



BALL and ROLLER BEARINGS

Catalog #A1000 – VI



WARRANTY

NTN bearings are warranted to be free from defects in materials and workmanship. The obligation of NTN under this warranty is limited to replacing any bearing which is proven to be defective within one year of purchase, under the following provisions:

1. The application of the product was approved by NTN.
2. The product is delivered to NTN with transportation charges prepaid.
3. Analysis of NTN verifies that the product was properly handled, mounted, lubricated and not subjected to abuse.

THIS WARRANTY IS IN LIEU OF ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR PURPOSE, OR AL OTHER WARRANTIES, EXPRESSED OR IMPLIED.

NTN shall not be liable for any special, indirect, or consequential damages. The remedies set forth herein are exclusive, and the liability of NTN with respect to any contract or sale or anything done in connection therewith, in contract, in tort, under any warranty, or otherwise, shall not exceed the price of the bearing on which such liability is based.

Although care has been taken to assure the accuracy of the data compiled in this catalog, NTN does not assume any liability to any company or person for errors or omissions.

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NTN is one of the three largest bearing companies in the world. With facilities at the hub of industrial centers around the globe, NTN Bearing Corporation is in an enviable position to best serve its customers, both domestic and worldwide.

In North America, as in all our manufacturing facilities, we attain maximum efficiency using our automated production equipment and processes to produce quality high-volume standard bearing sizes. Low-volume bearings and sizes are manufactured in a single facility and then exported worldwide according to customer requirements. All bearing types and sizes currently used in North America are in inventory at warehouses across the continent.

To best serve our customers, NTN devotes all resources to a single objective: production of the finest quality ball and roller bearings. All of our plants use advanced processing and high speed automated production equipment, engineered and built by NTN, to support our capacity for ultra-high quality bearings. NTN's Statistical Process Control programs ensure

that during the production run, every bearing produced meets or exceeds AFBMA and ISO standards. Electro-mechanical quality inspection is present at every phase of manufacturing.

Proof of NTN's success at meeting our objective are the many quality awards received from our customers. Another cherished award was received in 1954 when NTN became the first bearing manufacturer to win the Deming Prize. This prestigious award is given for outstanding performance above all mechanical industries in statistical quality control, and efficiency of machinery and management. NTN's rigid quality standards originated with the company in 1918, and is the basis for every product innovation and corporate decision made today.

NTN's highly trained employees are here to serve your engineering, sales, and manufacturing needs. Customers receive unparalleled attention through technical assistance from over 700 engineers in North America, Europe and the Far East — all linked through 24-hour global communications. This provides

you with access to support from research and development engineers, application experts and field engineers. Our extensive testing and development laboratories keep us at the leading edge of bearing technology. NTN's North American Technical Center located in Ann Arbor, Michigan, is fully equipped with the latest in metallurgical, mechanical, metrology, and electro-mechanical test equipment.

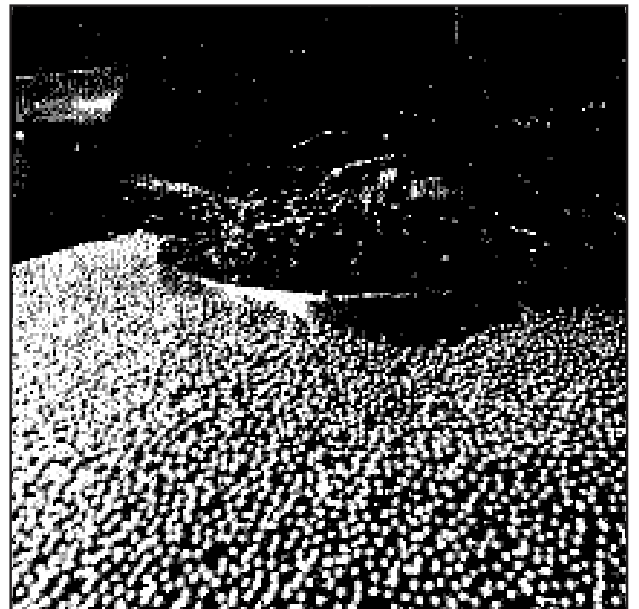
NTN became a world leader through attention to our customers' needs and constant technological innovations. Value-added bearings are NTN's forte. Our quality level allows purchasers to take them directly from receiving dock to application, eliminating incoming inspection costs. They add value to your end product with longer lifetime, less downtime and less maintenance.

