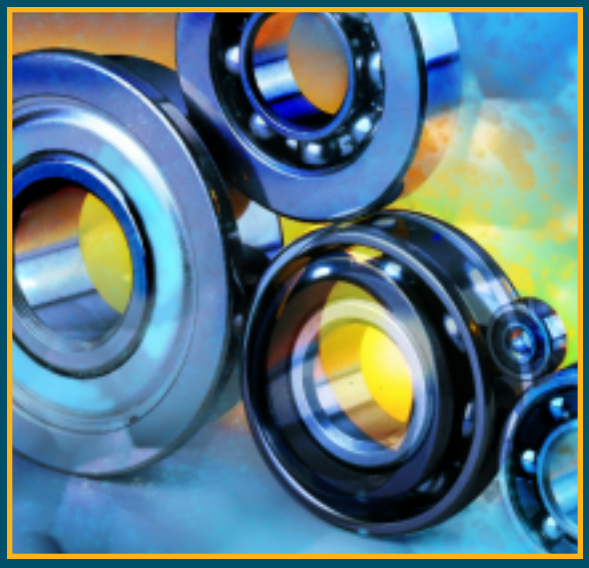
miniature and instrument ball bearings

Products and Engineering



Welcome to the Precision Division of NHBB

Since 1971 our modern manufacturing facility here in Chatsworth has been the leader in applying volume production methods to sophisticated, non-standard, ultra precision miniature and instrument bearing designs. Our position of leadership is maintained through the application of advanced technologies, significant investment in automated tooling for machining, grinding, assembly and testing, and unsurpassed process control systems.

The reputation NHBB has achieved for quality, cost-effective products has earned us the confidence of customers throughout the world. As the front-runner in high-speed miniature bearing design, the Precision Division has pioneered the first mass-production of autoclavable dental bearings using a polyamide-imide retainer material, as well as the finest quality miniature gyro spin bearings.

Initiatives such as ISO 9002 ensure the Precision Division's advanced capabilities will be maintained at leading edge levels.

The Precision Division's multi-million dollar facility renovation includes the addition of a Class 1000 clean room for all bearing assembly.

We are committed to the research and development of new materials, innovative high-performance bearing design, and the continuous improvement of existing products.

