Cages

Depending on the bearing series and size, SKF single row deep groove ball bearings are supplied with one of the following cages (→ **fig 9**):

- ribbon-type cage of steel or brass sheet (**a**)
- riveted cage of steel or brass sheet (**b**)
- machined brass cage (**c**)
- snap-type cage of polyamide 6,6 (**d**)

Bearings having a pressed steel cage in standard execution may also be available with a machined brass or polyamide cage. For higher operating temperatures, polyamide 4,6 or PEEK cages may be advantageous. Before ordering, please check for availability.

Note:

Deep groove ball bearings with polyamide 6,6 cages can be operated at temperatures up to +120 °C. The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties, with the exception of a few synthetic oils and greases with a synthetic oil base and lubricants containing a high proportion of EP additives when used at high temperatures.

For bearing arrangements, which are to be operated at continuously high temperatures or under arduous conditions, SKF recommends using bearings with a pressed steel or a machined brass cage.

For detailed information regarding the temperature resistance and the applicability of cages, please refer to the section "Cage materials", starting on **page 140**.

Minimum load

In order to provide satisfactory operation, deep groove ball bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the balls and cage, and the friction in the lubricant, can have a detrimental effect on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the balls and raceways.

The requisite minimum radial load to be applied to deep groove ball bearings can be estimated using

$$F_{rm} = k_r \left(\frac{\nu\, n}{1\,000}\right)^{2/3} \left(\frac{d_m}{100}\right)^2$$

where

F_{rm} = minimum radial load, kN
k_r = minimum load factor (→ product tables)
ν = oil viscosity at operating temperature, mm^2/s
n = rotational speed, r/min
d_m = bearing mean diameter = 0,5 (d + D), mm

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the deep groove ball bearing must be subjected to an additional radial load. For applications where deep groove ball bearings are used, an axial preload can be applied by adjusting the inner and outer rings against each other, or by using springs.

Axial load carrying capacity

If deep groove ball bearings are subjected to purely axial load, this axial load should generally not exceed the value of 0,5 C_0. Small bearings (bore diameter up to approx. 12 mm) and light series bearings (Diameter Series 8, 9, 0, and 1) should not be subjected to an axial load greater than 0,25 C_0. Excessive axial loads can lead to a considerable reduction in bearing service life.

Equivalent dynamic bearing load

$P = F_r$ when $F_a/F_r \le e$
$P = XF_r + YF_a$ when $F_a/F_r > e$

The factors e and Y depend on the relationship $f_0 F_a/C_0$, where f_0 is a calculation factor (→ product tables), F_a the axial component of the load and C_0 the basic static load rating.

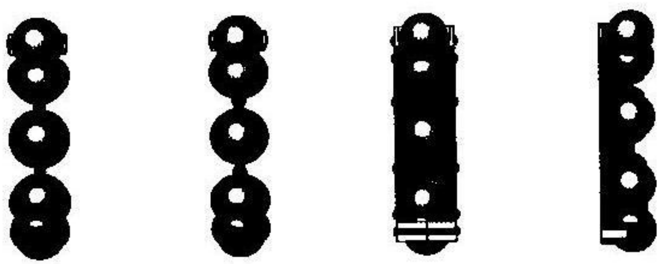
In addition, the factors are influenced by the magnitude of the radial internal clearance; increased clearance allows heavier axial loads to be supported. For bearings mounted with the usual fits as listed in **tables 2**, **4** and **5** on **pages 169** to **171**, the values for e, X and Y are listed in **table 5**. If a clearance greater than Normal is chosen because a reduction in clearance is expected in operation, the values given under "Normal clearance" should be used.

Equivalent static bearing load

$P_0 = 0,6\, F_r + 0,5\, F_a$

If $P_0 < F_r$, $P_0 = F_r$ should be used.

Fig 9



a b c d

Table 5

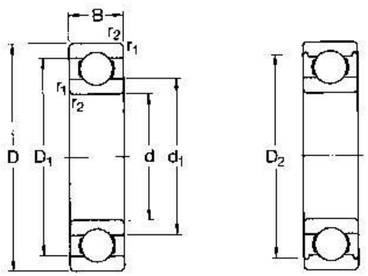
Calculation factors for single row deep groove ball bearings

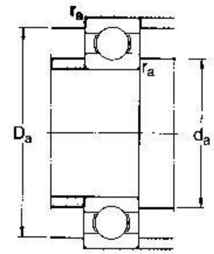
	Normal clearance			C3 clearance			C4 clearance		
$f_0 F_a/C_0$	e	X	Y	e	X	Y	e	X	Y
0,172	0,19	0,56	2,30	0,29	0,46	1,88	0,38	0,44	1,47
0,345	0,22	0,56	1,99	0,32	0,46	1,71	0,40	0,44	1,40
0,689	0,26	0,56	1,71	0,36	0,46	1,52	0,43	0,44	1,30
1,03	0,28	0,56	1,55	0,38	0,46	1,41	0,46	0,44	1,23
1,38	0,30	0,56	1,45	0,40	0,46	1,34	0,47	0,44	1,19
2,07	0,34	0,56	1,31	0,44	0,46	1,23	0,50	0,44	1,12
3,45	0,38	0,56	1,15	0,49	0,46	1,10	0,55	0,44	1,02
5,17	0,42	0,56	1,04	0,54	0,46	1,01	0,56	0,44	1,00
6,89	0,44	0,56	1,00	0,54	0,46	1,00	0,56	0,44	1,00

Intermediate values are obtained by linear interpolation

page 1

Single row deep groove ball bearings
d 3 – 10 mm





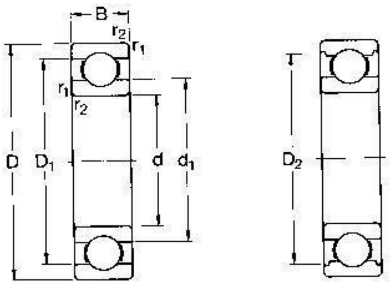
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
3	10	4	0,54	0,18	0,007	130 000	80 000	0,0015	**623**
4	9	2,5	0,54	0,18	0,007	140 000	85 000	0,0007	**618/4**
	11	4	0,715	0,232	0,010	130 000	80 000	0,0017	**619/4**
	12	4	0,806	0,28	0,012	120 000	75 000	0,0021	**604**
	13	5	0,936	0,29	0,012	110 000	67 000	0,0031	**624**
	16	5	1,11	0,38	0,016	95 000	60 000	0,0054	**634**
5	11	3	0,637	0,255	0,011	120 000	75 000	0,0012	**618/5**
	13	4	0,884	0,34	0,014	110 000	67 000	0,0025	**619/5**
	16	5	1,14	0,38	0,016	95 000	60 000	0,0050	* **625**
	19	6	2,34	0,95	0,04	80 000	50 000	0,0090	* **635**
6	13	3,5	0,884	0,345	0,015	110 000	67 000	0,0020	**618/6**
	15	5	1,24	0,475	0,02	100 000	63 000	0,0039	**619/6**
	19	6	2,34	0,95	0,04	80 000	50 000	0,0084	* **626**
7	14	3,5	0,956	0,4	0,017	100 000	63 000	0,0022	**618/7**
	17	5	1,48	0,56	0,024	90 000	56 000	0,0049	**619/7**
	19	6	2,34	0,95	0,04	85 000	53 000	0,0075	* **607**
	22	7	3,45	1,37	0,057	70 000	45 000	0,013	* **627**
8	16	4	1,33	0,57	0,024	90 000	56 000	0,0030	**618/8**
	19	6	1,9	0,735	0,031	80 000	50 000	0,0071	**619/8**
	22	7	3,45	1,37	0,057	75 000	48 000	0,012	* **608**
	24	8	3,9	1,66	0,071	63 000	40 000	0,017	* **628**
9	17	4	1,43	0,64	0,027	85 000	53 000	0,0034	**618/9**
	20	6	2,08	0,865	0,036	80 000	48 000	0,0076	**619/9**
	24	7	3,9	1,66	0,071	70 000	43 000	0,014	* **609**
	26	8	4,75	1,96	0,083	60 000	38 000	0,020	* **629**
10	19	5	1,38	0,585	0,025	80 000	48 000	0,0055	**61800**
	22	6	2,08	0,85	0,036	75 000	45 000	0,010	**61900**
	26	8	4,75	1,96	0,083	67 000	40 000	0,019	* **6000**
	28	8	4,62	1,96	0,083	63 000	40 000	0,022	**16100**
	30	9	5,4	2,36	0,1	56 000	34 000	0,032	* **6200**
	35	11	8,52	3,4	0,143	50 000	32 000	0,053	* **6300**

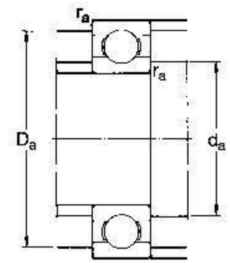
* SKF Explorer bearing

Dimensions					Abutment and fillet dimensions			Calculation factors	
d	d_1 ~	D_1 ~	D_2 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max	k_r	f_0
mm					mm			–	
3	5,2	7,5	8,2	0,15	4,2	8,8	0,1	0,025	7,5
4	5,2	7,5	–	0,1	4,6	8,4	0,1	0,015	10
	5,9	9	9,8	0,15	4,8	10,2	0,1	0,02	9,9
	6,1	9	–	0,2	5,4	10,6	0,2	0,025	10
	6,7	10,3	11,2	0,2	5,8	11,2	0,2	0,025	10
	8,4	12	13,3	0,3	6,4	13,6	0,3	0,03	8,4
5	6,8	9,3	–	0,15	5,8	10,2	0,1	0,015	11
	7,6	10,8	11,4	0,2	6,4	11,6	0,2	0,02	11
	8,4	12	13,3	0,3	7,4	13,6	0,3	0,025	8,4
	10,7	15,3	16,5	0,3	7,4	16,6	0,3	0,03	13
6	7,9	11,2	–	0,15	6,8	12,2	0,1	0,015	11
	8,6	12,4	13,3	0,2	7,4	13,6	0,2	0,02	10
	11,1	15,2	16,5	0,3	8,4	16,6	0,3	0,025	13
7	8,9	12,2	–	0,15	7,8	13,2	0,1	0,015	11
	9,8	14,2	15,2	0,3	9	15	0,3	0,02	10
	11,1	15,2	16,5	0,3	9	17	0,3	0,025	13
	12,2	17,6	19,2	0,3	9,4	19,6	0,3	0,025	12
8	10,1	14	–	0,2	9,4	14,6	0,2	0,015	11
	11,1	16,1	19	0,3	10	17	0,3	0,02	10
	12,1	17,6	19,2	0,3	10	20	0,3	0,025	12
	14,5	19,8	20,6	0,3	10,4	21,6	0,3	0,025	13
9	11,1	15	–	0,2	10,4	15,6	0,2	0,015	11
	12	17	17,9	0,3	11	18	0,3	0,02	11
	14,4	19,8	21,2	0,3	11	22	0,3	0,025	13
	14,8	21,2	22,6	0,3	11,4	23,6	0,3	0,025	12
10	12,6	16,4	–	0,3	12	17	0,3	0,015	9,4
	13	18,1	19	0,3	12	20	0,3	0,02	9,3
	14,8	21,2	22,6	0,3	12	24	0,3	0,025	12
	16,7	23,4	24,8	0,6	14,2	23,8	0,3	0,025	13
	17	23,2	24,8	0,6	14,2	25,8	0,6	0,025	13
	17,5	26,9	28,7	0,6	14,2	30,8	0,6	0,03	11

page 2

Single row deep groove ball bearings
d 12 – 22 mm





Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
12	21	5	1,43	0,67	0,028	70 000	43 000	0,0063	**61801**
	24	6	2,25	0,98	0,043	67 000	40 000	0,011	**61901**
	28	8	5,4	2,36	0,10	60 000	38 000	0,022	*** 6001**
	30	8	5,07	2,36	0,10	56 000	34 000	0,023	**16101**
	32	10	7,28	3,1	0,132	50 000	32 000	0,037	*** 6201**
	37	12	10,1	4,15	0,176	45 000	28 000	0,060	*** 6301**
15	24	5	1,56	0,8	0,034	60 000	36 000	0,0074	**61802**
	28	7	4,36	2,24	0,095	56 000	34 000	0,016	**61902**
	32	8	5,85	2,85	0,12	50 000	32 000	0,025	*** 16002**
	32	9	5,85	2,85	0,12	50 000	32 000	0,030	*** 6002**
	35	11	8,06	3,75	0,16	43 000	28 000	0,045	*** 6202**
	42	13	11,9	5,4	0,228	38 000	24 000	0,082	*** 6302**
17	26	5	1,68	0,93	0,039	56 000	34 000	0,0082	**61803**
	30	7	4,62	2,55	0,108	50 000	32 000	0,018	**61903**
	35	8	6,37	3,25	0,137	45 000	28 000	0,032	*** 16003**
	35	10	6,37	3,25	0,137	45 000	28 000	0,039	*** 6003**
	40	9	9,56	4,75	0,2	38 000	24 000	0,048	**98203**
	40	12	9,95	4,75	0,2	38 000	24 000	0,065	*** 6203**
	40	12	11,4	5,4	0,228	38 000	24 000	0,064	**6203 ETN9**
	47	14	14,3	6,55	0,275	34 000	22 000	0,12	*** 6303**
	62	17	22,9	10,8	0,455	28 000	18 000	0,27	**6403**
20	32	7	4,03	2,32	0,104	45 000	28 000	0,018	**61804**
	37	9	6,37	3,65	0,156	43 000	26 000	0,038	**61904**
	42	8	7,28	4,05	0,173	38 000	24 000	0,050	*** 16004**
	42	9	7,93	4,5	0,19	38 000	24 000	0,051	**98204 Y**
	42	12	9,95	5	0,212	38 000	24 000	0,069	*** 6004**
	47	14	13,5	6,55	0,28	32 000	20 000	0,11	*** 6204**
	47	14	15,6	7,65	0,325	32 000	20 000	0,096	**6204 ETN9**
	52	15	16,8	7,8	0,335	30 000	19 000	0,14	*** 6304**
	52	15	18,2	9	0,38	30 000	19 000	0,14	**6304 ETN9**
	72	19	30,7	15	0,64	24 000	15 000	0,40	**6404**
22	50	14	14	7,65	0,325	30 000	19 000	0,12	**62/22**
	56	16	18,6	9,3	0,39	28 000	18 000	0,18	**63/22**

* SKF Explorer bearing

SKF

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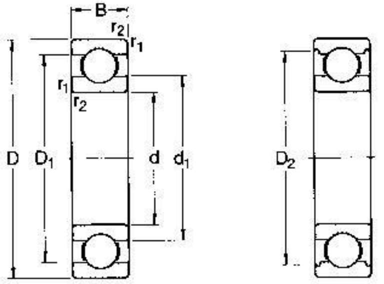
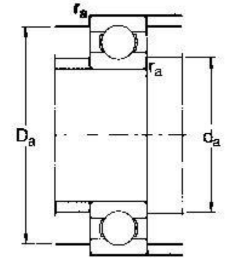
Dimensions					Abutment and fillet dimensions			Calculation factors	
d	d_1 ~	D_1 ~	D_2 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max	k_r	f_0
mm					mm			–	
12	15	18,2	–	0,3	14	19	0,3	0,015	9,7
	15,5	20,6	21,4	0,3	14	22	0,3	0,02	9,7
	17	23,2	24,8	0,3	14	26	0,3	0,025	13
	16,7	23,4	24,8	0,3	14,4	27,6	0,3	0,025	13
	18,5	25,7	27,4	0,6	16,2	27,8	0,6	0,025	12
	19,5	29,5	31,5	1	17,6	31,4	1	0,03	11
15	17,9	21,1	–	0,3	17	22	0,3	0,015	10
	18,4	24,7	25,8	0,3	17	26	0,3	0,02	14
	20,2	27	28,2	0,3	17	30	0,3	0,02	14
	20,5	26,7	28,2	0,3	17	30	0,3	0,025	14
	21,7	29	30,4	0,6	19,2	30,8	0,6	0,025	13
	23,7	33,7	36,3	1	20,6	36,4	1	0,03	12
17	20,2	23,2	–	0,3	19	24	0,3	0,015	10
	20,4	26,7	27,8	0,3	19	28	0,3	0,02	15
	22,7	29,5	31,2	0,3	19	33	0,3	0,02	14
	23	29,2	31,4	0,3	19	33	0,3	0,025	14
	24,5	32,7	–	0,6	21,2	35,8	0,6	0,025	13
	24,5	32,7	35	0,6	21,2	35,8	0,6	0,025	13
	23,9	33,5	–	0,6	21,2	35,8	0,6	0,03	12
	26,5	37,4	39,7	1	22,6	41,4	1	0,03	12
	32,4	46,6	–	1,1	23,5	55,5	1	0,035	11
20	24	28,3	–	0,3	22	30	0,3	0,015	15
	25,6	31,4	32,8	0,3	22	35	0,3	0,02	15
	27,3	34,6	–	0,3	22	40	0,3	0,02	15
	27,4	36	36,2	0,6	23,2	38,8	0,6	0,025	14
	27,2	34,8	37,2	0,6	23,2	38,8	0,6	0,025	14
	28,8	38,5	40,6	1	25,6	41,4	1	0,025	13
	28,2	39,6	–	1	25,6	41,4	1	0,025	12
	30,4	41,6	44,8	1,1	27	45	1	0,03	12
	30,2	42,6	–	1,1	27	45	1	0,03	12
	37,1	54,8	–	1,1	29	63	1	0,035	11
22	32,2	42,1	44	1	27,6	44,4	1	0,025	14
	32,2	46,2	–	1,1	29	47	1	0,03	12

page 3

Single row deep groove ball bearings
d 25 – 35 mm

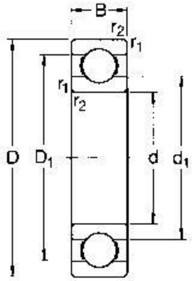


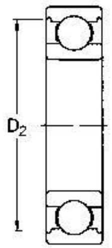


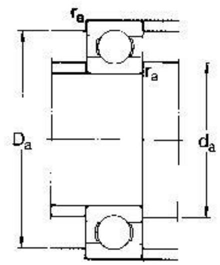
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
25	37	7	4,36	2,6	0,125	38 000	24 000	0,022	**61805**
	42	9	7,02	4,3	0,193	36 000	22 000	0,045	**61905**
	47	8	8,06	4,75	0,212	32 000	20 000	0,060	*** 16005**
	47	12	11,9	6,55	0,275	32 000	20 000	0,080	*** 6005**
	52	9	10,6	6,55	0,28	28 000	18 000	0,078	**98205**
	52	15	14,8	7,8	0,335	28 000	18 000	0,13	*** 6205**
	52	15	17,8	9,8	0,40	28 000	18 000	0,12	**6205 ETN9**
	62	17	23,4	11,6	0,49	24 000	16 000	0,23	*** 6305**
	62	17	26	13,4	0,57	24 000	16 000	0,21	**6305 ETN9**
	80	21	35,8	19,3	0,82	20 000	13 000	0,53	**6405**
28	58	16	16,8	9,5	0,405	26 000	16 000	0,18	**62/28**
	68	18	25,1	13,7	0,585	22 000	14 000	0,29	**63/28**
30	42	7	4,49	2,9	0,146	32 000	20 000	0,027	**61806**
	47	9	7,28	4,55	0,212	30 000	19 000	0,051	**61906**
	55	9	11,9	7,35	0,31	28 000	17 000	0,085	*** 16006**
	55	13	13,8	8,3	0,355	28 000	17 000	0,12	*** 6006**
	62	10	15,9	10,2	0,44	22 000	14 000	0,12	**98206**
	62	16	20,3	11,2	0,48	24 000	15 000	0,20	*** 6206**
	62	16	23,4	12,9	0,54	24 000	15 000	0,19	**6206 ETN9**
	72	19	29,6	16	0,67	20 000	13 000	0,35	*** 6306**
	72	19	32,5	17,3	0,74	22 000	14 000	0,33	**6306 ETN9**
	90	23	43,6	23,6	1,00	18 000	11 000	0,74	**6406**
35	47	7	4,75	3,2	0,17	28 000	18 000	0,030	**61807**
	55	10	9,56	6,8	0,29	26 000	16 000	0,080	**61907**
	62	9	13	8,15	0,38	24 000	15 000	0,11	*** 16007**
	62	14	16,8	10,2	0,44	24 000	15 000	0,16	*** 6007**
	72	17	27	15,3	0,66	20 000	13 000	0,29	*** 6207**
	72	17	31,2	17,6	0,75	20 000	13 000	0,27	**6207 ETN9**
	80	21	35,1	19	0,82	19 000	12 000	0,46	*** 6307**
	100	25	55,3	31	1,29	16 000	10 000	0,95	**6407**

* SKF Explorer bearing

Dimensions					Abutment and fillet dimensions			Calculation factors	
d	d_1 ~	D_1 ~	D_2 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max	k_r	f_0
mm					mm			–	
25	28,5	33,3	–	0,3	27	35	0,3	0,015	14
	30,2	36,8	37,8	0,3	27	40	0,3	0,02	15
	33,3	40,7	–	0,3	27	45	0,3	0,02	15
	32	40	42,2	0,6	28,2	43,8	0,6	0,025	14
	34,5	44	–	0,6	28,2	48,8	0,6	0,025	15
	34,4	44	46,3	1	30,6	46,4	1	0,025	14
	33,1	44,5	–	1	30,6	46,4	1	0,025	13
	36,6	50,4	52,7	1,1	32	55	1	0,03	12
	36,4	51,7	–	1,1	32	55	1	0,03	12
	45,4	62,9	–	1,5	34	71	1,5	0,035	12
28	37	49,2	–	1	33,6	52,4	1	0,025	14
	41,7	56	–	1,1	35	61	1	0.03	13
30	33,7	38,5	–	0,3	32	40	0,3	0,015	14
	35,2	41,8	42,8	0,3	32	45	0,3	0,02	14
	37,7	47,3	–	0,3	32	53	0,3	0,02	15
	38,2	46,8	49	1	34,6	50,4	1	0,025	15
	42,9	54,4	–	0,6	33,2	58,8	0,6	0,025	14
	40,4	51,6	54,1	1	35,6	56,4	1	0,025	14
	39,5	52,9	–	1	35,6	56,4	1	0,025	13
	44,6	59,1	61,9	1,1	37	65	1	0,03	13
	42,5	59,7	–	1,1	37	65	1	0,03	12
	50,3	69,7	–	1,5	41	79	1,5	0,035	12
35	38,7	43,5	–	0,3	37	45	0,3	0,015	14
	41,6	48,4	–	0,6	38,2	51,8	0,6	0,02	14
	44,1	53	–	0,3	37	60	0,3	0,02	14
	43,8	53,3	55,6	1	39,6	57,4	1	0,025	15
	46,9	60	62,7	1,1	42	65	1	0,025	14
	46,1	61,7	–	1,1	42	65	1	0,025	13
	49,6	65,4	69,2	1,5	44	71	1,5	0,03	13
	57,4	79,5	–	1,5	46	89	1,5	0,035	12







Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
40	52	7	4,94	3,45	0,19	26 000	16 000	0,034	**61808**
	62	12	13,8	10	0,43	24 000	14 000	0,12	**61908**
	68	9	13,8	9,15	0,44	22 000	14 000	0,13	* **16008**
	68	15	17,8	11,6	0,49	22 000	14 000	0,19	* **6008**
	80	18	32,5	19	0,80	18 000	11 000	0,37	* **6208**
	80	18	35,8	20,8	0,88	18 000	11 000	0,34	**6208 ETN9**
	90	23	42,3	24	1,02	17 000	11 000	0,63	* **6308**
	110	27	63,7	36,5	1,53	14 000	9 000	1,25	**6408**
45	58	7	6,63	6,1	0,26	22 000	14 000	0,040	**61809**
	68	12	14	10,8	0,47	20 000	13 000	0,14	**61909**
	75	10	16,5	10,8	0,52	20 000	12 000	0,17	* **16009**
	75	16	22,1	14,6	0,64	20 000	12 000	0,25	* **6009**
	85	19	35,1	21,6	0,92	17 000	11 000	0,41	* **6209**
	100	25	55,3	31,5	1,34	15 000	9 500	0,83	* **6309**
	120	29	76,1	45	1,90	13 000	8 500	1,55	**6409**
50	65	7	6,76	6,8	0,285	20 000	13 000	0,052	**61810**
	72	12	14,6	11,8	0,50	19 000	12 000	0,14	**61910**
	80	10	16,8	11,4	0,56	18 000	11 000	0,18	* **16010**
	80	16	22,9	16	0,71	18 000	11 000	0,26	* **6010**
	90	20	37,1	23,2	0,98	15 000	10 000	0,46	* **6210**
	110	27	65	38	1,6	13 000	8 500	1,05	* **6310**
	130	31	87,1	52	2,2	12 000	7 500	1,9	**6410**
55	72	9	9,04	8,8	0,38	19 000	12 000	0,083	**61811**
	80	13	16,5	14	0,60	17 000	11 000	0,19	**61911**
	90	11	20,3	14	0,70	16 000	10 000	0,26	* **16011**
	90	18	29,6	21,2	0,90	16 000	10 000	0,39	* **6011**
	100	21	46,2	29	1,25	14 000	9 000	0,61	* **6211**
	120	29	74,1	45	1,90	12 000	8 000	1,35	* **6311**
	140	33	99,5	62	2,60	11 000	7 000	2,3	**6411**
60	78	10	11,9	11,4	0,49	17 000	11 000	0,11	**61812**
	85	13	16,5	14,3	0,60	16 000	10 000	0,20	**61912**
	95	11	20,8	15	0,74	15 000	9 500	0,28	* **16012**
	95	18	30,7	23,2	0,98	15 000	9 500	0,42	* **6012**
	110	22	55,3	36	1,53	13 000	8 000	0,78	* **6212**
	130	31	85,2	52	2,20	11 000	7 000	1,7	* **6312**
	150	35	108	69,5	2,90	10 000	6 300	2,75	**6412**

* SKF Explorer bearing

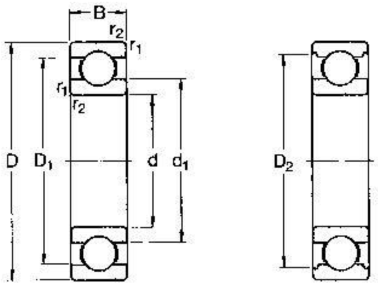
SKF

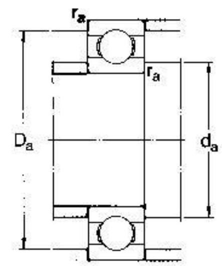
Dimensions					Abutment and fillet dimensions			Calculation factors	
d	d_1 ~	D_1 ~	D_2 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max	k_r	f_0
mm					mm			–	
40	43,7	48,5	–	0,3	42	50	0,3	0,015	14
	46,9	55,1	–	0,6	43,2	58,8	0,6	0,02	16
	49,4	58,6	–	0,3	42	66	0,3	0,02	14
	49,3	58,8	61,1	1	44,6	63,4	1	0,025	15
	52,6	67,4	69,8	1,1	47	73	1	0,025	14
	52	68,8	–	1,1	47	73	1	0,025	13
	56,1	73,8	77,7	1,5	49	81	1,5	0,03	13
	62,8	87	–	2	53	97	2	0,035	12
45	49,1	53,9	–	0,3	47	56	0,3	0,015	17
	52,4	60,6	–	0,6	48,2	64,8	0,6	0,02	16
	55	65,4	–	0,6	48,2	71,8	0,6	0,02	14
	54,8	65,3	67,8	1	50,8	69,2	1	0,025	15
	57,6	72,4	75,2	1,1	52	78	1	0,025	14
	62,2	82,7	86,7	1,5	54	91	1,5	0,03	13
	68,9	95,8	–	2	58	107	2	0,035	12
50	55,1	59,9	–	0,3	52	63	0,3	0,015	17
	56,9	65,1	–	0,6	53,2	68,8	0,6	0,02	16
	60	70	–	0,6	53,2	76,8	0,6	0,02	14
	59,8	70,3	72,8	1	54,6	75,4	1	0,025	15
	62,5	77,4	81,6	1,1	57	83	1	0,025	14
	68,8	91,1	95,2	2	61	99	2	0,03	13
	75,5	104	–	2,1	64	116	2	0,035	12
55	60,6	66,4	–	0,3	57	70	0,3	0,015	17
	63,2	71,8	–	1	59,6	75,4	1	0,02	16
	67	78,1	–	0,6	58,2	86,8	0,6	0,02	15
	66,3	78,7	81,5	1,1	61	84	1	0,025	15
	69,1	85,8	89,4	1,5	64	91	1,5	0,025	14
	75,3	99,5	104	2	66	109	2	0,03	13
	81,6	113	–	2,1	69	126	2	0,035	12
60	65,6	72,4	–	0,3	62	76	0,3	0,015	17
	68,2	76,8	–	1	64,6	80,4	1	0,02	16
	72	83	–	0,6	63,2	91,8	0,6	0,02	14
	71,3	83,7	86,5	1,1	66	89	1	0,025	16
	75,5	94,6	98	1,5	69	101	1,5	0,025	14
	81,9	108	112	2,1	72	118	2	0,03	13
	88,1	122	–	2,1	74	136	2	0,035	12

SKF

page 5

Single row deep groove ball bearings
d **65 – 85** mm

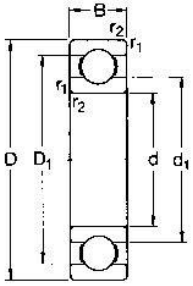


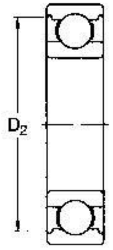


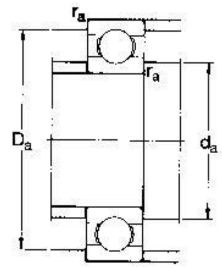
Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Reference speed	Limiting speed	**Mass**	**Designation**
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
65	85	10	12,4	12,7	0,54	16 000	10 000	0,13	**61813**
	90	13	17,4	16	0,68	15 000	9 500	0,22	**61913**
	100	11	22,5	16,6	0,83	14 000	9 000	0,30	* **16013**
	100	18	31,9	25	1,06	14 000	9 000	0,44	* **6013**
	120	23	58,5	40,5	1,73	12 000	7 500	0,99	* **6213**
	140	33	97,5	60	2,5	10 000	6 700	2,10	* **6313**
	160	37	119	78	3,15	9 500	6 000	3,30	**6413**
70	90	10	12,4	13,2	0,56	15 000	9 000	0,14	**61814**
	100	16	23,8	21,2	0,9	14 000	8 500	0,35	**61914**
	110	13	29,1	25	1,06	13 000	8 000	0,43	* **16014**
	110	20	39,7	31	1,32	13 000	8 000	0,60	* **6014**
	125	24	63,7	45	1,9	11 000	7 000	1,05	* **6214**
	150	35	111	68	2,75	9 500	6 300	2,50	* **6314**
	180	42	143	104	3,9	8 500	5 300	4,85	**6414**
75	95	10	12,7	14,3	0,61	14 000	8 500	0,15	**61815**
	105	16	24,2	19,3	0,965	13 000	8 000	0,37	**61915**
	110	12	28,6	27	1,14	13 000	8 000	0,38	**16115**
	115	13	30,2	27	1,14	12 000	7 500	0,46	* **16015**
	115	20	41,6	33,5	1,43	12 000	7 500	0,64	* **6015**
	130	25	68,9	49	2,04	10 000	6 700	1,20	* **6215**
	160	37	119	76,5	3	9 000	5 600	3,00	* **6315**
	190	45	153	114	4,15	8 000	5 000	6,80	**6415**
80	100	10	13	15	0,64	13 000	8 000	0,15	**61816**
	110	16	25,1	20,4	1,02	12 000	7 500	0,40	**61916**
	125	14	35,1	31,5	1,32	11 000	7 000	0,60	* **16016**
	125	22	49,4	40	1,66	11 000	7 000	0,85	* **6016**
	140	26	72,8	55	2,2	9 500	6 000	1,40	* **6216**
	170	39	130	86,5	3,25	8 500	5 300	3,60	* **6316**
	200	48	163	125	4,5	7 500	4 800	8,00	**6416**
85	110	13	19,5	20,8	0,88	12 000	7 500	0,27	**61817**
	120	18	31,9	30	1,25	11 000	7 000	0,55	**61917**
	130	14	35,8	33,5	1,37	11 000	6 700	0,63	* **16017**
	130	22	52	43	1,76	11 000	6 700	0,89	* **6017**
	150	28	87,1	64	2,5	9 000	5 600	1,80	* **6217**
	180	41	140	96,5	3,55	8 000	5 000	4,25	* **6317**
	210	52	174	137	4,75	7 000	4 500	9,50	**6417**

* SKF Explorer bearing

Dimensions					**Abutment and fillet dimensions**			**Calculation factors**	
d	d_1 ~	D_1 ~	D_2 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max	k_r	f_0
mm					mm			–	
65	71,6	78,4	–	0,6	68,2	81,8	0,6	0,015	17
	73,2	81,8	–	1	69,6	85,4	1	0,02	17
	76,5	88,4	–	0,6	68,2	96,8	0,6	0,02	16
	76,3	88,7	91,5	1,1	71	94	1	0,025	16
	83,3	102	106	1,5	74	111	1,5	0,025	15
	88,4	116	121	2,1	77	128	2	0,03	13
	94	131	–	2,1	79	146	2	0,035	12
70	76,6	83,4	–	0,6	73,2	86,8	0,6	0,015	17
	79,7	90,3	–	1	74,6	95,4	1	0,02	16
	83,3	96,8	–	0,6	73,2	106	0,6	0,02	16
	82,9	97,2	99,9	1,1	76	104	1	0,025	16
	87,1	108	111	1,5	79	116	1,5	0,025	15
	95	125	130	2,1	82	138	2	0,03	13
	104	146	–	3	86	164	2,5	0,035	12
75	81,6	88,4	–	0,6	78,2	91,8	0,6	0,015	17
	84,7	95,3	–	1	79,6	100	1	0,02	14
	88,3	102	–	0,6	77	108	0,3	0,02	16
	88,3	102	–	0,6	78,2	111	0,6	0,02	16
	87,9	102	105	1,1	81	109	1	0,025	16
	92,1	113	117	1,5	84	121	1,5	0,025	15
	101	133	138	2,1	87	148	2	0,03	13
	110	154	–	3	91	174	2,5	0,035	12
80	86,6	93,4	–	0,6	83,2	96,8	0,6	0,015	17
	89,8	100	102	1	84,6	105	1	0,02	14
	95,3	110	–	0,6	83,2	121	0,6	0,02	16
	94,4	111	114	1,1	86	119	1	0,025	16
	101	122	127	2	91	129	2	0,025	15
	108	142	147	2,1	92	158	2	0,03	13
	117	163	–	3	96	184	2,5	0,035	12
85	93,2	102	–	1	89,6	105	1	0,015	17
	96,4	109	–	1,1	91	114	1	0,02	16
	100	115	–	0,6	88,2	126	0,6	0,02	16
	99,4	116	119	1,1	92	123	1	0,025	16
	106	130	134	2	94	141	2	0,025	15
	115	151	155	3	99	166	2,5	0,03	13
	123	171	–	4	105	190	3	0,035	12







Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
90	115	13	19,5	22	0,915	11 000	7 000	0,28	**61818**
	125	18	33,2	31,5	1,23	11 000	6 700	0,59	**61918**
	140	16	43,6	39	1,56	10 000	6 300	0,85	* **16018**
	140	24	60,5	50	1,96	10 000	6 300	1,15	* **6018**
	160	30	101	73,5	2,8	8 500	5 300	2,15	* **6218**
	190	43	151	108	3,8	7 500	4 800	4,90	* **6318**
	225	54	186	150	5	6 700	4 300	11,5	**6418**
95	120	13	19,9	22,8	0,93	11 000	6 700	0,30	**61819**
	130	18	33,8	33,5	1,43	10 000	6 300	0,61	**61919**
	145	16	44,8	41,5	1,63	9 500	6 000	0,89	* **16019**
	145	24	63,7	54	2,08	9 500	6 000	1,20	* **6019**
	170	32	114	81,5	3	8 000	5 000	2,60	* **6219**
	200	45	159	118	4,15	7 000	4 500	5,65	* **6319**
100	125	13	19,9	24	0,95	10 000	6 300	0,31	**61820**
	140	20	42,3	41	1,63	9 500	6 000	0,83	**61920**
	150	16	46,2	44	1,73	9 500	5 600	0,91	* **16020**
	150	24	63,7	54	2,04	9 500	5 600	1,25	* **6020**
	180	34	127	93	3,35	7 500	4 800	3,15	* **6220**
	215	47	174	140	4,75	6 700	4 300	7,00	**6320**
105	130	13	20,8	19,6	1	10 000	6 300	0,32	**61821**
	145	20	44,2	44	1,7	9 500	5 600	0,87	**61921**
	160	18	54	51	1,86	8 500	5 300	1,20	* **16021**
	160	26	76,1	65,5	2,4	8 500	5 300	1,60	* **6021**
	190	36	140	104	3,65	7 000	4 500	3,70	* **6221**
	225	49	182	153	5,1	6 300	4 000	8,25	**6321**
110	140	16	28,1	26	1,25	9 500	5 600	0,60	**61822**
	150	20	43,6	45	1,66	9 000	5 600	0,90	**61922**
	170	19	60,2	57	2,04	8 000	5 000	1,45	* **16022**
	170	28	85,2	73,5	2,4	8 000	5 000	1,95	* **6022**
	200	38	151	118	4	6 700	4 300	4,35	* **6222**
	240	50	203	180	5,7	6 000	3 800	9,55	**6322**

* SKF Explorer bearing

Dimensions					Abutment and fillet dimensions			Calculation factors	
d	d_1 ~	D_1 ~	D_2 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max	k_r	f_0
mm					mm			–	
90	98,2	107	–	1	94,6	110	1	0,015	17
	101	114	117	1,1	96	119	1	0,02	16
	107	123	–	1	94,6	135	1	0,02	16
	106	124	128	1,5	97	133	1,5	0,025	16
	113	138	143	2	101	149	2	0,025	15
	121	159	164	3	104	176	2,5	0,03	13
	132	181	–	4	110	205	3	0,035	12
95	103	112	–	1	99,6	115	1	0,015	17
	106	119	122	1,1	101	124	1	0,02	17
	112	128	–	1	99,6	140	1	0,02	16
	111	129	133	1,5	102	138	1,5	0,025	16
	118	146	151	2,1	106	159	2	0,025	14
	128	167	172	3	109	186	2,5	0,03	13
100	108	117	–	1	105	120	1	0,015	17
	113	127	–	1,1	106	134	1	0,02	16
	116	134	–	1	105	145	1	0,02	17
	116	134	138	1,5	107	143	1,5	0,025	16
	125	155	160	2,1	111	169	2	0,025	14
	136	179	184	3	114	201	2,5	0,03	13
105	112	123	–	1	110	125	1	0,015	13
	118	132	–	1,1	111	139	1	0,02	17
	123	142	–	1	110	155	1	0,02	16
	123	143	147	2	116	149	2	0,025	16
	131	163	167	2,1	117	178	2	0,025	14
	142	188	–	3	119	211	2,5	0,03	13
110	119	131	–	1	115	135	1	0,015	14
	123	137	–	1,1	116	144	1	0,02	17
	130	150	–	1	115	165	1	0,02	16
	129	151	155	2	119	161	2	0,025	16
	138	172	177	2,1	122	188	2	0,025	14
	150	200	–	3	124	226	2,5	0,03	13

page 7

SKF double row deep groove ball bearings (→ **fig 1**) correspond in design to single row deep groove ball bearings. They have deep uninterrupted raceways and high conformity between the balls and raceways. They are able to carry axial loads acting in both directions in addition to radial loads.

Double row deep groove ball bearings are very suitable for bearing arrangements where the load carrying capacity of a single row bearing is inadequate. For the same outside and bore diameters, double row bearings are slightly wider than single row bearings but have considerably higher load carrying capacity than single row bearings in the 62 and 63 series.

Fig 1

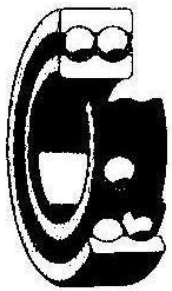
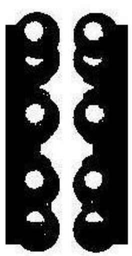


Fig 2



Bearing data – general

Dimensions

The boundary dimensions of SKF double row deep groove ball bearings are in accordance with ISO 15:1998.

Tolerances

SKF double row deep groove ball bearings are produced to Normal tolerances. The values for tolerances correspond to ISO 492:2002 and can be found in **table 3** on **page 125**.

Internal clearance

SKF double row deep groove ball bearings have Normal radial internal clearance as standard. The clearance limits are as specified in ISO 5753:1991 and can be found in **table 3** on **page 297**.

Misalignment

Misalignment of the inner ring relative to the outer ring of a double row deep groove ball bearing can only be accommodated by force, which leads to increased ball loads and cage forces and a reduction in bearing service life. For this reason, the maximum permissible angular misalignment is two minutes of arc. Any misalignment of the bearing rings will result in increased noise during operation.

Cages

SKF double row deep groove ball bearings are fitted with two glass fibre reinforced polyamide 6,6 cages (→ **fig 2**), designation suffix TN9.

Note:

Double row deep groove ball bearings with polyamide 6,6 cages can be operated at temperatures up to +120 °C. The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties, with the exception of a few synthetic oils and greases with a synthetic oil base, and lubricants containing a high proportion of EP additives when used at high temperatures.

For detailed information regarding the temperature resistance and the applicability of cages, please refer to the section "Cage materials", starting on **page 140**.

Minimum load

In order to obtain satisfactory operation, double row deep groove ball bearings, like all ball and roller bearings, must be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the balls and cages, and the friction in the lubricant, can have a detrimental effect on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the balls and raceways.

The requisite minimum load to be applied to double row deep groove ball bearings can be estimated using

$$F_{rm} = k_r \left(\frac{\nu n}{1\,000}\right)^{2/3} \left(\frac{d_m}{100}\right)^2$$

where

F_{rm} = minimum radial load, kN
k_r = minimum radial load factor (→ product table)
ν = oil viscosity at operating temperature, mm^2/s
n = rotational speed, r/min
d_m = bearing mean diameter = 0,5 (d + D), mm

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the double row deep groove ball bearings must be subjected to additional radial load.

Axial load carrying capacity

If double row deep groove ball bearings are subjected to a purely axial load, this axial load should generally not exceed the value of 0,5 C_0. Excessive axial loads can lead to a substantial reduction in bearing life.

Equivalent dynamic bearing load

$P = F_r$ when $F_a/F_r \leq e$
$P = 0{,}56\,F_r + YF_a$ when $F_a/F_r > e$

The factors e and Y depend on the relationship $f_0\,F_a/C_0$, where f_0 is a calculation factor (→ product table), F_a the axial component of the load and C_0 the basic static load rating.

If the bearings are mounted with the usual fits (shaft tolerance j5 or k5, depending on the shaft diameter, and housing bore tolerance J7) the values for e and Y given in **table 1** can be used to calculate the equivalent load.

Equivalent static bearing load

$P_0 = 0{,}6\,F_r + 0{,}5\,F_a$

If $P_0 < F_r$, $P_0 = F_r$ should be used.

