

12.7 THRUST BALL BEARINGS

Design

From a design perspective, thrust ball bearings are divided into single direction and double direction. Rings have flat seating surfaces. The rings in smaller bearings may alternatively have a round seating faces (see fig. 12.7.1) for seating in the hub. Rings must be supported such that all of the balls or loaded equally. Bearings cannot carry radial forces. The bearings can be disassembled; consequently, the rings and axial cages with balls can be taken apart.



Fig. 12.7.1

Single direction thrust bearings

Standard single direction thrust ball bearings are composed of a shaft and hub ring with races and of balls guided by a cage (see fig. 12.7.2). Bearings only transfer axial loads in one direction.

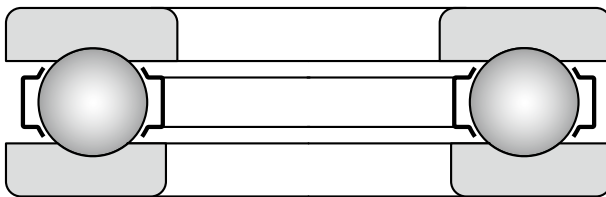


Fig. 12.7.2

Double direction thrust bearings

Standard double direction thrust ball bearings have two cages with balls between the centre shaft ring and two housing rings (see fig. 12.7.3). The shaft ring has races on both sides and is fastened on the journal. Bearings are only capable of transferring axial forces in both directions. Housing rings and cages with balls have identical components as single direction bearings of similar dimensions.

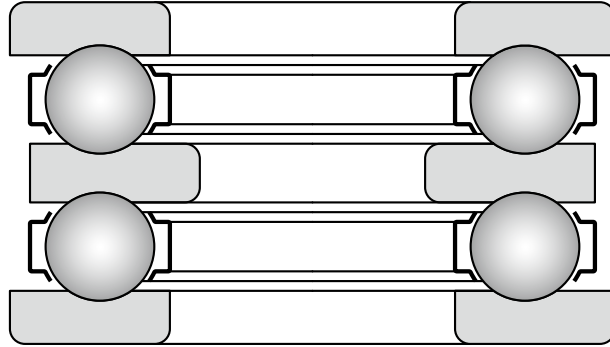


Fig. 12.7.3

Cages

Thrust ball bearings, in standard design, have a sheet metal cage according to fig. 12.7.4.

Larger size bearings use massive brass or steel cages (fig. 12.7.5).

In the rare exception, cages made from fibre-glass reinforced polyamide 6.6 are used.

Designation of the material and design is not specified in standard cages made from pressed steel sheeting. Any customer demands for special variations of cage structure and material must be consulted in advance with the supplier.

Basic information

Dimensions

The main dimensions of bearings are consistent with standard ISO 104 and are listed for individual bearings in the tables of the publication.

Precision

Bearings are currently produced at a normal degree of precision P0, which is not marked. Bearings are also supplied for more demanding loading at higher degrees of precision, P6 and P5. The availability of precision P5 bearings must be discussed with the supplier.

The dimensional and operational precision tolerances are listed in tables 7.16a and 7.16b and are consistent with standard ISO 199.

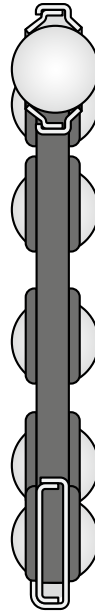


Fig. 12.7.4

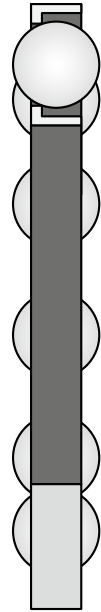


Fig. 12.7.5

Self-alignment ability

Bearings require that seating surface alignment tolerances be respected, because misalignment causes increased stress during contact of the balls with raceways. Thrust ball bearings with a flat housing ring face therefore should not be used, where conditions of alignment cannot be secured.

Bearings with a round housing ring face can be used for compensating misalignment (not for axial displacement) of axial bearing rings. Bearings are then installed with a spherical housing ring, and can thus compensate the above specified misalignment – see fig. 12.7.6.

Minimal load

Balls may slide between the ring raceways at higher speeds or during sudden changes in rotation. These slippages, which damage the bearings, are caused by centrifugal or inertial forces. In order to prevent damage, the axial load F_a must not drop during operation below the permitted value. We can calculate the permitted value $F_{a \min}$ from the equation:

$$F_{a \min} = M \left[\frac{n_{\max}}{1000} \right]^2$$

$F_{a \min}$ minimal axial load [kN]

n_{\max} maximum rotation speed [min^{-1}]

M coefficient of minimum axial load

The values are provided in the tables of the publication.

If it should occur that the value of the axial load drops below the value $F_{a \min}$, which can occur e.g. wherever there is unloading of the bearing during operation, e.g. of one row of balls in a double direction bearing or one bearing when using a pair of single direction thrust bearings, resp., minimal loading must be secured, e.g. by the use of springs.

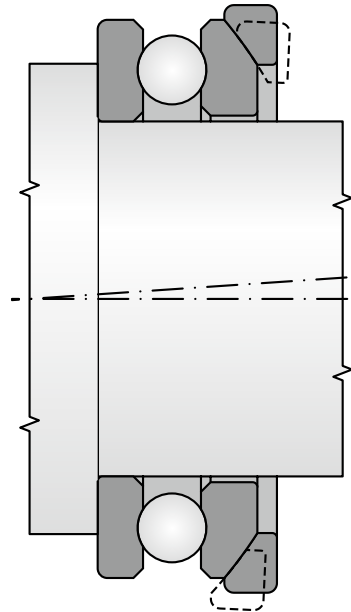


Fig. 12.7.6

Bearing equivalent dynamic load capacity

$$P_a = F_a$$

Bearing equivalent static load capacity

$$P_{0a} = F_a$$

Additional markings

Labelling of standard bearings is specified in the tables of the publication. Divergence from the standard design is marked by additional characters.

F Massive steel cage, guided by rolling elements

M Massive brass cage, guided by rolling elements

P6 Increased precision of dimensions and operation compared to the standard version (ISO 199)

P5 Increased precision of dimensions and operation compared to P6 (ISO 199)

TNG Injected cage made from fibreglass reinforced polyamide 6.6, ball-guided

Structure of related components

As specified earlier in the article on structure, smaller bearings may have housing rings with a spherical seating surface. Housing ring with a spherical surface that carry a load between the housing ring and the bearings - "U" rings, can also be supplied for these bearings - See fig. 12.7.7.

The availability of these rings must be consulted with the supplier. Rings are made from bearing steel and are unhardened. At request and subject to approval by the supplier, hardened rings can also be supplied.

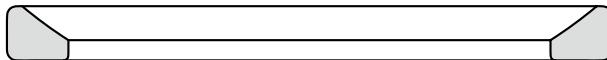
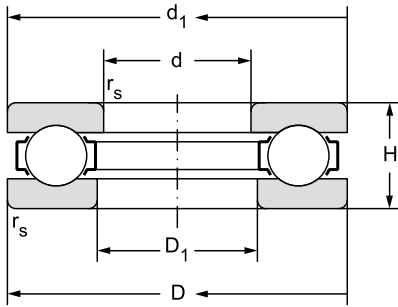


Fig. 12.7.7

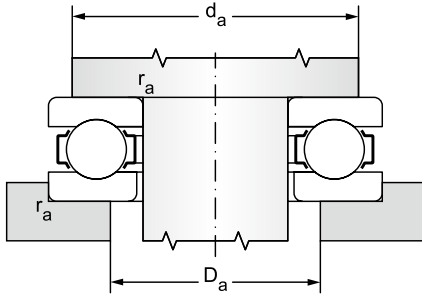
Single direction thrust ball bearings d = 160 to 630 mm

d = 10 to 50 mm



12.7.1

Main dimensions						Basic load rating		Fatigue load limit	Limiting speed for lubrication with	
d	D	d ₁	D ₁	H	r _s	dynamic	static		P _u	grease
					min	C _a	C _{0a}			
mm						kN		kN	min ⁻¹	
10	24	24	11	9	0,3	11,2	14,0	0,64	7900	10600
12	26	26	13	9	0,3	11,5	15,4	0,70	7500	10000
15	28	28	16	9	0,3	11,8	16,8	0,76	7100	9400
	32	13	17	12	0,6	17,3	24,4	1,11	6000	7900
17	30	30	18	9	0,3	12,7	19,6	0,89	7100	9400
	35	35	19	12	0,6	17,8	26,6	1,21	5600	7500
20	35	35	21	10	0,3	16,8	26,6	1,21	6300	8400
	40	40	22	14	0,6	24,5	37,7	1,71	5000	6700
25	42	42	26	11	0,6	20,3	35,5	1,61	5300	7100
	47	47	27	15	0,6	30,6	50,5	2,30	4500	6000
	52	52	27	18	1,0	38,9	61,5	2,80	3800	5000
	60	60	27	24	1,0	60,5	89,4	4,06	3200	4200
30	47	47	32	11	0,6	21,1	39,9	1,81	5000	6700
	52	52	32	16	0,6	30,3	58,2	2,65	4000	5300
	60	60	32	21	1,0	44,8	78,7	3,58	3300	4500
	70	70	32	28	1,0	79,2	126,0	5,73	2700	3500
35	52	52	37	12	0,6	22,5	46,6	2,12	4700	6300
	62	62	37	18	1,0	41,8	78,2	3,55	3500	4700
	68	68	37	24	1,0	58,8	105,0	4,77	2800	3800
	80	80	37	32	1,1	94,7	155,0	7,05	2200	3000
40	60	60	42	13	0,6	30,1	62,9	2,86	4200	5600
	68	68	42	19	1,0	48,4	92,4	4,20	3200	4200
	78	78	42	26	1,0	73,5	135,0	6,14	2700	3500
	90	90	42	36	1,1	122,0	205,0	9,32	2000	2700
45	65	65	47	14	0,6	31,3	69,2	3,15	4000	5300
	73	73	47	20	1,0	47,0	105,0	4,77	3000	4000
	85	85	47	28	1,0	87,2	164,0	7,45	2400	3200
	100	100	47	39	1,1	142,0	243,0	11,1	1900	2500
50	70	70	52	14	0,6	32,3	75,5	3,43	3800	5000
	78	78	52	22	1,0	51,9	111,0	5,05	2800	3800
	95	95	52	31	2,0	96,6	202,0	9,17	2200	3040

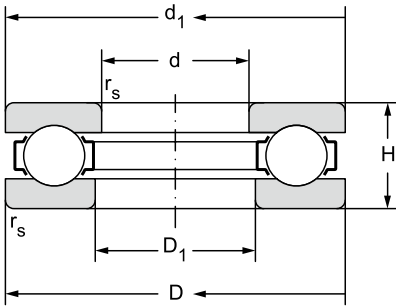


** Bearings in the new standard NEW FORCE

Bearing designation	Abutment and fillet dimensions			Weight	Minimum axial load factor
	d_a	D_a	r_a		
	min	max	max		
	mm			kg	
51100**	19	15	0,3	0,020	0,001
51101**	21	17	0,3	0,0	0,002
51102**	23	20	0,3	0,0	0,002
51202**	25	22	0,6	0,1	0,004
51103**	25	22	0,3	0,0	0,003
51203**	28	24	0,6	0,1	0,004
51104**	29	26	0,3	0,0	0,004
51204**	32	28	0,6	0,1	0,008
51105**	35	32	0,6	0,1	0,006
51205**	38	34	0,6	0,1	0,015
51305**	41	36	1,0	0,2	0,020
51405**	46	39	1,0	0,3	0,035
51106**	40	37	0,6	0,1	0,008
51206**	43	39	0,6	0,1	0,018
51306**	48	42	1,0	0,3	0,030
51406**	54	46	1,0	0,5	0,085
51107**	45	42	0,6	0,1	0,012
51207**	51	46	1,0	0,2	0,032
51307**	55	48	1,0	0,4	0,050
51407**	62	53	1,0	0,8	0,120
51108**	52	48	0,6	0,1	0,018
51208**	57	51	1,0	0,3	0,047
51308**	63	55	1,0	0,6	0,095
51408TNGN**	70	60	1,0	1,1	0,190
51109**	57	53	0,6	0,2	0,025
51209**	62	56	1,0	0,3	0,060
51309**	69	61	1,0	0,7	0,130
51409**	78	67	1,0	1,5	0,350
51110**	62	58	0,6	0,2	0,035
51210**	67	61	1,0	0,4	0,082
51310	68	77	2,0	1,0	0,190

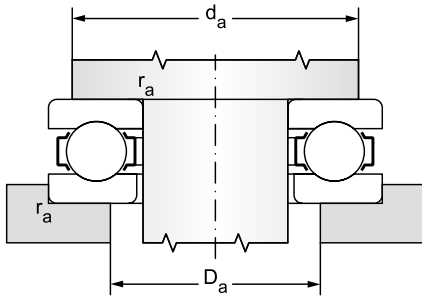
Single direction thrust ball bearings

d = 55 to 100 mm



12.7.1

Main dimensions						Basic load rating		Fatigue load limit	Limiting speed for lubrication with	
d	D	d ₁	D ₁	H	r _s	dynamic	static		P _u	grease
mm						kN		kN		min ⁻¹
					min	C _a	C _{0a}			
55	78	78	57	16	0,6	36,5	93,2	4,24	3300	4500
	90	90	57	25	1,0	73,6	159,0	7,2	2500	3300
	105	105	57	35	1,1	123,0	246,0	11,2	1900	2500
	120	120	57	48	1,5	214,0	397,0	18,1	1600	2100
60	85	85	62	17	1,0	46,4	113,0	5,1	3200	4200
	110	110	62	35	1,1	125,0	270,0	12,3	1900	2500
65	90	90	67	18	1,0	44,6	117,0	5,32	2300	3400
	100	100	67	27	1,0	76,4	189,0	8,6	2400	3200
	115	115	67	36	1,1	129,0	287,0	13,1	1800	2400
70	95	95	72	18	1,0	46,6	127,0	5,77	2800	3800
	105	105	72	27	1,0	76,9	199,0	9,1	2200	3000
	125	125	72	40	1,1	158,0	340,0	15,5	1700	2200
	150	150	73	60	2,0	273,0	553,0	24,0	1200	1600
75	100	100	77	19	1,0	49,8	136,0	6,18	2700	3500
	110	110	77	27	1,0	81,2	209,0	9,5	2200	3000
	135	135	77	44	1,5	193,0	426,0	18,9	1600	2100
80	105	105	82	19	1,0	50,0	141,0	6,41	2700	3500
	115	115	82	28	1,0	86,4	219,0	10,0	2000	2700
	170	170	83	68	2,1	327,0	751,0	30,5	890	1200
85	110	110	87	19	1,0	51,5	150,0	6,8	2700	3500
	125	125	88	31	1,0	105,0	264,0	11,7	2000	2700
	150	150	88	49	1,5	227,0	517,0	21,7	1300	1800
90	120	120	92	22	1,0	66,9	190,0	8,4	2000	2700
	155	155	93	50	1,5	237,0	556,0	22,8	1100	1500
	190	187	93	77	2,1	385,0	970,0	37,3	790	1060
100	135	135	102	25	1,0	95,3	268,0	11,2	2000	2700
100	170	170	103	55	1,5	266,0	628,0	24,6	1060	1400
100	210	205	103	85	3,0	453,0	1220,0	44,5	750	1000
100	210	205	103	85	3,0	453,0	1220,0	44,5	750	1000

