



# Bearings for Harsh Environments

- Ceramic bearings
- Plastic bearings
- 316 stainless steel bearings

**SMB**  
**BEARINGS LTD**

A range of bearings for the most challenging applications

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For many years, SMB Bearings have stocked corrosion resistant bearings in the form of 440 grade stainless steel bearings, but customers often came to us with problems that we were unable to solve with what we had on the shelf.

To enable us to offer more diverse solutions, we have expanded our range to include ceramic bearings, plastic bearings and 316 stainless steel bearings. These are all corrosion resistant and can withstand much harsher environments. These bearing types are also non-magnetic.

For more information, see the following pages:

**Ceramic bearings:**      **pages 1 - 4**

**Plastic bearings:**      **pages 5 - 8**

**316 stainless bearings:** **pages 9 - 11**

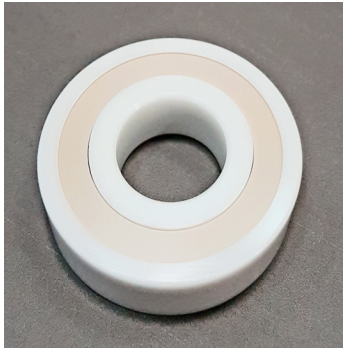
**Material overview:**      **pages 12 - inside rear cover**

This catalogue should give you an understanding of the capabilities of our corrosion resistant and non-magnetic bearings for harsh or challenging environments. If you require more information on these types or any of our miniature, stainless steel and thin-section bearings, please do not hesitate to contact us. More information is also available at [www.smbbearings.com](http://www.smbbearings.com).

# The ceramic bearing range

Our standard range of ceramic bearings is shown on the next pages. Other sizes, including angular contact bearings, are available on request.

The SMB range of ceramic bearings is stocked with P0/Abec1 tolerances but higher tolerances can be supplied. Our ceramic bearings are normally full complement or have PEEK cages. PEEK is highly corrosion resistant but does limit the temperature range of the ceramic bearing to -70/+250°C. Bearings can be supplied with PTFE or 316 stainless steel cages for extremely low temperatures. SMB ceramic bearings are usually dry but we can lubricate them to order if required. Ceramic bearings with cages are stocked as open or with PEEK seals (2PKS). We can supply them with PTFE seals for extreme low temperature applications. Full complement bearings are only available open.



## About ceramics

The most common materials for our ceramic bearings are zirconia (ZrO<sub>2</sub>) and silicon nitride (Si<sub>3</sub>N<sub>4</sub>). Both have excellent corrosion resistance and both are non-magnetic. As these materials have a low friction coefficient, ceramic bearings can be used without lubrication. Both types of ceramic bearing have excellent resistance to seawater and aggressive chemicals but there are important differences.

**Temperature:** ZrO<sub>2</sub> bearings can be used up to 400°C and Si<sub>3</sub>N<sub>4</sub> bearings up to 800°C. For these temperatures, the bearings should be full complement (cageless). Ceramics also have excellent low temperature performance down to approximately 200°C provided a suitable cage is used.

**Brittleness:** ceramics are harder than steel but also more brittle meaning care should be taken where impact or shock loads are present. ZrO<sub>2</sub> has higher bend strength and greater elasticity than Si<sub>3</sub>N<sub>4</sub> so offers some resistance to small shock loads and interference fits. Silicon nitride does not handle shock loads well.

**Coefficient of expansion:** ZrO<sub>2</sub> will expand at a similar rate to steel. Si<sub>3</sub>N<sub>4</sub> has a much lower rate of expansion so special attention should be paid to shaft and housing fits with changes in temperature.



## Applications

Due to the higher cost, ceramic bearings are mainly used in aggressive environments where other materials are not suitable. The most common applications are those where excellent corrosion resistance is required or the bearings are exposed to extremely low or high temperatures.

Ceramic bearings are fine for use in marine applications as they are not affected by salt water. They are also used in the chemical industry, food and beverage industry, chlorine systems, film processing equipment, fuel handling equipment or where contact with strong chemicals is likely as they are resistant to most strong acids and alkalis. As they are non-magnetic, they are suitable for motors used in MRI scanners, magnetometers, semi-conductor manufacturing equipment or any application in which bearings may be exposed to a strong magnetic field.



Ceramics have excellent low and high temperature stability which means they can be used in deep space and cryogenics as well as furnace applications. The roundness of the rings is not as good as those in high precision steel bearings and the material is more brittle so full ceramic bearings are not used for very high speeds in applications like machine tools or turbines where super precision hybrid bearings are preferred.



