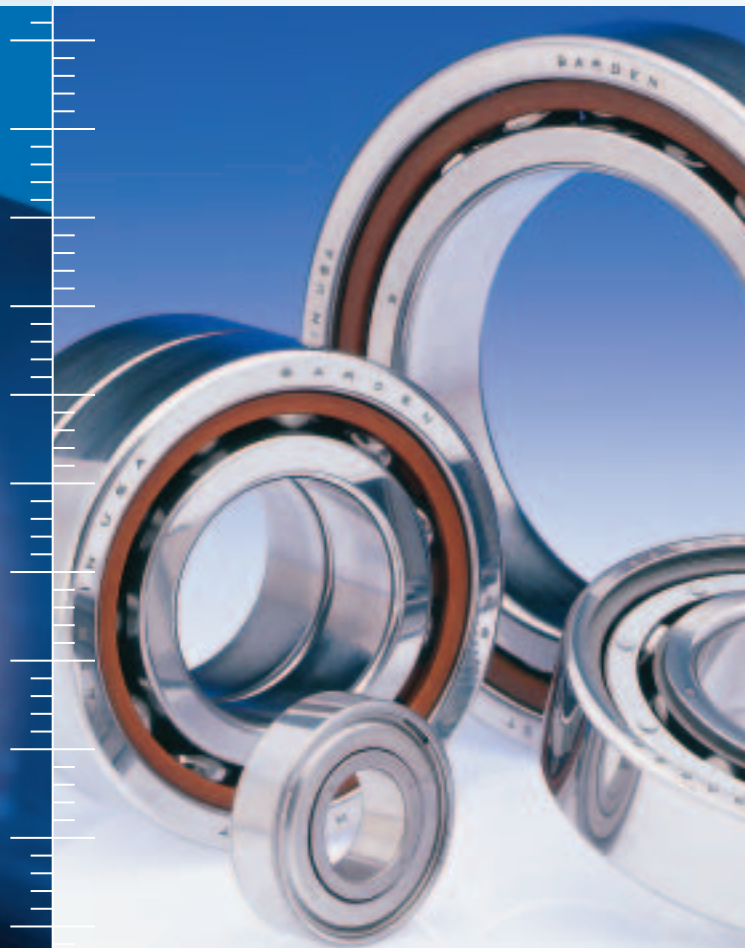




# The Barden Corporation

A company of the FAG Kugelfischer Group

**PRECISION  
TECHNOLOGY  
INSIDE**



**MRO CATALOG — C8A**



**FAG Aerospace and Super Precision Bearings**

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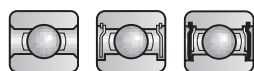
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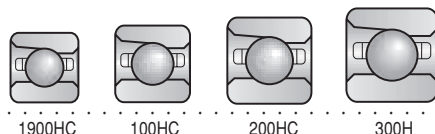


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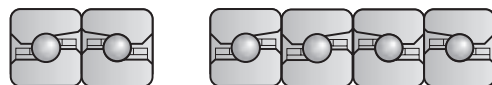
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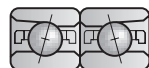
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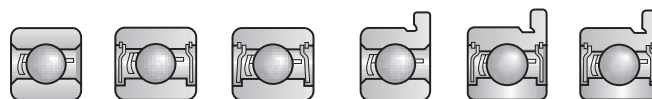


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## THE FINEST BEARINGS THAT CAN BE MADE



Barden's focus on super precision bearing technology has long been driven by the needs of our customers for greater accuracy, higher running speeds, longer life and a sensitivity to cost.

As a result, our entire R&D, design and manufacturing philosophy revolves around delivering innovative bearing solutions, better product reliability and lower system costs.

Meeting these stringent demands requires constant interaction with customers to learn more about their specific application requirements. Our own R&D efforts — along with our support of leading university mechanical engineering and metallurgical research projects — have laid the foundation for the development of new, ever more reliable precision bearing products.

While bearing tolerances are well-defined by DIN/ISO or ABEC standards, Barden super precision

bearings routinely exceed even these stringent guidelines, resulting in the production of the finest bearings that can be made.

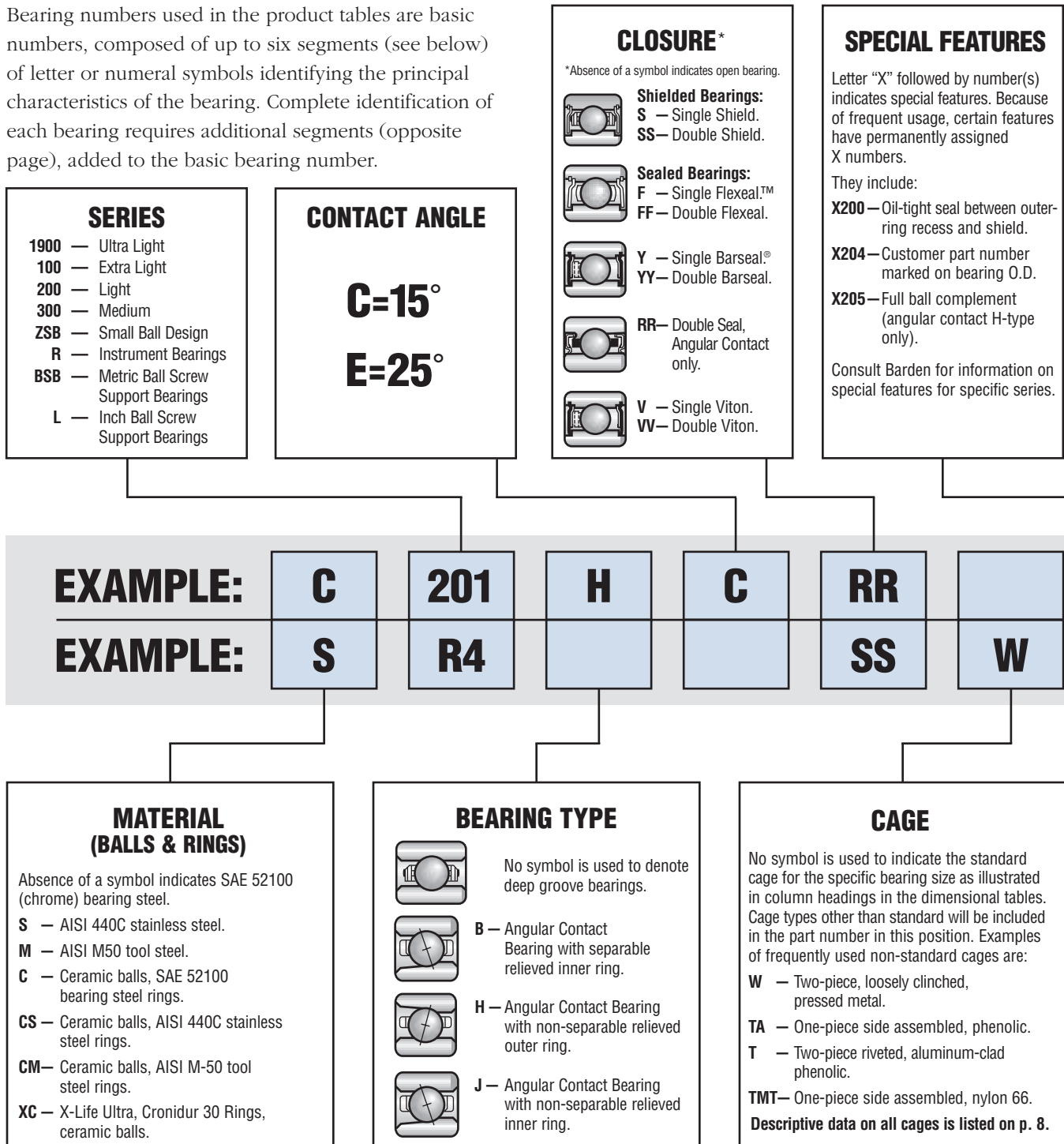
In addition to meeting — or exceeding — the demanding tolerance requirements of P4/ABEC 7 specifications, there are other Barden-imposed performance features not covered by these standards.

As a result, Barden super precision bearings set standards unchallenged by any other bearing manufacturer in the world today when it comes to performance reliability, greater accuracy, higher running speeds and longer life.

Barden's extensive product line means that whatever your application — from milling machines to textile winders to wood working machines — there's a precision bearing solution that's right for you.

## NOMENCLATURE

Bearing numbers used in the product tables are basic numbers, composed of up to six segments (see below) of letter or numeral symbols identifying the principal characteristics of the bearing. Complete identification of each bearing requires additional segments (opposite page), added to the basic bearing number.



### ABMA STANDARDS

Grades of precision have been set by the Annular Bearing Engineers Committee of the ABMA. Conventional ball bearings are manufactured to precision grades ABEC 1, ABEC 3, ABEC 5, ABEC 7 and ABEC 9 (highest). All Barden bearings in this catalog are produced to class ABEC 7 or ABEC 9.

## DUPLEXING

**U** — Single universal bearing. Any arrangement.

**DU** — Set of two universal bearings.

**DB** — Set of two bearings. Back-to-back arrangement.



**DF** — Set of two bearings. Face-to-face arrangement.



**DT** — Set of two bearings. Tandem arrangement.



## PRELOAD

**L** = Light **M** = Medium **H** = Heavy

## RADIAL RUNOUT

Only special radial runouts are shown in M & I bearing numbers and are identified by letter "E".

**E** — Radial runout less than standard tolerances. Consult Barden for details.

When "E" is followed by letter "R", high point of eccentricity is marked on bearing according to the following code:

**R** — Inner ring marked for high point of eccentricity.

**R1** — Outer ring marked for high point of eccentricity.

**R2** — Both inner and outer rings marked for high points of eccentricity.

## LUBRICATION

Type of lubricant used is always indicated in bearing number on packaging. Letter "O" denotes oil, letter "G" denotes grease. Number codes following letters indicate type of lubricant. Lubricants frequently used are:

### Oils

**O-9** — Exxon Aviation Instrument Oil

**O-11** — Winsorlube L-245X

**O-14** — Exxon 2389 Turbo Oil

**O-40** — Exxon Coray 100

### Greases

**G-2** — Exxon Beacon 325

**G-18** — Nye Rheotemp 500

**G-33** — Mobil Grease #28

**G-42** — Nye Rheolube 350-SBG-2

**G-46** — Kluber ISOFLEX NBU-15

**G-73** — Arcanol L-55

**G-74** — Exxon Unirex N3

**G-75** — Arcanol L-75

**DUL**

**X3**

**K3**

**V**

**E**

**C**

**O-11**

**G-2**

## RADIAL PLAY

Numeral indicates range of radial play for deep groove bearings. For angular contact bearings, no code is shown for standard contact angles.

**Note:** Radial play code number is preceded by letter "K" when previous section of bearing number ends in a number. Letter "K" functions only as a separating symbol to avoid confusion.

## FUNCTIONAL TEST

Most miniature and instrument bearings are available with low torque characteristics. Variations in torque levels are designated by the following symbols:

**V** — Guaranteed low maximum torque level.

**VK** — Very low starting torque.

**VM** — Very low running torque.

**VT** — Actual torque trace furnished with each VM level bearing.

Consult Barden for specific torque levels.

(Note: Prior designation for guaranteed very low maximum torque levels was **VL**.)

## CALIBRATION

Bearing with calibrated bore or O.D. is denoted by letter "C". Coding used is as follows:

**C** — Bore and O.D. tolerance range separated into increments of .0001" and group indicated on packaging.

**CXO** — Calibration of bore only.

**COX** — Calibration of O.D. only.

**C44** — Grouping of .00005", bore and O.D.

**C40** — Bore only calibrated in groups of .000050".

**C04** — O.D. only calibrated in groups of .000050".



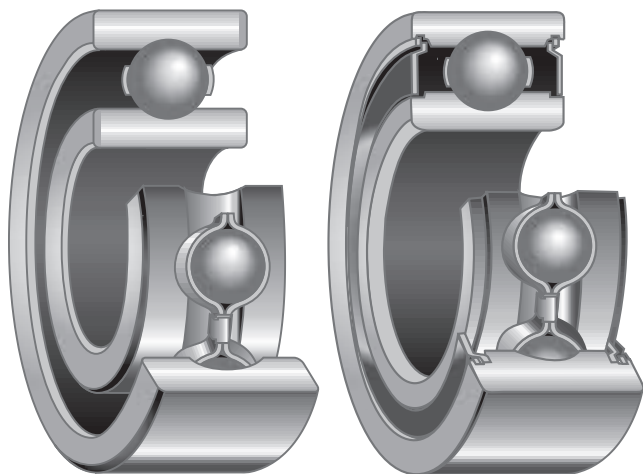
## BEARING FEATURES

### Types of Bearings

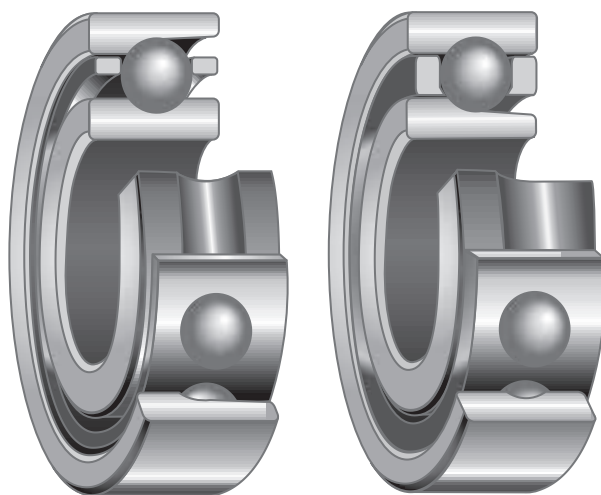
The three basic types of ball bearings offered in this catalog are Deep Groove, Angular Contact with Separable Inner Ring (B Types), and Angular Contact with Non-Separable Inner or Outer Rings (H and J Types).

#### Deep Groove Bearings

Deep groove bearings have full shoulders on both sides of the raceways of both inner and outer rings, with cages to separate the balls. The deep groove design permits the support of either radial or thrust loads. Because of this versatility they are preferred for many applications. Offered in many sizes, with a variety of cage types and in open, shielded, and sealed styles, they are the logical choice for first consideration.



*Typical deep groove bearings, open and shielded.*



*Angular contact bearings. Non-separable type H on left; separable type B on right. Shown with standard phenolic cages.*

#### Angular Contact Bearings

Angular contact bearings are ideally suited for high speed applications where both axial and radial loads are to be supported, and where system rigidity requires preloading. The design inherently limits thrust loads to one direction, and are generally used in pairs or sets. Radial load support is limited and occurs only when thrust loads are present or preload is used.

The non-separable (H type) angular contact design permits using a larger complement of balls than is possible in the same size deep groove bearing. For this reason it has greater capacity. It also has higher speeds because of the phenolic one-piece cage.

The separable (B type) angular contact bearing utilizes cages designed to retain the balls when the outer ring assembly (including cage and balls) is separated from the inner ring. This type of bearing has the same high speed capability as the H type non-separable angular contact bearing. The separable design has advantages for certain applications.

Separable bearings simplify assembly of units where bearings are located in blind holes. The separable feature also permits dynamic balancing of a rotating component with inner rings mounted in place, apart from the outer ring and housing.

Both separable and non-separable angular contact bearings utilize machined phenolic cages.

## Ball Bearing Closures

Closures (shields and seals) serve essentially the same purpose but to varying degrees. Each type of closure:

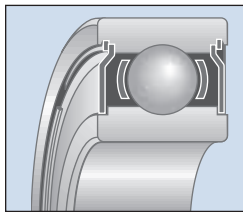
- Excludes contamination.
- Helps retain lubricants.
- Protects the internal assembly of the bearing from damage during handling or assembly.

The availability of shields and seals is shown in the tables that follow.

All types of closures are assembled in the outer ring in a manner as to provide controlled radial positioning with minimum distortion of the ring.

### Stainless Steel Shields

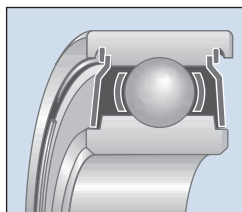
Shields are precision stamped of stainless steel to a



contoured configuration to provide strength and rigidity, resistance to vibration, and positive radial and axial positioning against the shield shoulder in the outer ring. The shield does not contact the inner ring and thus does not affect bearing performance.

### Flexeals

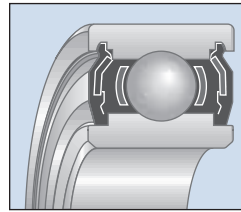
The Flexeal is a Barden-developed seal with superior high speed characteristics. A thin layer of inert fibrous material is permanently bonded to an aluminum washer, properly shaped by stamping, and positioned in the outer ring just as a shield. The fiber absorbs a proper amount of lubricant which is continuously fed to the ground seal wiping face on the inner ring notch. Positive Flexeal positioning provides a close control of seal wiping action, resulting in higher speed capability (compared with other seal designs) after run-in.



Flexeals are recommended in applications where contamination is generated around the bearing or in equipment which must operate in a contaminated environment.

Bearings with Flexeals are generally used at speeds where the dominant factors in torque are seal friction plus lubricant drag, which vary with type of lubricant, speed, and operating temperature. Flexeals may be used at temperatures up to 300°F. A maximum temperature of 350°F is acceptable for short periods. Total torque or power requirements are best determined by test in the application.

### Barseals



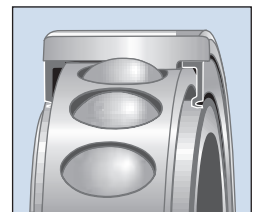
The barseal is a molded rubber seal which incorporates a metal stiffening insert. This design provides maximum volume within the bearing for lubrication. Speed considerations limit their use to grease-lubricated bearings with P or TMT cages. Effective outer ring sealing makes these seals preferred with outer ring rotation. Maximum operating temperature is 225°F.

### Sealed Angular Contact Spindle Bearings

Sealed spindle bearings allow the use of a more economical grease lubrication system. These bearings are factory-filled with Barden's high-performance G-75 grease, then fitted with "non-contact" seals on both sides.

The advantages of Barden's sealed spindle bearings include:

- A non-contacting seal design.
- Greased for life lubrication.
- Box-to-spindle (ready for assembly).
- Interchangeable with standard spindle bearings.
- Proper grease quantity.
- Controlled greasing process.
- Elimination of contamination during handling.
- Enhanced performance due to added sealing and grease near contact zone especially in vertical applications.



