FAG Four-Point Bearings

Standards · Basic design · Tolerances · Bearing clearance · Cages · Speed suitability

Four-point bearings are single row angular contact ball bearings which can accommodate high axial loads in both directions and low radial loads. To ensure low friction, particularly at high speeds, an axial minimum load is required (see Section "Equivalent dynamic load").

Four-point bearings feature a split inner ring; this allows a large complement of balls to be filled in. The outer ring with ball set and the inner ring halves can be mounted individually. The self-aligning capability is very limited.

Standards

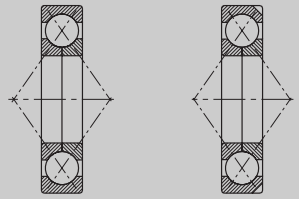
Angular contact ball bearings (four-point bearings)	DIN 628 part 4

Basic design

The high load carrying capacity in the axial direction is achieved by the large number of balls, the high shoulders and the contact angle of 35°.

Four-point bearings which are mounted as thrust bearings are loosely fitted in the housing to avoid radial loading.

Larger four-point bearings have two grooves for fixing the outer ring (suffix N2).



Contact angle α = 35°

N2
two retaining grooves

Tolerances

Four-point bearings of basic design are manufactured to normal tolerances.

Tolerances: radial bearings page 56.

Bearing clearance

The bearings of basic design have normal clearance. Bearings with larger bearing clearance (suffix C3) are available on request.

Axial clearance: four-point bearings page 78.

Cages

Most four-point bearings are fitted with machined brass cages (suffix MPA). These window-type cages are outer ring guided.

Four-point bearings with cages of glass-fibre reinforced polyamide 66 are suffixed TVP. Cages of glass-fibre reinforced polyamide 66 can be used at steady-state temperatures of up to 120 °C. If the bearings are lubricated with oil, any additives contained in the oil may reduce the cage service life if the temperature exceeds 100 °C. Also, aged oil may reduce the cage service life at these temperatures so that the oil change intervals have to be strictly observed (see also page 85).

▼ Standard cages of four-point bearings

Series	Machined brass cage (MPA) Bore reference number	Polyamide cage (TVP)
QJ2	up to 07, 10, 13, up to 16	08, 09, 11, 12, 14, 15
QJ3	04, from 10 on	05 up to 09

Other cage designs on request. The suitability for high speeds and high temperatures as well as the load ratings for such cages may deviate from the values indicated for bearings with standard cages.

Speed suitability

Four-point bearings attain high speeds if they are subjected to purely axial loads. The draft DIN 732 does not indicate (thermal) reference speeds for these bearings. The tables show therefore only the limiting speed values, see page 87. The values apply to oil sump lubrication and may only be exceeded on consultation with FAG.

Heat treatment

FAG four-point bearings are heat-treated in such a way that they can be used at operating temperatures of up to 150 °C. Bearings with an outside diameter of more than 240 mm are dimensionally stable at temperatures of up to 200 °C. If bearings with polyamide cages are used, the temperature limits of application of the cage material have to be observed.

Equivalent dynamic load

$P = F_r + 0.66 \cdot F_a$ [kN] for $\frac{F_a}{F_r} \leqq 0.95$

$P = 0.6 \cdot F_r + 1.07 \cdot F_a$ [kN] for $\frac{F_a}{F_r} > 0.95$

To prevent an undesirable friction increase in the four-point bearing, the axial load should be so high that the balls touch the raceways at only two points. This is the case when $F_a \geqq 1.2 \cdot F_r$.

Equivalent static load

$P_0 = F_r + 0.58 \cdot F_a$ [kN]

Suffixes

MPA machined window-type brass cage, outer ring guided

N2 two retaining grooves

TVP solid window-type cage of glass-fibre reinforced polyamide, ball riding

Abutment dimensions

The shoulder of the mating parts must be so high that even with maximum corner there is an adequate abutment surface area. The bearing tables list the maximum fillet radius r_g and the diameters of the abutment shoulders.

