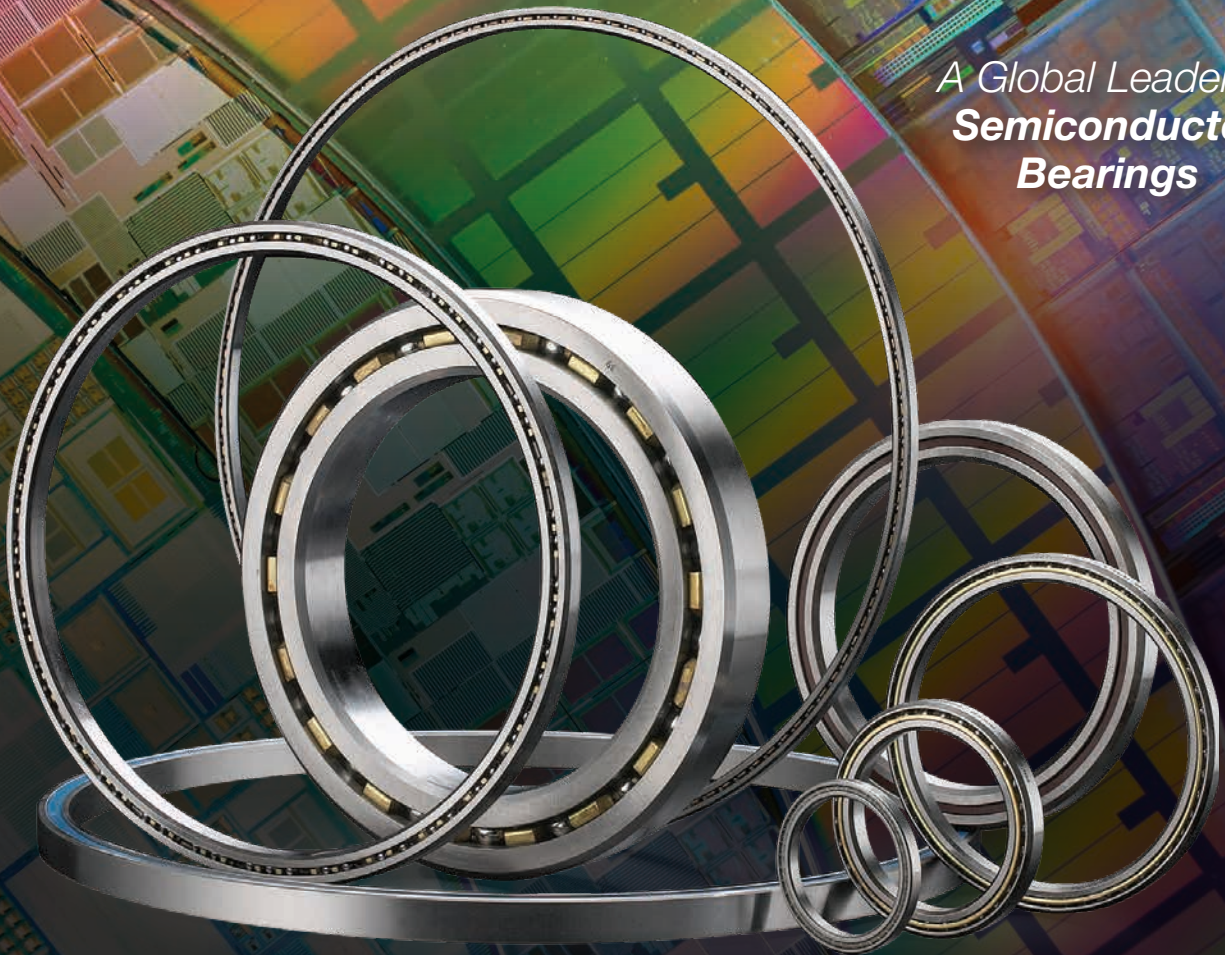




RBC Solutions

for Semiconductor Equipment Applications

*A Global Leader in
**Semiconductor
Bearings***



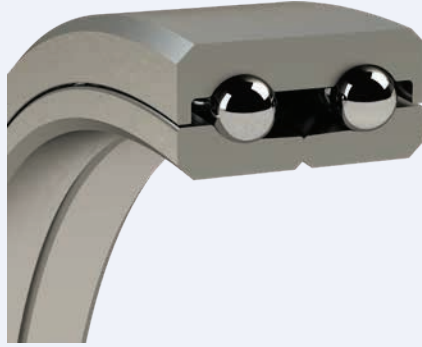
Unique design solutions to complex problems.

