

Thrust Ball Bearings



From the point of view of design, thrust ball bearings are divided into single direction and double direction.

Single direction thrust ball bearings consist of two washers with raceways and balls guided by a cage. Washers have flat seating surfaces, and that is why they must be supported so that all balls can be evenly loaded. Bearings carry the axial load only in one direction. They are not able to carry radial forces.

Double direction thrust ball bearings have two cages with balls between the central shaft washer and two housing washers with flat seating surfaces. The shaft washer has raceways on both sides and is fixed on the journal. Bearings are able to carry only axial forces in both directions.

Boundary Dimensions

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

Designation

Bearing designation in standard design is in the dimension tables of this publication.

Difference from standard design is designated by additional symbols (section 2.2).

Cage

Thrust ball bearings have in basic design cage a according to the table. Material and design designations are not indicated.

Customer's requiring special arrangements should be discuss this in advance with the supplier.

Bearings with Pressed Steel Cage	Bearings with Machined Brass or Steel Cage
51100 do 51144	51148 to 511/1000
51200 to 51236	51238 to 51260
51305 to 51324	51326 to 51330
51405 to 51418 ¹⁾	51420 to 51430
52202 to 52232	-
52305 to 52324	-
52405 to 52418 ¹⁾	52420

1) Bearings 51408 and 52408 are produced with solid cage made of polyamide with filling (TNGN)

Tolerance

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

Limiting values of dimension and running accuracy are shown in Table 20.

Misalignment

Bearings require keeping the tolerance for seating surfaces alignment, because misalignment causes increased stress at the contact of the balls with raceways. Therefore where alignment conditions cannot be kept, the use of thrust ball bearings is not recommended.

Axial Equivalent Dynamic Load

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

Minimum Axial Load

At higher rotational speeds danger of ball sliding between ring raceways can occur because of centrifugal forces, if axial load F_a drops under minimum value. Minimum value $F_{a \min}$ is calculated from equation:

$$F_{a \min} = M \left(\frac{n_{\max}}{1000} \right)^2 \quad [\text{kN}]$$

přičemž:

- $F_{a \min}$ - minimum axial load [kN]
- n_{\max} - maximum rotational speed [min⁻¹]
- M - minimum axial load factor
(values are in dimension tables)

If the axial load is smaller than $F_{a \min}$, or if bearing relieving comes into being during operation, e.g. of one ball row in double direction bearing, or of one bearing when using a pair of single direction thrust bearings, it is necessary to secure minimum load, e.g. by means of springs.