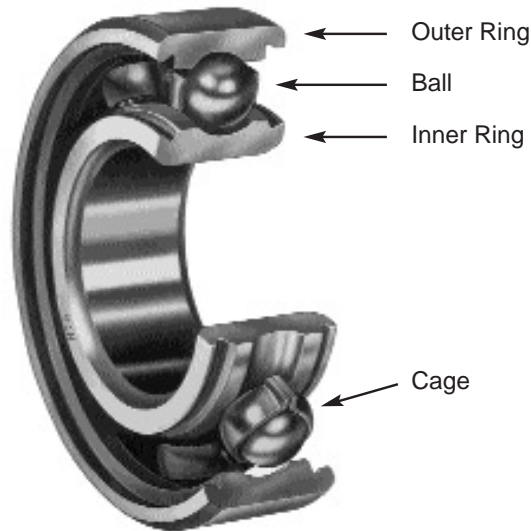




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| <p>1918 Began research and manufacture of ball bearings at Nishizono Ironworks (Uchibori, Kuwana-cho, Kuwanagun, Mie Pref.)</p> <p>1923 Nishizono Ironworks and Tomoe Trading Co. (Nishi-ku, Osaka) inaugurated joint manufacture and sale of bearings under the brand name NTN.</p> <p>1927 NTN Mfg. Co., Ltd. established with capital of ~50, 000.</p> <p>1937 Renamed the Toyo Bearing Mfg. Co., Ltd.</p> <p>1938 Established Showa Bearing Mfg. Co., Ltd. (Muko-gun, Hyogo Pref.)</p> <p>1939 Kuwana Plant constructed.
Showa Bearing Mfg. Co., Ltd. merged to become Muko-gawa Plant.</p> <p>1950 Established NTN Sales Co., Ltd.</p> <p>1954 Awarded Deming Prize for statistical quality control for the first time in the machinery industry.</p> <p>1960 Established Toyo Bearing Iwata Co., Ltd.
Established NTN Walzlager (Europa).</p> <p>1962 Constructed needle bearing factory in Toyo Bearing Iwata Co., Ltd.
Changed name of Muko-gawa Plant to Takarazuka Plant.
Established Toyo Bearing Machine Tool Laboratory Co., Ltd.</p> <p>1963 Established NTN Bearing Corp. of America, New York.
Skokie, IL, office and warehouse opened.</p> <p>1964 Established NTN France S.A.
Established NTN Bearings (UK) Ltd.</p> <p>1966 Established NTN Powdered Metal Co., Ltd.</p> <p>1967 Executed Technical Assistance Agreement with Tung Yang Bearing Mfg. Co., Ltd. (Taiwan)
NBCA Lincolnwood, IL, Head Office and warehouse established.</p> <p>1968 Established NTN Bearing Corp. of Canada Ltd.</p> <p>1970 NBCA California sales office opened.</p> <p>1971 Established American NTN Bearing Mfg. Corp. (Schiller Park, IL)</p> | <p>Established NTN Trading-Hong Kong Ltd.
Established Toyo Bearing Okayama Co.,Ltd.
Established NTN Kugellagerfabrik. (Deutschland)
NBCA Atlanta sales office opened.</p> <p>1972 Renamed as NTN Toyo Bearing Co., Ltd.
Established NTN Product Development Institute.
NBCA Irvine, CA, office and warehouse occupied.
NBCA Headquarters building occupied. (Des Plaines, IL)</p> <p>1973 Established NTN Bearing Mfg. (Canada) Ltd. (Merged into NTN Bearing Corp. of Canada Ltd. in 1980.)
Constructed constant-velocity joint factory in Toyo Bearing Iwata Co., Ltd.</p> <p>1975 Established NTN Elgin Corp. (U.S.A.). (Merged into American NTN Bearing Mfg. Corp. in 1985.)
New Takarazuka Plant completed.
NBCA Michigan sales office opened.</p> <p>1976 NBCA Dallas sales office opened.</p> <p>1977 NBCA Totowa, NJ, office and warehouse occupied.</p> <p>1980 NBCA Automitve Sales/Engineering Office established, Southfield, MI.
NBCA Distribution office and warehouse established, Mt. Prospect, IL.</p> <p>1981 Research Departments reorganized into General Engineering Laboratory.</p> <p>1982 Constructed constant-velocity joint factory in Toyo Bearing Okayama Co. Ltd.
Constant Velocity joint technology licensed to Hyundai Motors (South Korea).
NBCA Norcross, GA, office and warehouse occupied.</p> <p>1983 Constant velocity joint technology licensed to Lepco Co, Ltd. (Australia)
Merged with Toyo Bearing Iwata Co., Ltd. and Toyo Bearing Okayama Co., Ltd.
Constant velocity joint technology licensed to Taiway Ltd. (Taiwan)</p> |
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- NBCA Irving, TX, office and warehouse occupied.
- NBCA Headquarters building expanded. (Des Plaines, IL)
- NBCA Midwest and Central sales offices established. (Des Plaines, IL)
- NBCA Peopria, IL, sales office opened.
- 1984 Ground broken for Elgin, IL, tapered roller bearing manufacturing facility.
- 1985 Established Toyo Bearing Nagano Co. Ltd.
Bearing production technology licensed to National Engineering Industries Ltd. (India)
Established NTN-Bower Corporation, a joint venture with Federal-Mogul Corporation. (U.S.A.)
- 1986 Constructed (in Kuwana Plant) Japan's first plant dedicated to aerospace bearings.
- 1987 NTN-Bower Corporation became 100% owned affiliate.
- 1988 Established NTN Technical Center (U.S.A.) Inc. (Ann Arbor, MI)
- Established Unidrive Pty. Ltd., a joint venture manufacturer of constant velocity joints in Australia.
- Ground broken for Elgin, IL, bearing hub unit manufacturing facility.
- 1989 Built new building for R&D at Iwata Plant.
Merged with Toyo Bearing Nagano Co.
Established NTN Driveshaft Inc. (Columbus, IN — CVJ facility)
Renamed parent company NTN Corporation.
Bearing hub unit production began at Elgin, IL, facility.
- 1990 Built new building for R&D at Kuwana Plant.
NTN USA Corporation founded as headquarters in the U.S.A.
- 1991 NBCA and NTN USA Corp. occupied new Head Office in Mt. Prospect, IL.
NBCA Eastern Region occupied new offices, training center and warehouse in Exton, PA.