## SMB ceramic bearings - metric sizes

Bore	O.D.	Width	ZrO2 reference	Max Load (kgf)		Rpm (x1000)	Si3N4 reference	Max Load (kgf)		Rpm (x1000)
				Dyn	Stat			Dyn	Stat	
3	8	3	CCZR-693	40	13	13.0	CCSI-693	34	11	16.0
	8	4	CCZR-693-2PKS	40	13	13.0	CCSI-693-2PKS	34	11	16.0
	9	3	CCZR-603 (2PKS)	43	14	13.0	CCSI-603 (2PKS)	37	12	16.0
	10	4	CCZR-623 (2PKS)	44	15	12.0	CCSI-623 (2PKS)	37	13	15.0
4	9	2.5	CCZR-684	38	12	12.0	CCSI-684	41	14	16.0
	9	4	CCZR-684-2PKS	38	12	12.0	CCSI-684-2PKS	41	14	16.0
	11	4	CCZR-694 (2PKS)	72	26	11.0	CCSI-694 (2PKS)	62	21	14.0
	12	4	CCZR-604 (2PKS)	72	25	11.0	CCSI-604 (2PKS)	61	21	14.0
	13	5	CCZR-624 (2PKS)	95	34	10.0	CCSI-624 (2PKS)	81	29	12.0
	16	5	CCZR-634 (2PKS)	100	39	8.0	CCSI-634 (2PKS)	85	33	10.0
5	11	3	CCZR-685	53	21	11.0	CCSI-685	45	18	14.0
	11	5	CCZR-685-2PKS	53	21	11.0	CCSI-685-2PKS	45	18	14.0
	13	4	CCZR-695 (2PKS)	76	30	10.0	CCSI-695 (2PKS)	65	26	12.5
	14	5	CCZR-605 (2PKS)	95	36	10.0	CCSI-605 (2PKS)	81	30	12.5
	16	5	CCZR-625 (2PKS)	121	48	9.0	CCSI-625 (2PKS)	103	41	11.0
	19	6	CCZR-635 (2PKS)	177	67	8.0	CCSI-635 (2PKS)	151	57	10.0
6	13	3.5	CCZR-686	76	33	10.0	CCSI-686	65	28	12.0
	13	5	CCZR-686-2PKS	76	33	10.0	CCSI-686-2PKS	65	28	12.0
	15	5	CCZR-696 (2PKS)	101	39	9.0	CCSI-696 (2PKS)	86	33	11.0
	17	6	CCZR-606 (2PKS)	169	63	9.0	CCSI-606 (2PKS)	144	54	11.0
	19	6	CCZR-626 (2PKS)	175	77	8.0	CCSI-626 (2PKS)	149	67	10.0
	22	7	CCZR-636 (2PKS)	149	105	7.0	CCSI-636 (2PKS)	128	89	8.5
7	14	3.5	CCZR-687	90	38	10.0	CCSI-687	77	32	12.0
	14	5	CCZR-687-2PKS	90	38	10.0	CCSI-687-2PKS	77	32	12.0
	17	5	CCZR-697 (2PKS)	120	55	9.0	CCSI-697 (2PKS)	102	47	11.0
	19	6	CCZR-607 (2PKS)	177	67	9.0	CCSI-607 (2PKS)	150	57	11.0
	22	7	CCZR-627 (2PKS)	254	106	7.0	CCSI-627 (2PKS)	217	90	8.5
	26	9	CCZR-637 (2PKS)	351	174	6.5	CCSI-637 (2PKS)	297	149	8.0
8	16	4	CCZR-688	94	44	9.0	CCSI-688	80	38	11.0
	16	5	CCZR-688-2PKS	94	44	9.0	CCSI-688-2PKS	80	38	11.0
	19	6	CCZR-698 (2PKS)	166	69	9.0	CCSI-698 (2PKS)	142	60	11.0
	22	7	CCZR-608 (2PKS)	253	104	8.0	CCSI-608 (2PKS)	216	88	10.0
	24	8	CCZR-628 (2PKS)	261	107	7.0	CCSI-628 (2PKS)	223	91	8.5
	28	9	CCZR-638 (2PKS)	338	147	6.5	CCSI-638 (2PKS)	287	126	8.0
9	17	4	CCZR-689	101	51	9.0	CCSI-689	85	43	11.0
	17	5	CCZR-689-2PKS	101	51	9.0	CCSI-689-2PKS	85	43	11.0
	20	6	CCZR-699 (2PKS)	184	82	8.0	CCSI-699 (2PKS)	157	70	10.0
	24	7	CCZR-609 (2PKS)	254	89	8.0	CCSI-609 (2PKS)	217	76	10.0
	26	8	CCZR-629 (2PKS)	343	149	7.0	CCSI-629 (2PKS)	292	128	9.0
	30	10	CCZR-639 (2PKS)	351	153	6.0	CCSI-639 (2PKS)	299	130	7.2
10	15	3	CCZR-6700	61	33	4.5	CCSI-6700	52	28	5.6
	15	4	CCZR-6700-2PKS	61	33	4.5	CCSI-6700-2PKS	52	28	5.6
	19	5	CCZR-6800 (2PKS)	138	62	8.8	CCSI-6800 (2PKS)	118	53	11.0
	22	6	CCZR-6900 (2PKS)	202	96	8.2	CCSI-6900 (2PKS)	172	81	10.2
	26	8	CCZR-6000 (2PKS)	348	149	7.0	CCSI-6000 (2PKS)	297	127	8.5
	30	9	CCZR-6200 (2PKS)	392	182	6.0	CCSI-6200 (2PKS)	334	155	7.2
	35	11	CCZR-6300 (2PKS)	618	263	5.5	CCSI-6300 (2PKS)	529	224	6.8
12	18	4	CCZR-6701 (2PKS)	69	39	3.0	CCSI-6701 (2PKS)	59	33	3.8
	21	5	CCZR-6801 (2PKS)	143	76	8.0	CCSI-6801 (2PKS)	122	65	10.0
	24	6	CCZR-6901 (2PKS)	215	110	7.2	CCSI-6901 (2PKS)	183	94	9.0
	28	8	CCZR-6001 (2PKS)	391	183	6.4	CCSI-6001 (2PKS)	333	156	8.0
	32	10	CCZR-6201 (2PKS)	519	249	5.4	CCSI-6201 (2PKS)	443	213	6.8
	37	12	CCZR-6301 (2PKS)	742	321	5.0	CCSI-6301 (2PKS)	632	273	6.2