Part Numbering System

EXAMPLE: SSRI-418ZZEEA62HA5CXXP25L02P
RIF-1438FA7P13LG49U

GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7	GROUP 8
MATERIAL	TYPE	BASIC SIZE	SEALS & SHIELDS	MODIFICATIONS	DUPLEX PAIRS	PREMIUM FEATURES	CAGE
SS	**RI –** **RIF –**	**418** **1438**	**ZZ**	**EEA62**			**H** **F**
SS=AISI stainless steel (440C) **No Code**=Chrome alloy steel (52100) **CE**=Chrome alloy steel rings (52100) with ceramic balls **SB**=440C Modified **SE**=AISI stainless steel rings (440C) with ceramic balls **ST**=AISI stainless steel rings (440C) with TiC coated balls **XT**=Chrome alloy steel rings (52100) with TiC balls	**RI, R, L**=Radial **RIF, RF, LF**=Flanged radial **F**=Flanged, tapered O.D. **FR**=Duplex pair with one flanged and one unflanged bearing **RIFW, RFW, LFW**=Flanged with non-standard flange width **MBRI, MBR, MBL**=Inner ring relieved and separable **MBRIF, MBRF, MBLF**=Inner ring relieved and separable, flanged outer ring **MDRI, MDR, MDL**=Inner ring relieved and non-separable **MDRIF, MDRF, MDLF**=Inner ring relieved and non-separable, flanged outer ring **MERI, MER, MEL**=Outer ring relieved, and non-separable **MERIF, MERF, MELF**=Outer ring relieved, flanged and non-separable **MBF**=Inner ring relieved and separable, outer ring flanged and O.D. tapered **MDF**=Inner ring relieved and non-separable, outer ring flanged and O.D. tapered **Special Size Series**: **Z**=(Followed by letter and numbers indicates End Bell) **RA _ _ _ _**=Pulley type assemblies; shaft assemblies; mechanical parts; tape guides; special bearings	**Inch Series** First one or two digits indicates O.D. in 16ths of an inch. The following two or three digits indicate the bore size in a fraction of an inch, the first digit being the numerator and the second or the second and third digits being the denominator. **Metric Series** First two digits indicate O.D. in mm. Second two digits indicate I.D. in mm. **X**=(following basic size) Indicates special internal design, assigned in numerical sequence i.e. X1, X2, etc.	**Enclosures** **Z**=Single metallic shield-removable **ZZ**=Double metallic shield-removable **ZO**=Single shield on side opposite flange **D**=Single rubber seal **DD**=Double rubber seal **D1**=Single viton seal **DD1**=Double viton seal **L**=Single glass reinforced PTFE seal **LL**=Double glass reinforced PTFE seal **LO**=Single seal on side opposite flange **LZ**=Glass reinforced PTFE seal and shield with seal on flange side **ZL**=Shield and glass reinforced PTFE seal with shield on flange side **DZ**=Rubber seal and shield **L(L) BP**=Glass reinforced PTFE seal(s) with metal backing plate(s) **H**=Single metallic shield non-removable **HH**=Double metallic shield non-removable **S**=Single rubber seal, non-contact **SS**=Double rubber seal, non-contact **Q(Q)**=Glass reinforced PTFE seal(s), lip riding **Q(Q)4**=Glass reinforced PTFE seal(s) with protective shield(s), lip riding **DO, QO**=Single seal on side opposite flange	**Extended Inner Ring** **EE**=Both sides **E**=One side **Special External Dimension** **A _ _** =Larger than standard O.D. **A**=Semi-standard, larger width and O.D. bearing **A _ _ _ _**=Larger O.D. than standard and special width **W**=Wider than standard width **Y**=Narrower than standard width **N**=Larger or smaller bore than standard **G**=Special external groove in bearing **B**=Special bore tolerance **Special Design** **SD**=Special design bearing **CV**=Special race curvature	**Duplex** **DB**=Back-to-back configuration **DF**=Face-to-face configuration **DT**=Tandem configuration **DU**=Universal duplex. Numbers following letter code indicate mean preload in pounds. If not followed by a number, standard preload is applied.	**MC**=Premium ball & race finish for specific applications	**CR**=Ribbon PTFE coated **F**=Full ball complement **H**=Crown, land piloted **J**=Crown, acetal **JM**=Full type, acetal **JN**=Full type, molded acetal **KB**=Crown phenolic, paper base **KC**=Crown, phenolic, linen base **KF**=Crown phenolic, linen, non keyhole type outer land piloting **KG**=Crown phenolic, paper base, outer land piloted **KM**=Full type, phenolic, linen base **KN**=Full type, phenolic, paper base **M4**=Full type, polyimide **M5**=Crown, polyimide **R**=Ribbon, land piloted **RD**=Ribbon,ball piloted **SL**=Slug, PTFE **T1**=Crown, specialty material **TT**=Toroids, PTFE

GROUP 9	GROUP 10	GROUP 11	GROUP 12	GROUP 13	GROUP 14
ABEC TOLERANCE	DIMENSIONAL CODING	RADIAL PLAY	TORQUE	LUBRICANT	PACKAGING
A5 **A7**	**CXX**	**P25** **P13**		**LO2** **LG49**	**P** **U**

A1=ABEC 1*

A3=ABEC 3, 3P

A5=ABEC 5, 5P, 5T

A7=ABEC 7, 7P, 7T

A9=ABEC 9, 9P

Note: Selected ABEC 9 tolerances are available on all sizes. Please consult factory.

*A1 miniature and instrument bearings of both the metric and inch configurations meet the tolerances of ABMA Standard 20 for ABEC 1 metric series bearings.

CXX=I.D. and O.D. calibration in .0001 increments

COX=O.D. coding only, .0001 increments

CXO=I.D. coding only, .0001 increments

C44=I.D. and O.D. calibration in .000050 increments

C04=O.D. coding only, .000050 increments

C40=I.D. coding only, .000050 increments

P=Followed by two,three, or four numbers indicates the radial play limits in ten thousandths of an inch. Example: P25 indicates radial play of .0002" to .0005".

PC _ _ =Nominal contact angle in degrees

PA _ _ _ =Nominal axial play

Example: PA015 indicates axial play of .0015

T=Followed by a number indicates maximum starting torque in hundreds of mg. mm. Example: T15 indicates a maximum starting torque of 1500 mg. mm.

RT=Followed by a number indicates maximum running torque in hundreds of mg. mm. Example: RT15 indicates a maximum running torque of 1500 mg. mm.

Lubricant letter codes are followed by a number to indicate specific type.

