







Supplementary table 3 Boundary dimensions of single direction thrust bearings (with flat back faces) – diameter series 0, 1, 2, 3, 4, 5 –

Unit : mm

Thrust ball bgr.		511		512		513		514																							
Spherical thrust roller bearings		292		293		294		294																							
Bore dia. No.	Diameter series 0				Diameter series 1				Diameter series 2				Diameter series 3				Diameter series 4				Diameter series 5										
	Dimension series	70	90	10	Chamber	Dimension series	71	91	11	Chamber	Dimension series	72	92	12	Chamber	Dimension series	73	93	13	Chamber	Dimension series	74	94	14	Chamber	Dimension series	75	95	15	Chamber	
Bore dia. $d$	Outside dia. $D$	Height $T$	$r$ min.	$r$ min.	$r$ min.	Outside dia. $D$	Height $T$	$d_1$ max.	$d_1$ min.	$r$ min.	Outside dia. $D$	Height $T$	$d_1$ max.	$d_1$ min.	$r$ min.	Outside dia. $D$	Height $T$	$d_1$ max.	$d_1$ min.	$r$ min.	Outside dia. $D$	Height $T$	$d_1$ max.	$d_1$ min.	$r$ min.	Outside dia. $D$	Height $T$	$d_1$ max.	$d_1$ min.	$r$ min.	
4	12	4	—	6	0.3	—	—	—	—	—	16	6	—	8	16	4	0.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	16	5	—	7	0.3	—	—	—	—	—	20	6	—	9	20	6	0.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	18	5	—	7	0.3	—	—	—	—	—	22	6	—	9	22	6	0.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
00	10	20	5	—	7	0.3	24	6	—	9	24	11	0.3	26	7	—	11	26	12	0.6	30	9	—	14	30	10	0.6	—	—	—	
01	12	22	5	—	7	0.3	26	6	—	9	26	13	0.3	28	7	—	11	28	14	0.6	32	9	—	14	32	10	0.6	—	—	—	
02	15	26	5	—	7	0.3	28	6	—	9	28	16	0.3	32	8	—	12	32	17	0.6	37	10	—	15	37	15	0.6	—	—	—	
03	17	28	5	—	7	0.3	30	6	—	9	30	18	0.3	35	8	—	12	35	19	0.6	40	10	—	16	40	19	0.6	—	—	—	
04	20	32	6	—	8	0.3	35	7	—	10	35	21	0.3	40	9	—	14	40	22	0.6	47	12	—	18	47	22	1	—	—	—	
05	25	37	6	—	8	0.3	42	8	—	11	42	26	0.6	47	10	—	15	47	27	0.6	52	12	—	18	52	27	1	—	—	—	
06	30	42	6	—	8	0.3	47	8	—	11	47	32	0.6	52	10	—	16	52	32	0.6	60	14	—	21	60	32	1	—	—	—	
07	35	47	6	—	8	0.3	52	8	—	12	52	37	0.6	62	12	—	18	62	37	1	68	15	—	24	68	37	1	—	—	—	
08	40	52	6	—	9	0.3	60	9	—	13	60	42	0.6	68	13	—	19	68	42	1	78	17	—	26	78	42	1	—	—	—	
09	45	60	7	—	10	0.3	65	9	—	14	65	47	0.6	73	13	—	20	73	47	1	85	18	—	28	85	47	1	—	—	—	
10	50	65	7	—	10	0.3	70	9	—	14	70	52	0.6	78	13	—	22	78	52	1	95	20	—	30	95	52	1	—	—	—	
11	55	70	7	—	10	0.3	78	10	—	16	78	57	0.6	90	16	—	25	90	57	1	105	23	—	35	105	57	1	—	—	—	
12	60	75	7	—	10	0.3	85	11	—	17	85	62	1	95	16	—	26	95	62	1	110	23	—	36	110	62	1	—	—	—	
13	65	80	7	—	10	0.3	90	11	—	18	90	67	1	100	16	—	27	100	67	1	115	23	—	36	115	67	1	—	—	—	
14	70	85	7	—	10	0.3	95	11	—	18	95	72	1	105	16	—	27	105	72	1	125	25	—	34	125	72	1	—	—	—	
15	75	90	7	—	10	0.3	100	11	—	19	100	77	1	110	16	—	27	110	77	1	135	27	—	36	135	77	1	—	—	—	
16	80	95	7	—	10	0.3	105	11	—	19	105	82	1	115	16	—	28	115	82	1	140	27	—	36	140	82	1	—	—	—	
17	85	100	7	—	10	0.3	110	11	—	19	110	87	1	125	18	—	24	125	87	1	150	29	—	39	150	87	1	—	—	—	
18	90	105	7	—	10	0.3	120	14	—	22	120	92	1	135	20	—	27	135	93	1	155	29	—	39	155	93	1	—	—	—	
20	100	120	9	—	14	0.6	135	16	—	21	135	102	1	150	23	—	30	150	103	1	170	32	—	48	170	103	1	—	—	—	
22	110	130	9	—	14	0.6	145	16	—	21	145	112	1	160	23	—	30	160	113	1	190	36	—	48	190	113	1	—	—	—	
24	120	140	9	—	14	0.6	155	16	—	21	155	122	1	170	23	—	30	170	123	1	210	41	—	54	210	123	1	—	—	—	
26	130	150	9	—	14	0.6	170	18	—	24	170	132	1	190	27	—	36	170	133	1	225	42	—	58	225	133	1	—	—	—	
28	140	160	9	—	14	0.6	180	18	—	24	180	142	1	200	27	—	36	180	143	1	240	45	—	60	240	143	1	—	—	—	
30	150	170	9	—	14	0.6	190	18	—	24	190	152	1	215	29	—	39	190	153	1	270	50	—	67	270	153	1	—	—	—	
32	160	180	9	—	14	0.6	200	18	—	24	200	162	1	225	29	—	39	200	163	1	290	50	—	67	290	163	1	—	—	—	
34	170	190	9	—	14	0.6	215	20	—	27	215	172	1.1	240	32	—	42	215	173	1.5	300	54	—	73	300	173	1.5	—	—	—	
36	180	200	9	—	14	0.6	225	20	—	27	225	183	1.1	250	32	—	42	225	184	3	360	54	—	73	360	184	3	—	—	—	
38	190	215	11	—	17	1	240	23	—	30	240	193	1.1	270	36	—	48	240	194	2	320	58	—	78	320	194	2	—	—	—	
40	200	225	11	—	17	1	250	23	—	30	250	203	1.1	280	36	—	48	250	204	2	340	63	—	85	340	204	2	—	—	—	
44	220	250	14	—	22	1	270	23	—	30	270	223	1.1	300	36	—	48	270	224	2	360	63	—	85	360	224	2	—	—	—	
48	240	270	14	—	22	1	300	27	—	36	300	243	1.5	340	45	—	60	300	244	2.1	380	63	—	85	380	244	2.1	—	—	—	
52	260	290	14	—	22	1	320	27	—	36	320	263	1.5	360	45	—	60	320	264	2.1	420	73	—	95	420	264	2.1	—	—	—	
56	280	310	14	—	22	1	350	32	—	42	350	283	1.5	380	45	—	60	350	284	2.1	440	73	—	95	440	284	2.1	—	—	—	
60	300	340	18	—	24	30	1	380	36	—	48	380	304	2	420	54	—	73	380	304	3	480	82	—	109	480	304	3	—	—	—
64	320	360	18	—	24	30	1	400	36	—	48	400	324	2	440	54	—	73	400	324	3	500	82	—	109	500	324	3	—	—	—
68	340	380	18	—	24	30	1	420	36	—	48	420	344	2	460	54	—	73	420	344	3	540	90	—	122	540	344	3	—	—	—
72	360	400	18	—	24	30	1	440	36	—	48	440	364	2	500	63	—	85	440	364	4	560	100	—	122	560	364	4	—	—	—
76	380	420	18	—	24	30	1	460	36	—	48	460	384	2	520	63	—	85	460	384	4	600	100	—	122	600	384	4	—	—	—
80	400	440	18	—	24	30	1	480	36	—	48	480	404	2	540	63	—	85	480	404	4	620	100	—	122	620	404	4	—	—	—
84	420	460	18	—	24	30	1	500	36	—	48	500	424	2	580	73	—	95	424	2	640	100	—	122	640	424	2	—	—	—	
88	440	480	18	—	24	30	1	540	45	—	60	540	444	2.1	600	73	—	95	444	2.1	680	109	—	145	680	444	2.1	—	—	—	
92	460	500	18	—	24	30	1	560	45	—	60	560	464	2.1	620	73	—	95	464	2.1	700	112	—	150	700	464	2.1	—	—	—	
96	480	520	18	—	24	30	1	580	45	—	60	580	484	2.1	650	73	—	95	484	2.1	730	112	—	150	730	484	2.1	—	—	—	
/500	500	540	18	—	24	30	1	600	45	—	60	600	504	2.1	670	78	—	103	504	2.1	750	112	—	150	750	504	2.1	—	—	—	
/530	530	580	23	—	30	38	1.1	640	50	—	67	640	534	3	710	82	—	109	534	3	800	122	—	160	800	534	3	—	—	—	
/560	560	610	23	—	30	38	1.1	670	50	—	67	670	564	3	750	85	—	115	564	3	850	132	—	175	850	564	3	—	—	—	
/600	600	650	23	—	30	38	1.1	710	50	—	67	710	604	3	800	90	—	122	604	3	900	136	—	180	900	604	3	—	—	—	
/630	630	680	23	—	30	38	1																								

