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## A Global Leader in Semiconductor Bearings



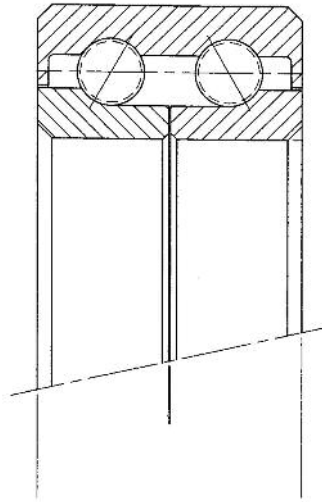
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# Semiconductor Equipment Applications

## Vacuum Operation

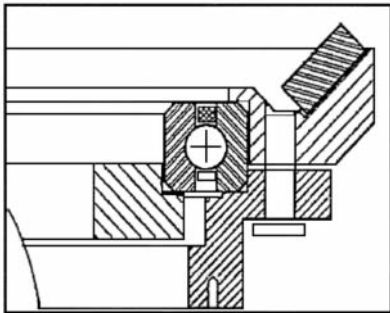
Bearing requirements include minimal radial runout, low torque, corrosion resistance, combined load capabilities, and vacuum operation. Specially designed duplex stainless steel angular contact thin section ball bearings provide the solutions required.



- 440C stainless steel spacer balls
- $\text{Si}_3\text{N}_4$  load balls
- Integral shields
- Low-out gassing
- Lubricant

## Next-Level Bearing Assembly

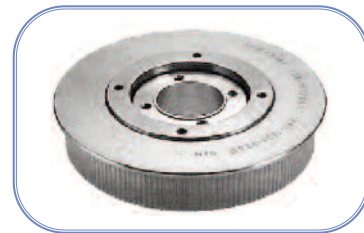
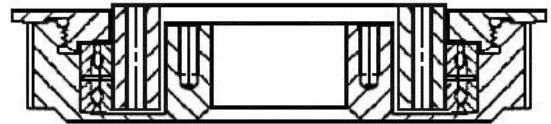
Incorporates bearing and housing components into bolt-on unit.



- 4-point contact ball bearing
- Al. geared ring
- Al. inner clasp ring
- Steel magnet ring

## Robot Wrist Assembly

Two angular contact thin section ball bearings mounted in aluminum housings to specified torque.



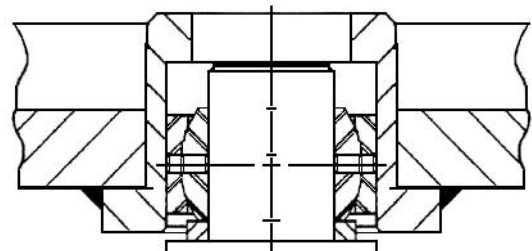
## Thin Section Ball Bearing

To provide necessary stiffness with a more compact, lighter weight machine design, use the 4-point contact thin section ball bearing.



## Hinge Pin

Stainless steel spherical plain bearing for misalignment and shaft support.



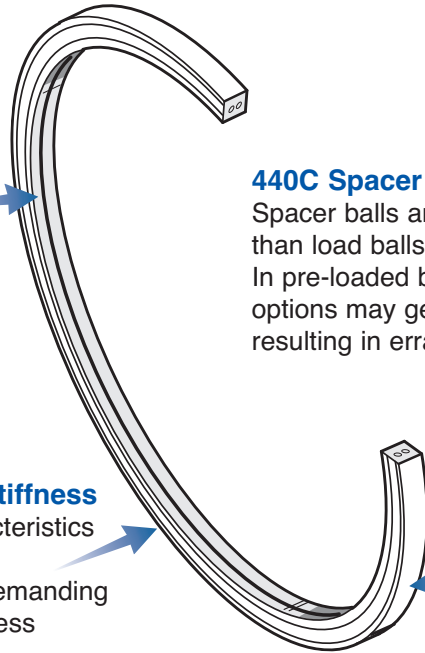
# General Features and Technical Specifications

## Low Torque Seals or Non-contacting Shields

Engineering assistance provided for optimum performance when evaluating application requirements.

### 440C Ring Material

Eliminates thin dense chrome plating while providing corrosion resistance protection and maintaining the precision, tolerance, and finish.

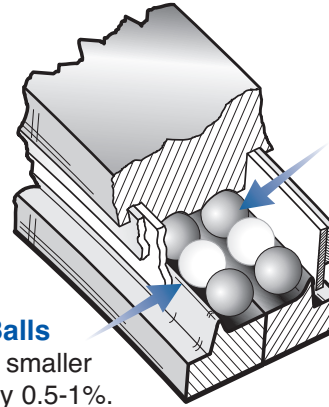


### Low Torque/High Stiffness

Internal design characteristics result in an optimized bearing solution for demanding low torque, high stiffness applications.

### 440C Spacer Balls

Spacer balls are smaller than load balls by 0.5-1%. In pre-loaded bearings, other separator options may generate particle shedding – resulting in erratic torque fluctuations.



### Silicon Nitride Load Balls ( $\text{Si}_3\text{N}_4$ )

$\text{Si}_3\text{N}_4$  balls promote a much lower coefficient of friction versus steel balls, therefore providing enhanced survivability under marginal lubrication.  $\text{Si}_3\text{N}_4$  balls also have a higher modulus of elasticity – 50% higher than steel balls to provide higher stiffness.

### SuperDuplex™ Design

A one-piece ring on a double row set design offers improved ring stiffness and reduced distortion, improved face-to-face runout, and parallelism. As a result, the bearing offers superior accuracy and performance reliability, including improved alignment and ease of next level assemblies.

## Integrated Assemblies



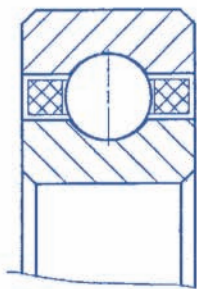
- Bearing fit-ups are factory-optimized and pre-loaded for repeatable stiffness and torque.
- Integrated assemblies are simply bolted in place, eliminating individual bearing fit-up time and assembly errors in the field.
- Most integrated assemblies are integrally shielded to prevent contamination and ensure long bearing life.
- Superior performance compared to conventional approach to bearing assemblies.
- Lower total cost of ownership.

More than bearings...

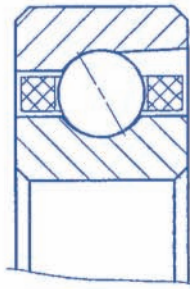
high performance.