Smoother. Faster. Longer.
Because That's How We Roll.

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.

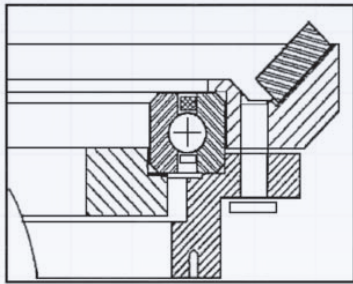


- ✓ 440C stainless steel spacer balls
- ✓ Si_3N_4 load balls
- ✓ Integral shields
- ✓ Low-out gassing
- ✓ Lubricant

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



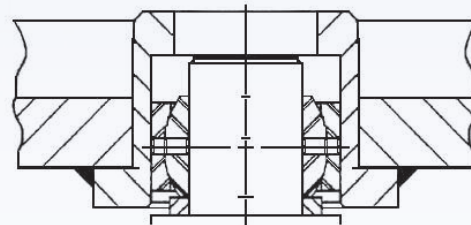
Robot Wrist Assembly

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



Hinge Pin

Stainless steel spherical plain bearing for misalignment and shaft support.



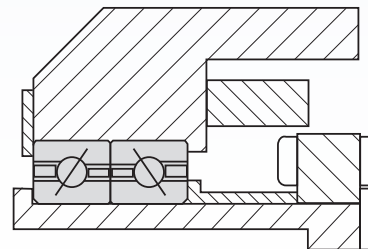
Thin Section Ball Bearing

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



Rotary Indexing Tables

Angular contact pair that can be used to accurately position a table.



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

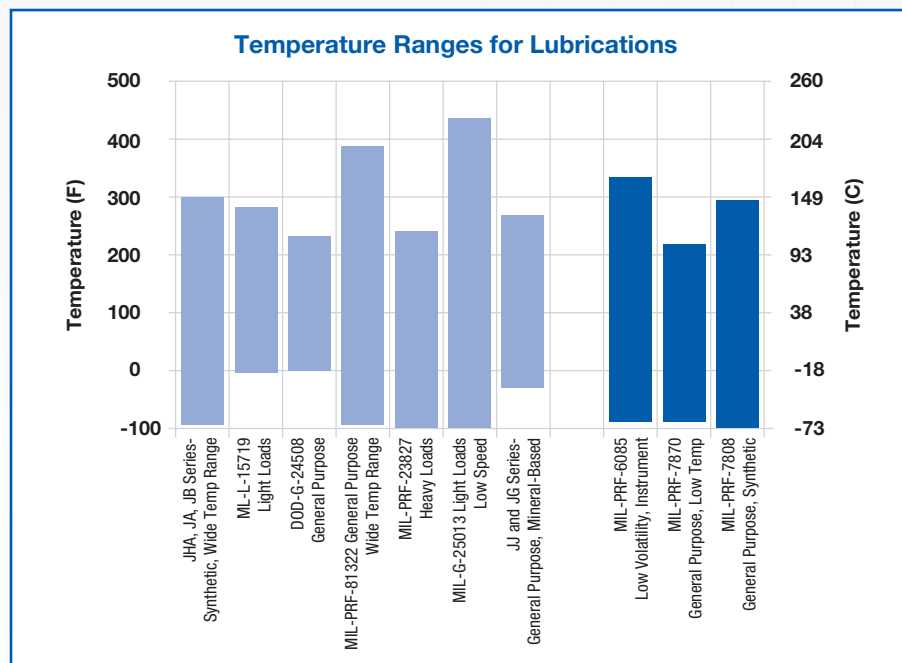
Spacer balls are smaller than load balls by 0.5-1%. In pre-loaded bearings, other separator options may generate particle shedding resulting in erratic torque fluctuations.