BC=Following lubricant code indicates barrier coating

LB=Mixture of oil and solvent

LD=Dry–no lubrication

LF=Dry film

LG=Greases

LM=Mixture of oil and grease

LO=Oils

LY=Expanded list of oils and greases

Grease Plate Code
(follows lubricant code)

GPL=light

GPM=medium

GPH=heavy

No Code=Plastic sealed vial

B=Individual boxes

E=Individual pack per MIL-B-22191

K=Kraft foil package

KB=Kraft bag and box

P=Pill pack

PB=Pill pack and box

U=Unit pack

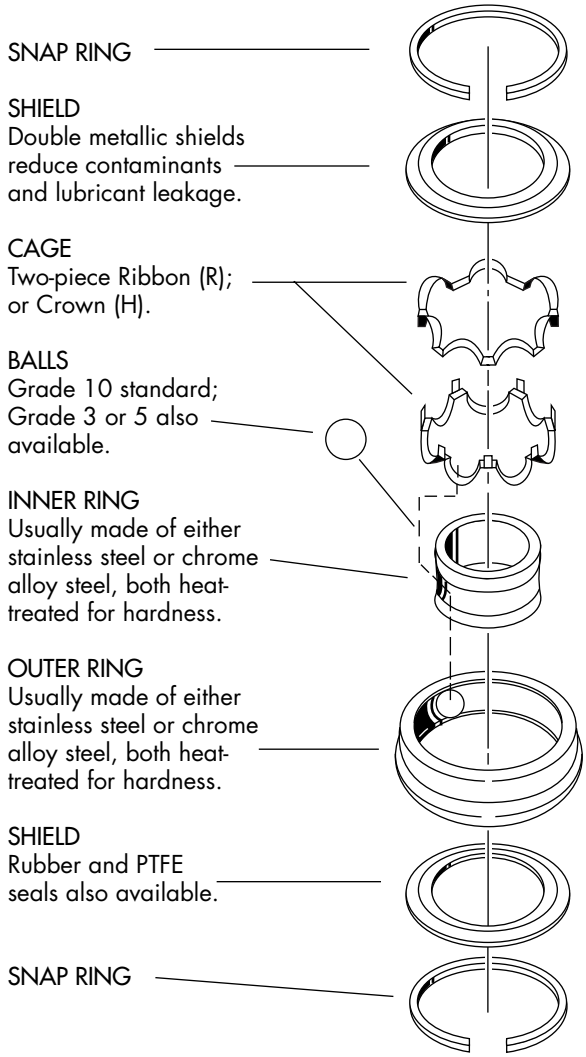
UB=Unit pack and box

IMPORTANT NOTE:
The NHBB numbering system identifies ball bearing size and design. This system is not a guide to create a customized ball bearing. Please use the numbering system to decipher the basic bearing numbers listed in this catalog, or to define a number given to you by a representative of NHBB. Please consult a member of the NHBB sales or engineering staff to help you design a new bearing or to interchange another manufacturer's part number.

Ball Bearing Components

This exploded view of a standard ball bearing can help you select the bearing with the appropriate components for your design or application. The cross-sectional view illustrates the relative position of these components in the ball bearing assembly.

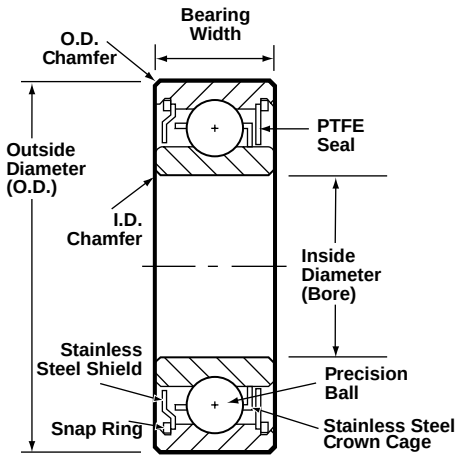
Exploded view of ball bearing

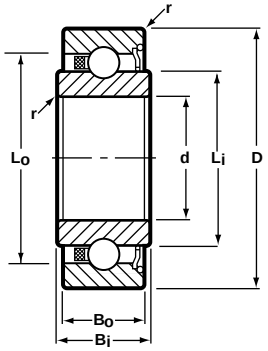


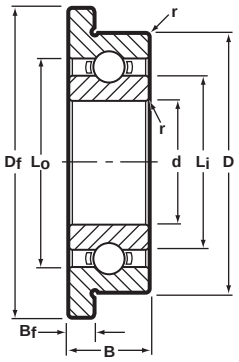
Basic Dimensions

The dimensions and reference codes used throughout this catalog are illustrated and defined below. These dimensions establish bearing size and other parameters which can help you choose the ball bearing best suited to your application.

