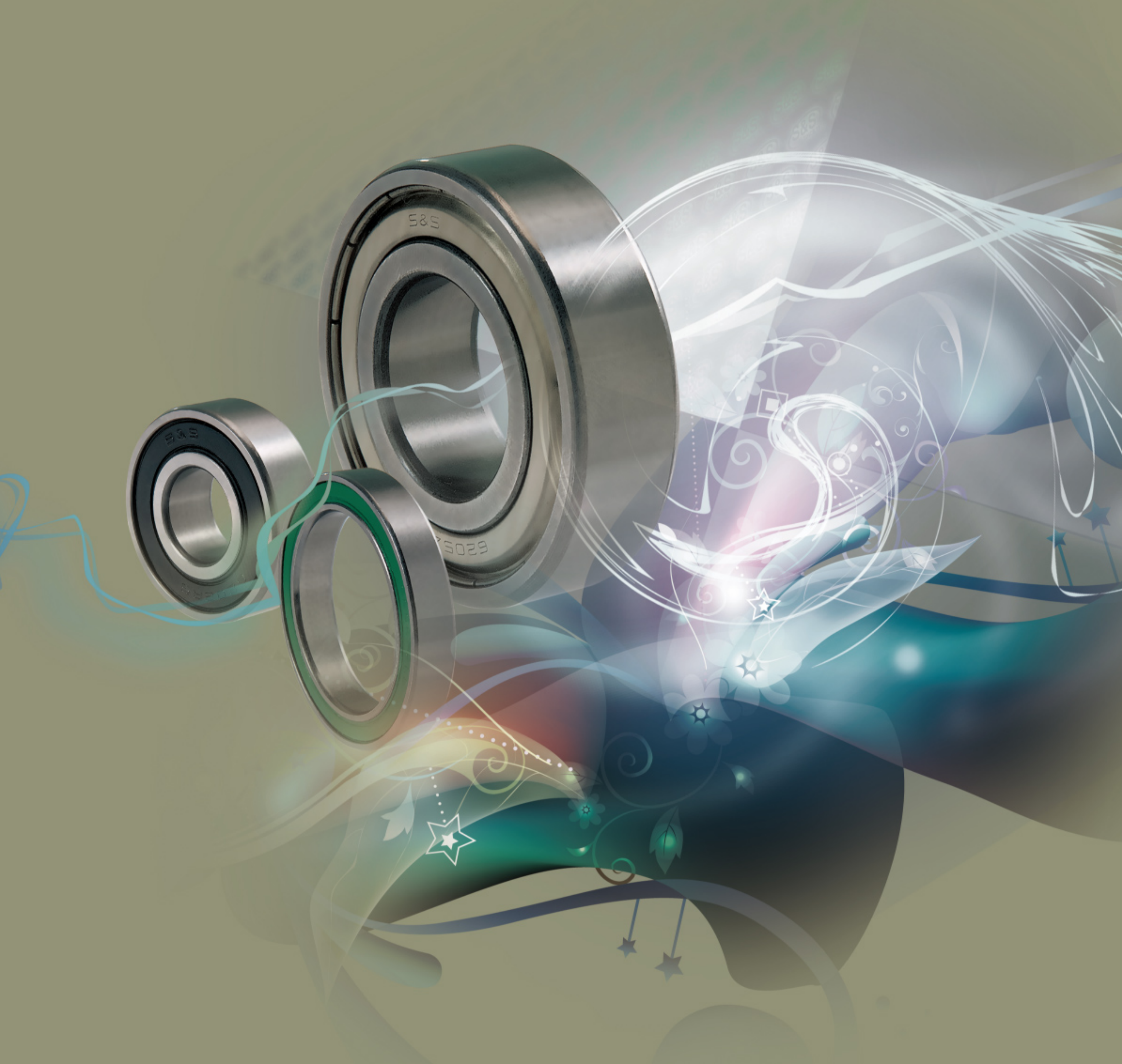
Hope Group

S&S Ball Bearings



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Index

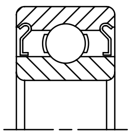
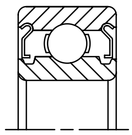
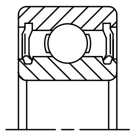
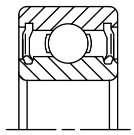
Deep groove ball bearings

1.Design features and special characteristics

Deep groove ball bearings are the most common type of rolling bearings and very widely used. A deep groove is formed on each inner and outer ring of the bearing enabling them to sustain radial and axial loads in either direction as well as the complex loads which result from the combination for high speed applications.

In addition to open type bearings, deep groove ball bearings include ball bearings with greased sealed inside (sealed or shielded) and bearings with a snap ring that simplify structure around the bearing and design. Table 1 shows the construction and special characteristics of various sealed deep groove ball bearings.

Table 1 Sealed ball bearings : construction and characteristics

Type ,code no.	Shielded type		Sealed type	
	Non-contact type ZZ		Non-contact type LLB	Contact type LLU
Construction				
Torque	Low	Low	Low	Rather high
Dust resistance	Good	Good	Better than ZZ-type	Excellent
Water resistance	Poor	Poor	Poor	Very good
Speed capacity	Same as open type	Same as open type	Same as open type	Limited by contact seals

2.Standard cage types

As shown in table 2, pressed cages are usually used in deep groove ball bearings and high-speed bearings.

Table 2 standard cage for deep groove ball bearings

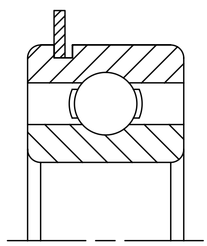
Bearing series	Pressed cages
67	6700~6706
68	6800~6834
69	6900~6934
160	16001~16052

Bearing series	Pressed cages
60	6000~6052
62	6200~6244
63	6300~6344
64	6403~6416

3.Other bearing type

3.1 Bearings with snap rings

Some bearings with a snap ring which is attached along the outer diameter of the outer ring. By using snap rings positioning in the axial direction is possible and housing installation is simplified.



3.2 Expansion compensating bearing (creep prevention bearings)

The boundary dimensions of expansion compensating deep groove ball bearings are the same as for standard bearings, but formed high polymer material with a high expansion rate is provided in the groove on the outer circumference of the outer ring (see Fig 1)

(1)Allowable load

maximum allowable load Cp (refer to the table of boundary dimensions)has been determined in accordance with outer ring strength.

(2)Housing and bearing fit

Table 3 shows the recommended fits for bearings with light metal alloy housings.

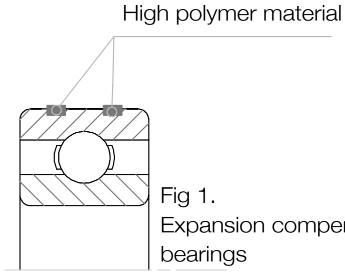


Fig 1.
Expansion compensating bearings

3.3 AC bearings (creep prevention bearings)

A C bearings have the same boundary dimensions as standard bearings with the addition of two O-rings imbedded in the outside circumference of the outer ring.(Fig 3)

(1)Allowable load

because allowable load Cp that takes outer ring strength into account (see dimensions table) is established, selection must be made so that maximum load on the bearing does not exceed Cp.

(2)Fit with housing

Fig.4 give recommended fit with steel housing.

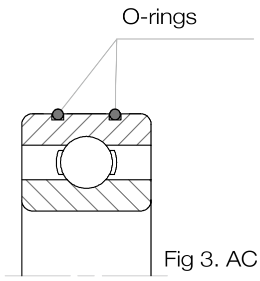


Fig 3. AC bearings

Table 3 Recommended fits for outer ring and housing bore

Conditions		Suitable bearing	Housing bore Tolerance class
Load type, etc.	Housing material		
Rotating outer ring load 、Rotating innerring load ；light load Direction indeterminate load ；ordinary load	Al alloy ；Mg alloy ；Other light alloys	Deep groove ball bearings Cylindrical roller bearings	H6
Rotating outer ring load ；heavy load Direction indeterminate load ；shock load	Al alloy ；Mg alloy ；Other light alloys	Thick-walled type deep groove ball bearings	N6

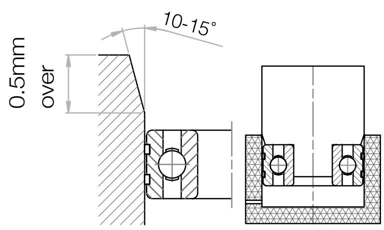


Fig 2.
Fitting method and housing inner diameter chamfer

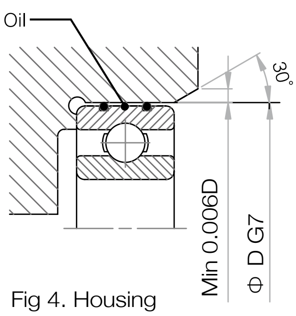
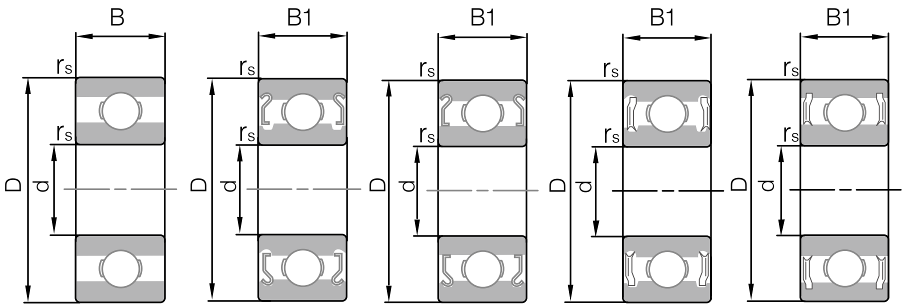


Fig 4. Housing

Extra small ball bearings and Miniature ball bearings

Metric design



Open Type | Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

Dynamic Equivalent Load

P=XFr+YFa

$\frac{Cor}{Fa}$	e	$\frac{Fa}{Fr} \leqq e$		$\frac{Fa}{Fr} > e$	
		X	Y	X	Y
5	0.35	1	0	0.56	1.26
10	0.29	1	0	0.56	1.49
15	0.27	1	0	0.56	1.64
20	0.25	1	0	0.56	1.76
25	0.24	1	0	0.56	1.85
30	0.23	1	0	0.56	1.92
50	0.20	1	0	0.56	2.13
70	0.19	1	0	0.56	2.28

Static Equivalent Load

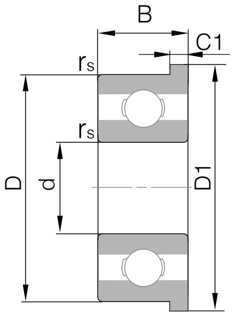
$\frac{Fa}{Fr} > 0.8$, Po=0.6Fr+0.5Fa

$\frac{Fa}{Fr} \leqq 0.8$, Po=Fr

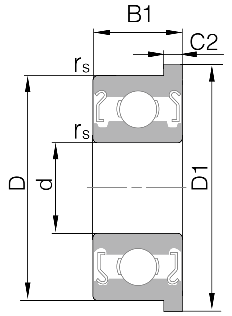
Boundary dimensions mm		Bearing numbes				Boundry dimensions mm						
d	**D**	**Open type**	**Shielded type**	**Non-contact sealed type**	**Contact sealed type**	**D1**	**C2**	**B**	**B1**	**C1**	**C2**	**rs min**
3	6	617/3	ZZ	--	--	7.2	7.2	2	2.5	0.6	0.6	0.08
	7	618/3	ZZ	--	--	8.1		8.1	3	0.5	0.8	0.1
	8	MR83	--	--	--	9.2		--	--	0.6	--	0.15
	8	619/3	ZZ	--	--	9.5		9.5	4	0.7	0.9	0.15
	9	MR93	ZZ	--	--	10.2	10.6	2.5	4	0.6	0.8	0.15
	9	603	ZZ	--	--	10.5	10.5	3	5	0.7	1	0.15
	10	623	ZZ	--	--	11.5	11.5	4	4	1	1	0.15
	13	633	ZZ	--	--	15	15	5	5	1	1	0.2
4	7	617/4	ZZ	--	--	8.2		8.2	2.5	0.6	0.6	0.1
	8	MR84	ZZ	--	--	9.2		9.2	3	0.6	0.6	0.1
	9	618/4	ZZ	--	--	10.3	10.3	2.5	4	0.6	1	0.1
	10	MR104	ZZ	--	--	11.2	11.6	3	4	0.6	0.8	0.15
	11	619/4	ZZ	--	--	12.5	12.5	4	4	1	1	0.15
	12	604	ZZ	--	--	13.5	13.5	4	4	1	1	0.2
	13	624	ZZ	--	--	15	15	5	5	1	1	0.2
	16	634	ZZ	--	--	18	18	5	5	1	1	0.3
5	8	617/5	ZZ	--	--	9.2		9.2	2.5	0.6	0.6	0.1
	9	MR95	ZZ	--	--	10.2	10.2	2.5	3	0.6	0.6	0.15
	10	MR105	ZZ	--	--	11.2	11.6	3	4	0.6	0.8	0.15
	11	618/5	ZZ	--	--	12.5	12.5	3	5	0.8	1	0.15
	13	619/5	ZZ	--	--	15	15	4	4	1	1	0.2
	14	605	ZZ	--	--	16	16	5	5	1	1	0.2
	16	625	ZZ	LLB	LLU	18	18	5	5	1	1	0.3
	19	635	ZZ	LLB	LLU	22	22	6	6	1.5	1.5	0.3