Supplementary table 4 Boundary dimensios of double direction thrust ball bearings

(with flat back faces)

Unit : mm

Bore dia. No.	522									523									524									Bore dia. No.
	Diameter series 2									Diameter series 3									Diameter series 4									
	Dimension series 22									Dimension series 23									Dimension series 24									
	Bore dia. $d_2$	Out-side dia. $D$	Height $T_1$	Central race height $B$	$d_3$ max.	$D_1$ min.	$r$ min.	$r_1$ min.	(Refer. $d^{1)}$	Bore dia. $d_2$	Out-side dia. $D$	Height $T_1$	Central race height $B$	$d_3$ max.	$D_1$ min.	$r$ min.	$r_1$ min.	(Refer. $d^{1)}$	Bore dia. $d_2$	Out-side dia. $D$	Height $T_1$	Central race height $B$	$d_3$ max.	$D_1$ min.	$r$ min.	$r_1$ min.	(Refer. $d^{1)}$	
02	10	32	22	5	32	17	0.6	0.3	15	10	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	02
04	15	40	26	6	40	22	0.6	0.3	20	15	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	04
05	20	47	28	7	47	27	0.6	0.3	25	20	52	34	8	52	27	1	0.3	25	20	52	34	8	52	27	1	0.6	25	05
06	25	52	29	7	52	32	0.6	0.3	30	25	60	38	9	60	32	1	0.3	30	25	60	38	9	60	32	1	0.6	30	06
07	30	62	34	8	62	37	1	0.3	35	30	68	44	10	68	37	1	0.3	35	30	68	44	10	68	37	1.1	0.6	35	07
08	30	68	36	9	68	42	1	0.6	40	30	78	49	12	78	42	1	0.6	40	30	78	49	12	78	42	1.1	0.6	40	08
09	35	73	37	9	73	47	1	0.6	45	35	85	52	12	85	47	1	0.6	45	35	85	52	12	85	47	1.1	0.6	45	09
10	40	78	39	9	78	52	1	0.6	50	40	95	58	14	95	52	1.1	0.6	50	40	95	58	14	95	52	1.5	0.6	50	10
11	45	90	45	10	90	57	1	0.6	55	45	105	64	15	105	57	1.1	0.6	55	45	105	64	15	105	57	1.5	0.6	55	11
12	50	95	46	10	95	62	1	0.6	60	50	110	64	15	110	62	1.1	0.6	60	50	110	64	15	110	62	1.5	0.6	60	12
13	55	100	47	10	100	67	1	0.6	65	55	115	65	15	115	67	1.1	0.6	65	55	115	65	15	115	67	2	1	65	13
14	55	105	47	10	105	72	1	1	70	55	125	72	16	125	72	1.1	1	70	55	125	72	16	125	72	2	1	70	14
15	60	110	47	10	110	77	1	1	75	60	135	79	18	135	77	1.5	1	75	60	135	79	18	135	77	2	1	75	15
16	65	115	48	10	115	82	1	1	80	65	140	79	18	140	82	1.5	1	80	65	140	79	18	140	82	2.1	1	80	16
17	70	125	55	12	125	88	1	1	85	70	150	87	19	150	88	1.5	1	85	70	150	87	19	150	88	2.1	1.1	85	17
18	75	135	62	14	135	93	1.1	1	90	75	155	88	19	155	93	1.5	1	90	75	155	88	19	155	93	2.1	1.1	90	18
20	85	150	67	15	150	103	1.1	1	100	85	170	97	21	170	103	1.5	1	100	85	170	97	21	170	103	3	1.1	100	20
22	95	160	67	15	160	113	1.1	1	110	95	190	110	24	189.5	113	2	1	110	95	190	110	24	189.5	113	3	1.1	110	22
24	100	170	68	15	170	123	1.1	1.1	120	100	210	123	27	209.5	123	2.1	1.1	120	100	210	123	27	209.5	123	4	1.5	120	24
26	110	190	80	18	189.5	133	1.5	1.1	130	110	225	130	30	224	134	2.1	1.1	130	110	225	130	30	224	134	4	2	130	26
28	120	200	81	18	199.5	143	1.5	1.1	140	120	240	140	31	239	144	2.1	1.1	140	120	240	140	31	239	144	4	2	140	28
30	130	215	89	20	214.5	153	1.5	1.1	150	130	250	140	31	249	154	2.1	1.1	150	130	250	140	31	249	154	4	2	150	30
32	140	225	90	20	224.5	163	1.5	1.1	160	140	270	153	33	269	164	3	1.1	160	140	270	153	33	269	164	5	2	160	32
34	150	240	97	21	239.5	173	1.5	1.1	170	150	280	153	33	279	174	3	1.1	170	150	280	153	33	279	174	5	2.1	170	34
36	150	250	98	21	249	183	1.5	2	180	150	300	165	37	299	184	3	2	180	150	300	165	37	299	184	5	3	180	36
38	160	270	109	24	269	194	2	2	190	160	320	183	40	319	195	4	2	190	160	320	183	40	319	195	-	-	-	38
40	170	280	109	24	279	204	2	2	200	170	340	192	42	339	205	4	2	200	170	340	192	42	339	205	-	-	-	40
44	190	300	110	24	299	224	2	2	220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	44

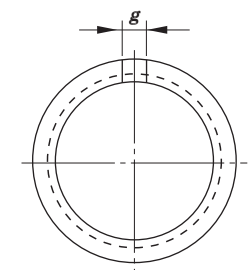
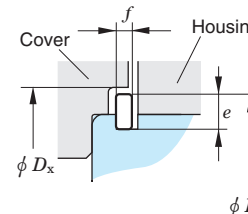
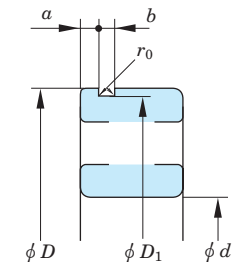
[Note] 1) Nominal bore diameter of single direction bearings of the same diameter series and with the same nominal outside diameter.