Silicon Nitride Load Balls (Si_3N_4)

Si_3N_4 balls promote a much lower coefficient of friction versus steel balls, therefore providing enhanced survivability under marginal lubrication. Si_3N_4 balls also have a higher modulus of elasticity - 50% higher than steel balls to provide higher stiffness.

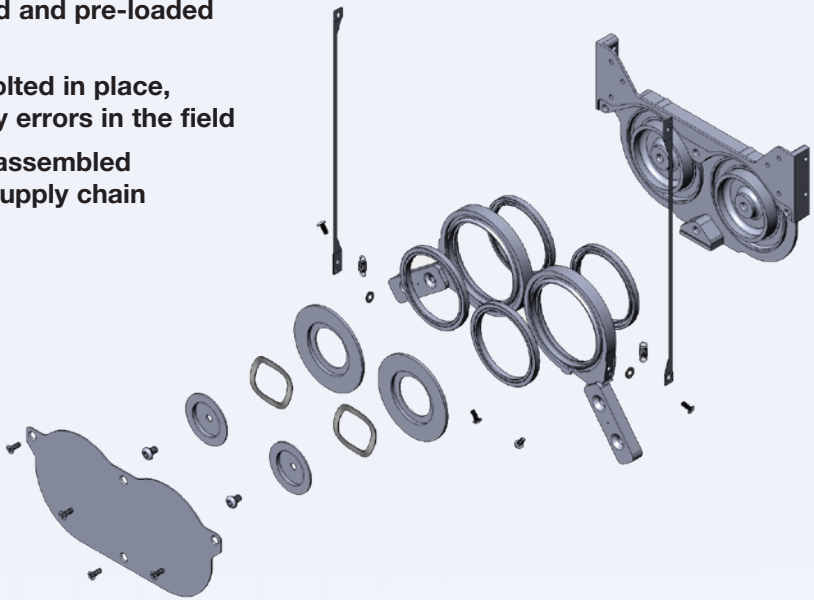
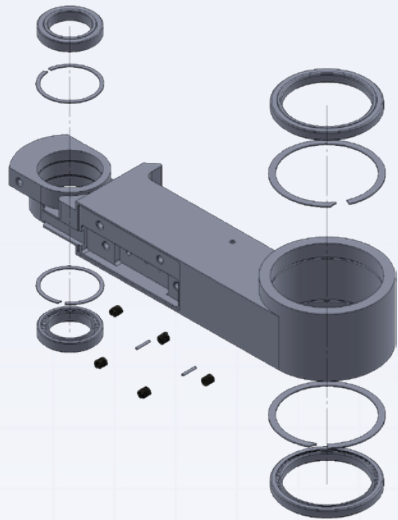
SuperDuplex™ Design

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.



