	2304KJC3
	38	26	8	32	28	47.0	5	1.0	0.27	2.4	3.7	2.5	0.14	0.070	1205KTNGC3
	38	29	8	32	28	47.0	5	1.0	0.35	1.8	2.8	1.9	0.16	0.075	2205EKTNGC3
	38	29	8	35	28	55.5	6	1.0	0.28	2.3	3.5	2.4	0.26	0.075	1305KTNGC3
	38	35	8	34	30	55.5	5	1.0	0.48	1.3	2.0	1.4	0.34	0.087	2305KTNGC3
	45	27	8	38	33	57.0	5	1.0	0.25	2.5	3.9	2.7	0.22	0.100	1206KTNGC3
	45	31	8	39	33	57.0	5	1.0	0.30	2.1	3.3	2.2	0.24	0.110	2206EKTNGC3
	45	31	8	42	33	65.5	6	1.0	0.26	2.4	3.7	2.5	0.38	0.110	1306KTNGC3
	45	38	8	40	35	65.5	5	1.0	0.45	1.4	2.2	1.5	0.49	0.130	2306KTNGC3
	52	29	9	45	38	65.5	5	1.0	0.22	2.8	4.3	2.9	0.32	0.130	1207KTNGC3
	52	35	9	44	39	65.5	5	1.0	0.30	2.1	3.3	2.2	0.40	0.140	2207EKTNGC3
	52	35	9	49	39	72.0	7	1.5	0.26	2.5	3.8	2.6	0.50	0.140	1307KTNGC3
	52	43	9	45	40	72.0	5	1.5	0.47	1.4	2.1	1.4	0.66	0.170	2307KTNGC3
	58	31	10	52	43	73.5	6	1.0	0.22	2.9	4.5	3.0	0.41	0.170	1208KTNGC3
	58	36	10	50	44	73.5	6	1.0	0.26	2.4	3.8	2.5	0.49	0.190	2208EKTNGC3
	58	36	10	55	44	82.0	6	1.5	0.25	2.5	3.9	2.6	0.70	0.190	1308KTNGC3
	58	46	10	51	45	82.0	6	1.5	0.43	1.5	2.3	1.5	0.90	0.220	2308KTNGC3
	65	33	11	57	48	78.5	6	1.0	0.21	3.0	4.7	3.2	0.46	0.230	1209KTNGC3
	65	39	11	56	50	78.5	8	1.0	0.26	2.4	3.8	2.5	0.53	0.250	2209EKTNGC3
	65	39	11	61	50	92.0	6	1.5	0.25	2.5	3.9	2.6	0.94	0.250	1309KTNGC3
	65	50	11	57	50	92.0	6	1.5	0.43	1.5	2.3	1.6	1.20	0.280	2309KTNGC3
	70	35	12	62	53	83.5	6	1.0	0.20	3.2	4.9	3.3	0.52	0.270	1210KTNGC3
	70	42	12	61	55	83.5	10	1.0	0.24	2.6	4.1	2.7	0.58	0.300	2210EKTNGC3
	70	42	12	68	55	101.0	6	2.0	0.24	2.6	4.0	2.7	1.20	0.300	1310KTNGC3
	70	55	12	63	56	101.0	6	2.0	0.43	1.5	2.3	1.5	1.60	0.360	2310KTNGC3
	75	37	12	69	60	92.0	7	1.5	0.19	3.3	5.1	3.5	0.69	0.310	1211KTNGC3
	75	45	12	68	60	92.0	11	1.5	0.22	2.9	4.5	2.1	0.79	0.390	2211EKTNGC3
	75	45	12	74	60	111.0	7	2.0	0.24	2.7	4.1	2.8	1.55	0.390	1311KTNGC3
	75	59	12	69	61	111.0	7	2.0	0.42	1.5	2.3	1.6	2.05	0.420	2311KTNGC3
	80	38	13	75	64	102.0	7	1.5	0.18	3.5	5.4	3.6	0.90	0.350	1212KTNGC3
	80	47	13	73	65	102.0	9	1.5	0.23	2.7	4.2	2.8	1.10	0.390	2212EKTNGC3
	80	47	13	83	65	119.0	7	2.0	0.23	2.8	4.3	2.9	1.95	0.390	1312KJC3
	80	62	13	74	66	119.0	7	2.0	0.40	1.6	2.4	1.7	2.60	0.490	2312KJC3
	85	40	14	83	70	112.0	7	1.5	0.18	3.6	5.5	3.7	1.15	0.400	1213KTNGC3
	85	50	14	79	70	112.0	9	1.5	0.23	2.8	4.3	2.9	1.45	0.460	2213EKTNGC3
	85	50	14	89	70	129.0	7	2.0	0.23	2.8	4.3	2.9	2.45	0.460	1313KJC3
	85	65	14	82	72	129.0	7	2.0	0.39	1.6	2.5	1.7	3.25	0.550	2313KJC3
	98	43	15	92	80	122.0	7	1.5	0.17	3.6	5.6	3.8	1.35	0.710	1215KTNGC3
	98	55	15	90	80	122.0	13	1.5	0.25	2.5	3.9	2.6	1.60	0.830	2215KJC3
	98	55	15	100	80	149.0	7	2.0	0.22	2.8	4.4	3.0	3.55	0.830	1315KJC3
	98	73	15	94	82	149.0	7	2.0	0.38	1.6	2.6	1.7	5.15	1.050	2315KJC3

Self Aligning Ball Bearings

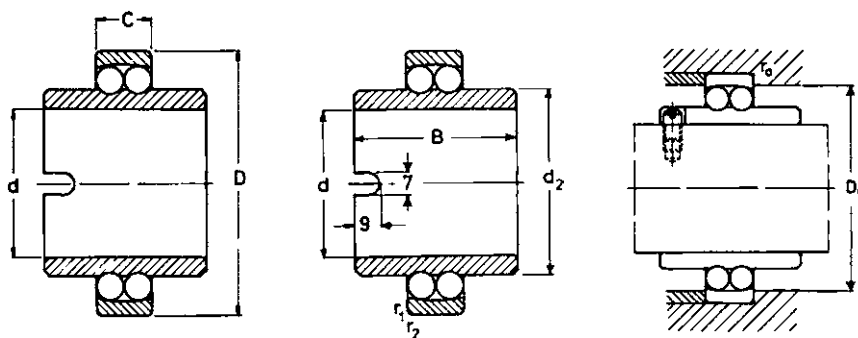
Sealed on both sides | Bore 12 – 65 mm



Dimensions				Abbreviation		Load ratings		Speed limits Grease	Abutment dimensions			Factors				Weight kg	Abbreviation
d Shaft	D	B	r _{1,2} min	Cylindrical bore	Tapered bore	dyn. C	stat. C ₀		d _a min	D _a max	r _a max	e	Y ₁	Y ₂	Y ₀		
mm						kN		min ⁻¹	mm				Fa/Fr ≤ e	Fa/fr > e			
12	32	14	0.6	2201-2RSTNG	—	5.60	1.27	16,000	16.0	28.0	0.6	0.37	1.7	2.6	1.8	0.06	2201-2RSTNG
15	35	14	0.6	2202-2RSTNG	—	7.50	1.76	15,000	19.0	31.0	0.6	0.34	1.9	2.9	2.0	0.06	2202-2RSTNG
	42	17	1.0	2302-2RSTN	—	9.50	2.28	15,000	20.0	37.0	1.0	0.35	1.8	2.8	1.9	0.13	2302-2RSTN
17	40	16	0.6	2203-2RSTNG	—	8.00	2.04	14,000	21.0	36.0	0.6	0.33	1.9	3.0	2.0	0.10	2203-2RSTNG
	47	19	1.0	2303-2RSTN	—	12.50	3.20	11,000	22.0	42.0	1.0	0.32	1.9	3.0	2.0	0.18	2303-2RSTN
20	47	18	1.0	2204-2RSTNG	2204K2RSTNGC3	10.00	2.65	11,000	25.0	42.0	1.0	0.28	2.2	3.5	2.3	0.16	2204-2RSTNG
	52	21	1.1	2304-2RSTNG	2304K2RSTNGC3	12.50	3.35	10,000	26.5	45.5	1.0	0.29	2.2	3.3	2.3	0.24	2304-2RSTNG
25	52	18	1.0	2205-2RSTNG	2205K2RSTNGC3	12.20	3.35	9,500	30.0	47.0	1.0	0.27	2.4	3.7	2.5	0.17	2205-2RSTNG
	62	24	1.1	2305-2RSTNG	2305K2RSTNGC3	18.00	5.00	8,000	31.5	55.5	1.0	0.28	2.3	3.5	2.4	0.38	2305-2RSTNG
30	62	20	1.0	2206-2RSTNG	2206K2RSTNGC3	15.60	4.65	8,000	35.0	57.0	1.0	0.25	2.5	3.9	2.7	0.28	2206-2RSTNG
	72	27	1.1	2306-2RSTNG	2306K2RSTNGC3	21.20	6.30	6,700	36.5	65.5	1.0	0.26	2.4	3.7	2.5	0.57	2306-2RSTNG
35	72	23	1.1	2207-2RSTNG	2207K2RSTNGC3	16.00	5.20	7,000	41.4	65.5	1.0	0.22	2.8	4.3	2.9	0.45	2207-2RSTNG
	80	31	1.5	2307-2RSTNG	2307K2RSTNGC3	25.00	8.00	6,000	43.0	72.0	1.5	0.26	2.5	3.8	2.6	0.79	2307-2RSTNG
40	80	23	1.1	2208-2RSTNG	2208K2RSTNGC3	19.30	6.55	6,300	46.5	73.5	1.0	0.22	2.9	4.5	3.0	0.55	2208-2RSTNG
	90	33	1.5	2308-2RSTNG	2308K2RSTNGC3	29.00	9.65	5,300	48.0	82.0	1.5	0.25	2.5	3.9	2.6	0.05	2308-2RSTNG
45	85	23	1.1	2209-2RSTNG	2209K2RSTNGC3	22.00	7.35	5,600	51.5	78.5	1.0	0.21	3.0	4.7	3.2	0.58	2209-2RSTNG
	100	36	1.5	2309-2RSTNG	2309K2RSTNGC3	38.00	12.90	4,800	53.0	92.0	1.5	0.25	2.5	3.9	2.6	0.40	2309-2RSTNG
50	90	23	1.1	2210-2RSTNG	2210K2RSTNGC3	22.80	8.15	5,300	56.5	83.5	1.0	0.20	3.2	4.9	3.3	0.63	2210-2RSTNG
	100	40	2.0	2310-2RSTNG	2310K2RSTNGC3	41.50	14.30	4,300	59.0	101.0	2.0	0.24	2.6	4.0	2.7	1.89	2310-2RSTNG
55	100	25	1.5	2211-2RSTNG	2211K2RSTNGC3	27.00	10.00	4,800	63.0	92.0	1.5	0.19	3.3	5.1	3.5	0.76	2211-2RSTNG
	120	43	2.0	2311-2RSTNG	2311K2RSTNGC3	51.00	18.00	3,800	66.0	109.0	2.0	0.24	2.7	4.1	2.8	2.37	2311-2RSTNG
60	110	28	1.5	2212-2RSTNG	2212K2RSTNGC3	30.00	11.60	4,300	68.5	101.5	1.5	0.18	3.5	5.4	3.6	1.11	2212-2RSTNG
65	120	31	1.5	2213-2RSTNG	2213K2RSTNGC3	31.00	12.40	4,000	74.0	111.0	1.5	0.18	3.6	5.5	3.7	1.53	2213-2RSTNG