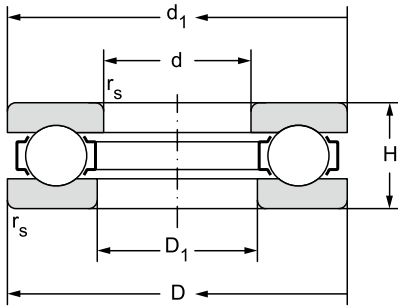


** Bearings in the new standard NEW FORCE

Bearing designation	Abutment and fillet dimensions			Weight	Minimum axial load factor
	d_a	D_a	r_a		
	min	max	max		
	mm			kg	
51111**	69	64	0,6	0,2	0,040
51211**	76	69	1,0	0,6	0,110
51311**	85	75	1,0	1,3	0,270
51411**	94	81	1,5	2,6	0,650
51112**	75	70	1,0	0,3	0,066
51312**	90	80	1,0	1,4	0,350
51113**	80	75	1,0	0,3	0,086
51213**	86	79	1,0	0,8	0,170
51313**	95	85	1,0	1,6	0,450
51114**	85	80	1,0	0,4	0,110
51214**	91	84	1,0	0,8	0,210
51314**	103	92	1,0	2,1	0,540
51414**	118	102	2,0	5,5	1,600
51115**	90	85	1,0	0,4	0,120
51215**	96	89	1,0	0,9	0,270
51315**	111	99	1,5	2,7	0,760
51116**	95	90	1,0	0,4	0,150
51216**	101	94	1,0	1,0	0,350
51416**	133	117	2,0	8,0	2,700
51117**	100	95	1,0	0,5	0,180
51217**	109	101	1,0	1,3	0,430
51317**	123	111	1,5	3,7	1,200
51118**	108	102	1,0	0,7	0,260
51318**	129	116	1,5	3,9	1,500
51418**	149	131	2,0	11,2	4,100
51120**	121	114	1,0	1,0	0,340
51320**	142	128	1,5	5,1	2,000
51420M**	165	145	2,5	15,6	7,700
51420F**	165	145	2,5	15,0	6,200

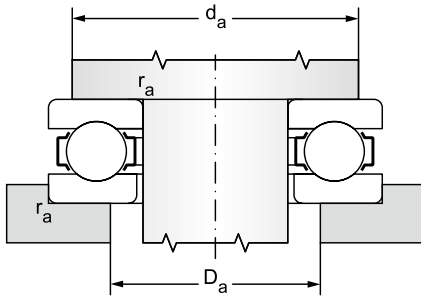
Single direction thrust ball bearings

d = 110 to 160 mm



12.7.1

Main dimensions						Basic load rating		Fatigue load limit	Limiting speed for lubrication with	
d	D	d ₁	D ₁	H	r _s	dynamic	static		P _u	grease
mm						kN		kN		min ⁻¹
min						C _a	C _{0a}			
110	145	145	112	25	1,0	97,8	288,0	11,6	1900	2500
	190	187	113	63	2,0	323,0	807,0	30,0	890	1200
	190	187	113	63	2,0	280,0	744,0	27,6	890	1200
	230	225	113	95	3,0	496,0	1400,0	48,8	670	890
	230	225	113	95	3,0	496,0	1400,0	48,8	670	890
120	155	155	122	25	1,0	95,1	308,0	11,9	1600	2100
	210	205	123	70	2,1	369,0	977,0	34,6	790	1060
	250	245	123	102	4,0	566,0	1590,0	53,1	630	840
	250	245	123	102	4,0	566,0	1590,0	53,1	630	840
130	170	170	132	30	1,0	127,0	406,0	15,1	1400	1900
	190	187	133	45	1,5	184,0	537,0	19,3	1170	1600
	225	220	134	75	2,1	389,0	1070,0	36,5	750	1000
	225	220	134	75	2,1	389,0	1070,0	36,5	750	1000
	225	220	134	75	2,1	358,0	1050,0	35,8	830	1100
	270	265	134	110	4,0	643,0	2010,0	64,6	560	750
	270	265	134	110	4,0	643,0	2010,0	64,6	560	750
140	240	235	144	80	2,1	439,0	1260,0	41,6	710	940
	240	235	144	80	2,1	439,0	1260,0	41,6	710	940
	240	235	144	80	2,1	407,0	1250,0	41,2	790	1040
150	190	188	152	31	1,0	132,0	448,0	15,6	1300	1800
	190	188	152	31	1,0	117,0	420,0	14,6	1250	1700
	190	188	152	31	1,0	117,0	420,0	14,6	1250	1700
	215	212	153	50	1,5	282,0	835,0	28,1	900	1300
	215	212	153	49,9	1,5	236,0	733,0	24,7	970	1400
	250	245	154	80	2,1	455,0	1360,0	43,7	670	900
	250	245	154	80	2,1	455,0	1360,0	43,7	670	900
	250	245	154	80	2,1	419,0	1340,0	43,1	750	1000
160	200	198	162	31	1,0	134,0	476,0	16,1	1300	1800
	200	198	162	31	1,0	121,0	448,0	15,2	1250	1700
	200	198	162	31	1,0	121,0	448,0	15,2	1250	1700
	225	222	163	51	1,5	289,0	874,0	28,6	890	1200
	225	222	163	51	1,5	239,0	768,0	25,2	1040	1400

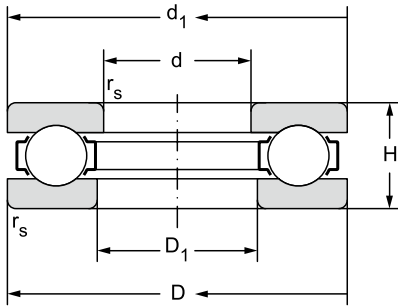


** Bearings in the new standard NEW FORCE

Bearing designation	Abutment and fillet dimensions			Weight	Minimum axial load factor
	d_a	D_a	r_a		
	min	max	max		
	mm			kg	
51122**	131	124	1,0	1,1	0,420
51322**	158	142	2,0	7,9	2,800
51322M	158	142	2,0	7,8	3,100
51422M**	181	159	2,5	20,2	9,000
51422F**	181	159	2,5	20,2	9,000
51124**	141	134	1,0	1,2	0,530
51324**	173	157	2,0	10,9	4,100
51424M**	197	173	3,0	25,5	13,000
51424F**	197	173	3,0	25,5	13,000
51126**	154	146	1,0	1,9	0,650
51226**	167	153	1,5	3,9	1,700
51326M**	186	169	2,0	13,3	6,200
51326F**	186	169	2,0	13,3	6,200
51326M	186	168	2,0	12,9	6,000
51426M**	213	187	3,0	32,0	18,000
51426F**	213	187	3,0	32,0	18,000
51328M**	199	181	2,0	15,9	8,000
51328F**	199	181	2,0	15,9	8,000
51328M	199	181	2,0	15,6	8,400
51130**	174	166	1,0	2,2	0,950
51130M**	174	166	1,0	2,3	1,000
51130F**	174	166	1,0	2,3	1,000
51230**	189	176	1,5	6,1	2,800
51230M	189	176	1,5	6,1	3,000
51330M**	209	191	2	16,5	10,000
51330F**	209	191	2,0	16,5	10,000
51330M	209	191	2,0	16,2	9,400
51132**	184	176	1,0	2,3	1,200
51132M**	199	186	1,5	2,3	1,200
51132F**	199	186	1,5	2,3	1,200
51232**	199	186	1,5	6,7	3,200
51232M	199	186	1,5	6,5	3,300

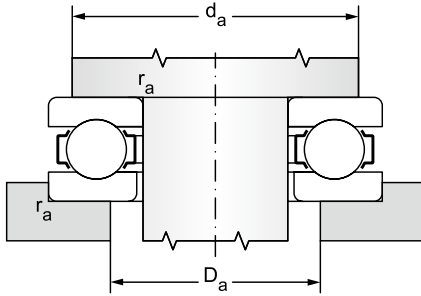
Single direction thrust ball bearings

d = 170 to 280 mm



12.7.1

Main dimensions						Basic load rating		Fatigue load limit	Limiting speed for lubrication with	
d	D	d ₁	D ₁	H	r _s	dynamic	static		P _u	grease
mm						kN		kN		min ⁻¹
min										
170	215	213	172	34	1,1	160,0	582,0	19,1	1200	1600
	215	213	172	34	1,1	154,0	563,0	18,5	1100	1500
	215	213	172	34	1,1	154,0	563,0	18,5	1100	1500
	240	237	173	55	1,5	301,0	897,0	28,5	840	1100
	240	237	173	55	1,5	283,0	930,0	29,5	920	1200
180	225	222	185	34	1,1	166,0	639,0	20,4	1100	1500
	225	222	185	34	1,1	152,0	563,0	18,0	1030	1400
	225	222	185	34	1,1	152,0	563,0	18,0	1030	1400
	250	247	183	56	1,5	325,0	1030,0	31,9	840	1100
	250	245	183	56	1,5	303,0	1030,0	32,0	920	1200
	250	247	183	56	1,5	294,0	987,0	30,6	770	1050
190	270	267	194	62	2,0	382,0	1240,0	37,2	750	1000
	270	267	194	62	2,0	382,0	1240,0	37,2	750	1000
	270	265	194	62	2,0	334,0	1170,0	35,1	830	1100
	270	267	194	62	2,0	334,0	1170,0	35,1	830	1100
200	250	247	203	37	1,1	197,0	738,0	22,4	1060	1400
	250	247	203	37	1,1	184,0	715,0	21,7	950	1300
	250	247	203	37	1,1	184,0	715,0	21,7	950	1300
	280	277	204	62	2,0	377,0	1240,0	36,4	750	1000
	280	277	204	62	2,0	377,0	1240	36,4	750	1000
220	280	275	204	62	2,0	339,0	1220	35,8	830	1100
	270	267	223	37	1,1	200,0	805,0	23,4	1000	1300
	270	267	223	37	1,1	187,0	760,0	22,1	880	1200
240	270	267	223	37	1,1	187,0	760,0	22,1	880	1200
	300	297	243	45	1,5	277,0	1040,0	28,8	840	1100
	300	297	243	45	1,5	277,0	1040,0	28,8	840	1100
260	340	335	244	78	2,1	461,0	2000,0	53,4	600	800
	320	317	263	45	1,5	272,0	1120,0	29,9	800	1100
	360	355	264	79	2,1	470,0	2160,0	55,8	560	750
280	350	347	283	53	1,5	312,0	1460,0	37,4	700	950
	380	375	284	80	2,1	483,0	2320,0	58,1	560	750

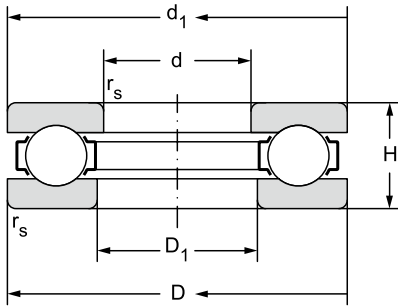


** Bearings in the new standard NEW FORCE

Bearing designation	Abutment and fillet dimensions			Weight	Minimum axial load factor
	d_a	D_a	r_a		
	min	max	max		
	mm			kg	
51134**	197	188	1,0	3,3	1,500
51134M**	212	198	1,5	3,0	1,800
51134F**	212	198	1,5	3,0	1,800
51234**	212	198	1,5	8,3	4,600
51234M	212	198	1,5	8,0	4,600
51136**	207	198	1,0	3,0	1,900
51136M**	207	198	1,0	3,1	1,900
51136F**	207	198	1,0	3,1	1,900
51236**	222	208	1,5	8,3	5,500
51236M**	220	208	1,5	8,5	5,500
51236F**	222	208	1,5	8,7	5,300
51236M	222	208	1,5	8,7	5,300
51138**	220	210	1,0	4,1	2,400
51238M**	238	222	2,0	11,9	8,400
51238F**	238	222	2,0	11,9	7,500
51238M	236	222	2,0	11,6	7,300
51140**	230	220	1,0	4,0	3,100
51140M**	230	220	1,0	4,2	2,900
51140F**	230	220	1,0	4,2	2,900
51240M**	248	232	2,0	12,4	9,500
51240F**	248	232	2,0	12,4	9,500
51240M	246	232	2,0	12,1	8,000
51144**	250	240	1,0	4,4	4,600
51144M**	250	240	1,0	4,6	3,300
51144F**	250	240	1,0	4,6	3,300
51148M**	276	264	1,5	7,6	6,500
51148F**	276	264	1,5	7,6	6,500
51248M	299	281	2,0	23,0	23,000
51152M	296	284	1,5	8,1	6,800
51252M	319	301	2,0	25,0	26,000
51156M	322	308	1,5	12,0	12,000
51256M	339	321	2,0	26,5	30,000

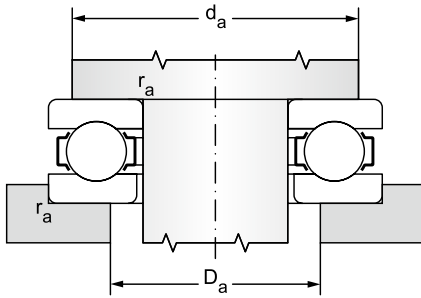
Single direction thrust ball bearings

d = 300 to 670 mm



12.7.1

Main dimensions						Basic load rating		Fatigue load limit	Limiting speed for lubrication with	
d	D	d ₁	D ₁	H	r _s min	dynamic	static	P _u	grease	oil
						C _a	C _{oa}			
mm						kN		kN	min ⁻¹	
300	380	376	304	62	2,0	359,0	1770,0	43,6	630	850
	420	415	304	95	3,0	590,0	3010,0		72,1	480
320	400	396	324	63	2,0	364,0	1860,0	44,6	600	800
	440	435	325	95	3,0	577,0	3010,0		70,2	450
340	420	416	344	64	2,0	369,0	1990,0	46,4	600	800
	460	456	345	96	3,0	606,0	3280,0		74,5	450
360	440	436	364	65	2,0	378,0	2080,0	47,3	560	750
	500	495	365	110	4,0	728,0	4200,0		92,1	400
380	460	456	384	65	2,0	383,0	2200,0	48,8	550	740
	520	515	385	112	4,0	704,0	4120,0		88,3	380
400	480	476	404	65	2,0	410,0	2300,0	49,8	530	700
420	500	496	424	65	2,0	412,0	2410,0	51,1	510	680
440	540	536	444	80	2,1	525,0	3200,0	65,7	450	600
460	560	556	464	80	2,1	530,0	3230,0	65,0	440	580
480	580	576	484	80	2,1	540,0	3290,0	65,0	430	560
500	600	596	504	80	2,1	560,0	3370,0	65,3	420	550
530	640	636	534	85	3,0	645,0	4380,0	82,3	400	530
560	670	666	564	85	3,0	665,0	4660,0	85,4	380	500
600	710	706	604	85	3,0	663,0	4800,0	85,3	370	490
630	750	746	634	95	3,0	730,0	5430,0	94,0	340	450
670	800	795	675	105	4,0	850,0	6680,0	112,0	300	400