## BEARING FEATURES

### Cages

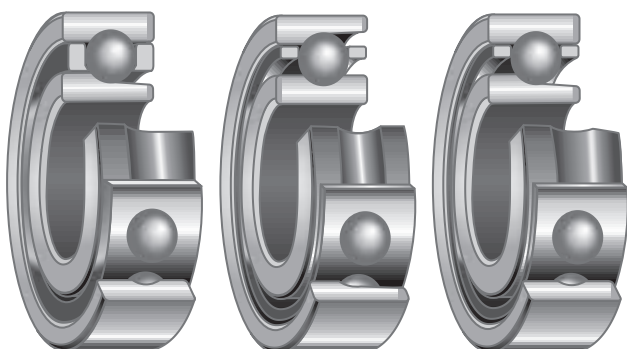
Barden deep groove and angular contact bearings are available with different types of cages offering a choice of performance characteristics for a range of applications.

### Deep Groove

Principal cage designs for deep groove bearings are the pressed stainless steel, one-piece snap type (Q), used in smaller sizes, and the two-piece ribbon style (P), used in larger sizes. The anti-windup cage (W), a Barden development, is available in many miniature and instrument sizes. It is a two-piece light-weight ribbon style designed to prevent cage windup in sensitive low torque applications. Phenolic high speed cages are one-piece snap style (TA) in smaller sizes, and two-piece riveted phenolic, reinforced with aluminum (T) in larger sizes.

### Angular Contact

Outer ring land-guided phenolic cages, designed for endurance at high speeds, are used in both separable and non-separable angular contact bearings.



**Separable Type B:** Outer ring has full shoulders, inner ring has one shoulder cut away. Inner ring is removable for mounting on the shaft separately from the outer ring assembly.

**Non-separable Type H:** Inner ring has full shoulders, outer has one shoulder cut away with a small retaining lip at the edge of raceway.

**Non-separable Type J:** Outer ring has full shoulders, inner ring has one shoulder cut away with a small retaining lip at the edge of raceway.

**Other cages are available, but should not be specified without consultation with Barden Product Engineering.**

### CAGES FOR DEEP GROOVE BEARINGS

Type	Cross Section	Illustration	Use	Material
<b>Q</b> – Crown type, snap cage			General purpose	Stainless steel AISI 410
<b>P</b> – 2-piece ribbon cage, full clinch			General purpose	Stainless steel AISI 430 AISI 305
<b>W</b> – 2-piece ribbon cage, loosely clinched			General purpose, low torque instruments	Stainless steel AISI 430 AISI 305
<b>TA</b> – Crown type, snap cage			High speed, general purpose	Phenolic
<b>T</b> – 2-piece riveted			High speed, general purpose	Phenolic Aluminum Clad
<b>TMT</b> – Crown type, snap cage			General purpose	Filled nylon 66
<b>TB</b> – Crown type, snap cage			Light load, no lubrication, in stainless steel bearing only, high and low temp., moderate speed	BarTemp
<b>TQ</b> – Crown type, snap cage			High speed, quiet operation	Delrin*

### CAGES FOR ANGULAR CONTACT BEARINGS

Type	Cross Section	Illustration	Use	Material
<b>B†</b> – 1-piece, for bearings with separable inner rings			High speed, general purpose	Phenolic
<b>H†</b> – 1-piece, for bearings with non-separable outer rings			High speed, general purpose	Phenolic
<b>J†</b> – 1-piece, for bearings with non-separable inner rings			High speed, general purpose	Phenolic

\* Reg. DuPont Trademark.

† Symbol for bearing type. No symbol is used in nomenclature for standard cage.



## TECHNICAL INFORMATION

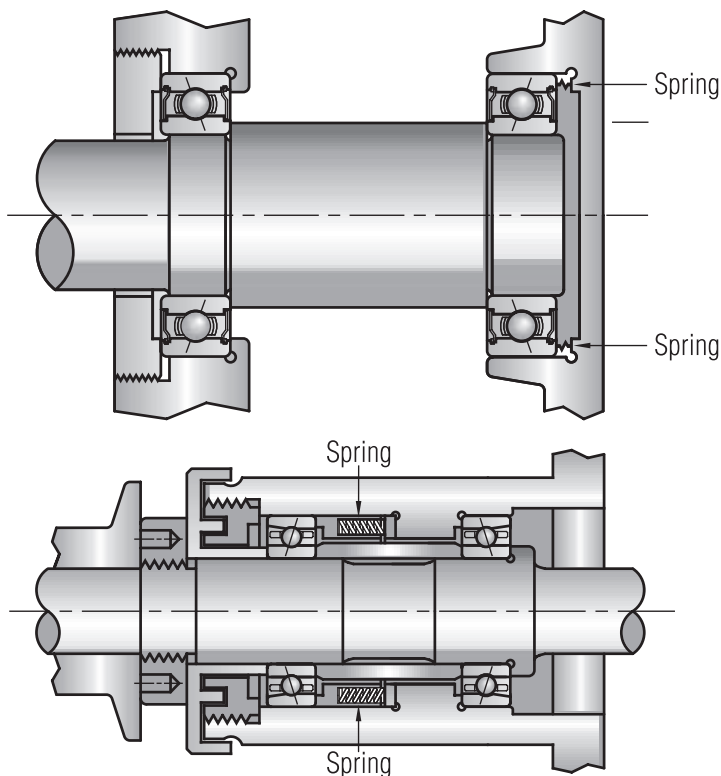
### Preloading

Preloading is the removal of internal clearance by placing a permanent thrust load on the bearings. Preloading is used to satisfy one or more of the following requirements:

1. Elimination of all radial and end play.
2. Increased rigidity of a system.
3. Reduction of non-repetitive runout.
4. Limitation of change in contact angle between inner and outer ring at very high speed.
5. Prevention of ball skidding under very high acceleration.

Bearings should not be preloaded more than is necessary to obtain the desired rigidity. Excessive preloads generate heat which reduces speed capability and bearing life. Two basic methods of achieving preload are:

1. Use of universal duplexed bearings (DU).
2. Spring preloading.



*Different types of spring preloading.*

### Spring Preloading

This is the simplest way to preload bearings. It should be considered first, and used if all application requirements can be met. Most assemblies which do not require specific yield characteristics can be successfully spring preloaded.

Spring preloading offers several advantages. With properly selected springs, it can be more constant than other systems. It is generally less sensitive to differential expansion, and offers more accommodation to minor misalignment. It also allows greater speeds than in rigidly preloaded systems.

Springs may be of many types — wavy washers, belleville washers, coil springs, spring block, etc.

### Rigid Preloading

To achieve, solid preload must be carried out with great care using highly accurate parts for the adjustment. Threaded members with spacers and precision shims are typical means of providing axial adjustment for preload. Lapped shims made to fine gradations of thickness are usually preferred since screw threads can produce misalignment effects.

Care must be taken in the mounting, design and installation procedures to avoid excessive preload due to thermal changes that can develop between assembly at room temperature and operating temperature.

The speed reduction factors shown on page 12 must be used with a rigidly preloaded system.

## TECHNICAL INFORMATION

### Duplexed Bearings

#### Angular Contact

Duplexed bearings are made by relieving selected faces of inner and outer rings by an amount called the preload offset. When the bearings are clamped into position, the offset faces are brought together, introducing a preload

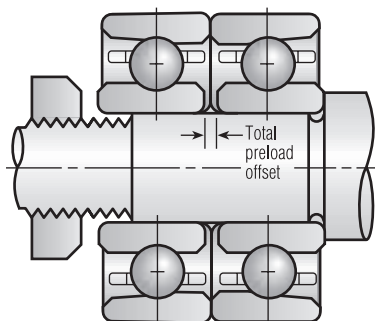


Fig. 1: DB mounting before clamping.

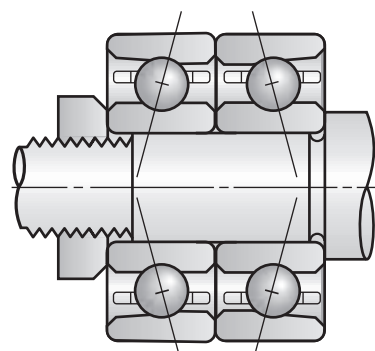


Fig. 2: DB mounting after clamping.

#### DB (back to back)

Preload offsets of abutting faces of inner rings causing contact angle lines of a pair of bearings to converge toward the outside diameter of the bearings. Bearings are mounted with marked faces or full shoulder side of outer rings together. Marked faces of outer rings and narrow faces of inner rings are mounted on separable (B) type bearings.

into the bearing system. Control of the preload is achieved by controlling the amount of preload offset. All Barden angular contact duplexed bearings are universally ground (DU), thus enabling them to be mounted in any of the three basic duplexing configurations.

High points of eccentricity are marked (asterisks) on inner rings of duplexed angular contact bearings to reduce assembly errors.

This mounting method is preferred for applications where high moment rigidity is required. DB mounting is also preferred where the shaft runs warmer than the housing, a common operating condition. Consequently, higher operating speeds are possible.

A Duplex DB pair before preloading (Fig. 1) has inner rings with a controlled preload offset. When inner rings are clamped together on the shaft (Fig. 2) the specified preload is established within the pair.

#### DF (face to face)

Preload offsets of abutting faces of the outer rings causing lines of contact of a pair of bearings to converge toward the bearing bores. Mounted with unmarked or relieved faces of outer rings and wide faces of inner rings are mounted together on separable (B) type bearings.

The DF mounting is preferred in slow speed applications where shaft binding due to misalignment will be encountered.

The DF pair before preloading (Fig. 3) has outer rings with controlled preload offset. When outer rings are clamped together in housing (Fig. 4) the specified preload is established within the pair of bearings.

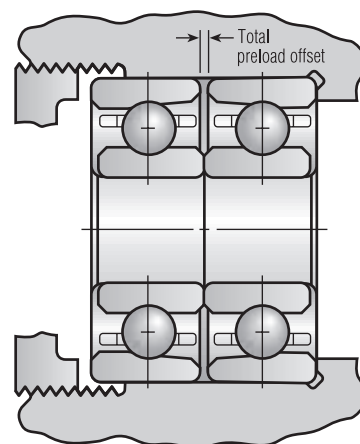


Fig. 3: DF mounting before clamping.

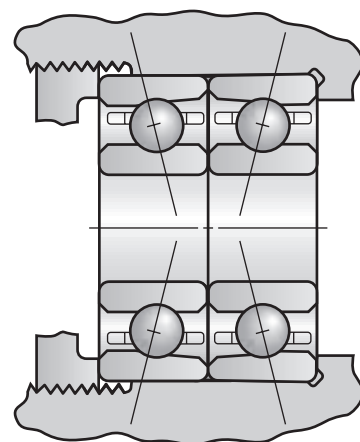
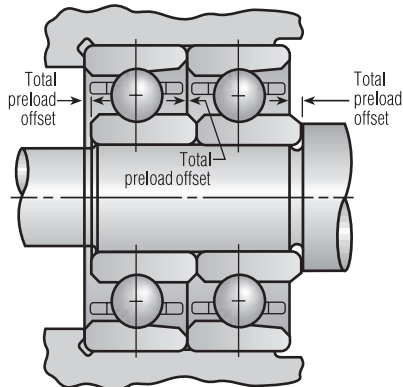


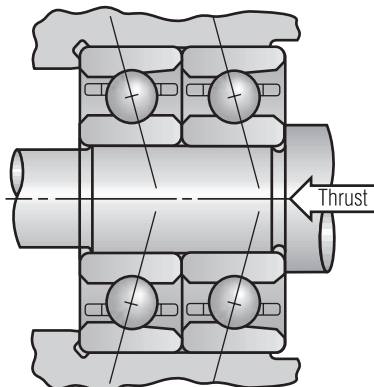
Fig. 4: DF mounting after clamping.

### DT (tandem)

Preload offsets of abutting faces of both inner and outer rings create parallel lines of contact. Mounted with marked or full



**Fig. 5:** DT mounting before preloading.



**Fig. 6:** DT mounting after preloading.

shoulder side of outer ring of one bearing against unmarked or relieved face of outer ring of other bearing.

DT pairs offer greater capacity without increasing bearing size, through load sharing. Additionally, they can be used to achieve a significant increase in axial and radial rigidity.

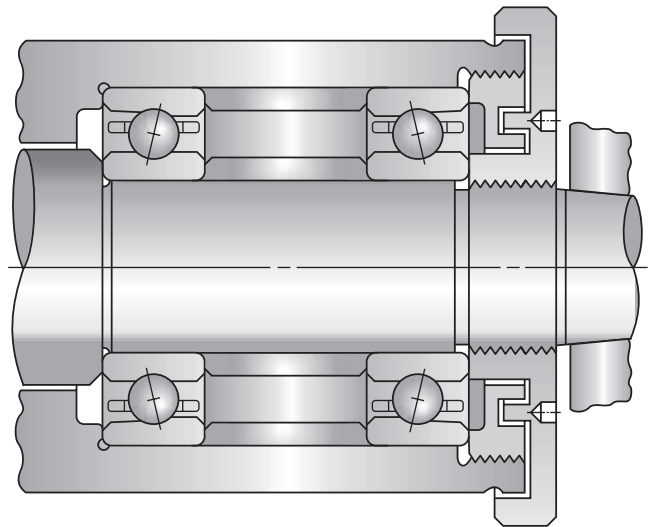
Duplex DT tandem pair before preloading (Fig. 5) has inner and outer rings with equalized offsets. When mounted and thrust loaded (Fig. 6), loads are shared equally by both bearings.

### Deep Groove

Deep groove bearings may also be duplexed and must be ordered as such. The mounting arrangements differ from angular contact bearings in that marked faces are outboard for DB mounting and inboard for DF mounting. Shields and seals are always installed on only the outboard sides of both rings.

### Spacers

All duplexed bearings can be separated by equal width spacers (Fig. 7) to increase moment rigidity. Inner and outer ring spacer widths (axial length) must be matched to within 0.001mm, and faces must be square, flat and parallel within 0.001mm to preserve preload and alignment.



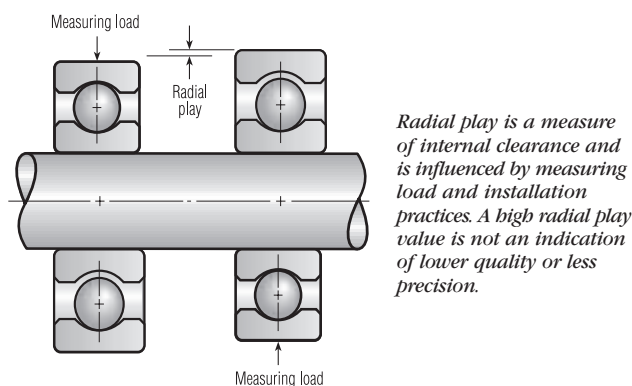
**Fig. 7:** Duplex bearing pairs with equal width spacers.

## TECHNICAL INFORMATION

### Radial Play

#### Deep Groove Bearings

Radial play is the measured clearance in the radial direction of an assembled bearing. Its magnitude is an important factor in bearing performance. Without radial play, interference fits and normal expansion of components cannot be accommodated, causing binding and early failure. High speeds create heat through friction and require greater than normal radial play. If thrust loads predominate, higher radial play will tend to increase load capacity, life, and axial rigidity. Low radial play codes are better suited for slow speed radially supported applications.



Deep groove bearings are available in a range of radial play groups. Each radial play code, represents limits to the range of internal clearance. Code 3 and Code 5 bearings are more readily available than those with other radial play codes.

RADIAL PLAY — DEEP GROOVE BEARINGS			
Bearing Sizes	Code 3	Code 5	Code 6
34 – 39, 100 – 103	.0002" to .0004"	.0005" to .0008"	.0008" to .0011"
R0 – 10, R133 – R1810	.0002" to .0004"	.0005" to .0008"	.0008" to .0011"
104 – 107, 200 – 205	.0002" to .0005"	.0005" to .0009"	.0009" to .0014"
108, 206 – 209	.0002" to .0005"	.0007" to .0012"	.0012" to .0017"
109 – 110, 210	.0004" to .0008"	.0008" to .0013"	.0013" to .0019"
111	.0005" to .0010"	.0010" to .0016"	.0016" to .0023"
(ABMA Designation)	0	3	4

### Angular Contact Bearings

Radial play, when combined with thrust loading, creates a line of contact between the ball and both races. The angle made by this line and a plane through the ball centers is called the contact angle. Standard spindle size angular contact bearings are assembled with a radial play that provides either a nominal 15° (C) or 25° (E) contact angle. The 15° contact angle bearing is standard for the 100H, 200H, and 300H series and provides the optimum combination of both axial and radial capacity and rigidity. Where greater axial rigidity is required, the 25° contact angle (100HE and 200HE series) is preferred. Where extreme axial rigidity is necessary, a 60° contact angle series is also available. Refer to the section on ball screw support bearings, page 24.

### Limiting Speeds

#### Spindle Bearings

Limiting speeds given in the product tables represent maximum values under ideal conditions, namely light spring loads, adequate lubrication, and proper installation and alignment. When less than ideal conditions exist, speeds should be limited to lower values. Factors for calculating the speed limits of rigidly preloaded bearing systems are given below.

SPEED REDUCTION ( $n \cdot f_r$ ) FOR SPINDLE BEARING SETS				
Bearing Arrangement		Factor $f_r$ , Bearing Preload		
		L	M	H
Large bearing distance				
		0.85	0.75	0.50
		0.80	0.70	0.50
		0.75	0.65	0.45
Locating bearing	Floating bearing			
		0.75	0.60	0.35
		0.65	0.50	0.30
		0.65	0.50	0.30
		0.72	0.57	0.37

## Lubricants

Lubricants for typical applications are listed below.

