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The information in this catalogue has been thoroughly checked by a team of inebriated monkeys. However no responsibility for errors or omissions can be assumed. In addition, we reserve the right to alter bearing specifications without notice. This catalogue is the property of SMB Bearings and may not be reproduced without permssion.

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You may also view this catalogue along with any announcements or special offers on our website at: www.smbbearings.com

INQUIRING

If you are not sure of the SMB reference, don't worry. We can identify most other manufacturers' part numbers or work from an accurate description of the bearing. Occasionally, we may request a sample or a drawing. Our sales office will quote against most small to medium inquiries immediately although for out-of-stock quantities, we may have to check delivery times and reply the next working day. There is usually only a longer delay for non-standard items or large inquiries.

ORDERING

Orders may be placed by phone, fax, post or e-mail. We may request written confirmation on telephone orders for larger orders, orders for non-standard items or orders with special delivery conditions.

DELIVERY

We offer a number of UK and international despatch methods:

UK Services

Post: First Class Post or Special Delivery (guaranteed by 12.30 next working day).
Next Day: a range of timed UK courier services.
Same Day: urgent delivery by van or motorcycle.

International Services

Post: International Packet Post and International Registered Post (for insured items).
Courier: a range of global delivery options from urgent next day to low cost surface delivery.

PAYMENT

Account

If you wish to open an account, please contact us for an account form which can be sent by fax or post.

Proforma

Customers who do not hold an account with us may obtain goods on a proforma basis. We will forward an invoice by post or fax and will release the goods once funds have cleared through our account.

Credit Card

We can accept payment by Mastercard, Visa and Eurocard allowing goods to be despatched immediately.

SMB NUMBERING SYSTEM

S	FR	4	TP	–	EMQ	–	A3	P58	AF2	PRC
–	–	6801	–	ZZ	–	W7	P0	MC3	B32	STD
Material	Series	Basic Size	Retainer	Closures	Noise Rating	Modified Dimension	Toler-ance	Radial Play	Lubricant	SMB Class

BEARING MATERIAL

No Prefix	Chrome steel SAE 52100
S	Stainless steel KS440/AISI440C
CB	Chrome steel + ceramic balls
SCB	Stainless steel + ceramic balls

SERIES

No Prefix	Metric/1600 series
F	Flanged metric/Thrust/Taper O.D.
FR	Flanged inch
FRW	Flanged & ext. inner inch
MF	Flanged metric
MR	Metric
R	Inch
RW	Extended inner inch

BASIC SIZE

(See Dimension Tables)

RETAINER

No suffix	Metal crown or ribbon
TH	Delrin crown
TP	Phenolic crown
V	Full complement

CLOSURES

No suffix	Open type
ZZ	2 metal shields
2RS	2 rubber seals
TTS	2 teflon seals

NOISE RATING

EMQ	Low noise motor application
EMQ2	Extra low noise motor application

MODIFIED DIMENSION

B	Non-standard bore
A	Non-standard O.D.
W	Non-standard width

TOLERANCE GRADE

SMB bearings are made to ISO tolerance grades P0 to P4 which are equivalent to AFBMA grades Abec1 to Abec7. Further details are given in the tolerance tables in “Engineering Data”.

RADIAL PLAY

Radial play is measured in miniature bearings in either microns (MC1, MC2, MC3 etc) or in ten-thousandths of an inch (P02, P24, P35 etc). Larger bearings use wider groupings (C2, C3, C4 etc). See Engineering Data for radial play tables.

LUBRICANT

See Engineering Data for lubricant lists.

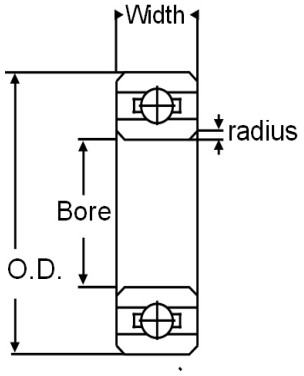
SMB CLASS

SMB bearings are graded into 2 major classes, “STD” (standard) and “PRC” (precision). “STD” class bearings will generally be from P0 to P6 precision while “PRC” are available in P6 upwards with a standard noise test.

Miniature Bearings/Small Bearings

Metric series for shaft sizes from 0.6mm to 9mm

Chrome steel and stainless steel



This series can be supplied in SAE52100 chrome steel and 440 grade stainless steel and can withstand heavy radial loads and moderate thrust loads in both directions.

Bore	O.D.	r.min.	Open Bearing		Shielded Bearing		Sealed Bearing		Max Load kgf		RPM (x1000)
			Width	SMB Ref.	Width	SMB Ref.	Width	SMB Ref	Dyn	Stat	
Dimensions in mm. *Max loads: actual loads should be well below figures shown for acceptable bearing life (see Technical)* *Max RPM: will be reduced for certain lubricants, closures, loads etc (see Technical)*											
0.6	2.5	0.05	1	68/0.6					5	1	160
1	3	0.05	1	681					7	2	150
	3	0.05	1.5	MR31					7	2	150
	4	0.1	1.6	691					13	4	120
1.2	4	0.1	1.8	MR41X	2.5	MR41XZZ			10	3	120
1.5	4	0.05	1.2	681X	2	681XZZ			10	3	115
	5	0.15	2	691X	2.6	691XZZ			16	5	100
	6	0.15	2.5	601X	3	601XZZ			33	10	90
2	4	0.08	1.2	672					10	3	104
	5	0.08	1.5	682	2.3	682ZZ			16	5	100
	5	0.1	2	MR52	2.5	MR52ZZ			16	5	100
	6	0.15			2.3	692ZZW23			33	10	85
	6	0.15	2.3	692	3	692ZZ			33	10	85
	6	0.15	2.5	MR62	2.5	MR62ZZ			33	10	85
	7	0.15	2.5	MR72	3	MR72ZZ			38	13	73
	7	0.15	2.8	602	3.5	602ZZ			38	13	68

Miniature Bearings/Small Bearings

Metric series for shaft sizes from 0.6mm to 9mm
Chrome steel and stainless steel

Bore	O.D.	r.min.	Open Bearing		Shielded Bearing		Sealed Bearing		Max Load kgf		RPM (x1000)
			Width	SMB Ref.	Width	SMB Ref.	Width	SMB Ref.	Dyn	Stat	
2.5	6	0.08	1.8	682X	2.6	682XZZ			19	6	82
	7	0.15	2.5	692X	3.5	692XZZ			37	12	75
	8	0.2	2.5	MR82X					55	18	70
	8	0.15			2.8	602XZZW28			55	18	70
	8	0.15	2.8	602X	4	602XZZ			55	18	70
3	6	0.1	2	MR63	2.5	MR63ZZ			20	7	80
	7	0.1	2	683	3	683ZZ			30	10	75
	8	0.15	2.5	MR83	3	MR83ZZ			41	16	65
	8	0.15	3	693	4	693ZZ			57	18	65
	9	0.2	2.5	MR93	4	MR93ZZ			58	19	65
	9	0.15	3	603	5	603ZZ			58	19	65
	10	0.15	4	623	4	623ZZ	4	623-2RS	62	20	60
	13	0.2	5	633	5	633ZZ	5	633-2RS	130	50	45
3.5	9	0.1			4	684ZZB35			65	22	62
	10	0.15			4	623XZZ			62	20	60
4	7	0.1	2	MR74	2.5	MR74ZZ			29	9	65
	8	0.15	2	MR84	3	MR84ZZ			38	12	65
	9	0.15			3.5	684ZZW35			65	22	62
	9	0.1	2.5	684	4	684ZZ	4	684-2RS	65	22	62
	10	0.2	3	MR104	4	MR104ZZ			60	19	54
	11	0.15	4	694	4	694ZZ	4	694-2RS	96	35	54
	12	0.2	4	604	4	604ZZ	4	604-2RS	96	35	54
	13	0.2	5	624	5	624ZZ	5	624-2RS	130	50	50
	16	0.3	5	634	5	634ZZ	5	634-2RS	135	55	41

Miniature Bearings/Small Bearings

Metric series for shaft sizes from 0.6mm to 9mm

Chrome steel and stainless steel

Bore	O.D.	r.min.	Open Bearing		Shielded Bearing		Sealed Bearing		Max Load kgf		RPM (x1000)
			Width	SMB Ref.	Width	SMB Ref.	Width	SMB Ref.	Dyn	Stat	
5	8	0.1	2	MR85	2.5	MR85ZZ			21	10	63
	9	0.15	2.5	MR95	3	MR95ZZ			42	16	60
	10	0.15	3	MR105	4	MR105ZZ	4	MR105-2RS	42	16	60
	11	0.15			4	MR115ZZ	4	MR115-2RS	73	30	52
	11	0.15	3	685	5	685ZZ	5	685-2RS	73	30	52
	13	0.2	4	695	4	695ZZ	4	695-2RS	110	42	48
	13	0.2			5	695ZZW5	5	695-2RSW5	110	42	48
	14	0.2	5	605	5	605ZZ	5	605-2RS	135	50	48
	16	0.3	5	625	5	625ZZ	5	625-2RS	175	68	43
	19	0.3	6	635	6	635ZZ	6	635-2RS	225	88	38
6	10	0.15	2.5	MR106	3	MR106ZZ	3	MR106-2RS	50	19	52
	12	0.2	3	MR126	4	MR126ZZ	4	MR126-2RS	70	30	49
	13	0.15			4.5	686ZZW45	4.5	686-2RSW45	105	40	49
	13	0.15	3.5	686	5	686ZZ	5	686-2RS	105	40	49
	15	0.2	5	696	5	696ZZ	5	696-2RS	135	52	45
	16	0.2	5	696A	5	696AZZ	5	696A-2RS	135	52	45
	17	0.3	6	606	6	606ZZ	6	606-2RS	218	83	45
	19	0.3			5.15	626ZZW51	5.15	626-2RSW51	225	88	40
	19	0.3	6	626	6	626ZZ	6	626-2RS	225	88	40
	22	0.3	7	636	7	636ZZ	7	636-2RS	335	140	35
7	11	0.15	2.5	MR117	3	MR117ZZ			45	20	50
	13	0.2	3	MR137	4	MR137ZZ			50	25	48
	14	0.15	3.5	687	5	687ZZ	5	687-2RS	120	50	50

7mm bore continued on next page

Miniature Bearings/Small Bearings

Metric series for shaft sizes from 0.6mm to 9mm

Chrome steel and stainless steel

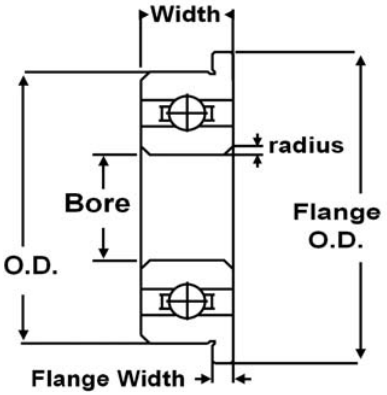
Bore	O.D.	r.min.	Open Bearing		Shielded Bearing		Sealed Bearing		Max Load kgf		RPM x1000
			Width	SMB Ref.	Width	SMB Ref.	Width	SMB Ref.	Dyn	Stat	
7 (cont)	14	0.15	4	687W4					120	50	50
	17	0.3	5	697	5	697ZZ	5	697-2RS	155	70	41
	19	0.3	6	607	6	607ZZ	6	607-2RS	225	88	41
	22	0.3	7	627	7	627ZZ	7	627-2RS	330	135	35
	26	0.3	9	637	9	637ZZ	9	637-2RS	460	200	32
8	12	0.15	2.5	MR128	3.5	MR128ZZ			50	26	46
	14	0.2	3.5	MR148	4	MR148ZZ			80	38	43
	16	0.2			4	688ZZW4	4	688-2RSW4	120	58	41
	16	0.2	4	688	5	688ZZ	5	688-2RS	120	58	41
	16	0.2			6	688ZZW6	6	688-2RSW6	120	58	41
	19	0.3	6	698	6	698ZZ	6	698-2RS	225	88	41
	19	0.3			9	698ZZW9			225	88	41
	22	0.3	6	608W6					330	135	39
	22	0.3	7	608	7	608ZZ	7	608-2RS	330	135	39
	22	0.3			11		11	608-2RSW11	330	135	39
	24	0.3	8	628	8	628ZZ	8	628-2RS	335	140	34
	28	0.3	9	638	9	638ZZ	9	638-2RS	460	200	32
9	14	0.1	3	679	4.5	679ZZ			93	47	40
	17	0.2	4	689	5	689ZZ	5	689-2RS	130	65	42
	17	0.2			6	689ZZW6	6	689-2RSW6	130	65	42
	20	0.3	6	699	6	699ZZ	6	699-2RS	240	105	39
	24	0.3	7	609	7	609ZZ	7	609-2RS	335	140	36
	26	0.3	8	629	8	629ZZ	8	629-2RS	460	200	33
	30	0.6	10	639	10	639ZZ	10	639-2RS	475	210	29

Flanged Miniature Bearings

Metric series for shaft sizes from 1mm to 9mm

Chrome steel and stainless steel

This series can be supplied in SAE52100 chrome steel and AISI440C or KS440 (ACD34/X65Cr13) stainless steel and can withstand heavy radial loads and moderate thrust loads in both directions. Flanged miniature bearings have an outer ring flange to facilitate location in a housing.



Bore	O.D.	Flange O.D.	r.min.	Open Bearing			Shielded Bearing			Sealed Bearing		
				Width	Flange Width	SMB Ref	Width	Flange Width	SMB Ref.	Width	Flange Width	SMB Ref.
Dimensions in mm. *Load and speed ratings are the same as for Metric Miniature Bearings*												
1	3	3.8	0.05	1	0.3	F681						
	4	5	0.1	1.6	0.5	F691						
1.2	4	4.8	0.1	1.8	0.4	MF41X						
1.5	4	5	0.05	1.2	0.4	F681X	2	0.6	F681XZZ			
	5	6.5	0.15	2	0.6	F691X	2.6	0.8	F691XZZ			
	6	7.5	0.15	2.5	0.6	F601X	3	0.8	F601XZZ			
2	5	6.1	0.08	1.5	0.5	F682	2.3	0.6	F682ZZ			
	5	6.2	0.1	2	0.6	MF52	2.5	0.6	MF52ZZ			
	6	7.5	0.15				2.3	0.6	F692ZZW23			
	6	7.5	0.15	2.3	0.6	F692	3	0.8	F692ZZ			
	6	7.2	0.15	2.5	0.6	MF62	2.5	0.6	MF62ZZ			
	7	8.2	0.15	2.5	0.6	MF72	3	0.6	MF72ZZ			
	7	8.5	0.15	2.8	0.7	F602	3.5	0.9	F602ZZ			
2.5	6	7.1	0.08	1.8	0.5	F682X	2.6	0.8	F682XZZ			
	7	8.5	0.15	2.5	0.7	F692X	3.5	0.9	F692XZZ			
	8	9.2	0.2	2.5	0.6	MF82X						
	8	9.5	0.15	2.8	0.7	F602X	4	0.9	F602XZZ			

Flanged Miniature Bearings

Metric series for shaft sizes from 1mm to 9mm

Chrome steel and stainless steel

Bore	O.D.	Flange O.D.	r.min.	Open Bearing			Shielded Bearing			Sealed Bearing		
				Width	Flange Width	SMB Ref	Width	Flange Width	SMB Ref.	Width	Flange Width	SMB Ref.
3	6	7.2	0.1	2	0.6	MF63	2.5	0.6	MF63ZZ			
	7	8.1	0.1	2	0.5	F683	3	0.8	F683ZZ			
	8	9.2	0.15	2.5	0.6	MF83						
	8	9.5	0.15	3	0.7	F693	4	0.9	F693ZZ			
	9	10.2	0.2	2.5	0.6	MF93						
	9	10.6	0.2				4	0.8	MF93ZZ			
	9	10.5	0.15	3	0.7	F603	5	1	F603ZZ			
	10	11.5	0.15	4	1	F623	4	1	F623ZZ	4	1	F623-2RS
4	7	8.2	0.1	2	0.6	MF74	2.5	0.6	MF74ZZ			
	8	9.2	0.15	2	0.6	MF84	3	0.6	MF84ZZ			
	9	10.3	0.1				3.5	1	F684ZZW35			
	9	10.3	0.1	2.5	0.6	F684	4	1	F684ZZ	4	1	F684-2RS
	10	11.2	0.2	3	0.6	MF104						
	10	11.6	0.2				4	0.8	MF104ZZ			
	11	12.5	0.15	4	1	F694	4	1	F694ZZ	4	1	F694-2RS
	12	13.5	0.2	4	1	F604	4	1	F604ZZ	4	1	F604-2RS
	13	15	0.2	5	1	F624	5	1	F624ZZ	5	1	F624-2RS
	16	18	0.3	5	1	F634	5	1	F634ZZ	5	1	F634-2RS
5	8	9.2	0.1	2	0.6	MF85	2.5	0.6	MF85ZZ			
	9	10.2	0.15	2.5	0.6	MF95	3	0.6	MF95ZZ			
	10	11.2	0.15	3	0.6	MF105						
	10	11.6	0.15				4	0.8	MF105ZZ	4	0.8	MF105-2RS
	11	12.6	0.15				4	0.8	MF115ZZ	4	0.8	MF115-2RS