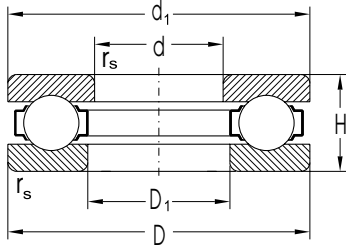
Axial Equivalent Static Load

$$P_{0a} = F_a \quad [\text{kN}]$$



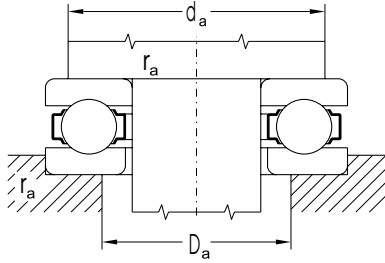
Single Direction Thrust Ball Bearings

d = 10 to 70 mm



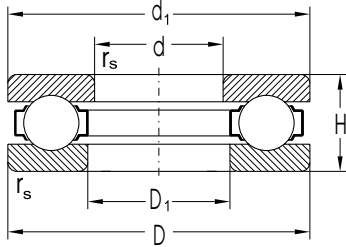
Dimensions							Basic Load Dynamic C_a	Rating Static C_{oa}	Fatigue load limit P_u	Limiting Speed for Lubrication with		Bearing Designation
d	D	d_1	D_1	H	r_s min	Grease				Oil		
mm							kN	kN	min ⁻¹			
10	24	24	11	9	0,3	11,20	14,0	0,64	7900	10600	51100**	
12	26	26	13	9	0,3	11,54	15,4	0,70	7500	10000	51101**	
15	28	28	16	9	0,3	11,76	16,8	0,76	7100	9400	51102**	
	32	13	17	12	0,6	17,27	24,4	1,11	6000	7900	51202**	
17	30	30	18	9	0,3	12,66	19,6	0,89	7100	9400	51103**	
	35	35	19	12	0,6	17,82	26,6	1,21	5600	7500	51203**	
20	35	35	21	10	0,3	16,80	26,6	1,21	6300	8400	51104**	
	40	40	22	14	0,6	24,53	37,7	1,71	5000	6700	51204**	
25	42	42	26	11	0,6	20,27	35,5	1,61	5300	7100	51105**	
	47	47	27	15	0,6	30,58	50,5	2,30	4500	6000	51205**	
	52	52	27	18	1,0	38,91	61,5	2,80	3800	5000	51305**	
30	60	60	27	24	1,0	60,50	89,4	4,06	3200	4200	51405**	
	47	47	32	11	0,6	21,06	39,9	1,81	5000	6700	51106**	
	52	52	32	16	0,6	30,28	58,2	2,65	4000	5300	51206**	
35	60	60	32	21	1,0	44,84	78,7	3,58	3300	4500	51306**	
	70	70	32	28	1,0	79,24	126,0	5,73	2700	3500	51406**	
	52	52	37	12	0,6	22,51	46,6	2,12	4700	6300	51107**	
40	62	62	37	18	1,0	41,84	78,2	3,55	3500	4700	51207**	
	68	68	37	24	1,0	58,83	105,0	4,77	2800	3800	51307**	
	80	80	37	32	1,1	94,72	155,0	7,05	2200	3000	51407**	
45	60	60	42	13	0,6	30,13	62,9	2,86	4200	5600	51108**	
	68	68	42	19	1,0	48,40	92,4	4,20	3200	4200	51208**	
	78	78	42	26	1,0	73,46	135,0	6,14	2700	3500	51308**	
50	90	90	42	36	1,1	122,08	205,0	9,32	2000	2700	51408TNGN**	
	65	65	47	14	0,6	31,25	69,2	3,15	4000	5300	51109**	
	73	73	47	20	1,0	46,97	105,0	4,77	3000	4000	51209**	
	85	85	47	28	1,0	87,20	164,0	7,45	2400	3200	51309**	
55	100	100	47	39	1,1	141,70	243,0	11,05	1900	2500	51409**	
	70	70	52	14	0,6	32,26	75,5	3,43	3800	5000	51110**	
	78	78	52	22	1,0	51,92	111,0	5,05	2800	3800	51210**	
60	78	78	57	16	0,6	36,54	93,2	4,24	3300	4500	51111**	
	90	90	57	25	1,0	73,56	159,0	7,23	2500	3300	51211**	
	105	105	57	35	1,1	122,57	246,0	11,18	1900	2500	51311**	
	120	120	57	48	1,5	214,24	397,0	18,05	1600	2100	51411**	
65	85	85	62	17	1,0	46,37	113,0	5,14	3200	4200	51112**	
	110	110	62	35	1,1	125,24	270,0	12,27	1900	2500	51312**	
	90	90	67	18	1,0	44,62	117,0	5,32	2300	3400	51113**	
70	100	100	67	27	1,0	76,40	189,0	8,59	2400	3200	51213**	
	115	115	67	36	1,1	129,28	287,0	13,05	1800	2400	51313**	
	95	95	72	18	1,0	46,55	127,0	5,77	2800	3800	51114**	
75	105	105	72	27	1,0	76,86	199,0	9,05	2200	3000	51214**	
	125	125	72	40	1,1	158,36	340,0	15,45	1700	2200	51314**	
	150	150	73	60	2,0	272,50	553,0	23,97	1200	1600	51414**	

** Bearings in the new standard NEW FORCE (see the catalogue NEW FORCE)



Abutment and Fillet Dimensions				Weight	Minimum Axial Load Factor
d	d_a min	D_a max	r_a max	~	
mm				kg	
10	19	15	0,3	0,020	0,001
12	21	17	0,3	0,020	0,002
15	23	20	0,3	0,020	0,002
	25	22	0,6	0,050	0,004
17	25	22	0,3	0,030	0,003
	28	24	0,6	0,050	0,004
20	29	26	0,3	0,040	0,004
	32	28	0,6	0,080	0,008
25	35	32	0,6	0,060	0,006
	38	34	0,6	0,120	0,015
	41	36	1,0	0,180	0,020
	46	39	1,0	0,340	0,035
30	40	37	0,6	0,070	0,008
	43	39	0,6	0,140	0,018
	48	42	1,0	0,270	0,030
	54	46	1,0	0,530	0,085
35	45	42	0,6	0,080	0,012
	51	46	1,0	0,220	0,032
	55	48	1,0	0,390	0,050
	62	53	1,0	0,790	0,120
40	52	48	0,6	0,120	0,018
	57	51	1,0	0,270	0,047
	63	55	1,0	0,550	0,095
	70	60	1,0	1,140	0,190
45	57	53	0,6	0,150	0,025
	62	56	1,0	0,320	0,060
	69	61	1,0	0,690	0,130
	78	67	1,0	1,470	0,350
50	62	58	0,6	0,160	0,035
	67	61	1,0	0,390	0,082
55	69	64	0,6	0,240	0,040
	76	69	1,0	0,610	0,110
	85	75	1,0	1,340	0,270
	94	81	1,5	2,640	0,650
60	75	70	1,0	0,290	0,066
	90	80	1,0	1,430	0,350
65	80	75	1,0	0,330	0,086
	86	79	1,0	0,770	0,170
	95	85	1,0	1,570	0,450
70	85	80	1,0	0,360	0,110
	91	84	1,0	0,810	0,210
	103	92	1,0	2,060	0,540
	118	102	2,0	5,480	1,600