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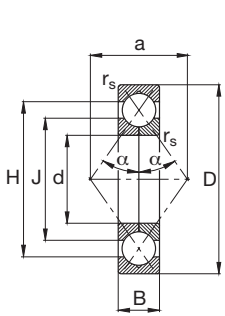
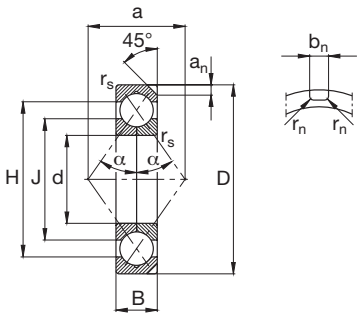
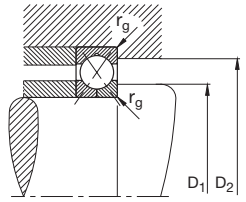


Contact angle α = 35°



N2
two retaining grooves



Rolling bearings can be fail-safe if $C_0/P_0 \geqq 8$, see page 41.

Shaft	Dimensions										Mass ≈	Load rating		Limiting speed	Code	Abutment dimensions		
	d	D	B	r_s min	H ≈	J ≈	a ≈	a_n	b_n	r_n		dyn. C	stat. C_0		Bearing	D_1 min	D_2 max	r_g max
	mm										kg	kN		min^{-1}	FAG	mm		
20	20	52	15	1.1	41.4	30.6	26				0.184	30	19.6	28000	**QJ304MPA**	27	45	1
25	25	52	15	1	43.1	34.2	27				0.171	25.5	18.6	26000	**QJ205MPA**	31	46	1
	25	62	17	1.1	49.5	37.5	31				0.256	44	31.5	14000	**QJ305TVP**	32	55	1
30	30	62	16	1	50.6	40.3	32				0.254	36.5	27.5	20000	**QJ206MPA**	36	56	1
	30	72	19	1.1	58	44	36				0.379	58.5	43	11000	**QJ306TVP**	37	65	1
35	35	72	17	1.1	59	47.9	38				0.359	44	35.5	18000	**QJ207MPA**	42	65	1
	35	80	21	1.5	64.8	50.7	41				0.504	62	51	9500	**QJ307TVP**	44	71	1.5
40	40	80	18	1.1	66.8	53.6	42				0.399	56	46.5	9500	**QJ208TVP**	47	73	1
	40	90	23	1.5	73.3	56.6	46				0.704	86.5	68	8500	**QJ308TVP**	49	81	1.5
45	45	85	19	1.1	72	58.4	45				0.467	64	57	8500	**QJ209TVP**	52	78	1
	45	100	25	1.5	81.7	63.6	51				0.934	102	83	7500	**QJ309TVP**	54	91	1.5
50	50	90	20	1.1	76.3	63.6	49				0.609	61	56	13000	**QJ210MPA**	57	83	1
	50	110	27	2	89.5	70.8	56				1.39	110	91.5	11000	**QJ310MPA**	61	99	2
55	55	100	21	1.5	84.7	70.6	54				0.697	80	76.5	7000	**QJ211TVP**	64	91	1.5
	55	120	29	2	97.8	77.5	61				1.76	127	108	10000	**QJ311MPA**	66	109	2
60	60	110	22	1.5	93	77.3	60				0.89	96.5	93	6300	**QJ212TVP**	69	101	1.5
	60	130	31	2.1	106.9	84.2	67				2.2	146	127	9000	**QJ312MPA**	72	118	2.1
65	65	120	23	1.5	101.5	84.1	65				1.27	104	104	9500	**QJ213MPA**	74	111	1.5
	65	140	33	2.1	114.4	90.9	72				2.71	163	146	8500	**QJ313MPA**	77	128	2.1
70	70	125	24	1.5	106.3	89.1	68				1.22	118	122	5600	**QJ214TVP**	79	116	1.5
	70	150	35	2.1	123.6	97.6	77				3.29	183	166	8000	**QJ314MPA**	82	138	2.1
75	75	130	25	1.5	111.5	94	72				1.35	125	129	5300	**QJ215TVP**	84	121	1.5
	75	160	37	2.1	131	104.3	82	10.1	8.5	2	3.96	212	204	7000	**QJ315N2MPA**	87	148	2.1
80	80	140	26	2	119.6	100.9	77				1.84	132	137	8000	**QJ216MPA**	91	129	2
	80	170	39	2.1	140.8	110.7	88	10.1	8.5	2	4.65	224	220	7000	**QJ316N2MPA**	92	158	2.1
85	85	150	28	2	128.6	107.5	82				2.3	153	160	7000	**QJ217MPA**	96	139	2
	85	180	41	3	148.6	117.8	93	11.7	10.5	2	5.54	245	255	6300	**QJ317N2MPA**	99	166	2.5