Cross section view of ball bearing







d - Inside Diameter or Bore
D - Outside Diameter – O.D.
B - Overall Bearing Width
B_i - Inner Ring Width
B_o - Outer Ring Width
D_f - Flange Outside Diameter
B_f - Flange Width or Thickness
L_i - Inner Ring Land Diameter
L_o - Outer Ring Land Diameter
r - Maximum Shaft or Housing Fillet Radius that bearing corners will clear
Z - Number of Balls per row
D_b - Nominal Diameter of Balls
Nmax - Maximum Speed/rpm
fn - Cage and Lubricant Factor. See pg. 39

Special Assemblies & Components

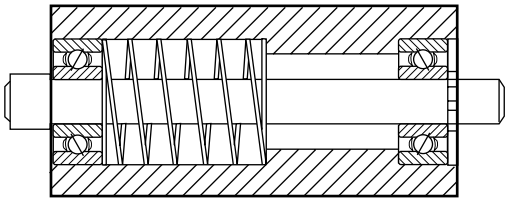
Today's high-technology products demand increasingly critical tolerances. NHBB stands ready to support your needs with:

- Next-level bearing assemblies & subassemblies
- Ultra-precision components
- Leading edge automated production techniques
- Complete in-house manufacturing
- ISO 9002 Quality System approval
- 50 years of experience in precision manufacturing and assembly

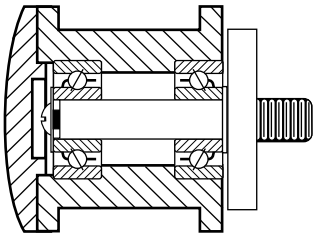
Our experienced staff can help you design quality, cost-effective subassemblies for your specific applications—and manufacture them in small or volume production quantities.

NHBB can provide complete manufacturing and assembly for a wide variety of special designs.

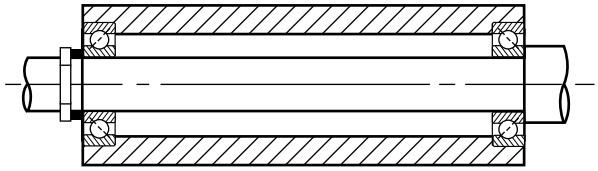
Spindle Assembly. Designed with compression coil spring — shaft rotation.



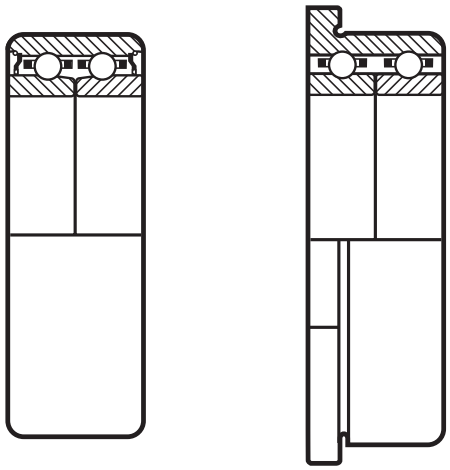
Typical Tape Guide. Design uses screw and washer to solidly preload by clamping inner rings — outer ring rotation.



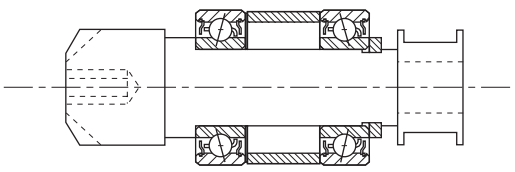
Shaft/Housing Assembly. Factory assembled to control fit ups and runouts.



Integral Super Duplex. Manufactured with outer raceway ground into housing.



Special Assembly. Manufacture and assemble several components to control proper fit and performance.



Bearing Selection

To ensure optimal speed and load carrying capacity, several factors must be considered when choosing the proper bearing for your application. These factors include the ring material, design, shields & seals, cage, ABEC grade, radial play, and lubricant.

Materials

Miniature and instrument bearings are normally made of either stainless steel or chrome alloy steel. NHBB offers 440C stainless steel for applications that require corrosion resistance, and 52100 chrome steel for maximum fatigue life. These materials are heat-treated to achieve optimum hardness and dimensional stability, and are suitable for most applications.