## SMB ceramic bearings - metric sizes

Bore	O.D.	Width	ZrO2 reference	Max Load (kgf)		Rpm (x1000)	Si3N4 reference	Max Load (kgf)		Rpm (x1000)
				Dyn	Stat			Dyn	Stat	
15	21	4	CCZR-6702 (2PKS)	71	44	2.6	CCSI-6702 (2PKS)	61	38	3.2
	24	5	CCZR-6802 (2PKS)	153	94	6.6	CCSI-6802 (2PKS)	131	79	8.2
	28	7	CCZR-6902 (2PKS)	321	167	6.2	CCSI-6902 (2PKS)	273	143	7.6
	32	9	CCZR-6002 (2PKS)	446	216	5.5	CCSI-6002 (2PKS)	380	183	6.8
	35	11	CCZR-6202 (2PKS)	583	287	4.8	CCSI-6202 (2PKS)	496	245	6.0
	42	13	CCZR-6302 (2PKS)	874	419	4.0	CCSI-6302 (2PKS)	749	356	5.0
17	23	4	CCZR-6703 (2PKS)	75	49	2.1	CCSI-6703 (2PKS)	64	41	2.6
	26	5	CCZR-6803 (2PKS)	164	108	6.0	CCSI-6803 (2PKS)	140	92	7.5
	30	7	CCZR-6903 (2PKS)	340	192	5.6	CCSI-6903 (2PKS)	289	163	7.0
	35	10	CCZR-6003 (2PKS)	458	251	5.0	CCSI-6003 (2PKS)	390	214	6.2
	40	12	CCZR-6203 (2PKS)	732	368	4.2	CCSI-6203 (2PKS)	634	314	5.2
	47	14	CCZR-6303 (2PKS)	1039	510	3.6	CCSI-6303 (2PKS)	889	435	4.5
20	27	4	CCZR-6704 (2PKS)	77	54	2.0	CCSI-6704 (2PKS)	66	47	2.5
	32	7	CCZR-6804 (2PKS)	299	183	4.8	CCSI-6804 (2PKS)	254	146	6.0
	37	9	CCZR-6904 (2PKS)	464	273	4.6	CCSI-6904 (2PKS)	395	231	5.7
	42	12	CCZR-6004 (2PKS)	717	388	4.2	CCSI-6004 (2PKS)	611	329	5.2
	47	14	CCZR-6204 (2PKS)	982	513	3.4	CCSI-6204 (2PKS)	834	438	4.2
	52	15	CCZR-6304 (2PKS)	1214	604	2.8	CCSI-6304 (2PKS)	1034	514	3.6
25	32	4	CCZR-6705 (2PKS)	79	61	1.6	CCSI-6705 (2PKS)	67	51	2.0
	37	7	CCZR-6805 (2PKS)	320	217	4.0	CCSI-6805 (2PKS)	272	186	5.0
	42	9	CCZR-6905 (2PKS)	517	335	3.6	CCSI-6905 (2PKS)	446	287	4.5
	47	12	CCZR-6005 (2PKS)	770	448	3.4	CCSI-6005 (2PKS)	659	382	4.3
	52	15	CCZR-6205 (2PKS)	1072	603	3.0	CCSI-6205 (2PKS)	918	513	3.6
	62	17	CCZR-6305 (2PKS)	1575	867	2.6	CCSI-6305 (2PKS)	1348	739	3.2
30	37	4	CCZR-6706 (2PKS)	85	71	1.4	CCSI-6706 (2PKS)	72	61	1.8
	42	7	CCZR-6806 (2PKS)	341	254	3.6	CCSI-6806 (2PKS)	291	214	4.5
	47	9	CCZR-6906 (2PKS)	540	374	3.4	CCSI-6906 (2PKS)	463	319	4.0
	55	13	CCZR-6006 (2PKS)	1011	632	3.0	CCSI-6006 (2PKS)	857	539	3.6
	62	16	CCZR-6206 (2PKS)	1488	869	2.6	CCSI-6206 (2PKS)	1264	736	3.2
	72	19	CCZR-6306 (2PKS)	2037	1155	2.4	CCSI-6306 (2PKS)	1728	974	3.0
35	44	5	CCZR-6707 (2PKS)	137	122	1.2	CCSI-6707 (2PKS)	118	104	1.5
	47	7	CCZR-6807 (2PKS)	352	286	3.2	CCSI-6807 (2PKS)	298	244	4.0
	55	10	CCZR-6907 (2PKS)	818	586	2.8	CCSI-6907 (2PKS)	698	593	3.5
	62	14	CCZR-6007 (2PKS)	1219	788	2.6	CCSI-6007 (2PKS)	1038	671	3.2
	72	17	CCZR-6207 (2PKS)	1963	1182	2.2	CCSI-6207 (2PKS)	1681	1009	2.8
	80	21	CCZR-6307 (2PKS)	2520	1478	2.1	CCSI-6307 (2PKS)	2170	1248	2.7
40	50	6	CCZR-6708 (2PKS)	187	166	1.0	CCSI-6708 (2PKS)	161	142	1.3
	52	7	CCZR-6808 (2PKS)	369	312	2.8	CCSI-6808 (2PKS)	315	267	3.5
	62	12	CCZR-6908 (2PKS)	982	744	2.6	CCSI-6908 (2PKS)	831	638	3.2
	68	15	CCZR-6008 (2PKS)	1283	882	2.4	CCSI-6008 (2PKS)	1096	748	3.0
	80	18	CCZR-6208 (2PKS)	2226	1371	2.0	CCSI-6208 (2PKS)	1893	1167	2.5
	90	23	CCZR-6308 (2PKS)	3090	1842	1.9	CCSI-6308 (2PKS)	2666	1560	2.4
45	55	6	CCZR-6709 (2PKS)	193	179	1.0	CCSI-6709 (2PKS)	165	153	1.3
	58	7	CCZR-6809 (2PKS)	464	403	2.4	CCSI-6809 (2PKS)	395	342	3.0
	68	12	CCZR-6909 (2PKS)	1035	811	2.2	CCSI-6909 (2PKS)	884	692	2.7
	75	16	CCZR-6009 (2PKS)	1357	922	2.0	CCSI-6009 (2PKS)	1151	787	2.4
	85	19	CCZR-6209 (2PKS)	2084	1222	1.8	CCSI-6209 (2PKS)	1772	1039	2.2
	100	25	CCZR-6309 (2PKS)	3996	2454	1.7	CCSI-6309 (2PKS)	2950	1800	2.1
50	62	6	CCZR-6710 (2PKS)	202	190	0.9	CCSI-6710 (2PKS)	173	161	1.1
	65	7	CCZR-6810 (2PKS)	472	420	2.2	CCSI-6810 (2PKS)	407	463	2.8
	72	12	CCZR-6910 (2PKS)	1058	827	2.0	CCSI-6910 (2PKS)	906	703	2.5
	80	16	CCZR-6010 (2PKS)	1388	995	1.8	CCSI-6010 (2PKS)	1181	846	2.2
	90	20	CCZR-6210 (2PKS)	2235	1395	1.6	CCSI-6210 (2PKS)	1905	1187	2.0
	110	27	CCZR-6310 (2PKS)	4680	2965	1.5	CCSI-6310 (2PKS)	3450	2150	1.9