Extra small ball bearings and Miniature ball bearings

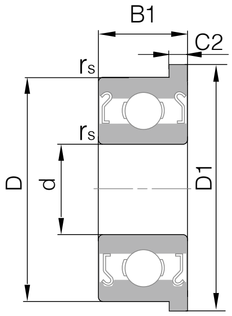
Metric design with flange



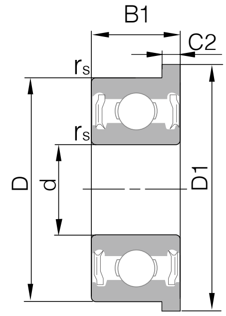
Open Type



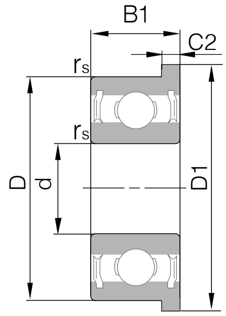
Shielded Type
Type 1



Shielded Type
Type 2



Sealed Type
Type 1

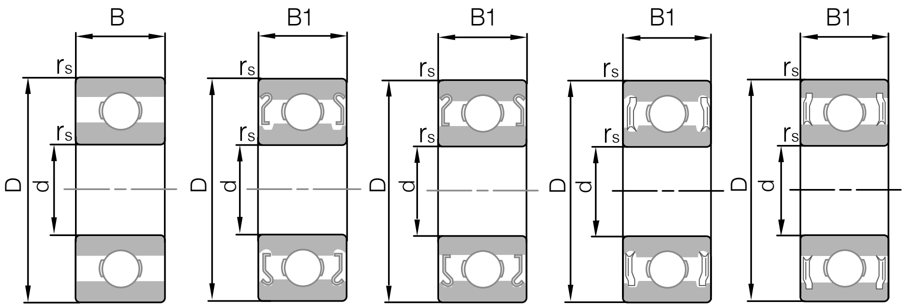


Sealed Type
Type 2

Bearing numbers Deep groove ball bearing with flanged outer ring				Load rating N		Limiting speeds rpm		Weight (g)				Boundary dimensions mm	
Open type	Shielded type	Non-contact sealed type	Contact sealed type	Cr	Cor	Grease	Oil	Deep groove ball bearing		With flanged outer ring		D	d
								Open	Closed	Open	Closed		
F617/3	ZZ	--	--	208	74	71000	80000	0.19	0.28	0.26	0.34	**6**	3
F618/3	ZZ	--	--	310	111	63000	75000	0.32	0.43	0.36	0.50	**7**	
MF83	--	--	--	560	179	60000	67000	0.51	--	0.56	--	**8**	
F619/3	ZZ	--	--	560	179	60000	67000	0.61	0.83	0.68	0.95	**8**	
MF93	ZZ	--	--	570	187	56000	67000	0.68	1.18	0.77	1.32	**9**	
F603	ZZ	--	--	570	187	56000	67000	0.84	--	0.97	--	**9**	
F623	ZZ	--	--	630	218	50000	60000	1.65	1.66	1.83	1.84	**10**	
F633	ZZ	--	--	1300	485	40000	48000	3.38	3.33	--	--	**13**	
MF74	ZZ	--	--	310	115	60000	67000	0.21	0.29	0.28	0.34	**7**	4
MF84	ZZ	--	--	395	139	56000	67000	0.33	0.56	0.41	0.63	**8**	
F618/4	ZZ	--	--	640	225	53000	63000	0.63	1.01	0.70	1.14	**9**	
MF104	ZZ	--	--	585	204	48000	56000	0.95	1.33	1.00	1.50	**10**	
F619/4	ZZ	--	--	960	345	48000	56000	1.70	1.75	1.89	1.96	**11**	
F604	ZZ	--	--	960	345	48000	56000	2.25	2.29	2.48	2.48	**12**	
F624	ZZ	--	--	1300	485	40000	48000	2.97	3.04	3.31	3.48	**13**	
F634	ZZ	--	--	1340	515	36000	43000	5.24	5.21	5.73	5.57	**16**	
F617/5	ZZ	--	--	310	120	53000	63000	0.24	0.34	0.33	0.41	**8**	5
MF95	ZZ	--	--	430	168	50000	60000	0.48	0.54	0.56	0.62	**9**	
MR105	ZZ	--	--	430	168	50000	60000	0.91	1.29	1.01	1.44	**10**	
F618/5	ZZ	--	--	715	281	45000	53000	1.20	1.95	1.35	2.14	**11**	
F619/5	ZZ	--	--	1080	430	43000	50000	2.38	2.50	2.72	2.79	**13**	
F605	ZZ	--	--	1330	505	40000	50000	3.54	3.48	3.85	3.89	**14**	
F625	ZZ	--	--	1880	680	36000	43000	4.95	4.86	5.37	5.22	**16**	
F635	ZZ	--	--	2340	885	32000	40000	8.53	8.37	9.39	9.39	**19**	

Extra small ball bearings and Miniature ball bearings

Metric design



Open Type | Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

Dynamic Equivalent Load

P=XFr+YFa

$\frac{Cor}{Fa}$	e	$\frac{Fa}{Fr} \leqq e$		$\frac{Fa}{Fr} > e$	
		X	Y	X	Y
5	0.35	1	0	0.56	1.26
10	0.29	1	0	0.56	1.49
15	0.27	1	0	0.56	1.64
20	0.25	1	0	0.56	1.76
25	0.24	1	0	0.56	1.85
30	0.23	1	0	0.56	1.92
50	0.20	1	0	0.56	2.13
70	0.19	1	0	0.56	2.28

Static Equivalent Load

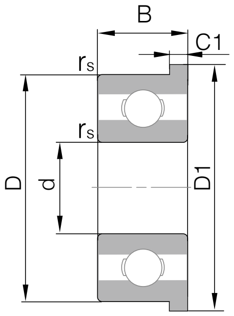
$\frac{Fa}{Fr} > 0.8$, Po=0.6Fr+0.5Fa

$\frac{Fa}{Fr} \leqq 0.8$, Po=Fr

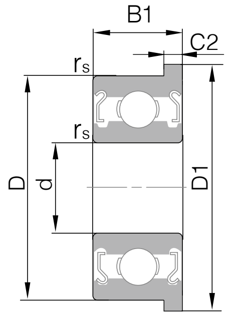
Boundary dimensions mm		Bearing numbers				Boundry dimensions mm						
d	D	Open type	Shielded type	Non-contact sealed type	Contact sealed type	D1	C2	B	B1	C1	C2	rs min
6	10	MR106	ZZ	--	--	11.2	11.2	2.5	3	0.6	0.6	0.1
	12	MR126	ZZ	--	--	13.2	13.6	3	4	0.6	0.8	0.15
	13	686	--	--	--	15	15	3.5	5	1	1.1	0.15
	15	696	ZZ	--	--	17	17	5	5	1.2	1.2	0.2
	17	606	ZZ	--	--	19	19	6	6	1.2	1.2	0.3
	19	626	ZZ	LLB	LLU	22	22	6	6	1.5	1.5	0.3
	22	636	ZZ	--	--	25	25	7	7	1.5	1.5	0.3
7	11	MR117	ZZ	--	--	12.2	12.2	2.5	3	0.6	0.6	0.1
	13	MR137	ZZ	--	--	14.2	14.6	3	4	0.6	0.8	0.15
	14	687	ZZ	--	--	16	16	3.5	5	1	1.1	0.15
	17	697	ZZ	--	--	19	19	5	5	1.2	1.2	0.3
	19	607	ZZ	LLB	LLU	22	22	6	6	1.5	1.5	0.3
	22	627	ZZ	LLB	LLU	25	25	7	7	1.5	1.5	0.3
	26	637	ZZ	--	--	29	29	9	9	2	2	0.3
8	12	MR128	ZZ	--	--	13.2	13.6	2.5	3.5	0.6	0.8	0.1
	14	MR148	ZZ	--	--	15.6	15.6	3.5	4	0.8	0.8	0.15
	16	688	ZZ	--	--	18	18	4	5	1	1.1	0.2
	19	698	ZZ	LLB	LLU	22	22	6	6	1.5	1.5	0.3
	22	608	ZZ	LLB	LLU	25	25	7	7	1.5	1.5	0.3
	24	628	ZZ	LLB	LLU	26	26	8	8	2	2	0.3
	28	638	ZZ	--	--	30.2	30.2	9	9	2.25	2.25	0.3
9	14	MR149	ZZ	--	--	15.5	--	3	4.5	0.8	--	0.1
	17	689	ZZ	--	--	19	19	4	5	1	1.1	0.2
	20	699	ZZ	LLB	LLU	23	23	6	6	1.5	1.5	0.3
	24	609	ZZ	LLB	LLU	27	27	7	7	1.5	1.5	0.3
	26	629	ZZ	LLB	LLU	28	28	8	8	2	2	0.3
	30	639	ZZ	--	--	32.5	32.5	10	10	2.5	2.5	0.6

Extra small ball bearings and Miniature ball bearings

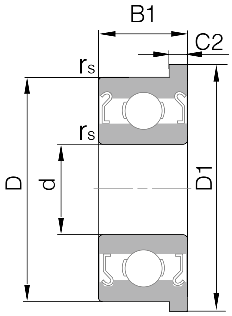
Metric design with flange



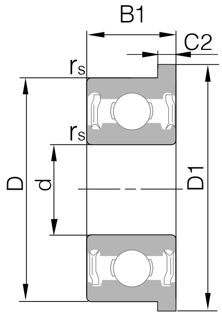
Open Type



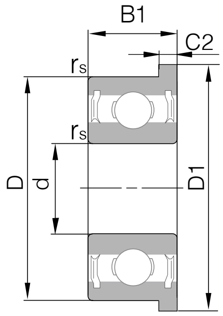
Shielded Type
Type 1



Shielded Type
Type 2



Sealed Type
Type 1

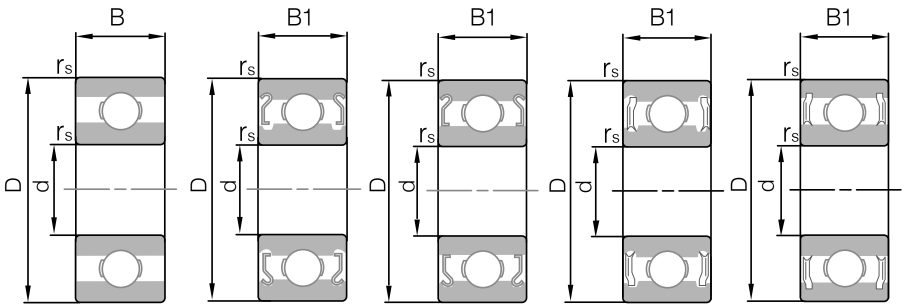


Sealed Type
Type 2

Bearing numbers Deep groove ball bearing with flanged outer ring				Load rating N		Limiting speeds rpm		Weight (g)				Boundary dimensions mm	
Open type	Shielded type	Non-contact sealed type	Contact sealed type	Cr	Cor	Grease	Oil	Deep groove ball bearing		With flanged outer ring		D	d
								Open	Closed	Open	Closed		
MF106	ZZ	--	-	495	218	45000	53000	0.53	0.66	.65	0.75	**10**	**6**
MF126	ZZ	--	--	715	292	43000	50000	1.20	1.70	1.31	1.90	**12**	
F686	ZZ	--	--	1080	440	40000	50000	1.90	2.64	2.22	3.02	**13**	
F696	ZZ	--	--	1340	515	40000	45000	3.79	3.72	4.26	4.62	**15**	
F606	ZZ	--	--	2260	835	38000	45000	5.94	6.08	6.47	6.61	**17**	
F626	ZZ	--	--	2340	885	32000	40000	8.15	7.97	8.99	8.99	**19**	
F636	ZZ	--	--	3300	1370	30000	36000	14.0	14.0	--	--	**22**	
MF117	ZZ	--	--	455	201	43000	50000	0.59	0.71	0.69	0.81	**11**	**7**
MF137	ZZ	--	--	540	276	40000	48000	1.50	1.98	1.62	2.20	**13**	
F687	ZZ	--	--	1170	510	40000	45000	2.10	2.97	2.44	3.34	**14**	
F697	ZZ	--	--	1610	710	36000	43000	5.26	5.01	5.54	5.54	**17**	
F607	ZZ	--	--	2340	885	36000	43000	7.67	7.54	8.56	8.56	**19**	
F627	ZZ	--	--	3300	1370	30000	36000	12.7	12.9	14.1	14.1	**22**	
F637	ZZ	--	--	4560	1980	28000	48000	24.0	25.0	--	--	**26**	
MF128	ZZ	--	--	545	275	40000	45000	0.68	0.95	0.79	1.13	**12**	**8**
MF148	ZZ	--	--	820	385	38000	43000	1.86	2.12	2.04	2.35	**14**	
F688	ZZ	--	--	1605	715	36000	43000	3.25	4.00	3.61	4.45	**16**	
F698	ZZ	--	--	2240	910	36000	40000	7.23	7.18	8.26	8.30	**19**	
F608	ZZ	--	--	3300	1370	34000	40000	12.1	12.2	13.3	13.4	**22**	
F628	ZZ	--	--	3350	1430	28000	34000	17.2	17.3	--	--	**24**	
F638	ZZ	--	--	4550	1970	28000	42000	28.3	28.6	--	--	**28**	
MF149	ZZ	--	--	920	465	36000	43000	--	--	--	--	**14**	**9**
F689	ZZ	--	--	1330	665	36000	40000	3.53	4.43	3.90	4.85	**17**	
F699	ZZ	--	--	2470	1080	34000	38000	8.45	8.33	9.51	9.51	**20**	
F609	ZZ	--	--	3350	1430	32000	34000	14.5	14.6	--	--	**24**	
F629	ZZ	--	--	4550	1970	28000	30000	19.5	19.0	--	--	**26**	
F639	ZZ	--	--	4650	2070	24000	--	35.7	36.0	--	--	**30**	

Deep groove ball bearings

Metric system series



Open Type | Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

Dynamic Equivalent Load

P=XFr+YFa

$\frac{Cor}{Fa}$	e	$\frac{Fa}{Fr} \leqq e$		$\frac{Fa}{Fr} > e$	
		X	Y	X	Y
5	0.35	1	0	0.56	1.26
10	0.29	1	0	0.56	1.49
15	0.27	1	0	0.56	1.64
20	0.25	1	0	0.56	1.76
25	0.24	1	0	0.56	1.85
30	0.23	1	0	0.56	1.92
50	0.20	1	0	0.56	2.13
70	0.19	1	0	0.56	2.28

Static Equivalent Load

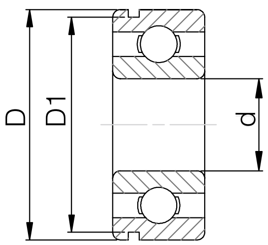
$\frac{Fa}{Fr} > 0.8$, Po=0.6Fr+0.5Fa

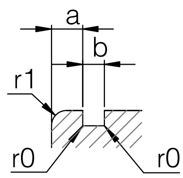
$\frac{Fa}{Fr} \leqq 0.8$, Po=Fr

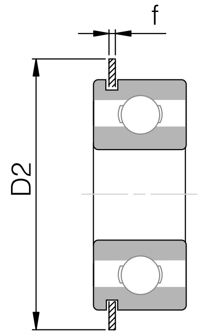
Boundary dimensions mm				earing numbers Deep groove ball bearings						Load rating N	
d	D	B1	rs min	Open type	Shielded type	Non-contact sealed type	Contact sealed type	With snap ring groove	With snap ring	Cr	Cor
10	**19**	5	0.3	6800	ZZ	LLB	LLU	--	--	1720	840
	19	7	0.3	63800	ZZ	LLB	LLU	--	--	1600	758
	22	6	0.3	6900	ZZ	LLB	LLU	N	NR	2700	1270
	26	8	0.3	6000	ZZ	LLB	LLU	N	NR	4550	1970
	26	10	0.3	60000	ZZ	LLB	LLU	--	--	4550	1970
	30	9	0.6	6200	ZZ	LLB	LLU	N	NR	5100	2390
	35	11	0.6	6300	ZZ	LLB	LLU	N	NR	8100	3450
12	**21**	5	0.3	6801	ZZ	LLB	LLU	--	--	1920	1040
	24	6	0.3	6901	ZZ	LLB	LLU	N	NR	2890	1460
	28	7	0.3	16001	--	--	--	--	--	5100	2370
	28	8	0.3	6001	ZZ	LLB	LLU	N	NR	5100	2370
	28	10	0.3	62001	ZZ	LLB	LLU	--	--	5100	2370
	28	12	0.3	63001	ZZ	LLB	LLU	--	--	5100	2370
	32	10	0.6	6201	ZZ	LLB	LLU	N	NR	6800	3050
	32	14	0.6	62201	ZZ	LLB	LLU	--	--	6100	2770
	37	12	1.0	6301	ZZ	LLB	LLU	N	NR	9700	4200
15	**24**	5	0.3	6802	ZZ	LLB	LLU	--	--	2070	1260
	28	7	0.3	6902	ZZ	LLB	LLU	N	NR	4350	2260
	32	8	0.3	16002	--	--	--	--	--	5600	2830
	32	9	0.3	6002	ZZ	LLB	LLU	N	NR	5600	2830
	32	11	0.3	62002	ZZ	LLB	LLU	--	--	5600	2830
	35	11	0.6	6202	ZZ	LLB	LLU	N	NR	7650	3750
	35	14	0.6	62202	ZZ	LLB	LLU	--	--	7750	3570
	42	13	1.0	6302	ZZ	LLB	LLU	N	NR	11400	5450