Barden Code*	Designation	Temperature	Limiting dN Value†
<b>OILS</b>			
0-9	Exxon Avia. Instrument Oil	−65°F to +150°F	$1.5 \times 10^6$
0-11	Winsorlube L-245X	−67°F to +175°F	$1.5 \times 10^6$
0-14	Exxon 2389 Turbo Oil	−65°F to +350°F	$1.5 \times 10^6$
<b>GREASES</b>			
G-2	Exxon Beacon 325	−65°F to +250°F	$.40 \times 10^6$
G-4	Nye Rheolube 757 SSG	−40°F to +200°F	$.65 \times 10^6$
G-12	Chevron SRI-2	−20°F to +300°F	$0.4 \times 10^6$
G-18	Nye Rheotemp 500	−50°F to +350°F	$0.5 \times 10^6$
G-33	Mobil #28	−80°F to +350°F	$0.4 \times 10^6$
G-42	Nye Rheolube 350-SBG-2	−30°F to +250°F	$.65 \times 10^6$
G-46	Kluber Isoflex NBU-15	−40°F to +250°F	$.75 \times 10^6$
G-74	Exxon Unirex N3	−40°F to +300°F	$.65 \times 10^6$
G-75	Arcanol L-75	−60°F to +250°F	$1.2 \times 10^6$

\* See Bearing Numbering System pages 4 – 5.

† dN = bearing bore in mm (or inches  $\times 25.4$ )  $\times$  speed in RPM.

Although greases will operate at maximum temperature and speeds indicated, grease life will be limited. Significantly greater grease life will be obtained at lower speeds and lower temperatures.

Bearings are furnished with the following standard lubricants:

Bearing Types	Lubricant Codes
All deep groove, open bearings — instrument	0-11
All deep groove, open bearings — spindle	0-9
All shielded or sealed bearings — instrument	G-2
All shielded or sealed bearings — spindle	G-74
All angular contact bearings — instrument	0-11
All angular contact bearings — spindle	0-11
All sealed angular contact bearings — spindle	G-75
All ball screw support bearings	G-73

## Tolerances

Barden precision ball bearings are manufactured to standard grades of precision which establish tolerances for size and geometric accuracy. These standards are set by the Annular Bearing Engineers Committee (ABEC) of the Anti-Friction Bearing Manufacturers Association, Inc. (ABMA). These same standards have been accepted by the American National Standards Institute, Inc. (ANSI) and, through international

agreements, conform essentially with standards for precision ball bearings developed by the International Organization for Standardization (ISO).

Barden manufactures spindle and turbine bearings to class ABEC 9 and instrument bearings to class ABEC 7P.

## Handling Bearings

All Barden bearings are manufactured, assembled, inspected and packaged in a strictly controlled environment.

If the quality and high performance potential built into precision bearings is to be realized by the bearing user, the same degree of care and cleanliness should be used in handling and installing the bearings.

Achievement of the required degree of cleanliness requires that all work spaces, tools, transport equipment, fixtures and the parts mated to the bearings be clean. Anyone handling bearings should recognize the need for careful handling and cleanliness.

### Guidelines for Handling Bearings

- Keep bearings in their original packaging until installation.
- Barden bearings are demagnetized prior to shipment. If there is any indication that bearings have become magnetized, which would attract contaminants, the wrapped bearings should be passed through a demagnetizer.
- Do not wash new bearings. Open bearings are lubricated with a petroleum-base oil which is compatible with oil mist lubricating systems and most spindle bearing greases. Sealed and shielded bearings are grease lubricated.
- Wear non-shedding, clean finger coverings, like plastic gloves or use tweezers when handling bearings.
- Use clean, burr-free tools, not painted or chrome-plated.
- Transmittal of forces through the bearing must be prevented to avoid brinelling which can damage bearings. Apply force only to the ring being fitted.
- Do not hammer. Use an arbor press or induction heater.
- Make sure outer rings are free to float for shaft expansion (if design requires a floating bearing arrangement).
- If it is ever necessary to open the packaged bearing except for installation, it should be stored in a clean, covered container with proper identification prior to installation. The full nomenclature will appear only on the original package.



## CERAMIC HYBRIDS AND X-LIFE ULTRA BEARINGS

### Ceramic Hybrids

Use of ceramic (silicon nitride) balls in place of steel balls can radically improve bearing performance several ways. Because ceramic balls are 50% lighter than steel balls, and because their surface finish is almost perfectly smooth, they exhibit vibration levels two to seven times lower than conventional steel ball bearings.

Ceramic hybrid bearings also run at significantly lower operating temperatures, and can allow running

#### Ceramic Ball Bearing Features

##### 60% lighter than steel balls

- Centrifugal forces reduced
- Lower vibration levels
- Less heat build up
- Reduced ball skidding
- Fatigue life increased

##### 50% higher modulus of elasticity

- Improved spindle rigidity
- Naturally fatigue resistant

##### Tribochemically inert

- Low adhesive wear
- Improved lubricant life
- Superior corrosion resistance

#### Benefits of Ceramic Ball Bearings

- Bearing service life is two to five times longer, five to ten times longer with X-Life
- Running speeds up to 50% higher
- Overall accuracy and quality improves
- Better workpiece finish characteristics
- Lower operating costs
- Increased productivity
- High temperature capability
- Cutting tool life is increased
- Electrically non-conductive

speeds to increase by as much as 40% to 50%.

Bearings with ceramic balls have been proven to last up to five times longer than conventional steel ball bearings. Lower operating temperatures help extend lubricant life.

Spindles equipped with ceramic hybrids show higher rigidity and higher natural frequency making them less sensitive to vibration. Improved stability leads to greater accuracy, better workpiece finish characteristics, lower scrap rates and reduced downtime. Diamond cutting tool life can also be prolonged.

Because of the unique properties of silicon nitride, ceramic balls drastically reduce the predominant cause of surface wear in conventional bearings (metal rings/metal balls). In conventional bearings, microscopic surface asperities on balls and races will “cold weld” or

COMPARISON OF BEARING STEEL & SILICON NITRIDE PROPERTIES		
Property	Steel	Ceramic
Density (g/cm <sup>3</sup> )	7.8	3.2
Elastic Modulus (10 <sup>6</sup> psi)	30	45
Hardness	R <sub>c</sub> 60	R <sub>c</sub> 78
Coefficient of thermal expansion (X10 <sup>-6</sup> /°F)	6.7	1.7
Coefficient of friction	0.42 dry	0.17 dry
Poisson's ratio	0.3	0.26
Maximum use temperature (°F)	620	2000
Chemically inert	No	Yes
Electrically non-conductive	No	Yes
Non-magnetic	No	Yes

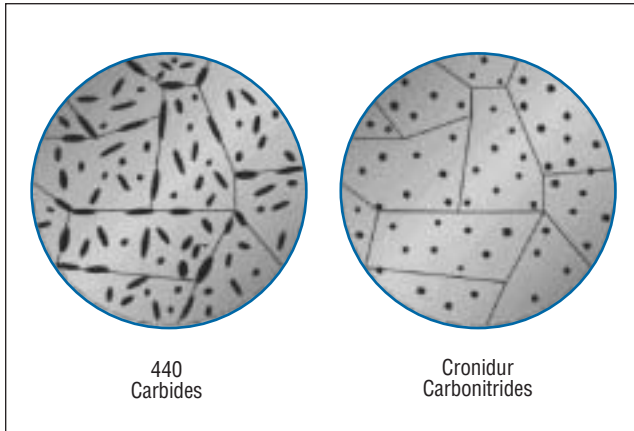
*Ceramic balls are lighter and harder than steel balls, characteristics which improve overall bearing performance.*

stick together even under normal lubrication and load conditions. As the bearing rotates, the microscopic cold welds break, producing roughness and, eventually, worn contact surfaces. This characteristic is known as adhesive wear. Since ceramic balls will not cold weld to steel rings, wear is dramatically reduced. Because wear particles generated by adhesive wear are not present in ceramic hybrids, lubricant life is also prolonged. The savings in reduced maintenance costs alone can be significant.

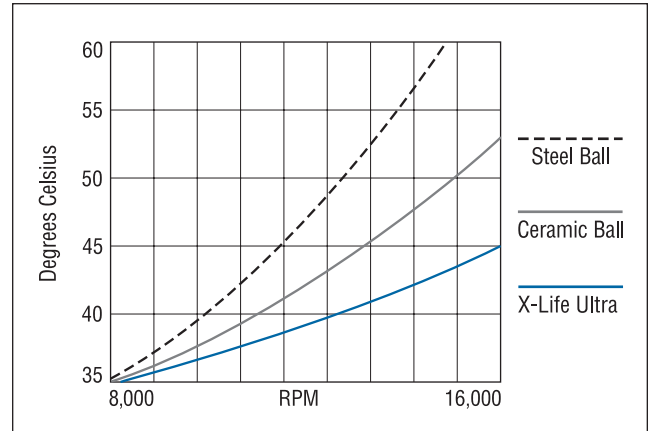
### X-Life Ultra Bearings

X-Life Ultra bearings were developed for the highest demands with respect to speed and loading capability. These bearings are hybrid ceramic bearings with bearing rings made from Cronidur 30, a high nitrogen, corrosion resistant steel. Cronidur 30 shows a much finer grain structure compared with the conventional bearing steel 100Cr6 (SAE 52100) resulting in cooler running and higher permissible contact stresses. Basically all bearing types are available as X-Life Ultra bearings.

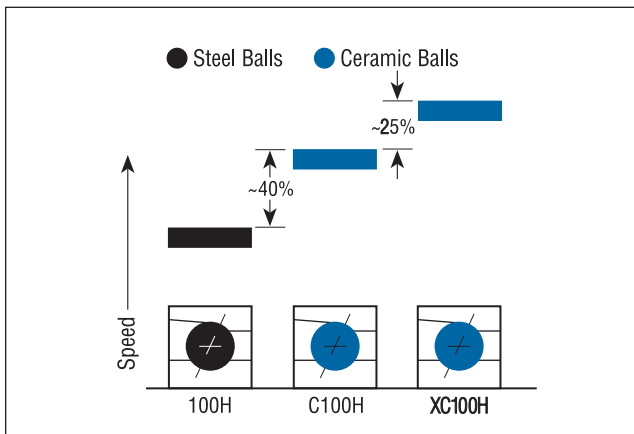
The longer service life of X-Life Ultra bearings when compared to conventional bearings also contributes to an overall reduction in the total system costs. When calculating the indirect costs of frequent bearing replacement — which include not just inventory, but machine down time, lost productivity and labor — the cost savings potential of X-Life Ultra bearings become significant.



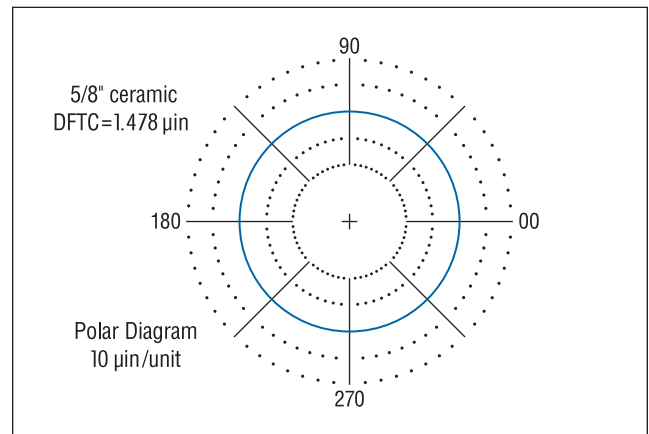
A comparison of 440C carbides and Cronidur carbonitrides shows that Cronidur has a much more homogeneous grain structure.



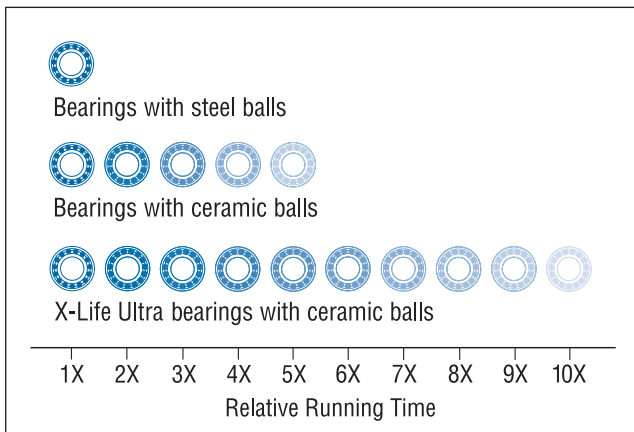
Lower operating temperature. As running speeds increase, ceramic balls always run cooler than conventional steel balls. With reduced heat build up, lubricant life is prolonged.



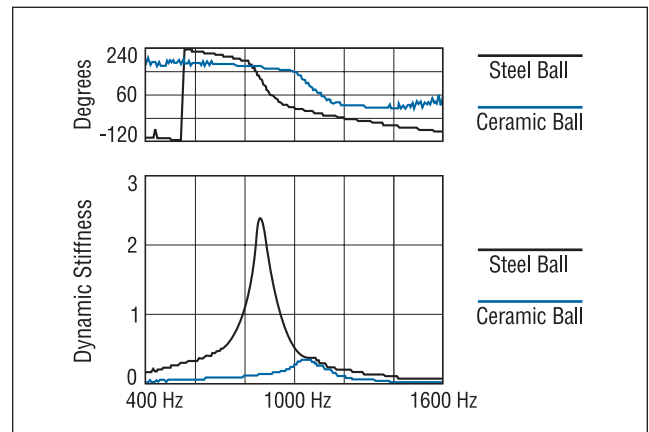
Running speed of ceramic ball exceeds same-size steel ball by 40%. Converting to an X-Life Ultra bearing with ceramic ball will boost running speeds an additional 25%.



Deviation from true circularity (DFTC). Polar trace of a 5/8" silicon nitride ball indicates near perfect roundness, which results in dramatically lower vibration levels.



Relative useful life of steel, ceramic hybrid and X-Life Ultra bearings with ceramic balls.

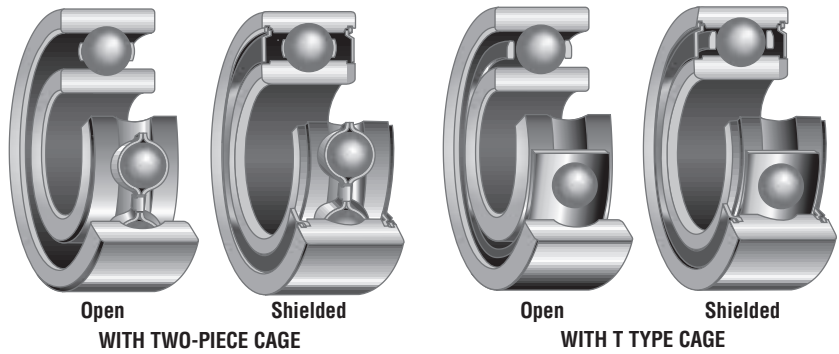








Dynamic stiffness analysis shows better rigidity and higher natural frequency for hybrid bearings.

## SERIES 30, 100 AND 200

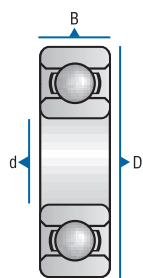
### Deep Groove Radial Ball Bearings

- Open and Shielded
- Extra Wide and Flexeal

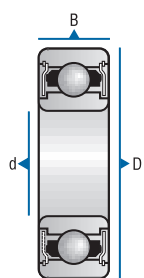


BEARING NUMBERS						BEARING FEATURES	
Open		Shielded		Sealed Flexeal			
 2-Piece Cage	 T Cage	 2-Piece Cage	 T Cage	 2-Piece Cage	 T Cage	Standard Preload  lb.	
SERIES 30							
• 37	—	• 37SS	—	—	—	12	
• 38	—	• 38SS	—	• 38FF	—	12	
• 39	—	• 39SS	—	—	—	15	
SERIES 100							
• 100	—	• 100SS	—	100FF	—	10	
—	101T	—	—	—	—	10	
—	102T						
103	103T	103SS	• 103SST	• 103FF	103FFT	18	
—	104T	—	104SST	—	104FFT	20	
—	105T	—	105SST	—	105FFT	25	
—	106T	—	106SST	—	106FFT	35	
—	107T	—	107SST	—	107FFT	40	
—	110T	—	110SST	—	—	75	
SERIES 200							
200	200T	200SS	—	200FF	—	12	
201	201T	201SS	—	201FF	—	14	
202	202T	202SS	202SST	202FF	202FFT	17	
203	203T	203SS	203SST	203FF	203FFT	22	
204	204T	204SS	204SST	204FF	204FFT	30	
205	205T	205SS	205SST	205FF	205FFT	35	
206	206T	206SS	206SST	206FF	206FFT	50	
207	207T	207SS	207SST	207FF	207FFT	70	
—	208T	—	—	—	—	85	
—	209T	—	—	—	—	90	
—	210T	—	—	—	—	110	
EXTRA WIDE SERIES							
—	—	—	37SSTX2	—	37FFTX2	12	
—	—	—	• 38SSTX2	—	• 38FFTX2	12	
—	—	38SSX6	38SSTX6	—	38FFTX6	15	
—	—	100SSX1	100SSTX1	—	100FFTX1	10	
—	—	—	101SSTX1	—	101FFTX1	13	
—	—	201SSX1	201SSTX1	—	201FFTX1	14	
—	—	202SSX1	202SSTX1	202FFX1	202FFTX1	17	
9204	9204T	9204SS	9204SST	9204FF	9204FFT	30	
9205	9205T	9205SS	9205SST	9205FF	9205FFT	35	
9206	9206T	9206SS	9206SST	9206FF	9206FFT	50	

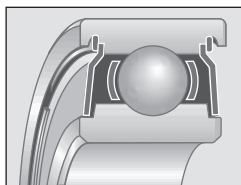
• Also available in AISI 440C stainless steel. To order, add prefix "S" to the basic bearing number.



Open



Shielded



Detail close-up showing how Flexeal Seals provide sealing action. If it is necessary to use a single Flexeal, indicate by using a single suffix "F" in the bearing number.

