

ROLLING BEARINGS



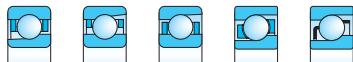
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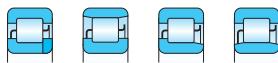




Single Row Deep Groove Ball Bearings



Single Row Angular Contact Ball Bearings



Single Row Cylindrical Roller Bearings



Special Cylindrical Roller Bearings for Railway Vehicles







Foreword

Publication Rolling Bearings shows a survey of standardized rolling bearings and accessories being produced and delivered under designation KINEX.

In the design, production, storage and sales of the rolling bearings international standards ISO and national standards are used.

Technical section of the publication contains the most important facts concerning calculations, the design data about the arrangement design, lubrication, as well as mounting and dismounting rolling bearings. The produced standardized rolling bearings and accessories in the basic design and in the main applications from the basic design, as e.g. bearings with tapered bore, shielded bearings or bearings with snap ring groove on outer ring, etc., are shown in the "Rolling Bearings Dimension Tables" part.





1. Basic Calculations

Required bearing size is determined by the action of the external forces and according to the bearing required life and its reliability in the arrangement. Magnitude, direction and kind of load acting on the bearing, as well as the operating speed, are decisive for the type and bearing size selection. Other special or important conditions of each individual arrangement must be taken into account, e.g. operating temperature, limited space availability, simplicity of mounting, lubrication requirements, sealing, etc., and all of these can influence selection of the most suitable bearing. For given concrete conditions various bearing types can meet those requirements.

From the point of view of outer load acting and the bearing function in respective arrangement or unit we distinguish two types of the rolling bearing load in the bearing technique:

- when rolling bearing rings are relatively rotating against each other and bearing is under outer load (which is valid for most bearings), this is called dynamic bearing load,

- when rolling bearing rings either do not move against each other or they move only very slowly, the bearing carries an oscillating motion or the outer load acts for a shorter time than one bearing revolution, this is called static bearing load.

For bearing safety calculation, the life limited by bearing breakdown due to material fatigue of a bearing component is decisive in the first case. In the second case there are durable deformations of functional surfaces on the contact surfaces of rolling elements and raceways.

1.1 Dynamic Load

1.1.1 Basic Dynamic Load Rating

Basic dynamic load rating is a constant invariable load which the bearing can theoretically carry at the nominal life of one million revolutions.

For radial bearings, the radial dynamic load rating C_r refers to constant load. For thrust bearings, the axial dynamic load rating C_a refers to unvariable, purely axial load, acting centrically.

Basic dynamic load ratings C_r and C_a , whose size depends on bearing dimensions, rolling element number, material and bearing design, are shown for each bearing in the dimension tables. Values of the basic dynamic load ratings were stated according to the standard STN ISO 281. These values are verified in testing equipments and by operation results.

1.1.2 Life

Rolling bearing life is defined as the number of revolution carried out by one bearing ring against the other ring, until the first signs of material fatigue occur on one ring or the rolling element.

Great differences in life can occur among bearings of the same type, that is why according to the standard STN ISO 281 the basic life is used as the basis for life calculation, i.e. life shown by the operation time attained or exceeded by a bearing group at 90% reliability.

Life Equation

Nominal bearing life is mathematically defined by the life equation valid for all bearing types.

$$L_{10} = \left(\frac{C}{P}\right)^p \text{ or } \frac{C}{P} 5 (L_{10})^{\frac{1}{p}}$$

L_{10} - nominal life $[10^6 \text{ rev}]$

C - basic dynamic load rating (values C_r, C_a are given in the dimension tables) $[\text{kN}]$

P - equivalent dynamic bearing load (equations for P_r, P_a calculations are in section 1.1.3 and at each design group of bearings) $[\text{kN}]$

p - exponent for ball bearings $p = 3$ for cylindrical, $p = \frac{10}{3}$ for needle-, spherical- and tapered roller bearings

C/P ratio in dependence on life L₁₀

Table 1

For ball bearings				For cylindrical roller, needle roller, spherical roller and tapered roller bearings			
Life L ₁₀	C P	Life L ₁₀	C P	Life L ₁₀	C P	Life L ₁₀	C P
10 ⁶ rev		10 ⁶ rev		10 ⁶ rev		10 ⁶ rev	
0.5	0.793	600	8.43	0.5	0.812	600	6.81
0.75	0.909	650	8.66	0.75	0.917	650	6.98
1	1	700	8.88	1	1	700	7.14
1.5	1.14	750	9.09	1.5	1.13	750	7.29
2	1.26	800	9.28	2	1.24	800	7.43
3	1.44	850	9.47	3	1.39	850	7.56
4	1.59	900	9.65	4	1.52	900	7.70
5	1.71	950	9.83	5	1.62	950	7.82
6	1.82	1 000	10	6	1.71	1 000	7.94
8	2	1 100	10.3	8	1.87	1 100	8.17
10	2.15	1 200	10.6	10	2	1 200	8.39
12	2.29	1 300	10.9	12	2.11	1 300	8.59
14	2.41	1 400	11.2	14	2.21	1 400	8.79
16	2.52	1 500	11.4	16	2.30	1 500	8.97
18	2.62	1 600	11.7	18	2.38	1 600	9.15
20	2.71	1 700	11.9	20	2.46	1 700	9.31
25	2.92	1 800	12.2	25	2.63	1 800	9.48
30	3.11	1 900	12.4	30	2.77	1 900	9.63
35	3.27	2 000	12.6	35	2.91	2 000	9.78
40	3.42	2 200	13	40	3.02	2 200	10.1
45	3.56	2 400	13.4	45	3.13	2 400	10.3
50	3.68	2 600	13.8	50	3.23	2 600	10.6
60	3.91	2 800	14.1	60	3.42	2 800	10.8
70	4.12	3 000	14.4	70	3.58	3 000	11
80	4.31	3 500	15.2	80	3.72	3 500	11.5
90	4.48	4 000	15.9	90	3.86	4 000	12
100	4.64	4 500	16.5	100	3.98	4 500	12.5
120	4.93	5 000	17.1	120	4.20	5 000	12.9
140	5.19	5 500	17.7	140	4.40	5 500	13.2
160	5.43	6 000	18.2	160	4.58	6 000	13.6
180	5.65	7 000	19.1	180	4.75	7 000	14.2
200	5.85	8 000	20	200	4.90	8 000	14.8
250	6.30	9 000	20.8	250	5.24	9 000	15.4
300	6.69	10 000	21.5	300	5.54	10 000	15.8
350	7.05	12 500	23.2	350	5.80	12 500	16.9
400	7.37	15 000	24.7	400	6.03	15 000	17.9
450	7.66	17 500	26	450	6.25	17 500	18.7
500	7.94	20 000	27.1	500	6.45	20 000	19.5
550	8.19	25 000	29.2	550	6.64	25 000	20.9

Table 1 shows dependence of the life L₁₀ in million revolutions and respective ratio C/P.

If the rotational speed does not change, the revised life calculation expressing the nominal life in operation hours can be used:

$$L_{10n} = \left(\frac{C}{P}\right)^p \cdot \frac{10^6}{60 \cdot n} \quad h - \text{nominal life} \quad [h] \\ n - \text{rotational speed} \quad [\text{min}^{-1}]$$

C/P dependence from the nominal life L₁₀ and the rotational speed n is shown for ball bearings in Table 2, for cylindrical roller, needle roller, spherical roller and tapered roller bearings in Table 3.

C/P ratio in dependence on life L₁₀ and rotational speed n for ball bearings

Table 2

Life L _{10h} h	Rotational speed n [min ⁻¹]													
	10	16	25	40	63	100	125	160	200	250	320	400	500	630
100	-	-	-	-	-	-	-	-	-	1.06	1.15	1.24	1.34	1.45
500	-	-	-	1.06	1.24	1.45	1.56	1.68	1.82	1.96	2.12	2.29	2.47	2.67
1 000	-	-	1.15	1.34	1.56	1.82	1.96	2.12	2.29	2.47	2.67	2.88	3.11	3.36
1 250	-	1.06	1.24	1.45	1.68	1.96	2.12	2.29	2.47	2.67	2.88	3.11	3.36	3.63
1 600	-	1.15	1.34	1.56	1.82	2.12	2.29	2.47	2.67	2.88	3.11	3.36	3.63	3.91
2 000	1.06	1.24	1.45	1.68	1.96	2.29	2.47	2.67	2.88	3.11	3.36	3.63	3.91	4.23
2 500	1.15	1.34	1.56	1.82	2.12	2.47	2.67	2.88	3.11	3.36	3.63	3.91	4.23	4.56
3 200	1.24	1.45	1.68	1.96	2.29	2.67	2.88	3.11	3.36	3.63	3.91	4.23	4.56	4.93
4 000	1.34	1.56	1.82	2.12	2.47	2.88	3.11	3.36	3.63	3.91	4.23	4.56	4.93	5.32
5 000	1.45	1.68	1.96	2.29	2.67	3.11	3.36	3.63	3.91	4.23	4.56	4.93	5.32	5.75
6 300	1.56	1.82	2.12	2.47	2.88	3.36	3.63	3.91	4.23	4.56	4.93	5.32	5.75	6.20
8 000	1.68	1.96	2.29	2.67	3.11	3.63	3.91	4.23	4.56	4.93	5.32	5.75	6.20	6.70
10 000	1.82	2.12	2.47	2.88	3.36	3.91	4.23	4.56	4.93	5.32	5.75	6.20	6.70	7.23
12 500	1.96	2.29	2.67	3.11	3.36	4.23	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81
16 000	2.12	2.47	2.88	3.36	3.91	4.56	4.93	5.23	5.75	6.20	6.70	7.23	7.81	8.43
20 000	2.29	2.67	3.11	3.63	4.23	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11
25 000	2.47	2.88	3.36	3.91	4.56	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83
32 000	2.67	3.11	3.63	4.23	4.93	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.60
40 000	2.88	3.36	3.91	4.56	5.32	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.60	11.50
50 000	3.11	3.63	4.23	4.93	5.75	6.70	7.23	7.81	8.43	9.11	9.83	10.60	11.50	12.40
63 000	3.36	3.91	4.56	5.32	6.20	7.23	7.81	8.43	9.11	9.83	10.60	11.50	12.40	13.40
80 000	3.36	4.23	4.93	5.75	6.70	7.81	8.43	9.11	9.83	10.60	11.50	12.40	13.40	14.50
100 000	3.91	4.56	5.32	6.20	7.23	8.43	9.11	9.83	10.6	11.50	12.40	13.40	14.50	15.60
200 000	4.93	5.75	6.70	7.81	9.11	10.60	11.50	12.40	13.40	14.50	15.60	16.80	18.20	19.60

Life L _{10h} h	Rotational speed n [min ⁻¹]													
	800	1000	1250	1600	2000	2500	3200	4000	5000	6300	8000	10000	12500	16000
100	1.68	1.82	1.96	2.12	2.29	2.47	2.67	2.88	3.11	3.36	3.63	3.91	4.23	4.56
500	2.88	3.11	3.36	3.63	3.91	4.23	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81
1 000	3.63	3.91	4.23	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83
1 250	3.91	4.23	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.60
1 600	4.23	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.60	11.50
2 000	4.56	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.60	11.50	12.40
2 500	4.93	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.60	11.50	12.40	13.40
3 200	5.32	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.60	11.50	12.40	13.40	14.50
4 000	5.75	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.60	11.50	12.40	13.40	14.50	15.60
5 000	6.20	6.70	7.23	7.81	8.43	9.11	9.83	10.60	11.50	12.40	13.40	14.50	15.60	16.80
6 300	6.70	7.23	7.81	8.43	9.11	9.83	10.60	11.50	12.40	13.40	14.50	15.60	16.80	18.20
8 000	7.23	7.81	8.43	9.11	9.83	10.60	11.50	12.40	13.40	14.50	15.60	16.80	18.20	19.60
10 000	7.81	8.43	9.11	9.83	10.60	11.50	12.40	13.40	14.50	15.60	16.80	18.20	19.60	21.20
12 500	8.43	9.11	9.83	10.60	11.50	12.40	13.40	14.50	15.60	16.80	18.20	19.60	21.20	22.90
16 000	9.11	9.83	10.6	11.50	12.40	13.40	14.50	15.60	16.80	18.20	19.60	21.20	22.90	24.70
20 000	9.83	10.6	11.5	12.40	13.40	14.50	15.60	16.80	18.20	19.60	21.20	22.90	24.70	26.70
25 000	10.60	11.50	12.40	13.40	14.50	15.60	16.80	18.20	19.60	21.20	22.90	24.70	26.70	28.80
32 000	11.50	12.40	13.40	14.50	15.60	16.80	18.20	19.60	21.20	22.90	24.70	26.70	28.80	31.10
40 000	12.40	13.40	14.50	15.60	16.80	18.20	19.60	21.20	22.90	24.70	26.70	28.80	31.10	-
50 000	13.40	14.50	15.60	16.80	18.20	19.60	21.20	22.90	24.70	26.70	28.80	31.10	-	-
63 000	14.50	15.60	16.80	18.20	19.60	21.20	22.90	24.70	26.70	28.80	31.10	-	-	-
80 000	15.60	16.80	18.20	19.60	21.20	22.90	24.70	26.70	28.80	31.10	-	-	-	-
100 000	16.80	18.20	19.60	21.20	22.90	24.70	26.70	28.80	31.10	-	-	-	-	-
200 000	21.20	22.90	24.70	26.70	28.80	31.10	-	-	-	-	-	-	-	-





**C/P ratio in dependence on life L₁₀ and rotational speed n for cylindrical roller,
spherical roller and tapered roller bearings**

Table 3

Life L _{10h} h	Rotational speed n [min ⁻¹]																
	10	16	25	40	63	100	125	160	200	250	320	400	500	630			
100	-	-	-	-	-	-	-	-	-	1.05	1.1	1.21	1.30	1.39	1.49		
500	-	-	-	1.05	1.21	1.39	1.49	1.60	1.71	1.83	1.97	2.11	2.26	2.42	2.59	2.78	2.97
1 000	-	-	1.13	1.30	1.49	1.71	1.83	1.97	2.11	2.26	2.42	2.59	2.78	2.97	3.19	3.42	3.66
1 250	-	1.05	1.21	1.39	1.60	1.83	1.97	2.11	2.26	2.42	2.59	2.78	2.97	3.19	3.42	3.66	3.92
1 600	-	1.13	1.30	1.49	1.71	1.97	2.11	2.26	2.42	2.59	2.78	2.97	3.19	3.42	3.66	3.92	4.20
2 000	1.05	1.21	1.39	1.60	1.83	2.11	2.26	2.42	2.59	2.78	2.97	3.19	3.42	3.66	3.92	4.20	4.50
2 500	1.13	1.30	1.49	1.71	1.97	2.26	2.42	2.59	2.78	2.97	3.19	3.42	3.66	3.92	4.20	4.50	4.82
3 200	1.21	1.39	1.60	1.83	2.11	2.42	2.59	2.78	2.97	3.19	3.42	3.66	3.92	4.20	4.50	4.82	5.17
4 000	1.30	1.49	1.71	1.97	2.26	2.59	2.78	2.97	3.19	3.42	3.66	3.92	4.20	4.50	4.82	5.17	5.54
5 000	1.39	1.60	1.83	2.11	2.42	2.78	2.97	3.19	3.42	3.66	3.92	4.20	4.50	4.82	5.17	5.54	5.94
6 300	1.49	1.71	1.97	2.26	2.59	2.97	3.19	3.42	3.66	3.92	4.20	4.50	4.82	5.17	5.54	5.94	6.36
8 000	1.60	1.83	2.11	2.42	2.78	3.19	3.42	3.66	3.92	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81
10 000	1.71	1.97	2.26	2.59	2.97	3.42	3.66	3.92	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30
12 500	1.83	2.11	2.42	2.78	3.19	3.66	3.92	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82
16 000	1.97	2.26	2.59	2.97	3.42	3.92	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38
20 000	2.11	2.42	2.78	3.19	3.66	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98
25 000	2.26	2.59	2.97	3.42	3.92	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62
32 000	2.42	2.78	3.19	3.66	4.20	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30
40 000	2.59	2.97	3.42	3.92	4.50	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00
50 000	2.78	3.19	3.66	4.20	4.82	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80
63 000	2.97	3.42	3.92	4.50	5.17	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.50
80 000	3.19	3.66	4.20	4.82	5.54	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.50	13.60
100 000	3.42	3.92	4.50	5.17	5.94	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.50	13.60	14.60
200 000	4.20	4.82	5.54	6.36	7.30	8.38	8.98	9.62	10.30	11.00	11.80	12.70	13.60	14.60	15.60	16.70	17.80

Life L _{10h} h	Rotational speed n [min ⁻¹]													
	800	1000	1250	1600	2000	2500	3200	4000	5000	6300	8000	10000	12500	16000
100	1.60	1.71	1.83	1.97	2.11	2.26	2.42	2.59	2.78	2.97	3.19	3.42	3.66	3.92
500	2.59	2.78	2.97	3.19	3.42	3.66	3.92	4.20	4.50	4.82	5.70	5.54	5.94	6.36
1 000	3.19	3.42	3.66	3.92	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82
1 250	3.42	3.66	3.92	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38
1 600	3.66	3.92	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98
2 000	3.92	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62
2 500	4.20	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30
3 200	4.50	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00
4 000	4.82	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80
5 000	5.17	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.70
6 300	5.54	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.70	13.60
8 000	5.94	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.70	13.60	14.60
10 000	6.36	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.70	13.60	14.60	15.60
12 500	6.81	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.70	13.60	14.60	15.60	16.70
16 000	7.30	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.70	13.60	14.60	15.60	16.70	17.90
20 000	7.82	8.38	8.98	9.62	10.30	11.00	11.80	12.70	13.60	14.60	15.60	16.70	17.90	19.20
25 000	8.38	8.98	9.62	10.30	11.00	11.80	12.70	13.60	14.60	15.60	16.70	17.90	19.20	20.60
32 000	8.98	9.62	10.30	11.00	11.80	12.70	13.60	14.60	15.60	16.70	17.90	19.20	20.60	-
40 000	9.62	10.30	11.00	11.80	12.70	13.60	14.60	15.60	16.70	17.90	19.20	20.60	-	-
50 000	10.30	11.00	11.80	12.70	13.60	14.60	15.60	16.70	17.90	19.20	20.60	-	-	-
63 000	11.00	11.80	12.70	13.60	14.60	15.60	16.70	17.90	19.20	20.60	-	-	-	-
80 000	11.80	12.70	13.60	14.60	15.60	16.70	17.90	19.20	20.60	-	-	-	-	-
100 000	12.70	13.60	14.60	15.60	16.70	17.90	19.20	20.60	-	-	-	-	-	-
200 000	15.60	16.70	17.90	19.20	20.60	-	-	-	-	-	-	-	-	-



In arrangements of the axles of road and railway vehicles the nominal life can be expressed by a revised relation in the volume of kilometers travelled.

$$L_{10km} = \left(\frac{C}{P}\right)^p \cdot \frac{\pi D}{1000}$$

L_{10km} - nominal life
 D - wheel diameter

[10^6 km]
[m]

Reference Nominal Life Values

In cases, where the life for a given arrangement is not specified in advance, the values in tables 4 and 5 can be considered as adequate

Reference Nominal Life Values in Operating Hours

Table 4

Machine Type	Nominal Life L_{10h} h
Devices and tools rarely used	1 000
Household electric appliances, small fans	2 000 to 4 000
Machines for intermittent operation, hand tools, workshop lifting tackles, agricultural machines	4 000 to 8 000
Machines with intermittent operation where high reliability is required, auxiliary power station equipment, belt conveyors, trucks, elevators	8 000 to 15 000
Rolling mills	6 000 to 12 000
Machines operating 8 - 16 hours - stationary electric motors, gear drives, textile machine spindles, plastic material processing machines, printing machines, cranes	15 000 to 30 000
Machine tools in general	20 000 to 30 000
Machines with continuous operation - stationary electric machines, conveying equipment, roller conveyors, pumps, centrifuges, blowers, compressors, hammer mills, crushers, briquetting presses, mine hoists, rope pulleys	40 000 to 60 000
Machines with continuous operation for high operating reliability - power station plants, water works machinery, paper making machines, ship machines	100 000 to 200 000

Reference Nominal Life Values in Kilometers

Table 5

Vehicle Type	Nominal Life L_{10km} km
Road vehicle wheels :	
motor cycles	60 000
passenger cars	150 000 to 250 000
trucks, buses	400 000 to 500 000
Axle box bearings for railway vehicles:	
freight wagons (according to UIC) under continuous maximum axle load acting	800 000
tram cars	1 500 000
railway passenger carriages	3 000 000
motor wagons and motor units	3 000 000 to 4 000 000
locomotives	3 000 000 to 5 000 000



Equation of Adjusted Life

Adjusted life is a corrected nominal life, where by calculation not only of the load but the influence of bearing components, material, physical, mechanical, and chemical qualities of lubricants and the temperature regime of the bearing the operating environment are taken into account.

$$L_{na} = a_1 \cdot a_{23} \cdot L_{10}$$

L_{na} - adjusted life for (100-n)% reliability
and other usual operation conditions [10⁶ rev]
 a_1 - life factor for other than 90% reliability, see Table 6
 a_{23} - life factor of material, lubricant, production technology
and operation conditions, see Pict. 1
 L_{10} - nominal life

Factor a_1 Values

Table 6

Reliability (%)	L_n	a_1
90	L_{10}	1,00
95	L_5	0,62
96	L_4	0,53
97	L_3	0,44
98	L_2	0,33
99	L_1	0,21

We can find basic values of a_{23} by using the diagram in Pict.1.

$$\chi = \frac{\nu}{\nu_1}$$

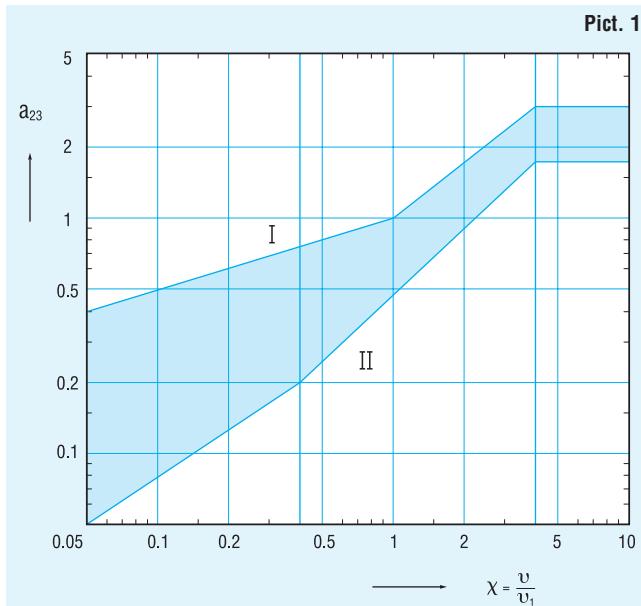
ν - kinematic lubricant viscosity by operation
bearing temperature [mm².s⁻¹]
 ν_1 - kinematic viscosity for defined rotational speed
and selected bearing dimensions [mm².s⁻¹]

Values ν and ν_1 are determined according to the diagrams in Pict. 23 or 24.

In the diagram, Pict. 1, the line I is valid for radial ball bearings operating in a very clean environment. In other cases the factor a_{23} is lower, depending on the environment cleanliness, and the decreasing tendency is dependent on the bearing design group in following order:

- angular contact ball bearings
- tapered roller bearings
- cylindrical roller bearings
- double row self-aligning ball bearings
- spherical roller bearings

Line II can be used when stating the factor a_{23} for spherical roller bearings operating in a dusty environment.



1.1.3 Equivalent Dynamic Load

In the arrangement the bearing is subjected to generally acting forces in various magnitudes, at various rotational speeds and with different acting period. From the point of view of calculation methodology the acting forces should be re-calculated into the constant load, by which the bearing will have the same life as it reaches in the conditions of the actual load.

Such a re-calculated constant radial or axial load is called the equivalent load P , or P_r (radial) or P_a (axial).

Combined Load Constant Load

Radial Bearings

The outer forces acting on a bearing are not changed both from the point of view of size and time dependence.

If the radial bearings are simultaneously subjected to constant forces in radial and axial directions, the following equation is valid for calculating the radial equivalent dynamic load:

$$P_r = X \cdot F_r + Y \cdot F_a \quad [\text{kN}]$$

P_r	- radial equivalent dynamic load	[kN]
F_r	- radial bearing load	[kN]
F_a	- axial bearing load	[kN]
X	- radial dynamic load factor	
Y	- axial dynamic load factor	

Factors X and Y depend on the ratio F_a/F_r . Values X and Y are shown in the dimension tables or in the introduction to each bearing type where closer information regarding bearing calculation of the respective type is given.

Thrust Bearings

Thrust ball bearings can carry only forces acting in axial direction and the following equation is valid for calculating axial equivalent dynamic load:

$$P_a = F_a \quad [\text{kN}]$$

P_a - axial equivalent dynamic load	[kN]
F_a - axial bearing load	[kN]



Spherical roller thrust bearings can also carry some radial load, but only by simultaneous acting of axial load, when condition $F_r \leq 0.55 F_a$ must be fulfilled. Axial equivalent dynamic load is calculated from equation

$$P_a = F_a + 1.2 F_r \quad [\text{kN}]$$

Fluctuating Load

Real fluctuating load, whose time course we know, is for calculation replaced by mean hypothetical load. This hypothetical load has the same influence on the bearing as the fluctuating load.

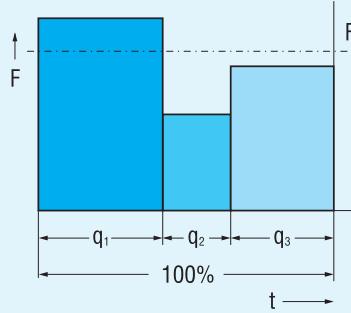
Change of Load Magnitude by Constant Rotational Speed

If the bearing is subjected to a load in a constant direction, whose magnitude is changed in dependence on time and the rotational speed is constant (Pict. 2), we can calculate the mean hypothetical load F_s according to the following equation

$$F_s = \left(\sum_{i=1}^n F_i^3 \cdot \frac{q_i}{100} \right)^{\frac{1}{3}} \quad [\text{kN}]$$

F_s - mean hypothetical constant load
 $F_i = F_1, \dots, F_n$ - constant partial actual load
 $q_i = q_1, \dots, q_n$ - share of fractional load effects

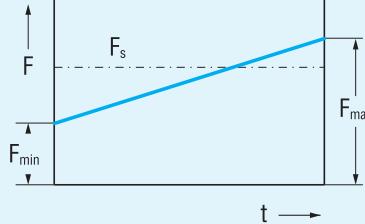
Pict. 2



At constant rotational speed with linear change of the load in constant direction (Pict. 3) the mean hypothetical load can be calculated from equation

$$F_s = \frac{F_{\min} + 2F_{\max}}{3} \quad [\text{kN}]$$

Pict. 3



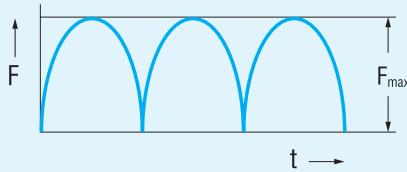


If the actual load has a sine behaviour (Pict. 4), the mean hypothetical load is

$$F_s = 0.75 \cdot F_{max}$$

[kN]

Pict. 4



Change of Load Magnitude by Change of Rotational Speed

If the bearing is subjected in time to a varying load and the rotational speed is being changed, the mean hypothetical load is calculated from equation

$$F_s = \left(\frac{\sum_{i=1}^n F_i^3 \cdot q_i \cdot n_i}{\sum_{i=1}^n q_i \cdot n_i} \right)^{\frac{1}{3}}$$

$n_i = n_1, \dots, n_n$ - constant rotational speed in time
of partial loads F_1, \dots, F_n acting [min⁻¹]
 $q_i = q_1, \dots, q_n$ - Share of partial load and rotational speed acting [%]

If in dependence on time only the rotational speed is changed, the mean hypothetical constant rotational speed is calculated from equation

$$n_s = \frac{\sum_{i=1}^n q_i \cdot n_i}{100}$$

n_s - mean rotational speed [min⁻¹]

Oscillating Motion of Bearing

By oscillating motion with amplitude γ (Pict. 5) it is the simplest way of substituting the oscillating motion by hypothetical rotation, when the rotational speed equals the oscillation frequency. For radial bearings the mean hypothetical load is calculated from the equation:

$$F_s = F_r \left(\frac{\gamma}{90} \right)^{\frac{1}{p}}$$

F_s - mean hypothetical load [kN]

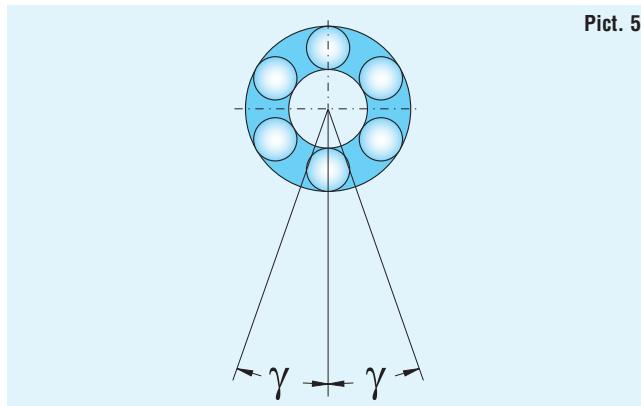
F_r - actual radial load [kN]

γ - oscillating motion amplitude [°]

p - exponent $p = 3$ for ball bearings

$p = \frac{10}{3}$ for cylindrical roller, needle roller, spherical roller and tapered roller bearings





Pict. 5

1.1.4 Temperature Influence

Delivered bearing assortment is determined for usage in an environment with operating temperatures up to 120 °C. Exceptions are double row spherical roller bearings which can work at temperatures up to 180 °C, and single row ball bearings with seals (RS, 2RS, RSR, 2RSR) applicable up to 110 °C, with seals RS2, -2RS2 applicable up to 180 °C.

For higher operation temperatures the bearings are produced so that their necessary physical and mechanical qualities and dimensional stability can be secured.

Values of the basic dynamic load ratings C_r or C_a shown in the dimension tables of this publication should be multiplied by factor f_t , shown in Table 7.

Values of f_t Factor

Table 7

Operating Temperature to [°C]	150	200	250	300
Factor f_t	0,95	0,9	0,75	0,6

1.2 Static Load

1.2.1 Basic Static Load Rating

Radial basic static load rating C_{or} and axial basic static load rating C_{oa} are shown for each bearing in the dimension tables of this publication. Values C_{or} and C_{oa} were stated by a calculation according to the standard STN ISO 76.

Basic static load rating is the load which corresponds to calculated contact stresses at the most heavily loaded contact zone of the rolling element and bearing raceway:

- 4 600 MPa for double row self-aligning ball bearings
- 4 200 MPa for the other ball bearings
- 4 000 MPa for cylindrical roller, needle roller, spherical roller and tapered roller bearings

1.2.2 Equivalent Static Load

Equivalent static load is a re-calculated radial load P_{or} for radial bearings and axial axis load P_{oa} for thrust bearings.

$$P_{or} = X_0 F_r + Y_0 F_a \quad [\text{kN}]$$

$$P_{oa} = X_0 F_r + Y_0 F_a \quad [\text{kN}]$$

P_{or} - radial static equivalent load [kN]

P_{oa} - axial static equivalent load [kN]

F_r - radial bearing load [kN]

F_a - axial bearing load [kN]

X_0 - radial load factor [kN]

Y_0 - axial load factor [kN]

Factor s_0

Table 8

Bearing motion	Type of load, demands on bearing running	s_0	
		Ball Bearings	Cylindrical roller, needle roller, spherical roller, tapered roller bearings
Rotary	distinct impact load, high demands on smooth running after static loading bearing rotates under smaller load	2 1.5	4 3
	normal demands on smooth running	1 0.5	1.5 1
	normal operating conditions and normal demands on running	2	3.5
	smooth impact-free operating	1.5	2.5
Oscillating	small oscillation angle with high frequency, with uneven impact loading	2	3.5
	large oscillating angle with low frequency and with approximately constant periodic load	1.5	2.5
Non-rotary	distinct impact load	1.5 to 1 1 to 0.4	3 to 2 2 to 0.8
	normal and small load, no special demands on bearing operation	-	4
	spherical roller thrust bearings at all kinds of motions and loads		

Factors X_0 and Y_0 are given for individual bearings in the dimensional tables of this publication. Subsequently, closer data for stating the equivalent static load of given bearing type are also given here.

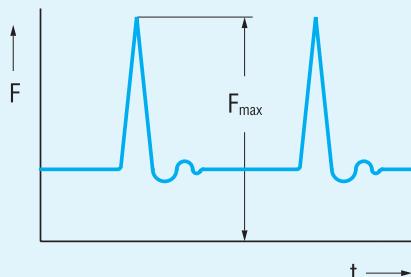
1.2.3 Bearing Safety under Static Load

In practice the bearing safety under static load is found by the ratio C_{0r}/P_{0r} or C_{0a}/P_{0a} and is compared with data in table 8, where the values of the least permissible factors s_0 for various operation conditions are shown.

$$s_0 = \frac{C_{0r}}{P_{0r}} \text{ or } \frac{C_{0a}}{P_{0a}}$$

s_0	- safety factor under static load	
C_{0r}	- radial basic static load rating	[kN]
C_{0a}	- axial basic static load rating	[kN]
P_{0r}	- radial equivalent static load or maximum acting impact force $F_{r \max}$ (Pict. 6) under distinct impact load	[kN]
P_{0a}	- axial equivalent static load or maximum acting impact force $F_{a \max}$ (Pict. 6) under distinct impact load	[kN]

Pict. 6





1.3 Limiting Speed

Limiting speed depends on the bearing type, its accuracy, cage design, internal clearance, operating conditions in arrangement, kind of lubrication and on other factors. This influence summary determines the heat generation in the bearing and also limited rotational speed which is first of all limited by the lubricant operating temperature.

For orientation, limiting rotational speed values are shown in the dimension tables for individual bearings in normal tolerance class, both for grease and oil lubrication.

Given values are valid under presumption of adequate load ($L_{10h} \geq 100\,000$ h), normal operating conditions and cooling.

It is also necessary to reduce the limiting speed values for radial bearings which are permanently loaded by relatively great axial force. The resulting limiting speed values depend on the ratio of axial and radial load F_a/F_r .

The shown limiting speed can be exceeded for ball bearings up to 3 times, cylindrical roller bearings up to 2 times, for other bearings except spherical roller and tapered roller bearings up to 1.5 times and for spherical roller bearings 1.3 times.

This exceeding requires :

- adaptation of lubrication and cooling
- higher bearing tolerance class and corresponding accuracy of the abutment parts
- higher radial clearance than normal
- cage of suitable design and material

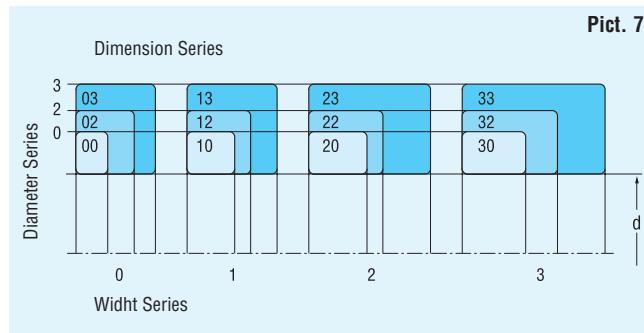


2. Rolling Bearing Design Data

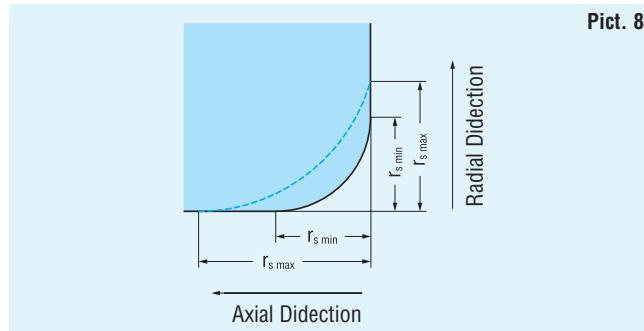
2.1 Boundary Dimensions

Bearings introduced in this publication are made in dimensions complying with the international standards STN ISO 15, STN ISO 355 and STN ISO 104.

In the dimensional plan each bearing bore diameter **d** corresponds to several outer diameters **D** and various widths are added to them - **B** or **T** for radial and **H** for thrust bearings. Bearings having the same bore diameter and outer diameter belong to one diameter series which is designated according to the ascending outer diameter by figures 7, 8, 9, 0, 1, 2, 3, 4. Within each diameter series there are bearings of various width series according to the ascending width: 8, 0, 1, 2, 3, 4, 5, 6 for radial bearings and 7, 9, 1, 2 for thrust bearings. Diameter and width series form dimension series which are designated by a two digit number, where the first digit indicates the width series and the second the diameter one, as shown in Pict. 7.



Dimensional plan also includes the bearing ring chamfer dimensions, so called mounting chamfer, see Pict. 8



2.2 Designation

Bearing designation is created by numerical and letter symbols indicating the type, size and design of the bearing, see the scheme.

In the basic design the bearings are designated by a basic designation which consists of bearing type and size designation. The type designation is usually created by the symbol indicating the bearing design (see position 3 in the scheme) and the symbol for dimension series or diameter series (positions 4 and 5 in the scheme), e.g. bearing type 223, 302, NJ22, 511, 62, 12, etc. Bearing size designation is created by symbols for the nominal bore diameter **d** (see position 6 in the scheme).

Bearings with bore diameter $d < 10$ mm:

Digit separated by a slash, or the last digit indicates directly the bore dimension in mm, e.g. 619/2, 624.



Overview of chamfer limiting values according to international standard STN ISO 582 is given in Table 9.

Limiting Dimensions of Mounting Chamfer

Table 9

r _s min	Radial Bearings except Tapered Roller Bearings				Tapered Roller Bearings				Thrust Bearings r _s max in radial and axial direction
	d or D above	to	r _s max in radial direction	in axial direction	d or D above	to	r _s max in radial direction	in axial direction	
	mm								
0.15	-	-	0.3	0.6	-	-	-	-	0.3
0.2	-	-	0.5	0.8	-	-	-	-	0.5
0.3	-	40	0.6	1	-	40	0.7	1.4	0.8
	40	-	0.8	1	40	-	0.9	1.6	0.8
0.6	-	40	1	2	-	40	1.1	1.7	1.5
	40	-	1.3	2	40	-	1.3	2	1.5
1	-	50	1.5	3	-	50	1.6	2.5	2.2
	50	-	1.9	3	50	-	1.9	3	2.2
1.1	-	120	2	3.5	-	-	-	-	2.7
	120	-	2.5	4	-	-	-	-	2.7
1.5	-	120	2.3	4	-	120	2.3	3	3.5
	120	-	3	5	120	250	2.8	3.5	3.5
	-	-	-	-	250	-	3.5	4	3.5
2	-	80	3	4.5	-	120	2.8	4	4
	80	220	3.5	5	120	250	3.5	4.5	4
	220	-	3.8	6	250	-	4	5	4
2.1	-	280	4	6.5	-	-	-	-	4.5
	280	-	4.5	7	-	-	-	-	4.5
2.5	-	100	3.8	6	-	120	3.5	5	-
	100	280	4.5	6	120	250	4	5.5	-
	280	-	5	7	250	-	4.5	6	-
3	-	280	5	8	-	120	4	5.5	5.5
	280	-	5.5	8	120	250	4.5	6.5	5.5
	-	-	-	-	250	400	5	7	5.5
	-	-	-	-	400	-	5.5	7.5	5.5
4	-	-	6.5	9	-	120	5	7	6.5
	-	-	-	-	120	250	5.5	7.5	6.5
	-	--	--	-	250	400	6	8	6.5
	-	-	-	-	400	-	6.5	8.5	6.5
5	-	-	8	10	-	180	6.5	8	8
	-	-	-	-	180	-	7.5	9	8
6	-	-	10	13	-	180	7.5	10	10
	-	-	-	-	180	-	9	11	10
7.5	-	-	12.5	17	-	-	-	-	12.5
9.5	-	-	15	19	-	-	-	-	15
12	-	-	18	24	-	-	-	-	18
15	-	-	21	30	-	-	-	-	21

Bearings with bore diameter d = 10 to 17 mm: double digit number 00 indicates bore d = 10 mm, e.g. 6200
01 d = 12 mm, e.g. 6001
02 d = 15 mm, e.g. 6202
03 d = 17 mm, e.g. 6303

An exception to the designation are separable single row ball bearings - types E and BO, where the double digit number indicates directly the bore diameter in mm, e.g. E17.

Bearings with bore diameter d = 20 to 480 mm: Bore diameter is a fivefold of the last double digit number, e.g. bearing 1320 has the bore diameter d = 20 x 5 = 100.



An exception create bearings with bore $d = 22, 28, and 32 mm, where the double digit number separated by a slash indicates directly the bore diameter in mm, e.g. 320/32AX, further separable single row ball bearings - type E and single row cylindrical roller bearings - type E, where the double digit number, or number indicates directly the bore diameter in mm, e.g.: E20.$

Bearings with bore diameter $d \geq 500$ mm

The last three or four digit number separated by a slash indicates directly the bore diameter in mm, e.g. 230/530M, NU29/1060.

Bearings produced in different design than standard are designated by so called complete designation, see the scheme. It consists of the basic designation and prefixes and suffixes indicating the difference from the basic design.

Meaning of Prefixes and Suffixes

In compliance with complete designation a survey and meaning of used prefixes and suffixes is given in the following part. (Number in brackets at individual groups corresponds to the position number in the scheme).

Prefixes Material Different from Standard Bearing Steel (1)

- X corrosion resisting steel, e.g. X 623
T case hardened steel, e.g. T 32240

Incomplete Bearing (2)

- L removable ring of separable bearing, e.g. LNU 206, for thrust ball bearings without shaft washer, e.g. L 51215
R separable bearing without removable ring, e.g. RNU 206 or RN 310
E single shaft washer of thrust roller bearing, e.g. E 51314
W single housing washer of thrust ball bearing, e.g. W 51411
K cage with rolling elements, e.g. K NU 320

Suffixes Difference of Internal Design (7)

- A single row angular contact ball bearing, contact angle $\alpha = 25^\circ$,
e.g. B7205 ATB P5
AA single row angular contact ball bearing with contact angle $\alpha = 26^\circ$,
e.g. B72010 AATB P4
B single row angular contact ball bearing with contact angle $\alpha = 40^\circ$,
e.g. 7304B
BE single row angular contact ball bearing with contact angle $\alpha = 40^\circ$,
in new design, e.g. 7310 BETNG
C Single row angular contact ball bearing with contact angle $\alpha = 15^\circ$,
e.g. B7202 CTB P4
CA single row angular contact ball bearing with contact angle $\alpha = 12^\circ$,
e.g. B7202 CATB P5
CB single row angular contact ball bearing with contact angle $\alpha = 10^\circ$,
e.g. B7206 CBTB P4
CC double row spherical roller bearing in new design, e.g. 23996 CCM
D single row ball bearing - type 160 with higher load rating, e.g.
16004D
E single row cylindrical roller bearing with higher load rating, e.g.
NU 209E

Difference of Boundary Dimensions

- X change of boundary dimensions, introduced by new international standards, e.g. 32028 AX

Shields or Seals

- RS seal on one side, e.g. 6304 RS
-2RS seals on both sides, e.g. 6204-2RS
RSN seal on one side and snap ring groove in outer ring opposite to seal side, e.g. 6306 RSN
RSNB seal on one side and snap ring groove in outer ring on the same side as seal, e.g. 6210 RSNB
-2RSN seals on both sides and snap ring groove in outer ring, e.g.
6310-2RSN
RSR seal on one side adhering to flat surface of inner ring, e.g. 624 RSR
-2RSR seals on both sides adhering to flat surface of inner ring,
e.g. 608-2RSR
Z metal shield on one side, e.g. 6206 Z



-2Z	metal shields on both sides, e.g. 6304-2Z
ZN	metal shield on one side and snap ring groove in outer ring opposite to metal shield, e.g. 6208 ZN
ZNB	metal shield on one side and snap ring groove in outer ring on the same side as shield, e.g. 6306 ZNB
-2ZN	metal shields on both sides and snap ring groove in outer ring, e.g. 6208-2ZN
ZR	metal shield on one side adhering to flat surface of inner ring, e.g. 608 ZR
-2ZR	metal shields on both sides adhering to flat surface of inner ring, e.g. 608-2ZR

Bearing Ring Design Variation (10)	K	tapered bore, taper 1:12, e.g. 6207 K
	K30	tapered bore, taper 1:30, e.g. 24064 K30M
	N	snap ring groove in outer ring, e.g. 6308 N
	NR	snap ring groove in outer ring and inserted snap ring, e.g. 6310 NR
	NX	snap ring groove in outer ring whose boundary dimensions do not correspond to STN 02 4605, e.g. 6210 NX
	D	split inner ring, e.g. 3309 D
	W33	groove and lubrication holes in bearing outer ring surface, e.g. 23148 W33M
	O	lubrication grooves in bearing outer ring, e.g. NU 10140

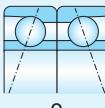
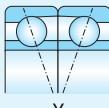
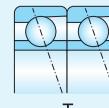
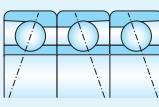
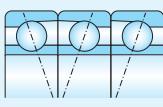
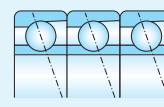
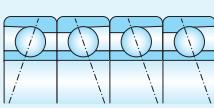
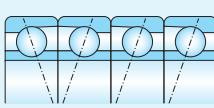
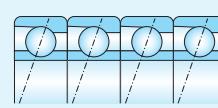
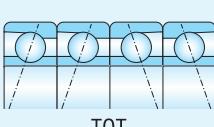
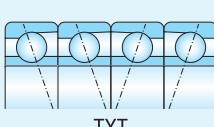
Cages (11)	Cage material for bearings in basic design is not usually indicated.	
J	pressed steel cage, rolling element centred, e.g. 6034 J	
Y	pressed brass cage, rolling elements centred, e.g. 6001 Y	
F	machined steel cage, rolling elements centred, e.g. 6418 F	
L	machined light metal cage, rolling elements centred, e.g. NG180L C3S0	
M	machined brass or bronze cage, rolling elements centred, e.g. NU 330M	
T	machined cage made of textite, rolling elements centred, e.g. 6005 T P5	
TN	machined cage made of polyamide or similar plastic, rolling elements centred, e.g. 6207 TN	
TNG	machined cage made of polyamide or similar plastic with glass fibres, rolling elements centred, e.g. 2305 TNG	

Cage design (introduced symbols are always used in connection with cage material symbols).

A	cage centred on outer ring, e.g. NU226 MA
B	cage centred on inner ring, e.g. 6210 TB
P	machined window-type cage, e.g. NU 1060 MAP
H	one-piece open-type cage, e.g. 6209 TNH
S	cage with lubrication grooves, e.g. NJ 418 MAS
V	bearing without cage, full rolling element number, e.g. NU 209V

Tolerance Class (12)	P0	standard tolerance class (not indicated), e.g. 6204
	P6	higher tolerance class than standard, e.g. 6322 P6
	P5	higher tolerance class than P6, e.g. 6201 P5
	P5A	in some parameters higher tolerance class than P5, e.g. 6006 TB P5A
	P4	higher tolerance class than P5, e.g. 6207 P4
	P4A	in some parameters higher tolerance class than P4, e.g. 6007 P4A
	P2	higher tolerance class than P4, e.g. 6306 P2
	P6E	higher tolerance class for rotating electric machines, e.g. 6204 P6E



Clearances (13)	C2	clearance less than normal, e.g. 608 C2
	C3	normal clearance (not indicated), e.g. 6204
	C4	clearance greater than normal, e.g. 6310 C3
	C5	clearance greater than C3, e.g. NU 320 M C4
	NA	radial clearance for bearings with non-interchangeable rings (always after radial clearance symbol), e.g. NU 215 P63 NA
	R...	radial clearance in non-standardized range (range in mm), e.g. 6210A R10-20
	A...	axial clearance in non-standardized range (range in mm), e.g. 3210 A20-30
Vibration Level (14)	C6	reduced vibration level lower than normal (not indicated) e.g. 6304 C6
	C06	reduced vibration level lower than C6, e.g. 6205 C06
	C66	reduced vibration level lower than C06, e.g. 6205 C66 Concrete C06 and C66 values are determined after negotiations between customer and supplier. <i>Note: Bearings in tolerance class P5 and higher have vibration level C6</i>
Increased Operation Safety	C7, C8, C9	- bearings with increased operation safety determined primarily for aircraft industry, e.g. 16008 C8
Symbol Combination (12 - 15)	P6 + C3 = P63	e.g. 6211 P63
	P6 + C8 = P68	e.g. 16002 P68
	C3 + C6 = C36	e.g. 6303-2RS C36
	P5 + C3 + C9 = P539	e.g. 6205MA P539
	P6 + C2NA + C6 = P626NA	e.g. NU1038 P626NA
Bearing Arrangement in Matched Set (16)	Designation of the arrangement in matched sets of two, three or four bearings consists of symbols indicating the bearing arrangement and symbols determining internal clearance, or preload of matched bearings.	
	Besides symbols shown in the table also U symbol is used and it indicates that respective bearings can be universally matched, e.g. B7003CTA P4UL.	
	0	
	X	
	T	
	OT	
	XT	
	TT	
	OTT	
	XTT	
	TTT	
	TOT	
	TXT	



Internal Clearance or Preload

Introduced symbols are always used in combination with matching symbols.

- A bearing matching with clearance, e.g. 73050 A
- O bearing matching without clearance, e.g. 7305 P6XO
- L bearing matching with light preload, e.g. B7205 CATB P4UL
- M bearing matching with medium preload, e.g. B7204 CATB P5XM
- S bearing matching with great preload, e.g. B7304 AATB P4OS

Stabilization for Operation at Higher Temperature

Both rings have stabilized dimensions for operation at higher temperature

- S0 for operating temperature up to 150°C
- S1 up to 200°C
- S2 up to 250°C
- S3 up to 300°C
- S4 up to 350°C
- S5 up to 400°C

Designation example - NG 160 LB C4S3.

Friction Moment (18)

- JU reduced friction moment, e.g. 619/2 JU
- JUA bearings with determined friction moment for starting up, e.g. 623 JUA
- JUB bearings with determined friction moment for running out, e.g. 623 JUB

Grease (19)

For designation of bearings with shields or seals on both sides, filled with grease different from the standard one, symbol combinations are used for designation. The first two symbols determine the operating temperature range and the third (a letter) the name or type of lubricant, according to producer's prescription, or another symbol (a digit) determines the grease volume, which the sealed or shielded inner bearing's space is filled with.

