

## 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.

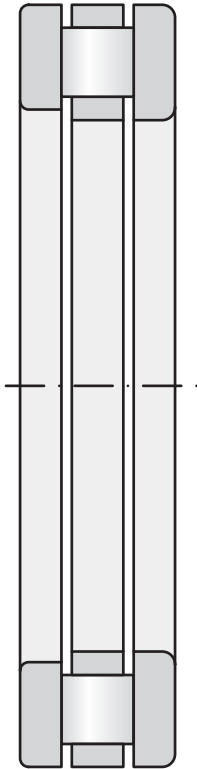


Fig. 12.8.1

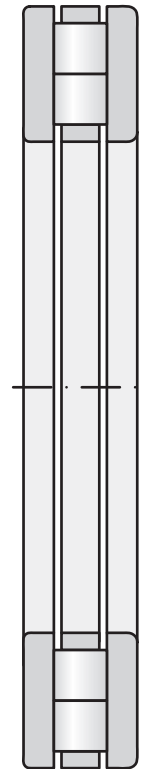


Fig. 12.8.2





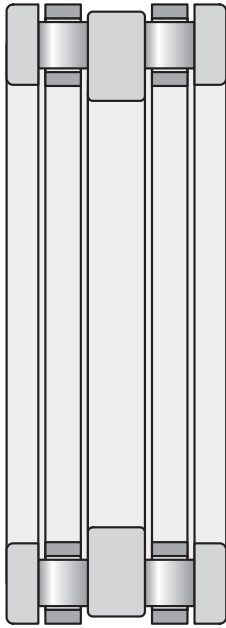


Fig. 12.8.4

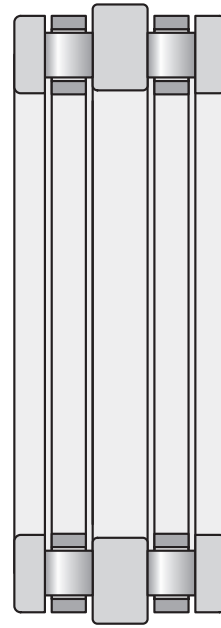


Fig. 12.8.5

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	Dw	DIN 5402-1:1993
Shaft ring, WS		
Bore diameter	d	Normal tolerance
Outer diameter	d1	-
Thickness	B	h11
Axial runout	Si	Normal tolerance
Tělesový kroužek, GS		
Outer diameter	D	Normal tolerance
Bore diameter	D1	-
Thickness	B	h11
Axial runout	Se	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 <sup>-1</sup> ]

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.

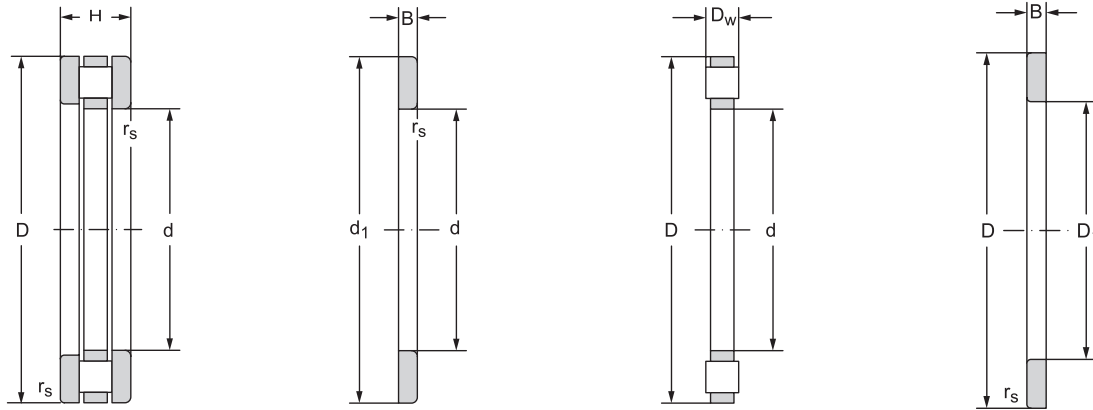
Table 12.8.3

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

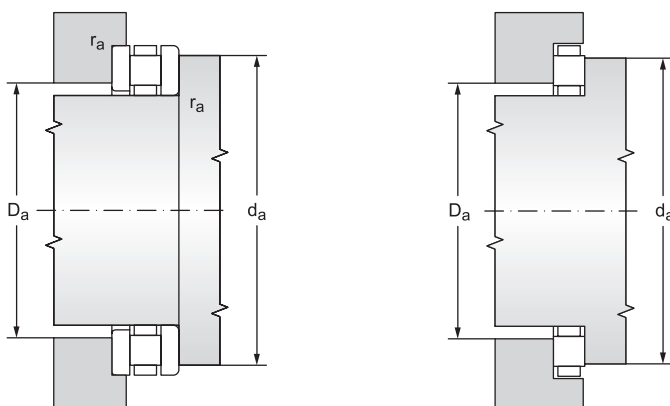
d = 15 to 80 mm



12.8.1

Main dimensions								Basic load rating		Fatigue load limit
d	D	H	d <sub>1</sub>	D <sub>1</sub>	B	D <sub>w</sub>	r <sub>s</sub>	dynamic	static	
							min	C <sub>a</sub>	C <sub>oa</sub>	P <sub>u</sub>
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