# RBC Thin Section Ball Bearing Selection

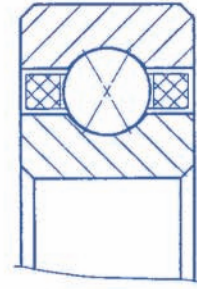
Bearing Type	Ball Contact	LOAD CONDITION				
		Radial	Axial	Moment	Reversing Axial	Combined Radial, Axial, & Moment
C	Radial	Good	Fair	Poor	Fair	Poor
A	Angular	Good	Very Good	Do Not Use	Do Not Use	Do Not Use
X	4-Point	Fair	Good	Good	Good	Fair
B	Double Angular	Very Good	Very Good	Very Good	Very Good	Good
F	Double Angular	Very Good	Very Good	Very Good	Very Good	Good
T	Double Angular	Excellent	Excellent	Do Not Use	Do Not Use	Do Not Use
M	Double Angular	Excellent	Excellent	Excellent	Excellent	Excellent
W	Double Angular	Excellent	Excellent	Excellent	Excellent	Excellent



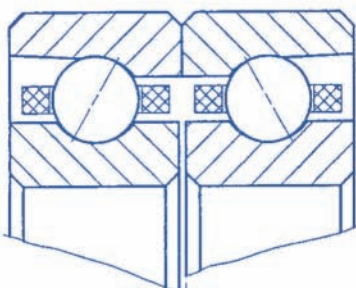
**C-Type**  
Radial Contact



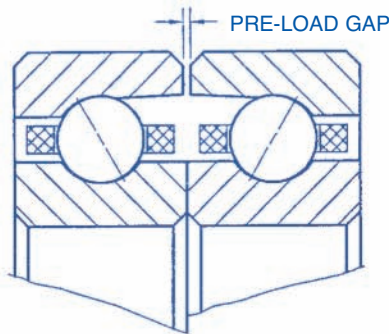
**A-Type**  
Angular Contact



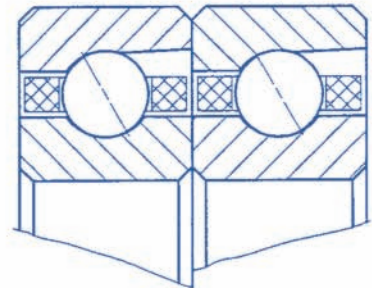
**X-Type**  
4-Point Contact



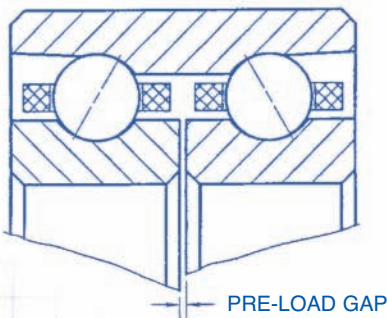
**B-Type**  
Duplex Back-to-Back (DB)



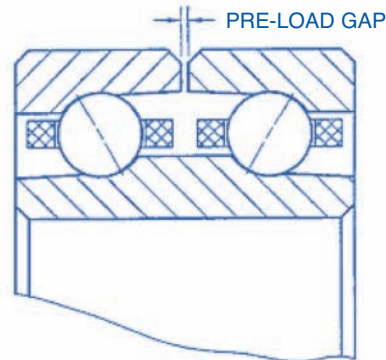
**F-Type**  
Duplex Face-to-Face (DF)



**T-Type**  
Duplex Tandem (DT)



**M-Type**  
SuperDuplex™ Back-to-Back



**W-Type**  
SuperDuplex™ Face-to-Face

# RBC Thin Section Ball Bearings Part Number Designation

<b>EXAMPLE</b>	<b>K</b>	<b>A</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>X</b>	<b>P</b>	<b>0</b>	<b>M*</b>	<b>RBC</b>
<b>NOMENCLATURE</b>	<b>Material</b>	<b>Series</b>	<b>Size</b>			<b>Type</b>	<b>Separator</b>	<b>Precision</b>	<b>Radial Play</b>	
<b>POSITION</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9**</b>	

Position 1 - Material		
	Rings, Balls	Seals, Shields, Coating
<b>J</b>	52100 Bearing steel	Two seals - molded rubber, steel reinforced
<b>K</b>	52100 Bearing steel	No seals or shields
<b>M</b>	M-50 Tool shield	No seals or shields
<b>N</b>	52100 Bearing steel	Thin dense chrome plating
<b>S</b>	440C Stainless steel	No seals or shields
<b>Z</b>	Other	

Positions 3, 4, 5 - Size
Bore size (inches) multiplied by 10

Position 8 - RBC Precision Class	
Class	Description
<b>0</b>	ABEC 1F
<b>3</b>	ABEC 3F
<b>4</b>	ABEC 5F
<b>6</b>	ABEC 7F
Reference: ANSI/ABMA Std 26.2	

Position 2 - Series			
Series	Radial Thickness	Width	
<b>AA</b>	0.187	x	0.187
<b>A</b>	0.250	x	0.250
<b>B</b>	0.312	x	0.312
<b>C</b>	0.375	x	0.375
<b>D</b>	0.500	x	0.500
<b>F</b>	0.750	x	0.750
<b>G</b>	1.000	x	1.000
<b>U</b>	0.375	x	0.500

Position 6 - Type	
Type	Description
<b>A</b>	Angular contact single bearing
<b>B</b>	Back-to-back angular contact duplex pair
<b>C</b>	Radial contact
<b>F</b>	Face-to-face angular contact duplex pair
<b>M</b>	SuperDuplex™ back-to-back
<b>T</b>	Tandem angular contact duplex pair
<b>W</b>	SuperDuplex™ face-to-face
<b>X</b>	4-point contact

Position 9 - Radial Clearance (G) Radial or Axial Pre-load (P)		
Code		
<b>A</b>	.0000 to .0005	C
<b>B</b>	.0000 to .0010	C
<b>C</b>	.0005 to .0010	C
<b>D</b>	.0005 to .0015	C
<b>E</b>	.0010 to .0020	C
<b>F</b>	.0015 to .0025	C
<b>G</b>	.0020 to .0030	C
<b>H</b>	.0030 to .0040	C
<b>I</b>	.0040 to .0050	C
<b>J</b>	.0050 to .0060	C
<b>K</b>	.0000 to .0005	P
<b>L</b>	.0000 to .0010	P
<b>M</b>	.0005 to .0010	P
<b>N</b>	.0005 to .0015	P
<b>P</b>	.0010 to .0020	P
<b>R</b>	.0015 to .0025	P
<b>S</b>	.0020 to .0030	P
<b>T</b>	.0030 to .0040	P
<b>U</b>	.0040 to .0050	P
<b>Z</b>	Other	