Self Aligning Ball Bearings

With extended inner ring | Bore 20 – 60 mm

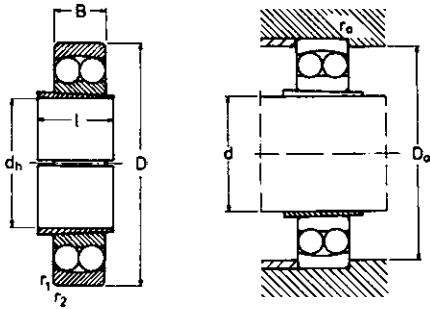


Dimensions				Abbreviation	Load ratings		Speed limits Grease	Dimensions		Abutment dimensions		Factors				Weight	Abbreviation
d	D	B	r _{1,2} min		dyn. C	stat. C ₀		d ₂	B	D _a max	r _a max	e	Y ₁	Y ₂	Y ₀		
mm					kN		min ⁻¹	mm					Fa/Fr ≤ e	Fa/fr > e		kg	
20	47	14	1.0	11204TNG	10.0	2.65	9,000	29.2	40	42.0	1.0	0.28	2.2	3.5	2.3	0.18	11204TNG
	52	15	1.0	11304TNG	12.5	3.20	8,500	31.5	44	45.5	1.0	0.29	2.2	3.3	2.3	0.28	11304TNG
25	52	15	1.0	11205TNG	12.2	3.35	8,000	33.3	44	47.0	1.0	0.27	2.4	3.7	2.5	0.22	11205TNG
	62	17	1.0	11305TNG	18.0	5.00	6,700	38.0	48	55.5	1.0	0.28	2.3	3.5	2.4	0.43	11305TNG
30	62	16	1.0	11206TNG	15.6	4.65	6,700	40.1	48	57.0	1.0	0.25	2.5	3.9	2.7	0.35	11206TNG
	72	19	1.0	11306TNG	21.2	6.30	5,600	45.0	52	65.5	1.0	0.26	2.4	3.7	2.5	0.64	11306TNG
35	72	17	1.1	11207TNG	16.0	5.20	5,600	47.7	52	65.5	1.0	0.22	2.8	4.3	2.9	0.54	11207TNG
	80	21	1.1	11307TNG	25.0	8.00	5,000	51.7	56	72.0	1.0	0.26	2.5	3.8	2.6	0.85	11307TNG
40	80	18	1.1	11208TNG	19.3	6.55	5,000	54.0	56	73.5	1.0	0.22	2.9	4.5	3.0	0.72	11208TNG
	90	23	1.1	11308TNG	29.0	9.65	4,500	57.7	58	82.0	1.0	0.25	2.5	3.9	2.6	1.12	11308TNG
45	85	19	1.1	11209TNG	22.0	7.35	4,500	57.7	58	78.5	1.0	0.21	3.0	4.7	3.2	0.77	11209TNG
	100	25	1.1	11309TNG	38.0	12.90	3,800	63.9	60	92.0	1.0	0.25	2.5	3.9	2.6	1.43	11309TNG
50	90	20	1.1	11210TNG	22.8	8.15	4,300	62.7	58	83.5	1.0	0.20	3.2	4.9	3.3	0.85	11210TNG
	110	27	1.1	11310TNG	41.5	14.30	3,600	70.3	62	83.5	1.0	0.24	2.6	4.0	2.7	1.82	11310TNG
55	100	21	1.5	11211TNG	27.0	10.00	4,000	70.3	60	92.0	1.5	0.19	3.3	5.1	3.5	1.17	11211TNG
60	110	22	1.5	11212TNG	30.0	11.60	3,600	78.0	62	102.0	1.5	0.18	3.5	5.4	3.6	1.50	11212TNG

Note: The bore tolerances do not comply with DIN 620. The bore tolerance corresponds to the tolerance zone J7.

Self Aligning Ball Bearings

Sleeve | Shaft 20 – 50 mm



Dimensions							Load ratings		Speed limits		Abutment dimensions		Factors				Weight	Abbreviation
d Shaft	d _h	D	B	l	r _{1,2} min	Abbreviation							e	Y ₁	Y ₂	Y ₀		
mm							dyn. C	stat. C ₀	Grease	Oil	D _a max	r _a max	Fa/Fr ≤ e		Fa/fr > e		kg	
20	20	47	14	23	1.0	11504TNGC3	10.0	2.65	15,000	18,000	41.0	1.0	0.28	2.2	3.5	2.3	0.120	11504TNGC3
25	25	52	15	25	1.0	11505TNGC3	12.2	3.35	13,000	16,000	46.5	1.0	0.27	2.4	3.7	2.5	0.144	11505TNGC3
30	30	62	16	25	1.0	11506TNGC3	15.6	4.65	11,000	14,000	56.5	1.0	0.25	2.5	3.9	2.7	0.227	11506TNGC3
35	35	72	17	26	1.1	11507TNGC3	16.0	5.20	9,500	12,000	65.0	1.0	0.22	2.8	4.3	2.9	0.335	11507TNGC3
40	40	80	18	27	1.1	11508TNGC3	19.3	6.55	8,500	10,000	73.0	1.0	0.22	2.9	4.5	3.0	0.435	11508TNGC3
45	45	85	19	28	1.1	11509TNGC3	22.0	7.35	7,500	9,000	78.0	1.0	0.21	3.0	4.7	3.2	0.480	11509TNGC3
50	50	90	20	30	1.1	11510TNGC3	22.8	8.15	7,000	8,500	83.0	1.0	0.20	3.2	4.9	3.3	0.540	11510TNGC3

Note: The bore of the inner ring and its 1:15 taper do not comply with DIN 616.