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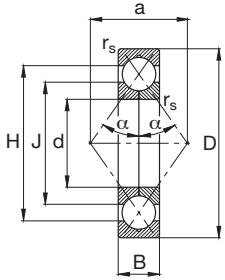
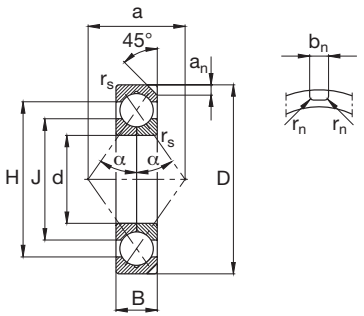
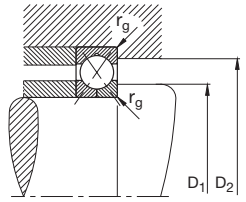


Contact angle α = 35°



N2
two retaining grooves



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Shaft	Dimensions										Mass ≈	Load rating		Limiting speed	Code	Abutment dimensions		
	d	D	B	r_s min	H ≈	J ≈	a ≈	a_n	b_n	r_n		dyn. C	stat. C_0		Bearing	D_1 min	D_2 max	r_g max
	mm										kg	kN		min^{-1}	FAG	mm		
90	90	160	30	2	136.1	114.2	88	8.1	6.5	1	2.8	176	186	7000	**QJ218N2MPA**	101	149	2
	90	190	43	3	157.1	124.5	98	11.7	10.5	2	6.44	265	285	6000	**QJ318N2MPA**	104	176	2.5
95	95	170	32	2.1	144.4	121	93	8.1	6.5	1	3.41	200	212	6300	**QJ219N2MPA**	107	158	2.1
	95	200	45	3	165.4	131.2	103	11.7	10.5	2	7.45	285	310	6000	**QJ319N2MPA**	109	186	2.5
100	100	180	34	2.1	153.6	127.7	98	10.1	8.5	2	4.1	224	240	6000	**QJ220N2MPA**	112	168	2.1
	100	215	47	3	176.6	138.9	110	11.7	10.5	2	9.04	325	365	5600	**QJ320N2MPA**	114	201	2.5
105	105	190	36	2.1	161.6	134.7	103	10.1	8.5	2	4.81	232	260	6000	**QJ221N2MPA**	117	178	2.1
110	110	200	38	2.1	169.8	141.6	109	10.1	8.5	2	5.66	250	285	5600	**QJ222N2MPA**	122	188	2.1
	110	240	50	3	195.5	156.4	123	11.7	10.5	2	12.2	345	415	5300	**QJ322N2MPA**	124	226	2.5
120	120	215	40	2.1	183.6	152.8	117	11.7	10.5	2	6.74	280	340	5300	**QJ224N2MPA**	132	203	2.1
	120	260	55	3	210.6	169.8	133	11.7	10.5	2	15.6	380	480	5000	**QJ324N2MPA**	134	246	2.5
130	130	230	40	3	195	165.4	127	11.7	10.5	2	7.66	290	365	5000	**QJ226N2MPA**	144	216	2.5
	130	280	58	4	228	184	144	12.7	10.5	2	19.2	425	570	4800	**QJ326N2MPA**	147	263	3
140	140	250	42	3	210.5	180	137	11.7	10.5	2	9.69	315	415	4800	**QJ228N2MPA**	154	236	2.5
	140	300	62	4	243	197	154	12.7	10.5	2	23.2	475	655	4300	**QJ328N2MPA**	157	283	3
