DOUBLE ROW ANGULAR CONTACT BALL BEARINGS

Design

Double row angular contact ball bearings in fact correspond with associated pair of single row angular contact ball bearings in configuration "O". At the same size (d and D), associated pair has total width smaller.

They can transfer radial load and also double direction axial loads. Bearings allow design of rigid location and transfer also overturning torques. Standard offer of ZKL double row angular contact ball bearings (fig. 12.2.4) includes:

- Bearings in standard version
- Bearings with seals

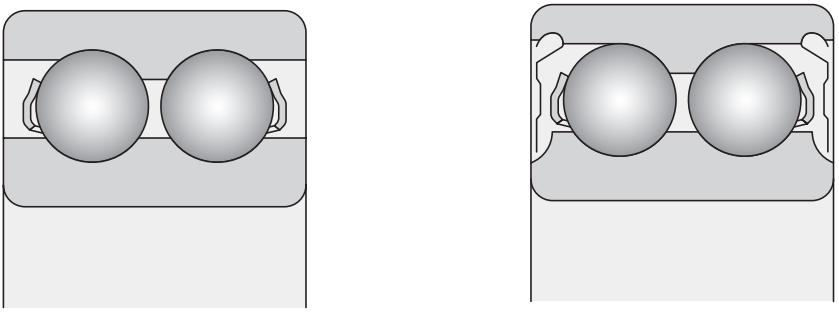


Fig. 12.2.4

Bearings in standard version

ZKL double row angular contact ball bearings in fact of 32 and 33 series produced in the NEW FORCE standard are marked with ** in the table section. The bearings feature optimised inner design. They have a filling slot on one side. If axial forces acting in one direction prevail, the bearing should be mounted so that these forces do not act against the filling slot.

The bearings have contact angle of 32°. Due to this design they are able to transfer axial load and higher overturning torques in axial plane so if there is a lack of space, only one bearing is enough for location of the rotary part.

Bearings with seals

The bearings have a design with contact angle of 25°. The 32 and 33 series bearings with sealing 2RS are filled with high quality lithium grease SHELL ALVANIA RL3. This grease features good anticorrosive properties, and can be therefore used in temperature ranging between -30 and 20 °C. The viscosity of basic oil compound is 100 mm^2/s at 40 °C or 10. mm^2/s at 100 °C.

Main dimensions

The main dimensions of the bearings comply with the ISO 15 standard, with the exception of the width of bearing 3200X. Dimensions of individual bearings are stated in the table section of the publication.

Designation

The system of designating the bearings in basic version is stated in the table section of the publication. Difference from the basic design is identified with additional characters as advised in chapter 7.6.

Cages

Double row angular contact ball bearings have cages pressed of steel plate (fig. 12.2.5). The design not identified. Bearings can be also supplied with polyamide cage PA6 or PA66, designated TNH (fig. 12.2.6)

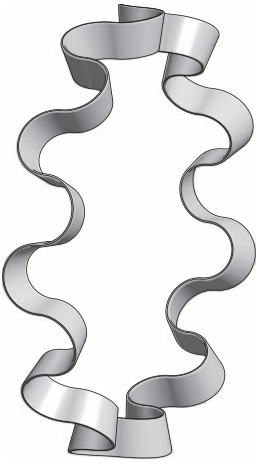


Fig. 12.2.5

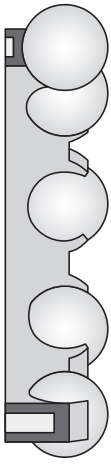


Fig. 12.2.6

Accuracy

Bearings are usually made in normal accuracy level P0 whilst this symbol is not presented. For more exacting locations bearings in higher accuracy level P6 are made.

The limit values of bearing dimension and run accuracy are stated in charts 7.2 to 7.4, and comply with the standard ISO 492.

Axial clearance

Commonly produced bearings feature normal axial clearance that is not identified. Special locations require bearings with reduced C2 and increased axial clearance C3 and C4. Axial clearance values are stated in chart 7.17b.

Misalignment

Bearings form very rigid locations and are extremely sensitive to misalignment of rings caused by assembly inaccuracies. Any misalignment of bearing rings in operation will also increase significantly the noise level and shorten the service life of the bearing.