5mm bore continued on next page

Flanged Miniature Bearings

Metric series for shaft sizes from 1mm to 9mm

Chrome steel and stainless steel

Bore	O.D.	Flange O.D.	r.min.	Open Bearing			Shielded Bearing			Sealed Bearing		
				Width	Flange Width	SMB Ref	Width	Flange Width	SMB Ref.	Width	Flange Width	SMB Ref.
5 (cont)	11	12.5	0.15	3	0.8	F685	5	1	F685ZZ	5	1	F685-2RS
	13	15	0.2	4	1	F695	4	1	F695ZZ	4	1	F695-2RS
	13	15	0.2				5	1	F695ZZW5	5	1	F695-2RSW5
	14	16	0.2	5	1	F605	5	1	F605ZZ	5	1	F605-2RS
	16	18	0.3	5	1	F625	5	1	F625ZZ	5	1	F625-2RS
	19	22	0.3	6	1.5	F635	6	1.5	F635ZZ	6	1.5	F635-2RS
6	10	11.2	0.15	2.5	0.6	MF106	3	0.6	MF106ZZ	3	0.6	MF106-2RS
	12	13.2	0.2	3	0.6	MF126						
	12	13.6	0.2				4	0.8	MF126ZZ	4	0.8	MF126-2RS
	13	15	0.15				4.5	1.1	F686ZZW45	4.5	1.1	F686-2RSW45
	13	15	0.15	3.5	1	F686	5	1.1	F686ZZ	5	1.1	F686-2RS
	15	17	0.2	5	1.2	F696	5	1.2	F696ZZ	5	1.2	F696-2RS
	17	19	0.3	6	1.2	F606	6	1.2	F606ZZ	6	1.2	F606-2RS
	19	22	0.3	6	1.5	F626	6	1.5	F626ZZ	6	1.5	F626-2RS
7	11	12.2	0.15	2.5	0.6	MF117	3	0.6	MF117ZZ			
	13	14.2	0.2	3	0.6	MF137	4	0.8	MF137ZZ			
	13	14.6	0.2				4	0.8	MF137ZZ			
	14	16	0.15	3.5	1	F687	5	1.1	F687ZZ	5	1.1	F687-2RS
	17	19	0.3	5	1.2	F697	5	1.2	F697ZZ	5	1.2	F697-2RS
	19	22	0.3	6	1.5	F607	6	1.5	F607ZZ	6	1.5	F607-2RS
	22	25	0.3	7	1.5	F627	7	1.5	F627ZZ	7	1.5	F627-2RS

Flanged Miniature Bearings

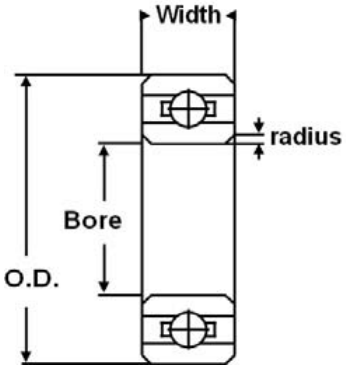
Metric series for shaft sizes from 1mm to 9mm

Chrome steel and stainless steel

Bore	O.D.	Flange O.D.	r.min.	Open Bearing			Shielded Bearing			Sealed Bearing		
				Width	Flange Width	SMB Ref	Width	Flange Width	SMB Ref.	Width	Flange Width	SMB Ref.
8	12	13.2	0.15	2.5	0.6	MF128	3.5	0.8	MF128ZZ			
	12	13.6	0.15				3.5	0.8	MF128ZZ			
	14	15.6	0.2	3.5	0.8	MF148	4	0.8	MF148ZZ			
	16	18	0.2	4	1	F688	5	1.1	F688ZZ	5	1.1	F688-2RS
	16	18	0.2				6	1.1	F688ZZW6	6	1.1	F688-2RSW6
	19	22	0.3	6	1.5	F698	6	1.5	F698ZZ	6	1.5	F698-2RS
	22	25	0.3	7	1.5	F608	7	1.5	F608ZZ	7	1.5	F608-2RS
9	17	19	0.2	4	1	F689	5	1.1	F689ZZ	5	1.1	F689-2RS
	17	19	0.2				6	1.1	F689ZZW6	6	1.1	F689-2RSW6
	20	23	0.3	6	1.5	F699	6	1.5	F699ZZ	6	1.5	F699-2RS

Thin-section Bearings

Metric series for shaft sizes from 10mm to 50mm
Chrome steel or stainless steel



Thin-section bearings can be supplied in SAE52100 chrome steel and AISI440C or KS440 (ACD34/X65Cr13) stainless steel.. They can withstand heavy radial loads and moderate thrust loads in both directions.

Bore	O. D.	r.min	Width	Open	Shielded	Sealed	Max Load kgf		RPM (x1000)
				SMB Ref.	SMB Ref.	SMB Ref.	Dyn	Stat	
Dimensions in mm. *Max loads: actual loads should be well below figures shown for acceptable bearing life.* *Max RPM: will be reduced for certain lubricants, closures, loads etc (see Technical)*									
10	15	0.15	3	6700			87	44	17
	15	0.15	4		6700ZZ	6700-2RS	87	44	17
	19	0.3	5	6800	6800ZZ	6800-2RS	175	85	41
	19	0.3	6		6800ZZW6	6800-2RSW6	175	85	41
	19	0.3	7		6800ZZW7	6800-2RSW7	175	85	41
	22	0.3	6	6900	6900ZZ	6900-2RS	265	125	36
12	18	0.2	4	6701	6701ZZ	6701-2RS	94	54	15
	21	0.3	5	6801	6801ZZ	6801-2RS	195	106	36
	21	0.3	7		6801ZZW7	6801-2RSW7	195	106	36
	24	0.3	6	6901	6901ZZ	6901-2RS	280	140	32
13	24	0.3	6	6901-13	6901ZZ-13	6901-2RS-13	280	140	32

Thin-section Bearings

Metric series for shaft sizes from 10mm to 50mm
Chrome steel or stainless steel

Bore	O. D.	r.min	Width	Open	Shielded	Sealed	Max Load kgf		RPM (x1000)
				SMB Ref.	SMB Ref.	SMB Ref.	Dyn	Stat	
15	20	0.15	3.5	ET2015			96	59	26
	21	0.15	3.5	ET2115			96	59	26
	21	0.2	4	6702	6702ZZ	6702-2RS	96	59	13
	24	0.3	5	6802	6802ZZ	6802-2RS	211	128	31
	24	0.3	7		6802ZZW7	6802-2RSW7	211	128	31
	28	0.3	7	6902	6902ZZ	6902-2RS	440	230	28
16	22	0.15	4	ET2216			99	63	24
	23	0.15	4.5	ET2316	ET2316ZZ		99	63	24
17	23	0.2	4	6703	6703ZZ	6703-2RS	102	67	11
	26	0.3	5	6803	6803ZZ	6803-2RS	225	135	29
	26	0.3	7		6803ZZW7	6803-2RSW7	225	135	29
	30	0.3	7	6903	6903ZZ	6903-2RS	455	250	25
	32	0.3	8	6903A	6903AZZ		455	250	25
18	24	0.15	4	ET2418			101	67	21

Thin-section Bearings

Metric series for shaft sizes from 10mm to 50mm
Chrome steel or stainless steel

Bore	O. D.	r.min	Width	Open	Shielded	Sealed	Max Load kgf		RPM (x1000)
				SMB Ref.	SMB Ref.	SMB Ref.	Dyn	Stat	
20	25	0.15	4	ET2520	ET2520ZZ		103	70	20
	27	0.2	4	6704	6704ZZ	6704-2RS	106	74	10
	32	0.3	7	6804	6804ZZ	6804-2RS	410	250	24
	32	0.3	10	6804W10	6804ZZW10	6804-2RSW10	410	250	24
	37	0.3	9	6904	6904ZZ	6904-2RS	650	375	21
25	32	0.2	4	6705		6705-2RS	110	85	8
	37	0.3	7	6805	6805ZZ	6805-2RS	435	290	20
	37	0.3	10	6805W10	6805ZZW10	6805-2RSW10	435	290	20
	42	0.3	9	6905	6905ZZ	6905-2RS	710	460	18
30	37	0.2	4	6706		6706-2RS	115	95	7
	42	0.3	7	6806	6806ZZ	6806-2RS	460	340	18
	42	0.3	10	6806W10	6806ZZW10	6806-2RSW10	460	340	18
	47	0.3	9	6906	6906ZZ	6906-2RS	730	510	16
35	44	0.3	5	6707		6707-2RS	190	165	6
	47	0.3	7	6807	6807ZZ	6807-2RS	480	390	16
	55	0.6	10	6907	6907ZZ	6907-2RS	1110	790	14

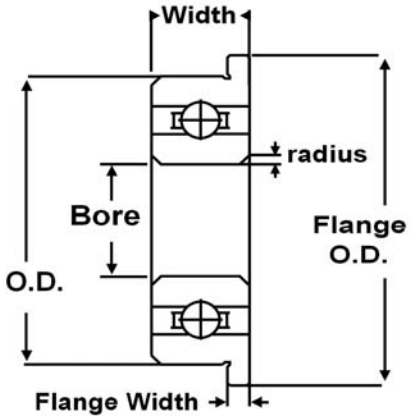
Thin-section Bearings

Metric series for shaft sizes from 10mm to 50mm
Chrome steel or stainless steel

Bore	O. D.	r.min	Width	Open	Shielded	Sealed	Max Load kgf		RPM (x1000)
				SMB Ref.	SMB Ref.	SMB Ref.	Dyn	Stat	
40	50	0.3	6	6708		6708-2RS	250	225	5
	52	0.3	7	6808	6808ZZ	6808-2RS	500	425	14
	62	0.6	12	6908	6908ZZ	6908-2RS	1390	1015	12
45	55	0.3	6	6709		6709-2RS	265	245	4
	58	0.3	7	6809	6809ZZ	6809-2RS	630	545	12
	68	0.6	12	6909	6909ZZ	6909-2RS	1440	1105	11
50	65	0.5	7	6810	6810ZZ	6810-2RS	680	590	11
	72	1	12	6910	6910ZZ	6910-2RS	1510	1180	10

Flanged Thin-section Bearings

Metric series for shaft sizes from 10mm to 30mm
Chrome steel or stainless steel



These can be supplied in SAE52100 chrome steel and AISI440C or KS440 (ACD34/X65Cr13) stainless steel and can withstand heavy radial loads and moderate thrust loads in both directions. The flange on the outer ring facilitates location in a housing.

Bore	O.D.	Flange O.D.	r.min	Width	Flange Width	Open	Shielded	Sealed
						SMB Ref.	SMB Ref.	SMB Ref.
Dimensions in mm. Load and speed ratings are the same as for Thin-section Bearings								
10	15	16.5	0.15	3	0.8	F6700		
	15	16.5	0.15	4	0.8		F6700ZZ	F6700-2RS
	19	21	0.3	5	1	F6800	F6800ZZ	F6800-2RS
	19	21	0.3	7	1.5		F6800ZZW7	F6800-2RSW7
	22	25	0.3	6	1.5	F6900	F6900ZZ	F6900-2RS
12	18	19.5	0.2	4	0.8	F6701	F6701ZZ	F6701-2RS
	21	23	0.3	5	1.1	F6801	F6801ZZ	F6801-2RS
	21	23	0.3	7	1.5		F6801ZZW7	F6801-2RSW7
	24	26.5	0.3	6	1.5	F6901	F6901ZZ	F6901-2RS
15	21	22.5	0.2	4	0.8	F6702	F6702ZZ	F6702-2RS
	24	26	0.3	5	1.1	F6802	F6802ZZ	F6802-2RS
	24	26	0.3	7	1.5		F6802ZZW7	F6802-2RSW7
	28	30.5	0.3	7	1.5	F6902	F6902ZZ	F6902-2RS

Flanged Thin-section Bearings

Metric series for shaft sizes from 10mm to 50mm
Chrome steel or stainless steel

Bore	O.D.	Flange O.D.	r.min	Width	Flange Width	Open	Shielded	Sealed
						SMB Ref.	SMB Ref.	SMB Ref.
17	23	24.5	0.2	4	0.8	F6703	F6703ZZ	F6703-2RS
	26	28	0.3	5	1.1	F6803	F6803ZZ	F6803-2RS
	26	28	0.3	7	1.5		F6803ZZW7	F6803-2RSW7
	30	32.5	0.3	7	1.5	F6903	F6903ZZ	F6903-2RS
20	27	28.5	0.2	4	0.8	F6704	F6704ZZ	F6704-2RS
	32	35	0.3	7	1.5	F6804	F6804ZZ	F6804-2RS
	32	35	0.3	10	2	F6804W10	F6804ZZW10	F6804-2RSW10
	37	40	0.3	9	2	F6904	F6904ZZ	F6904-2RS
25	32	34	0.2	4	1	F6705		F6705-2RS
	37	40	0.3	7	1.5	F6805	F6805ZZ	F6805-2RS
	42	45	0.3	9	2	F6905	F6905ZZ	F6905-2RS
30	37	39	0.2	4	1	F6706		F6706-2RS
	42	45	0.3	7	1.5	F6806	F6806ZZ	F6806-2RS
	47	50	0.3	9	2	F6906	F6906ZZ	F6906-2RS
35	47	50	0.3	7	1.5	F6807	F6807ZZ	F6807-2RS
	55	58	0.6	10	2.5	F6907	F6907ZZ	F6907-2RS

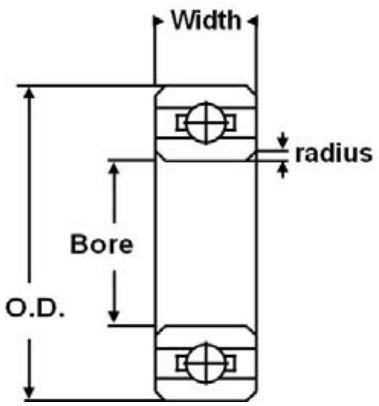
Flanged Thin-section Bearings

Metric series for shaft sizes from 10mm to 50mm
Chrome steel or stainless steel

Bore	O.D.	Flange O.D.	r.min	Width	Flange Width	Open	Shielded	Sealed
						SMB Ref.	SMB Ref.	SMB Ref.
40	52	55	0.3	7	1.5	F6808	F6808ZZ	F6808-2RS
	62	65	0.6	12	2.5	F6908	F6908ZZ	F6908-2RS
45	58	61	0.3	7	1.5	F6809	F6809ZZ	F6809-2RS
	68	71	0.6	12	2.5	F6909	F6909ZZ	F6909-2RS
50	65	68	0.3	7	1.5	F6810	F6810ZZ	F6810-2RS
	72	75	0.6	12	2.5	F6910	F6910ZZ	F6910-2RS

Popular Metric Bearings

Metric series to fit shaft sizes from 10mm up to 45mm
Chrome steel (see also Larger Stainless Steel types)



Available in SAE52100 chrome steel (for stainless steel types see separate page) these can withstand heavy radial loads and moderate thrust loads in both directions.