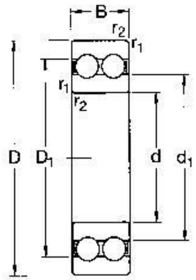
Table 1

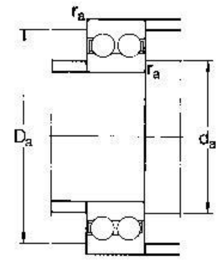
Calculation factors for double row deep groove ball bearings

$f_0\,F_a/C_0$	e	Y
0,172	0,19	2,30
0,345	0,22	1,99
0,689	0,26	1,71
1,03	0,28	1,55
1,38	0,30	1,45
2,07	0,34	1,31
3,45	0,38	1,15
5,17	0,42	1,04
6,89	0,44	1,00

Intermediate values are obtained by linear interpolation

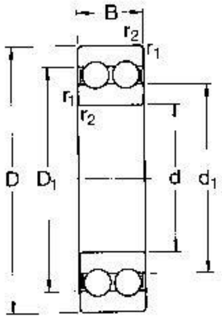
Double row deep groove ball bearings
d **10 – 65** mm

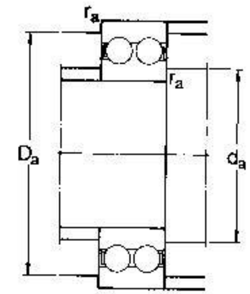




Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass	Designation
mm			kN		kN	r/min		kg	–
10	30	14	9,23	5,2	0,224	40 000	22 000	0,049	**4200 ATN9**
12	32	14	10,6	6,2	0,26	36 000	20 000	0,053	**4201 ATN9**
	37	17	13	7,8	0,325	34 000	18 000	0,092	**4301 ATN9**
15	35	14	11,9	7,5	0,32	32 000	17 000	0,059	**4202 ATN9**
	42	17	14,8	9,5	0,405	28 000	15 000	0,120	**4302 ATN9**
17	40	16	14,8	9,5	0,405	28 000	15 000	0,090	**4203 ATN9**
	47	19	19,5	13,2	0,56	24 000	13 000	0,16	**4303 ATN9**
20	47	18	17,8	12,5	0,53	24 000	13 000	0,14	**4204 ATN9**
	52	21	23,4	16	0,68	22 000	12 000	0,21	**4304 ATN9**
25	52	18	19	14,6	0,62	20 000	11 000	0,16	**4205 ATN9**
	62	24	31,9	22,4	0,95	18 000	10 000	0,34	**4305 ATN9**
30	62	20	26	20,8	0,88	17 000	9 500	0,26	**4206 ATN9**
	72	27	41	30	1,27	16 000	8 500	0,50	**4306 ATN9**
35	72	23	35,1	28,5	1,2	15 000	8 000	0,40	**4207 ATN9**
	80	31	50,7	38	1,63	14 000	7 500	0,69	**4307 ATN9**
40	80	23	37,1	32,5	1,37	13 000	7 000	0,50	**4208 ATN9**
	90	33	55,9	45	1,9	12 000	6 700	0,95	**4308 ATN9**
45	85	23	39	36	1,53	12 000	6 700	0,54	**4209 ATN9**
	100	36	68,9	56	2,4	11 000	6 000	1,25	**4309 ATN9**
50	90	23	41	40	1,7	11 000	6 000	0,58	**4210 ATN9**
	110	40	81,9	69,5	2,9	10 000	5 300	1,70	**4310 ATN9**
55	100	25	44,9	44	1,9	10 000	5 600	0,80	**4211 ATN9**
	120	43	97,5	83	3,45	9 000	5 000	2,15	**4311 ATN9**
60	110	28	57,2	55	2,36	9 500	5 300	1,10	**4212 ATN9**
	130	46	112	98	4,15	8 500	4 500	2,65	**4312 ATN9**
65	120	31	67,6	67	2,8	8 500	4 800	1,45	**4213 ATN9**
	140	48	121	106	4,5	8 000	4 300	3,25	**4313 ATN9**

Dimensions d	d_1 ~	D_1 ~	$r_{1,2}$ min	Abutment and fillet dimensions d_a min	D_a max	r_a max	Calculation factors k_r	f_0
mm				mm			–	
10	16,7	23,3	0,6	14	26	0,6	0,05	12
12	18,3	25,7	0,6	16	28	0,6	0,05	12
	20,5	28,5	1	17	32	1	0,06	12
15	21,5	29	0,6	19	31	0,6	0,05	13
	24,5	32,5	1	20	37	1	0,06	13
17	24,3	32,7	0,6	21	36	0,6	0,05	13
	28,7	38,3	1	22	42	1	0,06	13
20	29,7	38,3	1	25	42	1	0,05	14
	31,8	42,2	1,1	26,5	45,5	1	0,06	13
25	34,2	42,8	1	30	47	1	0,05	14
	37,3	49,7	1,1	31,5	55,5	1	0,06	13
30	40,9	51,1	1	35	57	1	0,05	14
	43,9	58,1	1,1	36,5	65,5	1	0,06	13
35	47,5	59,5	1,1	41,5	65,5	1	0,05	14
	49,5	65,4	1,5	43	72	1,5	0,06	13
40	54	66	1,1	46,5	73,5	1	0,05	15
	56,9	73,1	1,5	48	82	1,5	0,06	14
45	59,5	71,5	1,1	51,5	78,5	1	0,05	15
	63,5	81,5	1,5	53	92	1,5	0,06	14
50	65,5	77,5	1,1	56,5	83,5	1	0,05	15
	70	90	2	61	99	2	0,06	14
55	71,2	83,8	1,5	63	92	1,5	0,05	16
	76,5	98,5	2	64	111	2	0,06	14
60	75,6	90,4	1,5	68	102	1,5	0,05	15
	83,1	107	2,1	71	119	2	0,06	14
65	82,9	99,1	1,5	73	112	1,5	0,05	15
	89,6	115	2,1	76	129	2	0,06	14





Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
70	125	31	70,2	73,5	3,1	8 000	4 300	1,50	**4214 ATN9**
	150	51	138	125	5	7 000	3 800	3,95	**4314 ATN9**
75	130	31	72,8	80	3,35	7 500	4 000	1,60	**4215 ATN9**
	160	55	156	143	5,5	6 700	3 600	4,80	**4315 ATN9**
80	140	33	80,6	90	3,6	7 000	3 800	2,00	**4216 ATN9**
85	150	36	93,6	102	4	7 000	3 600	2,55	**4217 ATN9**
90	160	40	112	122	4,65	6 300	3 400	3,20	**4218 ATN9**
100	180	46	140	156	5,6	5 600	3 000	4,70	**4220 ATN9**

Dimensions				Abutment and fillet dimensions			Calculation factors	
d	d_1 ~	D_1 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max	k_r	f_0
mm				mm			–	
70	89,4	106	1,5	78	117	1,5	0,05	15
	96,7	124	2,1	81	139	2	0,06	14
75	96,9	114	1,5	83	122	1,5	0,05	16
	103	132	2,1	86	149	2	0,06	14
80	102	120	2	89	131	2	0,05	16
85	105	125	2	94	141	2	0,05	15
90	114	136	2	99	151	2	0,05	15
100	130	154	2,1	111	169	2	0,05	15

Load carrying capacity of bearing pairs

The values for basic load ratings and fatigue load limits given in the product table apply to single bearings. For bearing pairs mounted immediately adjacent to each other the following values apply:

- basic dynamic load rating for standard bearings in all arrangements and for SKF Explorer bearings in back-to-back or face-to-face arrangement
  $C = 1{,}62 \times C_{single\ bearing}$
- basic dynamic load rating for SKF Explorer bearings in tandem arrangement
  $C = 2 \times C_{single\ bearing}$
- basic static load rating
  $C_0 = 2 \times C_{0\ single\ bearing}$
- fatigue load limit
  $P_u = 2 \times P_{u\ single\ bearing}$

Minimum load

In order to provide satisfactory operation, angular contact ball bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the balls and cage, and the friction in the lubricant, have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the balls and raceways.

The requisite minimum load to be applied to single bearings and bearing pairs arranged in tandem can be estimated using

$$F_{am} = k_a \frac{C_0}{1\,000} \left(\frac{n\,d_m}{100\,000}\right)^2$$

and for bearing pairs arranged back-to-back or face-to-face from

$$F_{rm} = k_r \left(\frac{v\,n}{1\,000}\right)^{2/3} \left(\frac{d_m}{100}\right)^2$$

Table 3

Minimum load factors

Bearing series	Minimum load factors k_a	k_r
–	–	
72 BE	1,4	0,095
72 B	1,2	0,08
73 BE	1,6	0,1
73 B	1,4	0,09

where

F_{am} = minimum axial load, kN
F_{rm} = minimum radial load, kN
C_0 = basic static load rating of single bearing, or bearing pair, kN (→ product table)
k_a = minimum axial load factor according to **table 3**
k_r = minimum radial load factor according to **table 3**
v = oil viscosity at operating temperature, mm^2/s
n = rotational speed, r/min
d_m = bearing mean diameter = 0,5 (d + D), mm

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the angular contact ball bearing must be subjected to an additional load. Single bearings and bearing pairs arranged in tandem can be axially preloaded by adjusting the inner or outer rings against each other, or by using springs.

Equivalent dynamic bearing load

For single bearings and bearings paired in tandem

$P = F_r$ when $F_a/F_r \le 1{,}14$
$P = 0{,}35\,F_r + 0{,}57\,F_a$ when $F_a/F_r > 1{,}14$

When determining the axial force F_a reference should be made to the section "Determining axial force for bearings mounted singly or paired in tandem".

For bearings mounted in pairs arranged back-to-back or face-to-face

$P = F_r + 0{,}55\,F_a$ when $F_a/F_r \le 1{,}14$
$P = 0{,}57\,F_r + 0{,}93\,F_a$ when $F_a/F_r > 1{,}14$

F_r and F_a are the forces acting on the bearing pair.

Equivalent static bearing load

For single bearings and bearings paired in tandem

$P_0 = 0{,}5\,F_r + 0{,}26\,F_a$

If $P_0 < F_r$, then $P_0 = F_r$ should be used. When determining the axial force F_a reference should be made to the section "Determining axial force for bearings mounted singly or paired in tandem".

For bearings mounted in pairs arranged back-to-back or face-to-face

$P_0 = F_r + 0{,}52\,F_a$

F_r and F_a are the forces acting on the bearing pair.

Determining axial force for bearings mounted singly or paired in tandem

When a radial load is applied, the load is transmitted from one raceway to the other at an angle to the bearing axis and an internal axial force will be induced in single row angular contact ball bearings. This must be considered when calculating the equivalent bearing loads for bearing arrangements consisting of two single bearings and/or bearing pairs arranged in tandem.

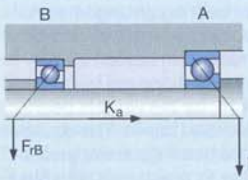
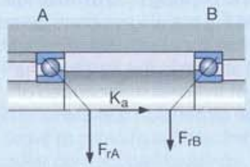
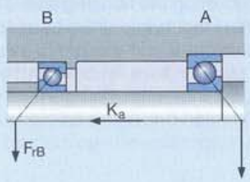
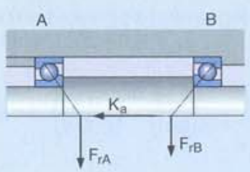
The necessary equations are given in **table 4, page 414**, for the various bearing arrangements and load cases. The equations are only valid if the bearings are adjusted against each other to practically zero clearance, but without any preload. In the arrangements shown, bearing A is subjected to a radial load F_{rA} and bearing B to a radial load F_{rB}. Both F_{rA} and F_{rB} are always considered positive even when they act in the direction opposite to that shown in the figures. The radial loads act at the pressure centres of the bearings (see dimension a in the product table).

Variable R

The variable R from **table 4** takes into account the contact conditions inside the bearing. The values for R can be obtained from **diagram 1, page 415**, as a function of the ratio K_a/C. K_a is the external axial load acting on the shaft or on the housing and C is the basic dynamic load rating of the bearing, which must accommodate the external axial load. For $K_a = 0$ use $R = 1$.

Table 4

Axial loading of bearing arrangements incorporating two single row B or BE design angular contact ball bearings and/or bearing pairs in tandem

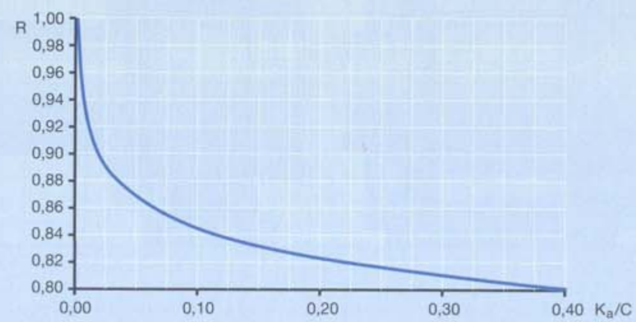
Bearing arrangement	Load case	Axial forces	
Back-to-back 	Case 1a $F_{rA} \ge F_{rB}$ $K_a \ge 0$	$F_{aA} = R\,F_{rA}$	$F_{aB} = F_{aA} + K_a$
	Case 1b $F_{rA} < F_{rB}$ $K_a \ge R\,(F_{rB} - F_{rA})$	$F_{aA} = R\,F_{rA}$	$F_{aB} = F_{aA} + K_a$
Face-to-face 	Case 1c $F_{rA} < F_{rB}$ $K_a < R\,(F_{rB} - F_{rA})$	$F_{aA} = F_{aB} - K_a$	$F_{aB} = R\,F_{rB}$
Back-to-back 	Case 2a $F_{rA} \le F_{rB}$ $K_a \ge 0$	$F_{aA} = F_{aB} + K_a$	$F_{aB} = R\,F_{rB}$
	Case 2b $F_{rA} > F_{rB}$ $K_a \ge R\,(F_{rA} - F_{rB})$	$F_{aA} = F_{aB} + K_a$	$F_{aB} = R\,F_{rB}$
Face-to-face 	Case 2c $F_{rA} > F_{rB}$ $K_a < R\,(F_{rA} - F_{rB})$	$F_{aA} = R\,F_{rA}$	$F_{aB} = F_{aA} - K_a$

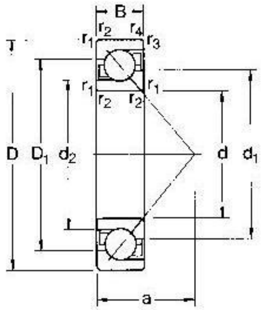
Supplementary designations

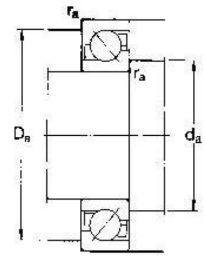
The designation suffixes used to identify certain features of SKF single row angular contact ball bearings are explained in the following.

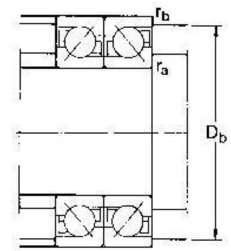
- **A** 30° contact angle
- **AC** 25° contact angle
- **B** 40° contact angle
- **CA** Bearing for universal matching in random order; when arranged back-to-back or face-to-face the axial internal clearance will be smaller than Normal (CB)
- **CB** Bearing for universal matching in random order; when arranged back-to-back or face-to-face the axial internal clearance will be Normal
- **CC** Bearing for universal matching in random order; when arranged back-to-back or face-to-face the axial internal clearance will be greater than Normal (CB)
- **DB** Two bearings matched back-to-back
- **DF** Two bearings matched face-to-face
- **DT** Two bearings matched in tandem
- **E** Optimized internal design
- **F** Machined steel cage
- **GA** Bearing for universal matching mounted in random order; when arranged back-to-back or face-to-face there will be a light preload
- **GB** Bearing for universal matching mounted in random order; when arranged back-to-back or face-to-face there will be a moderate preload
- **GC** Bearing for universal matching mounted in random order; when arranged back-to-back or face-to-face there will be a heavy preload
- **J** Pressed steel cage, ball centred
- **M** Machined brass cage, ball centred, different designs are identified by a figure, e.g. M1
- **N1** One locating slot in the outer ring
- **N2** Two locating slots in the outer ring, positioned at 180° to each other
- **P** Injection moulded cage of glass fibre reinforced polyamide 6,6, ball centred
- **PH** Injection moulded cage of polyether-etherketone (PEEK), ball centred
- **P5** Dimensional and running accuracy to ISO tolerance class 5
- **P6** Dimensional and running accuracy to ISO tolerance class 6
- **W64** Solid Oil filling
- **Y** Pressed window-type brass cage, ball centred

Diagram 1





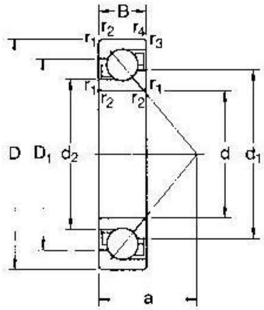


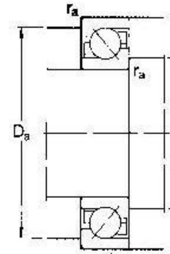


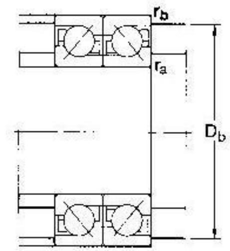
Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designations[1]	
			dynamic	static		Reference speed	Limiting speed		Universally matchable bearing	Basic design bearing
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
10	30	9	7,02	3,35	0,14	30 000	30 000	0,030	**7200 BECBP**	**7200 BEP**
12	32	10	7,61	3,8	0,16	26 000	26 000	0,036	**7201 BECBP**	**7201 BEP**
	37	12	10,6	5	0,208	24 000	24 000	0,063	–	**7301 BEP**
15	35	11	9,5	5,1	0,216	26 000	26 000	0,045	★ **7202 BECBP**	–
	35	11	8,84	4,8	0,204	24 000	24 000	0,045	–	**7202 BEP**
	42	13	13	6,7	0,28	20 000	20 000	0,081	**7302 BECBP**	**7302 BEP**
17	40	12	11	5,85	0,25	22 000	22 000	0,064	★ **7203 BECBP**	–
	40	12	10,4	5,5	0,236	20 000	20 000	0,064	–	**7203 BEP**
	40	12	11,1	6,1	0,26	20 000	20 000	0,064	–	**7203 BEY**
	40	12	11	5,85	0,25	22 000	22 000	0,070	★ **7203 BECBM**	–
	47	14	15,9	8,3	0,355	19 000	19 000	0,11	**7303 BECBP**	**7303 BEP**
20	47	14	14	8,3	0,355	18 000	18 000	0,11	**7204 BECBP**	**7204 BEP**
	47	14	14	8,3	0,355	18 000	18 000	0,11	**7204 BECBY**	–
	47	14	13,3	7,65	0,325	18 000	19 000	0,11	**7204 BECBM**	–
	52	15	19	10	0,425	18 000	18 000	0,14	★ **7304 BECBP**	–
	52	15	17,4	9,5	0,4	16 000	16 000	0,14	–	**7304 BEP**
	52	15	19	10,4	0,44	16 000	16 000	0,15	**7304 BECBY**	**7304 BEY**
	52	15	19	10	0,425	18 000	18 000	0,15	★ **7304 BECBM**	–
25	52	15	15,6	10	0,43	17 000	17 000	0,13	★ **7205 BECBP**	–
	52	15	14,8	9,3	0,4	15 000	15 000	0,13	–	**7205 BEP**
	52	15	15,6	10,2	0,43	15 000	15 000	0,13	**7205 BECBY**	**7205 BEY**
	52	15	15,6	10	0,43	17 000	17 000	0,14	★ **7205 BECBM**	–
	62	17	26,5	15,3	0,655	15 000	15 000	0,23	★ **7305 BECBP**	–
	62	17	24,2	14	0,6	14 000	14 000	0,23	–	**7305 BEP**
	62	17	26	15,6	0,655	14 000	14 000	0,24	**7305 BECBY**	**7305 BEY**
	62	17	26,5	15,3	0,655	15 000	15 000	0,24	★ **7305 BECBM**	–
30	62	16	24	15,6	0,655	14 000	14 000	0,19	★ **7206 BECBP**	–
	62	16	22,5	14,3	0,61	13 000	13 000	0,19	–	**7206 BEP**
	62	16	23,8	15,6	0,655	13 000	13 000	0,21	**7206 BECBY**	**7206 BEY**
	62	16	24	15,6	0,655	14 000	14 000	0,21	★ **7206 BECBM**	–
	72	19	35,5	21,2	0,9	13 000	13 000	0,33	★ **7306 BECBP**	–
	72	19	32,5	19,3	0,815	12 000	12 000	0,33	–	**7306 BEP**
	72	19	34,5	21,2	0,9	12 000	12 000	0,37	**7306 BECBY**	**7306 BEY**
	72	19	35,5	21,2	0,9	13 000	13 000	0,37	★ **7306 BECBM**	–

★ SKF Explorer bearing
[1] For available final variants → **matrix 1** on **page 417**

Dimensions							Abutment and fillet dimensions				
d	d_1 ~	d_2 ~	D_1 ~	$r_{1,2}$ min	$r_{3,4}$ min	a	d_a min	D_a max	D_b max	r_a max	r_b max
mm							mm				
10	18,3	14,6	22,9	0,6	0,3	13	14,2	25,8	27,6	0,6	0,3
12	20,2	16,6	25	0,6	0,3	14,4	16,2	27,8	29,6	0,6	0,3
	21,8	17	28,3	1	0,6	16,3	17,6	31,4	32,8	1	0,6
15	22,7	19	27,8	0,6	0,3	16	19,2	30,8	32,6	0,6	0,3
	22,7	19	27,8	0,6	0,3	16	19,2	30,8	32,6	0,6	0,3
	26	20,7	32,6	1	0,6	18,6	20,6	36,4	37,8	1	0,6
17	26,3	21,7	31,2	0,6	0,6	18	21,2	35,8	35,8	0,6	0,6
	26,3	21,7	31,2	0,6	0,6	18	21,2	35,8	35,8	0,6	0,6
	26,3	21,7	31,2	0,6	0,6	18	21,2	35,8	35,8	0,6	0,6
	26,3	21,7	31,2	0,6	0,6	18	21,2	35,8	35,8	0,6	0,6
	28,7	22,8	36,2	1	0,6	20,4	22,6	41,4	42,8	1	0,6
20	30,8	25,9	37	1	0,6	21	25,6	41,4	42,8	1	0,6
	30,8	25,9	37	1	0,6	21	25,6	41,4	42,8	1	0,6
	30,8	25,9	37	1	0,6	21	25,6	41,4	42,8	1	0,6
	33,3	26,8	40,4	1,1	0,6	22,8	27	45	47,8	1	0,6
	33,3	26,8	40,4	1,1	0,6	22,8	27	45	47,8	1	0,6
	33,3	26,8	40,4	1,1	0,6	22,8	27	45	47,8	1	0,6
	33,3	26,8	40,4	1,1	0,6	22,8	27	45	47,8	1	0,6
25	36,1	30,9	41,5	1	0,6	23,7	30,6	46,4	47,8	1	0,6
	36,1	30,9	41,5	1	0,6	23,7	30,6	46,4	47,8	1	0,6
	36,1	30,9	41,5	1	0,6	23,7	30,6	46,4	47,8	1	0,6
	36,1	30,9	41,5	1	0,6	23,7	30,6	46,4	47,8	1	0,6
	39,8	32,4	48,1	1,1	0,6	26,8	32	55	57,8	1	0,6
	39,8	32,4	48,1	1,1	0,6	26,8	32	55	57,8	1	0,6
	39,8	32,4	48,1	1,1	0,6	26,8	32	55	57,8	1	0,6
	39,8	32,4	48,1	1,1	0,6	26,8	32	55	57,8	1	0,6
30	42,7	36,1	50,1	1	0,6	27,3	35,6	56,4	57,8	1	0,6
	42,7	36,1	50,1	1	0,6	27,3	35,6	56,4	57,8	1	0,6
	42,7	36,1	50,1	1	0,6	27,3	35,6	56,4	57,8	1	0,6
	42,7	36,1	50,1	1	0,6	27,3	35,6	56,4	57,8	1	0,6
	46,6	37,9	56,5	1,1	0,6	31	37	65	67,8	1	0,6
	46,6	37,9	56,5	1,1	0,6	31	37	65	67,8	1	0,6
	46,6	37,9	56,5	1,1	0,6	31	37	65	67,8	1	0,6
	46,6	37,9	56,5	1,1	0,6	31	37	65	67,8	1	0,6



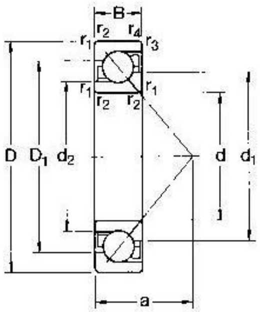


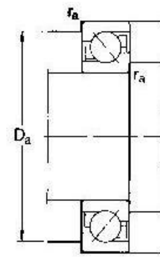


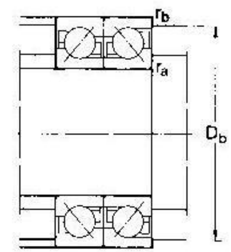
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designations[1)] Universally matchable bearing	Basic design bearing
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
35	72	17	31	20,8	0,88	12 000	12 000	0,28	* **7207 BECBP**	–
	72	17	29,1	19	0,815	11 000	11 000	0,28	–	**7207 BEP**
	72	17	30,7	20,8	0,88	11 000	11 000	0,30	**7207 BECBY**	**7207 BEY**
	72	17	31	20,8	0,88	12 000	12 000	0,30	* **7207 BECBM**	–
	80	21	41,5	26,5	1,14	11 000	11 000	0,45	* **7307 BECBP**	–
	80	21	39	24,5	1,04	10 000	10 000	0,45	–	**7307 BEP**
	80	21	39	24,5	1,04	10 000	10 000	0,49	**7307 BECBY**	**7307 BEY**
	80	21	41,5	26,5	1,14	11 000	11 000	0,49	* **7307 BECBM**	–
40	80	18	36,5	26	1,1	11 000	11 000	0,37	* **7208 BECBP**	–
	80	18	34,5	24	1,02	10 000	10 000	0,37	–	**7208 BEP**
	80	18	36,4	26	1,1	10 000	10 000	0,38	**7208 BECBY**	**7208 BEY**
	80	18	36,5	26	1,1	11 000	11 000	0,39	* **7208 BECBM**	–
	80	18	34,5	24	1,02	10 000	10 000	0,39	–	**7208 BEM**
	90	23	50	32,5	1,37	10 000	10 000	0,61	* **7308 BECBP**	–
	90	23	46,2	30,5	1,13	9 000	9 000	0,61	–	**7308 BEP**
	90	23	49,4	33,5	1,4	9 000	9 000	0,64	**7308 BECBY**	**7308 BEY**
	90	23	50	32,5	1,37	10 000	10 000	0,68	* **7308 BECBM**	–
45	85	19	38	28,5	1,22	10 000	10 000	0,42	* **7209 BECBP**	–
	85	19	35,8	26	1,12	9 000	9 000	0,42	–	**7209 BEP**
	85	19	37,7	28	1,2	9 000	9 000	0,43	**7209 BECBY**	**7209 BEY**
	85	19	38	28,5	1,22	10 000	10 000	0,44	* **7209 BECBM**	–
	100	25	61	40,5	1,73	9 000	9 000	0,82	* **7309 BECBP**	–
	100	25	55,9	37,5	1,73	8 000	8 000	0,82	–	**7309 BEP**
	100	25	60,5	41,5	1,73	8 000	8 000	0,86	**7309 BECBY**	**7309 BEY**
	100	25	61	40,5	1,73	9 000	9 000	0,90	* **7309 BECBM**	–
50	90	20	40	31	1,32	9 000	9 000	0,47	* **7210 BECBP**	–
	90	20	37,7	28,5	1,22	8 500	8 500	0,47	–	**7210 BEP**
	90	20	39	30,5	1,29	8 500	8 500	0,47	**7210 BECBY**	**7210 BEY**
	90	20	40	31	1,32	9 000	9 000	0,51	* **7210 BECBM**	–
	110	27	75	51	2,16	8 000	8 000	1,04	* **7310 BECBP**	–
	110	27	68,9	47,5	2	7 500	7 500	1,04	–	**7310 BEP**
	110	27	74,1	51	2,2	7 500	7 500	1,13	**7310 BECBY**	**7310 BEY**
	110	27	75	51	2,16	8 000	8 000	1,16	* **7310 BECBM**	–
55	100	21	48,8	38	1,63	7 500	7 500	0,62	**7211 BECBP**	**7211 BEP**
	100	21	48,8	38	1,63	7 500	7 500	0,62	**7211 BECBY**	**7211 BEY**
	100	21	46,2	36	1,53	7 500	8 000	0,66	**7211 BECBM**	–

* SKF Explorer bearing
[1)] For available final variants → **matrix 1** on **page 417**

Dimensions							Abutment and fillet dimensions				
d	d_1 ~	d_2 ~	D_1 ~	$r_{1,2}$ min	$r_{3,4}$ min	a	d_a min	D_a max	D_b max	r_a max	r_b max
mm							mm				
35	49,7	42	58,3	1,1	0,6	31	42	65	67,8	1	0,6
	49,7	42	58,3	1,1	0,6	31	42	65	67,8	1	0,6
	49,7	42	58,3	1,1	0,6	31	42	65	67,8	1	0,6
	49,7	42	58,3	1,1	0,6	31	42	65	67,8	1	0,6
	52,8	43,6	63,3	1,5	1	35	44	71	74,4	1,5	1
	52,8	43,6	63,3	1,5	1	35	44	71	74,4	1,5	1
	52,8	43,6	63,3	1,5	1	35	44	71	74,4	1,5	1
	52,8	43,6	63,3	1,5	1	35	44	71	74,4	1,5	1
40	56,3	48,1	65,6	1,1	0,6	34	47	73	75,8	1	0,6
	56,3	48,1	65,6	1,1	0,6	34	47	73	75,8	1	0,6
	56,3	48,1	65,6	1,1	0,6	34	47	73	75,8	1	0,6
	56,3	48,1	65,6	1,1	0,6	34	47	73	75,8	1	0,6
	56,3	48,1	65,6	1,1	0,6	34	47	73	75,8	1	0,6
	59,7	49,6	71,6	1,5	1	39	49	81	84,4	1,5	1
	59,7	49,6	71,6	1,5	1	39	49	81	84,4	1,5	1
	59,7	49,6	71,6	1,5	1	39	49	81	84,4	1,5	1
	59,7	49,6	71,6	1,5	1	39	49	81	84,4	1,5	1
45	60,9	52,7	70,2	1,1	0,6	37	52	78	80,8	1	0,6
	60,9	52,7	70,2	1,1	0,6	37	52	78	80,8	1	0,6
	60,9	52,7	70,2	1,1	0,6	37	52	78	80,8	1	0,6
	60,9	52,7	70,2	1,1	0,6	37	52	78	80,8	1	0,6
	66,5	55,3	79,8	1,5	1	43	54	91	94,4	1,5	1
	66,5	55,3	79,8	1,5	1	43	54	91	94,4	1,5	1
	66,5	55,3	79,8	1,5	1	43	54	91	94,4	1,5	1
	66,5	55,3	79,8	1,5	1	43	54	91	94,4	1,5	1
50	65.8	57,7	75,2	1,1	0,6	39	57	83	85,8	1	0.6
	65,8	57,7	75,2	1,1	0,6	39	57	83	85,8	1	0,6
	65,8	57,7	75,2	1,1	0,6	39	57	83	85,8	1	0,6
	65,8	57,7	75,2	1,1	0,6	39	57	83	85,8	1	0,6
	73,8	61,1	88,8	2	1	47	61	99	104	2	1
	73,8	61,1	88,8	2	1	47	61	99	104	2	1
	73,8	61,1	88,8	2	1	47	61	99	104	2	1
	73,8	61,1	88,8	2	1	47	61	99	104	2	1
55	72,4	63,6	83,7	1,5	1	43	64	91	94	1,5	1
	72,4	63,6	83,7	1,5	1	43	64	91	94	1,5	1
	72,4	63,6	83,7	1,5	1	43	64	91	94	1,5	1







Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designations[1] Universally matchable bearing	Basic design bearing
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
55 cont.	120	29	85	60	2,55	7 000	7 000	1,34	★ **7311 BECBP**	–
	120	29	79,3	55	2,32	6 700	6 700	1,34	–	**7311 BEP**
	120	29	85,2	60	2,55	6 700	6 700	1,48	**7311 BECBY**	**7311 BEY**
	120	29	85	60	2,55	7 000	7 000	1,49	★ **7311 BECBM**	–
60	110	22	61	50	2,12	7 500	7 500	0,78	★ **7212 BECBP**	–
	110	22	57,2	45,5	1,93	7 000	7 000	0,78	–	**7212 BEP**
	110	22	57,2	45,5	1,93	7 000	7 000	0,83	**7212 BECBY**	**7212 BEY**
	110	22	61	50	2,12	7 500	7 500	0,85	★ **7212 BECBM**	–
	130	31	104	76,5	3,2	6 700	6 700	1,71	★ **7312 BECBP**	–
	130	31	95,6	69,5	3	6 000	6 000	1,71	–	**7312 BEP**
	130	31	95,6	69,5	3	6 000	6 000	1,75	**7312 BECBY**	**7312 BEY**
	130	31	104	76,5	3,2	6 700	6 700	1,88	★ **7312 BECBM**	–
	130	31	95,6	69,5	3	6 000	6 300	1,88	–	**7312 BEM**
65	120	23	66,3	54	2,28	6 300	6 300	1,00	**7213 BECBP**	**7213 BEP**
	120	23	66,3	54	2,28	6 300	6 300	1,00	**7213 BECBY**	**7213 BEY**
	120	23	66,3	54	2,28	6 300	6 700	1,10	**7213 BECBM**	–
	140	33	116	86,5	3,65	6 300	6 300	2,10	★ **7313 BECBP**	–
	140	33	108	80	3,35	5 600	5 600	2,15	**7313 BECBY**	**7313 BEP**
	140	33	116	86,5	3,65	6 300	6 300	2,31	★ **7313 BECBM**	–
70	125	24	75	64	2,7	6 300	6 300	1.10	★ **7214 BECBP**	–
	125	24	71,5	60	2,5	6 000	6 000	1,10	**7214 BECBY**	**7214 BEP**
	125	24	72	60	2,55	6 300	6 300	1,18	★ **7214 BECBM**	–
	150	35	127	98	3,9	5 600	5 600	2,55	★ **7314 BECBP**	–
	150	35	119	90	3,65	5 300	5 300	2,67	**7314 BECBY**	**7314 BEP**
	150	35	127	98	3,9	5 600	5 600	2,83	★ **7314 BECBM**	–
75	130	25	72,8	64	2,65	5 600	5 600	1,18	**7215 BECBP**	**7215 BEP**
	130	25	72,8	64	2,65	5 600	5 600	1,26	**7215 BECBY**	–
	130	25	70,2	60	2,5	5 600	6 000	1,29	**7215 BECBM**	–
	160	37	132	104	4,15	5 300	5 300	3,06	★ **7315 BECBP**	–
	160	37	125	98	3,8	5 000	5 000	3,06	–	**7315 BEP**
	160	37	133	106	4,15	5 000	5 000	3,20	**7315 BECBY**	–
	160	37	132	104	4,15	5 300	5 300	3,26	★ **7315 BECBM**	–
80	140	26	85	75	3,05	5 600	5 600	1,43	★ **7216 BECBP**	–
	140	26	83,2	73,5	3	5 300	5 300	1,58	**7216 BECBY**	–
	140	26	85	75	3,05	5 600	5 600	1,59	★ **7216 BECBM**	–

★ SKF Explorer bearing
[1] For available final variants → **matrix 1 on page 417**

Dimensions							Abutment and fillet dimensions				
d	d_1 ~	d_2 ~	D_1 ~	$r_{1,2}$ min	$r_{3,4}$ min	a	d_a min	D_a max	D_b max	r_a max	r_b max
mm							mm				
55 cont.	80,3	66,7	96,6	2	1	51	66	109	114	2	1
	80,3	66,7	96,6	2	1	51	66	109	114	2	1
	80,3	66,7	96,6	2	1	51	66	109	114	2	1
	80,3	66,7	96,6	2	1	51	66	109	114	2	1
60	79,6	69,3	91,55	1,5	1	47	69	101	104	1,5	1
	79,6	69,3	91,6	1,5	1	47	69	101	104	1,5	1
	79,6	69,3	91,6	1,5	1	47	69	101	104	1,5	1
	79,6	69,3	91,6	1,5	1	47	69	101	104	1,5	1
	87,3	72,6	104,8	2,1	1,1	55	72	118	123	2	1
	87,3	72,6	104,8	2,1	1,1	55	72	118	123	2	1
	87,3	72,6	104,8	2,1	1,1	55	72	118	123	2	1
	87,3	72,6	104,8	2,1	1,1	55	72	118	123	2	1
	87,3	72,6	104,8	2,1	1,1	55	72	118	123	2	1
65	86,4	75,5	100	1,5	1	50	74	111	114	1,5	1
	86,4	75,5	100	1,5	1	50	74	111	114	1,5	1
	86,4	75,5	100	1,5	1	50	74	111	114	1,5	1
	94,2	78,5	112,9	2,1	1,1	60	77	128	133	2	1
	94,2	78,5	112,9	2,1	1,1	60	77	128	133	2	1
	94,2	78,5	112.9	2.1	1,1	60	77	128	133	2	1
70	91,5	80,3	104,8	1,5	1	53	79	116	119	1,5	1
	91,5	80,3	104,8	1,5	1	53	79	116	119	1,5	1
	91,5	80,3	104,8	1,5	1	53	79	116	119	1,5	1
	101,1	84,4	121	2,1	1,1	64	82	138	143	2	1
	101,1	84,4	121	2,1	1,1	64	82	138	143	2	1
	101,1	84,4	121	2,1	1,1	64	82	138	143	2	1
75	96,3	85,3	110,1	1,5	1	56	84	121	124	1,5	1
	96,3	85,3	110,1	1,5	1	56	84	121	124	1,5	1
	96,3	85,3	110,1	1,5	1	56	84	121	124	1,5	1
	108,3	91,1	128,7	2,1	1,1	68	87	148	153	2	1
	108,3	91,1	128,7	2,1	1,1	68	87	148	153	2	1
	108,3	91,1	128,7	2,1	1,1	68	87	148	153	2	1
	108,3	91,1	128,7	2,1	1,1	68	87	148	153	2	1
80	103,6	91,4	117,9	2	1	59	91	129	134	2	1
	103,6	91,4	117,9	2	1	59	91	129	134	2	1
	103,6	91.4	117,9	2	1	59	91	129	134	2	1

Internal clearance

SKF double row angular contact ball bearings in the 32 A and 33 A series are produced as standard with Normal axial internal clearance. They are also available with the greater C3 clearance (➔ **matrix 1** on **page 437**). For bearings with smaller C2 clearance, please check availability before ordering.

Bearings in the 33 D and 33 DNRCBM series are produced exclusively with an axial internal clearance according to the values given in **table 2**. They are valid for bearings before mounting under zero measuring loads.

Misalignment

Misalignment of the outer ring with respect to the inner ring of double row angular contact ball bearings can only be accommodated by generating forces between the balls and the raceways. Any misalignment will lead to increased noise in operation and reduced bearing service life.

Influence of operating temperature on bearing material

SKF angular contact ball bearings undergo a special heat treatment. When equipped with a steel or brass cage, they can operate at temperatures of up to +150 °C.

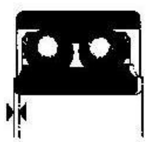
Cages

Depending on the bearing series, size and design, SKF double row angular contact ball bearings are fitted as standard with one of the following cages (➔ **fig 6**)

- an injection moulded snap-type cage of glass fibre reinforced polyamide 6,6, ball centred, designation suffix TN9 (**a**),
- a pressed snap-type cage of sheet steel, ball centred, no designation suffix or suffix J1 (**b**),
- a pressed crown cage of sheet steel, ball centred, no designation suffix (**c**),
- a machined brass cage, outer ring centred, designation suffix MA (**d**),

Table 2

Axial internal clearance of double row angular contact ball bearings



Bore diameter d		Axial internal clearance of bearings in series 32 A and 33 A						33 D		33 DNRCBM	
		C2		Normal		C3					
over	incl.	min	max	min	max	min	max	min	max	min	max
mm		µm						µm		µm	
–	10	1	11	5	21	12	28	–	–	–	–
10	18	1	12	6	23	13	31	–	–	–	–
18	24	2	14	7	25	16	34	–	–	–	–
24	30	2	15	8	27	18	37	–	–	–	–
30	40	2	16	9	29	21	40	33	54	10	30
40	50	2	18	11	33	23	44	36	58	10	30
50	65	3	22	13	36	26	48	40	63	18	38
65	80	3	24	15	40	30	54	46	71	18	38
80	100	3	26	18	46	35	63	55	83	–	–
100	110	4	30	22	53	42	73	65	96	–	–

- a machined brass cage, ball centred, designation suffix M (**e**).

Several bearings are available as standard with a choice of cage design so that bearings with a cage appropriate to the operating conditions can be chosen (➔ **matrix 1** on **page 437**).

Note:
Bearings with polyamide 6,6 cages can be operated at temperatures up to +120 °C. The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties, with the exception of a few synthetic oils and greases with a synthetic oil base, and lubricants containing a high proportion of EP additives when used at high temperatures.

For detailed information regarding the temperature resistance and the applicability of cages, please refer to the section "Cage materials", starting on **page 140**.

Minimum load

In order to provide satisfactory operation, double row angular contact ball bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the balls and cages, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the balls and raceways.

The requisite minimum radial load to be applied to double row angular contact ball bearings can be estimated using

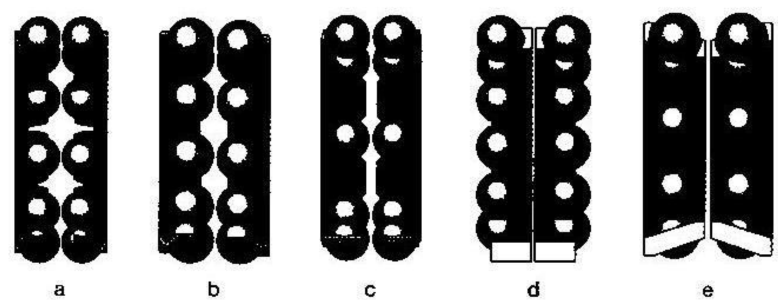
$$F_{rm} = k_r \left(\frac{\nu n}{1\,000}\right)^{2/3} \left(\frac{d_m}{100}\right)^2$$

where

F_{rm} = minimum radial load, kN
k_r = minimum radial load factor
0,06 for bearings in the 32 A series
0,07 for bearings in the 33 A series
0,095 for bearings in the 33 D and 33 DNR series
ν = oil viscosity at operating temperature, mm^2/s
n = rotational speed, r/min
d_m = bearing mean diameter = 0,5 (d + D), mm

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceed the requisite minimum load. If this is not the case, the double row angular contact ball bearing must be subjected to an additional radial load.

Fig 6



page 16

Equivalent dynamic bearing load

$P = F_r + Y_1 F_a$ when $F_a/F_r \le e$
$P = XF_r + Y_2 F_a$ when $F_a/F_r > e$

The values for the factors e, X, Y_1 and Y_2 depend on the bearing contact angle and are listed in **table 3**.

Equivalent static bearing load

$P_0 = F_r + Y_0 F_a$

The value for the factor Y_0 depends on the bearing contact angle and is given in **table 3**.

Table 3

Calculation factors for double row angular contact ball bearings

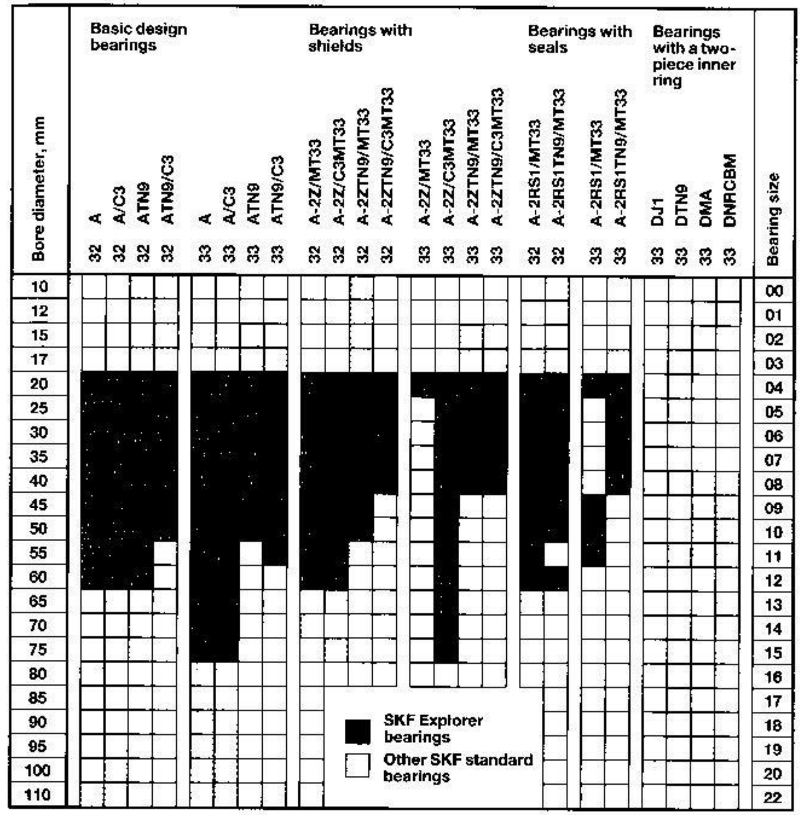
Bearing series	Limiting value e	Load factors X	Y_1	Y_2	Y_0
32 A (52 A)	0,8	0,63	0,78	1,24	0,66
33 A (53 A)	0,8	0,63	0,78	1,24	0,66
33 D	1,34	0,54	0,47	0,81	0,44
33 DNRCBM	1,14	0,57	0,55	0,93	0,52

Supplementary designations

The designation suffixes used to identify certain features of SKF double row angular contact ball bearings are explained in the following.

