

Thrust bearings

Thrust ball bearings	378
■ Definition and capabilities	378
■ Series	378
■ Tolerances	379
■ Design criteria	379
■ Installation/Assembly criteria	379
■ Characteristics	380
<i>Thrust ball bearings with simple effect</i>	380
Spherical roller thrust bearings	384
■ Definition and capabilities	384
■ Series	385
■ Tolerances	385
■ Design criteria	385
■ Installation/Assembly criteria	385
■ Characteristics	386
<i>Spherical roller thrust bearings</i>	386



Thrust ball bearings

Definition and capabilities

→ Definition

Thrust ball bearings have a contact angle of 90° and are designed to withstand axial loads only. They must therefore often be associated with a radial bearing.

Single-direction ball thrust bearings withstand the axial load of a shaft in only one direction. Thrust bearings are made of detachable elements: shaft-ring, housing-ring, ball-cage assembly.

■ Cages

Thrust bearings are equipped with a pressed steel cage.

→ Capabilities

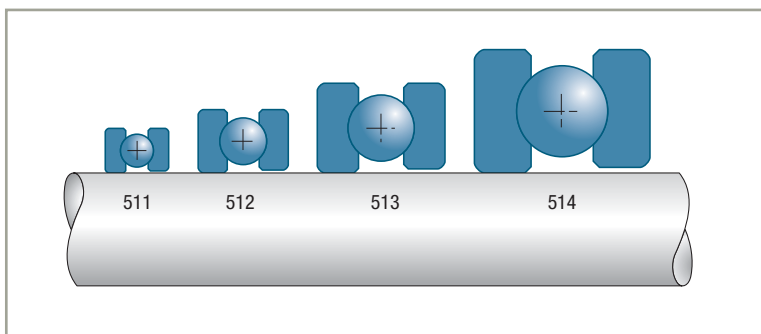
■ Loads and speeds

Can withstand axial loads only in one direction, and low speeds.

■ Misalignment

As the performance of a thrust bearing is related to the distribution of the load over the entire circumference, it is important to have virtually no misalignment between the shaft-ring and the housing-ring (misalignment angle less than 0.03°).

Series



Tolerances

In accordance with ISO 199 Standard, normal tolerance class.

Design criteria

■ Bearing life

■ Minimum dynamic axial load

To compensate for the effects of the centrifugal force being exerted on the balls, it is necessary to permanently exert on the thrusts an axial loading F_a whose minimal value F_{am} (in NR) is determined by the formula:

$$F_{am} = 10^{-14} (N \cdot C_0)^2$$

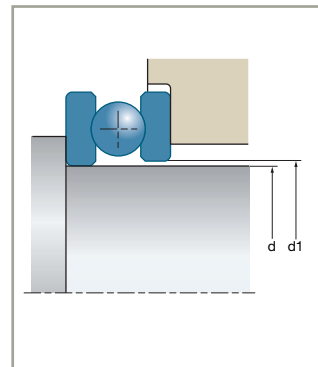
■ Maximum static axial capacity

This is defined by the basic static capacity C_0 .

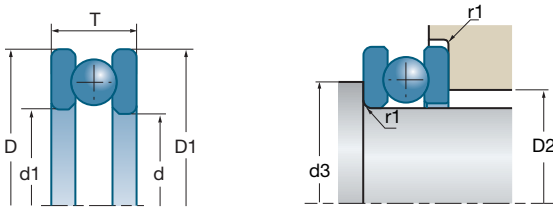
Installation/Assembly criteria

■ Fitting and adjustment

As the elements are detachable they are interchangeable. The shafting is mounted on its seat with an interference fit. The housing-ring must be free to centre itself. To ease the correct position of the thrust bearing when fitting, the housing-ring has a bore diameter (d_1) greater than that of the shaft-ring (d). If the axial load of the non-loaded thrust bearing is insufficient, a pre-load must be applied using springs to reach the minimum dynamic axial load defined above.