	BEARING DIMENSIONS						SPEED LIMITS Light Oil		SPEED LIMITS Grease Lubricated	
	Bore Diameter d		Outside Diameter D		Width B Rings		Cage Types		Cage Types	
	mm	inch	mm	inch	mm	inch	Two Piece RPM	T RPM	Two Piece RPM	T RPM
	<b>SERIES 30</b>									
	7	.2756	22	.8661	7	.2756	32,000	—	32,000	—
	8	.3150	22	.8661	7	.2756	32,000	—	32,000	—
	9	.3543	26	1.0236	8	.3150	—	72,000	25,000	—
	<b>SERIES 100</b>									
	10	.3937	26	1.0236	8	.3150	26,500	—	26,500	—
	12	.4724	28	1.1024	8	.3150	—	89,000	—	70,833
	15	.5906	32	1.2598	9	.3543	—	71,000	—	56,667
	17	.6693	35	1.3780	10	.3937	15,400	62,000	15,400	50,000
	20	.7874	42	1.6535	12	.4724	—	53,000	—	42,500
	25	.9843	47	1.8504	12	.4724	—	42,500	—	34,000
	30	1.1811	55	2.1654	13	.5118	—	35,000	—	28,333
	35	1.3780	62	2.4409	14	.5512	—	30,500	—	24,286
	50	1.9685	80	3.1496	16	.6299	—	22,500	—	17,000
	<b>SERIES 200</b>									
	10	.3937	30	1.1811	9	.3543	25,000	100,000	25,000	85,000
	12	.4724	32	1.2598	10	.3937	20,500	83,000	20,500	70,833
	15	.5906	35	1.3780	11	.4331	16,800	67,000	16,800	56,667
	17	.6693	40	1.5748	12	.4724	14,800	59,000	14,800	50,000
	20	.7874	47	1.8504	14	.5512	12,500	50,000	12,500	42,500
	25	.9843	52	2.0472	15	.5906	10,000	40,000	10,000	34,000
	30	1.1811	62	2.4409	16	.6299	8,400	33,500	8,400	28,333
	35	1.3780	72	2.8346	17	.6693	7,100	28,500	7,100	24,286
	40	1.5748	80	3.1496	18	.7087	—	25,000	—	21,250
	45	1.7717	85	3.3465	19	.7480	—	23,000	—	18,889
	50	1.9685	90	3.5433	20	.7874	—	20,000	—	17,000
	<b>EXTRA WIDE SERIES</b>									
	7	.2756	22	.8661	10.31	.4060	—	120,000	—	86,000
	8	.3150	22	.8661	10.31	.4060	—	120,000	—	86,000
	8	.3150	24	.9449	10.31	.4060	—	120,000	—	86,000
	10	.3937	26	1.0236	11.51	.4531	—	106,000	—	85,000
	12	.4724	28	1.1024	11.51	.4531	—	89,000	—	70,833
	13	.5118	32	1.2598	12.70	.5000	—	83,000	—	65,385
	15	.5906	35	1.3780	12.70	.5000	16,800	67,000	16,800	56,667
	20	.7874	47	1.8504	20.64	.8125	12,500	50,000	12,500	42,500
	25	.9843	52	2.0472	20.64	.8125	10,000	40,000	10,000	34,000
	30	1.1811	62	2.4409	23.81	.9375	8,400	33,500	8,400	28,333

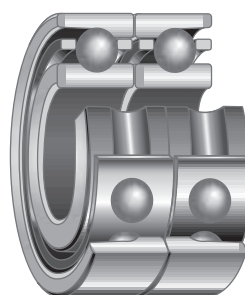
## SERIES 1900HC

### Angular Contact Bearings

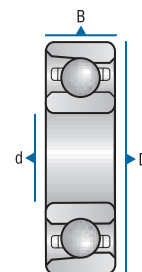
- Non-Separable
- 15° Contact Angle




Angular Contact Bearing



Duplex Pair



H Type

BEARING NUMBERS	BEARING DIMENSIONS					BEARING FEATURES						SPEED LIMITS	
<b>Phenolic Cage</b>  Non-Separable	Bore Diameter d		Outside Diameter D		Width B	Standard Preload						Phenolic Cage	
	mm	inch	mm	inch	Rings mm inch	Light N lbs.	Medium N lbs.	Heavy N lbs.				Grease rpm	Oil rpm
<b>SERIES 1900HC</b>													
1900HC	10	.3937	22	.8661	6 .2362	14	3.1	51	11	114	26	70,000	110,000
1901HC	12	.4724	24	.9449	6 .2362	15	3.4	56	13	126	28	60,000	90,000
1902HC	15	.5906	28	1.1024	7 .2756	20	4.5	77	17	167	38	50,000	75,000
1903HC	17	.6693	30	1.1811	7 .2756	21	4.7	81	18	176	40	48,000	70,000
1904HC	20	.7874	37	1.4567	9 .3543	41	9.2	137	31	297	67	38,000	56,000
1905HC	25	.9843	42	1.6535	9 .3543	40	9.0	141	32	326	73	32,000	48,000
1906HC	30	1.1811	47	1.8504	9 .3543	42	9.4	158	36	345	78	28,000	43,000
1907HC	35	1.3780	55	2.1654	10 .3937	61	13.7	209	47	481	108	24,000	38,000
1908HC	40	1.5748	62	2.4409	12 .4724	85	19.1	300	67	633	142	22,000	36,000
1909HC	45	1.7717	68	2.6772	12 .4724	89	20	315	71	667	150	19,000	32,000
1910HC	50	1.9685	72	2.8346	12 .4724	90	20	321	72	679	153	18,000	30,000
1911HC	55	2.1654	80	3.1496	13 .5118	112	25	391	88	825	185	16,000	26,000
1912HC	60	2.3622	85	3.3465	13 .5118	117	26	410	92	866	195	15,000	24,000
1913HC	65	2.5591	90	3.5433	13 .5118	118	27	417	94	883	198	14,000	22,000
1914HC	70	2.7559	100	3.9370	16 .6299	172	39	588	132	1,230	277	13,000	20,000
1915HC	75	2.9528	105	4.1339	16 .6299	174	39	596	134	1,246	280	12,000	19,000
1916HC	80	3.1496	110	4.3307	16 .6299	175	39	603	136	1,262	284	12,000	19,000
1917HC	85	3.3465	120	4.7244	18 .7087	239	54	804	181	1,672	376	11,000	18,000
1918HC	90	3.5433	125	4.9213	18 .7087	240	54	811	182	1,688	379	10,000	17,000
1919HC	95	3.7402	130	5.1181	18 .7087	245	55	827	186	1,724	388	9,500	16,000
1920HC	100	3.9370	140	5.5118	20 .7874	318	71	1,059	238	2,194	493	9,000	15,000
1921HC	105	4.1339	145	5.7087	20 .7874	318	71	1,059	238	2,194	493	8,500	14,000
1922HC	110	4.3307	150	5.9055	20 .7874	316	71	1,056	237	2,191	493	8,000	13,000
1924HC	120	4.7244	165	6.4961	22 .8661	408	92	1,344	302	2,773	623	7,000	11,000
1926HC	130	5.1181	180	7.0866	24 .9449	489	110	1,600	360	3,291	740	6,700	10,000
1928HC	140	5.5118	190	7.4803	24 .9449	506	114	1,661	373	3,412	767	6,000	9,000
1930HC	150	5.9055	210	8.2677	28 1.1024	710	160	2,286	514	4,680	1,052	5,600	8,500
1932HC	160	6.2992	220	8.6614	28 1.1024	727	163	2,341	526	4,793	1,077	5,000	7,500
1934HC	170	6.6929	230	9.0551	28 1.1024	747	168	2,410	542	4,941	1,111	4,800	7,000
1936HC	180	7.0866	250	9.8425	33 1.2992	966	217	3,086	694	6,300	1,416	4,500	6,700
1938HC	190	7.4803	260	10.2362	33 1.2992	894	201	2,996	674	6,210	1,396	4,300	6,300

*All 1900 Series Bearings also available with 25° contact angle. Please contact Barden Customer Service for details.*



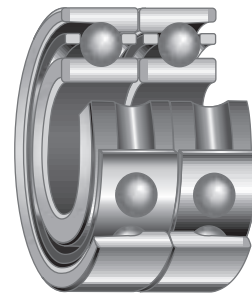
## SERIES 30H, 100HC AND 100H

### Angular Contact Bearings

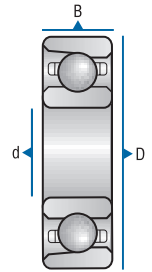
- Non-Separable
- 15° Contact Angle




Angular Contact Bearing



Duplex Pair



H Type

BEARING NUMBERS	BEARING DIMENSIONS						BEARING FEATURES						SPEED LIMITS	
<b>Phenolic Cage</b>  Non-Separable	Bore Diameter d		Outside Diameter D		Width B		Standard Preload						Phenolic Cage	
	mm	inch	mm	inch	mm	inch	Light N	lbs.	Medium N	lbs.	Heavy N	lbs.	Grease rpm	Oil rpm
<b>SERIES 30</b>														
34-5H	5	.1969	16	.6299	5	.1969	—	—	—	6	—	—	140,000	183,000
36H	6	.2362	19	.7480	6	.2362	—	—	—	6	—	—	166,000	250,000
38H	8	.3150	22	.8661	7	.2756	—	—	—	12	—	—	85,800	132,000
39H	9	.3543	26	1.0236	8	.3150	—	—	—	15	—	—	85,800	132,000
<b>SERIES 100</b>														
100HC	10	.3937	26	1.0236	8	.3150	17	4	67	15	145	33	60,000	90,000
101HC	12	.4724	28	1.1024	8	.3150	19	4	74	17	161	36	56,000	85,000
102HC	15	.5906	32	1.2598	9	.3543	28	6	102	23	216	49	48,000	70,000
103HC	17	.6693	35	1.3780	10	.3937	41	9	146	33	308	69	43,000	63,000
104HC	20	.7874	42	1.6535	12	.4724	52	12	179	40	377	85	36,000	53,000
105HC	25	.9843	47	1.8504	12	.4724	74	17	254	57	533	120	30,000	45,000
106HC	30	1.1811	55	2.1654	13	.5118	75	17	260	58	545	123	26,000	40,000
107HC	35	1.3780	62	2.4409	14	.5512	97	22	333	75	697	157	22,000	36,000
108HC	40	1.5748	68	2.6772	15	.5906	102	23	353	79	743	167	20,000	34,000
109HC	45	1.7717	75	2.9528	16	.6299	145	33	490	110	1,019	229	18,000	30,000
110HC	50	1.9685	80	3.1496	16	.6299	150	34	507	114	1,054	237	17,000	28,000
111HC	55	2.1654	90	3.5433	18	.7087	207	47	687	154	1,424	320	15,000	24,000
112HC	60	2.3622	95	3.7402	18	.7087	211	47	704	158	1,459	328	14,000	22,000
113HC	65	2.5591	100	3.9370	18	.7087	216	49	720	162	1,495	336	13,000	20,000
114HC	70	2.7559	110	4.3307	20	.7874	278	62	915	206	1,888	424	12,000	19,000
115HC	75	2.9528	115	4.5276	20	.7874	283	64	931	209	1,923	432	12,000	19,000
116HC	80	3.1496	125	4.9213	22	.8661	357	80	1,163	261	2,391	537	11,000	18,000
117HC	85	3.3465	130	5.1181	22	.8661	370	83	1,209	272	2,484	558	10,000	17,000
118HC	90	3.5433	140	5.5118	24	.9449	440	99	1,427	321	2,925	658	9,500	16,000
119HC	95	3.7402	145	5.7087	24	.9449	447	100	1,452	326	2,980	670	9,000	15,000
120HC	100	3.9370	150	5.9055	24	.9449	467	105	1,516	341	3,112	700	8,500	14,000
121H	105	4.1339	160	6.2992	26	1.0236	667	150	1,601	360	3,202	720	8,100	12,800
122H	110	4.3307	170	6.6929	28	1.1024	667	150	1,735	390	3,470	780	7,700	12,300
124H	120	4.7244	180	7.0866	28	1.1024	756	170	1,868	420	3,736	840	7,100	11,200
126H	130	5.1181	200	7.8740	33	1.2992	1,023	230	2,491	560	4,982	1,120	6,500	10,400
128H	140	5.5118	210	8.2677	33	1.2992	1,112	250	2,758	620	5,516	1,240	6,100	9,600
130H	150	5.9055	225	8.8583	35	1.3780	1,245	280	3,114	700	6,228	1,400	5,700	9,000

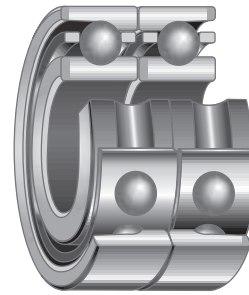
## SERIES 200HC, 200H AND 300H

### Angular Contact Bearings

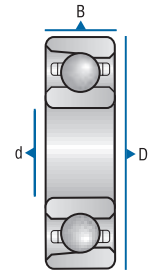
- Non-Separable
- 15° Contact Angle




Angular Contact Bearing




Duplex Pair



H Type

BEARING NUMBERS	BEARING DIMENSIONS						BEARING FEATURES						SPEED LIMITS	
<b>Phenolic Cage</b>  Non-Separable	<b>Bore Diameter</b> <b>d</b>		<b>Outside Diameter</b> <b>D</b>		<b>Width</b> <b>B</b>		Standard Preload						Phenolic Cage	
							Light		Medium		Heavy		Grease	Oil
	mm	inch	mm	inch	mm	inch	N	lbs.	N	lbs.	N	lbs.	rpm	rpm
<b>SERIES 200</b>														
200HC	10	.3937	30	1.1811	9	.3543	25	6	92	21	198	45	56,000	85,000
201HC	12	.4724	32	1.2598	10	.3937	35	8	124	28	264	59	50,000	75,000
202HC	15	.5906	35	1.3780	11	.4331	47	11	165	37	347	78	45,000	67,000
203HC	17	.6693	40	1.5748	12	.4724	53	12	186	42	391	88	38,000	56,000
204HC	20	.7874	47	1.8504	14	.5512	74	17	252	57	527	118	32,000	48,000
205HC	25	.9843	52	2.0472	15	.5906	79	18	269	60	562	126	28,000	43,000
206HC	30	1.1811	62	2.4409	16	.6299	122	27	412	93	856	192	24,000	38,000
207HC	35	1.3780	72	2.8346	17	.6693	136	31	454	102	942	212	20,000	34,000
208HC	40	1.5748	80	3.1496	18	.7087	176	40	584	131	1,204	271	18,000	30,000
209HC	45	1.7717	85	3.3465	19	.7480	184	41	607	136	1,252	281	17,000	28,000
210HC	50	1.9685	90	3.5433	20	.7874	242	54	792	178	1,631	367	16,000	26,000
211HC	55	2.1654	100	3.9370	21	.8268	261	59	849	191	1,750	393	14,000	22,000
212HC	60	2.3622	110	4.3307	22	.8661	315	71	1,022	230	2,100	472	13,000	20,000
213H	65	2.5591	120	4.7244	23	.9055	445	100	1,112	250	2,224	500	12,300	20,000
214H	70	2.7559	125	4.9213	24	.9449	445	100	1,157	260	2,314	520	11,400	18,500
215H	75	2.9528	130	5.1181	25	.9843	445	100	1,157	260	2,314	520	10,700	17,300
216H	80	3.1496	140	5.5118	26	1.0236	534	120	1,379	310	2,758	620	10,000	16,200
217H	85	3.3465	150	5.9055	28	1.1024	667	150	1,646	370	3,292	740	9,400	15,300
218H	90	3.5433	160	6.2992	30	1.1811	712	160	1,779	400	3,558	800	8,900	14,400
220H	100	3.9370	180	7.0866	34	1.3386	979	220	—	540	—	1,080	8,000	13,000
<b>SERIES 300H</b>														
304H	20	.7874	52	2.0472	15	.5906	89	20	245	55	490	110	30,000	50,000
305H	25	.9843	62	2.4409	17	.6693	133	30	356	80	712	160	24,000	40,000
306H	30	1.1811	72	2.8346	19	.7480	178	40	445	100	890	200	20,000	33,300
307H	35	1.3780	80	3.1496	21	.8268	222	50	556	125	1,112	250	17,100	28,600
308H	40	1.5748	90	3.5433	23	.9055	289	65	712	160	1,423	320	15,000	25,000
309H	45	1.7717	100	3.9370	25	.9843	334	75	845	190	1,690	380	13,300	22,200
310H	50	1.9685	110	4.3307	27	1.0630	400	90	1,023	230	2,046	460	12,000	20,000

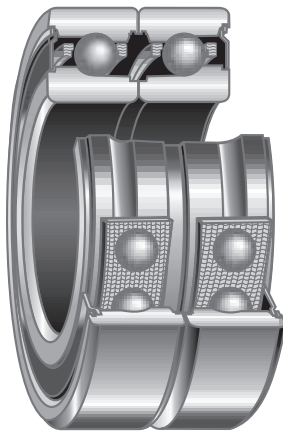
**SERIES 100HE, 200HE AND 2200H**
**Angular Contact Bearings • Non-Separable • 25° Contact Angle**

