
JAPAN P4
JAPAN R4


Angular contact ball bearing


High speed use angular contact ball bearing


Ultra high speed use angular contact ball bearing


Four-point contact ball bearing


Double row angular contact ball bearing

1. Design features and special characteristics

1.1 Angular contact ball bearing

Angular contact ball bearings are non-separable bearings which have a certain contact angle in the radial direction relative to the straight line that runs through the point where each ball makes contact with the inner and outer rings (see **Diagram 1**). **Table 1** gives contact angle and contact angle symbol.

In addition to radial loads, single direction axial loads can also be accommodated by angular contact ball bearings.

Furthermore, since an axial load is generated from a radial force, these bearings are generally used in pairs facing each other. Standard type, high speed use type and ultra high speed varieties of angular contact ball bearings are available through NTN, and there are also many duplex varieties. A bearing accuracy of JIS Class 5 or higher is applied to duplex type angular contact ball bearings, and in many cases they are given a preload, in compliance with standard preload levels, before being used in an application. **Table 2** shows information concerning angular contact ball bearings, and **Table 3** shows similar information for duplex angular contact ball bearings.

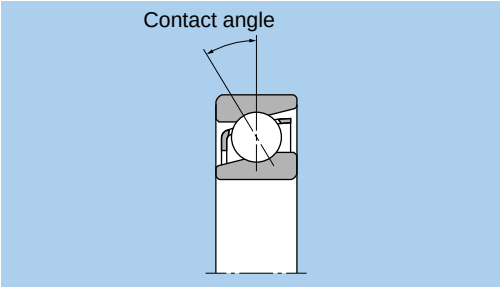


Diagram 1.

Table 1 Contact angle and contact angle codes

Contact angle	15°	30°	40°
Code	C	A❶	B

❶ Contact angle symbol A is omitted.

Table 2 Angular contact ball bearing types and characteristics

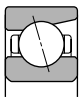
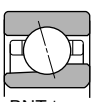
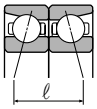
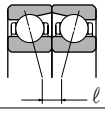
Type	Design	Characteristics
Standard type		● Available in bearing series 79, 70, 72, 72B, 73, and 73B. ● Contact angles: 30°and 40° (with B) available. ● Standard bearing cage type differs depending on bearing no. (Refer to **Table 4**)
High speed use		● Available in bearing series 78C, 79C, 70C, 72C, and 73C. ● Contact angles: 15° ● All bearing accuracies JIS Class 5 or higher. ● Standard bearing cage type differs depending on bearing no. (Refer to **Table 4**)
Ultra high speed use	 BNT type  HSB type	● Available in bearing series HSB9C, HSB0C, BNT0, and BNT2; all boundary dimensions agree with JIS series dimensions. ● Contact angles: 15°; HSB type HSB9 and HSB0: 15°and 30°. ● All bearing accuracies JIS Class 5 or higher. ● BNT type internal design can be altered; suitable for higher speed applications than high speed use bearings. ● HSB series bearings have smaller diameter of balls than high speed use type bearings, so benefit by less torque for high precision, high speed applications. ● The inner ring bore diameter and outer ring inner diameter of the HSB series have a ground undercut on one side enabling easy oil flow. ● For even higher speed applications, there is a bearing in this series equipped with ceramic ball bearings. ● For standard cage types refer to **Table 4**; molded resin cages are also available for some varieties.

Table 3 Duplex angular contact ball bearings — types and characteristics

Duplex type		Characteristics
Back-to-back duplex (DB)		● Can accommodate radial loads and axial loads in either direction. ● Has a large distance ℓ between the acting load center of the bearing, and therefore a large momentary force load capacity. ● Allowable misalignment angle is small.
Face-to face duplex (DF)		● Can accommodate radial loads and axial loads in either direction. ● Has a smaller distance ℓ between the acting load center of the bearing, and therefore a smaller momentary force load capacity. ● Has a larger allowable misalignment angle than back-to-back duplex type.
Tandem duplex (DT)		● Can accommodate radial loads and single direction axial loads. ● Axial loads are received by both bearings as a set, and therefore heavy axial loads can be accommodated.