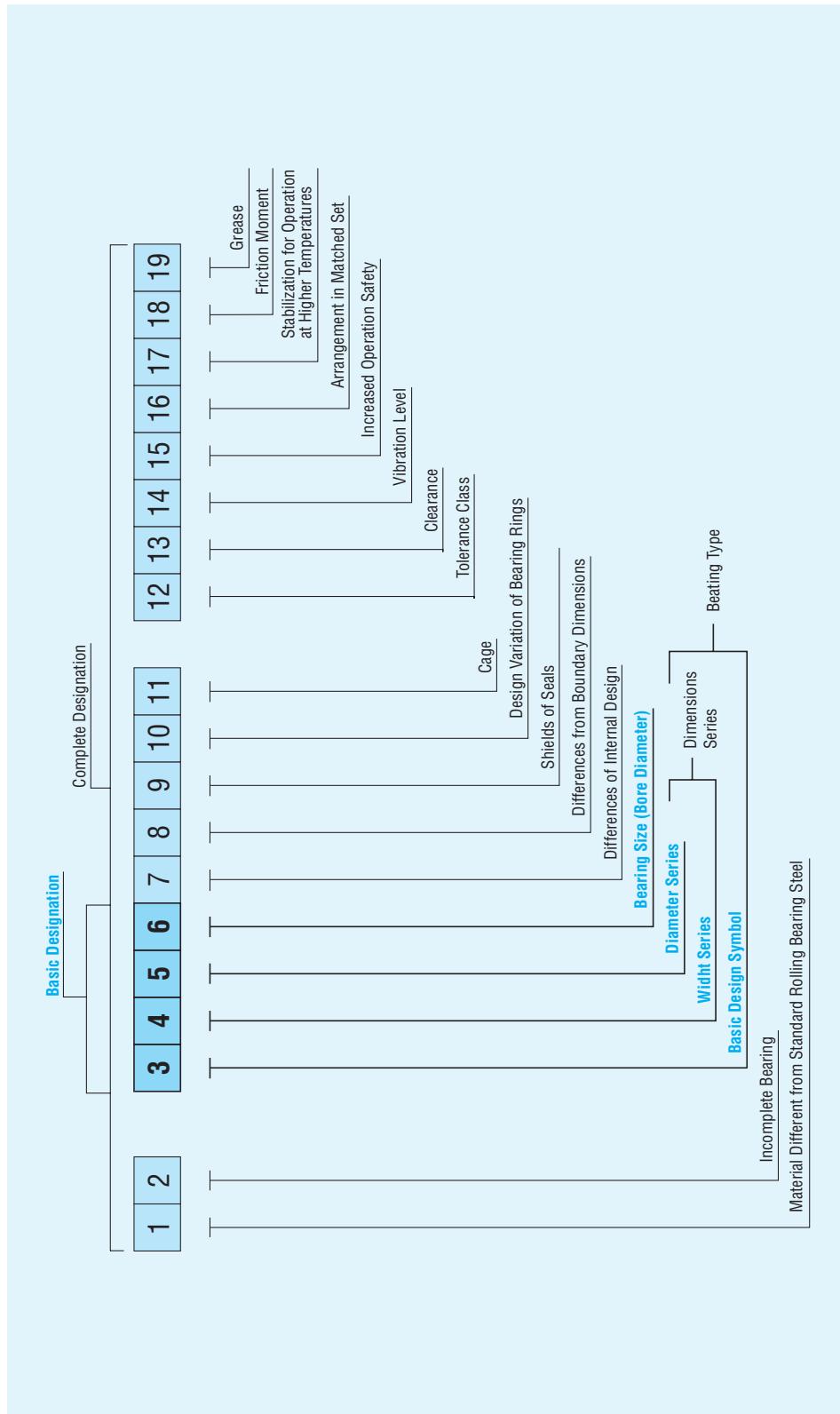
- TL grease for low operating temperatures from -60°C to +100°C, designation example 6302-2RS TL
- TM grease for medium operating temperatures from -35°C to +140°C, designation example 6204-2ZR TM
- TH grease for high operating temperatures from -30°C to +200°C, designation example 6202-2Z TH
- TW grease for both low and high operating temperatures from -40°C to +150°C, designation example 6310-2Z C4TW

Note: Symbol TM need not be marked on bearings and packages.

Bearings according to Special Drawing Documentation PLC

PLC A-BC-DE-F designation structure

- PLC symbol for special rolling bearing
- A design group
 - 0 single row ball bearings
 - 1 double row ball bearings
 - 2 thrust ball bearings
 - 3 not occupied
 - 4 single row cylindrical roller, spherical roller and needle roller bearings
 - 5 double and multi-row cylindrical roller, spherical roller and needle roller bearings
 - 6 single, double and four-row tapered roller bearings
 - 7 special double row bearings
 - 8 assembly units and separate parts
 - 9 thrust cylindrical roller, spherical roller, tapered roller and needle roller bearings
- BC dimensional group - two digit symbols
- DE series number in dimensional group - two digit symbols
- F variation of design - one digit symbol





2.3 Tolerance

Under bearing tolerance, dimension and operation accuracy is understood. Bearings are manufactured in tolerance classes P0, P6, P5A, P4, P4A, P2, SP and UP.

Tolerance class P0 is the basic one and a decreasing number in designation means the higher bearing tolerance class. Limiting values for dimension and operation accuracy shown in tables 20 to 30 comply with the standard STN ISO 492 and STN ISO 199. Designation P5A and P4A are used for bearings manufactured in corresponding tolerance class (P5, P4), or selected parameters are in higher tolerance class than P5 and P4.

Tolerance Symbols and Their Meaning

d	nominal bore diameter
d_1	nominal diameter of larger theoretical tapered bore diameter
d_2	nominal diameter of shaft washer of double direction thrust bearings
Δ_{ds}	deviation of a single bore diameter
Δ_{dmp}	deviation of mean bore diameter in a single plane
Δ_{d1mp}	deviation of mean larger theoretical diameter of tapered bore
Δ_{d2mp}	mean shaft washer bore diameter deviation of double direction thrust bearings in single radial plane
V_{dp}	Bore diameter variation ; difference between the largest and smallest single bore diameters in one radial plane
V_{dsp}	variation of bore diameter in a single plane
V_{dmp}	variation of mean bore diameter
V_{d2p}	shaft washer bore diameter variation of double direction thrust bearings
D	nominal outside diameter
Δ_{Ds}	deviation of a single outside diameter
Δ_{Dmp}	deviation of mean outside diameter in a single plane
V_{Dsp}	Outside diameter variation in a single plane
V_{Dp}	Outside diameter variation; difference between the largest and smallest single outsider diameters in one radial plane
V_{Dmp}	variation of mean outside diameter
B	nominal ring width
T	nominal bearing width
T_1	nominal effective width of inner subunit
T_2	nominal effective width of outer ring
Δ_{Bs}	deviation of a single inner ring width
Δ_{Cs}	deviation of a single outer ring width
Δ_{Ts}	deviation of the actual bearing height
Δ_{T1s}	deviation of the actual effective width of inner subunit
Δ_{T2s}	deviation of the actual effective width of outer ring
C	nominal ring width
V_{Bs}	inner ring single width variation
V_{Cs}	variation of ring width
K_{ia}	radial runout of inner ring of assembled bearing
K_{ea}	radial runout of outer ring of assembled bearing
S_i	parallelism of inner ring raceway with respect to the face
S_e	parallelism of outer ring raceway with respect to the face
S_{ia}	axial runout of inner ring of assembled bearing
S_{ea}	axial runout of outer ring of assembled bearing
S_d	perpendicularity of inner ring face with respect to the bore
S_D	perpendicularity of outer ring outside surface with respect to the face



Dimension and Running Accuracy of Radial Bearings (except Tapered Roller Bearings)

Table 10

Tolerance Class P0

Inner Ring

d mm		Cylindrical Bore Δ_{dmp} V_{dsp} V_{dmp} K_{ia} Δ_{Bs} V_{Bs}										Tapered Bore Δ_{dmp} Δ_{d1mp} Δ_{dmp} $V^{1)}_{dp}$				
		Diameter Series 7,8,9 0,1 2,3,4														
		over	to	max	min	max	max	max	max	min	max	max	min	max	min	max
				μm												
2.5	10	0	-8	10	8	6	6	10	0	-120	15	-	-	-	-	-
10	18	0	-8	10	8	6	6	10	0	-120	20	-	-	-	-	-
18	30	0	-10	13	10	8	8	13	0	-120	20	+21	0	+21	0	13
30	50	0	-12	15	12	9	9	15	0	-120	20	+25	0	+25	0	15
50	80	0	-15	19	19	11	11	20	0	-150	25	+30	0	+30	0	19
80	120	0	-20	25	25	15	15	25	0	200	25	+35	0	+35	0	25
120	180	0	-25	31	31	19	19	30	0	-250	30	+40	0	+40	0	31
180	250	0	-30	38	38	23	23	40	0	-300	30	+46	0	+46	0	38
250	315	0	-35	44	44	26	26	50	0	-350	35	+52	0	+52	0	44
315	400	0	-40	50	50	30	30	60	0	-400	40	+57	0	+57	0	50
400	500	0	-45	56	56	34	34	65	0	-450	50	+63	0	+63	0	56
500	630	0	-50	63	63	38	38	70	0	-500	60	-	-	-	-	-
630	800	0	-75	-	-	-	-	80	0	-750	70	-	-	-	-	-
800	1000	0	-100	-	-	-	-	90	0	-1000	80	-	-	-	-	-
1000	1250	0	-125	-	-	-	-	100	0	-1250	100	-	-	-	-	-

Outer Ring

D mm		V _{Dsp} Δ_{Dmp} Diameter Series 7, 8, 9 0, 1 2, 3, 4 bearings ²⁾ with seals										V _{Dmp} K _{ea} Δ_{Cs}, Δ_{Cs}				
		over to mm														
				max	min	max	max	max	max	max						
6	18	0	-8	10	8	6	10	6	15			Corresponds to Δ_{Bs}, V_{Bs} of the same bearing inner ring				
18	30	0	-9	12	9	7	12	7	15							
30	50	0	-11	14	11	8	16	8	20							
50	80	0	-13	16	13	10	20	10	25							
80	120	0	-15	19	19	11	26	11	35							
120	150	0	-18	23	23	14	30	14	40							
150	180	0	-25	31	31	19	38	19	45							
180	250	0	-30	38	38	23	-	23	50							
250	315	0	-35	44	44	26	-	26	60							
315	400	0	-40	50	50	30	-	30	70							
400	500	0	-45	56	56	34	-	34	80							
500	630	0	-50	63	63	38	-	38	100							
630	800	0	-75	94	94	55	-	55	120							
800	1000	0	-100	125	125	75	-	75	140							
1000	1250	0	-125	-	-	-	-	-	160							
1250	1600	0	-160	-	-	-	-	-	190							

¹⁾ Valid in any bore radial plane

²⁾ Valid only for bearings in diameter series 2, 3 and 4





Dimension and Running Accuracy of Radial Bearings (except Tapered Roller Bearings)

Table 11

Tolerance Class P6

Inner Ring

d		Δd_{mp}		V_{dsp}		V_{dmp}		K_{ia}	ΔB_s	V_{Bs}
over mm	to µm	Diameter Series 7, 8, 9 0, 1 2, 3, 4								
		max	min	max	max	max	max	max	min	max
2.5	10	0	-7	9	7	5	5	6	0	-120 15
10	18	0	-7	9	7	5	5	7	0	-120 20
18	30	0	-8	10	8	6	6	8	0	-120 20
30	50	0	-10	13	10	8	8	10	0	-120 20
50	80	0	-12	15	15	9	9	10	0	-150 25
80	120	0	-15	19	19	11	11	13	0	-200 25
120	180	0	-18	23	23	14	14	18	0	-250 30
180	250	0	-22	28	28	17	17	20	0	-300 30
250	315	0	-25	31	31	19	19	25	0	-350 35
315	400	0	-30	38	38	23	23	30	0	-400 40
400	500	0	-35	44	44	26	26	35	0	-450 45
500	630	0	-40	50	50	30	30	40	0	-500 50

Outer Ring

D		ΔD_{mp}		V_{Dsp}		V_{Dmp}		K_{ea}	$\Delta C_s, \Delta C_{cs}$
over mm	to µm	Diameter Series 7, 8, 9 0, 1 2, 3, 4 bearings ¹⁾ with seals							
		max	min	max	max	max	max	max	max
6	18	0	-7	9	7	5	9	5	8
18	30	0	-8	10	8	6	10	6	9
30	50	0	-9	11	9	7	13	7	10
50	80	0	-11	14	11	8	16	8	13
80	120	0	-13	16	16	10	20	10	18
120	150	0	-15	19	19	11	25	11	20
150	180	0	-18	23	23	14	30	14	23
180	250	0	-20	25	25	15	-	15	25
250	315	0	-25	31	31	19	-	19	30
315	400	0	-28	35	35	21	-	21	35
400	500	0	-33	41	41	25	-	25	40
500	630	0	-38	48	48	29	-	29	50
630	800	0	-45	56	56	34	-	34	60
800	1000	0	-50	75	75	45	-	45	75

¹⁾ Valid only for bearings in diameter series 0, 1, 2, 3 and 4



Dimension and Running Accuracy of Radial Bearings (except Tapered Roller Bearings)

Table 12

Tolerance Class P5

Inner Ring

d		Δ_{Dmp}		V_{dsp}		V_{Dmp}		K_{ia}	S_d	$S_{ia}^{(1)}$	Δ_{Bs}	V_{Bs}
				Diameter Series 7, 8, 9		0, 1, 2, 3, 4						
over	to	max	min	max	max	max	max	max	max	max	min	max
mm		μm										
2.5	10	0	-5	5	4	3	4	7	7	0	-40	5
10	18	0	-5	5	4	3	4	7	7	0	-80	5
18	30	0	-6	6	5	3	4	8	8	0	-120	5
30	50	0	-8	8	6	4	5	8	8	0	-120	5
50	80	0	-9	9	7	5	5	8	8	0	-150	6
80	120	0	-10	10	8	5	6	9	9	0	-200	7
120	180	0	-13	13	10	7	8	10	10	0	-250	8
180	250	0	-15	15	12	8	10	11	13	0	-300	10
250	315	0	-18	18	14	9	13	13	15	0	-350	13
315	400	0	-23	23	18	12	15	15	20	0	-400	15

Outer Ring

D		Δ_{Dmp}		V_{Dsp}		V_{Dmp}		K_{ea}	S_d	$S_{ea}^{(1)}$	Δ_{Cs}	V_{Cs}
				Diameter Series ²⁾ 7, 8, 9		0, 1, 2, 3, 4						
over	to	max	min	max	max	max	max	max	max	max	max	
mm		μm										
6	18	0	-5	5	4	3	5	8	8	Corresponds to Δ_{Bc} of the same bearing inner ring	5	
18	30	0	-6	6	5	3	6	8	8		5	
30	50	0	-7	7	5	4	7	8	8		5	
50	80	0	-9	9	8	5	8	8	10		6	
80	120	0	-10	10	8	5	10	9	11		8	
120	150	0	-11	11	8	6	11	10	13		8	
150	180	0	-13	13	10	7	13	10	14		8	
180	250	0	-15	15	11	8	15	11	15		10	
250	315	0	-18	18	14	9	18	13	18		11	
315	400	0	-20	20	15	10	20	13	20		13	
400	500	0	-23	23	17	12	23	15	23		15	
500	630	0	-28	28	21	14	25	18	25		18	
630	800	0	-35	35	26	18	30	20	30		20	

¹⁾ Valid only for ball bearings

²⁾ Not valid for shielded or sealed bearings





Dimension and Running Accuracy of Radial Bearings (except Tapered Roller Bearings)

Table 13

Tolerance Class P4

Inner Ring

d		Δ_{dmp}				$\Delta_{ds}^{1)}$		V_{dsp}	V_{dmp}	K_{ia}	S_d	$S_{la}^{2)}$	Δ_{Bs}	V_{Bs}	
						Diameter Series 7, 8, 9 0, 1, 2, 3, 4									
over	to	max	min	max	min	max	max	max	max	max	max	max	max	min	max
mm		μm													
2.5	10	0	-4	0	-4	4	3	2	2.5	3	3	0	-40	2.5	
10	18	0	-4	0	-4	4	3	2	2.5	3	3	0	-80	2.5	
18	30	0	-5	0	-5	5	4	2.5	3	4	4	0	-120	2.5	
30	50	0	-6	0	-6	6	5	3	4	4	4	0	-120	3	
50	80	0	-7	0	-7	7	5	3.5	4	5	5	0	-150	4	
80	120	0	-8	0	-8	8	6	4	5	5	5	0	-200	4	
120	180	0	-10	0	-10	10	8	5	6	6	7	0	-250	5	
180	250	0	-12	0	-12	12	9	6	8	7	8	0	-300	6	

Outer Ring

D		Δ_{Dmp}				$V_{Ds}^{1)}$		V_{Dsp}	V_{Dmp}	K_{ea}	S_d	$S_{ea}^{2)}$	Δ_{Cs}	V_{Cs}
						Diameter Series 3) 7, 8, 9 0, 1, 2, 3, 4								
over	to	max	min	max	min	max	max	max	max	max	max	max	max	max
mm		μm												
6	18	0	-4	0	-4	4	3	2	3	4	5	Corresponds to Δ_{Bs} of the same bearing inner ring	2.5	
18	30	0	-5	0	-5	5	4	2.5	4	4	5		2.5	
30	50	0	-6	0	-6	6	5	3	5	4	5		2.5	
50	80	0	-7	0	-7	7	5	3.5	5	4	5		3	
80	120	0	-8	0	-8	8	6	4	6	5	6		4	
120	150	0	-9	0	-9	9	7	5	7	5	7		5	
150	180	0	-10	0	-10	10	8	5	8	5	8		5	
180	250	0	-11	0	-11	11	8	6	10	7	10		7	
250	315	0	-13	0	-13	13	10	7	11	8	10		7	
315	400	0	-15	0	-15	15	11	8	13	10	13		8	

¹⁾ Valid only for bearings with diameter series 0, 1, 2, 3 and 4²⁾ Valid only for ball bearings³⁾ Not valid for shielded or sealed bearings



Dimension and Running Accuracy of Radial Bearings (except Tapered Roller Bearings)

Table 14

Tolerance Class SP (Double Row Cylindrical Roller Bearings)

Inner Ring

d over mm	to μm	Δ_{dmp} max	Δ_{d1mp} min	- Δ_{dmp} max	V_{dp} max	K_{ia} max	S_d max	Δ_{Bs} max	V_{Bs} min	V_{Bs} max	
18	30	+10	0	+4	0	3	3	8	0	-100	5
30	50	+12	0	+4	0	4	4	8	0	-120	5
50	80	+15	0	+5	0	5	4	8	0	-150	6
80	120	+20	0	+6	0	5	5	9	0	-200	7
120	180	+25	0	+8	0	7	6	10	0	-250	8
180	250	+30	0	+10	0	8	8	11	0	-300	10
250	315	+35	0	+12	0	9	10	13	0	-350	13
315	400	+40	0	+13	0	12	12	15	0	-400	15
400	500	+45	0	+15	0	14	12	18	0	-450	25

Outer Ring

D over mm	to μm	Δ_{Dmp} max	V_{Dp} min	K_{ea} max	S_D max	Δ_{Cs}, V_{Cs}
50	80	0	-9	5	5	8
80	120	0	-10	5	6	9
120	150	0	-11	6	7	10
150	180	0	-13	7	8	10
180	250	0	-15	8	10	11
250	315	0	-18	9	11	13
315	400	0	-20	10	13	13
400	500	0	-23	12	15	15
500	630	0	-28	14	17	18
630	800	0	-35	18	20	20



Dimension and Running Accuracy of Cylindrical Roller Bearings with Tapered Bore

Table 15

Tolerance Class UP (Double Row Cylindrical Roller Bearings)

Inner Ring

d over mm	to	Δ_{dmp} max	V_{dmp} min	Δ_{d1mp} max	$-\Delta_{dmp}$ min	V_{dp} max	K_{ia} max	S_d max	Δ_{Bs} max	V_{Bs} min	V_{Bs} max
		μm									
18	30	+6	0	+2	0	3	1.5	3	0	-25	1.5
30	50	+7	0	+3	0	3	2	3	0	-30	2
50	80	+8	0	+3	0	4	2	4	0	-40	3
80	120	+10	0	+4	0	4	3	4	0	-50	3
120	180	+12	0	+5	0	5	3	5	0	-60	4
180	250	+14	0	+6	0	6	4	6	0	-75	5
250	315	+17	0	+8	0	8	5	6	0	-90	6

Outer Ring

D over mm	to	Δ_{Dmp} max	V_{Dsp} min	K_{ea} max	S_D max	Δ_{Cs}, V_{Cs}
		μm				
50	80	0	-6	3	3	2
80	120	0	-7	4	3	3
120	150	0	-8	4	4	3
150	180	0	-9	5	4	3
180	250	0	-10	5	5	4
250	315	0	-12	6	6	4
315	400	0	-14	7	7	5

Dimension and Running Accuracy of Tapered Roller Bearings

Table 16

Tolerance Class P0

Cone and Overall Bearing Width

d over mm	to	Δ_{dmp} max	V_{dsp} min	V_{dmp} max	K_{ia} max	Δ_{Bs} max	Δ_{Ts} min	Δ_{T1s} max	Δ_{T1s} min	Δ_{T2s} max	Δ_{T2s} min	
		μm										
10	18	0	-12	12	9	15	0	-120	+200	0	+100	0
18	30	0	-12	12	9	18	0	-120	+200	0	+100	0
30	50	0	-12	12	9	20	0	-120	+200	0	+100	0
50	80	0	-15	15	11	25	0	-150	+200	0	+100	0
80	120	0	-20	20	15	30	0	-200	+200	-200	+100	-100
120	180	0	-25	25	19	35	0	-250	+350	-250	+150	-150
180	250	0	-30	30	23	50	0	-300	+350	-250	+150	-150

Cup

D over mm	to	Δ_{Dmp} max	V_{Dsp} min	V_{Dmp} max	K_{ea} max	Δ_{Cs} max	Δ_{Cs} min
		μm					
18	30	0	-12	12	9	18	0
30	50	0	-14	14	11	20	0
50	80	0	-16	16	12	25	0
80	120	0	-18	18	14	35	0
120	150	0	-20	20	15	40	0
150	180	0	-25	25	19	45	0
180	250	0	-30	30	23	50	0
250	315	0	-35	35	26	60	0
315	400	0	-40	40	30	70	0



Dimension and Running Accuracy of Tapered Roller Bearings

Table 17

Tolerance Class P6X

Cone and Overall Bearing Width

d over mm	Δ_{dmp} max	V_{dsp} min	V_{dmp} max	K_{ia} max	Δ_{Bs} max	Δ_{Ts} min	Δ_{T1s} max	Δ_{T1s} min	Δ_{T2s} max	Δ_{T2s} min	
to μm											
10 18	0	-12	12	9	15	0	-50	+100	0	+50	0
18 30	0	-12	12	9	18	0	-50	+100	0	+50	0
30 50	0	-12	12	9	20	0	-50	+100	0	+50	0
50 80	0	-15	15	11	25	0	-50	+100	0	+50	0
80 120	0	-20	20	15	30	0	-50	+100	0	+50	0
120 180	0	-25	25	19	35	0	-50	+150	0	+50	0

Cup

D over mm	Δ_{Dmp} max	V_{Dsp} min	V_{Dmp} max	K_{ea} max	Δ_{Cs} max	Δ_{Cs} min	
to μm							
18 30	0	-12	12	9	18	0	-100
30 50	0	-14	14	11	20	0	-100
50 80	0	-16	16	12	25	0	-100
80 120	0	-18	18	14	35	0	-100
120 150	0	-20	20	15	40	0	-100
150 180	0	-25	25	19	45	0	-100
180 250	0	-30	30	23	50	0	-100
250 315	0	-35	35	26	60	0	-100

Dimension and Running Accuracy of Tapered Roller Bearings

Table 18

Tolerance Class P6

Cone and Overall Bearing Width

d over mm	Δ_{dmp} max	K_{ia} min	Δ_{Bs} max	Δ_{Ts} min	Δ_{Ts} max	Δ_{Ts} min	
to μm							
10 18	0	-7	7	0	-200	+200	0
18 30	0	-8	8	0	-200	+200	0
30 50	0	-10	10	0	-240	+200	0
50 80	0	-12	10	0	-300	+200	0
80 120	0	-15	13	0	-400	+200	-200
120 180	0	-18	18	0	-500	+350	-250

Cup

D over mm	Δ_{Dmp} max	K_{ea} min	Δ_{Cs} max
to μm			
18 30	0	-8	9
30 50	0	-9	10
50 80	0	-11	13
80 120	0	-13	18
120 150	0	-15	20
150 180	0	-18	23
180 250	0	-20	25
250 315	0	-25	30

Corresponds to Δ_{Bs} of the same bearing cone



Dimension and Running Accuracy of Tapered Roller Bearings

Table 19

Tolerance Class P5

Cone and Overall Bearing Width

d over mm	to μm	Δ_{dmp} max	V_{dsp} min	V_{dmp} max	K_{ia} max	S_d max	Δ_{Bs} max	Δ_{Ts} min	Δ_{Ts} max	Δ_{Ts} min	
10	18	0	-7	5	5	5	7	0	-200	+200	-200
18	30	0	-8	6	5	5	8	0	-200	+200	-200
30	50	0	-10	8	5	5	8	0	-240	+200	-200
50	80	0	-12	9	6	7	8	0	-300	+200	-200
80	120	0	-15	11	8	8	9	0	-400	+200	-200
120	180	0	-18	14	9	11	10	0	-500	+350	-250

Cup

D over mm	to μm	Δ_{Dmp} max	V_{Dsp} min	V_{Dmp} max	K_{ea} max	S_d max	Δ_{Cs}
18	30	0	-8	6	5	6	8
30	50	0	-9	7	5	7	8
50	80	0	-11	8	6	8	8
80	120	0	-13	10	7	10	9
120	150	0	-15	11	8	11	10
150	180	0	-18	14	9	13	10
180	250	0	-20	15	10	15	11
250	315	0	-25	19	13	18	13



Dimension and Running Accuracy of Thrust Bearings

Table. 20

Tolerance Class P0, P6 and P5

Shaft Washer

d mm	Δd_{mp} Δd_{2mp}	V_{dsp} V_{d2p}	S_i P0	P6	P5	¹⁾
over mm	to μm	max	min	max	max	max
-	18	0	-8	6	10	5
18	30	0	-10	8	10	5
30	50	0	-12	9	10	6
50	80	0	-15	11	10	7
80	120	0	-20	15	15	8
120	180	0	-25	19	15	9
180	250	0	-30	23	20	10
250	315	0	-35	26	25	13
315	400	0	-40	30	30	15
400	500	0	-45	34	30	18
500	630	0	-50	38	35	21
630	800	0	-75	-	40	25
800	1000	0	-100	-	45	30

Housing Washer

D mm	ΔD_{mp} μm	V_{Dp}	S_e	¹⁾
over mm	to μm	max	min	max
18	30	0	-13	10
30	50	0	-16	12
50	80	0	-19	14
80	120	0	-22	17
120	180	0	-25	19
180	250	0	-30	23
250	315	0	-35	26
315	400	0	-40	30
400	500	0	-45	34
500	630	0	-50	38
630	800	0	-75	55
800	1000	0	-100	75
1000	1250	0	-125	-
1250	1600	0	-160	-

¹⁾ Not valid for thrust spherical roller bearings



2.4 Internal Clearance

Bearing clearance is the value of one bearing displacement length of assembled bearing with respect to the other ring from one end position to the other one. The displacement can be in radial direction (radial clearance) or axial (axial clearance).

In a mounted bearing smaller radial clearance can be found than the same bearing had before mounting. Radial clearance reduction is caused by interference of the bearing rings on the shaft and in housing bore and thus it is dependent on selected tolerance of bearing seating surface diameters.

Another change of radial clearance, mainly its reduction, arises during operation from temperatures evoked by its own operation and surrounding sources, but also by elastic deformations caused by load.

Clearance for standard designed bearings is determined so that one of the bearing rings can be fixed, what is sufficient for most operation conditions in the arrangement. For special arrangements with different requirement on the radial clearance bearings with various radial clearance designated C1 up to C5 are produced.

Values for various internal clearances according to the standard STN 024609 are shown for individual bearing types in tables 21 up to 27 and these values are valid for non-mounted bearings by zero measuring load.

For double row angular contact ball bearings instead of radial clearance the axial clearance measured at axial load 100 N is introduced.

Single row angular contact ball bearings and single row tapered roller bearings are usually mounted in pairs and the radial or axial clearance is adjusted during mounting.

Radial Clearance of Single Row Ball Bearings

Table 21

Bore Diameter		Radial Clearance									
d	over to	C2		normal		C3		C4		C5	
mm	μm	min	max	min	max	min	max	min	max	min	max
2.5	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	215

Axial Clearance of Double Row Angular Contact Ball Bearings

Table 22

Bore Diameter		Axial Clearance									
d	over to	C2		normal		C3		C4			
mm	μm	min	max	min	max	min	max	min	max	min	max
6	10	1	11	5	21	12	28	25	45		
10	18	1	12	6	23	13	31	27	47		
18	24	2	14	7	25	16	34	28	48		
24	30	2	15	8	27	18	37	30	50		
30	40	2	16	9	29	21	40	33	54		
40	50	2	19	11	33	23	44	36	58		
50	65	3	22	13	36	26	48	40	63		
65	80	3	24	15	40	30	54	46	71		



Radial Clearance of Double Row Self-Aligned Ball Bearing

Table 23

Bore Diameter	Cylindrical Bore Radial Clearance										Tapered Bore Radial Clearance										
	d over mm	C2					normal					C3					C4				
		min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
		μm																			
2.5	6	1	8	5	15	10	20	15	25	21	33	-	-	-	-	-	-	-	-	-	-
6	10	2	9	6	17	12	25	19	33	27	42	-	-	-	-	-	-	-	-	-	-
10	14	2	10	6	19	13	26	21	35	30	48	-	-	-	-	-	-	-	-	-	-
14	18	3	12	8	21	15	28	23	37	32	50	-	-	-	-	-	-	-	-	-	-
18	24	4	14	10	23	18	30	25	39	34	52	7	17	13	26	20	33	28	42	37	55
24	30	5	16	11	24	19	35	29	46	40	58	9	20	15	28	23	39	33	50	44	62
30	40	6	18	13	29	23	40	34	53	46	66	12	24	19	35	29	46	40	59	52	72
40	50	6	19	14	31	25	44	37	57	50	71	14	27	22	39	33	52	45	65	58	79
50	65	7	21	16	36	30	50	45	69	62	88	18	32	27	47	41	61	56	80	73	99
65	80	8	24	18	40	35	60	54	83	76	108	23	39	35	57	50	75	69	98	91	123
80	100	9	27	22	48	42	70	64	96	89	124	29	47	42	68	62	90	84	116	109	144
100	120	10	31	25	56	50	83	75	114	105	145	35	56	50	81	75	108	100	139	130	170
120	140	10	38	30	68	60	100	90	135	125	175	-	-	-	-	-	-	-	-	-	-
140	160	15	44	35	80	70	120	110	161	150	210	-	-	-	-	-	-	-	-	-	-

Radial Clearance of Single Row Cylindrical Roller Bearings

Table 24

Bore Diameter	Radial Clearance										
	d over mm	C2		normal		C3		C4		C5	
		min	max	min	max	min	max	min	max	min	max
		μm									
10	24	0	25	20	45	35	60	50	75	65	90
24	30	0	25	20	45	35	60	50	75	70	95
30	40	5	30	25	50	45	70	60	85	80	105
40	50	5	35	30	60	50	80	70	100	95	125
50	65	10	40	40	70	60	90	80	110	110	140
65	80	10	45	40	75	65	100	90	125	130	165
80	100	15	50	50	85	75	110	105	140	155	190
100	120	15	55	50	90	85	125	125	165	180	220
120	140	15	60	60	105	100	145	145	190	200	245
140	160	20	70	70	120	115	165	165	215	225	275
160	180	25	75	75	125	120	170	170	220	250	300
180	200	35	90	90	145	140	195	195	250	275	330
200	225	45	105	105	165	160	220	220	280	305	365
225	250	45	110	110	175	170	235	235	300	330	395
250	280	55	125	125	195	190	260	260	330	370	440
280	315	55	130	130	205	200	275	275	350	410	485
315	355	65	145	145	225	225	305	305	385	455	535
355	400	100	190	190	280	280	370	370	460	510	600
400	450	110	210	210	310	310	410	410	510	565	665
450	500	110	220	220	330	330	440	440	550	625	735



Radial Clearance of Double Row Cylindrical Roller Bearings with Tapered Bore Bearing with Non-Interchangeable Rings Determined for Machine Tool Spindles

Table 25

Bore Diameter		Radial Clearance			
d over mm	to	C1NA		C2NA	
		min	max	min	max
24	30	15	25	25	35
30	40	15	25	25	40
40	50	17	30	30	45
50	65	20	35	35	50
65	80	25	40	40	60
80	100	35	55	45	70
100	120	40	60	50	80
120	140	45	70	60	90
140	160	50	75	65	100

Bore Diameter		Radial Clearance			
d over mm	to	normal	min	max	C3 min max
			μm		
160	180	55	85	75	110
180	200	60	90	80	120
200	225	60	95	90	135
225	250	65	100	100	150
250	280	75	110	110	165
280	315	80	120	120	180
315	355	90	135	135	200
355	400	100	150	150	225
400	450	110	170	170	255

Radial Clearance of Single Row Needle Roller Bearings with Interchangeable Rings

Table 26

Bore Diameter		Radial Clearance			
d over mm	to	normal	min	max	C3 min max
			μm		
10	14	10	50	25	70
14	18	15	55	35	75
18	24	25	65	40	80
24	30	30	65	50	80
30	40	40	75	60	95
40	50	40	85	65	100
50	65	45	90	70	120
65	80	50	110	75	135
80	100	60	115	95	150
100	120	70	125	115	70
120	140	80	155	130	205
140	160	80	160	140	210



Radial Clearance of Double Row Spherical Roller Bearings

Tab. 27

Bore Diameter d over to mm	Cylindrical Bore Radial Clearance										Tapered Bore Radial Clearance									
	normal		C3		C4		C5		normal		C3		C4		C5					
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	μm	μm
30 40	15	30	30	45	45	60	60	80	80	100	25	35	35	50	50	65	65	85	85	105
40 50	20	35	35	55	55	75	75	100	100	125	30	45	45	60	60	80	80	100	100	130
50 65	20	40	40	65	65	90	90	120	120	150	40	55	55	75	75	95	95	120	120	160
65 80	30	50	50	80	80	110	110	145	145	180	50	70	70	95	95	120	120	150	150	200
80 100	35	60	60	100	100	135	135	180	180	225	55	80	80	110	110	140	140	180	180	230
100 120	40	75	75	120	120	160	160	210	210	260	65	100	100	135	135	170	170	220	220	280
120 140	50	95	95	145	145	190	190	240	240	300	80	120	120	160	160	200	200	260	260	330
140 160	60	110	110	170	170	220	220	280	280	350	90	130	130	180	180	230	230	300	300	380
160 180	65	120	120	180	180	240	240	310	310	390	100	140	140	200	200	260	260	340	340	430
180 200	70	130	130	200	200	260	260	340	340	430	110	160	160	220	220	290	290	370	370	470
200 225	80	140	140	220	220	290	290	380	380	470	120	180	180	250	250	320	320	410	410	520
225 250	90	150	150	240	240	320	320	420	420	520	140	200	200	270	270	350	350	450	450	570
250 280	100	170	170	260	260	350	350	460	460	570	150	220	220	300	300	390	390	490	490	620
280 315	110	190	190	280	280	370	370	500	500	630	170	240	240	330	330	430	430	540	540	680
315 355	120	200	200	310	310	410	410	550	550	690	190	270	270	360	360	470	470	590	590	740
355 400	130	220	220	340	340	450	450	600	600	760	210	300	300	400	400	520	520	650	650	820
400 450	140	240	240	370	370	500	500	660	660	820	230	330	330	440	440	570	570	720	720	910
450 500	140	260	260	410	410	550	550	720	720	900	260	370	370	490	490	630	630	790	790	1000
500 560	150	280	280	440	440	600	600	780	780	1000	290	410	410	540	540	680	680	870	870	1100
560 630	170	310	310	480	480	650	650	850	850	1100	320	460	460	600	600	760	760	980	980	1230
630 710	190	350	350	530	530	700	700	920	920	1190	350	510	510	670	670	850	850	1090	1090	1360
710 800	210	390	390	580	580	770	770	1010	1010	1300	390	570	570	750	750	960	960	1220	1220	1500
800 900	230	430	430	650	650	860	860	1120	1120	1440	440	640	640	840	840	1070	1070	1370	1370	1690





2.5 Cages

Cage in the rolling bearing fulfills the following roles

- separates rolling elements evenly around the periphery
- prevents contact of rolling elements and their sliding
- prevents falling out of the rolling elements from separable or self-aligning bearings when mounting.

From the point of view of design and material the cages are divided into pressed and machined.

Pressed cages are made of steel or brass sheet and are mostly used in dimensionally smaller and medium bearings. Their advantage in comparison with the solid cages is the smaller weight. Machined cages are made of steel, brass, bronze, light metals or plastic in various designs. Cages made of metals are used when there are higher demands on the cage rigidity and the bearing is determined for higher operational temperatures. Cages are radially centered on the rolling elements in bearings, this is the most usual way, or they are centered on the rib of either of the bearing rings.

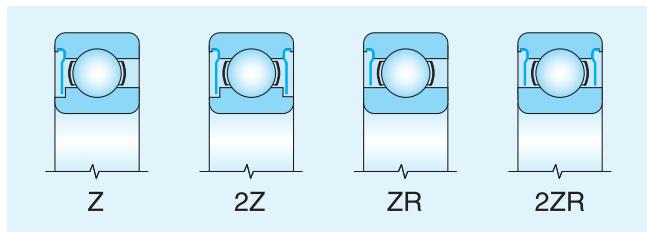
Bearings without cages, i.e. with full complement of rolling elements, are only rarely used, namely only for some bearing types, e.g. single row needle roller bearings.

In the texts about individual bearing types the survey of cages in standard design and delivery possibilities of bearings with cages of non-standard design are given in the section Cages.

2.6 Shields and Seals

Bearings with sealing on one or both sides are manufactured with shields (Z, 2Z, ZR, 2ZR) or seals (RS, 2RS, RSR, 2RSR).

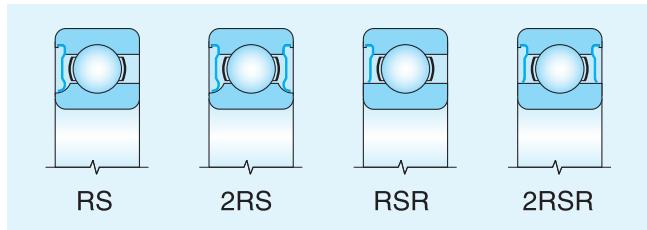
Shields form a non-contact sealing. In design Z and 2Z the fitting for the shield is in the inner ring, in design ZR and 2ZR the shield adheres on the smooth rib of the bearing inner ring.



Sealing is created by sealing rings made of rubber vulcanized on sheet steel reinforcement, which create an effective contact sealing with a chamfered fitting on the inner ring (RS, 2RS) as well as in design with contact on the smooth rib of the inner ring (RSR, 2RSR).

Seals and sealing rings are fastened in the grooves of the outer ring and are unseparable.

Sealing RS, 2RS, RSR, 2RSR can be used for temperature range -30°C to +110°C, sealing RS1, -2RS1, RSR1 and -2RSR1 for temperature range -45°C to +120°C, sealing RS2, -2RS2, RSR2, -RSR2 for temperature range -60°C to +180°C.



Bearings with sealings on both sides in standard design are filled with grease of a temperature range from -30°C to 110°C, whose qualities secure lubrication usually during the whole bearing life at normal operational conditions. Bearings in this design cannot be relubricated.



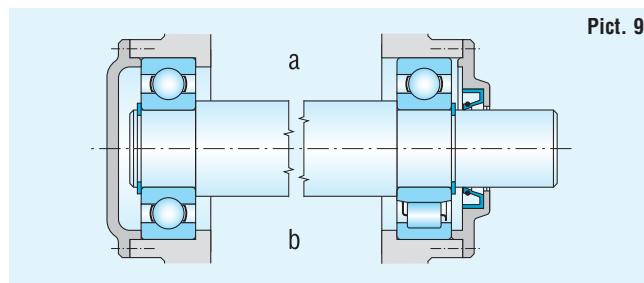
3. Bearing Arrangement Design

3.1 General Principles of Rolling Bearing Arrangement Design

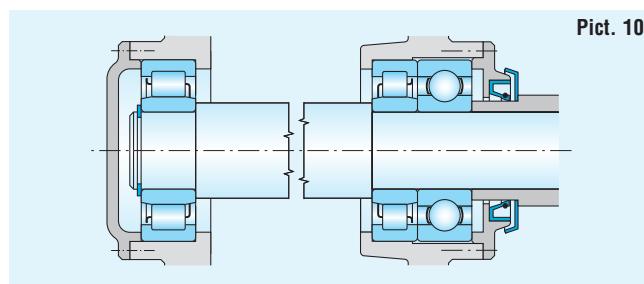
Rotating shaft or another component arranged in rolling bearings is guided by them in radial as well as in axial direction so that the basic condition, the movement uniqueness, can be fulfilled. The component should be, as far as possible, statically determined, i.e. supported in two points radially and in one point axially.

A typical example of such an arrangement is in Pict. 9, where the shaft is radially guided in two bearings, one of which secures it in axial direction. The locating bearing carries the radial load and simultaneously also the axial load in both directions. Radial bearings that can accommodate combined load are mostly used as locating bearings, which carry, e.g. single row ball bearings, double row angular contact ball bearings, double row self aligning ball bearings, double row spherical roller bearings or single row angular contact ball bearings and tapered roller bearings. The two last mentioned bearing types must be mounted in pairs. The non-locating bearing carries only radial load and must permit certain displacement of the shaft in axial direction so that arising of non-desired axial preload caused by environment (temperature dilatations, production inaccuracies of connecting arrangement components, etc.) can be hindered.

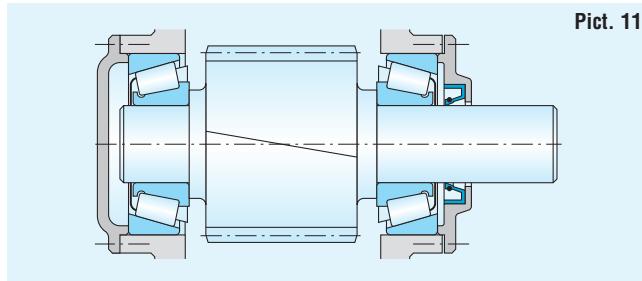
Axial displacement can be secured by displacement between one bearing ring and a machine part, which is directly connected with the bearing, e.g. between outer bearing ring and housing bore (Pict. 9a) or directly in the bearing (Pict. 9b).



Arrangements, in which greater radial and axial loads act by higher rotational speed, should be set up so that the bearing can accommodate only radial or axial forces, see Pict. 10. In these cases it is possible to use for radial guidance some of the radial bearings and for axial guidance those radial bearings which are also able to carry axial load or a pair of these bearings, or double direction thrust bearing, or a pair of single direction thrust bearings. There is a condition where the axially locating thrust bearing should be arranged with radial clearance.



Another, often used solution is the arrangement of two bearings, whose design enables the accommodation both radial and axial loads. Both bearings accommodate alternately the axial load, always according to direction of force acting, and simultaneously they carry also the radial load. An example of this arrangement is shown in Pict. 11.



As a verified design the pair of single row tapered roller bearings or single row angular contact ball bearings are used. There can be used other bearing types which are able to carry the load both in radial and axial direction simultaneously, e.g. separable single row ball bearings or single row cylindrical roller bearings in NJ design, etc.

3.2 Bearing Location

3.2.1 Radial Location of Bearing

Radial and axial bearing location on the shaft and in the housing bore or another part has a direct connection with the whole arrangement design. When selecting the way of location, the character and acting forces magnitude, the operating temperature in the arrangement and material of mating parts must be taken into account.

Mounting, dismounting and maintenance methods must be taken into consideration when designing mating parts dimensions.

The bearing is located in radial direction on the mating cylindrical shaft and housing bore surface. In some cases, adapter or withdrawal sleeves are used by mounting on the shaft, or the bearing can be mounted directly on the tapered shaft.

The correct radial location of the bearing on the shaft significantly influences utilization of its load rating and correct function in arrangement. The following viewpoints are important:

- safe location and uniform supporting of bearings
- simple mounting and dismounting
- displacement of non-locating bearing in axial direction

Basically, both bearing rings should be mounted in tight fits, because only in this way their reliable supporting around the whole periphery and radial fixing against turning can be achieved. To make mounting and dismounting easier or for moving the non-locating ring, a loose fit of one of the rings is permissible.

When selecting correct radial bearing location, following influences must be taken into account.

Circumferential Load

occurs if the respective bearing ring rotates and the load direction is not changed or if the ring rotates and the load does not rotate. The bearing ring periphery is gradually loaded during one revolution. In this case the loaded bearing ring must be always fitted with necessary interference fit.

Point Load

occurs when the bearing ring does not rotate and the external force is constantly directed into the same ring raceway point or if the ring and load rotate at the same rotating speed. The ring subjected to point load can be mounted with loose fit, if the conditions require it.

Indeterminate Load

occurs if the ring is subjected to varying external forces at which directions and load changes cannot be determined (e.g. unbalanced mass, shocks, etc.). Under these conditions in most applications bearings with greater radial clearance should be used.

Load Magnitude

directly influences selection of the interference fit (higher load - larger interference), especially in cases of impact loads. A firm fitting on the shaft or in the housing causes ring deformation, and as a result reduction of radial clearance



arises. To secure the necessary radial clearance in the firm arrangement, it is necessary to use bearings with greater radial clearance. Resulting clearance after mounting depends on the bearing type and its dimension.

Bearing Size and Type

determines the size of necessary interference fit of the fitted ring. For smaller sized bearings smaller interference fits are selected, and vice versa. Relatively smaller interferences are used, e.g. for the same sizes of ball bearings in comparison with the cylindrical roller, tapered roller or spherical roller bearings.

Material and Design of Mating Components

must be taken into account when determining their production tolerance. Results of practical experience are shown in the following tables. In cases where bearings are mounted into housings made of light metal alloys or on journals of hollow shafts, arrangements with higher interference are selected. Split housings are not suitable for arrangements with higher interferences, because there is danger of the bearing pinching in the dividing plane.

Heating generating

in the bearing can cause loosening of the interference on the journal and turning of the ring. In the housing a converse case can come into being. The heating causes clearance decreasing and subsequently limiting and even stopping of the axial displacement of the non-locating bearing ring. That is why we pay a great deal of attention to this fact when designing an arrangement.

Fitting Accuracy

from the point of view of its tolerances and geometric shapes is important because it can be transmitted towards the bearing ring raceways and defines the arrangement accuracy.

When using bearings with normal tolerance class, the tolerance of journal seating surface IT6 is selected, and for housing seating surface tolerance IT7.

For smaller dimensioned ball and cylindrical roller bearings it is possible to use for the journal tolerance IT5 and housing bore IT6.

For bearings in higher tolerance classes, for arrangements with high requirements on accuracy, e.g. spindels of machine tools, the least tolerance class IT5 is recommended for the shaft and for housing IT6.

Permissible ovality and conicity deviation and permissible lateral bearing runout of supporting surfaces must be in reference to axis smaller than the diameter tolerance of the journal and bore.

With higher bearing tolerance class also requirements on the seating surface accuracy increase. Recommended values are shown in tables 27 and 28.

Recommended Shape Accuracies of Bearing Seating Fits Table 27

Bearing Tolerance Class	Fitting Location	Permissible Ovality Deviation	Permissible Lateral Runout of Carrying Surfaces in Reference to Axis
P0, P6	shaft	IT ₅ 2	IT3
	housing	IT ₆ 2	IT4
P5, P4	shaft	IT ₃ 2	IT2
	housing	IT ₃ 2	IT3



Standard Tolerances IT2 to IT6

Table 28

Nominal Diameter over mm	to	Tolerance Class				
		IT2 μm	IT3 μm	IT4 μm	IT5 μm	IT6 μm
6	10	1.5	2.5	4	6	9
10	18	2	3	5	8	11
18	30	2.5	4	6	9	13
30	50	2.5	4	7	11	16
50	80	3	5	8	13	19
80	120	4	6	10	15	22
120	180	5	8	12	18	25
180	250	7	10	14	20	29
250	315	8	12	16	23	32
315	400	9	13	18	25	36
400	500	10	15	20	27	40

Mounting and Dismounting bearings

If one of the rings is arranged with a loose fit it is simple. If, because of operational reasons, it is necessary to arrange both of the rings with an interference, a suitable bearing type should be selected, e.g. a separable bearing (tapered roller, cylindrical roller, needle roller bearing) or a bearing with tapered bore. Journals for sleeve arrangements of bearings with tapered bore can be in tolerance class h9 or h10, geometric shape should be in tolerance class IT5 or IT7 according to arrangement requirements.

Axial Displacement of Non-Locating Bearing Rings

must be secured by all operation conditions. When using a non-separable bearing, displacement of the stationary loaded ring is reached by its fitting with clearance (moveable).

In light metal alloy housings it is necessary, if the outer ring is fitted with clearance, to put a steel bush in the bore.

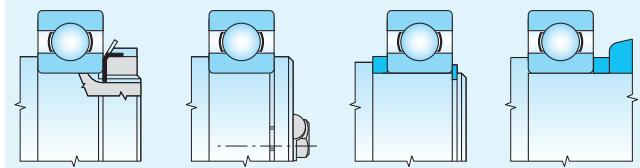
A reliable displacibility in axial direction is reached by using cylindrical roller bearing type N and NU or radial needle bearing.

Recommended journal and bore diameter tolerances of the mating components for radial and thrust bearings are shown in tables 29 to 34.

3.2.2 Axial Securing of Bearing

Inner bearing ring with cylindrical bore arranged on the journal with interference fit (fixed) is usually secured in the axial direction by means of a locknut, end-plate or snap ring, when the other face is usually supported by the shaft shoulder. Surrounding parts are used as abutment faces for inner rings, and if necessary, spacing rings are inserted between this component and bearing inner ring. Examples of axial bearing securing are shown in Pict.12.

Pict. 12





**Radial Bearing Shaft Diameter Tolerances
(Valid for Solid Steel Shafts)**

Table 29

Operating Conditions	Arrangement Examples	Journal Diameter [mm]			Tolerance
		Ball Bearings	Cylindrical, Needle ¹⁾ Tapered Roller Bearings	Spherical Roller Bearings	
Inner Ring Point Load					
Light and Normal Load $P_r \leq 0,15 C_r$	Free wheels, sheaves, belt pulleys			All Diameters	g6 ²⁾
Heavy Impact Load $P_r > 0,15 C_r$	Industrial truck wheels, tension pulleys				h6
Inner Ring Circumferential Load or Indeterminate Load					
Light and Variable Load $P_r \leq 0,07 C_r$	transport equipments, ventilators	(18) to 100 (100) to 200	≤ 40 (40) to 140	- -	j6 k6
Normal and Heavy Load $P_r > 0,07 C_r$	General engineering, electric motors, turbines, pumps, combustion motors, gear boxes, woodworking machines	≤ 18 (18) to 100 (100) to 140 (140) to 200	≤ 40 (40) to 100 (100) to 140 (140) to 200 > 200	- - (40) to 65 (65) to 100 (100) to 140 > 140	j5 k5 (k6) ³⁾ m5 (m6) ³⁾ m6 n6 p6
Extremely Heavy Load, Impacts, Complicated Operating Conditions $P_r > 0,15 C_r$	Axle bearings for railway vehicles, traction motors, rolling mills	- - -	(50) to 140 (140) to 500 > 500	(50) to 100 (100) to 500 > 500	n6 ⁴⁾ p6 ⁴⁾ r6 (p6) ⁴⁾
High Arrangement Accuracy under Light Load $P_r \leq 0,07 C_r$	Machine tools	≤ 18 (18) to 100 (100) to 200	≤ 40 (40) to 140 (140) to 200	- - -	h5 ⁵⁾ j5 ⁵⁾ k5 ⁵⁾ m5
Exclusively Axial Load		All Diameters			j6
Bearings with Tapered Bore and Adapter or Withdrawal Sleeve					
All Kinds of Load	General arrangements, axle bearings			All Diameters	h9/IT5
	for railway vehicles. Not complicated arrangements				h10/IT7

¹⁾ Tolerances for needle roller bearings without rings.