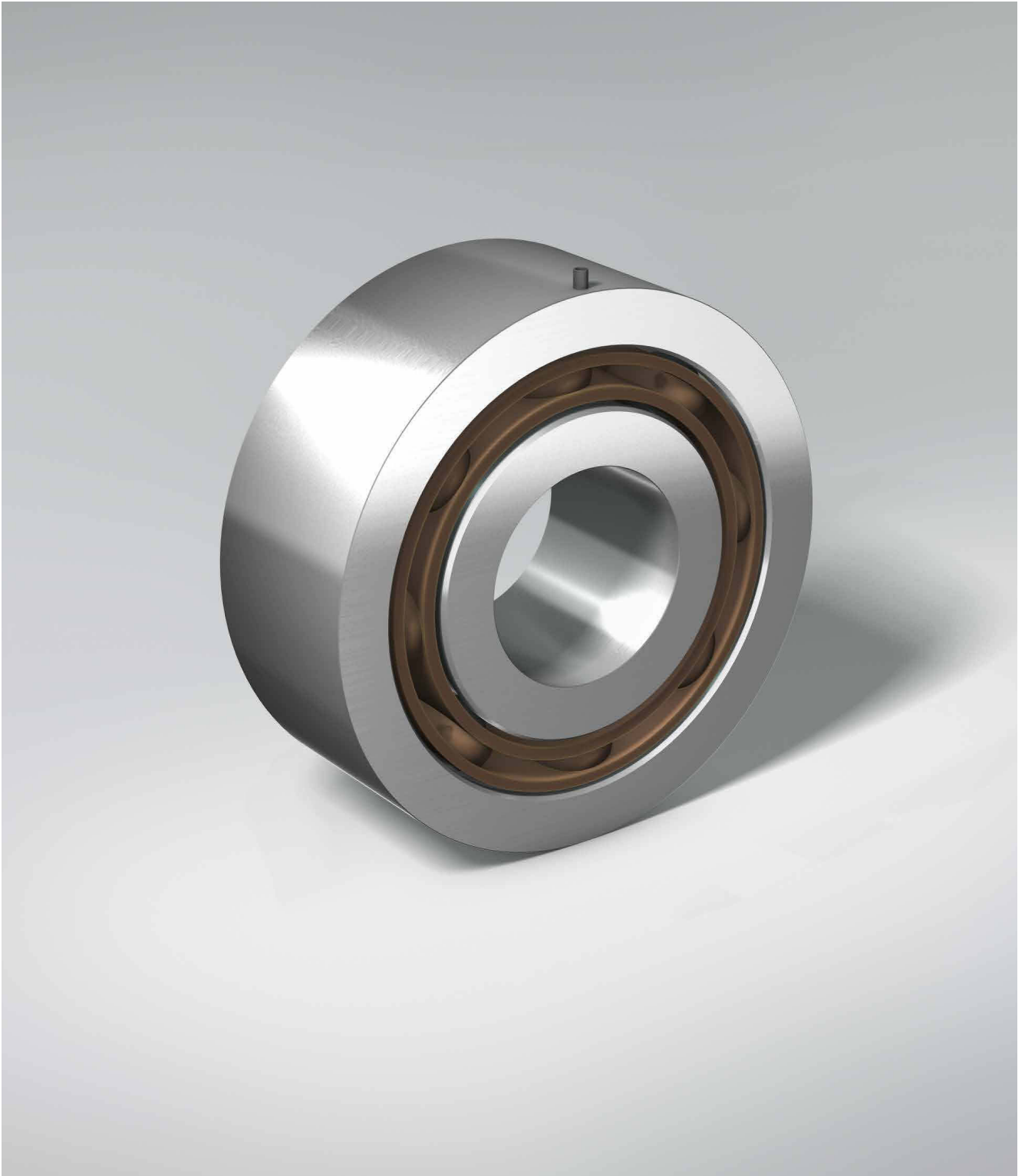
Notes

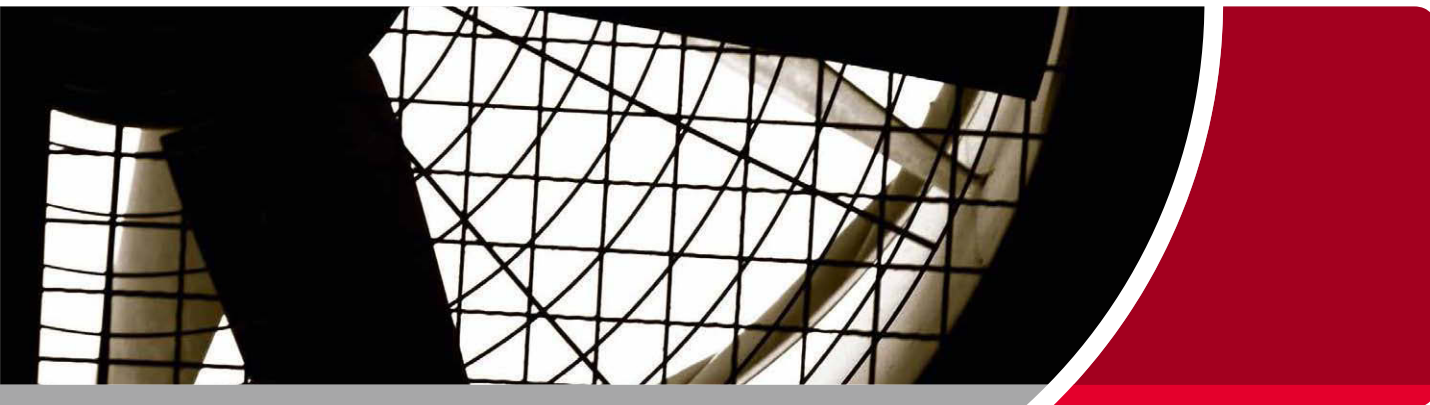


Lined area for notes, consisting of 20 horizontal lines.

Deep Groove Ball Bearings

Double Row





The structure and operation of Double Row Deep Groove Ball Bearings correspond to that of a pair of Single Row Deep Groove Ball Bearings. They should not be used where compensation for angular misalignment is required.

Standards, dimensions

DIN 625 Double Row Deep Groove Ball Bearings

Tolerances

The tolerances are stipulated in DIN 620.
Double Row Deep Groove Ball Bearings are only manufactured to standard tolerance P0.

Bearing clearance

Double Row Deep Groove Ball Bearings are normally supplied with the standard clearance C0 "Normal".
Other clearance groups are available on inquiry.

Cages

Double Row Deep Groove Ball Bearings are normally manufactured with snap cages made of glass-fiber reinforced Polyamide 66 and in a few cases, they are also provided with solid brass cages.

M solid cage made of brass,
guided in the outer ring

TNG snap cage made of glass-fiber
reinforced Polyamide 66

Bearings with cages made of glass-fiber reinforced polyamide are suitable for operating temperatures up to +120 °C.

Deep Groove Ball Bearings

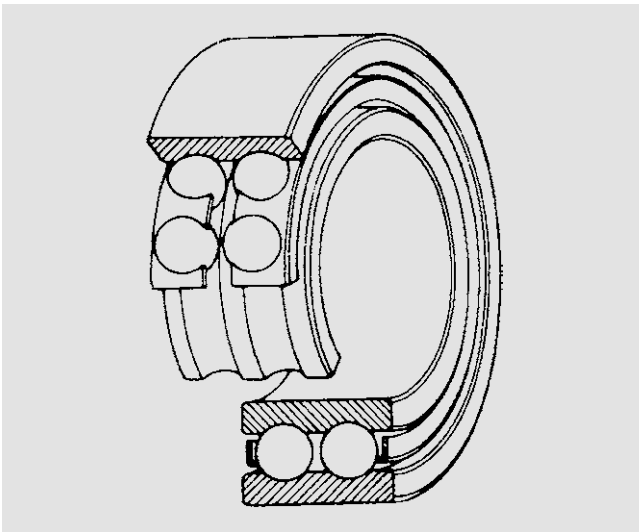
Double Row

Weights

The weights shown in the dimension tables apply to the open version of the Deep Groove Ball Bearings.

Angular adjustment facility

Because of their internal structure, Double Row Deep Groove Ball Bearings do not facilitate angular adjustment. When using these bearings, they must not be out of alignment.



Dynamic equivalent bearing load

$$P = F_r + F_a \quad (\text{Double Row Deep Groove Ball Bearings})$$

With Double Row Deep Groove Ball Bearings, it is essential that $F_a \leq 0.3 \cdot F_r$

Basic rating life

$$L_h = \frac{1,000,000}{n \cdot 60} \cdot \left(\frac{C}{P} \right)^3 \quad (\text{Running hours})$$

$$f_h = f_n \cdot \frac{C}{P} \quad (\text{Factors } f_h \text{ and } f_n, \text{ see tables on p. 40/41})$$

Static equivalent bearing load

$$P_0 = 0.6 \cdot F_r + 0.5 \cdot F_a$$

(Single and Double Row Deep Groove Ball Bearings)

If $P_0 \approx F_r$, then calculation must be with $P_0 = F_r$.

With Double Row Deep Groove Ball Bearings, it is essential that $F_a \leq 0.3 \cdot F_r$.