Bore	O.D.	r.min.	Width	Open SMB Ref	Shielded SMB Ref	Sealed SMB Ref	Max Load (kgf) Dyn	Max Load (kgf) Stat	RPM (x1000)
Dimensions in mm. *Max loads: actual loads should be well below figures shown for acceptable bearing life (see Technical)* *Max RPM: will be reduced for certain lubricants, closures, loads etc (see Technical)*									
10	26	0.3	8	6000	6000ZZ	6000-2RS	460	210	33
	30	0.6	9	6200	6200ZZ	6200-2RS	525	260	27
	35	0.6	11	6300	6300ZZ	6300-2RS	810	380	24
12	28	0.3	8	6001	6001ZZ	6001-2RS	525	260	30
	32	0.6	10	6201	6201ZZ	6201-2RS	685	330	25
	37	1	12	6301	6301ZZ	6301-2RS	980	460	22
12.7	32	0.6	10	6201-1/2	6201ZZ-1/2	6201-2RS-1/2	685	330	25
	35	0.6	11	6202-1/2	6202ZZ-1/2	6202-2RS-1/2	775	405	22
	40	0.6	12	6203-1/2	6203ZZ-1/2	6203-2RS-1/2	960	520	20
13	32	0.6	10	6201-13	6201ZZ-13	6201-2RS-13	685	330	25
15	32	0.3	9	6002	6002ZZ	6002-2RS	560	300	25
	35	0.6	11	6202	6202ZZ	6202-2RS	775	405	22
	42	1	13	6302	6302ZZ	6302-2RS	1160	590	18
15.875	35	0.6	11	6202-5/8	6202ZZ-5/8	6202-2RS-5/8	775	405	22
	40	0.6	12	6203-5/8	6203ZZ-5/8	6203-2RS-5/8	960	520	20

Popular Metric Bearings

Metric series to fit shaft sizes from 10mm up to 45mm
Chrome steel (see also Larger Stainless Steel types)

Bore	O.D.	r.min.	Width	Open SMB Ref	Shielded SMB Ref	Sealed SMB Ref	Max Load (kgf) Dyn	Max Load (kgf) Stat	RPM (x1000)
16	35	0.6	11	6202-16	6202ZZ-16	6202-2RS-16	775	405	22
	40	0.6	12	6203-16	6203ZZ-16	6203-2RS-16	960	520	20
17	35	0.3	10	6003	6003ZZ	6003-2RS	605	350	23
	40	0.6	12	6203	6203ZZ	6203-2RS	960	520	20
	47	1	14	6303	6303ZZ	6303-2RS	1370	725	16
19.05	40	0.6	12	6203-3/4	6203ZZ-3/4	6203-2RS-3/4	960	520	20
	47	1	14	6204-3/4	6204ZZ-3/4	6204-2RS-3/4	1310	720	16
20	42	0.6	12	6004	6004ZZ	6004-2RS	950	550	18
	47	1	14	6204	6204ZZ	6204-2RS	1310	720	16
	52	1.5	15	6304	6304ZZ	6304-2RS	1610	860	14
22.225	47	1	14	6204-7/8	6204ZZ-7/8	6204-2RS-7/8	1310	720	16
25	47	0.6	12	6005	6005ZZ	6005-2RS	1020	630	16
	52	1	15	6205	6205ZZ	6205-2RS	1425	855	14
	62	2	17	6305	6305ZZ	6305-2RS	2100	1230	12
25.4	52	1	15	6205-1	6205ZZ-1	6205-2RS-1	1425	855	14
30	55	1	13	6006	6006ZZ	6006-2RS	1335	890	13
	62	1	16	6206	6206ZZ	6206-2RS	1960	1290	11
	72	1.1	19	6306	6306ZZ	6306-2RS	2710	1560	10

Popular Metric Bearings

Metric series to fit shaft sizes from 10mm up to 45mm
Chrome steel (see also Larger Stainless Steel types)

Bore	O.D.	r.min.	Width	Open SMB Ref	Shielded SMB Ref	Sealed SMB Ref	Max Load (kgf) Dyn	Max Load (kgf) Stat	RPM (x1000)
35	62	1	14	6007	6007ZZ	6007-2RS	1625	1050	10
	72	1.1	17	6207	6207ZZ	6207-2RS	2600	1570	9
40	68	1	15	6008	6008ZZ	6008-2RS	1710	1190	10
	80	1.1	18	6208	6208ZZ	6208-2RS	2970	1830	9
45	75	1	16	6009	6009ZZ	6009-2RS	1810	1230	9

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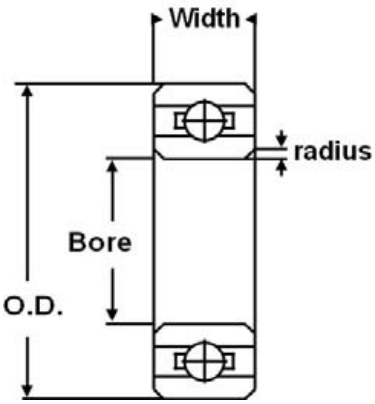
Stainless Steel Bearings

Large metric series for shaft sizes from 10mm to 45mm
Stainless steel



Stainless steel bearings listed here are made from either 440C grade or KS440 (ACD34/X65Cr13) corrosion resistant steel and can withstand heavy radial loads and moderate thrust loads in both directions. PLEASE NOTE: most miniature and thin-section bearings are also available in stainless steel.

Bore	O.D.	r.min.	Width	Open	Shielded	Sealed	Max Load (kgf)		RPM (x1000)
				SMB Ref	SMB Ref	SMB Ref	Dyn	Stat	
Dimensions in mm. ***Max loads: actual loads should be well below figures shown for acceptable bearing life.*** ***Max RPM: will be reduced for certain lubricants, closures, loads etc (see Technical)***									
10	26	0.3	8	S6000	S6000ZZ	S6000-2RS	370	160	33
	30	0.6	9	S6200	S6200ZZ	S6200-2RS	420	195	27
	35	0.6	11	S6300	S6300ZZ	S6300-2RS	650	285	24
12	28	0.3	8	S6001	S6001ZZ	S6001-2RS	420	195	30
	32	0.6	10	S6201	S6201ZZ	S6201-2RS	550	250	25
	37	1	12	S6301	S6301ZZ	S6301-2RS	790	345	22
15	32	0.3	9	S6002	S6002ZZ	S6002-2RS	450	230	25
	35	0.6	11	S6202	S6202ZZ	S6202-2RS	620	305	22
	42	1	13	S6302	S6302ZZ	S6302-2RS	930	445	18
17	35	0.3	10	S6003	S6003ZZ	S6003-2RS	485	265	23
	40	0.6	12	S6203	S6203ZZ	S6203-2RS	770	390	20
	47	1	14	S6303	S6303ZZ	S6303-2RS	1100	545	16

Stainless Steel Bearings

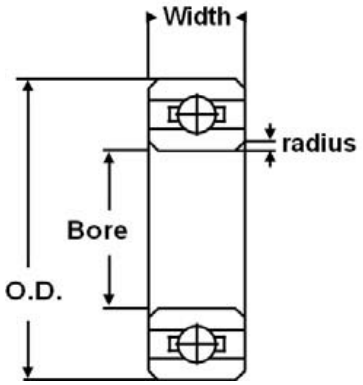
Large metric series for shaft sizes from 10mm to 45mm
Stainless steel

Bore	O.D.	r.min.	Width	Open	Shielded	Sealed	Max Load (kgf)		RPM (x1000)
				SMB Ref	SMB Ref	SMB Ref	Dyn	Stat	
20	42	0.6	12	S6004	S6004ZZ	S6004-2RS	765	415	18
	47	1	14	S6204	S6204ZZ	S6204-2RS	1050	545	16
	52	1.5	15	S6304	S6304ZZ	S6304-2RS	1290	645	14
25	47	0.6	12	S6005	S6005ZZ	S6005-2RS	820	475	16
	52	1	15	S6205	S6205ZZ	S6205-2RS	1140	640	14
	62	2	17	S6305	S6305ZZ	S6305-2RS	1680	925	12
30	55	1	13	S6006	S6006ZZ	S6006-2RS	1070	670	13
	62	1	16	S6206	S6206ZZ	S6206-2RS	1570	920	11
	72	1.1	19	S6306	S6306ZZ	S6306-2RS	2170	1170	10
35	62	1	14	S6007	S6007ZZ	S6007-2RS	1302	790	10
	72	1.1	17	S6207	S6207ZZ	S6207-2RS	2090	1180	9
40	68	1	15	S6008	S6008ZZ	S6008-2RS	1370	890	10
	80	1.1	18	S6208	S6208ZZ	S6208-2RS	2380	1370	9
45	75	1	16	S6009	S6009ZZ	S6009-2RS	1455	924	9

Electric Motor (EMQ) Bearings

Metric series to fit shaft sizes from 3mm up to 40mm

Chrome Steel



These are available in **EMQ** or **EMQ2** (very low noise) in various radial play groups but the most commonly stocked are **CN** (standard) or **C3** (loose). These bearings can withstand heavy radial loads and moderate thrust loads in both directions.

Bore	O.D.	r.min.	Width	Shielded SMB Ref	Sealed SMB Ref	Max Load (kgf) Dyn	Max Load (kgf) Stat	RPM (x1000)
Dimensions in mm. *Max loads: actual loads should be well below figures shown for acceptable bearing life (see Technical)* *Max RPM: will be reduced for certain lubricants, closures, loads etc (see Technical)*								
3	10	0.15	4	623ZZ EMQ/EMQ2	623-2RS EMQ/EMQ2	62	20	60
4	13	0.2	5	624ZZ EMQ/EMQ2	624-2RS EMQ/EMQ2	130	50	50
5	16	0.3	5	625ZZ EMQ/EMQ2	625-2RS EMQ/EMQ2	175	68	43
6	19	0.3	6	626ZZ EMQ/EMQ2	626-2RS EMQ/EMQ2	225	88	40
7	19	0.3	6	607ZZ EMQ/EMQ2	607-2RS EMQ/EMQ2	225	88	41
	22	0.3	7	627ZZ EMQ/EMQ2	627-2RS EMQ/EMQ2	330	135	35
8	22	0.3	7	608ZZ EMQ/EMQ2	608-2RS EMQ/EMQ2	330	135	39
9	24	0.3	7	609ZZ EMQ/EMQ2	609-2RS EMQ/EMQ2	335	140	36
	26	0.3	8	629ZZ EMQ/EMQ2	629-2RS EMQ/EMQ2	460	200	33
10	26	0.3	8	6000ZZ EMQ/EMQ2	6000-2RS EMQ/EMQ2	460	210	33
	30	0.6	9	6200ZZ EMQ/EMQ2	6200-2RS EMQ/EMQ2	525	260	27
	35	0.6	11	6300ZZ EMQ/EMQ2	6300-2RS EMQ/EMQ2	810	380	24

Electric Motor (EMQ) Bearings

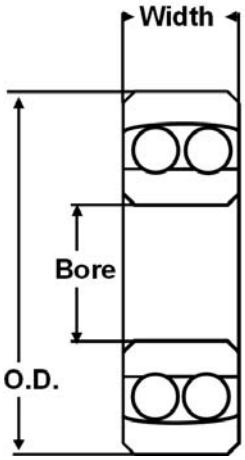
Metric series for shaft sizes from 3mm to 40mm

Chrome steel

Bore	O.D.	r.min.	Width	Shielded SMB Ref	Sealed SMB Ref	Max Load (kgf) Dyn	Max Load (kgf) Stat	RPM (x1000)
12	28	0.3	8	6001ZZ EMQ/EMQ2	6001-2RS EMQ/EMQ2	525	260	30
	32	0.6	10	6201ZZ EMQ/EMQ2	6201-2RS EMQ/EMQ2	685	330	25
	37	1	12	6301ZZ EMQ/EMQ2	6301-2RS EMQ/EMQ2	980	460	22
15	32	0.3	9	6002ZZ EMQ/EMQ2	6002-2RS EMQ/EMQ2	560	300	25
	35	0.6	11	6202ZZ EMQ/EMQ2	6202-2RS EMQ/EMQ2	775	405	22
	42	1	13	6302ZZ EMQ/EMQ2	6302-2RS EMQ/EMQ2	1160	590	18
17	35	0.3	10	6003ZZ EMQ/EMQ2	6003-2RS EMQ/EMQ2	605	350	23
	40	0.6	12	6203ZZ EMQ/EMQ2	6203-2RS EMQ/EMQ2	960	520	20
	47	1	14	6303ZZ EMQ/EMQ2	6303-2RS EMQ/EMQ2	1370	725	16
20	42	0.6	12	6004ZZ EMQ/EMQ2	6004-2RS EMQ/EMQ2	950	550	18
	47	1	14	6204ZZ EMQ/EMQ2	6204-2RS EMQ/EMQ2	1310	720	16
	52	1.5	15	6304ZZ EMQ/EMQ2	6304-2RS EMQ/EMQ2	1610	860	14
25	47	0.6	12	6005ZZ EMQ/EMQ2	6005-2RS EMQ/EMQ2	1020	630	16
	52	1	15	6205ZZ EMQ/EMQ2	6205-2RS EMQ/EMQ2	1425	855	14
	62	2	17	6305ZZ EMQ/EMQ2	6305-2RS EMQ/EMQ2	2100	1230	12
30	55	1	13	6006ZZ EMQ/EMQ2	6006-2RS EMQ/EMQ2	1335	890	13
	62	1	16	6206ZZ EMQ/EMQ2	6206-2RS EMQ/EMQ2	1960	1290	11
	72	1.1	19	6306ZZ EMQ/EMQ2	6306-2RS EMQ/EMQ2	2710	1560	10
35	62	1	14	6007ZZ EMQ/EMQ2	6007-2RS EMQ/EMQ2	1625	1050	10
	72	1.1	17	6207ZZ EMQ/EMQ2	6207-2RS EMQ/EMQ2	2600	1570	9
40	68	1	15	6008ZZ EMQ/EMQ2	6008-2RS EMQ/EMQ2	1710	1190	10
	80	1.1	18	6208ZZ EMQ/EMQ2	6208-2RS EMQ/EMQ2	2970	1830	9

Miniature Self-aligning Bearings

Metric series to fit shaft sizes from 5mm to 9mm
Chrome steel

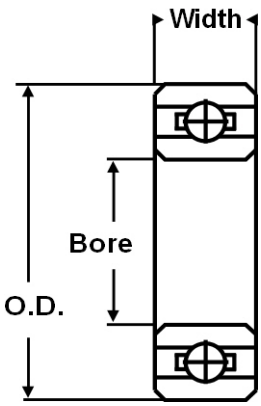


Miniature self-aligning bearings are only available open (without closures). Available in SAE52100 chrome steel, bearings are double row and designed to withstand small misalignment between shaft and housing due to incorrect mounting or shaft deflection.

Bore	O.D.	Width	SMB Ref	Max Load (kgf)		RPM (x1000)
				Dyn	Stat	
Dimensions in mm. Max loads should be well below figures shown for acceptable bearing life. Max RPM will be reduced for certain lubricants, closures, loads etc (see Technical)						
5	19	6	135	220	44	32
6	19	6	126	220	44	32
7	19	6	127	255	56	29
8	22	7	108	255	56	29
9	26	8	129	380	86	27

Plastic Bearings

Metric and inch series to fit shaft sizes from 6mm up to 25mm
Acetal resin with stainless steel or glass balls



These are manufactured with acetal resin rings & balls and 316 grade stainless (316 suffix) or glass balls (GL suffix). Plastic bearings are only suitable for low loads and low speeds and should not be used in temperatures greater than 90C. These may also be supplied to order with rubber seals. Normal inner and outer ring tolerances on these bearings are +/- 0.05mm.