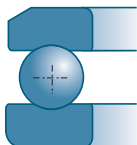
Thrust ball bearings (continued)



d		d1	D	D1	T		
						10 ⁶ N	10 ⁹ N
mm	References	mm	mm	mm	mm	10 ⁶ N	10 ⁹ N
10	51100	11	24	24	9	10.00	14.00
12	51101	13	26	26	9	10.30	15.40
15	51102	16	28	28	9	10.50	16.80
	51202	17	32	32	12	15.70	24.40
17	51103	18	30	30	9	11.30	19.60
	51203	19	35	35	12	16.20	26.60
20	51104	21	35	35	10	15.00	26.60
	51204	22	40	40	14	22.30	37.70
25	51105	26	42	42	11	18.10	35.50
	51205	27	47	47	15	27.80	50.50
	51305	27	52	52	18	35.70	61.50
	51405	27	60	60	24	55.50	89.40
30	51106	32	47	47	11	18.80	39.90
	51206	32	52	52	16	29.40	58.20
	51306	32	60	60	21	42.70	78.70
	51406	32	70	70	28	72.70	126.00
35	51107	37	52	52	12	20.10	46.60
	51207	37	62	62	18	39.10	78.20
	51307	37	68	68	24	55.50	105.00
	51407	37	80	80	32	86.90	155.00
40	51108	42	60	60	13	26.90	62.90
	51208	42	68	68	19	44.00	92.40
	51308	42	78	78	26	69.30	135.00
45	51109	47	65	65	14	27.90	69.20
	51209	47	73	73	20	46.50	105.00
	51309	47	85	85	28	80.00	164.00
	51409	47	100	100	39	130.00	243.00
50	51110	52	70	70	14	28.80	75.50
	51210	52	78	78	22	47.20	111.00
55	51111	57	78	78	16	34.80	93.20
	51211	57	90	90	25	69.40	159.00
	51311	57	105	105	35	119.00	246.00

Characteristics

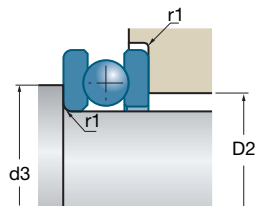
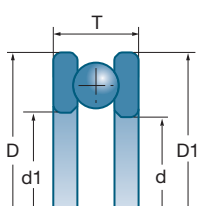
■ Thrust ball bearings with simple effect



References	rpm*	rpm*	d3 min	D2 max	r1 max	kg
51100	7900	10600	18	16	0.30	0.021
51101	7500	10000	20	18	0.30	0.023
51102 51202	7100 6000	9400 7900	23 25	20 22	0.30 0.60	0.025 0.042
51103 51203	7100 5600	9400 7500	25 28	22 24	0.30 0.60	0.025 0.050
51104 51204	6300 5000	8400 6700	29 32	26 28	0.30 0.60	0.038 0.078
51105 51205 51305 51405	5300 4500 3800 3200	7100 6000 5000 4200	35 38 41 46	32 34 36 39	0.60 0.60 1.00 1.00	0.058 0.110 0.167 0.340
51106 51206 51306 51406	5000 4000 3300 2700	6700 5300 4500 3500	40 43 48 54	37 39 42 46	0.60 0.60 1.00 1.00	0.065 0.133 0.270 0.530
51107 51207 51307 51407	4700 3500 2800 2200	6300 4700 3800 3000	45 51 55 62	42 46 48 53	0.60 1.00 1.00 1.10	0.081 0.203 0.377 0.790
51108 51208 51308	4200 3200 2700	5600 4200 3500	52 57 63	48 51 55	0.60 1.00 1.00	0.110 0.260 0.540
51109 51209 51309 51409	4000 3000 2400 1900	5300 4000 3200 2500	57 62 69 78	53 56 61 67	0.60 1.00 1.00 1.10	0.128 0.283 0.662 1.450
51110 51210	3800 2800	5000 3800	62 67	58 61	0.60 1.00	0.139 0.380
51111 51211 51311	3300 2500 1900	4500 3300 2500	69 76 85	64 69 75	0.60 1.00 1.10	0.220 0.590 1.350

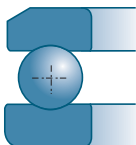
* These are the speed limits according to the SNR concept (see pages 85 to 87).