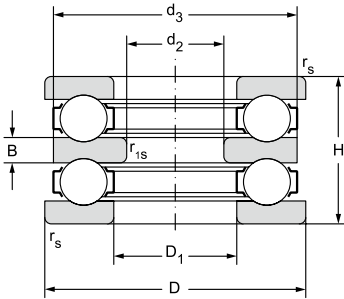


** Bearings in the new standard NEW FORCE

Bearing designation	Abutment and fillet dimensions			Weight	Minimum axial load factor
	d_a	D_a	r_a		
	min	max	max		
	mm			kg	
51160M	348	332	2,0	17,5	17,000
51260M	371	349	2,5	42,0	49,000
51164M	368	352	2,0	19,0	20,000
51264M	391	369	2,5	45,5	49,000
51168M	388	372	2,0	20,5	22,000
51268M	411	389	2,5	48,5	54,000
51172M	408	392	2,0	22,0	27,000
51272M	443	417	3,0	70,0	93,000
51176M	428	412	2,0	23,0	29,000
51276M	463	437	3,0	73,0	93,000
51180M**	448	432	2,0	24,0	30,000
51184M**	468	452	2,0	25,5	33,000
51188M**	499	481	2,0	42,0	59,000
51192M**	519	501	2,0	43,5	60,000
51196M**	539	521	2,0	45,5	68,000
511/500M**	559	541	2,0	46,5	70,000
511/530M**	595	575	2,5	58,5	105,000
511/560M**	625	606	2,5	61,0	116,000
511/600M**	665	645	2,5	65,0	124,000
511/630M**	701	679	2,5	84,0	158,000
511/670M**	747	723	3,0	105,0	234,000

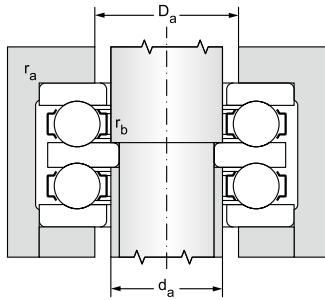
Double direction thrust ball bearings d = 10 to 140 mm

d = 10 to 55 mm



12.7.2

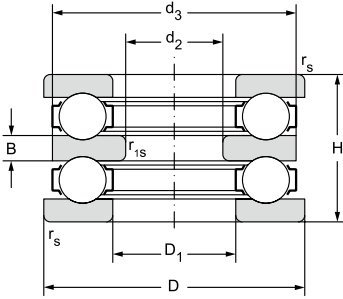
Main dimensions								Basic load rating		Fatigue load limit
d ₂	D	d ₃	D1	H	B	r _s	r _{1s}	dynamic	static	P _u
						min	min	C _a	C _{oa}	P _u
mm								kN		kN
10	32	32	17	22	5	0,6	0,3	17,27	24,4	1,11
15	40	40	22	26	6	0,6	0,3	24,53	37,7	1,71
	60	60	27	45	11	1	0,6	60,5	89,4	4,06
20	47	47	27	28	7	0,6	0,3	30,58	50,5	2,3
	52	52	27	34	8	1	0,3	38,91	61,5	2,8
	70	70	32	52	12	1	0,6	79,24	126	5,73
25	52	52	32	29	7	0,6	0,3	30,28	58,2	2,65
	60	60	32	38	9	1	0,3	44,84	78,7	3,58
	80	80	37	59	14	1,1	0,6	94,72	155	7,05
30	62	62	37	34	8	1	0,3	41,45	78,2	3,55
	68	68	37	44	10	1	0,3	60,5	105	4,77
	68	68	42	36	9	1	0,6	48,4	92,4	4,2
	78	78	42	49	12	1	0,6	74,15	135	6,14
	90	90	42	65	15	1,1	0,6	122,08	205	9,32
35	73	73	47	37	9	1	0,6	46,97	105	4,77
	85	85	47	52	12	1	0,6	87,2	164	7,45
	100	100	47	72	17	1,1	0,6	141,7	243	11,05
40	78	78	52	39	9	1	0,6	51,92	111	5,05
45	90	90	57	45	10	1	0,6	73,56	159	7,23
	105	105	57	64	15	1,1	0,6	123,76	246	11,18
	120	120	57	87	20	1,5	0,6	212,18	397	18,05
50	110	110	62	64	15	1,1	0,6	125,24	270	12,27
55	100	100	67	47	10	1	0,6	76,4	189	8,59
	115	115	67	65	15	1,1	0,6	129,28	287	13,05
	105	105	72	47	10	1	1	77,62	198	9
	125	125	72	72	16	1,1	1	161,32	340	15,45
	150	150	73	107	24	2	1	272,5	553	24,83



Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions					Weight	Coefficient of minimum axial load
grease	oil		d ₂	d _a	D _a	r _a	r _b		
min ⁻¹				max	max	max	max	kg	
6000	7900	52202**	10	15	22	0,6	0,3	0,08	0,004
5000	6700	52204**	15	20	28	0,6	0,3	0,15	0,008
3200	4200	52405**		25	39	1	0,6	0,63	0,035
4500	6000	52205**	20	25	34	0,6	0,3	0,23	0,015
3800	5000	52305**		25	36	1	0,3	0,33	0,02
2700	3500	52406**		30	46	1	0,6	1,00	0,085
4000	5300	52206**	25	30	39	0,6	0,3	0,27	0,018
3300	4500	52306**		30	42	1	3	0,49	0,03
2200	3000	52407**		35	53	1	0,6	1,44	0,12
3500	4700	52207**	30	35	46	1	0,3	0,42	0,032
2800	3800	52307**		35	48	1	0,3	0,71	0,05
3200	4200	52208**		40	51	1	0,6	0,54	0,047
2700	3500	52308**		40	55	1	0,6	1,06	0,095
2000	2700	52408TNGN**		40	60	1	0,6	2,03	0,19
3000	4000	52209**	35	45	56	1	0,6	0,62	0,06
2400	3200	52309**		45	61	1	0,6	1,29	0,13
1900	2500	52409**		45	67	1	0,6	2,71	0,35
2800	3800	52210**	40	50	61	1	0,6	0,71	0,082
2500	3300	52211**	45	55	69	1	0,6	1,12	0,11
1900	2500	52311**		55	75	1	0,6	2,51	0,27
1600	2100	52411**		55	81	1,5	0,6	4,70	0,65
1900	2500	52312**	50	60	80	1	0,6	2,68	0,35
2400	3200	52213**	55	65	79	1	0,6	1,36	0,17
1800	2400	52313**		65	85	1	0,6	2,90	0,45
2200	3000	52214**		70	84	1	0,6	1,48	0,21
1700	2200	52314**		70	92	1	1	3,90	0,54
1200	1600	52414**		70	102	2	1	9,71	1,6

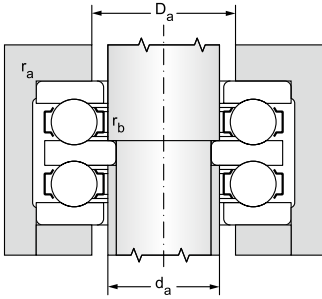
Double direction thrust ball bearings

d = 60 to 140 mm



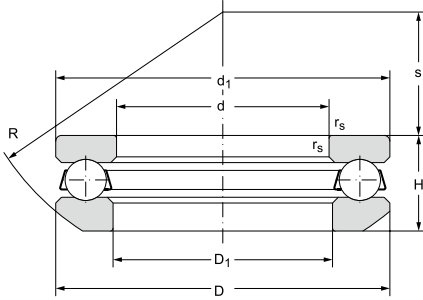
Main dimensions								Basic load rating		Fatigue load limit
d_2	D	d_3	D1	H	B	r_s	r_{1s}	dynamic	static	P_u
						min	min	C_a	C_{oa}	
mm								kN		kN
60	110	110	77	47	10	1	1	76,62	209	9,5
	135	135	77	79	18	1,5	1	193,2	426	19,36
65	115	115	82	48	10	1	1	86,35	219	9,95
	170	170	83	120	27	2,1	1	336,02	751	31,49
70	125	125	88	55	12	1	1	104,94	264	12
	150	150	88	87	19	1,5	1	243,07	517	22,41
	190	189,5	93	135	30	2,1	1,1	403,86	970	38,67
75	155	155	93	88	19	1,5	1	245,92	556	23,57
100	210	209,5	123	123	27	2,1	1,1	368,88	977	35,67
140	225	224,5	163	90	20	1,5	1,1	294,25	874	29,41

12.7.2



Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions					Weight	Coefficient of minimum axial load
grease	oil		d ₂	d _a	D _a	r _a	r _b		
min ⁻¹				max	max	max	max	kg	
2200	3000	52215**	60	75	89	1	1	1,57	0,27
1600	2100	52315**		75	99	1,5	1	4,83	0,76
2000	2700	52216**	65	80	95	1	1	1,69	0,35
890	1200	52416**		80	117	2	1	14,00	2,7
1900	2500	52217**	70	85	101	1	1	2,34	0,43
1300	1800	52317**		85	111	1,5	1	6,43	1,2
790	1060	52418**		90	131	2	1	19,60	4,1
1100	1500	52318**	75	90	116	1,5	1	6,60	1,5
790	1060	52324**	100	120	157	2	1	17,20	4,1
890	1200	52232**	140	160	186	1,5	1	12,20	3,2

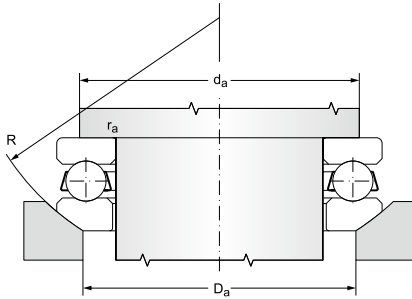
Thrust ball bearings with sphered housing washer $d = 15$ to 130 mm



12.7.3

Main dimensions												Basic load rating	
d	D	d ₁	D ₁	D ₂	D ₃	H	H ₁	C	R	s	r _s	C _a	C _{0a}
mm												kN	
15	32	32	17	24	35	13,3	15	4	28	12	0,6	17,3	24,4
17	35	35	19	26	38	13,2	15	4	32	16	0,6	17,8	26,6
20	40	40	22	30	42	14,73	17	5	36	18	0,6	24,5	37,7
25	47	47	27	36	50	16,72	19	5,5	40	19	0,6	30,6	50,5
30	52	52	32	42	55	17,8	20	5,5	45	22	0,6	30,3	58,2
	60	60	32	45	62	22,6	25	7	50	22	1,0	44,8	78,7
35	62	62	37	48	65	19,87	22	7	50	24	1,0	41,8	78,2
	68	68	37	52	72	25,6	28	7,5	56	24	1,0	58,8	105,0
40	68	68	42	55	72	20,3	23	7	56	28,5	1,0	48,4	92,4
	78	78	42	60	82	28,5	31	8,5	64	28	1,0	73,5	135,0
	90	90	42	65	95	38,2	42	12	72	26	1,1	122,1	205,0
45	73	73	47	60	78	21,3	24	7,5	56	26	1,0	47,0	105,0
	85	85	47	65	90	30,13	33	10	64	25	1,0	87,2	164,0
50	78	78	52	62	82	23,49	26	7,5	64	32,5	1,0	51,9	111,0
	90	90	57	72	95	27,35	30	9	72	35	1,0	73,6	159,0
		105	105	57	80	110	39,3	42	11,5	80	30	1,1	122,6
55	120	120	57	88	125	50,5	55	15,5	90	28	1,5	214,2	397,0
	110	110	62	85	115	38,3	42	11,5	90	41	1,1	125,2	270,0
65	100	100	67	82	105	28,7	32	9	80	40	1,0	76,4	189,0
	115	115	67	90	120	39,4	43	12,5	90	38,5	1,1	129,3	287,0
70	105	105	72	88	110	28,8	32	9	80	38	1,0	76,9	199,0
	125	125	72	98	130	44,2	48	13	100	43	1,1	158,4	340,0
	150	150	73	110	155	63,6	69	19,5	112	34	2,0	272,5	553,0
75	110	110	77	92	115	28,3	32	9,5	90	49	1,0	81,2	209,0
	135	135	77	105	140	48,1	52	15	100	37	1,5	193,2	426,0
80	115	115	82	98	120	29,5	33	10	90	46	1,0	86,4	219,0

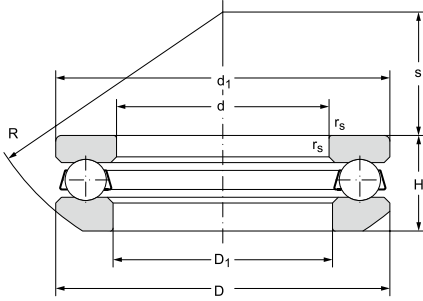
d = 15 to 80 mm



Fatigue load limit	Limiting speed for lubrication with		Designation		Abutment and fillet dimensions			Weight	Minimum axial load factor
	P _u	grease	oil	bearing	sphered housing washer	d _a	D _a	r _a	
kN	min ⁻¹				min	max	max	kg	
						mm			
1,11	6000	7900	53202**	U202	25	24	0,6	0,063	0,004
1,21	5600	7500	53203**	U203	28	26	0,6	0,071	0,004
1,71	5000	6700	53204**	U204	32	30	0,6	0,10	0,008
2,30	4500	6000	53205**	U205	38	36	0,6	0,15	0,015
2,65	4000	5300	53206**	U206	43	42	0,6	0,18	0,018
3,58	3300	4500	53306**	U306	48	45	1,0	0,33	0,030
3,55	3500	4700	53207**	U207	51	48	1,0	0,28	0,032
4,77	2800	3800	53307**	U307	55	52	1,0	0,46	0,050
4,20	3200	4200	53208**	U208	57	55	1,0	0,35	0,047
6,14	2700	3500	53308**	U308	63	60	1,0	0,67	0,095
9,32	2000	2700	53408TNGN**	U408	70	65	1,0	1,35	0,190
4,77	3000	4000	53209**	U209	62	60	1,0	0,39	0,060
7,45	2400	3200	53309**	U309	69	65	1,0	0,83	0,130
5,05	2800	3800	53210**	U210	67	62	1,0	0,47	0,082
7,23	2500	3300	53211**	U211	76	72	1,0	0,75	0,110
11,2	1900	2500	53311**	U311	85	80	1,0	1,68	0,270
18,1	1600	2100	53411**	U411	94	88	1,5	3,08	0,650
12,3	1900	2500	53312**	U312	90	85	1,0	1,71	0,350
8,59	2400	3200	53213**	U213	86	82	1,0	0,91	0,170
13,1	1800	2400	53313**	U313	95	90	1,0	1,89	0,450
9,05	2200	3000	53214**	U214	91	88	1,0	0,97	0,210
15,5	1700	2200	53314**	U314	103	98	1,0	2,50	0,540
24,0	1200	1600	53414**	U414	118	110	2,0	6,40	1,600
9,50	2200	3000	53215**	U215	96	92	1,0	1,00	0,270
18,9	1600	2100	53315**	U315	111	105	1,5	3,20	0,760
9,95	2000	2700	53216**	U216	101	98	1,0	1,10	0,350