Bore	O.D.	Width	SMB Ref	Max Load (kgf)		RPM (x1000)
				Dyn	Stat	
Dimensions in mm.						
6	19	6	AC626-316/GL	7	3	2.6
7	19	6	AC607-316/GL	7	3	2.6
8	22	7	AC608-316/GL	8	4	2.4
9.525	22.225	5.558	ACR6-316/GL	8	4	2.4
10	26	8	AC6000-316/GL	12	6	2
	30	9	AC6200-316/GL	14	7	1.9
	35	11	AC6300-316/GL	16	8	1.6
12	28	8	AC6001-316/GL	14	7	1.8
	32	10	AC6201-316/GL	16	8	1.7
	37	12	AC6301-316/GL	18	9	1.5

Plastic Bearings

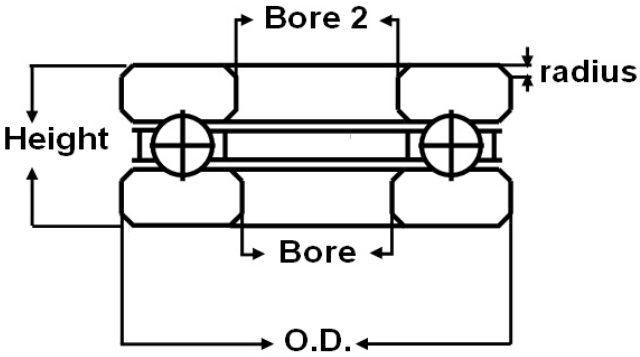
Metric and inch series to fit shaft sizes from 6mm up to 25mm
Acetal resin with stainless steel or glass balls

Bore	O.D.	Width	SMB Ref	Max Load (kgf)		RPM (x1000)
				Dyn	Stat	
15	32	9	AC6002-316/GL	16	8	1.6
	35	11	AC6202-316/GL	20	10	1.5
	42	13	AC6302-316/GL	26	13	1.4
17	35	10	AC6003-316/GL	18	9	1.5
	40	12	AC6203-316/GL	24	12	1.4
	47	14	AC6303-316/GL	34	17	1.3
20	42	12	AC6004-316/GL	24	12	1.2
	47	14	AC6204-316/GL	32	17	1.1
	52	15	AC6304-316/GL	38	22	1
25	47	12	AC6005-316/GL	38	16	1.1
	52	15	AC6205-316/GL		20	0.9

Miniature Thrust Bearings

Metric series for shaft sizes from 3mm to 10mm
Chrome steel/brass (stainless steel made to order)

Miniature thrust bearings can withstand axial or thrust loads only. There are separate types of miniature thrust bearing with either flat washers or washers incorporating a groove or raceway for heavier loads. The grooved type have one washer with a slightly larger bore for locating in the housing while the other washer has a smaller OD to locate on the shaft.



Thrust Bearings with Flat Washers

Bore	Bore2	O.D.	r.min.	Height	SMB Ref.	Max load kgf	
						Dyn	Stat
Dimensions in mm.							
2	2	6	0.10	3	F2-6	12	8
3	3	8	0.10	3.5	F3-8	17	14
4	4	9	0.15	4	F4-9	17	15
	4	10	0.15	4.5	F4-10	27	24
5	5	11	0.15	4.5	F5-11	28	28
6	6	12	0.2	4.5	F6-12	27	28
7	7	15	0.2	5	F7-15	56	55
8	8	16	0.2	5	F8-16	60	63
9	9	17	0.2	5	F9-17	44	54
10	10	18	0.2	5.5	F10-18	62	71

Miniature Thrust Bearings

Metric series for shaft sizes from 3mm to 10mm
Chrome steel/brass (stainless steel made to order)

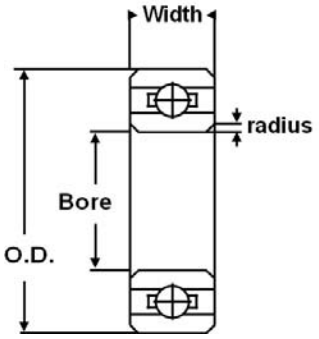
Thrust bearings with Grooved Washers

Bore	Bore2	O.D.	r.min.	Height	SMB Ref.	Max load kgf		RPM x1000
						Dyn	Stat	
Dimensions in mm.								
3	3.2	8	0.15	3.5	F3-8G	99	59	28
4	4.2	9	0.15	4	F4-9G	94	64	25
	4.2	10	0.15	4	F4-10G	92	66	24
5	5.2	10	0.2	4	F5-10G	108	92	23
	5.2	12	0.2	4	F5-12G	105	94	22
6	6.2	12	0.2	4.5	F6-12G	181	158	20
	6.2	13	0.2	5	F6-13G	190	165	19
	6.2	14	0.2	5	F6-14G	215	170	18
7	7.2	13	0.2	4.5	F7-13G	176	164	20
	7.2	17	0.3	6	F7-17G	308	267	15
8	8.2	16	0.3	5	F8-16G	391	339	17
	8.2	19	0.3	7	F8-19G	393	347	13
9	9.2	20	0.3	7	F9-20G	385	357	13
10	10.2	18	0.3	5.5	F10-18G	247	272	15

Miniature Bearings/Small Bearings

Inch series for shaft sizes from 0.04" to 1.00"

Chrome steel and stainless steel



This series can be supplied in SAE52100 chrome steel and 440 grade stainless steel and can withstand heavy radial loads and moderate thrust loads in both directions.

Bore	O.D.	r.min. (mm)	Open Bearing		Shielded Bearing		Sealed Bearing		Max Load kgf		RPM (x1000)
			Width	SMB Ref.	Width	SMB Ref.	Width	SMB Ref.	Dyn	Stat	
Dimensions in inches except radius. *Max loads: actual loads should be well below figures shown for acceptable bearing life (see Technical)* *Max RPM: will be reduced for certain lubricants, closures, loads etc (see Technical)*											
0.04	0.125	0.1	0.0469	R09					10	3	130
0.0469	0.1562	0.1	0.0625	R0	0.0937	R0ZZ			11	4	110
0.055	0.1875	0.1	0.0781	R1	0.1094	R1ZZ			22	8	95
0.0781	0.25	0.1	0.0937	R1-4	0.1406	R1-4ZZ			27	9	80
0.0937	0.1875	0.1	0.0625	R133	0.0937	R133ZZ			17	6	92
	0.25	0.1			0.0937	R143ZZW09			14	4	92
	0.3125	0.15	0.1094	R1-5	0.1406	R1-5ZZ			53	17	66
0.125	0.25	0.1			0.0937	R144ZZW09			27	9	75
	0.25	0.1	0.0937	R144	0.1094	R144ZZ			27	9	75
	0.3125	0.1			0.1094	R2-5ZZW10			53	17	67
	0.3125	0.1	0.1094	R2-5	0.1406	R2-5ZZ	0.1406	R2-5-2RS	53	17	67
	0.375	0.15			0.1094	R2-6ZZW10			60	21	74
	0.375	0.15	0.1094	R2-6	0.1406	R2-6ZZ	0.1406	R2-6-2RS	60	21	63
	0.375	0.3	0.1562	R2	0.1562	R2ZZ	0.1562	R2-2RS	60	21	63
	0.41	0.15	0.937	R174	0.1094	R174ZW10			60	21	63
	0.5	0.15	0.1094	R184	0.1094	R184ZZ			27	9	68
	0.5	0.3	0.1719	R2A	0.1719	R2AZZ	0.1719	R2A-2RS	60	21	63

Miniature Bearings/Small Bearings

Inch series for shaft sizes from 0.04" to 1.00"

Chrome steel and stainless steel

Bore	O.D.	r.min. (mm)	Open Bearing		Shielded Bearing		Sealed Bearing		Max Load kgf		RPM (x1000)
			Width	SMB Ref.	Width	SMB Ref.	Width	SMB Ref.	Dyn	Stat	
0.1562	0.3125	0.1	0.1094	R155	0.125	R155ZZ			35	13	62
0.1875	0.3125	0.1	0.1094	R156	0.125	R156ZZ	0.125	R156-2RS	35	13	62
	0.375	0.1	0.125	R166	0.125	R166ZZ	0.125	R166-2RS	68	27	59
	0.5	0.15	0.1094	R3W10	0.1094	R3ZW10			68	27	59
	0.5	0.15			0.125	R3ZZW12			68	27	59
	0.5	0.3			0.1562	R3ZZW15	0.1562	R3-2RSW15	125	49	50
	0.5	0.3	0.1562	R3	0.196	R3ZZ	0.196	R3-2RS	125	49	50
	0.625	0.3	0.196	R3A	0.196	R3AZZ	0.196	R3A-2RS	142	59	46
	0.6875	0.3	0.25	1601	0.25	1601ZZ			130	59	42
	0.6875	0.3					0.3125	1601-2RS	130	59	42
0.25	0.375	0.1	0.125	R168	0.125	R168ZZ	0.125	R168-2RS	36	17	57
	0.5	0.15			0.125	R188ZW12			106	43	51
	0.5	0.15	0.125	R188	0.1875	R188ZZ	0.1875	R188-2RS	106	43	51
	0.625	0.3	0.196	R4	0.196	R4ZZ	0.196	R4-2RS	142	59	44
	0.6875	0.3	0.25	1602	0.25	1602ZZ			130	59	42
	0.6875	0.3					0.3125	1602-2RS	130	59	42
	0.75	0.4	0.2188	R4A	0.2812	R4AZZ	0.2812	R4A-2RS	227	86	41
0.3125	0.5	0.15	0.1562	R1810	0.1562	R1810ZZ			53	26	48
	0.625	0.15	0.1562	R1810A	0.1562	R1810AZZ			53	26	48
	0.875	0.3	0.3438	1603	0.3438	1603ZZ			227	102	39
	0.9062	0.3					0.3125	1603-2RS	227	102	39
	1.125	0.3	0.375	1605	0.375	1605ZZ	0.375	1605-2RS	227	102	39

Miniature Bearings/Small Bearings

Inch series for shaft sizes from 0.04" to 1.00"

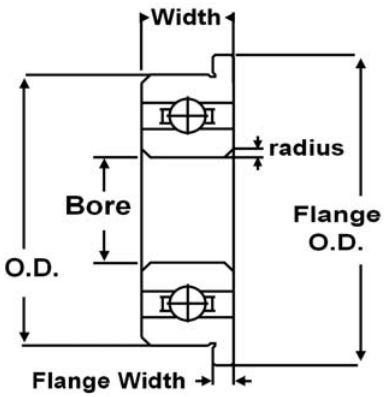
Chrome steel and stainless steel

Bore	O.D.	r.min. (mm)	Open Bearing		Shielded Bearing		Sealed Bearing		Max Load kgf		RPM (x1000)
			Width	SMB Ref.	Width	SMB Ref.	Width	SMB Ref.	Dyn	Stat	
0.375	0.625	0.25	0.1562	R1038	0.1562	R1038ZZ			85	42	33
	0.75	0.25	0.196	R1238	0.196	R1238ZZ			175	86	42
	0.875	0.4	0.2188	R6	0.2812	R6ZZ	0.2812	R6-2RS	328	141	37
	0.875	0.4					0.3438	1604-2RS	227	102	36
	0.9062	0.4	0.3125	1606	0.3125	1606ZZ	0.3125	1606-2RS	227	102	36
	1.125	0.6	0.375	1614	0.375	1614ZZ	0.375	1614-2RS	205	102	27
0.4375	0.9062	0.6	0.3125	1607	0.3125	1607ZZ	0.3125	1607-2RS	205	102	34
0.5	0.75	0.25	0.1562	R1212	0.1562	R1212ZZ			91	52	27
	0.75	0.25			0.196	R1212ZZW19			91	52	27
	0.875	0.25	0.196	R1412	0.196	R1412ZZ			192	101	39
	0.875	0.25	0.2188	R6-1/2	0.2812	R6ZZ-1/2	0.2812	R6-2RS1/2	192	101	39
	1.125	0.4	0.25	R8	0.3125	R8ZZ	0.3125	R8-2RS	511	237	28
	1.125	0.6	0.375	1616	0.375	1616ZZ	0.375	1616-2RS	205	102	30
	1.375	0.6	0.4375	1621	0.4375	1621ZZ	0.4375	1621-2RS	270	158	23
0.5625	1.375	0.6	0.4375	1622	0.4375	1622ZZ	0.4375	1622-2RS	270	158	23
0.625	0.875	0.25	0.1562	R1458	0.1562	R1458ZZ			92	59	24
	1.375	0.8	0.2812	R10	0.3438	R10ZZ	0.3438	R10-2RS	590	312	24
	1.375	0.8	0.4375	1623	0.4375	1623ZZ	0.4375	1623-2RS	270	158	23
	1.625	0.8	0.5	1628	0.5	1628ZZ	0.5	1628-2RS	330	202	20
0.75	1.0	0.25	0.1562	R1634	0.1562	R1634ZZ			98	63	20
	1.625	0.8	0.3125	R12	0.4375	R12ZZ	0.4375	R12-2RS	785	442	20
0.875	1.875	0.8	0.375	R14	0.50	R14ZZ	0.50	R14-2RS	1080	576	18
1.0	2.0	0.8	0.375	R16	0.50	R16ZZ	0.50	R16-2RS	1150	700	16

Flanged Miniature Bearings

Inch series for shaft sizes from 0.04" to 0.625"

Chrome steel and stainless steel



This series can be supplied in SAE52100 chrome steel and AISI440C or KS440 (ACD34/X65Cr13) stainless steel and can withstand heavy radial loads and moderate thrust loads in both directions. Flanged miniature bearings have an outer ring flange to facilitate location in a housing.

Bore	O.D.	Flange O.D.	r.min. mm	Open Bearing			Shielded Bearing			Sealed Bearing		
				Width	Flange Width	SMB Ref	Width	Flange Width	SMB Ref.	Width	Flange Width	SMB Ref.
Dimensions in inches except radius. Load and speed ratings are the same as for Inch Miniature Bearings												
** denotes sizes available with extended inner ring.*												
0.04	0.125	0.171	0.1	0.0469	0.013	FR09						
0.0469	0.1562	0.203	0.1	0.0625	0.013	FR0 *	0.0937	0.031	FR0ZZ *			
0.055	0.1875	0.234	0.1	0.0781	0.023	FR1 *	0.1094	0.031	FR1ZZ *			
0.0781	0.25	0.296	0.1	0.0937	0.023	FR1-4 *	0.1406	0.031	FR1-4ZZ *			
0.0937	0.1875	0.234	0.1	0.0625	0.018	FR133 *	0.0937	0.031	FR133ZZ *			
	0.3125	0.359	0.15	0.1094	0.023	FR1-5 *	0.1406	0.031	FR1-5ZZ *			
0.125	0.25	0.256	0.1	0.0937	0.023	FR144 *	0.1094	0.031	FR144ZZ *			
	0.3125	0.359	0.1	0.1094	0.023	FR2-5 *	0.1406	0.031	FR2-5ZZ *	0.1406	0.031	FR2-5-TTS
	0.375	0.422	0.15	0.1094	0.023	FR2-6 *	0.1406	0.031	FR2-6ZZ *	0.1406	0.031	FR2-6-TTS
	0.375	0.44	0.3	0.1562	0.03	FR2 *	0.1562	0.03	FR2ZZ *	0.1562	0.03	FR2-2RS
0.1562	0.3125	0.359	0.1	0.1094	0.023	FR155 *	0.125	0.036	FR155ZZ *			
0.1875	0.3125	0.359	0.1	0.1094	0.023	FR156 *	0.125	0.036	FR156ZZ *	0.125	0.036	FR156-TTS
	0.375	0.422	0.1	0.125	0.023	FR166 *	0.125	0.031	FR166ZZ *	0.125	0.031	FR166-TTS
	0.5	0.565	0.3	0.1562	0.042	FR3 *	0.196	0.042	FR3ZZ *	0.196	0.042	FR3-2RS
	0.5	0.565	0.3	0.196	0.042	FR3W19						

Flanged Miniature Bearings

Inch series for shaft sizes from 0.04" to 0.625"

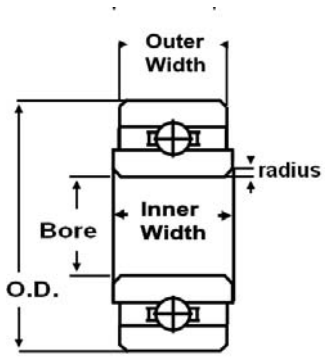
Chrome steel and stainless steel

Bore	O.D.	Flange O.D.	r.min.	Open Bearing			Shielded Bearing			Sealed Bearing		
				Width	Flange Width	SMB Ref	Width	Flange Width	SMB Ref.	Width	Flange Width	SMB Ref.
0.25	0.375	0.422	0.1	0.125	0.023	FR168 *	0.125	0.035	FR168ZZ *	0.125		
	0.5	0.547	0.15	0.125	0.023	FR188 *	0.1875	0.045	FR188ZZ *	0.1875	0.045	FR188-TTS
	0.625	0.69	0.3	0.196	0.042	FR4 *	0.196	0.042	FR4ZZ *	0.196	0.042	FR4-2RS
0.3125	0.5	0.547	0.15	0.1562	0.031	FR1810 *	0.1562	0.031	FR1810ZZ *			
0.375	0.875	0.969	0.4	0.2188	0.062	FR6	0.2812	0.062	FR6ZZ	0.2812	0.062	FR6-2RS
0.5	1.125	1.2252	0.4	0.25	0.062	FR8	0.3125	0.062	FR8ZZ	0.3125	0.062	FR8-2RS
0.625	1.375	1.50	0.8	0.2812	0.0687	FR10	0.3438	0.0687	FR10ZZ	0.3438	0.0687	FR8-2RS

Extended Inner Ring Bearings

Inch series for shaft sizes from 0,0469" to 0.3125"

Chrome steel and stainless steel



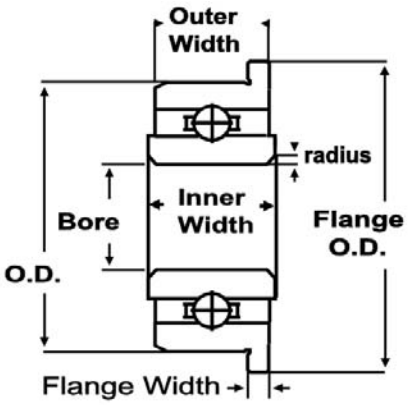
This series have an inner ring that is wider than the outer ring by 0.0312" (0.0156" on each side). Usually supplied in KS440 (ACD34/X65Cr13) stainless steel, these can withstand heavy radial loads and moderate thrust loads in both directions.