Minimum load

Bearings with point or line contact must be exposed to certain minimum load in order to ensure their proper operation. This applies also to double row ball bearings working at high revolutions where high acceleration or sudden changes of acting load occur. Under such conditions the inertial forces of balls and cages as well as the friction in the lubricant may have negative impact on the conditions of rolling, which might cause damage to the rolling elements and raceways due to slipping. The required minimum radial load for double row angular contact ball bearings can be estimated by the below relation:

$$F_{rm} = k_r \cdot \left[\frac{vn}{1000} \right]^{\frac{2}{3}} \cdot \left[\frac{d_m}{100} \right]^2$$

F_{rm} ..... is minimum radial load [kN]

k_r ..... is coefficient of minimum radial load

..... 0.06 for bearings of series 32

..... 0.07 for bearings of series 33

N ..... oil viscosity at service temperature [mm^2/s]

n ..... revolutions [min^{-1}]

d_m ..... mean diameter of bearing, i.e. 0.5 (d + D), [mm]

At start-up in low temperatures, or in use of grease with high viscosity even higher minimum load may be necessary. The weight of components captured by bearing, along with external forces is often higher than the minimum load required. If this is not the case, an additional radial load must act on double row angular contact ball bearing.

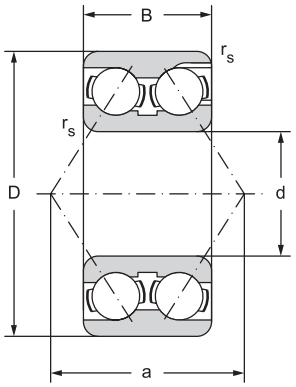
Equivalent radial dynamic load

$$P_r = F_r + 0.73F_a \qquad \text{for } F_a/F_r \leq 0.86$$

$$P_r = 0.62F_r + 1.17F_a \qquad \text{for } F_a/F_r > 0.86$$

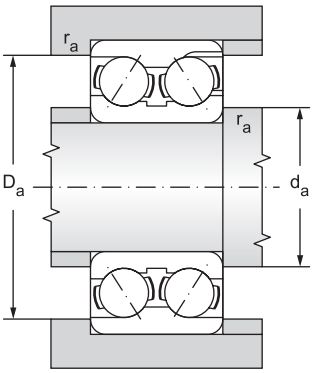
Equivalent radial static load

$$P_{or} = F_r + 0.63F_a$$



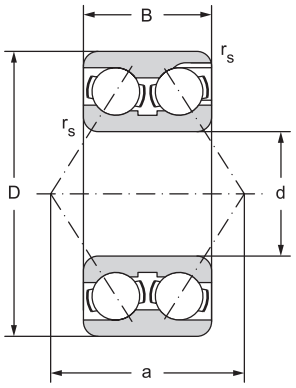
12.2.3

Main dimensions					Basic load rating		Fatique load limit
d	D	B	r_s	a	dynamic (C_r)	static (C_{or})	P_u
mm					kN		kN
10	30	14,0	0,6	20,0	9,253	5,840	0,265
	30	14,3	0,6	20,0	9,253	5,840	0,265
12	32	15,9	0,6	22,0	11,050	7,080	0,322
15	35	15,9	0,6	23,0	10,381	7,500	0,341
	42	19,0	1,0	27,0	17,369	11,900	0,541
17	40	17,5	0,6	27,0	14,418	10,600	0,482
	47	22,2	1,0	31,0	23,649	16,200	0,736
20	47	20,6	1,0	31,0	19,905	15,000	0,682
	52	22,2	1,1	34,0	23,656	18,500	0,841
25	52	20,6	1,0	35,0	21,539	18,100	0,823
	62	25,4	1,1	40,0	32,881	26,600	1,209
30	62	23,8	1,0	41,0	30,998	27,100	1,232
	72	30,2	1,1	47,0	43,688	36,200	1,645
35	72	27,0	1,1	47,0	42,125	37,600	1,709
	80	34,9	1,5	54,0	56,219	47,300	2,150
40	80	30,2	1,1	52,0	48,186	43,800	1,991
	90	36,5	1,5	58,0	59,431	59,600	2,709
45	85	30,2	1,1	56,0	51,994	51,100	2,323
	100	39,7	1,5	64,0	82,479	73,600	3,345
50	90	30,2	1,1	59,0	59,553	58,400	2,655
	110	44,4	2,0	73,0	99,898	96,200	4,373
55	100	33,3	1,5	64,0	74,481	66,800	3,036
	120	49,2	2,0	80,0	110,379	108,000	4,909
60	110	36,5	1,5	71,0	82,491	85,800	3,900
	130	54,0	2,1	86,0	128,709	128,000	5,818
65	120	38,1	1,5	76,0	90,746	94,400	4,291
	140	58,7	2,1	94,0	146,328	147,000	6,600
70	125	39,7	1,5	81,0	87,349	98,100	4,459