- **A** No filling slots
- **CB** Controlled axial internal clearance
- **C2** Clearance smaller than Normal
- **C3** Clearance greater than Normal
- **D** Two-piece inner ring
- **HT51** High temperature grease for operating temperatures in the range –30 to +140 °C
- **J1** Sheet steel cage, ball centred
- **M** Machined brass cage, ball centred
- **MA** Machined brass cage, outer ring centred
- **MT33** Grease with lithium thickener for operating temperatures in the range –30 to +120 °C
- **N** Snap ring groove in the outer ring
- **NR** Snap ring groove in the outer ring with snap ring
- **P5** Dimensional and running accuracy in accordance with ISO tolerance class 5
- **P6** Dimensional and running accuracy in accordance with ISO tolerance class 6
- **P62** P6 + C2
- **P63** P6 + C3
- **TN9** Snap type cage of glass fibre reinforced polyamide 6,6, ball centred
- **2RS1** Sheet steel reinforced acrylonitrile butadiene rubber seals on both sides of bearing
- **2Z** Pressed steel shields on both sides of bearing

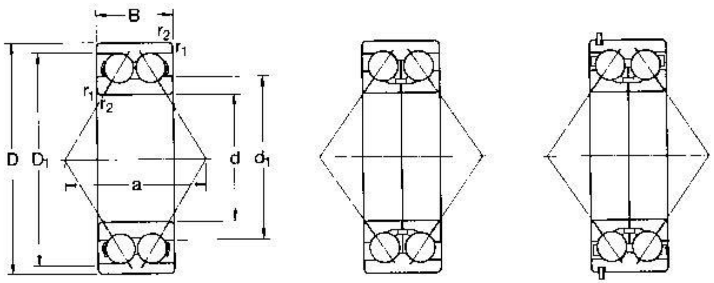
SKF double row angular contact ball bearings – standard assortment



Bearings in the 52 A and 53 A series
This matrix is also valid for bearings in the 52 A and 53 A series, which are identical to the corresponding bearings in the 32 A and 33 A series. However, sealed bearings in the 52 A and 53 A series are filled with a high-temperature grease (→ **page 430**). They do not carry any designation suffix for the grease.

Bearings above 110 mm bore
Please consult the "SKF Interactive Engineering Catalogue" on CD-ROM or online at www.skf.com.

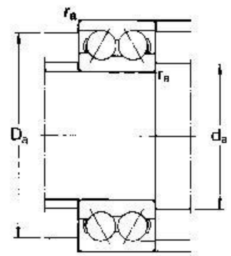
Double row angular contact ball bearings
d **10 – 50** mm



A design | 33 D | 33 DNRCBM[1)]

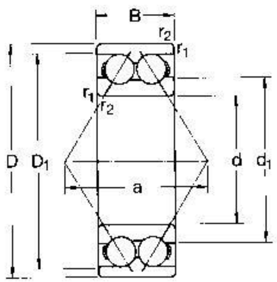
Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass	Designations[2)] Bearing with metal cage	polyamide cage
mm			kN		kN	r/min		kg	–	
10	30	14	7,61	4,3	0,183	22 000	24 000	0,051	–	**3200 ATN9**
12	32	15,9	10,1	5,6	0,24	20 000	22 000	0,058	–	**3201 ATN9**
15	35	15,9	11,2	6,8	0,285	17 000	18 000	0,066	–	**3202 ATN9**
	42	19	15,1	9,3	0,4	15 000	16 000	0,13	–	**3302 ATN9**
17	40	17,5	14,3	8,8	0,365	15 000	16 000	0,096	–	**3203 ATN9**
	47	22,2	21,6	12,7	0,54	14 000	14 000	0,18	–	**3303 ATN9**
20	47	20,6	20	12	0,51	14 000	14 000	0,16	**★ 3204 A**	**★ 3204 ATN9**
	52	22,2	23,6	14,6	0,62	13 000	13 000	0,22	**★ 3304 A**	**★ 3304 ATN9**
25	52	20,6	21,6	14,3	0,6	12 000	12 000	0,18	**★ 3205 A**	**★ 3205 ATN9**
	62	25,4	32	20,4	0,865	11 000	11 000	0,35	**★ 3305 A**	**★ 3305 ATN9**
30	62	23,8	30	20,4	0,865	10 000	10 000	0,29	**★ 3206 A**	**★ 3206 ATN9**
	72	30,2	41,5	27,5	1,16	9 000	9 000	0,53	**★ 3306 A**	**★ 3306 ATN9**
35	72	27	40	28	1,18	9 000	9 000	0,44	**★ 3207 A**	**★ 3207 ATN9**
	80	34,9	52	35,5	1,5	8 500	8 500	0,71	**★ 3307 A**	**★ 3307 ATN9**
	80	34,9	52.7	41,5	1,76	7 500	8 000	0,79	**3307 DJ1**	–
40	80	30,2	47,5	34	1,43	8 000	8 000	0,58	**★ 3208 A**	**★ 3208 ATN9**
	90	36,5	64	44	1,86	7 500	7 500	1,05	**★ 3308 A**	**★ 3308 ATN9**
	90	36,5	49,4	41,5	1,76	6 700	7 000	1,20	**3308 DNRCBM**	–
	90	36,5	68,9	64	2,45	6 700	7 000	1,05	**3308 DMA**	**3308 DTN9**
45	85	30,2	51	39	1,63	7 500	7 500	0,63	**★ 3209 A**	**★ 3209 ATN9**
	100	39,7	75	53	2,24	6 700	6 700	1,40	**★ 3309 A**	**★ 3309 ATN9**
	100	39,7	61,8	52	2,2	6 000	6 300	1,50	**3309 DNRCBM**	–
	100	39,7	79,3	69,5	3	6 000	6 300	1,60	**3309 DMA**	–
50	90	30,2	51	39	1.66	7 000	7 000	0,66	**★ 3210 A**	**★ 3210 ATN9**
	110	44,4	90	64	2,75	6 000	6 000	1,95	**★ 3310 A**	**★ 3310 ATN9**
	110	44,4	81,9	69,5	3	5 300	5 600	1,95	**3310 DNRCBM**	–
	110	44,4	93,6	85	3,6	5 300	5 600	2,15	**3310 DMA**	–

★ SKF Explorer bearing
1) For dimensions of snap ring groove and snap ring → **table 1** on **page 433**
2) For available final variants → **matrix 1** on **page 437**

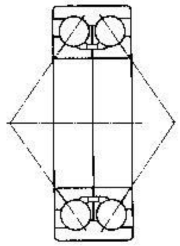


Dimensions d	d_1 ~	D_1 ~	$r_{1,2}$ min	a	Abutment and fillet dimensions d_a min	D_a max	r_a max
mm					mm		
10	17,7	23,6	0,6	16	14,4	25,6	0,6
12	19,1	26,5	0,6	19	16,4	27,6	0,6
15	22,1	29,5	0,6	21	19,4	30,6	0,6
	25,4	34,3	1	24	20,6	36,4	1
17	25,1	33,6	0,6	23	21,4	35,6	0,6
	27,3	38,8	1	28	22,6	41,4	1
20	27,7	40,9	1	28	25,6	41,4	1
	29,9	44,0	1,1	30	27	45	1
25	32,7	45,9	1	30	30,6	46,4	1
	35,7	53,4	1,1	36	32	55	1
30	38,7	55,2	1	36	35,6	56,4	1
	39,8	64,1	1,1	42	37	65	1
35	45,4	63,9	1,1	42	42	65	1
	44,6	70,5	1,5	47	44	71	1,5
	52,8	69,0	1,5	76	44	71	1,5
40	47,8	72,1	1,1	46	47	73	1
	50,8	80,5	1,5	53	49	81	1,5
	60,1	79,5	1,5	71	49	81	1,5
	59,4	80,3	1,5	84	49	81	1,5
45	52,8	77,1	1,1	49	52	78	1
	55,6	90	1,5	58	54	91	1,5
	68	87,1	1,5	79	54	91	1,5
	70	86,4	1,5	93	54	91	1,5
50	57,8	82,1	1,1	52	57	83	1
	62	99,5	2	65	61	99,5	2
	74,6	87	2	88	61	99	2
	76,5	94,2	2	102	61	99	2

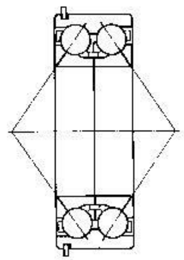
Double row angular contact ball bearings
d 55 – 110 mm



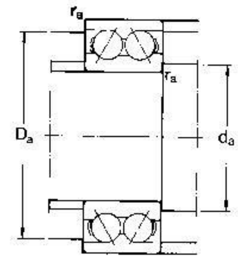
A design



33 D



33 DNRCBM[1]



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designations[2] Bearing with metal cage	polyamide cage
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
55	100	33,3	60	47,5	2	6 300	6 300	1,05	**★ 3211 A**	**★ 3211 ATN9**
	120	49,2	112	81,5	3,45	5 300	5 300	2,55	**★ 3311 A**	**★ 3311 ATN9**
	120	49,2	95,6	83	3,55	4 800	5 000	2,55	**3311 DNRCBM**	–
	120	49,2	111	100	4,3	4 800	5 000	2,80	**3311 DMA**	–
60	110	36,5	73,5	58,5	2,5	5 600	5 600	1,40	**★ 3212 A**	**★ 3212 ATN9**
	130	54	127	95	4,05	5 000	5 000	3,25	**★ 3312 A**	–
65	120	38,1	80,6	73,5	3,1	4 500	4 800	1,75	**3213 A**	–
	140	58,7	146	110	4,55	4 500	4 500	4,10	**★ 3313 A**	–
	140	58,7	138	122	5,1	4 300	4 500	4,00	**3313 DNRCBM**	–
70	125	39,7	88,4	80	3,4	4 300	4 500	1,90	**3214 A**	–
	150	63,5	163	125	5	4 300	4 300	5,05	**★ 3314 A**	–
75	130	41,3	95,6	88	3,75	4 300	4 500	2,10	**3215 A**	–
	160	68,3	176	140	5,5	4 000	4 000	5,55	**★ 3315 A**	–
80	140	44,4	106	95	3,9	4 000	4 300	2,65	**3216 A**	–
	170	68,3	182	156	6	3 400	3 600	6,80	**3316 A**	–
	170	68,3	190	196	7,35	3 400	3 600	7,55	**3316 DMA**	–
85	150	49,2	124	110	4,4	3 600	3 800	3,40	**3217 A**	–
	180	73	195	176	6,55	3 200	3 400	8,30	**3317 A**	–
90	160	52,4	130	120	4,55	3 400	3 600	4,15	**3218 A**	–
	190	73	195	180	6,4	3 000	3 200	9,25	**3318 A**	–
	190	73	225	250	8,8	3 000	3 200	10,0	**3318 DMA**	–
95	170	55,6	159	146	5,4	3 200	3 400	5,00	**3219 A**	–
	200	77,8	225	216	7,5	2 800	3 000	11,0	**3319 A**	–
	200	77,8	242	275	9,5	2 800	3 000	12,0	**3319 DMA**	–
100	180	60,3	178	166	6	3 000	3 200	6,10	**3220 A**	–
	215	82,6	255	255	8,65	2 600	2 800	13,5	**3320 A**	–
110	200	69,8	212	212	7,2	2 800	2 800	8,80	**3222 A**	–
	240	92,1	291	305	9,8	2 400	2 600	19,0	**3322 A**	–

★ SKF Explorer bearing
[1] For dimensions of snap ring groove and snap ring → **table 1** on **page 433**
[2] For available final variants → **matrix 1** on **page 437**

Dimensions					Abutment and fillet dimensions		
d	d_1 ~	D_1 ~	$r_{1,2}$ min	a	d_a min	D_a max	r_a max
mm					mm		
55	63,2	92,3	1,5	57	63	91	1,5
	68,4	109	2	72	66	109	2
	81,6	106,5	2	97	66	109	2
	81,3	104,4	2	114	66	109	2
60	68,8	101	1,5	63	69	101	1,5
	74,3	118	2,1	78	72	118	2
65	85	103	1,5	71	74	111	1,5
	78,5	130	2,1	84	77	130	2
	95,1	126	2,1	114	77	128	2
70	88,5	107	1,5	74	79	116	1,5
	84,2	139	2,1	89	82	138	2
75	91,9	112	1,5	77	84	121	1,5
	88,8	147	2,1	97	87	148	2
80	97,7	120	2	82	91	129	2
	108	143	2,1	101	92	158	2
	114	145	2,1	158	92	158	2
85	104	128	2	88	96	139	2
	116	153	3	107	99	166	2,5
90	111	139	2	94	101	149	2
	123	160	3	112	104	176	2,5
	130	167	3	178	104	176	2,5
95	119	147	2,1	101	107	158	2
	127	168	3	118	109	186	2,5
	138	177	3	189	109	186	2,5
100	125	155	2,1	107	112	168	2
	136	180	3	127	114	201	2,5
110	139	173	2,1	119	122	188	2
	153	200	3	142	124	226	2,5

Cages

SKF self-aligning ball bearings incorporate one of the following cage designs (➔ **fig 14**) as standard, depending on bearing series and size:

- a one-piece pressed steel cage (**a**), no designation suffix,
- a two-piece pressed steel cage (**b**), no designation suffix,
- a one-piece (**c**) or two-piece polyamide 6,6 cage with glass fibre reinforcement, designation suffix TN9,
- a one-piece (**c**) or two-piece polyamide 6,6 cage, designation suffix TN,
- a one-piece or two-piece (**d**) machined brass cage, designation suffix M.

Contact SKF for availability of bearings with non-standard cages.

Note:
Self-aligning ball bearings with polyamide 6,6 cages can be operated at temperatures up to +120 °C. The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties, with the exception of a few synthetic oils and greases with a synthetic oil base, and lubricants containing a high proportion of EP additives when used at high temperatures.

For bearing arrangements, which are to be operated at continuously high temperatures or under arduous conditions, it is recommended to use bearings with pressed steel or machined brass cage.

For detailed information regarding the temperature resistance and the applicability of cages, please refer to the section "Cage materials", starting on **page 140**.

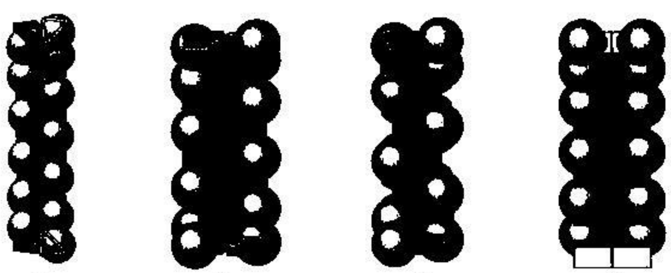
Axial load carrying capacity

The ability of a self-aligning ball bearing mounted on an adapter sleeve on smooth shafts without an integral shoulder to carry axial loads, depends on the friction between the sleeve and shaft. The permissible axial load can be approximately determined from

$$F_{ap} = 0{,}003\,B\,d$$

where
F_{ap} = maximum permissible axial load, kN
B = bearing width, mm
d = bearing bore diameter, mm

Fig 14



Minimum load

In order to provide satisfactory operation, self-aligning ball bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the balls and cage, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the balls and raceways.

The requisite minimum load to be applied to self-aligning ball bearings can be estimated using

$$P_{0m} = 0{,}01\,C_0$$

where
P_{0m} = minimum equivalent static bearing load, kN
C_0 = basic static load rating, kN (➔ product tables)

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the self-aligning ball bearing must be subjected to an additional radial load, for example, by increasing belt tension or by similar means.

Equivalent dynamic bearing load

$$P = F_r + Y_1 F_a \quad \text{when } F_a/F_r \le e$$
$$P = 0{,}65\,F_r + Y_2 F_a \quad \text{when } F_a/F_r > e$$

Values of Y_1, Y_2 and e will be found in the product tables.

Equivalent static bearing load

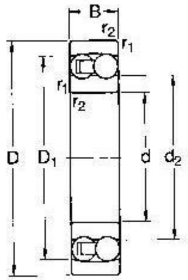
$$P_0 = F_r + Y_0 F_a$$

Values of Y_0 will be found in the product tables.

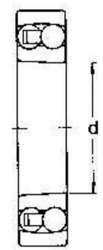
Supplementary designations

The designation suffixes used to identify certain features of SKF self-aligning ball bearings are explained in the following.

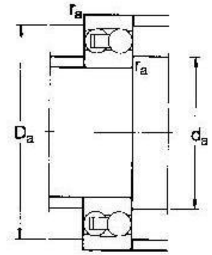
C3	Radial internal clearance greater than Normal
E	Optimized internal design
K	Tapered bore, taper 1:12
M	Machined brass cage
TN	Injection moulded polyamide 6,6 cage
TN9	Injection moulded glass fibre reinforced polyamide 6,6 cage
2RS1	Contact seal of acrylonitrile butadiene rubber (NBR) with sheet steel reinforcement on both sides of the bearing



Cylindrical bore

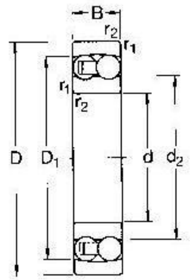


Tapered bore
taper 1 : 12 on diameter

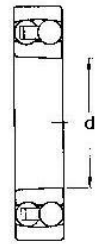


Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass	Designations Bearing with cylindrical bore	tapered bore
mm			kN		kN	r/min		kg	–	
5	19	6	2,51	0,48	0,025	63 000	45 000	0,009	**135 TN9**	–
6	19	6	2,51	0,48	0,025	70 000	45 000	0,009	**126 TN9**	–
7	22	7	2,65	0,56	0,029	63 000	40 000	0,014	**127 TN9**	–
8	22	7	2,65	0,56	0,029	60 000	40 000	0,014	**108 TN9**	–
9	26	8	3,90	0,82	0,043	60 000	38 000	0,022	**129 TN9**	–
10	30	9	5,53	1,18	0.061	56 000	36 000	0,034	**1200 ETN9**	–
	30	14	8,06	1,73	0,090	50 000	34 000	0,047	**2200 ETN9**	–
12	32	10	6,24	1,43	0,072	50 000	32 000	0,040	**1201 ETN9**	–
	32	14	8,52	1,90	0,098	45 000	30 000	0,053	**2201 ETN9**	–
	37	12	9,36	2,16	0,12	40 000	28 000	0,067	**1301 ETN9**	–
	37	17	11,7	2,70	0,14	38 000	26 000	0,095	**2301**	–
15	35	11	7,41	1,76	0,09	45 000	28 000	0,049	**1202 ETN9**	–
	35	14	8,71	2,04	0.11	38 000	26 000	0,060	**2202 ETN9**	–
	42	13	10,8	2,60	0,14	34 000	24 000	0,094	**1302 ETN9**	–
	42	17	11,9	2,90	0,15	32 000	24 000	0,12	**2302**	–
17	40	12	8,84	2,20	0,12	38 000	24 000	0,073	**1203 ETN9**	–
	40	16	10,6	2,55	0,14	34 000	24 000	0,088	**2203 ETN9**	–
	47	14	12,7	3,40	0,18	28 000	20 000	0,12	**1303 ETN9**	–
	47	19	14,6	3,55	0,19	30 000	22 000	0,16	**2303**	–
20	47	14	12,7	3,4	0,18	32 000	20 000	0,12	**1204 ETN9**	**1204 EKTN9**
	47	18	16,8	4,15	0,22	28 000	20 000	0,14	**2204 ETN9**	–
	52	15	14,3	4	0,21	26 000	18 000	0,16	**1304 ETN9**	–
	52	21	18,2	4,75	0,24	26 000	19 000	0,22	**2304 TN**	–
25	52	15	14,3	4	0,21	28 000	18 000	0,14	**1205 ETN9**	**1205 EKTN9**
	52	18	16,8	4,4	0,23	26 000	18 000	0,16	**2205 ETN9**	**2205 EKTN9**
	62	17	19	5,4	0,28	22 000	15 000	0,26	**1305 ETN9**	**1305 EKTN9**
	62	24	27	7,1	0,37	22 000	16 000	0,34	**2305 ETN9**	–

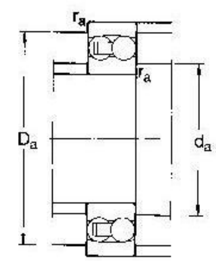
Dimensions d	d_2 ~	D_1 ~	$r_{1,2}$ min	Abutment and fillet dimensions d_a min	D_a max	r_a max	Calculation factors e	Y_1	Y_2	Y_0
mm				mm			–			
5	10,3	15,4	0,3	7,4	16,6	0,3	0,33	1,9	3	2
6	10,3	15,4	0,3	8,4	16,6	0,3	0,33	1,9	3	2
7	12,6	17,6	0,3	9,4	19,6	0,3	0,33	1,9	3	2
8	12,6	17,6	0,3	10,4	19,6	0,3	0,33	1,9	3	2
9	14,8	21,1	0,3	11,4	23,6	0,3	0,33	1,9	3	2
10	16,7	24,4	0,6	14,2	25,8	0,6	0,33	1,9	3	2
	15,3	24,3	0,6	14,2	25,8	0,6	0,54	1,15	1,8	1,3
12	18,2	26,4	0,6	16,2	27,8	0,6	0,33	1,9	3	2
	17,5	26,5	0,6	16,2	27,8	0,6	0,50	1,25	2	1,3
	20	30,8	1	17,6	31,4	1	0,35	1,8	2,8	1,8
	18,6	31	1	17,6	31,4	1	0,60	1,05	1.6	1,1
15	21,2	29,6	0,6	19,2	30,8	0,6	0,33	1,9	3	2
	20,9	30,2	0,6	19,2	30,8	0,6	0,43	1,5	2,3	1,6
	23,9	35,3	1	20.6	36,4	1	0,31	2	3,1	2,2
	23,2	35,2	1	20,6	36,4	1	0,52	1,2	1,9	1,3
17	24	33,6	0,6	21,2	35,8	0,6	0,31	2	3,1	2,2
	23,8	34,1	0,6	21,2	35,8	0,6	0,43	1,5	2,3	1,6
	28,9	41	1	22,6	41,4	1	0,30	2,1	3,3	2,2
	25,8	39,4	1	22,6	41,4	1	0,52	1,2	1,9	1,3
20	28,9	41	1	25,6	41,4	1	0,30	2,1	3,3	2,2
	27,4	41	1	25.6	41,4	1	0,40	1,6	2,4	1,6
	33,3	45,6	1,1	27	45	1	0,28	2,2	3,5	2,5
	28,8	43,7	1,1	27	45	1	0.52	1,2	1,9	1,3
25	33,3	45,6	1	30,6	46,4	1	0,28	2,2	3,5	2,5
	32,3	46,1	1	30,6	46,4	1	0,35	1,8	2,8	1,8
	37,8	52,5	1,1	32	55	1	0,28	2,2	3,5	2,5
	35,5	53,5	1,1	32	55	1	0,44	1,4	2,2	1,4



Cylindrical bore

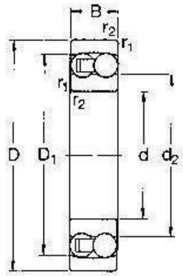


Tapered bore
taper 1 : 12 on diameter

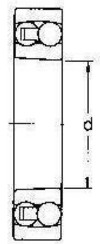


Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Refer-ence speed	Limiting speed	Mass	Designations Bearing with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
30	62	16	15,6	4,65	0,24	24 000	15 000	0,22	**1206 ETN9**	**1206 EKTN9**
	62	20	23.8	6,7	0.35	22 000	15 000	0,26	**2206 ETN9**	**2206 EKTN9**
	72	19	22,5	6,8	0,36	19 000	13 000	0,39	**1306 ETN9**	**1306 EKTN9**
	72	27	31,2	8,8	0,45	18 000	13 000	0,50	**2306**	**2306 K**
35	72	17	19	6	0,31	20 000	13 000	0,32	**1207 ETN9**	**1207 EKTN9**
	72	23	30,7	8,8	0,46	18 000	12 000	0,40	**2207 ETN9**	**2207 EKTN9**
	80	21	26,5	8,5	0,43	16 000	11 000	0.51	**1307 ETN9**	**1307 EKTN9**
	80	31	39,7	11,2	0,59	16 000	12 000	0,68	**2307 ETN9**	**2307 EKTN9**
40	80	18	19,9	6,95	0,36	18 000	11 000	0,42	**1208 ETN9**	**1208 EKTN9**
	80	23	31,9	10	0,51	16 000	11 000	0,51	**2208 ETN9**	**2208 EKTN9**
	90	23	33.8	11,2	0,57	14 000	9 500	0,68	**1308 ETN9**	**1308 EKTN9**
	90	33	54	16	0,82	14 000	10 000	0,93	**2308 ETN9**	**2308 EKTN9**
45	85	19	22,9	7,8	0,40	17 000	11 000	0,47	**1209 ETN9**	**1209 EKTN9**
	85	23	32,5	10,6	0,54	15 000	10 000	0,55	**2209 ETN9**	**2209 EKTN9**
	100	25	39	13,4	0,70	12 000	8 500	0,96	**1309 ETN9**	**1309 EKTN9**
	100	36	63,7	19,3	1	13 000	9 000	1,25	**2309 ETN9**	**2309 EKTN9**
50	90	20	26,5	9,15	0,48	16 000	10 000	0,53	**1210 ETN9**	**1210 EKTN9**
	90	23	33.8	11,2	0,57	14 000	9 500	0,60	**2210 ETN9**	**2210 EKTN9**
	110	27	43,6	14	0,72	12 000	8 000	1,20	**1310 ETN9**	**1310 EKTN9**
	110	40	63,7	20	1,04	14 000	9 500	1,65	**2310**	**2310 K**
55	100	21	27,6	10,6	0,54	14 000	9 000	0,71	**1211 ETN9**	**1211 EKTN9**
	100	25	39	13,4	0,70	12 000	8 500	0,81	**2211 ETN9**	**2211 EKTN9**
	120	29	50,7	18	0,92	11 000	7 500	1,60	**1311 ETN9**	**1311 EKTN9**
	120	43	76,1	24	1,25	11 000	7 500	2,10	**2311**	**2311 K**
60	110	22	31,2	12,2	0,62	12 000	8 500	0,90	**1212 ETN9**	**1212 EKTN9**
	110	28	48,8	17	0,88	11 000	8 000	1,10	**2212 ETN9**	**2212 EKTN9**
	130	31	58,5	22	1.12	9 000	6 300	1,95	**1312 ETN9**	**1312 EKTN9**
	130	46	87,1	28,5	1,46	9 500	7 000	2,60	**2312**	**2312 K**
65	120	23	35,1	14	0,72	11 000	7 000	1,15	**1213 ETN9**	**1213 EKTN9**
	120	31	57,2	20	1,02	10 000	7 000	1,45	**2213 ETN9**	**2213 EKTN9**
	140	33	65	25,5	1,25	8 500	6 000	2.45	**1313 ETN9**	**1313 EKTN9**
	140	48	95,6	32,5	1,66	9 000	6 300	3,25	**2313**	**2313 K**

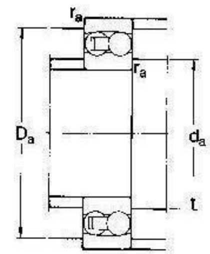
Dimensions				Abutment and fillet dimensions			Calculation factors			
d	d_2 ~	D_1 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm				mm			–			
30	40,1	53	1	35,6	56,4	1	0,25	2,5	3,9	2,5
	38,8	55	1	35,6	56,4	1	0,33	1,9	3	2
	44,9	60,9	1,1	37	65	1	0,25	2,5	3,9	2,5
	41,7	60,9	1,1	37	65	1	0,44	1,4	2,2	1,4
35	47	62,3	1,1	42	65	1	0,23	2,7	4,2	2,8
	45,3	64,2	1,1	42	65	1	0,31	2	3,1	2,2
	51,5	69,5	1,5	44	71	1,5	0,25	2,5	3,9	2,5
	46,5	68,4	1,5	44	71	1,5	0,46	1,35	2,1	1,4
40	53,6	68,8	1,1	47	73	1	0.22	2,9	4,5	2,8
	52,4	71,6	1,1	47	73	1	0,28	2,2	3,5	2,5
	61,5	81,5	1,5	49	81	1,5	0,23	2,7	4,2	2,8
	53,7	79,2	1,5	49	81	1,5	0,40	1,6	2,4	1,6
45	57,5	73,7	1,1	52	78	1	0,21	3	4,6	3,2
	55,3	74,6	1,1	52	78	1	0,26	2,4	3,7	2,5
	67,7	89.5	1,5	54	91	1,5	0,23	2,7	4,2	2,8
	60,1	87,4	1,5	54	91	1,5	0,33	1,9	3	2
50	61,7	79,5	1,1	57	83	1	0,21	3	4,6	3,2
	61,5	81,5	1,1	57	83	1	0,23	2,7	4,2	2,8
	70,3	95	2	61	99	2	0,24	2,6	4.1	2,8
	65,8	94,4	2	61	99	2	0,43	1,5	2,3	1,6
55	70,1	88,4	1,5	64	91	1,5	0,19	3,3	5,1	3,6
	67,7	89,5	1,5	64	91	1,5	0,23	2,7	4,2	2,8
	77,7	104	2	66	109	2	0,23	2,7	4,2	2,8
	72	103	2	66	109	2	0,40	1,6	2,4	1,6
60	78	97,6	1,5	69	101	1,5	0,19	3,3	5,1	3,6
	74,5	98,6	1,5	69	101	1,5	0,24	2,6	4,1	2,8
	91,6	118	2,1	72	118	2	0,22	2,9	4.5	2,8
	76,9	112	2,1	72	118	2	0,33	1,9	3	2
65	85,3	106	1,5	74	111	1.5	0,18	3,5	5,4	3,6
	80,7	107	1,5	74	111	1.5	0,24	2,6	4,1	2,8
	99	127	2,1	77	128	2	0,22	2,9	4,5	2,8
	85,5	122	2,1	77	128	2	0.37	1,7	2,6	1,8



Cylindrical bore



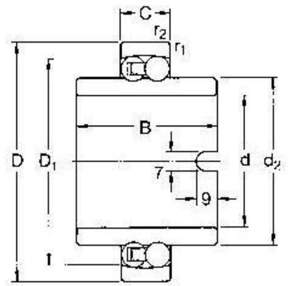
Tapered bore
taper 1 : 12 on diameter

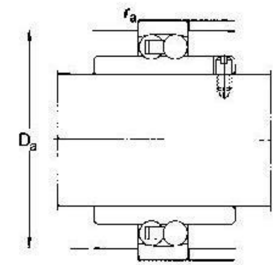


Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designations Bearing with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
70	125	24	35,8	14,6	0,75	11 000	7 000	1,25	**1214 ETN9**	–
	125	31	44.2	17	0,88	10 000	6 700	1,50	**2214**	–
	150	35	74,1	27,5	1,34	8 500	6 000	3,00	**1314**	–
	150	51	111	37,5	1,86	8 000	6 000	3.90	**2314**	–
75	130	25	39	15.6	0,80	10 000	6 700	1,35	**1215**	**1215 K**
	130	31	58,5	22	1,12	9 000	6 300	1,60	**2215 ETN9**	**2215 EKTN9**
	160	37	79,3	30	1,43	8 000	5 600	3,55	**1315**	**1315 K**
	160	55	124	43	2,04	7 500	5 600	4,70	**2315**	**2315 K**
80	140	26	39,7	17	0,83	9 500	6 000	1,65	**1216**	**1216 K**
	140	33	65	25,5	1,25	8 500	6 000	2,00	**2216 ETN9**	**2216 EKTN9**
	170	39	88,4	33,5	1,50	7 500	5 300	4,20	**1316**	**1316 K**
	170	58	135	49	2,24	7 000	5 300	6,10	**2316**	**2316 K**
85	150	28	46,8	20,8	0,98	9 000	5 600	2,05	**1217**	**1217 K**
	150	36	58,5	23.6	1,12	8 000	5 600	2,50	**2217**	**2217 K**
	180	41	97,5	38	1,70	7 000	4 800	5.00	**1317**	**1317 K**
	180	60	140	51	2.28	6 700	4 800	7,05	**2317**	**2317 K**
90	160	30	57,2	23,6	1,08	8 500	5 300	2,50	**1218**	**1218 K**
	160	40	70,2	28,5	1,32	7 500	5 300	3,40	**2218**	**2218 K**
	190	43	117	44	1,93	6 700	4 500	5,80	**1318**	**1318 K**
	190	64	153	57	2,50	6 300	4 500	8,45	**2318 M**	**2318 KM**
95	170	32	63,7	27	1,20	8 000	5 000	3,10	**1219**	**1219 K**
	170	43	83,2	34,5	1,53	7 000	5 000	4,10	**2219 M**	**2219 KM**
	200	45	133	51	2,16	6 300	4 300	6,70	**1319**	**1319 K**
	200	67	165	64	2,75	6 000	4 500	9.80	**2319 M**	–
100	180	34	68,9	30	1,29	7 500	4 800	3,70	**1220**	**1220 K**
	180	46	97,5	40.5	1,76	6 700	4 800	5,00	**2220 M**	**2220 KM**
	215	47	143	57	2,36	6 000	4 000	8,30	**1320**	**1320 K**
	215	73	190	80	3,25	5 600	4 000	12,5	**2320 M**	**2320 KM**
110	200	38	88.4	39	1,60	6 700	4 300	5,15	**1222**	**1222 K**
	200	53	124	52	2,12	6 000	4 300	7,10	**2222 M**	**2222 KM**
	240	50	163	72	2,75	5 300	3 600	12,0	**1322 M**	**1322 KM**
120	215	42	119	53	2,12	6 300	4 000	6,75	**1224 M**	**1224 KM**

Dimensions				Abutment and fillet dimensions			Calculation factors			
d	d_2 ~	D_1 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm				mm			–			
70	87,4	109	1,5	79	116	1,5	0,18	3,5	5,4	3,6
	87,5	111	1,5	79	116	1,5	0,27	2,3	3,6	2,5
	97,7	129	2,1	82	138	2	0,22	2,9	4,5	2,8
	91,6	130	2,1	82	138	2	0,37	1,7	2,6	1,8
75	93	116	1,5	84	121	1,5	0,17	3,7	5,7	4
	91,6	118	1,5	84	121	1,5	0,22	2,9	4,5	2,8
	104	138	2,1	87	148	2	0,22	2,9	4,5	2,6
	97,8	139	2,1	87	148	2	0,37	1,7	2,6	1,8
80	101	125	2	91	129	2	0,16	3,9	6,1	4
	99	127	2	91	129	2	0,22	2,9	4,5	2,8
	109	147	2,1	92	158	2	0,22	2,9	4,5	2,8
	104	148	2,1	92	158	2	0,37	1,7	2,6	1,8
85	107	134	2	96	139	2	0,17	3,7	5,7	4
	105	133	2	96	139	2	0,25	2,5	3,9	2,5
	117	155	3	99	166	2,5	0,22	2,9	4,5	2,8
	115	157	3	99	166	2,5	0,37	1,7	2,6	1,8
90	112	142	2	101	149	2	0,17	3,7	5,7	4
	112	142	2	101	149	2	0,27	2,3	3,6	2,5
	122	165	3	104	176	2,5	0,22	2,9	4,5	2,8
	121	164	3	104	176	2,5	0,37	1,7	2,6	1,8
95	120	151	2,1	107	158	2	0,17	3,7	5,7	4
	118	151	2,1	107	158	2	0,27	2,3	3,6	2,5
	127	174	3	109	186	2,5	0,23	2,7	4,2	2,8
	128	172	3	109	186	2,5	0,37	1,7	2,6	1,8
100	127	159	2,1	112	168	2	0,17	3,7	5,7	4
	124	160	2,1	112	168	2	0,27	2,3	3,6	2,5
	136	185	3	114	201	2,5	0,23	2,7	4,2	2,8
	135	186	3	114	201	2,5	0,37	1,7	2,6	1,8
110	140	176	2,1	122	188	2	0,17	3,7	5,7	4
	137	177	2,1	122	188	2	0,28	2,2	3,5	2,5
	154	206	3	124	226	2,5	0,22	2,9	4,5	2,8
120	149	190	2,1	132	203	2	0,19	3,3	5,1	3,6

Self-aligning ball bearings with extended inner ring
d **20 – 60** mm

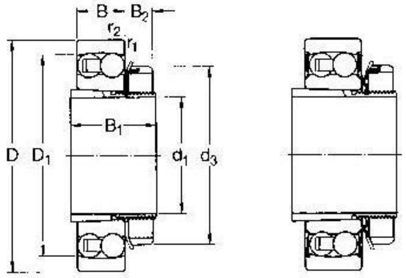




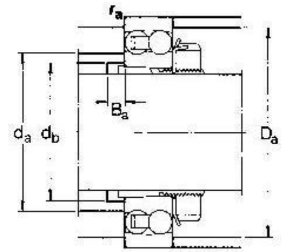
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Limiting speed	Mass	Designation
d	D	C	C	C_0	P_u			
mm			kN		kN	r/min	kg	–
20	47	14	12,7	3,4	0,18	9 000	0,18	**11204 ETN9**
25	52	15	14,3	4	0,21	8 000	0,22	**11205 ETN9**
30	62	16	15,6	4,65	0,24	6 700	0,35	**11206 TN9**
35	72	17	15,9	5,1	0,27	5 600	0,54	**11207 TN9**
40	80	18	19	6,55	0,34	5 000	0,72	**11208 TN9**
45	85	19	21,6	7,35	0,38	4 500	0,77	**11209 TN9**
50	90	20	22,9	8,15	0,42	4 300	0,85	**11210 TN9**
60	110	22	30,2	11,6	0,60	3 400	1,15	**11212 TN9**

Dimensions					Abutment and fillet dimensions		Calculation factors			
d	d_2 ~	D_1 ~	B	$r_{1,2}$ min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm					mm		–			
20	28,9	41	40	1	41,4	1	0,30	2,1	3,3	2,2
25	33,3	45,6	44	1	46,4	1	0,28	2,2	3,5	2,5
30	40,1	53,2	48	1	56,4	1	0,25	2,5	3,9	2,5
35	47,7	60,7	52	1,1	65	1	0,23	2,7	4,2	2,8
40	54	68,8	56	1,1	73	1	0,22	2,9	4,5	2,8
45	57,7	73,7	58	1,1	78	1	0,21	3	4,6	3,2
50	62,7	78,7	58	1,1	83	1	0,21	3	4,6	3,2
60	78	97,5	62	1,5	101	1,5	0,19	3,3	5,1	3,6

Self-aligning ball bearings on adapter sleeve
d_1 17 – 45 mm



Open bearing   Sealed bearing

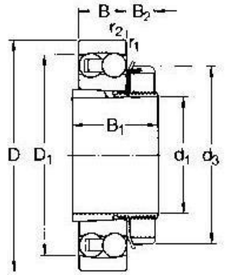


Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve	Designations Bearing	Adapter sleeve
d_1	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
17	47	14	12,7	3,4	0,18	32 000	20 000	0,16	**1204 EKTN9**	**H 204**
20	52	15	14,3	4	0,21	28 000	18 000	0,21	**1205 EKTN9**	**H 205**
	52	18	16,8	4,4	0,23	26 000	18 000	0,23	**2205 EKTN9**	**H 305**
	52	18	14,3	4	0,21	–	9 000	0,23	**2205 E-2RS1KTN9**	**H 305 C**
	62	17	19	5,4	0,28	22 000	15 000	0,33	**1305 EKTN9**	**H 305**
25	62	16	15,6	4,65	0,24	24 000	15 000	0,32	▸ **1206 EKTN9**	**H 206**
	62	20	23,8	6,7	0,35	22 000	15 000	0,36	**2206 EKTN9**	**H 306**
	62	20	15,6	4,65	0,24	–	7 500	0,36	**2206 E-2RS1KTN9**	**H 306 C**
	72	19	22,5	6,8	0,36	19 000	13 000	0,49	**1306 EKTN9**	**H 306**
	72	27	31,2	8,8	0,45	18 000	13 000	0,61	**2306 K**	**H 2306**
30	72	17	19	6	0,31	20 000	13 000	0,44	▸ **1207 EKTN9**	**H 207**
	72	23	30,7	8,8	0,46	18 000	12 000	0,54	**2207 EKTN9**	**H 307**
	72	23	19	6	0,31	–	6 300	0,55	**2207 E-2RS1KTN9**	**H 307 C**
	80	21	26,5	8,5	0,43	16 000	11 000	0,65	**1307 EKTN9**	**H 307**
	80	31	39,7	11,2	0,59	18 000	12 000	0,84	**2307 EKTN9**	**H 2307**
35	80	18	19,9	6,95	0,36	18 000	11 000	0,58	▸ **1208 EKTN9**	**H 208**
	80	23	31,9	10	0,51	16 000	11 000	0,58	**2208 EKTN9**	**H 308**
	80	23	19,9	6,95	0,36	–	5 600	0,67	**2208 E-2RS1KTN9**	**H 308 C**
	90	23	33,8	11,2	0.57	14 000	9 500	0,85	**1308 EKTN9**	**H 308**
	90	33	54	16	0,82	14 000	10 000	1,10	**2308 EKTN9**	**H 2308**
40	85	19	22,9	7,8	0.40	17 000	11 000	0,68	▸ **1209 EKTN9**	**H 209**
	85	23	32,5	10,6	0,54	15 000	10 000	0,78	**2209 EKTN9**	**H 309**
	85	23	22,9	7,8	0,40	–	5 300	1,20	**2209 E-2RS1KTN9**	**H 309 C**
	100	25	39	13,4	0,70	12 000	8 500	1,20	**1309 EKTN9**	**H 309**
	100	36	63,7	19,3	1	13 000	9 000	1,40	**2309 EKTN9**	**H 2309**
45	90	20	26,5	9,15	0,48	16 000	10 000	0,77	▸ **1210 EKTN9**	**H 210**
	90	23	33,8	11,2	0,57	14 000	9 500	0,87	**2210 EKTN9**	**H 310**
	90	23	22,9	8,15	0,42	–	4 800	0,84	**2210 E-2RS1KTN9**	**H 310 C**
	110	27	43,6	14	0,72	12 000	8 000	1,45	**1310 EKTN9**	**H 310**
	110	40	63,7	20	1,04	14 000	9 500	1.90	**2310 K**	**H 2310**

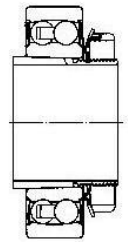
Dimensions						Abutment and fillet dimensions					Calculation factors			
d_1	d_3	D_1 ~	B_1	B_2	$r_{1,2}$ min	d_a max	d_b min	D_a max	B_a min	r_a max	e	Y_1	Y_2	Y_0
mm						mm					–			
17	32	41	24	7	1	28,5	23	41,4	5	1	0,30	2,1	3,3	2,2
20	38	45,6	26	8	1	33	28	46,4	5	1	0,28	2,2	3,5	2,5
	38	46,1	29	8	1	32	28	46,4	5	1	0,35	1,8	2,8	1,8
	38	46,3	29	8,5	1	31	28	46,4	5	1	0,28	2,2	3,5	2,5
	38	52,5	29	8	1,1	37	28	55	6	1	0,28	2,2	3,5	2,5
25	45	53	27	8	1	40	33	56,4	5	1	0,25	2,5	3,9	2,5
	45	55	31	8	1	38	33	56,4	5	1	0,33	1,9	3	2
	45	54,1	31	8,5	1	36	33	56,4	5	1	0,25	2,5	3,9	2,5
	45	60,9	27	8	1,1	44	33	65	6	1	0,25	2,5	3,9	2,5
	45	60,9	38	8	1,1	41	35	65	5	1	0,44	1,4	2,2	1.4
30	52	62,3	29	9	1,1	47	38	65	–	1	0,23	2,7	4,2	2,8
	52	64,2	35	9	1,1	45	39	65	5	1	0,31	2	3,1	2.2
	52	62.7	35	9,5	1,1	42	39	65	5	1	0,23	2,7	4,2	2,8
	52	69,5	35	9	1,5	51	39	71	7	1,5	0,25	2,5	3,9	2,5
	52	68,4	43	9	1,5	46	40	71	5	1,5	0,46	1,35	2,1	1.4
35	58	68,8	31	10	1,1	53	43	73	6	1	0,22	2,9	4,5	2,8
	58	71,6	36	10	1.1	52	44	73	6	1	0,28	2.2	3,5	2.5
	58	69.8	36	10,5	1,1	49	44	73	6	1	0,22	2,9	4,5	2,8
	58	81,5	36	10	1,5	61	44	81	6	1,5	0,23	2,7	4,2	2,8
	58	79,2	46	10	1.5	53	45	81	6	1,5	0,40	1.6	2,4	1,6
40	65	73,7	33	11	1,1	57	48	78	6	1	0,21	3	4,6	3,2
	65	74,6	39	11	1.1	55	50	78	8	1	0,26	2,4	3,7	2,5
	65	75,3	39	11,5	1,1	53	50	78	8	1	0,21	3	4,6	3,2
	65	89,5	39	11	1,5	67	50	91	6	1,5	0,23	2,7	4,2	2,8
	65	87,4	50	11	1,5	60	50	91	6	1,5	0,33	1,9	3	2
45	70	79,5	35	12	1,1	62	53	83	6	1	0,21	3	4,6	3,2
	70	81,5	42	12	1,1	61	55	83	10	1	0,23	2,7	4,2	2,8
	70	79,5	42	12,5	1,1	58	55	83	10	1	0,20	3,2	4,9	3,2
	70	95	42	12	2	70	55	99	6	2	0,24	2,6	4,1	2,8
	70	94,4	55	12	2	65	56	99	6	2	0,43	1,5	2,3	1,6