Bore	O.D.	r.min. (mm)	Open Bearing			Shielded Bearing			Sealed Bearing		
			Outer Width	Inner Width	SMB Ref.	Outer Width	Inner Width	SMB Ref.	Outer Width	Inner Width	SMB Ref.
Dimensions in inches except radius. Load and speed ratings are the same as for Inch Miniature Bearings											
0.0469	0.1562	0.1	0.0625	0.0937	RW0	0.0937	0.125	RW0ZZ			
0.055	0.1875	0.1	0.0781	0.1094	RW1	0.1094	0.1406	RW1ZZ			
0.0781	0.25	0.1	0.0937	0.125	RW1-4	0.1406	0.1719	RW1-4ZZ			
0.0937	0.1875	0.1	0.0625	0.0937	RW133	0.0937	0.125	RW133ZZ			
	0.3125	0.15	0.1094	0.1406	RW1-5	0.1406	0.1719	RW1-5ZZ			
0.125	0.25	0.1	0.0937	0.125	RW144	0.1094	0.1406	RW144ZZ			
	0.3125	0.1	0.1094	0.1406	RW2-5	0.1406	0.1719	RW2-5ZZ			
	0.375	0.15	0.1094	0.1406	RW2-6	0.1406	0.1719	RW2-6ZZ			
	0.375	0.3	0.1562	0.1875	RW2 *	0.1562	0.1875	RW2ZZ	0.1562	0.1875	RW2-2RS
0.1562	0.3125	0.1	0.1094	0.1406	RW155	0.125	0.1562	RW155ZZ			
0.1875	0.3125	0.1	0.1094	0.1406	RW156	0.125	0.1562	RW156ZZ			
	0.375	0.1	0.125	0.1562	RW166	0.125	0.1562	RW166ZZ			
	0.5	0.3	0.1562	0.1875	RW3	0.196	0.2273	RW3ZZ	0.196	0.2273	RW3-2RS
0.25	0.375	0.1	0.125	0.1562	RW168	0.125	0.1562	RW168ZZ			
	0.5	0.15	0.125	0.1562	RW188	0.1875	0.2188	RW188ZZ			
	0.625	0.3	0.196	0.2273	RW4	0.196	0.2273	RW4ZZ	0.196	0.2273	RW4-2RS
0.3125	0.5	0.15	0.1562	0.1875	RW1810	0.1562	0.1875	RW1810ZZ			

Flanged Extended Inner Ring Bearings

Inch series for shaft sizes from 0.0469" to 0.3125"

Chrome steel and stainless steel



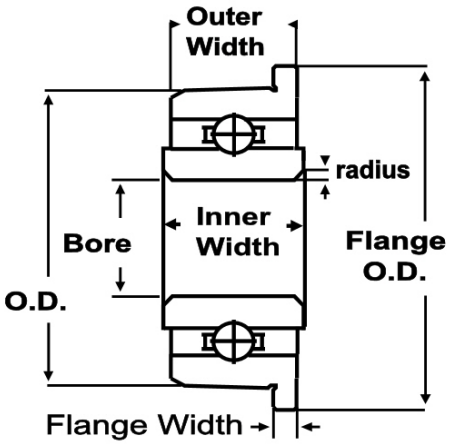
This series have an inner ring that is wider than the outer ring by 0.0312" (0.0156" on each side) and a flange on the outer ring for locating the bearing in a housing. Usually supplied in KS440 (ACD34/X65Cr13) stainless steel, these can withstand heavy radial loads and moderate thrust loads in both directions.

Bore	O.D.	Flange O.D.	r.min.	Open Bearing				Shielded Bearing			
				Outer Width	Inner Width	Flange Width	SMB Ref	Outer Width	Inner Width	Flange Width	SMB Ref.
*Dimensions in inches except radius. Load and speed ratings are the same as for Inch Miniature Bearings Sizes marked * are also available with rubber seals.*											
0.0469	0.1562	0.203	0.1	0.0625	0.0937	0.013	FRW0	0.0937	0.125	0.031	FRW0ZZ
0.055	0.1875	0.234	0.1	0.0781	0.1094	0.023	FRW1	0.1094	0.1406	0.031	FRW1ZZ
0.0781	0.25	0.296	0.1	0.0937	0.125	0.023	FRW1-4	0.1406	0.1719	0.031	FRW1-4ZZ
0.0937	0.1875	0.234	0.1	0.0625	0.0937	0.018	FRW133	0.0937	0.125	0.031	FRW133ZZ
	0.3125	0.359	0.15	0.1094	0.1406	0.023	FRW1-5	0.1406	0.1719	0.031	FRW1-5ZZ
0.125	0.25	0.256	0.1	0.0937	0.125	0.023	FRW144	0.1094	0.1406	0.031	FRW144ZZ
	0.3125	0.359	0.1	0.1094	0.1406	0.023	FRW2-5	0.1406	0.1719	0.031	FRW2-5ZZ
	0.375	0.422	0.15	0.1094	0.1406	0.023	FRW2-6	0.1406	0.1719	0.031	FRW2-6ZZ
	0.375	0.44	0.3	0.1562	0.1875	0.03	FRW2	0.1562	0.1875	0.03	FRW2ZZ *
0.1562	0.3125	0.359	0.1	0.1094	0.1406	0.023	FRW155	0.125	0.1562	0.036	FRW155ZZ
0.1875	0.3125	0.359	0.1	0.1094	0.1406	0.023	FRW156	0.125	0.1562	0.036	FRW156ZZ
	0.375	0.422	0.1	0.125	0.1562	0.023	FRW166	0.125	0.1562	0.031	FRW166ZZ
	0.5	0.565	0.3	0.1562	0.1875	0.042	FRW3	0.196	0.2273	0.042	FRW3ZZ *
0.25	0.375	0.422	0.1	0.125	0.1562	0.023	FRW168	0.125	0.1562	0.035	FRW168ZZ
	0.5	0.547	0.15	0.125	0.1562	0.023	FRW188	0.1875	0.2188	0.045	FRW188ZZ
	0.625	0.69	0.3	0.196	0.2273	0.042	FRW4	0.196	0.2273	0.042	FRW4ZZ *
0.3125	0.5	0.547	0.15	0.1562	0.1875	0.031	FRW1810	0.1562	0.1875	0.031	FRW1810ZZ

Taper O.D Bearings

Imperial series for shaft sizes from 0,125" to 0.3125"

Taper O.D. bearings have a flange on the outer ring, a wider inner ring and an outer ring that is slightly tapered for fitting into soft steel or sheet metal. They can withstand heavy radial loads and moderate thrust loads in both directions.



Bore	O.D.	Flange O.D.	r.min. (mm)	Outer Width	Inner Width	Flange Width	OD Taper per foot	SMB Ref.	Max Load kgf	
									Dyn.	Stat.
Dimensions in inches except radius										
0.125	0.3757	0.438	0.3	0.163	0.188	0.037	0.075	F2ZZ	30	13
0.1875	0.4375	0.5	0.3	0.163	0.188	0.042	0.075	F2V	104	59
	0.5632	0.625	0.3	0.163	0.188	0.042	0.068	F3ZZ	63	30
0.25	0.6257	0.687	0.3	0.226	0.25	0.042	0.068	F4ZZ	70	34
0.3125	0.6882	0.75	0.3	0.226	0.25	0.042	0.068	F5ZZ	168	62

Bearing Technical Information

We hope that the **bearing technical information** shown below will help you to gain a better understanding of bearings and their performance. If you require further information or an explanation of any of the sections below, please contact us.

1. Bearing Material

For chrome steel and stainless steel material composition and details on the different grades of stainless steel used in our bearings, please see our material tables

SAE52100 Chrome Steel (no prefix)

This is the standard steel for most ball bearings. It is harder than stainless steel and gives greater life ratings. It also has superior low noise qualities to standard 440 grade stainless steel. Chrome steel actually has a low chromium content and is not corrosion resistant so not suitable for corrosive environments or for dry (no lubricant) bearings as chrome bearings require a protective oil coating on the exterior surfaces which can contaminate the inside of the dry bearing. Chrome steel can tolerate continuous temperatures of up to 120C. Above this temperature, chrome steel undergoes greater dimensional change and the load capacity is reduced. It can withstand up to 150C intermittently but above this temperature, bearing life is reduced..

AISI440 and KS440/ACD34/X65Cr13 Martensitic Stainless Steel (prefix "S")

More resistant to corrosion due to the greater chromium content and the addition of nickel, 440 grade stainless steel is the most commonly used for corrosion resistant ball bearings. The chromium reacts with oxygen in the air to form a chromium oxide layer, known as the passive film, on the surface of the steel. It is hardenable and gives a good combination of strength and corrosion resistance. It is magnetic unlike some 300 grades. The load capacity of 440 grade is approximately 20 percent less than chrome steel so life ratings will be slightly reduced. This grade exhibits good corrosion resistant when exposed to fresh water and some weaker chemicals but may corrode in seawater environments or in contact with many aggressive chemicals. The corrosion resistance also depends on the surface finish. Iron particles and other impurities left on the surface during maching can lead to premature localised corrosion while surface irregularities or poorly finished surfaces also increase the likelihood of corrosion. ***KS440/ ACD34/X65Cr13*** grade stainless steel with a lower carbon content is used by EZO Japan and has greater corrosion resistance and superior low noise qualities to the standard AISI440C grade. Corrosion resistance can be increased by passivation (see section below). The 400 grade stainless steel will also ***withstand higher temperatures than chrome steel***, coping with up to 250C constant and up to 300C intermittent with reduced load capacity. Above 300C, bearing life can be considerably shortened.

A note on passivation....

Passivation is a process by which free iron particles and other impurities are removed from the surface of stainless steel by immersion in nitric or citric acid, thus regenerating the passive film. This reduces the likelihood of surface discolouration so making it a useful process in some corrosive environments. Passivation does not increase the resistance of stainless steel to pitting corrosion. This means that where a bearing has incidental contact with, say, salt spray, passivation may be beneficial but it will not offer long term protection in harsher applications.

AISI316 Austenitic Stainless Steel (prefix "S316")

Used for ***greater corrosion resistance*** or where bearings must be ***non-magnetic***, bearings made from this material are semi-precision and fine for applications such as marine pulleys but not suitable for precision instrument use. The main problem here is that 316 grade stainless steel is non hardenable, therefore as a softer steel, it will only support low loads and low speeds. The dynamic load rating of a 316 grade bearing may only be 10% of the 440 grade equivalent whereas the maximum speed may be 5% or less of the 440 stainless steel version. 316 grade

stainless steel exhibits good corrosion resistance in sea atmosphere and may perform well submerged in seawater. However, as the passive film on the surface of stainless steel relies on the presence of oxygen to regenerate itself, in a low oxygen underwater marine environment (e.g under washers or o-rings) the steel may be prone to pitting or crevice corrosion although 316 grade is still much more resistant to corrosion than 440 grade. Bearings made from 316 grade stainless steel can be used at high temperatures provided a suitable cage material is used. Due to the difficulty of using 316 grade for the cage, 304 grade stainless steel is normally used for metallic cages and nylon for non-metallic cages. Please remember that, as 316 grade bearings are far less popular, minimum quantities may apply and some smaller instrument bearings may not be available.

Plastic - acetal resin (prefix "AC")

Bearings made from acetal resin with balls made from 316 stainless steel or glass are more corrosion resistant. They will however, corrode in the prescence of certain chemicals for which made-to-order polyethylene or polypropylene bearings with glass balls may be a better choice. These are generally termed as "plastic" bearings and like 316 stainless steel bearings, are not suitable for anything other than low loads and low speeds and should not be used in temperatures of greater than 90C. These types are also low precision so not suitable for instrument use. The smaller bearings are not usually available in these synthetic materials.

Ceramics - Silicon Nitride (prefix "CB" or "CC")

Some types may be available with steel rings and ceramic balls ***(hybrid)*** or "all ceramic" bearings with ceramic rings and balls. These types may not be stock items and could be subject to minimum order quantities. There are many advantages to silicon nitride such as a ***lower friction coefficient***, much ***greater hardness and temperature resistance***. Silicon nitride has 40 percent of the density of bearing steel but is about twice as hard. The lower density means that the balls exert less force on the outer raceways reducing wear while the extra hardness means greater wear resistance. Hybrid bearings are also capable of higher speeds (usually up to 30 percent) and can also operate better with limited lubrication as the lower friction material generates less heat. However, ceramic bearings can be significantly more expensive, particularly "all ceramic" bearings partly due to the material and partly due to very low production quantities. The cost may be prohibitive for some sizes or quantities.
WARNING: Ceramics are often overrated particularly hybrid bearings.It is often thought that they will provide incredibly high speeds which is not correct unless you use special retainers or no retainer and the bearing still needs to be high quality. Customers often expect very low frictional torque with low noise and vibration levels. This may be possible but the bearing rings must have very good roundness and a high quality raceway finish while the balls must also have very good roundness and surface finish. There are many cheap hybrid bearings on the market that do a worse job than a good quality bearing with steel balls. Good hybrid bearings often prove too expensive for an application. Most sizes are made to order.

2. Retainer

Retainers keep the balls evenly spaced around the raceway preventing ball to ball contact and thus allowing higher speeds. They also help to retain grease around the balls and raceways. For greater accuracy and to prevent any additional friction, it is important that the retainer is not allowed too much radial movement. To achieve this, the retainer is guided by either the balls or one of the rings. See the sections below for information on how each cage type is guided.

Metal crown/ribbon

This standard retainer is manufactured from carbon steel for chrome bearings and AISI304 or AISI430 grade stainless steel for stainless bearings. These were often made from brass which also offered a high temperature capability but this is much less common due to higher cost of brass and advances in steel technology.

For higher temperatures, stainless steel is usually recommended. The crown cage and ribbon

cage perform the same function but the crown cage is used primarily on smaller miniature bearings and thin-section bearings where space is more limited.Steel cages are preferred for arduous operating conditions and where high levels of vibration are experienced.