Supplementary table 5 (1) Dimension of snap ring grooves and locating snap rings

- diameter series 18, 19 -

Unit : mm

Applicable bearing		Snap ring groove									Locating snap ring						Housing		
Bore dia. <i>d</i>	Outside dia. <i>D</i>	Snap ring groove dia. <i>D</i> <sub>1</sub>		Position of snap ring groove <i>a</i>				Snap ring groove width <i>b</i>		Fillet radius of snap ring groove <i>r</i> <sub>0</sub>	No.	Section height <i>e</i>		Thickness <i>f</i>		Mounted state		Shoulder bore dia. <i>D</i> <sub>x</sub>	
		max.	min.	max.	min.	max.	min.	max.	min.			max.	min.	max.	min.	Distance between cut ends <i>g</i>	Locating snap ring O.D. <i>D</i> <sub>2</sub>		
Dimension series				Dimension series 18		Dimension series 19													
18	19			max.	min.	max.	min.	max.	min.	max.	max.	min.	max.	min.	max.	min.	max.	max.	max.
-	10	22	20.8	20.5	-	-	1.05	0.9	1.05	0.8	0.2	NR 1022	2.0	1.85	0.7	0.6	2	24.8	25.5
-	12	24	22.8	22.5	-	-	1.05	0.9	1.05	0.8	0.2	NR 1024	2.0	1.85	0.7	0.6	2	26.8	27.5
-	15	28	26.7	26.4	-	-	1.3	1.15	1.2	0.95	0.25	NR 1028	2.05	1.9	0.85	0.75	3	30.8	31.5
-	17	30	28.7	28.4	-	-	1.3	1.15	1.2	0.95	0.25	NR 1030	2.05	1.9	0.85	0.75	3	32.8	33.5
20	-	32	30.7	30.4	1.3	1.15	-	-	1.2	0.95	0.25	NR 1032	2.05	1.9	0.85	0.75	3	34.8	35.5
22	-	34	32.7	32.4	1.3	1.15	-	-	1.2	0.95	0.25	NR 1034	2.05	1.9	0.85	0.75	3	36.8	37.5
25	20	37	35.7	35.4	1.3	1.15	1.7	1.55	1.2	0.95	0.25	NR 1037	2.05	1.9	0.85	0.75	3	39.8	40.5
-	22	39	37.7	37.4	-	-	1.7	1.55	1.2	0.95	0.25	NR 1039	2.05	1.9	0.85	0.75	3	41.8	42.5
28	-	40	38.7	38.4	1.3	1.15	-	-	1.2	0.95	0.25	NR 1040	2.05	1.9	0.85	0.75	3	42.8	43.5
30	25	42	40.7	40.4	1.3	1.15	1.7	1.55	1.2	0.95	0.25	NR 1042	2.05	1.9	0.85	0.75	3	44.8	45.5
32	-	44	42.7	42.4	1.3	1.15	-	-	1.2	0.95	0.25	NR 1044	2.05	1.9	0.85	0.75	4	46.8	47.5
-	28	45	43.7	43.4	-	-	1.7	1.55	1.2	0.95	0.25	NR 1045	2.05	1.9	0.85	0.75	4	47.8	48.5
35	30	47	45.7	45.4	1.3	1.15	1.7	1.55	1.2	0.95	0.25	NR 1047	2.05	1.9	0.85	0.75	4	49.8	50.5
40	32	52	50.7	50.4	1.3	1.15	1.7	1.55	1.2	0.95	0.25	NR 1052	2.05	1.9	0.85	0.75	4	54.8	55.5
-	35	55	53.7	53.4	-	-	1.7	1.55	1.2	0.95	0.25	NR 1055	2.05	1.9	0.85	0.75	4	57.8	58.5
45	-	58	56.7	56.4	1.3	1.15	-	-	1.2	0.95	0.25	NR 1058	2.05	1.9	0.85	0.75	4	60.8	61.5
-	40	62	60.7	60.3	-	-	1.7	1.55	1.2	0.95	0.25	NR 1062	2.05	1.9	0.85	0.75	4	64.8	65.5
50	-	65	63.7	63.3	1.3	1.15	-	-	1.2	0.95	0.25	NR 1065	2.05	1.9	0.85	0.75	4	67.8	68.5
-	45	68	66.7	66.3	-	-	1.7	1.55	1.2	0.95	0.25	NR 1068	2.05	1.9	0.85	0.75	5	70.8	72
55	50	72	70.7	70.3	1.7	1.55	1.7	1.55	1.2	0.95	0.25	NR 1072	2.05	1.9	0.85	0.75	5	74.8	76
60	-	78	76.2	75.8	1.7	1.55	-	-	1.6	1.3	0.4	NR 1078	3.25	3.1	1.12	1.02	5	82.7	84
-	55	80	77.9	77.5	-	-	2.1	1.9	1.6	1.3	0.4	NR 1080	3.25	3.1	1.12	1.02	5	84.4	86
65	60	85	82.9	82.5	1.7	1.55	2.1	1.9	1.6	1.3	0.4	NR 1085	3.25	3.1	1.12	1.02	5	89.4	91
70	65	90	87.9	87.5	1.7	1.55	2.1	1.9	1.6	1.3	0.4	NR 1090	3.25	3.1	1.12	1.02	5	94.4	96
75	-	95	92.9	92.5	1.7	1.55	-	-	1.6	1.3	0.4	NR 1095	3.25	3.1	1.12	1.02	5	99.4	101
80	70	100	97.9	97.5	1.7	1.55	2.5	2.3	1.6	1.3	0.4	NR 1100	3.25	3.1	1.12	1.02	5	104.4	106
-	75	105	102.6	102.1	-	-	2.5	2.3	1.6	1.3	0.4	NR 1105	4.04	3.89	1.12	1.02	5	110.7	112
85	80	110	107.6	107.1	2.1	1.9	2.5	2.3	1.6	1.3	0.4	NR 1110	4.04	3.89	1.12	1.02	5	115.7	117
90	-	115	112.6	112.1	2.1	1.9	-	-	1.6	1.3	0.4	NR 1115	4.04	3.89	1.12	1.02	5	120.7	122
95	85	120	117.6	117.1	2.1	1.9	3.3	3.1	1.6	1.3	0.4	NR 1120	4.04	3.89	1.12	1.02	7	125.7	127
100	90	125	122.6	122.1	2.1	1.9	3.3	3.1	1.6	1.3	0.4	NR 1125	4.04	3.89	1.12	1.02	7	130.7	132
105	95	130	127.6	127.1	2.1	1.9	3.3	3.1	1.6	1.3	0.4	NR 1130	4.04	3.89	1.12	1.02	7	135.7	137
110	100	140	137.6	137.1	2.5	2.3	3.3	3.1	2.2	1.9	0.6	NR 1140	4.04	3.89	1.7	1.6	7	145.7	147
-	105	145	142.6	142.1	-	-	3.3	3.1	2.2	1.9	0.6	NR 1145	4.04	3.89	1.7	1.6	7	150.7	152
120	110	150	147.6	147.1	2.5	2.3	3.3	3.1	2.2	1.9	0.6	NR 1150	4.04	3.89	1.7	1.6	7	155.7	157
130	120	165	161.8	161.3	3.3	3.1	3.7	3.5	2.2	1.9	0.6	NR 1165	4.85	4.7	1.7	1.6	7	171.5	173
140	-	175	171.8	171.3	3.3	3.1	-	-	2.2	1.9	0.6	NR 1175	4.85	4.7	1.7	1.6	10	181.5	183
-	130	180	176.8	176.3	-	-	3.7	3.5	2.2	1.9	0.6	NR 1180	4.85	4.7	1.7	1.6	10	186.5	188
150	140	190	186.8	186.3	3.3	3.1	3.7	3.5	2.2	1.9	0.6	NR 1190	4.85	4.7	1.7	1.6	10	196.5	198
160	-	200	196.8	196.3	3.3	3.1	-	-	2.2	1.9	0.6	NR 1200	4.85	4.7	1.7	1.6	10	206.5	208



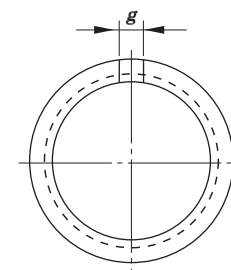
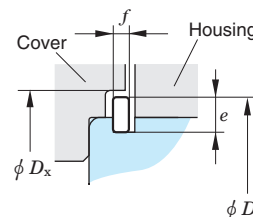
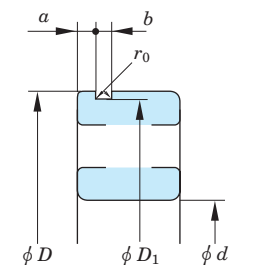
[Remark] Minimum chamfer dimension tolerances on snap ring groove-side outer ring are as follows :  
 Bearings belonging to dimension series 18 : 0.3 mm for those with nominal outside diameter not more than 78 mm ; 0.5 mm for those with nominal diameter over 78 mm.  
 Bearings belonging to dimension series 19 : 0.3 mm for those with nominal outside diameter not more than 47 mm ; 0.5 mm for those with nominal diameter over 47 mm.