Basic static load rating

$$s_0 = \frac{C_0}{P_0}$$

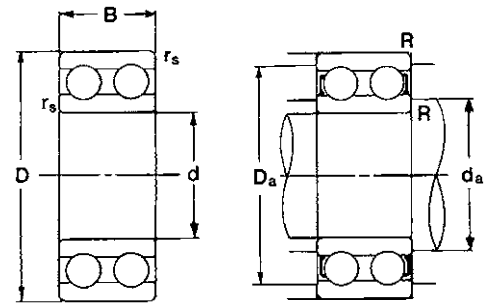
Radial bearing clearance of Single and Double Row Deep Groove Ball Bearings

Rated size of bore d (mm)		C2		C0 Standard		C3		C4		C5	
above	up to	min	max	min	max	min	max	min	max	min	max
—	10	0	7	2	13	8	23	14	29	20	37
10	18	0	9	3	18	11	25	18	33	25	45
18	24	0	10	5	20	13	28	20	36	28	48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90
65	80	1	15	10	30	25	51	46	71	65	105
80	100	1	18	12	36	30	58	53	84	75	120
100	120	2	20	15	41	36	66	61	97	90	140
120	140	2	23	18	48	41	81	71	114	105	160
140	160	2	23	18	53	46	91	81	130	120	180
160	180	2	25	20	61	53	102	91	147	135	200
180	200	2	30	25	71	63	117	107	163	150	230
200	225	2	35	28	82	73	132	120	187	—	—
225	250	2	40	31	92	87	152	140	217	—	—
250	280	2	45	36	97	97	162	152	237	—	—
280	315	2	55	42	110	110	180	175	260	—	—
315	355	3	60	50	120	120	200	200	290	—	—
355	400	3	70	60	140	140	230	230	330	—	—

Note: Bearing clearances in μm

Deep Groove Ball Bearings

Double Row | Bore 10 – 90 mm



Dimensions				Abbreviation	Load ratings		Speed limits		Abutment dimensions			Weight	Abbreviation
d	D	B	r _s min		dyn. C	stat. C ₀	Grease	Oil	d _a min	D _a max	R min		
mm					kN		min ⁻¹		mm			kg	
10	30	14	0.6	4200BTNG	9.15	5.2	18,000	24,000	14.0	26.0	0.6	0.049	4200BTNG
12	32	14	0.6	4201BTNG	9.30	5.5	16,000	20,000	16.0	28.0	0.6	0.053	4201BTNG
15	35	14	0.6	4202BTNG	10.4	6.7	14,000	18,000	19.0	31.0	0.6	0.059	4202BTNG
	42	17	1.0	4302BTNG	14.6	9.2	13,000	17,000	20.0	37.0	1.0	0.120	4302BTNG
17	40	16	0.6	4203BTNG	14.6	9.5	13,000	18,000	21.0	36.0	1.0	0.090	4203BTNG
	47	19	1.0	4303BTNG	19.6	13.2	11,000	17,000	22.0	42.0	1.0	0.160	4303BTNG
20	47	18	1.0	4204BTNG	18.0	12.7	10,000	14,000	25.0	42.0	1.0	0.140	4204BTNG
	52	21	1.1	4304BTNG	23.2	16.0	9,500	13,000	26.5	45.5	1.0	0.210	4304BTNG
25	52	18	1.0	4205BTNG	19.3	14.6	9,000	12,000	30.0	47.0	1.0	0.160	4205BTNG
	62	24	1.1	4305BTNG	31.5	22.4	8,000	10,000	31.5	55.5	1.0	0.340	4305BTNG
30	62	20	1.0	4206BTNG	26.0	20.8	7,500	9,500	35.0	57.0	1.0	0.260	4206BTNG
	72	27	1.1	4306BTNG	40.0	30.5	6,700	8,500	36.5	65.5	1.0	0.500	4306BTNG
35	72	23	1.1	4207BTNG	32.0	26.0	6,700	8,500	41.5	65.5	1.0	0.400	4207BTNG
	80	31	1.5	4307BTNG	51.0	38.0	6,300	8,000	43.0	72.0	1.5	0.690	4307BTNG
40	80	23	1.1	4208BTNG	34.0	30.0	6,000	7,500	46.5	73.5	1.0	0.500	4208BTNG
	90	33	1.5	4308BTNG	63.0	48.0	5,600	7,000	48.0	82.0	1.5	0.950	4308BTNG
45	85	23	1.1	4209BTNG	36.0	33.5	5,600	7,000	51.5	78.5	1.0	0.540	4209BTNG
	100	36	1.5	4309BTNG	72.0	60.0	4,800	6,000	53.0	92.0	1.5	1.250	4309BTNG
50	90	23	1.1	4210BTNG	37.5	36.5	5,000	6,300	56.5	83.5	1.0	0.580	4210BTNG
	110	40	2.0	4310BTNG	90.0	75.0	4,300	5,300	59.0	101.0	2.0	1.700	4310BTNG
55	100	25	1.5	4211BTNG	43.0	43.0	4,500	5,600	63.0	92.0	1.5	0.800	4211BTNG
	120	43	2.0	4311BTNG	104.0	90.0	4,000	5,000	64.0	111.0	2.0	2.150	4311BTNG
60	110	28	1.5	4212BTNG	57.0	58.5	4,000	5,000	68.0	102.0	1.5	1.100	4212BTNG
	130	46	2.1	4312BTNG	120.0	106.0	3,600	4,500	71.0	119.0	2.0	2.650	4312BTNG
65	120	31	1.5	4213BTNG	67.0	67.0	3,800	4,800	73.0	112.0	1.5	1.450	4213BTNG
	140	48	2.1	4313BTNG	129.0	98.0	3,600	4,500	76.0	129.0	2.0	3.250	4313BTNG
70	125	31	1.5	4214BTNG	69.5	73.5	3,600	4,500	78.0	117.0	1.5	1.500	4214BTNG
	150	51	2.1	4314BTNG	146.0	114.0	3,200	4,000	81.0	139.0	2.0	3.950	4314BTNG
75	130	31	1.5	4215BTNG	73.5	80.0	3,400	4,300	83.0	122.0	1.5	1.600	4215BTNG
	160	55	2.1	4315BTNG	170.0	134.0	3,000	3,800	86.0	149.0	2.0	5.380	4315BTNG
80	140	33	2.0	4216BTNG	80.0	90.0	3,200	4,000	89.0	131.0	2.0	2.000	4216BTNG
85	150	36	2.0	4217BTNG	93.0	106.0	3,000	3,800	94.0	141.0	2.0	2.550	4217BTNG
90	160	40	2.0	4218BTNG	112.0	122.0	2,800	3,600	99.0	151.0	2.0	3.200	4218BTNG

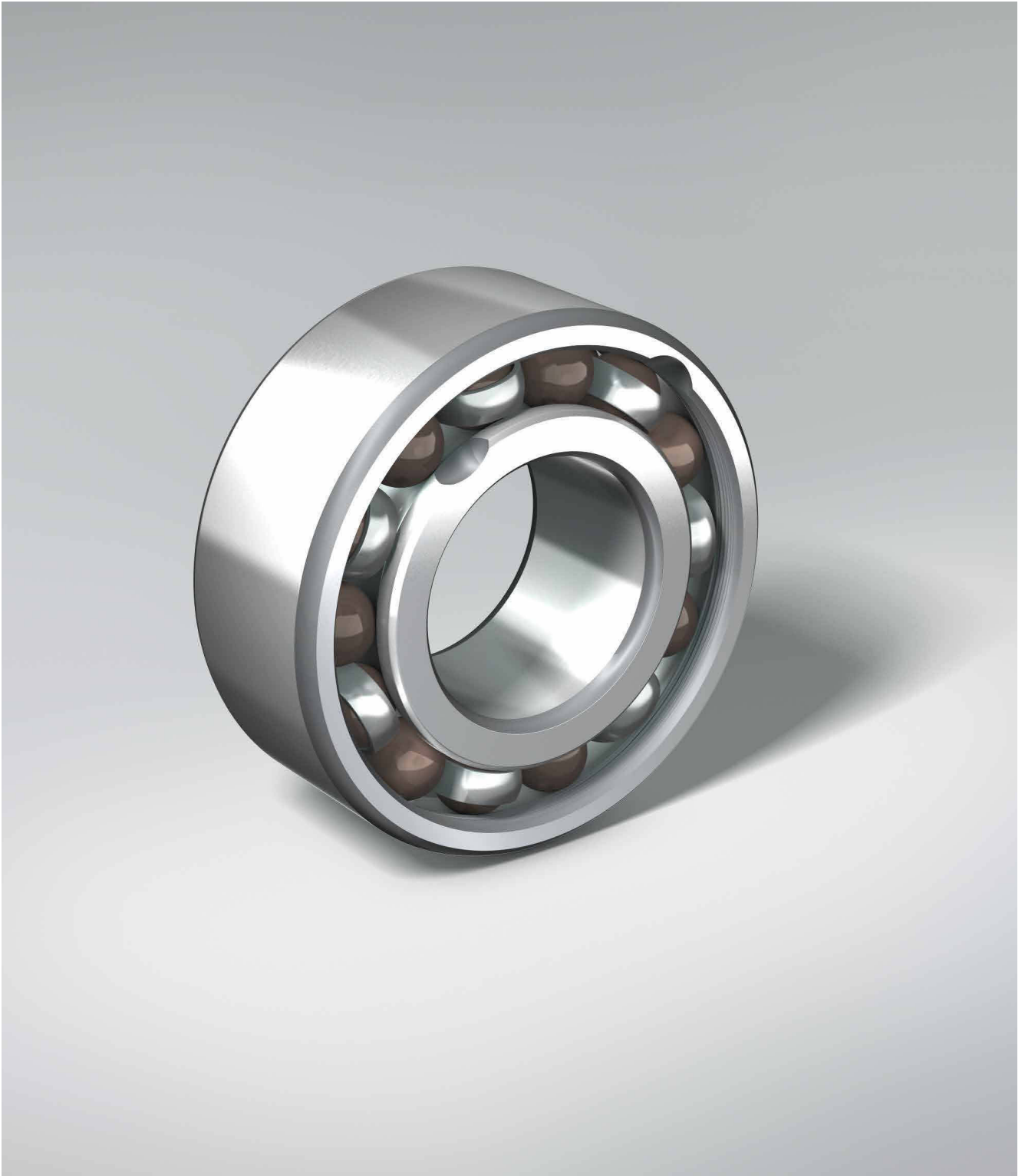
Notes



Lined area for notes, consisting of 20 horizontal lines.