• Good for low to medium speeds
• Can withstand higher temperatures according to the type of steel (see "Bearing Material" section)
• Crown type - inner ring guided
• Ribbon type - mainly ball guided

Nylon crown (TW)

This moulded synthetic retainer has better sliding characterisitics than the steel cage and produces fewer fluctuations in running torque. It can increase maximum speeds by up to 60 percent so is generally used in high speed applications and has good low noise properties. This retainer is not suitable for low temperature applications as it loses elasticity below about 35°C. In vacuum applications, it may become brittle.
• High speed and low noise
• Max temperature range approx -35 to +110°C
• Ball guided

Phenolic crown (TP)

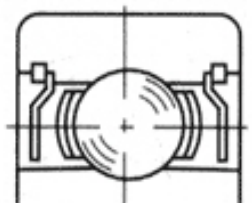
This retainer is also used for high speed applications. Generally more expensive, it does have advantages over the synthetic type such as absorbency allowing it to be vacuum impregnated with oil for long life application.
• Good oil retention.
• Can operate well with marginal lubrication
• Max temperature approx 140°C
• Inner ring guided

Full complement (F/B)

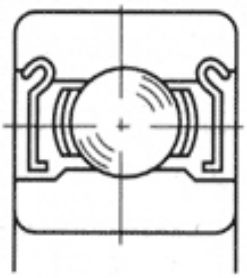
A full complement (or full ball) bearing contains extra balls and has no retainer. It is used for its greater radial load capacity although axial load capacity is very small. These bearings can only be used at low speeds due to ball to ball friction. An exception is a hybrid full complement bearing (ceramic balls) which can be used for very high speeds. Improved steel and hardening techniques have increased the load capacities of bearings with cages and the full complement bearing is much less common now.
• Higher radial load capacity
• Low speed only (except with ceramic balls)
• Low axial load

3. Closures

Shields (ZZ)



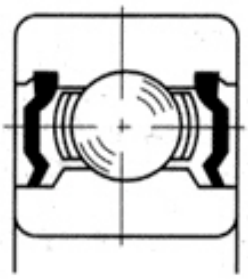
Most sizes are available with metal shields. Shields are designed to prevent larger particles from entering the bearing and also to keep grease inside the bearing. They may be pressed into the bearing’s outer ring (non-removable) or retained by a circlip (removable). As the



shields make no contact with the inner ring, they do not increase starting or running torque. Shields on stainless steel bearings are generally made from AISI 304 grade stainless steel.

- Prevent contamination by larger particles
- Reduce lubricant leakage
- No torque increase

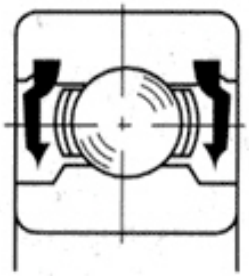
Contact seals (2RS)



The standard bearing seal consists of ***nitrile rubber*** bonded to a metal washer. High temperature ***teflon seals*** (up to 250C) or ***Viton seals*** (up to 230C) are available on some sizes. The inner lip of the seal rubs against the bearing inner ring to provide an effective seal against smaller particles such as dust and moisture while preventing lubricant leakage. Contact seals produce much higher frictional torque levels than shields and reduce the maximum speed of a bearing.

- Good protection against contamination
- Greatly reduce lubricant leakage
- Reduce maximum speed by approx. 40%
- Greatly increase bearing torque
- Temp. range –30°C/+110°C (nitrile rubber) or up to 230C (Viton) and 250C (Teflon)

Non-contact seals (2RU)



These seals are also made of ***nitrile rubber*** bonded to a metal washer but do not rub against the bearing inner ring and therefore do not have the same effect on bearing torque and maximum speed as contact seals so can be used for ***low torque***, ***high speed*** applications. They offer superior protection over metal shields but do not provide as effective a seal as the contact type.

- Good protection against contamination
- Reduced lubricant leakage
- No torque increase
- Do not affect maximum speed
- Temp. range –30°C/+110°C

4. Load Rating

Dynamic load rating

The dynamic load rating is that constant stationary radial load which 90% of a group of identical chrome steel bearings, with only the inner ring rotating, can endure for one million revolutions before the first signs of fatigue develop. ***AISI440C/KS440 stainless steel bearings will achieve approximately 80% of the figure quoted.*** These figures are used in the calculation of life ratings and bearings should not be subjected to such loads in normal application. For life ratings, please contact SMB.

Static load rating

This rating represents the purely radial load which will cause a total permanent deformation of the balls or raceway equal to one ten-thousandth of the ball diameter. This may be tolerable for certain applications but not where smoothness and accuracy are required. Static load ratings for stainless steel bearings are approximately 75% of the load ratings for chrome steel bearings.

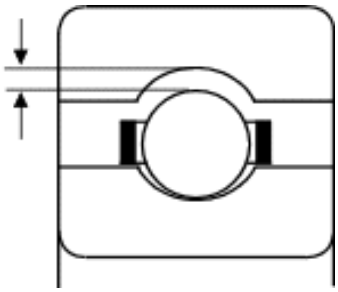
The load capacity of a bearing may be limited by the lubricant. Certain lubricants are only suitable for light loads while others are designed for high load applications. Load ratings are higher for full complement bearings (see Retainer). The axial load capacity of a radial ball bearing can be increased by specifying loose radial play.

Axial load rating

Small and thin-section deep groove ball bearings should not be subjected to axial (thrust) loads greater than 25 percent of the bearing's static load rating. For larger bearings (e.g. 6001, 6201, 6301 upwards) the figure rises to nearer 50 percent. To exceed the recommended limits will have a detrimental effect on bearing life.

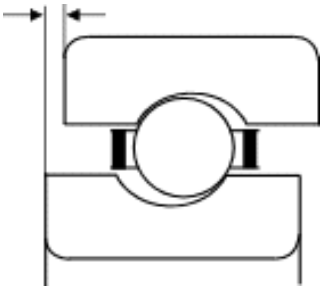
5. Internal Clearance

Radial



Also referred to as radial play, it is the amount of play or looseness between the inner and outer ring or more specifically: average outer ring raceway diameter minus average inner ring raceway diameter minus (2 x ball diameter). Radial play should not be confused with tolerance grade and is entirely separate.

Axial



Clearance measured along the bearing axis is known as axial play. Axial play is approximately 10 times the radial play value.

Internal clearance play may be greatly altered by the mounting conditions of a bearing. Interference fits on shaft or housing can reduce internal clearance by up to 80% of the interference fit. Temperature differentials between shaft and housing can increase or reduce clearance. Changes can also occur as a result of the shaft or housing materials having different expansion coefficients to the bearing steel.

For the actual clearances used in the radial play groups, please see our RADIAL PLAY TABLES.

Tight radial play	MC1/MC2, P02/ P13, C2	Consider for pure radial loads and low noise, low vibration applications. Beware of axial loads, high speed applications, heavy vibration and very low torque applications. Interference fits should not be used.
Medium radial play	MC3/MC4, P24/ P35, CN	Most commonly used and supplied as standard.
Loose radial play	MC5/MC6, P58/ P811, C3/C4	Consider for higher axial loads due to greater thrust load capacity. Greater interference fits and shaft misalignment can be tolerated. Not recommended for low noise applications unless tighter radial play not suitable.

6. Maximum Speed

A number of factors affect speed limitation such as ***temperature, load, vibration, radial play, retainer, lubricant, ball material and closures***. The speeds quoted in our catalogue pages are only approximate and valid for bearings used on a horizontal shaft with a metal cage, standard tolerance grade and radial play, medium loading, rotating inner ring and suitable lubricant (see below). Vertical shaft applications will necessitate a reduction of approximately 20 percent. Temperature excesses and heavy loadings will also require slower speeds. Bearings fitted with contact seals cannot achieve the same speeds due to increased friction between seal lip and bearing inner ring. The choice of lubricant may also have a significant effect on the speed rating. The maximum rpm at which a lubricant can effectively operate varies from type to type. The following adjustment factors are ***approximate*** and are based on bearings with a metal crown or ribbon cage. The maximum speed of a bearing can be increased by the use of a delrin or phenolic cage provided a suitable lubricant is used. The use of ceramic balls will increase bearing speed by up to 30 percent.

Speed reduction Table

	Rotating Inner ring		Rotating outer ring	
	Open/ZZ	2RS	Open/ZZ	2RS
Petroleum oil	Nil reduction	40% reduction	40% reduction	40% reduction
Synthetic oil	Nil reduction	40% reduction	40% reduction	40% reduction
Silicon oil	20% reduction	40% reduction	60% reduction	60% reduction
Standard grease	20% reduction	40% reduction	50% reduction	50% reduction
High speed grease	Nil reduction	40% reduction	40% reduction	40% reduction
Silicon grease	40% reduction	40% reduction	60% reduction	60% reduction

7. Shaft/Housing Fit

Bearing rings under a rotating load may need to be firmly located by an interference fit or other means such as a nut or adhesive. This prevents them from creeping in a circumferential direction which gives rise to increased wear. A bearing ring is subjected to a rotating load when the load is applied to all points of that ring during operation. Tighter fits may also be necessary where vibration occurs. Make sure that interference fits do not reduce the radial play of the bearing to an unacceptable level.

The standards of roundness and surface finish which apply to the bearing should also apply to shaft and housing. This is very important for electric motor and other quiet-running applications. Miniature and thin-section bearings are particularly susceptible to distortion which leads to higher noise and vibration levels. Care should be taken where shaft and housing materials have a different expansion coefficient to the bearing steel (11 x 10 -6 /°C). This may lead to an increase or reduction in radial play.

Interference fits can affect rotational accuracy by distorting bearing rings. If rotational accuracy is important, a combination of close bearing tolerances and close shaft/housing tolerances should be used to obtain the correct fit with the minimum interference. It should also be noted that an interference fit can reduce radial play by up to 80% of the interference fit. ***If further advice on shaft and housing fits is required, please contact us.***

8. Tolerance

Tolerances control the dimensional accuracy of the bearing. ***They have no effect on internal clearance*** although it is sometimes mistakenly thought that improving the tolerances will produce a bearing with less play. Assuming that the shaft and housing are manufactured to the same tolerances as the bearing, higher bearing tolerances will produce better mating between shaft/housing and bearing, lower noise and vibration due to improved roundness and lower starting and running torque (also subject to radial play and lubricant). ***For exact tolerance limits, please view our TOLERANCE TABLES***.

9. Frictional Torque

This affects the free-running of the bearing. Spin a bearing containing stiff grease with your finger and not much happens - relatively high frictional torque. Try a bearing with no lubrication and it will spin freely - low frictional torque. The effort required to rotate a bearing depends partly on the accuracy of the bearing components and raceway finish but much more so on the load and speed applied to the bearing, the lubrication and the closures. The greater the load, the greater the deformation of the bearing components leading to increased resistance. The higher the speed, the greater the lubricant drag. Instrument oils will often produce lower torque levels but the difference between these and many low torque greases is actually quite small, particularly if a low grease fill is used. A standard low torque grease such as Multemp SRL grease may give an increase of only 20 percent over a Aeroshell 12 oil. This can drop to under 5 percent for very low torque greases if a low (e.g 10 to 20 percent) fill is used. Initial torque levels for a greased bearing are briefly higher as the grease takes a short time to "run in" or be distributed inside the bearing. Contact seals will greatly increase the torque figures as will high viscosity lubricants.

Approximate figures for frictional torque for can be calculated using a simple formula. This is only valid if the bearing has low torque lubrication (and the grease fill is not high), is open, shielded or has non-contact seals and is subjected to low speed and low load. For radial ball bearings, the axial load should be less than 20 percent of the radial load while the load should be purely axial for thrust bearings. Contact us if you need more accurate figures taking into account the speed and the lubricant viscosity.

Frictional torque (measured in Nmm or Newton/millimetres)

Radial ball bearings: ***0.5*** x ***0.0015*** x ***radial load in Newtons**** x ***bearing bore (mm)***
Axial ball bearings: ***0.5*** x ***0.0013*** x ***axial load in Newtons**** x ***bearing bore (mm)***
*10 Newtons = 1 Kgf

10. Noise Rating

Bearing rings and balls are not perfectly round and the balls and raceways, even after extensive fine grinding and polishing, are not perfectly smooth. There are machining imperfections in the form of rough or uneven surfaces. For example, if a bearing inner ring is rotating and the outer ring fixed, these imperfections will cause the outer ring to move radially in relation to the inner ring. The amount and speed of this movement contributes to the amount of ***bearing vibration and noise***. Poor cage design can also increase bearing noise.

A low noise/vibration rating is achieved by paying particular attention to the surface finish of the raceways and balls, the roundness of the rings and balls and correct cage design. There are three ratings for low noise bearings: ***EMQ;, EMQ2*** and the quietest, ***EMQ3***. These ratings are independent of precision grade, for example, a P5 bearing may be offered with any of the three noise ratings. To help reduce noise levels even further, low noise greases are available and the choice is now greater due to improved lubricant manufacuring techniques. These greases are more finely filtered and contain fewer, smaller solid particles. These particles generate noise when they pass between the balls and raceway.

External factors such as surrounding vibration can affect bearing noise. Another problem, particularly with smaller and thin-section bearings, as mentioned in "Shaft/Housing Fits" (section 7) is ring distortion caused by poor poor shaft or housing roundness. Dirt or dust contamination will also increase noise and vibration levels. Poor fitting practice or incorrect handling is sometimes to blame, causing shock loads which, in turn, create scratches or dents in the raceway.

11. Lubricants

Correct lubrication is critical to bearing performance, reducing friction, dissipating heat and inhibiting corrosion on balls and raceways. The lubricant will affect maximum running speed and temperature, torque level, noise level and, ultimately, bearing life. Lubricants are available for a whole range of applications. Silicon lubricants have wide temperature ranges and change viscosity less with temperature. They also have good water-resistance but are unsuitable for high loads and speeds. Perfluorinated lubricants withstand temperatures of up to 300°C and are resistant to most chemicals. while certain mineral or synthetic based lubricants are designed for high speed use. Low viscosity oils and greases are used where low lubricant resistance is required but higher viscosity lubricants may be specified for high load applications. Although greases are usually thought to be stiffer than oils, many modern low torque greases can even produce similar torque figures to some of the instrument oils.

• **Oils** – maintain their consistency well over a wide temperature range and are easy to apply. For very low torque applications, a light instrument oil should be specified. Higher running speeds are possible with oil but the obvious drawback with oil is the fact that it tends not to stay in place. For anything other than very low speeds, continuous lubrication through oil mist, oil jet or oil bath is normally necessary. An exception to this is the use of a retainer (cage) that can be impregnated with oil such as the phenolic retainer. Perfluorinated oils can offer improved performance at slightly higher speeds as they don't migrate (run out) as easily.

• **Greases** – are simply oils mixed with a thickener to so that they stay inside the bearing. Greases are generally more suitable for heavy loads and have the obvious advantage of giving constant lubrication over a long period without maintenance. Finely filtered greases are used for low noise applications. Lithium based greases are multipurpose, often low torque and high speed and widely used. Polyurea thickened greases have very good water resistance and a wide temperature range while aluminium complex gives excellent resistance to water washout. Many food applications will require an edible food grade grease. PTFE thickened greases can withstand very high temperatures. Surprisingly, too much grease can be bad for a bearing. A high fill will mean greater rolling resistance (higher torque) which may not be suitable for many applications but worse still is the risk of heat build-up. The free space inside a bearing is important in allowing the heat to radiate away from contact area between balls and raceway. As a result, too much grease can lead to premature failure. The standard fill is 25% – 35% of the internal space but this may be varied if required. A smaller percentage may be specified for low torque, low load applications while a much higher fill may be advisable for a high load application provided the speed is low.

• **Dry Lubricants** – are used primarily in vacuum applications or where standard lubricants are unsuitable. We use molybdenum disulfide for its hardwearing and low friction properties and the fact that it is insoluble in water and dilute acids. It is also effective within a wide temperature range of -180 to +300C. By burnishing the balls and raceways of a bearing, friction is reduced allowing higher speeds than with dry bearings.