BEARING NUMBERS	BEARING DIMENSIONS						BEARING FEATURES						SPEED LIMITS	
	Bore Diameter d		Outside Diameter D		Width B		Standard Preload						Phenolic Cage	
Phenolic Cage  Non-Separable	mm	inch	mm	inch	mm	inch	Light N	lbs.	Medium N	lbs.	Heavy N	lbs.	Grease rpm	Oil rpm
<b>SERIES 100</b>														
100HE	10	.3937	26	1.0236	8	.3150	22	5	100	22	224	50	56,000	85,000
101HE	12	.4724	28	1.1024	8	.3150	23	5	110	25	250	56	50,000	75,000
102HE	15	.5906	32	1.2598	9	.3543	36	8	154	35	344	77	43,000	63,000
103HE	17	.6693	35	1.3780	10	.4724	54	12	221	50	487	109	38,000	56,000
104HE	20	.7874	42	1.6535	12	.4724	71	16	277	62	598	134	32,000	48,000
105HE	25	.9843	47	1.8504	12	.4724	101	23	384	86	828	186	28,000	43,000
106HE	30	1.1811	55	2.1654	13	.5118	102	23	397	89	861	194	24,000	38,000
107HE	35	1.3780	62	2.4409	14	.5512	136	31	518	116	1,116	251	20,000	34,000
108HE	40	1.5748	68	2.6772	15	.5906	142	32	547	123	1,180	265	19,000	32,000
109HE	45	1.7717	75	2.9528	16	.6299	209	47	768	173	1,638	368	17,000	28,000
110HE	50	1.9685	80	3.1496	16	.6299	211	47	779	175	1,663	374	15,000	24,000
111HE	55	2.1654	90	3.5433	18	.7087	298	67	1,066	240	2,257	507	14,000	22,000
112HE	60	2.3622	95	3.7402	18	.7087	299	67	1,075	242	2,281	513	13,000	20,000
113HE	65	2.5591	100	3.9370	18	.7087	310	70	1,118	251	2,372	533	12,000	19,000
114HE	70	2.7559	110	4.3307	20	.7874	398	89	1,397	314	2,945	662	11,000	18,000
115HE	75	2.9528	115	4.5276	20	.7874	408	92	1,439	323	3,027	680	11,000	18,000
116HE	80	3.1496	125	4.9213	22	.8661	529	119	1,830	411	3,825	860	9,500	16,000
117HE	85	3.3465	130	5.1181	22	.8661	545	123	1,888	424	3,949	888	9,000	15,000
118HE	90	3.5433	140	5.5118	24	.9449	649	146	2,217	498	4,623	1,039	8,500	14,000
119HE	95	3.7402	145	5.7087	24	.9449	675	152	2,308	519	4,813	1,082	8,000	13,000
120HE	100	3.9370	150	5.9055	24	.9449	685	154	2,347	528	4,902	1,102	7,500	12,000
<b>SERIES 200</b>														
200HE	10	.3937	30	1.1811	9	.3543	31	7	139	31	312	70	50,000	75,000
201HE	12	.4724	32	1.2598	10	.3937	47	11	191	43	420	94	45,000	67,000
202HE	15	.5906	35	1.3780	11	.4331	65	15	256	58	555	125	40,000	60,000
203HE	17	.6693	40	1.5748	12	.4724	75	17	289	65	626	141	36,000	53,000
204HE	20	.7874	47	1.8504	14	.5512	105	24	393	88	843	190	30,000	45,000
205HE	25	.9843	52	2.0472	15	.5906	113	25	420	94	901	203	26,000	40,000
206HE	30	1.1811	62	2.4409	16	.6299	175	39	637	143	1,357	305	22,000	36,000
207HE	35	1.3780	72	2.8346	17	.6693	197	44	714	161	1,521	342	19,000	32,000
208HE	40	1.5748	80	3.1496	18	.7087	259	58	912	205	1,925	433	17,000	28,000
209HE	45	1.7717	85	3.3465	19	.7480	270	61	955	215	2,016	453	15,000	24,000
210HE	50	1.9685	90	3.5433	20	.7874	355	80	1,230	277	2,583	581	14,000	22,000
211HE	55	2.1654	100	3.9370	21	.8268	381	86	1,331	299	2,797	629	13,000	20,000
212HE	60	2.3622	110	4.3307	22	.8661	467	105	1,599	359	3,333	749	12,000	19,000
2213H	65	2.5591	120	4.7244	23	.9055	667	150	1,690	380	3,380	760	11,100	18,000
2214H	70	2.7559	125	4.9213	24	.9449	712	160	1,824	410	3,648	820	10,300	16,700
2215H	75	2.9528	130	5.1181	25	.9843	712	160	1,824	410	3,648	820	9,600	15,600
2216H	80	3.1496	140	5.5118	26	1.0236	890	200	2,180	490	4,360	980	9,000	14,600
2217H	85	3.3465	150	5.9005	28	1.1024	867	195	2,891	650	5,970	1,342	8,600	13,000
2218H	90	3.5433	160	6.2992	30	1.1811	1,134	255	3,719	836	7,651	1,720	8,000	12,000
2219H	95	3.7402	170	6.6929	32	1.2598	1,192	268	3,906	878	8,042	1,808	7,000	11,000
2220H	100	3.9370	180	7.0866	34	1.3386	1,219	274	3,995	898	8,229	1,850	6,600	10,000

## SERIES ZSB/ SMALL BALL, HIGH SPEED

### Design

Barden engineers have developed the ZSB small ball angular contact sealed series spindle bearings to allow machine tools to operate at higher running speeds (up to 20% more) while maintaining optimum workpiece finish characteristics. The small ball feature of the ZSB series allows a greater number of balls to be used, increasing bearing stiffness, which leads to improved machining accuracy at higher speeds.



Barden's ZSB series are angular contact ball bearings that offer optional integral seals which reduce the chances of bearing failure through contamination and prolong lubricant life when bearings are grease lubricated. Seals are available as an option on most sizes. Check for availability.

The inner ring outside diameter land is removed from one side and the outer ring bore diameter land is removed from the opposite side. This allows for optimum exposure and flow through characteristics for air/oil lube systems.

**Contact Angles:** Standard contact angle is 15°. In the small ball product line Barden offers 25° bearings for high speeds which are preferred for many of the newer high speed applications.

In many machine tool spindle bearing applications at higher speeds the advanced design of the Barden 25° bearing will function at speeds more like a 15° bearing. The inner ring expands from centrifugal forces and reduces the radial clearance. As a result, the contact angle decreases in operation. Add to this the effect of the inner ring temperature being hotter than the outer ring and you have the operating contact angle of many high speed 25° bearings operating over one million dN.

Preload increase at the higher speeds is always a problem with high speed spindles due to the heat generation when solid preloading is used. Therefore, another major advantage of the 25° contact angle is a much lower preload increase at high speeds when compared to the 15° bearing, due to the favorable internal geometry.

**Bearing Data:** Bearing data applicable to these bearings is shown in the following tables. Lubrication and mounting data can be found in the Engineering section.

**Cages:** Standard cage is a one-piece phenolic type (no symbol) with circular ball pockets.

**Attainable Speeds:** Limits given are for spring preloaded single bearings.

**Material:** Standard material is SAE 52100 bearing steel for both rings and balls. With the option of using silicon nitride ceramic balls even higher speeds can be attained. Bearings also available in X-Life Ultra design (XCZSB).

**Duplexing:** All bearings are available universally ground (DU) for DB, DF, or DT mounting in sets of two or more. Bearings may also be ordered in specific DB or DF duplex pairs. Standard light, medium and heavy preloads are shown in the following product tables.

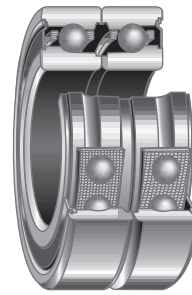
**Lubricant:** Desired lubrication should be specified when ordering, based on speed and temperature conditions of the application.

**Calibration:** For applications that cannot tolerate extreme fits, selective fitting with calibrated parts should be considered. Selective fitting utilizes a system of sizing bearings, shafts and housings within the diametral tolerance range and selectively assembling those parts which fall within the same respective area of the range. When Barden bearings are calibrated, they are sorted into groups and are specified by calibration code.

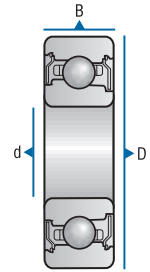
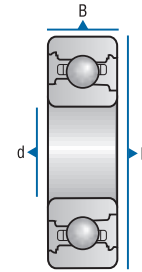
## SERIES ZSB/ SMALL BALL, HIGH SPEED


### Angular Contact Bearings

- Non-Separable
- 15° Contact Angle



Duplex Pair



BEARING NUMBERS	BEARING DIMENSIONS						BEARING FEATURES						SPEED LIMITS	
<b>Phenolic Cage</b>  Non-Separable	<b>Bore Diameter</b> d		<b>Outside Diameter</b> D		<b>Width</b> B		Standard Preload						Phenolic Cage	
							Light		Medium		Heavy		Grease rpm	Oil rpm
	mm	inch	mm	inch	mm	inch	N	lbs.	N	lbs.	N	lbs.		
<b>SERIES ZSB</b>														
ZSB101J	12	.4724	28	1.1024	8	.3150	22	5	44	10	89	20	91,600	133,000
ZSB102J	15	.5906	32	1.2598	9	.3543	22	5	44	10	89	20	73,300	106,700
ZSB103J	17	.6693	35	1.3780	10	.3937	22	5	44	10	89	20	64,700	94,100
ZSB104J	20	.7874	42	1.6535	12	.4724	44	10	89	20	178	40	55,000	80,000
ZSB105J	25	.9843	47	1.8504	12	.4724	67	15	133	30	267	60	44,000	64,000
ZSB106J	30	1.1811	55	2.1654	13	.5118	67	15	133	30	267	60	36,700	53,300
ZSB107J	35	1.3780	62	2.4409	14	.5512	89	20	178	40	356	80	31,400	45,700
ZSB108J	40	1.5748	68	2.6772	15	.5906	111	25	222	50	445	100	27,500	40,000
ZSB109J	45	1.7717	75	2.9528	16	.6299	133	30	267	60	534	120	24,000	38,000
ZSB110J	50	1.9685	80	3.1496	16	.6299	133	30	267	60	534	120	22,000	36,000
ZSB111J	55	2.1654	90	3.5433	18	.7087	178	40	356	80	712	160	20,000	29,100
ZSB112J	60	2.3622	95	3.7402	18	.7087	178	40	356	80	712	160	18,000	30,000
ZSB113J	65	2.5591	100	3.9370	18	.7087	222	50	445	100	890	200	16,900	24,600
ZSB114J	70	2.7559	110	4.3307	20	.7874	222	50	445	100	890	200	15,700	18,600
ZSB115J	75	2.9528	115	4.5276	20	.7874	267	60	534	120	1,068	240	15,000	24,000
ZSB116J	80	3.1496	125	4.9213	22	.8661	311	70	623	140	1,246	280	14,000	22,000
ZSB117J	85	3.3465	130	5.1181	22	.8661	356	80	712	160	1,424	320	13,000	20,000
ZSB118J	90	3.5433	140	5.5118	24	.9449	400	90	801	180	1,602	360	12,200	17,800
ZSB119J	95	3.7402	145	5.7087	24	.9449	400	90	801	180	1,602	360	11,000	18,000
ZSB120J	100	3.9370	150	5.9055	24	.9449	445	100	890	200	1,780	400	11,000	16,000
ZSB124J	120	4.7244	180	7.0866	28	1.1024	623	140	1,246	280	2,447	550	9,200	13,300
ZSB126J	130	5.1181	200	7.8740	33	1.2992	228	51	683	154	1,367	307	7,500	12,000
ZSB202J	15	.5906	35	1.3780	11	.4331	36	8	76	17	156	35	66,700	100,000
ZSB204J	20	.7874	47	1.8504	14	.5512	67	15	133	30	267	60	50,000	75,000
ZSB206J	30	1.1811	62	2.4409	16	.6299	111	25	222	50	445	100	33,300	50,000
ZSB207J	35	1.3780	72	2.8346	17	.6693	133	30	267	60	534	120	28,000	42,800
ZSB210J	50	1.9685	90	3.5433	20	.7874	200	45	400	90	801	180	20,000	30,000
ZSB211J	55	2.1654	100	3.9370	21	.8268	267	60	534	120	1,068	240	18,200	27,300

Pounds x 4.4488 = Newtons.

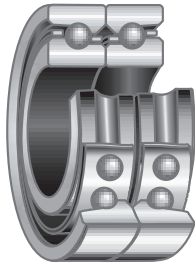
*All ZSB Series Bearings also available with 25° contact angle, ceramic balls and X-Life Ultra (Cronidur) rings.*



## BALL SCREW SUPPORT BEARINGS — SERIES L, BSB, AND 7602/7603 SERIES

### Design/Applications

Barden Series L (inch), BSB (metric), and 7602/7603 (metric) ball screw support bearings are manufactured specifically for high performance ball screw applications, where extreme rigidity requirements preclude the use of standard angular contact bearings. The internal configuration has been designed to provide an optimum combination of high rigidity, low drag torque, exceptional control of axial runout, higher running speeds and longer life.



All Barden ball screw support bearings are non-separable angular contact bearings and have cutaway shoulders on both the inner and outer rings. They can support very high thrust loads in one direction or combinations of radial and thrust loads, but not radial loading alone. These bearings are designed to provide machine tool drive systems with extreme axial rigidity, low drag torque and minimal axial runout. They are intended for specific applications in machine tools, e.g., ball screw supports, cross slides, X-Y table positioners and transfer tables. They should not be used in place of standard angular contact spindle bearings.

These bearings are available in standard duplex or quadruplex sets. In addition, we will supply custom combination sets to meet specialized application needs.

### Limiting Speeds

Limiting speeds shown on page 25 are useful guidelines. Actual speed limits must be based on application characteristics. Life requirements, heat transfer conditions, loading and lubrication methods are typical influential factors.

### Preloads

Standard values (heavy) shown in table will be supplied unless otherwise specified. Barden recognizes that some applications do not require the full axial stiffness (compliance) of the standard preload and will supply bearings with custom-ground preloads if required.

### Cages

All metric series bearings have a molded nylon, glass fiber reinforced polyamide cage with spherical ball pockets. Series L bearings have a land-piloted cage of reinforced phenolic, precision-machined, with evenly spaced ball pockets.

### Seals

Some ball screw support bearings may also be available in sealed versions. Ask your Barden sales engineer for details.

### Mounting and Fitting

Normal fitting practice is line-to-line to loose for both shaft and housing fits, as shown in table at right.

All bearing pairs and sets are match-marked on their outside diameter surfaces to indicate correct positioning of each bearing. Barden packaging also contains detailed instructions for proper installation.

Recommendations for shaft and housing shoulder diameters are based on maximum support of duplex-mounted bearings. In circumstances with other mounting arrangements, consult Barden Product Engineering.

### Life Calculations

Most ball screw support bearing applications are subject to duty-cycle loading with constantly changing feeds, speeds and operating loads. These factors, in combination with the heavy preloads built into the bearings, make L-10 life calculations irrelevant. Consult Barden Product Engineering for information which can be used in specific cases.

### Materials

All ball screw support bearings (rings and balls) are made from 52100 steel. Bearings are also available with X-life Ultra rings and ceramic (silicon nitride) balls for even greater speeds and longer life.

**Configurations:** Standard configuration includes a cage; some sizes are also available in a full complement version (X205 suffix). Please consult Barden.

**Maximum Shaft/Housing Fillet Radius Which Bearing Corner Will Clear:** .040" (1.00 mm).

**Attainable Speeds:** Limits given are for DU mounted sets with standard heavy preload.

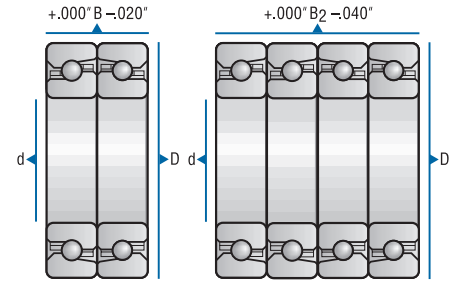
**Material:** SAE 52100 bearing steel is standard.

**Duplexing:** All bearings are universally ground D and can be mounted DU (Universal), DF (Face-to-Face), or DB (Back-to-Back), in pairs or in various combinations — three, four or more bearings as required. Standard preloads for pairs are shown. For quads (QUH), multiply the duplex preload indicated by two.

**Tolerances:** Standard precision class for all ball screw support bearings is ABEC 7, except for a tighter maximum raceway runout with side .0001" (2.5 µm).

**Lubricant:** Desired lubrication should be specified when ordering, based on torque, speed and temperature conditions of the application. Barden strongly recommends G-73 (L55), a NLGI Class 2 grease with EP additives. Consult Barden for details.