Deep groove ball bearings

Metric system series







With Snap Ring Groove
N

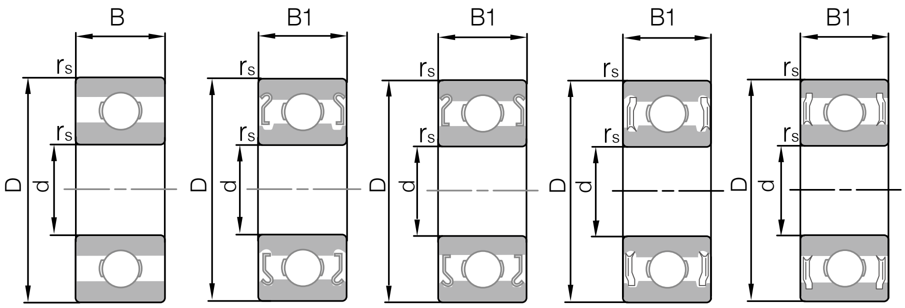
With Snap Ring
NR

Limiting speeds rpm			Snap ring groove dimensions mm				Snap ring dimensions mm			Boundary dimensions mm	
Grease		Oil	a max.	b min.	D1 max.	r0 max.	r1 min.	D2 max.	f max	D	d
Noncontact	contact										
34000	24000	40000	--	--	--	--	--	--	--	**19**	**10**
34000	24000	40000	--	--	--	--	--	--	--	**19**	
32000	22000	38000	1.05	0.8	20.8	0.2	0.2	24.8	0.7	**22**	
30000	22000	36000	1.73	0.8	25.15	0.2	0.3	29.2	0.7	**26**	
30000	22000	36000	--	--	--	--	--	--	--	**26**	
24000	18000	30000	2.06	1.35	28.17	0.4	0.5	34.7	1.12	**30**	
22000	17000	26000	2.06	1.35	33.17	0.4	0.5	39.7	1.12	**35**	
32000	20000	38000	--	--	--	--	--	--	--	**21**	**12**
30000	20000	36000	1.05	0.8	22.8	0.2	0.2	26.8	0.7	**24**	
28000	--	32000	--	--	--	--	--	--	--	**28**	
28000	18000	32000	1.74	0.96	26.8	0.26	0.3	30.8	0.85	**28**	
28000	18000	32000	--	--	--	--	--	--	--	**28**	
28000	18000	32000	--	--	--	--	--	--	--	**28**	
22000	17000	28000	2.06	1.35	30.15	0.4	0.5	36.7	1.12	**32**	
--	--	--	--	--	--	--	--	--	--	**32**	
20000	16000	24000	2.06	1.35	34.77	0.4	0.5	41.3	1.12	**37**	
28000	17000	34000	--	--	--	--	--	--	--	**24**	**15**
26000	17000	30000	1.30	0.95	26.7	0.25	0.3	30.8	0.85	**28**	
24000	--	28000	--	--	--	--	--	--	--	**32**	
24000	15000	28000	2.06	1.35	30.15	0.4	0.3	36.7	1.12	**32**	
24000	15000	28000	--	--	--	--	--	--	--	**32**	
20000	14000	24000	2.06	1.35	33.17	0.4	0.5	39.7	1.12	**35**	
20000	14000	24000	--	--	--	--	--	--	--	**35**	
17000	13000	20000	2.06	1.35	39.75	0.4	0.5	46.3	1.12	**42**	

S&S SINCE 1971

Deep groove ball bearings

Metric system series



Open Type | Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

Dynamic Equivalent Load

P=XFr+YFa

$\frac{Cor}{Fa}$	e	$\frac{Fa}{Fr} \leqq e$ X	$\frac{Fa}{Fr} \leqq e$ Y	$\frac{Fa}{Fr} > e$ X	$\frac{Fa}{Fr} > e$ Y
5	0.35	1	0	0.56	1.26
10	0.29	1	0	0.56	1.49
15	0.27	1	0	0.56	1.64
20	0.25	1	0	0.56	1.76
25	0.24	1	0	0.56	1.85
30	0.23	1	0	0.56	1.92
50	0.20	1	0	0.56	2.13
70	0.19	1	0	0.56	2.28

Static Equivalent Load

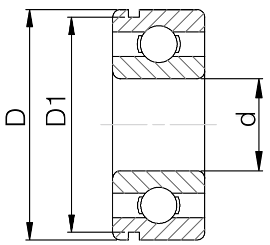
$\frac{Fa}{Fr}$>0.8, Po=0.6Fr+0.5Fa

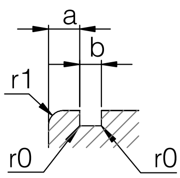
$\frac{Fa}{Fr} \leqq$0.8, Po=Fr

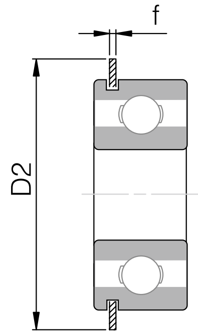
Boundary dimensions mm				Bearing numbers Deep groove ball bearings						Load rating N	
d	D	B1	rs min	Open type	Shielded type	Non-contact sealed type	Contact sealed type	With snap ring groove	With snap ring	Cr	Cor
17	26	5	0.3	6803	ZZ	LLB	LLU	--	-	2200	1400
	30	7	0.3	6903	ZZ	LLB	LLU	N	NR	4600	2550
	35	8	0.3	16003	--	--	--	--	--	6000	3250
	35	10	0.3	6003	ZZ	LLB	LLU	N	NR	6000	3250
	40	12	0.6	6203	ZZ	LLB	LLU	N	NR	9550	4800
	47	14	1.0	6303	ZZ	LLB	LLU	N	NR	13600	6650
20	27	4	0.2	61704	--	--	--	--	--	1040	730
	32	7	0.3	6804	ZZ	LLB	LLU	N	NR	4000	2470
	37	9	0.3	6904	ZZ	LLB	LLU	N	NR	6400	3700
	42	8	0.3	16004	--	--	--	--	--	7900	4450
	42	12	0.6	6004	ZZ	LLB	LLU	N	NR	9400	5000
	47	14	1.0	6204	ZZ	LLB	LLU	N	NR	12800	6600
	52	15	1.1	6304	ZZ	LLB	LLU	N	NR	15900	7900
	52	21	0.6	62304	ZZ	LLB	LLU	--	--	15900	7900
22	44	12	0.6	60/22	ZZ	LLB	LLU	N	NR	9400	5050
	50	14	1.0	62/22	ZZ	LLB	LLU	N	NR	12900	6800
	56	16	1.0	63/22	ZZ	LLB	LLU	N	NR	18400	9250
25	32	7	0.2	64705	--	--	--	N	NR	1090	840
	37	7	0.3	6805	ZZ	LLB	LLU	N	NR	4300	2950
	42	9	0.3	6905	ZZ	LLB	LLU	N	NR	7050	4550
	47	8	0.3	16005	--	--	--	--	--	8850	5600
	47	12	0.6	6005	ZZ	LLB	LLU	N	NR	10100	5850
	52	15	1.0	6205	ZZ	LLB	LLU	N	NR	14000	7850
	62	17	1.1	6305	ZZ	LLB	LLU	N	NR	20600	11200

Deep groove ball bearings

Metric system series







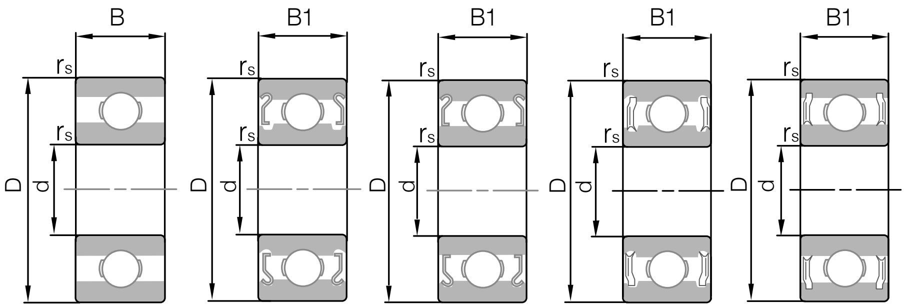
With Snap Ring Groove
N

With Snap Ring
NR

Limiting speeds rpm			Snap ring groove dimensions mm				Snap ring dimensions mm			Boundary dimensions mm	
Grease		Oil	a max.	b min.	D1 max.	r0 max.	r1 min.	D2 max.	f max	D	d
Noncontact	contact										
26000	15000	30000	--	--	--	--	--	--	--	**26**	**17**
24000	15000	28000	1.30	0.95	28.7	0.25	0.3	32.8	0.85	**30**	
22000	--	26000	--	--	--	--	--	--	--	**35**	
22000	13000	26000	2.06	1.35	33.17	0.4	0.3	39.7	1.12	**35**	
17000	12000	20000	2.06	1.35	38.10	0.4	0.5	44.6	1.12	**40**	
15000	11000	18000	2.46	1.35	44.60	0.4	0.5	52.7	1.12	**47**	
--	--	--	--	--	--	--	--	--	--	**27**	**20**
22000	13000	26000	1.30	0.95	30.7	0.25	0.3	34.8	0.85	**32**	
19000	12000	22000	1.70	0.95	35.7	0.25	0.3	39.8	0.85	**37**	
18000	--	20000	--	--	--	--	--	--	--	**42**	
18000	11000	20000	2.06	1.35	39.75	0.4	0.5	46.3	1.12	**42**	
15000	11000	18000	2.46	1.35	44.60	0.4	0.5	52.7	1.12	**47**	
14000	10000	17000	2.46	1.35	49.73	0.4	0.5	57.9	1.12	**52**	
14000	10000	17000	--	--	--	--	--	--	--	**52**	
17000	11000	20000	2.06	1.35	41.75	0.4	0.5	48.3	1.12	**44**	**22**
14000	9500	16000	2.46	1.35	47.60	0.4	0.5	55.7	1.12	**50**	
13000	9500	16000	2.46	1.35	53.60	0.4	0.5	61.7	1.12	**56**	
--	--	--	1.38	0.95	31.25	0.15	0.2	34.46	0.85	**32**	**25**
18000	10000	22000	1.30	0.95	35.7	0.25	0.3	39.8	0.85	**37**	
16000	10000	19000	1.70	0.95	40.7	0.25	0.3	44.8	0.85	**42**	
15000	--	18000	--	--	--	--	--	--	--	**47**	
15000	9500	18000	2.06	1.35	44.60	0.4	0.5	52.7	1.12	**47**	
13000	9000	15000	2.46	1.35	49.73	0.4	0.5	57.9	1.12	**52**	
11000	8000	13000	3.28	1.9	59.61	0.6	0.5	67.7	1.7	**62**	

Deep groove ball bearings

Metric system series



Open Type | Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

Dynamic Equivalent Load

P=XFr+YFa

$\frac{Cor}{Fa}$	e	$\frac{Fa}{Fr} \leqq e$		$\frac{Fa}{Fr} > e$	
		X	Y	X	Y
5	0.35	1	0	0.56	1.26
10	0.29	1	0	0.56	1.49
15	0.27	1	0	0.56	1.64
20	0.25	1	0	0.56	1.76
25	0.24	1	0	0.56	1.85
30	0.23	1	0	0.56	1.92
50	0.20	1	0	0.56	2.13
70	0.19	1	0	0.56	2.28

Static Equivalent Load

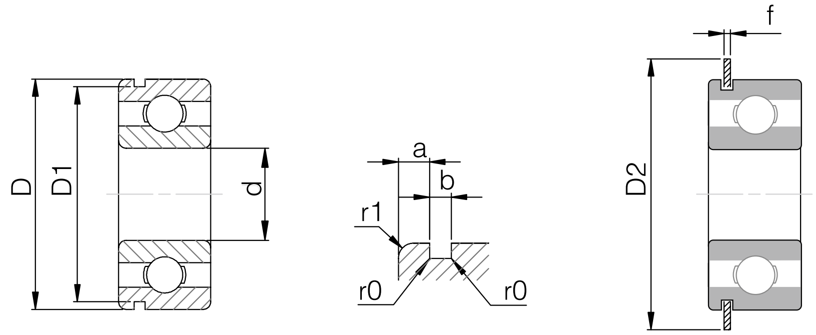
$\frac{Fa}{Fr} > 0.8$, Po=0.6Fr+0.5Fa

$\frac{Fa}{Fr} \leqq 0.8$, Po=Fr

Boundary dimensions mm				Bearing numbers Deep groove ball bearings						Load rating N	
d	D	B1	rs min	Open type	Shielded type	Non-contact sealed type	Contact sealed type	With snap ring groove	With snap ring	Cr	Cor
28	**52**	12	0.6	60/28	ZZ	LLB	LLU	N	NR	12500	7400
	58	16	1.0	62/28	ZZ	LLB	LLU	N	NR	16600	9500
	68	18	1.1	63/28	ZZ	LLB	LLU	N	NR	26700	14000
30	**37**	7	0.2	64706	--	--	--	N	NR	1150	945
	42	7	0.3	6806	ZZ	LLB	LLU	N	NR	4500	3450
	47	9	0.3	6906	ZZ	LLB	LLU	N	NR	7250	5000
	55	9	0.3	16006	--	--	--	--	--	11200	7350
	55	13	1.0	6006	ZZ	LLB	LLU	N	NR	13200	8300
	62	16	1.0	6206	ZZ	LLB	LLU	N	NR	19500	11300
	72	19	1.1	6306	ZZ	LLB	LLU	N	NR	26700	15000
35	**47**	7	0.3	6807	ZZ	LLB	LLU	N	NR	4750	2900
	55	10	0.6	6907	ZZ	LLB	LLU	N	NR	10600	7250
	62	9	0.3	16007	ZZ	LLB	LLU	N	NR	11700	8200
	62	14	1.0	6007	ZZ	LLB	LLU	N	NR	16000	10300
	72	17	1.1	6207	ZZ	LLB	LLU	N	NR	25700	15300
	80	21	1.5	6307	ZZ	LLB	LLU	N	NR	33500	19200
40	**52**	7	0.3	6808	ZZ	LLB	LLU	N	NR	4900	4350
	62	12	0.6	6908	ZZ	LLB	LLU	N	NR	13700	10000
	68	9	0.3	16008	--	--	--	--	--	12600	9650
	68	15	1.0	6008	ZZ	LLB	LLU	N	NR	16800	11500
	80	18	1.1	6208	ZZ	LLB	LLU	N	NR	29100	17800
	90	23	1.5	6308	ZZ	LLB	LLU	N	NR	40500	24000