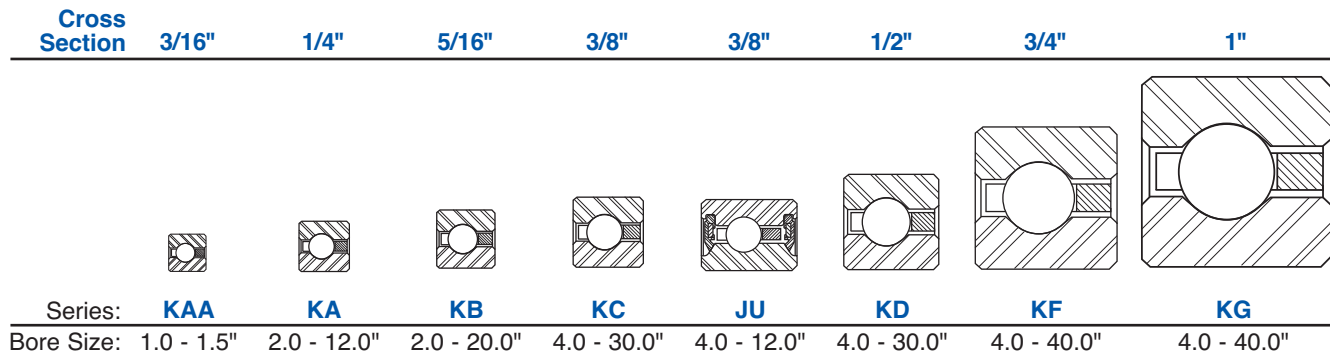
Position 7 - Separator		
Type	Design	Material
<b>D</b>	Snap-over cage	Phenolic laminate
<b>F</b>	None (full complement)	N/A
<b>G</b>	Circular pocket	Nylon
<b>H</b>	Circular pocket	Phenolic laminate
<b>L</b>	Snap-over cage	Nylon
<b>P</b>	Snap-over cage	Brass or composite
<b>R</b>	Circular pocket	Brass or composite
<b>T</b>	Snap-over cage	Stainless steel
<b>U</b>	Circular pocket	Stainless steel
<b>Z</b>	Other (toroids, spacer balls, etc.)	As specified

Note: Radially and axially pre-loaded bearings meet bore and O.D. tolerances prior to pre-load.

\*The alphanumeric identification system is used under license.

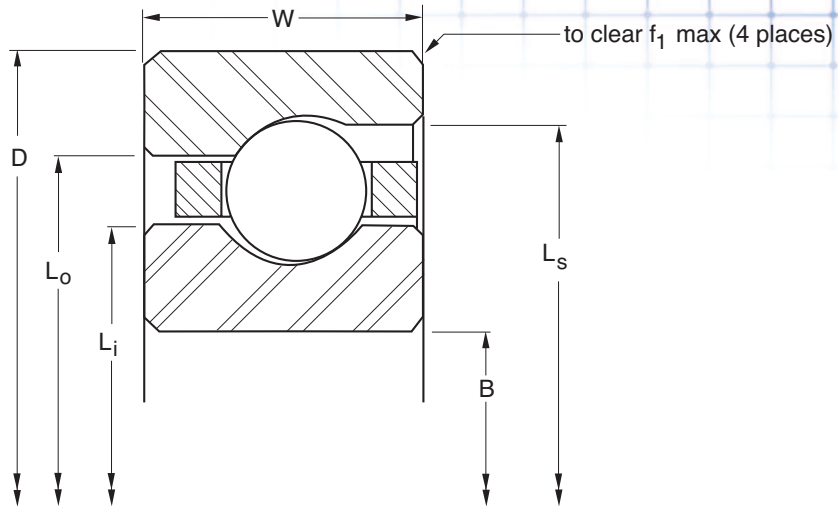
# RBC Thin Section Ball Bearings Specifications

Sample selection of bearing sizes. For full catalog, visit [www.rbcbearings.com](http://www.rbcbearings.com).



PART NUMBER*	B Bore		D Outside Diameter		W Width		Land Diameter						f <sub>1</sub> Housing Fillet		Ball Diameter
	in.	mm	in.	mm	in.	mm	L <sub>1</sub> - Inner Ring		L <sub>o</sub> - Outer Ring		L <sub>s</sub> - Counter		in.	mm	in.
							in.	mm	in.	mm	in.	mm			
KAA10CL0*RBC	1.0000	25.400	1.3750	34.925	0.1875	4.763	1.141	28.98	1.234	31.34	N/A	N/A	0.015	0.38	3/32
KAA15CL0*RBC	1.5000	38.100	1.8750	47.625	0.1875	4.763	1.641	41.68	1.734	44.04	N/A	N/A	0.015	0.38	3/32
KA020CP0*RBC	2.0000	50.800	2.5000	63.500	0.2500	6.350	2.188	55.58	2.313	58.75	N/A	N/A	0.025	0.64	1/8
KA030CP0*RBC	3.0000	76.200	3.5000	88.900	0.2500	6.350	3.188	80.98	3.313	84.15	N/A	N/A	0.025	0.64	1/8
KA060CP0*RBC	6.0000	152.400	6.5000	165.100	0.2500	6.350	6.188	157.18	6.313	160.35	N/A	N/A	0.025	0.64	1/8
KA080CP0*RBC	8.0000	203.200	8.5000	215.900	0.2500	6.350	8.188	207.98	8.313	211.15	N/A	N/A	0.025	0.64	1/8
KA090CP0*RBC	9.0000	228.600	9.5000	241.300	0.2500	6.350	9.188	233.38	9.313	236.55	N/A	N/A	0.025	0.64	1/8
KAA10XL0*RBC	1.0000	25.400	1.3750	34.925	0.1875	4.763	1.141	28.98	1.234	31.34	N/A	N/A	0.015	0.38	3/32
KAA15XL0*RBC	1.5000	38.100	1.8750	47.625	0.1875	4.763	1.641	41.68	1.734	44.04	N/A	N/A	0.015	0.38	3/32
KA020XP0*RBC	2.0000	50.800	2.5000	63.500	0.2500	6.350	2.188	55.58	2.313	58.75	N/A	N/A	0.025	0.64	1/8
KA030XP0*RBC	3.0000	76.200	3.5000	88.900	0.2500	6.350	3.188	80.98	3.313	84.15	N/A	N/A	0.025	0.64	1/8
KA060XP0*RBC	6.0000	152.400	6.5000	165.100	0.2500	6.350	6.188	157.18	6.313	160.35	N/A	N/A	0.025	0.64	1/8
KA080XP0*RBC	8.0000	203.200	8.5000	215.900	0.2500	6.350	8.188	207.98	8.313	211.15	N/A	N/A	0.025	0.64	1/8
KA090XP0*RBC	9.0000	228.600	9.5000	241.300	0.2500	6.350	9.188	233.38	9.313	236.55	N/A	N/A	0.025	0.64	1/8
KAA10AG0*RBC	1.0000	25.400	1.3750	34.925	0.1875	4.763	1.141	28.98	1.234	31.34	1.235	31.37	0.015	0.38	3/32
KAA15AG0*RBC	1.5000	38.100	1.8750	47.625	0.1875	4.763	1.641	41.68	1.734	44.04	1.735	44.07	0.015	0.38	3/32
KA020AR0*RBC	2.0000	50.800	2.5000	63.500	0.2500	6.350	2.188	55.58	2.313	58.75	2.375	60.33	0.025	0.64	1/8
KA030AR0*RBC	3.0000	76.200	3.5000	88.900	0.2500	6.350	3.188	80.98	3.313	84.15	3.375	85.73	0.025	0.64	1/8
KA060AR0*RBC	6.0000	152.400	6.5000	165.100	0.2500	6.350	6.188	157.18	6.313	160.35	6.375	161.93	0.025	0.64	1/8
KA080AR0*RBC	8.0000	203.200	8.5000	215.900	0.2500	6.350	8.188	207.98	8.313	211.15	8.375	212.73	0.025	0.64	1/8
KA090AR0*RBC	9.0000	228.600	9.5000	241.300	0.2500	6.350	9.188	233.38	9.313	236.55	9.375	238.13	0.025	0.64	1/8

\* The alphanumeric identification system is used under license.