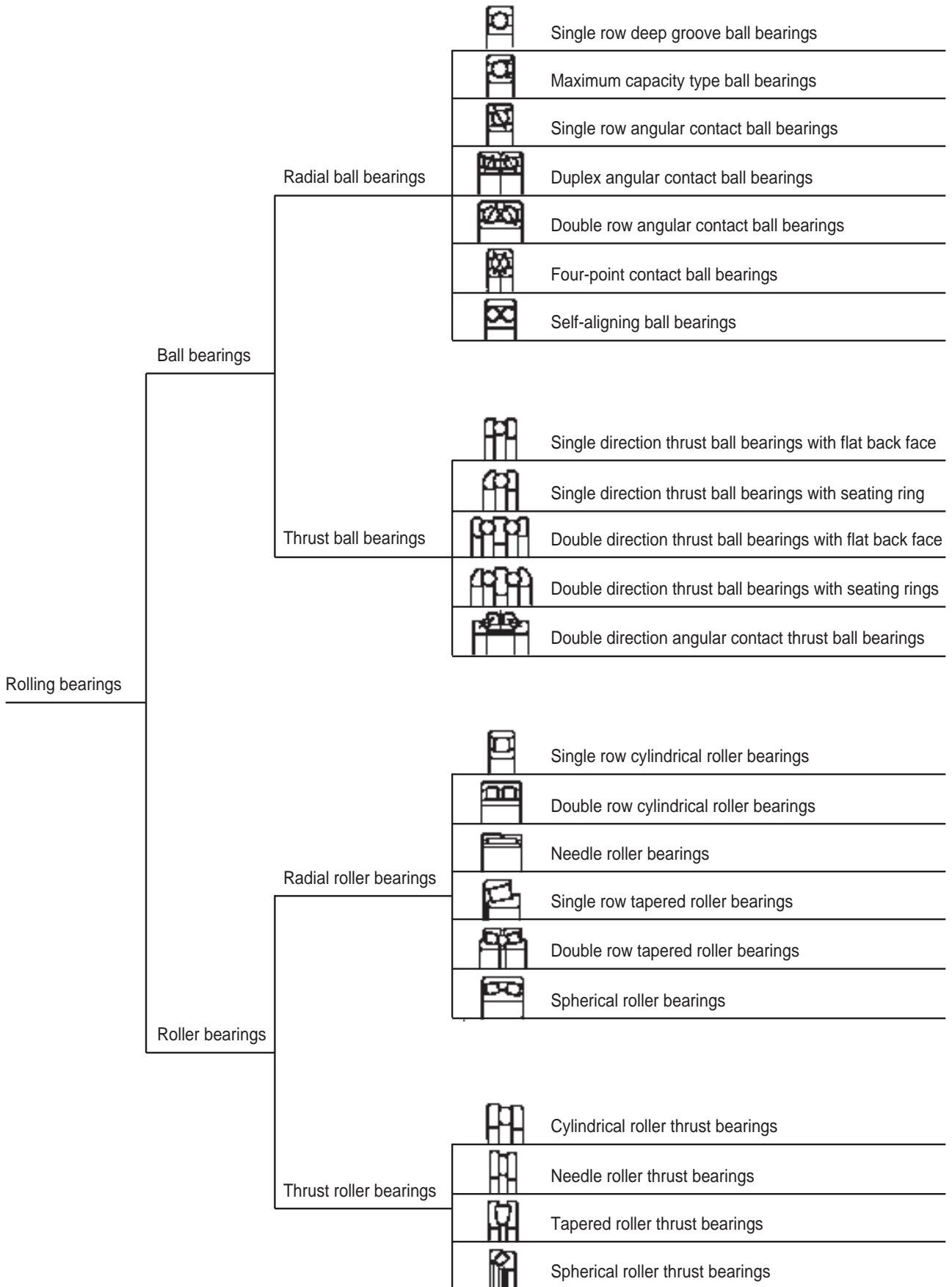
CLASSIFICATION OF ANTI-FRICTION BEARINGS