Design

The design of a bearing is critical in determining its load-carrying capability and maximum operating speed—factors which directly impact the bearing's operating life. Various types of bearings have been designed to meet the operating parameters of your application.

The **radial** or **conrad** bearing (also referred to as deep groove) is the most popular type due to its ability to handle radial and thrust loads in either direction. This type is offered with various seal or shield options.

The **angular contact** bearing is designed with a relieved shoulder to allow for a greater number of balls, thereby increasing its load-carrying capability. The angular contact design also allows for the use of a full section cage which is desirable for high speed applications. This type of bearing can handle thrust loads in one direction only.

Shields and Seals

Shields and seals are used in ball bearings to retain lubricants and prevent particulate contamination from reaching the critical surfaces. Shields are popular for most applications; seals are used where minimal clearance to light contact is required. Seals offer greater deterrence to particulate contamination, but increase torque and limit operating speed. NHBB offers a variety of enclosure options. The chart on page 34 in the Engineering Section describes these options in greater detail.

Cages

The cage, also referred to as the retainer or separator, is the component that separates and positions the balls at approximately equal intervals around the bearing raceway. Proper selection of a bearing cage is critical for meeting the load, speed and temperature requirements of your application.

The standard cages for radial or conrad miniature and instrument ball bearings are stamped metal ribbon or crown. The application flexibility and low-cost design of these types make them appropriate for most general purpose applications. For high-speed applications, machined cages made of phenolic, polyamide-imide and other materials are available. Refer to page 33 in the Engineering Section for more details on cage options.

ABEC Grade

When choosing the ABEC grade, the factors to be considered are: radial and axial runout requirements; bore and O.D. fits; and audible noise level. The table below shows the bore and O.D. size tolerances and the radial runout limits for each ABEC grade. Grades 5 and 7 are preferred for most standard applications.

ABEC Grade	O.D. Size	Radial Runout		Mean Diameter Tolerance	
		Inner Ring	Outer Ring	Bore	O.D.
1*	0-18mm (0-.7086 in.) over 18-30mm (over .7086-1.1811 in.)	.00040 .00040	.00060 .00060	+.0000 -.0003 +.0000 -.0004	+.0000 -.0003 +.0000 -.0004
3P	0-30mm (0-1.1811 in.)	.00020	.00040	+.0000 - .0002	+.0000 -.0003
5P	0-30mm (0-1.1811 in.)	.00015	.00020	+.0000 -.0002	+.0000 -.0002
7P	0-30mm (0-1.1811 in.)	.00010	.00015	+.0000 -.0002	+.0000 -.0002
9P	0-18mm (0-.7086 in.) over 18-30mm (over .7086-1.1811 in.)	.00005 .00010	.00005 .00010	+.0000 -.0001 +.0000 -.0001	+.0000 -.0001 +.0000 -.00015

**ABEC 1 miniature and instrument bearings of both the metric and inch configurations meet the tolerances of ABMA Standard 20 for ABEC 1 metric series bearings.*

The charts on pages 54–55 provide a complete description of the tolerances controlled by the ABEC level. Normally, race finish and race geometry are superior in ABEC 5P and higher. NHBB recommends these grades for precision assemblies where low noise (mechanical or audible), minimal runout and long life are important considerations for noise sensitive applications.

Radial Play

Radial Play is the free internal radial looseness between the balls and the races with no load applied to the bearing in any direction. Radial play is necessary to accommodate differential thermal expansions, the effects of interference fits, and to control axial play and deflection. The chart on page 35 of the Engineering Section shows the suggested radial play for some typical applications.

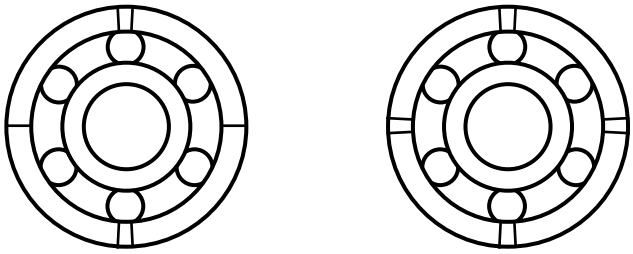
Lubricant

There are literally hundreds of lubricants available for ball bearings; selecting the optimal one is critical. Each has a particular characteristic which makes it suitable for a specific application. Unless torque is a problem, grease is preferred for prelubrication since it is less susceptible to migration and leakage. Grease can increase bearing torque by a factor of 1.2 to 5.0 depending on the grease type and quantity used. See pages 38-40 for further information.