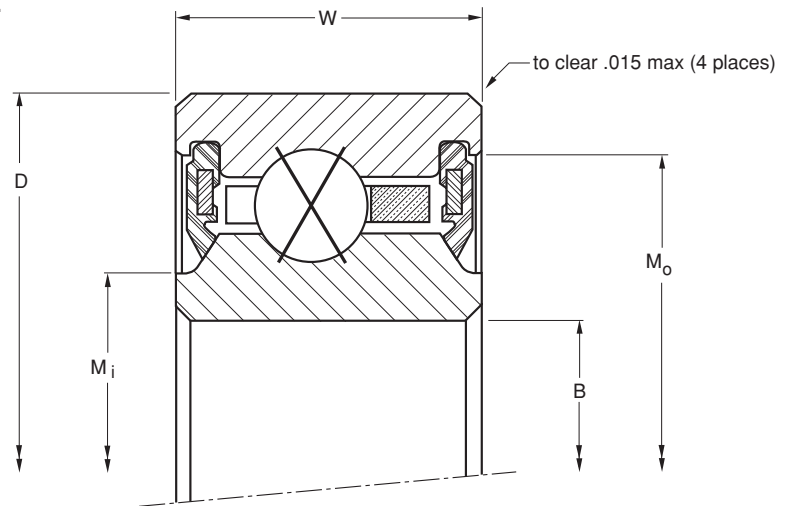
Ball Quantity	Approx. Weight		LOAD RATINGS												Limiting Speed (RPM)
			Radial*				Thrust				Moment				
			Static		Dynamic		Static		Dynamic		Static		Dynamic		
			lbs.	kg	lbf	N	lbf	N	lbf	N	lbf	N	lbf - in	Nm	
21	0.03	0.014	290	1,290	300	1,330	480	2,140	880	3,910	110	10	210	25	16,840
29	0.04	0.018	400	1,780	350	1,560	650	2,890	1,020	4,540	220	25	350	40	11,850
27	0.10	0.045	680	3,020	560	2,490	1,080	4,800	1,640	7,300	490	55	740	80	8,890
39	0.15	0.068	990	4,400	650	2,890	1,530	6,810	1,880	8,360	990	110	1,220	140	6,150
75	0.28	0.127	1,900	8,450	830	3,690	2,870	12,770	2,420	10,760	3,590	410	3,020	340	3,200
99	0.38	0.172	2,500	11,120	910	4,050	3,770	16,770	2,640	11,740	6,220	700	4,350	490	2,420
111	0.44	0.200	2,810	12,500	940	4,180	4,210	18,730	2,730	12,140	7,800	880	5,050	570	2,160
21	0.03	0.014	290	1,290	270	1,200	730	3,250	680	3,020	170	20	160	20	10,110
29	0.04	0.018	400	1,780	310	1,380	1,000	4,450	770	3,430	340	40	260	30	7,110
27	0.10	0.045	680	3,020	514	2,290	1,710	7,610	1,230	5,470	770	90	550	60	5,330
39	0.15	0.068	990	4,400	643	2,860	2,470	10,990	1,410	6,270	1,600	180	920	100	3,690
75	0.28	0.127	1,900	8,450	955	4,250	4,740	21,080	1,780	7,920	5,930	670	2,240	250	1,920
99	0.38	0.172	2,500	11,120	1,131	5,030	6,260	27,850	1,970	8,760	10,330	1,170	3,499	400	1,450
111	0.44	0.200	2,810	12,500	1,212	5,390	7,020	31,230	2,040	9,070	12,990	1,470	4,204	470	1,300
28	0.03	0.014	340	1,510	330	1,470	970	4,310	960	4,270	N/A	N/A	N/A	N/A	16,840
40	0.04	0.018	480	2,140	380	1,690	1,380	6,140	1,100	4,890	N/A	N/A	N/A	N/A	11,850
36	0.10	0.045	790	3,510	6,600	29,360	2,280	10,140	1,730	7,700	N/A	N/A	N/A	N/A	8,890
52	0.15	0.068	1,140	5,070	680	3,020	3,290	14,630	1,980	8,810	N/A	N/A	N/A	N/A	6,150
100	0.28	0.127	2,190	9,740	860	3,830	6,320	28,110	2,500	11,120	N/A	N/A	N/A	N/A	3,200
132	0.38	0.172	2,890	12,860	960	4,270	8,350	37,140	2,770	12,320	N/A	N/A	N/A	N/A	2,420
148	0.44	0.200	3,240	14,410	990	4,400	9,360	41,640	2,860	12,720	N/A	N/A	N/A	N/A	2,160

\* Radial load rating is two times the value per row ideally if both rows share load equally.

# Sealed 4-Point Contact, X-Type

Many molded seals used in bearings are made out of nitrile (molded rubber seal per MIL-R6855). The material has a relatively high coefficient of friction. In order to meet low torque bearing requirements, seal fit-up during installation must be adjusted to minimize contact pressure on the sealing surfaces - reducing torque by reducing sealing effectiveness. The inherent variability in the seal molding process can further aggravate these issues. Over time, torque fluctuations are nearly inevitable, since seals may reset or the amount of lube between the seal and the sealing surface may change.

Based on these performance characteristics, molded seals are often marginal and unreliable solutions for torque sensitive applications.