▸ Bearings and sleeves also available as KAM self-aligning ball bearing kits (→ **page 468**)

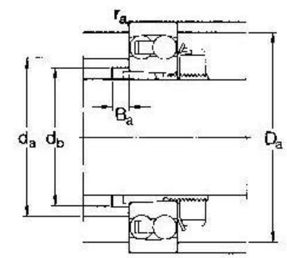
Self-aligning ball bearings on adapter sleeve
d_1 **50 – 85** mm



Open bearing



Sealed bearing



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve	Designations Bearing	Adapter sleeve
d_1	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
50	100	21	27,6	10,6	0,54	14 000	9 000	0,99	▸ **1211 EKTN9**	**H 211**
	100	25	39	13,4	0,70	12 000	8 500	1,15	**2211 EKTN9**	**H 311**
	100	25	27,6	10,6	0,54	–	4 300	1,10	**2211 E-2RS1KTN9**	**H 311 C**
	120	29	50,7	18	0.92	11 000	7 500	1,90	**1311 EKTN9**	**H 311**
	120	43	76,1	24	1,25	11 000	7 500	2,40	**2311 K**	**H 2311**
55	110	22	31,2	12,2	0,62	12 000	8 500	1,20	**1212 EKTN9**	**H 212**
	110	28	48,8	17	0,88	11 000	8 000	1,40	**2212 EKTN9**	**H 312**
	130	31	58,5	22	1.12	9 000	6 300	2,15	**1312 EKTN9**	**H 312**
	130	46	87,1	28,5	1,46	9 500	7 000	2.95	**2312 K**	**H 2312**
60	120	23	35,1	14	0,72	11 000	7 000	1,45	**1213 EKTN9**	**H 213**
	120	31	57,2	20	1,02	10 000	7 000	1.80	**2213 EKTN9**	**H 313**
	120	31	35,1	14	0,72	–	3 600	1,75	**2213 E-2RS1KTN9**	**H 313 C**
	140	33	65	25,5	1,25	8 500	6 000	2,85	**1313 EKTN9**	**H 313**
	140	48	95,6	32,5	1,66	9 000	6 300	3,60	**2313 K**	**H 2313**
65	130	25	39	15,6	0,80	10 000	6 700	2.00	**1215 K**	**H 215**
	130	31	58,5	22	1,12	9 000	6 300	2,30	**2215 EKTN9**	**H 315**
	160	37	79,3	30	1,43	8 000	5 600	4,20	**1315 K**	**H 315**
	160	55	124	43	2,04	7 500	5 600	5,55	**2315 K**	**H 2315**
70	140	26	39,7	17	0,83	9 500	6 000	2,40	**1216 K**	**H 216**
	140	33	65	25,5	1,25	8 500	6 000	2,85	**2216 EKTN9**	**H 316**
	170	39	88,4	33,5	1,50	7 500	5 300	5,00	**1316 K**	**H 316**
	170	58	135	49	2,24	7 000	5 300	7,10	**2316 K**	**H 2316**
75	150	28	48,8	20,8	0,98	9 000	5 600	2,95	**1217 K**	**H 217**
	150	36	58.5	23,6	1,12	8 000	5 600	3,30	**2217 K**	**H 317**
	180	41	97,5	38	1,70	7 000	4 800	6,00	**1317 K**	**H 317**
	180	60	140	51	2,28	6 700	4 800	8,15	**2317 K**	**H 2317**
80	160	30	57,2	23.6	1,08	8 500	5 300	3,50	**1218 K**	**H 218**
	160	40	70,2	28,5	1,32	7 500	5 300	5,50	**2218 K**	**H 318**
	190	43	117	44	1,93	6 700	4 500	6,90	**1318 K**	**H 318**
	190	64	153	57	2,50	6 300	4 500	9,80	**2318 KM**	**H 2318**
85	170	32	63,7	27	1,20	8 000	5 000	4,25	**1219 K**	**H 219**
	170	43	83,2	34,5	1,53	7 000	5 000	5,30	**2219 KM**	**H 319**
	200	45	133	51	2,16	6 300	4 300	7,90	**1319 K**	**H 319**

▸ Bearings and sleeves also available as KAM self-aligning ball bearing kits (→ **page 468**)

Dimensions						Abutment and fillet dimensions					Calculation factors			
d_1	d_3	D_1 ~	B_1	B_2	$r_{1,2}$ min	d_a max	d_b min	D_a max	B_a min	r_a max	e	Y_1	Y_2	Y_0
mm						mm					–			
50	75	88,4	37	12.5	1,5	70	60	91	7	1,5	0,19	3,3	5,1	3,6
	75	89,5	45	12,5	1,5	67	60	91	11	1,5	0,23	2,7	4,2	2,8
	75	88,5	45	12,5	1,5	65	60	91	11	1,5	0,19	3,3	5,1	3,6
	75	104	45	12.5	2	77	60	109	7	2	0,23	2,7	4,2	2,8
	75	103	59	12,5	2	72	61	109	7	2	0,40	1,6	2,4	1,6
55	80	97,6	38	13	1,5	78	64	101	7	1,5	0,19	3,3	5,1	3,6
	80	98,6	47	13	1,5	74	65	101	9	1,5	0,24	2,6	4,1	2,8
	80	118	47	13	2,1	87	65	118	7	2	0,22	2,9	4,5	2,8
	80	112	62	13	2,1	76	66	118	7	2	0,33	1,9	3	2
60	85	106	40	14	1,5	85	70	111	7	1,5	0,18	3,5	5,4	3,6
	85	107	50	14	1,5	80	70	111	9	1,5	0,24	2,6	4,1	2,8
	85	106	50	14	1,5	79	70	111	7	1,5	0,18	3,5	5,4	3,6
	85	127	50	14	2,1	89	70	128	7	2	0,22	2,9	4,5	2,8
	85	122	65	14	2,1	85	72	128	7	2	0,37	1,7	2,6	1,8
65	98	116	43	15	1,5	93	80	121	7	1,5	0,17	3,7	5,7	4
	98	118	55	15	1,5	93	80	121	13	1,5	0,22	2,9	4,5	2,8
	98	138	55	15	2,1	104	80	148	7	2	0,22	2,9	4,5	2,8
	98	139	73	15	2,1	97	82	148	7	2	0,37	1,7	2,6	1,8
70	105	125	46	17	2	101	85	129	7	2	0,16	3,9	6,1	4
	105	127	59	17	2	99	85	129	13	2	0,22	2,9	4,5	2,8
	105	147	59	17	2,1	109	85	158	7	2	0,22	2,9	4,5	2,8
	105	148	78	17	2,1	104	88	158	7	2	0,37	1,7	2,6	1,8
75	110	134	50	18	2	107	90	139	8	2	0,17	3,7	5,7	4
	110	133	63	18	2	105	91	139	13	2	0,25	2,5	3,9	2,5
	110	155	63	18	3	117	91	166	8	2,5	0,22	2,9	4,5	2,8
	110	157	82	18	3	111	94	166	8	2,5	0,37	1,7	2,6	1,8
80	120	142	52	18	2	112	95	149	8	2	0,17	3,7	5,7	4
	120	142	65	18	2	112	96	149	11	2	0,27	2,3	3,6	2,5
	120	165	65	18	3	122	96	176	8	2,5	0,22	2,9	4,5	2,8
	120	164	86	18	3	115	100	176	8	2,5	0,37	1,7	2,6	1,8
85	125	151	55	19	2,1	120	100	158	8	2	0,17	3,7	5,7	4
	125	151	68	19	2,1	118	102	158	10	2	0,27	2,3	3,6	2,5
	125	174	68	19	3	127	102	186	8	2,5	0,23	2,7	4,2	2,8

and two outer ring flanges and the axial internal clearance is relatively small, axial stresses may be induced in the bearing. In case of doubt, it is advisable to contact the SKF application engineering service.

Axial displacement

Cylindrical roller bearings with flangeless inner or outer rings, NU and N designs, and NJ-design bearings with one integral flange at the inner ring can accommodate axial displacement of the shaft with respect to the housing as a result of thermal expansion within certain limits (→ **fig 9**). As the axial displacement takes place within the bearing and not between the bearing and shaft or housing bore, there is practically no increase in friction as the bearing rotates. Values for the permissible axial displacement s from the normal position of one bearing ring relative to the other are given in the product table.

Influence of operating temperature on bearing material

SKF cylindrical roller bearings undergo a special heat treatment. When equipped with a steel or brass cage, they can operate at temperatures of up to +150 °C.

Cages

Depending on size and design, SKF single row cylindrical roller bearings are equipped as standard with one of the cages described below and shown in **fig 10**. Bearings included in the SKF standard programme are also available with a choice of up to four different cages (→ product table).

The various cages used for single row cylindrical roller bearings are

- moulded glass fibre reinforced polyamide 6,6 cage, roller centred, designation suffix P (**a**),
- unhardened pressed steel cage, roller centred, designation suffix J (**b**),
- one-piece window-type brass cage, inner or outer ring centred, designation suffixes ML and MP (**c**),
- two-piece machined brass cage, roller centred, designation suffix M, or outer ring centred, designation suffix MA, or inner ring centred, designation suffix MB (**d**).

Fig 9

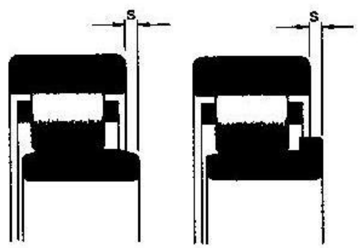
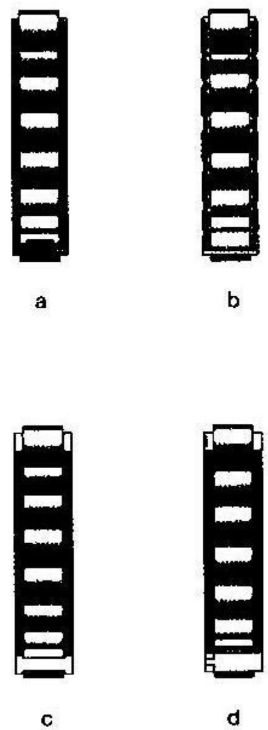


Fig 10



Note:
Single row cylindrical roller bearings with a polyamide cage can be operated at operating temperatures up to +120 °C. The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties, with the exception for a few synthetic oils and greases with synthetic base oil as well as some lubricants containing a high proportion of EP additives when used at elevated temperatures.

For bearing arrangements, which are to operate at continuously high temperatures or under difficult conditions, the use of bearings with metallic cages is recommended. For applications in equipment using refrigerants such as ammonia or freon replacements, bearings with a polyamide cage can be used for operating temperatures up to 70 °C. At higher operating temperatures bearings incorporating a machined brass or steel cage should be used.

For detailed information regarding the temperature resistance and the applicability of cages, please refer to the section "Cage materials", starting on **page 140**.

Speed ratings

The limiting speeds are determined by certain criteria that include the form stability and the strength of the cage (→ section "Limiting speeds" on **page 114**). The values listed in the product table are valid for the standard cage. To facilitate the estimation of the limiting speed for bearings with an alternative cage or vice-versa, **table 4** provides the appropriate conversion factors.

Table 4

Conversion factors for limiting speeds

Bearing with standard cage	alternative standard cage P, J, M, MR	MA, MB	ML, MP
P, J, M, MR	1	1,3	1,5
MA, MB	0,75	1	1,2
ML, MP	0,65	0,85	1

Minimum load

In order to provide satisfactory operation, single row cylindrical roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions, the inertia forces of the rollers and cage, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum load to be applied to single row cylindrical roller bearings can be estimated using

$$F_{rm} = k_r \left(6 + \frac{4\,n}{n_r}\right)\left(\frac{d_m}{100}\right)^2$$

where

F_{rm} = minimum radial load, kN
k_r = minimum load factor (→ product table)
n = rotational speed, r/min
n_r = reference speed, r/min (→ product table)
d_m = bearing mean diameter = 0,5 (d + D), mm

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the single row cylindrical roller bearing must be subjected to an additional radial load.

Dynamic axial load carrying capacity
Single row cylindrical roller bearings with flanges on both inner and outer rings can support axial loads in addition to radial loads. Their axial load carrying capacity is primarily determined by the ability of the sliding surfaces of the roller end/flange contact to support loads. Factors having the greatest effect on this ability are the lubrication, operating temperature and heat dissipation from the bearing.

Assuming the conditions cited below, the permissible axial load can be calculated with sufficient accuracy from

$$F_{ap} = \frac{k_1 C_0 10^4}{n(d+D)} - k_2 F_r$$

where
F_{ap} = maximum permissible axial load, kN
C_0 = basic static load rating, kN
F_r = actual radial bearing load, kN
n = rotational speed, r/min
d = bearing bore diameter, mm
D = bearing outside diameter, mm
k_1 = a factor
1,5 for oil lubrication
1 for grease lubrication
k_2 = a factor
0,15 for oil lubrication
0,1 for grease lubrication

The above equation is based on conditions that are considered typical for normal bearing operation:

- a difference of 60 °C between the bearing operating temperature and the ambient temperature;
- a specific heat loss from the bearing of 0,5 mW/mm^2 °C; with reference to the bearing outside diameter surface (π D B);
- a viscosity ratio $\kappa = 2$.

For grease lubrication the viscosity of the base oil in the grease may be used. If κ is less than 2, the friction will increase and there will be more wear. These effects can be reduced at low speeds, for example, by using oils with AW (anti-wear) and EP (extreme pressure) additives.

Where axial loads act for longer periods and the bearings are grease lubricated, it is advisable to use grease that has good oil bleeding properties at the operating temperatures (> 3 % according to DIN 51 817). Frequent relubrication is also recommended.

The values of the permissible load F_{ap} obtained from the heat balance equation are valid for a continuously acting constant axial load and adequate lubricant supply to the roller end/flange contacts. Where axial loads act only for short periods, the values may be multiplied by a factor of 2, or for shock loads by a factor of 3, provided the limits given in the following with regard to flange strength are not exceeded.

To avoid any risk of flange breakage, the constantly acting axial load F_a applied to the bearing should never exceed the numerical value of

- 0,0045 $D^{1,5}$ for bearings of series 2, and
- 0,0023 $D^{1,7}$ for bearings of other series.

Where the axial load acts only occasionally and for brief periods, F_a should never be greater than the numerical value of

- 0,013 $D^{1,5}$ for bearings of series 2, and
- 0,007 $D^{1,7}$ for bearings of other series

where
F_a = constantly or occasionally acting axial load, kN
D = bearing outside diameter, mm

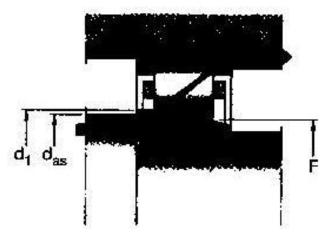
To obtain an even flange load and provide sufficient running accuracy of the shaft when single row cylindrical roller bearings are subjected to heavy axial loads, axial runout and the size of the abutment surfaces of adjacent components become particularly important. For the axial runout see the recommendations provided in the section "Dimensional, form and running accuracy of bearing seatings and abutments" on **page 194**. As to the diameter of the abutment surfaces, SKF recommends supporting the inner ring at a height corresponding to half of the flange height (→ **fig 11**). For the inner ring flange, for example, the abutment diameter can be obtained using

$$d_{as} = 0,5 (d_1 + F)$$

where
d_{as} = shaft abutment diameter, mm
d_1 = inner ring flange diameter, mm
F = inner ring raceway diameter, mm

Where the misalignment between the inner and outer rings exceeds 1 minute of arc, the action of the load on the flange changes considerably. The safety factors included in the guideline values may be inadequate. In these cases, please contact the SKF application engineering service.

Fig 11



Equivalent dynamic bearing load
For non-locating bearing

$P = F_r$

If bearings with flanges on both inner and outer rings are used to locate a shaft in one or both directions, the equivalent dynamic bearing load should be calculated using

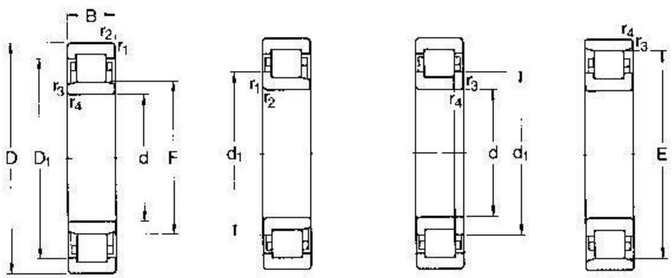
$P = F_r$ when $F_a/F_r \leq e$
$P = 0,92F_r + YF_a$ when $F_a/F_r > e$

where
e = limiting value
= 0,2 for bearings in the 10, 2, 3 and 4 series
= 0,3 for bearings in other series
Y = axial load factor
= 0,6 for bearings in the 10, 2, 3 and 4 series
= 0,4 for bearings in other series

Since axially loaded cylindrical roller bearings only operate satisfactorily when they are subjected to a simultaneously acting radial load, the ratio F_a/F_r should not exceed 0,5.

Equivalent static bearing load

$P_0 = F_r$



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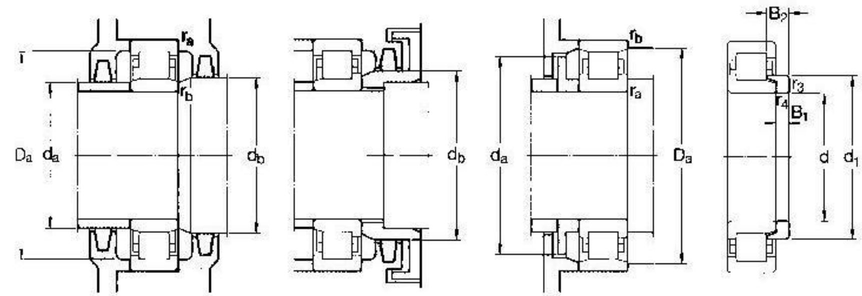


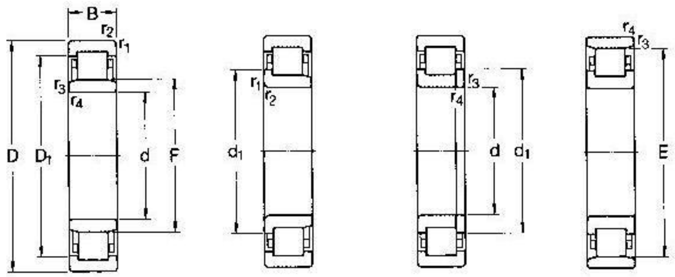
Angle ring

Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designations	
			dynamic	static		Reference speed	Limiting speed	Bearing with standard cage	Bearing with standard cage	Alternative standard cage designs[1]
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
15	35	11	12,5	10,2	1,22	22 000	26 000	0,047	**NU 202 ECP**	–
	35	11	12,5	10,2	1,22	22 000	26 000	0,048	**NJ 202 ECP**	–
17	40	12	17,2	14,3	1,73	19 000	22 000	0,068	**NU 203 ECP**	**ML**
	40	12	17,2	14,3	1,73	19 000	22 000	0,070	**NJ 203 ECP**	**ML**
	40	12	17,2	14,3	1,73	19 000	22 000	0,073	**NUP 203 ECP**	**ML**
	40	12	17,2	14,3	1,73	19 000	22 000	0,066	**N 203 ECP**	
	40	16	23,8	21,6	2,65	19 000	22 000	0,087	**NU 2203 ECP**	–
	40	16	23,8	21,6	2,65	19 000	22 000	0,093	**NJ 2203 ECP**	–
	40	16	23,8	21,6	2,65	19 000	22 000	0,097	**NUP 2203 ECP**	–
	47	14	24,6	20,4	2,55	15 000	20 000	0,12	**NU 303 ECP**	–
	47	14	24,6	20,4	2,55	15 000	20 000	0,12	**NJ 303 ECP**	–
	47	14	24,6	20.4	2,55	15 000	20 000	0,12	**N 303 ECP**	–
20	47	14	25,1	25,2	2,75	16 000	19 000	0,11	**NU 204 ECP**	**ML**
	47	14	25,1	25,2	2.75	16 000	19 000	0,11	**NJ 204 ECP**	**ML**
	47	14	25,1	25,2	2,75	16 000	19 000	0,12	**NUP 204 ECP**	**ML**
	47	14	25,1	25,2	2,75	16 000	19 000	0,11	**N 204 ECP**	–
	47	18	29,7	27,5	3,45	16 000	19 000	0,14	**NU 2204 ECP**	–
	47	18	29,7	27,5	3,45	16 000	19 000	0,14	**NJ 2204 ECP**	–
	52	15	35,5	26	3,25	15 000	18 000	0,15	* **NU 304 ECP**	–
	52	15	35,5	26	3,25	15 000	18 000	0,15	* **NJ 304 ECP**	–
	52	15	35,5	26	3,25	15 000	18 000	0,16	* **NUP 304 ECP**	–
	52	15	35,5	26	3,25	15 000	18 000	0,15	* **N 304 ECP**	–
	52	21	47,5	38	4,8	14 000	18 000	0,21	* **NU 2304 ECP**	–
	52	21	47,5	38	4,8	14 000	18 000	0,22	* **NJ 2304 ECP**	–
	52	21	47,5	38	4,8	14 000	18 000	0,23	* **NUP 2304 ECP**	–
25	47	12	14,2	13,2	1,4	18 000	18 000	0,083	**NU 1005**	–
	52	15	28,6	27	3.35	14 000	16 000	0,13	**NU 205 ECP**	**J, ML**
	52	15	28,6	27	3,35	14 000	16 000	0,14	**NJ 205 ECP**	**J, ML**
	52	15	28,6	27	3,35	14 000	16 000	0,14	**NUP 205 ECP**	**ML**
	52	15	28,6	27	3,35	14 000	16 000	0,13	**N 205 ECP**	–

* SKF Explorer bearing
[1] When ordering bearings with an alternative standard cage the suffix of the standard cage has to be replaced by the suffix of the cage in question, e.g. NU 203 ECP becomes NU 203 ECML (for speed ratings → **page 511**)

Dimensions							Abutment and fillet dimensions						Calculation factor	Angle ring			
d	d_1 ~	D_1 ~	F, E	$r_{1,2}$ min	$r_{3,4}$ min	s[1]	d_a min	d_a max	d_b, D_a min	D_a max	r_a max	r_b max	k_r	Designation	Mass	Dimensions B_1	B_2
mm							mm						–	–	kg	mm	
15	–	27,9	19,3	0,6	0,3	1	17,4	18,5	21	30,8	0,6	0,3	0,15	–			
	21,9	27.9	19,3	0,6	0,3	1	18,5	18,5	23	30,8	0,6	0,3	0,15	–			
17	–	32,4	22,1	0,6	0,3	1	19,4	21	24	35,8	0,6	0,3	0,15	–			
	25	32,4	22,1	0,6	0,3	1	21	21	27	35,8	0.6	0,3	0,15	–			
	25	32,4	22,1	0,6	0,3	–	21,2	–	27	35,8	0,6	0,3	0,15	–			
	25	–	35,1	0,6	0,3	1	21,2	33	37	37,6	0,6	0,3	0,15	–			
	–	32,4	22,1	0,6	0,3	1,5	19,4	21	24	35,8	0,6	0,3	0,20	–			
	25	32,4	22,1	0,6	0,3	1,5	21	21	27	35,8	0,6	0,3	0,20	–			
	25	32,4	22,1	0,6	0,3	–	21,2	–	27	35,8	0.6	0,3	0,20	–			
	–	37	24,2	1	0,6	1	21,2	23	26	41,4	1	0,6	0,15	–			
	27,7	37	24,2	1	0,6	1	22,6	23	29	41,4	1	0,6	0,15	–			
	27.7	–	40,2	1	0,6	1	22,6	38	42	42,8	1	0,6	0,15	–			
20	–	38.8	26,5	1	0,6	1	24,2	25	28	41,4	1	0,6	0,15	–			
	29,7	38,8	26,5	1	0,6	1	25	25	31	41,4	1	0,6	0,15	–			
	29,7	38,8	26,5	1	0,6	–	25,6	–	31	41,4	1	0,6	0,15	–			
	29,7	–	41.5	1	0,6	1	25,6	40	43	42,8	1	0,6	0,15	–			
	–	38,8	26,5	1	0,6	2	24,2	25	28	41,4	1	0,6	0.20	–			
	29,7	38,8	26,5	1	0,6	2	25	25	31	41,4	1	0,6	0,20	–			
	31,2	42,4	27,5	1,1	0,6	0,9	24,2	26	29	45	1	0,6	0.15	**HJ 304 EC**	0,017	4	6,5
	31,2	42,4	27,5	1,1	0,6	0,9	27	29	33	45	1	0,6	0,15	**HJ 304 EC**	0,017	4	6,5
	31,2	42,4	27,5	1,1	0,6	–	27	–	33	45	1	0.6	0,15	–			
	31,2	–	45,5	1,1	0,6	0,9	27	44	47	47,8	1	0,6	0,15	–			
	–	42,4	27,5	1,1	0,6	1,9	24,2	26	29	45	1	0,6	0,29	–			
	31,2	42,4	27,5	1,1	0.6	1,9	26	26	33	45	1	0,6	0,29	–			
	31,2	42,4	27,5	1,1	0,6	–	27	–	33	45	1	0,6	0,29	–			
25	–	38,8	30,5	0,6	0,3	2	27	29	32	43,8	0,6	0.3	0,1	–			
	34,7	43,8	31,5	1	0,6	1,3	29,2	30	33	46,4	1	0,6	0,15	**HJ 205 EC**	0,014	3	6
	34,7	43,8	31,5	1	0,6	1,3	30	30	36	46,4	1	0,6	0,15	**HJ 205 EC**	0,014	3	6
	34,7	43,8	31,5	1	0,6	–	30,6	–	36	46,4	1	0,6	0,15	–			
	34,7	–	46,5	1	0,6	1.3	30,6	45	48	47,8	1	0,6	0,15	–			

[1] Permissible axial displacement from the normal position of one bearing ring in relation to the other



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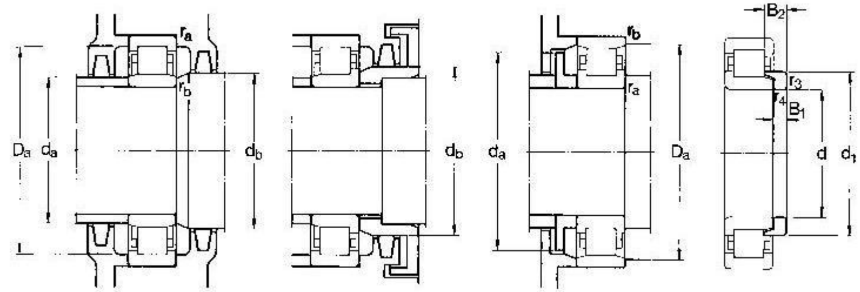


Angle ring

Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass Bearing with standard cage	Designations Bearing with standard cage	Alternative standard cage designs[1]
mm			kN		kN	r/min		kg	–	
25	52	18	34,1	34	4,25	14 000	16 000	0,16	**NU 2205 ECP**	**ML**
cont.	52	18	34,1	34	4,25	14 000	16 000	0,17	**NJ 2205 ECP**	**ML**
	52	18	34,1	34	4,25	14 000	16 000	0,17	**NUP 2205 ECP**	**ML**
	62	17	46,5	36,5	4,55	12 000	15 000	0,24	* **NU 305 ECP**	**J, ML**
	62	17	46,5	36,5	4,55	12 000	15 000	0,24	* **NJ 305 ECP**	**J, ML**
	62	17	46,5	36,5	4,55	12 000	15 000	0,25	* **NUP 305 ECP**	**J, ML**
	62	17	46,5	36,5	4,55	12 000	15 000	0,24	* **N 305 ECP**	–
	62	24	64	55	6,95	12 000	15 000	0,34	* **NU 2305 ECP**	**J, ML**
	62	24	64	55	6,95	12 000	15 000	0,35	* **NJ 2305 ECP**	**ML**
	62	24	64	55	6,95	12 000	15 000	0,36	* **NUP 2305 ECP**	**ML**
30	55	13	17,9	17,3	1,86	14 000	15 000	0,12	**NU 1006**	–
	62	16	44	36,5	4,55	13 000	14 000	0,20	* **NU 206 ECP**	**J, ML**
	62	16	44	36,5	4,55	13 000	14 000	0,20	* **NJ 206 ECP**	**J, ML**
	62	16	44	36,5	4,55	13 000	14 000	0,21	* **NUP 206 ECP**	**ML**
	62	16	44	36,5	4,55	13 000	14 000	0,20	* **N 206 ECP**	–
	62	20	55	49	6,1	13 000	14 000	0,26	* **NU 2206 ECP**	**J, ML**
	62	20	55	49	6,1	13 000	14 000	0,26	* **NJ 2206 ECP**	**J, ML**
	62	20	55	49	6,1	13 000	14 000	0,27	* **NUP 2206 ECP**	**ML**
	72	19	58,5	48	6,2	11 000	12 000	0,36	* **NU 306 ECP**	**J, M, ML**
	72	19	58,5	48	6,2	11 000	12 000	0,36	* **NJ 306 ECP**	**J, M, ML**
	72	19	58,5	48	6,2	11 000	12 000	0,38	* **NUP 306 ECP**	**J, M, ML**
	72	19	58,5	48	6,2	11 000	12 000	0,36	* **N 306 ECP**	–
	72	27	83	75	9,65	11 000	12 000	0,53	* **NU 2306 ECP**	**ML**
	72	27	83	75	9,65	11 000	12 000	0,54	* **NJ 2306 ECP**	**ML**
	72	27	83	75	9,65	11 000	12 000	0,55	* **NUP 2306 ECP**	**ML**
	90	23	60,5	53	6,8	9 000	11 000	0,75	**NU 406**	–
	90	23	60,5	53	6,8	9 000	11 000	0,79	**NJ 406**	–

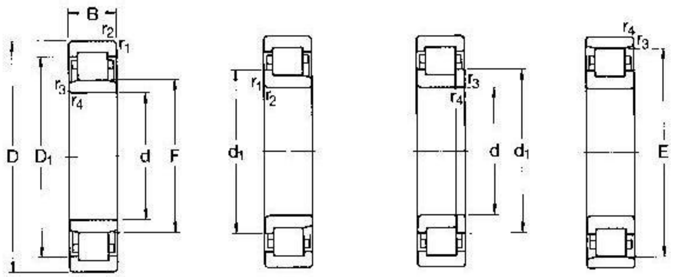
Dimensions d	d_1 ~	D_1 ~	F, E	$r_{1,2}$ min	$r_{3,4}$ min	s[1]	Abutment and fillet dimensions d_a min	d_a max	d_b, D_a min	D_a max	r_a max	r_b max	Calculation factor k_r	Angle ring Designation	Mass	Dimensions B_1	B_2
mm							mm						–	–	kg	mm	
25	34,7	43,8	31,5	1	0,6	1,8	29,2	30	33	46,4	1	0,6	0,20	**HJ 2205 EC**	0,014	3	6,5
cont.	34,7	43,8	31,5	1	0,6	1,8	30	30	36	46,4	1	0,6	0,20	**HJ 2205 EC**	0,014	3	6,5
	34,7	43,8	31,5	1	0,6	–	30,6	–	36	46,4	1	0,6	0,20	–			
	38,1	50,7	34	1,1	1,1	1,3	32	32	36	55	1	1	0,15	**HJ 305 EC**	0,023	4	7
	38,1	50,7	34	1,1	1,1	1,3	32	32	40	55	1	1	0,15	**HJ 305 EC**	0,023	4	7
	38,1	50,7	34	1,1	1,1	–	32	–	40	55	1	1	0,15	–			
	38,1	–	54	1,1	1,1	1,3	32	52	56	55	1	1	0,15	–			
	38,1	50,7	34	1,1	1,1	2,3	32	32	36	55	1	1	0,25	**HJ 2305 EC**	0,025	4	8
	38,1	50,7	34	1,1	1,1	2,3	32	32	40	55	1	1	0,25	**HJ 2305 EC**	0,025	4	8
	38,1	50,7	34	1,1	1,1	–	32	–	40	55	1	1	0,25	–			
30	–	45,6	36,5	1	0,6	2,1	33,2	35	38	50,4	1	0,6	0,1	–			
	41,2	52,5	37,5	1	0,6	1,3	34,2	36	39	56,4	1	0,6	0,15	**HJ 206 EC**	0,025	4	7
	41,2	52,5	37,5	1	0,6	1,3	35,6	36	43	56,4	1	0,6	0,15	**HJ 206 EC**	0,025	4	7
	41,2	52,5	37,5	1	0,6	–	35,6	–	43	56,4	1	0,6	0,15	–			
	41,2	–	55,5	1	0,6	1,3	35,6	54	57	57,8	1	0,6	0,15	–			
	–	52,5	37,5	1	0,6	1,8	34	36	39	57	1	0,6	0,2	–			
	41,2	52,5	37,5	1	0,6	1,8	34	36	43	57	1	0,6	0,2	–			
	41,2	52,5	37,5	1	0,6	–	34	–	43	57	1	0,6	0,2	–			
	–	58,9	40,5	1,1	1,1	1,4	37	39	42	65	1	1	0,15	–			
	45	58,9	40,5	1,1	1,1	1,4	37	39	47	65	1	1	0,15	–			
	45	58,9	40,5	1,1	1,1	–	37	–	47	65	1	1	0,15	–			
	45	–	62,5	1,1	1,1	1,4	37	60	64	65	1	1	0,15	–			
	–	58,9	40,5	1,1	1,1	2,4	37	39	42	65	1	1	0,25	–			
	45	58,9	40,5	1,1	1,1	2,4	37	39	47	65	1	1	0,25	–			
	45	58,9	40,5	1,1	1,1	–	37	–	47	65	1	1	0,25	–			
	50,5	66,6	45	1,5	1,5	1,6	41	43	47	79	1,5	1,5	0,15	**HJ 406**	0,080	7	11,5
	50,5	66,6	45	1,5	1,5	1,6	41	43	47	79	1,5	1,5	0,15	**HJ 406**	0,080	7	11,5

page 30

* SKF Explorer bearing
[1] When ordering bearings with an alternative standard cage the suffix of the standard cage has to be replaced by the suffix of the cage in question, e.g. NU 2205 ECP becomes NU 2205 ECML (for speed ratings → **page 511**)

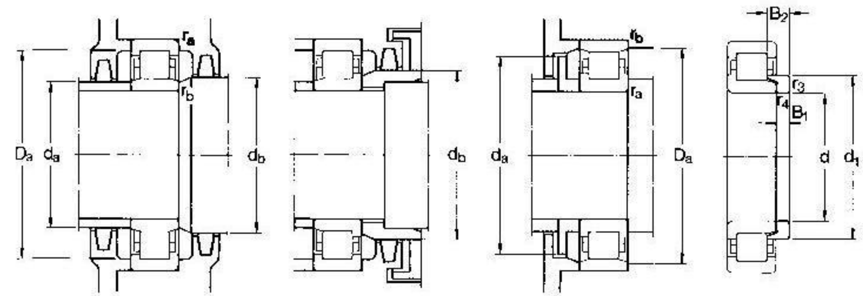
[1] Permissible axial displacement from the normal position of one bearing ring in relation to the other

Single row cylindrical roller bearings
d 35 – 40 mm



Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass Bearing with standard cage	Designations Bearing with standard cage	Alternative standard cage designs[1]
mm			kN		kN	r/min		kg	–	
35	62	14	35,8	38	4,55	12 000	13 000	0,16	**NU 1007 ECP**	–
	72	17	56	48	6,1	11 000	12 000	0,29	★ **NU 207 ECP**	**J, M, ML**
	72	17	56	48	6,1	11 000	12 000	0,30	★ **NJ 207 ECP**	**J, M, ML**
	72	17	56	48	6,1	11 000	12 000	0,31	★ **NUP 207 ECP**	**J, M, ML**
	72	17	56	48	6,1	11 000	12 000	0,30	★ **N 207 ECP**	–
	72	23	69,5	63	8,15	11 000	12 000	0,40	★ **NU 2207 ECP**	**J, ML**
	72	23	69,5	63	8,15	11 000	12 000	0,41	★ **NJ 2207 ECP**	**J, ML**
	72	23	69,5	63	8,15	11 000	12 000	0,42	★ **NUP 2207 ECP**	**ML**
	80	21	75	63	8,15	9 500	11 000	0,47	★ **NU 307 ECP**	**J, M, ML**
	80	21	75	63	8,15	9 500	11 000	0,49	★ **NJ 307 ECP**	**J, M, ML**
	80	21	75	63	8,15	9 500	11 000	0,50	★ **NUP 307 ECP**	**J, M, ML**
	80	21	75	63	8,15	9 500	11 000	0,48	★ **N 307 ECP**	–
	80	31	106	98	12,7	9 500	11 000	0,72	★ **NU 2307 ECP**	**J**
	80	31	106	98	12,7	9 500	11 000	0,73	★ **NJ 2307 ECP**	–
	80	31	106	98	12,7	9 500	11 000	0,76	★ **NUP 2307 ECP**	–
	100	25	76,5	69,5	9	8 000	9 500	1,00	**NU 407**	–
	100	25	76,5	69,5	9	8 000	9 500	1,05	**NJ 407**	–
40	68	15	25,1	26	3	11 000	18 000	0,23	**NU 1008 ML**	–
	80	18	62	53	6,7	9 500	11 000	0,37	★ **NU 208 ECP**	**J, M, ML**
	80	18	62	53	6,7	9 500	11 000	0,39	★ **NJ 208 ECP**	**J, M, ML**
	80	18	62	53	6,7	9 500	11 000	0,40	★ **NUP 208 ECP**	**J, M, ML**
	80	18	62	53	6,7	9 500	11 000	0,37	★ **N 208 ECP**	–
	80	23	81,5	75	9,65	9 500	11 000	0,49	★ **NU 2208 ECP**	**J, ML**
	80	23	81,5	75	9,65	9 500	11 000	0,50	★ **NJ 2208 ECP**	**J, ML**
	80	23	81,5	75	9,65	9 500	11 000	0,51	★ **NUP 2208 ECP**	**J, ML**
	90	23	93	78	10,2	8 000	9 500	0,65	★ **NU 308 ECP**	**J, M, ML**
	90	23	93	78	10,2	8 000	9 500	0,67	★ **NJ 308 ECP**	**J, M, ML**
	90	23	93	78	10,2	8 000	9 500	0,68	★ **NUP 308 ECP**	**M, ML**
	90	23	93	78	10,2	8 000	9 500	0,65	★ **N 308 ECP**	–

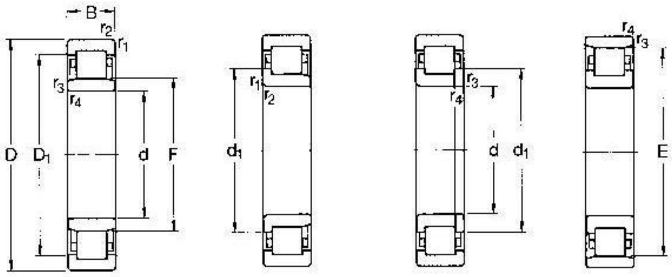
★ SKF Explorer bearing
[1] When ordering bearings with an alternative standard cage the suffix of the standard cage has to be replaced by the suffix of the cage in question, e.g. NU 207 ECP becomes NU 207 ECML (for speed ratings → **page 511**)



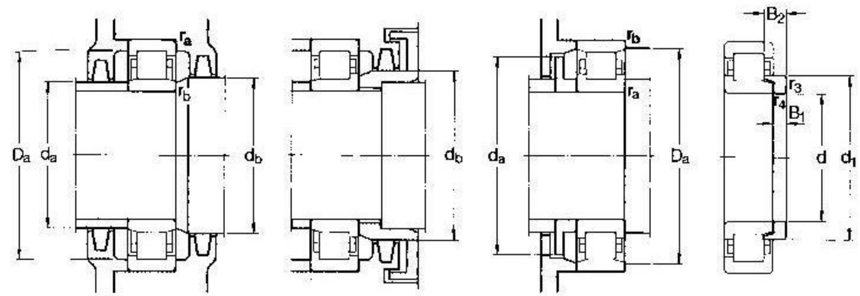
Angle ring

Dimensions d	d_1 ~	D_1 ~	F, E	$r_{1,2}$ min	$r_{3,4}$ min	s[1]	Abutment and fillet dimensions d_a min	d_a max	d_b, D_a min	D_a max	r_a max	r_b max	Calculation factor k_r	Angle ring Designation	Mass	Dimensions B_1	B_2
mm							mm						–	–	kg	mm	
35	–	54,5	42	1	0,6	1	38,2	41	44	56	1	0,6	0,1	–			
	48,1	60,7	44	1,1	0,6	1,3	39,2	42	46	65	1	0,6	0,15	**HJ 207 EC**	0,033	4	7
	48,1	60,7	44	1,1	0,6	1,3	42	42	50	65	1	0,6	0,15	**HJ 207 EC**	0,033	4	7
	48,1	60,7	44	1,1	0,6	–	42	–	50	65	1	0,6	0,15	–			
	48,1	–	64	1,1	0,6	1,3	42	62	66	67,8	1	0,6	0,15	–			
	–	60,7	44	1,1	0,6	2,8	39,2	42	46	65	1	0,6	0,2	–			
	48,1	60,7	44	1,1	0,6	2,8	42	42	50	65	1	0,6	0,2	–			
	48,1	60,7	44	1,1	0,6	–	42	–	48	65	1	0,6	0,2	–			
	51	66,3	46,2	1,5	1,1	1,2	42	44	48	71	1,5	1	0,15	**HJ 307 EC**	0,058	6	9,5
	51	66,3	46,2	1,5	1,1	1,2	44	44	53	71	1,5	1	0,15	**HJ 307 EC**	0,058	6	9,5
	51	66,3	46,2	1,5	1,1	–	44	–	53	71	1,5	1	0,15	–			
	51	–	70,2	1,5	1,1	1,2	44	68	72	73	1,5	1	0,15	–			
	–	66,3	46,2	1,5	1,1	2,7	42	44	48	71	1,5	1	0,25	–			
	51	66,3	46,2	1,5	1,1	2,7	44	44	53	71	1,5	1	0,25	–			
	51	66,3	46,2	1,5	1,1	–	44	–	53	71	1,5	1	0,25	–			
	–	76,1	53	1,5	1,5	1,7	46	50	55	89	1,5	1,5	0,15	–			
	59	76,1	53	1,5	1,5	1,7	46	50	61	89	1,5	1,5	0,15	–			
40	–	57,6	47	1	0,6	2,4	43,2	45	49	63,4	1	0,6	0,1	–			
	54	67,9	49,5	1,1	1,1	1,4	47	48	51	73	1	1	0,15	**HJ 208 EC**	0,047	5	8,5
	54	67,9	49,5	1,1	1,1	1,4	47	48	56	73	1	1	0,15	**HJ 208 EC**	0,047	5	8,5
	54	67,9	49,5	1,1	1,1	–	47	–	56	73	1	1	0,15	–			
	54	–	71,5	1,1	1,1	1,4	47	69	73	73	1	1	0,15	–			
	54	67,9	49,5	1,1	1,1	1,9	47	48	51	73	1	1	0,2	**HJ 2208 EC**	0,048	5	9
	54	67,9	49,5	1,1	1,1	1,9	47	48	56	73	1	1	0,2	**HJ 2208 EC**	0,048	5	9
	54	67,9	49,5	1,1	1,1	–	47	–	56	73	1	1	0,2	–			
	57,5	75,6	52	1,5	1,5	1,4	49	50	54	81	1,5	1,5	0,15	**HJ 308 EC**	0,084	7	11
	57,5	75,6	52	1,5	1,5	1,4	49	50	60	81	1,5	1,5	0,15	**HJ 308 EC**	0,084	7	11
	57,5	75,6	52	1,5	1,5	–	49	–	60	81	1,5	1,5	0,15	–			
	57,5	–	80	1,5	1,5	1,4	49	78	82	81	1,5	1,5	0.15	–			

[1] Permissible axial displacement from the normal position of one bearing ring in relation to the other