Supplementary table 5 (2) Dimension of snap ring grooves and locating snap rings

- diameter series 0, 2, 3, 4 -

Unit : mm

Applicable bearing				Snap ring groove									Locating snap ring						Housing		
Bore dia. <i>d</i>				Outside dia. <i>D</i>	Snap ring groove dia. <i>D</i> <sub>1</sub>		Position of snap ring groove <i>a</i>				Snap ring groove width <i>b</i>		Fillet radius of snap ring groove <i>r</i> <sub>0</sub>	No.	Section height <i>e</i>		Thickness <i>f</i>		Mounted state		Shoulder bore dia. <i>D</i> <sub>x</sub>
							Diameter series												Distance between cut ends <i>g</i>	Locating snap ring O.D. <i>D</i> <sub>2</sub>	
Diameter series						0		2, 3, 4													
0	2	3	4		max.	min.	max.	min.	max.	min.	max.	min.	max.	max.	min.	max.	min.	max.	max.		
-	10	9	8	30	28.17	27.91	-	-	2.06	1.9	1.65	1.35	0.4	NR 30	3.25	3.1	1.12	1.02	3	34.7	35.5
15	12	-	9	32	30.15	29.9	2.06	1.9	2.06	1.9	1.65	1.35	0.4	NR 32	3.25	3.1	1.12	1.02	3	36.7	37.5
17	15	10	-	35	33.17	32.92	2.06	1.9	2.06	1.9	1.65	1.35	0.4	NR 35	3.25	3.1	1.12	1.02	3	39.7	40.5
-	-	12	10	37	34.77	34.52	-	-	2.06	1.9	1.65	1.35	0.4	NR 37	3.25	3.1	1.12	1.02	3	41.3	42
-	17	-	-	40	38.1	37.85	-	-	2.06	1.9	1.65	1.35	0.4	NR 40	3.25	3.1	1.12	1.02	3	44.6	45.5
20	-	15	12	42	39.75	39.5	2.06	1.9	2.06	1.9	1.65	1.35	0.4	NR 42	3.25	3.1	1.12	1.02	3	46.3	47
22	-	-	-	44	41.75	41.5	2.06	1.9	-	-	1.65	1.35	0.4	NR 44	3.25	3.1	1.12	1.02	3	48.3	49
25	20	17	-	47	44.6	44.35	2.06	1.9	2.46	2.31	1.65	1.35	0.4	NR 47	4.04	3.89	1.12	1.02	4	52.7	53.5
-	22	-	-	50	47.6	47.35	-	-	2.46	2.31	1.65	1.35	0.4	NR 50	4.04	3.89	1.12	1.02	4	55.7	56.5
28	25	20	15	52	49.73	49.48	2.06	1.9	2.46	2.31	1.65	1.35	0.4	NR 52	4.04	3.89	1.12	1.02	4	57.9	58.5
30	-	-	-	55	52.6	52.35	2.08	1.88	-	-	1.65	1.35	0.4	NR 55	4.04	3.89	1.12	1.02	4	60.7	61.5
-	-	22	-	56	53.6	53.35	-	-	2.46	2.31	1.65	1.35	0.4	NR 56	4.04	3.89	1.12	1.02	4	61.7	62.5
32	28	-	-	58	55.6	55.35	2.08	1.88	2.46	2.31	1.65	1.35	0.4	NR 58	4.04	3.89	1.12	1.02	4	63.7	64.5
35	30	25	17	62	59.61	59.11	2.08	1.88	3.28	3.07	2.2	1.9	0.6	NR 62	4.04	3.89	1.7	1.6	4	67.7	68.5
-	32	-	-	65	62.6	62.1	-	-	3.28	3.07	2.2	1.9	0.6	NR 65	4.04	3.89	1.7	1.6	4	70.7	71.5
40	-	28	-	68	64.82	64.31	2.49	2.29	3.28	3.07	2.2	1.9	0.6	NR 68	4.85	4.7	1.7	1.6	5	74.6	76
-	35	30	20	72	68.81	68.3	-	-	3.28	3.07	2.2	1.9	0.6	NR 72	4.85	4.7	1.7	1.6	5	78.6	80
45	-	32	-	75	71.83	71.32	2.49	2.29	3.28	3.07	2.2	1.9	0.6	NR 75	4.85	4.7	1.7	1.6	5	81.6	83
50	40	35	25	80	76.81	76.3	2.49	2.29	3.28	3.07	2.2	1.9	0.6	NR 80	4.85	4.7	1.7	1.6	5	86.6	88
-	45	-	-	85	81.81	81.31	-	-	3.28	3.07	2.2	1.9	0.6	NR 85	4.85	4.7	1.7	1.6	5	91.6	93
55	50	40	30	90	86.79	86.28	2.87	2.67	3.28	3.07	3	2.7	0.6	NR 90	4.85	4.7	2.46	2.36	5	96.5	98
60	-	-	-	95	91.82	91.31	2.87	2.67	-	-	3	2.7	0.6	NR 95	4.85	4.7	2.46	2.36	5	101.6	103
65	55	45	35	100	96.8	96.29	2.87	2.67	3.28	3.07	3	2.7	0.6	NR100	4.85	4.7	2.46	2.36	5	106.5	108
70	60	50	40	110	106.81	106.3	2.87	2.67	3.28	3.07	3	2.7	0.6	NR110	4.85	4.7	2.46	2.36	5	116.6	118
75	-	-	-	115	111.81	111.3	2.87	2.67	-	-	3	2.7	0.6	NR115	4.85	4.7	2.46	2.36	5	121.6	123
-	65	55	45	120	115.21	114.71	-	-	4.06	3.86	3.4	3.1	0.6	NR120	7.21	7.06	2.82	2.72	7	129.7	131.5
80	70	-	-	125	120.22	119.71	2.87	2.67	4.06	3.86	3.4	3.1	0.6	NR125	7.21	7.06	2.82	2.72	7	134.7	136.5
85	75	60	50	130	125.22	124.71	2.87	2.67	4.06	3.86	3.4	3.1	0.6	NR130	7.21	7.06	2.82	2.72	7	139.7	141.5
90	80	65	55	140	135.23	134.72	3.71	3.45	4.9	4.65	3.4	3.1	0.6	NR140	7.21	7.06	2.82	2.72	7	149.7	152
95	-	-	-	145	140.23	139.73	3.71	3.45	-	-	3.4	3.1	0.6	NR145	7.21	7.06	2.82	2.72	7	154.7	157
100	85	70	60	150	145.24	144.73	3.71	3.45	4.9	4.65	3.4	3.1	0.6	NR150	7.21	7.06	2.82	2.72	7	159.7	162
105	90	75	65	160	155.22	154.71	3.71	3.45	4.9	4.65	3.4	3.1	0.6	NR160	7.21	7.06	2.82	2.72	7	169.7	172
110	95	80	-	170	163.65	163.14	3.71	3.45	5.69	5.44	3.8	3.5	0.6	NR170	9.6	9.45	3.1	3	10	182.9	185
120	100	85	70	180	173.66	173.15	3.71	3.45	5.69	5.44	3.8	3.5	0.6	NR180	9.6	9.45	3.1	3	10	192.9	195
-	105	90	75	190	183.64	183.13	-	-	5.69	5.44	3.8	3.5	0.6	NR190	9.6	9.45	3.1	3	10	202.9	205
130	110	95	80	200	193.65	193.14	5.69	5.44	5.69	5.44	3.8	3.5	0.6	NR200	9.6	9.45	3.1	3	10	212.9	215



[Remark] 1. Snap ring groove dimension does not apply to bearings of dimension series 00, 82 and 83.  
 2. The minimum permissible chamfer dimension for snap ring groove-side outer ring is 0.5 mm, except 0.3 mm for bearings belonging to diameter series 0 with nominal outside diameter not more than 35 mm.

Supplementary table 6 Shaft tolerances (deviation from nominal dimensions)

Unit :  $\mu\text{m}$  (Refer.)