²⁾ Tolerance f6 can be selected for securing axial displacability

³⁾ Tolerances in brackets are selected usually for single row tapered roller bearings
or at low rotational speeds where tolerance dispersion is not significant

⁴⁾ It is necessary to use bearings with higher radial clearance than normal

⁵⁾ Tolerances for single row ball bearings in tolerance classes P5 and P4 are shown on page 88 and 89.



**Housing Bore Diameter Tolerances for Radial Bearings
(Valid for Steel, Cast and Cast Steel Housings)**

Table 30

Operating Conditions	Displacibility of Outer Ring	Housing	Arrangement Examples	Tolerance
Outer Ring Circumferential Load				
Heavy Impact Load $P_r > 0.15 C_r$ Thin Walled Housings	not displacable	one-part	Wheel hubs with cylindrical roller bearings, big end bearings	P7
Normal and Heavy Load $P_r > 0.07 C_r$	not displacable		Wheel hubs with ball bearings, crane travel wheels, crankshaft bearings	N7
Light and Variable Load $P_r \leq 0.07 C_r$	not displacable		Conveyor rollers, tension pulleys	M7
Indeterminate Load				
Heavy Impact Load $P_r > 0.15 C_r$	not displacable	one-part	Traction motors	M7
Heavy and Normal Load $P_r > 0.07 C_r$	As a rule, not displacable		Electric motors, pumps, crankshafts	K7
Light and Varying Load $P_r \leq 0.07 C_r$	As a rule, displacable		Electric motors, pumps, ventilators, crankshafts	J7
Accurate Arrangement				
Light Load $P_r \leq 0.07 C_r$	As a rule, not displacable	one-part	Cylindrical roller bearings for machine tools ball bearings for	K6 ¹⁾
	Displacable		machine tools.	J6 ²⁾
	Easily displacable		Small electric motors	H6
Outer Ring Point Load				
Any Load	Easily displacable	one-part or two-part	General engineering, axle bearings of railway vehicles	H7 ³⁾
Light and Normal Load $P_r \leq 0.15 C_r$			General engineering, less complicated engineering	H8
			Drying rollers of paperworking machines, big electric motors	G7 ⁴⁾

¹⁾ For heavy loads tighter tolerances are selected - M6 or N6. For cylindrical roller bearings with tapered bore tolerances K5 or M5.

²⁾ Tolerances for single row ball bearings in tolerances P5 and P4 - see page 88 and 89.

³⁾ For bearings with outer diameter $D < 250$ mm, with temperature difference between outer ring and housing over 10°C , tolerance G7 is selected

⁴⁾ For bearings with outer diameter $D > 250$ mm, with temperature difference between outer ring and housing over 10°C , tolerance F7 is selected

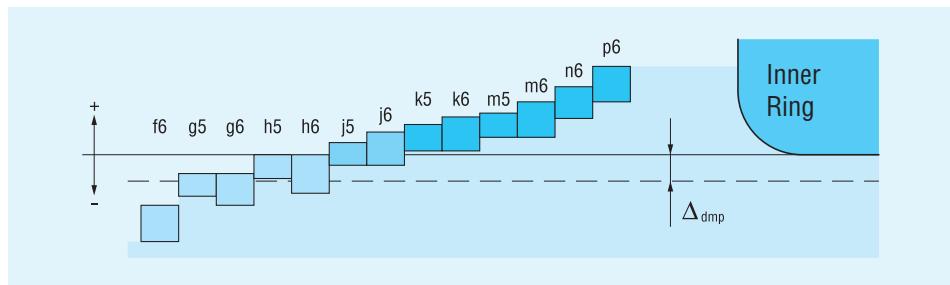
**Journal Diameter Tolerance for Thrust Bearings****Table 31**

Bearing Type	Load	Journal Diameter	Tolerance
		[mm]	
Thrust Ball Bearings	Exclusively Axial Load		j6
			j6
Diameters Thrust Spherical Roller Bearings	Simultaneously Axial and Radial Loads	Stationary Load of Shaft Washer or Indeterminate Load	All Diameters
		Rotating Load of Shaft Washer	≤ 200 (200) to 400 > 400
			k6 m6 n6

Housing Bore Diameter Tolerances for Thrust Bearings**Table 32**

Bearing Type	Load	Note	Tolerance
Thrust Ball Bearings arrangements housing	Exclusively Axial Load		H8
			-
Thrust Spherical Roller Bearings	Simultaneously Axial and Radial Load	Stationary Load or Indeterminate Load of Housing Washer	H7
		Rotating Load of Housing Washer	M7





Journal Diameter Tolerance Limiting Deviations

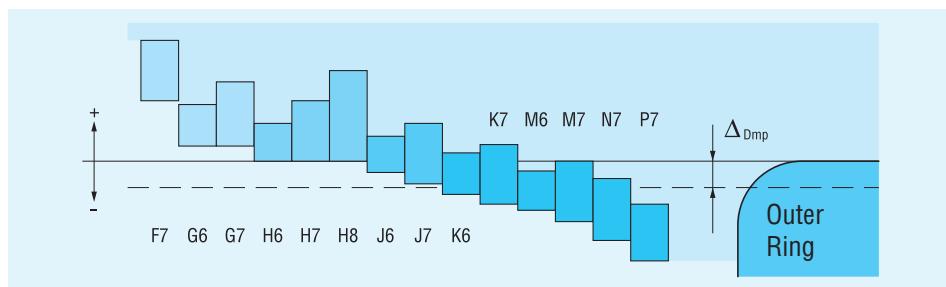
Table 33

Journal Nominal Diameter over to mm	f6	g5	g6	h5	h6	j5	j6(j _s 6)	k5						
	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower
	µm													

1 3	-6	-12	-2	-6	-2	-8	0	-4	0	-6	+2	-2	+4	-2	+4	0
3 6	-10	-18	-4	-9	-4	-12	0	-5	0	-8	+3	-2	+6	-2	+6	+1
6 10	-13	-22	-5	-11	-5	-14	0	-6	0	-9	+4	-2	+7	-2	+7	+1
10 18	-16	-27	-6	-14	-6	-17	0	-8	0	-11	+5	-3	+8	-3	+9	+1
18 30	-20	-33	-7	-16	-7	-20	0	-9	0	-13	+5	-4	+9	-4	+11	+2
30 50	-25	-41	-9	-20	-9	-25	0	-11	0	-16	+6	-5	+11	-5	+13	+2
50 80	-30	-49	-10	-23	-10	-29	0	-13	0	-19	+6	-7	+12	-7	+15	+2
80 120	-36	-58	-12	-27	-12	-34	0	-15	0	-22	+6	-9	+13	-9	+18	+3
120 180	-43	-68	-14	-32	-14	-39	0	-18	0	-25	+7	-11	+14	-11	+21	+3
180 250	-50	-79	-15	-35	-15	-44	0	-20	0	-29	+7	-13	+16	-13	+24	+4
250 315	-56	-88	-17	-40	-17	-49	0	-23	0	-32	+7	-16	+16	-16	+27	+4
315 400	-62	-98	-18	-43	-18	-54	0	-25	0	-36	+7	-18	+18	-18	+29	+4
400 500	-68	-108	-20	-47	-20	-60	0	-27	0	-40	+7	-20	+20	-20	+32	+5
500 630	-76	-120	-	-	-22	-66	-	-	0	-44	-	-	+22	-22	-	-
630 800	-80	-130	-	-	-24	-74	-	-	0	-50	-	-	+25	-25	-	-
800 1000	-86	-142	-	-	-26	-82	-	-	0	-56	-	-	+28	-28	-	-
1000 1250	-98	-164	-	-	-28	-94	-	-	0	-66	-	-	+33	-33	-	-

Journal Nominal Diameter over to mm	k6	m5	m6	n6	p6	h9 ¹⁾	IT5	h10 ¹⁾	IT7							
	upper	lower	upper	lower	upper	lower	upper	lower	upper							
	µm															
1 3	+6	0	+6	+2	+8	+2	+10	+4	+12	+6	0	-25	4	0	-40	10
3 6	+9	+1	+9	+4	+12	+4	+16	+8	+20	+12	0	-30	5	0	-48	12
6 10	+10	+1	+12	+6	+15	+6	+19	+10	+24	+15	0	-36	6	0	-58	15
10 18	+12	+1	+15	+7	+18	+7	+23	+12	+29	+18	0	-43	8	0	-70	18
18 30	+15	+2	+17	+8	+21	+8	+28	+15	+35	+22	0	-52	9	0	-84	21
30 50	+18	+2	+20	+9	+25	+9	+33	+17	+42	+26	0	-62	11	0	-100	25
50 80	+21	+2	+24	+11	+30	+11	+39	+20	+51	+32	0	-74	13	0	-120	30
80 120	+25	+3	+28	+13	+35	+13	+45	+23	+59	+37	0	-87	15	0	-140	35
120 180	+28	+3	+33	+15	+40	+15	+52	+27	+68	+43	0	-100	18	0	-160	40
180 250	+33	+4	+37	+17	+46	+17	+60	+31	+79	+50	0	-115	20	0	-185	46
250 315	+36	+4	+43	+20	+52	+20	+66	+34	+88	+56	0	-130	23	0	-210	52
315 400	+40	+4	+46	+21	+57	+21	+73	+37	+98	+62	0	-140	25	0	-230	57
400 500	+45	+5	+50	+23	+63	+23	+80	+40	+108	+68	0	-155	27	0	-250	63
500 630	+44	0	-	-	+70	+26	+88	+44	+122	+78	0	-175	30	0	-280	70
630 800	+50	0	-	-	+80	+30	+100	+50	+138	+88	0	-200	35	0	-320	80
800 1000	+56	0	-	-	+90	+34	+112	+56	+156	+100	0	-230	40	0	-360	90
1000 1250	+66	0	-	-	+106	+40	+132	+66	+186	+120	0	-260	46	0	-420	105

¹⁾ For journals made in tolerance h9 and H10 for bearings with adapter or withdrawal sleeves deviations of roundness and cylindricity must not exceed basic tolerances IT5 and IT7



Bore Diameter Tolerance Limiting Deviations

Table 34

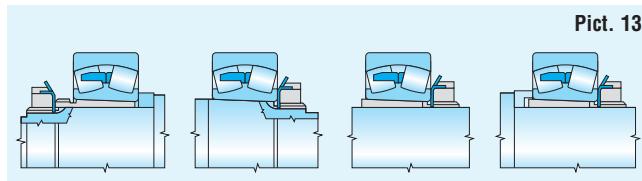
Bore Nominal Diameter over to mm	F7		G6		G7		H6		H7		H8		J6(J _s 6)	
	upper	lower	upper	lower										
6 10	+28	+13	+14	+5	+20	+5	+9	0	+15	0	+22	0	+5	-4
10 18	+34	+16	+17	+6	+24	+6	+11	0	+18	0	+27	0	+6	-5
18 30	+41	+20	+20	+7	+28	+7	+13	0	+21	0	+33	0	+8	-5
30 50	+50	+25	+25	+9	+34	+9	+16	0	+25	0	+39	0	+10	-6
50 80	+60	+30	+29	+10	+40	+10	+19	0	+30	0	+46	0	+13	-6
80 120	+71	+36	+34	+12	+47	+12	+22	0	+35	0	+54	0	+16	-6
120 180	+83	+43	+39	+14	+54	+14	+25	0	+40	0	+63	0	+18	-7
180 250	+96	+50	+44	+15	+61	+15	+29	0	+46	0	+72	0	+22	-7
250 315	+108	+56	+49	+17	+69	+17	+32	0	+52	0	+81	0	+25	-7
315 400	+119	+62	+54	+18	+75	+18	+36	0	+57	0	+89	0	+29	-7
400 500	+131	+68	+60	+20	+83	+20	+40	0	+63	0	+97	0	+33	-7
500 630	+146	+76	+66	+22	+92	+22	+44	0	+70	0	+110	0	+22	-22
630 800	+160	+80	+74	+24	+104	+24	+50	0	+80	0	+125	0	+25	-25
800 1000	+176	+86	+82	+26	+116	+26	+56	0	+90	0	+140	0	+28	-28
1000 1250	+203	+98	+94	+28	+133	+28	+66	0	+105	0	+165	0	+33	-33
1250 1600	+235	+110	+108	+30	+155	+30	+78	0	+125	0	+195	0	+39	-39

Bore Nominal Diameter over to mm	J7(J _s 7)		K6		K7		M6		M7		N7		P7	
	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower
6 10	+8	-7	+2	-7	+5	-10	-3	-12	0	-15	-4	-19	-9	-24
10 18	+10	-8	+2	-9	+6	-12	-4	-15	0	-18	-5	-23	-11	-29
18 30	+12	-9	+2	-11	+6	-15	-4	-17	0	-21	-7	-28	-14	-35
30 50	+14	-11	+3	-13	+7	-18	-4	-20	0	-25	-8	-33	-17	-42
50 80	+18	-12	+4	-15	+9	-21	-5	-24	0	-30	-9	-39	-21	-51
80 120	+22	-13	+4	-18	+10	-25	-6	-28	0	-35	-10	-45	-24	-59
120 180	+25	-14	+4	-21	+12	-28	-8	-33	0	-40	-12	-52	-28	-68
180 250	+30	-16	+5	-24	+13	-33	-8	-37	0	-46	-14	-60	-33	-79
250 315	+36	-16	+5	-27	+16	-36	-9	-41	0	-52	-14	-66	-36	-88
315 400	+39	-18	+7	-29	+17	-40	-10	-46	0	-57	-16	-73	-41	-98
400 500	+43	-20	+8	-32	+18	-45	-10	-50	0	-63	-17	-80	-45	-108
500 630	+35	-35	0	-44	0	-70	-26	-70	-26	-96	-44	-114	-78	-148
630 800	+40	-40	0	-50	0	-80	-30	-80	-30	-110	-50	-130	-88	-168
800 1000	+45	-45	0	-56	0	-90	-34	-90	-34	-124	-56	-146	-100	-190
1000 1250	+52	-52	0	-66	0	-105	-40	-106	-40	-145	-66	-171	-120	-225
1250 1600	+62	-62	0	-78	0	-125	-48	-126	-48	-173	-78	-203	-140	-265





Examples of axial locating of bearings with tapered bore seated directly on the tapered journal or by means of an adapter or withdrawal sleeve are in Pict. 13.

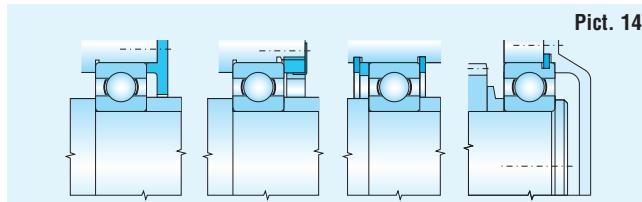


Permissible bearing axial load fixed by an adapter sleeve on smooth shafts without bearing resting on the shaft shoulder is calculated according to equation:

$$F_a = 3Bd$$

F_a - permissible bearing axial load [N]
B - bearing width [mm]
d - bearing bore diameter [mm]

If the axial displacement of the outer ring in the housing is not required, then we can use solution, when the face supporting or seating surface of the bearing cover, nut or snap ring are used. Bearings with grooves for snap ring (NR) do not require much space and their securing is simple. Examples - see Pict. 14.



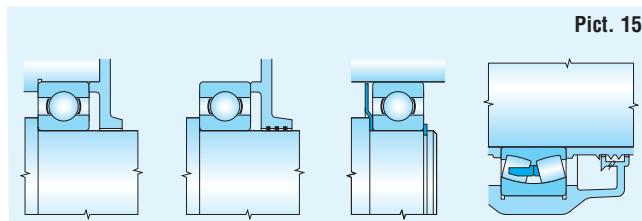
Abutment dimensions for each bearing shown in this publication are in the dimension tables.

3.3 Sealing

Sealing of the bearing space is very important, because damaging materials which can be found in the bearing environment influence it and often can cause its breakdown. Sealing also has an opposite function - it prevents the lubricant leaking out of the bearing and arrangement space. That is why sealing must always be designed with regard to operating conditions of machines or equipments, arrangement design, lubricating method, maintenance possibility and economic questions concerning production and utilization.

3.3.1 Non-Contact Sealing

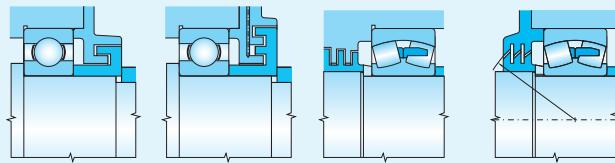
Between non-rotating and rotating parts there is only a narrow gap when using this sealing. It is filled with grease. Using this sealing, wear of components from friction does not occur and that is why this sealing can be used for the highest rotational speeds and for high operating temperatures. Examples of a gap sealing are in Pict. 15.





Another very effective sealing is the labyrinth sealing which can improve the sealing effect by a greater number of labyrinth or prolongation of sealing gaps. Examples - see Pict. 16.

Pict. 16

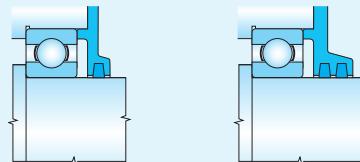


3.3.2 Rubber Sealing

Rubbing sealing is created of elastic or soft, but sufficiently impermeable material, which is inserted between the rotating and firm part. Such a sealing is usually cheap and is suitable for various designs. The disadvantage is the sliding friction of the contacting surfaces, and therefore there is limited utilization for high rotational speeds.

Sealing with a felt ring is the simplest (Pict. 17). It is suitable for operating temperature -40° to $+160^{\circ}\text{C}$ and for peripheral speeds to 7 m.s^{-1} and sliding surface roughness max. $R_a = 0,16$, hardness min. 45 HRC or hard chromium plating. Dimensions of the felt rings are given by corresponding national standards.

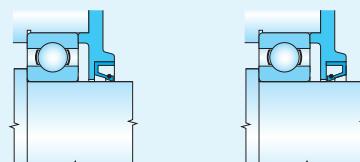
Pict. 17



A very wide-spread way of sealing is sealing with shaft washers (Pict. 18). Radial shaft seal washers are made of rubber or other suitable plastic reinforced by steel sheet reinforcement. According to the material used they are suitable for operating temperature from -30° to $+160^{\circ}\text{C}$. Permissible peripheral speed depends on sliding surface roughness:

- to 2 m.s^{-1} is roughness max. $R_a = 0,8$
- to 4 m.s^{-1} is roughness max. $R_a = 0,4$
- to 12 m.s^{-1} is roughness max. $R_a = 0,2$

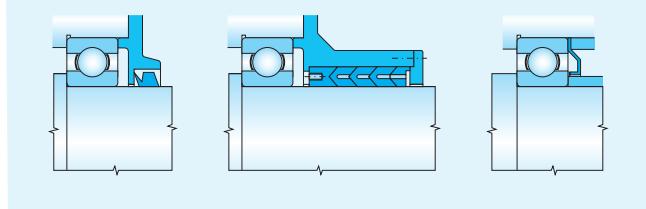
Pict. 18





Except for mentioned most commonly used sealing rings there are rubber sealing designs which use the just formed sealing rings made of rubber, plastic, etc., or special spring rings. This sealing is chosen either for applications with high requirements on bearing space sealing (great environment pollution, high temperature, chemical substance influence), or for economic reasons by mass or series production. Examples - see Pict. 19.

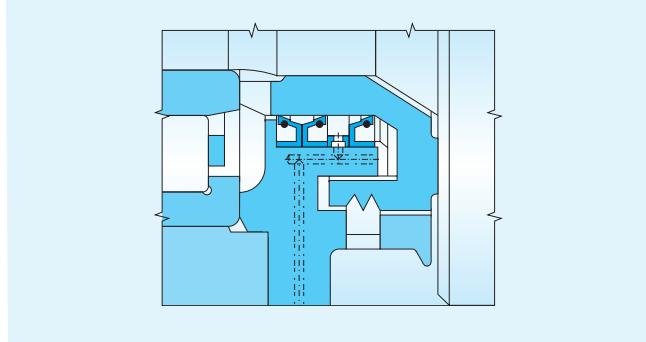
Pict. 19



3.3.3 Combined Sealing

Increase sealing effect can be reached by non-contact and rubbing sealing combination. Such a sealing is recommended for wet and polluted environment. Example - see Pict. 20.

Pict. 20





4. Bearing Lubrication

The correct bearing lubrication has a direct influence on the bearing life. Lubricant creates between the rolling element and bearing ring a carrying lubricating film which hinders their metal contact. It lubricates surfaces where friction arises, it has cooling effect, it protects the bearing from corrosion and in many cases seals the bearing space.

In the most cases - approximately 90%, bearings are lubricated with grease or oil, in rare exceptions by other lubricating means. When deciding which lubricant and which lubrication type should be used, operating conditions, characteristic qualities of the lubricant, equipment design and operating economy should be taken into account.

4.1 Grease Lubrication

In the design practice grease lubrication is preferred to oil lubrication from the point of view of arrangement simplicity, utilization of the sealing capabilities and simple maintenance.

For reliable bearing operation 1/3 to 1/2 of its free space is filled with grease at the first assembly. A greater grease amount has negative influence on the operation. Higher passive resistances cause the inner bearing space warming up undesirably, which can lead to its breakdown. Bearings making only a small number of revolutions during operation, from the point of view of corrosion protection should be completely filled.

4.1.1 Relubrication Interval

Relubrication interval is the period during which the grease has the necessary lubricating properties. After this period bearing must be relubricated, and old lubricant must be removed from the bearing space completely.

Relubricating period depends on the bearing type and size, rotational speed, operating temperature and grease quality. The recommended relubrication period for individual bearing types at normal load ($P \leq 0.15 C$) and normal operational conditions is shown in diagrams in Pict. 21 and 22. The diagrams are valid for common greases and temperatures to +70°C. For temperatures over +70°C, the relubrication period is shortened for each 15°C on the half of original value. For temperatures under +40°C the relubrication period can be doubled.

For small sized, especially single row ball bearings, the relubrication periods are several times longer than the bearing life, that is why the bearings are, as a rule, not relubricated.

For this reason it is advantageous to use these bearings shielded or sealed on both sides and filled with grease. For some rotational speeds the relubrication period is out of the diagram curve, i.e. the permissible limit for grease lubrication has been reached and oil lubrication should be used.

Necessary grease quantity for relubrication is calculated from the equation:

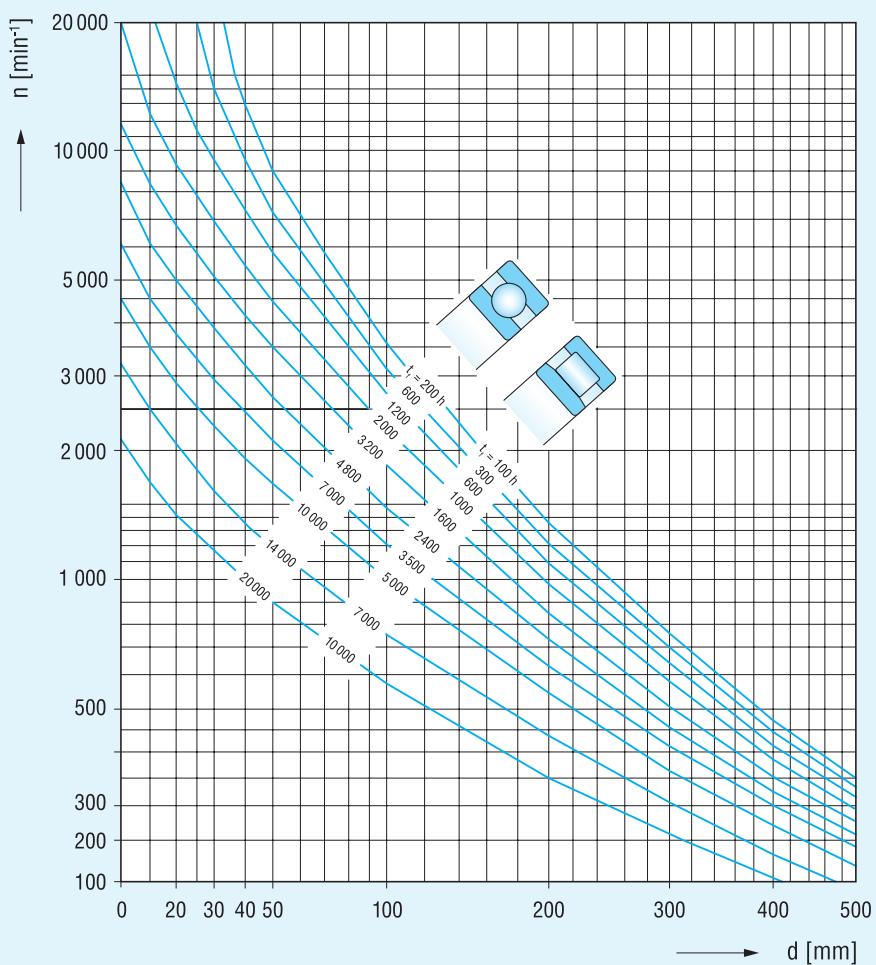
$$Q = 0.005 DB$$

Q	- grease quantity	[g]
D	- bearing outer diameter	[mm]
B	- bearing width	[mm]

For bearings with higher rotational speed requiring a more frequent relubrication, it is necessary to remove the used lubrication from the bearing space so that temperature increase should not occur. For this reason the grease escape valve is suitable.

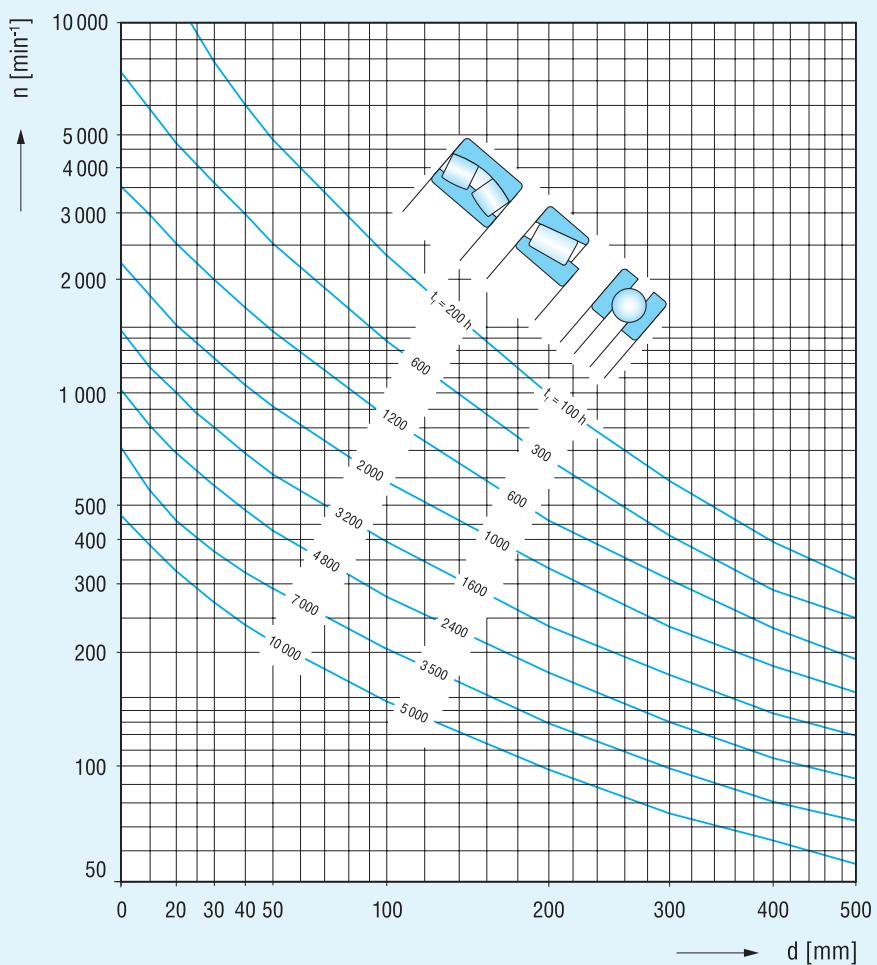


Pict. 21





Pict. 22





4.1.2 Bearing Greases

Bearing greases are produced most often of quality mineral or synthetic oils (sometimes with additives), thickened with fatty acid metallic soaps. Greases must have good lubricating properties and high chemical, temperature and mechanical stability. The grease list of bearing lubricants is in Table 35.

Rolling Bearing Grease Properties

Table 35

Kind of Grease Thickening Application	Basic Oil	Operating Temperature Extent	Properties Water	Resistance against
Agent		[°C]		
lithium soap	mineral	-20 ÷ 130	resistant	multi-purpose lubricant
lime soap	mineral	-20 ÷ 50	high resistance	good sealing effect against water
soda soap	mineral	-20 ÷ 100	irresistant	emulsifies with water
aluminium soap	mineral	-20 ÷ 70	resistant	good sealing effect against water
complex lithium soap	mineral	-20 ÷ 150	resistant	multi-purpose lubricant
complex lime soap	mineral	-30 ÷ 130	high resistance	multi-purpose lubricant suitable for higher temperatures and load
complex soda soap	mineral	-20 ÷ 130	resistant	suitable for higher temperature and load
complex aluminium soap		-20 ÷ 150	mineral	suitable for higher temperature and load
complex barium soap	mineral	-30 ÷ 140	resistant	suitable for higher temperature and load
bentonite	mineral		resistant	suitable for high temperatures at low rotational speed
polyurea	mineral	-20 ÷ 160	resistant	suitable for high temperatures at medium rotational speed
lithium soap	silicon	-40 ÷ 170	high resistance	suitable for wide temperature range at medium rotational speed
complex barium soap	ester	-60 ÷ 140	resistant	suitable for higher temperatures and higher rotational speeds

4.2 Oil Lubrication

Oil lubrication is used, when operating rotational speed is so high that the grease relubrication period is too short. Another reason can also be the necessity of heat transfer from the bearing, or the high temperature of environment, which does not enable utilization of grease, or if surrounding parts are already lubricated by oil (e.g. geared wheels in the gear box). Except for some cases, spherical roller thrust bearings are always lubricated by oil.

When oil lubricating, lubricating must be secured both at starting and during operation. Excess oil increases temperature and bearing temperature.

Oil feed into bearing is secured in various design ways, out of which oil bath lubrication with oil level reaching middle of the lowest rolling element, oil circulation lubrication, jet lubrication, oil mist lubrication etc., are the most common.

4.2.1 Bearing Oils

For bearing lubrication mostly refined oils with good chemical stability which can be improved by antioxidant agents are used.

The decisive oil property is kinematic viscosity which decreases with increasing temperature. Suitable oil viscosity ν_1 can be stated according to the diagram in Pict. 23 in dependence on the bearing mean diameter $d_s = (d+D)/2$ and rotational speed n . If the operating temperature is known or it can be found out, according to the diagram in Pict. 24 suitable oil and viscosity ν at internationally standardized temperature 40°C being necessary for calculation of ratio χ is determined.

By ratio $\chi < 1$ it is recommended to use EP oil with additives which improve the oil film load rating. By value χ decrease under 0.4 oils with EP additives are always used.



If the ratio χ is greater than 1, improved arrangement reliability is reached in operation.

Example :

- bearing $d = 180 \text{ mm}$, $D = 320 \text{ mm}$, $d_s = 250 \text{ mm}$
- rotational speed $n = 500 \text{ min}^{-1}$
- presumed operating temperature 60°C

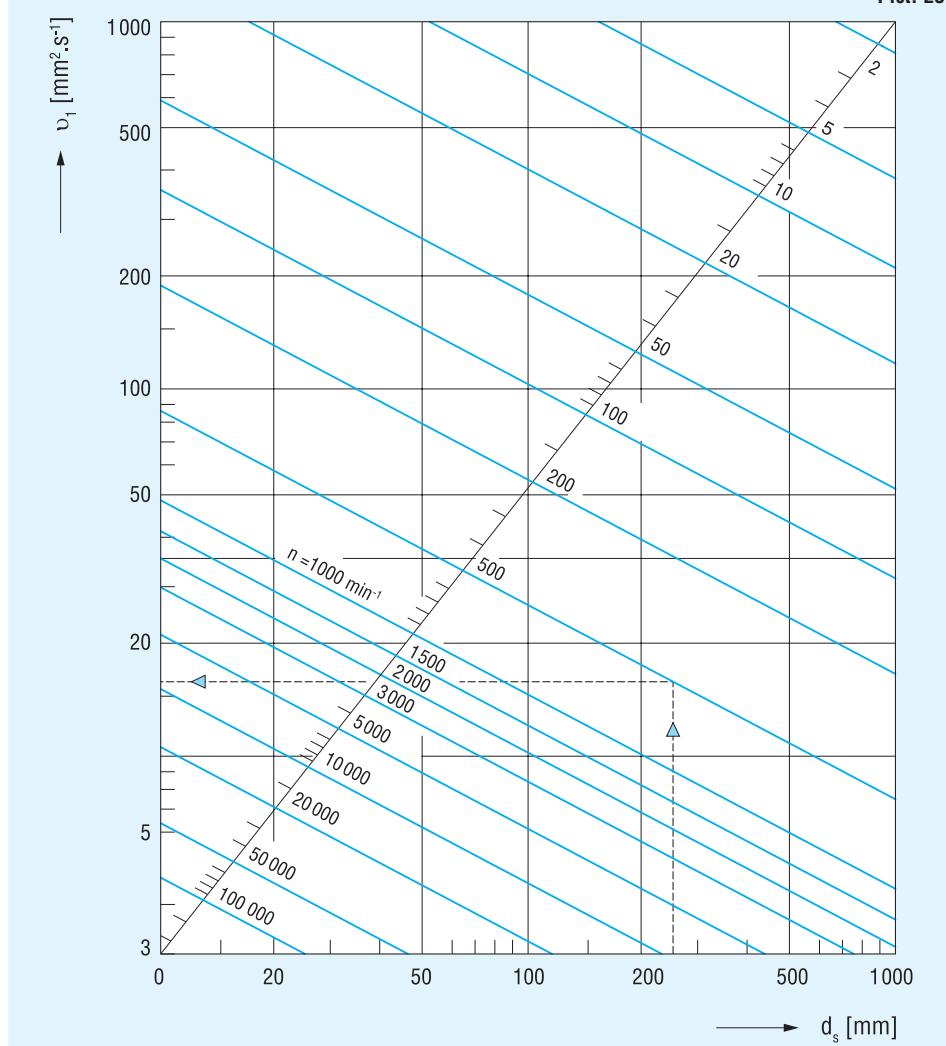
For these conditions according to diagram in Pict. 23 the minimum kinematic viscosity is $v_1 = 17 \text{ mm}^2 \cdot \text{s}^{-1}$.

If the operating temperature is 60°C , the oil selected according to the diagram in Pict. 24 at standardized temperature 40°C must have kinematic viscosity $v \text{ min. } 35 \text{ mm}^2 \cdot \text{s}^{-1}$.

4.3 Lubrication with Solid Lubricants

Solid lubricants are used for bearing lubrication when the grease or oil cannot fulfil the requirements for reliable lubrication in conditions of limiting friction or from the viewpoint of high operating temperatures, chemical influences, etc.

Pict. 23





5. Mounting and Dismounting Rolling Bearings

A very important requirement besides using the suitable mounting or dismounting tool is to make sure these tools are clean and the whole operation can be carried out in clean working environment. If this is not fulfilled, the impurities have decisive influence on the bearing behaviour in operation and can also cause bearing breakdown. In the same way the cleanliness conditions must be fulfilled by the preparation of all lubricating means and components connected with the arrangement.

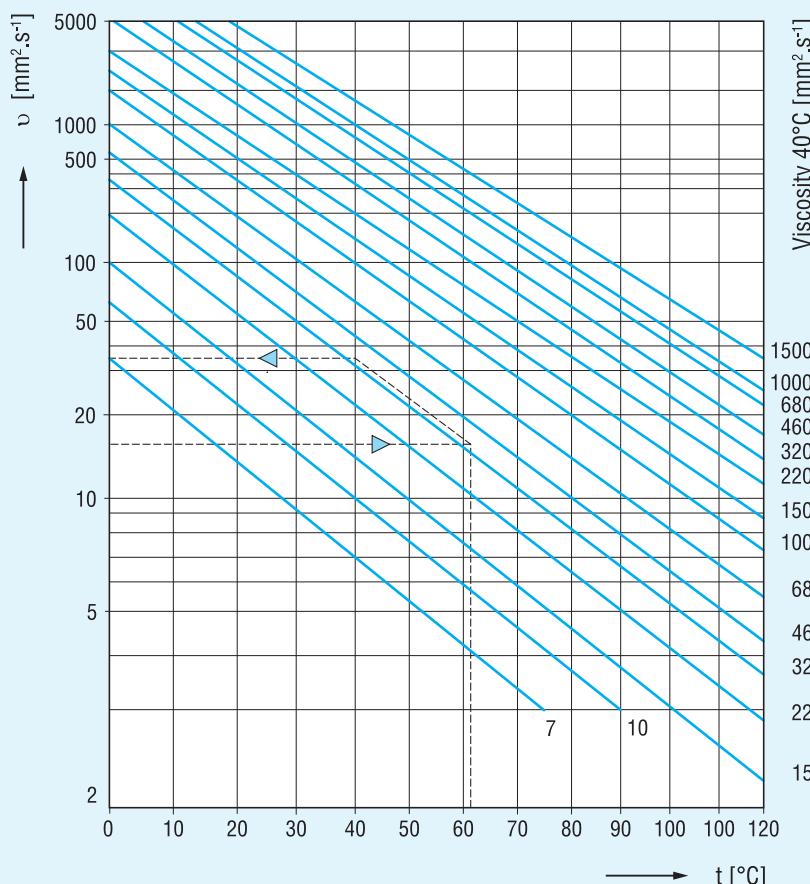
New bearings are preserved by manufacturer with preservatives which need not be removed before mounting. Bearings should be taken out just before mounting. Rarely the preservative is removed from the bearing. For this operation are used:

- gas with 5 to 10% oil additive
- benzol, - diesel fuel, - water-free oil

After washing the bearing should be oiled, preserved from pollution and mounted as soon as possible.

Before mounting, the seating surfaces dimensions should be checked for cleanliness or damage.

Pict. 24





Mounting Bearings with Cylindrical Bore

Bearings with cylindrical bore are mounted on the shaft at room temperature or heated. Dimensionally smaller bearings are mostly mounted at room temperature.

The force necessary for mounting is reached by hammer blows or more suitably by press. In both cases mounting jig is used. At mounting it is not permissible to transfer the mounting force through rolling elements. That is why the jig must always be placed on the ring or both rings being mounted while the mounting force is acting.

Heat mounting is used for greater bearings whose rings are fitted with a greater interference. Maximum heating temperature of the bearing is 100°C.

Mounting Bearings with Tapered Bore

Bearings with a tapered bore are mounted on the shaft by means of adapter or withdrawal sleeves or are seated directly on the tapered journal. Reliable mounting is reached either by pressing the inner ring by a nut, or by sufficient inserting of the sleeve. In both cases the inner ring expands and bearing radial clearance decreases.

When mounting double row self aligning ball bearings the adapter sleeve nut can be tightened, but only to such an extent that the outer ring can be easily turned and swivelled.

Mouting of Double Row Spherical Roller Bearings with conical bore

Tab. 38

Bore diameter d over to mm	Release of Radial Clearance min max μm	Axial Displacement on cone 1:12 on shaft on bush				Minimal allowed Bearing Radial Clearance with Clearance normal C3 C4 μm				
		min max		min max		min max				
				mm						
30	40	20	25	0,35	0,4	0,35	0,45	15	20	40
40	50	25	30	0,4	0,45	0,45	0,5	20	30	50
50	65	30	40	0,45	0,6	0,5	0,7	25	35	55
65	80	40	50	0,6	0,75	0,7	0,85	25	40	70
80	100	45	60	0,7	0,9	0,75	1	35	50	80
100	120	50	70	0,75	1,1	0,8	1,2	50	65	100
120	140	65	90	1,1	1,4	1,2	1,5	55	80	110
140	160	75	100	1,2	1,6	1,3	1,7	55	90	130
160	180	80	110	1,3	1,7	1,4	1,9	60	100	150
180	200	90	130	1,4	2	1,5	2,2	70	100	160
200	225	100	140	1,6	2,2	1,7	2,4	80	120	180
225	250	110	150	1,7	2,4	1,8	2,6	90	130	200
250	280	120	170	1,9	2,7	2	2,9	100	140	220
280	315	130	190	2	3	2,2	3,2	110	150	240
315	355	150	210	2,4	3,3	2,6	3,6	120	170	260
355	400	170	230	2,6	3,6	2,9	3,9	130	190	290
400	450	200	260	3,1	4,1	3,4	4,4	130	200	310
450	500	210	280	3,3	4,4	3,6	4,8	160	230	350
500	560	240	320	3,7	5	4,1	5,4	170	250	360
560	630	260	350	4	5,4	4,4	5,9	200	290	410
630	710	300	400	4,6	6,2	5,1	6,8	210	310	450
710	800	340	450	5,3	7	5,8	7,6	230	350	510
800	900	370	500	5,7	7,8	6,3	8,5	270	390	570

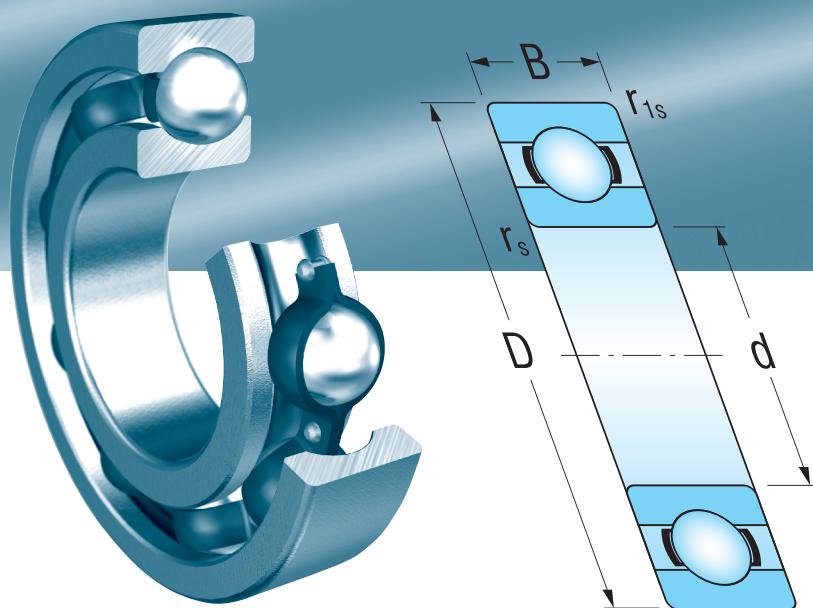


6. Standards

Survey of national and international standards utilized by design, production, warehousing and sales of bearings:

- STN EN ISO 8826-1 Technical drawings. Rolling bearings. Part 2: Detailed simplified representation (ISO 8826-2: 1994), (01 3222).
- STN EN ISO 8826-2 Technical drawings. Rolling bearings. Part 1: General simplified representation (ISO 8826-1: 1989), (01 3222).
- ISO 3290 Rolling bearings. Balls. Dimensions and tolerances.
- STN ISO 464 Rolling bearings. Radial bearings with locating snap ring. Dimensions and tolerances (02 4606).
- STN ISO 492 Rolling bearings. Radial bearings. Tolerances (02 4618).
- STN ISO 199 Rolling bearings. Thrust bearings. Tolerances (02 4737).
- STN ISO 582 Rolling bearings. Chamfer dimensions. Maximum values (02 4613).
- STN ISO 15 Rolling bearings. Radial bearings. Boundary dimensions. General plan (02 4690).
- STN ISO 104 Rolling bearings. Thrust bearings. Boundary dimension, general plan (02 4603).
- STN ISO 355 Rolling bearings. Metric tapered roller bearings. Boundary dimensions and series designations (02 4727).
- STN 02 4617 Rolling bearings. Single row cylindrical roller bearings for axles of railway vehicles.





SINGLE ROW DEEP GROOVE BALL BEARINGS



Single Row Deep Groove Ball Bearings

Single Row Deep Groove Ball Bearings

The single row deep groove ball bearings have relatively deep raceways on both rings without a filling slot and are non-separable. High load ratings are achieved by optimum sizes of balls and by their conformity to the raceways. They can carry axial and radial loads in both directions and are suitable even for high rotational speeds. These bearings are manufactured in a broad assortment and are the most common rolling bearing type.

The outer ring with one rib of separable single row ball bearings, types E and BO, is designed so that the inner ring with a cage and rolling elements can be mounted separately. The bearings are manufactured with a bore diameter up to $d = 20\text{ mm}$ and are suitable for lighter loads and high-speed applications.

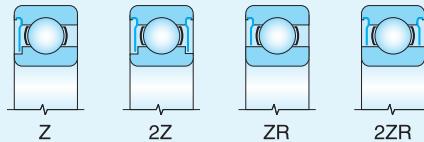
Boundary Dimensions

Boundary dimensions of the single row deep groove ball bearings given in the dimension tables with the exception of separable single row ball bearings of types E and BO, correspond to the international standard ISO 15. The snap ring groove dimensions comply with the international standard ISO 464.

Bearings with Shields or Seals

The single row deep groove ball bearings with sealing on one or on both sides are manufactured with metallic shields (Z, -2Z or ZR, -2ZR) or with seals (RS, -2RS or RSR, -2RSR).

Bearings with shields have a non-contact sealing. The bearings are manufactured in the original design with steps for shields on the inner ring (Z, -2Z) or, in the new design, with a shield and a smooth rib on the inner ring (ZR, -2ZR).



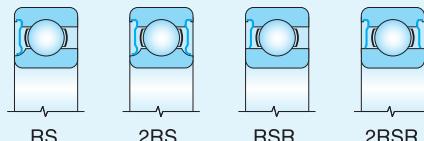
The sealing rings made of rubber, vulcanized on metallic reinforced rings, provide an effective friction type seal. The bearings are manufactured in the design with rounded steps on the inner ring (RS, 2RS) or, in a new design, with a seal and a smooth rib on the inner ring (RSR, -2RSR).

Bearings with seals can be used within the temperature range from -30°C to 110°C .

Supplies of bearings with seals within the operating temperature range from -60°C to 180°C (RS2, 2RS2) should be negotiated with the supplier in advance.

Shields and seals are firmly fixed in the groove of the outer ring and these are not removable.

Bearings with sealings on both sides (-2Z, -2RS or -2ZR, -2RSR) are filled with a quality grease the properties of which usually ensure the lubrication during the whole bearing life under normal operating conditions. The bearings of this design cannot be relubricated and can be used within the operating temperature range from -30°C to 100°C . The supply of bearings with a different grease should be negotiated with the supplier in advance.





Grease

For bearings sealed on both sides, the designation of the grease filling different from standard grease is indicated by a symbol combination the first two letters of which indicate the operating temperature range (a symbol in accordance with STN 02 4608) and the third symbol identifies the grease name.

TL – Grease for low operating temperatures
(from -60°C up to 100°C)

TM – Grease for medium operating temperatures
(from -30°C up to 110°C)

TH – Grease for high operating temperatures
(from -30°C up to 200°C)

TW – Grease for low and high operating temperatures
(from -40°C up to 150°C)

Note: The symbols of greases for medium operating temperatures need not be marked on the bearings.

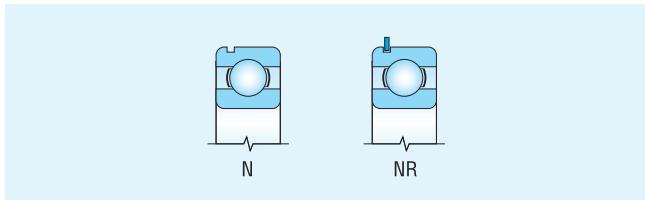
Bearings with Snap Ring Groove

The single row deep groove ball bearings with a snap ring groove (N) can be axially fixed in the housings easily and without high requirements on the space available simplifying the arrangement design.

For bearings with a groove in the outer ring, snap rings corresponding to STN 02 4605 are used (commercial designation R and the number indicating the outside diameter D of the corresponding bearing, e. g. R47).

Bearings with a snap ring groove and a locking snap ring are designated by the suffix NR, e. g. 6204NR. Locking snap rings for the bearings with a snap ring groove are supplied separately.

The bearings with snap ring groove can also be supplied in the modification with shields or seals (ZN, -2ZN or RSN, -2RSN). The supply of these bearings must be negotiated in advance.



Tapered Bore

For some less demanding applications, e. g. in agricultural machines, etc., some sizes of single row deep groove ball bearings of type 62 and 63 with a tapered bore (K), taper 1:12, are manufactured. These bearings are also manufactured in a design with shields on both sides. The bearings are fixed on the cylindrical shaft by means of adapter sleeves of types H2, H3 or directly on the tapered shaft.

Cages

The single row deep groove ball bearings of the basic design are equipped with a pressed cage made of steel sheet, guided on balls, which is not designated.

These bearings are produced with different types of cages for special applications. Namely, bearings with a solid polyamide cage (TNH, TNGH), with a solid cage of fabric reinforced phenolic resin (TB) and a machined brass cage (M, MA). The supply of these bearings should be negotiated in advance.

Tolerances

The limiting values of the dimensional and running accuracy deviation correspond to ISO 492. An exception is made only for the Single row deep groove ball bearings are commonly manufactured within the tolerance class P0 and P6. For special applications requiring high accuracy or for applications with a high rotational speed, the bearings in the higher tolerance classes P6, P5 and P4 are used. The bearings in higher tolerance class P6E are used for rotating electric machines.



The limiting values of the dimensional and running accuracy deviation correspond to ISO 492. An exception is made only for the separable single row ball bearings of types E or B0 the outer diameter D of which has the limiting deviation +0.01/0.00 mm.

The bearings in the tolerance classes P5 and P4 are made of higher quality materials such as electroslag or vacuum remelted bearing steels.

Radial Clearance

The commonly manufactured single row deep groove ball bearings have a normal radial clearance which is not indicated. For special arrangements the bearings with a reduced radial clearance (C2) or with an increased radial clearance (C3, C4, C5) are supplied.

Vibration Level

The currently manufactured single row deep groove ball bearings have a normal vibration level determined by the manufacturer. For special applications with high requirements on noiseless operation, bearings with reduced vibration level are supplied (C6).