Note: 1. Duplex bearings are manufactured in a set to specified clearance and preload values, therefore they must be assembled together with identically numbered bearings and not mixed with other arrangements.
2. Triplex arrangements of angular contact bearings are also available. Consult NTN Engineering for details.

1.2 Four-point angular contact ball bearings

Four-point angular contact ball bearings have a contact angle of 30˚ and inner rings which are separated in half. As shown in **Diagram 2**, when the inner and outer rings receive a radial load the ball bearings contact the inner and outer rings at four points. This construction enables a single bearing to accommodate axial loads from either direction, and when generally under a simple axial load or heavy axial load, the bearing functions in reliance on two contact points like ordinary bearings.

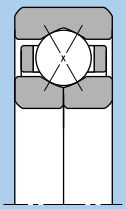


Diagram 2.

1.3 Double row angular contact ball bearings

The structure of double row angular contact ball bearings is designed by arranging two single row angular contact bearings back-to-back in duplex (DB) to form one united bearing with a contact angle of 25˚.

These bearings are capable of accommodating radial loads, axial loads in either direction, and have a high capacity for momentary loads as well.

As shown in **Diagram 3**, sealed and shielded type double row angular contact ball bearings are also available. Standard loads vary from those of open type bearings.

■Flush ground

"Flush ground" is the name given to the finishing method shown in **Diagram 4** where the offset of the front and back faces of the bearing are ground to the same value. By doing this, a stated clearance or preload value can be achieved by using bearings with identical codes for these values, in other words by combining either DB or DF series bearings. DT series bearings can also be used in various arrangements to achieve uniform load distribution.

All BNT type bearings are flush ground, but other angular contact ball bearing series are not. If it is necessary to flush grind any of these other bearings, please consult NTN Engineering.

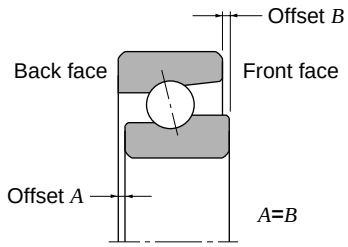
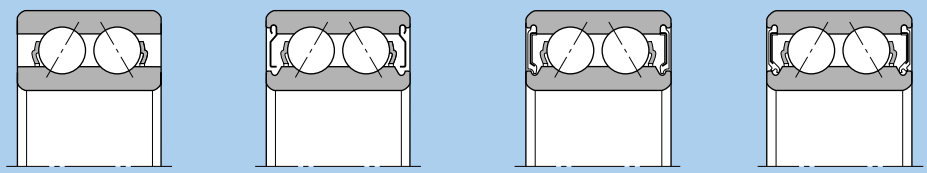


Diagram 4.



Open type | Shielded type **(ZZ)** | Non-contact sealed type **(LLM)** | Contact sealed type **(LLD)**

Diagram 3.

2. Standard cage types

Table 4 lists the standard cage types for angular contact ball bearings. For high speed use angular contact ball bearings, molded resin cages and machined cages are widely used.

Table 4 Standard cages for angular contact ball bearings

Type	Bearing series	Molded resin cage	Pressed cage	Machined cage
Standard	79 70 72 73 72B 73B	7904～7913 7000～7024 — — — —	— — 7200 ～7222 7300 ～7322 7200B～7222B 7300B～7322B	7914 ～7960 7026 ～7040 7224 ～7240 7324 ～7340 7224B ～7240B 7324B ～7340B
High speed use	78C 79C 70C 72C 73C	— 7904C～7913C 7000C～7024C 7200C～7220C 7303C～7312C	— — — — —	7805C ～7834C 7914C ～7934C 7026C ～7040C 7221C ～7240C 7300C ～7302C 7313C ～7340C
Ultra high speed use	BNT0 BNT2 HSB9C HSB0C	— — — HSB010C～HSB032C	— — — —	BNT000 ～BNT009 BNT200 ～BNT209 HSB910C ～HSB934C HSB034C
4-point contact	QJ2 QJ3	— —	— —	QJ208 ～QJ224 QJ306 ～QJ324
Double row	52 53	— —	5200S～5217S 5302S～5314S	— —

Note: 1. Standard cages for 5S-BNT and 5S-HSB type bearings are the same as cages for BNT and HSB type bearings.
2. Due to the material characteristics of molded resin cages, use at application temperatures in excess of 120˚C is not possible.