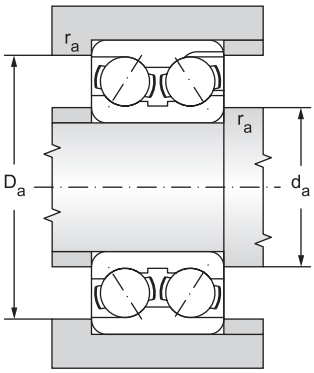
** Bearings in the new standard NEW FORCE

Limiting speed for lubrication with		Bearing designation	Abutment and Fillet Dimensions				Weight
Grease	Oil		d	d_a	D_a	r_a	
min^{-1}				min	max	max	kg
16 000	19 000	**3200X****	10	14	25	0,6	0,05
16 000	19 000	**3200****	10	14	25	0,6	0,05
14 000	17 000	**3201****	12	16	27	0,6	0,05
13 000	16 000	**3202****	15	19	30	0,6	0,07
10 600	12 600	**3302****	15	21	26	1	0,13
11 000	13 000	**3203****	17	21	35	0,6	0,1
9 400	11 000	**3303****	17	23	41	1	0,19
9 400	11 000	**3204****	20	25	42	1	0,17
8 400	10 000	**3304****	20	27	45	1	0,23
8 400	10 000	**3205****	25	30	46	1	0,19
7 100	8 400	**3305****	25	32	55	1	0,37
7 100	8 400	**3206****	30	35	56	1	0,31
6 000	7 100	**3306****	30	37	65	1	0,58
6 000	7 100	**3207****	35	41	65	1	0,48
5 300	6 300	**3307****	35	44	71	1,5	0,78
5 300	6 300	**3208****	40	46	73	1	0,65
4 700	5 600	**3308****	40	49	81	1,5	1,05
5 000	6 000	**3209****	45	51	78	1	0,7
4 200	5 000	**3309****	45	54	91	1,5	1,41
4 500	5 300	**3210****	50	56	83	1	0,74
3 800	4 500	**3310****	50	60	100	2	1,9
4 200	5 000	**3211****	55	62	91	1,5	1,05
3 300	4 000	**3311****	55	65	110	2	2,48
3 800	4 500	**3212****	60	67	101	1,5	1,36
3 200	3 800	**3312****	60	72	118	2	3,17
3 500	4 200	**3213****	65	72	111	1,5	1,76
3 000	3 500	**3313****	65	77	128	2	4,01
3 200	3 800	**3214****	70	77	116	1,5	1,93



12.2.3

Main dimensions					Basic load rating		Fatique load limit
d	D	B	r_s	a	dynamic (C_r)	static (C_{or})	P_u
mm					kN		kN
75	130	41,3	1,5	84,0	96,151	110,000	4,939
80	140	44,4	2,0	82,0	95,000	106,000	3,900
	170	68,3	2,1	101,0	156,000	182,000	6,000
85	150	49,2	2,0	88,0	110,000	124,000	4,400
	180	73,0	3,0	107,0	176,000	195,000	6,550
90	160	52,4	2,0	94,0	120,000	130,000	4,550
	190	73,0	3,0	112,0	180,000	195,000	6,400
95	170	55,6	2,1	101,0	146,000	159,000	5,400
	200	77,8	3,0	118,0	216,000	225,000	7,500
100	180	60,3	2,1	107,0	166,000	178,000	6,000
	215	82,6	3,0	127,0	255,000	255,000	8,650
110	200	69,8	2,1	119,0	212,000	212,000	7,200
	240	92,1	3,0	142,0	305,000	291,000	9,800



** Bearings in the new standard NEW FORCE

Limiting speed for lubrication with		Bearing designation	Abutment and Fillet Dimensions				Weight
Grease	Oil		d	d_a	D_a	r_a	
min^{-1}				min	max	max	kg
3 200	3 800	**3215****	75	82	121	1,5	2,08
2 800	3 800	**3216**	80	91	129	2	2,65
2 400	3 400	**3316**		92	158	2	6,8
2 600	3 600	**3217**	85	96	139	2	3,4
2 200	3 200	**3317**		99	166	2,5	8,3
2 400	3 400	**3218**	90	101	149	2	4,15
2 000	3 000	**3318**		104	176	2,5	9,25
2 200	3 200	**3219**	95	107	158	2	5
1 900	2 800	**3319**		109	186	2,5	11
2 000	3 000	**3220**	100	112	168	2	6,1
1 800	2 600	**3320**		114	201	2,5	13,5
1 900	2 800	**3222**	110	122	188	2	8,8
1 700	2 400	**3322**		124	226	2,5	19