Single Direction Thrust Ball Bearings d = 75 to 150 mm

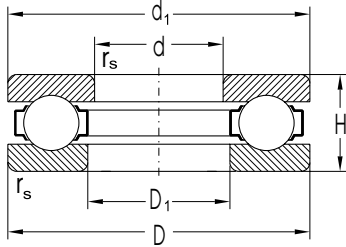


Dimensions						Basic Load Dynamic C_a	Rating Static C_{oa}	Fatigue load limit P_u	Limiting Speed for Lubrication with		Bearing Designation	
d	D	d_1	D_1	H	r_s min				Grease	Oil		
mm						kN	kN	min ⁻¹				
75	100	100	77	19	1,0	49,84	136,0	6,18	2700	3500	51115**	
	110	110	77	27	1,0	81,17	209,0	9,50	2200	3000	51215**	
	135	135	77	44	1,5	193,20	426,0	18,90	1600	2100	51315**	
80	105	105	82	19	1,0	49,95	141,0	6,41	2700	3500	51116**	
	115	115	82	28	1,0	86,35	219,0	9,95	2000	2700	51216**	
	170	170	83	68	2,1	326,51	751,0	30,53	890	1200	51416**	
85	110	110	87	19	1,0	51,52	150,0	6,82	2700	3500	51117**	
	125	125	88	31	1,0	104,94	264,0	11,71	2000	2700	51217**	
	150	150	88	49	1,5	227,46	517,0	21,68	1300	1800	51317**	
90	120	120	92	22	1,0	66,86	190,0	8,43	2000	2700	51118**	
	155	155	93	50	1,5	236,64	556,0	22,83	1100	1500	51318**	
	190	187	93	77	2,1	384,81	970,0	37,26	790	1060	51418**	
100	135	135	102	25	1,0	95,31	268,0	11,24	2000	2700	51120**	
	170	170	103	55	1,5	266,06	628,0	24,57	1060	1400	51320**	
	210	205	103	85	3,0	453,49	1220,0	44,54	750	1000	51420**	
110	145	145	112	25	1,0	97,78	288,0	11,59	1900	2500	51122**	
	190	187	113	63	2,0	323,30	807,0	29,95	890	1200	51322**	
	230	225	113	95	3,0	495,91	1400,0	48,81	670	890	51422**	
120	155	155	122	25	1,0	95,12	308,0	11,94	1600	2100	51124**	
	210	205	123	70	2,1	368,88	977,0	34,57	790	1060	51324**	
	250	245	123	102	4,0	566,04	1590,0	53,14	630	840	51424**	
130	170	170	132	30	1,0	127,33	406,0	15,07	1400	1900	51126**	
	225	220	134	75	2,1	389,02	1070,0	36,51	750	1000	51326**	
	270	265	134	110	4,0	643,37	2010,0	64,60	560	750	51426**	
140	240	235	144	80	2,1	438,84	1260,0	41,55	710	940	51328**	
	150	190	188	152	31	1,0	131,61	448,0	15,62	1300	1800	51130**
		215	212	153	50	1,5	281,84	835,0	28,10	900	1300	51230**
250		245	154	80	2,1	454,74	1360,0	43,71	670	900	51330**	