## SMB ceramic bearings - inch sizes

Bore	O.D.	Width	ZrO2 reference	Max Load (kgf)		Rpm (x1000)	Si3N4 reference	Max Load (kgf)		Rpm (x1000)
				Dyn	Stat			Dyn	Stat	
0.125	0.375	0.1562	CCZR-R2 (2PKS)	47	17	14.0	CCSI-R2 (2PKS)	40	15	17.0
0.1875	0.5	0.1562	CCZR-R3	97	37	11.0	CCSI-R3	82	32	14.0
	0.5	0.196	CCZR-R3-2PKS	97	37	11.0	CCSI-R3-2PKS	82	32	14.0
0.25	0.625	0.196	CCZR-R4 (2PKS)	109	46	9.0	CCSI-R4 (2PKS)	83	40	11.0
	0.75	0.2188	CCZR-R4A	174	68	8.5	CCSI-R4A	149	58	10.5
	0.75	0.2812	CCZR-R4A-2PKS	174	68	8.5	CCSI-R4A-2PKS	149	58	10.5
0.375	0.875	0.2188	CCZR-R6	253	104	8.0	CCSI-R6	216	89	10.0
	0.875	0.2812	CCZR-R6-2PKS	253	104	8.0	CCSI-R6-2PKS	216	89	10.0
0.5	1.125	0.25	CCZR-R8	391	183	6.4	CCSI-R8	333	156	8.0
	1.125	0.3125	CCZR-R8-2PKS	391	183	6.4	CCSI-R8-2PKS	333	156	8.0
0.625	1.375	0.2812	CCZR-R10	443	248	5.0	CCSI-R10	377	212	6.2
	1.375	0.3438	CCZR-R10-2PKS	443	248	5.0	CCSI-R10-2PKS	377	212	6.2
0.75	1.625	0.3125	CCZR-R12	586	334	4.2	CCSI-R12	498	289	5.2
	1.625	0.4375	CCZR-R12-2PKS	586	334	4.2	CCSI-R12-2PKS	498	289	5.2
0.875	1.875	0.375	CCZR-R14	810	433	3.6	CCSI-R14	689	370	4.5
	1.875	0.5	CCZR-R14-2PKS	810	433	3.6	CCSI-R14-2PKS	689	370	4.5
1.0	2.0	0.375	CCZR-R16	862	525	3.2	CCSI-R16	733	447	4.0
	2.0	0.5	CCZR-R16-2PKS	862	525	3.2	CCSI-R16-2PKS	733	447	4.0

## The plastic bearing range

We keep a range of plastic bearings in stock including popular metric sizes, thin section types and miniature plastic bearings. The standard metric range is from 3mm bore up to 50mm bore but we also offer a range of imperial plastic bearings from 0.125 inch to 1 inch bore. Some sizes are also offered with a flange on the outer ring. Sizes outside of this range, special sizes or those made from alternative materials, can be supplied to order.



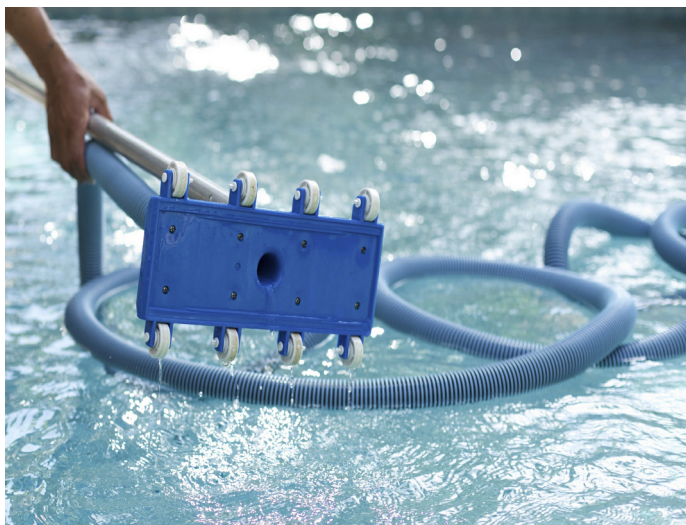
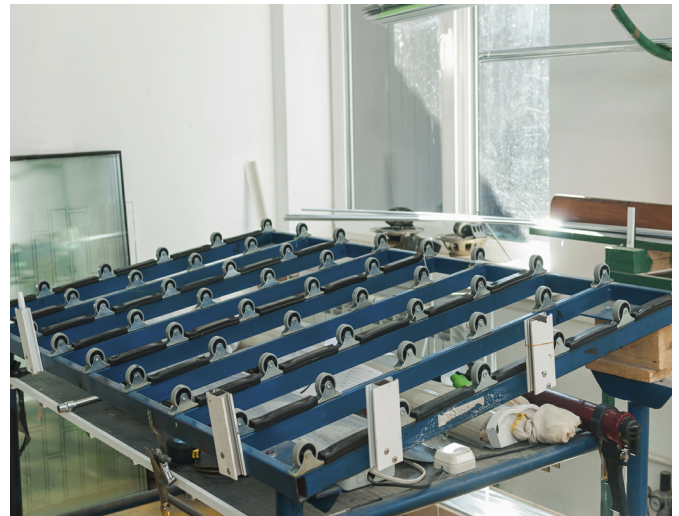
The standard ball material for our plastic bearings is 316 stainless steel or glass. The retainers are made from nylon. We can offer plastic bearings with balls or retainers of different materials to suit your application.