# BALL SCREW SUPPORT BEARINGS — SERIES L, BSB, AND 7602/7603 SERIES



Duplex Set

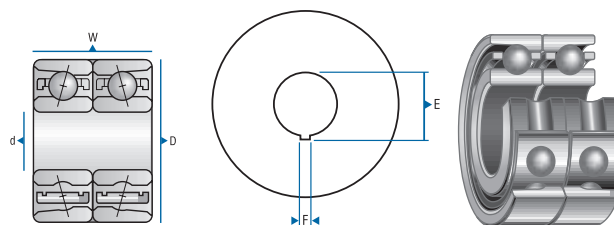
Quadruplex Set

Basic Bearing Nomenclature*	Bore Diameter d		Outside Diameter D		DUPLEX SET*** Width B		ATTAINABLE SPEEDS (RPM)		Standard Preloads (lbs.)**	Shaft and Housing Shoulder Diameters (mm)		Axial Spring Constant ( $\times 10^6$ lbs./ in.)	Drag Torque (in.-lbs.)	Dynamic Thrust Capacity (lbs.)	Static Thrust Capacity (lbs.)
	mm	inch	mm	inch	mm	inch	Oil	Grease		Shaft	Housing	Duplex	Duplex	Duplex	Duplex
7602012TVP	12	.4724	32	1.2598	20	.7874	24,000	17,000	300	17.0	27.0	2.7	0.14	2,600	2,800
7602015TVP	15	.5906	35	1.3780	22	.8661	20,000	20,000	290	20.5	30.0	2.9	0.18	2,800	3,380
7602017TVP	17	.6693	40	1.5748	24	.9449	18,000	13,000	380	23.0	34.5	3.3	0.27	3,730	4,500
7602020TVP	20	.7874	47	1.8504	28	1.1024	17,000	12,000	500	27.5	39.5	3.9	0.44	4,300	5,600
BSB2047	20	.7874	47	1.8504	30	1.1811	16,000	11,000	500	27.5	39.5	4.2	0.44	4,300	5,600
7603020TVP	20	.7874	52	1.8504	30	1.1811	17,000	11,000	630	30.5	43.5	4.4	0.54	5,500	7,200
7602025TVP	25	.9843	52	2.0472	30	1.1811	16,000	11,000	550	32.0	45.0	4.3	0.59	4,950	6,860
BSB2562	25	.9843	62	2.4409	30	1.1811	13,000	9,000	750	38.0	52.0	5.4	0.75	6,400	9,300
7603025TVP	25	.9843	62	2.4409	34	1.3386	13,000	9,000	730	38.0	52.0	5.1	0.77	6,400	9,300
BSB3062	30	1.1811	62	2.4409	30	1.1811	13,000	9,000	650	39.5	52.5	5.1	0.75	5,800	8,800
7602030TVP	30	1.1811	62	2.4409	32	1.2598	13,000	9,000	640	39.5	52.5	5.1	0.77	5,800	8,800
7603030TVP	30	1.1811	72	2.8346	38	1.4961	11,000	8,000	940	45.0	61.0	6.0	1.17	7,760	12,400
BSB3572	35	1.3780	72	2.8346	30	1.1811	11,000	8,000	750	46.5	60.5	6.0	1.02	6,700	11,200
7602035TVP	35	1.3780	72	2.8346	34	1.3386	11,000	8,000	730	46.5	60.5	5.7	1.04	6,700	11,200
7603035TVP	35	1.3780	80	3.1496	42	1.6535	9,500	7,000	1,050	51.0	67.0	6.7	1.53	8,200	13,700
BSB4072	40	1.5748	72	2.8346	30	1.1811	11,000	8,000	650	49.0	62.5	6.0	1.02	6,300	11,000
7602040TVP	40	1.5748	72	2.8346	36	1.4173	9,500	7,000	950	53.5	69.5	6.6	1.53	8,440	14,400
BSB4090	40	1.5748	90	3.5433	40	1.5748	8,500	6,300	1,240	56.5	75.5	7.2	4.00	11,250	18,680
7603040TVP	40	1.5748	90	3.5433	46	1.8110	8,500	6,300	1,240	56.5	75.5	7.2	4.00	11,250	18,680
BSB4575	45	1.7717	75	2.9528	30	1.1811	10,000	7,500	690	52.0	68.0	6.0	1.17	6,400	11,700
7602045TVP	45	1.7717	85	3.3465	38	1.4961	9,000	6,700	180	57.0	73.0	7.0	1.71	8,500	15,300
BSB45100	45	1.7717	100	3.9370	40	1.5748	7,500	5,600	1,530	64.5	85.5	8.2	2.70	13,200	23,400
7603045TVP	45	1.7717	100	3.9370	50	1.9685	7,500	5,600	1,530	64.5	85.5	8.2	2.70	13,200	23,400
7602050TVP	50	1.9685	90	3.5433	40	1.5748	8,500	6,300	1,090	63.0	79.0	7.6	2.07	8,800	16,900
BSB50100	50	1.9685	100	3.9370	40	1.5748	7,500	5,600	1,530	64.5	85.5	8.2	3.00	13,200	23,400
7603050TVP	50	1.9685	100	3.9370	54	2.1260	6,700	5,000	1,670	72.0	94.0	9.0	3.24	15,600	28,600
L078HDF	20.000	.7874	47.0	1.8504	31.75	1.2500	4,000	2,800	750	1.065	1.520	5.0	2.00	3,300	4,700
L093HDF	23.838	.9385	62.0	2.4409	31.75	1.2500	2,400	1,680	1,000	1.590	2.130	6.6	2.80	3,850	6,500
L150HDF	38.100	1.5000	72.0	2.8346	31.75	1.2500	1,600	1,100	1,500	1.880	2.430	8.4	4.00	4,000	7,500
L150HX4DF	38.100	1.5000	72.0	2.8346	31.75	1.2500	1,600	1,100	1,500	1.880	2.480	7.8	4.00	5,500	10,000
L175HDF	44.475	1.7510	76.2	3.0000	31.75	1.2500	1,400	1,000	1,500	2.140	2.680	9.1	4.50	4,100	8,200
L225HDF	57.150	2.2500	90.0	3.5433	31.75	1.2500	1,200	850	1,750	2.610	3.145	11.6	6.00	4,400	10,000
L300HDF	76.200	3.0000	110.0	4.3307	31.75	1.2500	800	600	2,250	3.385	3.915	14.3	8.00	4,850	12,900

\* Certain sizes listed in table may not be in current production. Check for availability. \*\* Duplex preloads. For quad set preloads multiply by 2.

\*\*\* Quadruplex widths are twice duplex widths.

## BARDEN EX-CELL-O REPLACEMENT BEARINGS



BARDEN REPLACEMENT NUMBER	EX-CELL-O Number	Bore	O.D.	Width (Pair)	Keyway		Preload	Maximum Speed		
		d	D	W	E	F	Lbs.	Grease	Oil	Mist
ZXLO50HD10	50	.8125 +.00000 -.00015	2.0000 +.0000 -.0002	1.000 +.000 -.020	.844 +.005 -.000	.063 +.002 -.002	10	22,000	24,000	32,000 22,000
ZXLO57HD20	57	1.06250	2.2500	1.000	1.082	.063	20	18,000	20,000	22,000
ZXLO57HD50		+.00000	+.0000	+.000	+.010	+.002	50	10,000	12,000	15,000
ZXLO57HD100		-.00015	-.0002	-.020	-.000	-.002	100	3,000	4,500	6,000
ZXLO67HD20	67	1.2500	2.4375	1.250	1.285	.125	20	12,500	15,000	20,000
ZXLO67HD60		+.0000	+.0000	+.000	+.010	+.002	60	6,000	9,000	12,000
ZXLO67HD90		-.0002	-.0002	-.020	-.000	-.002	90	3,600	4,500	6,000
ZXLO90HD20	90	1.6250	3.4375	1.625	1.660	.125	20	10,000	14,000	20,000
ZXLO90HD100		+.0000	+.0000	+.000	+.010	+.002	100	5,000	7,000	11,000
ZXLO90HD175		-.0002	-.0003	-.020	-.000	-.002	175	3,000	5,000	8,000
ZXLO90HD250							250	2,000	3,000	4,000
ZXLO90HD325							325	1,400	2,000	3,000
ZXLO155HD150	155	2.7500 +.0000 -.0002	4.7500 +.0000 -.0004	2.250 +.000 -.020	None		150	4,000	5,000	6,000
ZXLO155HD300							300	2,000	2,500	3,000

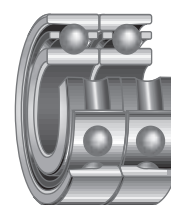
## SERIES 100B

### Angular Contact Bearings

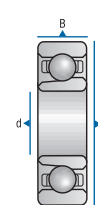
- Separable
- 15° Contact Angle




Angular Contact Bearing



Duplex Pair



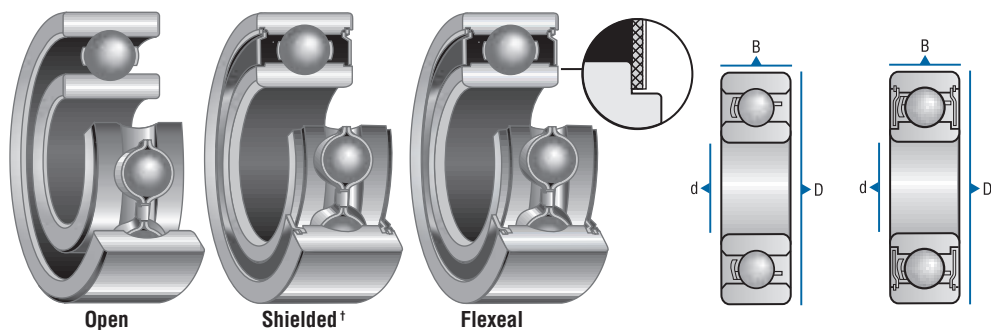
B and J Type






BEARING NUMBERS	BEARING DIMENSIONS						BEARING FEATURES			SPEED LIMITS
<b>Phenolic Cage</b>  Separable	Bore Diameter d		Outside Diameter D		Width B		Standard Preload			Phenolic Cage
	mm	inch	mm	inch	mm	inch	Light	Medium	Heavy	RPM
<b>SERIES 100B</b>										
101BX48	12	.4724	28	1.1024	8	.3150	5	12	24	129,000
102BX48	15	.5906	32	1.2598	9	.3543	5	13	26	103,300
103BX48	17	.6693	35	1.3780	10	.3937	6	15	30	91,200
104BX48	20	.7874	42	1.6535	12	.4724	10	25	50	77,500
105BX48	25	.9843	47	1.8504	12	.4724	12	30	60	62,000
106BX48	30	1.1181	55	2.1654	13	.5118	15	40	80	51,700
107BX48	35	1.3780	62	2.4409	14	.5512	20	50	100	44,300
108BX48	40	1.5748	68	2.6772	15	.5906	25	60	120	38,750
110BX48	50	1.9685	80	3.1496	16	.6299	35	85	170	31,000
113BX48	65	2.5591	100	3.9370	18	.7087	50	130	260	23,800
117BX48	85	3.3465	130	5.1181	22	.8661	90	230	460	18,200

## SERIES SR AND SFR

### Deep Groove Radial Instrument Ball Bearings

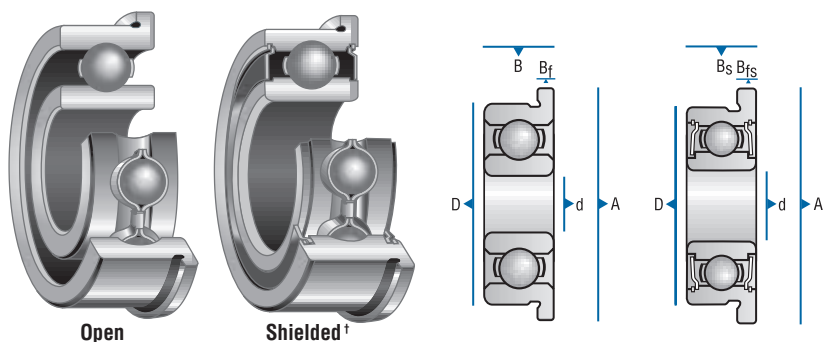
- Non Flanged OD

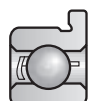
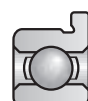





BEARING NUMBERS					BEARING DIMENSIONS			
OPEN		SHIELDED <sup>†</sup>		SEALED	Diameters		Widths	
					d Bore Inch	D O.D. Inch	B Ring Inch	B <sub>s</sub> Ring Inch
SR2	SR2W	SR2SS	SR2SSW	SR2FF	.1250	.3750	.1562	.1562
SR3	SR3W	SR3SS	SR3SSW	SR3FF	.1875	.5000	.1562	.1960
SR4*	SR4W	SR4SS*	SR4SSW	SR4FF*	.2500	.6250	.1960	.1960
SR4A*	—	SR4ASS*	—	SR4AFF*	.2500	.7500	.2188	.2812
SR6*	—	SR6SS*	—	SR6FF*	.3750	.8750	.2188	.2812
SR8*	—	SR8SS*	—	SR8FF*	.5000	1.1250	.2500	.3125
SR10*	—	SR10SS*	—	SR10FF*	.6250	1.3750	.2812	.3438

### Deep Groove Radial Instrument Ball Bearings

- Flanged OD



BEARING NUMBERS					BEARING DIMENSIONS						
OPEN		SHIELDED <sup>†</sup>		SEALED							
					Diameters		Widths		Widths		
Standard Cage	W Cage	Standard Cage	W Cage	Standard Cage	d Bore Inch	D O.D. Inch	B Ring Inch	B <sub>s</sub> Ring Inch	A O.D. Inch	B <sub>f</sub> Inch	B <sub>fs</sub> Inch
SFR3	SFR3W	SFR3SS	SFR3SSW	SFR3FF	.1875	.5000	.1960	.1960	.565	.042	.042
SFR4*	SFR4W	SFR4SS*	SFR4SSW	SFR4FF*	.2500	.6250	.1960	.1960	.690	.042	.042
SFR6*	SFR6W	SFR6SS*	SFR6SSW	SFR6FF*	.3750	.8750	.2812	.2812	.969	.062	.062

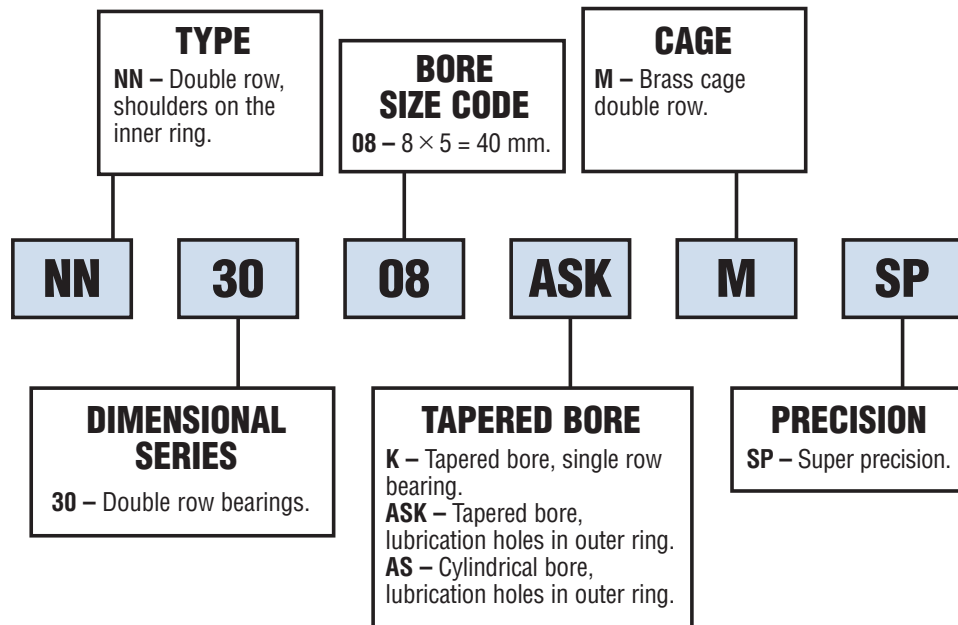
To specify single shield or seal, omit one suffix, either "S" or "F" in bearing number. \*Standard cage is two-piece pressed steel. For limiting speeds, see page 12.

<sup>†</sup>Where face width allows, inner rings have shield notches as shown.

## CYLINDRICAL ROLLER BEARINGS

### Bearing Nomenclature

#### EXAMPLE: NN3008ASK.M.SP



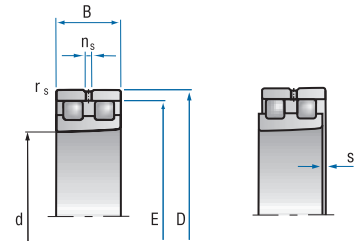
RADIAL RIGIDITY OF CYLINDRICAL ROLLER BEARINGS			
Bore Reference Number	C <sub>s</sub> NN30 lb./μin.	Bore Reference Number	C <sub>s</sub> NN30 lb./μin.
06	3.8	32	19.7
07	4.4	34	21.2
08	5.3	36	22.7
09	6.1	38	23.5
10	6.6	40	24.8
11	7.3	44	26.8
12	7.9	48	28.9
13	8.3	52	31.6
14	9.3	56	33.1
15	9.7	60	33.3
16	10.4	64	36.2
17	11.2	68	40.3
18	11.3	72	41.7
19	11.8	76	43.2
20	12.2	80	48.7
21	13.0	84	48.7
22	14.0	88	52.0
24	15.2	92	53.0
26	16.7	96	56.6
28	17.4	/500	56.6
30	18.5		

C<sub>s</sub> = rigidity [lb./μin.]



# CYLINDRICAL ROLLER BEARINGS

## NN30



BEARING NUMBER	BEARING DIMENSIONS (in millimeters)							LOAD RATING		ATTAINABLE SPEED		WEIGHT
Barden Nomenclature*	d	D	B	$r_{smin}$	E	$n_s$	s	dyn. C	stat. $C_0$	Grease rpm	Oil rpm	Weight $\approx$ lbs.
NN3006ASK.M.SP	30	55	19	1.0	48.5	4.8	1.4	6,525	7,650	16,000	19,000	0.4
NN3007ASK.M.SP	35	62	20	1.0	55.0	4.8	1.4	7,987	9,900	14,000	17,000	0.6
NN3008ASK.M.SP	40	68	21	1.0	61.0	4.8	1.4	10,125	13,162	12,000	15,000	0.7
NN3009ASK.M.SP	45	75	23	1.0	67.5	4.8	1.7	12,150	16,200	11,000	14,000	0.9
NN3010ASK.M.SP	50	80	23	1.0	72.5	4.8	1.7	12,825	18,000	10,000	13,000	0.9
NN3011ASK.M.SP	55	90	26	1.1	81.0	4.8	1.9	16,200	22,500	9,000	11,000	1.4
NN3012ASK.M.SP	60	95	26	1.1	86.1	4.8	1.9	16,875	24,750	8,500	10,000	1.4
NN3013ASK.M.SP	65	100	26	1.1	91.0	4.8	1.9	17,212	26,100	8,000	9,500	1.6
NN3014ASK.M.SP	70	110	30	1.1	100.0	6.5	2.3	22,050	33,750	7,000	8,500	2.4
NN3015ASK.M.SP	75	115	30	1.1	105.0	6.5	2.3	22,500	35,100	6,700	8,000	2.5
NN3016ASK.M.SP	80	125	34	1.1	113.0	6.5	2.5	27,000	41,850	6,300	7,500	3.4
NN3017ASK.M.SP	85	130	34	1.1	118.0	6.5	2.5	28,125	45,000	6,000	7,000	3.6
NN3018ASK.M.SP	90	140	37	1.5	127.0	6.5	2.5	31,500	50,400	5,600	6,700	4.7
NN3019ASK.M.SP	95	145	37	1.5	132.0	6.5	2.5	32,175	53,100	5,300	6,300	4.9
NN3020ASK.M.SP	100	150	37	1.5	137.0	6.5	2.5	32,850	55,125	5,300	6,300	5.1
NN3021ASK.M.SP	105	160	41	2.0	146.0	6.5	2.6	42,750	69,750	4,800	5,600	6.5
NN3022ASK.M.SP	110	170	45	2.0	155.0	6.5	2.8	49,500	81,000	4,500	5,300	8.3
NN3024ASK.M.SP	120	180	46	2.0	165.0	6.5	3.1	52,200	87,750	4,300	5,000	9.0
NN3026ASK.M.SP	130	200	52	2.0	182.0	9.5	3.3	65,250	112,500	3,800	4,500	13.3
NN3028ASK.M.SP	140	210	53	2.0	192.0	9.5	3.3	67,500	117,000	3,600	4,300	14.3
NN3030ASK.M.SP	150	225	56	2.1	206.0	9.5	3.7	75,375	131,625	3,400	4,000	17.4
NN3032ASK.M.SP	160	240	60	2.1	219.0	9.5	4.2	84,375	150,750	3,200	3,800	21.1
NN3034ASK.M.SP	170	260	67	2.1	236.0	9.5	4.5	101,250	180,000	3,000	3,600	28.7
NN3036ASK.M.SP	180	280	74	2.1	255.0	12.2	4.8	128,250	225,000	2,800	3,400	37.5
NN3038ASK.M.SP	190	290	75	2.1	265.0	12.2	4.8	131,625	234,000	2,600	3,200	39.7
NN3040ASK.M.SP	200	310	82	2.1	282.0	12.2	5.3	147,375	270,000	2,400	3,000	50.7
NN3044ASK.M.SP	220	340	90	3.0	310.0	15.0	5.5	180,000	328,500	2,200	2,800	72.5
NN3048ASK.M.SP	240	360	92	3.0	330.0	15.0	6.0	191,250	351,000	2,000	2,600	79.4
NN3052ASK.M.SP	260	400	104	4.0	364.0	15.0	6.5	238,500	450,000	1,900	2,400	105.8
NN3056ASK.M.SP	280	420	106	4.0	384.0	15.0	6.8	243,000	468,000	1,800	2,200	114.0
NN3060ASK.M.SP	300	460	118	4.0	418.0	17.7	7.4	285,750	540,000	1,600	1,900	157.6
NN3064ASK.M.SP	320	480	121	4.0	438.0	17.7	7.9	297,000	585,000	1,600	1,900	170.2
NN3068ASK.M.SP	340	520	133	5.0	473.0	17.7	8.7	366,750	731,250	1,400	1,700	227.1
NN3072ASK.M.SP	360	540	134	5.0	493.0	17.7	8.7	373,500	753,750	1,400	1,700	240.3
NN3076ASK.M.SP	380	560	135	5.0	513.0	17.7	9.0	382,500	776,250	1,300	1,600	251.3
NN3080ASK.M.SP	400	600	148	5.0	549.0	17.7	9.5	486,000	1,012,500	1,200	1,500	328.5
NN3084ASK.M.SP	420	620	150	5.0	569.0	17.7	10.0	477,000	1,012,500	1,200	1,500	343.9
NN3088ASK.M.SP	440	650	157	6.0	597.0	23.5	10.3	551,250	1,147,500	1,100	1,400	394.6
NN3092ASK.M.SP	460	680	163	6.0	624.0	23.5	10.5	585,000	1,215,000	1,100	1,400	449.7
NN3096ASK.M.SP	480	700	165	6.0	644.0	23.5	11.0	607,500	1,316,250	1,000	1,300	471.8
NN30/500ASK.M.SP	500	720	167	6.0	664.0	23.5	11.5	596,250	1,316,250	1,000	1,300	491.6

\*Tapered bore shown. Also available with cylindrical bores (AS).