Most rolling bearings consist of bearing rings (an inner ring and an outer ring), rolling elements and a rolling element retainer (cage). The retainer separates the rolling elements at regular intervals, holds them in place within the inner and outer raceways, and allows them to rotate freely.

Rolling bearings fall into two main classifications: ball bearings and roller bearings. Balls geometrically contact the raceway surfaces of the inner and outer rings at “points,” while the contact surface of rollers is a “line” contact. Rollers come in four basic geometric styles: cylindrical, needle,

tapered and spherical. Rolling bearings can further be classified according to the direction in which the load is applied: radial, thrust, or a combination of both.

While the rolling elements and the bearing rings take any load applied to the bearings (at the contact point between the rolling elements and raceway surfaces), the retainer takes no direct load. It only serves to hold the rolling elements at equal distances from each other, forcing the rolling elements to enter the load zones and prevent them from falling out.





DESIGN AND CHARACTERISTICS OF BALL AND ROLLER BEARINGS

SINGLE ROW RADIAL BALL BEARINGS are the most widely used bearings and utilize an uninterrupted raceway, which makes these bearings suitable for radial loads, or a combination of thrust and radial loads. This design permits precision tolerances even at high speed operation.



The cage in this bearing is pressed steel. For high speed bearings, machined brass cages are available. Bearings with locating snap rings are also available.

PRELUBRICATED BEARINGS have integral seals, or shields, which are packed with long-life grease. In many applications, these bearings may be used without supplementary seals, closures, or protective devices. This design offers the lowest possible manufacturing cost to the consumer.

The boundary dimension of this type is the same as the corresponding bearings without the seals or shields.

SHIELDED BALL BEARINGS are protected on one, or both sides (suffixes Z and ZZ, respectively) by metal shields fastened to the outer ring. This close clearance labyrinth seal retains the lubricant and prevents the entrance of foreign matter.