Deep groove ball bearings

Metric system series



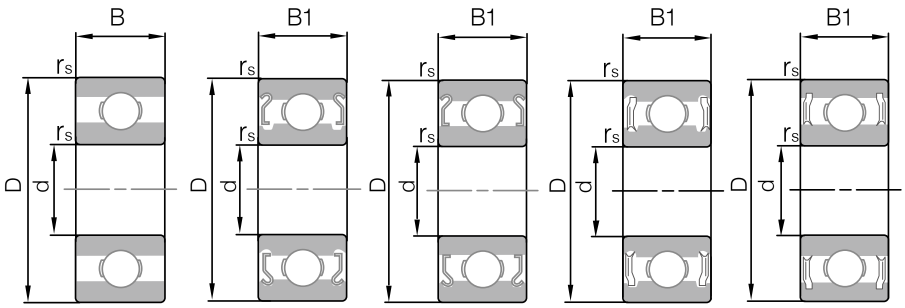
With Snap Ring Groove
N

With Snap Ring
NR

Limiting speeds rpm			Snap ring groove dimensions mm				Snap ring dimensions mm			Boundary dimensions mm	
Grease		Oil	a max.	b min.	D1 max.	r0 max.	r1 min.	D2 max.	f max	D	d
Noncontact	contact										
14000	8500	16000	2.06	1.35	49.73	0.4	0.5	57.9	1.12	**52**	**28**
12000	8000	14000	2.46	1.35	55.60	0.4	0.5	63.7	1.12	**58**	
10000	7500	13000	3.28	1.9	64.82	0.6	0.5	74.6	1.7	**68**	
--	--	--	1.38	0.95	36.15	0.15	0.2	39.2	0.85	**37**	**30**
15000	9000	18000	1.30	0.95	40.7	0.25	0.3	44.8	0.85	**42**	
14000	8500	17000	1.70	0.95	45.7	0.25	0.3	49.8	0.85	**47**	
13000	--	15000	--	--	--	--	--	--	--	**55**	
13000	8000	15000	2.08	1.35	52.60	0.4	0.5	60.7	1.12	**55**	
11000	7500	13000	3.28	1.9	59.61	0.6	0.5	67.7	1.7	**62**	
9500	6700	12000	3.28	1.9	68.81	0.6	0.5	78.6	1.7	**72**	
13000	7500	16000	1.30	0.95	45.7	0.25	0.3	49.8	0.85	**47**	**35**
12000	7500	15000	1.70	0.95	53.7	0.25	0.5	57.8	0.85	**55**	
11000	--	13000	--	--	--	--	--	--	--	**62**	
11000	6700	13000	2.08	1.9	59.61	0.6	0.5	67.7	1.7	**62**	
9500	6300	11000	3.28	1.9	68.81	0.6	0.5	78.9	1.7	**72**	
8500	6000	10000	3.28	1.9	76.81	0.6	0.5	86.6	1.7	**80**	
12000	6700	14000	1.30	0.95	50.7	0.25	0.3	54.8	0.85	**52**	**40**
11000	6300	13000	1.70	0.95	60.7	0.25	0.5	64.8	0.85	**62**	
10000	--	12000	--	--	--	--	--	--	--	**68**	
10000	6000	12000	2.49	1.9	64.82	0.6	0.5	74.6	1.7	**68**	
8500	5600	10000	3.28	1.9	76.81	0.6	0.5	86.6	1.7	**80**	
7500	5300	9000	3.28	2.7	86.79	0.6	0.5	96.5	2.46	**90**	

Deep groove ball bearings

Metric system series



Open Type | Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

Dynamic Equivalent Load

P=XFr+YFa

$\frac{Cor}{Fa}$	e	$\frac{Fa}{Fr} \leqq e$		$\frac{Fa}{Fr} > e$	
		X	Y	X	Y
5	0.35	1	0	0.56	1.26
10	0.29	1	0	0.56	1.49
15	0.27	1	0	0.56	1.64
20	0.25	1	0	0.56	1.76
25	0.24	1	0	0.56	1.85
30	0.23	1	0	0.56	1.92
50	0.20	1	0	0.56	2.13
70	0.19	1	0	0.56	2.28

Static Equivalent Load

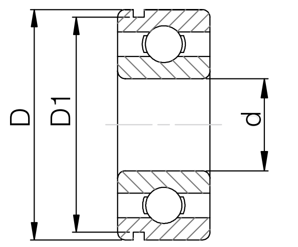
$\frac{Fa}{Fr} > 0.8$, Po=0.6Fr+0.5Fa

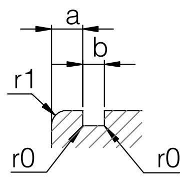
$\frac{Fa}{Fr} \leqq 0.8$, Po=Fr

Boundary dimensions mm				Bearing numbers Deep groove ball bearings						Load rating N	
d	D	B1	rs min	Open type	Shielded type	Non-contact sealed type	Contact sealed type	With snap ring groove	With snap ring	Cr	Cor
45	**58**	7	0.3	6809	ZZ	LLB	LLU	N	NR	5350	5250
	68	12	0.6	6909	ZZ	LLB	LLU	N	NR	14100	10900
	75	10	0.6	16009	--	--	--	--	--	14900	11400
	75	16	1.0	6009	ZZ	LLB	LLU	N	NR	20900	15200
	85	19	1.1	6209	ZZ	LLB	LLU	N	NR	31500	20400
	100	25	1.5	6309	ZZ	LLB	LLU	N	NR	53000	32000
50	**65**	7	0.3	6810	--	--	--	--	--	6400	6200
	72	12	0.6	6910	ZZ	LLB	LLU	N	NR	14500	11700
	80	10	0.6	16010	ZZ	LLB	LLU	N	NR	15400	12400
	80	16	1	6010	ZZ	LLB	LLU	N	NR	21800	16600
	90	20	1.1	6210	ZZ	LLB	LLU	N	NR	35000	23200
	110	27	2	6310	ZZ	LLB	LLU	N	NR	62000	38500
55	**72**	9	0.3	6811	ZZ	LLB	LLU	N	NR	8800	8500
	80	13	1.0	6911	ZZ	LLB	LLU	N	NR	16000	13300
	90	11	0.6	16011	ZZ	LLB	LLU	N	NR	19400	16300
	90	18	1.1	6011	ZZ	LLB	LLU	N	NR	28300	21200
	100	21	1.5	6211	ZZ	LLB	LLU	N	NR	43500	29300
	120	29	2.0	6311	ZZ	LLB	LLU	N	NR	71500	44500

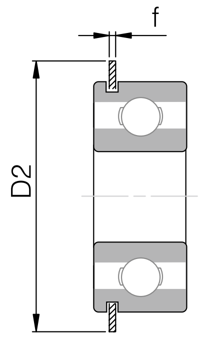
Deep groove ball bearings

Metric system series





With Snap Ring Groove
N

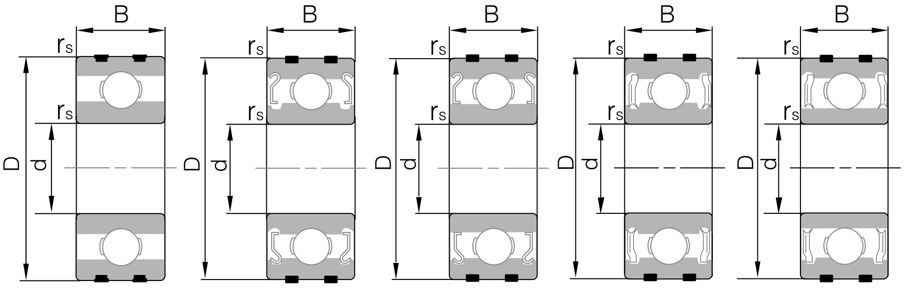


With Snap Ring
NR

Limiting speeds rpm			Snap ring groove dimensions mm				Snap ring dimensions mm			Boundary dimensions mm	
Grease		Oil	a max.	b min.	D1 max.	r0 max.	r1 min.	D2 max.	f max	D	d
Noncontact	contact										
11000	6000	13000	1.30	0.95	56.7	0.25	0.3	60.8	0.85	**58**	**45**
9500	5600	12000	1.70	0.95	66.7	0.25	0.5	70.8	0.85	**68**	
9000	--	11000	--	--	--	--	--	--	--	**75**	
9000	5300	11000	2.49	1.9	71.83	0.6	0.5	81.6	1.7	**75**	
7500	5300	9000	3.28	1.9	81.81	0.6	0.5	91.6	1.7	**85**	
6700	4800	8000	3.28	2.7	96.80	0.6	0.5	106.5	2.46	**100**	
9500	5300	11000	1.30	0.95	63.7	0.25	0.3	67.8	0.85	**65**	**50**
9000	5300	11000	1.70	0.95	70.7	0.25	0.5	74.8	0.85	**72**	
8500	--	10000	--	--	--	--	--	--	--	**80**	
8500	4800	10000	2.49	1.9	76.81	0.6	0.5	86.6	1.7	**80**	
7100	4800	8500	3.28	2.7	86.79	0.6	0.5	96.5	2.46	**90**	
6000	4300	7500	3.28	2.7	106.81	0.6	0.5	116.6	2.46	**110**	
8500	4800	10000	1.70	0.95	70.7	0.25	0.3	74.8	0.85	**72**	**55**
8000	4500	9500	2.1	1.3	77.9	0.4	0.5	84.4	1.12	**80**	
7500	--	9000	--	--	--	--	--	--	--	**90**	
7500	4500	9000	2.87	2.7	86.79	0.6	0.5	96.5	2.46	**90**	
6300	4300	7500	3.28	2.7	96.80	0.6	0.5	106.5	2.46	**100**	
5600	4000	6700	4.06	3.1	115.21	0.6	0.5	129.7	2.82	**120**	

Deep groove ball bearings

Expansion compensating bearings



Open Type | Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

Dynamic Equivalent Load

P=XFr+YFa

$\frac{Cor}{Fa}$	e	$\frac{Fa}{Fr} \leqq e$		$\frac{Fa}{Fr} > e$	
		X	Y	X	Y
5	0.35	1	0	0.56	1.26
10	0.29	1	0	0.56	1.49
15	0.27	1	0	0.56	1.64
20	0.25	1	0	0.56	1.76
25	0.24	1	0	0.56	1.85
30	0.23	1	0	0.56	1.92
50	0.20	1	0	0.56	2.13
70	0.19	1	0	0.56	2.28

Static Equivalent Load

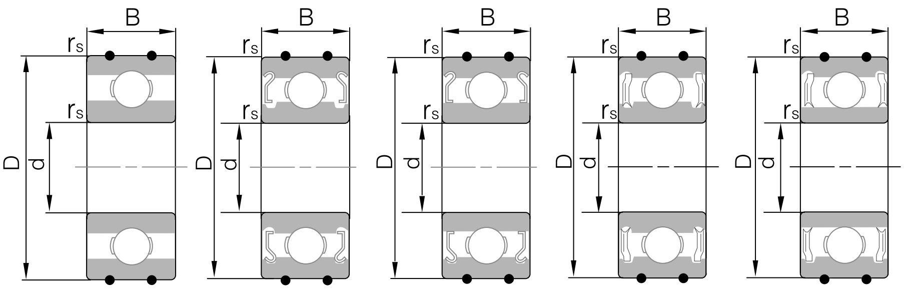
$\frac{Fa}{Fr} > 0.8$, Po=0.6Fr+0.5Fa

$\frac{Fa}{Fr} \leqq 0.8$, Po=Fr

Boundary dimensions mm				Bearing numbers Deep groove ball bearings				Load rating N		Limiting speeds rpm		
d	D	B1	rs min	Open type	Shielded type	Non-contact sealed type	Contact sealed type	Cr	Cor	Grease		Oil
										Noncontact	Contact	
10	**26**	8	0.3	EC-6000	ZZ	LLB	LLU	4550	1970	30000	26000	36000
	30	9	0.6	EC-6200	ZZ	LLB	LLU	5100	2390	14000	18000	30000
	35	11	0.6	EC-6300	ZZ	LLB	LLU	8100	3450	22000	17000	26000
12	**28**	8	0.3	EC-6001	ZZ	LLB	LLU	5100	2370	28000	18000	32000
	32	10	0.6	EC-6201	ZZ	LLB	LLU	6800	3050	22000	17000	28000
	37	12	1.0	EC-6301	ZZ	LLB	LLU	9700	4200	20000	16000	24000
15	**32**	9	0.3	EC-6002	ZZ	LLB	LLU	5600	2830	24000	15000	25000
	35	11	0.6	EC-6202	ZZ	LLB	LLU	7650	3750	20000	14000	24000
	42	13	1.0	EC-6302	ZZ	LLB	LLU	11400	4800	17000	13000	20000
17	**35**	10	0.3	EC-6003	ZZ	LLB	LLU	6000	3250	22000	13000	26000
	40	12	0.6	EC-6203	ZZ	LLB	LLU	9350	4800	17000	12000	20000
	47	14	1.0	EC-6303	ZZ	LLB	LLU	13600	6650	15000	11000	18000
20	**42**	12	0.6	EC-6004	ZZ	LLB	LLU	9400	5000	18000	11000	20000
	47	14	1.0	EC-6204	ZZ	LLB	LLU	12800	6600	15000	11000	18000
	52	15	1.1	EC-6304	ZZ	LLB	LLU	15900	7900	14000	10000	17000
25	**47**	12	0.6	EC-6005	ZZ	LLB	LLU	10100	5850	15000	9500	18000
	52	15	1.0	EC-6205	ZZ	LLB	LLU	14000	7850	13000	9000	15000
	62	17	1.1	EC-6305	ZZ	LLB	LLU	20600	11200	11000	8000	13000
30	**55**	13	1.0	EC-6006	ZZ	LLB	LLU	13200	8300	13000	8000	15000
	62	16	1.0	EC-6206	ZZ	LLB	LLU	29500	11300	11000	7500	13000
	72	19	1.1	EC-6306	ZZ	LLB	LLU	26700	15000	10000	6700	12000

Deep groove ball bearings

AC bearings



Open Type

Shielded Type Type 1

Shielded Type Type 2

Sealed Type Type 1

Sealed Type Type 2

Dynamic Equivalent Load

P=XFr+YFa

$\frac{Cor}{Fa}$	e	$\frac{Fa}{Fr} \leqq e$		$\frac{Fa}{Fr} > e$	
		X	Y	X	Y
5	0.35	1	0	0.56	1.26
10	0.29	1	0	0.56	1.49
15	0.27	1	0	0.56	1.64
20	0.25	1	0	0.56	1.76
25	0.24	1	0	0.56	1.85
30	0.23	1	0	0.56	1.92
50	0.20	1	0	0.56	2.13
70	0.19	1	0	0.56	2.28

Static Equivalent Load

$\frac{Fa}{Fr} > 0.8$, Po=0.6Fr+0.5Fa

$\frac{Fa}{Fr} \leqq 0.8$, Po=Fr

Boundary dimensions mm				Bearing numbers Deep groove ball bearings				Load rating N		Limiting speeds rpm		
d	D	B1	rs min	Open type	Shielded type	Non-contact sealed type	Contact sealed type	Cr	Cor	Grease		Oil
										Noncontact	Contact	
10	**26**	8	0.3	AC-6000	ZZ	LLB	LLU	4550	1970	30000	26000	36000
	30	9	0.6	AC-6200	ZZ	LLB	LLU	5100	2390	14000	18000	30000
	35	11	0.6	AC-6300	ZZ	LLB	LLU	8100	3450	22000	17000	26000
12	**28**	8	0.3	AC-6001	ZZ	LLB	LLU	5100	2370	28000	18000	32000
	32	10	0.6	AC-6201	ZZ	LLB	LLU	6800	3050	22000	17000	28000
	37	12	1.0	AC-6301	ZZ	LLB	LLU	9700	4200	20000	16000	24000
15	**32**	9	0.3	AC-6002	ZZ	LLB	LLU	5600	2830	24000	15000	25000
	35	11	0.6	AC-6202	ZZ	LLB	LLU	7650	3750	20000	14000	24000
	42	13	1.0	AC-6302	ZZ	LLB	LLU	11400	5450	17000	13000	20000
17	**35**	10	0.3	AC-6003	ZZ	LLB	LLU	6000	3250	22000	13000	26000
	40	12	0.6	AC-6203	ZZ	LLB	LLU	9350	4800	17000	12000	20000
	47	14	1.0	AC-6303	ZZ	LLB	LLU	13600	6650	15000	11000	18000
20	**42**	12	0.6	AC-6004	ZZ	LLB	LLU	9400	5000	18000	11000	20000
	47	14	1.0	AC-6204	ZZ	LLB	LLU	12800	6600	15000	11000	18000
	52	15	1.1	AC-6304	ZZ	LLB	LLU	15900	7900	14000	10000	17000
25	**47**	12	0.6	AC-6005	ZZ	LLB	LLU	10100	5850	15000	9500	18000
	52	15	1.0	AC-6205	ZZ	LLB	LLU	14000	7850	13000	9000	15000
	62	17	1.1	AC-6305	ZZ	LLB	LLU	20600	11200	11000	8000	13000
30	**55**	13	1.0	AC-6006	ZZ	LLB	LLU	13200	8300	13000	8000	15000
	62	16	1.0	AC-6206	ZZ	LLB	LLU	29500	11300	11000	7500	13000
	72	19	1.1	AC-6306	ZZ	LLB	LLU	26700	15000	10000	6700	12000