NU NJ NUP N



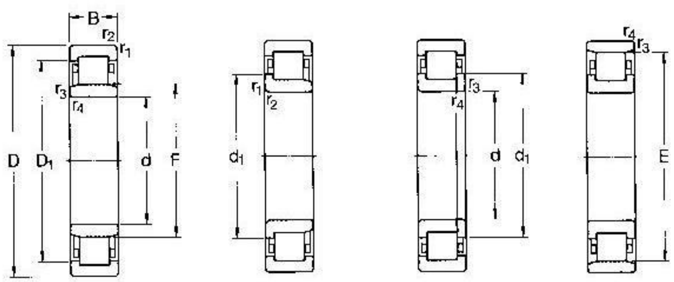
Angle ring

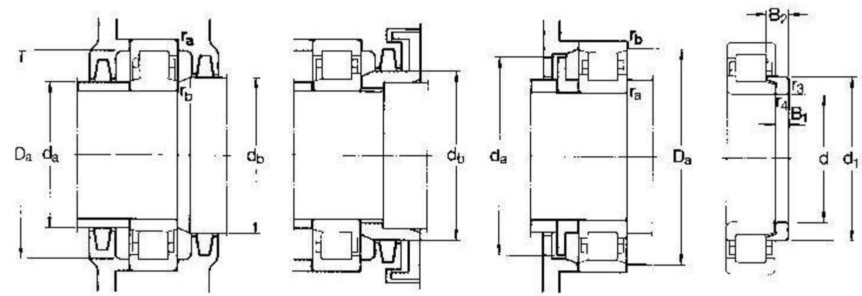
Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designations	
			dynamic	static		Reference speed	Limiting speed	Bearing with standard cage	Bearing with standard cage	Alternative standard cage designs[1]
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
40 cont.	90	33	129	120	15,3	8 000	9 500	0,94	* **NU 2308 ECP**	**J, M, ML**
	90	33	129	120	15,3	8 000	9 500	0,95	* **NJ 2308 ECP**	**J, M, ML**
	90	33	129	120	15,3	8 000	9 500	0,98	* **NUP 2308 ECP**	**M, ML**
	110	27	96,8	90	11,6	7 000	8 500	1,25	**NU 408**	–
	110	27	96,8	90	11,6	7 000	8 500	1,30	**NJ 408**	–
45	75	16	44,6	52	6,3	9 500	11 000	0,26	**NU 1009 ECP**	–
	85	19	69,5	64	8,15	9 000	9 500	0,43	* **NU 209 ECP**	**J, M, ML**
	85	19	69,5	64	8,15	9 000	9 500	0,44	* **NJ 209 ECP**	**J, M, ML**
	85	19	69,5	64	8,15	9 000	9 500	0,45	* **NUP 209 ECP**	**J, M, ML**
	85	19	69,5	64	8,15	9 000	9 500	0,43	* **N 209 ECP**	–
	85	23	85	81,5	10,6	9 000	9 500	0,52	* **NU 2209 ECP**	**J**
	85	23	85	81,5	10,6	9 000	9 500	0,54	* **NJ 2209 ECP**	**J**
	85	23	85	81,5	10,6	9 000	9 500	0,55	* **NUP 2209 ECP**	–
	100	25	112	100	12,9	7 500	8 500	0,90	* **NU 309 ECP**	**J, M, ML**
	100	25	112	100	12,9	7 500	8 500	0,92	* **NJ 309 ECP**	**J, M, ML**
	100	25	112	100	12,9	7 500	8 500	0,95	* **NUP 309 ECP**	**J, ML**
	100	25	112	100	12,9	7 500	8 500	0,88	* **N 309 ECP**	–
	100	36	160	153	20	7 500	8 500	1,30	* **NU 2309 ECP**	**ML**
	100	36	160	153	20	7 500	8 500	1,33	* **NJ 2309 ECP**	**ML**
	100	36	160	153	20	7 500	8 500	1,36	* **NUP 2309 ECP**	**ML**
	120	29	106	102	13,4	6 700	7 500	1,64	**NU 409**	–
	120	29	106	102	13,4	6 700	7 500	1,67	**NJ 409**	–
50	80	16	46,8	56	6,7	9 000	9 500	0,27	**NU 1010 ECP**	–
	90	20	73,5	69,5	8,8	8 500	9 000	0,48	* **NU 210 ECP**	**J, M, ML**
	90	20	73,5	69,5	8,8	8 500	9 000	0,49	* **NJ 210 ECP**	**J, M, ML**
	90	20	73,5	69,5	8,8	8 500	9 000	0,51	* **NUP 210 ECP**	**J, ML**
	90	20	73,5	69,5	8,8	8 500	9 000	0,48	* **N 210 ECP**	–

* SKF Explorer bearing
[1] When ordering bearings with an alternative standard cage the suffix of the standard cage has to be replaced by the suffix of the cage in question, e.g. NU 2308 ECP becomes NU 2308 ECML (for speed ratings → **page 511**)

Dimensions							Abutment and fillet dimensions						Calculation factor	Angle ring			
d	d_1 ~	D_1 ~	F, E	$r_{1,2}$ min	$r_{3,4}$ min	s[1]	d_a min	d_a max	d_b, D_a min	D_a max	r_a max	r_b max	k_r	Designation	Mass	Dimensions B_1	B_2
mm							mm						–	–	kg	mm	
40 cont.	–	75,6	52	1,5	1,5	2,9	49	50	54	81	1,5	1,5	0,25	–			
	57,5	75,6	52	1,5	1,5	2,9	49	50	60	81	1,5	1,5	0,25	–			
	57,5	75,6	52	1,5	1,5	–	49	–	60	81	1,5	1,5	0,25	–			
	–	84,2	58	2	2	2,5	53	56	60	97	2	2	0,15	–			
	64,8	84,2	58	2	2	2,5	53	56	67	97	2	2	0,15	–			
45	–	65,3	52,5	1	0,6	0,9	48,2	51	54	70,4	1	0,6	0,1	–			
	59	73	54,5	1,1	1,1	1,2	52	53	56	78	1	1	0,15	**HJ 209 EC**	0,052	5	8,5
	59	73	54,5	1,1	1,1	1,2	52	53	61	78	1	1	0,15	**HJ 209 EC**	0,052	5	8,5
	59	73	54,5	1,1	1,1	–	52	–	61	78	1	1	0,15	–			
	59	–	76,5	1,1	1,1	1,2	52	74	78	78	1	1	0,15	–			
	–	73	54,5	1,1	1,1	1,7	52	53	56	78	1	1	0,2	–			
	59	73	54,5	1,1	1,1	1,7	52	53	56	78	1	1	0,2				
	59	73	54,5	1,1	1,1	–	52	–	61	78	1	1	0,2	–			
	64,4	83,8	58,5	1,5	1,5	1,7	54	56	61	91	1,5	1,5	0,15	**HJ 309 EC**	0,11	7	11,5
	64,4	83,8	58,5	1,5	1,5	1,7	54	56	67	91	1,5	1,5	0,15	**HJ 309 EC**	0,11	7	11,5
	64,4	83,8	58,5	1,5	1,5	–	54	–	67	91	1,5	1,5	0,15	–			
	64,4	–	88,5	1,5	1,5	1,7	54	86	91	91	1,5	1,5	0,15	–			
	–	83,8	58,5	1,5	1,5	3,2	54	56	61	91	1,5	1,5	0,25	–			
	64,4	83,8	58,5	1,5	1,5	3,2	54	56	67	91	1,5	1,5	0,25	–			
	64,4	83,8	58,5	1,5	1,5	–	54	–	67	91	1,5	1,5	0,25	–			
	71,8	92,2	64,5	2	2	2,5	58	62	67	107	2	2	0,15	**HJ 409**	0,18	8	13,5
	71,8	92,2	64,5	2	2	2,5	58	62	74	107	2	2	0,15	**HJ 409**	0,18	8	13,5
50	–	70	57,5	1	0,6	1	53,2	56	60	75,4	1	0,6	0,1	–			
	64	78	59,5	1,1	1,1	1,5	57	57	62	83	1	1	0,15	**HJ 210 EC**	0,058	5	9
	64	78	59,5	1,1	1,1	1,5	57	57	66	83	1	1	0,15	**HJ 210 EC**	0,058	5	9
	64	78	59,5	1,1	1,1	–	57	–	66	83	1	1	0,15	–			
	64	–	81,5	1,1	1,1	1,5	57	79	83	83	1	1	0,15	–			

[1] Permissible axial displacement from the normal position of one bearing ring in relation to the other





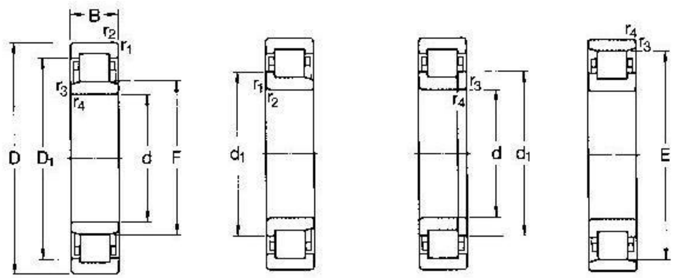
Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass Bearing with standard cage	Designations Bearing with standard cage	Alternative standard cage designs[1]
mm			kN		kN	r/min		kg	–	
50	90	23	90	88	11,4	8 500	9 000	0,56	* **NU 2210 ECP**	**J, M, ML**
cont.	90	23	90	88	11,4	8 500	9 000	0,57	* **NJ 2210 ECP**	**J, M, ML**
	90	23	90	88	11,4	8 500	9 000	0,59	* **NUP 2210 ECP**	**J, ML**
	110	27	127	112	15	6 700	8 000	1,14	* **NU 310 ECP**	**J, M, ML**
	110	27	127	112	15	6 700	8 000	1.17	* **NJ 310 ECP**	**J, M, ML**
	110	27	127	112	15	6 700	8 000	1,20	* **NUP 310 ECP**	**J, M, ML**
	110	27	127	112	15	6 700	8 000	1,14	* **N 310 ECP**	**M**
	110	40	186	186	24,5	6 700	8 000	1,73	* **NU 2310 ECP**	**ML**
	110	40	186	186	24,5	6 700	8 000	1,77	* **NJ 2310 ECP**	**ML**
	110	40	186	186	24,5	6 700	8 000	1,80	* **NUP 2310 ECP**	**ML**
	130	31	130	127	16,6	6 000	7 000	2,00	**NU 410**	–
	130	31	130	127	16,6	6 000	7 000	2,05	**NJ 410**	–
55	90	18	57,2	69,5	8,3	8 000	8 500	0,39	**NU 1011 ECP**	–
	100	21	96,5	95	12,2	7 500	8 000	0,66	* **NU 211 ECP**	**J, M, ML**
	100	21	96,5	95	12,2	7 500	8 000	0,67	* **NJ 211 ECP**	**J, M, ML**
	100	21	96,5	95	12,2	7 500	8 000	0,69	* **NUP 211 ECP**	**J, M, ML**
	100	21	96,5	95	12,2	7 500	8 000	0,66	* **N 211 ECP**	**M**
	100	25	114	118	15,3	7 500	8 000	0,79	* **NU 2211 ECP**	**J, M, ML**
	100	25	114	118	15,3	7 500	8 000	0,81	* **NJ 2211 ECP**	**J, M, ML**
	100	25	114	118	15,3	7 500	8 000	0,82	* **NUP 2211 ECP**	**J, ML**
	120	29	156	143	18,6	6 000	7 000	1,45	* **NU 311 ECP**	**J, M, ML**
	120	29	156	143	18,6	6 000	7 000	1,50	* **NJ 311 ECP**	**J, M, ML**
	120	29	156	143	18,6	6 000	7 000	1,55	* **NUP 311 ECP**	**J, M, ML**
	120	29	156	143	18,6	6 000	7 000	1,45	* **N 311 ECP**	**M**
	120	43	232	232	30,5	6 000	7 000	2,20	* **NU 2311 ECP**	**ML**
	120	43	232	232	30,5	6 000	7 000	2,25	* **NJ 2311 ECP**	**ML**
	120	43	232	232	30,5	6 000	7 000	2,30	* **NUP 2311 ECP**	**ML**
	140	33	142	140	18,6	5 600	6 300	2,50	**NU 411**	–
	140	33	142	140	18,6	5 600	6 300	2,55	**NJ 411**	–

* SKF Explorer bearing
[1] When ordering bearings with an alternative standard cage the suffix of the standard cage has to be replaced by the suffix of the cage in question e.g. NU 2210 ECP becomes NU 2210 ECML (for speed ratings → **page 511**)

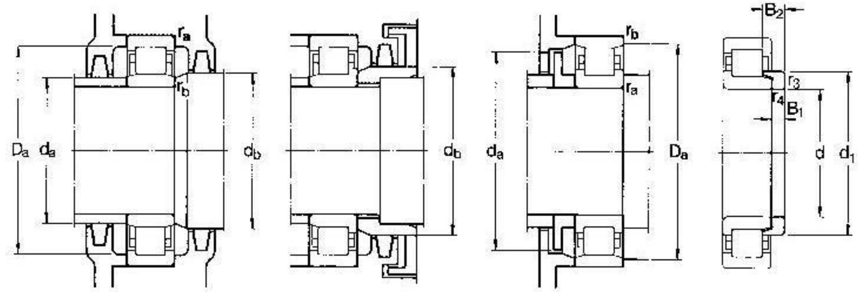
Dimensions d	d_1 ~	D_1 ~	F, E	$r_{1,2}$ min	$r_{3,4}$ min	s[1]	Abutment and fillet dimensions d_a min	d_a max	d_b, D_a min	D_a max	r_a max	r_b max	Calculation factor k_r	Angle ring Designation	Mass	Dimensions B_1	B_2
mm							mm						–	–	kg	mm	
50	–	78	59,5	1,1	1,1	1,5	57	57	62	83	1	1	0,2	–			
cont.	64	78	59,5	1,1	1,1	1,5	57	57	66	83	1	1	0,2	–			
	64	78	59,5	1,1	1,1	–	57	–	66	83	1	1	0,2	–			
	71,2	92,1	65	2	2	1,9	61	63	67	99	2	2	0,15	**HJ 310 EC**	0,14	8	13
	71,2	92,1	65	2	2	1,9	61	63	73	99	2	2	0,15	**HJ 310 EC**	0,14	8	13
	71,2	92,1	65	2	2	–	61	–	73	99	2	2	0,15	–			
	71,2	–	97	2	2	1,9	61	95	99	99	2	2	0,15	–			
	–	92,1	65	2	2	3,4	61	63	67	99	2	2	0,25	–			
	71,2	92,1	65	2	2	3,4	61	63	73	99	2	2	0.25	–			
	71,2	92,1	65	2	2	–	61	–	73	99	2	2	0,25	–			
	–	102	70,8	2,1	2,1	2,6	64	68	73	116	2	2	0,15	–			
	78,8	102	70,8	2,1	2.1	2,6	64	68	81	116	2	2	0,15	–			
55	–	79	64,5	1,1	1	0,5	59,6	63	67	84	1	1	0,1	–			
	70,8	86.3	66	1,5	1,1	1	62	64	68	91	1,5	1	0,15	**HJ 211 EC**	0,083	6	9,5
	70,8	86,3	66	1,5	1,1	1	64	64	73	91	1,5	1	0,15	**HJ 211 EC**	0,083	6	9,5
	70,8	86,3	66	1,5	1,1	–	64	–	73	91	1,5	1	0,15	–			
	70,8	–	90	1,5	1,1	1	64	88	92	93	1,5	1	0,15	–			
	70,8	86,3	66	1,5	1,1	1,5	62	64	68	91	1,5	1	0,2	**HJ 2211 EC**	0,085	6	10
	70,8	86,3	66	1,5	1,1	1,5	64	64	73	91	1,5	1	0,2	**HJ 2211 EC**	0.085	6	10
	70,8	86,3	66	1,5	1,1	–	64	–	73	91	1,5	1	0,2	–			
	77.5	101	70,5	2	2	2	66	68	73	109	2	2	0,15	**HJ 311 EC**	0,19	9	14
	77,5	101	70,5	2	2	2	66	68	80	109	2	2	0.15	**HJ 311 EC**	0,19	9	14
	77,5	101	70,5	2	2	–	66	–	80	109	2	2	0,15	–			
	77,5	–	106,5	2	2	2	66	104	109	109	2	2	0,15	–			
	77,5	101	70,5	2	2	3,5	66	68	73	109	2	2	0,25	**HJ 2311 EC**	0,19	9	15,5
	77,5	101	70,5	2	2	3,5	66	68	80	109	2	2	0,25	**HJ 2311 EC**	0,19	9	15,5
	77,5	101	70,5	2	2	–	66	–	80	109	2	2	0,25	–			
	85,2	108	77,2	2,1	2,1	2,6	69	74	79	126	2	2	0,15	–			
	85,2	108	77,2	2,1	2,1	2,6	69	74	88	126	2	2	0,15	–			

page 33

[1] Permissible axial displacement from the normal position of one bearing ring in relation to the other



NU NJ NUP N



Angle ring

Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass Bearing with standard cage	Designations Bearing with standard cage	Alternative standard cage designs[1]
mm			kN		kN	r/min		kg	–	
60	95	18	37,4	44	5,3	8 000	11 000	0,48	**NU 1012 ML**	–
	110	22	108	102	13,4	6 700	7 500	0,80	* **NU 212 ECP**	**J, M, ML**
	110	22	108	102	13,4	6 700	7 500	0,83	* **NJ 212 ECP**	**J, M, ML**
	110	22	108	102	13,4	6 700	7 500	0,86	* **NUP 212 ECP**	**J, ML**
	110	22	108	102	13,4	6 700	7 500	0,80	* **N 212 ECP**	**M**
	110	28	146	153	20	6 700	7 500	1,05	* **NU 2212 ECP**	**J, M, ML**
	110	28	146	153	20	6 700	7 500	1,10	* **NJ 2212 ECP**	**J, M, ML**
	110	28	146	153	20	6 700	7 500	1,15	* **NUP 2212 ECP**	**J, ML**
	130	31	173	160	20,8	5 600	6 700	1,77	* **NU 312 ECP**	**J, M, ML**
	130	31	173	160	20,8	5 600	6 700	1,83	* **NJ 312 ECP**	**J, M, ML**
	130	31	173	160	20,8	5 600	6 700	1,90	* **NUP 312 ECP**	**J, M, ML**
	130	31	173	160	20,8	5 600	6 700	1,80	* **N 312 ECP**	**M**
	130	46	260	265	34,5	5 600	6 700	2,75	* **NU 2312 ECP**	**ML**
	130	46	260	265	34,5	5 600	6 700	2,80	* **NJ 2312 ECP**	**ML**
	130	46	260	265	34,5	5 600	6 700	2,85	* **NUP 2312 ECP**	**ML**
	150	35	168	173	22	5 000	6 000	3,00	**NU 412**	–
	150	35	168	173	22	5 000	6 000	3,10	**NJ 412**	–
65	100	18	62,7	81.5	9,8	7 000	7 500	0,45	**NU 1013 ECP**	–
	120	23	122	118	15,6	6 300	6 700	1,03	* **NU 213 ECP**	**J, M, ML**
	120	23	122	118	15,6	6 300	6 700	1,07	* **NJ 213 ECP**	**J, M, ML**
	120	23	122	118	15,6	6 300	6 700	1,10	* **NUP 213 ECP**	**J, ML**
	120	23	122	118	15,6	6 300	6 700	1,05	* **N 213 ECP**	–
	120	31	170	180	24	6 300	6 700	1,40	* **NU 2213 ECP**	**J**
	120	31	170	180	24	6 300	6 700	1,45	* **NJ 2213 ECP**	**J**
	120	31	170	180	24	6 300	6 700	1,50	* **NUP 2213 ECP**	–
	140	33	212	196	25,5	5 300	6 000	2,20	* **NU 313 ECP**	**J, M, ML**
	140	33	212	196	25,5	5 300	6 000	2,30	* **NJ 313 ECP**	**J, M, ML**
	140	33	212	196	25,5	5 300	6 000	2,35	* **NUP 313 ECP**	**J, ML**
	140	33	212	196	25,5	5 300	6 000	2,20	* **N 313 ECP**	**M**

* SKF Explorer bearing
[1] When ordering bearings with an alternative standard cage the suffix of the standard cage has to be replaced by the suffix of the cage in question, e.g. NU 212 ECP becomes NU 212 ECML (for speed ratings → **page 511**)

Dimensions d	d_1 ~	D_1 ~	F, E	$r_{1,2}$ min	$r_{3,4}$ min	s[1]	Abutment and fillet dimensions d_a min	d_a max	d_b, D_a min	D_a max	r_a max	r_b max	Calculation factor k_r	Angle ring Designation	Mass	Dimensions B_1	B_2
mm							mm						–	–	kg	mm	
60	–	81,6	69,5	1,1	1	2,9	64,6	68	72	89	1	1	0,1	–			
	77,5	95,7	72	1,5	1,5	1,4	69	70	74	101	1,5	1,5	0,15	**HJ 212 EC**	0,10	6	10
	77,5	95,7	72	1,5	1,5	1,4	69	70	80	101	1,5	1,5	0,15	**HJ 212 EC**	0,10	6	10
	77,5	95,7	72	1,5	1,5	–	69	–	80	101	1,5	1,5	0,15	–			
	77,5	–	100	1,5	1,5	1,4	69	98	101	101	1,5	1,5	0,15	–			
	77,5	95,7	72	1,5	1,5	1,4	69	70	74	101	1,5	1,5	0,2	**HJ 212 EC**	0,10	6	10
	77,5	95,7	72	1,5	1,5	1,4	69	70	80	101	1,5	1,5	0,2	**HJ 212 EC**	0,10	6	10
	77,5	95,7	72	1,5	1,5	–	69	–	80	101	1,5	1,5	0,2	–			
	84,3	110	77	2,1	2,1	2,1	72	74	79	118	2	2	0,15	**HJ 312 EC**	0,22	9	14,5
	84,3	110	77	2,1	2,1	2,1	72	74	87	118	2	2	0,15	**HJ 312 EC**	0,22	9	14,5
	84,3	110	77	2,1	2,1	–	72	–	87	118	2	2	0,15	–			
	84,3	–	115	2,1	2,1	2,1	72	112	118	118	2	2	0,15	–			
	–	110	77	2,1	2,1	3,6	72	74	79	118	2	2	0,25	–			
	84,3	110	77	2,1	2,1	3,6	72	74	87	118	2	2	0,25	–			
	84,3	110	77	2,1	2,1	–	72	–	87	118	2	2	0,25	–			
	–	117	83	2,1	2,1	2,5	74	80	85	136	2	2	0,15	–			
	91,8	117	83	2,1	2,1	2,5	74	80	94	136	2	2	0,15	–			
65	–	88,5	74	1,1	1	1	69,6	72	77	94	1	1	0,1	–			
	84,4	104	78,5	1,5	1,5	1,4	74	76	81	111	1,5	1,5	0,15	**HJ 213 EC**	0,12	6	10
	84,4	104	78,5	1,5	1,5	1,4	74	76	87	111	1,5	1,5	0,15	**HJ 213 EC**	0,12	6	10
	84.4	104	78,5	1,5	1,5	–	74	–	87	111	1,5	1,5	0,15	–			
	84,4	–	108,5	1,5	1,5	1,4	74	106	111	111	1,5	1,5	0,15	–			
	–	104	78,5	1,5	1,5	1,9	74	76	81	111	1,5	1,5	0,2	–			
	84,4	104	78,5	1,5	1,5	1,9	74	76	87	111	1,5	1,5	0,2	–			
	84,4	104	78,5	1,5	1,5	–	74	–	87	111	1,5	1,5	0,2	–			
	90,5	119	82,5	2,1	2,1	2,2	77	80	85	128	2	2	0,15	**HJ 313 EC**	0,27	10	15,5
	90,5	119	82,5	2,1	2,1	2,2	77	80	93	128	2	2	0,15	**HJ 313 EC**	0.27	10	15,5
	90,5	119	82,5	2,1	2,1	–	77	–	93	128	2	2	0,15	–			
	90,5	–	124,5	2,1	2,1	2,2	77	122	127	128	2	2	0,15	–			

[1] Permissible axial displacement from the normal position of one bearing ring in relation to the other

Designs

Full complement cylindrical roller bearings incorporate a maximum number of rollers and are therefore suitable for very heavy radial loads. However, they cannot operate at the same high speeds as caged type cylindrical roller bearings. The standard SKF range of single row full complement cylindrical roller bearings consist of the NCF and NJG designs.

NCF design

NCF-design bearings (→ **fig 1**) have two integral flanges on the inner ring and one integral flange on the outer ring and can thus support axial loads acting in one direction and provide axial shaft location in one direction. A retaining ring at the flangeless side of the outer ring holds the bearing assembly together. The axial internal clearance in the bearing is given in the product table and is designed to permit small axial displacements of the shaft in relation to the housing, e.g. as a result of thermal expansion of the shaft, to be accommodated in the bearing.

NJG design

NJG-design bearings (→ **fig 2**) comprise the heavy dimension series 23 and are intended for very heavily loaded, slow speed applications. These bearings have two integral flanges on the outer ring and one integral flange on the inner ring and can thus support axial loads acting in one direction and provide axial shaft location in one direction. In contrast to the other full complement bearing designs, NJG-design bearings have a self-retaining roller complement. The outer ring with its two integral flanges together with the roller complement can therefore be withdrawn from the inner ring, without having to take any precautions to prevent the rollers from falling out. This simplifies mounting and dismounting.

Fig 1

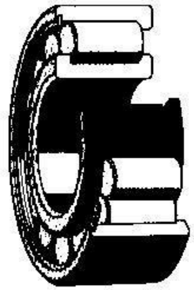
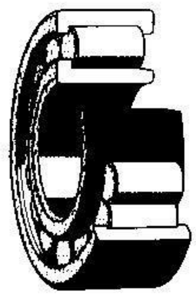


Fig 2



Bearing data – general

Dimensions

The boundary dimensions of SKF single row full complement cylindrical roller bearings are in accordance with ISO 15:1998.

Tolerances

SKF single row full complement cylindrical roller bearings are produced to Normal tolerances. The values for the tolerances correspond to ISO 492:2002 and can be found in **table 3 on page 125**.

Radial internal clearance

SKF single row full complement cylindrical roller bearings are produced with Normal radial internal clearance as standard. The majority of the bearings are also available with the greater C3 radial internal clearance. The values correspond to ISO 5753:1991 and are given in **table 1 on page 507**. The clearance limits apply to unmounted bearings under zero measuring load.

Misalignment

The ability of single row full complement cylindrical roller bearings to accommodate angular misalignment of the inner ring with respect to the outer ring is limited to a few minutes of arc. The actual values are

- 4 minutes of arc for bearings of the narrow dimension series 18, and
- 3 minutes of arc for bearings of the wide dimension series 22, 23, 28, 29 and 30.

The above guideline values apply provided the position of the shaft and housing axes remains constant. A larger misalignment is possible, but may result in reduced bearing service life. In such cases, please contact the SKF application engineering service.

Influence of operating temperature on bearing material

SKF single row full complement cylindrical roller bearings undergo a special heat treatment. They can operate at temperatures of up to +150 °C.

Minimum load

In order to provide satisfactory operation, single row full complement cylindrical roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at relatively high speeds ($n > 0,5$ times the reference speed) or are subjected to high accelerations or rapid changes in the direction of the load. Under such conditions the inertia forces of the rollers and the friction in the lubricant, can have a detrimental effect on the rolling conditions in the bearing arrangement and may cause damaging sliding movements and to occur between the rollers and raceways.

The requisite minimum load to be applied to single row full complement cylindrical roller bearings can be estimated using

$$F_{rm} = k_r \left(6 + \frac{4\,n}{n_r}\right)\left(\frac{d_m}{100}\right)^2$$

where

F_{rm} = minimum radial load, kN
k_r = minimum load factor
0,1 for bearing series 18
0,11 for bearing series 28
0,2 for bearing series 29
0,3 for bearing series 30 and 22
0,35 for bearing series 23
n = rotational speed, r/min
n_r = reference speed, r/min
(→ product table)
d_m = bearing mean diameter
= 0,5 (d + D), mm

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the single row full complement cylindrical roller bearing must be subjected to an additional radial load.

Dynamic axial load carrying capacity

Single row full complement cylindrical roller bearings with flanges on both inner and outer rings can support axial loads in one direction. Their axial load carrying capacity is primarily determined by the ability of the sliding surfaces of the roller end/flange contact to support loads. Factors having the greatest effect on this ability are the lubrication, operating temperature and heat dissipation from the bearing.

Assuming the conditions cited below, the permissible axial load can be calculated with sufficient accuracy from

$$F_{ap} = \frac{k_1 C_0 10^4}{n (d + D)} - k_2 F_r$$

where
F_{ap} = maximum permissible axial load, kN
C_0 = basic static load rating, kN
F_r = actual radial bearing load, kN
n = rotational speed, r/min
d = bearing bore diameter, mm
D = bearing outside diameter, mm
k_1 = a factor
1,0 for oil lubrication
0,5 for grease lubrication
k_2 = a factor
0,3 for oil lubrication
0,15 for grease lubrication

The above equation is based on conditions that are considered typical for normal bearing operation:

- a difference of 60 °C between the bearing operating temperature and the ambient temperature;
- a specific heat loss from the bearing of 0,5 mW/mm^2 °C with reference to the bearing outside diameter surface (π D B);
- a viscosity ratio $\kappa \geq 2$.

For grease lubrication the viscosity of the base oil in the grease may be used. If κ is less than 2, the friction will increase and there will be more wear. These effects can be reduced at low speeds, for example, by using oils with AW (anti-wear) and EP (extreme pressure) additives.

Where axial loads act for longer periods and the bearings are grease lubricated, it is advisable to use a grease that has good oil bleeding properties at the operating temperatures (> 3 % according to DIN 51 817). Frequent relubrication is also recommended.

The values of the permissible load F_{ap} obtained from the heat balance equation are valid for a continuously acting constant axial load and adequate lubricant supply to the roller end/flange contacts. Where axial loads act only for short periods, the values can be multiplied by 2, or for shock loads by 3, provided the limits given in the following with regard to flange strength are not exceeded.

To avoid any risk of flange breakage, the constantly acting axial load should never exceed

$$F_a = 0{,}0023\, D^{1,7}$$

and occasional shock loads should never be greater than

$$F_a = 0{,}007\, D^{1,7}$$

where
F_a = constantly or occasionally acting axial load, kN
D = bearing outside diameter, mm

To obtain an even flange load and provide sufficient running accuracy of the shaft when single row full complement cylindrical roller bearings are subjected to heavy axial loads, axial runout and the size of the abutment surfaces of adjacent components become particularly important.

If shaft deflection occurs together with an axial load, the inner ring flange should only be supported to half its height (→ **fig 3**) so that it is not subjected to damaging alternating stresses. The recommended shaft abutment diameter d_{as} can be obtained from the product table.

Where misalignment between the inner and outer rings exceeds 1 minute of arc, the action of the load on the flange changes considerably. As a result, the safety factors implicit in the guideline values may not be adequate. In these cases, contact the SKF application engineering service.

Equivalent dynamic bearing load

For non-locating bearings

$$P = F_r$$

If the bearings are used to locate a shaft in one direction, the equivalent dynamic bearing load should be calculated using

$P = F_r$ when $F_a/F_r \leq e$
$P = 0{,}92\, F_r + Y F_a$ when $F_a/F_r > e$

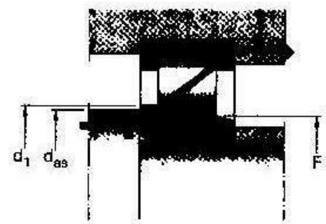
where
e = limiting value
= 0,2 for bearings in the 18 series
= 0,3 for bearings in the 22, 23, 28, 29 and 30 series
Y = axial load factor
= 0,6 for bearings in the 18 series
= 0,4 for bearings in the 22, 23, 28, 29 and 30 series

Since axially loaded single row full complement cylindrical roller bearings only operate satisfactorily when they are subjected to a simultaneously acting radial load, the ratio F_a/F_r should not exceed 0,5.

Equivalent static bearing load

$$P_0 = F_r$$

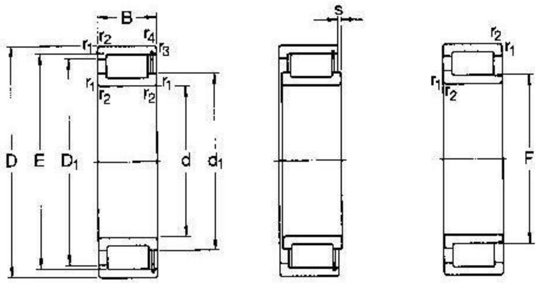
Fig 3



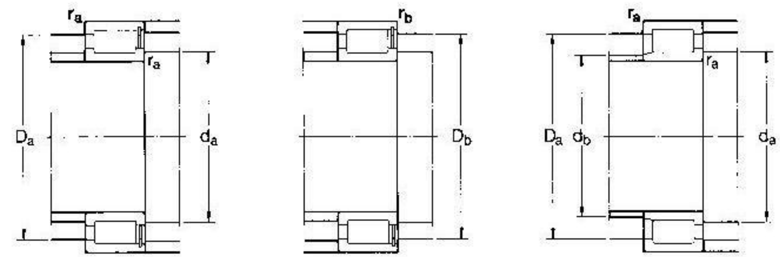
Supplementary designations

The designation suffixes used to identify certain features of SKF single row full complement cylindrical roller bearings are explained in the following.

- **CV** Modified internal design, full complement roller set
- **C3** Radial internal clearance greater than Normal
- **HA1** Inner and outer rings of case-hardened steel
- **HB1** Bainite hardened inner and outer rings
- **L4B** Bearing rings and rolling elements with special surface coating
- **L5B** Rolling elements with special surface coating
- **V** Full complement roller set (without cage)
- **VH** Full complement roller set (without cage), self-retaining



NCF NJG



Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass	Designation
mm			kN		kN	r/min		kg	–
20	42	16	28,1	28,5	3,1	8 500	10 000	0,11	**NCF 3004 CV**
25	47	16	31,9	35,5	3,8	7 000	9 000	0,12	**NCF 3005 CV**
	62	24	68,2	68	8,5	4 500	5 600	0,38	**NJG 2305 VH**
30	55	19	39,6	44	5	6 000	7 500	0,20	**NCF 3006 CV**
	72	27	84,2	86,5	11	4 000	4 800	0,56	**NJG 2306 VH**
35	62	20	48,4	56	6,55	5 300	6 700	0,26	**NCF 3007 CV**
	80	31	108	114	14,3	3 400	4 300	0,75	**NJG 2307 VH**
40	68	21	57,2	69,5	8,15	4 800	6 000	0,31	**NCF 3008 CV**
	90	33	145	156	20	3 000	3 600	1,00	**NJG 2308 VH**
45	75	23	60,5	78	9,15	4 300	5 300	0,40	**NCF 3009 CV**
	100	36	172	196	25,5	2 800	3 400	1,45	**NJG 2309 VH**
50	80	23	76,5	98	11,8	4 000	5 000	0,43	**NCF 3010 CV**
55	90	26	105	140	17,3	3 400	4 300	0,64	**NCF 3011 CV**
	120	43	233	260	33,5	2 200	2 800	2,30	**NJG 2311 VH**
60	85	16	55	80	9,15	3 600	4 500	0,29	**NCF 2912 CV**
	95	26	106	146	18,3	3 400	4 000	0,69	**NCF 3012 CV**
65	90	16	58,3	88	10,2	3 200	4 000	0,31	**NCF 2913 CV**
	100	26	112	163	20	3 000	3 800	0,73	**NCF 3013 CV**
	140	48	303	360	46,5	1 900	2 400	3,55	**NJG 2313 VH**
70	100	19	76,5	116	13,7	3 000	3 800	0,49	**NCF 2914 CV**
	110	30	128	173	22,4	2 800	3 600	1,02	**NCF 3014 CV**
	150	51	336	400	50	1 800	2 200	4,40	**NJG 2314 VH**
75	105	19	79,2	125	14,6	2 800	3 600	0,52	**NCF 2915 CV**
	115	30	134	190	24,5	2 600	3 200	1,06	**NCF 3015 CV**
	160	55	396	480	60	1 600	2 000	5,35	**NJG 2315 VH**

Dimensions d	d_1 ~	D_1 ~	E, F	$r_{1,2}$ min	$r_{3,4}$ min	s[1]	Abutment and fillet dimensions d_a min	d_{as}[2]	d_b max	D_a max	D_b max	r_a max	r_b max
mm							mm						
20	29	33	36,8	0,6	0,6	1,5	24	26.9	–	38	40	0,6	0,6
25	34	39	42,5	0,6	0,6	1,5	29	32,3	–	43	45	0,6	0,6
	36,1	48,2	31,74	1,1	–	1,7	32	33.9	30	55	–	1	–
30	40	45	49,6	1	1	2	35	37,8	–	50	52	1	1
	43,2	56,4	38,36	1,1	–	1,8	37	40,8	36	65	–	1	–
35	45	51	55,5	1	1	2	40	42,8	–	57	59	1	1
	50,4	65,8	44,75	1,5	–	2	44	47,6	42	71	–	1,5	–
40	50	58	61,7	1	1	2	45	47,9	–	63	65	1	1
	57,6	75,2	51,15	1,5	–	2,4	49	54,4	49	81	–	1,5	–
45	55	62	66,9	1	1	2	50	53	–	70	72	1	1
	62,5	80,1	56,14	1,5	–	2,4	54	59,3	54	91	–	1,5	–
50	59	68	72,3	1	1	2	55	56,7	–	75	77	1	1
55	68	79	83,5	1,1	1,1	2	61	65,8	–	84	86	1	1
	75,5	98,6	67,14	2	–	2,6	66	71,3	66	109	–	2	–
60	69	74,5	78,65	1	1	1	65	66,8	–	80	80	1	1
	71	82	86,7	1,1	1,1	2	66	68,9	–	89	91	1	1
65	75,5	81	85,35	1	1	1	70	73,4	–	85	85	1	1
	78	88	93,1	1,1	1,1	2	71	75,6	–	94	96	1	1
	89,9	116	80,71	2,1	–	3	77	85,3	78	128	–	2	–
70	80,5	88,5	92,5	1	1	1	75	78,5	–	95	95	1	1
	81	95	100,3	1,1	1,1	3	76	78,7	–	104	106	1	1
	93,8	121	84,22	2,1	–	3	82	89	81	138	–	2	–
75	86	93	97,6	1	1	1	80	83,8	–	100	100	1	1
	89	103	107,9	1,1	1,1	3	81	86,5	–	109	111	1	1
	101	131	91,24	2,1	–	3	87	96,1	88	148	–	2	–

[1] Permissible axial displacement from the normal position of one bearing ring in relation to the other
[2] Recommended shaft abutment diameter for axially loaded bearings → **page 556**

Bearing data – general

Dimensions

The boundary dimensions of SKF double row full complement cylindrical roller bearings are in accordance with ISO 15:1998, except for bearings in the NNF 50 and 3194(00) series. The outer rings of NNF bearings are 1 mm narrower than specified for the ISO Dimension Series 50. The dimensions of series 3194(00) bearings have been dictated by practical application requirements and are not covered by any international or national standard.

Tolerances

Double row full complement cylindrical roller bearings are manufactured to Normal tolerances as standard. The tolerances are in accordance with ISO 492:2002 and can be found in **table 3** on **page 125**.

Internal clearance

Double row full complement cylindrical roller bearings are manufactured with Normal radial internal clearance as standard. Bearings with the larger C3 or smaller C2 radial internal clearance can be supplied on request.

The clearance limits are in accordance with ISO 5753:1991 and can be found in **table 1** on **page 507**. The clearance limits apply to unmounted bearings under zero measuring load.

The axial internal clearance of NNC and NNF design bearings, which can axially locate the shaft in both directions, is 0,1 to 0,2 mm for all sizes.

Axial displacement

NNCL and NNCF design bearings can accommodate axial displacement of the shaft with respect to the housing as a result of thermal expansion of the shaft within certain limits (→ **fig 3**). As the axial displacement is accommodated within the bearing and not between the ring and shaft or housing bore, there is practically no additional friction when the bearing rotates. Values for the permissible axial displacement from the normal position of one bearing ring in relation to the other are given in the product table.

Misalignment

Any angular misalignment of the outer ring relative to the inner ring of double row full complement cylindrical roller bearings produces moment loads in the bearing. The resulting increased bearing load shortens bearing service life.

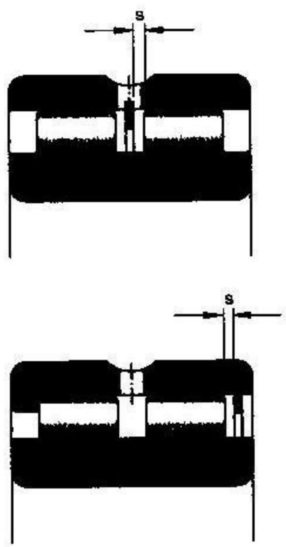
Influence of operating temperature on bearing material

SKF double row full complement cylindrical roller bearings undergo a special heat treatment. They can be used at temperatures of up to +150 °C.

Minimum load

In order to provide satisfactory operation, double row full complement cylindrical roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at relatively high speeds ($n > 0,5$ times the reference speed) or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rollers and the friction in the lubricant, can have a detrimental effect on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

Fig 3



The requisite minimum load to be applied to double row full complement cylindrical roller bearings can be estimated using

$$F_{rm} = k_r \left(6 + \frac{4\,n}{n_r}\right) \left(\frac{d_m}{100}\right)^2$$

where

F_{rm} = minimum radial load, kN

k_r = minimum loads of factor
- 0,2 for bearings of series 48
- 0,25 for bearings of series 49
- 0,4 for bearings of series NNF 50 and 3194(00)
- 0,5 for bearings of series NNCF 50

n = rotational speed, r/min

n_r = speed rating according to the product tables, r/min
- for open bearings use reference speed
- for sealed bearings use 1,3 × limiting speed

d_m = bearing mean diameter = 0,5 (d + D), mm

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the double row full complement cylindrical roller bearing must be subjected to an additional radial load.

Dynamic axial load carrying capacity

Double row full complement cylindrical roller bearings with flanges on both the inner and outer rings can support axial loads in addition to radial loads. Their axial load carrying capacity is primarily determined by the ability of the sliding surfaces of the roller end/flange contact to support loads. Factors having the greatest effect on this ability are the lubrication, operating temperature and heat dissipation from the bearing. Assuming the conditions cited below, the permissible axial load can be calculated with sufficient accuracy from

$$F_{ap} = \frac{k_1\,C_0\,10^4}{n\,(d + D)} - k_2\,F_r$$

where

F_{ap} = maximum permissible axial load, kN

C_0 = basic static load rating, kN

F_r = actual radial bearing load, kN

n = rotational speed, r/min

d = bearing bore diameter, mm

D = bearing outside diameter, mm

k_1 = a factor
- 0,35 for oil lubrication
- 0,2 for grease lubrication

k_2 = a factor
- 0,1 for oil lubrication
- 0,06 for grease lubrication

The above equation is based on conditions that are considered typical for normal bearing operation:

- a difference of 60 °C between the bearing operating temperature and the ambient temperature;
- a specific heat loss from the bearing of 0,5 mW/mm^2 °C; with reference to the bearing outside diameter surface (π D B);
- a viscosity ratio $\kappa \geq 2$.

For grease lubrication the viscosity of the base oil in the grease may be used. If κ is less than 2, the friction will increase and there will be more wear. These effects can be reduced at low speeds, for example, by using oils with AW (anti-wear) and EP (extreme pressure) additives.

Where axial loads act for longer periods and the bearings are grease lubricated, it is advisable to use a grease that has good oil bleeding properties at the operating temperature (> 3 % according to DIN 51 817). Frequent relubrication is also recommended.

The values of the permissible load F_{ap} obtained from the heat balance equation are valid for a continuously acting constant axial load and adequate lubricant supply to the roller end/flange contacts. Where axial loads act only for short periods, the values may be multiplied by 2, or for shock loads by 3, provided the limits given in the following with regard to flange strength are not exceeded.

To avoid any risk of flange breakage, the constantly acting axial load should never exceed

$$F_a = 0{,}0023\ D^{1,7}$$

and occasional shock loads should never be greater than

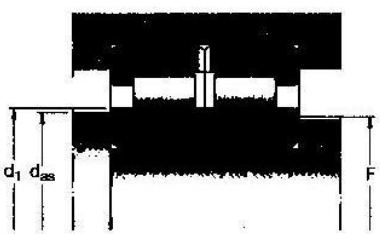
$$F_a = 0{,}007\ D^{1,7}$$

where
F_a = constantly or occasionally acting axial load, kN
D = bearing outside diameter, mm

To obtain an even flange load and provide sufficient running accuracy of the shaft when double row full complement cylindrical roller bearings are subjected to heavy axial loads, axial runout and the size of the abutment surfaces of adjacent components become particularly important.