Thrust ball bearings (continued)



d		d1	D	D1	T		
mm	References	mm	mm	mm	mm	10°N	10°N
60	51112 51312	62 62	85 110	85 110	17 35	41.40 124.00	113.00 270.00
65	51213 51313	67 67	100 115	100 115	27 36	74.90 128.00	189.00 287.00
70	51114 51214	72 72	95 105	95 105	18 27	43.10 76.10	127.00 199.00
75	51115 51215	77 77	100 110	100 110	19 27	44.50 77.30	136.00 209.00
80	51116 51216 51416	82 82 83	105 115 170	105 115 170	19 28 68	44.60 78.50 317.00	141.00 219.00 751.00
85	51117 51217	87 88	110 125	110 125	19 31	46.00 95.40	150.00 264.00
90	51118	92	120	120	22	59.70	190.00
100	51120	102	135	135	25	85.10	268.00
110	51122	112	145	145	25	87.30	288.00
120	51124	122	155	155	25	88.90	308.00
130	51126	132	170	170	30	119.00	406.00
150	51130	152	190	188	31	123.00	448.00
160	51132	162	200	198	31	125.00	476.00

■ Thrust ball bearings with simple effect (*continued*)



 References	 rpm*	 rpm*	d3 min mm	D2 max mm	r1 max mm	 kg
51112	3200	4200	75	70	1.00	0.257
51312	1900	2500	90	80	1.10	1.450
51213	2400	3200	86	79	1.00	0.729
51313	1800	2400	95	85	1.10	1.550
51114	2800	3800	85	80	1.00	0.354
51214	2200	3000	91	84	1.00	0.783
51115	2700	3500	90	85	1.00	0.398
51215	2200	3000	96	89	1.00	0.827
51116	2700	3500	95	90	1.00	0.430
51216	2000	2700	101	94	1.00	0.908
51416	890	1200	133	116	2.10	7.300
51117	2700	3500	100	95	1.00	0.442
51217	2000	2700	109	101	1.00	1.300
51118	2000	2700	108	102	1.00	0.598
51120	2000	2700	121	114	1.00	0.974
51122	1900	2500	131	124	1.00	1.060
51124	1600	2100	141	134	1.00	1.140
51126	1400	1900	154	146	1.00	1.740
51130	1300	1800	174	166	1.00	2.000
51132	1300	1800	184	176	1.00	2.100

* These are the speed limits according to the SNR concept (see pages 85 to 87).

Spherical roller thrust bearings

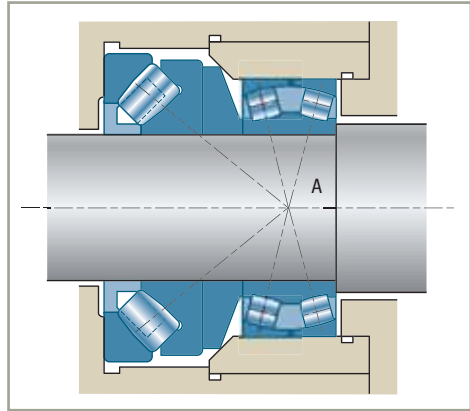
Definition and capabilities

→ Definition

Spherical roller thrust bearings are made up of two detachable components: the shaft ring on which are mounted the cage and the spherical-tapered rolling elements, and the housing ring whose spherical raceway enables the bearing to swivel.

SNR Spherical roller thrust bearings are equipped with a solid brass cage or sheet steel* centred (optimised E series) by a tube crimped in the bore of the shaft-washer. Eventually, SNR thrust bearings will be exclusively equipped with a sheet steel cage optimised E version.

When they are associated with a radial bearing (usually a double-row spherical roller bearing), their point of load application A must coincide with that of the bearing to permit self-alignment.



* Thrust bearings with metal sheet cage are interchangeable with competitors' designs.