Symbol Combination

The symbols for the tolerance classes, bearing internal clearances and vibration levels are combined with the simultaneous omission of the symbol C in the second and the following bearing special characteristics, e. g.:

P6 + C3 = P63	6004 P63
C3 + C6 = C36	6303-2RS C36
P6 + C3 + C6 = P636	6204-2Z P636

Stabilisation for Operation at Higher Temperature

For arrangements with a higher operating temperature than 120°C, special heat treated-stabilised-single row deep groove ball bearings are supplied the form stability of which at operating temperature 150°C up to 400°C (S0, S1, S2, S3, S4, S5) is ensured.

The supply of stabilised bearings should be negotiated with the supplier in advance.

Misalignment

For single row deep groove ball bearings only small mutual misalignment of bearing rings is permissible, therefore alignment deviation of seating surfaces can be very small. Misalignment causes additional loading of the bearing and thus its life is shortened.

Values of permissible misalignment at normal operating conditions are shown in the table.

Bearing Type	Load	
	light ($F_r < 0.15 C_{or}$)	heavy ($F_r \geq 0.15 C_{or}$)
618, 619, 160, 60	2' to 6'	5' to 10'
62, 63, 64	5' to 10'	8' to 16'

Radial Equivalent Dynamic Load

Single row deep groove ball bearings:

$$P_r = F_r \text{ for } F_a / F_r \leq e \quad P_r = 0.56 F_r + Y F_a \text{ for } F_a / F_r > e$$

Separable single row ball bearings:

$$P_r = F_r \text{ for } F_a / F_r \leq 0.2 \quad P_r = 0.5 F_r + 2.5 F_a \text{ for } F_a / F_r > 0.2$$

Coefficients

F_a/C_{or}	e	Y
0.025	0.22	2
0.040	0.24	1.8
0.070	0.27	1.6
0.130	0.31	1.4
0.250	0.37	1.2
0.500	0.44	1



Radial Equivalent Static Load

Single Row Deep Groove Ball Bearings:

$$P_{or} = 0.6 F_r + 0.5 F_a \quad (P_{or} \geq F_r)$$

Separable Single Row Ball Bearings:

$$P_{or} = 0.9 F_r + 0.3 F_a \quad (P_{or} \geq F_r)$$

Designation

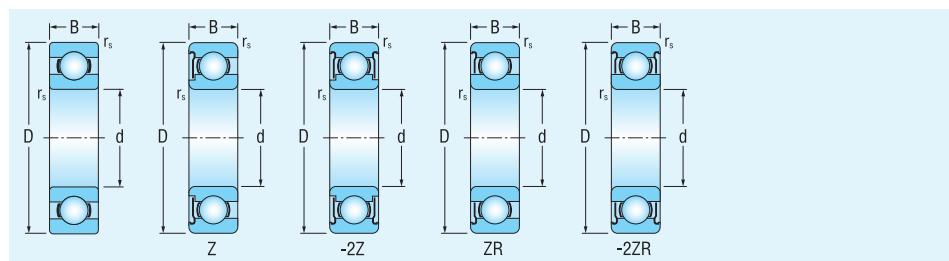
The bearing designation in the basic or current modified design is indicated in the dimension tables. The modification of the basic design is designated by additional symbols (prefixes and suffixes) in accordance with STN 02 4608. The meaning of the most frequently used symbols for the single row deep groove ball bearings is indicated in the table.

Symbol	Example of designation	Meaning
X	X 625 P5	Stainless steel
RS	6002 RS	Single seal
-2RS	6300-2RS	Double seal
RSR	6210 RSR	Seal on one side adhering to flat rib surface of inner ring
-2RSR	6210-2RSR	Seals on both sides adhering to flat rib surface of inner ring
Z	6317 Z	Metallic shield on one side
ZN	6204 ZN	Metallic shield on one side and snap ring groove on the opposite side
-ZZ	6308-ZZ	Metallic shields on both sides
-2ZR	6005-2ZR	Metallic shields on both sides resting on the flat rib of inner ring
K	6204-2ZK	Tapered bore with taper 1:12
N	6416 N	Snap ring groove in outer ring
NR	6310 NR	Snap ring groove in outer ring and inserted snap ring
Y	X 623 Y P5	Pressed brass cage, rolling element centered
TNH	6002 TNH	Balls guided plastic cage
M	6319 M	Solid brass cage guided on balls
MA	6209 MA	Solid brass cage guided on outer ring
TB	6308 TB	Solid cage made of textile, guided on inner ring
P6	6303 P6	Tolerance class higher than normal
P6E	6204-ZZ P6E	Higher tolerance class for rotating electric machines
P5	6208 P5	Tolerance class higher than P6
P4	6007 P4	Tolerance class higher than P5
C2	6003 C2	Radial clearance smaller than normal
C3	6302-2ZR C3	Radial clearance greater than normal
C4	6005-2RS C4	Radial clearance greater than C3
C5	6303-2ZR C5	Radial clearance greater than C4
C6	6300 C6	Reduced vibration level
R...	6210 R10-20	Radial clearance in non-standardized range (range in μm)
S0	6204 S0	Stabilization for operation at temperature up to 150°C
S1	6301 S1	Stabilization for operation at temperature up to 200°C
S2	6303-2ZR C5S2	Stabilization for operation at temperature up to 250°C
S3	6303-2ZR C5S3	Stabilization for operation at temperature up to 300°C
S4	6306-2ZR C5S4	Stabilization for operation at temperature up to 350°C
S5	6306-2ZR C5S5	Stabilization for operation at temperature up to 400°C
TPF	6204-ZZ P6E TPF	Bearings manufactured according to special technical terms agreed upon with the customer

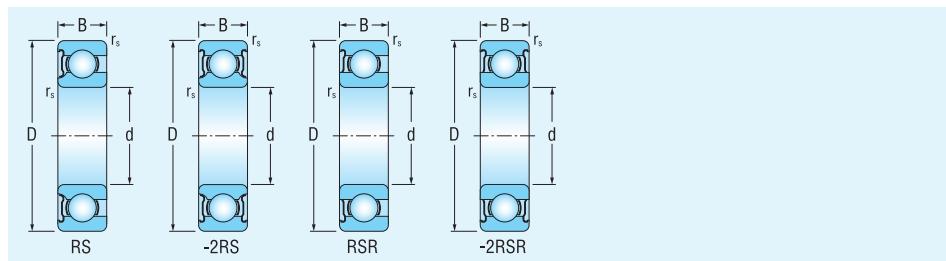


Single Row Deep Groove Ball Bearings (with Shield or Seals)

d = 10 - 15 mm



Dimensions			Bearing designation	Basic load rating dynamic C _r	Basic load rating static C _{or}	Fatigue load limit P _u	Limiting speed for lubrication with grease oil	
d	D	B		kN	kN	kN	min ⁻¹	
10	26	8	6000^{*2)}	4.580	1.980	0.090	28 000	33 000
	26	8	6000RSR*	4.580	1.980	0.090	19 000	-
	26	8	6000-2RSR*	4.580	1.980	0.090	19 000	-
	26	8	6000-2ZR*	4.580	1.980	0.090	28 000	-
	26	8	6000ZR*	4.580	1.980	0.090	28 000	33 000
	30	9	6200^{*1 2)}	6.047	2.51	0.114	25 000	30 000
	30	9	6200-2ZR*	6.047	2.51	0.114	25 000	-
	30	9	6200-2RSR*	6.047	2.51	0.114	17 000	-
	30	9	62200-2RSR*	6.047	2.51	0.114	17 000	-
	35	11	6300^{*1 2)}	8.072	3.43	0.156	22 000	27 000
	35	11	6300ZR*	8.072	3.43	0.156	22 000	27 000
	35	11	6300-2ZR*	8.072	3.43	0.156	22 000	-
	35	11	6300RS*	8.072	3.43	0.156	15 000	-
	35	11	6300-2RS*	8.072	3.43	0.156	15 000	-
12	28	7	16001^{*2)}	5.094	2.36	0.107	25 000	30 000
	28	8	6001^{*2)}	5.100	2.380	0.108	25 000	30 000
	28	8	6001RSR*	5.100	2.380	0.108	17 000	-
	28	8	6001-2RSR*	5.100	2.380	0.108	17 000	-
	28	8	6001-2ZR*	5.100	2.380	0.108	25 000	-
	28	8	6001ZR*	5.100	2.380	0.108	25 000	30 000
	32	10	6201^{*2)}	6.820	3.050	0.139	22 000	27 000
	32	10	6201ZR*	6.820	3.050	0.139	22 000	27 000
	32	10	6201-2RSR*	6.820	3.050	0.139	15 000	-
	32	10	6201-2ZR*	6.820	3.050	0.139	22 000	-
	32	10	6201RS*	6.820	3.050	0.139	15 000	15 000
	37	12	6301^{*1 2)}	9.759	4.235	0.193	20 000	24 000
	37	12	6301ZR*	9.759	4.234	0.192	20 000	24 000
	37	12	6301-2ZR*	9.759	4.234	0.192	20 000	-
	37	12	6301RS*	9.759	4.234	0.192	13 000	-
	37	12	6301-2RS*	9.759	4.234	0.192	13 000	-
15	32	8	16002^{*1)}	5.594	2.86	0.130	21 000	25 000
	32	9	6002^{*1 2)}	5.594	2.86	0.130	21 000	25 000
	32	9	6002ZR*	5.594	2.86	0.130	21 000	25 000
	32	9	6002-2ZR*	5.594	2.86	0.130	21 000	-
	32	9	6002RS*	5.594	2.86	0.130	14 000	-
	32	9	6002-2RS*	5.594	2.86	0.130	14 000	-
	35	11	6202^{*1 2)}	7.650	3.720	0.169	20 000	24 000
	35	11	6202-2RSR*	7.650	3.720	0.169	13 000	-
	35	11	6202-2ZR*	7.650	3.720	0.169	20 000	-
	35	11	6202RS*	7.650	3.720	0.169	13 000	-
	42	13	6302^{*1 2)}	11.31	5.33	0.243	18 000	21 000

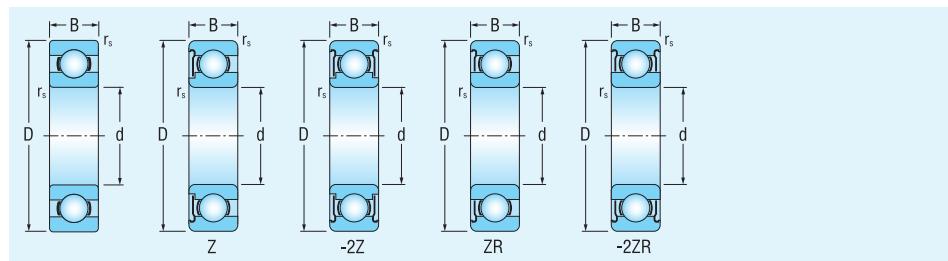


	Mass	Mating dimensions	
		r_s min	
	kg	mm	
	0.019	0.3	
	0.019	0.3	
	0.019	0.3	
	0.019	0.3	
	0.019	0.3	
	0.031	0.6	
	0.033	0.6	
	0.033	0.6	
	0.041	0.6	
	0.054	0.6	
	0.053	0.6	
	0.053	0.6	
	0.053	0.6	
	0.053	0.6	
	0.02	0.3	
	0.022	0.3	
	0.022	0.3	
	0.022	0.3	
	0.022	0.3	
	0.022	0.3	
	0.037	0.6	
	0.037	0.6	
	0.037	0.6	
	0.037	0.6	
	0.061	1	
	0.06	1	
	0.06	1	
	0.06	1	
	0.06	1	
	0.027	0.3	
	0.03	0.3	
	0.031	0.3	
	0.031	0.3	
	0.031	0.3	
	0.031	0.3	
	0.046	0.6	
	0.046	0.6	
	0.045	0.6	
	0.045	0.6	
	0.085	1	

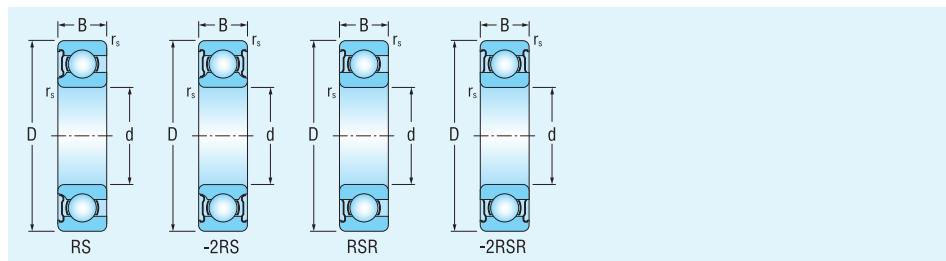


Single Row Deep Groove Ball Bearings (with Shield or Seals)

d = 15 - 25 mm



Dimensions			Bearing designation	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d mm	D	B		C_r kN	C_{or} kN	P_u kN	min ⁻¹	
15	42	13	6302ZR*	11.31	5.335	0.243	18 000	21 000
	42	13	6302-2ZR*	11.31	5.335	0.243	18 000	-
	42	13	6302RS*	11.31	5.335	0.243	12 000	-
	42	13	6302-2RS*	11.31	5.335	0.243	12 000	-
17	35	8	16003*¹⁾	5.999	3.265	0.148	20 000	24 000
	35	10	6003*¹⁾	6.001	3.267	0.149	20 000	24 000
	35	10	6003ZR*	5.999	3.265	0.148	20 000	24 000
	35	10	6003-2ZR*	5.999	3.265	0.148	20 000	-
	35	10	6003RS*	5.999	3.265	0.148	13 000	-
	35	10	6003-2RS*	5.999	3.265	0.148	13 000	-
	40	12	6203*^{1 2)}	9.534	4.734	0.215	18 000	21 000
	40	12	6203-2ZR*	9.534	4.734	0.215	18 000	-
	40	17.5	63203-2RSR*	9.534	4.734	0.215	12 000	-
	47	14	6303*^{1 2)}	13.565	6.56	0.298	16 000	19 000
	47	14	6303ZR*	13.565	6.563	0.298	16 000	19 000
	47	14	6303-2ZR*	13.565	6.563	0.298	16 000	-
	47	14	6303RS*	13.565	6.563	0.298	10 600	-
	47	14	6303-2RS*	13.565	6.563	0.298	10 600	-
20	62	17	6403*¹⁾	22.68	10.89	0.495	12 600	15 000
	42	8	16004D*¹⁾	9.371	4.972	0.226	17 000	20 000
	42	12	6004*^{1 2)}	9.371	4.972	0.226	17 000	20 000
	42	12	6004ZR*	9.371	4.972	0.226	17 000	20 000
	42	12	6004-2ZR*	9.371	4.972	0.226	17 000	-
	42	12	6004RS*	9.371	4.972	0.226	11 000	-
	42	12	6004-2RS*	9.371	4.972	0.226	11 000	-
	42	16	63004-2ZR*	9.371	4.972	0.226	17 000	-
	42	16	63004-2RS*	9.371	4.972	0.226	11 000	-
	47	14	6204*^{1 2)}	12.8	6.6	0.300	15 000	18 000
	47	14	6204ZR*	12.8	6.6	0.300	15 000	18 000
	47	14	6204-2ZR*	12.8	6.6	0.300	15 000	-
	47	14	6204RSR*	12.8	6.6	0.300	10 000	-
	47	14	6204-2RSR*	12.8	6.6	0.300	10 000	-
25	47	18	62204-2RS*	12.774	6.553	0.298	10 000	-
	47	20.6	63204-2RS*	12.774	6.553	0.298	10 000	-
	52	15	6304*²⁾	15.866	7.811	0.355	14 000	17 000
	52	15	6304-2RSR*	15.900	7.800	0.355	9 400	-
	52	15	6304-2ZR*	15.900	7.800	0.355	14 000	-
25	52	15	6304ZR*	15.900	7.800	0.355	14 000	17 000
	47	8	16005	7.0	4.60	0.209	14 000	17 000
	47	12	16005D*¹⁾	10.10	5.90	0.268	14 000	17 000



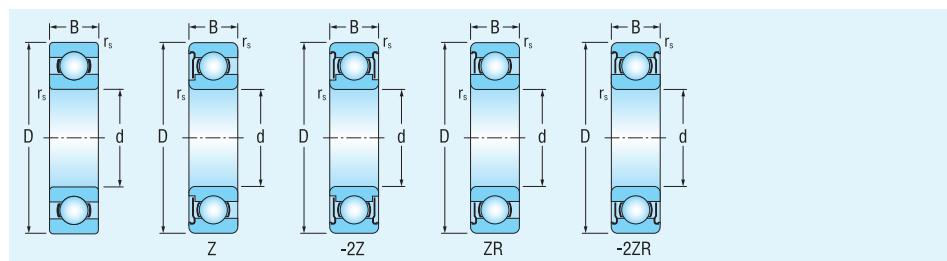
	Mass	Mating dimensions	
		r_s min	
	kg	mm	

	0.082	1	
	0.082	1	
	0.082	1	
	0.082	1	
	0.032	0.3	
	0.04	0.3	
	0.04	0.3	
	0.04	0.3	
	0.04	0.3	
	0.04	0.3	
	0.073	0.6	
	0.065	0.6	
	0.064	0.6	
	0.115	1	
	0.116	1	
	0.116	1	
	0.116	1	
	0.116	1	
	0.271	1.1	
	0.05	0.3	
	0.07	0.6	
	0.07	0.6	
	0.07	0.6	
	0.07	0.6	
	0.09	0.6	
	0.09	0.6	
	0.108	1	
	0.107	1	
	0.107	1	
	0.107	1	
	0.107	1	
	0.133	1	
	0.154	1	
	0.145	1.1	
	0.145	1.1	
	0.145	1.1	
	0.145	1.1	
	0.053	0.30	
	0.053	0.3	
	0.082	0.60	

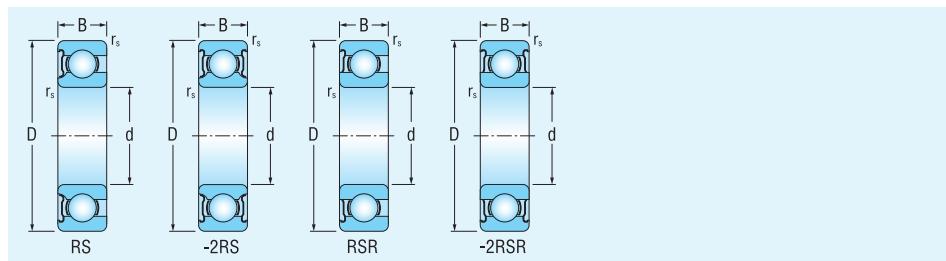


Single Row Deep Groove Ball Bearings (with Shield or Seals)

d = 20 - 35 mm



Dimensions			Bearing designation	Basic load rating dynamic C _r	static C _{or}	Fatigue load limit P _u	Limiting speed for lubrication with grease oil	
d	D	B		kN	kN	kN	min ⁻¹	
25	47	12	6005Z*	10.10	5.90	0.268	14 000	17 000
	47	12	6005-2ZR*	10.10	5.90	0.268	14 000	-
	47	12	6005RSR*	10.10	5.90	0.268	9 400	-
	47	12	6005-2RSR*	10.10	5.90	0.268	9 400	-
	52	15	6205^{*)2}	14.000	7.880	0.359	12 600	15 000
	52	15	6205-2RSR*	14.000	7.880	0.358	8 400	-
	52	15	6205-2ZR*	14.000	7.880	0.358	12 600	-
	52	15	6205RSR*	14.000	7.880	0.358	8 400	-
	52	15	6205ZR*	14.000	7.880	0.358	12 600	15 000
	62	17	6305^{*)2}	21.20	10.90	0.495	11 000	13 000
	62	17	6305ZR*	21.20	10.90	0.495	11 000	13 000
	62	17	6305-2ZR*	21.20	10.90	0.495	11 000	-
	62	17	6305RSR*	21.20	10.90	0.495	7 500	-
	62	17	6305-2RSR*	21.20	10.90	0.495	7 500	-
30	80	21	6405*	36.00	19.30	0.877	9 400	11 000
	55	9	16006*	11.30	7.4	0.335	12 000	14 000
	55	13	6006^{*)2}	13.20	8.3	0.375	12 000	14 000
	55	13	6006ZR*	13.20	8.30	0.377	12 000	14 000
	55	13	6006-2ZR*	13.20	8.30	0.377	12 000	-
	55	13	6006RSR*	13.20	8.30	0.377	7 900	-
	55	13	6006-2RSR*	13.20	8.30	0.377	7 900	-
	62	16	6206^{*)2}	19.40	11.19	0.508	11 000	13 000
	62	16	6206-2RSR*	19.500	11.200	0.514	7 500	-
	62	16	6206-2ZR*	19.500	11.200	0.514	11 000	-
	62	16	6206RSR*	19.500	11.200	0.514	7 500	7 500
	62	16	6206ZR*	19.500	11.200	0.514	11 000	13 000
	62	16	6206ZR*	19.50	11.30	0.514	11 000	13 000
	62	16	6206-2ZR*	19.50	11.30	0.514	11 000	-
35	72	19	6306^{*)2}	29.80	15.80	0.718	10 000	12 000
	72	19	6306ZR*	29.80	15.80	0.718	10 000	12 000
	72	19	6306-2ZR*	29.80	15.80	0.718	10 000	-
	72	19	6306RSR*	29.80	15.80	0.718	6 700	-
	72	19	6306-2RSR*	29.80	15.80	0.718	6 700	-
	90	23	6406*	43.10	23.60	1.073	8 400	10 000
	62	9	16007*	12.10	8.7	0.397	10 600	12 600
	62	14	6007^{*)2}	16.00	10.30	0.468	10 600	12 600
	62	14	6007ZR*	16.0	10.30	0.468	10 600	12 600
	62	14	6007-2ZR*	16.0	10.30	0.468	10 600	-
	62	14	6007RSR*	16.0	10.30	0.468	7 100	-
	62	14	6007-2RSR*	16.0	10.30	0.468	7 100	-
	72	17	6207²⁾	25.70	15.30	0.695	9 400	11 000

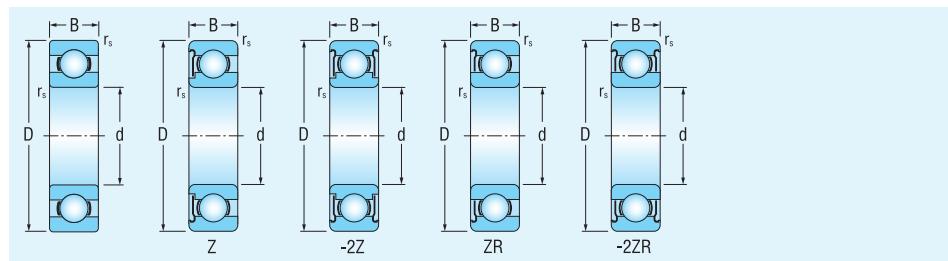


	Mass	Mating dimensions	
		r_s min	
	kg	mm	
	0.081	0.6	
	0.081	0.6	
	0.081	0.6	
	0.081	0.6	
	0.129	1	
	0.129	1	
	0.129	1	
	0.129	1	
	0.129	1	
	0.230	1.10	
	0.240	1.10	
	0.232	1.10	
	0.230	1.10	
	0.230	1.10	
	0.530	1.70	
	0.087	0.3	
	0.119	1.1	
	0.115	1.1	
	0.113	1.1	
	0.120	1.1	
	0.111	1.1	
	0.200	1.1	
	0.200	1.1	
	0.200	1.1	
	0.200	1.1	
	0.196	1.1	
	0.197	1.1	
	0.331	1.1	
	0.335	1.1	
	0.327	1.1	
	0.335	1.1	
	0.329	1.1	
	0.725	1.7	
	0.111	0.3	
	0.154	1.1	
	0.160	1.1	
	0.150	1.1	
	0.150	1.1	
	0.150	1.1	
	0.284	1.1	

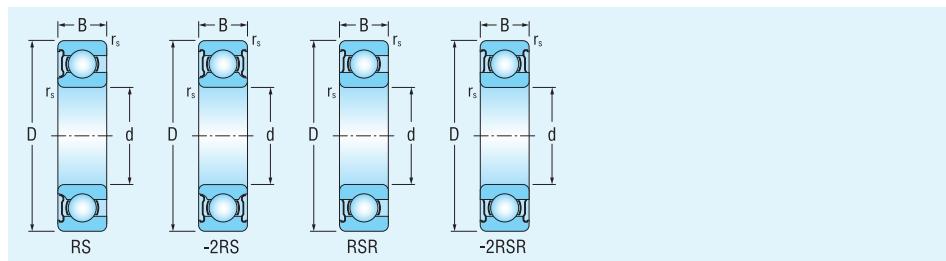


Single Row Deep Groove Ball Bearings (with Shield or Seals)

d = 35 - 45 mm



Dimensions			Bearing designation	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d	D	B		C_r kN	C_{or} kN	P_u kN	min ⁻¹	
35	72	17	6207ZR*	25.70	15.3	0.695	9 400	11 000
	72	17	6207-2ZR*	25.70	15.3	0.695	9 400	-
	72	17	6207RSR*	25.70	15.3	0.695	6 300	-
	72	17	6207-2RSR*	25.70	15.3	0.695	6 300	-
	80	21	6307^{*)2}	33.40	19.20	0.873	8 400	10 000
	80	21	6307ZR*	33.40	19.2	0.873	8 400	10 000
	80	21	6307-2ZR*	33.40	19.2	0.873	8 400	-
	80	21	6307RSR*	33.40	19.2	0.873	5 600	-
	80	21	6307-2RSR*	33.40	19.2	0.873	5 600	-
	100	25	6407*	54.80	30.80	1.400	7 500	8 900
40	68	9	16008*	12.60	9.60	0.436	9 400	11 000
	68	15	6008^{*)2}	16.80	11.50	0.523	9 400	11 000
	68	15	6008ZR*	16.8	11.50	0.523	9 400	11 000
	68	15	6008-2ZR*	16.8	11.50	0.523	9 400	-
	68	15	6008RSR*	16.8	11.50	0.523	6 300	-
	68	15	6008-2RSR*	16.8	11.50	0.523	6 300	-
	80	18	6208^{*)2}	29.50	18.10	0.823	8 400	10 000
	80	18	6208X9	29.50	18.10	0.823	8 400	10 000
	80	18	6208ZR*	32.60	19.90	0.905	8 400	10 000
	80	18	6208-2ZR*	32.60	19.90	0.905	8 400	-
	80	18	6208RSR*	32.60	19.90	0.905	5 600	-
	80	18	6208-2RSR*	32.60	19.90	0.905	5 600	-
	90	23	6308^{*)2}	40.70	23.90	1.086	7 900	9 400
	90	23	6308ZR*	40.70	23.90	1.086	7 900	9 400
	90	23	6308-2ZR*	40.70	23.90	1.086	7 900	-
	90	23	6308RSR*	40.70	23.90	1.086	4 700	-
	90	23	6308-2RSR*	40.70	23.90	1.086	4 700	-
45	75	10	16009*	15.60	12.20	0.555	8 400	10 000
	75	16	6009	21.00	15.20	0.691	8 400	10 000
	75	16	6009ZR*	21.00	15.20	0.691	8 400	10 000
	75	16	6009-2ZR*	21.00	15.20	0.691	8 400	-
	75	16	6009RSR*	21.00	15.20	0.691	5 600	-
	75	16	6009-2RSR*	21.00	15.20	0.691	5 600	-
	85	19	6209	31.70	20.70	0.941	7 500	9 000
	85	19	6209X9	31.70	20.70	0.941	7 500	9 000
	85	19	6209ZR*	32.70	20.50	0.932	7 900	9 400
	85	19	6209-2ZR*	32.70	20.50	0.932	7 900	-
	85	19	6209RSR*	32.70	20.50	0.932	5 300	-
	100	25	6309^{*)2}	52.80	31.70	1.441	7 100	8 400

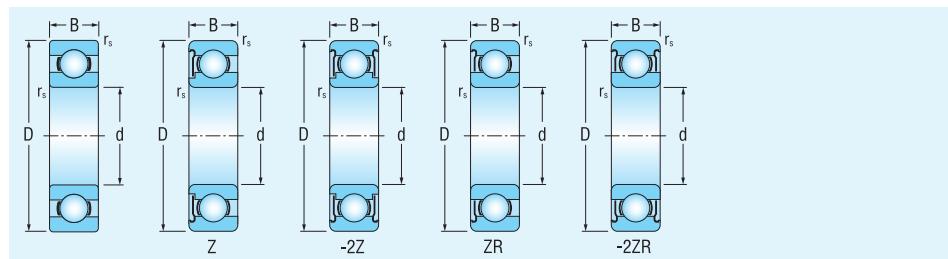


	Mass	Mating dimensions
		r_s min
	kg	mm
	0.297	1.1
	0.280	1.1
	0.286	1.1
	0.278	1.1
	0.447	1.7
	0.454	1.7
	0.440	1.7
	0.445	1.7
	0.460	1.7
	0.954	1.7
	0.125	0.3
	0.191	1.1
	0.187	1.1
	0.184	1.1
	0.194	1.1
	0.188	1.1
	0.349	1.1
	0.363	1.1
	0.363	1.1
	0.356	1.1
	0.345	1.1
	0.352	1.1
	0.625	1.7
	0.636	1.7
	0.631	1.7
	0.631	1.7
	0.632	1.7
	1.230	2.1
	0.170	0.6
	0.241	1.1
	0.237	1.1
	0.333	1.1
	0.240	1.1
	0.234	1.1
	0.404	1.1
	0.404	1.1
	0.400	1.1
	0.399	1.1
	0.406	1.1
	0.388	1.1
	0.828	1.7

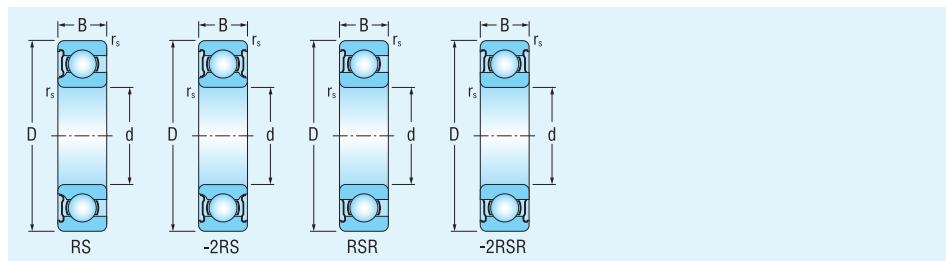


Single Row Deep Groove Ball Bearings (with Shield or Seals)

d = 45 - 60 mm



Dimensions			Bearing designation	Basic load rating dynamic C _r kN	Basic load rating static C _{or} kN	Fatigue load limit P _u kN	Limiting speed for lubrication with grease oil min ⁻¹	
d	D	B						
mm								
45	100	25	6309ZR*	52.80	31.70	1.441	7 100	8 400
	100	25	6309-2ZR*	52.80	31.70	1.441	7 100	-
	100	25	6309RSR*	52.80	31.70	1.441	4 700	-
	100	25	6309-2RSR*	52.80	31.70	1.441	4 700	-
	120	29	6409*	76.90	45.00	2.045	6 000	7 100
50	80	10	16010*	16.10	13.1	0.595	7 900	9 400
	80	16	6010*	21.80	16.60	0.755	7 900	9 400
	80	16	6010Z*	21.80	16.60	0.755	7 900	9 400
	80	16	6010-2Z*	21.80	16.60	0.755	7 900	-
	80	16	6010RSR*	21.80	16.60	0.755	5 300	-
	80	16	6010-2RSR*	21.80	16.60	0.755	5 300	-
	90	20	6210	35.10	23.20	1.055	7 100	8 400
	90	20	6210X5N	35.10	23.20	1.055	7 100	8 400
	90	20	6210Z*	35.10	23.20	1.055	7 100	8 400
	90	20	6210-2Z*	35.10	23.20	1.055	7 100	-
	90	20	6210RSR*	35.10	23.20	1.055	4 700	-
	90	20	6210-2RSR*	35.10	23.20	1.055	4 700	-
	110	27	6310* ²⁾	61.80	37.90	1.723	6 300	7 500
	110	27	6310Z*	61.80	37.90	1.723	6 300	7 500
	110	27	6310-2Z*	61.80	37.90	1.723	6 300	-
	110	27	6310RSR*	61.80	37.90	1.723	4 200	-
	110	27	6310-2RSR*	61.80	37.90	1.723	4 200	-
55	90	11	16011*	19.40	16.2	0.736	7 100	8 400
	90	18	6011	28.33	21.30	0.968	7 100	8 400
	90	18	6011Z*	28.30	21.30	0.968	7 100	8 400
	90	18	6011-2Z*	28.30	21.30	0.968	7 100	-
	90	18	6011RSR*	28.30	21.30	0.968	4 700	-
	90	18	6011-2RSR*	28.30	21.30	0.968	4 700	-
	100	21	6211* ²⁾	43.40	29.20	0.968	6 700	7 900
	100	21	6211Z*	43.40	29.20	0.968	6 700	7 900
	100	21	6211-2Z*	43.40	29.20	0.968	6 700	-
	100	21	6211RSR*	43.40	29.20	0.968	4 500	-
60	100	21	6211-2RSR*	43.40	29.20	1.327	4 500	-
	120	29	6311*	71.50	44.60	2.027	5 600	6 700
	120	29	6311Z*	71.50	44.60	2.027	5 600	6 700
	120	29	6311-2Z*	71.50	44.60	2.027	5 600	-
	120	29	6311RSR*	71.50	44.60	2.027	3 800	-
	120	29	6311-2RSR*	71.50	44.60	2.027	3 800	-
	140	33	6411*	100.20	62.00	2.818	5 300	6 300
	95	18	6012*	29.40	23.20	1.055	6 700	7 900

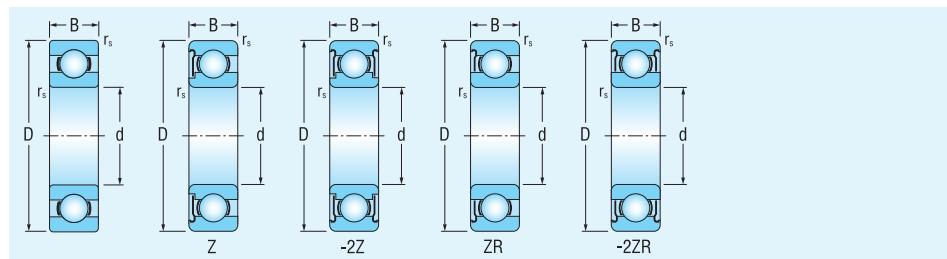


	Mass	Mating dimensions	
		r_s min	
	kg	mm	
	0.832	1.7	
	0.824	1.7	
	0.834	1.7	
	1.060	1.7	
	1.540	2.1	
	0.188	0.6	
	0.260	1.1	
	0.256	1.1	
	0.254	1.1	
	0.246	1.1	
	0.252	1.1	
	0.460	1.1	
	0.460	1.1	
	0.445	1.1	
	0.447	1.1	
	0.455	1.1	
	0.441	1.1	
	1.060	2.1	
	1.060	2.1	
	1.080	2.1	
	1.080	2.1	
	1.060	2.1	
	1.890	2.1	
	0.260	0.6	
	0.383	1.1	
	0.379	1.1	
	0.374	1.1	
	0.387	1.1	
	0.375	1.1	
	0.597	1.7	
	0.590	1.7	
	0.588	1.7	
	0.600	1.7	
	0.586	1.7	
	1.380	2.1	
	1.380	2.1	
	1.360	2.1	
	1.390	2.1	
	1.360	2.1	
	2.290	2.1	
	0.411	1.1	

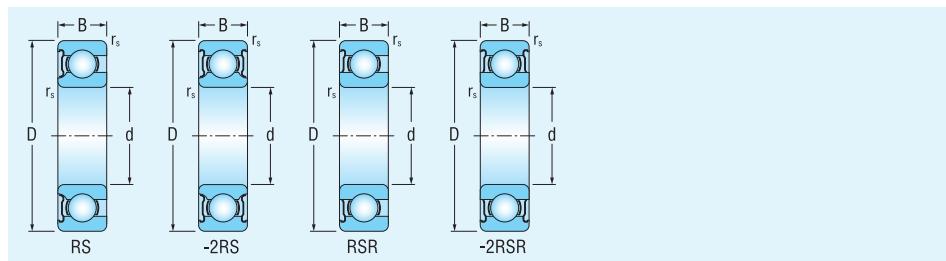


Single Row Deep Groove Ball Bearings (with Shield or Seals)

d = 60 - 70 mm



Dimensions			Bearing designation	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d	D	B		C_r kN	C_{or} kN	P_u kN	min ⁻¹	
60	95	18	6012ZR*	29.40	23.20	1.055	6 700	7 900
	95	18	6012-2ZR*	29.40	23.20	1.055	6 700	-
	95	18	6012RSR*	29.40	23.20	1.055	4 500	-
	95	18	6012-2RSR*	29.40	23.20	1.055	4 500	-
	110	22	6212*	47.80	32.90	1.495	6 000	7 100
	110	22	6212ZR*	52.50	35.9	1.632	6 000	7 100
	110	22	6212-2ZR*	52.50	35.9	1.632	6 000	-
	110	22	6212RSR*	52.50	35.9	1.632	4 000	-
	110	22	6212-2RSR*	52.50	35.9	1.632	4 000	-
	130	31	6312*	81.80	51.80	2.355	5 300	6 300
	130	31	6312ZR*	81.80	51.80	2.355	5 300	6 300
	130	31	6312-2ZR*	81.80	51.80	2.355	5 300	-
	130	31	6312RSR*	81.80	51.80	2.355	3 500	-
	130	31	6312-2RSR*	81.80	51.80	2.355	3 500	-
	150	35	6412*	109.10	70.10	3.110	4 700	5 600
65	100	11	16013*	21.20	19.70	0.895	6 300	7 500
	100	18	6013*	30.5	25.20	1.145	6 300	7 500
	100	18	6013ZR*	30.5	25.2	1.145	6 300	7 500
	100	18	6013-2ZR*	30.5	25.2	1.145	6 300	-
	100	18	6013RSR*	30.5	25.2	1.145	4 200	-
	100	18	6013-2RSR*	30.5	25.2	1.145	4 200	-
	120	23	6213^{*)}	57.20	40.00	1.818	5 300	7 500
	120	23	6213ZR*	57.2	40.0	1.809	5 300	7 500
	120	23	6213-2ZR*	57.2	40.0	1.809	5 300	-
	120	23	6213RSR*	57.2	40.0	1.809	3 500	-
	120	23	6213-2RSR*	57.2	40.0	1.809	3 500	-
	140	33	6313*	92.6	59.70	2.680	5 000	6 000
	140	33	6313ZR*	92.6	59.7	2.680	5 000	6 000
	140	33	6313-2ZR*	92.6	59.7	2.680	5 000	-
	140	33	6313RSR*	92.6	59.7	2.680	3 300	-
	140	33	6313-2RSR*	92.6	59.7	2.680	3 300	-
70	110	13	16014*	27.90	25.00	1.136	5 600	6 700
	110	20	6014*	38.00	30.90	1.405	5 600	6 700
	110	20	6014ZR*	38.00	30.9	1.405	5 600	6 700
	110	20	6014-2ZR*	38.00	30.9	1.405	5 600	-
	110	20	6014RSR*	38.00	30.9	1.405	3 800	-
	110	20	6014-2RSR*	38.00	30.9	1.405	3 800	-
	125	24	6214*	62.20	44.00	2.000	5 300	6 300
	125	24	6214ZR*	62.2	44	2.000	5 300	6 300
	125	24	6214-2ZR*	62.2	44	2.000	5 300	-



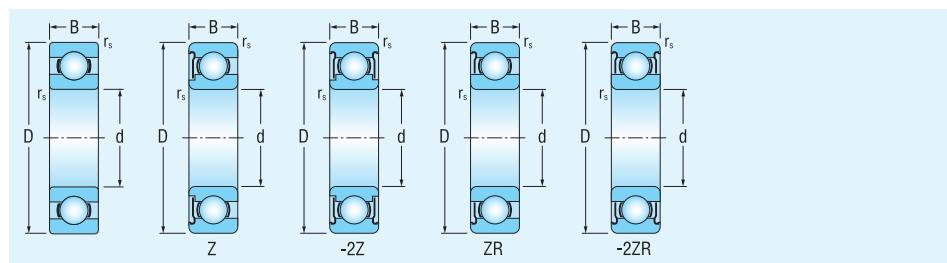
	Mass	Mating dimensions	
		r_s min	
	kg	mm	

	0.415	1.1	
	0.405	1.1	
	0.415	1.1	
	0.405	1.1	
	0.771	1.7	
	0.775	1.7	
	0.765	1.7	
	0.773	1.7	
	0.763	1.7	
	1.720	2.1	
	1.710	2.1	
	1.710	2.1	
	1.700	2.1	
	1.670	2.1	
	2.760	2.1	
	0.300	0.6	
	0.437	1.1	
	0.432	1.1	
	0.425	1.1	
	0.439	1.1	
	0.421	1.1	
	0.997	1.7	
	0.988	1.7	
	0.996	1.7	
	0.999	1.7	
	0.978	1.7	
	2.100	2.1	
	2.110	2.1	
	2.090	2.1	
	2.120	2.1	
	2.110	2.1	
	3.280	2.1	
	0.433	0.6	
	0.604	1.1	
	0.558	1.1	
	0.587	1.1	
	0.611	1.1	
	0.581	1.1	
	1.090	1.7	
	1.090	1.7	
	1.080	1.7	

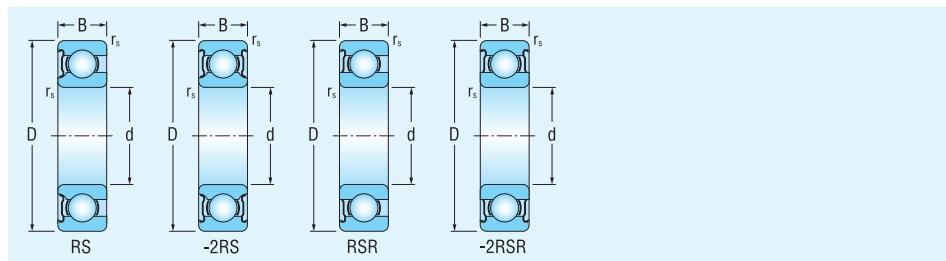


Single Row Deep Groove Ball Bearings (with Shield or Seals)

d = 70 - 80 mm



Dimensions			Bearing designation	Basic load rating dynamic		static	Fatigue load limit	Limiting speed for lubrication with grease oil	
d	D	B		C_r	C_{or}		P_u		
mm				kN			kN	min ⁻¹	
70	125	24	6214RSR*	62.2	44	2.000	3 500	-	
	125	24	6214-2RSR*	62.2	44	2.000	3 500	-	
	150	35	6314*	104.00	68.00	2.947	4 700	5 600	
	150	35	6314Z*	104.000	68	2.947	4 700	5 600	
	150	35	6314-2Z*	104.000	68	2.947	4 700	-	
	150	35	6314RSR*	104.000	68	2.947	3 200	-	
	150	35	6314-2RSR*	104.000	68	2.947	3 200	-	
	180	42	6414*²⁾	143.40	103.40	4.204	4 000	4 700	
75	115	13	6015*	28.7	26.80	1.218	5 300	6 300	
	115	20	6015*	39.50	33.50	1.523	5 300	6 300	
	115	20	6015Z*	39.5	33.5	1.523	5 300	6 300	
	115	20	6015-2Z*	39.5	33.5	1.523	5 300	-	
	115	20	6015RSR*	39.5	33.5	1.523	3 500	-	
	115	20	6015-2RSR*	39.5	33.5	1.523	3 500	-	
	130	25	6215*²⁾	66.20	49.30	2.213	5 000	6 000	
	130	25	6215Z*	66.2	49.3	2.213	5 000	6 000	
	130	25	6215-2Z*	66.2	49.3	2.213	5 000	-	
	130	25	6215RSR*	66.2	49.3	2.213	3 300	-	
	130	25	6215-2RSR*	66.2	49.3	2.213	3 300	-	
	160	37	6315*	113.40	77.00	3.229	4 200	5 000	
	160	37	6315Z*	113.4	77	3.229	4 200	5 000	
	160	37	6315-2Z*	113.4	77	3.229	4 200	-	
	160	37	6315RSR*	113.4	77	3.229	4 200	5 000	
	160	37	6315-2RSR*	113.4	77	3.229	4 200	-	
	190	45	6415*	153.00	113.70	4.490	3 800	4 500	
80	125	14	6016*	33.10	31.40	1.410	5 000	6 000	
	125	22	6016*	47.60	39.70	1.782	5 000	6 000	
	125	22	6016Z*	47.6	39.7	1.782	5 000	6 000	
	125	22	6016-2Z*	47.6	39.7	1.782	5 000	-	
	125	22	6016RSR*	47.6	39.7	1.782	3 300	-	
	125	22	6016-2RSR*	47.6	39.7	1.782	3 300	-	
	140	28	6216*	72.70	53.00	2.297	4 700	5 600	
	140	28	6216Z*	72.7	53	2.297	4 700	5 600	
	140	28	6216-2Z*	72.7	53	2.297	4 700	-	
	140	28	6216RSR*	72.7	53	2.297	3 200	-	
	140	28	6216-2RSR*	72.7	53	2.297	3 200	-	
	170	39	6316*	123.00	86.50	3.517	4 000	4 700	
	170	39	6316Z*	123.000	86.5	3.517	4 000	4 700	
	170	39	6316-2Z*	123.000	86.5	3.517	4 000	-	
	170	39	6316RSR*	123.000	86.5	3.517	2 700	-	
	170	39	6316-2RSR*	123.000	86.5	3.517	2 700	-	

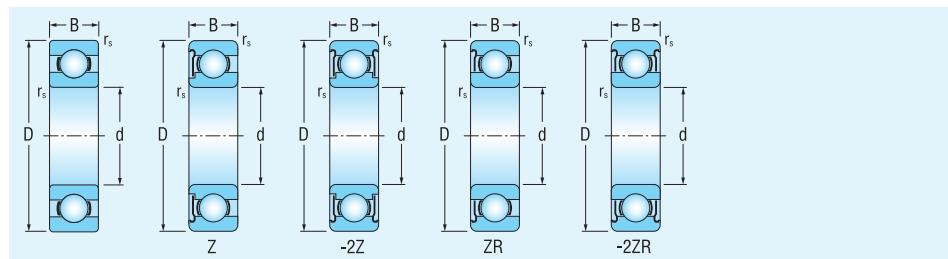


	Mass	Mating dimensions	
		r_s min	
	kg	mm	
	1.080	1.7	
	1.070	1.7	
	2.540	2.1	
	2.550	2.1	
	2.530	2.1	
	2.560	2.1	
	2.560	2.1	
	4.850	3	
	0.457	0.6	
	0.640	1.1	
	0.649	1.1	
	0.623	1.1	
	0.648	1.1	
	0.636	1.1	
	1.180	1.7	
	1.110	1.7	
	1.190	1.7	
	1.190	1.7	
	1.170	1.7	
	3.060	2.1	
	3.070	2.1	
	3.050	2.1	
	3.060	2.1	
	3.060	2.1	
	5.740	3	
	0.597	0.6	
	0.860	1.1	
	0.856	1.1	
	0.847	1.1	
	0.840	1.1	
	0.845	1.1	
	1.400	2.1	
	1.430	2.1	
	1.400	2.1	
	1.350	2.1	
	1.390	2.1	
	3.632	2.1	
	3.650	2.1	
	3.650	2.1	
	3.800	2.1	
	3.800	2.1	

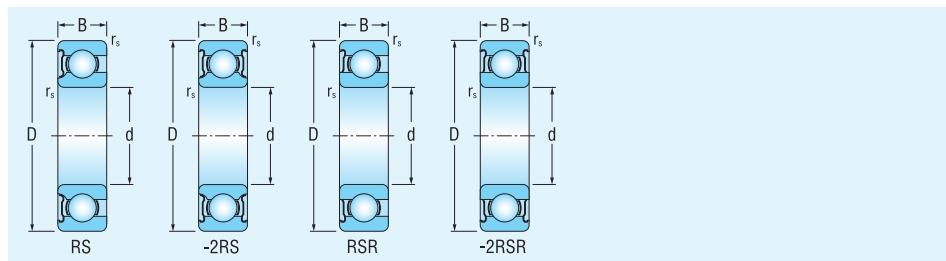


Single Row Deep Groove Ball Bearings (with Shield or Seals)

d = 85 - 110 mm



Dimensions			Bearing designation	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d	D	B		C_r kN	C_{or} kN	P_u kN	min ⁻¹	
85	130	14	16017^{*)}	34.00	33.30	1.460	4 700	5 600
	130	22	6017*	49.50	43.00	1.885	4 700	5 600
	130	22	6017Z*	49.5	43	1.885	4 700	5 600
	130	22	6017-2ZR*	49.5	43	1.885	4 700	-
	130	22	6017RSR*	49.5	43	1.885	3 200	-
	130	22	6017-2RSR*	49.5	43	1.885	3 200	-
	150	28	6217*	83.20	63.80	2.670	4 200	5 000
	150	28	6217Z*	83.2	63.8	2.670	4 200	5 000
	150	28	6217-2ZR*	83.2	63.8	2.670	4 200	-
	150	28	6217RSR*	83.2	63.8	2.670	2 800	-
	150	28	6217-2RSR*	83.2	63.8	2.670	2 800	-
	180	41	6317*	132.70	96.60	3.815	3 800	4 500
	180	41	6317Z*	132.7	96.6	3.815	3 800	4 500
	180	41	6317-2ZR*	132.7	96.6	3.815	3 800	-
90	210	52	6417^{*)}	173.40	135.80	5.083	3 300	4 000
	140	16	16018^{*)}	41.5	39.30	1.666	4 500	5 300
	140	24	6018*	58.20	49.6	2.102	4 500	5 300
	140	24	6018Z*	58.2	49.6	2.102	4 500	5 300
	140	24	6018-2ZR*	58.2	49.6	2.102	4 500	-
	140	24	6018RSR*	58.2	49.6	2.102	3 000	-
	140	24	6018-2RSR*	58.2	49.6	2.102	3 000	-
	160	30	6218^{*)}	96.00	71.50	2.907	4 000	4 700
	190	43	6318^{*)}	142.60	107.20	4.118	3 500	4 200
95	225	54	6418^{*)}	192.50	157.60	5.708	3 200	3 800
	145	16	16019^{*)}	42.70	41.90	1.739	4 200	5 000
	145	24	6019*	60.50	53.70	2.228	4 200	5 000
100	170	32	6219^{*)}	108.70	81.70	3.226	3 800	4 500
	150	16	16020^{*)}	43.90	44.30	1.801	4 200	5 000
	150	24	6020*	60.10	54.20	2.204	4 200	5 000
	150	24	6020Z*	60.1	54.2	2.204	4 200	5 000
	150	24	6020-2ZR*	60.1	54.2	2.204	4 200	-
	150	24	6020RSR*	60.1	54.2	2.204	2 800	-
	150	24	6020-2RSR*	60.1	54.2	2.204	2 800	-
105	180	34	6220^{*)}	122.10	92.70	3.561	3 500	4 200
	215	47	6320^{*)}	173.00	140.40	5.085	3 200	3 800
	160	26	6021*	72.5	65.5	2.586	4 000	4 700
110	225	49	6321^{*)}	185.0	153.0	5.414	3 000	3 500
	170	19	16022^{*)}	57.40	56.70	2.178	3 800	4 500
	170	28	6022*	82.00	72.80	2.797	3 800	4 500
	200	38	6222^{*)}	145.00	118.00	4.308	3 200	3 800