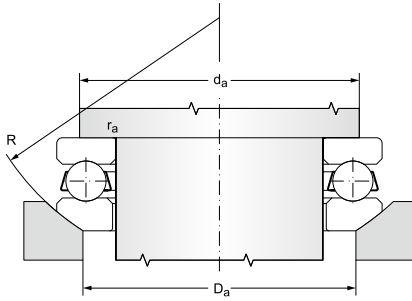
Thrust ball bearings with sphered housing washer

d = 85 až 130 mm



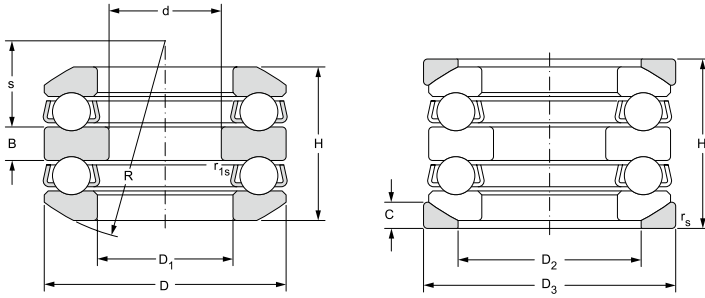
Main dimensions												Basic load rating	
d	D	d ₁	D ₁	D ₂	D ₃	H	H ₁	C	R	s	r _s	C _a	C _{0a}
mm												kN	
85	125	125	88	105	130	33,1	37	11	100	52	1,0	104,9	264,0
	150	150	88	115	155	53,1	58	17,5	112	43	1,5	227,5	517,0
90	155	155	93	120	160	54,6	59	18	112	40	1,5	236,6	556,0
	190	187	93	140	195	81,2	88	25,5	140	40	2,1	384,8	970,0
100	170	170	103	135	175	59,2	64	18	125	46	1,5	266,1	628,0
	210	205	103	155	220	90	98	27	160	50	3,0	453,5	1220,0
	210	205	103	155	220	90	98	27	160	50	3,0	453,5	1220,0
110	190	187	113	150	195	67,2	72	20,5	140	51	2,0	323,3	807,0
	190	187	113	150	195	67,2	72	21	140	51	2,0	280,0	744,0
120	210	205	123	165	220	74,1	80	22	160	63	2,1	368,9	977,0
130	190	187	133	160	195	47,9	53	17	140	67	1,5	183,8	537,4

12.7.3



Fatigue load limit	Limiting speed for lubrication with		Designation		Abutment and fillet dimensions			Weight	Minimum axial load factor
	grease	oil	bearing	sphered housing washer	d_a	D_a	r_a		
P_u					min	max	max	bearing + washer	
kN	min ⁻¹				mm			kg	
11,7	2000	2700	53217**	U217	109	105	1,0	1,50	0,430
21,7	1300	1800	53317**	U317	124	115	1,5	4,35	1,200
22,8	1100	1500	53318**	U318	129	120	1,5	4,70	1,500
37,3	790	1060	53418**	U418	133	125	2,0	12,80	4,100
24,6	1060	1400	53320**	U320	142	135	1,5	5,95	2,000
44,5	750	1000	53420 M**	U420	165	155	2,5	18,0	7,700
44,5	750	1000	53420 F**	U420	165	155	2,5	18,0	6,200
30,0	890	1200	53322**	U322	158	150	2,0	8,9	2,800
27,6	890	1200	53322 M	U322	158	150	2,0	9,1	3,100
34,6	790	1060	53324**	U324	173	165	2,0	12,2	4,100
19,3	1170	1600	53226 **	U226	167	160	1,5	4,85	1,700

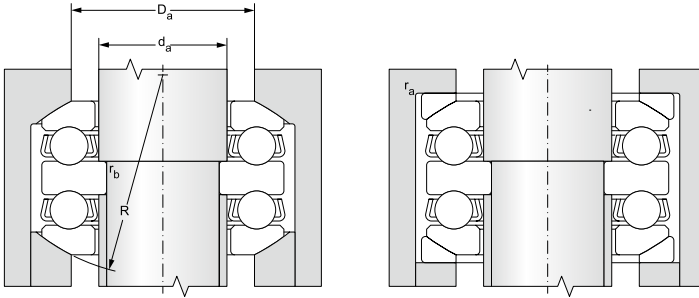
Double direction thrust ball bearings with sphered housing washers $d = 25$ to 70 mm



Main Dimensions													Basic load rating	
d	D	D ₁	D ₂	D ₃	H	H ₁	B	C	R	s	r _s	r _{1s}	dynamic	static
													C _a	C _{0a}
mm													kN	
25	60	32	45	62	41,3	46	9	7	50	19,5	1	0,3	44,84	78,7
30	62	37	48	65	37,73	42	8	7	50	21	1	0,3	41,45	78,2
	68	37	52	72	47,19	52	10	7,5	56	21	1	0,3	60,5	105
	68	42	55	72	38,6	44	9	7	56	25	1	0,6	48,4	92,4
	78	42	60	82	54,1	59	12	8,5	64	23,5	1	0,6	74,15	135
35	73	47	60	78	39,6	45	9	7,5	56	23	1	0,6	46,97	105
	85	47	65	90	56,2	62	12	10	64	21	1	0,6	87,2	164
	100	47	72	105	78,9	86	17	12,5	80	23,5	1,1	0,6	141,7	243
45	90	57	72	95	49,6	55	10	9	72	32,5	1	0,6	73,56	159
50	110	62	85	115	70,7	78	15	11,5	90	36,5	1,1	0,6	125,24	270
65	170	83	125	175	128,5	140	27	22	125	30,5	2,1	1	336,02	751
70	150	88	115	155	95,2	105	19	17,5	112	39	1,5	1	243,07	517

12.7.4





Fatigue load limit	Limiting speed for lubrication with		Designation		Abutment and fillet dimensions					Weight	Minimum axial load factor
	P_u	grease	oil	bearing	sphered housing washer	d	d_a	D_a	r_a		
kN	min ⁻¹				mm					kg	
3,58	3300	4500	54306**	U306	20	30	45	1	0,3	0,58	0,03
3,55	3500	4700	54207**	U207	30	35	48	1	0,3	0,53	0,032
4,77	2800	3800	54307**	U307		35	52	1	0,3	0,85	0,05
4,2	3200	4200	54208**	U208		40	55	1	0,6	0,63	0,047
6,14	2700	3500	54308**	U308		40	60	1	0,6	1,17	0,095
4,77	3000	4000	54209**	U209	35	45	60	1	0,6	0,78	0,06
7,45	2400	3200	54309**	U309		45	65	1	0,6	1,6	0,13
11,05	1900	2500	54409**	U409		45	72	1	0,6	3	0,35
7,23	2500	3300	54211**	U211	45	55	72	1	0,6	1,3	0,11
12,27	1900	2500	54312**	U312	50	60	85	1	0,6	2,9	0,35
31,49	890	1200	54416**	U416	65	80	125	2	1	14	2,7
22,41	1300	1800	54317**	U317	70	85	115	1,5	1	7,95	1,2

12.8 CYLINDRICAL ROLLER THRUST BEARINGS

Design

Cylindrical roller thrust bearings are design for solid and sustainable loadings and resistant to shock stressing. They are standardly offered as single direction bearings that can transfer axial loads only in one direction.

Bearings have a simple shape and can have a single row (fig. 12.8.1) or double row (fig. 12.8.2) design. They are used primarily in heavy-duty loadings, in which thrust ball bearings sometimes fail.

Cylindrical rollers with a modified surface that ensure optimal rolling without edge stressing are installed in the bearings.

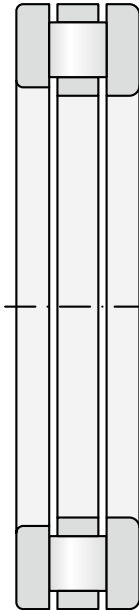


Fig. 12.8.1

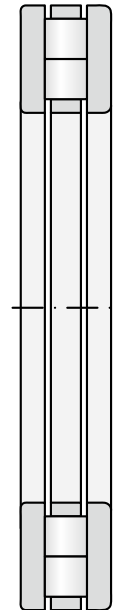


Fig. 12.8.2

Components

Bearing components allow for numerous combinations of bearing designs, where e.g. only a cage with rollers is used and the raceways form individual machine parts (fig. 12.8.3) or a combined loading may be used, when the machine part comprises one raceway and the bearing ring the second part. An independent cage with rollers has the additional marking K, an independent shaft ring WS, and an independent housing ring GS.

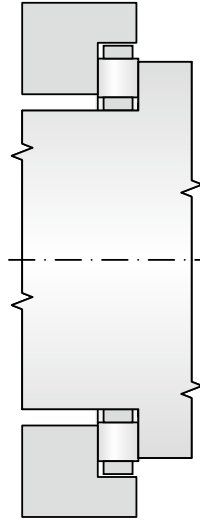


Fig. 12.8.3

Double direction bearings

Bearings can be assembled from housing rings or shaft rings with two cages with rollers and a corresponding centre ring, which is centred on the inner diameter (fig. 12.8.4) or outer (fig. 12.8.5) diameter. The centre ring must be made in the same quality as the respective bearing rings. We recommend consulting BTL Technical and Consultation Services for more information.

Basic information

Dimensions

Main dimensions of thrust ball bearings conform to ISO 104.

Tolerances

Standard manufacturing of bearings is provided at a normal degree of precision, which is not labelled. Bearings may also be supplied at higher precision P5. Bearing dimension tolerances meet standard ISO 199. These values are provided in tables 7.16a and 7.16b.

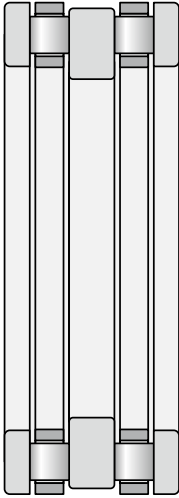


Fig. 12.8.4

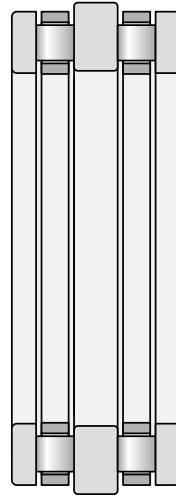


Fig. 12.8.5

Shaft and housing rings and rollers with a cage are manufactured to tolerances specified in tables 12.8.1. and 12.8.2. Rollers in a single cage are from one sorting group and their diameter variance is 1 μm .

Table 12.8.1

Bearing component tolerances		
Bearing components Dimensions		Tolerances
Cage with rollers, K		
Bore diameter	d	E11
Outer diameter	D	a13
Roller diameter	D_w	DIN 5402-1:1993
Shaft ring, WS		
Bore diameter	d	Normal tolerance
Outer diameter	d_1	-
Thickness	B	h11
Axial runout	S_1	Normal tolerance
Tělesový kroužek, GS		
Outer diameter	D	Normal tolerance
Bore diameter	D_1	-
Thickness	B	h11
Axial runout	S_e	Normal tolerance

Table 12.8.2

ISO Tolerances							
Nominal diameter		Tolerance					
d, D		a13		h11		E11	
over	including	max	min	max	min	max	min
mm		µm					
10	18	-290	-560	0	-110	+142	+32
18	30	-300	-630	0	-130	+170	+40
30	40	-310	-700	0	-160	+210	+50
40	50	-320	-710	0	-160	+210	+50
50	65	-340	-800	0	-190	+250	+60
65	80	-360	-820	0	-190	+250	+60
80	100	-380	-920	0	-220	+292	+72
100	120	-410	-950	0	-220	+292	+72
120	140	-460	-1090	0	-250	+335	+85
140	160	-520	-1150	0	-250	+335	+85
160	180	-580	-1210	0	-250	+335	+85
180	200	-660	-1380	0	-290	+390	+100
200	225	-740	-1460	0	-290	+390	+100
225	250	-820	+1540	0	-290	+390	+100
250	280	-920	-1730	0	-320	+430	+110
280	315	-1050	-1860	0	-320	+430	+110
315	355	-1200	-2090	0	-360	+485	+125
355	400	-1350	-2240	0	-360	+485	+125
400	450	-1500	-2470	0	-400	+535	+135
450	500	-1650	-2620	0	-400	+535	+135
500	630	-1900	-3000	0	-440	+585	+145
630	800	-2100	-3350	0	-500	+660	+150

Misalignment

Misalignment between the shaft and the housing is not permitted. Spherical roller thrust bearings do not allow for compensation of such misalignment.

Cages

Thrust ball bearings are equipped with a massive brass cage, additional markings M, MB.

Minimal axial load

A certain minimal load, which ensures reliable operation, must act on thrust ball bearings. Failure to adhere to this load could lead to non-standard rolling off, slippage, and subsequent damage of ring raceways and roller elements.

The minimal requisite load is determined from the equation:

$$F_{a \min} = \left(\frac{C_{0a}}{2000} \right) + M \cdot \left(\frac{n}{1000} \right)^2$$

$F_{a \min}$	minimal load	(kN)
C_0	static bearing capacity	(kN)
M	coefficient of minimum axial load	(see tables)
n	revolutions	(min ⁻¹)

A higher minimal load is required when starting the bearing under low temperatures or when using a high viscosity lubricant. If the minimal load is not derived naturally in the arrangement of the bearing structure, then the bearing must be loaded with an auxiliary force by springs or by the shaft nut.

Bearing equivalent dynamic load capacity

$$P = F_a$$

Bearing equivalent static load capacity

$$P_0 = F_a$$

Additional markings

Additional markings after the basic markings express a particular bearing characteristic:

- K cage with rollers
- WS shaft ring
- GS housing ring
- M massive brass cage guided on rollers
- MB massive brass shaft-guided cage

Structure of related components

Perfect resting of rings must be ensured in the developed hub along its entire perimeter and across its breadth. The support surfaces in the hub and on the shaft must be perpendicular to the axis of the shaft. Required dimensional tolerances of loadings for bearings on a shaft and in the hub are listed in table 12.8.3.

Higher speeds necessitate the selection of cage guiding on a shaft, and the shaft guiding surfaces must thus be polished.

Raceways on the shaft and in the hub

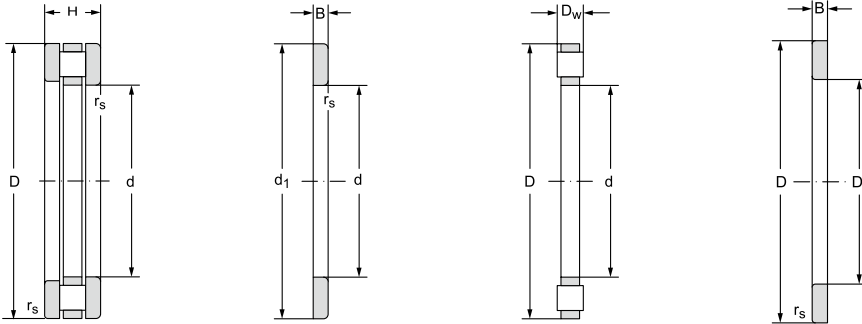
Orbits on the shaft and in the hub should have the same hardness and surface quality as bearing raceways. Failure to meet the specified parameters will result in failure to achieve the bearing load capacity parameters.