→ Capabilities

■ Loads and speeds

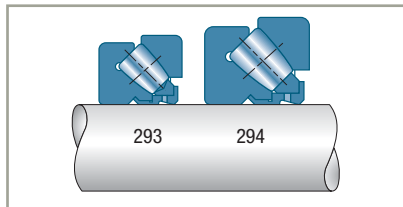
- Very high axial load capacity
- Possibility of withstanding relatively high radial loads, of about half the value of the axial load, thanks to a high contact angle of about 50°
- Low speeds

■ Misalignment

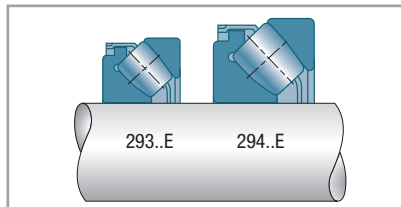
The self-alignment possibility provided by the spherical raceway of the housing-ring enables it to accept misalignment of about 3°. The misalignment may be limited, depending on the sealing system used.

Bearing type	Permitted tilting
292...	2°
293...	2°30'
294...	3°

Solid cage



Sheet steel cage



Tolerances

Spherical roller thrust bearings are manufactured in standard precision to the tolerances fixed for the ball thrust bearings (ISO 199).

Design criteria

- Bearing life
- Minimum axial load

To ensure smooth and slip-free rotation of the rollers, the thrust bearings must be subjected to a permanent minimum axial load F_{am} (in N) of:

$$F_{am} = 2 \cdot 10^{-16} (N \cdot C_0)^2$$

If the operating axial load is less than the minimum axial load, pre-load the thrust bearing with springs.

Installation/Assembly criteria

The elements are detachable and interchangeable.

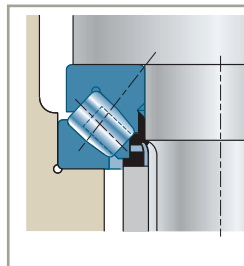
The shaft-ring is interference-fitted on its seat. The other ring is centred in its housing if the thrust bearing is not associated with another radial bearing.

Conversely, if centring is secured by a radial bearing, the thrust bearing housing-ring must be free to centre itself.

■ Lubrication

Spherical roller thrust bearings usually have to work under very high loads needing oil lubrication.

In view of the internal design of this type of thrust bearing, lubrication with grease can only be considered for low speeds of rotation and moderate loads.

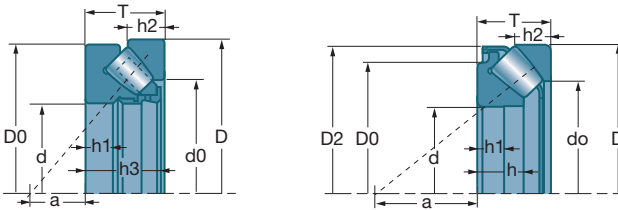


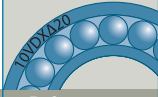
■ Maximum permissible axial load on the cage centring tube

In certain assemblies, because the mild-steel cage centring tube acts as a seat for a spacer-type washer, it must be checked that the axial thrust load does not exceed the values indicated below:

- $0.4 C_0$ for thrust bearings 29300
- $0.5 C_0$ for thrust bearings 29400

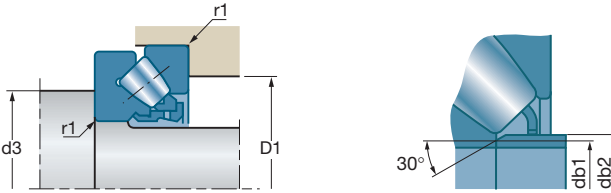
Spherical roller thrust bearings (continued)