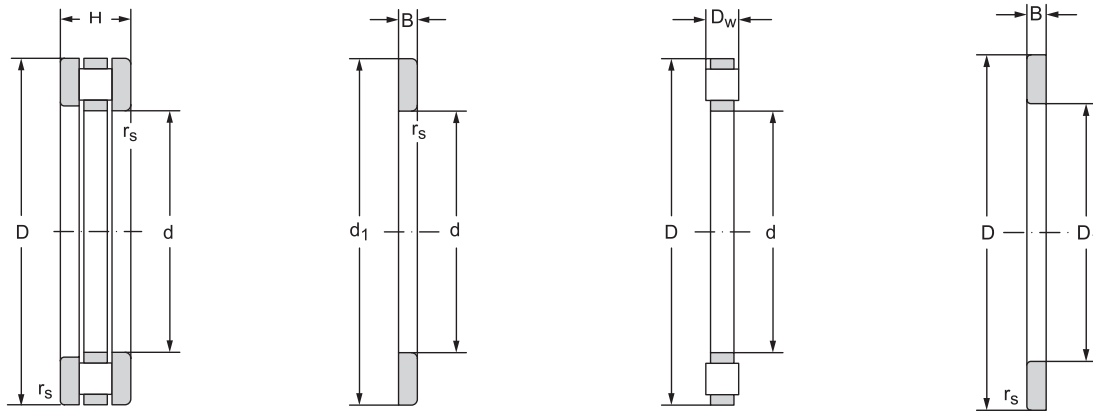


Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions				Weight	Bearing component designation			Min. axial load factor	
grease	oil		d	d <sub>a</sub>	D <sub>a</sub>	r <sub>a</sub>		~	Cage with rollers	Shaft ring		Housing ring
min <sup>-1</sup>			min	max	max		kg					
						mm						
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	



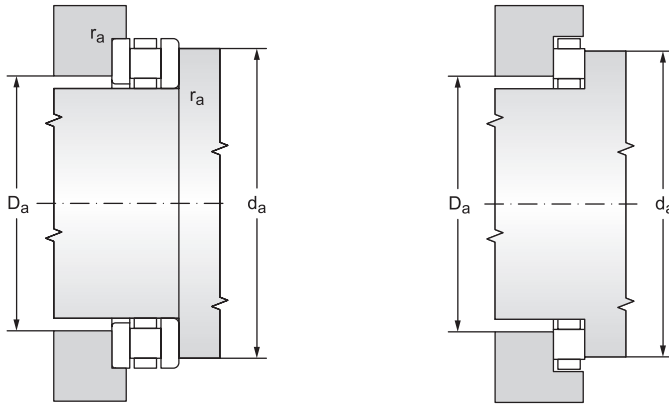
Cylindrical roller thrust bearings

d = 85 to 220 mm



12.8.1

Main dimensions								Basic load rating		Fatigue load limit
d	D	H	d <sub>1</sub>	D <sub>1</sub>	B	D <sub>w</sub>	r <sub>s</sub>	dynamic	static	
							min	C <sub>a</sub>	C <sub>oa</sub>	P <sub>u</sub>
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

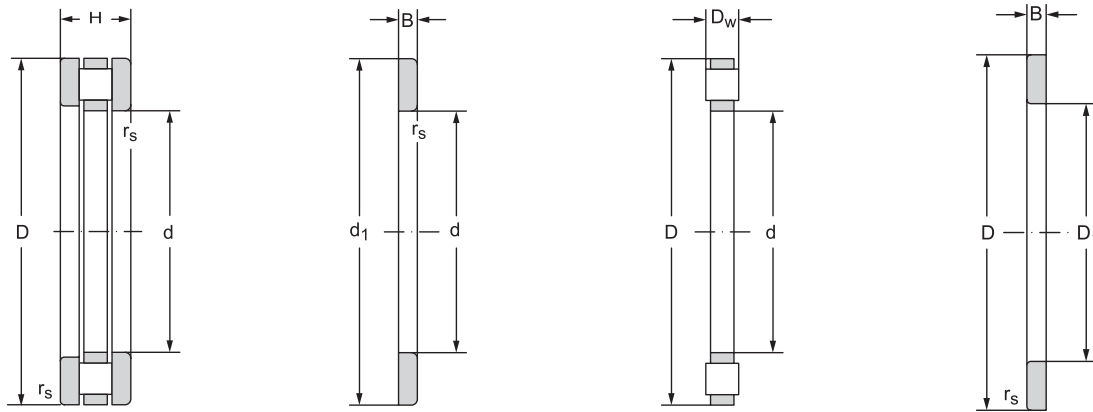


Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions				Weight	Bearing component designation			Min. axial load factor
grease	oil		d	d <sub>a</sub>	D <sub>a</sub>	r <sub>a</sub>		~	Cage with rollers	Shaft ring	
min <sup>-1</sup>			min	max	max		kg				
			mm								
950	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