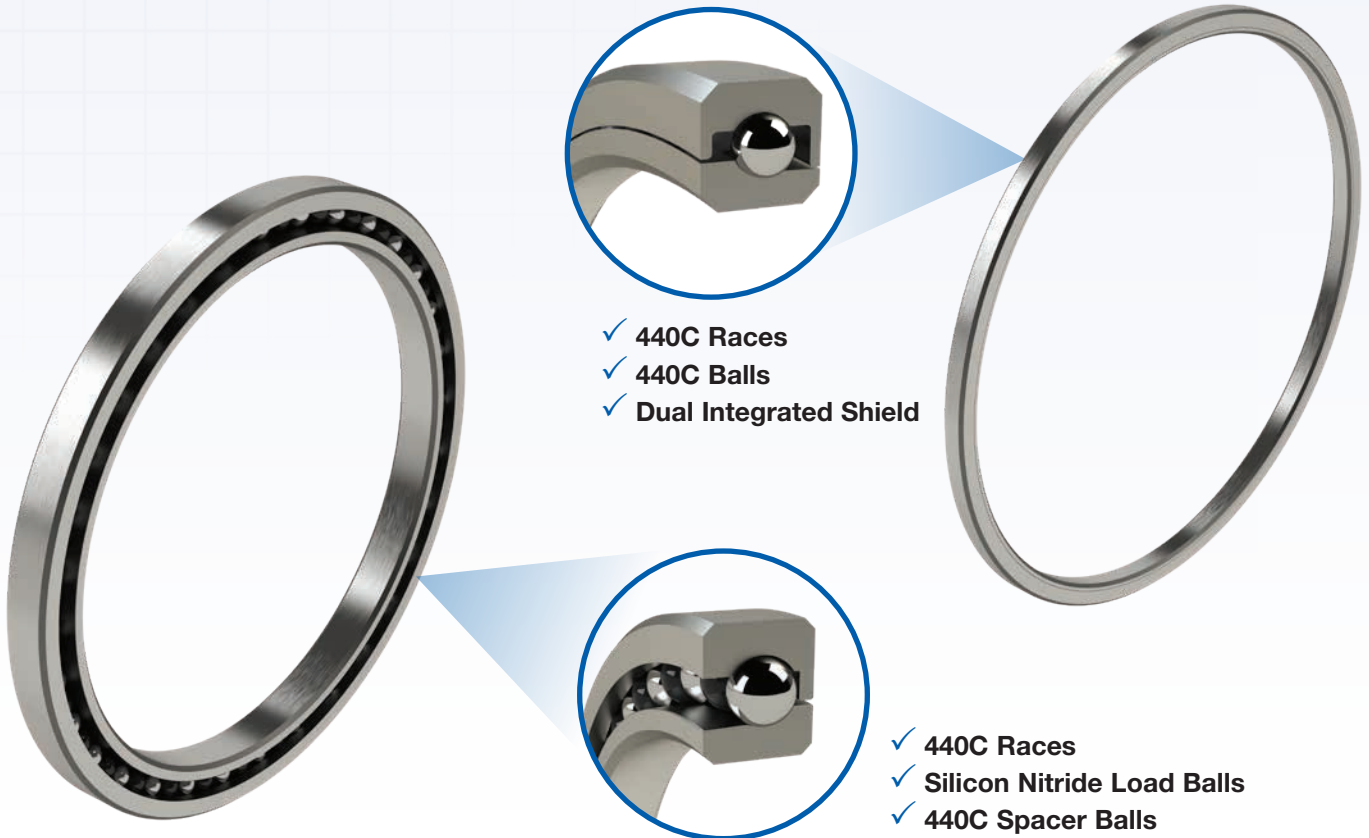
Integrated Bearing Assemblies

- ✓ Bearing fit ups are factory optimized and pre-loaded for repeatable stiffness and torque
- ✓ Integrated assemblies are simply bolted in place, eliminating fit-up time and assembly errors in the field
- ✓ All components manufactured and assembled by RBC divisions, simplifying your supply chain



Customized Solutions

RBC has been in the semicon business for decades and created a wide variety of custom solutions!



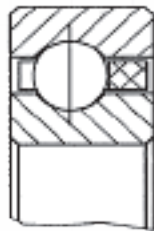
- ✓ 440C Races
- ✓ 440C Balls
- ✓ Dual Integrated Shield

- ✓ 440C Races
- ✓ Silicon Nitride Load Balls
- ✓ 440C Spacer Balls

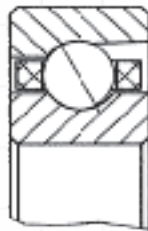
RBC Thin Section Ball Bearings

Selection Guide

Bearing Type	Load Condition					
	Ball Contact	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