If shaft deflection occurs together with an axial load, the inner ring flange should only be supported to half its height (→ **fig 4**) so that it is not subjected to damaging alternating stresses. The recommended shaft abutment diameter d_{as} can be obtained from the product tables.

Fig 4



Where misalignment between the inner and outer rings exceeds 1 minute of arc, the action of the load on the flange changes considerably. As a result, the safety factors implicit in the guideline values may not be adequate. In these cases, contact the SKF application engineering service.

Equivalent dynamic bearing load
For non-locating bearings

$$P = F_r$$

If double row full complement cylindrical roller bearings with flanges on both inner and outer rings are used to locate a shaft in one or both directions, the equivalent dynamic bearing load should be calculated using

$$P = F_r \quad \text{when } F_a/F_r \leq 0{,}15$$
$$P = 0{,}92\ F_r + 0{,}4\ F_a \quad \text{when } F_a/F_r > 0{,}15$$

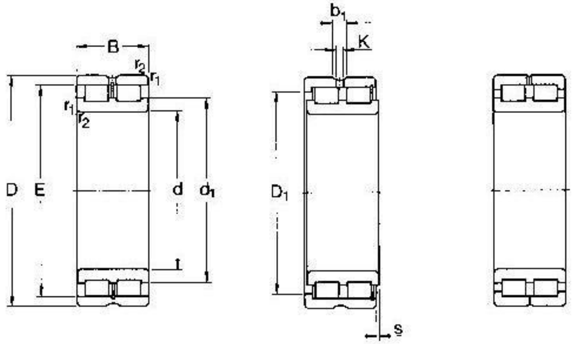
Since axially loaded double row full complement cylindrical roller bearings only operate satisfactorily when they are subjected to a simultaneously acting radial load, the ratio F_a/F_r should not exceed 0,25.

Equivalent static bearing load

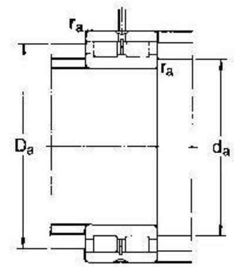
$$P_0 = F_r$$

Supplementary designations
The designation suffixes used to identify certain features of SKF double row full complement cylindrical roller bearings are explained in the following.

- **ADA** Modified snap ring grooves in the outer ring; two-piece inner ring held together by a retaining ring
- **CV** Modified internal design, full complement roller set
- **C2** Radial internal clearance smaller than Normal
- **C3** Radial internal clearance greater than Normal
- **DA** Modified snap ring grooves in the outer ring; two-piece inner ring held together by a retaining ring
- **L4B** Bearing rings and rolling elements with special surface coating
- **L5B** Rolling elements with special surface coating
- **V** Full complement roller set (without cage)
- **2LS** Contact seals of polyurethane (AU) on both sides of the bearing



NNCL NNCF NNC



Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass	Designation
mm			kN		kN	r/min		kg	–
20	42	30	52,3	57	6,2	8 500	10 000	0,20	**NNCF 5004 CV**
25	47	30	59,4	71	7,65	7 000	9 000	0,23	**NNCF 5005 CV**
30	55	34	73,7	88	10	6 000	7 500	0,35	**NNCF 5006 CV**
35	62	36	89,7	112	12,9	5 300	6 700	0,46	**NNCF 5007 CV**
40	68	38	106	140	16,3	4 800	6 000	0,56	**NNCF 5008 CV**
45	75	40	112	156	18,3	4 300	5 300	0,71	**NNCF 5009 CV**
50	80	40	142	196	23,6	4 000	5 000	0,76	**NNCF 5010 CV**
55	90	46	190	280	34,5	3 400	4 300	1,16	**NNCF 5011 CV**
60	85	25	78,1	137	14,3	3 600	4 500	0,49	**NNCF 4912 CV**
	85	25	78,1	137	14,3	3 600	4 500	0,49	**NNC 4912 CV**
	85	25	78,1	137	14,3	3 600	4 500	0,49	**NNCL 4912 CV**
	95	46	198	300	36,5	3 400	4 000	1,24	**NNCF 5012 CV**
65	100	46	209	325	40	3 000	3 800	1,32	**NNCF 5013 CV**
70	100	30	114	193	22,4	3 000	3 800	0,78	**NNCF 4914 CV**
	100	30	114	193	22,4	3 000	3 800	0,78	**NNC 4914 CV**
	100	30	114	193	22,4	3 000	3 800	0,78	**NNCL 4914 CV**
	110	54	238	345	45	2 800	3 600	1,85	**NNCF 5014 CV**
75	115	54	251	380	49	2 600	3 200	1,93	**NNCF 5015 CV**
80	110	30	121	216	25	2 600	3 400	0,88	**NNCF 4916 CV**
	110	30	121	216	25	2 800	3 400	0,88	**NNC 4916 CV**
	110	30	121	216	25	2 600	3 400	0,88	**NNCL 4916 CV**
	125	60	308	455	58,5	2 400	3 000	2,59	**NNCF 5016 CV**
85	130	60	314	475	60	2 400	3 000	2,72	**NNCF 5017 CV**

Dimensions d	d_1 ~	D_1 ~	E	b_1	K	$r_{1,2}$ min	s[1]	Abutment and fillet dimensions d_a min	d_{as}[2]	D_a max	r_a max
mm								mm			
20	28,4	33,2	36,81	4,5	3	0,6	1	23,2	26,6	38,8	0,6
25	34,5	38,9	42.51	4,5	3	0,6	1	28,2	28,2	43.8	0,6
30	40	45,3	49,6	4,5	3	1	1,5	34,6	34,6	50,4	1
35	44,9	51,3	55,52	4,5	3	1	1,5	39,6	39,6	57,4	1
40	50,5	57,2	61,74	4,5	3	1	1,5	44,6	44,6	63,4	1
45	55,3	62,5	66,85	4,5	3	1	1,5	49,6	49,6	70,4	1
50	59,1	67,6	72,23	4,5	3	1	1,5	54.6	54,6	75.4	1
55	68,5	78,7	83,54	4,5	3,5	1,1	1,5	61	61	84	1
60	70,5	73,5	77,51	4,5	3,5	1	1	64,6	68,5	80,4	1
	70,5	73,5	77,51	4,5	3,5	1	–	64,6	68,5	80,4	1
	70,5	–	77,51	4,5	3,5	1	1	64,6	–	80,4	1
	71,7	81,9	86,74	4,5	3,5	1,1	1,5	66	69,2	89	1
65	78,1	88,3	93,09	4,5	3,5	1,1	1,5	71	71	94	1
70	83	87	91,87	4,5	3,5	1	1	74,6	80,4	95,4	1
	83	87	91,87	4,5	3,5	1	–	74,6	80,4	95,4	1
	83	–	91,87	4,5	3,5	1	1	74,6	–	95,4	1
	81,5	95	100,28	5	3,5	1,1	3	76	78,9	104	1
75	89	103	107,9	5	3,5	1,1	3	81	81	109	1
80	91,4	96	97,78	5	3,5	1	1	84,6	89,4	105,4	1
	92	96	100,78	5	3,5	1	–	84,6	89,4	105,4	1
	92	–	100,78	5	3,5	1	1	84,6	–	105,4	1
	95	111	116,99	5	3,5	1,1	3,5	86	92	119	1
85	99	117	121,44	5	3,5	1,1	3,5	91	91	124	1

1) Permissible axial displacement from the normal position of one bearing ring in relation to the other
2) Recommended shaft abutment diameter for axially loaded bearings → **page 576**

Internal clearance and preload

The internal clearance of single row taper roller bearings can only be obtained after mounting and is determined by adjustment of the bearing against a second bearing, which provides location in the opposite direction. Further details will be found in the section "Bearing preload", starting on **page 206**.

Adjustment and running in

When adjusting taper roller bearings against each other, the bearings must be rotated, so that the rollers assume their correct position, i.e. the large end face of the rollers must be in contact with the guide flange.

Conventional taper roller bearings normally have a relatively high friction torque during the first hours of operation, which drops to a lower level after the running-in period. During this running-in period, bearing temperature increases rapidly because of the high initial friction and falls off to an equilibrium level as the running-in phase is completed.

This running-in phase is considerably reduced with bearings made to the SKF "Q" specification. In these bearings, the initial friction is also much lower, so that temperature increase is almost negligible. This also applies to the high-performance CL7C specification bearings, which are designed for easy adjustment.

Misalignment

The ability of a conventional single row taper roller bearing to accommodate angular misalignment of the inner ring with respect to the outer ring is limited to a few minutes of arc. SKF bearings have the logarithmic contact profile and can tolerate misalignments of approximately 2 to 4 minutes of arc.

These guideline values apply provided the position of the shaft and housing axes are constant. Larger misalignment is possible, depending on the load and requisite service life. For additional information, please contact the SKF application engineering service.

Cages

Single row SKF taper roller bearings are equipped as shown in **fig 4** with

- a pressed steel window-type cage, no designation suffix or suffixes J1 or J2 (**a**),
- a glass fibre reinforced polyamide 6,6 window-type cage, designation suffix TN9 (**b**).

Note:
Taper roller bearings with a polyamide 6,6 cage can be operated at temperatures up to +120 °C. The lubricants generally used for rolling bearings do not have a detrimental effect on polyamide cage properties, with the exception of a few synthetic oils and greases with a synthetic oil base, and lubricants containing a high proportion of EP additives when used at high temperatures.

For bearing arrangements, which are to be operated at continuously high temperatures or under arduous conditions, SKF recommends using bearings with a pressed steel or high-temperature polymer cage.

For detailed information regarding the temperature resistance and the applicability of cages, please refer to the section "Cage materials", starting on **page 140**.

Minimum load

In order to provide satisfactory operation, taper roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rollers and cage, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum radial load to be applied to SKF standard taper roller bearings can be estimated from

$$F_{rm} = 0{,}02\,C$$

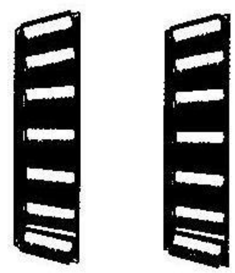
and for SKF Explorer bearings from

$$F_{rm} = 0{,}017\,C$$

where
F_{rm} = minimum radial load, kN
C = basic dynamic load rating, kN (→ product tables)

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the single row taper roller bearing must be subjected to an additional radial load, which can be achieved easily by applying preload. For additional information, please refer to the section "Bearing preload", starting on **page 206**.

Fig 4



Equivalent dynamic bearing load

$P = F_r$ when $F_a/F_r \leq e$
$P = 0{,}4\,F_r + YF_a$ when $F_a/F_r > e$

The values of the calculation factors e and Y will be found in the product tables.

Equivalent static bearing load

$P_0 = 0{,}5\,F_r + Y_0F_a$

When $P_0 < F_r$, $P_0 = F_r$ should be used. The value of the calculation factor Y_0 will be found in the product tables.

Determining axial force for bearings mounted singly or paired in tandem
When a radial load is applied to a single row taper roller bearing, the load is transmitted from one raceway to the other at an angle to the bearing axis and an internal axial force will be induced in the bearing. This must be considered when calculating the equivalent bearing loads for bearing arrangements consisting of two single bearings and/or bearing pairs arranged in tandem.

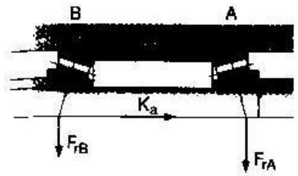
The necessary equations are given in **table 3** for the various bearing arrangements and load cases. The equations are only valid if the bearings are adjusted against each other to practically zero clearance, but without any preload. In the arrangements shown, bearing A is subjected to a radial load F_{rA} and bearing B to radial load F_{rB}. Values of the loads F_{rA} and F_{rB} are always considered positive even when they act in the direction opposite to that shown in the figures. The radial loads act at the pressure centres of the bearings (dimension a in the product tables).

In addition an external force K_a acts on the shaft (or on the housing). Cases 1c and 2c are also valid when $K_a = 0$. Values of the factor Y will be found in the product tables.

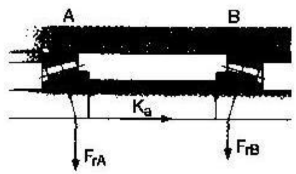
Table 3

Axial loading of bearing arrangements incorporating two single row taper roller bearings and/or bearing pairs in tandem

Back-to-back

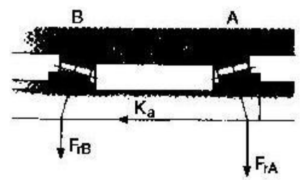


Face-to-face

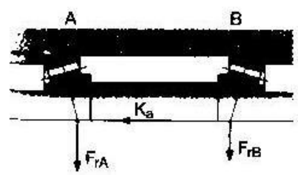


Arrangement	Load case	Axial forces	
Back-to-back / Face-to-face	1a) $\frac{F_{rA}}{Y_A} \geq \frac{F_{rB}}{Y_B}$ $K_a \geq 0$	$F_{aA} = \frac{0{,}5\,F_{rA}}{Y_A}$	$F_{aB} = F_{aA} + K_a$
	1b) $\frac{F_{rA}}{Y_A} < \frac{F_{rB}}{Y_B}$ $K_a \geq 0{,}5\left(\frac{F_{rB}}{Y_B} - \frac{F_{rA}}{Y_A}\right)$	$F_{aA} = \frac{0{,}5\,F_{rA}}{Y_A}$	$F_{aB} = F_{aA} + K_a$
	1c) $\frac{F_{rA}}{Y_A} < \frac{F_{rB}}{Y_B}$ $K_a < 0{,}5\left(\frac{F_{rB}}{Y_B} - \frac{F_{rA}}{Y_A}\right)$	$F_{aA} = F_{aB} - K_a$	$F_{aB} = \frac{0{,}5\,F_{rB}}{Y_B}$

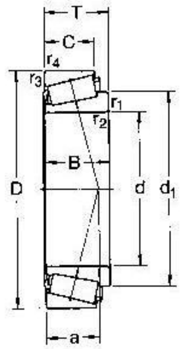
Back-to-back

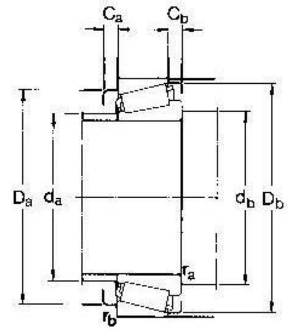


Face-to-face



Arrangement	Load case	Axial forces	
Back-to-back / Face-to-face	2a) $\frac{F_{rA}}{Y_A} \leq \frac{F_{rB}}{Y_B}$ $K_a \geq 0$	$F_{aA} = F_{aB} + K_a$	$F_{aB} = \frac{0{,}5\,F_{rB}}{Y_B}$
	2b) $\frac{F_{rA}}{Y_A} > \frac{F_{rB}}{Y_B}$ $K_a \geq 0{,}5\left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B}\right)$	$F_{aA} = F_{aB} + K_a$	$F_{aB} = \frac{0{,}5\,F_{rB}}{Y_B}$
	2c) $\frac{F_{rA}}{Y_A} > \frac{F_{rB}}{Y_B}$ $K_a < 0{,}5\left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B}\right)$	$F_{aA} = \frac{0{,}5\,F_{rA}}{Y_A}$	$F_{aB} = F_{aA} - K_a$



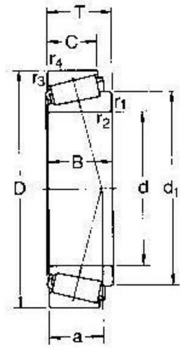


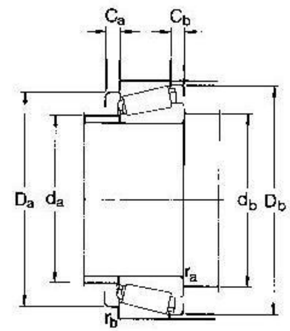
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation	Dimension Series to ISO 355 (ABMA)
d	D	T	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	–
15	42	14,25	22,4	20	2,08	13 000	18 000	0,095	**30302 J2**	2FB
17	40	13,25	19	18,6	1,83	13 000	18 000	0,075	**30203 J2**	2DB
	47	15,25	28,1	25	2,75	12 000	16 000	0,13	**30303 J2**	2FB
	47	20,25	34,7	33,5	3,65	11 000	16 000	0,17	**32303 J2/Q**	2FD
20	42	15	24,2	27	2,7	12 000	16 000	0,097	**32004 X/Q**	3CC
	47	15,25	27,5	28	3	11 000	15 000	0,12	**30204 J2/Q**	2DB
	52	16,25	34,1	32,5	3,6	11 000	14 000	0,17	**30304 J2/Q**	2FB
	52	22,25	44	45,5	5	10 000	14 000	0,23	**32304 J2/Q**	2FD
22	44	15	25,1	29	2,85	11 000	15 000	0,10	**320/22 X**	3CC
25	47	15	27	32,5	3,25	11 000	14 000	0,11	**32005 X/Q**	4CC
	52	16,25	30,8	33,5	3,45	10 000	13 000	0,15	**30205 J2/Q**	3CC
	52	19,25	35,8	44	4,65	9 500	13 000	0,19	**32205 BJ2/Q**	5CD
	52	22	54	56	6	10 000	13 000	0,23	* **33205/Q**	2DE
	62	18,25	44,6	43	4,75	9 000	12 000	0,26	**30305 J2**	2FB
	62	18,25	38	40	4,4	7 500	11 000	0,26	**31305 J2**	7FB
	62	25,25	60,5	63	7,1	8 000	12 000	0,36	**32305 J2**	2FD
28	52	16	36,5	38	4	10 000	13 000	0,15	* **320/28 X/Q**	4CC
	58	17,25	36	41,5	4,4	9 000	12 000	0,25	**302/28 J2**	-
	58	20,25	41,8	50	5,5	8 500	12 000	0,25	**322/28 BJ2/Q**	5DD
30	55	17	35,8	44	4,55	9 000	12 000	0,17	**32006 X/Q**	4CC
	62	17,25	40,2	44	4,8	8 500	11 000	0,23	**30206 J2/Q**	3DB
	62	21,25	50,1	57	6,3	8 500	11 000	0,28	**32206 J2/Q**	3DC
	62	21,25	49,5	58,5	6,55	8 000	11 000	0,30	**32206 BJ2/QCL7CVA606**	5DC
	62	25	64,4	76,5	8,5	7 500	11 000	0,37	**33206/Q**	2DE
	72	20,75	56,1	56	6,4	7 500	10 000	0,39	**30306 J2/Q**	2FB
	72	20,75	47,3	50	5,7	6 700	9 500	0,39	**31306 J2/Q**	7FB
	72	28,75	76,5	85	9,65	7 000	10 000	0,55	**32306 J2/Q**	2FD
32	53	14,5	27	35,5	3,65	9 000	12 000	0,11	**JL 26749 F/710**	(L 26700)
	58	17	36,9	46,5	4,8	8 500	11 000	0,19	**320/32 X/Q**	4CC

Dimensions							Abutment and fillet dimensions									Calculation factors		
d	d_1 ~	B	C	$r_{1,2}$ min	$r_{3,4}$ min	a	d_a max	d_b min	D_a min	D_a max	D_b min	C_a min	C_b min	r_a max	r_b max	e	Y	Y_0
mm							mm									–		
15	27,7	13	11	1	1	9	22	21	36	36	38	2	3	1	1	0,28	2,1	1,1
17	28	12	11	1	1	10	23	23	34	34	37	2	2	1	1	0,35	1,7	0,9
	30,4	14	12	1	1	10	25	23	40	41	42	2	3	1	1	0,28	2,1	1,1
	30,7	19	16	1	1	12	24	23	39	41	43	3	4	1	1	0,28	2,1	1,1
20	31,1	15	12	0,6	0,6	10	25	25	36	37	39	2	3	0,6	0,6	0,37	1,6	0,9
	33,2	14	12	1	1	11	27	26	40	41	43	2	3	1	1	0,35	1,7	0,9
	34,3	15	13	1,5	1,5	11	28	27	44	45	47	2	3	1,5	1,5	0,3	2	1,1
	34,5	21	18	1,5	1,5	14	27	27	43	45	47	3	4	1,5	1,5	0,3	2	1,1
22	33,3	15	11,5	0,6	0,6	11	27	27	38	39	41	3	3,5	0,6	0,6	0,40	1,5	0,8
25	36,5	15	11,5	0,6	0,6	11	30	30	40	42	44	3	3,5	0,6	0,6	0,43	1,4	0,8
	37,4	15	13	1	1	12	31	31	44	46	48	2	3	1	1	0,37	1,6	0,9
	40,2	18	15	1	1	16	30	31	41	46	50	3	4	1	1	0,57	1,05	0,6
	38,6	22	18	1	1	14	30	31	43	46	49	4	4	1	1	0,35	1,7	0,9
	41,5	17	15	1,5	1,5	13	34	32	54	55	57	2	3	1,5	1,5	0,3	2	1,1
	45,8	17	13	1,5	1,5	20	34	32	47	55	59	3	5	1,5	1,5	0,83	0,72	0,4
	41,7	24	20	1,5	1,5	15	33	32	52	55	57	3	5	1,5	1,5	0,3	2	1,1
28	40,3	16	12	1	1	12	34	34	45	46	49	3	4	1	1	0,43	1,4	0,8
	41,8	16	14	1	1	13	35	34	50	52	54	2	3	1	1	0,37	1,6	0,9
	43,9	19	16	1	1	17	33	34	46	52	55	3	4	1	1	0,57	1,05	0,6
30	43	17	13	1	1	13	35	36	48	49	52	3	4	1	1	0,43	1,4	0,8
	44,6	16	14	1	1	14	38	36	53	56	57	2	3	1	1	0,37	1,6	0,9
	45,2	20	17	1	1	15	37	36	52	56	58	3	4	1	1	0,37	1,6	0,9
	47,3	20	17	1	1	18	36	36	50	56	60	3	4	1	1	0,57	1,05	0,6
	45,8	25	19,5	1	1	16	36	36	53	56	59	5	5,5	1	1	0,35	1,7	0,9
	48,4	19	16	1,5	1,5	15	41	37	62	65	66	3	4,5	1,5	1,5	0,31	1,9	1,1
	52,7	19	14	1,5	1,5	22	40	37	55	65	68	3	6,5	1,5	1,5	0,83	0,72	0,4
	48,7	27	23	1,5	1.5	18	39	37	59	65	66	3	5,5	1,5	1,5	0,31	1,9	1,1
32	43,6	15	11,5	3,5	1,3	11	38	43	47	47	50	2	3	3	1	0.33	1.8	1
	45,6	17	13	1	1	14	38	38	50	52	55	3	4	1	1	0,46	1.3	0,7

* SKF Explorer bearing

Metric single row taper roller bearings
d 35 – 40 mm



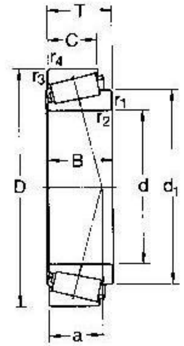


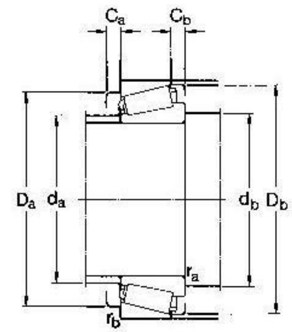
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation	Dimension Series to ISO 355 (ABMA)
d	D	T	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	–
35	62	18	49	54	5,85	8 500	11 000	0,22	* **32007 X/Q**	4CC
	62	18	42,9	49	5.2	8 000	11 000	0,22	**32007 J2/Q**	–
	72	18,25	51,2	56	6,1	7 000	9 500	0,32	**30207 J2/Q**	3DB
	72	24,25	66	78	8,5	7 000	9 500	0,43	**32207 J2/Q**	3DC
	72	28	84,2	106	11,8	6 300	9 500	0,56	**33207/Q**	2DE
	80	22,75	72,1	73,5	8,3	6 700	9 000	0,52	**30307 J2/Q**	2FB
	80	22,75	61,6	67	7,8	6 000	8 500	0,52	**31307 J2/Q**	7FB
	80	32,75	95,2	106	12,2	6 300	9 000	0,73	**32307 J2/Q**	2FE
	80	32,75	93,5	114	13,2	6 000	8 500	0,80	**32307 BJ2/Q**	5FE
37	80	32,75	93,5	114	13,2	6 000	8 500	0,85	**32307/37 BJ2/Q**	–
38	63	17	36,9	52	5,4	7 500	11 000	0,20	**JL 69349 A/310/Q**	(L 69300)
	63	17	36,9	52	5,4	7 500	11 000	0,20	**JL 69349 X/310/Q**	(L 69300)
	63	17	36,9	52	5,4	7 500	11 000	0,19	**JL 69349/310/Q**	(L 69300)
	63	17	36,9	52	5,4	7 500	11 000	0,19	**JL 69345 F/310/Q**	(L 69300)
	68	19	52,8	71	7,65	7 000	9 500	0,28	**32008/38 X/Q**	–
40	68	19	52,8	71	7,65	7 000	9 500	0,27	**32008 X/Q**	3CD
	68	19	52,8	71	7,65	7 000	9 500	0,27	**32008 XTN9/Q**	3CD
	75	26	79,2	104	11,4	6 700	9 000	0,51	**33108/Q**	2CE
	80	19,75	61,6	68	7,65	6 300	8 500	0,42	**30208 J2/Q**	3DB
	80	24,75	74,8	86,5	9,8	6 300	8 500	0,53	**32208 J2/Q**	3DC
	80	32	105	132	15	5 600	8 500	0,77	**33208/QCL7C**	2DE
	85	33	121	150	17,3	6 000	9 000	0,90	**T2EE 040/QVB134**	2EE
	90	25,25	85,8	95	10,8	6 000	8 000	0,72	**30308 J2/Q**	2FB
	90	25,25	85	81,5	9,5	5 600	7 500	0,72	* **31308 J2/QCL7C**	7FB
	90	35,25	117	140	16	5 300	8 000	1,00	**32308 J2/Q**	2FD

Dimensions							Abutment and fillet dimensions									Calculation factors		
d	d_1 ~	B	C	$r_{1,2}$ min	$r_{3,4}$ min	a	d_a max	d_b min	D_a min	D_a max	D_b min	C_a min	C_b min	r_a max	r_b max	e	Y	Y_0
mm							mm									–		
35	49,2	18	14	1	1	15	41	41	54	56	59	4	4	1	1	0,46	1,3	0,7
	49,5	18	15	1	1	16	41	41	53	56	59	2	3	1	1	0,44	1,35	0,8
	51,8	17	15	1,5	1,5	15	44	42	62	65	67	3	3	1,5	1,5	0,37	1,6	0,9
	52,4	23	19	1,5	1,5	17	43	42	61	65	67	3	5	1,5	1,5	0,37	1,6	0,9
	53,4	28	22	1,5	1,5	18	42	42	61	65	68	5	6	1,5	1,5	0,35	1,7	0,9
	54,5	21	18	2	1,5	16	46	44	70	71	74	3	4,5	2	1,5	0,31	1,9	1,1
	59,6	21	15	2	1,5	25	45	44	62	71	76	3	7,5	2	1,5	0,83	0,72	0,4
	54,8	31	25	2	1,5	20	44	44	66	71	74	4	7,5	2	1,5	0,31	1,9	1,1
	59,3	31	25	2	1,5	24	42	44	61	71	76	4	7,5	2	1,5	0,54	1,1	0,6
37	54,8	31	25	2	1,5	20	44	44	66	71	74	4	7,5	2	1,5	0,54	1,1	0,6
38	52,2	17	13,5	1,3	1,3	14	44	44	55	56,5	60	3	3,5	1	1	0,43	1,4	0,8
	52.2	17	13,5	2,3	1,3	14	44	47	55	56,5	60	3	3,5	2	1	0,43	1,4	0,8
	52,2	17	13,5	3,6	1,3	14	44	49	55	56,5	60	3	3,5	3,5	1	0,43	1,4	0,8
	52,2	17	13,5	3,6	1,3	14	44	49	55	56,5	60	3	3,5	3,5	1	0,43	1,4	0,8
	54,2	19	14,5	1	1	15	46	44	60	62	65	4	4,5	1	1	0,37	1,6	0,9
40	54,2	19	14,5	1	1	15	46	46	60	62	65	4	4,5	1	1	0,37	1,6	0,9
	54,2	19	14,5	1	1	15	46	46	60	62	65	4	4,5	1	1	0,37	1,6	0,9
	57,5	26	20,5	1.5	1,5	18	47	47	65	68	71	4	5,5	1,5	1,5	0,35	1,7	0,9
	57,5	18	16	1,5	1,5	16	49	47	69	73	74	3	3,5	1,5	1,5	0,37	1,6	0,9
	58,4	23	19	1,5	1,5	19	49	47	68	73	75	3	5,5	1,5	1,5	0,37	1,6	0,9
	59.7	32	25	1,5	1,5	21	47	47	67	73	76	5	7	1,5	1,5	0,35	1,7	0,9
	61,2	32,5	28	2,5	2	22	48	50	70	75	80	5	5	2	2	0,35	1,7	0.9
	62,5	23	20	2	1,5	19	53	49	77	81	82	3	5	2	1,5	0,35	1,7	0,9
	67,1	23	17	2	1,5	28	51	49	71	81	86	3	8	2	1.5	0,83	0,72	0,4
	62,9	33	27	2	1,5	23	51	49	73	81	82	3	8	2	1,5	0,35	1,7	0,9

* SKF Explorer bearing

Metric single row taper roller bearings
d **45 – 50** mm





Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designation	Dimension Series to ISO 355 (ABMA)
			dynamic	static		Reference speed	Limiting speed			
d	D	T	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	–
45	75	20	58,3	80	8,8	6 300	8 500	0,34	**32009 X/Q**	3CC
	80	26	96,5	114	12,9	6 700	8 000	0,56	* **33109/Q**	3CE
	85	20.638	70,4	81,5	9,3	6 000	8 500	0,50	**358 X/354 X/Q**	(355)
	85	20,75	66	76,5	8,65	6 000	8 000	0,48	**30209 J2/Q**	3DB
	85	24,75	91,5	98	11	6 300	8 000	0,58	* **32209 J2/Q**	3DC
	85	32	108	143	16,3	5 300	7 500	0.82	**33209/Q**	3DE
	90	24,75	82,5	104	12,2	5 300	8 000	0.65	**32210/45 BJ2/QVB022**	–
	95	29	89,7	112	12,7	4 800	7 000	0,92	**T7FC 045/HN3QCL7C**	7FC
	95	36	147	186	20,8	5 300	8 000	1,20	**T2ED 045**	2ED
	100	27.25	108	120	14,3	5 300	7 000	0,97	**30309 J2/Q**	2FB
	100	27,25	106	102	12,5	5 000	6 700	0,95	* **31309 J2/QCL7C**	7FB
	100	38,25	140	170	20,4	4 800	7 000	1,35	**32309 J2/Q**	2FD
	100	38,25	134	176	20	4 800	6 700	1,45	**32309 BJ2/QCL7C**	5FD
46	75	18	50,1	71	7.65	6 300	9 500	0.30	**LM 503349/310/QCL7C**	(LM 503300)
50	80	20	60,5	88	9,65	6 000	8 000	0,37	**32010 X/Q**	3CC
	80	20	60,5	88	9,65	6 000	8 000	0,37	**32010 X/QCL7CVB026**	3CC
	80	24	69.3	102	11,4	6 000	8 000	0,45	**33010/Q**	2CE
	82	21,5	72,1	100	11	6 000	8 500	0,43	**JLM 104948 AA/910 AA/Q**	(LM 104900)
	85	26	85,6	122	13,4	5 600	7 500	0,59	**33110/Q**	3CE
	90	21.75	76,5	91,5	10,4	5 600	7 500	0,54	**30210 J2/Q**	3DB
	90	24,75	82,5	100	11,4	5 600	7 500	0,61	**32210 J2/Q**	3DC
	90	28	106	140	16	5 300	8 000	0,75	**JM 205149/110/Q**	(M 205100)
	90	28	106	140	16	5 300	8 000	0,75	**JM 205149/110 A/Q**	(M 205100)
	90	32	114	160	18,3	5 000	7 000	0,90	**33210/Q**	3DE
	100	36	154	200	22,4	5 000	7 500	1,30	**T2ED 050/Q**	2ED
	105	32	108	137	16	4 300	6 300	1,20	**T7FC 050/QCL7C**	7FC
	110	29,25	143	140	16,6	5 300	6 300	1,25	* **30310 J2/Q**	2FB
	110	29,25	122	120	14,3	4 500	6 000	1,20	* **31310 J2/QCL7C**	7FB
	110	42,25	172	212	24	4 300	6 300	1,80	**32310 J2/Q**	2FD
	110	42,25	172	212	24	4 300	6 300	1,80	**32310 TN9**	2FD
	110	42,25	183	216	24.5	4 500	6 000	1,85	* **32310 BJ2/QCL7C**	5FD

* SKF Explorer bearing

Dimensions							Abutment and fillet dimensions									Calculation factors		
d	d_1 ~	B	C	$r_{1,2}$ min	$r_{3,4}$ min	a	d_a max	d_b min	D_a min	D_a max	D_b min	C_a min	C_b min	r_a max	r_b max	e	Y	Y_0
mm							mm									–		
45	60,4	20	15,5	1	1	16	52	51	67	69	72	4	4,5	1	1	0,4	1,5	0,8
	62,7	26	20,5	1,5	1,5	19	52	52	69	73	77	4	5,5	1,5	1,5	0,37	1,6	0,9
	62,4	21,692	17,462	2	1,5	16	55	53	76	77	80	3	3	2	1,5	0,31	1,9	1,1
	63	19	16	1,5	1,5	18	54	52	74	78	80	3	4,5	1,5	1,5	0,4	1,5	0,8
	64	23	19	1,5	1,5	20	54	52	73	78	80	3	5,5	1,5	1,5	0,4	1,5	0,8
	65,2	32	25	1,5	1,5	22	52	52	72	78	81	5	7	1,5	1,5	0,4	1,5	0,8
	68,5	23	19	1,5	0,3	21	58	52	78	87	85	3	5,5	1,5	0,3	0,6	1	0,6
	74	26,5	20	2,5	2,5	32	54	56	71	83	91	3	9	2	2	0,88	0,68	0,4
	68,5	35	30	2,5	2,5	23	55	56	80	83	89	6	6	2	2	0,33	1,8	1
	70,1	25	22	2	1,5	21	59	53	86	91	92	3	5	2	1,5	0,35	1,7	0,9
	74,7	25	18	2	1,5	31	57	53	79	91	95	4	9	2	1,5	0,83	0,72	0,4
	70,4	36	30	2	1,5	25	57	53	82	91	93	4	8	2	1,5	0,35	1,7	0,9
	74,8	36	30	2	1,5	30	55	53	76	91	94	5	8	2	1,5	0,54	1,1	0,6
46	60,4	18	14	2,3	1,5	16	53	55	67	67,5	71	2	4	2	1,5	0,4	1,5	0,8
50	65,6	20	15,5	1	1	18	57	56	72	74	77	4	4,5	1	1	0,43	1,4	0,8
	65,6	20	15,5	3	1	18	57	62	72	74	77	4	4,5	2,5	1	0,43	1,4	0,8
	64,9	24	19	1	1	17	56	56	72	74	76	4	5	1	1	0,31	1,9	1,1
	65,1	21,5	17	3	0,5	16	57	64	74	79	78	4	4,5	2,5	0,5	0,3	2	1,1
	67,9	26	20	1,5	1,5	20	57	57	74	78	82	4	6	1,5	1,5	0,4	1,5	0,8
	67,9	20	17	1,5	1,5	19	58	57	79	83	85	3	4,5	1,5	1,5	0,43	1,4	0,8
	68,5	23	19	1,5	1,5	21	58	57	78	83	85	3	5,5	1,5	1,5	0,43	1,4	0,8
	68,7	28	23	3	2,5	20	58	64	78	76	85	5	5	2,5	2	0,33	1,8	1
	68,7	28	23	3	0,8	20	58	64	78	85	85	5	5	2,5	0,6	0,33	1,8	1
	70,7	32	24,5	1,5	1,5	23	57	57	77	83	87	5	7,5	1,5	1,5	0,4	1,5	0,8
	73,5	35	30	2,5	2,5	25	59	60	84	88	94	6	6	2	2	0,35	1,7	0,9
	81	29	22	3	3	36	60	62	78	91	100	4	10	2,5	2,5	0,88	0,68	0,4
	77,2	27	23	2,5	2	23	65	60	95	100	102	4	6	2	2	0,35	1,7	0,9
	81,5	27	19	2,5	2	34	62	60	87	100	104	4	10	2	2	0,83	0,72	0,4
	77,7	40	33	2,5	2	27	63	60	90	100	102	5	9	2	2	0,35	1,7	0,9
	77,7	40	33	2,5	2	27	63	60	90	100	102	5	9	2	2	0,35	1,7	0,9
	82,9	40	33	2,5	2	34	62	60	83	100	103	5	9	2	2	0,54	1,1	0,6

Misalignment
Any misalignment of the outer rings relative to the inner rings of matched bearing pairs can only be accommodated between the rollers and raceways by force. The increased stress in the bearing caused by misalignment should be avoided. If misalignment cannot be avoided, SKF recommends using the less stiff face-to-face arrangement.

Cages
The single row taper roller bearings that are matched in bearing sets, are fitted with a pressed steel window-type cage (→ fig 3).

Minimum load
In order to provide satisfactory operation, paired taper roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are to be subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rollers and cages, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum radial load to be applied to matched pairs of SKF standard bearings can be estimated from

$$F_{rm} = 0,02\ C$$

and for matched pairs of SKF Explorer bearings from

$$F_{rm} = 0,017\ C$$

where
F_{rm} = minimum radial load for a bearing pair, kN
C = basic dynamic load rating of a bearing pair, kN (→ product tables)

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing pair, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the bearing pair must be subjected to an additional radial load.

Fig

Equivalent dynamic bearing load
For bearing pairs arranged face-to-face or back-to-back

$P = F_r + Y_1 F_a$ when $F_a/F_r \leq e$
$P = 0,67\ F_r + Y_2 F_a$ when $F_a/F_r > e$

and for bearing pairs arranged in tandem

$P = F_r$ when $F_a/F_r \leq e$
$P = 0,4\ F_r + Y_2 F_a$ when $F_a/F_r > e$

F_r and F_a are the forces acting on the bearing pair. Values for the calculation factors e, Y_1 and Y_2 are given in the product tables.

When determining the axial force for bearing pairs arranged in tandem reference should be made to the section "Determining axial force for bearings mounted singly or paired in tandem" on **page 606**.

Equivalent static bearing load
For bearing pairs arranged face-to-face or back-to-back

$$P_0 = F_r + Y_0 F_a$$

and for bearing pairs arranged in tandem

$$P_0 = 0,5\ F_r + Y_0 F_a$$

When $P_0 < F_r$, $P_0 = F_r$ should be used. F_r and F_a are the forces acting on the bearing pair. Values of the calculation factor Y_0 are given in the product tables.

When determining the axial force for bearing pairs arranged in tandem reference should be made to the section "Determining axial force for bearings mounted singly or paired in tandem" on **page 606**.

Supplementary designations
The designation suffixes used to identify certain features of SKF paired single row taper roller bearings are explained in the following.

- **CL7C** High-performance design for pinion bearing arrangements
- **C...** Special clearance. The two or three-figure number immediately following the C gives the mean axial internal clearance in µm.
- **DB** Matched bearing pair arranged back-to-back. A figure combination immediately following the DB identifies the design of the intermediate rings
- **DF** Matched bearing pair arranged face-to-face. A figure combination immediately following the DF identifies the design of the intermediate ring
- **DT** Matched bearing pair arranged in tandem. A figure combination immediately following the DF identifies the design of the intermediate rings
- **HA1** Inner and outer ring made of case-hardened steel
- **HA3** Inner ring made of case-hardened steel
- **J** Pressed steel window-type cage. A figure following the J indicates a different cage design
- **Q** Optimized contact geometry and surface finish
- **T** T, followed by a figure, identifies the total width of bearing pairs arranged back-to-back or in tandem.
- **X** Boundary dimensions altered to conform to ISO

Fits for bearing pairs

The values of axial internal clearance given in **table 2** on **page 671** are so dimensioned that if the bearings are mounted on shafts machined to

- m5 for shaft diameters up to and including 140 mm,
- n6 for shaft diameters over 140 mm and up to and including 200 mm, or
- p6 for shaft diameters above 200 mm

an appropriate operational clearance will be obtained. These shaft seating tolerances are recommended where loads are moderate to heavy and rotating loads apply for the inner ring. If tighter fits are selected, it is necessary to check that the bearings do not become pinched or clamped.

For stationary outer ring load, the recommended housing bore tolerance is J6 or H7.

Determining the load acting on bearing pairs

If matched pairs of taper roller bearings arranged face-to-face or back-to-back are mounted together with a third bearing, the bearing arrangement is statically indeterminate. In these cases the size of the radial load F_r acting on the bearing pair must first be determined.

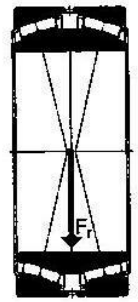
Bearing pairs arranged face-to-face
For bearing pairs where the two bearings are arranged face-to-face (→ **fig 4**) it can be assumed that the radial load will act at the geometric centre of the bearing set as the distance between the pressure centres of the two bearings is short compared with the distance between the geometric centres of the set and the other bearing. In this case it can be assumed that the bearing arrangement is statically determined.

Bearing pairs arranged back-to-back
The distance between the pressure centres of two bearings arranged back-to-back in a matched set is large compared with the distance L between the geometric centres of the set and the other bearing (→ **fig 5**). It is therefore necessary to determine the magnitude of the load acting on the bearing pair and also the distance a_1 at which the load acts. The magnitude of the radial load can be obtained from the equation

$$F_r = \frac{L_1}{L - a_1} K_r$$

where
F_r = radial load acting on a bearing pair, kN
K_r = radial force acting on the shaft, kN
L = distance between the geometric centres of the two bearing positions, mm
L_1 = distance between the centre of bearing position I and the point of action of the force K_r, mm
a = distance between the bearing pressure centres, mm
a_1 = distance between the geometric centre of the bearing set and the point of action of the radial load F_r, mm

Fig 4



The distance a_1 can be determined using **diagram 1**. The distance of the pressure centres a and the calculation factor Y_2 are given in the product table.