Angular Contact Ball Bearings

Double Row





The structure and operation of double row, Angular Contact Ball Bearings correspond to that of a pair of back-to-back mounted Single Row Angular Contact Ball Bearings. They absorb radial and axial forces in both directions. The tilting moments can also be transferred.

NSK supplies Double Row Angular Contact Ball Bearings with two different contact angles. The Series 32..J and 33..J bearings have a contact angle of 32° and are fitted with a cage made of sheet steel. These bearings have filling slots on one side. The bearings must therefore be installed so that most of the axial force is transferred by the side without the slots.

The Series 32.. and 33.. bearings with the suffix "BTNG" have a contact angle of 25° and are provided with a cage made of glass-fibre reinforced Polyamide 66. These bearings do not have filling slots and can therefore transfer axial forces in both directions.

As well as the open version, NSK supplies Double Row Angular Contact Ball Bearings with the suffix "BTNG" also with shield or seals on one or both sides of the bearing. All Series 32..BTNG and 33..BTNG bearings are supplied with grease as standard. The version with the cage made of sheet-steel must be used for operating temperatures above 120°C .

Tolerances

The bearings are only manufactured to standard tolerance P0.

Angular adjustment facility

Double Row Angular Contact Ball Bearings do not facilitate angular adjustment.

Bearing clearance

The axial clearance of Double Row Angular Contact Ball Bearings is specified. The bearings are mass produced with axial clearance C0 "Normal". Other clearance groups are available on inquiry. The axial clearances can be found in the table on p. 31.

The radial clearance of Version "BTNG" is approx. 45 % of its axial clearance. The radial clearance of Version "J" is approx. 60 % of its axial clearance.

Angular Contact Ball Bearings

Double Row

Seals

As well as the open version, NSK manufactures Double Row Angular Contact Ball Bearings with the suffix "BTNG" also with shield or seals on one or both sides of the bearing.

Shields ZR

Shields ZR are sheet-steel discs which are fixed inside the bearing outer ring forming a small gap for the bearing inner ring. The bearings are available with one shield on one side of the bearing "ZR" or shields on both sides of the bearing "ZZR".

Seals RSR

Seals RSR consist of nitrile rubber and are reinforced with a steel disc embedded in the rubber. The seals are fixed in the outer ring and seal against the inner ring with a friction sealing lip. The bearings are available with one seal on one side of the bearing "RSR" or seals on both sides of the bearing "2RSR".

Lubrication

With Double Row Angular Contact Ball Bearings, the gap between the cage and the rings is relatively small. When lubricating with grease, it is therefore not easy for the user to introduce the grease which is required for the initial lubrication. For this reason, NSK also supplies non-sealed Double Row Angular Contact Ball Bearings pre-filled with grease at the factory. The grease which is supplied is a high-quality lithium-based grease with a temperature range of -30°C to $+120^{\circ}\text{C}$. The grease used by NSK is compatible with all other mineral-oil-based greases.

There is no problem using oil lubrication on bearings which have been lubricated with grease by NSK, providing that the oil used is mineral-oil based. A special version of the bearing is necessary for use with synthetic oils or greases. In these cases, please consult NSK.

Dynamic equivalent bearing load

With Series 32..BTNG and 33..BTNG:

$$P = F_r + 0.92 \cdot F_a \quad [\text{kN}] \quad \text{where } F_a/F_r \leq 0.68$$

$$P = 0.67 \cdot F_r + 1.41 \cdot F_a \quad [\text{kN}] \quad \text{where } F_a/F_r > 0.68$$

With Series 32..J and 33..J:

$$P = F_r + 0.73 \cdot F_a \quad [\text{kN}] \quad \text{where } F_a/F_r \leq 0.86$$

$$P = 0.62 \cdot F_r + 1.17 \cdot F_a \quad [\text{kN}] \quad \text{where } F_a/F_r > 0.86$$

Basic rating life

$$L_h = \frac{1,000,000}{n \cdot 60} \cdot \left(\frac{C}{P} \right)^3 \quad (\text{Running hours})$$

Static equivalent bearing load

$$f_h = f_n \cdot \frac{C}{P} \quad (\text{Factors } f_h \text{ and } f_n, \text{ see tables on p. 40/41})$$

With Series 32..BTNG and 33..BTNG:

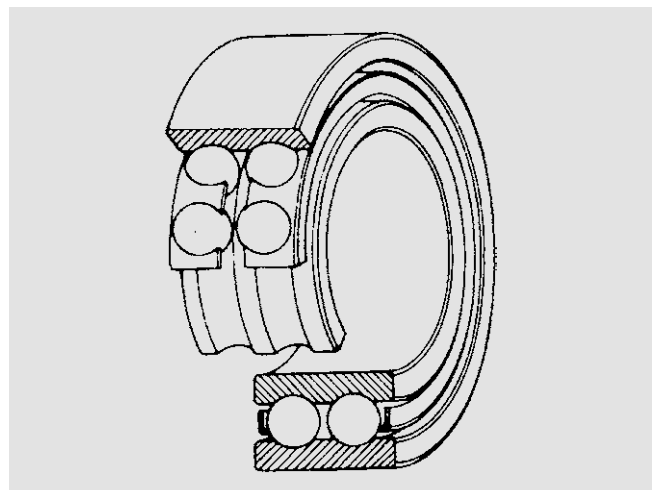
$$P_0 = F_r + 0.76 \cdot F_a \quad [\text{kN}]$$

With Series 32..J and 33..J:

$$P_0 = F_r + 0.63 \cdot F_a \quad [\text{kN}]$$

Basic static load rating

$$s_0 = \frac{C_0}{P_0}$$



Axial bearing clearance of Double Row Angular Contact Ball Bearings without load

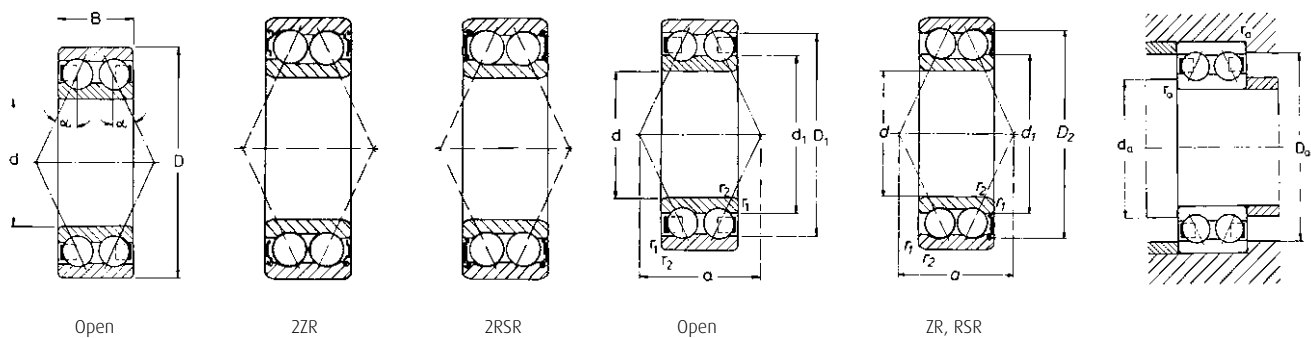
Rated size of bore (mm)	above	6	10	18	24	30	40	50	65	80
	up to	10	18	24	30	40	50	65	80	100
C2	min.	1	1	2	2	2	2	3	3	3
	max.	11	12	14	15	16	18	22	24	26
C0 Standard	min.	5	6	7	8	9	11	13	15	18
	max.	21	23	25	27	29	33	36	40	46
C3	min.	12	13	16	18	21	23	26	30	35
	max.	28	31	34	37	40	44	48	54	63
C4	min.	25	27	28	30	33	36	40	46	55
	max.	45	47	48	50	54	58	63	71	83