150	150	270	45	3	226.7	193.7	147	11.7	10.5	2	12.2	345	480	4500	**QJ230N2MPA**	164	256	2.5
	150	320	65	4	261	211.3	165	12.7	10.5	2	28	510	735	3800	**QJ330N2MPA**	167	303	3
160	160	290	48	3	240	210	158	12.7	10.5	2	15.3	375	530	4300	**QJ232N2MPA**	174	276	2.5
	160	340	68	4	279.9	222.7	175	12.7	10.5	2	32.8	585	865	3600	**QJ332N2MPA**	177	323	3
170	170	310	52	4	259	221.3	168	12.7	10.5	2	18.9	425	630	3800	**QJ234N2MPA**	187	293	3
	170	360	72	4	292	238	186	12.7	10.5	2	38.4	585	915	3200	**QJ334N2MPA**	187	343	3
180	180	320	52	4	269	231	175	12.7	10.5	2	19.6	430	670	3600	**QJ236N2MPA**	197	303	3
	180	380	75	4	311	249.1	196	12.7	10.5	2	44.9	680	1080	3000	**QJ336N2MPA**	197	363	3
190	190	340	55	4	286.3	245.8	186	12.7	10.5	2	23.8	455	735	3200	**QJ238N2MPA**	207	323	3
	190	400	78	5	327	262.5	207	12.7	10.5	2	52.1	735	1250	2800	**QJ338N2MPA**	210	380	4
200	200	360	58	4	302	258.6	196	12.7	10.5	2	28	510	850	3000	**QJ240N2MPA**	217	343	3

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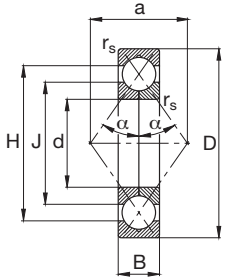

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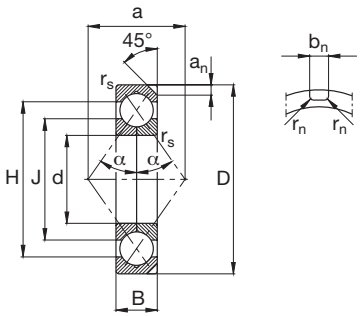
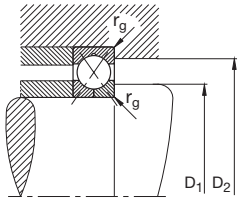


N2
two retaining grooves



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Shaft	Dimensions										Mass ≈	Load rating		Limiting speed	Code	Abutment dimensions		
	d	D	B	r_s min	H ≈	J ≈	a ≈	a_n	b_n	r_n		dyn. C	stat. C_0		Bearing	D_1 min	D_2 max	r_g max
	mm										kg	kN		min^{-1}	**FAG**	mm		
220	220	400	65	4	336	284.6	217	12.7	10.5	2	38.6	630	1120	2800	**QJ244N2MPA**	237	383	3
	220	460	88	5	378	302	238	15	12.5	2.5	77	900	1660	2800	**QJ344N2MPA**	240	440	4
240	240	440	72	4	367	312.5	238	15	12.5	2.5	53.1	680	1270	2800	**QJ248N2MPA**	257	423	3
	240	500	95	5	410	330.7	259	15	12.5	2.5	98.2	1020	1960	2600	**QJ348N2MPA**	260	480	4

Information on other designs will be supplied on request.