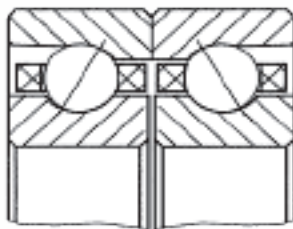
C-Type
Radial Contact



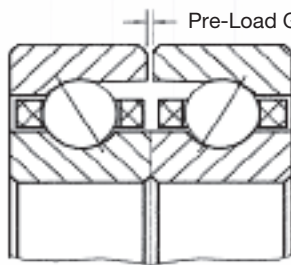
A-Type
Angular Contact



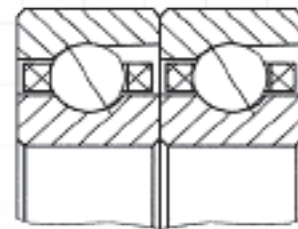
X-Type
4-Point Contact



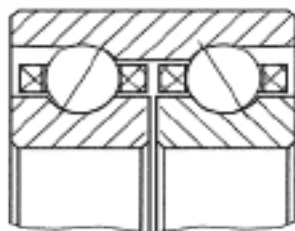
Pre-Load Gap
B-Type
Duplex Back-to-Back (DB)



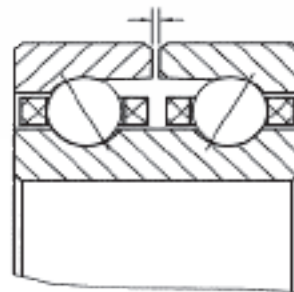
Pre-Load Gap
F-Type
Duplex Face-to-Face (DF)



X-Type
Duplex Tandem (DT)



Pre-Load Gap
M-Type
SuperDuplex™ Back-to-Back



Pre-Load Gap
V-Type
SuperDuplex™ Face-to-Face

RBC Thin Section Ball Bearings

Part Number Designation

Example:	KA120XP0M*RBC									
	K	A	1	2	0	X	P	0	M*	RBC
Nomenclature	Material	Series	Size			Type	Separator	Precision	Radial Play	
Position	1	2	3	4	5	6	7	8	9**	

Position 1: Materials

	Rings, Balls	Seals, Shields, Coating
J	52100 Bearing Steel	Two seals - molded rubber, steel reinforced
K	17-4 PH CRES Stainless	No seals or shields
M	Inconel 718	No seals or shields
N	Titanium 6AL4V	Thin dense chrome plating
S	316 Stainless	No seals or shields
Z	Other	

Position 2: Series

	Radial Thickness	x	Width
AA	0.187	x	0.187
A	0.250	x	0.250
B	0.312	x	0.312
C	0.375	x	0.375
D	0.500	x	0.500
F	0.750	x	0.750
G	1.000	x	1.000
U	0.375	x	0.500

Position 3, 4, 5: Bore Size

Bore size (in inches) multiplied by 10
Ex. 12" Bore = 120

Position 6: Type

A	Angular contact single bearing
B	Back-to-back angular contact duplex pair
C	Radial contact
F	Face-to-face angular contact duplex pair
M	SuperDuplex™ back-to-back
T	Tandem angular contact duplex pair
W	SuperDuplex™ face-to-face
X	4-point contact

Position 7: Separator

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

Position 8: RBC Precision Class

0	ABEC 1F
3	ABEC 3F
4	ABEC 5F
5	ABEC 7F

Position 9: Radial Play

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

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

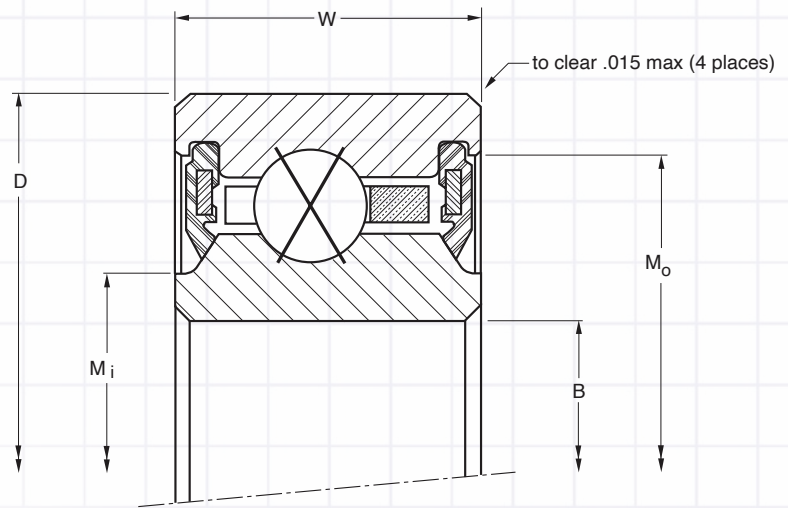
*The alphanumeric identification system is used under license.