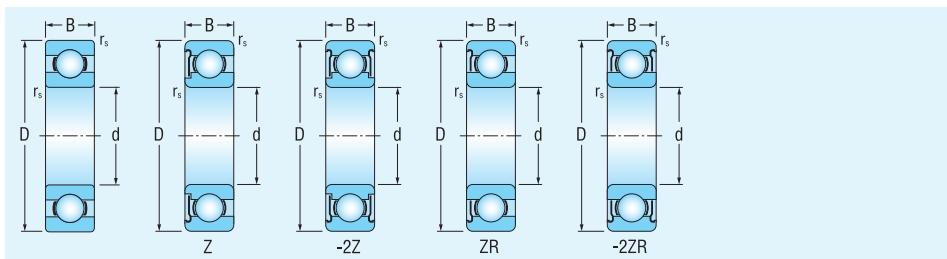


	Mass	Mating dimensions	
		r_s min	
	kg	mm	
	0.626	0.6	
	0.890	1.1	
	0.888	1.1	
	0.891	1.1	
	0.888	1.1	
	0.888	1.1	
	1.800	2.1	
	1.800	2.1	
	1.790	2.1	
	1.728	2.1	
	1.780	2.1	
	4.201	4	
	4.180	4	
	4.180	4	
	7.880	4	
	0.848	1	
	1.200	1.7	
	1.180	1.7	
	1.080	1.7	
	1.100	1.7	
	1.140	1.7	
	2.160	2	
	4.950	3	
	11.400	4	
	0.890	1	
	1.260	1.7	
	2.600	2.1	
	0.910	1	
	1.271	1.7	
	1.280	1.7	
	1.260	1.7	
	1.220	1.7	
	1.240	1.7	
	3.130	2.1	
	7.070	3	
	1.640	2.1	
	8.000	3	
	1.460	1	
	2.010	2.1	
	4.370	2.1	



Single Row Deep Groove Ball Bearings (with Shield or Seals)

d = 120 - 170 mm

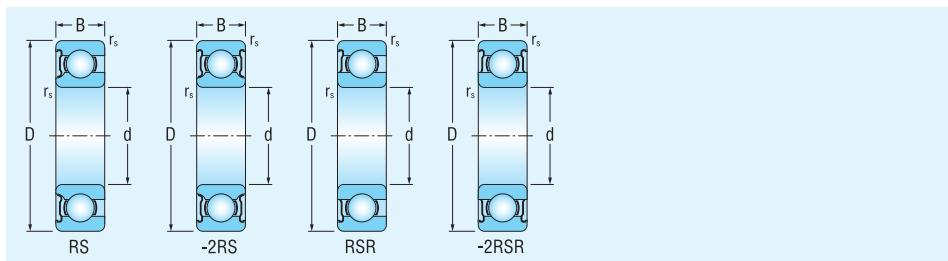


Dimensions			Bearing designation	Basic load rating dynamic		static	Fatigue load limit	Limiting speed for lubrication with grease oil	
d mm	D	B		C_r kN	C_{or} kN		P_u kN	min ⁻¹	
120	180	19	16024^{*)}	58.80	60.40	2.242	3 600	4 300	
	180	28	6024*	84.90	79.20	2.939	3 300	4 000	
	180	28	6024ZR*	84.9	79.2	2.939	3 300	4 000	
	180	28	6024-2ZR*	84.9	79.2	2.939	3 300	-	
	215	40	6224^{*)}	145.00	118.00	4.144	3 000	3 500	
130	200	33	6026*	106.40	100.60	3.560	3 200	3 800	
	230	40	6226^{*)}	152.6	134.00	4.540	2 800	3 300	
140	210	33	6028^{*)}	110.0	109.00	3.745	3 000	3 500	
	250	42	6228^{*)}	166.2	149.6	4.883	2 500	3 000	
150	225	24	16030^{*)}	95.20	104.00	3.452	2 700	3 200	
	225	35	6030^{*)}	125.8	125.9	4.183	2 700	3 200	
	270	45	6230^{*)}	189.00	183.00	5.740	2 200	2 700	
170	260	42	6034^{*)}	168.3	172.00	5.332	2 200	2 700	

* produced after agreement with customer

¹⁾ Tolerance class P0, P6

²⁾ Tolerance class P4, P5

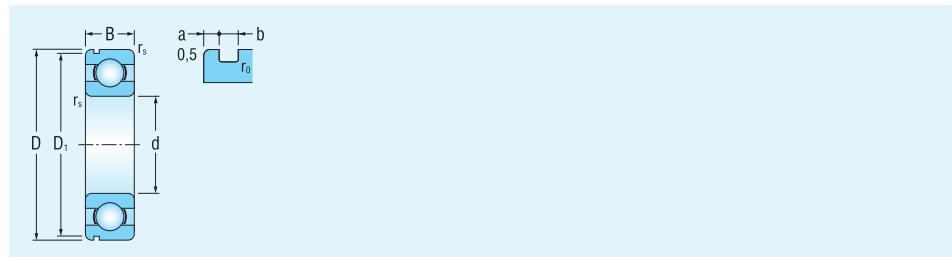


	Mass	Mating dimensions	
		r_s min	
	kg	mm	
	1.800	1	
	2.150	2.1	
	2.130	2.1	
	2.110	2.1	
	5.150	2.1	
	3.300	2.1	
	6.200	3	
	3.390	2	
	7.560	3	
	3.580	1.1	
	4.160	2.1	
	9.850	3	
	6.910	2.1	



Single Row Deep Groove Ball Bearings with Snap Ring Groove on Outer Ring

d = 12 - 65 mm



Dimensions			Bearing designation	Basic load rating dynamic	static	Fatigue load limit	Limiting speed for lubrication with grease oil	
d mm	D	B		C_r kN	C_{or}	P_u kN	min⁻¹	
12	37	12	6301N*	9.759	4.235	0.193	20 000	24 000
15	42	13	6302N*	11.31	5.33	0.242	18 000	21 000
17	47	14	6303N*	13.565	6.563	0.298	16 000	19 000
20	42	12	6004N*	9.371	4.972	0.226	17 000	20 000
	47	14	6204N*	12.774	6.553	0.298	15 000	18 000
25	47	12	6005N*	10.07	5.806	0.264	14 000	17 000
	52	15	6205N*	14.000	7.880	0.358	12 600	15 000
	62	17	6305N*	21.20	10.90	0.495	11 000	13 000
	80	21	6405N*	36.0	19.30	0.877	9 400	11 000
30	55	13	6006N*	13.20	8.3	0.377	12 000	14 000
	62	16	6206N*	19.60	11.30	0.514	11 000	13 000
	72	19	6306N*	29.80	15.8	0.718	10 000	12 000
	90	23	6406N*	43.10	23.60	1.073	8 400	10 000
35	62	14	6007N*	16.0	10.30	0.468	10 600	12 600
	72	17	6207N*	25.70	15.3	0.695	9 400	11 000
	80	21	6307N*	33.40	19.2	0.873	8 400	10 000
	100	25	6407N*	54.80	30.80	1.400	7 500	8 900
40	68	15	6008N*	16.8	11.50	0.523	9 400	11 000
	80	18	6208N*	32.70	20.50	0.932	8 400	10 000
	90	23	6308N*	40.70	23.90	1.086	7 900	9 400
	110	27	6408N*	63.50	36.40	1.655	6 700	7 900
45	75	16	6009N*	21.80	15.20	0.691	8 400	10 000
	85	19	6209N*	32.70	20.50	0.932	7 900	9 400
	100	25	6309N*	52.80	31.70	1.441	7 100	8 400
	120	29	6409N*	76.90	45.0	2.045	6 000	7 100
50	80	16	6010N*	21.80	16.60	0.755	7 900	9 400
	90	20	6210N*	35.10	23.20	1.055	7 100	8 400
	110	27	6310N*	61.80	37.90	1.723	6 300	7 500
	130	31	6410N*	87.30	51.80	2.355	5 600	6 700
55	90	18	6011N*	28.30	21.30	0.968	7 100	8 400
	100	21	6211N*	43.40	29.20	1.327	6 700	8 400
	120	29	6311N*	71.50	44.60	2.027	5 600	6 700
	140	33	6411N*	100.2	62.0	2.818	5 300	6 300
60	95	18	6012N*	29.40	23.20	1.055	6 700	7 900
	110	22	6212N*	52.50	35.9	1.632	6 000	7 100
	130	31	6312N*	81.80	51.80	2.355	5 300	6 300
	150	35	6412N*	109.10	70.10	3.186	4 700	5 600
65	100	18	6013N*	30.5	25.20	1.145	6 300	7 500
	120	23	6213N*	57.20	40.0	1.818	5 300	7 500
	140	33	6313N*	92.6	59.70	2.714	5 000	6 000

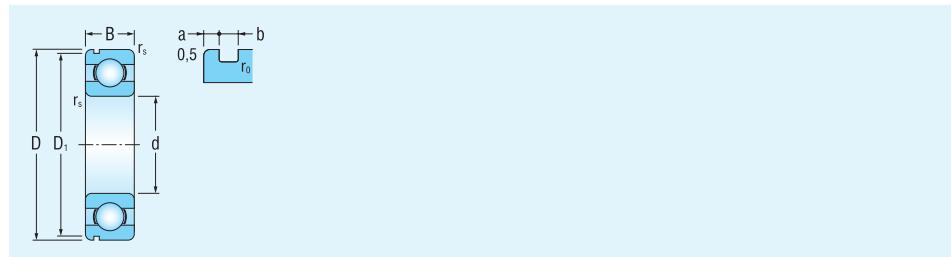


Mass	Mating Dimensions						Appropriate snap ring	
	r _s min	D ₁ max	a _{max}	b _{min}	r ₀ max			
	kg	mm						
0.061	1	34.77	2.06	1.35	0.4	R37		
0.085	1	39.75	2.06	1.35	0.4	R42		
0.115	1	44.6	2.46	1.35	0.4	R47		
0.07	0.6	39.75	2.06	1.35	0.4	R42		
0.108	1	44.6	2.46	1.35	0.4	R47		
0.082	0.6	44.6	2.06	1.35	0.4	R47		
0.082	1.0	44.6	2.06	1.35	0.4	R47		
0.230	1.1	59.61	3.28	1.9	0.6	R62		
0.530	1.7	76.81	3.28	1.9	0.6	R80		
0.119	1	52.6	2.06	1.35	0.4	R55		
0.200	1	59.61	3.28	1.9	0.6	R62		
0.331	1.1	68.81	3.28	1.9	0.6	R72		
0.725	1.7	86.79	3.28	2.7	0.6	R90		
0.154	1.1	59.61	2.06	1.9	0.6	R62		
0.284	1.1	68.81	3.28	1.9	0.6	R72		
0.447	1.7	76.81	3.28	1.9	0.6	R80		
0.957	1.7	96.8	3.28	2.7	0.6	R100		
0.191	1.1	64.82	2.49	1.9	0.6	R68		
0.349	1.1	76.81	3.28	1.9	0.6	R80		
0.625	1.7	86.79	3.28	2.7	0.6	R90		
1.230	2.1	106.81	3.28	2.7	0.6	R110		
0.241	1.1	71.83	2.49	1.9	0.6	R75		
0.404	1.1	81.81	3.28	1.9	0.6	R85		
0.828	1.7	96.8	3.28	2.7	0.6	R100		
1.540	2.1	115.21	4.06	3.1	0.6	R120		
0.260	1.1	76.81	2.49	1.9	0.6	R80		
0.460	1.1	86.79	3.28	2.7	0.6	R90		
1.060	2.1	106.81	3.28	2.7	0.6	R110		
1.867	2.1	125.22	4.06	3.1	0.6	R130		
0.389	1.1	86.79	2.87	2.7	0.6	R90		
0.597	1.7	96.8	3.28	2.7	0.6	R100		
1.380	2.1	115.21	4.06	3.1	0.6	R120		
2.290	2.1	135.23	4.9	3.1	0.6	R140		
0.411	1.1	91.82	2.87	2.7	0.6	R95		
0.771	1.7	106.81	3.28	2.7	0.6	R110		
1.720	2.1	125.22	4.06	3.1	0.6	R130		
2.760	2.1	145.24	4.9	3.1	0.6	R150		
0.437	1.1	96.8	2.87	2.7	0.6	R100		
0.997	1.7	115.21	4.06	3.1	0.6	R120		
2.100	2.1	135.23	4.9	3.1	0.6	R140		



Single Row Deep Groove Ball Bearings with Snap Ring Groove on Outer Ring

d = 70 - 90 mm



Dimensions			Bearing designation	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d mm	D	B		C_r kN	C_{or}	P_u kN	min ⁻¹	
70	110	20	6014N*	38.00	30.9	1.409	5 600	6 700
	125	24	6214N*	62.20	44.0	1.991	5 300	6 300
	150	35	6314N*	104.1	68.0	2.951	4 700	5 600
75	115	20	6015N*	39.50	33.50	1.523	5 300	6 300
	130	25	6215N*	66.20	49.30	2.213	5 000	6 000
	160	37	6315N*	113.40	77.0	3.204	4 200	5 000
80	125	22	6016N*	47.60	39.70	1.782	5 000	6 000
	140	26	6216N*	72.70	53.00	2.297	4 700	5 600
85	150	28	6217N*	83.20	63.80	2.670	4 200	5 000
	180	41	6317N*	132.70	96.60	3.815	3 800	4 500
90	160	30	6218N*	96	71.5	2.907	4 000	4 700

* produced after agreement with customer

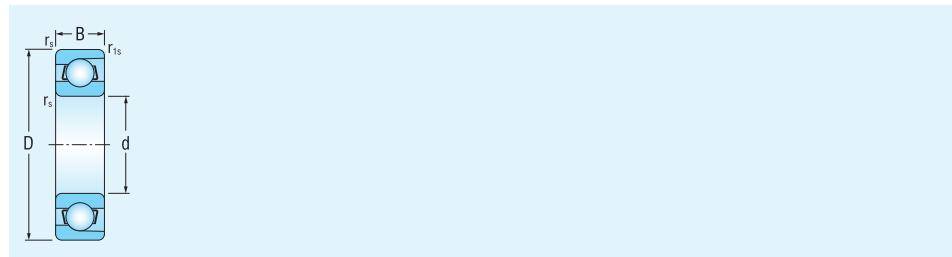


	Mass	Mating Dimensions					Appropriate snap ring	
		r _s min	D ₁ max	a _{max}	b _{min}	r ₀ max		
kg	mm							
0.604	1.1	106.81	2.87	2.7	0.6	R110		
1.090	1.7	120.22	4.06	3.1	0.6	R125		
2.540	2.1	145.24	4.9	3.1	0.6	R150		
0.640	1.1	111.81	2.87	2.7	0.6	R115		
1.190	1.7	125.22	4.06	3.1	0.6	R130		
3.060	2.1	155.22	4.9	3.1	0.6	R160		
0.860	1.1	120.22	2.87	3.1	0.6	R125		
1.400	2.1	135.23	4.9	3.1	0.6	R140		
1.800	2.1	145.24	4.9	3.1	0.6	R150		
4.192	4	173.66	5.69	3.5	0.6	R180		
2.130	2	155.22	4.9	3.1	0.6	R160		



Single Row Deep Groove Ball Bearings - Separable

d = 10 - 20 mm



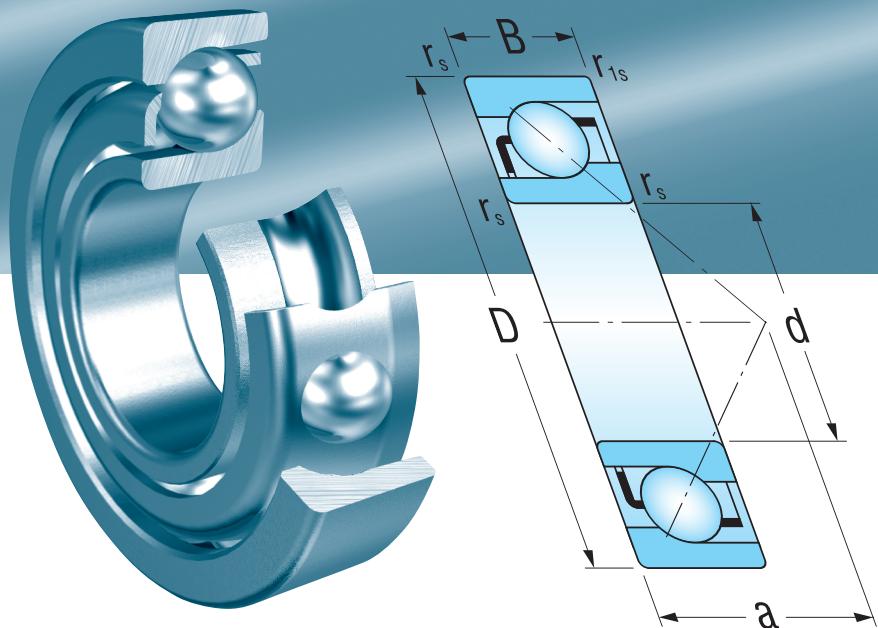
Dimensions			Bearing designation	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil		
d mm	D	B		C_r kN	C_{or}	P_u kN	min ⁻¹		
10	28	8	E10*	3.2	0.63	0.029	24 000	30 000	
	28	8	E10Y*	3.2	0.63	0.029	24 000	30 000	
12	32	7	E12TNG*	3.41	0.722	0.033	22 000	28 000	
13	30	7	E13ETNG*	3.41	0.72	0.033	22 000	28 000	
15	35	8	E15*	4.47	0.98	0.045	20 000	24 000	
	35	8	E15Y*	4.47	0.98	0.045	20 000	24 000	
	35	8	E15ETNG*	4.47	0.98	0.045	20 000	24 000	
17	44	11	E17*	5.62	1.26	0.057	16 000	19 000	
	44	11	E17Y*	5.62	1.26	0.057	16 000	19 000	
	44	11	B017*	8.91	2.03	0.092	14 000	17 000	
	44	11	B017Y*	8.91	2.03	0.092	14 000	17 000	
20	47	12	E20*	8.91	2.03	0.092	14 000	17 000	
	47	12	E20Y*	8.91	2.03	0.092	14 000	17 000	

* produced after agreement with customer



	Mass	Mating Dimensions		
		r _s min	r _{1S} mix	
	kg	mm		
	0.022	0.3	0.15	
	0.022	0.3	0.15	
	0.029	0.3	0.15	
	0.02	0.3	0.15	
	0.034	0.3	0.15	
	0.034	0.3	0.15	
	0.031	0.3	0.15	
	0.079	0.6	0.3	
	0.079	0.6	0.3	
	0.075	0.6	0.3	
	0.075	0.6	0.3	
	0.089	1	0.6	
	0.089	1	0.6	





SINGLE ROW ANGULAR CONTACT BALL BEARINGS



Single Row Angular Contact Ball Bearings

Single Row Angular Contact Ball Bearings

The group of single row angular contact ball bearings comprises of bearings with contact angle $\alpha = 26^\circ$ and $\alpha = 40^\circ$ designed for standard seating and the high-precise single-row ball bearings designed for high rotation frequency.

Single Row Angular Contact Ball Bearings $\alpha = 26^\circ$ and $\alpha = 40^\circ$.

These products have deep raceway enabling to absorb the radial load at relative big axial load in single direction. In order to absorb the axial load in both directions, these bearings are mounted in pairs, face-to-face or back-to-back.

Values of axial clearance of angular contact bearing $\alpha = 40^\circ$, mounted in pairs in "O" and "X" arrangement are in the table.

Type 72		Axial clearance		Type 73		Axial clearance	
Bore diameter d from	to	min.	max.	Bore diameter d from	to	min.	max.
[mm]		[μm]		[mm]		[μm]	
10	30	16	36	10	25	16	36
30	50	17	47	25	40	17	47
50	80	25	65	40	70	26	65

Different clearance must be negotiate with supplier.

Single-Row Angular Contact Ball Bearings for high frequency of rotation

Single-row angular contact ball bearings for high rotation frequency and high accuracy of seating differ from normal angular contact ball bearings by inner design of bearing rings, by value of contact angle between ball and normal raceways of rings, by workmanship of cage and by high precise tolerance class of running. The bearings are non-separable and their suitable seating arrangement assures required firmness and accuracy of housing.

Bearings with ceramic balls are manufactured for extreme high speed with requirements for low friction and low heat generation in bearing, which gives less lubrication demands and higher lifetime of seating.

The KINEX BEARINGS delivers the single-row ball bearings with contact angles of $\alpha = 10^\circ$, $\alpha = 12^\circ$, $\alpha = 15^\circ$, $\alpha = 25^\circ$ and $\alpha = 26^\circ$.

The bearings have special textile cage guided by inner ring (TB) or by outer ring (TA). Part of assortment has the massive brass cage guided by inner ring MB. Bearings with contact angle of $\alpha = 10^\circ$ (designation B72..CBTB and B72..CBTA) have been designed for shaft support in grinding electro-spindles. The bearings are manufactured in tolerance class P4 according to the STN ISO 492, or in tightened tolerance class P4A (bearings of the P4A tolerance had been formerly delivered with additional TPF 1148 designation).

The bearings with contact angle of $\alpha = 12^\circ$ (designation B70...CATB and B72..CATB) and those with $\alpha = 26^\circ$ (designation B70...AATB and B72..AATB) have been designed for rotation seating of spindles and headstocks of tool machines and similar high-speed machines that require high accuracy of seating. The bearings are normally manufactured in tolerance classes P5 and P4 in accordance with the STN ISO 492.

The bearings with contact angle of $\alpha = 15^\circ$ (designation B70...CTA, C B70..CTA and C B72..CTA) and $\alpha = 25^\circ$ (designation B70...ATA, C B70..ATA and C B72..ATA) have the cage guided by asymmetric outer ring and they are manufactured in tolerance classes P5 and P4A.



Range of angles from $\alpha = 12^\circ$ to $\alpha = 26^\circ$ was given by customer requirements in a period of production of single-row ball bearings in production plant resident in town of Skalica since the year 1960. This range assures the wide scope of products in terms of functional parameters of product and its seating. Products with contact angle of $\alpha = 10^\circ$, $\alpha = 12^\circ$ and $\alpha = 26^\circ$ were formerly designed for specific seating and they can also be used in new seating provided that the product design and its functional parameters listed in dimension tables meet requirement of seating, first of all in terms of lubrication of bearings.

Functional product parameters are listed in dimension tables.

Main dimensions

The main and connection dimensions of bearings listed in dimension tables meet the international dimensional plan ISO 15.

Designation

Designation of bearings of basic workmanship is listed in dimensional tables. Modification of basic type is designated by additional symbols according to the STN 02 4608. Meaning of individual signs for single-row angular contact ball bearings is specified in designation scheme. The values Δ_{Dmp} and Δ_{dmp} are indicated on rings and on outer package at bearings manufactured in tolerance classes P4, P4A and P2 and at universal matched bearings.

Δ_{Dmp} - deviation of middle outer diameter in single radial plane

Δ_{dmp} - deviation of middle bore diameter in single radial plane

Accuracy

The single-row angular contact ball bearings are normally manufactured in tolerance classes P5, P4 and P2 according to the STN ISO 492. Tolerances of dimensions and deviations from geometry of functional surfaces for bearings manufactured in tolerance P4A are listed in following table:

Machining tolerances for outer and inner rings manufactured in the P4A class

Inner ring							
Nominal dimension of bearing bore [mm]							
from	0	10	18	30	50	80	
to	10	18	30	50	80	120	
P4A tolerance accuracy values [μm]							
Deviance of bore diameter	Δ_{dmp}	0-4	0-4	0-5	0-6	0-8	0-10
Tolerance of ring height	Δ_{Bs}	-100	-100	-120	-120	-150	-200
Variance of ring height	V_{Bs}	1,5	1,5	1,5	1,5	1,5	2,5
Radial run-out of ring	K_{ia}	1,5	1,5	2,5	2,5	2,5	2,5
Axial run-out of ring front	S_d	1,5	1,5	1,5	1,5	1,5	2,5
Axial run-out of ring	S_{ia}	1,5	1,5	2,5	2,5	2,5	2,5
Outer ring							
Nominal dimension of outer bearing diameter [mm]							
from	18	30	50	80	120	150	180
to	30	50	80	120	150	180	250
P4A tolerance accuracy values [μm]							
Deviance of bearing diameter D	Δ_{Dmp}	0-5	0-6	0-7	0-8	0-9	0-10
Variance of ring height	V_{Cs}	1,5	1,5	1,5	2,5	2,5	4
Radial run-out of ring	K_{ea}	2,5	2,5	4	5	5	7
Axial run-out of ring front	S_d	1,5	1,5	1,5	2,5	2,5	4
Axial run-out of ring	S_{ea}	2,5	2,5	4	5	5	7
Tolerances of ring heights V_{Ba} and V_{Ca} are identical							

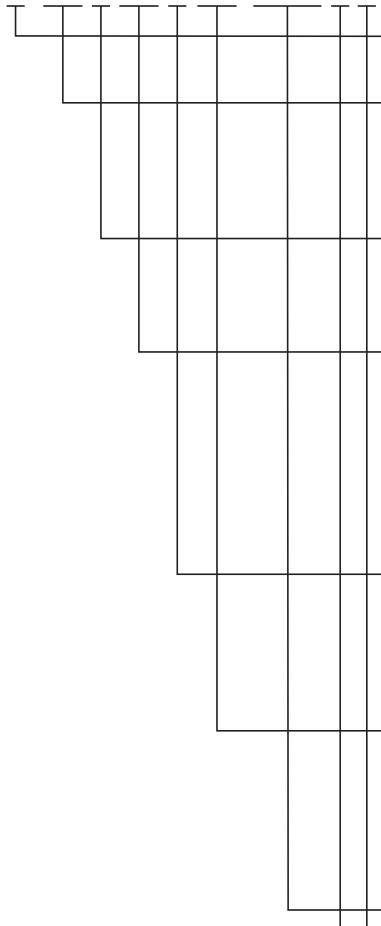
Inner clearance

Inner clearance in a bearing must assure the required contact angle between balls and raceways of rings.



Designation scheme

C B 7 0 0 6 C T A P 4 A U L



Material *

C Ceramic balls

Basic design letter

A Outer symmetrical ring
B Inner symmetrical ring
7 Single-row angular contact ball bearings

Dimension group

19 Light class
0 Middle class
2 Heavy class

Size of bearing (bore diameter)

7 7 mm
9 9 mm
00 10 mm
01 12 mm
02 15 mm
03 17 mm
04 20 mm = 4 x 5
05 25 mm = 5 x 5

Contact angle

CB 10°
CA 12°
C 15°
A 25°
AA 26°

Cage **

TA Cage made of special textile guided on outer ring
TB Cage made of special textile guided on inner ring
MB Cage made of brass guided on inner ring

Tolerance **

P5 Tolerance class higher than the P6
P4 Tolerance class higher than the P5
P4A Tolerance class higher than the P4
P2 Tolerance class higher than the P4A

Arrangement of bearings **

U Single bearing, random arranged
DU Two universal bearings in one set
O Set of 2 bearings in "O" arrangement
X Set of 2 bearings in "X" arrangement
T Set of 2 bearings in "T" arrangement
TO Set of 3 bearings in "TO" arrangement
TOT Set of 4 bearings in "TOT" arrangement

Preload

L Light
M Medium
S Heavy

* Designated only when other material than highly pure re-melted bearing steel is used.

** Different design of cage than in dimension table, tolerance class P2 and other matching style as indicated on page 98; we recommend discussing with manufacturer of bearings.

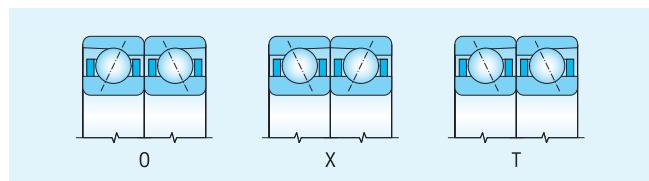


Material:

High-grade pure and re-melted bearing steel is used for production of rings and steel balls.
Ceramic balls are made of material Si₃N₄.

Bearings arranged in pairs:

Single-row angular contact ball bearings intended for high-speed rotation are delivered as single or paired mounting.
Individual systems of pair mounting are as follows:



1. Back-to-back arrangement (O)

This pair is characterised by strong firmness with respect to tilt and can transfer axial forces in both directions. But these forces are always absorbed by one bearing only. The pair is suitable for elimination of tilt moments.

2. Face-to-face arrangement (X)

This pair is characterised by a bit lesser tilt firmness as in case of "O" arrangement and it can transfer axial forces in both directions. But these forces are always absorbed by one bearing only.

3. Tandem arrangement (T)

This pair is characterised by strong firmness and it is suitable for absorbing of axial forces acting in one direction.

4. Universal arrangement (U)

These bearings are normally arranged in paired mounting "O", "X" and "T". They are manufactured with slight preload (UL) or with middle preload (UM). The bearings are delivered in packing by singles or by pairs. Other packing ways can be agreed with producer of bearings.

Paired mounting of bearings is delivered in one package. Bearings of different pairs can not be interchanged. The spot of most radial runout of ring is marked by line on the front faces. Mutual position of bearings or the sequence of paired bearings is marked by convergent lines of "V" shape on outer roller faces of paired mounting. Bearings are assembled in pairs into seating in such manner that the lines, marking the spot of most radial runout of appropriate rings (inner or outer), must be parallel-aligned with the axis of shaft. Marking of most radial runout serves for minimisation of effects of radial runout of seating faces.

Paired mounting of bearings, arranged in "O" or "X" are delivered with low (L), middle (M) or high (S) axial preload. Universal paired bearings, packed by two pieces (DUL) are interchangeable and they are not marked by arrow on the face.

Axial preload

Values of axial preload F_p for arrangement of bearings are listed in dimension tables.

Values of dynamic basic load rating C_r and static basic load rating C_{or} for single bearing are listed in dimension tables.

$$C_{rs} = C_r \cdot i^{0.7}$$

$$C_{ors} = C_r \cdot i$$

where:

C_r and C_{or} - are values of radial basic load ratings in kN of relevant bearing listed in dimension tables.

i - number of matched bearings within the group.



Speed limit frequency

Operational revolutions of seating are also given, besides bearing construction and its workmanship accuracy, by number of bearings and their arrangement, and by energetic, power and geometric parameters of seating. Pilot values of limit speed for single bearing are listed in dimension tables. Recommended speed for paired mounting are listed in following table: For pairs arranged in "X" at greater mutual distance of bearings there is necessary to take account of slight speed reduction; for pairs arranged in "OT" there is assumption of slight increase of speed.

Arrangement of bearings	Speed nr for preload		
	L	M	S
in pairs	$n \times 0.85$	$n \times 0.75$	$n \times 0.5$
in triples	$n \times 0.75$	$n \times 0.65$	$n \times 0.4$
in tetrads	$n \times 0.7$	$n \times 0.6$	$n \times 0.3$

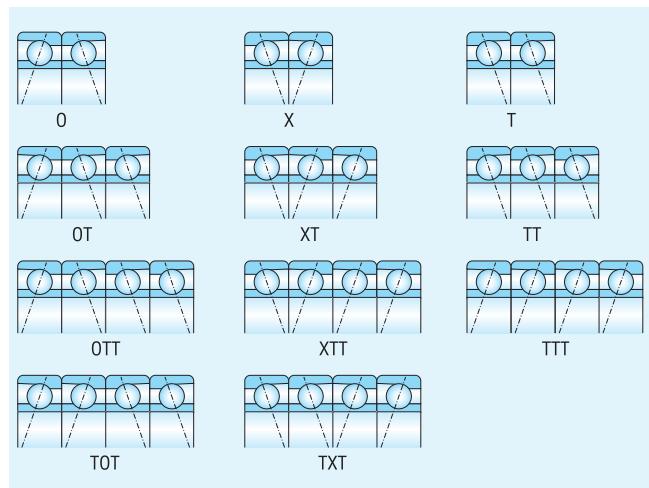
Speed for another arrangements must be tested or discussed with producer of bearings.

nr - reduced speed

n - speed listed in dimension table

Bearings arranged in triples and tetrads

Single-row angular contact ball bearings are delivered arranged in triples or tetrads in special cases of precise seating with requirements for higher strength parameters of seating. Examples of most frequent ways of arrangements are shown in following picture:



Static and dynamic equivalent radial load

Equivalent radial dynamic load

Bearings with contact angle
 $\alpha = 40^\circ$ (BE and B)

Single bearings: $P_r = F_r$
 $P_r = 0.35 + 0.57F_a$ for $F_a/F_r \leq 1.14$
for $F_a/F_r > 1.14$

Bearings with contact angle
 $\alpha = 25^\circ$ and $\alpha = 26^\circ$
(A and AA)

Single bearings arranged in "T" pair
 $P_r = F_r$
 $P_r = 0.41F_r + 0.87F_a$ for $F_a/F_r \leq 0.68$
for $F_a/F_r > 0.68$

Paired mounting arranged in "O" and "X"
 $P_r = F_r + 0.92F_a$
 $P_r = 0.67F_r + 1.14F_a$ for $F_a/F_r \leq 0.68$
for $F_a/F_r > 0.68$



Bearings with contact angle
 $\alpha = 15^\circ$ (C)
 Single bearings and pairs
 arranged in "T"

		F_a	i.C_{or}	e	Y	
$P_r = F_r$	$F_a/F_r \leq e$	0.015	0.38	1.47		
$P_r = 0.41F_r + 0.87F_a$	$F_a/F_r > e$	0.029	0.40	1.40		
		0.058	0.43	1.30		
		0.087	0.46	1.23		
		0.12	0.47	1.19		
		0.17	0.50	1.12		
		0.29	0.55	1.02		
		0.44	0.56	1.00		
		0.58	0.56	1.00		

Bearings with contact angle
 $\alpha = 15^\circ$ (C)
 Paired mounting arranged
 in "O" and "X"

		F_a	i.C_{or}	e	Y₁	Y₂
$P_r = F_r + Y_1 F_a$	$F_a/F_r \leq e$	0.015	0.38	1.65	2.39	
$P_r = 0.72F_r + Y_2F_a$	$F_a/F_r > e$	0.029	0.40	1.57	2.28	
		0.058	0.43	1.46	2.11	
		0.087	0.46	1.38	2.00	
		0.12	0.47	1.34	1.93	
		0.17	0.50	1.26	1.82	
		0.29	0.55	1.14	1.66	
		0.44	0.56	1.12	1.63	
		0.58	0.56	1.12	1.63	

Bearings with contact angle
 $\alpha = 12^\circ$. (CA)
 Single bearings and pairs
 arranged in "T"

		F_a	i.C_{or}	e	Y	
$P_r = F_r$	$F_a/F_r \leq e$	0.014	0.3	1.81		
$P_r = 0.45F_r + YF_aF_a$	$F_a/F_r > e$	0.029	0.34	1.62		
		0.057	0.37	1.46		
		0.086	0.41	1.34		
		0.11	0.45	1.22		
		0.17	0.48	1.13		
		0.29	0.52	1.04		
		0.43	0.54	1.01		
		0.57	0.54	1.00		

Bearings with contact angle
 $\alpha = 12^\circ$. (CA)
 Paired mounting arranged
 in "O" and "X"

		F_a	i.C_{or}	e	Y₁	Y₂
$P_r = F_r + Y_1 F_a$	$F_a/F_r \leq e$	0.014	0.30	2.08	2.94	
$P_r = 0.74F_r + Y_2F_a$	$F_a/F_r > e$	0.029	0.34	1.84	2.63	
		0.057	0.37	1.69	2.37	
		0.086	0.41	1.52	2.18	
		0.11	0.45	1.39	1.98	
		0.17	0.48	1.30	1.84	
		0.29	0.52	1.20	1.69	
		0.43	0.54	1.16	1.64	
		0.57	0.54	1.16	1.62	

Bearings with contact angle
 $\alpha = 10^\circ$. (CB)
 Single bearings and pairs
 arranged in "T"

		F_a	i.C_{or}	e	Y	
$P_r = F_r$	$F_a/F_r \leq e$	0.014	0.29	1.88		
$P_r = 0.46F_r + YF_a$	$F_a/F_r > e$	0.029	0.32	1.71		
		0.057	0.36	1.52		
		0.086	0.38	1.41		
		0.11	0.40	1.34		
		0.17	0.44	1.23		
		0.29	0.49	1.10		
		0.43	0.54	1.01		
		0.57	0.54	1.00		



Bearings with contact angle
 $\alpha = 10^\circ$. (CB)
Paired mounting arranged
in "O" and "X"

F_a	$i \cdot C_{or}$	e	Y_1	Y_2
$P_r = F_r + Y_1 F_a$	$F_a/F_r \leq e$	0.014	0.29	2.18
$P_r = 0.46F_r + Y_2 F_a$	$F_a/F_r > e$	0.029	0.32	2.78
		0.057	0.36	1.76
		0.086	0.38	2.29
		0.11	0.40	2.18
		0.17	0.44	2.00
		0.29	0.49	1.79
		0.43	0.54	1.64
		0.54	0.54	1.63

Equivalent radial static load

Bearings with contact angle
 $\alpha = 40^\circ$ (BE and B)

$$P_{or} = 0.5F_r + 0.26F_a \quad (P_{or} \geq F_r)$$

Bearings with contact angle
 $\alpha = 25^\circ$ and $\alpha = 26^\circ$ (A and AA)

Single bearings and pairs arranged in "T" $P_{or} = 0.5F_r + 0.37F_a \quad (P_{or} \geq F_r)$

Paired mounting arranged in "O" and "X" $P_{or} = F_r + 0.74F_a$

Bearings with contact angle
 $\alpha = 15^\circ$ (C)

Single bearings and pairs arranged in "T" $P_{or} = 0.5F_r + 0.46F_a \quad (P_{or} \geq F_r)$

Paired mounting arranged in "O" and "X" $P_{or} = F_r + 0.92F_a$

Bearings with contact angle
 $\alpha = 12^\circ$ (CA)

Single bearings and pairs arranged in "T" $P_{or} = 0.5F_r + 0.47F_a \quad (P_{or} \geq F_r)$

Paired mounting arranged in "O" and "X" $P_{or} = F_r + 0.94F_a$

Bearings with contact angle
 $\alpha = 10^\circ$ (CB)

Single bearings and pairs arranged in "T" $P_{or} = 0.6F_r + 0.5F_a \quad (P_{or} \geq F_r)$

Paired mounting arranged in "O" and "X" $P_{or} = F_r + 0.97F_a$



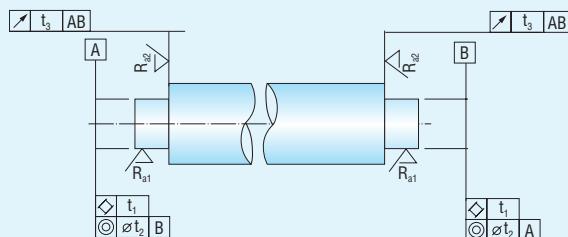


Tolerances for machining of seating parts

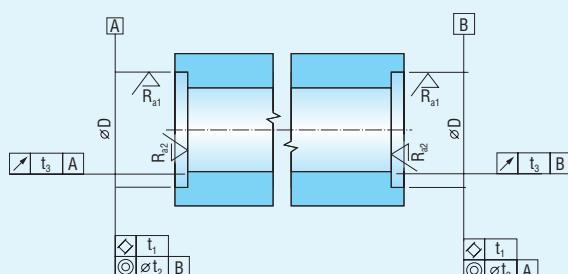
Usage of parameters of high-precise single-row angular contact ball bearings is possible only while the seating functional faces have comparable parameters. Tested and recommended tolerances and accuracy values of seating functional faces are listed in following tables.

Recommended tolerances and accuracy values for shape of both pin and body of seating.

Pin diameter	Shape deviations of pin functional faces (μm)						
	Cylindrical form		Symmetry		Runout		Ra
	Accuracy of bearing						
from	to	P5	P4A, P2	P5	P4A, P2	P5	P4A, P2
10	10	1	0.6	5	3	2.5	1.5
10	18	1	0.6	5	3	2.5	1.5
18	30	1.2	0.7	6	4	3	2
30	50	1.2	0.7	7	4	3.5	2
50	80	1.5	1	8	5	4	2.5
80	120	2	1.2	10	6	5	3



Sleeve diameter	Shape deviations of sleeve functional faces (μm)						
	Cylindrical form		Symmetry		Runout		Ra
	Accuracy of bearing						
from	to	P5	P4A, P2	P5	P4A, P2	P5	P4A, P2
10	10	1	0.6	5	3	2.5	1.5
10	18	1	0.6	5	3	2.5	1.5
18	30	1.2	0.7	6	4	3	2
30	50	1.2	0.7	7	4	3.5	2
50	80	1.5	1	8	5	4	2.5
80	120	2	1.2	10	6	5	3





Orientation values for tolerance of functional pin diameter

Nominal diameter of pin [mm]		Deviation from nominal diameter [μm]	
from	to	P5	P4A, P2
	10	+2 -3	+2 -2
10	18	+2 -4	+2 -3
18	30	+3 -5	+3 -3
30	50	+3 -5	+3 -4
50	80	+4 -5	+4 -4
80	120	+4 -7	+4 -6

Orientation values for tolerance of functional body diameter

Nominal diameter of body [mm]		Deviation from nominal diameter [μm]			
from	to	Straight seated bearing		Floating bearing	
		P5	P4A, P2	P5	P4A, P2
18	30	+4 -4	+4 -2	+11 +2	+8 +2
30	50	+7 -2	+5 -2	+11 +2	+9 +2
50	80	+9 -2	+6 -2	+12 +2	+10 +2
80	120	+9 -3	+7 -3	+13 +3	+12 +3
120	180	+10 -3	+9 -3	+17 +4	+15 +4
180	250	+12 -4	+10 -4	+21 +5	+19 +6

Comparison of designation of spindle bearings

KINEX STN 02 4608	FAG	GMN	SKF	SNFA	SNR	NSK
Construction group						
B719..	B719..	S619..	719..	SEB	719..	719..
B70..	B70..	S60..	70..	EX..	70..	70..
B72..	B72..	S62..	72..	E..	72..	72..

Contact angle

CA = 12°			CC	0		
C = 15°	C	C	C	1	C	C
A = 25°	E	E	AC	3	H	A5

Cage

TA TB	TPA	TA TB	-	CE C1	G45	TR
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Accuracy

P2	P2	UP	PA9	9	P2	P2
P4A	P4S	A7/9 HG	P4A97			P3 (P4Y)
P4	P4	P4	P4	7	P4	P4
P5	P5	P5	P5	5	P4	P5

Arrangement

„O“	DB	DB	DB	DD	DB	DB
„X“	DF	DF	DF	FF	DF	DF
„T“	DT	DT	DT	T	DT	DT
„TO“	TBT	TTB	TBT	TD	Q16	DBD
„TOT“	QBC	QTBT	QBC	TDT	Q21	DBT
„U“ „DU“	U DU	U	G	U	U	SU DU

Preload

L	L	L	A	L	7	L
M	M	M	B	M	8	M

Ceramic balls

C	HC	HY	HC	NS	CH	SN24
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Comparison of designation some types of spindle bearings from different manufacturers:

KINEX	FAG	GMN	SKF	SNFA
B7009CTA P4UL	B7009C.TPA.P4.UL	SM6009CTA P4GUL	7009CDGA/ P4A	VEX45 7CE1UL
C B7003CTA P4OL	HCB7003C.TPA.P4.UL	HY SM61909CTA P4GUL	7009CDDBA/ HCP4A	VEX17/NS 7CE1DDL

KINEX	SNR	NSK	Fafnir-Torrington	NTN
B7009CTA P4UL	7009C P4UL	7009CTRSULP4	2MM209WICRSUL	7009CT1G/GLP4
C B7003CTA 4OL	CH 7003C P4UL	7009CSN24TRDBLP4	2MMC203WICRDBL	

Note:

Comparison listed in table does not contain entire scope of using characters. Continual innovation proceeds within assortment of angular contact bearings. Some characters used in original documentation are overlaid on the market. Some manufacturers also designate the universal matched bearings by characters intended for specific way of arrangement. Foreign manufacturers do not produce the bearings with contact angle of 10°, 26° and with massive brass cage within this assortment. The S preload is used only sporadically at this assortment of bearings.