PART NUMBER*	B Bore		D Outside Diameter		W Width		Mi		Mo		Ball Diameter	Ball Quantity
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm		
JU040XP0*RBC	4.0000	101.600	4.7500	120.650	0.5000	12.700	4.155	105.54	4.550	115.57	3/16	35
JU042XP0*RBC	4.2500	107.950	5.0000	127.000	0.5000	12.700	4.405	111.89	4.800	121.92	3/16	37
JU045XP0*RBC	4.5000	114.300	5.2500	133.350	0.5000	12.700	4.655	118.24	5.050	128.27	3/16	39
JU047XP0*RBC	4.7500	120.650	5.5000	139.700	0.5000	12.700	4.905	124.59	5.300	134.62	3/16	41
JU050XP0*RBC	5.0000	127.000	5.7500	146.050	0.5000	12.700	5.155	130.94	5.550	140.97	3/16	43
JU055XP0*RBC	5.5000	139.700	6.2500	158.750	0.5000	12.700	5.655	143.64	6.050	153.67	3/16	47
JU060XP0*RBC	6.0000	152.400	6.7500	171.450	0.5000	12.700	6.155	156.34	6.550	166.37	3/16	51
JU065XP0*RBC	6.5000	165.100	7.2500	184.150	0.5000	12.700	6.655	169.04	7.050	179.07	3/16	55
JU070XP0*RBC	7.0000	177.800	7.7500	196.850	0.5000	12.700	7.155	181.74	7.550	191.77	3/16	59
JU075XP0*RBC	7.5000	190.500	8.2500	209.550	0.5000	12.700	7.655	194.44	8.050	204.47	3/16	63
JU080XP0*RBC	8.0000	203.200	8.7500	222.250	0.5000	12.700	8.155	207.14	8.550	217.17	3/16	67
JU090XP0*RBC	9.0000	228.600	9.7500	247.650	0.5000	12.700	9.155	232.54	9.550	242.57	3/16	75
JU100XP0*RBC	10.0000	254.000	10.7500	273.050	0.5000	12.700	10.155	257.94	10.550	267.97	3/16	83
JU110XP0*RBC	11.0000	279.400	11.7500	298.450	0.5000	12.700	11.155	283.34	11.550	293.37	3/16	91
JU120XP0*RBC	12.0000	304.800	12.7500	323.850	0.5000	12.700	12.155	308.74	12.550	318.77	3/16	99

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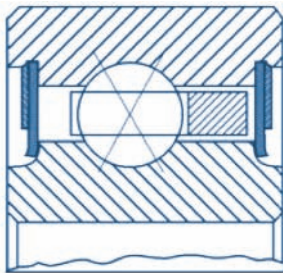


# Elastomer Molded Seals vs. PTFE/300SS Seals vs. Shields

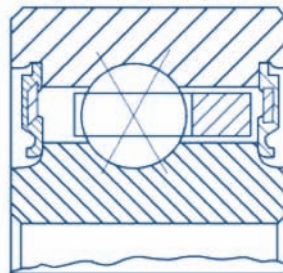
RBC's solution is a combination seal-shield design. The seal is made from either pure PTFE Teflon® or glass fiber reinforced PTFE Armalon®. PTFE is chemically inert, has a very low coefficient of friction (inherent lubricity), and provides the widest operating temperature range of any sealing material. The seal is held in place and shielded with a stainless steel (300 series) flat ring. The seal drag torque in this design is minimal, predictable, and consistent over time.

RBC invariably recommends this design for all low torque or torque sensitive applications that require sealing. RBC can readily retrofit problematic molded seal designs with a PTFE/300SS optimized solution.

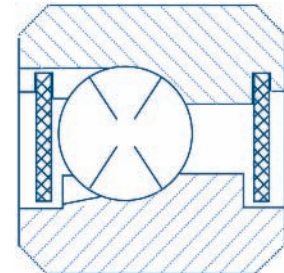
For versions that cannot allow a seal, we offer a shield in its place.



Typical PTFE/300SS Design



Typical Elastomer Molded Design



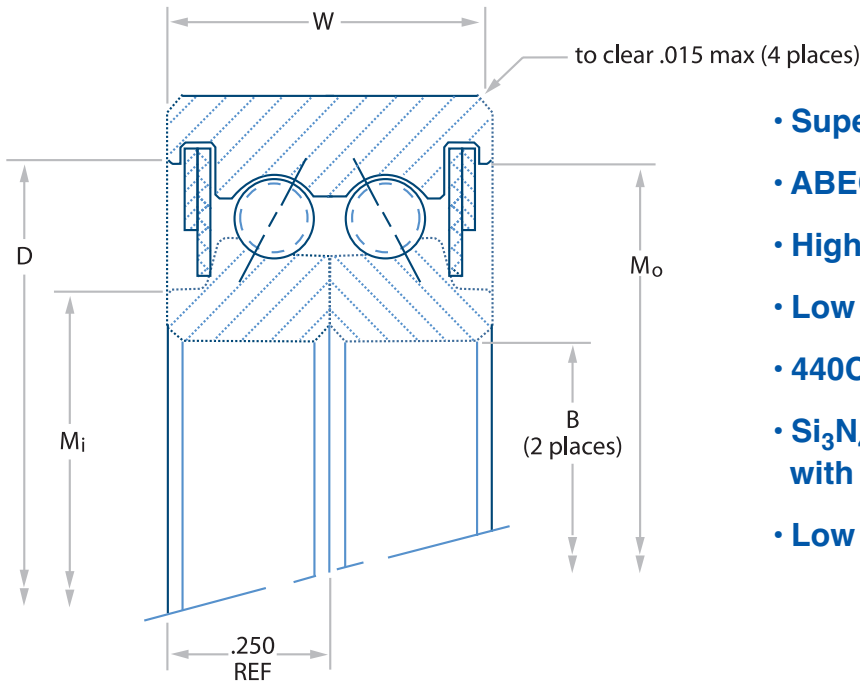
Separable Shields

Teflon® is a registered trademark of Dupont.  
 Armalon® is a registered trademark of Indaco®.

	Approx. Weight		LOAD RATINGS												Limiting Speed (RPM)
			Radial*				Thrust				Moment				
			Static		Dynamic		Static		Dynamic		Static		Dynamic		
			lbs.	kg	lbf	N	lbf	N	lbf	N	lbf - in	Nm	lbf - in	Nm	
0.55	0.249	2,100	9,340	1,417	6,300	5,260	23,400	2,810	12,500	4,600	520	2,460	280	2,280	
0.58	0.263	2,220	9,880	1,464	6,510	5,560	24,730	2,870	12,770	5,140	580	2,650	300	2,160	
0.61	0.277	2,340	10,410	1,510	6,720	5,860	26,070	2,920	12,990	5,710	650	2,850	320	2,050	
0.65	0.295	2,460	10,940	1,556	6,920	6,160	27,400	2,970	13,210	6,320	710	3,040	340	1,950	
0.68	0.308	2,590	11,520	1,600	7,120	6,460	28,740	3,040	13,520	6,950	790	3,270	370	1,860	
0.74	0.336	2,830	12,590	1,687	7,500	7,060	31,400	3,120	13,880	8,300	940	3,717	420	1,700	
0.81	0.367	3,070	13,660	1,770	7,870	7,660	34,070	3,220	14,320	9,770	1,100	4,234	480	1,570	
0.87	0.395	3,310	14,720	1,851	8,230	8,270	36,790	3,300	14,680	11,370	1,280	4,775	540	1,460	
0.93	0.422	3,550	15,790	1,931	8,590	8,870	39,460	3,420	15,210	13,080	1,480	5,341	600	1,360	
0.99	0.449	3,790	16,860	2,007	8,930	9,470	42,120	3,480	15,480	14,910	1,680	5,930	670	1,270	
1.06	0.481	4,030	17,930	2,082	9,260	10,070	44,790	3,560	15,840	16,870	1,910	6,542	740	1,190	
1.18	0.535	4,510	20,060	2,226	9,900	11,270	50,130	3,690	16,410	21,130	2,390	7,830	880	1,070	
1.31	0.594	4,990	22,200	2,364	10,520	12,470	55,470	3,930	17,480	25,880	2,920	9,201	1,040	970	
1.43	0.649	5,470	24,330	2,496	11,100	13,680	60,850	4,180	18,590	31,110	3,510	10,651	1,200	880	
1.56	0.708	5,950	26,470	2,622	11,660	14,880	66,190	4,420	19,660	36,830	4,160	12,174	1,380	810	