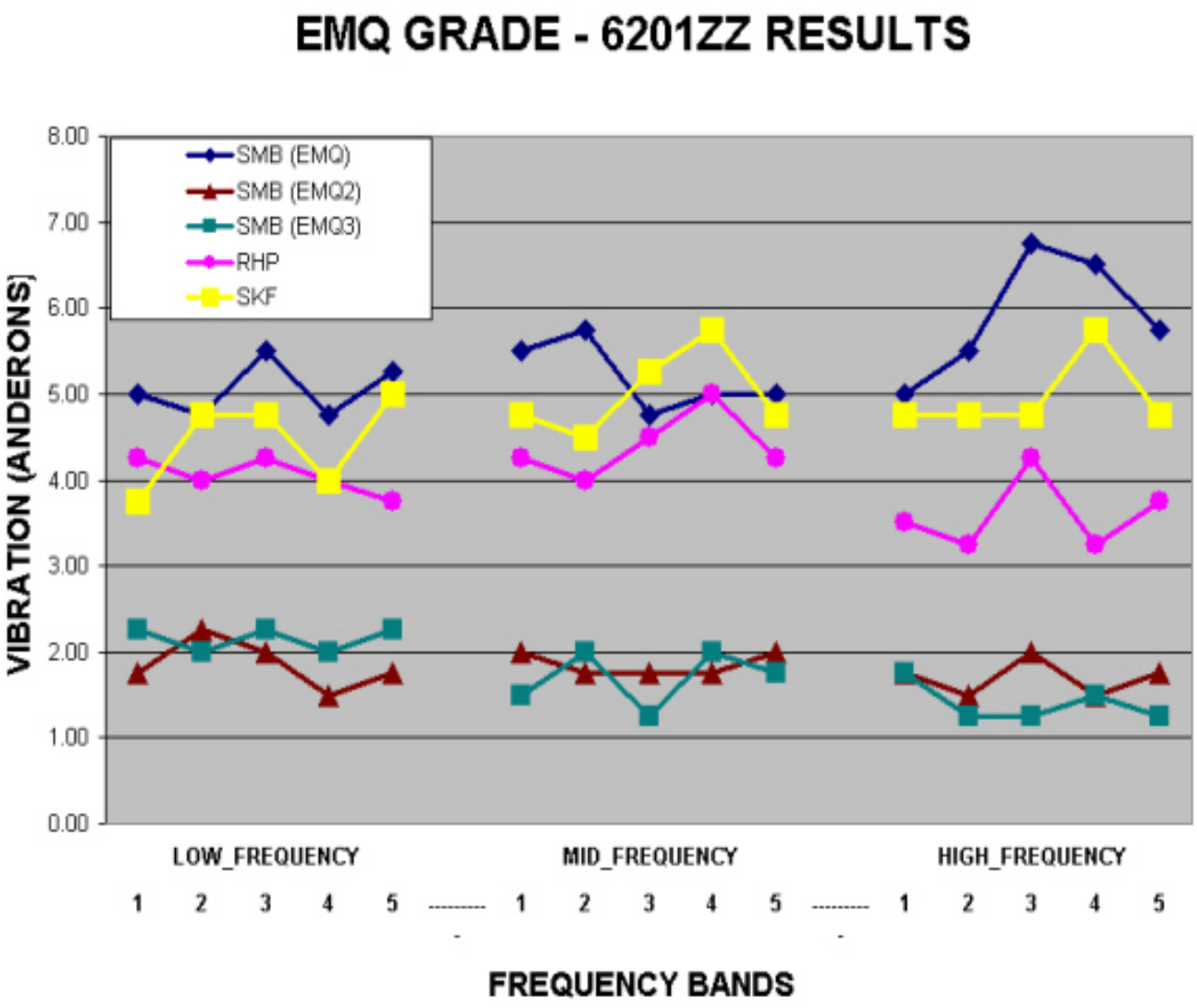
We stock many different lubricants but for more information on our standard oils and greases, please see our LUBRICANT TABLES.

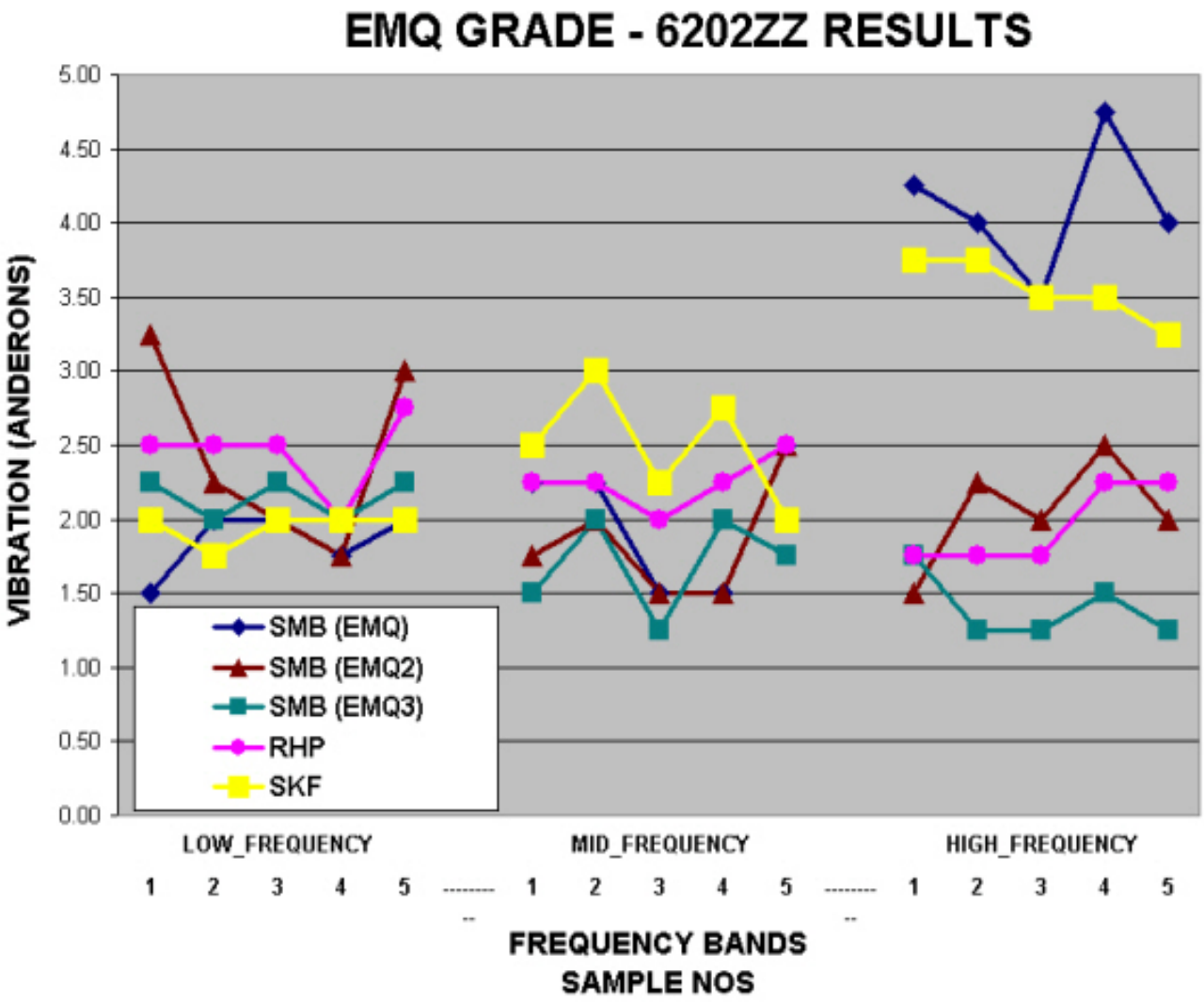
What exactly is an electric motor bearing and what exactly does EMQ mean?

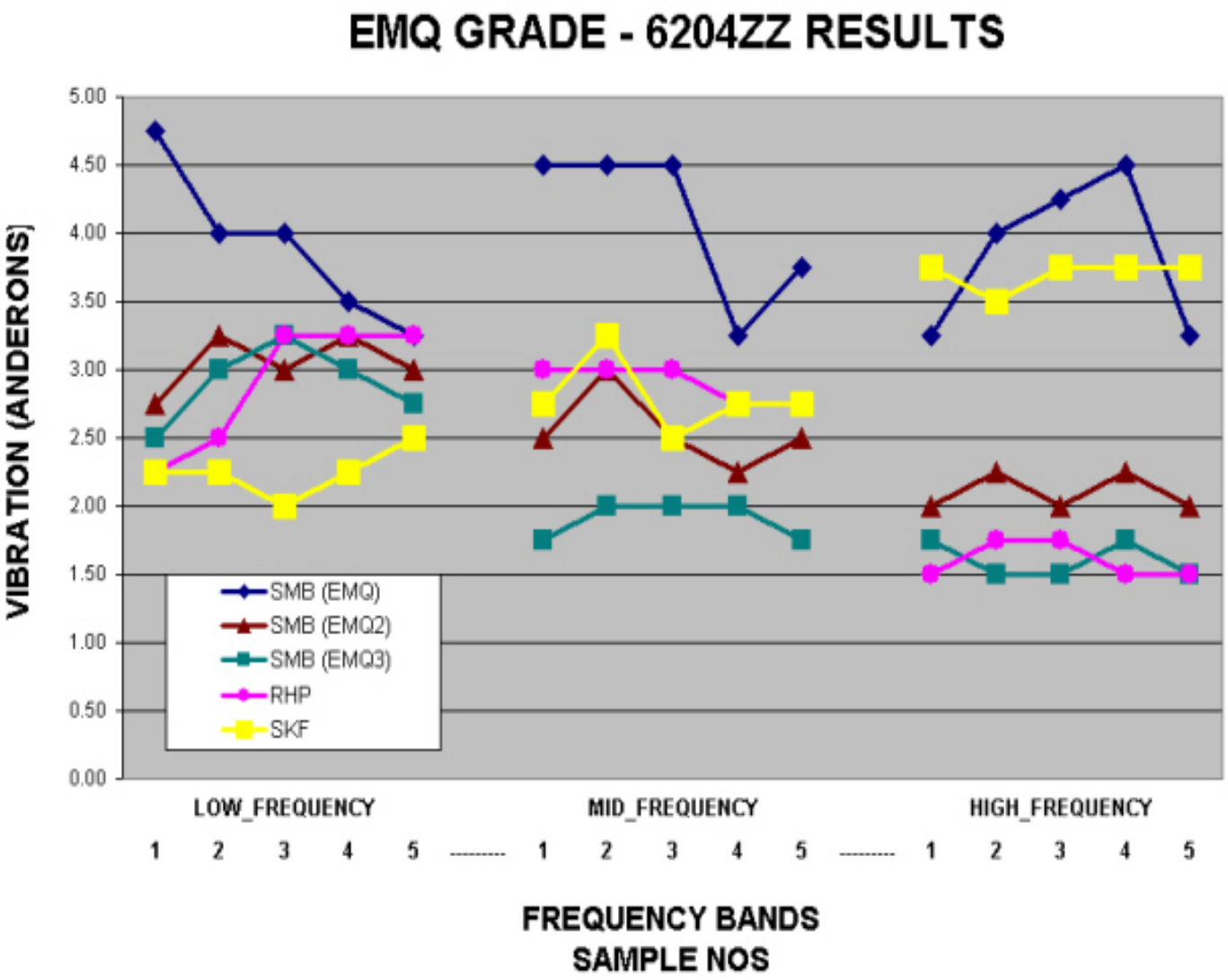
The term is widely used to denote bearings of lower than standard noise level for electric motor or other noise critical applications but how do you know how quiet the electric motor bearings really are and how they compare to other electric motor bearings or indeed other well known brands? We could quote specific noise levels but these can be measured in either Anderons or decibels so that may not help, particularly if you don't have the same information for the brand that works for you. ***This means that the term "EMQ" is meaningless on its own.***

We needed to demonstrate that our electric motor bearings would stand up well against **recognised quality brands** for noise and vibration. We decided to have our electric motor bearings independently tested against two other brands. There are a number of quality bearing manufacturers out there so we picked two of the best, **SKF** and **NSK-RHP**. These manufacturers are known for the quality and consistency of their products. We used new bearings, purchased from authorised distributors to give a fair comparison. We should stress that both manufacturers will offer extra low noise versions of their bearings but, due to the quality of their product, the standard bearings are successfully used in low noise applications throughout the world.

The tables below give the results of independent noise tests carried out on our behalf, comparing EMQ, EMQ2 and EMQ3 grade with the SKF and NSK-RHP bearings.




EMQ GRADE - 6202ZZ RESULTS
VIBRATION (ANDERONS)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
SMB (EMQ)
SMB (EMQ2)
SMB (EMQ3)
RHP
SKF
LOW_FREQUENCY
MID_FREQUENCY
HIGH_FREQUENCY
1 2 3 4 5 -------- 1 2 3 4 5 -------- 1 2 3 4 5
FREQUENCY BANDS
SAMPLE NOS


EMQ GRADE - 6204ZZ RESULTS
VIBRATION (ANDERONS)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
SMB (EMQ)
SMB (EMQ2)
SMB (EMQ3)
RHP
SKF
LOW_FREQUENCY
MID_FREQUENCY
HIGH_FREQUENCY
1 2 3 4 5 -------- 1 2 3 4 5 -------- 1 2 3 4 5
FREQUENCY BANDS
SAMPLE NOS

Steel Specification Tables

(a) Chemical composition of bearing steel

Steel Type	Spec	C%	Si%	Mn%	P%	S%	Cr%	Mo%	Ni	N	Hard-ness
Chrome	SAE52100 SUJ2	0.95 - 1.10	0.15 -0.35	0.50 max	0.025 max	0.025 max	1.30 -1.60	-	-	-	60-64 HRC
Stainless Steel	AISI440C SUS440C X105CrMo17	0.95 -1.20	1.00 max	1.00 max	0.04 max	0.03 max	16.0 -18.0	0.75 max	-	-	58-62 HRC
	KS440 ACD34 X65Cr13	0.60 -0.75	1.00 max	1.00 max	0.04 max	0.03 max	11.50 -13.50	0.75 max	-	-	58-62 HRC
	AISI420B SUS420J2 X30Cr13	0.26 -0.35	1.00 max	1.50 max	0.04 max	0.03 max	12.0 -14.0	-	-	-	53-57 HRC
	AISI304 SUS304 X5CrNi1810	0.08 max	0.75 max	2.00 max	0.045 max	0.03 max	18.0 - 20.0	-	10.5	0.1 max	92 HRB
	AISI316 SUS316 X5CrNiMo17-12-2	0.08 max	0.75 max	2.00 max	0.045 max	0.03 max	16.0 - 18.0	2.0 - 3.0	10.0 - 14.0	0.1 max	95 HRB

(b) Stainless steel grades for EZO Japan bearings

Component	Stainless Steel Grade	Bearing Types	Comments
Inner and outer rings	AISI440C SUS440C X105CrMo17	S6709 upwards S6809 upwards S6907 upwards S6006 upwards S6206 upwards S6305 upwards	
	KS440 ACD34 X65Cr13	0.6mm - 9mm bore 0.04" - 0.75" bore S6700 - S6708 S6800 - S6808 S6900 - S6906 S6000 - S6005 S6200 - S6205 S6300 - S6304	
Balls	AISI440C SUS440C X105CrMo17	All	

(b) Stainless steel grades for EZO Japan bearings cont...