Nominal shaft dia. (mm)		Deviation classes of shaft dia.																				Nominal shaft dia. (mm)		$\Delta_{dmp}^D$ of bearing (class 0)							
over	up to	d 6	e 6	f 6	g 5	g 6	h 5	h 6	h 7	h 8	h 9	h 10	js 5	js 6	js 7	j 5	j 6	k 5	k 6	k 7	m 5	m 6	m 7		n 5	n 6	p 6	r 6	r 7	over	up to
3	6	-30 -38	-20 -28	-10 -18	-4 -9	-4 -12	0 -5	0 -8	0 -12	0 -18	0 -30	0 -48	$\pm 2.5$	$\pm 4$	$\pm 6$	+3 -2	+6 -2	+6 +1	+9 +1	+13 +1	+9 +4	+12 +4	+16 +4	+13 +8	+16 +8	+20 +12	+23 +15	+27 +15	3	6	0 -8
6	10	-40 -49	-25 -34	-13 -22	-5 -11	-5 -14	0 -6	0 -9	0 -15	0 -22	0 -36	0 -58	$\pm 3$	$\pm 4.5$	$\pm 7.5$	+4 -2	+7 -2	+7 +1	+10 +1	+16 +1	+12 +6	+15 +6	+21 +6	+16 +10	+19 +10	+24 +15	+28 +19	+34 +19	6	10	0 -8
10	18	-50 -61	-32 -43	-16 -27	-6 -14	-6 -17	0 -8	0 -11	0 -18	0 -27	0 -43	0 -70	$\pm 4$	$\pm 5.5$	$\pm 9$	+5 -3	+8 -3	+9 +1	+12 +1	+19 +1	+15 +7	+18 +7	+25 +7	+20 +12	+23 +12	+29 +18	+34 +23	+41 +23	10	18	0 -8
18	30	-65 -78	-40 -53	-20 -33	-7 -16	-7 -20	0 -9	0 -13	0 -21	0 -33	0 -52	0 -84	$\pm 4.5$	$\pm 6.5$	$\pm 10.5$	+5 -4	+9 -4	+11 +2	+15 +2	+23 +2	+17 +8	+21 +8	+29 +8	+24 +15	+28 +15	+35 +22	+41 +28	+49 +28	18	30	0 -10
30	50	-80 -96	-50 -66	-25 -41	-9 -20	-9 -25	0 -11	0 -16	0 -25	0 -39	0 -62	0 -100	$\pm 5.5$	$\pm 8$	$\pm 12.5$	+6 -5	+11 -5	+13 +2	+18 +2	+27 +2	+20 +9	+25 +9	+34 +9	+28 +17	+33 +17	+42 +26	+50 +34	+59 +34	30	50	0 -12
50	80	-100 -119	-60 -79	-30 -49	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	0 -120	$\pm 6.5$	$\pm 9.5$	$\pm 15$	+6 -7	+12 -7	+15 +2	+21 +2	+32 +2	+24 +11	+30 +11	+41 +11	+33 +20	+39 +20	+51 +32	+60 +41	+71 +41	50	80	0 -15
80	120	-120 -142	-72 -94	-36 -58	-12 -27	-12 -34	0 -15	0 -22	0 -35	0 -54	0 -87	0 -140	$\pm 7.5$	$\pm 11$	$\pm 17.5$	+6 -9	+13 -9	+18 +3	+25 +3	+38 +3	+28 +13	+35 +13	+48 +13	+38 +23	+45 +23	+59 +37	+73 +51	+86 +51	80	120	0 -20
120	180	-145 -170	-85 -110	-43 -68	-14 -32	-14 -39	0 -18	0 -25	0 -40	0 -63	0 -100	0 -160	$\pm 9$	$\pm 12.5$	$\pm 20$	+7 -11	+14 -11	+21 +3	+28 +3	+43 +3	+33 +15	+40 +15	+55 +15	+45 +27	+52 +27	+68 +43	+88 +63	+103 +63	120	180	0 -25
180	250	-170 -199	-100 -129	-50 -79	-15 -35	-15 -44	0 -20	0 -29	0 -46	0 -72	0 -115	0 -185	$\pm 10$	$\pm 14.5$	$\pm 23$	+7 -13	+16 -13	+24 +4	+33 +4	+50 +4	+37 +17	+46 +17	+63 +17	+51 +31	+60 +31	+79 +50	+106 +77	+123 +77	180	250	0 -30
250	315	-190 -222	-110 -142	-56 -88	-17 -40	-17 -49	0 -23	0 -32	0 -52	0 -81	0 -130	0 -210	$\pm 11.5$	$\pm 16$	$\pm 26$	+7 -16	+16 -16	+27 +4	+36 +4	+56 +4	+43 +20	+52 +20	+72 +20	+57 +34	+66 +34	+88 +56	+126 +94	+146 +94	250	315	0 -35
315	400	-210 -246	-125 -161	-62 -98	-18 -43	-18 -54	0 -25	0 -36	0 -57	0 -89	0 -140	0 -230	$\pm 12.5$	$\pm 18$	$\pm 28.5$	+7 -18	+18 -18	+29 +4	+40 +4	+61 +4	+46 +21	+57 +21	+78 +21	+62 +37	+73 +37	+98 +62	+144 +108	+165 +108	315	400	0 -40
400	500	-230 -270	-135 -175	-68 -108	-20 -47	-20 -60	0 -27	0 -40	0 -63	0 -97	0 -155	0 -250	$\pm 13.5$	$\pm 20$	$\pm 31.5$	+7 -20	+20 -20	+32 +5	+45 +5	+68 +5	+50 +23	+63 +23	+86 +23	+67 +40	+80 +40	+108 +68	+166 +126	+189 +126	400	500	0 -45
500	630	-260 -304	-145 -189	-76 -120	-22 -54	-22 -66	0 -32	0 -44	0 -70	0 -110	0 -175	0 -280	$\pm 16$	$\pm 22$	$\pm 35$	-	-	+32 0	+44 0	+70 0	+58 +26	+70 +26	+96 +26	+76 +44	+88 +44	+122 +78	+194 +150	+220 +150	500	630	0 -50
630	800	-290 -340	-160 -210	-80 -130	-24 -60	-24 -74	0 -36	0 -50	0 -80	0 -125	0 -200	0 -320	$\pm 18$	$\pm 25$	$\pm 40$	-	-	+36 0	+50 0	+80 0	+66 +30	+80 +30	+110 +30	+86 +50	+100 +50	+138 +88	+225 +175	+255 +175	630	800	0 -75
800	1000	-320 -376	-170 -226	-86 -142	-26 -66	-26 -82	0 -40	0 -56	0 -90	0 -140	0 -230	0 -360	$\pm 20$	$\pm 28$	$\pm 45$	-	-	+40 0	+56 0	+90 0	+74 +34	+90 +34	+124 +34	+96 +56	+112 +56	+156 +100	+266 +210	+300 +210	800	1000	0 -100

[Note] 1)  $\Delta_{dmp}^D$  : single plane mean bore diameter deviation



Supplementary table 7 Housing bore tolerances (deviation from nominal dimensions)

Unit :  $\mu\text{m}$  (Refer.)

Nominal Bore dia. (mm)		Deviation classes of housing bore																				Nominal Bore dia. (mm)		$\Delta D_{mp}^{(1)}$ of bearing (class 0)															
over	up to	E 6	F 6	F 7	G 6	G 7	H 6	H 7	H 8	H 9	H 10	JS 5	JS 6	JS 7	J 6	J 7	K 5	K 6	K 7	M 5	M 6	M 7	N 5		N 6	N 7	P 6	P 7	R 7	over	up to								
10	18	+43 +32	+27 +16	+34 +16	+17 +6	+24 +6	+11 0	+18 0	+27 0	+43 0	+70 0	$\pm 4$	$\pm 5.5$	$\pm 9$	+6 -5	+10 -8	+2 -6	+2 -9	+6 -12	-4 -12	-4 -15	0 -18	-9 -17	-9 -20	-5 -23	-15 -26	-11 -29	-16 -34	10	18	0 -8								
18	30	+53 +40	+33 +20	+41 +20	+20 +7	+28 +7	+13 0	+21 0	+33 0	+52 0	+84 0	$\pm 4.5$	$\pm 6.5$	$\pm 10.5$	+8 -5	+12 -9	+1 -8	+2 -11	+6 -15	-5 -14	-4 -17	0 -21	-12 -21	-11 -24	-7 -28	-18 -31	-14 -35	-20 -41	18	30	0 -9								
30	50	+66 +50	+41 +25	+50 +25	+25 +9	+34 +9	+16 0	+25 0	+39 0	+62 0	+100 0	$\pm 5.5$	$\pm 8$	$\pm 12.5$	+10 -6	+14 -11	+2 -9	+3 -13	+7 -18	-5 -16	-4 -20	0 -25	-13 -24	-12 -28	-8 -33	-21 -37	-17 -42	-25 -50	30	50	0 -11								
50	80	+79 +60	+49 +30	+60 +30	+29 +10	+40 +10	+19 0	+30 0	+46 0	+74 0	+120 0	$\pm 6.5$	$\pm 9.5$	$\pm 15$	+13 -6	+18 -12	+3 -10	+4 -15	+9 -21	-6 -19	-5 -24	0 -30	-15 -28	-14 -33	-9 -39	-26 -45	-21 -51	-30 -60	50	65	0 -13								
80	120	+94 +72	+58 +36	+71 +36	+34 +12	+47 +12	+22 0	+35 0	+54 0	+87 0	+140 0	$\pm 7.5$	$\pm 11$	$\pm 17.5$	+16 -6	+22 -13	+2 -13	+4 -18	+10 -25	-8 -23	-6 -28	0 -35	-18 -33	-16 -38	-10 -45	-30 -52	-24 -59	-38 -73	80	100	0 -15								
120	180	+110 +85	+68 +43	+83 +43	+39 +14	+54 +14	+25 0	+40 0	+63 0	+100 0	+160 0	$\pm 9$	$\pm 12.5$	$\pm 20$	+18 -7	+26 -14	+3 -15	+4 -21	+12 -28	-9 -27	-8 -33	0 -40	-21 -39	-20 -45	-12 -52	-36 -61	-28 -68	-48 -88	120	140	(up to 150) 0								
180	250	+129 +100	+79 +50	+96 +50	+44 +15	+61 +15	+29 0	+46 0	+72 0	+115 0	+185 0	$\pm 10$	$\pm 14.5$	$\pm 23$	+22 -7	+30 -16	+2 -18	+5 -24	+13 -33	-11 -31	-8 -37	0 -46	-25 -45	-22 -51	-14 -60	-41 -70	-33 -79	-60 -106	180	200	0 -30								
250	315	+142 +110	+88 +56	+108 +56	+49 +17	+69 +17	+32 0	+52 0	+81 0	+130 0	+210 0	$\pm 11.5$	$\pm 16$	$\pm 26$	+25 -7	+36 -16	+3 -20	+5 -27	+16 -36	-13 -36	-9 -41	0 -52	-27 -50	-25 -57	-14 -66	-47 -79	-36 -88	-74 -126	250	280	0 -35								
315	400	+161 +125	+98 +62	+119 +62	+54 +18	+75 +18	+36 0	+57 0	+89 0	+140 0	+230 0	$\pm 12.5$	$\pm 18$	$\pm 28.5$	+29 -7	+39 -18	+3 -22	+7 -29	+17 -40	-14 -39	-10 -46	0 -57	-30 -55	-26 -62	-16 -73	-51 -87	-41 -98	-87 -144	315	355	0 -40								
400	500	+175 +135	+108 +68	+131 +68	+60 +20	+83 +20	+40 0	+63 0	+97 0	+155 0	+250 0	$\pm 13.5$	$\pm 20$	$\pm 31.5$	+33 -7	+43 -20	+2 -25	+8 -32	+18 -45	-16 -43	-10 -50	0 -63	-33 -60	-27 -67	-17 -80	-55 -95	-45 -108	-103 -166	400	450	0 -45								
500	630	+189 +145	+120 +76	+146 +76	+66 +22	+92 +22	+44 0	+70 0	+110 0	+175 0	+280 0	$\pm 16$	$\pm 22$	$\pm 35$	-	-	0 -32	0 -44	0 -70	-26 -58	-26 -70	-26 -96	-44 -76	-44 -88	-44 -114	-78 -122	-78 -148	-150 -220	500	560	0 -50								
630	800	+210 +160	+130 +80	+160 +80	+74 +24	+104 +24	+50 0	+80 0	+125 0	+200 0	+320 0	$\pm 18$	$\pm 25$	$\pm 40$	-	-	0 -36	0 -50	0 -80	-30 -66	-30 -80	-30 -110	-50 -86	-50 -100	-50 -130	-88 -138	-88 -168	-175 -255	630	710	0 -75								
800	1000	+226 +170	+142 +86	+176 +86	+82 +26	+116 +26	+56 0	+90 0	+140 0	+230 0	+360 0	$\pm 20$	$\pm 28$	$\pm 45$	-	-	0 -40	0 -56	0 -90	-34 -74	-34 -90	-34 -124	-56 -96	-56 -112	-56 -146	-100 -156	-100 -190	-210 -300	800	900	0 -100								
1000	1250	+261 +195	+164 +98	+203 +98	+94 +28	+133 +28	+66 0	+105 0	+165 0	+260 0	+420 0	$\pm 23.5$	$\pm 33$	$\pm 52.5$	-	-	0 -47	0 -66	0 -105	-40 -87	-40 -106	-40 -145	-66 -113	-66 -132	-66 -171	-120 -186	-120 -225	-250 -355	1000	1120	0 -125								