d		D	T	d0	D0	D2	h	h1	h2	h3	a
mm	References	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
60	29412 E	130	42	88.0	112.3	126.2	27.0	15.0	20.5		38.0
65	29413 E	140	45	96.5	122.8	136.2	29.5	16.0	22.0		42.0
70	29414 E	150	48	105.0	131.6	146.0	31.0	17.0	23.0		44.0
75	29415 E	160	51	109.0	141.8	156.2	33.5	18.0	24.0		47.0
80	29416 E	170	54	117.0	150.8	165.2	35.0	19.0	24.0		50.0
85	29417 E	180	58	123.0	160.6	175.2	37.0	19.0	28.0		54.0
90	29418 E	190	60	130.0	170.8	186.2	39.0	22.0	29.0		56.0
100	29320 E	170	42	128.0	149.9	168.0	26.2	15.0	20.5		58.0
	29420 E	210	67	144.5	189.8	205.2	43.0	24.0	32.0		62.0
110	29322	190	48	143.0	176.0			16.0	23.0	45.5	64.0
	29322 E	190	48	140.5	171.0	185.5	30.3	16.0	23.0		64.0
	29422 E	230	73	159.0	211.5	225.0	47.0	27.0	35.0		69.0
120	29324	210	54	157.5	194.0			18.0	26.0	51.0	70.0
	29424 E	250	78	173.0	227.8	244.0	50.5	29.0	37.0		74.0
130	29326	225	58	170.0	205.0			19.0	28.0	55.0	76.0
	29326 E	225	58	165.7	199.7	218.0	36.7	21.0	30.1		76.0
	29426 E	270	85	188.0	245.4	262.5	54.0	31.0	41.0		81.0
140	29328	240	60	183.0	219.0			20.0	29.0	57.0	82.0
	29328 E	240	60	178.8	213.7	232.0	38.5	22.0	30.0		82.0
	29428 E	280	85	196.5	254.0	273.5	54.0	32.0	41.0		86.0
150	29330	250	60	193.0	229.0			20.0	29.0	57.0	87.0
	29330 E	250	60	189.6	222.5	244.0	38.0	22.0	28.0		87.0
	29430 E	300	90	209.5	273.0	292.5	58.0	34.0	44.0		92.0
160	29332	270	67	207.0	248.0			23.0	32.0	64.0	92.0
	29332 E	270	67	202.3	243.6	263.5	42.0	24.0	33.0		92.0
	29432	320	95	226.0	306.0			34.0	45.0	91.0	99.0

Characteristics

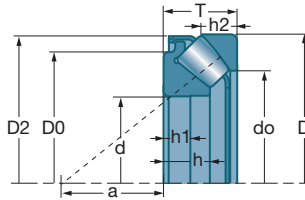
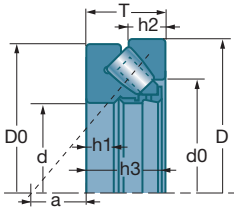
■ Spherical roller thrust bearings



References	10°N	10°N	rpm*	d3 min	D1 max	r1 max	db1 max	db2 max	kg
29412 E	335	951	2500	90	107	1,5	67	67	2,47
29413 E	405	1157	2300	100	117	2.0	72	72	3.26
29414 E	440	1280	2200	105	125	2.0	77.5	77.5	3.98
29415 E	512	1502	2000	115	133	2.0	82.5	82.5	4.90
29416 E	607	1636	1900	120	141	2.1	88	88	5.68
29417 E	692	1945	1800	130	151	2.1	94	94	6.67
29418 E	703	2172	1700	135	158	2.1	99	99	7.77
29320 E	436	1402	2100	130	147	1.5	107	107	3.65
29420 E	865	2578	1500	150	175	3.0	110	110	10.80
29322	475	1520	1900	145	166	2.0			5.48
29322 E	570	1760	1900	145	164	2.0	113	119.5	5.40
29422 E	1022	3078	1400	165	193	3.0	120.5	129	13.50
29324	600	1960	1700	160	184	2.1			7.58
29424 E	1180	3590	1300	180	209	4.0	132	141	17.50
29326	680	2230	1600	170	198	2.1			9.30
29326 E	765	2950	1500	175	194	2.1	138	145	9.08
29426 E	1395	4300	1200	195	227	4.0	142.5	153	21.60
29328	750	2500	1500	185	211	2.1			11.00
29328 E	850	3150	1400	185	208	2.1	148	155	10.50
29428 E	1509	4686	1100	205	236	4.0	153	162	23.00
29330	770	2650	1400	195	222	2.1			11.50
29330 E	863	3230	1400	195	219	2.1	158	165	10.90
29430 E	1626	5241	1000	220	253	4.0	163	175	23.00
29332	890	3050	1300	210	239	3.0			15.20
29332 E	1040	3980	1200	210	235	3.0	169	176	14.40
29432	1510	5000	1000	230	274	5.0			37.30

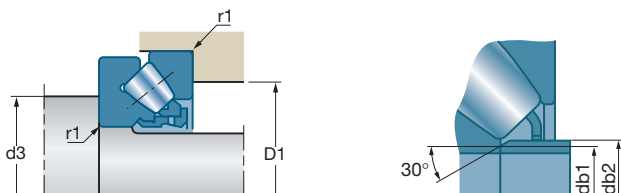
* These are the speed limits according to the SNR concept (see pages 85 to 87).