RBC Thin Section, Sealed 4-Point Contact, X-Type

Product Capabilities

Many molded seals used in bearings are made out of nitrile (molded rubber seal per MIL-R-6855). 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.

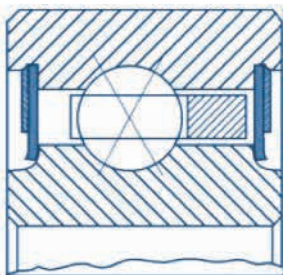


Elastomer Molded Seals vs. PTFE/300SS Seals vs. Shields

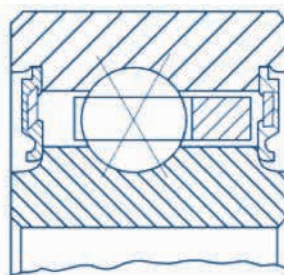
RBC's solution is a combination seal-shield design. The seal is made from either pure PTFE Teflon® or glass fiber reinforced PTFE Armalon®. PTFE is chemically inert, has a very low coefficient of friction (inherent lubricity), and provides the widest operating temperature range of any sealing material. 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.

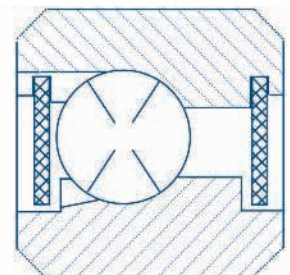
For versions that cannot allow a seal, we offer a shield in its place.



Typical PTFE/300SS Design



Typical Elastomer Molded Design



Separable Shields

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

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:

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

E

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

2

k = constant, see following table

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

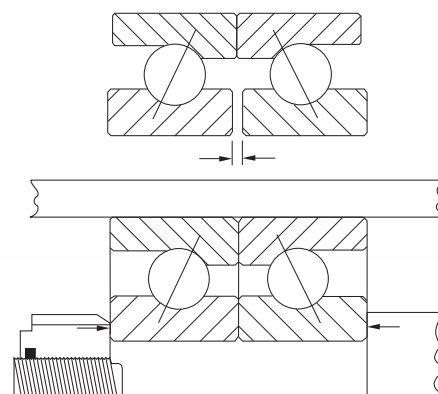
The k values shown give the maximum speeds at which a typical thin section ball bearing can operate. It is recommended that operating speeds of large diameter bearings in a given series be reduced up to 40% of the calculated rating to avoid high bearing temperatures. Speed ratings can also be impacted 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 & Axial Pre-Loading

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:

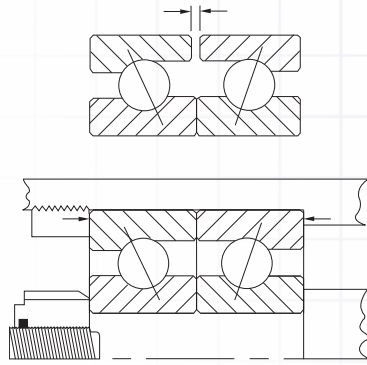
- Back-to-Back (DB), B-Type
- Face-to-Face (DF), F-Type
- Tandem (DT), T-Type