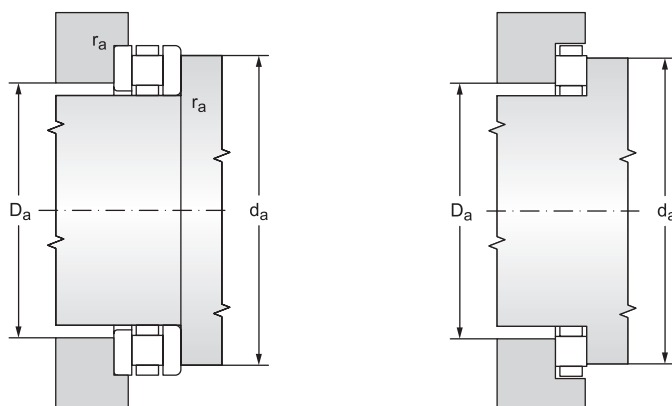
Cylindrical roller thrust bearings

d = 240 to 630 mm



12.8.1

Main dimensions								Basic load rating		Fatigue load limit
d	D	H	d <sub>1</sub>	D <sub>1</sub>	B	D <sub>w</sub>	r <sub>s</sub>	dynamic C <sub>a</sub>	static C <sub>oa</sub>	P <sub>u</sub>
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 <sub>a</sub>	D <sub>a</sub>	r <sub>a</sub>		~	Cage with rollers	Shaft ring	
min <sup>-1</sup>			min	max	max						
			mm			kg					
430	560	<b>81148M</b>	240	296	248	1,5	7,35	K 81148M	WS 81148	GS 81148	0,500
300	400	<b>81248M</b>	240	335	261	2,0	22,1	K 81248M	WS 81248	GS 81248	1,900
400	530	<b>81152M</b>	260	316	268	1,5	7,90	K 81152M	WS 81152	GS 81152	0,560
280	380	<b>81252M</b>	260	353	280	2,0	24,1	K 81252M	WS 81252	GS 81252	2,300
360	480	<b>81156M</b>	280	346	288	1,5	10,5	K 81156M	WS 81156	GS 81156	1,100
260	360	<b>81256M</b>	280	373	300	2,0	26,1	K 81256M	WS 81256	GS 81256	2,400
320	430	<b>81160M</b>	300	373	315	2,0	16,4	K 81160M	WS 81160	GS 81160	1,500
220	320	<b>81260M</b>	300	413	328	2,5	40,3	K 81260M	WS 81260	GS 81260	4,200
300	400	<b>81164M</b>	320	394	334	2,0	18,0	K 81164M	WS 81164	GS 81164	1,900
200	300	<b>81264M</b>	320	434	348	2,5	42,6	K 81264M	WS 81264	GS 81264	4,800
280	380	<b>81168M</b>	340	414	354	2,0	19,4	K 81168M	WS 81168	GS 81168	2,000
200	280	<b>81268M</b>	340	452	367	2,5	46,9	K 81268M	WS 81268	GS 81268	5,300
270	370	<b>81172M</b>	360	434	374	2,0	19,4	K 81172M	WS 81172	GS 81172	2,100
180	260	<b>81272M</b>	360	492	393	3,0	65,3	K 81272M	WS 81272	GS 81272	8,800
260	360	<b>81176M</b>	380	453	393	2,0	23,5	K 81176M	WS 81176	GS 81176	2,20
250	350	<b>81180M</b>	400	473	413	2,0	24,3	K 81180M	WS 81180	GS 81180	2,60
240	340	<b>81184M**</b>	420	493	433	2,0	27,0	K 81184M	WS 81184	GS 81184	2,80
210	310	<b>81188M**</b>	440	533	459	2,0	41,6	K 81188M	WS 81188	GS 81188	5,30
200	300	<b>81192M**</b>	460	553	479	2,0	44,0	K 81192M	WS 81192	GS 81192	5,80
190	280	<b>81196M**</b>	480	583	500	2,0	47,3	K 81196M	WS 81196	GS 81196	6,10
180	270	<b>811/500M**</b>	500	592	519	2,0	49,8	K 811/500M	WS 811/500	GS 811/500	7,10
180	260	<b>811/530M**</b>	530	632	554	2,5	59,1	K 811/530M	WS 811/530	GS 811/530	9,20
170	260	<b>811/560M**</b>	560	662	584	2,5	62,3	K 811/560M	WS 811/560	GS 811/560	9,90
170	240	<b>811/600M**</b>	600	702	624	2,5	34,1	K 811/600M	WS 811/600	GS 811/600	12,00
160	220	<b>811/630M**</b>	630	732	650	2,5	82,3	K 811/630M	WS 811/630	GS 811/630	17,00