[Note] 1)  $\Delta D_{mp}$  : single plane mean outside diameter deviation

Supplementary table 8 Numerical values for standard tolerance grades IT (ISO 286-1 : 1988)

Basic size (mm)		Standard tolerance grades (IT)																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14 <sup>1)</sup>	15 <sup>1)</sup>	16 <sup>1)</sup>	17 <sup>1)</sup>	18 <sup>1)</sup>
over	up to	Tolerances (μm)											Tolerances (mm)						
–	3	0.8	1.2	2	3	4	6	10	14	25	40	60	0.10	0.14	0.26	0.40	0.60	1.00	1.40
3	6	1	1.5	2.5	4	5	8	12	18	30	48	75	0.12	0.18	0.30	0.48	0.75	1.20	1.80
6	10	1	1.5	2.5	4	6	9	15	22	36	58	90	0.15	0.22	0.36	0.58	0.90	1.50	2.20
10	18	1.2	2	3	5	8	11	18	27	43	70	110	0.18	0.27	0.43	0.70	1.10	1.80	2.70
18	30	1.5	2.5	4	6	9	13	21	33	52	84	130	0.21	0.33	0.52	0.84	1.30	2.10	3.30
30	50	1.5	2.5	4	7	11	16	25	39	62	100	160	0.25	0.39	0.62	1.00	1.60	2.50	3.90
50	80	2	3	5	8	13	19	30	46	74	120	190	0.30	0.46	0.74	1.20	1.90	3.00	4.60
80	120	2.5	4	6	10	15	22	35	54	87	140	220	0.35	0.54	0.87	1.40	2.20	3.50	5.40
120	180	3.5	5	8	12	18	25	40	63	100	160	250	0.40	0.63	1.00	1.60	2.50	4.00	6.30
180	250	4.5	7	10	14	20	29	46	72	115	185	290	0.46	0.72	1.15	1.85	2.90	4.60	7.20
250	315	6	8	12	16	23	32	52	81	130	210	320	0.52	0.81	1.30	2.10	3.20	5.20	8.10
315	400	7	9	13	18	25	36	57	89	140	230	360	0.57	0.89	1.40	2.30	3.60	5.70	8.90
400	500	8	10	15	20	27	40	63	97	155	250	400	0.63	0.97	1.55	2.50	4.00	6.30	9.70
500	630	–	–	–	–	–	44	70	110	175	280	440	0.70	1.10	1.75	2.80	4.40	7.00	11.00
630	800	–	–	–	–	–	50	80	125	200	320	500	0.80	1.25	2.00	3.20	5.00	8.00	12.50
800	1000	–	–	–	–	–	56	90	140	230	360	560	0.90	1.40	2.30	3.60	5.60	9.00	14.00
1000	1250	–	–	–	–	–	66	105	165	260	420	660	1.05	1.65	2.60	4.20	6.60	10.50	16.50
1250	1600	–	–	–	–	–	78	125	195	310	500	780	1.25	1.95	3.10	5.00	7.80	12.50	19.50
1600	2000	–	–	–	–	–	92	150	230	370	600	920	1.50	2.30	3.70	6.00	9.20	15.00	23.00
2000	2500	–	–	–	–	–	110	175	280	440	700	1100	1.75	2.80	4.40	7.00	11.00	17.50	28.00
2500	3150	–	–	–	–	–	135	210	330	540	860	1350	2.10	3.30	5.40	8.60	13.50	21.00	33.00

[Note] 1) Standard tolerance grades IT 14 to IT 18 (incl.) shall not be used for basic sizes less than or equal to 1 mm.

Supplementary table 9 Greek alphabet list

Name	Roman type		Italic type		Name	Roman type		Italic type	
	Capital	Lowercase	Capital	Lowercase		Capital	Lowercase	Capital	Lowercase
alpha	A	a	Α	α	nu	N	n	Ν	ν
beta	B	b	Β	β	xi	Ξ	ξ	Ξ	ξ
gamma	Γ	γ	Γ	γ	omicron	O	ο	Ο	ο
delta	Δ	δ	Δ	δ	pi	Π	π	Π	π
epsilon	E	ε	Ε	ε	rho	Ρ	ρ	Ρ	ρ
zeta	Z	ζ	Ζ	ζ	sigma	Σ	σ	Σ	σ
eta	H	η	Η	η	tau	T	τ	Τ	τ
theta	Θ	θ	Θ	θ	upsilon	Υ	υ	Υ	υ
iota	I	ι	Ι	ι	phi	Φ	φ	Φ	φ
kappa	K	κ	Κ	κ	chi	Χ	χ	Χ	χ
lambda	Λ	λ	Λ	λ	psi	Ψ	ψ	Ψ	ψ
mu	M	μ	Μ	μ	omega	Ω	ω	Ω	ω

Supplementary table 10 Prefixes used with SI units

Factor	Prefix		Factor	Prefix	
	Name	Symbol		Name	Symbol
10 <sup>18</sup>	exa	E	10 <sup>-1</sup>	deci	d
10 <sup>15</sup>	peta	P	10 <sup>-2</sup>	centi	c
10 <sup>12</sup>	tera	T	10 <sup>-3</sup>	milli	m
10 <sup>9</sup>	giga	G	10 <sup>-6</sup>	micro	μ
10 <sup>6</sup>	mega	M	10 <sup>-9</sup>	nano	n
10 <sup>3</sup>	kilo	k	10 <sup>-12</sup>	pico	p
10 <sup>2</sup>	hecto	h	10 <sup>-15</sup>	femto	f
10	deka	da	10 <sup>-18</sup>	atto	a