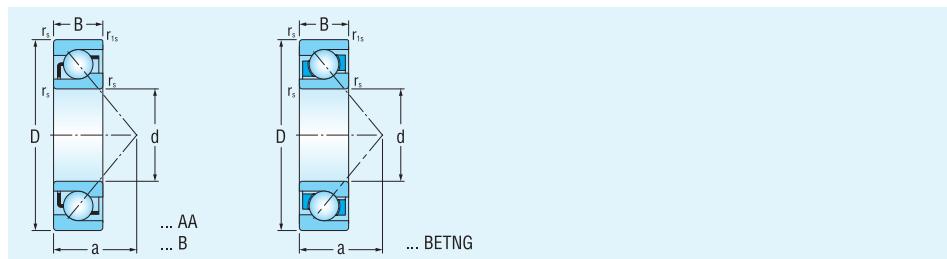
The table shows the mostly used combinations according to individual manufacturers





Single Row Angular Contact Ball Bearings

d = 10 - 60 mm



Dimensions			Bearing designation	Basic load rating dynamic C _r kN	static C _{or} kN	Fatigue load limit P _u kN	Limiting speed for lubrication with grease oil min ⁻¹	
d	D	B						
mm								
10	30	9	7200BETNG*	6.963	3.29	0.150	21 000	28 000
12	32	10	7201BETNG*	7.53	3.778	0.172	19 000	26 000
15	35	11	7202AA*	8.97	4.875	0.222	17 000	20 000
	35	11	7202B*	8.04	4.368	0.199	17 000	20 000
	42	13	7302BETNG*	13.034	6.575	0.299	14 000	17 000
17	47	14	7303AA*	15.115	7.89	0.359	12 600	15 000
	47	14	7303B*	13.795	7.2	0.327	12 600	15 000
	47	14	7303BTNG*	14.798	8	0.364	12 600	15 000
20	47	14	7204AA*	14.858	8.535	0.388	12 600	15 000
	47	14	7204B*	13.307	7.645	0.348	12 600	15 000
	47	14	7204BTNG*	13.307	7.645	0.348	13 000	18 000
25	62	17	7305B*	24.38	14.57	0.662	9 400	11 000
	62	17	7305BTNG*	24.39	14.58	0.663	10 000	12 500
35	80	21	7307B*	36.65	24.1	1.095	7 100	8 400
45	100	25	7309B*	58.3	40.386	1.836	5 600	6 700
55	100	21	7211AA*	52.60	40.70	1.850	5 300	6 300
	120	29	7311B*	78.742	56.38	2.563	4 700	5 600
60	110	22	7212AA*	63.60	50.10	2.277	5 000	6 000

* produced after agreement with customer



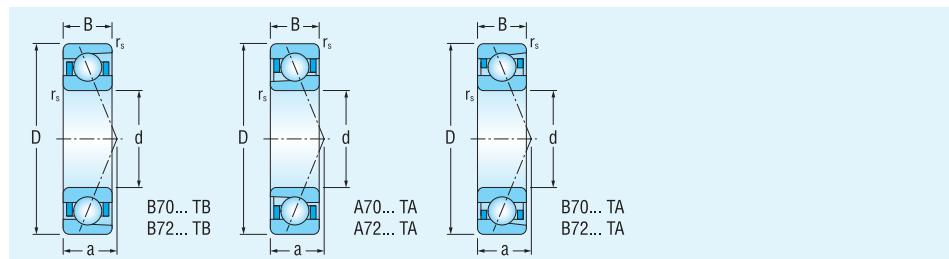
	Mating dimensions			Mass
	r _{smin}	r _{1smin}	a	
	mm			kg

0.6	0.3	13	0.03	
0.6	0.3	14	0.037	
0.6	0.3	12	0.05	
0.6	0.3	16	0.05	
1	0.6	18	0.08	
1	0.6	15	0.12	
1	0.6	20	0.12	
1	0.6	20	0.107	
1	0.6	15	0.11	
1	0.6	21	0.11	
1	0.6	21	0.105	
1.1	0.6	27	0.24	
1.2	0.7	28	0.23	
1.5	1	35	0.48	
1.5	1	43	0.88	
1.5	1	29.5	0.63	
2	1	51	1.45	
1.5	1	32	0.8	



Single Row Angular Contact Ball Bearings for High Frequency of Rotation

d = 10 – 65 mm



Dimensions			Bearing designation	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d mm	D	B		C_r kN	C_{or} kN	P_u kN	min ⁻¹	
10	30	9	B7200CBTB	5	2.29	0.10	60 000	89 000
	30	9	B7200CATB	6.67	2.9	0.13	42 000	63 000
12	32	10	B7201CBTB	5.48	2.65	0.12	56 000	84 000
	32	10	B7201CATB	7.43	3.46	0.16	38 000	56 000
	32	10	AC7201ATA ¹⁾	7.04	3.21	0.15	33 000	50 000
15	35	11	B7202CBTB	6.48	3.45	0.16	50 000	75 000
	35	11	B7202CATB	8.26	4.18	0.19	33 000	50 000
17	40	12	B7203CBTB	7.83	4.25	0.19	45 000	67 000
	40	12	B7203CATB	10.2	5.29	0.24	28 000	42 000
20	47	14	B7204CBTB	9.6	5.54	0.25	40 000	60 000
	47	14	B7204CATB	13.67	7.32	0.33	25 000	38 000
	47	14	B7204AATB	13	6.99	0.32	22 000	33 000
25	52	15	B7205CBTB	13.12	7.96	0.36	33 000	50 000
	52	15	B7205CATB	14.81	8.63	0.39	22 000	33 000
	52	15	B7205AATB	13.96	8.15	0.37	20 000	30 000
30	62	16	B7206CBTB	16.81	10.72	0.49	28 000	42 000
	62	16	B7206CATB	20.57	12.42	0.56	20 000	30 000
	62	16	B7206AATB	19.42	11.58	0.53	17 000	25 000
35	62	14	B7007AATB	17.3	12.05	0.55	9 400	11 000
	72	17	B7207CBTB	21.01	14.34	0.65	25 000	38 000
	72	17	B7207CATB	28.93	18.6	0.85	16 000	24 000
	72	17	B7207CAMB	30.66	20.29	0.92	16 000	24 000
	72	17	B7207AATB	27.2	17.4	0.79	13 000	20 000
40	68	15	B7008AATB	18.56	14.13	0.64	8 400	10 000
	80	18	B7208CBTB	24.5	17.3	0.79	22 000	33 000
	80	18	B7208CATB	36.73	23.77	1.08	13 000	20 000
45	85	19	B7209CBTB	28.29	20.31	0.92	20 000	30 000
	85	19	B7209CATB	36.85	24.61	1.12	12 600	19 000
50	80	16	B7210AATB	22.66	18.52	0.84	9 500	11 000
	90	20	B7210CBTB	32.33	23.56	1.07	18 000	27 000
	90	20	B7210CATB	38.99	27.26	1.24	12 000	18 000
	90	20	B7210AATB	36.56	25.92	1.18	10 600	16 000
55	90	18	B7011AATB	30.99	25.38	1.15	6 300	7 500
	100	21	B7211CBTB	38.46	29.12	1.32	17 000	25 000
	100	21	B7211CATB	48.2	34.5	1.57	11 000	17 000
60	110	22	B7212CBTB	42.98	33.8	1.54	15 000	22 000
	110	22	B7212CATB	58.26	42.6	1.94	10 000	15 000
	110	22	B7212AATB	54.82	39.96	1.82	8 900	13 000
65	120	23	B7213CATB	70.5	54.78	2.49	8 900	13 000

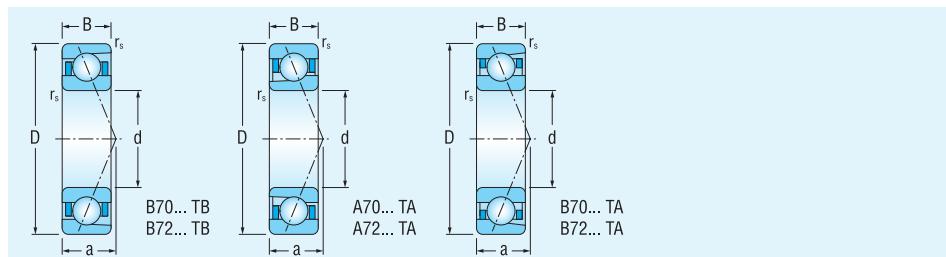


	Axial preload F_p of not installed matched bearings			Mating dimensions			Mass	
	L	M	S	r_s min	r_{1s} min	a		
	N			mm		kg		
	20	70	140	0.6	0.3	6	0.027	
	33	105	213	0.6	0.3	6.5	0.028	
	22	77	154	0.6	0.3	7	0.035	
	37	118	235	0.6	0.3	7.5	0.036	
				0.6	0.3	10.5	0.036	
	25	90	180	0.6	0.3	7.5	0.042	
	41	132	264	0.6	0.3	8	0.043	
	31	109	219	0.6	0.3	8.5	0.060	
	51	163	326	0.6	0.3	9	0.061	
	38	134	268	1	0.6	10	0.098	
	68	218	437	1	0.6	10.5	0.100	
	156	455	910	1	0.6	15	0.102	
	53	183	367	1	0.6	11	0.119	
	74	237	474	1	0.6	11.5	0.122	
	167	488	977	1	0.6	17	0.124	
	67	235	470	1	0.6	12	0.184	
	102	325	655	1	0.6	13	0.189	
	233	679	1 740	1	0.6	19	0.192	
	207	605	1 210	1	0.6	18.5	0.148	
	84	280	588	1.1	0.6	13	0.268	
	144	462	925	1.1	0.6	14	0.275	
	153	490	981	1.1	0.6	15	0.323	
	326	952	1 900	1.1	0.6	10	0.281	
	222	645	1 290	1	0.6	20.5	0.185	
	98	343	686	1.1	0.6	14	0.337	
	180	587	1 170	1.1	0.6	15.5	0.347	
	113	396	792	1.1	0.6	15	0.381	
	184	590	1 175	1.1	0.6	16.5	0.381	
	270	793	1 580	1	0.6	15.8	0.253	
	129	450	905	1.1	0.6	16	0.432	
	195	623	1 245	1.1	0.6	17.5	0.443	
	438	1 275	2 550	1.1	0.6	26	0.447	
	371	1 080	2 160	1.1	0.6	26.5	0.395	
	153	538	1 075	1.5	1	17	0.567	
	241	771	1 540	1.5	1	18.5	0.582	
	172	602	1 200	1.5	1	18	0.735	
	291	932	1 860	1.5	1	20	0.754	
	657	1 915	3 830	1.5	1	32	0.759	
	352	1 128	2 250	1.5	1	21.5	0.994	



Single Row Angular Contact Ball Bearings for High Frequency of Rotation

d = 70 – 130 mm



Dimensions			Bearing designation	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d mm	D	B		C_r kN	C_{or}	P_u kN	min⁻¹	
70	110	20	B7014AATB	41.15	36.46	1.66	7 900	12 000
	125	24	B7214CBTB	58.56	47.66	2.17	12 600	19 000
	125	24	B7214CATB	76.65	60.13	2.73	7 900	12 000
75	130	25	B7215CATB	76.53	61.39	2.83	7 500	11 000
	130	25	B7215AATB	71.52	58.32	2.68	6 700	10 000
	130	25	B7215AAMB	74.9	62.49	2.88	4 200	5 000
80	125	22	B7016CATB	55.36	50.01	2.30	7 500	11 000
	125	22	B7016AATB	53.44	49.44	2.28	6 700	10 000
	140	26	B7216CATB	89.5	73.05	3.48	6 700	10 000
	140	26	B7216AATB	84.07	68.04	3.24	6 300	9 400
85	130	22	B7017AATA	54.44	52.69	2.48	4 200	5 000
	130	28	B7017AAMB	56.24	55.33	2.61	6 300	9 400
	150	28	B7217CATB	100.52	86.08	4.24	6 300	9 400
	150	28	B7217AATB	94.26	80.67	3.97	6 000	8 900
90	140	24	B7018CATB	67.63	62.47	3.05	6 300	9 400
	140	24	B7018AATB	65.29	61.75	3.01	4 000	4 700
	180	34	B7220AATB	141.1	120.96	6.39	5 300	7 900
120	180	28	B7024CATB	101.1	103.66	5.77	5 000	7 500
	180	28	B7024AATB	96.1	101.28	5.64	3 000	3 500
130	165	11	B70826AAMB	13.475	19.1	1.05	3 200	3 800

Produced bearings in version CA (12°) it could be delivered also in version C (15°)

Produced bearings in version AA (26°) it could be delivered also in version A (25°)



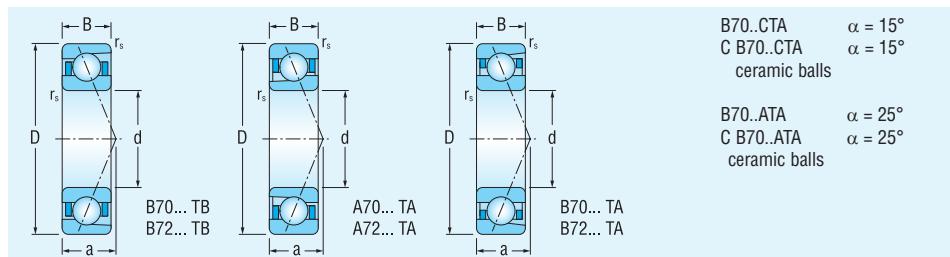
	Axial preload F_p of not installed matched bearings			Mating dimensions			Mass	
	L	M	S	r_{smin}	r_{1smin}	a		
	N			mm			kg	
	493	1 140	2 050	1.1	0.6	32	0.597	
	234	820	1 640	1.5	1	20.5	1.040	
	373	1 190	2 350	1.5	1	22.5	1.070	
	383	1 250	2 450	1.5	1	23.5	1.160	
	858	2 500	500	1.5	1	37.5	1.260	
	898	2 620	5 240	1.5	1	37.5	1.390	
	276	885	1 770	1.1	0.6	22	0.841	
	267	855	1 710	1.1	0.6	36	0.848	
	447	1 432	2 860	2	1	24.5	1.410	
	1 008	2 940	5 880	2	1	40	1.420	
	653	1 900	3 800	1.1	0.6	37	0.912	
	675	1 970	3 940	1.1	0.6	37	1.060	
	502	1 608	3 210	2	1	26.5	1.800	
	1 310	3 290	6 590	2	1	42.5	1.820	
	338	1 080	2 160	1.5	1	24	1.150	
	783	2 280	4 570	1.5	1	40	1.160	
	1 690	4 930	9 870	2.1	1.1	51	3.320	
	505	1 617	3 230	2	1	30	2.100	
	1 153	3 363	6 727	2	1	50.5	2.090	
				1	0.5	41.5	0.635	

¹⁾ separable single row angular contact bearings intended for separable arrangement of parts of machine tool spindles



Single Row Angular Contact Ball Bearings for High Frequency of Rotation

d = 10 – 45 mm



Dimensions			Bearing designation	Basic load rating dynamic	static	Fatigue load limit	Limiting speed for lubrication with grease oil	
d mm	D	B		C_r kN	C_{or} kN	P_u kN	min⁻¹	
10	30	9	B7200CTA	5.9	3.2	0.15	56 000	85 000
	30	9	B7200ATA	5.7	3	0.14	50 000	73 000
	30	9	C B7200CTA	4.1	2.1	0.10	65 000	100 000
	30	9	C B7200ATA	3.9	2	0.09	55 000	85 000
15	32	9	B7002CTA	6.5	3.5	0.16	45 000	70 000
	32	9	B7002ATA	6.2	3.2	0.15	40 000	65 000
	32	9	C B7002CTA	4.4	2.3	0.10	55 000	85 000
	32	9	C B7002ATA	4.2	2.2	0.10	50 000	72 000
17	35	10	B7003CTA	7.4	4.45	0.20	44 000	67 500
	35	10	B7003ATA	7.1	4.25	0.19	38 000	56 000
	35	10	C B7003CTA	5.8	3.4	0.15	55 000	80 000
	35	10	C B7003ATA	5.55	3	0.14	45 000	65 000
20	42	12	B7004CTA	11.1	6.2	0.28	39 000	57 000
	42	12	B7004ATA	10.9	6	0.27	35 000	50 000
	42	12	C B7004CTA	7.4	4.2	0.19	45 000	65 000
	42	12	C B7004ATA	7.2	4	0.18	35 000	55 000
25	47	12	B7005CTA	12.85	8.6	0.39	35 000	50 000
	47	12	B7005ATA	12.3	8.2	0.37	30 000	45 000
	47	12	C B7005CTA	8.9	5.7	0.26	40 000	55 000
	47	12	C B7005ATA	8.5	5.6	0.25	35 000	50 000
30	55	13	B7006CTA	15.2	10.3	0.47	26 000	40 000
	55	13	B7006ATA	14.5	10.1	0.46	24 000	38 000
	55	13	C B7006CTA	10.6	7.2	0.33	30 000	45 000
	55	13	C B7006ATA	10.1	6.9	0.31	28 000	43 000
35	62	14	B7007CTA	19.4	14.4	0.65	22 000	36 000
	62	14	B7007ATA	18.8	13.25	0.60	20 000	32 000
	62	14	C B7007CTA	13.4	10	0.45	30 000	45 000
	62	14	C B7007ATA	13	9.4	0.43	25 000	40 000
40	68	15	B7008CTA	20.6	16.1	0.73	20 000	34 000
	68	15	B7008ATA	19.6	15.2	0.69	19 000	30 000
	68	15	C B7008CTA	14.2	11	0.50	26 000	40 000
	68	15	C B7008ATA	13.2	10.6	0.48	22 000	35 000
45	68	12	B71909CTA	14.9	12.6	0.57	20 000	32 000
	68	12	B71909ATA	14.2	12	0.55	18 000	30 000
	68	12	C B71909CTA	10.8	9.1	0.41	25 000	38 000
	68	12	C B71909ATA	10.1	8.8	0.40	22 000	35 000
	75	16	B7009CTA	25.3	20.4	0.93	18 000	30 000
	75	16	B7009ATA	24	19.3	0.88	17 000	28 000
	75	16	C B7009CTA	17.7	14.3	0.65	23 000	37 000
	75	16	C B7009ATA	16.8	13.5	0.61	21 000	33 000

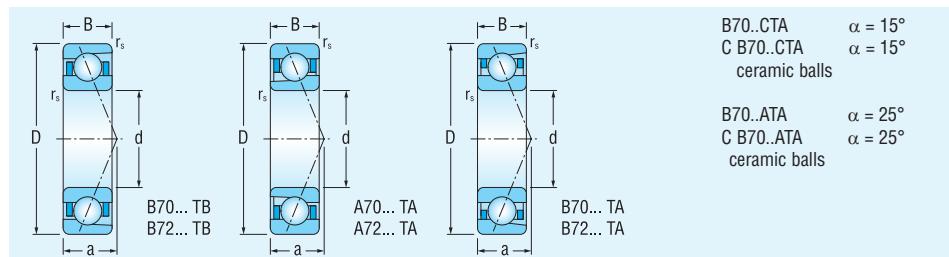


	Axial preload F_p of not installed matched bearings			Mating dimensions			Mass	
	L	M	S	r_s min	r_{1s} min	a		
	N			mm			kg	
	28	100	200	0.6	0.3	7.18	0.028	
	32	141	320	0.6	0.3	9.16	0.028	
	15	60	130	0.6	0.3	7.18	0.028	
	22	80	195	0.6	0.3	9.16	0.028	
	30	110	225	0.3	0.15	7.648	0.043	
	37	155	355	0.3	0.15	9.98	0.043	
	11	52	115	0.3	0.15	7.648	0.043	
	18	68	170	0.3	0.15	9.98	0.043	
	40	150	260	0.3	0.15	8.48	0.039	
	50	190	420	0.3	0.15	16.78	0.039	
	18	75	165	0.3	0.15	8.48	0.039	
	30	100	230	0.3	0.15	16.78	0.039	
	55	180	400	0.6	0.3	9.15	0.066	
	75	290	645	0.6	0.3	12.22	0.066	
	25	100	200	0.6	0.3	9.15	0.066	
	30	120	300	0.6	0.3	12.22	0.066	
	65	220	470	0.6	0.3	10.32	0.080	
	100	360	740	0.6	0.3	13.89	0.080	
	30	120	250	0.6	0.3	10.32	0.080	
	35	180	410	0.6	0.3	13.89	0.080	
	75	260	555	1	0.6	12.2	0.115	
	105	405	885	1	0.6	25.85	0.115	
	37	140	300	1	0.6	12.2	0.115	
	40	200	450	1	0.6	25.85	0.115	
	100	330	710	1	0.6	13.49	0.155	
	140	530	1 150	1	0.6	28.98	0.155	
	48	180	380	1	0.6	13.49	0.155	
	60	270	600	1	0.6	28.98	0.155	
	105	350	755	1	0.6	14.73	0.185	
	150	560	1 200	1	0.6	20.1	0.185	
	50	190	410	1	0.6	14.73	0.185	
	60	280	630	1	0.6	20.1	0.185	
	90	320	535	0.6	0.3	13	0.130	
	100	390	840	0.6	0.3	18.19	0.130	
	35	140	310	0.6	0.3	13	0.110	
	70	200	450	0.6	0.3	18.19	0.110	
	140	470	935	1	0.6	0.03	0.260	
	195	750	1 500	1	0.6	21.98	0.260	
	70	250	530	1	0.6	16.03	0.230	
	85	370	840	1	0.6	21.98	0.230	



Single Row Angular Contact Ball Bearings for High Frequency of Rotation

d = 50 – 90 mm

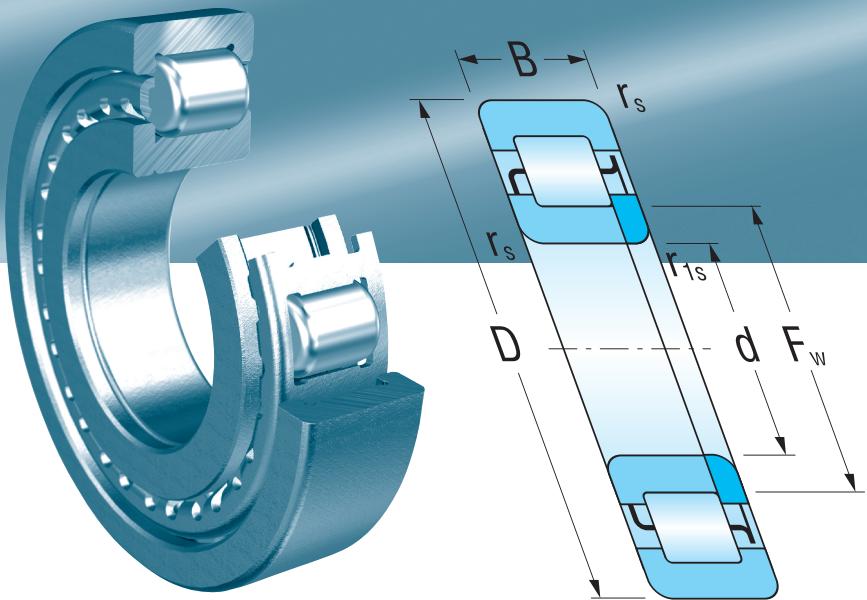
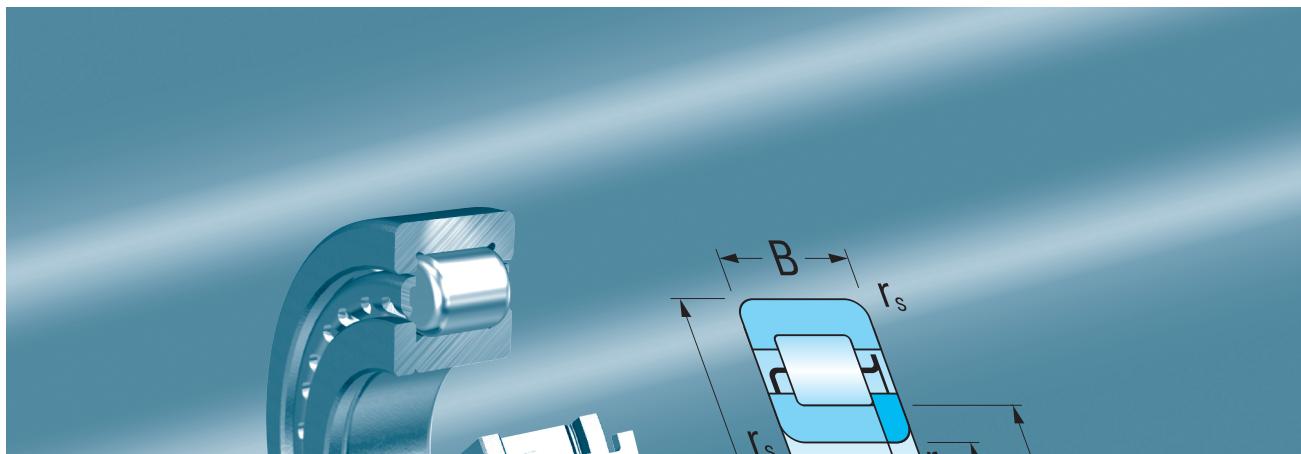


Dimensions			Bearing designation	Basic load rating dynamic		Fatigue load limit	Limiting speed for lubrication with grease oil	
d mm	D	B		C_r kN	C_{or} kN	P_u kN	min⁻¹	
50	80	16	B7010CTA	26	21.8	0.99	17 000	28 000
	80	16	B7010ATA	24.6	20.8	0.95	15 000	24 000
	80	16	C B7010CTA	18.5	15.3	0.70	22 000	35 000
	80	16	C B7010ATA	17.5	14.6	0.66	18 000	30 000
60	95	18	B7012CTA	35.1	32	1.45	14 000	22 000
	95	18	B7012ATA	33.4	30.4	1.38	13 000	20 000
	95	18	C B7012CTA	24.6	22.4	1.02	18 000	30 000
	95	18	C B7012ATA	23.4	21.3	0.97	15 000	25 000
70	110	20	B7014CTA	48.4	45	2.05	13 000	19 000
	110	20	B7014ATA	45.9	42.9	1.95	11 000	17 000
	110	20	C B7014CTA	33.4	31.2	1.42	15 000	25 000
	125	24	C B7014ATA	32.1	21.8	0.99	14 000	20 000
80	125	22	B7016CTA	60.6	57.5	2.65	10 000	18 000
	125	22	B7016ATA	57.9	55.1	2.54	9 000	15 000
	125	22	C B7016CTA	42.4	40.2	1.85	14 000	22 000
	125	22	C B7016ATA	40.5	38.6	1.78	13 000	20 000
85	130	22	B7017CTA	62	58.7	2.77	10 000	17 000
	130	22	B7017ATA	61.4	58.2	2.74	9 000	15 000
	130	22	C B7017CTA	43.4	41.4	1.95	12 000	19 000
	130	22	C B7017ATA	43	40.7	1.92	10 000	18 000
90	140	24	B7018CTA	74	72.4	3.53	10 000	16 000
	140	24	B7018ATA	70.1	69	3.36	9 000	15 000
	140	24	C B7018CTA	51.8	57.9	2.82	12 000	19 000
	140	24	C B7018ATA	49.1	40.5	1.97	10 000	17 000
100	150	24	B7020CTA	80.8	80.8	4.11	8 000	14 000
	150	24	B7020ATA	76.4	76.4	3.88	7 000	12 000
	150	24	C B7020CTA	55.7	55.7	2.83	11 000	18 000
	150	24	C B7020ATA	52.7	52.7	2.68	9 000	15 000
	180	34	B7220CTA	145.6	125.6	6.76	8 000	12 000
	180	34	B7220ATA	138.9	120	6.45	7 000	10 000
	180	34	C B7220CTA	95.9	86	4.63	10 000	15 000
120	180	34	C B7220ATA	89.5	83	4.46	8 000	13 000
	180	28	B7024CTA	103.1	107.8	6.00	7 000	10 000
	180	28	B7024ATA	97.5	102.1	5.68	6 000	9 000
	180	28	C B7024CTA	71.1	75.4	4.20	9 000	14 000
	180	28	C B7024ATA	67.3	71.5	3.98	8 000	12 000



	Axial preload F_p of not installed matched bearings			Mating dimensions			Mass
	L	M	S	r_s min	r_{1s} min	a	
	N			mm			kg
	150	510	965	1	0.6	19.73	0.25
	210	750	1 550	1	0.6	23.15	0.25
	75	280	580	1	0.6	19.73	0.21
	90	400	880	1	0.6	23.15	0.21
	210	700	1 305	1.1	1	21.66	0.41
	290	1 000	2 100	1.1	1	27.1	0.41
	100	360	780	1.1	1	21.66	0.35
	130	540	1 150	1.1	1	27.1	0.35
	280	930	1 825	1.1	0.6	22.06	0.60
	390	1 390	2 910	1.1	0.6	30.99	0.60
	140	500	1 020	1.1	0.6	22.06	0.50
	180	720	1 600	1.5	1	30.99	0.50
	350	1 140	2 290	1.1	0.6	24.73	0.85
	500	1 800	3 700	1.1	0.6	34.9	0.85
	180	620	1 350	1.1	0.6	24.73	0.71
	250	950	1 950	1.1	0.6	34.9	0.71
	380	1 240	2 350	1.1	0.6	25.4	0.91
	540	1 870	3 900	1.1	0.6	30.06	0.91
	190	640	1 400	1.1	0.6	25.4	0.77
	260	1 000	2 100	1.1	0.6	30.06	0.77
	450	1 450	2 800	1.5	1	27.41	1.15
	620	2 200	4 580	1.5	1	38.81	1.15
	230	760	1 590	1.5	1	27.41	0.97
	315	1 150	2 550	1.5	1	38.81	0.97
	470	1 520	3 070	1.5	0.6	28.75	1.29
	680	2 340	4 950	1.5	0.6	41.15	1.29
	235	815	1 700	1.5	0.6	28.75	1.10
	335	1 265	2 710	1.5	0.6	41.15	1.10
	800	2 500	5 350	2.1	1.1	35.76	3.35
	1 300	4 400	8 850	2.1	1.1	49.77	3.35
	450	1 460	2 950	2.1	1.1	35.76	2.89
	640	2 200	5 580	2.1	1.1	49.77	2.89
	670	2 000	4 100	2	1	34.1	2.10
	950	3 200	6 550	2	1	48.98	2.10
	320	1 100	2 220	2	1	34.1	1.85
	450	1 680	3 550	2	1	48.98	1.85





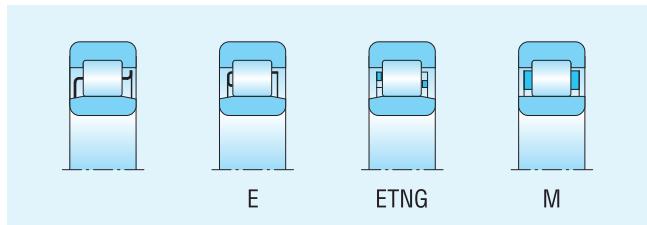
SINGLE ROW CYLINDRICAL ROLLER BEARINGS



Single Row Cylindrical Roller Bearings

Single Row Cylindrical Roller Bearings

These bearings are separable and are produced in several designs. Design NU has cylindrical rollers guided between guiding ribs of the outer ring, the design N between guiding ribs of the inner ring. Both designs enable mutual bearing rings displacement in both directions.



Single Row Angular Contact Ball Bearings for High Frequency of Rotation

Design NJ has two guiding ribs on the outer ring and one on the inner ring, which enables to accomodate the axial forces in one direction.

NUP design has a loose inner rib creating the second guiding rib of the inner ring and this enables the bearing to carry limited axial forces in both directions. Axial guiding in both directions can be achieved by means of angle rings HJ for bearings in NJ design and in one direction in NU design.

Single row cylindrical roller bearings have in comparison with single row ball bearings of the same size higher basic load rating and are suitable for arrangements with high radial load, high rotational speed and when tight fitting of both rings is desirable.

The bearings in the "E" design show the basic dynamic load rating on the average by 30% higher than the bearings in the basic design.

Boundary Dimensions

Boundary dimensions comply with the standard ISO 15 and are shown in the dimension tables of this publication.

Designation

Bearing designation in standard design is in the dimension tables. Difference from standard design is designated by additional symbols.

Cages

Bearings in standard design are equipped with a cage according to dimension tables. Material symbol and symbol of the cage design are not indicated by bearings with pressed steel cage.

For special arrangements bearings with plastic or brass cages are produced.

Bearing Type	Bearings with Pressed Steel Cage Bearing Size	Bearings with Reinforced solid Plastic Cage	Bearings with Machined Brass or Steel Cage
NU10	–	–	16 – 40
NU/NJ/NUP/N2	05 – 28	–	48
NU/NJ/NUP/N2E	09, 15	04 – 24	22 – 40
NU/NJ/NUP22	05 – 07, 10, 11, 13, 14, 19	–	06 – 36
NU/NJ/NUP22E	09, 15, 17	40 – 20	22 – 30
NU/NJ/NUP/N3	05 – 24	–	26 – 30
NU/NJ/NUP/N3E	–	04 – 17	18 – 30
NU/NJ/NUP23	07, 12, 13, 15	–	–
NU/NJ/NUP23E	09	04 – 17	07, 08, 10, 14 18 – 30
NU/NJ/NUP/N4	06 – 12, 14 – 16	–	13, 17 – 24



Symbol	Example of designation	Meaning
R	RNU205	Bearing without one (separable) ring
L	LNU206	Removable ring of separable bearing
C2	NU206 C2	Radial clearance smaller than normal
C3	NJ311 C3	Radial clearance greater than normal
C4	NU222 C4	Radial clearance greater than C3
C5	NH417 C5	Radial clearance greater than C4
R...	NU210 R70-90	Radial clearance in non-standardized range (range in μm)
E	NU2209 E	Modification of internal design, higher load rating
M	NJ219 M	Solid brass or bronze cage centered on cylindrical rollers
MA	NU324 MA	Solid brass or bronze cage centered on outer ring
MAS	NJ2307 EMAS	Solid brass or bronze cage centered on outer ring with lubrication grooves
MB	N313 MB	Solid brass or bronze cage centered on inner ring
TNG	NU306 ETNG	Solid polyamide cage centered on cylindrical roller
V	NFD2915 V	Bearing without cage, full complement bearing
N	NU207 N	Snap ring groove on outer ring
NR	NU206 NR	Snap ring groove on outer ring and inserted snap ring
NA	NU224 C3NA	Cylindrical roller bearings with non-interchangeable rings always indicated after the symbol of a radial clearance group
P6	NU217 P6	Tolerance class higher than normal
S0	NU220 C3S0	Stabilization for operation at temperature up to 150 °C
S1	NU220 C3S1	Stabilization for operation at temperature up to 200 °C
S2	NU220 C3S2	Stabilization for operation at temperature up to 250 °C
S3	NU220 C3S3	Stabilization for operation at temperature up to 300 °C
S4	NU220 C3S4	Stabilization for operation at temperature up to 350 °C
S5	NU220 C3S5	Stabilization for operation at temperature up to 400 °C

Tolerances

Bearings are commonly produced in normal tolerance class P0 which is not indicated. Bearings for more demanding arrangements are delivered in tolerance classes P6, P5 and P4.

Radial Clearance

Commonly produced bearings have normal radial clearance which is not indicated. For special arrangements bearings with smaller clearance C2 or greater radial clearance C3, C4 and C5 are delivered.

The symbols for a tolerance class and radial clearance are grouped together in the basic designation, e.g.:

P6 + C3 = P63

P6 + C4 = P64 etc.

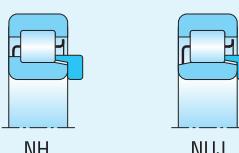
Bearings with Angle Rings

Examples of bearing designation:

NJ2 + HJ2 = NH2	NU2 + HJ2 = NUJ2
NJ3 + HJ3 = NH3	NU3 + HJ3 = NUJ3
NJ4 + HJ4 = NH4	NU4 + HJ4 = NUJ4

Angle rings – type HJ2, HJ2E, HJ3, HJ3E and HJ4 can be used for bearings in NJ and NU designs.

Pictures of individual basic designs and combinations are in the dimension tables of the publication.



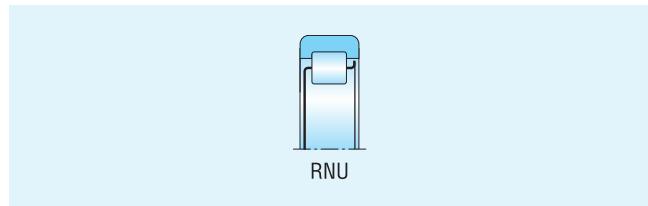


Bearings without Inner Ring

For arrangements with limited space for bearing mounting, single row cylindrical roller bearings without inner ring designated RNU are delivered.

The inner bearing ring raceway is created directly by the hardened and ground journal.

Dimension tolerance on the journal is usually "g6" for normal radial clearance, "f6" for greater radial clearance and "h5" for smaller radial clearance. Ovality and cylindricity deviations of the "raceway" on this journal must not be greater than deviations for tolerance class IT3. Surface roughness for this surface should be $R_a = 0.2$ and for less demanding arrangements $R_a = 0.4$.



Basic load rating C_r and C_{or} values shown in the dimension tables, are valid for bearings RNU if the journal surface hardness will be in the range 59 to 65 HRC. With decreasing hardness value also load rating values C_r decrease. It must be multiplied by the factor f_h from following table. Minimum depth of journal hardening after grinding depends on the cylindrical roller diameter and load magnitude and should be 1 to 3 mm.

Hardness HRC	58	56	54	51	48	45	40	35	30
Factor f_h	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.25	0.2

Misalignment

Mutual bearing ring misalignment of single row cylindrical roller bearings is very small. Permissible misalignment values are in the table.

Bearing	Type Load	
	small ($F_r < 0,1C_{or}$)	great ($F_r \geq 0,1C_{or}$)
NU10, NU2, NU3, NU4	2' - 3'	5' - 7'
NU22, NU23	1' - 3'	3' - 4'
Designs NJ, NUP, N ¹⁾ of all dimension series	1' - 2'	3' - 4'

¹⁾ Smaller values of the number pair are valid for bearings of width series 2 and higher

Radial Equivalent Dynamic Load

$$P_r = F_r \quad [\text{kN}]$$

Radial Equivalent Static Load

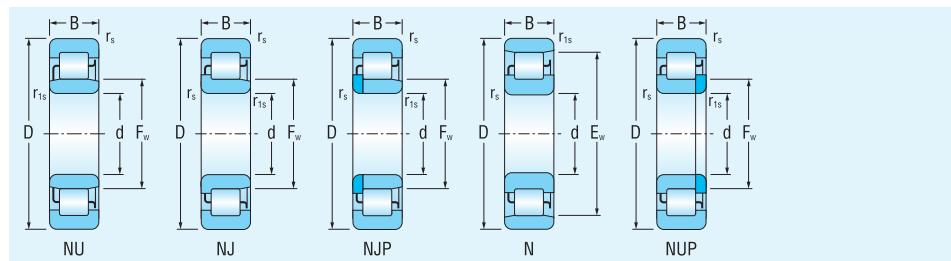
$$P_{or} = F_r \quad [\text{kN}]$$



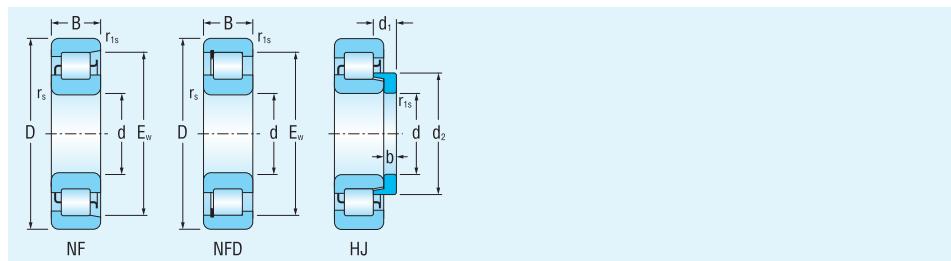


Single Row Cylindrical Roller Bearings

d = 20 - 25 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Oil
d	D	B		HJ	C _r kN	C _{or}	P _u kN	min ⁻¹	
20	47	14	NUP204ETNG		27.4	24.7	3.012	14 000	17 000
	47	14	NU204ETNG		27.4	24.7	3.012	14 000	17 000
	47	14	NJ204ETNG		27.4	24.7	3.012	14 000	17 000
	47	14	NUP204ETNG*		27.4	24.7	3.012	14 000	17 000
	47	14	NJ204MA*		15.4	12.7	1.537	14 000	17 000
	47	14	NF204*		15.4	12.7	1.537	14 000	17 000
	47	14	NJ204		15.4	12.7	1.537	14 000	17 000
	47	14	NU204		15.4	12.7	1.537	14 000	17 000
	47	18	NJ2204*		20.7	18.4	2.244	14 000	17 000
	52	15	NJ304		21.4	17.3	2.110	13 000	16 000
	52	15	NU304		21.4	17.3	2.110	13 000	16 000
25	52	15	NJ205ETNG		31.0	29.9	3.646	12 600	15 000
	52	15	NUP205ETNG		31.0	29.9	3.646	12 600	15 000
	52	15	NU205ETNG		31.0	29.9	3.646	12 600	15 000
	52	15	NJ205MAS*	HJ205	17.7	15.7	1.915	12 600	15 000
	52	15	NJ205E		29.3	27.7	3.378	12 600	15 000
	52	15	NU205MA*	HJ205	17.7	15.7	1.915	12 600	15 000
	52	15	NJ205MA*	HJ205	17.7	15.7	1.915	12 600	15 000
	52	15	NF205*		17.7	15.7	1.915	12 600	15 000
	52	15	N205		17.7	15.7	1.915	12 600	15 000
	52	15	NUP205		17.7	15.7	1.915	12 600	15 000
	52	15	NU205	HJ205	17.7	15.7	1.915	12 600	15 000
	52	15	NJ205	HJ205	17.7	15.7	1.915	12 600	15 000
	52	18	NUP2205ETNG		36.9	37.3	4.549	12 000	14 000
	52	18	NU2205EMA		34.9	34.7	2.780	12 000	14 000
	52	18	NU2205ETNG		36.9	37.3	4.549	12 000	14 000
	52	18	NU2205MA*		23.7	22.8	4.220	12 600	15 000
	52	18	NJ2205		23.7	22.8	2.780	12 600	15 000
	52	18	NU2205		23.7	22.8	2.780	12 600	15 000
62	62	17	NUP305ETNG		44.4	40.8	4.976	10 000	12 000
	62	17	NJ305ETNG		44.4	40.8	4.976	10 000	12 000
	62	17	NU305ETNG*		44.4	40.8	4.976	10 000	12 000
	62	17	NU305EMAS		41.6	37.4	4.561	10 000	12 000
	62	17	NJ305EMAS*		41.6	37.4	4.561	10 000	12 000
	62	17	NUP305MA*		29.3	25.2	3.073	10 000	12 000
	62	17	NU305M*	HJ305	29.3	25.2	3.073	10 000	12 000
	62	17	NJ305MA*	HJ305	29.3	25.2	3.073	10 000	12 000
	62	17	N305		29.3	25.2	3.073	10 000	12 000
	62	17	NUP305		29.3	25.2	3.073	10 000	12 000
	62	17	NJ305	HJ305	29.3	25.2	3.073	10 000	12 000
	62	17	NU305	HJ305	29.3	25.2	3.073	10 000	12 000

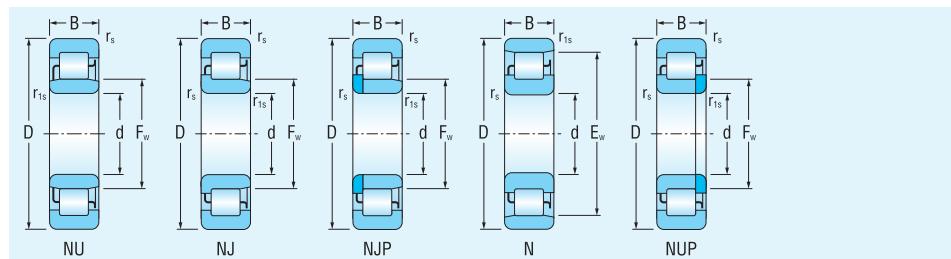


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions								S ¹⁾
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁		
	kg		mm								
	0.17		1.1	0.6	26.5						1.2
	0.113		1.1	0.6	26.5						1.2
	0.116		1.1	0.6	26.5						1.2
	0.17		1.1	0.6	26.5						1.2
	0.128		1.1	0.6	27						1.4
	0.114		1.1	0.6		40					1.4
	0.114		1.1	0.6	27						1.4
	0.109		1.1	0.6	27						1.4
	0.147		1.1	0.6	27						2
	0.150		1.1	0.6	28.5						1.2
	0.147		1.1	0.6	28.5						1.2
	0.138		1.1	0.6	31.5						1.4
	0.141		1.1	0.6	31.5						
	0.135		1.1	0.6	31.5						1.4
	0.156	0.020	1.1	0.6	32		35	3	7.25	1.5	
	0.147		1.1	0.6	31.5						1.4
	0.156	0.020	1.1	0.6	32		35	3	7.25	1.5	
	0.156	0.020	1.1	0.6	32		35	3	7.25	1.5	
	0.140		1.1	0.6	45						1.5
			1.1	0.6	45						1.5
			1.1	0.6	32						
	0.130	0.020	1.1	0.6	32		35	3	7.25	1.5	
	0.110	0.020	1.1	0.6	32		35	3	7.25	1.5	
	0.176		1.1	0.6	31.5						
	0.188		1.1	0.6	31.5						2.2
	0.170		1.1	0.6	31.5						2.2
	0.182		1.1	0.6	32						2.2
	0.169		1.1	0.6	32						1.6
	0.164		1.1	0.6	32						1.6
	0.227		1.1	1.1	34						1.4
	0.227		1.1	1.1	34						1.4
	0.222		1.1	1.1	34						1.4
	0.255		1.1	1.1	34						1.4
	0.283		1.1	1.1	34						1.4
	0.297		1.1	1.1	35						
	0.277	0.028	1.1	1.1	35		39	4	8	1.4	
	0.294	0.028	1.1	1.1	35		39	4	8	1.4	
	0.230		1.1	1.1		53	39				1.4
	0.252		1.1	1.1	35		39				
	0.250	0.028	1.1	1.1	35		39	4	8	1.4	
	0.247	0.028	1.1	1.1	35		39	4	8	1.4	

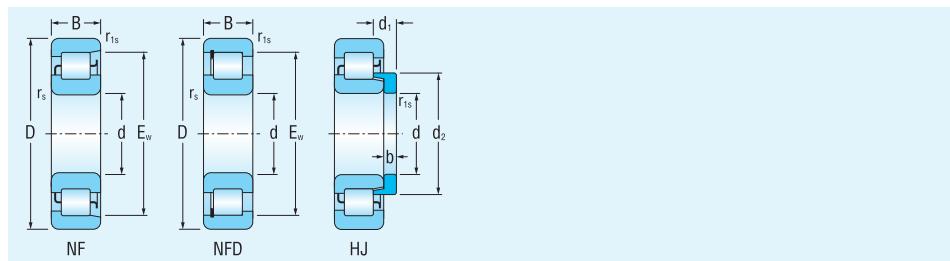


Single Row Cylindrical Roller Bearings

$d = 25 - 30 \text{ mm}$



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Limiting speed for lubrication with oil
d	D	B		HJ	C_r kN	C_{or}	P_u kN		
mm								min ⁻¹	
25	62	24	NJ2305		42.7	41.0	5.000	11 000	13 500
	62	24	NU2305		42.7	41.0	5.000	11 000	13 500
	80	21	NJ405*		44.7	37.7	4.598	8 400	10 000
	80	21	NU405		44.7	37.7	4.598	8 400	10 000
30	62	16	NUP206ETNG		41.3	40.2	4.902	10 600	12 600
	62	16	NU206ETNG		41.3	40.2	4.902	10 600	12 600
	62	16	NJ206ETNG		41.3	40.2	4.902	10 600	12 600
	62	16	NJ206E		39.1	37.4	4.561	10 600	12 600
	62	16	NUP206E		39.1	37.4	4.561	10 600	12 600
	62	16	NU206MA*	HJ206	23.5	21.5	2.622	10 600	12 600
	62	16	NU206E		39.1	37.4	4.561	10 600	12 600
	62	16	N206		23.5	21.5	2.622	10 600	12 600
	62	16	NUP206		23.5	21.5	2.622	10 600	12 600
	62	16	NU206	HJ206	23.5	21.5	2.622	10 600	12 600
	62	16	NJ206	HJ206	23.5	21.5	2.622	10 600	12 600
	62	20	NJ2206ETNG*		51.7	53.7	6.549	10 600	12 600
	62	20	NJ2206MA*		32.8	33.1	4.037	10 600	12 600
	62	20	NU2206ETNG		51.7	53.7	6.549	10 600	12 600
	62	20	NJ2206M*		32.8	33.1	4.037	10 600	12 600
	62	20	NUP2206		32.8	33.1	4.037	10 600	12 600
	62	20	NJ2206		32.8	33.1	4.037	10 600	12 600
	62	20	NU2206		32.8	33.1	4.037	10 600	12 600
	72	19	N306ETNG*		54.1	51.5	6.280	8 400	10 000
	72	19	NJ306ETNG*		54.1	51.5	6.280	8 400	10 000
	72	19	NU306ETNG*		54.1	51.5	6.280	8 400	10 000
	72	19	NJ306EM*		50.9	47.5	5.793	8 400	10 000
	72	19	NJ306E*		50.9	47.5	5.793	8 400	10 000
	72	19	NU306E		50.9	47.5	5.793	8 400	10 000
	72	19	NU306MA*	HJ306	38.6	35.2	4.293	8 900	10 600
	72	19	NJ306MA*	HJ306	38.6	35.2	4.293	8 900	10 600
	72	19	NF306*		38.6	35.2	4.293	8 900	10 600
	72	19	N306		38.6	35.2	4.293	8 900	10 600
	72	19	NUP306		38.6	35.2	4.293	8 900	10 600
	72	19	NU306	HJ306	38.6	35.2	4.293	8 900	10 600
	72	19	NJ306	HJ306	38.6	35.2	4.293	8 900	10 600
	72	27	NU2306EMA		72.5	74.9	9.134	9 500	11 500
	72	27	NJ2306		51.4	50.8	6.195	9 500	11 500
	90	23	NUP406M*		60.4	52.4	6.390	7 100	8 400
	90	23	NJ406M*		60.4	52.4	6.390	7 100	8 400
	90	23	NU406M		60.4	52.4	6.390	7 100	8 400
	90	23	NUP406*		60.4	52.4	6.390	7 100	8 400

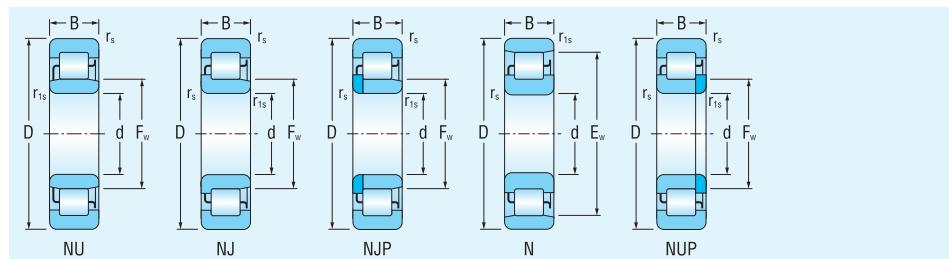


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁	s ¹⁾
kg	mm									
	0.343		1.1	1.1	35					2.2
	0.335		1.1	1.1	35					2.2
	0.577		1.5	1.5	38.8					1.4
	0.564		1.5	1.5	38.8					1.4
	0.216		1.1	0.6	37.5					
	0.211		1.1	0.6	37.5					1.4
	0.216		1.1	0.6	37.5					1.4
	0.221		1.1	0.6	37.5					1.4
	0.221		1.1	0.6	37.5					
	0.234	0.027	1.1	0.6	38.5		41.8	4	8.25	1.5
	0.220		1.1	0.6	37.5					1.4
	0.201		1.1	0.6		46	41.8			1.5
	0.220		1.1	0.6	38.5		41.8			
	0.205	0.027	1.1	0.6	38.5		41.8	4	8.25	1.5
	0.211	0.027	1.1	0.6	38.5		41.8	4	8.25	1.5
	0.270		1.1	0.6	37.5					1.7
	0.300		1.1	0.6	38.5					1.6
	0.268		1.1	0.6	37.5					1.7
	0.297		1.1	0.6	38.5					1.6
	0.274		1.1	0.6	38.5					
	0.268		1.1	0.6	38.5					1.6
	0.262		1.1	0.6	38.5					1.6
	0.356		1.1	1.1		62.5				1.4
	0.375		1.1	1.1	40.5					1.4
	0.367		1.1	1.1	40.5					1.4
	0.422		1.1	1.1	40.5					1.4
	0.383		1.1	1.1	40.5					1.4
	0.375		1.1	1.1	40.5					1.4
	0.400	0.040	1.1	1.1	42		46.6	5	9.5	1.4
	0.406	0.040	1.1	1.1	42		46.6	5	9.5	1.4
	0.363		1.1	1.1		62				1.4
	0.470		1.1	1.1		62				1.4
	0.379		1.1	1.1	42					
	0.356	0.040	1.1	1.1	42		46.6	5	9.5	1.4
	0.367	0.040	1.1	1.1	42		46.6	5	9.5	1.4
	0.610		1.1	1.1	40.5					2
	0.532		1.1	1.1	42					3.2
	0.877		1.5	1.5	45					1.5
	0.877		1.5	1.5	45					1.5
	0.860		1.5	1.5	45					1.5
	0.794		1.5	1.5	45					

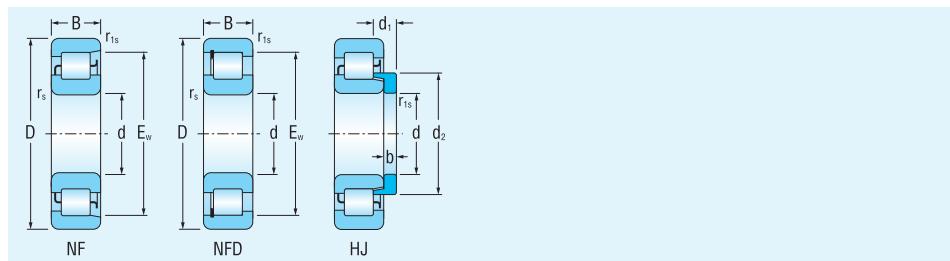


Single Row Cylindrical Roller Bearings

d = 30 - 35 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Oil
d	D	B		HJ	C_r kN	C_{or}	P_u kN		min ⁻¹
mm									
30	90	23	NJ406		60.4	52.4	6.390	7 100	8 400
	90	23	NU406		60.4	52.4	6.390	7 100	8 400
35	62	20	NFD3007V*		48.0	55.7	6.793	2 800	5 000
	72	17	NUP207ETNG*		52.9	53.8	6.561	8 900	10 600
	72	17	NJ207ETNG		52.9	53.8	6.561	8 900	10 600
	72	17	NU207ETNG		52.9	53.8	6.561	8 900	10 600
	72	17	NUP207E*		50.3	50.2	6.122	8 900	10 600
	72	17	NJ207E		50.3	50.2	6.122	8 900	10 600
	72	17	NU207E		50.3	50.2	6.122	8 900	10 600
	72	17	NF207*		33.6	31.5	3.841	9 400	11 000
	72	17	NJ207MA*	HJ207	33.6	31.5	3.841	9 400	11 000
	72	17	N207		33.6	31.5	3.841	9 400	11 000
	72	17	NUP207		33.6	31.5	3.841	9 400	11 000
	72	17	NU207	HJ207*	33.6	31.5	3.841	9 400	11 000
	72	17	NJ207	HJ207*	33.6	31.5	3.841	9 400	11 000
	72	23	NUP2207ETNG		64.9	69.9	8.524	8 900	10 600
	72	23	NJ2207ETNG		64.9	69.9	8.524	8 900	10 600
	72	23	NU2207ETNG		64.9	69.9	8.524	8 900	10 600
	72	23	NUP2207		49.0	51.2	6.244	9 400	11 000
	72	23	NU2207		49.0	51.2	6.244	9 400	11 000
	72	23	NJ2207		49.0	51.2	6.244	9 400	11 000
	80	21	NU307MA	HJ307	47.3	44.1	5.378	7 900	9 400
	80	21	NJ307MA	HJ307	47.3	44.1	5.378	7 900	9 400
	80	21	NF307*		44.3	40.4	4.927	7 900	9 400
	80	21	N307		44.3	40.4	4.927	7 900	9 400
	80	21	NUP307		44.3	40.4	4.927	7 900	9 400
	80	21	NU307	HJ307	44.3	40.4	4.927	7 900	9 400
	80	21	NU307M*	HJ307	44.3	40.4	4.927	7 900	9 400
	80	21	NJ307	HJ307	44.3	40.4	4.927	7 900	9 400
	80	31	NU2307EMAS		91.0	97.6	11.902	7 100	8 400
	80	31	NJ2307EMAS		91.0	97.6	11.902	7 100	8 400
	80	31	NJ2307		58.3	57.6	7.024	8 000	9 500
	80	31	NU2307		58.3	57.6	7.024	8 000	9 500
	100	25	NJ407MAS*		75.3	68.9	8.402	6 300	7 500
	100	25	NU407MAS		75.3	68.9	8.402	6 300	7 500
	100	25	NJ407M*		75.3	68.9	8.402	6 300	7 500
	100	25	N407		75.3	68.9	8.402	6 300	7 500
	100	25	NUP407*		75.3	68.9	8.402	6 300	7 500
	100	25	NJ407		75.3	68.9	8.402	6 300	7 500
	100	25	NU407		75.3	68.9	8.402	6 300	7 500