## About plastics

Our plastic bearings are usually made from acetal resin (POM-C). These plastic bearings are non-magnetic and highly resistant to water and many chemicals.

Acetal resin bearings with nylon cages are not suitable for long-term use below -40°C and above 80°C. Where greater corrosion resistance is required or for more extreme temperature applications, alternative materials such as PEEK can be supplied. PEEK will allow the bearings to operate between -70°C and 250°C subject to ball and retainer materials. The load rating for PTFE is lower than the other materials but it has better low temperature performance below -70°C.

Acetal resin has high strength and hardness for a plastic material but is still much softer than steel so the bearings are only suitable for low loads and low speeds. In addition, they are not made to the same close tolerances as steel bearings so are classed as semi-precision. Acetal resin, PEEK, PTFE and many other plastics have low friction coefficients so our plastic bearings do not need to be lubricated.



Acetal resin is affected by some chemicals such as chlorine in swimming pools. Where acetal resin is not sufficiently chemical resistant, PEEK, PTFE or PVDF can be used. Plastic bearings have excellent resistance to seawater so are a good choice for low load, low speed marine applications. They are also used in medical equipment and business machines.

## Applications

Acetal resin has low water absorption making it suitable for use in wet environments. The standard retainer is made from nylon. Nylon can swell after prolonged contact with water so we offer alternative retainer materials where this is likely. Our plastic bearings are suitable for use in food applications where 316 stainless steel balls are often specified so the balls can be detected by a metal detector in the event of failure. Plastic bearings are used in food conveyors and other material handling equipment.

## SMB plastic bearings - metric sizes

Bore	O.D.	Width	316 stainless balls	Glass balls	Max Load (kgf)		Rpm (x1000)
					Dyn	Stat	
3	8	3	AC693-316	AC693-GL	3	2	3.0
	9	3	AC603-316	AC603-GL	4	3	3.0
	10	4	AC623-316	AC623-GL	7	5	3.0
	13	5	AC633-316	AC633-GL	9	7	3.0
4	9	2.5	AC684-316	AC684-GL	4	3	3.0
	11	4	AC694-316	AC694-GL	6	4	3.0
	12	4	AC604-316	AC604-GL	6	4	3.0
	13	5	AC624-316	AC624-GL	7	5	3.0
	16	5	AC634-316	AC634-GL	10	7	3.0
5	11	3.5	AC685-316	AC685-GL	5	3	3.0
	13	4	AC695-316	AC695-GL	7	5	3.0
	14	5	AC605-316	AC605-GL	7	5	3.0
	16	5	AC625-316	AC625-GL	9	7	2.6
	19	6	AC635-316	AC635-GL	12	9	2.6
6	13	3.5	AC686-316	AC686-GL	7	5	2.6
	15	5	AC696-316	AC696-GL	8	6	2.6
	17	6	AC606-316	AC606-GL	9	7	2.6
	19	6	AC626-316	AC626-GL	9	7	2.6
	22	7	AC636-316	AC636-GL	13	10	2.6
7	14	3.5	AC687-316	AC687-GL	7	5	2.6
	17	5	AC697-316	AC697-GL	8	6	2.6
	19	6	AC607-316	AC607-GL	9	7	2.6
	22	7	AC627-316	AC627-GL	12	9	2.4
	26	9	AC637-316	AC637-GL	14	11	2.4
8	16	4	AC688-316	AC688GL	7	5	2.6
	19	6	AC698-316	AC698-GL	8	6	2.6
	22	7	AC608-316	AC608-GL	12	9	2.6
	24	8	AC628-316	AC628-GL	12	9	2.4
	28	9	AC638-316	AC638-GL	15	12	2.4
9	17	4	AC689-316	AC689-GL	7	5	2.6
	20	6	AC699-316	AC699-GL	8	6	2.6
	24	7	AC609-316	AC609-GL	12	9	2.6
	26	8	AC629-316	AC629-GL	14	11	2.4
	30	10	AC639-316	AC639-GL	15	12	2.4
10	19	5	AC6800-316	AC6800-GL	10	8	2.0
	22	6	AC6900-316	AC6900-GL	11	9	2.0
	26	8	AC6000-316	AC6000-GL	14	11	2.0
	30	9	AC6200-316	AC6200-GL	16	13	1.9
	35	11	AC6300-316	AC6300-GL	19	16	1.6
12	21	5	AC6801-316	AC6801-GL	11	8	1.8
	24	6	AC6901-316	AC6901-GL	12	10	1.8
	28	7	AC16001-316	AC16001-GL	16	13	1.8
	28	8	AC6001-316	AC6001-GL	16	13	1.8
	32	10	AC6201-316	AC6201-GL	20	16	1.7
	37	12	AC6301-316	AC6301-GL	23	19	1.5
15	24	5	AC6802-316	AC6802-GL	12	9	1.6
	28	7	AC6902-316	AC6902-GL	14	11	1.6
	32	8	AC16002-316	AC16002-GL	18	15	1.6
	32	9	AC6002-316	AC6002-GL	18	15	1.6
	35	11	AC6202-316	AC6202-GL	23	19	1.5
	42	13	AC6302-316	AC6302-GL	29	24	1.4