Supplementary table 11 (1) SI units and conversion factors

Mass	SI units	Other units <sup>1)</sup>	Conversion into SI units	Conversion from SI units
Angle	rad [radian(s)]	° [degree(s)] * ' [minute(s)] * " [second(s)] *	1° = π /180 rad 1' = π /10 800 rad 1" = π /648 000 rad	1 rad = 57.295 78°
Length	m [meter(s)]	Å [Angstrom unit] μ [micron(s)] in [inch(es)] ft [foot(feet)] yd [yard(s)] mile [mile(s)]	1Å = 10 <sup>-10</sup> m = 0.1nm = 100pm 1μ = 1 μm 1in = 25.4 mm 1ft = 12 in = 0.304 8 m 1yd = 3 ft = 0.914 4 m 1mile = 5 280 ft = 1 609.344 m	1m = 10 <sup>10</sup> Å 1m = 39.37 in 1m = 3.280 8 ft 1m = 1.093 6 yd 1km = 0.621 4 mile
Area	m <sup>2</sup>	a [are(s)] ha [hectare(s)] acre [acre(s)]	1a = 100 m <sup>2</sup> 1ha = 10 <sup>4</sup> m <sup>2</sup> 1acre = 4 840 yd <sup>2</sup> = 4 046.86 m <sup>2</sup>	1km <sup>2</sup> = 247.1 acre
Volume	m <sup>3</sup>	ℓ , L [liter(s)] * cc [cubic centimeters] gal(US) [gallon(s)] floz(US) [fluid ounce(s)] barrel(US) [barrels(US)]	1 ℓ = 1 dm <sup>3</sup> = 10 <sup>-3</sup> m <sup>3</sup> 1cc = 1 cm <sup>3</sup> = 10 <sup>-6</sup> m <sup>3</sup> 1gal(US) = 231 in <sup>3</sup> = 3.785 41dm <sup>3</sup> 1floz(US) = 29.573 5 cm <sup>3</sup> 1barrel(US) = 158.987 dm <sup>3</sup>	1m <sup>3</sup> = 10 <sup>3</sup> ℓ 1m <sup>3</sup> = 10 <sup>6</sup> cc 1m <sup>3</sup> = 264.17 gal 1m <sup>3</sup> = 33 814 floz 1m <sup>3</sup> = 6.289 8 barrel
Time	s [second(s)]	min [minute(s)] * h [hour(s)] * d [day(s)] *		
Angular velocity	rad/s			
Velocity	m/s	kn [knot(s)] m/h *	1kn = 1 852 m/h	1km/h = 0.539 96 kn
Acceleration	m/s <sup>2</sup>	G	1G = 9.806 65 m/s <sup>2</sup>	1m/s <sup>2</sup> = 0.101 97 G
Frequency	Hz [hertz]	c/s [cycle(s)/second]	1c/s = 1s <sup>-1</sup> = 1 Hz	
Rotational frequency	s <sup>-1</sup>	rpm [revolutions per minute] min <sup>-1</sup> * r/min	1rpm = 1 / 60 s <sup>-1</sup>	1s <sup>-1</sup> = 60 rpm
Mass	kg [kilogram(s)]	t [ton(s)] * lb [pound(s)] gr [grain(s)] oz [ounce(s)] ton (UK) [ton(s)(UK)] ton (US) [ton(s)(US)] car [carat(s)]	1t = 10 <sup>3</sup> kg 1lb = 0.453 592 37 kg 1gr = 64.798 91 mg 1oz = 1/16 lb = 28.349 5 g 1ton(UK) = 1 016.05 kg 1ton(US) = 907.185 kg 1car = 200 mg	1kg = 2.204 6 lb 1g = 15.432 4 gr 1kg = 35.274 0 oz 1t = 0.984 2 ton(UK) 1t = 1.102 3 ton(US) 1g = 5 car

[Note] \*: Unit can be used as an SI unit.  
No asterisk : Unit cannot be used.

Supplementary table 11 (2) SI units and conversion factors

Mass	SI units	Other units <sup>1)</sup>	Conversion into SI units	Conversion from SI units
Density	kg/m <sup>3</sup>			
Linear density	kg/m			
Momentum	kg·m/s			
Moment of momentum, angular momentum	} kg·m <sup>2</sup> /s			
Moment of inertia		kg·m <sup>2</sup>		
Force	N [newton(s)]	dyn [dyne(s)] kgf [kilogram-force] gf [gram-force] tf [ton-force] lbf [pound-force]	1 dyn = 10 <sup>-5</sup> N 1kgf = 9.806 65 N 1gf = 9.806 65×10 <sup>-3</sup> N 1tf = 9.806 65×10 <sup>3</sup> N 1lbf = 4.448 22 N	1N = 10 <sup>5</sup> dyn 1N = 0.101 97 kgf 1N = 0.224 809 lbf
Moment of force	N·m [Newton meter(s)]	gf·cm kgf·cm kgf·m tf·m lbf·ft	1gf·cm = 9.806 65×10 <sup>-5</sup> N·m 1kgf·cm = 9.806 65×10 <sup>-2</sup> N·m 1kgf·m = 9.806 65 N·m 1tf·m = 9.806 65×10 <sup>3</sup> N·m 1lbf·ft = 1.355 82 N·m	1N·m = 0.101 97 kgf·m 1N·m = 0.737 56 lbf·ft
Pressure, Normal stress	Pa [Pascal(s)]  or N/m <sup>2</sup> { 1 Pa = 1 N/m <sup>2</sup> }	gf/cm <sup>2</sup> kgf/mm <sup>2</sup> kgf/m <sup>2</sup> lbf/in <sup>2</sup> bar [bar(s)] at [engineering air pressure] mH <sub>2</sub> O, mAq [meter water column] atm [atmosphere] mHg [meter mercury column] Torr [torr]	1gf/cm <sup>2</sup> = 9.806 65×10 Pa 1kgf/mm <sup>2</sup> = 9.806 65×10 <sup>6</sup> Pa 1kgf/m <sup>2</sup> = 9.806 65 Pa 1lbf/in <sup>2</sup> = 6 894.76 Pa 1bar = 10 <sup>5</sup> Pa 1at = 1kgf/cm <sup>2</sup> = 9.806 65×10 <sup>4</sup> Pa 1mH <sub>2</sub> O = 9.806 65×10 <sup>3</sup> Pa 1atm = 101 325 Pa 1mHg = $\frac{101\ 325}{0.76}$ Pa 1Torr = 1 mmHg = 133.322 Pa	1MPa = 0.101 97 kgf/mm <sup>2</sup> 1Pa = 0.101 97 kgf/m <sup>2</sup> 1Pa = 0.145×10 <sup>-3</sup> lbf/in <sup>2</sup> 1Pa = 10 <sup>-2</sup> mbar 1Pa = 7.500 6×10 <sup>-3</sup> Torr
Viscosity	Pa·s [pascal second]	P [poise] kgf·s/m <sup>2</sup>	10 <sup>-2</sup> P = 1 cP = 1 mPa·s 1kgf·s/m <sup>2</sup> = 9.806 65 Pa·s	1Pa·s = 0.101 97 kgf·s/m <sup>2</sup>
Kinematic viscosity	m <sup>2</sup> /s	St [stokes]	10 <sup>-2</sup> St = 1 cSt = 1 mm <sup>2</sup> /s	
Surface tension	N/m			

Supplementary table 11 (3) SI units and conversion factors

Mass	SI units	Other units <sup>1)</sup>	Conversion into SI units	Conversion from SI units
Work, energy	J [joule(s)] {1 J=1 N·m}	eV [electron volt(s)] * erg [erg(s)] kgf·m lbf·ft	1eV = (1.602 189 2± 0.000 004 6)×10 <sup>-19</sup> J 1 erg = 10 <sup>-7</sup> J 1 kgf·m = 9.806 65 J 1 lbf·ft = 1.355 82 J	1 J = 10 <sup>7</sup> erg 1 J = 0.101 97 kgf·m 1 J = 0.737 56 lbf·ft
Power	W [watt(s)]	erg/s [ergs per second] kgf·m/s PS [French horse-power] HP [horse-power (British)] lbf·ft/s	1 erg/s = 10 <sup>-7</sup> W 1 kgf·m/s = 9.806 65 W 1 PS = 75 kgf·m/s = 735.5 W 1 HP = 550 lbf·ft/s = 745.7 W 1 lbf·ft/s = 1.355 82 W	1 W = 0.101 97 kgf·m/s 1 W = 0.001 36 PS 1 W = 0.001 34 HP
Thermo-dynamic temperature	K [kelvin(s)]			
Celsius temperature	°C [Celsius(s)] {t°C = (t+273.15)K}	°F [degree(s) Fahrenheit]	t °F = $\frac{5}{9}(t-32)$ °C	t °C = $(\frac{9}{5}t+32)$ °F
Linear expansion coefficient	K <sup>-1</sup>	°C <sup>-1</sup> [per degree]		
Heat	J [joule(s)] {1 J=1 N·m}	erg [erg(s)] kgf·m cal <sub>IT</sub> [I. T. calories]	1 erg = 10 <sup>-7</sup> J 1 cal <sub>IT</sub> = 4.186 8 J 1 Mcal <sub>IT</sub> = 1.163 kW·h	1 J = 10 <sup>7</sup> erg 1 J = 0.238 85 cal <sub>IT</sub> 1 kW·h = 0.86 × 10 <sup>6</sup> cal <sub>IT</sub>
Thermal conductivity	W/(m·K)	W/(m·°C) cal/(s·m·°C)	1 W/(m·°C) = 1 W/(m·K) 1 cal/(s·m·°C) = 4.186 05 W/(m·K)	
Coefficient of heat transfer	W/(m <sup>2</sup> ·K)	W/(m <sup>2</sup> ·°C) cal/(s·m <sup>2</sup> ·°C)	1 W/(m <sup>2</sup> ·°C) = 1 W/(m <sup>2</sup> ·K) 1 cal/(s·m <sup>2</sup> ·°C) = 4.186 05 W/(m <sup>2</sup> ·K)	
Heat capacity	J/K	J/°C	1 J/°C = 1 J/K	
Massic heat capacity	J/(kg·K)	J/(kg·°C)		