\* Radial load rating is two times the value per row ideally if both rows share load equally.

# Simplex™ Bearing Series – SuperDuplex™ (DB) Sealed Bearings



- SuperDuplex™ Back-to-Back
- ABEC-3
- High stiffness
- Low torque
- 440C stainless steel rings
- Si<sub>3</sub>N<sub>4</sub> ceramic load balls with 440C spacer balls
- Low torque PTFE seals

PART NUMBER*	B Bore		D Outside Diameter		W Width		M <sub>i</sub>		M <sub>o</sub>		Ball Diameter	Ball Quantity
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm		
ZU040MZ3*RBC	4.0000	101.600	4.7500	120.650	0.5000	12.700	4.155	105.54	4.550	115.57	1/8	54
ZU042MZ3*RBC	4.2500	107.950	5.0000	127.000	0.5000	12.700	4.405	111.89	4.800	121.92	1/8	57
ZU045MZ3*RBC	4.5000	114.300	5.2500	133.350	0.5000	12.700	4.655	118.24	5.050	128.27	1/8	60
ZU047MZ3*RBC	4.7500	120.650	5.5000	139.700	0.5000	12.700	4.905	124.59	5.300	134.62	1/8	63
ZU050MZ3*RBC	5.0000	127.000	5.7500	146.050	0.5000	12.700	5.155	130.94	5.550	140.97	1/8	66
ZU055MZ3*RBC	5.5000	139.700	6.2500	158.750	0.5000	12.700	5.655	143.64	6.050	153.67	1/8	72
ZU060MZ3*RBC	6.0000	152.400	6.7500	171.450	0.5000	12.700	6.155	156.34	6.550	166.37	1/8	79
ZU065MZ3*RBC	6.5000	165.100	7.2500	184.150	0.5000	12.700	6.655	169.04	7.050	179.07	1/8	85
ZU070MZ3*RBC	7.0000	177.800	7.7500	196.850	0.5000	12.700	7.155	181.74	7.550	191.77	1/8	91
ZU075MZ3*RBC	7.5000	190.500	8.2500	209.550	0.5000	12.700	7.655	194.44	8.050	204.47	1/8	97
ZU080MZ3*RBC	8.0000	203.200	8.7500	222.250	0.5000	12.700	8.155	207.14	8.550	217.17	1/8	104
ZU090MZ3*RBC	9.0000	228.600	9.7500	247.650	0.5000	12.700	9.155	232.54	9.550	242.57	1/8	116
ZU100MZ3*RBC	10.0000	254.000	10.7500	273.050	0.5000	12.700	10.155	257.94	10.550	267.97	1/8	129
ZU110MZ3*RBC	11.0000	279.400	11.7500	298.450	0.5000	12.700	11.155	283.34	11.550	293.37	1/8	141
ZU120MZ3*RBC	12.0000	304.800	12.7500	323.850	0.5000	12.700	12.155	308.74	12.550	318.77	1/8	154

\* The alphanumeric identification system is used under license.



	Approx. Weight		LOAD RATINGS												Limiting Speed (RPM)
			Radial*				Thrust				Moment				
			Static		Dynamic		Static		Dynamic		Static		Dynamic		
			lbs.	kg	lbf	N	lbf	N	lbf	N	lbf	N	lbf - in	Nm	
0.55	0.249	(2x) 905	(2x) 4,030	(2x) 640	(2x) 2,850	2,710	12,050	1,850	8,230	4,130	470	1,555	180	3,660	
0.58	0.263	(2x) 950	(2x) 4,230	(2x) 655	(2x) 2,910	2,850	12,680	1,900	8,450	4,540	510	1,670	190	3,460	
0.61	0.277	(2x) 995	(2x) 4,430	(2x) 660	(2x) 2,940	2,990	13,300	1,915	8,520	5,070	570	1,840	210	3,280	
0.65	0.295	(2x) 1,050	(2x) 4,670	(2x) 675	(2x) 3,000	3,140	13,970	1,955	8,700	5,575	630	1,990	220	3,120	
0.68	0.308	(2x) 1,090	(2x) 4,850	(2x) 685	(2x) 3,050	3,285	14,610	1,995	8,870	6,105	690	2,130	240	2,980	
0.74	0.336	(2x) 1,190	(2x) 5,290	(2x) 700	(2x) 3,110	3,580	15,920	2,035	9,050	7,235	820	2,450	280	2,720	
0.81	0.367	(2x) 1,305	(2x) 5,800	(2x) 730	(2x) 3,250	3,925	17,460	2,125	9,450	8,575	970	2,835	320	2,510	
0.87	0.395	(2x) 1,400	(2x) 6,230	(2x) 755	(2x) 3,360	4,210	18,730	2,185	9,720	9,910	1,120	3,200	360	2,330	
0.93	0.422	(2x) 1,500	(2x) 6,670	(2x) 760	(2x) 3,380	4,495	19,990	2,200	9,790	11,340	1,280	3,565	400	2,170	
0.99	0.449	(2x) 1,600	(2x) 7,120	(2x) 775	(2x) 3,450	4,780	21,260	2,250	10,010	12,870	1,450	3,950	450	2,030	
1.06	0.481	(2x) 1,710	(2x) 7,610	(2x) 815	(2x) 3,630	5,130	22,820	2,350	10,450	14,630	1,650	4,405	500	1,910	
1.18	0.535	(2x) 1,905	(2x) 8,470	(2x) 840	(2x) 3,740	5,705	25,380	2,420	10,760	18,180	2,050	5,275	600	1,700	
1.31	0.594	(2x) 2,110	(2x) 9,390	(2x) 875	(2x) 3,890	6,330	28,160	2,550	11,340	22,290	2,520	6,250	710	1,540	
1.43	0.649	(2x) 2,300	(2x) 10,230	(2x) 905	(2x) 4,030	6,915	30,760	2,625	11,680	26,620	3,010	7,235	820	1,410	
1.56	0.708	(2x) 2,515	(2x) 11,190	(2x) 935	(2x) 4,160	7,545	33,560	2,720	12,100	31,560	3,570	8,330	940	1,300	

\* Radial load rating is two times the value per row ideally if both rows share load equally.

extended life.