## SMB plastic bearings - metric sizes

Bore	O.D.	Width	316 stainless balls	Glass balls	Max Load (kgf)		Rpm (x1000)
					Dyn	Stat	
17	26	5	AC6803-316	AC6803-GL	14	11	1.5
	30	7	AC6903-316	AC6903-GL	15	12	1.5
	35	8	AC16003-316	AC16003-GL	20	16	1.5
	35	10	AC6003-316	AC6003-GL	20	16	1.5
	40	12	AC6203-316	AC6203-GL	24	19	1.4
	47	14	AC6303-316	AC6303-GL	34	27	1.3
20	32	7	AC6804-316	AC6804-GL	16	13	1.2
	37	9	AC6904-316	AC6904-GL	18	14	1.2
	42	8	AC16004-316	AC16004-GL	24	19	1.2
	42	12	AC6004-316	AC6004-GL	24	19	1.2
	47	14	AC6204-316	AC6204-GL	32	26	1.1
	52	15	AC6304-316	AC6304-GL	38	29	1.0
25	37	7	AC6805-316	AC6805-GL	18	15	1.2
	42	9	AC6905-316	AC6905-GL	20	16	1.2
	47	8	AC16005-316	AC16005-GL	29	22	1.2
	47	12	AC6005-316	AC6005-GL	29	22	1.2
	52	15	AC6205-316	AC6205-GL	37	29	1.1
	62	17	AC6305-316	AC6305-GL	43	33	1.0
30	42	7	AC6806-316	AC6806-GL	21	17	1.2
	47	9	AC6906-316	AC6906-GL	23	19	1.2
	55	9	AC16006-316	AC16006-GL	31	26	1.2
	55	13	AC6006-316	AC6006-GL	31	26	1.2
	62	16	AC6206-316	AC6206-GL	39	33	1.1
	72	19	AC6306-316	AC6306-GL	46	35	1.0
35	47	7	AC6807-316	AC6807-GL	24	20	1.1
	55	10	AC6907-316	AC6907-GL	26	22	1.1
	62	14	AC6007-316	AC6007-GL	37	30	1.0
	72	17	AC6207-316	AC6207-GL	43	36	1.0
40	52	7	AC6808-316	AC6808-GL	27	22	1.1
	62	12	AC6908-316	AC6908-GL	29	25	1.1
	68	15	AC6008-316	AC6008-GL	40	33	1.0
	80	18	AC6208-316	AC6208-GL	47	40	1.0
45	58	7	AC6809-316	AC6809-GL	29	34	1.0
	68	12	AC6909-316	AC6909-GL	35	41	1.0
	75	16	AC6009-316	AC6009-GL	42	49	0.9
	85	19	AC6209-316	AC6209-GL	51	59	0.9
50	65	7	AC6810-316	AC6810-GL	31	36	0.9
	72	12	AC6910-316	AC6910-GL	38	44	0.9
	80	16	AC6010-316	AC6010-GL	45	52	0.8
	90	20	AC6210-316	AC6210-GL	55	64	0.8

## SMB plastic bearings - inch sizes

Bore	O.D.	Width	316 stainless balls	Glass balls	Max Load (kgf)		Rpm (x1000)
					Dyn	Stat	
0.125	0.375	0.1562	ACR2-316	ACR2-GL	5	3	3.0
0.1875	0.5	0.1562	ACR3-316	ACR3-GL	7	5	3.0
0.25	0.625	0.196	ACR4-316	ACR4-GL	8	6	2.6
	0.75	0.2188	ACR4A-316	ACR4A-GL	9	7	2.6
0.375	0.875	0.2188	ACR6-316	ACR6-GL	12	9	2.6
0.5	1.125	0.25	ACR8-316	ACR8-GL	16	13	1.8
0.625	1.375	0.2812	ACR10-316	ACR10-GL	18	15	1.6
0.75	1.625	0.3125	ACR12-316	ACR12-GL	24	19	1.2
0.875	1.875	0.375	ACR14-316	ACR14-GL	29	22	1.2
1.0	2.0	0.375	ACR16-316	ACR16-GL	37	29	1.1

## The 316 stainless steel bearing range

The range covers the most commonly used sizes of 316 grade stainless steel radial ball bearings from 3mm bore up to 50mm bore and 1/8 inch bore up to 1 inch bore. Sizes outside of this range can be manufactured on request.

Our 316 grade stainless steel bearings are usually supplied with PE (polyethylene) retainers and seals but for more aggressive chemicals or higher temperatures, PEEK or PTFE can be used instead. 316 stainless steel will also withstand temperature extremes of -200°C to +500°C but a cageless, full complement bearing will be required if the bearing is to be used beyond the temperature limits of PE, PEEK or PTFE.



## About 316 stainless steel

316 stainless steel is often referred to as marine grade stainless steel because of its resistance to seawater and aggressive chemicals. The most common grade of stainless steel for bearings is 440 grade due to its greater strength and load-bearing capabilities but 316 grade steel has far greater resistance to saltwater and many chemicals.

AISI-316 steel is an austenitic steel and cannot be hardened by heat treatment which means it is only suitable for much lower loads and speeds than 440 grade stainless steel. This also makes it more difficult to achieve close tolerances so 316 stainless steel bearings are semi-precision bearings.



## Applications

Due to the greater corrosion resistance of 316 stainless steel bearings, they are often used in low load and low speed applications in the marine industry when used above the waterline or where the bearings can be washed down after temporary submersion in seawater. They can be immersed in seawater for longer periods if there is a regular flow of water over the bearings although the corrosion risk increases when immersed in warm seawater.