## DOUBLE DIRECTION ANGULAR CONTACT THRUST BALL BEARINGS

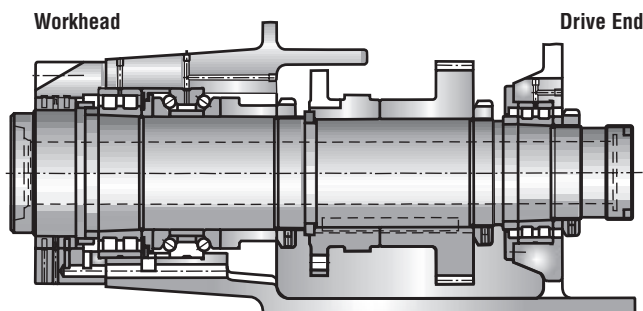
Double direction angular contact thrust ball bearings are designed for use in machine tool spindles, in combination with cylindrical roller bearings. They are manufactured to precision tolerances. Double direction angular contact thrust ball bearings are designed to carry only thrust loads. They match the mounting dimensions of the NN30 Series double row cylindrical roller bearings.

### External Dimensions

Double direction angular contact thrust ball bearings are designed to be mounted in conjunction with a double row radial cylindrical roller bearing (see pages 28-29). The nominal size of the external diameter is the same for both bearings which simplifies the machining of the housing bore. The external diameter tolerance of the double direction angular contact thrust ball bearing is designed so that there is clearance between the bearing O.D. and the housing bore. Use of this bearing type, in combination with a double row cylindrical roller bearing, offers the advantage of supporting both axial and radial forces separately.

### Bearing Design

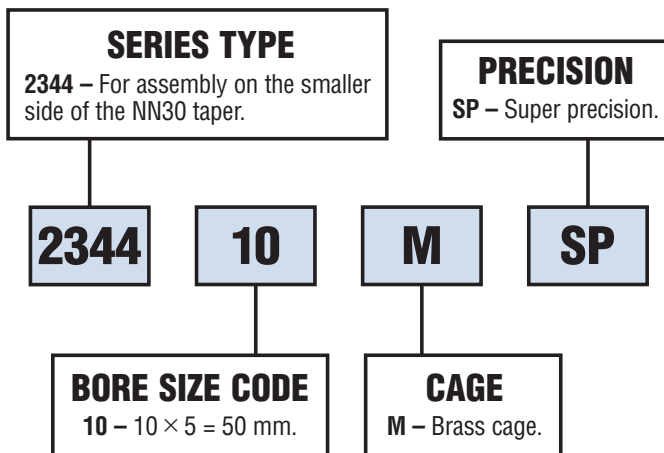
Double direction angular contact thrust ball bearings have a contact angle of 60° and are axially preloaded. The contact angle and the axial preload ensures good ball control, especially under the centrifugal forces with fast rotating spindles. These bearings are designed to accommodate high thrust loads. They have solid one piece machined brass cages which are ball guided.



*This illustration of a milling spindle shows typical placement of a double direction angular contact thrust ball bearing used in combination with a double row cylindrical roller bearing in the workhead. The drive end of the spindle features one double row cylindrical bearing. This combination allows the spindle to operate with high rigidity at speed, while accommodating both axial and radial loads.*

## Bearing Nomenclature

### Example: 234410M.SP



### Speedability

Double direction angular contact thrust ball bearings are ideally suited for low to medium speeds. Speed limit values for grease and oil lubrication are given in the bearing table on page 31.

### Lubrication

Double direction angular contact thrust ball bearings can be lubricated with either grease or oil. The outer ring O.D. has a lubricating groove in the center with lubricating holes. The application of the lubricant between the two rows of balls allows optimal distribution of lubricant to both raceways.

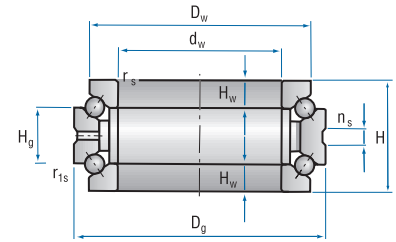
### Rigidity

For optimum performance, machine tool spindle bearings must exhibit high rigidity as well as high precision. This means that they must run precisely and must allow only slight deflection under load. The double direction angular contact thrust ball bearings achieve high rigidity through their internal design with steep contact angle and internal defined heavy preload.

## DOUBLE DIRECTION ANGULAR CONTACT THRUST BALL BEARINGS

**2344**

- Contact Angle = 60°



BEARING NUMBER	BEARING DIMENSIONS (in millimeters)									*	LOAD RATING		ATTAINABLE SPEED		WEIGHT
Barden Nomenclature	d <sub>w</sub>	D <sub>g</sub>	D <sub>w</sub>	H	H <sub>g</sub>	H <sub>w</sub>	r <sub>smin</sub>	r <sub>1smin</sub>	n <sub>s</sub>	S <sub>a</sub> lb./μin.	dyn. C lbs.	stat. C <sub>0</sub> lbs.	Grease rpm	Oil rpm	Weight ≈ lbs.
234406M.SP	30	55	47	32	16	8.0	1.0	0.15	4.8	1.5	3,217	5,400	11,000	16,000	0.6
234407M.SP	35	62	53	34	17	8.5	1.0	0.15	4.8	1.8	3,960	7,087	9,500	14,000	0.8
234408M.SP	40	68	58.5	36	18	9.0	1.0	0.15	4.8	2.0	4,680	8,550	8,500	12,000	1.0
234409M.SP	45	75	65	38	19	9.5	1.0	0.15	4.8	2.2	5,220	10,125	7,500	10,000	1.3
234410M.SP	50	80	70	38	19	9.5	1.0	0.15	4.8	2.3	5,400	11,025	7,000	9,500	1.4
234411M.SP	55	90	78	44	22	11.0	1.1	0.30	6.5	2.6	7,650	15,075	6,300	8,500	2.1
234412M.SP	60	95	83	44	22	11.0	1.1	0.30	6.5	2.6	7,537	15,300	6,000	8,000	2.2
234413M.SP	65	100	88	44	22	11.0	1.1	0.30	6.5	2.8	8,100	17,212	5,600	7,500	2.4
234414M.SP	70	110	97	48	24	12.0	1.1	0.30	6.5	3.1	9,562	20,925	5,300	7,000	3.3
234415M.SP	75	115	102	48	24	12.0	1.1	0.30	6.5	3.3	9,900	22,500	5,000	6,700	3.5
234416M.SP	80	125	110	54	27	13.5	1.1	0.30	6.5	3.6	11,700	27,000	4,500	6,000	4.8
234417M.SP	85	130	115	54	27	13.5	1.1	0.30	9.5	3.6	11,700	28,125	4,500	6,000	5.0
234418M.SP	90	140	123	60	30	15.0	1.5	0.30	9.5	3.9	13,725	32,850	4,000	5,300	6.4
234419M.SP	95	145	128	60	30	15.0	1.5	0.30	9.5	4.0	13,725	33,750	4,000	5,300	6.7
234420M.SP	100	150	133	60	30	15.0	1.5	0.30	9.5	4.2	13,950	35,100	3,800	5,000	7.0
234421M.SP	105	160	142	66	33	16.5	2.0	0.60	9.5	4.3	15,637	39,600	3,600	4,800	9.0
234422M.SP	110	170	150	72	36	18.0	2.0	0.60	9.5	4.8	20,250	50,400	3,400	4,500	11.4
234424M.SP	120	180	160	72	36	18.0	2.0	0.60	9.5	5.1	20,925	54,000	3,200	4,300	12.3
234426M.SP	130	200	177	84	42	21.0	2.0	0.60	12.2	5.4	26,550	67,500	2,800	3,800	18.2
234428M.SP	140	210	187	84	42	21.0	2.1	0.60	12.2	5.9	27,450	72,000	2,600	3,600	19.3
234430M.SP	150	225	200	90	45	22.5	2.1	0.60	15.0	6.2	29,700	79,875	2,600	3,600	23.8
234432M.SP	160	240	212	96	48	24.0	2.1	0.60	15.0	6.5	35,100	93,375	2,400	3,400	28.4
234434M.SP	170	260	230	108	54	27.0	2.1	0.60	15.0	7.0	43,425	117,000	2,200	3,200	39.0
234436M.SP	180	280	248	120	60	30.0	2.1	0.60	15.0	7.3	48,600	131,625	2,000	3,000	51.6
234438M.SP	190	290	258	120	60	30.0	2.1	0.60	15.0	7.9	50,400	141,750	1,900	2,800	54.40
234440M.SP	200	310	274	132	66	33.0	2.1	0.60	15.0	8.1	59,625	162,000	1,800	2,600	69.4
234444M.SP	220	340	304	144	72	36.0	3.0	1.10	15.0	9.0	70,875	202,500	1,600	2,200	91.9
234448M.SP	240	360	322	144	72	36.0	3.0	1.10	15.0	9.6	73,125	217,125	1,500	2,000	96.6
234452M.SP	260	400	354	164	82	41.0	4.0	1.50	17.7	10.1	85,500	265,500	1,400	1,900	142.2
234456M.SP	280	420	374	164	82	41.0	4.0	1.50	17.7	10.7	87,750	285,750	1,300	1,800	152.1
234460M.SP	300	460	406	190	95	47.5	4.0	1.50	17.7	11.2	101,250	344,250	1,200	1,700	216.9
234464M.SP	320	480	426	190	95	47.5	4.0	1.50	17.7	12.1	102,375	366,750	1,200	1,700	224.9
234468M.SP	350	520	459	212	106	53.0	4.0	1.50	17.7	12.6	121,500	450,000	1,100	1,600	284.4
234472M.SP	360	540	479	212	106	53.0	4.0	1.50	17.7	12.9	121,500	459,000	1,000	1,500	317.5
234476M.SP	380	560	499	212	106	53.0	4.0	1.50	17.7	13.8	126,000	495,000	1,000	1,500	339.5
234480M.SP	400	600	532	236	118	59.0	5.0	2.00	17.7	14.3	141,750	573,750	900	1,300	436.5

\* S<sub>a</sub> = axial rigidity [lb./μin.]

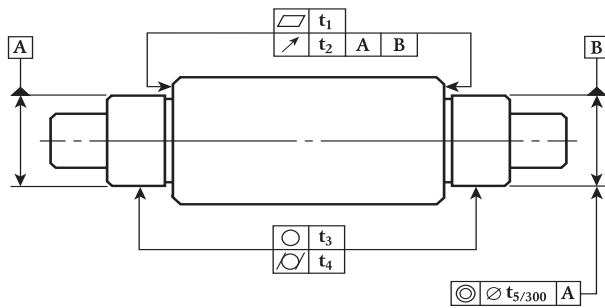
# ENGINEERING

## Bearing Mounting and Fitting

### Mounting & Fitting

After a bearing selection has been made, the product or system designer should pay careful attention to details of bearing mounting and fitting.

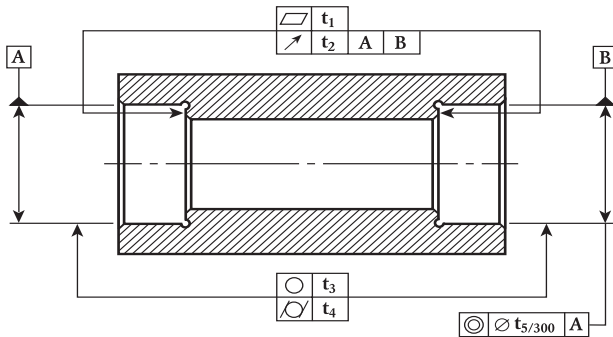
Bearing seats on shafts and housings must be accurately machined, and should match the bearing ring



**Table 1:** Dimensional accuracy recommendations for shafts.

Characteristic	OUTSIDE DIAMETER OF SHAFT BEARING SEAT, mm							
	<6	6-10	11-18	19-30	31-50	51-80	81-120	121-180
Flatness, $t_1$	30	60	80	100	100	120	150	200
Runout, $t_2$	40	100	120	150	150	200	250	300
Roundness, $t_3$	25	50	60	75	75	100	125	150
Taper, $t_4$	25	50	60	75	75	100	125	150
Concentricity, $t_5$	40	100	120	150	150	200	250	300

Values in microinches.



**Table 2:** Dimensional accuracy recommendations for housings.

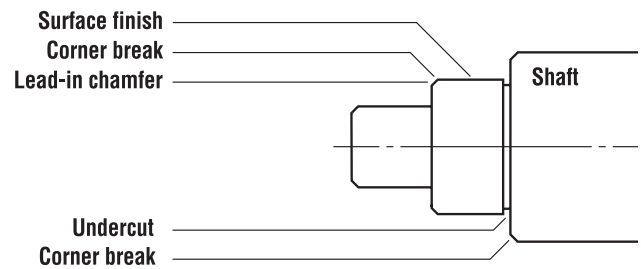
Characteristic	BORE DIAMETER OF BEARING HOUSING, mm							
	<10	10-18	19-30	31-50	51-80	81-120	121-180	181-250
Flatness, $t_1$	65	80	100	100	120	150	200	300
Runout, $t_2$	100	120	150	150	200	250	300	400
Roundness, $t_3$	60	75	100	125	150	150	200	250
Taper, $t_4$	50	60	75	75	100	125	150	200
Concentricity, $t_5$	100	120	150	150	200	250	300	400

Values in microinches.

width to provide maximum seating surface.

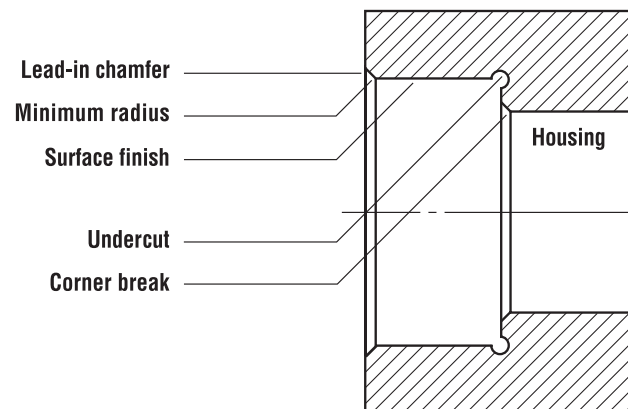
Recommendations for geometry and surface finish of bearing seats and shoulders are shown in Table 3.

Dimensional accuracy recommendations for shafts and housings can be found in Tables 1 and 2.



**Table 3:** Recommended finish of bearing seats and shoulders.

Detail or Characteristic	Specification
Lead-in chamfer	Required
Undercut	Preferred
All corners	Burr-free at 5x magnification
Surface finish	16 microinch AA maximum
Bearing seats	Clean at 5x magnification



**Table 4:** Recommended geometry of corners.

Detail	NOMINAL BORE DIAMETER, mm			
	<6	6-50	51-120	121-180
Corner break, min.	.001	.002	.003	.004
Minimum radius	.003	.003	.003	.004

Values in inches.

# ENGINEERING

## Bearing Mounting and Fitting

### Shaft & Housing Fits

The ideal mounting for a precision bearing has a line-to-line fit, both on the shaft and in the housing. Such an idealized fit has no interference or looseness.

As a practical matter, many influencing factors have to be considered:

- Operating conditions such as load, speed, temperature.
- Provision for axial expansion.
- Ease of assembly and disassembly.
- Requirements for rigidity and rotational accuracy.
- Machining tolerances.

Thus, the appropriate fit may have moderate interference, moderate looseness or even a transitional nature, as governed by operating requirements and the mounting design. Tables 5 and 6 provide general guidelines for typical applications, according to dominant requirements.

### Fitting Practice

Interference fits (press fits) may be required when there is:

- A need to avoid mass center shifts.
- Heavy radial loading.
- Vibration that could cause fretting and wear.
- A need for heat transfer.
- A lack of axial clamping.
- To compensate for centrifugal growth of inner ring.