Component	Stainless Steel Grade	Bearing Types	Comments
Shield	AISI304 SUS304 X5CrNi1810	All	
Cage	AISI304 SUS304 X5CrNi1810	0.6mm - 9mm bore 0.04" - 0.75" bore S6701 upwards S6800 upwards S6900 upwards S6000 upwards S6200 upwards S6300 upwards	ribbon cage only +SMR128/SMR137 crown cage ribbon cage only S6000-2RS - S6006-2RS have nylon crown cage S6200-2RS - S6206-2RS have nylon crown cage
	SUS420J2 X30Cr13	0.6mm - 9mm bore 0.04" - 0.75" bore S6700	crown cage only + SMR137/ SMR128 ribbon cage crown cage only

(c) Stainless steel grades for SMB China bearings

Component	Stainless Steel Grade	Bearing Types	Comments
Inner and outer rings	AISI440C SUS440C X105CrMo17	All	
Balls	AISI440C SUS440C X105CrMo17	All	
Shield	AISI304 SUS304 X5CrNi1810	All	
Cage	AISI304 SUS304 X5CrNi1810	All	

Radial Play Tables

(a) Radial play for bore size under 10 mm

	Tight		Normal		Loose	
Metric .001mm	MC1 0-5	MC2 3-8	MC3 5-10	MC4 8-13	MC5 13-20	MC6 20-28
Inch .0001"	P02 0-2	P13 1-3	P24 2-4	P35 3-5	P58 5-8	P811 8-11

(b) Radial play for bore size from 10 mm

Nominal		C2 (tight)		CN (normal)		C3 (loose)		C4 (looser)	
Over	Incl.	Metric .001mm	Inch .0001"	Metric .001mm	Inch .0001"	Metric .001mm	Inch .0001"	Metric .001mm	Inch .0001"
-	10	0-7	0-3	2-13	1-5	8-23	3-9	14-29	6-11
10	18	0-9	0-3.5	3-18	1-7	11-25	4-10	18-33	7-13
18	24	0-10	0-4	5-20	2-8	13-28	5-11	20-36	8-14
24	30	1-11	0-4.5	5-20	2-8	13-28	5-11	23-41	9-16
30	40	1-11	0-4.5	6-20	2-8	15-33	6-13	28-46	11-18
40	50	1-11	0-4.5	6-23	2-9	18-36	7-14	30-51	12-20

Inner Ring Tolerances

(a) Inner Ring and Width – up to 2.5 mm bore (Tolerances in .001 mm)

Grade	Mean Bore Deviation	Single Bore Variation			Mean Bore Variation	Width Deviation	Width Variation	Radial Runout	Face Runout /Bore	Face Runout/ Raceway
		7,8,9	0	2,3						
P0	+0/-8	10	8	6	6	0-40	12	10	-	-
P6	+0/-7	9	7	5	5	0-40	12	5	-	-
P5	+0/-5	5	4	4	3	0-40	5 *(1)*	4	7	7
P4	+0/-4	4	3	3	2	0-40	2.5 *(1)*	2.5	3	3

(1) applies to inner ring only

(b) Inner Ring and Width – over 2.5mm to 10 mm bore (Tolerances in .001 mm)

Grade	Mean Bore Deviation	Single Bore Variation			Mean Bore Variation	Width Deviation	Width Variation	Radial Runout	Face Runout /Bore	Face Runout/ Raceway
		7,8,9	0	2,3						
P0	+0/-8	10	8	6	6	0-120	15	10	-	-
P6	+0/-7	9	7	5	5	0-120	15	6	-	-
P5	+0/-5	5	4	4	3	0-40	5*(1)*	4	7	7
P4	+0/-4	4	3	3	2	0-40	2.5 *(1)*	2.5	3	3

(1) applies to inner ring only

(c) Inner Ring and Width – over 10mm to 18 mm bore (Tolerances in .001 mm)

Grade	Mean Bore Deviation	Single Bore Variation			Mean Bore Variation	Width Deviation	Width Variation	Radial Runout	Face Runout /Bore	Face Runout/ Raceway
		7,8,9	0	2,3						
P0	+0/-8	10	8	6	6	0-120	20	10	-	-
P6	+0/-7	9	7	5	5	0-120	20	7	-	-
P5	+0/-5	5	4	4	3	0-80	5*(1)*	4	7	7
P4	+0/-4	4	3	3	2	0-80	2.5 *(1)*	2.5	3	3

(1) applies to inner ring only

(d) Inner Ring and Width – over 18mm to 30 mm bore (Tolerances in .001 mm)

Grade	Mean Bore Deviation	Single Bore Variation			Mean Bore Variation	Width Deviation	Width Variation	Radial Runout	Face Runout /Bore	Face Runout/ Raceway
		7,8,9	0	2,3						
P0	+0/-10	13	10	8	8	0-120	20	13	-	-
P6	+0/-8	10	8	6	6	0-120	20	8	-	-
P5	+0/-6	6	5	5	3	0-120	5*(1)*	4	8	8
P4	+0/-5	5	4	4	2.5	0-120	2.5 *(1)*	3	4	4

(1) applies to inner ring only

(e) Inner Ring and Width – over 30mm to 50 mm bore (Tolerances in .001 mm)

Grade	Mean Bore Deviation	Single Bore Variation			Mean Bore Variation	Width Deviation	Width Variation	Radial Runout	Face Runout /Bore	Face Runout/ Raceway
		7,8,9	0	2,3						
P0	+0/-12	15	12	9	9	0-120	20	15	-	-
P6	+0/-10	13	10	8	8	0-120	20	10	-	-
P5	+0/-8	8	6	6	4	0-120	5*(1)*	5	8	8
P4	+0/-6	6	5	5	3	0-120	3 *(1)*	4	4	4

(1) applies to inner ring only

Outer Ring Tolerances

(f) Outer Ring– up to 6mm O.D. (Tolerances in .001 mm)

Grade	Mean O.D. Deviation	Single O.D. Variation				Mean O. D. Variation	Width Variation	Radial Runout	Face Runout /O.D.	Face Runout/ Raceway
		7,8,9 open	0 open	2,3 open	0,2,3 ZZ,2RS					
P0	+0/-8	10	8	6	10	6	*(2)*	15	-	-
P6	+0/-7	9	7	5	9	5	*(2)*	8	-	-
P5	+0/-5	5	4	4	-	3	5	5	8	8
P4	+0/-4	4	3	3	-	2	2.5	3	4	5

(2) same as inner ring value

(g) Outer Ring– over 6mm up to 18mm O.D. (Tolerances in .001 mm)

Grade	Mean O.D. Deviation	Single O.D. Variation				Mean O. D. Variation	Width Variation	Radial Runout	Face Runout /O.D.	Face Runout/ Raceway
		7,8,9 open	0 open	2,3 open	0,2,3 ZZ,2RS					
P0	+0/-8	10	8	6	10	6	*(2)*	15	-	-
P6	+0/-7	9	7	5	9	5	*(2)*	8	-	-
P5	+0/-5	5	4	4	-	3	5	5	8	8
P4	+0/-4	4	3	3	-	2	2.5	3	4	5

(2) same as inner ring value

(h) Outer Ring– over 18mm up to 30mm O.D. (Tolerances in .001 mm)

Grade	Mean O.D. Deviation	Single O.D. Variation				Mean O. D. Variation	Width Variation	Radial Runout	Face Runout /O.D.	Face Runout/ Raceway
		7,8,9 open	0 open	2,3 open	0,2,3 ZZ,2RS					
P0	+0/-9	12	9	7	12	7	*(2)*	15	-	-
P6	+0/-8	10	8	6	10	6	*(2)*	9	-	-
P5	+0/-6	6	5	5	-	3	5	6	8	8
P4	+0/-5	5	4	4	-	2.5	2.5	4	4	5

(2) same as inner ring value

(i) Outer Ring– over 30mm up to 50mm O.D. (Tolerances in .001 mm)

Grade	Mean O.D. Deviation	Single O.D. Variation				Mean O. D. Variation	Width Variation	Radial Runout	Face Runout /O.D.	Face Runout/ Raceway
		7,8,9 open	0 open	2,3 open	0,2,3 ZZ,2RS					
P0	+0/-11	14	11	8	16	8	*(2)*	20	-	-
P6	+0/-9	11	9	7	13	7	*(2)*	10	-	-
P5	+0/-7	7	5	5	-	4	5	7	8	8
P4	+0/-6	6	5	5	-	3	2.5	5	4	5

(2) same as inner ring value

(j) Outer Ring– over 50mm up to 80mm O.D. (Tolerances in .001 mm)

Grade	Mean O.D. Deviation	Single O.D. Variation				Mean O. D. Variation	Width Variation	Radial Runout	Face Runout /O.D.	Face Runout/ Raceway
		7,8,9 open	0 open	2,3 open	0,2,3 ZZ,2RS					
P0	+0/-13	16	13	10	20	10	*(2)*	25	-	-
P6	+0/-11	14	11	8	16	8	*(2)*	13	-	-
P5	+0/-9	9	7	7	-	5	6	8	8	10
P4	+0/-7	7	5	5	-	3.5	3	5	4	5

(2) same as inner ring value

Flange Tolerances

(k) All Sizes (Tolerances in .001 mm)

Grade	Mean O.D. Deviation	Mean O.D. Variation
P0	+125/-50	+0/-50
P6	+125/-50	+0/-50
P5	+0/-25	+0/-50
P4	+0/-25	+0/-50

SMB Standard Lubricants

Standard Oils

Code	Product Manufacturer	Type	Temp. Range C (F)	Viscosity CS +38C/+99C	MIL Spec	Comments
A402	Anderol 402 (Anderol BV)	Ester	–55/+150 (–67/+302)	12/3.5	DEF/Stan 91–49/1	General purpose aircraft/ instrument.
AF2	Aeroshell 12 (Shell)	Diester	–50/+130 –58/+266)	14/3.5	L–6085A, DEF/Stan 91–49	General purpose aircraft/ instrument.
AF3	Aeroshell 3 (Shell)	Mineral	–55/+115 –67/+239)	11/2.3	L–7870	General purpose aircraft/ instrument.
K143	Krytox 143AZ (Du Pont)	Fluoro-carbon	–53/+162 (–63/+324)	40/7		High temp. Chemically inert. High torque at low temp.
VF50	Versilube F50 (G.Electric)	Silicon	–73/+204 –100/+400)	50/16	S–81087	Wide temp. range, low speed/ load.

Standard Greases

Code	Product Manufacturer	Base Oil	Thickener	Temp. Range C (F)	MIL Spec	Comments
AG5	Aeroshell 5 (Shell Oil)	Mineral	Microgel	–40/+177 (–40/+350)	G-3545C	High load grease.
AG7	Aeroshell 7 (Shell Oil)	Diester	Microgel	–73/+149 (–100/+300)	G–23827A/ G-287/G-354	Good water-resistance. High load. Wide temp. range.
AG15	Aeroshell 15 (Shell Oil)	Silicon	Teflon	–73/+232 (–100/+450)	G–25013E XG300	Water resistant. Wide temp range. Low load/speed.
AKC	Andok C (Exxon Corp)	Mineral	Sodium	–30/+120 (–22/+250)		Non-migratory, high-speed grease.
AQUA2	Sapphire Aqua2 (Rocol)	Mineral	Alum Complex	–20/+150 (–4/+302)		Highly water resistant
AV2	Alvania 2 (Shell Oil)	Mineral	Lithium	–25/+120 (–13/+250)		Multi-purpose bearing grease for larger bearings.
AVRA	Alvania RA (Shell Oil)	Mineral	Lithium	–40/+145 (–40/+293)		Multi-purpose grease with wide temp. range.
B32	Beacon 325 (Exxon Corp)	Diester	Lithium	–55/+120 (–67/+248)	G–3278A/ DTD825B	Low torque, quiet running.
B4272	Kluberelectric (Kluber)	Synthetic Hydrocarbon	Lithium	–40/+140 (–40/+284)		Conductive grease
B601	Braycote 601 (Bray Oil)	Perfluor	Tetrafluoro-ethylene	–80/+204 (–112/+400)		Chemically inert, instrument & aerospace vacuum grease.
FL2	Foodlube 2 (Rocol)	Ester glyceride	Calcium Soap	–20/+110 (–4/+230)		Food grade grease.
FLHT2	Foodlube HT2 (Rocol)	Ester glyceride	Calcium Soap	–20/+200 (–4/+392)		High temp. food grade grease

SMB Standard Lubricants cont...

Standard Greases cont....

Code	Product Manufacturer	Base Oil	Thickener	Temp. Range C (F)	MIL Spec	Comments
G110	Nucleol G110 (Castrol)	Mineral	Clay	–20/+150 (–4/+302)		UKAEA High speed. Radiation resistant.
GHY72	Asonic GHY72 (Kluber)	Ester	Polyurea	–40/+180 (–40/+356)		Low noise
KAC	Krytox 240AC (Du Pont)	Fluoro-carbon	Vidax	–34/+288 (–30/+550)	G–27617A	High temp. Chemically inert. High torque at low temp.
LDS18A	LDS18 Spec. A (Kluber)	Synthetic	Lithium	–60/+130 (–76/+266)	G–23827A/ DTD844B	Low noise, high speed.
M44	Molycote 44 (Dow Corning)	Silicon	Lithium	–73/+204 –100/+400)	G–15719A	Wide temp. range, low load.
MG28	Grease 28 (Mobil Oil)	Hydro-carbon	Clay	–54/+177 (–65/+350)	G–81322	Wide temp. range.
PEM	Polyrex EM (Mobil)	Mineral	Polyurea	–40/+180 (–40/+356)		Good water resistance, wide temp range, low noise.
SRI-2	Chevron SRI-2 (Caltex)	Mineral	Urea	-30/+175 (-22/+347)	G-3545G	Very good resistance to water/ saltwater
SRL	Multemp SRL (Kyodo Yushi)	Ester	Lithium	–40/+150 (–40/+302)		Low torque, quiet running.

APPENDIX F

Fraction	Decimal	metres	Fraction	Decimal	metres	Fraction	Decimal	mm
1/64	0.0156	0.397	–	**0.2756**	**7.0**	–	**0.6299**	**16.0**
1/32	0.0312	0.794	9/32	0.2813	7.144	41/64	0.6406	16.272
–	**0.0394**	**1.0**	19/64	0.2969	7.541	21/32	0.6563	16.669
3/64	0.0469	1.191	5/16	0.3125	7.938	–	**0.6693**	**17.0**
–	**0.0472**	**1.2**	–	**0.3150**	**8.0**	43/64	0.6719	17.066
–	**0.0591**	**1.5**	21/64	0.3281	8.334	11/16	0.6875	17.463
1/16	0.0625	1.588	11/32	0.3438	8.731	45/64	0.7031	17.859
–	**0.0629**	**1.6**	–	**0.3543**	**9.0**	–	**0.7087**	**18.0**
–	**0.0709**	**1.8**	23/64	0.3594	9.128	23/32	0.7188	18.256
5/64	0.0781	1.984	3/8	0.375	9.525	47/64	0.7344	18.653
–	**0.0787**	**2.0**	25/64	0.3906	9.922	–	**0.7480**	**19.0**
–	**0.0906**	**2.3**	–	**0.3937**	**10.0**	3/4	0.75	19.05
3/32	0.0938	2.381	13/32	0.4063	10.319	49/64	0.7656	19.447
–	**0.0984**	**2.5**	27/64	0.4219	10.716	25/32	0.7813	19.844
–	**0.1024**	**2.6**	–	**0.4331**	**11.0**	–	**0.7874**	**20.0**
7/64	0.1094	2.778	7/16	0.4375	11.112	51/64	0.7969	20.241
–	**0.1181**	**3.0**	29/64	0.4531	11.509	13/16	0.8125	20.638
1/8	0.125	3.175	15/32	0.4688	11.906	–	**0.8268**	**21.0**
–	**0.1378**	**3.5**	–	**0.4724**	**12.0**	53/64	0.8281	21.034
9/64	0.1406	3.572	31/64	0.4844	12.303	27/32	0.8438	21.431
5/32	0.1562	3.969	1/2	.50	12.70	55/64	0.8594	21.828
–	**0.1575**	**4.0**	–	**0.5118**	**13.0**	–	**0.8661**	**22.0**
11/64	0.1719	4.366	33/64	0.5156	13.097	7/8	0.875	22.225
–	**0.1772**	**4.5**	17/32	0.5313	13.494	57/64	0.8906	22.622
3/16	0.1875	4.762	35/64	0.5469	13.891	–	**0.9055**	**23.0**
–	**0.1969**	**5.0**	–	**0.5512**	**14.0**	29/32	0.9063	23.019
13/64	0.2031	5.159	9/16	0.5625	14.288	59/64	0.9219	23.416
7/32	0.2188	5.556	37/64	0.5781	14.684	15/16	0.9375	23.813
15/64	0.2344	5.953	–	**0.5906**	**15.0**	–	**0.9449**	**24.0**
–	**0.2362**	**6.0**	19/32	0.5938	15.081	61/64	0.9531	24.209
1/4	0.25	6.35	39/64	0.6094	15.478	31/32	0.9688	24.606
17/64	0.2656	6.747	5/8	0.625	15.875	–	**0.9843**	**25.0**

To convert inch measurements to millimetres, multiply by 25.4
To convert millimetre measurements to inches, divide by 25.4