Note: Bearing clearances in μm

Angular Contact Ball Bearings

Double Row | Bore 10 – 90 mm

Dimensions				Abbreviation			Load ratings		
d	D	B	r _{1,2} min	Open	with shields	with seals	dyn. C	stat. C ₀	
mm							kN		
10	30	14.0	0.6	3200BTNG	..B2ZRTNG	..B2RSRTNG	7.80	4.55	
12	32	15.9	0.6	3201BTNG	..B2ZRTNG	..B2RSRTNG	10.60	5.85	
	37	19.0	1.0	3301BTNG	..B2ZRTNG	..B2RSRTNG	14.50	8.20	
15	35	15.9	0.6	3202BTNG	..B2ZRTNG	..B2RSRTNG	11.80	7.10	
	42	19.0	1.0	3302BTNG	..B2ZRTNG	..B2RSRTNG	16.30	10.00	
17	40	17.5	0.6	3203BTNG	..B2ZRTNG	..B2RSRTNG	14.60	9.00	
	47	22.2	1.0	3303BTNG	..B2ZRTNG	..B2RSRTNG	20.80	12.50	
20	47	20.6	1.0	3204BTNG	..B2ZRTNG	..B2RSRTNG	19.60	12.50	
	52	22.2	1.1	3304BTNG	..B2ZRTNG	..B2RSRTNG	23.20	15.00	
25	52	20.6	1.0	3205BTNG	..B2ZRTNG	..B2RSRTNG	21.20	14.60	
	62	25.4	1.1	3305BTNG	..B2ZRTNG	..B2RSRTNG	30.00	20.00	
30	62	23.8	1.0	3206BTNG	..B2ZRTNG	..B2RSRTNG	30.00	21.20	
	72	30.2	1.1	3306BTNG	..B2ZRTNG	..B2RSRTNG	41.50	28.50	
35	72	27.0	1.1	3207BTNG	..B2ZRTNG	..B2RSRTNG	39.00	28.50	
	80	34.9	1.5	3307BTNG	..B2ZRTNG	..B2RSRTNG	51.00	34.50	
40	80	30.2	1.1	3208BTNG	..B2ZRTNG	..B2RSRTNG	48.00	36.50	
	90	36.5	1.5	3308BTNG	..B2ZRTNG	..B2RSRTNG	62.00	45.00	
45	85	30.2	1.1	3209BTNG	..B2ZRTNG	..B2RSRTNG	48.00	37.50	
	100	39.7	1.5	3309BTNG	..B2ZRTNG	..B2RSRTNG	68.00	51.00	
50	90	30.2	1.1	3210BTNG	..B2ZRTNG	..B2RSRTNG	51.00	42.50	
	110	44.4	2.0	3310BTNG	..B2ZRTNG	..B2RSRTNG	81.00	62.00	
55	100	33.3	1.5	3211BTNG	..B2ZRTNG	..B2RSRTNG	58.50	49.00	
	120	49.2	2.0	3311BTNG	..B2ZRTNG	..B2RSRTNG	102.00	78.00	
60	110	36.5	1.5	3212BTNG	..B2ZRTNG	..B2RSRTNG	72.00	61.00	
	130	54.0	2.1	3312BTNG	..B2ZRTNG	..B2RSRTNG	125.00	98.00	
65	120	38.1	1.5	3213BTNG	..B2ZRTNG	..B2RSRTNG	80.00	73.50	
	140	58.7	2.1	3313BTNG	..B2ZRTNG	..B2RSRTNG	150.00	118.00	
70	125	39.7	1.5	3214BTNG	..B2ZRTNG	..B2RSRTNG	83.00	76.50	
	150	63.5	2.1	3314BTNG	..B2ZRTNG	..B2RSRTNG	159.30	128.40	
75	130	41.3	1.5	3215BTNG	..B2ZRTNG	..B2RSRTNG	91.50	85.00	
	160	68.3	2.1	3315BTNG	..B2ZRTNG	..B2RSRTNG	173.40	145.30	
80	140	44.4	2.0	3216BTNG	..B2ZRTNG	..B2RSRTNG	98.00	93.00	
85	150	49.2	2.0	3217BTNG	..B2ZRTNG	..B2RSRTNG	116.00	110.00	
90	160	52.4	2.0	3218BTNG	..B2ZRTNG	..B2RSRTNG	124.60	120.30	

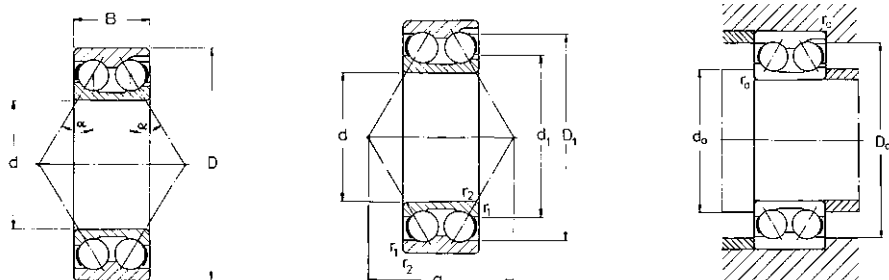


	Speed limits		Dimensions (mm)			Abutment dimensions (mm)			Weight	Abbreviation
	Grease	Oil	d ₁	D ₁ , D ₂	a	d _a	D _a	r _a		
	min ⁻¹						min	max	max	
	16,000	22,000	17.9	23.9	15.1	15	25.0	0.6	0.043	3200BTNG
	15,000	20,000	18.3	25.7	16.6	17	27.0	0.6	0.051	3201BTNG
	10,500	11,500	21.1	30.4	19.4	19	32.0	1.0	0.090	3301BTNG
	14,000	19,000	21.0	29.3	18.0	20	30.0	0.6	0.058	3202BTNG
	11,000	16,000	25.6	34.2	21.2	21	36.0	1.0	0.112	3302BTNG
	12,000	17,000	24.0	33.1	20.5	22	35.0	0.6	0.085	3203BTNG
	10,000	15,000	26.2	37.7	24.0	23	41.0	1.0	0.161	3303BTNG
	10,000	15,000	28.9	38.7	24.2	26	41.0	1.0	0.139	3204BTNG
	9,000	13,000	31.2	42.6	26.4	27	45.0	1.0	0.197	3304BTNG
	8,500	12,000	33.9	43.7	26.5	31	46.0	1.0	0.159	3205BTNG
	7,500	10,000	37.1	50.0	30.7	32	55.0	1.0	0.316	3305BTNG
	7,000	9,500	40.0	52.7	31.4	36	56.0	1.0	0.265	3206BTNG
	6,300	8500	44.0	59.0	36.2	37	65.0	1.0	0.496	3306BTNG
	6,300	8,500	47.2	60.4	36.6	42	65.0	1.0	0.412	3207BTNG
	5,600	7,500	49.2	65.4	41.5	44	71.0	1.5	0.664	3307BTNG
	5,600	7,500	52.9	67.9	40.9	47	73.0	1.0	0.550	3208BTNG
	5,000	6700	55.4	74.3	46.1	49	81.0	1.5	0.905	3308BTNG
	5,000	6,700	57.1	72.6	43.2	52	78.0	1.0	0.583	3209BTNG
	4,500	6,000	62.2	81.6	50.0	54	91.0	1.5	1.210	3309BTNG
	4,800	6,300	61.9	78.1	45.5	57	83.0	1.0	0.632	3210BTNG
	4,000	5,300	68.2	89.6	54.9	60	100.0	2.0	1.600	3310BTNG
	4,300	5,600	68.6	85.3	49.9	64	91.0	1.5	0.876	3211BTNG
	3,800	5,000	75.2	98.4	61.2	65	110.0	2.0	2.110	3311BTNG
	3,800	5,000	75.7	94.3	55.1	69	101.0	1.5	1.180	3212BTNG
	3,400	4,500	81.2	108.7	67.3	72	118.0	2.0	2.700	3312BTNG
	3,400	4,500	84.5	103.5	59.8	74	111.0	1.5	1.520	3213BTNG
	3,200	4,300	88.2	118.0	73.3	77	128.0	2.0	3.390	3313BTNG
	3,400	4,500	86.7	106.2	61.6	79	116.0	1.5	1.640	3214BTNG
	3,000	4,000	94.7	125.0	80.8	84	135.0	2.1	4.900	3314BTNG
	3,200	4,300	92.4	112.6	65.0	89	116.6	1.5	1.910	3215BTNG
	2,800	3,800	101.4	133.0	83.8	90	143.0	2.1	5.700	3315BTNG
	3,000	4,000	98.5	120.3	69.0	91	129.0	2.0	2.450	3216BTNG
	2,800	3,800	106.4	128.5	74.6	100	135.0	2.0	3.300	3217BTNG
	2,600	3,600	113.2	136.6	78.9	109	141.0	2.1	4.170	3218BTNG