** Bearings in the new standard NEW FORCE (see the catalogue NEW FORCE)

Single Direction Thrust Ball Bearings

d = 160 to 240 mm

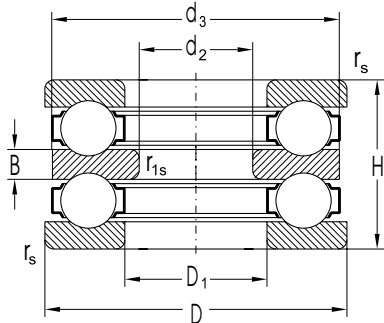


Dimensions						Basic Load Dynamic C_a	Rating Static C_{oa}	Fatigue load limit P_u	Limiting Speed for Lubrication with		Bearing Designation
d	D	d_1	D_1	H	r_s min				Grease	Oil	
mm						kN		kN	min ⁻¹		
160	200	198	162	31	1,0	133,75	476,0	16,13	1300	1800	51132**
	225	222	163	51	1,5	288,75	874,0	28,63	890	1200	51232**
170	215	213	172	34	1,1	160,14	582,0	19,07	1200	1600	51134**
	240	237	173	55	1,5	300,67	897,0	28,48	840	1100	51234**
180	225	222	185	34	1,1	165,64	639,0	20,41	1100	1500	51136**
	250	247	183	56	1,5	325,28	1030,0	31,93	840	1100	51236**
190	240	237	193	37	1,1	200,09	715,0	22,16	1060	1400	51138**
	270	267	194	62	2,0	381,99	1240,0	37,17	750	1000	51238**
200	250	247	203	37	1,1	197,40	738,0	22,36	1060	1400	51140**
	280	277	204	62	2,0	376,64	1240,0	36,38	750	1000	51240**
220	270	267	223	37	1,1	200,09	760,0	22,07	1000	1300	51144**
240	300	297	243	45	1,5	277,13	1040,0	28,77	840	1100	51148**

** Bearings in the new standard NEW FORCE (see the catalogue NEW FORCE)

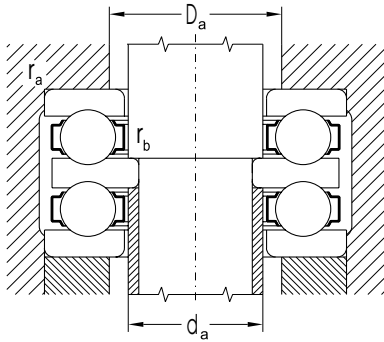
Double Direction Thrust Ball Bearings

$d_2 = 10$ to 140 mm



Dimensions								Basic Load Rating		Fatigue load limit P_u	Limiting Speed for Lubrication with		
d_2	D	d_3	D_1	H	B	$r_{s \min}$	$r_{1s \min}$	Dynamic C_a	Static C_{oa}		Grease	Oil	
mm								kN		kN	min ⁻¹		
10	32	32,0	17	22	5	0,6	0,3	17,27	24,4	1,11	6000	7900	
15	40	40,0	22	26	6	0,6	0,3	24,53	37,7	1,71	5000	6700	
	60	60,0	27	45	11	1,0	0,6	60,50	89,4	4,06	3200	4200	
20	47	47,0	27	28	7	0,6	0,3	30,58	50,5	2,30	4500	6000	
	52	52,0	27	34	8	1,0	0,3	38,91	61,5	2,80	3800	5000	
	70	70,0	32	52	12	1,0	0,6	79,24	126,0	5,73	2700	3500	
25	52	52,0	32	29	7	0,6	0,3	30,28	58,2	2,65	4000	5300	
	60	60,0	32	38	9	1,0	0,3	44,84	78,7	3,58	3300	4500	
	80	80,0	37	59	14	1,1	0,6	94,72	155,0	7,05	2200	3000	
	30	62	62,0	37	34	8	1,0	0,3	41,45	78,2	3,55	3500	4700
30	68	68,0	37	44	10	1,0	0,3	60,50	105,0	4,77	2800	3800	
	68	68,0	42	36	9	1,0	0,6	48,40	92,4	4,20	3200	4200	
	78	78,0	42	49	12	1,0	0,6	74,15	135,0	6,14	2700	3500	
	90	90,0	42	65	15	1,1	0,6	122,08	205,0	9,32	2 000	2700	
	35	73	73,0	47	37	9	1,0	0,6	46,97	105,0	4,77	3000	4000
	85	85,0	47	52	12	1,0	0,6	87,20	164,0	7,45	2400	3200	
100	100,0	47	72	17	1,1	0,6	141,70	243,0	11,05	1900	2500		
40	78	78,0	52	39	9	1,0	0,6	51,92	111,0	5,05	2800	3800	
45	90	90,0	57	45	10	1,0	0,6	73,56	159,0	7,23	2500	3300	
	105	105,0	57	64	15	1,1	0,6	123,76	246,0	11,18	1900	2500	
	120	120,0	57	87	20	1,5	0,6	212,18	397,0	18,05	1600	2100	
	50	110	110,0	62	64	15	1,1	0,6	125,24	270,0	12,27	1900	2500
55	100	100,0	67	47	10	1,0	0,6	76,40	189,0	8,59	2400	3200	
	115	115,0	67	65	15	1,1	0,6	129,28	287,0	13,05	1800	2400	
	105	105,0	72	47	10	1,0	1,0	77,62	198,0	9,00	2200	3000	
	125	125,0	72	72	16	1,1	1,0	161,32	340,0	15,45	1700	2200	
	150	150,0	73	107	24	2,0	1,0	272,50	553,0	24,83	1200	1600	
60	110	110,0	77	47	10	1,0	1,0	76,62	209,0	9,50	2200	3000	
	135	135,0	77	79	18	1,5	1,0	193,20	426,0	19,36	1600	2100	
65	115	115,0	82	48	10	1,0	1,0	86,35	219,0	9,95	2000	2700	
	170	170,0	83	120	27	2,1	1,0	336,02	751,0	31,49	890	1200	
	70	125	125,0	88	55	12	1,0	1,0	104,94	264,0	12,00	1900	2500
70	150	150,0	88	87	19	1,5	1,0	243,07	517,0	22,41	1300	1800	
	190	189,5	93	135	30	2,1	1,1	403,86	970,0	38,67	790	1060	
	75	155	155,0	93	88	19	1,5	1,0	245,92	556,0	23,57	1100	1500
100	210	209,5	123	123	27	2,1	1,1	368,88	977,0	35,67	790	1060	
140	225	224,5	163	90	20	1,5	1,1	294,25	874,0	29,41	890	1200	