Back-to-Back (DB) B-Type



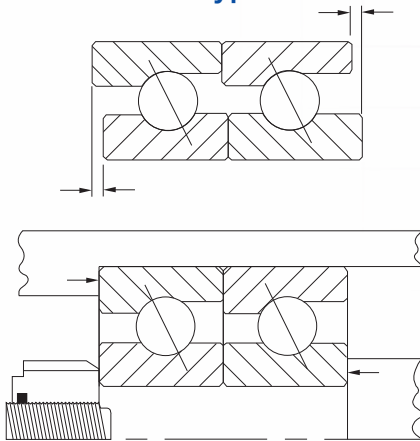
- Heavy radial loads
- Combined radial and thrust loads
- Reversing thrust loads
- Excellent rigidity
- Moment loads

Duplex Face-to-Face (DF) B-Type



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

Duplex Tandem (DT) T-Type



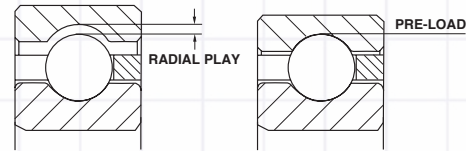
- High one-direction thrust loads
- Minimum axial shaft deflection
- Heavy radial loads

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.

PIC Design[®], a division of RBC, offers various products for Semicon Applications

Gears

- ✓ Anti-backlash Gears
- ✓ Bevel Gears
- ✓ Spur Gears
- ✓ Helical Gears
- ✓ Worm and Wheel Gears
- ✓ Gear Racks

Gear Capabilities	
Pitch	16-120 D.P
Pitch Diameter	.375" to 6"
AGMA Classes	Q10, Q12, Q14
Materials	Stainless, Aluminum, Acetal, Bronze
Special Coatings	
Standard and Custom Designs	



For a full catalog list of our Gears, scan the QR code or visit us at www.pic-designcatalog.com/gears



Miniature Ball Bearings

- ✓ ABEC 3 and 7 available in 440 SS
- ✓ ABEC 1 available in 52100 Steel
- ✓ Sealed and flanged options
- ✓ Inch and metric sizes available
- ✓ .04" to 1.5" (3 mm to 40 mm) bore sizes



For a full catalog list of our Miniature Ball Bearings, scan the QR code or visit us at www.pic-designcatalog.com/bearings-and-bushings/precision-ball-bearings/



PIC Design®, a division of RBC, offers various products for Semicon Applications

Precision Hardware



✓ Dowel Pins

- Slip or press fit types available
- 303 SS, 416 SS, and special materials available
- 1/32" to 1/2" in diameter, and custom sizes
- 3/32" to 1/2" length

✓ Shoulder Screws

- Slotted, socket, or phillips head
- Available in 303 SS or 416 SS
- 1/8" to 1/2" shoulder diameter range
- 1/8" to 1" shoulder length range
- Available thread sizes from 4-40 to 3/8-16



✓ Set Screws

- Silver grip, No Mar, Brass Tip and Cup Point
- 300 SS Series and Heat Treated Alloy Steel
- Hex and Slotted head types
- Threaded length from 1/8" to 1"

Belts and Pulleys

- ✓ Single and Dual Core belts available using stainless steel or aramid fiber
- ✓ No Slip and No Slide Belt System
- ✓ Wide Selection of pulleys

For a full catalog list of our Precision Hardware, Belts, and Pulleys, scan the QR code or visit us at www.pic-designcatalog.com

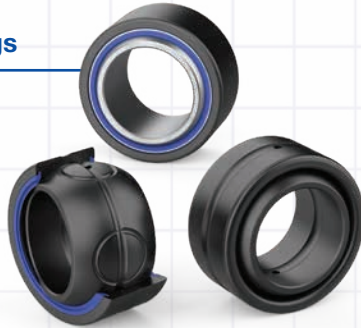


RBC® Bearings

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
- ✓ Integral Shields
- ✓ Stainless Steel
- ✓ Bearing Assemblies
- ✓ Special Lubricants
- ✓ Sealed
- ✓ Non-Outgassing
- ✓ Hybrid/Ceramic Options