## OPERATING CONDITIONS

### Lubrication

Lubricants serve a number of very important purposes in ball bearings, including:

- Protecting bearing surfaces from corrosion
- Reducing rolling and sliding friction
- Preventing metal-to-metal contact between balls and raceway
- Providing a barrier against external contaminants (grease)
- Removing heat (oil)

Lack of lubrication or inadequate lubrication is the most common cause of bearing failure.

Standard RBC thin section ball bearings are lubricated with either oil or grease. The unsealed bearings, the K series, are thoroughly coated in MIL-PRF-3150 oil and drained of excess. Sealed bearings are lubricated with MIL-PRF-23827 grease. The external surfaces of sealed bearings are lightly coated with the same grease for corrosion resistance. Additional lubricants are also available. RBC Applications Engineering can help select the appropriate lubricant for special applications.

### Temperature

Standard RBC thin section ball bearings can operate at temperatures from -65°F to 250°F. Temperatures up to 350°F can be reached if the bearings are temperature stabilized. By the use of special materials, RBC can provide bearings for operation to 700°F. Contact RBC Sales Engineers for recommendations on bearings operating above 250°F.

### Limiting Speed

The limiting speed of a bearing is dependent upon a number of different factors including bearing size, bearing type, ball separator design, lubrication, and loading. The limiting speeds for the bearings shown in this catalog are determined using the following:

$$N = \frac{1000 * k}{E} \quad \text{with } N = \text{Speed (RPM)}$$

$$E = \frac{D+B}{2} \quad (\text{Bearing Pitch Diameter})$$

k = constant, see table below

Bearing Type	Load Condition	k Value	
		Grease	Oil
C or A	Radial or Thrust	16	20
X	Thrust	10	12
X	Radial, Combined Radial and Thrust, or Moment	3	4

The k values shown give the maximum speeds at which a typical thin section ball bearing can operate. It is recommended that operating speeds of large diameter bearings in a given series be reduced up to 40% of the calculated rating to avoid high bearing temperatures. Speed ratings can also be impacted by load conditions, lubrication, alignment, and ambient temperature. All of these factors must be considered when designing thin section ball bearings into your application.

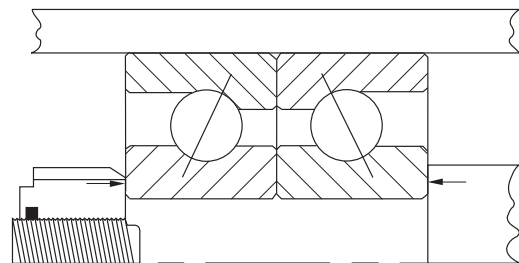
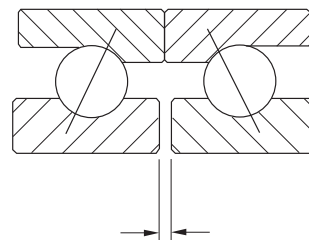
## DUPLEX PAIRS AND AXIAL PRE-LOADING

### Duplex Pairs

Duplex bearings are a pair of angular contact RBC thin section ball bearings specially ground for use as a matched set. A duplexed pair can be used to provide accurate shaft location, to increase capacity, or to increase stiffness of the bearing assembly. A duplex pair of RBC thin section ball bearings is ground so that when mounted using recommended fits, there will be no internal clearance in the bearings. There are three basic mounting methods to accommodate different loading requirements:

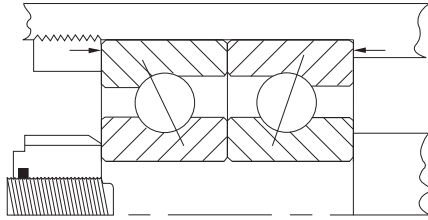
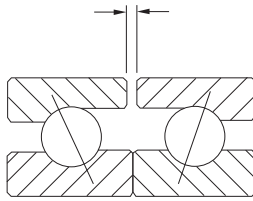
- Back-to-Back (DB), B-Type
- Face-to-Face (DF), F-Type
- Tandem (DT), T-Type

**Back-to-Back, DB  
B-Type**



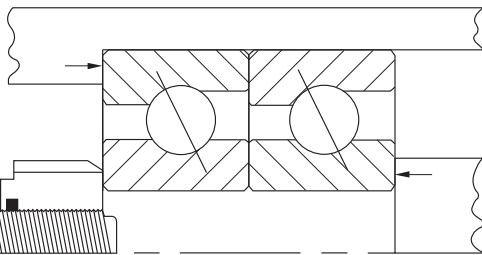
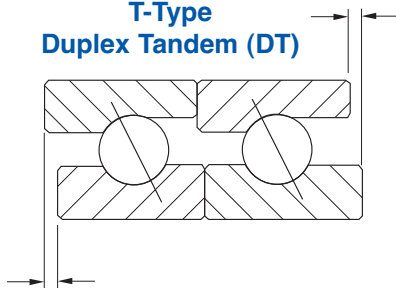
- Heavy radial loads
- Combined radial and thrust loads
- Reversing thrust loads
- Excellent rigidity
- Moment loads

### F-Type Duplex Face-to-Face (DF)



- Heavy radial loads
- Combined radial and thrust loads
- Reversing thrust loads
- Moment loads

### T-Type Duplex Tandem (DT)



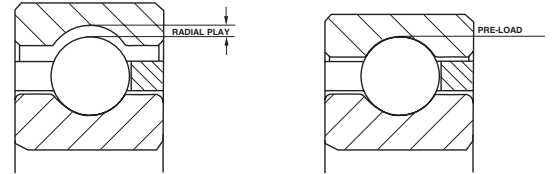
- High one-direction thrust loads
- Minimum axial shaft deflection
- Heavy radial loads

### Axial Pre-loading

Standard duplex bearings are ground so that there will be a light axial pre-load induced on the bearing at nominal conditions. In some applications increased bearing stiffness may be required. In these cases the duplex grinding can be done such that a heavier axial load is induced in the mounted bearing. This load can be increased or decreased to meet the requirements of a particular application. Consult RBC Sales Engineers for special requirements.

### Radial Play

Radial play (diametral clearance) is the distance the inner ring can be moved radially from one extreme position to the other. Standard RBC thin section ball bearings are manufactured with enough radial play that some clearance remains after the bearing is properly installed.



When there is negative radial play (diametral pre-load) there is interference rather than clearance between the balls and the races. As the interference increases, the friction, stiffness, and torque also increases. RBC thin section ball bearings can be manufactured with customer specified diametral pre-load or clearance.