Angular Contact Ball Bearings

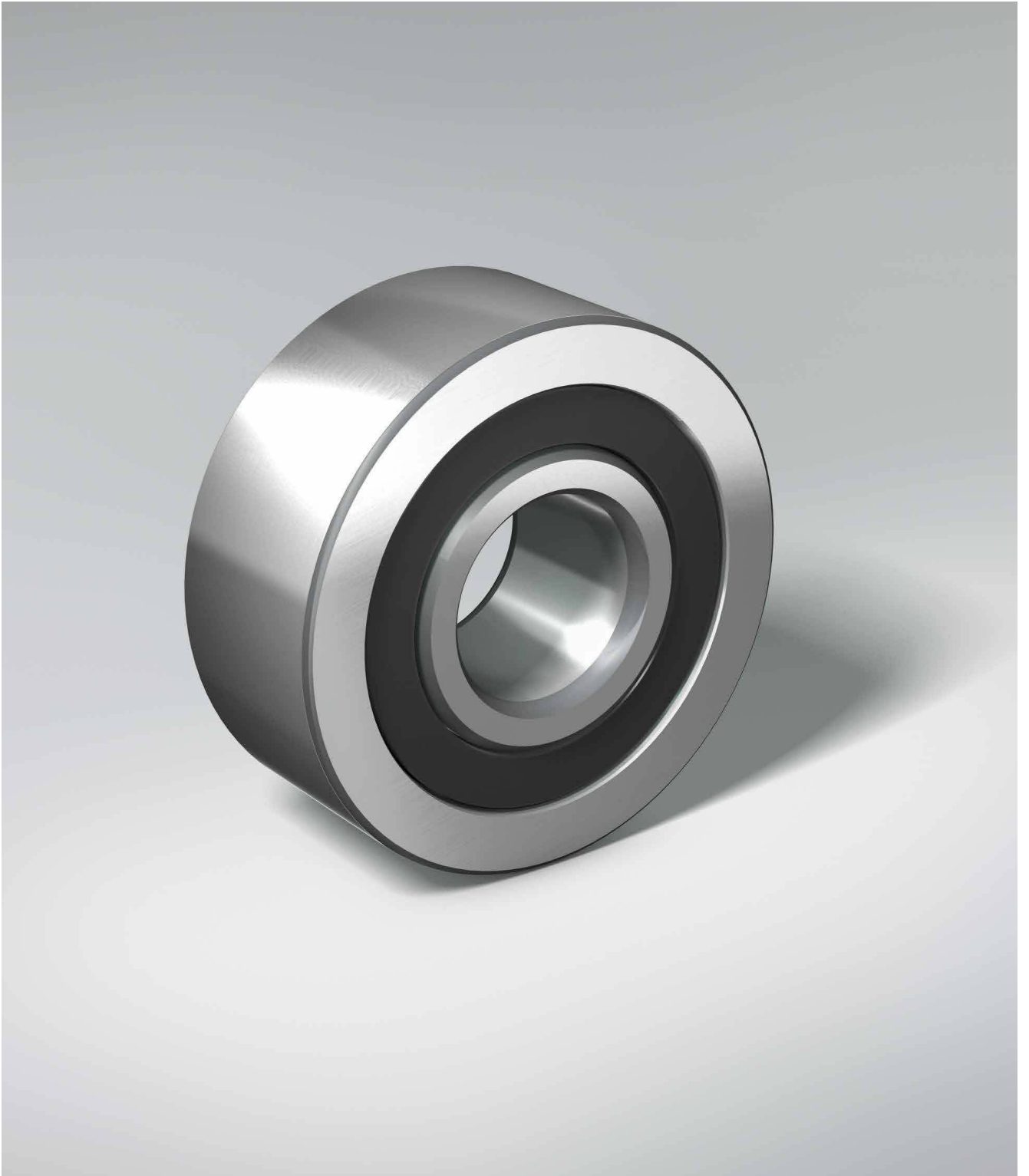
Double Row with filling slot | Bore 10 – 70 mm

Dimensions				Abbreviation	Load ratings		Speed limits		
d	D	B	r _{1,2} min		dyn. C	stat. C ₀	Grease	Oil	
mm					kN		min ⁻¹		
10	30	14.0	0.6	3200J	8.0	5.9	17,000	24,000	
12	32	15.9	0.6	3201J	9.5	7.1	15,000	20,000	
15	35	15.9	0.6	3202J	10.8	9.0	13,000	18,000	
	42	19.0	1.0	3302J	14.5	12.3	12,000	17,000	
17	40	17.5	0.6	3203J	12.6	10.8	12,000	17,000	
	47	22.2	1.0	3303J	20.7	16.7	10,000	15,000	
20	47	20.6	1.0	3204J	17.2	15.3	10,000	15,000	
	52	22.2	1.1	3304J	20.8	18.5	9,500	14,000	
25	52	20.6	1.0	3205J	19.0	18.5	8,500	12,000	
	62	25.4	1.1	3305J	28.9	26.7	7,500	10,000	
30	62	23.8	1.0	3206J	27.2	27.3	7,000	9,500	
	72	30.2	1.1	3306J	38.1	36.5	6,300	8,500	
35	72	27.0	1.1	3207J	36.8	38.0	6,300	8,500	
	80	34.9	1.5	3307J	48.5	47.5	5,600	7,500	
40	80	30.2	1.1	3208J	42.0	44.8	5,600	7,500	
	90	36.5	1.5	3308J	59.8	64.8	4,800	6,300	
45	85	30.2	1.1	3209J	45.4	52.1	5,000	6,700	
	100	39.7	1.5	3309J	73.1	80.9	4,300	5,600	
50	90	30.2	1.1	3210J	48.2	56.0	4,800	6,300	
	110	44.4	2.0	3310J	87.6	98.3	4,000	5,300	
55	100	33.3	1.5	3211J	55.7	69.9	4,300	5,600	
	120	49.2	2.0	3311J	100.5	115.3	3,600	4,800	
60	110	36.5	1.5	3212J	71.4	86.1	3,800	5,000	
	130	54.0	2.1	3312J	116.1	135.3	3,400	4,500	
65	120	38.1	1.5	3213J	76.4	98.4	3,600	4,800	
	140	58.7	2.1	3313J	133.7	156.4	3,200	4,300	
70	125	39.7	1.5	3214J	84.2	109.5	3,200	4,300	
	150	63.5	2.1	3314J	146.9	175.5	2,800	3,800	



	Dimensions (mm)			Abutment dimensions (mm)			Weight kg	Abbreviation
	d ₁	D ₁	a	d _a	D _a	r _a		
				max	max	max		
	17.2	24.4	20	14	26	0.6	0.052	3200J
	19.3	26.9	22	16	28	0.6	0.063	3201J
	22.6	30.4	24	19	31	0.6	0.072	3202J
	24.9	34.4	27	21	36	1.0	0.132	3302J
	25.5	33.8	27	21	36	0.6	0.103	3203J
	27.6	40.0	31	23	41	1.0	0.192	3303J
	29.5	40.5	32	26	41	1.0	0.168	3204J
	32.0	43.0	34	27	45	1.0	0.230	3304J
	34.6	45.1	35	31	46	1.0	0.194	3205J
	38.5	52.5	40	32	55	1.0	0.369	3305J
	41.2	54.0	41	36	56	1.0	0.316	3206J
	45.4	61.3	47	37	65	1.0	0.585	3306J
	47.8	63.3	47	42	65	1.0	0.484	3207J
	50.8	69.2	54	44	71	1.5	0.816	3307J
	54.0	70.4	53	47	73	1.0	0.654	3208J
	59.4	80.1	59	49	81	1.5	1.070	3308J
	59.8	76.4	56	52	78	1.0	0.709	3209J
	66.2	89.1	64	54	91	1.5	1.400	3309J
	63.7	80.8	59	57	83	1.0	0.764	3210J
	72.5	96.4	73	60	100	2.0	1.950	3310J
	72.0	89.7	64	64	91	1.5	1.050	3211J
	80.2	106.4	80	65	110	2.0	2.550	3311J
	78.2	98.3	71	69	101	1.5	1.400	3212J
	86.2	115.0	86	72	118	2.0	3.250	3312J
	84.7	105.8	76	74	111	1.5	1.750	3213J
	92.5	123.0	94	77	128	2.0	4.100	3313J
	88.7	111.5	81	79	116	1.5	1.900	3214J
	98.5	131.0	101	82	138	2.0	5.050	3314J

Pulleys





Pulleys are developments of Double Row Angular Contact Ball Bearings with a reinforced outer ring. The outer ring can be either of cylindrical or spherical design. The inner ring of these bearings is provided with lubrication holes. The bearings have no filling slot and absorb radial and axial forces in both directions.

The contact angle of these bearings is 25°. The bearing cage is made of glass-fibre reinforced Polyamide 66. Pulleys are supplied with seals or shields on both sides. They are normally supplied filled with grease at the factory. Special pulleys with galvanised bearing inner and outer rings are also available on enquiry.

Tolerances

The bearings are only manufactured to the standard tolerance P0.

Angular adjustment facility

Double Row Pulleys do not facilitate angular adjustment.

Bearing clearance

With Double Row Pulleys, the axial bearing clearance is specified. The bearings are normally supplied with axial clearance C0 "Normal". The axial clearances can be found in the table below. The radial clearances are approx. 45 % of the axial clearances

Cages

Double Row Pulleys are fitted with cages made of glass-fibre reinforced Polyamide 66.

Seals

NSK manufactures pulleys with seals and shields on both sides of the bearing.

Shields ZR

Shields are sheet-steel discs which are fixed inside the bearing outer ring forming a small gap for the bearing inner ring. The bearings are available with shields on both sides "ZZR".

Seals RSR

Seals RSR consist of nitrile rubber and are reinforced with a steel disc embedded in the rubber. The seals are fixed in the outer ring and seal against the inner ring with a friction sealing lip. The bearings are available with seals on both sides of the bearing "ZRSR".

Axial clearance of Double Row Pulleys without load

Rated size of bore (mm)	above	6	10	18	24	30	40	50	65
	up to	10	18	24	30	40	50	65	80
C0 Standard	min.	5	6	7	8	9	11	13	15
	max.	21	23	25	27	29	33	36	40

Note: Bearing clearances in µm

Pulleys

Bore 10 – 35 mm

Lubrication

NSK supplies pulleys filled with grease at the factory. This is a high-quality lithiumbased grease with an admissible temperature range of -30 °C to +110 °C. The grease used by NSK is compatible with all other mineral-oil-based greases. The inner rings of the pulleys are provided with a lubrication hole so that bearings can be re-lubricated. With Version 2RSR, the grease must be pressed in slowly to avoid damaging the seals.