** Bearings in the new standard NEW FORCE (see the catalogue NEW FORCE)



Bearing Designation	Abutment and Fillet Dimensions					Weight ~	Minimum Axial Load Factor
	d ₂	d _a max	D _a max	r _a max	r _b max		
	mm					kg	
52202**	10	15	22	0,6	0,3	0,08	0,004
52204**	15	20	28	0,6	0,3	0,15	0,008
52405**		25	39	1,0	0,6	0,63	0,035
52205**	20	25	34	0,6	0,3	0,23	0,015
52305**		25	36	1,0	0,3	0,33	0,020
52406**		30	46	1,0	0,6	1,00	0,085
52206**	25	30	39	0,6	0,3	0,27	0,018
52306**		30	42	1,0	3,0	0,49	0,030
52407**		35	53	1,0	0,6	1,44	0,120
52207**	30	35	46	1,0	0,3	0,42	0,032
52307**		35	48	1,0	0,3	0,71	0,050
52208**		40	51	1,0	0,6	0,54	0,047
52308**		40	55	1,0	0,6	1,06	0,095
52408TNGN**		40	60	1,0	0,6	2,03	0,190
52209**	35	45	56	1,0	0,6	0,62	0,060
52309**		45	61	1,0	0,6	1,29	0,130
52409**		45	67	1,0	0,6	2,71	0,350
52210**	40	50	61	1,0	0,6	0,71	0,082
52211**	45	55	69	1,0	0,6	1,12	0,110
52311**		55	75	1,0	0,6	2,51	0,270
52411**		55	81	1,5	0,6	4,70	0,650
52312**	50	60	80	1,0	0,6	2,68	0,350
52213**	55	65	79	1,0	0,6	1,36	0,170
52313**		65	85	1,0	0,6	2,90	0,450
52214**		70	84	1,0	0,6	1,48	0,210
52314**		70	92	1,0	1,0	3,90	0,540
52414**		70	102	2,0	1,0	9,71	1,600
52215**	60	75	89	1,0	1,0	1,57	0,270
52315**		75	99	1,5	1,0	4,83	0,760
52216**	65	80	95	1,0	1,0	1,69	0,350
52416**		80	117	2,0	1,0	14,00	2,700
52217**	70	85	101	1,0	1,0	2,34	0,430
52317**		85	111	1,5	1,0	6,43	1,200
52418**		90	131	2,0	1,0	19,60	4,100
52318**	75	90	116	1,5	1,0	6,60	1,500
52324**	100	120	157	2,0	1,0	17,20	4,100
52232**	140	160	186	1,5	1,0	12,20	3,200