

1. Design features and special characteristics

1.1 Angular contact ball bearing

Angular contact ball bearings are non-separable type bearings. The line connecting the contact points of the ball and inner ring and the ball and outer ring creates an angle with the line drawn in the radial direction called the contact angle.

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.

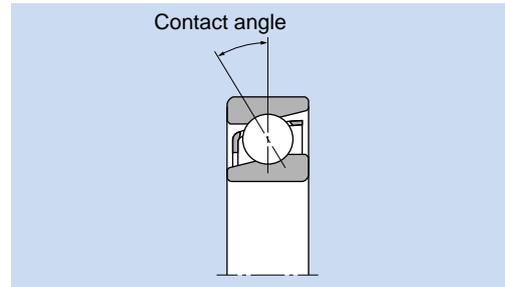


Diagram 1.

Table 1 Contact angle and contact angle codes

Contact angle	15°	30°	40°
Code	C	A ^①	B

① A 30° contact angle is standard, and therefore the code "A" will usually be omitted.

Table 2 Angular contact ball bearing types and characteristics

Type	Design	Characteristics
Standard type		<ul style="list-style-type: none"> 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		<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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)		<ul style="list-style-type: none"> • 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)		<ul style="list-style-type: none"> • 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)		<ul style="list-style-type: none"> • 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.

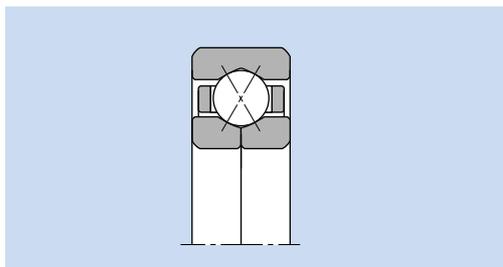


Diagram 2.

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 30° .

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.

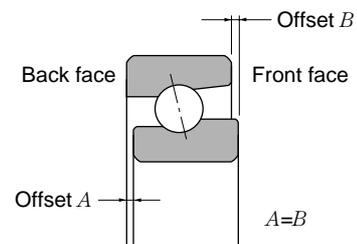


Diagram 4.

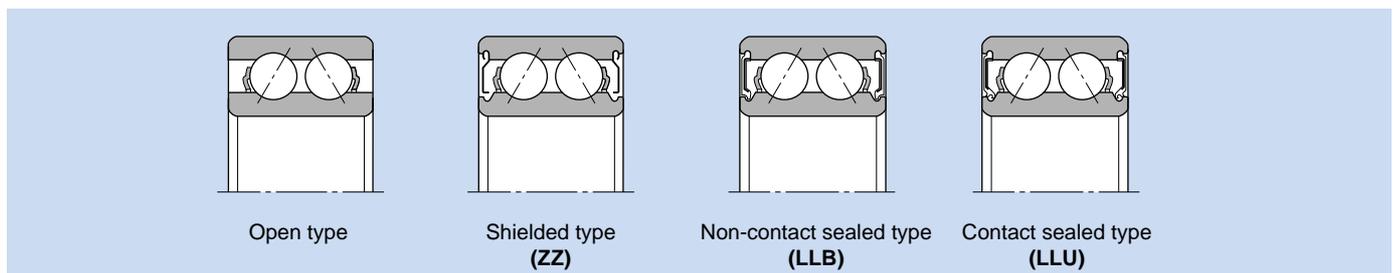


Diagram 3.

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	7904 ~ 7913 7000 ~ 7024	7200 ~ 7222 7300 ~ 7322 7200B ~ 7222B 7300B ~ 7322B	7914 ~ 7960
	70			7026 ~ 7040
	72			7224 ~ 7240
	73			7324 ~ 7340
	72B			7224B ~ 7240B
	73B			7324B ~ 7340B
High speed use	78C	7904C ~ 7913C 7000C ~ 7024C 7200C ~ 7220C 7303C ~ 7312C		7805C ~ 7834C
	79C			7914C ~ 7934C
	70C			7026C ~ 7040C
	72C			7221C ~ 7240C
	73C			7300C ~ 7302C 7313C ~ 7340C
Ultra high speed use	BNT0	HSB010C ~ HSB032C		BNT000 ~ BNT009
	BNT2			BNT200 ~ BNT209
	HSB9C			HSB910C ~ HSB934C
	HSB0C			HSB034C
4-point contact	QJ2			QJ208 ~ QJ224
	QJ3			QJ306 ~ QJ324
Double row	52		5200 ~ 5218 5302 ~ 5315	5219 , 5220
	53			

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 is not possible.