S&S SINCE 1971

Deep groove ball bearings

Inch system series

Dynamic Equivalent Load

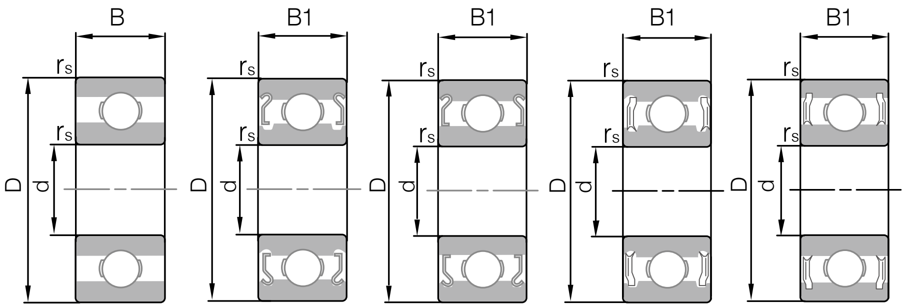
P=XFr+YFa

Cor/Fa	e	Fa/Fr ≦e X	Fa/Fr ≦e Y	Fa/Fr >e X	Fa/Fr >e Y
5	0.35	1	0	0.56	1.26
10	0.29	1	0	0.56	1.49
15	0.27	1	0	0.56	1.64
20	0.25	1	0	0.56	1.76
25	0.24	1	0	0.56	1.85
30	0.23	1	0	0.56	1.92
50	0.20	1	0	0.56	2.13
70	0.19	1	0	0.56	2.28

Static Equivalent Load

$\frac{Fa}{Fr}>0.8$, Po=0.6Fr+0.5Fa

$\frac{Fa}{Fr}\leqq 0.8$, Po=Fr

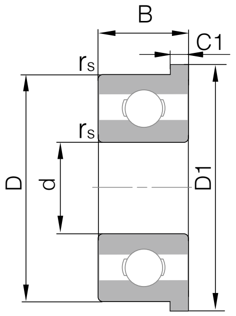


Open Type | Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

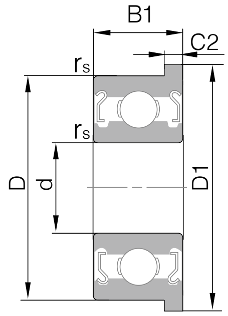
Boundary dimensions mm		Bearing numbers Deep groove ball				Boundry dimensions mm					
d	D	Open type	Shielded type	Non-contact sealed type	Contact sealed type	D1	B	B1	C1	C2	rs min
3.175	**6.350**	R144	ZZ	--	--	7.518	2.380	2.779	0.584	0.787	0.1
	7.938	R2-5	ZZ	--	--	9.119	2.779	3.571	0.584	0.787	0.1
	9.525	R2-6	ZZ	--	--	10.719	2.779	3.571	0.584	0.787	0.15
	9.525	R2	ZZ	--	--	11.176	3.967	3.967	0.762	0.762	0.3
	12.700	R2A	ZZ	--	--	--	4.366	4.366	--	--	0.3
3.967	**7.938**	R155	ZZ	--	--	9.119	2.779	3.175	0.584	0.914	0.1
4.762	**7.938**	R156	ZZ	--	--	9.119	2.779	3.175	0.584	0.914	0.1
	9.525	R166	ZZ	--	--	10.719	3.175	3.175	0.584	0.787	0.1
	12.700	R3	ZZ	--	--	14.351	3.967	4.978	1.067	1.067	0.3
	15.875	R3A	ZZ	--	--	--	4.978	4.978	--	--	0.3
6.350	**9.525**	R168	ZZ	--	--	10.719	3.175	3.175	0.584	0.914	0.1
	12.700	R188	ZZ	--	--	13.894	3.175	4.762	0.584	1.143	0.15
	15.875	R4	ZZ	LLB	LLU	17.526	4.978	4.978	1.067	1.067	0.3
	19.050	R4A	ZZ	LLB	LLU	--	5.558	7.142	--	--	0.4
7.938	**12.700**	R1810	ZZ	--	--	13.894	3.967	3.967	0.787	0.787	0.15
9.525	**22.225**	R6	ZZ	LLB	LLU	24.613	5.558	7.142	1.570	1.570	0.4
12.700	**28.575**	R8	ZZ	LLB	LLU	31.120	6.350	7.938	1.571	1.575	0.4
15.875	**34.925**	R10	ZZ	LLB	LLU	--	7.142	8.733	--	--	0.8
19.050	**41.275**	R12	ZZ	LLB	LLU	--	7.938	11.113	--	--	0.8

Deep groove ball bearings

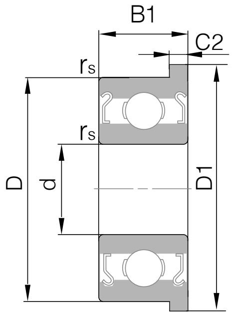
Inch system series



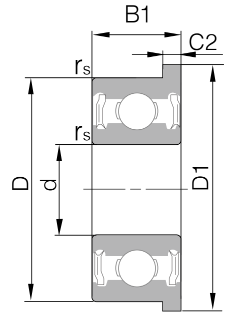
Open Type



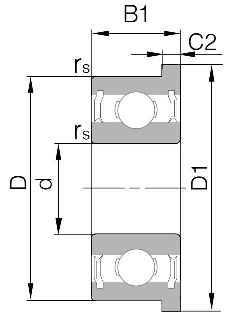
Shielded Type
Type 1



Shielded Type
Type 2



Sealed Type
Type 1

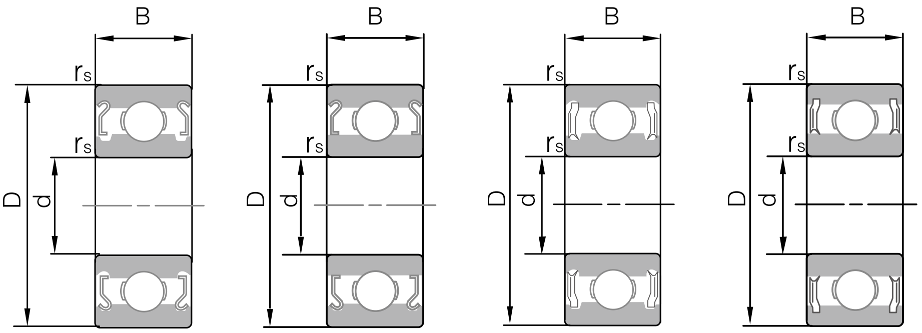


Sealed Type
Type 2

Bearing numbers Deep groove ball bearing with flanged outer ring				Load rating N		Limiting speeds rpm		Weight (g)				Boundary dimensions mm	
Open type	Shielded type	Non-contact sealed type	Contact sealed type	Cr	Cor	Grease	Oil	Deep groove ball bearing		With flanged outer ring		D	d
								Open	Closed	Open	Closed		
FR144	ZZ	--	--	238	95	67000	80000	0.25	0.27	0.31	0.35	**6.350**	**3.175**
FR2-5	ZZ	--	--	560	179	60000	67000	0.55	0.72	0.62	0.81	**7.938**	
FR2-6	ZZ	--	--	640	225	53000	63000	0.96	1.13	1.04	1.25	**9.525**	
FR2	ZZ	--	--	630	218	56000	67000	1.36	1.39	1.51	1.55	**9.525**	
--	--	--	--	640	225	53000	63000	3.30	3.23	--	--	**12.700**	
FR155	ZZ	--	--	360	149	53000	63000	0.51	0.56	0.59	0.67	**7.938**	**3.967**
FR156	ZZ	--	--	360	149	53000	63000	0.39	0.42	0.47	0.53	**7.938**	**4.762**
FR166	ZZ	--	--	710	270	50000	60000	0.81	0.85	0.90	0.98	**9.525**	
FR3	ZZ	--	--	1300	485	43000	53000	2.21	2.79	2.97	3.09	**12.700**	
--	--	--	--	1480	615	38000	45000	--	--	--	--	**15.875**	
FR168	ZZ	--	--	375	173	48000	56000	0.57	0.54	0.65	0.68	**9.525**	**6.350**
FR188	ZZ	--	--	1080	440	40000	50000	1.53	2.21	1.64	2.43	**12.700**	
FR4	ZZ	--	--	1480	615	38000	45000	4.46	4.42	4.82	4.78	**15.875**	
--	--	--	--	2340	885	36000	43000	7.48	9.17	--	--	**19.050**	
FR1810	ZZ	--	--	540	276	40000	48000	1.56	1.48	1.71	1.63	**12.700**	**7.938**
FR6	ZZ	--	--	3350	1410	32000	38000	9.02	11.00	10.00	12.10	**22.225**	**9.525**
FR8	ZZ	--	--	5115	2415	26000	32000	--	--	--	--	**28.575**	**12.700**
--	--	--	--	6000	3250	22000	26000	--	--	--	--	**34.925**	**15.875**
--	--	--	--	7920	4430	17000	19000	--	--	--	--	**41.275**	**19.050**

Deep groove ball bearings

Automobil purpose

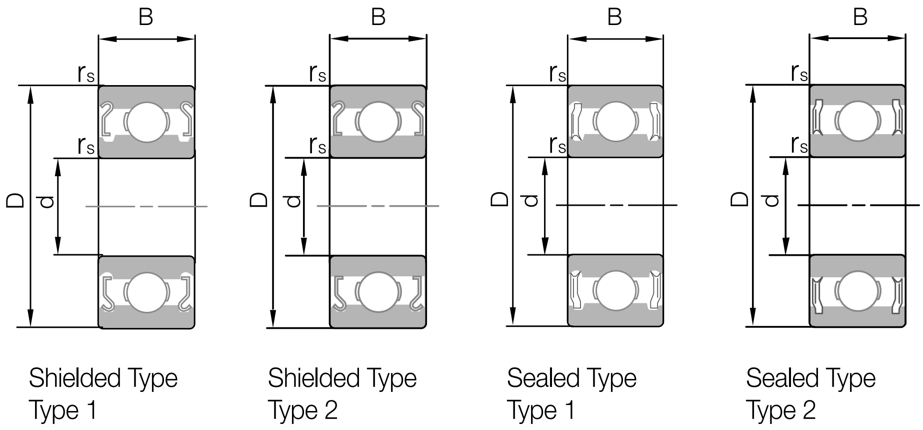


Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

Boundary dimensions mm				Bearing numbers Deep groove ball bearings		Load rating N		Limiting speeds rpm		
d	D	B1	rs min	Ref.NO	S&S	Cr	Cor	Grease Noncontact	Grease Contact	Oil
8	22	11	0.6	B8-74D	608X2NR-2RSTN1(W)	3300	1370	34000	--	40000
	23	11	0.6	B8-79D	608X3.1NR-2RSTN1(W)	3300	1370	34000	--	40000
	23	14	0.3	B8-23D	608X3.2N2-2RSTN1/YA5(W)	3910	1530	34000	--	40000
	23	14	0.6	B8-85D	608X3NR-2RSTN1(W)	3300	1370	34000	--	40000
10	23	11	0.6	B10-46D	61900X3NR-2RSTN1(W)	2700	1270	32000	22000	38000
	26	8	0.3	6000TT	6000N2-2RS(W)	4570	1970	30000	22000	36000
	26	10	0.3	62000-2RS	62000-2RS/YA4(W)	4570	1970	30000	22000	36000
	27	11	0.6	B10-50D	6000X3NR-2RSTN1(W)	4570	1970	30000	22000	32000
12	28	8	0.3	--	6001-2ZL/YA	5115	2390	28000	18000	32000
	28	10	0.3	62001-2RS	62001-2RS	5115	2390	28000	18000	32000
	28	12	0.3	63001-2RS	63001-2RS	5115	2388	28000	18000	28000
	32	10	0.6	B20-12D	6201/YA5-2RSNR	6820	3060	22000	17000	28000
	32	10	0.6	--	6201/YA5-2RS1	6106	2770	22000	17000	28000
	32	13	0.6	--	6201X2-2RSTNN1R1	6820	3060	22000	17000	28000
	32	14	0.6	--	62201-2RS	6106	2770	22000	17000	28000
15	32	11	0.3	B15-7D	62002-2RS	5590	2830	24000	15000	28000
	35	11	0.6	949100/295	62202-2RS	7750	3570	20000	14000	24000
	35	11	0.6	--	63302X1-2RS	7750	3570	20000	14000	24000
	35	13	0.6	--	6202X2-2RSTN3	7650	3750	20000	14000	24000
	35	13	0.6	B15-69	6202X2-2RSNR	7750	3750	20000	14000	24000
	35	14	0.6	--	62202-2RS	7750	3570	20000	14000	24000
	38	19	1.0	348	63302X1-2RS	9450	4390	17000	13000	20000

Deep groove ball bearings

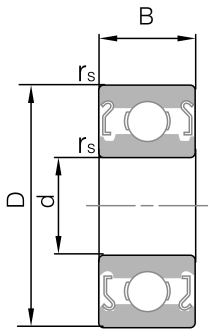
Automobil purpose



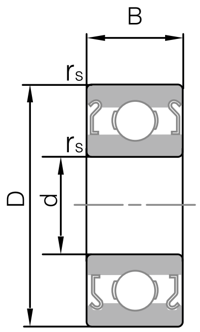
Boundary dimensions mm				Bearing numbers Deep groove ball bearings		Load rating N		Limiting speeds rpm		
d	D	B1	rs min	Ref.NO	S&S	Cr	Cor	Grease Noncontact	Grease Contact	Oil
15	42	13	1.0	--	6302-2RS	11400	5450	17000	13000	20000
	43	13	1.0	319-2RS	6302X1-2RSTN3	11430	5430	17000	13000	20000
	46	14	1.0	336-2RS	63/15-2RSTN3	13580	6590	15000	11000	18000
	47	14	1.0	B15-86D	6303/15-2RSTN3	13580	6590	15000	11000	18000
	47	18	1.0	B15-B3D	6302X3-2RSTN3	13460	6485	17000	13000	20000
	52	16	1.0	382-2RS	6402X2-2RS	15760	7735	17000	12000	20000
17	40	12	0.6	--	6203-2RS	9550	4800	17000	12000	20000
	40	12	0.6	--	6203-2RSTN3	9550	4800	17000	12000	20000
	40	12	0.6	--	6203-2LS/YA	9550	4800	17000	12000	20000
	40	12	0.6	--	6203-2LS1	9550	4800	17000	12000	20000
	40	12	0.6	--	6203-2RS1TN/YA4S1	9550	4800	17000	12000	20000
	40	12	0.6	--	6203-2RS/YA	9550	4800	17000	12000	20000
	47	14	1.0	--	6303-2RS1	13580	6590	15000	11000	18000
	47	14	1.0	--	6303-2RSTN3/YA	13466	6488	15000	11000	18000
	47	18	1.0	--	6303X2-2RSTN3/YA	13466	6488	15000	11000	18000
	52	17	1.1	10-3043-4	6304/17-2RS1	16000	7938	14000	10000	17000
	52	17	1.1	--	6403X1-2LS	18100	9000	--	--	--
	52	21	1.1	10-62304-4	6304/17-2RS	16000	7938	14000	10000	17000
	52	16	1.1	333	63/17-2RSTN3	15930	7875	14000	10000	17000
25	47	12	0.6	--	--	10100	5850	15000	9500	18000
	62	25	1.1	W6305	63305-2RS	22388	11498	11000	8000	13000