Bearing load capacity

If the pulley is supported by a flat contact surface, only a small surface area of the outer ring of the pulleys comes into contact with the rolling plane. The elastic deformation of the outer ring reduces the load-bearing capacity of the pulley. In this case, the values specified in the "Pulley load ratings" table must be used in the calculation.

On the other hand, when installing the pulley in a housing bore, the "Bearing load ratings" apply which are also listed.

Suffixes

- LZ** Pulley with cylindrical outer ring (prefix)
- LB** Pulley with spherical outer ring (prefix)
- B** 25° Contact angle
- S** Lubrication hole in inner ring
- TNG** Cage made of glass-fibre reinforced Polyamide 66
- 2ZR** Shields on both sides
- 2RSR** Seals on both sides

Dynamic equivalent bearing load

$$P = F_r + 0.92 \cdot F_a \quad [\text{kN}] \quad \text{where } F_a/F_r \leq 0.68$$
$$P = 0.67 \cdot F_r + 1.41 \cdot F_a \quad [\text{kN}] \quad \text{where } F_a/F_r > 0.68$$

Basic rating life

$$L_h = \frac{1,000,000}{n \cdot 60} \cdot \left(\frac{C}{P} \right)^3 \quad (\text{Running hours})$$

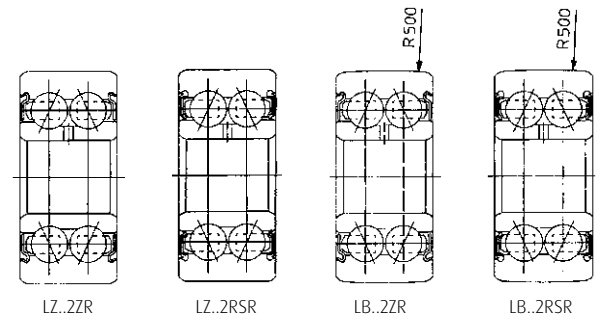
$$f_h = f_n \cdot \frac{C}{P} \quad (\text{Factors } f_h \text{ and } f_n \text{ see tables on p. 40/41})$$

Static equivalent bearing load

$$P_0 = F_r + 0.76 \cdot F_a \quad [\text{kN}]$$

Basic static load rating

$$S_0 = \frac{C_0}{P_0}$$



Dimensions				Abbreviation for		Load ratings [kN]				Speed limits	Weight
d	D*	B	r _s min			Bearing		Pulley			
				Shields		Seals		dyn.	stat.		
mm						C	C ₀	C	C ₀		
10	32	14.0	0.6	LZ3200B2ZRSTNG LB3200B2ZRSTNG	LZ3200B2RSRSTNG LB3200B2RSRSTNG	7.8	4.55	7.45	4.15	16,000	0.061
12	35	15.9	0.6	LZ3201B2ZRSTNG LB3201B2ZRSTNG	LZ3201B2RSRSTNG LB3201B2RSRSTNG	10.6	5.85	9.95	5.20	15,000	0.079
15	40	15.9	0.6	LZ3202B2ZRSTNG LB3202B2ZRSTNG	LZ3202B2RSRSTNG LB3202B2RSRSTNG	11.8	7.10	11.00	6.45	13,000	0.100
17	47	17.5	0.6	LZ3203B2ZRSTNG LB3203B2ZRSTNG	LZ3203B2RSRSTNG LB3203B2RSRSTNG	14.6	9.00	13.80	8.30	10,000	0.165
20	52	20.6	1.0	LZ3204B2ZRSTNG LB3204B2ZRSTNG	LZ3204B2RSRSTNG LB3204B2RSRSTNG	19.6	12.50	18.30	11.00	9,000	0.210
25	62	20.6	1.0	LZ3205B2ZRSTNG LB3205B2ZRSTNG	LZ3205B2RSRSTNG LB3205B2RSRSTNG	21.2	14.60	19.90	13.40	8,000	0.330
30	72	23.8	1.0	LZ3206B2ZRSTNG LB3206B2ZRSTNG	LZ3206B2RSRSTNG LB3206B2RSRSTNG	30.0	21.20	27.90	18.60	7,100	0.500
35	80	27.0	1.0	LZ3207B2ZRSTNG LB3207B2ZRSTNG	LZ3207B2RSRSTNG LB3207B2RSRSTNG	39.0	28.50	36.20	25.0	6,300	0.660

* with spherical outer ring D 0.05 mm

Life factors (f_h) for ball bearings

f_h values for ball bearings $f_h = \sqrt[3]{\frac{L_h}{500}}$									
L_h (h)	f_h	L_h (h)	f_h	L_h (h)	f_h	L_h (h)	f_h	L_h (h)	f_h
100	0.585	400	0.928	1,500	1.440	5,000	2.150	20,000	3.420
110	0.604	420	0.944	1,600	1.470	5,500	2.220	22,000	3.530
120	0.621	440	0.958	1,700	1.500	6,000	2.290	24,000	3.630
130	0.638	460	0.973	1,800	1.530	6,500	2.350	26,000	3.730
140	0.654	480	0.986	1,900	1.560	7,000	2.410	28,000	3.830
150	0.669	500	1.000	2,000	1.590	7,500	2.470	30,000	3.910
160	0.684	550	1.030	2,200	1.640	8,000	2.520	35,000	4.120
170	0.698	600	1.060	2,400	1.690	8,500	2.570	40,000	4.310
180	0.711	650	1.090	2,600	1.730	9,000	2.620	45,000	4.480
190	0.724	700	1.120	2,800	1.780	9,500	2.670	50,000	4.640
200	0.737	750	1.140	3,000	1.820	10,000	2.710	55,000	4.790
220	0.761	800	1.170	3,200	1.860	11,000	2.800	60,000	4.930
240	0.783	850	1.190	3,400	1.890	12,000	2.880	65,000	5.070
260	0.804	900	1.220	3,600	1.930	13,000	2.960	70,000	5.190
280	0.824	950	1.240	3,800	1.970	14,000	3.040	75,000	5.310
300	0.843	1,000	1.260	4,000	2.000	15,000	3.110	80,000	5.430
320	0.862	1,100	1.300	4,200	2.030	16,000	3.170	85,000	5.540
340	0.879	1,200	1.340	4,400	2.060	17,000	3.240	90,000	5.650
360	0.896	1,300	1.380	4,600	2.100	18,000	3.300	95,000	5.750
380	0.913	1,400	1.410	4,800	2.130	19,000	3.360	100,000	5.850

Speed factors (f_n) for ball bearings

f_n values for ball bearings $f_n = \sqrt[3]{\frac{33\frac{1}{2}}{n}}$									
n (min ⁻¹)	f_n	n (min ⁻¹)	f_n	n (min ⁻¹)	f_n	n (min ⁻¹)	f_n	n (min ⁻¹)	f_n
10	1.490	50	0.874	300	0.481	1,500	0.281	7,500	0.1640
11	1.450	55	0.846	320	0.471	1,600	0.275	8,000	0.1610
12	1.410	60	0.822	340	0.461	1,700	0.270	8,500	0.1580
13	1.370	65	0.800	360	0.452	1,800	0.265	9,000	0.1550
14	1.340	70	0.781	380	0.444	1,900	0.260	9,500	0.1520
15	1.300	75	0.763	400	0.437	2,000	0.255	10,000	0.1490
16	1.280	80	0.747	420	0.430	2,200	0.247	11,000	0.1450
17	1.250	85	0.732	440	0.423	2,400	0.240	12,000	0.1410
18	1.230	90	0.718	460	0.417	2,600	0.234	13,000	0.1370
19	1.210	95	0.705	480	0.411	2,800	0.228	14,000	0.1340
20	1.190	100	0.693	500	0.405	3,000	0.223	16,000	0.1280
22	1.150	110	0.672	550	0.393	3,200	0.218	18,000	0.1230
24	1.120	120	0.652	600	0.382	3,400	0.214	20,000	0.1190
26	1.090	130	0.635	650	0.372	3,600	0.210	22,000	0.1150
28	1.060	140	0.620	700	0.362	3,800	0.206	24,000	0.1120
30	1.040	150	0.606	750	0.354	4,000	0.203	26,000	0.1090
32	1.010	160	0.593	800	0.347	4,200	0.199	28,000	0.1060
34	0.993	170	0.581	850	0.340	4,400	0.196	30,000	0.1040
36	0.975	180	0.570	900	0.333	4,600	0.194	32,000	0.1010
38	0.957	190	0.560	950	0.327	4,800	0.191	34,000	0.0993
40	0.941	200	0.550	1,000	0.322	5,000	0.188	36,000	0.0975
42	0.926	220	0.533	1,100	0.312	5,500	0.182	38,000	0.0957
44	0.912	240	0.518	1,200	0.303	6,000	0.177	40,000	0.0941
46	0.898	260	0.504	1,300	0.295	6,500	0.172	45,000	0.0905
48	0.886	280	0.492	1,400	0.288	7,000	0.168	50,000	0.0875



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