Table 12.8.3

Shaft and hub bore tolerances			
Bearing component Name	Prefix	Tolerance	
		Shaft	Hub bore
Cage with rollers	K	h8	-
Shaft ring	WS	h8	-
Hub ring	GS	-	H9

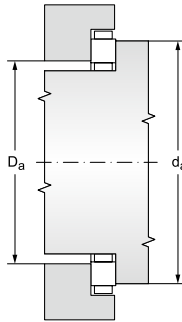
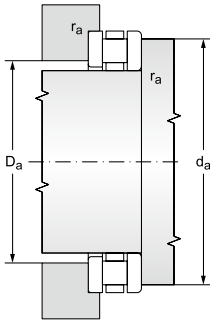
Cylindrical roller thrust bearings d = 15 to 630 mm

d = 15 to 80 mm



12.8.1

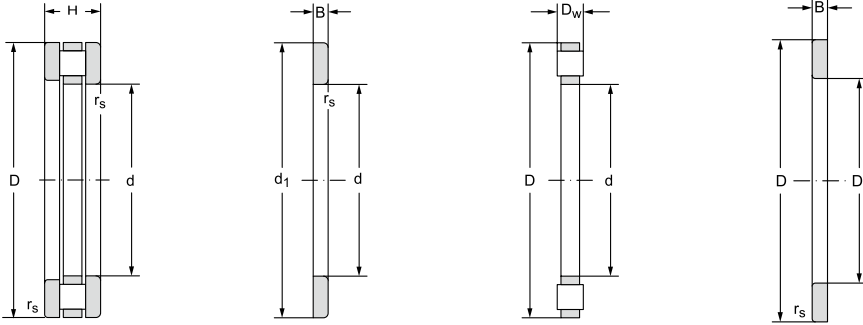
Main dimensions								Basic load rating		Fatigue load limit
d	D	H	d ₁	D ₁	B	D _w	r _s	dynamic	static	P _u
							min	C _a	C _{oa}	
mm								kN		kN
15	28	9,0	28,0	16,0	2,75	3,5	0,3	9,3	26,8	3,27
17	30	9,0	30,0	18,0	2,75	3,5	0,3	11,5	30	3,66
20	35	10,0	35,0	21,0	2,75	4,5	0,3	16,9	45	5,47
25	42	11,0	42,0	26,0	3,00	5,0	0,6	23,8	66,5	8,11
30	47	11,0	47,0	32,0	3,00	5,0	0,6	26,1	75,5	9,21
	52	16,0	52,0	32,0	4,25	7,5	0,6	48,9	131	16,00
35	52	12,0	52,0	37,0	3,50	5,0	0,6	27,8	90,5	11,00
	62	18,0	62,0	37,0	5,25	7,5	1,0	60,1	184	22,40
40	60	13,0	60,0	42,0	3,50	6,0	0,6	41,2	135	16,50
	68	19,0	68,0	42,0	5,00	9,0	1,0	82	147	17,90
45	65	14,0	65,0	47,0	4,00	6,0	0,6	43,2	149	18,20
	73	20,0	73,0	47,0	5,50	9,0	1,0	81,3	250	30,50
50	70	14,0	70,0	52,0	4,00	6,0	0,6	44,9	160	19,50
	78	22,0	78,0	52,0	6,50	9,0	1,0	90,1	296	36,10
55	78	16,0	78,0	57,0	5,00	6,0	0,6	66,9	281	34,30
	90	25,0	90,0	57,0	7,00	11,0	1,0	120	379	46,20
60	85	17,0	85,0	62,0	4,75	7,5	1,0	77,9	294	35,90
	95	26,0	95,0	62,0	7,50	11,0	1,0	134	458	55,90
65	90	18,0	90,0	67,0	5,25	7,5	1,0	81,7	314	38,30
	100	27,0	100,0	67,0	8,00	11,0	1,0	137	481	58,70
70	95	18,0	95,0	72,0	5,25	7,5	1,0	84,7	340	41,50
	105	27,0	105,0	72,0	8,00	11,0	1,0	144	519	63,30
75	100	19,0	100,0	77,0	5,75	7,5	1,0	82	331	40,40
	110	27,0	110,0	77,0	8,00	11,0	1,0	134	482	58,80
80	105	19,0	105,0	82,0	5,75	7,5	1,0	79,1	328	40,00
	115	28,0	115,0	82,0	8,50	11,0	1,0	149	602	73,40



Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions				Weight	Bearing component designation			Min. axial load factor
grease	oil		d	d _a	D _a	r _a		~	Cage with rollers	Shaft ring	
min ⁻¹			mm			kg					
3200	4300	81102	15	27	16	0,3	0,023	K 81102	WS 81102	GS 81102	0,00006
3200	4300	81103	17	29	18	0,3	0,027	K 81103	WS 81103	GS 81103	0,00008
2800	3800	81104	20	34	21	0,3	0,037	K 81104	WS 81104	GS 81104	0,00019
2200	3200	81105	25	41	26	0,6	0,053	K 81105	WS 81105	GS 81105	0,0004
2000	3000	81106	30	46	31	0,6	0,057	K 81106	WS 81106	GS 81106	0,0005
1700	2400	81206	30	50	31	0,6	0,12	K 81206	WS 81206	GS 81206	0,0014
1900	2800	81107	35	51	36	0,6	0,073	K 81107	WS 81107	GS 81107	0,0007
1500	2000	81207	35	58	39	1,0	0,20	K 81207	WS 81207	GS 81207	0,003
1700	2400	81108	40	58	42	0,6	0,11	K 81108	WS 81108	GS 81108	0,0016
1400	1900	81208	40	66	43	1,0	0,25	K 81208	WS 81208	GS 81208	0,0053
1600	2200	81109	45	63	47	0,6	0,13	K 81109	WS 81109	GS 81109	0,002
1300	1800	81209	45	70	48	1,0	0,29	K 81209	WS 81209	GS 81209	0,0059
1600	2100	81110	50	68	52	0,6	0,14	K 81110	WS 81110	GS 81110	0,0023
1200	1700	81210	50	75	53	1,0	0,36	K 81210	WS 81210	GS 81210	0,0072
1400	1900	81111	55	77	56	0,6	0,22	K 81111	WS 81111	GS 81111	0,0068
950	1400	81211	55	85	59	1,0	0,57	K 81211	WS 81211	GS 81211	0,013
1200	1800	81112	60	82	62	1,0	0,28	K 81112	WS 81112	GS 81112	0,0075
900	1350	81212	60	91	64	1,0	0,65	K 81212	WS 81212	GS 81212	0,018
1200	1700	81113	65	87	67	1,0	0,31	K 81113	WS 81113	GS 81113	0,0083
900	1300	81213	65	96	69	1,0	0,73	K 81213	WS 81213	GS 81213	0,020
1150	1650	81114	70	92	72	1,0	0,34	K 81114	WS 81114	GS 81114	0,0098
870	1250	81214	70	102	74	1,0	0,78	K 81214	WS 81214	GS 81214	0,023
1100	1600	81115	75	97	78	1,0	0,40	K 81115	WS 81115	GS 81115	0,0068
850	1200	81215	75	106	79	1,0	0,80	K 81215	WS 81215	GS 81215	0,015
1000	1500	81116	80	102	83	1,0	0,41	K 81116	WS 81116	GS 81116	0,0074
830	1150	81216	80	112	84	1,0	0,92	K 81216	WS 81216	GS 81216	0,029

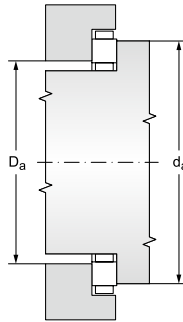
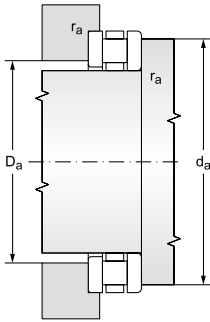
Cylindrical roller thrust bearings

d = 85 to 220 mm



12.8.1

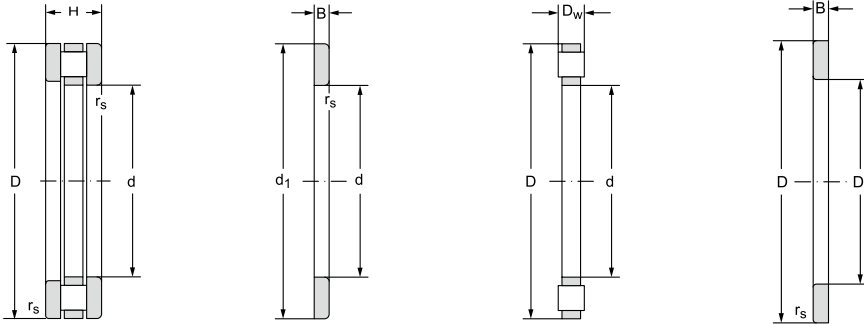
Main dimensions								Basic load rating		Fatigue load limit
d	D	H	d ₁	D ₁	B	D _w	r _s	dynamic	static	P _u
								C _a	C _{oa}	
mm								kN		kN
85	110	19,0	110,0	87,0	5,75	7,5	1,0	86	360	44,00
	125	31,0	125,0	88,0	9,50	12,0	1,0	166	624	76,00
90	120	22,0	120,0	92,0	6,50	9,0	1,0	102	444	53,40
	135	35,0	135,0	93,0	10,50	14,0	1,1	231	860	101,00
100	135	25,0	135,0	102,0	7,00	11,0	1,0	152	605	70,30
	150	38,0	150,0	103,0	11,50	15,0	1,1	255	1010	115,00
110	145	25,0	145,0	112,0	7,0	11,0	1,0	160	670	76,00
	160	38,0	160,0	113,0	11,5	15,0	1,1	255	988	110,00
120	155	25,0	155,0	122,0	7,0	11,0	1,0	167	729	80,80
	170	39,0	170,0	123,0	12,0	15,0	1,1	260	1020	111,00
130	170	30,0	170,0	132,0	9,0	12,0	1,0	189	865	93,40
	190	45,0	187,0	133,0	13,0	19,0	1,5	371	1390	147,00
140	180	31,0	178,0	142,0	9,5	12,0	1,0	201	920	97,40
	200	46,0	197,0	143,0	13,5	19,0	1,5	349	1300	135,00
150	190	31,0	188,0	152,0	9,5	12,0	1,0	210	980	102,00
	215	50,0	212,0	153,0	14,5	21,0	1,5	457	1840	187,00
160	200	31,0	198,0	162,0	9,5	12,0	1,0	202	980	100,00
	225	51,0	222,0	163,0	15,0	21,0	1,5	477	1900	190,00
170	215	34,0	213,0	172,0	10,0	14,0	1,1	282	1330	133,00
	240	55,0	237,0	173,0	16,5	22,0	1,5	529	2190	215,00
180	225	34,0	222,0	183,0	10,0	14,0	1,1	264	1210	119,00
	250	56,0	247,0	183,0	17,0	22,0	1,5	549	2390	232,00
190	240	37,0	237,0	193,0	11,0	15,0	1,1	302	1360	132,00
	270	62,0	267,0	194,0	18,0	26,0	2,0	691	2880	274,00
200	250	37,0	247,0	203,0	11,0	15,0	1,1	303	1470	141,00
	280	62,0	277,0	204,0	18,0	26,0	2,0	711	3050	286,00
220	270	37,0	267,0	223,0	11,0	15,0	1,1	329	1670	156,00
	300	62,0	297,0	224,0	18,5	26,0	2,0	738	3230	296,00



Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions				Weight	Bearing component designation			Min. axial load factor
grease	oil		d	d _a	D _a	r _a		~	Cage with rollers	Shaft ring	
min ⁻¹			mm			kg					
950	1500	81117	85	108	87	1,0	0,42	K 81117	WS 81117	GS 81117	0,012
800	1100	81217	85	119	90	1,0	1,26	K 81217	WS 81217	GS 81217	0,025
900	1300	81118	90	117	93	1,0	0,63	K 81118	WS 81118	GS 81118	0,014
750	1000	81218	90	129	95	1,0	1,75	K 81218	WS 81218	GS 81218	0,061
850	1200	81120	100	131	104	1,0	0,94	K 81120	WS 81120	GS 81120	0,028
670	900	81220	100	142	107	1,0	2,15	K 81220	WS 81220	GS 81220	0,056
800	1100	81122M	110	141	114	1,0	1,04	K 81122M	WS 81122	GS 81122	0,031
630	850	81222M	110	152	117	1,0	2,28	K 81222M	WS 81222	GS 81222	0,068
750	1050	81124M	120	151	124	1,0	1,10	K 81124M	WS 81124	GS 81124	0,038
530	800	81224M	120	162	127	1,0	2,55	K 81224M	WS 81224	GS 81224	0,076
700	950	81126M	130	165	135	1,0	2,72	K 81126M	WS 81126	GS 81126	0,049
530	700	81226M	130	181	137	1,5	4,30	K 81226M	WS 81226	GS 81226	0,170
670	900	81128M	140	175	145	1,0	2,05	K 81128M	WS 81128	GS 81128	0,059
530	650	81228M	140	191	147	1,5	4,61	K 81228M	WS 81228	GS 81228	0,162
530	850	81130M	150	185	155	1,0	2,10	K 81130M	WS 81130	GS 81130	0,067
480	630	81230M	150	211	158	1,5	6,04	K 81230M	WS 81230	GS 81230	0,300
630	830	81132M	160	195	165	1,0	2,23	K 81132M	WS 81132	GS 81132	0,085
450	600	81232M	160	220	168	1,5	6,27	K 81232M	WS 81232	GS 81232	0,330
600	800	81134M	170	209	176	1,0	2,98	K 81134M	WS 81134	GS 81134	0,110
430	560	81234M	170	235	180	1,5	7,80	K 81234M	WS 81234	GS 81234	0,430
560	750	81136M	180	219	185	1,0	3,10	K 81136M	WS 81136	GS 81136	0,130
410	540	81236M	180	245	190	1,5	8,35	K 81236M	WS 81236	GS 81236	0,470
530	700	81138M	190	233	197	1,0	3,90	K 81138M	WS 81138	GS 81138	0,170
380	500	81238M	190	265	200	2,0	10,6	K 81238M	WS 81238	GS 81238	0,680
510	680	81140M	200	243	206	1,0	4,10	K 81140M	WS 81140	GS 81140	0,190
370	490	81240M	200	275	210	2,0	12,2	K 81240M	WS 81240	GS 81240	0,790
500	670	81144M	220	263	226	1,0	4,60	K 81144M	WS 81144	GS 81144	0,240
360	480	81244M	220	296	230	2,0	13,4	K 81244M	WS 81244	GS 81244	0,910