Deep groove ball bearings

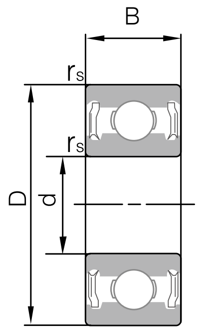
Motorcycle purpose



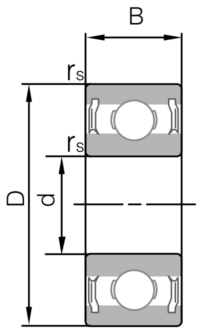
Shielded Type
Type 1



Shielded Type
Type 2



Sealed Type
Type 1

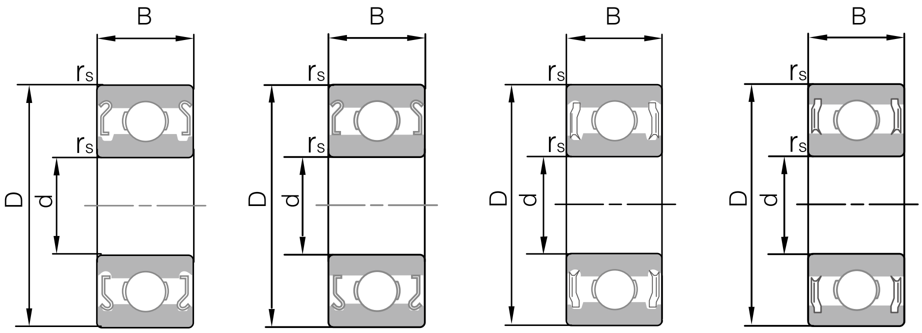


Sealed Type
Type 2

Boundary dimensions mm				Bearing numbers Deep groove ball bearings		Load rating N		Limiting speeds rpm		
								Grease		
d	D	B1	rs min	Open	Closed type	Cr	Cor	Noncontact	Contact	Oil
8	**28**	9	0.3	--	638-Z/P6	4370	1977	--	--	--
12	**28**	8	0.3	6001	--	5100	2370	28000	18000	32000
	32	10	0.6	6202	--	6800	3050	22000	17000	28000
	37	12	1.0	6301	--	9700	4200	20000	16000	24000
15	**32**	8	0.3	16002/P6	--	5600	2830	24000	--	28000
	32	9	0.3	6002	6002-RS/P5	5600	2380	24000	15000	28000
	35	11	0.6	6202	6202-RS/P6	7650	3750	20000	14000	24000
	42	13	1.0	6302	--	11400	5450	17000	13000	20000
17	**35**	8	0.3	16003	--	6000	3250	22000	--	26000
	35	10	0.3	6003	6002-RS/P5	6000	3250	22000	13000	26000
	40	12	0.6	6203	--	9550	4800	17000	12000	20000
	42	13	0.6	--	6203X3/P53Z2	9550	4800	17000	12000	20000
	47	14	1.0	6303	--	13600	6650	15000	11000	18000
20	**55**	15	1.1	6304D2X1	--	15900	7900	14000	10000	17000
22	**47**	14	1.0	--	62/22X1-RS/P53Z2	12900	6800	14000	9500	16000

Deep groove ball bearings

Motorcycle purpose



Shielded Type Type 1 | Shielded Type Type 2 | Sealed Type Type 1 | Sealed Type Type 2

Boundary dimensions mm				Bearing numbers Deep groove ball bearings		Load rating N		Limiting speeds rpm		
								Grease		
d	D	B1	rs min	Open	Closed type	Cr	Cor	Noncontact	Contact	Oil
25	**50**	14	1.0	62/22/YA5	62/22YA5-2RS	12900	6800	14000	9500	16000
	56	15	1.0	63/22X2JD2S1	--	20700	10426	13000	9500	16000
	56	21	1.1	--	63/22X2-1-2RS	20700	10426	13000	9500	16000
	37	7	0.3	61805	--	4500	3150	18000	10000	22000
	47	12	0.6	6005/P5	6002-RS/P5	10100	5850	15000	9500	18000
	52	15	1.0	6205/P5	--	14000	7850	13000	9000	15000
	62	17	1.1	6305/P5	--	20600	11200	11000	8000	13000
	62	16	1.1	--	6305X2-Z/P53Z2	20600	11200	11000	8000	13000
28	**58**	16	1.0	62/28	63/28-RS	17915	9798	12000	8000	13000
	68	18	1.1	63/28YA5/P5	63/28-RS/YA5P53Z2	26700	14000	10000	7500	13000
35	**55**	13	1.0	6006/P6	--	13000	8000	13000	8000	15000
	35	10	0.3	6007/P63Z2	--	6000	3250	22000	13000	26000
	35	10	0.3	6007/P53Z2	--	6000	3250	22000	13000	26000

Technical information

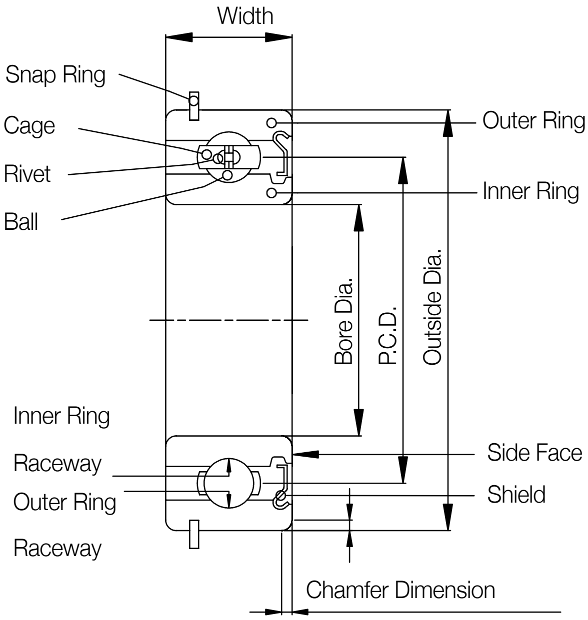
1. THE STRUCTURE AND CHARACTERISTICS OF ROLLER BEARINGS

1.1 Structure and classification

Roller bearing (below abbreviated as bearing) is commonly composed of ring, roller, cage. It is divided into ball bearing and roller bearing according to the rolling category.

Please refer to Table 1.1 to see the bearing conceptual diagram with the representative structure.

Table 1.1



Single-Row Deep Groove Ball Bearing

1.2 Structure and features

The rolling bearing has the following characteristics:

(1) It is equipped with high standard and ample specifications with fine interchangeability.

(2) Commonly it can simultaneously bear radial load and axial load.

(3) It is applicable for use in high and low temperature.

(4) It is fit for use in high speed conditions.

Single-row deep groove ball bearing is the structure with the widest application in rolling bearings. The bearing can simultaneously bear radial load and axial load. It is fit for use in the occasions such as high-speed rotation, low noise etc.

Apart from open-type, it also has the bearing with steel shield, e.g. 608ZZ, the bearing with rubber seal ring, e.g. 608-2RS.

2. BEARING SELECTION METHOD

It is increasingly strict to the market requirement performances of various mechanical devices, instruments etc. which use rolling bearings. It becomes more diversified to the conditions, performances required by the bearings.

In order to choose the most applicable bearings among vast structures and sizes, it should be researched into from multiple angles.

While choosing the bearings, commonly the customers will make an approximate decision to the bearing structure according to the bearing arrangement of the shafting, installation, disassembly difficulty degree, bearing allowable space & size, bearing market competitive power etc.

Secondary, the customers can comparatively research into various mechanical design lives and all kinds of durability limits to the used bearings and decide the bearing dimensions at the same time.

While selecting the bearings, it is a usual case to only put the bearing fatigue life into consideration. But of course it is not correct. What is more, it should fully research into the lubricating grease life, wear-ability, noise etc. caused by the lubricating grease ageing.

Besides, it is necessary to choose the specially- designed bearings out of the requirements such as accuracy, clearance, cage structure, lubricating grease and so on according to different uses.

But there is no definite sequence and rule to the bearing selection. Top priority should be given to the conditions and performances required by bearings. It is especially practical to consider the most related items to the bearings. Please contact with S&S in choosing the bearings with new machinery, special use conditions or special ambient conditions.

As an ordinary referential example to bearing selection, its procedures have been indicated in Table 2.1:

Table 2.1 (BEARING SELECTION METHOD)

- ·Conditions and performances required by bearings
- ·Service condition, ambient condition
- ·Vast items such as bearing installation part size etc.

RESEARCH INTO THE BEARING STRUCTURE

- ·Bearing allowable space
- ·Load capacity and direction
- ·Vibration, impact
- ·Rotating speed, bearing limit rotating speed
- ·Inner and outer ring inclination
- ·Axial orientation fixation and bearing array
- ·Loading and unloading difficulty degree
- ·Noise, torque
- ·Rigidity
- ·Market competitive power, economy performance

Decide the bearing structure and arrangement

RESEARCH INTO BEARING SIZE

- ·Service machinery and design life
- ·Equivalent dynamic load or equivalent static load
- ·Rotating speed
- ·Allowable static load coefficient
- ·Allowable axial load (under the condition of cylindricalroller bearing)

Decide the bearing size

RESEARCH INTO THE ACCURACY

- ·Accuracy of rotating run-out
- ·High speed rotation
- ·Torque variation

Decide the bearing accuracy classification

RESEARCH INTO COORDINATION

- ·Rotating condition
- ·Load capacity and property
- ·Temperature conditions
- ·Shaft and casing material, size and accuracy

Decide to make coordination

RESEARCH INTO THE INTERNAL CLEARANCE

- ·Coordination
- ·The temperature difference of inner and outer rings
- ·Rotating speed
- ·Inner and outer ring inclination
- ·Preliminary pressure amount

Decide (internal) clearance

RESEARCH INTO CAGE

- ·Rotating speed
- ·Noise
- ·Service temperature

Decide the cage shape and material

RESEARCH INTO THE SPECIAL SPECIFICATIONS

- ·Service temperature
- ·Media(see water, vacuum, gas, medicine)
- ·Enhance the lubricity

Decide special material, size stability Heat treatment, surface treatment

RESEARCH INTO LUBRICATION METHOD

- ·Service temperature
- ·Rotating speed
- ·Lubricating means
- ·Seal means
- ·Repair and maintenance

Decide the lubrication method, lubricant, seal methods

RESEARCH INTO ASSEMBLY AND DISASSEMBLY

- ·Assembly and disassembly sequence
- ·Operation fixture and mould
- ·Sizes related to the installation

Decide the sizes related to the installation
Decide the loading and unloading methods

The final specification of bearing and its surrounding parts

Technical information

3. BEARING SIZE SELECTION

3.1 Bearing life

After certain period of the bearing running, the accuracy has been lowered, the noise and vibration have been increased with lubricating grease ageing. The running face has been stripped because of fatigue. Therefore the bearing can not be used any more. The service life of this kind of bearing is called the bearing life in a broad sense. They are respectively names as accuracy life, noise life, lubricating grease life, rolling fatigue life etc.

3.1.1 Rated fatigue life

Rated fatigue life refers to total frequency of bearing running with 90% reliability to same model bearings under the same operating conditions. Under the circumstances of definite rotating speed, it usually indicates the rated fatigue life by total running period. It is common to only take the fatigue life into consideration for the research of bearing life.

3.2 Basic dynamic load rating

3.2.1 Basic dynamic load rating

functions as theconstant load to the external ring static bearing. Under this kind of load, the rated fatigue life is 1 million revolutions, r.p.m.

3.2.2 Basic rated life of ball bearing

(Total rotary number) L10 = (c/p)3 ......(3.1)

It indicates the relations amid basic rated transient load, equivalent moving load and basic rated life.

(Time) L10 = (106/60n) (c/p)3 ......(3.2)

It is more convenient to indicate the life by time when the bearing is rotated by constant speed, as it is shown in Formula (3.2).

In the formula,

L10 indicates the basic rated life.

L10h is indicated by hour to show the basic rated life.

P indicates the equivalent moving load, N (kgf)

C indicates the basic dynamic load rating, N (kgf)

N indicates the rotating speed, rpm

3.2.3 Revise the basic dynamic load rating according to the specific temperature

When the rolling bearings have been used under heat conditions, the bearing hardness will be reduced, the fatigue life will be lowered than that for use in normal temperature. Therefore the basic dynamic load rating should be assessed a little smaller correspondingly.

Ct=ft X C......(3.3)

In the formula:

Ct indicates the basic dynamic load according to the temperature correction.

ft indicates the temperature coefficient (Table 3.1)

C indicates the basic dynamic load rating.

When the bearing will be used under the high temperatures above 120℃, it should commonly be implemented with size stability treatment.

Table 3.1

Bearing temperature ℃	125	150	175	200	250
Temperature coefficient ft	1.00	1.00	0.95	0.90	0.75

3.2.4 Revised rated fatigue life

The basic formula of the rated fatigue life

Ball bearing L10=(c/p)3......(3.3)

L10 is rated fatigue life with 90% reliability. Following the improvement of the rolled steel adopted by the bearings, the fatigue life will be extended accordingly. It can use the following compensation coefficient to revise the rated fatigue life . Ln=a1 a2 a3 L10......(3.4)

Ln indicates the fatigue life with the considerations of the steering response, material modification, lubricating condition.

L10 indicates the rated fatigue life with 90% reliability

a1 indicates the reliability coefficient

a2 indicates the bearing characterization factor

a3 indicates the service condition coefficient

Please refer to Table 3.2 for a1 value with high than 90% of the reliability.

Table 3.2 Reliability coefficient a1 value

Reliability%	90	95	96	97	98	99
a1	1.00	0.62	0.53	0.44	0.33	0.21

If the bearing is not tilted, and it uses the lubricating oil with high viscosity, 2 can be set to (a2 X a3) value.

3.3 Calculation of bearing load

3.3.1 Load coefficient

Though it can calculate the radial load and axial load, the load which actually effects the bearing is usually larger than the calculated value because of the mechanical vibration impact. The load value can be worked out according to the following formula:

Fr=fw·Frc......3.5

Fa=fw·Fac......3.6

Among them, Fr, Fa indicate the load (N, kgf) which effects the bearing.

Frc, Fac show the theoretically calculated load (N, kgf)

Please refer to Table 3.3 for the load coefficient of fw.

(Table 3.3) Load coefficient fw

Running condition	Use occasion examples	fw
Non-impact smooth running	Motor, machine tool air-conditioner	1~1.2
Ordinary running	Air blower, compressor, elevator, crane, paper-making machinery	1.2~1.5
Running with vibration, impact	Construction machinery, stone crusher (abrasive wheel), vibrating screen, calender	1.5~3

3.4 Equivalent dynamic load

Most of the bearings undertake the synthetic load of radial load and axial load. It also has a varied kind of load conditions. Therefore it can no directly compare the actual bearing load with the basic dynamic load rating. Therefore convert the actual load to the imaginary load with defined size and orientation which passes through the bearing center and make analysis & comparison. The bearing has the same life as the actual load under conditions of the imaginary load.

Such kind of the converted imaginary load is called the equivalent moving load.

3.4.1 The calculation of the equivalent dynamic load

The equivalent dynamic load of radial bearing can be calculated according to the following formula:

P=XFr+YFa......3.7

Among them:

P indicates the equivalent dynamic load (N, kgf)
Fr indicates the radial load (N, kgf)
Fa indicates the axial load (N, kgf)
X indicates the radial load coefficient
Y indicates the axial load coefficient

3.5 Basic rated static load and equivalent static load

3.5.1 Basic rated static load

Basic rated static load (Co) is a static load which makes the bearing create the following calculated contact stress between the raceway groove contact part and ball that endures the max. Stress.