The excellent chemical resistance of 316 stainless steel is why these bearings are found in the food processing industry, in bakeries and fish or meat processing plant, where the frequent washing down

of equipment with cleaning chemicals can corrode other materials. This chemical resistance is why 316 stainless steel bearings are used in the manufacturing of inks, bleaches, photographic and other chemicals, the dyeing industry, the textile industry, the pharmaceutical industry and the paper industry. Depending on cage material, 316 stainless steel bearings are suitable for cryogenic applications down to around -200°C and very high temperature applications of over 250°C although with reduced load capacity at temperature extremes.

## SMB 316 stainless bearings - metric sizes

Bore	O.D.	Width	Open	Sealed	Max Load (kgf)		Rpm (x1000)
					Dyn	Stat	
3	10	4	S316-623	S316-623-2PES	8	4	4.2
4	13	5	S316-624	S316-624-2PES	16	8	3.2
5	16	5	S316-625	S316-625-2PES	21	11	2.8
6	17	6	S316-606	S316-606-2PES	27	14	2.7
	19	6	S316-626	S316-626-2PES	28	14	2.4
7	19	6	S316-607	S316-607-2PES	29	15	2.6
	22	7	S316-627	S316-627-2PES	40	22	2.2
8	22	7	S316-608	S316-608-2PES	40	22	2.4
	24	8	S316-628	S316-628-2PES	41	23	2.1
9	24	7	S316-609	S316-609-2PES	41	23	2.3
	26	8	S316-629	S316-629-2PES	56	32	2.0
10	26	8	S316-6000	S316-6000-2PES	56	32	2.2
	30	9	S316-6200	S316-6200-2PES	62	39	1.7
	35	11	S316-6300	S316-6300-2PES	99	56	1.6
12	28	8	S316-6001	S316-6001-2PES	62	39	1.9
	32	10	S316-6201	S316-6201-2PES	83	49	1.6
	37	12	S316-6301	S316-6301-2PES	119	68	1.5
15	32	9	S316-6002	S316-6002-2PES	68	46	1.6
	35	11	S316-6202	S316-6202-2PES	93	61	1.4
	42	13	S316-6302	S316-6302-2PES	140	89	1.4
17	35	10	S316-6003	S316-6003-2PES	73	54	1.4
	40	12	S316-6203	S316-6203-2PES	117	79	1.3
	47	14	S316-6303	S316-6303-2PES	166	109	1.1
20	42	12	S316-6004	S316-6004-2PES	115	83	1.3
	47	14	S316-6204	S316-6204-2PES	157	109	1.1
	52	15	S316-6304	S316-6304-2PES	194	129	1.0
25	47	12	S316-6005	S316-6005-2PES	123	96	1.1
	52	15	S316-6205	S316-6205-2PES	171	128	0.9
	62	17	S316-6305	S316-6305-2PES	252	185	0.8
30	55	13	S316-6006	S316-6006-2PES	162	135	0.9
	62	16	S316-6206	S316-6206-2PES	238	184	0.8
	72	19	S316-6306	S316-6306-2PES	326	247	0.7
35	62	14	S316-6007	S316-6007-2PES	195	168	0.8
	72	17	S316-6207	S316-6207-2PES	314	252	0.7
	80	21	S316-6307	S316-6307-2PES	401	309	0.6
40	68	15	S316-6008	S316-6008-2PES	205	188	0.7
	80	18	S316-6208	S316-6208-2PES	356	299	0.6
	90	23	S316-6308	S316-6308-2PES	488	384	0.5
45	75	16	S316-6009	S316-6009-2PES	218	197	0.6
	85	19	S316-6209	S316-6209-2PES	333	261	0.5
	100	25	S316-6309	S316-6309-2PES	587	472	0.4
50	80	16	S316-6010	S316-6010-2PES	223	212	0.6
	90	20	S316-6210	S316-6210-2PES	357	298	0.5
	110	27	S316-6310	S316-6310-2PES	744	459	0.4



## SMB 316 stainless bearings - inch sizes

Bore	O.D.	Width	Open	Sealed	Max Load (kgf)		Rpm (x1000)
					Dyn	Stat	
0.125	0.375	0.1562	S316-R2	S316-R2-2PES	8	4	4.2
0.1875	0.5	0.1562	S316-R3		16	8	3.2
	0.5	0.196		S316-R3-2PES	16	8	3.2
0.25	0.625	0.196	S316-R4	S316-R4-2PES	27	14	2.7
	0.75	0.2188	S316-R4A		28	14	2.4
	0.75	0.2812		S316-R4A-2PES	28	14	2.4
0.375	0.875	0.2188	S316-R6		40	23	1.9
	0.875	0.2812		S316-R6-2PES	40	23	1.9
0.5	1.125	0.25	S316-R8		61	38	1.5
	1.125	0.3125		S316-R8-2PES	61	38	1.5
0.625	1.375	0.2812	S316-R10		72	39	1.2
	1.375	0.3438		S316-R10-2PES	72	39	1.2
0.75	1.625	0.3125	S316-R12		95	71	1.0
	1.625	0.4375		S316-R12-2PES	95	71	1.0
0.875	1.875	0.375	S316-R14		130	92	0.9
	1.875	0.5		S316-R14-2PES	130	92	0.9
1.0	2.0	0.375	S316-R16		138	112	0.8
	2.0	0.5		S316-R16-2PES	138	112	0.8

# Advantages and disadvantages of SMB corrosion resistant and non-magnetic materials

## CERAMIC

### Zirconia (prefix "CCZR")

- ☺ Very good corrosion resistance to water, salt water, acids and alkalis
- ☺ Good extreme temperature performance from -190°C up to 400°C
- ☺ Non-magnetic and electrically insulating
- ☺ Higher fracture toughness than other ceramics so better for small shock loads
- ☺ Expansion similar to steel so not a problem to use with steel shaft at high temperature
- ☹ May degrade in the presence of hot water or steam
- ☹ Lower speed and load than steel bearings
- ☹ Not suitable for low noise applications