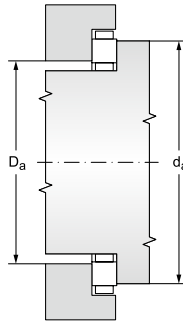
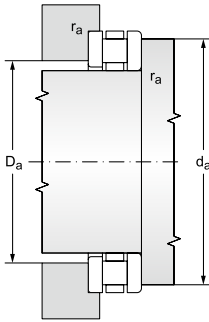
Cylindrical roller thrust bearings

d = 240 to 630 mm



12.8.1

Main dimensions								Basic load rating		Fatigue load limit
d	D	H	d ₁	D ₁	B	D _w	r _s	dynamic	static	P _u
								C _a	C _{oa}	
mm								kN		kN
240	300	45,0	297,0	243,0	13,5	18,0	1,5	368	2400	217,00
	340	78,0	335,0	244,0	23,0	32,0	2,1	1070	4850	430,00
260	320	45,0	317,0	263,0	13,5	18,0	1,5	488	2650	235,00
	360	79,0	355,0	264,0	23,5	32,0	2,1	1090	5200	452,00
280	350	53,0	347,0	283,0	15,5	22,0	1,5	672	3440	297,00
	380	80,0	375,0	284,0	24,0	32,0	2,0	1150	5510	470,00
300	380	62,0	376,0	304,0	18,5	25,0	2,0	851	4400	372,00
	420	95,0	415,0	304,0	28,5	38,0	3,0	1520	7210	599,00
320	400	63,0	396,0	324,0	19,0	25,0	2,0	878	4590	381,00
	420	95,0	435,0	325,0	28,5	38,0	3,0	1550	7480	616,00
340	420	64,0	416,0	344,0	19,5	25,0	2,0	871	4730	386,00
	460	96,0	455,0	345,0	29,0	38,0	3,0	1580	7890	635,00
360	440	65,0	436,0	364,0	20,0	25,0	2,0	885	4830	389,00
	500	110,0	495,0	365,0	32,5	45,0	4,0	2050	9900	779,00
380	460	65,0	456,0	384,0	20,0	25,0	2,0	915	5100	404,00
400	480	65,0	476,0	404,0	20,0	25,0	2,0	950	5370	420,00
420	500	65,0	495,0	424,0	20,0	25,0	2,0	985	5630	434,00
440	540	80,0	535,0	444,0	24,0	32,0	2,1	1370	7810	591,00
460	560	80,0	555,0	464,0	24,0	32,0	2,1	1400	8020	600,00
480	580	80,0	575,0	484,0	24,0	32,0	2,1	1460	8460	626,00
500	600	80,0	595,0	505,0	24,0	32,0	2,1	1490	8670	634,00
530	640	85,0	635,0	535,0	25,5	34,0	3,0	1670	10000	718,00
560	670	85,0	665,0	565,0	25,5	34,0	3,0	1760	10600	750,00
600	710	85,0	705,0	605,0	25,5	34,0	3,0	1850	11300	784,00
630	750	85,0	746,0	634,0	25,5	38,0	3,0	2160	13200	902,00



Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions				Weight	Bearing component designation			Min. axial load factor
grease	oil		d	d _a	D _a	r _a		~	Cage with rollers	Shaft ring	
min ⁻¹			mm			kg					
430	560	81148M	240	296	248	1,5	7,35	K 81148M	WS 81148	GS 81148	0,500
300	400	81248M	240	335	261	2,0	22,1	K 81248M	WS 81248	GS 81248	1,900
400	530	81152M	260	316	268	1,5	7,90	K 81152M	WS 81152	GS 81152	0,560
280	380	81252M	260	353	280	2,0	24,1	K 81252M	WS 81252	GS 81252	2,300
360	480	81156M	280	346	288	1,5	10,5	K 81156M	WS 81156	GS 81156	1,100
260	360	81256M	280	373	300	2,0	26,1	K 81256M	WS 81256	GS 81256	2,400
320	430	81160M	300	373	315	2,0	16,4	K 81160M	WS 81160	GS 81160	1,500
220	320	81260M	300	413	328	2,5	40,3	K 81260M	WS 81260	GS 81260	4,200
300	400	81164M	320	394	334	2,0	18,0	K 81164M	WS 81164	GS 81164	1,900
200	300	81264M	320	434	348	2,5	42,6	K 81264M	WS 81264	GS 81264	4,800
280	380	81168M	340	414	354	2,0	19,4	K 81168M	WS 81168	GS 81168	2,000
200	280	81268M	340	452	367	2,5	46,9	K 81268M	WS 81268	GS 81268	5,300
270	370	81172M	360	434	374	2,0	19,4	K 81172M	WS 81172	GS 81172	2,100
180	260	81272M	360	492	393	3,0	65,3	K 81272M	WS 81272	GS 81272	8,800
260	360	81176M	380	453	393	2,0	23,5	K 81176M	WS 81176	GS 81176	2,20
250	350	81180M	400	473	413	2,0	24,3	K 81180M	WS 81180	GS 81180	2,60
240	340	81184M**	420	493	433	2,0	27,0	K 81184M	WS 81184	GS 81184	2,80
210	310	81188M**	440	533	459	2,0	41,6	K 81188M	WS 81188	GS 81188	5,30
200	300	81192M**	460	553	479	2,0	44,0	K 81192M	WS 81192	GS 81192	5,80
190	280	81196M**	480	583	500	2,0	47,3	K 81196M	WS 81196	GS 81196	6,10
180	270	811/500M**	500	592	519	2,0	49,8	K 811/500M	WS 811/500	GS 811/500	7,10
180	260	811/530M**	530	632	554	2,5	59,1	K 811/530M	WS 811/530	GS 811/530	9,20
170	260	811/560M**	560	662	584	2,5	62,3	K 811/560M	WS 811/560	GS 811/560	9,90
170	240	811/600M**	600	702	624	2,5	34,1	K 811/600M	WS 811/600	GS 811/600	12,00
160	220	811/630M**	630	732	650	2,5	82,3	K 811/630M	WS 811/630	GS 811/630	17,00

12.9 SPHERICAL ROLLER THRUST BEARINGS

Spherical roller thrust bearings have a large number of asymmetrical spherical rollers with good adhesion to shaft and housing rings, making them suitable for capturing large axial loads as well as certain radial loads at relatively high speeds. Bearings are detachable, which can be utilized during installation. Bearings are manufactured with a pressed steel-sheet cage, which forms an integral unit with the shaft ring and spherical rollers. In addition, Dunlop also manufactures bearings with a massive cage. A massive brass cage is guided by the sleeve fastened in the shaft ring bore and together also form an integral unit. The internal bearing design with massive cage requires oil lubrication. In other cases, the bearings may also be lubricated with greases – preferably with EP additives. In such cases, a sufficient amount of lubricant must be supplied into contact with the spherical roller faces and the guide flanges. Both variants of the structural design are illustrated in figure 12.9.1.

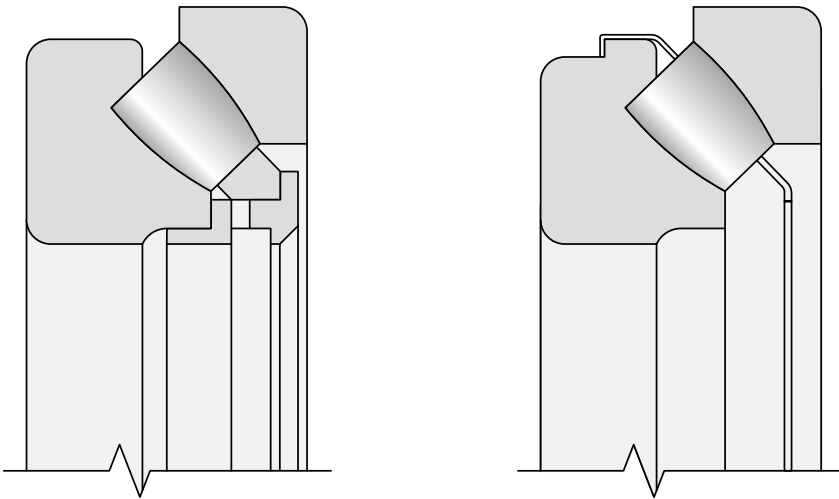


Fig. 12.9.1

Main dimensions

The main dimensions of bearings are consistent with standard ISO 104 and are listed for individual bearings in the tables of the publication.

Labelling

Labelling of standard bearings is specified in the tables of the publication. Divergence from the standard design is marked by additional characters specified in the catalogue introduction.

J Bearing with cage made from steel sheeting

EJ Optimized internal design with steel cage

M Bearing with massive brass cage

EM Optimized internal design with massive brass cage

EF Optimized internal design with massive steel cage

Cage

Spherical roller thrust bearings in "M" and "EM" versions have brass cages guided by the steel sleeve on the shaft ring. "EF" design is identical to "EM"; the cage material is steel. "J" version bearings have a steel-sheet cage guided on a shaft ring. "J" -version bearings are interchangeable with bearings with a massive brass cage. If a bearing with a massive brass cage is to be substituted in a loading, where the shaft ring is supported on the shaft by the steel sleeve face that guides the cage by a bearing designed with a sheet metal cage, then a spacing ring must be inserted between the shaft ring and the original fitting on the shaft – see figure 12.9.2. When replacing bearings of older designs or from a different manufacturer, the dimensions of the spacing ring must also be checked or machined to the dimension needed (fig. 12.9.3). The recommended outer ring diameter is specified in the tables. The ring must be tempered and the faces must be precisely grinded.

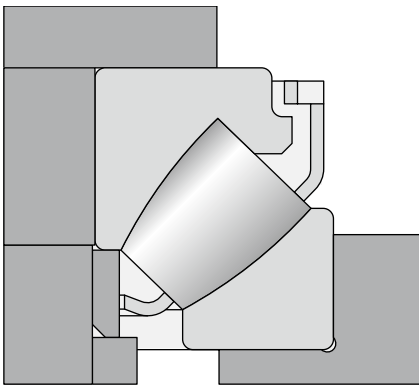


Fig. 12.9.2

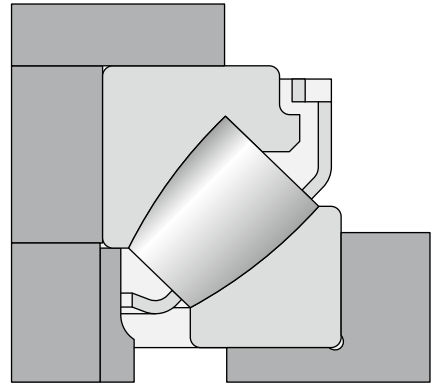


Fig. 12.9.3

Precision

Bearings are currently produced at a normal degree of precision P0, which is not marked. The dimensional and operational precision tolerances are listed in table 7.16.

Self-alignment ability

The spherical raceway of the bearing housing ring during regular operating conditions ($F_a \leq 0.1C_a$) enables self-alignment from the centre position without interfering with the proper bearing function by the values specified in the table.

Table 12.9.1

Bearing type	Permissible misalignment
292	2°
293	2°30'
294	3°

Loading structure

The connecting dimensions, specified in the tables of the publication, are suitable for bearings, where the load $F_a = 0.1C_a$. Bearing rings should be supported along their entire faces during greater loads, i.e. $d_a = d_1$ a $D_a = D_1$.

When using bearings with a sheet-metal cage, we recommend enlarging the hub bore near the cage by 20mm to prevent any shaft onset from coming into contact with the cage [fig. 12.9.4].

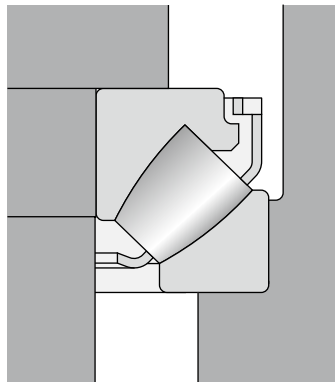


Fig. 12.9.4

Axial equivalent dynamic load

$$P_a = F_a + 1,2F_r \quad (F_r \leq 0,55F_a) \quad [\text{kN}]$$

Axial equivalent static load

$$P_{oa} = F_a + 2,7F_r \quad (F_r \leq 0,55F_a) \quad [\text{kN}]$$

The static safety coefficient for Spherical roller thrust bearings must be $s_o \geq 4$.

Minimal axial load

Higher rotation speeds in spherical roller thrust bearings present a risk of rolling elements sliding between the raceways due to the centrifugal forces in cases, when the axial load F_a falls below the permissible value. The following relationship is used for calculating the $F_{a \min}$ value:

when $1.8F_r < 0.0005 C_0$

$$F_{a \min} = 0,0005 C_0 + M (0,001n)^2$$

otherwise

$$F_{a \min} = 1,8F_r + M (0,001n)^2$$

$F_{a \min}$ minimal axial load [kN]

F_r radial load [kN]

C_{oa} axial static load rating [kN]

. (values are provided in the tables of the publication)

n rotating speed [min⁻¹]

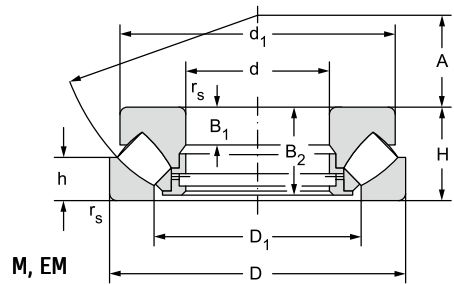
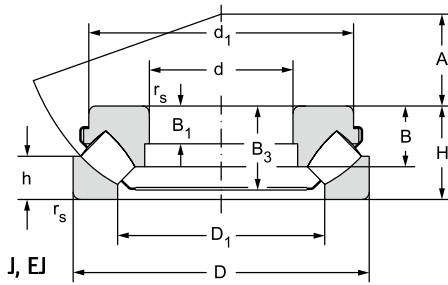
M coefficient of minimum axial load

. (values are provided in the tables of the publication)

If the external axial load of the bearing is too small or if the bearing is unloaded during operation, e.g. in bearing pairs, then an axial load must be created, e.g. by the use of springs. If a radial load is simultaneously acting, the following condition must be met: $F_r \leq 0.55F_a$.