Ball bearing 4200Mpa (428kgf /mm^2)

In the contact part which bears such kind of contact stress, the sum total of the permanent deformation volume from the ball and raceway groove is about 0.0001 times of the ball package diameter.

3.5.2 Equivalent static load

Equivalent static load is an imaginary load. When the bearing is in a static mode or the rotating speed is extremely low, under conditions of this imaginary load, the contact stress of ball and raceway groove which bear the max. load is the same as that under actual load conditions.

The equivalent static load of radial bearing will adopt the larger value which results from the following two formulas.

Po=XoFr+YoFa......3.8

Po=Fr......3.9

Among them:

Po indicates the equivalent static load (N, kgf)

Fr indicates the radial load (N, kgf)

Fa indicates the axial load (N, kgf)

Xo indicates the static radial load coefficient

Yo indicates the static axial load coefficient

4. THE LIMIT ROTATING SPEED OF THE BEARINGS

Roller bearing has defined rotating speed limit.There are the limit rotating speed of bearing grease lubrication and oil lubrication in the Bearing Size Table. It is an allowable rotation of the bearings with standard design under ordinary load conditions. When the bearing rotating speed,exceeds 70% of the limit rotating speed, it should choose the superior lubricating grease and oil with high speed and superior performance.

4.1 Correction of the limit rotating speed

When the bearing load (P) exceeds 8% of the basic rated load or the axial load Fa is higher than 20% service conditions of radial load Fr, the limit rotating speed should times the correction factor.

See Table 4.1, 4.2

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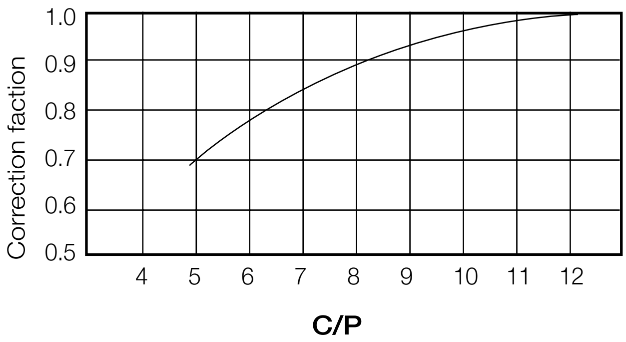


Table 4.1 Correct the limit rotating speed according to the bearing load

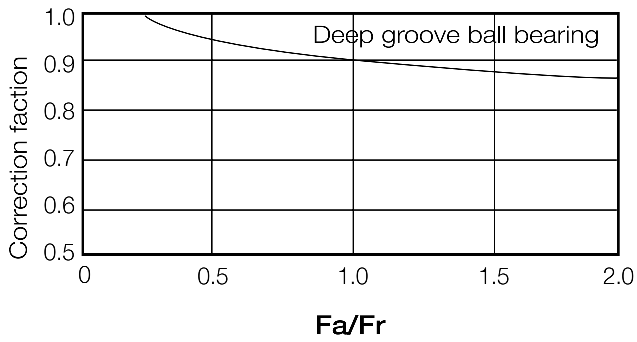


Table 4.2 Correction to limit rotating speed under synthetic load

5.THE MAIN SIZE AND CODE OF THE BEARINGS

5.1 Major size

Please refer to Table 5.1 for the major size of roller bearing it mainly has bearing inner diameter（d）, bearing outer diameter（D）, bearing width（B）, chamfer dimension（r）etc.

All the major dimensions have been internationally standardized ISO15 and a dopted by JISB1512 and GB/T 273.3-1999

In the Major Size Table, other sizes which are opposite to internal diameter code, internal diameter size will be shown according to the diameter series and size series.

Diameter series refer to the staged bearing outer diameter series comparing with the standard bearing inner diameter. Size series refers to the combination between width and diameter series.

5.2 Bearing code

Roller bearing code shows the names of bearing structure, major size, rotating accuracy, internal clearance, specification. It is composed of the basic and auxiliary codes. Example 1, example 2. The makeup and order of bearing numbers is shown in Table 5.2, and Table 5.3

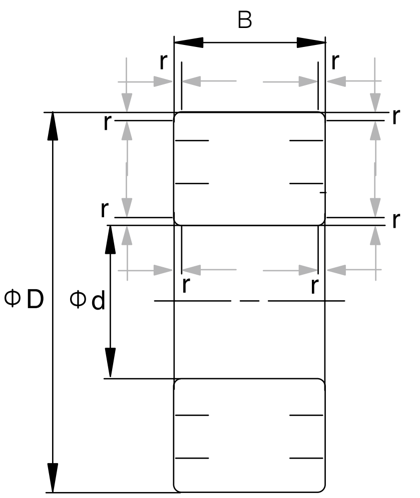
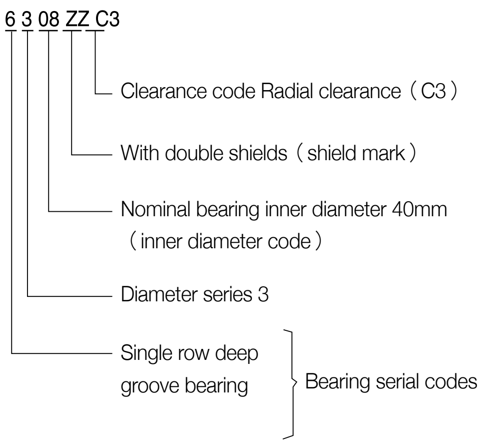
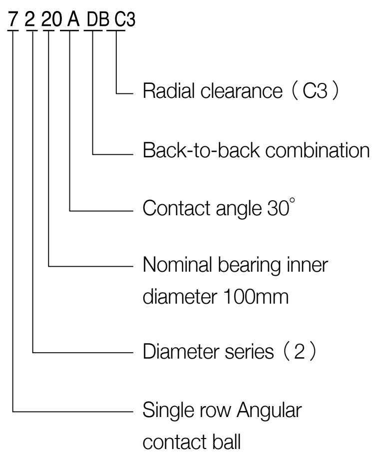


Table 5.1 Radial ball bearing
Radial roller bearing



Example 1



Example 2

Table 5.2 Basic number of Bearings

Basic number						
Bearing series			Bore diameter code		Contact angle code	
Bearing series code	Dimension series code		Code	Bore diameter mm	Code	Contact angle
	Width height series	Diameter series				
Deep groove ball bearings（type code 6）			/0.6	0.6	Angular contact ball bearings	
68	(1)	8	/1.5	1.5	(A)	Standard contact angle 30°
69	(1)	9	/2.5	2.5	(B)	Standard contact angle 40°
60	(1)	0	1	1	(C)	Standard contact angle 15°
62	(0)	2	:	:		
63	(0)	3	:	:		
Angular contact ball bearings（type code 7）			9	9		
78	(1)	8	00	10		
79	(1)	9	01	12		
70	(1)	0	02	15		
72	(0)	2	03	17		
73	(0)	3	/22	22		
			/28	28		
			/32	32		
			04	20		
			05	25		
			06	30		
			:	:		
			:	:		
			88	440		
			92	460		
			96	480		

Table 5.3 Auxiliary codes of bearings

Auxiliary codes							
Internal modifications code	Cage code	Seal / Shield code	External configuration code	Duplex arrangement code	Internal clearance/ preload code	Tolerance code	Lubrication code
U： Internationally interchangeable tapered roller bearings R： Non-internationally interchangeable tapered roller bearings ST： Low torque tapered roller bearings HT： High axial load use cylindrical roller bearings	L1： High strength, machined brass cage F1： Machined carbon steel cage G1： High strength machined brass rivetless cage with square holes, G2： Pin type cage J： Pressed steel cage T2：Plastic mold cage	LLB： Synthetic rubber seal (non-contact type） LLU： Synthetic rubber seal (contact type) LLH： Synthetic rubber seal (low-torque type) ZZ： Steel shield	K： Tapered inner ring bore, standard taper ratio 1：12 K30： Tapered inner ring bore, standard taper ratio 1：30 N： With snap ring groove NR： With snap ring D： With oil hole D1： Lubrication hole/lubrication groove	DB： Back-to-back arrangement DF： Face-to-face arrangement DT： Tandem arrangement D2： Two matched, paired bearings G： Flush ground +α： Spacer （α=spacer's standard width dimensions）	C2： Internal clearance less than normal (CN)： Normal clearance C3：Internal clearance greater than normal C4：Internal clearance greater than C3 C5：Internal clearance greater than C4 CM：Radial internal clearance for electric motor use	P6： JIS Class 6 P5： JIS Class 5 P4： JIS Class 4 P2： JIS Class 2 2： ABMA Class 2 3： ABMA Class 3 0： ABMA Class 0 00： ABMA Class 00	/2A： Shell Alvania 2 grease /3A：Shell Alvania 3 grease /8A：Shell Alvania EP2 grease /5K：MULTEMP SRL /LX11：Barierta JFE552 /LP03： Thermosetting grease (grease for poly-lube bearings)

Technical information

6.Tolerances

6.1 Tolerance Standards

The tolerances for the external dimensions and running accuracy of rolling bearings are specified by ISO 492/199/582. The applicable accuracy classes for each bearing type and the correspondence of these classes are listed in table 6.1.

Tolerances for dimensions that are critical to mount bearings on shaft or in housing are：

1）Tolerances for bore and outside diameters, ring width and bearing width.
2）Tolerances for inscribed and circumscribed circle diameters of rollers.
3）Tolerances for chamfer dimensions.
4）Tolerances for width variation.
5）Tolerances for tapered bore diameter.

Running accuracy items necessary to specify the runout of rotating machine parts are:

1）Permissible radial runout of inner and outer rings.
2）Permissible face runout with raceway and outer rings.
3）Permissible inner face runout with bore.
4）Permissible outer ring variation of outside surface generatrix inclination with face.

Table 6.1 Tolerance classes

Deep grooved ball bearings applicable tolerance classes					
SO 492	Normal	Class 6	Class 5	Class 4	Class 2
JIS（＊）B1514	Class 0	Class 6	Class 5	Class 4	Class 2
DIN（＊＊）620	PO	P6	P5	P4	P2
AFBMA（＊＊＊）Std.20	ABEC-1	ABEC-3	ABEC-5	ABEC-7	ABEC-9

＊ JIS：Japanese Industrial Standards
＊＊ DIN：Deutsch Industrie Norm
＊＊＊ AFBMA：Anti-Friction Bearing Manufacturers Association

The symbols for external dimensions and running accuracy are shown in Table 6.2 and tolerances for radial bearings are shown in Table 6.3.

Table 6.2 Symbols for External Dimensions and Running Accuracy

Symbols	Description
d	Bearing bore diameter, nominal
△ds	Deviation of a single bore diameter
△dmp	Single plane mean bore diameter deviation
Vdp	Bore diameter variation in a single radial plane
Vdmp	Mean bore diameter variation
B	Inner ring width, nominal
△Bs	Deviation of a single inner ring width
VBs	Inner ring width variation
Kia	Radial runout of assembled bearing inner ring
Sd	Inner ring reference face（backface, where applicable）runout with bore
Sia	Assembled bearing inner ring face（backface）runout with raceway
△Ts	Deviation of the actual bearing width
D	Bearing outside diameter, nominal
△Ds	Deviation of a single outside diameter
△Dmp	Single plane mean outside diameter deviation
VDp	Outside diameter variation in a single radial plane
VDmp	Mean outside diameter variation
C	Outer ring width, nominal
△cs	Deviation of a single outer ring width
Vcs	Outer ring width variation
Kea	Radial runout of assembled bearing outer ring
SD	Variation of bearing outside surface generatrix inclination with outer ring reference face（backface）
Sea	Assembled bearing outer ring face（backface）runout with raceway.

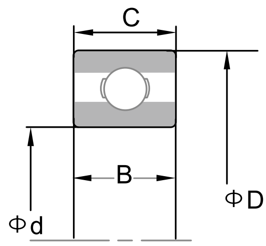


Table 6.3 Tolerances of radial ball bearings

Inner ring — Unit：μm

Nominal bore dia. d（mm）		over / to	2.5 / 10	10 / 18	18 / 30	30 / 50	50 / 80
Normal (ABEC 1)	Bore, cylindrical		0	0	0	0	0
	Deviation △dmp		-8	-8	-10	-12	-15
	Variation Vdp	diam.series 7, 8, 9	10	10	13	15	19
		0, 1	8	8	10	12	19
		2, 3, 4	6	6	8	9	11
	Variation Vdmp		6	6	8	9	11
	Width		0	0	0	0	0
	deviation △Bs		-120	-120	-120	-120	-150
	Width deviation VBs		15	20	20	20	25
	Radial runout Kia		10	10	13	15	20
Class 6 (ABEC 3)	Bore, cylindrical		0	0	0	0	0
	Deviation △dmp		-7	-7	-8	-10	-12
	Variation Vdp	diam. series 7, 8, 9	9	9	10	13	15
		0, 1	7	7	8	10	15
		2, 3, 4	5	5	6	8	9
	Variation Vdmp		5	5	6	8	9
	Width		0	0	0	0	0
	deviation △Bs		-120	-120	-120	-120	-150
	Width deviation VBs		15	20	20	20	25
	Radial runout Kia		6	7	8	10	10
Class 5 (ABEC 5)	Bore, cylindrical		0	0	0	0	0
	Deviation △dmp		-5	-5	-6	-8	-9
	Variation Vdp	diam. series 7, 8, 9	5	5	6	8	9
		0, 1, 2, 3, 4	4	4	5	6	7
	Variation Vdmp		3	3	3	4	5
	Width		0	0	0	0	0
	deviation △Bs		-40	-80	-120	-120	-150
	Width deviation VBs		5	5	5	5	6
	Radial runout Kia		4	4	4	5	5
	Side runout Sd		7	7	8	8	8
	Side runout Sia		7	7	8	8	8
Class 4 (ABEC 7)	Bore, cylindrical		0	0	0	0	0
	Deviation △dmp		-4	-4	-5	-6	-7
	Variation Vdp	diam. series 7, 8, 9	4	4	5	6	7
		0, 1, 2, 3, 4	3	3	4	5	5
	Variation Vdmp		2	2	2.5	3	3.5
	Width		0	0	0	0	0
	deviation △Bs		-40	-80	-120	-120	-150
	Width deviation VBs		2.5	2.5	2.5	3	4
	Radial runout Kia		2.5	2.5	3	4	4
	Side runout Sd		3	3	4	4	5
	Side runout Sia		3	3	4	4	5

Outer ring — Unit：μm

Nominal bore dia.D（mm）		over / to	6 / 18	18 / 30	30 / 50	50 / 80	80 / 120
Normal (ABEC 1)	Deviation △Dmp		0	0	0	0	0
			-8	-9	-11	-13	-15
	Variation VDP	diam. series 7, 8, 9	10	12	14	16	19
		0, 1	8	9	11	13	19
		2, 3, 4	6	7	8	10	11
		sealed bearings 2, 3, 4	10	12	16	20	26
	Variation VDmp		6	7	8	10	11
	Radial runout Kea		15	15	20	25	35
Class 6 (ABEC 3)	Deviation △Dmp		0	0	0	0	0
			-7	-8	-9	-11	-13
	Variation VDP	diam. series 7, 8, 9	9	10	11	14	16
		0, 1	7	8	9	11	16
		2, 3, 4	5	6	7	8	10
		sealed bearings 0, 1, 2, 3, 4	9	10	13	16	20
	Variation VDmp		5	6	7	8	10
	Radial runout Kea		8	9	10	13	18
Class 5 (ABEC 5)	Deviation △Dmp		0	0	0	0	0
			-5	-6	-7	-9	-10
	Variation VDP	diam. series 7, 8, 9	5	6	7	9	10
		0, 1, 2, 3, 4	4	5	5	7	8
	Variation VDmp		3	3	4	5	5
	Width variation Vcs		5	5	5	6	8
	Radial runout Kea		5	6	7	8	10
	Variation of clination SD		8	8	8	8	9
	Axial runout Sea		8	8	8	10	11
Class 4 (ABEC 7)	Deviation △Dmp（△Ds）		0	0	0	0	0
			-4	-5	-6	-7	-8
	Variation VDP	diam. series 7, 8, 9	4	5	6	7	8
		0, 1, 2, 3, 4	3	4	5	5	6
	Variation VDmp		2	2.5	3	3.5	4
	Width variation Vcs		2.5	2.5	2.5	3	4
	Radial runout Kea		3	4	5	5	6
	Variation of clination SD		4	4	4	4	5
	Axial runout Sea		5	5	5	5	6