Fig 5

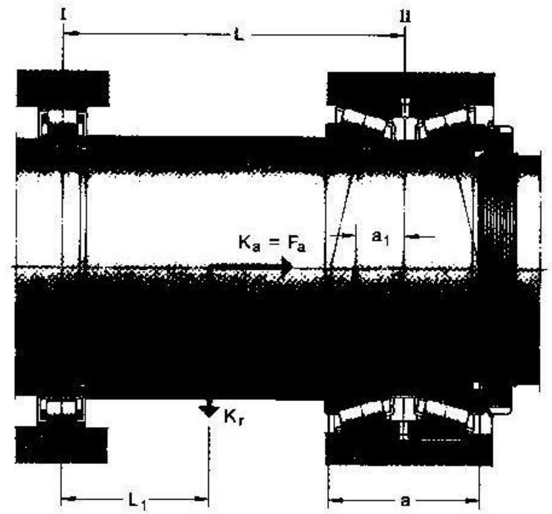
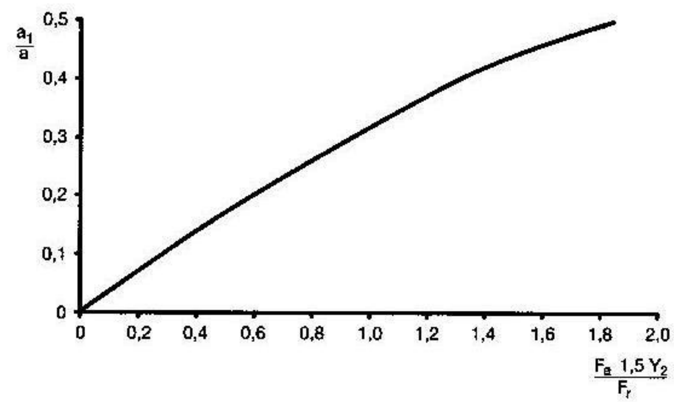
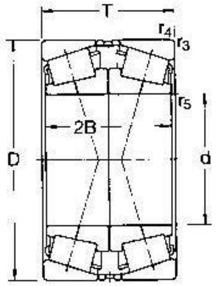
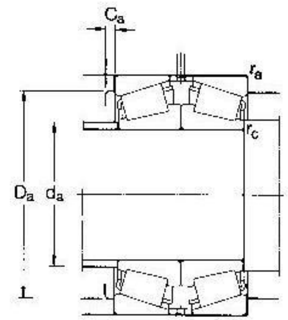


Diagram 1



Single row taper roller bearings
paired face-to-face
d 25 – 80 mm



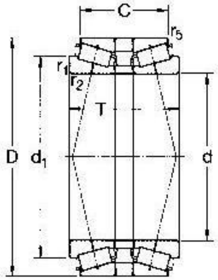


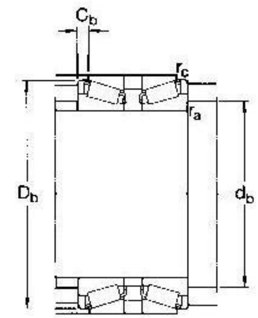
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	T	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
25	62	36,5	64,4	80	8,65	6 000	11 000	0,55	**31305 J2/QDF**
30	72	41,5	80,9	100	11,4	5 300	9 500	0,85	**31306 J2/QDF**
35	80	45,5	105	134	15,6	4 500	8 500	1,10	**31307 J2/QDF**
40	90	50,5	146	163	19	4 500	7 500	1,50	* **31308 J2/QCL7CDF**
45	100	54,5	180	204	24,5	4 000	6 700	2,00	* **31309 J2/QCL7CDF**
50	90	43,5	130	183	20,8	4 500	7 500	1,10	**30210 J2/QDF**
	110	58,5	208	240	28,5	3 600	6 000	2,60	* **31310 J2/QCL7CDF**
55	90	54	180	270	30,5	4 500	7 000	1,35	* **33011/QDF03C170**
	120	63	209	275	33,5	3 000	5 600	3,30	**31311 J2/QDF**
60	95	46	163	245	27	4 300	6 700	1,90	* **32012 X/QCL7CDFC250**
	110	59,5	216	320	37,5	3 600	6 000	2,40	**32212 J2/QDFC290**
	130	67	246	335	40,5	2 800	5 300	4,10	**31312 J2/QDF**
65	120	49,5	228	270	32,5	3 600	5 600	1,20	* **30213 J2/QDF**
	140	72	281	380	47,5	2 600	4 800	5,05	**31313 J2/QCL7CDF**
70	110	50	172	305	34,5	3 400	5 600	1,80	**32014 X/QDF**
	110	62	220	400	45,5	3 400	5 600	2,40	**33014/DF**
	150	76	319	440	54	2 400	4 500	6,15	**31314 J2/QCL7CDF**
75	115	62	233	455	52	3 200	5 300	2,40	**33015/QDF**
	125	74	303	530	63	3 000	5 000	3,80	**33115/QDFC150**
	130	54,5	238	355	41,5	3 000	5 000	2,85	**30215 J2/QDF**
	130	66,5	275	425	49	3 000	5 000	3,40	**32215 J2/QDF**
	160	80	358	490	58,5	2 200	4 300	7,25	**31315 J2/QCL7CDF**
80	125	58	233	430	49	3 000	5 000	2,65	**32016 X/QDFC165**
	140	70,5	319	490	57	2 800	4 500	4,25	**32216 J2/QDF**
	170	85	380	530	64	2 200	4 000	8,75	**31316 J1/QCL7CDF**

Dimensions				Abutment and fillet dimensions						Calculation factors			
d	2B	$r_{3,4}$ min	r_5 min	d_a max	D_a min	D_a max	C_a min	r_a max	r_c max	e	Y_1	Y_2	Y_0
mm				mm						–			
25	34	1,5	0,6	34	47	55	3	1,5	0,6	0,83	0,81	1,2	0,8
30	38	1,5	0,6	40	55	65	3	1,5	0,6	0,83	0,81	1,2	0,8
35	42	1,5	0,6	45	62	71	3	1,5	0,6	0,83	0,81	1,2	0,8
40	46	1,5	0,6	51	71	81	3	1,5	0,6	0,83	0,81	1,2	0,8
45	50	1,5	0,6	57	79	91	4	1,5	0,6	0,83	0,81	1,2	0,8
50	40	1,5	0,6	58	79	83	3	1,5	0,6	0,43	1,6	2,3	1,6
	54	2	0,6	62	87	100	4	2	0,6	0,83	0,81	1,2	0,8
55	54	1,5	0,6	63	81	83	5	1,5	0,6	0,31	2,2	3,3	2,2
	58	2	0,6	68	94	112	4	2	0,6	0,83	0,81	1,2	0,8
60	46	1,5	0,6	67	85	88	4	1,5	0,6	0,43	1,6	2,3	1,6
	56	1,5	0,6	69	95	103	4	1,5	0,6	0,4	1,7	2,5	1,6
	62	2,5	1	74	103	118	5	2	1	0,83	0,81	1,2	0,8
65	46	1,5	0,6	78	106	113	4	1,5	0,6	0,4	1,7	2,5	1,6
	66	2,5	1	80	111	128	5	2	1	0,83	0,81	1,2	0,8
70	50	1,5	0,6	78	98	103	5	1,5	0,6	0,43	1,6	2,3	1,6
	62	1,5	0,6	78	99	103	5	1,5	0,6	0,28	2,4	3,6	2,5
	70	2,5	1	85	118	138	5	2	1	0,83	0,81	1,2	0,8
75	62	1,5	0,6	84	104	108	6	1,5	0,6	0,3	2,3	3,4	2,2
	74	1,5	0,6	84	109	117	6	1,5	0,6	0,4	1,7	2,5	1,6
	50	1,5	0,6	86	115	122	4	1,5	0,6	0,43	1,6	2,3	1,6
	62	1,5	0,6	85	114	122	4	1,5	0,6	0,43	1,6	2,3	1,6
	74	2,5	1	91	127	148	6	2	1	0,83	0,81	1,2	0,8
80	58	1,5	0,6	90	112	117	6	1,5	0,6	0,43	1,6	2,3	1,6
	66	2	0,6	91	122	130	5	2	0,6	0,43	1,6	2,3	1,6
	78	2,5	1	97	134	158	6	2	1	0,83	0,81	1,2	0,8

* SKF Explorer bearing

Single row taper roller bearings
paired back-to-back
d **40 – 170** mm





Principal dimensions d	D	T	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass	Designation
mm			kN		kN	r/min		kg	–
40	90	72	147	190	21,6	4 800	8 000	1,90	**30308T72 J2/QDBC220**
75	130	70	238	355	41,5	3 000	5 000	3,25	**30215T70 J2/DBC270**
	130	80	275	425	49	3 000	5 000	6,80	**32215T80 J2/QDB**
80	140	78	319	490	57	2 800	4 500	4,45	**32216T78 J2/QDBC110**
85	130	66	238	450	51	2 800	4 800	2,70	**32017T66 X/QDB/C280**
	130	70	308	620	69,5	2 800	4 800	3,50	**33017T70/QDB**
	150	71	303	440	51	2 600	4 300	4,10	**30217T71 J2/QDB**
90	190	103	457	630	73,5	1 900	3 400	12,5	**31318T103 J2/DB31**
100	180	108	539	880	96,5	2 200	3 600	10,5	**32220T108 J2/DB**
	180	140	539	880	96,5	2 200	3 600	12,5	**32220T140 J2/DB11**
110	170	84	402	780	85	2 200	3 600	6,50	**32022T84 X/QDBC200**
120	180	84	418	830	88	2 000	3 400	7,00	**32024T84 X/QDBC200**
	215	146	792	1 400	146	1 800	3 000	21,0	**32224T146 J2/DB31C210**
	260	146	935	1 400	146	1 400	2 400	35,0	**31324T146 XJ2/DB**
130	230	97,5	627	980	106	1 700	2 800	15,0	**30226T97.5 J2/DB**
	280	142	1 080	1 600	166	1 400	2 400	36,5	**30326T142 J2/DB11C150**
140	210	130	561	1 160	116	1 700	2 800	12,7	**32028T130 X/QDB**
	250	106	721	1 140	116	1 500	2 600	19,5	**30228T106 J2/DB**
	250	158	1 100	2 000	200	1 500	2 600	31,0	**32228T158 J2/DB**
150	270	168	1 250	2 280	224	1 400	2 400	38,0	**32230T168 J2/DB**
	270	248	1 250	2 280	224	1 400	2 400	39,5	**32230T248 J2/DB31**
	320	179	1 340	2 040	200	1 100	2 000	58,5	**31330T179 XJ2/DB**
160	290	179	1 510	2 800	265	1 300	2 200	52,5	**32232T179 J2/DB32C230**
170	260	162	880	1 830	180	1 400	2 200	30,5	**32034T162 X/DB31**

Dimensions d	d_1 ~	C	$r_{1,2}$ min	r_5 min	a	Abutment and fillet dimensions d_b min	D_b min	C_b min	r_a max	r_c max	Calculation factors e	Y_1	Y_2	Y_0
mm						mm					–			
40	62,5	61,5	2	0,6	50	49	82	5	2	0.6	0,35	1,9	2,9	1,8
75	99,2	59,5	2	0,6	69	84	124	5	2	0,6	0,43	1,6	2,3	1,6
	100	67,5	2	0,6	72	84	125	6	2	0,6	0,43	1,6	2,3	1,6
80	106	63,5	2,5	0,6	68	90	134	7	2	0.6	0,43	1,6	2,3	1,6
85	108	52	1,5	0,6	64	92	125	7	1,5	0,6	0,44	1,5	2,3	1,4
	108	56	1,5	0,6	68	92	125	7	1,5	0,6	0,44	1,5	2,3	1,4
	112	58,5	2,5	0,6	71	95	141	6,5	2	0,6	0,43	1,6	2,3	1,6
90	138	70	4	1	124	105	179	16,5	3	1	0,83	0,81	1,2	0,8
100	135	88	3	1	92	112	171	10	2,5	1	0,43	1,6	2,3	1,6
	135	120	3	1	124	112	171	10	2,5	1	0,43	1,6	2,3	1,6
110	140	66	2,5	0,6	80	121	163	9	2	0,6	0,43	1,6	2,3	1.6
120	150	66	2,5	0,6	86	131	173	9	2	0,6	0,46	1,5	2,2	1,4
	163	123	3	1	125	132	204	11,5	2,5	1	0,43	1,6	2,3	1,6
	190	134	4	1	166	135	244	26	3	1	0,83	0,81	1,2	0,9
130	173	78	4	1	99	146	217	9,5	3	1	0,43	1,6	2,3	1,6
	196	112,5	5	1,5	117	150	255	14,5	4	1,5	0,35	1,9	2,9	1,8
140	175	108	2,5	0,6	132	152	202	11	2	0,6	0,46	1,5	2,2	1,4
	186	86,5	4	1	108	156	234	9,5	3	1	0,43	1,6	2,3	1,6
	191	130,5	4	1	134	156	238	13,5	3	1	0,43	1,6	2,3	1,6
150	205	134	4	1	142	166	254	17	3	1	0,43	1,6	2,3	1,6
	205	214	4	1	222	166	254	17	3	1	0,43	1,6	2,3	1,6
	234	115	5	1,5	207	170	300	32	4	1,5	0,83	0,81	1,2	0,8
160	221	145	4	1	150	176	274	17	3	1	0,43	1,6	2,3	1,6
170	214	134	3	1	160	184	249	14	2,5	1	0,44	1,5	2,3	1,6

Influence of operating temperature on bearing material
All SKF spherical roller bearings undergo a special heat treatment so that they can be operated at higher temperatures for longer periods, without the occurrence of inadmissible dimensional changes. For example, a temperature of +200 °C for 2 500 h, or for short periods at even higher temperatures, is permitted.

Axial load carrying capacity
Because of their special internal design, SKF spherical roller bearings are able to accommodate heavy axial loads and even purely axial loads.

Axial load carrying capacity of bearings mounted on an adapter sleeve

If spherical roller bearings with adapter sleeves are mounted on smooth shafts with no fixed abutment, the magnitude of the axial load that can be supported is determined by the friction between the shaft and sleeve. Provided the bearings are correctly mounted, the permissible axial load can be calculated from

$$F_{ap} = 0{,}003\, B\, d$$

where
F_{ap} = maximum permissible axial load, kN
B = bearing width, mm
d = bearing bore diameter, mm

Minimum load
In order to provide satisfactory operation, spherical roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rollers and cage(s), and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum load to be applied to spherical roller bearings can be estimated using

$$P_{0m} = 0{,}01\, C_0$$

where
P_{0m} = minimum equivalent static bearing load, kN
C_0 = basic static load rating, kN (→ product tables)

In some applications it is not possible to reach or exceed the requisite minimum load. However, if the bearing is oil lubricated lower minimum loads are permissible. These loads can be calculated when $n/n_r \le 0{,}3$ from

$$P_{0m} = 0{,}003\, C_0$$

and when $0{,}3 < n/n_r \le 2$ from

$$P_{0m} = 0{,}003\, C_0 \left(1 + 2\sqrt{\frac{n}{n_r} - 0{,}3}\right)$$

where
P_{0m} = minimum equivalent static bearing load, kN
C_0 = basic static load rating, kN (→ product tables)
n = rotational speed, r/min
n_r = reference speed, r/min (→ product tables)

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads than $P_{0m} = 0{,}01\, C_0$ may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the spherical roller bearing must be subjected to an additional radial load.

NoWear spherical roller bearings have proven to give reliable operation at very low loads. They can withstand longer periods of insufficient lubrication, sudden variations in load and rapid speed changes (→ **page 939**)

Equivalent dynamic bearing load

$P = F_r + Y_1 F_a$ when $F_a/F_r \le e$
$P = 0{,}67\, F_r + Y_2 F_a$ when $F_a/F_r > e$

The values of the calculation factors e, Y_1 and Y_2 will be found in the product tables.

Equivalent static bearing load

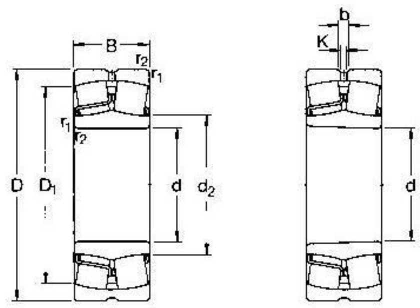
$$P_0 = F_r + Y_0 F_a$$

The value of the calculation factor Y_0 will be found in the product tables.

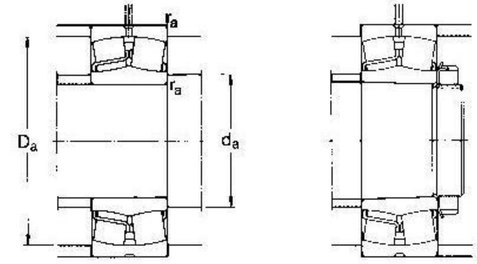
Supplementary designations
The designation suffixes used to identify certain features of SKF spherical roller bearings are explained in the following. The suffixes used to identify bearing (and cage) design, e.g. CC or E, are not included here as they are explained in the section "Standard bearings" on **page 692**.

C2	Radial internal clearance smaller than Normal
C3	Radial internal clearance greater than Normal
C4	Radial internal clearance greater than C3
C5	Radial internal clearance greater than C4
C08	Heightened running accuracy to ISO tolerance class 5
C083	C08 + C3
C084	C08 + C4
2CS	Sheet steel reinforced contact seal of acrylonitrile butadiene rubber (NBR) on both sides of the bearing. Annular groove and three lubrication holes in the outer ring covered with a polymer band. Lubricated with an extreme pressure bearing grease according to **table 1** on **page 694**
2CS2	Sheet steel reinforced contact seal of fluoro rubber (FPM) on both sides of the bearing. Annular groove and three lubrication holes in the outer ring; covered with a polymer band. Lubricated with a polyurea high temperature grease
2CS5	Sheet steel reinforced contact seal of hydrogenated acrylonitrile butadiene rubber (HNBR) on both sides of the bearing. Otherwise as 2CS2
HA3	Inner ring of case-hardened steel
K	Tapered bore, taper 1:12
K30	Tapered bore, taper 1:30
P5	Dimensional and running accuracy to ISO tolerance class 5
P6	Dimensional and running accuracy to ISO tolerance class 6
P62	P6 + C2
VA405	Bearings for vibratory applications with surface hardened cages
VA406	VA405 and PTFE-coated bore
VE552(E)	Outer ring with three equally spaced threaded holes in one side face to accommodate hoisting tackle; the E indicates that appropriate eye bolts are supplied with the bearings
VE553(E)	As VE552 but with threaded holes in both side faces
VG114	Surface hardened pressed steel cage
VQ424	Running accuracy better than C08
VT143	Grease fill with an extreme pressure grease according to **table 1** on **page 694**
W	Without annular groove and lubrication holes in outer ring
W20	Three lubrication holes in the outer ring
W26	Six lubrication holes in the inner ring
W33	Annular groove and three lubrication holes in the outer ring
W64	Solid Oil filling
W77	Plugged W33 lubrication holes
W513	W26 + W33
235220	Inner ring of case-hardened steel with helical groove in bore

Spherical roller bearings
d 20 – 70 mm



Cylindrical bore　　Tapered bore

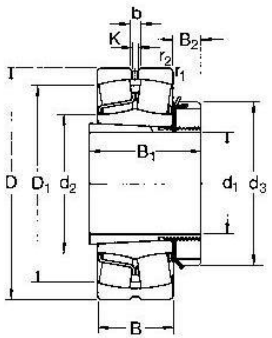


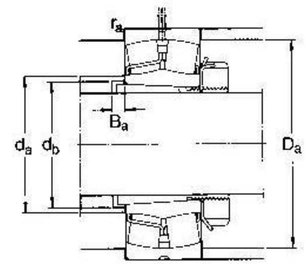
Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass	Designations Bearing with cylindrical bore	tapered bore
mm			kN		kN	r/min		kg	–	
20	52	18	49	44	4,75	13 000	17 000	0,28	***22205/20 E**	–
25	52	18	49	44	4,75	13 000	17 000	0,26	***22205 E**	***22205 EK**
	62	17	41,4	41,5	4,55	8 500	12 000	0,28	**21305 CC**	–
30	62	20	64	60	6,4	10 000	14 000	0,29	***22206 E**	***22206 EK**
	72	19	55,2	61	6,8	7 500	10 000	0,41	**21306 CC**	**21306 CCK**
35	72	23	86,5	85	9,3	9 000	12 000	0,45	***22207 E**	***22207 EK**
	80	21	65,6	72	8,15	6 700	9 500	0,55	**21307 CC**	**21307 CCK**
40	80	23	96,5	90	9,8	8 000	11 000	0,53	***22208 E**	***22208 EK**
	90	23	104	108	11,8	7 000	9 500	0,75	***21308 E**	***21308 EK**
	90	33	150	140	15	6 000	8 000	1,05	***22308 E**	***22308 EK**
45	85	23	102	98	10,8	7 500	10 000	0,58	***22209 E**	***22209 EK**
	100	25	125	127	13,7	6 300	8 500	0,99	***21309 E**	***21309 EK**
	100	36	183	183	19,6	5 300	7 000	1,40	***22309 E**	***22309 EK**
50	90	23	104	108	11,8	7 000	9 500	0,63	***22210 E**	***22210 EK**
	110	27	156	166	18,6	5 600	7 500	1,35	***21310 E**	***21310 EK**
	110	40	220	224	24	4 800	6 300	1,90	***22310 E**	***22310 EK**
55	100	25	125	127	13,7	6 300	8 500	0,84	***22211 E**	***22211 EK**
	120	29	156	166	18,6	5 600	7 500	1,70	***21311 E**	***21311 EK**
	120	43	270	280	30	4 300	5 600	2,45	***22311 E**	***22311 EK**
60	110	28	156	166	18,6	5 600	7 500	1,15	***22212 E**	***22212 EK**
	130	31	212	240	26,5	4 800	6 300	2,10	***21312 E**	***21312 EK**
	130	46	310	335	36,5	4 000	5 300	3,10	***22312 E**	***22312 EK**
65	100	35	132	173	20,4	4 300	6 300	0,95	***24013 CC/W33**	***24013 CCK30/W33**
	120	31	193	216	24	5 000	7 000	1,55	***22213 E**	***22213 EK**
	140	33	236	270	29	4 300	6 000	2,55	***21313 E**	***21313 EK**
	140	48	340	360	38	3 800	5 000	3,75	***22313 E**	***22313 EK**
70	125	31	208	228	25,5	5 000	6 700	1,55	***22214 E**	***22214 EK**
	150	35	285	325	34,5	4 000	5 600	3,10	***21314 E**	***21314 EK**
	150	51	400	430	45	3 400	4 500	4,55	***22314 E**	***22314 EK**

Dimensions d	d_2 ~	D_1 ~	b	K	$r_{1,2}$ min	Abutment and fillet dimensions d_a min	D_a max	r_a max	Calculation factors e	Y_1	Y_2	Y_0
mm						mm			–			
20	31,2	44,2	3,7	2	1	25,6	46,4	1	0,35	1,9	2,9	1,8
25	31,2	44,2	3,7	2	1	30,6	46,4	1	0,35	1,9	2,9	1,8
	35,7	50,7	–	–	1,1	32	55	1	0,30	2,3	3,4	2,2
30	37,5	53	3.7	2	1	35,6	56,4	1	0,31	2,2	3,3	2,2
	43,3	58,8	–	–	1,1	37	65	1	0,27	2,5	3,7	2,5
35	44,5	61,8	3,7	2	1,1	42	65	1	0,31	2,2	3,3	2,2
	47,2	65,6	–	–	1,5	44	71	1,5	0,28	2,4	3,6	2,5
40	49,1	69,4	5,5	3	1,1	47	73	1	0,28	2,4	3,6	2,5
	59,9	79,8	5,5	3	1,5	49	81	1,5	0,24	2,8	4,2	2,8
	49,7	74,3	5,5	3	1,5	49	81	1,5	0,37	1,8	2,7	1,8
45	54,4	74,4	5,5	3	1,1	52	78	1	0,26	2,6	3,9	2,5
	65,3	88	5,5	3	1,5	54	91	1,5	0,24	2,8	4,2	2,8
	56,4	83,4	5,5	3	1,5	54	91	1,5	0,37	1,8	2,7	1,8
50	59,9	79	5,5	3	1,1	57	83	1	0,24	2,8	4,2	2,8
	71,6	96,8	5,5	3	2	61	99	2	0,24	2,8	4,2	2,8
	62,1	91,9	5,5	3	2	61	99	2	0,37	1,8	2,7	1,8
55	65,3	88	5,5	3	1,5	64	91	1,5	0,24	2,8	4,2	2,8
	71,6	96,2	5,5	3	2	66	109	2	0,24	2,8	4,2	2,8
	70,1	102	5,5	3	2	66	109	2	0,35	1,9	2,9	1,8
60	71,6	96,5	5,5	3	1,5	69	101	1,5	0,24	2,8	4,2	2,8
	87,8	115	5,5	3	2,1	72	118	2	0,22	3	4,6	2,8
	77,9	110	8,3	4,5	2,1	72	118	2	0,35	1,9	2,9	1,8
65	73,8	87,3	3,7	2	1,1	71	94	1	0,27	2,5	3,7	2,5
	77,6	106	5,5	3	1,5	74	111	1,5	0,24	2,8	4,2	2,8
	94,7	124	5,5	3	2,1	77	128	2	0,22	3	4,6	2,8
	81,6	118	8,3	4,5	2,1	77	128	2	0,35	1,9	2,9	1,8
70	83	111	5,5	3	1,5	79	116	1,5	0,23	2,9	4,4	2,8
	101	133	5,5	3	2,1	82	138	2	0,22	3	4,6	2,8
	90,3	128	8,3	4,5	2,1	82	138	2	0,33	2	3	2

* SKF Explorer bearing

Spherical roller bearings on adapter sleeve
d_1 **20 – 65** mm





Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve	Designations Bearing	Adapter sleeve
d_1	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
20	52	18	49	44	4,75	13 000	17 000	0,33	* **22205 EK**	**H 305**
25	62	20	64	60	6,4	10 000	14 000	0,39	* **22206 EK**	**H 306**
	72	19	55,2	61	6,8	7 500	10 000	0,51	**21306 CCK**	**H 306**
30	72	23	86,5	85	9,3	9 000	12 000	0,59	* **22207 EK**	**H 307**
	80	21	65,6	72	8,15	6 700	9 500	0,69	**21307 CCK**	**H 307**
35	80	23	96,5	90	9,8	8 000	11 000	0,68	* **22208 EK**	**H 308**
	90	23	104	108	11,8	7 000	9 500	0,92	* **21308 EK**	**H 308**
	90	33	150	140	15	6 000	8 000	1,25	* **22308 EK**	**H 2308**
40	85	23	102	98	10,8	7 500	10 000	0,81	* **22209 EK**	**H 309**
	100	25	125	127	13,7	6 300	8 500	1,20	* **21309 EK**	**H 309**
	100	36	183	183	19,6	5 300	7 000	1,70	* **22309 EK**	**H 2309**
45	90	23	104	108	11,8	7 000	9 500	0,90	* **22210 EK**	**H 310**
	110	27	156	166	18,6	5 600	7 500	1,60	* **21310 EK**	**H 310**
	110	40	220	224	24	4 800	6 300	2,25	* **22310 EK**	**H 2310**
50	100	25	125	127	13,7	6 300	8 500	1,10	* **22211 EK**	**H 311**
	120	29	156	166	18,6	5 600	7 500	1,95	* **21311 EK**	**H 311**
	120	43	270	280	30	4 300	5 600	2,85	* **22311 EK**	**H 2311**
55	110	28	156	166	18,6	5 600	7 500	1,45	* **22212 EK**	**H 312**
	130	31	212	240	26,5	4 800	6 300	2,35	* **21312 EK**	**H 312**
	130	46	310	335	36,5	4 000	5 300	3,50	* **22312 EK**	**H 2312**
60	120	31	193	216	24	5 000	7 000	1,95	* **22213 EK**	**H 313**
	125	31	208	228	25,5	5 000	6 700	2,15	* **22214 EK**	**H 314**
	140	33	236	270	29	4 300	6 000	2,90	* **21313 EK**	**H 313**
	140	48	340	360	38	3 800	5 000	4,20	* **22313 EK**	**H 2313**
	150	35	285	325	34,5	4 000	5 600	3,70	* **21314 EK**	**H 314**
	150	51	400	430	45	3 400	4 500	5,35	* **22314 EK**	**H 2314**
65	130	31	212	240	26,5	4 800	6 300	2,45	* **22215 EK**	**H 315**
	160	37	285	325	34,5	4 000	5 600	4,50	* **21315 EK**	**H 315**
	160	55	440	475	48	3 200	4 300	6,50	* **22315 EK**	**H 2315**

* SKF Explorer bearing

Dimensions									Abutment and fillet dimensions					Calculation factors			
d_1	d_2 ~	d_3	D_1 ~	B_1	B_2	b	K	$r_{1,2}$ min	d_a max	d_b min	D_a max	B_a min	r_a max	e	Y_1	Y_2	Y_0
mm									mm					–			
20	31,2	38	44,2	29	8	3,7	2	1	31	28	46,4	5	1	0,35	1,9	2,9	1,8
25	37,5	45	53	31	8	3,7	2	1	37	33	56,4	5	1	0,31	2,2	3,3	2,2
	43,3	45	58,8	31	8	–	–	1,1	43	33	65	6	1	0,27	2,5	3,7	2,5
30	44,5	52	61,8	35	9	3,7	2	1,1	44	39	65	5	1	0,31	2,2	3,3	2,2
	47,2	52	65,6	35	9	–	–	1,5	47	39	71	7	1,5	0,28	2,4	3,6	2,5
35	49,1	58	69,4	36	10	5,5	3	1,1	49	44	73	5	1	0,28	2,4	3,6	2,5
	59,9	58	79,8	36	10	5,5	3	1,5	59	44	81	5	1,5	0,24	2,8	4,2	2,8
	49,7	58	74,3	46	10	5,5	3	1,5	49	45	81	6	1,5	0,37	1,8	2,7	1,8
40	54,4	65	74,4	39	11	5,5	3	1,1	54	50	78	7	1	0,26	2,6	3,9	2,5
	65,3	65	88	39	11	5,5	3	1,5	65	50	91	5	1,5	0,24	2,8	4,2	2,8
	56,4	65	83,4	50	11	5,5	3	1,5	56	50	91	6	1,5	0,37	1,8	2,7	1,8
45	59,9	70	79	42	12	5,5	3	1,1	59	55	83	9	1	0,24	2,8	4,2	2,8
	71,6	70	96,8	42	12	5,5	3	2	71	55	99	5	2	0.24	2,8	4,2	2,8
	62,1	70	91,9	55	12	5,5	3	2	62	56	99	6	2	0,37	1,8	2,7	1,8
50	65,3	75	88	45	12,5	5,5	3	1,5	65	60	91	10	1,5	0,24	2,8	4,2	2,8
	71,6	75	96,2	45	12,5	5,5	3	2	71	60	109	6	2	0,24	2,8	4,2	2,8
	70,1	75	102	59	12,5	5,5	3	2	70	61	109	6	2	0,35	1,9	2.9	1,8
55	71,6	80	96,5	47	13	5,5	3	1,5	71	65	101	9	1,5	0,24	2,8	4,2	2,8
	87,8	80	115	47	13	5,5	3	2,1	87	65	118	6	2	0,22	3	4,6	2,8
	77,9	80	110	62	13	8,3	4,5	2,1	77	66	118	6	2	0,35	1,9	2,9	1,8
60	77,6	85	106	50	14	5,5	3	1,5	77	70	111	8	1,5	0,24	2,8	4,2	2,8
	83	92	111	52	14	5,5	3	1,5	83	75	116	9	1,5	0,23	2,9	4,4	2,8
	94,7	85	124	50	14	5,5	3	2,1	94	70	128	6	2	0,22	3	4,6	2,8
	81,6	85	118	65	14	8,3	4,5	2,1	81	72	128	5	2	0,35	1,9	2,9	1,8
	101	92	133	52	14	5,5	3	2,1	101	75	138	6	2	0,22	3	4,6	2,8
	90,3	92	128	68	14	8,3	4,5	2,1	90	76	138	6	2	0,33	2	3	2
65	87,8	98	115	55	15	5,5	3	1,5	87	80	121	12	1,5	0,22	3	4,6	2,8
	101	98	133	55	15	5,5	3	2,1	101	80	148	6	2	0,22	3	4,6	2,8
	92,8	98	135	73	15	8,3	4,5	2,1	92	82	148	5	2	0,35	1,9	2,9	1,8

Bearing data – general

Dimensions

The boundary dimensions of SKF thrust ball bearings with flat or sphered housing washers conform to DIN 711:1988 and DIN 715:1987. The dimensions of the bearings with flat housing washers conform to ISO 104:2002.

The values given for the height H_1 for bearings with sphered housing washer(s) are valid only for SKF bearings with SKF washers.

Tolerances

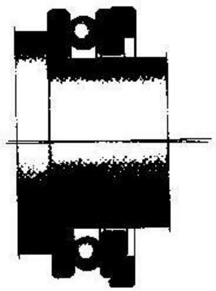
SKF thrust ball bearings are made to Normal tolerances as standard. Some single direction bearings with flat housing washer are also available with increased accuracy to tolerance class P6 or tolerance class P5 specifications. Contact SKF for availability before ordering.

Normal, P6 and P5 tolerances are in accordance with ISO 199:1997. The values can be found in **table 10** on **page 132**.

Misalignment

Thrust ball bearings with flat housing washers cannot accommodate any misalignment between the shaft and housing or angular misalignment between the support surfaces in the housing and on the shaft.

The bearings with sphered housing washers are generally used with sphered seating washers and can compensate for



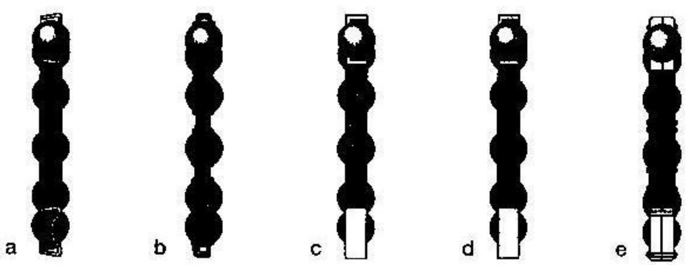
initial misalignment between the support surfaces in the housing and on the shaft (→ **fig 7**).

Cages

SKF thrust ball bearings are fitted with different standard cages (→ **fig 8**) depending on the bearing series and size as follows:

- pressed steel cage (**a** and **b**), no designation suffix,
- injection moulded cage of glass fibre reinforced polyamid 6,6, designation suffix TN9,
- one-piece machined brass cage (**c**), designation suffix M,
- one-piece machined steel cage (**d**), designation suffix F,
- two-piece machined brass cage (**e**), designation suffix M.

Fig



Minimum load

In order to provide satisfactory operation, thrust ball bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the balls and cage(s), and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the balls and raceways.

The requisite minimum axial load to be applied to thrust ball bearings can be estimated using

$$F_{am} = A \left(\frac{n}{1\,000}\right)^2$$

where

F_{am} = minimum axial load, kN
A = minimum load factor (→ product tables)
n = rotational speed, r/min

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, particularly when the shaft is vertical, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the thrust ball bearing must be preloaded, e.g. by springs.

Equivalent dynamic bearing load

$$P = F_a$$

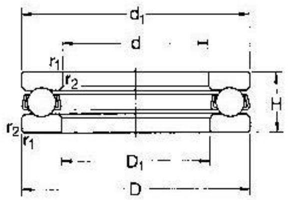
Equivalent static bearing load

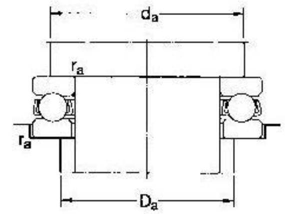
$$P_0 = F_a$$

Supplementary designations

The designation suffixes used to identify certain features of SKF thrust ball bearings are explained in the following.

F Machined steel cage
JR Cage comprising two flat pressed steel washers
M Machined brass cage
P5 Increased dimensional and running accuracy to ISO tolerance class 5
P6 Increased dimensional and running accuracy to ISO tolerance class 6
TN9 Injection moulded glass fibre reinforced polyamid 6,6 cage

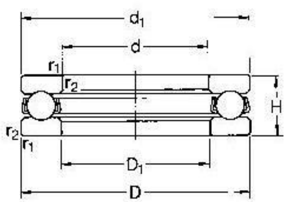


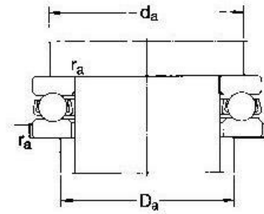


Principal dimensions			Basic load ratings		Fatigue load limit	Minimum load factor	Speed ratings		Mass	Designation
			dynamic	static			Reference speed	Limiting speed		
d	D	H	C	C_0	P_u	A				
mm			kN		kN	–	r/min		kg	–
3	8	3,5	0,806	0,72	0,027	0,000003	26 000	36 000	0,0009	**BA 3**
4	10	4	0,761	0,72	0,027	0,000003	22 000	30 000	0,0015	**BA 4**
5	12	4	0,852	0,965	0,036	0,000005	20 000	28 000	0,0021	**BA 5**
6	14	5	1,78	1,92	0,071	0,000019	17 000	24 000	0,0035	**BA 6**
7	17	6	2,51	2,9	0,108	0,000044	14 000	19 000	0,0065	**BA 7**
8	19	7	3,19	3,8	0,143	0,000075	12 000	17 000	0,0091	**BA 8**
9	20	7	3,12	3,8	0,143	0,000075	12 000	16 000	0,010	**BA 9**
10	24	9	9,95	15,3	0,56	0,0012	9 500	13 000	0,020	**51100**
	26	11	12,7	18,6	0,70	0,0018	8 000	11 000	0,030	**51200**
12	26	9	10,4	16,6	0,62	0,0014	9 000	13 000	0,022	**51101**
	28	11	13,3	20,8	0,77	0,0022	8 000	11 000	0,034	**51201**
15	28	9	10,6	18,3	0,67	0,0017	8 500	12 000	0,023	**51102**
	32	12	16,5	27	1	0,0038	7 000	10 000	0,046	**51202**
17	30	9	11,4	21,2	0,78	0,0023	8 500	12 000	0,025	**51103**
	35	12	17,2	30	1,1	0,0047	6 700	9 500	0,053	**51203**
20	35	10	15,1	29	1,08	0,0044	7 500	10 000	0,037	**51104**
	40	14	22,5	40,5	1,53	0,0085	6 000	8 000	0,083	**51204**
25	42	11	18,2	39	1,43	0,0079	6 300	9 000	0,056	**51105**
	47	15	27,6	55	2,04	0,015	5 300	7 500	0,11	**51205**
	52	18	34,5	60	2,24	0,018	4 500	6 300	0,17	**51305**
	60	24	55,3	96,5	3,6	0,048	3 600	5 000	0,34	**51405**
30	47	11	19	43	1,6	0,0096	6 000	8 500	0,063	**51106**
	52	16	25,5	51	1,9	0,013	4 800	6 700	0,13	**51206**
	60	21	37,7	71	2,65	0,026	3 800	5 300	0,26	**51306**
	70	28	72,8	137	5,1	0,097	3 000	4 300	0,52	**51406**

Dimensions				Abutment and fillet dimensions		
d	d_1 ~	D_1 ~	$r_{1,2}$ min	d_a min	D_a max	r_a max
mm				mm		
3	7,8	3,2	0,15	5,8	5	0,15
4	9,8	4,2	0,15	7,5	6,5	0,15
5	11,8	5,2	0,15	8	9	0,15
6	13,8	6,2	0,2	11	9,5	0,2
7	16,8	7,2	0,2	12,5	11	0,2
8	18,8	8,2	0,3	14,5	12,5	0,3
9	19,8	9,2	0,3	15,5	13,5	0,3
10	24	11	0,3	19	15	0,3
	26	12	0,6	20	16	0,6
12	26	13	0,3	21	17	0,3
	28	14	0,6	22	18	0,6
15	28	16	0,3	23	20	0,3
	32	17	0,6	25	22	0,6
17	30	18	0,3	25	22	0,3
	35	19	0,6	28	24	0,6
20	35	21	0,3	29	26	0,3
	40	22	0,6	32	28	0,6
25	42	26	0,6	35	32	0,6
	47	27	0,6	38	34	0,6
	52	27	1	41	36	1
	60	27	1	46	39	1
30	47	32	0,6	40	37	0,6
	52	32	0,6	43	39	0,6
	60	32	1	48	42	1
	70	32	1	54	46	1

Single direction thrust ball bearings
d 35 – 70 mm

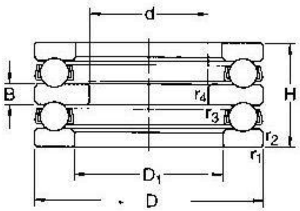


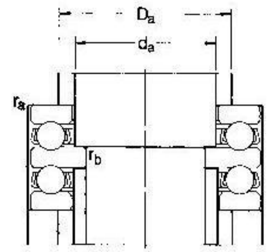


Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Minimum load factor	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	H	C	C0	Pu	A				
mm			kN		kN	–	r/min		kg	–
35	52	12	19,9	51	1,86	0,013	5 600	7 500	0,080	**51107**
	62	18	35,1	73,5	2,7	0,028	4 000	5 600	0,22	**51207**
	68	24	49,4	96,5	3,55	0,048	3 200	4 500	0,39	**51307**
	80	32	87,1	170	6,2	0,15	2 600	3 800	0,79	**51407**
40	60	13	26	63	2,32	0,02	5 000	7 000	0,12	**51108**
	68	19	46,8	106	4	0,058	3 800	5 300	0,28	**51208**
	78	26	61,8	122	4,5	0,077	3 000	4 300	0,53	**51308**
	90	36	112	224	8,3	0,26	2 400	3 400	1,10	**51408**
45	65	14	26,5	69,5	2,55	0,025	4 500	6 300	0,14	**51109**
	73	20	39	86,5	3,2	0,038	3 600	5 000	0,30	**51209**
	85	28	76,1	153	5,6	0,12	2 800	4 000	0,66	**51309**
	100	39	130	265	9,8	0,37	2 200	3 000	1,40	**51409**
50	70	14	27	75	2,8	0,029	4 300	6 300	0,16	**51110**
	78	22	49,4	116	4,3	0,069	3 400	4 500	0,37	**51210**
	95	31	88,4	190	6,95	0,19	2 600	3 600	0,94	**51310**
	110	43	159	340	12,5	0,60	2 000	2 800	2,00	**51410**
55	78	16	30,7	85	3,1	0,039	3 800	5 300	0,23	**51111**
	90	25	61,8	146	5,4	0,11	2 800	4 000	0,59	**51211**
	105	35	104	224	8,3	0,26	2 200	3 200	1,30	**51311**
	120	48	178	390	14,3	0,79	1 800	2 400	2,55	**51411**
60	85	17	41,6	122	4,55	0,077	3 600	5 000	0,20	**51112**
	95	26	62,4	150	5,6	0,12	2 800	3 800	0,65	**51212**
	110	35	101	224	8,3	0,26	2 200	3 000	1,35	**51312**
	130	51	199	430	16	0,96	1 600	2 200	3,10	**51412 M**
65	90	18	37,7	108	4	0,06	3 400	4 800	0,33	**51113**
	100	27	63,7	163	6	0,14	2 600	3 600	0,78	**51213**
	115	36	106	240	8,8	0,30	2 000	3 000	1,50	**51313**
	140	56	216	490	18	1,2	1 500	2 200	4,00	**51413 M**
70	95	18	40,3	120	4,4	0,074	3 400	4 500	0,35	**51114**
	105	27	65	173	6,4	0,16	2 600	3 600	0,79	**51214**
	125	40	135	320	11,8	0,53	1 900	2 600	2,00	**51314**
	150	60	234	550	19,3	1,6	1 400	2 000	5,00	**51414 M**

Dimensions				Abutment and fillet dimensions		
d	d1 ~	D1 ~	r1,2 min	da min	Da max	ra max
mm				mm		
35	52	37	0,6	45	42	0,6
	62	37	1	51	46	1
	68	37	1	55	48	1
	80	37	1,1	62	53	1
40	60	42	0,6	52	48	0,6
	68	42	1	57	51	1
	78	42	1	63	55	1
	90	42	1,1	70	60	1
45	65	47	0,6	57	53	0,6
	73	47	1	62	56	1
	85	47	1	69	61	1
	100	47	1,1	78	67	1
50	70	52	0,6	62	58	0,6
	78	52	1	67	61	1
	95	52	1,1	77	68	1
	110	52	1,5	86	74	1,5
55	78	57	0,6	69	64	0,6
	90	57	1	76	69	1
	105	57	1,1	85	75	1
	120	57	1,5	94	81	1,5
60	85	62	1	75	70	1
	95	62	1	81	74	1
	110	62	1,1	90	80	1
	130	62	1,5	102	88	1,5
65	90	67	1	80	75	1
	100	67	1	86	79	1
	115	67	1,1	95	85	1
	140	68	2	110	95	2
70	95	72	1	85	80	1
	105	72	1	91	84	1
	125	72	1,1	103	92	1
	150	73	2	118	102	2

Double direction thrust ball bearings
d **10 – 55** mm





Principal dimensions d	D	H	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Minimum load factor A	Speed ratings Reference speed	Limiting speed	Mass	Designation
mm			kN		kN	–	r/min		kg	–
10	32	22	16,5	27	1	0,0038	7 000	10 000	0,081	**52202**
15	40	26	22,5	40,5	1,53	0,0085	6 000	8 000	0,15	**52204**
20	47	28	27,6	55	2,04	0,015	5 300	7 500	0,22	**52205**
	52	34	34,5	60	2,24	0,018	4 500	6 300	0,33	**52305**
	70	52	72,8	137	5,1	0,097	3 600	5 000	1,00	**52406**
25	52	29	25,5	51	1,9	0,013	4 800	6 700	0,25	**52206**
	60	38	37,7	71	2,65	0,026	3 800	5 300	0,47	**52306**
	80	59	87,1	170	6,2	0,15	3 000	4 300	1,45	**52407**
30	62	34	35,1	73,5	2,7	0,028	4 000	5 600	0,41	**52207**
	68	36	46,8	106	4	0,058	3 800	5 300	0,55	**52208**
	68	44	49,4	96,5	3,55	0,048	3 200	4 500	0,68	**52307**
	78	49	61,8	122	4,5	0,077	3 000	4 300	1,05	**52308**
	90	65	112	224	8,3	0,26	2 400	3 400	2,05	**52408**
35	73	37	39	86,5	3,2	0,038	3 600	5 000	0,60	**52209**
	85	52	76,1	153	5,6	0,12	2 800	4 000	1,25	**52309**
	100	72	130	265	9,8	0,37	2 200	3 000	2,70	**52409**
40	78	39	49,4	116	4,3	0,069	3 400	4 500	0,71	**52210**
	95	58	88,4	190	6,95	0,19	2 600	3 600	1,75	**52310**
45	90	45	61,8	146	5,4	0,11	2 800	4 000	1,10	**52211**
	105	64	104	224	8,3	0,26	2 200	3 200	2,40	**52311**
	120	87	178	390	14,3	0,79	1 800	2 400	4,70	**52411**
50	95	46	62,4	150	5,6	0,12	2 200	3 000	1,20	**52212**
	110	64	101	224	8,3	0,26	1 600	2 200	2,55	**52312**
	130	93	199	430	16	0,96	1 600	2 200	6,35	**52412 M**
55	100	47	63,7	163	6	0,14	2 600	3 600	1,35	**52213**
	105	47	65	173	6,4	0,16	2 600	3 600	1,50	**52214**
	115	65	106	240	8,8	0,30	2 000	3 000	2,75	**52313**
	125	72	135	320	11,8	0,53	1 900	2 600	3,65	**52314**
	150	107	234	550	19,3	1,6	1 400	2 000	9,70	**52414 M**

Dimensions d	D_1 ~	B	$r_{1,2}$ min	$r_{3,4}$ min	Abutment and fillet dimensions d_a	D_a max	r_a max	r_b max
mm					mm			
10	17	5	0,6	0,3	15	22	0,6	0,3
15	22	6	0,6	0,3	20	28	0,6	0,3
20	27	7	0,6	0,3	25	34	0,6	0,3
	27	8	1	0,3	25	36	1	0,3
	32	12	1	0,6	30	46	1	0,6
25	32	7	0,6	0,3	30	39	0,6	0,3
	32	9	1	0,3	30	42	1	0,3
	37	14	1,1	0,6	35	53	1	0,6
30	37	8	1	0,3	35	46	1	0,3
	42	9	1	0,6	40	51	1	0,6
	37	10	1	0,3	35	48	1	0,3
	42	12	1	0,6	40	55	1	0,6
	42	15	1,1	0,6	40	60	1	0,6
35	47	9	1	0,6	45	56	1	0,6
	47	12	1	0,6	45	61	1	0,6
	47	17	1,1	0,6	45	67	1	0,6
40	52	9	1	0,6	50	61	1	0,6
	52	14	1,1	0,6	50	68	1	0,6
45	57	10	1	0,6	55	69	1	0,6
	57	15	1,1	0,6	55	75	1	0,6
	57	20	1,5	0,6	55	81	1,5	0,6
50	62	10	1	0,6	60	74	1	0,6
	62	15	1,1	0,6	60	80	1	0,6
	62	21	1,5	0,6	60	88	1,5	0,6
55	67	10	1	0,6	65	79	1	0,6
	72	10	1	1	70	84	1	1
	67	15	1,1	0,6	65	85	1	0,6
	72	16	1,1	1	70	92	1	1
	73	24	2	1	70	102	2	1

Misalignment
Cylindrical roller thrust bearings cannot tolerate any angular misalignment between the shaft and housing, nor any errors of alignment between the support surfaces in the housing and on the shaft.