Other Bearing Products

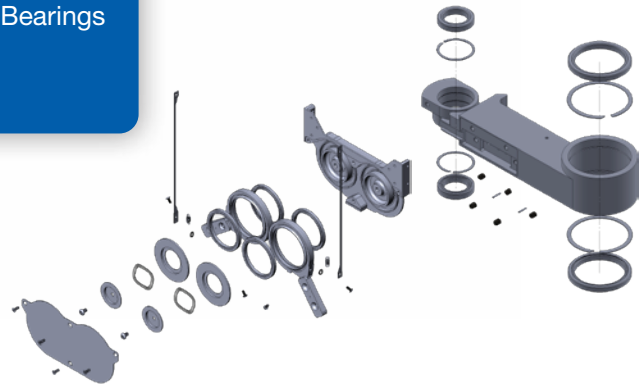
- ✓ Tapered Roller Bearings
- ✓ Needle Bearings
- ✓ Sleeve & Journal Bearings
- ✓ Pins/Shfts

Thin Section Ball Bearings



PIC Design Portfolio

- ✓ Gears
- ✓ Belts and Pulleys
- ✓ Precision Hardware
- ✓ Miniature Ball Bearings



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

US | Tel: 310.537.3750 **Fax:** 310.537.2913

Europe | Tel: +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 _____ eMail _____

Description of application: _____

Speed: Rotational _____ rpm ☐ Inner Ring Rotating

Oscillatory _____ cpm ☐ Outer Ring Rotating

Temperature: Average Running Temp _____ 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

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This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no text or other markings on the paper.

RBC Bearings® has been producing bearings in the USA since 1919. In addition to unique custom bearings, RBC Bearings® offers a full line of standard industrial and aerospace bearings, including:



Tapered Roller Thrust Bearings

Case-hardened tapered roller thrust bearings for oilfield top drives and swivels. Available in full complement, maximum capacity versions.



Thin Section Ball Bearings

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



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.



Cylindrical Roller Bearings

Cylindrical roller bearings designed for mud pump pinion and eccentric positions. Fully interchangeable to industry standards.



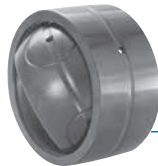
Needle Roller Bearings

Pitchline® caged heavy duty needle roller bearings ideal for cross head bearings applications. These double row bearings are available in single row and TandemRoller® versions.



Commercial Rod Ends

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



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.



Tapered Roller Bearings

Single, double, & multi row versions available for main bearing positions in mud pumps, gear boxes, etc. Bearings are constructed of case hardened steel washers and rollers with bore size of 11" or greater.



TP Series Bearings

RBC Bearings® TP Series cylindrical roller thrust bearings ideal for crane hooks, oil well swivels, winch systems, and gear boxes. Fully interchangeable with industry standard offering.



Keyless Locking Devices

Mechanical bushings used to connect power transmission components onto rotating shafts. Without the use of keyways, KLDs eliminate the problems associated with backlash including fretting, corroding, and wallowing.



Lubron® Bearings

Lubron® self-lubricating bearings designed and custom manufactured in most any size, material and bearing configuration. Applications include hydro power and water control, nuclear power generation, infrastructure, architecture, offshore marine, industrial, machinery and heavy equipment.



Shaft Collars

Used to position or locate a component on a shaft. Made from mild steel, type 303 or 316 stainless steel, aluminum, or acetal. Available in inch and metric sizes.



Self-Lubricating Bearings

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



Rigid Couplings

Shaft couplings serve as components to time, join, or align shafts at lower speeds and torque, especially when zero backlash is desired. Made from mild steel with a black oxide finish type 303 stainless steel, or aluminum. Available in inch and metric sizes.



Specials

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



Ball Bearings

Precision ground, semiground, unground. High loads, long life, smooth operation. Nice® branded products are offered in caged and full complement configurations.



PIC Design®

Complete line of precision gears, precision hardware, timing belts, pulleys, and linear motion systems. Industries served include industrial, aerospace, defense, medical, robotics and automation, material handling, and assembly. Custom design support for unique applications.