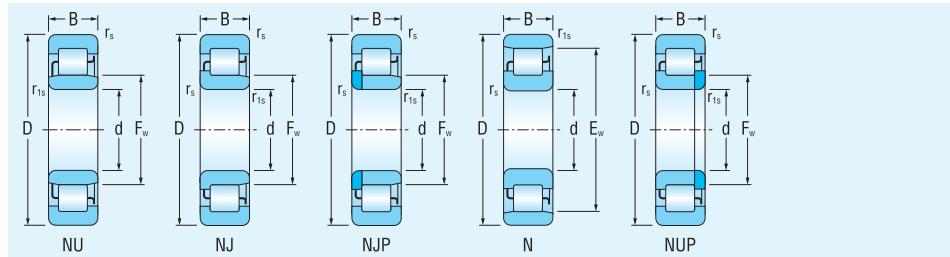


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁	s ¹⁾
	kg		mm							
	0.776		1.5	1.5	45					1.5
	0.759		1.5	1.5	45					1.5
	0.251		1.1	1.1		55.61				2
	0.370		1.1	0.6	44					1.4
	0.370		1.1	0.6	44					1.4
	0.360		1.1	0.6	44					1.4
	0.319		1.1	0.6	44					1.4
	0.319		1.1	0.6	44					1.4
	0.312		1.1	0.6	44					1.4
	0.300		1.1	0.6		61.8				1.5
	0.346	0.033	1.1	0.6	43.8		47.8	4	8	1.5
	0.294		1.1	0.6		61.8	47.8			1.5
	0.315		1.1	0.6	43.8		47.8			
	0.297	0.033	1.1	0.6	43.8		47.8	4	8	1.5
	0.306	0.033	1.1	0.6	43.8		47.8	4	8	1.5
	0.390		1.1	0.6	44					
	0.416		1.1	0.6	44					1.6
	0.385		1.1	0.6	44					1.6
	0.427		1.1	0.6	43.8					
	0.409		1.1	0.6	43.8					1.6
	0.418		1.1	0.6	43.8					1.6
	0.536	0.061	1.5	1.1	46.2		50.8	6	11	1.4
	0.552	0.061	1.5	1.1	46.2		50.8	6	11	1.4
	0.484		1.5	1.1		68.2				1.4
	0.463		1.5	1.1		68.2				1.4
	0.505		1.5	1.1	46.2					
	0.473	0.061	1.5	1.1	46.2		50.8	6	11	1.4
	0.473	0.061	1.5	1.1	46.2		50.8	6	11	1.4
	0.489	0.061	1.5	1.1	46.2		50.8	6	11	1.4
	0.751		1.5	1.1	46.2					2.7
	0.849		1.5	1.1	46.2					2.7
	0.717		1.5	1.1	46.2					4
	0.697		1.5	1.1	46.2					4
	1.160		1.5	1.5	53					1.5
	1.135		1.5	1.5	53					1.5
	1.137		1.5	1.5	53					1.5
	0.982		1.5	1.5		83				1.5
	1.040		1.5	1.5	53					
	1.028		1.5	1.5	53					1.5
	1.004		1.5	1.5	53					1.5

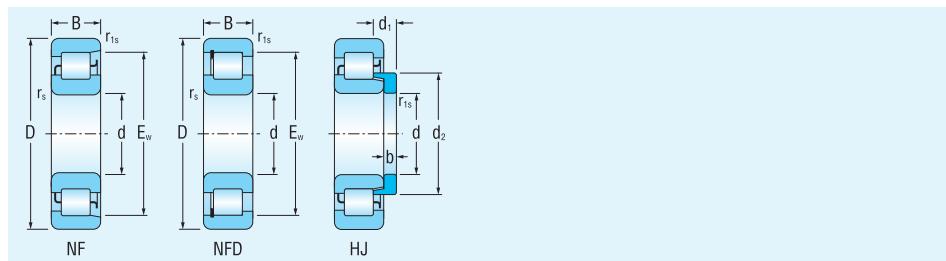


Single Row Cylindrical Roller Bearings

d = 40 - 45 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Oil
d	D	B		HJ	C_r kN	C_{or}	P_u kN		
mm								min ⁻¹	
40	80	18	NUP208E		53.1	52.1	6.354	7 900	9 400
	80	18	NJ208E		53.1	52.1	6.354	7 900	9 400
	80	18	N208M*		43.7	42.9	5.232	7 900	9 400
	80	18	NU208M*	HJ208	43.7	42.9	5.232	7 900	9 400
	80	18	NJ208M*	HJ208	43.7	42.9	5.232	7 900	9 400
	80	18	NF208*		43.7	42.9	5.232	7 900	9 400
	80	18	N208		43.7	42.9	5.232	7 900	9 400
	80	18	NUP208		43.7	42.9	5.232	7 900	9 400
	80	18	NU208	HJ208	43.7	42.9	5.232	7 900	9 400
	80	18	NJ208	HJ208	43.7	42.9	5.232	7 900	9 400
	80	23	NFD2208V		80.90	90.10	10.988	2 200	4 100
	80	23	NUP2208E		69.90	74.30	9.061	7 500	8 900
	80	23	NJ2208E		69.90	74.30	9.061	7 500	8 900
	80	23	NU2208E		69.90	74.30	9.061	7 500	8 900
	80	23	NU2208		58.20	62.00	7.561	7 900	9 400
	80	23	NJ2208		58.20	62.00	7.561	7 900	9 400
	90	23	NUP308ETNG*		85.3	84.5	10.305	6 700	7 900
	90	23	NU308ETNG*		85.3	84.5	10.305	6 700	7 900
	90	23	NU308EMA*		80.40	78.0	9.512	6 700	7 900
	90	23	NUP308E		80.4	78.0	9.512	6 700	7 900
	90	23	NJ308E		80.4	78.0	9.512	6 700	7 900
	90	23	NU308E		80.4	78.0	9.512	6 700	7 900
	90	23	NF308MB*		56.1	53.8	6.561	7 100	8 400
	90	23	NU308MA*	HJ308	56.1	53.8	6.561	7 100	8 400
	90	23	NJ308M	HJ308	56.1	53.8	6.561	7 100	8 400
	90	23	NF308*		56.1	53.8	6.561	7 100	8 400
	90	23	N308		56.1	53.8	6.561	7 100	8 400
	90	23	NUP308		56.1	53.8	6.561	7 100	8 400
	90	23	NU308	HJ308	56.1	53.8	6.561	7 100	8 400
	90	23	NJ308	HJ308	56.1	53.8	6.561	7 100	8 400
45	90	33	NJ2308EMAS		111.40	118.80	14.488	6 300	7 500
	90	33	NUP2308ETNG*		118.3	128.7	15.695	6 300	7 500
	90	33	NU2308EMAS		111.40	118.80	14.488	6 300	7 500
	110	27	NJ408	HJ408*	93.8	86.8	10.573	5 600	6 700
	110	27	NU408	HJ408*	93.8	86.8	10.573	5 600	6 700
	85	19	N209ETNG*		63.4	67.0	8.171	7 500	8 900
	85	19	NJ209ETNG	HJ209E	63.4	67.0	8.171	7 500	8 900
	85	19	NU209ETNG*	HJ209E	63.4	67.0	8.171	7 500	8 900
	85	19	NUP209E		60.4	62.8	7.659	7 500	8 900
	85	19	NJ209E	HJ209E	60.4	62.8	7.659	7 500	8 900
	85	19	NF209*		46.0	46.9	5.720	7 500	8 900

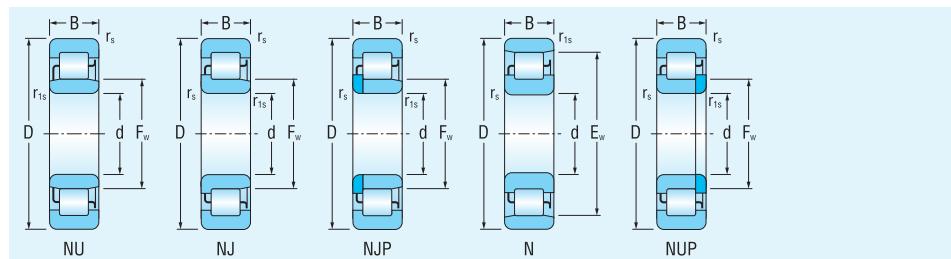


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r_s min	r_s max	F_w	E_w	d_2	b	b_1	s ¹⁾
kg	mm									
	0.402		1.1	1.1	49.5					
	0.402		1.1	1.1	49.5					1.4
	0.432		1.1	1.1		70				1.5
	0.420	0.048	1.1	1.1	50		54.2	5	9	1.5
	0.432	0.048	1.1	1.1	50		54.2	5	9	1.5
	0.386		1.1	1.1		70				1.5
	0.370		1.1	1.1		70	54.2			1.5
	0.402		1.1	1.1	50		54.2			
	0.370	0.048	1.1	1.1	50		54.2	5	9	1.5
	0.389	0.048	1.1	1.1	50		54.2	5	9	1.5
	0.536		1.1	1.1		71.1				1
	0.515		1.1	1.1	49.5					2
	0.515		1.1	1.1	49.5					2
	0.504		1.1	1.1	49.5					2
	0.514		1.1	1.1	50					1.6
	0.514		1.1	1.1	50					1.6
	0.630		1.5	1.5	52					
	0.630		1.5	1.5	52					1.4
	0.765		1.5	1.5	52					1.4
	0.690		1.5	1.5	52					
	0.690		1.5	1.5	52					1.4
	0.660		1.5	1.5	52					1.4
	0.761		1.5	1.5		77.5				1.4
	0.745	0.092	1.5	1.5	53.5		58.4	7	12.5	1.4
	0.742	0.092	1.5	1.5	53.5		58.4	7	12.5	1.4
	0.670		1.5	1.5		77.5				1.4
	0.639		1.5	1.5		77.5	58.4			1.4
	0.700		1.5	1.5	53.5		58.4			
	0.656	0.092	1.5	1.5	53.5		58.4	7	12.5	1.4
	0.678	0.092	1.5	1.5	53.5		58.4	7	12.5	1.4
	1.130		1.5	1.5	52					2.9
	1.000		1.5	1.5	52					
	1.100		1.5	1.5	52					2.9
	1.312	0.140	2.1	2.1	58		65.8	8	13	1.5
	1.282	0.140	2.1	2.1	58		65.8	8	13	1.5
	0.463		1.1	1.1		76.5	58.9			1.4
	0.463	0.053	1.1	1.1	54.5		58.9	5	8.5	1.4
	0.452	0.053	1.1	1.1	54.5		58.9	5	8.5	1.4
	0.479		1.1	1.1	54.5		58.9			
	0.455	0.053	1.1	1.1	54.5		58.9	5	8.5	1.4
	0.430		1.1	1.1		75				1.5

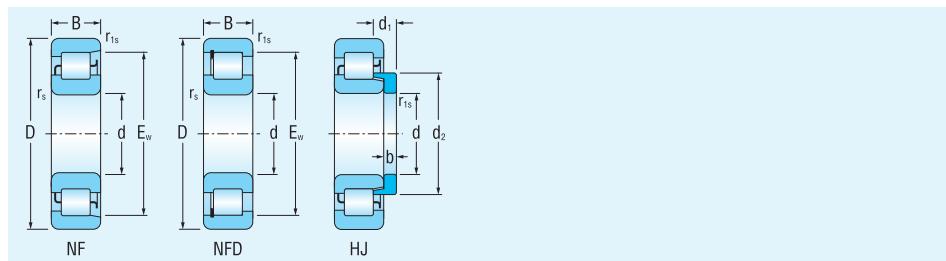


Single Row Cylindrical Roller Bearings

d = 45 - 50 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Limiting speed for lubrication with oil
d	D	B		HJ	C_r kN	C_{or}	P_u kN	min ⁻¹	
mm									
45	85	19	NU209E	HJ209E	60.4	62.8	7.659	7 500	8 900
	85	19	N209		46.0	46.9	5.720	7 500	8 900
	85	23	NUP2209EM		73.5	80.9	9.866	7 100	8 400
	85	23	NUP2209E		73.5	80.9	9.866	7 100	8 400
	85	23	NJ2209E		73.5	80.9	9.866	7 100	8 400
	85	23	NU2209E		73.5	80.9	9.866	7 100	8 400
	100	25	NUP309E		97.4	98.3	8.268	6 000	7 100
	100	25	NJ309E		97.4	98.3	8.268	6 000	7 100
	100	25	NU309E		97.4	98.3	8.268	6 000	7 100
	100	25	N309MB*		75.9	74.0	9.024	6 300	7 500
	100	25	NJ309MA*	HJ309	75.9	74.0	9.024	6 300	7 500
	100	25	NJ309M*	HJ309	75.9	74.0	9.024	6 300	7 500
	100	25	NU309M	HJ309	75.9	74.0	9.024	6 300	7 500
	100	25	NF309*		75.9	74.0	9.024	6 300	7 500
	100	25	NUP309		71.1	67.8	11.988	6 300	7 500
	100	25	N309		71.1	67.8	11.988	6 300	7 500
	100	25	NJ309	HJ309	71.1	67.8	11.988	6 300	7 500
	100	25	NU309	HJ309	71.1	67.8	11.988	6 300	7 500
	100	36	NUP2309E*		137.3	153.0	18.659	5 600	6 700
	100	36	NJ2309E		137.3	153.0	18.659	5 600	6 700
	100	36	NU2309E		137.4	153.1	18.659	5 600	6 700
50	120	29	NJ409M*	HJ409	113.0	109.0	13.293	5 300	6 300
	120	29	N409*		105.2	99.1	12.085	5 300	6 300
	120	29	NU409M*	HJ409	113.0	109.0	13.293	5 300	6 300
	120	29	NUP409		105.2	99.1	12.085	5 300	6 300
	120	29	NJ409	HJ409*	105.2	99.1	12.085	5 300	6 300
	120	29	NU409	HJ409*	105.2	99.1	12.085	5 300	6 300
	90	20	NJ210ETNG		66.1	72.2	8.805	6 700	7 900
	90	20	NU210ETNG*		66.1	72.2	8.805	6 700	7 900
	90	20	NUP210E		63.2	68.0	8.293	6 700	7 900
	90	20	NJ210E		63.2	68.0	8.293	6 700	7 900
	90	20	NU210E		63.2	68.0	8.293	6 700	7 900
	90	20	NU210MA*		48.2	51.0	6.220	7 100	8 400
	90	20	NF210*		48.2	51.0	6.220	7 100	8 400
	90	20	N210		48.2	51.0	6.220	7 100	8 400
	90	20	NUP210		48.2	51.0	6.220	7 100	8 400
	90	20	NU210		48.2	51.0	6.220	7 100	8 400
	90	23	NJ2210ETNG*		80.5	93.1	11.354	6 300	7 500
	90	23	NFD2210*		90.9	109.5	13.354	2 000	3 400
	90	23	NU2210ETNG*		80.5	93.1	11.354	6 300	7 500

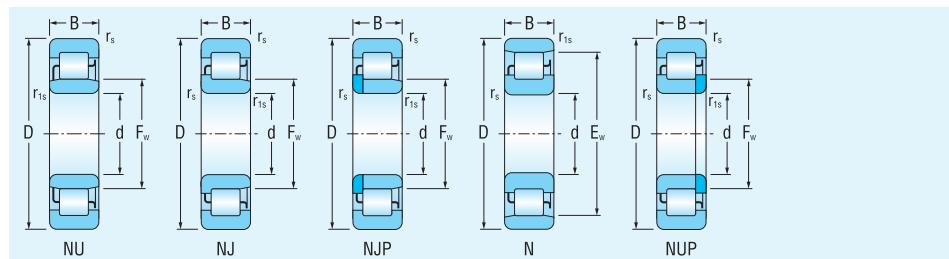


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁	s ¹⁾
kg	mm									
	0.450	0.053	1.1	1.1	54.5		58.9	5	8.5	1.4
	0.420		1.1	1.1		75				1.5
	0.630		1.1	1.1	54.5					
	0.568		1.1	1.1	54.5					
	0.555		1.1	1.1	54.5					1.6
	0.543		1.1	1.1	54.5					1.6
	0.924		1.5	1.5	58.5					
	0.924		1.5	1.5	58.5					1.4
	0.915		1.5	1.5	58.5					1.4
	0.870		1.5	1.5		86.5				1.4
	0.870	0.106	1.5	1.5	58.5		64.7	7	12.5	1.4
	0.970	0.106	1.5	1.5	58.5		64.7	7	12.5	1.4
	0.970	0.106	1.5	1.5	58.5		64.7	7	12.5	1.4
	0.876		1.5	1.5		86.5				1.4
	0.910		1.5	1.5	58.5					
	0.841		1.5	1.5		86.5				1.4
	0.886	0.106	1.5	1.5	58.5		64.7	7	12.5	1.4
	0.856	0.106	1.5	1.5	58.5		64.7	7	12.5	1.4
	1.360		1.5	1.5	58.5					
	1.318		1.5	1.5	58.5					2.9
	1.33		1.5	1.5	58.6					2.1
	1.869	0.190	2.1	2.1	64.5		71.8	8	13.5	1.5
	1.577		2.1	2.1		100.5	71.8			1.5
	1.860	0.190	2.1	2.1	64.5		71.8	8	13.5	1.5
	1.700		2.1	2.1	64.5					
	1.659	0.190	2.1	2.1	64.5		71.8	8	13.5	1.5
	1.618	0.190	2.1	2.1	64.5		71.8	8	13.5	1.5
	0.499		1.1	1.1	59.5					1.6
	0.500		1.1	1.1	59.5					1.6
	0.518		1.1	1.1	59.5					
	0.518		1.1	1.1	59.5					1.6
	0.460		1.1	1.1	59.5					1.6
	0.544		1.1	1.1	60.4					1.5
	0.480		1.1	1.1		80.4				1.5
	0.472		1.1	1.1		80.4				1.5
	0.498		1.1	1.1	60.4					1.5
	0.481		1.1	1.1	60.4					1.5
	0.498		1.1	1.1	60.4					1.5
	0.610		1.1	1.1	59.5					1.7
	0.619		1.1	1.1		81.5				1
	0.610		1.1	1.1	59.5					1.7

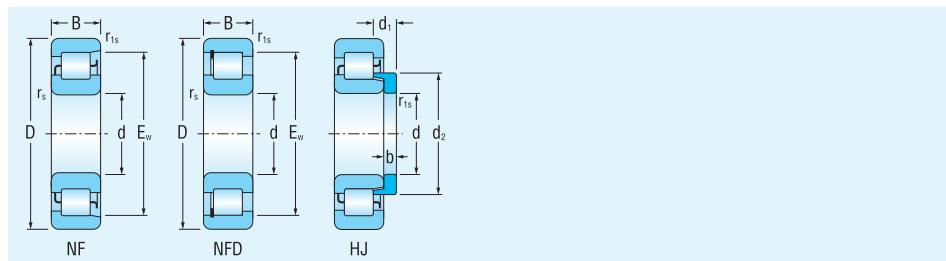


Single Row Cylindrical Roller Bearings

d = 50 - 55 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Oil
d	D	B		HJ	C _r kN	C _{or}	P _u kN	min ⁻¹	
mm									
50	90	23	NUP2210		64.2	73.6	8.976	7 100	8 400
	90	23	NJ2210		64.2	73.6	8.976	7 100	8 400
	90	23	NU2210		64.2	73.6	8.976	7 100	8 400
	110	27	N310ETNG*		116.4	121.8	14.854	5 300	6 300
	110	27	NJ310ETNG	HJ310E*	116.4	121.8	14.854	5 300	6 300
	110	27	NUP310ETNG*		116.4	121.8	14.854	5 300	6 300
	110	27	NJ310MA*	HJ310	86.9	86.2	10.512	5 600	6 700
	110	27	NU310ETNG	HJ310E*	116.4	121.8	14.854	5 300	6 300
	110	27	NJ310M*	HJ310	86.9	86.2	10.512	5 600	6 700
	110	27	NU310M	HJ310	86.9	86.2	10.512	5 600	6 700
	110	27	NF310*		86.9	86.2	10.515	5 600	6 700
	110	27	N310		86.9	86.2	10.515	5 600	6 700
	110	27	NJ310	HJ310	86.9	86.2	10.515	5 600	6 700
	110	27	NUP310		86.9	86.2	10.515	5 600	6 700
	110	27	NU310	HJ310	86.9	86.2	10.515	5 600	6 700
55	110	40	NJ2310EMAS*		162.5	186.5	22.744	5 000	6 000
	110	40	NU2310EMAS		162.5	186.5	22.744	5 000	6 000
	110	40	NUP2310		120.5	131.5	16.037	5 600	6 700
	110	40	NJ2310		120.5	131.5	16.037	5 600	6 700
	110	40	NU2310		120.5	131.5	16.037	5 600	6 700
	130	31	NJ410MAS*	HJ410	138.5	135.9	16.561	4 700	5 600
	130	31	NJ410M*	HJ410	138.5	135.9	16.573	4 700	5 600
	130	31	N410		129.0	123.5	15.061	4 700	5 600
	130	31	NU410M*	HJ410	138.5	135.9	16.573	4 700	5 600
	130	31	NUP410		129.0	123.5	15.061	4 700	5 600
	130	31	NJ410*	HJ410	129.0	123.5	15.061	4 700	5 600
	130	31	NU410	HJ410	129.0	123.5	15.061	4 700	5 600
55	90	18	NJ1011ETNG*		62.3	72.1	8.793	7 100	8 400
	100	21	NUP211E		83.1	94.2	11.488	6 300	7 500
	100	21	NJ211E		83.1	94.2	11.488	6 300	7 500
	100	21	NU211E		83.1	94.2	11.488	6 300	7 500
	100	21	NJ211MAS*	HJ211	58.0	62.5	7.622	6 300	7 500
	100	21	NU211MAS*	HJ211	58.0	62.5	7.622	6 300	7 500
	100	21	NF211*		58.0	62.5	7.622	6 300	7 500
	100	21	N211		58.0	62.5	7.622	6 300	7 500
	100	21	NUP211		58.0	62.5	7.622	6 300	7 500
	100	21	NJ211	HJ211	58.0	62.5	7.622	6 300	7 500
	100	21	NU211	HJ211	58.0	62.5	7.622	6 300	7 500
100	100	25	NUP2211		76.4	89.0	10.854	6 300	7 500
	100	25	NJ2211		76.4	89.0	10.854	6 300	7 500
	100	25	NU2211		76.4	89.0	10.854	6 300	7 500

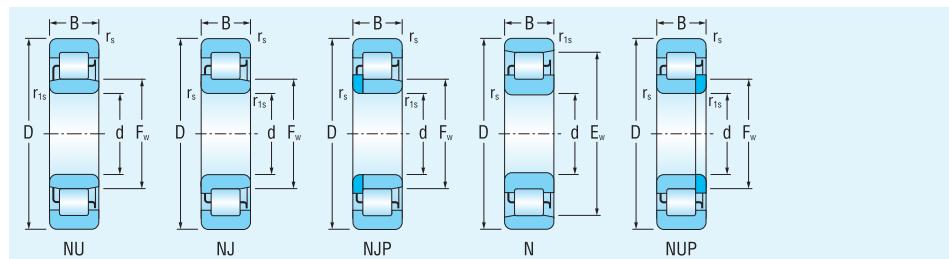


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁	s ¹⁾
kg	mm									
	0.608		1.1	1.1	60.4					
	0.596		1.1	1.1	60.4					1.6
	0.584		1.1	1.1	60.4					1.6
	1.130		2.1	2.1		97				1.5
	1.225	0.140	2.1	2.1	65		71.4	8	13	1.5
	1.225		2.1	2.1	65					
	1.310	0.146	2.1	2.1	65		71	8	14	1.5
	1.200	0.140	2.1	2.1	65		71.4	8	13	1.5
	1.288	0.146	2.1	2.1	65		71	8	14	1.5
	1.258	0.146	2.1	2.1	65		71	8	14	1.5
	1.155		2.1	2.1		95				1.5
	1.105		2.1	2.1		95	71			1.5
	1.160	0.146	2.1	2.1	65		71	8	14	1.5
	1.210		2.1	2.1	65		71			
	1.130	0.146	2.1	2.1	65		71	8	14	1.5
	2.040		2.1	2.1	65					3
	1.830		2.1	2.1	65					3
	1.770		2.1	2.1	65					
	1.730		2.1	2.1	65					3
	1.687		2.1	2.1	65					3
	2.359	0.232	2.1	2.1	70.8		78.8	9	14.5	2
	2.308	0.232	2.1	2.1	70.8		78.8	9	14.5	2
	1.948		2.1	2.1		110.8	78.8			2
	2.260	0.232	2.1	2.1	70.8		78.8	9	14.5	2
	2.080		2.1	2.1	70.8					
	2.032	0.232	2.1	2.1	70.8		78.8	9	14.5	2
	1.984	0.232	2.1	2.1	70.8		78.8	9	14.5	2
	0.450		1.1	1.1	62.5					1.2
	0.702		1.5	1.1	66					
	0.688		1.5	1.1	66					1.6
	0.740		1.5	1.1	66					1.6
	0.743	0.086	1.5	1.1	66.5		70.8	6	11	1.6
	0.720	0.086	1.5	1.1	66.5		70.8	6	11	1.6
	0.669		1.5	1.1		88.5				1.6
	0.636		1.5	1.1		88.5	70.8			1.6
	0.697		1.5	1.1	66.5		70.8			
	0.669	0.086	1.5	1.1	66.5		70.8	6	11	1.6
	0.647	0.086	1.5	1.1	66.5		70.8	6	11	1.6
	0.817		1.5	1.1	66.5					
	0.800		1.5	1.1	66.5					1.6
	0.783		1.5	1.1	66.5					1.6

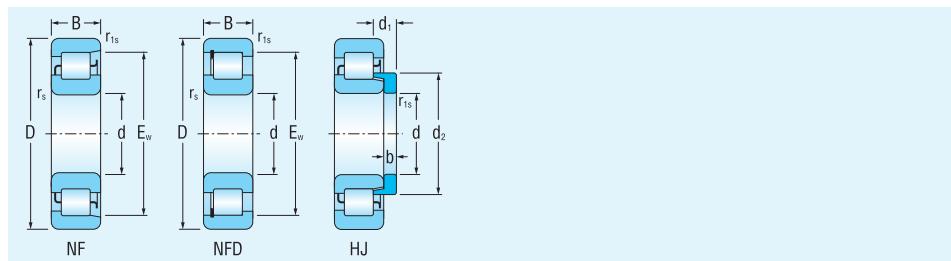


Single Row Cylindrical Roller Bearings

d = 55 - 60 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic static		Fatigue load limit P_u	Limiting speed for lubrication with grease oil min^-1	
d	D	B		HJ	C_r kN	C_0r	kN	min^-1	
55	120	29	N311M*		108.5	108.5	13.232	5 300	6 300
	120	29	NJ311ETNG		134.8	139.4	17.000	4 700	5 600
	120	29	NU311M	HJ311	108.5	108.5	13.232	5 300	6 300
	120	29	NJ311M*	HJ311	108.5	108.5	13.232	5 300	6 300
	120	29	NF311*		108.5	108.5	13.232	5 300	6 300
	120	29	N311		108.5	108.5	12.866	5 300	6 300
	120	29	NJ311	HJ311*	108.5	108.5	12.866	5 300	6 300
	120	29	NUP311		108.5	108.5	12.866	5 300	6 300
	120	29	NU311	HJ311*	108.5	108.5	12.866	5 300	6 300
	140	33	NJ411M*		139.2	138.4	16.829	4 500	5 300
	140	33	N411*		139.2	138.4	16.878	4 500	5 300
	140	33	NUP411*		139.2	138.4	16.878	4 500	5 300
	140	33	NJ411		139.2	138.4	16.878	4 500	5 300
	140	33	NU411		139.2	138.4	16.878	4 500	5 300
60	95	26	NFD3012V		90.6	119.4	14.561	2 000	3 400
	110	22	NJ212EM*	HJ212E	94.0	102.3	12.476	5 600	6 700
	110	22	NU212EM*	HJ212E	94.0	102.3	12.476	5 600	6 700
	110	22	NUP212ETNG		98.4	108.7	13.256	5 600	6 700
	110	22	NJ212ETNG	HJ212E	98.4	108.7	13.256	5 600	6 700
	110	22	NU212ETNG	HJ212E	98.4	108.7	13.256	5 600	6 700
	110	22	NJ212	HJ212*	68.8	75.5	9.207	5 600	6 700
	110	22	N212		68.8	75.5	9.207	5 600	6 700
	110	22	NU212	HJ212*	68.8	75.5	9.207	5 600	6 700
	110	28	NJ2212ETNG		133.7	161.3	19.671	5 300	6 300
	110	28	NUP2212ETNG		133.7	161.3	19.671	5 300	6 300
	110	28	NU2212ETNG*		133.7	161.3	19.671	5 300	6 300
	110	28	NU2212M		98.1	119.1	14.512	5 600	6 700
	110	28	NJ2212		98.1	119.1	14.524	5 600	6 700
	110	28	NU2212		98.1	119.1	14.524	5 600	6 700
	130	31	NU312EM*		149.5	156.9	19.134	4 500	5 300
	130	31	N312MB*		121.3	123.3	15.037	4 700	5 600
	130	31	NUP312MA*		121.3	123.3	15.037	4 700	5 600
	130	31	NJ312MA*	HJ312	121.3	123.3	15.037	4 700	5 600
	130	31	NJ312M	HJ312	121.3	123.3	15.037	4 700	5 600
	130	31	NU312M	HJ312	121.3	123.3	15.037	4 700	5 600
	130	31	N312		121.3	123.3	15.037	4 700	5 600
	130	31	NUP312		121.3	123.3	15.037	4 700	5 600
	130	31	NJ312	HJ312	121.3	123.3	15.037	4 700	5 600
	130	31	NU312	HJ312	121.3	123.3	15.037	4 700	5 600
	130	46	NJ2312		166.3	184.9	22.549	4 700	5 600
	130	46	NU2312		166.3	184.9	22.549	4 700	5 600

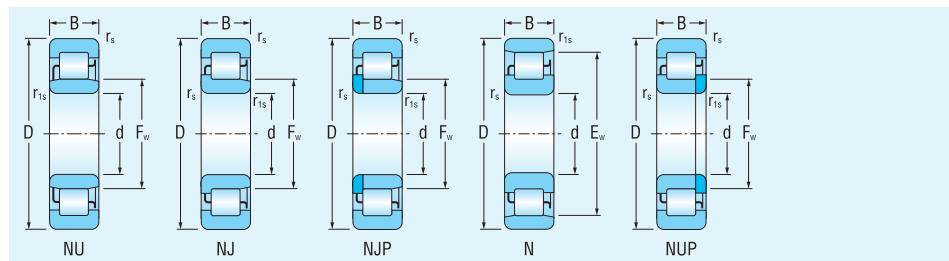


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions								S ¹⁾
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁		
kg	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
	1.570		2.1	2.1		87.5					1.5
	1.900		2.1	2.1	70.5						1.5
	1.617	0.185	2.1	2.1	70.5		77.5	9	15		1.5
	1.657	0.185	2.1	2.1	70.5		77.5	9	15		1.5
	1.461		2.1	2.1		104.5					1.5
	1.401		2.1	2.1		104.5	77.5				1.5
	1.485	0.185	2.1	2.1	70.5		77.5	9	15		1.5
	1.520		2.1	2.1	70.5		77.5				
	1.445	0.185	2.1	2.1	70.5		77.5	9	15		1.5
	2.549		2.1	2.1	77.2						3
	2.439		2.1	2.1		117.2					3
	2.610		2.1	2.1	77.2						
	2.549		2.1	2.1	77.2						3
	2.489		2.1	2.1	77.2						3
	0.664		1.1	1.1		86.75					2
	0.950	0.105	1.5	1.5	72		77.5	6	10		1.6
	0.931	0.105	1.5	1.5	72		77.5	6	10		1.6
	0.880		1.5	1.5	72		77.5				
	0.880	0.105	1.5	1.5	72		77.5	6	10		1.6
	0.798	0.105	1.5	1.5	72		77.5	6	10		1.6
	0.861	0.110	1.5	1.5	73.5		79	6	11		1.6
	0.816		1.5	1.5		97.5					1.6
	0.837	0.110	1.5	1.5	73.5		79	6	11		1.6
	1.170		1.5	1.5	72						1.2
	1.170		1.5	1.5	72						
	1.170		1.5	1.5	72						1.2
	1.180		1.5	1.5	73.5						1.6
	1.105		1.5	1.5	73.5						1.6
	1.085		1.5	1.5	73.5						1.6
	2.140		2.1	2.1	77						1.5
	2.048		2.1	2.1		113					1.5
	2.160		2.1	2.1	77						
	2.107	0.226	2.1	2.1	77		84.2	9	15.5		1.5
	2.076	0.226	2.1	2.1	77		84.2	9	15.5		1.5
	2.026	0.226	2.1	2.1	77		84.2	9	15.5		1.5
	1.767		2.1	2.1		113	84.2				1.5
	1.923		2.1	2.1	77		84.2				
	1.876	0.226	2.1	2.1	77		84.2	9	15.5		1.5
	1.826	0.226	2.1	2.1	77		84.2	9	15.5		1.5
	2.743		2.1	2.1	77						4.5
	2.743		2.1	2.1	77						4.5

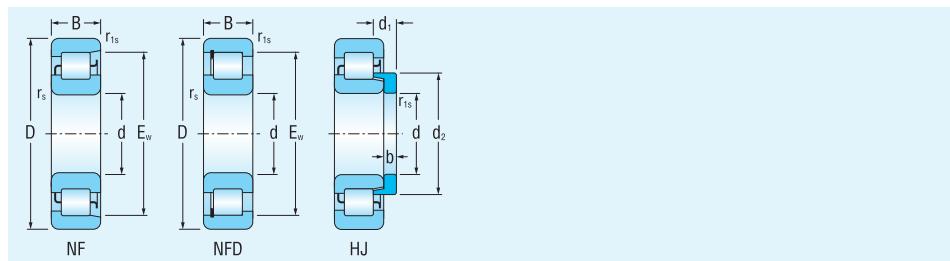


Single Row Cylindrical Roller Bearings

d = 60 - 70 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Oil
d	D	B		HJ	C_r kN	C_{or}	P_u kN		
mm								min ⁻¹	
60	150	35	NUJ12MA*		178.5	183.6	22.065	4 200	5 000
	150	35	NJ12M*		178.5	183.6	22.065	4 200	5 000
	150	35	NU412M		178.5	183.6	22.065	4 200	5 000
	150	35	NU412MA		178.5	183.6	22.065	4 200	5 000
	150	35	NUP412*		167.2	168.3	20.226	4 200	5 000
	150	35	NJ412		167.2	168.3	20.226	4 200	5 000
	150	35	NU412		167.2	168.3	20.226	4 200	5 000
65	120	23	NU213EMA*		107.5	118.8	14.488	5 000	6 000
	120	23	N213		80.5	89.6	10.927	5 300	6 300
	120	23	NUP213*		80.5	89.6	10.927	5 300	6 300
	120	23	NJ213		80.5	89.6	10.927	5 300	6 300
	120	23	NU213		80.5	89.6	10.927	5 300	6 300
	120	23	NJ213ETNG		112.5	126.2	15.390	5 000	6 000
	120	31	NU2213E*		149.0	180.9	22.061	4 700	5 600
	120	31	NUP2213NM*		116.9	144.8	17.646	5 300	6 300
	120	31	NUP2213		116.9	144.8	17.659	5 300	6 300
	120	31	NJ2213		116.9	144.8	17.659	5 300	6 300
	120	31	NU2213		116.9	144.8	17.659	5 300	6 300
	140	33	NU313EM*		180.5	191.5	23.114	4 000	4 700
	140	33	NJ313MA*		134.8	138.9	16.814	4 500	5 300
	140	33	NJ313M*		134.8	138.9	16.814	4 500	5 300
	140	33	NU313M		134.8	138.9	16.814	4 500	5 300
	140	33	N313		134.8	138.9	16.814	4 500	5 300
	140	33	NUP313*		134.8	138.9	16.814	4 500	5 300
	140	33	NJ313		134.8	138.9	16.814	4 500	5 300
70	140	33	NU313		134.8	138.9	16.814	4 500	5 300
	140	48	NU2313M*		187.6	212.5	25.723	4 500	5 300
	140	48	NJ2313		187.6	212.5	25.723	4 500	5 300
	140	48	NU2313		187.6	212.5	25.723	4 500	5 300
	160	37	NUP413MAS*		194.6	202.7	23.874	3 800	4 500
	160	37	NJ413MAS		194.6	202.7	23.874	3 800	4 500
	160	37	NU413MAS		194.6	202.7	23.874	3 800	4 500
	160	37	NJ413		182.3	185.9	21.895	3 800	4 500
70	160	37	NJ413M		194.6	202.7	23.874	3 800	4 500
	125	24	NUP214ETNG*		123.8	145.0	17.683	5 000	6 000
	125	24	NJ214ETNG		123.8	145.0	17.683	5 000	6 000
	125	24	NU214E*		118.6	137.0	16.707	5 000	6 000

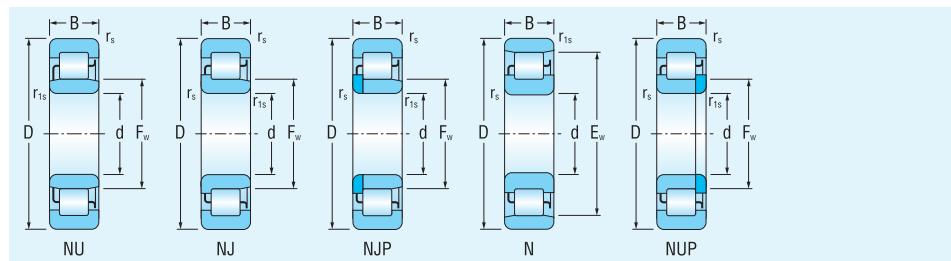


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							S ¹⁾
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁	
kg	mm									
	3.510		2.1	2.1	83					2
	3.370		2.1	2.1	83					2
	3.370		2.1	2.1	83					2
	3.440		2.1	2.1	83					2
	3.130		2.1	2.1	83					2
	3.060		2.1	2.1	83					2
	2.990		2.1	2.1	83					2
	1.200		1.5	1.5	78.5					1.2
	1.060		1.5	1.5		105.6				1.6
	1.115		1.5	1.5	79.6					
	1.093		1.5	1.5	79.6					1.6
	1.063		1.5	1.5	79.6					1.6
	1.07		1.5	1.5	78.5					1.2
	1.500		1.5	1.5	78.5					1.7
	1.650		1.5	1.5	79.6					
	1.510		1.5	1.5	79.6					
	1.480		1.5	1.5	79.6					1.6
	1.453		1.5	1.5	79.6					1.6
	2.560		2.1	2.1	82.5					1.5
	2.260		2.1	2.1	83.5					1.5
	2.556		2.1	2.1	83.5					1.5
	2.486		2.1	2.1	83.5					1.5
	2.167		2.1	2.1		121.5				1.5
	2.360		2.1	2.1	83.5					
	2.300		2.1	2.1	83.5					1.5
	2.230		2.1	2.1	83.5					1.5
	3.540		2.1	2.1	83.5					4.5
	3.330		2.1	2.1	83.5					4.5
	3.250		2.1	2.1	83.5					4.5
	4.270		2.1	2.1	89.3					
	4.180		2.1	2.1	89.3					2
	4.090		2.1	2.1	89.3					2
	3.700		2.1	2.1	89.3					2
	4.110		2.1	2.1	89.3					2
	1.270		1.7	1.7	83.5					
	1.270		1.7	1.7	83.5					1.2
	1.170		1.5	1.5	83.5					1.2
	1.310		1.5	1.5		110.5				1.6
	1.128		1.5	1.5		110.5				1.6
	1.185		1.5	1.5	84.5					1.6
	1.150		1.5	1.5	84.5					1.6

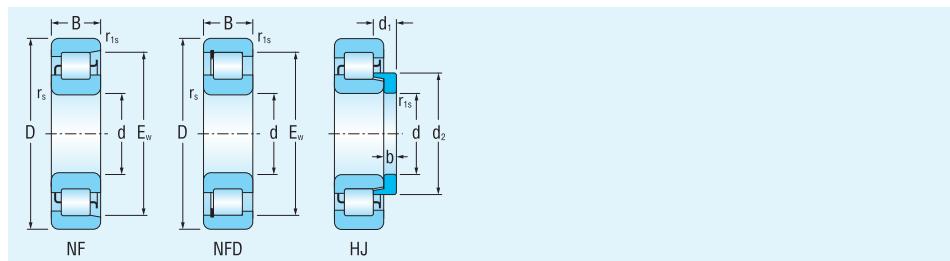


Single Row Cylindrical Roller Bearings

d = 70 - 75 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d	D	B		HJ	C_r kN	C_{or}	P_u kN		min⁻¹
70	125	31	NUP2214		116.3	145.9	17.793	5 000	6 000
	125	31	NJ2214		116.3	145.9	17.793	5 000	6 000
	125	31	NU2214		116.3	145.9	17.793	5 000	6 000
	150	35	NU314EMA		204.6	222.0	26.310	4 200	5 000
	150	35	NUP314EMA*		204.6	222.0	26.310	4 200	5 000
	150	35	NJ314MA*	HJ314	158.1	168.5	19.910	4 400	5 200
	150	35	NU314M		158.1	168.5	19.970	4 200	5 000
	150	35	NU314MA		158.1	168.5	19.970	4 200	5 000
	150	35	N314M*		158.1	168.5	19.970	4 200	5 000
	150	35	NUP314NM*		158.1	168.5	19.970	4 200	5 000
	150	35	NJ314M*	HJ314	158.1	168.5	19.970	4 200	5 000
	150	35	N314		148.9	155.5	18.429	4 200	5 000
	150	35	NJ314	HJ314	148.9	155.5	18.429	4 200	5 000
	150	35	NUP314		148.9	155.5	18.429	4 200	5 000
	150	35	NU314	HJ314	148.9	155.5	18.429	4 200	5 000
	150	51	NJ2314EMAS*		273.8	322.9	38.164	3 800	4 500
	150	51	NJ2314		210.0	241.9	28.591	4 200	5 000
	150	51	NU2314EMAS		273.8	322.9	38.164	3 800	4 500
	150	51	NU2314		210.0	241.9	28.591	4 200	5 000
75	180	42	NJ414MA*	HJ414	238.2	250.6	29.607	3 300	4 000
	180	42	NJ414M*	HJ414	238.2	250.6	28.514	3 300	4 000
	180	42	NUP414		223.2	229.7	26.136	3 300	4 000
	180	42	NU414M	HJ414	238.2	250.6	28.514	3 300	4 000
	180	42	NU414	HJ414	223.2	229.7	26.136	3 300	4 000
	180	42	NJ414	HJ414	223.2	229.7	26.136	3 300	4 000
	105	19	NFD2915V*		81.4	109.5	13.4	1 300	2 600
	130	25	NJ215EMA*		130.0	156.4	18.877	4 500	5 300
	130	25	NU215EMA		130.0	156.4	18.877	4 500	5 300
	130	25	NJ215EM*		130.0	156.4	18.877	4 500	5 300
	130	25	NUP215E		130.0	156.4	18.877	4 500	5 300
	130	25	NU215E		130.0	156.4	18.877	4 500	5 300
	130	25	NJ215E		130.0	156.4	18.877	4 500	5 300
	130	25	NF215*		92.9	105.5	12.771	4 700	5 600
	130	25	N215		92.9	105.5	12.771	4 700	5 600
	130	31	NUP2215E		161.8	207.2	25.009	4 500	5 300
	130	31	NJ2215E		161.8	207.2	25.009	4 500	5 300
	130	31	NU2215E		161.8	207.2	25.009	4 500	5 300
	160	37	NU315MA		190.1	204.6	23.773	3 800	4 500
	160	37	NJ315MA*		190.1	204.6	23.773	3 800	4 500
	160	37	NUP315M		190.1	204.6	23.773	3 800	4 500
	160	37	NJ315M		190.1	204.6	23.773	3 800	4 500

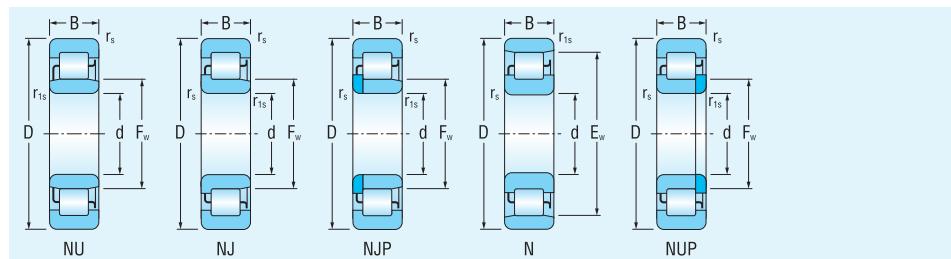


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions								S ¹⁾
			r _s min	r _s max	F _w	E _w	d ₂	b	b ₁		
kg	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
	1.570		1.5	1.5	84.5						1.6
	1.542		1.5	1.5	84.5						1.6
	1.512		1.5	1.5	84.5						1.6
	3.360		2.1	2.1	89						
	3.360		2.1	2.1	89						
	3.140	0.345	2.1	2.1	90		98	10	17.5	1.5	
	2.628		2.1	2.1	130						1.5
	2.628		2.1	2.1	130						1.5
	2.628		2.1	2.1	130						1.5
	3.018		2.1	2.1	90						
	3.100	0.345	2.1	2.1	90		98	10	17.5	1.5	
	2.734		2.1	2.1	130	98					1.5
	2.770	0.345	2.1	2.1	90		98	10	17.5	1.5	
	2.860		2.1	2.1	90		98				
	2.690	0.345	2.1	2.1	90		98	10	17.5	1.5	
	4.730		2.1	2.1	89						4.1
	4.040		2.1	2.1	90						4.1
	4.640		2.1	2.1	89						4.1
	3.950		2.1	2.1	90						4.1
	6.070	0.630	4	4	100		110.5	12	20	2	
	5.970	0.630	4	4	100		110.5	12	20	2	
	5.520		4	4	100		110.5				
	5.840	0.630	4	4	100		110.5	12	20	2	
	5.260	0.630	4	4	100		110.5	12	20	2	
	5.390	0.630	4	4	100		110.5	12	20	2	
	0.413		1.1	1.1		99.68					1
	1.480		1.5	1.5	88.5						1.6
	1.460		1.5	1.5	88.5						1.6
	1.480		1.5	1.5	88.5						1.6
	1.357		1.5	1.5	88.5						
	1.300		1.5	1.5	88.5						1.6
	1.330		1.5	1.5	88.5						1.6
	1.265		1.5	1.5	116.5						1.6
	1.215		1.5	1.5	116.5						1.6
	1.782		1.5	1.5	88.5						
	1.660		1.5	1.5	88.5						2.1
	1.630		1.5	1.5	88.5						2.1
	3.810		2.1	2.1	95.5						1.5
	3.810		2.1	2.1	95.5						1.5
	3.940		2.1	2.1	95.5						
	3.740		2.1	2.1	95.5						1.5

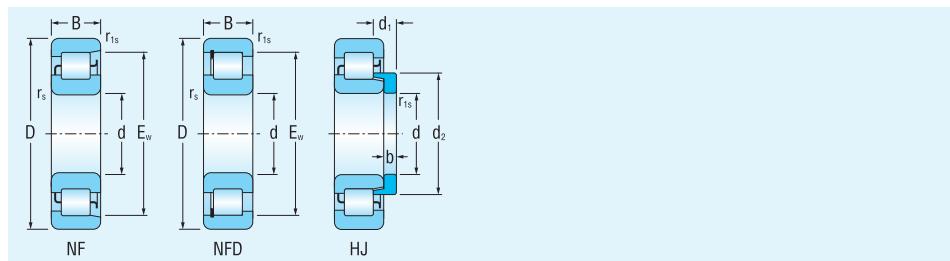


Single Row Cylindrical Roller Bearings

$d = 75 - 80 \text{ mm}$



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d	D	B		HJ	C_r kN	C_{or}	P _u kN	min ⁻¹	
75	160	37	NU315M		190.1	204.6	23.773	3 800	4 500
	160	37	N315		179.0	188.8	21.937	3 800	4 500
	160	37	NUP315*		179.0	188.8	21.937	3 800	4 500
	160	37	NU315		179.0	188.8	21.937	3 800	4 500
	160	37	NJ315		179.0	188.8	21.937	3 800	4 500
	160	55	NJ2315		258.1	302.1	35.101	3 800	4 500
	160	55	NU2315MA		274.0	327.3	38.030	3 800	4 500
	160	55	NU2315		258.1	302.1	35.101	3 800	4 500
	190	45	NJ415EM*	HJ415E*	329.7	340.7	38.185	3 000	3 500
	190	45	NJ415MAS	HJ415	274.9	291.5	32.671	3 200	3 800
	190	45	NU415MAS	HJ415	274.9	291.5	32.671	3 200	3 800
	190	45	N415*		257.5	267.2	29.947	3 200	3 800
	190	45	NJ415M	HJ415	274.9	291.5	32.671	3 200	3 800
	190	45	NJ415	HJ415*	257.5	267.2	29.947	3 200	3 800
	190	45	NU415	HJ415*	257.5	267.2	29.947	3 200	3 800
80	125	22	NU1016M		71.4	89.3	10.810	5 000	6 000
	140	26	N216		106.2	122.3	14.482	4 500	5 300
	140	26	NUP216		106.2	122.3	14.482	4 500	5 300
	140	26	NJ216		106.2	122.3	14.482	4 500	5 300
	140	26	NU216		106.2	122.3	14.482	4 500	5 300
	140	33	NJ2216E		186.3	243.0	28.697	4 200	5 000
	140	33	NUP2216E		186.3	243.0	28.697	4 200	5 000
	140	33	NU2216E		186.3	243.0	28.697	4 200	5 000
	170	39	NJ316EM	HJ316E*	251.1	275.1	23.655	3 300	4 000
	170	39	NJ316EMA*	HJ316E	251.1	275.1	31.302	3 300	4 000
	170	39	NUP316M		190.0	207.4	23.655	3 500	4 200
	170	39	NU316M	HJ316	190.0	207.4	23.655	3 500	4 200
	170	39	NJ316M*	HJ316	190.0	207.4	23.655	3 500	4 200
	170	39	N316		190.0	207.4	23.655	3 500	4 200
	170	39	NJ316	HJ316*	190.0	207.4	23.655	3 500	4 200
	170	58	NJ2316M	HJ2316	273.9	331.8	37.843	3 500	4 200
	170	58	NU2316M	HJ2316	273.9	331.8	37.843	3 500	4 200
	170	58	NJ2316	HJ2316*	273.9	331.8	37.843	3 500	4 200
	170	58	NU2316	HJ2316*	273.9	331.8	37.843	3 500	4 200
	200	48	NUP416EM*		361.0	373.8	41.209	2 900	3 200
	200	48	NUP416M*		314.0	336.0	37.041	3 000	3 500
	200	48	NU416M	HJ416	314.0	336.0	37.041	3 000	3 500
	200	48	NJ416M	HJ416	314.0	336.0	37.041	3 000	3 500
	200	48	NU416	HJ416	294.2	308.0	33.955	3 000	3 500
	200	48	NJ416	HJ416	294.2	308.0	33.955	3 000	3 500