Cages
Depending on the series and size, SKF cylindrical roller thrust bearings are fitted with one of the following cages (→ **fig 7**):

- an injection moulded cage of glass fibre reinforced polyamide 6,6 (**a**), designation suffix TN or
- a machined brass cage (**b**), designation suffix M.

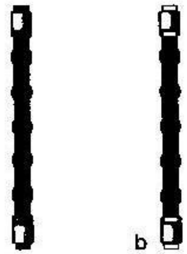
Note:
Cylindrical roller thrust bearings that incorporate a polyamide 6,6 cage can be used at operating temperatures of up to +120 °C. The cage properties will not be affected by the lubricants normally used for ball and roller bearings with the exception of some synthetic oils or greases with synthetic base oils and lubricants containing a high proportion of EP additives when used at elevated temperatures.

For bearing arrangements, which are to operate at continuously high temperatures or under otherwise difficult conditions, it is recommended that bearings fitted with metallic cages be used.

For detailed information regarding the temperature resistance and the applicability of cages, please refer to the section "Cage materials", starting on **page 140**.

Minimum load
In order to provide satisfactory operation, cylindrical roller thrust bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rollers and cage, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

Fig 7



The requisite minimum load to be applied to cylindrical roller thrust bearings can be estimated using

$$F_{am} = 0{,}0005\,C_0 + A\left(\frac{n}{1\,000}\right)^2$$

where
F_{am} = minimum axial load, kN
C_0 = basic static load rating, kN (→ product table)
A = minimum load factor (→ product table)
n = rotational speed, r/min

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, particularly when the shaft is vertical, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the cylindrical roller thrust bearing must be preloaded, e.g. by springs or a shaft nut.

Equivalent dynamic bearing load

$P = F_a$

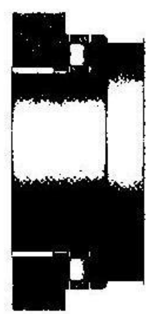
Equivalent static bearing load

$P_0 = F_a$

Supplementary designations
The designation suffixes used to identify certain features of SKF cylindrical roller bearings are explained in the following.

- **HB1** Shaft and housing washers bainite hardened
- **M** Machined brass cage
- **P5** Increased dimensional and running accuracy to ISO tolerance class 5
- **TN** Injection moulded glass fibre reinforced polyamide 6,6 cage

Fig 8



Design of associated components

The support surfaces in the housing and on the shaft must be at right angles to the shaft axis and should provide uninterrupted support for the bearing washers across the whole extent and width of the raceways (→ **fig 8**).

Suitable tolerances for shafts and housings which are known to provide satisfactory radial guidance for the individual thrust bearing components will be found in **table 3**.

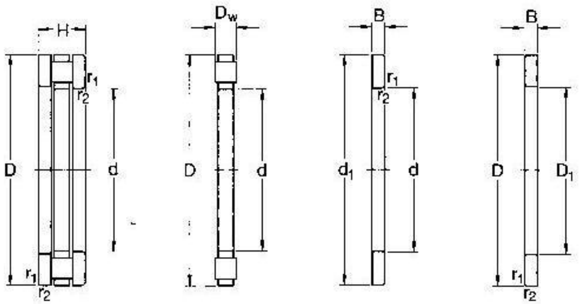
Cylindrical roller and cage thrust assemblies are generally guided radially on the shaft in order to obtain the lowest possible sliding speed against the guiding surfaces. At high speeds radial guidance must be provided on the shaft and the guiding surface must be ground.

Raceways on shafts and in housings
Raceways on the shaft and in the housing should have the same hardness and surface finish as normally used for bearing raceways, if the load carrying capacity of the cylindrical roller and cage thrust assemblies is to be fully exploited. Details regarding suitable materials as well as surface hardness and surface finish will be found in the section "Raceways on shafts and in housings", starting on **page 198**.

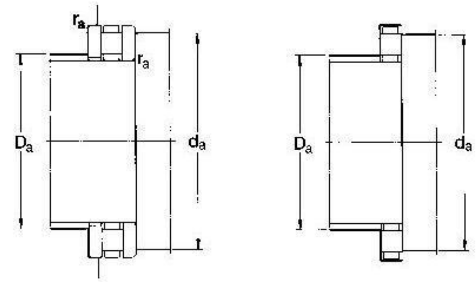
Table 3

Tolerances for shafts and housings

Bearing component Description	Prefix	Tolerances Shaft	Housing bore
Cylindrical roller and cage thrust assembly	K	h8	–
Shaft washer	WS	h8	–
Housing washer	GS	–	H9



Complete bearing | Cylindrical roller and cage thrust assembly | Shaft washer | Housing washer



Principal dimensions d	D	H	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Minimum load factor A	Speed ratings Reference speed	Limiting speed	Mass	Designation
mm			kN		kN	–	r/min		kg	–
15	28	9	11,2	27	2,45	0,000058	4 300	8 500	0,024	**81102 TN**
17	30	9	12,2	31,5	2,85	0,000079	4 300	8 500	0,027	**81103 TN**
20	35	10	18,6	48	4,65	0,00018	3 800	7 500	0,037	**81104 TN**
25	42	11	25	69,5	6,80	0,00039	3 200	6 300	0,053	**81105 TN**
30	47	11	27	78	7,65	0,00049	3 000	6 000	0,057	**81106 TN**
	52	16	50	134	13,4	0,0014	2 400	4 800	0,12	**81206 TN**
35	52	12	29	93	9,15	0,00069	2 800	5 600	0,073	**81107 TN**
	62	18	62	190	19,3	0,0029	2 000	4 000	0,20	**81207 TN**
40	60	13	42,5	137	13,7	0,0015	2 400	5 000	0,11	**81108 TN**
	68	19	83	255	26,5	0,0052	1 900	3 800	0,25	**81208 TN**
45	65	14	45	153	15,3	0,0019	2 200	4 500	0,13	**81109 TN**
	73	20	86,5	270	28	0,0058	1 800	3 600	0,29	**81209 TN**
50	70	14	47,5	166	16,6	0,0022	2 200	4 300	0,14	**81110 TN**
	78	22	91,5	300	31	0,0072	1 700	3 400	0,36	**81210 TN**
55	78	16	69,5	285	29	0,0065	1 900	3 800	0,22	**81111 TN**
	90	25	122	390	40	0,012	1 400	2 800	0,57	**81211 TN**
60	85	17	80	300	30,5	0,0072	1 800	3 600	0,27	**81112 TN**
	95	26	137	465	47,5	0,017	1 400	2 800	0,64	**81212 TN**
65	90	18	83	320	32,5	0,0082	1 700	3 400	0,31	**81113 TN**
	100	27	140	490	50	0,019	1 300	2 600	0,72	**81213 TN**
70	95	18	86,5	345	34,5	0,0095	1 600	3 200	0,33	**81114 TN**
	105	27	146	530	55	0,022	1 300	2 600	0,77	**81214 TN**
75	100	19	75	290	29	0,0067	1 600	3 200	0,39	**81115 TN**
	110	27	125	440	45	0,015	1 200	2 400	0,80	**81215 TN**
80	105	19	76,5	300	30,5	0,0072	1 500	3 000	0,40	**81116 TN**
	115	28	160	610	63	0,029	1 200	2 400	0,90	**81216 TN**

Dimensions d	d_1 ~	D_1 ~	B	D_w	$r_{1,2}$ min	Abutment and fillet dimensions d_a min	D_a max	r_a max	Designation of components Cylindrical roller and cage thrust assembly	Shaft washer	Housing washer
mm						mm			–		
15	28	16	2,75	3,5	0,3	27	16	0,3	**K 81102 TN**	**WS 81102**	**GS 81102**
17	30	18	2,75	3,5	0,3	29	18	0,3	**K 81103 TN**	**WS 81103**	**GS 81103**
20	35	21	2,75	4,5	0,3	34	21	0,3	**K 81104 TN**	**WS 81104**	**GS 81104**
25	42	26	3	5	0,6	41	26	0,6	**K 81105 TN**	**WS 81105**	**GS 81105**
30	47	32	3	5	0,6	46	31	0,6	**K 81106 TN**	**WS 81106**	**GS 81106**
	52	32	4,25	7,5	0,6	50	31	0,6	**K 81206 TN**	**WS 81206**	**GS 81206**
35	52	37	3,5	5	0,6	51	36	0,6	**K 81107 TN**	**WS 81107**	**GS 81107**
	62	37	5,25	7,5	1	58	39	1	**K 81207 TN**	**WS 81207**	**GS 81207**
40	60	42	3,5	6	0,6	58	42	0,6	**K 81108 TN**	**WS 81108**	**GS 81108**
	68	42	5	9	1	66	43	1	**K 81208 TN**	**WS 81208**	**GS 81208**
45	65	47	4	6	0,6	63	47	0,6	**K 81109 TN**	**WS 81109**	**GS 81109**
	73	47	5,5	9	1	70	48	1	**K 81209 TN**	**WS 81209**	**GS 81209**
50	70	52	4	6	0,6	68	52	0,6	**K 81110 TN**	**WS 81110**	**GS 81110**
	78	52	6,5	9	1	75	53	1	**K 81210 TN**	**WS 81210**	**GS 81210**
55	78	57	5	6	0,6	77	56	0,6	**K 81111 TN**	**WS 81111**	**GS 81111**
	90	57	7	11	1	85	59	1	**K 81211 TN**	**WS 81211**	**GS 81211**
60	85	62	4,75	7,5	1	82	62	1	**K 81112 TN**	**WS 81112**	**GS 81112**
	95	62	7,5	11	1	91	64	1	**K 81212 TN**	**WS 81212**	**GS 81212**
65	90	67	5,25	7,5	1	87	67	1	**K 81113 TN**	**WS 81113**	**GS 81113**
	100	67	8	11	1	96	69	1	**K 81213 TN**	**WS 81213**	**GS 81213**
70	95	72	5,25	7,5	1	92	72	1	**K 81114 TN**	**WS 81114**	**GS 81114**
	105	72	8	11	1	102	74	1	**K 81214 TN**	**WS 81214**	**GS 81214**
75	100	77	5,75	7,5	1	97	78	1	**K 81115 TN**	**WS 81115**	**GS 81115**
	110	77	8	11	1	106	79	1	**K 81215 TN**	**WS 81215**	**GS 81215**
80	105	82	5,75	7,5	1	102	83	1	**K 81116 TN**	**WS 81116**	**GS 81116**
	115	82	8,5	11	1	112	84	1	**K 81216 TN**	**WS 81216**	**GS 81216**

Minimum load

In order to provide satisfactory operation, spherical roller thrust bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of the load. Under such conditions, the inertia forces of the rollers and cage, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum axial load to be applied to spherical roller thrust bearings can be estimated using

$$F_{am} = 1{,}8\,F_r + A\left(\frac{n}{1\,000}\right)^2$$

where

F_{am} = minimum axial load, kN

F_r = radial component of the load for bearings subjected to combined load, kN

C_0 = basic static load rating, kN (→ product table)

A = minimum load factor (→ product table)

n = rotational speed, r/min

If $1{,}8\,F_r < 0{,}0005\,C_0$ then $0{,}0005\,C_0$ should be used in the above equation instead of $1{,}8\,F_r$.

At speeds higher than the reference speed or when starting up at low temperatures, or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the spherical roller thrust bearing must be preloaded, e.g. by springs. For additional information, contact the SKF application engineering service.

Equivalent dynamic bearing load

Normally a spherical roller thrust bearing is arranged so that runouts in the bearing arrangement do not affect the load distribution in the bearing. For a spherical roller thrust bearing arranged under these conditions, provided $F_r \leq 0{,}55\,F_a$

$$P = 0{,}88\,(F_a + 1{,}2\,F_r)$$

When runouts in the bearing arrangement affect the load distribution in the spherical roller thrust bearing, provided $F_r \leq 0{,}55\,F_a$

$$P = F_a + 1{,}2\,F_r$$

If $F_r > 0{,}55\,F_a$, the SKF application engineering service should be contacted.

Equivalent static bearing load

$$P_0 = F_a + 2{,}7\,F_r$$

provided $F_r \leq 0{,}55\,F_a$.

If $F_r > 0{,}55\,F_a$, the SKF application engineering service should be contacted.

Supplementary designations

The designation suffixes used to identify certain features of SKF spherical roller thrust bearings are explained in the following.

E	Optimized internal design and steel window-type cage
EF	Optimized internal design and machined steel cage
EM	Optimized internal design and machined brass cage
N1	One locating slot in the housing washer
N2	Two locating slots at 180° to each other in the housing washer
VE447	Shaft washer with three equally spaced threaded holes in one side face to take hoisting tackle
VE447E	Shaft washer with three equally spaced threaded holes in one side face to take hoisting tackle and three appropriate eye bolts
VE632	Housing washer with three equally spaced threaded holes in one side face to take hoisting tackle

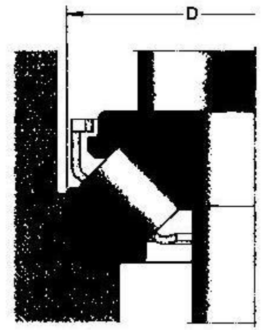
Design of associated components

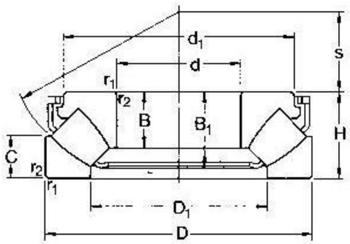
The abutment dimensions d_a and D_a in the product table apply for bearing loads up to approximately $F_a = 0{,}1\,C_0$. Where bearings are to be subjected to heavier loads it may be necessary for both shaft and housing washers to be fully supported ($d_a = d_1$ and $D_a = D_1$) and for radial support to be provided for the housing washer. For additional information, contact the SKF application engineering service.

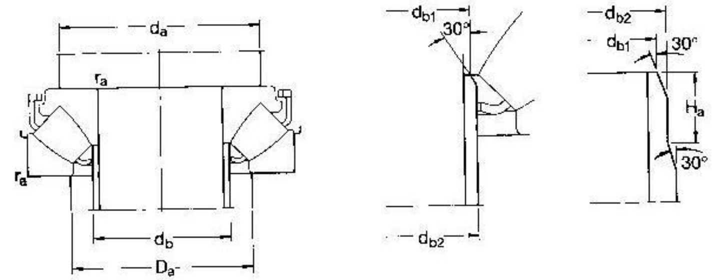
For E-design bearings with a pressed steel cage, the housing bore must be recessed (→ **fig 5**) to prevent the cage from rubbing against the housing if the shaft should become misaligned. Recommended guideline values for the diameter of this recess are

- D + 15 mm for bearings with outside diameter up to and including 380 mm and
- D + 20 mm for larger bearings.

Fig 5





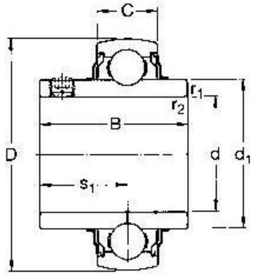


Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Minimum load factor	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	H	C	C_0	P_u	A				
mm			kN		kN	–	r/min		kg	–
60	130	42	390	915	114	0,080	2 800	5 000	2,60	*** 29412 E**
65	140	45	455	1 080	137	0,11	2 600	4 800	3,20	*** 29413 E**
70	150	48	520	1 250	153	0,15	2 400	4 300	3,90	*** 29414 E**
75	160	51	600	1 430	173	0,19	2 400	4 000	4,70	*** 29415 E**
80	170	54	670	1 630	193	0,25	2 200	3 800	5,60	*** 29416 E**
85	150	39	380	1 060	129	0,11	2 400	4 000	2,75	*** 29317 E**
	180	58	735	1 800	212	0,31	2 000	3 600	6,75	*** 29417 E**
90	155	39	400	1 080	132	0,11	2 400	4 000	2,85	*** 29318 E**
	190	60	815	2 000	232	0,38	1 900	3 400	7,75	*** 29418 E**
100	170	42	465	1 290	156	0,16	2 200	3 600	3,65	*** 29320 E**
	210	67	980	2 500	275	0,59	1 700	3 000	10,5	*** 29420 E**
110	190	48	610	1 730	204	0,28	1 900	3 200	5,30	*** 29322 E**
	230	73	1 180	3 000	325	0,86	1 600	2 800	13,5	*** 29422 E**
120	210	54	765	2 120	245	0,43	1 700	2 800	7,35	*** 29324 E**
	250	78	1 370	3 450	375	1,1	1 500	2 600	17,5	*** 29424 E**
130	225	58	865	2 500	280	0,59	1 600	2 600	9,00	*** 29326 E**
	270	85	1 560	4 050	430	1,6	1 300	2 400	22,0	*** 29426 E**
140	240	60	980	2 850	315	0,77	1 500	2 600	10,5	*** 29328 E**
	280	85	1 630	4 300	455	1,8	1 300	2 400	23,0	*** 29428 E**
150	215	39	408	1 600	180	0,24	1 800	2 800	4,30	**29230 E**
	250	60	1 000	2 850	315	0,77	1 500	2 400	11,0	*** 29330 E**
	300	90	1 860	5 100	520	2,5	1 200	2 200	28,0	*** 29430 E**
160	270	67	1 180	3 450	375	1,1	1 300	2 200	14,5	*** 29332 E**
	320	95	2 080	5 600	570	3	1 100	2 000	33,5	*** 29432 E**
170	280	67	1 200	3 550	365	1,2	1 300	2 200	15,0	*** 29334 E**
	340	103	2 360	6 550	640	4,1	1 100	1 900	44,5	*** 29434 E**

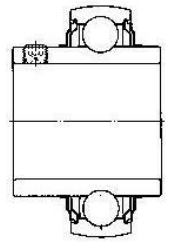
* SKF Explorer bearing

Dimensions								Abutment and fillet dimensions					
d	d_1 ~	D_1 ~	B	B_1	C	$r_{1,2}$ min	s	d_a min	d_{b1} max	d_{b2} max	H_a min	D_a max	r_a max
mm								mm					
60	112,2	85,5	27	36,7	21	1,5	38	90	67	67	–	107	1,5
65	120,6	91,5	29,5	39,8	22	2	42	100	72	72	–	117	2
70	129,7	99	31	41	23,8	2	44,8	105	77,5	77,5	–	125	2
75	138,3	105,5	33,5	45,7	24,5	2	47	115	82,5	82,5	–	133	2
80	147,2	112,5	35	48,1	26,5	2,1	50	120	88	88	–	141	2
85	134,8	109,5	24,5	33,8	20	1,5	50	115	90	90	–	129	1,5
	155,8	121	37	51,1	28	2,1	54	130	94	94	–	151	2
90	138,6	115	24,5	34,5	19,5	1,5	53	120	95	95	–	134	1,5
	164,6	127,5	39	54	28,5	2,1	56	135	99	99	–	158	2
100	152,3	127,5	26,2	36,3	20,5	1,5	58	130	107	107	–	147	1,5
	182,2	141,5	43	57,3	32	3	62	150	110	110	–	175	2,5
110	171,1	140	30,3	41,7	24,8	2	63,8	145	117	117	–	164	2
	199,4	155,5	47	64,7	34,7	3	69	165	120,5	129	–	193	2,5
120	188,1	154	34	48,2	27	2,1	70	160	128	128	–	181	2
	216,8	171	50,5	70,3	36,5	4	74	180	132	142	–	209	3
130	203,4	165,5	36,7	50,6	30,1	2,1	75,6	175	138	143	–	194	2
	234,4	184,5	54	76	40,9	4	81	195	142,5	153	–	227	3
140	216,1	177	38,5	54	30	2,1	82	185	148	154	–	208	2
	245,4	194,5	54	75,6	41	4	86	205	153	162	–	236	3
150	200,4	176	24	34,3	20,5	1,5	82	180	154	154	14	193	1,5
	223,9	190	38	54,9	28	2,1	87	195	158	163	–	219	2
	262,9	207,5	58	80,8	43,4	4	92	220	163	175	–	253	3
160	243,5	203	42	60	33	3	92	210	169	176	–	235	2,5
	279,3	223,5	60.5	84,3	45,5	5	99	235	175	189	–	270	4
170	251.2	215	42,2	61	30,5	3	96	220	178	188	–	245	2,5
	297,7	236	65,5	91,2	50	5	104	250	185	199	–	286	4

Y-bearings for high temperatures with grub screw locking for metric shafts
d 20 – 60 mm



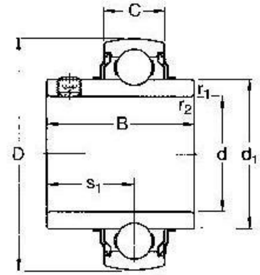
VA201



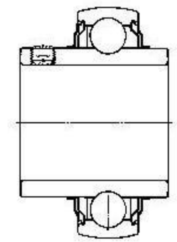
VA228

Dimensions							Basic static load rating	Mass	Designations	
									Bearing with pressed steel cage	one-piece "coronet" cage of graphite
d	D	B	C	d_1 ~	s_1	$r_{1,2}$ min	C_0			
mm							kN	kg	–	
20	47	31	14	28,2	18,3	0,6	6.55	0,14	**YAR 204-2FW/VA201**	**YAR 204-2FW/VA228**
25	52	34,1	15	33.7	19,8	0,6	7,8	0,17	**YAR 205-2FW/VA201**	**YAR 205-2FW/VA228**
30	62	38,1	18	39,7	22,2	0,6	11,2	0,28	**YAR 206-2FW/VA201**	**YAR 206-2FW/VA228**
35	72	42,9	19	46,1	25,4	1	15,3	0,41	**YAR 207-2FW/VA201**	**YAR 207-2FW/VA228**
40	80	49,2	21	51,8	30,2	1	19	0,55	**YAR 208-2FW/VA201**	**YAR 208-2FW/VA228**
45	85	49,2	22	56,8	30,2	1	21,6	0,60	**YAR 209-2FW/VA201**	**YAR 209-2FW/VA228**
50	90	51,6	22	62,5	32,6	1	23,2	0,69	**YAR 210-2FW/VA201**	**YAR 210-2FW/VA228**
55	100	55.6	25	69,1	33,4	1	29	0,94	**YAR 211-2FW/VA201**	**YAR 211-2FW/VA228**
60	110	65,1	26	75,6	39,7	1,5	36	1,30	**YAR 212-2FW/VA201**	**YAR 212-2FW/VA228**

Y-bearings for high temperatures with grub screw locking for inch shafts
d 3/4 – 2 7/16 in



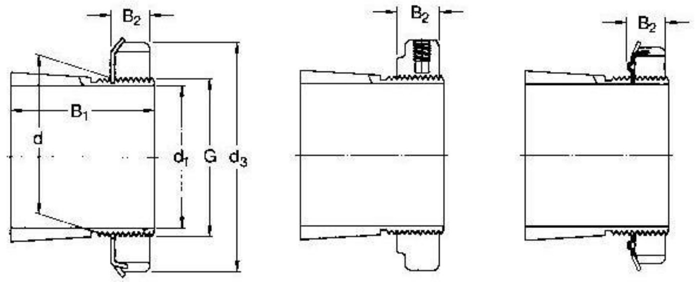
VA201



VA228

Dimensions							Basic static load rating	Mass	Designations	
									Bearing with pressed steel cage	one-piece "coronet" cage of graphite
d	D	B	C	d_1 –	s_1	$r_{1,2}$ min	C_0			
in	mm						kN	kg	–	
3/4	47	31	14	28,2	18,3	0,6	6,55	0,14	**YAR 204-012-2FW/VA201**	**YAR 204-012-2FW/VA228**
1	52	34,1	15	33,7	19,8	0,6	7.8	0,17	**YAR 205-100-2FW/VA201**	**YAR 205-100-2FW/VA228**
1 3/16	62	38,1	18	39,7	22,2	0,6	11,2	0,27	**YAR 206-103-2FW/VA201**	**YAR 206-103-2FW/VA228**
1 1/4	72	42,9	19	46,1	25,4	1	15,3	0,46	**YAR 207-104-2FW/VA201**	**YAR 207-104-2FW/VA228**
1 7/16	72	42,9	19	46,1	25,4	1	15,3	0.38	**YAR 207-107-2FW/VA201**	**YAR 207-107-2FW/VA228**
1 1/2	80	49,2	21	51,8	30,2	1	19	0,59	**YAR 208-108-2FW/VA201**	**YAR 208-108-2FW/VA228**
1 11/16	85	49,2	22	56,8	30,2	1	21,6	0,66	**YAR 209-111-2FW/VA201**	**YAR 209-111-2FW/VA228**
1 3/4	85	49,2	22	56,8	30,2	1	21,6	0,62	**YAR 209-112-2FW/VA201**	**YAR 209-112-2FW/VA228**
1 15/16	90	51,6	22	62,5	32,6	1	23,2	0,71	**YAR 210-115-2FW/VA201**	**YAR 210-115-2FW/VA228**
2	100	55,6	25	69,1	33,4	1	29	0.94	**YAR 211-200-2FW/VA201**	**YAR 211-200-2FW/VA228**
2 3/16	100	55,6	25	69,1	33,4	1	29	0,92	**YAR 211-203-2FW/VA201**	**YAR 211-203-2FW/VA228**
2 7/16	110	65,1	26	75,6	39,7	1,5	36	1,30	**YAR 212-207-2FW/VA201**	**YAR 212-207-2FW/VA228**

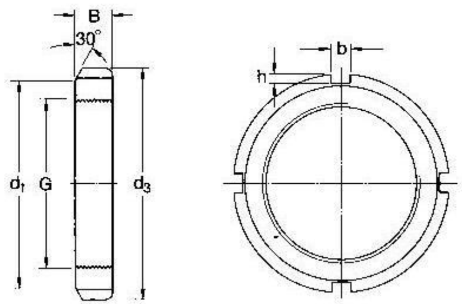
Adapter sleeves for metric shafts
d_1 **17 – 75** mm



H H..E H..C

Dimensions						Mass	Designations Adapter sleeve with nut and locking device	Lock nut	Locking device	Appropriate hydraulic nut
d_1	d	d_3	B_1	B_2	G					
mm						kg	–			
17	20	32	24	7	M 20×1	0,036	**H 204**	KM 4	MB 4	–
	20	32	28	7	M 20×1	0,040	**H 304**	KM 4	MB 4	–
20	25	38	26	8	M 25×1,5	0,064	**H 205**	KM 5	MB 5	–
	25	38	29	8	M 25×1,5	0,071	**H 305**	KM 5	MB 5	–
	25	38	29	8,5	M 25×1,5	0,071	**H 305 C**	KM 5	MB 5 C	–
	25	38	29	10,5	M 25×1,5	0,076	**H 305 E**	KMFE 5	–	–
25	30	45	27	8	M 30×1,5	0,086	**H 206**	KM 6	MB 6	–
	30	45	31	8	M 30×1,5	0,095	**H 306**	KM 6	MB 6	–
	30	45	31	8,5	M 30×1,5	0,095	**H 306 C**	KM 6	MB 6 C	–
	30	45	31	10,5	M 30×1,5	0,11	**H 306 E**	KMFE 6	–	–
	30	45	38	8	M 30×1,5	0,11	**H 2306**	KM 6	MB 6	–
30	35	52	29	9	M 35×1,5	0,12	**H 207**	KM 7	MB 7	–
	35	52	35	9	M 35×1,5	0,14	**H 307**	KM 7	MB 7	–
	35	52	35	9,5	M 35×1,5	0,14	**H 307 C**	KM 7	MB 7 C	–
	35	52	35	11,5	M 35×1,5	0,15	**H 307 E**	KMFE 7	–	–
	35	52	43	9	M 35×1,5	0,16	**H 2307**	KM 7	MB 7	–
35	40	58	31	10	M 40×1,5	0,16	**H 208**	KM 8	MB 8	–
	40	58	36	10	M 40×1,5	0,17	**H 308**	KM 8	MB 8	–
	40	58	36	10,5	M 40×1,5	0,17	**H 308 C**	KM 8	MB 8 C	–
	40	58	36	13	M 40×1,5	0,19	**H 308 E**	KMFE 8	–	–
	40	58	46	10	M 40×1,5	0,22	**H 2308**	KM 8	MB 8	–
40	45	65	33	11	M 45×1,5	0,21	**H 209**	KM 9	MB 9	–
	45	65	39	11	M 45×1,5	0,23	**H 309**	KM 9	MB 9	–
	45	65	39	11,5	M 45×1,5	0,23	**H 309 C**	KM 9	MB 9 C	–
	45	65	39	13	M 45×1,5	0,24	**H 309 E**	KMFE 9	–	–
	45	65	50	11	M 45×1,5	0,27	**H 2309**	KM 9	MB 9	–
45	50	70	35	12	M 50×1,5	0,24	**H 210**	KM 10	MB 10	HMV 10 E
	50	70	42	12	M 50×1,5	0,27	**H 310**	KM 10	MB 10	HMV 10 E
	50	70	42	12,5	M 50×1,5	0,27	**H 310 C**	KM 10	MB 10 C	HMV 10 E
	50	70	42	14	M 50×1,5	0,30	**H 310 E**	KMFE 10	–	HMV 10 E
	50	70	55	12	M 50×1,5	0,34	**H 2310**	KM 10	MB 10	HMV 10 E
50	55	75	37	12,5	M 55×2	0,28	**H 211**	KM 11	MB 11	HMV 11 E
	55	75	45	12,5	M 55×2	0,32	**H 311**	KM 11	MB 11	HMV 11 E
	55	75	45	13	M 55×2	0,32	**H 311 C**	KM 11	MB 11 C	HMV 11 E
	55	75	45	14	M 55×2	0,34	**H 311 E**	KMFE 11	–	HMV 11 E
	55	75	59	12,5	M 55×2	0,39	**H 2311**	KM 11	MB 11	HMV 11 E
55	60	80	38	13	M 60×2	0,31	**H 212**	KM 12	MB 12	HMV 12 E
	60	80	47	13	M 60×2	0,36	**H 312**	KM 12	MB 12	HMV 12 E
	60	80	47	14	M 60×2	0,40	**H 312 E**	KMFE 12	–	HMV 12 E
	60	80	62	13	M 60×2	0,45	**H 2312**	KM 12	MB 12	HMV 12 E
60	65	85	40	14	M 65×2	0,36	**H 213**	KM 13	MB 13	HMV 13 E
	65	85	50	14	M 65×2	0,42	**H 313**	KM 13	MB 13	HMV 13 E
	65	85	50	15	M 65×2	0,42	**H 313 C**	KM 13	MB 13 C	HMV 13 E
	65	85	50	15	M 65×2	0,43	**H 313 E**	KMFE 13	–	HMV 13 E
	65	85	65	14	M 65×2	0,52	**H 2313**	KM 13	MB 13	HMV 13 E
	70	92	52	14	M 70×2	0,67	**H 314**	KM 14	MB 14	HMV 14 E
	70	92	52	15	M 70×2	0,67	**H 314 E**	KMFE 14	–	HMV 14 E
	70	92	68	14	M 70×2	0,88	**H 2314**	KM 14	MB 14	HMV 14 E
65	75	98	43	15	M 75×2	0,66	**H 215**	KM 15	MB 15	HMV 15 E
	75	98	55	15	M 75×2	0,78	**H 315**	KM 15	MB 15	HMV 15 E
	75	98	55	16	M 75×2	0,80	**H 315 E**	KMFE 15	–	HMV 15 E
	75	98	73	15	M 75×2	1,10	**H 2315**	KM 15	MB 15	HMV 15 E
70	80	105	46	17	M 80×2	0,81	**H 216**	KM 16	MB 16	HMV 16 E
	80	105	59	17	M 80×2	0,95	**H 316**	KM 16	MB 16	HMV 16 E
	80	105	59	18	M 80×2	1,01	**H 316 E**	KMFE 16	–	HMV 16 E
	80	105	78	17	M 80×2	1,20	**H 2316**	KM 16	MB 16	HMV 16 E
75	85	110	50	18	M 85×2	0,94	**H 217**	KM 17	MB 17	HMV 17 E
	85	110	63	18	M 85×2	1,10	**H 317**	KM 17	MB 17	HMV 17 E
	85	110	63	19	M 85×2	1,17	**H 317 E**	KMFE 17	–	HMV 17 E
	85	110	82	18	M 85×2	1,35	**H 2317**	KM 17	MB 17	HMV 17 E

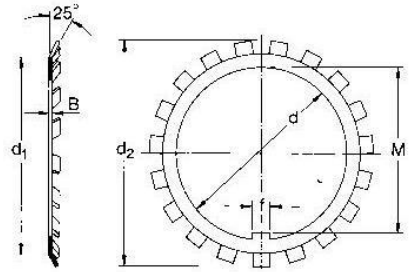
KM(L) lock nuts with locking washer
M 10×0,75 – M 200×3



Dimensions G	d_1	d_3	B	b	h	Axial load carrying capacity static	Mass	Designations Lock nut	Appropriate locking washer	spanner
mm						kN	kg	–		
M 10×0,75	13,5	18	4	3	2	9,8	0,004	**KM 0**	MB 0	–
M 12×1	17	22	4	3	2	11,8	0,006	**KM 1**	MB 1	HN 1
M 15×1	21	25	5	4	2	14,6	0,009	**KM 2**	MB 2	HN 2
M 17×1	24	28	5	4	2	19,6	0,012	**KM 3**	MB 3	HN 3
M 20×1	26	32	6	4	2	24	0,025	**KM 4**	MB 4	HN 4
M 25×1,5	32	38	7	5	2	31,5	0,028	**KM 5**	MB 5	HN 5
M 30×1,5	38	45	7	5	2	36,5	0,039	**KM 6**	MB 6	HN 6
M 35×1,5	44	52	8	5	2	50	0,059	**KM 7**	MB 7	HN 7
M 40×1,5	50	58	9	6	2,5	62	0,078	**KM 8**	MB 8	HN 8
M 45×1,5	56	65	10	6	2,5	78	0,11	**KM 9**	MB 9	HN 9
M 50×1,5	61	70	11	6	2,5	91,5	0,14	**KM 10**	MB 10	HN 10
M 55×2	67	75	11	7	3	91,5	0,15	**KM 11**	MB 11	HN 11
M 60×2	73	80	11	7	3	95	0,16	**KM 12**	MB 12	HN 12
M 65×2	79	85	12	7	3	108	0,19	**KM 13**	MB 13	HN 13
M 70×2	85	92	12	8	3,5	118	0,23	**KM 14**	MB 14	HN 14
M 75×2	90	98	13	8	3,5	134	0,27	**KM 15**	MB 15	HN 15
M 80×2	95	105	15	8	3,5	173	0,36	**KM 16**	MB 16	HN 16
M 85×2	102	110	16	8	3,5	190	0,41	**KM 17**	MB 17	HN 17
M 90×2	108	120	16	10	4	216	0,51	**KM 18**	MB 18	HN 18
M 95×2	113	125	17	10	4	236	0,55	**KM 19**	MB 19	HN 19
M 100×2	120	130	18	10	4	255	0,64	**KM 20**	MB 20	HN 20

Dimensions G	d_1	d_3	B	b	h	Axial load carrying capacity static	Mass	Designations Lock nut	Appropriate locking washer	spanner
mm						kN	kg	–		
M 105×2	126	140	18	12	5	290	0,79	**KM 21**	MB 21	HN 21
M 110×2	133	145	19	12	5	310	0,87	**KM 22**	MB 22	HN 22
M 115×2	137	150	19	12	5	315	0,91	**KM 23**	MB 23	TMFN 23-30
M 120×2	135	145	20	12	5	265	0,69	**KML 24**	MBL 24	TMFN 23-30
	138	155	20	12	5	340	0,97	**KM 24**	MB 24	TMFN 23-30
M 125×2	148	160	21	12	5	360	1,09	**KM 25**	MB 25	TMFN 23-30
M 130×2	145	155	21	12	5	285	0,80	**KML 26**	MBL 26	TMFN 23-30
	149	165	21	12	5	365	1,09	**KM 26**	MB 26	TMFN 23-30
M 135×2	160	175	22	14	6	430	1,39	**KM 27**	MB 27	TMFN 23-30
M 140×2	155	165	22	12	5	305	0,92	**KML 28**	MBL 28	TMFN 23-30
	160	180	22	14	6	430	1,40	**KM 28**	MB 28	TMFN 23-30
M 145×2	171	190	24	14	6	520	1,80	**KM 29**	MB 29	TMFN 23-30
M 150×2	170	180	24	14	5	390	1,25	**KML 30**	MBL 30	TMFN 23-30
	171	195	24	14	6	530	1,88	**KM 30**	MB 30	TMFN 23-30
M 155×3	182	200	25	16	7	540	2,09	**KM 31**	MB 31	TMFN 30-40
M 160×3	180	190	25	14	5	405	1,39	**KML 32**	MBL 32	TMFN 23-30
	182	210	25	16	7	585	2,29	**KM 32**	MB 32	TMFN 30-40
M 165×3	193	210	26	16	7	570	2,31	**KM 33**	MB 33	TMFN 30-40
M 170×3	190	200	26	16	5	430	1,56	**KML 34**	MBL 34	TMFN 30-40
	193	220	26	16	7	620	2,34	**KM 34**	MB 34	TMFN 30-40
M 180×3	200	210	27	16	5	450	1,78	**KML 36**	MBL 36	TMFN 30-40
	203	230	27	18	8	670	2,78	**KM 36**	MB 36	TMFN 30-40
M 190×3	210	220	28	16	5	475	1,84	**KML 38**	MBL 38	TMFN 30-40
	214	240	28	18	8	695	3,05	**KM 38**	MB 38	TMFN 30-40
M 200×3	222	240	29	18	8	625	2,61	**KML 40**	MBL 40	TMFN 30-40
	226	250	29	18	8	735	3,37	**KM 40**	MB 40	TMFN 30-40

MB locking washers
d 10 – 280 mm



Dimensions d	d1	d2	B	f	M	Mass	Designation
mm						kg	–
10	13,5	21	1	3	8,5	0,001	**MB 0**
12	17	25	1	3	10,5	0,002	**MB 1**
	17	25	1,2	3	10,5	0,002	**MB 1 A**
15	21	28	1	4	13,5	0,003	**MB 2**
	21	28	1,2	4	13,5	0,003	**MB 2 A**
17	24	32	1	4	15,5	0,003	**MB 3**
	24	32	1,2	4	15,5	0,003	**MB 3 A**
20	26	36	1	4	18,5	0,004	**MB 4**
	26	36	1,2	4	18,5	0,005	**MB 4 A**
25	32	42	1,25	5	23	0,006	**MB 5**
	32	42	1,8	5	23	0,009	**MB 5 A**
30	38	49	1,25	5	27,5	0,008	**MB 6**
	38	49	1,8	5	27,5	0,011	**MB 6 A**
35	44	57	1,25	6	32,5	0,011	**MB 7**
	44	57	1,8	6	32,5	0,016	**MB 7 A**
40	50	62	1,25	6	37,5	0,013	**MB 8**
	50	62	1,8	6	37,5	0,018	**MB 8 A**
45	56	69	1,25	6	42,5	0,015	**MB 9**
	56	69	1,8	6	42,5	0,021	**MB 9 A**
50	61	74	1,25	6	47,5	0,016	**MB 10**
	61	74	2,3	6	47,5	0,023	**MB 10 A**
55	67	81	1,5	8	52,5	0,022	**MB 11**
	67	81	2,5	8	52,5	0,037	**MB 11 A**
60	73	86	1,5	8	57,5	0,024	**MB 12**
	73	86	2,5	8	57,5	0,040	**MB 12 A**
65	79	92	1,5	8	62,5	0,030	**MB 13**
	79	92	2,5	8	62,5	0,050	**MB 13 A**
70	85	98	1,5	8	66,5	0,032	**MB 14**
	85	98	2,5	8	66,5	0,053	**MB 14 A**
75	90	104	1,5	8	71,5	0,035	**MB 15**
	90	104	2,5	8	71,5	0,058	**MB 15 A**
80	95	112	1,75	10	76,5	0,046	**MB 16**
	95	112	2,5	10	76,5	0,066	**MB 16 A**
85	102	119	1,75	10	81,5	0,053	**MB 17**
	102	119	2,5	10	81,5	0,076	**MB 17 A**
90	108	126	1,75	10	86,5	0,061	**MB 18**
	108	126	2,5	10	86,5	0,087	**MB 18 A**
95	113	133	1,75	10	91,5	0,066	**MB 19**
	113	133	2,5	10	91,5	0,094	**MB 19 A**
100	120	142	1,75	12	96,5	0,077	**MB 20**
	120	142	2,5	12	96,5	0,11	**MB 20 A**
105	126	145	1,75	12	100,5	0,083	**MB 21**
110	133	154	1,75	12	105,5	0,091	**MB 22**
115	137	159	2	12	110,5	0,11	**MB 23**
120	135	152	2	14	115	0,07	**MBL 24**
	138	164	2	14	115	0,11	**MB 24**
125	148	170	2	14	120	0,12	**MB 25**
130	145	161	2	14	125	0,08	**MBL 26**
	149	175	2	14	125	0,12	**MB 26**
135	160	185	2	14	130	0,14	**MB 27**
140	155	172	2	16	135	0,09	**MBL 28**
	160	192	2	16	135	0,14	**MB 28**
145	172	202	2	16	140	0,17	**MB 29**
150	170	189	2	16	145	0,10	**MBL 30**
	171	205	2	16	145	0,18	**MB 30**
155	182	212	2,5	16	147,5	0,20	**MB 31**
160	180	199	2,5	18	154	0,14	**MBL 32**
	182	217	2,5	18	154	0,22	**MB 32**
165	193	222	2,5	18	157,5	0,24	**MB 33**
170	190	211	2,5	18	164	0,15	**MBL 34**
	193	232	2,5	18	164	0,24	**MB 34**
180	200	222	2,5	20	174	0,16	**MBL 36**
	203	242	2,5	20	174	0,26	**MB 36**
190	210	232	2,5	20	184	0,17	**MBL 38**
	214	252	2,5	20	184	0,26	**MB 38**
200	222	245	2,5	20	194	0,22	**MBL 40**
	226	262	2,5	20	194	0,28	**MB 40**
220	250	292	3	24	213	0,35	**MB 44**
240	270	313	3	24	233	0,46	**MB 48**
260	300	342	3	28	253	0,64	**MB 52**
280	320	362	3	28	273	0,74	**MB 56**