### Silicon Nitride (prefix "CCSI")

- ☺ Very good corrosion resistance to water, salt water, acids and alkalis
- ☺ Good extreme temperature performance from -210°C up to 800°C
- ☺ Non-magnetic and electrically insulating
- ☺ Much lighter than steel or Zirconia
- ☹ Very low thermal expansion so consider shaft/housing fits in high temperature applications
- ☹ Lower speed and load than steel bearings
- ☹ Not suitable for low noise applications
- ☹ Not recommended for shock loads

Full ceramic bearings are much more expensive than steel bearings so are normally used in environments that are too hostile for steel bearings. They have good to excellent corrosion resistance depending on the material and the chemicals encountered and are normally supplied without lubrication.

They are non-magnetic and electrically insulating. Full ceramic bearings may have PTFE, PEEK or 316 stainless steel retainers or be supplied as full complement type for very high temperatures. As ceramics are more brittle than steel, full ceramic bearings, particularly silicon nitride, are not recommended where heavy shock loads are likely due to the risk of cracking. Full ceramic bearings will accept approximately 65% to 75% of the load of a steel bearing. The limiting speed of a full ceramic bearing is only about 25% of the speed of the same steel bearing due to the inferior roundness of the rings and the greater risk of sudden failure due to the lower flexural (bend) strength of ceramics compared to steel.

Using silicon nitride bearings with steel shafts or housings in high temperature applications can cause fitting problems due to the large difference in thermal expansion. Bearing damage can occur if allowance is not made for the the greater expansion of a steel shaft in a silicon nitride inner ring at high temperature. This is much less of a problem with zirconia as the coefficient of expansion is very similar to steel.

## PLASTIC

### Acetal resin/POM-C (prefix "AC")

- ☺ Excellent corrosion resistance to water, salt water and weak chemicals
- ☺ Non magnetic and electrically insulating
- ☹ Maximum temperature 110°C
- ☹ Semi-precision and suitable for very low load and low speed only

### PEEK (prefix "PK")

- ☺ Excellent corrosion resistance to water, salt water and most chemicals
- ☺ Good high temperature performance
- ☺ Non-magnetic and electrically insulating
- ☺ Wide temperature range of -70/+250°C
- ☹ Semi-precision but suitable for higher load and speed than other plastics

### **PTFE (prefix "PT")**

- ☺ Excellent corrosion resistance to water, salt water and most chemicals
- ☺ Good high temperature performance
- ☺ Non-magnetic and electrically insulating
- ☺ Very wide temperature range of -190/+250°C
- ☹ Semi-precision and suitable for lower loads and speeds than the other plastics

### **PVDF (prefix "PV")**

- ☺ Excellent corrosion resistance to water, salt water and most chemicals
- ☺ Non magnetic and electrically insulating
- ☺ Wide temperature range of -50/+150°C
- ☹ Semi-precision and suitable for low load and low speed only

Our standard plastic corrosion resistant bearings have acetal resin (POM-C) rings, nylon (PA66) cages and 316 stainless steel or glass balls. They are also suitable for food applications. They are affected by certain chemicals and PA66 cages will absorb water after long exposure causing loss of tensile strength. A number of alternative materials for rings, cages and balls, such as PEEK, PTFE or PVDF, are available to suit a variety of applications.

All plastic bearings are semi precision and like 316 stainless steel bearings, should not be used for precision applications. Due to the softer material, they are not suitable for anything other than low loads and low speeds although PEEK has better load bearing capabilities.

Corrosion resistance varies between the materials with PTFE and PEEK giving the best all round chemical resistance. Care should be taken to choose the correct material when using plastic bearings at elevated temperatures. Acetal bearings should not be used in temperatures of greater than 110°C and PVDF should only be used up to 150°C but other materials have good high temperature resistance such as PTFE or PEEK which are both suitable for temperatures of up to 250°C.

Generally plastic bearings are not recommended for vacuum applications apart from PEEK which has very good outgassing characteristics.

## **AISI-316 STAINLESS STEEL**

- ☺ Excellent corrosion resistance to water, salt water and chemicals
- ☺ Good for temperatures up to 500°C as full complement type
- ☺ Suitable for cryogenic applications down to -250°C
- ☺ Non-magnetic and electrically insulating
- ☹ More expensive than 440 grade due to low production quantities.
- ☹ Semi-precision and suitable for very low load and low speed only

316 grade stainless steel is used instead of 440 grade steel for greater corrosion resistance to seawater, salt spray and some acids/alkalis. 316 stainless steel bearings are suitable for very high temperature applications as the steel is useful in temperatures of up to 500°C. They can also be used in cryogenic applications as the steel retains its toughness down to -250°C. As 316 grade stainless steel cannot be hardened by heat treatment, these bearings will only support low loads and low speeds. The load and speed ratings for 316 grade bearings are significantly lower than those for the 440 grade equivalents.

AISI-316 stainless steel exhibits good corrosion resistance in marine environments when used above the waterline or when temporarily submerged if washed down with clean water after use. It is less suitable when permanently submerged unless there is a regular flow of water over the bearing. This is because 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. no flow of water or under mud/silt) the steel may be prone to pitting or crevice corrosion. 316 grade stainless steel is less resistant to warm seawater. Pitting corrosion is a risk when immersed in seawater over 30°C whereas crevice corrosion can occur in as little as 10-15°C but it is still much more resistant to corrosion than 440 grade steel.

Bearings made from 316 grade stainless steel can be used at high temperatures provided a suitable cage material is used or the bearings are full complement. Polyethylene, PEEK or PTFE are often used for the retainers.

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