### Radial and Axial Runout

Radial runout of RBC thin section ball bearings is a measurement of the thickness variation of the bearing rings. The outer ring is measured from the ball path to the outer diameter of the ring, and the inner ring is measured from the ball path to the bore. Radial runout is defined as the wall thickness variation of the rotating ring.

Axial runout is measured from the ball path to the face of the bearing rings. The variation in thickness measured is the axial runout.

## TOLERANCES

### Precision Grades

RBC thin section ball bearings are available in 4 precision grades. RBC precision classes 0, 3, 4, and 6 correspond to ABMA ABEC grades 1F, 3F, 5F, and 7F respectively.

### Shaft and Housing Fits

Proper shaft and housing fits are critical to the successful operation of a thin section ball bearing. The internal clearance of the bearing will be reduced proportionally by an interference fit. In addition, the roundness of the shaft and housing will directly effect the roundness of the inner and outer ring raceways. For most applications, the inner ring is rotating and the load is stationary with respect to the outer ring. In this circumstance, a light press fit onto the shaft is recommended.

# RBC Bearings - Solutions for the Semiconductor Equipment Industry



## Spherical Plain Bearings

- Standards
- Stainless steel
- Specials available
- Corrosion resistant



## Rod Ends

- Heim®
- Spherco®
- Unibal®
- Precision
- Self-lubricating
- Inch and metric
- Stainless steel
- Corrosion resistant



## Cam Followers

- Standard stud
- Heavy stud
- Yoke type
- Type SRF caged roller follower
- RBC Roller® long life cam followers
- Heavy stud
- Corrosion resistant

## Bearing Options Available

- Custom
- Modified
- Full integral
- Stainless steel
- Bearing assemblies
- Special lubricants
- Sealed
- Non-out gassing
- Sealed
- Hybrid/ceramic options

## Other Bearing Products

- Tapered roller bearings
- Needle bearings
- Sleeve and journal bearings
- Pins - Shafts

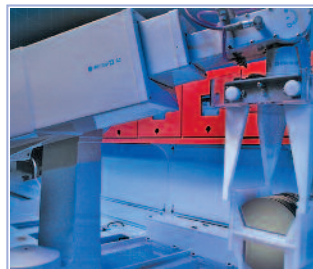


## Thin Section Ball Bearings



## Airframe Control

- Ball bearing types
- Self-lubricating types
- Needle and track rollers
- Corrosion resistant



## Robot Bearing Assemblies

- Wrist
- Elbow
- Waist
- Shoulder positions

# Engineering Application Data

For assistance in selecting the correct bearings for your design, complete this form and fax or mail it to:

**RBC Bearings**  
**Industrial Tectonics Bearings Division**  
18301 S. Santa Fe Avenue  
Rancho Dominguez, CA 90221-9998  
Ph: 310.537.3750 • Fax: 310.537.2913  
For Europe only: Ph: +33 (0) 1 60 92 17 35 • Fax: +33 (0) 1 69 86 12 84  
www.rbcbearings.com

Company Name: \_\_\_\_\_ Date: \_\_\_\_\_

Street Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_ E-mail: \_\_\_\_\_

Description of application: \_\_\_\_\_

\_\_\_\_\_

**Speed:**

Rotational \_\_\_\_\_ rpm  Inner Ring Rotating  
Oscillatory \_\_\_\_\_ cpm  Outer Ring Rotating

**Temperature:**

Average running \_\_\_\_\_ min \_\_\_\_\_ max \_\_\_\_\_

**Loading:**

Shock  Vibration  Safety factor (Please specify) \_\_\_\_\_

Dynamic radial \_\_\_\_\_ Lbs.  Stationary Load  Rotating Load

Dynamic thrust \_\_\_\_\_ Lbs.

Dynamic moment \_\_\_\_\_ Ft. Lbs.  Stationary Load  Rotating Load  
(show application of load on sketch)

Static radial \_\_\_\_\_ Lbs.

Static thrust \_\_\_\_\_ Lbs.

Static moment \_\_\_\_\_ Ft. Lbs. (show application of load on sketch)

**Life:** \_\_\_\_\_

**Lubricant:**

Grease  Oil  Special (Please specify) \_\_\_\_\_

**Size limitations:**

Max. O.D. \_\_\_\_\_ inches Min. Bore \_\_\_\_\_ inches Max. Width \_\_\_\_\_ inches

**Other data:**

Seals  Shields  Special (Please specify)

Housing material \_\_\_\_\_ Shaft material \_\_\_\_\_

**Additional description of application and/or special requirements:**

Sketch included

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RBC Bearings Incorporated has been producing bearings in the USA since 1919. RBC offers a full line of industrial and aerospace bearings, including unique custom configurations.



### Spherical Plain Bearings

Radial, angular contact, extended inner ring, high misalignment. QuadLube®, ImpactTuff®, SpreadLock® Seal, CrossLube®, DuraLube™, and self-lubricating bearings. Available in inch and metric sizes.



### Needle Roller Bearings

Pitchline® caged heavy duty needle roller bearings, inner rings, TJ TandemRoller® bearings for long life.



### Thin Section Ball Bearings

Standard cross sections to one inch. Sizes to 40 inches. Stainless steel and other materials are available. Seals are available on all sizes and standard cross sections. Super duplex configurations.



### Self-Lubricating Bearings

Radial, thrust, rod ends, spherical bearings, high temperature, high loads. Available in inch and metric sizes. Fiberglide® self-lubricating bearings.



### Tapered Roller Bearings

Tyson® case-hardened and through-hardened tapered roller bearings. Available in many sizes. Used in Class 8 heavy truck and trailer wheel bearings, gear boxes, and final drive transmissions.



### Airframe Control Bearings

Ball bearing types, self-lubricating types, needle roller track rollers.



### Tapered Roller Thrust Bearings

Case-hardened. Sealed and unsealed for truck, tractor, and construction equipment steer axles, and Class 8 trailer landing gear.



### Dowel Pins, Loose Needle Rollers, Shafts

Precision Products dowel pins, loose needle rollers, and shafts.



### Commercial Rod Ends

Commercial and industrial, precision, Mil-Spec series, self-lubricating, and aircraft. Sold under the Heim®, Unibal®, and Spherco® brands. Available in inch and metric sizes.



### Ball Bearings

Precision ground, semi-ground, unground. High loads, long life, smooth operation. Nice® ball bearings are offered in caged and full complement configurations.



### Integrated Assemblies

For robots and other process tool applications. Engineering design assistance. Production volume capacity.



### Cam Followers

Standard stud, heavy stud, yoke type, caged roller followers. Patented RBC Roller® cylindrical roller cam followers, HexLube® universal cam followers, airframe track rollers.



### Specials

RBC manufactures many specialty bearings for the aerospace, oil and energy, semiconductor equipment, packaging, transportation, and other industries.



[www.rbcbearings.com](http://www.rbcbearings.com)

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