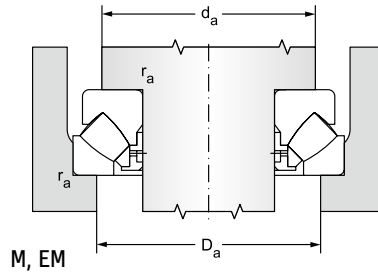
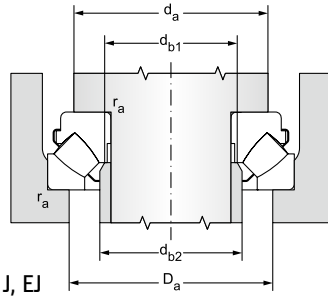
Spherical roller thrust bearings d = 50 to 1120 mm

d = 50 to 130 mm



12-9.1

Main dimensions											Basic load rating		
d	D	H	d ₁	D ₁	B	B ₁	B ₂	B ₃	h	A	r _s	dynamic	static
mm											C _a	C _{0a}	
											kN		
50	110	36	95,0	70,0	25	13		32,0	20,5	32	1,5	299	930
60	130	42	118,0	88,0	28	15	39,5	35,5	20,0	38	1,5	287	809
	130	42	112,3	87,0	27	27		37,0	20,0	38	1,2	345	951
65	140	45	128,0	96,5	28	16	42,5	38,0	21,0	42	2,0	340	973
	140	45	122,8	93,0	29,5	16		39,0	21,0	42	2,0	417	1155
70	150	48	137,0	102,0	32	17	45,5		23,0	44	2,0	371	1070
	150	48	131,6	105,0	31	17		43,5	23,0	44	2,0	453	1280
75	160	51	146,0	109,0	34,5	18	48,0		24,0	47	2,0	429	1250
	160	51	141,8	108,0	33,5	18		47,0	24,0	47	2,0	527	1500
80	170	54	155,0	116,0	36	19	51,0		24,0	50	2,1	464	1370
	170	54	150,8	116,0	36	19		46,5	24,0	50	2,1	625	1640
85	180	58	164,0	125,0	38	21	55,0		28,0	54	2,1	527	1570
	180	58	164,0	123,0	37	21		50,0	28,0	54	2,1	713	1945
90	190	60	174,0	130,0		22	57,0		29,0	56	2,1	578	1780
	190	60	170,8	130,0		22	57,0		29,0	56	2,1	724	2172
100	170	42	150,0	128,0	26,2	15		37,3	20,5	58	1,5	449	1400
	210	67	193,0	144,5		24	64,0		32,0	62	3,0	705	2170
	210	67	189,8	144,0		24	64,0		32,0	62	2,5	891	2578
110	190	48	176,0	143,0		16	45,5		23,0	64	2,0	442	1420
	190	48	176,0	143,0	31	16		42,0	23,0	64	2,0	587	1760
	230	73	212,0	160,0		26	69,0		35,0	69	3,0	817	2600
	230	73	209,5	159,0		27			35,0	69	2,5	1053	3078
120	210	54	194,0	157,5		18	51,0		26,0	70	2,1	577	1830
	210	54	187,1	155,5	35,5	19		47,0	27,0	70	2,1	670	2100
	250	78	229,0	172,0		29	74,0		37,0	74	4,0	934	3000
	250	78	226,8	173,0		29			37,0	74	4,0	1215	3590
130	225	58	205,0	170,0	37	19	55,0		28,0	76	2,1	647	2070
	225	58	201,5	165,7		21		49,6	30,1	76	2,1	788	2950
	270	85	247,0	188,0	55,5	31	81,0		41,0	81	4,0	1090	3540
	270	85	245,0	188,0		31			41,0	81	4,0	1437	4300

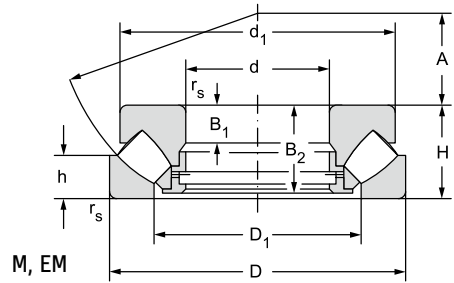
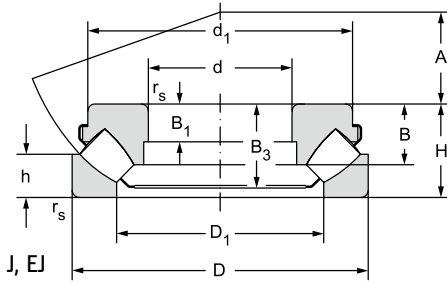


Deliveries of bearings marked * must be first consulted with the manufacturer, ** NEW FORCE

Fatigue load limit	Limiting speed for lubrication with	Bearing designation	Abutment and fillet dimensions						Weight	Minimum axial load factor
			d	d _a	d _{b1}	D _a	d _{b2}	r _a		
P _v	oil		min	max	max	max	max	-		
kN	min ⁻¹		mm						kg	
110	3100	29410EJ**	50	70	55,8	90	59,5	1,5	1,67	0,11
99	2400	29412M*	60	90		109		1,5	2,60	0,08
120	2600	29412EJ**		90	67,0	117	67	1,5	2,47	0,11
120	2200	29413M*	65	100		118		2,0	3,30	0,12
140	2400	29413EJ**		100	72,0	118	72	2,0	3,26	0,17
130	2000	29414M*	70	105		126		2,0	4,00	0,14
160	2200	29414EJ**		105	77,5	126	77,5	2,0	3,98	0,2
150	2000	29415M*	75	115		134		2,0	4,90	0,2
180	2200	29415EJ**		115	82,5	134	82,5	2,0	4,90	0,28
170	1900	29416M*	80	120		141		2,0	5,80	0,23
200	2000	29416EJ**		120	88,0	141	88	2,0	5,80	0,34
190	1800	29417M*	85	130		153		2,0	6,90	0,31
240	1800	29417EJ**		130	94,0	153	94	2,0	6,67	0,47
220	1700	29418M*	90	135		161		2,0	8,10	0,4
260	1800	29418EJ**		135	99,0	161	99	2,0	8,10	0,59
170	2000	29320EJ**	100	130	107,0	147	107	1,5	3,95	0,25
260	1500	29420M*		150		178		2,5	11,8	0,59
310	1600	29420EJ**		150	110,0	175	110	3,0	10,8	0,83
150	1600	29322M*	110	145		165		2,0	5,50	0,25
190	1600	29322EJ**		145	117,0	165	117	2,0	5,40	0,39
270	1400	29422M*		165		196		2,5	14,5	0,85
320	1400	29422EJ**		165	120,5	193	129	2,5	13,5	1,2
190	1400	29324M**	120	160		184		2,0	7,60	0,42
220	1600	29324EJ**		160	128,0	181	128	2,0	7,41	0,55
300	1300	29424M*		180		212		3,0	18,1	1,1
360	1300	29424EJ**		180	132,0	209	140	3,0	17,5	1,6
210	1300	29326M**	130	170		198		2,0	9,30	0,54
300	1500	29326EJ**		175	138,0	194	143	2,0	9,08	1,1
350	1200	29426M*		195		229		3,0	22,5	1,6
430	1200	29426EJ**		195	142,5	227	153	3,0	21,6	2,3

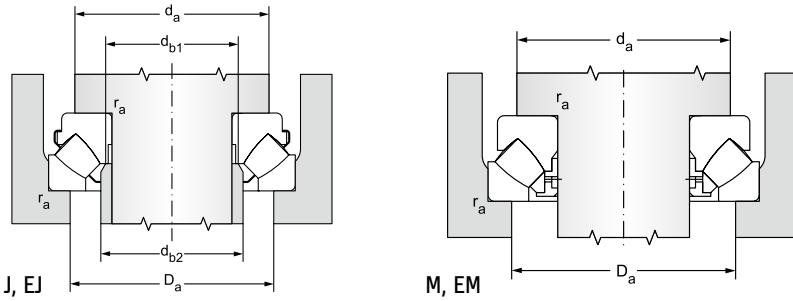
Spherical roller thrust bearings

d = 140 to 220 mm



12-91

Main dimensions												Basic load rating	
d	D	H	d ₁	D ₁	B	B ₁	B ₂	B ₃	h	A	r _s	dynamic	static
mm												C _a	C _{0a}
												kN	
140	240	60	219,0	183,0		20	57,0		29,0	82	2,1	695	2310
	240	60	214,9	178,9	38,5	22		52,4	30,0	82	2,1	876	3150
	280	85	257,0	197,5		31	81,0		41,0	86	4,0	1164	3750
	280	85	254,0	196,5	54	32		74,0	41,0	86	4,0	1554	4686
150	250	60	229,0	193,0		20	57,0		29,0	87	2,1	718	2430
	250	60	222,5	189,6	38	22		53,8	28,0	87	2,1	889	3236
	300	90	276,0	211,5		32	86,0		44,0	92	4,0	1318	4270
	300	90	273,0	209,5	58	34		79,0	44,0	92	4,0	1675	5241
160	270	67	248,0	207,0		23	64,0		32,0	92	3,0	831	2810
	270	67	243,6	202,3	42	24		58,6	33,0	92	3,0	1067	3977
	320	95	306,0	226,0		34	91,0		45,0	99	5,0	1504	4810
	320	95	282,8	221,7	60,5	35		82,0	45,5	99	5,0	1854	5930
170	280	67	258,0	215,0		23	64,0		32,0	96	3,0	858	2950
	280	67	253,6	214,6	42,2	24		60,0	32,0	96	3,0	1090	4098
	340	103	324,0	240,0		37	99,0		50,0	104	5,0	1669	5380
	340	103	301,0	236,0	65,5	36		88,0	50,0	104	5,0	2029	6230
180	300	73	277,0	231,0		25	69,0		35,0	103	3,0	1014	3530
	300	73	270,4	228,3	46	26		64,3	35,5	103	3,0	1280	4813
	360	109	342,0	255,0		39	105,0		52,0	110	5,0	1854	6010
	360	109	320,6	248,7	69,5	38		93,0	53,0	110	5,0	2297	7160
190	320	78	294,0	246,0		27	74,0		38,0	110	4,0	1120	4010
	320	78	284,4	239,5	49	28		68,0	36,0	110	4,0	1483	4840
	380	115	360,0	270,0		41	111,0		55,0	117	5,0	2019	6610
	380	115	339,2	263,0	73	41		98,0	55,5	117	5,0	2493	7750
200	280	48	264,0	233,0	32	17	45,0		24,0	108	2,1	731	3150
	340	85	325,0	261,0		29	81,0		41,0	116	4,0	1300	4740
	340	85	302,8	253,6	53,5	29		73,0	40,0	116	4,0	1669	5480
	400	122	365,0	284,0		43	117,0		59,0	122	5,0	2210	7510
400	122	355,7	276,5	77	43		104,0	59,4	122	5,0	2791	8790	
220	300	48	286,0	252,0		17	46,0		24,0	117	2,0	757	3350
	360	85	345,0	280,0		29	81,0		41,0	125	4,0	1340	4970
	360	85	324,4	273,0	55	29		74,0	41,0	125	4,0	1792	6300
	420	122	400,0	305,0		43	117,0		58,0	132	6,0	2328	7970
	420	122	375,3	296,0	77	44		103,0	58,5	132	6,0	2905	9070

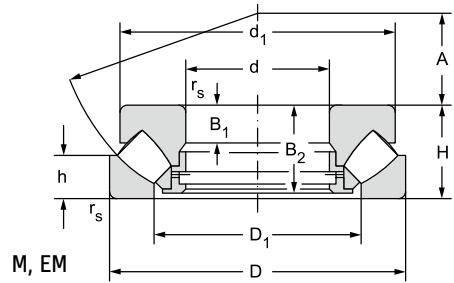
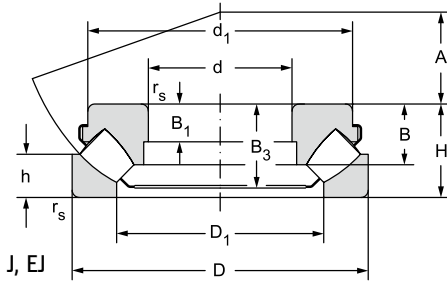


Deliveries of bearings marked * must be first consulted with the manufacturer, ** NEW FORCE

Fatigue load limit	Limiting speed for lubrication with	Bearing designation	Abutment and fillet dimensions						Weight	Minimum axial load factor
			d	d _a	d _{b1}	D _a	d _{b2}	r _a		
P _u	oil		min	max	max	max	max	-		
kN	min ⁻¹		mm						kg	
230	1300	29328M**	140	185		211		2,0	11,0	0,67
320	1400	29328EJ**		185	148,0	208	154	2,0	10,5	1,2
370	1200	29428M**		205		239		3,0	24,2	1,8
460	1200	29428EJ**		205	153,0	239	162	3,0	23,0	2,7
240	1200	29330M**	150	195		222		2,0	11,5	0,74
320	1400	29330EJ**		195	158,0	219	163	2,0	10,9	1,3
410	1100	29430M**		220		257		3,0	29,4	2,3
500	1100	29430EJ**		220	163,0	275	175	3,0	28,2	3,4
270	1100	29332M**	160	210		239		2,5	15,2	0,99
390	1200	29332EJ**		210	169,0	235	176	2,5	14,4	2
450	1000	29432M**		230		274		4,0	35,5	2,9
560	1000	29432EJ**		235	175,0	270	179	4,0	33,3	4,4
280	1100	29334M**	170	220		248		2,5	16,0	1,1
390	1200	29334EJ**		220	178,0	245	187,5	2,5	15,1	2,1
500	940	29434M**		245		291		4,0	43,7	3,6
570	950	29434EJ**		250	185,0	286	199	4,0	40,1	4,9
330	1000	29336M**	180	235		266		2,5	20,3	1,6
450	1100	29336EJ**		235	189,0	262	195	2,5	19,1	2,9
540	890	29436M**		260		307		4,0	52,0	4,5
650	900	29436EJ**		265	195,0	304	210	4,0	48,1	6,4
370	940	29338M*	190	250		283		3,0	24,8	2
450	1100	29338EJ**		250	199,0	280	208,5	3,0	23,3	2,9
590	840	29438M**		275		325		4,0	60,0	5,5
690	850	29438EJ**		280	206,0	321	223	4,0	55,7	7,5
300	1150	29240EM**	200	235		260		2,0	8,76	1,2
430	890	29340M**		265		300		3,0	33,0	2,8
500	950	29340EJ**		265	211,0	300	221,5	3,0	28,9	3,8
660	790	29440M*		290		343		4,0	69,0	7,1
770	800	29440EJ**		298	217,5	334	234	4,0	66,3	9,7
310	1300	29244EM**	220	285		260		2,0	9,64	1,4
440	840	29344M**		285		320		3,0	32,8	3,1
560	950	29344EJ**		285	229,0	316	237,5	3,0	31,6	5
690	750	29444M**		310		364		5,0	74,0	7,9
780	750	29444EJ**		315	238,0	355	254	5,0	69,1	10