Marking

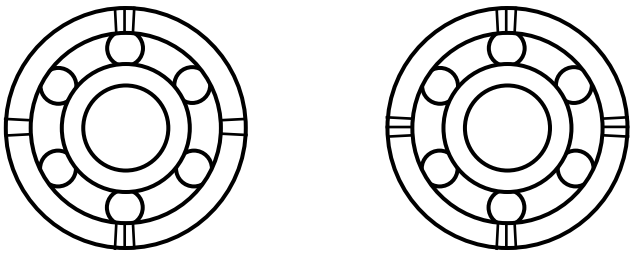
The following figures illustrate the standard marking system used for NHBB Precision Bearing Division ball bearings per MIL-STD-1647. Shown below are the markings for 440C Stainless Steel and the markings for 52100 Chrome Alloy Steel.

ABEC 5, 7 and higher tolerances



440C 52100

ABEC 1*, 3 and 3P tolerances



440C 52100

**ABEC 1 miniature and instrument bearings of both the metric and inch configurations meet the tolerances of ABMA Standard 20 for ABEC 1 metric series bearings.*

Packaging

NHBB's bearings are normally packaged in plastic vials, 8 or more per vial. If prelubrication or protective coating is not specified, oil per MIL-L-6085 (NHBB code LO1) will be used to prevent corrosion.

Vial Pack (No Code) — 8 or more per vial.

Pill Pack (Code P) — One bearing per sealed, plastic compartment. Connected in strips of 4.

Unit Pack (Code U) — Individual bearing placed in a plastic bag; bag is sealed; 10 or more packed in a paperboard box.

Other packaging options are available to suit your specific needs. See page 3 for more information.

PRODUCT QUALITY IS OUR FIRST PRIORITY

The Precision Division meets the requirements of ISO 9001:2000 and was registered to ISO 9002 in 1994. Our quality systems meet the requirements of MIL-Q-9858A and MIL-I-45208. Our computerized calibration system meets the requirements of ANSI/NCSL Z 540-1-1994. All bearings are assembled in a Class 1000 clean room environment. 100% Anderonmeter (dynamic noise and vibration) testing is standard on all of our bearing products.

VOLUME PRODUCTION OF SPECIALTY BEARINGS

The Precision Division's specialty is volume production of ultra precision miniature and instrument bearings. Additionally, we provide facilities to develop and incorporate special materials and lubricants to meet the stringent requirements of leading-edge applications. NHBB has developed many bearing types using the latest technologies including ceramic and TiC balls, dry films and advanced lubrication strategies. We also have the capability to produce precision sub-assemblies and cylindrical components.

Miniature & Instrument Bearings
Precision Division

Hybrid Ceramic Bearings
Precision Division
HiTech Division

Ultra Precision Machine Tool Bearings
HiTech Division

ONGOING NEW PRODUCT DEVELOPMENT

Rod Ends, Sphericals and Link Assemblies
Astro Division

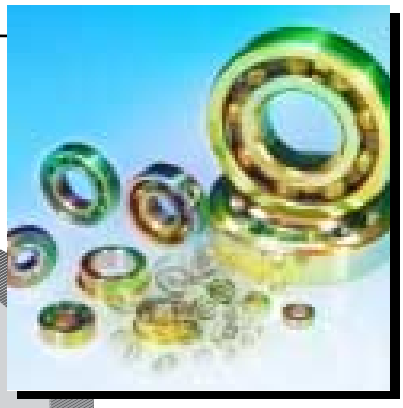
Cylindrical Roller Bearings
HiTech Division

The NHBB organization offers our customers complete access to our full range of corporate capabilities, including custom bearing design and manufacture. Just ask your contact at the Precision Division to help you reach our HiTech or Astro Division engineers as early as possible in the product design phase. At Precision, we are here to help you—our valued customer.

Racing Series Bearings
Astro Division

ENGINEERING

Missile/Space
Guidance Systems, Propulsion Systems, Gear Motors...



Aircraft
Instruments, Environmental Systems, Fuel Controls, Actuators...

PRODUCT OFFERING

Ultra Precision Miniature and Instrument Bearings

Hybrid Ceramics

Airframe Control

Duplex Pairs

Thinex

Dental/Medical
Handpieces, Centrifuges, Diagnostic Equipment, Laser Articulating Arms...

Industrial/ Computer
Motors, Flow Meters, Storage Devices, Semiconductor Processing, Scanners...

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