SEALED BALL BEARINGS incorporate steel reinforced rubber seals securely fastened to a groove on the outer ring. Contact with the inner ring is by sealing lip (Contact Suffix LLU). Or, non-contact with the inner ring is by labyrinth seal (Non-contact Suffix LLB) to provide positive sealing at all times.



SINGLE ROW ANGULAR CONTACT BALL BEARINGS feature raceways with high and low shoulders. These opposing raceways are designed to carry thrust load in one direction.

These bearings may be preloaded at the factory so that the correct preload will develop within the bearing.



The bearings in this series are assembled with a specific internal clearance so that they will have a speci-

fied contact angle under load. The standard contact load used by NTN is 30°; bearings made to a 40° contact angle carry the suffix B.

For high speed grinding spindles, the 7000C, 7200C and the 7300C series are available. They are high accuracy bearings with a 15° contact angle, and phenolic resin cages for high speed operations.

DOUBLE ROW ANGULAR CONTACT BALL BEARINGS have an inner and outer ring with a double raceway.

The two rows are so related that the contact angle is similar to a pair of back-to-back single row bearings. The 5200 and 5300 series offer continuous races and can carry thrust loads in either direction. Since the 3200 and 3300 series have filling slots, it is necessary to mount them with the thrust load acting against the unnotched face of the rings.



DOUBLE ROW SELF-ALIGNING BEARINGS utilize an inner ring with two rows of balls in two deep raceways, and an outer ring with a single spherical raceway. In this way, the inner and outer rings can be misaligned relative to each other. The resulting effect is a comparatively large angle imposing moment loads upon the balls.

The boundary dimensions of the 1200 and 1300 series are the same as the 6200 and 6300 single row deep groove bearings.

CYLINDRICAL ROLLER BEARINGS have rollers which are essentially cylindrical in shape. This provides a modified line contact with the cylindrical inner and outer ring raceways, while the rollers are guided by ground ribs on either the inner or outer ring.

The cylindrical shape allows the inner ring to have axial movement relative to the outer ring (except the NH type). This is especially important when accommodating thermal expansion when both rings must be press fitted.

In this series, the NJ, NF and NH types can carry light or intermittent thrust loads.

The NN3000 and NN3000K series are available in high precision tolerances and are well suited for use in machine tool spindles.

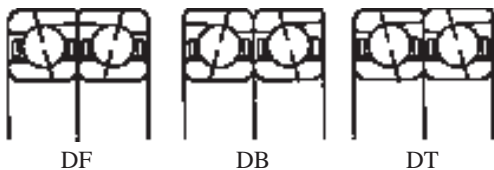
TAPERED ROLLER BEARINGS utilize conical rollers and raceways arranged so that the rollers and raceways meet at a common apex. The rollers are guided by contact between the large end of the roller and a rib on the inner ring. This provides high capacity for radial and single thrust loads.



SPHERICAL ROLLER BEARINGS have two rows of rollers in separate raceways which allows the bearing to compensate for angular thrust errors. They have large radial and thrust load capacity for heavy shock and impact loads, making them suitable for heavy industrial equipment.

DUPLEX BEARINGS use a set of two on a common shaft with the inner and outer rings clamped solidly together. They are used to gain axial shaft control, rigidity and extra capacity.

There are three fundamental combinations in duplex bearings: face-to-face (DF), back-to-back (DB), and tandem (DT).

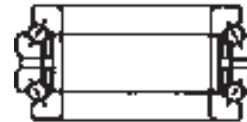


SINGLE DIRECTION THRUST BEARINGS consist of two washers having ball grooves ground into their adjacent faces with balls and cages mounted between these grooves. They are normally equipped with either pressed or machined cages and are suitable for carrying thrust loads at moderate speeds.



DOUBLE DIRECTION ANGULAR CONTACT THRUST BALL BEARINGS are back-to-back duplex bearings with a larger contact angle than that of normal angular contact ball bearings.

These bearings are primarily designed as thrust bearings for machine tools. They utilize machined brass cages.



SPHERICAL ROLLER THRUST BEARINGS are similar to double row spherical roller bearings, but have a greater contact angle. They are guided by ground flanges on the inner ring and operate against the spherical raceway in the outer ring. The contact angle is approximately 45°. Machined cages are normally used, and oil lubrication is recommended.