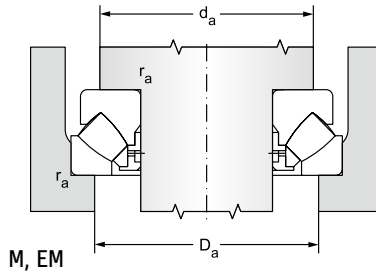
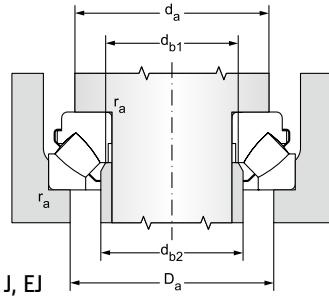
Spherical roller thrust bearings

d = 240 to 380 mm



12-9.1

Main dimensions												Basic load rating	
d	D	H	d ₁	D ₁	B	B ₁	B ₂	B ₃	h	A	r _s	dynamic	static
mm												C _a	C _{0a}
												kN	
240	340	60	330,0	283,0		19	57,0		30,0	130	2,1	793	3450
	380	85	365,0	300,0		29	81,0		41,0	135	4,0	1340	5190
	380	85	343,7	294,8	54	29		75,0	40,5	135	4,0	1844	6490
	440	122	420,0	321,0		43	117,0		59,0	142	6,0	2410	8420
260	440	122	393,0	320,0	76	44		103,0	59,0	142	6,0	3039	9770
	360	60	350,0	302,0		19	57,0		30,0	139	2,1	825	3650
	420	95	405,0	325,0		32	91,0		45,0	148	5,0	1780	6820
	420	95	380,3	320,4	61	32		84,0	46,0	148	5,0	2307	8310
280	480	132	460,0	346,0		48	127,0		64,0	154	6,0	2812	9870
	480	132	430,7	344	86	48		117	63	154	6	3667	12080
	380	60	370,0	323,0		19	57,0		30,0	150	2,1	872	3950
	440	95	423,0	345,0		32	91,0		46,0	158	5,0	1780	7100
300	440	95	401,7	342,1	62	32		84,0	45,0	158	5,0	2276	8490
	520	145	495,0	380,0		52	140,0		68,0	166	6,0	3327	11840
	520	145	468,9	370,8	95	52		125,0	70,0	166	6,0	4604	15750
	420	73	405,0	355,0		21	69,0		38,0	162	3,0	1061	4670
320	480	109	460,0	375,0		37	105,0		50,0	168	5,0	2180	8500
	480	109	431,9	366,7	70	36		95,0	51,0	168	5,0	2730	11000
	540	145	515,0	398,0		52	140,0		70,0	175	6,0	3317	11850
	540	145	489,2	370,0	95	55		128,0	70,0	175	6,0	4645	16460
340	440	73	430,0	375,0		21	69,0		38,0	172	3,0	1102	4930
	500	109	482,0	395,0		37	105,0		53,0	180	5,0	2180	8850
	500	109	456,1	387,0	78	37		95,0	53,0	180	5,0	2936	10920
	580	155	555,0	430,0		55	149,0		75,0	191	7,5	4007	14690
360	580	155	525,6	421,8	102	55		134,0	74,5	191	7,5	5160	21200
	460	73	436,0	389,5		21	69,0		37,0	183	3,0	1442	6600
	540	122	520,0	424,0		41	117,0		59,0	192	5,0	2719	10550
	620	170	590,0	452,0		61	164,0		82,0	201	7,5	4481	16410
380	620	170	561,8	442,2	112	54		146,0	84,0	201	7,5	5995	25080
	500	85	485,0	420,0		25	81,0		44,0	194	4,0	1442	6600
	560	122	540,0	444,0		41	117,0		59,0	202	5,0	2730	11030
	520	85	505,0	440,0		27	81,0		42,0	202	4,0	1597	7510
380	670	175	622,0	504,0		63	168,0		85,0	222	7,5	4841	19100

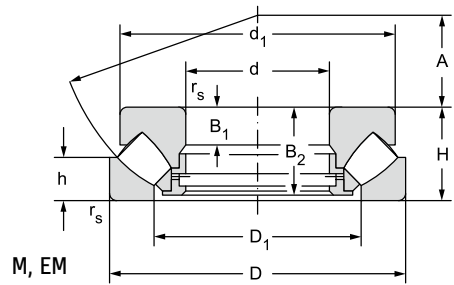
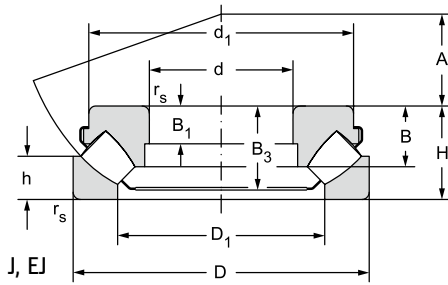


Deliveries of bearings marked * must be first consulted with the manufacturer, ** NEW FORCE

Fatigue load limit	Limiting speed for lubrication with	Bearing designation	Abutment and fillet dimensions						Weight	Minimum axial load factor
			d	d _a	d _{b1}	D _a	d _{b2}	r _a		
P _u	oil			min	max	max	max			
kN	min ⁻¹		mm						kg	
310	890	29248M**	240	285		311		2,0	16,7	1,5
450	790	29348M*		300		340		3,0	35,3	3,4
560	900	29348EJ**		305	249,0	336	256	3,0	33,4	5,3
710	750	29448M**		330		383		5,0	79,0	8,9
830	750	29448EJ**		335	258,0	377	276	5,0	73,5	12
320	890	29252M**	260	305		331		2,0	18,5	1,7
580	750	29352M*		330		374		3,0	48,5	5,8
700	800	29352EJ**		335	272,0	370	283,2	4,0	46,9	8,6
810	670	29452M**		360		419		5,0	105	12
990	670	29452EJ**		406	278	378	296	5	96,1	18
340	840	29256M**	280	325		351		2,0	19,5	2
590	710	29356M*		350		394		4,0	52,5	6,3
710	800	29356EJ**		355	293,0	390	302	4,0	49,5	9
950	630	29456M**		390		453		5,0	132	18
1 300	630	29456EJ**		395	298,0	446	316,5	5,0	127	31
390	750	29260M**	300	355		386		2,5	30,5	2,7
690	630	29360M*		380		429		4,0	74,0	9
890	700	29360EJ**		385	312,0	423	325,8	4,0	68,7	15
940	600	29460M**		410		471		5,0	140	18
1 300	600	29460EJ**		415	318,0	465	339	5,0	133	34
400	710	29264M**	320	375		406		2,5	32,9	3
710	630	29364M*		400		449		4,0	77,0	9,8
870	670	29364EJ**		405	332,0	442	336	4,0	72,1	15
1 100	560	29464M*		435		507		6,0	175	27
1 600	560	29464EJ**		450	342,0	500	364	6,0	164	56
530	850	29268EM**	340	400		422		2,5	33,0	5,4
820	560	29368M**		430		484		4,0	103	14
1 300	500	29468M**		465		451		6,0	218	34
1 900	380	29468EJ**		475	358,0	530	364	6,0	211	79
520	630	29272M**	360	420		461		3,0	51,8	5,4
850	560	29372M**		450		504		4,0	107	15
580	600	29276M**	380	440		480		3,0	52,8	7,1
1 400	470	29476EM**		504		570		6,0	263	46

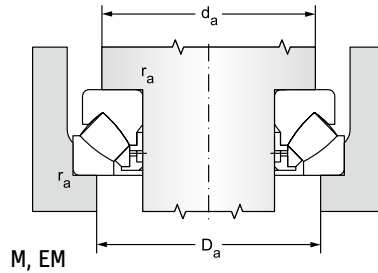
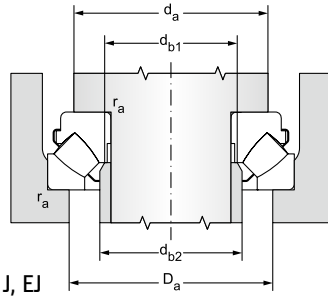
Spherical roller thrust bearings

d = 400 to 750 mm



12.9.1

Main dimensions											Basic load rating		
d	D	H	d ₁	D ₁	B	B ₁	B ₂	B ₃	h	A	r _s	dynamic	static
mm											C _a	C _{0a}	
											min	kN	
400	540	85	526,0	460,0		27	81,0		42,0	212	4,0	1648	7900
	620	132	596,0	494,0		44	127,0		64,0	225	6,0	3389	14120
	710	185	680,0	530,0		67	178,0		89,0	236	7,5	7014	26500
420	580	95	553,0	484,2		30	91,0		46,0	225	5,0	2369	11230
	650	140	626,0	520,0		48	135,0		68,0	235	6,0	3512	14700
	730	185	663,0	540,0		67	175,0		90,0	244	7,5	7056	31020
440	680	145	655,0	546,0		49	140,0		70,0	245	6,0	3976	16850
	780	206	745,0	576,0		74	199,0		100,0	260	9,5	6468	24650
	780	206	718	554		77	199		101	257	9,5	8250	33270
480	650	103	635,0	554,0	61	33	99,0		55,0	259	6,0	1978	11000
	850	224	772,0	611,6		81	214,0		108,0	280	9,5	9935	44398
500	670	103	654,0	574,0		33	99,0		55,0	268	5,0	2472	12120
	750	150	725,0	611,0		51	144,0		74,0	280	6,0	4347	18660
	870	224	801,0	625,6		81	218,0		110,0	290	9,5	10326	48568
530	800	160	772,0	648,0		54	154,0		76,0	295	7,5	5284	22730
600	800	122	760,0	680,0		44	117,0		60,0	321	5,0	3832	19060
	900	180	850,0	731,0		64	171,0		87,0	335	7,5	7004	31500
630	850	132	820,0	724,0		42	127,0		67,0	338	6,0	4378	22500
	950	190	880	743		68	183		92	359	9,5	8940	38700
	1090	280	995	796		107	270		137	365	12	15244	63200
670	900	140	858,0	762,0		50	130,0		73,0	361	6,0	4635	23280
	1150	290	1045	844		110	280		141	387	15	16274	69300
710	1060	212	985	835		74	205		103	405	9,5	10506	46400
	1220	308	1110,0	899,0		118	298,0		149,0	415	15,0	18128	76500
750	1000	150	950	838		52	144		74	409	6	6448	31600
	1120	224	1086	890		76	216		109	415	9,5	9909	45800
	1280	315	1170	942		122	305		153	436	15	19776	86600

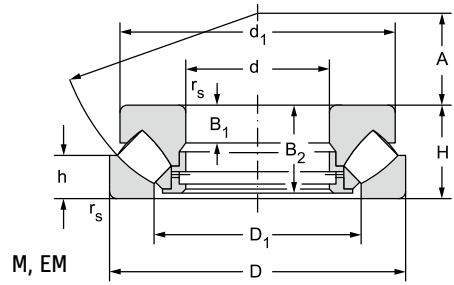
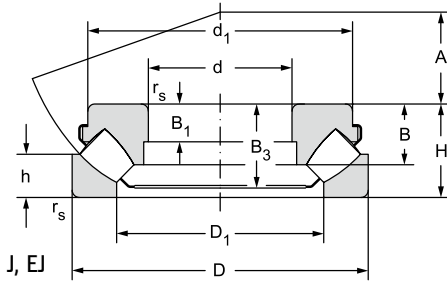


Deliveries of bearings marked * must be first consulted with the manufacturer, ** NEW FORCE

Fatigue load limit	Limiting speed for lubrication with	Bearing designation	Abutment and fillet dimensions						Weight	Minimum axial load factor
			d	d _a	d _{b1}	D _a	d _{b2}	r _a		
P _v	oil			min	max	max	max	-		
kN	min ⁻¹		mm						kg	
610	600	29280M**	400		460,0	500	3		55,3	7,8
1 100	500	29380M**			498,0	557	5		150	25
1 900	450	29480EM**			550,0	615	6		306	88
850	700	29284EM**	420	500		525		4	73,0	16
1 100	450	29384M**			523,0	585	5		170	27
2 200	430	29484EM**			592,0	684	8		308	120
1 200	450	29388M**	440		548,0	614	5		190	35
1 700	400	29488M**			592,0	684	8		407	76
2 400	380	T29488EM**		612		662		8	412	140
800	500	29296M**	480		558,0	603	4		96,5	15
3 100	340	29496EM**			660,0	735	8		518	250
870	470	292/500M**	500		578,0	622	4		101	18
1 300	400	293/500M**			613,0	680	5		220	44
3 300	340	294/500EM**		685		755		8	548	290
1 600	380	293/530M**	530		651,0	724	6		286	65
1 300	450	292/600EM**	600	700		725		4	160	45
2 100	330	293/600EM**			735,0	815	6		390	120
1 500	350	292/630M**	630		730,0	789	5		211	63
2500	320	293/630EM**		795		860		8	488	190
4000	260	294/630EM**		860		950		10	1108	500
1 500	380	292/670EM**	670	790		815		5	237	68
4300	240	294/670EM**		905		1000		12	1269	600
2900	280	293/710EM**	710	890		960		8	665	270
4 700	220	T 294/710EM**		970		1050		12	1420	730
2000	325	292/750EM**	750	880		925		5	327	120
2800	260	293/750EM**		935		1000		8	775	260
5200	200	274/750EF**		1015		1120		12	1660	940

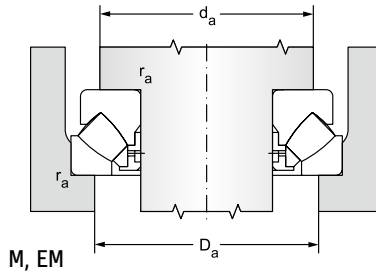
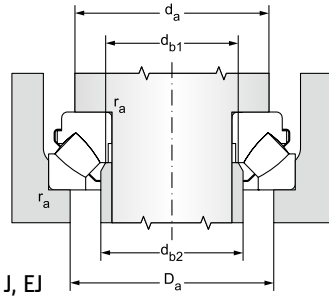
Spherical roller thrust bearings

d = 800 to 1120 mm



Main dimensions											Basic load rating		
d	D	H	d_1	D_1	B	B_1	B_2	B_3	h	A	r_s	dynamic	static
											C_a	C_{0a}	
mm											kN		
800	1060	155	1010	890		52	149		77	434	7,5	6942	35200
	1180	230	1146	943		78	222		111	440	9,5	10506	49900
	1360	335	1300,0	1040,0		120	324,0		162,0	462	15,0	16830	72360
	1360	335	1250	1010		122	324		165	462	15	21321	94800
850	1120	160	1060	945		47	154		82	455	7,5	7117	36700
950	1250	180	1185	1056		58	174		88	507	7,5	8755	46400
1000	1460	276	1365	1165		100	267		137	561	12	18334	88100
1060	1400	206	1325	1183		66	199		100	566	9,5	11124	59600
1120	1460	206	1385	1243		70	199		97	601	9,5	11948	63100

12.9.1



Deliveries of bearings marked * must be first consulted with the manufacturer, ** NEW FORCE

Fatigue load limit	Limiting speed for lubrication with	Bearing designation	Abutment and fillet dimensions					Weight	Minimum axial load factor	
			d	d _a	d _{b1}	D _a	d _{b2}			r _a
P _v	oil		min	max	max	max	max	-		
kN	min ⁻¹		mm					kg		
2200	320	292/800EM**	800	935		980		6	383	150
3000	240	293/800EM**		995		1060		8	871	310
4 300	220	294/800M **			1055,0	1200	12		2010	650
5600	190	294/800EF**		1080		1185		12	2039	1100
2200	300	292/850EM**	850	980		1030		6	428	170
2700	260	292/950EM**	950	1095		1155		6	604	270
5000	180	293/1000EF**	1000	1245		1330		10	1560	970
3400	220	292/1060EF**	1060	1225		1290		8	866	440
3500	220	292/1120EF**	1120	1300		1365		8	906	500