[Note] \*: Unit can be used as an SI unit.  
No asterisk : Unit cannot be used.

Supplementary table 11 (4) SI units and conversion factors

Mass	SI units	Other units <sup>1)</sup>	Conversion into SI units	Conversion from SI units
Electric current	A [ampere(s)]			
Electric charge, quantity of electricity	C [coulomb(s)] {1 C = 1 A·s}	A·h * * 1 A·h = 3.6 kC		
Tension, electric potential	V [volt(s)] {1 V = 1 W/A}			
Capacitance	F [farad(s)] {1 F = 1 C/V}			
Magnetic field strength	A/m	Oe [oersted(s)]	1 Oe = $\frac{10^3}{4\pi}$ A/m	1 A/m = 4 π × 10 <sup>-3</sup> Oe
Magnetic flux density	T [tesla(s)] $\left\{ \begin{array}{l} 1T=1N/(A\cdot m) \\ =1Wb/m^2 \\ =1V\cdot s/m^2 \end{array} \right\}$	Gs [gauss(es)] γ [gamma(s)]	1 Gs = 10 <sup>-4</sup> T 1 γ = 10 <sup>-9</sup> T	1 T = 10 <sup>4</sup> Gs 1 T = 10 <sup>9</sup> γ
Magnetic flux	Wb [weber(s)] {1 Wb = 1 V·s}	Mx [maxwell(s)]	1 Mx = 10 <sup>-8</sup> Wb	1 Wb = 10 <sup>8</sup> Mx
Self inductance	H [henry(-ries)] {1 H = 1 Wb/A}			
Resistance (to direct current)	Ω [ohm(s)] {1 Ω = 1 V/A}			
Conductance (to direct current)	S [siemens] {1 S = 1 A/V}			
Active power	W $\left\{ \begin{array}{l} 1 W=1 J/s \\ =1 A\cdot V \end{array} \right\}$			



**Supplementary table 14 Surface roughness comparison**

Arithmetical mean deviation of the profile R <sub>a</sub>	Maximum height of the profile R <sub>max</sub>	Ten-point height of irregularities R <sub>z</sub>	Roughness grade numbers N
0.013 a	0.05 S	0.05 Z	–
0.025 a	0.1 S	0.1 Z	N 1
0.05 a	0.2 S	0.2 Z	N 2
0.10 a	0.4 S	0.4 Z	N 3
0.20 a	0.8 S	0.8 Z	N 4
0.40 a	1.6 S	1.6 Z	N 5
0.80 a	3.2 S	3.2 Z	N 6
1.6 a	6.3 S	6.3 Z	N 7
3.2 a	12.5 S	12.5 Z	N 8
6.3 a	25 S	25 Z	N 9
12.5 a	50 S	50 Z	N 10
25 a	100 S	100 Z	N 11
50 a	200 S	200 Z	N 12
100 a	400 S	400 Z	–

[Note] Above table is applicable only when processed surface peaks are of equal height.  
 Above table is roughly applicable to processed surface for general use.  
 Numbers are combined only for convenience in deciding surface roughness.

**Supplementary table 15 Viscosity conversion**

Kinematic viscosity mm <sup>2</sup> /s	Saybolt SUS (second)		Redwood R (second)		Engler E (degree)
	100°F	210°F	50°C	100°C	
2	32.6	32.8	30.8	31.2	1.14
3	36.0	36.3	33.3	33.7	1.22
4	39.1	39.4	35.9	36.5	1.31
5	42.3	42.6	38.5	39.1	1.40
6	45.5	45.8	41.1	41.7	1.48
7	48.7	49.0	43.7	44.3	1.56
8	52.0	52.4	46.3	47.0	1.65
9	55.4	55.8	49.1	50.0	1.75
10	58.8	59.2	52.1	52.9	1.84
11	62.3	62.7	55.1	56.0	1.93
12	65.9	66.4	58.2	59.1	2.02
13	69.6	70.1	61.4	62.3	2.12
14	73.4	73.9	64.7	65.6	2.22
15	77.2	77.7	68.0	69.1	2.32
16	81.1	81.7	71.5	72.6	2.43
17	85.1	85.7	75.0	76.1	2.54
18	89.2	89.8	78.6	79.7	2.64
19	93.3	94.0	82.1	83.6	2.76
20	97.5	98.2	85.8	87.4	2.87
21	102	102	89.5	91.3	2.98
22	106	107	93.3	95.1	3.10
23	110	111	97.1	98.9	3.22
24	115	115	101	103	3.34
25	119	120	105	107	3.46
26	123	124	109	111	3.58
27	128	129	112	115	3.70
28	132	133	116	119	3.82
29	137	138	120	123	3.95
30	141	142	124	127	4.07
31	145	146	128	131	4.20
32	150	150	132	135	4.32
33	154	155	136	139	4.45
34	159	160	140	143	4.57
35	163	164	144	147	4.70
36	168	170	148	151	4.83
37	172	173	153	155	4.96
38	177	178	156	159	5.08
39	181	183	160	164	5.21
40	186	187	164	168	5.34
41	190	192	168	172	5.47
42	195	196	172	176	5.59
43	199	201	176	180	5.72
44	204	205	180	185	5.85
45	208	210	184	189	5.98
46	213	215	188	193	6.11
47	218	219	193	197	6.24
48	222	224	197	202	6.37
49	227	228	201	206	6.50
50	231	233	205	210	6.63
55	254	256	225	231	7.24
60	277	279	245	252	7.90
65	300	302	266	273	8.55
70	323	326	286	294	9.21
75	346	349	306	315	9.89
80	371	373	326	336	10.5
85	394	397	347	357	11.2
90	417	420	367	378	11.8
95	440	443	387	399	12.5
100	464	467	408	420	13.2
120	556	560	490	504	15.8
140	649	653	571	588	18.4
160	742	747	653	672	21.1
180	834	840	734	757	23.7
200	927	933	816	841	26.3
250	1159	1167	1020	1051	32.9
300	1391	1400	1224	1241	39.5

[Remark] 1mm<sup>2</sup>/s = 1 cSt (centi stokes)



# GLOBAL NETWORK

## BEARING BUSINESS OPERATIONS

### JTEKT CORPORATION NAGOYA HEAD OFFICE

No.7-1, Meieki 4-chome, Nakamura-ku, Nagoya, Aichi 450-8515, JAPAN  
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FAX : 81-52-527-1911

### JTEKT CORPORATION OSAKA HEAD OFFICE

No.5-8, Minamisemba 3-chome, Chuo-ku, Osaka 542-8502, JAPAN  
TEL : 81-6-6271-8451  
FAX : 81-6-6245-3712

### Sales & Marketing Headquarters

No.5-8, Minamisemba 3-chome, Chuo-ku, Osaka 542-8502, JAPAN  
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FAX : 81-6-6244-9007

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FAX : 1-905-681-1392

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FAX : 1-440-835-9347

#### -Detroit Office-

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FAX : 1-734-454-4076

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FAX : 52-55-5207-3873

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FAX : 507-264-2782/507-269-7578

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FAX : 55-11-3887-3039

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FAX : 91-80-4276-4568

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FAX : 66-38-830-579

### PT. JTEKT INDONESIA

d/a. MM2100 Industrial Town Block DD-3, Cikarang Barat, Bekasi 17520, INDONESIA  
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FAX : 82-2-549-7923

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FAX : 31-184606857

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