Spherical roller thrust bearings (continued)



d		D	T	d0	D0	D2	h	h1	h2	h3	a
mm	References	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
170	29334	280	67	215.0	258.0			23.0	32.0	64.0	96.0
	29334 E	280	67	214.6	253.6	273.5	42.2	24.0	32.0		96.0
	29434	340	103	240.0	324.0			37.0	50.0	99.0	104.0
180	29336	300	73	231.0	277.0			25.0	35.0	69.0	103.0
	29336 E	300	73	228.3	270.4	294.0	46.0	26.0	35.5		103.0
	29436	360	109	255.0	342.0			39.0	52.0	105.0	110.0
190	29338 E	320	78	239.5	284.4	308.8	49.0	28.0	36.0		110.0
	29438	380	115	270.0	360.0			41.0	55.0	111.0	117.0
200	29340 E	340	85	253.6	302.8	327.2	53.5	29.0	40.0		110.0
	29440	400	122	284.0	380.0			43.0	59.0	117.0	122.0
220	29344 E	360	85	273.0	324.4	348.8	55.0	29.0	41.0		125.0
	29444	420	122	305.0	400.0			43.0	58.0	117.0	132.0
240	29348 E	380	85	294.8	343.7	371.2	54.0	29.0	40.5		135.0
	29448	440	122	321.0	420.0			43.0	59.0	117.0	142.0
260	29352 E	420	95	320.4	380.3	397.8	61.0	32.0	46.0		148.0
	29452	480	132	346.0	460.0			48.0	64.0	127.0	154.0
280	29356 E	440	95	342.1	401.7	429.2	62.0	32.0	45.0		158.0
	29456 E	520	145	370.0	468.9	499.7	95.0	52.0	70.0		166.0
300	29360 E	480	109	366.7	431.9	462.5	70.0	36.0	51.0		168.0
	29460 E	540	145	370.0	489.2	519.9	95.0	55.0	70.5		175.0
320	29364 E	500	109	387.0	456.1	486.7	68.0	37.0	53.0		180.0
	29464 E	580	155	422.0	525.6	556.3	102.0	55.0	74.5		191.0

■ Spherical roller thrust bearings (continued)



References	10°N	10°N	rpm*	d3 min	D1 max	r1 max	db1 max	db2 max	kg
29334	910	3200	1300	220	248	3.0			16.00
29334 E	1060	4100	1200	220	245	3.0	178	188	15.10
29434	1670	5500	950	245	291	5.0			43.70
29336	990	3500	1200	235	266	3.0			20.30
29336 E	1240	4810	1100	235	262	3.0	189	196	19.10
29436	1870	6300	900	260	307	5.0			52.00
29338 E	1437	4835	1100	250	280	4.0	200	209	23.30
29438	2030	6900	850	275	325	5.0			63.10
29340 E	1621	5475	1000	265	297	4.0	211	222	29.00
29440	2280	7800	800	290	343	5.0			69.00
29344 E	1744	6298	980	285	316	4.0	229	238	31.60
29444	2350	8300	750	310	364	6.0			74.00
29348 E	1786	6487	910	305	336	4.0	249	257	33.40
29448	2420	8700	700	330	383	6.0			83.00
29352 E	2238	8305	830	335	370	5.0	273	284	46.90
29452	2850	10300	660	360	419	6.0			105.00
29356 E	2211	8486	780	355	390	5.0	293	303	49.50
29456 E	4472	15751	620	395	446	6.0	300	319	127.00
29360 E	2650	11000	730	385	423	5.0	313	327	68.70
29460 E	4512	16458	580	415	465	6.0	319	339	133.00
29364 E	2850	10923	690	405	442	5.0	332	346	72.10
29464 E	5005	21200	540	450	500	7.5	344	366	164.00

* These are the speed limits according to the SNR concept (see pages 85 to 87).