Interference fits should be used cautiously, as they can distort the raceway and reduce radial play. In preloaded pairs, reduction of radial play increases the preload. If excessive, this can result in markedly reduced speed capability, higher operating temperature and premature failure.

Loose fits may be advisable when:

- There are axial clamping forces.
- Ease of assembly is important.
- There must be axial movement to accommodate spring loading or thermal movements.

**Table 5:** Shaft/housing fits for miniature & instrument bearings.

	Dominant Requirements*		Fit Extremes, inches**	
			Random Fitting	Selective Fitting
Shaft Fits	Inner ring clamped	Normal accuracy.	.0000 – .0004	– .0001 – .0003
		Very low runout, high radial rigidity.	+ .0001 – .0003	.0000 – .0002
	Inner ring not clamped	Normal accuracy.	+ .0001 – .0003	.0000 – .0002
		Very low runout, high radial rigidity.	+ .0003 – .0001	+ .0002 .0000
		Very high speed service.	+ .0002 – .0002	+ .0001 – .0001
		Inner ring must float to allow for expansion.	.0000 – .0004	– .0001 – .0003
		Inner ring must hold fast to rotating shaft.	+ .0003 – .0001	+ .0002 .0000
Housing Fits	Normal accuracy, low to high speeds. Outer ring can move readily in housing for expansion.		.0000 – .0004	– .0001 – .0003
	Very low runout, high radial rigidity. Outer ring need not move readily to allow for expansion.		+ .0001 – .0003	.0000 – .0002
	Heavy radial load. Outer ring rotates.		+ .0001 – .0003	.0000 – .0002
	Outer ring must hold fast to rotating housing. Outer ring not clamped.		+ .0004 .0000	+ .0003 + .0001

\*Radial loads are assumed to be stationary with respect to rotating ring.

\*\*Interference fits are positive (+) and loose fits negative (–) for use in shaft and housing size determination, page 35.

# ENGINEERING

## Bearing Mounting and Fitting

Loose fits for stationary rings can be a problem if there is a dominant rotating radial load (usually unbalanced). While axial clamping, tighter fits and anti-rotation devices can help, a better solution is good dynamic balancing of rotating mass.

The appropriate fit may also vary, as governed by operating requirements and mounting design. To ensure a proper fit, assemble only clean, burr-free parts. Even small amounts of dirt on the shaft or housing can cause severe bearing misalignment problems.

When press fitting bearings onto a shaft, force should be applied evenly and only to the ring being fitted or internal damage to the bearing — such as

brinelling — could result. If mounting of bearings remains difficult, selective fitting practices should be considered. Selective fitting — utilizing a system of bearing calibration — allows better matching of bearing, shaft and housing tolerances, and can provide more control over assembly.

### Fitting Notes:

1. Before establishing tight interference fits, consider their effect on radial internal clearance and bearing preloads (if present). Also realize that inaccuracies in shaft or housing geometry may be transferred to the bearings through interference fits.

**Table 6:** Shaft and housing fits for spindle and turbine bearings.

	Dominant Requirements*		Fit Extremes, inches**						
			Nominal Bore Diameter, mm						
			7–30	31–80	81–180				
Shaft Fits	Inner ring clamped	Very low runout, high radial rigidity.		+	.0002	+	.0003	+	.0004
				–	.0001	–	.0001	–	.0002
		Low to high speeds, low to moderate radial loads.		+	.00015	+	.0002	+	.0003
				–	.00015	–	.0002	–	.0003
		Heavy radial load	Inner ring rotates	+	.0003	+	.0004	+	.0006
				.0000	.0000	.0000	.0000		
			Outer ring rotates	.0000	+	.0001	+	.0001	
				–	.0003	–	.0003	–	.0005
	Inner ring not clamped	Very low runout, high radial rigidity, light to moderate radial loads.		+	.0003	+	.0004	+	.0006
				.0000	.0000	.0000	.0000		
		Heavy radial load	Inner ring rotates	+	.0004	+	.0005	+	.0007
				+	.0001	+	.0001	+	.0001
			Outer ring rotates	.0000	+	.0001	+	.0001	
				–	.0003	–	.0003	–	.0005
		Inner ring must float to allow for expansion, low speed only.		.0000	–	.0001	–	.0008	
				–	.0003	–	.0005	–	.0002
			Nominal Outside Diameter, mm						
			18–80	81–120	121–250				
Housing Fits	Normal accuracy, low to high speeds, moderate temperature.		.0000	+	.0001	+	.0002		
			–	.0004	–	.0005	–	.0006	
	Very low runout, high radial rigidity. Outer ring need not move readily to allow for expansion.		+	.0001	+	.0002	+	.0002	
			–	.0003	–	.0004	–	.0006	
	High temperature, moderate to high speed. Outer ring can move readily to allow for expansion.		–	.0001	–	.0001	–	.0002	
			–	.0005	–	.0007	–	.0010	
	Heavy radial load, outer ring rotates.		+	.0004	+	.0006	+	.0008	
			.0000	.0000	.0000	.0000			

\*Radial loads are assumed to be stationary with respect to rotating ring.

\*\*Interference fits are positive (+) and loose fits negative (–) for use in shaft and housing size determination, page 35.



# ENGINEERING

## Bearing Mounting and Fitting

2. Radial internal clearance is reduced by up to 80% of an interference fit. Thus, an interference of .00025" could cause an estimated .0002" decrease in internal clearance. Bearings with Code 3 radial play or less should have little or no interference fitting.
  3. Keep in mind that mounting fits may be substantially altered at operating temperatures due to differential expansion of components. Excessive thermal expansion can quickly cause bearing failure if the radial play is reduced to zero or less, creating a radial preload.
  4. An axially floating loose fit for one bearing of two-bearing system is usually needed to avoid preloading caused by thermal expansion during operation.
  5. When an interference fit is used, it is generally applied to the rotating ring. The stationary ring is fitted loose for ease of assembly.
  6. Spring-loaded bearings require a loose fit to ensure that the spring loading remains operational.
  7. In the case of loose fits, inner and outer rings should be clamped against shoulders to minimize the possibility of non-repetitive runout.
  8. Diameter and squareness tolerances for shaft and housing mounting surfaces and shoulders should be similar to those for the bearing bore and O.D. The surface finish and hardness of mating components should be suitable for prolonged use, to avoid deterioration of fits during operation.
  9. Proper press-fitting techniques must be used to prevent damage during assembly. Mounting forces must never be transmitted through the balls from one ring to the other. Thus, if the inner ring is being press fitted, force must be applied directly to the inner ring.
  10. When a more precise fit is desired, bearings can be obtained that are calibrated into narrower bore and O.D. tolerance groups. These can be matched to similarly calibrated shafts and housings to cut the fit tolerance range by 50% or more.
  11. Mounting bearings directly in soft non-ferrous alloy housings is considered poor practice unless loads are very light and temperatures are normal and steady — not subject to wide extremes. When temperatures vary drastically, as in aircraft applications, where aluminum is a common structural material, steel housing liners should be used to resist the effects of excessive thermal contraction or expansion upon bearing fits. Such liners should be carefully machined to the required size and tolerance while in place in the housing, to minimize possibility of runout errors.

Other problems associated with non-ferrous alloys are galling during assembly and “pounding out” of bearing seats. Any questions that arise in unusual mounting situations should be discussed with the Barden Product Engineering Department.
  12. For a more secure mounting of a bearing on a shaft or in a housing, clamping plates are considered superior to threaded nuts or collars. Plates are easily secured with separate screws.
- When used with shafts and housings that are not shouldered, threaded nuts or collars can misalign bearings. Care must be taken to assure that threaded members are machined square to clamping surfaces. For high-speed precision applications, it may be necessary to custom scrape the contact faces of clamping nuts. In all cases, the clamping forces developed should not be capable of distorting the mating parts.

### Shaft and Housing Size Determination

The fits listed in Tables 5 and 6 (pages 33 and 34) apply to normal operating temperatures and are based on average O.D. and bore sizes. The size and tolerance of the shaft or housing for a particular application can be readily computed by working back from the resulting fit, as shown in the example. Note that the total fit tolerance is always the sum of the bearing bore or O.D. tolerance plus the mating shaft or housing tolerance.

# REPLACEMENT INTERCHANGE

## DUPLEX SPINDLE BEARINGS (light preload indicated)

Barden	Fafnir	NSK	SKF	Barden	Fafnir	NSK	SKF
100HCDUL	2MMV9100WIDUL	7000CTDULP3	7000CD/P4ADGA	215HDL	2MMV215WIDUL	7215CTDULP3	7215CD/P4ADGA
101HCDUL	2MMV9101WIDUL	7001CTDULP3	7001CD/P4ADGA	216HDL	2MMV216WIDUL	7216CTDULP3	7216CD/P4ADGA
102HCDUL	2MMV9102WIDUL	7002CTDULP3	7002CD/P4ADGA	217HDL	2MMV217WIDUL	7217CTDULP3	7217CD/P4ADGA
103HCDUL	2MMV9103WIDUL	7003CTDULP3	7003CD/P4ADGA	218HDL	2MMV218WIDUL	7218CTDULP3	7218CD/P4ADGA
104HCDUL	2MMV9104WIDUL	7004CTDULP3	7004CD/P4ADGA	220HDL	2MMV220WIDUL	7220CTDULP3	7220CD/P4ADGA
105HCDUL	2MMV9105WIDUL	7005CTDULP3	7005CD/P4ADGA	304HDL	2MMV304WICRDUL	This series not shown in their latest precision catalogs.	
106HCDUL	2MMV9106WIDUL	7006CTDULP3	7006CD/P4ADGA	305HDL	2MMV305WICRDUL		
107HCDUL	2MMV9107WIDUL	7007CTDULP3	7007CD/P4ADGA	306HDL	2MMV306WICRDUL		
108HCDUL	2MMV9108WIDUL	7008CTDULP3	7008CD/P4ADGA	307HDL	2MMV307WICRDUL		
109HCDUL	2MMV9109WIDUL	7009CTDULP3	7009CD/P4ADGA	308HDL	2MMV308WICRDUL		
110HCDUL	2MMV9110WIDUL	7010CTDULP3	7010CD/P4ADGA	309HDL	2MMV309WICRDUL	7900CTDULP3 71900CD/P4ADGA	
111HCDUL	2MMV9111WIDUL	7011CTDULP3	7011CD/P4ADGA	310HDL	2MMV310WICRDUL		
112HCDUL	2MMV9112WIDUL	7012CTDULP3	7012CD/P4ADGA	1900HCDUL	2MMV9300WICRDUL	7901CTDULP3	71901CD/P4ADGA
113HCDUL	2MMV9113WIDUL	7013CTDULP3	7013CD/P4ADGA	1901HCDUL	2MMV9301WICRDUL	7902CTDULP3	71902CD/P4ADGA
114HCDUL	2MMV9114WIDUL	7014CTDULP3	7014CD/P4ADGA	1902HCDUL	2MMV9302WICRDUL	7903CTDULP3	71903CD/P4ADGA
115HCDUL	2MMV9115WIDUL	7015CTDULP3	7015CD/P4ADGA	1903HCDUL	2MMV9303WICRDUL	7904CTDULP3	71904CD/P4ADGA
116HCDUL	2MMV9116WIDUL	7016CTDULP3	7016CD/P4ADGA	1904HCDUL	2MMV9304WICRDUL	7905CTDULP3	71905CD/P4ADGA
117HCDUL	2MMV9117WIDUL	7017CTDULP3	7017CD/P4ADGA	1905HCDUL	2MMV9305WICRDUL	7906CTDULP3	71906CD/P4ADGA
118HCDUL	2MMV9118WIDUL	7018CTDULP3	7018CD/P4ADGA	1906HCDUL	2MMV9306WICRDUL	7907CTDULP3	71907CD/P4ADGA
119HCDUL	2MMV9119WIDUL	7019CTDULP3	7019CD/P4ADGA	1907HCDUL	2MMV9307WICRDUL	7908CTDULP3	71908CD/P4ADGA
120HCDUL	2MMV9120WIDUL	7020CTDULP3	7020CD/P4ADGA	1908HCDUL	2MMV9308WICRDUL	7909CTDULP3	71909CD/P4ADGA
121HDL	2MMV9121WIDUL	7021CTDULP3	7021CD/P4ADGA	1909HCDUL	2MMV9309WICRDUL	7910CTDULP3	71910CD/P4ADGA
122HDL	2MMV9122WIDUL	7022CTDULP3	7022CD/P4ADGA	1910HCDUL	2MMV9310WICRDUL	7911CTDULP3	71911CD/P4ADGA
124HDL	2MMV9124WIDUL	7024CTDULP3	7024CD/P4ADGA	1911HCDUL	2MMV9311WICRDUL	7912CTDULP3	71912CD/P4ADGA
126HDL	2MMV9126WIDUL	7026CTDULP3	7026CD/P4ADGA	1912HCDUL	2MMV9312WICRDUL	7913CTDULP3	71913CD/P4ADGA
128HDL	2MMV9128WIDUL	7028CTDULP3	7028CD/P4ADGA	1913HCDUL	2MMV9313WICRDUL	7914CTDULP3	71914CD/P4ADGA
130HDL	2MMV9130WIDUL	7030CTDULP3	7030CD/P4ADGA	1914HCDUL	2MMV9314WICRDUL	7915CTDULP3	71915CD/P4ADGA
200HCDUL	2MMV200WIDUL	7200CTDULP3	7200CD/P4ADGA	1915HCDUL	2MMV9315WICRDUL	7916CTDULP3	71916CD/P4ADGA
201HCDUL	2MMV201WIDUL	7201CTDULP3	7201CD/P4ADGA	1916HCDUL	2MMV9316WICRDUL	7917CTDULP3	71917CD/P4ADGA
202HCDUL	2MMV202WIDUL	7202CTDULP3	7202CD/P4ADGA	1917HCDUL	2MMV9317WICRDUL	7918CTDULP3	71918CD/P4ADGA
203HCDUL	2MMV203WIDUL	7203CTDULP3	7203CD/P4ADGA	1918HCDUL	2MMV9318WICRDUL	7919CTDULP3	71919CD/P4ADGA
204HCDUL	2MMV204WIDUL	7204CTDULP3	7204CD/P4ADGA	1919HCDUL	2MMV9319WICRDUL	7920CTDULP3	71920CD/P4ADGA
205HCDUL	2MMV205WIDUL	7205CTDULP3	7205CD/P4ADGA	1920HCDUL	2MMV9320WICRDUL	7921CTDULP3	71921CD/P4ADGA
206HCDUL	2MMV206WIDUL	7206CTDULP3	7206CD/P4ADGA	1921HCDUL	2MMV9321WICRDUL	7922CTDULP3	71922CD/P4ADGA
207HCDUL	2MMV207WIDUL	7207CTDULP3	7207CD/P4ADGA	1922HCDUL	2MMV9322WICRDUL	7923CTDULP3	71923CD/P4ADGA
208HCDUL	2MMV208WIDUL	7208CTDULP3	7208CD/P4ADGA	1924HCDUL	2MMV9324WICRDUL	7926CTDULP3	71926CD/P4ADGA
209HCDUL	2MMV209WIDUL	7209CTDULP3	7209CD/P4ADGA	1926HCDUL	2MMV9326WICRDUL	7928CTDULP3	71928CD/P4ADGA
210HCDUL	2MMV210WIDUL	7210CTDULP3	7210CD/P4ADGA	1928HCDUL	2MMV9328WICRDUL	7930CTDULP3	71930CD/P4ADGA
211HCDUL	2MMV211WIDUL	7211CTDULP3	7211CD/P4ADGA	1930HCDUL	2MMV9330WICRDUL	7932CTDULP3	71932CD/P4ADGA
212HCDUL	2MMV212WIDUL	7212CTDULP3	7212CD/P4ADGA	1932HCDUL	2MMV9332WICRDUL	7934CTDULP3	71934CD/P4ADGA
213HDL	2MMV213WIDUL	7213CTDULP3	7213CD/P4ADGA	1934HCDUL	2MMV9334WICRDUL	7936CTDULP3	71936CD/P4ADGA
214HDL	2MMV214WIDUL	7214CTDULP3	7214CD/P4ADGA	1936HCDUL	2MMV9336WICRDUL	7938CTDULP3	71938CD/P4ADGA
				1938HCDUL	2MMV9338WICRDUL		

Note: Light preload is indicated in all part numbers listed.  
All Barden bearings are ABEC 9 super precision with 15° contact angle.

## BALL SCREW SUPPORT BEARINGS

### Duplex Sets (Inch)

### Duplex Sets (Metric)

Barden	Fafnir	Barden	Fafnir
L078HDF	MM9306WI-2H DUH	BSB2047DUH	BSB20BS47DUH
L093HDF	MM9308WI-2H DUH	BSB2562DUH	BSB25BS62DUH
L150HDF	MM9310WI-2H DUH	BSB3062DUH	BSB30BS62DUH
L175HDF	MM9311WI-3H DUH	BSB3572DUH	BSB35BS72DUH
L225HDF	MM9313WI-5H DUH	BSB4072DUH	BSB40BS72DUH
L300HDF	MM9316WI-3H DUH		
L400HDF	MM9321WI-3H DUH		

### Preload Designation

	Barden	Fafnir	NSK	SKF
Light	L	L	L or C7	A
Medium	M	M	M or C8	B
Heavy	H	H	H or C9	C

### 25° Contact Angle Designation

Series	Barden	Fafnir	NSK	SKF
100	100HEDUL	3MM9100WIDUL	7000A5TDULP4	7000ACD/P4ADGA
200	200HEDUL	3MM200WIDUL	7200A5TDULP4	7200ACD/P4ADGA

## INSTRUMENT BEARINGS

(SR Series, Shielded, Stainless Steel, Cylindrical O.D.)

Barden	NHBB	MPB
SR2SS	SR2PP	SR2CHH7
SR3SS	SR3PP	SR3CHH7
SR4SS	SR4PPD	SR4RHH7
SR4ASS	SR4APPD	SR4ARHH7
SR6SS	SR6PPD	SR6RHH7
SR8SS	SR8PPD	SR8RHH7
SR10SS	SR10PPD	—

Open Type: Barden — Delete SS      Flanged Type: Barden — SFR (Prefix)  
NHBB — Delete PP      NHBB — SFR (Prefix)  
MPB — Delete HH      MPB — S (Size) F (Suffix)



## THE BARDEN CORPORATION

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