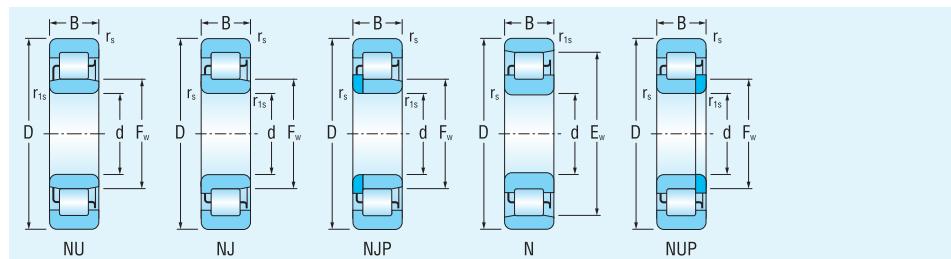


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions								S ¹⁾
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁		
	kg		mm								
	3.646		2.1	2.1	95.5						1.5
	3.169		2.1	2.1		139.5					1.5
	3.440		2.1	2.1	95.5						1.5
	3.250		2.1	2.1	95.5						1.5
	3.340		2.1	2.1	95.5						1.5
	5.000		2.1	2.1	95.5						4.5
	5.450		2.1	2.1	95.5						4.5
	4.875		2.1	2.1	95.5						4.5
	7.700	0.800	4	4	100.5		112	13	19.5		1.2
	7.210	0.740	4	4	104.5		116.5	13	21.5		2
	7.060	0.740	4	4	104.5		116.5	13	21.5		2
	6.100		4	4		160.5	116.5				2
	7.010	0.740	4	4	104.5		116.5	13	21.5		2
	6.380	0.740	4	4	104.5		116.5	13	21.5		2
	6.230	0.740	4	4	104.5		116.5	13	21.5		2
	0.849		1.1	1.1	91.5						1.2
	1.486		2.1	2.1		125.3					2
	1.600		2.1	2.1	95.3						
	1.563		2.1	2.1	95.3						2
	1.523		2.1	2.1	95.3						2
	2.080		2.1	2.1	95.3						2.5
	2.080		2.1	2.1	95.3						2.5
	2.050		2.1	2.1	95.3						2.5
	4.580	0.469	2.1	2.1	101		110.4	11	17		0.6
	4.650	0.469	2.1	2.1	101		110.4	11	17		0.6
	4.567		2.1	2.1	103						
	4.330	0.510	2.1	2.1	103		112.8	11	19.5		1.5
	4.450	0.510	2.1	2.1	103		112.8	11	19.5		1.5
	3.843		2.1	2.1		147					
	4.040	0.510	2.1	2.1	103		112.8	11	19.5		1.5
	3.920	0.510	2.1	2.1	103		112.8	11	19.5		1.5
	6.510	0.543	2.1	2.1	103		112.8	11	23		4.5
	6.360	0.543	2.1	2.1	103		112.8	11	23		4.5
	6.040	0.543	2.1	2.1	103		112.8	11	23		4.5
	5.890	0.543	2.1	2.1	103		112.8	11	23		4.5
	7.520		4	4	106						2
	8.490		4	4	110						
	8.110	0.810	4	4	110		122	13	22		2
	8.300	0.810	4	4	110		122	13	22		2
	7.290	0.810	4	4	110		122	13	22		0.6
	7.480	0.810	4	4	110		122	13	22		0.6

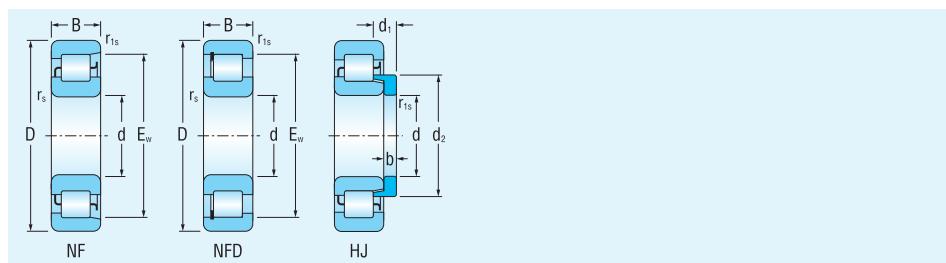


Single Row Cylindrical Roller Bearings

$d = 85 - 90 \text{ mm}$



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Limiting speed for lubrication with oil
d	D	B		HJ	C_r kN	C_{or}	P_u kN		min^{-1}
85	130	22	NU1017M*		70.9	89.8	10.716	4 700	5 600
	150	28	NUP217ETNG*		171.3	205.5	23.817	4 000	4 700
	150	28	NJ217ETNG*		171.3	205.5	23.817	4 000	4 700
	150	28	NJ217MA*		126.0	148.9	17.288	4 200	5 000
	150	28	N217		120.4	140.2	16.278	4 200	5 000
	150	28	NU217MA*		126.0	148.9	17.288	4 200	5 000
	150	28	NUP217*		120.4	140.2	16.278	4 200	5 000
	150	28	NJ217		120.4	140.2	16.278	4 200	5 000
	150	28	NU217		120.4	140.2	16.278	4 200	5 000
	150	36	NU2217E		214.7	274.1	31.767	3 800	4 500
	150	36	NJ2217E		214.7	274.1	31.767	3 800	4 500
	150	49.21	NU5217M*		240.1	328.2	37.989	3 800	4 500
	180	41	NJ317EMA*	HJ317E	285.9	322.7	36.046	3 200	3 800
	180	41	NJ317EM	HJ317E*	285.9	322.7	36.046	3 200	3 800
	180	41	N317M*		224.8	247.1	27.726	3 300	4 000
	180	41	NUP317M		224.8	247.1	27.726	3 300	4 000
	180	41	NJ317M	HJ317	224.8	247.1	27.726	3 300	4 000
	180	41	NU317M	HJ317	224.8	247.1	27.726	3 300	4 000
	180	41	N317		211.7	228.1	25.594	3 300	4 000
	180	41	NUP317*		211.7	228.1	25.594	3 300	4 000
	180	41	NJ317	HJ317*	211.7	228.1	25.594	3 300	4 000
	180	41	NU317	HJ317*	211.7	228.1	25.594	3 300	4 000
	210	52	NJ417M	HJ417	355.0	381.8	41.650	3 000	3 500
	210	52	NUP417M*		355.0	381.8	41.650	3 000	3 500
	210	52	NU417M	HJ417	355.0	381.8	41.650	3 000	3 500
	210	52	NU417MA	HJ417	355.0	381.8	41.650	3 000	3 500
90	160	30	NJ218MA*		156.0	184.4	21.032	4 000	4 700
	160	30	NU218MA*		156.0	184.4	21.032	4 000	4 700
	160	30	N218M*		156.0	184.4	21.032	4 000	4 700
	160	30	N218		149.0	173.6	19.800	4 000	4 700
	160	30	NUP218		149.0	173.6	19.800	4 000	4 700
	160	30	NU218		149.0	173.6	19.800	4 000	4 700
	160	30	NJ218		149.0	173.6	19.800	4 000	4 700
	190	43	NJ318EM*	HJ318E*	310.8	346.9	38.121	3 000	3 500
	190	43	NU318EM	HJ318E*	310.8	346.9	38.121	3 000	3 500
	190	43	NJ318M	HJ318	234.9	258.4	28.487	3 200	3 800
	190	43	N318		234.9	258.4	28.487	3 200	3 800
	190	43	NU318M	HJ318	234.9	258.4	28.487	3 200	3 800
	190	43	NU318MA	HJ318	234.9	258.4	28.487	3 200	3 800
	190	43	NJ318	HJ318	234.9	258.4	28.487	3 200	3 800
	190	43	NU318	HJ318	234.9	258.4	28.487	3 200	3 800

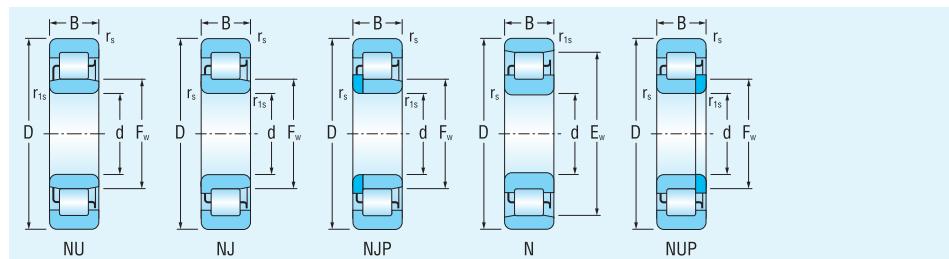


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							S ¹⁾
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁	
	kg		mm	mm	mm	mm	mm	mm	mm	
	1.050		1.1	1.1	96.5					1.5
	2.218		2.1	2.1	100.5					
	2.218		2.1	2.1	100.5					2
	2.162		2.1	2.1	101.8					2
	1.860		2.1	2.1	133.8					2
	2.162		2.1	2.1	101.8					2
	2.010		2.1	2.1	101.8					
	1.955		2.1	2.1	101.8					2
	1.900		2.1	2.1	101.8					2
	2.520		2.1	2.1	100.5					2
	2.533		2.1	2.1	100.5					2
	3.690		2.1	2.1	102.01					5.5
	5.350	0.581	4	4	108		117.8	12	18.5	1.1
	5.350	0.581	4	4	108		117.8	12	18.5	1.1
	4.980		4	4	156					2
	5.350		4	4	108					
	5.210	0.575	4	4	108		118.15	12	20.5	2
	5.080	0.575	4	4	108		118.15	12	20.5	2
	4.440		4	4	156		118.15			2
	4.884		4	4	108		118.15			
	4.660	0.575	4	4	108		118.15	12	20.5	2
	4.530	0.575	4	4	108		118.15	12	20.5	2
	9.840	0.900	4	4	113		125.9	14	24	2.5
	10.070		4	4	113		125.9			
	9.620	0.900	4	4	113		125.9	14	24	2.5
	9.620	0.900	4	4	113		125.9	14	24	2.5
	2.727		2.1	2.1	107					2
	2.657		2.1	2.1	107					2
	2.603		2.1	2.1	143					2
	2.304		2.1	2.1	143					2
	2.480		2.1	2.1	107					
	2.324		2.1	2.1	107					2
	2.394		2.1	2.1	107					2
	6.230	0.641	4	4	113.5		124	12	18.5	2
	6.229	0.641	4	4	113.5		124	12	18.5	2
	6.070	0.667	4	4	115		125	12	21	2
	5.250		4	4	165		125			2
	5.910	0.667	4	4	115		125	12	21	2
	5.910	0.667	4	4	115		125	12	21	2
	5.520	0.667	4	4	115		125	12	21	2
	5.360	0.667	4	4	115		125	12	21	2

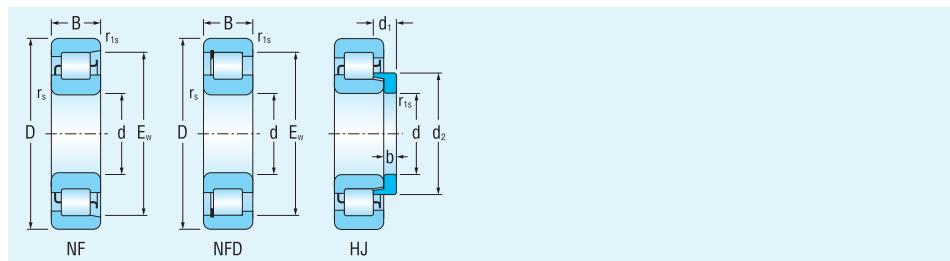


Single Row Cylindrical Roller Bearings

d = 90 - 100 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Oil
d	D	B		HJ	C_r kN	C_{or}	P_u kN		
mm								min ⁻¹	
90	190	64	NJ2318EMAS	HJ2318E*	430.2	526.7	57.879	2 800	3 300
	190	64	NU2318EMAS	HJ2318E*	430.2	526.7	57.879	2 800	3 300
	225	54	NJ418MAS*		389.6	422.3	44.907	2 700	3 200
	225	54	NU418MAS*		389.6	422.3	44.907	2 700	3 200
	225	54	NU418M*		389.6	422.3	44.939	2 700	3 200
	225	54	NJ418M*		389.6	422.3	44.939	2 700	3 200
95	170	32	NUP219EM*		220.2	264.7	29.600	3 500	4 200
	170	32	NJ219EM	HJ219E	220.2	264.7	29.600	3 500	4 200
	170	32	NJ219MA*		173.2	207.0	23.189	3 800	4 500
	170	32	NJ219M*		173.2	207.0	23.200	3 800	4 500
	170	32	NU219M*		173.2	207.0	23.200	3 800	4 500
	170	32	N219		165.5	194.8	21.833	3 800	4 500
	170	32	NU219		165.5	194.8	21.833	3 800	4 500
	170	32	NJ219		165.5	194.8	21.833	3 800	4 500
	170	43	NUP2219		230.3	297.9	33.388	3 800	4 500
	170	43	NJ2219		230.3	297.9	33.388	3 800	4 500
	170	43	NU2219		230.3	297.9	33.388	3 800	4 500
	200	45	NJ319EM		328.9	378.5	40.913	2 800	3 300
	200	45	NU319EM		328.9	378.5	40.913	2 800	3 300
	200	45	N319M*		267.9	303.4	32.928	3 200	3 800
	200	45	NU319M*		267.9	303.4	32.928	3 200	3 800
	200	45	N319		253.5	281.8	30.584	3 200	3 800
	200	45	NJ319		253.5	281.8	30.584	3 200	3 800
	200	45	NU319		253.5	281.8	30.584	3 200	3 800
100	67	NU2319EMA*			472.3	602.8	65.158	2 700	3 200
	55	NJ419M*			415.2	465.0	48.577	2 500	3 000
	55	NU419M			415.2	465.0	48.577	2 500	3 000
	34	N220M*			191.3	230.8	25.444	3 500	4 200
	34	NJ220M	HJ220		191.3	230.8	25.444	3 500	4 200
	34	NUP220M*			191.3	230.8	25.444	3 500	4 200
	34	NU220M	HJ220		191.3	230.8	25.444	3 500	4 200
	34	N220			182.8	217.2	23.945	3 500	4 200
	34	NUP220			182.8	217.2	23.945	3 500	4 200
	34	NJ220	HJ220*		182.8	217.2	23.945	3 500	4 200
	34	NU220	HJ220*		182.8	217.2	23.945	3 500	4 200
125	46	NU2220EMA*			333.5	444.4	48.887	3 200	3 900
	46	NJ2220M*			269.7	359.0	39.577	3 500	4 200
	46	NUP2220			257.7	337.9	37.251	3 500	4 200
	46	NJ2220			257.7	337.9	37.251	3 500	4 200
	46	NU2220			257.7	337.9	37.251	3 500	4 200
	47	NU320EMA*			379.1	424.3	44.981	2 700	3 200

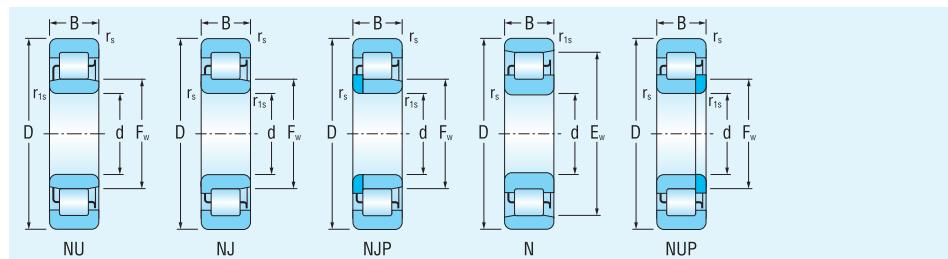


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r _s min	r _{ls} min	F _w	E _w	d ₂	b	b ₁	s ¹⁾
kg	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
	9.420	0.691	4	4	113.5		124	12	22	3.8
	9.210	0.691	4	4	113.5		124	12	22	3.8
	11.990		4	4	123.5					2.5
	11.540		4	4	123.5					2.5
	11.540		4	4	123.5					2.5
	11.790		4	4	123.5					2.5
	3.410		2.1	2.1	112.5					
	3.250	0.354	2.1	2.1	112.5		120.5	9	14	1.5
	3.220		2.1	2.1	113.5					2
	3.240		2.1	2.1	113.5					2
	3.150		2.1	2.1	113.5					2
	2.790		2.1	2.1		151.5				2
	2.830		2.1	2.1	113.5					2
	2.920		2.1	2.1	113.5					2
	3.960		2.1	2.1	113.5					
	3.880		2.1	2.1	113.5					3
	3.810		2.1	2.1	113.5					3
	7.170		4	4	121.5					1.9
	7.110		4	4	121.5					1.9
	6.720		4	4		173.5				2
	6.748		4	4	121.5					2
	6.090		4	4		173.5				2
	6.390		4	4	121.5					2
	6.200		4	4	121.5					2
	10.900		4	4	121.5					4.1
	13.860		4	4	133.5					2.5
	13.570		4	4	133.5					2.5
	3.730		2.1	2.1		160				2
	3.900	0.450	2.1	2.1	120		129.2	10	17	2
	3.940		2.1	2.1	120					
	3.780	0.450	2.1	2.1	120		129.2	10	17	2
	3.340		2.1	2.1		160				2
	3.600		2.1	2.1	120					
	3.510	0.450	2.1	2.1	120		129.2	10	17	2
	3.390	0.450	2.1	2.1	120		129.2	10	17	2
	5.420		2.1	2.1	119					2.5
	5.170		2.1	2.1	120					3
	4.810		2.1	2.1	120					
	4.720		2.1	2.1	120					3
	4.630		2.1	2.1	120					3
	8.840		4	4	127.5					2

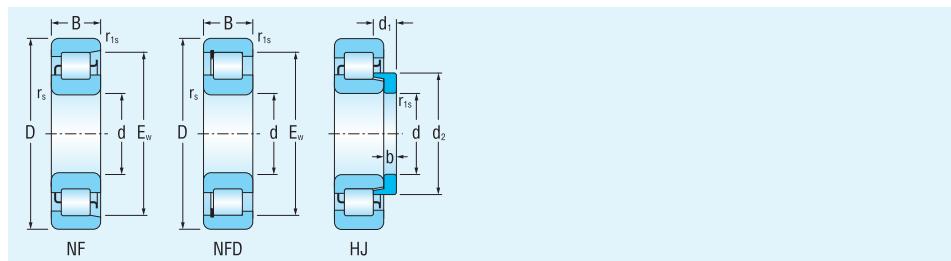


Single Row Cylindrical Roller Bearings

d = 100 - 110 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d	D	B		HJ	C_r kN	C_{or}	P_u kN	min⁻¹	
100	215	47	NUP320M		309.6	354.5	37.724	2 800	3 300
	215	47	N320M		309.6	354.5	37.724	2 800	3 300
	215	47	NJ320M	HJ320	309.6	354.5	37.724	2 800	3 300
	215	47	NU320M	HJ320	309.6	354.5	37.724	2 800	3 300
	215	47	NUP320*		293.0	329.2	35.032	2 800	3 300
	215	47	N320		293.0	329.2	35.032	2 800	3 300
	215	47	NJ320	HJ320	293.0	329.2	35.032	2 800	3 300
	215	47	NU320	HJ320	293.0	329.2	35.032	2 800	3 300
	215	73	NU2320EMAS		570.1	717.0	76.011	2 500	3 000
	215	73	NJ2320EMAS		570.1	717.0	76.011	2 500	3 000
	215	73	NJ2320EM		570.1	717.0	76.011	2 500	3 000
	215	73	NU2320EM		570.1	717.0	76.011	2 500	3 000
105	190	36	NU221M		210.1	256.0	27.784	3 300	4 000
	190	36	NUP221*		200.8	241.0	26.156	3 300	4 000
	190	36	N221		200.8	241.0	26.156	3 300	4 000
	190	36	NJ221		200.8	241.0	26.156	3 300	4 000
	190	36	NU221		200.8	241.0	26.156	3 300	4 000
	225	49	N321M*		354.2	408.2	42.836	2 700	3 200
	225	49	NJ321M*		354.2	408.2	42.836	2 700	3 200
	225	49	NU321M		354.2	408.2	42.836	2 700	3 200
	225	49	N321		335.0	379.1	39.783	2 700	3 200
	225	49	NJ321		335.0	379.1	39.783	2 700	3 200
	225	49	NU321		335.0	379.1	39.783	2 700	3 200
110	260	60	NJ421M	HJ421	515.1	585.1	59.571	2 200	2 700
	260	60	NU421M	HJ421	515.1	585.1	59.571	2 200	2 700
	200	38	NJ222MA*		240.1	289.7	30.947	3 200	3 800
	200	38	NU222MA		240.1	289.7	30.947	3 200	3 800
	200	38	NJ222		240.1	289.7	30.947	3 200	3 800
	200	38	N222		240.1	289.7	30.947	3 200	3 800
	200	38	NU222		240.1	289.7	30.947	3 200	3 800
	200	53	NJ222		333.2	441.5	47.163	3 200	3 800
	200	53	NU222		333.2	441.5	47.163	3 200	3 800
	240	50	NJ322EM*		439.6	507.6	52.157	2 400	2 800
	240	50	NU322EM*		439.6	507.6	52.157	2 400	2 800
	240	50	NJ322M	HJ322	401.0	467.1	48.160	2 500	3 000
	240	50	NJ322MA*		401.0	467.1	48.160	2 500	3 000
	240	50	N322M*		401.0	467.1	48.160	2 500	3 000
	240	50	NU322M	HJ322	401.0	467.1	48.160	2 500	3 000
	240	50	NJ322	HJ322	379.6	433.8	44.726	2 500	3 000
	240	50	N322		379.6	433.8	44.726	2 500	3 000

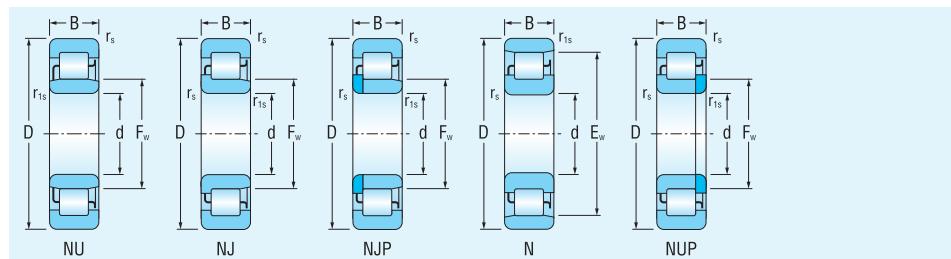


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r_s min	r_1s min	F_w	E_w	d_2	b	b_1	s ¹⁾
kg	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
	9.000		4	4	129.5					
	8.370		4	4		185.5				2
	8.720	0.930	4	4	129.5		141.9	13	22.5	2
	8.500	0.930	4	4	129.5		141.9	13	22.5	2
	8.100		4	4	129.5		141.9			
	7.530		4	4		185.5	141.9			2
	7.880	0.930	4	4	129.5		141.9	13	22.5	2
	7.660	0.930	4	4	129.5		141.9	13	22.5	2
	13.900		4	4	127.5					4.9
	14.100		4	4	127.5					4.9
	13.900		4	4	127.5					4.9
	13.900		4	4	127.5					4.9
	16.440		4	4	139					2.5
	4.470		2.1	2.1	126.8					
	4.400		2.1	2.1	126.8					2
	4.000		2.1	2.1		168.8				2
	4.185		2.1	2.1	126.8					2
	4.065		2.1	2.1	126.8					2
	9.580		4	4		195				4.5
	9.860		4	4	135					4.5
	9.670		4	4	135					4.5
	8.580		4	4		195				4.5
	8.930		4	4	135					4.5
	8.740		4	4	135					4.5
	17.620	1.740	4	4	144.5		159.7	16	27	2.5
	17.250	1.740	4	4	144.5		159.7	16	27	2.5
	5.510		2.1	2.1	132.5					2.5
	5.370		2.1	2.1	132.5					2.5
	4.910		2.1	2.1	132.5					2.5
	4.700		2.1	2.1		178.5				2.5
	4.770		2.1	2.1	132.5					2.5
	6.860		2.1	2.1	132.5					5
	6.720		2.1	2.1	132.5					5
	12.006		4	4	143					2.9
	11.806		4	4	143					2.9
	11.830	1.020	4	4	143		147.5	13	22.5	2.7
	11.830	1.020	4	4	143		147.5	13	22.5	2.7
	11.420		4	4		207				2.7
	11.580	1.020	4	4	143		147.5	13	22.5	2.7
	10.690	1.020	4	4	143		147.5	13	22.5	2.7
	10.280		4	4		207	147.5	13	22.5	2.7

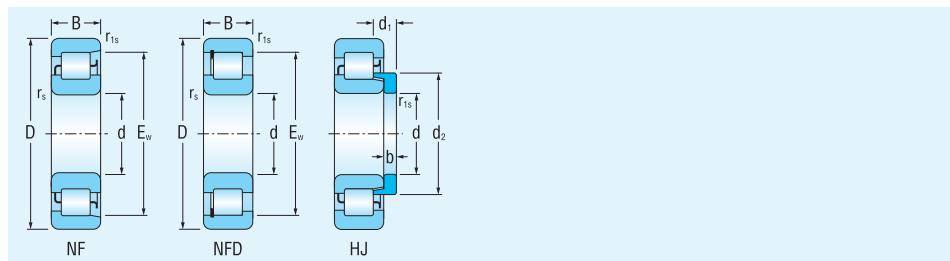


Single Row Cylindrical Roller Bearings

d = 110 - 140 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Oil
d	D	B		HJ	C_r kN	C_{or}	P_u kN		
mm								min ⁻¹	
110	240	50	NU322	HJ322	379.6	433.8	44.726	2 500	3 000
	280	65	NJ422M		569.5	654.7	65.346	2 100	2 500
	280	65	NU422M		569.5	654.7	65.346	2 100	2 500
120	180	28	NU1024M		138.6	191.0	20.625	3 300	4 000
	215	40	NUP224MA*		272.0	338.4	35.341	3 000	3 500
	215	40	NJ224MA*		272.0	338.4	35.341	3 000	3 500
	215	40	N224M*		272.0	338.4	35.352	3 000	3 500
	215	40	NJ224M		272.0	338.4	35.352	3 000	3 500
	215	40	N224		259.9	318.5	33.273	3 000	3 500
	215	40	NU224M		272.0	338.4	35.352	3 000	3 500
	215	40	NUP224		259.9	318.5	33.273	3 000	3 500
	215	40	NJ224		259.9	318.5	33.273	3 000	3 500
	215	40	NU224		259.9	318.5	33.273	3 000	3 500
	215	58	NJ224EM*		446.4	609.2	63.415	2 600	3 100
	215	58	NJ224EMA*		446.4	609.2	63.415	2 600	3 100
	215	58	NU2224		364.7	492.2	51.419	3 000	3 500
	215	58	NJ2224		364.7	492.2	51.419	3 000	3 500
	260	55	NUP324M		465.1	534.1	53.726	2 400	2 800
	260	55	NU324EM		516.2	592.8	59.443	2 200	2 700
	260	55	NJ324EMA		516.2	592.8	59.443	2 200	2 700
	260	55	NJ324MA*		465.1	534.1	53.726	2 400	2 800
	260	55	NJ324M	HJ324	465.1	534.1	53.726	2 400	2 800
	260	55	NU324M	HJ324	465.1	534.1	53.726	2 400	2 800
	260	86	NJ2324EMAS*		782.1	1 011.2	101.399	2 100	2 500
	260	86	NU2324EMAS		782.1	1 011.2	101.399	2 100	2 500
	310	72	NJ424M		714.4	834.5	80.887	1 900	2 200
	310	72	NU424M		714.4	834.5	80.887	1 900	2 200
130	180	30	NFD2926V		211.0	349.9	37.634	800	1 600
	200	33	NU1026MA		162.8	221.4	23.234	3 200	3 800
	200	33	NU1026M		162.8	221.4	23.234	3 200	3 800
	230	40	NU226MA		282.1	362.4	37.050	2 700	3 200
	230	40	NJ226M*		282.1	362.4	37.050	2 700	3 200
	230	40	NU226M		282.1	362.4	37.050	2 700	3 200
	230	40	N226		270.3	342.3	34.995	2 700	3 200
	230	40	NJ226		270.3	342.3	34.995	2 700	3 200
	230	40	NU226		270.3	342.3	34.995	2 700	3 200
	280	58	NU326EM	HJ326E*	603.2	715.6	70.156	2 000	2 400
	280	58	NJ326EM	HJ326E*	603.2	715.6	70.156	2 000	2 400
140	250	42	NJP228EMA*		385.1	502.0	50.105	2 300	2 800
	250	42	NU228EMA*		385.1	502.0	50.105	2 300	2 800
	250	42	N228M*		318.3	410.5	40.972	2 500	3 000

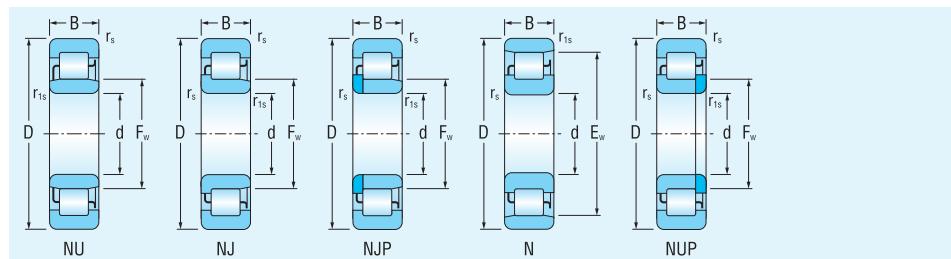


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁	s ¹⁾
	kg		mm							
	10.440	1.020	4	4	143		147.5	13	22.5	2.7
	22.350		4	4	155					2.7
	21.880		4	4	155					2.7
	2.180		2.1	1.1	135					2
	6.745		2.1	2.1	143.5					
	6.620		2.1	2.1	143.5					2.5
	6.178		2.1	2.1		191.5				2.5
	6.473		2.1	2.1	143.5					2.5
	5.620		2.1	2.1		191.5				2.5
	6.350		2.1	2.1	143.5					2.5
	6.040		2.1	2.1	143.5					
	5.870		2.1	2.1	143.5					2.5
	5.710		2.1	2.1	143.5					2.5
	10.300		2.1	2.1	143.5					4.6
	10.300		2.1	2.1	143.5					4.6
	8.290		2.1	2.1	143.5					5.4
	8.480		2.1	2.1	143.5					5.4
	15.330		4	4	154		168.5			
	15.200		4	4	154					2.9
	15.200		4	4	154					2.9
	15.040	1.440	4	4	154		168.5	14	23.5	2.7
	15.040	1.440	4	4	154		168.5	14	23.5	2.7
	14.710	1.440	4	4	154		168.5	14	23.5	2.7
	24.700		4	4	154					6.4
	24.300		4	4	154					6.4
	30.590		5	5	170					2.7
	29.960		5	5	170					2.7
	2.300		2.1	2.1		166				2
	3.780		2.1	1.1	148					2
	3.710		2.1	1.1	148					2
	7.330		4	4	156					2.5
	7.315		4	4	156					2.5
	7.315		4	4	156					2.5
	6.430		4	4		204				2.5
	6.700		4	4	156					2.5
	6.510		4	4	156					2.5
	18.600	1.700	4	4	167		182	14	23	2.9
	19.000	1.700	4	4	167		182	14	23	2.9
	9.650		4	4	169					1.6
	9.440		4	4	169					1.6
	8.897		4	4		221				2.5

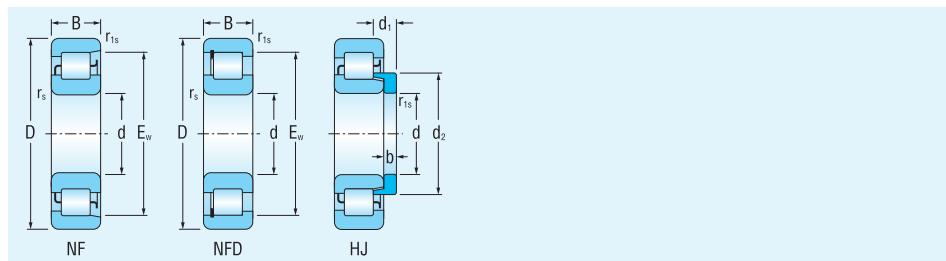


Single Row Cylindrical Roller Bearings

d = 140 - 180 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic	Basic load rating static	Fatigue load limit	Limiting speed for lubrication with grease	Oil
d	D	B		HJ	C_r kN	C_{or}	P_u kN		
mm								min ⁻¹	
140	250	42	NUP228M*		318.3	410.5	40.972	2 500	3 000
	250	42	NJ228M		318.3	410.5	40.972	2 500	3 000
	250	42	NU228M		318.3	410.5	40.972	2 500	3 000
	250	42	N228		305.0	387.7	38.696	2 500	3 000
	250	42	NU228		305.0	387.7	38.696	2 500	3 000
	250	42	NJ228		305.0	387.7	38.696	2 500	3 000
	300	62	NJ328EM*		663.2	797.1	76.523	1 900	2 200
	300	62	NJ328EMA*		663.2	797.1	76.523	1 900	2 200
	300	62	NU328M		603.4	725.8	69.868	2 000	2 400
	300	62	NJ328M		603.4	725.8	69.868	2 000	2 400
	300	102	NJ2328EM*		1 018.8	1 384.5	132.915	1 900	2 200
	300	102	NJP2328M*		909.3	1 229.8	118.063	2 000	2 400
	300	102	NU2328EM		1 018.8	1 384.5	132.915	1 900	2 200
	300	102	NJ2328M*	HJ2328	909.3	1 229.8	118.063	2 000	2 400
	300	102	NU2328M	HJ2328	909.3	1 229.8	118.063	2 000	2 400
150	225	35	NU1030M		192.2	274.9	27.763	2 700	3 200
	270	45	NJP230EMA*		440.2	581.3	56.583	2 200	2 700
	270	45	NJ230EMA*		440.2	581.3	56.583	2 200	2 700
	270	45	NU230EMA*		440.2	581.3	56.583	2 200	2 700
	270	45	NJ230EM*		440.2	581.3	56.583	2 200	2 700
	270	45	NU230EM		440.2	581.3	56.583	2 200	2 700
	270	45	NUP230M*		367.7	480.5	46.895	2 200	2 700
	270	45	NJ230M*		367.7	480.5	46.895	2 200	2 700
	270	45	NU230M		367.7	480.5	46.895	2 200	2 700
	270	45	NJ230		367.7	480.5	46.904	2 200	2 700
	270	45	NU230		367.7	480.5	46.904	2 200	2 700
	320	65	NJ330EM*		757.6	921.6	86.647	1 800	2 100
	320	65	NJ330M	HJ330	663.1	807.4	76.202	1 900	2 200
	320	65	NU330M	HJ330	663.1	807.4	76.202	1 900	2 200
160	290	48	NJ232EM	HJ232E*	498.6	666.4	63.550	2 000	2 400
	290	48	NU232EM	HJ232E*	498.6	666.4	63.550	2 000	2 400
	340	68	NU332EM		857.8	1 053.2	97.337	1 700	2 000
170	230	36	NFD2934V		307.6	565.7	56.090	600	1 100
	260	42	NU1034M		277.5	399.7	38.743	2 200	2 700
	310	52	NJP234EM*		589.0	777.2	72.617	1 900	2 200
	310	52	NJ234EM	HJ234E*	589.0	777.2	72.617	1 900	2 200
	310	52	NU234EM	HJ234E*	589.0	777.2	72.617	1 900	2 200
180	250	42	NFD2936V*		389.9	692.7	67.379	560	1 000
	280	46	NU1036M		334.6	474.5	44.418	2 100	2 500
	320	52	NJ236EM	HJ236E*	611.3	826.0	76.248	1 800	2 100

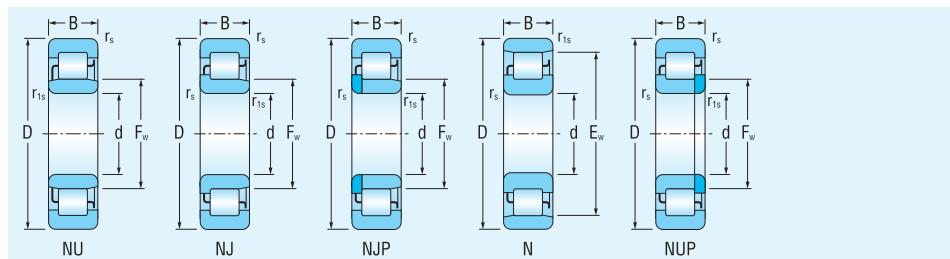


	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r_s min	r_1s min	F_w	E_w	d_2	b	b_1	s ¹⁾
	kg		mm							
	9.870		4	4	169					2.5
	9.330		4	4	169					2.5
	9.110		4	4	169					2.5
	8.140		4	4	169	221				2.5
	8.240		4	4	169					2.5
	8.460		4	4	169					2.5
	22.900		4	4	180					1.8
	22.900		4	4	180					1.8
	22.100		4	4	180					2.7
	22.840		4	4	180					2.7
	37.600		4	4	180					7.9
	36.760		4	4	180					9.2
	37.600		4	4	180					7.9
	36.100	2.380	4	4	180	197.6	15	33.5	9.2	
	35.300	2.380	4	4	180	197.6	15	33.5	9.2	
	47.16		5	5	196					
	4.680		2.1	1.7	169.5					2
	12.520		4	4	182					2.4
	12.520		4	4	182					2.4
	12.160		4	4	182					2.4
	12.520		4	4	182					2.4
	12.000		4	4	182					2.4
	12.050		4	4	182					
	11.800		4	4	182					2.4
	11.800		4	4	182					2.4
	10.810		4	4	182					2.4
	10.550		4	4	182					2.4
	27.100		4	4	193					1.8
	26.840	2.420	4	4	193	210	15	26.5	2.7	
	26.280	2.420	4	4	193	210	15	26.5	2.7	
	14.700	1.520	4	4	195	206.2	12	20	2.5	
	14.700	1.520	4	4	195	206.2	12	20	2.5	
	32.200		4	4	204					2.4
	4.230		2.1	2.1	215.35					2
	7.900		2.1	2.1	193					3
	18.400		4	4	207					2.9
	19.200	1.740	4	4	207	221.4	12	20	2.9	
	16.600	1.740	4	4	207	221.4	12	20	2.9	
	6.210		2.1	2.1	231.5					2.5
	9.858		2.1	2.1	205					3.6
	19.500	1.820	4	4	217	230.5	12	20	2.9	



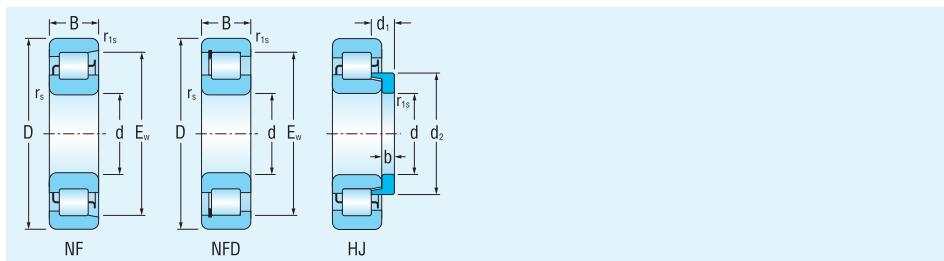
Single Row Cylindrical Roller Bearings

d = 180 - 200 mm



Dimensions			Bearing designation	Separate Thrust Collar	Basic load rating dynamic static		Fatigue load limit	Limiting speed for lubrication with grease oil	
d	D	B		HJ	C _r	C _{or}	P _u	kN	min ⁻¹
mm					kN				
180	320	52	NU236EM	HJ236E*	611.3	826.0	76.248	1 800	2 100
	320	86	NJ236M*		713.5	1 082.9	100.321	1 800	2 100
	320	86	NU236M*		713.5	1 082.9	100.321	1 800	2 100
190	290	46	NJP1038EMA*		411.2	612.0	57.395	1 970	2 360
	290	46	NU1038M*		354.8	520.3	48.795	1 900	2 200
200	310	51	NUP1040M*		381.9	567.1	52.226	1 900	2 200
	310	51	NJ1040M*		381.9	567.1	52.226	1 900	2 200
	310	51	NU1040M		381.9	567.1	52.226	1 900	2 200
	360	58	NJ240EM	HJ240E*	749.9	1 033.7	92.267	1 500	1 800
	360	58	NU240EM	HJ240E*	749.9	1 033.7	92.267	1 500	1 800

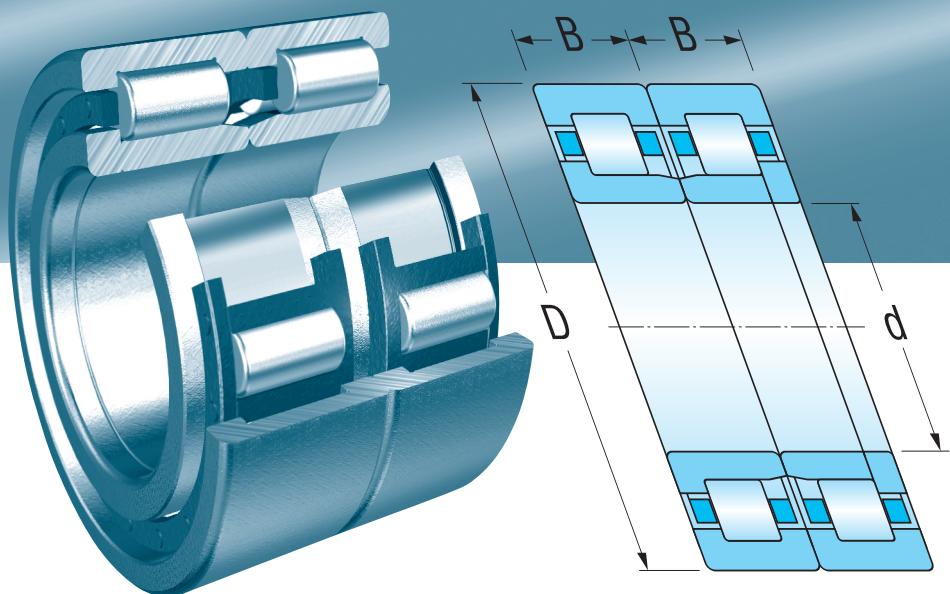
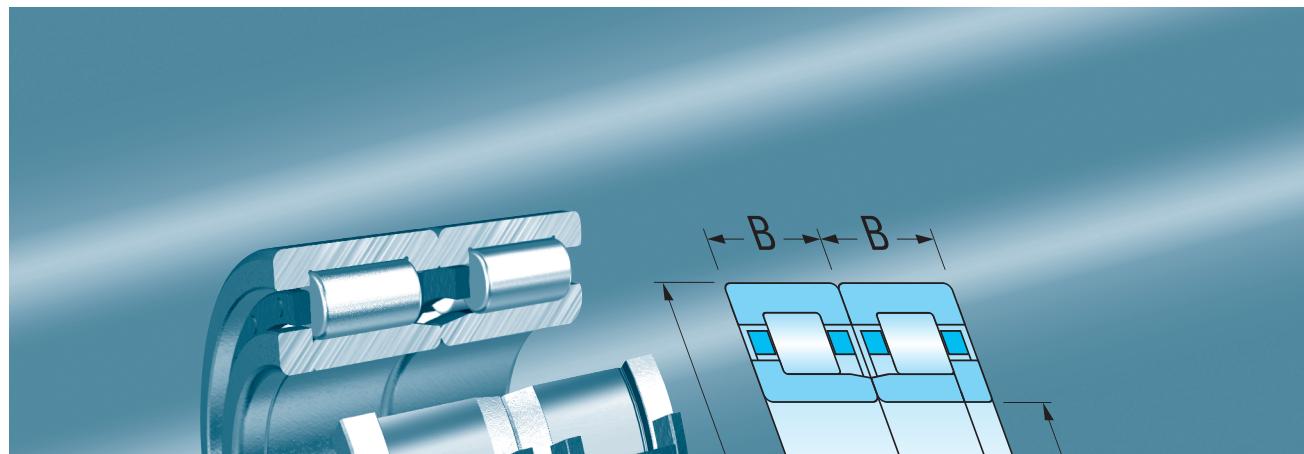
* produced after agreement with customer



	Mass of Bearings	Mass of separate Thrust Collar	Mating Dimensions							
			r _s min	r _{1s} min	F _w	E _w	d ₂	b	b ₁	s ¹⁾
	kg		mm							
	19.200	1.820	4	4	217		230.5	12	20	2.9
	31.900		4	4	218					6.9
	31.200		4	4	218					6.9
	12.100		2.1	2.1	214					2.5
	9.510		2.1	2.1	215					3.5
	14.750		2.1	2.1	229					
	14.000		2.1	2.1	229					4.2
	13.804		2.1	2.1	229					4.2
	27.900	2.710	4	4	243		257.8	14	23	2.9
	27.300	2.710	4	4	243		257.8	14	23	2.9

¹⁾ Permissible axial displacement out off central position





SPECIAL CYLINDRICAL ROLLER BEARINGS FOR RAILWAY VEHICLES



Special Cylindrical Roller Bearings for Railway Vehicles

KINEX bearings are used in railway vehicles for axleboxes, in traction motors and generators, in drives of blowers, in exciters and axle-driven generators, in compressors' motors and in gear-boxes.

For railway vehicle axleboxes the bearings with machined brass or plastic cages are manufactured. For higher speeds the internal design is specifically adapted.

The roller bearings with machined brass cages, in various design versions, are used mostly for traction motors and drives arrangements.

Under the term "railway vehicle" we understand:

- diesel and electric locomotives,
- diesel and electric motor train sets,
- motor coaches,
- passenger coaches,
- goods wagons,
- special railway vehicles.

The axle box bearing production is assured in compliance with the European standard EN 12080. The axle bearings correspond to the requirements of the European standard EN 12082, UIC 515-5.

Detailed information on bearings for railway vehicles (calculations, mounting, dismounting, maintenance...) are given in a special publication "Bearings for Railway Vehicles".

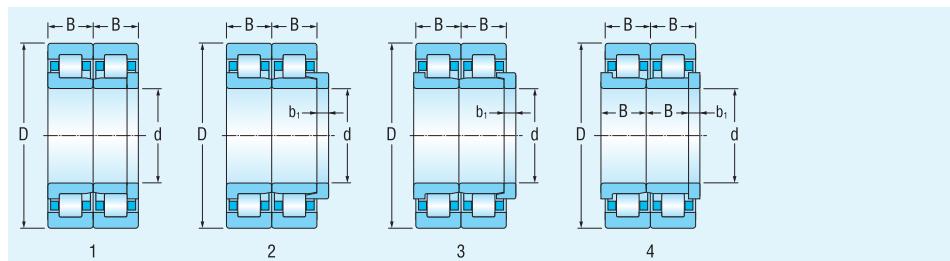






Single Row Cylindrical Roller Bearings for Railway Vehicle Axleboxes

d = 100 - 180 mm



Dimensions				Bearing designation	Cage	
d	D	B	b₁			
mm						
100	180	60.3	—	PLC 49-200-2	PLC 49-201-2 ¹⁾ ²⁾	TNG
110	215	73	—	PLC 410-207-1	PLC 410-208-1 ¹⁾ ²⁾	M
118	215	80	—	PLC 410-213-3	PLC 410-214-3	M
	240	80	—	PLC 410-13-2-3	PLC 410-14-2-3	TNG
	240	80	—	PLC 410-23	PLC 410-24 ¹⁾	M
119	240	80	—	PLC 410-13-2-4	PLC 410-14-2-4	TNG
120	200	62	—	PLC 49-202	PLC 49-203	M
	215	80	—	PLC 410-213	PLC 410-214	M
	240	80	—	PLC 410-13-2	PLC 410-14-2 ¹⁾ ²⁾	TNG
	240	80	—	PLC 410-13-1	PLC 410-14-1 ¹⁾ ²⁾	M
	240	80	—	PLC 410-13	PLC 410-14 ¹⁾ ²⁾	M
130	240	80	—	PLC 410-33-2	PLC 410-34-2 ¹⁾ ²⁾	TNG
	240	80	—	PLC 410-33-1	PLC 410-34-1 ¹⁾ ²⁾	M
	240	80	—	PLC 410-15	PLC 410-16 ¹⁾ ²⁾	M
	240	80	—	PLC 410-15-2	PLC 410-16-2	TNG
	240	80	—	PLC 410-215	PLC 410-216	TNG
	250	80	—	PLC 410-17	PLC 410-18 ¹⁾	M
159	300	84	15	PLC 411-20	PLC 411-21 ¹⁾	M
160	300	84	15	PLC 411-10	PLC 411-12 ¹⁾	M
180	320	86	17	NJ2236XM C4	NUC2236M C4 + NUP2236 ⁴⁾	M
	320	86	15	NJ2236XMAS C4	NUC2236MAS C4 + PLC 810-1	MAS
	320	86	15	NJ2236XM C4	NUC2236M C4 + PLC 810-1	M
	320	86	12	NJ2236M C4A450-900	NUC2236M C4 + HJ2236X	M

¹⁾ Pair of bearings is designated shortly e. g. PLC 410-13/14

²⁾ Bearings correspond to International Railway Standards UIC 510-1 and STN 024617

³⁾ TNG - Glass fibre reinforced Solid polyamide cage
M - Two piece machined brass cage

MAS - Two piece machined brass cage centered on outer ring with lubrication grooves

⁴⁾ Angle ring

Radial equivalent dynamic load:

Radial equivalent static load:

$$P_F = F_F$$

$$P_{or} = F_F$$



	Basic load rating dynamic	static	Fatigue load limit	Maximum speed of rail vehicle	Radial clearance	Tolerance class	Mass of a pair of bearings	Pict.
	C _r kN	C _{or}	P _u kN		min km.hod ⁻¹	max μm		
	333.5	444.4	48.887	160	105	140	P6	12
	494.5	668.6	70.485	160	105	160	P6	24.9
	519.8	740.9	77.125	160	125	160	P0	25.7
	553.8	742.5	75.910	160	120	160	P6	32.3
	553.8	742.5	75.910	160	120	160	P0	34.2
	553.8	742.5	75.910	160	120	160	P6	32.1
	372.8	549.1	58.157	120	120	165	P0	16
	519.8	740.9	77.125	160	125	160	P0	25.7
	553.8	742.5	75.910	160	120	160	P6	31.7
	553.8	742.5	75.910	160	120	160	P6	33.7
	553.8	742.5	75.910	160	120	160	P0	33.7
	539.6	775.4	78.753	160	135	180	P6	30.2
	539.6	775.4	78.753	160	135	180	P6	32.7
	516.3	752.1	76.262	160	135	180	P0	32.7
	516.3	752.1	76.262	160	135	180	P0	30.65
	539.6	775.4	78.753	200	130	180	P6	30.6
	580.0	800.3	80.503	160	135	180	P0	36.6
	869.5	1214.3	115.344	160	130	195	P0	57.9
	869.5	1214.3	115.344	160	130	195	P0	57.5
	713.5	1082.8	100.312	160	150	215	P0	64.8
	713.5	1082.8	100.312	160	150	215	P0	64.9
	713.5	1082.8	100.312	160	150	215	P0	64.9
	713.5	1082.8	100.312	160	150	215	P0	64.6