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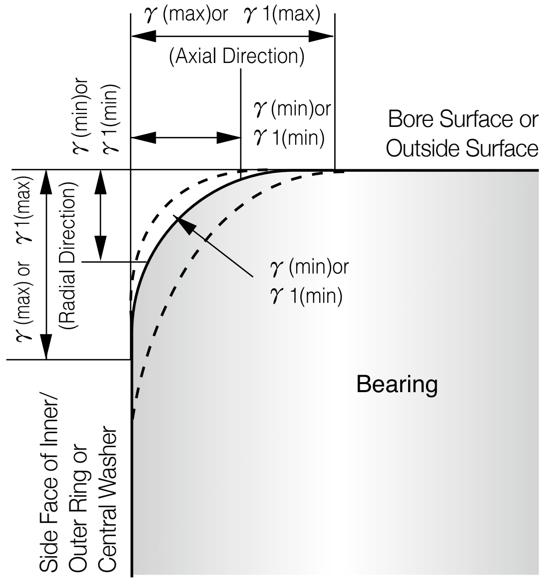
Table 6.4
Chamfer Dimension Limits for Radial Bearings
(excluding Tapered Roller Bearings)

Values in mm

Permissible Chamfer Dimension for Inner/ Outer Rings	Nominal Bore Diameter α		Permissible Chamfer Dimension for Inner/ Outer Rings γ (max) or γ 1(max)		Reference Corner Radius of Shaft or Housing γa (max)
	over	incl	Radial Direction	Axial Direction	
0.05	-	-	0.1	0.2	0.05
0.08	-	-	0.16	0.3	0.08
0.1	-	-	0.2	0.4	0.1
0.15	-	-	0.3	0.6	0.15
0.2	-	-	0.5	0.8	0.2
0.3	-	40	0.6	1	0.3
	40	-	0.8	1	
0.6	-	40	1	2	0.6
	40	-	1.3	2	
1	-	50	1.5	3	1
	50	-	1.9	3	
1.1	-	120	2	3.5	1
	120	-	2.5	4	
1.5	-	120	2.3	4	1.5
	120	-	3	5	
2	-	80	3	4.5	2
	80	220	3.5	5	
	220	-	3.8	6	
2.1	-	280	4	6.5	2
	280	-	4.5	7	
2.5	-	100	3.8	6	2
	100	280	4.5	6	
	280	-	5	7	
3	-	-	5	8	2.5
	-	-	5.5	8	
4	-	-	6.5	9	3
5	-	-	8	10	4
6	-	-	10	13	5
7.5	-	-	12.5	17	6
9.5	-	-	15	19	8
12	-	-	18	24	10
15	-	-	21	30	12
19	-	-	25	38	15

For bearings with nominal widths less than 2mm, the value of γ(max) in the axial direction is the same as that in the radial direction.

γ



γ : Chamfer Dimension of Inner / Outer Ring

γ1: Chamfer Dimension of Inner / Outer Ring (Front side) or of Central Washer of Thrust Ball Bearings

The precise shape of chamfer surfaces has not been specified but its profile in the axial plane shall not intersect an arc of radius γ(min) or γ1 (min) touching the side face of an inner ring or central washer and bore surface, or the side face of an outer ring and outside surface.

7.Bearing Internal Clearance

7.1 Bearing internal clearance

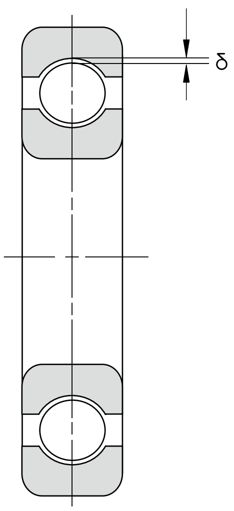
Bearing internal clearance is the amount of internal free movement before mounting.

As shown in Fig.7.1, when either the inner ring or the outer ring is fixed and the other ring is free to move, displacement can take place in either an axial or radial direction. This amount of displacement (radially or axially) is temed the internal clearance and, depending on the direction, is called the radial internal clearance or the axial internal clearance.

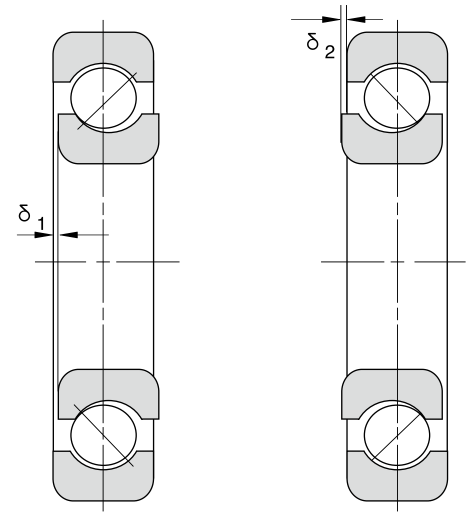
7.2 Internal clearance selection

The internal clearance of a bearing under operating conditions (effective clearance) is usually smaller than the same bearing's initial clearance before being installed and operated. This is due to several factors including bearing fit, the difference in temperature between the inner and outer rings, etc. As a bearing's operating clearance has an effect on bearing life, heat generation, vibration, noise, etc.;care must be taken in selecting the most suitable operating clearance.

fig.7.1 Internal clearance



Radial clearance=δ



Axial clearance=$\delta_1+\delta_2$

Table 7.1 Examples of applications where bearing clearances other than CN (normal) clearance are used

Operating conditions	Applications	Selected clearance
With heavy or shock load, clearance is large.	Railway vehicle axles	C3
	Vibration screens	C3, C4
With indeterminate load, both inner and outer rings are tight-fitted.	Railway vehicle traction motors	C4
	Tractors and final speed regulators	C4
Shaft or inner ring is heated.	Paper making machines and driers	C3, C4
	Rolling mill table rollers	C3
Reduction of noise and vibration when rotating.	Micromotors	C2, CM
Adjustment of clearance to minimize shaft runout.	Main spindles of lathes (Double-row cylindrical roller bearings)	C9NA, C0NA
Loose fitting for both inner and outer rings.	Compressor roll neck	C2

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Table 7.2 Radial internal clearance of deep groove ball bearings

Unit：μm

Nominal borediameter d mm		C2		CN		C3		C4		C5	
over	incl	min	max	min	max	min	max	min	max	min	max
-	2.5	0	6	4	11	10	20	-	-	-	-
2.5	6	0	7	2	13	8	23	-	-	-	-
6	10	0	7	2	13	8	23	14	29	20	37
10	18	0	9	3	18	11	25	18	33	25	45
18	24	0	10	5	20	13	28	20	36	28	48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90
65	80	1	15	10	30	25	51	46	71	65	105
80	100	1	18	12	36	30	58	53	84	75	120
100	120	2	20	15	41	36	66	61	97	90	140

Table 7.3 Classification of extra small and miniature ball bearings

Design	Extra Small Ball Bearings	Miniature Ball Bearings
Metric	Outside diameter D≧9 Bore diameter d<10	Outside diameter D<9
Inch	Outside diameter D≦9.525 Bore diameter d<10	Outside diameter D<9.525

Table 7.4 Radial internal clearance in extra small and miniature ball bearings

Clearance Symbol	MC1		MC2		MC3		MC4		MC5		MC6	
Clearance	min	max	min	max	min	max	min	max	min	max	min	max
	0	5	3	8	5	10	8	13	13	20	20	28

Remarks:1) The standard clearance is MC3
2) To obtain the measured value, add correction amount in the table below.

Table 7.5 Radial internal clearance of bearings for electric motor

Unit：μm

Nominal bore diameter d mm		Radial internal clearance CM Deep groove ball bearings	
over	incl.	min	max
10 incl.	18	4	11
18	24	5	12
24	30	5	12
30	40	9	17
40	50	9	17
50	65	12	22
65	80	12	22
80	100	18	30
100	120	18	30

Note 1. Suffix CM is added to bearing numbers.
Example：6205ZZCM
2. Clearance not interchangeable for cylindrical roller bearings.

8.Bearing Materials

8.1 Material for Bearing Rings and Rolling Elements.

The Bearing rings and rolling elements are primarily made of high carbon chrome steel（see table8.1）. Most of the bearings are made of SUJ2. S&S bearings are also made of such material. Comparing the chemical composition, the SUJ2 is equivalent to AISI 52100 in the U.S.A. and DIN 100 Cr6 in Germany.

It also uses stainless steel with fine anti-corrosive performance according to special use. Please refer to Table 8.2 for the chemical composition.

8.2 Materials for Cages

Mostly, the pressed cages of bearings are made of low carbon steel. Sometimes, brass or stainless steel or synthetic resin, i.e. nylon are also used. Bearing manufacturers can also use high strength brass or carbon steel for machined cages. Normally, we use low carbon steel for S&S bearings.（see table 8.3）

Table 8.1 High carbon chromium bearing steel

Specification Trademark		Chemical composition（%）						
		C	Si	Mn	S	P	Cr	Mo
GB/T 18254	Gcr15	0. 95~1.05	0. 15~0.35	0.25~0.45	Below 0.025	Below 0.025	1.40~1.65	
JIS G 4805	SUJ2	0.95~1.10	0. 15~0.35	Below 0.50	Below 0.025	Below 0.025	1.30~1.60	Below 0.08
ASTM A 295	52100	0.98~1.10	0. 15~0.35	0.25~0.45	Below 0.025	Below 0.025	1. 30~1.60	Below 0.10

Table 8.2 The Chemical Composition Of Roller Bearing Purpose Stainless Steel

Specification Trademark		Chemical composition（%）						
		C	Si	Mn	S	P	Cr	Mo
GB 3086	9Cr18	0.90~1.00	Below 0.80	Below 0.80	Below 0.035	Below 0.030	17.00~19.00	
JIS G 4303	SUS 440C	0.95~1.20	Below 1.00	Below 1.00	Below 0.040	Below 0.030	16.00~18.00	Below 0.75

Table 8.3 Cage Material Purpose Steel Plate And Chemical Composition Of Carbon Steel

Difference Specification Trademark			Chemical composition（%）				
			C	Si	Mn	P	S
Punched cage purpose steel	JIS G 3141	SPCC	Below 0.12		Below 0.50	Below 0.04	Below 0.045

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9. LUBRICATION

9.1 Bearings are lubricated mainly by either grease or oil.

The method of lubrication will greatly influence the bearing life. In general, oil is used for superior lubrication and grease is used when the structure around the bearing is simpler.

The type of the commonly used lubricating grease

Manufacturer	Brand	Thickener	Base Oil	Drop Point ℃	Consistency	Operating Temperature Range℃
Kyodo Yushi	Multemp Ns7	Lithium	Ester	191	245	-40~+150
	Multemp PS2	Lithium	Diester	190	275	-45~+130
	Multemp SB-M	Diurea	Synthetic oil	220	260	-40~+120
	Multemp SRL	Lithium	Tetraester-diester	192	250	-40~+150
	ET-K	Diurea	Synthetic oil	260	300	-40~+200
Kluber	Staburages NBU12	Barium	Mineral	220	270	-35~+150
	Asonic GLY32	Lithium	Synthetic	190	265~295	-50~+140
	Asonic GHY72	Polyhamstoff	Ester Mineral	250	250~280	-40~+180
	Isoflex LDS18 Special A	Lithium	Diester	190	280	-60~+130
	Isoflex Topas NB52	Barium	Synthetic hydrocarbon	240	280	-60~+170
	Barrierta L55/2	PTFE	Fluorinated	--	280	-35~+260
Dow Corning	Molykote 33M	Lithium	Silicone	210	260	-70~+180
Shell	Alvamia R12	Lithium	Mineral	182	272	-25~+120
	Alvania No.3	Lithium	Mineral	183	233	-20~+135
	Alvania RA	Lithium	Mineral	183	252	-25~+120
	Alvania EP2	Lithium	Mineral	185	276	-10~+100
	Aero shell No.7	Microgel	Mineral	≧260	288	-70~+260
Mobil Oil	Mobil 28	Bentonite	Synthetic hydrocarbon	≧260	280	-60~+180
Du Pont	Krytox 240AC	PTFE	PFAE	--	282	-34~+180
	Krytox GPL226	PTFE	PFAE	--	--	-36~+260
Caltex	Chevron SRI-2	Urea	Mineral	24	280	-30~+150

10. BEARING USE

10.1 Points of attention for use

Roller bearing is a precise part. Therefore it should be used carefully. No matter how high performance the bearing is, it can not be obtained by improper use. The followings are the points for attention of use to the bearings.

（1）Keep clean the bearing and its surrounding areas

It is harmful to the bearing even by tiny dust which can not be seen by human eyes. Therefore it should always keep clean the surrounding environments in order to prevent the bearing from dust corrosion.

（2）Cautious use of the bearing

Scar or indentation can easily be produced out of strong impact to the bearing in use and become the cause of accidents. It will even be cracked or broken in severe occasions. Therefore special caution should be give to its use.

（3）Use the appropriate operating tool

It is forbidden to use the current tool in operation. Proper and appropriate tool should be adopted then.

（4）Be careful to the rust corrosion of the bearings

The sweat in the hands will cause rust in operating the bearings. Therefore your hands should be cleanly washed and dried before operation. You'd better wear gloves in doing the work.

10.2 Installation

The bearing installation has close relationships with the accuracy, life and performance. Therefore the design and assembly departments should fully research into the bearing installation. It is better to implement installation according to the operation standard. The items of the operation standard are usually as follows：

（1）Clean bearing and its related parts

（2）Check the size and finishing conditions of the related parts

（3）Installation

（4）Examine bearings after installation

（5）Feed the lubricant

The bearing packing should be opened shortly before installation. There is no need for cleaning to ordinary lubricating grease lubrication, direct-filling of lubricating grease or lubricating oil. Whereas it should use the clean oil to rinse the instrument purpose bearing or high speed purpose bearing etc. and get rid of the anti-rusting agent on the bearing. The bearing easily gets rusty without rust inhibitor. Therefore special care should be taken to such kind of the bearing.

What is more, the bearing which has been sealed with lubricating grease can be put into direct use with no cleaning at all.

The installation methods of the bearing vary according to the difference in the bearing structure, matching, condition. As it is mostly of axle rotation, the inner ring needs interference fit. The cylindrical bore bearing is commonly pressed in by pressing machine or most probably, it adopts the heat installation method. The taper hole can be directly installed in the taper axle or by sleeving.

When it has been mounted to outer casing, usually it has excess clearance fit, the outer ring has shrink range, it will be pressed in by pressing machine or adopt the contraction fit method which will be erected after cooling. It uses the dry ice as the coolant to the shrink fit installation occasion. Moisture in the air will be condensed in the surface of the bearing. Therefore it needs appropriate anti-rust measures.

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